FOR·THE·INCREASE·AND·DIFFVSION·OF·KNOWLEDGE·AMONG·MEN·

PER ORBEM

·SMITHSONIAN·INSTITVTION·

·WASHINGTON·1846·

SMITHSONIAN INSTITUTION
UNITED STATES NATIONAL MUSEUM

PROCEEDINGS

OF THE

UNITED STATES NATIONAL MUSEUM

VOLUME 87

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1941

ADVERTISEMENT

The scientific publications of the National Museum include two series, known, respectively, as *Proceedings* and *Bulletin.*

The *Proceedings* series, begun in 1878, is intended primarily as a medium for the publication of original papers, based on the collections of the National Museum, that set forth newly acquired facts in biology, anthropology, and geology, with descriptions of new forms and revisions of limited groups. Copies of each paper, in pamphlet form, are distributed as published to libraries and scientific organizations and to specialists and others interested in the different subjects. The dates at which these separate papers are published are recorded in the table of contents of each of the volumes.

The present volume is the eighty-seventh of this series.

The series of *Bulletins*, the first of which was issued in 1875, contains separate publications comprising monographs of large zoological groups and other general systematic treatises (occasionally in several volumes), faunal works, reports of expeditions, catalogs of type specimens, special collections, and other material of similar nature. The majority of the volumes are octavo in size, but a quarto size has been adopted in a few instances in which large plates were regarded as indispensable. In the *Bulletin* series appear volumes under the heading *Contributions from the United States National Herbarium*, in octavo form, published by the National Museum since 1902, which contain papers relating to the botanical collections of the Museum.

Alexander Wetmore,
Assistant Secretary, Smithsonian Institution.

Washington, D. C., *August 15, 1941.*

CONTENTS

[1] Date of publication.

[1] Date of publication.

ILLUSTRATIONS

PLATES

TEXT FIGURES

PROCEEDINGS OF THE UNITED STATES NATIONAL MUSEUM

issued by the

SMITHSONIAN INSTITUTION
U. S. NATIONAL MUSEUM

Vol. 87 Washington: 1939 No. 3066

CERATOPSIAN DINOSAURS FROM THE TWO MEDICINE FORMATION, UPPER CRETACEOUS OF MONTANA

By Charles W. Gilmore

Three expeditions for dinosaurian remains have now been conducted by me to the Two Medicine formation, as exposed on the Blackfeet Indian Reservation in northern Montana. These explorations have resulted in the accumulation of a considerable number of dinosaurian specimens, among which are several pertaining to the Ceratopsia that are of more than ordinary interest.

The first expedition, in 1913, under the auspices of the U. S. Geological Survey, discovered the type and other materials of *Brachyceratops montanensis*,[1] all juvenile specimens; the second, in 1928, recovered the type of *Styracosaurus ovatus*,[2] and portions of the skull and skeleton of a *Monoclonius flexus;* and the third, in 1935, yielded two fragmentary skeletons pertaining to the genus *Leptoceratops* and a disarticulated skull and a few bones of a nearly adult *Brachyceratops montanensis.* These specimens of the 1935 expedition are described in the present paper. The figures illustrating them were drawn by Sydney Prentice.

Family PROTOCERATOPSIDAE

Genus LEPTOCERATOPS Brown

LEPTOCERATOPS species

The two specimens of *Leptoceratops* found in the Two Medicine formation for the most part are very fragmentary, but sufficiently

[1] Gilmore, C. W., Smithsonian Misc. Coll., vol. 63, No. 3, pp. 1–10, 1914.
[2] Gilmore, C. W., Proc. U. S. Nat. Mus., vol. 77, art. 16, pp. 36, 37, pl. 10, figs. 1, 2, 1930.

diagnostic parts were present to indicate clearly that their affinities are with this genus. They are the first recognizable remains of *Leptoceratops* to be found in the Two Medicine formation, and their discovery considerably extends the known geological and geographical range of this little-known dinosaur. A nearly complete articulated hind limb and foot contributes to a better understanding of the skeletal anatomy, as a complete pes was previously unknown.

The genus *Leptoceratops* was founded [3] upon an incomplete skeleton from the Edmonton formation in southern Alberta, and in 1916 a fine skeleton lacking the skull was discovered near the bottom of the St. Mary River formation in Montana, which lies above the Two Medicine. This latter specimen is now mounted in the American Museum of Natural History.

The occurrence of *Leptoceratops* in the Two Medicine formation would suggest, on geological position alone, that it probably represents a species distinct from these found in the Edmonton and St. Mary River formations. Comparison, however, fails to disclose in the materials now available any character, except size, that would serve to distinguish them. Through the courtesy of Dr. Barnum Brown, limb and foot bones of *Leptoceratops gracilis* were lent me for direct comparison, but the closest agreement was found in all the bones contrasted. The much smaller size of the National Museum specimens is in all probability due to immaturity, as indicated by the open sutures of the skull parts and the noncoalescence of the vertebral processes. For the present I shall, therefore, regard these specimens specifically indeterminable in the hope that the discovery of more complete materials will eventually clear up the uncertainty of their specific identity.

Specimen U.S.N.M. No. 13863 consists of the incomplete right maxillary containing five worn teeth; a premaxillary portion containing the roots of two teeth; six scattered teeth; distal half of right femur; the tibia, fibula, tarsus, and nearly complete pes. All these limb and foot bones were found articulated. Included also are shaft portions of the radius and ulna. Collected by George B. Pearce, July 25, 1935, on the south side of Two Medicine River, Teton County, Mont.

Specimen U.S.N.M. No. 13864 was completely weathered out of the ground, but from the fragmentary parts the following recognizable elements have been pieced together: Nasals, supraoccipital, and portion of parietal; frontals; numerous other unidentified skull parts; four teeth; incomplete predentary; scapula; ischia; ilia; pubes all incomplete; parts of ulnae, radii, femora, and tibiae, a few foot bones. Dorsal, caudal, and sacral centra, pieces of ribs. Collected by George

[3] Brown, Barnum, Bull. Amer. Mus. Nat. Hist., vol. 33, pp. 567–580, 1914.

F. Sternberg, July 30, 1935, on the north side of Two Medicine River, Teton County, Mont.

Description of skull parts.—The frontals are represented by the median transverse portions of both elements, as shown in figure 1. Transversely between the orbital borders the superior surfaces of the cojoined frontals are concave from side to side, being much more strongly dished than the corresponding part of the *Protoceratops* skull. On the posterior border the surface dips downward but is slightly hollowed out on each side of a low longitudinal median ridge. The median posterior border is incomplete and thus gives no indica-

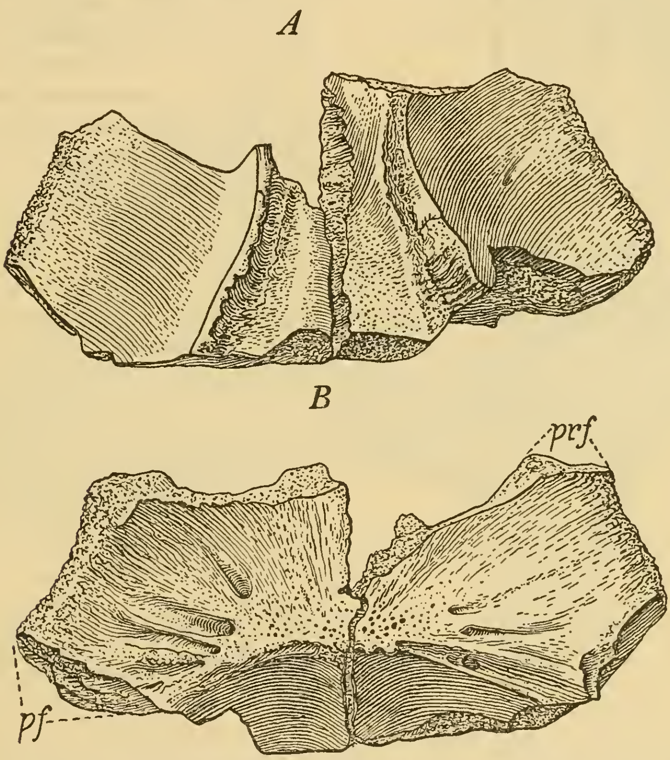


FIGURE 1.—Frontals of *Leptoceratops* sp. (U.S.N.M. No. 13864): *A*, ventral view; *B*, dorsal view. *pf*, Sutural union for postfrontal; *prf*, sutural union for prefrontal. One-half natural size.

tion of its contact with the parietal. The outer posterior border, which looks backward and outward, has a strongly grooved surface for sutural union with the postfrontal. The outer rounded edges, for a space of 22 mm., form the frontal contribution to the orbital rims. The anterior border presents broken surfaces except for portions of the sutural contact for the prefrontals on each side. The superior surface on each side of the midline is perforated by a number of small foramina that probably carried nutrient blood vessels into the interior of the bones.

On the ventral side the subtriangular central portion forms the roof over the olfactory part of the brain. The roughened grooves at each side of this central area represent the sutural contacts of the frontals with the underlying ethmoid and orbitosphenoid bones. Outside of these sutures the surfaces are smoothly excavated, forming the roof of the orbital cavities. Measured at the center of the orbital rim the frontals have a greatest width of 77 mm. This part of the skull was apparently not recovered with any of the American Museum of Natural History specimens of *Leptoceratops*, and thus it cannot be contrasted with them. From the frontals of the related *Protoceratops* these may be distinguished by the greater concavity of the dorsal surfaces, relatively shorter contribution to the orbital rim, and the more transverse direction of the sutural union with the postfrontal.

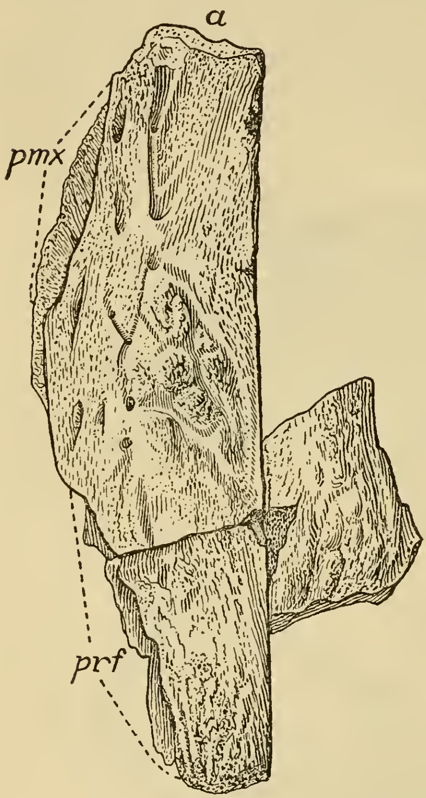


FIGURE 2.—Nasals of *Leptoceratops* sp. (U.S.N.M. No. 13864): Top view. *a*, Anterior; *p*, posterior; *pmx*, sutural surface for articulation with the premaxillary; *prf*, sutural surface for articulation with the prefrontal. One-half natural size.

The nasals are represented by the greater portion of the left, and a small median part of the right, as shown in figure 2. On the median line they are united by a continuous tongue-and-groove suture, as in *Leptoceratops gracilis* Brown.

The anterior end of the left nasal is broken off and missing, but most of its outer lateral border is complete, thus displaying the extent of the sutural contact between it and the ascending process of the premaxillary and with the prefrontal, as indicated in figure 2. Judged from the skull of *Protoceratops* the lachrymal probably filled the intervening space. The external surface of each nasal bone, more especially the median posterior portions, is roughened and further sculptured by shallow grooves, evidently for the transmission of nutrient blood vessels. These surfaces gave no evidence of the presence of a nasal horn. The internal surface is smooth, with well-defined longitudinal grooves that mark the course of nares superiorly. On the underside at the posterior end the left nasal displays part of the strongly grooved sutural surface for union with the frontal. This end is slightly incomplete.

An incomplete right maxillary containing five posterior teeth is illustrated in figure 3. Most of the borders are incomplete except for the concave posterior border, which has a vertically striated sutural surface for the articulation of the ectopterygoid, and a short median portion of the upper border, which probably articulated with the premaxillary. In *Protoceratops* the pterygoid is said to articulate with this posterior border, no mention being made of the

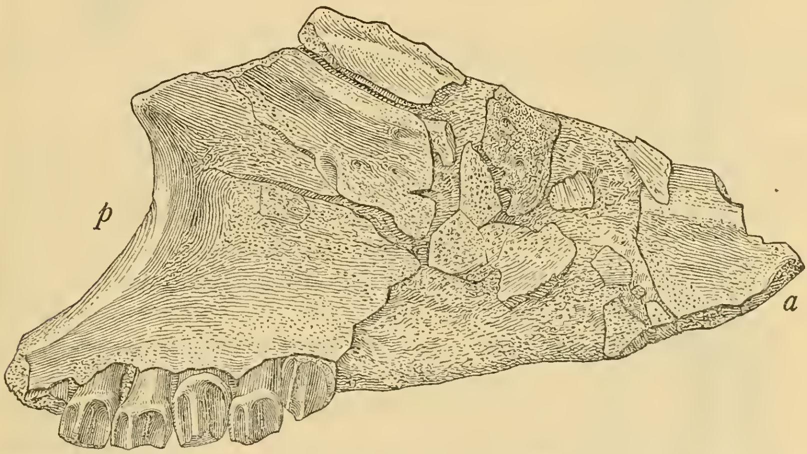


FIGURE 3.—Right maxillary of *Leptoceratops* sp. (U.S.N.M. No. 13863): Lateral view. *a*, Anterior end; *p*, posterior end. Nine-tenths natural size.

ectopterygoid. In *Triceratops*, however, as shown by Hatcher,[4] it is the ectopterygoid that unites with this border. It is quite possible that the ectopterygoid is fused with the pterygoid in *Protoceratops* and was not recognized as a separate element.

A fragmentary bone containing the simple roots of two teeth is identified as the dentigerous border of the premaxillary. Measured from center to center these roots are 8 mm. apart, showing the premaxillary teeth to be more widely spaced than in *Protoceratops*.

No recognizable parts of the frill portion of the skull were found.

Teeth.—The few teeth present except for being slightly smaller are in accord with those of *Leptoceratops gracilis*. The roots are simple, not bifid as in the Ceratopsidae. The fully adult teeth that have not

[4] U. S. Geol. Surv. Monogr. 49, p. 26, fig. 21, 1907

been subjected to wear have transversely compressed crowns that are rounded anteroposteriorly with dentate borders. The four posterior teeth retained in place in the maxillary of U.S.N.M. No. 13683 have the crowns much worn. Their outer surfaces have a characteristic sculp-

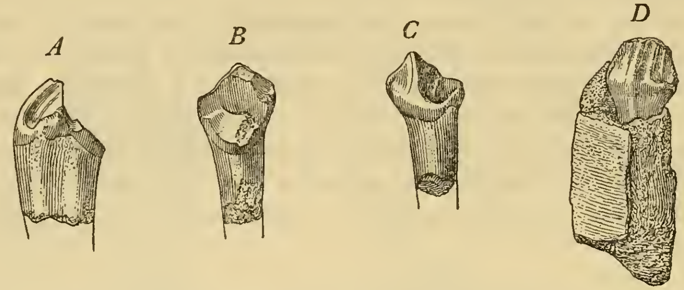


FIGURE 4.—Teeth of *Leptoceratops* sp. (U.S.N.M. No. 13864): Side (*A*), inner (*B*), and outer (*C*) views of worn upper tooth; *D*, inner view of slightly worn lower tooth. Natural size.

ture, consisting of a prominent vertical ridge placed slightly posterior to the middle of the crown and lesser ridges both in front and back of the main carina. While the main ridge merges into the cingulum at the base of the crown, the lesser ridges fade out before reaching the base. On the inner face the surface is sculptured by a series of lesser parallel ridges, which appear to correspond in number to the denticles on the cutting edge. The four teeth in the maxillary (fig. 3) occupy a space 33 mm. in length. In the figures of the teeth of *Leptoceratops gracilis* as illustrated by Brown,[5] they have been inadvertently mislabeled; the outer should be the inner, in both the upper and lower teeth.

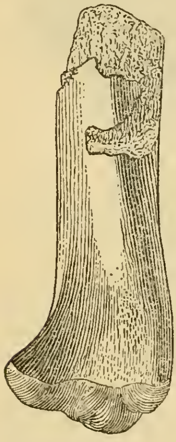


FIGURE 5.—Distal end of right femur *Leptoceratops* sp. (U.S.N.M. No. 13863): External view. One-half natural size.

Hind limb and foot.—The right hand limb and foot of U.S.N.M. No. 13863 were found articulated and for the first time give a complete knowledge of the pes and tarsus in the genus *Leptoceratops*. Only the distal third of the femur is preserved, but it shows the same straight shaft, round in cross section, with distal articular face at right angles to the shaft as found in *L. gracilis*. In outline the distal end is squarish with a deep intercondylar notch (fig. 5).

The tibia is complete, but the proximal end has been badly compressed. The ends are relatively less expanded than in the typical ceratopsians and the shaft is subround, but insofar as it can be com-

[5] Bull. Amer. Mus. Nat. Hist., vol. 33, figs. 2, 6, 1914.

pared with the incomplete tibia of *Leptoceratops gracilis*, except for its smaller size, the bones are in full accord.

The fibula is relatively slender with an expanded proximal end, especially the anterior border, which strongly overhangs the shaft. On the inner side of the upper fourth the fibula is longitudinally hollowed out. The distal end is slightly widened transversely and articulates closely with the calcaneum. The shaft is flattened, with a strong torque in the distal third of the shaft, which throws the greatest diameters of the ends at right angles to one another.

The astragalus is proportionately larger than in *Triceratops* and articulates with two-thirds of the distal end of the tibia (fig. 6). When articulated it shows considerably less from a posterior view than in *Leptoceratops gracilis;* otherwise they are in full accord.

The calcaneum when articulated is applied entirely to the anterior side of the tibia and is hardly visible from a posterior view of this bone. Its superior surface is cupped and receives the distal end of the fibula. Its outer surface is deeply excavated; anteriorly it projects forward prominently beyond the astragulus and presents a broadly convex articular surface dorsoventrally. Its inner side abuts the astragalus.

There are two ossified bones in the distal row of the tarsus. These were slightly displaced in the matrix so that their exact relationship to the metatarsals is somewhat uncertain. The outer one (fig. 7) was not far removed from the end of metatarsal IV, and the presence of a cupped upper articular surface for the calcaneum and a smooth hemispherical distal surface for articulation with the cupped articular end of metatarsal IV indicate its proper position in the tarsus. Viewed from above this bone is quadrangular, and it is thought that its longer diameter is anteroposterior in the articular foot. In this position, which puts the thickened end in front, it makes its most perfect articulation with metatarsal IV and with the calcaneum. The other tarsal is a flattened quadrangular bone, which may have articulated with metatarsals II and III. I find no clue as to its exact position.

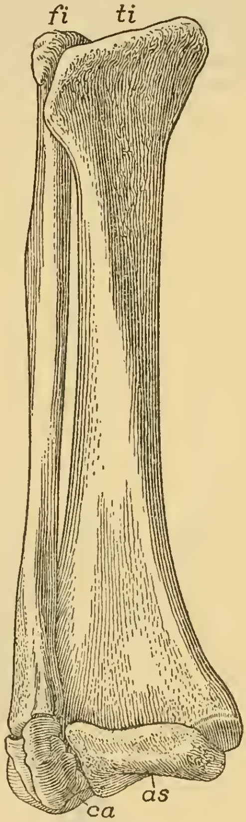


FIGURE 6.—Right tibia, fibula, astragalus, and calcaneums of *Leptoceratops* sp. (U.S.N.M. No. 13863): Anterior view. *as*, Astragulus; *ca*, calcaneum; *fi*, fibula; *ti*, tibia. One-half natural size.

TABLE 1.—*Hind-limb measurements of* Leptoceratops *sp.* (*U.S.N.M. No. 13863*)

Measurement	Mm.
Total length of tibia, including astragalus	200
Total length of fibula, about	190
Greatest diameter anteroposteriorly of tibia, proximal end	72
Greatest diameter transversely of tibia, distal end	62
Least diameter of midshaft of tibia	20
Greatest diameter anteroposteriorly of fibula, proximal end	26
Greatest diameter transversely of fibula, distal end	16
Least diameter of midshaft of fibula	7

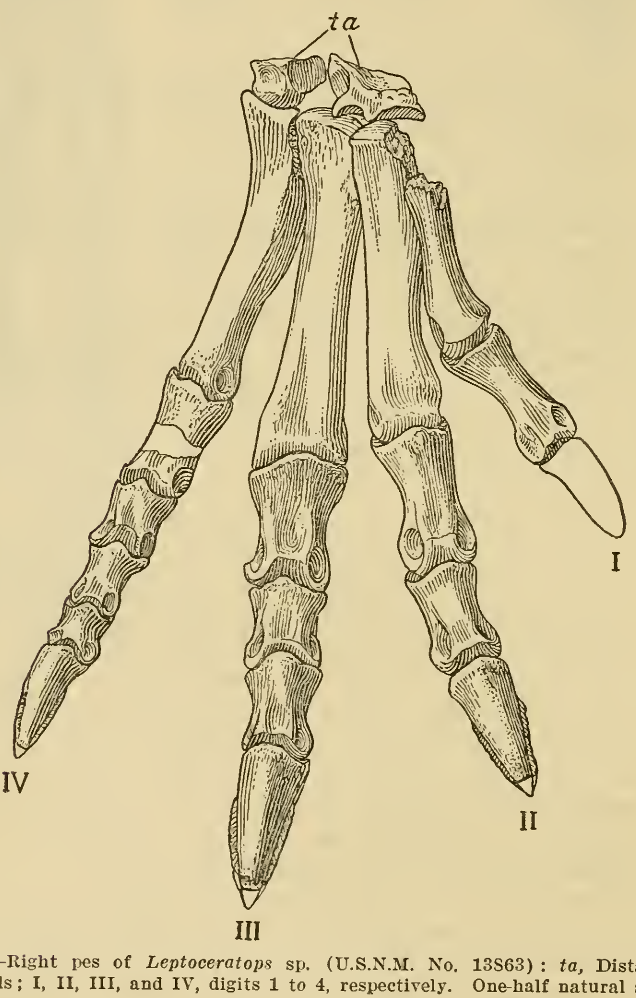


FIGURE 7.—Right pes of *Leptoceratops* sp. (U.S.N.M. No. 13863): *ta*, Distal row of tarsals; I, II, III, and IV, digits 1 to 4, respectively. One-half natural size.

The foot is complete except for the loss of the proximal end of metatarsal I and the ungual phalanx of digit I. It is possible that digit 5 may have been represented by a remnant of the metatarsal, but no trace of this bone was found.

Metatarsal I lacks its upper extremity, but it is quite evident from the relationships of the distal ends in the matrix (fig. 7) that it was about three-fourths the length of metatarsal II. The shaft is very slender, flattened on the inner side where it laps against metatarsal II,

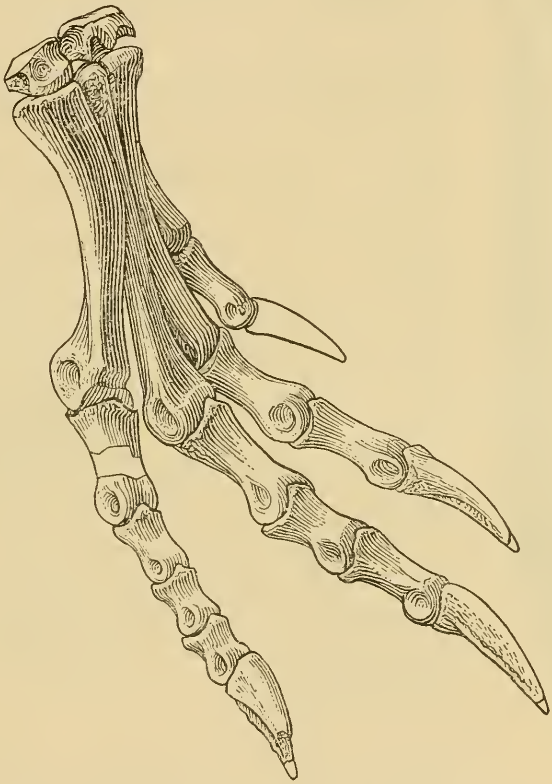


FIGURE 8.—Right pes of *Leptoceratops* sp. (U.S.N.M. No. 13863): Viewed diagonally. One-half natural size.

the lower end divaricated away from the axis of the foot. The articular face is subquadrangular, with the lateral sides of the end excavated, more especially the outer. Metatarsal II is slightly longer than metatarsal IV. The shaft is straight. The proximal end is elongated anteroposteriorly, the distal end transversely. Beginning about one-third its length from the distal end the outer side of the shaft thins out to a sharp edge and presents a flattened surface that looks more backward than outward and is closely opposed to metatarsal III when articulated. Below this beveled articular surface there is a slight divarication of the distal end outward from the axis of the foot. The proximal end is somewhat damaged through crushing, so that its precise form cannot be determined from this specimen. The distal face is quadrangular, the articular surface rounding well up on the anterior face and broadly hollowed out on the posterior side. The outer lateral face is slightly hollowed out.

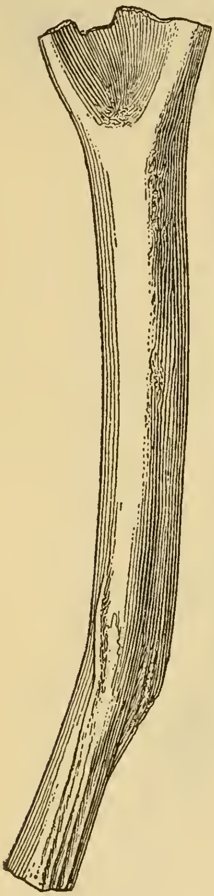


FIGURE 9.—Ischium of *Leptoceratops* sp. (U.S.N.M. No. 13864): Lateral view. One-half natural size.

Metatarsal III is the longest bone of the pes. Viewed from the front the distal end is widest, gradually narrowing to the proximal end where the greatest diameter is anteroposterior. The inner side presents a beveled surface that looks forward and inward for the articulation of metatarsal II. The outer border is flattened on the upper third for the articulation of metatarsal IV.

Metatarsal IV is widely expanded at the proximal end. The proximal articular face is subtriangular in outline, with a cupped surface. The shaft is flattened anteroposteriorly, with the outer border presenting a sharp edge. The inner side shows a hollowed-out proximal surface that becomes flattened ventrally and disappears below the middle of the bone. This flattened surface indicates the contact between metatarsal III and IV. Below this contact the bone is divaricated outward away from the axis of the foot.

The distal end has the greatest diameter anteroposteriorly, and the outer side of the distal end is hollowed out with a strong lip given off from the posterior border.

No trace was found of a vestigial metatarsal V.

The phalangial formula is the typical 2, 3, 4, 5, 0, and all but the ungual of digit I are present. The ends of both the metatarsals and the phalanges present smooth articular surfaces, thus indicating it to be a strong, compact, well-articulated foot.

The proximal phalanges have pully-shaped distal and concave proximal ends. A median, rounded, vertical ridge on the proximal end fits into a corresponding depression on the distal end of another, thus forming a strong union of the phalanges, which permits but little lateral motion. There are moderately deep, well-defined pits on the sides for the attachment of ligaments on most of the phalanges. The ungual phalanges are depressed as in all predentate Dinosauria, rather bluntly pointed, and slightly curved longitudinally. Digit III bears the most robust ungual.

There is a striking resemblance between this pes and that of *Camptosaurus*, in its general structure. The compact, strong articulations of the metatarsals and phalanges show *Leptoceratops* to have one of the most specialized hind feet of any known quadrupedal dinosaur with the exception of *Protoceratops*, which it closely resembles.

TABLE 2.—*Measurements of hind foot of* Leptoceratops *sp.* (*U. S. N. M. No. 13863*)

Measurement	Digits			
	I	II	III	IV
	Mm.	*Mm.*	*Mm.*	*Mm.*
Greatest length of metatarsals	------	100	108	92
Greatest anteroposterior diameter, proximal end	------	16. 5	------	15. 5
Greatest transverse diameter, proximal end	------	17. 5	------	19
Greatest transverse diameter, distal end	15. 3	18	23	17
Greatest length of first row of phalanges	41. 4	38	37	------
Greatest length of second row of phalanges	------	31	27. 5	21
Greatest length of third row of phalanges	------	35−	29. 5	21
Greatest length of fourth row of phalanges	------	------	41	18. 5
Greatest length of fifth row of phalanges	------	------	------	31−

Pelvic bones.—Portions of both ilia preserved with specimens U.S.N.M. No. 13864 resemble those of *Protoceratops* in having the blade portion nearly vertical and without the reflected upper border, found in other members of the Ceratopsidae. These bones bear a much closer resemblance to the ornithishian ilium than to those of the true horned dinosaurs. Shaft portions of both ischia of this same specimen (fig. 9) show them to be somewhat curved, as contrasted with the straighter ischia of *Protoceratops*.

Both Brown (*loc. cit.*) and Lull [6] have already stressed many points of resemblance between *Leptoceratops* and *Protoceratops*, and these newly acquired materials still further emphasize the nearness of this relationship. The genera, however, are distinctly separate, and I am in full accord with Lull who points out their wide divergence from all other members of the Ceratopsidae.

[6] Mem. Peabody Mus. Nat. Hist., vol. 3, pt. 3, 1933.

Family CERATOPSIDAE

Genus BRACHYCERATOPS Gilmore

BRACHYCERATOPS MONTANENSIS Gilmore

A disarticulated skull and a few bones of the skeleton obtained by the 1935 Smithsonian expedition in northern Montana is clearly referable to the genus *Brachyceratops*. It is of interest in displaying for the first time some of the adult skeletal features of this genus. This specimen is nearly twice the size of the type on which the genus was established, and it further demonstrates the very young character of those materials.

Although the generic relationship is clear, there may be some question as to its specific affinities, but for the present I shall regard it as belonging to *Brachyceratops montanensis*, attributing to more advanced age such differences in structure as are observed between it and the type. The specimen was found about a mile distant from the spot where the type was discovered, and on the south side of Milk River at approximately the same level in the formation.

The following elements of the skull and skeleton (U.S.N.M. No. 14765) were recovered: Right half of the frill lacking the squamosal; articulated left postorbital, jugal, postfrontal and prefrontal, lachrymal and supraorbital; right maxillary containing several teeth; left premaxillary, rostral, a portion of the right half of the nasal horn core; fragment of the basioccipital; unidentified skull fragments; both femora, left scapula, first rib; one dorsal vertebra and two phalangial bones.

This is the first undoubted *Brachyceratops* specimen to be found since the discovery of the types in 1913, and it now enables me to make several corrections in the restoration of the skull published in 1914. Furthermore, several skull elements not present in the type are here described [7] for the first time.

It is in the frill that the greatest growth changes have taken place, and attention is especially directed to the presence of a series of well-developed processes projecting outward from the border of the frill (fig. 10). In my description of the frill of the type specimen,[8] it was pointed out that there were "no epoccipital bones on the margins of the frill but a series of prominences on either side of the median emargination gave the periphery a peculiar scalloped effect." In the light of the specimen now before me it is evident that these prominences were the incipient processes so prominently developed in the adult skull. It further substantiates my original statement that there

[7] Gilmore, C. W., Smithsonian Misc. Coll., vol. 63, No. 3, pls. 1, 2, 1914.
[8] Gilmore, C. W., U. S. Geol. Surv. Prof. Paper 103, p. 12, 1917.

were no epoccipital bones developed on the frill of *Brachyceratops*, these processes being direct outgrowths of the frill itself. There is no indication of sutural contact, and were these processes separate ossifications as in *Triceratops*, *Pentaceratops*, and many other ceratopsian genera, there would be evidence of their union, since all other sutural contacts of the skull are plainly visible.

FIGURE 10.—Interparietal? of *Brachyceratops montanensis* (U.S.N.M. No. 14765): Viewed from above. One-seventh natural size.

Hatcher [9] has pointed out that in *Monoclonius* "they [the epoccipitals] are not derived from separate centers of ossification, as are the epoccipitals in *Triceratops*, but are present even in young individuals, firmly attached to and forming a part of the squamosals and parietals." That he was mistaken in this conclusion is shown by

[9] U. S. Geol. Surv. Monogr. 49, p. 19, 1907.

both Brown [10] and Lull,[11] who have found epoccipitals to be distinct ossifications in skulls of *Monoclonius flexus* studied by them. In a recent letter Dr. Brown says: "In Cope's type of *Monoclonius crassus* I cannot be sure whether they [epoccipitals] are separate."

While it is true that many aged individuals of the Ceratopsidae have complete coalescence of the epoccipital bones with the frill, in *Brachyceratops* we appear to have a type of frill ornamentation whose origin is unlike that of other horned *Dinosauria.*

Most of the epoccipital processes are incomplete, as this portion of the frill was protruding from the bank. There were certainly six, possibly seven, of these processes on the border of the interparietal? as contrasted with four on the *Monoclonius* frill. These decrease in size from above downward. On the left side of the median emargination the first two processes, although incomplete, are abnormal in development, either as the result of a diseased condition or of an old injury. There is no indication of forwardly directed processes at the rear of the fenestra as found in specimens of *Monoclonius.*

Although none of the borders of the fontanelle are preserved, this specimen demonstrates this opening to be farther removed from the central bar than indicated in the first restoration. Viewed laterally (fig. 11) the interparietal? is more concave from end to end than in the juvenile specimens.

The anterior median end is almost completely preserved, and it displays the same sutural borders for articulation as those of the juvenile specimen, which have been fully described.

At the time of describing the detailed skull structure of *B. montanensis*, following Hay [12] and von Huene,[13] the median element previously called parietal was referred to as the dermosupraoccipital or interparietal. Since that time two important papers have been published, Lull's [14] "Revision of the Ceratopsia" and Sternberg's [15] "Homologies of Certain Bones of the Ceratopsian Skull." The former returns to the use of parietal for the median element but without discussing the dissenting opinions; Sternberg, however, presents arguments based on a further study of the type skull of *Styracosaurus albertensis*, in which he attempts to prove this median element of the frill is the parietal, and further dissents from my identification of the postfrontals, which he calls frontals. Although willing to concede that there is reason for a difference of opinion as to my original interpretation of the bones in question, I

---

[10] Bull. Amer. Mus. Nat. Hist., vol. 33, p. 551, 1914.
[11] Mem. Peabody Mus. Nat. Hist., vol. 3, pt. 3, pp. 33, 34, 1933.
[12] Proc. U. S. Nat. Mus., vol. 36, p. 97, 1909.
[13] Neues Jahrb., Band 2, pp. 150–156, 1912.
[14] Mem. Peabody Mus. Nat. Hist., vol. 3, pt. 3, 1933
[15] Trans. Roy. Soc. Canada, vol. 21, sect. 4, 1927.

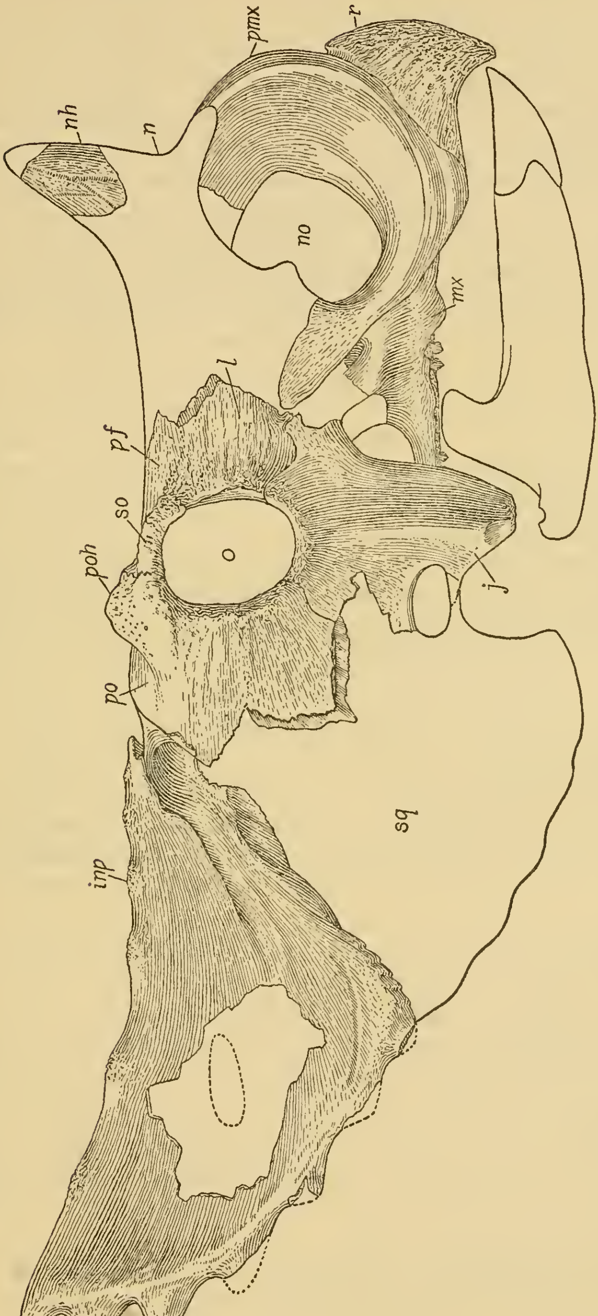


FIGURE 11.—Right lateral view of skull of *Brachyceratops montanensis* (U.S.N.M. No. 14765); *inp*, Interparietal?; *j*, jugal; *l*, lachrymal; *mx*, maxillary; *n*, nasal; *nh*, nasal horncore; *no*, anterior nareal opening; *o*, orbit; *pf*, prefrontal; *pmx*, premaxillary; *po*, postorbital; *poh*, postorbital horncore; *r*, rostral; *sq*, squamosal; *so*, supraorbital. About one-seventh natural size.

cannot believe that the correct answer to this perplexing problem has yet been found. Sternberg, I believe, has correctly determined the limits, and sutural unions of the so-called parietal and frontal bones in the *Styracosaurus* skull, for they are in perfect accord with my original assembly of the scattered elements of the *Brachyceratops* skull and substantiated by the adult specimen under discussion. My objection to accepting the proposed identifications rests entirely on the fact that neither of these bones gives any indication on their ventral surfaces of ever having participated in the formation of the brain case, which they do in all reptilian skulls of which we have knowledge. If it can be shown that they do enter into the formation of the brain case, I will then be willing to accept this latest interpretation.

The presence on one side or the other of most of the lateral elements of the skull now permits of a second restoration of the skull (fig. 11). This reconstruction presents details of some of the structure not given in the first attempt and presents for the first time an illustration of a nearly adult skull of this genus.

Though there is probability of error in assembling the disarticulated elements of a skull, some parts of which were slightly distorted, it is believed this reconstruction gives a fairly accurate representation of the cranium. The more striking growth changes of this specimen as contrasted with the juvenile skull are the development of prominent epoccipital processes along the borders of the frill and the lengthening of the facial region. The latter may be slightly exaggerated in the reconstruction. That fenestra were present in the frill appears to be indicated by the extreme thinness of the bone, although nowhere do the broken borders give any indication of a finished edge. The opening has been tentatively indicated in the drawing.

The left jugal preserved with specimen U.S.N.M. No. 14765 shows for the first time in *Brachyceratops* its exact relationships to the surrounding elements, as this bone was missing in the type specimen. In form it closely resembles the jugal in *Monoclonius*, from which it differs only in minor details. As in *Monoclonius* and *Chasmosaurus* the infratemporal fossa lies principally within the jugal, only its posterior border being formed by the squamosal. Above it forms about one-third of the orbital rim, articulating with the postorbital by a diagonally directed suture at the back of the orbit, and with the lachrymal at the front of the orbit.

Anteriorly the jugal sends forward a short process that is widely notched for union with the superior process of the maxillary. As in *Triceratops* a slender, forward-directed spur is interposed between the lachrymal and maxillary. Posteriorly the lachrymal articulated with the squamosal, but the damaged condition of this border renders its precise outline somewhat uncertain. The jugal thus forms the external surface of the skull between the orbit and forward of the infratemporal fossa. Its relations to the surrounding elements is well shown in figure 11.

If an epijugal was present in *Brachyceratops* it was extremely small. A small rounded pit on the outer posteroventral border may represent the seat of this missing element (fig. 11).

The lachrymal is a subquadrangular bone that fills the interspace between the jugal below and the prefrontal (frontal of authors) and supraorbital above. Its thickened posterior end contributes to the formation of the anterior border of the orbit for a space of 42 mm. Its lower anterior end is notched and forms the posterior boundary of the preorbital fossa. The upper portion of this end was broadly in contact with the nasal and probably the posterior branch of the premaxillary, a point that cannot be positively determined from this incomplete specimen. Viewed laterally the jugal-lachrymal suture loops downward into the jugal as in *Monoclonius*, instead of continuing straight forward and downward from the orbit as in many ceratopsians.

The supraorbital is a rectangular blocklike bone whose thickened outer border forms the upper anterior portion of the orbital rim between the lachrymal below and the postorbital above. Internally it is wholly in contact with the prefrontal. It is quite evident from this specimen that there is early coalescence of the sutures and that in aged individuals all trace of them would probably be obliterated through fusion. This element was entirely missing in the type, but its presence was indicated by the surrounding sutural borders.

In the right maxillary the unworn crowns of seven young teeth are preserved. Four are near the front of the dental series, probably the second, third, fourth, and fifth. The other three are near the back of the series. These teeth agree in all particulars with the young teeth of the type specimen, which have been described.[16] About the only new information regarding the teeth to be gained from the present specimen is that the anterior teeth are considerably smaller than the posterior ones. The total number of teeth in the maxillary series cannot be positively determined in this specimen, owing to injury of the alveolar borders, but it would seem to be in accord with the original determination of 20.

A median portion of the right half of the nasal horn shows it to be divided into right and left halves as in the type specimen. The internal side is flattened, this surface being sculptured by alternating longitudinal grooves and flat-topped ridges that probably fitted into

---

[16] Gilmore, C. W., U. S. Geol. Surv. Prof. Paper 103, p. 16, figs. 18–20, 1917.

their counterparts on the opposite side. A portion of the anterior border indicates the horn to have been slightly recurved. The external surface is sculptured by a few longitudinal ramifying vascular grooves.

The left premaxillary is preserved in almost its entirety. It shows the median septum to be more extensive with a resulting diminution in size of the nareal opening through these bones as contrasted with the original restoration of this part of the skull; also the ascending posterior process is longer and thus extends back farther on the side of the face. It closely resembles the premaxillary of *Monoclonius* in being short and deep.

The rostral except for its larger size is in perfect agreement with the rostral of the immature specimens. The outer surfaces are more rugose, a difference naturally expected in an animal of more advanced age.

The left scapula is nearly twice the size of those found with the typical specimens, but it is in accord with them in all respects. The blade is relatively narrower, especially at the center, than in any of the *Monoclonius* scapulae with which it was compared.

The single anterior dorsal vertebral preserved with this specimen agrees in all particulars with those of the type specimen. It shows the same strongly elevated diapophyses with relatively small centrum. The femora are about 580 mm. long, this measurement being uncertain because of the crushing to which both have been subjected. On this account they offer no basis of comparison with those of other members of the Ceratopsia.

In 1933, after reviewing the skeletal characters of the *Brachyceratops* skeleton, Lull[17] remarks: "The relationship of *Brachyceratops* with other genera is obscure." This study of a nearly adult specimen I believe clears up some of that obscurity. It now seems quite apparent that its closest affinities are with the genus *Monoclonius*. The short, deep facial region of the skull; similarities in frill development, especially the short squamosal; small brow horns and large nasal horns; and saddle-shaped crest are all features held in common. A summary of the distinguishing skull features of *Brachyceratops* are as follows: Longitudinal division of the nasal horn; reduced number of teeth in the dental series; epoccipital processes outgrowths of the frill not separate ossifications; greater number of epoccipital processes on the frill; and small fenestra in the frill.

[17] Mem. Peabody Mus. Nat. Hist., vol. 3, pt. 3. p. 102, 1933.

U. S. GOVERNMENT PRINTING OFFICE: 1939

PROCEEDINGS OF THE UNITED STATES NATIONAL MUSEUM

issued by the

SMITHSONIAN INSTITUTION
U. S. NATIONAL MUSEUM

Vol. 87 Washington: 1939 No. 3067

TWO NEW PARASITIC ISOPODS FROM THE EASTERN COAST OF NORTH AMERICA

By A. S. Pearse and Henry A. Walker

Entoniscids are degenerate isopod crustaceans that live within, or at times outside, the bodies of other crustaceans. They have not hitherto been reported from North America, though they have been found in Brazil and Greenland. This paper describes two new species, from North Carolina and Prince Edward Island. These were taken from xanthid crabs. During the summer of 1938 we examined 622 specimens of *Panopeus herbstii* Milne-Edwards at Beaufort, N. C., and 227 *Neopanope texana* (Smith) at Ellerslie, Prince Edward Island. From these males, females, eggs, larvae, and young entoniscids were obtained. Grateful acknowledgement is made to Dr. H. F. Prytherch, director of the Beaufort Biological Station of the United States Bureau of Fisheries, and to Dr. A. W. H. Needler, director of the Prince Edward Island Station of the Fisheries Research Board of Canada, for many courtesies extended to us at their respective stations.

Genus CANCRION Giard and Bonnier

CANCRION CAROLINUS, new species

Figure 12

Female.—Body bent, so that the dorsal side of abdomen is against the dorsal side of thorax; length, flexed 15 mm., extended 24 mm. The cephalogaster bears two large ovate lobes, 2.5 mm. long (fig. 12, *B*, *cg*); in front of these are a pair of small (0.5 mm.) spherical maxillipeds (*mf*). The thorax bears five pairs of oostegites. On the dorsal side of the abdomen is a prominent hemispherical cardiac tubercle. The pleura (*pl*) and exopods (*ex*) on the abdomen are deli-

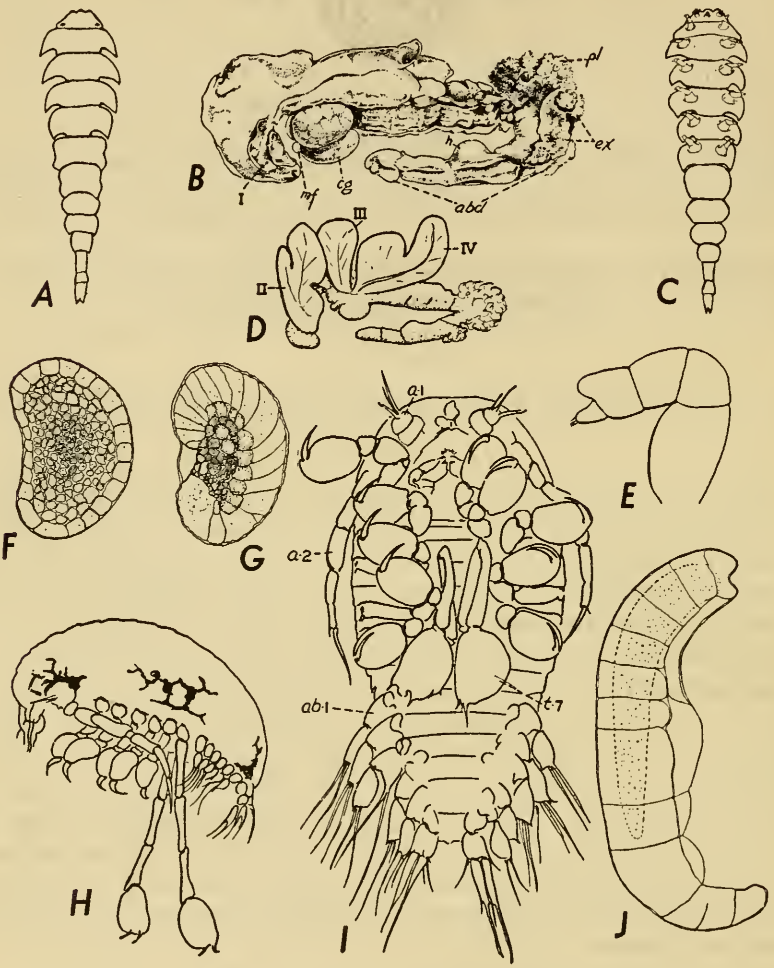


FIGURE 12.—*Cancrion carolinus*, new species: *A*, Dorsal view of male; *B*, lateral view of female (*abd*, abdomen; *cg*, head, or cephalogaster; *ex*, exopods of second and third abdominal segments; *h*, cardiac prominence; *mf*, maxilliped; *pl*, pleural lamellae of first abdominal segments); *C*, ventral view of male; *D*, side view of female showing oostegites (II–IV); *E*, posterior view of third right leg of male; *F*, *G*, developing eggs; *H*, sketch of side view of epicarid larva; *I*, camera-lucida drawing of ventral side of epicarid larva (*a–1*, first antenna; *a–2*, second antenna; *ab–1*, first abdominal leg; *t–7*, last thoracic leg; *j*, young female from body cavity of a crab.

cate, much folded, and convoluted. The first pair of oostegites (I) are small and folded against the side of the frontal prominence; the second pair (fig. 12, *D*, II) cover the first when seen laterally and are notched distally; the third pair (III) are truncate and expanded distally; and the fourth (IV) are notched and extend to the abdominal pleura. The brood chamber is closed in most adults. All oostegites are supported by chitinous thickenings arranged like the veins in an apple leaf. The last three abdominal appendages are absent, but pleural folds are present along the lateral margins, those of the first three form complicated folded structures.

Male.—Body (fig. 12, *A*, *C*) slender, tapered toward posterior end; length 2.1 mm. Head weakly trilobed in front, twice as wide as long, anterior less than half width of posterior margin, two small, laterally elongated eye spots near posterior angles. Antennae absent; antennules 1-segmented, very short, not reaching beyond frontal margin, with 11 setae at tip. The styliform mandibles are enclosed in a suctorial oral cone. Thoracic legs (fig. 12, *C*, *E*) stout, 5-segmented; the penultimate segment expanded distally; the terminal segment much narrower, conical, and bearing two spines at its tip. Abdomen without appendages; terminal segment notched at tip and the rami acute. Males were always found attached to females.

Development.—During July eggs and developmental stages were found (fig. 12, *F*, *G*) in females, and on September 2 a female with epicarid larvae in her brood pouch was found (fig. 12, *H*, *I*). The latter were remarkable for the great length of their last thoracic legs (*t-7*) and swam about actively in sea water. In July wormlike young females of various sizes were found. Apparently the epicarid larva molts into a young female without appendages (fig. 12, *J*).

Occurrence.—Females occurred in various positions in the thoracic cavity of crabs, and males present were clinging to them. Once two mature females were present in one crab; in another crab there were a mature female and two young females. In the 622 crabs examined at Beaufort 3 males, 5 mature females, and 5 young females were collected. The best collecting ground was found to be the marsh east of the railroad bridge at Beaufort; 51 crabs examined from other localities yielded nothing.

Types.—Female holotype, U.S.N.M. No. 77217, from *Panopeus herbstii* Milne Edwards, Beaufort, N. C., September 2, 1938. Male allotype, U.S.N.M. No. 77218, same locality and host, July 13, 1938, A. S. Pearse, collector.

CANCRION NEEDLERI, new species

FIGURE 13

Only one pair of this entoniscid was collected in the body of the first crab examined at Ellerslie, Prince Edward Island; 226 other crabs were searched carefully but no more parasites were found, except one other dead, shriveled female entoniscid.

Female.—Body straight; abdomen not flexed on thorax; length 18 mm. The rounded frontal lobes project dorsally and anteriorly;

total length, 8 mm.; the cockscomblike middle lobe (5.2 mm.) longer than the other two; cephalogastric lobes are spherical, 2.7 mm. in diameter; maxillipeds very small and inconspicuous. The thorax shows a pair of low prominences for the anterior oostegites (*p*) and the last two appear as paired conical papillae (IV, V). The anterior portion of the abdomen is covered by loose, wrinkled, fluffy pleura (*pl*) and exopods (*ex*); behind these three well-defined segments with rounded lateral expansions connect with a small rounded terminal segment. Length of cephalothorax, without frontal lobes, 9.5 mm.; length of abdomen, 7 mm.

Male.—Body rather plump, tapered from middle posteriorly; length 1.4 mm. Head rounded (fig. 3, *B*), not angulate, about twice as wide as long; with two large, round eyespots near posterolateral borders. Terminal segment of abdomen (fig. 13, *C*) bifid at tip, with rami blunt and rounded.

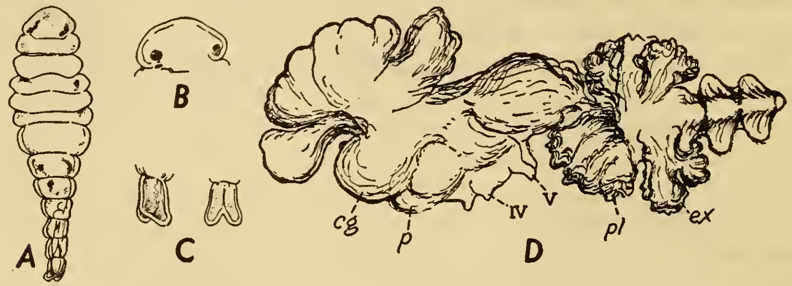


FIGURE 13.—*Cancrion needleri*, new species: *A*, Dorsal view of male; *B*, dorsal view of head of male; *C*, lateral and dorsal views of posterior end of male; *D*, female (*cg*, cephalogaster; *ex*, exopods of second and third abdominal segments; *p*, oostegites I–III; *pl*, pleural lamellae of first abdominal segment).

Types.—Female holotype and male allotype, U.S.N.M. No. 77216, from *Neopanope texana* (Smith), Ellerslie, Prince Edward Island, August 4, 1938, A. S. Pearse, collector.

The two entoniscids described belong in the genus *Cancrion* as defined by Giard and Bonnier (1887), on account of the character of the epicarid larva (p. 228) and adults (p. 239). They differ as follows from the three species previously described: In females the anterior oostegites have fewer and less prominent lobes, the abdominal segments are more clearly defined, the branchial pleural lamellae are confined to the first three abdominal segments, and the cardiac prominences are low; in males groups of denticles are absent from the abdominal segments and thoracic legs, the head is short and broad, and the thoracic pleural lamellae are narrow. They more closely resemble each other than the three species described by Giard and Bonnier from crabs of the genera *Xantho* and *Pilumnus* along the coast of France.

BIBLIOGRAPHY

ATKINS, DAPHNE.

1933. *Pinnotherion vermiforme* Giard and Bonnier, an entoniscid infecting *Pinnotheres pisum*. Proc. Zool. Soc. London, 1933, pp. 319–363, 14 figs., 6 pls.

BONNIER, JULES.

1900. Contribution à l'étude des épicarides—Les Bopyridae. Trav. Zool. Stat. Wimereux, vol. 8, 475 pp., 41 pls.

CAULLERY, MAURICE.

1922. La parasitisme et la symbiose, 400 pp., 53 figs. Paris.

GIARD, ALFRED, and BONNIER, JULES.

1887. Contributions à l'étude des bopyriens. Trav. Inst. Zool. Lille et Stat. Mar. Wimereux, vol. 5, 272 pp., 10 pls.

KOSSMANN, ROBBY.

1881. Studien über Bopyriden. Zeitschr. Wiss. Zool., vol. 35, pp. 652–680, 4 pls.

1882. Endoparasitismus der Entoniscidens. Zool. Anz., vol. 5, pp. 57–61.

RICHARDSON, HARRIET.

1904. Contributions to the natural history of the Isopoda. Proc. U. S. Nat. Mus., vol. 27, pp. 1–89, 92 figs.

U. S. GOVERNMENT PRINTING OFFICE: 1939

PROCEEDINGS OF THE UNITED STATES NATIONAL MUSEUM

issued by the

SMITHSONIAN INSTITUTION
U. S. NATIONAL MUSEUM

Vol. 87 Washington: 1939 No. 3068

THE HEDERELLOIDEA, A SUBORDER OF PALEOZOIC CYCLOSTOMATOUS BRYOZOA

By Ray S. Bassler

The middle and upper Paleozoic strata of North America contain many incrusting, tubular, corallike organisms usually classified as aberrant cyclostomatous Bryozoa. *Hederella*, *Reptaria*, and *Hernodia* are the best-known genera, each represented by a few previously described species some of which have been identified from such widely separated horizons and localities that their names have little stratigraphic significance. The care of large collections of these fossils accumulated in the United States National Museum during the past 30 years led me to take up their study and, in 1934,[1] to propose the name Hederelloidea as a new order of the Cyclostomata, since the typical bryozoan ancestrula was observed in a number of the species. With the present-day recognition of the Cyclostomata as an order, the Hederelloidea becomes subordinal in rank. At present all the six known genera are classified under a single family—Reptariidae Simpson, 1897.

The earliest known forms of cyclostomatous Bryozoa occur in the lowest Ordovician (Buffalo River series) of Arkansas, where several species of *Crepipora* Ulrich, 1882, of the suborder Ceramoporoidea occur. This suborder expands rapidly, particularly in the Devonian and Mississippian periods, with the very abundant development of *Fistulipora* and its allies, but so far as known becomes extinct with the close of the Paleozoic. In the Chazyan, following the Buffalo

[1] Proc. Geol. Soc. America for 1933, p. 346, 1934.

River series, the Cyclostomata are represented also by typical examples of the suborder Tubuliporina, with *Stomatopora*, *Corynotrypa*, *Proboscina*, and *Berenicea* abundant until the Middle Silurian, where a few species occur. In the Middle Devonian appeared the last Paleozoic representatives of Tubuliporina, comprising a single species of *Corynotrypa* from France and one from Ontario. Then in early Mesozoic times species of this suborder reappear in large numbers, forming the predominating Bryozoa throughout this era and continuing in less abundance throughout the Cenozoic and into Recent seas. Curiously enough the range of the Hederelloidea occupies the interval from the Silurian to the Permian, where the Tubuliporina are either very rare or entirely absent. The relations of the lower Paleozoic to the post-Paleozoic Tubuliporina, therefore, become as interesting a question as those of the Hederelloidea to the Tubuliporina in general.

Close study of the American Hederelloidea reveals a considerable number of species, not all of which are described in this paper. A typical *Hederella* from the Middle Devonian of Australia is also herein described, and comments are made upon species of the several genera known to occur in Europe, especially in the Eifel Devonian,[2] and in the Bohemian Silurian and Devonian.[3] Furthermore, only the species with incrusting zoaria belonging to the genera *Hederella*, *Reptaria*, *Hernodia*, and the new genus *Hederopsis* are treated here. In general these species usually have the appearance of giant examples of *Stomatopora* or *Proboscina*, this resemblance being emphasized by the same bulblike ancestrula noted in some of them. However, the Hederelloidea differ, first, in that the walls are less perforate than in the Tubuliporina; second, each zooecium is separate and not merged in a general crust; third, lateral budding occurs with probably a perforated plate of separation between the zooecia, represented at the surface as a distinct suture line; and fourth, the zooecial aperture is transversely elliptical and terminal, equaling the width of the tubes. This assemblage of characters seems to justify the suborder.

Closely resembling the Hederelloidea and occurring in practically the same geologic range are the Auloporidae, including the Moniloporidae of Grabau. This family, externally very similar but containing still larger tubular organisms, is now placed with the corals, although its systematic position requires further study. A ready method of distinction from the Reptariidae is that the Auloporidae have terminal gemmation instead of lateral budding with no line of separation at the surface, circular orifices, and thick imperforate walls.

---

[2] Solle (Gerhard). *Hederella*, eine amerikanische Bryozoen Gattung im rheinischen Unterdevon., Senckenbergiana, vol. 19, pp. 15–21, 1937. (*H. rhenana* and *H. applicata*, new species.)

[3] Prantl, Ferdinand. Revision of the Bohemian Paleozoic Reptariidae (Bryozoa), Acta Musei Nationalis Pragae, vol. 1 (B), No. 6, pp. 73–84, pl. 4, 1938.

The discrimination of the Reptariidae is difficult because a single species presents so many variations in growth. Zoaria growing upon smooth organisms exhibit the size of zooecia and method of branching and budding characteristic for the species, but when, as in many cases, the host presents an uneven, often rough surface, the aspect of the zoarium is considerably changed. Age also has its effect, for the youthful zoarium may appear so different from older examples of the same species that numerous specimens are necessary to determine the true specific limits. Fortunately the measurements as to size of zooecia and angle of branching seem to be fairly constant when averages are considered.

For convenience of description, the following terms are employed in this paper: The *zoarium* commences with a bulblike *ancestrula*, from which the initial *zooecial tube* emerges to give rise by lateral budding, alternating to the right and the left, to the primary branch. This, therefore, consists of individual *zooecia* springing from about the middle of the side of the preceding tube so that apparently a continuous central tube appears to be present. Then after a certain distance characteristic for the species, one of the tubes, branching off at a definite angle, continues to bud in that direction and forms a new branch, which later on will repeat the process until finally the entire zoarium is produced, made up of primary, secondary, and even later branches. Thus, the angle of branching of the zoarium may be distinguished from the angle at which the individual tubes bud, and branching and budding, although based upon the same phenomenon, should be discriminated. With these distinctions in mind, the specific characters then comprise the angle and interval of zoarial branching, the angle and frequency of budding of the individual tubes, the length and width of the tubes, the number of tubes occurring along a branch in a definite distance, their rate of expansion, and their surface ornamentation. The measurements are computed as follows: The diameter of a tube is taken at its distal end, the length of a zooecium is that of a normal bud from a branch, and the number of zooecia in a given length is measured along the same side of a regularly developed branch. The bibliography of this suborder is not large, and it is believed that all references to the literature are cited in the course of this paper.

The Paleozoic Cyclostomata as well as the Trepostomata in most instances form solid calcareous colonies, grouped together as stony Bryozoa. Special care is necessary in illustrating these Bryozoa, and many articles even of recent date have been published with wholly inadequate illustrations. I have devoted much time to the subject of proper illustration of such fossils, and a grant from the Penrose Fund of the Geological Society of America has enabled me to prepare the illustrations for much unpublished work on the stony Bryozoa. The present contribution is the first to appear under this grant. Most of the type specimens herein described are the property of the U. S. National Museum.

The general characters of this suborder and its genera are described below. Then follow in order the descriptions of species, faunal lists showing geological and geographical distribution, and finally a table of measurements for use in the separation of species.

Order CYCLOSTOMATA Busk

Suborder HEDERELLOIDEA Bassler, 1934

Zoarium usually incrusting but sometimes rising into solid branches composed of tubular zooecia with perforated walls derived from a bulbous ancestrula, as in typical Cyclostomata. Zooecia of individual tubes, budded from the lateral wall of the preceding zooecium, the ends of each separated by a plate, probably perforated; apertures transversely elliptical and terminal equaling the diameter of the zooecial tubes.

Family REPTARIIDAE Simpson, 1897

Family characters as for the suborder.

Range.—Middle Silurian to Mississippian.

Genus HEDERELLA Hall, 1881

Zoarium attached to various foreign organic objects and rarely to pebbles or other inorganic substances, branching, consisting of a tubular axis composed of the earlier part of successive zooecia from which the zooecia bud laterally, alternately to right and left; tubes annulated transversely and finely striated longitudinally; apertures terminal, transversely elliptical (fig. 14, A, B).

Genotype.—*Alecto canadensis* Nicholson, 1874. Middle Silurian to Mississippian.

Genus HERNODIA Hall, 1881

Zoarium as in *Hederella* but consisting of linear series of elongated club-shaped zooecia with no central tubular axis, budding alternately from about the middle of the sides of preceding zooecia; each zooecium gives rise to one or more daughter zooecia (fig. 14, *C*).

Genotype.—*H. humifusa* Hall, 1881. Upper Silurian, Devonian.

Genus REPTARIA Rollé, 1851

Zoarium incrusting, formed of regularly dividing parallel-edged branches, composed of short, cylindrical, annulated zooecia of equal length, in contact but not coalescing along their sides and proceeding in the plane of their host laterally upward from a median line and then gently outward. Gemmation takes place at the initial portion

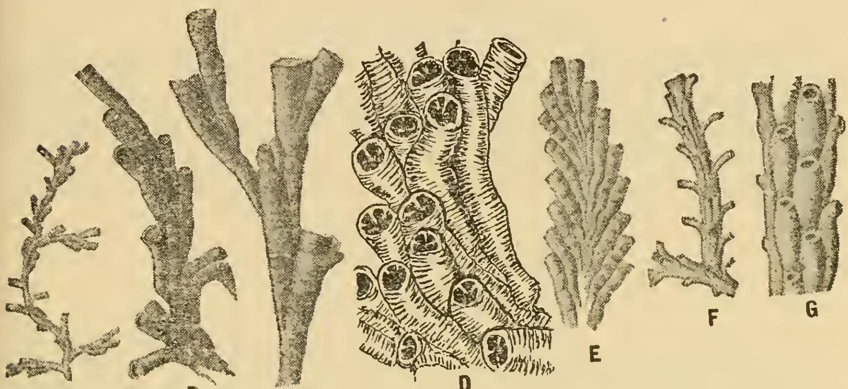


FIGURE 14.—GENERA OF REPTARIIDAE

A, B, Hederella Hall, 1881: *A*, Portion of the incrusting zoarium (× 2) of a typical species, *H. filiformis* (Billings, 1859), illustrating budding at angle of 45° and branching at nearly right angles; *B, H. parallela*, new species (× 8), in which the tubes bud at such a low angle as to remain practically in contact.

C, Hernodia Hall, 1881: Genotype, *H. humifusa* Hall, 1881 (× 4); the incrusting zoarium is characterized by linear club-shaped zooecia, each budding at an acute angle from about the middle of the preceding tube.

D, Hederopsis, new genus: Sketch of genotype, *H. typicalis*, new species (× 4), showing carina within the tubes.

E, Reptaria Rollé, 1851: Small portion of genotype, *R. stolonifera* Rollé, 1851 (× 4); the parallel-edged branches formed of closely adjacent tubes, arising alternately from the basal portions of the preceding ones, characterize the genus.

F, Clonopora Hall, 1881: Fragment (× 4) of genotype, *C. semireducta* Hall, 1881, illustrating erect cylindrical growth.

G, Cystopora Hall, 1881: Genotype, *C. geniculata* Hall, 1883 (× 6), much resembling *Clonopora* but differing in the terminal constriction of the zooecial tubes.

(All figures except *D* after Hall and Simpson, 1887.)

of the preceding opposite zooecium so that no central line of tubes occurs as in *Hederella* (fig. 14, *E*).

Genotype.—R. stolonifera Rollé, 1851. Upper Silurian, Devonian.

HEDEROPSIS, new genus

Similar to *Hederella* in form of zoarium and general zooecial structure, but within the tubes on their basal side there occurs a well-defined longitudinal septum, joined by transverse partitions, outlining two rows of compartments (fig. 14, *D*).

Genotype.—H. typicalis, new species. Middle Devonian.

Genus CLONOPORA Hall, 1881

Zoarium ramose, branches cylindrical, consisting of elongate tubular zooecia cohering for part of their length then bending outward and becoming free; apertures terminal, not contracted, arranged in rings or spirally around the branch (fig. 14, *F*).

Genotype.—*C. semireducta* Hall, 1881. Lower and Middle Devonian.

Genus CYSTOPORA Hall, 1881

Zoarium cylindrical, ramose, consisting of tubular flask-shaped zooecia cohering for the greater part of their length; distally the zooecia bend outward becoming free and much contracted; apertures transversely elliptical, subterminal (fig. 14, *G*).

Genotype.—*C. geniculata* Hall, 1881. Lower and Middle Devonian.

DESCRIPTIONS OF SPECIES

Genus HEDERELLA Hall, 1881

Hederella Hall, Trans. Albany Inst., vol. 10, p. 194, 1883 (abstract, p. 194, 1881).—Hall and Simpson, Pal. New York, vol. 6, p. 26, 1887.—Miller, North Amer. Geol. Pal., p. 308, 1889.—Simpson, 14th Ann. Rep. State Geol. New York, 1894, p. 599, 1897.—Grabau, Bull. Buffalo Soc. Nat. Sci., vol. 6, p. 178, 1899.—Nickles and Bassler, U. S. Geol. Surv. Bull. 173, p. 21, 1900.—Prantl, Acta Mus. Nat. Pragae, vol. 1 (B), p. 75, 1938.

Nicholsonia Davis (part), Kentucky Foss. Corals, pt. 2, 1885 (name proposed but not defined). [Genotype: *N. canadensis* Davis (not Nicholson) = *Hernodia davisi* and *Hederella contortilis*, new species.]

Thamnocoelum Počta, Syst. Silur. Boheme, vol. 8, p. 208, 1894. (Genotype: *T. fruticosum* Počta, 1894.) Silurian of Bohemia (see pl. 12, fig. 2).

This widespread genus is so prolific in species that it is convenient to subdivide it into four groups: (1) The *Hederella canadensis* group, which includes the numerous species with small zooecia and the rather simple structure of the genotype; (2) the *H. alpenensis* group, in which the branches divide frequently and the zooecia bud regularly and alternately; (3) a group characterized by *H. magna*, where the tubes, although large, are comparatively short and rapidly expanding with wide-open apertures; and (4) the *H. parallela* group wherein the zooecia remain so long in contact as to appear parallel. In each of these groups the branching and budding and size of tubes are fairly constant in the initial and mature stages, but old examples often develop such a dense network around the oldest part of the zoarium that the real specific characters can be seen only in the younger portions of the colony. Bohemian species of this genus not considered in the present article are *H. fruticosa* (Počta) 1894, *H. formosa* Prantl, 1938, and *H. obscura* Prantl, 1938.

HEDERELLA CANADENSIS GROUP

Zoarium consisting of a single, narrow, tubular axis formed of the initial portions of successive zooecia branching at rather regular angles and distances, with the zooecial tubes arising one at a time alternately to right and left from about the middle of the side of the preceding one. For comparative purposes the 34 species here described under this group are arranged under four headings: (1) The typical section with 13 species with small zooecia, (2) the ten species grouped around *H. vagans*, with wider unilinear branches loosely subdividing and budding at long intervals, (3) three species with long straight tubes as in *H. blainvillei*, and (4) nine species characterized by *H. thedfordensis*, with a robust zoarium of rather long, wide, frequently budding zooecia.

Hederella canadensis section

HEDERELLA CANADENSIS (Nicholson, 1874)

PLATE 7, FIGURES 2–4

Alecto ? canadensis NICHOLSON, Can. Nat., ser. 2, vol. 7, p. 146, 1874.
Aulopora ? canadensis NICHOLSON, Pal. Prov. Ontario, p. 124, fig. 57a–e, 1874.
Hederella canadensis HALL, Trans. Albany Inst., vol. 10, p. 194, 1883 (abstract, p. 194, 1881); Rep. State Geol. New York 1883 p. 53, 1884.—MILLER, North Amer. Geol. Pal., fig. 483 (p. 308), 1889.—WHITEAVES, Contr. Can. Pal., vol. 1, p. 210, pl. 28, figs. 8, 8a, 1891.—SIMPSON, 14th Ann. Rep. State Geol. New York, 1894, pl. 25, figs. 12, 13, 1897.—GRABAU, Bull. Buffalo Soc. Nat. Sci., vol. 6, p. 178, fig. 77, 1899. Not *Hederella canadensis* HALL and SIMPSON, Pal. New York, vol. 6, pl. 65, figs. 1–7, 14, 16, 1887 (includes various species from the Hamilton at York, N. Y., as follows: Figures 1, 6, and 8=*H. filiformis* (Billings, 1859); 2=*H. thedfordensis* n. sp.; 3=*H. parallela* n. sp.; 4=*H. cirrhosa* Hall, 1881; 5, 7=*H. delicatula* n. sp.; 14=*H. vagans* n. sp.; 16=*H. contortilis*).

Specimens from both the Onondaga limestone and the Hamilton shales were included among the original figured types of this species, but the original of figure 57c of Nicholson's illustration is here selected as the holotype, as it appears to be the most accurate drawing and, moreover, agrees exactly with a topotype in the U. S. National Museum collections identified by Nicholson himself. As thus restricted, *H. canadensis* is a slender, delicate species occurring usually as molds in the siliceous Onondaga fossils of Ontario, but gutta-percha squeezes furnish excellent representations of the surface. The zoarium incrusts cup corals and other objects and consists of a narrow tubular axis, which branches at rather regular intervals of about 5 mm. at an angle of 30°, from which the zooecia are given off alternately to the right and left at distances averaging 1.2 mm.; measuring on the same side of the axis 3 to 4 zooecia occur in 5 mm. The zooecial tubes are indistinctly annulated, are about 0.2 mm. in diameter and 0.7 mm. long, with the aperture terminal, transversely oval; they arise from the branch at such an acute angle that they often remain in contact with it. Although much like *H. cirrhosa* Hall, 1881, *H. canadensis* has smaller dimensions.

Occurrence.—Middle Devonian (Onondaga): Port Colborne, Ontario (Decewville limestone); vicinity Ann Arbor, Mich. (drift).

Plesiotype.—U.S.N.M. Nos. 52961, 87898.

HEDERELLA SILURIANA, new species

PLATE 13, FIGURE 3

The type and only known example of this, the oldest known species of the Hederelloidea, incrusts a brachiopod, *Protothyris didyma* (Dalman), from the Silurian of Gotland, and at first sight seems to represent a well-developed *Stomatopora*. Closer examination shows it is an infrequently branching *Hederella* with short zooecial tubes of about the same dimensions as in *H. rectifurcata*. The type consists of several overlapping branches, but a single one exhibits branching at a right angle and 2 mm. intervals, with very short zooecial buds 1 to 2 mm. long, 0.4 mm. in diameter, arising 3 mm. apart on the same side of the branch at nearly a right angle. More careful comparison with *H. rectifurcata* will show other differences, such as the extreme angularity of branching and budding in the latter.

Occurrence.—Silurian (Gotlandian): Island of Gotland (probably Klintehamn).

Holotype.—U.S.N.M. No. 93954.

HEDERELLA COLBORNENSIS, new species

PLATE 7, FIGURE 1

Associated with the genotype, *H. canadensis*, at Port Colborne and closely simulating it in size, this new species differs in the more straggly arrangement of the branches and the longer and more infrequently budding zooecia. Here the general zooecial arrangement is much as in *H. vagans*, but all of the dimensions are smaller and the zooecia themselves consist of elongated tubes budding from the main axis in a decided curve at an acute angle. Branching irregular but usually about 4 mm. apart at 60° angle. Length of zooecial tubes about 1.25 mm.; width 0.3 mm.; 4 to 5 zooecia in 5 mm.

Occurrence.—Onondaga (Decewville limestone): Port Colborne, Ontario.

Holotype.—U.S.N.M. No. 87986.

HEDERELLA CONCINNA, new species

PLATE 7, FIGURES 10–15; PLATE 15, FIGURE 2

A delicate species resembling *H. canadensis* in general size and zoarial form, but differing in that the zooecial tubes are longer and arise more regularly from the axis at shorter distances and at such a low angle (30° or less) that they frequently remain in contact with it. Closer measurements show that the diameter of the tubes is 0.3 mm., with 5 to 6 tubes in 5 mm. Length of zooecial tubes about 0.75 mm.; branching somewhat irregular but often at right angles and at intervals of more than 5 mm.

Occurrence.—Middle Devonian: Erie County (cotype) (Wanakah shale), 3 miles west of East Bethany (cotype) and Livingstone County (Centerfield shale), near Pavilion, 1½ miles south of East Bethany, and Darien (Tichenor limestone), and Kashong Creek (Ludlowville shale), all in New York; Thedford (cotype) and Arkona, Ontario (Widder shale); Bell quarry, 2.1 miles east of Bay Shore, Emmet County (Traverse-Gravel Point limestone) and 1½ miles northeast of Bay View (Traverse-Petoskey formation), Mich.; Sandusky, Ohio (Onondaga-Columbus limestone).

Cotypes.—U.S.N.M. Nos. 54078, 87955, 87957, 87961, 87884.

HEDERELLA PARVIRUGOSA, new species

PLATE 6, FIGURES 12–14

This new species shows considerable resemblance to *H. concinna*, but comparison of the illustrations magnified on the same scale indicates that it is larger in all its dimensions. The branches subdivide at intervals of about 7 mm. when the growth is normal, in which case 4 zooecia occur in 5 mm. The zooecia are short, 1 mm. long and 0.35 mm. wide, expand rapidly and arise regularly at angles of about 45°, often remaining free the greater part of the length.

H. regularis is a related form but has smaller zooecial measurements, with branching more frequent and more regular. *H. arachnoidea* is similar but has less rapidly expanding zooecia.

Occurrence.—Middle Devonian: Elma (cotype) (Wanakah shale), Skaneateles Lake (Ludlowville shale), Moscow (cotype) (Moscow shale), Pavilion (Tichenor limestone), and 1½ miles southeast of East Bethany (Kashong shale), all in New York; Thedford (cotype), Marshs Mill, 2½ miles east of Arkona, Ontario (Widder shale); 2½ miles southwest of Sylvania, Ohio (Silica shale); 3½ miles west of Charlestown, Ind. (Silver Creek dolomite); and abandoned shale pit, Alpena Portland Cement Co., Alpena County, Mich. (Traverse-Upper Ferron Point formation).

Cotypes.—U.S.N.M. Nos. 10858, 54120, 78158, 87917–87921.

HEDERELLA REGULARIS, new species

PLATE 8, FIGURES 1, 2

Although apparently closely related to *H. concinna* in its microscopic measurements, this species may be separated by the great regularity not only in the branching of the zoarium but also in the size and arrangement of the zooecial tubes. The type specimen, which incrusts a *Cystiphyllum* over a space of at least 10 sq. cm., shows the same unusually regular arrangment throughout the single zoarium of which it is composed. Zooecial tubes short, slightly curved, emerging at an angle of about 45°, very delicately lined transversely, and with terminal transverse oval aperture slightly raised. Zoarial branching at intervals of 3 to 5 mm. Zooecial diameter 0.15 mm., length 0.6 mm.; 6 tubes in 5 mm. Compared with other species, *H. regularis* is not so delicate as *H. delicatula* and is smaller than *H. parvirugosa.*

Occurrence.—Hamilton group: Thedford, Ontario (holotype) (Widder shale); 3 miles west of East Bethany, N. Y. (Centerfield shale).

Holotype.—U.S.N.M. Nos. 26575, 94558.

HEDERELLA ARACHNOIDEA Clarke, 1900

PLATE 13, FIGURE 7

Hederella arachnoidea CLARKE, Mem. New York State Mus., vol. 3, No. 3, p. 61, pl. 9, fig. 11, 1900.

Only the type specimen, a zoarium incrusting the inner surface of a trilobite glabella, has been found, but it shows relationship to the *H. canadensis* group, differing from other small species in the considerable length of its branches and the regularity with which the zooecia arise alternately from the branch. Length of zooecia 1.3 mm., width of zooecia 0.25 mm.; branching at intervals of about 5 mm., often at nearly right angles, with zooecia arising at angle of about 35°; 4 zooecia in 5 mm.

H. concinna is a related species but has smaller dimensions. *H. parvirugosa* is perhaps still closer but its zooecia are shorter, more rapidly expanding, and wider at their extremity.

Occurrence.—Oriskany sandstone: Becraft Mountain, near Hudson, N. Y.

Plastoholotype.—U.S.N.M. No. 93957.

HEDERELLA CIRRHOSA Hall, 1881

PLATE 6, FIGURES 1–8

Hederella cirrhosa HALL, Trans. Albany Inst., vol. 10, p. 194, 1883 (abstract, p. 194, 1881); Rep. State Geol. New York for 1883, p. 53, 1884.—HALL and SIMPSON, Pal. New York, vol. 6, p. 277, pl. 65, figs. 12, 13, 1887.—SIMPSON, 14th Ann. Rep. State Geol. New York, 1894, pl. 25, figs. 10, 11, 1897.—WHITEAVES, Contr. Can. Pal., vol. 1, pt. 5, p. 381, 1898.—BASSLER, *in* Cleland, Wisconsin Geol. Nat. Hist. Surv., Bull. 21, sci. ser. 6, p. 57, pl. 6, figs. 4, 5, 1911.—STEWART, Geol. Surv. Ohio, ser. 4, Bull. 32, p. 26, pl. 1, fig. 18, 1927.

Hederella canadensis HALL and SIMPSON (part), Pal. New York, vol. 6, pl. 65, fig. 4, 1887.

This graceful species incrusts crinoid stems, cup corals, and other organisms where its branches cover several square centimeters. The zoarium consists of a narrow single tubed main axis from which slightly curving zooecial tubes, 1½ mm. long and 0.3 mm. wide, emerge alternately and regularly at an angle of 30° to 45° at intervals averaging 1 mm. Branching of the main axis occurs at long intervals usually, but in one regularly growing specimen 7½ mm. was the average distance. Two or three zooecia occur in 5 mm. measuring in the usual manner, although this number is doubled when, as in rare cases, all the zooecial budding occurs on the same side of a branch.

H. concinna is a related but more delicate species, while *H. canadensis* has also smaller and shorter zooecia.

Occurrence.—Middle Devonian: West Bloomfield, York, and Skaneateles Lake (Ludlowville shale), Athol Springs, etc., Erie County (Wanakah shale), 1½ miles south of East Bethany (Tichenor limestone), 3 miles west of East Bethany (Centerfield shale), and Pavilion (Moscow shale), all in New York; Arkona and Thedford, Ontario (Widder shale); 3½ miles west of Charlestown, Ind. (Silver Creek dolomite); and Partridge Point, 3 miles south of Alpena, Mich. (Traverse-Partridge Point formation).

Plesiotypes.—U.S.N.M. Nos. 54105, 87905–87910, 87956.

HEDERELLA FILIFORMIS (Billings, 1859)

PLATE 1, FIGURES 1–6′

Aulopora filiformis BILLINGS, Can. Journ., new ser., vol. 4, p. 119, 1859.—NICHOLSON, Pal. Prov. Ontario, p. 42, figs. 11a, b, 1874.

Hederella filiformis HALL, Trans. Albany Inst., vol. 10, p. 194, 1883 (abstract, p. 194, 1881); Rep. State Geol. New York, 1883, p. 54, 1884.—HALL and SIMPSON, Pal. New York, vol. 6, p. 278, pl. 65, figs. 9–11, 1887.—WHITEAVES, Contr. Can. Pal., vol. 1, p. 211, pl. 29, fig. 1, 1897.—GRABAU, Bull. Buffalo Soc. Nat. Sci., vol. 6, p. 179, fig. 77a, 1899.—BASSLER, *in* Cleland, Wisconsin Geol. Nat. Hist. Surv., Bull. 21, sci. ser. 6, p. 55, pl. 6, figs. 1–3, 1911.

Hederella canadensis HALL and SIMPSON (part), Pal. New York, vol. 6, pl. 65, figs. 1, 6, 8, 1887.—GRABAU and SHIMER, North Amer. Index Foss., p. 120, fig. 179a, 1907.—STEWART, Geol. Surv. Ohio, ser. 4, Bull. 32, p. 28, pl. 1, figs. 16, 17, 1927.

Although several distinct species were first figured under this name, there is little doubt that the specimens here selected for illustration agree in all respects with Billings' original *Aulopora filiformis*. These, like the original type are incrusting *Spirifer mucronatus thedfordensis*, where they occur in zoaria of several centimeters in diameter composed of a unilinear axis, 0.5 mm. wide, branching almost at right angles at intervals of about 5.5 mm. Short, slightly curved, rapidly expanding zooecial tubes about 1 mm. long arise at an angle of about 45° on alternate sides of the branch; surface of tubes delicately annulated; apertures transversely oval, opening upward; 4 zooecia in 5 mm. measuring along a straight branch.

Of the hundred or more specimens studied, this species maintains its specific characters rather well, differences in its appearance being due to the uneven surface it may incrust, or to old-age conditions in which a regular mat is formed as in other species of the genus.

Occurrence.—Middle Devonian: Arkona and Thedford and vicinity, Ontario (Widder shale); 18-Mile Creek and Athol Springs (Wanakah), Pavilion and 1½ miles south of East Bethany (Tichenor limestone), 1½ miles southeast of East Bethany (Kashong shale), and 3 miles west of East Bethany (Centerfield shale), all in New York; 2½ miles southwest of Sylvania, Ohio (Silica shale); Milwaukee, Wis. (Milwaukee limestone); Rockport quarry (Upper Bell shale), Rockport quarry and abandoned shale pit, Alpena Portland Cement Co. quarry (Upper Ferron Point formation), 7-Mile Dam and ½ mile southeast of 4-Mile Dam, Alpena County (Norway Point formation), 1½ miles northeast of Bay View and 1.6 miles north of Norwood, Charlevoix County (Petoskey formation), ¼ mile northwest Bolton, Alpena County (Alpena limestone), all in Traverse group of Michigan.

Plesiotypes.—U.S.N.M. Nos. 13754, 57526, 71769, 87914, 87915.

HEDERELLA BROWNAE, new species

PLATE 1, FIGURE 13

This new species, based upon a well-preserved specimen incrusting a *Spirifer* and collected by Dr. Ida Brown, of the University of Sydney, is interesting as the first record of the suborder in Australia, and in its close resemblance to the American species *H. filiformis* Billings. The Australian species differs, however, in the greater length of the zooecia (1.6 mm.) and the shorter interval (3 mm.), and the smaller angle of branching (60°). The abundant American species *H. thedfordensis* is quite similar in zoarial growth, but it has distinctly larger zooecial measurements.

Occurrence.—Middle Devonian: Taemas, south side of Murrumbidgee River, New South Wales.

Holotype.—U.S.N.M. No. 97240.

HEDERELLA ALTERNATA (Hall and Whitfield, 1873)

PLATE 5, FIGURES 1–3

Stomatopora? alternata HALL and WHITFIELD, 23d Ann. Rep. New York State Mus., p. 235, pl. 10, figs. 7, 8, 1873.

Hederella alternata FENTON and FENTON, Strat. and Fauna Hackberry Stage, Upper Devonian, p. 72, pl. 17, figs. 5, 6, 1924.

A species of moderate size for the genus, in which the alternate arrangement of the zooecia in their development along the branches is exceptionally well marked. Specimens growing upon rather smooth brachiopod shells where the normal arrangement of the tubes has been undisturbed by surface rugosities show that a small bulblike ancestrula is followed by a very short tube, which soon commences to emit branches at right angles to each other at intervals of about 3½ mm., and that these give rise on alternate sides to zooecia, seldom over 1 mm. long, emerging at angles of usually 45°. Four zooecia may be counted in 5 mm., and the usual width of both the zooecia and branches is about 0.35 mm.

Occurrence.—Devonian (Hackberry-Cerro Gordo shale): Rockford, Iowa, and vicinity.

Plesiotypes.—U.S.N.M. Nos. 54081, 65548.

HEDERELLA LINEARIS (Fenton and Fenton, 1924)

PLATE 5, FIGURES 6, 7

Hernodia linearis FENTON and FENTON, Strat. and Fauna Hackberry Stage, Upper Devonian, p. 73, pl. 17, fig. 7, 1924.

Although approaching *Hernodia* in the regularity of its budding, this species seems to be a *Hederella* characterized by its short, broad zooecia arising at regular intervals of 1.25 mm. alternately on the sides of the branch at an angle of 30° or less. Branching of the zoarium also occurs rather regularly at intervals of about 6½ mm. and at angles of about 60°. Measuring along an uncurved branch 3 zooecia occur in 5 mm. Length of zooecial tubes 1.2 mm., width 0.35 mm. The associated *H. alternata* of similar dimensions has less regular branching and zooecia emerging at a higher angle. *H. filiformis* is also similar in size but has very short, broad zooecia and branching more at a right angle.

Occurrence.—Devonian (Hackberry-Cerro Gordo shale): Rockford, Iowa, and vicinity.

Plesiotype.—U.S.N.M. No. 87887.

HEDERELLA CONCINNOIDES, new species

PLATE 11, FIGURE 9

A very slender species related to *H. concinna*, from which it may be separated by its more delicate unilinear branches dividing at angles of about 60° at intervals of 2.5 mm. and emitting zooecia 1 mm. long and 0.15 mm. wide at an equally high angle. *H. delicatula* is also related, but its branches are still more delicate and not so regular, while its zooecia arise at an acute angle.

Occurrence.—Middle Devonian: 2½ miles southwest of Sylvania, Ohio (holotype) (Silica shale); 3 miles west of East Bethany, N. Y. (Centerfield shale).

Holotype.—U.S.N.M. No. 94585.

HEDERELLA DELICATULA, new species

PLATE 11, FIGURES 1–8

Hederella canadensis (part) HALL and SIMPSON, Pal. New York, vol. 6, pl. 65, figs. 5, 7, 1887.

This very delicate but abundant species may be recognized easily by its threadlike zoarium, which, upon sufficient magnification, resolves itself into a main axis giving rise, often at right angles and intervals of about 1.5 to 6 mm., to equally narrow branches from which, as well as from the main axis, the short zooecia arise on alternate sides at angles of about 45°. All the other characters are as in the larger typical species of the genus. Frequent overgrowth of the branches results in a dense mat in which it is hard to trace the arrangement of the tubes. Zooecial tubes are 0.8 mm. in length and 0.15 mm. in width; 4 to 5 zooecia in 5 mm.

This, the most delicate member of the genus, is in marked contrast with such forms as *H. robusta* and *H. reimanni*, yet the zooecial characters of the three are essentially the same except for size.

Occurrence.—Middle Devonian: 18-Mile Creek, etc., Erie County (cotype) (Wanakah shale), 3 miles west of East Bethany, and York (Centerfield shale), 1½ miles south of East Bethany (cotype) and Pavilion (Tichenor limestone), Moscow, Leicester and Kashong Creek (Moscow shale), all in New York; Thedford (cotype) and Arkona, Ontario (Widder shale); 2½ miles southwest of Sylvania, Ohio (Silica shale); Lebanon, Ky. (cotype) (Sellersburg limestone); Milwaukee, Wis. (cotype) (Milwaukee limestone); Falls of the Ohio (Upper Jeffersonville limestone) (cotype); Petoskey Cement Co., Petoskey (Gravel Point limestone), Phelps Quarry (Upper Alpena limestone), and Rockport quarry, Alpena County (Upper Ferron Point formation), ½ mile southeast of 4-Mile Dam, Alpena County (Norway Point formation), Partridge Point, 3 miles south of Alpena (Partridge Point formation), 1½ miles northeast of Bay View and 1.6 miles north of Norwood, Charlevoix County (Petoskey formation), ¼ mile northwest of Bolton, Alpena County, and Thunder Bay quarry, Alpena (Alpena limestone, Dock Street clay), all in Traverse group of Michigan.

Cotypes.—U.S.N.M. Nos. 26574, 50247, 54082, 54100, 54120, 57529, 87898, 87899, 87900–87906.

Hederella vagans section

HEDERELLA VAGANS, new species

PLATE 4, FIGURES 1, 2

Hederella canadensis HALL and SIMPSON (part), Pal. New York, vol. 6, pl. 65, fig. 14, 1887 (not Nicholson, 1874).

Zoarium usually incrusting the epithecated sides of *Favosites* but also growing upon *Heliophyllum* and other cup corals and consisting of a set of loosely arranged, straggly tubes about 0.4 mm. in width, branching at long intervals, 15 mm. or more, and giving rise to short zooecia 1 mm. in length at angles of 30° to 45°, at distances averaging 2.5 mm. Tubes faintly annulated; zooecial apertures terminal, transversely oval, opening upward and equaling the tubes in diameter. Two zooecia in 5 mm.

Occurrence.—Middle Devonian: Thedford (cotypes), Arkona, and Bartletts Mills, Ontario (Widder shale); Pavilion and 1½ miles south of East Bethany, N. Y. (Tichenor limestone); 2½ miles southwest of Sylvania, Ohio (Silica shale); Ann Arbor, Mich. (drift).

Cotypes.—U.S.N.M. Nos. 26574, 54117, 87969.

HEDERELLA GERMANA, new species

PLATE 4, FIGURE 6

Although related to *H. vagans*, this species can be distinguished by its wider, more coarsely annulated tubes, branching at considerable, although shorter, intervals (12 mm.), usually at a right angle, and its longer, more distantly spaced zooecia emerging at such a low angle as often to remain in contact. Length of zooecial tubes 1.6 mm., width 0.5 mm., with 1 to 2 zooecia in 5 mm.

H. canadensis and *H. crassilinea* are also related species, which have been distinguished under their respective descriptions.

Occurrence.—Hamilton (Widder shale): Thedford, Ontario.

Holotype.—U.S.N.M. No. 87934.

HEDERELLA CONTORTILIS, new species

PLATE 8, FIGURES 5–8

Nicholsonia canadensis DAVIS (not *Hederella canadensis* Nicholson), Kentucky Foss. Corals, pt. 2, pl. 73, figs. 10, 11, pl. 78, fig. 16, 1885 (not pl. 57, fig. 6= *Hernodia davisi;* not pl. 80, fig. 15, undetermined).

Hederella canadensis HALL and SIMPSON (part), Pal. New York, vol. 6, pl. 65, fig. 16, 1887.

Associated with *H. adnata*, and like it incrusting fenestellid Bryozoa, is another species that differs in its distinctly narrower and shorter zooecial tubes (0.4 mm. wide and 1.5 mm. long). It often grows in such profusion as to form a contorted mat, but a colony unobscured by other zoaria or its own branches shows that the zoarial growth is rather regular, consisting of a main axis of a single tube from which branches emerge at an angle of 50° or more at intervals of 3 mm., these emitting zooecial tubes on alternate sides at an angle of 50°–60° and at distances of about their own length with about 3 in 5 mm. Frequently the zooecial tubes all arise on one side of the branch, thus adding confusion among them.

H. vagans has about the same width of tubes, but its zooecia are shorter and branch at less frequent intervals.

Occurrence.—Onondaga (Upper Jeffersonville limestone-*Spirifer acuminatus* bed): Falls of the Ohio.

Cotypes—U.S.N.M. No. 87954.

HEDERELLA ANGULATA (Davis, 1885)

PLATE 7, FIGURES 5, 6

Nicholsonia angulata DAVIS, Kentucky Foss. Corals, pl. 80, fig. 15, 1885.

A species much like *H. vagans* but differing in that the primary axial tubes, 0.3 mm. in width, give rise at short intervals (1.5 mm. to 3 mm.) to long secondary branches at more or less of a right angle, from which in turn emerge very short zooecia (0.5 mm.) at intervals of 2 to 3 mm. at a 45° angle with 1 to 2 in 5 mm. Surface very delicately annulated. Comparisons with *H. rectifurcata* are given under description of the latter.

Occurrence.—Onondaga (Upper Jeffersonville limestone-*Spirifer acuminatus* zone): Falls of the Ohio.

Plesiotype.—U.S.N.M. No. 54092.

HEDERELLA TENERA, new species

PLATE 7, FIGURES 7–9

Associated with *H. angulata* is a more delicate species also closely related to *H. vagans* but distinguished from both by its narrow branches (0.25 mm. in width), which subdivide at an angle less than 45° at intervals of 1.5 to 2 mm., with longer zooecia (1.3 mm. and 3 in 5 mm.) emerging at an equally small angle at long distances. In this, as in the related species, the surface ornament is exceedingly delicate and the transversely oval zooecial apertures bend slightly upward.

Occurrence.—Onondaga (Upper Jeffersonville limestone-*Spirifer acuminatus* bed): Falls of the Ohio.

Cotypes—U.S.N.M. No. 87913.

HEDERELLA ULRICHI, new species

PLATE 13, FIGURE 8

This species is based upon a mold in sandstone, gutta-percha squeezes of which indicate a form related to *H. crassilinea* from the Snyder Creek shale of Missouri but differing in that the zooecia are larger (2 mm. long and 0.7 mm. wide, with 2½ in 5 mm.) and bud alternately from the main axis at smaller angles (less than 45°) so that they form narrow branches, which in themselves bifurcate at distances of about 10 mm. Better specimens will show other characters for this robust species.

The specific name is in honor of Dr. E. O. Ulrich, who collected the type specimen.

Occurrence.—Helderbergian (50 feet below top): Big Stone Gap, Va.
Holotype.—U.S.N.M. No. 93956.

HEDERELLA OCCIDENTALIS, new species

PLATE 6, FIGURE 15

This species, represented by a none-too-well preserved specimen, is described mainly to show the occurrence of *Hederella* in the Devonian faunas of the Western United States. The type, which incrusts a *Schizophoria*, consists of a portion of a frequently branching zoarium, dividing at intervals of 3 mm. at angles of 50° to 60°, emitting zooecia 1.5 mm. long and 0.5 mm. wide, also at a high angle.

Occurrence.—Devonian (Percha shale): Lake Valley, N. Mex.
Holotype.—U.S.N.M. No. 87936.

HEDERELLA CRASSILINEA, new species

PLATE 4, FIGURE 4; PLATE 13, FIGURES 4, 5

Although similar to *H. germana* from the Widder beds of Ontario in the width of zooecia, surface ornamentation, and the right-angled method of branching, this new species can be readily recognized by the more regular and frequent budding of the tubes. These are short (1.3 mm. long and 0.6 mm. wide) and emerge at an angle of about 45° at quite regular intervals of about 2 mm., with 2½ to 3 in 5 mm. Branching occurs at intervals of 5 to 10 mm.

H. camdenensis from the Helderbergian of west Tennessee is also similar but has longer zooecia and less regular budding.

Occurrence.—Devonian: Fulton, etc., Callaway County, Mo. (holotype) (Snyder Creek shale); railroad fill northeast of Randalia (paratype) and Iowa City (paratype), Iowa (Cedar Valley formation).
Holotype and *paratypes.*—U.S.N.M. Nos. 25462; 78639, 94571.

HEDERELLA CAMDENENSIS, new species

PLATE 6, FIGURE 16

This species, represented by a fragmentary zoarium incrusting a *Gypidula*, is described in order to call attention to the presence of this group of the genus in the Helderbergian of Tennessee. Although evidently related to *H. vagans*, the present species branches more frequently, the zooecia are longer (1.6 mm.) and wider (0.5 mm.) and bud from the main axis at an angle of about 45° at more frequent intervals, with 3 zooecia in 5 mm. More complete specimens will probably reveal additional characters.

Occurrence.—Helderbergian (New Scotland-Birdsong shale): Just south of Camden, Tenn.
Holotype.—U.S.N.M. No. 87968.

139917—39——2

HEDERELLA RECTIFURCATA, new species

PLATE 7, FIGURE 16

This species is characterized by its rather straight primary branches from which secondary branches arise at intervals of about 3 mm. almost at right angles, both of which in turn give origin at the same angle (at intervals of 1.5 mm.) to very short zooecia terminated by elliptical apertures directed upward. Branches and tubes about 0.3 mm. in diameter; 2 to 3 zooecia in 5 mm.

The rectangular method of branching and the very short zooecial tubes arising at a right angle make this species of the *H. canadensis* group easily recognized. Although similar to *H. angulata* (Davis) in general dimensions and short buds, *H. rectifurcata* is readily distinguished by its closer branching and its budding at a right angle.

Occurrence.—Middle Devonian: 18-Mile Creek (holotype) and Athol Springs (Wanakah shale), 1½ miles southeast of East Bethany (Moscow-Kashong shale), Kashong Creek (Ludlowville shale), 3 miles west of East Bethany (Centerfield shale) and 1½ miles south of East Bethany (Tichenor limestone), all in New York; 2½ miles southwest of Sylvania, Ohio (Silica shale); Milwaukee, Wis. (Milwaukee limestone); Petoskey Cement Co., Petoskey, Mich. (Traverse-Gravel Point limestone); Thedford and vicinity, Ontario (Widder shale).

Holotype.—U.S.N.M. Nos. 50247, 87923–87926.

Hederella blainvillei section

HEDERELLA BLAINVILLEI Clarke, 1907

PLATE 13, FIGURE 6

Hederella blainvillei Clarke, New York State Mus. Bull. 107, p. 289, fig., 1907; New York State Mus. Mem. 9, pt. 1, p. 242, pl. 48, fig. 2, 1908.

This species, which forms gracefully expanding incrustations upon brachiopod shells, is closely related to *H. ramea* Clarke but differs in its "much more rapidly branching zoaria and consequently shorter cells producing a fuller and denser stock." The original illustration on plate 13 exhibits these features and shows that the bushy aspect of the zoarium is caused by the very regular branching at intervals of about 4 mm. and at an angle of about 30°, and the equally regular budding of the zooecia at the same angle. Width of branches and zooecia 0.5 mm., length of zooecia 2 to 3 mm.

As noted, *H. ramea* Clarke has a similar method of growth but the zooecia are longer and narrower. *Hederella* species,[4] described by Clarke from the Lower Devonian Moose River sandstone of Moosehead Lake, Maine, is almost certainly the same as *H. blainvillei.*

[4] Clarke, New York State Mus. Mem. 9, pt. 2, pl. 21, figs. 18, 19, 1909.

Occurrence.—Devonian (Gaspé sandstone): Portage Road, Gaspé, and Haldemand, Quebec.

Pleisotypes.—U.S.N.M. Nos. 87981, 87982.

HEDERELLA RAMEA Clarke, 1900

PLATE 13, FIGURE 10

Hederella ramea CLARKE, Mem. New York State Mus., vol. 3, No. 3, p. 62, pl. 9, fig. 9, 1900.

As shown by the original illustration and a further enlargement of the holotype on Clarke's plate 9, this species is related to *H. blainvillei*, differing in that branching occurs more regularly and at shorter intervals, sometimes as close together as 3 mm. The zooecial tubes also are not so wide (0.35 mm. instead of 0.5 mm.) and much longer (3 mm.), sometimes reaching a length of an entire branch before giving rise to other zooecia. The angle both of branching and of budding is less than 30°, but both zooecia and branches remain quite separate and form a palmate expansion.

Occurrence.—Oriskany sandstone: Becraft Mountain, near Hudson, N. Y.

Plastoholotype.—U.S.N.M. No. 87922.

HEDERELLA PAVILIONENSIS, new species

PLATE 4, FIGURE 5

Zoarium as in *H. vagans* and *H. ramea*, with the same loose manner of growth but the unilinear axis branches more frequently at a 45° angle, forming a much divided ensemble with quite elongated individual tubes, which bud at an angle less than 45°. Growth in general more robust than in *H. vagans*, the tube diameter being 0.5 mm. and the zooecia 2 to 4 mm. or more long. *H. germana* has the same width of zooecia but differs in its right-angled branching and shorter zooecia.

Occurrence.—Hamilton group: Pavilion and 1½ miles south of East Bethany (Tichenor limestone), and 3 miles west of East Bethany (Centerfield shale), N. Y.

Holotype.—U.S.N.M. Nos. 87932, 87933.

Hederella thedfordensis section

HEDERELLA THEDFORDENSIS, new species

PLATE 1, FIGURES 7–12; PLATE 13, FIGURE 2

Hederella canadensis HALL and SIMPSON (part), Pal. New York, vol. 6, pl. 65, fig. 2, 1887.

Associated with *H. filiformis* in the type locality in equal abundance and also growing usually upon *Spirifer mucronatus thedfordensis* is a more robust species that differs in that all of its dimensions are greater: The zooecial diameter (0.7 mm.) is twice that of the former; the length of the zooecia is 2.5 mm, they bud at an angle less than 30°, and their number in 5 mm. is 2; the main axis from which the branches emerge at an angle of 60° is strongly and more uniformly developed; and the branching is less uniform. The basal part of an old zoarium consists of an almost solid mass of radiating tubes in which all trace of the method of branching is lost. An interesting feature of the branching is that at intervals of about 4 mm., groups of 4 or 5 short, wide tubes are developed on alternate sides.

H. thedfordensis is similar to *H. nicholsoni*, but in the latter a single zooecium emerges alternately from each side of the branch.

Occurrence.—Middle Devonian: Thedford (cotype), Arkona, etc., Ontario (Arkona and Widder shales); Livingston County, Kashong Creek (Ludlowville); 3 miles west of East Bethany (Centerfield shale), Averys Creek and Hamburg (Wanakah shale), and 1½ miles southeast of East Bethany (cotype) (Kashong shale), all in New York; 2½ miles southwest of Sylvania, Ohio (Silica shale) (cotype); abandoned shale pit, Alpena Portland Cement Co. quarry (Genshaw formation) and Thunder Bay quarry (Alpena-Dock Street clay), all in Traverse group of Alpena County, Mich.

Cotypes.—U.S.N.M. Nos. 26572, 54101, 87927–87931, 87983, 87984.

HEDERELLA NICHOLSONI, new species

PLATE 4, FIGURES 8, 8′; PLATE 12, FIGURE 4

Though resembling *H. helderbergia* in its general proportions, *H. nicholsoni* may be recognized by its broad tubes 2 mm. long and 0.6 mm. thick issuing from the main axis at an angle of about 35° and usually remaining free throughout the entire length. Branching is rather regular, occurring at intervals of 5 to 6 mm. at angles less than 45°; 2½ to 3 zooecia may be found in 5 mm. *H. thedfordensis* is similar but has somewhat larger zooecia and particularly more closely arranged tubes, which in budding give rise to clusters of 4 or 5 on alternate sides.

This specific name is in honor of Dr. H. A. Nicholson, eminent pioneer student of American Paleozoic corals and Bryozoa.

Occurrence.—Middle Devonian: 18-Mile Creek (holotype), Wanakah, Athol Springs, Elma, and Bay View (Wanakah shale), 3 miles west of East Bethany (Centerfield shale), all in New York; Rockport Quarry, Alpena County, Mich. (Traverse-Upper Bell shale) (paratype).

Holotype and paratype.—U.S.N.M. Nos. 72800, 73060, 78159, 87937–87939.

HEDERELLA NODIFERA, new species

Plate 12, Figure 3

A species with the same general features as *H. nicholsoni* and *H. thedfordensis* but with more frequently divided and crowded branches and particularly with a nodelike swelling near the extremity of each zooecium. Division at very acute angles for both branches and zooecia bringing them almost in contact; individual zooecia 3 mm. long and 0.6 mm. wide normally, but 1 mm. across at a node. The node or swollen part of the tube occurs regularly about one-quarter of a tube length behind the aperture. Its cause is unknown, as the type, the only known specimen, gives no clue.

Occurrence.—Helderbergian (Birdsong shale): Perryville, Tenn.

Holotype.—U.S.N.M. No. 87968.

HEDERELLA QUEBECENSIS, new species

Plate 13, Figure 9

This species resembles *H. thedfordensis* in its general measurements and method of branching but differs in the conspicuous clusters of zooecia developed on alternate sides at regular intervals of about 4 mm. with few intermediate single tubes. Gutta-percha impressions of the type, which occurs as a mold in a brachiopod shell, show the tubes to average 2 mm. in length and 0.6 mm. in width, with 5 or 6 to a cluster.

Occurrence.—Devonian (Gaspé sandstone): Near Gaspé, Quebec.

Holotype.—U.S.N.M. No. 94568.

HEDERELLA HELDERBERGIA, new species

Plate 8, Figure 3

The type and only specimen so far discovered incrusts a brachiopod shell and consists of several parallel primary branches emitting at intervals of 4 or 5 mm. secondary branches at such an angle as to form a latticework ensemble. From both the main and secondary branches slightly curved zooecial tubes 2 mm. long and 0.35 mm. wide arise at angles of approximately 45° and about 1 mm. distant from each other, with about 3 zooecia in 5 mm. The secondary branches usually end in a tuft of 4 or 5 zooecia, which, with the latticelike arrangement of the primary and secondary branches, give a characteristic aspect of regularity to the species.

Occurrence.—Helderbergian (New Scotland limestone): Schoharie County, N. Y.

Holotype.—U.S.N.M. No. 26032.

HEDERELLA CHESTERENSIS, new species

PLATE 6, FIGURES 9–11

Zoarium incrusting brachiopods, cup corals, crinoid stems, and other organic objects indiscriminately, where it forms colonies sometimes several square centimeters in area, particularly well distinguished by the curved clusters of zooecia produced in the course of branching. From the single-tubed primary branch a gently curved zooecium emerges at about 45° and within a short distance by successive budding forms a cluster of 4 or 5 zooecia usually curving away from the branch, then after a short interval a similar group arises on the other side. Likewise, the secondary branches emit alternately such zooecial groups. Zooecia are about 2½ mm. long, 0.3 mm. wide, and average 3 in 5 mm.

Occurrence.—Chester group: Marion (cotype), Sloans Valley (cotype), near Stephensport, Smithland, etc., Ky. (Glen Dean limestone); Evansville, Ind. (cotype); and Chester, Ill.

Cotypes.—U.S.N.M. Nos. 50316, 54112, 54095–54099, 54127, 87953.

HEDERELLA ADNATA (Davis, 1885)

PLATE 11, FIGURES 10–12

Nicholsonia adnata DAVIS, Kentucky Foss. Corals, pt. 2, pl. 78, fig. 19, 1885 (not described).

This species, although resembling *H. vagans* in its general zooecial arrangement, differs in that the tubes are wider (0.6 mm.) and more robust in general, the zoarial branching, although irregular, occurs usually at a distance of 5 mm., and the zooecial tubes are much longer (2.5 mm.) and more closely set, with 2 in 5 mm. and an angle of budding of 30°. Although rather common, all the specimens of this species have been found incrusting fenestellid bryozoans.

Occurrence.—Onondaga (Upper Jeffersonville limestone-*Spirifer acuminatus* bed): Falls of the Ohio at Louisville, Ky.

Plesiotypes.—U.S.N.M. No. 54085.

HEDERELLA ? LAXA (Whiteaves, 1891)

PLATE 13, FIGURE 1

Stomatopora laxa WHITEAVES, Contr. Can. Pal., vol. 1, p. 210, pl. 28, figs. 8, 8a, 1891.

The generic position of this species is still doubtful, although it is perhaps best placed with *Hederella.* A gutta-percha squeeze of the type seems to indicate that the zooecia bud from the middle of the side of the preceding tube as in that genus. The branches divide at intervals of 3.5 mm. and at an angle of less than 45°, and the zooecia are unusually short and broad (1.2 mm. long and 0.65 mm. wide), a combination of characters quite different from other species of *Hederella*.

Occurrence.—Devonian: 40 miles above mouth of Hay River, Canada.

Plastoholotype.—U.S.N.M. No. 54214.

HEDERELLA ALPENENSIS GROUP

This group, typified by an abundant species in the Traverse group of Michigan and represented by 10 species, is characterized by the regular arrangement of the branches, with short, closely spaced zooecia dividing so frequently that a central tube is not developed. Species of *Reptaria* have a somewhat similar aspect, but their zooecia arise so regularly from the basal portion of the opposite one that they form a symmetrical branch of two rows of parallel tubes in contact.

HEDERELLA ALPENENSIS, new species

PLATE 3, FIGURES 1–6

Zoarium incrusting brachiopods, cup corals, massive bryozoans, and other organisms, often spreading over several square centimeters. It consists of a compactly arranged set of short zooecia springing alternately from the side of the opposite preceding one, thus leaving no definite central tube. The zooecia are of equal length (1.1 mm.), arising at such a slight angle as to remain often in contact and almost parallel to each other. Width of zooecia 0.4 mm., with 4 to 5 occurring in 5 mm. Branching occurs frequently at intervals of about 3½ mm. and at an angle of 60°.

Occurrence.—Middle Devonian: Long Lake near Alpena and El Cajon Beach, Alpena County (cotype) (Genshaw formation) abandoned shale pit, Alpena Portland Cement Co., Alpena County, etc. (cotype) (Upper Ferron Point formation), Petoskey Cement Co., Petoskey (cotype), and Bay View (Gravel Point limestone), ½ mile southeast of 4-mile Dam, 7-mile Dam (Norway Point formation) (cotype), and ¼ mile northwest of Bolton, Alpena County (Alpena limestone), all in Traverse group of Michigan; 2½ miles southwest of Sylvania, Ohio (Silica shale); Milwaukee, Wis. (Milwaukee–Lindwurm).

Cotypes.—U.S.N.M. Nos. 54086, 54108, 54111, 54113, 87971–87975.

HEDERELLA AEQUIDISTANS, new species

PLATE 9, FIGURE 6

This well-marked species, occurring as incrustations on cephalopod shells over areas as large as 10 sq.cm., is characterized by its regularly branching habit at right angles from the main axis at a distance of about 3 mm. The main axis is composed of a single row of tubes from which narrow elongate zooecia emerge at a low angle, then bend almost at right angles, whereupon they themselves issue, alternately to the right and left, rather long zooecial tubes, which remain practically in contact. Length of zooecial tubes about 2 mm., width 0.3 mm., 2 to 3 in 5 mm. measured on the same side of a branch.

Occurrence.—Upper Devonian (Tully limestone-West Brook member): 2½ miles south of Sherburne, N. Y.

Holotype.—U.S.N.M. No. 87970.

HEDERELLA GRACILIOR Clarke, 1900

Plate 3, Figure 12

Hederella gracilior Clarke, Mem. New York State Mus., vol. 3, No. 3, p. 62, pl. 9, fig. 10, 1900.

This species is evidently closely related to *H. alpenensis*, with which it agrees in general arrangement of the tubes and method of branching (60° angle) but differs in that the zooecia are longer (1.5 mm.) and wider (0.5 mm.) and sometimes exhibit an elongated central tube. Branching occurs at intervals of 6 to 7 mm., with 3 to 3½ zooecia in 5 mm. Only the type specimen is known, and additional material may show further characters.

Occurrence.—Oriskany sandstone: Becraft Mountain, near Hudson, N. Y.

Plastoholotype.—U.S.N.M. No. 87912.

HEDERELLA EDWARDSI, new species

Plate 4, Figure 7

This new species, allied to *H. alpenensis*, differs in its more robust characters. While the method of branching is similar (angle of about 30°), occurring at intervals of 6 mm., the tubes are much larger, being 2.5 mm. long and 0.6 mm. wide, with about 2 zooecia in 5 mm. and budding at an angle of about 20°. The surface ornamentation is more evident, and in general the tubes have a more irregular appearance. The specific name is in honor or Dr. Ira Edwards, curator of geology of the Milwaukee Public Museum.

Occurrence.—Middle Devonian (Milwaukee limestone-Lindwurm member): Milwaukee, Wis.

Holotype.—U.S.N.M. No. 57531.

HEDERELLA HALYSON (Fenton and Fenton, 1924)

Plate 2, Figure 6; Plate 5, Figures 4, 5; Plate 12, Figure 1

Hernodia halyson Fenton and Fenton, Strat. and Fauna Hackberry Stage, Upper Devonian, p. 73, pl. 17, fig. 4, pl. 18, fig. 4, 1924.

Although originally referred to *Hernodia* in which the zooecia arise rather regularly from the middle portion of the preceding tube, this character is shown only in the younger branches. Older parts of the zoarium, as shown on plate 5, figure 4, bud as in *Hederella*. The zoarium forms small colonies upon brachiopods and cup corals, consisting of a central, rather confused part in which, however, the shape of the zooecia and radial arrangement of the branches around the ancestrula are visible, the terminal portions of the branches presenting the more regular budding and branching, the latter at an angle of 60°. Here the zooecia arise alternately from about the middle of the preceding one, are about 2 mm. long and 0.55 mm. wide, with 3 in 5 mm. measuring on the same side of the branch. In all parts of the colony the zooecia are rather straight, short, and stout, budding at angles of 25° and remaining free a considerable part of their length.

Occurrence.—Devonian: Rockford and vicinity (Hackberry-Cerro Gordo shale), Buffalo (Cedar Valley formation), Iowa; Milwaukee, Wis. (Milwaukee limestone).

Plesiotypes.—U.S.N.M. Nos. 54083, 66222, 94561.

HEDERELLA PERSIMILIS, new species

PLATE 2, FIGURES 4, 5

Associated with *H. alpenensis* at several Michigan localities is a form closely allied but exhibiting tubes regularly twice as long and considerably wider. This is here separated as a distinct species. Zooecia 2 mm. in length and 0.5 mm. in width but sometimes as much as 3 mm. long. As a rule 3 zooecia occur in 5 mm., but in some parts of the zoarium 1½ occupy the same space. Branching occurs at 6-mm. intervals with a tendency to form clumps of zooecia at the bifurcation.

Occurrence.—Middle Devonian: Bay View and Petoskey Cement Works, Petoskey (cotypes), Charlevoix (Gravel Point limestone), Norway Point Dam (Norway Point formation), Partridge Point, 3 miles south of Alpena (Partridge Point formation), 1.6 miles north of Norwood, Charlevoix County (Petoskey formation), all in the Traverse group of Michigan; Athol Springs, N. Y. (Wanakah shale); Thedford, Ontario (Widder shale).

Cotypes.—U.S.N.M. Nos. 87878–87880, 87974.

HEDERELLA RUGOSA, new species

PLATE 2, FIGURE 7; PLATE 3, FIGURES 7, 8

Complete zoaria of this well-marked species have been found incrusting cup corals and other organisms. Starting with an ancestrula, a small smooth bulb similar to that in typical Cyclostomata, it then passes through a stage of frequently dividing, strongly rugose tubes, which emerge from the main axis at a considerably high angle to the mature stage where branching occurs less often (at intervals of about 4 mm. and an angle of 40°), and the zooecia remain more in contact with each other (budding at 20°), forming a biserial arrangement. Measurements in the mature stage: Zooecia about 2 mm. in length and 0.6–0.7 mm. in width, with about 3 in 5 mm. Surface of tubes strongly rugose.

Occurrence.—Middle Devonian: Erie County (cotype) (Wanakah shale), Pavilion and 1½ miles south of East Bethany (Tichenor limestone), 3 miles west of East Bethany (Centerfield shale), 1½ miles southeast of East Bethany (Kashong), Moscow (Moscow shale-Windom member), and Canandaigua Lake and York (Ludlowville shale), all in New York; Thedford and Arkona, Ontario (cotype) (Widder shale); Thunder Bay Quarry, Alpena, Mich. (cotype) (Alpena limestone) Partridge Point, 3 miles south of Alpena (Partridge Point formation), 1½ miles northeast of Bay View (Petoskey formation), all in the Traverse group of Michigan.

Cotypes.—U.S.N.M. Nos. 54082, 87916, 87950–87952.

HEDERELLA CONFERTA (Hall, 1881)

PLATE 9, FIGURES 4, 5

Ptilionella conferta HALL, Trans. Albany Inst., vol. 10, p. 195, 1883 (abstract, p. 195, 1881); Rep. State Geol. New York, 1883, p. 56, 1884.

Hederella conferta HALL and SIMPSON, Pal. New York, vol. 6, p. 279, 1887.—HALL, 10th Ann. Rep. State Geol. New York, 1890, p. 56, 1891; 44th Ann. Rep. New York State Mus., p. 86, 1891.

Our description of this interesting species, heretofore unfigured, is based upon a specimen incrusting an *Orthoceras* over a space of more than 32 sq. cm. The general zoarial arrangement and branching of the tubes are similar to that in *H. aequidistans*, but the strong zooecial annulations in *H. conferta* and the greater number of tubes to a branch will serve to distinguish them. Branching occurs at intervals of about 4 mm. and an angle of 45°, with zooecia 2 mm. in length and 0.35 mm. in width and budding at 45°.

Occurrence.—Hamilton (Ludlowville shale): Canandaigua Lake, Kashong Creek, etc., N. Y.

Plesiotype.—U.S.N.M. No. 54121.

HEDERELLA CLARKEI, new species

PLATE 10, FIGURE 3

The type and only known specimen incrusts a *Fistulipora* and is readily distinguished by the many rows of short tubes to a branch due to their frequent budding at a low angle. Branching occurs at intervals of 3 mm. and an angle of more than 45°, with the zooecial tubes averaging 1.5 mm. in length, 0.35 mm. in width, and about 4 in 5 mm. Rapid proliferation on alternate sides of the single initial tube of a branch and its successors quickly increase the number of rows so that as many as 10 may occur at a bifurcation.

Although related to *H. conferta* in growth features, the shorter and less strongly marked zooecia of *H. clarkei* arranged in many rows will easily distinguish it. The specific name is in memory of the late Dr. John M. Clarke, eminent student of Devonian paleontology.

Occurrence.—Hamilton (Centerfield shale): 3 miles west of East Bethany, N. Y.

Holotype.—U.S.N.M. No. 87987.

HEDERELLA CALVINI, new species

PLATE 9, FIGURE 2

Zoarium attached to a flat frond of *Fistulipora* and consisting of rather broad branches dividing rather regularly at intervals of about 5 mm. at an angle of less than 30°, composed of flattened zooecial tubes about 2 mm. in length and 0.4 mm. in width budding from the main axis at such a low angle as to remain in contact throughout their length and so frequently as to show 4 or more rows in a single branch. The apertures are narrow, transversely elliptical; 2½ zooecia occur in 5 mm.; surface ornamentation of very delicate transverse lines. Branches in the older part of the zoarium so close together as to form solid incrustations. The broad branches dividing at small angles and the four or more rows of zooecia in close contact in most of the branches readily distinguish this fine species, named in honor of the late Dr. Samuel Calvin, leading student of Iowa geology and paleontology.

Occurrence.—Devonian (Cedar Valley formation): Davenport, Iowa.

Holotype.—U.S.N.M. No. 54091.

HEDERELLA MAGNA GROUP

The robust zoarium of *Hederella magna*, consisting of a thick, rather infrequently branching tubular axis from which large ventricose but usually short zooecia emerge at close intervals alternately to right and left, has a type of growth shared by the nine forms here classified under this heading.

HEDERELLA MAGNA Hall, 1881

PLATE 3, FIGURES 9, 10

Hederella magna HALL, Trans. Albany Inst., vol. 10, p. 195, 1883 (abstract, p. 195, 1881); Rep. State Geol. New York, 1883, p. 55, 1884.—HALL and SIMPSON, Pal. New York, vol. 6, p. 280, pl. 65, fig. 15, 1887.—WHITEAVES, Contr. Can. Pal., Geol. Surv. Canada, vol. 1, pt. 5, p. 382, 1898.—BASSLER, *in* Cleland, Wisconsin Geol. Nat. Hist. Surv., Bull. 21, sci. ser. 6, p. 55, pl. 6, fig. 6, 1911.—STEWART, Geol. Surv. Ohio, ser. 4, Bull. 32, p. 26, pl. 1, fig. 19, 1927.

Zoarium incrusting cup corals and other organisms over considerable areas and consisting of large, swollen zooecia 2.2 mm. long and 1 mm. wide at the aperture, emerging alternately from a long central tube, which may be as much as 15 mm. in length before bending outward as a typical zooecium and giving rise to another similar tube from which the zooecia bud. Branching rather infrequent, with sometimes an interval of 20 mm. Zooecia short for their size, rapidly expanding, with 2 to 2.5 in 5 mm. measuring on one side of a branch, and usually adherent throughout the length (angle of less than 20°). Surface with delicate annulations throughout and coarser wrinkles taking the place of every third or fourth annulation. Apertures fairly round and bent slightly upward.

The robust zoarium with short, wide zooecia in contact and regular arrangement and the infrequent branching characterize this fine species.

Occurrence.—Middle Devonian: Bay View, etc., Erie County, York (plesiotype) (Wanakah shale), Pavilion (Tichenor limestone), 3 miles west of East Bethany and Murder Creek, Darien (Centerfield shale), and 18-Mile Creek (Moscow shale), all in New York; Arkona (Arkona shale) and Thedford (Widder shale), Ontario; 2½ miles southwest of Sylvania, Ohio (Silica shale).

Plesiotype.—U.S.N.M. Nos. 54107, 87912, 87962–87966.

HEDERELLA MAGNA PRAECEDENS, new variety

PLATE 3, FIGURE 11

Hederella magna CLARKE, Mem. New York State Mus., vol. 3, No. 3, p. 61, pl. 9, fig. 10, 1900.

Zooecia shorter (2.0 mm. in length and 1.0 mm. wide) and blunter than in typical *H. magna*, with about 3 instead of 2.5 in 5 mm.

The single specimen upon which this variety is founded shows that it differs from the typical Hamilton form in its longer, blunter, more parallel-edged tubes arising at such a narrow angle as to remain in close contact. Branching appears to occur at shorter intervals and other specimens may show further differences.

Occurrence.—Oriskany sandstone: Becraft Mountain near Hudson, N. Y.

Plastoholotype.—U.S.N.M. No. 94163.

HEDERELLA MAGNIVENTRA, new species

PLATE 10, FIGURES 5, 6

This vigorous species may be easily recognized by its broad, stout, linear branches with a single row of tubes dividing at irregular and sometimes long intervals, usually at a right angle, with the zooecia emerging from one side, quite swollen at the base, and with round, erect apertures. The branches are 1.2 mm. in diameter, the zooecial tubes are 2 mm. or less in length, the aperture averages 0.75 mm. in width, and 2½ to 3 zooecia occur in 5 mm. Surface very minutely porous and with annulations so faintly indicated that it is almost smooth.

Occurrence.—Middle Devonian (Traverse): Petoskey Cement Co., Petoskey (holotype) (Lower Gravel Point limestone), Thunder Bay River (Norway Point formation), Alpena and Thunder Bay quarry (Alpena limestone, Dock Street clay), all in Michigan.

Holotype.—U.S.N.M. Nos. 54110, 87940, 87942–87945.

HEDERELLA OBESA, new species

PLATE 10, FIGURE 4

Although evidently related to *H. magniventra*, this species may be recognized by its more regular zoarium branching at an angle of 45° or less and at intervals of 10 to 12 mm., by its short, swollen zooecial tubes arranged alternately on both sides of the central axis instead of one, and by the larger dimensions of the zooecia, their length averaging 2.7 mm., their width 1 mm., and 2 to 2.5 occurring in 5 mm. on the same side of a branch. The type specimen is a colony covering about 35 sq. cm. of a flat frond of *Fistulipora*.

H. major has a similar method of growth but has tubes half again as long, which expand gradually in diameter instead of immediately becoming ventricose.

Occurrence.—Hamilton (Ludlowville-Tichenor limestone): 18-Mile Creek, N. Y.

Holotype.—U.S.N.M. No. 87935.

HEDERELLA MAJOR, new species

PLATE 8, FIGURE 4

The type specimen incrusting a lamellate *Fistulipora* represents a new species in which the tubes are unusually large and in close contact for the greater part of their length, arising alternately from the side of the preceding one and forming branches 4 mm. wide, arising at an angle of 45°. The zooecial tubes average 4 mm. in length and 1.5 mm. in width, with 2 in 5 mm.

The unusual size of the zooecial tubes and branches of this species makes its recognition easy. The surface ornamentation is as in other members of the family, and the method of budding is exactly the same as in *Hederella*, so that it does not seem possible that it could belong to the Auloporidae, where it might be referred.

Occurrence.—Hamilton (Widder shale): Thedford, Ontario.

Holotype.—U.S.N.M. No. 26576.

HEDERELLA MICHIGANENSIS, new species

PLATE 10, FIGURES 1, 1′, PLATE 12, FIGURE 5

The several zoaria upon which this species is based are clearly related to the other members of the *H. magna* group, but they differ in that the branching is less regular, the zooecia are longer and emerge usually at a greater angle, and the microscopic dimensions although large for the genus are all smaller. In *H. michiganensis* the zooecial tubes average 2 mm. in length, their diameter is about 0.8 mm., and they issue from the main axis at intervals of their own length so that usually 2 occur in a distance of 5 mm. The details of the surface are rather similar to the other members of the group.

Occurrence.—Middle Devonian: Lake Shore at Bay View, Emmet County (cotypes) (Upper Gravel Point limestone), Thunder Bay River (Norway Point formation), Rockport quarry, Alpena County (cotype) (Upper Ferron Point formation), 1.6 miles north of Norwood, Charlevoix County (Petoskey formation), ¼ mile northwest of Bolton, Alpena County (Alpena limestone), all in Traverse group of Michigan; Falls of the Ohio (Sellersburg limestone).

Cotypes.—U.S.N.M. Nos. 87941, 93966, 94591.

HEDERELLA ROBUSTA, new species

PLATE 10, FIGURE 2; PLATE 12, FIGURES 6, 7

The robust colony in this species is occasioned by the very frequent branching of zooecial tubes, which in their general form and size are similar to those in other species of the group. Branching occurs at rather regular intervals of about 6 mm. and an angle of 45°, and the initial zooecium of a branch gives rise by frequent budding to 5 or 6 tubes before a new branch commences. The zooecia after leaving the parent tube vary in length according to age, but the average mature one is at least 3 mm. long and 1.2 mm. wide, with 2 usually occurring in 5 mm. Budding is usually at an angle of 30°. Surface very finely annulated with slightly coarser ridges at intervals. Although similar to *H. hibbardi*, the growth is more robust, tubes are larger, and branching more distinct.

Occurrence.—Middle Devonian: Norway Point Dam (holotype) (Norway Point formation) and other localities in Alpena County (Genshaw and Ferron Point formations), 1½ miles northeast of Bay View and 1.6 miles north of Norwood, Charlevoix County (Petoskey formation), ¼ mile northwest of Bolton, Alpena County (Alpena limestone), all in Traverse group of Michigan; 1½ miles southeast of East Bethany (Kashong shale) (paratype) and 3 miles west of East Bethany, N. Y. (paratype) (Centerfield shale); Thedford, Ontario (Widder shale).

Holotype and paratypes.—U.S.N.M. Nos. 87946, 93961, 93964, 93965, 93968.

HEDERELLA REIMANNI, new species

PLATE 12, FIGURE 8

Although of large proportions, this giant species is so similar to such minute but typical forms as *H. concinna* that there can be no doubt of its correct reference to *Hederella.* In *H. reimanni* the zooecial tubes are about 4 mm. long and 1.0 mm. wide, with about 1 in 5 mm., budding at such an acute angle as to nearly remain in contact, with zoarial branching at 10-mm. intervals, thus making this the largest *Hederella* known.

The specific name is given in recognition of the researches of Irving G. Reimann, of the Buffalo Society of Natural History, on the geology of western New York.

Occurrence.—Middle Devonian: Bay View (holotype) and 18-Mile Creek (Wanakah shale), and Pavilion (Tichenor limestone), N. Y.; 2½ miles southwest of Sylvania, Ohio (Silica shale).

Holotype.—U.S.N.M. Nos. 93963, 93967.

HEDERELLA HIBBARDI, new species

PLATE 4, FIGURES 3, 3′

The zoarium in this species occurs as a thick mat of large, broad zooecial tubes in close contact, which when analyzed shows the characteristic branching of this section, differing from such species as *H. robusta* in that the zooecia are less in length (2.5 mm.) and in width (0.7 mm.). Branching occurs at short intervals, averaging perhaps 4 mm., but at such an acute angle (20°) that the branches are usually in contact; 2½ to 3 zooecia may be measured in 5 mm.

The specific name is in honor of Raymond R. Hibbard, of Buffalo, N. Y., well-known student of the Bryozoa and Middle Devonian faunas.

Occurrence.—Hamilton (Arkona shale): 1 mile east of Marshs Mills and Arkona, Ontario.

Holotype and paratype.—U.S.N.M. No. 87967.

HEDERELLA PARALLELA GROUP

In the eight species classified under this heading the zooecia bud at such a low angle from the main axis that they usually remain in contact throughout the greater part of their length, thus giving the aspect of parallel arrangement.

HEDERELLA PARALLELA, new species

PLATE 2, FIGURES 1–2′

Hederella canadensis HALL and SIMPSON, Pal. New York, vol. 6, pl. 65, fig. 3, 1887.—GRABAU and SHIMER, North Amer. Index Foss., p. 120, fig. 179b, 1907.

Zoaria incrusting cup corals and other organisms where they form colonies as much as 7 cm. in length and branching at intervals of 8 mm. at angles of about 45°. Each branch appears to be made of three parallel rows of elongate tubes, which in reality consist of a central one giving rise on alternate sides to zooecia about 2 mm. long and 0.35 mm. wide at such a low angle as to remain in contact. Surface of tubes transversely rugose; apertures transversely oval and equaling the tubes in width; 2½ to 3 zooecia in 5 mm. measured along the same side of a straight branch.

Occurrence.—Hamilton group: Moscow (cotype) (Moscow shale–Windom member), 3 miles west of East Bethany (Centerfield shale), and 1½ miles south of East Bethany (cotype) (Tichenor limestone), 1½ miles southeast of East Bethany (Kashong shale), all in New York; Thedford, Ontario (Widder shale) (cotype).

Cotypes.—U.S.N.M. Nos. 87947–87949.

HEDERELLA COMPACTA, new species

PLATE 5, FIGURE 13

Allied to *H. parallela* is a species from the Middle Devonian of Michigan, with a similar growth habit but differing in that the zooecia are conspicuously shorter and broader (1.5 mm. long by 0.7 mm. wide), with 4 to 4½ in 5 mm., and budding at an equally acute angle. The initial tube from which they arise is so narrow that the zooecia appear as a parallel, compactly and alternately arranged series of rectangular tubes on each side of the middle line. Branching of the zoarium occurs at an angle of 20° and more frequently than in other members of the group.

Occurrence.—Middle Devonian (Traverse-Partridge Point formation): Partridge Point, 3 miles south of Alpena, Mich.

Holotype.—U.S.N.M. No. 54114.

HEDERELLA BILINEATA, new species

PLATE 5, FIGURES 9–11

The specific name of this minute species of the *H. parallela* group is suggested by the characteristic bilineate arrangement of the two rows of small, short, broad rectangular zooecia. The zoarium branches rather regularly at intervals of 3 mm. in the vicinity of the ancestrula, but elsewhere it may form delicate lines of zooecia 9 mm. or more in length before division occurs, in this case at an angle of 60°–90°. The zooecia average 1.0 mm. in length and about 0.3 mm. in width, with 5 to 6 in 5 mm.; they bud from the main axis at such a low angle that they remain confluent with each other, and are decorated with delicate transverse wrinkles. Apertures transversely oval, rising at an angle from the zooecial tubes.

Occurrence.—Middle Devonian: 3 miles west of East Bethany (cotype) (Centerfield shale), York (Ludlowville shale) (cotype), 18-Mile Creek (Wanakah shale), 1½ miles south of East Bethany, and Pavilion (Tichenor limestone), all in New York; Arkona, Ontario (Widder shale); 2½ miles southwest of Sylvania, Ohio (Silica shale); Lebanon, Ky.

Cotypes.—U.S.N.M. Nos. 87976–87980.

HEDERELLA CONSIMILIS, new species

Plate 5, Figure 12

Although closely allied to *H. bilineata* in size and general aspect, this new species differs in that it branches quite regularly at intervals of about 4½ mm. at a right angle, that the zooecia, although of about the same length (1 mm. long and 0.2 mm. wide, and 6 in 5 mm.), are narrower and bud at a wider angle (25°), so that they do not remain in contact throughout their length.

Occurrence.—Onondaga (Upper Jeffersonville limestone–*Spirifer acuminatus* bed): Falls of the Ohio.

Holotype.—U.S.N.M. No. 54123.

HEDERELLA LOUISVILLENSIS, new species

Plate 5, Figure 8

Although similar to *H. consimilis* in general aspect, the larger, wider, more swollen, and more rapidly expanding zooecia of this new species will distinguish it at once. The zooecia average 1.5 mm. in length, 0.4 mm. in width, and 4 occur in 5 mm. Budding occurs at an angle of 25° and branching at intervals of about 10 mm. and an angle of 50°.

Occurrence.—Onondaga (Upper Jeffersonville limestone–*Spirifer acuminatus* bed): Falls of the Ohio, Louisville, Ky.

Holotype.—U.S.N.M. No. 87985.

HEDERELLA ROMINGERI, new species

Plate 9, Figure 3

In this new species, named in honor of Dr. Carl Rominger, pioneer student of American Paleozoic corals, the zoarium occurs as a dense mat of tubes incrusting some foreign object, in the case of the holotype a ramose bryozoan. By unraveling the tubes it may be perceived that branching occurs at intervals of 5 mm. and that both the branches and the zooecia divide at such a small angle that the resulting colony is closely compacted. The zooecial tubes average 2.2 mm. in length, 0.5 mm. in width, and about 3 zooecia occur in 5 mm.; surface strongly rugose.

The presence of a narrow central tube, from which the zooecia bud alternately to right and left, and the parallel arrangement of the latter

139917—39——3

because they remain in contact seem to relate this species to the *H. parallela* group.

Occurrence.—Middle Devonian (Traverse–Genshaw formation): Long Lake near Alpena, Mich.

Holotype.—U.S.N.M. No. 54106.

HEDERELLA TRISERIATA, new species

Plate 2, Figure 3

This species is similar to *H. parallela* in the development of a long median tube that extends for some distance before it terminates as a zooecium, so that the branch appears to be made of three parallel rows. Compared further with *H. parallela,* the zooecial tubes are shorter and broader, averaging 1.6 mm. in length, with a width of about 0.4 mm. and an angle of budding of 25°. The branch is about 1.3 mm. wide and divides more frequently and at an angle of 45°; 3 zooecia occur in 5 mm.

Occurrence.—Devonian (Snyder Creek shale): Fulton, Mo.

Holotype.—U.S.N.M. No. 25462.

HEDERELLA VARSOVIENSIS, new species

Plate 9, Figure 1

The fragmentary zoarium forming the holotype of this species incrusts a *Fenestrellina* and seems to belong to the *H. parallela* group because of the narrow branches with parallel zooecial tubes in its early stages, but later it forms compact masses by frequent division. The initial branches are only about 1 mm wide and divide at considerable intervals, often 9 mm; later division occurs at close intervals (3 mm.) and at such a low angle that a fan-shaped expansion of closely set tubes results. The tubes average 2 mm. in length, 0.35 mm. in width, and 2 to 3 occur in 5 mm. Their surface ornamentation is a very delicate but distinct transverse annulation.

Occurrence.—Mississippian (Warsaw limestone): Warsaw, Ill.

Holotype.—U.S.N.M. No. 54098.

HEDEROPSIS, new genus

Zoarium externally similar to *Hederella* but distinguished internally by the presence of a well-defined longitudinal septum within the zooecial tubes along their basal side. In some tubes this septum or carina is joined at right angles by transverse partitions at regular intervals, thus dividing the base of the zooecium into two series of parallel compartments. The purpose of the septum and compartments is unknown, but as they appear in at least six species having other characters in common it is believed they form a good generic character.

Genotype: *Hederopsis typicalis,* new species. Devonian (Onondaga, Hamilton).

HEDEROPSIS TYPICALIS, new species

PLATE 14, FIGURES 2–6

Zoarium incrusting fenestellid Bryozoa and other organic objects, formed of robust cylindrical tubes averaging 3 mm. in length and 1.3 mm. in width, budding at an angle of 45°, with 3 to 4 in 5 mm., and branching at intervals of 5 mm. and 45° angle. The tubes are attached by only a small portion of their basal surface and in budding often grow over each other so as sometimes to form a composite colony of a centimeter or so in thickness. Apertures large, open, terminal, exhibiting on their basal side the characteristic septum and the transverse partitions. Occasionally the zoarium becomes freed of the object upon which growth started, in which case it may be clearly noted how one zooecium serves as a central tube giving rise alternately on each side to the usual zooecia, which in turn bud at intervals to form a central tube of a new branch. Both upper and under sides of the tubes are strongly wrinkled.

Occurrence.—Onondaga (Upper Jeffersonville limestone-*Spirifier acuminatus* bed): Falls of the Ohio.

Cotypes,—U.S.N.M. No. 54093.

HEDEROPSIS RAASCHI, new species

PLATE 14, FIGURE 1

This well-developed species shows considerable resemblance to the *H. magna* group of *Hederella,* but the interior of the tubes exhibits the characteristic basal carina of *Hederopsis.* The zoarium incrusts brachiopod shells, ramose Bryozoa, and other organisms indiscriminately, forming colonies of several square centimeters in size, composed of short, broad branches arising rather regularly at intervals of 5 mm. or less at an angle of about 60°, each starting with a single tube that buds to the right and left alternately several times before a new branch arises. This arrangement is rather marked when the growth is regular. The zooecial tubes average about 2.5 mm. in length and 0.7 mm. in width, budding at an angle of 25°. The apertures are terminal and more rounded than usual. The characteristic basal septum is easily distinguished on the better-preserved tubes. Surface ornamentation of rugose wrinkles with a faintly pitted or porous structure on all the walls.

Although closely related to the genotype, this species may be easily distinguished by its much smaller zooecial tubes and different method of branching and budding. The specific name is in recognition of the work of Gilbert Raasch upon the Milwaukee Devonian section.

Occurrence.—Middle Devonian (Milwaukee limestone, Lindwurm member): Milwaukee, Wis.

Holotype.—U.S.N.M. No. 57530.

HEDEROPSIS BIFURCATA, new species

Plate 14, Figure 9

This species forms regularly bifurcating expansions upon fenestellid Bryozoa, composed of somewhat narrow elongate zooecia 3 to 4 mm. in length and 0.35 mm. in width, with about 2 in 5 mm. Branching occurs rather regularly at intervals of 5 or 6 mm., each branch consisting of a main tube giving rise on alternate sides at distances of 2 mm. to new tubes at a low angle but remaining separate. The median carina, although often not so well preserved in the tubes, is frequently represented by traces in the form of an excavation.

The narrow zooecia and the regularity of bifurcation of both branches and tubes well characterize this species.

Occurrence.—Onondaga (Upper Jeffersonville limestone–*Spirifer acuminatus* bed): Falls of the Ohio.

Holotype.—U.S.N.M. No. 87890.

HEDEROPSIS CONNATA, new species

Plate 14, Figure 10

In this robust species the characteristic basal septum is well developed and the zooecial tubes are unusually large, their measurements being 4 to 5 mm. in length and 1 mm. wide, with 1 to 2 in 5 mm. Branching occurs rather regularly at intervals of about 6 mm. and angle of 45°, each branch consisting of a broad expansion of 4 or 5 rows of tubes and budding at 45°. The zooecia are usually in contact especially along the middle line. Budding occurs at close intervals on alternate sides of the main axis, thus increasing the compact aspect of the zoarium.

The broad, solid, regularly dividing branches of long, wide, closely arranged zooecia well characterize this species.

Occurrence.—Onondaga (Upper Jeffersonville limestone–*Spirifer acuminatus* bed): Falls of the Ohio.

Holotype.—U.S.N.M. No. 87891.

HEDEROPSIS CURTA, new species

Plate 14, Figure 7

This neat species is characterized by its short, broad tubes with erect, rounded apertures arranged in bilinear branches, which bifurcate at an angle of about 30° at intervals of about 6 mm. The first zooecium of a branch is 3 mm. in length, but the following average only 1½ mm., although the width varies little from 0.66 mm. Budding occurs not laterally as in *Hederella* but from the underside at an acute angle, so that each zooecium overlaps the succeeding one. There are 2 to 3 zooecia in 5 mm., measuring along one side of the branch.

The zooecial diameter is similar to that in *H. raaschi*, but the bilinear arrangement and quite different method of branching will serve to distinguish *H. curta*.

Occurrence.—Onondaga (Upper Jeffersonville limestone–*Spirifer acuminatus* bed): Falls of the Ohio.

Holotype.—U.S.N.M. No. 54089.

HEDEROPSIS LONGITUBA, new species

Plate 14, Figure 8

This species is readily recognized by its long zooecial tubes and by the well-marked carina or longitudinal septum on their basal wall. The zooecia bud alternately from the main axis at such a low angle that for a portion of their length they remain in contact and then diverge slightly. The tubes are unusually long, 4 mm. in length and 0.66 mm. in diameter with 1 or 2 in 5 mm. As usual the main axis persists for some distance before ending as a zooecium and giving rise to another tube, which continues as the axis. The zooecia also are rather rounded and tend to become detached from the substratum. In budding they frequently cross the main axis or otherwise depart from normal regularity. However, in normally growing zoaria definite branching occurs at intervals of about 6 mm. The apertures are terminal, broadly elliptical, with the median carina plainly visible within them.

Occurrence.—Onondaga (Upper Jeffersonville limestone–*Spirifer acuminatus* bed): Falls of the Ohio.

Holotype.—U.S.N.M. No. 87889.

Genus REPTARIA Rollé, 1851

Reptaria Rollé, *in* Leonhard and Bronn, Neues Jahrbuch, p. 810, 1851.—Hall and Simpson, Pal. New York, vol. 6, p. 25, 1887.—Miller, North Amer. Geol. Pal., p. 320, 1889.—Simpson, 14th Ann. Rep. State Geol. New York, 1894, p. 599, 1897.—Grabau, Bull. Buffalo Soc. Nat. Sci., vol. 6, p. 178, 1899.—Nickles and Bassler, U. S. Geol. Surv. Bull. 173, p. 21, 1900.—Prantl, Acta Musei Nationalis Pragae, vol. 1 (B), p. 80, 1938.

Ptilioneila Hall, Trans. Albany Inst., vol. 10, p. 599, 1883 (abstract, p. 195, 1881).

Bryozoon Barrande, Syst. Sil. Centre Boheme, Cephalopoda, vol. 11, pl. 248, 1868.

In this genus the cylindrical annulated zooecia are all alike in shape and length and arise alternately from the basal part of the preceding one at a low angle and with such regularity as to remain in contact almost their whole length, and furthermore the branches divide so uniformly that the zoarium altogether has a featherlike aspect. The regularity of budding gives the impression that the zooecia arise from a central line, but this is not true, since well-preserved examples as well as weathered specimens show that the regularity is due to the uniform size of the zooecia and direction of budding, and also since each arises near the base of the preceding one on the opposite side of the branch. The surface characters and the shape of the aperture are the same as in *Hederella.*

Reptaria can, therefore, be considered as a *Hederella* in which the zooecia arise so nearly opposite each other as to give the branch the appearance of two equal parallel rows arising from a median line. In addition to the following species, the genus includes *Reptaria* (*Bryozoon*) *steiningeri* (Barrande, 1868) (*Thamnocoelum pennulatum* Počta, 1894) and *R. gigas* Prantl, 1938, from the Silurian and Devonian of Bohemia.

REPTARIA STOLONIFERA Rollé, 1851

PLATE 16, FIGURES 4–8

Reptaria stolonifera ROLLÉ, in Leonhard and Bronn, Neues Jahrbuch, p. 810, pl. 9, figs. 5, 6, 1851.—HALL and SIMPSON, Pal. New York, vol. 6, p. 274, pl. 65, pp. 17–19, 1887.—SIMPSON, 14th Ann. Rept. State Geol. New York, 1894, pl. 25, figs. 8, 9, 1897.—GRABAU, Bull. Buffalo Soc. Nat. Sci., vol. 6, p. 178, fig. 76, 1899.—GRABAU and SHIMER, North Amer. Index Foss., p. 120, fig. 180, 1907.—BASSLER, *in* Cleland, Wisconsin Geol. Nat. Hist. Surv. Bull. 21, sci. ser. 6, p. 57, pl. 6, figs. 7, 8, 1911.—STEWART, Geol. Surv. Ohio, ser. 4, Bull. 32, p. 27, pl. 2, figs. 1, 2, 1927.

Ptilionella penniformis HALL, Trans. Albany Inst., vol. 10, p. 195, 1883 (abstract, p. 195, 1881); Rep. State Geol. New York, 1883, p. 56, 1884.

Ptilionella nodata HALL, Trans. Albany Inst. vol. 10, p. 195, 1883 (abstract, p. 195, 1881); Rep. State Geol. New York, 1883, p. 57, 1884.

Reptaria nodata HALL and SIMPSON, Pal. New York, vol. 6, p. 276, 1887.

The zoarium in this species, the genotype, usually incrusts cephalopod shells, where it covers areas as much as 50 sq. cm., composed of branches of a uniform diameter of about 3 mm. dividing at long intervals at angles of 45°–60°, but sometimes as often as every 10 mm. or even less. Zooecia strongly annulated, the rings at times appearing rather nodose, budding from near the base of the opposite preceding one at an angle of less than 45° and increasing in width and curving gently outward, attaining a length of 3 mm. and a width of 0.5 mm. Measuring on one side of a branch, 5 to 6 zooecia in 5 mm.

The type of *Reptaria nodata* Hall proves to be a much-branched example of *R. stolonifera.* *Thamnocoelum pennulatum* Počta, 1894, from the Devonian (E_2) of Bohemia, judged from the illustration here reproduced (pl. 16, fig. 9), is certainly a very closely related species.

Occurrence.—Middle Devonian: Cazenovia, Brookfield, Kashong Creek, etc., N. Y. (Ludlowville shale); Thedford, Ontario (Widder shale); Milwaukee, Wis. (Milwaukee limestone-Lindwurm member); 2½ miles southwest of Sylvania, Ohio (Silica shale); Falls of the Ohio (Sellersburg limestone).

Plesiotypes.—U.S.N.M. Nos. 54577, 87892, 87893.

REPTARIA GASPÉENSIS, new species

PLATE 16, FIGURE 1

The type specimen of this species, which incrusts a brachiopod, shows that the zooecia are as wide as but much shorter and more nodose than in *R. stolonifera*, and the branches subdivide at closer intervals at an angle of 45°. Zooecia 1.5 mm. long, 0.5 mm. wide, with 6 to 7 zooecia in 5 mm.; budding at angle of about 30°. The branches are 2 mm. wide and divide at intervals of 6 mm.

Occurrence.—Devonian (Gaspé sandstone): Gaspé, Quebec.

Holotype.—U.S.N.M. No. 94576.

REPTARIA CAYUGA, new species

PLATE 16, FIGURE 2

Hederella sp. MONAHAN, Amer. Midl. Nat., vol. 12, No. 10, p. 389, pl. 3, fig. 3, 1931.

The type specimen of this new species, in the collection of the Buffalo Society of Natural History, consists of a natural mold or excavation in a cephalopod shell (*Mitroceras*) representing a species of *Reptaria* that differs from the genotype in the smaller dimensions of the zooecia, in their less regular arrangement, the lesser width of the branch, and the greater separation of the zooecia. The zooecia average 2 mm. in length, width 0.3 mm. bud at an angle of about 30°, and 6 occur in 5 mm.; the branches subdivide rather frequently at an angle of 45°, and average 2 mm. in width. This species, collected by the late Joseph W. Monahan, is interesting in being geologically the earliest known of the genus.

Occurrence.—Silurian (Cayugan-Bertie limestone): Quarries at Buffalo, N. Y.

Plastoholotype.—U.S.N.M. No. 87897.

REPTARIA CLOUDI, new species

PLATE 16, FIGURE 3

Compared with the genotype, this species is at once separated by its smaller dimensions both in the size of the tubes (average length 2 mm. and 0.3 mm. in width, with 4 in 5 mm.) and branches. The zoarium of the type specimen incrusts a cephalopod and consists of branches slightly less than 2 mm. in diameter, dividing rather regularly at an angle of about 70° at intervals of 7 mm. or more. Although approaching *R. cayuga* in general dimensions, the rectangular method of branching and the more closely and regularly arranged zooecia, separate the present form. The specific name is in recognition of the work of Preston Cloud on the faunas of the Middle Devonian of North America.

Occurrence.—Upper Devonian (Tully limestone-West Brook member): 2½ miles south of Sherburne, N. Y.

Holotype.—U.S.N.M. No. 87894.

Genus HERNODIA Hall, 1881

Hernodia Hall, Trans. Albany Inst., vol. 10, p. 196, 1883 (abstract, p. 196, 1881); Rep. State Geol. New York, 1883, p. 58, 1884—Hall and Simpson, Pal. New York, vol. 6, p. 26, 1887.—Miller, North Amer. Geol. Pal., p. 309, 1889.—Simpson, 14th Ann. Rep. State Geol. New York, 1894, p. 596, 1897.—Nickles and Bassler, U. S. Geol. Surv. Bull. 173, p. 21, 1900.

Nicholsonia Davis (part), Kentucky Foss. Corals, pt. 2, 1885 (name proposed but not defined). [Genotype: *N. canadensis* Davis (not Nicholson) = *Hernodia davisi* and *Hederella contortilis*, new species.]

This genus may be distinguished from *Hederella* by its elongate, club-shaped, annulated zooecia budding regularly from the middle of the lateral wall of the preceding zooecia, each in this manner giving rise to one or more daughter cells. At intervals rather constant for the species a bud inaugurates a new branch as in *Hederella*, and this in turn divides still further. Thus *Hernodia* may be considered as a *Hederella* with clavate zooecia arising from the middle portion of the preceding one. Besides the following species, *Hernodia* includes *H. poutai* Prantl, 1938, and *H. perminuta* Prantl, 1938, from the Silurian and Devonian, respectively, of Bohemia.

HERNODIA HUMIFUSA Hall, 1881

Plate 15, Figures 5, 6

Hernodia humifusa Hall, Trans. Albany Inst., vol. 10, p. 196, 1883 (abstract, p. 196, 1881); Rep. State Geol. New York 1883, p. 58, 1884.—Hall and Simpson, Pal. New York, vol. 6, p. 281, pl. 65, figs. 20, 21, 1887.—Simpson, 14th Rep. State Geol. New York, 1894, pl. 25, figs. 1, 2, 1897.—Grabau and Shimer, North Amer. Index Foss., p. 120, 1907.—Bassler, *in* Cleland, Wisconsin Geol. Nat. Hist. Surv., Bull. 21, sci. ser. 6, p. 58, pl. 6, figs. 9, 10, 1911.

This, the genotype, is a robust, well-marked species, with zooecia 5 to 6 mm. in length, giving rise regularly toward the middle of each side at an angle of 45° to buds 0.25 mm. in diameter at their base, expanding gradually to the full width of the tube, 1 mm. Branching occurs rather regularly at distances sometimes of 15 mm. and at angles of 45° or less, so that the entire zoarium presents a graceful aspect.

Occurrence.—Middle Devonian: Cazenovia, etc. (Ludlowville shale), N. Y.; Milwaukee, Wis. (Milwaukee limestone).

Plesiotype.—U.S.N.M. Nos. 87885, 94623.

HERNODIA CORNUCOPIA, new species

PLATE 15, FIGURE 7

At first sight this well-developed species appears far removed from the genotype, but upon tracing the method of branching and the type of budding it is apparently a *Hernodia*, differing from typical species in that the branches are composed of tubes in close contact but arising in the normal manner on alternate sides from the midlength of the preceding tube. Although the type specimen is almost a solid mass of closely arranged tubes, branching occurs at intervals of about 10 mm. and at angles of about 45°, each branch starting with a single tube and, by its subdivision, increasing to a width of 10 mm., exhibiting 10 rows of zooecia before another bifurcation occurs. Each zooecium is distinctly horn-shaped, 3 to 4 mm. in length, and 1.3 mm. in width at its distal end, budding at such a low angle from the preceding one as to remain practically in contact. The apertures are terminal and elliptical; surface marked with very delicate transverse lines widely spaced.

Occurrence.—Middle Devonian (Traverse-Genshaw formation): Long Lake, Alpena, Mich.

Holotype.—U.S.N.M. No. 87886.

HERNODIA ULRICHI, new species

PLATE 15, FIGURE 8

Although evidently related to the genotype in method of budding and branching, this new species, named in honor of Dr. E. O. Ulrich, is separated at once by its smaller dimensions, the zooecia averaging only 3.5 mm. in length and 0.8 mm. in width. Furthermore, the zooecia expand more rapidly and bud at a greater angle (40°), while the branches subdivide at intervals of about 5 mm. at angles of more than 45°.

The type specimen, preserved as a siliceous cast of the interior, shows the specific characters very well, but a better-preserved example would form a most interesting fossil.

Occurrence.—Onondaga (Upper Jeffersonville limestone-*Spirifer acuminatus* bed): Falls of the Ohio.

Holotype.—U.S.N.M. No. 54128.

HERNODIA TENNESSEENSIS, new species

PLATE 15, FIGURE 1

Gutta-percha impressions of the type specimen, which is represented by an excavation in the base of a massive stony bryozoan, indicate a well-marked species that can be referred to only as a *Hernodia* with long zooecial tubes much narrowed in the proximal portion whence budding proceeds. The zooecia are regularly 4 mm. long, including the narrow proximal part, and 0.6 mm. wide at their distal end. They emerge at a rather acute angle and bend slightly outward, remaining free but close together throughout their course, with 3 to 4 in 5 mm. Branching is also rather regular at intervals of about 6 mm. and at an angle of 45°.

This species shows considerable resemblance to *Reptaria*, differing mainly in that the zooecia bud on alternate sides instead of practically opposite each other.

Occurrence.—Helderbergian (Birdsong shale): Swaynes Mills, Benton County, Tenn.

Holotype.—U.S.N.M. No. 54127.

HERNODIA DAVISI, new species

PLATE 15, FIGURE 9

Nicholsonia canadensis DAVIS (not *Hederella canadensis* Nicholson), Kentucky Foss. Corals, pt. 2, pl. 51, fig. 6 (not pl. 80, fig. 15, or pl. 73, figs. 10, 11), 1885.

This interesting species forms featherlike incrustations upon brachiopod shells, where it covers areas of several centimeters in extent. Branching at intervals of 7 mm. or more and at an angle between 45° and 90° prevents the zooecia from forming compact masses. Each zooecial tube is distinct, curving slightly outward, and averages 2 mm. in length and 0.4 mm. in width, with about 3½ in 5 mm. Each arises at an angle of 25° on alternate sides of a prolonged central tube composed of the narrow proximal parts of the successive zooecia.

Closely allied to *H. tennesseensis* in zooecial dimensions, *H. davisi* can be distinguished by its loosely dividing branches, free tubes, and more distinctly developed central tube, in the last respect showing relations to *Hederella*.

Our figured specimen corresponds exactly with Davis' illustration, but a new name is necessary since his name *Nicholsonia canadensis* evidently referred to *Hederella canadensis* Nicholson.

Occurrence.—Middle Devonian: Falls of the Ohio (Silver Creek dolomite); 2 miles north of Arkona, Ontario (Widder shale).

Holotype.—U.S.N.M. No. 54118.

HERNODIA ? COOPERI, new species

PLATE 16, FIGURE 10

This well-marked species exhibits all the generic features of *Hernodia* except that the tubes have the thick walls and the nearly smooth surface characteristic of the Auloporidae. Its generic position is, therefore, doubtful, but at any rate it represents a distinct species.

Except for the wall structure, *H. ? cooperi* may be distinguished from other species of *Hernodia* by its short (2 mm.) rapidly expanding zooecia (0.6 mm. wide at distal end, budding at angle of 25°, with 2 to 3 in 5 mm.) and its branching at short but regular intervals (3 mm.) at an angle of more than 45°. With continued growth only a small opening is left between the branches, which disappear in old specimens leaving all the tubes in contact.

Occurrence.—Middle Devonian: Averys Creek, Erie County, N. Y. (Ludlowville-Wanakah shale); Rockport quarry, Alpena County (Traverse-Upper Ferron Point formation), 1.6 miles north of Norwood, Charlevoix County (Petoskey formation), Thunder Bay quarry, Alpena (Alpena limestone-Dock Street clay), all in Traverse group of Michigan.

Holotype.—U.S.N.M. No. 94586.

HERNODIA ? MONAHANI, new species

PLATE 15, FIGURE 3

Hederella cfr. *canadensis* MONAHAN, Amer. Midl. Nat., vol. 12, No. 10, p. 388, pl. 3, fig. 2, pl. 4, fig. 2, 1931.

This new species is named in honor of Joseph W. Monahan, whose early death lost to science an enterprising student of Devonian paleontology. It occurs as an excavation in the surface of a cephalopod (*Mitroceras*) preserved in the Museum of the Buffalo Society of Natural Sciences as No. 13342.

Gutta-percha squeezes of this mold indicate a well-marked species of either *Hederella* or *Hernodia*, which is of interest further in that it comes from Silurian rocks. As the illustration on plate 15 shows, the zooecia bud very regularly and alternately from a median axis, but the preservation is not good enough to enable one to determine whether this axis is formed of the caudal extremities of the tubes as in *Hernodia* or an elongate tube that gives rise on each side to buds as in *Hederella*.

In *H. ? monahani* branching is rather regular, at intervals of not less than 6 mm. and at angles of about 45°. The zooecia are small, cornucopia-shaped, bending outward in a curve, at an angle of 45°, averaging 1.3 mm. in length, 0.4 mm in width, and 4 in 5 mm. measuring along one side of the axis.

Occurrence.—Silurian (Cayugan-Bertie limestone): Near Buffalo, N. Y.

Plastoholotype.—U.S.N.M. No. 87883.

HERNODIA (?HEDERELLA) COMPACTA, new species

Plate 15, Figure 4

Incrusting brachiopod shells in the Columbus limestone is a species belonging possibly to *Hederella*, characterized by the very compact arrangement of the zooecia. The few specimens available for study indicate a frequently branching *Hernodia* (angle of 60°–90°), in which the zooecial tubes bud from each other so frequently and at such a low angle that they remain practically in contact throughout their length. The tubes are 1½ to 2 mm. in length and 0.6 mm. in width, with 3 to 4 in 5 mm. They clearly originate alternately from about the midlength of the preceding zooecium at an angle of 30°.

Occurrence.—Onondaga (Columbus limestone): Sandusky, Ohio.

Holotype.—U.S.N.M. No. 54124.

FAUNAL LISTS SHOWING GEOLOGICAL AND GEOGRAPHICAL DISTRIBUTION

Silurian (Gotlandian): Island of Gotland.
Hederella siluriana, new species.

Silurian (Ludlow-Budnany limestone): Kosor, etc., Bohemia.
Hederella fruticosa (Počta, 1894); *H. formosa* Prantl, 1938; *Hernodia počtai* Prantl, 1938; *Reptaria steiningeri* (Barrande, 1868).

Silurian (Cayugan-Bertie limestone): Buffalo, N. Y.
Hernodia ? monahani, new species; *Reptaria cayuga*, new species.

Helderbergian (New Scotland limestone): Schoharie, Schoharie County, N. Y.
Hederella helderbergia, new species.

Helderbergian (New Scotland-Birdsong shale): Swaynes Mills (S), Perryville (P), and south of Camden (C), Tenn.
Hederella camdenensis, new species (C); *H. nodifera* new species (P); *Hernodia tennesseensis*, new species (S).

Helderbergian (50 feet below top): Big Stone Gap, Va.
Hederella ulrichi, new species.

Oriskany sandstone: Becraft Mountain near Hudson, N. Y.
Hederella arachnoidea Clarke, 1900; *H. gracilior* Clarke, 1900; *H. magna praecedens*, new variety; *H. ramea* Clarke, 1900.

Onondaga (Upper Jeffersonville limestone–*Spirifer acuminatus* bed): Falls of the Ohio at Louisville, Ky.
Hederella adnata (Davis, 1885); *H. angulata* (Davis, 1885); *H. consimilis*, new species; *H. contortilis*, new species; *H. delicatula*, new species; *H. louisvillensis*, new species; *H. tenera*, new species; *Hederopsis bifurcata*, new species; *H. connata*, new species; *H. curta*, new species; *H. longituba*, new species; *H. typicalis*, new species; *Hernodia ulrichi*, new species.

Onondaga (Columbus limestone): Sandusky, Ohio.
Hederella concinna, new species; *Hernodia (?Hederella) compacta*, new species.

Onondaga (Decewville limestone): Port Colborne, Ontario.
Hederella canadensis (Nicholson, 1874); *H. colbornensis*, new species.

Onondaga drift: Vicinity of Ann Arbor, Mich.
Hederella canadensis (Nicholson, 1874).

DEVONIAN (Gaspé sandstone): Portage Road (P), Haldemand (H), and Gaspé (G), Quebec.

Hederella blainvillei Clarke, 1907 (P, H, G); *H. quebecensis*, new species (G); *Reptaria gaspéensis*, new species (G).

HAMILTON (Arkona shale): Arkona (A), Bartletts Mills (B), and 1 mile east of Marshs Mill (M), Ontario.

Hederella hibbardi, new species (A, M); *H. magna* Hall, 1881 (A); *H. thedfordensis*, new species (B).

HAMILTON (Widder shale): Arkona (A), Thedford (T), Bartletts Mills (B), Ontario.

Hederella bilineata, new species (A); *H. cirrhosa* Hall, 1881 (A, T); *H. concinna*, new species (A, T); *H. delicatula*, new species (A, T); *H. filiformis* (Billings, 1859) (A, T); *H. germana*, new species (T); *H. magna* Hall, 1881 (A. T); *H. major*, new species (T); *H. parallela*, new species (T); *H. parvirugosa*, new species (T, A, Marshs Mill, 2½ miles east of Arkona); *H. persimilis*, new species (T); *H. rectifurcata*. new species (T); *H. regularis* new species (T), *H. robusta* new species (T); *H. rugosa*, new species (A, T); *H. thedfordensis*, new species (A, B, T); *H. vagans*, new species (A, B, T); *Hernodia davisi*, new species (A); *Reptaria stolonifera* Rollé, 1851 (T).

HAMILTON (Ludlowville-Wanakah shale): 18-mile Creek (18), York (Y), Wanakah (W), Elma (E), Bay View (B), Athol Springs (A), Hamburg (H), Averys Creek (Av), Erie County in general (Er), N. Y.

Hederella bilineata, new species (18, Y); *H. cirrhosa* Hall, 1881 (Y, A, Er); *H. concinna*, new species (Er); *H. delicatula*, new species (18, Er); *H. filiformis* (Billings, 1859) (18, A); *H. magna* Hall, 1881 (B, Er); *H. nicholsoni*, new species (18, W, E, B, A); *H. parvirugosa*, new species (E); *H. persimilis*, new species (A); *H. rectifurcata*, new species (18, A); *H. reimanni*, new species (B, 18); *H. rugosa*, new species (Er); *H. thedfordensis*, new species (H, Av); *Hernodia ? cooperi*, new species (Av).

HAMILTON (Ludlowville shale exact zone indefinite): Kashong Creek (K), Skaneateles Lake (S), Canandaigua Lake (C), York (Y), West Bloomfield (W), Livingston County (L), Cazenovia (Ca), and Brookfield (B), N. Y.

Hederella bilineata, new species (Y); *H. cirrhosa* Hall, 1881 (W, Y, S); *H. concinna*, new species (K, L); *H. conferta* (Hall, 1881) (K, C); *H. delicatula*, new species (Y); *H. parvirugosa*, new species (S); *H. rectifurcata*, new species (K); *H. rugosa*, new species (C, Y); *H. thedfordensis*, new species K, L); *Hernodia humifusa* Hall, 1881 (Ca); *Reptaria stolonifera* Rollé, 1851 (K, Ca, B).

HAMILTON (Ludlowville-Centerfield shale): 3 miles west of East Bethany, N. Y.

Hederella bilineata, new species; *H. cirrhosa* Hall, 1881; *H. clarkei*, new species; *H. concinna*, new species; *H. concinnoides*, new species; *H. delicatula*, new species; *H. filiformis* (Billings, 1859); *H. magna* Hall, 1881; *H. nicholsoni*, new species; *H. parallela*, new species; *H. pavilionensis*, new species; *H. rectifurcata*, new species; *H. regularis*, new species; *H. robusta*, new species; *H. rugosa*, new species; *H. thedfordensis*, new species.

HAMILTON (Ludlowville-Tichenor limestone): 18-mile Creek (18), 1½ miles south of East Bethany (E), Darien (D), and near Pavilion (P), N. Y.

Hederella bilineata, new species (P, E); *H. cirrhosa* Hall, 1881 (E); *H. concinna*, new species (P, D, E); *H. delicatula*, new species (P, E); *H. filiformis* (Billings, 1859) (P, E); *H. magna* Hall, 1881 (P); *H. parallela*, new species (E); *H. parvirugosa*, new species (P); *H. obesa*, new species (18); *H. pavilionensis*, new species (P, E); *H. rectifurcata*, new species (E); *H. reimanni*, new species (P); *H. rugosa*, new species (P, E); *H. vagans*, new species (P, E).

HAMILTON (Moscow shale): Moscow (Windom) (M), 18-Mile Creek (18), Pavilion (P), Leicester (Windom) (L), Kashong Creek (Windom) (K), N. Y.

Hederella cirrhosa Hall, 1881 (P); *H. delicatula*, new species (M, K, L); *H. magna* Hall, 1881 (18); *H. parallela*, new species (M); *H. parvirugosa*, new species (M); *H. rugosa*, new species (M).

HAMILTON (Moscow-Kashong shale): Tile yard, 1½ miles southeast of East Bethany, N. Y.

Hederella filiformis (Billings, 1859); *H. parallela*, new species; *H. parvirugosa*, new species; *H. rectifurcata*, new species; *H. robusta*, new species; *H. rugosa*, new species; *H. thedfordensis*, new species.

MIDDLE DEVONIAN (Sellersburg limestone): Falls of the Ohio (F), Lebanon, Ky. (L), 3½ miles west of Charlestown, Ind. (C).

Hederella bilineata, new species (L); *H. cirrhosa* Hall, 1881 (C, Silver Creek dolomite); *H. delicatula*, new species (L); *H. michiganensis*, new species (F); *H. parvirugosa*, new species (C, Silver Creek); *Hernodia davisi*, new species (F, Silver Creek); *Reptaria stolonifera* Rollé, 1851 (F).

MIDDLE DEVONIAN (Milwaukee limestone-Lindwurm member): Milwaukee, Wis.

Hederella alpenensis, new species; *H. delicatula*, new species; *H. edwardsi*, new species; *H. filiformis* (Billings, 1859); *H. halyson* (Fenton and Fenton); *H. rectifurcata*, new species; *Hederopsis raaschi*, new species; *Hernodia humifusa* Hall, 1881; *Reptaria stolonifera* Rollé, 1851.

MIDDLE DEVONIAN (Silica shale): 2½ miles southwest of Sylvania, Ohio.

Hederella alpenensis, new species; *H. bilineata*, new species; *H. concinnoides*, new species; *H. delicatula*, new species; *H. filiformis* (Billings, 1859); *H. magna* Hall, 1881; *H. parvirugosa*, new species; *H. rectifurcata*, new species; *H. reimanni*, new species; *H. thedfordensis*, new species; *H. vagans*, new species; *Reptaria stolonifera* Rollé, 1851.

MIDDLE DEVONIAN (Traverse-Upper Bell shale): Rockport quarry, northeast corner of Alpena County, Mich.

Hederella filiformis (Billings, 1859); *H. nicholsoni*, new species.

MIDDLE DEVONIAN (Traverse-Upper Ferron Point formation): Abandoned shale pit of Alpena Portland Cement Co., SE¼ Sec. 18, T. 32 N., R. 9 E. (P), Rockport quarry (R), and Alpena Cement Co. (A), Alpena County, Mich.

Hederella alpenensis, new species (P); *H. delicatula*, new species (R); *H. filiformis* (Billings, 1859) (P, R); *H. michiganensis*, new species (R); *H. parvirugosa*, new species (P); *H. robusta*, new species (A); *Hernodia ? cooperi*, new species (R).

MIDDLE DEVONIAN (Traverse-Genshaw formation): Southwest shore of Long Lake, Alpena County (L), Alpena County (A), Mich.

Hederella alpenensis, new species (El Cajon Beach, L); *H. magniventra*, new species (A); *H. robusta*, new species (A); *H. romingeri*, new species (L); *H. thedfordensis*, new species (A); *Hernodia cornucopia*, new species (L).

MIDDLE DEVONIAN (Traverse-Alpena limestone): Alpena (A), ¼ mile northwest of Bolton, Alpena County (B), Thunder Bay quarry, Alpena (T, Dock Street clay), Mich.

Hederella alpenensis, new species (B); *H. delicatula*, new species (B, T); *H. filiformis* (Billings, 1859) (B); *H. magniventra*, new species (A, T); *H. michiganensis*, new species (B); *H. robusta*, new species (B); *H. rugosa*, new species (T); *H. thedfordensis*, new species (T); *Hernodia ? cooperi*, new species (T).

MIDDLE DEVONIAN (Traverse-Norway Point formation): ½ mile southeast of 4-Mile Dam, Alpena County (4), Thunder Bay River (T), and Norway Point Dam (N), Mich.

Hederella alpenensis, new species (4); *H. delicatula*, new species (4); *H. filiformis* (Billings, 1859) (4); *H. magniventra*, new species (T); *H. michiganensis*, new species (T); *H. persimilis*, new species (N); *H. robusta*, new species (N).

MIDDLE DEVONIAN (Traverse-Partridge Point formation): Partridge Point, about 3 miles south of Alpena, Mich.

Hederella cirrhosa Hall, 1881; *H. compacta*, new species; *H. delicatula*, new species; *H. persimilis*, new species; *H. rugosa*, new species.

MIDDLE DEVONIAN (Traverse-Gravel Point limestone): Petoskey Cement Co., Petoskey, (P), Bell Quarry, 2.1 miles east of Bayshore, Emmet County (E), Charlevoix (Ch), and Bay View (B), Mich.

Hederella alpenensis, new species (P, B); *H. concinna*, new species (B, E); *H. delicatula*, new species (P); *H. magniventra*, new species (P, Ch); *H. michiganensis*, new species (B); *H. persimilis*, new species (P, B, Ch); *H. rectifurcata*, new species (P).

MIDDLE DEVONIAN (Traverse-Petoskey formation): 1½ miles northeast of Bay View (B), and 1.6 miles north of Norwood, Charlevoix County (N), Mich.

Hederella concinna, new species (B); *H. delicatula*, new species (B, N); *H. filiformis* (Billings, 1859) (B, N); *H. michiganensis*, new species (N); *H. persimilis*, new species (N); *H. robusta*, new species (B, N); *H. rugosa*, new species (B); *Hernodia ? cooperi*, new species (N).

UPPER DEVONIAN (Tully limestone–West Brook member): 2½ miles south of Sherburne, N. Y.

Hederella aequidistans, new species; *Reptaria cloudi*, new species.

DEVONIAN (Cedar Valley formation): Iowa City (I), Davenport (D), Buffalo (B), and near Randalia (R), Iowa.

Hederella calvini, new species (D); *H. crassilinea*, new species (I, R); *H. halyson* (Fenton and Fenton, 1924) (B).

DEVONIAN (Hackberry–Cerro Gordo shale): Rockford and vicinity, Iowa.

Hederella alternata (Hall and Whitfield, 1873); *H. halyson* (Fenton and Fenton, 1924); *H. linearis* (Fenton and Fenton, 1924).

DEVONIAN (Snyder Creek shale): Fulton, Mo.

Hederella crassilinea, new species; *H. triseriata*, new species.

DEVONIAN: 40 miles above mouth of Hay River, Canada.

Hederella ? laxa (Whiteaves, 1891).

DEVONIAN (Percha shale): Lake Valley, N. Mex.

Hederella occidentalis, new species.

MIDDLE DEVONIAN: Taemas, south side of Murrumbidgee River, New South Wales.

Hederella brownae, new species.

DEVONIAN: Bohemia.

Hederella obscura Prantl, 1938 (Koniepruss limestone at Suchomasty); *Hernodia perminuta* Prantl, 1938 (Branik limestone, Branik); *Reptaria gigas* Prantl, 1938 (Branik limestone, Karlstejn).

DEVONIAN (Oberkoblenzian): Near Coblenz, Germany.

Hederella applicata Solle, 1937; *H. rhenana* Solle, 1937.

MISSISSIPPIAN (Warsaw limestone): Warsaw, Ill.

Hederella varsoviensis, new species.

MISSISSIPPIAN (Chester): Smithland (S), east of Grayson Springs Station (G), Sloans Valley (S1), Marion (M), Stephensport (St), Ky. (Glen Dean limestone), Chester, Ill. (C), Evansville, Ind. (E).

Hederella chesterensis, new species (C, E, S, G, S1, M, St).

TABLE 1.—*Average measurements of* Hederelloidea *described herein*

(The species of each genus are arranged on the basis of zooecial width as the most convenient factor for identification and comparison)

Name	Illustration	Zooecial width	Zooecial length	Zooecia in 5 mm.	Angle of budding	Interval of branching	Angle of branching
HEDERELLA:		*Mm.*	*Mm.*			*Mm.*	
regularis	Pl. 8, figs. 1-2	0.15	0.6	6	45°	3-5	----------
concinnoides	Pl. 11, fig. 9	0.15	1	5	60°	2.5	60°
delicatula	Pl. 11, figs. 1-8	0.15	0.8	4-5	45°	1.5-6	90°
canadensis	Pl. 7, figs. 2-4	0.2	0.7	3-4	Acute	5	30°
consimilis	Pl. 5, fig. 12	0.2	1.0	6	25°	4½	90°
arachnoidea	Pl. 13, fig. 7	0.25	1.3	4	35°	5	90°
tenera	Pl. 7, figs. 7-9	0.25	1.3	3	45°	1.5-2	45°
colbornensis	Pl. 7, fig. 1	0.3	1.25	4-5	Acute	4	60°
concinna	Pl. 7, figs. 10-15; pl. 15, fig. 2.	0.3	0.75	5-6	30°	5	90°
cirrhosa	Pl. 6, figs. 1-8	0.3	1.5	2-3	30-45°	7½	----------
angulata	Pl. 7, figs. 5, 6	0.3	0.5	1-2	45°	1.5-3	90°
rectifurcata	Pl. 7, fig. 16	0.3	Short	2-3	90°	3	About 90°
chesterensis	Pl. 6, figs. 9-11	0.3	2.5	3	45°	----------	45-60°
bilineata	Pl. 5, fig. 9	0.3	1.0	5-6	Acute	3	60-90°
aequidistans	Pl. 9, fig. 6	0.3	2	2-3	Acute	3	90°
helderbergia	Pl. 8, fig. 3	0.35	2	3	45°	4-5	----------
alternata	Pl. 5, figs. 1-3	0.35	1	4	45°	3½	90°
linearis	Pl. 5, figs. 6, 7	0.35	1.2	3	30°	6½	60°
ramea	Pl. 13, fig. 10	0.35	3	----------	30°	3	30°
conferta	Pl. 9, figs. 4, 5	0.35	2	3	About 45°	4	45°
clarkei	Pl. 10, fig. 3	0.35	1.5	4	Acute	3	45°
parallela	Pl. 2, figs. 1-2	0.35	2	2½-3	Acute	8	About 45°
varsoviensis	Pl. 9, fig. 1	0.35	2	2-3	Acute	3	30°
parvirugosa	Pl. 6, figs. 12-14	0.35	1	4	45°	7	----------
siluriana	Pl. 13, fig. 3	0.4	1-2	----------	90°	2	90°
vagans	Pl. 4, figs. 1, 2	0.4	1	2	30-45°	15+	----------
contortilis	Pl. 8, figs. 5-8	0.4	1.5	3	50-60°	3	50°
alpenensis	Pl. 3, figs. 1-6	0.4	1.1	4-5	Acute	3½	60°
calvini	Pl. 9, fig. 2	0.4	2	2½	Acute	5	30°
louisvillensis	Pl. 5, fig. 8	0.4	1.5	4	About 25°	10	About 50°
triseriata	Pl. 2, fig. 3	0.4	1.6	3	About 25°	----------	45°
filiformis	Pl. 1, figs. 1-6	0.5	1	4	45°	5.5	90°
brownae	Pl. 1, fig. 13	0.5	1.6	4	45°	3	60°
germana	Pl. 4, fig. 6	0.5	1.6	1-2	Acute	12	90°
occidentalis	Pl. 6, fig. 15	0.5	1.5	----------	60-90°	3	50-60°
camdenensis	Pl. 6, fig. 16	0.5	1.6	3	45°	----------	----------
blainvillei	Pl. 13, fig. 6	0.5	2-3	----------	30°	4	30°
pavilionensis	Pl. 4, fig. 5	0.5	2-4	----------	30°	----------	45°
gracilior	Pl. 3, fig. 12	0.5	1.5	3-3½	Acute	6-7	60°
persimilis	Pl. 2, figs. 4, 5	0.5	2	3	30°	6	About 45°
romingeri	Pl. 9, fig. 3	0.5	2.2	About 3	Acute	5	About 20°
halyson	Pl. 5, figs. 4, 5; pl. 2, fig. 6; pl. 12, fig. 1.	0.55	2	3	25°	----------	60°
crassilinea	Pl. 4, fig. 4; pl. 13, figs. 4, 5.	0.6	1.3	2½-3	45°	5-10	90°
nicholsoni	Pl. 4, figs. 8, 8′; pl. 12, fig. 4.	0.6	2	2½-3	35°	5-6	45°—

TABLE 1.—*Average measurements of* Hederelloidea *described herein*—Continued

Name	Illustration	Zooecial width	Zooecial length	Zooecia in 5 mm.	Angle of budding	Interval of branching	Angle of branching
HEDERELLA—Con.		*Mm.*	*Mm.*			*Mm.*	
nodifera	Pl. 12, fig. 3	0.6	3		Acute		Acute
quebecensis	Pl. 13, fig. 9	0.6	2			4	
adnata	Pl. 11, figs. 10–12	0.6	2.5	2	30°	5	
edwardsi	Pl. 4, fig. 7	0.6	2.5	2	About 20°	6	About 30°
?laxa	Pl. 13, fig. 1	0.65	1.2			3.5	45°—
rugosa	Pl. 2, fig. 7; pl. 3, figs. 7, 8.	0.6–0.7	2	3	20°	4	40°
ulrichi	Pl. 13, fig. 8	0.7	2	2½	Less than 45°	10	
thedfordensis	pl. 1, figs. 7–12; pl. 13, fig. 2.	0.7	2.5	2	30°		60°
hibbardi	Pl. 4, figs. 3, 3′	0.7	2.5	2½–3	Acute	4	About 20°
compacta	Pl. 5, fig. 13	0.7	1.5	4–4½	Acute		20°—
magniventra	Pl. 10, figs. 5, 6	0.75	1–2	2½–3			90°
michiganensis	Pl. 10, figs. 1, 1′; pl. 12, fig. 5.	0.8	2	2	45°+	4	90°
magna	Pl. 3, figs. 9, 10	1	2.2	2–2.5	About 20°	20	60–90°
magna praecedens.	Pl. 3, fig. 11	1	2	3	Acute	15—	45°
obesa	Pl. 10, fig. 4	1	2.7	2–2.5	Acute	10–12	45°
reimanni	Pl. 12, fig. 8	1	4	About 1	Acute	10	90°
robusta	Pl. 10, fig. 2; pl. 12, figs. 6, 7.	1.2	3	2	30°	6	45°
major	Pl. 8, fig. 4	1.5	4	2	Acute		45°
HEDEROPSIS:							
bifurcata	Pl. 14, fig. 9	0.35	3–4	About 2	Acute	5–6	30°
curta	Pl. 14, fig. 7	0.66	1.5	2–3	Acute	6	About 30°
longituba	Pl. 14, fig. 8	0.66	4	1–2	Acute	6	30°
raaschi	Pl. 14, fig. 1	0.7	2.5	2	25°	5	About 60°
connata	Pl. 14, fig. 10	1	4–5	1–2	45°	6	About 45°
typicalis	Pl. 14, figs. 2–6	1.3	3	3–4	About 45°	5	About 45°
REPTARIA:							
cayuga	Pl. 16, fig. 2	0.3	2	6	30°	2	About 45°
cloudi	Pl. 16, fig. 3	0.3	2	4	45°	7	70°
stolonifera	Pl. 16, figs. 4–8	0.5	3	5–6	45°—	Long	45–60°
gaspéensis	Pl. 16, fig. 1	0.5	1.5	6–7	30°	6	About 45°
HERNODIA:							
davisi	Pl. 15, fig. 9	0.4	2	3½	About 25°	7	45–90°
?monahani	Pl. 15, fig. 3	0.4	1.3	4	45°	6	45°
tennesseensis	Pl. 15, fig. 1	0.6	4	3–4	Acute	6	45°
?cooperi	Pl. 16, fig. 10	0.6	2	2–3	25°	3	45°
compacta	Pl. 15, fig. 4	0.6	1½–2	3–4	30°		60–90°
ulrichi	Pl. 15, fig. 8	0.8	3.5	1–2	About 40°	5	45°
humifusa	Pl. 15, figs. 5–6	1	5–6	About 1	45°	15	45°
cornucopia	Pl. 15, fig. 7	1.3	3–4	1½	Acute	10	45°

PLATES

(All figures are magnified × 4 unless otherwise indicated.)

139917—39——5

PLATE 1

Page

1–6′. *Hederella filiformis* (Billings, 1859) ---------------------------------- 35

1, 2, A colony two-thirds natural size growing upon *Spirifer mucronatus thedfordensis*, and a portion enlarged (after Nicholson).

3, A typical example exhibiting the main axis with branches arising at almost a right angle and short, broad zooecia budding from each at 45°.

4, Portion of same, × 8, showing the zooecial budding and surface in more detail.

5, Another example with slightly longer zooecial tubes, which tend to coil.

Hamilton (Widder shale), Thedford, Ontario.

6, A Wisconsin specimen identified with this species.

Middle Devonian (Milwaukee limestone-Lindwurm member), Milwaukee, Wis.

6′, A Michigan example illustrating more frequent branching than usual.

Traverse (Ferron Point formation), Rockport quarry, Alpena County, Mich.

7–12. *Hederella thedfordensis*, new species (see also pl. 13, fig. 2) --------- 43

7, A colony with ancestrula incrusting a *Tropidoleptus*, showing the coarsely lined tubes budding rather irregularly.

8, Ancestrular part of same colony, × 8; the suture line marking the budding points is quite visible.

Hamilton (Moscow-Kashong shale), Tile Factory, 1½ miles southeast of East Bethany, N. Y.

9, An example illustrating budding of two short zooecia at intervals, from each side of the main axis and its branches.

Middle Devonian (Silica shale): 2½ miles southwest of Sylvania, Lucas County, Ohio.

10, Basal part of a zoarium in which frequent branching has produced a compact colony.

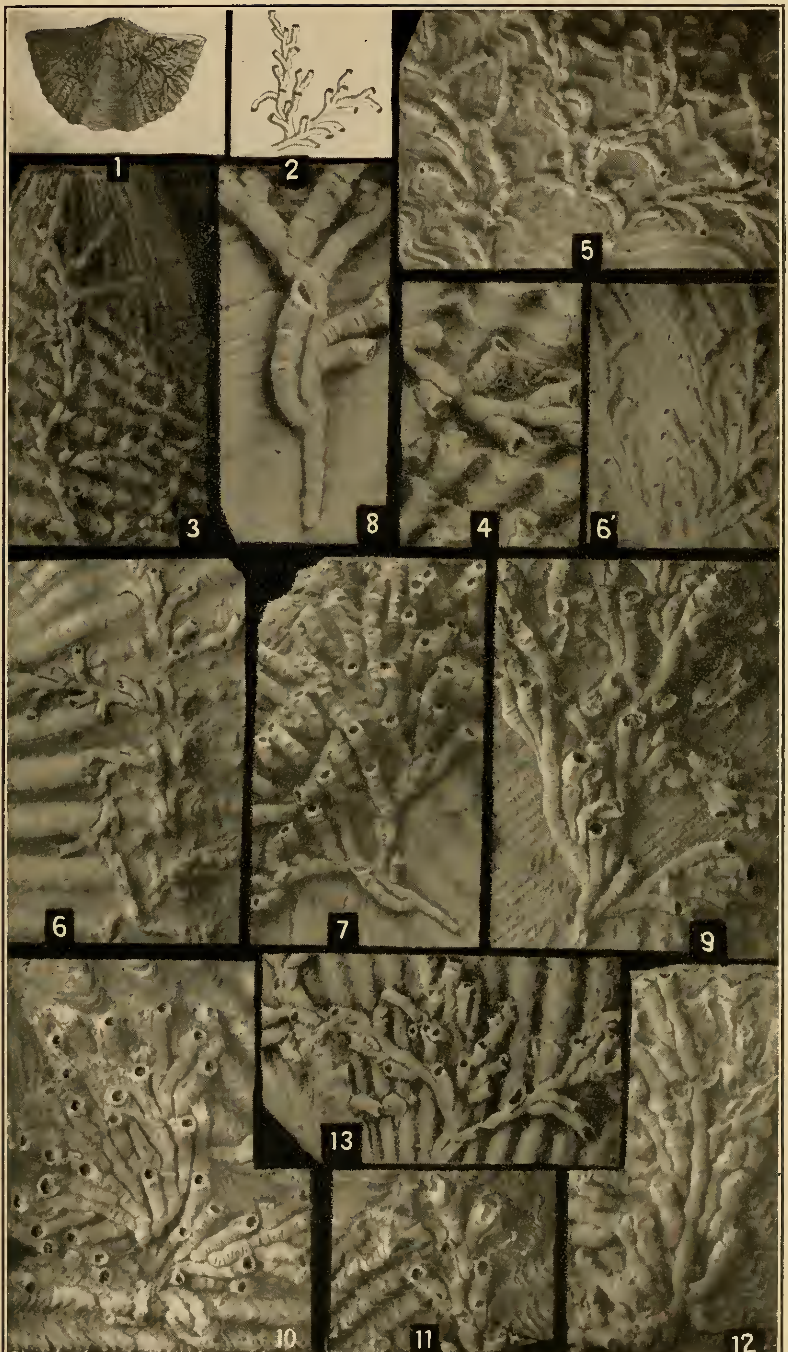
11, Part of the main axis of a colony incrusting a *Spirifer mucronatus thedfordensis* in which branching has not obscured the details of zooecial budding.

12, Portion of a colony with the main axis especially well developed.

Hamilton (Widder shale), Thedford, Ontario.

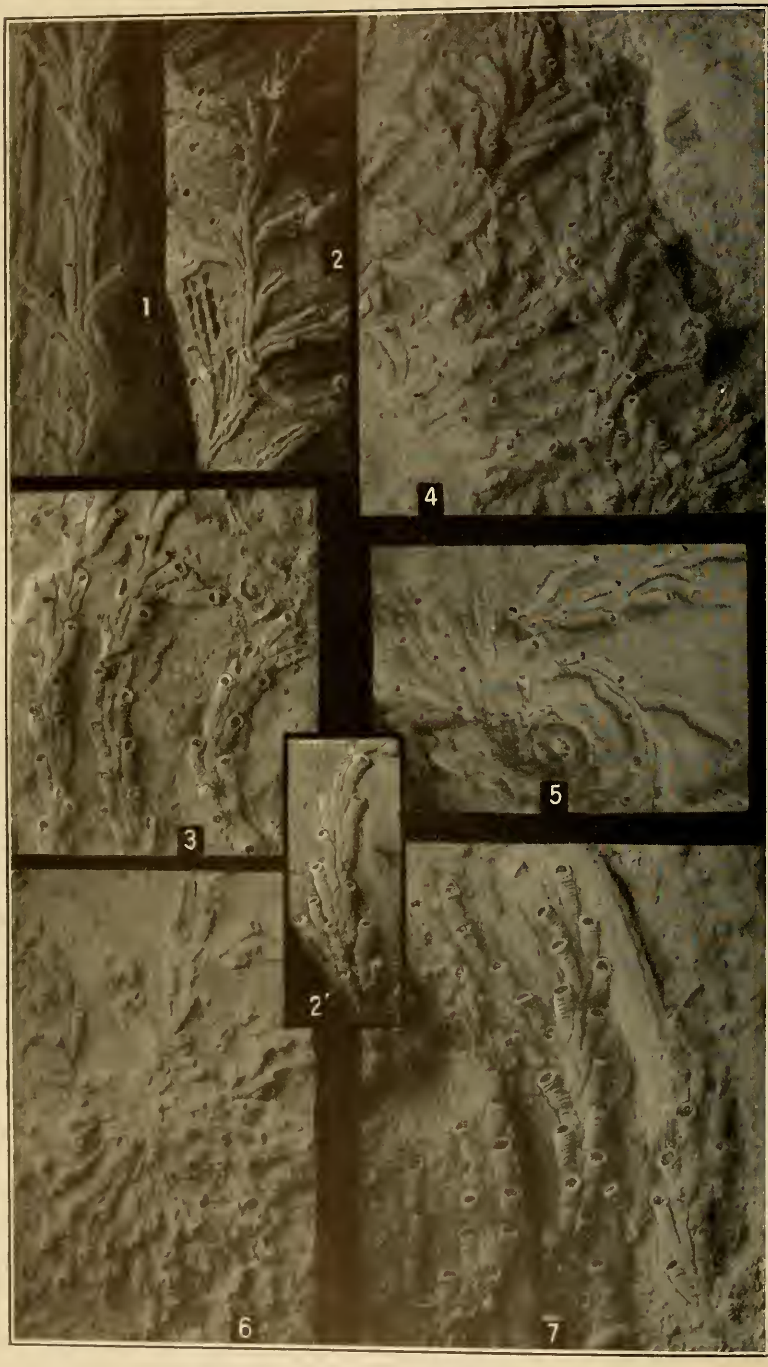
13. *Hederella brownae*, new species: Portion of the type incrusting a *Spirifer* -- 36

Middle Devonian: Taemas, south side of Murrumbidgee River, New South Wales.



SPECIES OF HEDERELLA.

FOR EXPLANATION SEE OPPOSITE PAGE.



SPECIES OF HEDERELLA.

FOR EXPLANATION SEE OPPOSITE PAGE.

Plate 2

Page

1–2′. *Hederella parallela*, new species ---------------------------------- 55

1, Portion of a zoarium incrusting a cup coral (*Heliophyllum*) showing the main axis and several branches composed of zooecial tubes almost parallel to one another.

Hamilton (Ludlowville–Tichenor limestone), 1½ miles south of East Bethany, N. Y.

2. Portion of a main branch incrusting a terebratuloid shell.

Hamilton (Widder shale), Thedford, Ontario.

2′, Another example incrusting a coral in which the main axes of two colonies cross each other.

Hamilton (Moscow shale), Moscow, N. Y.

3. *Hederella triseriata*, new species ---------------------------------- 58

The type zoarium incrusting a *Stropheodonta*, showing a portion with parallel branches with zooecia in contact and broader than in the related *H. parallela*.

Devonian (Snyder Creek shale), Fulton, Mo.

4, 5. *Hederella persimilis*, new species ---------------------------------- 49

4, An example in which overlapping of the branches has produced a complex zoarium.

Middle Devonian (Traverse–Gravel Point limestone), Bay View, Mich.

5, Young zoarium illustrating method of branching and budding.

Middle Devonian (Traverse–Lower Gravel Point limestone), Petoskey Cement Co., Petoskey, Mich.

6. *Hederella halyson* (Fenton and Fenton, 1924) (see also pl. 5, figs. 4, 5, and pl. 12, fig. 1) ---------------------------------- 48

Base of a zoarium with ancestrular portion much obscured but with radiating branches showing the typical structure.

Devonian (Cedar Valley formation), Buffalo, Iowa.

7. *Hederella rugosa*, new species (see also pl. 3, figs. 7, 8) -------------- 49

A well-developed example incrusting *Heliophyllum*.

Hamilton (Widder shale), Thedford, Ontario.

Plate 3

Page

1–6. *Hederella alpenensis*, new species . . . 47

1, An example with branching more frequent than usual.

Middle Devonian (Traverse-Genshaw formation), Long Lake, near Alpena, Mich.

2, Basal portion of colony with details of growth obscured by branching and overlapping of tubes.

Middle Devonian (Traverse-Norway Point formation), 7-Mile Dam, Alpena County, Mich.

3, A small colony with branches crossing one another.

4, A colony illustrating the typical method of branching and budding of the tubes.

5, Portion of fig. 4, × 8, indicating surface ornamentation and budding of tubes in more detail.

Devonian (Traverse-Genshaw formation), near El Cajon Beach, Alpena County, Mich.

6, Youthful stage with initial branching almost at right angles.

Middle Devonian (Traverse-Gravel Point limestone), Petoskey Cement Co., Petoskey, Mich.

7, 8. *Hederella rugosa*, new species (see also pl. 2, fig. 7) . . . 49

7, A colony illustrating the ancestrula, the rugose tubes arising from it succeeded by the normal, broader, less wrinkled zooecia.

8, The initial stage of the same colony, × 8.

Hamilton (Ludlowville-Wanakah shale), Erie County, N. Y.

9, 10. *Hederella magna* Hall, 1881 . . . 51

9, The original illustration of this species (after Hall and Simpson).

10, A branch showing the large, short, wide, and rapidly expanding zooecia with flaring apertures.

Hamilton (Ludlowville-Wanakah shale), Erie County, N. Y.

11. *Hederella magna praecedens*, new variety . . . 52

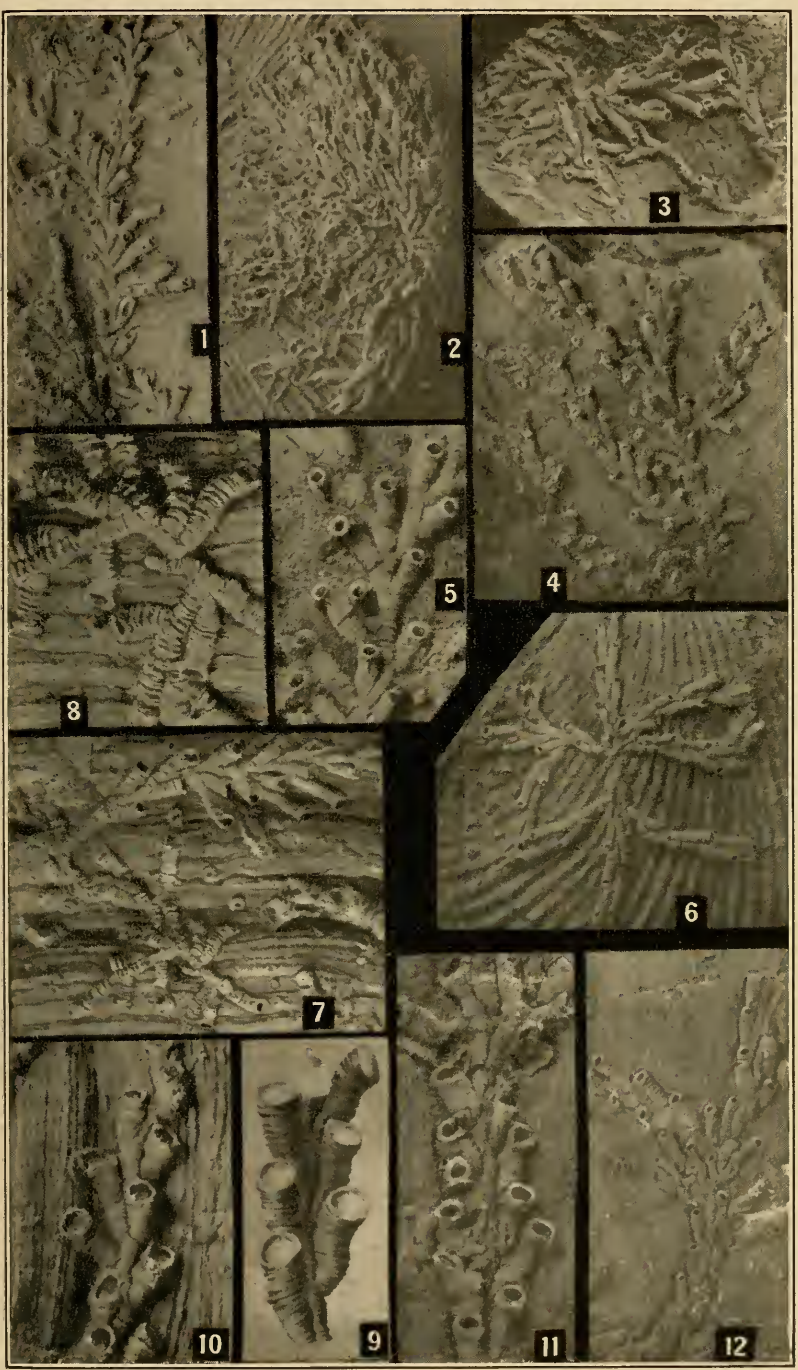
Photograph of Clarke's figured specimen of *H. magna* distinguished by its shorter broad tubes with even diameter.

Oriskany: Becraft Mountain, near Hudson, N. Y.

12. *Hederella gracilior* Clarke, 1900 . . . 48

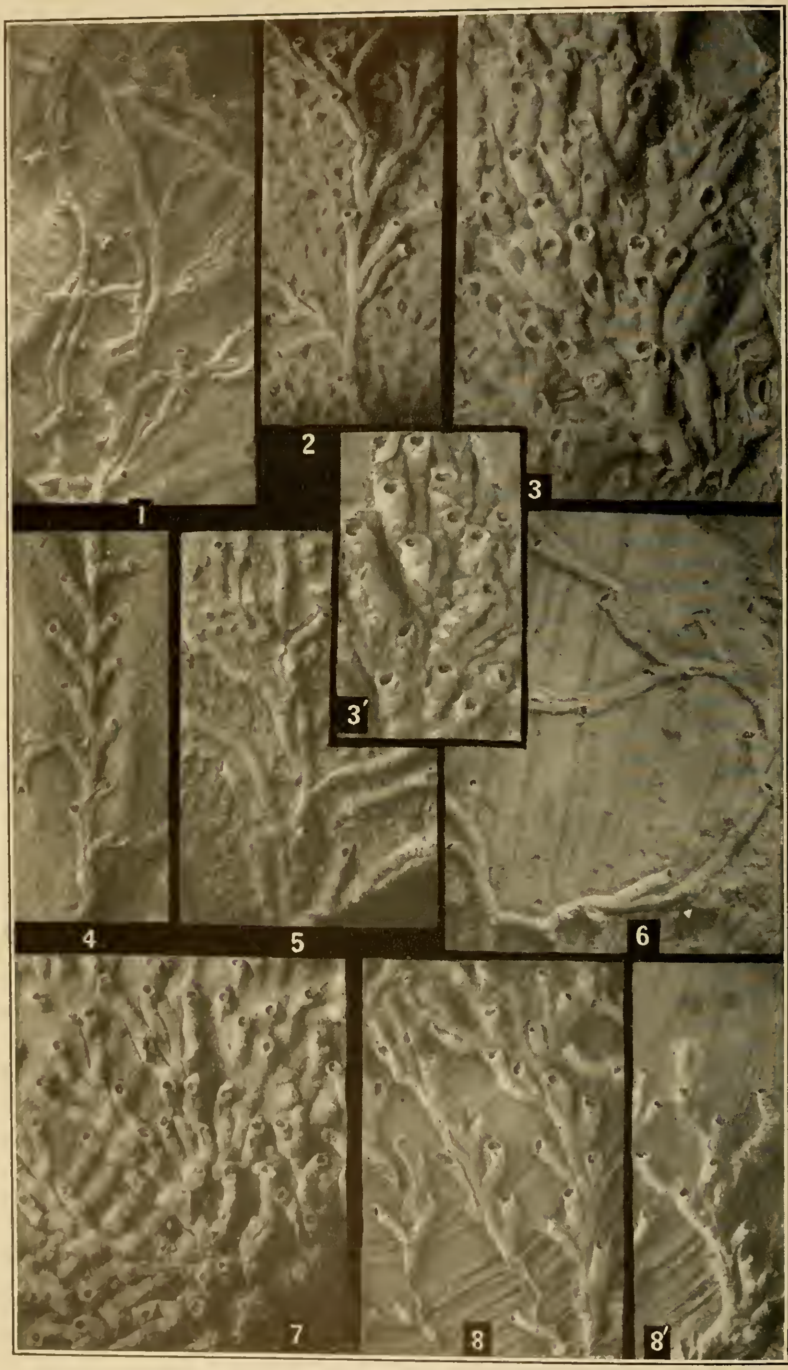
Photograph of the type illustrating the budding of the zooecia and the method of branching.

Oriskany: Becraft Mountain, near Hudson, N. Y.



SPECIES OF HEDERELLA.

FOR EXPLANATION SEE OPPOSITE PAGE.



SPECIES OF HEDERELLA.

FOR EXPLANATION SEE OPPOSITE PAGE.

Plate 4

		Page
1, 2.	*Hederella vagans*, new species	38
	1, Portion of the loosely growing incrusting colony with the main axis a single tube branching at long, infrequent intervals.	
	2, Small part of another example, showing more frequent branching.	
	Hamilton (Widder shale), Thedford, Ontario.	
3, 3′.	*Hederella hibbardi*, new species	55
	3, The type specimen incrusting *Spirifer mucronatus arkonensis*, a colony of short, wide, swollen zooecia with branches closely arranged.	
	3′, Portion of another example, showing strong rugosities.	
	Hamilton (Arkona shale), Arkona, Ontario, and vicinity.	
4.	*Hederella crassilinea*, new species (see also pl. 13, figs. 4, 5)	41
	The holotype incrusting a cup coral and showing the linear main axis branching at right angles at considerable intervals and with short, thick zooecia budding at an angle of 45°.	
	Devonian (Snyder Creek shale), Fulton, Mo.	
5.	*Hederella pavilionensis*, new species	43
	Colony incrusting a *Fistulipora*, resembling *H. vagans* but differing in its wider, longer zooecia.	
	Hamilton (Tichenor shale), Pavilion, N. Y.	
6.	*Hederella germana*, new species	39
	The type incrusting *Heliophyllum*, the zoarium differing from *H. vagans* in the wider branches and the larger angle of bifurcation.	
	Hamilton (Widder shale), Thedford, Ontario.	
7.	*Hederella edwardsi*, new species	48
	Portion of a very complete colony incrusting a *Spirifer* with the characteristic short, wide, frequently budding zooecia and the branches dividing at short intervals.	
	Middle Devonian (Milwaukee limestone-Lindwurm member), Milwaukee, Wis.	
8, 8′.	*Hederella nicholsoni*, new species (see also pl. 12, fig. 4)	44
	Two portions of the holotype incrusting *Athyris spiriferoides* and illustrating differences in the method of division of the branches and the rise of the zooecia at angles of about 45°.	
	Hamilton (Ludlowville-Wanakah shale), 18-Mile Creek, N. Y.	

PLATE 5

Page

1–3. *Hederella alternata* (Hall and Whitfield, 1873) ---------- 36

1, A small complete zoarium incrusting a *Spirifer* and showing the ancestrula, the method of branching, and the regular alternate budding of the zooecia.

2, More mature portion of another zoarium with branching and budding plan quite visible.

3, A slightly abraded example.

Devonian (Hackberry–Cerro Gordo shale), Rockford, Iowa.

4, 5. *Hederella halyson* (Fenton and Fenton, 1924) (see also pl. 2, fig. 6, and pl. 12, fig. 1) ---------- 48

4, Incomplete small zoarium incrusting a *Spirifer*.

5, A small colony illustrating the budding of the short tube directly from the short preceding one.

Devonian (Hackberry–Cerro Gordo shale), Rockford, Iowa.

6, 7. *Hederella linearis* (Fenton and Fenton, 1924) ---------- 37

6, A zoarium incrusting a *Spirifer* and showing the similar angle of branching and budding.

7, Portion of a colony illustrating the short but rather wide zooecial tube.

Devonian (Hackberry-Cerro Gordo shale), Rockford, Iowa.

8. *Hederella louisvillensis*, new species ---------- 57

A colony incrusting the interior of a brachiopod shell, illustrating similarity to *H. bilineata* but differing in the larger size of the zooecia.

Onondaga (Upper Jeffersonville limestone), Falls of the Ohio.

9–11. *Hederella bilineata*, new species ---------- 56

9, Zoarium with ancestrula incrusting a brachiopod; the small bilinearly arranged zooecia and the regular branching of the zoarium are evident.

Hamilton (Ludlowville-Centerfield shale), 3 miles west of East Bethany, N. Y.

10, 11, Two portions of a zoarium incrusting a cup coral; the zoarial branching is at greater intervals than in the preceding, owing perhaps to the rough surface.

Hamilton (Ludlowville shale), York, N. Y.

12. *Hederella consimilis*, new species ---------- 57

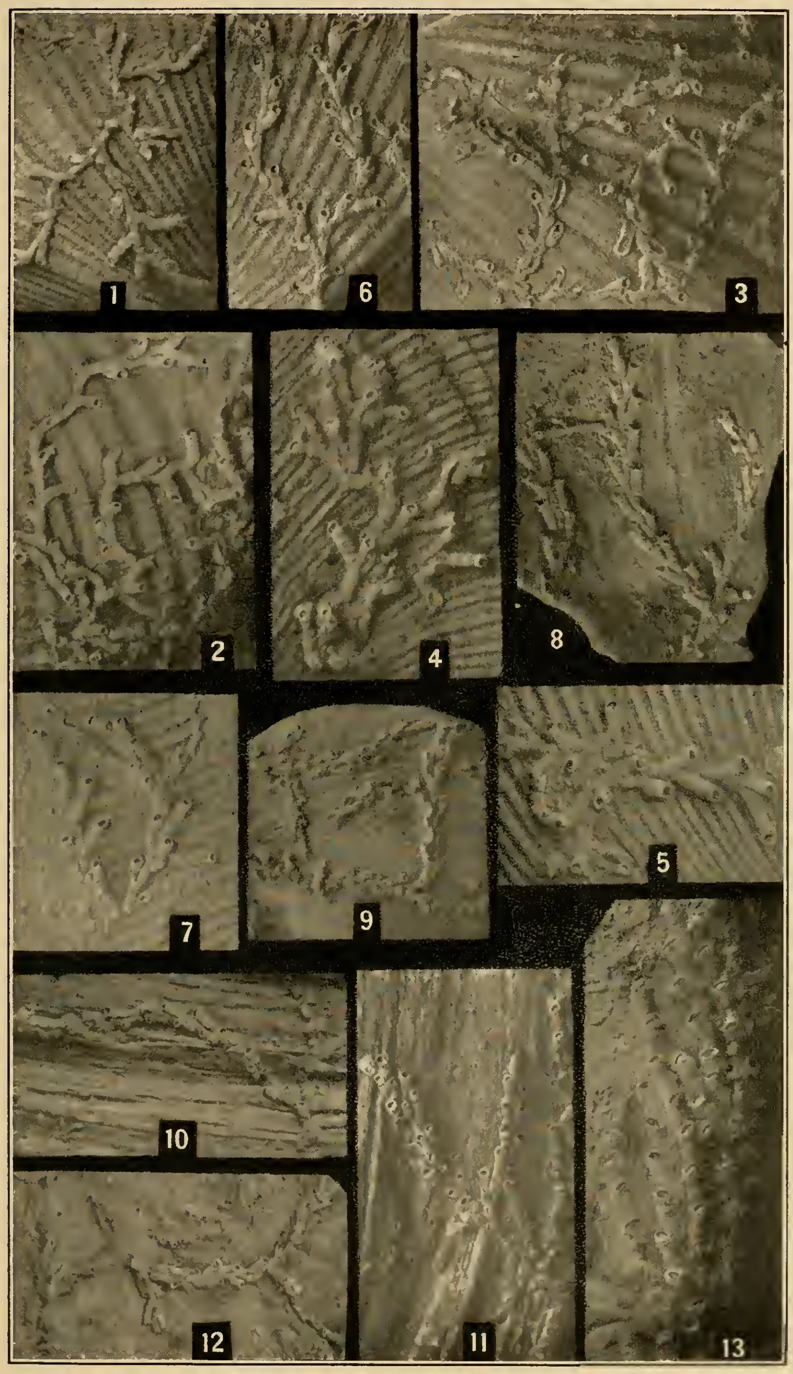
The type specimen incrusting the interior of a brachiopod, showing similarity to *H. bilineata* but with slightly longer and narrower zooecia.

Onondaga (Upper Jeffersonville limestone), Falls of the Ohio.

13. *Hederella compacta*, new species ---------- 56

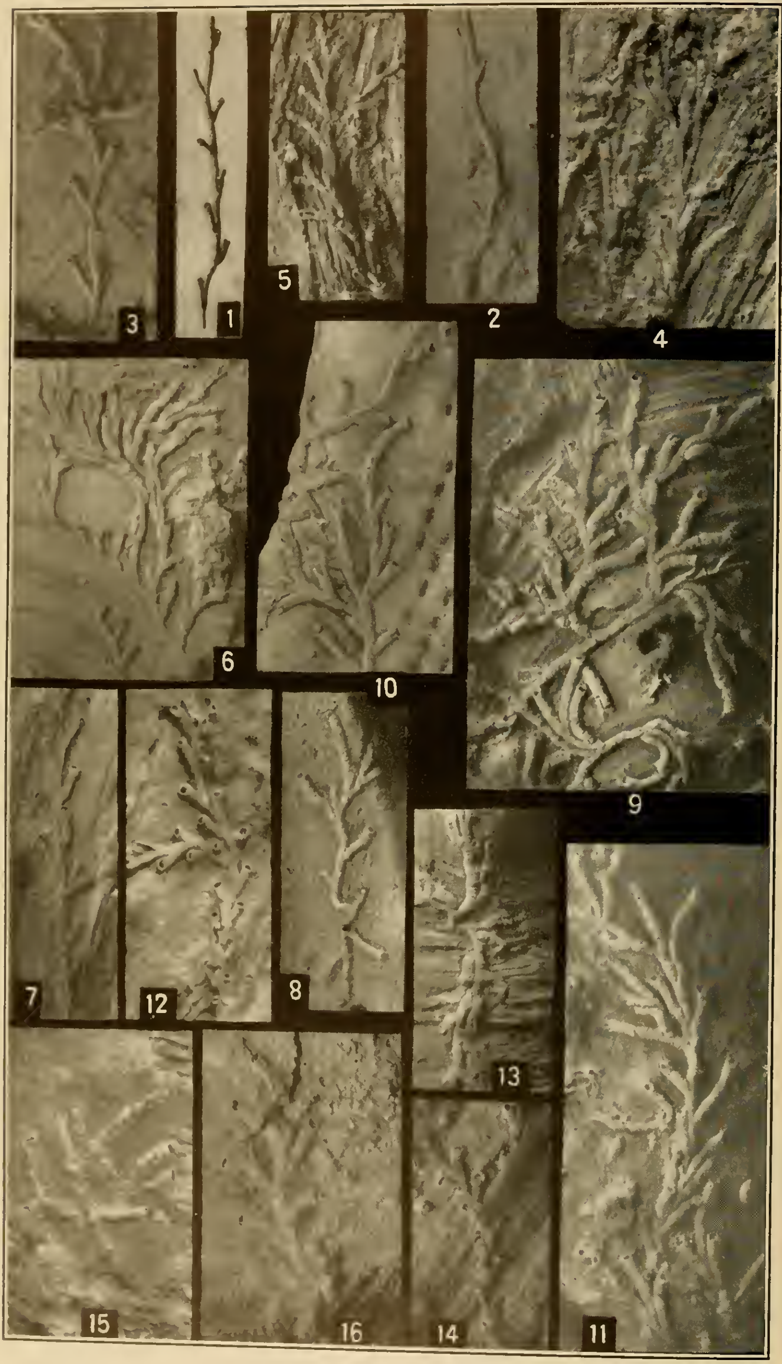
Zoarium incrusting a crinoid column; the closely spaced branches of short, wide, compactly arranged zooecia are evident.

Middle Devonian (Traverse-Partridge Point formation), Partridge Point, 3 miles south of Alpena, Mich.



SPECIES OF HEDERELLA.

FOR EXPLANATION SEE OPPOSITE PAGE.



SPECIES OF HEDERELLA.

FOR EXPLANATION SEE OPPOSITE PAGE.

Plate 6

		Page
1–8.	*Hederella cirrhosa* Hall, 1881	34

1, The type specimen (after Hall and Simpson).
2, Photograph of a cast of the type.
Hamilton (Ludlowville shale), West Bloomfield, N. Y.
3, An example with long intervals between the zooecia.
4, Portion of a zoarium with crowded branches and unusually long tubes.
Hamilton (Ludlowville-Centerfield limestone), 3 miles west of East Bethany, N. Y.
5, A specimen referred doubtfully to the species but differing in the shorter intervals between the zooecia.
Hamilton (Ludlowville-Wanakah shale), Erie County, N. Y.
6, Part of a zoarium with budding developed on one side only, reducing the distance between the zooecia but showing the normal arrangement on one of the branches.
Hamilton (Widder shale), Arkona, Ontario.
7, An example similar to the original type but with less distance between the zooecia.
Hamilton (Ludlowville shale), Skaneateles Lake, N. Y.
8, Specimen with ancestrula and illustrating the less regular growth in the young stages.
Middle Devonian (Silver Creek dolomite), Charlestown, Ind.

9-11. *Hederella chesterensis*, new species ---- 46

9, One of the types, illustrating the main axis giving rise to branches of single zooecia that curve and bud into characteristic groups.
10, An example incrusting a *Lyropora* showing the outer branches of the zoarium.
11, An elongate branch incrusting a cup coral in which the curved aspect of the groups is not so apparent.
Chester group: Marion (9) and Sloans Valley (11), Ky. (Glen Dean limestone), and Evansville, Ind. (10).

12–14. *Hederella parvirugosa*, new species ---- 33

12, Portion of zoarium exhibiting the method of division of both zooecia and branches.
Hamilton (Widder shale), Thedford, Ontario.
13, Ancestrula and young zooecia.
Hamilton (Ludlowville-Wanakah shale), Elma, N. Y.
14, Portion of a mature colony, illustrating usual budding of zooecia and branching.
Hamilton (Moscow shale), Moscow, N. Y.

15. *Hederella occidentalis*, new species ---- 41

The type specimen, a worn zoarium but distinct enough for description.
Devonian (Percha shale), Lake Valley, N. Mex.

16. *Hederella camdenensis*, new species ---- 41

The somewhat abraded type specimen characterized by its stout linear branch with widely divergent zooecia.
Lower Devonian (Helderbergian-Birdsong shale), just south of Camden, Tenn.

PLATE 7

		Page
1.	*Hederella colbornensis*, new species	32

Gutta-percha impression of the type, a zoarium incrusting a cup coral.

Middle Devonian (Onondaga–Decewville limestone), Port Colborne, Ontario.

2–4. *Hederella canadensis* (Nicholson, 1874) — 31

2, Nicholson's figure of the Corniferous limestone specimen selected as the holotype.

3, A topotype identified by Nicholson, showing similarity to *H. cirrhosa* but plainly much smaller.

4, Portion of the same, × 8.

Middle Devonian (Onondaga–Decewville limestone), Port Colborne, Ontario.

5, 6. *Hederella angulata* (Davis, 1885) — 40

The loosely branching zoarium incrusting the noncelluliferous side of a *Fenestrellina*, and a portion, × 8.

Onondaga (Upper Jeffersonville limestone), Falls of the Ohio.

7–9. *Hederella tenera*, new species — 40

7, 8, The zoarium, and a portion × 8, incrusting the noncelluliferous side of a *Polypora;* the very narrow frequently dividing tubes are characteristic.

9, Another example in which frequent overlapping of the branches gives a crowded aspect.

Onondaga (Upper Jeffersonville limestone), Falls of the Ohio.

10–15. *Hederella concinna*, new species (see also pl. 15, fig. 2) — 32

10, Young stage of a zoarium, illustrating the ancestrula and the less regularly branching tubes emitted from it.

Hamilton (Ludlowville–Wanakah shale), Erie County, N. Y.

11, Another young specimen in which a tendency of the zooecial tubes to coil at their extremity is shown.

Hamilton (Widder shale), Thedford, Ontario.

12, Portion of zoarium showing change from young condition to mature stage where the zooecia remain nearly in contact.

13, Portion of the same, × 8, showing change from youthful to mature arrangement of the tubes.

14, Portion of a colony illustrating branching of zoarium.

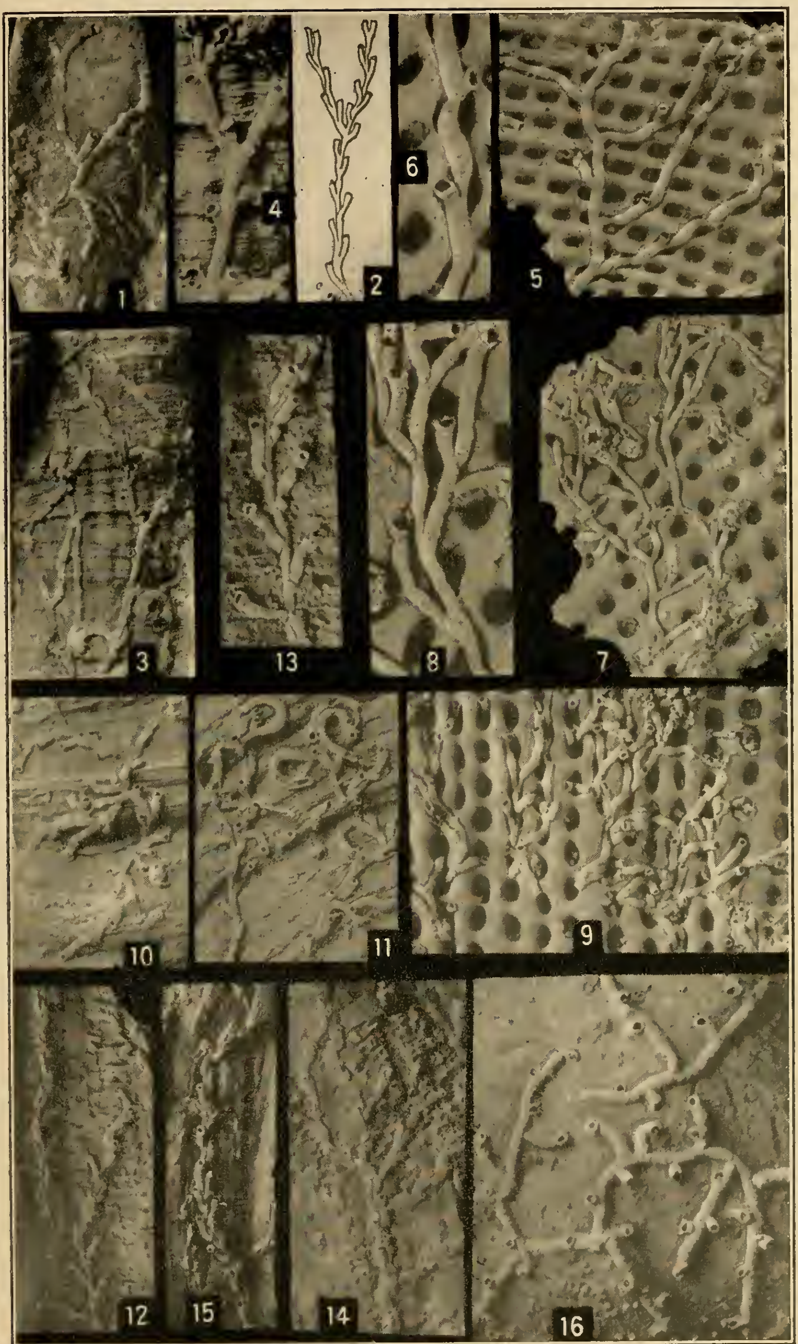
15, Mature portion of a colony attached to a *Fistulipora*.

Hamilton (Ludlowville–Centerfield shale), 3 miles west of East Bethany, N. Y.

16. *Hederella rectifurcata*, new species — 42

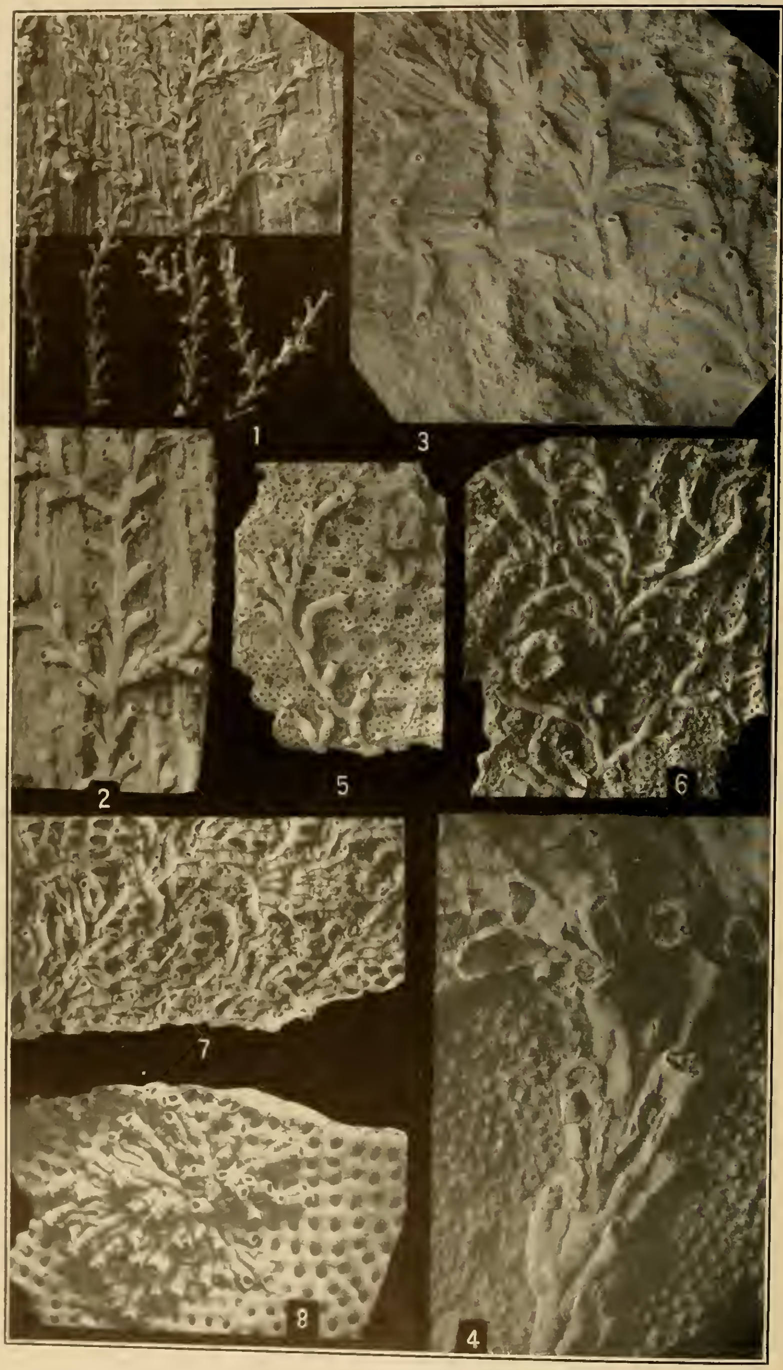
Zoarium incrusting a coral and illustrating the very short zooecial tubes and the emission of both zooecia and branches at right angles.

Hamilton (Ludlowville–Wanakah shale), 18-Mile Creek, N. Y.



Species of Hederella.

For explanation see opposite page.



SPECIES OF HEDERELLA.

FOR EXPLANATION SEE OPPOSITE PAGE.

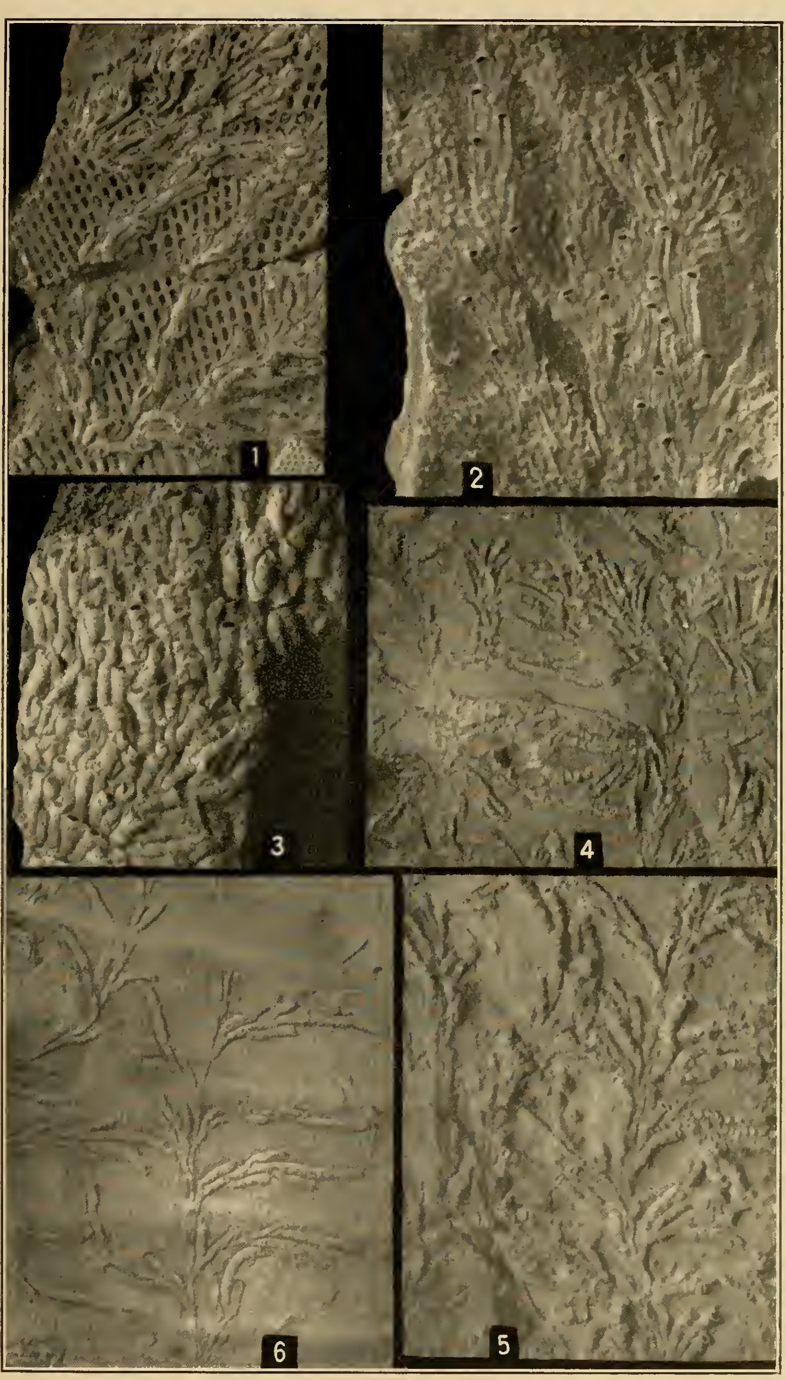
PLATE 8

		Page
1, 2.	*Hederella regularis*, new species	33
	1, The type specimen, a large zoarium incrusting a *Cystiphyllum*, with the background in the lower half blackened to bring out the regular branching and budding of the zooecia.	
	2, Small portion of same, ×8.	
	Hamilton (Widder shale), Thedford, Ontario.	
3.	*Hederella helderbergia*, new species	45
	The type specimen, consisting of robust, regularly branching zooecia incrusting a brachiopod shell.	
	Lower Devonian (Helderbergian–New Scotland limestone), Schoharie County, N. Y.	
4.	*Hederella major*, new species	53
	View of zoarium showing the very large tubes in close contact and the method of branching.	
	Hamilton (Widder shale), Thedford, Ontario.	
5–8.	*Hederella contortilis*, new species	39
	5, Fragmentary zoarium not complicated by excessive branching.	
	6, Colony with more complex arrangement of the branches.	
	7, Colony with the zooecial tubes almost forming a mat.	
	8, Initial portion of a colony with the specific characters obscured by the tangle of tubes.	
	Onondaga (Upper Jeffersonville limestone), Falls of the Ohio.	

139917—39——6

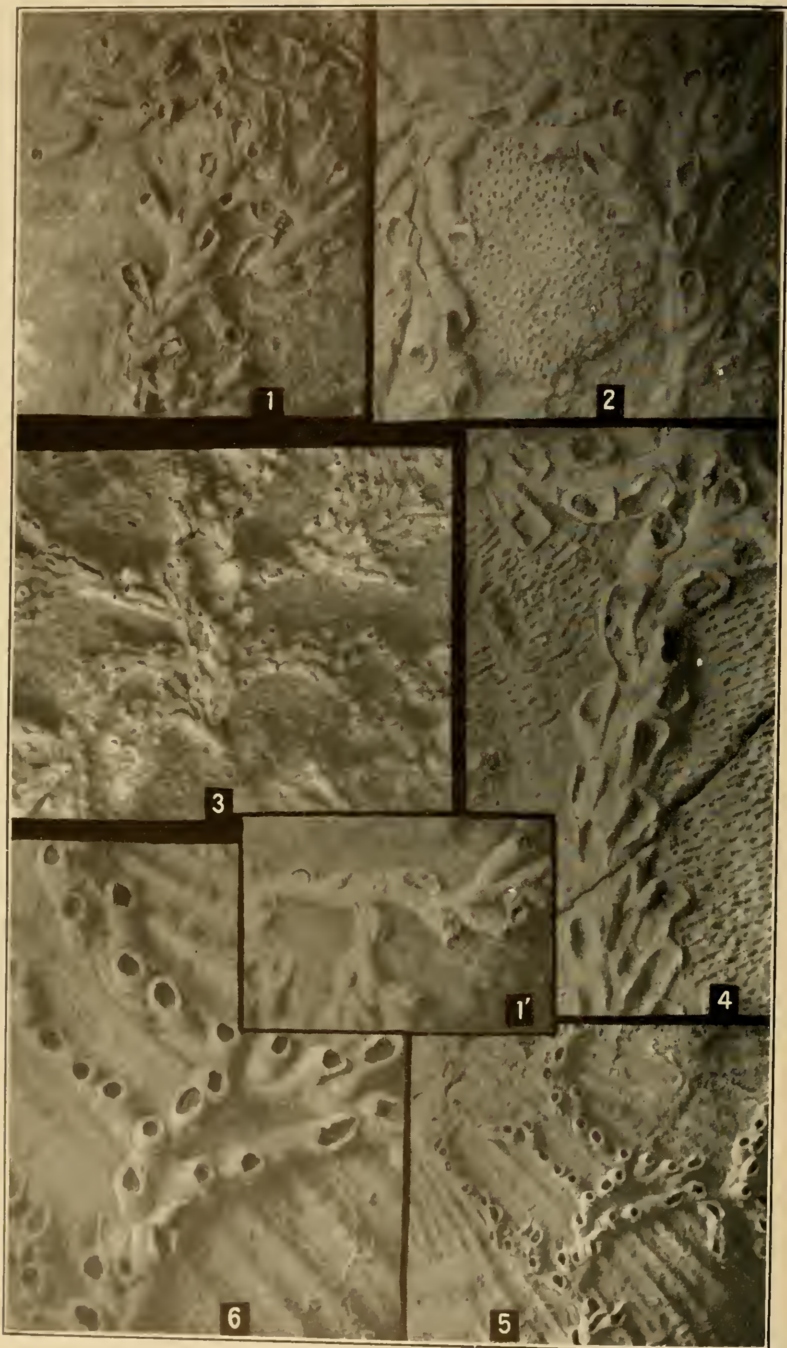
PLATE 9

		Page
1.	*Hederella varsoviensis*, new species	58
	The type zoarium showing branching at considerable intervals, with zooecia of closely arranged, parallel, somewhat contorted tubes.	
	Mississippian (Warsaw limestone), Warsaw, Ill.	
2.	*Hederella calvini*, new species	51
	The zoarium incrusting a species of *Fistulipora* and consisting of frequently dividing branches with zooecia closely arranged in 4 or 5 rows to a branch.	
	Devonian (Cedar Valley formation), Davenport, Iowa.	
3.	*Hederella romingeri*, new species	57
	The type specimen, illustrating such frequent budding and branching that a closely knit mass of tubes results.	
	Middle Devonian (Traverse-Genshaw formation), Long Lake, near Alpena, Mich.	
4, 5.	*Hederella conferta* (Hall, 1881)	50
	4, Portion of a colony, $\times$ 2.6, incrusting a cephalopod and illustrating the characteristic budding at regular intervals from a few tubes into a fan-shaped group.	
	5, Portion of the same with rugose surface characters better shown.	
	Hamilton (Ludlowville shale), Canandaigua Lake, N. Y.	
6.	*Hederella aequidistans*, new species	47
	Portion of a zoarium incrusting a cephalopod and illustrating the branching at equal distances.	
	Upper Devonian (Tully limestone-West Brook member), 2½ miles south of Sherburne, N. Y.	



Species of Hederella.

For explanation see opposite page.



SPECIES OF HEDERELLA.

FOR EXPLANATION SEE OPPOSITE PAGE.

Plate 10

		Page
1, 1'.	*Hederella michiganensis*, new species (see also pl. 12, fig. 5) ----------	54
	1, Portion of one of the types consisting of large irregularly branching zooecia.	
	Middle Devonian (Traverse-Upper Gravel Point limestone), Emmet County, Mich.	
	1, Portion of an example incrusting a *Heliophyllum*, illustrating more regular branching.	
	Traverse (Ferron Point formation), Rockport quarry, Alpena County, Mich.	
2.	*Hederella robusta*, new species (see also pl. 12, figs. 6, 7) -------------	54
	The holotype showing the large tubes branching regularly into well-defined groups.	
	Middle Devonian (Traverse-Norway Point formation), Norway Point Dam, Alpena County, Mich.	
3.	*Hederella clarkei*, new species ------------------------------------	50
	The holotype, well characterized by its zoarium of medium-sized tubes branching at regular intervals into broad clusters of zooecia.	
	Hamilton (Ludlowville-Centerfield shale), 3 miles west of East Bethany, N. Y.	
4.	*Hederella obesa*, new species ------------------------------------	53
	Portion of the type, a large specimen incrusting the base of a *Fistulipora*. The large, very short, broad zooecia arising on alternate sides of a central tube form the specific characters.	
	Hamilton (Ludlowville-Tichenor limestone), 18-Mile Creek, N. Y.	
5, 6.	*Hederella magniventra*, new species ------------------------------	52
	The type specimen, × 2 and × 4, incrusting a brachiopod and illustrating the short, large, swollen zooecia and the rather frequently dividing branches. The example of *H. delicatula* in the lower right corner illustrates the great variation in size in species of *Hederella*.	
	Middle Devonian (Traverse-Lower Gravel Point limestone), Petoskey, Mich	

PLATE 11

Page

1–8. *Hederella delicatula*, new species ---------- 38

1, A typical zoarium incrusting a *Heliophyllum* and illustrating the delicacy of the tubes and the method of branching.

Hamilton (Ludlowville–Wanakah shale), Erie County, N. Y.

2, An example growing on a cup coral with crowded branches caused by several colonies crossing one another in the course of growth.

3, 4, Portion of a colony, and a part × 8, showing the structure in more detail and demonstrating that branches of the same colony will cross one another.

Hamilton (Ludlowville–Tichenor limestone), $1\frac{1}{2}$ miles south of East Bethany, N. Y.

5, A small example incrusting a crinoid column.

Hamilton (Widder shale), Thedford, Ontario.

6, Colony attached to a stony bryozoan (*Lioclema*).

Middle Devonian (Milwaukee limestone–Lindwurm member), Milwaukee, Wis.

7, An unusual example, doubtfully referred to this species, in which branching has occurred in such way that the tubes appear in two rows.

Onondaga (Upper Jeffersonville limestone), Falls of the Ohio.

8, Two species of *Hederella*, the smaller one identified as *H. delicatula* and the larger as *H. bilineata*.

Hamilton (Sellersburg limestone), Lebanon, Ky.

9. *Hederella concinnoides*, new species ---------- 37

The type specimen, similar to *H. delicatula* but with slightly wider tubes and zooecia emerging at a greater angle.

Middle Devonian (Silica shale), $2\frac{1}{2}$ miles southwest of Sylvania, Ohio.

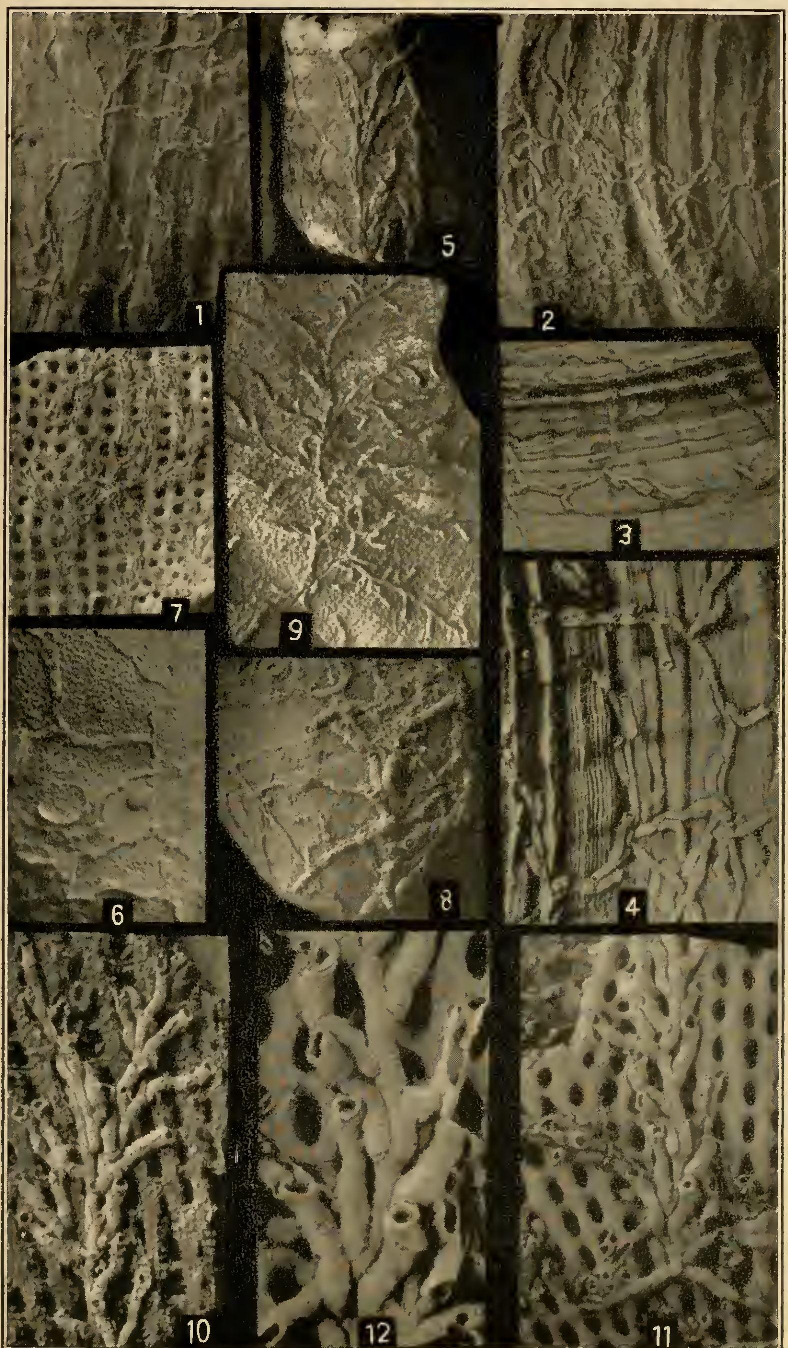
10–12. *Hederella adnata* (Davis, 1885) ---------- 46

10, Example incrusting a bryozoan (*Polypora*), with branching somewhat less regular than usual.

11, Tubes attached to the noncelluliferous side of a bryozoan, showing normal method of branching.

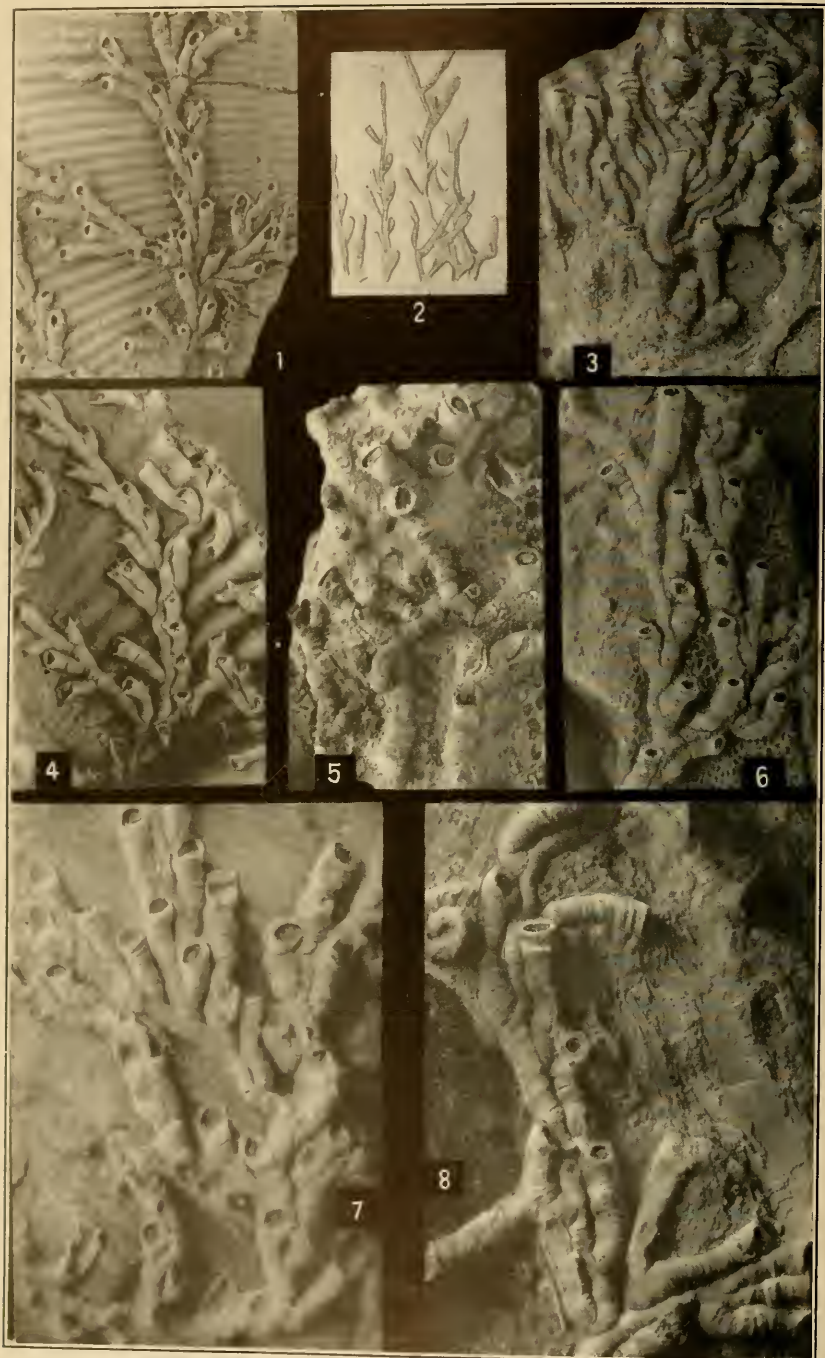
12, Portion of fig. 11, × 8, exhibiting structure in more detail.

Onondaga (Upper Jeffersonville limestone), Falls of the Ohio.



SPECIES OF HEDERELLA.

FOR EXPLANATION SEE OPPOSITE PAGE.



SPECIES OF HEDERELLA.

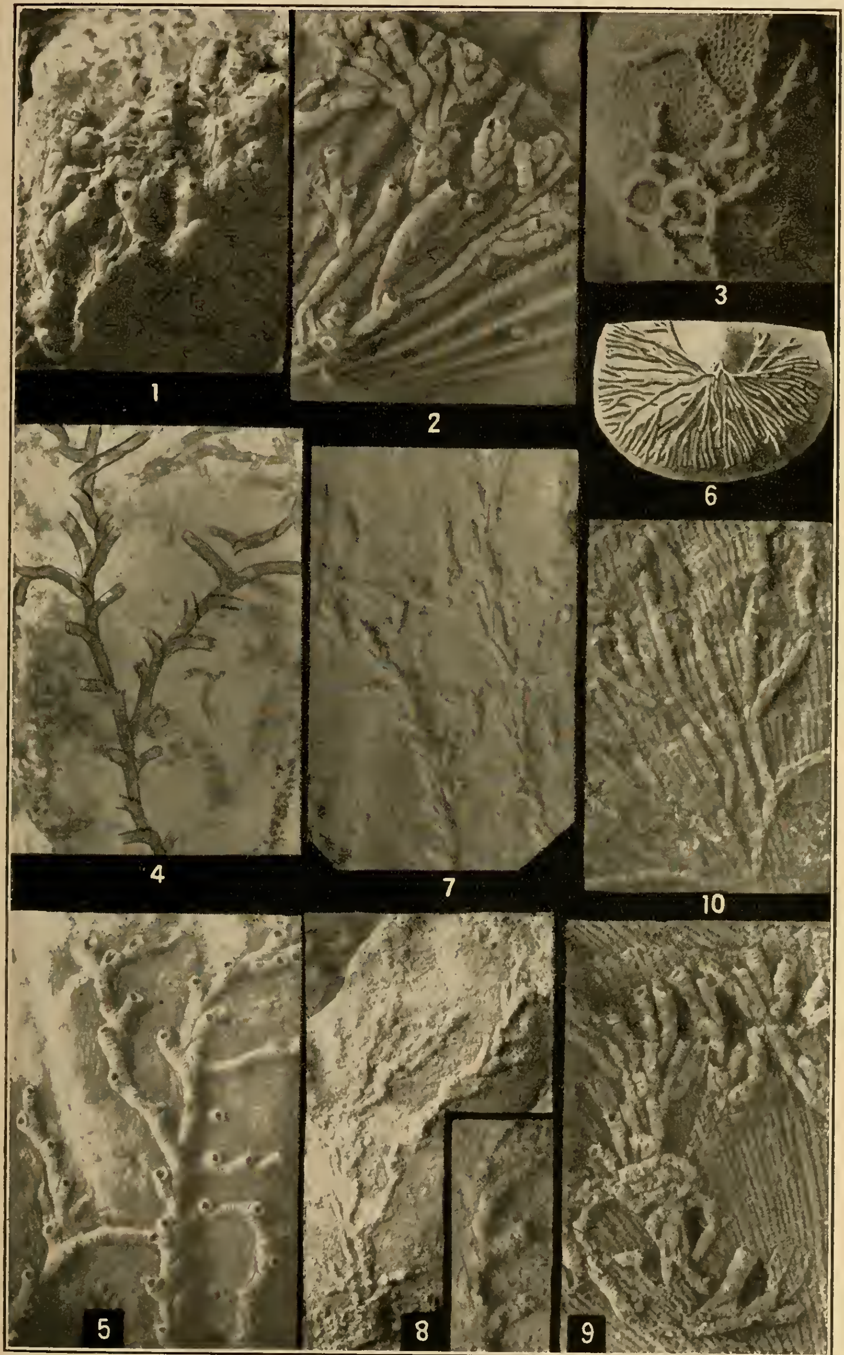
FOR EXPLANATION SEE OPPOSITE PAGE.

Plate 12

		Page
1.	*Hederella halyson* (Fenton and Fenton, 1924) (see also pl. 2, fig. 6, and pl. 5, figs. 4, 5)	48
	A well-preserved colony showing the normal method of branching.	
	Devonian (Hackberry–Cerro Gordo shale), 3 miles southwest of Rockford, Iowa.	
2.	*Hederella fruticosa* (Počta, 1894).	
	Portion of Počta's enlarged view of the genotype of *Thamnocoelum.*	
	Silurian (Budnany limestone), Kosor, Bohemia.	
3.	*Hederella nodifera,* new species	45
	The type specimen incrusting a brachiopod and showing the development of nodes at regular intervals on the branches.	
	Lower Devonian (Helderbergian–Birdsong shale), Perryville, Tenn.	
4.	*Hederella nicholsoni,* new species (see also pl. 4, figs. 8, 8′)	44
	Portion of the type specimen attached to *Spirifer mucronatus.*	
	Middle Devonian (Traverse–Upper Bell shale), Rockport quarry, Alpena County, Mich.	
5.	*Hederella michiganensis,* new species (see also pl. 10, fig. 1)	54
	Portion of zoarium illustrating the method of branching.	
	Middle Devonian (Traverse–Gravel Point limestone), Lake shore, Bay View, Mich.	
6, 7.	*Hederella robusta,* new species (see also pl. 10, fig. 2)	54
	6, A paratype believed to represent a simple growth form.	
	Hamilton (Moscow–Kashong shale), 1½ miles southeast of East Bethany, N. Y.	
	7, An example (paratype) incrusting a cup coral and showing very regular branching and budding of the large zooecia.	
	Hamilton (Ludlowville–Centerfield shale), 3 miles west of East Bethany, N. Y.	
8.	*Hederella reimanni,* new species	55
	Portion of the type specimen incrusting *Athyris spiriferoides* and showing the large elongate tubes and the method of branching.	
	Hamilton (Ludlowville–Wanakah shale), Bay View, N. Y.	

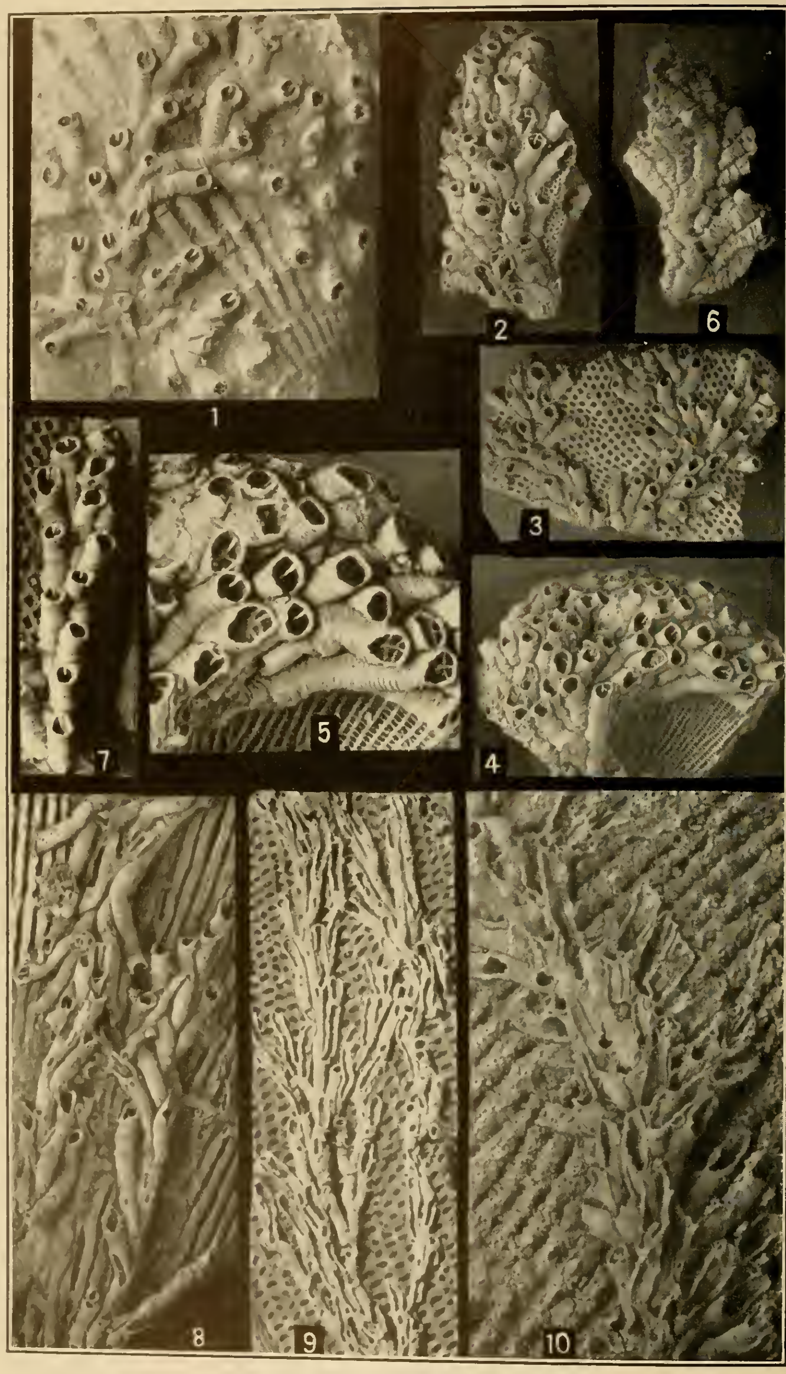
Plate 13

		Page
1.	*Hederella ? laxa* (Whiteaves, 1891)	46
	Photograph of a gutta-percha squeeze of the holotype.	
	Devonian, 40 miles above mouth of Hay River, Canada.	
2.	*Hederella thedfordensis*, new species (see also pl. 1, figs. 7–12)	43
	An example incrusting a *Tropidoleptus* and exhibiting the method of branching.	
	Hamilton (Moscow-Kashong shale), 1½ miles southeast of East Bethany, N. Y.	
3.	*Hederella siluriana*, new species	32
	View of the holotype incrusting a bryozoan, which is attached to an example of *Protathyris didyma*.	
	Silurian, Island of Gotland (probably Klintehamn).	
4, 5.	*Hederella crassilinea*, new species (see also pl. 4, fig. 4)	41
	4, View of the basal side of this species exhibited in the interior of a cephalopod shell.	
	5, Part of zoarium incrusting a cup coral and showing the method of branching and the short zooecial buds.	
	Devonian (Cedar Valley formation), railroad fill northeast of Randalia (4) and Iowa City (5), Iowa.	
6.	*Hederella blainvillei* Clarke, 1907	42
	The type specimen, natural size, exhibiting the regular branching of the tubes (after Clarke).	
	Devonian (Gaspé sandstone), Gaspé, Quebec.	
7.	*Hederella arachnoidea* Clarke, 1900	34
	Photograph of the type specimen incrusting a trilobite head.	
	Oriskany, Becraft Mountain, near Hudson, N. Y.	
8.	*Hederella ulrichi*, new species	40
	Photograph of a gutta-percha squeeze of the type, × 2, and portion, × 4, exhibiting the distant branching and the budding of the tubes.	
	Helderbergian (50 feet below top), Big Stone Gap, Va.	
9.	*Hederella quebecensis*, new species	45
	View of a gutta-percha impression of the type, which incrusted a valve of *Leptostrophia blainvillei*.	
	Devonian (Gaspé sandstone), near Gaspé, Quebec.	
10.	*Hederella ramea* Clarke, 1900	43
	View of portion of type specimen showing the regularly dividing unilinear branches and resemblance to *H. blainvillei*.	
	Oriskany, Becraft Mountain, near Hudson, N. Y.	



SPECIES OF HEDERELLA.

FOR EXPLANATION SEE OPPOSITE PAGE.



SPECIES OF HEDEROPSIS.

FOR EXPLANATION SEE OPPOSITE PAGE.

PLATE 14

		Page
1.	*Hederopsis raaschi*, new species	59
	The holotype of short, broad, frequently branching zooecia exhibiting the central carina.	
	Middle Devonian (Milwaukee limestone-Lindwurm member), Milwaukee, Wis.	
2–6.	*Hederopsis typicalis*, new species	59
	2, Mature portion of a colony, × 2.	
	3, Portion of a zoarium, × 2, in which the method of branching is not obscured by crowding.	
	4, 5, Part of a colony, × 2 and × 4, in which the characteristic inner carina of the tubes is shown.	
	6, Basal side of a zoarium, × 2, which has become detached from its host and exposes the long central tube.	
	Onondaga (Upper Jeffersonville limestone), Falls of the Ohio.	
7.	*Hederopsis curta*, new species	60
	The type example incrusting a fenestellid fragment; the short, wide, zooecia with the internal carina are characteristic.	
	Onondaga (Upper Jeffersonville limestone), Falls of the Ohio.	
8.	*Hederopsis longituba*, new species	61
	Colony incrusting a fenestellid (*Semicoscinium*) with branches composed of elongate, regularly budding tubes.	
	Onondaga (Upper Jeffersonville limestone), Falls of the Ohio.	
9.	*Hederopsis bifurcata*, new species	60
	The holotype incrusting a bryozoan (*Unitrypa*); the narrow, elongate, frequently bifurcating zooecia separate this from other species.	
	Onondaga (Upper Jeffersonville limestone), Falls of the Ohio.	
10.	*Hederopsis connata*, new species	60
	The type specimen growing upon a *Polypora*, exhibiting the features of the species, short, broad, internally carinated zooecia budding from the midline.	
	Onondaga (Upper Jeffersonville limestone), Falls of the Ohio.	

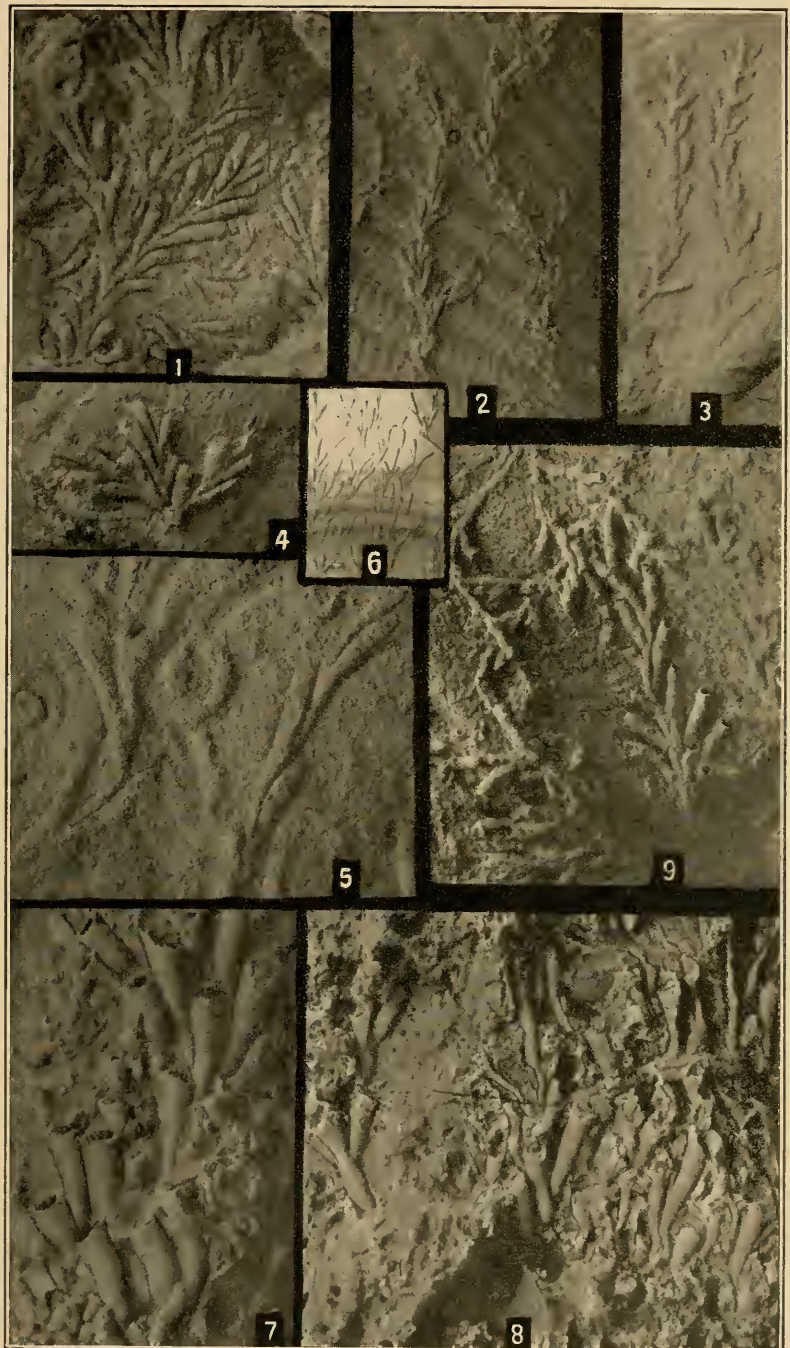
PLATE 15

Page

1. *Hernodia tennesseensis*, new species ---- 65
   Gutta-percha impression of the type specimen represented by an excavation in the base of a massive bryozoan (*Monotrypa*).
   Lower Devonian (Helderbergian–Birdsong shale), Swaynes Mills, Benton County, Tenn.
2. *Hederella concinna*, new species (see also pl. 7, figs. 10–15) ---- 32
   A portion of the delicate zoarium incrusting a brachiopod. Middle Devonian (Onondaga-Columbus limestone), Sandusky, Ohio.
3. *Hernodia* (?) *monahani*, new species ---- 67
   Gutta-percha squeeze of a part of the type preserved as a mold in a cephalopod.
   Silurian (Cayugan-Bertie limestone), near Buffalo, N. Y.
4. *Hernodia* (?*Hederella*) *compacta*, new species ---- 68
   Small portion of the zoarium incrusting a brachiopod large enough to show the very compact arrangement of the zooecia.
   Middle Devonian (Onondaga-Columbus limestone), Sandusky, Ohio.

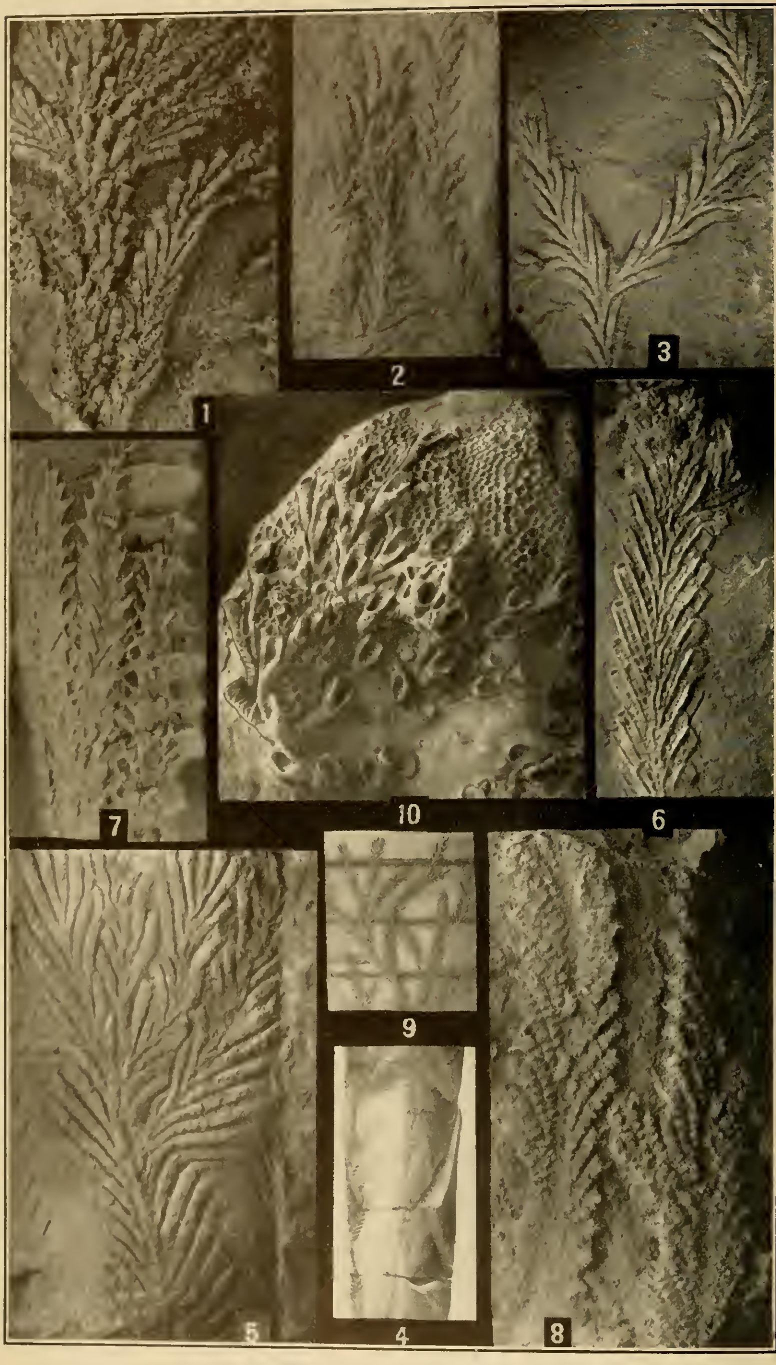
5, 6. *Hernodia humifusa* Hall, 1881 ---- 64
   5, Natural cast of a specimen with the large dimensions and other characters of the type.
   Devonian (Milwaukee limestone-Lindwurm member), Milwaukee, Wis.
   6, Portion of the original type, × 2 (after Hall).
   Middle Devonian (Ludlowville shale), Cazenovia, N. Y.

7. *Hernodia cornucopia*, new species ---- 65
   The type specimen resembling the genotype but differing in the closer arrangement and greater breadth of the tubes.
   Middle Devonian (Traverse-Genshaw formation), Long Lake, near Alpena, Mich.
8. *Hernodia ulrichi*, new species ---- 65
   View of the type preserved in porous chert showing the short, rapidly expanding separated zooecia.
   Onondaga (Upper Jeffersonville limestone), Falls of the Ohio.
9. *Hernodia davisi*, new species ---- 66
   Portion of the type incrusting a brachiopod showing the wide spacing of the zooecial tubes.
   Hamilton (Silver Creek dolomite), Falls of the Ohio.



SPECIES OF HERNODIA.

FOR EXPLANATION SEE OPPOSITE PAGE.



SPECIES OF REPTARIA AND HERNODIA.

FOR EXPLANATION SEE OPPOSITE PAGE.

PLATE 16

		Page
1.	*Reptaria gaspéensis*, new species	63

View of gutta-percha squeeze of the holotype exhibiting the frequent zoarial branching and the short, thick, close-set tubes, attached to a brachiopod valve.

Devonian (Gaspé sandstone), Gaspé, Quebec.

2. *Reptaria cayuga*, new species ---- 63

Gutta-percha squeeze of the type, occurring as an excavation in a cephalopod shell (*Mitroceras*); the small dimensions of the zooecia and their less regular arrangement are the distinguishing characters.

Silurian (Cayugan-Bertie limestone), near Buffalo, N. Y.

3. *Reptaria cloudi*, new species ---- 63

Part of the type preserved as a cast upon a cephalopod shell but exhibiting small zooecial dimensions and the rectangular method of branching.

Upper Devonian (Tully limestone-West Brook member), 2½ miles south of Sherburne, N. Y.

4–8. *Reptaria stolonifera* Rollé, 1851 ---- 62

4, Copy of Hall's illustration, × 7, showing method of branching.

Hamilton (Ludlowville shale), Cazenovia, N. Y.

5, Portion of a much-branched zoarium with the tubes preserved as molds in the rock.

6, View of a single branch with the zooecial tubes crushed but still showing their regular arrangement.

Hamilton (Ludlowville shale), Kashong Creek, N. Y.

7, Young specimen showing the ends of the branches with tubes not yet reaching their normal length.

Hamilton (Widder shale), Thedford, Ontario.

8, An example with tubes marked by distinct wrinkles.

Hamilton (Sellersburg limestone), Falls of the Ohio.

9. *Reptaria* (*Bryozoon*) *steiningeri* (Barrande, 1868) (*Thamnocoelum pennulatum* Počta, 1894).

View of the type, two-thirds natural size, incrusting an *Orthoceras* shell (after Počta).

10. *Hernodia* (?) *cooperi*, new species ---- 66

The type specimen incrusting a stony bryozoan and exhibiting the short, rapidly expanding zooecia.

Hamilton (Ludlowville-Wanakah shale), Averys Creek, Erie County, N. Y.

139917—39——7

U. S. GOVERNMENT PRINTING OFFICE: 1939

PROCEEDINGS OF THE UNITED STATES NATIONAL MUSEUM

issued by the

SMITHSONIAN INSTITUTION
U. S. NATIONAL MUSEUM

Vol. 87 Washington : 1939 No. 3069

A GENERIC REVISION OF THE STAPHYLINID BEETLES OF THE TRIBE PAEDERINI

By Richard E. Blackwelder

A recent attempt to classify a large number of Paederini from the West Indies led to the recognition of the necessity for a complete revision of the genera and subgenera. Such a study was undertaken and brought as near to completion as the available materials will permit. Although this was first planned as a supplement to the study of the West Indies fauna, it now seems advisable to publish the revision separately because of its application to faunas of other parts of the world. An examination of the material available has showed that 219 generic or subgeneric names have been proposed in this tribe and that genotypes of 100 of these are available with other species of 25 more. With the primary synonyms that are recognized as such, it has been possible to place 147 of the names in this revision. Of the remaining 72 names, 42 are monobasic, and none of the others are sufficiently well known to be of special importance.

This revision is divided into three parts: A key to the genera and subgenera of the Paederini, a proposed systematic arrangement, and a list of the genotypes on which the foregoing are based.

The key is entirely artificial, although an attempt is made to use characters of greatest significance in the primary separations. Several characters are employed that have not to my knowledge been previously noticed. Each one has been worded carefully and must be taken literally, and it is quite essential to the satisfactory use of the key that each character be examined with considerable care. Several new genera and subgenera are proposed in the key. These are described in footnotes with descriptions of their type species, if new.

The second part of this study is an attempt to arrange the genera in a natural order, beginning with what seem to be the least specialized. The arrangement is based on the assumptions that the closure of the front coxal cavities is a high specialization, that the "normal" antennal form is the most primitive, and that the extreme constriction of the neck is more specialized. Although the genera have been carefully arranged, the subgenera are not placed in any special sequence. It has not been possible to examine them with sufficient care to determine their interrelationships. This systematic list has been expanded to contain a list of the species that were examined in each genus and subgenus. In each case are given the original genus, the genus in which it has been recently placed (if different from the one to which it is herein assigned), a key to the authority for the specific identification, and an indication of the habitat of the species. The specimens have come from the following sources: The United States National Museum (including among others the T. L. Casey collection, the Hubbard and Schwarz collection, and the C. F. Baker collection), the collection of the writer, and a very useful series of oriental species presented by Dr. M. Cameron. The Casey collection has furnished over three-fourths of the genotypes and a large part of the other species included.

The designation of genotypes in such a group as this is a very important foundation for revisionary work. It must be done with great care, however, especially in a group like this in which there have been very few previous designations. Of the 227 names listed here, 19 have had genotypes designated, 127 were monobasic, and types are herein designated for the remainder.

In view of the fact that Col. T. L. Casey proposed a complete classification for the American Paederini (and certain others), it is necessary to explain why his arrangement has not been satisfactory as a basis for the present study. The first character in Casey's key is arranged as a triplet and involves the separation of those forms having the prosternum reaching to the mesosternum from those having it short. I have never been able to use this separation when keying out species of the *Medon–Lithocharis* group, and I am now able to state, after a careful examination of the Casey collection, that the distinction either does not exist or at least does not have the importance that was attributed to it. The third part of the triplet does involve a fundamental difference from the first two parts. Nevertheless, it seems to me that the Stilici should have been placed with the first group rather than with the second, since the sternal structure is a slight modification of the more generalized type and is not similar to the highly modified types of the Stilicopses, Sunii, and Echiasteres.

Most writers have placed emphasis on the relative length of the posterior tarsal subsegments and the dilation of the anterior tarsi.

These characters seem to me to be superficial and of little use in generic divisions, at least. It should also be pointed out that, although the labrum does present some characters of value, especially for subgenera, it cannot be relied on blindly at all times. The slight differences in the labra are generally accompanied by more important or more readily usable characters in other parts of the body.

In the present study there are several weak points that should be pointed out. The character in couplet 16 involving the ctenidia of the apex of the posterior tibia is not entirely satisfactory. I have been unable to find another to replace it, and it apparently holds for the species examined. The fundamental character of umbilicate punctation is not sufficiently understood to permit the use of a satisfactory terminology. This type of sculpture undoubtedly is closely related to the setigerous tuberculi, which are rather common. Certain inconsistencies will appear if the use of this term is misunderstood. Care must be exercised in couplet 43. The sternite may be (and usually is) touching the hypomera even though not united to it. Often a narrow space is visible between them, whereas in the connate species the sternite is obviously united to the inner side of the hypomera.

KEY TO THE GENERA AND SUBGENERA OF THE PAEDERINI

1. Prosternum not dilated under front coxae as far as hypomera 2
   Prosternum expanded laterally and caudally, either connate with hypomera or very narrowly separated from them 43
2. Anterior coxal cavities closed by an independent sclerotization behind sternite, which extends laterally to or almost to hypomera 3
   Anterior coxal cavities entirely open behind 5
3. Eyes entirely lacking .... Scotonomus
   Eyes present, normal 4
4. Elytra well developed; length 4 to 10 mm .... Leptobium
   Elytra very much abbreviated; length over 15 mm .... Dolicaon
5. Antennae anteriorly flexile and strongly geniculate at first joint, basal segment very much elongate 6
   Antennae posteriorly flexile, not strongly geniculate, basal segment not very elongate 14
6. Neck less than one-fourth as wide as head 7
   Neck more than one-fourth as wide as head 8
7. Head greatly prolonged posteriorly in a slender neck .... Ophites
   Head not prolonged posteriorly in a slender neck .... Scopaeodes
8. Gular sutures united throughout their length .... Monocrypta
   Gular sutures separate throughout their length 9
9. Elytra with a pleural fold near side margin 10
   Elytra without trace of a pleural fold 12
10. Neck entirely unconstricted above and below .... Aderobium
    Neck abruptly constricted across dorsal surface 11
11. Integuments highly polished, very sparsely punctate, without ground sculpture .... Lissobiops

Integuments not highly polished, rather densely punctate, with ground sculpture in part.............................. **Homoeotarsus**

A. Eyes placed just behind middle of head.................................subgenus **Eucryptina**
Eyes placed in front of middle of head...B
B. Subbasal abdominal segments modified in male...C
Only apical segments modified in male...D
C. Seventh sternite of male with a densely pubescent depression at middle; eighth sternite emarginate...subgenus **Nemoeotus** [1]
Seventh sternite of male without depression at middle; eighth sternite not distinctly emarginate...subgenus **Gastrolobium**
D. Male with seventh sternite abruptly emarginate......................subgenus **Homoeotarsus**
Male with seventh sternite not abruptly emarginate....................................E
E. Eyes minute, at over 6 times their diameter from base; elytra shorter than pronotum...subgenus **Homoeobium** [2]
Eyes small, at less than 4 times their diameter from base; elytra longer than pronotum...subgenus **Hesperobium**

12. Labrum not dentate..13
Labrum bidentate (the denticles sometimes obtusely rounded)..**Cryptobium**

A. Neck less than half as wide as head; antennal grooves obsolescent... ...... subgenus **Ababactus**
Neck more than half as wide as head; antennal grooves completely separating eyes from anterior margin of head...B
B. Subbasal sternites of males modified..................................subgenus **Neobactus** [3]
Subbasal sternites of males not at all modified......................................C
C. Basal segment of antennae two-thirds as long as head; head and generally pronotum with very fine ground sculpture............................ subgenus **Cryptobiella**
Basal segment of antennae one-half as long as head; without ground sculpture subgenus **Cryptobium**

---

[1] **Nemoeotus**, new subgenus. *Diagnosis:* Characters of genus *Homoeotarsus* except as follows: Eyes moderately small, placed in front of middle of head; fourth and fifth sternites of male with transverse setose foveae at middle, seventh with a densely pubescent depression at middle, eighth emarginate.

[2] **Homoeobium**, new subgenus. *Diagnosis:* Characters of genus *Homoeotarsus* except as follows: Eyes minute, separated by more than 6 times their diameter from base of head; elytra unusually short, shorter than pronotum.

Homoeotarsus (Homoeobium) bakerianus, new species. *Description:* Head black, pronotum, elytra, and abdomen rufopiceous. *Head* robust behind, with basal angles obliterated; eyes very small, separated from base of head by 6 times their length; basal segment of antennae longer than next three together; gular sutures parallel and approximate in front; with rather large and dense punctures, not very abrupt but somewhat umbilicate, almost absent between antennal prominences, intervals rather flat; without distinct ground sculpture. *Pronotum* longer than wide, widest in front, feebly narrowed to narrowly rounded posterior angles; with a narrow irregular impunctate midline; punctures as on head but a little less dense; without ground sculpture. *Elytra* about as wide as long, closely appressed to thorax; very indefinitely punctate, the large depressions separated by irregular convex intervals. *Abdomen* punctured as elytra but with the depressions more punctiform and sometimes submuricate. *Male*, eighth sternite with an excision one-half longer than wide with sides parallel at apex, which is rounded and expanding posteriorly, segment flattened or impressed in front of excision. *Female*, unknown. *Length*, 11 mm. *Type locality*, Philippine Islands, Baguio, Benguet Province. *Types*, holotype and paratype, males, U.S.N.M. No. 52660, collected by C. F. Baker.

[3] **Neobactus**, new subgenus. *Diagnosis:* Characters of genus *Cryptobium* except as follows: Male, fourth sternite with a more or less circular modification near the middle of the posterior border, fifth sternite with a large oval fovea or spongy area posteriorly on segment at middle.

Ababactus (Neobactus) nunenmacheri, new species. *Description:* Black, abdomen in part rufescent. *Head* with basal angles rounded from eyes, which are at nearly 3 times their length from base; labrum truncate in front, with two blunt prominences separated by a feeble, rounded emargination; gular sutures feebly converging to basal third; punctures very scattered, generally separated by twice their diameter, unusually large but not distinctly umbilicate, with dense but not coarse ground sculpture throughout. *Pronotum* a little longer than wide, sides feebly arcuate, a little wider anteriorly; punctures a little finer than on head, arranged in part along a median smooth area; ground sculpture as on head. *Elytra* coarsely and rather densely punctured, the intervals more or less convex and vaguely coriaceous. *Abdomen* with small and indefinite punctures, each excavated behind. *Male*, fourth sternite with a circular elevation at middle of posterior border, bearing a very large puncture; fifth sternite with a large oval spongy area posteriorly at middle; seventh sternite very feebly bilobed at center; eighth sternite with an abrupt impression 3 times as long as wide and within this depression a narrow excision, rounded at apex and enlarged posteriorly, more than twice as long as greatest width. *Female*, unknown. *Length*, 8 mm. *Type locality*, Arizona, Nogales, Santa Cruz County. *Types*, holotype, male, U.S.N.M. No. 52661, collected on August 24, 1906, by F. W. Nunenmacher.

13. Pronotum sculptured similarly to head; prosternum transversely impressed before coxae; fifth sternite not lobed....**Pycnocrypta**
Pronotum scarcely distinguishably sculptured; prosternum not transversely impressed before coxae; fifth sternite of male lobed behind at middle....**Biocrypta**
14. Fourth segment of maxillary palpus not strongly compressed or very short, glabrous....15
Fourth segment of maxillary palpus compressed, truncate, and pubescent....**Paederus**

A. Elytra closely appressed to metathorax and abdomen, narrowed at base with basal angles more or less obliterated; hind wings absent....B
Elytra normal, quadrate, not closely appressed, generally larger than base of abdomen and not strongly narrowed, with basal angles rounded but distinct; hind wings present....subgenus **Paederus**
B. Each mandible with an additional dorsal tooth....subgenus **Gnathopaederus**
Mandibles without additional dorsal teeth....subgenus **Neopaederus** [4]

15. First segment of antennae large, rest smaller, even, strongly compressed from sixth, with dense pile and long setae at sides of each segment from sixth....**Suniotrichus**
Antennae normal or with first two segments larger and rest not compressed....16
16. Neck never at all less than one-fourth as wide as head; apex of posterior tibia with a distinct ctenidium on both sides....17
Neck variable; apex of posterior tibia with a ctenidium only on inner side....25
17. Eyes wholly obsolete....**Glyptomerus**
Faceted eyes present and distinct....18
18. Fourth segment of maxillary palpus large, conical, apex truncate....19
Fourth segment of maxillary palpus small, acute or acicular....20
19. Labrum completely divided into 2 elongate lobes....**Achenium**
Labrum divided into 2 transverse rounded lobes....**Scimbalium**
20. Fourth segment of maxillary palpus longer than greatest width of third; labrum semicircularly emarginate; punctation dense and umbilicate....**Scopobium** [5]
Fourth segment of maxillary palpus shorter than greatest width of third; labrum bilobed or triangularly emarginate; punctation generally not umbilicate....21
21. Head with punctures not very dense, not coarsely umbilicate....22
Head with very dense umbilicate punctures....**Domene**

A. Elytra with pleural fold....subgenus **Domene**
Elytra without pleural fold....subgenus **Neodomene** [6]

---

[4] **Neopaederus**, new subgenus. *Diagnosis:* Characters of genus *Paederus* except as follows: Mandibles without an additional dorsal tooth; elytra closely appressed to thorax, narrowed at base with the basal angles more or less obliterated; hind wings absent; anterior tarsi strongly dilated.

[5] **Scopobium**, new genus. *Diagnosis:* Punctures dense and umbilicate; antennae normal; labrum broadly semicircularly emarginate; fourth segment of maxillary palpus acicular, longer than the greatest width of the third; gular sutures very approximate throughout their length, not at all united though obscured by the sculpture; neck about one-half as wide as head; prosternum not dilated beneath the coxae; hypomera prolonged in a lobe partly behind the coxae; anterior coxal cavities entirely open behind; front coxae very large, exserted; middle coxal cavities confluent; posterior coxae contiguous, "conical"; first and second abdominal sternites absent, third strongly carinate at middle basally; basal half of front tibia with a concavity lined with diagonal ctenidia; front tarsi broadly expanded; apex of posterior tibia with a ctenidium on each side.

[6] **Neodomene**, new subgenus. *Diagnosis:* Characters of genus *Domene* but lacking any trace of a pleural fold above the side margin of the elytra.

22. Elytra with a longitudinal fold above side margin ---------- 23
Elytra without a fold above side margin ---------- **Lathrobium**

A. Eyes very small, at 6 times their length from base ---------- subgenus **Abletobium**
Eyes moderately small, at not over 4 times their length from base ---------- B
B. Elytra conjointly wider than long ---------- subgenus **Apterallum**
Elytra not wider than long ---------- C
C. Head slightly emarginate behind; less than 5 mm. long ---------- D
Head rounded or truncate behind; generally more than 5 mm. long ---------- F
D. Gular sutures divergent posteriorly ---------- E
Gular sutures parallel ---------- subgenus **Lathrobioma**
E. Pronotum much longer than wide; elytral punctures not serial ---------- subgenus **Lathrolepta**
Pronotum scarcely longer than wide; elytral punctures in series ---------- subgenus **Lathrobiopsis**
F. Gular sutures divergent from front ---------- subgenus **Deratopeus**
Gular sutures most approximate along middle or posteriorly ---------- G
G. Neck about one-third as wide as head ---------- subgenus **Tetartopeus**
Neck about one-half as wide as head ---------- subgenus **Lathrobium**

23. Integuments subglabrous, subimpunctate, and highly polished; labrum broadly rounded and deeply emarginate at middle ---------- 24
Integuments moderately sparsely punctate; labrum bilobed ---------- **Lobrathium**

A. Head above with distinct ground sculpture throughout ---------- subgenus **Platydomene**
Head above without ground sculpture except occasionally at sides ---------- B
B. Gular sutures converging posteriorly ---------- subgenus **Eulathrobium**
Gular sutures most approximate at middle or anteriorly ---------- C
C. Gular sutures most approximate along middle ---------- subgenus **Lobrathium**
Gular sutures diverging from before middle ---------- subgenus **Pseudolathra**

24. Labrum strongly bidentate ---------- **Acalophaena**
Labrum not dentate ---------- **Dacnochilus**

25. Neck one-fourth as wide as head, or more ---------- 26
Neck one-fifth to one-eighth as wide as head ---------- 35

26. Basal half of front tibia with a concavity lined with diagonal ctenidia, usually with an expansion along posterior edge of concavity and a corresponding anterior prominence on femur ---------- 27
Basal half of front tibia often with a concavity but never more than margined with a single row of setae, without strong prominences on tibia or femur ---------- **Lobochilus**

27. Antennae normal ---------- 28
Antennae with first two segments larger, rest verticillate, slender, of equal thickness throughout ---------- **Thinocharis**

A. Labrum bidentate at middle ---------- subgenus **Sciocharis**
Labrum not dentate at middle ---------- B
B. Gular sutures widely divergent posteriorly ---------- subgenus **Sciocharella**
Gular sutures most approximate posteriorly or along middle ---------- subgenus **Thinocharis**

28. Pronotum distinctly longer than wide; seventh abdominal sternite in male generally distinctly modified; punctures of head not distinctly umbilicate though not very fine ---------- 29
Pronotum not or scarcely longer than wide; seventh abdominal sternite of male rarely modified; punctures of head umbilicate or fine and dense ---------- 30

29. Eyes entirely absent ---------- **Micranops**
Compound eyes normal ---------- **Orus**

A. Labrum quadridentate ---------- B
Labrum at most indistinctly bidentate ---------- subgenus **Leucorus**
B. Male characters involving fourth to eighth sternites ---------- subgenus **Pycnorus**
Male characters involving only seventh and eighth sternites ---------- subgenus **Orus**

30. Head with few or many distinctly umbilicate punctures, surface sometimes densely punctulate ---------- 31

Head and pronotum densely and very finely punctate or sculptured, without any umbilicate punctures except at margins--**Lithocharis**

A. Gular sutures widely diverging posteriorly--------subgenus **Pseudomedon**
Gular sutures most approximate posteriorly or along middle--------B
B. Gular sutures distinctly converging posteriorly--------C
Gular sutures parallel along middle--------subgenus **Ophiomedon**
C. Labrum with a median tooth--------subgenus **Lithocharis**
Labrum with 2 denticles near center--------subgenus **Stilocharis**

31. Labrum with median tooth or prominence--------32
Labrum without median tooth--------33
32. Umbilicate punctures of head sparse and not strong--------**Aderocharis**

A. Labrum without additional denticles; umbilicate punctures small; vertex not grooved above neck--------B
Labrum with 2 additional denticles; umbilicate punctures very large; vertex deeply grooved above neck--------subgenus **Dorocharis**[1]
B. All punctures distinctly umbilicate, generally even--------subgenus **Aderocharis**
Umbilicate punctures very sparse, with dense and fine (sometimes tuberculate) punctures between--------subgenus **Panscopaeus**

Head densely and strongly umbilicately punctured--------**Stilomedon**

A. Gular sutures separate; labrum with 2 additional denticles--------subgenus **Stilomedon**
Gular sutures united; labrum with 4 additional denticles--------subgenus **Polymedon**

33. Gular sutures united in great part--------**Neomedon**
Gular sutures not at all united--------34
34. Gular sutures distinctly diverging posteriorly from before middle-**Hypomedon**

A. Head and pronotum very densely punctate or sculptured--------B
Head and pronotum sparsely punctate, shining--------subgenus **Oligopterus**
B. Head with umbilicate punctures very dense; without distinct ground sculpture--------C
Head with umbilicate punctures not very dense; with distinct ground sculpture--------subgenus **Hypomedon**
C. Prosternum not at all carinate at any point--------subgenus **Trachysectus**
Prosternum strongly carinate posteriorly--------subgenus **Caloderma**

Gular sutures most approximate along middle or at base--------**Medon**

A. Punctures of head very irregular, of various sizes, some distinctly umbilicate; without distinct ground sculpture--------subgenus **Tetramedon**
Punctures of head nearly all of one type, distinctly umbilicate; with or without ground sculpture--------B
B. Head with dense ground sculpture; umbilicate punctures moderate, generally separated by their diameter or more--------C
Head without ground sculpture; umbilicate punctures large, generally separated by less than one-half their diameter--------subgenus **Medon**
C. Punctures of head almost completely obscured by sculpture; head distinctly cordate; body strongly depressed; gular sutures converging to base; prosternum carinate throughout--------subgenus **Medonodonta**
Punctures of head not much obscured by sculpture; head not cordate; body not strongly depressed; gular sutures most approximate along middle; prosternum carinate only posteriorly--------subgenus **Paramedon**

---

[1] **Dorocharis**, new subgenus. *Diagnosis:* Characters of genus *Aderocharis* except as follows: Umbilicate punctures of head and pronotum very large; vertex deeply grooved above the neck; labrum with two additional denticles; neck scarcely one-fourth as wide as head.

Aderocharis (Dorocharis) chapini, new species. *Description:* Uniform rufotestaceous throughout. *Head* somewhat emarginate at base, posterior angles narrowly rounded, vertex above neck deeply grooved longitudinally; eyes small, at about four times their length from base; labrum tridentate, teeth within a broad and abrupt emargination; gular sutures very approximate throughout but not united; punctures rather large, distinctly umbilicate, not crowded on disk, almost absent between antennal prominences; with minute punctulae scattered between the large punctures. *Pronotum* slightly wider than long, widest at anterior angles, somewhat produced to neck, moderately narrowed posteriorly to obtuse basal angles; punctation similar to that of head, with a trace of smooth midline posteriorly. *Elytra* wider than long, not punctate except for setigerous tuberculi which are prominent but not dense, surface between rather finely coriaceous; each elytron with three longitudinal impressions on the disk. *Abdomen* sculptured as elytra; ninth tergite deeply semicircularly emarginate. *Male*, eighth sternite very feebly emarginate. *Female*, eighth sternite not emarginate. *Length*, 7½ mm. *Type locality*, Costa Rica, Hamburg Farm, Reventazon. *Types*, holotype, male, and two paratypes, female, U.S.N.M. No. 52662, collected by Ferdinand Nevermann.

35. Gular sutures always united, at least basally ---- 36
Gular sutures never united in any part ---- 41
36. Head coarsely umbilicately punctured or with coarse and deep elongate punctures; without dense ground sculpture throughout ---- 37
Head not or indistinctly umbilicately punctate; with dense ground sculpture ---- 40
37. Punctures of head very dense; labrum with denticles in pairs only ---- 38
Punctures of head not very dense; labrum with median tooth ---- 39
38. Head emarginate at base; labrum with median teeth separated by twice their average width, notch rounded; pronotum punctured very differently from head ---- **Pachystilicus**
Head not emarginate at base; labrum with median teeth separated by less than twice their average width, notch not rounded; pronotum punctured similarly to head ---- **Stilicus**
39. Labrum with median tooth only ---- **Acrostilicus**
Labrum with additional teeth ---- **Stiliderus**
40. Head obtriangular; labrum without prominent teeth; head, pronotum, and elytra with short, stiff, erect bristles ---- **Megastilicus**
Head suborbicular; labrum with prominent teeth; with only normal pubescence ---- **Stilicolina**
41. Head with dense, coarse, umbilicate punctures ---- **Medome**
Head very finely punctate (or sparsely obsoletely umbilicately punctate) ---- 42
42. Labrum not dentate, feebly emarginate; vertex sometimes carinate in males ---- **Monista**
Labrum generally quadridentate; vertex not carinate in males ---- **Scopaeus**

A. Head, pronotum, and elytra almost impunctate, with sparse long upright hairs ---- subgenus **Scopaeodera**
Head, pronotum, and elytra finely or moderately punctate or sculptured ---- B
B. Head truncate or emarginate behind ---- subgenus **Scopaeus**
Head strongly rounded behind ---- C
C. Inner labral teeth modified on inner edge, generally denticulate ---- subgenus **Scopaeopsis**
Inner labral teeth without additional inner denticle or other modification ---- subgenus **Scopaeoma**

43. Prosternum connate with edge of hypomera ---- 44
Prosternum not connate with edges of hypomera ---- 51
44. Antennae anteriorly flexile, basal segment very much elongate ---- **Cephalochetus**
Antennae posteriorly flexile, basal segment not very elongate ---- 45
45. Prothorax very elongate; head grooved behind eyes; third segment of maxillary palpus globose ---- **Sphaeronum**
Prothorax generally not very elongate; head not separately grooved behind eyes; third segment of maxillary palpus large but not subspherical ---- 46
46. Head, pronotum, and elytra with strong tuberculi and dense ground sculpture ---- **Myrmecosaurus**
Head and pronotum with feeble umbilicate punctures, without ground sculpture ---- 47
47. Labrum denticulate ---- 48
Labrum not denticulate ---- **Sclerochiton**
48. Labrum quadridentate ---- 49
Labrum bidentate ---- 50
49. Integuments not very densely punctate, with prominent shining intervals ---- **Nazeris**

Integuments very densely punctate, without shining intervals----**Echiaster**

A. Eyes very small, separated from base by nearly 3 times their diameter------subgenus **Leptogenius**
Eyes large, separated from base by less than twice their diameter----------subgenus **Echiaster**

50. Labral teeth slender, acute------------------------------------**Astenus**
Labral teeth short, rounded----------------------------------**Sunesta** [8]
51. Prothorax narrowly prolonged at middle in front------------**Stamnoderus**
Prothorax not distinctly prolonged in front------------------------------52
52. Labrum more or less denticulate------------------------------------53
Labrum not at all denticulate----------------------------------**Stilicopsis**
53. With very large and distinctly umbilicate punctures on head and pronotum--54
Head and pronotum densely sculptured but without umbilicate punctures--**Suniocharis**
54. Head rounded posteriorly-----------------------------------**Dibelonetes**
Head truncate posteriorly, emarginate above neck-------------**Stiliphacis**

[8] **Sunesta**, new genus. *Diagnosis:* Head and pronotum with feeble umbilicate punctures, without ground sculpture; antennae normal; labrum with 2 short and blunt denticles within an abrupt emargination; third segment of maxillary palpus large but not subspherical, fourth segment small, distinguishable from third only with difficulty; gular sutures united in great part; neck one-third as wide as head; prothorax not greatly elongate; prosternum expanded laterally under the coxae and connate with the hypomera; hypomera broad but not distinctly lobed behind the coxae; front coxae large, exserted; middle coxal cavities confluent; posterior coxae contiguous, "conical"; first and second abdominal sternites absent; basal half of anterior tibia with a concavity lined with diagonal ctenidia; apex of posterior tibia with a distinct ctenidium only on the inner edge.

GENERIC ARRANGEMENT AND SPECIES EXAMINED

The following abbreviations are used to indicate the authority for the identification of the species listed:

BakC----------	C. F. Baker Collection, U. S. National Museum.
BCA-----------	Biologia Centrali-Americana deposit, U. S. National Museum.
BM------------	British Museum, by exchange.
Bnhr----------	Dr. Max Bernhauer.
Brg-----------	Alexander Bierig.
Bruch---------	Carlos Bruch.
Cam-----------	Dr. Malcolm Cameron.
CC------------	T. L. Casey Collection, U. S. National Museum.
Cotype--------	Paratype.
Csy-----------	Col. T. L. Casey.
Dodero--------	A. Dodero.
EAC-----------	Dr. E. A. Chapin.
Fenyes--------	Dr. A. Fenyes.
Janson--------	Via Janson & Sons.
Linell--------	M. L. Linell.
NM------------	U. S. National Museum collections.
PT------------	Paratype.
REB-----------	Dr. R. E. Blackwelder.
Reitt---------	Via Edm. Reitter.
Roelofs-------	Willem Roelofs.
Shp-----------	David Sharp.
Type----------	Holotype.
Various-------	Several independent sources.
Wend----------	Hans Wendeler.

Lobochilus Bnhr., 1920, p. 179.
Neosclerus Cam., 1924, p. 188.
fortepunctatus Cam. (*Neosclerus*) (Cam)----India
Suniotrichus Shp., 1886, p. 587.
sp. (EAC)----Central America
Thinocharis Kr., 1859, p. 142.
Subg. *Thinocharis* s. str.
carinicollis Kr. (*Thinocharis*) (Cam)----Ceylon
nigricans Cam. (*Thinocharis*) (Cam)----Sumatra, India
pygmaeus Kr. (*Thinocharis*) (Cam)----Ceylon
Subg. *Sciocharis* Lynch, 1884, p. 260.
bakeri Csy. (*Sciocharis*) (*Thinocharis*) (Type)----West Indies
carolinensis Csy. (*Sciocharis*) (*Thinocharis*) (Type)----North America
congruens Csy. (*Sciocharis*) (*Thinocharis*) (Type)----North America
fuscina Cam. (*Thinocharis*) (Cam)----West Indies
nubipennis Csy. (*Sciocharis*) (*Thinocharis*) (Type)----North America
smithi Cam. (*Thinocharis*) (Cam)----West Indies
subopacus Bnhr. (*Thinocharis*) (Bnhr)----South America
Subg. *Sciocharella* Csy., 1905, p. 151.
delicatulus Csy. (*Sciocharella*) (*Thinocharis*) (Type)----North America
exilis Er. (*Lithocharis*) (*Thinocharis*) (REB)----South America
fragilis Shp. (*Sciocharis*) (*Thinocharis*) (PT)----Central America
pertenuis Csy. (*Sciocharella*) (*Thinocharis*) (Type)----West Indies
Lithocharis Boisd. & Lac., 1835, p. 431.
Arthocharis Cam., 1921, p. 372.
Metaxyodonta Csy., 1886, p. 29.
Sunius Steph., 1832, p. 274 (not Er.).
Subg. *Lithocharis* s. str.
alutaceus Csy. (*Metaxyodonta*) (*Medon*) (Type)----North America
ochraceus Grav. (*Paederus*) (*Medon*) (Various)----Cosmopolitan
quadricollis Csy. (*Metaxyodonta*) (*Medon*) (Type)----North America
simplex Csy. (*Lithocharis*) (*Medon*) (Type)----North America
sonoricus Csy. (*Lithocharis*) (*Medon*) (Type)----North America
sororcula Kr. (*Lithocharis*) (*Medon*) (REB)----Cosmopolitan in Tropics
vilis Kr. (*Lithocharis*) (*Medon*) (Cam)----Cosmopolitan in Tropics
Subg. *Pseudomedon* Muls. & Rey, 1878, p. 122.
Ramona Csy., 1886, p. 213.
alabamae Csy. (*Pseudomedon*) (*Medon*) (Type)----North America
capitula Csy. (*Ramona*) (*Medon*) (Type)----North America
clarescens Csy. (*Pseudomedon*) (*Medon*) (Type)----North America
obsoleta Nord. (*Lathrobium*) (*Medon*) (CC)----Europe, Australia
ruficollis Csy. (*Pseudomedon*) (*Medon*) (Type)----North America
thoracica Csy. (*Pseudomedon*) (*Medon*) (Type)----North America
Subg. *Stilocharis* Shp., 1886, p. 576.
limbata Er. (*Lithocharis*) (*Medon*) (REB)----South America
obfuscata Cam. (*Lithocharis*) (*Medon*) (REB)----West Indies
Aderocharis Shp., 1886, p. 552.
Subg. *Aderocharis* s. str.
conifer Cam. (*Aderocharis*) (*Medon*) (PT)----North America
corticinus Grav. (*Paederus*) (*Medon*) (Various)----North America
furtivus Shp. (*Aderocharis*) (*Medon*) (Cam)----West Indies
obscurior Cam. (*Aderocharis*) (*Medon*) (Cam)----West Indies

Subg. *Panscopaeus* Shp., 1889, p. 262.
bakeri Bnhr. (*Medon*) (BakC)----------------------------Philippines
chinensis Boh. (*Lathrobium*) (*Medon*) (Bnhr)------------------Orient
dimidiatus Mots. (*Lithocharis*) (*Medon*) (Bnhr)-----------------India
lithocharoides Shp. (*Scopaeus*) (*Medon*) (EAC)------------------Japan
luzonicus Bnhr. (*Medon*) (Bnhr)--------------------------Philippines
Subg. *Dorocharis* Blkwr. (see above, p. 99).
chapini Blkwr. (Type)-------------------------------Central America
Stilomedon Shp., 1886, p. 565.
Subg. *Stilomedon* s. str.
connexum Shp. (*Lithocharis*) (Cam, BCA)------------Tropical America
insularum Cam. (*Medon*) (*Neomedon*) (REB)-------------West Indies
strigicolle Shp. (*Stilomedon*) (EAC)------------------Central America
triseriatum Shp. (*Stilomedon*) (EAC)-----------------Central America
Subg. *Polymedon* Csy., 1905, p. 151.
tabacinum Csy. (*Lithocharis*) (*Medon*) (Type)------ ----North America
Neomedon Shp., 1886, p. 557.
arizonense Csy. (*Neomedon*) (*Medon*) (Type)-----------North America
Hypomedon Muls. & Rey, 1878, p. 122.
Chloëcharis Lynch, 1884, p. 259.
Euastenus Fiori, 1915, p. 10.
Hemimedon Csy., 1905, p. 152.
Lena Csy., 1905, p. 189.
Subg. *Hypomedon* s. str.
angustum Csy. (*Hemimedon*) (*Medon*) (Type)----------North America
brevipenne Csy. (*Caloderma*) (*Medon*) (Type)-----------North America
conjux Csy. (*Caloderma*) (*Medon*) (Type)---------------North America
continens Csy. (*Caloderma*) (*Medon*) (Type)------------North America
contractum Csy. (*Caloderma*) (*Medon*) (Type)----------North America
debilicorne Woll. (*Lithocharis*) (*Medon*) (Various)--------Cosmopolitan
discolor Csy. (*Caloderma*) (*Medon*) (Type)--------------North America
exile Csy. (*Caloderma*) (*Medon*) (Type)-----------------North America
luculentun Csy. (*Caloderma*) (*Medon*) (Type)-----------North America
mobile Csy. (*Caloderma*) (*Medon*) (Type)---------------North America
molle Csy. (*Caloderma*) (*Medon*) (Type)----------------North America
peregrinum Csy. (*Caloderma*) (*Medon*) (Type)----------North America
pollens Csy. (*Caloderma*) (*Medon*) (Type)--------------North America
quadripenne Csy. (*Caloderma*) (*Medon*) (Type)---------North America
reductum Csy. (*Caloderma*) (*Medon*) (Type)------------North America
rufipes Csy. (*Hemimedon*) (*Medon*) (Type)--------------North America
tantillum Csy. (*Caloderma*) (*Medon*) (Type)------------North America
testaceum Csy. (*Lena*) (*Medon*) (Type)-----------------North America
Subg. *Oligopterus* Csy., 1886, p. 12.
Micromedon Csy., 1905, p. 153.
Medonella Csy., 1905, p. 154.
cuneicolle Csy. (*Oligopterus*) (*Medon*) (Type) ----------North America
filum Csy. (*Oligopterus*) (*Medon*) (Type)---------------North America
flexile Csy. (*Oligopterus*) (*Medon*) (Type)--------------North America
melanocephalum Fabr. (*Paederus*) (*Medon*) (CC)--------------Europe
minutum Csy. (*Medonella*) (*Medon*) (Type)-------------North America
remotum Csy. (*Oligopterus*) (*Medon*((Type)------------North America
seminigrum Fairm. (*Lithocharis*) (*Medon*) (CC)-Europe, northern Africa

Subg. *Caloderma* Csy., 1886, p. 5.
angulatum Csy. (*Caloderma*) (*Medon*) (Type)----------North America
rugosum Csy. (*Caloderma*) (*Medon*) (Type)----------North America
semibrunneum Csy. (*Caloderma*) (*Medon*) (Type)-------North America
Subg. *Trachysectus* Csy., 1886, p. 32.
confluentum Say (*Lathrobium*) (*Medon*) (Csy)----------North America
Medon Steph., 1832, p. 273.
Oxymedon Csy., 1905, p. 177.
Subg. *Medon* s. str.
americanum Csy. (*Medon*) (Type)------------------North America
brunneum Er. (*Lithocharis*) (Reitt)-------------------------Europe
curtulum Er. (*Lithocharis*) (Cam, REB)--------------South America
fusculum Mann. (*Rugilus*) (CC)-------------Europe, northern Africa
oblitum Er. (*Lithocharis*) (Cam, REB)---------------South America
rubrum Csy. (*Oxymedon*) (Type)--------------------North America
texanum Csy. (*Medon*) (Type)----------------------North America
Subg. *Tetramedon* Csy., 1905, p. 178.
rufipenne Csy. (*Tetramedon*) (Type)----------------North America
Subg. *Paramedon* Csy., 1905, p. 166.
Platymedon Csy., 1889, p. 184.
arizonicum Csy. (*Paramedon*) (Type)----------------North America
boreale Csy. (*Paramedon*) (Type)-------------------North America
conforme Csy. (*Paramedon*) (Type)------------------North America
consanguineum Csy. (*Lithocharis*) (Type)-------------North America
contiguum Csy. (*Lithocharis*) (Type)----------------North America
convergens Csy. (*Lithocharis*) (Type)----------------North America
debile Csy. (*Paramedon*) (Type)--------------------North America
difforme Csy. (*Paramedon*) (Type)------------------North America
distans Csy. (*Paramedon*) (Type)-------------------North America
explicans Csy. (*Medon*) (Type)---------------------North America
gregale Csy. (*Lithocharis*) (Type)------------------North America
gulare Csy. (*Paramedon*) (Type)--------------------North America
helenae Csy. (*Medon*) (Type)-----------------------North America
humboldti Csy. (*Paramedon*) (Type)-----------------North America
inquilinum Csy. (*Medon*) (Type)--------------------North America
insulare Csy. (*Medon*) (Type)----------------------North America
kernianum Csy. (*Paramedon*) (Type)-----------------North America
lacustre Csy. (*Medon*) (Type)----------------------North America
languidum Csy. (*Lithocharis*) (Type)----------------North America
laticolle Csy. (*Platymedon*) (Type)-----------------North America
latiusculum Csy. (*Lithocharis*) (Type)--------------North America
lepidum Csy. (*Lithocharis*) (Type)------------------North America
luctuosum Csy. (*Lithocharis*) (Type)----------------North America
malacum Csy. (*Lithocharis*) (Type)-----------------North America
mimulum Csy. (*Lithocharis*) (Type)-----------------North America
montanum Csy. (*Paramedon*) (Type)-----------------North America
nevadicum Csy. (*Platymedon*) (Type)----------------North America
nitidulum Csy. (*Medon*) (Type)---------------------North America
oriens Csy. (*Paramedon*) (Type)--------------------North America
pallescens Csy. (*Paramedon*) (Type)-----------------North America
pallidipenne Csy. (*Paramedon*) (Type)---------------North America
puberulum Csy. (*Lithocharis*) (Type)----------------North America
retrusum Csy. (*Lithocharis*) (Type)-----------------North America
sinuatocolle Csy. (*Lithocharis*) (Type)--------------North America

shastanicum Csy. (*Paramedon*) (Type)----------------North America
sublestum Csy. (*Lithocharis*) (Type)----------------North America
subsimile Csy. (*Paramedon*) (Type)----------------North America
tahoense Csy. (*Paramedon*) (Type)----------------North America
vancouveri Csy. (*Paramedon*) (Type)----------------North America
Subg. *Medonodonta* Csy., 1905, p. 176.
alutaceum Csy. (*Medonodonta*) (Type) ----------------North America
Micranops Cam., 1913, p. 350.[9]
Orus Csy., 1884, p. 136.
Subg. *Orus* s. str.
boreellus Csy. (*Orus*) (*Scopaeus*) (Type)----------------North America
deceptor Csy. (*Orus*) (*Scopaeus*) (Type)----------------North America
distinctus Csy. (*Orus*) (*Scopaeus*) (Type)----------------North America
filius Csy. (*Orus*) (*Scopaeus*) (Type)----------------North America
fraternus Fall (*Orus*) (*Scopaeus*) (Csy)----------------North America
longicollis Csy. (*Orus*) (*Scopaeus*) (Type)----------------North America
montanus Fall (*Orus*) (*Scopaeus*) (Csy)----------------North America
pallidus Csy. (*Orus*) (*Scopaeus*) (Type)----------------North America
parallelus Csy. (*Orus*) (*Scopaeus*) (Type)----------------North America
pinalinus Csy. (*Orus*) (*Scopaeus*) (Type)----------------North America
provensis Csy. (*Orus*) (*Scopaeus*) (Type)----------------North America
pugetanus Csy. (*Orus*) (*Scopaeus*) (Type)----------------North America
punctatus Csy. (*Orus*) (*Scopaeus*) (Type)----------------North America
robustulus Csy. (*Orus*) (*Scopaeus*) (Type)----------------North America
shastanus Csy. (*Orus*) (*Scopaeus*) (Type)----------------North America
sonomae Csy. (*Orus*) (*Scopaeus*) (Type)----------------North America
Subg. *Leucorus* Csy., 1905, p. 191.
ferrugineus Csy. (*Leucorus*) (*Scopaeus*) (Type)----------------North America
luridus Csy. (*Leucorus*) (*Scopaeus*) (Type)----------------North America
ochrinus Csy. (*Leucorus*) (*Scopaeus*) (Type)----------------North America
rubens Csy. (*Leucorus*) (*Scopaeus*) (Type)----------------North America
Subg. *Pycnorus* Csy., 1905, p. 194.
dentiger Lec. (*Scopaeus*) (Csy)----------------North America
iowanus Csy. (*Pycnorus*) (*Scopaeus*) (Type)----------------North America
Scopaeus Er., 1840, p. 604.
Leptorus Csy., 1886, p. 217.
Polyodontus Sol., 1849, p. 310.
Pseudorus Csy., 1910, p. 190.
Scoponaeus Mots., 1858, p. 641.
Subg. *Scopaeus* s. str.
angustissimus Csy. (*Scopaeus*) (Type)----------------North America
arizonae Csy. (*Scopaeus*) (Type)----------------North America
beesoni Cam. (*Scopaeus*) (Cam)----------------India
bicolor Csy. (*Leptorus*) (*Scopaeus*) (Type)----------------North America
brachypterus Csy. (*Scopaeus*) (Type)----------------North America
carolinae Csy. (*Scopaeus*) (Type)----------------North America
cervicula Csy. (*Orus*) (*Scopaeus*) (Type)----------------North America
cognatus Muls. & Rey (*Scopaeus*) (Cam)----------------Europe
crassulus Csy. (*Scopaeus*) (Type)----------------North America
degener Csy. (*Scopaeus*) (Type)----------------North America
decipiens Kr. (*Scopaeus*) (BakC)----------------Ceylon
delicatus Csy. (*Scopaeus*) (Type)----------------North America

[9] This genus has been placed in the key and the systematic arrangement on the basis of characters given in the original description.

didymus Er. (*Scopaeus*) (Csy) ---------- Europe
dilutus Mots. (*Scopaeus*) (Bnhr, Cam) ---------- India
exiguus Er. (*Scopaeus*) (Csy) ---------- North America
fasciatellus Er. (*Scopaeus*) (REB) ---------- West Indies
filus Shp. (*Scopaeus*) (*REB*) ---------- Central America
gilensis Csy. (*Scopaeus*) (Type) ---------- North America
hudsonicus Csy. (*Scopaeus*) (Type) ---------- North America
limbatus Kr. (*Scopaeus*) (Cam) ---------- Ceylon, India
longiceps Csy. (*Leptorus*) (*Scopaeus*) (Type) ---------- North America
macilentus Csy. (*Scopaeus*) (Type) ---------- North America
marginatus Cam. (*Scopaeus*) (REB) ---------- West Indies
nitidulus Mots. (*Scopaeus*) (Bnhr) ---------- India
notangulus Csy. (*Scopaeus*) (Type) ---------- North America
pallidulus Kr. (*Scopaeus*) (Cam) ---------- Ceylon
picipes Csy. (*Orus*) (*Scopaeus*) (Type) ---------- North America
prolixipennis Csy. (*Pseudorus*) (*Scopaeus*) (Type) ---------- North America
pygmaeus Er. (*Scopaeus*) (REB) ---------- West Indies
quadripennis Csy. (*Scopaeus*) (Type) ---------- North America
saginellus Csy. (*Scopaeus*) (Type) ---------- North America
salvini Shp. (*Scopaeus*) (PT) ---------- Central America
semifuscus Kr. (*Scopaeus*) (BakC) ---------- Ceylon
simplicicollis Cam. (*Scopaeus*) (REB) ---------- West Indies
spectralis Csy. (*Pseudorus*) (*Scopaeus*) (Type) ---------- North America
subfasciatus Kr. (*Scopaeus*) (BakC) ---------- Ceylon, India
texanus Csy. (*Leptorus*) (*Scopaeus*) (Type) ---------- North America
versicolor Csy. (*Leptorus*) (*Scopaeus*) (Type) ---------- North America

Subg. *Scopaeodera* Csy., 1886, p. 217.

nitidus Lec. (*Echiaster*) (*Scopaeus*) (Csy) ---------- North America
pulchellus Er. (*Scopaeus*) (REB) ---------- South America
sonoricus Csy. (*Scopaeodera*) (*Scopaeus*) (Type) ---------- North America

Subg. *Scopaeopsis* Csy., 1905, p. 191.

duryi Csy. (*Scopaeopsis*) (*Scopaeus*) (Type) ---------- North America
elaboratus Csy. (*Scopaeopsis*) (*Scopaeus*) (Type) ---------- North America
opacus Lec. (*Echiaster*) (*Scopaeus*) (Csy) ---------- North America
pallens Csy. (*Scopaeopsis*) (*Scopaeus*) (Type) ---------- North America
ventralis Csy. (*Scopaeopsis*) (*Scopaeus*) (Type) ---------- North America

Subg. *Scopaeoma* Csy., 1905, p. 191.

angusticeps Csy. (*Scopaeoma*) (*Scopaeus*) (Type) ---------- North America
laxus Shp. (*Scopaeus*) (Bruch) ---------- South America
procerus Csy. (*Scopaeoma*) (*Scopaeus*) (Type) ---------- North America
puritanus Csy. (*Scopaeoma*) (*Scopaeus*) (Type) ---------- North America
rotundiceps Csy. (*Scopaeus*) (Type) ---------- North America
truncaticeps Csy. (*Scopaeus*) (Type) ---------- North America

Monista Shp., 1876, p. 271.

maculata Brg. MS. (Cotype) ---------- Central America
personata Cam. (*Monista*) (Cam) ---------- West Indies

Medome Cam., 1931, p. 188.

bicolor Cam. (*Medome*) (Cam) ---------- India

Megastilicus Csy., 1889, p. 183.

formicarius Csy. (*Megastilicus*) (Type) ---------- North America

Stilicolina Csy., 1905, p. 228.

Omostilicus Csy., 1905, p. 229.

sonorina Csy. (*Omostilicus*) (Type) ---------- North America
tristis Melsh. (*Stilicus*) (*Stilicolina*) (Cam) ---------- North America

Pachystilicus Csy., 1905, p. 226.
hanhami Wickh. (*Stilicus*) (Csy)----------North America
Stilicus Latr., 1828, p. 495.
Rugilus Curt., 1827, p. 168.
Stilicosoma Csy., 1905, p. 219.
abbreviellus Csy. (*Stilicus*) (Type)----------North America
agnatus Cam. (*Stilicus*) (Cam)----------West Indies
angularis Er. (*Stilicus*) (Csy)----------North America
angustatus Fourc. (*Staphylinus*) (Csy)----------Europe
apicalis Csy. (*Stilicus*) (Type)----------North America
biarmatus Lec. (*Stilicus*) (Csy)----------North America
capitalis Gemm. & Har. (*Stilicus*) (Csy)----------Europe
ceylanensis Kr. (*Stilicus*) (Cam, Bnhr)----------Ceylon
chilensis Sol. (*Rugilus*) (*Stilicus*) (Bruch)----------South America
cribratus Shp. (*Stilicus*) (PT, Brg)----------Central America
densipennis Bnhr. (*Stilicus*) (Bnhr)----------South America
dentatus Say (*Rugilus*) (*Stilicus*) (Csy)----------North America
geniculatus Er. (*Stilicus*) (Reitt)----------Europe
insularus Cam. (*Stilicus*) (REB)----------West Indies
jucundus Cam. (*Stilicus*) (Cam)----------West Indies
lacustrinus Csy. (*Stilicus*) (Type)----------North America
latiusculus Csy. (*Stilicus*) (Type)----------North America
luculentus Csy. (*Stilicus*) (Type)----------North America
minusculus Csy. (*Stilicus*) (Type)----------North America
nigrolucens Csy. (*Stilicus*) (Type)----------North America
ocularis Fvl. (*Stilicus*) (Cam)----------Birma
opaculus Lec. (*Stilicus*) (Csy)----------North America
orbiculatus Payk. (*Paederus*) (Roelofs)----------Europe
oregonus Csy. (*Stilicus*) (Type)----------North America
pruinosus Cam. (*Stilicus*) (Cam)----------Java, Sumatra
rudis Lec. (*Stilicus*) (Csy)----------North America
rufescens Shp. (*Stilicus*) (CC)----------Japan
rufipes Germ. (*Rugilus*) (*Stilicus*) (Csy, Reitt)----------Europe
similis Er. (*Stilicus*) (Cam)----------Europe
velutinus Fvl. (*Stilicus*) (Cam)----------Birma
Acrostilicus Hubb., 1896, p. 299.
hospes Hubb. (*Acrostilicus*) (Type)----------North America
Stiliderus Mots., 1858, p. 639.
Psilotrachelus Kr., 1859, p. 124.
Stilicoderus Shp., 1889, p. 320.
Styliderus Gemm. & Har., 1868, p. 623.
crassus Kr. (*Psilotrachelus*) (Bnhr, Cam)----------Sumatra, Ceylon
feae Fvl. (*Stilicoderus*) (Cam)----------Birma
fenestratus Fvl. (*Stilicoderus*) (Cam)----------Birma
nitidipennis Bnhr. (*Psilotrachelus*) (Bnhr)----------Philippines
sculptipennis Kr. (*Psilotrachelus*) (Cam)----------India
splendidipennis Bnhr. (*Psilotrachelus*) (Bnhr)----------Philippines
Scopobium Blkwr. (see above, p. 97).
anthracinum Cam. (*Ophiomedon*) (*Medon*) (REB)----------West Indies
Domene Fvl., 1872, p. 305.
Subg. *Domene* s. str.
aciculata Hoffg. (*Domene*) (Reitt)----------Europe
scabricollis Er. (*Lathrobium*) (Reitt)----------Europe
sp. (NM)----------Japan

Subg. *Neodomene* Blkwr. (see above, p. 97).
indica Cam. (*Domene*) (Cam) ---------- India

Lathrobium Grav., 1802, p. 51.
Centrocnemis Jos., 1868, p. 365.

Subg. *Lathrobium* s. str.
Litolathra Csy, 1905, p. 71.

amplipenne Csy. (*Lathrobium*) (Type) ---------- North America
amputans Csy. (*Litolathra*) (Type) ---------- North America
armatum Say (*Lathrobium*) (Csy) ---------- North America
brunnipes Fabr. (*Paederus*) (NM) ---------- Europe, Asia
concolor Lec. (*Lathrobium*) (Csy) ---------- North America
confusum Lec. (*Lathrobium*) (Csy) ---------- North America
convictor Csy. (*Litolathra*) (Type) ---------- North America
crurale Csy. (*Litolathra*) (Type) ---------- North America
dakotanum Csy. (*Lathrobioma*) (Type) ---------- North America
deceptivum Csy. (*Lathrobium*) (Type) ---------- North America
divisum Lec. (*Lathrobium*) (Csy) ---------- North America
elongatum Linn. (*Staphylinus*) (Various) ---------- Europe
franciscanum Csy. (*Lathrobium*) (Type) ---------- North America
fulvipenne Grav. (*Staphylinus*) (Various) ---------- Europe
geminum Kr. (*Lathrobium*) (CC) ---------- Europe
gravidulum Csy. (*Lathrobium*) (Type) ---------- North America
hesperum Csy. (*Lathrobioma*) (Type) ---------- North America
illini Csy. (*Lathrobium*) (Type) ---------- North America
innocens Csy. (*Lathrobium*) (Type) ---------- North America
inops Csy. (*Lathrobium*) (Type) ---------- North America
inornatum Csy. (*Litolathra*) (Type) ---------- North America
longiventre Csy. (*Lathrobium*) (Type) ---------- North America
neglectum Csy. (*Lathrobium*) (Type) ---------- North America
nigrolineum Csy. (*Lathrobioma*) (Type) ---------- North America
nigrolucens Csy. (*Lathrobium*) (Type) ---------- North America
obtusum Csy. (*Lathrobium*) (Type) ---------- North America
oregonum Csy. (*Lathrobioma*) (Type) ---------- North America
othioides Lec. (*Lathrobium*) (Csy) ---------- North America
picescens Csy. (*Lathrobium*) (Type) ---------- North America
postremum Csy. (*Lathrobium*) (Type) ---------- North America
praelongum Csy. (*Lathrobium*) (Type) ---------- North America
procerum Csy. (*Lathrobium*) (Type) ---------- North America
quadratum Payk. (*Staphylinus*) (NM) ---------- Europe, Asia
rhodeanum Csy. (*Litolathra*) (Type) ---------- North America
rigidum Csy. (*Lathrobium*) (Type) ---------- North America
scolopaceum Csy. (*Lathrobioma*) (Type) ---------- North America
simile Lec. (*Lathrobium*) (Csy) ---------- North America
simplex Lec. (*Lathrobium*) (Csy) ---------- North America
sparsellum Csy. (*Lathrobium*) (Type) ---------- North America
spissicorne Csy. (*Lathrobium*) (Type) ---------- North America
subaequale Csy. (*Lathrobium*) (Type) ---------- North America
subgracile Csy. (*Litolathra*) (Type) ---------- North America
suspectum Csy. (*Litolathra*) (Type) ---------- North America
vancouveri Csy. (*Lathrobium*) (Type) ---------- North America
virginicum Csy. (*Lathrobioma*) (Type) ---------- North America
washingtoni Csy. (*Lathrobium*) (Type) ---------- North America

Subg. *Lathrolepta* Csy., 1905, p. 72.
debile Lec. (*Lathrobium*) (Csy) ---------------------- North America
Subg. *Deratopeus* Csy., 1905, p. 73.
nanulum Csy. (*Lathrobioma*) (Type) ------------------ North America
nitidulum Lec. (*Lathrobium*) (Csy) ------------------- North America
parvipenne Csy. (*Deratopeus*) (Type) ----------------- North America
semirubidum Csy. (*Litolathra*) (Type) ---------------- North America
Subg. *Tetartopeus* Czwal., 1888, p. 349.
agitans Csy. (*Tetartopeus*) (Type) -------------------- North America
angulare Lec. (*Lathrobium*) (Csy) --------------------- North America
callidum Csy. (*Tetartopeus*) (Type) ------------------- North America
captiosum Csy. (*Tetartopeus*) (Type) ----------------- North America
finitimum Lec. (*Lathrobium*) (Csy) -------------------- North America
floridanum Csy. (*Tetartopeus*) (Type) ---------------- North America
furvulum Csy. (*Tetartopeus*) (Type) ------------------- North America
hebes Csy. (*Tetartopeus*) (Type) ----------------------- North America
lacustre Csy. (*Tetartopeus*) (Type) -------------------- North America
nigerum Lec. (*Lathrobium*) (Csy) ---------------------- North America
nigrescens Csy. (*Tetartopeus*) (Type) ----------------- North America
punctulatum Lec. (*Lathrobium*) (Csy) ----------------- North America
rubripenne Csy. (*Tetartopeus*) (Type) ----------------- North America
semirubrum Csy. (*Tetartopeus*) (Type) ---------------- North America
stibium Csy. (*Tetartopeus*) (Type) --------------------- North America
terminatum Grav. (*Lathrobium*) (Various) ------------------- Europe
tetricum Csy. (*Tetartopeus*) (Type) -------------------- North America
Subg. *Abletobium* Csy., 1905, p. 70.
pallescens Csy. (*Abletobium*) (Type) ------------------ North America
Subg. *Apteralium* Csy., 1905, p. 70.
brevipenne Lec. (*Lathrobium*) (Csy) ------------------- North America
carolinae Csy. (*Apteralium*) (Type) ------------------- North America
Subg. *Lathrobiopsis* Csy., 1905, p. 72.
texana Csy. (*Lathrobiopsis*) (Type) ------------------- North America
Subg. *Lathrobioma* Csy., 1905, p. 72.
tenue Lec. (*Lathrobium*) (Csy) ------------------------- North America
Lobrathium Muls. & Rey, 1878, p. 29.
Bathrolium Gozis, 1886, p. 14.
Lathrobiella Csy., 1905, p. 75.
Lathrotaxis Csy., 1905, p. 74.
Subg. *Platydomene* Ganglb., 1895, p. 504.
bicolor Er. (*Lathrobium*) (CC) ------------------------------ Europe
Subg. *Eulathrobium* Csy., 1905, p. 73.
Lathrotropis Csy., 1905, p. 74.
caseyi Blaisd. (*Lathrotropis*) (*Lathrobium*) (PT) --------- North America
gnomum Csy. (*Lathrotropis*) (*Lathrobium*) (Type) ------- North America
grande Lec. (*Lathrobium*) (Csy) ------------------------ North America
jacobinum Lec. (*Lathrobium*) (Csy) -------------------- North America
puncticeps Lec. (*Lathrobium*) (Csy) -------------------- North America
relictum Csy. (*Lathrotropis*) (*Lathrobium*) (Type) ------- North America
subseriatum Lec. (*Lathrobium*) (Csy) ----------------- North America
ustulatum Csy. (*Lathrotropis*) (*Lathrobium*) (Type) ------ North America
vafrum Csy. (*Lathrotropis*) (*Lathrobium*) (Type) -------- North America
validiceps Csy. (*Lathrotropis*) (*Lathrobium*) (Type) ------ North America

Subg. *Pseudolathra* Csy., 1905, p. 74.

Linolathra Csy., 1905, p. 75.

Microlathra Csy., 1905, p. 75.

Paralathra Csy., 1905, p. 75.

aemulum Csy. (Lathrobiella) (Lathrobium) (Type)-----North America
ambiguum Lec. (*Lathrobium*) (Csy)-------------------North America
anale Lec. (*Lathrobium*) (Csy)-----------------------North America
angustulum Csy. (*Lathrobiella*) (*Lathrobium*) (Type)-----North America
angustum Csy. (*Lathrotaxis*) (*Lathrobium*) (Type)-------North America
atriventre Csy. (*Lathrobiella*) (*Lathrobium*) (Type)-------North America
bardum Csy. (*Lathrobiella*) (*Lathrobium*) (Type)--------North America
caffrum Boh. (*Lathrobium*) (NM)---------------------Africa, Orient
cupidum Csy. (*Lathrobiella*) (*Lathrobium*) (Type)------North America
depressulum Csy. (*Lathrobiella*) (*Lathrobium*) (Type)----North America
dimidiatum Say (*Lathrobium*) (Csy)-------------------North America
famelicum Csy. (*Lathrobiella*) (*Lathrobium*) (Type)------North America
filicorne Csy. (*Paralathra*) (*Lathrobium*) (Type)---------North America
filitarse Csy. (*Pseudolathra*) (*Lathrobium*) (Type)-------North America
fragile Csy. (*Lathrobiella*) (*Lathrobium*) (Type)---------North America
gaudens Csy. (*Pseudolathra*) (*Lathrobium*) (Type)-------North America
gracilicorne Csy. (*Lathrobiella*) (*Lathrobium*) (Type)-----North America
habile Csy. (*Lathrobiella*) (*Lathrobium*) (Type)----------North America
integrum Csy. (*Lathrobiella*) (*Lathrobium*) (Type)-------North America
leviceps Csy. (*Pseudolathra*) (*Lathrobium*) (Type)-------North America
lineiforme Csy. (*Microlathra*) (*Lathrobium*) (Type)------North America
lituarium Lec. (*Lathrobium*) (Csy)-------------------North America
margipallens DuVal (*Lathrobium*) (REB)----------------West Indies
merens Csy. (*Lathrobiella*) (*Lathrobium*) (Type)---------North America
modestum Csy. (*Lathrobiella*) (*Lathrobium*) (Type)------North America
nigricans Csy. (*Lathrobiella*) (*Lathrobium*) (Type)------North America
nitidum Er. (*Lathrobium*) (REB)---------------------South America
oregonense Csy. (*Lathrobiella*) (*Lathrobium*) (Type)------North America
pallidulum Lec. (*Lathrobium*) (Csy)------------------North America
robustulum Csy. (*Lathrobiella*) (*Lathrobium*) (Type)-----North America
rubidum Fvl. (*Lithocharis*) (*Lathrobium*) (REB)----------West Indies
rubidum Csy. (*Lathrobiella*) (*Lathrobium*) (Type)-------North America
rutilans Csy. (*Microlathra*) (*Lathrobium*) (Type)--------North America
tricolor Csy. (*Lathrobium*) (Type)--------------------North America
unicolor Kr. (*Lathrobium*) (NM)--------------------------------India
vagans Csy. (*Lathrobiella*) (*Lathrobium*) (Type)---------North America
ventrale Lec. (*Lathrobium*) (Csy)---------------------North America

Subg. *Lobrathium* s. str.

acomanum Csy. (*Lathrotaxis*) (*Lathrobium*) (Type)------North America
atronitens Csy. (*Lathrotaxis*) (*Lathrobium*) (Type)-------North America
bipartitum Csy. (*Lobrathium*) (*Lathrobium*) (Type)------North America
californicum Lec. (*Lathrobium*) (Csy)-----------------North America
canorum Csy. (*Lathrotaxis*) (*Lathrobium*) (Type)--------North America
centurio Csy. (*Lathrotaxis*) (*Lathrobium*) (Type)--------North America
collare Er. (*Lathrobium*) (Csy)----------------------North America
coloradense Csy. (*Lobrathium*) (*Lathrobium*) (Type)-----North America
expressum Csy. (*Lathrotaxis*) (*Lathrobium*) (Type)------North America
fallaciosum Csy. (*Lathrotaxis*) (*Lathrobium*) (Type)-----North America
fallax Csy. (*Lathrobiella*) (*Lathrobium*) (Type)----------North America

floridae Csy. (*Lathrotaxis*) (*Lathrobium*) (Type)---------North America
galvestonicum Csy. (*Lathrotaxis*) (*Lathrobium*) (Type)----North America
longiusculum Grav. (*Lathrobium*) (Csy))---------------North America
montanicum Csy. (*Lobrathium*) (*Lathrobium*) (Type)----North America
multipunctum Grav. (*Lathrobium*) (Cam)---------------------Europe
nigerrimum Cam. (*Lathrobium*) (Cam)-------------------------India
picipes Er. (*Lathrobium*) (CC)------------------------------Europe
politum Grav. (*Lathrobium*) (Csy)--------------------North America
praeceps Csy. (*Lathrotaxis*) (*Lathrobium*) (Type)--------North America
rubricolle Csy. (*Lathrotaxis*) (*Lathrobium*) (Type)-------North America
semicoeruleum Cam. (*Lathrobium*) (Cam)----------------------India
soror Csy. (*Lathrotaxis*) (*Lathrobium*) (Type)----------North America
tacomae Csy. (*Lobrathium*) (*Lathrobium*) (Type)--------North America
triste Cam. (*Lathrobium*) (Cam.)----------------------------India

Acalophaena Shp., 1886, p. 554.
Calophaena Lynch, 1884, p. 267.
compacta Csy. (*Acalophaena*) (Type)-----------------North America
horridula Csy. (*Acalophaena*) (Type)-------------------------Mexico
picta Shp. (*Lithocharis*) (Bruch)--------------------South America

Dacnochilus Lec., 1863, p. 47.
angularis Er. (*Lithocharis*) (*Acalophaena*) (NM)------Tropical America
laetus Lec. (*Dacnochilus*) (Csy)---------------------North America
sp. (NM)---North America

Glyptomerus Müller, 1856, p. 308.
Typhlobium Kr., 1856, p. 625.
cavicolus Müller (*Glyptomerus*) (Reitt)----------------------Europe

Achenium Curt., 1826, t. 115.
depressum Grav. (*Lathrobium*) (Various)--------------------Europe
ephippium Er. (*Achenium*) (Cam)----------------------------Europe
humile Nicolai (*Lathrobium*) (NM)----------------------------Europe
reitteri Ganglb. (*Achenium*) (Reitt)--------------------------Europe
striatum Latr. (*Lathrobium*) (Cam)-----------Europe, northern Africa

Scimbalium Er., 1840, p. 579.
Scymbalium Lac., 1854, p. 92.
Lathrobiomorphus Gemm. & Har., 1868, p. 612.
Lathrobomorphus Mots., 1858, p. 645.
Micrillus Raffr., 1873, p. 362.

Subg. *Scimbalium* s. str.
anale Nord. (*Achenium*) (Various)------------Europe, northern Africa
pallidum Reitt. (Scimbalium) (Reitt)-------------------Asia Minor
planicolle Er. (*Scimbalium*) (NM)-------------------------Europe

Paederus Fabr., 1775, p. 268.
Paederomorphus Gaut., 1862, p. 75.

Subg. *Paederus* s. str.
Leucopaederus Csy., 1905, p. 59.
Paederidus Muls. & Rey, 1878, p. 245.
Paederillus Csy., 1905, p. 59.
apicalis Shp. (*Paederus*) (BCA)------------------Central America
basalis Bnhr. (*Paederus*) (Cam)----------------------------India
birmanus Fvl. (*Paederus*) (Cam)----------------------------Birma
brasiliensis Er. (*Paederus*) (Bruch)------------------South America
canonicus Csy. (*Paederillus*) (*Paederus*) (Type)--------North America
carolinae Csy. (*Paederillus*) (*Paederus*) (Type)---------North America

colombinus Lap. (*Paederus*) (NM) — South America
compotens Lec. (*Paederus*) (*Paederillus*) (NM) — North America
cruenticollis Germ. (*Paederus*) (Janson) — Australia
cyanocephalus Er. (*Paederus*) (BakC) — Siam
femoralis Lec. (*Paederus*) (Various) — North America
floridanus Aust. (*Paederus*) (*Paederillus*) (Various) — North America
fuscipes Curt. (*Paederus*) (Various) — Eurasia, Africa, Australia
grandis Aust. (*Paederus*) (Csy) — North America
himalayicus Bnhr. (*Paederus*) (Cam) — India
idae Lewis (*Paederus*) (Linell) — Japan
intermedius Boh. (*Paederus*) (Wend) — Philippines
iowensis Csy. (*Paederillus*) (*Paederus*) (Type) — North America
irritans Chpn. (*Paederus*) (Type) — South America
laetus Er. (*Paederus*) (BCA) — Mexico
littorarius Grav. (*Paederus*) (*Paederillus*) (Various) — North America
longipennis Er. (*Paederus*) (NM) — Europe
melanurus Aragona (*Paederus*) (Reitt) — Europe
memnonius Er. (*Paederus*) (Fenyes) — North Africa
mexicanus Er. (*Paederus*) (Linell) — Mexico
mixtus Shp. (*Paederus*) (REB) — Orient
mutans Shp. (*Paederus*) (BM) — South America
nevadensis Aust. (*Paederus*) (*Paederillus*) (Csy) — North America
nigricornis Bnhr. (*Paederus*) (Cam) — India
obliteratus Lec. (*Paederus*) (*Paederillus*) (Various) — North America
peregrinus Er. (*Paederus*) (BakC) — East Indies, India
philippinus Bnhr. (*Paederus*) (Wend) — Philippines
protensus Shp. (*Paederus*) (NM) — South America
pugetensis Csy. (*Paederillus*) (*Paederus*) (Type) — North America
riparius Linn. (*Staphylinus*) (*Paederus*) (Various) — Europe, North America
ruficollis Fabr. (*Paederus*) (*Paederidus*) (Various) — Europe
sabaeus Er. (*Paederus*) (EAC) — Africa
saginatus Csy. (*Paederillus*) (*Paederus*) (Type) — North America
sanguinicollis Steph. (*Paederus*) (*Paederidus*) (CC) — Europe
signaticornis Shp. (*Paederus*) (BCA) — Central America
simsoni Blackb. (*Paederus*) (NM) — Tasmania
sondaicus Fvl. (*Paederus*) (Cam) — East Indies
tamulus Er. (*Paederus*) (Cam, Wend) — India
tempestivus Er. (*Paederus*) (NM) — South America
texanus Csy. (*Paederillus*) (*Paederus*) (Type) — North America
tricolor Er. (*Paederus*) (BM) — West Indies
usticollis Fvl. (*Paederus*) (Cam) — East Africa
ustus Lec. (*Paederus*) (*Leucopaederus*) (NM) — North America
yucateca Shp. (*Paederus*) (Csy, BCA) — Central America

Subg. *Gnathopaederus* Chpn., 1927, p. 75 (not Wendeler).

szechuanus Chpn. (*Gnathopaederus*) (*Paederus*) (Type) — China

Subg. *Neopaederus* Blkwr. (see above, p. 97).

baudii Fairm., (*Paederus*) (NM) — Europe
crassus Boh. (*Paederus*) (NM) — South Africa
laetipes Shp. (*Paederus*) (Linell) — Mexico
lativentris Wend. (*Paederus*) (PT) — Philippines
littoreus Aust. (*Paederus*) (NM, Csy) — North America
morio Mann. (*Paederus*) (REB) — West Indies
palustris Aust. (*Paederus*) (*Paederillus*) (NM) — North America

poweri Shp. (*Paederus*) (Linell) ---------------------------------- Japan
salvini Shp. (*Paederus*) (BCA) ---------------------- Central America
Monocrypta Csy., 1905, p. 27.
apicata Shp. (*Cryptobium*) (Shp) ------------------------------ Japan
Aderobium Csy., 1905, p. 23.
angustifrons Shp. (*Cryptobium*) (Shp) ------------------ South America
Lissobiops Csy., 1905, p. 25.
serpentinus Lec. (*Cryptobium*) (Csy) ------------------ North America
Homoeotarsus Hochh., 1851, p. 34.
Spirosoma Mots., 1858, p. 206.
Subg. *Homoeotarsus* s. str.
chaudoiri Hochh. (*Homoeotarsus*) (*Cryptobium*) (Reitt) ------- Europe
Subg. *Eucryptina* Csy., 1905, p. 24.
opacus Shp. (*Cryptobium*) (*Eucryptina*) (Shp) -------- South America
Subg. *Gastrolobium* Csy., 1905, p. 23.
albipes Er. (*Cryptobium*) (REB) ------------------------- West Indies
apicipennis Shp. (*Cryptobium*) (BCA) --------------- Central America
argentinus Lynch (*Cryptobium*) (Bruch) ---------------- South America
arizonensis Horn (*Cryptobium*) (*Gastrolobium*) (Csy) ---- North America
atriceps Csy. (*Gastrolobium*) (*Cryptobium*) (Type) ------- North America
badius Grav. (*Lathrobium*) (*Gastrolobium, Cryptobium*) (Csy) -- North America
bicolor Grav. (*Lathrobium*) (*Cryptobium, Gastrolobium*) (Csy) -- North America
carolinus Er. (*Cryptobium*) (*Gastrolobium*) (Csy) -------- North America
collaris Shp. (*Cryptobium*) (PT) -------------------- Central America
coloradensis Csy. (*Gastrolobium*) (*Cryptobium*) (Type) --- North America
convergens Csy. (*Cryptobium*) (*Gastrolobium*) (Type) ----- North America
despectus Lec. (*Cryptobium*) (*Gastrolobium*) (Csy) ------- North America
floridanus Lec. (*Cryptobium*) (*Gastrolobium*) (Csy) ------ North America
illinianis Csy. (*Gastrolobium*) (*Cryptobium*) (Type) ------ North America
lecontei Horn (*Cryptobium*) (*Gastrolobium*) (Csy) -------- North America
lugubris Lec. (*Cryptobium*) (*Gastrolobium*) (Csy) -------- North America
melanocephalus Er. (*Cryptobium*) (*Gastrolobium*) (Csy) -- North America
nigriventris Shp. (*Cryptobium*) (BCA) --------------- Central America
obliquus Lec. (*Cryptobium*) (*Gastrolobium*) -------------- North America
parallelus Csy. (*Cryptobium*) (*Gastrolobium*) (Type) ----- North America
peninsularis Csy. (*Gastrolobium*) (*Cryptobium*) (Type) -- North America
pimerianus Lec. (*Cryptobium*) (*Gastrolobium*) (Csy) ----- North America
proximus Csy. (*Cryptobium*) (*Gastrolobium*) (Type) ----- North America
spissiceps Csy. (*Gastrolobium*) (*Cryptobium*) (Type) ----- North America
strenuus Csy. (*Gastrolobium*) (*Cryptobium*) (Type) ------ North America
subatrus Csy. (*Gastrolobium*) (*Cryptobium*) (Type) ------ North America
suturalis Csy. (*Gastrolobium*) (*Cryptobium*) (Type) ------ North America
texanus Lec. (*Cryptobium*) (*Gastrolobium*) (Csy) -------- North America
vagus Horn (*Cryptobium*) (*Gastrolobium*) (Csy) ---------- North America
ventralis Horn (*Cryptobium*) (*Gastrolobium*) (Csy) ------- North America
virginicus Csy. (*Gastrolobium*) (*Cryptobium*) (Type) ----- North America
Subg. *Hesperobium* Csy., 1905, p. 33.
atronitens Csy. (*Hesperobium*) (*Cryptobium*) (Type) ----- North America
bernhaueri Cam. (*Cryptobium*) (Cam) ------------------------ India
californicus Lec. (*Cryptobium*) (*Hesperobium*) (Csy) ----- North America
capito Csy. (*Cryptobium*) (*Hesperobium*) (Type) -------- North America
ceylanensis Kr. (*Cryptobium*) (Cam) ------------------------ Ceylon

cinctus Say (*Lathrobium*) (*Hesperobium*, *Cryptobium*) (Csy) ---- North America
clavicornis Csy. (*Hesperobium*) (*Cryptobium*) (Type) ---- North America
cribratus Lec. (*Cryptobium*) (*Hesperobium*) (Csy) ---- North America
flavicornis Lec. (*Cryptobium*) (*Hesperobium*) (Csy) ---- North America
humeralis Cam. (*Cryptobium*) (*Cam*) ---- India
indicus Kr. (*Cryptobium*) (Cam) ---- Ceylon, India
japonicus Shp. (*Cryptobium*) (Bnhr) ---- Japan
kumaonensis Champ. (*Cryptobium*) (Cam) ---- India
marginatus Mots. (*Cryptobium*) (Cam) ---- India
pacificus Csy. (*Hesperobium*) (*Cryptobium*) (Type) ---- North America
pallipes Grav. (*Lathrobium*) (*Hesperobium*, *Cryptobium*) (Csy) North America
parviceps Csy. (*Hesperobium*) (*Cryptobium*) (Type) ---- North America
rosti Schub. (*Cryptobium*) (Cam) ---- India
rubripennis Csy. (*Hesperobium*) (*Cryptobium*) (Type) ---- North America
sellatus Lec. (*Cryptobium*) (*Hesperobium*) (Csy) ---- North America
tumidus Lec. (*Cryptobium*) (*Hesperobium*) (Csy) ---- North America
vancouveri Csy. (*Hesperobium*) (*Cryptobium*) (Type) ---- North America

Subg. *Nemoeotus* Blkwr. (see above, p. 96).

philippinus Bnhr. (*Cryptobium*) (Bnhr) ---- Philippines
rubiginosus Bnhr. (*Cryptobium*) (Bnhr) ---- Philippines

Subg. *Homoeobium* Blkwr. (see above, p. 96).

bakerianus Blkwr. (*Homoeotarsus*) (Type) ---- Philippines

Cryptobium Mann., 1830, p. 38.

Subg. *Ababactus* Shp., 1885, p. 533.

pallidiceps Csy. (*Ababactus*) (Type) ---- North America

Subg. *Cryptobiella* Csy., 1905, p. 26.

colonicum Csy. (*Cryptobiella*) (Type) ---- Central America

Subg. *Cryptobium* s. str.

fracticorne Payk. (*Paederus*) (Various) ---- Europe, Northern Africa

Subg. *Neobactus* Blkwr. (see above, p. 96).

nunenmacheri Blkwr. (*Cryptobium*) (Type) ---- North America

Pycnocrypta Csy., 1905, p. 25.

maxillosa Guer. (*Cryptobium*) (CC) ---- South America

Biocrypta Csy., 1905, p. 26.

fulvipes Er. (*Cryptobium*) (REB) ---- West Indies
hastiventre Bnhr. (*Cryptobium*) (Bruch) ---- South America
magnolia Blatch. (*Biocrypta*) (Cotype) ---- North America
prospiciens Lec. (*Cryptobium*) (Csy) ---- North America

Ophites Er., 1840, p. 627.

versatilis Er. (*Ophites*) (NM) ---- South America

Scopaeodes Shp., 1876, p. 208.

gracilis Shp. (*Scopaeodes*) (Shp) ---- North America

Scotonomus Fvl., 1872, p. 327.

raymondi Fvl. (*Scotonomus*) (CC) ---- Europe

Leptobium Csy., 1905, p. 57.

biguttulum Bois. & Lac. (*Lathrobium*) (*Dolicaon*) (CC, NM) Europe, Northern Africa
illyricum Er. (*Dolicaon*) (NM) ---- Europe
indicum Kr. (*Dolicaon*) (NM) ---- Asia, India, Africa
melanocephalum Reiche (*Lathrobium*), (*Dolicaon*) (NM) ---- Europe

Dolicaon Lap., 1835, p. 119.

lathrobioides Lap. (*Dolicaon*) (CC) ---- South Africa

Stilicopsis Sachse, 1852, p. 144.
auripilis Cam. (*Stilicopsis*) (Cam) ---------- West Indies
circumflexa Cam. (*Stilicopsis*) (Cam) ---------- West Indies
paradoxa Sachse (*Stilicopsis*) (Csy) ---------- North America
subtropica Csy (*Stilicopsis*) (*Type*) ---------- North America
thoracica Cam. (*Stilicopsis*) (REB) ---------- West Indies
Dibelonetes Sahlb., 1847, p. 791.
sp. (CC) ---------- Central America
Stiliphacis Brg., 1938, p. 143.
occipitalis Brg. (Brg) ---------- West Indies
Stamnoderus Shp., 1886, p. 607.
apicalis Cam. (*Stamnoderus*) (REB) ---------- West Indies
bernhaueri Cam. (*Stamnoderus*) (REB) ---------- West Indies
carolinae Csy. (*Stamnoderus*) (Type) ---------- North America
cubensis Bierig MS. (Brg) ---------- West Indies
delauneyi Fleut. & Salle (*Stamnoderus*) (REB) ---------- West Indies
dissimilis Cam. (*Stamnoderus*) (REB) ---------- West Indies
labeo Er. (*Sunius*) (REB) ---------- West Indies
monstrosus Lec. (*Sunius*) (Csy) ---------- North America
oligothorax Bierig MS. (Brg) ---------- West Indies
pallidus Csy. (*Stamnoderus*) (Type) ---------- North America
varians Cam. (*Stamnoderus*) (Cam) ---------- West Indies
Suniocharis Shp., 1886, p. 586.
sp. (REB) ---------- West Indies
Sclerochiton Kr., 1859, p. 133.
Saurellus Mots., 1859, p. 71.
indicus Mots. (*Echiaster*) (*Saurellus*) (Bnhr) ---------- India
Astenus Steph., 1832, p. 275.
Astenognathus Reitt., 1909, p. 150.
Sunius Er., 1839, p. 523 (not Stephens).
Subg. *Astenus* s. str.
americanus Csy. (*Sunius*) (Type) ---------- North America
andrewesi Cam. (*Astenus*) (Cam) ---------- India
angustatus Payk. (*Staphylinus*) (*Sunius*) (Roelofs)
Europe, northern Africa
arizonianus Csy. (*Sunius*) (Type) ---------- North America
bimaculatus Er. (*Sunius*) (*Astenognathus*) (Dodero) ---------- Europe
binotatus Say (*Paederus*) (Csy) ---------- North America
brevipennis Aust. (*Sunius*) (Csy) ---------- North America
californicus Aust. (*Sunius*) (Csy) ---------- North America
castaneus Cam. (*Astenus*) (Cam) ---------- Singapore
cinctus Say (*Paederus*) (Csy) ---------- North America
discopunctatus Say (*Paederus*) (Csy) ---------- North America
filiformis Latr. (*Paederus*) (*Astenognathus*) (CC)
Europe, northern Africa
filus Aube (*Sunius*) (Reitt) ---------- Europe, northern Africa
fusciceps Csy. (*Sunius*) (Type) ---------- North America
hindostanus Cam. (*Astenus*) (Cam) ---------- India
inconstans Csy. (*Sunius*) (Type) ---------- North America
linearis Er. (*Sunius*) (Csy) ---------- North America
longiusculus Mann. (*Paederus*) (Csy) ---------- North America
luzonicus Bnhr. (*Astenus*) (BakC) ---------- Philippines
maculipennis Kr. (*Sunius*) (BakC) ---------- Ceylon

melanurus Küst. (*Sunius*) (*Astenognathus*) (Cam) Europe, northern Africa
modestus Bnhr. (*Astenus*) (BakC) ---------- Philippines
neglectus Maerk. (*Sunius*) (CC) ---------- Europe
ornatellus Csy. (*Sunius*) (Type) ---------- North America
prolixus Er. (*Sunius*) (Csy) ---------- North America
pulchellus Heer (*Sunius*) (*Astenognathus*) (Reitt) ---------- Europe, Asia
pulchripennis Cam. (*Astenus*) (Cam) ---------- India
robustulus Csy. (*Sunius*) (Type) ---------- North America
sectator Csy. (*Sunius*) (Type) ---------- North America
signatus Sahlb. (*Sunius*) (Bruch) ---------- South America
similis Aust. (*Sunius*) (Csy) ---------- North America
simulans Csy. (*Sunius*) (Type) ---------- North America
specter Csy. (*Sunius*) (Type) ---------- North America
strigilis Csy. (*Sunius*) (Type) ---------- North America
sumatrensis Cam. (*Astenus*) (Cam) ---------- Sumatra
tenuiventris Csy. (*Sunius*) (Type) ---------- North America
zuni Csy. (*Sunius*) (Type) ---------- North America

Echiaster Er., 1840, p. 636.

Subg. *Echiaster* s. str.

buphthalmus Cam. (*Echiaster*) (Cam) ---------- West Indies
curtus Shp. (*Echiaster*) (EAC) ---------- Central America
depressus Sol. (*Rugilus*) (NM) ---------- South America
ludovicianus Csy. (*Echiaster*) (Type) ---------- North America
pulcher Bnhr. (*Echiaster*) (Bruch) ---------- South America
solitarius Shp. (*Echiaster*) (EAC) ---------- Tropical America
waterhousei Cam. (*Echiaster*) (PT) ---------- West Indies

Subg. *Leptogenius* Csy., 1886, p. 214.

brevicornis Csy. (*Leptogenius*) (Type) ---------- North America

Subg. *Sunesta* Blkwr. (see above, p. 101).

breviceps Fvl. (*Stilicopsis*) (Cam) ---------- East Indies
dorsolineata Cam. (*Stilicopsis*) (Cam) ---------- India
obliqua Cam. (*Stilicopsis*) (Cam) ---------- Singapore, Sumatra
setigera Shp. (*Acanthoglossa*) (*Stilicopsis*) (Bnhr) ---------- Japan
umbilicata Fvl. (*Stilicopsis*) (Bnhr) ---------- Birma

Nazeris Fvl., 1872, p. 298.

Mesunius Shp., 1874, p. 68.

pallidipes Reitt. (*Nazeris*) (CC) ---------- Caucasus

Sphaeronum Shp., 1876, p. 225.

Sphaerinum Shp., 1876, p. 36 (misspelling).
Sphaerinium Csy., 1905, p. 55 (misspelling).
Sphaeronium Csy., 1905, p. 55 (misspelling).

pallidum Shp. (*Sphaeronum*) (Shp) ---------- South America

Cephalochetus Kr., 1859, p. 122.

Cephalochaetus Gemm. & Har., 1868, p. 616.
Calliderma Mots., 1858, p. 653.

philippinus Bnhr. (*Cephalochaetus*) (Bnhr) ---------- Philippines
rufus Cam. (*Calliderma*) (Cam) ---------- Singapore

GENOTYPES OF THE PAEDERINI

Ababactus Shp., *A. depressus* Shp. (designated here).
Abletobium Csy., *A. pallescens* Csy. (monobasic).
Acalophaena Shp., *Calophaena basalis* Lynch=*Acalophaena basalis* (Lynch) (isogenotypic with *Calophaena* Lynch, under International Rules, Article 30, II, *f*).
Acanthoglossa Kr., *A. hirta* Kr. (designated here).
Achenium Curt., *Lathrobium depressum* Grav.=*Achenium depressum* (Grav.) (monobasic).
Achenomorphus Mots., *A. columbicus* Mots. (monobasic).
Achenopsis Fvl., *A. inaequalis* Fvl. (designated here).
Acrostilicus Hubb., *A. hospes* Hubb. (monobasic).
Adelobium Nord., *A. brachypterum* Nord. (monobasic).
Aderobium Csy., *Cryptobium angustifrons* Shp.=*Aderobium angustifrons* (Shp.) (monobasic and original designation).
Apteralium Csy., *Lathrobium brevipenne* Lec.=*Apteralium brevipenne* (Lec.) (designated here).
Apteronates Brg., *Dibelonetes* (*Apteronates*) *apterus* Bnhr. (monobasic and original designation).
Aderocharis Shp., *Paederus corticinus* Grav.=*Aderocharis corticina* (Grav.) (designated here).
Argoderus Brg., *A. panamensis* Brg. (original designation).
Arthocharis Cam., *Paederus ochraceus* Grav.=*Arthocharis ochracea* (Grav.) (designated here).
Astenobium Bnhr., *Cryptobium* (*Astenobium*) *excellens* Bnhr. (monobasic).
Astenognathus Reitt., *Sunius bimaculatus* Er.=*Astenognathus bimaculatus* (Er.) (designated here).
Astenus Steph., *A. brunneus* Steph. (designated by Gozis, 1886).
Attaxenus Wasm., *A. horridus* Wasm. (monobasic).
Baryopsis Fairm. & Germ., *B. brevipennis* Fairm. & Germ. (monobasic).
Bathrolium Gozis, *Staphylinus punctatus* Fourc.=*Lathrobium punctatum* (Fourc.)=*Bathrolium punctatum* (Fourc.) (implied by Gozis, 1886).
Biocrypta Csy., *Cryptobium prospiciens* Lec.=*Biocrypta prospiciens* (Lec.) (monobasic and original designation).
Bolbophites Fvl., *B. pustulosus* Fvl. (designated here).
Brachynetes Bnhr., *B. apterus* Bnhr. (designated here).
Calliderma Mots., *C. brunnea* Mots. (monobasic).
Caloderma Csy., *C. rugosa* Csy. (designated here).
Calophaena Lynch, *C. basalis* Lynch (monobasic).
Centrocnemis Jos., *Lathrobium* (*Centrocnemis*) *krniense* Jos. (monobasic).
Cephalochetus Kr., *C. indicus* Kr. (designated here).
Cephisus Fvl., *C. orientis* Fvl. (monobasic).
Charichirus Shp., *Lithocharis spectabilis* Kr.=*Charichirus spectabilis* (Kr.) (monobasic).
Cheilaster Bnhr., *C. csikii* Bnhr. (monobasic).
Chloëcharis Lynch, *C. rufula* Lynch (monobasic).
Cryptobiella Csy., *C. colonica* Csy. (original designation). (*Cryptobium erratum* Shp. erroneously designated by Bierig, 1935).
Cryptobium Mann., *Paederus fracticornis* Payk.=*Cryptobium fracticorne* (Payk.) (monobasic).
Cryptoporus Mots., *C. flavipes* Mots. (monobasic).
Dacnochilus Lec., *D. laetus* Lec. (monobasic).
Deratopeus Csy., *D. parvipennis* Csy. (designated here).

Deroderus Shp., *D. vestitus* Shp. (designated here).
Dibelonetes Sahlb., *D. biplagiatus* Sahlb. (monobasic).
Dibelophacis Brg., *D. horni* Brg. (monobasic and original designation).
Dicax Fvl., *Lathrobium longiceps* Fvl.=*Dicax longiceps* (Fvl.) (designated here).
Dolicaon Lap., *D. lathrobioides* Lap. (monobasic).
Domene Fvl., *Lathrobium scabricolle* Er.=*Domene scabricollis* (Er.) (monobasic).
Dorocharis Blkwr., *Aderocharis* (*Dorocharis*) *chapini* Blkwr. (monobasic and original designation).
Dysanabatium Bnhr., *D. jacobsoni* Bnhr. (monobasic).
Echiaster Er., *E. longicollis* Er. (designated here).
Ecitomedon Bnhr., *E. bruchi* Bnhr. (monobasic).
Ecitonides Wasm., *E. tuberculosus* Wasm. (monobasic).
Ennalagium Bnhr., *Domene* (*Ennalagium*) *diabolica* Bnhr. (monobasic).
Eomedon Shp., *E. hirtellus* Shp. (monobasic).
Euastenus Fiori, *E. pallidus* Fiori (monobasic).
Eucryptina Csy., *Cryptobium opacum* Shp. (monobasic and original designation).
Eulathrobium Csy., *Lathrobium grande* Lec.=*Eulathrobium grande* (Lec.) (monobasic).
Euphonus Fvl., *E. pallidus* Fvl. (monobasic).
Eurysunius Reitt., *Sunius paradoxus* Epp.=*Astenus* (*Eurysunius*) *paradoxus* (Epp.) (designated here).
Eusclerus Shp., *E. sordidus* Shp. (designated here).
Euscopaeus Shp., *E. gracilicornis* Shp. (designated here).
Eustilicus Shp., *E. crassidens* Shp. (designated here).
Exomedon Cam., *E. andrewesi* Cam. (monobasic).
Formicocephalus Hell., *F. uranoscopus* Hell. (monobasic).
Gastrolobium Csy., *Lathrobium bicolor* Grav.=*Gastrolobium bicolor* (Grav.) (designated here).
Glyptomerus Müll., *G. cavicola* Müll. (monobasic).
Gnathopaederus Chpn., *G. szechuanus* Chpn. (monobasic and original designation).
Gnathopaederus Wend., *Paederus* (*Gnathopaederus*) *turrialbanus* Wend. (monobasic).
Gnathymenus Sol., *G. apterus* Sol. (monobasic).
Hemimedon Csy., *H. rufipes* Csy. (designated here).
Hesperobium Csy., *Cryptobium tumidum* Lec.=*Hesperobium tumidum* (Lec.) (original designation).
Heteronetes Brg., *Dibelonetes* (*Heteronetes*) *vulcanus* Brg. (original designation).
Heterosoma Bnhr., *H. dohrni* Bnhr. (monobasic).
Homoeobium Blkwr., *Cryptobium* (*Homoeobium*) *bakerianum* Blkwr. (monobasic and original designation).
Homoeotarsus Hochh., *H. chaudoiri* Hochh. (monobasic).
Hyperomma Fvl., *H. lacertinum* Fvl. (monobasic).
Hypomedon Muls. & Rey, *Lithocharis debilicornis* Woll.=*Hypomedon debilicornis* (Woll.) (designated here).
Isocheilus Shp., *Lithocharis staphylinoides* Kr.=*Isocheilus staphylinoides* (Kr.) (monobasic).
Labrocharis Brg., *L. obsoleta* Brg. (monobasic and original designation).
Labroporus Brg., *Labrocharis* (*Labroporus*) *imitatrix* Brg. (original designation).
Lathrobidium Port., *Lathrobium lusitanicum* Er.=*Lathrobidium lusitanicum* (Er.) (monobasic).
Lathrobiella Csy., *Lathrobium collare* Er.=*Lathrobiella collaris* (Er.) (designated here).
Lathrobioma Csy., *Lathrobium tenue* Lec.=*Lathrobioma tenuis* (Lec.) (designated here).

Lathrobiopsis Csy., *L. texana* Csy. (monobasic).
Lathrobium Grav., *Staphylinus elongatus* Linn.=*Lathrobium elongatum* (Linn.) (designated by Latreille, 1810). (In 1886 Gozis erroneously stated that the type is *L. multipunctum* Grav.)
Lathrobomorphus Mots., *L. badius* Mots. (monobasic).
Lathrolepta Csy., *Lathrobium debilis* Lec.=*Lathrolepta debilis* (Lec.) (monobasic).
Lathrotaxis Csy., *Lathrobium longiuscula* Grav.=*Lathrotaxis longiuscula* (Grav.) (designated here).
Lathrotropis Csy., *Lathrobium jacobinum* Lec.=*Lathrotropis jacobina* (Lec.) (designated here).
Latona Guer., *L. spinolae* Guer. (designated here).
Leiporaphes Bnhr., *Medon* (*Leiporaphes*) *attarum* Bnhr. (monobasic).
Lena Csy., *L. testacea* Csy. (monobasic).
Leptobium Csy., *Lathrobium biguttulum* Boisd. & Lac.=*Leptobium biguttulum* (Boisd. & Lac.) (monobasic).
Leptogenius Csy., *L. brevicornis* Csy. (monobasic).
Leptorus Csy., *Scopaeus exiguus* Er.=*Leptorus exiguus* (Er.) (designated here).
Leucopaederus Csy., *Paederus ustus* Lec.=*Leucopaederus ustus* (Lec.) (monobasic).
Leucorus Csy., *L. rubens* Csy. (designated here).
Lindus Shp., *L. religans* Shp. (monobasic).
Linolathra Csy., *L. filitarsis* Csy. (designated here).
Lissobiops Csy., *Cryptobium serpentinum* Lec.=*Lissobiops serpentina* (Lec.) (monobasic).
Lithocaon Shp., *L. sparsus* Shp. (monobasic).
Lithocharis Er., *Paederus ochraceus* Grav.=*Lithocharis ochracea* (Grav.) (designated here).
Litolathra Csy., *L. suspecta* Csy. (designated here).
Lobochilus Bnhr., *L. javanus* Bnhr. (monobasic).
Lobrathium Muls. & Rey, *Lathrobium multipunctum* Grav.=*Lathrobium* (*Lobrathium*) *multipunctum* (Grav.) (designated here).
Lypeticus Shp., *L. munda* Shp. (original designation).
Macrodicax Lea, *M. potens* Lea (monobasic).
Mecognathus Woll., *M. chimaera* Woll. (monobasic).
Medome Cam., *M. bicolor* Cam. (monobasic).
Medon Steph., *M. ruddii* Steph. (monobasic).
Medonella Csy., *M. minuta* Csy. (monobasic and original designation).
Medonodonta Csy., *M. alutacea* Csy. (monobasic).
Megastilicus Csy., *M. formicarius* Csy. (monobasic).
Melanates Brg., *Dibelonetes* (*Melanates*) *melzeri* Brg. (original designation).
Mespalerus Shp., *M. praeustus* Shp. (designated here).
Mesunius Shp., *M. wollastoni* Shp. (monobasic).
Metaxyodonta Csy., *M. testacea* Csy. (monobasic).
Micranops Cam., *M. brunneus* Cam. (monobasic).
Micrillus Raff., *M. subterraneus* Raff. (monobasic).
Microlathra Csy., *Lathrobium pallidula* Lec. = *Microlathra pallidula* (Lec.) (designated here).
Micromedon Csy., *Medon seminigrum* Fairm. = *Micromedon seminigrum* (Fairm.) (monobasic).
Mimophites Fvl., *M. bouvieri* Fvl. (designated here).
Monista Shp., *M. typica* Shp. (original designation, under Rules, Article 30, I, b).
Monocharis Shp., *M. vestita* Shp. (monobasic).
Monocrypta Csy., *Cryptobium apicatum* Shp. = *Monocrypta apicata* (Shp.) (designated here).

Myrmecomedon Bnhr., *M. bruchi* Bnhr. (monobasic).
Myrmecosaurus Wasm., *M. solenopsidis* Wasm. (designated here).
Myrmecoscopaeus Brethes, *M. gallardoi* Brethes (monobasic).
Nazeris Fvl., *Sunius pulcher* Aube = *Nazeris pulcher* (Aube) (monobasic).
Nemoeotus Blkwr., *Cryptobium rubiginosum* Bnhr. = *Cryptobium* (*Nemoeotus*) *rubiginosum* Bnhr. (original designation).
Neobactus Blkwr., *Cryptobium* (*Neobactus*) *nunenmacheri* Blkwr. (monobasic and original designation).
Neodomene Blkwr., *Domene indicum* Cam. = *Domene* (*Neodomene*) *indica* Cam. (monobasic and original designation).
Neognathus Shp., *N. angulatus* Shp. (monobasic).
Neolindus Scheerp., *Lindus religans* Shp. = *Neolindus religans* (Shp.) (isogenotypic with *Lindus* Shp., under Rules, Article 30, II, f).
Neomedon Shp., *N. princeps* Shp. (designated here).
Neopaederus Blkwr., *Paederus morio* Mann. = *Paederus* (*Neopaederus*) *morio* Mann. (original designation).
Neosclerus Cam., *N. fortepunctatus* Cam. (designated here).
Nesomedon Shp., *N. brunnescens* Shp. (original designation).
Notobium Sols., *N. australicum* Sols. (monobasic).
Noumea Fvl., *N. serpens* Fvl. (monobasic).
Oligopterus Csy., *O. cuneicollis* Csy. (monobasic).
Omostilicus Csy., *O. sonorinus* Csy. (monobasic).
Ophiomedon Shp., *O. stipes* Shp. (designated here).
Ophites Er., *O. versatilis* Er. (designated here).
Ophryomedon Wasm., *O. crenatum* Wasm. (monobasic).
Orus Csy., *O. punctatus* Csy. (designated here).
Oxymedon Csy., *O. rubrum* Csy. (monobasic).
Pachymedon Cam., *Medon granulicollis* Bnhr. = *Pachymedon granulicollis* (Bnhr.) (designated here).
Pachystilicus Csy., *Stilicus hanhami* Wickh. = *Pachystilicus hanhami* (Wickh.) (designated here).
Paederidus Muls. & Rey, *Paederus ruficollis* Fabr. = *Paederus* (*Paederidus*) *ruficollis* (Fabr.) (designated here).
Paederillus Csy., *Paederus littorarius* Grav. = *Paederillus littorarius* (Grav.) (designated here).
Paederognathus Wend., *Paederus* (*Gnathopaederus*) *turrialbanus* Wend. = *Paederus* (*Paederognathus*) *turrialbanus* Wend. (new name; Article 30, II, f).
Paederomorphus Gaut., *P. pedoncularius* Gaut. (designated here).
Paederus Fabr., *Staphylinus riparius* Linn. = *Paederus riparius* (Linn.) (designated by Latreille, 1810).
Panscopaeus Shp., *P. lithocharoides* Shp. (monobasic).
Paralathra Csy., *P. filicornis* Csy. (monobasic).
Paramedon Csy., *P. arizonicum* Csy. (designated here).
Parascopaeus Cam., *P. nitidus* Cam. (monobasic).
Perierpon Bnhr., *P. hewitti* Bnhr. (designated here).
Phanophilus Shp., *Lithocharis comptus* Broun = *Phanophilus comptus* (Broun) (monobasic).
Pinobius MacLeay, *P. mastersii* MacLeay (monobasic).
Platybrathium Brg., *P. panamense* Brg. (monobasic and original designation).
Platydomene Ganglb., *Lathrobium bicolor* Er. = *Platydomene bicolor* (Er.) (designated here).
Platygonium Mots., *P. sculticeps* Mots. (monobasic).
Platymedon Csy., *P. laticolle* Csy. (monobasic).
Polyasterellus Bnhr., *Echiaster* (*Polyasterellus*) *bruchi* Bnhr. (monobasic).

Polymedon Csy., *Lithocharis tabacina* Csy. = *Polymedon tabacinum* (Csy.) (monobasic).
Polyodontus Sol., *P. angustatus* Sol. (monobasic).
Pseudobium Muls. & Rey, *Lathrobium labile* Er. = *Pseudobium labile* (Er.) (monobasic).
Pseudocryptobium Bnhr., *Latona bruchi* Bnhr. = *Pseudocryptobium bruchi* (Bnhr.) (New name; Article 30, II, f).
Pseudolathra Csy., *Lathrobium anale* Lec. = *Pseudolathra analis* (Lec.) (designated here).
Pseudomedon Muls. & Rey, *Lathrobium obsoletum* Nord. = *Pseudomedon obsoletum* (Nord.) (designated here).
Pseudopaederus Bnhr., *Paederus* (*Pseudopaederus*) *nigerrimus* Bnhr. (designated here).
Pseudorus Csy., *P. prolixipennis* Csy. (designated here).
Psilotrachelus Kr., *P. crassus* Kr. (designated here).
Pycnocrypta Csy., *Cryptobium maxillosum* Guer. = *Pycnocrypta maxillosa* (Guer.) (monobasic and original designation).
Pycnorus Csy., *Scopaeus dentiger* Lec. = *Pycnorus dentiger* (Lec.) (designated here).
Ramona Csy., *R. capitulum* Csy. (monobasic).
Rugilus Curt., *Paederus orbiculatus* Fabr. = *Rugilus orbiculatus* (Fabr.) (designated here).
Santiagonus Bruch, *S. gomezi* Bruch (monobasic).
Saurellus Mots., *S. indicus* Mots. (monobasic).
Schatzmayria Grid., *S. meridionalis* Grid. (designated here).
Scimbalium Er., *Achenium anale* Nord. = *Scimbalium anale* (Nord.) (designated here).
Sciocharella Csy., *S. delicatula* Csy. (monobasic).
Sciocharis Lynch, *S. castanoptera* Lynch (designated here).
Scioporus Shp., *S. brunneus* Shp. (original designation).
Sclerochiton Kr., *S. ochraceus* Kr. (monobasic).
Scopaeodera Csy., *Echiaster nitidus* Lec. = *Scopaeodera nitida* (Lec.) (designated here).
Scopaeodes Shp., *S. gracilis* Shp. (designated by Casey, 1905).
Scopaeoma Csy., *Scopaeus rotundiceps* Csy. = *Scopaeoma rotundiceps* (Csy.) (designated here).
Scopaeomerus Shp., *S. palmatus* Shp. (designated here).
Scopaeopsis Csy., *Echiaster opaca* Lec. = *Scopaeopsis opaca* (Lec.) (designated here).
Scopaeus Er., *S. didymus* Er. (designated here).
Scopobium Blkwr., *Ophiomedon anthracinum* Cam. = *Scopobium anthracinum* (Cam.) (original designation).
Scoponeus Mots., *S. testaceus* Mots. (designated here).
Scotonomus Fvl., *S. raymondi* Fvl. (monobasic).
Scymbalopsis Reitt., *Scimbalium grandiceps* Reitt. = *Scymbalopsis grandiceps* (Reitt.) (monobasic).
Sphaeronum Shp., *S. pallidum* Shp. (designated here).
Spirosoma Mots., *S. fulvescens* Mots. (monobasic.)
Stamnoderus Shp., *S. godmani* Shp. (designated here).
Stereocephalus Lynch, *S. seriatipennis* Lynch (monobasic).
Stilicoderus Shp., *S. signatus* Shp. (monobasic).
Stilicolina Csy., *Stilicus tristis* Melsh. = *Stilicolina tristis* (Melsh.) (monobasic).
Stilicopsis Sachse, *S. paradoxa* Sachse (monobasic).

Stilicosoma Csy., *Stilicus rufipes* Germ. = *Stilicosoma rufipes* (Germ.) (monobasic).
Stilicus Latr., *Staphylinus orbiculatus* Fabr. = *Stilicus orbiculatus* (Fabr.) (designated here).
Stiliderus Mots., *S. cicatricosus* Mots. (monobasic).
Stiliphacis Brg., *S. occipitalis* Brg. (monobasic and original designation).
Stilocharis Shp., *S. longula* Shp. (monobasic).
Stilomedon Shp., *Lithocharis connexa* Shp. = *Stilomedon connexum* (Shp.) (designated here).
Sunesta Blkwr., *Acanthoglossa setigera* Shp. = *Sunesta setigera* (Shp.) (original designation).
Sunides Mots., *S. boreophiloides* Mots. (monobasic).
Suniocharis Shp., *S. modesta* Shp. (designated here).
Suniogaster Reitt., *Sunius ampliventris* Reitt. = *Suniogaster ampliventris* (Reitt.) (monobasic.)
Suniopsis Fvl., *S. singularis* Fvl. (monobasic).
Suniosaurus Brg., *S. cuadriceps* Brg. (monobasic and original designation).
Suniotrichus Shp., *S. capillaris* Shp. (designated here).
Sunius Er., *Staphylinus angustatus* Fabr. = *Sunius angustatus* (Fabr.) (designated here).
Sunius Steph. *Paederus melanocephalus* Fabr. = *Sunius melanocephalus* (Fabr.) (designated by Gozis, 1886).
Tetartopeus Czwal., *Lathrobium terminatum* Grav. = *Lathrobium* (*Tetartopeus*) *terminatum* (Grav.) (designated here).
Tetramedon Csy., *T. rufipenne* Csy. (monobasic).
Thinocharis Kr., *T. pygmaea* Kr. (designated here).
Throbalium Muls. & Rey, *Lathrobium dividuum* Er. = *Throbalium dividuum* (Er.) (monobasic).
Trachysectus Csy., *Lathrobium confluentum* Say = *Trachysectus confluentus* (Say) (monobasic and original designation).
Tripectenopus Lea, *T. caecus* Lea (monobasic).
Trochocerus Shp., *T. godmani* Shp. (designated here).
Typhlobium Kr., *T. stagnophilum* Kr. (monobasic).
Xenocharis Brg., *X. occipitalis* Brg. (monobasic and original designation).
Xenomedon Fall, *X. formicarius* Fall (monobasic).
Zonaster Shp., *Z. optatus* Shp. (monobasic).

REFERENCES

Bernhauer, Max.

1903. Beitrag zur Staphylinidenfauna von Ostindien und der Sundainseln. Stettiner Ent. Zeit., vol. 64, pp. 21–36.

1911. Zur Staphylinidenfauna von Süd-Amerika. (7. Beitrag.) Deutsche Ent. Zeitschr., 1911, pp. 403–422.

1915. Neue Staphyliniden der indo-malaiischen Fauna, insbesondere der Sunda-Insel Borneo. (9. Beitrag.) Verh. zool.-bot. Ges. Wien, vol. 65, pp. 134–158.

1920. Neue Staphyliniden des indo-malaiischen Gebietes. (16. Beitrag.) Arch. für Naturg., vol. 84 (1918), Abt. A, Heft 10, pp. 177–188.

Boisduval, Jean Baptiste Alphonse, and Lacordaire, Jean Theodore.

1835. Faune entomologique des environs de Paris . . . , vol. 1, 696 pp., 3 pls. Paris.

Cameron, Malcolm.

1913. Descriptions of new species of Staphylinidae from the West Indies. Part I. Ann. Mag. Nat. Hist., ser. 8, vol. 12, pp. 321–351.

1921. New species of Staphylinidae from Singapore. Part IV (Conclusion). Trans. Ent. Soc. London, 1920, pp. 347–412.

1924. New species of Staphylinidae from India. Trans. Ent. Soc. London, 1924, pp. 160–198.

1931. The fauna of British India, including Ceylon and Burma. Coleoptera. Staphylinidae. Vol. 2, 257 pp., 2 pls. London.

Casey, Thomas Lincoln.

1884. Contributions to the descriptive and systematic coleopterology of North America. Part II, pp. 61–198.

1886. Revision of the California species of *Lithocharis* and allied genera. Bull. California Acad. Sci. (No. 5), vol. 2, pp. 1–40.

1889. Notes on the Paederini. Entomologia Americana, vol. 5, pp. 182–184.

1905. A revision of the American Paederini. Trans. Acad. Sci. St. Louis, vol. 15, pp. 17–248.

1910. Synonymic and descriptive notes on the Paederini and Pinophilini. Memoirs on the Coleoptera, vol. 1, pp. 184–201.

Chapin, Edward Albert.

1927. A new genus and species of Staphylinidae from Sze-Chuan, China. Proc. Biol. Soc. Washington, vol. 40, pp. 75–78.

Curtis, John.

1826. British entomology, vol. 3. London.

1827. British entomology, vol. 4. London.

Czwalina, Gustav.

1888. Die Forcipes der Staphyliniden-Gattung Lathrobium (s. str. Rey) Grav. Deutsche Ent. Zeitschr., vol. 32, pp. 337–354.

Erichson, Wilhelm Ferdinand.

1839. Die Käfer der Mark Brandenburg, vol. 1, pt. 2, pp. 385–740. Berlin.

1840. Genera et species staphylinorum insectorum coleopterorum familiae, pt. 2, pp. 401–954, 4 pls. Berlin.

Fabricius, Johann Christian.

1775. Systema entomologiae, 832 pp. Lipsiae.

Fauvel, Albert.

1872. Faune Gallo-Rhénane . . ., vol. 3, 738 pp., 4 pls. Caën.

FIORI, ANDREA.
1915. Appunti sulla fauna coleotterologica dell'Italia meridionale e della Sicilia. Riv. Coleott. Italiana, vol. 13, pp. 5–17.

GANGLBAUER, LUDWIG.
1895. Die Käfer von Mitteleuropa . . ., vol. 2, 880 pp. Wien.

GAUTIER DES COTTES.
1862. Genre nouveau de Staphylinien et description de nouvelles espèces de Coléoptères de Syrie et d'Europe. Ann. Soc. Ent. France, ser. 4, vol. 2, pp. 75–78.

GEMMINGER, MAX, and HAROLD, EDGAR VON.
1868. Catalogus coleopterorum . . ., vol. 2, pp. 425–978. Monachii.

GOZIS, MAURICE DES.
1886. Recherche de l'espèce typique de quelques anciens genres . . ., 36 pp. Montlucon.

GRAVENHORST, JOHANN LUDWIG CHRISTIAN.
1802. Coleoptera Microptera Brunsvicensia . . ., 206 pp. Brunsuigae.

GRIDELLI, EDVARDO.
1914. Ein neues Staphyliniden-Genus der europäischen Fauna. Coleop. Rundschau, vol. 3, pp. 69–71.

HOCHHUTH, JOHANN HEINRICH.
1851. Beitraege zur naeheren Kenntniss der Staphylinen Russlands . . . Bull. Naturf. Ges. Moscou, vol. 24, pp. 1–58.

HUBBARD, HARVEY GUERNSEY.
1896. Additional notes on the insect guests of the Florida land tortoise. Proc. Ent. Soc. Washington, vol. 3, pp. 299–303.

JOSEPH, GUSTAV.
1868. *Lathrobium* (*Centrocnemis*) *krniense* n. sp. Berliner Ent. Zeitschr., vol. 12, pp. 365–366.

KRAATZ, GUSTAV.
1856. Eine neue Gattung aus der Familie der Staphylinen. Verh. zool.-bot. Ges. Wien, vol. 6, pp. 625–626.
1859. Die Staphylinen-Fauna von Ostindien, insbesondere der Insel Ceylan. Arch. für Naturg., vol. 25, Heft 1, pp. 1–193, 3 pls.

LACORDAIRE, JEAN THEODORE.
1854. Histoire naturelle des insectes. Genera des Coleoptères . . ., vol. 2, 548 pp. Paris.

LAPORTE, FRANCIS L. DE (Comte de Castelnau).
1835. Études entomologiques . . . , pt. 1, 159 pp., 4 pls. Paris.

LATREILLE, PIERRE ANDRÉ.
1828. Encyclopédie méthodique . . . , vol. 10, pp. 346–732. Paris.

LECONTE, JOHN LAWRENCE.
1863. New species of North American Coleoptera. Smithsonian Misc. Coll., vol. 6, No. 167, pt. 1, pp. 1–86.

LYNCH-ARRIBALZAGA, ENRIQUE.
1884. Estafilinos de Buenos Aires. Bol. Acad. Nac. Cienc. Cordoba, vol. 7, pp. 6–392.

MACLEAY, WILLIAM.
1873. Notes on a collection of insects from Gayndah. Trans. Ent. Soc. New South Wales, vol. 2, pp. 79–318.

MANNERHEIM, CARL GUSTAV.
1830. Précis d'un nouvel arrangement de la famille des Brachélytres, de l'ordre des insectes Coléoptères. Mem. Acad. Imp. Sci. St. Petersbourg, vol. 1, pp. 1–87.

MOTSCHOULSKY, VICTOR.
1858. Énumération des nouvelles espèces de Coléoptères rapportés de ses voyages. Bul. Soc. Imp. Nat. Moscou, vol. 31, pt. 2, pp. 634–670; pt. 3, pp. 204–264, pl. 1.

MÜLLER, HERMANN.
1856. Beschreibung eines augenlosen Käfers aus der Familie der Staphylinen. Stettiner Ent. Zeit., vol. 17, pp. 308–312.

MULSANT, MARTIAL ETIENNE, and REY, CLAUDIUS.
1878. Histoire naturelle des Coléoptères de France. Brévipennes. Pédériens-Évesthétiens, 338 pp., 6 pls. Paris.

NORDMANN, ADOLF.
1837. Symbolae ad monographiam Staphylinorum, 167 pp., 2 pls. Petropoli. (Also in Mem. Acad. Imp. Sci. St. Petersbourg, Mem. des Sav. Etrang., vol. 4, pp. 1–167, 1845.)

PORTEVIN, GASTON.
1929. Histoire naturelle des coléoptères de France, vol. 1, *in* Encyclopédie entomologique, ser. A, vol. 12, 649 pp., 5 pl. Paris.

RAFFRAY, ACHILLE.
1873. *In* Fairmaire and Raffray, Coléoptères du Nord de l'Afrique. Rev. Mag. Zool., ser. 3, vol. 1, pp. 331–385.

REITTER, EDMUND.
1909. Fauna Germanica . . . , vol. 2, 392 pp., 40 pls. Stuttgart.

SACHSE, PAUL.
1852. Neue Käfer. Stettiner Ent. Zeit., vol. 13, pp. 142–149.

SAHLBERG, REGINALDUS F.
1847. Coleoptera Diebus XV–XXVII Decembris Anni MDCCCXXXIX ad Rio Janeiro lecta. Acta Soc. Scient. Fennicae, vol. 2, pt. 2, pp. 787–805.

SHARP, DAVID.
1874. The Staphylinidae of Japan. Trans. Ent. Soc. London, 1874, pp. 1–103
1876. Contributions to an insect fauna of the Amazon Valley. Coleoptera-Staphylinidae. Trans. Ent. Soc. London, 1876, pp. 27–424.
1885. Biologia Centrali-Americana. Insecta, Coleoptera, vol. 1, pt. 2, pp. 393–536.
1886. *Idem*, pp. 537–672.
1889. The Staphylinidae of Japan. Ann. Mag. Nat. Hist., ser. 6, vol. 3, pp. 249–267.

SOLIER, ANTOINE JOSEPH JEAN.
1849. *In* Gay, Historia fisica y politica de Chile. Zoologia. Tomo Quarto, 510 pp. Paris.

SOLSKY, SIMON MARTIN.
1864. Description de quelques nouvelles espèces de Staphylinides. Bull. Soc. Imp. Nat. Moscou, vol. 37, pt. 2, pp. 433–451.

STEPHENS, JAMES FRANCIS.
1832. Illustrations of British Entomology . . ., Mandibulata, vol. 5, 448 pp., 4 pls. London.

WENDELER, HANS.
1927. Ein neues Subgenus und eine neue Species des Genus *Paederus*. Neue Beitr. syst. Insektenk., vol. 4, pp. 1–2.
1928. Paederognathus nom. nov. Deutsche Ent. Zeitschr., 1928, p. 37.

WOLLASTON, THOMAS VERNON.
1854. Insecta Maderensia . . ., 634 pp., 13 pls. London.

U. S. GOVERNMENT PRINTING OFFICE: 1939

PROCEEDINGS OF THE UNITED STATES NATIONAL MUSEUM

issued by the

SMITHSONIAN INSTITUTION
U. S. NATIONAL MUSEUM

Vol. 87 Washington: 1939 No. 3070

NEW TURRITID MOLLUSKS FROM FLORIDA

By Paul Bartsch and Harald A. Rehder

A recent sending of a lot of turritid mollusks by Dr. Louise M. Perry, of Sanibel Island, Fla., has made it necessary to put on record some new superspecific groups, as well as species, which are here defined.

CERODRILLIA, new genus

Small, elongate-turreted shells having a waxy appearance with the nuclear whorls smooth, passing directly into the postnuclear sculpture without intermediate stages. The whorls are provided with strong axial ribs. The spiral sculpture varies as indicated in the two subgenera described below. Aperture with a short anterior channel; outer lip with a deep sinus immediately below the summit and a stromboid notch near the anterior margin.

Type: *Cerodrillia clappi*, new species.

We are recognizing two subgenera of this genus, which the following key will help to differentiate:

KEY TO THE SUBGENERA OF CERODRILLIA

Shell with spiral sculpture on base and columella________________ **Cerodrillia**
Shell without spiral sculpture on base and columella______________ **Lissodrillia**

Cerodrillia, new subgenus

Small shells of elongate-turreted outline. Nuclear whorls smooth, passing directly into the postnuclear sculpture without intermediate stages. Postnuclear whorls appressed at the summit, marked by prominent, retractively slanting, somewhat sigmoid axial ribs, which extend from the summit to the columella, where they evanesce. The entire surface of the shell is marked by scarcely perceptible incremental lines and equally faint spiral striations; the latter change into feeble threads on the base and columella, being stronger on the latter. Aperture irregularly oval, decidedly channeled anteriorly; outer lip with a deep sinus immediately below the summit, separated from this only by the thickened peristome. Anterior to the sinus the shell is protracted into a clawlike element. There is a feeble stromboid notch at the anterior end of the outer lip; the inner lip is reflected over the columella as a heavy callus, which extends in varying degrees over the parietal wall.

Type: *Cerodrillia* (*Cerodrillia*) *clappi*, new species.

CERODRILLIA (CERODRILLIA) PERRYAE, new species

Plate 17, Figure 1

Shell elongate-turreted, flesh-colored, with a broad golden-brown band, which extends from the middle of the turns to a little beyond the periphery. Nuclear whorls 2, strongly rounded, smooth. Postnuclear whorls moderately rounded, marked by strong, distantly spaced, broad axial ribs, which on the early whorls attain their greatest development at the periphery; in the later whorls the hump is a little anterior to the middle. Of these ribs, nine occur on the first, second, and third, eight on the fourth and fifth, and two on the last quarter of a turn. The spaces separating these ribs are broad and shallow and marked by microscopic incremental lines and equally faint spiral striations. Periphery well rounded, the axial ribs evanescing at the periphery. Base moderately long, marked by feeble spiral threads which increase in length from the periphery anteriorly and develop into five equal and almost equally spaced cords on the columella. Outer lip of the type, which is not quite mature, since it has not yet developed the deep notch, but merely a shallow sinus anterior to the summit, protracted anteriorly to the sinus and backed by a heavy varix. Anterior channel profound; inner lip reflected over the columella as a callus which extends up on the parietal wall.

The type, U.S.N.M. No. 508644, was collected by Dr. Perry at Sanibel Island. It has 8.2 whorls and measures: Length, 12.9 mm.; greater diameter, 5.3 mm.

Cerodrillia (*Cerodrillia*) *thea* (Dall) differs from this species in being of a uniform chocolate-brown color and in having the axial ribs shorter and broader, the knobs more pronounced.

CERODRILLIA (CERODRILLIA) CLAPPI, new species

Plate 17, Figure 4

Shell small, elongate-turreted, yellowish white, with a faint pale-brown band a little anterior to the broadest expansion of the axial ribs. There is another broader band at the periphery of the last whorl, which on the early turn is covered. Nuclear whorls 2, small, strongly rounded, smooth. Postnuclear whorls almost flattened on the early turns, appressed at the summit, but more rounded on the later, marked by slightly retractively slanting, broad axial ribs. On the later whorls these have a decided hump a little anterior to the middle. Of these ribs 10 occur on the first, 11 on the second and third, 10 on the fourth, 8 on the fifth, 9 on the sixth, and 6 on the last half. The spaces separating the axial ribs are broad and shallow and marked by microscopic incremental lines and equally weak spiral striations. Base rather long, marked by the continuation of the incremental lines and feeble spiral threads, which gain in strength anteriorly and develop into 5 weak cords on the columella. Aperture irregularly oval, decidedly channeled anteriorly and with a profound sinus immediately below the summit on the outer lip, which is bordered by a thick callus extending over the parietal wall as a hook. Anterior to the sinus the outer lip is protracted into a clawlike element bearing a feeble stromboid notch at its anterior margin. The inner lip is reflected over the columella as a heavy callus, which becomes attenuated on the parietal wall. Behind the outer lip is a heavy varix.

The type, U.S.N.M. No. 493408, is one of a series of specimens dredged by John B. Henderson, Jr., in 4 fathoms in Hawk Channel, Fla. It has 8.5 whorls and measures: Length, 11.5 mm.; greater diameter, 4.2 mm.

We take pleasure in naming this species for Dr. George H. Clapp, who accompanied Mr. Henderson on his collecting expedition.

We also have specimens from No Name Key collected by Hemphill, and another lot from Hawk Channel taken in 3 to 20 fathoms.

This species is smaller and slenderer than either *Cerodrillia* (*Cerodrillia*) *thea* or *C.* (*C.*) *perryae*, differing also in coloration.

LISSODRILLIA, new subgenus

Shell very small, elongate-turreted. Nuclear whorls 2, well rounded, smooth, passing directly into the postnuclear sculpture without any intermediate stage. The postnuclear whorls are appressed at the summit and marked by strong axial ribs. The spiral sculpture on the spire and base absent, also on the columella. Aperture decidedly channeled anteriorly with a sinus immediately below the summit, which is rather deep and thickened by the reflected peristome. Anterior to the notch the outer lip is produced as a clawlike element and bears a feeble stromboid notch anteriorly. Inner lip reflected over and appressed to the columella, extending as a callus on the parietal wall.

Type: *Cerodrillia* (*Lissodrillia*) *schroederi*, new species.

This subgenus recalls *Cerodrillia*, but it is separated from that by lacking the spiral sculpture on the spire, base, and columella.

CERODRILLIA (LISSODRILLIA) SCHROEDERI, new species

PLATE 17, FIGURE 8

Shell very small, elongate-turreted, milk-white. Nuclear whorls 2, strongly rounded, smooth. Postnuclear whorls appressed at the summit, slightly rounded, marked by very slightly retractively curved, broad, rounded axial ribs, which are as broad as the spaces that separate them. Of these ribs 10 occur on the first, 11 on the second, 12 on the third, and on the last two-thirds of a turn they become quite obsolete. These ribs are flattened on the first turn but become slightly humped below the middle on the remaining turns. They pass over the periphery and evanesce at the insertion of the columella. The ribs and intercostal spaces are marked by scarcely perceptible lines of growth. Base moderately long, marked by the feeble continuation of the axial ribs and inconspicuous spiral striations. Columella without spiral cords. Aperture elongate-oval, decidedly channeled anteriorly; outer lip with a profound sinus immediately below the summit and a weak stromboid notch anteriorly; inner lip covered with a heavy callus which extends over the parietal wall.

The type, U.S.N.M. No. 530585, has 6.2 whorls and measures: Length, 4.8 mm.; greater diameter, 1.9 mm. It was dredged by the United States Bureau of Fisheries steamer *Albatross* at station 2410 in 28 fathoms off Charlotte Harbor, Fla., on a bottom of fine white sand and broken shells.

The species is named for Lt. Seaton Schroeder, navigator on the *Albatross* at the time this dredging was made.

RUBELLATOMA, new genus

Shell, small, elongate-turreted, nuclear whorls forming an acute apex, consisting of about 2 strongly rounded, smooth whorls, which are succeeded by a short stretch of moderately strong, retractively curved, slender, axial riblets, which in turn give way to heavy postnuclear sculpture. The postnuclear whorls are angulated at or a little anterior to the middle, and they are appressed at the summit and marked by very strong sigmoid axial ribs, which taper toward the summit and evanesce on the columella. The broad intercostal spaces and the axial ribs are marked by incremental lines and incised spiral lines, the combination producing a somewhat fenestrated pattern. Base rather long, bearing the same sculpture as the spire. Columella short, stubby, marked by irregular incremental lines.

Aperture elongate-ovate, decidedly channeled anteriorly and with a shallow sinus at the posterior angle; outer lip acute; inner lip reflected over the columella as a callus, extending on the parietal wall.

Type: *Rubellatoma rubella* (Kurtz and Stimpson) (=*Mangelia rubella* Kurtz and Stimpson).

RUBELLATOMA DIOMEDEA, new species

Plate 17, Figure 3

Shell elongate-turreted. Nuclear whorls bright chestnut-brown, the rest of the whorls with a broad brown band covering the posterior half of the whorls. There is a second broad band a little less wide immediately anterior to the periphery followed by a pale zone of almost equal width, while the tip is chestnut-brown. The interior of the aperture shows the exterior coloration. The first 1.5 nuclear whorls are smooth, the succeeding half turn is marked by slender, retractively curved, axial riblets followed by the postnuclear sculpture. Postnuclear whorls appressed at the summit, with a decided angle, the crest of which occupies the anterior fourth between the summit and suture. The whorls are marked by strong sinuous axial ribs, which attain their highest elevation at the angulation and taper gently toward the summit and columella where they evanesce. Of these ribs, 12 occur on the first postnuclear turn, 9 on the second, third, and fourth, 10 on the fifth, and 7 on the last seven-tenths of a turn. The axial ribs are not quite so wide as the spaces that separate them. The entire surface of the shell is marked by numerous incremental lines and equally strong spiral striations, the combination of which gives to the surface a feebly fenestrated pattern. Base rather long, marked by the same sculpture as that which characterizes the spire. Columella short, stubby, marked by incremental lines and weak spiral threads. Aperture elongate-ovate, decidedly channeled anteriorly, with the posterior sinus shallow immediately below the summit. Outer lip somewhat thickened behind the edge, sharp at the edge, slightly protracted anteriorly at the notch and marked like the spire; the inner lip is appressed to the columella as a callus extending up on the parietal wall.

The type, U.S.N.M. No. 508645, was collected by Dr. Perry at Sanibel Island, Fla. It has 7.6 whorls and measures: Length, 9.7 mm.; greater diameter, 4.0 mm. An additional specimen is in Dr. Perry's collection.

Three young specimens, U.S.N.M. No. 323723, were collected by the U. S. Bureau of Fisheries steamer *Albatross* at station 2389 in 27 fathoms, on gray sand and shell bottom off Mobile Bay, Ala.

This species differs from *Rubellatoma rubella* (Kurtz and Stimpson) in having the nuclear whorls chestnut-brown instead of horn-color and in having the angle of the whorls much more anterior; that is, occupying not the middle but the anterior fourth of the space between the summit and suture.

STELLATOMA, new genus

Shell small, elongate-ovate. Nuclear whorls with the first stage smooth followed by a small area marked by slender, rather closely spaced axial ribs, which merges into the postnuclear sculpture. The postnuclear whorls have a broad sloping shoulder below the appressed summit that extends over about one-third of the whorls, which is bounded anteriorly by an angle; the anterior portion of the whorls is greatly rounded. The whorls are marked by axial ribs, which taper toward the summit and evanesce at the insertion of the columella. The spiral sculpture on the early whorls consists of rather strong cords, which weaken on the latter in some of the species. Base marked like the spire. Columella short and stubby, marked by spiral threads. Aperture elongate-ovate, decidedly channeled anteriorly and at the posterior angle; outer lip much thickened, marked by transverse striations and bearing a strong denticle at the anterior termination of the posterior sinus; the inner lip also bears a broad internal fold at the insertion of the columella.

Type: *Stellatoma stellata* (Stearns) (=*Mangelia stellata* Stearns).

Genus PYRGOCYTHARA Woodring

PYRGOCYTHARA HEMPHILLI, new species

PLATE 17, FIGURE 2

Shell small, elongate-ovate, varying in ground color from chestnut-brown to wax yellow, usually with a pale zone at the angle of the shoulder. The outer lip and base of the columella may be orange or dark purplish orange. Nuclear whorls slender, the first 1.5 smooth, succeeded by about two-tenths of a turn that shows slender, retractively curved, axial riblets, which in turn are followed by the postnuclear sculpture. Postnuclear whorls moderately well rounded, appressed at the summit. The postnuclear whorls are marked by very strong, sinuous axial ribs, which taper at the summit and evanesce on the columella. Of these ribs 10 occur on the first and second, 9 on the third and fourth, 10 on the fifth, and 9 on the last. In addition to the axial ribs, the entire surface of the shell is marked by microscopic incremental lines. The spiral sculpture consists of a low, rounded, obsolete keel, which occupies the middle of the turns on the first four whorls but falls a little posterior to this on the rest of the shell. This produces a decided shoulder on the whorls. Anterior to the shoulder three ill-defined spiral cords are present on all but the last two whorls, on which there are four, the penultimate having four, while on the last turn intercalated cords appear between these. Base rather long, marked by the continuation of the axial ribs, which become slightly enfeebled anteriorly and the same type of sculpture as that characterizing the shell anterior to the angle. Columella stout, about as long as the base, marked by obliquely slanting, closely approximated, spiral cords, which vary in size and spacing. Aperture narrowly auriculate, decidedly channeled anteriorly and posteriorly. The anterior channel is deep and well rounded and is situated immediately below the summit. The lip posterior to the sinus is somewhat thickened. Anterior to the sinus the lip is much thickened but tapers to an edge and is slightly protracted. The inside of the outer lip immediately anterior to the channel bears a decided denticle. The inner lip is appressed to the columella as a small callus and thickened on the parietal wall.

The type, U.S.N.M. No. 86898a, was collected in low water in Sarasota Bay, Fla., by Henry Hemphill. It has 7.5 whorls and measures: Length, 8.9 mm.; greater diameter, 3.3 mm.

Hemphill likewise collected it on low-water mud flats at Boca Ceiga.

Genus BELLASPIRA Conrad

PLATE 17, FIGURE 6

1868. *Bellaspira* CONRAD, American Journ. Conch., vol. 3, p. 261.

This genus appears to be very poorly understood. The senior author has for that reason made a careful examination of Conrad's type, *Mangelia virginiana* Conrad, which came from the Miocene of Yorktown, Va. This bears Academy of Natural Sciences of Philadelphia No. 1610.

It may be redescribed as having the shell elongate-ovate, the nuclear whorls decollated; the postnuclear whorls strongly rounded with a decided angle at the middle of the turns where the first spiral cord is located. The whorls are marked by strong axial ribs, of which 10 are present on the first, 12 on the second and the last whorl. The intercostal spaces are about one and one-half times as wide as the axial ribs. On the last turn in addition to the spiral cord mentioned above, two more are present anterior to this between it and the periphery. Base moderately long, marked by the continuation of the axial ribs, which evanesce on the middle of the columella. The specimen appears too worn to yield evidence as to the presence of spiral threads on the base. Columella bears 7 spiral threads. Aperture moderately large, ovate, decidedly channeled anteriorly with a posterior sinus at the summit of the outer lip, limited by a thickening at the outer edge.

The outer lip also is reenforced by a varixlike thickening behind the peristome; the inner lip is appressed to the columella as a callus.

The type has 4.5 whorls, which measure: Length, 4.5 mm.; greater diameter, 2.3 mm.

Our figure is taken from the type.

Genus KURTZIELLA Dall

KURTZIELLA PERRYAE, new species

PLATE 17, FIGURES, 7, 9

Shell minute, elongate-turreted, milk-white with a creamy tinge. The first nuclear turn is well rounded, smooth. This is followed by a turn marked by closely spaced axial riblets and 4 spiral cords, the latter rendering the axial riblets roundly nodulose at their junction. The third cord is a little anterior to the middle and forms an angle. Postnuclear whorls appressed at the summit, marked by very strong axial ribs, which become enfeebled toward the summit and extend anteriorly on the last whorl to the columella. These ribs are more strongly pronounced on the middle of the turns, which they angulate. Of these ribs, 12 occur on the first, 11 on the second, 10 on the third, fourth, and fifth, and 5 on the last half of the last turn. The ribs are only about half as wide as the spaces that separate them. In addition to these strong ribs slender, very regular, closely spaced axial threads are present, which are crossed by spiral threads of equal strength, the junctions of which produce slender rounded nodules, that give to the entire surface of the shell a decidedly granulose effect. This type of sculpture also characterizes the base where the spirals are a little more distantly spaced and the nodulation less pronounced. Columella short and stubby, marked by rather rough oblique lines. Aperture oval, strongly channeled anteriorly with a deep sinus immediately below the summit, whose outer edge is somewhat thickened and reflected. Anterior to the sinus the outer lip is produced into a clawlike element. Inner lip appressed to the columella as a callus extending over the parietal wall.

The type, U.S.N.M. No. 508646, was collected by Dr. Perry at Sanibel Island, Fla. It has 7.5 whorls and measures: Length, 6.5 mm.; greater diameter, 2.3 mm.

This species, while in general type of sculpture and nuclear characters resembling *Kurtziella limonitella* Dall, differs from it in its much slenderer form, much more distantly spaced and less numerous and less strongly developed axial ribs, and much finer spiral sculpture. It also lacks the dark-colored tip of the columella and nuclear whorls.

Genus CRASSISPIRA Swainson

CRASSISPIRELLA, new subgenus

Shell large. The first nuclear whorl well rounded, smooth, succeeded by a fraction of a turn in which faint, closely spaced, retractively curved axial riblets are present, which in turn merges into the postnuclear sculpture. Postnuclear whorls well rounded, the anterior third marked by strongly elevated spiral threads; the posterior two-thirds by strong axial ribs and spiral threads. The latter pass in equal strength over both ribs and intercostal spaces. Base marked by the continuation of the axial ribs, which evanesce on reaching the pillar, and spiral threads. The pillar is rather short, stout, with an obsolete fasciole a little posterior to the tip, marked by spiral threads a little wider than those on the base. In addition to this, the entire surface of the whorls is marked by lines of growth and spiral striations. The sinus falls in the concave area between the summit and the posterior termination of the axial ribs and is moderately broad, deep, and reflected. Anterior to the sinus the outer lip is protracted into a clawlike element that terminates anteriorly in a notch a little posterior to the tip. Inner lip slightly sigmoid, reflected over and appressed to the base. Parietal wall covered by a moderately thick callus, which is not developed into a conspicuous hump at the parietal wall. A little distance behind the outer lip there is a weakly developed varix. Operculum unknown.

Type: *Crassispira* (*Crassispirella*) *rugitecta* (Dall) (=*Turris rugitecta* Dall). Lower California.

CRASSISPIRA (CRASSISPIRELLA) SANIBELENSIS, new species

PLATE 17, FIGURES 11, 12

Shell elongate-turreted, brown, with the intercostal spaces flesh-colored, the edge of the aperture corresponding to the dark color outside, but the interior is livid. First nuclear whorl smooth, followed by a turn with rather closely spaced axial riblets and an indication of spiral threads with the possibility of nodules at their junction. Postnuclear whorls moderately rounded, appressed at the summit, marked by broad, low axial ribs, which terminate at the anterior extremity of the broad siphonal channel. These ribs are broader than the spaces that separate them. In addition there are numerous threadlike incremental lines. The spiral sculpture consists of heavy cords of which the first one is on the shoulder anterior to the summit. Two strong cords appear anterior to the sutural sinus on all but the last two of the remaining turns; on these, three cords are present that render the broad axial ribs nodulose, the nodules having their long axis parallel with the spiral sculpture. In addition to the coarser spiral sculpture, microscopic spiral lines are present on the entire surface. Base moderately long with a narrow umbilical chink at the tip, marked by four spiral cords, which slightly decrease in size anteriorly. Columella stout, stubby, with six heavy cords and several slender threads anterior to these. Aperture oval, decidedly channeled anteriorly with a deep sinus immediately anterior to the cord at the summit. Anterior to the sinus the outer lip is protracted into a clawlike element that bears a series of nodules corresponding to the cords on the outside; inner lip heavy and reflected over the columella. A callus extends over the parietal wall joining the heavy cord at the summit.

The type, U.S.N.M. No. 508647, as well as a young specimen, U.S.N.M. No. 508648, from which the tip was described, was collected by Dr. Perry at Sanibel Island, Fla. The type has 6.5 whorls remaining and measures: Length, 25.8 mm.; greater diameter, 9.9 mm.

The species seems to range down to Key West and into the Bahamas. *Melatoma hadromeres* Melvill from Jamaica appears to be a congener.

CRASSISPIRA (CRASSISPIRELLA) TAMPAENSIS, new species

Plate 17, Figures 5, 13

Shell elongate-turreted, chestnut-brown; interior of the aperture livid. The first nuclear whorl is well rounded, smooth, succeeded by a fraction of a turn in which faint, closely spaced, retractively curved, axial riblets are present, which in turn merges into the postnuclear sculpture. Postnuclear whorls rendered somewhat shouldered at the summit by a strong spiral cord, which is followed anteriorly by a broad siphonal channel, anterior to which the whorls are marked by strong, somewhat sigmoid, axial ribs extending to the insertion of the columella. These ribs are about half as wide as the spaces that separate them; of these, 19 are present on the last turn and 17 on the antipenultimate, the early whorls being eroded in the type. In addition to the axial ribs, the whorls are marked by fine incremental lines, which are decidedly retractively curved in the subsutural channel. The spiral sculpture consists of deeply incised lines, which leave the spaces between them as slightly elevated, flattened ribs; of these, 3 cross the axial ribs posterior to the suture. The base, which is moderately long, is similarly marked, and here the incised lines are broader and separate 4 well-differentiated cords, which render the axial ribs nodulose at their junction. Columella short and stout, marked by 9 spiral cords, which decrease in width from the insertion of the columella anteriorly. Aperture elongate pear-shaped; outer lip with a profound sinus a little below the summit; anterior to the sinus it is protracted into a clawlike element with a mere indication of stromboid notching anteriorly; the inner lip extends over the columella as a broad callus leaving a narrow umbilical chink at its anterior end. A callus extends over the parietal wall.

The type, U.S.N.M. No. 493409, was collected by C. W. Johnson at Tampa Bay, Fla. It has 10 whorls remaining and measures: Length, 22.0 mm.; greater diameter, 7.3 mm.

U.S.N.M. No. 412154 contains 4 young specimens from the same source, the tip of one of which has served for our nuclear description.

MONILISPIRA, new genus

Shell moderately large. The first 2 nuclear whorls are smooth, followed by a turn in which there are moderately strong, retractively curved axial riblets, which are about as wide as the spaces that separate them; following this is the postnuclear sculpture. Postnuclear whorls with a strong, broad, somewhat wavy, nodulose spiral cord at the summit and a series of very large conic nodules immediately above the periphery. The base is marked by 3 nodulose spiral threads, while the posterior portion of the columella bears 2. In addition, the entire surface of the whorls from the summit to the tip of the columella is marked by lines of growth and fine spiral striations. The sinus is moderately deep and broad and falls between the spiral cord at the summit and the nodules anterior to it. The outer lip is protracted anterior to the sinus; inner lip is reflected and appressed to the columella; parietal wall covered with a moderately thick callus, which is at best but slightly thickened at the posterior angle of the aperture. Operculum claw-shaped, with apical nucleus and concentric lines of growth.

Type: *Monilispira monilifera* (Carpenter) (=*Drillia monilifera* Carpenter). Gulf of California.

This group is known from the Gulf of California as well as Florida and the West Indies.

MONILISPIRA MONILIS, new species

PLATE 17, FIGURE 10

Shell elongate-turreted, chestnut-brown except for the tubercles, which are pale yellow, the interior of the aperture reflecting the coloration of the outside. The first 2 nuclear whorls are smooth, followed by a turn in which there are moderately strong, retractively curved axial riblets, which are about as wide as the spaces that separate them; following this is the postnuclear sculpture. Postnuclear whorls with a spiral cord immediately below the summit and a broad tuberculated cord immediately above the suture. The latter is marked by a secondary cord, which coincides with the crest of the tubercles and a little heavier one immediately anterior to the major portion of the tubercles. This on the early turn falls into the suture, but on the last whorl is slightly posterior to it. Of the tubercles 12 are present on the first of the postnuclear turns, 10 on the second, third, and fourth, 11 on the fifth and sixth, and 6 on the last half of the last turn. In addition to the above sculpture, the entire spire and base are marked by numerous, closely spaced, spiral threads, which in combination with the slightly weaker incremental lines lend to the surface, under high magnification, a somewhat fenestrated aspect. Base moderately long, marked by 3 tuberculated spiral cords. Columella stubby, marked by 9 spiral cords, which range from as strong as the last basal to mere threads at the tip of the columella. Aperture irregularly pyriform, decidedly channeled anteriorly; outer lip with a very deep sinus a little below the summit whose edge is reflected. Posterior to the sinus there is a heavy hump anterior to the sinus and the outer lip is protracted into a clawlike element, which is rendered sinuous by the external sculpture; inner lip reflected over the columella as a very heavy callus, which extends up on the parietal wall.

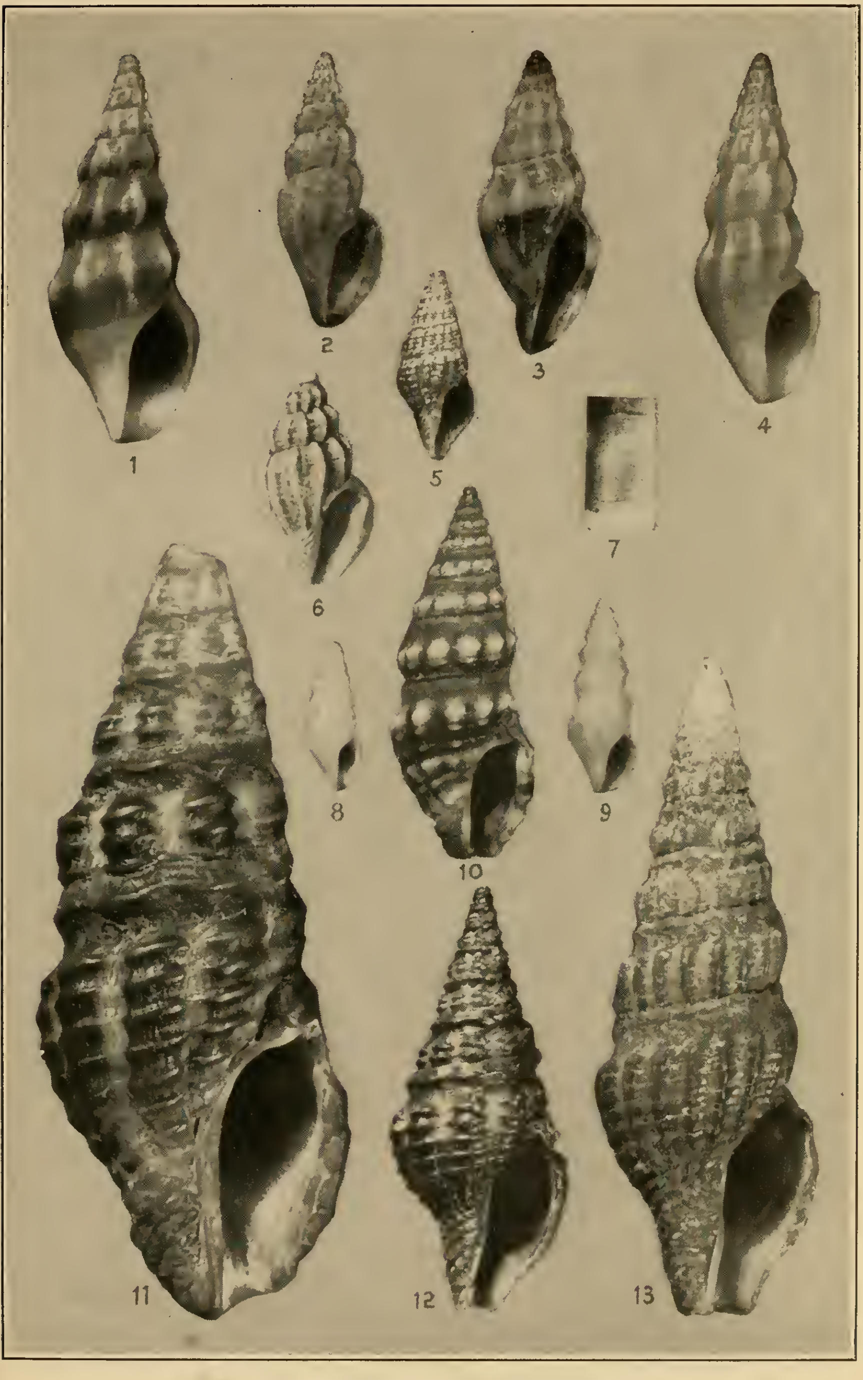
The type, U.S.N.M. No. 508649, was collected by H. B. Olds at Waveland, Dade County, Fla. It has 10 whorls and measures: Length, 12.5 mm.; greater diameter, 5.0 mm.

We have seen specimens also from Cape Sable, Cape Romano, Marco, Punta Rasa, and Sanibel Island.

EXPLANATION OF PLATE 17

1, *Cerodrillia* (*Cerodrillia*) *perryae*, new genus and species; 2, *Pyrgocythara hemphilli*, new species; 3, *Rubellatoma diomedea*, new genus and species; 4, *Cerodrillia* (*Cerodrillia*) *clappi*, new species; 5, *Crassispira* (*Crassispirella*) *tampaensis*, new species, tip; 6, *Bellaspira virginiana* (Conrad); 7; *Kurtziella perryae*, new species, detail of sculpture; 8, *Cerodrillia* (*Lissodrillia*) *schroederi*, new species; 9, *Kurtziella perryae;* 10, *Monilispira monilis*, new genus and species; 11, *Crassispira* (*Crassispirella*) *sanibelensis*, new species; 12 *C.* (*C.*) *sanibelensis*, tip; 13, *C.* (*C*) *tampaensis*. × 5.

U. S. GOVERNMENT PRINTING OFFICE: 1939



Turritid Mollusks from Florida.

For explanation see opposite page.

PROCEEDINGS OF THE UNITED STATES NATIONAL MUSEUM

issued by the

SMITHSONIAN INSTITUTION
U. S. NATIONAL MUSEUM

Vol. 87 Washington : 1939 No. 3071

A NEW TREMATODE FROM THE LOON, GAVIA IMMER, AND ITS RELATIONSHIP TO HAEMATOTREPHUS FODIENS LINTON, 1928

By W. Carl Gower

Linton (1928) described a trematode, *Haematotrephus fodiens* (Cyclocoelidae), from the intestine and pancreas of a loon (*Gavia immer*) taken at Woods Hole, Mass. He obtained one specimen from the intestine and several from cysts in the pancreas. Although these two forms are strikingly different, he included them as morphological variations of the above species. Witenberg (1928) questioned that Linton's species belonged to the Cyclocoelidae and further commented that "the generic identification of this species remains problematical." Later, Ejsmont (1931) transferred *H. fodiens* to the genus *Diasia* Travassos (Pachytreminae: Opisthorchiidae) but did not comment on the two morphological types described by Linton.

The writer, through the courtesy of Dr. E. W. Price, of the United States Bureau of Animal Industry, obtained Linton's material for study from the United States National Museum Helminthological Collection. The material consisted of two slides, Nos. 7915 and 7916, the former containing one specimen of the "free form" and the latter two complete specimens and three fragments of the "encysted form." Linton designated No. 7915 as the type.

A study of this material shows that Linton was dealing with two distinct species rather than two morphological forms of the same species. The "free form" should be retained in the genus *Diasia* as indicated by Ejsmont, but the "encysted form" is regarded as representing a new species belonging to the genus *Amphimerus* Barker (Opisthorchiinae). In view of Linton's very brief description, both species are described in this paper. Measurements of *D. fodiens* are necessarily based on the single specimen.

Genus AMPHIMERUS Barker

AMPHIMERUS LINTONI, new species

Synonym: *Haematotrephus fodiens* Linton, 1928 (encysted form).

Description.—Opisthorchiinae. With characters of the genus. Elongate trematodes about 15 mm. in length and 0.8 to 0.9 mm. in greatest width, which occurs in the region of the testes. Posterior end broadly rounded, tapering almost to a point at anterior end; body musculature feebly developed. Acetabulum weakly developed, 0.05 to 0.06 mm. in diameter, situated 1.2 to 1.4 mm. from the anterior end. Oral sucker atrophied, mouth terminal, a buccal tube 0.08 to 0.09 mm. in length leading from oral opening to pharynx. Pharynx (fig. 15, *C*) 0.085 by 0.056 mm.; esophagus narrow, 0.08 to 0.1 mm. long. Intestinal crura irregular and equal, parallel to sides of body and extending to posterior end. Testes in posterior end, slightly lobed, longer than wide, and 0.16 to 0.24 mm. in width by 0.30 to 0.38 mm. in length, placed either one in front of the other or slightly tandem. Vas deferens slightly sinuous, passing anteriorly and opening into the common genital pore at anterior margin of acetabulum; seminal vesicle absent. Ovary lobed, 0.11 to 0.16 mm. long by 0.32 mm. wide, median, anterior to anterior testis. Seminal receptacle oval, 0.17 by 0.73 mm., located immediately behind ovary. Mehlis' gland diffuse, in front of ovary. Uterus densely coiled, filled with eggs, extending from ovary to acetabulum and overlapping intestines, especially in its posterior extent. Vitellaria weakly developed, consisting of four to six fimbriated groups of follicles on each side; the posteriormost group is opposite the posterior testis, and the anterior group near the posterior boundary of the middle fifth of the body. The vitellaria overlap the intestine. Excretory bladder sinuous, Y-shaped, opening slightly subterminal. Eggs yellowish, 0.024 by 0.013 mm.

Host.—*Gavia immer* (pancreas).

Distribution.—North America (Woods Hole, Mass.).

Cotypes.—Two complete specimens, U. S. Nat. Mus. Helm. Coll. No. 7916.

Remarks.—*Amphimerus lintoni* is more like *A. elongatus* Gower, 1938, from ducks than any other species of the genus. Both of these species differ from all other members of the genus in that the oral sucker is completely atrophied. *A. lintoni* may be distinguished from *A. elongatus* by the testes, which are more lobed and relatively smaller in the former than in the latter. The mouth opening is subterminal in *A. elongatus* and terminal in *A. lintoni*. The vitellaria are much better developed in *A. elongatus* than in *A. lintoni*.

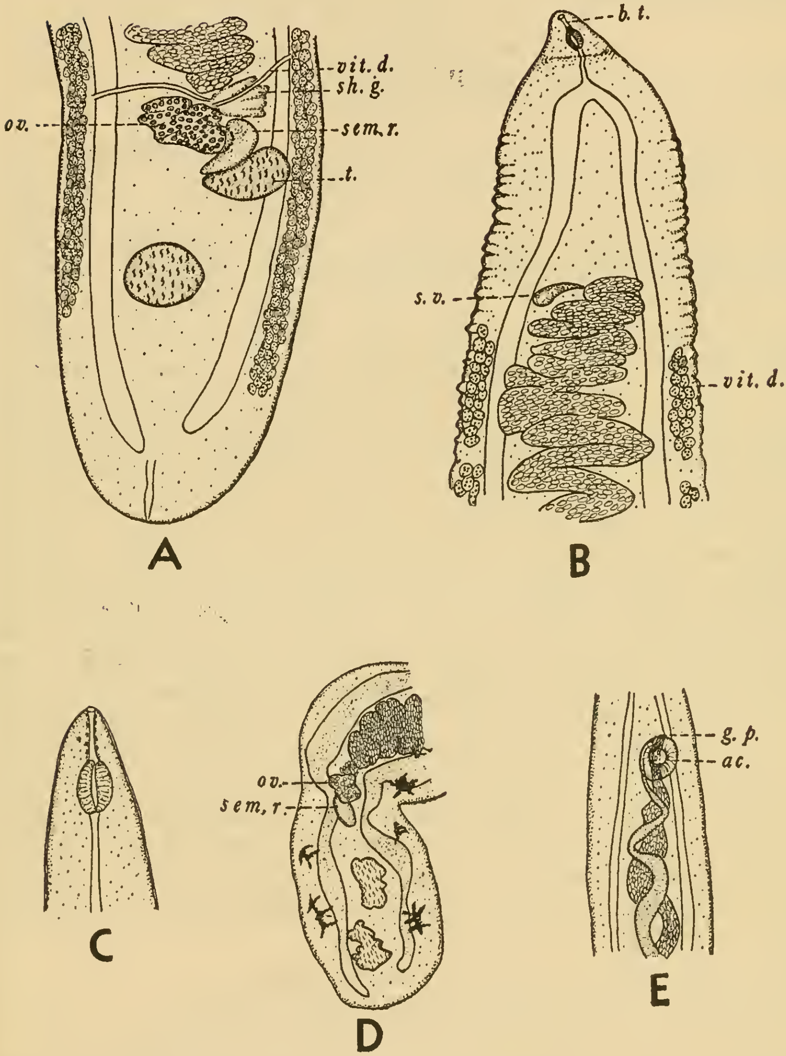


FIGURE 15.—A, *Diasia fodiens*, posterior portion showing arrangement of sex organs; B, *D. fodiens*, anterior portion; C, *Amphimerus lintoni*, new species, auterior tip; D, *A. lintoni*, posterior tip showing sex organs; E, *A. lintoni*, acetabulum and genital pore. *ac*, Acetabulum; *b. t.*, buccal tube; *g. p.*, genital pore; *ov*, ovary; *sem. r.*, seminal receptacle; *sh. g.*, shell gland; *s. v.*, seminal vesicle; *t.*, testis; *vit. d.*, vitelline duct.

The total absence of an oral sucker in these two species might be considered sufficient reason for erecting a new genus, but in the absence of other differences they should be retained for the present in the genus *Amphimerus*.

Genus DIASIA Travassos

DIASIA FODIENS (Linton, 1928) Ejsmont, 1931

Synonym: *Haematotrephus fodiens* Linton, 1928 (free form).

Description.—Pachytreminae. Elongate muscular worms, with sides of body more or less parallel, posterior end rounded, anterior end roughly pointed. Total length 11 mm.; greatest width 1.85 mm., near center of body. Near the genital pore the width is 1.4 mm. and at the second testis 1.68 mm. Skin aspinose. Suckers atrophied. Anterior tip of body differentiated into a triangular-shaped protrusible organ (?). Mouth opening subterminal. Pharynx pear-shaped, 0.15 by 0.24 mm. Esophagus 0.05 mm. in diameter and 0.45 mm. long, slightly sinuous. Intestinal crura relatively large, thin-walled, and reaching nearly to posterior end; not continuous. Testes entire, subspherical, slightly tandem, in posterior sixth of body; anterior testis 0.35 by 0.56 mm., posterior testis 0.40 by 0.52 mm. Seminal vesicle small, pyriform, in anterior body third, just anterior to anterior margin of uterus, slightly to left of midline; it is 0.16 by 0.58 mm. Copulatory organs absent. Ovary strongly lobed, broader than long, 0.22 by 0.70 mm., just anterior to anterior testis. Mehlis' gland anterior and to right of ovary. Seminal receptacle 0.33 by 0.83 mm., between ovary and anterior testis. Uterus extending from ovary to posterior border of anterior sixth of the body, confined within the intestinal crura, and filled with small yellowish eggs. Eggs 0.024 by 0.012 mm. Vitellaria extracecal, consisting of small spherical follicles, forming a more or less continuous line from just posterior of the anterior margin of the uterus to posterior of the posterior testis; vitelline ducts arising opposite Mehlis' gland. Excretory bladder Y-shaped.

Host.—*Gavia immer* (reported from intestine).

Distribution.—North America (Woods Hole, Mass.).

Specimen.—U. S. Nat. Mus. Helm. Coll. No. 7915 (type).

Remarks.—Two species have been described for the genus *Diasia*. Travassos (1922) erected the genus to contain the type species *D. diasia*, from the pancreas of *Plotus anhinga* in Brazil. His description of the genus is very brief. Olsen (1938) has described *D. podilymbi* from the mesenteries of *Podilymbus podiceps* from North America. He has also amended the generic diagnosis and pointed out the differences in the species.

LITERATURE CITED

EJSMONT, LEOPOLD.
1931. Über die Identität von *Proshystera rossittensis* Korkhaus und *Tanaisia fedtschenkoi* Skrjabin, nebst einigen Bermerkungen über Trematoden mit verbundenen Darmschenkeln. Bull. Int. Acad. Polon. Sci. et Lettres, ser. B (II), 1931, pp. 531–547.

GOWER, W. CARL.
1938. Studies on the trematode parasites of ducks in Michigan with special reference to the mallard. Michigan State Coll. Agr. Exp. Stat. Mem. 3, 94 pp.

LINTON, EDWIN.
1928. Notes on trematode parasites of birds. Proc. U. S. Nat. Mus., vol. 73, art. 1, 36 pp., 11 pls.

OLSEN, O. WILFORD.
1938. A new species of trematode, *Diasia podilymbi* (Opisthorchiidae), from the pied-billed grebe, *Podilymbus podiceps* (Linn.). Journ. Parasit., vol. 24, pp. 215–218, 1 pl.

TRAVASSOS, LAURO.
1922. Informações sobre a fauna helminthologica de Matto Grosso. Folha Medica, anno 3, No. 24, pp. 187–190.

WITENBERG, GEORGE.
1928. Notes on Cyclocoelidae. Ann. Mag. Nat. Hist., ser. 10, vol. 2, pp. 410–417, 2 figs.

U. S. GOVERNMENT PRINTING OFFICE: 1939

PROCEEDINGS OF THE UNITED STATES NATIONAL MUSEUM

issued by the

SMITHSONIAN INSTITUTION
U. S. NATIONAL MUSEUM

Vol. 87 Washington: 1939 No. 3072

A STUDY OF LECONTE'S TYPES OF THE BEETLES IN THE GENUS MONOXIA, WITH DESCRIPTIONS OF NEW SPECIES

By Doris Holmes Blake

The genus *Monoxia* has been much neglected since its description by LeConte in 1865. The only treatments are those of Crotch,[1] who was able to distinguish only four of LeConte's six species, and of Horn,[2] who further reduced the original species to three and referred to the genus a fourth (*puncticollis* Say) belonging to a quite different group of beetles, which in an earlier paper I have referred to the genus *Erynephala*.[3] Jacoby [4] added a species from Guatemala (*semifasciata*), and Blatchley [5] one from Florida (*batisii*), Weise [6] included in his Catalogue a doubtful Fabrician species (*Galleruca atomaria* [7]) from "Caroline," and I have recently described a new species (*beebei*)[8] from Lower California.

In the mass of material of the genus that has gradually accumulated in the U. S. National Museum, there has been little attempt to arrange or identify the species. At first a revisional study of the genus was planned, but as soon as the size of the undertaking and the

[1] Proc. Acad. Nat. Sci. Philadelphia, vol. 25, p. 56, 1873.

[2] Trans. Amer. Ent. Soc., vol. 20, p. 82, 1893.

[3] Journ. Washington Acad. Sci., vol. 26, pp. 424–430, 1936.

[4] Biologia Centrali-Americana, vol. 6, pt. 1, p. 497, 1887.

[5] Can. Ent., vol. 39, p. 273, 1917.

[6] Coleoptorum catalogus, pt. 78, p. 181, 1924.

[7] Systema eleutheratorum . . ., vol. 1, p. 490, 1801. Fabricius described the prothorax of *G. atomaria* as margined ("marginatus") and the elytra as smooth ("laevia"), and since no species of *Monoxia* has a prothorax that can be interpreted by any feature of shape or color as margined, and all have the elytra pubescent, it seems improbable that this description could have applied to a species of *Monoxia*.

[8] Zoologica, vol. 22, pt. 1, pp. 89-91, 1937.

great amount of biological work necessary for an adequate understanding of the species became apparent, I decided to limit the study to a reconsideration of the forms described by LeConte and to the description of a few obviously distinct new species. In view of the preliminary nature of this paper, the key to the species here given will inevitably prove deficient in identifying specimens, since it by no means includes all the species that are likely to be collected.

The genus *Monoxia* was described by LeConte,[9] who assigned to it the following species: *Galleruca consputa*, *G. guttulata*, *G. sordida*, and *G. angularis*, all previously described by himself, and the new species *M. obtusa* and *M. debilis*. Because it is one of the largest and easiest to recognize of the species originally included in this homogeneous group, I hereby designate *M. angularis* as the type of the genus *Monoxia*. LeConte in his key to the Galerucinae of North America separated *Monoxia* from related genera by the character of the claws, which he described as acute and usually entire. He states that the genus is made up of "small testaceous species densely clothed with yellow hair, and easily recognized by the ungues being neither cleft nor appendiculate," but "slender, acute, not toothed, nor dilated at base, in one section, and with a small acute tooth not divergent as in *Galleruca* in the second section. The deflexed pygidium readily distinguishes this genus, and gives to the ventral surface somewhat the appearance observed in genera allied to *Clythra*." Crotch added to LeConte's description by observing that the claws of the male are finely toothed and those of the female simple. Horn pointed out as the defining characters of the genus the open anterior coxal cavities and the dimorphous claws, bifid in the male and simple in the female. Horn makes little of the vertical pygidium, remarking that while it is more or less vertical in the male of the small species, it is not different from other Galerucinae in the large species or in the female. Horn was correct in saying that the pygidium of the female is not vertical. He distinguished *Monoxia* from *Galerucella* by its shorter antennae.

On account of the difference in the claws of the male and female, Weise has placed *Monoxia* in the subfamily Apophyliini, a group composed of African and Asiatic genera and far removed from *Galerucella*. A study of the claws of the different species of *Monoxia* shows that those of the female are not always simple but are sometimes toothed and indistinguishable from those of the male. This is the case in at least four species, and while three of the species with this character form a group somewhat unlike the other species of *Monoxia*, the remaining one is so closely related to the other species of the genus that I can scarcely distinguish it except by the toothed claws of the female. Except for its family likeness, the only resemblance *Monoxia* bears to the other genera of the subfamily Apophyliini is the difference in

[9] Proc. Acad. Nat. Sci. Philadelphia, vol. 17, p. 221, 1865.

the claws of the sexes in the majority of the species, and its inclusion in this subfamily is purely artificial.

Although *Monoxia* is an easily recognized, homogeneous group of species occurring chiefly in western North America and having, so far as is known, the distinctive larval habit, peculiar among closely related genera, of mining leaves, it is exceedingly difficult to find characters that in all cases will separate it from *Galerucella*. Generally the claws of the male are toothed and those of the female simple, but not always. Generally the antennae of *Monoxia* are shorter, but even here it is extremely difficult at times to draw a line. Usually, the prothorax is longer and more deeply impressed and the elytra narrower and with a less broadly rounded apex and a narrower lateral margin, and the abdomen of the male has a "deflexed pygidium," but certain species of *Galerucella* are as narrowly oblong as *Monoxia*, and at least four species of *Monoxia* do not have a very evident pygidium in the male.

DESCRIPTION OF THE GENUS

The body is elongate-oblong-oval, more or less densely pubescent with short, fine, and usually recumbent hairs. The head is withdrawn into the prothorax to behind the eyes; it is moderately wide, very little produced in the lower front, and with a median impressed line; there is little evidence of frontal tubercles, and the upper part of the head is punctate and pubescent. The antennae are short, not half the length of the body, and do not come much below the elytral humeri. The first and third joints are longest, the fourth and remainder, except the apical one, about the same length, gradually thickening. In the male, the joints are slightly longer and slenderer, while in the female the eighth, ninth, and tenth joints frequently are thicker. The prothorax is usually scarcely twice as broad as long, often considerably less, and only in one group of species over twice as broad as long; the sides are arcuate or angulate, sometimes nearly straight, but usually broadest in the middle, with a little tooth at the basal angle, more or less prominent in different species. The basal margin is usually sinuate over the scutellum and joins at an obtuse angle with the sides. The upper surface is uneven and has a median channel and lateral depressions. In some species these depressions are very pronounced, in others a mere unevenness of surface. The surface is generally densely punctate and pubescent. The scutellum is truncate. The elytra are broader than the prothorax, with parallel sides and a narrow margin which extends nearly to the tip; the humeri are prominent, and there is often a long incurving intrahumeral depression extending to behind the middle. In some species there is also a linear lateral depression behind the middle. The surface is more densely and finely punctate than in most species of *Galerucella* and more or less pubescent. As in *Galerucella*, there are often traces of one or two raised lines on the inner half of the elytra, parallel to the suture and particularly evident in the basal half. The epipleura do not extend to the apex. Beneath, the body is finely pubescent. The prosternum disappears between the anterior coxae, and the precoxal cavities are open. Usually the tip of the abdomen appears truncate in the male, owing to the pygidium coming down and meeting the concave last visible sternite much like the flap of an envelope. In the female the pygidium is less in evidence, and the tip of the abdomen is more oval. In some species, as in the *sordida* group, and also in *M. batisii*, this development of the pygidium in the male is not so striking and the two sexes are not easily differentiated by it. The legs are without spurs or teeth and the tibiae are glabrous on the outer edge. The claws are toothed in the male, but usually simple in the female.

In one group of species, consisting of *sordida* and two closely related species, the claws are toothed in both sexes. These species are also peculiar in having a short, wide prothorax, over twice as wide as long. Furthermore, the abdomen of the male in most specimens is not so truncate as in the other species. These peculiarities make the group somewhat intermediate in character between the genera *Monoxia* and *Galerucella*. Besides these three species, another species, described here as *Monoxia schizonycha*, has the claws toothed in both sexes, but in other characters it is similar to *M. consputa* and others in which the claws are dimorphous. The abdomen of the male of *M. schizonycha*, also, is truncate, as in the majority of the species.

The aedeagus of all the species is a simple bowed structure. In some it is short, broad, and with a well-rounded tip; in others, long, narrow, and tapering acutely to the tip. Frequently the aedeagus varies somewhat in specimens of a species from different localities. The general structure and shape are the same, but sometimes there is considerable diversity in the length or in the shape of the tip or in the position of the dorsal opening. This is most marked in species having a wide range (as in *sordida*, which occurs in eastern Texas and Western United States) and has led me to doubt if the eastern colonies are the same as the western. In such cases more biological work is necessary before any conclusion can be reached. Even in a series from a single locality there is considerable variation, and in some cases, among groups of closely related species, the aedeagus does not afford good distinctive characters.

The color and markings vary so as to be exceedingly misleading. In almost every species is found a gradation from pale forms, often without any markings whatever, through various stages to heavily marked. In fact, it is rather rare to find two specimens of a species marked alike. There is a certain typical pattern, traces of which occur in practically every species of *Monoxia*. When moderately developed it consists of humeral, sometimes lateral, and usually subsutural infuscations. From the slightly darkened sutural edges at the scutellum, again before the middle, and sometimes again before the apex, a darkened branch curves outward about a quarter of the way across the elytron and then, in the case of the upper two branches, curves downward parallel to the suture. The apical branch when present usually enlarges at the end and often joins with the lateral darkening. In the majority of the specimens, the suture is pale and only the ends of the branches, running parallel to the suture, remain, forming what has been described as the interrupted subsutural vitta. In certain heavily marked specimens, on the other hand, the sutural and subsutural vittae unite to form a wide, dark vitta common to both elytra. In others, as in *sordida*, the branches take the form of rounded lobes. In many all that remains of the branches is a series of spots in a line, suggesting a vitta. Finally these spots may disappear, leaving the elytra pale. The humeri are usually darkened and an indefinite lateral darkening often occurs. Between this and the subsutural vitta are irregular spots, often in a series. Although the elytral pattern is fundamentally alike in all species, some tend to be paler, for example, certain Arizona species of arid areas, and some tend to be more darkly marked.

The question has been raised whether the species of this genus are not in too active a stage of evolution to justify an attempt to reduce them to order. For instance, in LeConte's species *M. consputa, angularis*, and *sordida* specimens from different localities show appreciable differences in minor features. This variation may indicate that these species are still in the process of active evolution. It is possible, however, to distinguish LeConte's species as variable units, but at this stage of our knowledge of the genus it does not appear advisable to do more than to describe the variation in the characters of these species without distinguishing the forms by name. The attempt to establish finer distinctions within the limits of these species should be based on further study along biological lines. Other species, such as *M. schizonycha, puberula*, and *apicalis*, are more constant and clearly defined. For the differentiation of the species, the pubescence and punctation, together with the shape of the prothorax and aedeagus, and the presence or absence of depressions on the elytra prove important characters.

In this homogeneous group there is the greatest need for careful biological study and the correlation of host plants. Apparently the species may be roughly divided into two classes according to their food plants, those feeding on Chenopodiaceae, both the wild *Cheno-*

podium and its cultivated relative, sugar beet, and hence of importance economically, and those feeding on Compositae, such as *Artemisia*, *Chrysothamnus*, *Grindelia*, and *Gutierrezia*. In addition to these food plants one species is recorded by Profs. R. A. Cooley and E. O. Essig as injuring cottonwood. In general, the beetles feed on desert and salt marsh plants, and because of their occurrence in such regions they have become popularly known in the Western United States as "alkali bugs." They are found from the Pacific coast eastward to western Texas, Kansas, Nebraska, the Dakotas, and Alberta. At least four species have been collected along the coast of southeastern Texas. Only one is known from farther east, *M. batisii*, which has been collected in Florida by W. S. Blatchley on *Batis maritima*, a shrub occurring about the Gulf of Mexico and north to North Carolina. *M. batisii* is also found in Texas (San Patricio County, Corpus Christi, Brownsville) and Mexico (one specimen in the collection of the Illinois State Natural History Survey from Tampico). As yet, only a few species are reported from Mexico, but it is probable that many of the southwestern species will be found there.

I wish to thank the following entomologists for their courtesy in lending their private collections or the collections in their charge: Nathan Banks, Museum of Comparative Zoology; K. G. Blair, British Museum; Warwick Benedict, University of Kansas; Prof. Melville H. Hatch, University of Washington; Prof. William A. Hilton, Pomona College; S. C. McCampbell, Colorado State College of Agriculture and Mechanic Arts; G. A. Mail, Montana Agriculture Experiment Station; Dr. H. H. Ross, Illinois State Natural History Survey; Prof. H. C. Severin, South Dakota State College; Prof. E. C. Van Dyke, California Academy of Sciences; H. R. Brisley; the late F. S. Carr; D. K. Duncan; C. A. Frost; Ralph Hopping; H. Lanchester; M. C. Lane; and A. T. McClay.

KEY TO SPECIES OF MONOXIA

1. Claws in both sexes toothed -- 2
   Claws in female simple, in male toothed ---------------------------- 5
2. Head without pronounced median vertical depression; prothorax not twice as broad as long; elytra strongly and moderately coarsely punctate; beetles medium sized (3.5 to 4 mm.) **schizonycha**, new species
   Head with pronounced median vertical depression; prothorax short and fully twice as broad as long; elytra finely punctate; beetles tending to be smaller (2.5 to 3.8 mm.) ---------------------- 3
3. Densely pubescent, punctation on elytra hidden; apex of aedeagus seen from above broad with a short, pointed tip - **sordida** LeConte
   Less densely pubescent, elytral punctation distinctly visible; apex of aedeagus seen from above narrow and gradually tapering to a point -- 4

4. Elytra usually darkly marked with transverse dark areas at base, at middle, and near apex at the suture, apex pale; aedeagus rather short and stout with a fine, narrow tip — **apicalis**, new species
   Elytra usually without heavy sutural darkenings; aedeagus long, slender, and tapering — **brisleyi**, new species
5. Aedeagus long and slender, with a dorsoventrally flattened apex — 6
   Aedeagus shorter and robust and not with a dorsoventrally flattened apex — 10
6. Beetles large (4 to 5.3 mm.) — 7
   Beetles smaller (2 to 4 mm.) — 8
7. Pronotum with prominent hind angles; Western United States, feeding on Chenopodiaceae — **angularis** LeConte
   Pronotum without prominent hind angles; Florida, southeastern Texas, and eastern Mexico, feeding on *Batis maritima* — **batisii** Blatchley
8. Narrowly oblong, slender, prothorax with lateral sides angulate at middle, disk uneven with lateral and median depressions — **minuta**, new species
   More broadly oblong, prothorax with lateral sides arcuate and disk more smoothly convex with only slight depressions — 9
9. Aedeagus unusually long, elytra finely and shallowly punctate; southeastern Texas — **obesula**, new species
   Aedeagus not unusually long, elytra rather coarsely and distinctly punctate; Colorado, Idaho — **pallida**, new species
10. Aedeagus very broadly rounded, almost truncate at apex when viewed from above — **elegans**, new species
    Aedeagus more or less tapering, sometimes acute at apex when viewed from above — 11
11. Medium sized (3 to 4 mm.), with rather scant, short pubescence or with fine, silken pubescence, not deeply punctate — 12
    Larger (3.5 to 5 mm.), conspicuously pubescent and coarsely punctate — 14
12. Elytra without long intrahumeral sulcus, with scant, short pubescence and finely punctate, somewhat shining; feeding on *Gutierrezia* — **puberula**, new species
    Elytra sometimes with a long intrahumeral sulcus, either covered with a fine silken pubescence or not shining but distinctly punctate — 13
13. Elytra depressed, with a conspicuous deep intrahumeral sulcus, not densely pubescent, punctation quite visible and distinct — **consputa** LeConte
    Elytra not depressed, with a shallow intrahumeral sulcus, elytral punctation somewhat concealed by fine, dense pubescence; Lower California — **beebei** Blake
14. Elytra with a long intrahumeral sulcus, pubescence long and not closely appressed but erectish; vicinity of San Francisco, feeding on *Artemisia* — **guttulata** LeConte
    Elytra with only a short intrahumeral sulcus, pubescence closely appressed — 15
15. Elytra shallowly and very densely punctate, aedeagus viewed from above rather abruptly contracted into a somewhat blunt, wedge-shaped apex; feeding on *Grindelia* — **inornata**, new species
    Elytra deeply and more coarsely punctate, aedeagus usually longer and gradually narrowed at apex — 16

16. Prothorax little depressed, the width considerably less than twice the length; elytral punctation markedly coarse and distinct; Rocky Mountains and Great Plains---------- **debilis LeConte**
    Prothorax wider and more depressed on the sides, dense grayish elytral pubescence somewhat obscuring the coarse punctation; aedeagus long and heavy; Montana, Idaho, Alberta, feeding on *Artemisia* and *Solidago*---------------- **grisea, new species**

MONOXIA CONSPUTA (LeConte)

PLATE 19, FIGURE 18

Galleruca consputa LECONTE, Reports of explorations and surveys for a railroad route from the Mississippi River to the Pacific Ocean, vol. 9, No. 1, p. 70, 1857.

Monoxia consputa LECONTE, Proc. Acad. Nat. Sci. Philadelphia, vol. 17, p. 222, 1865.—HORN, Trans. Amer. Ent. Soc., vol. 20, p. 85, 1893 (in part).

LeConte's Latin description of *Galleruca consputa* may be translated thus: Elongate, yellow-testaceous, pubescent, densely and not finely punctate, with a median black line down the head, the prothorax canaliculate and impressed here and there near the sides, with a black dorsal vitta and a dark lateral clouding; the elytra with an oblique intrahumeral depression and another depression along the sides from the humerus posteriorly, with elevated black suture and numerous small black spots, the undersurface fuscous, the legs testaceous, black-spotted. Length 0.15 inch. The type locality is given as San José, Calif., in his original description, although later the localities San José and San Francisco are both given. He states that it occurs on oak leaves. It is described as narrower than *G. debilis*, with the elytra more coarsely punctate, the sides compressed and impressed, and the disk obliquely impressed behind the middle.

In the LeConte collection are five specimens, all with the gilt label indicating the locality California, the first of which, a male, is labeled *consputa*, locality San José, Museum of Comparative Zoology type No. 4386. Although it is rather difficult to see the claws, I believe all four others are males with toothed claws. All are similarly marked and correspond with LeConte's description. The head is more or less darkly speckled on the lower front, with a dark streak above the antennal sockets and also below, and the median line and labrum are dark. The pubescence is long, moderately dense, and covers the punctation on the occiput. The antennae have darker and thicker apical joints. The prothorax is nearly twice as wide as long and has median and lateral depressions, not so deep as in *angularis* or *guttulata*, the sides somewhat rounded, the basal angles not prominent, and the pubescence not dense, showing beneath it the shallow, rather coarse punctation. The elytra have the humeri well marked, with a pronounced and long incurving intrahumeral depression, and there is also a distinct postmedian lateral depression, running from the side obliquely toward the apex. The punctation is rather coarse and dense, becoming finer toward the apex, and the pale pubescence is moderately long, recumbent, not dense, and not obscuring the punctation. Beneath, the body is dark except the last two or three abdominal segments, and the legs are speckled.

Compared with the other species described by LeConte, *consputa* stands out as being next in size to the tiny *sordida*, that is, one-third smaller than *angularis* and considerably smaller than *guttulata* or *debilis*. *M. consputa*, besides being smaller than *angularis*, has a differently shaped prothorax, the basal angles of which are not conspicuous, shallower elytral punctation, and a quite differently shaped aedeagus. Compared with *guttulata*, it is not only less elongate and smaller, but the pubescence is shorter and less conspicuous and more closely appressed. Unlike *debilis*, the elytra are not convex but have pronounced depressions. Among the medium-sized species it is distinctive because of the coarse elytral punctation. The majority of the specimens examined are darkly marked, with the head speckled, the prothorax with an M-shaped configuration, and the elytra with a darkened sutural vitta.

Specimens of this species from about San Francisco (Mount Tamalpais and Monterey) correspond entirely with LeConte's types. On the other hand, there are many specimens from other localities throughout the Western States and in Texas that closely resemble *M. consputa* but have slight differences. In all the aedeagi are very similar. Whether these are varieties of a single species or are specifically distinct is not clear. As in some other species, notably in *M. sordida*, the status of these closely related forms cannot at present be satisfactorily worked out. Possibly as a species *M. consputa* is not yet fixed but still in the process of evolution. A series of specimens from Beaver Creek, Utah, is slenderer and has shorter pubescence. Another series that I collected in numbers on *Chrysothamnus nauseosus* in Yellowstone Park, Wyo., is slightly larger, with a little coarser elytral punctation and with inconspicuous pubescence. A single specimen from Williams, Ariz., similar to typical specimens in elytral punctation and depressions, is more pubescent. A series from Ritzville and Toppenish, Wash., is more pubescent and darker in coloring.

MONOXIA GUTTULATA (LeConte)

Plate 19, Figure 13

Galleruca guttulata LeConte, Reports of explorations and surveys for a railroad route from the Mississippi River to the Pacific Ocean, vol. 9, No. 1, p. 70, 1857.

Monoxia guttulata LeConte, Proc. Acad. Nat. Sci. Philadelphia, vol. 17, p. 222, 1865.

Monoxia consputa Horn, Trans. Amer. Ent. Soc., vol. 20, p. 85, 1893 (in part; not LeConte, 1865).

LeConte's Latin description of *Galleruca guttulata* may be translated thus: Elongate, fuscous-testaceous, strongly cinereous pubescent, densely and strongly punctate, with the short prothorax widely canaliculate and uneven near the sides; elytra widely sulcate within the humeri, obliquely impressed near the margin, with sparse, subseriate, round black spots. Length 0.19 inch. One specimen only is cited, and the type locality for that given as San Francisco. Compared with *consputa*, *M. guttulata*, according to LeConte, is larger and the suture is not elevated and not dark.

In the LeConte collection is a single female, with simple claws, without doubt the one from which LeConte drew up his description, which bears the label *guttulata* and a gilt circle indicating the locality California. It has also the Museum of Comparative Zoology type No. 4384. The head is pale below, gradually darkening to deeper yellow on the occiput, and the labrum and median line, which is not much impressed, are dark. The pubescence is moderately long and dense and conceals the occipital punctation. The four basal joints of the antennae are pale and the remaining ones darker. The prothorax is depressed in the middle and on the sides; the basal tooth is small and not conspicuous; the pubescence long and appressed, nearly concealing the dense punctation below. The elytral humeri are prominent, with a long incurving intrahumeral depression extending a third of the way down the elytra and a less marked postmedian lateral one. The punctation is coarse, very dense, and partly concealed by the dense, long, erectish, grayish-yellow hairs. The elytral markings consist of small dark spots. Beneath, the legs are pale, the metasternum and first abdominal segments dark and shining under the fine, dense pubescence.

The most striking characteristic of *guttulata*, distinguishing it from any of the other large species, is the long and somewhat erectish elytral pubescence together with the conspicuous, long, intrahumeral depression. *M. guttulata* is a little smaller than *angularis* and has a different kind of elytral punctation, the punctures appearing rounder and the surface less honeycombed than in *angularis*, and the pubescence is long and not closely appressed as in *angularis*, and the antennae are slenderer. *M. consputa* is smaller and not so pubescent. *M. debilis* does not have the striking intrahumeral depression although similar in its elytral punctation and *debilis* also has a longer prothorax. The aedeagus of *guttulata*, similar in shape to that of *consputa*, is longer. The majority of the specimens examined are heavily marked with spots, often appearing nearly black. Thus far I have seen specimens only from the region about San Francisco: Carmel, Monterey, Ross, Lagunitas (Marin County), Los Gatos. Dr. E. C. Van Dyke has collected it in numbers on a species of *Artemisia*.

MONOXIA SORDIDA (LeConte)

PLATE 18, FIGURE 6

Galleruca sordida LECONTE, Proc. Acad. Nat. Sci. Philadelphia, vol. 10, p. 88, 1858.
Monoxia sordida LECONTE, Proc. Acad. Nat. Sci. Philadelphia, vol. 17, p. 210, 1865.—HORN, Trans. Amer. Ent. Soc., vol. 20, p. 86, 1893.

LeConte's Latin description of *Galleruca sordida* may be translated thus: Testaceous, covered with dense, pale, sordid pubescence, the head canaliculate, the prothorax short with subangulate sides, deeply canaliculate and depressed ("late excavato") on either side; the elytra somewhat 3-sulcate, the second sulcus directed obliquely inward forward, the third very short; the elytra marked at the middle by a common slightly impressed dark sutural spot, and by several spots especially near the middle; the antennae less than half the length of the body, a little thickened outwardly; the breast fuscous. Length 0.13 inch. The type locality is given in the original description as Fort Yuma, Calif., and in a later publication as the Colorado Desert, Calif., and the number of specimens as two. In the earlier publication *sordida* is said to be related to *G. guttulata* but to be more finely punctured and still more densely pubescent, so that the punctures are not visible. Later LeConte compared it with *G. consputa*, but here also the elytra are said to be more finely punctured and the punctures almost concealed by the dense golden pubescence.

In the LeConte collection are two specimens, both with round gilt labels indicating the locality as California. The one bearing the label *sordida* and the Museum of Comparative Zoology type No. 4387 has also the abbreviation "Col." meaning probably Colorado Desert. It is the more heavily marked specimen. The second specimen is pale yellow-brown with only a faintly marked median sutural spot. The head in both has a pronounced median depression, more marked than in the other species described by LeConte. The prothorax is shorter and broader, tending to be more rectangular in shape than in the other species, and more deeply and widely depressed on the sides. The elytra are by far the most densely pubescent of any of those hitherto described, the fine, recumbent pubescence entirely concealing the punctation. The abdomen in both is so shriveled that it is impossible for me to determine the sex. These two specimens without doubt are the ones from which LeConte drew up his description.

In LeConte's description of the species he placed emphasis on the dense pubescence, and this character makes it perhaps the most readily recognizable of the genus. The thick silken pubescence gives the elytra the appearance of being plushy. *M. sordida* is also one of the smallest species (2.6 to 3.8 mm.) and has a distinctive, short, broad prothorax, twice as broad as long and sometimes more so, in contrast with that of the other species in which the prothorax is either less than twice or barely twice as broad as long. The shape of the prothorax places this species, together with two hitherto undescribed ones, *apicalis* and *brisleyi*, in a separate group. These three have another point in common—the claws are not simple in the female, as in most species of *Monoxia*, but have a small tooth, making them indistinguishable from the males in this respect. The abdomen of the male does not appear so truncate as in most species of *Monoxia*. The only other species of the genus known to the author having this latter characteristic is the eastern *M. batisii*, which also somewhat resembles the *sordida* group in the shape of its prothorax. *M. batisii*, however, has simple claws in the female.

As in most species of the genus, there is great variability in markings. Some specimens are entirely pale or with only faint reddish-brown spots, while others are heavily and darkly marked. The Texas specimens are large and have unusually long pubescence. Possibly these eastern colonies represent a different species or subspecies. Some of the Arizona specimens are also large, and are very dark, while others are tiny and pale, resembling the Colorado Desert specimens of LeConte. While the general shape of the aedeagus remains the same in all, there is considerable variation in this structure even in a series from a single locality. More study of a greater amount of material is necessary before the status of this widespread and variable species can be satisfactorily worked out.

In Arizona a small pale series has been reported as feeding on *Gutierrezia sarothrae*, "the larvae and adults equally severe in destroying the foliage completely in some badly infested areas" (C. N. Ainslie). H. R. Brisley has collected a large dark series on *Lycium pallidum* in Arizona, and another specimen, much smaller but also dark, on *Gutierrezia sarothrae*. At Thermal, Calif., H. O. Marsh bred a small dark series on *Dondia* sp. Dr. E. P. Van Duzee, at the type locality, collected typical specimens on *Atriplex lentiformis*.

Specimens have been examined from Texas (Brownsville, Del Rio, Corpus Christi, Sabinal), Arizona (Catalina Springs, Santa Rita Mountains, Oracle, Tucson, Tempe, Winslow), Utah (Salt Lake, Kelton, Cisco), Colorado (Delta, Rocky Ford), Nevada (Humboldt Lake), California (Fort Yuma, Thermal, Los Angeles, San Diego, Needles), Baja California (Agua Verde).

MONOXIA ANGULARIS (LeConte)

PLATE 18, FIGURE 2

Galleruca angularis LECONTE, Proc. Acad. Nat. Sci. Philadelphia, vol. 11, p. 90, 1859.

Monoxia angularis LECONTE, Proc. Acad. Nat. Sci. Philadelphia, vol. 17, p. 221, 1865.

Monoxia consputa HORN, Trans. Amer. Ent. Soc., vol. 20, p. 85, 1893 (in part; not LeConte, 1865).

LeConte's Latin description of *Galleruca angularis* may be translated thus: Above ochreous, densely pubescent, densely and not finely punctate, with the prothorax uneven, almost twice as broad as long, anteriorly and posteriorly transversely impressed, canaliculate, with sides oblique, rounded, at base sinuate, the posterior angles with acute prominences; the elytra with an infuscate lateral vitta and small remote spots in a triple series; the body beneath black, the legs yellow, and antennae fuscous. Length 0.22 inch. In a later description he gave the locality as "California near San Francisco? given me by Mr. S. S. Rathvon" and stated that the elytra are finely and densely punctured and not depressed and that the species is easily distinguished by the very prominent angles of the prothorax. He differentiated it from *guttulata* by the form of the prothorax and by the black elytral dots being arranged in series.

In the LeConte collection there are six specimens under this name, one of which bears LeConte's label and the Museum of Comparative Zoology type No. 4382. Of these six specimens two have gilt labels indicating the locality California, three are labeled California and have dots such as Crotch and Casey used, and the last specimen is labeled "S.Ill." The specimen bearing LeConte's label *angularis* corresponds entirely with his description. It is a female, approximately 5.3 mm. long, with simple claws. The head is pale and covered with dense gray pubescence. A dark median line, somewhat impressed, extends down the front. The tip of the mandibles is also dark. The antennae are pale at the base with darker and thicker apical joints; the third joint is scarcely twice as long as the fourth. The prothorax is not quite twice as wide as long, with arcuate sides and prominent basal angles on which is a blunt tooth. The disk is depressed in the middle and on the sides, coarsely and densely punctate, with short, closely appressed pubescence not concealing the punctures. In color it is pale yellow-brown, with faint reddish-brown markings on the sides. The elytra are considerably wider than the prothorax, without marked depressions. The humeri are prominent, the punctation dense, rather coarse and deep at base, and toward the apex becoming finer and shallower. The pubescence is fine, short, and closely appressed without concealing the punctures. Beneath, the body is dark except the last abdominal segments, which are paler on the sides, the last segment being almost entirely pale. The legs are pale. The second specimen, a female, nearly a third smaller (4 mm.), differs from the first by not having the basal angles of the prothorax prominent and by lacking the lateral dark vitta on the elytra and is not the same species. The remaining specimens are all similar to the first and without doubt the same. It seems probable that LeConte had only one specimen at the time that he made his original description, since the second specimen does not agree with it and since he does not mention the other localities.

LeConte gave as the distinguishing mark of this species the prominent posterior angles of the prothorax, a character that is usually pronounced in this species. This prominence of the basal angles is due primarily to the width of the prothorax, coupled with the unusually well developed tooth and the deep incurvation below the tooth on the basal margin. The prothorax is wider than in many species, being nearly twice as wide as long, and covered with short appressed pubescence. It is somewhat irregularly depressed on the sides both at the base and apex. The elytra are broadly oblong, with a short intrahumeral depression, but this is not so long or so pronounced as in *guttulata* or *consputa*, and the punctation is not so shallow as in those two species. The pubescence, shorter than in *guttulata*, differs also in being fine and closely appressed. The apical joints of the antennae are usually stouter than in any other species of *Monoxia*. Besides having rather prominent basal angles of the prothorax, it is still further distinguished by being one of the largest species, the length ranging from 4.5 to 5.3 mm. and the width from 2 to 2.5 mm. It is much larger than *consputa* with which Horn synonymized it. The aedeagus is longer than that of any of the other large western species except *M. grisea*, which has a thicker and heavier aedeagus. The aedeagus of *angularis* resembles somewhat that of *M. batisii* Blatchley, a quite different species occurring in Texas and Florida.

As in both *M. consputa* and *M. sordida*, there appear to be various closely related forms or races of *angularis* from different localities. Along the Pacific coast, from California to British Columbia, the specimens have rather scanty, closely appressed, and inconspicuous elytral pubescence with the punctation beneath distinctly visible. Specimens from eastern Washington (Elk, Pullman, Ritzville), on the other hand, have moderately dense elytral pubescence, and the prothorax is not so depressed on the sides. Specimens from Idaho, Montana, Wyoming, Utah, and Colorado have still denser elytral pubescence, which almost conceals the punctation beneath. In these the prothorax appears wider and less depressed on the sides, with the basal angles more prominent. In all the specimens examined from various localities, the aedeagus is similar in being long, curved, and slender. The tip, however, in specimens from eastern Washington, Idaho, Montana, Utah, and Colorado is wider than in specimens from the Pacific coast and somewhat wedge-shaped. It is possible that with fuller knowledge of their biology, the specimens from the eastern part of its range may prove to represent one or more distinguishable subspecies.

M. angularis is one of the most abundant species of the genus throughout the Pacific and northwestern States, but apparently does not occur in Arizona and New Mexico. It has been collected frequently on *Chenopodium album* and sugar beet (*Beta vulgaris*), and in Colorado and Montana the beetles have been reported as damaging sugar beets.

Distribution.—British Columbia (Creston, Merritt, Rykerts, Trinity Valley, Vernon); Washington (Elk, Medical Lake, Pullman, Ritzville, Spokane Falls, Yakima); Oregon (Corvallis, Forest Grove, Huntington); California (Amadee, Grant Forest, Tulare County; Isabella, King City, Los Angeles; Meadows Valley, Plumas County; Mill Creek Canyon, San Bernardino County; North Hollywood, Pomona, Sacramento, San Joaquin Mill, San José, Shasta County, Sprekels); Idaho (Blackfoot, Bliss, Bonners Ferry, Cabinet, Cascade, Challis, Clarks Fork, Clayton, Council, Driggs, Emmett, Headquarters, Heron, Kura, Lowman, Nampa, Parma, Porthill, Rexburg, Shoshone, Solomon, Twin Falls); Montana (Armstead, Bozeman, Grantsdale, Carlos Mountains, Florence, Hamilton, Musselshell County, Paradise, Plains, Whitehall); Wyoming (Corbett, Jackson, Lake McElroy, Paha); Colorado (Alamosa, Antonito, Colorado Springs, Delta, Fowler, Glen Springs, Gunnison, Gypsum, Hotchkiss, Manitou Park, Paonia); Nevada (Carson City, Lovelock); Utah (Beaver Valley, Bountiful, Coalville, Joseph, Lehi, Ogden, Salt Lake); North Dakota (Williston); "Kentucky"; "S. Ill." (these last two probably not correctly labeled).

MONOXIA DEBILIS LeConte

PLATE 18, FIGURES 7, 8

Monoxia obtusa LECONTE, Proc. Acad. Nat. Sci. Philadelphia, vol. 17, p. 222, 1865.
Monoxia debilis LECONTE, Proc. Acad. Nat. Sci. Philadelphia, vol. 17, p. 222, 1865.—HORN, Trans. Amer. Ent. Soc., vol. 20, pp. 85, 86, 1893.

In LeConte's paper both *obtusa* and *debilis* are described on the same page, the description of *obtusa* preceding that of *debilis*. Horn when uniting them selected the name *debilis*, and his choice is valid under Article 28 of the International Rules of Zoological Nomenclature.

LeConte's Latin description of *debilis* may be translated thus: Pale testaceous, densely covered with pale pubescence, the prothorax less than twice as broad as long, with rounded sides, the posterior angles with a minute tooth, the disk densely punctate, canaliculate, and on each side depressed here and there in places; elytra wider than the prothorax, deeply punctate, the punctures stronger anteriorly; transversely convex and each elytron ornamented with small black spots in a fourfold series; antennae fuscous on the outside. Length 0.15 to 0.18 inch. The type locality is given as "N. M. Mr. Ulke." The pubescence is dense and somewhat silvery; the black dots of the elytra are minute, and those of the subsutural series usually coalesce, forming a narrow, abbreviated line; the humeri are prominent and marked with a larger black spot.

In the LeConte collection is a series of five specimens all labeled "N. M.," the one bearing the label *debilis* being a male with toothed claws. It also bears the Museum of Comparative Zoology type No. 4385. Of the remaining four, two are males and at least one is a female with simple claws. Three of these four are without doubt the same species as the first, but one, a male, which is slenderer and less densely punctate and pubescent, belongs to a different species. It is probable that LeConte did not have before him this entire series when writing his description, since one, a female, does not answer his description of the species as having toothed claws, and another one, with sparser pubescence, is obviously unlike his description (see p. 166). The one bearing the label and the two males like it are similar in coloring. The female has darker markings—the prothorax has two lateral spots and a median streak uniting anteriorly to form an M-shaped figure, and the elytra have the suture dark and the spots coalescing in places to form interrupted vittae, and the under surface is nearly dark with the exception of the last abdominal segments. In the paler male specimens the prothorax is unmarked or only faintly marked, the elytra have less continuous spots, and the mesosternum, metasternum, and first abdominal segments are in part darkened. The head in all four is without prominences; the median line is not much impressed; the pubescence is dense but not long and covers the occipital punctation; the color is pale, deepening on the occiput, but the labrum and median line are dark. The antennae have slightly darker reddish-brown and thicker outer joints. The prothorax has well-rounded sides and is not greatly depressed in the middle and on the sides; the basal tooth is small; the pubescence is dense but not long, obscuring the dense punctation beneath. The elytra are convex with only a short intrahumeral depression and have deep and coarse but distinct and not confluent punctures, becoming finer and shallower at the apex. The pubescence is conspicuous in being moderately dense and of a pale silvery color, but not long.

LeConte's Latin description of *obtusa* may be translated thus: Testaceous, with pale pubescence, the prothorax strongly and densely punctate, less than twice as broad as long, with the sides rounded, the posterior angles obtuse, with a small tooth at the apex, the disk canaliculate and on both sides widely impressed; the elytra densely punctate, the punctures stronger anteriorly; the outer edge of the antennae and the breast and abdomen infuscate. Length 0.20 inch. He based his description on three specimens, one from Andover, Mass. (Mr. Sanborn), and two from Kansas. He distinguished *obtusa* from *angularis* by the angles of the prothorax not being prominent, and from *guttulata* by the elytra being convex and not impressed. In his description of *debilis*, he states that *debilis* most closely resembles *obtusa*, but the claws are distinctly cleft with the inner portion acute and shorter than the outer one.

In the LeConte collection are the three specimens mentioned by LeConte under *obtusa*, two bearing the round green label indicating the locality Kansas and the third with the label "Andover." All three are females with simple claws, and all are pale yellow-brown without elytral markings. The specimen with the label *obtusa*, which also bears the Museum of Comparative Zoology type No. 4383, and the one from Andover are alike, but the third specimen, although closely resembling these, represents an entirely different species, with shallower, denser elytral punctation and with a prothorax quite differently shaped. LeConte's description of *obtusa* without doubt is based on this as well as the other two specimens. He described the prothorax as being widely impressed on the sides, and this applies to this specimen rather than the other two. The first Kansas specimen bearing the label *obtusa* and the one with the label *Andover* are females of LeConte's species *debilis*. Since LeConte himself gives as the chief distinction between *debilis* and *obtusa* the fact that *obtusa* has simple claws, in reality a mere sex difference, it seems best to regard these two specimens (females of *debilis*) as LeConte's *obtusa*, which Horn has already synonymized with *debilis*, and to describe as a new species the second of LeConte's Kansas specimens. This is treated later in this paper as *M. inornata*.

In his descriptions LeConte emphasizes the fact that *obtusa* and *debilis* have convex elytra without depressions and also that the elytra are covered with a dense, silvery, pale pubescence, and unlike any of his descriptions of the other species of *Monoxia* he describes the elytra as being deeply ("profunde") punctate, the punctures being stronger anteriorly. These are the most striking characteristics of the species. *M. debilis* may be distinguished (1) by its size, which approximates that of *guttulata* and *angularis;* (2) by the shape of its prothorax, which is unusually long, and with the width considerably less than twice the length; not greatly depressed, the basal angles not at all prominent, and with a small, acute tooth; (3) the moderately dense silvery pubescence, not so long and not so fine as in some species; (4) the elytral punctation, which is unusually deep, well spaced and not at all confluent anteriorly; in *guttulata* and *consputa* the punctures are much denser; (5) the convex elytra, without depressions.

As Horn states, the locality Andover, Mass., is evidently a mistake. Specimens have been examined from the following localities: Alberta (Medicine Hat, Edmonton); Idaho; Montana (Whitehead); North Dakota (Mott); Kansas; Colorado (Colorado Springs, near Durango, La Plata County; Garland, Manitou, Pingree Park, Ridgway, Rocky

Mountain National Park); Arizona (Flagstaff, Cloudcroft); New Mexico (Magdalena Mountains).

MONOXIA INORNATA, new species

Plate 18, Figure 9

Large (about 4.5 mm.), broadly oblong-oval, pale yellow-brown, frequently without elytral markings or with only pale reddish-brown traces of subsutural vitta and darkened humeri, under surface usually more or less dark; prothorax not twice as broad as long, with posterior angles not pronounced and sides not greatly narrowed anteriorly; elytra without depressions, densely punctate and pubescent. Head with pale lower front, gradually deepening in color over occiput; mouth parts frequently pale or only in part brown, median line dark; the dense occipital punctation partially concealed by pubescence. Antennae pale with outer joints darker. Prothorax more rectangular in shape than in *debilis*, but not twice as broad as long, and with the sides not very arcuate and not much narrowed anteriorly; disk more depressed in middle and on sides than in *debilis*, the basal angles tending to be less obtuse than in *debilis*, and with blunter basal tooth; punctation dense and shallow, somewhat obscured by pubescence; usually without markings, sometimes with an M-shaped darkening. Elytra with intrahumeral sulcus not marked; punctation dense, tending to be confluent, shallow and coarse, and not entirely concealed by the long but not dense pubescence; color frequently entirely pale or with pale reddish-brown traces of subsutural vitta and darkened humeral spot, occasionally the latter extending down the sides. Undersurface more or less darkened, usually metasternum and first abdominal segments dark, but occasionally whole undersurface except last abdominal segment dark. Legs pale. Length, 3.5 to 4.6 mm.; width, 1.5 to 2 mm.

Type, male, and 6 paratypes (3 males, 3 females), U. S. N. M. No. 44019, collected by F. H. Snow; 60 paratypes in collection of University of Kansas.

Type locality.—Gove County, Kansas.

Distribution.—Kansas (western Kansas, Gove County); Texas; Nebraska (Lincoln); North Dakota (Williston); Montana (Glendive); Alberta (Medicine Hat); Wyoming (Sheridan); Colorado (Fort Collins, Salida, Joliet, Paonia, Denver); New Mexico.

Food plants.—Gumweed, *Grindelia* sp. (H. H. Brisley, F. S. Carr), *Grindelia squarrosa* (Colorado Agricultural College).

Remarks.—*M. inornata* has been collected repeatedly on species of *Grindelia*. It is one of the larger species of *Monoxia* and is usually pale yellow-brown with few elytral markings. It differs from *M. angularis* in lacking the prominent basal angles of the prothorax and in having shallower elytral punctation, and it differs from *guttulata* in not having so long or so erect pubescence and not having a marked depression on the elytra. The aedeagus, too, is more acutely tipped. It resembles most closely M. *debilis* but is distinguished from it (1) by the shape of the prothorax, which is more rectangular and depressed, and not so long as that of *debilis*, with only slightly arcuate sides and with blunter basal tooth; (2) by having shallower, denser elytral punctation; (3) by having longer pubescence, particularly noticeable on the prothorax. The aedeagus is not so heavy as that of *debilis* and is more acutely pointed. As stated in the discussion of *debilis*, LeConte confused this species with *obtusa* (=*debilis*).

Both Cooley [10] and Essig [11] refer to a species of *Monoxia* injurious to cottonwood, but in all the collections examined, only a single series, collected by A. N. Caudell at Denver, Colo., which closely resembles this species and which consists of a larva, a pupa, and three shriveled, immature adults, is labeled as being found on cottonwood. I have been unable to learn of any other collector who has observed a *Monoxia* on cottonwood.

MONOXIA GRISEA, new species

PLATE 19, FIGURE 15

Large (about 4.5 mm.), broadly oblong, with dense gray pubescence; elytra not depressed, coarsely but shallowly punctate; aedeagus longer than that of *M. debilis*. Head covered with long, appressed, pale pubescence hiding the punctation; lower front usually paler yellow than occiput, labrum and median line dark, occasionally in dark specimens head entirely dark. Prothorax not twice as broad as long, with arcuate sides and well-developed but not conspicuous basal tooth, disk depressed in middle and on sides; the coarse dense punctation obscured by dense, closely appressed pubescence. Elytra broadly oblong, coarsely but rather shallowly punctate, covered with dense gray pubescence; often entirely pale and appearing grayish from the pubescence; in dark specimens elytra heavily mottled. Body beneath densely pubescent; in pale specimens sometimes entirely pale, in dark specimens dark except the last abdominal segments. Legs pale or speckled. Length, 4.2 to 5 mm.; width, 2 to 2.2 mm.

Type, male, and 4 paratypes (3 males, 1 female), U. S. N. M. No. 44020, collected in June 1904, collector unknown.

Type locality.—Bozeman, Mont.

Distribution.—Montana (Bozeman, Glendive, Gallatin County, Musselshell, Shields River, Yellowstone River Valley); Idaho (Beaver Canyon); Alberta (Medicine Hat, Edmonton).

---

[10] Montana Agr. Coll. Exp. Stat. Bull. 112, p. 60, 1916.

[11] Insects of western North America, p. 473, 1926.

Food plants.—Collected on *Artemisia* sp. (sagebrush) by Kenneth M. King at Musselshell, Mont., and on both *Artemisia* sp. and *Solidago* (goldenrod) by F. S. Carr at Medicine Hat, Alberta.

Remarks.—Like *M. guttulata, M. grisea* has been collected on sagebrush. Unlike *M. guttulata,* it has no conspicuous elytral depressions and also has a longer and differently shaped aedeagus. It is closely related to *M. debilis,* but is usually larger, and may be distinguished by its even denser pubescence and coarser but shallower punctation. The prothorax is a little wider and frequently more depressed than in *M. debilis,* and the aedeagus is considerably longer and more acutely pointed. The species, apparently, is confined to Idaho, Montana, and Alberta.

MONOXIA ELEGANS, new species

Plate 18, Figure 1

Medium sized (about 4 mm.), oblong, moderately convex, with a broad head and narrow and not greatly depressed prothorax; sometimes entirely pale, again with the prothorax and elytra darkly marked and under surface more or less darkened; densely covered with short, fine pubescence, and rather finely and shallowly punctate. Head unusually wide, densely pubescent; in pale specimens entirely pale, in dark ones, speckled; the median line, labrum, and tubercles above antennal base dark. Antennae slender, usually reddish yellow, in dark specimens with the outer edges darkened. Prothorax not twice as broad as long and not much wider than the head, with arcuate, sometimes angulate sides, and small tooth at basal angle; not much depressed in the median line and the sides usually without depressions and more smoothly rounded than in most species of *Monoxia;* densely covered with closely appressed pubescence covering punctation; in pale specimens pronotum entirely pale, in dark specimens sometimes entire disk except margin mottled. Elytra oblong, moderately convex; without depressions; humeri well developed with a short, intrahumeral sulcus; punctation shallow, dense, and rather fine, somewhat obscured by the short pubescence; color variable, usually entirely pale, but sometimes heavily mottled. Body beneath covered with fine pubescence; sometimes pale, occasionally under surface and legs speckled. Length, 3.4 to 4.5 mm.; width, 1.5 to 2.2 mm.

Type, male, and 5 paratypes (4 males, 1 female), U. S. N. M. No. 44021, collected by H. F. Wickham, July 11, 1912. Paratypes also in collection of Museum of Comparative Zoology, Cambridge, Mass., and California Academy of Sciences, San Francisco, Calif.

Type locality.—Deming, N. Mex.

Distribution.—New Mexico (Albuquerque, Deming, Mesilla Park, Las Cruces, State College, Tula Rosa); Arizona (Chiricahua Mountains, Glendale, Hot Springs, Sacaton, Winslow); Utah (Salt Lake); Nevada (Esmeralda County, Pyramid Lake); Colorado, Montana, Idaho (Bruneau, Parma, Succor); Oregon (Adrian).

Food plants.—Kafircorn (*Sorghum vulgare* var. *caffrorum*); *Atriplex canescens* (C. N. Ainslie); *Chenopodium* sp.; sugar beet (*Beta vulgaris*).

Remarks.—This species, approaching in size *M. angularis, guttulata, debilis, inornata,* and *grisea,* the largest species of the genus, is at once differentiated from them by its finer and shallower punctation and its slenderer antennae. In its convexity and comparative lack of pronotal and elytral depressions it is similar to *debilis.* The head in this species appears unusually broad in relation to the prothorax, which is not much wider, in contrast to such species as *M. angularis,* in which the prothorax is much wider than the head. The aedeagus is unlike that of any other species of the genus, being short, broad, and with a broad, rounded tip.

A series of specimens from Salt Lake, Utah, is considerably smaller and darker but otherwise not distinguishable from the usually large and entirely pale Arizona and New Mexico specimens. There is a series from Sprekels, Calif., that has much denser elytral pubescence, which entirely conceals the punctation below. In these the aedeagus, while of similar shape, is even broader. It is not clear whether these California specimens represent a geographic race or subspecies of *elegans* or possibly a distinct species. Specimens from Adrian, Oreg. (on the border between Idaho and Oregon), Idaho, and Montana do not differ from the Arizona and New Mexico ones.

MONOXIA PUBERULA, new species

PLATE 19, FIGURE 14

Medium sized (about 3.5 mm.), slender, not depressed, with a narrow prothorax, pale yellow-brown with few pale reddish-brown markings, and with rather finely punctate and somewhat shining elytra covered with short, inconspicuous pubescence. Head with pale lower front, the color gradually deepening over the occiput; labrum and median vertical line darker. Punctation shallow and obscured by pubescence. Antennae with paler basal joints. Prothorax distinctly less than twice as broad as long, with arcuate, sometimes angulate, sides and a small tooth at the basal angle; disk not greatly depressed, often with only a slight median channel and not marked lateral depressions; densely but shallowly punctate with short, inconspicuous pubescence; sometimes entirely pale, sometimes with reddish-brown Y-shaped median mark and two lateral spots. Elytra elongate, not depressed, with a short intrahumeral sulcus, densely and shallowly punctate, and with short, fine, not at all conspicuous pubescence; surface somewhat shining, sometimes entirely pale, or with faint reddish-brown humeral spot and traces of subsutural vitta and lateral spots, seldom with heavy black markings. Body beneath and legs pale, metasternum occasionally a little darkened; finely pubescent. Length, 3.5 to 4 mm.; width, 1.5 to 1.8 mm.

Type, male, and 44 paratypes, U. S. N. M. No. 44024, collected by D. K. Duncan, July 1931. Paratypes also in collections of Museum of Comparative Zoology, Illinois State Natural History Survey, Kansas University, California Academy of Sciences, Colorado Agricultural College, F. S. Carr, D. K. Duncan, C. A. Frost, H. R. Brisley, M. H. Hatch, and Ralph Hopping.

Type locality.—Wheatfields, near Globe, Ariz.

Distribution.—Texas (Marathon, Marfa); Arizona (Bowie, Bright Angel, Chiricahua Mountains, Globe, Skull Valley); New Mexico (Alamogordo, Sacramento Mountains); California (Mountain Spring); Colorado (Boulder, La Junta, White Rocks, Boulder County); Utah (Salt Lake); Alberta (Medicine Hat).

Food plants.—*Gutierrezia sarothrae* (H. R. Brisley), *Gutierrezia* sp. (F. S. Carr); *Lepidium alyssoides* (J. D. Mitchell and R. A. Cushman, at Marfa, Tex.).

Remarks.—This slender, pale, medium-sized species, evidently abundant in western Texas, Arizona, and New Mexico and extending north to Alberta, is distinctive in being one of the least pubescent of the genus. F. S. Carr wrote that when alive the beetles are a "beautiful translucent light yellow." The elytral punctation, although dense, is shallow and fine, and the pubescence is very short and inconspicuous, so that the elytra appear smoother and more shining than in the other species. Of about the same size as *M. consputa*, it is not so distinctly punctate a species and is slenderer, with a narrower prothorax, and is not depressed. A specimen of *puberula* is in the LeConte collection in the series under *debilis*. It has been reported from both Arizona and Alberta as feeding on species of *Gutierrezia*.

MONOXIA SCHIZONYCHA, new species

PLATE 19, FIGURE 16

Medium sized (about 4 mm.), slender, pale yellow-brown, usually with darker reddish-brown humeral spot and traces of subsutural vitta, occasionally heavily marked with spots and lateral infuscation; elytra rather coarsely and deeply punctate and with short, fine pubescence; claws in both sexes toothed. Head with paler lower front, gradually deepening in color to darker yellow on occiput; labrum and median line dark; punctation dense, pubescence dense and appressed. Antennae paler at base. Prothorax scarcely twice as broad as long, with rounded sides and small basal tooth; punctation dense, shallow, and obscured by the short, dense pubescence; disk depressed in middle and at sides; usually entirely pale but sometimes with a reddish-brown M-shaped marking. Elytra with a long intrahumeral sulcus extending well down the elytra; punctation moderately coarse, dense, and deep, and not obscured by the short, pale and not very dense pubescence; elytra sometimes entirely pale or with traces of the typical interrupted subsutural vittae, often with other scattered pale brown spots, and occasionally heavily marked. Body beneath and legs usually pale, densely pubescent. Claws in both sexes toothed. Length, 3.6 to 4 mm.; width, 1.6 to 1.8 mm.

Type, female, and 4 paratypes (2 males and 2 females), U. S. N. M. No. 44023, collected by R. C. Shannon.

Type locality.—Ritzville, Wash.

Distribution.—Washington (Ritzville); Oregon (La Grande, Echo, Crater Lake Park, Silver Lake, Klamath County); California (Facht, Lassen County); Idaho (Stanley, Atlanta); Colorado (Logan County).

Food plants.—Sugar beet (E. S. G. Titus); *Chrysothamnus* (E. A. Scullen).

Remarks.—Although this species is unquestionably closely related to others of the genus, it differs from most of them by having the claws of both sexes toothed. The only other species of the genus having this peculiarity are three belonging to the *sordida* group. *M. schizonycha* is not related to this group but closely resembles *consputa*. It is a little slenderer and the punctation is a little deeper and coarser than in *consputa*, and the elytral depressions not so pronounced. The punctation is not so shallow and nearly obsolete as in *puberula* but distinct, and the elytral pubescence is a little longer.

MONOXIA OBESULA, new species

PLATE 19, FIGURE 12

Small (about 3 mm.), robust, covered with dense pubescence, the prothorax and elytra not depressed, pale yellow with few elytral markings, metasternum usually dark; elytra distinctly punctate. Head pale, deeper in coloring on the occiput, labrum and median line dark; pubescence dense, hiding punctation. Antennae with slightly darker outer joints. Prothorax considerably less than twice as broad as long, the sides arcuate and with a distinct basal tooth; disk little depressed in middle or on sides; usually entirely pale and covered with dense pubescence hiding the punctation. Elytra broadly oblong, convex, with slight intrahumeral sulcus; punctation dense, shallow and partially concealed by the fine pale pubescence; elytra sometimes entirely pale, usually with small spots forming traces of a subsutural vitta, and often other spots scattered on the sides. Body beneath densely pubescent; mesosternum and metasternum dark, sometimes the first two or three abdominal segments also dark; legs pale. Length, 3 to 3.4 mm.; width, 1.4 to 1.8 mm.

Type, male, and 6 paratypes (4 males, 2 females), U. S. N. M. No. 44025, collected by D. K. McMillan, May 12, 1909.

Type locality.—Kingsville, Tex.

Distribution.—Texas (Corpus Christi, Brownsville, Beeville, Kingsville).

Food plant.—*Chenopodium* sp. (McMillan).

Remarks.—This small, convex, broadly oblong, and densely pubescent species is not easily confused with the other small species, which are all slenderer and usually more depressed. It is similar to the following species, *M. pallida*, and may possibly be an eastern variety, although the punctation is finer and the aedeagus considerably longer.

MONOXIA PALLIDA, new species

PLATE 19, FIGURE 11

Medium sized (about 3.5 mm.), robust, prothorax and elytra little depressed, covered with rather long, pale pubescence, elytra densely and rather coarsely punctate; pale yellow, usually with few elytral spots, metasternum dark. Head pale with a dark median streak and dark labrum; the pale pubescence covering punctation on occiput. Antennae pale. Prothorax not twice as wide as long, with arcuate sides and small basal tooth, little depressed; the coarse, dense punctation nearly concealed by the closely appressed pubescence; usually entirely pale, but sometimes with pale reddish-brown irregular markings. Elytra broadly oblong, convex, with a short intrahumeral sulcus, rather coarsely and densely punctate and covered with dense, pale, sometimes erectish pubescence; usually with few small markings. Body beneath finely pubescent, pale, with the metasternum and sometimes the first abdominal segments dark. Legs pale. Length, 3.2 to 3.8 mm.; width, 1.5 to 1.8 mm.

Type, male, and 52 paratypes, U. S. N. M. No. 44026, collection of H. Soltau.

Type locality.—Florence, Colo.

Distribution.—Colorado (Denver, Florence, Fort Collins, Grand Junction, Hotchkiss, La Veta, Rocky Ford); Idaho (Blackfoot, Parma).

Food plants.—Sugar beet (E. G. S. Titus, H. O. Marsh); *Chenopodium* sp. (H. Lanchester).

Remarks.—*M. pallida* so closely resembles *M. obesula* that I have hesitated in describing it as specifically distinct. In general, the specimens are a little larger, the elytral punctation coarser, and the pubescence not so fine. The aedeagus, while similar, is much shorter. *M. obesula* is known only from along the coast of southeastern Texas, and *pallida* has been collected only in Colorado and Idaho. Possibly specimens from intermediate stations may reveal a gradation between these two very similar although geographically widely separated colonies. The food plant of both is *Chenopodium*.

MONOXIA MINUTA, new species

PLATE 19, FIGURE 10

Small (2.3 to 3 mm.), slender, oblong, prothorax barely twice as broad as long, the sides angulate, disk impressed in the middle and on the sides; elytra finely but distinctly punctate; pubescence moderately dense; color varying from pale yellow with no markings to thickly speckled with black, but even in the pale specimens the under surface more or less darkened. Head variable in color, sometimes entirely pale, sometimes thickly speckled; punctation on occiput nearly concealed by fine pubescence. Antennae pale in pale specimens, with darkened edges in dark ones. Prothorax scarcely twice as broad as long, with sides angulate and with distinct basal tooth; disk impressed in the middle and on the sides; punctation hidden by dense pale pubescence; usually entirely pale, sometimes with faint markings. Elytra narrowly oblong, somewhat depressed, with a long, shallow intrahumeral sulcus; punctation dense, fine but distinct; pubescence moderately dense; color varying from entirely pale yellow to thickly speckled with black. Body beneath covered with fine pubescence; metasternum, at least, and often entire under surface dark; legs pale or speckled. Length, 2.3 to 3 mm.; width, 1.2 to 1.4 mm.

Type, male, and 4 paratypes (3 males, 1 female), U. S. N. M. No. 44027, collected by H. K. Morrison. Three paratypes in Museum of Comparative Zoology, Bowditch collection, Cambridge.

Type locality.—Arizona ("No. Sonora, Mexico").

Remarks.—This is one of the smaller species of *Monoxia* and is distinguished by its slender, oblong shape, its angulate prothorax, distinctly punctate elytra, and long curved aedeagus that has a broad flattened tip, the dorsal opening on which is situated at some distance from the tip. It differs from the *sordida* group in having a narrower prothorax and in being more distinctly and yet not coarsely punctate. Like *M. obesula*, its aedeagus is long and flattened at the tip, but the tip is broader. It is a narrower species than *obesula*, and the sides of the prothorax are more angulate and the disk more depressed.

There are several forms very closely related to this species. Possibly *M. minuta* is a representative of another group like that to which *consputa*, *angularis*, and *sordida* belong, which may be still actively evolving. A series of specimens from Salt Lake, Utah, and one from Challis, Idaho, are unusually small, a little more coarsely punctate, and although the aedeagus is similar the dorsal opening is situated nearer the tip. Still other series from Flagstaff, Williams, Bright Angel, and Ashfork, Ariz., are slightly larger and more coarsely punctate, but in their case the opening on the aedeagus appears to be situated still farther from the tip. A small series from Los Angeles, Calif., appears to be a little more coarsely punctate than the typical ones, and the aedeagus is a little wider.

MONOXIA APICALIS, new species

PLATE 18, FIGURE 5

Small (about 3 mm.), in shape and markings similar to darkly marked specimens of *M. sordida*, but less densely pubescent, with the punctation distinctly visible, the elytra even somewhat shining; claws of both sexes toothed. Head densely punctate and lightly pubescent, with the median line impressed and a slight callosity on either side of the vertex near eye; a dark occipital spot sometimes extending down front to below eyes; front usually pale and labrum dark. Antennae pale, often with darker outer joints. Prothorax fully twice as wide as long, with the sides slightly rounded and with a small tooth at the basal angle; disk widely depressed at sides and in the middle; the pubescence partly concealing the rather dense punctation; usually pale with dark median and lateral spots, these often coalescing. Elytra somewhat depressed, with an intrahumeral depression that extends downward and inward about one-third the length of the elytra; densely and distinctly punctate, the pubescence moderately long but not at all obscuring the punctation; heavy dark markings usually predominating over the pale, the pattern similar to darkly marked specimens of *M. sordida*, with the apex pale. Body beneath shining, sparsely pubescent, more or less darkened; legs usually pale, with a dark ring about middle of femora and tibiae; claws of both sexes toothed. Length, 3 to 3.5 mm.; width, 1.4 to 1.7 mm.

Type, male, and 3 paratypes, U. S. N. M. No. 44029, collected by H. K. Morrison; 8 paratypes in collection of the Museum of Comparative Zoology, Bowditch collection, Cambridge.

Type locality.—Arizona ("No. Sonora, Mexico").

Distribution.—Arizona (Higley, Galiuro Mountain), California (Palm Springs).

Remarks.—Jacoby [12] figured this species in the Biologia Centrali-Americana as *M. guttulata* LeConte. It is a much smaller species than *guttulata* and belongs to a different group, being closely related to *M. sordida*. It has a similarly shaped short, wide prothorax, and the claws are toothed in both sexes, as in *sordida*. The abdomen of the male, however, is more distinctly truncate than in most specimens of *sordida*. It is also distinguished from *sordida* by having less pubescent elytra, which are somewhat shining and the punctation of which is coarser and distinctly visible. The prothorax also appears

[12] Biologia Centrali-Americana, vol. 6, pt. 1, p. 497, pl. 27, fig. 25, 1887.

a little shorter. Unlike most species of *Monoxia*, *apicalis* is uniformly darkly marked in all the specimens examined, the apex of the elytra being always pale. The elytral pattern resembles that of heavily marked specimens of *sordida*. The aedeagus has a slenderer and more finely pointed tip than that of *sordida*.

MONOXIA BRISLEYI, new species

Plate 18, Figure 4.

Small (about 3 mm.), similar in shape to *M. sordida*, with a short, broad prothorax and with the claws toothed in both sexes, but differing from *sordida* in being more lightly pubescent; all the specimens examined much paler than *apicalis;* the aedeagus longer and slenderer than in either *sordida* or *apicalis*. Head with a small callosity on either side of vertex near the eye, the median line impressed; pubescense dense and covering punctation on occiput; color pale, deepening on occiput, labrum sometimes darker brown. Antennae pale with outer joints a little darker. Prothorax approximately twice as wide as long, with slightly angulate sides and small basal tooth; disk depressed on sides and in middle; densely and shallowly punctate, the punctation not entirely concealed by the fine pubescence; color pale, sometimes with a darker median area. Elytra with well-marked humeri and long incurving intrahumeral depression; finely and densely punctate and finely pubescent; color either entirely pale or with small brown spots, more or less serially arranged. Body beneath either entirely pale or with the metasternum and first abdominal segments darker, finely pubescent; legs pale with a dark ring about the middle of the femora and tibiae. Claws in both sexes toothed. Length 2.8 to 3.4 mm.; width 1.3 to 1.5 mm.

Type and 6 paratypes, U. S. N. M. No. 44030, collected by H. F. Wickham, August 10; 3 paratypes in the Museum of Comparative Zoology, Bowditch collection, Cambridge.

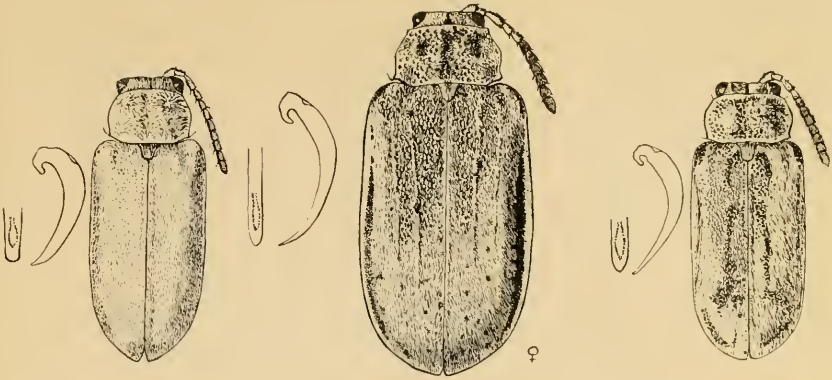
Type locality.—Lancaster, Calif.

Distribution.—Arizona, Utah, California (Inyo Mountains, Lancaster, Palmdale).

Food plant.—Reared from *Chenopodium album* (H. R. Brisley).

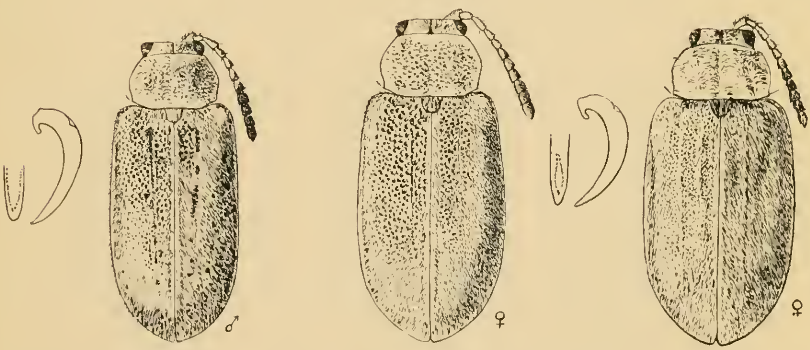
Remarks.—This tiny species, closely related to *sordida* and *apicalis*, differs from both by having a longer and slenderer aedeagus. It is not so densely pubescent as *sordida* and is paler than *apicalis*, often being without any dark elytral markings. The punctation of the elytra is finer and less conspicuous than in *apicalis*, and the elytra are not at all shining as they are in *apicalis*. The abdomen of the male is not so deflexed as in the majority of the species. *M. brisleyi* is named after H. R. Brisley, who reared it from *Chenopodium album* and set it aside as a new species. A. T. McClay has collected it in numbers in the Mojave Desert on a wild desert plant.

U. S. GOVERNMENT PRINTING OFFICE: 1939



1 M. elegans 2. M. angularis type 3. M. batisii

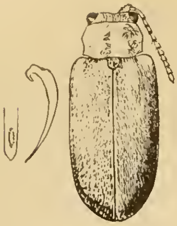
4. M. brisleyi 5. M. apicalis 6. M. sordida type



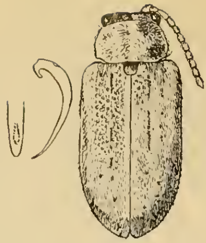
7 M. debilis ♂ type 8. M. debilis ♀ (obtusa type) 9. M. inornata

SPECIES OF MONOXIA.

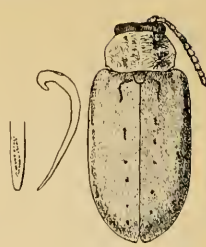
1, *M. elegans*, new species, Deming, N. Mex.; 2, *M. angularis* (LeConte), type, genitalia from Oregon specimen; 3, *M. batisii* Blatchley, Dunedin, Fla.; 4, *M. brisleyi*, new species, Lancaster, Calif.; 5, *M. apicalis*; new species, Arizona; 6, *M. sordida* (LeConte), type, genitalia from Tempe, Ariz., specimen; 7, *M. debilis* (LeConte) type, genitalia from Flagstaff, Ariz., specimen; 8, *M. debilis* (type of *obtusa*, LeConte); 9, *M. inornata*, new species, second specimen under *obtusa* in LeConte collection, genitalia from Gove County, Kan., specimen.



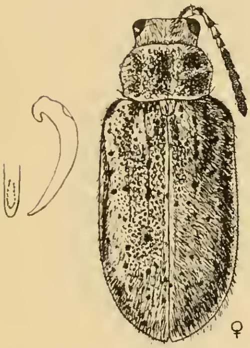
10 M. minuta



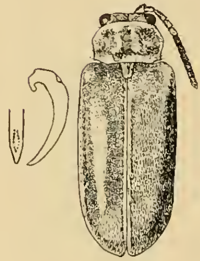
11. M. pallida



12. M. obesula

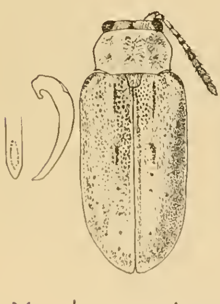


13. M. guttulata type

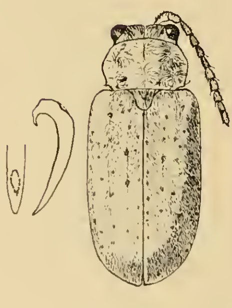


14. M. puberula

15. M. grisea



16 M. schizonycha



17. M. beebei

18 M. consputa type

SPECIES OF MONOXIA.

10, *M. minuta*, new species, Arizona; 11, *M. pallida*, new species, Florence, Colo.; 12, *M. obesula*, new species, Corpus Christi, Tex.; 13, *M. guttulata* (LeConte,) type, genitalia from Ross, Calif., specimen; 14, *M. puberula*, new species, Globe, Ariz.; 15, *M. grisea*, new species, Bozeman, Mont.; 16, *M. schizonycha*, new species, La Grande, Oreg.; 17, *M. beebei* Blake, type, Santa Inez Island, Baja California; 18, *M. consputa* (LeConte), type, genitalia from Mount Tamalpais, Calif., specimen.

PROCEEDINGS OF THE UNITED STATES NATIONAL MUSEUM

issued by the

SMITHSONIAN INSTITUTION
U. S. NATIONAL MUSEUM

Vol. 87 Washington : 1939 No. 3073

OBSERVATIONS ON THE BIRDS OF NORTHERN VENEZUELA

By Alexander Wetmore

An extended journey in the southern republics of South America several years ago aroused a wish to know something in life of the birds of the northern section of that great continent, a desire that was finally gratified in the latter part of 1937 when arrangement was made for field work in Venezuela. In brief, in this second journey work began at the seacoast 50 miles west of La Guaira, was extended inland to the higher levels of the Cordillera de la Costa at Rancho Grande, and, with brief observations at Maracay in the valley of Aragua, was concluded with a stay at El Sombrero in the northern Orinoco Valley 80 miles due south of the capital city of Caracas. The studies thus included a transit through the arid tropical zone of the north coast, the subtropical rain forests of the coast range, the open valley of Aragua, and the northern section of the llanos down to that point where the blanket of thorny scrub that extends southward from the hills on the northern boundary of that great level plain begins to open out in the vast savannas that reach toward the Río Orinoco.

The collections from the region included in the Parque Nacionál serve as a link to join work done by earlier investigators in the region of the Cumbre de Valencia and Puerto Cabello in Estado Carabobo, and in the vicinity of Caracas. The region between Ortiz and El Sombrero is one that has been known to ornithologists only casually.

ITINERARY

At 7 o'clock on the morning of October 16, 1937, the S. S. *Stuyvesant* of the Royal Netherlands Steamship Co. came slowly in to the crowded dock at the port of La Guaira, Venezuela, where with the assistance of Louis B. Mazzeo, American vice-consul, free entry for my equipment for scientific work was soon arranged. Shortly after 11 I was on the way to Caracas by auto up the winding road that leads across the steep, dry, stony slopes of the coastal mountain range, partly covered with low, thorny scrub, and partly bare except for clumps of grassy vegetation. Near the summit, where the clouds hung low, the land is productive and vegetation more abundant.

Through the friendly cooperation of the American Minister, the Honorable Meredith Nicholson, and the gracious assistance of Dr. E. Gil Borges, Ministro de Relaciones Exteriores of Venezuela, necessary permissions for travel and for the collection of specimens were quickly arranged. The Minister of the Departmento de Agricultura y Cria, Señor H. Parra Pérez, and the Director de Tierras Baldias, Bosques y Aguas, Señor Miguel Parra Sanoja of the same department, were interested in my proposed studies and afforded the fullest cooperation. I had also the friendly assistance of Dr. Henri Pittier, the veteran botanist, long a friend and correspondent of the Smithsonian Institution. While these arrangements were going forward I had opportunity to visit the bird market in Caracas, the Museum Bolívar, where I saw the sundial said to have been made by Humboldt, and many other historical objects of interest, and to become familiar with the city.

On October 20 I moved to Maracay where field work began the following day, when Ventura Barnés, Jr., took me to an old estate at La Providencia, 10 kilometers east of Maracay. Here I worked through an area of level land divided between small, open fields and woodland in which much of the undergrowth had been cleared. Beyond lay rolling hills grown with grass, with thick scrub filling the valleys. My first birds were obtained in this area.

On October 22, Dr. Pittier, strong and active at the age of 80, took me into the great Parque Naciónál, recently established by the Venezuelan Government as a wildlife reserve under the Department of Agriculture. It was my privilege here to make a preliminary survey of the birdlife of this vast area where few observations had been made before, with highly interesting results that are detailed in the pages that follow.

A paved auto road extends through the park from the southern border at Guamitas, 14 kilometers northwest of Maracay, over the mountain range of the Cordillera de la Costa, down through broken foothills and across the lowlands on the north to the sea, with a branch toward the west to Turiamo. On the way over we stopped briefly near Los Riitos to examine the beautiful rain forest and then continued to Ocumare de la Costa, where I was established near the beach at Independencia in an airy, comfortable little house belonging to the park administration. The small bay of Ocumare, about 2 miles across, is bounded by rocky headlands extending on either side into the sea. A rush-grown lagoon or cienaga lay back of the house in a level, open playa, indicating a former greater extent for the lake. This led to steep, rocky hills grown with great cacti and thorny scrub, while in the background was the sprawling village shaded with coconut palms, with the distant mountains beyond. This was typical arid tropical zone.

Farther inland, along the Río Ocumare, the climate seemed more humid, and the tree growth was heavier and more verdant. Here were extensive plantations of cacao and a few rubber trees with tall shade trees overhead.

On October 23 in company with Dr. Pittier I collected along the Río Ocumare at La Trilla at about 250 feet elevation in the foothills, 10 kilometers south of the village of Ocumare de la Costa. Here were small brush-grown pastures, small plantations along the river, and brush-grown hill slopes above. On October 24 and 31 Mr. and Mrs. Ventura Barnés, who had come over for these week ends, took me to the winding valley of the Río Cumboto toward Turiamo, where we climbed to an elevation of 700 feet. The valley was given over to cacao plantations, with partly open slopes above on which grew a gallery forest that in places tended to become very dense.

For the rest of the time I worked near Independencia, about the lagoon, back into the hills on either side, and on the west crossed over a high, narrow ridge into the wooded valley behind the uninhabited Playa de Maya. Inland the sun was extremely hot, but at my house on the beach there was always a cooling breeze.

On the evening of October 31 I returned to Maracay, and remained the following day, having opportunity to visit the zoological gardens at Las Delicias, 6 kilometers from town, and the shores of Lake Valencia. That evening I returned to the mountains, where through the kindness of Señor Tacito A. Martinez I was established in the country house called Quinta Rancho Chico, built on a mountain shoulder on the southern slope at an elevation of 3,320 feet, less than half a mile from the hotel under construction at Rancho Grande, also on the south slope but nearer the crest. The highest point on the pass through which the road passes is known as El Portachuelo, where the elevation is 3,540 feet. Slopes were steep, so that in my work I climbed either up or down, sometimes laboriously because of wet and slippery ground. Seldom did I find an extensive space of level trail.

The mountain slopes above 3,000 feet on the south and above 2,000 feet on the north were covered with a magnificent rain forest that extended over all the higher region. In many places huge trees rose from buttressed roots to heights of 150 feet or more, and everywhere the growth was dense. Tree trunks were wound with climbing figs and other vines, masses of parasitic plants covered their limbs, and from their higher branches long, slender lianas hung like ropes, sometimes extending down for 50 to 75 feet without leaf or branch to break their straight, symmetrical lines. Below these the undergrowth was dense, forming heavy shade. On the mountain slopes a small palm with the trunk set closely with long, black, needle-sharp spines was something to be avoided with care. On the higher pitches were masses of a climbing bamboo. Only along the roadway were there small clearings.

It rained daily in the afternoon, and for much of each day clouds of mist swept across the mountains so that the undergrowth was always saturated with water.

Trails in this forest were few, and in general I worked along the ridges in going into the higher levels. One of the best localities for birds lay along an old trail leading along the crest of the ridge to the west from El Portachuelo. Here the air currents were such that there was greater freedom from fog than elsewhere nearby, so that birds seemed to come up the slopes from either side and to congregate along the ridge. This trail ascended to about 3,700 feet elevation. It was not particularly difficult to go to the same altitude or a little higher on the slopes above the house, and on November 8 I climbed up the Cumbre de Rancho Grande to the summit of the lower of the two peaks of this range at 4,500 feet elevation. Above 3,700 feet the land rose less steeply and the undergrowth was more open, so that it was possible to see about. Here I found an old trail, formerly used in crossing the mountain to Ocumare de la Costa, but now abandoned, leading across the ridges. A small, creeping bamboo, also found lower down, at 4,000 feet, gave some trouble. I had expected to climb the higher peak, but by the time I had reached the ridge leading to it the clouds swept over the mountain, so that there was no point in going farther, as there was no view and birds could not be found.

In the deep shadows of the undergrowth of this forest it was always wet and birds were frequently difficult to see. A number of small species ranged through the forest in little flocks, so that sometimes I would travel for some distance without seeing the flutter of a wing, and then the branches all around would be alive with quickly moving forms of a dozen species of birds. Other kinds were solitary and ranged in pairs or alone. In working here I had always a man with me to retrieve my specimens, and when a bird fell I had to watch carefully until he had laboriously reached the spot, as otherwise the specimen would certainly have been lost. Daily I heard strange birds, often close at hand, that I could not identify, and daily novel species that I had not seen before came to hand.

The air in these mountains was cool and pleasant, and rushing streams furnished an abundance of pure water, uncontaminated, as there were no human inhabitants in the forest above. Morning and evening I had wonderful views of Lake Valencia and the broad valley of Aragua, and at other times I never tired of looking out as I worked during the afternoon with specimens or with notes to watch the swift, soundless drift of fog across the slopes. Rain, which fell daily, came mainly in the afternoon or at night and so did not interfere with morning field work. On one or two days when fog covered the mountains and birds could not be found I descended to 3,000 feet on the north toward Guamitas to the open slopes below the forest. I worked down also to 2,500 feet below Los Riitos on the north.

On the evening of November 10 I returned to Maracay, and on November 11 I collected again in the area of little fields and partly cut-over woodland at La Providencia. The sun seemed almost oppressively hot after the work of the last few days in the cool, shaded forests of the mountains, and mosquitoes were very bad. Birds abounded, and I marveled at their number as well as at their almost bewildering variety.

At dawn on November 12 Ventura Barnés and I left Maracay by auto for the northern llanos. Near Turmero we turned south, passed an extensive swamp near Cagua, and then crossed through a low pass to San Juan de los Morros, the latter being two high points of stone of picturesque form. A huge statue of San Juan, 60 or 70 feet tall, recently erected, dominated the flat-topped village.

From this point the hills became lower and the valleys broader, with the land everywhere covered with low thorn scrub. We stopped to collect at points north and south of Parapara. Beyond Ortiz the hills disappeared and the land was level except for slight undulations. The thorn scrub here was dense and in places rose to the dimension of trees. By noon the heat was intense, and we stopped for a time at a farm called Hato Paya, 28 kilometers north of El Sombrero, to prepare the birds we had secured, before they spoiled. The elevation here was 400 feet above the sea. Our host had not seen motion pictures as yet, but had heard a radio. There was much complaint of malaria.

At nightfall we reached the town of El Sombrero, where we located in a small hotel, and the following day collected at a point 12 miles to the south. Barnés then returned to Maracay.

El Sombrero is a town of a few hundred people at an altitude of 400 feet on the Río Guarico, which here runs beneath a low bluff, the town and the region north of it called La Meseta being elevated about 40 feet above the surrounding plain. El Sombrero is at the point where open savannas appear, there being one of some extent on the Meseta near town and others to the south. The Great Banco de la Sabana begins below Calabozo. In these savannas the soil is stony and poor, the vegetation mainly clumps of grass, and the earth is visible everywhere. The prairies are surrounded by dense thorn scrub and are dotted with occasional bushes. Along the edge of the Meseta are small lagoons, about which several species of trees grew to good height.

The Río Guarico here is a shallow, muddy stream running swiftly, 50 to 60 yards wide, with many winding sloughs leading back into its flood plain. These were bordered with bushes, and in places there were heavy stands of low trees or thickets with scattered larger trees among them. The ground was open beneath because of floods. Where the land was higher some of it was farmed, but most of the area was used only for grazing. Heavy, driving rains came during my stay here but fell in afternoon or at night, the mornings being clear.

On November 21 I returned to Maracay, stopping en route briefly to collect in the thickets and woods along a little stream at Hato Paya. The following day was given to packing, and on the morning of November 23 I returned to Caracas. On November 24 I sailed north from La Guaira on the Grace Line steamer *Caracas* (of the old Red D Line).

NORTH AMERICAN MIGRANTS

To appreciate fully the intricate marvel of the great migrations that annually carry millions of our birds south and then bring them again to their northern homes one needs to see the arrival, movement, and departure of these familiar birds in the Tropics. Here well-known species stand out in bold relief among the scores of strangers with whom they mingle, and the fact of their long journeys, known in the abstract before, becomes concrete and definite. Never have I had this impressed on me more forcefully than during my observations at Ocumare de la Costa, Venezuela, during the latter part of October 1937.

Beyond the sandy beach in front of my veranda the blue waters of the Caribbean Sea reached to the north to distant Puerto Rico and Hispaniola, interrupted only by the nearby islands of Curaçao, Bonaire, and Los Roques and a few scattered islets, all out of sight below my horizon. To the northeast lie the Lesser Antilles, and much farther to the northwest are Jamaica and Cuba.

The southward movement of migration was in full swing during the period of my observation, and daily birds of the North, familiar friends since boyhood, passed before me. Spotted and solitary sandpipers, greater and lesser yellowlegs, and western sandpipers fed about the lagoon, bobolinks called to me from the rushes, barn swallows circled about the kiosk (built for Gómez) where I ate my meals, and scores of blackpoll warblers fluttered through the trees and bushes. In my collecting I scanned birds indistinctly seen with field glasses to avoid shooting more of these migrant individuals than my studies required. Here daily I had self-evident fact that northern birds did winter in the Tropics, and I was literally forced to ponder on the irresistible urge that had carried them over the vast intervening distance and the mysterious force that had guided them to the shores of northern South America over routes that to those individuals hatched that year at least were wholly unknown.

There was brought home to me also more definitely than ever before the tremendous loss of life that this journey entails. The wastage of modern human battlefields, though terrible beyond words, is as nothing in comparison. Here on this open shore small, feathered migrants often made a land fall in a state of evident exhaustion. Blackpoll warblers that travel south through the Eastern United States late in September with their bodies so cased in oily fat that the skin is fairly distended reached the Venezuelan coast with this reserve entirely exhausted and even the body muscles obviously thin and wasted. Often in early morning I found little groups of them feeding rather listlessly on the short herbage of the open flats where they hopped slowly about in search of food. Others ranged through weeds and bushes without caring at the moment to proceed farther inland to the more secure shelter of the forests.

Some obviously had barely made a land fall after an exhausting sea journey, as in some of those that I handled the flight muscles that move the wings were reduced to thin bands through which the angular ridges of the breast bone projected. One yellow-billed cuckoo found freshly dead in the bushes back of the beach in early morning had evidently arrived too exhausted to survive, as little remained of its once strong muscles except flaccid bands over its bones.

It was easy to visualize the hundreds and thousands that wandered over the water until they fell to drown, and the hundreds of others that arrived only to succumb to the strains imposed by the exhausting journey.

ANNOTATED LIST OF SPECIES

Family COLYMBIDAE

COLYMBUS DOMINICUS SPECIOSUS (Lynch Arribálzaga)

Podiceps speciosus FELIX LYNCH ARRIBÁLZAGA, La Ley, Buenos Aires, July 2, 1877, p. 1 (Baradero, Buenos Aires, Argentina).

A number of these small grebes lived in the lagoon at Independencia, below Ocumare de la Costa, where they were seen daily from October 22 to 31. On October 29 I collected two males. They swam about on the open water when undisturbed, but at any alarm pattered off across the surface or dived to the cover of rushes.

So far as I am aware smaller size and the absence of decorative plumes in the breeding plumage are the only definite criteria for using *Poliocephalus* Selby as a genus separate from *Colymbus* for the present species of grebe and its relatives. The distinction does not appear to me sufficient to sanction such procedure.

A number of years ago I called attention to the description of *Podiceps speciosus* by Felix Lynch Arribálzaga in La Ley, a daily paper published in Buenos Aires, Argentina, for a short period under the editorship of Enrique Lynch Arribálzaga, indicating that this might become a valid name.[1] Recently Steullet and Deautier [2] have used *speciosus* as a subspecific name, giving as its range western Ecuador and Matto Grosso to Paraguay, Uruguay, and Argentina. *Colymbus dominicus brachyrhynchus* Chapman,[3] currently used for these grebes from South America, becomes a synonym, as the name *speciosus* apparently should apply to these grebes throughout the entire range in South America. The only specimen I have seen from Argentina, a male that I collected at Kilometer 182 in the Territory of Formosa, is paler than others from farther north, the difference in color apparently being due to the fact that it is an immature individual. Birds from Matto Grosso southward, including the type of *brachyrhynchus*, have slightly longer wings than most of those from the northern part of the continent. There is, however, much variation, some of the northern birds being as large as the southern ones. With the material at hand it is not possible to work out two distinct groups on the basis of size.

Family PELECANIDAE

PELECANUS OCCIDENTALIS Linnaeus: Brown Pelican

Pelecanus occidentalis LINNAEUS, Systema naturae, ed. 12, vol. 1, 1766, p. 215 (Jamaica).

My first view of the brown pelican came at La Guaira on October 16 as our ship came into harbor. From October 22 to 31 they were

[1] Wetmore, A., U. S. Nat. Mus. Bull. 133, 1926, pp. 43–44.

[2] Cat. Sist. Aves República Argentina, Obra Cincuentenario Mus. La Plata, vol. 1, pt. 1, 1935, p. 175.

[3] *Colymbus dominicus brachyrhynchus* Chapman, Bull. Amer. Mus. Nat. Hist., vol. 12, December 23, 1899, p. 255 (Chapada, Matto Grosso, Brazil).

so common in the Ensenada de Ocumare that they were constantly in view from the house where I had my quarters. Birds in immature and adult plumage were observed, with some of the adults in winter and some in breeding dress. They seemed to roost on the rocky islet called El Morro opposite the eastern headland of the bay, and it appeared that there was a breeding colony there. One morning at dawn two pelicans came flying out from this island past the house to begin their fishing while it was still so dark that bats were circling over the beach.

It is unfortunate that the short time available and preoccupation with other birds did not allow me to carry out my intention of collecting specimens of this pelican, since there is some question as to the form that occurs here. Dr. Robert Cushman Murphy [4] refers a specimen from Cumaná, Venezuela, to the northern race, *P. o. carolinensis*. Additional material should be examined to determine definitely which form breeds in this area, as there is possibility that the northern bird may reach Venezuela as a migrant or wanderer.

Family SULIDAE

SULA LEUCOGASTER LEUCOGASTER (Boddaert): Brown Booby

Pelecanus Leucogaster Boddaert, Table des planches enluminéez, 1783, p. 57 (Cayenne).

From October 23 to 31 a single bird was seen at intervals fishing with the brown pelicans in the Ensenada de Ocumare.

Family FREGATIDAE

FREGATA MAGNIFICENS ROTHSCHILDI Mathews: Caribbean Man-o'-war-bird

Fregata minor rothschildi Mathews, The birds of Australia, vol. 4, 1915, p. 280 (Aruba Island).

In the Ensenada de Ocumare the man-o'-war-bird was as common as the brown pelican, so that it was seen daily from October 22 to 31. The birds roosted on the rocky islet of El Morro opposite the eastern headland bounding the bay and very probably nested there. On October 31 I saw one flying with the throat pouch enlarged, bright red in color, and evidently in mating stage.

When schools of small fishes broke at the surface before the drive of submarine predators I saw the man-o'-war-birds sweeping down repeatedly to snatch at them with their bills, darting their heads into the crests of the waves as, supported by their broad wings, they poised or rose and fell. On other occasions they were observed pursuing royal terns carrying fish, in their common parasitic role of robber.

[4] Oceanic birds of South America, vol. 2, 1936, p. 808.

To me, though I have cited these notes under the name *rothschildi*, there is still uncertainty as to the distinctness of an eastern race of this bird in the Caribbean–Gulf of Mexico area as distinguished from the group found on the Galápagos Islands.

Family ARDEIDAE

BUTORIDES VIRESCENS VIRESCENS (Linnaeus): Eastern Green Heron

Ardea virescens LINNAEUS, Systema naturae, ed. 10, vol. 1, 1758, p. 144 (South Carolina).

On October 29 I found two green herons in low bushes and trees standing in water in the lagoon behind the beach north of Ocumare de la Costa and collected a female. The birds were shy, and the one secured was obtained with difficulty.

The specimen is evidently a bird of the year as it has the sides of the neck duller, less rufescent than in adults, agreeing in this with immature individuals. The wing measures 179 mm. It is assumed to be a migrant, from the date at which it was obtained, and is apparently the first record of this race for Venezuela. Todd and Carriker [5] report *B. v. virescens* from the coastal area of the Santa Marta region, Colombia, in October and December.

BUTORIDES STRIATUS STRIATUS (Linnaeus)

Ardea striata LINNAEUS, Systema naturae, ed. 12, 1766, p. 238 (Surinam).

At El Sombrero two herons of this group (with gray necks) were seen along the Río Guarico on November 20. Their allocation to the typical subspecies is based on supposition, since specimens were not taken.

FLORIDA CAERULEA CAERULESCENS (Latham)

Ardea caerulescens LATHAM, Index ornithilogicus, vol. 2, 1790, p. 690 (Cayenne).

Recorded daily at the lagoon near the beach at Ocumare de la Costa from October 22 to 31, and seen near El Sombrero on November 14 and 20.

LEUCOPHOYX THULA THULA (Molina): Snowy Heron

Ardea Thula MOLINA, Saggio sulla storia naturale del Chili, 1782, p. 235 (Chile).

Single individuals were observed about the lagoon near the beach below Ocumare de la Costa on October 28 to 31, at La Providencia near Maracay on November 11, and near El Sombrero about small lagoons and along the Río Guarico November 18 to 20.

[5] Ann. Carnegie Mus., vol. 14, 1922, p. 135.

TIGRISOMA LINEATUM LINEATUM (Boddaert)

Ardea lineata Boddaert, Table des planches enluminéez, 1783, p. 52 (Cayenne).

Near a small slough leading into the Río Guarico below El Sombrero on November 20 I watched a tiger bittern for some time as it rested quietly in the open branches of a low shrub.

Family THRESKIORNITHIDAE

GUARA ALBA (Linnaeus): White Ibis

Scolopax alba Linnaeus, Systema naturae, ed. 10, vol.1, 1758, p. 145 (South Carolina).

At Independencia, below Ocumare de la Costa, an immature bird was seen daily in the lagoon from October 25 to 30.

Family ANATIDAE

QUERQUEDULA DISCORS (Linnaeus): Blue-winged Teal

Anas discors Linnaeus, Systema naturae, ed. 12, vol. 1, 1766, p. 205 (South Carolina).

From October 22 to 30 from 6 to 20 of these teals were seen daily on the lagoon at Independencia, below Ocumare de la Costa. No one hunted them and they were quite tame, paying little attention to my shooting at other birds except when I was working about the shores of the lagoon. On October 28 at sunrise while watching with 8-power binoculars a man-o'-war-bird far out at sea, I saw in the distance beyond it a bird flying low over the water coming from due north toward the land. Gradually its form became larger and larger in my vision until finally as it reached the beach and rose a little to cross over to the lagoon I identified it as a swiftly flying blue-winged teal. I realized then that I had actually seen a northern migrant as it made a landfall on the Venezuelan coast after its long flight across the Caribbean Sea.

Family CATHARTIDAE

CORAGYPS ATRATUS FOETENS (Lichtenstein)

Cathartes foetens Lichtenstein, Verzeichniss von ausgestopften Säugethieren und Vögeln, 1818, p. 30 (Paraguay).

The black vulture, known ordinarily as the zamuro, was seen constantly in the air over the towns and cities and was widely distributed in the lowlands where it was seen daily. The humid forested section near Rancho Grande in the mountains was less to its liking, so that it appeared over the higher slopes only on exceptionally clear days. In the llanos it was especially common. At times a hundred or more were seen gathered in a close band on the ground about some dead animal.

CATHARTES AURA RUFICOLLIS Spix

Cathartes ruficollis SPIX, Avium species novae . . . Braziliam, vol. 1, 1824, p. 2 (interior of Bahia and Piauhy).

The turkey vulture though less abundant than the black vulture was observed in all the localities visited. One was seen near La Guaira on October 16, and these birds were common at Ocumare de la Costa October 23 to 31. They were observed regularly in the mountains near Rancho Grande November 4 to 10. In the northern llanos they were more common, so that many were noted near El Sombrero from November 13 to 21.

From field observation of birds resting in the sun with outspread wings it seemed to me that the end of the wing was more rounded than in *C. a. septentrionalis*, the bird of the Eastern United States. In supsequent examination of specimens in museums this supposition seemingly is verified, as in three skins from Venezuela I found the length of the wing tip (i. e., the extension of the longest primary beyond the end of the longest secondary) to range from 85 to 106 mm., while the total length of the wing varied from 495 to 503 mm. In 11 birds from the Eastern United States the wing tip varies from 97 to 170 mm., 7 of this series measuring from 130 to 170 mm., the total wing length being 520 to 570 mm. The matter should be checked with more specimens of *ruficollis*.

Family ACCIPITRIDAE

HARPAGUS BIDENTATUS BIDENTATUS (Latham)

Falco bidentatus LATHAM, Index ornithologicus, vol. 1, 1790, p. 38 (Cayenne).

On November 6 in heavy forest along the trail at El Portachuelo above Rancho Grande my attention was attracted by the insistent chipping calls of a large hummer (*Cyanolesbia kingii margarethae*), and I looked up to see it scolding one of these hawks resting on an open limb a few feet above my head. The bird proved to be a female, very fat. In color this specimen is somewhat darker above than four skins in the National Museum from Demerara. It measures as follows: Wing 227, tail 145, culmen from cere 16.2, tarsus 44.8 mm. The iris was orange-red; maxilla black, except for a dull-gray area extending across the posterior tooth and the base of the tomium behind; mandible dull gray; cere dull greenish; tarsus bright yellow; claws black.

HETEROSPIZIAS MERIDIONALIS MERIDIONALIS (Latham)

Falco meridionalis LATHAM, Index ornithologicus, vol. 1, 1790, p. 36 (Cayenne).

One was seen near Ortiz on November 12, and from November 13 to 21 one or two were recorded nearly every day near El Sombrero.

The call is a high-pitched scream, suggesting that of the red-tailed hawk (*Buteo jamaicensis*).

BUTEO PLATYPTERUS PLATYPTERUS (Vieillot): Broad-winged Hawk

Sparvius Platypterus VIEILLOT, Tableau encyclopedique et méthodique . . ., vol. 3, 1823, p. 1273 (Schuylkill River, Pa.).

On the evening of November 5 at Rancho Grande I was told that there was a hawk resting in a tree nearby and walked out to shoot a female broadwing. This bird was thin and poor like other recently arrived migrants from the north. On November 6 I saw another, and on November 9 I killed another female in the lower garden at the house.

BUTEO MAGNIROSTRIS MAGNIROSTRIS (Gmelin)

Falco magnirostris GMELIN, Systema naturae, vol. 1, pt. 1, 1788, p. 282 (Cayenne).

At Ocumare de la Costa this hawk was fairly common at the end of October, but none were seen in the rain forest area at Rancho Grande. Near Maracay several were seen on October 21, when a male was taken, and on November 11. Areas of open forest seem best suited to the needs of this species so that in the scrubs covering the northern llanos it was abundant. I secured a male near Parapara on November 12 and from November 13 to 21 saw several daily near El Sombrero. Usually they rested quietly on open branches and when I approached protested with shrill, squalling calls, finally flying off through the trees.

As indicated by Peters [6] the group of hawks that has been called *Rupornis* is not separable generically from *Buteo*. As a group *Buteo magnirostris* differs from such ordinary Buteos of the New World as *B. jamaicensis*, *B. lineatus*, and *B. platypterus* in having the color pattern of the immature little different from that of the adult. But this can hardly be considered a generic character.

The hawks of this type from northern Venezuela have been listed as *Buteo magnirostris insidiatrix* (Bangs and Penard), which differs from *magnirostris* in paler color particularly above, but if this race occurs in the Republic it must be in the coastal region of the northwestern section. The two specimens secured at Maracay and Parapara are slightly darker above than *magnirostris* as represented by skins from British Guiana, and a male in the National Museum from Valle in the Mérida region is also dark, all being very distinct from the paler *insidiatrix*.

HYPOMORPHNUS URUBITINGA URUBITINGA (Gmelin)

Falco Urubitinga GMELIN, Systema naturae, vol. 1, pt. 1, 1788, p. 265 (Brazil).

Near Ocumare de la Costa from October 25 to 31 these hawks were seen occasionally resting on tall cacti or agave stalks on the dry

[6] Check-list of birds of the world, vol. 1, 1931, p. 228.

hillsides above the lagoon. Others were observed near El Sombrero from November 17 to 20. Once a bird in partly adult plumage screamed shrilly at me from the branches of a low tree but did not fly as I approached, though finally I shot a small bird within 50 yards of it, merely hopping and walking through the limbs to the farther side of the tree.

GERANOSPIZA CAERULESCENS (Vieillot)

Sparvius caerulescens VIEILLOT, Nouv. Dict. Hist. Nat., vol. 10, 1817, p. 318 (Cayenne).

Near El Sombrero this hawk was fairly common. On November 13, 12 miles south, as Ventura Barnés and I were examining some birds we had just shot in a dense growth of scrub, one alighted on a limb near us and was taken. This was a male. Others were seen on November 15 and 18.

While it has been proposed to consider all the forms of *Geranospiza* conspecific it appears to me that they should be separated into three distinct species as follows:

GERANOSPIZA GRACILIS (Temminck):

With buff to nearly white under tail coverts, and underparts barred narrowly with black and white. Two races *gracilis* and *flexipes*.

GERANOSPIZA CAERULESCENS (Vieillot):

Slate gray below, including the under tail coverts. When white bars are present these are narrow, separated by wide spaces of slaty gray.

GERANOSPIZA NIGRA (Du Bus):

Dark neutral gray to almost black below. White cross bars almost obsolete separated widely by the darker color. Three races, *nigra*, *livens*, and *balzarensis*.

Family FALCONIDAE

MICRASTUR RUFICOLLIS ZONOTHORAX (Cabanis)

Climacocercus zonothorax CABANIS, Journ. für Orn., 1865, p. 406 (Puerto Cabello, Venezuela).

On November 9 at an elevation of 3,300 feet below Rancho Grande I heard a loud, squalling call coming from heavy woods near the highway. After I had "squeaked" a time or two this beautiful hawk came flying to a branch in heavy shade where I shot it. Apparently this was a regular perch as the ground beneath was covered with droppings. The specimen is in the rufescent color phase and had the maxilla, tip of the mandible, and the cere dull black; the bare skin about the eye and loral region, and the base of the mandible dull orange-yellow; tarsus and toes orange-yellow; claws black; and the iris rufous-brown, of the same shade as the back. On November 10 I heard the barking calls of another in the woods above the house but could not find the bird. These small forest hawks seem rather inactive, probably because with food abundant and easily secured there is little reason for them to move about.

The female taken has the following measurements: Wing 182, tail 173, culmen from cere 15.8, tarsus 56.2 mm.

MILVAGO CHIMACHIMA CORDATUS Bangs and Penard

Milvago chimachima cordata Bangs and Penard, Bull. Mus. Comp. Zoöl., vol. 62, 1918, p. 35 (San Miguel Island, Pearl Islands, Bay of Panamá).

Near Ocumare de la Costa these birds were seen October 24 and 30, and at El Sombrero they were common from November 12 to 21. They perched familiarly on the backs of burros and on cattle, which ordinarily paid no attention to them. I saw the birds on occasion tearing at the sores made by parasitic fly larvae. As no specimens were taken identification is made on geographic grounds.

POLYBORUS CHERIWAY CHERIWAY (Jacquin)

Falco cheriway Jacquin, Beyträge zur Geschichte der Vögel, 1784, p. 17, pl. 4 (Aruba, and coast of Venezuela).

The caracara was found in small numbers near Ocumare de la Costa, was fairly common near Maracay, and was observed daily at El Sombrero from November 13 to 21.

FALCO FUSCO-COERULESCENS FUSCO-COERULESCENS Vieillot

Falco fusco-coerulescens Vieillot, Nouv. Dict. Hist. Nat., vol. 11, 1817, p. 90 (Paraguay).

On November 13 Ventura Barnés and I found a beautiful pair of these falcons in a tree at the edge of a small savanna 12 miles south of El Sombrero. They rested quietly, facing the wind, while we walked up within easy shooting distance. On November 15 I saw two more pairs flying across open country on the Meseta. The male taken measures as follows: Wing 237, tail 157, culmen from cere 15.0, tarsus 44.5 mm.

The geographic races of this falcon are not clearly outlined at the present time in material that I have seen, which includes the specimens in the U. S. National Museum and the American Museum of Natural History. According to Swann [7] there are four forms, of which three are found in South America—a very large one, *pichinchae*,

[7] Monograph of the birds of prey, pt. 14, Dec. 1936, pp. 424–427.

in the northern Andes; a very small one, *femoralis*, in Venezuela and Brazil; and a larger one, *fusco-coerulescens*, in Argentina and Chile. In specimens that I have examined birds from Venezuela are slightly smaller than those from elsewhere, the wing in 5 males ranging from 226 to 237 and in 5 females from 245 to 262.5 mm. From Matto Grosso 4 males measure 235 to 237 and 4 females 250 to 264 mm., and from Bolivia 1 female 249 mm. From Argentina, a male from the Territory of Formosa has the wing 239 mm., and a male from the Territory of Chaco is 243 and a female 269. One female from Salta is 251; from Tucumán 4 males measure 235 to 259 and 1 female 269. Small birds extend down into Chubut as two males from Rio Chico and Valle del Lago Blanco have the wing 238 and 240 mm. These smaller birds extend thus through the type locality of *Falco fusco-coerulescens* Vieillot so that they must bear this name with *Falco femoralis* Temminck [8] as a synonym. It seems quite certain that some of the larger birds that have been collected in northern South America are migrant *F. f. septentrionalis* from North America. Whether these migrants extend to the far south and so account for the larger individuals from Chile and Argentina remains to be established. From Buenos Aires I have seen one female that measures 280, from Chile a female with the wing of 285 mm.

FALCO SPARVERIUS ISABELLINUS Swainson

Falco isabellinus SWAINSON, Animals in menageries, 1837, p. 281 (Demerara, British Guiana).

On November 13, 1937, I collected a female 12 miles south of El Sombrero, as in company with another it rested in a tree near the road. On November 21 I observed two pairs 5 miles north of town and was interested to note that in one instance one bird was distinctly white on the breast while the other was strongly rufescent. The two rested only 2 or 3 feet apart so that comparison was easy.

The female taken is in the white-breasted phase, the gray of the crown being pale with a fair-sized patch of brown. It measures as follows: Wing 180, tail 118, culmen from cere 12.4, tarsus 33.7 mm. It seems to agree in characters best with the most eastern race of northern South America.

Family PHASIANIDAE

COLINUS CRISTATUS SONNINI (Temminck)

Perdix Sonnini TEMMINCK, Histoire naturelle générale des pigeons et des gallinacés, vol. 3, 1815, pp. 451, 737 (Cayenne).

Quail are found about Maracay, but I did not encounter them until I came to El Sombrero. Here they were common in the scrub, particularly near open ground but were so secretive that they were

[8] Nouveau recueil de planches coloriées d'oiseaux, 1822, pls. 121, 343 (Brazil).

recorded only when I came directly on them. On November 15 at the edge of a prairie I walked onto a family flock of 15 or more with young barely large enough to fly, the chicks buzzing off through the branches while adult birds ran about on the ground beneath calling excitedly. As I moved to get a clearer view a dozen grown birds flushed from the same covert with roaring wings and went off into the thicket. As they rose again I dropped a female bird. The following day I flushed one bird in heavy scrub, and on November 17 I enscountered several coveys and shot another female that was not quite adult. These birds frequently alighted on the branches of the thorn scrub. On another day I found several in weedy fields near the Río Guarico, and on November 21 found my last in patches of weeds near Hato Paya. In notes and appearance these birds are the counterpart of the bobwhite of the United States.

While *Eupsychortyx* has been recognized as a genus for these quail and their relatives because of the long, slender crest, intergradation between these crested birds of northern South America and the smooth-headed *Colinus virginianus* of the North through various species in Central America is so definite that I feel that this name can be used only in a subgeneric sense. There is no trenchant line between *Colinus* and *Eupsychorytx* when all the forms involved are considered.

Todd [9] considers *sonnini* as a distinct species. Peters [10] includes it and related forms as races of *cristatus*.

Family OPISTHOCOMIDAE

OPISTHOCOMUS HOAZIN (Müller): Hoatzin

Phasianus hoazin P. L. S. Müller, Natursystem, Suppl., 1776, p. 125 (Cayenne).

On November 19, while following a muddy, 10-foot-wide channel leading back from the Río Guarico just above the town of El Sombrero, I heard a harsh, aspirated call without particular accent, that might have come from bird or mammal. As I peered among the dense branches of the low trees overhanging the water to locate the sound there was a sudden, heavy beating of wings and to my utter astonishment a hoatzin came blundering out to perch with raised crest, spread tail and partly opened wings within 40 feet of me. Immediately I saw another, and heard others calling near at hand. Those in sight held the mouth open with the feathers over the body loosely raised, and continued in harsh reiteration the calls that had attracted my attention. For nearly an hour I worked along this channel and its branches watching and studying the uncouth birds,

[9] Auk, 1920, pp. 194–201.
[10] Check-list of birds of the world, vol. 2, 1934, pp. 50–51.

my first encounter with this interesting form in life. They were in pairs or little groups of half a dozen, and though many seemed to be completing a molt I believed that they were about to breed. The birds were tame, and though they moved heavily, flew easily from the top of one low tree to another, being far less sedentary then I had supposed from what I had read of their habits. I selected one in fair plumage and shot it, and skinning my specimen for ease in carrying, I found it to be a male. A native boy who saw it called it the roble. The large crop with its muscular walls resembled an external stomach. The breast and wing muscles were red and well supplied with blood, indicating definite use, being quite different in appearance from the paler flesh of ground-haunting gallinaceous birds. In spite of the name "stinking pheasant" that has been given to this bird I detected no particular odor in the flesh, no more so, in fact, than in that of hawks that I have skinned in the field in the same way. The odor of an ani to me is far more disagreeable.

On the following day I found several more hoatzins in low, dense trees bordering sloughs on the opposite side of the Río Guarico.

While the hoatzin is known to be common along the Río Orinoco and its larger branches, it was unexpected to find it so far from these main channels. Apparently its range is more extensive than has been supposed.

Family RALLIDAE

ARAMIDES CAJANEA CAJANEA (Müller)

Fulica Cajanea P. L. S. Müller, Natursystem, Suppl., 1776, p. 119 (Cayenne).

In the cacao plantations back of Ocumare de la Costa I had an occasional glimpse of a wood rail but did not obtain a specimen until I reached El Sombrero. In the evening the curious calls of these birds came regularly from low woods along the Río Guarico, and on November 19 I came across a little group of half a dozen in a wet thicket below the town. They ran instantly away and disappeared. The following day, when in heavy forest near the bank of the river several began to call near me, their notes seeming more musical than my remembrance of those of the larger *Aramides ypecaha* found farther south. Slipping behind the cover of a large tree I finally saw one wading in shallow water beneath some bushes and secured it, finding it to be a male.

GALLINULA CHLOROPUS PAUXILLA Bangs

Gallinula chloropus pauxilla Bangs, Proc. New England Zoöl. Club, vol. 5, May 17, 1915, p. 96 (Guabinas, Río Cauca, western Colombia).

The supposition of Outram Bangs in his original description that this race, distinguished from *G. c. galeata* by decidedly smaller size, might extend into western Venezuela is borne out by a male collected on the lagoon at Independencia below Ocumare de la Costa on October 29. This specimen has the following measurements: Wing 159.5, tail 64.4, tarsus 54.8 mm.

There were a number of these birds on this lagoon, where they were observed daily from October 22 to 31. They were seen constantly on the water or in the grass near the shore but at any alarm entered dense growths of cattails where they were safe from guns.

Family JACANIDAE

JACANA JACANA INTERMEDIA (Sclater)

Parra intermedia P. L. Sclater, Proc. Zool. Soc. London, 1856 (1857), p. 282 (Venezuela).

About the lagoon at Independencia near the beach below Ocumare de la Costa jaçanas were the most common water bird from October 22 to 31, and an adult female was taken on October 29. Compared with a good series of *Jacana j. jacana* this individual shows very definitely the character of darker chestnut back that characterizes the race *intermedia.* The bird has the following measurements: Wing 130.5, tail 43.0, bill from nostril 18.4, tarsus 56.1 mm.

Recent treatment of the jaçanas by Hellmayr and Peters gives the russet-backed forms of South America as conspecific with those of Central America and Mexico, and the West Indies. The birds from Panamá northward, with those of the Greater Antilles, have the posterior margin of the frontal shield with three definite lobes while the rictal wattle is rudimentary or absent. The birds of South America have two lobes only on the posterior margin of the frontal shield and have a large rictal wattle. The differences indicated are definite and certain with no intermediate stages that I have seen. They appear in immature individuals as soon as they are fully grown though still in the light-colored immature plumage. I have not seen any fully grown specimens in which these characters were not readily evident. I can therefore find no justification for combining both types under one species name. The birds from South America should be separated as *Jacana jacana* distinct from *Jacana spinosa* from farther north.

These birds ranged over the short grass bordering the lagoon where they walked about pecking at the ground like long-legged chickens. At any alarm they flew off with cackling calls to a safe distance. One day I saw one swimming across an open pool, something that I have not observed previously.

Near El Sombrero several were seen on the shores of a small lagoon on November 14. As no specimens were taken it is not certain that these were of the race *intermedia.*

Family CHARADRIIDAE

BELONOPTERUS CHILENSIS CAYENNENSIS (Gmelin)

Parra cayennensis GMELIN, Systema naturae, vol. 1, pt. 2, 1789, p. 706 (Cayenne).

Near El Sombrero these handsome plovers, known as *alcaravan*, were found in small numbers on the open prairies or along the gravel bars of the Río Guarico. They ranged in pairs and were rather wild, so that they usually kept out of gun range. When I shot one, three or four came flying over and circled around me much disturbed. One evening I heard the notes of this species from birds passing overhead in the darkness shortly after sunset.

The female taken is typical of its race, having the black line of the throat narrowed and interrupted below by gray so that it does not connect with the black of the breast. It has the following measurements: Wing 222.0, tail 92.8, culmen from base 30.3, tarsus 73.8.

HOPLOXYPTERUS CAYANUS (Latham)

Charadrius cayanus LATHAM, Index ornithologicus, vol. 2, 1790, p. 749 (Cayenne).

About the lagoon at Independencia below Ocumare de la Costa I found this bird on several occasions. At noon on October 27 as I looked out across the water my eye caught the beautifully contrasted black and light markings of one as it walked quickly and alertly across the short-cropped turf. As I approached it flew when I could only admire its pleasing color pattern, as grazing burros everywhere in the background prevented a shot. A few moments later, however, I secured it as it flew again, to find that it was a male. The feet and margin of the eyelids in life were brilliant orange-scarlet. One of the wing spurs was aborted. The following day I observed another at the edge of the water and watched as it walked quickly for a few steps, paused with a graceful swing of its body, and then walked again. Two were seen on October 29 and one on October 31.

At El Sombrero I found this bird along the Río Guarico and heard its call, a low-toned, mellow whistle.

As this plover has been supposed to range in Venezuela mainly in the Orinoco Basin, its occurrence on the north coast is of particular interest.

PAGOLLA WILSONIA CINNAMOMINA Ridgway

Pagolla wilsonia cinnamomina RIDGWAY, U. S. Nat. Mus. Bull. 50, pt. 8, 1919, pp. 108, 113 (Sabanilla, Colombia).

One was recorded with other shorebirds at the lagoon near the beach below Ocumare de la Costa, October 25 and 26. Allocation to subspecies is made on geographic grounds, as the bird was not collected.

Family SCOLOPACIDAE

TOTANUS FLAVIPES (Gmelin): Lesser Yellow-legs

Scolopax flavipes Gmelin, Systema naturae, vol. 1, pt. 2, 1789, p. 659 (New York).

Several found each day from October 23 to 31 about the lagoon below Ocumare de la Costa.

TOTANUS MELANOLEUCUS (Gmelin): Greater Yellow-legs

Scolopax melanoleuca Gmelin, Systema naturae, vol. 1, pt. 2, 1789, p. 659 (Chateaux Bay, Labrador).

Several seen each day at the lagoon below Ocumare de la Costa from October 23 to 31.

TRINGA SOLITARIA SOLITARIA Wilson: Eastern Solitary Sandpiper

Tringa solitaria Wilson, American ornithology, vol. 7, 1813, p. 53, pl. 58, fig. 3 (Pocono Mountain, Pa., Kentucky, and New York).

A male taken at the lagoon below Ocumare de la Costa on October 29 has the following measurements: Wing 122.6, tail 50.2, culmen from base 25.9, tarsus 30.0 mm. The inner web of the outer primary is plain without mottling, and there is no buff in the light spotting of the upper surface. This individual was in good condition but had no fat whatever on the body.

Other solitary sandpipers were observed near El Sombrero from November 14 to 20 about small lagoons or sloughs. None were taken, so that the geographic race of these individuals is uncertain.

ACTITIS MACULARIA (Linnaeus): Spotted Sandpiper

Tringa macularia Linnaeus, Systema naturae, ed. 12, vol. 1, 1766, p. 249 (Pennsylvania).

Two or three were recorded daily about the lagoon at Independencia below Ocumare de la Costa from October 23 to 31. On November 19 one was seen along the Río Guarico near El Sombrero.

EREUNETES MAURI Cabanis: Western Sandpiper

Ereunetes Mauri Cabanis, Journ. für Orn., vol. 6, Nov. 1856 (1857), p. 419 (Cuba).

From October 22 to 31 small sandpipers of this type were common in little flocks about the lagoon at Independencia below Ocumare de la Costa. A male taken October 29 has the culmen 22.7 mm. in length and belongs clearly to the western species. Whether *Ereunetes pusillus* was present also is not known.

PISOBIA BAIRDII (Coues): Baird's Sandpiper

Actodromas (*Actodromas*) *Bairdii* COUES, Proc. Acad. Nat. Sci. Philadelphia, 1861, p. 194 (Fort Resolution, Great Slave Lake, Canada).

On October 27 several were noted at the lagoon below Ocumare de la Costa.

PISOBIA MELANOTOS (Vieillot): Pectoral Sandpiper

Tringa melanotos VIEILLOT, Nouv. Dict. Hist. Nat., vol. 34, 1819, p. 462 (Paraguay).

A migrant was seen at the lagoon near Ocumare de la Costa October 28, and on October 31 one was taken there by Ventura Barnés. At El Sombrero on November 14 half a dozen fed at a rain pool on open prairie.

PISOBIA FUSCICOLLIS (Vieillot): White-rumped Sandpiper

Tringa fuscicollis VIEILLOT, Nouv. Dict. Hist. Nat., vol. 34, 1819, p. 461 (Paraguay).

Two were seen with other sandpipers at the lagoon below Ocumare de la Costa on October 29.

MICROPALAMA HIMANTOPUS (Bonaparte): Stilt Sandpiper

Tringa himantopus BONAPARTE, Ann. Lyc. Nat. Hist. New York, vol. 2, 1826, p. 157 (Long Branch, N. J.).

At the lagoon below Ocumare de la Costa eight waded in water nearly to their bodies on October 24, and half a dozen more were seen on October 28.

Family RECURVIROSTRIDAE

HIMANTOPUS MEXICANUS (Müller): Black-necked Stilt

Charadrius Mexicanus P. L. S. MÜLLER, Natursystem, Suppl., 1776, p. 117 (Mexico).

A few were seen daily at the lagoon at Independencia below Ocumare de la Costa from October 23 to 31. A male, taken on October 29, has the following measurements: Wing 208, tail 71.4, culmen from base 65.0, tarsus 103.0 mm.

As there is absolutely no indication of intergradation in pattern, I can see no reason for considering *Himantopus mexicanus* a geographic race of *H. himantopus* as is currently suggested. The recurrence of style of pattern in cases of this kind is not to be considered as indication of conspecific relationship. It happens that among the stilts there are only two plumage colors involved, black and white (gray being a blend of these two). The combinations of these colors in pattern arrangement are therefore limited and are paralleled in different parts of the world where there is no probability of close relationship.

Family LARIDAE

LARUS ATRICILLA Linnaeus: Laughing Gull

Larus Atricilla LINNAEUS, Systema naturae, ed. 10, vol. 1, 1758, p. 136 (Bahamas).

Several in winter dress were observed in the harbor at La Guaira on October 16.

THALASSEUS MAXIMUS MAXIMUS (Boddaert): Royal Tern

Sterna maxima BODDAERT, Table des planches enluminéez, 1783, p. 58 (Cayenne).

From October 22 to 31 I found this tern common along the beach at Independencia below Ocumare de la Costa. One evening at sunset one was diving rapidly in the surf, when its activity was noted by keen-eyed fishermen who came running up to cast their nets to secure the sardines that were present in schools. The tern, their guide, was driven away by this human invasion. On November 25 a flock of 25 royal terns circled about the harbor at La Guaira and then alighted on a large buoy.

Family COLUMBIDAE

COLUMBA GYMNOPHTALMOS Temminck

Columba Gymnophtalmos TEMMINCK, *in* Knip, Les pigeons, 1809, p. 48, pl. 18 (no type locality).

In view of current statements in literature that in Venezuela this is a species of the arid coastal region, it was a surprise to me to find it common near El Sombrero in the northern llanos. A male collected on November 19 had the iris light orange, the bare eyelids neutral gray, the bill light brownish white, with the cere slightly darker, and the tarsus and toes rose-red. The papillae forming the prominent circle about the eye were blackish distally, and brownish at the concealed bases. The birds were most common near the Río Guarico but were found also inland. They had the habits usual to this group of birds of resting in the tops of trees concealed among the leaves, or in early morning on open branches in the sun. When alarmed they flew out with a clapping of wings.

ZENAIDURA AURICULATA VINACEO-RUFA (Ridgway)

Zenaida vinaceo-rufa RIDGWAY, Proc. U. S. Nat. Mus., vol. 7, 1884, p. 176 (Curaçao, Dutch West Indies).

In the llanos about El Sombrero these doves were common, particularly at the borders of savannas, where they were usually seen in swift, direct flight. Two females taken on November 16 were shot at a lagoon where a number had come in to water about 9:30 a. m. Others were recorded on the two days following.

Peters [11] has pointed out that the species *auriculata*, formerly placed in *Zenaida*, agrees with *Zenaidura* in having 14 rectrices and belongs properly in the latter genus. The doves included in *Zenaida* have only 12 tail feathers.

As indicated in a recent review of *auriculata* by Mrs. E. M. B. Naumburg,[12] this species is one ranging widely over South America and is separated into a number of geographic races. According to Mrs. Naumburg's findings the specimens here listed under *vinaceo-rufa* would be called *rubripes*, but with this treatment I do not agree after examination of a fair series of specimens in the U. S. National Museum. The material at hand from northern South America seems properly grouped in the following categories:

ZENAIDURA A. VINACEO-RUFA (Ridgway):

Reference given above.

Grayer, less vinaceous below than the two forms that follow; wing, males 135.4–138.3 (3 specimens), females 127.0–133.6 (5 specimens).

Grenada, Trinidad, Curaçao to Margarita Islands, and Venezuela (except western part) south to the Orinoco River, and the Guianas, probably into northern Brazil.

ZENAIDURA A. JESSIEAE (Ridgway):

Zenaida jessieae RIDGWAY, Proc. U. S. Nat. Mus., vol. 10, Aug. 6, 1888, p. 527 (Diamantina, near Santarem, Brazil).

Darker, deeper vinaceous below, tips of external rectrices paler than in *robinsoni*.

Region of lower Amazon River.

ZENAIDURA A. ROBINSONI (Ridgway):

Zenaida ruficauda robinsoni RIDGWAY, Proc. Biol. Soc. Washington, vol. 28, May 27, 1915, p. 107 (Honda, Colombia).

Like *jessieae* but deeper in color below, particularly on the under tail coverts, tips of external rectrices decidedly darker, wing, males 129.8–134.6 (two specimens).

Magdalena Valley, Colombia, probably to western Venezuela.

ZENAIDURA A. RUFICAUDA (Bonaparte):

Zenaida ruficauda BONAPARTE, Compt. Rend. Acad. Sci. Paris, vol. 40, 1855, p. 97 (Colombia).

---

[11] Condor, 1934, pp. 213–215.

[12] Amer. Mus. Nov., No. 648, July 21, 1933, pp. 1–15.

Similar to *robinsoni* but definitely larger, wing, male 142.9 (one specimen from Capás, 2,500 m., Mérida region, Venezuela).

Temperate zone of eastern Andes in Colombia (Bogotá savanna) to the Mérida region of Venezuela.

This survey does not include other forms described from the Andean region and from Brazil. According to this two forms are definitely recorded from Venezuela, with probability of a third.

SCARDAFELLA SQUAMMATA RIDGWAYI Richmond

Scardafella ridgwayi Richmond, Proc. U. S. Nat. Mus., vol. 18, Aug. 12, 1896, p. 660 (Margarita Island, Venezuela).

Near Ocumare de la Costa this small, long-tailed dove was fairly common from October 23 to 30, many were seen in driving from Maracay to El Sombrero November 12, and in the vicinity of El Sombrero they were common from November 13 to 21. They feed on the ground in the shelter of dry scrub, often near trails or other openings, in pairs or groups of three or four. They fly with a considerable flutter of wings to concealed perches among limbs where their position is often indicated by a rapid up-and-down motion of the tail. While fairly tame it was often difficult to see them, as they flew or walked among the branches to keep behind cover as I approached. The call is a rapid *coo coo coo* rather strongly accented, while an alarm note is guttural and explosive.

An adult and an immature male were taken near Ocumare de la Costa on October 26, and a female near El Sombrero on November 16.

Examination of a considerable series verifies the conclusions of Hellmayr [13] as to the character and distribution of this race. In a fair series, including the type of *ridgwayi*, birds from Margarita Island do not seem separable from those of the Venezuelan mainland.[14] The specimens from Margriata seen are somewhat more heavily barred with black above and below, but many skins from scattered localities in Venezuela are identical. Probably with more specimens the apparent preponderance of heavier markings from the insular locality would disappear.

COLUMBIGALLINA PASSERINA ALBIVITTA (Bonaparte)

Chamaepelia albivitta Bonaparte, Compt. Rend. Acad. Sci. Paris, vol. 40, 1855, p. 21 (Cartagena, Colombia).

Near Ocumare de la Costa these small doves were common through the dry scrubs, and as I passed they flushed constantly from the ground or from perches in the trees to fly swiftly with a flash of reddish brown

[13] Nov. Zool., vol. 15, June 1908, pp. 92–93.

[14] See Berlepsch and Hartert, Nov. Zool., vol. 9, Apr. 1902, pp. 119–120.

from their wings. I heard their insistent, monotonous, cooing calls constantly, and on October 25 I found a nest on the ground that contained two white eggs, placed in a fairly substantial cup of fine twigs and grasses. An immature male, fully grown, was taken on this same day.

At Maracay ground doves were common on November 11 in little scattered groups in open pastures and fields. The following day in my travel to El Sombrero many were observed along the highway, and near El Sombrero from November 13 to 21 they were common.

The specimen taken, like others from Venezuela, averages slightly darker than skins from northern Colombia but seems best identified as *albivitta*. Whether the bird of Curaçao and Margarita is also to be included here appears to me to be a matter for further consideration.[15] It appears to me from examination of a small series that birds from these islands average paler below and browner above, so that the form *perpallida* of Hartert may be valid.

COLUMBIGALLINA TALPACOTI RUFIPENNIS (Bonaparte)

Chamaepelia rufipennis BONAPARTE, Compt. Rend. Acad. Sci. Paris, vol. 40, 1855, p. 22 (Cartagena, Colombia).

Near Ocumare de la Costa on October 28 I found several of these ground doves in dense scrub in a little valley where they flew ahead with a rapid flutter of wings, keeping out of sight among the leaves. A little later I collected one that flew up from the ground near a road leading through a cacao plantation. Others were seen here on October 30 and 31. On November 11 I recorded several in brush grown pastures and along hedgerows near Maracay, and found them fairly common on the road to El Sombrero the following day. Several were noted near El Sombrero November 16, and on November 18 I collected a female in juvenile dress.

LEPTOTILA VERREAUXI VERREAUXI Bonaparte

Leptotila verreauxi BONAPARTE, Compt. Rend. Acad. Sci. Paris, vol. 40, 1855, p. 99 (Colombia).

Near Ocumare de la Costa these pigeons were common in the thorny scrub, where they walked on the ground or rested on low perches, hidden by limbs. When flushed they rise with a flutter of wings in which there is a prominent display of brown, and dart immediately behind cover. If they alight on the ground they walk quickly away, while among branches they remain concealed from sight. Shooting them here was difficult. The only one taken was very fat. Below Rancho Grande, on the south slope of the Cordillera

[15] See Todd, Ann. Carnegie Mus., vol. 8, 1913, p. 555.

de la Costa, I heard these birds calling on November 9, and on November 11 saw several in open woodland near Maracay.

The single specimen from near Ocumare de la Costa is an immature female that is allocated under the typical race on geographic grounds. It is dark in color but because of its age is not exactly comparable with other material at hand. The species is one in which a complete revision is needed.

LEPTOTILA VERREAUXI BRASILIENSIS (Bonaparte)

Peristera brasiliensis Bonaparte, Compt. Rend. Acad. Sci. Paris, vol. 43, 1856, p. 945 (French and Dutch Guiana, British Guiana and Rio Branco).[16]

Near El Sombrero these pigeons were common through the dry scrubs and were abundant in the low woods near the Río Guarico, from November 12 to 21. A male taken on November 17, while intermediate toward those at hand from Panamá and western Costa Rica, is distinctly dark and is believed to be nearer the type found along the Río Orinoco, which I have identified as *brasiliensis.*

From the few specimens at hand it appears to me that *L. v. insularis* Richmond of Margarita Island is distinct. More material is needed to establish the races of this pigeon found in Venezuela.

Family PSITTACIDAE

ARATINGA PERTINAX AERUGINOSA (Linnaeus)

Psittacus aeruginosus Linnaeus, Systema naturae, ed. 10, vol. 1, 1758, p. 98 (Calamar, lower Magdalena River, Colombia).

Around El Sombrero this parakeet, called *loro cara sucia* by the native boys because of its dull-brown cheeks, was common. The birds ranged in the forest growth and showed little fear of me, except to sidle behind cover as I approached and to utter chattering calls. On November 17 when I collected a pair the others paid no attention to the fall of their companions. On November 21 I noted several at Hato Paya.

With regard to the generic placement of this species, it appears necessary to include it in *Aratinga* rather than to segregate it in a separate group *Eupsittula*, as it does not appear to have characters of generic value. As Peters has indicated,[17] the original basis for Linnaeus' *Psittacus aeruginosus* is Edwards' brown-throated parakeet,[18] which that author was told came from the "West Indies." The female in question refers to the race of this bird found from Colombia to north-central Venezuela so that Chapman's designation of the type

[16] See Hellmayr, Field Mus. Nat. Hist., zool. ser., vol. 12, 1929, p. 471.

[17] Check-list of birds of the world, vol. 3, 1937, p. 190.

[18] Edwards, George, A natural history of birds, pt. 4, 1751, p. 177, pl. 177.

locality as given above may be accepted. The locality of Cumaná, Venezuela, suggested by Berlepsch and Hartert[19] is incorrect, since the color of the bird of eastern Venezuela does not agree with Edwards' plate, according to Peters' statement.

ARATINGA HAEMORRHOUS NEOXENA (Cory)

Conurus neoxenus Cory, Field Mus. Nat. Hist. Publ., orn. ser., vol. 1, 1909, p. 243 (Boca del Río, Margarita Island, Venezuela).

Near El Sombrero these birds were common in pairs and little flocks from November 14 to 19. A male was taken on the first date mentioned.

I agree with Peters[20] that the genus *Aratinga* includes the group segregated by Ridgway as *Thectocercus*, though the slender, acuminate tip of the bill of the latter is sufficient to separate it as a subgenus. Another character assigned by Ridgway to *Thectocercus*, that of lack of feathering behind the nostrils, does not hold, as this condition is found also in related species.

While *Aratinga acuticaudata* is closely allied to *haemorrhous*, the definite blue color of the sides of the head seems sufficient to set it off specifically, at least until intergradation can be proved. The skin from El Sombrero is definitely darker green than one from Paranahyba, Brazil, and so bears out the characters given by Cory to his race *neoxena*.

ARATINGA WAGLERI TRANSILIS Peters

Aratinga wagleri transilis Peters, Proc. New England Zoöl. Club, vol. 9, June 24, 1927, p. 111 (Cuchivano, northeastern Venezuela).

While Peters has listed this distinct form, separated from *A. w. wagleri* by dark color and slightly smaller size, only from the Paria Peninsula, it ranges westward as far as San Esteban, near Puerto Cabello. A male in the National Museum from the latter locality measures as follows: Wing 173, tail 144, culmen from cere 25.1, tarsus 15.7 mm. This bird is definitely darker than several from Palomina, in the Santa Marta region of Colombia. Two males that I secured at Rancho Grande at 3,400 feet in the Cordillera de la Costa on November 3 are very dark and measure as follows: Wing 173.5, 175; tail 136, 146; culmen from cere 25.7, 26.2; tarsus 17.9, 17.9 mm.

Near Rancho Grande I found these parakeets so numerous from November 3 to 10 that I heard their calls constantly through the day both from birds at rest in the woodlands and from little flocks passing in flight overhead, their notes being the usual raucous screech common to species of this group. In flock formation on the wing they were always grouped in pairs. The two taken were shot from

[19] Nov. Zool., vol. 9, 1902, p. 107.

[20] Check-list of birds of the world, vol. 3, 1937, p. 185.

the top of a dead tree standing in the open on the crest of a steep-sided ridge.

FORPUS PASSERINUS VIRIDISSIMUS (Lafresnaye)

Psittacula viridissima LAFRESNAYE, Rev. Zool., 1848, p. 172 (Caracas, Venezuela).

At Ocumare de la Costa on October 26 I found two feeding in the tops of low trees in dense scrub and collected a female, and on October 30 secured another female from a little flock feeding in low trees above a road. Near Maracay on November 11 I recorded several flocks in level pastures dotted with trees and shrubs and heard their twittering, finchlike notes. The birds flew in rather close formation twisting and turning considerably. Near El Sombrero I saw them on November 17 and 19. Many were kept in captivity.

AMAZONA OCHROCEPHALA OCHROCEPHALA (Gmelin)

Psittacus ochrocephalus GMELIN, Systema naturae, vol. 1, pt. 1, 1788, p 339 (Venezuela).

Near El Sombrero I found these parrots common around the Meseta, but rather wild. On November 20 in low woods near the Río Guarico many were feeding in the trees, seeming indifferent to my approach unless I came quite near, and then flying only for a short distance. Even when I shot one the others paid little attention, though several saw the bird as it fell to the ground with a loud thump.

The male taken I have identified as the subspecies *ochrocephala*, though I am not satisfied with the present limits assigned to the typical race and to *panamensis*. It measures as follows: Wing 199.0, tail 112.1, culmen from cere 31.4, tarsus 24.1, mm. On the left side of the crown the yellow color extends to the cere with a faint barely distinguishable line of green extending along its anterior margin. On the right the green color spreads across behind the cere cutting off completely the yellow of the crown. It will be noted that in size and in head marking there is approach to the characters ordinarily attributed to *panamensis*.

Family CUCULIDAE

COCCYZUS AMERICANUS AMERICANUS (Linnaeus): Yellow-billed Cuckoo

Cuculus americanus LINNAEUS, Systema naturae, ed. 10, vol. 1, 1758, p. 111 (South Carolina).

At Ocumare de la Costa I collected a male on October 26 in low bushes back of the beach near the lagoon. I had the impression that it had just arrived from the north as its thin, gaunt body with no fat whatever and the shrunken pectoral muscles, so reduced that the keel and the posterior margin of the sternum projected prominently, were most striking. On October 29 one was seen in a sea-grape tree on the beach, and a freshly dead bird, found in low bushes near the shore, was brought to me. It showed no signs of injury but was emaciated to such an extreme that its frame was merely a skeleton covered with skin and feathers. It appeared that it had made a landing too exhausted by its long flight to recover. I wondered how many did not arrive at all.

On November 4 I recorded one at an elevation of 3,500 feet at Rancho Grande.

PIAYA CAYANA COLUMBIANA (Cabanis)

Pyrrhococcyx columbiana CABANIS, Journ. für Orn., 1862, p. 170 (Cartagena, Colombia).

Near El Sombrero these cuckoos were fairly common from November 13 to 20 in rather heavy woods. They move alertly and quietly, usually along horizontal or gently sloping limbs. One uttered a rattling cuckoolike call audible for only a few yards. They were seen sometimes low down near the ground in bushes.

A female taken on November 13 is slightly paler in its brown tints than those from farther north in Venezuela, has the black on the rectrices considerably restricted, and the underparts somewhat paler.

CROTOPHAGA ANI Linnaeus

Crotophaga ani LINNAEUS, Systema naturae, ed. 10, vol. 1, 1758, p. 105 (Jamaica).

Near Maracay on November 11 I found a small flock of anis in a brush-grown pasture and collected a male. Others were seen at Ortiz on November 12 and near El Sombrero on November 16 and 17.

CROTOPHAGA SULCIROSTRIS SULCIROSTRIS Swainson

Crotophaga sulcirostris SWAINSON, Philos. Mag., new ser., vol. 1, June 1827, p. 440 (Tableland, Temascaltepec, Mexico).

Seen at Ocumare de la Costa on October 28 and 30. At El Sombrero they were fairly common, and specimens were secured on November 15 and 18.

CROTOPHAGA MAJOR Gmelin

Crotophaga major GMELIN, Systema naturae, vol. 1, pt. 1, 1788, p. 363 (Cayenne).

Near El Sombrero I found an occasional flock of the large ani in heavy growths of low trees at the edge of the Meseta and near the Río Guarico on November 17, 19, and 20. They were quite wary, began to call as soon as they saw me, and immediately flew away to safety behind the protection of heavy cover. One that I shot on November 17 near the Meseta was a bird of predatory appearance, strongly muscled, and very fat. The peculiar odor of the flesh found in anis was pronounced. The iris was light grayish white.

It was an interesting experience at El Sombrero to see all three species of anis in the course of a day.

Family TYTONIDAE

TYTO ALBA (Scopoli)

Strix alba Scopoli, Annus I: Historico-naturalis, 1769, p. 21 (Friaul, northern Italy).

On several evenings during my stay in El Sombrero I heard the familiar notes of young barn owls from a hole in the side of the church tower but by day was never able to see the birds. Whether these should be listed as *Tyto alba stictica* (Madarász)[21] can be ascertained only when specimens are obtained.

Family STRIGIDAE

GLAUCIDIUM BRASILIANUM PHALOENOIDES (Daudin)

Strix phaloenoides Daudin, Traité . . . d'ornithologie, vol. 2, 1800, p. 206 (Trinidad).

On November 13 Ventura Barnés, Jr., killed one of these small owls for me in dense scrub 12 miles south of El Sombrero. On November 15 on the Meseta a short distance from town one flew into the topmost branches of a tree in a little grove on the open prairie and remained there in bright light looking about until I shot it. The numerous small birds in the same grove paid little attention to it.

Both of these birds are in the gray phase. In identifying them as *phaloenoides* I have followed current practice, which allocates birds from northern Venezuela to that race as the series of these owls at hand does not allow critical consideration.

Family CAPRIMULGIDAE

NYCTIDROMUS ALBICOLLIS ALBICOLLIS (Gmelin)

Caprimulgus albicollis Gmelin, Systema naturae, vol. 1, pt. 2, 1789, p. 1030 (Cayenne).

At Ocumare de la Costa on October 30 and at Hato Paya, northwest of El Sombrero, on November 21, I saw individuals in dense thickets where the cover was heavy above and the ground open beneath, but in each case the birds eluded capture.

CHORDEILES MINOR (Forster): Nighthawk

Caprimulgus minor Forster, Catalogue of the animals of North America, 1771, p. 13 (South Carolina).

Near Guamitas at dusk on November 10 a nighthawk rested on the paved road flying only a few feet as our car passed. We stopped and I saw the bird again but was not successful in collecting it. I was certain, however, that it was the larger, northern bird. The light

[21] *Strix stictica* Madarász, Ann. Hist. Nat. Mus. Nat. Hungarici, vol. 2, June 25, 1904, p. 115 (Mérida, Venezuela).

markings were very pale. At dawn on November 12 at the Hotel La Barraca in Maracay several flew about the large patio.

Family MICROPODIDAE

CHAETURA BRACHYURA (Jardine)

Acanthylis brachyura JARDINE, Ann. Mag. Nat. Hist., vol. 18, Aug. 1846, p. 120 (Tobago).

In Tropical America swifts are tantalizing birds usually seen out of range, so that it was with keen interest that on October 28 near Ocumare de la Costa I found a dozen short-tailed swifts circling rapidly over an open pasture just above the scattered trees, and I secured one of them. While I was searching for this bird in thick grass the others disappeared. On November 4 at Rancho Grande several circled out of range. This species appears very black as it flies overhead, so that at first glance it suggests the black swift (*Nephoecetes niger*), but a second look distinguishes it by the shorter, light-colored tail. The specimen taken, a male, measures as follows: Wing 118.7, tail 29.0, culmen from base 5.8, tarsus 11.8 mm.

STREPTOPROCNE ZONARIS ALBICINCTA (Cabanis)

Hemiprocne albicincta CABANIS, Journ. für Orn., 1862, p. 165 (Guiana).

While I was collecting in El Portachuelo above Rancho Grande on November 3, 6, and 10, groups of these large swifts dashed at intervals through the pass at lightning speed with a great rushing of wings. Occasionally I observed them circling high in air.

Family TROCHILIDAE

PHOETHORNIS AUGUSTI (Bourcier)

Trochilus augusti BOURCIER, Ann. Sci. Phys. Nat. Agric. Ind., Lyon, vol. 10, 1847, p. 623 (Caracas, Venezuela).

On the south slope of the mountains at 3,000 feet elevation near Rancho Grande I saw several of these large hummers on November 9 and collected two females. The first one was in a deeply shaded ravine, where it flew up to hover in the air directly in front of me and only 4 or 5 feet away for a minute or more apparently attracted by the openings in the end of my double-barreled gun. As it turned from side to side the long median tail feathers were opened widely scissors-fashion, but when the bird poised they remained together. Another was taken gleaning at flowers. In life the basal three-fourths of the mandible was light red; rest of bill black; tarsus and toes flesh color; nails black.

While easily confused in the field with the closely allied *Phoethornis a. anthophilus*, the form of the tail readily distinguishes the two. In *augusti* the pair of tail feathers adjacent to the central ones are also narrow and much elongated, extending for nearly half their length beyond those on either side. In *anthophilus* the tail, while much graduated, has only the central pair narrowed and elongate, the fourth (adjacent) pair being broad and extending little beyond the next pair at the side.

PHOETHORNIS ANTHOPHILUS ANTHOPHILUS (Bourcier)

Trochilus anthophilus Bourcier, Rev. Zool., vol. 6, Mar. 1843, p. 71 (Upper Magdalena Valley, Colombia).

At Ocumare de la Costa October 27 I found a male of this species flying quickly but rather heavily about branches in the scrub in search for food. The white-tipped tail was prominent in life, while in the hand I noticed particularly the very long neck. The sexual organs were somewhat enlarged. I shot another in dense scrub near the Río Cumboto on October 31, and as the tip of the bill was broken I preserved it as a skeleton.

AGYRTINA FIMBRIATA FIMBRIATA (Gmelin)

Trochilus fimbriatus Gmelin, Systema naturae, vol. 1, pt. 1, 1788, p. 493 (Cayenne).

A common, widely distributed species in lowland areas that was taken at Ocumare de la Costa on October 25, near Maracay on November 11, and near El Sombrero on November 14. They were found about flowers or resting on shaded perches at moderate elevations in the trees. The white abdomen was prominent in birds that I had in the hand. These specimens appear very slightly darker gray on the back than skins seen from British Guiana.

SAUCEROTTIA TOBACI MONTICOLA Todd

Saucerottia tobaci monticola Todd, Proc. Biol. Soc. Washington, vol. 26, Aug. 8, 1913, p. 174 (Guarico, Estado Lara, Venezuela).

This was the most common hummingbird in the vicinity of El Sombrero, where I collected two males on November 16 and 17. They were found about small trees and shrubs that were in flower and in places congregated until they were actually abundant. On November 17 I saw one male in a typical display in which it swung in a broad curve that started high up, descended to pass closely to a hummer at rest on a twig, and then continued to rise again on the other side. It moved in this arc several times, making a curious rattling sound on the rise. Others were perching quietly in low branches of thorn trees. In handling freshly killed birds the white feathers of the tibiae are a striking mark. The two taken are darker, less bronzy in color than a series of *S. t. feliciae* from La Guaira, and so agree with Todd's description of *monticola*.

CHRYSURONIA OENONE OENONE (Lesson)

Ornismya oenone LESSON, Histoire naturelle des Colibris, Suppl., 1832, p. 157, pl. 30 ("Trinidad").

The only one identified was a female taken on November 6 at 2,800 feet elevation on the north slope of the Cordillera de la Costa below Rancho Grande. The bird was working over flowers on a steep bank adjacent to heavy woodland.

The rather long, brassy-colored tail, green back, and bluish-green head seem characteristic. Identification to subspecies follows custom in allocating birds from northern Venezuela to the typical race as comparative material is not at hand. While the type locality is given in the original description as Trinidad, Hartert[22] indicates that it probably should be Venezuela.

CHLOROSTILBON CARIBAEUS Lawrence

Chlorostilbon caribaeus LAWRENCE, Ann. Lyc. Nat. Hist. New York, vol. 10, 1871, p. 13 (Curaçao).

Near Ocumare de la Costa on October 25 these little hummers swarmed about a small tree to feed at its blossoms, sometimes hovering and sometimes resting for a few seconds with extended wings on the flower clusters. I collected two adult males here on October 26, secured a female, and a male in immature dress, and saw others feeding at flowers or searching over branches in the dry scrub. Many were observed the day following.

The two adult males taken are peculiar in having a distinct blue sheen extending over the entire under surface, a region that ordinarily is glittering green. I have seen only a few other birds that resemble these two; where blue is present ordinarily it is restricted to the breast. They apparently represent the extreme of the type named *lessoni*,[23] which was alleged to have the middle of the breast with a bluish tinge. This, however, seems to be individual variation as has been pointed out by Hartert.[24]

CHLOROSTILBON ALICE (Bourcier and Mulsant)

Trochilus alice BOURCIER and MULSANT, Rev. Zool., 1848, p. 274 (Caracas, Venezuela).

On November 9 at an elevation of 3,000 feet on the north slope of the Cordillera de la Costa near Rancho Grande I found these hummers common about roadside flowers. Two males were collected. The specific name, usually given as *aliciae*, is as written above.

---

[22] Nov. Zool., vol. 5, 1898, p. 518.

[23] *Chlorostilbon carribeus Lessoni* Simon and Dalmas, Ornis, vol. 11, 1901, p. 212 (Carúpano, Cariaco, Andes de Cumaná, Ciudad Bolívar).

[24] Nov. Zool., vol. 9, 1902, p. 86.

CHALYBURA BUFFONII AENEICAUDA Lawrence

Chalybura aeneicauda Lawrence, Proc. Acad. Nat. Sci. Philadelphia, vol. 17, 1865, p. 38 (Venezuela).

A female was taken on October 31 from several seen feeding at the flowers of an orange-colored morning-glory at 4,000 feet elevation in the valley of the Río Cumboto near Ocumare de la Costa.

ANTHRACOTHORAX NIGRICOLLIS NIGRICOLLIS (Vieillot)

Trochilus nigricollis Vieillot, Nouv. Dict. Hist. Nat., vol. 7, 1817, p. 349 (Brazil).

A female was taken as it fed at flowers near the road at Hato Paya, 18 miles northwest of El Sombrero.

ADELOMYIA MELANOGENYS AENEOSTICTA Simon

Adelomyia aeneosticta Simon, Mém. Soc. Zool. France, vol. 2, pt. 2, 1889, p. 223 (San Esteban, Venezuela).

From November 3 to 10 these birds were common in the vicinity of Rancho Grande, Four specimens were taken, including a male on November 4 and females on November 3 and 6. They were especially common in dense, wet forest at El Portachuelo, where often I heard the subdued humming of their wings when the birds themselves were hidden from sight in the shrubbery. Frequently they appeared within a few feet of me. They were feeding mainly at the flowers of a peculiar shrub in which the blossom grows directly from the sides of little branches. As the twigs were fairly thick, free wing movement for a hummer was often difficult. In such circumstances the birds perched to probe the blossoms and, when finished with one, to reach a further food supply often hopped from one twig to another, sometimes with a flit of the wings, but more often without such aid. The method of progression for these short distances was like that of a perching bird, and entirely different from anything that I have seen a hummingbird do before.

These hummers were found also at times about other flowers at the border of the forest, and once I found several working over herbage on a steep bank. I recorded them from 2,800 feet on the north slope of the Cordillera de la Costa to 3,700 feet above El Portachuelo.

CYANOLESBIA KINGII MARGARETHAE (Heine)

Lesbia Margarethae Heine, Journ. für Orn., 1863, p. 213 (Caracas, Venezuela).

Fairly common in heavy forest near Rancho Grande. On November 5 I saw several at 3,700 feet feeding at large, deep-red flowers growing in shade, and collected a male. On November 6 one scolded with an insistent chipping call at a hawk perched in dense growth, and when I shot the hawk the hummer came and hovered for several seconds in front of me. On November 8 I found them to 4,000 feet elevation. The wings of these birds produce a resonant humming sound; and I saw males opening and closing the long tail like a pair of scissors. The male taken shows clearly the green color of the middle rectrices that marks this race.

KLAIS GUIMETI (Bourcier and Mulsant)

Trochilus guimeti BOURCIER and MULSANT, Ann. Sci. Phys. Nat. Agric. Ind., Lyon, vol. 6, 1843, p. 38, pl. 2 (Caracas, Venezuela).

The only one seen was a female shot as it poised before flowers on the open roadside near Los Riitos at 2,600 feet elevation.

No type locality is given in the original description, but Hellmayr and Seilern [25] indicate that the type comes from Caracas.

Family TROGONIDAE

TROGONURUS COLLARIS COLLARIS (Vieillot)

Trogon collaris VIEILLOT, Nouv. Dict. Hist. Nat., vol. 8, 1817, p. 320 (Cayenne).

In the early morning of November 9 at Rancho Grande I heard a curious mewing call that drew my attention to the steadily jerking tail of a bird concealed in heavy brush. After the shot it was a distinct surprise to have my *peón* bring me a male of this trogon. The bird was in the rain forest at 3,300 feet elevation.

PHAROMACHRUS FULGIDUS FULGIDUS (Gould)

Trogon fulgidus GOULD, A monograph of the Trogonidae, 1838, pl. 24 and text ("Guiana" = Venezuela).

At Rancho Grande I saw these resplendent birds at elevations ranging from 2,800 to 3,300 feet on November 5 and 6 but did not secure a specimen until November 9. On that day while hunting through a section of open forest at 4,500 feet I shot a beautiful male. I was working slowly along a slope searching for tinamous, intent on the ground in front of me, when suddenly my companion Zembrano gave an exclamation that attracted my eye to one of these birds resting on an open branch where it was visible for a considerable distance. Intent on other game we had approached within a hundred feet before we saw it. It rested in the usual trogon position with the body against the limb, tail straight down, and head drawn in. From time to time it turned the head to look about, but otherwise was motionless. On preparing it I found the skin noticeably tougher and the feathers more firmly attached than in the smaller trogons.

Comparison of this specimen with Gould's plate of *Trogon fulgidus* leaves no question that this bird is the form of Venezuela, since the details of the white on the outer tail feathers, the brief length of the antrorse frontal feathers, and the extension of the longest upper tail

[25] Arch. Naturg., vol. 78, 1912, p. 148.

covert beyond the tail are identical. These details are repeated in the second plate in Gould's second edition,[26] where it is stated that the bird had been sent "in tolerable abundance from Venezuela." Peters[27] therefore is correct in using *fulgidus* as the older name, though the typical name should be applied to the bird found in Venezuela west at least to the Cumbre of Valencia. The Santa Marta race, named *festatus* by Bangs, is distinguished in part by the longer upper tail coverts and the greater development of the loral plumes. According to Todd and Carriker[28] the upper tail coverts in the adult male of *festatus* extend "more than an inch" beyond the tail in the adult male. In my specimen from Rancho Grande this difference is only 10 mm. Mr. Todd informs me (in litt.) that in three Santa Marta males in the Carnegie Museum the upper tail coverts project 32, 34, and 39 mm., respectively, beyond the tail, while in two from Colonia Tovar and Mirasol (near Cumanacoa), Venezuela, this projection is only 16 to 19 mm. Measurements for my specimen are as follows: Wing 183, tail 154, cullmen from base 22.8, tarsus 18.8 mm.

Family ALCEDINIDAE

MEGACERYLE TORQUATA TORQUATA (Linnaeus)

Alcedo torquata LINNAEUS, Systema naturae, ed. 12, 1766, p. 180 (Mexico).

On November 11 I recorded one at La Providencia near Maracay, and on November 19 saw another along the Río Guarico near El Sombrero. To hear a blackbirdlike *chuck* and then to look up to see this large kingfisher always amuses me.

CHLOROCERYLE AMAZONA (Latham)

Alcedo amazona LATHAM, Index ornithologicus, vol. 1, 1790, p. 257 (Cayenne).

A pair seen along a small stream near Parapara.

Family GALBULIDAE

GALBULA RUFICAUDA RUFICAUDA Cuvier

Galbula ruficauda CUVIER, Le règne animal, vol. 1, 1817, p. 420 (Cayenne).

My first acquaintance with this interesting species of jacamar was on the morning of October 26 near Ocumare de la Costa when, as I came over the slope of a little hill, I saw one perching quietly on an open, shaded perch under the spreading top of a thorny tree. The bird, a female, rested rather erect, with the tail hanging straight down, turning the head slowly from side to side. Near the tip of its bill it held a small butterfly with orange in the wings that fluttered away as I walked up after shooting my specimen. Two days later I collected

[26] A monograph of the Trogonidae, ed. 2, 1858, pl. 3 and text.
[27] Auk, 1929, pp. 115-116.
[28] Ann. Carnegie Mus., vol. 14, 1922, p. 243.

another, a male, in dense scrub. These jacamars are more active and alert than I had anticipated, with nothing of the stolidness of the puffbirds. I saw them fly quickly and gracefully, even through crowded branches, and when at rest occasionally they twitch the tail slightly. One called *kwee kwee kwee* in a somewhat petulant tone. Occasionally I saw them resting as high as 35 feet from the ground but always in shade.

At La Providencia near Maracay I noted several and collected one on November 11, and shot another in wet woods near El Sombrero November 20. I saw a pair near Hato Paya on November 21. Many of the country people confused jacamars with hummingbirds, and some of them told me that they were hummers that nested in holes in the ground.

The bird from El Sombrero, a male, has the green of the chest band partly covered by a suffusion of a metallic-coppery shade. The few specimens that I have seen from the northern coastal region of Venezuela (Puerto Cabello, Ocumare de la Costa, and San Julián) have the brown of the under surface faintly paler than in those from inland, in this showing some approach to the paler *Galbula ruficauda pallens* found on the coast of Colombia and that probably occurs in extreme northwestern Venezuela in the coastal area.

Berlepsch and Hartert [29] indicate the type locality of *ruficauda* as "La Guyane, sc. Cayenne," so that Cory [30] is wrong in citing it as "Colombia."

Family BUCCONIDAE

MALACOPTILA MYSTACALIS (Lafresnaye)

Monasa mystacalis LAFRESNAYE, Rev. Mag. Zool., 1850, p. 215 (Valparaiso, Santa Marta Mountains, Colombia).[31]

A female was taken on November 7 at an elevation of 2,600 feet near Los Riitos on the northern slope of the Cordillera de la Costa below Rancho Grande, the point being within the cloud forest that covers the upper reaches of those mountains. The bird was found at the edge of a high bank along the auto road where it rested motionless in the woodenlike, dumpy attitude common to all puffbirds. I was much interested in the fresh specimen in the white mustachial streaks as these could be made to stand out in a very prominent marking, which no doubt is used in display.

Hellmayr and Seilern [32] have listed a specimen from Las Quiguas, near San Esteban, Venezuela, under the name *Malacoptila aspersa* Sclater, saying that it differs from *M. mystacalis* of western Colombia in smaller size, weaker bill, less extent of white on the forehead, and

[29] Nov. Zool., vol. 9, 1902, p. 103.
[30] Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 2, 1919, p. 383.
[31] Fixed by Chapman, Bull. Amer. Mus. Nat. Hist., vol. 36, 1917, p. 342.
[32] Arch. Naturg., vol. 78, 1912, pp. 156–157.

streaked breast and sides. These distinctions do not apply in the case of my bird from Los Riitos, which differs from the Colombian specimens that I have seen only in being a little paler below, probably only an individual variation. Two skins in the American Museum from Cumbre Chiquito near San Esteban do not appear to differ from birds from Santa Marta.

HYPNELUS BICINCTUS BICINCTUS (Gould)

Tamatia bicincta GOULD, Proc. Zool. Soc. London, 1836 (1837), p. 80 (Venezuela).[33]

On October 26 I collected two near Ocumare de la Costa as they rested stolidly on shaded, open perches beneath the crown of spreading trees. They perched with the body inclined somewhat forward, tail held at an angle, and impressed me as rather dull and stupid. October 28 I recorded one eating a large insect. At El Sombrero on November 16 one flew from near the ground to an open limb in a tall tree, uttering a croaking note. The two from Ocumare were molting the primaries.

Family RAMPHASTIDAE

AULACORHYNCHUS SULCATUS SULCATUS (Swainson)

Pteroglossus sulcatus SWAINSON, Quart. Journ. Sci. Lit. Arts, vol. 9, 1820, p. 267 (Venezuela).

Near Rancho Grande on November 8 I saw several of these birds in heavy forest at 4,000 feet elevation; I shot one but lost it over the edge of a steep slope. The following day, lower down at 3,000 feet, a grunting note called my attention to one of these birds in a tree at the edge of the road. This one also fell far below and was lost. I was told that the bill was prized by the country people for medicine, for what purpose I did not learn, and that it was worth 5 bolívars.

Family PICIDAE

VENILIORNIS KIRKII CONTINENTALIS Hellmayr

Veniliornis kirkii continentalis HELLMAYR, Nov. Zool., vol. 13, Feb. 1906, p. 39 (Caripé, near Cumaná, Venezuela).

At La Providencia, near Maracay, on November 11 I found two working over open tree tunks in a grove and collected a male. One was seen at Parapara on November 12, and on November 21, I collected a female in heavy woods at Hato Paya north of El Sombrero as it climbed busily over the larger limbs. These specimens measure as follows: Male, wing 82.3, tail 49.5, culmen from base 21.4, tarsus 15.3 mm.; female, wing 84.1, tail 49.8, culmen from base 19.0, tarsus 15.7 mm. The female differs decidedly from the male in much narrower dark bars below, so that it is lighter colored on the lower

[33] Hellmayr and Seilern, Arch. Naturg., vol. 78, 1912, p. 156.

surface. From examination of other material, however, it appears that this is due to individual variation.

VENILIORNIS OLEAGINUS REICHENBACHI (Cabanis and Heine)

Phaeonerpes Reichenbachi CABANIS and HEINE, Museum Heineanum, pt. 4, 1863, p. 141 (Caracas, Venezuela).

Near Rancho Grande on November 2 I secured a female in heavy forest at 3,900 feet elevation. Others were seen at the borders of the woodland on November 3 and 7. The one taken measures as follows: Wing 94.3, tail 52.6, culmen from base 21, tarsus 16.8 mm.

While I have followed current usage in taking the name *reichenbachi* for birds from northern Venezuela, I am uncertain as to the characters of the races of this bird from South America.

PHLOEOCEASTES MELANOLEUCOS MELANOLEUCOS (Gmelin)

Picus melanoleucos GMELIN, Systema naturae, vol. 1, pt. 1, 1788, p. 426 (Surinam).

This handsome woodpecker was found in the forests of the Sierra de la Costa where, near Rancho Grande on November 5, I heard one drumming on a dead tree trunk, producing two rapid blows followed after a slight interval by another. The performance was decidedly like that of the related species *leucopogon* [34] of more southern range. On November 7 at Los Riitos on the north slope of the mountains I saw a fine pair of these birds flying overhead and collected them as they moved rather deliberately over the trunk of a huge tree. They peered and postured with alertly moving heads but were silent. Both were heavily infested with a large mite that crawled on my hands and arms and immediately began to bite. At El Sombrero on November 17 a beautiful bird was taken at the edge of heavy woodland, and on November 20 near the Río Guarico I watched one for some time within a distance of 20 feet. This species has a tough skin, firmly attached to the body, especially to the skull.

The present species, since Ridgway's review [35] of the generic status of the ivory-billed woodpeckers as a group (the old genus *Campephilus*) has been treated usually in the genus *Scapaneus*. After careful examination I can see no trenchant separation in structure between the species placed in *Scapaneus* and those allotted in *Phloeoceastes*. The only apparent difference is in the relatively greater length of the tenth primary in *Phloeoceastes robustus* (type of that genus). It appears to me necessary to unite these two, and the generic name will be *Phloeoceastes* as that is the older appellation of the two.

The male specimens obtained agree in color with *melanoleucos* from farther south and east. The female appears somewhat intermediate toward *Phloeoceastes melanoleucos malherbii* from farther west in more

[34] See Wetmore, U. S. Nat. Mus. Bull. 133, 1926, p. 215.
[35] U. S. Nat. Mus. Bull. 50, pt. 6, 1914, pp. 9–10.

buffy coloration and heavier barring of the under surface. A female in the National Museum from San Julián, a short distance east of La Guaira, seems also to show this intermediate character. It may be noted that this specimen and the one from Los Riitos come from the north slope of the coastal mountains. Birds from the Mérida region in Venezuela and from the mountains of the Santa Marta region in Colombia are typical *malherbii*, while skins from Fundación and from Los Pendales, Atlántico, in Colombia are somewhat intermediate but are to be called *malherbii*.

CENTURUS RUBRICAPILLUS RUBRICAPILLUS Cabanis

Centurus rubricapillus Cabanis, Journ. für Orn., 1862, p. 328 (Barranquilla, Colombia).

The first specimen was taken at La Providencia near Maracay on October 21, and others were seen there on November 11. Near Ocumare de la Costa they were common from October 23 to 30 and were found in a variety of situations from the large cacti growing over the arid hills or isolated trees in fields and pastures to the tall, rather dense groves of trees used as shade over the cacao plantations. Near El Sombrero they were recorded from November 14 to 21. My attention was usually attracted to them by their shrill, chattering calls. Four specimens taken come from the three localities mentioned.

After comparison of a considerable series I find it difficult to distinguish races in these birds except for the very distinct *seductus* found on San Miguel Island in the bay of Panamá. In general, in birds from Colombia, Venezuela, Trinidad, and Tobago the male has the light frontal band between the red of the crown and the base of the bill averaging wider. In some there is also a gray band across the back of the pileum separating the red of the crown from that of the nape. Both sexes have the white markings on the tail usually less extensive. This is typical *rubricapillus*.

Specimens from Panamá and Costa Rica have the light frontal band in the male averaging narrower, and the red of the crown always unbroken. In both sexes the white markings on the tail are usually more extensive. If these are recognized as distinct they will bear the name *wagleri*.

There is much individual variation among them, so that the characters given hold for only a part of the specimens from either area.

CHRYSOPTILUS PUNCTIGULA PUNCTIPECTUS Cabanis and Heine

Chrysoptilus punctipectus Cabanis and Heine, Museum Heineanum, pt. 4, 1863, p. 163 (Venezuela).

Near El Sombrero these woodpeckers were found regularly from November 14 to 20, working over open branches in the trees. A male taken November 14 measures as follows: Wing 103, tail 63.4, culmen from base 25.7, tarsus 21.6 mm.

PICUMNUS SQUAMULATUS OBSOLETUS Allen

Picumnus obsoletus ALLEN, Bull. Amer. Mus. Nat. Hist., vol. 4, Apr. 6, 1892, p. 55 (El Pilar, near Carúpano, Venezuela).

On October 28 I found one of these tiny birds in dense scrub near Ocumare de la Costa, resting across a branch, yawning prodigiously and stretching its neck, apparently to aid in ejecting a pellet of hard, indigestible insect remains. Near El Sombrero on November 16 I collected another as it rested on a vertical branch, which it hammered vigorously, clinging with its relatively huge feet while the tail swung clear. On November 20 one worked actively through small branches, 20 feet from the ground in wet woodland near the Río Guarico.

All three specimens are males. The one from Ocumare, in fresh plumage, is lighter colored above than the two from El Sombrero, which are somewhat worn. Measurements are as follows: Wing 51.5, 50.8, 50.8, tail 27.2, 24.5, 27.4, culmen from base 11.8, 12.4, 11.8, tarsus 11.8, 12.8, 11.8 mm.

Family DENDROCOLAPTIDAE

DENDROPLEX PICIROSTRIS PHALARA Wetmore

Dendroplex picirostris phalara WETMORE, Smithsonian Misc. Coll., vol. 98, No. 4, Mar. 10, 1939, p. 4 (El Sombrero, Estado Guarico, Venezuela).

The first of these birds was seen on November 12 near Parapara, where one was collected as it worked among the larger branches of a thorny tree. Near El Sombrero they were fairly common, so that three were obtained on November 14, 18, and 19. They were found in the more open scrub and also in low, wet woods. They climbed like *Lepidocolaptes*. On November 20 I found two chattering and calling about holes in trees in heavy forest near the Río Guarico.

These birds are distinct from typical *picirostris* in the greater extent of light color over the upper breast, lighter auricular region, paler forehead, more extensive light streakings on the hindneck, and heavier bill. They are nearly allied to *longirostris* of Margarita Island in greater extent of white on the breast and in larger bill, but they have the light spots on the crown and hindneck larger, the light area on the forehead more extensive, and the breast markings more buffy. The breast is browner and lighter colored, less blackish. While I have seen specimens from Parapara and El Sombrero only, it is probable that this race extends across the northern llanos.

XIPHORHYNCHUS TRIANGULARIS HYLODROMUS Wetmore

Xiphorhynchus triangularis hylodromus WETMORE, Smithsonian Misc. Coll., vol. 98, No. 4, Mar. 10, 1939, p. 2 (4,500 feet elevation above Rancho Grande, Estado Aragua, Venezuela).

Near Rancho Grande these birds were fairly common in heavy forest, two being taken on November 3 and 5 at 3,700 feet elevation and two on November 8 at 4,500 feet. They were seen climbing over the stems of large creepers, or the trunks of trees, probing in crevices with the bill. The two last mentioned were calling loudly and seemed to be mated.

Hellmayr and Seilern,[36] in discussing a small series of this bird from the Cumbre de Valencia, remarked on a slight difference in the color of the back when their birds were compared with those of Bogotá. The four skins obtained at Rancho Grande indicate other distinctions that set off a well-marked race, distinguished from the typical form by brighter olive-brown color above, with the secondaries darker, less reddish brown, the under surface lighter, more greenish olive and more abundantly spotted, the spots being lighter colored. The throat is decidedly lighter, with the dark marginal lines on the feathers reduced in width. The present form is now known from Rancho Grande and the Cumbre de Valencia.

XIPHORHYNCHUS NANUS DEMONSTRATUS Hartert and Goodson

Xiphorhynchus nanus demonstratus HARTERT and GOODSON, Nov. Zool., vol. 24, 1917, p. 419 (San Esteban Valley, Venezuela).

Specimens were taken at Maracay on October 21 and at Ocumare de la Costa on October 28. A third was secured at an elevation of 3,600 feet in El Portachuelo above Rancho Grande on November 7. The birds were seen climbing about in trees, sometimes among the higher branches and sometimes near the base. The one taken at Rancho Grande gave a loud, whistled song. The bird last mentioned, which comes from heavy rain forest, is distinctly brighter colored, with the spots and streakings lighter than the other two from lowland areas. While Hellmayr gives this form and *nanus* as races of *guttatus*, they differ so in duller color and slenderer bill that I prefer to consider them specifically distinct.

LEPIDOCOLAPTES SOULEYETII LITTORALIS (Hartert and Goodson)

Picolaptes albolineatus littoralis HARTERT and GOODSON, Nov. Zool., vol. 24, 1917, p. 417 (Quebrada Seca, "Estado Bermudez," Venezuela).

On October 24 I saw several in the lower edge of the rain forest at an elevation of 700 feet in the valley of the Río Cumboto west of Ocumare de la Costa. My attention was attracted to one by its

[36] Arch. Naturg., vol. 78, 1912, p. 110.

steady pecking at the trunk of a tree, a noise that I attributed at first to some woodpecker. On November 11 I collected two from several seen climbing over the trunks of trees in an open grove at La Providencia near Maracay, and on November 12 I shot one in open scrub near Parapara, Estado Guarico. Others were seen at El Sombrero on November 18 and 20 and at Hato Paya on November 21.

LEPIDOCOLAPTES LACHRYMIGER LAFRESNAYI (Cabanis and Heine)

Thripobrotus Lafresnayi CABANIS and HEINE, Museum Heineanum, vol. 2, 1859, p. 38 (Caracas, Venezuela).

A female was taken November 8 at an elevation of 4,000 feet above Rancho Grande in heavy forest. It measures as follows: Wing 94.2, tail 80.3, culmen from base 27.0, tarsus 19.3 mm.

From *L. s. littoralis* of the lowlands this bird is distinguished by slightly larger size and by spotted rather than streaked crown.

CAMPYLORHAMPHUS TROCHILIROSTRIS VENEZUELENSIS (Chapman)

Xiphorhynchus venezuelensis CHAPMAN, Bull. Amer. Mus. Nat. Hist., vol. 2, 1889, p. 156 (Venezuela).

Near El Sombrero on November 18 I collected a female in a stand of good-sized trees bordering a shallow ravine near La Meseta. Two days later I recorded another in low, wet woods near the Río Guarico. The specimen secured measures as follows: Wing 94.7, tail 89.7, culmen from base 73.4, tarsus 23 mm.

SITTASOMUS GRISEICAPILLUS GRISEUS Jardine

Sittasomus griseus JARDINE, Ann. Mag. Nat. Hist., vol. 19, 1847, p. 82 (Tobago).

On November 2 at 3,700 feet elevation in the Cordillera de la Costa above Rancho Grande I shot a male from a little flock of forest birds traveling in company. Another was seen on November 6, like the first one creeping over a tree trunk. Without comparative material at hand I have identified this bird in accordance with Hellmayr's treatment.[37]

DENDROCINCLA FULIGINOSA MERULOIDES (Lafresnaye)

Dendrocops meruloides LAFRESNAYE, Rev. Mag. Zool., 1851, p. 467 (near Cumaná, Venezuela).[38]

The only one secured was a male, taken on November 6 at 3,000 feet elevation near Rancho Grande. It was climbing rather slowly over the trunk of a tree in heavy forest. Zimmer [39] includes this form as a race of *fuliginosa*.

[37] Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 4, 1925, pp. 359–360.
[38] According to Hellmayr, Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 4, 1925, p. 366.
[39] Amer. Mus. Nov., No. 728, 1934, p. 18.

Family FURNARIIDAE

SYNALLAXIS CINNAMOMEA BOLIVARI Hartert

Synallaxis terrestris bolivari Hartert, Bull. Brit. Orn. Club, vol. 37, Mar. 6, 1917, p. 31 (Silla de Caracas, Venezuela).

On November 6 at 2,800 feet elevation on the north slope of the mountains near Rancho Grande, I heard a high-pitched, excited call from a tangle of morning-glory and other low growth beside the road and finally secured an adult male of this bird as it moved about under heavy cover.

SYNALLAXIS ALBESCENS OCCIPITALIS Madarász

Synallaxis occipitalis Madarász, Ann. Hist. Nat. Mus. Nat. Hungarici, vol. 1, pt. 2, Nov. 18, 1903, p. 463 (El Valle, 3,000 metres, Venezuela).

On November 10 at 3,500 feet elevation near Rancho Grande I heard the chattering call of this bird from high grass on an open bank beside the highway, and after long watching I secured a female in worn plumage. In identifying this specimen I have followed Zimmer [40] who includes the area eastward to Caracas in the range of this form. The crown and shoulder are dark in hue.

SYNALLAXIS ALBESCENS TRINITATIS Zimmer

Synallaxis albescens trinitatis Zimmer, Amer. Mus. Nov., No. 819, Sept. 17, 1935, p. 2 (Princestown, Island of Trinidad).

On November 19 near El Sombrero I found these birds very common in high grass and weeds near the Río Guarico and collected a male. All seen were in very worn plumage. This bird compared with the one from Rancho Grande has the crown and shoulder distinctly paler, the breast lighter, the flanks distinctly paler, and the sides of the head lighter gray.

CERTHIAXIS CINNAMOMEA FUSCIFRONS (Madarász)

Synallaxis fuscifrons Madarász, Orn. Monatsb., vol. 21, Feb. 1913, p. 22 (Aracataca, Santa Marta District, Colombia).

A female taken at El Sombrero, November 17, typical of this form in having the entire forehead dull olive-gray, marks a southern extension of the range. Near the Meseta this bird flew to a small tree with a little brush about its base growing on a slight hummock in a shallow, very muddy lagoon, and proceeded to move leisurely with constantly jerking tail first through the higher branches and then lower down near the ground. It seemed entirely intent on its own affairs, paying no attention to the passing of other birds, disregarding even hawks. It was equally oblivious to the sticks and stones that I

[40] Amer. Mus. Nov., No. 861, June 22, 1936, pp. 14, 18.

threw at it in an attempt to frighten it to another situation where I could secure it, even when these missiles struck within a foot or two. Finally it flew with quickly undulating flight to a tree on the shore when I shot it.

CRANIOLEUCA SUBCRISTATA (Sclater)

Synallaxis subcristata SCLATER, Proc. Zool. Soc. London, 1874, p. 20, pl. 4, fig. 1 (near Caracas, Venezuela).

The only one seen was taken in the valley of the Río Cumboto at 400 feet elevation near Ocumare de la Costa, October 31, as it climbed actively about a tangle of vines at the edge of dense scrub. The dusky streaking on the crown is so indistinct as to be barely made out, and there is no suggestion of a superciliary streak.

PHACELLODOMUS RUFIFRONS INORNATUS Ridgway

Phacellodomus inornatus RIDGWAY, Proc. U. S. Nat. Mus., vol. 10, July 2, 1887' p. 152 (Caracas, Venezuela).

The nest of sticks of this bird, pendant at the end of a branch, met my eye as I entered the grounds of the Agricultural School, at La Providencia near Maracay, on October 21, my first day afield in Venezuela, and these same structures were seen constantly as I traveled through the country. They were noted at Ocumare de la Costa, where I collected a bird on October 31, at Parapara (specimen) and Ortiz on November 12, and near El Sombrero from November 13 to 21 (specimen November 16). Two skins were secured at Maracay on October 21. The birds frequented tangles of brush and vines, usually in pairs or little groups of half a dozen, and often chattered and scolded about their nests.

XENICOPSOIDES MONTANUS VENEZUELANUS (Hellmayr)

Philydor venezuelanus HELLMAYR, Rev. Franç. Orn., vol. 2, Apr. 7, 1911, p. 49 (Cumbre de Valencia, Estado Carabobo, Venezuela).

Near Rancho Grande these birds were fairly common. On November 4 two were seen and one taken in dense brush at the edge of the forest, where they appeared near at hand to utter low, querulous notes. The following day I collected a pair at an elevation of 3,700 feet as they clambered about among twigs and leaves. One was seen in a display in which it circled with spread wings among the trees while it called excitedly in a high-pitched tone. Another was taken on November 10 near this same point while it moved rather slowly through low growth in heavy forest.

PHILYDOR RUFUS COLUMBIANUS Cabanis and Heine

Philydor columbianus CABANIS and HEINE, Museum Heineanum, pt. 2, 1859, p. 29 (Cumbre de Valencia).

The three taken include two females collected at 3,700 and 3,900 feet elevation near Rancho Grande, November 2 and 4, and a male from lower down on the north slope of the Cordillera de la Costa at 2,600 feet near Los Riitos on November 7. The birds were found working about among creepers and leafy branches in dense forest, except for the one from Los Riitos, which was shot as it flew across the road.

While Cabanis and Heine have given the type locality as "Porto Cabello," Hellmayr [41] has corrected this to Cumbre de Valencia, as the bird is found in the forested mountains and not on the coast.

THRIPADECTES VIRGATICEPS KLAGESI (Hellmayr and Seilern)

Automolus klagesi HELLMAYR and SEILERN, Verh. Orn. Ges. Bayern, vol. 11, 1912, p. 157 (Cumbre de Valencia, Estado Carabobo, Venezuela).

The only specimen seen was a male taken on November 10 at an elevation of 4,000 feet in El Portachuelo above Rancho Grande. It was moving quietly about in low brush growing in the shade of dense forest. It measures as follows: Wing 89.5, tail imperfect, culmen from base 25.0, tarsus 27.1 mm.

XENOPS MINUTUS NEGLECTUS Todd

Xenops genibarbis neglectus TODD, Proc. Biol. Soc. Washington, vol. 26, Aug. 8, 1913, p. 173 (Las Quiguas, Estado Carabobo, Venezuela).

The only one seen was taken on October 31 in a tangle of vines at the edge of dense scrub along the Río Cumboto near Ocumare de la Costa. It hung often back down like a titmouse, the light marks on the side of the head showing prominently.

SCLERURUS ALBIGULARIS ALBIGULARIS Sclater and Salvin

Sclerurus albigularis SCLATER and SALVIN, Proc. Zool. Soc. London, 1869, p. 630 (Cumbre de Valencia, Estado Carabobo, Venezuela).[42]

At 3,600 feet elevation in El Portachuelo above Rancho Grande, Venezuela, one was taken low down in heavy growth on November 7. Measurements are as follows: Wing 86.8, tail 61.7, culmen from base 23.7, tarsus 23.4 mm.

Family FORMICARIIDAE

TARABA MAJOR GRANADENSIS (Cabanis)

Diallactes granadensis CABANIS, Journ. für Orn., 1872, p. 234 (Bogotá, Colombia).

Found only at 400 feet elevation along the Río Cumboto near Ocumare de la Costa on October 31. In dense brush one came hopping slowly toward me through the branches, scolding and chattering.

[41] Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 4, 1925, p. 205.
[42] Hellmayr, Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 4, 1925, p. 247.

It proved to be a juvenile bird fully grown but with the indistinctly barred juvenal plumage on breast, flanks, and back. A few minutes later I secured an adult female.

SAKESPHORUS CANADENSIS INTERMEDIUS (Cherrie)

Hypolophus canadensis intermedius CHERRIE, Brooklyn Inst. Mus. Sci. Bull., vol. 2, No. 6, 1916, p. 277 (Caicara, Orinoco River, Venezuela).

A common species of highly attractive appearance found in dense scrub. At Ocumare de la Costa specimens were taken on October 28 and 31. Near El Sombrero I collected one each on November 16, 20, and 21, the last one coming from Hato Paya. The birds chattered and scolded at me from cover but were often difficult to find. When seen the raised crest always attracted the eye.

There is considerable variation in color of the back, both in males and females, but all are distinct from the brighter brown *S. c. pulchellus* of farther west. They are identified as *intermedius* tentatively only, with the assumption that probably at least two forms are represented. Males from Ocumare are decidedly grayish brown on the back and have the under tail coverts white without black at the base. The female is duller brown than a female from Trinidad. The males from El Sombrero have larger bills and are lighter, brighter brown on the back. Below the black of the breast is restricted, and the sides are whiter. The female is lighter on the back, has the black streaks on the breast nearly obsolete, and shows more white on the abdomen. It is probable that the specimens from Ocumare represent an undescribed form.

THAMNOPHILUS DOLIATUS FRATERCULUS Berlepsch and Hartert

Thamnophilus doliatus fraterculus BERLEPSCH and HARTERT, Nov. Zool., vol. 9, 1902, p. 70 (Altagracia, Río Orinoco, Venezuela).

This interesting bird was first taken at Parapara on November 12 and was fairly common near El Sombrero from November 16 to 20. One was observed at Hato Paya on November 21. It was encountered in thorn scrub, where it moved about under cover but was called out into sight without much difficulty. The three collected are females.

DYSITHAMNUS PLUMBEUS TUCUYENSIS Hartert

Dysithamnus tucuyensis HARTERT, Nov. Zool., vol. 1, 1894, p. 674, pl. 15 (Bucarito, Tocuyo, Venezuela).

Near Rancho Grande three males were taken on November 3, 6, and 8 at elevations ranging from 3,700 to 4,000 feet. The birds were found in heavy forest, twice in low undergrowth, and once with a little flock of forest birds moving quickly through the treetops. Their dark-gray coloration made them difficult to see. Two of the birds are immature, one with indistinctly streaked throat suggesting the markings of the female, the other with tiny spots of dull white on the throat and the sides of the head. An adult with the throat plain has a concealed shoulder marking of white that is lacking in the youngest of the other two and only faintly indicated in the other.

DYSITHAMNUS MENTALIS CUMBREANUS Hellmayr and Seilern

Dysithamnus mentalis cumbreanus Hellmayr and Seilern, Verh. Orn. Ges. Bayern, vol. 12, 1915, p. 203 (Las Quiguas, San Esteban Valley, Estado Carabobo, Venezuela).

At Rancho Grande on November 2 and 8 I collected six of these little birds at elevations of 3,900 and 4,000 feet. They ranged in little groups through medium or high levels in heavy forest. They made a regular part of little roving bands of forest birds and hopped and flitted actively, ordinarily behind the cover of leaves. At a distant glance they often suggested warblers.

MYRMOTHERULA SCHISTICOLOR SANCTAE-MARTAE Allen

Myrmotherula sanctae-martae Allen, Bull. Amer. Mus. Nat. Hist., vol. 13, Aug. 25, 1906, p. 160 (Valparaiso, Santa Marta region, Colombia).

The four taken near Rancho Grande on November 3, 5, and 6 were obtained at elevations of 3,700 and 3,800 feet in heavy forest. They are tiny birds that ranged in dense brush or in masses of creepers, feeding actively and nervously through the twigs. The series includes one immature male that is paler colored than the adult, that lacks the white tips on the wing coverts, and that has the black throat patch only faintly indicated.

NEORHOPIAS GRISEA INTERMEDIA (Cabanis)

Formicivora intermedia Cabanis, Arch. Naturg., 1847, p. 225 (Aragua,[43] Venezuela).

In the region around Ocumare de la Costa where five specimens were collected these small birds were common from October 23 to 31, several were seen near Maracay on November 11, and one was taken at Parapara on November 12. Near El Sombrero they were common. They were found in dense scrubs and in growths of weeds and vines near the ground, ordinarily not going higher than the lower limbs of the trees. Near Maracay they were noted in brush-grown pastures, and at El Sombrero I found them in low woods near the river as well as in the drier scrubs. Many were seen at Hato Paya. At a little distance the males often appear entirely black except for the flash of white in the wing bars. The notes are a trilling chatter.

[43] Designated by Hellmayr, Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 3, 1924, p. 187.

CHAMAEZA RUFICAUDA CHIONOGASTER Hellmayr

Chamaeza turdina chionogaster HELLMAYR, Bull. Brit. Orn. Club, vol. 16, May 28, 1906, p. 91 (E. Guacharo, near Caripé, Estado Monagas, Venezuela).

Near Rancho Grande this interesting bird was fairly common. Specimens were taken on November 6 at 3,700 feet and on November 8 at 4,000 feet. Soon after my arrival in this section I began to hear a loud, whistled song from dense growth with no clue as to the musician until one day in El Portachuelo one sang near at hand. I called and watched intently until suddenly a bird moved in the dark shadows of the undergrowth with a rattling of its wings and a moment later I had it in my hand. On November 8 at 4,000 feet elevation in heavy forest with the ground fairly open beneath I saw one within a few feet of me. It walked easily and alertly and then, suddenly, sang its song, a steady repetition of a single whistled note, given slowly at first and then more rapidly and insistently to die away again quickly toward the end. To me this was one of the most interesting of the forest birds.

GRALLARICULA LORICATA (Sclater)

Grallaria loricata SCLATER, Proc. Zool. Soc. London, 1857, p. 129 (near Caracas, Venezuela).

The only one seen was taken on November 7 at 3,600 feet elevation in El Portachuelo above Rancho Grande. It flew up in heavy undergrowth to rest quietly only a few feet away.

GRALLARIA HAPLONOTA HAPLONOTA Sclater

Grallaria haplonota SCLATER, Ibis, 1877, p. 442 (Venezuela near Caracas [44]).

These interesting birds were found in small numbers along a winding trail through dense, wet forest in El Portachuelo above Rancho Grande. Here I shot an immature female at 3,600 feet on November 4 and a male at 3,900 feet on November 10. One morning as I descended this trail toward noon I had a glimpse of an alert, long-legged bird that ran quickly across a little open space and then disappeared. The following day at the same place one ran down the sloping path and into the cover of leaves at the side. A moment later at a call it ran out suddenly with a quick, robinlike movement and in another moment was in my hand. On November 10 a little higher on the same trail, following a shot I heard a call that for a moment I thought came from some laborer giving me warning that he was in the forest. I wondered casually what had brought a workman into this remote woodland, when suddenly the note came more clearly and I recognized that it was a bird. It was a sound difficult to describe except to say that it was a low-pitched, rather hollow-sounding whistle that I could imitate with sufficient accuracy to

[44] According to Hellmayr, Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 3, 1924, p. 338.

draw the bird up within a few feet. It answered me regularly, coming nearer and nearer, until suddenly I found the caller in one of these ant-pittas that appeared with a thrushlike flirt of its wings on a log a few feet away. It eyed me for an instant and then dropped out of sight, but presently it came up again and I secured it. Another was heard farther on at 4,000 feet. The natives know this bird as *pichón*. The breast muscles were moderate in size and light in color, indicating little use. The juvenile bird has a few streaks of cinnamon-buff scattered over the back and sides of the crown.

Family COTINGIDAE

EUCHLORNIS FORMOSA FORMOSA (Hartlaub)

Ampelis formosa Hartlaub, Rev. Mag. Zool., 1849, p. 275, pl. 14, fig. 1 (Caracas,[45] Venezuela).

These were birds of the rain forest at Rancho Grande where I secured specimens on November 4, 7, and 10 and where I found them from 3,600 feet upward. They ranged low in heavy undergrowth where they came to feed on a blue colored berry. They moved about rather actively at times and again slowly and deliberately but stopped frequently to rest for a few minutes so that I sometimes had difficulty in seeing them. They are heavy bodied, have a very small oil gland, and the feathers on back and rump are very loosely attached. The adult male is one of the most beautifully colored of all forest birds, with its black head and throat, green back, wings, and tail, white spots on the ends of the tertials, green flanks, and yellow underparts with a large spot of deep red on the upper breast and lower foreneck.

PACHYRAMPHUS POLYCHOPTERUS TRISTIS (Kaup)

Psaris marginatus tristis Kaup, Proc. Zool. Soc. London, 1851 (Oct. 28, 1852), p. 48 (Cayenne).[46]

Seen on three occasions near El Sombrero—on November 13, when a female was shot as it moved actively through the branches of a thorn bush; on November 14, when one was seen in dense scrub; and on November 21, when a female was taken in dense woods near Hato Paya, 18 miles northwest.

Family PIPRIDAE

CHIROXIPHIA LANCEOLATA (Wagler)

Pipra lanceolata Wagler, Isis (von Oken), 1830, p. 931 ("Guiana sive Cajenna").

On October 30 near Ocumare de la Costa at the edge of a patch of dense scrub I heard a whistled call, reminiscent of Guatemala, and

[45] The original description says Venezuela only. Caracas is indicated by Hellmayr, Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 6, 1929, p. 121.

[46] Designated by Bangs and Penard, Bull. Mus. Comp. Zoöl., vol. 64, 1921, p. 387.

soon determined that the note was that of the present species. I secured two here in heavy growth, one low down and the other about 20 feet from the ground. The call seemed somewhat louder than that of *C. linearis*, which I had known elsewhere, and the birds ranged somewhat higher in the thickets. On the following day, now that I knew the note, I found this a common bird along the valley of the Río Cumboto. Here its whistled calls and an occasional mewing, scolding note came constantly from the brush where the birds kept to dense cover. As they ordinarily present the breast to the observer and are usually seen indistinctly because of intervening leaves they give the impression of being entirely black. When one flew across the highway, however, my eye caught a flash of light blue from the back.

Family TYRANNIDAE

SAYORNIS NIGRICANS LATIROSTRIS (Cabanis and Heine)

Aulanax latirostris Cabanis and Heine, Museum Heineanum, pt. 2, 1859, p. 68 (Bolivia).

In crossing the Cordillera de la Costa on October 22 I was delighted to see this friendly bird as soon as we had reached the elevation of the rain forest below Rancho Grande, and the following day Ventura Barnés, Jr., brought me my first specimen. Later, I secured others on November 3, 5, and 9. The birds were found from an elevation of 1,500 feet on the north side to the summit of the pass in El Portachuelo and were most common above 2,500 feet. They were observed only along the roadway, about cutbanks and at the crossings of barrancas, never penetrating into the forest. In all their mannerisms they recalled the race of the black phoebe of the Southwestern United States. The four taken have the white edgings of wings and tails decidedly more extensive than the three other *latirostris* I have seen (two from Perú and one from the Santa Marta region), a difference due possibly to fresher plumage.

FLUVICOLA PICA (Boddaert)

Muscicapa Pica Boddaert, Table des planches enluminéez, 1783, p. 42 (Cayenne).

At Ocumare de la Costa on October 25 I took a male from a shaded perch in a little tree on the playa at Independencia. With steadily twitching tail it moved actively near the ground. On October 29 I watched another for some time as it circled above the water of the lagoon, flapping and turning for minutes at a time and after a rest on some projecting stub continuing its flight. With its pointed wings it resembled a little swallow. At El Sombrero on November 16 I collected one at a nearly dry lagoon located in a small opening in the woods.

Fluvicola pica in its broadly white shoulders and the extent of white on the rump and upper tail coverts is so different from *F. albiventer* in which the back is wholly dark and there is only a narrow line of white on the rump that I do not believe it proper to consider them conspecific, at least until intergradation is proved. All that I have seen refer definitely to one group or the other.

PYROCEPHALUS RUBINUS SATURATUS Berlepsch and Hartert

Pyrocephalus rubinus saturatus BERLEPSCH and HARTERT, Nov. Zool., vol. 9, Apr. 1902, p. 34 (Altagracia, Río Orinoco, Venezuela).

At Ocumare de la Costa I secured a fine adult male as it rested on a shaded perch beneath a little tree on the open playa. This bird is not quite in full plumage, being dark brown on the back. Others were seen here on October 29 and 30. On November 12 and 21 I observed them frequently between Maracay and El Sombrero, and at the latter point they were common from November 13 to 20. A male taken on November 16 is in full plumage, with the upper surface and the under wing coverts sooty black, as is characteristic of this dark race.

MACHETORNIS RIXOSA FLAVIGULARIS Todd

Machetornis rixosa flavigularis TODD, Ann. Carnegie Mus., vol. 8, May 20, 1912, p. 210 (Tocuyo, Estado Lara, Venezuela).

The southern race of this curious flycatcher has been so well known to me that it was a delight to make the acquaintance of the somewhat yellower northern form when on October 17 I saw two perched on the back of a horse near the little stream in the lower part of the city of Caracas. At Ocumare de la Costa on October 25 and 28 I collected two specimens on the open playa at Independencia, where the birds rested in the tops of small, solitary trees or ran about on the ground among grazing goats and burros. They were seen alone or in groups of two or three and were alert and tame, calling occasionally with weak, squeaky notes. One was taken at La Providencia near Maracay on November 11, and at El Sombrero I saw them on the open prairies from November 15 to 21. On the latter date they were recorded at Hato Paya.

MUSCIVORA TYRANNUS MONACHUS (Hartlaub)

Tyrannus (*Milvulus*) *monachus* HARTLAUB, Rev. Zool., vol. 7, 1844, p. 214 (Guatemala).

The only one recorded was a male taken on November 15 on an open prairie on the Meseta at El Sombrero. In early morning, following a heavy rain, the bird rested on a stick a foot from the ground.

The specimen shows the characters assigned by Zimmer [47] in his review of this species. The two outer primaries are much narrowed at the tip, the narrowed portion being from 2.0 to 2.7 mm. wide and 13.0 to 13.4 mm. long, set off by an abrupt, deep notch from the rest of the feather. The third primary has the narrowed portion 4.5 to 5.0 mm. wide and 15 mm. long, the basal notch not deeply incised. The fourth feather is not modified. The breast is pure white and the back light gray with an indication of a narrow white collar on the hindneck.

TYRANNUS DOMINICENSIS DOMINICENSIS (Gmelin)

Lanius dominicensis GMELIN, Systema naturae, vol. 1, pt. 1, 1788, p. 302 (Hispaniola).

At Ocumare de la Costa one was taken on October 30, and another was observed the day before. Near El Sombrero a second specimen was collected on November 18, and one was seen on the sixteenth.

TYRANNUS MELANCHOLICUS CHLORONOTUS Berlepsch

Tyrannus chloronotus BERLEPSCH, Ornis, vol. 14, 1907, p. 474 (Temax, Yucatán).

Three males were taken at Ocumare de la Costa on October 23 and 27 and at El Sombrero on November 18. The birds were common and were seen in the grounds of the American Legation at Caracas on October 17, at Maracay on October 21 and November 11, and along the highway from Maracay to El Sombrero on November 12 and 21.

EMPIDONOMUS VARIUS SEPTENTRIONALIS Todd

Empidonomus varius septentrionalis TODD, Proc. Biol. Soc. Washington, vol. 29, June 6, 1916, p. 96 (El Trompillo, Estado Carabobo, Venezuela).

At El Sombrero on November 18 I found one in the dry scrub where it rested on open perches.

MYIODYNASTES CHRYSOCEPHALUS INTERMEDIUS Chapman

Myiodynastes chrysocephalus intermedius CHAPMAN, Bull. Amer. Mus. Nat. Hist., vol. 31, July 23, 1912, p. 152 (Las Nubes, 5,000 feet, Sierra Nevada de Santa Marta, Colombia).

Three males were secured in heavy forest near Rancho Grande at elevations ranging from 3,000 to 4,000 feet, where they were found at the edge of an open trail, or in small openings made by a falling tree. They seemed to be true forest birds, reminding me in their choice of haunt of the *Tolmarchus* with which I had been familiar in Haiti and Puerto Rico. The birds are probably commoner than these few observations indicate since they perch quietly in the smaller trees and in the dense growth are easily overlooked.

---

[47] Amer. Mus. Nov., No. 962, 1937, pp. 4–7.

CONOPIAS INORNATA (Lawrence)

Myiozetetes inornatus Lawrence, Ann. Lyc. Nat. Hist. New York, vol. 9, 1869, p. 268 (Valencia, Venezuela).

At El Sombrero I saw this unusual bird on several occasions. A female was taken on November 15 in a small grove on the open prairie at the Meseta. Others were seen later in similar situations or about small lagoons. In the field they are easily confused with *Myiozetetes c. rufipennis*, as the color pattern is the same in both. *C. inornata* is distinguished by lack of the yellow and orange crown patch, deeper yellow under surface, and slightly larger size. The one taken measures as follows: Wing 93.7, tail 80.8, culmen from base 17.3, tarsus 22.0 mm.

MYIOZETETES CAYANENSIS RUFIPENNIS Lawrence

Myiozetetes rufipennis Lawrence, Ann. Lyc. Nat. Hist. New York, vol. 9, 1869, p. 267 (Valencia, Venezuela).

A common bird in northern Venezuela that was recorded at Caracas on October 17, near Ocumare de la Costa October 28 to 31, and near El Sombrero in November. At Ocumare where the birds were especially common I took a female on October 28. They were found along roads, in pastures, or about lagoons, where the trees grew in open formation. Often they were seen in pairs or in little groups that flew ahead of me with chattering calls, and a flash of yellow color, sometimes displaying the yellow and orange in the crown. The bird taken measures as follows: Wing 83.5, tail 67.5, culmen from base 15.4, tarsus 17.8 mm.

PITANGUS SULPHURATUS RUFIPENNIS (Lafresnaye)

Saurophagus rufipennis Lafresnaye, Rev. Mag. Zool., 1851, p. 471 (Caracas, Venezuela).

Recorded at Maracay on October 21 and November 11 (specimen), Ocumare de la Costa October 23 to 31, and El Sombrero November 13 to 21 (specimen). This is one of the common birds seen in travel in this country.

MYIARCHUS FEROX VENEZUELENSIS Lawrence

Myiarchus venezuelensis Lawrence, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 38 (Venezuela).

One was taken on November 20 in wet woodland along the Río Guarico near El Sombrero. It was a long, slender bird that moved slowly through the branches, in such a peculiar manner that at first I took it for a small cuckoo. It proves to be an immature bird, though fully grown, with the rectrices bordered on both webs very narrowly with cinnamon and a brownish wash on the upper tail coverts. Identification to subspecies is made on geographic grounds.

MYIARCHUS TYRANNULUS TYRANNULUS (Müller)

Muscicapa tyrannulus MÜLLER, Natursystem, Suppl., 1776, p. 169 (Cayenne).

Recorded as follows: Maracay, October 21 (specimen); Ocumare de la Costa, October 25 to 30 (two specimens); El Sombrero, November 13 to 21 (specimen). Birds seen on the open south slopes below the rain forest at Rancho Grande on November 4 and 9 are supposed to have been this form, but of this I was not certain. At Maracay they were found in the tops of fair-sized trees in open groves, but in the dry scrub they rested usually on shaded perches in the larger bushes. I saw them also in the high shade trees over cacao plantations.

MYIARCHUS TUBERCULIFER TUBERCULIFER (d'Orbigny and Lafresnaye)

Tyrannus tuberculifer D'ORBIGNY and LAFRESNAYE, Synopsis avium, Mag. Zool., vol. 7, cl. 2, 1837, p. 43 (Guarayos, Bolivia).

One was taken October 21 as it rested on the middle branches of a tree in a grove at La Providencia near Maracay. Another was seen here on November 11.

NUTTALLORNIS BOREALIS (Swainson): Olive-sided Flycatcher

Tyrannus borealis SWAINSON, Fauna Boreali-Americana, vol. 2, 1831 (Feb. 1832), p. 141, pl. 35 (Carlton House, Saskatchewan).

From November 3 to 10 I saw occasional individuals resting in the dead limbs at the tops of tall trees standing on ridges, where the birds had commanding views over the valleys, or heard their calls as I traveled hidden mountain trails below. Truly this flycatcher must be a connoisseur of mountain scenery, since similar localities make favorite haunts for it on its breeding grounds in the north. The birds are quite fearless, as I shot two parakeets one after the other from a dead tree only a few feet distant from one of these flycatchers, which merely turned its head to watch its larger companions fall.

A male olive-sided flycatcher taken on November 3 was in good flesh but was not fat. It had already begun the molt and renewal of the inner wing feathers. This specimen measured as follows: Wing 107.5, tail 65.8, culmen from base 18, tarsus 15.5 mm.

Recently van Rossem [48] has shown that the name *Muscicapa mesoleuca* Lichtenstein [49] that has been attributed by Hellmayr [50] to the olive-sided flycatcher in reality is *Elaenia mesoleuca* of South America, allowing return to the familiar specific name of *borealis* for the bird here under discussion.

---

[48] Trans. San Diego Soc. Nat. Hist., vol. 7, 1934, pp. 350–352.

[49] Preis-Verzeichniss mexicanischer Vögel . . ., 1830, p. 2.

[50] Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 5, 1927, p. 189.

The contention that there are two subspecies of olive-sided flycatchers, one that breeds in the eastern part of the United States and Canada and the other in the West, is not borne out by examination of a long series of specimens. There is no difference in color evident that is not due to individual variation. As for size differences, while it is true that the smallest individuals as indicated by wing measurement come from the East and the largest from the West, and that a small average difference in a considerable series from the two areas is evident, the overlap in wing size is so extensive that it covers more than half the individuals seen. In other words, if two races are distinguished more than half the birds examined could be placed in either group. Under these circumstances recognition of two forms is not justified, a matter in which I agree with John T. Zimmer, who has investigated this question with the extensive series in the American Museum of Natural History.

MYIOCHANES CINEREUS BOGOTENSIS (Bonaparte)

Tyrannula bogotensis BONAPARTE, Conspectus avium, vol. 1, 1850, p. 190 (Bogotá, Colombia).

The first one seen was taken in an open grove at La Providencia near Maracay, October 21. Near Ocumare de la Costa I shot another at an elevation of 700 feet in the Río Cumboto Valley, where it rested on an open perch above the road. Another was seen there on October 31. Twelve miles south of El Sombrero on November 13 I obtained one in thorn scrub, where it was flying out from a perch to capture passing insects with a snap of the bill. The bird from Ocumare de la Costa, a female, is darker and a little larger, and measures as follows: Wing 69.0, tail 59.0, culmen from base 13.6, tarsus 12.8 mm. The other two are a little paler above and in the gray of the sides and breast. They measure as follows: Maracay, female, wing 69.0, tail 57.6, culmen from base 13.3, tarsus 12.7 mm.; El Sombrero, male, wing 67.3, tail 56.2, culmen from base 14.5, tarsus 13.4 mm. While indicating perhaps an approach toward the paler forms of farther south they are definitely *bogotensis*.

MYIOCHANES FUMIGATUS CINERACEUS (Lafresnaye)

Tyrannula cineracea LAFRESNAYE, Rev. Zool., vol. 11, 1848, p. 7 (Caracas, Venezuela).

Two were taken at Rancho Grande on November 4 and 9. The birds were common in the rain forest and were observed from 2,600 to 3,500 feet, probably ranging higher. Like the olive-sided flycatcher they seek perches on dead branches in the tops of tall trees where they have a commanding outlook. They were seen frequently near the highway as it was open here, and in the forest I often heard their clear calls of *whit pray teer*, when the birds themselves were invisible above.

Measurements of these two are as follows: Male, wing 88.8, tail 72.0, culmen from base 17.0, tarsus 14.7 mm.; female, wing 80.4, tail 71.6, culmen from base 16.6, tarsus 14.1 mm.

While I have used here the generic name *Myiochanes*, under the International Code there will be return to the older title *Contopus* for the generic name of this group of flycatchers.

PYRRHOMYIAS VIEILLOTOÏDES VIEILLOTOÏDES (Lafresnaye)

Muscicapa (Tyrannula) vieilloloïdes LAFRESNAYE, Rev. Zool., vol. 11, 1848, p. 174 (Caracas, Venezuela).

On October 22 as I crossed the Cordillera de la Costa in company with Dr. Henri Pittier at an elevation of 2,850 feet near Los Riitos below Rancho Grande I collected a fine pair of this species. The birds were resting among vines hanging from the face of a steep bark at the edge of heavy forest and were evidently mated.

These two attracted attention by their darker coloration and led to the description of the paler race *spadix* from the Cumaná region.[51]

TOLMOMYIAS SULPHURESCENS EXORTIVUS (Bangs)

Rhynchocyclus sulphurescens exortivus BANGS, Proc. Biol. Soc. Washington, vol. 21, July 27, 1908, p. 163 (La Concepción, Santa Marta region, Colombia).

At El Sombrero these birds were fairly common, three specimens being taken on November 18 and 21 (the last at Hato Paya). These three appear brighter yellow on the under surface and greener on the crown than the single specimen from the Santa Marta region at hand, and they are also a little smaller. They measure as follows: One male, wing 64.5, tail 51.3, culmen from base 12.6, tarsus 17.9 mm.; two females, wing 59.5, 62.8, tail 52.3, 55.5, culmen from base 13.0, 14.7, tarsus 17.8, 18.0 mm.

TOLMOMYIAS FLAVIVENTRIS AURULENTUS (Todd)

Rhynchocyclus flaviventris aurulentus TODD, Proc. Biol. Soc. Washington, vol. 26, Aug. 8, 1913, p. 171 (Mamatoco, Santa Marta region, Colombia).

The three taken come from Ocumare de la Costa, October 30; Maracay, November 11; and El Sombrero, November 14. The birds were found in thickets and open brush where they moved about actively. At El Sombrero it was interesting to find this species, smaller and brighter yellow in color, with the somewhat larger, more greenish *T. sulphurescens exortivus*.

[51] *Pyrrhomyias vieillotoïdes spadix* Wetmore, Smithsonian Misc. Coll., vol. 98, No. 4, Mar. 10, 1939, p. 5 (Los Palmales, elevation 450 meters, Estado Monagas, Venezuela).

TODIROSTRUM SYLVIA GRISEOLUM Todd

Todirostrum schistaceiceps griseolum Todd, Proc. Biol. Soc. Washington, vol. 26, Aug. 8, 1913, p. 170 (El Hacha, Bolívar Railroad, Estado Lara, Venezuela).

A male was taken in dense scrub at La Trilla at an elevation of 250 feet inland from Ocumare de la Costa on October 23. The several species of small flat-billed flycatchers with grayish breasts, yellowish flanks, and more or less greenish backs found in this area make field observations difficult. The present race has the bill entirely black, the head darker, and the back and the wing feathers unmodified.

TODIROSTRUM CINEREUM CINEREUM (Linnaeus)

Todus cinereus Linnaeus, Systema naturae, ed. 12, vol. 1, 1766, p. 178 (Surinam).

Two females were taken at Maracay October 21, and 12 miles south of El Sombrero on November 13. Several were seen at Ocumare de la Costa on October 28 and 30. They were found in dense brush or scrub, or in tangles of branches and vines, sometimes 30 feet from the ground, where they often moved about actively, more like warblers than flycatchers.

EUSCARTHMORNIS IMPIGER (Sclater and Salvin)

Euscarthmus impiger Sclater and Salvin, Proc. Zool. Soc. London, 1868, p. 171, pl. 13, fig. 1 (near Caracas, Venezuela).

At Ocumare de la Costa a female was taken on October 27, and others were seen on October 28 and 31. They were observed at Maracay on November 11, and two more were taken at El Sombrero on November 13 and 19, the last locality being a definite extension of the previously known range. It is probable that in common with certain other species they range down through the belt of thorn scrub to the region of savannas. The iris in a female was pale yellow. These birds hopped among the branches like little vireos, moving deliberately and pausing to look quietly about with tail hanging straight down. Sometimes one darted out to seize an insect on the wing. The light-colored eye was always noticeable.

ATALOTRICCUS PILARIS VENEZUELENSIS Ridgway

Atalotriccus pilaris venezuelensis Ridgway, Proc. Biol. Soc. Washington, vol. 19, Sept. 6, 1906, p. 115 (San Antonio, Estado Monagas, Venezuela).

A female taken at Maracay on October 21 hopped quickly about in vines and branches 20 feet from the ground. On November 19 I secured a male near El Sombrero as it moved slowly near the ground in dry scrub. Neither of these birds shows any approach to the dark-headed race *griseiceps* of farther south, back and crown being uniform clear green. Specimens in the American Museum of Natural History from the hills of Quebrada Seca, the Santa Ana Valley, and Rincón of San Antonio, in northeastern Venezuela (from the area from which the race *venezuelensis* was described), have the crown very slightly darker than the back. The two birds that I secured seem to represent a transition stage from the bird of the region mentioned to the Colombian form *A. p. pilaris*, which is duller green above.

POGONOTRICCUS OPHTHALMICUS Taczanowski

Pogonotriccus ophthalmicus TACZANOWSKI, Proc. Zool. Soc. London, June 1874, p. 135 (Amable-Maria, Montaña de Vitoc, Dept. Junín, Perú).

Near Rancho Grande a female was taken November 2 at 3,900 feet, and a male November 5 at 3,700 feet. Both were hopping about among vines in dense forest. While these birds from Venezuela are listed as the same as those from Perú I doubt very much that this is true, without having material for definite comparison. Measurements of the two from Rancho Grande are as follows: Male, wing 59.7, tail 54.3, culmen from base 10.6, tarsus 16 mm.; female, wing 54.7, tail 49.6, culmen from base 10.8, tarsus 14.7 mm.

CAPSIEMPIS FLAVEOLA CERULA Wetmore

Capsiempis flaveola cerula WETMORE, Smithsonian Misc. Coll., vol. 98, No. 4, 1939, p. 6 (Independencia, Ocumare de la Costa, Estado Aragua, Venezuela).

Near Ocumare de la Costa these birds were fairly common, specimens being taken on October 23, 28, and 31. They were found in growths of scrub, sometimes in more open localities, and sometimes in the denser growth. They move alertly among the leaves like vireos or titmice. On October 23 I saw a female collecting nesting material.

These specimens from Ocumare de la Costa with a considerable series from the Orinoco region serve to separate the Venezuelan birds as a distinct race, a matter that has been suspected by other workers. The new form differs from *Capsiempis flaveola flaveola* in having the lores and the feathers behind the nostril distinctly whitish and the throat whiter. Skins from the Orinoco Valley vary slightly toward the typical form but still are distinct. *Capsiempis flaveola leucophrys* has the throat much more extensively white, the underparts duller yellow, the back duller green and is larger in size. The race *cerula* ranges throughout Venezuela so far as is known at present.

INEZIA SUBFLAVA CAUDATA (Salvin)

Capsiempis caudata SALVIN, Bull. Brit. Orn. Club, vol. 7, 1897, p. 16 (Ourumee, British Guiana).

On November 14 I secured one of these interesting birds in dense scrub near El Sombrero. Another was seen on November 18, and on November 20 I shot two in low woods along the Río Guarico. They were found moving through branches low down near the ground. This seems to be a northern record for the species.

From specimens from the upper Orinoco and the Casiquiare, which I have called *I. s. subflava*, these differ in lighter, more brownish upper surface with a grayish wash on the forehead, broader white wing bars, more white on the throat, and slightly lighter yellow under surface. A male measures as follows: Wing 51.8, tail 52.3, culmen from base 11.5, tarsus 17.8 mm. The sex could not be determined on one of the other specimens, and the third seems to be immature.

ELAENIA CRISTATA Pelzeln

Elainea cristata Pelzeln, Zur Ornithologie Brasiliens, pt. 2, 1869, p. 177 (City of Goyaz, Brazil).

Near La Trilla, toward the mountains to the south of Ocumare de la Costa, at an elevation of 250 feet, I secured an adult female with a grown young bird, in the tops of bushes in an open thicket. The identification of these two birds has offered some difficulty and has been made only after careful study of extensive material in the National Museum and in the American Museum of Natural History. There is no question that they represent *cristata*, which heretofore has been recorded north only to the Orinoco, and also there is little doubt that they belong to a race that has still to be recognized systematically. *E. cristata* differs from related species in decidedly larger bill and in larger, heavier feet and tarsi. In these characters the two birds from La Trilla are well marked. The adult female, however, is definitely darker above than skins from farther south and seems to have bill and feet even larger than the average. As has just been stated these two represent an undescribed form but more material is required to properly delimit it. The specimens represent a new record for northern Venezuela.

ELAENIA VIRIDICATA PALLENS (Bangs)

Myiopagis placens pallens Bangs, Proc. New England Zoöl. Club, vol. 3, Mar. 31, 1902, p. 85 (Santa Marta, Colombia).

At El Sombrero on November 15 I shot an adult male as it moved about near the ground in a little grove at the edge of the prairie on the Meseta. On November 18 I secured an immature bird in heavy growth when it was working quietly through the limbs. This individual, which is decidedly smaller than the other, apparently because of its immaturity, has the crown dull brown except for two or three small feathers that mark the anterior section of the light crown streak. The back has a mixture of dull brown, and the wing coverts are dull brown centrally, with slightly paler, brighter edgings.

ELAENIA FLAVOGASTER FLAVOGASTER (Thunberg)

Pipra flavogaster Thunberg, Mem. Acad. Imp. Sci. St. Pétersbourg, vol. 8, 1822, p. 286 (Rio de Janeiro, Brazil).

This common species was taken first at Maracay on October 21, when I found one hopping actively through a treetop at La Providencia. Near Ocumare de la Costa on October 28 and 30 they were common about berry-bearing shrubs in dense scrub where they kept carefully under cover. Three were taken there. Near El Sombrero they were seen on various occasions, and one was taken on November 13.

Lönnberg [52] who identified Thunberg's type said that it was marked as from Brazil. Hellmayr [53] has designated Rio de Janeiro as the type locality.

SUBLEGATUS MODESTUS GLABER Sclater and Salvin

Sublegatus glaber SCLATER and SALVIN, Proc. Zool. Soc. London, 1868, p. 171, pl. 13, fig. 2, and text figure (Caracas, Venezuela).

One was taken at Ocumare de la Costa on October 27 and another at El Sombrero on November 18. The birds were found in growths of scrub where they moved about in the branches of low trees.

While in the original description Sclater indicates only "in Venezuela" as a locality, on page 168 in a table in which "the exact localities are added when they are stated on the specimens," the bird is listed from "Caracas." Specimens from Aruba, Bonaire, Curaçao, and Margarita at first glance appear paler, grayer above than others, but while many of the mainland birds appear darker numerous specimens can be found from Venezuela that match the island skins exactly.

PHAEOMYIAS MURINA INCOMTA (Cabanis and Heine)

Elainea incomta CABANIS and HEINE, Museum Heineanum, pt. 2, 1859, p. 59 (Cartagena, Colombia).

The four specimens obtained were secured at Maracay, October 21, Ocumare de la Costa, October 28, and El Sombrero, November 17 and 19. The birds were found in thorn scrub, or other thickets, sometimes where the growth was fairly open and again in the denser areas. They were usually rather low down and moved slowly through the branches. The light line, partly concealed by overlying feathers, running along the side of the head behind the eye is a distinctive mark with the bird in the hand. The bird from Ocumare is partially albinistic with a few yellowish-white feathers scattered over the back.

CAMPTOSTOMA OBSOLETUM NAPAEUM (Ridgway)

Ornithion napaeum RIDGWAY, Proc. U. S. Nat. Mus., vol. 10, Aug. 6, 1888, p. 520 (Diamantina, near Santarem, Brazil).

The only one seen, a female, was taken near El Sombrero, November 18, as it worked about a clump of a parasitic plant in a small

[52] Ibis, 1903, pp. 241–242.

[53] Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 5, 1927, p. 402.

thorn bush. The tips of the greater coverts are white, those of the lesser coverts deep olive-buff, the two wing bands being thus distinctly different in color. The bird is slightly grayer above than specimens from the type locality. It measures as follows: Wing 46.3, tail 33.9, culmen from base 9, tarsus 14.1 mm.

MIONECTES OLIVACEUS VENEZUELENSIS Ridgway

Mionectes olivaceus venezuelensis Ridgway, Proc. Biol. Soc. Washington, vol. 19, Sept. 6, 1906, p. 116 (Guacharo, Estado Monagas, Venezuela).

The first of these curious birds was shot at an elevation of 700 feet in dense rain forest in a deep ravine above the Río Cumboto near Ocumare de la Costa. Others were taken in heavy forest near Rancho Grande on November 5 and 10. They moved through the branches with the mannerisms of a titmouse or a vireo, ranging low down in undergrowth near the ground.

These three differ slightly from three others examined, including the type, in the American Museum of Natural History in being slightly brighter yellow below, not only on the abdomen but also on the chest and foreneck. In this they indicate a slight approach toward *M. o. galbinus* from the Santa Marta region in Colombia.

Family HIRUNDINIDAE

IRIDOPROCNE ALBIVENTER (Boddaert)

Hirundo albiventer Boddaert, Table des planches enluminéez, 1783, p. 32 (Cayenne).

On November 14 on the Meseta at El Sombrero several alighted on bare spots of ground on the open prairie and remained there for some time. Others flew actively about or rested on vines. In the air or at rest the white markings were striking. Two adult males were taken. On November 20 I saw several along the Río Guarico.

STELGIDOPTERYX RUFICOLLIS AEQUALIS Bangs

Stelgidopteryx ruficollis aequalis Bangs, Proc. New England Zoöl. Club, vol. 2, 1901, p. 58 (Santa Marta, Colombia).

This swallow was common along the roadside through the coast range near Guamitas above Maracay and through the foothill country back of the northern coastal plain from October 22 to November 10. The birds were found alone, in pairs, or in little groups where the highways were bordered by rocky cuts. As I approached they circled out from little openings in the bank where they were evidently preparing to nest, sometimes alighting on bare, dead branches in the tops of trees nearby, but more often disappearing out over the valleys not to return until I had passed. The fact that they seemed rather shy was explained by the small boys who practiced marksmanship on them with stones if they stopped nearby.

Near El Sombrero from November 14 to 20 these swallows were recorded in open country, or more frequently along the Río Guarico. In early morning they often alighted on bare ground on the prairies or along the roads.

On the wing this swallow appears plain gray-brown and white, the rufous brown of the throat and upper breast and the yellowish color of the abdomen showing rarely and then only under the most favorable conditions of light. They have the circling indecisive flight of all small swallows, and in general appearance and habits suggest the northern roughwing, though the call note is louder and sharper.

Three specimens were obtained, a male taken at El Limón, above Maracay, October 30, by Ventura Barnés, Jr., and two females shot near Rancho Grande on November 3 and 9. All these have the rump decidedly paler than the back, the extent of this lighter color varying in the three. One of the females is renewing the outer primaries in molt. In the male the roughened serration of the outer web of the outer primary is decidedly more evident than in the females.

HIRUNDO RUSTICA ERYTHROGASTER Boddaert: Barn Swallow

Hirundo erythrogaster BODDAERT, Table des planches enluminéez, 1783, p. 45 (Cayenne).

At Ocumare de la Costa from October 23 to 31 the migrant barn swallow was common, resting on wires at the houses near the beach at Independencia or circling over the open flats. On November 13 I saw one 12 miles south of El Sombrero.

On my return north, on November 26 a female followed the ship, the *Caracas*, all day, and at nightfall we were only a short distance from the southeastern coast of Puerto Rico. The bird through following this course thus was returning northward, though it was the time of fall migration.

I have indicated elsewhere my belief that our American barn swallow is a geographic race of the bird of the Old World.

PYGOCHELIDON CYANOLEUCA CYANOLEUCA (Vieillot)

Hirundo cyanoleuca VIEILLOT, Nouv. Dict. Hist. Nat., vol. 14, 1817, p. 509 (Paraguay).

At Rancho Grande numbers of these swallows were found about the hotel near El Portachuelo during the early part of November.

Family CORVIDAE

XANTHOURA YNCAS CAERULEOCEPHALA (Dubois)

Cyanocorax yncas var. *caeruleocephala* Dubois, Bull. Acad. Roy. Belgique, vol. 38, 1874, p. 493 (Caracas, Venezuela).

In the mountain forests at Rancho Grande this jay was fairly common and was seen to 3,600 feet elevation. They ranged in heavy cover and were secretive but usually could be decoyed out into the open by an imitation of their notes. They were found here and elsewhere in little flocks of 6 to 10. One morning at sunrise such a band came into the lower garden at the house, where I could watch them from above as they worked through low bushes or came out to hop about on the ground, a beautiful and attractive sight. One was taken here on November 2. They were also noted near El Sombrero, one flock being seen in the scrub 12 miles south, which must be near the southern limit of their range. Another was shot near the town on November 18. In this area they frequented dense growths of the larger trees, often in localities where the ground was open underneath. Sometimes through curiosity they came within a few feet of me, and frequently two or three perched near together on the same branch. While some of their notes were peculiar other calls resembled those of the blue jay (*Cyanocitta cristata*) of the Eastern United States. They were known as *kinkin* from one of their common notes.

Family TROGLODYTIDAE

HELEODYTES NUCHALIS BREVIPENNIS (Lawrence)

Campylorhynchus brevipennis Lawrence, Ann. Lyc. Nat. Hist. New York, vol. 8, 1866, p. 344 (Venezuela).

At Maracay these birds were seen on November 11; at Cagua, Estado Aragua, one was taken on November 12; and at El Sombrero, where the birds were common, one was collected on November 14. They were observed at Hato Paya on November 21. These wrens are found in dense thickets or in tangles of vines and branches, ranging from near the ground to the tops of tall trees. Attention is called to them ordinarily by their explosive, grating, croaking notes, so grotesque in sound as to be most amusing, and so unusual in type as to suggest some strange frog rather than a bird. The wrens move about actively but when alarmed remain motionless and hide so that a little flock seen in vines in some treetop may disappear completely.

The barred, spotted plumage of black and white, with gray on the crown and more or less brown on the hind neck and upper back, is subject to considerable variation in these birds. After examining considerable material I offer the following segregation into geographic races:

HELEODYTES NUCHALIS NUCHALIS (Cabanis):

Campylorhynchus nuchalis CABANIS, Arch. Naturg., vol. 13, 1847, p. 206 (Cumaná, Venezuela).

Less heavily spotted below, throat and upper foreneck unmarked, bill smaller.

A fair series from Cumaná and San Felix show the extreme development of these characters, being less heavily marked below than birds from the Orinoco.

Orinoco Valley from Caicara to Ciudad Bolívar (probably farther) extending to the northeast to the Cumaná region.

HELEODYTES NUCHALIS BREVIPENNIS (Lawrence):

Campylorhynchus brevipennis LAWRENCE, Ann. Lyc. Nat. Hist. New York, vol. 8, 1866, p. 344 (Venezuela).

Much more heavily spotted below, the markings extending over foreneck, blackish crown markings more extensive and prominent, gray of crown darker, bill large and heavy.

Northern Venezuela south through the Aragua Valley.

HELEODYTES NUCHALIS PARDUS (Sclater):

Campylorhynchus pardus SCLATER, Proc. Zool. Soc. London, 1857 (Jan. 1858), p. 271 (Santa Marta, Colombia).

Black spottings on lower surface reduced, pileum lighter gray, bill large and heavy.

Northern Colombia, including Santa Marta region.

The specimen from El Sombrero is intermediate toward *nuchalis* but shows more of the characters of *brevipennis*. The bird from Cagua also seems to verge a little toward the southern form.

HELEODYTES MINOR MINOR Cabanis

Heleodytes minor CABANIS, Museum Heineanum, pt. 1, 1851, p. 80 (Venezuela).

Near El Sombrero these large wrens were found in groves on the Meseta or along the borders of the adjacent scrub. Their croaking, choking calls were similar to those of the related form with barred and spotted plumage *Heleodytes nuchalis*, but were harsher, suggesting even more the grotesque calls of some frog or toad. In calling they often pose with swelling throat, bill pointed perpendicularly, and the tail hanging straight down. These birds sought cover but were found both near the ground and high in the trees, where they examined bark and leaves in search of food. They were seen usually in pairs and were quite tame.

These specimens show no approach to *H. m. albicilius*.

THRYOPHILUS RUFALBUS CUMANENSIS (Cabanis)

Troglodytes cumanensis "Licht." CABANIS, Journ. für Orn., 1860, p. 408 (Cartagena, Colombia).

On October 24 in a deep, wooded ravine above the Río Cumboto, near Ocumare de la Costa, I saw two of these wrens working about near the ground. They scolded in wren fashion and then disappeared, but by careful watching I took one, an immature female. This bird has the duller dorsal coloration of these wrens in northern Venezuela.

While Hellmayr [54] has adopted van Rossem's suggestion [55] that *Pheugopedius* and *Thryophilus* be merged, as well as possibly *Thryothorus*, I am not prepared to accept this until the whole matter has been more carefully studied.

THRYOPHILUS LEUCOTIS VENEZUELANUS (Cabanis)

Thryothorus venezuelanus CABANIS, Museum Heineanum, vol. 1, 1851, p. 78 (Venezuela).

At Ocumare de la Costa on October 30 I secured two of these wrens after much patient labor in low scrub where they inhabited the densest cover. One is an immature female that has just completed the molt into the first adult plumage. This specimen measures as follows: Wing 59.5, tail 40.8, culmen from base 18.3, tarsus 19.7 mm. The other, an adult female, is in full molt on the body and head.

THRYOPHILUS LEUCOTIS HYPOLEUCUS Berlepsch and Hartert

Thryophilus albipectus hypoleucus BERLEPSCH and HARTERT, Bull. Brit. Orn. Club, vol. 12, Oct. 30, 1901, p. 12 (Altagracia, Río Orinoco, Venezuela).

On November 20 I secured an adult male at El Sombrero in a tangle of vines and branches in low woods near the Río Guarico. This specimen is much paler than the two from Ocumare de la Costa, being nearly white on the throat and breast, with the color of the flanks and posterior underparts paler, and is grayer above, except for the tail, which is lighter, brighter brown. It measures as follows: Wing 62.1, tail 43.8, culmen from base 18.5, tarsus 21.3 mm. It agrees with skins from Soledad and Ciudad Bolívar and marks a considerable extension in the range of this form.

PHEUGOPEDIUS MYSTACALIS RUFICAUDATUS (Berlepsch)

Thryothorus ruficaudatus BERLEPSCH, Ibis, 1883, p. 491 (Puerto Cabello, Venezuela).

The only specimen of this rare bird secured was shot in heavy forest at an elevation of 3,900 feet above Rancho Grande, where it was working through branches and creepers not far above the ground

[54] Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 7, 1934, p. 153.

[55] Trans. San Diego Soc. Nat. Hist., vol. 6, 1930, p. 208.

in company with other small forest birds. It seemed a most unusual type of wren.

TROGLODYTES MUSCULUS CLARUS Berlepsch and Hartert

Troglodytes musculus clarus BERLEPSCH and HARTERT, Nov. Zool., vol. 9, Apr. 1902, p. 8 (Bartica Grove, British Guiana).

This house wren was seen at all points visited, beginning with the grounds of the American Legation at Caracas on October 17. At Ocumare de la Costa one was taken on October 28, and birds were in song about the house where I lived during the rest of my stay. In the mountains, near Rancho Grande, the wren was found in clearings about houses, and one was taken on November 7 at Los Riitos. Near El Sombrero the bird was common, and a breeding male was taken on November 20 near the Río Guarico, where, with a female in attendance, it was singing about holes in trees along an old road. The song, while generally similar to that of *Troglodytes aëdon* of the United States, is sharper in tone and more emphatic, particularly at its close. Part of the scolding notes, however, are distinctly different. The bird frequents tangles of vines and low bushes near the ground, and in its habits seems identical with the northern house wrens.

HENICORHINA LEUCOPHRYS VENEZUELENSIS Hellmayr

Henicorhina leucophrys venezuelensis HELLMAYR, Journ. für Orn., 1903, p. 530 (Mount Bucarito, near Tocuyo, Estado Lara, Venezuela).

Near Rancho Grande from November 2 to 10 this wren was one of the commonest birds of the heavy forest. Six specimens were taken. The birds ranged in the densest woodland, and were seen up to 4,000 feet elevation, probably going higher. They were also found where the thickets were sufficiently dense alone the roadways when the forest proper had been cleared away. They ranged near the ground, being partial to dead falls and similar shelter, always in damp, shadowy locations where their dull colors made it difficult to see them except when they were in motion. They were tame and frequently came within a few feet of me.

They were found always in pairs. The loud, clear song, to be described as vociferous rather than highly musical, was given ordinarily as a duet in which both male and female joined. One bird, presumably the male, begins with notes of two or three kinds, while the other sounds a single call that is given in sequence in the intervals between calls of the other, so that at a little distance the whole sounds like the effort of one individual. Only with the birds near the observer can the two be separated. If one gives the calls first mentioned without response from its mate immediately it ceases to sing. The two range in company exactly as do the Carolina wrens *Thryothorus ludovicianus* of the United States.

The specimens taken at Rancho Grande are slightly grayer on the breast than one from El Limón, near Caracas.

Family MIMIDAE

MIMUS GILVUS MELANOPTERUS Lawrence

Mimus melanopterus LAWRENCE, Ann. Lyc. Nat. Hist. New York, vol. 5, May 1849, p. 35, pl. 2 (Venezuela).

At Ocumare de la Costa from October 22 to 31 these large, light-colored mockingbirds were common through the dry scrub and in scattered trees over the open playa back of the lagoon. As I approached them in this open area they retreated to little thorny trees to hide. They sang, sometimes from the tops of houses, with leisurely effort, without great energy. Two were taken on October 25 and 26. Along the highway from Maracay to El Sombrero on November 12 and 21 mockers were fairly common, and at El Sombrero I noted them daily from November 13 to 21. Two were shot here on November 14.

Family TURDIDAE

TURDUS FUMIGATUS AQUILONALIS (Cherrie)

Planesticus fumigatus aquilonalis CHERRIE, Mus. Brooklyn Inst. Arts Sci., Sci. Bull., vol. 1, June 30, 1909, p. 387 (Heights of Aripo, Trinidad).

On October 23 at an elevation of 250 feet near La Trilla, inland from Ocumare de la Costa, I shot one of these brown-breasted thrushes from a shaded perch where it had flown from a fruit-bearing tree.

TURDUS LEUCOMELAS ALBIVENTER Spix

Turdus albiventer SPIX, Avium species novae . . . Brasiliam, vol. 1, 1824, p. 70, pl. 69, fig. 2 (Pará, Brazil).[56]

On November 17 near El Sombrero I shot an immature female from a little group of three or four that flew up from near the ground to shaded perches in the tops of tall trees. The others disappeared instantly at the discharge of my gun.

This northern race is given as *epphipialis* by Hellmayr,[57] but with only limited material at hand for comparison, it appears to me that Todd [58] is correct in calling it *albiventer*.

---

[56] The original description gives "Minas Geraës et Parae," which is restricted to Pará by Hellmayr, Abh. Kön. Bayer. Akad. Wiss., Kl. II, vol. 22, 1906, p. 618.

[57] Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 7, 1934. p. 401.

[58] Proc. Biol. Soc. Washington, vol. 44, June 29, 1931, p. 52.

Family SYLVIIDAE

POLIOPTILA PLUMBEA PLUMBICEPS Lawrence

Polioptila plumbiceps LAWRENCE, Proc. Acad. Nat. Sci. Philadelphia, vol. 17, 1865, p. 37 (Venezuela).

In the somewhat open scrub covering the hot hillsides near Ocumare de la Costa, from October 23 to 31, this was one of the most prominent of the small birds, as whenever I paused for a moment in the shade of a tree in traveling the trails I was almost certain to see a gnatcatcher working through the twigs with wings dropped and tail at a jaunty angle above its back. Four were taken here, a pair at La Trilla on October 23 and others near Independencia on October 25 and 26. Near Maracay I shot another on November 11, and at El Sombrero I saw them regularly from November 13 to 20. In form and mannerisms these birds are identical with other gnatcatchers that I have known. The song is a simple *swees swees swees swee*, a pleasing trilling note of more volume than that of *Polioptila caerulea* of the United States. Natives at Ocumare called them *blanquitas*, though I was not entirely certain that this was not a descriptive term rather than a true name. Both male and female had the dark spot on either side of the base of the tongue that I have seen in other species of the genus.

The male and four females at hand all have the feathers behind the nostrils distinctly whitish, a marking that I do not find in any other specimens assigned to *plumbiceps* that are available. The mark is especially prominent in the male.

Family CYCLARHIDAE

CYCLARHIS GUYANENSIS FLAVIPECTUS Sclater

Cyclorhis flavipectus SCLATER, Proc. Zool. Soc. London, 1858 (1859), p. 448 (Trinidad).

The four specimens taken include a male from Maracay, November 11, another from Ortiz, November 12, and a pair from El Sombrero, November 16 and 21, the latter from Hato Paya. One chattered harshly from concealment among leaves in the grounds of the American Legation at Caracas on October 17. The bird collected at Ortiz was singing a clear, whistled song as it moved leisurely through a treetop. At El Sombrero they were seen in open scrub on the uplands and in wet woodlands along the Río Guarico.

The specimens are identified in accordance with the treatment of Hellmayr,[59] who notes that the type specimen in the British Museum is from Trinidad.

---

[59] Field Mus. Nat. Hist., zool. ser., vol. 13, p. 8, 1935, p. 198.

Family VIREONIDAE

HYLOPHILUS AURANTIIFRONS SATURATA (Hellmayr)

Pachysylvia aurantiifrons saturata Hellmayr, Nov. Zool., vol. 13, Feb. 1906, p. 12 (Rincón de San Antonio, Estado Sucre, Venezuela).

These are little forest birds that I encountered first at Ocumare de la Costa, where one was taken on October 24, at an elevation of 700 feet above the Río Cumboto in the middle level of the trees in heavy forest. It was in company with a band of other small forest birds. At El Sombrero on November 20 I found a little flock in low, wet woods near the Río Guarico and shot three. One sang steadily in a most amusing manner repetition of the phrase *re-seárch re-seárch* as all fed with the restless motion of little warblers through the smaller branches.

The skins from El Sombrero are slightly more yellowish below than the average of those from farther east and north.

HYLOPHILUS FLAVIPES ACUTICAUDUS Lawrence

Hylophilus acuticaudus Lawrence, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 37 (Puerto La Cruz, Estado Aragua, Venezuela).[60]

Near Ocumare de la Costa two were taken on October 26 and 28 in dense scrub, where they moved rather slowly through branches near the ground, in habits suggesting somewhat the typical vireos. One shot near El Sombrero on November 18 was rather more active in dense tree growth bordering a dry wash.

Family COEREBIDAE

COEREBA FLAVEOLA LUTEOLA (Cabanis)

Certhiola luteola Cabanis, Museum Heineanum, vol. 1, 1851, p. 96 (Puerto Cabello(?), Venezuela).

A common bird in suitable localities. On October 17 several were seen in the grounds of the American Legation in Caracas. Near Ocumare de la Costa from October 25 to 31 they were found in numbers in the dry scrub near Independencia, particularly about flowering trees, where they flitted about, pursuing one another, and then turned to the nectar of the blossoms. Three were taken here on October 25 and 26. Others were seen in shade trees over a cacao plantation, and in woodlands along the Río Cumboto. At La Providencia near Maracay on November 11 one was seen carrying nesting material, and a female taken was in breeding condition. Others were seen at Parapara and Ortiz November 12, and from November 13 to 21 they were found in fair numbers near El Sombrero, one being taken on November 19.

[60] Type locality designated by Todd, Proc. Biol. Soc. Washington, vol. 42, 1929, p. 198.

The specimens from Ocumare de la Costa and Maracay are typical of *luteola* in dark dorsal coloration, deep yellow of underparts and rump, and large white spot on the outer primaries. The skin from El Sombrero is distinctly grayer above but otherwise is similar. It indicates the beginning of an approach to *guianensis*.

Family COMPSOTHLYPIDAE

MNIOTILTA VARIA (Linnaeus): Black and White Warbler

Motacilla varia LINNAEUS, Systema naturae, ed. 12, vol. 1, 1766, p. 333 (Hispaniola).

At Rancho Grande on November 3 I shot an adult female in heavy forest at 3,700 feet elevation. The bird was not fat but was in good condition. On November 8 at 4,000 feet I collected an adult male from a flock of small forest-inhabiting birds. The men with me examined it as a curiosity and considered it the most interesting of the many strange birds that I took this day, an interest that increased when I told them that it was a migrant from my own country.

COMPSOTHLYPIS PITIAYUMI ELEGANS Todd

Compsothlypis pitiayumi elegans TODD, Ann. Carnegie Mus., vol. 8, May 20, 1912, p. 204 (Anzoategui, Estado Lara, Venezuela).

On October 24 I shot one in rain forest at 700 feet elevation above the Río Cumboto southwest of Ocumare de la Costa, where the bird was found in the higher branches of the trees. On November 13 I took one in dense scrub 12 miles south of El Sombrero and recorded another near the town on November 18.

DENDROICA AESTIVA AESTIVA (Gmelin)

Motacilla aestiva GMELIN, Systema naturae, vol. 1, pt. 2, 1789, p. 996 (Canada).

One seen at Caracas in the grounds of the American Legation, October 17, an adult male taken at Maracay, October 21, from a tall tree in open forest at the border of a plantation, and one seen on November 19 and an adult female taken on November 20 near the Río Guarico at El Sombrero constitute the records made for this northern migrant.

DENDROICA CAERULESCENS CAERULESCENS (Gmelin): Black-throated Blue Warbler

Motacilla caerulescens GMELIN, Systema naturae, vol. 1, pt. 2, 1789, p. 960 (Hispaniola).

At Ocumare de la Costa on October 27 I watched a female for some time in a sea-grape tree growing on the beach. The light was exceptionally good, and the warbler most of the time only a few feet away so that I could easily see that it was distinctly light colored. In view of this, though the bird was not taken I venture to record it as the typical form, since that is the race that has been reported from northern South America.

DENDROICA CERULEA (Wilson): Cerulean Warbler

Sylvia cerulea Wilson, American ornithology, vol. 2, 1810, p. 141, pl. 17, fig. 5 (Philadelphia, Pa.).

At Rancho Grande in the early morning of November 4 a dozen or more were feeding actively through the treetops at the house where I was living.

DENDROICA STRIATA (Forster): Black-poll Warbler

Muscicapa striata J. R. Forster, Philos. Trans., vol. 62, 1772, p. 428 (Fort Severn, west coast of Hudson Bay).

At Ocumare de la Costa on October 25 I shot two of these migrant warblers from the north as they fed in the tops of low trees in the dry scrub. Accustomed for years to the layers of oily fat that cover the bodies of black-polls as they pass south through the Eastern United States in fall migration, it was a great surprise to find these two thin to emaciation. The following day I saw one, and on October 27 observed several and collected another. Evidently they were arriving regularly from the north as I saw them constantly in a large sea-grape tree on the beach near my porch as I worked on specimens during the afternoon. As they became more common I sometimes found little groups feeding on the ground on the open flats near the lagoon at Independencia, at some distance from trees or bushes. When I first noted them I thought they must be some other bird and was much surprised to find that they were this species, ordinarily restricted to trees. I was of the opinion that these ground-feeding individuals had just arrived from the long flight over the sea as they appeared quiet and listless. One or two that I handled were so thin that there was noticeable shrinkage in the large muscles of the breast. Four taken here at Ocumare were all adults and included birds of both sexes.

At Rancho Grande I recorded black-polls on November 5, 6, and 7, observing them up to 3,700 feet, and there can be no doubt that they spread over the entire mountain. Birds taken here were in good flesh though not fat, so that their recovery from the rigors of their long journey apparently is rapid. At El Sombrero I noted them on November 13 and 15.

While under the International Code the name of this species will become *Dendroica breviunguis* (Spix) as given by Hellmayr,[61] I prefer here to use the name *Dendroica striata* (Forster), since this is the name that is current among North American ornithologists. The code of

[61] Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 8, 1935, p. 403.

nomenclature of the American Ornithologists' Union does not recognize secondary homonyms, a change that might be accepted in the International Code for reasons that will be obvious, on a little reflection to those interested in such matters.

SEIURUS NOVEBORACENSIS NOVEBORACENSIS (Gmelin): Northern Water-thrush

Motacilla noveboracensis GMELIN, Systema naturae, vol. 1, pt. 2, 1789, p. 958 (New York).

On October 23 at La Trilla, elevation 250 feet, inland from Ocumare de la Costa, I saw and heard several water-thrushes along the rapidly running Río Ocumare. An adult female taken was very thin in flesh, so that I assumed that it was a recently arrived migrant. It measures as follows: Wing 73.4, tail 48.7, culmen from base 14.4, tarsus 22.0 mm. On October 29 two were seen near the lagoon at Independencia. Near El Sombrero I saw one in low, wet woods near the Río Guarico on November 20, and on November 21 shot an adult female at Hato Paya, 18 miles northwest. This bird measures as follows: Wing 73.5, tail 48.5, culmen from base 14.4, tarsus 20.2 mm. Both specimens taken are decidedly yellow below and definitely olive rather than grayish above; this coloration with the measurements identifies them as the eastern form.

OPORORNIS AGILIS (Wilson): Connecticut Warbler

Sylvia agilis WILSON, American ornithology, vol. 5, 1812, p. 64, pl. 39, fig. 4 (Connecticut).

On October 23 I collected an adult male at an elevation of 250 feet near La Trilla, inland from Ocumare de la Costa, as it hunted among weeds near the ground in the shade of a spreading tree. The bird was thin and in poor flesh, so that I assumed that it was a recently arrived migrant.

SETOPHAGA RUTICILLA (Linnaeus): American Redstart

Motacilla Ruticilla LINNAEUS, Systema naturae, ed. 10, vol. 1, 1758, p. 186 (Virginia).

This migrant from the north was recorded as follows: Caracas, October 17; Maracay, October 21 (specimen) and November 11; Ocumare de la Costa, October 23 (specimen from La Trilla), 29, and 30 (seen at sea level); El Sombrero, near the Río Guarico, November 20.

MYIOBORUS MINIATUS PALLIDIVENTRIS (Chapman)

Setophaga verticalis pallidiventris CHAPMAN, Bull. Amer. Mus. Nat. Hist., vol. 12, 1899, p. 153 (Quebrada Seca, near San Antonio, northeastern Venezuela).

Near Rancho Grande these alert, active birds were common, so that I secured three specimens on November 5 and 8. They were seen almost daily about the house in which I lived where they ranged through the tops of the tall trees that grew up from deep, steep-sided valleys to the level of the yard, but in such locations it was impossible to secure them, as specimens shot here would have fallen into the depths below to be lost. They were regular parts of the flocks of small birds that ranged through the forest and were seen up to 4,000 feet. The yellow underparts and white in the tail made prominent field marks. Once I saw one spread the tail feathers in a wide fan and hold them thus for several seconds, a striking display that was repeated several times. The gradual transition by graded steps from this yellow form to the one with red breast found in Mexico and Guatemala is truly remarkable.

BASILEUTERUS MERIDANUS MERIDANUS Sharpe

Basileuterus meridanus SHARPE, Catalogue of the birds in the British Museum, vol. 10, 1885, p. 387 (Mérida, Venezuela).

Near Rancho Grande these birds were fairly common in dense forest, where they worked among the lower branches of the trees or in the tops of undergrowth, often in company with little groups of other small, forest-loving kinds. The five shot on November 2, 5, 8, and 10 were taken at elevations ranging from 3,700 to 4,000 feet.

In my opinion Todd [62] is correct in considering that *meridanus* is specifically distinct from *tristriatus* because of the difference in head markings. From examination of a good series it appears that true *meridanus* ranges from the Mérida region east in the mountains to the vicinity of Rancho Grande, birds from the mountains about Caracas being separable under the subspecific name *bessereri* of Hellmayr, on basis of duller, less yellowish color below and lighter greenish tinge of the back. I have seen specimens of *bessereri* from El Limón, Cotiza, Silla de Caracas, Galipan in the Cerro de Avila, near Caracas, and from Colonia Tovar, Estado Aragua. The specimens secured at Rancho Grande agree perfectly with birds from the Mérida region and mark the easternmost point from which true *meridanus* is at present known.

BASILEUTERUS CULICIVORUS CABANISI Berlepsch

Basileuterus Cabanisi, BERLEPSCH, Ornith. Centralbl., vol. 4, 1879, p. 63 (Puerto Cabello, Venezuela).

On October 24 I collected two in heavy rain forest at an elevation of 700 feet above the Río Cumboto, southwest of Ocumare de la Costa. The birds ranged through the middle level of the trees with other small

---

[62] Proc. U. S. Nat. Mus., vol. 74, art. 7, 1929, pp. 55–56.

forest species. The elevation where my specimens were taken is lower than the 1,000-foot level indicated by Todd.[63]

BASILEUTERUS FLAVEOLUS (Baird)

Myiothlypis flaveolus BAIRD, Review of American birds, 1865, p. 252 (Río Paraguay, Paraguay).

Near Ocumare de la Costa on October 30 I collected two of these birds and saw several others in an area of dense brush, where the ground beneath was open. They walked gracefully and alertly, sometimes half raising the wings for an instant. Near El Sombrero on November 20 one sang as it walked along the ground, the song being a repetition of a single note given rather forcefully, in tone suggestive of warblers of the *Oporornis* group.

The type specimen, in the U. S. National Museum, collected by the expedition under Capt. T. J. Page in June 1859, marked "Paraguay," was without question collected along the Río Paraguay.

DOLICHONYX ORYZIVORUS (Linnaeus): Bobolink

Fringilla oryzivora LINNAEUS, Systema naturae, ed. 10, vol. 1, 1758, p. 179 (South Carolina).

Shortly after sunrise on October 16 as our ship entered the harbor at La Guaira a flock of about 75 small birds swept in along the shore in close formation and rose to pass over the docks. At a casual glance I took them for sandpipers, but as I obtained a better look I saw that they were bobolinks. I supposed that they had just arrived in migration and were making a landfall as there was no place here for them to feed. At Ocumare de la Costa before seven on the morning of October 28, one flew with a low call from a large sea-grape tree on the beach and went uncertainly toward the marsh beyond. It seemed to be newly arrived. The following day I flushed half a dozen from rushes growing in the lagoon.

STURNELLA MAGNA PARALIOS Bangs

Sturnella magna paralios BANGS, Proc. New England Zoöl. Club, vol. 2, Feb. 15, 1901, p. 56 (San Sebastian, 6,600 feet elevation, Santa Marta region, Colombia).

Near Cagua, Estado Aragua, I saw one of these birds on November 12 but did not have opportunity to collect it. I noted a few others offered for sale alive in the bird market in Caracas. An old specimen in the U. S. National Museum collection from Valencia, Venezuela, agrees in color and size with a skin from San Sebastian, the type locality of *paralios*.

---

[63] Proc. U. S. Nat. Mus., vol. 74, art. 7, 1929, p. 72.

GYMNOMYSTAX MEXICANUS (Linnaeus)

Oriolus mexicanus LINNAEUS, Systema naturae, ed. 12, vol. 1, 1766, p. 162 (Cayenne [64]).

This fine species was recorded at Cagua on November 12, and in the vicinity of El Sombrero it was common from November 13 to 20. The birds were found in flocks sometimes in cultivated fields, sometimes on open prairies, while often I saw them passing in flight overhead. While they walked about over open ground and perched on posts and other low elevations, at any alarm they flew into trees where they often moved behind masses of leaves and creepers so that I could not see them. Aside from this habit they resembled in mannerisms and even in notes the familiar yellow-headed blackbird *Xanthocephalus xanthocephalus* of the Western United States. While often called orioles, in manner of life they belong certainly with the blackbird group. As they fly overhead the black feet show distinctly against the clear yellow of the abdomen. At this season they were in molt. Two adult females were prepared as skins on November 13 and 15.

ICTERUS ICTERUS ICTERUS (Linnaeus)

Oriolus Icterus LINNAEUS, Systema naturae, ed. 12, vol. 1, 1766, p. 161 ("Cayenne").

The *trupial* is a favored cage bird in Venezuela and is kept in many homes. I frequently saw them in a wild state about Maracay but did not have opportunity to collect specimens until I reached El Sombrero, where I secured a pair on November 17. They frequent densely leaved trees, and though I heard their pleasant whistled calls daily it was often difficult to catch sight of them. Birds kept in captivity after a time become decidedly paler in color.

ICTERUS NIGROGULARIS NIGROGULARIS (Hahn)

Xanthornus nigrogularis HAHN, Vögel aus Asien, Africa, America und Neuholland, livr. 5, 1819, pl. 1 (Jamaica, Mexico, and Cayenne).[65]

The first of these orioles obtained was a female shot from a tree at the edge of a pasture near Ocumare de la Costa on October 30. Near El Sombrero, where they were common, five more were taken on November 14, 15, 17, 18, and 21 (the last from Hato Paya). They were found about groves of trees growing on the prairies, at the borders of heavy woodlands, in open scrub growth, or along roadways, living among branches and at this season of the year rather silent.

[64] Designated by Berlepsch and Hartert, Nov. Zool., vol. 9, 1902, p. 32.

[65] Hellmayr, Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 10, 1937, p. 132, says that the type, in the Münich Museum, is labeled Brazil.

HOLOQUISCALUS LUGUBRIS LUGUBRIS (Swainson)

Quiscalus lugubris SWAINSON, Animals in menageries, 1838, p. 299 (British Guiana).[66]

Near Ocumare de la Costa, where three females were taken on October 25, 27, and 29, these grackles were fairly common on the open, pastured flats around the lagoon at Independencia. They ranged in flocks of six or eight birds that walked about on the ground and when alarmed took shelter in low trees or in the rushes of the lagoon. Occasionally a whole flock would fly suddenly to perch on the back of some grazing goat, which paid no attention to them whatever. At Maracay these birds came about the hotels, and one flew familiarly through a broad, high-ceilinged room with large patios on either side. A male in full molt was taken at the school at La Providencia on November 11. At El Sombrero grackles were common, especially in the pasturelands along the Río Guarico, and many were found in the town itself. The dining tables at the hotel were set under the shelter of a little balcony that looked out on a small, paved patio with a few shrubs and flowers. After the noon meal when all was quiet one or two grackles often came to search for food about the tables, eying me sharply as I sat preparing specimens, but without fear. The iris in this species is yellow.

MOLOTHRUS BONARIENSIS VENEZUELENSIS Stone

Molothrus venezuelensis STONE, Auk, Oct. 1891, p. 347 (Lake Valencia, Venezuela).

On November 11 a considerable flock walked among the cattle in the grounds of the Agricultural School at La Providencia near Maracay. The type specimen, in the U. S. National Museum, is from Lake Valencia, not from San Esteban as stated by Hellmayr.[67]

CACICUS CELA CELA (Linnaeus)

Parus Cela LINNAEUS, Systema naturae, ed. 10, vol. 1, 1758, p. 191 (Surinam) [68]

The *arrendajo* is universally known in northern Venezuela, and several times I had glimpses of birds that I was sure were this species. But it was not until November 16 at El Sombrero that I shot my first specimen, an adult male, as it ranged in good-sized trees near a small lagoon, where I heard it giving a musical, oriolelike call. Others were seen in heavy timber on November 18, and on the following day I found a number about the blossoms of a flowering shrub and collected an adult and an immature female. Many were seen on November 20 in low woods near the Río Guarico. The adult female is duller black than the male, and the immature female is distinctly more grayish, especially on the lower surfaces of the body, than the adult. Like *Ostinops* the plumage of these birds has a distinct musky odor.

[66] Designated by Berlepsch and Hartert, Nov. Zool., vol. 9, 1902, p. 33.
[67] Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 10, 1937, p. 64.
[68] Designated by Hellmayr, Nov. Zool., vol. 13, 1906, p. 20.

OSTINOPS ANGUSTIFRONS OLEAGINEUS Sclater

Ostinops oleagineus Sclater, Ibis, 1883, p. 154, pl. 7 (Venezuela).

At Rancho Grande in early morning on November 5 a flock came about the house with much chattering and calling to investigate the banana plantation, and then to continue into the woods. Some of their odd notes suggest in a way some of the calls of the male cowbird (*Molothrus ater*). A male taken was molting the wings and tail. Others were seen on the two days following. The natives call this bird *conote*.

The proper generic name for this group of species is *Ostinops*, Hellmayr [69] being completely in error in using *Xanthornus*, and in his statement that through vote at the International Zoological Congress at Padua Brissonian names are no longer recognized as valid. While such a motion was introduced at the Congress it was not sanctioned or accepted by the International Committee on Zoological Nomenclature, which has power in these matters. The generic names of Brisson are accepted and have definite status.

OSTINOPS DECUMANUS DECUMANUS (Pallas)

Xanthornus decumanus Pallas, Spicilegia zoologica, fasc. 6, 1769, p. 1, pl. 1 (Surinam).

A male was taken on October 30 at Ocumare de la Costa from a flock of half a dozen found scattered through the tall trees shading a cacao plantation. The throat of this bird was filled with banana pulp. Near El Sombrero yellow-tails passed overhead daily in early morning, and on November 20 I found them common in woods near the Río Guarico. One that I shot was in bad plumage and was injured so that I preserved only the skull. The one taken, with a specimen from San Julián, Venezuela, and two from Demerara agree in having a faint indistinct edging or wash of deep chestnut bordering the feathers of the middle and lower back, in this differing from skins from Colombia west to Panamá, which are blacker above, thus supporting Todd's contention that the Colombian birds represent a distinct race, *O. d. melanterus*.

Family THRAUPIDAE

CHLOROSPINGUS OPHTHALMICUS JACQUETI Hellmayr

Chlorospingus venezuelanus jacqueti Hellmayr, Anz. Ornith. Ges. Bayern, vol. 4, Mar. 1921, p. 28 (Galipán, Cerro de Avila, near Caracas, Venezuela).

In the subtropical forest of the Cordillera de la Costa near Rancho Grande this was one of the common birds, so that seven skins were prepared between November 3 and 10. These small tanagers ranged

[69] Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 10, 1937, pp. 10–11.

from low bushes at the borders of the woodlands to the tops of the tallest trees in heavy growth and were found usually with companies of other small forest-loving birds. When low down they sometimes came within a few feet of me, to hop quickly and alertly through the branches with a flutter of wings, with the tail jerking sideways. At such times the light-yellow iris showed clearly, while at a distance the white mark forming a semicircle around the posterior margin of the eye and the yellow breast band were prominent. These specimens agree closely with birds in the National Museum from Colonia Tovar and from Pico Naiguata, Estado Miranda.

TACHYPHONUS RUFUS (Boddaert)

Tangara rufa BODDAERT, Table des planches enluminéez, 1783, p. 44 (Cayenne).

This wide-ranging bird, known to me previously in northern Argentina, I saw on October 17 in the grounds of the American Legation in Caracas. At Ocumare de la Costa they were common, but it was October 30 before I secured my first specimen, a female, as the birds frequented the borders of dense scrub where it was difficult to see them. A male in molt into adult black plumage, with brown feathers still remaining in the wings, was taken on October 31 along the Río Cumboto. Near Rancho Grande they ranged in the brush along the highway or in growths of heavy weeds, being seen to an elevation of 3,500 feet. Several were seen at Maracay on November 11, and I shot a male 9 miles north of Parapara, Estado Guarico, on November 12.

RAMPHOCELUS CARBO VENEZUELENSIS Lafresnaye

Ramphocelus Venezuelensis LAFRESNAYE, Rev. Mag. Zool., 1853, p. 243 (Caracas, Venezuela).

At La Trilla, inland from Ocumare de la Costa, I collected an adult male on October 23, and on the 28th shot two more from a little company of four chattering in the lower branches of the shade trees in a cacao plantation. They were seen also in the valley of the Río Cumboto. At Rancho Grande they were recorded on November 9 and 10 about growths of dense brush along the open roadway. One called loudly *whis whis* as it rested with jerking tail on an open perch.

HEMITHRAUPIS GUIRA NIGRIGULA (Boddaert)

Tanagra nigrigula BODDAERT, Table des planches enluminéez, 1783, p. 45 (Cayenne).[70]

On November 12 I shot a male in a small thorn tree 2 miles south of Parapara, Estado Guarico. The following day I saw another near El Sombrero working through the branches of thorny trees almost as actively as a warbler.

---

[70] While Boddaert says Cayenne, Buffon, Histoire naturelle des oiseaux, vol. 4, p. 283, gives "Guyane."

The specimen taken, which is just completing the molt, has the following measurements: Wing 67.5, tail 55.3, culmen from base 11.8, tarsus 17.0 mm. While it is identified as *nigrigula* it must be pointed out that the lengths of wing and tail suggest the characters assigned to *roraimae*. More specimens are desirable to check the identity of the bird from this area, and the name assigned here is given only tentatively because of lack of material.

PIRANGA RUBRA (Linnaeus): Summer Tanager

Fringilla rubra LINNAEUS, Systema naturae, ed. 10, vol. 1, 1758, p. 181 (South Carolina).

At Rancho Grande on November 4 one was calling from trees on an open slope at an elevation of 3,400 feet.

PIRANGA LEUCOPTERA ARDENS (Tschudi)

Phoenisoma ardens TSCHUDI, Arch. Naturg., vol. 10, 1844, p. 287 (Vitoc, Department Junín, Perú).[71]

In the great forests near Rancho Grande this handsome tanager was fairly common, and it was always a delight to look from the yard at my house and see a glowing red male resting in the morning sun among the tops of trees rising from deep valleys to the level of my eyes. The birds moved deliberately, resting for minutes at a time, so that their beauties could be appreciated to the fullest advantage. Yellow-breasted females were taken at 3,700 feet on November 4 and at 2,600 feet near Los Riitos on November 7. The broad, white wing bars are a prominent field mark in both sexes.

COMPSOCOMA SOMPTUOSA VENEZUELANA Hellmayr

Compsocoma somptuosa venezuelana HELLMAYR, Verh. Orn. Ges. Bayern, vol. 11, 1913, p. 317 (Cumbre de Valencia, Estado Carabobo, Venezuela).

An adult female was taken in heavy forest at 3,700 feet elevation above Rancho Grande on November 10 as it fed about the ends of branches. Another had been seen earlier at about this same elevation. *Compsocoma flavinucha* of Bolivia differs in its extensively blue rump so definitely from the northern members of this group that it can hardly be held to be conspecific though it has been so indicated recently by Hellmayr,[72] who lists the bird of northern Venezuela under the name *Compsocoma flavinucha venezuelana*.

---

[71] Designated by Hellmayr, Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 9, 1936, p. 289.

[72] Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 9, 1936, pp. 199–204.

THRAUPIS EPISCOPUS CANA (Swainson)

Tanagra cana SWAINSON Ornithological drawings, pt. 3, 1836, pl. 37 (Caracas, Venezuela).[73]

This, one of the abundant birds in forested regions, is found in pairs or little groups, ranging well above the ground. They move rather rapidly through the higher branches and make bounding flights for considerable distances above the forests. They were observed as follows: Caracas, October 17 (in the grounds of the American Legation); Maracay, October 21 (specimen) and November 11; Ocumare de la Costa, October 23 (at La Trilla, at an elevation of 250 feet), 24 (valley of Río Cumboto), and 30 (specimen near Independencia); Rancho Grande, November 3 to 10 (specimen, November 4; seen up to 3,600 feet elevation); El Sombrero, November 13 to 21 (specimen, November 19).

CALOSPIZA CHRYSOPHRYS CHRYSOPHRYS (Sclater)

Calliste chrysophrys SCLATER, Jardine's Contr. Orn., vol. 4, Jan. 1851, p. 24, pl. 69, fig. 2 (near Caracas, Venezuela).

The only one seen was an adult male taken on November 7 near Rancho Grande at an elevation of 3,200 feet, where it was feeding at the berries of a small tree in company with other species of this genus.

CALOSPIZA RUFIGENIS (Sclater)

Calliste rufigenis SCLATER, Proc. Zool. Soc. London, 1856 (Mar. 10, 1857), p. 311 (Venezuela).

These tanagers were fairly common in the heavy forest of the Cordillera de la Costa at Rancho Grande where I secured three skins on November 3 and 10. They were most easily seen when they came to small trees laden with berries, but were observed occasionally working quickly through the limbs of large trees in company with related tanagers and warblers. Some of its colorful relatives so far outshine this species in hue that by comparison *rufigenis* seems dull and ordinary until examined by itself alone.

CALOSPIZA VIRIDISSIMA VIRIDISSIMA (Lafresnaye)

Aglaia viridissima LAFRESNAYE, Rev. Zool., vol. 10, Sept. 1847, p. 277 (Trinidad).[74]

These beautiful birds were found through the heavy rain forest at Rancho Grande, where four skins were obtained on November 4, 5, 7, and 9. Ordinarily they moved actively about in the treetops, though I saw them also about trees bearing small berries.

[73] Designated by Hellmayr, Arch. Naturg., vol. 90, 1924, p. 185.

[74] Designated by Hellmayr, Nov. Zool., vol. 13, 1906, p. 14.

The four taken when compared with *C. v. toddi* of the Santa Marta region have the brown of the head distinctly darker and the coloration of the lower surface more bluish green, resembling thus the typical form of Trinidad. The shade of green is duller in my November skins than in others that I have seen taken in February and June, but this I assume is due to wear in the case of the latter. While Hellmayr [75] has united *viridissima* and *toddi* as races of *Calospiza gyrola*, that bird is so different in its blue-marked underparts and yellow shoulders that I can see no reason for this action. While generally similar the two groups are specifically distinct.

CALOSPIZA ARTHRUS (Lesson)

Tanagra Arthrus Lesson, Illustrations de zoologie, livr. 3, Oct. 1832, pl. 9, with text (Caracas, Venezuela).[76]

One of the most pleasing of forest birds in its beautifully contrasted markings of chestnut, yellow, and black this tanager had the fortunate additional merit of being common over the timbered slopes at Rancho Grande, where four skins were prepared on November 2, 4, and 5. The birds ranged from the undergrowth to the tops of the tallest trees, coming with others to small berry-bearing trees in the lower growth. In their movements they suggested titmice at times as they moved quickly and then paused to look about. While under proper light conditions their colors were visible at some distance, on many occasions they appeared as dark silhouettes so that their beauty in the hand was a surprise.

Until intergradation is known it seems to me useless and confusing to try to list the related members of this group as geographic races of *arthrus*. The only resemblance is in the colors represented, the pattern arrangement and the extent of the various colors being widely divergent.

TANAGRA XANTHOGASTER EXSUL (Berlepsch)

Euphonia ruficeps exsul Berlepsch, Verh. V Int. Orn.-Kongr. Berlin, 1912, p. 1017 (San Esteban, Estado Carabobo, Venezuela).

At Rancho Grande I collected a female at 3,700 feet elevation on November 4 and a male at 3,000 feet on November 6. Both had the intestinal tract filled with the seeds of a mistletoe, and on November 10 I saw one at close range with a mistletoe berry in its bill. This species seems to be more sluggish and to move more slowly than the smaller ones with which I have been familiar. They were not heard giving the whistled notes of related species.

[75] Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 9, 1936, p. 148.

[76] Designated by Hellmayr, Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 9, 1936, p. 100.

TANAGRA TRINITATIS (Strickland)

Euphonia trinitatis STRICKLAND, Jardine's Contr. Orn., pt. 2, 1851, p. 72 (Island of Trinidad).

At El Sombrero I shot a male on November 19; a small species found usually in pairs, and seen ordinarily near the clumps of mistletoe whose berries form its food. Until more information is available I prefer to list this as a distinct species rather than as a race of *chlorotica*.[77]

TANAGRA LANIIROSTRIS CRASSIROSTRIS (Sclater)

Euphonia crassirostris SCLATER, Proc. Zool. Soc. London, 1856 (Jan. 26, 1857), p. 277 (Bogotá).

The only one seen was an immature male, barely grown, taken from the top of a medium-sized tree at 700 feet elevation above the Río Cumboto, inland from Ocumare de la Costa, on October 24. My attention was attracted to this bird by its high-pitched whistle, common to many euphonias. The specimen has no trace of the adult plumage.

CHLOROPHONIA FRONTALIS FRONTALIS (Sclater)

Euphonia frontalis SCLATER, Jardine's Contr. Orn., pt. 3, 1851, p. 89 (Caracas, Venezuela).

An adult male was taken from a tall tree at the edge of the forest near Rancho Grande at an elevation of 3,700 feet on November 4. The alimentary tract resembled that of *Tanagra*[78] and was filled with seeds of mistletoe. Until futher information is available it seems to me desirable to retain this bird as a species distinct from *Chlorophonia cyanea*, rather than unite the two groups as is done by Hellmayr.[79]

Family FRINGILLIDAE

SALTATOR ORENOCENSIS ORENOCENSIS Lafresnaye

Saltator Orenocensis LAFRESNAYE, Rev. Zool., vol. 9, Aug. 1846, p. 274 (mouth of Orinoco).

This beautifully marked bird was first seen on November 12 to the south of Parapara, Estado Guarico, where I shot one from the top of a low tree at the border of dense scrub. Several were found near El Sombrero in dense thorn scrub on November 18 and 19, and on the first of these days I secured another. In color these two agree with specimens from Ciudad Bolívar and Soledad on the Orinoco, except that the bills average heavier in the skins that I secured. Only one specimen from the Orinoco in a series of eight is equal to them in this

[77] See Hellmayr, Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 9, 1936, p. 37.
[78] See Wetmore, A., Development of the stomach in the euphonias. Auk, 1914, pp. 458-461.
[79] Field Mus. Nat. Hist., Zool. ser., vol. 13. pt. 9, 1936, pp. 6-11.

respect. Apparently they show slight variation toward the large-billed *S. o. rufescens* found farther west. The two taken, both females, measure as follows: Wing 87.0, 91.9, tail 82.3, 85.5, culmen from base 18.2, 18.5, tarsus 22.6, 23.2 mm. In both there is a faint wash of buff across the breast, but the center of the abdomen is white.

SALTATOR COERULESCENS BREWSTERI Bangs and Penard

Saltator olivascens brewsteri Bangs and Penard, Bull. Mus. Comp. Zoöl., vol. 62, Apr. 1918, p. 91 (Caparo, Trinidad).

An adult female in partial molt was taken on November 16 near El Sombrero among fairly large trees in dense scrub. Others were observed on November 18.

SALTATOR STRIATIPICTUS STRIATIPICTUS Lafresnaye

Saltator striatipictus Lafresnaye, Rev. Zool., vol. 10, Mar. 1847, p. 73 (Cali, Cauca Valley, Colombia).

One was taken in scrub growth near Ocumare de la Costa on October 26.

COCCOPSIS NIGRO-GENIS (Lafresnaye)

Nemosia nigro-genis Lafresnaye, Rev. Zool., vol. 9, 1846, p. 273 (mouth of the Orinoco River, Venezuela).

On November 16 I shot an adult male as it flew out from dense scrub and three days later noted several more in thickets along the Río Guarico. This point seems to be the farthest north at which these birds have yet been recorded, though it is probable that they will be found to extend to the north to the vicinity of Ortiz.

After a further review of the subject I still feel that this species and its near relatives in more slender bill, less rounded culmen, less abrupt deflexure at the gape, more exposed nostrils and more rounded tail are generically distinct from the species typical of *Paroaria*, so that the genus *Coccopsis* should be recognized. In my original statement [80] through a slip of the pen I wrote "more strongly rounded culmen" when the reverse is what was intended. Unless actual, direct intergradation can be shown I see no reason for considering *nigro-genis* a geographic race of the black-throated *gularis*.

TIARIS BICOLOR OMISSA Jardine

Tiaris omissa Jardine, Ann. Mag. Nat. Hist., vol. 20, 1847, p. 332 (Tobago).

At Ocumare de la Costa the Carib grassquit, an old friend from work in Puerto Rico and Hispaniola, was fairly common, two specimens, including adult and immature males, being taken on October 27 and 28. The birds were found in small flocks that fed on the

[80] U. S. Nat. Mus. Bull. 133, 1926, p. 400.

ground in openings in the scrub, and at any alarm flew immediately into dense cover. They were quite shy in such shelter. At Rancho Grande on November 10 I saw several males along the open roadway between 3,300 and 3,500 feet, and a few were recorded at El Sombrero, November 17 to 19, and near Hato Paya, November 21.

SPOROPHILA NIGRICOLLIS NIGRICOLLIS (Vieillot)

Pyrrhula Nigricollis VIEILLOT, Tableau encyclopédique et méthodique . . ., livr. 93, July 1823, p. 1027 (Brazil).

At Ocumare de la Costa I found little bands of half a dozen of these seed-eaters feeding in low, open scrub bordering pasturelands or on grass-grown slopes on hot hillsides. The birds flew quickly to cover when startled. An immature male was taken here on October 23. At Rancho Grande a few were found in small tracts of grass and weeds bordering the highway at elevations of from 3,000 to 3,500 feet. An adult male taken on November 3 is molting over the entire body. On November 12, an immature female was shot 2 miles south of Ortiz, Estado Guarico, and several were seen at El Sombrero on November 19. The species formerly was known as *Sporophila gutturalis* (Lichtenstein).

SPOROPHILA BOUVRONIDES (Lesson)

Pyrrhula bouvronides LESSON, Traité d'ornithologie, livr. 6, Feb. 1831, p. 450 (Trinidad).[81]

An adult taken on October 24 at 700 feet elevation above the Río Cumboto near Ocumare de la Costa was found at the edge of a thicket.

VOLATINIA JACARINA SPLENDENS (Vieillot)

Fringilla splendens VIEILLOT, Nouv. Dict. Hist. Nat., vol. 12, June 1817, p. 173 (Cayenne).

In the grounds of the American Legation in Caracas I saw several blue-black grassquits on October 17. Near El Sombrero they were fairly common in weed-grown fields near the Río Guarico, where I shot one on November 19 but lost it from my game bag in some way while returning to town.

SPINUS PSALTRIA COLUMBIANUS (Lafresnaye)

Carduelis columbianus LAFRESNAYE, Rev. Zool., vol. 6, 1843, p. 292 (Bogotá, Colombia).

Near Rancho Grande I found small flocks of these little goldfinches ranging in open lands that when disturbed disappeared in the cover of vines or low trees. They were observed along the roadway as high as the hotel at 3,500 feet. An adult male taken on November 9 at 3,000 feet has the tail entirely black.

[81] Designated by Hellmayr, Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 11, 1938, p. 211.

SICALIS FLAVEOLA FLAVEOLA (Linnaeus)

Fringilla flaveola LINNAEUS, Systema naturae, ed. 12, 1766, p. 321 (Surinam).[82]

Two immature individuals molting into first fall dress shot at La Providencia near Maracay, October 21, were the first birds that I collected in Venezuela. As I entered a little pasture several flew from weeds into the top of a low tree, where they rested quietly. On November 11 I noted others in this locality and observed that on the ground they walked as readily as blackbirds. At Ocumare de la Costa, where I collected an adult female in worn plumage on October 26, they were common. Near my house at the beach I saw them in little companies of eight or ten, walking about in close company in the grass, or, inland, found them in openings in the brush or at the edge of the woodland. The song is high-pitched and squeaky. As immature and adult birds mingled there was much variation among them in depth of color. Between Maracay and El Sombrero on November 12 and 21 I found them abundant along the highway, and at El Sombrero from November 13 to 20 they were common.

CORYPHOSPINGUS PILEATUS BREVICAUDUS Cory

Coryphospingus pileatus brevicaudus CORY, Field Mus. Nat. Hist., orn. ser., vol. 1, Aug. 30, 1916, p. 345 (Margarita Island, Venezuela).

This little red-crested sparrow was first seen on November 12, 9 miles north of Parapara, Estado Guarico, where an immature female was taken. From this point to El Sombrero these birds were common and in all six specimens were prepared, including adult and immature individuals. The birds fed on the ground at the borders of the thorny scrub in little flocks of six or eight that flew up with a flash of black from tail and wings contrasting with the gray and white of the body plumage to alight on twigs near the ground, and if alarmed again disappeared in heavy cover.

The northern race *brevicaudus* is rather indefinitely characterized by shorter tail on the average, and by very slightly darker dorsal color, when compared with *C. p. pileatus* of the south.

ATLAPETES BRUNNEI-NUCHA XANTHOGENYS (Cabanis)

Buarremon xanthogenys CABANIS, Museum Heineanum, pt. 1, 1851, p. 141 (Caracas, Venezuela).

On November 8, at an elevation of 4,000 feet above Rancho Grande, in heavy forest with fairly open undergrowth I watched one of these interesting birds for a short time as it walked and ran on the ground. The white underparts made a striking mark in the dim light and attracted the eye as the bird moved. In this remote forest, where men seldom penetrated, the bird seemed unafraid, far less shy than

[82] Designated by Berlepsch and Hartert, Nov. Zool., vol. 9, 1902, p. 27.

I have found this species elsewhere. On skinning the specimen it proved to be an adult male.

There is no objection apparent to Hellmayr's proposal to unite the currently recognized genus *Buarremon* with *Atlapetes*.[83]

ARREMONOPS CONIROSTRIS CONIROSTRIS (Bonaparte)

Arremon conirostris BONAPARTE, Conspectus generum avium, vol. 1, 1850, p. 488 (Colombia).

Near Ocumare de la Costa these sparrows were found in dense growths of scrub, where they moved about among the branches near the ground. Specimens were taken on October 26, 27, and 30, the last being a female in molt.

MYOSPIZA HUMERALIS HUMERALIS (Bosc)

Tanagra humeralis BOSC, Journ. Hist. Nat. (Choix de Mémoires), vol. 2, No. 17, Sept. 1, 1792, p. 179, pl. 34, fig. 4 (Cayenne).

On November 13, 12 miles south of El Sombrero, I flushed two of these birds in high grass in a little opening in the thorn scrub and collected one, an adult female. The specimen is molting from very worn plumage so that its characters of color are obscure. Identification as the typical form is made therefore principally on the basis of accepted range, though so far as can be told the bird resembles those from farther south.

[83] Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 11, 1938, p. 384.

O

PROCEEDINGS OF THE UNITED STATES NATIONAL MUSEUM

issued by the

SMITHSONIAN INSTITUTION
U. S. NATIONAL MUSEUM

Vol. 87 Washington : 1939 No. 3074

A REVISION OF THE SOAPFISHES OF THE GENUS RYPTICUS

By Leonard P. Schultz and Earl D. Reid

For many years an attempt has been made to distinguish the species of soapfishes by such characters as number of spines on preoperculum, on operculum, and in the dorsal fin and the amount of separation of spinous and soft dorsal fins. Doubtless these characters were considered sufficient, because only a few specimens were available to previous authors. With larger series at hand, however, we find that none of these characters is of much value in the separation of the species.

Perhaps some of the misconceptions prevalent in regard to the soapfishes are caused by the fleshiness of the fins. This makes it impossible to count the fin rays accurately without careful dissections and has led several authors to state that the spinous and soft dorsals are separated. Dissection of the dorsal fin in our specimens shows definitely that the fin supports are of about equal spacing from first dorsal spine to the first few soft rays, after which the rays are closer together posteriorly.

The state of preservation of the fleshy nature of the vertical fins, no doubt, causes the dorsal spines, in some specimens, to appear more or less separated from the soft rays. The scales, too, are difficult to count because they are embedded and covered with mucus. Measurements were made on the various organs of the body, but none of these was found to be significant. The general body form appears to be very similar for all the species.

We wish to thank the following men and institutions for the privilege of examining specimens: Dr. S. F. Hildebrand and Isaac Ginsburg,

of the U. S. Bureau of Fisheries; A. C. Weed, of the Field Museum of Natural History; and J. R. Norman, of the British Museum.

Genus RYPTICUS Cuvier

Rypticus Cuvier, *in* Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 3, p. 60, 1829 (*Anthias saponaceus* Bloch and Schneider).

Rypticus Cuvier, Le règne animal, p. 144, 1829 (*Anthias saponaceus* Bloch and Schneider).

Smecticus Valenciennes, Voyage *Venus* Ichthyologie, p. 305, 1855 (*Rypticus bicolor* Valenciennes).

Promicropterus Gill, Proc. Acad. Nat. Sci. Philadelphia, 1861, p. 53 (*Rypticus maculatus* Holbrook).

Eleutheractis Cope, Trans. Amer. Philos. Soc., new ser., vol. 14, p. 467, fig. 3, 1871 (*Eleutheractis coriaceus* Cope).

To the genus *Rypticus* we refer all those species of serranids [1] that combine the following characters: Dorsal spines 2 or 3; preopercular spines usually 2 or 3, rarely 1 or 4; opercular spines 2 or 3; anal rounded, without spines; caudal, dorsal, and pectoral fins rounded; pelvics 1, 5, inserted a little in advance of the insertion of the pectorals; dorsal fin low in front gradually rising posteriorly, the spiny and soft portions not separated as often indicated in descriptions; body oblong, compressed, covered with small elongate smooth scales somewhat embedded, these scales occurring at least halfway out on all the fins; vertical fins fleshy, the tissue between the rays spongy near their bases; lateral line present, complete; head scaly; mouth large, oblique, the lower jaw longer almost entering profile; maxillary with supplemental bone; interorbital narrow; teeth villiform in bands on jaws, vomer, and palatines; gill rakers short, broad, their edges spiny; branchiostegals 7. Other characters somewhat constant for the genus are: Distance from tip of snout to insertion of pelvics 0.8 to 1.1 times in distance from rear edge of eye to origin of dorsal; depth 2.9 to 3.9 times in standard length; head 2.6 to 3.3; diameter of eye 3.7 to 6.0 in head.

The key and table 1 give the characters that we have found most useful in distinguishing the species of *Rypticus*.

KEY TO SPECIES AND SUBSPECIES OF RYPTICUS

1*a*. Background darker with light spots or color uniform reddish to brown, number and arrangement of light spots or blotches (sometimes marbled), when present, more or less variable, usually numerous and distinct in young but often fading in adults and sometimes absent altogether in specimens 5 inches or longer; young specimens usually have a light narrow band extending backward from eye across side of head and another from tip of snout in middorsal line to origin of dorsal fin, both of which fade on adults; rows of scales crossing lateral line 97 to 130.

[1] Jordan, D. S., Classification of fishes, Stanford Univ. Publ., biol. ser., vol. 3, No. 2, p. 191–192, 1923, transfers all those serranids with a supplemental maxillary bone into the family Epinephelidae.

2*a*. Pacific form. Number of fin rays in dorsal, anal, and one pectoral minus dorsal spines averages more than in Atlantic form, usually from 56 to 61 (see table for distribution of counts). *Range:* Lower California, Cape San Lucas, Gulf of California (Angeles Bay) to Panama and Galapagos Islands---------------------------saponaceus bicolor Valenciennes

2*b*. Atlantic form. Number of soft fin rays in dorsal, anal, and one pectoral minus dorsal spines averages fewer, usually 53 to 59 (see table for distribution of counts). *Range:* Newport, R. I., Bermuda, West Indies, Gulf of Mexico, Central America to Brazil and off west coast of Africa---------------saponaceus saponaceus (Bloch and Schneider)

1*b*. Background of a lighter color, with small brown or blackish spots on head and body, spots sometimes fading in adults.

3*a*. Scale rows crossing lateral line 75 to 94 (scale rows were counted from point on head above preopercular bone where lateral line begins to base of caudal fin rays); in young the body is speckled with small brown spots very numerous and not arranged in a few rows. *Range:* Key West, Fla., West Indies, Central America to Brazil, and west coast of Africa arenatus Cuvier

3*b*. Scale rows crossing lateral line 95 to 114, brown spots larger and fewer in number; some of which are about the size of the pupil and arranged in 4 to 6 irregular horizontal rows; middle row extending backward from eye is most regular and contains the largest spots numbering 14 or 15. *Range:* West Indies and in Atlantic off Panama---subbifrenatus Gill

RYPTICUS SAPONACEUS BICOLOR Valenciennes

Rypticus bicolor VALENCIENNES, Voyage *Venus* Poissons, pl. 2, fig. 2, 1846 (Galapagos).—JORDAN and EIGENMANN, Bull. U. S. Fish Comm., vol. 8, p. 339, 1890.—JORDAN and EVERMANN, Rep. U. S. Comm. Fish and Fisher. for 1895, app. 5, p. 379, 1896; U. S. Nat. Mus. Bull. 47, pt. 1, p. 1231, 1896.—SNODGRASS and HELLER, Proc. Washington Acad. Sci., vol. 6, pp. 373–426, 1905.—JORDAN, EVERMANN, and CLARK, Rep. U. S. Comm. Fisher. for 1928, pt. 2, p. 316, 1930.

Rypticus saponaceus bicolor HILDEBRAND, Zoologica, vol. 24, pt. 1, p. 39, 1939.

Rhypticus bicolor GÜNTHER, Catalogue of fishes in the British Museum, vol. 1, p. 173, 1859.

Smecticus bicolor VALENCIENNES, Voyage *Venus* Ichthyologie, p. 307 (pl. 2, fig. 2), 1855.—GILL, Proc. Acad. Nat. Sci. Philadelphia, 1861, p. 53; 1863, p. 164.—BLEEKER, Arch. Neerland. Sci. Exartes Natur., vol. 11, p. 258, 1876.

Rhypticus nigripinnis GILL, Proc. Acad. Nat. Sci. Philadelphia, 1861, p. 53 (Panama).—JORDAN and GILBERT, Proc. U. S. Nat. Mus., vol. 5, pp. 359, 375, 381, 1882.—JORDAN, Rep. U. S. Comm. Fish and Fisher. for 1884, p. [86], 1885; Proc. U. S. Nat. Mus., vol. 8, p. 378, 1885.—BOULENGER, Catalogue of fishes in the British Museum, vol. 1, p. 349, 1895.

Rypticus nigripinnis JORDAN and EIGENMANN, Bull. U. S. Fish Comm., vol. 8, p. 339, 1890 (based on U.S.N.M. No. 29277).—JORDAN and EVERMANN, Rep. U. S. Comm. Fish and Fisher. for 1895, app. 5, p. 380, 1896; U. S. Nat. Mus. Bull. 47, pt. 1, p. 1234, 1896.—GILBERT and STARKS, Contr. Hopkins Seaside Lab. Mem., No. 32, p. 100, 1904 (also Mem. California Acad. Sci., vol. 4, p. 100).—FOWLER, Proc. Acad. Nat. Sci. Philadelphia, 1916, p. 140.—MEEK and HILDEBRAND, Marine fishes of Panama, pt. 2, p. 482, 1925.—WALFORD, Marine game fishes Pacific coast Alaska to Equator, p. 125, pl. 16, fig. C, 1937.

Promicropterus nigripinnis=*R. nigripinnis* Gill, Proc. Acad. Nat. Sci. Philadelphia, 1863, p. 164.

Promicropterus nigripinnis Jordan, Evermann, and Clark, Rep. U. S. Comm. Fisher. for 1928, pt. 2, p. 317, 1930.

Rhypticus maculatus Gill (non Holbrook), Proc. Acad. Nat. Sci. Philadelphia, 1862, p. 251 (Cape San Lucas); 1863, p. 164.

Rhypticus xanti Gill, Proc. Acad. Nat. Sci. Philadelphia, 1862, p. 250 (Cape San Lucas, Lower California); 1863, p. 164.—Jordan and Gilbert, Proc. U. S. Nat. Mus., vol. 5, pp. 359, 371, 1882.—Jordan, Proc. U. S. Nat. Mus., vol. 8, p. 377, 1885; Rep. U. S. Comm. Fish and Fisher. for 1884, p. [85], 1885.

Rypticus xanti Jordan and Eigenmann, Bull. U. S. Fish Comm., vol. 8, p. 339, 1890.—Jordan, Starks, and Williams, Contr. Biol. Hopkins Lab. Biol. Mem., vol. 1, p. 452, 1895.—Jordan and Evermann, Rep. U. S. Comm. Fish and Fisher. for 1895, app. 5, p. 379, 1896; U. S. Nat. Mus. Bull. 47, pt. 1, p. 1231, 1896 (description based on U.S.N.M. No. 7740).—Meek and Hildebrand, Marine fishes of Panama, pt. 2, p. 481, pl. 48, 1925.—Jordan, Evermann, and Clark, Rep. U. S. Comm. Fisher. for 1928, pt. 2, p. 316, 1930.—Breder, Bull. Bingham Oceanogr. Coll., vol. 2, art. 3, p. 24, 1936.

Promicropterus decoratus Gill, Proc. Acad. Nat. Sci. Philadelphia, 1863, p. 164 (west coast of Central America).

Rhypticus decoratus Günther, Trans. Zool. Soc. London, vol. 6, pp. 383, 385, 412, 1869.—Jordan and Gilbert, U. S. Nat. Mus. Bull. 16, p. 543, 1882.

The color of *R. saponaceus bicolor* and *R. s. saponacues* is very variable. The white spots on some specimens are very few in number, not over a dozen on each side, while in others twice that number, and grading upward to those with very numerous light spots. In some the spots are so numerous that they meet to give the soapfish the appearance of a marbled pattern. The specimens that are plain in color appear not to be different otherwise from the spotted forms.

Since large adults of *R. subbifrenatus* have not been seen by us, there is a possibility that specimens of *Rypticus* that have no light spots and that are plain in color may be confused with *R. subbifrenatus*. We do not have ample material of the latter to determine the variation in the number of fin rays, which might be of some aid in its separation from *R. s. saponaceus* of the Atlantic.

The presence of *Rypticus s. saponaceus* on the western coast of Africa is verified by counts made on two specimens kindly lent to us by J. R. Norman, of the British Museum. Fin counts of these specimens from Accra, Gold Coast, and Cape Verde Islands, respectively, are as follows: Dorsal rays III, 24; III, 25. Anal rays 16; 16. Pectoral rays 16; 16. Preopercular spines 4, 3; 3, 3. Opercular spines 4, 4; 3, 3. Scale rows along side of body about 105; 113.

The following collections in the U. S. National Museum have been examined:

No. 3689 (type *R. maculatus*). "Cape San Lucas." J. Xantus.
No. 3700 (type *R. nigripinnis*). "Panama." Rev. I. Rowell.
No. 7740. Colima, Mexico. J. Xantus.

No. 29277. Panama. C. H. Gilbert.
No. 30740 (type *R. xanti*). Cape St. Lucas. J. Xantus.
No. 30961 (type *P. decoratus*). Panama. Capt. Dow.
No. 41259. Panama, March 5, 1888. *Albatross.*
No. 41329. St. Lucia, 1888. *Albatross.*
No. 41378. Socorro Island. *Albatross.*
No. 50361. Panama. C. H. Gilbert.
No. 76573. Panama City, Panama, October 3, 1914. James Zetek.
No. 76816. Panama City, Panama, July 27, 1915. James Zetek.
No. 76817. Panama City, Panama, December 1914. James Zetek.
No. 80229. Tide pools, Panama, Panama, March 21, 1912. Meek and Hildebrand.
No. 80230. Tide pools, Panama, Panama, March 24, 1912. Meek and Hildebrand.
No. 80231. Tide pools, Panama, Panama, March 22, 1912. Meek and Hildebrand.
No. 80233. Tide pools, Panama, Panama, March 23, 1912. Meek and Hildebrand.
No. 80235. Tide pools, Panama, Panama, March 24, 1912. Meek and Hildebrand.
No. 80236. Panama Bay, Panama, March 25, 1912. Meek and Hildebrand.
No. 80298. Panama Market, Panama. April 6, 1911. Meek and Hildebrand.
No. 80299. Panama Bay, Balboa, C. Z. March 25, 1912. Meek and Hildebrand.
Nos. 82002, 82003. Chame Point, Panama, Autumn 1912. Robert Tweedlie.
No. 94010. Albemarle Island, Galapagos, January 25, 1934. W. L. Schmitt, Hancock Expedition.
No. 101858. Pinas Bay, Panama, January 29, 1935. W. L. Schmitt, Hancock Expedition.
No. 104965. Costa Rica, Golfa Dulce, February 1933. M. Valerio.
No. 106622. Miraflores Locks, C. Z. April 28, 29, 1937. A. O. Foster.
No. 106615. Miraflores Locks, C. Z. April 28, 29, 1937. S. F. Hildebrand.
No. 106621. Miraflores Locks, C. Z. March 26, 1937. S. F. Hildebrand.
No. 106617. Panama City, San Francisco Reef tide pools, February 13, 1937. S. F. Hildebrand.
No. 106620. Miraflores Locks, March 26–29, 1937. S. F. Hildebrand.
No. 106623. Venado Beach, Panama, February 26, 1937. S. F. Hildebrand.
No. 106624. Farfan Beach, C. Z. February 24, 1937. S. F. Hildebrand.
No. 106626. Balboa, C. Z. January 29, 1937. S. F. Hildebrand.
No. 106618. Panama City, San Francisco Reef tide pools. February 18, 1937. S. F. Hildebrand.
No. 106616. Panama, San Francisco Beach, February 10, 1937. S. F. Hildebrand.
U.S.B.F. 393. Socorro Island, March 8, 1889. *Albatross.*

RYPTICUS SAPONACEUS SAPONACEUS (Bloch and Schneider)

Anthias saponaceus Bloch and Schneider, Systema ichthyologiae . . . , p. 310, 1801 (after Jabonsilla Parra, Descripcíon de diferentes piezas de historia natural . . . , No. 51, lam. 24, fig. 2, 1787) (Habana).

Rypticus saponaceus Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 3, p. 63, 1829.—Richardson, Fauna Boreali-Americana, p. 32, 1836.—Storer, A synopsis of the fishes of North America, p. 37 (289), 1846.—Poey, Repertorio fisiconatural de la isla de Cuba, vol. 1, p. 270, 1866.—Bleeker, Arch. Neerland. Sci. Exact. et Natur., vol. 11, p. 258, 1876.—Jordan and Eigenmann, Bull. U. S. Fish Comm., vol. 8, p. 340, 1890.—Jordan and Evermann, Rep. U. S. Comm. Fish and Fisher. for 1895, app. 5, p. 379, 1896; U. S. Nat. Mus. Bull. 47, pt. 1, p. 1232, 1896.—Evermann and Marsh, Bull. U. S. Fish Comm., vol. 20, pt. 1, p. 163, 1902.—JORDAN and THOMPSON, Bull. U. S. Bur. Fisher., vol. 24, p. 241, 1905.—RIBEIRO, Arch. Mus. Nac. Rio de Janeiro, vol. 17, Serranidae, p. 5, 1915.—NICHOLS, Bull. Amer. Mus. Nat. Hist., vol. 44, art. 3, p. 23, 1921.—MEEK and HILDEBRAND, Marine fishes of Panama, pt. 2, p. 480, pl. 47, 1925.—BREDER, Field book of marine fishes of the Atlantic coast, p. 166, 1929.—NICHOLS, Sci. Surv. Porto Rico and Virgin Islands, New York Acad. Sci., vol. 10, pt. 2, p. 257, 1929.—JORDAN, EVERMANN, and CLARK, Rep. U. S. Comm. Fisher. for 1928, pt. 2, p. 316, 1930.—FOWLER, Proc. Acad. Nat. Sci. Philadelphia, vol. 82, p. 273, 1930.—BEEBE and TEE-VAN, Field book of shore fishes of Bermuda, p. 133, fig., 1933.—FOWLER, Bull. Amer. Mus. Nat. Hist., vol. 70, pt. 2, p. 778, 1936.—HILDEBRAND, Zoologica, vol. 24, pt. 1, p. 27, 1939.

Rhypticus saponaceus GÜNTHER, Catalogue of fishes in the British Museum, vol. 1, p. 172, 1859.—GILL, Proc. Acad. Nat. Sci. Philadelphia, 1861, p. 52; 1863, p. 163.—GÜNTHER, Proc. Zool. Soc. London, 1868, p. 225.—POEY, Synopsis piscium cubensium, p. 297, 1868.—COPE, Trans. Amer. Philos. Soc., new ser., vol. 14, p. 467, 1871.—MELLISS, St. Helena . . . , p. 103, 1875.—POEY, Enumeratio piscium cubensium, p. 34, 1875.—PETERS, Monatsb. Preuss. Akad. Wiss. Berlin, 1876, p. 245.—GÜNTHER, Report on the shore fishes (*in* Zoology of the voyage of H. M. S. *Challenger*, vol. 1, pt. 6), pp. 3, 8, 1880.—STAHL, Catalogo Gabinette Zoologico, pt. 1, class. sist., Fauna puertoriquena cuadros sinopticos, p. 162, 1882.—JORDAN, Proc. U. S. Nat. Mus., vol. 7, p. 35, 1884; *ibid.*, p. 546, 1885; Rep. U. S. Comm. Fish and Fisher., for 1884, p. [85], 1885.—ROCHEBRUNE, Faune de la Sénégambie, Poissons, p. 44, 1885.—JORDAN, Proc. U. S. Nat. Mus., vol. 9, p. 581, 1887.—BOULENGER, Catalogue of fishes in the British Museum, vol. 1, p. 348, 1895.—OSORIO, Jorn. Sci. Math. Phys. Nat. Acad. Sci. Lisboa, ser. 2, vol. 3, No. 12, p. 244, 1895; vol. 5, No. 19, pp. 188, 195, 1898; Mem. Mus. Bocage Lisboa, fasc. 1, p. 60, 1909.—CLARK, Proc. Roy. Phys. Soc. Edinburgh, vol. 19, No. 3, p. 52, 1913.—METZELAAR, Report on the fishes collected by J. Boeke in the Dutch West Indies, 1904–1905, Rep. Toestand Visscherij Curaçao, pp. xvii, 56, 234, 1919.—ROULE, Poissons *Princesse-Alice* (1891–1903) et *Hirondelle II* (1914), Res. Camp. Sci. Albert I, Prince de Monaco, fasc. 52, p. 49, 1919.—BARNARD, Ann. South African Mus., vol. 21, p. 491, 1927 (Cape seas).

Bodianus bis-trispinus MITCHILL, Amer. Monthly Mag. Crit. Rev., vol. 2, No. 4, p. 247, 1818 (Str. Bahama).

Rhypticus bistrispinus JORDAN, Proc. U. S. Nat. Mus., vol. 7, p. 149, 1884; Rep. U. S. Comm. Fish and Fisher. for 1884, p. [86], 1885; Proc. U. S. Nat. Mus., vol. 9, p. 581, 1887.—METZELAAR, Rep. Toestand Visscherij Curaçao, pp. xvii, 57, 1919.

Rypticus bistrispinus JORDAN and EIGENMANN, Bull. U. S. Fish Comm., vol. 8, p. 338, 1890.—JORDAN and EVERMANN, Rep. U. S. Comm. Fish and Fisher. for 1895, app. 5, p. 380, 1896; U. S. Nat. Mus. Bull. 47, pt. 1, p. 1233, pl. 194, fig. 509, 1896.—EVERMANN and MARSH, Bull. U. S. Fish Comm., vol. 20, pt. 1, p. 163, fig. 46, 1902.—T. H. BEAN, Field Columbian Mus. Publ., zool. ser., vol. 7, No. 2, p. 55, 1906.—FOWLER, Proc. Boston Soc. Nat. Hist., vol. 35, No. 4, p. 111, 1917; Proc. Biol. Soc. Washington, vol. 36, p. 22, 1923.—EVERMANN and SEALE, Univ. Iowa Studies Nat. Hist., vol. 10, No. 4, p. 31, 1924.—NICHOLS and BREDER, Zoologica, vol. 9, pt. 1, p. 81, fig., 1926.—BREDER, Bull. Bingham Oceanogr. Coll., vol. 1, art. 1, p. 45, 1927.—BORODIN, Bull. Vanderbilt Oceanogr. Mus., vol. 1, art. 1, p. 19, 1928.—NICHOLS, Sci. Surv. Porto Rico and Virgin Islands, New York Acad. Sci., vol. 10, pt. 2, p. 258, fig. 126, 1929.—BEEBE and TEE-VAN, Field book of shore fishes of Bermuda, p. 132, fig., 1933.

Rhypticus bistrispineus BOULENGER, Catalogue of fishes in the British Museum, vol. 1, p. 350, 1895.

Rhypticus bistrispinosus ROSÉN, Lunds Univ. Arsskr. Följd, Afd. 2, Bd. 7, No. 5, p. 55, 1911.

Rypticus bistrispenus BREDER, Field book of marine fishes of the Atlantic coast, p. 166, fig., 1929.

Promicropterus bistrispinus JORDAN, EVERMANN, and CLARK, Rep. U. S. Comm. Fisher. for 1928, pt. 2, p. 316, 1930.

Rypticus microps CASTELNAU, Animaux nouveaux ou rares recueillis . . . l'Amerique du Sud, p. 6, 1855.

Rypticus maculatus HOLBROOK, Ichthyology of South Carolina, p. 39, pl. 6, fig. 2, 1855 (South Carolina); ed. 2, p. 42, pl. 6, fig. 2, 1860 (Cape Romain).

Rhypticus maculatus GÜNTHER, Catalogue of the fishes in the British Museum, vol. 1, p. 173, 1859.—JORDAN and GILBERT, U. S. Nat. Mus. Bull. 16, p. 543, 1882.—JORDAN, Proc. U. S. Nat. Mus., vol. 7, p. 35, 1884.

Promicropterus maculatus GILL, Proc. Acad. Nat. Sci. Philadelphia, 1861, p. 53; 1863, p. 164.

Promicropterus decoratus (non Gill) COPE, Proc. Acad. Nat. Sci. Philadelphia, 1870, p. 119.

Eleutheractis coriaceus COPE, Trans. Amer. Philos. Soc., new. ser., vol. 14, p. 467, fig. 3, 1871.

Rypticus coriaceus JORDAN and EIGENMANN, Bull. U. S. Fish Comm., vol. 8, p. 341, 1890.—JORDAN and EVERMANN, Rep. U. S. Comm. Fish and Fisher. for 1895, app. 5, p. 379, 1896; U. S. Nat. Mus. Bull. 47, pt. 1, p. 1233, 1896.—EVERMANN and MARSH, Bull. U. S. Fish Comm., vol. 20, pt. 1, p. 163, 1902.—STARKS, The fishes of the Stanford expedition to Brazil, p. 45, 1913.—BEEBE and TEE-VAN, Zoologica, vol. 10, No. 1, p. 133, 1928.—NICHOLS, Sci. Surv. Porto Rico and Virgin Islands, New York Acad. Sci., vol. 10, pt. 2, p. 258, fig. 125, 1929.—JORDAN, EVERMANN, and Clark, Rep. U. S. Comm. Fisher. for 1928, pt. 2, p. 316, 1930.

The following collections in the U. S. National Museum have been examined:

No. 21394. Bermudas, 1877. G. Brown Goode.

No. 21544. Charleston, S. C., July 1878. C. C. Leslie.

No. 25994. Charleston, S. C. C. C. Leslie.

No. 30130. Jamaica, West Indies, 1881. Kingston Public Museum.

No. 43278. Bahia, Brazil, 1887. *Albatross.*

No. 44468. Patuca River, Honduras, January 1892. H. W. Perry.

No. 44716. Central America, 1893. Frank P. Davis.

No. 50188. Hucares, Puerto Rico, February 13, 1899. *Fish Hawk.*

No. 53136. Nassau, Bahamas, July 2, 1903. B. A. Bean.

No. 53367. Off New Smyrna, Fla., December 1, 1905. B. A. Bean.

No. 62695. Palm Beach, Fla., December 7, 1908. B. A. Bean, *Orian.*

No. 80232. Salt Water Division, Corozal, Panama, C. Z., February 15, 1911. Meek and Hildebrand.

No. 80234. Mindi Cut, Canal Zone, Panama, February 3–4, 1911. Meek and Hildebrand.

No. 89654. Petit Baraderes Bay, Haiti, April 9, 1930. Smithsonian-Parish Expedition. W. M. Perrygo.

No. 106514. West coast of Florida, St. Martins, 28°34′45″ N., 83°08′00″ W., January 15, 1902. *Fish Hawk* station 7221.

No. 106515. Gulf of Mexico, 28°47′30″ N., 84°37′ 00″ W., March 15, 1885. *Albatross* station 2407.

No. 106625. Gatun Locks, C. Z., January 4, 1935. S. F. Hildebrand.
U. S. B. F. No. 863. Mayaguez, Puerto Rico, January 19, 1899. *Fish Hawk*.

Specimens from the Field Museum:

No. 5295. Nonsuch Islands, Bermuda. T. H. Bean.
No. 2824. Jamaica. Roberts.

RYPTICUS SUBBIFRENATUS Gill

Rhypticus subbifrenatus GILL, Proc. Acad. Nat. Sci. Philadelphia, 1861, p. 53 (St. Thomas in Caribbean); 1863, p. 164.

Rhypticus nigromaculatus STEINDACHNER, Sitzber. math.-nat. Akad. Wiss. Wien, vol. 56, pt. 1, p. 348 [42], 1867.—JORDAN, Proc. U. S. Nat. Mus., vol. 9, p. 581, 1887.

Rypticus nigromaculatus JORDAN and EIGENMANN, Bull. U. S. Fish Comm., vol. 8, p. 341, 1890.

Rhypticus spec. juv. METZELAAR, Rep. Toestand Visscherij Curaçao, pp. xvii, 58, fig. 22, 1919.

The color of *R. subbifrenatus* consists of 5 or 6 horizontal rows of black or brown spots, one along base of dorsal fin, which sometimes branches off the one that begins over eye and extends along back to below end of soft dorsal fin; another or a branch of the latter begins at anterior end of lateral line, sometimes dividing below spinous dorsal to form two irregular rows; the longest and most regular row begins behind middle of eye and consists of three or four oblong spots on head, extending posteriorly along middle of body to base of caudal fin; the ventralmost row begins on preopercle in front of the pectoral fin base, continuing backward to under side of caudal peduncle; there are a few black spots near basal half of pectoral fin rays.

The following collections have been studied:

U.S.N.M. No. 82432, San Antonio, Cuba, 1914. Henderson and Bartsch.
No. 106516. Reef and beach St. Thomas, Smith Bay, April 25, 1937. W. L. Schmitt, Smithsonian-Hartford Expedition 1937, station 68.
No. 106619. Limon Bay, Fort Sherman (Toro Point), C. Z., February 20, 1937. J. B. Shropshire.

RYPTICUS ARENATUS Cuvier

Rypticus arenatus CUVIER, *in* Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 3, p. 65, pl. 46, 1829 (Brazil); Le règne animal, vol. 2, p. 144, 1829.—JORDAN and EIGENMANN, Bull. U. S. Fish Comm., vol. 8, p. 340, 1890.—JORDAN and EVERMANN, Rep. U. S. Comm. Fish and Fisher. for 1895, app. 5, p. 379, 1896; U. S. Nat. Mus. Bull. 47, pt. 1, p. 1232, 1896.—FOWLER, Proc. Acad. Nat. Sci. Philadelphia, 1916, p. 402.—JORDAN, EVERMANN, and CLARK, Rep. U. S. Comm. Fisher. for 1928, pt. 2. p. 316, 1930.—FOWLER, Bull. Amer. Mus. Nat. Hist., vol. 70, pt. 2, p. 779, fig. 343, 1936.

Rhypticus arenatus GÜNTHER, Catalogue of fishes in the British Museum, vol. 1, p. 173, 1859.—GILL, Proc. Acad. Nat. Sci. Philadelphia, 1861, p. 53; 1863, p. 163.—STEINDACHNER, Sitzber. math.-nat. Akad. Wiss. Wien, vol. 56, pt. 1, p. 347 [41], 1867.—CAPELLO, Jorn. Sci. Math. Phys. Nat. Acad. Sci. Lisboa, vol. 3, p. 196, 1867.—GÜNTHER, Report on the shore fishes (*in* Zoology of the voyage of H. M. S. *Challenger*, vol. 1, pt. 6), p. 6, 1880.—BEAN and DRESSEL, Proc. U. S. Nat. Mus., vol. 7, p. 163, 1884.—JORDAN, Proc. U. S. Nat. Mus., vol. 9, p. 581, 1887.—BOULENGER, Catalogue of fishes in the British Museum, vol. 1, p. 349, 1895.—Osorio, Jorn. Sci. Math. Phys. Nat. Acad. Sci. Losboa, ser. 2, vol. 3, No. 12, p. 244, 1895; vol. 5, No. 19, p. 195, 1898; Mem. Mus. Bocage Lisboa, fasc. 1, p. 60, 1909.—Ribeiro, Arch. Mus. Nac. Rio de Janeiro, vol. 17, Serranidae, p. 6, 1915.—Metzelaar, Rep. Toestand Visscherij Curaçao, p. 234, 1919.

Rhypticus pituitosus Goode and Bean, Proc. U. S. Nat. Mus., vol. 2, p. 341, 1880 (Key West, Fla.); vol. 5, p. 238, 1882.—Jordan and Gilbert, U. S. Nat. Mus. Bull. 16, p. 543, 1882.

Rypticus boroni Beebe and Tee-Van, Zoologica, vol. 10, No. 1, p. 132, fig., 1928.

?*Rhypticus coriaceus* Metzelaar, Rep. Toestand Visscherij Curaçao, pp. xvii, 57, fig. 21, 1919.

The following collections have been studied:

U.S.N.M. No. 23555 (type *R. pituitosus*). Key West, Fla. J. W. Velie.
No. 37439. Cuba, 1885. F. Poey.
No. 43559. 25°12′ N., 83°20′30″ W., 1889. *Grampus.*
No. 50208. Culebra, Puerto Rico, February 10, 1899. *Fish Hawk.*
No. 53137. Green Cay, Bahamas, June 30, 1903. B. A. Bean.
U. S. B. F. 905. Culebra, Puerto Rico, February 10, 1899. *Fish Hawk.*
Field Museum 3261. Off Culebra, Puerto Rico. February 6, 1899. B. W. Evermann.

Table 1.—*Counts made on* Rypticus

Species	Dorsal fin rays									Anal fin rays					Pectoral fin rays			
	Spines		Soft rays															
	II	III	21	22	23	24	25	26	27	14	15	16	17	18	14	15	16	17
R. s. saponaceus	9	22	----	----	4	15	6	1	1	7	8	11	1	----	1	7	18	1
R. s. bicolor	29	8	----	1	1	3	16	10	6	----	3	20	13	1	1	2	25	9
R. arenatus	17	----	----	----	----	4	8	4	2	8	8	2	----	----	13	4	----	----
R. subbifrenatus	----	3	1	----	2	----	----	----	----	1	2	----	----	----	2	1	----	----

Species	Preopercular spines				Opercular spines		Total gill rakers					Scales above lateral line									
	1	2	3	4	2	3	7	8	9	10	11	9	10	11	12	13	14	15	16	17	18
R. s. saponaceus	6	35	12	---	10	40	3	9	8	5	1	---	---	---	1	4	10	4	5	1	1
R. s. bicolor	3	59	11	2	-----	72	3	17	7	4	---	---	---	---	---	5	12	5	3	1	---
R. arenatus	---	32	2	---	-----	34	1	10	7	2	---	1	7	6	---	---	---	---	---	---	---
R. subbifrenatus	---	5	1	---	-----	6	1	2	---	---	---	---	---	---	2	1	---	---	---	---	---

Species	Rows of scales crossing lateral line																												
	73 74	75 76	77 78	79 80	81 82	83 84	85 86	87 88	89 90	91 92	93 94	95 96	97 98	99 100	101 102	103 104	105 106	107 108	109 110	111 112	113 114	115 116	117 118	119 120	121 122	123 124	125 126	127 128	129 130
R. s. saponaceus	--	--	--	--	--	--	--	--	--	--	--	--	--	---	---	---	7	2	6	3	1	---	---	---	---	---	2	---	1
R. s. bicolor	--	--	--	--	--	--	--	--	--	--	--	--	2	2	---	6	5	4	4	2	2	---	1	2	---	1	---	---	---
R. arenatus	--	1	2	2	--	5	2	1	2	--	1	--	--	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
R. subbifrenatus	--	--	--	--	--	--	--	--	--	--	--	1	--	---	---	---	---	---	---	1	1	---	---	---	---	---	---	---	---

TABLE 1.—*Counts made on* Rypticus—Continued

Species	Total soft fin rays in dorsal and anal and one pectoral minus the dorsal spines											
	50	51	52	53	54	55	56	57	58	59	60	61
R. s. saponaceus	----	----	----	4	4	4	7	4	3	1	----	----
R. s. bicolor	----	----	----	1?	----	----	3	12	11	6	2	2
R. arenatus	----	----	2	6	2	3	2	2	1	----	----	----
R. subbifrenatus	1	----	2	----	----	----	----	----	----	----	----	----

U. S. GOVERNMENT PRINTING OFFICE: 1939

PROCEEDINGS OF THE UNITED STATES NATIONAL MUSEUM

issued by the

SMITHSONIAN INSTITUTION
U. S. NATIONAL MUSEUM

Vol. 87 Washington : 1939 No. 3075

A TAXONOMIC STUDY OF NEOTROPICAL BEETLES OF THE FAMILY MORDELLIDAE, WITH DESCRIPTIONS OF NEW SPECIES

By Eugene Ray

The Mordellidae are an obscure family of small or minute beetles that have never commanded much attention, owing to the relatively innocuous habits of the adults and larvae. Very little has ever been done with this group except in a taxonomic way, and not a single complete life history is known.

Unfortunately, many of the forms collected in obscure places are known only from unique specimens. It seems unlikely that taxonomists will ever arrive at a point where unlimited material will be available for all species, and, no doubt, many uniques will remain alone in collections for years to come. However, some of these single individuals are sufficiently distinct from their closest allies in the matter of actual description and structural characters to permit their proposal as new names. It has been the policy of the present writer to describe such uniques only when they can be separated on the basis of characters that are known not to vary in other members of the family. Many more, which seem distinct but are closely allied to known forms, have been set aside without names, because the characters needed for their separation are known to be variable in certain cases. No description has been made on the basis of color and pubescent markings alone, since these features are often considerably aberrant, but rather, when one or more structural points of differentiation can be found, the color and pattern of pubescence are distinct enough to make immediate, superficial separation possible. In all cases a combination of characters, rather than a single one, has been used for specific and generic diagnosis.

A peculiar characteristic has been observed in the present study. At the ends of the tarsi are the tarsal claws, which are distinct structures bearing one or more teeth on their mesal surfaces. These teeth apparently vary in number, position, and shape according to the species being considered. At present it seems premature to state definitely that these will form a new character of specific value, but there is apparently a diversity of detail that seems to provide much the same diagnostic character as that provided by the genitalia in certain other groups.

Closely appressed to the tarsal claws, and scarcely distinguishable without being mounted on a slide, is an additional pair of tarsal "claws," somewhat less heavily chitinized than the other pair. These "claws" are attached to the pretarsus at the same point as the other pair. Their specific value is probably somewhat less than that of the external pair, owing to their lesser chitinization, which permits a bending into various shapes before the integument hardens upon emergence of the adult insect. This character has been observed only in the subfamily Mordellinae, the Anaspinae apparently being without it. In addition, all the Anaspinae that the writer has observed have but the single terminal tooth on the tarsal claw.

One new genus and 29 new species are herein recorded. Thirty others are found to be much more widely distributed than has hitherto been supposed. Mention of described species is limited to those forms known only from restricted localities. One other species is taken out of synonymy.

This study has been based primarily on material received from the United States National Museum and the Mexican Department of Agriculture, together with a small series of specimens from the University of Puerto Rico and the Deutsches Entomologisches Institut. The types of all new species are deposited in the National Museum.[1] Paratypes, when available, remain in the collection of the writer.

Grateful acknowledgment is made to officials of the National Museum; Dr. A. Dampf, chief entomologist of the Mexican Department of Agriculture; Prof. S. A. Danforth, of the University of Puerto Rico; and Dr. Walther Horn, director of the Deutsches Entomologisches Institut. My thanks are due to Miss Kathryn Summerman and Julius Bosen, graduate students in the Department of Entomology at the University of Illinois, for their kind assistance

[1] The types of *Mordella militaris*, new species, received from the Deutsches Entomologisches Institut, are returned to that institution.

in the preparation of the figures. Finally, I wish to express my indebtedness to Prof. C. L. Metcalf, head of the Department of Entomology at the University of Illinois, under whose direction this study was made.

Genus GLIPA LeConte

Glipa LeConte, Coleoptera of Kansas and eastern New Mexico, p. 17, 1857.

GLIPA HIEROGLYPHICA Schwarz

Figure 17, *k*

Glipa hieroglyphica Schwarz, Proc. Amer. Philos. Soc., vol. 17, p. 372, 1878.
Tomoxia hilaris Smith, Trans. Amer. Ent. Soc., vol. 10, p. 80, pl. 1, figs. 30, 32, 1882.

Six specimens: Two from the Dominican Republic, June–July 1913 (H. W. Foote, Yale Expedition); one from Alhajuelo, Panama, April 12, 1911 (A. Busck); one from Porto Bello, Panama, March 4, 1911 (A. Busck); one from Taboga, Panama, February 23, 1912 (A. Busck); one from Trinidad Rio, Panama, March 8, 1912 (A. Busck).

This species, originally described from Florida, has, I believe, been wrongly suppressed as a synonym of *G. hilaris* (Say) (1835, p. 190) since the publication of the J. B. Smith paper in 1882. Additional specimens, from the Dominican Republic and Panama, as recorded above, tally more closely with the Florida types in the United States National Museum than with true specimens of *hilaris* (*vide* Barber, on pin label of specimen, det. 1935). Structurally, there can be no doubt that the two species are distinct. Comparison of specimens of *hilaris* from Illinois with the above-mentioned examples of *hieroglyphica* shows distinct differences in the maxillary palpi, antennae, and tarsal claws (fig. 17, *k*, *l*). In addition, the pattern of the dermal color and pubescence of the dorsal surface is distinctly different. In my opinion there can be no doubt that *hieroglyphica* merits valid specific standing.

Genus TOMOXIA Costa

Tomoxia Costa, Fauna Regni Napoli, Mordellidae, p. 8, 1854.

TOMOXIA SPINIFER Champion

Tomoxia spinifer Champion, Biologia Centrali-Americana, Coleoptera, vol. 4, pt. 2, pp. 261, 462, pl. 9, figs. 8, 8a, 1891.

Three specimens: One from Turrialba, Costa Rica (Schild and Burgdorf); one from Livingston, Guatemala, April 5 (Barber and Schwarz); one from Peru, October 3, 1935, found dead in dried wood at Washington, D. C. (H. Y. Gouldman).

TOMOXIA FULVICEPS Champion

FIGURE 17, *f*

Tomoxia fulviceps CHAMPION, Biologia Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 262, pl. 11, fig. 10, 1891.

Three specimens: One from Cabima, Panama, May 25, 1911 (A. Busck); one from Porto Bello, Panama, March 14, 1911 (A. Busck); one from San Carlos, Costa Rica (Schild and Burgdorf).

TOMOXIA FIEBRIGI, new species

FIGURE 17, *d*

This species is closely allied to *auratonotata* Ray (1936a, p. 145) but may easily be separated from the latter member of the genus by the broader scutellum, shorter intermediate tibiae, and the equality in length between abdominal segments 3 and 4.

Length: 3.95 mm.; including anal style, 4.65 mm. Form short, quite robust, subcuneate, broadest at middle of thorax, sides narrowing posteriorly. Derm entirely black, except for labial palpi, which are orange-red. Body densely covered with fine, recumbent, silvery pubescence, rufobrunneous on elytra.

Antennae 1.25 mm. long, reaching middle of lateral pronotal margin; segments 3 and 4 equal; 5–10 each as long as 4, considerably broadened apically; 11 distinctly longer than 10, oval, sides rounded, apex slightly rounded. Distal segment of maxillary palpi enlarged, form of a scalene triangle, basal angle a right angle, outer margin broadly rounded, inner margin almost straight, corners rounded, base arcuate, midbasal lobe short, sides angular, base truncate. Scutellum twice as broad as long, sides slightly angular, posterior emargination wanting. Elytra four-tenths longer than broad (2.65 by 1.85 mm.), sides attenuate for their entire length, apices broadly, individually rounded. Intermediate tarsi distinctly longer than their tibiae; penultimate segments of anterior and intermediate tarsi simple. Tarsal claws with four distinct, broad, blunt teeth, distal one longest, and a small subacute, premedian tooth (fig. 17, *d*). "Median claws" twice as thick at base as medially, apical half of mesal margin with four thin, very acute teeth, outer edge rounded. Outer spine of posterior tibiae twice as long as inner one. Anal style twice as long as apical ventral segment (0.7 by 0.35 mm.), very stout, short, evenly attenuate, broadly truncate at apex.

Type locality.—San Bernardino, Paraguay.

Type.—Male, U.S.N.M. No. 52926, a unique specimen collected by K. Fiebrig.

TOMOXIA BREVIPENNIS, new species

FIGURES 17, *a*; 19, *c*

This species is most closely allied to *binotata*, new species, but may be easily separated from that member of the genus by the greater number of elytral spots, the longer, narrower body, the shorter, broader, anterior and intermediate tibiae, the shorter distal segment of the maxillary palpi, and the narrower scutellum. From *latenotata* Pic (1924, p. 23) it may be separated by the much shorter anal style, the narrower scutellum, the shorter anterior and intermediate tarsi, and the different position of the elytral spots.

Length: 6.6 mm.; including anal style, 8.5 mm. Form moderately robust, elongate, sides narrowing posteriorly, broadest near middle of pronotum. Derm piceous, eyes, antennae, mouth parts, anterior femora and tarsi, and spurs of posterior tibiae castaneous, remainder of legs and ventral abdominal segments fuscocastaneous. Body densely covered with fine, recumbent pubescence, reddish brown except for the following whitish areas: mixed on head; covering margins of pronotum broadly, with a curved band extending from anterior angles into disk and meeting posterior marginal line on either side of middle; scutellum entirely; an indeterminate humeral spot shortly curving into disk, an oblong scutellar spot extending along suture, a large, rounded, postmedian, subsutural spot, and a pair of irregular postmedian spots on middle of disk curving posteriorly, reaching neither suture nor margins; intermediate and posterior legs, parts of mesosternum and metasternum, and bases of abdominal segments, basal one and anal style broadly, whitish.

Antennae 2.1 mm. long, reaching posterior angles of pronotum; segment 4 twice as long as and much broader than 3; 5–10 each as long as 4 but successively narrower distad; 11 distinctly longer than 10, broadest beyond middle, sides and apex rounded. Distal segment of maxillary palpi enlarged, with form of a broad scalene triangle, sides curved, apex straight. Pronotum much broader than long (2.8 by 2.1 mm.), sides rounded, broadest medially, base arcuate, midbasal lobe short, but rounded. Scutellum of a broad, modified triangular shape, twice as broad as long, sides angularly cutting into elytra, apex broadly rounded, subtruncate. Elytra three-fourths longer than broad (4.5 by 2.6 mm.), sides attenuate posteriorly, apices individually rounded. Anterior tarsi much shorter than their tibiae; intermediate pair equal in length; three intermediate segments of anterior and intermediate tarsi dilated, flattened. Tarsal claws bearing three teeth, distal one longest (fig. 17, *a*). Outer spur of posterior tibiae one-half longer than apical ventral segment (1.9 by 1.2 mm.), stout, evenly attenuate, truncate at apex; last ventral segment twice as long as penultimate one.

Type locality.—Barro Colorado Island, Canal Zone, Panama.

Type.—Female, U.S.N.M. No. 52923, collected April 26, 1926, by C. T. Greene.

TOMOXIA BINOTATA, new species

FIGURE 17, *c*

This species is most closely allied to *innotata* Pic (1924, p. 23) and may be separated from the latter member of the genus by the binotate elytra, the peculiar character of the antennae, the broad distal segment of the maxillary palpi, and the much larger size.

Length: 7 mm.; including anal style, 8.5 mm. Form short, moderately robust, subcuneate, sides narrowing posteriorly, broadest near base of prothorax. Derm fuscopiceous, femora of anterior and intermediate legs, mesal half of distal segment of maxillary palpi, and antennae, fuscocastaneous. Body densely covered with fine recumbent brownish pubescence, which assumes a violaceous tinge in certain lights; a pair of postmedian, elytral spots as far from suture as width of spot and almost touching lateral margins, and basal margins of ventral abdominal segments, white.

Antennae 1.8 mm. long, reaching middle of lateral pronotal margin; segment 3 slightly longer than 4; 5–10 each succeedingly shorter than preceding, 10 two-thirds as long as 3; 11 as long as 4, broadest subapically, subtriangular in profile, rounded at corners. Distal segment of maxillary palpi enlarged, form of an isosceles triangle, mesal edge straight, outer edge curved, corners rounded. Pronotum broader than long (3 by 2 mm.), sides rounded, base arcuate, midbasal lobe short, truncate. Scutellum slightly broader than long, sides angular, apex truncate, not emarginate, apical angles rounded. Elytra two-thirds longer than broad (4 by 2.3 mm.), sides attenuate posteriorly, apices broadly, individually rounded. Intermediate tarsi longer than their tibiae; penultimate segment of anterior and intermediate tarsi simple. Tarsal claws with three distinct, broad teeth, distal one longest, and a large, blunt, premedian tooth (fig. 17, *c*). "Median claws" twice as thick at base as medially, apical three-fourths of mesal margin and entire lateral margin broadly rounded. Outer spur of posterior tibiae one-half longer than inner one, densely covered with coarse pubescence, broadest subapically, thence rounded to apex. Anal style two and one-half times as long as apical ventral segment (1.3 by 0.5 mm.), stout, evenly attenuate, truncate at apex.

Type locality.—Barro Colorado Island, Canal Zone, Panama.

Type.—A unique male, U.S.N.M. No. 52925, collected July 17, 1923, by R. C. Shannon.

TOMOXIA SERRICORNIS, new species

Figure 16, *g*

This species is most closely allied to *horni* Ray (1936b, p. 147) but may adequately be separated from the latter member of the genus by the more parallel-sided form, difference in color and pattern of pubescence, the greater length of the intermediate tarsi and of the outer tibial spur, and the shorter elytra.

Length: 3.4 mm.; including anal style, 4.1 mm. Robust, sides subparallel; body fuscobrunneous, maxillary palpi and anterior legs flavocastaneous. Surface densely covered with fine, recumbent, whitish pubescence, uniformly covering derm, except on disk of elytra, where it is irregularly disposed and not forming definite spots, except for a postmedian, transverse arcuate band.

Antennae 1.1 mm. long, reaching base of pronotum, segments 3 and 4 large, equal; 5 to 10 subequal, each much broader and longer than 4; 11 distinctly longer than 10, apex and sides rounded. Distal segment of maxillary palpi enlarged, ovate, broadest at middle, sides and apex rounded, outer side greatly so (fig. 16, *g*). Pronotum distinctly broader than long (1.4 by 1 mm.), apex and sides rounded, basal angles obtuse, base arcuate, midbasal lobe short, truncate. Scutellum broader than long, sides angular, apical angles obtuse. Elytra one and seven-tenths times as long as broad (2.4 by 1.4 mm.), sides parallel to within one-fourth of apex, broadly curved posteriorly, apices individually rounded. Intermediate tarsi longer than their tibiae; penultimate segment of anterior and intermediate tarsi simple. Tarsal claws with two distinct teeth, and a large, thick, blunt, premedian elevation. Outer spur of posterior tibiae three and one-half times as long as inner one. Anal style one-half longer than apical ventral segment (0.7 by 0.48 mm.), stout, apex broadly truncate.

Type locality.—Roxborough, Tobago.

Type.—A single female, U.S.N.M. No. 52924, taken at the Archibald Estate, Roxborough, Tobago, November 6, 1918 (H. Morrison).

MORDELLOIDES, new genus

This genus is allied to both *Zeamordella* Broun (1886, p. 847) and *Mordella* Linnaeus (1758, p. 420). From the former it may be separated by the angular insertion of the distal segment of the maxillary palpi, the much longer length of the posterior legs, the thin, filiform tarsi, and the much longer, acute anal style. From *Mordella* it may be separated by the semicircular scutellum, the lengthy intermediate tibiae, the angulate anterior angles of the pronotum, the single flattened spur of the posterior tibiae, and the truncate apex of the last ventral segment. From *Reynoldsiella* Ray (1930, p. 184), to which genus it is also allied, it may be separated by the presence of a subapical ridge on the posterior tibiae, the much narrower shape of the body, the flat tibial spur, and characters as mentioned in comparison with *Mordella* above. *Mordelloides*, *Zeamordella*, and *Reynoldsiella* may be linked together because of the semicircular scutellum.

The single broad, flattened spur of the posterior tibiae is unique among known Mordellidae and will readily separate this form from any other member of the family.

Form suboval, moderately robust, convex. Distal segment of maxillary palpi broadly, equilaterally triangular, inserted at the corner. Antennae subserrate, distal segment distinctly longer than penultimate segment. Pronotum much broader than long, anterior angles obtuse, not rounded. Scutellum fairly large, semicircular. Mesosternum produced posteriorly in the form of a rounded lobe. Posterior coxae elongate, contiguous, meeting in a depressed sutural line; anterior margin of latter part closely connected with rounded lobe of mesosternum. Anal style long, more than four times length of last ventral segment, broadest at its basal fifth, then suddenly narrowed and attenuate to apex, curved ventrad. Intermediate tibiae longer than their tarsi, the latter filiform; posterior tibiae with but a single, broad, flattened, tibial spur, concave on its anterior surface, convex on its posterior surface.

The genotype is *Mordelloides acuticauda*, new species, described below.

MORDELLOIDES ACUTICAUDA, new species

FIGURES 17, *i*; 19, *b*

The single, flattened spur of the posterior tibiae, the semicircular scutellum, the peculiar antennae, and other generic characters will serve adequately to separate this species from any of its allies that might superficially resemble it.

Length: 2.3 mm.; including anal style, 5.8 mm. Form moderately robust, convex, suboval, sides attenuate, narrowing posteriorly, broadest near base of pronotum. Head castaneous, darkening evenly caudad, piceous at occipital margin, mouth parts and antennae flavocastaneous, distal segment of latter somewhat fuscous in certain lights; pronotum fuscous, sides broadly castaneous; elytra fuscocastaneous, a broad, curved, humeral stria extending toward but not reaching the suture, castaneous; anterior and middle legs, posterior tarsi, and middle of ventral abdominal segments, flavocastaneous; posterior tibiae and anal style brunneous. Surface densely covered with fine, recumbent pubescence, yellowish on head, pronotum, and elytra, condensed on latter part to form the following fasciae: a curved humeral line covering underlying castaneous derm, a transverse, postmedian fascia, extending to and along lateral margins but not reaching humeri, extending posteriorly along suture and coalescing with a preapical curved fascia that fails to reach lateral margins; a mixed yellowish white on ventral surface and legs.

Antennae 0.9 mm. long, scarcely reaching base of lateral prothoracic margin; segments 3 and 4 equal; 5–10 subserrate, each broadest medially and each twice as long as 4; 11 broadly rounded on sides and apex, distinctly broader and twice as long as 10, broadest premedially, apparently truncate at apex. Distal segment of maxillary palpi enlarged, form of an equilateral triangle, sides straight, angles rounded. Pronotum almost twice as broad as long (1.05 by 0.6 mm.), apical angles obtuse, pointed, sides rounded, basal angles obtuse, base arcuate, midbasal pronotal lobe short, declivious, truncate. Elytra almost twice as long as broad (1.9 by 1 mm.), sides visibly attenuate from base to apex, apices individually rounded. Intermediate tibiae distinctly longer than their tarsi; penultimate segment of anterior and intermediate tarsi filiform. Tarsal claws with four distinct teeth (fig. 17, *i*). Posterior tibiae with a single, broad, flattened tibial spur, attenuate to apex, two-thirds length of basitarsus, concave on anterior surface, convex on posterior surface. Anal style four and one-half times as long as apical ventral segment (1.4 by 0 3 mm.), narrow, thin, curved ventrad at its middle, broad at basal fifth, thence narrowing abruptly distad and attenuate to apex; last ventral segment truncate at apex, but one-half longer than penultimate one.

Type locality.—Tierra Blanca, Veracruz, Mexico.

Type.—A unique female, U.S.N.M. No. 52922, collected on September 17, 1924, from weeds of the coastal plain, near railway of the Isthmian line (A. Dampf).

Remarks.—The dermal color of the elytra is changeable according to the angle from which it is viewed, a more noticeable castaneous tinge being visible from certain diagonal directions. The description of the elytra was made from a direct dorsal view.

Genus MORDELLA Linnaeus

Mordella LINNAEUS, Systema naturae, ed. 10, p. 420, 1758.

MORDELLA DIVERGENS, new species

FIGURE 19, *a*

This species is most closely allied to the North American *M. lunulata* Helmuth (1865, p. 96), but it may be separated from the latter member of the genus by the divergent line of pubescence on the elytra, the rounded mesal edge of the terminal segment of the maxillary palpi, and the larger size.

Length: 5.4 mm.; including anal style, 6.8 mm. Moderately robust, subcuneate; dermal color black; surface densely covered with fine, recumbent pubescence, partaking of ground color, except for the following whitish areas: head and pronotum completely, condensed on latter part to form three short, longitudinal, basal bands; scutellum completely; elytra with humeri narrowly and two divergent stripes, anterior extending submarginally to within one-sixth of apex and separated from margin by its own width, interior one extending diagonally across disk and joining whitish suture subapically, sides of mesosternum and metasternum densely, bases of abdominal segments, and legs somewhat less distinctly.

Antennae 1.4 mm. long, scarcely reaching posterior coxae; segments 3 and 4 equal in length; 5–10 each one-half longer than 4 and considerably broadened; 11 rounded, one-half longer than 10. Distal segment of maxillary palpi enlarged, subtriangular, rounded on mesal surface and apex. Pronotum one-third broader than long (2.1 by 1.6 mm.), convex, sides finely margined, basal angles obtuse, midbasal lobe short, broad, subtruncate. Scutellum twice as broad as long, rounded-triangular. Elytra broadest subbasally, almost twice as long as broad (3.8 by 2.1 mm.), sides attenuate to apex, latter parts individually rounded, distinctly obtuse. Intermediate tibiae and tarsi equal in length. Tarsal claws with four teeth, all somewhat blunt at ends, proximal one rudimentary. Anal style 3 times length of apical ventral segment, narrowly truncate at apex.

Type locality.—Mount Puilsboreau, Haiti.

Type.—A unique male, U.S.N.M. No. 52930, collected on May 29, 1927, by G. N. Wolcott.

MORDELLA LATITHORAX, new species

This species is somewhat allied to *biformis* Champion (1891, p. 295) but differs from the latter member of the genus in numerous particulars, the most striking of which are the decidedly transverse pronotum, the equilateral condition of the distal segment of the maxillary palpi, the much narrower and more elongate antennae, and the different color.

Length: 3.5 mm.; including anal style, 4.8 mm. Form moderately broad, sides parallel posteriorly to middle of elytra, thence broadly rounded to apex; body broadest near base of pronotum. Head castaneous, with a piceous rounded spot on vertex reaching occiput and extending laterally in a narrow line to eyes, anteriorly not extending beyond middle of eyes; pronotum piceous, with a pair of castaneous spots on either side of middle, separated by a piceous line, extending posteriorly along lateral margins, but not reaching base; elytra piceous, with apex narrowly castaneous; mesosternum and metasternum, posterior femora and tibiae, and distal half of anal style fuscopiceous; antennae, mouth parts, anterior and intermediate legs, posterior tarsi, abdomen, and base of anal style castaneous. Surface densely covered with fine, recumbent pubescence, partaking of ground color, except on dorsal surface, where it has been abraded and only a few yellowish hairs remain.

Antennae 1.1 mm. long, slender, reaching base of lateral pronotal margin; segment 4 one-half longer than 3; 5–10 each one-third longer than 4 and but slightly broader; 11 missing. Distal segment of maxillary palpi enlarged, with form of an equilateral triangle. Pronotum six-tenths broader than long (1.6 by 1 mm.), apex and sides broadly rounded, basal angles obtuse, base arcuate, midbasal lobe moderately produced, rounded. Scutellum large, broadly triangular, sides but slightly curved, apical angle rounded. Elytra but seven-tenths longer than broad (2.5 by 1.45 mm.), sides parallel on basal half, thence strongly curved to apex, apices individually rounded. Intermediate tibiae and tarsi approximately equal in length, second and third segments of latter part short, somewhat dilated, penultimate segment considerably broadened, fifth segment being inserted near base of latter and only claws visible beyond distal margin. Outer spur of posterior tibiae two and one-half times as long as inner one. Anal style two and one-half times as long as apical ventral segment (1.3 by 0.5 mm.), moderately thick at base, attenuate to apex; last ventral segment eight times length of penultimate one.

Type locality.—Limon Plantation, Chagres River, Panama.

Type.—Male, U.S.N.M. No. 52927, a unique individual taken on July 14, 1918, from sweepings around a cornfield (H. F. Dietz and J. Zetek).

Remarks.—The three distal segments of the posterior tarsi are missing in the type and no mention can therefore be made of the tarsal claws.

MORDELLA SCUTELLARIS Fabricius

Mordella scutellaris Fabricius, Systema eleutheratorum, vol. 2, p. 123. 1801.

Five specimens: One from Arecibo, Puerto Rico, November 1, 1932, on flower of *Curte amor;* one from Ponce, Puerto Rico, August 21, 1933, on flower of *Senegalia* (R. G. Oakley); one from Bayamon, Puerto Rico, June 2, 1934, on milkweed (Lesesne et al.); two from Arecibo, Puerto Rico, March 13, 1934, and March 21, 1935, on *Margarita* (Anderson).

MORDELLA HAITIENSIS, new species

FIGURE 16, *a*

In addition to its difference in color pattern this species may be separated from its closest ally, *dimidiata* Champion (1891, p. 234), by the greater length of the fourth antennal segment, the emarginate apex of the distal segment of the maxillary palpi, and the very long last ventral abdominal segment.

Length: 2.75 mm.; including anal style, 4 mm. Moderately robust, sides attenuate, narrowing posteriorly, broadest at middle of pronotum. Head piceous, antennae and mouth parts flavous; prothorax flavobrunneous; elytra piceous, with a diagonal, quadrangular, flavous spot on disk near base, separated from lateral margin by less than one-half its width; ventral surface black; anterior legs flavous, intermediate pair fuscobrunneous. Surface densely covered with fine, recumbent pubescence, yellowish white, except on elytra, where it forms golden areas, as follows: covering subbasal flavous spot and entire apical half, whence it extends in a broad line along suture to base.

Antennae 0.37 mm. long, reaching base of pronotum, segment 4 distinctly longer than 3; 5–10 serrate, each one-half longer than 4 and much broader at apex, slightly decreasing in length distally; 11 distinctly longer 10, broadest at apical third, sides and apex broadly rounded. Distal segment of maxillary palpi enlarged, form of a scalene triangle, outer side longest, apical angle emarginate (fig. 16, *a*). Pronotum distinctly broader than long (1 by 0.78 mm.), apex and sides rounded, basal angles obtuse, base arcuate, midbasal lobe very short, truncate. Scutellum small, triangular. Elytra twice as long as broad (2 by 1 mm.), sides visibly attenuate on their apical two-thirds, broadly curved subapically, apices individually rounded. Intermediate tarsi distinctly longer than their tibiae; penultimate segment of anterior and intermediate tarsi simple. Tarsal claws with three distinct teeth. Outer spur of posterior tibiae twice as long as inner one. Anal style one-half longer than apical ventral segment (1.2 by 0.82 mm.), narrow, attenuate to apex; last ventral segment seven times as long as penultimate one.

Type locality.—Mariani, Haiti.

Type.—Male, U.S.N.M. No. 52929, a unique individual taken on September 17, 1918, by W. A. Hoffman.

MORDELLA VIDUA Solier

Mordella vidua SOLIER, in Gay, Historia fisica y politica de Chile, vol. 5, p. 270, 1851.

Three specimens: Two from Angol, Chile, January 14, 1928 (D. S. Bullock); one from Chile (E. C. Reed).

MORDELLA MILITARIS, new species

This species is most closely allied to *ogloblini* Pic (1930, p. 29) and may be separated from the latter member of the genus by the absence of distinct maculations on the elytra, the more slender, attenuate anal style, and the smaller size. In the synopsis of the Argentinian species of *Mordella* (Pic, 1936, pp. 114, 115) *militaris* keys out to *ogloblini*.

Length: (male) 5.85 and (female) 7.35 mm.; including anal style, (male) 8.1 and (female) 9.35 mm. Elongate, sides narrowing posteriorly to apex of elytra, body subcuneate in shape; dermal color piceous, except for basal three-fourths of elytra, which are golden-brown. Surface densely clothed with fine, recumbent pubescence, partaking of ground color, except for the following whitish areas: head; pronotum, densest on lateral and basal margins; elytra, condensed on suture and apex of golden-brown area; mesosternum and metasternum; basal margins of ventral abdominal segments, densest at lateral edge; base of anal style; legs.

Antennae (male) 2.2 and (female) 2.4 mm. long, reaching posterior coxae; segments 3 and 4 equal in length; 5–10 distinctly serrate, each slightly longer and twice as broad as 4; 11 rounded, slightly longer than 10. Distal segment of maxillary palpi enlarged, with form of a scalene triangle, outer margin distinctly curved, cephalic surface with a median, elongate depression. Prothorax distinctly broader than long (1.6 by 1.5 mm.), sides rounded, base arcuate, basal lobe short, subtruncate. Scutellum small, subtriangular, sides and apical angle rounded. Elytra twice as long as broad (3.6 by 1.8 mm.), sides straight, attenuate to apex, apices individually rounded. Tarsal claws with seven teeth, the distal one longest, successively shortening proximad, the proximal one scarcely more than rudimentary. Anal style slightly more than twice as long as apical ventral segment, slender from a dorsal view, attenuate to apex.

Type locality.—Argentina.

Type.—Male, in the collection of the Deutsches Entomologisches Institut.

Remarks.—A male and female example (type and allotype), with the data merely as "Argentina—Coll. Kraatz," contains all available information. There is no visible external difference between the sexes. The middle tarsi are missing in both specimens.

MORDELLA SUMMERMANAE, new species

This species cannot be closely allied with any of the known North American forms. The form of the body, with its subovate form, the extremely short anal style, the short elytra, and the narrow distal segment of the maxillary palpi separate it at once from any species recorded in the literature. For systematic position it may be placed near *seriata* Champion (1891, p. 298).

Length: 2.2 mm.; including anal style, 2.7 mm. Form short, broad, subovate, broadest near base of pronotum; dermal color black, antennae and legs fuscous, spurs of posterior tibiae and genitalia flavous. Surface densely covered with fine, recumbent, yellowish-brown pubescence, except on ventral abdominal segments, where it is whitish.

Antennae 0.5 mm. long, scarcely reaching base of pronotum; segments 3 and 4 equal in length; 5–10 each as broad as long, strongly serrate, broadest apically; 11 distinctly longer than 10, rounded on sides and apex, broadest medially; distal segment of maxillary palpi enlarged, with form of an elongate isosceles triangle, sides slightly curved, corners rounded. Pronotum distinctly broader than long (0.85 by 0.6 mm.), broadest subbasally, apex and sides rounded, basal angles almost right angles, base arcuate, midbasal lobe short, but rounded. Scutellum small, broadly triangular, sides visibly curved, apical angle rounded. Elytra less than twice as long as broad (1.6 by 0.85 mm.), sides distinctly curved from base to apex, apices individually rounded. Anterior and intermediate tibiae longer than their tarsi, second and third segments of latter part short, but not dilated. Tarsal claws with three teeth, all blunt, basal one obtuse, very much flattened. Anal style short (0.5 by 0.4 mm.), but one-fourth longer than apical ventral segment, very broad at base, but one-third longer than broad from a dorsal view, sides straight, apex rounded.

Type locality.—Constanza, Dominican Republic.

Type.—A unique female, U.S.N.M. No. 52928, taken on May 22, 1927, by A. Wetmore.

MORDELLA FLAVOFASCIATA Champion

Mordella flavofasciata Champion, Biologia Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 287, pl. 11, fig. 18, 1891.

One specimen: Potrero, Veracruz, Mexico, October 28, 1924, on weeds, 600 meters elevation (A. Dampf).

MORDELLA SERIATA Champion

Mordella seriata Champion, Biologia Centrali-Americana, vol. 4, pt. 2, p. 298, pl. 13, figs. 9, 9a, 1891.

One specimen: Finca Vergel, Huixtla Valley, Chiapas, Mexico, May 15, 1935, 700 meters elevation (A. Dampf).

Genus CALYCE Champion

Calyce Champion, Biologia Centrali-Americana, vol. 4, pt. 2, p. 307. 1891.

CALYCE MACULATA Pic

Calyce maculata Pic, L'Échange, vol. 27, p. 191, 1911.

One specimen: Trinidad (A. Busck).

CALYCE FULVA Champion

Calyce fulva Champion, Biologia Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 307, pl. 13, figs. 21, 21a, 1891.

One specimen: San Carlos, Costa Rica (Schild and Burgdorf).

Genus GLIPODES LeConte

Glipodes LeConte, Proc. Acad. Nat. Sci. Philadelphia, vol. 14, p. 48, 1862.

GLIPODES SERICANS (Melsheimer)

Mordella sericans Melsheimer, Proc. Acad. Nat. Sci. Philadelphia, vol. 2, p. 312, 1846.

Glipodes sericans LeConte, Proc. Acad. Nat. Sci. Philadelphia, vol. 14, p. 48, 1862.

Two specimens: One from Cacao, Trece Aguas, Alta V. Paz, Guatemala, March 27 (Schwarz and Barber); one from Paraiso, Canal Zone, Panama, April 29, 1911 (E. A. Schwarz).

GLIPODES HELVA LeConte

Glipodes helva LeConte, Proc. Acad. Nat. Sci. Philadelphia, vol. 14, p. 48, 1862.

Three specimens: One from Xolitla, Guererro, Mexico, August 3, 1930, at light (J. Parra); one from Trinidad Rio, Panama, June 9, 1912 (A. Busck); one from Caño Saddle, Gatun Lake, Panama, May 3, 1923 (R. C. Shannon).

Genus CONALIA Mulsant and Rey

Conalia Mulsant and Rey, Ann. Soc. Agr. Lyon, ser. 3, vol. 2, p. 313, 1858.

CONALIA EBENINA Champion

Conalia ebenina Champion, Biologia Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 306, pl. 13, figs. 20, 20a, b, c, 1891.

Conalia fulvoplagiata Champion, Trans. Ent. Soc. London, 1896, p. 50.—Ray, Coleopt. Contr., vol. 1, pt. 3, p. 163, 1930.

Twenty-nine specimens: One from San Rafael, Jicaltepec, Veracruz, Mexico (Townsend); one from Montemorelo, Nuevo Leon, Mexico, June 3, 1931, grass-citrus, 432 meters elevation (A. Dampf); five from Santa Anita, Jalisco, Mexico, August 7, 1927, on weeds, 2,000 meters elevation (A. Dampf); one from Plancha Piedra, Peten Department, on the border between British Honduras and Guatemala, October 27, 1925, swept from weeds (A. Dampf); one from La Ceiba, Honduras, August 27, 1916 (F. J. Dyar); one from Cacao, Trece Aguas, Alta Vera Paz, Guatemala, February 25 (Schwarz and Barber); one from Gamboa, Canal Zone, Panama, July 17, 1918, sweepings (H. F. Dietz and J. Zetek); two from Pueblo Buevo, Papaya Plantation, 4 miles from Panama City, Panama, August 1926 (H. Morrison); three from Limon Plantation, Chagres River, Panama, July 14, 1918, sweepings around cornfield (H. F. Dietz and J. Zetek); one from Montserrat, Trinidad, June 29 (A. Busck); two from D'Abadie, Trinidad, October 13, 1918 (H. Morrison); one from Department of Agriculture grounds, Port-of-Spain, Trinidad, November 23, 1918 (H. Morrison); three from Tobago Island, Panama, September 21, 22, 1918 (H. F. Dietz); one from La Romana Centrale, Dominican Republic, July 15, 1917 (H. Morrison); one from San Pedro de Maoris, Dominican Republic, July 15, 1917 (H. Morrison); one from Tucuman, Argentina (G. F. Mozuetta); and three from San Bernardino, Paraguay.

Genus MORDELLISTENA Costa

Mordellistena Costa, Fauna Regni Napoli, Mordellidae, pp. 16, 31, 1854.

MORDELLISTENA CRUX Champion

Mordellistena crux Champion, Biologia Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 346, pl. 15, figs. 21, 21a, 1891.

Two specimens: One from Tampico, Mexico, December 8 (E. A. Schwarz); one from Cacao, Trece Aguas, Alta Vera Paz, Guatemala, March 26 (Schwarz and Barber).

MORDELLISTENA BICINCTELLA LeConte

Mordellistena bicinctella LeConte, Proc. Acad. Nat. Sci. Philadelphia, vol. 14, p. 48, 1862.

Five specimens: All from Trece Aguas, Alta Vera Paz, Guatemala (Barber and Schwarz), on the following dates: December 12 (1), March 26 (1), April 5 (2), no date (1).

MORDELLISTENA RHENOLEPIS, new species

Figures 16, *c*; 18, *a*

This species is allied to *ozarkensis* Ray (1936a, p. 125) and may be separated from the latter member of the genus by the additional ridge on the posterior tibiae, the completely flavocastaneous condition of the head and pronotum, the more parallel form, and the longer, hammerlike distal segment of the maxillary palpi. Among the Central American forms *rhenolepis* is most closely allied to *beata* Champion (1891, p. 347) and may easily be separated by the unicolored pronotum, the difference in the number of comblike ridges on the posterior tibiae and tarsi, the different position of the basal cinereous vitta on the elytra, and the greater length of the fourth antennal segment.

Length: 2.3 mm.; including anal style, 3.2 mm. Form narrow, elongate, sides subparallel to within one-fourth of apex of elytra, broadest near base of pronotum. Head, pronotum, antennae, mouth parts, legs, last two ventral abdominal segments and anal style, middle of mesosternum and metasternum, and a rounded, oblique, subbasal spot on elytra reaching lateral margins but not suture, flavocastaneous; elytra, sides of mesosternum and metasternum, basal abdominal segments, and eyes, piceous-black. Body densely covered with fine, recumbent pubescence, partaking of ground color, except on elytra, where it forms the following whitish vittae: covering subbasal rounded spot mentioned above, and broad, transverse, postmedian vitta, reaching both lateral margins and suture, and prolonged anteriorly near suture to form a blunt, rounded area.

Antennae 0.7 mm. long, filiform, reaching metacoxae; segments 3 and 4 equal in length, latter somewhat broader; 5–10 each one-half longer and much broader than 4; 11 one-third longer than 10, sides and apex rounded, broadest postmedially. Distal segment of maxillary palpi enlarged, subrectangular, slightly narrower subapically, lateral margin slightly convex, mesal margin slightly concave, apical margin subangulate, corners at both apex and base rounded, two and two-thirds times as long as broad (fig. 16, *c*). Pronotum one-third broader than long (0.8 by 0.6 mm.), sides and apex rounded, basal angles obtuse, base arcuate, midbasal lobe short, but rounded. Scutellum moderately large, rounded-triangular, broader than long, sides and apical angle rounded. Elytra slightly more than twice as long as broad (1.7 by 0.8 mm.), sides broadest at base, subparallel to within a fourth of apex, thence strongly rounded, apices individually rounded. Intermediate tibiae and tarsi approximately equal in length; penultimate segment of anterior and intermediate tarsi short, filiform, simple. Posterior tibiae with two short, oblique ridges, neither extending more than one-third across outer surface; basitarsi with two short ridges extending one-third across outer surface. Tarsal claws with three long, acute, postmedian teeth (fig. 18, *a*). Anal style two and one-fourth times length of apical ventral segment (0.9 by 0.4 mm.), narrow, evenly attenuate to apex; last ventral segment about twice length of penultimate one.

Type locality.—Guatemala.

Type.—Male, U.S.N.M. No. 52938.

Remarks.—The type and two male paratypes, all with protruding genitalia, were taken at Washington, D. C., October 17, 1916, upon emergence from the rhizome of *Rhenolepis* sp. received from Guatemala (H. L. Sanford).

165175—39——3

MORDELLISTENA HONDURENSIS, new species

FIGURE 16, *l*; 18, *b*

This species is most closely allied to *schwarzi*, new species, described below, and may be separated from the latter member of the genus by the difference in the maculation of the elytra, the difference in the breadth of antennal segments 3 and 4, the peculiar shape of the distal antennal segment, the additional tooth on the tarsal claws, and the peculiar condition of the penultimate segment of the anterior and intermediate tarsi. From *xanthopyga* Champion (1891, p. 344), which it resembles in color, it may be distinguished by the shorter length of the basal ridge of the posterior tibiae, the flavobrunneous condition of the pronotum, and the difference in the shape of the maxillary palpus.

Length: 0.9–1.15 mm.; including anal style, 1.15–1.55 mm. Form elongate, narrow, sides subparallel, narrowing only one-fourth from apex of elytra, broadest near middle of pronotum. Head (including antennae and mouth parts), pronotum, apex and middle of metasternum, last two ventral abdominal segments, and anal style, flavobrunneous; elytra piceous, with following flavous areas: a subtriangular, rounded, subbasal area reaching sides but not suture and a broad, transverse, postmedian fascia extending entirely across disk from lateral margins to suture. Surface densely covered with fine, recumbent pubescence, partaking of ground color, a mixture of flavous and piceous hairs on head and pronotum, giving these parts a darker tinge, except along margins.

Antennae 0.28–0.4 mm. long, reaching metacoxae, somewhat thickened but not serrate; segments 3 and 4 equal in length; 5–10 each almost as long as 3 and 4 together, and distinctly broader; 11 one-half longer than 10, broadest medially, outer edge straight, mesal margin rounded from middle to apex, the latter subacute. Distal segment of maxillary palpi enlarged, subquadrate, mesal margin straight, lateral and apical margins broadly rounded (fig. 16, *l*). Pronotum but slightly broader than long (0.28–0.35 by 0.25–0.3 mm.), sides rounded, basal angles obtuse, base arcuate, midbasal lobe short, rounded. Scutellum small, broadly triangular. Elytra slightly less than two and two-thirds times as long as broad (0.65–0.8 by 0.28–0.35 mm.), sides parallel to within one-fourth of apex, thence attenuate and broadly rounded to apex, apices individually rounded. Intermediate tibiae and tarsi equal in length; penultimate segment of anterior and intermediate tarsi filiform, excavate beneath, bearing fifth segment on middle of ventral surface. Posterior tibiae with two oblique ridges, basal one extending three-fourths, other one-half, across outer surface; basitarsi with two, second segment with one oblique ridge, all extending halfway across outer surface. Tarsal claws with four distinct teeth, basal one shorter than others and obtuse (fig. 18, *b*). A single spur on posterior tibiae, thick, two-thirds as long as basitarsus. Anal style almost three times as long as apical ventral segment (0.28–0.4 by 0.1–0.15 mm.), fairly stout, attenuate to apex; last ventral segment but twice as long as penultimate one.

Type locality.—La Ceiba, Honduras.

Type.—Male, U.S.N.M. No. 52913.

Remarks.—The type was collected at La Ceiba, Honduras, August 25, 1916 (F. J. Dyer). A male paratype was taken at Peto, Yucatan, Mexico, August 9, 1925, at about 30 meters elevation, in a dense bush forest (A. Dampf). This latter specimen has the pronotum fuscopiceous, except for a small flavous area at middle of lateral margin, the seven apical segments are slightly darker than in the type, and the basal elytral spot is smaller, so that it does not reach the lateral margin. Structurally the paratype, even including the nature, disposition, and length of the teeth on the tarsal claws, is identical with the type.

MORDELLISTENA SCHWARZI, new species

FIGURES 16, *b* (♂), *d* (♀); 18, *d*

This species may be separated from both *diluta* Champion (1891, p. 338) and *emarginata*, new species, described below, by the complex maculation of the elytra, the very peculiar shape of the distal segment of the maxillary palpi in the male, the much greater length of the second over the first antennal segment, the equal length but greater width of segment 4 over segment 3, the longer comparative length of the apical ventral segment, and a distinct difference in the form of the tarsal claws.

Length: 1.07 mm.; including anal style, 1.5 mm. Elongate, narrow, sides subparallel, narrowing only one-fourth from apex of elytra, broadest at middle of pronotum. Head (including mouth parts and antennae), pronotum, and elytra, flavocastaneous, latter part with the following piceous areas: a triangular humeral patch, a Y-shaped sutural area at base narrowly connected to humeral patch, a broad marginal spot at middle extending halfway to suture, and an area covering apical sixth; ventral surface flavocastaneous, abdomen slightly darker (base and sides of mesosternum and sides of metasternum up to a point parallel with posterior coxae, piceocastaneous in female); ridges of posterior tibiae and tarsi piceous. Surface densely covered with fine, recumbent pubescence, partaking of ground color.

Antennae 0.35 mm. long, reaching middle of lateral prothoracic margin; segment 2 one-half longer than 1; 4 equal in length to 3 but broader; 5–10 filiform, each one-half longer than 4 and distinctly broader; 11 longer than 10, sides subparallel, rounded from apical third to apex. Distal segment of maxillary palpi enlarged, showing a sexually dimorphic form, viz: in male, two anteapical segments thickened, distal one oblong-ovate, sides subparallel, angles all rounded (fig. 16, *b*); in female, anteapical segments normal, thin, distal one with the form of an elongate scalene triangle, apical angle acute, mesal angle rounded, broadest at apical third (fig. 16, *d*). Eyes large, coarsely faceted, entire, without emargination. Pronotum slightly broader than long (0.32 by 0.26 mm.), apex and sides rounded, basal angles obtuse, base arcuate, midbasal lobe short, but rounded. Scutellum small, broadly triangular. Elytra about two and two-thirds times as long as broad (0.8 by 0.32 mm.), sides parallel to within one-fourth of apex, thence attenuate and broadly rounded to apex, apices individually rounded. Intermediate tibiae and tarsi long, equal in length; penultimate segment of anterior and intermediate tarsi simple. Posterior tibiae with two oblique ridges extending halfway across outer surface; basitarsi with two, second segment with one oblique ridge, all extending halfway across outer surface. Tarsal claws with three distinct teeth (fig. 18, *d*). A single spur visible on posterior tibiae, thick, three-fourths as long as basitarsus. Anal style three times as long as apical ventral segment (0.45 by 0.15 mm.), narrow, attenuate to apex; last ventral segment two and one-half times as long as penultimate one.

Type locality.—Paraiso, Canal Zone, Panama.

Type.—Male, U.S.N.M. No. 52914.

Remarks.—Both the type and allotype were taken at Paraiso, Canal Zone, Panama, January 25 and 30, 1911 (E. A. Schwarz). As noted above there exists a distinct sexual dimorphism in the difference of the color of the ventral surface and in the shape of the distal segment of the maxillary palpi.

MORDELLISTENA SPARSA Champion

Mordellistena sparsa CHAMPION, Biologia Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 335, pl. 15, figs. 4, 4a, 1891.

Five specimens: District Federale, Mexico (L. Conradt).

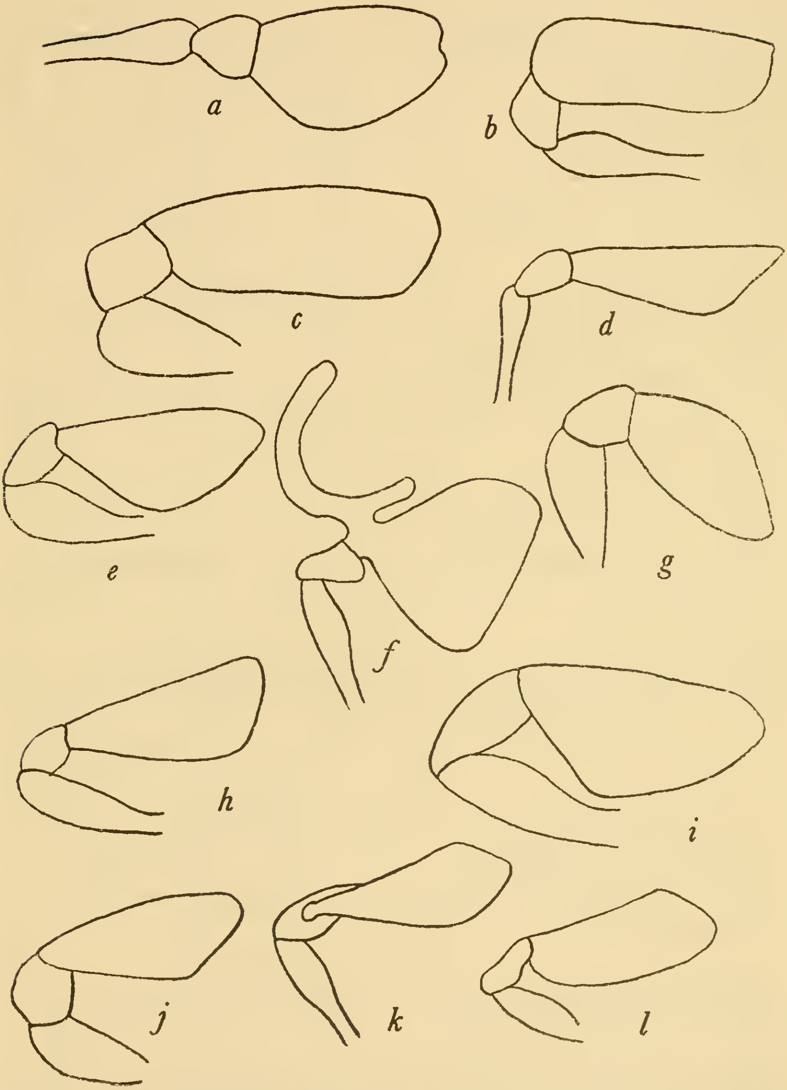


FIGURE 16.—Maxillary palpi of MORDELLA, MORDELLISTENA, GLIPODES, and TOMOXIA.

a, Mordella haitiensis, new species; *b, Mordellistena schwarzi,* new species, male; *c, M. rhenolepis,* new species; *d, M. schwarzi,* new species, female; *e, M. funerea* Champion; *f, Glipodes sericans* (Melsheimer), male; *g, Tomoxia serricornis,* new species; *h, Mordellistena laticornis,* new species; *i, M. boseni,* new species; *j, M. dampfi,* new species; *k, M. candelabra,* new species; *l, M. hondurensis,* new species.

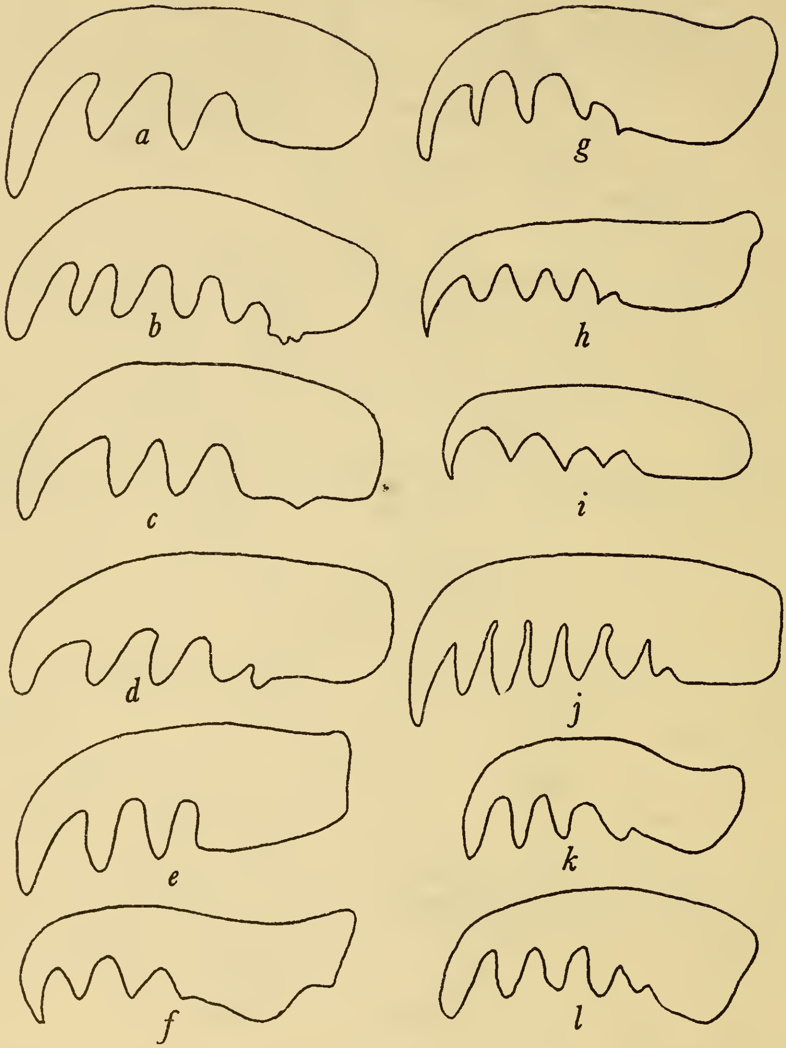


FIGURE 17.—Tarsal claws TOMOXIA, CALYCE, MORDELLOIDES, MORDELLA, and GLIPA.

a, *Tomoxia brevipennis*, new species; *b*, *T. bidentata* (Say); *c*, *T. binotata*, new species; *d*, *T. fiebrigi*, new species; *e*, *T. spinifer* Champion; *f*, *T. fulviceps* Champion; *g*, *Calyce maculata* Pic; *h*, *C. fulva* Champion; *i*, *Mordelloides acuticauda*, new genus and species; *j*, *Mordella 4-signata* Chevrolat; *k*, *Glipa hieroglyphica* Schwarz; *l*, *G. hilaris* (Say).

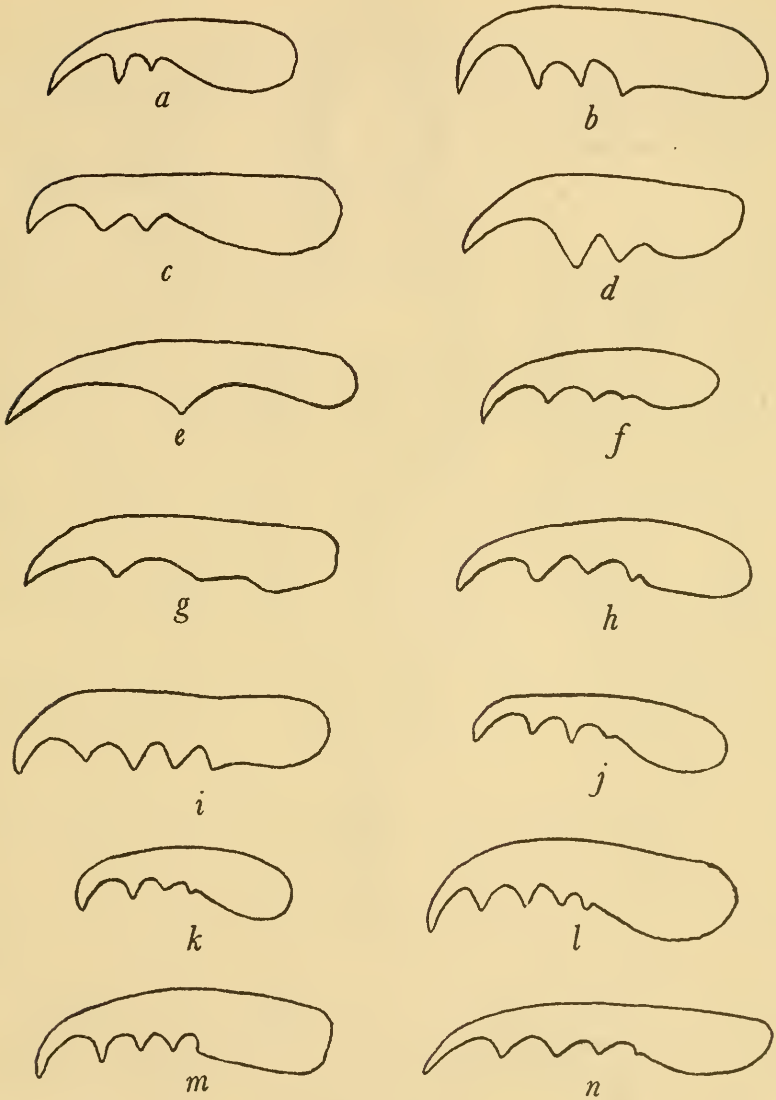


FIGURE 18.—Tarsal claws of MORDELLISTENA.

a, *Mordellistena rhenolepis*, new species; *b*, *M. hondurensis*, new species; *c*, *M. emarginata*, new species; *d*, *M. schwarzi*, new species; *e*, *M. dampfi*, new species; *f*, *M. sonorensis*, new species; *g*, *M. candelabra*, new species; *h*, *M. decora*, new species; *i*, *M. ornatipennis*, new species; *j*, *M. latipalpalis*, new species; *k*, *M. laticornis*, new species; *l*, *M. boseni*, new species; *m*, *M. flavocollaris*, new species; *n*, *M. chiapensis*, new species.

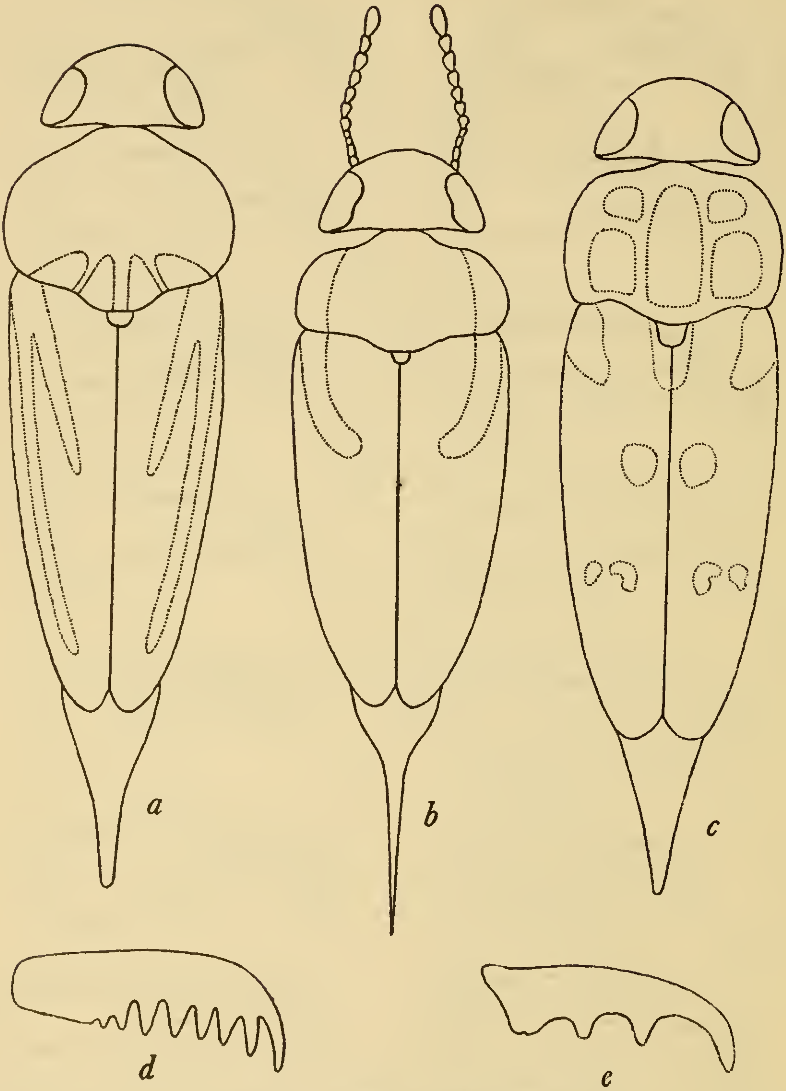


FIGURE 19.—Dorsal views of MORDELLA, MORDELLOIDES, and TOMOXIA, and tarsal claws of MORDELLA and MORDELLISTENA.

Dorsal view of: *a, Mordella divergens,* new species; *b, Mordelloides acuticauda,* new genus and species; *c, Tomoxia brevipennis,* new species. Tarsal claws of: *d, Mordella clavicornis* Kirby; *e, Mordellistena sepia,* new species.

MORDELLISTENA EMARGINATA, new species

FIGURE 18, *c*

This species is closely allied to *diluta* Champion (1891, p. 338) but may easily be separated from the latter member of the genus by the much smaller size, the equality in length between antennal segments 3 and 4, the filiform condition of segments 5–10, and the presence of an emargination at the frontal edge of the eye.

Length: 1.1 mm.; including anal style, 1.4 mm. Elongate, narrow, sides subparallel, narrowing only at apical fourth of elytra, broadest at middle of pronotum. Head (including antennae and mouth parts) and pronotum flavotestaceous, latter with a narrow, dark brown line along base and posterior half of lateral margin; elytra flavobrunneous, somewhat darker along suture and sides; ventral surface flavopiceous, three apical ventral segments flavobrunneous; anterior and intermediate legs flavotestaceous, posterior pair flavobrunneous; ridges of posterior tibiae and tarsi piceous. Surface densely covered with fine, recumbent pubescence, partaking of ground color except on dark areas of ventral surface, where it is flavous.

Antennae 0.35 mm. long, almost reaching base of abdomen; segments 3 and 4 small, equal; 5–10 filiform, each almost as long as 3 and 4 together, but each slightly broader than 4; 11 distinctly longer than 10, broadest at middle, rounded to apex. Distal segment of maxillary palpi enlarged, fairly robust, elongate-ovate, broadest at middle. Eyes large, coarsely granulated, with a distinct emargination on frontal edge near antennal declivity. Pronotum slightly broader than long (0.35 by 0.28 mm.), apex and sides rounded, basal angles obtuse, base arcuate, midbasal lobe moderately long, rounded. Scutellum small, broadly triangular. Elytra about two and one-half times as long as broad (0.8 by 0.28 mm.), sides parallel to within one-fourth of apex, thence attenuate and broadly rounded to apex, apices individually rounded. Intermediate tibiae and tarsi equal in length; penultimate segment of anterior and intermediate tarsi simple. Posterior tibiae with two oblique ridges extending halfway across outer surface; basitarsi with two, second segment with one oblique ridge, all extending halfway across outer surface. Tarsal claws with three distinct teeth and a premedian, blunt, very small elevation (fig. 18, *c*). Outer spur of posterior tibiae three times as long as inner one. Anal style three times as long as apical ventral segment (0.3 by 0.1 mm.), narrow, attenuate to apex; last ventral segment but slightly longer than penultimate one.

Type locality—La Ceiba, Honduras.

Type.—A unique male, U.S.N.M. No. 52915, taken on October 18, 1916, by F. J. Dyer.

MORDELLISTENA TESSELLATA Champion

Mordellistena tessellata CHAMPION, Biologia Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 336, pl. 15, figs. 5, 5a, 1891.

Five specimens: One from Antigua, Guatemala, May 2, 1926 (J. M. Aldrich); one from Monterey, Nuevo Leon, Mexico, November 25, 1909 (F. C. Bishopp); two from Coapa, District Federale, Mexico, June 12, 1922 (E. G. Smyth); one from Mexico City, Mexico (O. W. Barrett).

MORDELLISTENA DAMPFI, new species

FIGURES 16, *j*; 18, *e*

This species is allied to *diluta* Champion (1891, p. 338) and may be separated from the latter member of the genus by the black head, the equality in length between antennal segments 3 and 4, the elongate-triangular shape of the distal segment of the maxillary palpi, the much smaller size, and the peculiar condition of the tarsal claws.

Length: 0.8 mm.; including anal style, 1.18 mm. Form elongate, narrow, sides subparallel, narrowing approximately one-fourth from apex of elytra, broadest near middle of pronotum. Head piceous black, thorax, elytra, antennae, mouth parts, and legs, flavocastaneous, sides of mesosternum and metasternum and abdomen (except anal style and apical ventral segment) piceocastaneous. Body densely covered with fine, recumbent, flavous pubescence, thickest on anal style, where it gives this structure a coarse appearance.

Antennae 0.25 mm. long, slender, filiform; segments 3 and 4 equal in length, latter distinctly broader of two; 5–10 each as long as 3 and 4 together, each twice as thick as 3, with straight sides; 11 distinctly longer than 10, apically rounded. Distal segment of maxillary palpi enlarged, with form of an elongate scalene triangle, sides straight, corners rounded (fig. 16, *j*). Pronotum distinctly broader than long (0.25 by 0.2 mm.), sides rounded, basal angles obtuse, base arcuate, midbasal lobe short, rounded. Scutellum small, broadly triangular. Elytra two and one-third times as long as broad (0.6 by 0.26 mm.), sides parallel to within a fourth of apex, thence attenuate and broadly rounded to apex, apices individually rounded. Intermediate tibiae and tarsi equal in length; penultimate segment of anterior and intermediate tarsi dilated, excavate beneath, bearing fifth segment on middle of its ventral surface. Posterior tibiae with two oblique ridges, basal one extending slightly more than half distance across outer surface; basitarsi with three (basal one rudimentary), second segment with one oblique ridge. Tarsal claws with but two teeth, distal one long, acute, terminal, other one broad, short, median, the two sides forming a right angle (fig. 18, *e*). Outer spur of posterior tibiae twice as long as inner one. Anal style almost three times length of apical ventral segment (0.28 by 0.1 mm.), stout, dorsal surface rounded to apex, latter acute, bearing several short, black bristles; ventral surface straight; last ventral segment but twice as long as penultimate one.

Type locality.—Paraiso, Canal Zone, Panama.

Type.—A unique male, U.S.N.M. No. 52919, collected on April 22, 1911 (E. A. Schwarz).

Remarks.—This species is named for Dr. A. Dampf, chief entomologist of the Mexican Department of Agriculture, who so largely contributed to the possibility of this work by sending an assortment of 802 specimens collected over a period of years.

MORDELLISTENA AZTECA Champion

Mordellistena azteca Champion, Biologia Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 334, pl. 15, figs. 3, 3a, 1891.

Seventeen specimens: San Rafael, Jicaltepec, Veracruz, Mexico (Townsend).

MORDELLISTENA LUTEIFRONS Champion

Mordellistena luteifrons Champion, Biologia Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 330, pl. 14, fig. 24a, 1891.

Five specimens: All from District Federale, Mexico, July 11, 1924, on *Arracia multifida* (A. Dampf).

MORDELLISTENA CANDELABRA, new species

Figures 16, *k*; 18, *g*

This species is most closely allied to *xanthopyga* Champion (1891, p. 344) and may be separated from the latter member of the genus by the difference in color pattern, the peculiar shape of the distal segment of the maxillary palpi, the longer length of the third antennal segment, and the presence of but a single spur at the apex of the posterior tibiae.

Length: 1.82 mm.; including anal style, 2.38 mm. Elongate, narrow, sides subparallel; body flavocastaneous, eyes and ridges on posterior tibiae and tarsi fuscocastaneous, elytra and ventral abdominal segments (except distal segment) piceocastaneous. Surface covered with fine, recumbent, uniform pubescence, partaking of ground color, with contrasting areas on elytra, as follows: a broad humeral patch extending obliquely into disk and reaching suture; a broad, transverse, postmedian band; and a broad sutural line connecting the preceding two.

Antennae 0.48 mm. long, reaching base of lateral pronotal margin; segments 1 and 2 large, equal; 3 distinctly longer but narrower than

4; 5–10 each successively shorter and narrower than preceding; 11 as long as 1, spindle-shaped, broadest subbasally, attenuate to apex. Distal segment of maxillary palpi enlarged, elongate, with form of a scalene triangle, sides and apex but slightly rounded (fig. 16, *k*). Pronotum but slightly broader than long (0.56 by 0.52 mm.), apex and sides rounded, basal angles obtuse, base arcuate, midbasal lobe short, rounded. Scutellum small, triangular. Elytra two and four-tenths times as long as broad (1.26 by 0.52 mm.), sides gradually narrowing to within one-fourth of apex, where they become broadly rounded, apices individually rounded. Penultimate segment of anterior and intermediate tarsi filiform. Posterior tibiae with a short subapical ridge, a short median one, and a long oblique one extending entirely across outer surface near basal articulations; basitarsi with two short, oblique ridges, each very oblique; second segment with one short, oblique ridge. Tarsal claws with two distinct, broad teeth. distal one longest, and a small, blunt, median elevation on concave surface (fig. 18, *g*). Outer spur of posterior tibiae more than half as long as basitarsus; inner spur lacking. Anal style two and two-thirds times as long as apical ventral segment (0.55 by 0.2 mm.), narrow, evenly attenuate to apex.

Type locality.—Panama City, Panama.

Type.—Male, U.S.N.M. No. 52939.

Remarks.—Seven specimens: The type and a male paratype were taken at Panama City, Panama, April 12 (A. H. Jennings); the allotype and two female paratypes were taken at Paraiso, Canal Zone, Panama, on January 17, 1911, and April 18, 1911, respectively (E. A. Schwarz); a female paratype was taken at Pedro Miguel, Canal Zone. Panama, April 17, 1911 (E. A. Schwarz).

I have been unable to find the shorter spur of the posterior tibiae in any of the seven specimens at hand; in the absence of any damage to the series this peculiarity is unaccountable. If this is the normal case for this and several other species, it is the first occurrence of such an omission in the family.

The males of *candelabra* are darker than the females, with ventral surface of abdomen a uniform piceocastaneous (except distal segment).

MORDELLISTENA XANTHOPYGA Champion

Mordellistena xanthopyga Champion, Biologia Centrali-Americana, Coleoptera. vol. 4, pt. 2, p. 344, 462, pl. 15, figs. 18, 18a, 1891.

One specimen: Paraiso, Canal Zone, Panama, April 26, 1911 (E. A. Schwarz).

MORDELLISTENA TIARA Ray

Mordellistena tiara Ray, Can. Ent., vol. 68, p. 127, pl. 9, figs. 2, 5, 8, 1936.

One specimen: Tampico, Mexico, December 14 (E. A. Schwarz).

MORDELLISTENA SONORENSIS, new species

FIGURE 18, *f*

This species is most closely allied to *funerea* Champion (1891, p. 343) and may be separated from the latter member of the genus by the bicolored antennae, the much shorter, distal segment of the maxillary palpi, the longer antennae, the larger size, the oval form of the body, and the emarginate anterior margin of the compound eye.

Length: 2.4 mm.; including anal style, 3.2 mm. Form elongate, narrow, sides rounded, subovate, elytra broadest at base, distinctly narrowing and rounded caudad. Derm piceous black, five distal segments of antennae and anterior and intermediate legs fuscous, basal six segments of antennae and mouth parts flavocastaneous. Body densely covered with fine, recumbent, yellowish-white pubescence, except on castaneous parts, where it partakes of ground color.

Antennae 1.5 mm. long, reaching to posterior coxae; segments 3 and 4 very short, equal; 5–10 each as long as 3 and 4 together and distinctly broader; 11 distinctly longer than 10, sides and apex rounded, broadest medially. Distal segment of maxillary palpi enlarged, with form of a scalene triangle, lateral margin almost straight, corners, and mesal and apical margins distinctly rounded, broadest premedially. Eyes coarsely faceted, distinctly emarginate on anterior margins. Prothorax four-tenths broader than long (0.7 by 0.5 mm.), sides and apex rounded, basal angles obtuse, base arcuate, midbasal lobe short, but rounded. Scutellum short, subtriangular, sides and apex rounded, broader than long. Elytra two and two-thirds times as long as broad (1.9 by 0.7 mm.), broadest at base, sides distinctly rounded to apex, curvature greatest on apical fourth, apices individually rounded. Intermediate tarsi distinctly longer than their tibiae; penultimate segment of anterior and intermediate tarsi simple, filiform. Posterior tibiae with two oblique ridges, basal one extending entirely across outer face, the other halfway; basitarsi with three, second segment with two oblique ridges, each extending halfway across outer surface. Tarsal claws with four teeth, distal one long, acute, two intermediate ones short, their sides almost forming right angles, the proximal, subbasal one rudimentary (fig. 18, *f*). Only a single spur visible at apex of posterior tibiae, one-half length of basitarsus. Anal style short, fairly stout, but one-half longer than apical ventral segment (0.75 by 0.5 mm.), evenly attenuate to apex; apical ventral segment almost twice length of penultimate one.

Type locality.—Nainari, Sonora, Mexico.

Type.—A unique male, U.S.N.M. No. 52940, collected on August 19, 1927, on grass in ricefield (A. Dampf).

MORDELLISTENA DECORA, new species

FIGURE 18, *h*

This species is closely allied to *filicornis* Champion (1891, p. 342), but may easily be separated from the latter member of the genus by the greater length of the fourth antennal segment, the shorter, bicolored antennae, and the broader, much shorter distal segment of the maxillary palpi.

Length: 3.7 mm.; including anal style, 5 mm. Form narrow, elongate, sides subparallel, but slightly narrowing caudad until apical fourth of elytra, broadest near base of pronotum. Head, pronotum, anterior and intermediate legs, four basal segments of antennae and spurs of posterior tibiae, castaneous; elytra, eyes, and ventral surface piceous, seven distal segments of antennae and posterior legs piceo-castaneous. Body densely covered with fine, recumbent pubescence, partaking of ground color on castaneous parts, yellowish white elsewhere, short and indistinct on eyes.

Antennae 1.2 mm. long, almost reaching base of lateral pronotal margin; segment 4 slightly longer and broader than 3; 5–10 each one-half longer and distinctly thicker than 4, not serrate, however, broadest subapically; 11 large, one-half longer than 10, sides and apex rounded, broadest postmedially. Distal segment of maxillary palpi enlarged, form of a broad, scalene triangle, lateral margin straight, corners and other two sides rounded. Pronotum but slightly broader than long (1.1 by 1 mm.), sides rounded, basal angles obtuse, base arcuate, midbasal lobe short, subtruncate. Scutellum small, broadly triangular, sides straight, apical angle rounded. Elytra almost two and one-half times as long as broad (2.7 by 1.1 mm.), sides gently narrowing on basal three-fourths, thence broadly rounded to apex, apices individually rounded. Intermediate tarsi distinctly longer than their tibiae; penultimate segment of anterior and intermediate tarsi short, filiform. Posterior tibiae with two oblique ridges, basal one extending entirely across outer surface, the other halfway; basitarsi with three, second segment with two oblique ridges, each extending halfway across outer surface. Tarsal claws with four teeth, three acute and long, fourth short, blunt, premedian (fig. 18, *h*). Outer spur of posterior tibiae two and one-half times as long as inner one. Anal style two and six-tenth times length of apical ventral segment (1.3 by 0.5 mm.), narrow, attenuate to apex; last ventral segment slightly more than twice length of penultimate one.

Type locality.—Centinela, Colima, Mexico.

Type.—A unique male, U.S.N.M. No. 52941, collected on January 28, 1930, on cotton (A. Dampf).

MORDELLISTENA FLAVICORNIS Champion

Mordellistena flavicornis Champion, Biologia Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 342, pl. 15, fig. 15, 1891.

One specimen: Juan Mina Plantation, Canal Zone, Panama, July 13, 1928, swept from grass and cowpeas (H. J. Dietz and J. Zetek).

MORDELLISTENA MUTABILIS Champion

Mordellistena mutabilis Champion, Biologia Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 339, pl. 15, figs. 9–11, 1891.

Eight specimens: Six from Cordoba, Veracruz, Mexico, (3) April 30, (1) May 5, and (2) May 17, 1908 (A. Fenyes); two from Cacao, Trece Aguas, Alta Vera Paz, Guatemala, March 30 and April 29 (Schwarz and Barber).

MORDELLISTENA ORNATIPENNIS, new species

Figure 18, *i*

This species is most closely allied to *basimacula* Champion (1891, p. 341) and may be separated from the latter member of the genus by the shorter, broader, terminal segment of the maxillary palpi and the *two* long ridges of the posterior tibiae.

Length: (male) 2.25 mm., (female) 2.75 mm.; including anal style, (male) 3.25, (female) 3.75 mm. Elongate, narrow, sides subparallel; head fuscocastaneous; pronotum fuscocastaneous with a large, rounded, castaneous spot on each side at middle; elytra fuscopiceous, with an oblique, narrow, castaneous, humeral spot extending obliquely toward suture and separated from latter by less than its own width; front and middle legs and anal style castaneous, ventral surface and posterior legs fuscopiceous. Surface densely covered with fine, recumbent, flavous pubescence.

Antennae 0.7 mm. long, reaching posterior coxae; segments 3 and 4 equal; 5 to 10 each almost as long as 3 and 4 together; 11 rounded, one-third longer than 10. Distal segment of maxillary palpi enlarged, subtriangular, outer margin straight, corners rounded, apical and inner margins curved. Pronotum as long as broad, apex and sides rounded, basal angles obtuse, base arcuate, midbasal lobe short, rounded. Scutellum small, triangular, apical angle rounded. Elytra three times as long as broad (1.75 by 0.58 mm.), sides parallel to within one-fourth of apex, apices individually rounded. Penultimate segment of anterior and intermediate tarsi dilated. Posterior tibiae with a short subapical ridge and two long, oblique ridges, each extending entirely across outer surface; basitarsi with three oblique ridges, each extending two-thirds across outer surface; second segment with two ridges, each almost completely spanning articulation. Tarsal claws with four rather thick, blunt teeth, distal one longest.

proximal, median one broad, the sides forming a right angle (fig. 18, *i*). Anal style more than three times as long as apical ventral segment, narrow, attenuate to apex.

Type locality.—Paraiso, Canal Zone, Panama.

Type.—Male: U.S.N.M. No. 52916.

Remarks.—The type was taken at Paraiso, Canal Zone, Panama, January 17, 1911 (E. A. Schwarz), the allotype at Pedro Miguel, Canal Zone, Panama, April 17, 1911 (A. H. Jennings); and a male paratype at Palo Seco, Trinidad, October 20, 1918 (H. Morrison).

The two long ridges of the posterior tibiae in this species is the first record of such an occurrence in any member of the family and this character alone will separate *ornatipennis* from any species recorded in the "Biologia." The castaneous humeral spot is variable in size and in the paratype extends the length of the elytra, leaving only a narrow, piceous, sutural and marginal line.

MORDELLISTENA GRACILIFORMIS, new species

This species is mostly closely allied to *4-fasciata* Champion (1891, p. 337), a Mexican form, but may easily be separated from the latter member of the genus by the completely black dermal color, the smaller, more irregular pubescent patches on the pronotum and elytra, and by the shorter distal segment of the maxillary palpi.

Length: 2.75 mm.; including anal style, 3.65 mm. Elongate, subparallel; dermal color entirely black. Surface densely covered with fine, yellowish-white pubescence, dense on pronotum and elytra, where it forms a number of irregular, broken, transverse fasciae.

Antennae 1 mm. long, reaching basal abdominal segment; segment 4 equal in length to 3, but slightly broader; 5–10 each one-half longer than 4 and considerably broadened; 11 rounded, but little longer than 10. Distal segment of maxillary palpi enlarged, broadly triangular, rounded on mesal edge and apex. Prothorax slightly broader than long (0.8 by 0.75 mm.), sides rounded, base arcuate, midbasal lobe short, subtruncate. Scutellum small, triangular, apical angle rounded. Elytra twice as long as broad (2 by 1 mm.), sides gradually narrowing from broadest posthumeral position to apex, apices individually rounded. Tarsal claws with three teeth, all short, blunt, proximal one situated medially. Posterior tibiae with two oblique ridges extending halfway across outer surface; basitarsi with three, second segment with two oblique ridges, all extending halfway across outer surface. Anal style three times as long as apical ventral segment (0.9 by 0.3 mm.), narrow, attenuate to apex, sides straight; last ventral segment but twice length of penultimate one.

Type locality.—Coliseo, Cuba.

Type.—Male, U.S.N.M. No. 52917.

Remarks.—The type and a male paratype were collected at Coliseo, Province of Matanzas, Cuba, June 15, 1934 (S. T. Danforth). The allotype and a female paratype were collected at Central Jaronu, Cuba, June 2, 1930, on weeds and grasses (L. C. Scaramuzza) and Central Jagueyal, Cuba, June 30, 1927, on grasses (L. C. Scaramuzza).

MORDELLISTENA LATIPALPALIS, new species

FIGURE 18, *j*

This species is rather closely allied to *aequinoctialis* Champion (1891, p. 311) but may be separated from the latter member of the genus without difficulty by means of the much smaller size, the different character of the antennal segments, the broader terminal segment of the maxillary palpi of the male, and the general difference in color.

Length: 2.95 mm.; including anal style, 4.15 mm. Form elongate, narrow, sides subparallel, attenuate, and gradually rounded caudad from middle of elytra. Dermal color dark fuscocastaneous, legs, except posterior femora, maxillary palpi, antennae, two basal segments lighter, apex of front, and clypeus, flavocastaneous. Surface rather densely covered with fine, recumbent, yellowish-white pubescence, densest on elytra, abdomen, and anal style; eyes sparsely covered with short, whitish hairs.

Antennae 1 mm. long, slender, reaching intermediate coxae; segments 1 and 2 subequal; 3 and 4 equal in length, narrow; 5–10 each one-third longer and broader than 4, lateral margins straight, mesal margins curved, broadest at apex; 11 one-half longer than 10, sides and apex rounded, broadest medially. Distal segment of maxillary palpi enlarged, somewhat pear-shaped, broad, mesal margin straight, lateral margin and apex broadly rounded, greatest width on apical third. Pronotum distinctly broader than long (0.95 by 0.85 mm.), apex and sides rounded, basal angles subacute, forming a right angle, base arcuate, midbasal lobe moderately produced, subtruncate. Scutellum broadly subtriangular, broader than long, apex abruptly transversely truncate, angles obtuse. Elytra distinctly more than twice as long as broad (2.1 by 0.95 mm.), sides subparallel on basal half, narrowly attenuate caudad, broadly rounded on caudal fourth, apices individually rounded. Hind tibiae with two oblique ridges extending halfway across outer surface; basitarsi with three, second segment with two oblique ridges, all extending halfway across outer surface. Tarsal claws with four teeth, the distal three long, acute, postmedian, proximal one short, blunt, and median in position (fig. 18, *j*). Anal style elongate, narrow, attenuate to apex, three times length of apical ventral segment (1.2 by 0.4 mm.); last ventral segment three times as long as penultimate one.

Type locality.—Plancha Piedra, between British Honduras and Guatemala.

Type.—Male, U.S.N.M. No. 52942.

Remarks.—The single male at hand was collected at Plancha Piedra, on the border between British Honduras and Guatemala, in the Peten Department, October 27, 1925, swept from weeds (A. Dampf).

MORDELLISTENA LATICORNIS, new species

FIGURE 16, *h;* 18, *k*

This species is most closely allied to *hexastigma* Champion (1891, p. 321) and may be separated from the latter member of the genus by the unicolored antennae, the different nature and position of the spots on the elytra, the much greater length and breadth of the fourth antennal segment, the different shape of the distal segment of the maxillary palpi, the small number of comblike ridges on the posterior tibiae and tarsi, and the smaller size.

Length: 2.5 mm.; including anal style, 3.45 mm. Form moderately robust, subcuneate, elytra broadest at base, thence narrowing to apex, body broadest near base of pronotum. Head, pronotum, antennae, mouth parts, spurs of posterior tibiae, and legs, except posterior femora, flavocastaneous; ventral surface, except last ventral segment and base of anal style, and elytra, piceous black, the elytra with a castaneous, semilunate, humeral fascia, curving posteriorly and mesad, not reaching suture and extending one-fourth into disk; posterior femora, last ventral segment, and base of anal style fuscocastaneous. Body densely covered with fine, recumbent pubescence, partaking of ground color on castaneous areas, whitish yellow on ventral surface, black on elytra, except for following whitish areas: a semilunate fascia overlying castaneous dermal spot mentioned above, a broad, transverse, postmedian fascia, interrupted at suture and not quite reaching lateral margins, and a short area covering the extreme apex.

Antennae 1.1 mm. long, reaching basal abdominal segment; segment 4 one-half longer and much broader than 3; 5–10 each one third longer than 4, broad, flattened, but not serrate, broadest subapically; 11 distinctly longer than 10, sides and apex rounded, broadest medially. Distal segment of maxillary palpi enlarged, form of an elongate scalene triangle, outer margin straight, mesal and apical edges and corners rounded, broadest at apical third (fig. 16, *h*). Pronotum distinctly broader than long (0.85 by 0.7 mm.), sides and apex rounded, basal angles obtuse, base arcuate, midbasal lobe short, but rounded. Scutellum moderately large, triangular, sides straight, apical angle rounded. Elytra slightly more than twice as long as broad (1.8 by

0.85 mm.), sides broadest at base, evenly attenuate to apex, apices individually rounded. Intermediate tibiae and tarsi approximately equal in length; penultimate segment of anterior and intermediate tarsi dilated, emarginate at apex, bearing distal segment on its ventral surface. Posterior tibiae with two and a rudimentary third oblique ridge, each extending approximately halfway across outer surface; basitarsi with three, second segment with two oblique ridges, each extending halfway across outer surface. Tarsal claws with four teeth, two distal ones long, acute, two proximal ones short, blunt (fig. 18, *k*). Outer spur of posterior tibiae almost twice length of inner one. Anal style slightly more than twice length of apical segment (0.95 by 0.45 mm.), rather stout at base, evenly attenuate to apex; last ventral segment almost three times length of penultimate one.

Type locality.—Tegucigalpa, Honduras.

Type.—A unique male, U.S.N.M. No. 52912, taken on March 31, 1917, by F. J. Dyer.

MORDELLISTENA SEPIA, new species

FIGURE 19, *e*

This species is most closely allied to *tabascana* Champion (1891, p. 330) and may be separated from the latter member of the genus by a distinct difference in color and pubescent maculation, the shorter form and the isosceles condition of the distal segment of the maxillary palpi, the greater length of the fourth antennal segment, and the oddly shaped scutellum.

Length: 1.5 mm.; including anal style, 2 mm. Form moderately elongate, robust, sides attenuate beyond basal third of elytra, broadest near base of pronotum. Derm warm sepiaceous in color, meso- and metasternum and anal style piceocastaneous. Body densely covered with fine, recumbent, flavobrunneous pubescence, partaking of ground color in the following areas: a somewhat rounded spot on middle of disk of pronotum, a subbasal, subsutural spot extending to middle of elytra, produced posteriorly and recurved anterolaterad, but not reaching lateral margins; and a broad, transverse, arcuate band reaching neither suture nor lateral margins and produced anteriorly, almost touching previously mentioned subsutural line.

Antennae 0.7 mm. long, reaching base of abdomen, filiform, slender, segment 4 twice as long and much broader than 3; 5–10 but slightly longer than 4 and subequal in length and width; 11 slightly longer than 10, broadest at apical third, thence rounded to apex. Distal segment of maxillary palpi enlarged, with form of an elongate scalene triangle, apical margin and angles rounded, mesal and lateral margins straight. Pronotum slightly broader than long (0.47 by

0.37 mm.), sides rounded, base arcuate, midbasal lobe short, rounded. Scutellum subangulate, base straight, sides convex, very obtusely angulate, apical angle acute. Elytra twice as long as broad (1.02 by 0.53 mm.), sides attenuate and narrowing from basal third to apex, apices broadly, individually rounded. Intermediate tibiae and tarsi subequal in length; antepenultimate segment of anterior and intermediate tarsi short, slightly broadened, penultimate segment dilated, excavate beneath. Posterior tibiae with three subequal, oblique ridges extending halfway across outer surface; basitarsi with three, second segment with two oblique ridges, all extending halfway across outer surface. Tarsal claws with three distinct, acute teeth. Outer spur of posterior tibiae twice as long as inner one. Anal style three times as long as apical ventral segment (0.5 by 0.16 mm.), moderately robust, attenuate to apex.

Type locality.—La Ceiba, Honduras.

Type.—A unique male, U.S.N.M. No. 52920, collected on August 23, 1916, by F. J. Dyer.

MORDELLISTENA BOSENI, new species

FIGURES 16, *i*; 18, *l*

This species bears close resemblance to both *infima* LeConte (1863a, p. 49) and *tiara* Ray (1936a, p. 127), but may easily be separated from either of these members of the genus by the black, enclosed area of pubescence on the elytra, the bicolored antennae and legs, the larger size, the larger number of comblike ridges on the posterior tibiae and tarsi, the larger size, and the greater length of the fourth antennal segment.

Length: 3.3 mm.; including anal style, 4.55 mm. Form narrow, elongate, sides subparallel, narrowing from apical fourth of elytra, broadest near base of pronotum. Derm piceous black, apical margins of abdominal segments a shining, castaneous color, basal four segments of antennae, mouth parts, anterior legs, and spurs of posterior tibiae, flavocastaneous. Body densely covered with fine, recumbent pubescence, a distinct yellowish-greenish white, condensed on elytra to form the following fasciae: a broad humeral area curving posteromesad and reaching suture; a narrow line along base, embracing scutellum and continuing along entire length of suture; an irregular, transverse, postmedian band broadening laterally and extending along lateral margins to reach both humeral area and an apical fascia; apical sixth of elytra, longest basally near suture, pubescence between these areas consisting chiefly of dark, fuscopiceous hairs.

Antennae 1.2 mm. long, reaching posterior coxae; segment 4 one-half longer than 3; 5–10 each one-third longer and considerably broader than 4, broadest subapically; 11 one-half longer than 10, mesal edge, apex and corners rounded, broadest postmedially. Distal segment of maxillary palpi enlarged, with form of a scalene triangle, broad, lateral margin straight, other edge and corners rounded (fig. 16, *i*). Pronotum four-tenths broader than long (1.1 by 0.8 mm.), sides and apex rounded, basal angles obtuse, base arcuate, midbasal lobe short, distinctly truncate. Scutellum moderately large, triangular, sides straight, apical angle rounded. Elytra two and three-tenths times as long as broad (2.5 by 1.1 mm.), sides subparallel on basal three-fourths, thence broadly rounded to apex, apices individually rounded. Intermediate tarsi longer than their tibiae; penultimate segment of anterior and intermediate tarsi dilated, emarginate at apex, bearing the distal segment on its ventral surface. Posterior tibiae with three short, oblique ridges, each extending less than halfway across outer surface; basitarsi with four, second segment with two oblique ridges, each extending less than halfway across outer surface. Tarsal claws with four teeth, all long, acute (fig. 18, *l*). Outer spur of posterior tibiae twice length of inner one. Anal style two and one-half times length of apical ventral segment (1.25 by 0.5 mm.), slender, attenuate to apex; last ventral segment three times length of penultimate one.

Type locality.—San Cristobal, Chiapas, Mexico.

Type.—Male, U.S.N.M. No. 52943.

Remarks.—The type was taken at San Cristobal, Chiapas, Mexico, July 7, 1926, by sweeping, at 2,200 meters elevation (A. Dampf); a male paratype was taken at Cerro Ecatepec, Chiapas, Mexico, June 24, 1926, on shrubs, at 2,400 meters elevation (A. Dampf).

MORDELLISTENA FLAVOCOLLARIS, new species

FIGURE 18, *m*

This species is most closely allied to *sanguinicollis* Champion (1891, p. 320) and may be separated from the latter member of the genus by the difference in the pattern of the elytral pubescence, the equality in length between antennal segments 3 and 4, the broader distal segments of the same, the difference in the color of the ventral surface, legs, and antennae, and the smaller number of comblike ridges on the posterior tibiae.

Length: 3.6 mm.; including anal style, 4.7 mm. Form moderately robust, sides attenuate, narrowing slightly but visibly from base of elytra posteriorly, broadly rounded from apical fourth of elytra to apex, apices individually rounded, broadest near base of pronotum. Head, except clypeus, and elytra, piceous black; pronotum castaneous, with an indefinite dorsal cloud on posterior half of disk; antennae, mouth parts, anterior legs, caudal margins of metasternum and abdominal segments, last one entirely, flavocastaneous; intermediate and posterior legs piceocastaneous. Body covered with fine, recumbent pubescence, whitish on all parts of body except pronotum, where it is distinctly yellowish and on apical half of anal style, where it is piceous; condensed on elytra to form the following whitish spots: an indefinite area along base and embracing humeri, with two black areas enclosed, a sutural line continuing for two-thirds length, a postmedian band extending from suture almost to lateral margin and broadened anteriorly and posteriorly for a short distance at latter point, and a small, irregular, apical area.

Antennae 1.5 mm. long, filiform, distal segments fairly stout; segments 3 and 4 equal in both length and width; 5–10 each one-half longer and much broader than 4, distinctly longer than broad, broadest at distal end; 11 one-half longer than 10, rounded on sides and apex, broadest medially. Distal segment of maxillary palpi enlarged, with form of a broad isosceles triangle, thick, lateral and mesal surfaces noticeably convex, angles rounded. Pronotum distinctly broader than long (1.3 by 0.9 mm.), sides and apex rounded, basal angles obtuse, midbasal lobe short, rounded. Scutellum small, subtriangular, corners and apex broadly rounded, so as to indicate a subtruncate appearance. Elytra slightly more than twice as long as broad (2.7 by 1.3 mm.), sides attenuate, broadest at base, gently narrowing from latter point to three-fourths length, where it becomes broadly rounded to apex, apices individually rounded. Intermediate tibiae and tarsi equal in length; penultimate segment of anterior and intermediate tarsi dilated, excavate beneath, bearing fifth segment on middle of its ventral surface, posterior tibiae with three oblique ridges, all extending less than half distance across outer surface; basitarsi with four, second segment with two oblique ridges, each extending less than halfway across outer surface. Tarsal claws with four teeth, distal one blunt, others acute (fig. 18, *m*). Outer spur of posterior tibiae stout, but twice as long as inner one. Anal style but twice length of apical ventral segment (1.1 by 0.55 mm.), stout, suddenly constricted at middle, thence attenuate to apex, latter narrowly truncate; last ventral segment but twice as long as penultimate one.

Type locality.—Jalapa, Mexico.

Type.—A unique male, U.S.N.M. No. 52918, collected by J. T. Mason.

MORDELLISTENA TEXANA Smith

Mordellistena texana SMITH, Trans. Amer. Ent. Soc., vol. 10, pp. 89, 98, pl. 3, fig. 28, 1882.

One specimen: Colima, Colima, Mexico (L. Conradt).

MORDELLISTENA CHIAPENSIS, new species

FIGURE 18, *n*

This species is most closely allied to *gracilicornis* Champion (1891, p. 318) and may be separated from the latter member of the genus by the distinct difference in color pattern of the dorsal surface, the shorter, broader antennae, the broader, more rounded distal segment of the maxillary palpi, and the longer anal style.

Length: (male) 3.9 and (female) 4.9 mm.; including anal style, (male) 4.9 and (female) 6 mm. Form elongate, narrow, sides subparallel, distinctly narrowing at apical third of elytra, broadest at middle of pronotum. Body brunneous, legs a little lighter, eyes, tips of mandibles, and ridges of posterior tibiae and tarsi black. Surface densely covered with fine, recumbent pubescence, distinctly yellowish on entire body, except on posterior tibiae and tarsi and anal style, where it partakes of ground color.

Antennae (male) 1.4 and (female) 1.7 mm. long, reaching base of abdomen; segment 4 distinctly longer but very little broader than 3; 5–10 somewhat flattened and a little dilated at apex, each as long as and noticeably broader than 4; 11 one-third longer than 10, sides and apex rounded, broadest at distal third. Distal segment of maxillary palpi enlarged, strongly robust, with the form of an isosceles triangle, mesal and apical sides equal in length, all sides and corners distinctly rounded, broadest medially. Eyes large, coarsely granulated, anterior margin emarginate (male) or truncate (female). Pronotum but slightly broader than long (1.2 by 1 mm. in male, 1.5 by 1.3 mm. in female), sides subparallel to within a third of apex, thence attenuate and broadly rounded to apex, apices individually rounded. Intermediate tibiae and tarsi equal in length; penultimate segment of anterior and intermediate tarsi dilated, emarginate at apex, receiving distal segment on its ventral surface. Posterior tibiae with four subequal, oblique ridges extending halfway across outer surface; basitarsi with four, second segment with two oblique ridges, all extending halfway across outer surface. Tarsal claws with five distinct teeth, distal four long, acute, proximal one premedian, short, blunt, obtuse (fig. 18, *n*). Outer spur of posterior tibiae less than twice as long as inner one. Anal style distinctly more than twice as long as apical ventral segment (1 by 0.4 mm. in male, broken in female), narrow, attenuate to apex; last ventral segment twice length of penultimate one.

Type locality.—Finca Belen, Chiapas, Mexico.

Type.—Male, U.S.N.M. No. 52944.

Remarks.—Two specimens, type and allotype, were taken at Finca Belen, Chiapas, Mexico, April 22, 1932, at light, 800 meters elevation (A. Dampf).

As noted in the description above, there exists a distinct sexual difference in the condition of the anterior margin of the compound eye. The antennae, maxillary palpi, and the ridges of the posterior tibiae and tarsi do not indicate a further possibility of sexual separation.

MORDELLISTENA HEXASTIGMA Champion

Mordellistena hexastigma CHAMPION, Biologia Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 321, pl. 14, figs. 12, 12a, 1891.

One specimen: Porto Bello, Panama, February 18, 1911 (E. A. Schwarz).

MORDELLISTENA RUFONOTATA Champion

Mordellistena rufonotata CHAMPION, Biologia Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 318, pl. 14, fig. 7, 1891.

Two specimens: Both from San Cristobal las Casas, Chiapas, Mexico, June 4, 1926 (A. Dampf).

MORDELLISTENA CALLENS Champion

Mordellistena callens CHAMPION, Biologia Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 315, 1891.

Three specimens: One from Finca Vergel, Chiapas, Mexico, May 19, 1935, on wing, 700 meters elevation (A. Dampf); one from La Ceiba, Honduras, September 23, 1916 (F. J. Dyer); one from Paraiso, Canal Zone, Panama, April 29, 1911 (E. A. Schwarz).

MORDELLISTENA VAFER Champion

Mordellistena vafer CHAMPION, Biologia Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 314, 1891.

One specimen: Panama City, April 13, 1911 (A. H. Jennings).

MORDELLISTENA CASTANEICOLOR Champion

Mordellistena castaneicolor CHAMPION, Biologia Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 313, pl. 14, figs. 1, 1a, 1891.

Five specimens: Three from Port Bello, Panama, February 15, 20, and March 1, 1911 (E. A. Schwarz); two from Finca Vergel, Huixtla Valley, Chiapas, Mexico, May 19, 1935, at light, 1,200 meters elevation (A. Dampf).

Genus DICLIDIA LeConte

Diclidia LECONTE, Proc. Acad. Nat. Sci. Philadelphia, vol. 14, p. 43, 1862.

DICLIDIA UNDATA Champion

Diclidia undata CHAMPION, Biologia Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 250, pl. 11, figs. 1, 1a, 1891.

Two specimens: Both from Zacatepec, Pueblo, Mexico, June 28, 1932, at light, 2,000 meters elevation (A. Dampf).

DICLIDIA MEXICANA, new species

This species may easily be separate from the only other Central American member of the genus, *undata* Champion (1891, p. 250), by the difference in color, the broader distal segments of the antennae, the broader, more depressed form, and the shorter antennae. From *inyoensis* Liljeblad (1921, p. 181) it may be distinguished by the difference in color, the much larger size, the peculiar character of the antennae, and the greater compression and elevation of the mesosternum.

Length: 3.5 mm. Form oblong-ovate, rounded anteriorly and poteriorly, broadest near middle of elytra. Head fuscocastaneous, pronotum castaneous, elytra piceous; antennae flavous at base, successively darker distally, last five segments piceous; ventral surface piceous, anterior legs castaneous, intermediate and posterior pair fuscocastaneous. Body densely covered with fine, whitish-yellow pubescence; surface of pronotum and elytra covered with fine, whitish-yellow pubescence; surface of pronotum and elytra covered with fine, transverse strigae, generally obscured by the pubescence.

Antennae 1.1 mm. long, reaching base of lateral pronotal margin; segments 1 and 2 equal; 4 more than one-half longer than 3; 5 equal to 4; 6 equal to 2; 7–10 short, dilated, forming a loose, elongate club, as broad as long; 11 almost twice as long as 10 and equally broad, broadest medially, sides almost straight, apex rounded. Maxillary palpi missing. Pronotum one-half broader than long (1.2 by 0.8 mm.), apex and sides broadly rounded in a continuous semicircle, broadest at base, basal angles acute, base but slightly arcuate, no midbasal lobe being distinguishable. Scutellum large, triangular. Elytra slightly more than twice as long as broad at base (2.5 by 1.2 mm.), sides visibly curved from base to apex, apices individually rounded. Anterior and intermediate tibiae slender, as long as their tarsi, second and third segments of latter part short, penultimate segment dilated with emarginate apex, bearing distal segment on its ventral surface. Tarsal claws with but the single distal prolongation.

Type locality.—Santa Anita, Jalisco, Mexico.

Type.—Female, U.S.N.M., No. 52931, a unique specimen taken August 7, 1927, on weeds, 2,000 meters elevation (A. Dampf).

Genus NAUCLES Champion

Naucles CHAMPION, Biologia Centrali-Americana, Coleoptera, vol. 4. pt. 2, p. 257, 1891.

NAUCLES BASALIS Champion

Naucles basalis CHAMPION, Biologia Centrali-Americana, Coleoptera, vol. 4, pt. 2, p. 258, 1891.

Six specimens: Four from Tampico, Mexico, February 16 (3) and December (E. A. Schwarz); two from Progreso, Yucatan, Mexico, June 7 (F. Knab).

NAUCLES FASCIATA, new species

Superficially this species resembles *Anthobatula quadriguttata* Champion (1891, p. 255), but the much smaller size, the entirely different character of the maxillary palpi and antennae, and the five visible ventral abdominal segments adequately distinguish *fasciata* from *quadriguttata*. This species is unquestionably a species of the genus *Naucles* and may easily be separated from the four previously known members of the genus by the difference in the length of the various antennal segments, the maculation of the elytra, and the larger size.

Length: 1.7 mm. Form oblong-ovate, rounded anteriorly and posteriorly, broadest near middle of elytra. Derm flavous, eyes black, nine distal segments of antennae, mesosternum and metasternum and ventral abdominal segments fuscocastaneous; elytra with base, suture, except apical sixth, lateral margin, except broadly rounded apical portion, and a broad, postmedian, transverse band, fuscous. Body densely covered with fine, recumbent, flavous pubescence.

Antennae 0.5 mm. long, reaching intermediate coxae; segment 2 twice as long as 1; 3 slightly longer than 4; 4–6 equal 7–10 broadened, forming a loose, elongate club, each segment distinctly broader than long; 11 as long as 10, but narrower, broadest subbasally, sides and apex rounded. Distal segment of maxillary palpi enlarged, elongate, with form of a scalene triangle, apical margin very obliquely truncate, corners and sides rounded; terminal segment of labial palpi slender, apical half prolonged, acuminate. Pronotum distinctly broader than long (0.65 by 0.45 mm.), apex and sides broadly rounded in a continuous semicircle, broadest at base, basal angles acute, base arcuate, midbasal lobe short, but rounded; entire surface covered with fine, transverse strigae. Scutellum moderately large, semicircular. Elytra almost two-thirds longer than broad (1.25 by 0.8 mm.), lateral margin distinctly curved, broadest submedially, apical fourth broadly rounded, apices individually curved; basal fourth of surface faintly covered with transverse strigae. Penultimate and antepenultimate segments of anterior and intermediate legs much shortened, as broad as long. Tarsal claws with but the single distal prolongation.

Type locality.—Ponce, Puerto Rico.

Type.—Female, U.S.N.M. No. 52921.

Remarks.—The type and seven female paratypes were collected at Ponce, Puerto Rico, August 7, 1933, on flowers of *Randia mitis* (R. G. Oakley). Another female paratype, from the same locality, was taken on August 8, 1935 (R. G. Oakley). Since six of the specimens have protruding genitalia and all are alike in other respects, I am obliged to consider them as apparently all females.

The markings on the elytra vary considerably in both width of fasciae and depth of color. In one specimen they are visible only when turned at an angle to the disk.

Genus ANTHOBATULA Strand

Anthobatula Strand, Acta Univ. Latviensis, vol. 20, p. 23, 1929.
Anthobates LeConte, *nec* Gistel, *in* Agassiz and Cabot, Lake Superior, p. 231, 1850.
Pentaria Mulsant, Ann. Soc. Linn. Lyon, ser. 2, vol. 3, p. 391, 439, 1856.

ANTHOBATULA MULTIPILIS, new species

In Champion's key to the Central American species of *Pentaria* (1891, p. 252) this species runs to *flavipes* Champion (1891, p. 253). It may be separated from that member of the genus, however, by the unicolorous antennae, which do not have the distal segments transverse, in the color of the ventral surface and legs, and in the broader form of the body. *A. multipilis* is not closely allied to any of the North American members of the genus.

Length: 2.1 mm. Form oblong-ovate, rounded anteriorly and posteriorly, broadest near middle of elytra. Derm piceous, dull, apex of front, clypeus, metasternum, abdomen, legs, and antennae castaneous, maxillary palpi and genitalia flavous. Body densely covered with fine, short, recumbent pubescence, silvery on dorsal surface, partaking of ground color ventrally.

Antennae 0.7 mm. long, reaching intermediate coxae; segments 3–6 equal; 7–10 each twice as long as 5 but slightly broader; 11 slightly longer and narrower than 10, sides straight, apex rounded. Distal segment of maxillary palpi enlarged, with form of an elongate, scalene triangle, basal and apical angles acute, mesal angle obtuse, all rounded, sides straight, except apical fifth of lateral margin, which is distinctly rounded. Pronotum one-half broader than long (0.9 by 0.6 mm.), sides and apex broadly rounded in a single continuous curve, basal angles obtuse, base arcuate, midbasal lobe very short, but rounded. Scutellum subtriangular, sides and apical angle rounded. Elytra but one-half longer than broad (1.5 by 1 mm.), sides visibly rounded, broadest postmedially, apices individually rounded; surface completely covered with numerous, fine, transverse strigae. Intermediate and posterior tibiae approximately equal in length to their tarsi, third and fourth segments of latter structure short, fourth segment dilated, receiving distal segment in a cavity near basal margin. Tarsal claws with but a single tooth, the distal prolongation.

Type locality.—Cayamas, Cuba.

Type.—Male, U.S.N.M. No. 52932.

Remarks.—The type was taken on January 17, the allotype on January 16, seven paratypes (2 males, 5 females) were taken January 22, February 3, January 20, February 10 (2), February 24, and June 10; all were taken at Cayamas, Cuba (E. A. Schwarz).

There is some variation in the color of the ventral surface and in the extent of the castaneous area on the front and clypeus. It is entirely possible that some specimens in a larger series would be entirely piceous.

LITERATURE CITED

BROUN, T.

1886. Manual of New Zealand Coleoptera, pt. 4.

CHAMPION, G. C.

1891. Mordellidae. In Biologia Centrali-Americana, Coleoptera, vol. 4, pt. 2, pp. 250–350, 5 pls.

HELMUTH, C. A.

1865. New species of Mordellidae collected in Illinois. Proc. Acad. Nat. Sci. Philadelphia, vol. 17, p. 96.

LECONTE, JOHN L.

1862. Synopsis of the Mordellidae of the United States. Proc. Acad. Nat. Sci. Philadelphia, vol. 14, pp. 43–51.

LILJEBLAD, E.

1921. Notes on the Mordellidae of the United States, with descriptions of new species. Can. Ent., vol. 53, pp. 181–186.

LINNAEUS, CAROLUS.

1758. Systema naturae, ed. 10.

PIC, M.

1924. Nouveautés diverses. Mél. Exot.-Ent., fasc. 42, 32 pp.

1930. *Mordella ogloblini.* Rev. Soc. Ent. Argentina, vol. 3, p. 30.

1936. Contribution à l'étude du genre Hétéromère. *Mordella* L. Rev. Soc. Ent. Argentina, vol. 9, pp. 111–115.

RAY, EUGENE.

1930. A study of South American Mordellidae. Coleopt. Contrib., vol. 1, pt. 3, pp. 161–171, 1 pl.

1936a. Studies on North American Mordellidae, I. Can. Ent., vol. 68, pp. 124–129, 1 pl.

1936b. The Neotropical Mordellidae of the Deutsches Entomologisches Institut, with descriptions of new species. Arb. Morph. Taxon. Ent. Berlin-Dahlem, vol. 3, Nos. 2, 3, pp. 142–150, 215–221, 8 figs.

SAY, THOMAS.

1835. Descriptions of new North American Coleoptera. Boston Journ. Nat. Hist., vol. 1, pp. 151–203.

SMITH, J. B.

1882. A synopsis of the Mordellidae of the United States. Trans. Amer. Ent. Soc., vol. 10, pp. 73–100, 3 pls.

U. S. GOVERNMENT PRINTING OFFICE: 1939

PROCEEDINGS OF THE UNITED STATES NATIONAL MUSEUM

issued by the

SMITHSONIAN INSTITUTION
U. S. NATIONAL MUSEUM

Vol. 87 Washington: 1940 No. 3076

CATALOG OF HUMAN CRANIA IN THE UNITED STATES NATIONAL MUSEUM COLLECTIONS: INDIANS OF THE GULF STATES

By Aleš Hrdlička

INTRODUCTION

This is the fourth catalog of crania of North America and the fifth of the present series.[1] It covers, as far as our collections go, the Gulf region and such neighboring States as have not been dealt with before. It completes the survey of the available cranial materials north of Mexico, except that since 1924, when the Alaska catalog appeared, there have accumulated important and large new collections from those parts which will necessitate an eventual revision of that number.

The object of these catalogs, it may be restated here, is to furnish workers in anthropology with reliable data on the main proportions of the American skull of different tribes and localities. There are many variants of this skull; these as yet are known but imperfectly, particularly abroad; and our collections have now reached such magnitudes that they can furnish much more substantial data than had before been possible.

To assure the reliability of the data, all the measurements were taken personally by the author, with the same repeatedly tested instruments, and with the object of the undertaking held constantly in mind.

[1] Catalog of human crania in the United States National Museum collections. The Eskimo, Alaska and related Indians, Northeastern Asiatics. Proc. U. S. Nat. Mus., vol. 63, art. 12, No. 2480, 51 pp., 1924.

Idem. The Algonkin and related Iroquois, Siouan, Caddoan, Salish and Sahaaptin, Shoshonean, and Californian Indians. Proc. U. S. Nat. Mus., vol. 69, art. 5, No. 2631, 127 pp., 1927.

Idem. Australians, Tasmanians, South African Bushmen, Hottentots, and Negro. Proc. U. S. Nat. Mus., vol. 71, art. 24, No. 2696, 140 pp., 1928.

Idem. Pueblos, southern Utah Basket-Makers, Navaho. Proc. U. S. Nat. Mus., vol. 78, art. 2, No. 2845, 95 pp., 1931.

155192—40——1

Craniometry is far from being simply a mechanical technique. It demands besides this a high degree of trained judgment and experience. Many a specimen is found more or less damaged, or affected by age. Damage of various sorts is particularly frequent in such materials as dealt with here, for they all come from old burials. On this continent, moreover, above any other part of the world, there are the plagues of artificial cranial deformations, and of much wear of teeth. Under all these difficulties the constant endeavor has been to present to those who may need them sound initial data on the complex American craniological conditions. A much more desirable way would be, of course, to offer a thorough study of the materials, but that will require much time and must of necessity be a matter for the future; meanwhile the essentials given in these catalogs may be serviceable.

To obviate any possible uncertainties as to the methods used, these are herewith briefly described. They apply equally to all the preceding numbers of the catalog. Except for a few additional details they are the same as those of the International Agreements and as outlined in my "Anthropometry" [2] and in my "Practical Anthropometry." [3]

MEASUREMENTS

Maximum length.—The maximum glabello-occipital diameter of the vault.

Maximum breadth.—The greatest transverse diameter of the vault above the mastoids and roots of zygomae.

Basion-bregma height.—Self-explanatory.

Minimum frontal diameter.—The shortest horizontal diameter between the two temporal crests on the frontal bone.

Capacity.—See author's Anthropometries.

Menton-nasion height (or "nasion-menton diameter").—The distance from menton to nasion, with the lower jaw in place and the teeth in apposition. Due allowance made for wear of teeth, when present.

Alveolar point-nasion height (or "naso-alveolar diameter").—Landmarks: Superiorly—the nasion; inferiorly—the lowest point of the alveolar border between the two median upper incisors.

Maximum bizygomatic diameter.—Distance between the most widely separated points on the external surface of the zygomatic arches.

Basio-alveolar diameter.—Distance between the endobasion [4] and the prealveolar point.[5]

Endobasion-subnasal point diameter.—Distance between endobasion and the left subnasal point.[6]

---

[2] Wistar Institute, Philadelphia, pp. 14, 107 et seq., 1920.

[3] Wistar Institute, Philadelphia, 1939.

[4] The foremost point on the anterior border of the foramen magnum, within the lumen of the foramen.

[5] The foremost point on the upper alveolar arch, above the median incisors.

[6] Point laterally just below the lower border of the nasal aperture.

The angle between the endobasion-prealveolar point and the alveolar point-subnasal point lines gives the measure of alveolar prognathism, which it is useful to show separately from the facial prognathism.

Endobasion-nasion.—Distance between endobasion and nasion.

The angle between the endobasion-prealveolar point line and that from the alveolar point to nasion, gives the facial angle, which is the expression of the combined alveolar and facial protrusion.

Nasal height.—Distance from nasion to the middle of a line connecting the lowest points of the two nasal fossae.

If instead of the border there is a gutter, the measurement is taken to the level of the nasal floor.

Nasal breadth.—The greatest horizontal breadth of the aperture.

Orbits: Height.—Maximum height between normal points on the inferior and superior border of each orbit.

Orbits: Breadth.—The breadth of each orbit from the dacryon to the farthest point on the lateral border of the orbit.

(If the dacryon is damaged the measurement is taken from the nearest point on the mesial border of the orbit.)

Length of the alveolar arch.—The anteroposterior distance between the foremost point of the alveolar border above the median incisors and the middle of a transverse line connecting the posterior extremities of the alveolar border.

Breadth of the upper alveolar border.—The greatest breadth externally of the normal alveolar arch.

DEFORMATIONS

The cranial deformations throughout these series were artificial and are of one type, namely the "flat-head" or fronto-occipital compression. As will be seen from the data the frequency of the practice differed much in different tribes and more or less also in different localities. The greatest proportion of deformed skulls occurred in Mississippi and the neighboring regions, among the old Natchez and related tribes; the lowest incidence is noted in the more central and southern parts of Florida. The Texas material alone shows no trace of the practice, which is suggestive.

IDENTIFICATION OF SEX

The sexing of adult Indian crania in general and with due experience is not difficult, and in many cases of the skulls here reported upon, it has further been facilitated by the presence of other skeletal parts, more particularly the pelvic bones, the greater sciatic notch of which is one of the best sex distinguishing characters. The few specimens—certainly not over 5 percent—in which some doubt as to the sex remained, are in all probability distributed equally in the male and female records and can have no effect on the results.

For greater serviceability this catalog comprises the Florida crania measurements of which were given in my "The Anthropology of Florida."[7] Among these are included, from localities mostly not represented in the National Museum collection, specimens preserved in the Academy of Natural Sciences, Philadelphia (A. N. S. P.), and in the Wistar Institute of the same city (W. I.), besides as yet unpublished small series from the American Museum of Natural History, New York City.

MATERIALS

The total number of crania reported here is 1,259, all of adults. Of these, 621 were identified as male, 638 as female; and 1,022 (508 m., 514 f.) were undeformed (or so slightly deformed that there was no substantial interference with the measurements), while 237 (113 m., 124 f.) were deformed so that the measurements of the vault were affected. The distribution of the specimens ranges thus:

Crania measured

State or tribe	Male (621)		Female (638)	
	Undeformed	Deformed	Undeformed	Deformed
Georgia	13		13	
Florida	357	(8)	343	(6)
Tennessee	23	(21)	38	(24)
Alabama	6	(3)	11	(2)
Mississippi	6	(18)	6	(24)
Arkansas	38	(40)	52	(51)
Louisiana	34	(23)	29	(17)
Texas	19		16	
Seminole	11		2	
Tonkaway	1			
Choctaw			4	
Totals	508	(113)	514	(124)

[7] Publ. Florida State Hist. Soc., 146 pp., 1922.

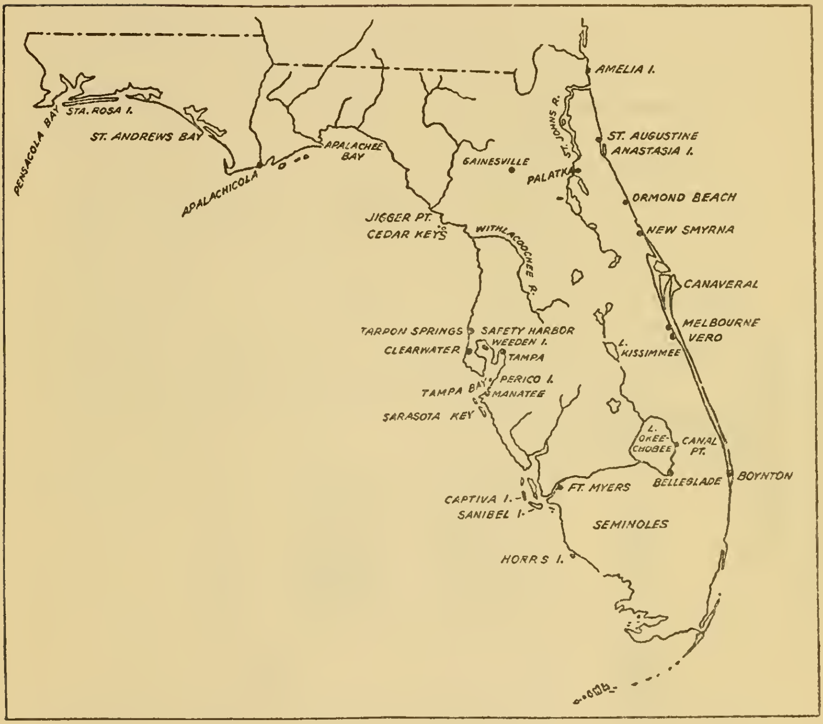


FIGURE 20.—Location of Florida localities yielding cranial material herein described.

GULF STATES INDIANS

GEORGIA: MALES

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlicka's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt. - Nasion height (b)
378952	U.S.N.M.	St. Simons Island	35		18.8	14.4	[1] 14.6	*76.60*	*87.95*	*101.39*	15.93				8.0
378954	do	do	30	Post mortem (asymmetry).	17.5	13.6	High	*77.71*							6.8
243808	do	Sapelo Island, McIntosh County.	55	Moderate occipital asymmetry.	19.3	15.0	15.5	*77.72*	*90.38*	*103.33*	16.60				
379026 [2]	do	Cannons Point	35		17.3	13.9	15.0	*80.35*	*96.15*	*107.91*	15.40				7.5
243807	do	Sapelo Island, McIntosh County.	35		17.5	14.1	13.9	*80.57*	*87.97*	*98.58*	15.17			12.7	7.4
227368	do	Near Darien, McIntosh County.	60	Slight occipital asymmetry.	18.2	14.7	[1] 14.6	*80.77*	*88.75*	*99.32*	15.83				7.3
377932	do	Near Kennesaw	35	Moderate frontal; no occipital flattening.	17.8	[1] 14.5	13.9	*81.46*	*86.07*	*95.86*	15.40			12.1	7.1
378983	do	St. Simons Island	70	Moderate occipital asymmetry.	18.3	15.0	15.2	*81.97*	*91.29*	*101.33*	16.17				
378958	do	do	Young adult.		17.5	14.4		*82.29*							
378981	do	do	Elderly		18.2	15.2		*83.52*							
378955	do	do	do		17.6	14.8		*84.09*							
378953	do	do	70	Slight frontal occipital.	17.6	15.0	14.1	*85.23*	*86.50*	*94.0*	15.57				[1] 7.6
378014	do	Sea Island	40		18.1	15.9	[1] 14.2	*87.85*	*83.53*	*89.31*	16.07				8.0
Specimens					(13)	(13)	(9)	*(13)*	*(9)*	*(9)*	(9)			(2)	(8)
Totals					233.7	190.5	131.0				142.14			24.80	59.7
Averages					18.0	14.65	14.55	*81.51*	*88.69*	*101.15*	15.79			12.4	7.5
Minima					17.3	13.6	13.9	*76.60*	*83.53*	*89.31*	15.17			12.1	6.8
Maxima					19.3	15.9	15.5	*87.85*	*96.15*	*107.91*	16.60			12.7	8.0

Catalog No.	Diam. Bizygomatic maxim. (c)	Facial Index, total $\left(\frac{a\times100}{c}\right)$	Facial Index, upper $\left(\frac{b\times100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	Orbital Index, right	Orbital Index, left	Nose, height	Nose, breadth, maxim.	Nasal Index	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	Upper Alveolar Arch, Index	Lower Jaw, height at Symphysis	Diam. frontal minim.
							°	°														
378952	14.5		55.17						3.65	3.7	3.9	3.9	93.6	94.9	5.75	2.45	42.6	6.4	7.3	87.7		9.3
378954									3.4	3.5	4.0	3.8	85.0	92.1	5.0	2.4	48.0	5.8	6.2	93.6		9.6
243808						11.0																10.3
379026 [2]	13.7		54.74	10.2	8.8	10.5	71.0	47.0	3.15	3.2	3.65	3.6	86.3	88.9	5.5	2.75	50.0	6.4	6.8	94.1		8.6
243807	14.3	88.81	51.75	10.5	9.4	10.6	70.0	51.0	3.65	3.7	4.1	4.1	89.0	90.2	5.6	2.7	48.21	5.7	6.9	82.6	3.7	9.5
227368	14.7		49.66							3.35		3.75		89.3	5.0	2.6	52.0			(3)		9.4
377932				9.7	8.8	10.0	71.0	57.0		3.05		3.6		84.7	5.2	2.35	45.2	5.4	6.5	83.1	3.4	9.1
378983	14.8				9.4	10.8			3.6	3.6	4.0	3.9	90.0	92.3	5.1	2.45	48.0					10.1
378958																						9.4
378981																						9.7
378955																						9.8
378953	14.9		51.01	[1] 10.3	9.3	11.0	74.0	58.5	3.5	3.45	4.0	4.0	87.5	86.3	5.35	2.7	50.5					10.2
379014	15.9			11.0	9.4	10.4	64.0	47.5	3.75		3.9		96.2		5.4	2.8	51.9	6.2	7.2	86.1		11.0
Specimens	(7)	(1)	(5)	(5)	(6)	(7)	(5)	(5)	(7)	(8)	(7)	(8)	(7)	(8)	(9)	(9)	(9)	(6)	(6)	(5)	(2)	(13)
Totals	102.8			51.70	55.10	74.3	350.0	261.0	24.7	27.55	27.55	30.65			47.90	32.2		35.90	40.90		7.1	126.0
Averages	14.7		52.43	10.3	9.2	10.6	70.0	52.2	3.5	3.4	3.9	3.8	89.66	89.89	5.3	2.6	48.43	6.0	6.8	87.78	3.55	9.7
Minima	13.7		49.66	9.7	8.8	10.0	64.0	47.0	3.15	3.05	3.65	3.6	85.0	84.7	5.0	2.35	42.6	5.4	6.2	82.6	3.4	8.6
Maxima	15.9		55.17	11.0	9.4	11.0	74.0	58.5	3.75	3.7	4.1	4.1	96.2	94.9	5.75	2.8	52.0	6.4	7.3	94.1	3.7	11.0

[1] Near.
[2] Male, though somewhat small.
[3] Lower median incisors knocked out long ago. Glass beads in mound. Frontal bone shows syphilis.

GEORGIA: FEMALES

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
171845	U.S.N.M.	Rome	25	Compression [1]	17.9	14.2	14.0	79.33	87.23	98.59	15.37			12.2	6.9
378980	do	St. Simons Island	45		17.4	13.9	[2] 14.0	79.89	89.45	100.72	15.10				6.9
379000	do	Sea Island	50		17.4	13.9	13.2	79.89	84.35	94.96	14.83				6.9
378966	do	St. Simons Island	Subadult		16.5	13.4		81.21							
379012	do	Sea Island	45	Post mortem (asymmetry).	17.5	14.3		81.71							7.5
378979	do	St. Simous Island	30		17.0	13.9		81.76							7.1
378957	do	do	Young adult. [3]		[2] 17.7	14.8		83.62							
378992	do	Sea Island	do		17.0	14.4		84.71							
378965	do	St. Simons Island	60		16.4	14.0		85.37							
243809	do	Sapelo Island, McIntosh County.	25	Slight frontal occipital compression.	15.9	13.6	12.6	85.53	85.43	92.65	14.03				7.4
	do	Georgia	55		16.8	14.4		85.71							
378977	do	St. Simons Island	Young adult.		16.4	14.4		87.80							
379018	do	Charley King Mound	40 (or near to).		15.6	14.2	13.3	91.03	89.26	93.66	14.37				6.9
Specimens					(13)	(13)	(5)	(13)	(5)	(5)	(5)			(1)	(7)
Totals					219.5	183.4	67.10				73.70				49.6
Averages					16.88	14.11	13.42	83.55	87.14	96.13	14.74				7.09
Minima					15.6	13.6	12.6	79.33	84.35	92.65	14.03				6.9
Maxima					17.9	14.8	14.0	91.03	89.45	100.72	15.37				7.5

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a \times 100}{c}\right)$	*Facial Index, upper* $\left(\frac{b \times 100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth, maxim.	*Nasal Index*	Upper Alveolar Arch, length, maxim.	Upper Alveolar Arch, breadth, maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
171845	[2] 13.0	*93.85*	*53.08*	10.4	9.5	10.8	73.5°	55.0°	3.3	3.4	3.9	3.7	*84.6*	*91.9*	5.2	(3.05)	(*58.7*)[3]	5.4	6.2	*87.1*	3.1	9.1
378980	13.4		*51.49*							3.75		3.9		*96.2*	5.05	2.5	*49.5*	5.9	6.5	*90.8*		9.5
379000	13.3		*51.88*	9.7	8.4	9.7	69.0	47.5		3.45		3.9		*88.5*	4.9	2.35	*48.0*	5.4	6.4	[4] *84.4*		9.3
378966																						9.2
379012	[2] 13.6		*55.15*						4.05	4.0	4.3	4.2	*94.2*	*95.2*	5.3	2.6	*49.1*	5.6	7.1	*78.9*		9.4
378979	[2] 13.2		*53.79*						3.5		3.6		*97.2*		5.2	2.5	*48.1*		6.3			8.7
378957																						9.9
378992																						9.3
378965	13.5								3.8		3.9		*97.4*									9.4
243809	13.1		*56.49*	9.5	8.4	9.7	69.0	50.0	3.75	3.8	4.1	4.0	*91.5*	*95.0*	5.6	2.2	*39.3*	5.6	6.7	*83.6*		
																						9.1
378977																						9.3
379018	[2] 13.2		*52.27*			8.6			3.4	3.4	3.65	3.55	*93.2*	*95.8*	5.0	2.4	*48.0*	5.2	6.2	*83.9*		9.1
Specimens	(8)	(*1*)	(*7*)	(3)	(3)	(4)	(3)	(3)	(6)	(6)	(6)	(6)	(*6*)	(*6*)	(7)	(6)	(*6*)	(6)	(7)	(*6*)	(1)	(12)
Totals	106.3			29.6	26.3	38.8	211.5	152.5	21.80	21.80	23.45	23.25			36.25	14.55		33.10	45.40			111.3
Averages	13.29		*53.45*	9.87	8.77	9.70	70.5	50.83	3.63	3.63	3.91	3.88	*92.96*	*93.76*	5.18	2.43	*46.83*	5.52	6.49	*84.65*		9.28
Minima	13.0		*51.49*	9.5	8.4	8.6	69.0	47.5	3.3	3.4	3.6	3.55	*84.6*	*88.5*	4.9	2.2	*39.3*	5.2	6.2	*78.9*		8.7
Maxima	[2] 13.6		*56.49*	10.4	9.5	10.8	73.5	55.0	4.05	3.8	4.3	4.2	*97.4*	*96.2*	5.6	2.6	*49.5*	5.9	7.1	*90.8*		9.9

[1] Where deformation affected dimensions, measurements will be in parentheses.
[2] Near.
[3] Negro admixture? (not evident, but nose broad).
[4] Top of vault syphilitic.

FLORIDA, EAST COAST: MALES

ST. JOHNS RIVER

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
1809	A. N. S. P.	St. Johns River	Adult		18.2	14.0	[1] 14.1	*76.9*	*87.6*	*100.7*	15.77				
1803	do	do	do		18.8	14.6	14.6	*77.7*	*87.4*	*100.0*	16.0				
1781	do	do	do		18.2	14.7	13.7	*80.8*	*83.3*	*93.2*	15.53				7.2
1804	do	do	do		17.2	13.9		*80.8*							
1805	do	do	do		17.8	14.5		*81.5*							
1802	do	do	do		18.1	14.8	14.3	*81.8*	*86.9*	*96.6*	15.73				7.9
1807	do	do	do		17.7	14.5		*81.9*							
1790	do	do	do		18.3	[1] 15.0		*82.0*							
1810	do	do	do		17.8	14.6	14.0	*82.0*	*86.4*	*95.9*	15.47				
1782	do	do	do		18.1	14.9	14.5	*82.3*	*87.9*	*97.3*	15.83				7.1
1785	do	do	do	Slight frontal flattening.	17.8	14.7		*82.6*							
1797	do	do	do		17.8	14.7		*82.6*							
1784	do	do	do		18.6	15.6		*83.9*						[1] 13.3	7.5
1796	do	do	do	Slight frontal flattening.	18.1	15.3	14.6	*84.5*	*87.4*	*95.4*	16.0				
1792 [2]	do	do	do		17.3	15.0	13.8	*86.7*	*85.4*	*92.0*	15.37				
1811	do	do	do		17.6	15.3		*86.9*							
Specimens					(16)	(16)	(8)	*(16)*	*(8)*	*(8)*	(8)			(1)	(4)
Totals					287.4	236.1	113.6				125.7				29.7
Averages					18.0	14.8	14.2	*82.15*	*86.55*	*96.35*	15.71				7.4
Minima					17.3	13.9	13.7	*76.9*	*83.3*	*92.0*	15.37				7.1
Maxima					18.8	15.6	14.6	*86.9*	*87.9*	*100.7*	16.0				7.9

AMELIA ISLAND, ST. AUGUSTINE, NEW SMYRNA

242662	U.S.N.M.	Amelia Island	Adult		18.4	14.2	14.3	77.2	87.7	100.7	15.63	1,435		11.9	7.4
178813	do	St. Augustine	do [3]		18.8	14.4	13.3	76.6	80.1	92.4	15.50	1,520			6.9
242664	do	do	do		18.1	14.4		79.6							
242625	do	New Smyrna	do		18.6	14.4	14.2	77.4	86.1	98.6	15.73				
242619	do	do	do	Slight asymmetry	17.2	14.2	13.8	82.6	87.9	97.2	15.07	1,440			
242650	do	do	50		17.8	14.7	14.2	82.6	87.4	96.6	15.57	1,520			7.3
242624	do	do	Adult		17.6	14.6	13.8	83.0	85.7	94.5	15.33	1,430		[1] 11.7	
330836	do	do	do		18.4	15.8	14.4	85.9	84.2	91.1	16.20	1,610			7.9
Specimens					(8)	(8)	(7)	(8)	(7)	(7)	(7)	(6)		(2)	(4)
Totals					144.9	116.7	98.0				109.03	8,955		23.6	29.5
Averages					18.1	14.6	14.0	80.54	85.55	95.80	15.58	1,492.5		11.8	7.4
Minima					17.2	14.2	13.3	76.6	80.1	91.1	15.07	1,430		11.7	6.9
Maxima					18.8	15.8	14.4	85.9	87.9	100.7	16.20	1,610		11.9	7.9

ORMOND BEACH

372603	U.S.N.M.	Ormond Beach	60		18.9	14.6	High	77.25							
372615	do	do	60		18.7	14.8	14.6	79.14	87.16	98.65	16.03			[4] 12.5	7.2
372649	do	do	45		18.5	14.8		80.0						13.1	7.7
372645	do	do	50		18.2	14.9	[1] 14.5	81.87	87.61	97.32	15.87			[4] 12.7	7.3
372617	do	do	30		17.8	14.6	13.2	82.02	81.48	90.41	15.20			12.1	7.3
372640	do	do	35		[1] 18.3	15.6	14.4	82.25	84.96	92.31	16.10				
372628	do	do	45		17.8	15.2	13.4	85.39	81.21	88.16	15.47			[4] 12.6	7.3
372653	do	do	65		17.9	15.4	[1] 14.6	86.03	87.69	94.81	15.97				
372641	do	do	50	Slight occipital flattening.	(17.2)	(15.4)	(15.0)	(89.53)	(92.02)	(97.40)	15.87			[4] 12.7	7.4
Specimens					(8)	(8)	(6)	(8)	(6)	(6)	(7)			(6)	(6)
Totals					146.1	119.9	84.7				110.51			75.7	44.2
Averages					18.3	15.0	14.1	82.07	85.04	93.59	15.79			12.6	7.4
Minima					17.8	14.6	13.2	77.25	81.21	88.16	15.20			12.1	7.2
Maxima					18.9	15.6	14.6	86.03	87.69	98.65	16.10			13.1	7.7

[1] Near.
[2] Syphilitic.
[3] Probably a mixblood.
[4] Restored.

FLORIDA, EAST COAST: MALES—Continued

CANAVERAL

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
377465	U.S.N.M.	Canaveral	70		18.8	13.9	14.7	*73.94*	*89.91*	*105.76*	15.80				
377466	do	do	45		18.7	14.0	14.2	*74.87*	*86.85*	*101.43*	15.63			[4]12.6	7.2
377428	do	do	50		18.9	14.4	15.0	*76.19*	*90.09*	*104.16*	16.10			[4]12.8	7.5
377501	do	do	65		18.9	14.4	14.0	*76.19*	*84.08*	*97.22*	15.77				
377582	do	do	50		18.6	14.4	14.2	*77.42*	*86.06*	*98.61*	15.73				
377473	do	do	50		19.1	14.8	14.0	*77.49*	*82.60*	*94.59*	15.97				
377471	do	do	55		17.0	13.2	14.6	*77.65*	*96.69*	*110.61*	14.93			[4]12.9	7.5
377493	do	do	45		18.4	14.3	13.8	*77.72*	*84.40*	*96.50*	15.50			[4]13.1	7.8
377513	do	do	45		18.0	14.0	14.0	*77.78*	*87.50*	*100.00*	15.33			[4]12.0	6.9
377458	do	do	60		18.5	14.5	14.6	*78.38*	*88.48*	*100.68*	15.87				
377602	do	do	50		18.2	14.4	14.4	*79.12*	*88.34*	*100.00*	15.67			[4]12.4	7.5
377435	do	do	65		18.6	14.8	15.1	*79.57*	*90.42*	*102.03*	16.17			[4]13.0	7.6
377574	do	do	55	Slight lateral occipital flattening.	18.2	14.5	14.5	*79.67*	*88.69*	*100.00*	15.73				8.1
377481	do	do	35		18.0	14.4	14.6	*80.00*	*90.12*	*101.39*	15.67			[4]12.7	7.6
377525	do	do	35		18.4	14.8	14.2	*80.43*	*85.54*	*95.95*	15.80				
377446	do	do	55		18.5	14.9	14.6	*80.54*	*87.43*	*97.99*	16.00				
377441	do	do	55		18.6	15.0	15.0	*80.65*	*89.29*	*100.00*	16.20				8.1
377609	do	do	35		18.1	14.6		*80.66*							
377578	do	do	45		18.5	15.0	14.3	*81.08*	*85.37*	*95.33*	15.93				
377437	do	do	40		18.7	15.2		*81.28*							
377490	do	do	35		17.6	14.4	14.2	*81.82*	*88.75*	*98.61*	15.40				
377500	do	do	30		17.6	14.4	14.7	*81.82*	*91.88*	*97.96*	15.57				
377577	do	do	26		18.0	14.8	13.4	*82.22*	*81.71*	*90.54*	15.40			[4]12.4	7.2
377655	do	do	50		18.0	14.8	14.0	*82.22*	*85.37*	*94.59*	15.60			[4]12.4	7.5
377653	do	do	30		18.0	14.8	14.8	*82.22*	*90.24*	*100.00*	15.87				
377528	do	do	55		18.1	14.9	14.6	*82.32*	*88.48*	*97.99*	15.87				
377447	do	do	70		18.2	15.0	13.6	*82.42*	*81.93*	*90.67*	15.60				
377529	do	do	50		18.8	15.5	14.8	*82.45*	*86.30*	*95.48*	16.37				
377575	do	do	60		17.4	14.4	14.0	*82.76*	*88.05*	*97.22*	15.27				
377583	do	do	40		17.7	14.7	14.6	*83.05*	*90.12*	*99.32*	15.67				
377439	do	do	60		18.9	15.7	14.2	*83.07*	*82.08*	*90.45*	16.27				

377435	do	do	45		17.2	14.3	13.4	83.14	85.08	93.71	14.97				
377605	do	do	40		18.4	15.3	15.3	83.15	90.80	100.00	16.33			[4]13.6	7.9
377527		do	60		17.5	14.6	14.4	83.43	89.16	98.63	15.50				7.7
377517	do	do	50		18.2	15.2	14.6	83.52	87.43	96.05	16.00				
277478	do	do	40		17.0	14.2	14.0	83.53	89.74	98.59	15.07			[4]12.9	7.9
377526		do	40		18.3	15.3	15.0	83.61	89.29	98.04	16.20				
377495	do	do	50		18.0	15.1	14.8	83.89	89.43	98.01	15.97				
377487	do	do	25		17.8	15.0	14.5	84.27	88.41	96.67	15.77			13.0	7.8
377505	do	do	35		18.1	15.3	14.4	84.53	86.23	94.12	15.93				7.9
377450	do	do	24		17.0	14.4	14.1	84.71	89.81	97.92	15.17			12.5	[1]7.1
377584	do	do	35		17.2	14.6	13.7	84.88	86.16	93.84	15.17			[4]12.7	7.7
377507	do	do	35		18.0	15.3	14.0	85.00	84.08	91.50	15.77			[4]13.2	7.6
377581		do	24	Slight lateral occipital flattening.	18.0	15.4	14.6	85.56	87.43	94.81	16.00				
377530		do	60		17.6	15.1		85.80							
377502		do	60		17.3	15.0	14.4	86.71	89.16	96.00	15.57				7.9
377579		do	40		17.6	15.3	14.4	86.93	87.54	94.12	15.77				
377576		do	65		17.8	15.5	14.4	87.08	86.49	92.90	15.90				
377489	do	do	75	Slight or none	17.6	15.4	15.2	87.50	92.12	98.70	16.07				
377521		do	45	Slight lateral occipital flattening.	17.4	15.3	13.9	87.93	85.02	90.85	15.53				
377467	do	do	35	Moderate occipital flattening.	(16.9)	(14.2)	(14.8)	(84.02)	(95.48)	(104.23)	15.30			13.0	7.7
377580	do	do	25	Moderate lateral occipital flattening.	(16.8)	(14.8)	(13.2)	(88.10)	(83.54)	(89.19)	14.93				
Specimens					(50)	(50)	(47)	(50)	(47)	(47)	(49)			(17)	(22)
Totals					903.0	738.5	675.8				769.61			217.2	167.7
Averages					18.1	14.8	14.4	81.78	87.64	97.43	15.7			12.8	7.6
Minima					17.0	13.2	13.4	73.94	81.71	90.45	14.93			12.0	7.1
Maxima					18.9	15.7	15.3	87.93	96.69	110.61	16.37			13.6	8.1

MELBOURNE

331421	U.S.N.M.	Near Melbourne	35		18.4	14.8	14.8	80.4	89.2	100.0	16.00	1,620			
331422	do	do	60		18.8	15.2	14.4	80.9	84.7	94.7	16.13	1,630		13.2	8.1
331411	do	do	70		18.0	15.0	14.0	83.3	84.9	93.3	15.67	1,450			[1]7.8
331413	do	do	60		17.6	15.0	14.0	85.2	85.9	93.3	15.53	1,490		13.3	[1]8.2
331415	do	do	55		17.2	15.0		87.2							
331409	do	do	60	Slight occipital or none.	17.5	15.5	14.4	88.6	87.3	92.9	15.80	1,470		12.8	7.6
Specimens					(6)	(6)	(5)	(6)	(5)	(5)	(5)	(5)		(3)	(4)
Totals					107.5	90.5	71.6				79.13	7,660		39.3	31.7
Averages					17.9	15.1	14.3	84.19	86.37	94.83	15.86	1,532.0		13.1	7.9
Minima					17.2	14.8	14.0	80.4	84.7	92.9	15.53	1,450		12.8	7.6
Maxima					18.8	15.5	14.8	88.6	89.2	100.0	16.13	1,630		13.3	8.2

[1] Near.
[4] Restored.

FLORIDA, EAST COAST: MALES—Continued

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
INDIAN RIVER															
242621	U.S.N.M.	Indian River	Senile		19.0	15.1	15.0	*79.5*	*88.0*	*99.3*	16.37	1,700			
20-2317	A.M.N.H.	East Peninsula of Indian River.	Adult		18.6	14.9	14.8	*80.11*	*88.4*	*93.3*	16.10				6.9
MICCO															
20-2317b	A.M.N.H.	Micco	Adult		19.2	14.7	14.8	*76.56*	*87.32*	*100.68*	16.23				8.2
1-4164	do	do	do		18.9	14.8	14.7	*78.31*	*87.24*	*99.32*	16.13	1,460		12.9	7.9
VERO															
292754	U.S.N.M.	Near Vero	Adult	Slight asymmetry	17.9	14.5	14.6	*81.0*	*90.1*	*100.7*	15.67	1,425		12.9	8.1
292778	do	do	do		17.4	14.4	14.8	*82.8*	*93.1*	*102.8*	15.53	1,320		12.6	7.9
LAKE OKEECHOBEE															
228338	U.S.N.M.	Lake Okeechobee	Adult		17.6	13.2	High	*75.0*						12.2	[1]7.1
228451	do	do	do		18.2	13.9	14.2	*76.4*	*85.8*	*102.2*	15.77	1,440		13.1	7.7
243688	do	do	do		17.5	13.5	14.0	*77.1*	*90.3*	*103.7*	15.0			11.4	
CANAL POINT															
345883	U.S.N.M.	Canal Point	55		19.0	14.0	13.8	*73.7*	*83.6*	*98.6*	15.60	1,510			
345769	do	do	25		18.2	14.4	14.7	*79.1*	*90.2*	*80.8*	15.77	[1]1,600			
345889	do	do	60		18.2	14.8		*81.3*				[1]1,550			

BOYNTON															
327802	U.S.N.M.	Near Boynton	30		18.1	14.4	14.7	*79.6*	*90.5*	*102.1*	15.73	1,475		12.5	7.8
MIAMI															
332100 [5]	U.S.N.M.	Near Miami	Adult		18.6	14.2	14.6	*76.3*	*89.0*	*102.8*	15.80	1,485		12.3	[1] 7.2
228462	do	Miami	do		18.6	14.5	15.5	*78.0*	*93.6*	*106.9*	16.20	1,650		12.2	7.4
SOUTHERN FLORIDA															
219417	U.S.N.M.	Southern Florida	Adult		18.6	14.7		*79.0*							
BELLEGLADE															
Provisional No.															
35	U.S.N.M.	Belleglade	50		[1] 19.2	14.2	14.5	*73.96*	*86.83*	*102.11*	15.97				7.8
6	do	do	40		18.4	14.4		*78.26*							
38	do	do	50		18.6	14.6	14.4	*78.49*	*86.76*	*98.63*	15.87				
31	do	do	Old		18.8	14.8		*78.72*							
39	do	do	25		[1] 18.3	14.6	14.6	*79.78*	*88.75*	*100.0*	15.83				
9	do	do	60		18.0	14.4		*80.0*							
23	do	do	60		17.8	14.3	14.6	*80.34*	*90.97*	*102.10*	15.57				
28	do	do	Old		18.1	14.7		*81.22*							
17	do	do	55	Slight or no occipital flattening	17.2	14.0	14.2	*81.40*	*91.03*	*101.43*	15.13			[4] 12.3	7.4
22	do	do	35		18.0	14.7	13.4	*81.67*	*81.96*	*91.16*	15.37				
5	do	do	60		18.7	15.3		*81.82*							
41	do	do	35		18.5	15.2	14.5	*82.16*	*86.05*	*95.39*	16.07			13.0	7.8
18	do	do	40		18.0	14.8	14.9	*82.22*	*90.85*	*100.68*	15.90				
19	do	do	35		18.0	14.8	14.2	*82.22*	*86.59*	*95.95*	15.67				
32	do	do	Old		18.0	14.8	14.4	*82.22*	*87.80*	*97.30*	15.73				
27	do	do	Elderly		17.6	14.7	15.0	*83.52*	*92.88*	*102.04*	15.77				
42	do	do	Old		18.4	15.6		*84.78*							
Specimens					(17)	(17)	(11)	*(17)*	*(11)*	*(11)*	(11)			(2)	(3)
Totals					309.6	249.9	158.7				172.88			25.3	23.0
Averages					18.2	14.7	14.4	*80.72*	*88.19*	*98.76*	15.72			12.7	7.7
Minima					17.2	14.0	13.4	*73.96*	*81.96*	*91.16*	15.13			12.3	7.4
Maxima					19.2	15.6	15.0	*84.78*	*92.88*	*102.11*	16.07			13.0	7.8

[1] Near. [4] Restored. [5] Seminole.

FLORIDA, EAST COAST: MALES—Continued

ST. JOHNS RIVER

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a \times 100}{c}\right)$	*Facial Index, upper* $\left(\frac{b \times 100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth, maxim.	*Nasal Index*	Upper Alveolar Arch, length, maxim.	Upper Alveolar Arch, breadth, maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal, minim.
							°	°														
1809																						
1803																						
1781	15.1		*47.7*												5.2	2.4	*46.2*					
1804																						
1805																						
1802	14.6		*54.1*												5.5	2.35	*42.7*					
1807																						
1790															5.4							
1810	14.5														5.4							
1782	15.0		*47.3*												5.0	2.3	*46.0*					
1785																						
1797																						
1784	[1] 15.4	*86.4*	*48.7*												4.9	2.4	*49.0*					
1796																						
1792 [2]																						
1811																						
Specimens	(5)	*(1)*	*(4)*												(6)	(4)	*(4)*					
Totals	74.6														31.4	9.45						
Averages	14.9		*49.42*												5.2	2.4	*45.87*					
Minima	14.5		*47.3*												4.9	2.3	*42.7*					
Maxima	15.4		*54.1*												5.5	2.4	*49.0*					

AMELIA ISLAND, ST. AUGUSTINE, NEW SMYRNA

242662	------	------	------	10.4	9.4	10.6	71.0	57.0	3.7	3.6	4.0	4.0	92.5	90.0	5.2	2.2	42.3	5.3	6.55	89.9	3.5	------
178813	12.7	------	54.3	9.3	8.4	9.55	71.0	58.0	3.15	3.1	3.7	3.6	85.1	86.1	4.9	2.2	44.9	5.4	6.0	90.0	------	------
242664	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
212625	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
242619	13.8	------	------	------	8.7	9.8	------	------	3.7	3.7	4.1	4.0	90.2	92.5	5.3	2.5	47.2	------	6.5	------	------	------
242650	14.2	------	51.4	9.8	8.8	10.0	69.5	53.0	3.8	3.85	4.0	3.95	95.0	97.5	5.5	2.9	52.7	5.2	6.9	75.4	------	9.3
212624	[1] 14.2	82.4	------	[1] 10.2	9.0	9.4	------	------	3.7	3.6	4.1	4.0	90.2	90.0	5.5	2.5	45.4	------	6.5	------	------	------
330836	[1] 14.9	------	53.0	10.6	9.1	10.4	67.0	50.5	3.7	------	------	4.2	------	------	------	------	------	------	------	------	3.7	------
Specimens	(5)	(1)	(3)	(5)	(6)	(6)	(4)	(4)	(6)	(5)	(5)	(6)	(5)	(5)	(5)	(5)	(5)	(3)	(5)	(3)	(2)	(1)
Totals	69.8	------	------	50.3	53.4	59.75	278.5	218.5	21.75	17.85	19.9	23.75	------	------	26.4	12.3	------	15.9	32.45	------	7.2	------
Averages	14.0	------	52.87	10.1	8.9	9.95	69.6	54.6	3.6	3.6	4.0	4.0	90.70	91.30	5.3	2.5	46.59	5.3	6.5	81.75	3.6	------
Minima	12.7	------	51.4	9.3	8.4	9.4	67.0	50.5	3.15	3.1	3.7	3.6	85.1	86.1	4.9	2.2	42.3	5.2	6.0	75.4	3.5	------
Maxima	14.9	------	54.3	10.6	9.4	10.6	71 0	58.0	3.8	3.85	4.1	4.2	95.0	97.5	5.5	2.9	52.7	5.4	6.9	90.0	3.7	------

ORMOND BEACH

372603	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
372615	[1] 14.5	86.21	49.66	10.8	9.8	10.8	70.5	56.0	3.3	3.3	3.9	3.7	84.62	89.19	5.15	3.2	62.14	------	------	------	------	------
372649	------	------	------	------	------	------	------	------	3.6	3.6	3.8	3.8	94.74	94.74	5.5	2.5	45.45	5.7	6.4	89.06	------	------
372645	14.1	90.07	51.77	------	------	------	------	------	------	------	------	------	------	------	5.2	2.7	51.92	5.7	6.6	86.36	------	------
372317	14.0	86.43	52.14	10.0	8.9	10.2	70.0	54.0	3.4	------	3.7	------	91.89	------	5.2	2.8	53.85	5.7	6.2	91.94	------	------
372640	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
372628	------	------	------	------	------	10.2	------	------	------	------	------	------	------	------	5.3	2.25	42.45	5.7	6.5	87.69	------	------
372653	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
372641	[1] 14.8	85.81	50.0	10.7	9.6	10.8	71.0	51.5	3.6	3.7	3.9	3.9	92.31	94.87	5.5	2.6	47.27	5.7	6.7	85.07	------	------
Specimens	(4)	(4)	(4)	(3)	(3)	(4)	(3)	(3)	(4)	(3)	(4)	(3)	(4)	(3)	(6)	(6)	(6)	(5)	(5)	(5)	------	------
Totals	57.4	------	------	31.5	28.3	42.0	211.5	161.5	13.9	10.6	15.3	11.4	------	------	31.85	16.05	------	28.5	32.4	------	------	------
Averages	14.4	87.11	50.87	10.5	9.4	10.5	70.5	53.83	3.5	3.5	3.8	3.8	90.85	92.98	5.3	2.7	50.39	5.7	6.5	87.96	------	------
Minima	14.0	85.81	49.66	10.0	8.9	10.2	70.0	51.5	3.3	3.3	3.7	3.7	84.62	89.19	5.15	2.25	42.45	5.7	6.2	85.07	------	------
Maxima	14.8	90.07	52.14	10.8	9.8	10.8	71.0	56.0	3.6	3.7	3.9	3.9	94.74	94.87	5.5	3.2	62.14	5.7	6.6	91.94	------	------

[1] Near.

[2] Syphilitic.

FLORIDA, EAST COAST: MALES—Continued

CANAVERAL

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a \times 100}{c}\right)$	*Facial Index, upper* $\left(\frac{b \times 100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
							°	°														
377465	15.3				10.0	11.5			3.4	3.25	3.9	4.0	87.18	81.25	5.2	2.35	45.19					
377466	[1] 14.4	87.50	50.00	10.6	9.2	10.3	68.0	49.5	3.4	3.5	4.0	4.0	85.00	87.50	5.05	2.4	47.62	5.7	6.1	93.44		
377428	[1] 14.9	85.91	50.34	10.9	9.8	10.8	69.0	58.5		3.5		4.0		87.50	5.0	2.4	48.0	5.9	6.9	85.51		
377501	[1] 14.7					10.4																
377582						10.4												5.8	6.8	85.29		
377473						10.7																
377471	14.0	92.14	53.57	10.1	9.0	9.6	64.0	58.0	3.35	3.15	3.9	3.9	85.90	80.77	4.9	2.4	48.98	5.7	[1] 6.5	87.69		
377493	14.2	92.25	54.93	10.8	9.4	10.4	65.5	51.5	3.55	3.45	4.0	3.9	88.75	88.46	5.3	2.7	50.94	6.1	6.8	89.71		
377513	14.9	80.54	46.31	10.0	9.0	10.5	74.0	54.5	3.55	3.45	3.8	3.6	93.42	95.83	5.0	2.1	42.0	5.6	6.1	91.80		
377458	[1] 14.5				10.0	10.8			3.5		4.1		85.37		5.0	2.65	53.0					
377602	14.4	86.11	52.08	10.4	9.2	10.6	70.0	54.0	3.6	3.6	4.2	4.1	85.71	87.80	5.2	2.7	51.92	5.5	6.8	80.88		
377435	15.0	86.67	50.67	11.2	10.2	11.3	71.0	58.0	3.5	3.5	4.0	3.9	87.50	89.74	5.35	2.4	49.86	5.9	7.0	84.29		
377574				10.6	9.2	11.1	71.0	51.5	3.8	3.85	4.1	4.0	92.68	96.25	5.65	2.6	46.02	5.7	6.4	89.06		
377481	14.5	87.59	52.41	10.7	9.6	10.6	68.0	56.0	3.5	3.55	4.1	4.15	85.37	85.54	5.3	2.5	47.17	5.9	6.6	89.39		
377525	14.5					10.6			3.45	3.4	3.9	3.85	88.46	88.31	5.2	2.7	51.92					
377446						10.5																
377441	15.9		50.94	10.4	9.4	11.0	71.5	59.0	3.9	4.0	4.2	4.0	92.86	100.00	5.8	2.8	48.28	6.1	7.0	87.14		
377609																						
377578	[1] 14.6					10.8																
377437																						
377490	[1] 14.9					10.2																
377500						10.3												5.4	6.7	80.60		
377577	13.7	90.51	52.55	10.1	8.8	9.8	66.5	51.0	3.65	3.6	3.85	3.7	94.81	97.30	4 95	2.45	49.49	5.6	6.8	82.35		
377655	14.2	87.32	52.82	9.6	8.6	9.8	68.5	58.0	3.6	3.6	3.9	3.9	92.31	92.31	5.15	2.4	46.60					
377653	14.5																	5.8	6.5	89.23		
377528	14.9					10.4				3.35		3.7		90.54								
377447	14.8				8.9	10.3			3.45	3.5	4.1	4.0	84.15	87.50	5.3	2.4	45.28					
377529						10.6																
377575	[1] 14.7				8.2	9.6			3.5		4.0		87.50		5.3	2.3	43.40					
377583						9.6																

377439						10.9																
377435	[1]13.5					9.8				3.65		4.0		91.25								
377605	[1]15.4	88.31	51.30	10.7	9.6	10.9	69.5	53.5	3.2	3.2	4.3	4.2	74.42	76.19	5.2	2.45	47.12					
377527	14.9		51.68	9.6	8.8	10.4	73.0	62.0		3.85		3.85		100.00	5.5	2.4	43.64					
377517	[1]15.8					10.7																
377478	14.3	90.21	55.24	10.8	9.4	10.7	67.5	52.5	3.5		3.9		89.74		5.3	2.5	47.17	5.9	6.5	90.77		
377526	[1]15.8					11.0																
377495						9.7																
377487	15.2	85.53	51.32	10.7	9.6	10.7	68.5	56.0	3.5		4.2		83.35		5.5	2.6	47.27	5.6	6.7	83.58		
377505	15.8		50.00	10.4	9.4	11.0	72.5	57.0	3.85	3.8	4.25	4.2	90.59	90.48	5.65	2.5	44.25	5.9	[1]7.2	81.94		
377450				[1]9.5	8.4	10.0	72.0	48.0		3.5		3.7		94.59	5.4	2.6	48.15					
377584	[1]14.3	88.81	53.85			9.6									5.6	2.4	42.86	5.3	6.5	81.54		
377507	[1]15.1	87.42	50.33	10.7	9.5	10.4	66.5	56.5	3.8		4.1		92.68		5.15	2.5	48.54	5.9	6.8	86.76		
377581						10.0																
377530																						
377502	[1]15.1		52.32	10.4	9.4	10.9	71.5	60.5		3.7		4.1		90.24	5.3	2.4	45.28					
377576						10.8																
377579						10.5																
377489	[1]14.7				8.8	10.2			3.45	3.5	4.0	3.9	86.25	89.74	5.3	2.5	47.17					
377521						9.9																
377467	14.8	87.84	52.03	10.4	9.4	10.3	67.0	59.5	3.3	3.3	4.1	4.1	80.49	80.49	5.0	2.6	52.0	5.8	6.9	84.06		
377580						(9.7)																
Specimens	(34)	(16)	(20)	(21)	(26)	(47)	(21)	(21)	(23)	(24)	(23)	(24)	(23)	(24)	(28)	(28)	(28)	(20)	(20)	(20)		
Totals	502.2			218.6	240.9	490.9	1,455.	1,165.0	80.3	84.75	92.9	94.75			147.55	69.7		115.1	133.6			
Averages	14.8	87.73	51.68	10.4	9.3	10.4	69.29	55.48	3.5	3.5	4.04	3.9	86.44	89.45	5.3	2.5	47.24	5.8	6.7	86.15		
Minima	13.5	80.54	46.31	9.5	8.2	9.6	64.0	48.0	3.2	3.2	3.8	3.6	74.42	76.19	4.9	2.1	42.0	5.3	6 1	80.60		
Maxima	15.9	92.25	55.24	11.2	10.2	11.5	74.0	62.0	3.9	4.0	4.3	4.2	94.81	100.	5.8	2.8	53.0	6.1	7.2	93.44		

MELBOURNE

							°	°														
331421						10.9																9.0
331422	15.5	85.2	52.3	11.0	9.8	10.8	67.0	56.0	3.9	3.95	4.15	4.1	94.0	96.3	5.6	2.6	46.4	6.0	7.0	85.7	3.9	10.6
331411	14.4		54.2			9.8			3.75		3.9		96.2		5.4	2.6	48.2				3.3	9.6
331413	15.5	85.8	52.9		9.0	10.2			3.7	3.7	3.9	3.9	94.9	94.9	5.6	2.35	42.0				3.9	10.1
331415	15.1																					9.7
331409	15.5	82.6	49.0	10.8	9.4	10.4	61.0	50.0	3.7		4.0		92.5		5.3	2.3	43.4	5.7	7.1	80.3	3.6	10.6
Specimens	(5)	(3)	(4)	(2)	(3)	(5)	(2)	(2)	(4)	(2)	(4)	(2)	(4)	(2)	(4)	(4)	(4)	(2)	(2)	(2)	(4)	(6)
Totals	76.0			21.8	28.2	52.1	128.0	106.0	15.05	7.65	15.95	8.0			21.9	9.85		11.7	14.1		14.7	59.6
Averages	15.2	84.52	52.05	10.9	9.4	10.6	64.0	53.0	3.8	3.8	4.0	4.0	94.36	95.63	5.5	2.46	44.98	5.85	7.05	82.98	3.8	10.0
Minima	14.4	82.6	49.0	10.8	9.0	9.8	61.0	50.0	3.7	3.7	3.9	3.9	92.5	94.9	5.3	2.3	42.0	5.7	7.0	80.3	3.3	9.0
Maxima	15.5	85.8	54.2	11.0	9.8	10.9	67.0	56.0	3.9	3.95	4.15	4.1	96.2	96.3	5.6	2.6	48.2	6.0	7.1	85.7	3.9	10.6

[1] Near.

FLORIDA, EAST COAST: MALES—Continued

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index total* $\left(\frac{a\times100}{c}\right)$	*Facial Index upper* $\left(\frac{b\times100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal, minim.
INDIAN RIVER																						
242621	15.1	----	----	----	9.4	10.7	°	°	3.3	3.3	4.1	4.0	*80.5*	*82.5*	5.4	2.85	*52.8*	----	----	----	----	----
20-2317	----	----	----	----	----	----	----	----	*Mean* 3.9		*Mean* 4.15		*Mean* *93.98*		5.2	2.75	*52.9*	----	----	----	----	----
MICCO																						
20-2317b	----	----	----	----	----	----	----	----	*Mean*		*Mean*		*Mean*		5.8	2.55	*43.97*	----	----	----	----	----
1-4164	[1] 15.3	*84.31*	*51.63*	----	----	----	----	----	3.45		4.3		*80.23*		5.35	2.6	*48.60*	----	----	----	----	----
VERO																						
292754	14.6	*88.4*	*55.5*	10.6	9.6	10.9	70.0	61.0	3.6	3.5	3.9	3.9	*92.3*	*89.7*	5.55	2.55	*45.9*	[1] 5.7	----	----	3.8	----
292778	14.1	*89.4*	*56.0*	11.0	10.0	11.2	71.0	59.0	3.6	3.6	4.1	4.1	*87.8*	*87.8*	5.6	2.8	*50.0*	5.6	6.45	*86.8*	----	----
LAKE OKEECHOBEE																						
228338	14.6	*83.6*	*48.6*	[1] 10.5	9.4	10.6	71.0	57.0	----	----	[1] 3.9	3.9	----	----	4.8	2.4	*50.0*	5.5	6.6	*83.3*	4.2	----
228451	13.8	*94.9*	*55.8*	[1] 10.0	9.0	10.45	71.5	58.0	3.45	3.5	4.0	3.9	*86.2*	*89.7*	5.5	2.5	*45.4*	5.5	6.6	*83.3*	4.2	----
243688	13.1	*87.0*	----	----	----	----	----	----	----	----	----	----	----	----	4.9	2.5	*51.0*	----	----	----	----	----
CANAL POINT																						
345883	----	----	----	----	----	10.2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
345769	----	----	----	----	----	10.1	----	----	----	3.25	----	3.8	----	*85.5*	----	----	----	----	----	----	3.5	9.5
345889	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	10.2

BOYNTON																						
327802	14.0	89.3	55.7	11.0	9.7	10.3	64.0	52.5	------	3.2	------	3.55	------	90.1	5.4	2.5	46.3	6.2	6.8	91.2	3.6	9.3
MIAMI																						
332100	14.15	86.9	50.9	[1] 10.3	9.35	10.6	72.0	57.0	3.4	3.15	4.0	4.0	85.0	78.8	5.25	2.5	47.6	5.5	(6.8)	(80.9)	3.7	------
228462	14.0	87.1	52.9	9.9	9.0	10.65	74.5	60.0	3.6	3.7	4.0	4.1	90.0	97.6	5.3	2.45	46.2	5.4	6.5	83.1	3.6	------
SOUTHERN FLORIDA																						
219417	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
BELLEGLADE																						
Provisional No.																						
35	14.2	------	54.93	10.8	8.8	10.2	° 64.0	° 38.5	3.4	3.4	4.0	4.0	85.0	85.0	5.35	2.7	50.47	6.2	6.7	92.54	------	------
6	15.5	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
38	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
31	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
39	------	------	------	------	------	10.9	------	------	------	------	------	------	------	------	------	------	------	6.1	6.9	88.41	------	------
9	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
23	------	------	------	------	------	10.4	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
28	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
17	14.3	86.01	51.75	10.0	9.0	10.4	71.5	54.5	3.7	3.75	4.1	3.9	90.24	96.15	5.5	2.9	52.73	5.5	6.7	82.09	------	------
22	14.2	------	------	------	------	9.7	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
5	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
41	14.8	87.84	52.70	10.3	9.2	10.6	70.0	56.0	3.55	3.6	3.85	3.8	92.21	94.74	5.5	2.85	51.82	5.7	7.1	80.28	------	------
18	[1] 14.9	------	------	------	------	10.4	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
19	------	------	------	------	------	11.4	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
32	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
27	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
42	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Specimens	(6)	(2)	(3)	(3)	(3)	(8)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(4)	(4)	(4)	------	------
Totals	87.9	------	------	31.1	27.0	84.0	205.5	149.0	10.65	10.75	11.95	11.7	------	------	16.35	8.45	------	23.5	27.4	------	------	------
Averages	14.65	86.94	53.12	10.4	9.0	10.5	68.5	49.67	3.6	3.6	4.0	3.9	89.12	91.88	5.45	2.8	51.68	5.9	6.85	85.77	------	------
Minima	14.2	86.01	51.75	10.0	8.8	9.7	64.0	38.5	3.4	3.4	3.85	3.8	85.0	85.0	5.35	2.7	50.47	5.5	6.7	80.28	------	------
Maxima	15.5	87.84	54.93	10.8	9.2	11.4	71.5	56.0	3.7	3.75	4.1	4.0	92.21	96.15	5.5	2.9	52.73	6.2	7.1	92.54	------	------

[1] Near.

FLORIDA, WEST COAST: MALES

PENSACOLA BAY

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
242665	U.S.N.M.	Pensacola Bay	Adult		18.6	13.7	14.9	*73.7*	*92.3*	*108.8*	15.73	1,610			7.7
242631	do	do	do	Slight lateral occipital flattening.	17.7	14.4	14.7	*81.4*	*91.6*	*102.0*	15.60			12.9	8.1
242630	do	do	do		18.8	15.4		*81.9*							
242671	do	do	do		17.4	14.3		*82.2*							7.1
242632	do	do	do	Moderate occipital flattening.	(16.7)	(15.3)	(14.8)	*(91.6)*	*(92.5)*	*(96.7)*	15.60	1,500	Moderate	(15.0)	(8.9)
242670	do	do	do	Pronounced occipital flattening.	(18.3)	(15.6)	(14.8)				16.23				
Specimens					(4)	(4)	(2)	*(4)*	*(2)*	*(2)*	(4)	(2)		(1)	(3)
Totals					72.5	57.8	29.6				63.16	3,110			22.9
Averages					18.1	14.5	14.8	*78.96*	*91.93*	*105.54*	15.79	1,555			7.6
ST. ANDREWS BAY—APALACHICOLA															
2194	A. N. S. P.	St. Andrews Bay	Adult	Moderate frontal (not affecting dimensions).	18.1	14.7	13.8	*81.2*	*84.2*	*93.9*	15.53				7.3
2188	do	Near Apalachicola	do		17.2	14.0	13.6	*81.4*	*87.2*	*97.1*	14.93				6.6
GAINESVILLE															
242683	U.S.N.M.	Gainesville	Adult		17.8	14.5	14.5	*81.5*	*89.8*	*100.0*	15.60	1,420			[1]7.0

CEDAR KEYS

227499	U.S.N.M.	Cedar Keys	Adult		18.9	14.5	14.2	*76.7*	*85.0*	*97.9*	15.87				8.4
2204	A. N. S. P.	do	do		18.4	14.2	14.0	*77.2*	*85.9*	*98.6*	15.53				7.0
2200	do	do	do		18.0	14.0	14.0	*77.8*	*87.5*	*100.0*	15.33				6.8
2199	do	do	do		17.5	13.8	14.3	*78.9*	*91.4*	*103.6*	15.20				
2205	do	do	do		17.6	14.0	13.7	*79.6*	*86.7*	*97.9*	15.10				7.0
2202	do	do	do		17.7	14.4	14.1	*81.4*	*87.9*	*97.9*	15.40				7.6
2197	do	do	do		16.5	13.6	13.6	*82.4*	*90.4*	*100.0*	14.57				7.3
2203	do	do	do	Slight frontal occipital flattening.	18.1	15.0	14.4	*82.9*	*87.0*	*96.0*	15.83			12.7	7.6
2198	do	do	do		17.8	14.8	14.4	*83.2*	*88.3*	*97.3*	15.67				7.3
16533	U.S.N.M.	do	do		17.5	14.7		*84.0*							
16332	do	do	do	Slight lateral occipital flattening.	17.9	15.1	14.2	*84.4*	*86.1*	*94.0*	15.73	1,460		13.5	8.4
2196	A. N. S. P.	do	do		16.8	14.4	13.8	*85.7*	*88.5*	*95.8*	15.0				6.9
242611	U.S.N.M.	do	do	Pronounced frontal occipital flattening	(17.4)	(15.8)		*(90.8)*				1,490			[1] 6.9
Specimens					(12)	(12)	(11)	*(12)*	*(11)*	*(11)*	(11)	(2)		(2)	(11)
Totals					212.70	172.5	154.7				169.23	2,950.0		26.20	81.20
Averages					17.7	14.4	14.0	*81.10*	*87.65*	*98.04*	15.4	1,475.0		13.1	7.4
Minima					16.5	13.6	13.6	*76.7*	*85.0*	*94.0*	14.57	1,460.0		12.7	6.8
Maxima					18.9	15.1	14.4	*85.7*	*91.4*	*103.6*	15.87	1,490.0		13.5	8.4

OCALA

225081	U.S.N.M.	Ocala	Adult		17.8	14.2	14.6	*79.8*	*91.2*	*102.8*	15.53				7.6

WITHLACOOCHEE RIVER

1-2860	A.M.N.H.	Withlacoochee River	Adult		18.3	14.2		*77.60*							
1-2861	do	do	do		18.1	14.2	13.9	*78.45*	*86.07*	*97.89*	15.40				
1-2852	do	do	do		18.5	14.6	14.7	*78.92*	*88.82*	*100.68*	15.93				
1-2862	do	do	do		18.7	15.0		*80.21*							
1-2855	do	do	do		17.4	14.1		*81.03*							
1-2851	do	do	do		17.6	14.9	15.1	*84.66*	*92.92*	*101.34*	15.87				7.2
1-2867	do	do	do		18.5	15.8	14.6	*85.41*	*85.13*	*92.41*	16.30	1,630			
Specimens					(7)	(7)	(4)	(7)	(4)	(4)	(4)	(1)			(1)
Totals					127.10	102.8	58.3				63.5				
Averages					18.2	14.7	14.6	*80.88*	*88.20*	*97.98*	15.88				
Minima					17.4	14.1	13.9	*77.60*	*85.13*	*92.41*	15.40				
Maxima					18.7	15.8	15.1	*85.41*	*92.92*	*101.34*	16.30				

[1] Near.

FLORIDA, WEST COAST: MALES—Continued

TARPON SPRINGS

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
16099	W. I.	Tarpon Springs	Adult		18.8	14.4		76.6							
15782	do	do	do	Slight frontal occipital flattening.	18.1	14.2	14.0	78.4	86.7	98.6	15.43				
15851	do	do	do		18.4	14.6	14.7	79.4	89.1	100.7	15.90				
15853	do	do	do		18.4	14.7	14.0	79.9	84.6	95.2	15.70				
16007	do	do	do		18.4	14.7		79.9							
15791	do	do	do	Slight frontal flattening.	18.5	14.8	14.2	80.0	85.3	96.0	15.83				
16001	do	do	do		18.5	14.8		80.0							
16012	do	do	do		18.2	14.6	14.2	80.2	86.6	97.3	15.67				7.8
15788	do	do	do		17.8	14.3	14.1	80.3	87.8	98.6	15.40				
15849	do	do	do		18.4	14.8	14.4	80.4	86.8	97.3	15.87				
15485	do	do	do		18.0	14.6	13.9	81.1	85.3	95.2	15.50				
15852	do	do	do	Slight occipital flattening.	18.4	15.0	13.8	81.5	82.6	92.0	15.73				
15961	do	do	do		18.6	15.5		83.3							
15855	do	do	do	Slight frontal occipital flattening.	17.6	14.7	14.0	83.5	86.7	95.2	15.43				7.3
15856	do	do	do		17.8	14.9	13.6	83.7	83.2	91.3	15.43				8.1
15858	do	do	do		17.4	14.6		83.9							
15958	do	do	do		17.4	14.6		83.9							
15481	do	do	do		17.9	15.1	14.3	84.4	86.7	94.7	15.77				
15844	do	do	do		17.9	15.1	14.6	84.4	88.5	96.7	15.87				
15790	do	do	do		18.6	15.7		87.2							
Specimens					(20)	(20)	(13)	(20)	(13)	(13)	(13)				(3)
Totals					362.5	295.7	183.8				203.53				23.2
Averages					18.1	14.8	14.1	81.57	86.13	96.03	15.66				7.7
Minima					17.4	14.2	13.6	76.6	82.6	91.3	15.40				7.3
Maxima					18.8	15.7	14.7	87.2	89.1	100.7	15.90				8.1

HOG ISLAND

Seen locally		Hog Island	50		18.5	13.9	13.9	75.1	85.8	100.0	15.43			13.8	8.6
2207	A. N. S. P.	do.	Adult		17.7	14.0	13.8	79.1	87.1	98.6	15.17			12.7	7.8
22020	do.	do.	do.		17.7	14.0	14.2	79.1	89.6	101.4	15.30				6.6
22022	do.	do.	do.		18.2	14.4	14.9	79.1	91.4	103.5	15.83				8.1
22024	do.	do.	do.		17.8	14.1	14.0	79.2	87.8	99.3	15.30				7.6
22023	do.	do.	do.		17.0	13.7	13.1	80.6	85.3	95.6	14.60				7.6
2209	do.	do.	do.		17.6	14.2	14.2	80.7	89.3	100.0	15.33			12.9	7.2
2206	do.	do.	do.		17.8	14.1	14.0	80.9	87.0	97.2	15.40				7.8
2208	do.	do.	do.		17.2	14.0	13.6	81.4	87.2	97.1	14.93				7.2
22021	do.	do.	do.		17.7	14.4	14.5	81.4	90.3	100.7	15.53			12.9	7.8
Specimens					(10)	(10)	(10)	(10)	(10)	(10)	(10)			(4)	(10)
Totals					177.2	141.1	140.2				152.82			52.30	76.3
Averages					17.7	14.1	14.0	81.94	88.09	99.86	15.28			13.1	7.6
Minima					17.0	13.7	13.1	75.1	85.3	95.6	14.60			12.7	6.6
Maxima					18.5	14.4	14.9	81.4	91.4	103.5	15.83			13.8	8.6

ANCLOTE RIVER

242684	U.S.N.M.	Anclote River	Adult		18.4	14.7	14.8	79.9	89.4	100.7	15.97				

SAFETY HARBOR

350372	U.S.N.M.	Safety Harbor	50		19.4	14.3		73.7							
350298	do.	do.	60		19.2	14.4	14.0	75.0	83.3	97.2	15.87				
350354	do.	do.	65		18.5	14.0	14.3	75.7	86.7	102.1	15.60	[1] 1,480		13.1	8.1
350325	do.	do.	40		17.6	13.6	13.9	77.3	89.1	102.2	15.03			12.9	7.7
350317	do.	do.	55		18.6	14.4	13.8	77.4	83.6	95.8	15.60				
350285	do.	do.	60		[1] 18.5	14.5		78.4							
350320	do.	do.	50		18.7	14.7	13.8	78.6	82.6	93.8	15.73			13.9	8.2
350323	do.	do.	55		18.3	14.4	14.0	78.7	85.6	97.2	15.57	1,500		[1] 12.5	7.7
350311	do.	do.	50		18.0	[1] 14.2	15.2	78.9	94.4	107.0	15.80			13.2	8.1
350277	do.	do.	60	Slight or none	18.7	14.8		79.1				1,510		12.3	7.1
350286	do.	do.	65		18.4	14.6		79.4							
350322	do.	do.	24		17.5	14.1	14.4	80.6	91.1	102.1	15.33	1,420		12.4	7.4
350278	do.	do.	60		17.6	14.2		80.7						13.1	7.7
350321	do.	do.	50		18.2	14.7	14.1	80.8	85.7	95.9	15.67				
350319	do.	do.	45		18.0	14.6		81.1							
350279	do.	do.	50		18.7	15.2		81.3				[1] 1,520		13.3	8.0
350330	do.	do.	40		18.2	14.8		81.3							
350329	do.	do.	45		18.4	15.0		81.5							
350313	do.	do.	70		18.5	15.1		81.6				[1] 1,510		13.4	7.8
350287	do.	do.	40		18.3	15.0		82.0							
350358	do.	do.	35		18.3	15.0		82.0							7.9

[1] Near.

FLORIDA, WEST COAST: MALES—Continued

SAFETY HARBOR—Continued

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
350276	U.S.N.M.	Safety Harbor	65		18.4	15.2	14.7	*82.6*	*87.5*	*96.7*	16.10	1,530		13.5	8.4
350344	do	do	50		18.0	15.0		*83.3*							7.7
350342	do	do	75		17.8	14.9		*83.7*							
350305	do	do	60		17.2	14.6		*84.9*							
350334	do	do	55		17.2	14.6		*84.9*						13.2	8.1
350282	do	do	30	Slight or none	16.6	14.2	14.7	*85.5*	*95.5*	*103.5*	15.17	1,480		12.0	7.0
Specimens					(27)	(27)	(11)	*(27)*	*(11)*	*(11)*	(11)	(8)		(13)	(15)
Totals					490.8	394.1	156.9				171.47	11,950		168.8	116.9
Averages					18.2	14.6	14.2	*80.30*	*87.78*	*98.96*	15.59	1,493.75		13.0	7.8
Minima					16.6	13.6	13.8	*73.7*	*82.6*	*93.8*	15.03	1,420		12.0	7.0
Maxima					19.4	15.2	15.2	*85.5*	*95.5*	*107.0*	16.10	1,530		13.9	8.4

CLEARWATER

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
243688	U.S.N.M.	Clearwater	Adult		17.5	13.5	14.0	*77.1*	*90.3*	*103.7*	15.00	1,475		11.4	7.2
243693	do	do	do		18.4	14.4		*78.3*							
243696	do	do	do	Slight occipital flattening.	18.6	15.0		*80.6*							
243691	do	do	do		18.2	14.8	14.0	*81.3*	*84.8*	*94.6*	15.73	1,400			[1] 8.1
243695	do	do	do		17.6	14.7		*83.5*							
243690	do	do	do		18.6	15.6	15.0	*83.9*	*87.7*	*96.2*	16.40				8.0
243689	do	do	do	Slight occipital flattening.	17.9	15.4	14.0	*86.0*	*84.3*	*90.9*	15.77	1,600			
Specimens					(7)	(7)	(4)	(7)	*(4)*	*(4)*	(4)	(3)		(1)	(3)
Totals					126.8	103.4	57.0				62.9	4,475			23.3
Averages					18.1	14.8	14.3	*81.55*	*86.69*	*96.12*	15.73	1,491.7			7.8
Minima					17.5	13.5	14.0	*77.1*	*84.3*	*90.9*	15.00	1,400			7.2
Maxima					18.6	15.6	15.0	*86.0*	*90.3*	*103.7*	16.40	1,600			8.1

TAMPA BAY

242651	U.S.N.M.	Tampa Bay	50		19.4	14.5		*74.7*				1,620			
242653	do	do	Adult	Slight asymmetry	18.1	13.6	14.6	*75.1*	*92.1*	*107.3*	15.43				7.9
2211	A. N. S. P.	do	do		19.1	14.6	14.2	*76.4*	*84.3*	*97.3*	15.97			11.7	7.0
242640	U.S.N.M.	do	do		18.8	14.4		*76.6*							
2219	A. N. S. P.	do	do		17.6	13.6	13.6	*77.3*	*87.2*	*100.0*	14.93				7.0
242639	do	do	do		19.0	14.7	14.6	*77.4*	*86.6*	*99.3*	16.10				
2216	do	do	do		17.1	13.4	13.6	*78.4*	*89.2*	*101.5*	14.70				7.4
242652	U.S.N.M.	do	do	Very slight, occipital flattening.	17.7	14.0	15.0	*79.1*	*94.6*	*107.1*	15.57			12.2	7.4
242620	do	do	do		18.3	14.5		*79.2*							
2217	A. N. S. P.	do	do		17.0	13.7	13.8	*80.6*	*89.9*	*100.7*	14.83				7.4
362999	U.S.N.M.	Near Tampa	60		17.9	14.5	14.6	*81.0*	*90.1*	*100.7*	15.67	1,550			
2212	A. N. S. P.	do	Adult		18.0	14.6	14.4	*81.1*	*88.3*	*98.6*	15.67				7.5
242630	U.S.N.M.	Tampa	65		18.7	15.4		*82.4*							
242682	do	Tampa Bay	Adult		17.7	14.9		*84.2*							
242613	do	Tampa	60		18.2	16.0		*87.9*							
242610	do	Tampa Bay	Adult	Moderate, occipital flattening.											8.0
Specimens					(15)	(15)	(9)	*(15)*	*(9)*	*(9)*	(9)	(2)		(2)	(8)
Totals					272.6	216.4	128.4				138.87	3,170		23.9	59.6
Averages					18.2	14.4	14.3	*79.38*	*89.10*	*101.34*	15.43	1,585		11.95	7.8
Minima					17.0	13.4	13.6	*74.7*	*84.3*	*97.3*	14.70	1,550		11.7	7.0
Maxima					19.4	16.0	15.0	*87.9*	*94.6*	*107.3*	16.10	1,620		12.2	8.0

WEEDEN ISLAND

329389	U.S.N.M.	Weeden Island	30		17.9	13.6		*76.0*							
329388	do	do	45		18.5	14.2		*76.7*							
329417	do	do	35		18.4	14.2		*77.2*							
329380	do	do	60		19.1	14.8		*77.5*							
329386	do	do	65		18.6	14.9		*79.7*				(1,650)			
329400	do	do	65		18.0	14.5		*80.6*							
329379	do	do	40		18.1	14.6		*80.7*							
329392	do	do	50		17.7	14.5		*81.9*							
329407	do	do	65		18.3	15.4		*84.2*							
329394	do	do	50		17.8	15.0		*84.3*							
329390	do	do	45		16.8	14.4		*85.7*							7.6
329397	do	do	Adult		18.2	15.6		*85.7*							
329399	do	do	70		17.3	15.2		*87.9*							
Specimens					(13)	(13)		*(13)*							(1)
Totals					234.7	190.9									
Averages					18.0	14.7		*81.34*							
Minima					17.3	13.6		*76.0*							
Maxima					19.1	15.6		*87.9*							

[1] Near.

FLORIDA, WEST COAST: MALES—Continued

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
MAXIME CREEK															
242629	U.S.N.M.	Maxime Creek	Adult		18.8	14.9	14.4	*79.3*	*85.5*	*96.6*	16.03				7.6
BOGO SEGO BAY															
331248	U.S.N.M.	Bogo Sego Bay	70	Slight frontal flattening.	18.4	16.0		*87.0*				[1] 1,700			
MANATEE COUNTY															
306701	U.S.N.M.	Manatee County	Adult		18.2	14.9	14.4	*81.9*	*87.0*	*96.6*	15.83	1,430		12.1	7.7
SARASOTA BAY															
225075	U.S.N.M.	Sarasota Bay	Adult		17.9	15.6	13.7	*87.1*	*81.8*	*87.8*	15.73				7.5
PERICO ISLAND															
373476	U.S.N.M.	Perico Island	35		19.3	14.3	14.6	*74.09*	*86.90*	*102.10*	16.07			[2] 12.3	7.2
373621	do	do	40		19.0	14.1	[1] 13.7	*74.21*	*82.78*	*97.16*	15.60			[2] 12.5	7.6
373494	do	do	40		18.5	13.8	14.6	*74.59*	*90.40*	*105.80*	15.63			[2] 13.2	7.8
373595	do	do	35		18.7	14.0		*74.87*							
373498	do	do	60		18.4	13.9	14.8	*75.54*	*91.64*	*106.47*	15.70				
373493	do	do	35		18.2	13.8	13.8	*75.82*	*86.25*	*100.00*	15.27			12.7	7.5
373503	do	do	35		18.8	14.3	14.6	*76.06*	*88.22*	*102.10*	15.90			[2] 13.2	8.0
373597	do	do	30		18.2	13.9		*76.37*							

373487	do	do	55		18.8	14.5	13.6	*77.13*	*81.68*	*93.79*	15.63			[2] 12.7	7.8
373618	do	do	50		18.4	14.3	13.6	*77.72*	*83.18*	*95.10*	15.43			[2] 12.5	7.3
373573	do	do	65	Slight posterior asymmetry.	19.0	14.8	[1] 14.2	*77.89*	*84.02*	*95.95*	16.00				8.2
373543	do	do	40		18.4	14.4	14.2	*78.26*	*86.59*	*98.61*	15.67			[2] 13.1	7.9
373615	do	do	55		19.4	15.2	[1] 14.7	*78.35*	*84.97*	*96.71*	16.43				
373608	do	do	30		18.1	14.2	[1] 13.6	*78.45*	*84.21*	*95.77*	15.30				
373602	do	do	55		18.6	14.6		*78.49*							
373606	do	do	50		18.0	14.2	13.3	*78.89*	*82.61*	*93.66*	15.7			[2] 12.5	7.2
373592	do	do	50		18.1	14.3		*79.01*							
373611	do	do	50		18.6	14.8	[1] 13.7	*79.57*	*82.04*	*92.57*	15.70			[2] 11.9	7.3
373500	do	do	30		18.5	14.8	14.0	*80.00*	*84.08*	*94.59*	15.77				7.7
373480	do	do	50		17.8	14.3	14.3	*80.34*	*89.10*	*100.00*	15.47			[2] 13.2	7.7
373495	do	do	50		17.9	14.4	13.9	*80.45*	*86.07*	*96.53*	15.40			[2] 11.6	6.9
373530	do	do	45		18.5	14.9	14.2	*80.54*	*85.03*	*95.30*	15.87			[2] 12.6	7.6
373588	do	do	50	Slight lateral occipital flattening.	18.5	14.9	[1] 14.3	*80.54*	*85.63*	*95.97*	15.90				
373612	do	do	40		18.1	14.6		*80.66*						12.5	7.4
373602	do	do	35		17.6	14.2	[1] 13.8	*80.68*	*86.79*	*97.18*	15.20				7.7
373508	do	do	25		18.2	14.7	13.6	*80.77*	*82.67*	*92.52*	15.50			[2] 12.5	7.6
373616	do	do	50		17.7	14.4	[1] 13.8	*81.36*	*85.98*	*95.83*	15.30			[2] 12.0	7.4
373558	do	do	35		18.1	14.8	14.0	*81.77*	*85.11*	*94.59*	15.63				
373561	do	do	70		18.3	15.0	14.1	*81.97*	*84.68*	*94.0*	15.80				
373488	do	do	40		[1] 17.8	14.6	14.4	*82.02*	*33.89*	*98.63*	15.60				
373567	do	do	55		18.7	15.4	14.6	*82.35*	*85.53*	*94.81*	16.23				
373589	do	do	65		18.4	15.2		*82.61*						[2] 12.7	7.7
373572	do	do	35		17.9	15.0		*83.80*							
373537	do	do	35		18.1	15.2	[1] 14.3	*83.98*	*85.89*	*94.08*	15.87				
373650	do	do	45		17.4	14.7		*84.48*							
373477	do	do	40	Possibly slight occipital flattening.	18.0	15.3	14.6	*85.0*	*87.69*	*95.42*	15.97			[2] 12.6	7.4
373579	do	do	45		18.1	15.8	14.7	*87.29*	*86.73*	*93.04*	16.20			[2] 12.9	7.4
373565	do	do	45	Moderate lateral occipital flattening.	(18.6)	(15.0)	(15.3)	*(80.65)*	*(91.07)*	*(102.0)*	16.30			[2] 13.2	7.8
373501	do	do	70	do	(17.7)	(15.0)	(14.0)	*(84.75)*	*(85.63)*	*(93.33)*	15.57				[1] 7.6
373596	do	do	45	Slight occipital flattening.	(17.6)	(15.4)	[1] (14.1)	*(87.50)*	*(85.45)*	*(91.56)*	15.70			[2] 12.7	7.7
Specimens					(37)	(37)	(29)	*(37)*	*(29)*	*(29)*	(32)			(21)	(25)
Totals					678.1	539.6	409.6				503.31			265.1	189.4
Averages					18.3	14.6	14.1	*79.58*	*85.69*	*96.76*	15.73			12.6	7.6
Minima					17.4	13.8	13.3	*74.09*	*82.04*	*92.52*	15.20			11.6	6.9
Maxima					19.4	15.8	14.8	*87.29*	*91.64*	*106.47*	16.43			13.2	8.2

OSPREY

	Seen locally	Osprey	Adult		17.8	13.7	13.6	77.0	86.4	*99.3*	15.03				

[1] Near.
[2] Restored.

FLORIDA, WEST COAST: MALES—Continued

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
CHADWICK BEACH															
331075	U.S.N.M.	Chadwick Beach, Charlotte County.	55		17.7	[1] 15.2	14.3	*85.9*	*86.9*	*94.1*	15.73	1,420			7.5
CHARLOTTE BAY															
300118	U.S.N.M.	Charlotte Bay	Senile		18.5	14.8	13.6	*80.0*	*81.7*	*91.9*	15.63	1,515			[1] 7.4
CAPTIVA ISLAND															
340636	U.S.N.M.	Captiva Island	60		18.8	13.7	13.5	*72.9*	*83.1*	*93.5*	15.33	1,400			
340628	do	do	65		18.0	13.8		*76.7*				[1] 1,500			
340630	do	do	65		19.0	14.6	15.1	*76.8*	*89.9*	*103.4*	16.23	[1] 1,610			
340650	do	do	60		19.4	15.0	14.2	*77.3*	*82.6*	*94.7*	16.20	1,565		13.0	7.8
340666	do	do	60		19.3	15.1	14.8	*78.2*	*86.1*	*98.0*	16.40	1,580			
340675	do	do	60		18.8	14.8		*78.7*							
340680	do	do	55		17.8	14.0	14.3	*78.7*	*89.9*	*102.1*	15.37				
340613	do	do	40		18.4	14.7	[1] 15.0	*79.9*	*90.6*	*102.0*	16.03	[1] 1,630		[1] 12.5	7.6
340653	do	do	60		18.7	15.0	14.0	*80.2*	*83.1*	*93.3*	15.90	1,625		[1] 13.0	7.8
340615	do	do	70		17.8	14.3	12.8	*80.3*	*79.8*	*89.5*	14.97	1,310		12.4	7.3
340632	do	do	70		18.3	14.7		*80.3*				1,540			
340660	do	do	65		18.7	15.1		*80.8*							
340647	do	Captiva Bay	70		17.8	14.4		*80.9*							
340657	do	Captiva Island	40		17.7	14.4	13.2	*81.4*	*82.2*	*91.7*	15.10			12.5	7.1
340635	do	do	65		18.3	14.9	14.4	*81.4*	*86.8*	*96.6*	15.87	1,540			
340645	do	do	45		18.5	15.1		*81.6*							
340637	do	do	55		19.0	15.5	15.1	*81.6*	*87.5*	*97.4*	16.53	1,670		12.5	7.5
340624	do	do	50		17.9	14.6		*81.6*							

340643	do	do	35		17.8	[1]14.6	15.0	*82.0*	*92.6*	*102.7*	15.80				
340662	do	Capitva Bay	60		18.4	15.2		*82.6*							
340618	do	do	70		18.4	15.3		*83.2*				1,530			
340612	do	Captiva Island	75		18.0	15.1		*83.9*				1,490			
340621	do	do	30		18.1	15.2	[1] 13.6	*84.0*	*81.7*	*89.5*	15.63	1,500			
340664	do	do	Adult		17.6	15.0		*85.2*				[1] 1,550			
340670	do	do	70		17.9	15.4		*86.0*				1,530			
340678	do	do	Adult	Moderate asymmetry.	17.4	15.0	14.3	*86.2*	*88.3*	*95.3*	15.57				
Specimens					(26)	(26)	(14)	*(26)*	*(14)*	*(14)*	(14)	(16)		(6)	(6)
Totals					475.8	384.5	199.3				220.93	24.570		75.9	45.1
Averages					18.3	14.8	14.2	*80.81*	*86.0*	*96.75*	15.78	1,535.6		12.7	7.5
Minima					17.6	13.7	12.8	*72.9*	79.8	*89.5*	14.97	1,220		12.4	7.1
Maxima					19.4	15.5	15.1	86.2	*92.6*	*103.4*	16.53	1,670		13.0	7.8

FORT MYERS

15477	W. I.	Near Fort Myers	Adult		19.0	14.8		*77.9*							
15487	do	do	do	Possessing slight frontal occipital flattening.	18.4	14.7		*79.9*							
292775	U.S.N.M.	do	do		18.3	14.7	14.9	*80.3*	*90.3*	*101.4*	15.97			*12.5*	7.8
2230	A. N. S. P.	do	do		18.0	14.5	14.2	*80.6*	*87.4*	*97.9*	15.57				[1] 6.8
292776	U.S.N.M.	do	do		19.3	15.7		*81.3*							
292753	do	do	do		17.2	14.0		*81.4*							7.7
2228	A. N. S. P.	do	do		17.8	14.5	14.4	*81.5*	*89.2*	*99.3*	15.57				7.6
2229	do	do	do		17.6	14.4	14.0	*81.8*	*87.5*	*97.2*	15.33				6.8
Specimens					(8)	(8)	(4)	(8)	*(4)*	*(4)*	(4)			(1)	(5)
Totals					145.6	117.3	57.5				62.44				36.70
Averages					18.2	14.7	14.4	*80.56*	*88.60*	*98.97*	15.61				7.34
Minima					17.2	14.0	14.2	*77.9*	*87.4*	*97.2*	15.33				6.8
Maxima					19.0	15.7	14.9	*81.8*	*90.3*	*101.4*	15.97				7.8

CORA KEY

247171	U.S.N.M.	Cora Key, Lee County.	Adult	Slight asymmetry	17.9	13.8	14.4	*77.1*	*91.1*	*104.4*	15.37			11.2	6.8

CAPE BLANCO

315004	U.S.N.M.	Cape Blanco, Lee County.	Adult		17.9	13.9	14.3	*77.6*	*89.9*	*102.9*	15.37	1,460		12.7	7.8

[1] Near.

FLORIDA, WEST COAST: MALES—Continued

BONITO SPRINGS

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
340096	U.S.N.M.	Bonito Springs	Adult		18.6	13.8		*74.2*				1,420			8.0

HORRS ISLAND

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
352092	U.S.N.M.	Horrs Island, Collier County.	60		20.0	14.4	14.5	*72.0*	*84.3*	*100.7*	16.30	1,670		[1] 11.7	6.9
352132	do	do	50		19.4	14.0		*72.2*							
352159	do	do	70		19.7	14.3	15.1	*72.6*	*88.8*	*105.6*	16.37	1,670		13.3	7.8
352144	do	do	40		19.4	14.6		*75.3*							7.8
352118	do	do	55		18.0	13.6		*75.6*							
352139	do	do	55		19.7	15.0		*76.1*							
352133	do	do	40		18.4	14.0		*76.1*							
352085	do	do	55		19.0	14.5		*76.3*							
352070	do	do	50		18.8	14.5		*77.1*							
352103	do	do	25		18.5	14.3	13.7	*77.3*	*83.5*	*95.8*	15.50	[1] 1,440		12.3	7.4
352068	do	do	55		18.6	14.4		*77.4*							
352065	do	do	65		17.6	[1] 13.7		*77.8*						[1] 12.4	7.5
352069	do	do	60		18.4	14.5		*78.8*				[1] 1,330			
352142	do	do	50		18.2	14.4		*79.1*							
352123	do	do	60		18.2	14.4	14.2	*79.1*	*87.1*	*93.6*	15.60	1,400			7.7
352051	do	do	60		18.6	14.8	14.4	*79.6*	*86.2*	*97.3*	15.93	1,490		[1] 13.0	7.9
352062	do	do	50	Slight occipital	18.2	14.5	[1] 14.2	*79.7*	*86.9*	*97.9*	15.63	1,490		12.8	8.1
352160	do	do	35		18.3	14.7		*80.3*				1,590		12.7	7.8
352164	do	do	50		17.9	14.4		*80.5*				[1] 1,390		12.8	7.7
352102	do	do	45		18.2	14.7	[1] 15.0	*80.8*	*91.2*	*102.0*	15.97			13.3	8.1
352116	do	do	35		18.5	15.0		*81.1*							
352107	do	do	30		18.4	15.0		*81.5*							
352088	do	do	(?)		19.0	15.5		*81.6*							
352124	do	do	40		17.9	14.7		*82.1*							7.7
352167	do	do	60		18.4	15.1		*82.1*							
352157	do	do	40		18.1	14.9	13.8	*82.3*	*83.6*	*92.6*	15.60				
350409	do	do	45		18.5	15.3		*82.7*							

352104	do	do	60		18.1	15.0		*82.9*				1,580			
352168	do	do	30		17.6	14.6		*83.0*				1,370		12.9	8.0
352072	do	do	65		18.5	15.5		*83.8*							7.6
352158	do	do	45		18.3	15.5	14.8	*84.7*	*87.6*	*95.5*	16.20	1,670			7.9
352169	do	do	65		17.6	15.0		*85.2*							
352073	do	do	60		18.1	15.6	14.2	*86.2*	*84.3*	*91.0*	15.97	1,570			
Specimens					(33)	(33)	(10)	*(33)*	*(10)*	*(10)*	(10)	(13)		(10)	(15)
Totals					610.1	484.4	143.9				159.07	19,710		127.2	115.9
Averages					18.5	14.7	14.4	*79.40*	*86.32*	*97.63*	15.91	1,516.2		12.7	7.7
Minima					17.6	13.6	13.7	*72.0*	*83.5*	*91.0*	15.5	1,370		11.7	6.9
Maxima					20.0	15.6	15.1	*86.2*	*91.2*	*105.6*	16.37	1,670		13.3	8.1

PENSACOLA BAY

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a\times100}{c}\right)$	*Facial Index, upper* $\left(\frac{b\times100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
							°	°														
242665						11.2									5.6	2.7	*48.2*					
242631	14.3	*90.2*	*56.6*	10.4	9.0	10.45	68.0	52.5		3.5		3.8		*92.1*	5.5	2.4	*46.4*	5.9	6.7	*88.1*		
242630																						
242671									3.4	3.5	3.7	3.8	*91.9*	*92.1*	5.3	2.5	*47.2*		6.8			
242632	13.6	*(110.3)*	*(65.4)*	9.4	8.4	10.3	68.5	61.0	3.8	3.7	3.8	3.8	*100.0*	*97.4*	(6.0)	(2.15)	*(35.8)*	5.3	6.8	*77.9*	5.1	
242670																						
Specimens	(2)	*(1)*	*(1)*	(2)	(2)	(3)	(2)	(2)	(2)	(3)	(2)	(3)	*(2)*	*(3)*	(3)	(3)	*(3)*	(2)	(3)	*(2)*	(1)	
Totals	27.9			19.8	17.4	31.95	136.5	113.5	7.2	10.7	7.5	11.4			16.4	7.60		11.2	20.3			
Averages	13.95			9.9	8.7	10.65	68.3	56.8	3.6	3.6	3.8	3.8	*96.0*	*93.86*	5.5	2.5	*46.34*	5.6	6.8	*82.96*		

ST. ANDREWS BAY—APALACHICOLA

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total*	*Facial Index, upper*	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
2194	14.2		*51.4*												5.2	2.3	*44.2*					
2188	13.8		*47.8*												4.6	2.6	*56.5*					

[1] Near.

FLORIDA, WEST COAST: MALES—Continued

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a \times 100}{c}\right)$	*Facial Index, upper* $\left(\frac{b \times 100}{c}\right)$	Basion-Alveolat Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Otbital Index, right*	*Orbital Index, left*	Nose, heigh	Nose, breadth maxim	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
GAINESVILLE																						
242683	[1] 14.2	-----	[1] 49.3	[1] 10.4	9.2	10.2	° 69.0	° 51.0	3.4	3.4	3.7	3.7	91.9	91.9	5.0	2.3	46.0	[1] 5.7	6.3	90.5	-----	-----
CEDAR KEYS																						
227499	15.2	-----	55.3	-----	-----	10.4	-----	-----	-----	-----	-----	-----	-----	-----	5.3	2.65	50.0	-----	-----	-----	-----	-----
2204	14.7	-----	47.6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	4.8	2.2	45.8	-----	-----	-----	-----	-----
2200	14.3	-----	47.6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	4.9	2.55	52.0	-----	-----	-----	-----	-----
2199	13.4	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	(3.1)	2.1	(67.7)	-----	-----	-----	-----	-----
2205	14.2	-----	49.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	5.1	2.5	49.0	-----	-----	-----	-----	-----
2202	13.8	-----	55.1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	5.0	2.45	49.0	-----	-----	-----	-----	-----
2197	14.0	-----	52.1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	5.3	2.5	47.2	-----	-----	-----	-----	-----
2203	14.8	85.5	51.4	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	5.5	2.8	50.9	-----	-----	-----	-----	-----
2198	14.6	-----	50.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	5.5	2.65	48.2	-----	-----	-----	-----	-----
16533	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
16332	15.15	89.1	55.4	10.6	9.2	10.45	65.5	55.0	3.6	3.65	4.2	4.2	85.7	86.9	5.3	2.6	49.1	6.1	6.4	95.3	4.3	-----
2196	13.8	-----	50.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	4.6	2.4	52.2	-----	-----	-----	-----	-----
242611	-----	-----	-----	-----	-----	-----	-----	-----	3.7	-----	4.0	-----	92.5	-----	5.0	2.55	51.0	-----	-----	-----	-----	-----
Specimens	(11)	(2)	(10)	(1)	(1)	(2)	(1)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(11)	(12)	(11)	(1)	(1)	(1)	(11)	-----
Totals	157.95	-----	-----	-----	-----	20.85	-----	-----	7.3	-----	8.2	-----	-----	-----	56.3	29.95	-----	-----	-----	-----	-----	-----
Averages	14.4	87.48	51.41	-----	-----	10.4	-----	-----	3.65	-----	4.1	-----	89.02	-----	5.1	2.5	49.47	-----	-----	-----	-----	-----
Minima	13.4	85.8	47.6	-----	-----	10.4	-----	-----	3.6	-----	4.0	-----	85.7	-----	4.6	2.1	45.8	-----	-----	-----	-----	-----
Maxima	15.2	89.1	55.4	-----	-----	10.45	-----	-----	3.7	-----	4.2	-----	92.5	-----	5.5	2.8	52.2	-----	-----	-----	-----	-----
OCALA																						
225081	13.8	-----	55.1	10.8	9.3	11.0	71.0	49.5	3.5	-----	4.05	4.0	86.4	-----	5.2	2.8	53.8	5.8	6.55	88.6	-----	-----

WITHLACOOCHEE RIVER

1-2860																						
1-2861																						
1-2852																						
1-2862																						
1-2855																						
1-2851									*Mean* 3.65		*Mean* 4.15		*Mean* *87.95*		5.2	[1] 2.5	*48.08*					
1-2867																						
Specimens									(1)		(1)		*(1)*		(1)	(1)	*(1)*					
Totals																						
Averages																						
Minima																						
Maxima																						

TARPON SPRINGS

16099																						
15782																						
15854																						
15853																						
16007																						
15791																						
16001																						
16012	[1] 14.6		*53.4*												5.3	2.3	*43.4*					
15788																						
15849																						
15485																						
15852																						
15961																						
15855	14.1		*51.8*												5.1	2.6	*51.0*					
15856															5.8	2.7	*46.6*					
15858																						
15958																						
15481																						
15844																						
15790																						
Specimens	(2)		*(2)*												(3)	(3)	*(3)*					
Totals	28.7														16.20	7.60						
Averages	14.35		*52.61*												5.40	2.53	*46.91*					
Minima	14.1		*51.8*												5.1	2.3	*43.4*					
Maxima	14.6		*53.4*												5.8	2.7	*51.0*					

[1] Near.

FLORIDA, WEST COAST: MALES—Continued

HOG ISLAND

Catalog No.	Diam. Bizygomatic maxim (c)	*Facial Index, total* $\left(\frac{a\times100}{c}\right)$	*Facial Index, upper* $\left(\frac{b\times100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
Seen locally	(13.8)	*(100.0)*	*(62.3)*	10.4	8.8	10.3	° 65.0	° 52.5	3.7	3.7	[1] 4.1	3.9	*90.2*	*94.9*	5.4	2.4	*44.4*	5.7	6.7		3.9	
2207	13.9	*91.4*	*56.1*												5.4	2.7	*50.0*					
22020	13.9		*47.5*												4.9	2.6	*53.1*					
22022	14.8		*54.7*												5.7	2.2	*38.6*					
22024	13.7		*55.5*												5.6	2.4	*42.9*					
22023	13.2		*57.6*												5.3	2.35	*44.3*					
2209	14.1	*91.5*	*51.1*												5.3	2.3	*43.4*					
2206	14 4		*54.2*												5.4	2.5	*46.3*					
2208	13.5		*53.3*												5.1	2.3	*45.1*					
22021	13.7	*94.2*	*56.9*												5.7	2.5	*43.9*					
Specimens	(9)	*(3)*	*(9)*	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	*(1)*	*(1)*	(10)	(10)	*(10)*	(1)	(1)		(1)	
Totals	125.2														48.5	24.25						
Averages	13.9	*92.33*	*54.07*												4.85	2.4	*50.0*					
Minima	13.2	*91.4*	*47.5*												4.9	2.2	*38.6*					
Maxima	14.8	*94.2*	*57.6*												5.7	2.7	*53.1*					

ANCLOTE RIVER

Catalog No.	Diam. Bizygomatic maxim (c)	*Facial Index, total*	*Facial Index, upper*	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
242684					9.2	10.6			3.6	3.7	3.95	4.0	*91.1*	*92.5*	5.4	2.6	*48.2*					

SAFETY HARBOR

Catalog No.	Diam. Bizygomatic maxim (c)	*Facial Index, total*	*Facial Index, upper*	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
350372																						9.6
350298																					4.0	
350354				11.1	9.8	10.9	66.5	53.5	3.45	3.4	4.05	4.05	*85.2*	*84.0*	5.6	2.7	*48.2*				3.8	9.5

350325	[1] 13.8	93.5	55.6	10.3	9.4	10.3	68.0	59.5		3.4		3.7		91.9	5.6	2.5	45.5				3.7	
350317						10.4															3.75	9.6
350285																						
350320				10.9	9.4	10.6	66.0	49.5		3.85		4.05		95.1	5.8	2.8	48.3	5.7	7.0	81.4	4.0	10.0
350323	[1] 15.0	83.3	51.3	10.5	9.2	10.2	61.0	53.5	3.4	3.5	4.0	4.0	85.0	87.5	5.15	2.6	50.5				3.7	9.6
350311	14.4	91.7	56.3	10.4	8.8	10.4	62.0	47.0		3.9		4.2		92.9	5.5	2.7	49.1	5.7	6.3	90.5	3.9	9.6
350277	14.4	85.4	49.3						3.3	3.35	3.9	3.8	84.6	88.2	5.0	2.7	54.0	5.9	6.8	86.8	3.6	8.9
350286																						9.2
350322	[1] 14.0	88.6	52.9	11.2	9.8	10.4	63.5	50.0	3.3	3.1	4.0	4.1	82.5	75.6	4.9	2.55	52.0	6.0	6.6	90.9	4.0	10.0
350278	14.4	91.0	53.5						3.6	3.65	3.9	3.8	92.3	96.1	5.5	2.4	43.6	5.4	6.6	81.8	3.8	9.0
350321						10.8												6.1	6.3	96.8	4.0	9.0
350319																					3.8	10.0
350279	14.5	91.72	55.2						3.4		4.1		82.9		5.7	2.8	49.1	6.0	7.1	84.5	4.0	9.7
350330																						
350329																						
350343	14.3	93.7	44.6							3.65		3.9		93.6	5.1	2.5	49.0	6.3	6.7	94.0	3.7	9.5
350287																						
350358									3.25	3.2	3.9	4.0	83.3	80.0	5.3	2.8	52.8	6.3	7.1	88.7		10.0
350276	14.6	92.5	57.5	10.7	9.5	10.6	66.0	57.0		3.9		4.3		90.7	5.7	2.6	45.6				[1] 4.2	9.8
350344									3.45		3.9		88.5									9.7
350342																						
350305																					3.7	
350334															5.6	2.6	46.4	6.0	6.7	89.6	3.8	9.4
350282	13.9	86.3	50.4	9.5	8.6	9.9	72.0	53.5	3.6		3.9		92.3		5.35	2.3	43.0	5.5	6.1	90.2	3.9	9.7
Specimens	(10)	(10)	(10)	(8)	(8)	(10)	(8)	(8)	(9)	(11)	(9)	(11)	(9)	(11)	(14)	(14)	(14)	(11)	(11)	(11)	(18)	(19)
Totals	143.3			84.6	74.5	104.5	525.0	423.5	30.75	38.9	35.65	43.9			75.80	36.55		64.9	73.3		69.35	181.8
Averages	14.3	89.74	53.66	10.6	9.3	10.5	65.6	52.9	3.4	3.5	4.0	4.0	86.26	88.61	5.4	2.6	48.22	5.9	6.7	88.54	3.85	9.6
Minima	13.8	83.3	44.6	9.5	8.6	10.2	62.0	47.0	3.25	3.1	3.9	3.7	82.5	80.0	4.9	2.3	43.6	5.4	6.1	81.4	3.6	8.9
Maxima	15.0	93.7	57.5	11.2	9.8	10.9	72.0	59.5	3.6	3.9	4.1	4.3	92.3	96.1	5.8	2.8	54.0	6.3	7.1	96.8	4.2	10.0

CLEARWATER

243688	13.1	87.0	55.0	[1] 9.3	7.9	9.05	65.0	48.5	[1] 3.2	3.3	4.0	4.0	80.0	82.5	4.9	2.45	50.0				3.4	
243693																						
243696																						
243691				10.4	9.2	10.2	65.5	56.0	3.5	3.5	4.1	4.0	85.4	87.0	5.5	2.55	46.4		[1] 7.0			
243695																						
243690				10.3	9.2	10.5	69.0	58.0	3.7	3.7	3.9	4.0	94.9	92.5	5.5	2.4	43.6	5.8	[1] 7.2	80.6		
243689						9.7															[1] 3.8	
Specimens	(1)	(1)	(1)	(3)	(3)	(4)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(1)	(2)	(1)	(2)	
Totals				30.0	26.3	39.45	199.5	162.5	10.4	10.5	12.0	12.0			15.9	7.4			14.2		7.2	
Averages				10.0	8.8	9.9	66.5	54.2	3.5	3.5	4.0	4.0	86.67	87.50	5.3	2.5	46.54		7.1		3.6	
Minima				9.3	7.9	9.05	65.0	48.5	3.2	3.3	3.9	4.0	80.0	82.5	4.9	2.4	43.6		[1] 7.0		3.4	
Maxima				10.4	9.2	10.5	69.0	58.0	3.7	3.7	4.1	4.0	94.9	92.5	5.5	2.55	50.0		7.2		3.8	

[1] Near.

FLORIDA, WEST COAST: MALES—Continued

TAMPA BAY

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a\times100}{c}\right)$	*Facial Index, upper* $\left(\frac{b\times100}{c}\right)$	Basion-Alveolat Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Otbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
							°	°														
242651																						9.3
242653				1 10.6	9.6	11.0	71.0	56.0							5.9	2.7	*45.8*	1 5.8	6.6	*87.9*	4.2	
2211	14.7	*79.6*	*47.6*												4.9	2.7	*55.1*					
242640																					3.4	
2219	13.7		*51.1*												4.9	2.4	*49.0*					
242639						10.5																
2216	13.9		*53.2*												5.1	2.3	*45.1*					
242652				1 (10.7)	9.4	1 10.8	1 71.0	1 50.0		3.3		3.9		*84.6*	5.2	2.6	*50.0*				4.0	
242620																						
2217	13.4		*55.2*												4.9	2.2	*44.9*					
362999						10.2															3.5	9.4
2212	14.2		*52.8*												5.6	2.3	*41.1*					
242630																						
242682																						
242613																						10.0
242610									3.5	3.5	4.0	4.1	*87.5*	*85.4*	5.5	2.9	*52.7*	1 5.6				
Specimens	(5)	*(1)*	(5)	(1)	(2)	(4)	(2)	(2)	(1)	(2)	(1)	(2)	*(1)*	*(2)*	(8)	(8)	(8)	(2)	(1)	*(1)*	(4)	(3)
Totals	69.9				19.0	42.5	142.0	106.0		6.8		8.0			42.0	20.10		11.4			15.1	28.7
Averages	14.0		*51.93*		9.5	10.6	71.0	53.0		3.4		4.0		*85.0*	5.25	2.5	*47.80*	5.7			3.8	9.6
Minima	13.4		*47.6*		9.4	10.2	71.0	50.0		3.3		3.9		*84.6*	4.9	2.2	*41.1*	5.6			3.4	9.3
Maxima	14.7		*55.2*		9.6	11.0	71.0	56.0		3.5		4.1		*85.4*	5.9	2.9	*52.7*	5.8			4.2	10.0

WEEDEN ISLAND

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total*	*Facial Index, upper*	Basion-Alveolat Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Otbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
329389																		5.5	6.8	*80.9*		
329388										3.3		3.9		*84.6*								9.6
329417																						9.7
329380																						9.6
329386																						10.3
329400																						

329379																						9.3
329392										3.7		3.9		94.9	5.7	2.8	49.1					
329407																					3.6	10.4
329394									3.55		4.1		86.6		5.3	2.9	54.7	6.2	7.3	84.9		9.8
329390	13.9		54.7						3.3	3.4	3.8	3.7	86.8	91.9	5.3	2.15	40.6	5.8	6.5	89.2	3.3	9.2
329397																						
329399																						10.0
Specimens	(1)		(1)						(2)	(3)	(2)	(3)	(2)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(2)	(9)
Totals									6.85	10.4	7.9	11.5			16.3	7.85		17.5	20.6		6.9	87.9
Averages									3.4	3.5	3.95	3.8	86.71	90.43	5.4	2.6	48.16	5.8	6.9	84.95	3.45	9.8
Minima									3.3	3.3	3.8	3.7	86.6	84.6	5.3	2.15	40.6	5.5	6.5	80.9	3.3	9.2
Maxima									3.55	3.7	4.1	3.9	86.8	94.9	5.7	2.9	54.7	6.2	7.3	89.2	3.6	10.4
MAXIME CREEK																						
242629				11.6	10.5	11.05	67.0	57.0	3.35	3.4	3.8	3.8	88.2	89.5	5.3	3.0	56.6	6.2	6.7	92.5		
BOGO SEGO BAY																						
331248																						10.5
MANATEE COUNTY																						
306701	14.9	81.2	51.7	10.1	9.25	10.75	73.0	60.0	3.4	3.4	3.9	3.9	87.2	87.2	5.8	2.6	44.7	5.7	6.75	84.4	3.3	
SARASOTA BAY																						
225075	14.5		51.7	[1] 9.9	9.15	10.25	70.5	63.0	3.9	3.8	4.3	4.3	90.7	88.4	5.4	2.5	46.3					
PERICO ISLAND																						
373476	14.6	84.25	49.32	10.4	9.4	10.9	73.5	53.5	3.8	3.8	4.1	4.0	92.68	95.00	5.35	2.4	44.86	5.9	6.4	92.19		
373621	14.2	88.03	53.52						3.6	3.8	4.1	4.0	87.80	95.0	5.4	2.7	50.00	5.8	6.5	89.23		
373494	[1] 14.8	89.19	52.70	10.1	9.2	10.6	71.0	59.0	3.6	3.65	4.0	3.8	90.00	96.05	5.6	2.6	46.43	5.6	6.9	81.16		
373595																						
373498	[1] 14.5				9.3	10.6			3.7	3.7	4.0	3.9	92.50	94.87	4.9	2.6	53.06					
373493	14.4	83.19	52.08	11.0	9.7	11.0	70.0	51.5	3.4	3.55	4.0	3.9	85.00	91.03	5.3	2.7	50.94	6.0	6.2	96.77		
373503	15.0	88.00	53.33	11.2	10.0	10.9	66.5	54.0	3.7	3.7	4.1	4.0	90.24	92.50	5.6	2.5	44.64	6.0	7.1	84.51		
373597																						
373487	14.1	90.07	55.32	10.8	9.4	10.6	67.5	51.5	3.6	3.7	4.1	3.9	87.80	94.87	5.3	2.6	49.06	6.0	6.6	90.91		
373618	14.1	88.65	51.77	10.1	9.0	10.2	69.5	54.0	3.9	3.9	4.05	3.9	93.24	100.0	5.1	2.25	44.12	5.5	6.3	87.30		
373573	[1] 15.4		53.25						3.9	3.9	4.25	4.1	91.76	95.12	5.55	2.6	46.85	5.6	6.3	88.89		
373543	[1] 15.0	87.33	52.67	10.4	9.3	10.6	69.5	57.5		3.4		3.9		87.18	5.4	2.6	48.15	5.9	6.6	89.39		
373615	[1] 15.6								3.5	3.5	4.0	3.9	87.50	89.74	5.2	2.6	50.0					
373608																						

[1] Near.

FLORIDA, WEST COAST: MALES—Continued

PERICO ISLAND—Continued

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a \times 100}{c}\right)$	*Facial Index, upper* $\left(\frac{b \times 100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
							°	°														
373602	14.7																					
373606	14.6	*85.62*	*49.32*	10.0	8.6	9.6	*65.5*	*48.0*	3.3	3.45	3.9	3.7	*84.62*	*93.24*	5.0	2.6	*52.0*	5.5	[1] 6.6	*83.33*		
373592																						
373611									3.45	3.45	3.9	3.8	*88.46*	*90.79*	4.9	2.5	*51.02*					
373500	14.9		*51.68*	10.3	8.8	10.4	*69.0*	*49.5*	3.6	3.7	4.0	4.0	*90.00*	*92.50*	5.25	2.7	*51.43*	5.7	6.3	*90.48*		
373480	14.3	*92.31*	*53.85*	10.5	9.2	10.6	*69.5*	*51.5*	3.9	3.8	4.1	4.1	*95.12*	*92.68*	5.4	2.6	*48.15*	5.5	7.0	*78.57*		
373495	14.2	*81.69*	*48.59*	9.6	8.6	10.0	*72.5*	*52.0*	3.4	3.4	3.7	3.6	*91.89*	*94.44*	5.15	2.7	*52.43*	5.1	6.2	*82.26*		
373530	14.3	*88.11*	*53.15*	11.0	10.0	10.9	*69.0*	*57.5*	3.6	3.6	4.1	4.1	*87.80*	*87.80*	5.4	2.6	*48.15*	5.8	6.4	*90.63*		
373588																						
373612	[1] 14.6	*85.62*	*50.68*						3.7	3.8	4.0	4.0	*92.5*	*95.00*	5.2	2.15	*41.35*	5.7	6.4	*89.06*		
373602	14.0		*55.00*						3.6	3.65	4.1	4.1	*87.80*	*89.02*	5.2	2.3	*44.23*					
373508	14.9	*83.89*	*51.01*	10.1	9.0	10.2	*69.0*	*54.0*	3.85	3.95	4.1	3.9	*93.90*	*101.28*	5.5	2.7	*49.09*	5.7	6.6	*86.36*		
373616	14.4	*83.33*	*51.39*						3.3	3.3	3.7	3.7	*89.19*	*89.19*	5.15	2.55	*49.51*	6.0	6.6	*90.91*		
373558	[1] 14.6					10.8																
373561																						
373488																						
373567	14.7					11.1																
373589	15.3	*83.01*	*50.33*							3.5		4.0		*87.50*	5.5	2.7	*49.09*					
373572	14.6																					
373537																						
373650																						
373477	14.9	*84.56*	*49.66*	10.1	9.0	10.2	*69.0*	*55.0*	3.7	3.7	4.0	4.0	*92.50*	*92.50*	5.2	2.3	*44.23*	5.5	6.6	*83.33*		
373579	15.2	*84.87*	*48.68*	9.9	8.9	10.4	*72.0*	*55.5*		3.8		3.9		*97.44*	5.25	2.65	*50.48*	5.6	6.9	*81.16*		
373565	15.1	*87.42*	*51.66*	10.9	9.8	10.9	*68.5*	*57.5*	3.4	3.4	4.0	4.0	*85.0*	*85.0*	5.25	2.65	*50.48*	6.0	6.9	*86.96*		
373501	13.9		*54.68*		8.6	10.2			3.7		4.1		*90.24*		5.05	2.25	*44.55*					
373596	14.3	*88.81*	*53.85*						3.7	3.7	3.8	3.9	*97.37*	*94.87*	5.45	2.2	*40.37*	5.5	6.5	*84.62*		
Specimens	(30)	*(20)*	*(24)*	(16)	(18)	(20)	*(16)*	*(16)*	(24)	(26)	(24)	(26)	*(24)*	*(26)*	(27)	(27)	*(27)*	(21)	(21)	*(21)*		
Totals	439.2			166.4	165.8	210.7	*1,111.5*	*861.5*	86.9	94.8	96.2	102.1			142.55	68.3		119.9	137.9			
Averages	14.6	*86.62*	*51.95*	10.4	9.2	10.5	*69.47*	*53.84*	3.6	3.6	4.0	3.9	*90.33*	*92.85*	5.28	2.53	*47.91*	5.7	6.6	*86.95*		
Minima	13.9	*81.69*	*48.59*	9.6	8.6	9.6	*65.5*	*51.5*	3.3	3.3	3.7	3.6	*84.62*	*85.0*	4.9	2.2	*40.37*	5.1	6.2	*78.57*		
Maxima	15.6	*92.31*	*55.32*	11.2	10.0	11.1	*73.5*	*59.0*	3.9	3.95	4.25	4.1	*97.37*	*101.28*	5.6	2.7	*53.06*	6.0	7.1	*96.77*		

OSPREY																						
	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
CHADWICK BEACH																						
331075	14.6	------	51.4	10.4	9.1	10.2	67.5	53.5	3.45	3.45	4.0	3.9	*86.3*	*88.5*	5.0	2.4	*48.0*	5.5	6.9	*79.7*	------	9.7
CHARLOTTE BAY																						
300118	14.8	------	*50.0*	[1] 10.3	9.5	10.6	71.5	50.0	3.45	3.5	4.0	4.0	*86.2*	*87.5*	5.6	2.7	*48.2*	------	------	------	------	------
CAPTIVA ISLAND																						
340636						10.7															3.7	8.8
340628										3.6		4.0		*90.0*	5.7	2.3	*40.4*				3.45	9.2
340630						10.8															3.8	10.2
340650	15.3	*85.0*	*51.0*	10.3	9.2	10.6	70.5	56.5	3.7	3.7	4.1	4.1	*90.2*	*90.2*	5.6	2.55	*45.5*	5.7	6.9	*82.6*		11.0
340666						10.8																
340675																						10.2
340680																						
340613	14.6	*85.6*	*52.1*							3.75		4.1		91.5	5.6	2.6	*46.4*	5.4	6.5	*83.1*	3.5	9.8
340653	14.7	*88.4*	*53.1*	10.6	9.2	10.6	68.5	50.5	3.65		4.1		*89.0*		5.4	2.4	*44.4*	5.9	6.9	*85.5*	3.8	9.6
340615	14.6	*84.9*	*50.0*	11.0	9.8	10.4	65.5	52.0	3.7	3.9	3.5	3.9	94.6	100.0	5.1	2.3	*45.1*				3.5	9.2
340632	15.0																					10.1
340660																						10.2
340647																						
340657	[1] 14.4	*86.8*	*49.3*	10.2	9.0	10.1	68.5	51.0	3.65	3.55	3.8	3.8	*96.1*	*93.4*	5.0	2.5	*50.0*	5.6	6.4	*87.5*	3.6	9.3
340635						10.8				3.5		4.2		*83.3*								9.6
340645																						9.8
340637				10.4	9.4	10.5	70.0	57.0		3.35		3.8		*88.2*	5.3	2.25	*42.5*				3.5	9.5
340624																						
340643				8.6																		
340662																						9.6
340618																					3.7	9.7
340612										3.95		4.0		*98.8*								10.1
340621																						9.7
340664																						
340670																						9.7
340678																					[1] 3.8	9.8
Specimens	(6)	*(5)*	*(5)*	(6)	(5)	(9)	(5)	(5)	(4)	(8)	(4)	(8)	*(4)*	(8)	(7)	(7)	(7)	(4)	(4)	*(4)*	(10)	(20)
Totals	88.6	------	------	61.1	46.6	95.3	343.0	267.0	14.7	29.3	15.5	31.9	------	------	37.7	16.9	------	22.6	26.7	------	36.35	195.1
Averages	14.8	*86.14*	*51.09*	10.2	9.3	10.6	68.6	53.4	3.7	3.7	3.9	4.0	*94.84*	*91.85*	5.4	2.4	*44.83*	5.7	6.7	*84.64*	3.6	9.75
Minima	14.4	*84.9*	*49.3*	8.6	9.0	10.1	65.5	50.5	3.65	3.35	3.5	3.8	*89.0*	*83.3*	5.0	2.25	*40.4*	5.4	6.4	*82.6*	3.45	8.8
Maxima	15.3	*88.4*	*53.1*	11.0	9.8	10.8	70.5	57.0	3.7	3.95	4.1	4.2	*96.1*	*100.0*	5.7	2.6	*50.0*	5.9	6.9	*87.5*	3.8	11.0

FLORIDA, WEST COAST: MALES—Continued

FORT MYERS

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a\times100}{c}\right)$	*Facial Index, upper* $\left(\frac{b\times100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
							°	°														
15477																						
15487																						
292775	14.4	*86.8*	*54.2*			[1] 10.3									5.4	2.6	*48.1*	5.9	6.7	*88.1*	4.2	
2230	13.3		*51.1*												4.8	2.7	*56.2*					
292776																						
292753	14.1		*54.6*						3.7	3.7	3.9	3.9	*94.9*	*94.9*	5.4	2.4	44.4	5.6	6.7	*83.6*		
2228	14.5		*52.4*												5.3	2.5	*47.2*					
2229	13.7		*49.6*												4.8	2.3	*47.9*					
Specimens	(5)	*(1)*	*(5)*			(1)			(1)	(1)	(1)	(1)	*(1)*	*(1)*	(5)	(5)	*(5)*	(2)	(2)	*(2)*	(1)	
Totals	70.0														25.7	12.5		11.50	13.4			
Averages	14.0		*52.43*												5.1	2.5	*48.64*	5.75	6.7	*85.82*		
Minima	13.3		*49.6*												4.8	2.3	*44.4*	5.6	6.7	*83.6*		
Maxima	14.5		*54.6*												5.4	2.7	*56.2*	5.9	6.7	*88.1*		

CORA KEY

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total*	*Facial Index, upper*	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
247171	13.3	*84.2*	*51.1*	10.1	8.9	10.25	71.5	48.0	3.3	3.3	4.0	3.9	*82.5*	*84.6*	50.5	2.1	*41.6*	5.4	6.5	*83.1*	3.6	

CAPE BLANCO

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total*	*Facial Index, upper*	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
315004	13.9	*91.4*	*56.1*	10.6	9.2	10.2	65.0	47.0	3.6	3.6	3.8	3.9	*94.7*	*92.3*	5.7	2.4	*42.1*	5.9	6.9	*85.5*	3.8	

BONITO SPRINGS

340096	14.4		55.6						3.75	3.7	4.45	4.45	84.3	83.1	5.5	2.85	51.8	5.7	6.7	85.1		

HORRS ISLAND

352092	15.0	78.0	46.0	10.9	10.0	10.8	71.0	58.5	3.4	3.5	3.9	3.9	87.2	89.7	4.85	2.75	56.7	5.7	6.8	83.8	3.5	9.9
352132																					4.2	9.5
352159	14.7	90.5	53.1	10.4	9.4	10.8	70.5	58.5	3.9	3.8	4.1	4.3	95.1	88.4	5.5	2.7	49.1				3.7	10.0
352144															5.5	2.7	49.1				4.2	9.3
352118																					3.7	9.5
352139																					3.7	9.5
352133																					3.8	8.9
352085	[1]15.2																				3.4	10.1
352070																						9.3
352103	14.1	87.2	52.5	11.2	9.6	10.0	60.5	43.0							5.2	2.65	51.0	6.0	6.6	90.9	3.5	9.7
352068																					3.8	9.4
352065	[1]14.2	87.3	52.8																		3.95	9.5
352069																		[1]6.2	6.6	93.9	3.95	9.1
352142																					4.2	9.2
352123	14.6		52.7			10.6			3.9		4.05		96.30		5.7	2.65	46.5					9.5
352051	14.9	87.3	53.0	11.2	9.9	10.6	64.5	51.5	3.55	3.55	4.0	4.0	88.8	88.8	5.5	2.8	50.9	6.5	7.1	91.6	3.6	9.3
352062	14.8	86.5	54.7						3.6	3.55	3.8	3.75	94.7	94.7	5.5	2.5	45.5	5.7	6.9	82.6	3.65	9.2
352160	14.2	89.4	54.9						3.7	3.7	4.05	4.1	91.4	90.2	5.7	2.65	46.5	5.9	6.4	92.2	3.6	9.4
352164	[1]14.8	86.5	52.0						3.6	3.5	4.0	4.1	90.0	85.4	5.35	2.7	50.5				3.5	9.3
352102	[1]14.8	89.9	54.7			10.5									5.9	2.5	42.4	5.8	6.7	86.6	3.6	10.2
352116																		5.7	6.9	82.6	3.5	9.5
352107																		6.4	6.9	92.75	4.2	9.7
352088																						
352124	[1]15.5		49.7							3.65		4.0		91.3	5.6	2.75	49.1	5.7	6.6	86.4		9.6
352167																					3.7	10.3
352157																		6.1	7.0	87.1	4.0	
350409																						
352104																		5.8	6.9	84.1	3.5	9.2
352168	[1]14.6	88.4	54.8						3.5	3.55	3.7	3.7	94.59	95.95	5.8	2.35	40.5	5.8	6.8	85.3	3.4	9.4
352072									3.4		3.9		87.2		5.3	2.6	49.1	6.4	7.1	90.1	4.0	10.2
352158	15.5		51.0	10.9	9.8	10.9	69.0	56.5	3.7	3.65	4.3	4.1	86.1	89.0	5.55	2.9	52.3	6.1	7.3	83.6		10.3
352169																					4.0	9.5
352073																		5.7	6.4	89.1	3.65	9.7
Specimens	(14)	(10)	(13)	(5)	(5)	(7)	(5)	(5)	(10)	(9)	(10)	(9)	(10)	(9)	(14)	(14)	(14)	(16)	(16)	(16)	(27)	(30)
Totals	206.9			54.6	48.7	74.2	335.5	268.0	36.25	32.45	39.8	35.95			76.95	37.2		95.5	109.0		101.5	287.2
Averages	14.8	87.06	52.43	10.9	9.7	10.6	67.1	53.6	3.6	3.6	4.0	4.0	91.08	90.26	5.5	2.7	48.34	6.0	6.8	87.61	3.8	9.6
Minima	14.1	78.0	46.0	10.4	9.4	10.0	60.5	43.0	3.4	3.5	3.7	3.7	86.1	85.4	4.85	2.5	40.5	5.7	6.4	82.6	3.4	8.9
Maxima	15.5	90.5	54.9	11.2	10.0	10.9	71.0	58.5	3.9	3.8	4.3	4.3	95.1	96.3	5.9	2.9	56.7	6.5	7.3	93.9	4.2	10.3

[1] Near.

SEMINOLE INDIANS: MALES

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlicka's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
1286 [1]	A. N. S. P.	*Various* (all fresh or nearly so).	Adult		17.2	12.7	13.8	*73.8*	*92.3*	*108.7*	14.57				6.8
1732	do	do	do		18.4	13.7	14.1	*74.5*	*87.9*	*102.9*	15.40			11.8	6.9
1840	do		do		18.3	13.7	14.1	*74.9*	*88.1*	*102.9*	15.37				7.1
15490	U.S.N.M.		do		18.0	13.6	14.6	*75.6*	*92.4*	*107.4*	15.60				7.2
1698	A. N. S. P.		do		18.0	13.8	14.0	*76.7*	*88.0*	*101.4*	15.27				7.4
1105	do		do		17.6	13.5	13.7	*76.7*	*88.1*	*101.5*	14.93				7.2
1754	do		do		17.5	13.6	13.5	*77.7*	*86.8*	*99.3*	14.87				[3] 6.7
1730	do		do		18.0	14.0	13.1	*77.8*	*81.9*	*93.6*	15.03				7.7
1708	do		do		17.8	14.0	13.6	*78.6*	*85.5*	*97.1*	15.13				6.7
1604	do		do		18.4	14.7	14.4	*79.9*	*87.0*	*98.0*	15.83				7.2
1707	do		do		17.9	14.5	13.9	*81.0*	*85.8*	*95.9*	15.43				7.1
Specimens					(11)	(11)	(11)	*(11)*	*(11)*	*(11)*	(11)			(1)	(11)
Totals					197.1	151.8	152.8				167.43				78.0
Averages					17.9	13.8	13.9	*77.02*	*87.59*	*100.66*	15.22				7.1
Minima					17.2	12.7	13.1	*73.8*	*81.9*	*93.6*	14.57				6.7
Maxima					18.4	14.7	14.6	*81.0*	*92.4*	*108.7*	15.83				7.7

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a \times 100}{c}\right)$	*Facial Index, upper* $\left(\frac{b \times 100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
							°	°														
1286 [1]	12.7		*53.5*												5.0	2.4	*48.0*					
1732	14.2	*83.1*	*48.6*												5.2	2.4	*46.2*					
1840	14.3		*49.6*												5.3	2.6	*49.1*					
15490	13.5		*53.3*												5.1	2.75	*53.9*					
1698	13.0		*56.9*												5.0	2.65	*53.0*					
1105	13.4		*53.7*												5.4	2.5	*46.3*					
1754	13.6		*49.3*												(Cleft palate)							
1730	13.9		*55.4*												5.1	2.8	*54.9*					
1708	12.9		*51.9*												5.1	2.65	*52.0*					
1604	13.6		*52.9*												5.4	2.75	*50.9*					
1707	13.4		*53.0*												5.2	2.7	*51.9*					
Specimens	(11)	(*1*)	(*11*)												(10)	(10)	(*10*)					
Totals	148.5														51.8	26.2						
Averages	13.5		*52.53*												5.2	2.6	*50.58*					
Minima	12.7		*48.6*												5.0	2.4	*46.2*					
Maxima	14.3		*56.9*												5.4	2.8	*54.9*					

[1] Small, but male.

[2] Near.

FLORIDA, EAST COAST: FEMALES

ST. JOHNS RIVER

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
1794	A. N. S. P.	St. Johns River	Adult		17.7	14.0	12.9	*79.1*	*81.4*	*92.1*	14.87				
1808	do	do	do		17.5	13.9	14.0	*79.4*	*89.2*	*100.7*	15.13				
1787	do	do	do	Slight frontal flattening.	[1] 17.1	14.0		*81.9*							
1795	do	do	do		17.2	14.3	14.0	*83.1*	*88.9*	*97.9*	15.17				
1783	do	do	do		15.9	13.6	13.8	*85.5*	*93.6*	*101.5*	14.43				6.4
1789	do	do	do		16.5	14.3	13.1	*86.7*	*85.1*	*91.6*	14.63				
1790	do	do	do		16.7	14.7		*88.0*							
Specimens					(7)	(7)	(5)	(7)	(5)	(5)	(5)				(1)
Totals					118.6	98.8	67.8				74.23				
Averages					16.9	14.1	13.6	*83.31*	*87.54*	*96.72*	14.85				
Minima					15.9	13.6	12.9	*79.1*	*81.4*	*91.6*	14.43				
Maxima					17.7	14.7	14.0	*88.0*	*93.6*	*101.5*	15.17				

ST. AUGUSTINE

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
242666	U. S. N. M.	St. Augustine	Adult		16.8	13.2	13.6	*78.6*	*90.7*	*103.0*	14.53	1,220			
242685	do	do	do		17.0	13.9		*81.8*							6.8
242686	do	do	do		16.8	13.9	13.3	*82.7*	*86.6*	*95.7*	14.67	1,330		12.0	7.6

ANASTASIA ISLAND

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
229094	U S. N. M.	Anastasia Island	Adult		17.4	13.4		*77.*							

CRESCENT BEACH

Seen locally		Crescent Beach	50		16.6	13.7	13.1	78.9	86.5	95.6	14.47				

NEW SMYRNA

242627	U.S.N.M.	New Smyrna	Adult		17.4	13.3	14.0	76.4	91.2	105.8	14.90	1,335			
242622	do	do	do		17.3	13.5	14.1	78.0	91.6	107.6	14.97	1,280			
242626	do	do	do		17.0	13.9	13.4	81.8	86.7	96.4	14.77				
242623	do	do	do		17.0	14.1	13.8	82.9	88.7	97.9	14.97	1,310.0			(6.4)
242628	do	do	do		16.8	14.0		83.3							
330835	do	Near New Smyrna	do	Moderate occipital flattening.	(16.6)	(14.6)	(13.6)	(88.0)	(87.2)	(93.2)	14.93	[1](1,300)			
Specimens					(10)	(10)	(7)	(10)	(7)	(7)	(8)	(5)		(1)	(2)
Totals					170.1	136.9	95.3				118.21	6,475			14.4
Averages					17.0	13.7	13.6	80.48	88.86	99.69	14.78	1,295			7.2
Minima					16.6	13.2	13.1	76.4	86.5	95.6	14.47	1,220			6.8
Maxima					17.4	14.1	14.1	83.3	91.6	107.6	14.97	1,335			7.6

ORMOND BEACH

372633	U.S.N.M.	Ormond Beach	55		17.8	13.8	13.7	77.53	86.71	99.28	15.10				
372601	do	do	35		17.8	14.1		79.21							
372613	do	do	25		16.8	13.4	13.9	79.76	92.05	103.73	14.70				
372614	do	do	35		17.6	14.2	13.4	80.68	84.28	94.37	15.07				7.3
372626	do	do	60		18.2	14.8	[1] 13.4	81.32	81.21	90.54	15.47				6.9
372616	do	do	35		17.1	14.0	13.7	81.87	88.10	97.86	14.93				6.6
372637	do	do	40		17.3	14.2	13.4	82.08	85.08	94.37	14.97				
372608	do	do	35		17.5	14.4	13.2	82.29	82.76	91.67	15.03				
372611	do	do	45		17.1	14.3	[1] 13.4	83.63	85.35	93.71	14.93				
372644	do	do	50		17.8	14.9	[1] 13.7	83.71	83.79	91.95	15.47				
372624	do	do	30		17.5	14.7	[1] 13.8	84.00	85.72	93.88	15.33				
372612	do	do	Subadult		17.2	[1] 14.5		84.30							
372636	do	do	40		16.6	14.2	[1] 13.5	85.54	87.66	96.48	14.77				
372607	do	do	50		16.0	13.8		86.25							
372627	do	do	35		16.7	14.6	[1] 13.9	87.43	88.82	95.21	15.07				
372622	do	do	45		16.6	[1] 15.0	[1] 14.1	90.36	89.24	94.00	15.23				
Specimens					(16)	(16)	(13)	(16)	(13)	(13)	(13)				(3)
Totals					275.6	228.9	177.1				196.07				20.8
Averages					17.2	14.3	13.6	82.06	86.16	94.96	15.08				6.9
Minima					16.0	13.4	13.2	77.53	81.21	90.54	14.47				6.6
Maxima					18.2	15.0	14.1	90.36	92.05	103.73	15.47				7.3

[1] Near.

FLORIDA, EAST COAST: FEMALES—Continued

CANAVERAL

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
377523	U.S.N.M.	Canaveral	40		17.5	13.4	13.2	*76.57*	*85.44*	*98.51*	14.70				
377452	do	do	55		17.5	13.7	13.0	*78.29*	*83.33*	*94.89*	14.73				
377586	do	do	35		17.0	13.4	13.3	*78.82*	*87.50*	*99.25*	14.57				
377453	do	do	25		17.8	14.1	14.4	*79.21*	*90.28*	*102.12*	15.43				
377426	do	do	65		16.4	13.0	12.7	*79.27*	*86.39*	*97.69*	14.03				
377509	do	do	24		17.2	13.7	13.2	*79.65*	*85.44*	*96.35*	14.70				
377590	do	do	35		17.2	13.7	13.7	*79.65*	*88.67*	*100.00*	14.87				
377592	do	do	35		18.0	14.4	[1] 13.8	*80.00*	*85.19*	*95.83*	15.40				
377524	do	do	30		17.5	14.1	13.4	*80.57*	*84.81*	*95.04*	15.00				
377504	do	do	50		17.6	14.2	14.0	*80.68*	*88.05*	*98.59*	15.26				
377612	do	do	60		17.6	14.2	14.4	*80.68*	*90.57*	*101.41*	15.40				7.4
377488	do	do	26		17.0	13.8	14.1	*81.18*	*91.56*	*102.17*	14.97				7.3
377593	do	do	50		17.1	13.9	13.6	*81.29*	*87.74*	*97.84*	14.87				
377459	do	do	35		16.8	13.7	14.7	*81.55*	*96.39*	*107.30*	15.07			[2] 11.6	7.0
377430	do	do	23		17.0	13.9	13.1	*81.76*	*84.79*	*94.24*	14.67			11.3	7.0
377439	do	do	60		18.1	14.8	14.2	*81.77*	*86.32*	*95.95*	15.70				
377469	do	do	40		17.3	14.2	13.7	*82.08*	*86.98*	*96.48*	15.07			[2] 12.9	7.7
377497	do	do	50		17.1	14.1	13.4	*82.46*	*85.90*	*95.04*	14.87				7.0
377515	do	do	60		17.7	14.6	13.8	*82.49*	*85.45*	*94.52*	15.37				
377588	do	do	30		16.7	13.8	13.8	*82.63*	*90.49*	*100.00*	14.77			[2] 12.1	7.1
377654	do	do	50		17.6	14.7		*83.52*						[2] 12.2	7.2
377594	do	do	50		17.0	14.2	13.6	*83.53*	*87.18*	*95.77*	14.93			[2] 11.6	6.6
377429	do	do	70		17.4	14.6	13.6	*83.91*	*85.00*	*93.15*	15.20				
377503	do	do	30		16.8	14.1	14.0	*83.93*	*90.61*	*99.29*	14.97			[2] 12.2	7.5
377595	do	do	45		17.0	14.4	13.7	*84.71*	*87.26*	*95.14*	15.03				
377587	do	do	45		16.2	13.8	12.6	*85.19*	*84.00*	*91.30*	14.20				
377436	do	do	55		18.3	15.6	15.1	*85.25*	*89.09*	*96.79*	16.33				
377591	do	do	55		17.1	14.6	13.6	*85.38*	*85.80*	*93.15*	15.10				
377440	do	do	45		16.6	14.2	14.0	*85.54*	*90.91*	*98.59*	14.93			[2] 12.4	7.4
377510	do	do	65		16.8	14.4	13.0	*85.71*	*83.33*	*90.28*	14.73				7.0
377585	do	do	25		16.8	14.4	12.7	*85.71*	*81.41*	*88.19*	14.63				

377516	do	do	25		16.5	14.2	13.1	*86.06*	*85.34*	*92.25*	14.60				
377460	do	do	70		17.1	14.8	13.6	*86.55*	*85.27*	*91.89*	15.17				
377484	do	do	35		17.0	14.8	13.9	*87.06*	*87.42*	*93.92*	15.23			[2]12.1	7.1
377494	do	do	70		17.3	15.1	13.7	*87.28*	*84.57*	*90.73*	15.37				
377432	do	do	60		16.8	14.7	13.5	*87.50*	*85.71*	*91.84*	15.00				7.1
377589	do	do	25		16.7	15.0	14.0	*89.82*	*88.33*	*93.33*	15.23				
377508	do	do	50		16.7	15.4		*92.22*							
377522	do	do	55	Slight occipital flattening.	17.0	15.7	13.6	*92.35*	*83.18*	*86.62*	15.43				
Specimens					(39)	(39)	(37)	*(39)*	*(37)*	*(37)*	(37)			(9)	(14)
Totals					668.8	557.4	504.8				555.53			108.4	100.4
Averages					17.1	14.3	13.6	*83.34*	*86.90*	*95.73*	15.01			12.04	7.2
Minima					16.2	13.0	12.6	*76.57*	*81.41*	*86.62*	14.03			11.3	6.6
Maxima					18.3	15.7	15.1	*92.35*	*96.39*	*107.30*	15.70			12.9	7.7

MELBOURNE

331414	U.S.N.M.	Near Melbourne	50		17.4	14.0	13.2	*80.5*	*84.1*	*94.3*	14.87				7.2
331424	do	do	55		16.9	13.6	12.0	*80.5*	*78.7*	*88.2*	14.17				
331408	do	do	23		17.8	14.7	13.8	*82.6*	*84.9*	*93.9*	15.43				
331423	do	do	55		17.7	14.7	14.4	*83.1*	*88.9*	*98.0*	15.60				
331420	do	do	45		17.3	14.5	13.5	*83.8*	*84.9*	*93.1*	15.10	1,450			
331412	do	do	50		16.8	14.1	13.8	*83.9*	*89.3*	*97.9*	14.90			11.9	7.1
Specimens					(6)	(6)	(6)	*(6)*	*(6)*	*(6)*	(6)	(1)		(1)	(2)
Totals					103.9	85.6	80.7				90.07				14.3
Averages					17.3	14.3	13.5	*82.39*	*85.17*	*94.28*	15.01				7.15
Minima					16.8	13.6	12.0	*80.5*	*78.7*	*88.2*	14.17				7.1
Maxima					17.8	14.7	14.4	*83.9*	*89.3*	*98.0*	15.60				7.2

OLYMPIA LIGHT

363321	U.S.N.M.	Olympia Light	50		17.6	14.0	13.4	*79.6*	*84.8*	*95.7*	15.00	1,255			
363320	do	do	40		18.1	14.6	14.0	*80.7*	*85.6*	*95.9*	15.57	1,380			

LAKE OKEECHOBEE

228452	U.S.N.M.	Lake Okeechobee	Adult		17.3	13.6	14.0	*78.6*	*90.6*	*102.9*	14.97	1,325			6.9
228336	do	do	30		16.2	13.0	13.1	*80.3*	*89.7*	*100.8*	14.10	1,140			
228337	do	do	Adult		15.2	12.6	12.8	*82.9*	*92.1*	*101.6*	13.53	1,030			6.3

[1] Near.
[2] Restored.

FLORIDA, EAST COAST: FEMALES—Continued

CANAL POINT

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
345768	U.S.N.M.	Canal Point	35		17.4	12.7	13.4	*73.0*	*89.0*	*105.5*	14.50	1,190		11.1	6.8
345884	do	do	20		18.1	13.8		*76.2*							
345767	do	do	70		17.7	13.7	13.4	*77.4*	*85.3*	*97.8*	14.93	1,350		11.2	6.4
345887	do	do	35		17.7	14.6		*82.5*							
345885	do	do	65		17.3	15.0		*86.7*							
Specimens					(5)	(5)	(2)	*(5)*	*(2)*	*(2)*	(2)	(2)		(2)	(2)
Totals					88.2	69.8	26.8				29.43	2,540		22.3	13.2
Averages					17.6	14.0	13.4	*79.14*	*87.15*	*101.52*	14.72	1,270		11.2	6.6
Minima					17.3	12.7	13.4	*73.0*	*85.3*	*97.8*	14.50	1,190		11.1	6.4
Maxima					18.1	15.0	13.4	*86.7*	*89.0*	*105.5*	14.93	1,350		11.2	6.8

BELLEGLADE

Provisional No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
21	U.S.N.M.	Belleglade	Near middle age.		18.5	[1] 14.0	13.8	*75.68*	*84.92*	*98.57*	15.43				
20	do	do	24		17.8	13.6	13.5	*76.40*	*85.99*	*99.26*	14.97			11.1	6.8
33	do	do	35		17.2	13.4		*77.91*							
1	do	do	30		17.8	13.9	14.0	*78.09*	*88.33*	*100.72*	15.23			12.5	7.6
3	do	do	70		17.5	13.7	13.8	*78.29*	*88.46*	*100.73*	15.00				
11	do	do	Young adult.		[1] 17.1	13.5		*78.95*							
12	do	do	do		17.6	14.1		*80.11*							
14	do	do	Middle aged.		16.6	13.3		*80.12*							
26	do	do	Young adult.		17.7	14.2		*80.23*							

7	do	do	70		17.8	14.3		80.34							
8	do	do	70		17.9	14.4	13.6	80.45	84.21	94.44	15.30				
15	do	do	35		17.4	14.0	14.0	80.46	89.17	100.00	15.13				
36	do	do	24		16.9	13.6	13.0	80.47	85.25	95.59	14.50			11.3	6.7
37	do	do	45		17.8	14.4	14.1	80.90	87.58	97.92	15.43				
30	do	do	Old		17.0	13.8	13.9	81.18	90.26	100.72	14.90				
2	do	do	25	Occipital SM. asymmetry.	17.8	14.5		81.46							
25	do	do	Old		18.0	14.7	13.9	81.67	85.02	94.56	15.53				
10	do	do	20		17.0	14.0		82.35							
24	do	do	Old		17.6	14.6	14.1	82.95	87.58	96.58	15.43				
42	do	do	do		16.8	14.1	13.4	83.93	86.73	95.04	14.77				
13	do	do	Young adult.		16.6	14.1	[1] 13.5	84.94	87.95	95.74	14.73				
34	do	do	do		16.9	14.4	13.4	85.21	85.62	93.06	14.90				
16	do	do	Middle aged.		16.3	13.9	14.0	85.28	92.72	100.72	14.73				
4	do	do	Subadult		16.2	14.0		86.42							
40	do	do	40		16.5	14.5	13.1	87.88	84.52	90.34	14.70			10.7	
29	do	do	Elderly		[1] 17.4	15.3	14.0	87.93	85.63	91.50	15.57				
Specimens					(26)	(26)	(17)	(26)	(17)	(17)	(17)			(4)	(3)
Totals					449.7	366.3	233.1				256.25			45.6	21.1
Averages					17.3	14.1	13.7	81.45	87.03	96.72	15.1			11.4	7.03
Minima					16.2	13.3	13.0	75.68	84.21	90.34	14.50			10.7	6.7
Maxima					18.5	15.3	14.1	87.93	92.72	100.73	15.57			12.5	7.6

BOYNTON

Catalog No.															
327806	U.S.N.M.	Near Boynton	65		17.2	13.7	13.6	79.7	88.0	99.3	14.83	1,215			
327808	do	do	60		18.0	14.6		81.1				[1] 1,480			
327803	do	do	25		16.9	13.8		81.7							
327805	do	do	70		17.4	14.3	[1] 13.4	82.2	84.5	93.7	15.03	[1] 1,305			
327804	do	do	60		16.9	14.1	13.1	83.4	84.5	92.9	14.70				
327801	do	do	45		17.0	14.3		84.1							
Specimens					(6)	(6)	(3)	(6)	(3)	(3)	(3)	(3)			
Totals					103.4	84.8	40.1				44.56	4,000			
Averages					17.2	14.1	13.4	82.01	85.68	95.25	14.85	1,333.3			
Minima					16.9	13.7	13.1	79.7	84.5	92.9	14.70	1,215			
Maxima					18.0	14.6	13.6	84.1	88.0	99.3	15.03	1,480			

DELRAY

284702	U.S.N.M.	Near Delray	Adult		17.6	14.2	14.0	80.7	88.0	98.6	15.27	1,375		11.9	

[1] Near.

FLORIDA, EAST COAST: FEMALES—Continued

ST. JOHNS RIVER

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a \times 100}{c}\right)$	*Facial Index, upper* $\left(\frac{b \times 100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
							°	°														
1794																						
1808																						
1787																						
1795																						
1783	12.8		*50.0*												4.9	2.0	*40.8*					
1789																						
1790																						
Specimens	(1)		*(1)*												(1)	(1)	*(1)*					
Totals																						
Averages																						
Minima																						
Maxima																						
ST. AUGUSTINE																						
242666						10.2																
242685									3.5		3.9		*89.7*									
242686	13.2	*90.9*	*57.6*	9.6	8.5	9.8	68.5	55.0	3.4	3.5	3.6	3.7	*94.4*	*94.6*	5.4	2.4	*44.4*	5.5	6.2	*88.7*	3.6	
ANASTASIA ISLAND																						
229094																						

CRESCENT BEACH

Seen locally						9.4				3.15		3.35		*94.03*	4.3	2.1	*48.8*					

NEW SMYRNA

242627						10.1																
242622						9.8																
242626						9.9																
242623	[1] 12.9		(*49.6*)	[1] 10.0	9.0	10.1	[1] 72.0	49.0		3.6		3.8		*94.7*	4.9							
242628																						
330835																						
Specimens	(2)	(*1*)	(*1*)	(2)	(2)	(7)	(2)	(2)	(2)	(3)	(2)	(3)	(2)	(3)	(3)	(2)	(2)	(1)	(1)	(*1*)	(1)	
Totals	26.1			19.6	17.5	69.3	140.5	104.0	6.9	10.25	7.5	10.85			14.6	4.5						
Averages	13.05			9.8	8.75	9.9	70.25	52.0	3.45	3.6	3.75	3.6	*92.0*	*94.47*	4.9	2.25	*46.39*					
Minima	12.9			9.6	8.5	9.4	68.5	49.0	3.4	3.15	3.6	3.35	*89.7*	94.03	4.3	2.1	*44.4*					
Maxima	13.2			10.0	9.0	10.2	72.0	55.0	3.5	3.6	3.9	3.8	*94.4*	*94.7*	5.4	2.4	*48.8*					

ORMOND BEACH

372633						10.8																
372601																						
372613						9.7																
372614	13.3		*54.89*			9.9									5.0	2.4	*48.0*					
372626	13.7		*50.36*	10.4	9.0	9.8	*6.55*	*4.34*		3.3		3.9		*84.62*	5.0	2.6	*52.0*					
372616	13.2		*50.00*			10.2									4.8	2.6	*54.17*	5.7	6.0	*95.0*		
372637						10.4																
372608						9.7																
372611																						
372644																						
372624																						
372612																						
372636						10.4																
372607																						
372627																						
372622																						
Specimens	(3)		(*3*)	(1)	(1)	(8)	(*1*)	(*1*)		(1)		(1)		(*1*)	(3)	(3)	(*3*)	(1)	(1)	(*1*)		
Totals	40.2					80.9									14.8	7.6						
Averages	13.4		*51.74*			10.1									4.9	2.5	*51.35*			*95.0*		
Minima	13.2		*50.00*			9.7									4.8	2.4	*48.0*					
Maxima	13.7		*54.89*			10.8									5.0	2.6	*54.17*					

[1] Near.

FLORIDA, EAST COAST: FEMALES—Continued

CANAVERAL

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index total* $\left(\frac{a\times100}{c}\right)$	*Facial Index upper* $\left(\frac{b\times100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
							°	°														
377523	13.7					10.1																
377452	[1]14.0				8.6	9.8				3.7		4.1		*90.24*	5.15	2.65	*51.46*					
377586																						
377453	[1]14.0					10.4												5.7	6.4	*89.06*		
377426	13.0				8.2	9.4			3.45	3.6	4.1	3.8	*84.15*	*94.74*	5.3	2.0	*37.74*					
377509						9.8																
377590						10.3																
377592																						
377524						10.2																
377504	13.4					10.2																
377612				9.8	8.8	10.0	*69.5*	*57.0*	3.5	3.45	3.8	3.75	*92.11*	*92.00*	5.3	2.5	*47.17*					
377488	13.7		*53.28*	10.0	9.0	10.3	*71.5*	*55.5*	3.5	3.6	4.0	4.0	*87.50*	*90.00*	5.0	2.35	*47.0*	5.4	6.3	*85.71*		
377593						10.6																
377459	13.4	*86.57*	*52.24*	10.2	9.2	10.4	*71.0*	*57.0*	3.4	3.4	3.7	3.7	*91.89*	*91.89*	4.95	2.5	*50.51*	5.3	6.4	*82.81*		
377430	13.1	*86.26*	*53.44*	9.9	8.8	9.7	*67.0*	*52.0*	3.4	3.35	3.65	3.65	*93.15*	*91.78*	5.0	2.4	*48.0*	5.4	6.3	*85.71*		
377439	14.3				9.2	10.4				3.6		4.0		*90.00*	5.3	2.65	*50.0*					
377469	14.0	*92.14*	*55.00*	10.6	9.4	10.1	*64.5*	*55.0*	3.6	3.6	3.9	3.7	*92.31*	*97.30*	5.2	2.5	*48.08*	5.9	6.9	*85.51*		
377497	[1]13.8		*50.72*	10.5	9.5	10.0	*66.0*	*54.0*	3.35		3.8		*88.16*		5.05	2.5	*49.50*					
377515						10.3																
377588						10.0			3.6		4.1		*87.80*		5.2	2.65	*50.96*	5.6	6.4	*87.50*		
377654	13.7	*89.05*	*52.55*						3.7	3.7	4.1	4.1	*90.24*	*90.24*	5.25	2.5	*47.62*	5.3	6.0	*88.33*		
377594	13.7	*84.67*	*48.18*	9.5	8.4	9.4	*68.5*	*49.0*	3.45	3.4	3.7	3.65	*93.24*	*93.15*	4.9	2.65	*54.08*	5.1	6.3	*80.95*		
377429	13.9					10.1																
377503	13.9	*87.77*	*53.96*	10.3	9.2	10.3	*68.0*	*53.0*	3.3	3.25	3.8	3.8	*86.84*	*85.53*	5.3	2.5	*47.17*	5.8	6.7	*86.57*		
377595	[1]14.6					9.9																
377587						9.6																
377436	14.8					10.7																
377591						10.0																
377440	13.5	*91.85*	*54.81*	10.2	9.0	9.9	*66.0*	*53.0*	3.2	3.3	3.8	3.75	*84.21*	*88.00*	4.85	2.45	*50.52*	5.5	6.6	*83.33*		
377510	13.6		*51.47*	9.5	8.4	9.6	*69.0*	*52.5*	3.65	3.65	4.2	4.1	*86.90*	*89.02*	5.0	2.55	*51.0*					

377585	14.2					9.9																
377516						9.1									5.2	2.2	*42.31*	5.3	6.2	*85.48*		
377460						10.1																
377484	[1] 14.1	*85.82*	*50.35*	10.0	8.9	10.0	*69.0*	*50.0*	3.6	3.7	3.9	3.75	*92.31*	*98.67*	5.3	2.5	*47.17*					
377494	[1] 13.8					9.5																
377432						9.6			3.7		3.9		*94.87*		5.0	2.4	*48.0*					
377589						9.7																
377508						9.8																
377522						10.1																
Specimens	(22)	*(8)*	*(11)*	(11)	(14)	(36)	*(11)*	*(11)*	(15)	(14)	(15)	(14)	*(15)*	*(14)*	(18)	(18)	*(18)*	(11)	(11)	*(11)*		
Totals	304.2			110.5	124.6	359.3	*750.0*	*588.0*	52.4	49.3	58.45	53.85			92.25	44.45		60.3	70.5			
Averages	13.8	*88.03*	*52.36*	10.05	8.9	9.98	*68.18*	*53.45*	3.5	3.5	3.9	3.8	*89.65*	*91.55*	5.1	2.5	*48.18*	5.5	6.4	*85.53*		
Minima	13.0	*84.67*	*48.18*	9.5	8.2	9.1	*64.5*	*49.0*	3.2	3.25	3.65	3.65	*84.15*	*85.53*	4.85	2.0	*37.74*	5.1	6.0	*80.95*		
Maxima	14.8	*92.14*	*55.0*	10.6	9.5	10.7	*71.5*	*57.0*	3.7	3.7	4.2	4.1	*94.87*	*98.67*	5.3	2.65	*54.08*	5.9	6.9	*89.06*		

MELBOURNE

331414	13.6		*52.9*	10.4	9.2	10.2	68.0	52.0	3.55	3.45	3.9	3.8	*91.0*	*90.8*	5.2	2.5	*48.1*	5.9	6.6	*89.4*		9.3
331424						9.5															3.4	9.5
331408																						10.4
331423																						
331420						10.1																9.9
331412	13.5	*88.2*	*52.6*	9.8	8.4	9.4	65.5	48.0	3.3	3.3	3.9	3.9	*84.6*	*84.6*	4.9	2.4	*49.0*	5.6	6.3	*88.9*	3.6	9.6
Specimens	(2)	*(1)*	*(2)*	(2)	(2)	(4)	(2)	(2)	(2)	(2)	(2)	(2)	*(2)*	*(2)*	(2)	(2)	*(2)*	(2)	(2)	*(2)*	(2)	(5)
Totals	27.1			20.2	17.6	39.2	133.5	100.0	6.85	6.75	7.8	7.7			10.1	4.9		11.5	12.9		7.0	48.7
Averages	13.6		*52.77*	10.1	8.8	9.8	66.8	50.0	3.4	3.4	3.9	3.85	*87.82*	*87.66*	5.05	2.45	*48.51*	5.75	6.45	*89.15*	3.5	9.7
Minima	13.5		*52.6*	9.8	8.4	9.4	65.5	48.0	3.3	3.3	3.9	3.8	*84.6*	*84.6*	4.9	2.4	*48.1*	5.6	6.3	*88.9*	3.4	9.3
Maxima	13.6		*52.9*	10.4	9.2	10.2	68.0	52.0	3.55	3.45	3.9	3.9	*96.2*	*90.8*	5.2	2.5	*49.0*	5.9	6.6	*89.4*	3.6	10.4

OLYMPIA LIGHT

363321	13.7					9.8				3.6		3.8		*94.7*								9.5
363320	14.2					10.4			3.55		4.05		*87.7*									9.2

LAKE OKEECHOBEE

228452				[1] 9.8	8.9	10.1	72.5	58.0		3.3		3.9		*84.6*	4.9						3.05	
228336	12.4																				3.5	9.4
228337				[1] 10.0	8.8	9.4	66.0	43.0		3.3		3.6		*91.7*	4.7			[1] 5.4	5.8	*93.1*		

[1] Near.

FLORIDA, EAST COAST: FEMALES—Continued

CANAL POINT

Catalog No.	Diam. Bizygomatic maxim (c)	Facial Index, total $\left(\frac{a\times100}{c}\right)$	Facial Index, upper $\left(\frac{b\times100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	Orbital Index, right	Orbital Index, left ×	Nose, height	Nose, breadth maxim.	Nasal Index	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	Upper Alveolar Arch, Index	Lower Jaw, height at Symphysis	Diam. frontal minim.
345768	13.0	*85.4*	*52.3*	9.4	8.4	9.7	° 72.0	° 54.0	3.35	3.3	3.6	3.4	*93.1*	*97.1*	4.9	2.4	*49.0*	5.3	6.4	*82.8*	3.0	9.0
345884																						
345767	13.7	*81.8*	*46.7*	10.0	9.0	10.2	73.5	54.0	3.2	3.3	3.7	3.6	*86.5*	*90.4*	4.6	2.5	*54.4*	5.6	6.3	*88.9*	3.2	9.1
345887																						
345885																						
Specimens	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Totals	26.7			19.4	17.4	19.9	145.5	108.0	6.55	6.6	7.3	7.0			9.5	4.9		10.9	12.7		6.2	18.1
Averages	13.4	*83.52*	*49.44*	9.7	8.7	10.0	72.75	54.0	3.3	3.3	3.65	3.5	*89.73*	*94.29*	4.75	2.45	*51.58*	5.45	6.35	*85.83*	3.1	9.1
Minima	13.0	*81.8*	*46.7*	9.4	8.4	9.7	72.0	54.0	3.2	3.3	3.6	3.4	*86.5*	*90.4*	4.6	2.4	*49.0*	5.3	6.3	*82.8*	3.0	9.0
Maxima	13.7	*85.4*	*52.3*	10.0	9.0	10.2	73.5	54.0	3.35	3.3	3.7	3.6	*93.1*	*97.1*	4.9	2.5	*54.4*	5.6	6.4	*88.9*	3.2	9.1

BELLEGLADE

Provisional No.	Diam. Bizygomatic maxim (c)	Facial Index, total	Facial Index, upper	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	Orbital Index, right	Orbital Index, left	Nose, height	Nose, breadth maxim.	Nasal Index	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	Upper Alveolar Arch, Index	Lower Jaw, height at Symphysis	Diam. frontal minim.
21						9.9																
20	13.4	*82.84*	*50.75*	10.0	8.4	9.4	° *65.0*	° *39.5*	3.8	3.8	4.0	3.9	*95.00*	*97.44*	4.9	2.6	*53.06*	5.3	6.4	*82.81*		
33																						
1	14.1	*88.65*	*53.90*	10.2	9.0	10.5	*71.0*	*54.0*	3.4		3.85		*88.31*		5.3	2.7	*50.94*	5.6	6.8	*82.35*		
3	13.5				8.4	9.6			3.7	3.9	4.1	4.0	*90.24*	*97.50*	4.8	2.7	*56.25*					
11																						
12																						
14																						
26																						
7																						

8						10.9																
15	13.9					10.3																
36	12.9	87.60	51.94	9.0	8.0	9.2	70.0	55.5	3.7	3.65	3.6	3.6	102.78	101.39	4.7	2.45	52.13	5.1	6.1	83.61		
37	13.5				8.4	10.2			3.5	3.5	3.85	3.8	90.91	92.11	5.15	2.75	53.40					
30																						
2																						
25	13.8				8.7	10.1			3.6	3.7	4.0	3.9	90.00	94.87	5.2	2.95	56.73					
10																						
24	13.8					10.1																
42	13.2																					
13																						
34	13.3					9.3																
16	[1]13.2					10.1																
4																						
40	13.4	79.85			8.2	9.1			3.75	3.75	3.9	3.7	96.15	101.35	5.05	2.6	51.49					
29						9.9																
Specimens	(12)	(4)	(3)	(3)	(7)	(14)	(3)	(3)	(7)	(6)	(7)	(6)	(7)	(6)	(7)	(7)	(7)	(3)	(3)	(3)		
Totals	162.0			29.2	59.1	138.6	206.0	149.0	25.45	22.3	27.3	22.9			35.1	18.75		16.0	19.3			
Averages	13.5	84.76	52.23	9.7	8.4	9.9	68.67	49.67	3.6	3.7	3.9	3.8	93.22	97.38	5.01	2.7	53.42	5.3	6.4	82.90		
Minima	12.9	79.85	50.75	9.0	8.0	9.1	65.0	39.5	3.4	3.5	3.6	3.6	88.31	92.11	4.7	2.45	50.94	5.1	6.1	82.35		
Maxima	14.1	88.65	53.90	10.2	9.0	10.9	71.0	55.5	3.75	3.9	4.1	4.0	102.78	101.39	5.3	2.95	56.73	5.6	6.8	83.61		

BOYNTON

Catalog No.																						
							°	°														
327806						10.4																9.3
327808																						10.2
327803																					3.3	9.0
327805																						10.2
327804						9.9																9.2
327801																						8.8
Specimens						(2)															(1)	(6)
Totals						20.3																56.7
Averages						10.2																9.45
Minima						9.9																8.8
Maxima						10.4																10.2

DELRAY

284702	13.2	90.2			9.1	9.85			3.5	3.6	3.8	3.8	92.1	94.7	5.15	2.3	44.7		6.7			

[1] Near.

FLORIDA, WEST COAST: FEMALES

PENSACOLA BAY

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
242667	U. S. N. M.	Pensacola Bay	Adult	Moderate frontal occipital flattening.	(16.2)	(14.3)	(13.2)	*(88.3)*	*(86.6)*	*(92.3)*	14.57	1,260	Slight	11.6	7.0
242669	do	do	do	Slight occipital flattening.	(16.0)	(14.4)	(14.0)	*(90.0)*	*(92.1)*	*(97.2)*	14.80	1,190			
242668	do	do	do	Pronounced occipital flattening.	(16.2)	(14.4)	(14.0)	*(88.9)*	*(91.5)*	*(97.2)*	14.87		Moderate	12.2	8.0
CEDAR KEYS															
243694	U.S.N.M.	Cedar Keys	Adult		17.0	14.1		*82.9*							
242617	do	do	do		16.9	14.4	12.8	*85.2*	*81.8*	*88.9*	14.70				
331765	do	do	do		16.2	13.8		*85.2*				[1] 1,320			
ANCLOTE KEY															
15857	W. I.	Anclote Key	Adult		17.2	13.4	13.6	*77.9*	*88.9*	*101.5*	14.73				7.4
TARPON SPRINGS															
15839	W. I.	Tarpon Springs	Adult		17.2	13.4	12.6	*77.9*	*82.4*	*94.0*	14.40				7.1
15483	do	do	do		17.6	14.0		*79.6*							7.3
16010	do	do	do		15.8	12.9	12.7	*81.6*	*88.5*	*98.4*	13.80				
15480	do	do	do		17.6	14.6	13.6	*83.0*	*84.5*	*93.2*	15.27				
15840	do	do	do		16.8	14.1		*83.9*							
15957	do	do	do		17.6	14.8		*84.1*							

15478	do	do	do		17.2	14.6		84.9							
15794	do	do	do		16.5	14.1		85.4							
15962	do	do	do		16.4	14.3	[1] 13.6	87.2	88.6	95.1	14.77				
16009	do	do	do	Slight frontal occipital flattening.	(16.9)	(15.4)		(91.1)							6.8
Specimens					(9)	(9)	(4)	(9)	(4)	(4)	(4)				(3)
Totals					152.7	126.8	52.5				58.24				21.20
Averages					17.0	14.1	13.1	83.04	85.92	95.11	14.56				7.1
Minima					15.8	12.9	12.6	77.9	82.4	93.2	13.80				7.1
Maxima					17.6	14.6	13.6	87.2	88.6	98.4	15.27				7.3

SAFETY HARBOR

350284	U.S.N.M.	Safety Harbor	65		18.5	13.8		74.6				[1] 1,250			
350353	do	do	25		17.5	13.7		78.3							
350337	do	do	45		18.0	14.2		78.9							
350346	do	do	30		16.8	13.3	13.4	79.2	83.0	100.8	14.50			11.3	7.2
350335	do	do	60		17.7	14.1		79.6							6.6
350292	do	do	25		17.6	14.1		80.1							
350288	do	do	25		17.3	13.9		80.4							
350310	do	do	45		17.5	14.2	13.6	81.1	85.8	95.8	15.10	[1] 1,270			
350356	do	do	30		17.0	13.8	13.4	81.2	87.0	97.1	14.73	1,210		11.3	6.8
350316	do	do	35		18.2	14.8		81.3							
350283	do	do	35		17.2	14.0	13.0	81.4	83.3	92.9	14.73				
350318	do	do	50		[1] 17.1	14.0	13.0	81.9	83.6	92.9	14.70				
350326	do	do	50		16.8	13.8		82.1							
350280	do	do	35		17.1	14.1	13.6	82.5	87.2	96.5	14.93	1,250		11.8	7.0
350313	do	do	60		17.6	[1] 14.6		83.0							
350307	do	do	20		16.6	13.8		83.1							
350359	do	do	50		17.0	14.3	13.2	84.1	84.4	92.3	14.83				
350294	do	do	25		16.6	14.0		84.3							
350328	do	do	55		16.6	14.0	13.7	84.3	89.5	97.9	14.77	1,325			
350281	do	do	50		16.7	14.1	13.6	84.4	88.3	96.4	14.80	1,225		11.4	6.8
350312	do	do	40		16.8	14.2	13.2	84.5	85.2	93.0	14.73	1,230			
350309	do	do	25		17.3	14.8		85.6							
350299	do	do	24		17.0	14.9		87.7							
350308	do	do	35												
Specimens					(23)	(23)	(10)	(23)	(10)	(10)	(10)	(7)		(4)	(5)
Totals					396.5	324.5	133.7				147.82	8,760		45.8	34.4
Averages					17.2	14.1	13.4	81.84	86.31	95.50	14.78	1,251.4		11.45	6.9
Minima					16.6	13.3	13.0	74.6	83.0	92.3	14.50	1,210		11.3	6.6
Maxima					18.5	14.9	13.7	87.7	89.5	100.8	15.10	1,325		11.8	7.2

[1] Near.

FLORIDA, WEST COAST: FEMALES—Continued

TAMPA BAY

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
242648	U. S. N. M.	Tampa Bay	Adult		17.6	13.3	13.8	*75.6*	*89.3*	*103.8*	14.57				
242637	do	do	do		17.3	13.5	14.2	*78.0*	*92.2*	*105.2*	15.00				
242679	do	do	do		17.4	13.6		*78.2*						10.8	6.6
242645	do	do	do		17.5	13.7		*78.3*							
2213	A. N. S. P.	do	do		17.0	13.4	13.3	*78.8*	*87.5*	*99.2*	14.57				6.8
242614	U. S. N. M.	do	do		18.1	14.3		*79.0*							
2210	A. N. S. P.	do	do		17.1	13.6	12.8	*79.5*	*83.3*	*94.1*	14.50			11.0	6.8
242674	U. S. N. M.	do	do		17.3	13.8		*79.8*							
242636	do	do	do		17.8	14.3	14.8	*80.3*	*92.2*	*103.5*	15.63				[1]7.2
2215	A. N. S. P.	do	do		17.6	14.3	13.7	*81.2*	*85.9*	*95.8*	15.20			11.5	7.1
242643	U. S. N. M.	do	do		17.0	13.9	13.3	*81.8*	*86.1*	*95.7*	14.73				
242672	do	do	do		17.4	[1]14.3		*82.2*							
242642	do	do	do		17.2	14.2	14.4	*82.6*	*91.7*	*101.4*	15.27				6.6
242635	do	do	do		17.6	14.6		*83.0*							
2218	A. N. S. P.	do	do		16.5	14.7	13.8	*89.1*	*88.5*	*93.9*	15.0				6.9
Specimens					(15)	(15)	(9)	*(15)*	*(9)*	*(9)*	(9)			(3)	(7)
Totals					260.4	209.5	124.1				134.47			33.3	48.0
Averages					17.36	13.97	13.79	*79.07*	*88.55*	*99.12*	14.94			11.1	6.86
Minima					16.5	13.3	12.8	*75.6*	*83.3*	*93.9*	14.50			10.8	6.6
Maxima					18.1	14.7	14.8	*89.1*	*92.2*	*105.2*	15.63			11.5	[1]7.2

CLEARWATER

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
243692	U. S. N. M.	Clearwater	Adult		17.7	14.0	13.4	*79.1*	*84.5*	*95.7*	15.03	1,320			

WEEDEN ISLAND

329412	U. S. N. M.	Weeden Island	60		17.7	13.7		77.4							
329413	do	do	75		18.0	14.0		77.8							
329378	do	do	65		17.4	13.6		78.2							
329419	do	do	60		17.4	13.7		78.7							
329398	do	do	50	Moderate lateral occipital.	18.2	14.4		79.1							
329409	do	do	40		17.5	14.0		80.0							
329403	do	do	50		16.2	13.0		80.3							
329410	do	do	45		17.4	14.0		80.5				[1] 1,360			
329406	do	do	60		17.1	13.8		80.7							
329377	do	do	55		18.1	14.7		81.2							
329387	do	do	60		17.3	14.1		81.5							7.1
329391	do	do	40		16.8	13.7		81.6							
329408	do	do	60		17.4	14.4		82.8							
329416	do	do	45	Slight lateral occipital.	17.0	14.1		82.9							
329393	do	do	35		16.4	13.6		82.9							
329402	do	do	40		17.3	14.4		83.2							
329396	do	do	25		17.3	14.4		83.2							
329376	do	do	50		16.5	13.9		84.2							
329411	do	do	65		17.2	14.6		84.9							
329381	do	do	25		17.2	14.6		84.9							
329418	do	do	70		16.8	14.6		86.9							
329383	do	do	60		16.0	14.2		88.8							
Specimens					(22)	(22)		(22)				(1)			(1)
Totals					378.2	309.5									
Averages					17.2	14.1		81.84							
Minima					16.0	13.0		77.4							
Maxima					18.2	14.7		88.8							

PUNTA GORDA

331426	U. S. N. M.	Punta Gorda	65		16.8	14.1	13.4	83.9	86.7	95.0	14.77	1,235		12.3	7.1

PERICO ISLAND

373554	U.S.N.M.	Perico Island	30		18.3	13.6	14.6	74.32	91.54	93.15	15.50			[2] 12.8	7.8
373479	do	do	55		18.0	13.4	13.2	74.44	84.06	98.51	14.87				
373545	do	do	55		17.8	13.7		76.97							
373586	do	do	Young adult.		17.6	13.6		77.27							
373571	do	do	50		18.1	14.0	13.8	77.35	85.98	98.57	15.30				7.3
373623	do	do	65		18.3	14.2	[1] 13.7	77.60	84.31	96.48	15.40				

[1] Near.
[2] Restored.

FLORIDA, EAST COAST: FEMALES—Continued

PERICO ISLAND—Continued

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt. · Nasion height (b)
373478	U.S.N.M.	Perico Island	40		18.0	14.0	13.5	*77.78*	*84.38*	*96.43*	15.17			[2] 12.3	[1] 7.5
373553	do	do	60		17.7	13.8	13.4	*77.97*	*85.08*	*97.10*	14.97				
373548	do	do	30		17.8	13.9	14.0	*78.09*	*88.33*	*100.72*	15.23				
373531	do	do	28		17.1	13.4	12.8	*78.36*	*83.93*	*95.52*	14.43			12.0	7.1
373624	do	do	50		17.6	13.8		*78.41*							7.3
373484	do	do	40		17.6	13.8	13.6	*78.41*	*86.62*	*93.55*	15.00				
373580	do	do	30		18.1	14.2	[1] 13.8	*78.45*	*85.45*	*97.18*	15.37			11.9	6.8
373540	do	do	45	Occipital slight asymmetry.	18.0	14.2		*78.89*						[2] 12.4	7.2
373603	do	do	35		17.6	13.9	[1] 13.7	*78.98*	*86.98*	*98.56*	15.07			[2] 12.4	7.5
373535	do	do	40		17.2	13.6	13.4	*79.07*	*87.01*	*98.53*	14.73				
373504	do	do	40		17.7	14.0	13.8	*79.10*	*87.07*	*98.57*	15.17				
373604	do	do	75		18.2	14.4		*79.12*							
373492	do	do	50		17.4	13.8	13.3	*79.31*	*85.27*	*96.38*	14.83			[2] 12.4	7.5
373489	do	do	45		18.0	14.3	13.5	*79.44*	*83.59*	*94.41*	15.27				7.3
373557	do	do	40		18.0	14.3	14.2	*79.44*	*87.93*	*99.30*	15.50				7.4
373617	do	do	45		17.6	14.0	[1] 14.1	*79.55*	*89.24*	*100.71*	15.23				
373594	do	do	24		17.2	13.7		*79.65*						11.8	6.9
373505	do	do	30		17.7	14.1	13.9	*79.66*	*87.42*	*98.58*	15.23				7.3
373626	do	do	35		17.3	13.8	13.4	*79.77*	*86.17*	*97.10*	14.83			[2] 12.0	7.2
373507	do	do	35		17.3	13.8	13.9	*79.77*	*89.39*	*100.72*	15.00			[2] 12.1	7.2
373481	do	do	45		17.0	13.6	13.3	*80.00*	*86.93*	*97.79*	14.63				[1] 6.5
373590	do	do	70		17.8	14.3		*80.34*							
373585	do	do	35	Occipital small asymmetry.	17.9	14.4		*80.45*						12.1	7.2
373627	do	do	60		17.0	13.7	12.1	*80.59*	*78.83*	*88.32*	14.27			[2] 11.3	6.7
373591	do	do	30		17.6	14.2		*80.68*							
373560	do	do	Subadult		17.1	13.8	13.6	*80.70*	*88.08*	*98.55*	14.83				
373547	do	do	50		17.2	[1] 13.9		*80.81*							
373497	do	do	50		17.8	14.4	13.6	*80.90*	*84.47*	*94.44*	15.27				
373549	do	do	50		17.8	[1] 14.4		*80.90*							
373532	do	do	45		18.0	14.6	14.4	*81.11*	*88.34*	*98.63*	15.67				
373482	do	do	50		18.0	14.6	14.3	*81.11*	*87.73*	*97.95*	15.63				7.3
373569	do	do	50		17.5	14.2		*81.14*							

293065	do	do	Adult		16.6	[1]13.5	13.4	*81.33*	*89.04*	*99.26*	14.50	1,200			6.9
373619	do	do	50		17.4	[1]14.2		*81.61*							
373552	do	do	40		18.1	14.8	14.4	*81.77*	*87.54*	*97.80*	15.77			[2]12.7	7.7
373529	do	do	50		17.1	14.0	14.0	*81.87*	*90.03*	*100.00*	15.03				
373556	do	do	25		17.3	14.2		*82.08*							
373628	do	do	40		16.9	13.9	[1]13.0	*82.25*	*84.42*	*93.53*	14.60			11.5	
373607	do	do	45		17.6	14.5	14.0	*82.39*	*87.23*	*96.55*	15.37				
373575	do	do	30		16.7	[1]13.8		*82.63*							
373539	do	do	50		17.0	14.1		*82.94*							
373509	do	do	19		17.1	14.2	13.2	*83.04*	*84.35*	*92.96*	14.83			11.2	6.6
373486	do	do	65		17.2	14.3		*83.14*						[2]11.8	7.0
373598	do	do	40		[1]17.3	14.4		*83.24*							
373562	do	do	45		17.8	14.9	13.9	*83.71*	*85.02*	*93.29*	15.53			[1]11.7	7.0
373601	do	do	40	Slight or none	16.8	14.1		*83.93*							
373491	do	do	20		17.3	14.6	13.6	*84.39*	*85.27*	*93.15*	15.17			11.3	6.9
373499	do	do	40		16.6	14.0	13.0	*84.34*	*84.97*	*92.86*	14.53			[2]11.8	[1]7.1
373613	do	do	70		17.0	14.4	12.6	*84.71*	*80.25*	*87.50*	14.67				[1]7.2
373587	do	do	Subadult		17.0	14.4		*84.71*							
373502	do	do	40		16.5	14.2	14.0	*86.06*	*91.21*	*98.59*	14.90			[2]12.3	7.3
373506	do	do	45		17.0	14.8	13.9	*87.06*	*87.42*	*93.92*	15.23				
373592	do	do	30		17.1	14.9		*87.13*							
373563	do	do	60	Slight occipital flattening or none.	16.6	14.8	13.8	*89.16*	*87.90*	*93.24*	15.07			[2]11.8	7.0
363605	do	do	24												
373555	do	do	30	Moderate occipital flattening.	(16.6)	(14.1)	(14.0)	*(84.94)*	*(91.21)*	*(99.29)*	14.90			11.8	7.0
Specimens					(60)	(60)	(39)	*(60)*	*(39)*	*(39)*	(40)	(1)		(22)	(30)
Totals					1,047.9	846.4	531.7				602.5	1,200		263.4	214.7
Averages					17.5	14.1	13.6	*80.77*	*86.37*	*96.81*	15.06			12.0	7.2
Minima					16.5	13.4	12.1	*74.32*	*78.83*	*87.50*	14.27			11.2	6.5
Maxima					18.3	14.9	14.6	*89.16*	*91.54*	*100.72*	15.77			12.8	7.8

CHARLOTTE BAY

2227	A. N. S. P.	Charlotte Bay	Adult		16.6	14.0	13.5	*84.8*	*88.2*	*96.4*	14.70				6.7

CAPTIVA ISLAND

340622	U.S.N.M.	Captiva Island	35		17.9	13.2	13.4	*73.7*	*86.2*	*101.5*	14.83	[1]1,320			
340629	do	do	35		17.5	13.1	13.4	*74.9*	*87.6*	*102.3*	14.67	1,200		11.5	7.1
340626	do	do	55		18.3	13.7		*74.9*				[1]1,360			
340679	do	do	25		17.8	13.4		*75.3*							
340641	do	do	65		19.0	14.3		*75.3*							
292755	do	do	Adult		17.5	13.4		*76.6*							
340681	do	do	40		18.2	14.0		*76.9*				[1]1,370			
340665	do	do	50		18.1	14.0		*77.4*							
340644	do	do	60		18.3	14.2		*77.6*							
340661	do	do	75		17.9	13.9		*77.7*							

[1] Near.

[2] Restored.

FLORIDA, WEST COAST: FEMALES—Continued

CAPTIVA ISLAND—Continued

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
340639	U.S.N.M.	Captiva Island	60		18.5	14.4		77.8							
340654	do	do	30		18.0	14.0	13.1	77.8	81.9	93.6	15.03	1,220			
340671	do	do	50		18.2	14.2		78.0							
340611	do	do	55		17.5	13.7	12.9	78.3	82.7	94.2	14.70	1,140		11.3	6.7
340668	do	do	60		17.7	13.9	13.8	78.5	87.3	99.3	15.13	1,340			
340663	do	do	18		16.8	13.4		79.8							
340640	do	do	23		18.4	14.7		79.9							
340638	do	do	30		17.5	14.0	13.4	80.0	85.1	95.7	14.97	1,210			
340651	do	do	50		17.0	13.6	13.2	80.0	86.3	97.1	14.60			11.8	7.1
340610	do	do	55		17.6	14.1	12.5	80.1	78.9	88.7	14.73	1,230			
340655	do	do	45		17.6	14.1		80.1				[1] 1,360			
340656	do	do	40		17.3	13.9	13.2	80.4	84.6	95.0	14.80	1,310		11.4	6.6
340631	do	do	30		17.5	14.1	13.0	80.6	82.3	92.2	14.87	[1] 1,180		12.1	7.1
340687	do	do	25		17.2	13.9	13.2	80.8	84.9	95.0	14.77				7.7
340614	do	do	50		17.3	14.0		80.9				[1] 1,350			
340616	do	do	50		17.3	14.0	13.5	80.9	86.3	99.3	14.93	1,190		11.8	7.0
340674	do	do	65		18.3	14.8		80.9							
340642	do	do	25		17.0	13.8	13.4	81.2	87.0	97.1	14.73	1,290		11.8	7.4
340669	do	do	55		17.6	14.3	13.4	81.3	84.0	93.7	15.10	1,350			
340686	do	do	65		17.7	14.4		81.4							
292752	do	do	Adult		17.8	14.5	13.2	81.5	81.7	91.0	15.17	1,260			
340619	do	do	40		17.6	14.4	13.3	81.8	83.1	92.4	15.10	1,325			
340667	do	do	20		17.6	14.4		81.8				[1] 1,460			
340620	do	do	25		17.7	14.5		81.9				[1] 1,340			
340658	do	do	18		17.2	14.1		82.0							
340682	do	do	50		17.2	14.2	13.1	82.6	83.4	92.3	14.83				
340659	do	do	65		17.6	14.6		83.0				[1] 1,400			
340633	do	do	65		16.9	14.1		83.4				[1] 1,210			
340652	do	do	35		17.0	14.2	13.0	83.5	83.3	91.6	14.73	[1] 1,210		10.6	6.4
340634	do	do	60	Slight lateral occipital.	16.8	14.2		84.5				1,190			

300117	do	do	Adult	Slight occipital flattening.	17.0	14.4	13.8	*84.7*	*87.9*	*95.8*	15.07	1,280		12.1	7.6
340617	do	do	55		17.4	14.8	13.0	*85.1*	*80.8*	*87.8*	15.07	[1]1,350			
340672	do	do	55	Slight occipital frontal or none.	16.4	14.1		*86.0*							
Specimens					(43)	(43)	(20)	*(43)*	*(20)*	*(20)*	(20)	(26)		(9)	(10)
Totals					756.7	605.0	264.8				297.83	33,475		104.4	70.7
Averages					17.6	14.1	13.2	*79.95*	*84.24*	*94.54*	14.89	1,287.5		11.6	7.1
Minima					16.4	13.1	12.5	*73.7*	*78.9*	*87.8*	14.60	1,140		10.6	6.4
Maxima					19.0	14.8	13.8	*86.0*	*87.9*	*102.3*	15.17	1,460		12.1	7.7
				FORT MYERS											
292751	U.S.N.M.	Near Fort Myers	Adult		17.5	13.5	14.0	*77.1*	*90.3*	*103.7*	15.00	1,295		11.4	7.3
227842	do	do	do		18.0	14.6	14.0	*81.1*	*85.9*	*95.9*	15.53				
				LEE COUNTY											
247171	U.S.N.M.	Lee County	40		17.8	13.8	14.4	*77.5*	*91.1*	*104.4*	15.33	1,410		11.6	7.0
				BONITO SPRINGS											
340694	U.S.N.M.	Bonito Springs	50		18.1	14.2	13.9	*78.4*	*86.1*	*97.9*	15.40				
340097	do	do	Adult	Slight asymmetry	17.8	14.2		*79.8*				1,375			7.1
340696	do	do	35		17.8	14.4	13.6	*80.9*	*84.5*	*94.4*	15.27	1,435		11.4	6.4
340695	do	do	40		17.3	14.4		*83.2*				[1]1,390			
				HORRS ISLAND											
352117	U.S.N.M.	Horrs Island, Collier County.	35		18.5	13.3		*71.9*				1,300		11.8	6.8
352120	do	do	25		17.8	13.2		*74.2*				[1]1,250			
352090	do	do	50		17.9	13.3		*74.3*							
352108	do	do	27		18.0	13.4		*74.4*							
352091	do	do	65		18.8	14.0		*74.5*							
352171	do	do	35		17.9	13.5		*75.4*				[1]1,210		12.4	7.5
352115	do	do	55		18.9	14.3		*75.7*				1,440			7.0
352059	do	do	35		18.4	14.0		*76.1*							
352063	do	do	40		17.6	13.6		*77.3*				1,340			
352105	do	do	50		17.7	13.8		*78.0*							
352109	do	do	80		18.4	14.4		*78.3*							
352062	do	do	30		17.2	13.5		*78.5*							
352170	do	do	25		16.9	13.3	13.1	*78.7*	*86.8*	*98.5*	14.43	1,180		12.5	7.7
352066	do	do	25	Plagioc. (p. m.) but +.	18.0	14.2		*78.9*							
352064	do	do	35		17.6	13.9	13.4	*79.0*	*85.1*	*96.4*	14.97	1,200		11.9	7.3

[1] Near.

FLORIDA, WEST COAST: FEMALES—Continued

HORRS ISLAND—Continued

Catalog No.	Collection	Loclity	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion, Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
352057	U.S.N.M.	Horrs Island, Collier County.	60		17.2	13.6		*79.1*							
352076	do	do	45		17.3	13.7	13.8	*79.2*	*89.0*	*100.7*	14.93	[1] 1,280		12.3	7.6
352089	do	do	65		17.6	14.0		*79.6*				1,380			
352095	do	do	65		17.9	14.3		*79.9*				1,420			7.0
352125	do	do	65		17.6	14.1		*80.1*				1,205		[1] 12.0	7.3
352121	do	do	24		17.5	[1] 14.1		*80.6*							
352134	do	do	35		18.0	14.5		*80.6*							
352087	do	do	65		18.0	14.5		*80.6*				1,410			7.3
352114	do	do	75		17.1	13.8		*80.7*				[1] 1,330			
352082	do	do	65		18.2	14.7		*80.8*							7.9
352166	do	do	60		17.8	14.4		*80.9*							
352074	do	do	35		17.2	14.0	13.2	*81.4*	*84.6*	*94.3*	14.80	1,290		11.0	6.8
352101	do	do	24		17.6	14.4	13.4	*81.8*	*83.8*	*93.1*	15.13	1,340		11.4	6.8
352112	do	do	30		16.9	13.9		*82.3*						[1] 12.4	7.3
352106	do	do	35		17.7	14.6		*82.5*							
352111	do	do	30		17.3	14.3		*82.7*						11.6	7.2
352140	do	do	60		17.4	14.4		*82.8*							
352096	do	do	35		17.1	14.3	13.0	*83.6*	*82.8*	*90.9*	14.80	[1] 1,360		11.0	7.1
352161	do	do	45		16.6	14.0		*84.3*							
352.097	do	do	28		16.2	13.8	13.0	*85.2*	*86.7*	*94.2*	14.33	1,130		11.2	6.9
352151	do	do	35											11.9	7.0
Specimens					(35)	(35)	(7)	*(35)*	*(7)*	*(7)*	(7)	(17)		(13)	(17)
Totals					617.8	489.1	92.9				103.39	22,065		153.4	122.5
Averages					17.7	14.0	13.3	*79.17*	*85.50*	*95.38*	14.77	1,297.9		11.8	7.2
Minima					16.2	13.2	13.0	*71.9*	*82.8*	*90.9*	14.33	1,130		11.0	6.8
Maxima					18.9	14.7	13.8	*85.2*	*89.0*	*100.7*	15.13	1,440		12.5	7.9

[1] Near.

FLORIDA, WEST COAST: FEMALES—Continued

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a\times100}{c}\right)$	*Facial Index, upper* $\left(\frac{b\times100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
PENSACOLA BAY																						
242667	12.8	*90.6*	*54.7*	9.5	8.35	9.65	° 70.0	° 48.0	3.4	3.5	3.7	3.7	*91.9*	*94.6*	5.3	2.45	*46.2*	5.25	6.4	*82.0*	3.2	------
242669	------	------	------	[1] 9.5	8.2	9.7	------	------	------	3.3	------	3.7	------	*89.2*	5.2	2.5	*48.2*	------	------	------	------	------
242668	13.1	*93.1*	*61.1*	10.0	8.6	10.1	67.0	53.0	3.3	3.3	3.8	3.8	*86.8*	*86.8*	5.3	[2] 2.65	*50.0*	5.9	(6.0)	*(98.3)*	4.0	------
CEDAR KEYS																						
243694	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
242617	------	------	------	------	------	9.8	------	------	------	------	------	------	------	------	------	------	------	------	------	------	3.3	------
331765	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	[1] 3.2	------
ANCLOTE KEY																						
15857	------	------	------	------	------	------	------	------	------	------	------	------	------	------	5.2	2.5	*48.2*	------	------	------	------	------
TARPON SPRINGS																						
15839	[1] 13.9	------	*51.1*	------	------	------	------	------	------	------	------	------	------	------	5.2	2.3	*44.2*	------	------	------	------	------
15483	------	------	------	------	------	------	------	------	------	------	------	------	------	------	5.3	2.2	*41.5*	------	------	------	------	------
16010	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
15480	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
15840	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
15957	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
15478	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
15794	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
15962	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
16009	------	------	------	------	------	------	------	------	------	------	------	------	------	------	4.7	2.4	*51.1*	------	------	------	------	------

[1] Near.

[2] Left side of upper jaw small.

FLORIDA, WEST COAST: FEMALES—Continued

TARPON SPRINGS—Continued

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index total* $\left(\frac{a\times100}{c}\right)$	*Facial Index upper* $\left(\frac{b\times100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
							°	°														
Specimens	(1)		*(1)*												(3)	(3)	*(3)*					
Totals															15.2	6.9						
Averages															5.1	2.3	*45.39*					
Minima															4.7	2.2	*41.5*					
Maxima															5.3	2.4	*51.1*					

SAFETY HARBOR

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index total*	*Facial Index upper*	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
350284																						8.8
350353										3.5		3.9		*89.7*	5.1	2.7	*52.9*					
350337																					3.2	
350346				9.6	8.6	10.1	72.5	57.5							5.0	2.4	*48.0*				3.1	
350335										3.25		3.8		*85.5*	4.9	[1] 2.4	*49.0*				3.4	8.9
350292																						9.3
350288																						
350310																					3.45	9.8
350356	[1] 12.9	*87.6*	*52.7*	9.7	8.7	9.8	70.0	54.5	3.25	3.35	3.8	3.9	*85.5*	*85.9*	4.85	2.35	*48.5*	5.5	6.4	*85.9*	3.5	9.3
350316																						9.4
350283						10.4															3.5	9.6
350318																		5.4	6.3	*85.7*	3.4	9.0
350326																						8.8
350280	[1] 13.4	*88.1*	*52.2*	9.4	8.6	9.9												5.1	6.1	*83.6*	3.5	9.3
350313																					3.2	9.0
350307																						
350359																					3.3	8.7
350294																					2.95	9.0
350328																		5.2	6.2	*83.9*	3.8	9.3
350281	13.0	*87.7*	*52.3*	10.5	9.0	9.6	63.5	40.0	3.15		3.9		*80.8*		5.0	2.35	*47.0*	5.7	6.1	*93.4*	3.3	9.3
350312																						
350309																						9.5

350299																					3.8	10.1
350308									3.55		4.0		88.8		4.8	2.7	56.3	5.6	6.9	81.2	3.3	10.1
Specimens	(3)	(3)	(3)	(4)	(4)	(5)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(6)	(6)	(6)	(6)	(6)	(6)	(15)	(18)
Totals	39.3			39.2	34.9	49.8	206.0	152.0	9.95	10.1	11.7	11.6			29.65	14.9		32.5	38.0		50.7	167.2
Averages	13.1	87.79	52.42	9.8	8.7	10.0	68.7	50.7	3.3	3.4	3.9	3.9	85.04	87.07	5.0	2.5	50.25	5.4	6.3	85.53	3.4	9.3
Minima	12.9	87.6	52.2	9.4	8.6	9.6	63.5	40.0	3.15	3.25	3.8	3.8	80.8	85.5	4.8	2.35	47.0	5.1	6.1	81.2	2.95	8.7
Maxima	13.4	88.1	52.7	10.5	9.0	10.4	72.5	57.5	3.6	3.5	4.0	3.9	88.8	89.7	5.1	2.7	56.3	5.7	6.9	93.4	3.8	10.1
TAMPA BAY																						
242648																						
242637																						
242679																						
242645																						
2213	13.3		51.1												4.6	2.2	47.8					
242614																						
2210	13.6	80.9	50.0												4.9	2.5	51.0					
242674																						
242636				[1] 10.3	9.4	10.25	69.0	56.5		3.4		3.8		89.5	5.4	2.6	48.2	[1] 5.4				
2215	13.3	86.5	53.4												4.9	2.4	49.0					
242643					8.9	9.7				[1] 3.3		[1] 3.6		91.7								
242672																						
242642				9.9	9.1	10.0	71.5	58.0	3.25	[1] 3.3	3.6	3.6	90.3	91.7	4.9	[1] 2.6	53.1	[1] 5.5	6.35	86.6		
242635																						
2218	13.4		51.5												4.7	2.3	48.9					
Specimens	(4)	(2)	(4)	(2)	(3)	(3)	(2)	(2)	(1)	(3)	(1)	(3)	(1)	(3)	(6)	(6)	(6)	(2)	(1)	(1)		
Totals	53.6			20.2	27.4	29.95	140.5	114.5		10.0		11.0			29.4	14.6		10.9				
Averages	13.4	83.64	51.49	10.1	9.1	10.0	70.25	57.25		3.3		3.7		90.91	4.9	2.4	49.66	5.45				
Minima	13.3	80.9	50.0	9.9	8.9	9.7	69.0	56.5		3.3		3.6		89.5	4.6	2.2	47.8	5.4				
Maxima	13.6	86.5	53.4	10.3	9.4	10.25	71.5	58.0		3.4		3.8		91.7	5.4	2.6	53.1	5.5				
CLEARWATER																						
243692						10.2																
WEEDEN ISLAND																						
329412																						9.7
329413																						10.0
329378																						9.2
329419																					4.0	
329398																					3.4	
329409																						9.7
329403																					2.8	9.2

[1] Near.

FLORIDA, WEST COAST: FEMALES—Continued

WEEDEN ISLAND—Continued

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a\times100}{c}\right)$	*Facial Index, upper* $\left(\frac{b\times100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
							°	°														
329410																						10.0
329406																						9.3
329377																						9.5
329387	13.3		*53.4*						3.6	3.6	3.8	3.6	*94.7*	*100.0*	5.2	2.4	*46.2*	5.6	6.2	*90.3*		9.3
329391																					3.0	8.9
329408																						
329416																						9.6
329393																		5.2	6.4	*81.3*	3.3	9.2
329402																					3.6	9.3
329396																						9.7
329376																						9.1
329411																						9.3
329381																						9.2
329418																						9.4
329383																						9.8
Specimens	(1)		*(1)*						(1)	(1)	(1)	(1)	*(1)*	*(1)*	(1)	(1)	*(1)*	(2)	(2)	*(2)*	(6)	(19)
Totals																		10.8	12.6		20.1	179.4
Averages																		5.4	6.3	*85.71*	3.35	9.4
Minima																		5.2	6.2	*81.3*	2.8	8.9
Maxima																		5.6	6.4	*90.3*	4.0	10.0
PUNTA GORDA																						
331426	13.7	*89.8*	*51.8*	9.9	8.8	9.7	67.0	55.5	3.4		3.9		*87.2*		4.9	2.45	*50.0*				3.65	9.8

PERICO ISLAND

373554	13.9	*92.09*	*56.12*	10.8	9.6	10.6	*67.0*	*56.5*	3.65	3.7	4.3	4.2	*84.88*	*88.10*	5.2	2.5	*48.08*	5.7	6.2	*91.94*	-----	-----
373479	[1]13.7	-----	-----	-----	10.2	10.7	-----	-----	3.3	3.35	4.05	3.8	*81.48*	*88.16*	4.8	2.65	*55.21*	-----	-----	-----	-----	-----
373545	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
373586	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
373571	-----	-----	-----	10.3	9.2	10.5	*71.0*	*52.0*	3.6	-----	4.1	-----	*87.80*	-----	5.4	2.6	*48.15*	5.5	6.2	*88.71*	-----	-----
373623	[1]14.3	-----	-----	-----	-----	-----	-----	-----	3.6	-----	4.0	-----	*90.00*	-----	5.0	2.6	*52.00*	-----	-----	-----	-----	-----
373478	13.4	*91.79*	*55.97*	-----	9.4	10.4	-----	-----	3.5	-----	3.9	-----	*89.74*	-----	5.1	2.4	*47.06*	[1]5.5	6.5	*84.62*	-----	-----
373553	-----	-----	-----	-----	-----	-----	-----	-----	3.7	3.6	4.0	4.0	*92.50*	*90.00*	5.2	2.55	*49.04*	-----	-----	-----	-----	-----
373548	-----	-----	-----	-----	-----	10.8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
373531	13.3	*90.23*	*53.38*	10.6	9.6	9.8	*63.5*	*56.0*	3.3	3.35	4.0	3.8	*82.50*	*88.16*	5.0	2.65	*53.0*	5.6	6.3	*88.89*	-----	-----
373624	-----	-----	-----	-----	-----	-----	-----	-----	3.7	-----	4.0	-----	*92.50*	-----	5.3	2.6	*49.06*	5.5	6.3	*87.30*	-----	-----
373484	-----	-----	-----	-----	-----	10.1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
373580	14.0	*85.50*	*48.57*	-----	-----	-----	-----	-----	3.4	3.45	3.8	3.7	*89.47*	*93.24*	4.9	2.6	*53.06*	5.5	6.5	*84.62*	-----	-----
373540	13.4	*92.54*	*53.73*	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	5.15	2.3	*44.66*	5.7	6.6	*86.36*	-----	-----
373603	-----	-----	-----	-----	-----	-----	-----	-----	3.3	3.4	4.0	3.9	*82.50*	*87.18*	5.0	2.5	*50.0*	5.7	6.2	*91.94*	-----	-----
373535	-----	-----	-----	-----	-----	9.9	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
373504	14.3	-----	-----	-----	-----	10.2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	5.4	6.0	*90.0*	-----	-----
373604	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
373492	12.9	*96.12*	*58.14*	10.5	9.3	10.0	*65.5*	*53.0*	3.1	-----	3.7	-----	*83.78*	-----	5.25	2.5	*47.62*	6.0	6.5	*92.31*	-----	-----
373489	13.7	-----	*53.28*	10.1	8.9	10.4	*71.5*	*53.0*	3.5	3.55	4.0	4.0	*87.50*	*88.75*	5.1	2.65	*51.96*	5.4	6.1	*88.52*	-----	-----
373557	13.8	-----	*53.62*	10.4	9.2	10.2	*67.0*	*54.0*	3.6	3.5	4.0	3.9	*90.00*	*89.74*	5.05	2.7	*53.47*	-----	-----	-----	-----	-----
373617	-----	-----	-----	-----	-----	-----	-----	-----	3.2	-----	4.0	-----	*80.00*	-----	4.9	2.5	*51.02*	5.4	6.3	*85.71*	-----	-----
373594	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	4.7	2.4	*51.06*	5.5	5.8	*91.94*	-----	-----
373505	13.6	-----	*53.68*	10.2	9.0	10.3	*69.5*	*49.0*	3.65	3.7	3.8	3.8	*96.05*	*97.37*	5.5	2.45	*44.55*	5.5	6.1	*90.16*	-----	-----
373626	-----	-----	-----	10.6	9.5	10.6	*71.0*	*55.0*	-----	-----	-----	-----	-----	-----	5.1	2.3	*45.10*	5.7	6.3	*90.48*	-----	-----
373507	13.4	*90.30*	*53.73*	10.1	9.0	10.2	*70.0*	*55.0*	3.35	3.4	3.8	3.9	*88.16*	*87.18*	5.0	2.5	*50.0*	5.3	5.9	*89.33*	-----	-----
373481	-----	-----	-----	-----	-----	9.8	-----	-----	-----	-----	-----	-----	-----	-----	4.8	2.5	*52.08*	-----	-----	-----	-----	-----
373590	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
373585	14.1	*85.82*	*51.06*	-----	-----	-----	-----	-----	3.45	3.55	3.9	3.8	*88.46*	*93.42*	4.9	2.5	*51.02*	5.7	6.2	*91.94*	-----	-----
373627	13.6	*83.09*	*49.26*	10.2	8.8	9.3	*62.5*	*46.5*	3.3	3.3	3.7	3.7	*89.19*	*89.19*	4.5	2.5	*55.56*	-----	-----	-----	-----	-----
373591	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	5.6	6.5	*86.15*	-----	-----
373560	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
373547	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
373497	-----	-----	-----	-----	-----	-----	-----	-----	-----	3.45	-----	3.85	-----	*89.61*	-----	-----	-----	5.2	6.5	*80.0*	-----	-----
373549	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	5.8	6.3	*92.06*	-----	-----
373532	-----	-----	-----	-----	-----	10.5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
373482	-----	-----	-----	10.0	9.0	10.2	*70.0*	*57.0*	-----	3.6	-----	3.7	-----	*97.30*	5.0	2.6	*52.0*	4.9	6.2	*79.03*	-----	-----
373569	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
293065	13.4	-----	*51.49*	10.0	8.9	9.95	69.0	50.0	3.65	3.65	3.8	3.85	*96.05*	94.81	5.1	2.35	*46.08*	5.4	6.3	*85.71*	-----	-----
373619	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
373552	14.2	*89.44*	*54.23*	9.8	8.8	10.4	*72.0*	*59.0*	3.8	3.75	4.2	4.1	*90.48*	*91.46*	5.35	2.8	*52.34*	5.5	6.7	*82.09*	-----	-----
373529	13.3	-----	-----	-----	-----	10.5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
373556	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
373628	13.6	*84.56*	-----	-----	-----	-----	-----	-----	3.2	3.25	3.6	3.6	*88.89*	*90.28*	4.45	2.45	*55.06*	-----	-----	-----	-----	-----
373607	-----	-----	-----	-----	-----	10.4	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
373575	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	5.5	6.1	*90.16*	-----	-----
373539	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
373509	13.1	*85.50*	*50.38*	9.6	8.6	9.5	*69.0*	*56.0*	3.3	3.25	3.8	3.75	*86.84*	*86.67*	4.6	2.5	*54.35*	5.6	6.4	*87.50*	-----	-----

[1] Near.

FLORIDA, WEST COAST: FEMALES—Continued

PERICO ISLAND—Continued

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a \times 100}{c}\right)$	*Facial Index, upper* $\left(\frac{b \times 100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle °	Alveolar Angle °	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
373486									3.6	3.5	3.7	3.6	97.30	95.89	4.8	2.4	50.0	5.2	6.0	86.67		
373598																						
373562	14.1	82.98	49.65		9.0	10.0			3.45	3.5	4.0	3.8	86.25	92.11	4.7	2.2	46.81					
373601																						
373491	13.1	86.26	52.67	9.7	8.8	10.2	66.5	56.5		3.6		3.8		94.74	5.1	2.5	49.01	5.0	6.2	80.65		
373499	13.5	87.41	52.59	9.6	8.6	9.6	68.0	53.0	3.4	3.65	3.8	3.7	89.47	98.65	5.2	2.5	48.08					
373613	13.7		52.55		9.0	9.8			3.2	3.7	3.2	3.7	86.49	86.49	4.7	2.5	53.19					
373587																						
373502	14.1	87.23	51.77	10.2	9.2	10.2	69.0	56.5		3.55		3.65		97.26	5.3	2.6	49.06	5.6	6.4	87.50		
373506															5.1	2.4	47.06					
373592																						
373563	13.8	85.51	50.72	9.3	8.1	9.6	71.0	52.5	3.7	3.6	3.8	3.8	97.37	97.30	4.9	2.35	47.96					
373605																		5.3	6.2	85.48		
373555	13.7	86.13	51.09	10.0	8.9	10.2	72.0	49.0	3.35	3.4	3.8	3.8	88.16	89.47	5.3	2.45	46.23	5.3	6.8	77.94		
Specimens	(27)	(18)	(22)	(19)	(23)	(31)	(19)	(19)	(28)	(26)	(28)	(26)	(28)	(26)	(36)	(36)	(36)	(30)	(30)	(30)		
Totals	369.0			192.0	208.6	314.85	1,305	1,019.5	96.85	91.3	108.75	99.1			180.45	90.05		164.5	188.6			
Averages	13.7	87.85	52.60	10.1	9.1	10.2	68.7	53.7	3.45	3.5	3.9	3.8	89.06	92.13	5.0	2.5	49.90	5.5	6.3	87.22		
Minima	12.9	82.98	48.57	9.3	8.1	9.6	62.5	46.5	3.1	3.25	3.6	3.6	80.0	86.49	4.45	2.2	44.55	4.9	5.8	77.94		
Maxima	14.3	96.12	58.14	10.8	10.2	10.8	72.0	59.0	3.8	3.75	4.3	4.2	97.37	98.65	5.5	2.8	55.56	6.0	6.8	92.31		

CHARLOTTE BAY

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total*	*Facial Index, upper*	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
2227	13.7		48.9												5.1	2.15	42.2					

CAPTIVA ISLAND

340622						10.2																9.1
340629	[1]13.0	*88.5*	*54.6*	10.1	9.2	10.2	70.0	58.5	3.3	3.3	3.8	3.8	*86.8*	*86.8*	5.2	2.2	*42.3*	5.5	5.9	*93.2*	3.0	8.9
340626																						9.5
340679																						8.8
340641																						9.6
292755																						
340681																						9.2
340665																						9.5
340644																						9.4
340661																						9.4
340639																					3.4	9.3
340654						10.2												5.7	6.4	*89.1*	3.1	8.7
340671																						
340611	13.4	*84.3*	*50.0*	9.7	9.0	10.0	72.5	62.0	3.35	3.35	3.65	3.65	*91.8*	*91.8*	5.0	2.55	*51.0*	5.0	6.3	*79.4*	3.0	8.8
340668						10.5				3.35		3.6		*93.1*								8.9
340663																						9.7
340640																						
340638				9.6	8.7	9.6				3.15		3.7		*85.1*	5.3	2.5	*47.2*	5.5	6.4	*85.9*	2.8	8.8
340651	13.4	*88.1*	*53.0*	9.9	9.0	10.0	63.0	46.5	3.1	3.1	3.65	3.65	*84.9*	*84.9*	5.1	2.3	*45.1*	5.2	6.0	*86.7*	3.3	8.7
340610	13.6					10.0																9.5
340655									3.45		3.9		*88.5*		4.0	2.3	*46.9*	5.0	6.2	*80.7*	3.2	9.2
340656	13.4	*85.1*	*49.3*	9.9	9.0	10.0	72.0	56.5	3.6	3.5	3.85	3.85	*93.5*	*90.9*	4.8	2.3	*47.9*	5.2	6.2	*83.9*	3.15	9.3
340631	13.2	*91.7*	*53.8*	10.2	9.4	9.9	66.5	61.5	3.8	3.4	3.8	3.7	*86.8*	*91.9*	5.0	2.4	*48.0*	5.5	6.3	*87.3*	3.3	8.8
340687	13.3		*57.9*	9.6	8.6	9.5	65.5	57.5							5.4	2.5	*46.3*	5.6	6.5	*86.2*		9.3
340614																					3.2	9.3
340616	13.9	*84.9*	*50.4*	10.5	9.7	10.5	71.0	60.5	3.3	3.2	3.8	3.85	*86.8*	*83.1*	5.1	2.5	*49.0*	5.6	6.5	*86.2*	3.7	9.4
340674																					3.3	9.5
340642	13.3	*88.7*	*55.6*	9.6	8.6	9.6	67.0	56.5	3.6	3.6	3.9	3.8	*92.3*	*94.7*	5.3	2.5	*47.2*	5.3	6.4	*82.8*	3.3	9.2
340669						10.3																9.1
340686																						9.6
292752						10.0																
340619																						9.2
340667																						9.2
340620																						9.3
340658																						
340682															5.3	2.5	*47.2*					9.6
340659																		5.5	6.1	*90.2*		9.1
340633																						8.6
340652	13.0	*81.5*	*49.2*	9.8	8.4	9.4	70.0	42.0	3.25	3.25	3.7	3.8	*87.8*	*85.5*	4.7	2.5	*53.2*	5.5	6.3	*87.3*	3.05	9.5
340634																					3.1	9.3
300117	13.7	*88.3*	*55.5*	10.0	8.8	9.8	66.0	54.5	3.4	3.4	3.9	4.0	*87.2*	*85.0*	5.2	2.4	*46.2*	5.8	[1]6.3	*92.1*	3.9	
340617						9.5															3.25	9.0
340672																						
Specimens	(11)	*(9)*	*(10)*	(11)	(11)	(18)	(10)	(10)	(10)	(11)	(10)	(11)	*(10)*	*(11)*	(13)	(13)	*(13)*	(14)	(14)	*(14)*	(17)	(36)
Totals	147.2			108.9	98.4	179.2	683.5	556.0	33.65	36.6	37.95	41.4			66.3	31.45		75.9	87.8		55.05	331.3
Averages	13.4	*86.78*	*52.92*	9.9	8.9	10.0	68.35	55.6	3.4	3.3	3.8	3.8	*88.67*	*88.41*	5.1	2.4	*47.44*	5.4	6.3	*86.45*	3.2	9.2
Minima	13.0	*81.5*	*49.2*	9.6	8.4	9.4	63.0	42.0	3.1	3.1	3.65	3.6	*84.9*	*83.1*	4.7	2.2	*42.3*	5.0	5.9	*79.4*	2.8	8.6
Maxima	13.9	*91.7*	*57.9*	10.5	9.7	10.5	72.5	62.0	3.6	3.6	3.9	4.0	*93.5*	*94.7*	5.4	2.55	*53.2*	5.8	6.5	*93.2*	3.9	9.7

[1] Near.

FLORIDA, EAST COAST: FEMALES—Continued

FORT MYERS

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a \times 100}{c}\right)$	*Facial Index, upper* $\left(\frac{b \times 100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
292751	13.0	*87.7*	*56.2*	10.3	9.05	10.0	67.0°	52.0°	3.3	3.3	4.0	3.9	*82.5*	*84.6*	5.0	2.45	*49.0*	6.0	6.55	*91.6*	3.4	
227842						10.2																

LEE COUNTY

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a \times 100}{c}\right)$	*Facial Index, upper* $\left(\frac{b \times 100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
247171	13.3	*87.2*	*52.6*	10.2	8.9	10.2	70.0	48.0	3.3	3.3	4.0	4.0	*82.5*	*82.5*	5.05	2.1	*41.6*	5.5	6.5	*84.6*	3.55	9.5

BONITO SPRINGS

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a \times 100}{c}\right)$	*Facial Index, upper* $\left(\frac{b \times 100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
340694						10.8															3.0	9.6
340097	14.4		*49.3*						3.55	3.55	4.05	4.0	*87.6*	*88.7*	5.15	2.45	*47.6*	5.4	6.2	*87.1*		
340696	14.0	*81.4*	*52.3*	10.2	9.0	10.0	70.0	47.0	3.6	3.6	4.3	4.3	*83.7*	*83.7*	4.7	2.3	*48.9*	5.7	6.5	*87.7*	3.3	9.8
340695																						9.8

HORRS ISLAND

352117	13.3	*88.7*	*51.1*							3.35		3.8		*88.2*	4.8	2.3	*47.9*	5.6	6.4	*87.5*	3.4	9.2
352120																					3.7	9.1
352090																					3.6	9.2
352108																					3.8	9.3
352091																						9.4
352171	12.9	*96.1*	*58.1*						[1] 3.7		3.9		*94.9*		5.2	2.45	*47.1*	5.6	6.1	*91.8*	3.5	8.8
352115									3.6	3.55	3.9	4.0	*92.3*	*88.8*	5.0	2.4	*48.0*					9.5
352059																						9.6
352063																					3.6	8.8
352105																					3.5	
352109																						10.1
352062																					3.1	9.4
352170	12.9	*96.9*	*59.7*	10.0	9.0	9.9	66.5	62.0	3.3	3.3	3.7	3.5	*89.2*	*94.3*	4.9	2.25	*45.9*	5.9	6.8	*86.8*	3.7	8.7
352066																						
352064	14.1	*84.4*	*51.8*	10.4	9.3	10.2	68.0	57.0	3.3	3.3	3.8	3.9	*86.8*	*84.6*	4.85	2.4	*49.5*	5.7	6.7	*85.1*	3.7	9.5
352057																						
352076	13.1	*93.9*	*58.0*	10.4	9.3	10.4	69.0	53.5	3.6	3.6	3.8	3.9	*94.7*	*92.3*	5.4	2.45	*45.4*	5.4	6.5	*83.1*	3.4	9.2
352089	13.5																				3.5	9.5
352095	13.4		*52.2*							3.6		3.9		*92.3*	4.8	2.7	*56.3*				3.5	9.2
352125	13.4	*89.6*	*54.5*						3.8	3.8	3.9	3.8	*97.4*	*100.0*	5.1	2.7	*52.9*	5.0	6.4	*78.1*	3.5	9.2
352121																		5.3	5.8	*91.4*	3.0	9.4
352134																						9.6
352087	13.0		*56.2*												5.3	2.35	*44.3*				3.6	8.8
352114																						8.5
352082															5.7	2.4	*42.1*	6.0	7.1	*84.5*		
352166																		5.4	6.1	*88.5*	3.9	9.1
352074	13.8	*79.7*	*49.3*	10.0	8.8	9.8	68.5	52.5	3.45	3.5	3.7	3.7	*93.2*	*94.6*	4.75	2.5	*52.6*	5.4	6.4	*84.4*	3.1	9.2
352101	13.7	*83.2*	*49.6*	9.8	9.1	10.2	78.0	62.5	3.6	3.6	3.9	3.9	*92.3*	*92.3*	5.05	2.3	*45.5*	5.3	6.0	*88.3*	3.25	9.6
352112										3.4		3.7		*91.9*	5.45	2.45	*45.0*	5.7	6.3	*90.5*	3.5	9.0
352106															5.0	2.7	*54.0*				3.5	9.6
352111	13.9	*83.5*	*51.8*							3.5		4.0		*87.5*	5.1	2.25	*44.1*	5.7	6.3	*90.5*	3.2	9.1
352140																					3.1	9.8
352096	13.8	*79.7*	*51.5*			9.8			3.7		3.8		*97.4*		5.1	2.35	*46.1*	5.3	5.9	*89.8*	2.85	10.0
352161																					2.8	9.2
352097	13.1	*85.5*	*52.7*	9.6	8.7	9.6	69.0	58.0	3.5	3.6	3.7	3.7	*94.6*	*97.3*	4.75	2.4	*50.5*	5.3	6.1	*86.8*	3.15	9.1
352151															4.9	2.4	*49.0*	5.3	6.7	*79.1*	3.4	
Specimens	(14)	*(11)*	*(13)*	(6)	(6)	(7)	(6)	(6)	(10)	(12)	(10)	(12)	*(10)*	*(12)*	(18)	(18)	*(18)*	(16)	(16)	*(16)*	(30)	(31)
Totals	187.9			60.2	54.2	69.9	419.0	345.5	35.55	42.1	38.1	46.8			91.15	43.75		87.9	101.6		91.85	287.7
Averages	13.4	*87.23*	*53.50*	10.0	9.0	10.0	69.8	57.6	3.55	3.5	3.8	3.9	*93.31*	*89.96*	5.1	2.4	*48.0*	5.5	6.4	*86.52*	3.4	9.3
Minima	12.9	*79.7*	*49.3*	9.6	8.7	9.6	66.5	52.5	3.3	3.3	3.7	3.5	*86.8*	*84.6*	4.75	2.25	*42.1*	5.0	5.8	*78.1*	2.8	8.5
Maxima	14.1	*96.9*	*59.7*	10.4	9.3	10.4	78.0	62.5	3.8	3.8	3.9	4.0	*97.4*	*100.0*	5.7	2.7	*56.3*	6.0	7.1	*91.8*	3.9	10.1

[1] Near.

SEMINOLE INDIANS: FEMALES

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt. - Nasion height (b)
1788	A. N. S. P.		Adult		16.8	13.4	13.7	*79.8*	*90.7*	*102.2*	14.63				
1726	do		do		16.6	14.1	13.4	*84.9*	*87.3*	*95.0*	14.70				6.4

Catalog No.	Diam. Bizygomatic maxim (c)	*Facial Index, total* $\left(\frac{a \times 100}{c}\right)$	*Facial Index, upper* $\left(\frac{b \times 100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth, maxim.	*Nasal Index*	Upper Alveolar Arch, length, maxim.	Upper Alveolar Arch, breadth, maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
							°	°														
1788																						
1726	12.6		*50.8*												4.5	2.45	*54.4*					

UNDEFORMED TENNESSEE: MALES [1]

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a) [2]	Alveol. Pt.-Nasion height (b)
243099	U.S.N.M.	Mound near Nashville	65		18.8	13.5	14.2	*71.8*	*87.9*	*105.2*	15.50	1,510			
243134	do	do	60		19.2	14.1	High	*73.4*				1,510			7.5
283245	do	Prevatts Landing, Benton County.	65		18.0	13.3	High	*73.9*				[3] 1,370			
243103	do	Mound near Nashville	70		18.2	13.5	14.6	*74.2*	*92.1*	*108.2*	15.43			12.9	7.9
310380	do	Castalian Springs	70		18.5	13.8	14.2	*74.6*	*87.9*	*102.9*	15.50	1,380			
243098	do	Mound near Nashville	35		18.2	[3] 13.6	High	*74.7*						12.9	7.8
237210	do	Prevatts Landing, Benton County.	Adult		17.6	13.2	High	*75.0*				[3] 1,370		12.9	7.1
243130	do	Mound near Nashville	60		19.0	14.3	High	*75.3*				[3] 1,550			
317586	do	Near Bristol	55		18.8	14.2	14.1	*75.5*	*85.5*	*99.3*	15.70	1,450			
290771	do	Lauderdale County	35		17.8	13.6	14.7	*76.4*	*93.6*	*108.1*	15.37	1,480		12.1	7.0
243119	do	Mound near Nashville	50		17.2	13.3	High	*77.3*						11.7	7.0
243091	do	Near Nashville	70		17.4	13.5	Medium	*77.6*							
310376	do	Castalian Springs	45		18.7	14.6	14.8	*78.1*	*88.9*	*101.4*	16.03	1,590			
317587	do	Near Bristol	40	Small asymmetry	17.6	13.8	14.2	*78.4*	*90.5*	*102.9*	15.20	1,420			7.0
243122	do	Mound near Nashville	65		17.8	14.0	High	*78.7*							
97450	do	do	40	Slight occipital flattening	17.9	14.2	14.5	*79.3*	*90.3*	*102.1*	15.53	1,430			
292211	do	Near Clarksville	40	Occipital asymmetry	17.4	14.1	High	*81.0*						12.5	7.4
226075	do	Mound Jefferson County	60		17.8	14.7	High	*82.6*				1,490			7.4
243136	do	Mound near Nashville	50	Moderate lateral occipital.	17.8	14.8	14.2	*83.2*	*87.1*	*96.0*	15.60	1,425			7.9
325323	do	Sumner County	60		17.6	14.8	14.3	*84.1*	*88.3*	*96.6*	15.57	1,420			
243107	do	Near Chattanooga	40		16.8	14.2		*84.5*							
243108	do	do	Young adult.	Slight occipital	16.8	14.9		*88.7*							
243125	do	Nashville	60												
226080	do	Jefferson County	55		17.8	Broad	High								8.2
Specimens					(23)	(22)	(10)	*(22)*	*(10)*	*(10)*	(10)	(14)		(6)	(11)
Totals					412.7	308.0	143.8				155.43	20,395		75.0	82.2
Averages					17.9	14.0	14.4	*77.99*	*89.18*	*102.13*	15.54	1,456.8		12.5	7.5
Minima					16.8	13.2	14.2	*71.8*	*85.5*	*96.0*	15.20	1,370		11.7	7.0
Maxima					19.2	14.9	14.8	*88.7*	*93.6*	*108.2*	16.03	1,590		12.9	8.2

[1] Some plainly Virginia-like; some different, broader to much broader.

[2] Menton-Nasion height reconstructed where teeth worn.

[3] Near

UNDEFORMED TENNESSEE: MALES—Continued

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a \times 100}{c}\right)$	*Facial Index, upper* $\left(\frac{b \times 100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
							°	°														
243099						10.6															3.6	9.2
243134	13.0		*57.7*							3.25		3.9		*83.3*	5.1	2.4	*47.1*	6.2	7.1	*87.3*		9.2
283245									3.4	3.3	3.9	3.8	*87.2*	*86.8*	5.1	2.65	*52.0*				3.4	9.2
243103	14.5	*89.0*	*54.5*	10.4	9.2	10.8	71.5	56.0	3.6	3.65	4.1	4.0	*87.8*	*91.3*	5.5	2.7	*49.1*	5.7	6.9	*82.6*	4.0	9.6
310380	13.8				8.8	10.8			3.0	3.05	3.85	3.85	*77.9*	*79.2*	5.2	2.6	*50.0*					9.1
243098	Moderate								3.35	3.4	3.8	3.6	*88.2*	*94.4*	5.5	2.4	*43.6*	5.6	6.7	*83.6*	3.9	9.1
287210	13.3	*97.0*	*53.4*							3.4		3.7		*91.9*	4.9	2.5	*51.0*	5.6	6.2	*90.3*	4.0	9.4
243130	13.8									3.4		3.9		*87.2*	5.3	2.85	*53.8*				4.0	9.6
317586	14.9				8.6	10.8																
290771	13.7	*88.3*	*51.1*	9.6	8.7	10.4	76.0	60.0	3.45	3.35	3.9	3.8	*88.5*	*88.2*	4.9	2.6	*53.1*	5.4	6.6	*81.8*	3.45	9.5
243119	13.4	*87.3*	*52.2*						3.3	3.35	3.8	3.75	*86.8*	*89.3*	5.0	2.7	*54.0*	5.1	6.9	*73.9*	3.3	8.6
243091																						8.9
310376						10.7																9.8
317587	14.1		*49.7*	9.8	8.8	10.3	74.0	52.5	3.5	3.4	4.1	4.0	*85.4*	*85.0*	5.05	2.5	*49.5*	5.7	6.8	*83.8*		9.4
243122																						8.9
97450						10.3															3.6	10.0
292211									3.4		3.9		*87.2*		5.4	2.6	*48.2*				3.7	9.6
226075										3.5		3.8		*92.1*	5.2	2.5	*48.1*					
243136	14.0		*56.4*						3.35	3.4	4.1	3.8	*81.7*	*89.5*	5.35	2.4	*44.9*	5.7	7.6	*75.0*		9.1
325323	14.3					10.1												5.6	6.8	*82.4*	3.7	9.6
243107																		5.6	6.5	*86.2*	3.9	9.0
243108																						
243125																		5.5	7.1	*77.5*	3.65	
226080										3.5		3.7		*94.6*	5.8	2.55	*44.0*	5.6	7.1	*78.9*		
Specimens	(11)	*(4)*	(7)	(3)	(5)	(9)	(3)	(3)	(9)	(13)	(9)	(13)	*(9)*	*(13)*	(14)	(14)	*(14)*	(12)	(12)	*(12)*	(13)	(19)
Totals	152.8			29.8	44.1	94.8	221.5	168.5	30.35	43.95	35.45	49.6			73.3	35.95		67.3	82.3		48.2	176.8
Averages	13.4	*90.35*	*53.54*	9.9	8.8	10.5	73.83	56.17	3.4	3.4	3.9	3.8	*85.61*	*88.61*	5.2	2.6	*49.05*	5.6	6.9	*81.77*	3.7	9.3
Minima	13.0	*87.3*	*49.7*	9.6	8.6	10.1	71.5	52.5	3.0	3.05	3.8	3.6	*77.9*	*79.2*	4.9	2.4	*43.6*	5.1	6.2	*73.9*	3.3	8.6
Maxima	14.9	*97.0*	*57.7*	10.4	9.2	10.8	76.0	60.0	3.6	3.65	4.1	4.0	*88.5*	*94.6*	5.8	2.85	*54.0*	6.2	7.6	*90.3*	4.0	10.0

DEFORMED TENNESSEE: MALES[1]

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	*Face:* Teeth, wear	Menton-Nasion height (a)[2]	Alveol. Pt.-Nasion height (b)
116043	U.S.N.M.	Loudon County	50	Medium frontal occipital	(16.4)	(17.2)	(13.6)	*(104.9)*	*(81.0)*	*(79.1)*	15.73	1,560		12.6	7.7
116056	do	do	60	Slight occipital flattening	(17.7)	(14.5)	(13.4)	*(81.9)*	*(83.2)*	*(92.4)*	15.20	1,560			7.5
150195a	do	Carter County	60	Slight frontal	(16.8)	(16.0)	Med.	*(95.2)*							
228350	do	Near Nashville	50	Slight occipital	(17.7)	(14.8)	(14.6)	*(83.6)*	*(89.9)*	*(98.7)*	15.70	[3]1,670		12.6	7.0
228351	do	do	40	Slight frontal medium occipital.	(16.6)	(14.2)	(14.5)	*(85.5)*	*(94.2)*	*(102.1)*	15.10	1,340		11.7	6.9
243106	do	Mound near Nashville.	30	Pronounced occipital	(15.9)	(15.5)		*(97.5)*				[3]1,420		12.0	7.1
243116	do	Near Nashville	55	Pronounced occipital flattening.	(16.2)	(15.2)	(14.0)	*(93.8)*	*(89.2)*	*(92.1)*	15.13	1,430			
243117	do	do	50	do	(16.7)	(14.8)	(15.1)	*(88.6)*	*(95.9)*	*(102.0)*	15.53	1,450		13.0	7.9
243118	do	do	45	Medium occipital	(16.8)	(15.4)		*(91.7)*						12.5	7.4
243135	do	Mound near Nashville.	55	Pronounced occipital	(15.2)	(15.4)		*(101.3)*				1,370			7.3
243137	do	Clarksville	50	do	(16.4)	(15.5)		*(94.5)*							
283243	do do	Citico Mound, Hamilton County.	25	Slight frontal pronounced occipital.	(16.2)	(15.7)	(14.6)	*(96.9)*	*(91.5)*	*(93.0)*	15.50	1,420		12.0	7.2
286797	do	Hamilton County	50	Medium frontal occipital	(16.4)	(15.1)	[3] (14.3)	*(92.1)*	*(90.8)*	*(94.7)*	15.27	[3]1,470			
290769	do	Hales Point, Lauderdale County.	50	Moderate frontal pronounced occipital.	(16.2)	(16.6)	(14.8)	*(102.5)*	*(90.2)*	*(89.2)*	15.87	1,450		13.0	7.5
290776	do	do	60	Pronounced occipital	(15.2)	(16.4)	(15.0)	*(107.9)*	*(94.9)*	*(91.5)*	15.53	1,480			7.3
291283	do	Mound near Nashville	40	do	(17.0)	(16.6)	14.6)	*(97.7)*	*(86.9)*	*(88.0)*	16.07	1,560		13.6	8.4
292202	do	Near Clarksville	Young adult.	Slight occipital	(17.2)	(15.2)		*(88.4)*							
292214	do	Liberty	do	Pronounced occipital	(16.6)	(16.0)		*(96.4)*							
310356	do	Whittaker Village	60	do	(16.4)	(14.7)	High	*(89.6)*				1,380		12.2	7.0
310378	do	Castalian Springs	55	Medium occipital	(17.3)	(15.4)	(14.6)	*(89.0)*	*(89.3)*	*(94.8)*	15.77	[3]1,450			
316098	do	Near Nashville	65	Slight frontal pronounced occipital.	(16.0)	(14.8)	(14.2)	*(92.5)*	*(92.2)*	*(96.0)*	15.00	1,440		12.4	7.4
Specimens					(21)	(21)	(13)	*(21)*	*(13)*	*(13)*	(13)	(16)		(11)	(14)
Totals					346.9	325.0	187.3				201.4	23,450		137.6	103.6
Averages					16.5	15.5	14.4	*(93.69)*	*(89.85)*	*(93.05)*	15.49	1,465.6		12.5	7.4
Minima					15.2	14.2	13.4	*(81.9)*	*(81.0)*	*(79.1)*	15.00	1,340		11.7	6.9
Maxima					17.7	17.2	15.1	*(107.9)*	*(95.9)*	*(102.1)*	16.07	1,670		13.6	8.4

[1] Some plainly Virginialike; some different, broader to much broader.

[2] Menton-Nasion height reconstructed where teeth worn.

[3] Near.

DEFORMED TENNESSEE: MALES—Continued

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a \times 100}{c}\right)$	*Facial Index, upper* $\left(\frac{b \times 100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
							°	°														
116043	14.3	88.1	53.9	10.5	9.2	9.8	63.0	52.0		3.55		3.9		91.0	5.3	3.0	56.6	5.5	7.1	77.5	3.6	10.1
116056	14.0		53.6	10.2	8.8	9.7	64.5	48.0	3.45	3.4	3.8	3.8	90.8	89.5	5.2	2.5	48.1	5.6	6.5	86.2		9.6
150195a															4.8	2.5	52.1				3.8	9.3
228350	14.5	86.9	48.3	9.9	8.8	10.4	73.5	50.0	3.55		3.85		92.2		5.3	2.7	50.9				4.1	
228351	13.3	88.0	51.9	9.9	8.8	10.2	72.0	56.5	3.4	3.25	3.6	3.6	94.4	90.3	4.6	2.55	55.4	5.2	6.6	78.8	3.4	9.1
243106	14.5	82.8	49.0						3.4		3.9		87.2		5.4	2.7	50.0	5.4	6.8	79.4	3.4	
243116										3.3		3.7		89.19								9.5
243117	14.1	92.2	56.0	10.4	9.2	10.8	71.5	56.0	3.6	3.55	3.95	3.9	91.1	91.0	5.5	2.4	43.6	5.6	6.8	82.4	3.9	9.2
243118									3.4	3.3	3.9	3.8	87.2	86.8	5.2	2.5	48.1	5.1	7.0	72.9	3.7	9.1
243135	14.9		49.0						3.2	3.2	4.0	4.0	80.0	80.0	5.1	2.7	52.9	5.6	7.1	78.9		9.6
243137																		5.9	6.5	90.8	3.9	9.6
283243	14.5	82.8	49.7	10.6	9.6	10.0	65.0	58.0	3.2		3.8		84.2		4.9	2.8	57.1.	5.6	6.7	83.6	3.7	9.8
286797	14.0																				3.8	10.4
290769	15.1	86.1	49.7	9.9	8.8	10.4	72.0	55.0	3.8	3.65	3.95	3.85	96.2	94.8	5.4	2.4	44.4	5.6	7.3	76.7	3.85	10.1
290776						9.8				3.5		4.0		87.5	5.3	2.65	50.0				3.15	9.4
291283	15.4	88.3	54.6						3.6	3.5	4.0	4.0	90.0	87.5	5.6	2.6	46.4	5.8	7.2	80.6	4.4	10.6
292202	14.4																					10.0
292214																					3.5	10.1
310356	13.8	88.4	50.7						3.0	3.0	3.7	3.6	81.1	83.3	4.9	2.5	51.0	6.0	7.2	83.3	3.9	8.2
310378						10.8															3.9	9.9
316098	13.6	91.2	54.4	10.3	9.2	10.2	68.0	57.0	3.4	3.35	3.85	3.85	88.3	87.0	5.05	2.8	55.5				3.8	9.5
Specimens	(14)	(10)	(12)	(8)	(8)	(10)	(8)	(8)	(12)	(12)	(12)	(12)	(12)	(12)	(15)	(15)	(15)	(12)	(12)	(12)	(17)	(19)
Totals	200.4			81.7	72.4	102.1	549.5	432.5	41.0	40.55	46.3	46.0			77.5	539.3		66.9	82.8		63.8	183.1
Averages	14.3	87.42	51.69	10.2	9.05	10.2	68.7	54.1	3.4	3.4	3.9	3.8	88.55	88.15	5.2	2.6	50.68	5.6	6.9	80.80	3.8	9.6
Minima	13.3	82.8	48.3	9.9	8.8	9.7	63.0	48.0	3.0	3.0	3.6	3.6	80.0	80.0	4.6	2.4	43.6	5.1	6.5	72.9	3.4	8.2
Maxima	15.4	92.2	56.0	10.6	9.6	10.8	73.5	58.0	3.8	3.65	4.0	4.0	96.2	94.8	5.6	3.0	57.1	6.0	7.3	90.8	4.4	10.6

UNDEFORMED TENNESSEE: FEMALES

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)[1]	Alveol. Pt. - Nasion height (b)
236803	U.S.N.M.	Marion County	55		18.2	13.2	14.0	72.5	89.2	106.1	15.13	1,310		10.6	6.3
243131	do	Near Nashville	30		18.0	13.3	13.8	73.9	88.2	103.8	15.03			11.2	6.7
243102	do	do	55		17.4	13.2	High	75.9							
134906	do	London County	Young adult.		17.5	13.3	14.2	76.0	92.2	106.8	15.00				
243133	do	Near Nashville	40		17.5	13.3	14.0	76.0	90.9	105.3	14.93	1,310			7.5
287215	do	Leadbetter Landing Benton County.	35		18.0	13.7	14.2	76.1	89.6	103.7	15.30				
287212	do	do	45		17.6	13.4		76.1							
283244	do	do	70		17.2	13.1	12.5	76.2	82.5	95.4	14.27	1,165			
243095	do	Near Nashville	25		17.2	13.2	High	76.7							
310400	do	Lovers' Leap, Smith County.	50		17.2	13.2	14.0	76.7	92.1	106.1	14.80	1,410			
243128	do	Near Nashville	40		17.0	13.1	High	77.1				1,310		11.9	6.7
287209	do	Prevatts Landing	Young adult.	Small occipital asymmetry.	17.1	13.2		77.2							
310385	do	Castalian Springs	do		17.8	13.8		77.5							
287213	do	Leadbetter Landing, Benton County.	65		18.3	14.2	12.8	77.6	78.8	90.1	15.10				
286796	do	Hamilton County	50		17.0	13.3	13.8	78.2	91.1	103.8	14.70	1,230		11.8	7.1
243105	do	Near Nashville	30		17.1	13.4	14.3	78.4	93.8	106.7	14.93	1,375			7.2
290778	do	Lauderdale County	28		17.3	13.6	14.4	78.6	93.2	105.9	15.10	1,330		11.2	7.1
243132	do	Walnut Mound, Nashville.	30		15.7	12.4	High	79.0				1,130			6.5
287214	do	Leadbetter Landing, Benton County.	40		17.6	13.9	13.2	79.0	83.8	95.0	14.90				
315001	do	Nashville	50	Small occipital asymmetry.	17.7	14.0		79.1							
243126	do	Near Nashville	30	Slight lateral	16.6	13.3	14.4	80.1	96.3	108.3	14.77	1,320			7.0
226502	do	do	35		16.4	13.2	13.9	80.5	93.9	105.3	14.50	1,190			7.3
290779	do	Hales Point, Lauderdale County.	70		16.1	13.0	13.6	80.8	92.5	104.6	14.23	1,120			

[1] Menton-Nasion height reconstructed where teeth worn.

UNDEFORMED TENNESSEE: FEMALES—Continued

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
243146	U.S.N.M.	Ashland, Cheatham County.	55		16.8	13.6	Moderate	*81.0*				[2] 1,200			
290770	do	Hales Point, Lauderdale County.	35		17.0	13.8	13.3	*81.2*	*86.4*	*96.4*	14.70	1,280		11.6	7.1
243101	do	Near Nashville	50		17.3	14.2		*82.1*							
228343	do	do	35		15.7	12.9	12.9	*82.2*	*90.2*	*100.0*	13.83	1,140			6.7
243112	do	do	50		16.6	13.7	13.4	*82.5*	*88.5*	*97.8*	14.57	1,290		12.4	7.4
243110 [3]	do	do	20		15.6	12.9	13.0	*82.7*	*91.2*	*100.8*	13.83	1,090		(10.4)	(5.9)
243129	do	do	45		16.4	13.6	13.9	*82.9*	*92.7*	*102.2*	14.63	1,290		12.1	7.2
226074	do	Jefferson County	Young adult, or subadult.		16.2	13.5		*83.3*							
243104	do	Near Nashville	65		17.0	14.4	13.8	*84.7*	*87.9*	*95.8*	15.07	1,460			
243087	do	Flynns Lick	40		17.0	14.4	High	*84.7*							
226513	do	Strawberry Plains	40	Slight lateral	17.2	14.7	14.0	*85.5*	*87.8*	*95.2*	15.30	1,350			7.4
243123	do	Near Nashville	55		15.8	13.6	13.5	*86.1*	*91.8*	*99.3*	14.30	1,260		11.6	7.0
286801	do	Hamilton County	35		16.8	14.6	13.4	*86.9*	*85.4*	*91.8*	14.93	1,360		11.5	6.7
226076	do	Jefferson County	Young adult.		15.8	15.1		*95.6*							
243121	do	Nashville	30												
Specimens					(37)	(37)	(24)	*(37)*	*(24)*	*(24)*	(24)	(22)		(10)	(17)
Totals					628.7	502.3	328.3				353.85	27,920		115.9	118.9
Averages					17.0	13.6	13.7	*79.90*	*89.54*	*100.95*	14.74	1,269.1		11.6	7.0
Minima					15.6	12.4	12.5	*72.5*	*78.8*	*90.1*	13.83	1,090		10.6	6.3
Maxima					18.3	15.1	14.4	*95.6*	*96.3*	*108.3*	15.30	1,460		12.4	7.5

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a\times100}{c}\right)$	*Facial Index, upper* $\left(\frac{b\times100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
							°	°														
286803	12.3	*86.2*	*51.2*	9.6	8.9	10.2	77.0	58.0	3.2	3.2	3.6	3.6	*88.9*	*88.9*	4.9	2.6	*53.1*				2.8	8.5
243131	12.7	*88.2*	*52.8*	9.7	8.5	9.9	71.5	50.0	3.35	3.4	3.7	3.7	*90.5*	*91.9*	4.8	2.7	*56.3*	5.4	6.3	*85.7*	3.4	9.4
243102									3.1		3.6		*86.1*		4.7	2.3	*48.9*				3.5	9.7
134906																						
243133	12.4		*60.5*		8.3	10.0			3.45	3.45	3.8	3.7	*90.8*	*93.2*	4.9	2.45	*50.0*	5.3	6.4	*82.8*		9.4
287215																						9.5
287212																					3.4	8.5
283244																						9.3
243095																					3.4	9.6
310400	12.8								3.5		3.6		*97.2*		5.6	2.7	*48.2*					9.6
243128	12.2	*97.5*	*54.9*							3.5		3.7		*94.6*	4.7	2.2	*46.8*	5.1	6.0	*85.0*	3.7	8.4
287209																						9.2
310385																						
287213					8.8	9.9			3.05	3.15	3.75	3.7	*81.3*	*85.1*	4.85	2.6	*53.6*				3.4	8.5
286796	12.0	*98.3*	*59.2*	9.7	8.4	9.9	70.0	51.5	3.45	3.35	3.7	3.7	*93.2*	*90.5*	4.85	2.5	*51.6*	5.2	6.1	*85.3*	3.6	9.4
243105	12.6		*57.1*	9.5	8.4	9.8	70.0	57.0	3.2	3.3	3.8	3.7	*84.2*	*89.2*	4.75	2.6	*54.7*	5.4	5.8	*93.1*		9.0
290778	12.8	*87.5*	*55.5*	9.8	8.9	10.4	74.0	59.0	3.55	3.55	3.55	3.45	*100.0*	*102.90*	5.1	2.5	*49.0*	5.2	6.9	*75.4*	3.0	8.9
243132	11.7		*55.6*						3.3	3.3	3.5	3.5	*94.3*	*94.3*	4.75	2.3	*48.4*	5.2	6.1	*85.3*	3.2	8.1
287214																					3.2	8.8
315001																					3.1	8.6
243126	[2] 12.3		*56.9*						3.4	3.45	3.6	3.6	*94.4*	*95.8*	4.9	2.45	*50.0*	5.5	6.4	*85.9*		9.1
226502	12.4		*58.9*	9.8	8.8	10.2	71.0	56.5	3.5	3.7	3.75	3.65	*93.3*	*101.4*	5.1	2.6	*51.0*	5.2	6.0	*86.7*	3.7	8.6
290779	12.6				8.8	10.4			3.6	3.6	3.9	3.9	*92.3*	*92.3*	4.95	2.5	*50.5*					8.9
243146																						8.4
290770	13.0	*89.2*	*54.6*	10.0	8.9	10.0	70.0	54.5	3.45	3.5	3.7	3.6	*93.2*	*97.2*	5.05	2.5	*49.5*	5.6	6.6	*84.9*	3.45	9.3
243101																					3.7	9.1
228343	12.1		*55.4*	9.1	8.0	9.2	69.5	55.0	3.4	3.35	3.4	3.6	*100.0*	*93.1*	4.6	2.4	*52.2*	5.0	6.2	*80.7*		8.6
243112	12.5	*99.2*	*59.2*	10.1	8.7	10.0	68.0	49.0	3.1	3.15	2.7	2.7	*114.8*	*116.7*	5.2	2.5	*48.1*	5.4	6.7	*80.6*	3.8	9.1
243110 [3]	(11.9)	*(87.4)*	*(49.6)*	9.5	8.1	8.8	(64.5)	(42)	(2.9)	(2.95)	(3.5)	(3.4)	*(82.9)*	*(86.8)*	(3.9)	(2.35)	*(60.3)*	(5.1)	(6.1)	*(83.6)*	3.3	8.7
243129	13.5	*89.6*	53.3	9.6	8.4	9.8	61.0		3.4	3.4	3.7	3.6	*91.9*	*94.4*	4.85	2.4	*49.5*	5.3	6.5	*81.5*	3.6	9.0
226074																						8.8

[2] Near.
[3] Undeformed but exceptionally small.

UNDEFORMED TENNESSEE: FEMALES—Continued

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a\times100}{c}\right)$	*Facial Index, upper* $\left(\frac{b\times100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle °	Alveolar Angle °	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
243104	12.9	-------	-------	-------	8.4	9.8	-------	-------	3.75	3.75	4.0	4.0	*93.8*	*93.8*	5.4	2.55	*47.2*	-------	-------	-------	-------	9.1
243087	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	3.4	9.9
226513	13.6	-------	*54.4*	9.8	8.8	10.2	71.5	58.5	3.3	3.2	3.8	3.9	*86.8*	*82.1*	5.1	2.65	*52.0*	5.5	7.1	*77.5*	------	10.2
243123	12.7	*91.3*	*55.1*	-------	-------	-------	-------	-------	3.35	3.3	3.6	3.6	*93.1*	*91.7*	4.95	2.65	*53.5*	-------	-------	-------	3.4	8.3
236801	13.3	*86.5*	*50.4*	10.0	8.7	9.6	67.0	49.0	3.25	3.35	3.9	3.8	*83.3*	*88.2*	4.5	2.7	*60.0*	5.6	6.2	*90.3*	3.65	9.5
226076	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
243121	------	-------	-------	-------	-------	-------	-------	-------	-------	3.55	------	3.9	-------	*91.0*	5.3	2.6	*49.1*	5.4	6.7	*80.6*	------	8.8
Specimens	(20)	*(10)*	*(17)*	(13)	(17)	(17)	(12)	(12)	(21)	(21)	(21)	(21)	*(21)*	*(21)*	(23)	(23)	*(23)*	(16)	(16)	*(16)*	(21)	(35)
Totals	252.4	-------	-------	126.2	145.8	168.1	848.5	652.0	70.65	71.5	76.65	76.6	-------	-------	113.8	57.95	------	85.3	102.0	------	71.7	315.8
Averages	12.6	*91.26*	*55.53*	9.7	8.6	9.9	70.71	54.33	3.4	3.4	3.65	3.65	*92.17*	*93.34*	4.9	2.5	*50.92*	5.3	6.4	*83.63*	3.4	9.3
Minima	11.7	*86.2*	*50.4*	9.1	8.0	8.8	67.0	49.0	3.05	3.15	2.7	2.7	*81.3*	*82.1*	4.5	2.2	*46.8*	5.0	5.8	*75.4*	2.8	8.1
Maxima	13.6	*99.2*	*60.5*	10.1	8.9	10.4	77.0	59.0	3.75	3.75	4.0	4.0	*114.8*	*116.7*	5.7	2.7	*60.0*	5.6	7.1	*93.1*	3.8	10.2

DEFORMED TENNESSEE: FEMALES

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)[1]	Alveol. Pt. - Nasion height (b)
114332	U.S.N.M.	Munroe County	35	Medium frontal occipital flattening.	(16.7)	(15.3)		*(91.6)*							
97449	do	Near Nashville	25	Medium occipital	(15.5)	(13.9)	(13.4)	*(89.7)*	*(91.2)*	*(96.4)*	14.27	1,150			
228341	do	do	35	Medium frontal occipital.	(16.1)	(14.2)	(14.0)	*(88.2)*	*(92.4)*	*(98.6)*	14.77	1,235			7.2
228342	do	do	70	Slight frontal pronounced occipital.	(15.5)	(15.2)		*(98.1)*				[2]1,220			7.1
228344	do	do	65	Medium occipital	(16.2)	(14.6)	(14.4)	*(90.1)*	*(93.5)*	*(98.6)*	15.07	1,350			[2]7.2
228347	do	do	45	Slight frontal medium occipital.	(15.6)	(14.8)	(13.4)	*(94.9)*	*(88.2)*	*(90.5)*	14.60	1,230			7.2
228352	do	do	55	Medium occipital	(16.2)	(14.3)	(13.9)	*(88.3)*	*(91.2)*	*(97.2)*	14.80	1,300		11.5	6.5
228354	do	do	60	do	(16.6)	(14.7)	(14.8)	*(88.6)*	*(94.6)*	*(100.7)*	15.37			11.7	7.0
243088	do	do	30	do	(15.4)	(14.4)	(14.4)	*(93.5)*	*(96.6)*	*(100.0)*	14.73	1,190		12.0	7.4
243089	do	do	40	Slight frontal occipital.	(15.8)	(14.2)	(13.4)	*(89.9)*	*(89.3)*	*(94.4)*	14.47	[2]1,160			7.2
243097	do	do	35	do	(16.2)	(13.6)	High	*(84.0)*						11.7	6.8
243111	do	do	30	Medium occipital	(16.0)	(14.1)	(13.0)	*(88.1)*	*(86.4)*	*(92.2)*	14.37	1,245		11.3	6.7
243127	do	do	55	Slight frontal medium occipital.	(15.8)	(14.0)	(13.8)	*(88.6)*	*(92.6)*	*(98.6)*	14.53				7.4
283246	do	Swallow Bluff Island.	60	Moderate occipital	(16.6)	(14.8)		*(89.2)*				[2]1,380			
286800	do	Hamilton County	40	Pronounced frontal occipital.	(14.8)	(16.2)	(13.6)	*(109.5)*	*(87.7)*	*(84.0)*	14.87	1,330		12.0	7.2
290772	do	Hales Point, Lauderdale County.	50	Slight frontal occipital.	(16.1)	(14.8)	(13.6)	*(91.9)*	*(88.0)*	*(91.9)*	14.83	1,190		12.7	7.6
290773	do	do	50	Slight frontal medium occipital.	(15.4)	(15.6)	(14.0)	*(101.3)*	*(90.3)*	*(89.7)*	15.00				7.3
290775	do	do	35	do	(16.1)	(16.0)	(14.2)	*(99.4)*	*(88.5)*	*(88.8)*	15.43	1,415			6.9
292201	do	Near Liberty, Wilson County.	25	Medium frontal pronounced occipital.	(15.4)	(14.6)		*(94.8)*						11.5	7.2
292216	do	Wilson County	25	Medium frontal slight occipital.	(15.8)	(14.4)	(13.6)	*(91.1)*	*(90.1)*	*(94.4)*	14.60	1,210			7.0
305797	do	Near Chattanooga	60	Medium frontal occipital.	(15.9)	(15.4)	(13.0)	*(96.9)*	*(83.1)*	*(84.4)*	14.77	1,270			

[1] Menton-Nasion height reconstructed where teeth worn.
[2] Near.

DEFORMED TENNESSEE: FEMALES—Continued

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
310358	do	Whittaker village	35	Medium occipital	(15.1)	(15.1)	High	*(100.0)*				[2] 1,360			
310379	do	Castalian Springs	30	Slight frontal pronounced occipital.	(15.2)	(14.3)	(13.8)	*(94.1)*	*(93.6)*	*(96.5)*	14.43	1,260			
316099	do	Davidson County	30	Slight frontal occipital	(15.8)	(14.3)		*(90.5)*							
Specimens					(24)	(24)	(17)	*(24)*	*(17)*	*(17)*	(17)	(17)		(8)	(17)
Totals					379.8	352.8	234.3				250.91	21,495		94.4	120.9
Averages					15.8	14.7	13.8	*92.89*	*90.39*	*93.76*	14.76	1,264.4		11.8	7.1
Minima					14.8	13.6	13.0	*84.0*	*83.1*	*84.0*	14.27	1,150		11.3	6.5
Maxima					16.7	16.2	14.8	*109.5*	*96.6*	*100.7*	15.43	1,415		12.7	7.6

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a \times 100}{c}\right)$	*Facial Index, upper* $\left(\frac{b \times 100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length, maxim.	Upper Alveolar Arch, breadth, maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
							°	°														
114332																					3.8	9.7
97449						9.9																8.7
228341	13.1		*55.0*	9.9	9.2	10.2	71.0	64.0	3.65	3.7	3.9	3.8	*93.6*	*97.4*	5.2	2.5	*48.1*	5.1	6.8	*75.0*		9.4
228342	13.7		*51.8*			10.2			3.25		4.05		*80.2*		4.7	2.4	*51.1*	5.5	6.1	*90.2*		9.6
228344	13.3		*54.1*	10.1	8.8	10.2	70.0	53.5	3.25	3.3	3.7	3.6	*87.8*	*91.7*	4.8	2.4	*50.0*					9.1
228347	13.6		*52.9*	10.2	8.8	9.6	64.0	50.0	3.2	3.2	3.8	3.7	*84.2*	*86.5*	4.8	2.5	*52.1*	5.5	7.0	*78.6*		8.8
228352				10.0	8.6	9.6	67.5	46.5	3.1	3.05	3.8	3.85	*81.6*	*79.2*	4.5	2.65	*58.9*	5.5	6.7	*82.1*	3.6	8.9

228354	13.7	85.4	51.1	9.9	8.7	10.1	71.5	54.0	3.4	3.4	3.9	3.9	87.2	87.2	4.85	2.8	57.7	5.6	7.1	78.9	3.4	9.7
243088	12.6	95.2	58.7	9.4	8.4	10.2	73.5	58.0	------	3.2	------	3.6	------	88.9	5.15	2.3	44.7	5.2	6.4	81.3	3.7	8.6
243089	13.1	------	55.0	9.6	8.2	9.6	68.0	47.0	3.5	3.45	3.9	3.8	89.7	90.8	5.1	2.45	48.0	5.6	6.7	83.6	------	8.6
243097	[2]13.3	88.0	51.1	------	------	------	------	------	3.6	3.55	3.8	3.6	94.7	98.6	4.7	2.2	46.8	5.2	6.5	80.0	3.6	8.9
243111	12.8	88.3	52.3	9.9	8.4	9.6	67.5	45.5	3.1	3.1	3.6	3.6	86.1	86.1	4.55	2.6	57.1	5.5	6.2	88.7	3.5	9.1
243127	12.9	------	57.4	10.4	9.2	10.4	69.5	56.5	3.25	3.3	3.7	3.7	87.8	89.2	4.9	2.3	46.9	5.6	6.3	88.9	------	9.0
283246	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	5.2	6.5	80.0	3.6	9.7
286800	(15.2)	(79.0)	(47.4)	------	------	------	------	------	------	3.5	------	4.0	------	87.5	5.15	2.8	54.4	5.5	6.8	80.9	3.2	(10.6)
290772	13.9	91.4	54.7	------	------	10.3	------	------	3.45	------	4.1	------	84.2	------	5.2	2.65	51.0	5.7	7.1	80.3	3.5	9.8
290773	------	------	------	------	------	9.8	------	------	------	------	------	------	------	------	5.2	2.7	51.9	5.7	7.3	78.1	3.6	10.2
290775	13.2	------	52.3	9.8	8.5	9.5	66.5	47.5	3.25	3.25	3.7	3.7	87.8	87.8	4.9	2.4	49.0	5.4	6.7	80.6	------	9.5
292201	[2]12.6	91.3	57.1	------	------	------	------	------	3.25	3.25	3.8	3.7	85.5	87.8	5.2	2.3	44.2	5.2	6.3	82.5	3.2	8.7
292216	13.2	------	53.0	9.7	8.5	9.6	68.0	54.5	3.45	3.5	3.8	3.8	90.8	92.1	4.7	2.25	47.9	5.4	6.6	81.8	------	8.8
305797	------	------	------	------	------	9.6	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	9.6
310358	------	------	------	------	------	------	------	------	------	------	------	------	------	------	4.9	2.1	42.9	------	------	------	3.3	9.0
310379	12.8	------	------	------	8.5	9.8	------	------	3.25	3.2	3.6	3.6	90.3	88.9	------	------	------	------	------	------	------	8.2
316099	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	3.25	8.8
Specimens	(15)	(6)	(14)	(11)	(12)	(16)	(11)	(11)	(15)	(15)	(15)	(15)	(15)	(15)	(18)	(18)	(18)	(17)	(17)	(17)	(13)	(23)
Totals	197.8	------	------	108.9	103.8	158.0	757.0	577.0	49.95	49.95	57.15	55.95	------	------	88.5	44.3	------	92.4	113.1	------	45.25	210.4
Averages	13.2	89.96	54.00	9.9	8.65	9.9	68.82	52.45	3.3	3.3	3.8	3.7	87.40	89.28	4.9	2.5	50.06	5.4	6.65	81.70	3.5	9.1
Minima	12.6	85.4	51.1	9.4	8.2	9.5	64.0	45.5	3.1	3.05	3.6	3.6	80.2	79.2	4.5	2.1	42.9	5.1	6.1	75.0	3.2	8.2
Maxima	13.9	95.2	58.7	10.4	9.2	10.4	73.5	64.0	3.65	3.7	4.1	4.0	94.7	98.6	5.2	2.8	58.9	5.7	7.3	90.2	3.8	10.2

[2] Near.

UNDEFORMED ALABAMA: MALES

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
327830	U.S.N.M.	Near Courtland	70		18.8	13.6		*72.3*							
327285	do	Near Town Creek	Adult		18.6	[1] 13.8		*74.2*							
327287	do	Hog Island	50		18.0	14.3		*79.4*							
324745	do	Near Courtland	Adult		17.6	14.2	14.4	*80.7*	*90.6*	*101.4*	15.40	1,390			[1] 7.0
287217	do	Limestone County	do	Slight frontal occipital flattening.	18.0	14.8	14.5	*82.2*	*88.4*	*98.0*	15.77	1,470	Much worn.	12.0	7.6
327292	do	Near Town Creek	do	do	[1] 18.0	14.8		*82.2*				[1] 1,520			
Specimens					(6)	(6)	(2)	(6)	(2)	(2)	(2)	(3)		(1)	(2)
Totals					109.0	85.5	28.9				31.17	4,380			14.6
Averages					18.2	14.3	14.45	*78.44*	*89.47*	*99.66*	15.58	1,460			7.3
Minima					17.6	13.6	14.4	*72.3*	*88.4*	*98.0*	15.40	1,390			7.0
Maxima					18.8	14.8	14.5	*82.2*	*90.6*	*101.4*	15.77	1,520			7.6

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a\times100}{c}\right)$	*Facial Index, upper* $\left(\frac{b\times100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam., frontal minim.
							°	°														
327830																						9.3
327285																					3.6	
327287																		5.9	6.6	*89.4*	3.6	9.6
324745	Broad			[1] 9.8	8.8	10.4	74.5	54.0	3.5	3.45	3.95	3.95	*88.6*	*87.3*	5.2	[2] 2.5	*48.1*	(5.1)			3.75	
287217	13.8	*87.0*	*55.1*	10.8	9.6	10.7	68.5	54.0	3.4	3.55	4.0	4.0	*85.0*	*88.8*	5.25	2.6	*49.5*	5.8	6.3	*92.1*	3.9	
327292	14.3									3.7		[1] 4.2		*88.1*				5.45	6.6	*82.6*	3.8	

Specimens	(2)	(1)	(1)	(2)	(2)	(2)	(2)	(2)	(2)	(3)	(2)	(3)	(2)	(3)	(2)	(2)	(2)	(3)	(3)	(3)	(5)	(2)
Totals	28.1	----	----	20.6	18.4	21.1	143.0	108.0	6.9	10.7	7.95	12.15	----	----	10.45	5.1	----	17.15	19.5	----	18.65	18.9
Averages	14.05	----	----	10.3	9.2	10.6	71.5	54.0	3.45	3.6	4.0	4.0	*86.79*	*88.07*	5.2	2.6	*48.80*	5.7	6.5	*84.48*	3.7	9.5
Minima	13.8	----	----	9.8	8.8	10.4	68.5	54.0	3.4	3.45	3.95	3.95	*85.0*	*87.3*	5.2	2.5	*48.1*	5.45	6.3	*82.6*	3.6	9.3
Maxima	14.3	----	----	10.8	9.6	10.7	74.5	54.0	3.5	3.7	4.0	4.2	*88.6*	*88.8*	5.25	2.6	*49.5*	5.9	6.6	*92.1*	3.9	9.6

DEFORMED ALABAMA: MALES

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
228325	U.S.N.M.	Tombigbee River	Adult	Pronounced frontal occipital flattening.	(16.4)	(15.4)	----	*(93.9)*	----	----	----	[1] 1,390	----	----	7.4
283247	do	Lauderdale County	do	Pronounced occipital flattening.	(16.4)	(16.4)	(14.8)	*(100.0)*	*(90.2)*	*(90.2)*	15.87	1,610	Moderate	12.6	7.8
327290	do	Near Town Creek	do	do	(16.4)	(16.4)	(14.6)	*(100.0)*	*(89.0)*	*(89.0)*	15.80	1,450	----	----	[1] 7.5

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a \times 100}{c}\right)$	*Facial Index, upper* $\left(\frac{b \times 100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length, maxim.	Upper Alveolar Arch, breadth, maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam., frontal minim.
							°	°														
228325	----	----	----	----	----	----	----	----	----	3.95	----	4.1	----	*96.3*	5.25	----	----	5.3	6.9	*76.8*	[1] 3.7	----
283247	(14.4)	*(87.5)*	*(54.2)*	10.1	10.6	9.0	71.5	60.0	3.65	3.4	3.95	4.0	*92.4*	*85.0*	5.15	2.55	*49.5*	5.3	6.5	*81.5*	4.0	----
327290	(15.0)	----	*(50.0)*	[1] 10.2	9.1	10.1	68.0	58.0	----	3.3	----	4.0	----	*82.5*	5.0	----	----	----	----	----	3.8	----

[1] Near.
[2] Inner breadth; borders not sharp.

UNDEFORMED ALABAMA: FEMALES

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlicka's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
327281	U.S.N.M.	Hog Island	30		17.6	[1]13.4		*76.1*							
327282	do	do	65		17.8	13.7		*77.0*							
287218	do	Limestone County	Adult		16.4	12.8	13.1	*78.1*	*89.7*	*102.3*	14.10	1,145			
327291	do	Near Town Creek	do		17.0	[1]13.5		*79.4*							
327283	do	do	do		17.2	13.7		*79.7*							6.9
327294	do	do	do		17.0	13.8		*81.2*				[1]1,250			
287216	do	Limestone County	do	Slight asymmetry	17.0	14.0	[1]13.8	*82.4*	*89.0*	*98.6*	14.93	[1]1,250			
326845	do	Near Courtland	do		17.1	14.1	14.4	*82.5*	*92.3*	*102.1*	15.20	1,320		11.9	7.2
283248	do	Lauderdale County	do		17.1	14.2	13.8	*83.0*	*88.2*	*97.2*	15.03	1,325		[1,2]12.2	7.5
287219	do	Limestone County	do	Slight asymmetry	16.8	14.6	14.0	*86.9*	*89.2*	*95.9*	15.13	1,395	Slight	11.5	7.2
286806	do	Jackson County	do	Slight frontal occipital flattening.	16.7	14.6		*87.4*				1,430			7.1
Specimens					(11)	(11)	(5)	*(11)*	(5)	(5)	(5)	(7)		(3)	(5)
Totals					187.7	152.4	69.1				74.39	9,115		35.6	35.9
Averages					17.2	13.9	13.8	*81.25*	*89.68*	*99.2*	14.88	1,302		11.9	7.2
Minima					16.4	12.8	13.1	*76.1*	*88.2*	*95.9*	14.10	1,145		11.5	6.9
Maxima					17.8	14.6	14.4	*87.4*	*92.3*	*102.3*	15.20	1,430		12.2	7.5

CHOCTAW

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlicka's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
243885	U.S.N.M.	Near Mobile	50		16.5	13.5	13.5	*81.8*	*90.0*	*100.0*	14.50	1,230			6.8
225253	do	do	25		16.5	13.7	13.0	*83.0*	*86.1*	*94.9*	14.40	1,150		11.1	7.0
243884	do	Near Mt. Vernon Arsenal.	25		16.0	13.7	13.3	*85.6*	*89.6*	*97.1*	14.33	1,150		11.4	7.1
225247	do	Mobile	40		17.0	14.6	14.1	*85.9*	*89.2*	*96.6*	15.23	1,335			
Specimens					(4)	(4)	(4)	*(4)*	*(4)*	*(4)*	(4)	(4)		(2)	(3)
Totals					66.0	55.5	53.9				58.46	4,865		22.5	20.9
Averages					16.5	13.88	13.48	*84.09*	*88.72*	*97.10*	14.62	1,216.25		11.25	6.97
Minima					16.0	13.5	13.0	*81.8*	*86.1*	*94.9*	14.33	1,150		11.1	6.8
Maxima					17.0	14.6	14.1	*85.9*	*90,0*	*100.0*	15.23	1,335		11.4	7.1

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a \times 100}{c}\right)$	*Facial Index, upper* $\left(\frac{b \times 100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle
							°	°
327281								
327282								
287218	12.5					10.4		
327291								
327283								
327294								
287216						10.7		
326845				9.9	8.9	10.2	71.0	59.5
283248	13.9	*87.8*	*54.00*	10.1	8.7	10.3	70.0	47.5
287219	13.3	*86.5*	*54.1*	9.6	8.5	9.8	69.5	54.0
286806								
Specimens	(3)	(*2*)	(*2*)	(3)	(3)	(5)	(3)	(3)
Totals	39.70			29.6	26.1	51.4	210.5	161.0
Averages	13.2	*87.13*	*54.04*	9.9	8.7	10.3	70.2	53.7
Minima	12.5	*86.5*	*54.0*	9.6	8.5	9.8	69.5	47.5
Maxima	13.9	*87.8*	*54.1*	10.1	8.9	10.7	71.0	59.5
CHOCTAW								
243885	12.2		*55.7*	9.4	8.2	9.4	69.00	50.00
225253	13.0	*85.4*	*53.9*	9.8	8.8	9.8	69.50	57.50
243884	12.0	*95.0*	*59.2*	9.8	8.4	9.8	69.00	47.50
225247	12.6				8.8	10.2		
Specimens	(4)	(*2*)	(*3*)	(3)	(4)	(4)	(3)	(3)
Totals	49.8			29.0	34.2	39.2	207.5	155.0
Averages	12.45	*90.00*	*56.18*	9.67	8.55	9.8	69.17	51.67
Minima	12.0	*85.4*	*53.9*	9.4	8.2	9.4	69.0	47.5
Maxima	13.0	*95.0*	*59.2*	9.8	8.8	10.2	69.5	57.5

Catalog No.	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth, maxim.
327281								
327282								
287218								
327291								
327283								
327294								
287216		3.5		3.9		*89.7*		
326845							5 2	2.4
283248	3.5	[1] 3.6	4.0	3.9	*87.5*	*92.3*	5.25	[3] 2.4
287219	3.5	3.5	3.8	3.8	*92.1*	*92.1*	5.1	2.35
286806	3.35	3.45	4.1	4.0	*81.7*	*86.3*	5.1	2.6
Specimens	(3)	(4)	(3)	(4)	(*3*)	(*4*)	(4)	(4)
Totals	10.35	14.05	11.9	15.60			20.65	9.75
Averages	3.45	3.5	4.0	3.9	*86.97*	*90.06*	5.2	2.4
Minima	3.35	3.45	3.8	3.8	*81.7*	*86.3*	5.1	2.35
Maxima	3.5	3.6	4.1	4.0	*92.1*	*92.3*	5.25	2.6
CHOCTAW								
243885	3.3	3.4	3.8	3.8	*86.8*	*89.5*	4.8	2.6
225253	3.4	3.4	4.1	4.0	*82.9*	*85.0*	4.8	2.5
243884	3.4	3.6	3.9	3.75	*87.2*	*96.0*	4.9	2.4
225247	3.6	3.6	3.65	3.65	*98.6*	*98.6*	5.4	2.4
Specimens	(4)	(4)	(4)	(4)	(*4*)	(*4*)	(4)	(4)
Totals	13.7	14.0	15.45	15.20			19.9	9.9
Averages	3.43	3.5	3.86	3.8	*88.86*	*92.11*	4.98	2.48
Minima	3.3	3.4	3.65	3.65	*82.9*	*85.0*	4.8	2.4
Maxima	3.6	3.6	4.1	4.0	*98.6*	*98.6*	5.4	2.6

Catalog No.	*Nasal Index*	Upper Alveolar Arch, length, maxim.	Upper Alveolar Arch, breadth, maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
327281					2.9	
327282						
287218					3.4	
327291						
327283						
327294						
287216					3.9	
326845	*46.2*	4.9	6.6	*74.2*	3.6	
283248	*45.7*	5.6			3.8	
287219	*46.1*	5.3	[1] 6.3	*84.1*	3.6	
286806	*51.0*	5.15			3.3	
Specimens	(*4*)	(4)	(2)	(*2*)	(7)	
Totals		20.95	12.9		24.5	
Averages	*47.22*	5.2	6.5	*79.07*	3.5	
Minima	*45.7*	4.9	6.3	*74.2*	2.9	
Maxima	*51.0*	5.6	6.6	*84.1*	3.9	
CHOCTAW						
243885	*54.2*	5.4	6.2	*87.1*	3.1	7.9
225253	*52.1*				3.1	8.4
243884	*49.0*	5.6	6.2	*90.3*	3.5	8.7
225247	*44.4*				3.1	9.8
Specimens	(*4*)	(2)	(2)	(*2*)	(4)	(4)
Totals		11.0	12.4		12.8	34.8
Averages	*49.75*	5.5	6.2	*88.71*	3.2	8.7
Minima	*44.4*	5.4	6.2	*87.1*	3.1	7.9
Maxima	*54.2*	5.6	6.2	*90.3*	3.5	9.8

[1] Near.

[2] +. +.

[3] Inner breadths; borders not sharp.

DEFORMED ALABAMA: FEMALES

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
286804	U.S.N.M.	Marshall County	Adult	Pronounced occipital flattening.	(16.5)	(15.8)	(13.8)	*(95.8)*	*(98.6)*	*(87.3)*	15.37	1,380	Slight	11.6	7.4
228324	do	Tombigbee River	do	Pronounced frontal occipital flattening.	(16.0)	(16.6)	(13.4)	*(103.8)*	*(82.2)*	*(80.7)*	15.33	1,280	Medium	12.1	7.6

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a\times100}{c}\right)$	*Facial Index, upper* $\left(\frac{b\times100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
							°	°														
286804	13.2	*87.9*	*56.1*	9.8	8.8	10.0	69.5	58.0	3.35	3.35	3.75	3.85	*89.3*	*87.0*	5.1	2.3	*45.1*	5.5	6.3	*87.3*	3.3	------
228324	(14.1)	*85.8*	*53.9*	10.6	9.3	10.1	64.5	50.5	3.4	3.3	3.9	3.75	*87.2*	*88.0*	5.3	2.8	*52.8*	5.8	6.8	*85.3*	3.7	------

UNDEFORMED MISSISSIPPI: MALES

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
243076	U.S.N.M.	Near Vicksburg	70	Slight occipital flattening.	18.3	14.7	High	*80.3*							
243040	do	do	35	Slight asymmetry	19.0	15.4		*81.1*				(1,540)			
243054	do	do	50		18.4	15.4	14.8	*83.7*	*87.6*	*96.1*	16.20	1,640			
326517	do	Near Church Hill	60	Slight frontal flattening.	17.6	14.8	[1] 14.2	*84.1*	*87.7*	*96.0*	15.53				
326518	do	do	60		17.2	14.9	[1] 14.2	*86.6*	*85.8*	*95.3*	15.43			12.1	7.4
243038	do	Near Vicksburg	35	Slight asymmetry											
Specimens					(5)	(5)	(3)	*(5)*	*(3)*	*(3)*	(3)	(1)		(1)	(1)
Totals					90.5	75.2	43.2				47.16				
Averages					18.1	15.0	14.4	*83.09*	*87.89*	*95.79*	15.72				
Minima					17.2	14.7	14.2	*80.3*	*85.8*	*95.3*	15.43				
Maxima					19.0	15.4	14.8	*86.6*	*87.7*	*96.1*	16.20				

[1] Near.

UNDEFORMED MISSISSIPPI: MALES—Continued

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a \times 100}{c}\right)$	*Facial Index, upper* $\left(\frac{b \times 100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
							°	°														
243076															5.4	2.6	*48.2*					10.0
243040																						10.4
243054	14.8					10.5																9.9
326517																					3.8	8.7
326518	14.0	*86.4*	*52.9*						3.4	3.4	3.8	3.8	*89.5*	*89.5*	5.2	2.5	*48.1*	5.6	6.6	*84.9*	3.3	8.8
243038									3.2	3.25	3.8	3.7	*84.2*	*87.8*	4.4	2.3	*52.3*					9.4
Specimens	(2)	*(1)*	*(1)*			(1)			(2)	(2)	(2)	(2)	*(2)*	*(2)*	(3)	(3)	*(3)*	(1)	(1)	*(1)*	(2)	(6)
Totals	28.8								6.6	6.65	7.6	7.5			15.0	7.4					7.1	57.2
Averages	14.4								3.3	3.3	3.8	3.8	*86.84*	*88.67*	5.0	2.5	*49.33*			*84.9*	3.6	9.5
Minima	14.0								3.2	3.25	3.8	3.7	*84.2*	*87.8*	4.4	2.3	*48.1*				3.3	8.7
Maxima	14.8								3.4	3.4	3.8	3.8	*89.5*	*89.5*	5.4	2.6	*52.3*				3.8	10.4

DEFORMED MISSISSIPPI: MALES

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
243043	U.S.N.M.	Near Vicksburg	60	Moderate occipital flattening.	(16.9)	(14.9)		*(88.2)*				1,450			
243052	do	do	65	Slight frontal, considerable occipital compression.	(16.0)	(15.6)	(14.5)	*(97.5)*	*(91.8)*	*(93.0)*	15.37	1,460			
243055	do	do	40	Slight frontal, moderate occipital flattening.	(17.1)	(15.1)	(15.2)	*(88.3)*	*(94.4)*	*(100.7)*	15.80	1,480		12.2	7.5
243056	do	do	55	Pronounced occipital flattening.	(15.6)	(15.7)		*(100.6)*						12.1	7.5
243058	do	do	65	Medium occipital, flattening.	(17.0)	(15.1)		*(88.8)*							7.2
243064	do	do	70	Slight frontal, medium occipital flattening.	(17.8)	(15.2)	(15.8)	*(85.4)*	*(95.8)*	*(104.0)*	16.27				7.7
243066	do	do	50	Slight frontal occipital flattening.	(17.2)	(14.1)	(14.8)	*(82.0)*	*(94.6)*	*(105.0)*	15.37	1,425		12.6	7.6
243067	do	do	50	Slight frontal, considerable occipital flattening.	(16.4)	(15.6)		*(95.1)*				1,485		12.0	[1] 7.2
243068	do	do	55	Pronounced occipital flattening.	(16.6)	(15.5)		*(93.4)*				[1] 1,440			
243069	do	do	75	Slight frontal, pronounced occipital flattening.	(15.6)	(15.2)		*(97.4)*							
243081	do	do	60	Pronounced occipital flattening.	(15.5)	(15.3)	(14.5)	*(98.7)*	*(94.1)*	*(94.8)*	15.10	1,400		12.1	7.0
243084	do	do	70	Moderate frontal, pronounced occipital flattening.	(18.6)	(15.9)		*(85.5)*							
243085	do	do	65	Moderate occipital flattening.	(17.6)	(14.7)	High	*(83.5)*							
263405	do	Washington County	55	Medium occipital flattening.	(17.2)	(15.6)	(14.4)	*(90.7)*	*(87.8)*	*(92.3)*	15.73	1,485			7.3

[1] Near.

DEFORMED MISSISSIPPI: MALES—Continued

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
263406	U.S.N.M.	Washington County	70	Slight frontal, pronounced occipital flattening.	(16.7)	(14.8)	(13.7)	*(88.6)*	*(87.0)*	*(92.6)*	15.07	1,460			
326507	do	Near Church Hill	65	Moderate frontal, occipital flattening.	(16.4)	(15.9)	(14.5)	*(97.0)*	*(89.8)*	*(91.2)*	15.60	[1] 1,535		11.8	6.9
326519	do	do	35	Moderate occipital flattening.	(16.6)	(14.8)	(14.4)	*(89.2)*	*(91.7)*	*(97.3)*	15.27				7.3
326521	do	do	65	Very pronounced occipital flattening.	(15.6)	(16.9)	(14.0)	*(108.3)*	*(86.2)*	*(82.8)*	15.50	[1] 1,430			
Specimens					(18)	(18)	(10)	*(18)*	*(10)*	*(10)*	(10)	(11)		(6)	(10)
Totals					300.4	275.9	145.8				155.08	16,050		72.8	73.2
Averages					16.7	15.3	14.6	*91.84*	*91.30*	*95.11*	15.51	1,459.1		12.1	7.3
Minima					15.5	14.1	13.7	*82.0*	*86.2*	*82.8*	15.07	1,400		11.8	6.9
Maxima					18.6	16.9	15.8	*108.3*	*95.8*	*105.0*	15.80	1,535		12.6	7.7

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a\times100}{c}\right)$	*Facial Index, upper* $\left(\frac{b\times100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle °	Alveolar Angle °	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
243043	13.7									3.5		4.0		*87.5*	5.0	2.2	*44.0*				3.7	9.9
243052						10.2			3.75		3.8		*98.7*		5.2	2.5	*48.1*					10.0
243055	14.6	*83.6*	*51.4*	10.5	9.5	10.9	57.5	72.5		3.6		3.75		*96.0*	5.2	2.8	*53.9*	5.5	7.1	*77.5*	3.7	9.6
243056	14.6	*82.9*	*51.4*							3.7		3.9		*94.9*	5.3	2.8	*52.8*	5.8	6.9	*84.1*	3.5	10.5
243058										3.5		4.1		*85.4*	5.0	2.4	*48.0*	5.4	6.4	*84.4*		10.4
243064	14.0		*55.0*												5.1	2.8	*54.9*	5.4	6.5	*83.1*		10.3
243066	14.2	*88.7*	*53.5*	10.3	9.0	10.6	70.0	50.5	3.7	3.8	4.2	4.0	*88.1*	*95.0*	5.4	2.6	*48.2*	5.8	7.2	*80.6*	3.7	9.7
243067	14.5	*82.8*	*49.7*						3.6	3.7	3.6	3.6	*100.0*	*97.3*	5.0	2.6	*52.0*				3.4	9.9
243068																					3.6	9.5
243069										3.15		3.7		*85.1*								9.4
243081	14.7	*82.3*	*47.6*	9.8	8.6	9.2	64.0	50.0		3.5		3.9		*89.7*	5.0	2.6	*52.0*				3.4	10.4
243084									3.25		4.0		*81.3*		5.4	2.8	*51.9*					10.4
243085	13.9																					9.7
263405				10.7	9.2	10.2	66.0	42.5	3.25		3.75		*86.7*		5.35	2.8	*52.3*	5.9	7.1	*83.1*		10.2
263406																						9.4
326507				10.3	9.2	10.4	71.0	52.0		3.3		3.8		*86.8*	5.0	2.5	*50.0*				3.4	9.5
326519						10.4				3.4		3.7		*91.9*							3.5	9.2
326521						9.9															3.6	9.8
Specimens	(8)	*(5)*	*(6)*	(5)	(5)	(8)	(5)	(5)	(5)	(10)	(5)	(10)	*(5)*	*(10)*	(12)	(12)	*(12)*	(6)	(6)	*(6)*	(10)	(18)
Totals	114.2			51.6	45.5	81.8	328.5	267.5	17.55	35.15	19.35	38.45			61.95	31.4		33.8	41.2		35.5	177.8
Averages	14.3	*84.02*	*51.39*	10.3	9.1	10.2	65.7	53.5	3.5	3.5	3.9	3.8	*90.70*	*91.42*	5.2	2.6	*50.69*	5.6	6.9	*82.04*	3.6	9.9
Minima	13.7	*82.3*	*47.6*	9.8	8.6	9.2	57.5	42.5	3.25	3.15	3.6	3.6	*81.3*	*85.1*	5.0	2.2	*44.0*	5.4	6.4	*77.5*	3.4	9.2
Maxima	14.7	*88.7*	*55.0*	10.7	9.5	10.9	71.0	72.5	3.75	3.8	4.2	4.1	*100.0*	*97.3*	5.4	2.8	*54.9*	5.9	7.2	*84.4*	3.7	10.5

[1] Near.

UNDEFORMED MISSISSIPPI: FEMALES

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt. - Nasion height (b)
243039	U.S.N.M.	Near Vicksburg	50		16.9	13.5		*79.9*				1,175			6.5
331046	do	Crandall Mound	Young		16.6	13.4		*80.7*							
326506	do	Near Church Hill	50		[1] 17.4	14.4	[1] 14.5	*82.8*	*91.2*	*100.7*	15.43				
243078	do	Near Vicksburg	70		16.8	14.2		*84.5*							
331044	do	Hiwannee Mound	35	Slight frontal flattening.	17.6	15.2		*86.4*							
331045	do	do	Young adult.		16.7	14.6		*87.4*							
Specimens					(6)	(6)	(1)	*(6)*	*(1)*	*(1)*	(1)	(1)		(0)	(1)
Totals					102.0	85.3									
Averages					17.0	14.2		*83.63*							
Minima					16.6	13.4									
Maxima					17.6	15.2									

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a \times 100}{c}\right)$	*Facial Index, upper* $\left(\frac{b \times 100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
							°	°														
243039	13.4		*48.5*						3.5	3.45	4.1	4.0	*85.4*	*86.3*	4.7	2.5	*53.2*	5.3	6.2	*85.5*		9.4
331046																						8.7
326506																					3.7	
243078																						8.8
331044																						9.4
331045																						9.2
Specimens	(1)		*(1)*						(1)	(1)	(1)	(1)	*(1)*	(1)	(1)	(1)	*(1)*	(1)	(1)	*(1)*	(1)	(5)
Totals																						45.5
Averages																						9.1
Minima																						8.7
Maxima																						9.4

[1] Near.

DEFORMED MISSISSIPPI: FEMALES

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
243062	U.S.N.M.	Near Vicksburg	30	Slight frontal occipital.	(10.1)	(15.6)		*(96.9)*						11.6	7.0
243051	do	do	70	Pronounced frontal occipital flattening.	(15.0)	(15.6)		*(104.0)*				1,210		[1] 11.7	7.0
243048	do	do	50	Slight frontal pronounced occipital flattening.	(15.6)	(14.1)	(13.4)	*(90.4)*	*(90.2)*	*(95.0)*	14.37	1,220			
243072	do	do	70	Marked frontal occipital flattening.	(16.0)	(15.4)		*(96.3)*				[1] 1,370			
243073	do	do	60	Slight frontal pronounced occipital flattening.	(14.8)	(15.8)		*(106.8)*							
243044	do	do	70	Medium occipital flattening.	(15.5)	(14.3)		*(92.3)*							
243047	do	do	20	Pronounced occipital flattening.											7.0
243049	do	do	60	do	(15.8)	(15.4)	(14.4)	*(97.5)*	*(92.3)*	*(93.5)*	15.20	1,435		11.8	7.1
243050	do	do	75	do	(15.7)	(15.2)	(14.1)	*(96.8)*	*(91.3)*	*(92.8)*	15.00				
243053	do	do	30	do	(15.0)	(14.7)	(14.0)	*(98.0)*	*(94.3)*	*(95.2)*	14.57	1,260		11.8	7.3
243057	do	do	50	Moderate occipital flattening.	(16.9)	(14.0)	(13.4)	*(82.8)*	*(86.7)*	*(95.7)*	14.77				
243061	do	do	55	Pronounced occipital flattening.	(15.2)	(15.2)		*(100.0)*							7.0
243065	do	do	45	Slight frontal occipital flattening.	(15.9)	(14.6)		*(91.8)*							7.1
243074	do	do	45	Pronounced occipital flattening.	(15.2)	(14.9)	(13.6)	*(98.0)*	*(90.4)*	*(91.3)*	14.57				6.8
243075	do	do	65	Medium frontal occipital flattening.	(15.8)	(14.9)		*(94.3)*				1,250			
243079	do	do	45	Pronounced occipital flattening.	(15.4)	(15.2)		*(98.7)*							
243082	do	do	50	Medium occip tal flattening.	(15.6)	(14.8)		*(94.9)*							7.3

243083	do	do	70	Pronounced occipital flattening.	(14.9)	(14.9)		(100.0)							
243086	do	do	50	Moderate frontal pronounced occipital flattening.	(16.6)	(15.6)		(94.0)							
317,591	do	Walls	50	Medium frontal occipital flattening.	(16.4)	(14.6)	(14.7)	(89.0)	(94.8)	(100.7)	15.23	1,300		12.1	7.8
317,593	do	do	45	do	(16.5)	(14.5)	(13.2)	(87.9)	(85.2)	(91.0)	14.73	1,300			6.6
317,594	do	do	60	Slight frontal moderate occipital flattening.	(15.8)	(14.9)	(13.8)	(94.3)	(89.9)	(92.6)	14.83	1,210			7.1
317,595	do	do	35	Slight frontal pronounced occipital flattening.	(15.4)	(15.4)	(14.0)	(100.0)	(90.9)	(90.9)	14.93	1,380			
326,510	do	New Church Hill	65	Medium occipital flattening.	(16.5)	(15.2)		(92.1)							
326,513	do	do	60	Moderate frontal pronounced occipital flattening.	(15.7)	(15.5)	(14.3)	(98.7)	(91.7)	(93.3)	15.17				
349,933	do	Woodbine Mound, Yazoo County.	45	Moderate frontal occipital flattening.											6.8
Specimens					(24)	(24)	(11)	(24)	(11)	(11)	(11)	(10)		(5)	(13)
Totals					377.30	60.3	152.9				163.37	12,935		59.0	91.9
Averages					15.7	15.0	13.9	95.42	90.69	93.69	14.85	1,293.5		11.8	7.1
Minima					14.8	14.0	13.2	82.8	85.2	90.9	14.37	1,210.0		11.6	6.6
Maxima					16.9	15.8	14.7	106.8	94.8	100.7	15.23	1,435		12.1	7.8

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a \times 100}{c}\right)$	*Facial Index, upper* $\left(\frac{b \times 100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
							°	°														
243062									3.1		3.7		83.8		4.8	2.6	54.2				3.5	9.5
243051	13.8	84.8	50.7						3.2	3.1	3.95	4.0	81.0	77.5	4.9	2.8	57.1				3.3	9.3
243048						9.6															3.3	9.1
243072																						9.9
243073									3.4		3.65		93.2		4.9	2.5	51.0					9.0
243044																						9.2
243047															4.9	2.4	49.0	5.1	6.5	78.5	3.1	
243049	13.7	86.1	51.8	9.5	8.2	9.3	66.5	47.5	3.7	3.5	3.95	4.0	93.7	87.5	5.1	2.5	49.0	5.5	6.7	82.1	3.1	9.3

[1] Near.

DEFORMED MISSISSIPPI: FEMALES—Continued

Catalog No.	Diam. Bizygomatic maxim (c)	*Facial Index, total* $\left(\frac{a \times 100}{c}\right)$	*Facial Index, upper* $\left(\frac{b \times 100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
							°	°														
243050																						
243053	13.4	*88.1*	*54.5*	9.9	8.6	9.6	65.5	51.5	3.35	3.45	3.75	3.6	*89.3*	*95.8*	5.0	2.3	*46.0*	5.8	6.9	*84.1*	3.9	9.5
243057									3.6		4.1		*87.8*		5.0	2.6	*52.0*					9.4
243061										3.5		3.8		*92.1*	5.2	2.5	*48.1*	5.6	6.8	*82.4*		9.3
243065	13.6		*52.2*						3.65	3.65	3.63	3.6	*100.0*	*101.4*	5.0	2.5	*50.0*	5.3	6.3	*84.1*		9.3
243074									3.4		4.0		*85.0*		4.9	2.6	*53.1*	5.6	6.5	*86.2*		10.2
243075	12.9																				3.25	9.4
243079																						
243082										3.55		3.95		*89.9*								
243083																						9.2
243086																						9.9
317, 591	14.1	*85.8*	*55.3*	10.0	9.0	10.2	68.5	57.5	3.45	3.45	3.95	3.95	*87.3*	*87.3*	5.6	2.7	*48.2*	5.7	6.9	*82.6*	3.5	8.8
317, 593	13.8		*47.8*						3.25	3.4	3.9	3.8	*83.3*	*89.5*	4.65	2.8	*60.2*	5.2	6.6	78.8		9.8
317, 594	12.6		*56.4*	9.5	8.4	9.6	69.5	58.0	3.3	3.3	3.8	3.7	*86.8*	*89.2*	4.8	3.0	62.5	5.7	6.7	*85.1*		9.0
317, 595	13.6					9.3																9.7
326, 510																						
326, 513																					3.6	
349, 933									3.25	3.3	3.9	3.8	*83.3*	*86.8*	4.6	2.5	*54.4*	5.2	6.4	*81.3*		9.4
Specimens	(9)	*(4)*	(7)	(4)	(4)	(6)	(4)	(4)	(12)	(10)	(12)	(10)	*(12)*	*(10)*	(14)	(14)	*(14)*	(10)	(10)	*(10)*	(9)	(20)
Totals	121.5			38.9	34.2	57.6	270.0	214.5	40.65	34.2	46.3	38.2			69.35	36.3		54.7	66.3		30.55	188.2
Averages	13.5	*86.18*	*52.63*	9.7	8.6	9.6	67.5	53.6	3.4	3.4	3.9	3.8	*87.80*	*89.53*	4.95	2.6	*52.34*	5.5	6.6	*82.50*	3.4	9.4
Minima	12.6	*84.8*	*47.8*	9.5	8.2	9.3	65.5	47.5	3.1	3.1	3.65	3.6	*81.0*	77.5	4.6	2.3	*46.0*	5.1	6.3	78.5	3.1	8.8
Maxima	14.1	*88.1*	*56.4*	10.0	9.0	10.2	69.5	58.0	3.7	3.65	4.1	4.0	*100.0*	*101.4*	5.6	3.0	*62.5*	5.8	6.9	*86.2*	3.9	10.2

UNDEFORMED ARKANSAS: MALES

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
362445	U. S. N. M.	Cedar Grove Cave	70		19.0	13.7	13.8	*72.1*	*84.4*	*100.7*	15.50	1,500		12.4	7.4
255177	do	Mississippi County	50		18.0	13.3	14.0	*73.9*	*89.5*	*105.3*	15.10				7.7
262539	do	Cross County	60		18.7	14.0	14.4	*74.9*	*88.1*	*102.9*	15.70	1,530		12.3	7.5
258749	do	do	45	Slight frontal	19.4	14.7	14.2	*75.8*	*83.2*	*96.6*	16.10	1,560		12.7	7.6
258757	do	do	50		17.9	13.7	14.2	*76.5*	*89.9*	*103.7*	15.27	1,400		12.3	7.1
258750	do	do	60		18.0	13.8	High	*76.7*							
243165	do	Pecan Point, Mississippi County.	50–60		18.2	14.0	Fair	*76.9*							
262546	do	Mississippi County	30	Moderate frontal	17.4	13.4	14.2	*77.0*	*92.2*	*106.0*	15.00	1,410		11.9	7.4
255178	do	do	70	do	18.5	14.3	14.0	*77.3*	*85.4*	*97.9*	15.60	1,510			
114022	do	Miller Mound, Little River.	40		18.0	14.0	14.3	*77.8*	*89.4*	*102.1*	15.43	1,460		13.1	[1] 8.2
362442	do	Cedar Grove Cave	28		18.0	14.0	High	*77.8*				1,550		11.6	6.9
261820	do	Cross County	35		17.7	13.9	14.2	*78.5*	*89.9*	*102.2*	15.27	1,410		11.9	7.2
262560	do	Mississippi County	30		17.0	13.4	13.8	*78.8*	*90.8*	*103.0*	14.73	1,295		12.1	7.8
243171	do	Pecan Point, Mississippi County.	50–60		17.9	14.2	14.3	*79.3*	*89.1*	*100.7*	15.47	1,445			7.8
261784	do	Cross County	35	Slight frontal	17.6	14.0	14.1	*79.6*	*89.2*	*100.7*	15.23	1,410		12.3	7.4
243162	do	Drew County	50		18.1	14.4	(?) Good	*79.6*				(2)			
261783	so	Poinsett County	50		18.2	14.5	14.6	*79.7*	*89.3*	*100.7*	15.77	1,570			
258759	do	Cross County	55		17.2	13.8	14.6	*80.2*	*94.2*	*105.8*	15.20	1,395		12.9	7.9
197828	do		35	Broader elliptical	17.1	13.8	14.4	*80.7*	*93.2*	*104.4*	15.10	1,555			7.4
262537	do	Lee County	70		17.3	14.0	13.6	*80.9*	*86.9*	*97.1*	14.97	1,295		12.6	7.8
243148	do	Drew County	60–70		18.3	14.9	14.0	*81.4*	*84.3*	*94.0*	15.73				
253712	do	Bassett, Mississippi County.	50–60	Or very slight frontal	17.4	14.2	14.1	*81.6*	*89.2*	*99.3*	15.23			12.3	7.6
276644	do	Mississippi County	35	Slight frontal	18.0	14.7	14.5	*81.7*	*88.7*	*98.6*	15.73	1,560		13.3	8.1
262549	do	do	60	Slight frontal small asymmetry.	16.7	13.7	13.8	*82.0*	*90.8*	*100.7*	14.73	1,355		11.8	6.9
258762	do	Cross County	50	Moderate frontal	17.5	14.4	14.4	*82.3*	*90.3*	*100.0*	15.43	1,510		12.7	7.7
243173	do	Pecan Point, Mississippi County.		Very slight compression.	17.7	14.6	15.3	*82.5*	*94.7*	*104.8*	15.87	1,460		(3)	7.8

[1] Near.
[2] Large, probably over 1,600.
[3] Between 13.6 and 13.9.

UNDEFORMED ARKANSAS: FEMALES—Continued

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt - Nasion height (b)
255149	U. S. N. M.	Boyts Field, Union County.	50		17.3	14.3	13.5	82.7	85.4	94.4	15.03	[4]		11.3	6.9
261819	do	Cross County	60		17.2	14.3	13.6	83.1	86.4	95.1	15.03	[1] 1,330			
255126	do	Boyts Field, Union County.	30–35		17.6	14.8	14.0	84.1	86.4	94.6	15.47	(?) Fair		12.2	7.3
258755	do	Cross County	35	Moderate frontal+	17.6	14.8	13.8	84.1	85.2	93.2	15.40	[1] 1,460			7.2
243141	do	Bradleys Landing	55–65	Very slight frontal compression.	17.2	14.5	Good	84.3							
262543	do	Mississippi County	60	Slight frontal	17.6	14.9	14.1	84.7	86.8	94.6	15.53	1,465		12.9	7.2
262567	do	do	50	do	17.3	14.8	High	85.6				1,420		12.8	7.5
249915	do	Near Menard Mound, Arkansas County.	50–60	do	17.8	15.4	14.3	86.5	86.1	92.9	15.83	1,425		12.4	7.7
243145	do	Drew County	35–40	Very slight lateral occipital compression.	17.5	[1] 15.3	Good	87.4							
255119	do	Boyts Field, Union County.	40		16.7	14.7	14.1	88.0	89.8	95.9	15.17	1,475		11.6	6.9
243154	do	Drew County	30		16.5	14.7	Fair	89.1						12.1	7.5
249919	do	Near Greer, Jefferson County.	55–60	(?) not flathead	16.5	14.8	14.6	89.7	93.3	98.6	15.30	1,345			
Specimens					(38)	(38)	(30)	(38)	(30)	(30)	(30)	(27)		(23)	(28)
Totals					671.6	542.7	424.8				460.92	39,100		283.5	209.4
Averages					17.7	14.3	14.2	80.81	86.68	99.44	15.36	1,448		12.3	7.5
Minima					16.5	13.3	13.6	72.1	83.2	92.9	14.73	1,295		11.3	6.9
Maxima					19.4	15.4	14.6	89.7	94.7	106.0	16.10	1,570		13.3	8.2

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a \times 100}{c}\right)$	*Facial Index, upper* $\left(\frac{b \times 100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
							°	°														
362445	14.0	*88.6*	*52.9*	10.3	9.4	10.4	70.0	58.5	3.5	3.6	4.1	4.1	*85.4*	*87.8*	5.4	2.6	*48.2*	5.8	6.5	*89.2*	3.4	9.9
255177	14.0	------	*55.0*	10.3	9.4	11.0	74.0	62.5	3.65	3.5	4.1	4.0	*89.0*	*87.5*	5.7	2.7	*47.4*	5.6	6.7	*83.6*	------	9.2
262539	13.5	*91.1*	*55.6*	10.0	9.2	10.2	69.5	62.0	3.9	3.75	4.05	4.05	*96.3*	*92.6*	5.3	2.6	*49.1*	------	------	------	------	9.4
258749	13.9	*91.4*	*54.7*	10.2	8.9	10.6	72.0	50.5	3.5	3.5	4.0	3.9	*87.5*	*89.7*	5.4	2.55	*47.2*	5.8	6.8	*85.3*	------	9.2
258757	13.5	*91.1*	*52.6*	9.8	8.7	10.2	71.5	55.0	3.4	3.4	3.5	3.5	*97.1*	*97.1*	4.75	2.6	*54.7*	5.4	6.5	*83.1*	------	9.0
258750	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	9.6
243165	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	8.9
262546	13.1	*90.8*	*56.5*	9.7	8.8	10.6	75.0	60.0	3.7	3.75	3.9	3.7	*94.9*	*101.4*	5.25	2.55	*48.6*	5.2	6.2	*83.9*	------	9.2
255178	13.7	------	------	------	8.7	10.0	------	------	3.85	3.8	4.0	3.9	*96.3*	*97.4*	5.6	2.6	*46.4*	------	------	------	------	9.5
114022	13.5	*97.0*	*60.7*	------	8.4	10.3	------	------	3.65	3.75	3.85	3.8	*94.8*	*98.7*	5.6	2.8	*50.0*	------	------	------	3.9	10.1
362412	14.3	*81.1*	*48.3*	------	------	------	------	------	------	3.2	------	3.6	------	*88.9*	5.0	2.3	*46.0*	5.6	6.8	*82.4*	3.6	8.9
261820	14.0	*85.0*	*51.4*	10.8	9.7	10.8	70.0	53.0	3.2	3.2	3.9	3.8	*82.1*	*84.2*	5.2	2.8	*53.9*	5.4	6.8	*79.4*	------	9.0
262560	13.6	*89.0*	*57.4*	10.2	9.1	10.0	66.0	52.5	3.4	3.7	3.8	3.7	*89.5*	*100.0*	5.7	2.5	*43.9*	5.7	6.8	*83.8*	------	8.5
243171	------	------	------	10.0	8.8	10.0	------	------	3.7	3.6	3.7	3.65	*100.0*	*98.6*	5.35	2.8	*52.3*	5.8	6.9	*84.1*	------	9.2
261784	13.9	*88.5*	*53.2*	9.8	8.8	10.2	71.0	55.5	3.65	3.7	4.0	3.9	*91.3*	*94.9*	5.5	2.75	*50.0*	5.5	6.9	*79.7*	------	9.5
243162	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	10.7
261783	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	6.0	7.1	*84.5*	------	9.2
258759	13.9	*92.8*	*56.8*	10.1	9.0	10.1	66.5	58.5	3.65	3.6	3.9	3.9	*93.6*	*92.3*	5.3	2.5	*47.2*	6.0	6.9	*87.0*	------	9.2
197828	13.5	------	*54.8*	------	------	------	------	------	------	------	------	------	------	------	5.7	2.6	*45.6*	------	------	------	------	9.1
262537	13.4	*94.0*	*58.2*	10.4	9.0	10.4	68.0	49.0	3.4	3.4	3.75	3.75	*90.7*	*90.7*	5.6	2.8	*50.0*	5.7	6.7	*85.1*	------	9.4
243148	------	------	------	------	8.9	10.9	------	------	3.7	3.65	3.95	3.9	*93.7*	*93.6*	5.45	2.75	*50.5*	------	------	------	------	------
253712	14.6	*84.3*	*52.1*	10.5	9.5	10.7	70.5	55.5	3.4	3.55	4.2	4.1	*81.0*	*86.6*	5.45	2.7	*49.5*	5.6	7.2	*77.8*	3.5	8.4
276644	14.4	*92.4*	*56.3*	10.8	9.4	10.7	67.0	53.0	3.55	3.55	3.9	3.9	*91.0*	*91.0*	5.4	2.7	*50.0*	6.3	7.0	*90.0*	------	10.2
262549	13.2	*89.4*	*52.3*	9.9	8.6	10.0	70.5	49.5	3.6	3.7	4.05	3.9	*88.9*	*94.9*	4.8	2.65	*55.2*	------	------	------	------	9.5
258762	14.4	*88.2*	*53.5*	10.2	9.0	10.0	61.5	49.0	3.65	3.7	3.9	3.9	*93.6*	*94.9*	5.8	2.95	*50.9*	5.8	7.0	*82.9*	------	9.4
243173	(3)	------	------	[1] 9.5	8.5	10.4	73.5	57.5	3.5	3.4	3.75	3.7	*93.3*	*91.9*	(5.6)	(2.4)	*(42.9)*	[1] 5.7	7.0	*81.4*	------	10.2
255149	13.7	*82.5*	*50.4*	10.0	9.2	10.2	71.0	62.0	3.15	3.3	4.0	4.0	*78.8*	*82.5*	4.7	2.4	*51.1*	5.4	6.1	*88.5*	3.9	8.7
261819	------	------	------	------	------	10.3	------	------	------	------	------	------	------	------	------	------	------	5.5	6.6	*83.3*	------	9.7
255126	14.3	*85.3*	*51.0*	10.7	9.7	11.0	72.0	56.0	3.5	------	4.1	------	*85.4*	------	5.2	2.8	*53.8*	(6.2)	------	------	3.9	10.0
258755	14.2	------	*50.7*	------	------	10.1	------	------	3.65	------	4.0	------	*91.3*	------	5.4	2.75	*50.9*	------	------	------	------	9.5
243141	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	9.8
262543	13.4	*96.3*	*53.7*	10.0	8.8	10.4	72.0	54.5	3.6	3.65	3.85	3.8	*93.5*	*96.1*	4.85	2.6	*53.6*	------	------	------	------	9.4

[1] Near.
[4] Submedium.

UNDEFORMED ARKANSAS: MALES Continued

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index total* $\left(\frac{a\times100}{c}\right)$	*Facial Index upper* $\left(\frac{b\times100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal, minim.
							°	°														
262567	14.1	*90.8*	*53.2*						3.45	3.4	4.1	4.0	*84.2*	*85.0*	5.4	2.7	*50.0*	5.7	7.1	*80.3*		9.3
249915	14.6	*84.9*	*52.7*	10.7	9.8	11.4	74.0	60.0	3.45	3.4	4.5	4.55	*76.7*	*74.7*	5.45	2.75	*50.5*	5.8	[1]6.9	*84.1*	3.4	9.8
243145																						
255119	13.8	*84.1*	*50.0*	10.0	8.9	10.2	71.0	51.0	3.45	3.6	4.0	3.95	*86.3*	*91.1*	5.0	2.55	*51.0*	5.5	6.2	*88.7*	3.6	10.2
243154	13.7	*88.3*	*54.7*												5.45	2.7	*49.5*	5.8	6.55	*88.5*	3.3	9.8
249919	14.5			10.5	8.95				3.2	3.2	3.9	3.85	*82.1*	*83.1*	5.0	2.5	*50.0*					10.15
Specimens	(28)	*(23)*	*(26)*	(23)	(26)	(27)	(21)	(21)	(28)	(27)	(28)	(27)	*(28)*	*(27)*	(30)	(30)	*(30)*	(23)	(23)	*(23)*	(9)	(36)
Totals	388.7			234.4	235.15	281.1	1,476.5	1,165.0	99.0	95.55	110.75	104.8			159.7	79.55		130.6	155.25		32.5	33.31
Averages	13.9	*88.93*	*53.76*	10.2	9.0	10.4	70.3	55.5	3.5	3.5	4.0	3.9	*89.39*	*91.17*	5.3	2.65	*49.81*	5.7	6.4	*84.12*	3.6	9.25
Minima	13.1	*81.1*	*48.3*	9.5	8.4	10.0	61.5	49.0	3.15	3.2	3.5	3.5	*76.7*	*74.7*	4.7	2.3	*43.9*	5.2	6.1	*77.8*	3.3	8.4
Maxima	14.6	*97.0*	*60.7*	10.8	9.8	11.4	75.0	62.5	3.9	3.8	4.2	4.55	*100.0*	*101.4*	5.7	2.95	*55.2*	6.3	7.2	*90.0*	3.9	10.7

DEFORMED ARKANSAS: MALES

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
197829	U.S.N.M.		75	Slight fronto-occipital flattening.	(17.6)	(14.3)	(14.3)	*(81.3)*	*(89.7)*	*(100.0)*	15.40	1,555			
243142	do	Drew County	55	Moderate occipital flattening.	(17.2)	(15.7)	(15.1)	*(91.3)*	*(91.8)*	*(96.2)*	16.00	1,600			7.4
243147 [2]	do	do	50–55	do	(16.4)	(15.3)	(14.5)	*(93.3)*	*(91.5)*	*(94.8)*	15.40				
243157	do	do	55	Slight occipital flattening	(17.1)										7.6
243164	do	do	50–60	Considerable occipital moderate frontal flattening.	(18.2)	(15.6)	(14.4)	*(85.7)*	*(85.2)*	*(92.3)*	16.07	1,590			
243167	do	Pecan Point, Mississippi County.	35–40	Pronounced fronto-occipital flattening.	(16.0)	(15.9)	(14.2)	*(99.4)*	*(89.0)*	*(89.3)*	15.37	1,420			
243168	do	do	50	Moderate occipital flattening.	(16.2)	(15.8)	(14.7)	*(97.5)*	*(91.9)*	*(93.0)*	15.57				
243172	do	do	45	Slight occipital flattening.	(16.9)	(14.6)	(15.1)	*(86.4)*	*(95.9)*	*(103.4)*	15.53				7.6
243176	do	do	Young adult.	do	(16.7)	(15.4)	(14.6)	*(92.2)*	*(91.0)*	*(94.8)*	15.57				
247348	do	Mound on Mississippi River, Crittenden County.	do	Pronounced fronto-occipital.	(15.6)	(16.8)		*(107.7)*							
247349	do	do	Aging adult.	do	(15.6)	(14.8)		*(94.9)*							
255123	do	Boyts Field, Union County.	35–40	Moderate occipital flattening.	(16.9)	(14.6)		*(86.4)*				Medium		12.0	7.1
255124	do	do	45	Medium fronto-occipital flattening.	(16.4)	(15.7)	(14.3)	*(95.7)*	*(89.1)*	*(91.1)*	15.47	1,480			7.1
255127	do	do	20	Very slight frontal considerable occipital flattening.	(15.9)	(15.4)	(14.6)	*(96.9)*	*(93.3)*	*(94.8)*	15.30	1,455		11.7	6.9
255128	do	do	35–40	Medium occipital flattening.	(16.2)	(15.9)		*(98.2)*							
255141	do	do	55-60	Moderate occipital flattening.	(17.6)	(15.1)	(14.8)	*(85.8)*	*(90.5)*	*(98.0)*	15.83	1.670		11.5	6.8
255145	do	do	50	Pronounced occipital flattening.	(17.3)	(15.7)		*(90.8)*				Medium			

[1] Menton-Nasion height restored where teeth worn.

[2] Some doubt as to sex.

DEFORMED ARKANSAS: MALES—Continued

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
255150	U.S.N.M.	Boyts Field, Union County.	45	Moderate lateral occipital flattening.	(17.7)	(14.8)	(14.3)	(83.6)	(88.0)	(96.6)	15.60	1,470		11.7	7.3
255152	do	do	55	Pronounced fronto-occipital flattening.	(16.9)	(16.1)	(14.5)	(95.3)	(87.9)	(90.1)	15.83	Fair		12.0	7.2
258752	do	Cross County	30	Slight fronto-occipital.	(17.7)	(14.6)		(82.5)							
258754	do	do	35	Medium frontal slight occipital.	(17.4)	(14.8)	(14.4)	(85.1)	(89.4)	(97.3)	15.53	1,435		13.4	7.8
259298	do	Lawrence County	60	Medium fronto-occipital.	(17.0)	(14.4)	(14.2)	(84.7)	(90.5)	(98.6)	15.20	1,410			
259299	do	do	55	Pronounced occipital.	(15.2)	(15.7)	(14.6)	(103.3)	(94.5)	(93.0)	15.17	[3] 1,370		11.8	6.8
258786	do	Poinsett County	40	Medium frontal	(16.6)	(13.9)	(13.8)	(83.7)	(90.5)	(99.3)	14.77	1,415			7.5
261791	do	do	35	Medium frontal slight occipital.	(17.1)	(14.9)	(15.0)	(87.1)	(93.8)	(100.7)	15.67	1,510		12.1	7.2
261796	do	do	30	Medium fronto-occipital.	(16.4)	(14.8)	(14.6)	(90.2)	(93.6)	(98.7)	15.27	1,450			
261831	do	St. Francis County	60	Slight fronto-occipital.	(16.7)	(14.0)	(14.0)	(83.8)	(91.2)	(100.0)	14.90	1,400		12.9	7.9
262541	do	Poinsett County	28	Slight occipital	(16.5)	(14.0)	(14.2)	(94.9)	(93.1)	(101.4)	14.90	1,315		12.4	7.6
262542	do	Mississippi County	45	Slight fronto-occipital.	(17.0)	(14.6)	(14.4)	(85.9)	(91.1)	(98.6)	15.33	[3] 1,380		13.0	7.9
262550	do	do	60	Medium fronto-occipital.	(17.1)	(14.6)	(14.0)	(85.4)	(88.3)	(95.9)	15.23	1,410		12.2	7.5
262551	do	do	50	Moderate fronto-occipital.	(16.0)	(15.4)	(13.6)	(96.3)	(86.6)	(88.3)	15.00	1,370			7.6
262563	do	do	75	Slight fronto-occipital.	(17.4)	(14.6)	(13.9)	(83.9)	(86.9)	(95.2)	15.30	1,425			
262565	do	do	45	Medium frontal slight occipital.	(16.5)	(14.4)	(13.8)	(87.3)	(89.3)	(95.8)	14.90	1,380			7.6
262568	do	do	55	Modenate fronto-occipital.	(17.6)	(15.2)	(14.8)	(86.4)	(90.2)	(97.4)	15.87	1,610		12.9	7.8

262574	do	do	55	Medium fronto-occipital.	(17.2)	(15.2)		(88.4)				1,450		12.4	7.5
262575	do	do	45	Pronounced frontal	(17.6)	(14.6)	(13.4)	(83.0)	(83.2)	(91.8)	15.20	1,465		12.8	8.0
272542	do	Red River, Miller County.	75	Pronounced fronto-occipital.	(18.2)	(15.8)	(13.2)	(86.8)	(77.7)	(83.5)	15.73	1,520			[3] 8.1
272544	do	do	60	do	(16.7)	(15.4)	(13.3)	(92.2)	(82.9)	(86.4)	15.13	[3] 1,420			
272546	do	do	45	Medium fronto-occipital.	(17.8)	(15.0)	(13.7)	(84.3)	(83.5)	(91.3)	15.50	1,410		12.5	7.5
272547	do	do	30	do	(17.5)	(14.2)	(14.4)	(81.1)	(90.9)	(101.4)	15.37	1,500		11.9	7.2
Specimens					(40)	(39)	(32)	(39)	(32)	(32)	(32)	(28)		(17)	(25)
Totals					675.6	587.6	456.7				492.91	40,885		209.2	186.5
Averages					16.9	15.1	14.3	89.23	89.37	95.15	15.40	1,460.2		12.3	7.5
Minima					15.2	13.9	13.2	81.1	77.7	83.5	14.77	1,315		11.5	6.8
Maxima					18.2	16.8	15.1	107.7	95.9	103.4	16.07	1,670		13.4	8.1

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a\times100}{c}\right)$	*Facial Index, upper* $\left(\frac{b\times100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
							°	°														
197829	14.4				9.8	11.0			2.45	2.55	3.8	3.75	*64.5*	*68.0*	5.8	2.95	*50.9*					9.3
243142	14.2		*52.1*	9.7	8.8	10.4	73.5	57.0	3.45	3.5	3.9	3.9	*88.5*	*89.7*	5.5	2.7	*49.1*					9.7
243147 [3]						10.7																9.4
243157									3.35	3.3	3.8	3.7	*88.2*	*89.2*	5.4	2.75	*50.9*	5.8	6.9	*84.1*		9.1
243164						10.6																8.9
243167						9.9																
243168						10.6															3.2	8.9
243172	14.3		*53.1*	10.0	9.0	10.3	70.0	58.0	3.6	3.55	3.65	3.7	*98.6*	*96.0*	5.3	2.45	*46.2*	[3] 5.8	7.4	*78.4*		9.6
243176						9.5																9.4
247348																					3.6	9.4
247349																						
255123															4.8	2.45	*51.0*	5.3	6.5	*81.5*	3.7	9.8
255124	14.0		*50.7*	10.4	9.0	10.0	66.0	48.0	3.8	3.7	4.0	3.95	*95.0*	*93.7*	5.0	2.45	*49.0*	6.0	6.7	*89.6*		9.8
255127	13.3	*88.0*	*51.9*	9.8	9.2	10.1	72.0	67.0	3.1	3.15	3.9	3.75	*79.5*	*84.0*	4.8	2.35	*49.0*	5.4	6.7	*80.6*	3.5	9.7
255128																2.35		5.6	7.1	*78.9*		9.6
255141	13.6	*84.6*	*50.0*	10.3	9.1	10.7	74.0	50.0	3.65	3.55	4.0	4.05	*91.3*	*87.8*	4.85	2.45	*50.5*	5.8	6.5	*89.2*	3.5	9.8
255145																		5.8	7.1	*81.7*	3.9	9.9
255150	14.1	*83.0*	*51.8*	10.1	9.0	10.6	73.0	53.0	3.3		4.1		*80.5*		5.35	2.5	*46.7*	5.5	6.3	*87.3*	3.2	9.6
255152	(15.2)	*(78.9)*	*(47.4)*	10.4	9.3	10.6	71.0	53.0	3.7	3.8	4.1	4.1	*90.2*	*92.7*	5.25	2.8	*53.3*	5.5	6.7	*82.1*	3.6	9.4

[3] Near.

DEFORMED ARKANSAS: MALES—Continued

Catalog No.	Diam. Bizygomatic maxim (c)	*Facial Index, total* $\left(\frac{a \times 100}{c}\right)$	*Facial Index, upper* $\left(\frac{b \times 100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
							°	°														
258752																		6.0	7.3	*82.2*		10.2
258754	13.8	*97.1*	*56.5*	10.5	9.5	10.5	68.0	57.5	3.6	3.5	3.6	3.6	*100.0*	*97.2*	5.6	2.6	*46.4*	6.0	7.2	*83.3*		8.5
259298	14.5				9.0	10.6			3.7	3.7	3.9	3.8	*94.9*	*97.4*	5.2	2.4	*46.2*					8.2
259299	13.7	*86.1*	*49.6*						3.1	3.15	3.7	3.6	*83.8*	*87.5*	4.85	2.45	*50.5*	5.7	7.2	*79.2*		9.4
258786	13.1		*57.3*	10.1	8.6	9.9	66.5	43.5		3.45		3.6		*95.8*	5.45	2.6	*47.7*	5.7	6.9	*82.6*		9.4
261791	14.2	*85.2*	*50.7*	9.5	8.6	10.2	74.0	58.5	3.6	3.65	3.75	3.75	*96.0*	*97.3*	5.1	2.35	*46.1*	5.6	6.5	*86.2*		9.1
261796	13.4				9.0	10.0			3.35	3.4	3.8	3.7	*88.2*	*91.9*	5.0	2.55	*51.0*					9.3
261831	14.6	*88.4*	*54.1*	10.3	9.2	10.4	67.5	56.0	3.85	4.0	4.3	4.2	*89.5*	*95.2*	5.6	2.7	*48.2*	5.7	7.8	*73.1*		9.3
262541	13.9	*89.2*	*54.7*	9.8	8.8	10.4	72.5	58.0	3.55	3.75	4.05	4.0	*87.7*	*93.8*	5.4	2.6	*48.2*	5.6	7.0	*80.0*		9.7
262542	13.5	*96.3*	*58.5*	9.7	8.7	10.3	71.0	59.0	3.7	3.85	3.9	3.75	*94.9*	*102.7*	5.6	2.6	*46.4*	5.6	6.4	*87.5*		9.3
262550	13.5	*90.4*	*55.6*	9.7	8.4	10.0	70.0	51.5	3.5	3.5	3.7	3.6	*94.6*	*97.2*	5.25	2.55	*48.6*					9.0
262551	14.0		*54.3*	9.6	8.4	9.7	67.5	53.0	3.5	3.5	3.8	3.8	*92.1*	*92.1*	5.35	2.4	*44.9*	5.3	6.7	*79.1*		9.3
262563						10.0																9.8
262565	13.9		*54.7*	9.5	8.6	10.1	71.0	59.0	3.8	3.85	3.85	3.85	*98.7*	*100.0*	5.5	2.3	*41.8*	5.1	6.9	*73.9*		8.8
262568	14.6	*88.4*	*53.4*	10.6	9.2	10.7	69.0	48.5	3.3	3.45	3.8	3.7	*86.8*	*93.2*	5.6	2.9	*51.8*	6.1	7.4	*82.4*		9.4
262574	14.7	*84.4*	*51.0*						3.7	3.65	4.0	3.9	*92.5*	*93.6*	5.25	2.5	*47.6*	5.7	6.7	*85.1*		10.1
262575	14.3	*89.5*	*55.9*	10.2	9.1	10.2	67.0	59.0	3.8		3.9		*97.4*		5.3	2.75	*51.9*	5.7	6.7	*85.1*		9.3
272543	14.9		*54.4*		10.0	10.5			3.7	3.6	4.0	4.0	*92.5*	*90.0*	5.2	2.8	*53.9*					(10.8)
272544	13.7																	6.1	7.3	*83.6*		10.1
272546	14.6	*85.6*	*51.4*	10.2	9.2	10.2	68.0	59.0	3.8	3.7	3.8	3.8	*100.0*	*97.4*	5.1	2.4	*47.1*	5.9	7.0	*84.3*		9.1
272547	14.2	*83.8*	*50.7*	10.1	9.1	10.7	74.5	57.0	3.8	3.8	3.9	3.9	*97.4*	*97.4*	5.1	2.7	*52.9*	5.7	6.6	*86.4*		9.7
Specimens	(26)	*(16)*	*(22)*	(20)	(24)	(30)	(20)	(20)	(26)	(25)	(26)	(25)	*(26)*	*(25)*	(28)	(29)	*(28)*	(26)	(26)	*(26)*	(8)	(37)
Totals	365.0			200.5	216.6	309.4	1,406.	1,105.5	91.75	88.6	101.0	95.45			147.5	74.35		148.0	179.5		28.2	348.3
Averages	14.0	*87.94*	*53.27*	10.0	9.0	10.3	70.30	55.28	3.5	3.5	3.9	3.8	*90.84*	*92.82*	5.3	2.6	*48.81*	5.7	6.9	*82.45*	3.5	9.4
Minima	13.1	*83.0*	*49.6*	9.5	8.4	9.5	66.0	43.5	2.45	2.55	3.6	3.6	*64.5*	*68.0*	4.8	2.3	*41.8*	5.1	6.3	*73.1*	3.2	8.2
Maxima	14.9	*97.1*	*58.5*	10.6	10.0	11.0	74.5	59.0	3.85	4.0	4.3	4.2	*100.0*	*102.7*	5.8	2.95	*53.9*	6.1	7.8	*89.6*	3.9	10.2

UNDEFORMED ARKANSAS: FEMALES

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)[1]	Alveol. Pt.-Nasion height (b)
243166	U.S.N.M.	Pecan Point	50		17.5	13.1	13.6	*74.9*	*88.9*	*103.8*	14.73				[2] 6.8
262557	do	Mississippi County	30	Slight frontal	17.8	13.5	14.7	*75.8*	*93.9*	*108.9*	15.33	1,350		12.6	7.5
258751	do	Cross County	50		17.1	13.0	14.0	*76.0*	*93.0*	*107.7*	14.70				
261801	do	Poinsett County	65	Slight frontal	18.1	13.8	14.1	*76.2*	*88.4*	*102.2*	15.33	1,330			7.7
263416	do	Crittenden County	55		16.6	12.8	13.3	*77.1*	*90.5*	*103.9*	14.23	1,240			
263417	do	do	35		17.6	13.6	14.2	*77.3*	*91.0*	*104.4*	15.13	1,395			7.8
261835	do	St. Francis County	50	Slight occipital	16.5	12.8	14.0	*77.6*	*95.6*	*109.4*	14.43	1,250		11.2	6.7
262548	do	Mississippi County	45		17.1	13.3	13.4	*77.8*	*88.2*	*100.8*	14.60	1,160			6.8
261799	do	Poinsett County	60	Medium fronto-occipital.	16.9	13.2	13.6	*78.1*	*90.4*	*103.0*	14.57	1,240			
262554	do	Mississippi County	25	Slight frontal	17.5	13.7	14.1	*78.3*	*90.4*	*102.9*	15.10	1,400			
262581	do	do	35		16.5	13.1	13.4	*79.4*	*90.5*	*102.3*	14.33	1,200		11.4	7.0
261818	do	Poinsett County	55	Slight frontal	17.1	13.6	13.8	*79.5*	*89.9*	*101.5*	14.83	1,270		11.9	7.3
243143	do	Drew County	Yg. adult		17.3	13.8	13.9	*79.8*	*89.4*	*100.7*	15.00	1,330			
262558	do	Mississippi County	55		16.8	13.4	14.0	*79.8*	*92.7*	*104.5*	14.73	1,255		11.8	7.1
362446	do	Cedar Grove Cave	60		16.8	13.4	13.3	*79.8*	*88.1*	*99.3*	14.50	[2] 1,260		11.7	6.9
262569	do	Mississippi County	35		17.4	14.0	13.8	*80.5*	*87.9*	*98.6*	15.07	[2] 1,430			
263410	do	Crittenden County	30		17.1	13.9	13.3	*81.3*	*85.8*	*95.7*	14.77	1,330		11.4	7.0
263412	do	do	60		16.7	13.6	13.9	*81.4*	*91.8*	*102.2*	14.73	1,345			6.5
261800	do	Poinsett County	50		17.3	14.1	14.0	*81.5*	*89.2*	*99.3*	15.13	[2] 1,380		12.2	7.8
261788	do	do	30		16.4	13.4	13.7	*81.7*	*92.0*	*102.2*	14.50	1,265			7.2
261812	do	do	50	Slight fronto+	16.6	13.6	13.1	*81.9*	*86.8*	*96.3*	14.43	1,245		12.0	7.3
255143	do	Boyt's Field, Union County.	45		16.8	13.8	13.6	*82.1*	*88.9*	*98.6*	14.73	(?) Medium		10.9	
262547	do	Mississippi County	50	Slight frontal	16.6	13.7	13.1	*82.5*	*86.5*	*95.6*	14.47	1,260		11.3	6.9
262535	do	do	65	Occipital asymmetry.	16.5	13.7		*83.0*				1,210			7.2
255120	do	Boyt's Field, Union County.	45		16.7	13.9	(?) Fair	*83.2*				(?) Medium		11.2	7.0
243175	do	Pecan Point, Mississippi County.	Yg. adult		16.7	13.9	13.9	*83.2*	*90.9*	*100.0*	14.83	1,310			
243177	do	do	50		16.5	13.8	[2] 13.3	*83.6*	*87.8*	*96.4*	14.53	1,250			
262553	do	Mississippi County	35		15.9	13.3	13.5	*83.7*	*92.5*	*101.5*	14.23	1,135		11.7	7.4
261809	do	Poinsett County	60	Moderate fronto +	16.6	13.9	14.1	*83.7*	*92.5*	*101.4*	14.87	1,345			
262556	do	Mississippi County	50	Occipital small asymmetry.	16.2	13.6	13.6	*84.0*	*91.3*	*100.0*	14.47	1,295		11.5	7.0

[1] Menton-Nasion height restored where teeth worn.
[2] Near

UNDEFORMED ARKANSAS: FEMALES—Continued

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
258753	U.S.N.M.	Cross County	35	Slight fronto +	16.2	13.6	13.6	*84.0*	*91.3*	*100.0*	14.47	1.185		11.8	7.2
262545	do	Mississippi County	22	Small occipital asymmetry.	16.4	13.8	12.9	*84.2*	*85.4*	*93.5*	14.37	1,345			7.0
263409	do	Crittenden County	25		16.5	13.9	14.1	*84.2*	*92.8*	*101.4*	14.83	1,350		11.3	7.1
249921	do	Jefferson County	35		17.2	14.5	14.15	*84.3*	*89.3*	*97.6*	15.26	1,260		11.9	7.45
261810	do	Poinsett County	35		16.7	14.1	14.0	*84.4*	*90.9*	*99.3*	14.93			11.6	7.2
258761	do	Cross County	25	Slight fronto +	16.8	14.2	13.4	*84.5*	*86.5*	*94.4*	14.80	1,245		10.7	6.7
262580	do	Mississippi County	45	Slight fronto-occipital.	16.3	13.8	13.4	*84.7*	*89.0*	*97.1*	14.50	1,150		11.8	7.1
363150	do	Near Atkins	55		16.4	13.9	14.1	*84.8*	*93.1*	*101.4*	14.80	1,270		11.7	7.0
262573	do	Mississippi County	50	Slight fronto +	17.4	14.8	13.7	*85.1*	*85.1*	*92.6*	15.30	1,400			
261785	do	Poinsett County	35	do	16.2	13.8	13.4	*85.2*	*89.3*	*97.1*	14.47	1,210		11.7	7.4
262561	do	Mississippi County	23	Slight fronto + occipital.	16.1	13.8	13.8	*85.7*	*92.3*	*100.0*	14.57	1,250			6.7
262570	do	do	55	do	16.4	14.1	14.0	*86.0*	*91.8*	*99.3*	14.83	[1]1,270		12.0	7.6
249923	do	Near Greer, Jefferson County.	35		16.5	14.3	13.7	*86.7*	*89.0*	*95.8*	14.83	1,250		10.0	6.7
205607	do	1 mile south of West Memphis.	Yg. adult	Slight occipital asymmetry.	16.3	14.2	13.7	*87.1*	*89.8*	*96.5*	14.73	1,180			
262536	do	Mississippi County	60	Slight fronto +	16.3	14.3	13.7	*87.7*	*89.5*	*95.8*	14.77	1,335			
262582	do	do	25	do	16.6	14.6	13.1	*88.0*	*84.0*	*89.7*	14.77	1,310		11.8	7.2
249925	do	Near Greer, Jefferson County.	35	Slight fronto-compression.	15.7	13.9	13.6	*88.5*	*91.9*	*97.8*	14.40	1,140			7.25
262576	do	Mississippi County	35		16.2	14.4	13.9	*88.9*	*90.9*	*96.5*	14.83	1,340			
249920	do	Near Greer, Jefferson County.	40		16.2	14.5	13.9	*89.5*	*90.6*	*95.9*	14.87	1,185			
276645	do	Mississippi County	50	Slight frontal	16.0	14.4	13.4	*90.0*	*88.2*	*93.1*	14.60	1,330			
243152	do	Drew County	Yg. adult		15.9	15.1	13.1	*95.0*	*84.5*	*86.8*	14.70				
243170	do	Pecan Point, Mississippi County.	Adult		16.4	15.6	12.9	*95.1*	*80.6*	*82.7*	14.97				
Specimens					(52)	(52)	(50)	*(52)*	*(50)*	*(50)*	(50)	(45)		(25)	(34)
Totals					867.9	719.9	683.85				736.9	57,485		289.1	242.5
Averages					16.7	13.8	13.7	*82.95*	*89.57*	*98.78*	14.74	1,277.4		11.6	7.1
Minima					15.7	12.8	12.9	*74.9*	*80.6*	*82.7*	14.23	1,135.0		10.0	6.5
Maxima					18.1	14.8	14.2	*95.1*	*95.6*	*109.4*	15.33	1,430.0		12.6	7.8

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a \times 100}{c}\right)$	*Facial Index, upper* $\left(\frac{b \times 100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle °	Alveolar Angle °	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
243166	12.3		55.3		9.5	10.2			3.35	3.4	3.8	3.7	88.2	91.9	4.95	2.6	52.5	[1] (5.3)	6.3	(84.1)		9.3
262557	12.7	99.2	59.1	9.5	8.4	10.0	71.0	53.5	3.5	3.3	3.5	3.5	100.0	94.3	5.4	2.35	43.5	5.1	6.4	79.7		8.5
258751						10.5																8.4
261801	13.3		57.9	10.4	9.0	10.4	68.0	51.0	3.6	3.5	4.0	3.9	90.0	89.7	5.35	2.5	46.7					8.5
263416	12.7					10.0																8.6
263417	13.0		60.0	9.8	8.4	10.0	68.5	51.5	3.85	3.95	4.1	4.0	93.9	98.8	5.3	2.6	49.1	5.6	6.8	82.4		9.8
261835	13.0	86.2	51.5	10.0	8.8	10.2	72.0	49.0	3.3	3.25	3.6	3.6	91.7	90.3	4.8	2.65	55.2					8.8
262548	13.8		49.3		9.6	10.1			3.4	3.5	3.9	3.7	87.2	94.6				5.5	6.9	79.7		9.2
261799	13.3					10.1				3.8		3.8		100.0								8.6
262554						10.6																10.0
262581	12.0	95.0	58.3	9.6	8.4	9.7	69.5	53.0	3.65	3.65	3.6	3.6	101.4	101.4	5.1	2.45	48.0					9.0
261818	13.2	90.2	55.3	10.1	8.9	10.2	69.0	51.5	3.5	3.5	3.9	3.9	89.7	89.7	5.2	2.5	48.1	5.5	6.8	80.9		8.5
243143						10.2																9.0
262558	13.4	88.1	53.0			10.1			3.4		3.85		88.31		5.1	2.2	43.1					9.0
362446	12.7	92.1	54.3						3.5	3.5	4.0	3.8	87.5	92.1	5.15	2.4	46.6	5.5	6.3	87.3	3.3	8.0
262569						10.0												5.2	6.6	78.8		9.8
263410	12.7	89.8	55.1	10.4	9.2	9.6	63.5	51.5	3.4	3.35	3.8	3.7	89.5	90.5	4.85	2.5	51.6	5.7	6.2	91.9		9.1
263412	13.3		48.9	9.8	8.6	9.9	71.0	46.5	3.5	3.5	3.8	3.7	92.1	94.6	4.85	2.8	57.7					9.2
261800	13.3	91.7	58.7	10.3	8.8	10.4	68.5	46.0							5.65	2.5	44.3	5.7	7.0	81.4		8.9
261788				10.2	9.0	9.9	66.5	53.0							4.9	2.35	48.0	5.5	6.3	87.3		9.0
261812	12.3	97.6	59.4	9.7	8.5	9.4	65.5	51.5	3.6	3.5	3.7	3.65	97.3	95.9	5.2	2.8	53.9	5.2	6.1	85.3		8.5
255143						9.5									4.4	2.6	59.1				3.5	8.6
262547	13.1	86.3	52.7	8.7	8.0	9.2	72.5	61.0	3.4	3.35	3.7	3.65	91.9	91.8	5.15	2.25	43.7	5.[illegible]	6.1	83.6		8.3
262535	12.7		56.7							3.6		3.8		94.7	5.1	2.6	51.0	5.4	6.1	88.5		8.9
255120	12.5	89.6	56.0												4.8	2.5	52.1				3.6	8.7
243175	13.0					9.8																8.9
243177						9.4									4.95	2.7	54.5					9.1
262553	12.2	95.9	60.7	10.0	8.6	9.8	66.5	49.0	3.7	3.7	3.8	3.8	97.4	97.4	5.2	2.3	44.2	5.4	5.9	91.5		8.4
261809	12.9					9.9																9.5
262556	12.8	89.8	54.7	9.4	8.2	9.4	68.0	49.0	3.8	3.9	3.8	3.9	100.0	100.0	4.95	2.4	48.5	5.7	6.5	87.7		8.9
258753	12.3	95.9	58.5	9.2	8.3	9.4	69.0	54.0	3.85	3.75	3.6	3.6	106.9	104.2	5.0	2.65	53.0	5.4	6.4	84.4		9.6
262545	12.2		57.4	9.2	8.4	9.2	67.5	59.0	3.5	3.6	3.7	3.6	94.6	100.0	5.1	2.5	49.0	5.1	6.2	82.3		8.8
263409	12.3	91.9	57.7	9.8	8.8	10.2	72.5	5.45	3.5		3.7		94.6		5.2	2.9	55.8	5.5	6.6	83.3		9.9
249921	13.2	90.2	56.4	10.2	9.0	10.5	71.0	51.0	3.45	3.45	3.9	3.85	88.5	89.6	5.4	2.5	46.3	5.8	6.9	84.1	[1] 3.6	9.4
261810	13.1	88.6	55.0	10.4	9.1	10.2	68.0	47.5	3.4	3.4	3.7	3.6	91.9	94.4	5.25	2.7	51.4	5.7	6.7	85.1		8.8

[1] Near.

UNDEFORMED ARKANSAS: FEMALES—Continued

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index total* $\left(\frac{a \times 100}{c}\right)$	*Facial Index upper* $\left(\frac{b \times 100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
							°	°														
258761	13.0	82.3	51.5	9.4	8.3	9.2	67.0	53.0	3.6	3.65	3.8	3.7	94.7	98.7	4.65	2.4	51.6	5.4	6.7	80.6	------	9.0
262580	13.2	89.4	53.8	10.3	8.9	9.8	65.5	49.0	3.4	3.55	3.8	3.7	89.5	96.0	4.85	2.85	58.8	5.8	7.2	80.6	------	8.4
363150	12.6	92.9	55.6	9.5	8.2	10.0	72.0	45.0	------	3.35	------	3.8	------	88.2	5.2	2.5	48.1	5.3	6.0	88.3	3.4	9.7
262573	14.0	------	------	------	------	10.2	------	------	------	------			------	------	------	------	------	6.0	7.2	83.3	------	9.4
261785	13.5	86.7	54.8	9.7	8.4	9.8	68.5	54.0	3.7	3.65	3.9	3.8	94.9	96.1	5.3	2.6	49.1	5.3	6.5	81.5	------	9.3
262561	12.7	------	52.8	9.4	8.4	9.2	65.5	54.0	3.35	3.35	3.6	3.5	93.1	95.7	4.7	2.15	45.7	5.2	6.5	80.0	------	8.7
262570	12.3	97.6	61.8	------	------	------	------	------	3.55	3.55	3.7	3.7	96.0	96.0	5.25	2.8	53.3	5.6	6.7	83.6	------	9.5
249923	13.3	75.2	50.4	9.4	8.5	9.9	64.0	52.0	3.5	3.5	3.75	3.8	93.3	92.1	5.15	2.55	49.5	5.35	6.8	78.7	3.15	9.4
205607	------	------	------	------	------	10.45	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	9.5
262536	13.4	------	------	------	8.8	9.8	------	------	3.65	3.7	3.8	3.7	96.1	100.0	5.2	2.55	49.0	------	------	------	------	9.0
262582	12.2	96.7	59.0	9.7	8.5	9.6	68.0	54.5	3.55	------	3.65	------	97.3	------	4.8	2.5	52.1	5.5	6.5	84.6	------	9.2
249925	12.8	------	56.6	10.0	9.0	10.15	70.0	56.0	3.4	3.45	3.65	3.55	93.2	97.2	5.2	2.6	50.0	5.6	6.55	85.5	------	9.1
262576	------	------	------	------	------	9.8	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	9.0
249920	------	------	------	------	------	9.8	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	8.9
276645	12.9	------	------	------	------	9.5	------	------	3.1	------	3.6	------	86.1	------	5.0	2.65	53.0	------	------	------	------	8.7
243152	------	------	------	------	------	9.3	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	9.0
243170	------	------	------	------	------	9.6	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	9.4
Specimens	(40)	(24)	(33)	(27)	(30)	(48)	(27)	(27)	(31)	(30)	(31)	(30)	(31)	(30)	(37)	(37)	(37)	(29)	(30)	(29)	(6)	(52)
Totals	515.2	------	------	264.1	260.5	474.1	1,848.5	1,400.5	108.95	106.2	116.7	111.6	------	------	187.6	93.95	------	158.65	195.75	------	20.55	468.7
Averages	12.9	90.65	55.63	9.8	8.7	9.9	68.5	51.9	3.5	3.5	3.8	3.7	93.36	95.16	5.1	2.5	50.08	5.5	6.5	81.05	3.4	9.0
Minima	12.0	75.2	48.9	8.7	8.0	9.2	63.5	45.0	3.1	3.25	3.5	3.5	86.1	88.2	4.4	2.15	43.1	5.1	5.9	78.7	3.15	8.0
Maxima	14.0	99.2	61.8	10.4	9.6	10.6	72.5	61.0	3.85	3.95	4.1	4.0	106.9	104.2	5.65	2.9	59.1	6.0	7.2	91.9	3.6	10.0

DEFORMED ARKANSAS: FEMALES

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)[1]	Alveol. Pt.-Nasion height (b)
243151	U.S.N.M.	Drew County	55–60	Pronounced occipital.	(16.6)	(14.2)	(14.8)	*(85.5)*	*(96.1)*	*(104.2)*	15.20	1,395			
243155	do	do	55	Moderate lateral occipital flattening.	(16.8)	(14.6)		*(86.9)*							7.5
243158	do	do	35	do	(15.7)	(13.7)	(14.2)	*(87.3)*	*(96.6)*	*(103.6)*	14.53				7.0
243169	do	Pecan Point, Mississippi County.	35–40	Slight frontal moderate occipital flattening.	(16.2)	(16.2)	(12.8)	*(100.0)*	*(79.0)*	*(79.0)*	15.07				7.2
243174	do	do	40	Moderate frontal occipital flattening.	(14.8)	(14.9)	(14.0)	*(100.7)*	*(94.3)*	*(94.0)*	14.57	1,250			6.8
255121	do	Boyts Field, Union County.	50	Considerable occipital flattening.	(15.7)	(15.2)	(13.7)	*(96.8)*	*(88.7)*	*(90.1)*	14.87	1,310			6.9
255122	do	do	45	Moderate fronto-occipital flattening.	(16.3)	(15.0)		*(92.0)*							
255125	do	do	50	Slight occipital flattening.	(17.3)	(14.2)	(13.8)	*(82.1)*	*(87.6)*	*(97.2)*	15.10	1,315		11.8	7.2
255129	do	do	50	Moderate occipital flattening.	(16.6)	[2](14.3)	[2] (14.5)	*(86.1)*	*(93.9)*	*(101.4)*	15.13			11.9	7.3
255130	do	do	35	Slight frontal moderate occipital flattening.	(15.8)	(14.6)	(13.6)	*(92.4)*	*(89.5)*	*(93.2)*	14.67			11.1	6.5
255144	do	do	50	Slight frontal, pronounced occipital flattening.	(15.4)	(15.3)	(13.6)	*(99.4)*	*(88.6)*	*(88.9)*	14.77				
255146	do	do	45	Slight fronto-occipital flattening.	(16.1)	(14.6)		*(90.7)*							
255147	do	do	45	do	(16.9)	(14.7)	(12.7)	*(87.0)*	*(80.4)*	*(86.4)*	14.77				
255151	do	do	50	Slight occipital flattening.	(16.6)	(14.7)		*(88.6)*				1,280			
249916	do	Near Menard's Mound, Arkansas County.	30–35	Medium "flathead"	(15.1)	(15.3)	(14.0)	*(101.3)*	*(92.1)*	*(91.5)*	14.80	1,290		13.2	8.05

[1] Menton-Nasion height reconstructed where teeth worn.
[2] Near.

DEFORMED ARKANSAS: FEMALES—Continued

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
249918	U.S.N.M.	Near Greer, Jefferson County.	35	"Flathead" great post flattening.	(15.2)	(15.5)	[2] (14.0)	*(102.0)*	*(91.2)*	*(90.3)*	[2] 14.90	1,170		11.6	7.1
249922	do	do	45	Lateral occipital flattening.	(16.4)	(14.1)	(14.7)	*(86.0)*	*(96.4)*	*(104.3)*	15.07	1,305		12.0	7.35
249924	do	do	40	Moderate irregular "flathead."	(16.4)	(15.1)	(13.2)	*(92.1)*	*(83.8)*	*(87.4)*	14.90	1,240		12.0	7.65
258756	do	Cross County	35	Moderate fronto-occipital.	(16.9)	(14.0)	(13.8)	*(82.8)*	*(89.3)*	*(98.6)*	14.90	1,270			7.7
258758	do	do	55	do	(16.0)	(14.1)	(14.3)	*(88.1)*	*(95.0)*	*(101.4)*	14.80	1,270			7.6
258763	do	do	70	Pronounced fronto-occipital.	(16.3)	(14.6)	(13.5)	*(89.6)*	*(87.4)*	*(92.5)*	14.80	1,235			
259296	do	Woodruff County	55	Medium occipital	(16.3)	(14.7)	(13.8)	*(90.2)*	*(89.0)*	*(93.9)*	14.93	1,385		11.9	7.0
259297	do	do	60	Moderate frontal-occipital.	(17.6)	(13.9)	(13.3)	*(79.0)*	*(84.4)*	*(95.7)*	14.93	1,220			7.3
262544	do	Mississippi County	30	Slight occipital	(16.7)	(14.3)	(14.2)	*(85.6)*	*(91.6)*	*(99.3)*	15.07	1,365		11.9	7.2
262552	do	do	45	Medium frontal	(16.6)	(14.7)	(13.8)	*(88.6)*	*(88.2)*	*(93.9)*	15.03	1,350		11.6	7.0
262571	do	do	30	Slight fronto-occipital.	(15.8)	(14.9)	(14.6)	*(94.3)*	*(95.1)*	*(98.0)*	15.10			12.4	7.6
259294	do	Prairie County	60	Slight frontal, pronounced occipital.	(16.5)	(15.0)	(14.1)	*(90.9)*	*(89.5)*	*(94.0)*	15.20				
261792	do	Poinsett County	40	Moderate frontal	(15.9)	(13.7)	(12.9)	*(86.2)*	*(87.2)*	*(94.2)*	14.17	[2] 1,240			6.5
261805	do	do	30	Medium fronto-occipital.	(16.3)	(14.6)	(13.2)	*(89.6)*	*(85.4)*	*(90.4)*	14.70	1,260		11.8	7.1
261806	do	do	35	Moderate frontal	(16.6)	(14.2)		*(85.5)*						11.6	7.1
261816	do	do	30	Medium frontal	(16.1)	(14.0)	(13.8)	*(87.0)*	*(91.7)*	*(98.6)*	14.63	[2] 1,250			
261828	do	Cross County	22	do	(16.6)	(14.2)	(13.4)	*(85.5)*	*(87.0)*	*(94.4)*	14.73	1,300		11.3	7.0
262532	do	Mississippi County	45	Medium frontal pronounced occipital.	(15.3)	(15.4)	(13.8)	*(100.7)*	*(89.9)*	*(89.6)*	14.83	1,285		12.1	7.2
262533	do	do	40	Moderate fronto-occipital.	(16.4)	(15.0)	(13.8)	*(91.5)*	*(87.9)*	*(92.0)*	15.07	1,350			
262534	do	do	65	Slight fronto-occipital.	(16.3)	(14.7)	(14.0)	*(90.2)*	*(90.3)*	*(95.2)*	15.00	1,345		12.0	7.4
262555	do	do	50	do	(16.0)	(14.6)	(13.6)	*(91.3)*	*(88.9)*	*(93.2)*	14.73	1,255		12.1	7.2

262559	U.S.N.M.	Mississippi County.	60	Slight frontal medium occipital	(16.6)	(14.6)	(14.3)	*(88.0)*	*(91.7)*	*(98.0)*	15.17	1,340		11.8	7.1
262562	do	do	50	Pronounced fronto-occipital.	(15.8)	(16.0)	(13.5)	*(101.3)*	*(84.9)*	*(84.4)*	15.10	1,360		11.8	7.0
262564	do	do	40	Medium fronto-occipital.	(15.1)	(13.9)	(13.8)	*(92.1)*	*(95.2)*	*(99.3)*	14.27	1,190		11.1	6.9
262565	do	do	40	Slight frontal medium occipital.	(15.7)	(15.3)	(14.4)	*(97.5)*	*(92.9)*	*(94.1)*	15.13	1,380		11.7	6.9
262572	do	do	35	Slight fronto-occipital.	(15.8)	(14.6)	(13.4)	*(92.4)*	*(88.2)*	*(91.8)*	14.60	1,330		11.6	7.4
262577	do	do	25	Slight occipital	(15.8)	(14.5)	High	*(91.8)*				1,180		12.0	7.4
262578	do	do	30	Medium frontal slight occipital.	(15.7)	(14.6)	(13.4)	*(93.0)*	*(88.5)*	*(91.8)*	14.57	1,260			6.9
262579	do	do	50	Medium fronto-occipital.	(15.6)	(15.0)	(12.9)	*(96.2)*	*(84.3)*	*(86.0)*	14.50	1,215		11.2	6.7
272545	do	Foster Place, Lafayette County.	40	Pronounced fronto-occipital.	(17.4)	(15.1)	(13.3)	*(86.8)*	*(81.9)*	*(88.1)*	15.27	1,270		12.3	7.5
272548	do	Miller County	45	Slight frontal medium occipital.	(16.4)	(15.4)	(13.8)	*(93.9)*	*(86.8)*	*(89.6)*	15.20				6.9
263408	do	Crittenden County	40	Slight fronto-occipital.	(16.0)	(13.9)	(13.5)	*(86.9)*	*(90.3)*	*(97.1)*	14.50	1,230		12.2	7.4
263413	do	do	26	Medium occipital	(15.3)	(14.6)	(13.3)	*(95.4)*	*(89.0)*	*(91.1)*	14.40	1,180		10.9	6.6
263414	do	do	25	Moderate frontal slight occipital.	(15.6)	(13.4)	(13.2)	*(85.9)*	*(91.0)*	*(98.5)*	14.07	1,095		11.0	6.9
263418	do	do	30	do	(16.2)	(13.5)	(13.4)	*(83.3)*	*(93.4)*	*(99.3)*	14.37	1,240		11.8	7.3
263419	do	do	30	Medium frontal pronounced occipital.	(14.6)	(14.8)	(13.9)	*(101.4)*	*(94.6)*	*(93.9)*	14.43	1,185		11.3	6.9
Specimens					(51)	(51)	(45)	*(51)*	*(45)*	*(45)*	(45)	(38)		(30)	(41)
Totals					821.7	746.0	617.6				666.55	48,390		353.0	293.25
Averages					16.1	14.6	13.7	*90.79*	*89.38*	*93.80*	14.81	1,273.4		11.8	7.2
Minima					14.6	13.4	12.7	*82.1*	*79.0*	*79.0*	14.07	1,095		10.9	6.5
Maxima					17.6	16.2	14.8	*102.0*	*96.6*	*104.3*	15.27	1,395		13.2	8.05

[1] Near.

DEFORMED ARKANSAS: FEMALES—Continued

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a \times 100}{c}\right)$	*Facial Index, upper* $\left(\frac{b \times 100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth, maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
							°	°														
243151	13.3				9.1	10.3			3.4	3.5	4.1	4.0	82.9	87.5	4.95	2.6	52.5					9.5
243155															5.2	2.55	49.0	5.6	6.3	88.9		8.1
243158	13.7		51.1	9.4	8.3	9.8	72.0	53.5	3.65	3.6	3.9	3.85	93.6	93.5	5.0	2.45	49.0	5.5	6.55	84.0		9.4
243169	[2] 13.2		54.6	10.0	8.6	9.7	66.0	47.5	3.55	3.55	3.75	3.7	94.7	96.0	5.0	2.7	54.0	5.7	5.95	95.8		9.5
243174	[2] 13.4		50.8	9.4	8.3	9.5	69.5	54.5	3.4	3.35	3.65	3.7	93.2	90.5	4.7	2.7	57.5	5.1	6.75	75.6		9.2
255121	(14.2)		(48.6)	10.2	9.2	10.3	71.0	55.0	3.45	3.5	3.9	3.9	88.5	89.7	4.9	2.6	53.1	5.3	6.5	81.5		9.3
255122																						9.3
255125	13.9	84.9	51.8	9.9	8.8	10.1	70.0	55.0	3.5	3.5	4.2	4.1	83.3	85.4	4.9	2.6	53.1	5.8	6.3	92.1	3.6	9.3
255129									3.40	3.25	3.90	3.90	87.2	83.3	4.9	2.7	55.1	6.0	6.7	89.6		9.1
255130						9.9									4.7	2.5	53.2	5.3	6.2	85.5	3.1	9.0
255144	13.2																				3.6	9.3
255146																2.2					3.5	10.0
255147						9.7															3.5	9.1
255151										3.35		3.65		91.8								9.4
249916	12.7	103.9	63.4	10.4	9.0	10.0	64.0	54.0	3.6	3.7	3.85	3.6	93.5	102.8	5.2	2.45	47.1	6.2	7.1	87.3		9.85
249918	13.7	84.7	51.8						3.25	3.35	3.75	3.8	86.7	88.2	4.9	2.5	51.0	5.6	6.9	81.2	3.25	8.8
249922	13.2	90.9	55.7	10.2	9.15	10.6	72.0	58.0	3.5	3.45	4.05	4.0	86.4	86.3	5.05	2.3	45.5	5.75	6.6	87.1	3.5	9.4
249924	13.1	91.6	58.4	10.6	9.3	10.2	66.0	51.0	3.45	3.50	3.65	3.8	94.5	92.1	5.3	2.4	45.3	5.8	6.65	87.2	3.5	9.2
258756	13.1		58.8	10.2	8.6	9.8	64.5	46.0	3.65	3.7	3.9	3.8	93.6	97.4	5.3	2.55	48.1	5.8	6.5	89.2		9.4
258758	12.7		59.8	10.0	8.8	10.4	70.0	55.0	3.4	3.4	3.75	3.8	90.7	89.5	5.35	2.4	44.9	5.4	6.7	80.6		9.1
258763	14.1				8.3	9.5				3.3		3.8		86.8	5.05	2.5	49.5					8.9
259296	13.7	86.9	51.1	9.8	8.8	10.0	70.0	57.0	3.2		3.6		88.9		4.75	2.4	50.5	5.4	6.8	79.4		9.2
259297	13.6		53.7	10.1	8.9	10.2	69.0	49.0	3.7	3.75	3.9	3.9	94.9	96.2	5.3	2.6	49.1	5.4	6.3	85.7		9.3
262544	13.3	89.5	54.1	10.6	9.1	10.2	67.0	45.5	3.5	3.5	3.8	3.7	92.1	94.6	5.0	2.8	56.0	5.6	6.6	84.9		9.2
262552	13.2	87.9	53.0	9.8	8.5	9.6	67.0	49.0	3.8	3.85	3.9	3.9	97.4	98.7	5.0	2.6	52.0	5.6	6.5	86.2		10.0
262571	14.0	88.6	54.3			10.0			3.5		3.9		89.7		5.4	2.7	50.0	5.6	6.5	86.2		9.9
259294						10.1												5.3	6.3	84.1		9.6
261792	12.1		53.7			9.4			3.55		3.5		101.4									9.3
261805	13.2	89.4	53.8	9.8	8.4	9.8	69.5	44.0	3.75	3.65	3.7	3.7	101.4	98.7	5.2	2.6	50.0	5.3	6.4	82.8		9.6
261806									3.5	3.4	3.6	3.6	97.2	94.4	4.9	2.4	49.0	5.6	6.3	88.9		9.1
261816	13.6					9.5												5.6	6.6	84.9		8.9
261828	12.7	89.0	55.1	9.6	8.7	9.8	70.0	57.5	3.7	3.75	3.75	3.7	98.7	101.4	5.1	2.4	47.1					9.3

262532	13.1	92.4	55.0	10.3	8.6	9.6	64.0	43.5	3.15	3.25	3.65	3.5	86.3	92.9	4.9	2.35	48.0	5.9	6.7	88.1	------	9.3
262533	------	------	------	------	------	10.1	------	------	------	------	------	------	------	------	------	------	------	5.4	6.8	79.4	------	9.3
262534	13.2	90.9	56.1	10.3	9.0	10.0	66.5	53.0	3.6	3.6	3.9	3.9	92.3	92.3	5.0	2.3	46.0	------	------	------	------	9.0
262555	13.9	87.1	51.8	9.8	8.8	10.0	70.5	59.0	3.55	3.55	3.8	3.7	93.4	96.0	4.95	2.4	48.5	5.5	6.6	83.3	------	9.2
262559	12.9	91.5	55.0	9.7	8.8	10.1	72.0	59.0	------	3.3	------	3.7	------	89.2	5.15	2.8	54.4	5.6	6.4	87.5	------	8.9
262562	13.5	87.4	51.9	9.3	8.4	9.6	70.0	57.5	3.4	3.4	3.6	3.55	94.4	95.8	5.1	2.2	43.1	5.3	6.2	85.5	------	8.8
262564	13.1	84.7	52.7	9.8	8.8	10.4	75.0	54.5	3.8	3.65	3.8	3.75	100.0	97.3	5.1	2.1	41.2	5.3	6.5	81.5	------	8.4
262565	13.4	87.3	51.5	9.7	8.8	10.2	73.0	59.0	3.5	------	3.9	------	89.7	------	4.75	2.5	52.6	5.3	6.4	82.8	------	9.2
262572	13.2	87.9	56.1	9.5	8.4	9.6	67.5	55.5	3.75	3.7	4.0	4.0	93.8	92.5	5.2	2.35	45.2	5.6	6.9	81.2	------	9.0
262577	13.3	90.2	55.6	------	------	------	------	------	3.4	3.5	3.8	3.7	89.5	94.6	5.4	2.65	49.1	5.6	6.4	87.5	------	9.5
262578	12.7	------	54.3	10.6	9.0	9.8	64.0	42.0	3.35	3.35	3.6	3.6	93.1	93.1	4.8	2.5	52.1	6.1	6.8	89.7	------	9.1
262579	13.5	83.0	49.6	10.5	9.0	9.8	65.0	41.5	3.2	3.25	3.75	3.6	85.3	90.3	4.75	2.65	55.8	5.7	6.7	85.1	------	8.6
272545	13.5	91.1	55.6	10.6	9.2	10.5	63.5	51.0	3.7	3.75	4.1	4.1	90.2	91.5	5.0	2.4	48.0	6.0	7.0	85.7	------	9.9
272548	13.4	------	51.5	------	------	------	------	------	------	------	------	------	------	------	4.9	2.6	53.1	------	------	------	------	9.5
263408	12.7	96.1	58.3	9.4	7.9	9.4	67 0	49.5	3.4	3.6	3.7	3.7	91.9	97.3	4.95	2.5	50.5	5.5	6.2	88.7	------	9.3
263413	13.1	83.2	50.4	10.5	9.2	9.6	64.5	41.0	3.35	3.35	3.65	3.55	91.8	94.4	4.5	2.6	57.8	5.5	6.5	84.6	------	9.0
263414	12.8	85.9	53.9	9.9	8.8	9.8	68.5	48.0	3.55	3.6	3.9	3.9	91.0	92.3	5.2	2.75	52.9	5.4	6.5	83.1	------	9.0
263418	12.7	92.9	57 5	10.0	9.0	10.2	70.0	54.0	3.4	3.6	3.8	3.7	89.5	97.3	5.5	2.55	46.4	5.5	6.5	84.6	------	8.7
263419	12.6	89.7	54.8	------	8.4	9.4	------	------	3.45	3.35	3.65	3.65	94.5	91.8	5.1	2.1	41.2	------	------	------	------	8.8
Specimens	(40)	(27)	(36)	(31)	(34)	(41)	(31)	(31)	(38)	(37)	(38)	(37)	(38)	(37)	(42)	(43)	(42)	(39)	(39)	(39)	(8)	(51)
Totals	529.3	------	------	309.9	297.95	406.5	2,118.5	1,599.5	132.95	129.7	144.6	139.5	------	------	211.3	107.5	------	277.45	255.1	------	27.55	470.05
Averages	13.2	89.14	54.29	10.0	8.8	9.9	68.34	51.60	3.5	3.5	3.8	3.8	91.94	92.97	5.0	2.5	49.8	5.6	6.5	85.24	3.4	9.2
Minima	12.1	83.0	49.6	9.3	7.9	9.4	63.5	41.0	3.15	3.25	3.5	3.5	82.9	83.3	4.5	2.1	41.2	5.1	5.95	75.6	3.1	8.1
Maxima	14.1	103.9	63.4	10.6	9.3	10.6	75.0	59.0	3.8	3.85	4.2	4.1	101.4	101.4	5.5	2.8	57.8	6.2	7.1	95.8	3.6	10.0

[2] Near.

UNDEFORMED LOUISIANA: MALES

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
334213	U. S. N. M.	Coppell Place, Pecan Island.	65		19.6	13.7		*69.9*							
334201	do	do	60		18.2	13.0	14.4	*71.4*	*92.3*	*110.8*	15.20	[1] 1,370			6.9
334211	do	do	70		18.5	13.5		*73.0*							
334217	do	do	60		19.0	14.0		*73.7*				[2] (1,600)			
334203	do	do	60		19.1	14.1		*73.8*				[1] 1,490			
334214	do	do	65		18.7	13.8		*73.8*							
334206	do	do	70		18.1	13.5		*74.6*				[1] 1,400		12.8	7.8
334218	do	do	65		18.5	13.8		*74.6*							
334241	do	do	55		19.0	14.2	14.7	*74.7*	*88.6*	*103.5*	15.97				
334220	do	do	65		19.0	14.3	14.9	*75.3*	*89.5*	*104.2*	16.07				
334226	do	do	60		18.7	14.4		*77.0*							
334210	do	do	75		18.0	13.9	14.5	*77.2*	*90.9*	*104.3*	15.47	1,370			
334209	do	do	50		18.6	14.4		*77.4*							
334204	do	do	50		17.8	13.8		*77.5*						11.7	
255154	do	Franklin County	55		18.3	14.2	15.3	*77.6*	*94.2*	*107.8*	15.93	1,560			
272887	do	Avoyelles Parish	Adult		18.7	14.6		*78.1*				[1] 1,580			7.2
334219	do	Coppell Place, Pecan Island.	65		19.4	15.2		*78.4*							
272888	do	Avoyelles Parish	Adult		19.1	15.0	15.0	*78.5*	*88.0*	*100.0*	16.37	1,640			
255114	do	Ouachita County	55	Moderate lateral occipital flattening.	18.2	14.3	14.4	*78.6*	*88.6*	*100.7*	15.63	1,545		12.8	7.9
334208	do	Coppell Place, Pecan Island.	55		19.2	15.1		*78.7*				(1,750)			7.2
277723	do	Iberville Parish	35	Slight fronto-occipital flattening.	18.3	14.5	15.3	*79.2*	*93.3*	*105.5*	16.03	1,630			7.5
334205	do	Coppell Place, Pecan Island.	70		17.8	14.1		*79.2*							
334202	do	do	75		18.4	14.6	14.3	*79.4*	*86.7*	*98.0*	15.77	1,510			
334212	do	do	65		18.5	14.8		*80.0*							
255211	do	Morehouse County	55		18.1	14.5	14.5	*80.1*	*89.0*	*100.0*	15.70	1,470		12.7	8.0
334222	do	Coppell Place, Pecan Island.	70		18.3	14.7	14.8	*80.3*	*89.7*	*100.7*	15.93	(1,630)			
334223	do	do	45	Slight frontal	18.3	14.7		*80.3*							

277731	do	Iberville Parish	55	Slight frontal and moderate occipital flattening.	19.1	15.4	14.3	*80.6*	*82.9*	*92.9*	16.27	1,600		14.2	8.5
255203	do	Morehouse County	60		17.6	14.3	14.8	*81.2*	*92.8*	*103.5*	15.57				
277724	do	Iberville Parish	55	Slight fronto-occipital flattening.	17.7	14.4	14.9	*81.4*	*92.8*	*103.5*	15.67	1,490		13.2	7.9
341222	do	Monroe	35		17.6	14.4	15.0	*81.8*	*93.8*	*104.2*	15.67	1,630			
255107	do	Ouachita County	35	Very slight occipital flattening.	18.2	15.1		*83.0*							7.4
277728	do	Iberville Parish	50	Slight fronto-occipital flattening.	18.3	15.2	14.0	*83.1*	*83.6*	*92.1*	15.83	1,430		13.3	8.1
341223	do	Monroe	60		17.0	14.2	13.8	*83.5*	*88.5*	*97.2*	15.00				
Specimens					(34)	(34)	(17)	*(34)*	*(17)*	*(17)*	(17)	(15)		(7)	(11)
Totals					26.9	487.7	248.9				268.08	22,715		90.7	84.4
Averages					618.4	14.3	14.6	*77.80*	*89.65*	*101.65*	15.8	1,514.3		12.96	7.7
Minima					17.0	13.0	13.8	*69.9*	*82.9*	*92.1*	15.0	1,300		11.7	6.9
Maxima					19.6	15.4	15.3	*83.5*	*94.2*	*110.8*	16.37	1,640		14.2	8.5

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a \times 100}{c}\right)$	*Facial Index, upper* $\left(\frac{b \times 100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
							°	°														
334213																						
334201	14.3		*48.3*	11.4	10.0	10.8	67.0	40.5	3.2	3.25	4.1	3.9	*78.1*	*83.3*	5.2	2.8	*53.9*	6.0	7.2	*83.3*		9.9
334211																						9.8
334217																					4.0	9.7
334203	13.9									3.4		4.1		*82.9*								10.2
334214																						9.0
334206	14.3	*89.5*	*54.6*							3.35		4.0		*83.8*							3.7	9.4
334218																						8.8
334241																						9.8
334220																		6.3	7.3	*86.3*		10.5
334226																					3.7	9.8
334210										3.4		4.0		*85.0*	5.9	2.8	*47.5*					9.8
334209																					3.7	9.6
331204	14.1	*83.0*							3.0	3.05	3.6	3.6	*83.3*	*84.7*	5.0	2.2	*44.0*				3.8	10.1

[1] Near.

[2] Capacities in parentheses are but close approximations.

UNDEFORMED LOUISIANA: MALES—Continued

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index total* $\left(\frac{a\times100}{c}\right)$	*Facial Index upper* $\left(\frac{b\times100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
							°	°														
255154						11.0										2.6		5.7	[1] 6.7	*85.1*	3.7	
272887	14.6		*49.6*						3.95	3.85	4.2	4.2	*94.0*	*91.7*	5.35	2.5	*46.7*	5.4	[1] 6.9	*78.3*		
334219	15.7																				3.4	10.3
272888						11.1												[1] 5.9				
255114	14.3	*89.5*	*55.2*	11.0	9.8	11.1	70.0	56.0	3.7	3.6	4.05	4.1	*91.4*	*87.8*	5.4	2.6	*48.2*	5.8	6.6	*87.9*	4.0	
334208	14.4		*50.0*												5.5	2.7	*49.1*	5.8	7.1	*81.7*		9.6
277723	14.6		*51.4*	10.7	9.7	11.1	73.0	57.5	3.7	3.5	4.0	3.9	*92.5*	*89.7*	5.4	2.55	*47.2*	5.6	6.9	*81.2*		
334205																						9.6
334202	14.2				8.8	10.6			3.6	3.65	4.1	3.9	*85.7*	*89.0*	5.4	2.5	*46.3*					9.9
334212																						
255211	14.6	*87.0*	*54.8*	10.8	9.7	10.8	68.5	57.5	3.4	3.5	4.4	4.2	*77.3*	*83.3*	5.5	2.75	*50.0*	6.1	6.8	*89.7*	[1] 3.8	
334222	14.6																				3.5	10.1
334223																					3.6	10.9
277731	15.3	*92.8*	*55.6*	11.4	9.9	11.0	65.5	51.0	3.7	3.8	4.35	4.2	*85.1*	*90.5*	5.85	3.0	*51.3*	6.3	7.4	*85.1*	4.4	
255203						10.4									5.1	2.5	*49.0*				3.4	
277724	14.7	*89.8*	*53.7*	10.2	8.8	10.4	69.0	54.0	3.7	3.8	4.2	3.9	*88.1*	*97.4*	5.15	2.7	*52.4*	5.8	6.8	*85.3*	4.3	
341222	14.4					10.9			3.65	3.75	4.3	4.2	*84.9*	*89.3*							4.1	10.3
255107															5.2	2.35	*45.2*	5.7	6.4	*89.1*		
277728	15.4	*86.4*	*52.6*	11.3	10.0	11.1	68.0	52.0	3.6	3.7	4.2	4.1	*85.7*	*90.2*	5.8	3.3	*56.9*	6.6	7.2	*91.7*	4.2	
341223	14.5				8.7	10.0			3.55	3.55	3.8	3.8	*93.4*	*93.4*	5.2	2.6	*50.0*					10.2
Specimens	(17)	*(7)*	*(10)*	(7)	(9)	(13)	(7)	(7)	(12)	(15)	(12)	(15)	*(12)*	*(15)*	(15)	(16)	*(15)*	(13)	(12)	*(12)*	(16)	(21)
Totals	247.9			76.8	85.4	140.3	481.0	368.5	42.75	53.15	49.3	60.1			80.95	42.45		77.0	83.3		61.3	207.3
Averages	14.6	*88.32*	*52.56*	10.97	9.5	10.8	68.7	52.6	3.6	3.5	4.1	4.0	*86.71*	*88.44*	5.4	2.7	*49.23*	5.9	6.9	*85.35*	3.8	9.9
Minima	13.9	*83.0*	*48.3*	10.2	8.7	10.0	65.5	40.5	3.0	3.05	3.6	3.6	*77.3*	*82.9*	5.0	2.2	*44.0*	5.4	6.4	*78.3*	3.4	8.8
Maxima	15.7	*92.8*	*55.6*	11.4	10.0	11.1	73.0	57.5	3.95	3.8	4.4	4.2	*94.0*	*97.4*	5.9	3.0	*56.9*	6.6	7.4	*91.7*	4.4	10.9

[1] Near.

DEFORMED LOUISIANA: MALES

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
334251	U.S.N.M.	Pecan Island	Adult	Pronounced fronto-occipital flattening.	(18.6)	(14.2)	[1](14.3)	(76.3)	(87.2)	(100.7)	15.70	1,540	Moderate	13.3	8.4
277730	do	Iberville Parish	50	do	(18.0)	(14.0)	(13.9)	(77.8)	(86.9)	(99.3)	15.30	1,430	Slight	12.7	7.8
277729	do	do	45	Moderate fronto-occipital flattening.	(19.2)	(15.0)	(15.2)	(78.1)	(88.9)	(101.3)	16.47	1,740	do	13.5	8.0
255102	do	Ouachita Parish	40	Moderate occipital flattening.	(17.2)	(14.0)		(81.4)							
243803	do	Opposite Vicksburg	Senile	Pronounced occipital flattening.	(17.4)	(14.4)		(82.8)							
272889	do	Aroyelles Parish	Adult	Moderate frontal flattening.	(17.8)	(14.8)	(14.2)	(83.2)	(87.1)	(96.0)	15.60	[1] 1,540	Medium	12.5	7.7
277726	do	Iberville Parish	50	Moderate fronto-occipital flattening.	(18.1)	(15.1)	(15.8)	(83.4)	(95.2)	(104.6)	16.33	1,765	Slight	13.6	8.3
272886	do	Aroyelles Parish	Adult	do	(18.2)	(15.3)	(15.0)	(84.1)	(89.6)	(98.0)	16.17	1,570			[1] 7.0
255215	do	Morehouse Parish	50	Lateral fronto-occipital flattening.	(17.7)	(15.1)	(14.2)	(85.3)	(86.6)	(94.0)	15.67	1,400		12.0	7.4
255217	do	do	60	Moderate occipital flattening.	(17.1)	(14.6)	(14.8)	(85.4)	(93.4)	(101.4)	15.50	1,440			
243798	do	Opposite Vicksburg	Senile	Considerable occipital flattening.	(16.8)	(14.4)	(14.5)	(85.7)	(93.0)	(100.7)	15.23				
255201	do	Morehouse Parish	55	Moderate occipital flattening.	(17.7)	(15.2)	(14.5)	(85.9)	(88.1)	(95.4)	15.80	1,570	Moderate	11.9	7.0
277732	do	Iberville Parish	60	Moderate fronto-occipital flattening.	(17.5)	(15.2)	(15.4)	(86.9)	(94.2)	(101.3)	16.03	1,585	do	11.8	[1] 7.2
255115	do	Ouachita Parish	60	Moderate occipital flattening.	(16.9)	(14.7)	(14.3)	(87.0)	(90.5)	(97.3)	15.30				7.9
255204	do	Morehouse Parish	50	do	(17.3)	(15.1)	(15.0)	(87.3)	(92.6)	(99.3)	15.80	1,580	Medium	13.4	8.0
227301	do	Rayville	50–55	Pronounced occipital flattening.	(16.7)	(14.6)		(87.4)							7.5
243801	do	Opposite Vicksburg	Near senile	do	(16.9)	(15.0)	(14.9)	(88.8)	(93.4)	(99.3)	15.60				
255210	do	Morehouse Parish	50	Moderate fronto-occipital flattening.	(16.5)	(14.7)		(89.1)				[1] 1,420		12.1	7.4
255104	do	Ouachita Parish	50	Moderate occipital flattening.	(16.5)	(14.8)	(14.1)	(89.7)	(90.1)	(95.3)	15.13		Moderate	11.5	7.1
255202	do	Morehouse Parish	40	do	(16.5)	(15.0)	(14.0)	(90.9)	(88.9)	(93.3)	15.17	1,480	Slight	11.0	6.6
255209	do	do	55	do	(16.8)	(15.5)		(92.3)							

[1] Near.

DEFORMED LOUISIANA: MALES—Continued

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
255218	U.S.N.M.	Morehouse Parish	45	Medium occipital flattening.	(16.3)	(15.1)	------	*(92.6)*	------	------	------	[1] 1,350	------	------	7.5
255106	do	Ouachita Parish	50	Considerable occipital flattening.	(16.0)	(15.5)	(14.6)	*(96.9)*	*(92.7)*	*(94.2)*	15.37	1,420	------	------	------
Specimens					(23)	(23)	(17)	*(23)*	*(17)*	*(17)*	(17)	(15)	------	(12)	(16)
Totals					397.7	341.3	248.7	------	------	------	266.17	22,830	------	149.3	120.8
Averages					17.3	14.8	14.6	*85.82*	*90.47*	*98.30*	15.66	1,522	------	12.4	7.5
Minima					16.0	14.0	13.9	*76.3*	*86.6*	*94.0*	15.13	1,350	------	11.0	6.6
Maxima					19.2	15.5	15.8	*96.9*	*95.2*	*104.6*	16.47	1,765	------	13.6	8.4

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a\times100}{c}\right)$	*Facial Index, upper* $\left(\frac{b\times100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth, maxim	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
							°	°														
334251	14.7	*90.5*	*57.1*	------	------	------	------	------	3.7	3.8	4.3	4.3	*86.0*	*88.4*	5.5	3.0	*54.5*	[1] 6.0	[1] 6.7	*89.6*	(3.8)	------
277730	13.5	*94.1*	*57.8*	11.1	10.1	10.7	66.5	58.0	3.5	3.5	3.8	3.8	*92.1*	*92.1*	5.6	2.8	*50.0*	6.2	6.8	*91.2*	3.3	------
277729	14.8	*91.2*	*54.1*	11.0	9.5	11.4	72.0	51.0	3.5	3.6	4.1	4.1	*85.4*	*87.8*	5.55	2.6	*46.8*	[1] 6.1	[1] 6.6	*92.4*	4.0	------
255102	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	[1] 2.3	------	------	------	------	------	------
243803	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
272889	------	------	------	10.6	9.3	10.4	67.0	52.5	3.5	3.5	3.9	4.0	*89.7*	*87.5*	5.3	2.3	*43.4*	[1] 5.9	------	------	3.8	------
277726	15.3	*88.9*	*54.2*	11.2	10.2	11.7	72.0	61.0	3.8	3.85	4.2	4.1	*90.5*	*93.9*	5.85	3.0	*51.3*	6.2	7.1	*87.3*	4.2	------
272886	14.75	------	------	[1] 10.3	9.4	10.7	74.0	58.0	3.25	3.25	4.0	4.1	*81.2*	*79.3*	5.1	3.05	*59.8*	[1] 5.4	------	------	------	------
255215	14.4	*83.3*	*51.4*	10.6	9.0	10.4	68.0	48.0	3.4	3.4	3.9	3.8	*87.2*	*89.5*	4.9	2.6	*53.1*	6.0	[1] 6.5	*92.3*	3.4	------
255217	[1] 14.7	------	------	------	8.7	10.5	------	------	3.75	3.7	4.2	4.0	*89.3*	*92.5*	5.45	2.75	*50.4*	------	------	------	------	------

243798																					
255201	14.6	81.5	47.9	10.0	9.0	10.4	73.0	57.0							4.95	2.7	54.5	5.4	6.6	81.8	3.8	
277732	[1]15.3	77.1	47.4	[1]10.8	9.8	10.9	71.0	51.0	3.7	3.6	4.1	[1]4.0	90.2	90.0	5.55	2.6	46.8	[1]5.6	6.5	86.2	[1]3.5	
255115	[1]14.5		54.5	10.2	9.1	10.5	70.0	58.5	3.85	3.85	4.15	4.05	92.8	95.1	5.2	2.5	48.1	5.7	6.8	83.8		
255204				10.5	9.1	10.5	68.0	52.5							5.4	2.65	49.1	6.0	7.3	82.2	4.4	
227301															5.5	2.5	45.4	5.6	6.9	81.2		
243801						10.6																
255210	13.4	90.3	55.2						3.65	3.75	4.0	3.9	91.2	96.2	5.05	2.4	47.5	5.5	6.5	84.6	3.8	
255104	13.7	83.9	51.8	10.1	9.3	10.6	74.0	61.5	3.6	3.6	3.6	3.6	100.0	100.0	5.1	2.7	52.9	5.5	[1]6.2	88.7	3.7	
255202	13.6	80.9	48.5	9.5	8.3	9.5	69.5	49.5	3.3	3.4	3.8	3.7	86.8	91.9	4.75	2.35	49.5	5.6	6.6	84.8	3.35	
255209																					3.6	
255218	14.6		51.4						3.6	3.55	4.0	4.1	90.0	86.6	5.3	3.0	56.6					
255106	[1]14.1					10.2			[1]3.5		3.9		89.7								[1]3.5	
Specimens	(15)	(10)	(12)	(12)	(13)	(15)	(12)	(12)	(15)	(14)	(15)	(14)	(15)	(14)	(17)	(18)	(17)	(15)	(13)	(13)	(13)	
Totals	215.95			125.4	120.8	159.0	845.0	658.5	53.6	50.35	59.95	55.55			90.05	47.80		86.7	87.1		48.35	
Averages	14.4	86.11	52.55	10.5	9.3	10.6	70.4	54.9	3.6	3.6	4.0	4.3	89.41	90.64	5.3	2.7	50.53	5.8	6.7	86.57	3.7	
Minima	13.4	77.1	47.4	9.5	8.3	9.5	66.5	48.0	3.25	3.25	3.6	3.6	81.2	79.3	4.75	2.3	43.4	5.4	6.2	81.2	3.3	
Maxima	15.3	94.1	57.8	11.2	10.2	11.7	74.0	61.5	3.85	3.85	4.3	4.3	100.0	100.0	5.85	3.05	59.8	6.2	7.3	92.4	4.4	

[1] Near.

UNDEFORMED LOUISIANA: FEMALES

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt. - Nasion height (b)
334232	U.S.N.M.	Coppell Place, Pecan Island.	65		17.2	12.9		75.0							
213804	do	Opposite Vicksburg.	Near Senile.		17.9	13.5	12.6	75.4	80.2	93.3	14.67	1,225			
334234	do	Coppell Place, Pecan Island.	60		17.5	13.4	13.5	76.6	87.4	100.8	14.80	1,230		11.5	6.9
334250	do	Morgan Mound, Pecan Island.	50		17.6	13.5		76.7						11.4	7.1
255230	do	Avoyelles Parish	Adult		17.1	13.5	14.5	79.0	94.8	93.1	15.03	1,260			7.4
334227	do	Coppell Place, Pecan Island.	25		17.9	14.2		79.3							
334230	do	do	65		17.4	13.8		79.3							
334268	do	do	50		17.5	13.9		79.4						11.3	6.8
334252	do	do	35		17.6	14.0		79.6							
255095	do	Coldwell Parish	40		17.6	14.1	14.5	80.1	91.5	102.8	15.40	1,370		11.3	6.8
334237	do	Coppell Place, Pecan Island.	50		17.2	13.8		80.2							
334240	do	do	55		18.0	14.6		81.1							

[1] Near.

UNDEFORMED LO UISIANA: FEMALES—Continued

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
277733	U.S.N.M.	Iberville Parish	45	Slight fronto-occipital flattening.	17.2	14.0	13.0	*81.4*	*83.3*	*92.9*	14.73	1,300		10.9	6.3
334239	do	Coppell Place, Pecan Island.	40		17.9	14.6		*81.6*						12.2	7.8
334233	do	do	60		17.5	14.3		*81.7*							
255094	do	Coldwell Parish	60		17.6	14.4		*81.8*							
255213	do	Morehouse Parish	40		16.6	13.6	13.6	*81.9*	*90.1*	*100.0*	14.60	1,215		11.7	7.1
334238	do	Coppell Place, Pecan Island.	50		16.7	13.7		*82.0*						11.5	6.8
334231	do	do	25		17.3	14.2		*82.1*							
334235	do	do	25		16.8	13.8		*82.1*							
277725	do	Iberville Parish	50	Slight fronto-occipital flattening.	17.5	14.4	13.6	*82.3*	*85.3*	*94.4*	15.17	1,395			7.9
272890	do	Avoyelles Parish	Adult	Slight lateral occipital flattening.	16.4	13.6	13.4	*82.9*	*89.3*	*98.5*	14.47	1,210			6.9
277737	do	Iberville Parish	45	Slight fronto-occipital flattening.	17.1	14.2	14.5	*83.0*	*92.6*	*102.1*	15.27	1,390			7.2
255116	do	Ouachita Parish	25	Very slight occipital flattening.	16.6	13.8	13.6	*83.1*	*89.5*	*98.6*	14.67			12.2	7.3
334236	do	Coppell Place, Pecan Island.	20		17.8	14.8	13.9	*83.2*	*85.3*	*93.9*	15.50				
277735	do	Iberville Parish	50	Very slight fronto-occipital flattening.	17.0	14.2	13.9	*83.5*	*89.1*	*97.9*	15.03	1,380		11.7	7.1
341224	do	Monroe	26		15.7	13.3	14.0	*84.7*	*96.6*	*105.3*	14.33	1,270		11.1	6.7
255113	do	Ouachita Parish	50		16.6	14.7	14.1	*88.6*	*90.1*	*95.9*	15.13			[1] 11.2	[1] 7.2
255207	do	Morehouse Parish	45		16.2	14.5	14.3	*89.5*	*93.2*	*98.6*	15.00			[1] 11.3	[1] 6.8
334229	do	Coppell Place, Pecan Island.	50											11.7	7.1
Specimens					(29)	(29)	(15)	*(29)*	*(15)*	*(15)*	(15)	(11)		(14)	(18)
Totals					499.0	405.3	207.0				223.8	14,245		161.0	127.2
Averages					17.2	13.98	13.8	*81.22*	*89.15*	*98.76*	14.9	1,295.0		11.5	7.1
Minima					15.7	12.9	12.6	*75.0*	*80.2*	*92.9*	14.33	1,210		10.9	6.3
Maxima					18.0	14.8	14.5	*89.5*	*96.6*	*105.3*	15.50	1,395		12.2	7.9

[1] Near.

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a\times100}{c}\right)$	*Facial Index, upper* $\left(\frac{b\times100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
							°	°														
334232																					3.4	9.4
243804	13.1								3.8	3.7	4.0	4.1	95.0	90.2	5.0	2.7	54.0					
334234	14.0	82.1	49.3							3.25		3.7		87.8	5.1	2.7	52.9				3.1	9.3
334250	13.0	87.7	54.6															5.5	6.3	87.3	2.45	9.3
255230	13.25		55.8	10.2	9.0	10.2	69.0	55.0	3.2	3.2	3.9	3.8	82.0	84.2	5.1	2.5	49.0	5.6	6.55	85.5		
334227																						9.6
334230																					3.2	9.3
334268	13.2	85.6	51.5						3.4	3.45	3.9	3.8	87.2	90.8	5.1	2.6	51.0	5.5	6.5	84.6	2.95	9.5
334252																		5.5	6.4	85.9		
255095	13.4	84.3	50.8	10.2	8.9	10.7	75.5	50.5	3.6	3.5	3.9	3.8	92.3	92.1	4.85	2.3	47.4	5.4	6.0	90.0	3.5	
334237																					3.5	9.3
334240																					3.2	10.1
277733	12.9	84.5	48.8	10.0	8.8	10.0	72.0	48.0	3.25	3.25	3.8	3.8	85.5	85.5	4.5	2.7	60.0	5.3	6.0	88.3	3.4	
334239	14.3	85.3	54.6	11.2	10.0	10.8	66.5	58.0	3.4	3.45	4.1	4.1	82.9	84.2	5.1	2.75	53.9	6.1	6.4	95.3	3.5	9.9
334233	14.1																				3.6	9.0
255094	[1] 12.8																					
255213	13.0	90.0	54.6	9.7	8.5	9.7	69.0	53.0	3.35	3.4	3.65	3.55	91.8	95.8	4.9	2.3	46.9	5.4	[1] 6.1	88.5	3.7	
334238									3.4	3.4	3.9	3.9	87.2	87.2	5.0	2.45	49.0	5.6	6.2	90.3	3.3	9.2
334231																						9.3
334235																					3.2	9.0
277725	14.3		55.2	10.0	8.8	10.0	67.0	54.0	3.7	3.7	3.9	3.8	94.9	97.4	5.6	2.4	42.9	6.0	6.7	89.6		
272890				10.5	8.9	9.8	65.0	43.5	3.4	3.3	3.8	3.9	89.5	84.6	4.7	2.8	59.6	5.7	[1] 6.8	83.8		
277737	[1] 13.5		53.3	10.0	9.0	10.2	70.5	56.0	3.6	3.5	3.9	3.8	92.3	92.1	5.15	2.85	55.3	5.2	6.2	83.9		
255116						9.7									5.3			5.6	6.5	86.2	3.2	
334236																						
277735	12.9	90.7	55.0	9.4	8.6	9.7	70.5	61.5	3.7	3.8	3.8	3.8	97.4	100.0	5.0	2.6	52.0	5.3	6.6	80.3	3.4	
341224	12.9	86.1	51.9	9.3	8.2	9.4	70.5	49.0	3.4	3.3	3.6	3.6	90.8	91.7	4.7	2.2	46.8	5.1	6.5	78.5	3.3	8.8
255113						9.9									[1] 5.2						3.3	
255207						10.7									[1] 5.0	2.5	50.0	5.5	6.7	82.1	3.25	
334229	[1] 13.7	85.4	51.8						3.3	3.3	3.85	3.85	85.7	85.7	5.4	2.9	53.7	5.3	6.4	82.8	3.25	9.7
Specimens	(16)	(10)	(13)	(10)	(10)	(13)	(10)	(10)	(14)	(15)	(14)	(15)	(14)	(15)	(18)	(16)	(16)	(17)	(17)	(17)	(20)	(15)
Totals	214.35			100.5	88.7	130.8	695.5	528.5	48.5	51.5	54.0	57.3			90.7	41.25		93.6	108.85		65.7	140.7
Averages	13.4	86.12	52.88	10.05	8.87	10.06	69.6	5.29	3.5	3.4	3.9	3.8	89.81	89.88	5.0	2.58	51.43	5.5	6.4	85.99	3.3	9.4
Minima	12.8	82.1	48.8	9.3	8.2	9.4	65.0	43.5	3.2	3.2	3.6	3.55	82.0	84.2	4.5	2.2	42.9	5.1	6.0	78.5	2.45	8.8
Maxima	14.3	90.7	55.8	11.2	10.0	10.8	75.5	61.5	3.8	3.8	4.1	4.1	97.4	100.0	5.6	2.9	60.0	6.1	6.8	95.3	3.7	10.1

[1] Near.

DEFORMED LOUISIANA: FEMALES

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt. - Nasion height (b)
277736	U.S.N.M.	Iberville Parish	60	Medium fronto-occipital flattening.	(16.7)	(13.5)	(13.9)	*(80.8)*	*(92.0)*	*(103.0)*	14.70	1,285	Moderate	11.5	7.2
277739	do	do	50	Moderate fronto-occipital flattening.	(16.7)	(13.5)	(13.8)	*(80.8)*	*(91.4)*	*(102.2)*	14.67	1,275	Slight	11.7	7.3
255105	do	Ouachita Parish	55	Moderate occipital flattening.	(17.6)	(14.5)	(13.8)	*(82.4)*	*(86.0)*	*(95.2)*	15.30	1,410			
255208	do	Morehouse Parish	55	Slight fronto-occipital flattening.	(16.5)	(13.9)	(12.5)	*(84.2)*	*(82.2)*	*(89.9)*	14.30	1,130			[1] 6.6
277734	do	Iberville Parish	35	Medium fronto-occipital flattening.	(16.2)	(13.8)	(13.3)	*(85.2)*	*(88.7)*	*(96.4)*	14.43	1,230	Slight	10.9	6.7
255118	do	Ouachita Parish	50	Moderate occipital flattening.	(16.6)	(14.2)	(14.6)	*(85.5)*	*(94.8)*	*(102.8)*	15.13				
255111	do	do	40	do	(16.6)	(14.3)		*(86.1)*				1,390			[1] 6.2
255112	do	do	60	Very slight occipital flattening.	(16.8)	(14.6)	(14.3)	*(86.9)*	*(91.1)*	*(98.0)*	15.23	1,390			
243799	do	Opposite Vicksburg	Young Adult	Slight occipital flattening.	(16.7)	(14.7)	(13.7)	*(88.0)*	*(87.3)*	*(93.2)*	15.03				
255103	do	Ouachita Parish	50	Moderate occipital flattening.	(16.0)	(14.3)	(13.5)	*(89.4)*	*(89.1)*	*(94.4)*	14.60				7.0
255216	do	Morehouse Parish	35	Slight frontal and pronounced occipital flattening.	(16.6)	(14.9)	(13.4)	*(89.8)*	*(85.1)*	*(89.9)*	14.97	1,325	Medium	11.2	7.2
255219	do	do	45	Slight lateral, frontal and moderate lateral occipital flattening.	(16.1)	(14.5)	(13.2)	*(90.1)*	*(86.3)*	*(91.0)*	14.60				6.5
255117	do	Ouachita Parish	22	Slight occipital flattening.	(16.3)	(14.9)	(14.1)	*(91.4)*	*(90.4)*	*(94.6)*	15.10		Slight	11.7	6.9
277738	do	Iberville Parish	45	Marked fronto-occipital flattening.	(16.8)	(15.4)	(14.0)	*(91.7)*	*(87.0)*	*(90.9)*	15.40	1,445	do	11.2	7.2
255212	do	Morehouse Parish	55	Pronounced occipital flattening.	(15.7)	(14.6)	(13.6)	*(93.0)*	*(89.8)*	*(93.2)*	14.63	1,330	Medium	10.6	6.6
255220	do	do	50	Medium occipital flattening.	(15.5)	(14.5)	(14.0)	*(93.6)*	*(93.3)*	*(96.6)*	14.67				

255214	do	do	40	Very slight frontal and pronounced occipital flattening.	(15.5)	(14.9)	(13.7)	(96.1)	(90.1)	(92.0)	14.70	1,390			6.9
Specimens					(17)	(17)	(16)	(17)	(16)	(16)	(16)	(11)		(7)	(12)
Totals					278.9	245.0	219.4				237.46	14,600		78.8	82.3
Averages					16.4	14.4	13.7	87.85	89.0	95.10	14.84	1,327.3		11.25	6.9
Minima					15.5	13.5	12.5	80.8	82.2	89.9	14.30	1,130		10.6	6.5
Maxima					17.6	15.4	14.6	96.1	94.8	103.0	15.40	1,480		11.7	7.3

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a \times 100}{c}\right)$	*Facial Index, upper* $\left(\frac{b \times 100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
277736	[1]13.2	87.1	54.6	9.6	8.6	9.8	70.0	54.0	3.6	3.65	4.05	3.9	88.9	93.6	5.3	2.9	54.7	5.4			3.3	
277739	13.2	88.6	55.3	10.1	8.8	10.3	71.0	50.0	3.4	3.4	3.6	3.55	94.4	95.8	5.2	2.1	40.4	5.4	6.3	85.7	3.15	
255105	[1]13.1				8.2	9.9			3.4	3.4	3.75	3.8	85.7	89.5	4.85	2.5	51.6				[1]3.4	
255208	12.8		51.6			9.2			3.4		3.75		90.7		4.8	2.7	56.2					
277734	[1]13.5	80.7	49.6	10.0	9.0	9.7	68.0	52.5		3.4		3.8		89.5	5.0	2.6	52.0	5.4	6.4	84.4	2.9	
255118					[1]9.1	[1]10.2			3.45	3.55	4.0	4.0	86.2	88.8	4.9	2.6	53.1					
255111															4.5	2.6	57.8					
255112	13.4				9.0	10.0			3.3	3.4	3.9	3.8	84.6	89.5	4.8	2.7	56.2					
243799						9.5																
255103						10.2									5.15	2.6	50.5				3.3	
255216	13.4	83.6	53.7	10.1	8.9	9.8	67.0	53.0	3.5	3.5	3.7	3.75	94.6	93.3	4.95	2.7	54.6	5.6	[1]6.8	82.4	3.4	
255219	[1]13.5		48.2			9.7									4.75	2.85	60.0					
255117						9.0									4.95	2.45	49.5	5.4	6.8	79.4	3.6	
277738	13.7	81.8	52.6	9.7	9.0	10.2	72.5	64.0	3.8	3.8	4.05	4.0	93.8	95.0	5.2	2.5	48.1	5.0	6.1	82.0	3.1	
255212	13.3	79.7	49.6	9.3	8.3	9.5	71.5	53.0	3.3	3.35	3.85	3.85	85.7	87.0	4.85	2.7	55.7	4.9	[1]6.2	79.0	3.3	
255220	13.4				8.5	9.6			3.45	3.45	3.95	3.8	87.4	90.8	4.65	2.85	61.3				3.45	
255214	13.6		50.7	9.4	8.4	9.7	71.5	57.0	3.65	3.65	3.8	3.75	93.4	97.3	4.9	2.35	48.0	5.1	6.5	78.5		
Specimens	(12)	(6)	(9)	(7)	(11)	(16)	(7)	(7)	(11)	(11)	(11)	(11)	(11)	(11)	(16)	(16)	(16)	(8)	(7)	(7)	(10)	
Totals	160.1			68.2	95.8	157.2	491.5	383.5	38.25	38.55	42.4	42.0			78.75	41.70		42.2	45.1		32.90	
Averages	13.3	83.56	51.75	9.7	8.7	9.8	70.2	54.8	3.5	3.5	3.85	3.8	90.21	91.79	4.9	2.6	52.95	5.3	6.4	81.60	3.3	
Minima	12.8	79.7	48.2	9.3	8.2	9.2	67.0	50.0	3.3	3.35	3.6	3.55	84.6	87.0	4.65	2.1	40.4	4.9	6.1	78.5	2.9	
Maxima	13.7	88.6	55.3	10.1	9.1	10.3	72.5	64.0	3.8	3.8	4.05	4.0	94.6	97.3	5.3	2.9	61.3	5.6	6.8	85.7	3.6	

[1] Near.

UNDEFORMED TEXAS (NARROW TYPE): MALES

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
377981	U.S.N.M.	Near Abilene	40		19.6	[1]12.2	High (14.4)	*62.24*	*(90.57)*	*(118.03)*	15.40				7.6
2	Witte Museum.	Shumla	65		18.7	12.4	[1]13.1	*66.31*	*84.24*	*105.65*	14.73				
372526	U.S.N.M.	Goat Cave, Val Verde County.	75		19.0	12.6	13.3	*66.32*	*84.18*	*105.56*	14.97				
1670 A (1)	Sul Ross State Teachers College.	Shumla	65		19.6	13.1	14.2	*66.84*	*86.85*	*108.40*	15.63				7.0
A	Witte Museum.	Shumla (1933)	80		18.8	12.6	13.6	*67.02*	*86.62*	*107.94*	15.00				
377983	U.S.N.M.	Near Abilene	50		[1]19.2	[1]13.0	High	*67.71*							
372525	do	Goat Cave, Val Verde County.	75		18.6	12.6	12.8	*67.74*	*82.05*	*101.59*	14.67				
1	Witte Museum.	Shumla	60		18.7	12.7	13.2	*67.91*	*84.08*	*103.94*	14.87				
1670 A (2)	Sul Ross State Teachers College.	do	65		19.0	13.0	13.0	*68.42*	*81.25*	*100.0*	15.00				
377982	U.S.N.M.	Near Abilene	35		19.3	13.4	14.4	*69.43*	*88.07*	*107.46*	15.37				7.3
3037A	Sul Ross State Teachers' College.	Van Horn	55		17.9	13.1	13.2	*73.18*	*88.00*	*100.76*	14.73			[2]12.7	7.4
C	Witte Museum	Shumla	Old	Somewhat pathological.	(19.1)	(12.2)	(14.2)	*(64.21)*	*(91.03)*	*(116.39)*	15.13				
Specimens					(11)	(11)	(9)	*(11)*	*(9)*	*(9)*	(11)			(1)	(4)
Totals					208.4	140.7	120.8				165.5				29.3
Averages					18.9	12.8	13.4	*67.51*	*84.74*	*104.58*	15.05				7.3
Minima					17.9	12.2	12.8	*62.24*	*81.25*	*100.0*	14.67				7.0
Maxima					19.6	13.4	14.4	*73.18*	*90.57*	*118.03*	15.63				7.6

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a\times100}{c}\right)$	*Facial Index, upper* $\left(\frac{b\times100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length, maxim.	Upper Alveolar Arch, breadth, maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
							°	°														
377981	[1]13.0	------	*58.46*	------	------	------	------	------	[1]3.75	3.75	4.0	4.0	*93.75*	*93.75*	5.4	[1]2.4	*44.44*	5.7	6.3	*90.48*	------	8.9
2	13.7	------	------	------	------	------	------	------	3.3	3.25	3.85	3.75	*85.71*	*86.67*	4.85	2.7	*55.67*	------	------	------	------	------
372526	12.7	------	------	------	8.7	9.8	------	------	2.9	2.9	3.65	3.75	*79.45*	*77.33*	4.5	2.65	*58.89*	------	------	------	------	------
1670 A (1)	14.2	------	*49.30*	9.7	8.8	10.6	76.5	55.0	3.2	3.2	4.05	4.05	*79.01*	*79.01*	5.25	2.9	*55.24*	5.2	6.9	*75.36*	------	------
A	13.7	------	------	------	9.2	10.3	------	------	3.1	3.1	3.9	3.8	*79.49*	*81.58*	5.25	2.7	*51.43*	------	------	------	------	------
377983	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	[1]3.4	9.0
372525	13.1	------	------	------	8.8	9.9	------	------	------	3.2	------	3.7	------	*86.49*	4.7	2.5	*53.19*	------	------	------	------	------
1	12.9	------	------	------	8.6	10.0	------	------	3.3	3.4	3.8	3.9	*86.84*	*87.18*	4.75	2.6	*54.74*	------	------	------	------	------
1670 A (2)	13.5	------	------	------	9.0	10.4	------	------	3.1	3.15	3.8	3.75	*81.58*	*84.0*	5.25	2.5	*47.62*	5.3	6.4	*82.81*	------	------
377982	13.8	------	*52.90*	10.4	9.4	10.8	73.0	59.0	3.4	3.2	3.9	4.05	*87.18*	*79.01*	5.05	2.65	*52.48*	5.8	7.0	*82.86*	------	8.7
3037A	13.0	*97.69*	*56.92*	[1]9.7	8.5	10.0	69.5	51.0	3.4	------	3.75	------	*90.67*	------	5.4	2.4	*44.44*	[1]5.4	6.6	*81.82*	------	------
C	13.4	------	------	------	9.0	10.1	------	------	3.25	3.3	4.0	4.0	*81.25*	*82.50*	5.0	2.9	*58.0*	------	------	------	------	------
Specimens	(11)	*(1)*	(4)	(3)	(9)	(9)	(3)	(3)	(10)	(10)	(10)	(10)	*(10)*	*(10)*	(11)	(11)	*(11)*	(5)	(5)	(5)	(1)	(3)
Totals	147.0	------	------	29.8	80.0	91.9	219.0	165.0	32.7	31.45	38.7	38.75	------	------	55.4	28.90	------	27.4	33.2	------	------	26.6
Averages	13.4	------	*54.26*	9.9	8.9	10.2	73.0	55.0	3.3	3.1	3.9	3.9	*84.50*	*81.16*	5.04	2.6	*52.17*	5.5	6.6	*82.53*	------	8.9
Minima	12.7	------	*49.30*	9.7	8.5	9.8	69.5	51.0	2.9	2.9	3.65	3.7	*79.01*	*77.33*	4.5	2.4	*44.44*	5.2	6.3	*75.36*	------	8.7
Maxima	14.2	------	*58.46*	10.4	9.4	10.8	76.5	59.0	3.75	3.75	4.05	4.05	*93.75*	*93.75*	5.4	2.9	*58.89*	5.8	7.0	*90.48*	------	9.0

[1] Near.
[2] Restored.

UNDEFORMED TEXAS (BROAD TYPE): MALES

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
276998	U.S.N.M.	Port Arthur	40		18.3	14.0	High	*76.5*				[1] 1,400			7.9
289717	do	Panhandle, Wolf Creek.	75		17.6	14.2	13.3	*80.7*	*83.7*	*93.7*	15.03				
243831	do	Near Flat Top Mountain.	40		17.4	14.3	12.8	*82.2*	*80.8*	*89.5*	14.83	1,425			7.0
243494	do	Western Texas	65		18.2	15.2	([2])	*83.5*				1,510			
243489	do	Near Victoria	50		17.6	14.8	13.6	*84.1*	*84.0*	*91.9*	15.33	1,435		12.0	7.2
243937	do	Near Jacksboro	26		17.6	14.8	13.1	*84.1*	*80.9*	*88.5*	15.17	1,390			7.9
243859	do	Near Fort Bliss	30		17.8	15.2	14.2	*85.4*	*86.1*	*93.4*	15.73	1,505			6.8
Specimens					(7)	(7)	(5)	(7)	(5)	(5)	(5)	(6)		(1)	(5)
Totals					124.5	102.5	67.0				76.09	8,665			36.8
Averages					17.8	14.6	13.4	*82.02*	*83.08*	*91.41*	15.22	1,446.2			7.4
Minima					17.4	14.0	12.8	*76.5*	*80.8*	*88.5*	15.03	1,390			6.8
Maxima					18.3	15.2	14.2	*85.4*	*86.1*	*93.7*	15.73	1,510			7.9

TONKAWAY (OKLAHOMA)

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
243486 [3]	U.S.N. M.	Fort Cobb	60		17.4	14.8	13.4	*85.1*	*83.2*	*90.5*	15.20	1,400		12.9	7.8

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a\times100}{c}\right)$	*Facial Index, upper* $\left(\frac{b\times100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim.
							°	°														
276998	-----	-----	-----	-----	-----	-----	-----	-----	3.6	-----	3.9	-----	*92.3*	-----	5.8	2.4	*41.4*	5.4	7.2	*75.0*	-----	9.7
289717	-----	-----	-----	-----	-----	-----	-----	-----	3.35	3.5	3.8	3.9	*88.2*	*89.7*	5.3	2.8	*52.8*	-----	-----	-----	-----	9.0
243831	14.3	-----	*49.0*	9.9	8.8	10.0	70.5	50.0	3.6	3.6	3.9	4.1	*92.3*	*87.8*	5.2	2.8	*53.9*	5.4	6.5	*83.1*	-----	10.0
243494	14.8	-----	-----	-----	-----	-----	-----	-----	3.5	3.5	3.8	3.8	*92.1*	*92.1*	5.4	2.6	*48.2*	-----	-----	-----	-----	9.6
243489	13.7	*87.6*	*52.6*	10.0	8.7	9.9	70.0	52.0	3.7	3.7	4.1	4.0	*90.2*	*92.5*	5.1	2.45	*48.0*	5.6	6.3	*88.9*	-----	-----
243937	14.1	-----	*56.0*	10.4	9.2	10.2	66.5	55.0	3.6	3.7	3.9	3.9	*92.3*	*94.9*	5.6	2.7	*48.2*	5.9	7.1	*83.1*	-----	9.6
243859	14.0	-----	*48.6*	9.6	8.7	10.4	77.0	59.0	3.3	3.3	3.6	3.6	*91.7*	*91.7*	4.85	2.85	*58.8*	5.1	6.1	*83.6*	-----	9.9
Specimens	(5)	*(1)*	*(4)*	(4)	(4)	(4)	(4)	(4)	(7)	(6)	(7)	(6)	*(7)*	*(6)*	(7)	(7)	*(7)*	(5)	(5)	*(5)*	-----	(6)
Totals	70.9	-----	-----	39.9	35.4	40.5	284.0	216.0	24.65	21.3	27.0	23.3	-----	-----	37.25	18.60	-----	27.4	33.2	-----	-----	57.8
Averages	14.2	-----	*51.52*	9.98	8.9	10.1	71.0	54.0	3.5	3.6	3.9	3.9	*91.30*	*91.42*	5.3	2.7	*49.98*	5.5	6.6	*82.52*	-----	9.6
Minima	13.7	-----	*48.6*	9.6	8.7	9.9	66.5	50.0	3.3	3.3	3.6	3.6	*88.2*	*87.8*	4.85	2.4	*41.4*	5.1	6.1	*75.0*	-----	9.0
Maxima	14.8	-----	*56.0*	10.4	9.2	10.4	77.0	59.0	3.7	3.7	4.1	4.1	*92.3*	*94.9*	5.8	2.85	*58.8*	5.9	7.2	*88.9*	-----	10.0
TONKAWAY (OKLAHOMA)																						
243486 [3]	14.5	*89.0*	*53.8*	10.5	9.4	10.2	65.0	54.5	3.45	3.45	4.1	4.0	*84.2*	*86.3*	5.5	2.75	*50.0*	6.0	6.8	*88.2*	3.9	9.8

[1] Near.
[2] Moderately high.
[3] Medicine man.

UNDEFORMED TEXAS: FEMALES

NARROW TYPE

Catalog No.	Collection	Locality	Approximate age of subject	Deformation	Diam. antero-posterior maxim. (glabella ad maximum)	Diam. lateral maxim.	Basion-Bregma height	*Cranial Index*	*Mean Height Index*	*Height-Breadth Index*	Cranial Module	Capacity, in c. c. (Hrdlička's method)	Teeth, wear	Menton-Nasion height (a)	Alveol. Pt.-Nasion height (b)
372527	U.S.N.M.	Goat Cave, Val Verde County.	60		18.0	12.0	12.5	*66.67*	*83.33*	*104.17*	14.17				[1] 6.1
372528	do	Moorehead Cave, Val Verde County.	35		18.2	12.2	12.6	*67.03*	*82.89*	*103.28*	14.33			[2] 10.4	6.1
4	Witte Museum.	Shumla	55		17.9	12.0	12.8	*67.04*	*85.62*	*106.67*	14.23			[2] 10.1	6.0
3036A	Sul Ross State Teachers College.	Van Horn	30		18.5	12.8	12.5	*69.20*	*79.87*	*97.66*	14.60			10.9	6.5
3040A	do	do	25		18.4	13.0	13.0	*70.65*	*82.80*	*100.00*	14.80			[2] 10.3	5.9
243488	U.S.N.M.	Fort Cobb,[3] Washita River.	25		17.8	13.1	13.0	*73.60*	*84.14*	*99.24*	14.63	1,240		11.0	6.8
3038A	Sul Ross State Teachers College.	Van Horn	45		18.2	13.4	12.2	*73.62*	*77.22*	*91.04*	14.60			[2] 11.3	6.6
3048A	do	do	Adolescent		16.6	11.2	11.4	*67.47*	*82.01*	*101.79*	13.07				6.0
372531	U.S.N.M.	Goat Cave, Val Verde County.	6-7		17.2	12.8	12.2	*74.42*	*81.33*	*95.31*	14.07				
Specimens					(7)	(7)	(7)	(7)	(7)	(7)	(7)	(1)		(6)	(7)
Totals					127.0	88.5	88.6				101.36			64.0	44.0
Averages					18.1	12.6	12.7	*69.69*	*82.23*	*100.11*	14.48			10.7	6.3
Minima					17.8	12.0	12.2	*66.67*	*77.22*	*91.04*	14.17			10.1	5.9
Maxima					18.5	13.4	13.0	*73.62*	*85.62*	*106.67*	14.80			11.3	6.8

MEDIUM TYPE

243936	U.S.N.M.	Near Jacksboro	35		17.8	13.6		*76.40*							7.0
243483	do	Fort Cobb	35		17.2	13.4	12.4	*77.91*	*81.05*	*92.54*	14.33	1,220		11.8	7.2
243492	do	Horse Head Hills	40		17.4	13.6	12.8	*78.16*	*82.58*	*94.12*	14.60	1,190			[1] 7.2
286840	do	Port Arthur	45		17.2	13.6		*79.07*							
345773	do	Bloomington	60		17.8	14.1	[1] 12.2	*79.21*	*76.49*	*86.52*	14.70	1,300			
Specimens					(5)	(5)	(3)	*(5)*	*(3)*	*(3)*	(3)	(3)		(1)	(3)
Totals					87.4	68.3	37.4				43.63	3,710			21.4
Averages					17.5	13.7	12.5	*78.15*	*80.0*	*91.0*	14.5	1,236.7			7.1
Minima					17.2	13.4	12.2	*76.40*	*76.49*	*86.52*	14.33	1,190			7.0
Maxima					17.8	14.1	12.8	*79.21*	*82.58*	*94.12*	14.70	1,300			7.2

BROAD TYPE

315117	U.S.N.M.	Gatesville	30	Somewhat assymmetrical.	17.5	14.0	13.2	*80.0*	*83.81*	*97.06*	14.90	1,330			6.1
243833	do	Picked up on prairie.	40		17.9	15.0	13.0	*83.80*	*79.03*	*86.67*	15.30	1,420		11.6	7.2
315113	do	Gatesville	70		16.2	14.4	13.6	*88.89*	*88.89*	*94.44*	14.73				
3047A	Sul Ross State Teachers College.	Goat Cave	70				12.5								
Specimens					(3)	(3)	(4)	*(3)*	*(3)*	*(3)*	(3)	(2)		(1)	(2)
Totals					51.6	43.4	52.3				44.93	2,750			13.3
Averages					17.2	14.47	13.08	*84.11*	*83.79*	*91.71*	14.98	1,375			6.65

[1] Near.
[2] Restored.
[3] Fort Cobb is now in Oklahoma.

UNDEFORMED TEXAS: FEMALES—Continued

NARROW TYPE

Catalog No.	Diam. Bizygomatic maxim. (c)	*Facial Index, total* $\left(\frac{a\times100}{c}\right)$	*Facial Index upper* $\left(\frac{b\times100}{c}\right)$	Basion-Alveolar Pt.	Basion-Subnasal Pt.	Basion-Nasion	Facial Angle	Alveolar Angle	Orbits—Height, right	Orbits—Height, left	Orbits—Breadth, right	Orbits—Breadth, left	*Orbital Index, right*	*Orbital Index, left*	Nose, height	Nose, breadth maxim.	*Nasal Index*	Upper Alveolar Arch, length maxim.	Upper Alveolar Arch, breadth maxim.	*Upper Alveolar Arch, Index*	Lower Jaw, height at Symphysis	Diam. frontal minim
							°	°														
372527	12.4	----	*49.19*	----	8.9	9.9	----	----	2.95	3.05	3.7	3.8	*79.73*	*80.26*	4.35	2.6	*59.77*	----	----	----	----	----
372528	12.8	*81.88*	*47.66*	9.3	8.2	9.6	*74.0*	*44.5*	3.25	3.4	3.6	3.5	*90.28*	*97.14*	4.7	2.6	*55.32*	5.0	5.7	*87.72*	----	----
4	[1]12.2	*82.79*	*49.18*	9.6	8.6	9.4	*69.0*	*48.5*	2.9	2.9	3.45	3.55	*84.06*	*81.69*	4.4	2.15	*48.86*	4.9	5.8	*84.48*	----	----
3036A	12.0	*90.83*	*54.17*	10.0	8.8	9.6	*67.5*	*48.0*	3.3	3.4	3.7	3.6	*89.19*	*94.44*	4.65	2.35	*50.54*	5.3	5.9	*89.83*	----	----
3040A	12.9	*79.84*	*45.74*	10.0	8.6	9.8	*70.5*	*41.0*	3.2	3.2	3.7	3.7	*86.49*	*86.49*	4.25	2.65	*62.35*	5.4	6.3	*85.71*	----	----
243488	12.4	*88.71*	*54.84*	10.2	9.4	10.7	*67.0*	*47.0*	3.3	3.3	3.7	3.7	*89.19*	*89.19*	4.9	2.6	*53.06*	5.8	6.5	*89.23*	----	----
3038A	12.8	*88.28*	*51.56*	9.7	8.4	9.4	*67.0*	*41.5*	3.3	3.45	3.8	3.65	*86.84*	*94.52*	4.85	2.6	*53.61*	5.3	6.2	*85.48*	----	----
3048A	----	----	----	----	8.1	9.1	----	----	3.4	----	3.6	----	*94.44*	----	4.5	2.6	*57.78*	4.7	5.9	*79.66*	----	----
372531	11.4	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Specimens	(7)	(6)	(7)	(6)	(7)	(7)	(6)	(6)	(7)	(7)	(7)	(7)	(7)	(7)	(7)	(7)	(7)	(6)	(6)	(6)	----	----
Totals	87.5	----	----	58.8	60.9	68.4	*415.0*	*270.5*	22.2	22.7	25.65	25.5	----	----	32.10	17.55	----	31.7	36.4	----	----	----
Averages	12.5	*85.22*	*50.29*	9.8	8.7	9.8	*69.17*	*45.08*	3.2	3.2	3.7	3.6	*86.55*	*89.02*	4.6	2.5	*54.67*	5.3	6.1	*87.09*	----	----
Minima	12.0	*79.84*	*47.66*	9.3	8.2	9.4	*67.0*	*41.0*	2.9	2.9	3.45	3.5	*79.73*	*80.26*	4.25	2.15	*48.86*	4.9	5.7	*84.48*	----	----
Maxima	12.9	*90.83*	*54.84*	10.2	9.4	10.7	*74.0*	*48.5*	3.3	3.45	3.8	3.8	*90.28*	*97.14*	4.9	2.65	*62.35*	5.8	6.5	*89.83*	----	----

MEDIUM TYPE

243936	13.0	----	*53.85*	----	----	----	----	----	3.35	3.25	3.8	3.8	*88.16*	*85.53*	4.9	2.4	*48.98*	5.2	6.2	*83.87*	----	----
243483	13.3	*88.72*	*54.14*	9.2	8.6	10.1	*61.5*	*45.5*	3.4	3.4	3.85	3.95	*88.31*	*86.08*	4.9	2.7	*55.10*	5.6	6.4	*87.50*	----	----
243492	13.7	----	*52.55*	9.7	8.6	----	----	----	3.3	3.35	3.8	3.7	*86.84*	*90.54*	5.0	2.9	*58.0*	----	----	----	----	----
286840	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
345773	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Specimens	(3)	*(1)*	*(3)*	(2)	(2)	(1)	*(1)*	*(1)*	(3)	(3)	(3)	(3)	*(3)*	(3)	(3)	(3)	*(3)*	(2)	(2)	*(2)*	----	----
Totals	40.0	----	----	18.9	17.2	----	----	----	10.05	10.0	11.45	11.45	----	----	14.8	8.0	----	10.8	12.6	----	----	----
Averages	13.3	----	*53.50*	9.45	8.6	----	----	----	3.35	3.3	3.8	3.8	*87.77*	*87.34*	4.9	2.7	*54.05*	5.4	6.3	*85.71*	----	----
Minima	13.0	----	*52.55*	9.2	8.6	----	----	----	3.3	3.25	3.8	3.7	*86.84*	*85.53*	4.9	2.4	*48.98*	5.2	6.2	*83.87*	----	----
Maxima	13.7	----	*54.14*	9.7	8.6	----	----	----	3.4	3.4	3.85	3.95	*88.31*	*90.54*	5.0	2.9	*58.0*	5.6	6.4	*87.50*	----	----

BROAD TYPE

315117	[1]13.6	----	*44.85*	10.0	8.7	9.4	66.0	41.0	3.2	3.3	3.7	3.7	*86.49*	*89.19*	4.5	2.3	*51.11*	5.2	5.8	*89.66*	----	----
243833	13.3	*87.22*	*54.14*	9.9	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
315113	12.6	----	----	10.2	8.4	----	----	----	3.5	----	3.7	----	*94.59*	----	4.7	2.2	*46.81*	----	----	----	----	----
3047A	13.2	----	----	----	8.8	9.7	----	----	3.3	3.2	3.65	3.65	*90.47*	*87.67*	5.1	2.7	*52.94*	----	----	----	----	----
Specimens	(4)	*(1)*	*(2)*	(3)	(3)	(2)	(1)	(1)	(3)	(2)	(3)	(2)	(3)	*(2)*	(3)	(3)	*(3)*	(1)	(1)	*(1)*	----	----
Totals	52.7	----	----	30.1	25.9	19.10	----	----	10.0	6.5	11.05	7.35	----	----	14.3	7.2	----	----	----	----	----	----
Averages	13.18	----	*49.44*	10.03	8.63	9.55	----	----	3.33	3.25	3.68	3.68	*90.50*	*88.44*	4.77	2.40	*50.35*	----	----	----	----	----

[1] Near.

ABSTRACTS AND NOTES

CRANIAL INDICES IN UNDEFORMED CRANIA

State or tribe	Males		Females	
	Specimens	Means	Specimens	Means
Texas (narrow type)	(11)	67.51	(7)	69.69
Seminoles	(11)	77.02	(2)	82.34
Louisiana	(34)	77.80	(29)	81.22
Tennessee	(22)	77.99	(37)	79.90
Alabama	(6)	78.44	(11)	81.25
Florida	(356)	80.69	(341)	81.21
Arkansas	(38)	80.81	(52)	82.95
Georgia	(13)	81.51	(13)	83.55
Texas (broad type)	(7)	82.02	(3)	84.11
Mississippi	(5)	83.09	(6)	83.63
Choctaw	------	------	(4)	84.09

FLORIDA CRANIA, BY CRANIAL INDEX

Location or tribe	Males		Females	
	Specimens	Means	Specimens	Means
Seminoles	(11)	77.02	[1]	------
Pensacola Bay	(4)	78.96	[2]	------
Canal Point	------	------	(5)	79.14
Tampa	(15)	79.38	(15)	79.07
Horrs Island	(33)	79.40	(36)	79.17
Perico Island	(37)	79.58	(61)	80.77
Safety Harbor	(27)	80.30	(23)	81.84
Amelia Island, St. Augustine, New Smyrna	(8)	80.54	(10)	80.48
Fort Myers	(8)	80.56	------	------
Belleglade	(17)	80.72	(26)	81.45
Captiva Island	(26)	80.81	(43)	79.95
Withlacootchee River	(7)	80.88	------	------
Cedar Keys	(13)	81.10	(3)	84.43
Weeden Island	(13)	81.34	(22)	81.84
Clearwater	(7)	81.55	------	------
Tarpon Springs	(20)	81.57	(10)	83.04
Canaveral	(52)	81.78	(39)	83.34
Hog Island	(10)	81.94	------	------
Boynton	[1]	------	(6)	82.01
Ormond Beach	(9)	82.07	(16)	83.06
St. Johns River	(16)	82.15	(7)	83.31
Melbourne	(6)	[3] 84.19	(6)	82.39

[1] Numbers insignificant, or no specimens of this sex; see detailed charts.
[2] None deformed.
[3] 3 of the skulls range from 80.4 to 83.3, 3 from 85.2 to 88.6.

In considering the above, it must be borne in mind that the numbers of specimens from the different localities are very uneven and in some of the cases not adequate enough to give more than an indication as to the type of the skull in that locality. Nevertheless the showing is of much interest. The largest part by far of the peninsula is occupied by moderate to pronounced brachycephals. Only the northwestern portion, and the Canal Point in the southeast, tend toward narrower skulls. Such skulls characterize the Seminole, and this strain, now in the southern part of Florida, originally formed a part of the Creek and Muskhogean complex, whose territories ranged from what is now northwestern Florida westward and northward. It would seem therefore that the Seminole cranial type has influenced, and that considerably, that of the northwestern parts of the State; or that the prevalent Floridian cranial type influenced what may of old have been a Seminole region.

The Canal Point exception, in the southeast, may possibly be due to Seminole influence, or even their burials, after the tribe moved southward; it is in the Seminole territory. Similar oblong individual crania are encountered also here and there along the more southern parts of the west coast of Florida.

The Seminole type itself, both in the cranial index and in other respects, connects apparently with that of the southeastern Algonkins.[1] The prevalent broader-headed and high-vaulted Floridian type connects, in turn, with that of Georgia and reaches, irregularly, as far westward at least as Mississippi. It well deserves henceforth to be known as the Gulf type of the American Indian.

THE MEAN HEIGHT INDEX

$$\left(\frac{H\times 100}{\text{Mean of } L+B}\right)$$

This very valuable index of the skull shows the following distribution in undeformed crania, in the Gulf States:

State or tribe	Males		Females	
	Crania	Mean height index	Crania	Mean height index
Texas, broad type	(5)	83.08	(3)	84.11
Texas, narrow type	(9)	84.74	(7)	82.23
Florida	(232)	87.16 (85.04–91.93)[1]	(194)	86.50 (84.24–88.86)[2]
Arkansas	(30)	86.68	(50)	89.57
Seminoles	(11)	87.59	------	------
Mississippi	(3)	87.89	(1)	91.19
Georgia	(9)	88.69	(5)	87.14
Tennessee	(10)	89.18	(24)	89.54
Alabama	(2)	89.47	(5)	89.68
Louisiana	(17)	89.65	(15)	89.15
Choctaw	------	------	(4)	88.72

[1] Range in the different localities.

[2] See relevant Catalog, 1927.

The above data show, first, that Texas, in both its broad and its narrow cranial types so far as the evidence goes, stands apart from the rest of the Gulf States—its skulls are of but moderate height.

The rest of the Gulf and neighboring States stand out in this important respect as a unit, characterized throughout by a relatively high vault. With that of some of the Pueblos[2] it is the highest, in crania of similar breadth and cranial index, on the North American Continent. And we do not know as yet of such a broad high-headed large human group elsewhere.[3] The outstanding character may be, it would seem, of a regional development.

The size of the head in the Gulf States, with the exception seemingly of Texas, compares well with that of tribes of similar stature elsewhere on the North American Continent.[4] Among the States themselves the differences are moderate and doubtless partly due to insufficiency of numbers, partly to differences in statute.

The proportion of male to female module and capacity are about the usual for American crania; and the females show very clearly the disproportion between the module and the capacity which is characteristic of the sex.

The module and capacity in the deformed are practically the same as in the undeformed skulls, showing again that it is only the shape of the vault that suffers through the deformation.

CRANIAL MODULE AND CRANIAL CAPACITY

UNDEFORMED SKULLS[1]

State or tribe	Males				Females			
	Crania	Module (mean diameter)	Crania	Capacity	Crania	Module (mean diameter)	Crania	Capacity
		Centimeters		*Cubic centimeters*		*Centimeters*		*Cubic centimeters*
Texas (narrow type)	(10)	15.00			(7)	14.48	(1)	(1,240)
Texas (broad type)	(5)	15.22	(6)	1,446	(3)	14.98	(2)	1,375
Arkansas	(30)	15.36	(27)	1,448	(50)	14.74	(45)	1,277
Tennessee	(10)	15.54	(14)	1,457	(24)	14.74	(22)	1,269
Alabama	(2)	15.58	(3)	1,460	(5)	14.88	(7)	1,302
Florida	(232)	15.67	(78)	1,510	(193)	14.96	(80)	1,227
Mississippi	(3)	15.72						
Georgia	(9)	15.79			(5)	14.74		
Louisiana	(17)	15.80	(16)	1,500	(14)	14.90	(11)	1,295
Choctaw					(4)	14.62	(4)	1,216
Seminoles	(11)	15.22			(2)	14.67		

[1] Arranged consecutively on basis of module in males.

[2] And the closely blood-related Navaho. See Catalog, 1931.

[3] Relatively high skulls are found in narrow American crania, especially the Algonkin (Catalog, 1927), and also in some of the Eskimo (see author's "Anthropological Survey in Alaska," 46th Ann. Rep. Bur. Amer. Ethn., 1930); but those are other matters.

[4] Compare data in previous catalog.

CRANIAL MODULE AND CRANIAL CAPACITY—Continued

DEFORMED SKULLS

State or tribe	Males				Females			
	Crania	Module (mean diameter)	Crania	Capacity	Crania	Module (mean diameter)	Crania	Capacity
		Centimeters		*Cubic centimeters*		*Centimeters*		*Cubic centimeters*
Arkansas	(32)	15.40	(28)	1,460	(45)	14.81	(37)	1,274
Tennessee	(13)	15.49	(16)	1,465	(17)	14.76	(17)	1,264
Mississippi	(10)	15.51	(11)	1,459	(11)	14.85	(10)	1,293
Louisiana	(17)	15.66	(15)	1,522	(16)	14.84	(11)	1,327
Florida	(8)	15.69			(5)	14.81	(3)	1,250
Alabama	(2)	15.84	(3)	1,483	(2)	15.35	(2)	1,330

FACIAL INDICES[1]

UNDEFORMED SKULLS[2]

State or tribe	Males				Females			
	Specimens	Facial index total	Specimens	Facial index upper	Specimens	Facial index total	Specimens	Facial index upper
Alabama	(1)	(87.00)	(1)	(55.10)	(2)	87.13	(2)	54.04
Seminoles			(11)	52.53				
Florida	(90)	87.34 (84.52–92.33)[3]	(138)	52.24 (49.42–54.68)[3]	(62)	87.13 (83.52–88.03)[3]	(82)	52.47 (49.44–53.50)[3]
Georgia			(5)	52.43			(7)	53.45
Louisiana	(7)	88.32	(10)	52.56	(10)	86.12	(13)	52.88
Mississippi			(1)	52.86				
Tennessee	(4)	90.35	(7)	53.54	(10)	91.26	(17)	55.53
Arkansas	(23)	88.93	(26)	53.76	(24)	90.65	(33)	55.63
Choctaw					(2)	90.00	(3)	56.18

DEFORMED SKULLS

State or tribe	Specimens	Facial index total	Specimens	Facial index upper	Specimens	Facial index total	Specimens	Facial index upper
Alabama	(1)	(87.50)	(2)	52.04	(2)	86.31	(2)	54.95
Florida	(5)	91.74	(6)	54.45	(3)	89.90	(3)	55.56
Louisiana	(10)	86.11	(12)	52.55	(6)	83.56	(9)	51.75
Mississippi	(5)	84.02	(6)	51.39	(4)	86.18	(7)	52.63
Tennessee	(10)	87.42	(12)	51.69	(6)	89.86	(14)	54.00
Arkansas	(15)	87.94	(22)	53.27	(27)	89.14	(36)	54.29

[1] Arranged consecutively on the basis of the upper facial index in males.

[2] No definite effect on the indices observed in the moderately deformed; but in pronounced deformations the indices are lowered.

[3] Range in locality groups.

These facial indices are well within one class, and both, but particularly the upper, have many analogies in other North American tribes. They are especially close to those of some of the Pueblos.[4]

[4] See Catalogs, 1927, 1931.

No definite sex differences appear in the total index, but the numbers of specimens in this category is too irregular and mostly inadequate to be of decisive value. The upper facial index tends in general to be higher in the females, owing to the relatively smaller bizygomatic breadth in that sex.

In deformed skulls the facial indices tend to be lower, owing to the fact that the fronto-occipital compression has broadened the vault and with it the bizygomatic diameter.

FACIAL ANGLES

UNDEFORMED CRANIA

State or Tribe	Males			Females		
	Skulls	Facial angle	Alveolar angle	Skulls	Facial angle	Alveolar angle
		°	°		°	°
Florida	(89)	67.91	54.31	(66)	68.72	53.55
Louisiana	(7)	68.70	52.60	(10)	69.60	52.90
Georgia	(5)	70.00	52.20	(3)	70.50	50.83
Arkansas	(21)	70.30	55.50	(27)	68.50	51.90
Texas, broad	(4)	71.00	54.00	(1)	66.00	41.00
Alabama	(2)	71.50	54.00	(3)	70.20	53.70
Texas, narrow	(3)	73.00	55.00	(6)	69.17	45.08
Tennessee	(3)	73.83	56.17	(12)	70.71	54.33
Choctaw				(3)	69.17	51.67

DEFORMED SKULLS

Florida	(4)	68.75	57.38	(3)	69.37	50.00
Louisiana	(12)	70.40	54.90	(7)	70.20	54.80
Arkansas	(20)	70.30	55.28	(31)	68.34	51.60
Alabama	(2)	69.75	59.00	(2)	67.00	54.25
Tennessee	(8)	68.70	54.10	(11)	68.82	52.45
Mississippi	(5)	65.70	53.50	(4)	67.50	53.60

The differences in the group as well as sex means are moderate, irregular, and doubtless affected by uneven and mostly inadequate numbers; but as the indices are they harmonize with those of various other North American tribes [1] and show nothing special, aside perhaps from the Texas females, which show the greatest alveolar protrusion. Sex differences are fairly evident, especially in the alveolar angle—the females in general are somewhat more prognathic.

The total facial and the alveolar angle appear to be, to a considerable extent, independent of each other.

There is no clear effect of the deformation on either of the angles. In the best represented series in both categories the showings in the deformed and the undeformed crania are practically identical.

[1] See Catalog, 1931.

ORBITAL INDEX [1]

State	Male				Female			
	Skulls	Index in undeformed [2]	Skulls	Index in deformed	Skulls	Index in undeformed	Skulls	Index in deformed
Texas, narrow type	(10)	82.94	(1)	81.88	(7)	87.78		
Tennessee	(14)	87.36	(15)	88.35	(23)	92.76	(17)	88.33
Alabama	(3)	87.56	(3)	89.10	(4)	88.73	(2)	87.87
Louisiana	(15)	87.66	(15)	90.00	(15)	89.85	(12)	91.00
Mississippi	(2)	87.75	(13)	91.18			(14)	88.58
Florida	(149)	89.23 (groups 85.83–94.87)	(5)	90.72	(112)	90.38 (groups 86.05–95.12)		
Georgia	(9)	89.78			(8)	93.36		
Arkansas	(29)	90.26	(27)	91.80	(34)	94.24	(41)	92.45
Texas, broad type	(7)	91.35			(3)	89.67		

The index as a rule is higher in the females.

The range of the means is moderate, with Texas lowest, which strengthens other indications of its anthropological separateness from the rest of the Gulf States. The old native Arkansans had the highest orbits, considerably higher than the otherwise related Louisianians. The means of the Gulf region, however, fall well within those of the North American tribes.[3]

The index in the deformed skulls is perceptibly higher than that in the undeformed in all the male groups, but in the females the showings, in two of the better represented series at least, appear to tend in the opposite direction. The deformation in the males exceeds in general that in the females, which may be responsible for the condition; but the evidence is inconclusive.

NASAL INDEX

State or tribe	Male				Female			
	Skulls	Index in undeformed	Skulls	Index in deformed	Skulls	Index in undeformed	Skulls	Index in deformed
Georgia	(9)	48.43			(6)	46.86		
Alabama	(2)	48.80			(4)	47.22	(2)	49.04
Tennessee	(14)	49.05	(15)	50.68	(23)	50.92	(18)	50.06
Louisiana	(15)	49.23	(17)	50.53	(16)	51.43	(16)	52.95
Mississippi	(3)	49.33	(12)	50.69			(14)	52.34
Florida	(180)	49.43	(6)	47.52	(123)	49.08	(4)	47.63
Arkansas	(30)	49.81	(28)	48.81	(37)	50.08	(42)	49.80
Texas, broad type	(7)	49.93			(3)	50.35		
Choctaw					(4)	49.75		
Seminole	(10)	50.58						
Texas, narrow type	(10)	51.59	(1)	58.00	(7)	54.67		

[1] Arranged consecutively.

[2] Mean of the two orbits.

[3] In Catalogs 1927, 1931

The nasal index, barring Texas, is throughout of medium proportions (mesorhinic); in Texas alone it rises toward platyrhiny. This is one more difference which separates Texas crania from those of the rest of the Gulf States.

In the female skulls the index tends mostly to be slightly higher than in the males, owing to predominantly lower relative height of the female nose.

The deformed skulls show no regular significant difference in nasal index.

The mesorhinic type of nose is widely represented in North American tribes.[1]

INDEX OF THE UPPER ALVEOLAR ARCH

State or tribe	Male				Female			
	Skulls	Index in undeformed	Skulls	Index in deformed	Skulls	Index in undeformed	Skulls	Index in deformed
Tennessee	(12)	81.77	(12)	80.80	(16)	83.63	(16)	81.70
Texas, narrow type	(5)	82.53			(6)	87.09		
Texas, broad type	(5)	82.53			(1)	89.66		
Arkansas	(23)	84.12	(26)	82.45	(29)	81.05	(39)	85.24
Alabama	(3)	84.48	(2)	(79.10)	(2)	79.07	(2)	(86.26)
Mississippi	(1)	(84.85)	(6)	82.04	(1)	(85.48)	(10)	82.50
Louisiana	(12)	85.35	(13)	86.57	(17)	85.99	(7)	81.60
Florida	(106)	87.30	(5)	83.73	(93)	86.79	(3)	85.68
Georgia	(6)	87.78			(6)	84.65		
Choctaw					(2)	88.71		

The upper alveolar arch presents evidently regional differences of some significance. It is relatively broader in Florida and Georgia, and also Louisiana, than it is in the other States. The group range falls well within that of other North American tribes.[2]

Sex differences in the index are irregular and doubtless mostly unreliable owing to inadequate numbers of specimens.

The arch in the deformed in the majority of cases appears relatively slightly narrower, but there are exceptions, and the differences in the numbers of specimens in some of the cases make matters uncertain.

[1] See Catalogs 1927, 1931.

[2] See Catalog 1931.

SUMMARIES OF MEASUREMENTS

MALES

UNDEFORMED SKULLS

[All measurements on deformed crania affected by the deformation are in parentheses]

	Georgia	Florida[1]: St. Johns River	Amelia Island, St. Augustine, New Smyrna	Ormond Beach	Canaveral	Near Melbourne	Belleglade	Pensacola Bay
Number of skulls[2]	(13)	(16)	(8)	(9)	(52)	(6)	(17)	(4)
Vault:								
Length	18.00	17.96	18.11	18.26	18.06	17.91	18.21	18.13
Breadth	14.65	14.76	14.58	14.99	14.77	15.08	14.70	14.45
Height	14.55	14.20	14.00	14.12	14.38	14.32	14.43	14.80
Cranial index	*81.51*	*82.15*	*80.54*	*82.07*	*81.78*	*84.19*	*80.72*	*78.96*
Mean height index	*88.69*	*86.55*	*85.55*	*85.04*	*87.64*	*86.37*	*88.19*	*91.93*
Module	15.79	15.71	15.58	15.79	15.71	15.86	15.72	15.79
Capacity	-------	-------	1,492.50	-------	-------	1,532.00	-------	1,555.00
Face:								
Menton-Nasion height	[3] 12.40	[3] 13.30	11.80	12.62	12.78	13.10	12.65	[3] 12.90
Alveolar Point-Nasion height	7.46	7.42	7.38	7.37	7.62	7.93	7.67	7.63
Breadth	14.69	14.92	13.96	14.35	14.77	15.20	14.65	13.95
Facial index, total	[3] *88.81*	[3] *86.36*	[3] *82.39*	*87.11*	*87.73*	*84.52*	*86.94*	[3] *90.21*
Facial index, upper	*52.43*	*49.42*	*52.87*	*50.87*	*51.68*	*52.05*	*53.12*	[3] *56.64*
Orbits:								
Mean height	3.48	-------	3.60	3.50	3.51	3.78	3.57	3.58
Mean breadth	3.88	-------	3.97	3.81	3.99	3.99	3.94	3.78
Mean index	*89.78*	-------	*90.72*	*91.76*	*87.96*	*94.51*	*90.49*	*94.71*
Nose:								
Height	5.32	5.23	5.28	5.31	5.27	5.48	5.45	5.47
Breadth	2.58	2.36	2.46	2.68	2.49	2.46	2.82	2.53
Index	*48.43*	*45.87*	*46.59*	*50.39*	*47.24*	*44.98*	*51.68*	*46.34*

[1] In geographical sequence.

[2] Not all the measurements and determinations were possible on all the skulls; for the numbers with each item see the Summaries of Indices.

[3] 1 skull.

155192—40——10

SUMMARIES OF MEASUREMENTS—Continued

MALES—Continued

UNDEFORMED SKULLS—Continued

[All measurements on deformed crania affected by the deformation are in parentheses]

	Florida [1]							
	Cedar Keys	Withlacoochee River	Tarpon Springs	Perico Island	Captiva Island	Fort Myers	Horrs Island, Collier County	Seminoles
Number of skulls [2]	(13)	(7)	(20)	(37)	(26)	(8)	(33)	(11)
Vault:								
Length	17.73	18.16	18.13	18.33	18.30	18.20	18.49	17.92
Breadth	14.38	14.69	14.79	14.58	14.79	14.66	14.68	13.80
Height	14.06	14.58	14.14	14.12	14.24	14.38	14.39	13.89
Cranial index	*81.10*	*80.88*	*81.57*	*79.58*	*80.81*	*80.56*	*79.40*	*77.02*
Mean height index	*87.65*	*88.20*	*86.13*	*85.69*	*86.00*	*88.60*	*86.32*	*87.59*
Module	15.38	15.88	15.66	15.73	15.78	15.61	15.91	15.22
Capacity	1,475.00				1,535.50		1,516.00	
Face:								
Menton-Nasion height	13.10			12.62	12.65	[3] 12.50	12.72	[3] 11.80
Alveolar Point-Nasion height	7.38		7.73	7.58	7.52	7.34	7.73	7.09
Breadth	14.36		14.35	14.64	14.77	14.00	14.78	13.50
Facial index, total	*87.48*			*86.62*	*86.14*	[3] *86.81*	*87.06*	[3] *83.10*
Facial index, upper	*51.41*		*52.61*	*51.95*	*51.09*	*52.43*	*52.43*	*52.53*
Orbits:								
Mean height	3.65	[3] 3.65		3.63	3.67	3.70	3.62	
Mean breadth	4.13	[3] 4.15		3.97	3.95	3.90	3.99	
Mean index	*88.31*	[3] *87.95*		*91.63*	*92.83*	*94.87*	*90.69*	
Nose:								
Height	5.12	[3] 5.20	5.40	5.28	5.39	5.14	5.50	5.18
Breadth	2.49	[3] 2.50	2.53	2.53	2.41	2.50	2.66	2.62
Index	*49.47*	[3] *48.08*	*46.91*	*47.91*	*44.83*	*48.64*	*48.34*	*50.58*

[1] In geographical sequence.

[2] Not all the measurements and determinations were possible on all the skulls; for the numbers with each item see the Summaries of Indices.

[3] 1 skull.

SUMMARIES OF MEASUREMENTS—Continued

MALES—Continued

UNDEFORMED SKULLS—Continued

[All measurements on deformed crania affected by the deformation are in parentheses]

	Florida—Continued					Tennessee		Alabama	
	Hog Island	Safety Harbor	Clear-water	Tampa Bay	Weeden Island	Unde-formed	De-formed	Unde-formed	De-formed
Number of skulls	(10)	(27)	(7)	(15)	(13)	(24)	(21)	(6)	(3)
Vault:									
Length	17.72	18.18	18.11	18.17	18.05	17.94	(16.52)	18.17	(16.40)
Breadth	14.11	14.60	14.77	14.43	14.68	14.00	(15.48)	14.25	(16.20)
Height	14.02	14.26	14.25	14.27	(damaged)	14.38	(14.42)	14.45	(14.27)
Cranial index	*81.94*	*80.30*	*81.55*	*79.38*	*81.34*	*77.99*	(*93.69*)	*78.44*	(*99.39*)
Mean height index	*88.09*	*87.78*	*86.69*	*89.10*	----------	*89.18*	(*89.85*)	*89.47*	(*87.17*)
Module	15.28	15.59	15.73	15.43	----------	15.54	15.49	15.59	15.67
Capacity	------	1,468.00	1,491.50	1,585.00	----------	1,456.5	1,465.5	1,460.0	1,432.5
Face:									
Menton-Nasion height	13.08	12.98	[3] 11.40	11.95	----------	12.50	12.52	[3] 12.00	12.35
Alveolar Pt.-Nasion height	7.63	7.79	7.77	7.45	[3] 7.60	7.47	7.40	7.30	7.58
Breadth	13.91	14.33	[3] 13.10	13.98	[3] 13.90	13.89	14.31	14.05	14.50
Facial index, total	*92.33*	*89.74*	[3] *87.02*	[3] *79.59*	----------	*90.35*	*87.42*	[3] *87.00*	*86.67*
Facial index, upper	*54.07*	*53.66*	[3] *54.96*	*51.93*	*54.68*	*53.54*	*51.69*	*56.10*	*52.64*
Orbits:									
Mean height	[3] 3.70	3.48	3.48	3.43	3.45	3.38	3.40	3.52	3.50
Mean breadth	[3] 4.00	3.98	4.00	4.00	3.88	3.87	3.85	4.02	3.95
Mean index	[3] *92.50*	*87.55*	*87.08*	*85.83*	*88.92*	*87.36*	*88.35*	*87.56*	*88.61*
Nose:									
Height	4.85	5.41	5.30	5.25	5.43	5.24	5.17	5.22	5.18
Breadth	2.43	2.61	2.47	2.51	2.62	2.57	2.62	2.55	2.68
Index	*50.00*	*48.22*	*46.54*	*47.86*	*48.16*	*49.05*	*50.68*	*48.80*	*51.20*

	Mississippi		Arkansas		Louisiana		Texas	
	Unde-formed	De-formed	Unde-formed	De-formed	Unde-formed	De-formed	Unde-formed[4]	Unde-formed[5]
Number of skulls	(6)	(18)	(38)	(40)	(34)	(23)	(11)	(7)
Vault:								
Length	18.10	(16.69)	17.67	(16.89)	18.44	(17.29)	18.94	17.79
Breadth	15.04	(15.33)	14.28	(15.07)	14.34	(14.84)	12.79	14.64
Height	14.40	(14.58)	14.16	(14.27)	14.64	(14.63)	13.42	13.40
Cranial index	*83.09*	(*91.84*)	*80.81*	(*89.23*)	*77.80*	(*85.82*)	*67.51*	*82.02*
Mean height index	*87.89*	(*91.30*)	*86.68*	(*89.37*)	*89.65*	(*90.47*)	*84.74*	*88.08*
Module	15.72	15.51	15.36	15.40	15.79	15.66	15.05	15.22
Capacity	[3] 1,640.0	1,459.0	1,448.0	1,460.0	1,501.0	1,522.0	--------	1,446.0
Face:								
Menton-Nasion height	[3] 12.10	12.13	12.33	12.30	12.96	12.44	[3] 12.70	[3] 12.00
Alveolar Pt.-Nasion height	[3] 7.40	7.32	7.48	7.46	7.67	7.55	7.33	7.36
Breadth	14.40	14.28	13.88	14.04	14.58	14.40	13.36	14.18
Facial index, total	[3] *86.43*	*84.02*	*88.93*	*87.94*	*88.32*	*86.11*	[3] *97.69*	[3] *87.59*
Facial index, upper	[3] *52.86*	*51.39*	*53.76*	*53.27*	*52.56*	*52.55*	*54.28*	*51.52*
Orbits:								
Mean height	3.31	3.51	3.54	3.54	3.55	3.58	3.21	3.53
Mean breadth	3.78	3.85	3.92	3.85	4.10	4.00	3.87	3.87
Mean index	*87.75*	*91.18*	*90.26*	*91.80*	*87.66*	*90.00*	*82.83*	*91.35*
Nose:								
Height	5.00	5.16	5.32	5.27	5.40	5.30	5.04	5.32
Breadth	2.47	2.62	2.65	2.56	2.65	2.52	2.63	2.66
Index	*49.33*	*50.69*	*49.81*	*48.81*	*49.23*	*50.53*	*52.17*	*49.93*

[3] 1 skull. [4] Narrow type. [5] Broader type.

SUMMARIES OF MEASUREMENTS—Continued

FEMALES

UNDEFORMED SKULLS—Continued

[All measurements on deformed crania affected by the deformation are in parentheses]

	Florida [1]						
	Georgia	St. Johns River	St. Augustine, Anastasia Island, Crescent Beach, New Smyrna	Ormond Beach	Canaveral	Near Melbourne	Canal Point
Number of skulls [2]	(13)	(7)	(10)	(16)	(39)	(6)	(5)
Vault:							
Length	16.88	16.94	17.01	17.22	17.15	17.32	17.64
Breadth	14.11	14.11	13.69	14.31	14.29	14.27	13.96
Height	13.42	13.56	13.67	13.62	13.64	13.45	13.40
Cranial index	*83.55*	*83.31*	*80.48*	*83.06*	*83.34*	*82.39*	*79.14*
Mean height index	*87.14*	*87.54*	*88.86*	*86.16*	*86.90*	*85.17*	*87.15*
Module	14.74	14.85	14.78	15.08	15.01	15.01	14.72
Capacity	----------	----------	1,295.00	----------	----------	[3] 1,450.00	1,270.00
Face:							
Menton-Nasion height	12.20	----------	[3] 12.00	----------	12.04	[3] 11.90	11.15
Alveolar Pt. Nasion height	7.09	[3] 6.40	7.20	6.93	7.17	7.15	6.60
Breadth	13.29	[3] 12.80	13.05	13.40	13.83	13.55	13.35
Facial index, total	*98.85*	----------	[3] *90.91*	----------	*88.03*	[3] *88.20*	*83.52*
Facial index, upper	*53.45*	*50.00*	[3] *57.58*	*51.74*	*52.86*	*52.77*	*49.44*
Orbits:							
Mean height	3.63	----------	3.43	[4] 3.30	3.51	3.40	3.29
Mean breadth	3.89	----------	3.67	[4] 3.90	3.87	3.88	3.58
Mean index	*93.36*	----------	*93.46*	[4] *84.62*	*90.56*	*87.74*	*91.96*
Nose:							
Height	5.18	4.90	4.87	4.93	5.13	5.05	4.75
Breadth	2.43	2.00	2.25	2.53	2.47	2.45	2.45
Index	*40.14*	*40.82*	*46.39*	*51.35*	*48.18*	*48.51*	*51.58*

[1] In geographical sequence.

[2] Not all the measurements and determinations were possible on all the skulls; for the numbers with each item see the Summaries of Indices.

[3] One skull.

[4] Lefts only.

SUMMARIES OF MEASUREMENTS—Continued

FEMALES—Continued

UNDEFORMED SKULLS—Continued

[All measurements on deformed crania affected by the deformation are in parentheses]

	Florida [1]						
	Belle-glade	Near Boynton	Tarpon Springs	Safety Harbor	Tampa Bay	Weeden Island	Perico Island
Number of skulls [2]	(26)	(6)	(10)	(23)	(15)	(22)	(61)
Vault:							
Length	17.29	17.23	16.97	17.24	17.36	17.19	17.47
Breadth	14.09	14.13	14.09	14.11	13.97	14.07	14.11
Height	13.71	13.37	13.13	13.37	13.79	----------	13.63
Cranial index	*81.45*	*82.01*	*83.04*	*81.84*	*79.07*	*81.84*	*80.77*
Mean height index	*87.03*	*85.68*	*85.92*	*86.31*	*88.55*	----------	*86.37*
Module	15 07	14.85	14.56	14.78	14.94	----------	15.06
Capacity	----------	1,333.00	----------	1,251.40	----------	[3] 1,360.00	[3] 1,200.00
Face:							
Menton-Nasion height	11.40	----------	----------	11.45	11.10	----------	11.97
Alveolar Pt. Nasion height	7.03	----------	7.07	6.88	6.86	[3] 7.10	7.16
Breadth	13.50	----------	[3] 13.90	13.10	13.40	[3] 13.30	13.67
Facial index, total	*84.76*	----------	----------	*87.79*	*83.64*	----------	*87.85*
Facial index, upper	*52.23*	----------	[3] *51.08*	*52.42*	*51.49*	[3] *53.38*	*52.60*
Orbits:							
Mean height	3.67	----------	----------	3.34	3.31	[3] 3.60	3.48
Mean breadth	3.86	----------	----------	3.88	3.65	[3] 3.70	3.85
Mean index	*95.12*	----------	----------	*86.05*	*90.75*	[3] *97.30*	*90.52*
Nose:							
Height	5.01	----------	5.07	4.94	4.90	[3] 5.20	5.01
Breadth	2.68	----------	2.30	2.48	2.43	[3] 2.40	2.50
Index	*53.42*	----------	*45.39*	*50.25*	*49.66*	[3] *46.15*	*49.90*

[1] In geographical sequence.

[2] Not all the measurements and determinations were possible on all the skulls; for the numbers with each item see the Summaries of Indices.

[3] One skull.

SUMMARIES OF MEASUREMENTS—Continued

FEMALES—Continued

	Florida		Tennessee		Alabama	Choctaw	Mississippi	
	Captiva Island	Horrs Island, Collier County	Undeformed	Deformed			Undeformed	Deformed
Number of skulls	(43)	(36)	(37)	(24)	(11)	(4)	(6)	(26)
Vault:								
Length	17.60	17.65	16.99	(15.83)	17.06	16.50	17.00	(15.72)
Breadth	14.07	13.97	13.58	(14.70)	13.85	13.88	14.22	(15.01)
Height	13.24	13.27	13.68	(13.78)	13.82	13.48	14.50	(13.90)
Cranial index	*79.95*	*79.17*	*79.90*	*(92.89)*	*81.25*	*84.09*	*83.63*	*(95.42)*
Mean height index	*84.24*	*85.50*	*89.54*	*(90.39)*	*89.68*	*88.72*	[3] *91.19*	*(90.69)*
Module	14.89	14.77	14.74	14.76	14.88	14.62	[3] 15.43	14.85
Capacity	1,287.50	1,297.90	1,269.1	1,264.4	1,302.0	1,216.3	[3] 1,175.0	1,293.5
Face:								
Menton-Nasion height	11.60	11.80	11.59	11.80	11.87	11.25	----------	11.80
Alveolar Pt.-Nasion height	7.07	7.20	6.99	7.11	7.18	6.97	[3] 6.50	7.07
Breadth	13.38	13.42	12.62	13.19	13.23	12.45	[3] 13.40	13.50
Facial index, total	*86.78*	*87.23*	*91.26*	*89.86*	*87.13*	*90.00*	----------	*86.18*
Facial index, upper	*52.92*	*53.50*	*55.53*	*54.00*	*54.04*	*56.18*	[3] *48.50*	*52.63*
Orbits:								
Mean height	3.35	3.53	3.38	3.33	3.49	3.46	[3] 3.50	3.40
Mean breadth	3.78	3.86	3.65	3.77	3.93	3.83	[3] 4.00	3.84
Mean index	*88.53*	*91.46*	*92.76*	*88.33*	*88.73*	*90.88*	*85.80*	*88.58*
Nose:								
Height	5.10	5.06	4.95	4.92	5.16	4.98	[3] 4.70	4.95
Breadth	2.42	2.43	2.52	2.46	2.44	2.48	[3] 2.50	2.59
Index	*47.44*	*48.00*	*50.92*	*50.06*	*47.22*	*49.75*	[3] *53.19*	*52.34*

	Arkansas		Louisiana		Texas		
	Undeformed	Deformed	Undeformed	Deformed	Undeformed [5]	Undeformed [6]	Undeformed [7]
Number of skulls	(52)	(51)	(29)	(17)	(7)	(5)	(3)
Vault:							
Length	16.69	(16.11)	17.21	(16.40)	18.14	17.48	17.20
Breadth	13.84	(14.63)	13.98	(14.41)	12.64	13.66	14.47
Height	13.68	(13.72)	13.80	(13.71)	12.66	12.47	13.08
Cranial index	*82.95*	*(90.79)*	*81.22*	*(87.85)*	*69.69*	*78.15*	*84.11*
Mean height index	*89.57*	*(89.38)*	*89.15*	*(89.00)*	*82.23*	*80.00*	*83.79*
Module	14.74	14.81	14.91	14.84	14.48	14.54	14.93
Capacity	1,277.4	1,273.5	1,295.0	1,327.3	[3] 1,240.0	1,236.5	1,375.0
Face:							
Menton-Nasion height	11.56	11.39	11.50	11.25	10.67	[3] 11.80	[3] 11.60
Alveolar Pt.-Nasion height	7.13	7.15	7.07	6.86	6.29	7.13	6.65
Breadth	12.88	13.26	13.40	13.34	12.50	13.33	13.18
Facial index, total	*90.65*	*89.14*	*86.12*	*83.56*	*85.22*	[3] *88.72*	[3] *87.22*
Facial index, upper	*55.63*	*54.29*	*52.88*	*51.75*	*50.29*	*53.50*	*49.44*
Orbits:							
Mean height	3.53	3.50	3.45	3.49	3.21	3.34	3.30
Mean breadth	3.74	3.79	3.84	3.84	3.65	3.82	3.68
Mean index	*94.24*	*92.45*	*89.85*	*91.00*	*87.73*	*87.55*	*89.67*
Nose:							
Height	5.07	5.03	5.04	4.92	4.59	4.93	4.77
Breadth	2.54	2.50	2.58	2.60	2.51	2.67	2.40
Index	*50.08*	*49.88*	*51.48*	*52.95*	*54.67*	*54.05*	*50.35*

[3] One skull. [5] Narrow type. [6] Medium type. [7] Broad type.

U. S. GOVERNMENT PRINTING OFFICE: 1940

PROCEEDINGS OF THE UNITED STATES NATIONAL MUSEUM

issued by the

SMITHSONIAN INSTITUTION
U. S. NATIONAL MUSEUM

Vol. 87 Washington: 1940 No. 3077

FURTHER STUDIES ON THE OPALINID CILIATE INFUSORIANS AND THEIR HOSTS

By Maynard M. Metcalf

INTRODUCTION

This paper should be read in connection with "The Opalinid Ciliate Infusorians," U. S. National Museum Bulletin 120, 1923, of which it is really a revision and a second part. About 30 new species and subspecies are described; species described by others since 1923 are considered and illustrations and measurements copied; the taxonomy of the family is reviewed, as well as the data and hypotheses as to geographic distribution; and former reviews of the literature (Metcalf, 1909 and 1923a) are brought to date. Thus, Bulletin 120 and the present paper together cover the family Opalinidae as now known.[1]

The whole body of data as to geographical distribution of the parasites and the hosts is discussed in an attempt to answer a number of questions as to, e. g., place of origin of each of the several families, subfamilies, and some of the genera of Anura; the geologic period of

[1] The cytology of the opalinids described in the present monograph has not been studied in detail. The author welcomes and cordially subscribes to the findings and conclusions of his friend Dr. T. T. Chen, who, in a series of studies, has described the behavior of opalinid chromosomes during mitosis in greater detail than has been done previously. Dr. Chen has demonstrated for the first time for the opalinids the following: (1) Individuality of chromosomes; (2) diploidy; (3) the relation between chromosomes and nucleoli; (4) that the so-called "macrochromosomes" described by other investigators are not chromosomes or a distinct set of chromosomes different from the ordinary kind but parts of certain chromosomes; (5) that the so-called "midmitotic resting stage" described by other investigators is a misinterpretation, the nucleoli in the resting nucleus having been considered as chromosomes. These phenomena had escaped observation or proper interpretation by other workers, though some of them were working in the best laboratories for protozoan cytology. I have seen Dr. Chen's preparations, and I am very glad of this opportunity to refer to the skill and accuracy of his beautiful studies, which place the cytology of the opalinids on a new and sound basis.

the origin of each group of these hosts; the routes and the geologic times of the distribution of several groups of hosts; the places and times of origin of the several genera and some of the subgenera of opalinids and the routes and times of their distribution. Paleogeographic hypotheses of Arldt, Haug, Scharff, Schuchert, and others are tested by using them in connection with the distributional data from Anura and opalinids and seeing whether the hypotheses furnish reasonable explanations of the faunal data. The methods of speciation in the opalinids and the general principles of their evolution also are discussed.

ACKNOWLEDGMENTS

I have received invaluable assistance of various sorts from many sources during the course of these studies. Many institutions have contributed to the work: The Johns Hopkins University, before I was elected to the faculty, welcomed me for a year to its department of zoology and for another year to its school of hygiene; the United States National Museum gave permission to gather opalinids from its anuran collections, Dr. Leonhard Stejneger aided with many suggestions, and Miss Doris Cochran assisted by identification of species, especially of tadpoles from India and Burma; Prof. T. N. Annandale and the Indian Museum at Culcutta sent numerous Indian Anura, as also did the Colombo and Madras Museums; the National Academy of Sciences helped, with a grant of money and with introductions, toward a half-year trip to South America for collecting and study, and for this trip Prof. Vernon Kellogg, executive secretary of the National Research Council, Dr. C. D. Walcott, secretary of the Smithsonian Institution, and Dr. Leo S. Rowe, director general of the Pan American Union, gave most helpful introductions; the Oswaldo Cruz Institute, especially Prof. Adolpho Lutz, Miss Bertha Lutz, and Dr. Gualter A. Lutz, obtained for me fine collections of living Anura from Rio de Janeiro and several neighboring Brazilian states and furnished me luxurious laboratory facilities; the Institute of Hygiene and Public Health of the University of Montevideo rendered similar service; the Marine Biological Laboratory of Woods Hole, Mass., furnished much material, including a large series of tadpoles of *Rana clamitans* in all stages of development; the Zoological Museum at Ann Arbor, Mich., through the kindness of Prof. A. G. Ruthven and Mrs. Helen T. Gaige, gave a complete series of larvae of *Ascaphus truei*; Prof. C. E. McClung and Dr. C. L. Parmenter, of the University of Pennsylvania, proffered the hospitality of their vivarium for about two years to a hundred or more specimens of *Bombina igneus* and *B. pachypus*, though unfortunately the fire toads did not breed.

Many individuals also have helped greatly with material or data or both: Prof. W. A. Haswell and the late Prof. Launcelot Harrison (data on Australian Anura); Prof. W. B. Benham, of Dunedin, New Zealand (specimens of the very rare *Liopelma* and data as to its habits and development); Prof. G. E. Gates (Anura from Rangoon, Burma); Prof. Robert Hegner (Anura from the Philippine Islands); Dr. Ergastri Cordero, of Montevideo, and Dr. Carlos Porter, of Santiago de Chile (South American Anura and data); and Prof. E. V. Cowdry (two specimens of the very rare *Heleophryne regis*). Miss Margaret Cowles (Mrs. Wilson Shaffer), of Johns Hopkins University, has worked through the life history of *Opalina virguloidea* in tadpoles of *Rana sylvatica*, as well as helping in the preparation of some of the South American material. I am also indebted to Mrs. Lura Carper, of the zoological laboratory of the Johns Hopkins University, for revising the bibliography, and to Mrs. Caroline Hutzler Bernstein for copying several drawings of opalinids used.

For all this assistance from all sources and for the many personal kindnesses accompanying it I take this opportunity to express most grateful appreciation.

DESCRIPTIONS OF SPECIES AND NEW DATA AS TO HOSTS AND DISTRIBUTION [2]

Genus PROTOOPALINA Metcalf

PROTOOPALINA APPENDICULATA Fantham

FIGURE 21

Host: *Rana fuscigula* Duméril and Bibron, from Johannesburg, South Africa.

This is a distinct and very interesting species, chiefly because of the marked tail. An elongated, slender, posterior end is characteristic of numerous species of *Protoopalina*. In all of them the cilia are long at the anterior end of the body, and they usually diminish in length and in number toward the posterior end, which is free of cilia. See p. 559 for a discussion of the comparative structure of the posterior ends of different species in the several genera.

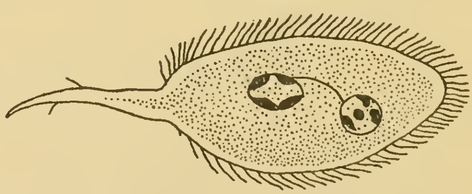


FIGURE 21.—*Protoopalina appendiculata* Fantham, × 470. (After Fantham)

Fantham's specimens measured, in microns: Length, 87–136; width, 22–51. Nucleoli are described as 2 and 4 in different indi-

[2] The drawings that illustrate this section are generally incomplete; for example, usually only a few of the cilia are drawn, or but few of the nuclei in the multinucleate species; only few of the lines of cilia are indicated and these only partially. Only enough is shown to give the features used in diagnosis of the species. A pair of dots outside the contour of the body in the drawings when found indicate the limits of the morphologically anterior end.

viduals. Mitosis was not described, and in consequence the number of nucleoli is not definitely determined.

PROTOOPALINA BIBRONII, new species

FIGURE 22

Type: U.S.N.M. No. 22621.

Host: *Pseudophryne bibronii* Günther, four infections from Australia as follows: U.S.N.M. No. 10968 from the Paris Museum; No. 63181 from Port Lincoln, Kangaroo Island; and two, Nos. 64056 and

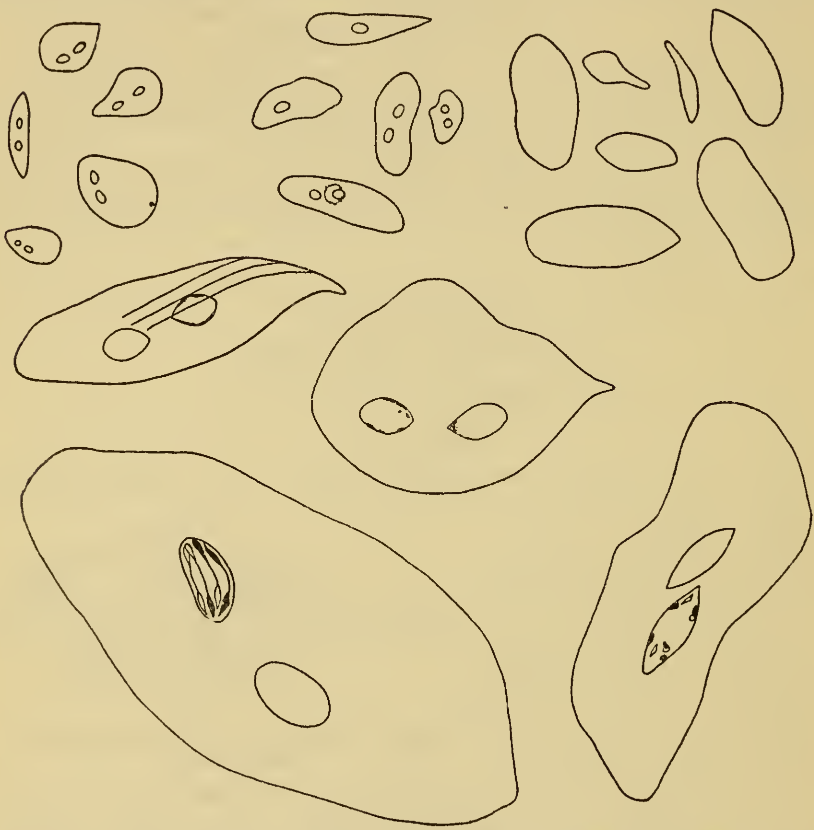


FIGURE 22.—*Protoopalina bibronii*, new species: Upper three groups of figures, × 146; other four, × 673.

64057, from Ehor, New South Wales; these and the Port Lincoln specimen collected by Hoy.

Measurements in microns: Body, 80 by 25 (average specimen), 60 by 37 (wide form), 67 by 20 (narrow form); nuclei, 21 by 6, 17 by 8, 11 by 6, 9 by 6; cilia line interval anteriorly 2, posteriorly 3. Nucleoli number 4. The infection in frog No. 63181 (fig. 22, upper left group) shows many broad, flat forms, with regions of the protoplasm abnormal, the animals containing generally a huge, irregular, lateral vacuole. Had these abnormal, partly degenerate, usually flattened forms been the only ones found, they would probably have been thought to be Zelleriellas. Indeed I so labeled the unstained specimens. Probably the host was dead some time before it and the parasites were preserved.

This species is very distinct from any of the other Australian species described. It resembles *P. intestinalis* and *P. hylarum* and is classed with them in the subgeneric group II, which contains the parasites characteristic of the bell toads.

PROTOOPALINA BORNEONENSIS, new species

FIGURE 23

Type: U.S.N.M. No. 22622.

Host: *Polypedates reinwardtii* (Boie), U.S.N.M. No. 57819, from Borneo.

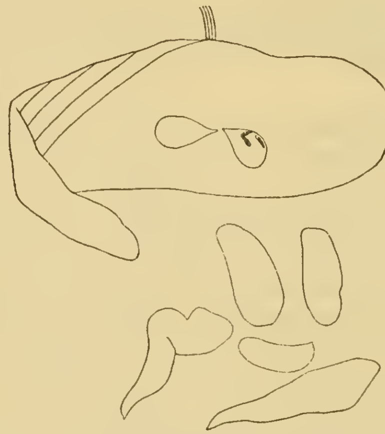


FIGURE 23.—*Protoopalina borneonensis*, new species, × 124 and 505.

Measurements, in microns: Large specimen, 200 by 36; medium individual, 140 by 40; small specimen, 89 by 30; nucleus of medium individual, 17 by 8.5; cilia length, 9.1; cilia line interval in posterior half of body, 4.1. This species somewhat resembles *P. africana* Metcalf.

"PROTOOPALINA CACCOSTERNI" Fantham

FIGURE 24

Host: *Cacosternum boettgeri* (Boulenger), tadpole, from Johannesburg, South Africa.

Measurements, in microns: Length of body, 37.3–63.6; width of body, 6.4–11; length of nucleus, 6–8; width of nucleus, 2–3. Nucleoli "3" in each end of the nucleus when found in an anaphase of mitosis.

This odd number of what appear to be daughter nucleoli seems inconsistent with the derivation of half the number of nucleoli from the male and half from the female, and observation of the sexual phenomena in several species of opalinids seems to have shown that the male and the female gamete each contribute the same number of nucleoli and that the zygote contains the double number. In several other species of opalinids an odd number of nucleoli seems to be present. How shall the puzzle be resolved? Chen (1936b) has shown that when two or more nucleoli are close together they may fuse into a single body. This offers a plausible explanation.

I have tried for a number of years to get material for restudy of the sexual phases of the life-history in some *Protoopalina*, preferably the Protoopalinas of *Bombina*, the fire toad, either *P. intestinalis* or *P. caudata*, but repeated attempts have failed. The Bombinas, although successfully imported and living for more than a year in vivaria, do not breed. When freed by the dozens into apparently suitable environments they are not seen again. And freshly imported specimens, arriving before the eggs are laid, do not breed or even copulate, and if set free disappear. The restudy of the sexual phenomena must apparently be done in Europe if *Protoopalina* is to be used, but *Zelleriella* might be better as shown by the recent work of Chen (1936a and b). Metcalf (1909) failed to distinguish between the real chromosomes and other nuclear structures.

FIGURE 24.—"*Protoopalina caccosterni*" Fantham, × 100. (After Fantham.)

Items of interest to take into account in connection with Fantham's report of three nucleoli in daughter nuclei of *P. caccosterni* are: (a) The appearance of three nucleoli in daughter nuclei of *P. ovalis* (fig. 30) and of five nucleoli in the nuclei of several multinucleate species; (b) the presence of one large and three small nucleoli in each nucleus of *P. axonucleata lata* (see Metcalf, 1923a), the nucleoli not being in pairs, and of *P. meridionalis* (fig. 28); (c) the presence of one large nucleolus and a chromatin skein in the nuclei of cysts and of young forms of *Opalina chattoni* (Weill, 1929); (d) the presence of one large nucleolus and of scattered small chromatin granules in nuclei of adults of *O. nucleolata* (p. 538); (e) the transverse division of nucleoli in *Protoopalina intestinalis* and *P. caudata* at about the time of the ill-defined equatorial plate stage (Metcalf, 1909), and the appearance of longitudinal splitting of the nucleolus in the telophases of the same nuclei (Metcalf, 1909, cf. Konsuloff, 1922); [Are the apparently daughter nucleoli in the anaphases and telophases in *Protoopalina* really double?] (f) the origin of the nucleoli in the postsexual stages of the life history. These and other items should be studied.

We should realize that "*P. caccosterni*" is reported only from tadpole hosts. It may not be a *Protoopalina* at all but may be the *Protoopalina*-stage in the development of a *Cepedea* or an *Opalina*, though this is very unlikely, since no individuals with more than two nuclei are reported and tadpoles naturally infected would probably show parasites of different ages, the older of which would be multinucleate if the adults were *Cepedea* or *Opalina*.

PROTOOPALINA [CAPENSIS, new species]

Host: *Heleophryne regis* Hewitt.

Through the kindness of Dr. E. V. Cowdry I obtained two specimens of this very rare and extremely interesting little frog, collected by Dr. John E. Rex at Eastford, Krupna, Cape Province, South Africa. They were preserved in formalin and after some weeks were transferred to alcohol, not a satisfactory method of preservation, since formalin allows deterioration of the opalinids. One frog, 44 mm. long, now deposited in the U. S. National Museum as No. 67842, contained numerous Protoopalinas, slenderly pointed behind and belonging evidently to what I have described as the most archaic subgeneric group of this most primitive genus. The other frog showed no opalinids.

Heleophryne was regarded by Hewitt as a leptodactylid, and such it appears to be from its external appearance and its arciferous shoulder girdle. But the leptodactylids are a family of southern South American origin, which colonized Australasia, entering by way of Antarctica. They are unknown in Africa except for *Heleophryne*, which is represented there by only two species. Is *Heleophryne* a true leptodactylid and, if so, how did it get from Patagonia to Africa? In South America and Australasia the characteristic opalinid of the Leptodactylidae is *Zelleriella*. If *Heleophryne* in South Africa carried *Zelleriella*, an opalinid that was evolved in South America in the Leptodactylidae and was carried wherever the Leptodactylidae have spread, it would clinch the evidence for the leptodactylid nature of *Heleophryne* and its origin from South American ancestors. It was this consideration that led Professor Cowdry to undertake to get for me specimens of *Heleophryne*.

Zelleriella was not found, but rather a species of a more archaic group, representative of which are found in Patagonian and Australasian leptodactylids, in Papuan Hylas, and in tropical African Pipidae (Xenopodinae), and so the question of the origin and relationships of *Heleophryne* is still open. Its parasite is consistent with *Heleophryne*'s origin from a South American leptodactylid but does not clinch this hypothesis as finding *Zelleriella* would have done. If such was the origin of *Heleophryne*, the spread from Patagonia to Africa was later than the origin of leptodactylids in Patagonia, and this was later than the separation of Australasia from Asia in the early Cretaceous period, probably considerably later. Interpretation of *Heleophryne* as a leptodactylid indicates connection between South America and Africa at least as late as the middle Cretaceous period.

Dr. Stejneger, however, has expressed doubt of the leptodactylid affinities of *Heleophryne*, in spite of its resemblance, suggesting that it may well be a ranid in a state of arrested development. Its parasite throws no light upon this suggestion.

I am unable to give illustrations of the *Protoopalina* from *Heleophryne*, to which when found I gave the provisional name of "*capensis*, new species." In some way, not understood, during my several years of illness the material has disappeared. It was of such unique interest that I separated it from the material of about 30 other species still to be studied, and placed it so carefully away that with all my searching it has not reappeared. Apparently moving my laboratory and getting settled in a new place, when I was too ill to give it proper attention, led to the disappearance of this especially prized material. The provisional name must not be accepted without more adequate description and the preservation of a type specimen. I gave it only for convenience of reference. The fact of the infection of a specimen of *Heleophryne regis* by a *Protoopalina* of the most primitive subgenus is, however, definitely recorded.

PROTOOPALINA CAUDATA MICROHYLA Nie

FIGURE 25

Host: *Microhyla ornata* Duméril and Bibron, Indian Mus. No. 17287, sent by Professor Annandale; collected at Harnai, Ratnagiri District (south of Bombay), among mountains.

Measurements, in microns: Body, 147.7 by 43.3; nucleus, 14 by 8.5; cilia length, 9.7. Apparently 6 (?) nucleoli.

This form resembles *P. caudata*. Its posterior end is slightly pointed in a few specimens. Its measurements are about as in *P. c. discoglossi*.

PROTOOPALINA DORSALIS (Raff)

FIGURE 26

Host: *Limnodynastes dorsalis* (Gray). I have had one good infection from a frog 54 mm. long (U.S.N.M. No. 64043) from Busselton, Western Australia, collected by C. N. Hoy, June 8, 1920.

Measurements, in microns: Body, 240 by 60, 100 by 68, 180 by 33; nucleus, 25 by 8.9; cilia length, 9.8. Nucleoli, 4.

My specimens belong apparently to Raff's species. They are somewhat intermediate in appearance between *P. caudata* and *P. intestinalis*. I am therefore placing *dorsalis*, along with *P. peronii*, in group II with them.

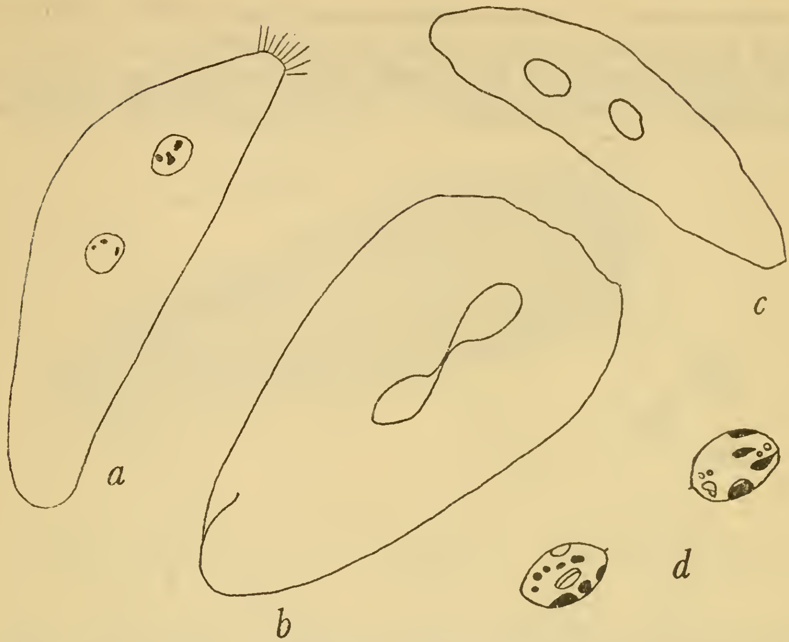


FIGURE 25.—*Protoopalina caudata microhyla* Nie: *a–c*, × 460; *d*, × 1010; *b*, a daughter cell just from transverse division (?); *d*, nuclei of an ordinary individual.

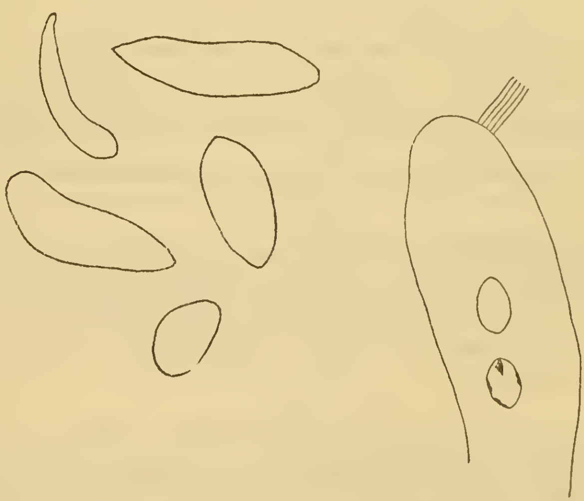


FIGURE 26.—*Protoopalina dorsalis* (Raff), × 117 and 505.

PROTOOPALINA LUZONENSIS, new species

FIGURE 27

Type: U.S.N.M. No. 22624.

Host: *Kaloula picta* (Eydoux and Souleyet), a gastrophrynid, from Luzon, Philippine Islands, U.S.N.M. No. 57758, 32 mm. long, very abundant infection.

Measurements, in microns, for some individuals: Body, 313 by 80, 70 by 23; nucleus, 19 by 19, 20 by 15; cilia length, 9.

The widely separated nuclei with no connecting thread help to distinguish this very long species. *P. hylarum* (Raff) has this same

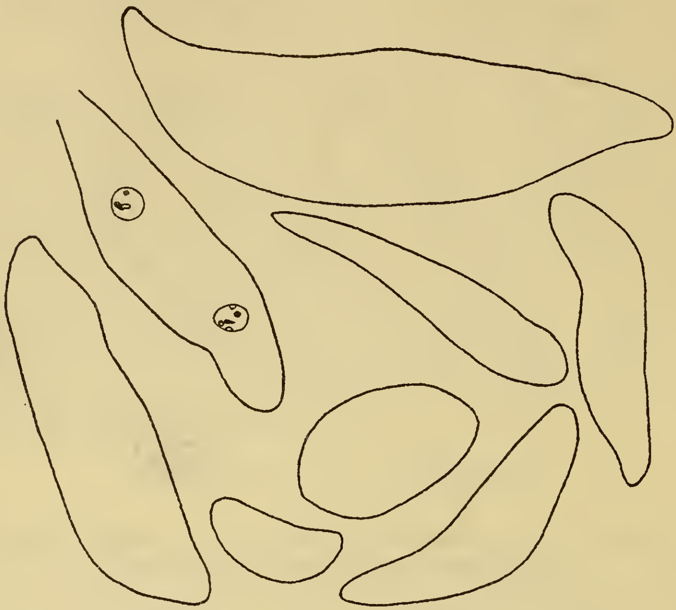


FIGURE 27.—*Protoopalina luzonensis*, new species, × 249.

feature, but it is nearly twice as large (linear measurement) and its nuclei are smaller. The number of nucleoli is undetermined.

PROTOOPALINA MERIDIONALIS Fantham and Robertson

Figure 28

Host: *Rana delalandii* (Tschudi), from Johannesburg, South Africa.

Measurements, in microns (given by Fantham): Body length 80–240, width 24–80; nuclei length 10–20, width 7.5–12.5. Note the large nucleolus in each of the nuclei in figure 28, *b* (cf. the dimensions under *P. caccosterni*).

PROTOOPALINA MOSSAMBICENSIS Metcalf (?)

Fantham found what he regards as this species in the same host, *Rana adspersa* Tschudi, from Johannesburg, South Africa. The measurements, in microns, he gives are: Body, 127 by 50. He reports the nuclei as "spherical to ellipsoidal." The specimens described by Metcalf (1923a) from Mozambique have slender, spindle-shaped nuclei even in the cysts, though one cyst is drawn with an unusually large, nearly spherical nucleus. In the adults Metcalf found the slender nuclei united always by a thread. The specific identity of the Johannesburg and the Mozambique forms seems doubtful.

PROTOOPALINA NYANZA Lavier

Host: *Varanus niloticus* Linnaeus, from the shores of Lake Victoria Nyanza. This is probably an adventitious, temporary infection due to the host having eaten the natural, anuran host. It is unlikely that

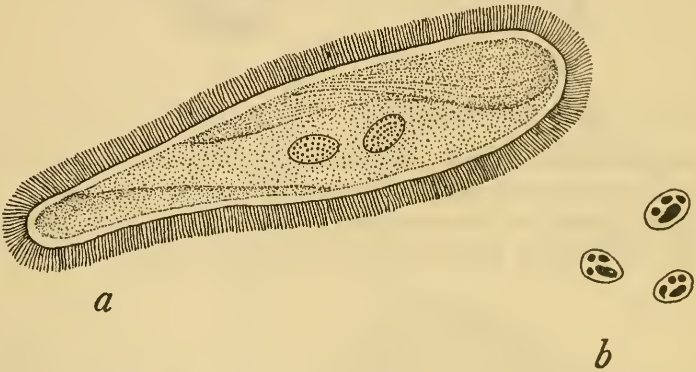


FIGURE 28.—*Protoopalina meridionalis* Fantham and Robertson: *a*, × 350; *b*, three nuclei, × 400. (After Fantham.)

a lizard would have aquatic breeding and feeding habits that would allow propagation of its opalinid parasites, at least without an intermediate host.

Lavier gives no drawings. The chief points on his description are as follows: Elongated, circular in cross section or some individuals a a little flat; length of body 88–212μ, width of body 20–43μ; nucleus length 13–20μ, width 8–12μ; posterior spine 8–9μ long. The resting nucleus shows 4 nucleoli. A unique (?, see Leger and Duboscq, 1904, *Protoopalina saturnalis*) band of nucleolar substance occupies three-quarters of the equator of the spindle and makes it difficult to count the individual nucleoli. Anterior cilia 22–25μ long, the posterior ones grading down to a length of 6μ; cilia line interval 3μ in front, 3.5μ behind. The whole length of the body is ciliated except the posterior spine. The oval endospherules are 1–2μ.

PROTOOPALINA OCTOMIXA Fantham

FIGURE 29

Host: *Bufo carens* A. Smith, from Johannesburg, South Africa.

Measurements given, in microns: Body length 175–425, width 55–140; nucleus length 26–36, width 18–27. Nucleoli 4.

PROTOOPALINA OVALIS Fantham

FIGURE 30

Host: *Rana fuscigula* Duméril and Bibron, from Johannesburg, South Africa.

Measurements, in microns: Body length, 76–156.3, width, 30.8–84; nucleus length, 10–19, width, 4.5–14. Nucleoli 6 in large individuals,

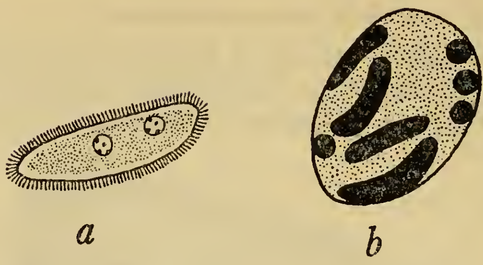


FIGURE 29.—*Protoopalina octomixa* Fantham: *a*, × 75; *b*, a nucleus, × 800. (After Fantham.)

3 in daughter cells with their nuclei recently from division (Fantham's fig. 6) (see dimension under *P. caccosterni*).

Fantham figures an arrangement of the lines of cilia that differs markedly from any I have ever found in any opalinid. In all other

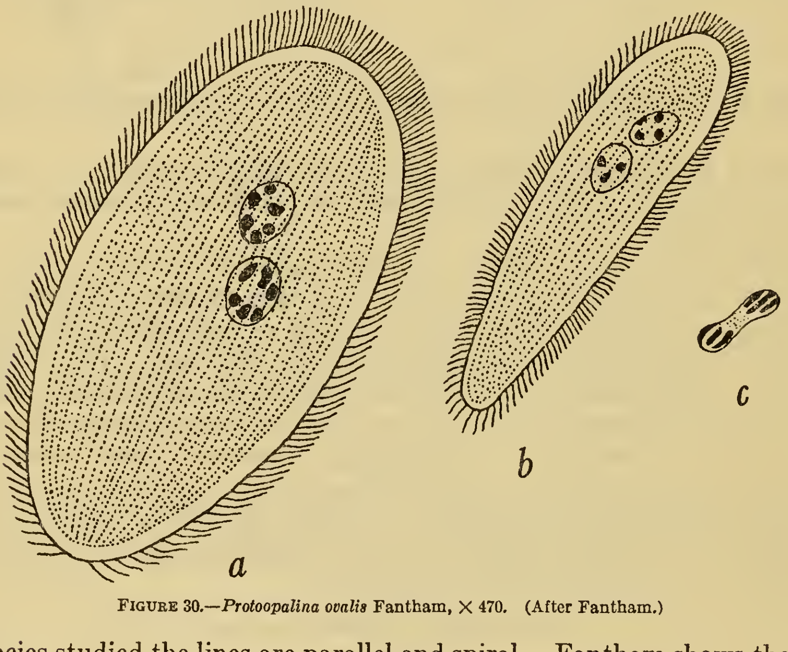


FIGURE 30.—*Protoopalina ovalis* Fantham, × 470. (After Fantham.)

species studied the lines are parallel and spiral. Fantham shows them as converging to the two ends of the body. It would be well to reobserve these animals as to this feature. The lines of cilia were not discovered in my rather poorly preserved *P. ovoidea* (Metcalf, 1923a).

PROTOOPALINA STEJNEGERI Metcalf

FIGURE 31

Host: *Ascaphus truei* Stejneger, from the Olympic and Siskiyou Mountains in extreme Northwestern United States.

For the sake of having all known opalinids at least briefly mentioned in U. S. National Museum Bulletin 120 or in this paper, which is really a second part of that bulletin, I am copying some of the figures and part of the data from my former descriptions published elsewhere.

Measurements, in microns: Length of body 170 (large), 124 (medium), 62 (small); width of body 24 (large), 23 (medium), 17

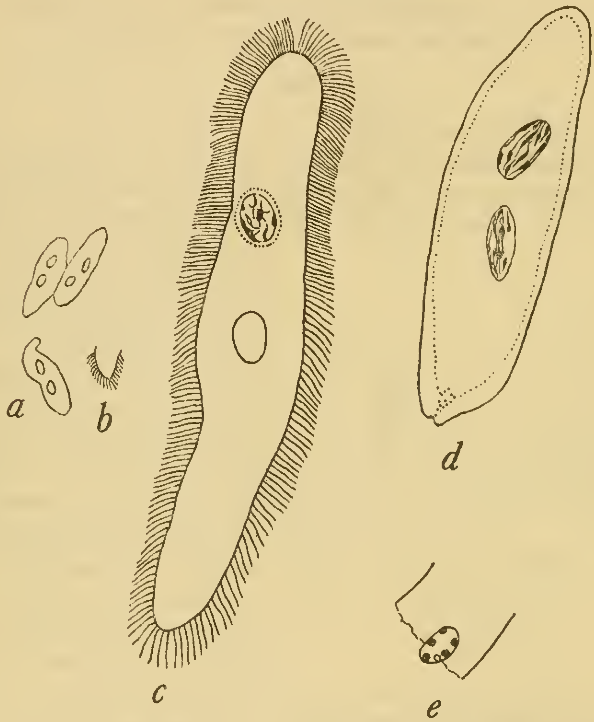


FIGURE 31.—*Protoopalina stejnegeri* Metcalf: *a*, Three individuals, × 50; *b*, posterior end of an individual slightly more magnified; *c* and *d*, × 450; *e*, × 400. (From Metcalf, 1928a.)

(small); length of nucleus 14 (large), 13 (medium), 7 (small); width of nucleus 9 (large), 8 (medium), 6 (small); cilia length 10–12; nucleoli 6.

PROTOOPALINA TRANSVAALENSIS Fantham

FIGURE 32

Host: *Bufo regularis* Reuss, from Johannesburg, South Africa.

Measurements of ordinary individuals, in microns: Body length 318–506, width 65–125. A young individual measured 165μ long and 53μ wide, a precystic individual measuring 96μ long and 28μ wide, a binucleate individual just hatched from the cyst measuring 46μ long and 18μ wide.

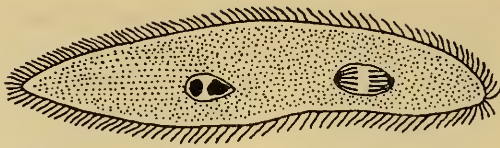


FIGURE 32.—*Protoopalina transvaalensis* Fantham, × 160. (After Fantham.)

PROTOOPALINA XAMACHANA, new species

FIGURE 33

Type: U.S.N.M. No. 22625.

Host: *Eleutherodactylus luteolus* (Gosse), a leptodactylid, from Jamaica, West Indies. Two preserved specimens of this host were examined, both collected by W. Harris, August 18, 1905. One showed no infection; the other, 29 mm. long, was abundantly infected. Two elongated nuclei, often dumbbell-shaped, with 4 nucleoli in each end, are usually found. The yellow hosts along with their eggs were found by Harris in the water in the cups at the bases of *Bromelia* leaves growing as epiphytes on trees on Mount Diabolo. It is interesting that these "aquatic" tadpoles in *Bromelia* leaf cups are infected like other aquatic tadpoles that live in much larger pools.

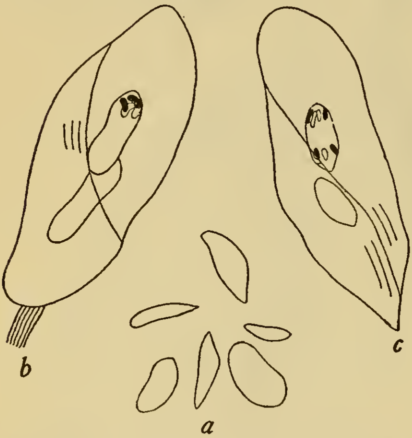


FIGURE 33.—*Protoopalina xamachana*, new species: *a*, × 124; *b* and *c*, × 505.

Measurements, in microns: Body 90 by 40, 90 by 30, 52 by 14; nucleus (elliptical, in anaphase) 18.1 by 7.1, nucleus (dumbbell-shaped, early telophase) 27 by 6.1; cilia length 10; cilia line interval 2; nucleoli 4. A few of the animals show a slight posterior point. The character of the nuclei places this species in group V.

PROTOOPALINA XENOPODOS Metcalf

I described this species from *Xenopus calcaratus* Buchholz and Peters, from the Belgian Congo. Fantham describes what he regards as the same species from *X. laevis* from Johannesburg, South Africa.

Fantham gives measurements, in microns, as follows: Body length 82–144, width 14–27; one ciliate 156 long and 31 wide; tailed gamete from tadpole 44.2 by 5.8. Nucleoli 4 (Fantham says 8 but shows 4 at each end of the dividing nucleus).

PROTOOPALINA YUNNANENSIS, new species

FIGURE 34

Type: U.S.N.M. No. 22626.

Host: *Bombina maxima* (Boulenger), from the Province of Yunnan, southwestern China, at the eastern end of the Himalaya highlands.

In the only specimen of this bell toad that I had for examination (U.S.N.M. No. 86068) four distorted Protoopalinas were found. Figure 34, *a*, shows the least distorted specimen, and figure 34, *b* and *c*, show single nuclei from pairs in two others. The nucleoli are fragmented in each case.

Measurements, in microns: Body about 230 by 46; nucleus (the longer) 18 by 10.

This species differs from *P. luzonensis* in having the nuclei near together in the center of the body instead of far apart (one far forward, the other near the middle). They are probably distinct. This is the species referred to, but not described, in my paper on the bell toads and their opalinid parasites (Metcalf, 1928a).

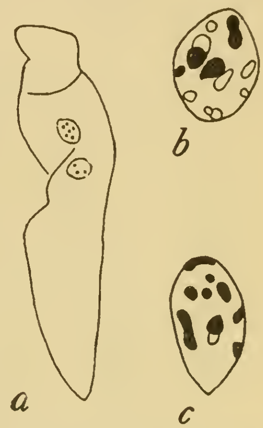


FIGURE 34.—*Protoopalina yunnanensis*, new species: *a*, ×249; *b* and *c*, the nuclei (from a second and a third individual) ×1010.

PROTOOPALINA YUNNANENSIS CHENI, new subspecies

FIGURE 35

My friend Dr. T. T. Chen sent me slides and drawings of Protoopalinas from *Bombina maxima* Boulenger collected in Yunnan, and he has kindly allowed me to include his form in this paper. It is much larger and has larger nuclei than *yunnanensis*, and in every individual seen the nuclei are united by a thread.

In each of the other species of *Bombina* studied—*igneus*, *pachypus*, and *orientalis*—there are found two species of *Protoopalina*. *Bombina igneus* and *B. pachypus*, occurring in Europe, each carry (but not in the same individual) *P. caudata* and *P. intestinalis*. *Bombina orientalis*, which is found in an extensive region centering around the base of the Korean Peninsula, carries (also in separate individual hosts) *P. macrocaudata* and *P. orientalis*. *Protoopalina caudata* has 6 nucleoli; *P. intestinalis* and *P. macrocaudata* have 8; their number is undetermined in *P. orientalis*, *P. yunnanensis*, and the form *cheni*.

Protoopalina yunnanensis and *P. cheni* more nearly resemble each other than do either of the other pairs of Protoopalinas in a species of *Bombina*, and we can indicate this by classing, say, *cheni* as a subspecies of *yunnanensis.* It would, however, seem well to know the number of at least the nucleoli in the two Protoopalinas from *Bombina maxima* before deciding more than tentatively as to specific or subspecific divergence between them. If the numbers of the

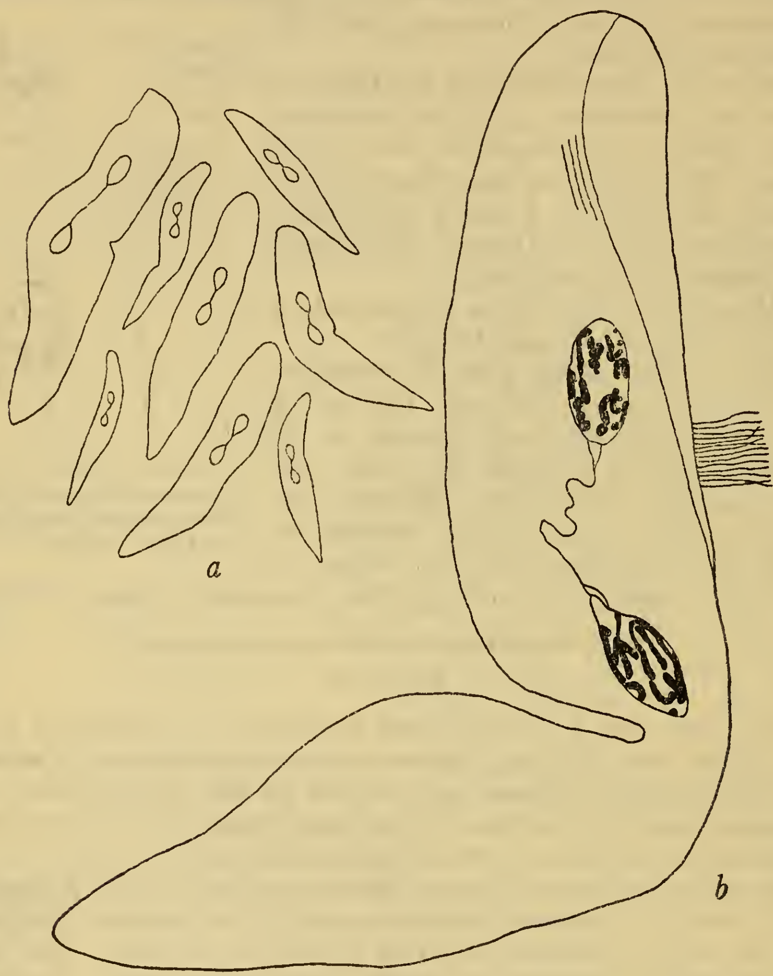


FIGURE 35.—*Protoopalina yunnanensis cheni,* new subspecies: *a*, A group of individuals from one infection, × 133; *b*, an individual × 482.

nucleoli are different in the two forms it would seem natural to class them as separate species. Among the specimens of the form Dr. Chen has sent me are none that show mitosis, and so nucleolus number has not been determined.

Bombina maxima occurs in the probable ancestral home of the Discoglossidae (see Stejneger, 1905), and its Protoopalinas may well be the most archaic of the species infecting the Bombinas. The most probable view of the origin of the Bombinas and their Protoopalinas seems to be that *B. maxima* is the most ancient of the four hosts and that its two closely similar Protoopalinas show an early condition of evolutionary divergence. In *B. orientalis*, during its wandering to its present home near the base of the Korean Peninsula and during its subsequent residence there, the two Protoopalinas, probably already present, diverged still farther to give the now very distinct species *P. macrocaudata* and *P. orientalis.* Two Bombinas, or perhaps their common ancestor, wandered north from southwestern China and turned westward to reach Europe. During this extensive period of migration and of residence in the west, the species evolved into two, one, *B. igneus*, now living in the low country, the other, *B. pachypus*, living among the hills, although their habitats overlap. *B. igneus* breeds usually in larger pools of still water or in sluggish streams, while *B. pachypus* is more likely to lay its eggs in small, perhaps transient, pools, even in puddles in wheel ruts. Probably as a result of their overlapping habitats and the consequent at least occasional common breeding pools, the two hosts still carry the same two species of *Protoopalina.* If the altitude preferences of the two species of *Bombina* should become more sharply distinct, causing them to breed always in separate pools, *B. igneus* only at low altitudes, *B. pachypus* only at higher altitudes, opportunity would be given for evolution to develop in each host its own distinctive two species of parasites, as has occurred in *B. orientalis.*

Measurements, in microns, of *Protoopalina yunnanensis cheni:*

Measurement	*a*	*b*	*c*
Length of body	400	450	250
Width of body	83	90	------
Length of daughter nuclus	52	43	------
Width of daughter nucleus	20	21	------
Length of cilia	24	------	------
Interval between lines of cilia, anterior	1. 3	------	------

PROTOOPALINA LIMNOCHARIS Nie

FIGURE 36

Host: *Rana limnocharis* Gravenhorst, from Nanking, China.

Body is rather flattened and about 10 times as long as broad. The greatest width is at a region a little anterior to the middle of the body, and from there the body tapers very gradually toward the ends.

The two pear-shaped nuclei are connected by a long thread. The anterior nucleus is situated at about the anterior sixth, while the posterior one lies a little anterior to the middle part of the body. Each nucleus contains about 10 nucleoli of different size and shape and irregularly disposed.

166877—40——2

The layer of ectosarc is rather thick and consists of very large and prominent alveoles. The endospherules in the endosarc are large, being ellipsoidal, rounded, or pear-shaped.

Measurements for a number of specimens, in microns: Length of body 238–428.4, width 22.8–36.1; length of nucleus 22.8–26.6, width

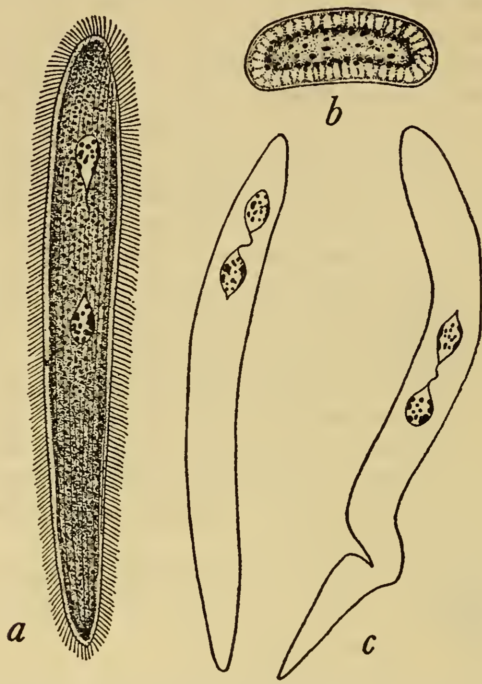


FIGURE 36.—*Protoopalina limnocharis:* *a*, Structure of the animal, × ca. 250; *b*, cross section, posterior to the midregion, × ca. 500; *c*, two young animals soon after binary fission, × ca. 250. (After Nie.)

9.5–13.3. The measurements of some of the endospherules show the average length to be 2.7μ, and the average width 0.9μ. The measurement of the cilia line interval of one animal was 1.9μ on the anterior end and 3.4μ on the posterior end.

This species seems to be closely related to *Protoopalina filiformis* Metcalf (1923a). It differs from the latter mainly in number of nucleoli (6 in *P. filiformis*). The body is more flattened and the endospherules are much larger as compared with *P. filiformis*.

PROTOOPALINA PINGI Nie

FIGURE 37

Host: *Rana plancyi* Lataste, from Nanking, China.

This species is relatively small. The body is somewhat spindle-shaped, the posterior end being narrow or sharply pointed while the anterior end is somewhat narrow and rounded. The animal is usually bent to one side at the anterior end. The layer of ectosarc is fairly thick. The endosarc in the axial region of the body contains numerous endospherules, and 4 to 6 (usually 4) ellipsoidal or rounded nuclei. The number of the nucleoli, as seen in midanaphase, are distinctly 6.

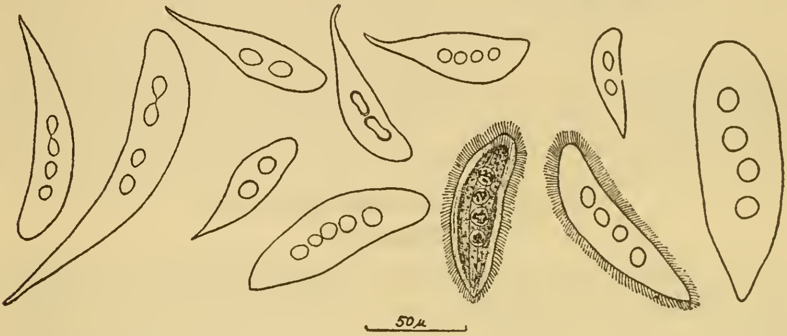


FIGURE 37.—*Protoopalina pingi* Nie: A group of individuals showing the range of size and shape. (After Nie.)

In a number of animals measured length of the body varies from 55 to 160 μ, width of the body from 12.5 to 26 μ, diameter of the nucleus from 10 by 5 μ to 12.5 by 7.5 μ.

Genus ZELLERIELLA Metcalf

ZELLERIELLA BRASILIENSIS (Pinto)

FIGURE 38

Host: *Crossodactylus gaudichaudii* Duméril and Bibron, from Rio de Janeiro, Brazil, one specimen, 16 mm. long, uninfected, and a

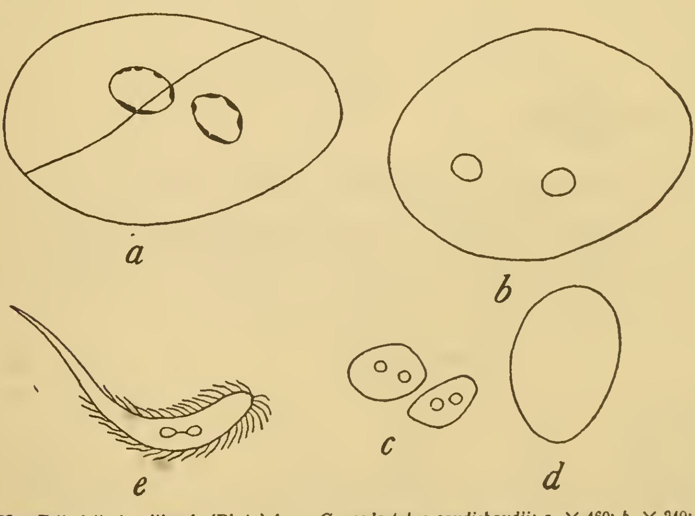


FIGURE 38.—*Zelleriella brasiliensis* (Pinto) from *Crossodactylus gaudichaudii*: *a*, × 460; *b*, × 249; *c*, × 117; *d*, × ?; *e*, × 1010.

second, 31 mm. long, very abundantly infected; also a tadpole, 55 mm. long, in which were found some *Protoopalina*-like larvae.

Measurements, in microns:

Measurement	*a*	*b*	*c*	*d*	*e*	*f*	*g*
Body length	165	100	86	50	40	72	20
Body width	128	65	61	25	14	100	84
Nucleus length	18. 7	19	15	5	2	12	9. 1
Nucleus width	15	13	13	4	1. 2	-----	-----
Cilia line interval	-------	-----	----	----	------	-----	1. 8

ZELLERIELLA BRASILIENSIS (Pinto) (?)

FIGURE 39

In a tadpole of *Leptodactylus ocellatus* (Linnaeus) from Manguinhos, Rio de Janeiro, Brazil, were two sorts of opalinids, one *Zelleriella*

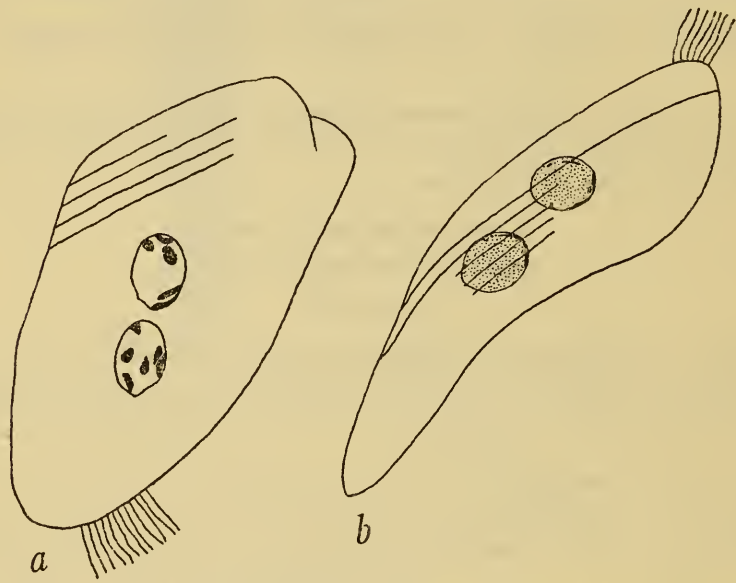


FIGURE 39.—*Zelleriella brasiliensis* (Pinto) (?) from a tadpole of *Leptodactylus ocellatus*, × 820.

(fig. 39), the other *Cepedea*. The tadpole measured (in mm.): Total length 59, length of body 18, length of hind legs 12; no forelegs visible.

The Zelleriellas measured, in microns:

Measurement	*a*	*b*
Body length	82	90
Body width	39	22. 5
Nucleus length	12. 2	12
Nucleus width	8. 3	9
Cilia length	9	9
Interval between lines of cilia	2	2

Nucleoli seemingly 6, but they were not observed in anaphases of mitosis, where they are most easily and reliably counted. The second individual shown in the figure (fig. 39, *b*) seems almost a *Protoopalina* and represents, doubtless, a *Protoopalina* stage in the development. The species is probably *brasiliensis*, the usual one found in *Leptodactylus ocellatus*, but study of more material would be necessary to determine. The *Cepedea* present in the same tadpole is described on page 512. There are in the infection a number of individuals that are abnormal, as indicated by one of their two nuclei staining uniformly dark with Delafield's haematoxylin (fig. 39, *b*).

ZELLERIELLA URUGUAYENSIS, new species

FIGURE 40

Type: U.S.N.M. No. 22627.

Host: *Bufo arenarum* Hensel. Five specimens from Montevideo were infected; 16 from the same locality carried a huge *Zelleriella* up to four times as large (linear dimensions) as Pinto's *Z. brasiliensis*, with which it might carelessly be confused.

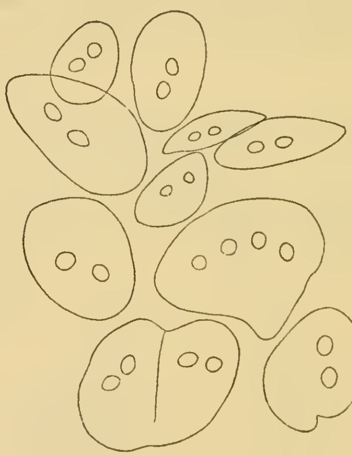


FIGURE 40.—*Zelleriella uruguayensis*, new species, from *Bufo arenarum*, × 59.

The largest specimens of Pinto's species (I have studied his slides) are much smaller than the smallest from *B. arenarum*, and the nuclei are situated farther back in the body. The largest individuals of *Z. magna*, from Venezuela, in *Leptodactylus typhonius* (Daudin) are as large as the smallest specimens in *B. arenarum*, but the shape is very different. The largest *Z. opisthocarya*, from Nicaragua, in *B. coniferus* Cope are as large as medium-sized specimens from *B. arenarum* and they agree in shape, and the position of the nuclei is usually well back on the body, but the nuclei are but half as large as in the Montevideo species. This is clearly distinct.

Measurements, in microns:

Measurement	*Dividing, 4 nuclei*	*Large*	*Medium*	*Small*
Body length	338	441	327	245
Body width	401	247	195	140
Nucleus length	55	65	44	25.7

The nucleoli are probably 6 in number.

Two individuals were found broader than long and with four nuclei in a line across the much widened body. I interpret this as due to the delay of one longitudinal division. A much-elongated individual with 10 circular nuclei I interpret as due to repeated nuclear division without fission. The direction of the rows of cilia in this specimen is nearly transverse to the greatest length of the body. The condition is still more abnormal than that shown in the 4-nucleated forms, more than two morphologically longitudinal fissions having been omitted and the "width" having become greatly overdeveloped. The host of these Zelleriellas had been kept in captivity for about 10 days before its parasites were studied.

ZELLERIELLA URUGUAYENSIS QUADRATA, new forma

FIGURE 41

Type: U.S.N.M. No. 22628.

Host: *Bufo dorbignyi* Duméril and Bibron.

In this host from Rio de Janeiro, and perhaps also from Montevideo (records confused), are many infections containing individuals

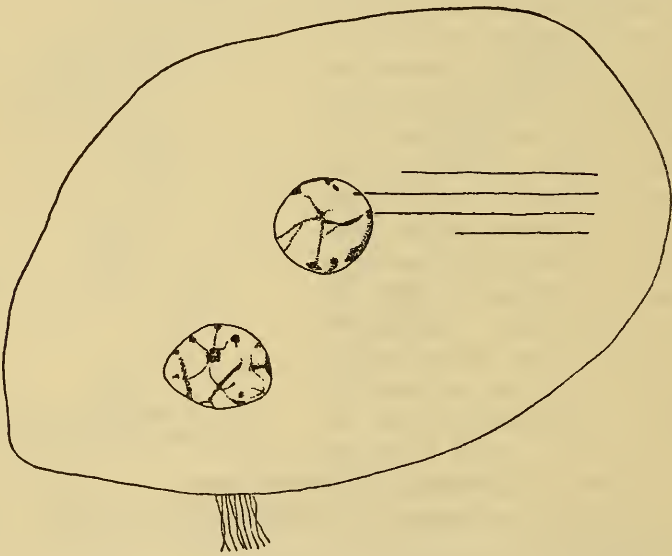


FIGURE 41.—*Zelleriella uruguayensis quadrata*, new forma, from a tadpole of *Bufo dorbignyi*, × 750.

shaped like and as large as small *Z. uruguayensis*, and they have as large nuclei; among these are other individuals having a more or less truncate posterior end. Comparison with undeveloped *Z. antunesi*, to be described, from tadpoles of *Bufo crucifer* suggests that the broadly truncate condition is due to what is really an undeveloped point or rudimentary tail at one posterior angle, the other being rounded. In some individuals the posterior end appears split, the nascent point being demarcated by a furrow at its base from the rest of the posterior end of the body. This is an intermediate condition between the "species" *uruguayensis* and *antunesi*. I am describing it as a form of *Z. uruguayensis*.

Measurements, in microns:

Measurement	*a*	*b*	*c*	*d*	*e*
Body length	276	268	223. 8	------	-----
Body width	184	214	156	------	-----
Nucleus length	34. 4	36	25. 2	57. 2	35. 2
Nucleus width	26. 8	24	25. 2	21. 2	30
Cilia line interval, posterior	3	-----	-------	------	-----
Cilia line interval, anterior	2. 5	-----	-------	------	-----

Nucleoli 6.

The form *quadrata*, with the same general measurements, is found also in *Bufo crucifer*.

ZELLERIELLA ANTUNESI Pessôa

FIGURES 42, 43

Hosts: *Leptodactylus ocellatus* (Linnaeus), *Bufo crucifer* Wied, *B. dorbignyi* Duméril and Bibron, and *B. arenarum* (Hensel).

In these four hosts at Rio de Janeiro and at Montevideo there are Zelleriellas that it is difficult to distinguish, for after study of many infections one realizes that they seem to grade into one another. One form, *Z. antunesi*, is astonishing. It is usually quite distinct, but in a few infections its most distinctive character, the remarkable tail, is but little developed. When the tail is in the usual condition, the body of the animal is almost double, consisting of a lower portion without tail and a second upper portion fused in front with the lower, but becoming more and more elevated behind, until at the back of the body it forms a high, narrow ridge, which is drawn out to a cylindrical, pointed tail projecting upward and backward to a distance almost equal to half the length of the body. Study of individuals in which the tail is developed to varying degrees, especially those infrequent individuals in which it is almost rudimentary, shows that in its fundamental morphology the tail is the posterior point that occurs in many species of all four genera of opalinids. It will be discussed later.

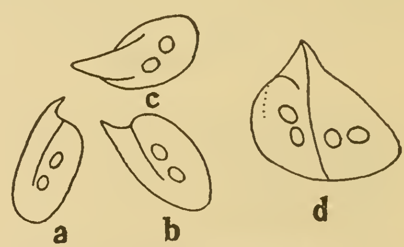


FIGURE 42.—*Zelleriella antunesi* Pessôa: *a–c*, From *Bufo crucifer; d*, from *Leptodactylus ocellatus*. All ×117.

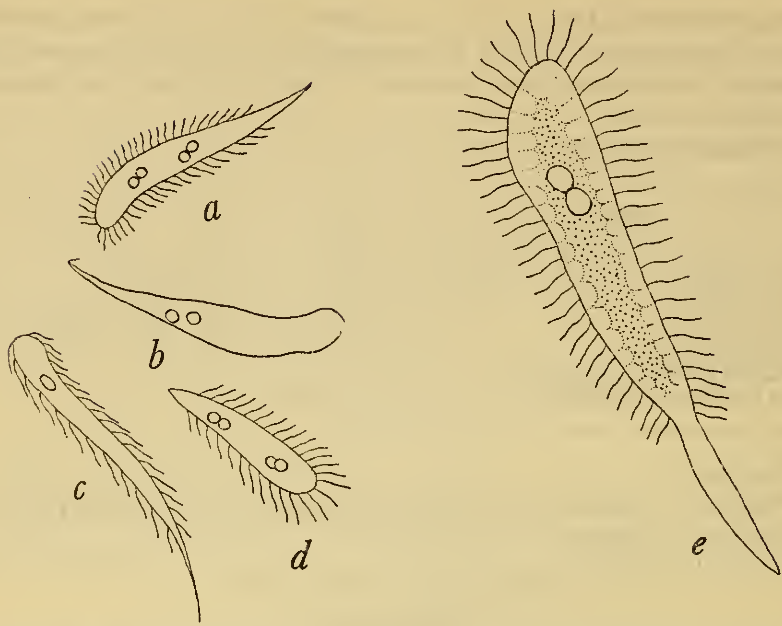


FIGURE 43.—*Zelleriella antunesi* Pessôa (?) from tadpoles of *Bufo crucifer:* Free-hand drawings from life or from nonpermanent specimens treated with acetic acid or with acetocarmine. Magnifications not recorded. All are in *Protoopalina*-larval stages.

Measurements, in microns, of 4 individuals—*a*, *b*, and *c* from *Bufo crucifer*, *d* from *Leptodactylus ocellatus:*

Measurement	*a*	*b*	*c* (in fission)	*d*
Length of main body	89	121	----------	100
Length to tip of tail	146	149	175	125
Width of body	68	70	23	60
Length of nucleus	22.9	23	23	17
Width of nucleus	12.8	13.9	15	12.3

ZELLERIELLA ANTUNESI QUADRATA, new forma

Type: U.S.N.M. No. 22629.

Host: *Bufo crucifer* Wied, from Rio de Janeiro, Brazil.

Of 24 individuals of this toad, 12 were uninfected with opalinids, 5 bore abundant *Z. antunesi*, 2 showed *Z. uruguayensis*, and 5 bore intermediate forms either with slight tails or a peculiar angular contour, not protuberant, where a tail might have developed. These last might almost be called forma *quadrata*. Their small nuclei differentiate them from the species *uruguayensis*. In a small pond, with some adult toads, were many tadpoles; of those examined several bore interesting small Zelleriellas, with tails developed to different degrees, but none were found of fully adult shape. In one smaller tadpole were *Zelleriella* larvae in the *Protoopalina* stage and other cells that perhaps were stages in the development of male gametes.

Figure 43 shows free-hand sketches from living parasites or nonpermanent preparations from tadpoles of *B. crucifer*. They resemble Protoopalinas of what I have considered the most archaic subgeneric group. They have elongated posterior ends, slender, unciliated, and sharp-pointed. One, not drawn, shows two nuclei still united by a thread after division. Another shows a single nucleus with several axial excretory vacuoles in front of and behind it. These individuals may represent *Zelleriella* larvae in a *Protoopalina* stage or they may be stages in the development of male gametes. These forms from the tadpole host were studied with a magnification of 1,010 diameters after staining with acetocarmine and were not kept.

Of 28 adult specimens of *Leptodactylus ocellatus* from Rio de Janeiro, 15 bore no opalinids, 13 were infected with large or small Zelleriellas. Fourteen of these frogs had been in captivity for six weeks or more, and on this account the opalinids may have disappeared from some of them. Some of the parasites were *Z. uruguayensis*, some *Z. brasiliensis*, a few were *Z. antunesi*, and some were intermediate, such as I am calling forma *quadrata*. In one individual typical *Z. brasiliensis* and *Z. antunesi* were present, their nuclei being large in *antunesi* and small in *brasiliensis*. This is one of the few instances in which I have found in one individual host what seem to be two species of opalinids.

The conditions of parasitism in *Leptodactylus ocellatus*, *Bufo dorbignyi*, *B. crucifer*, and *B. arenarum*, both in Brazil and in Uruguay, are very puzzling. There are large Zelleriellas with large nuclei ("*uruguayensis*"), small Zelleriellas with nuclei of half the relative size ("*brasiliensis*"), tailed forms ("*antunesi*") with nuclei of the relative size found in "*uruguayensis*," and posteriorly truncate forms ("*quadrata*") with nuclei relatively large. Through *quadrata* forms *antunesi* seems to grade into *Z. uruguayensis* but not into *Z. brasiliensis*.

ZELLERIELLA DUBIA, new species

FIGURE 44

Type: U.S.N.M. No. 22630.

Host: *Eupemphix nana* Boulenger. Three specimens from Angra dos Reis, State of Rio de Janeiro, Brazil, showed no opalinids; three were heavily infected.

Measurements, in microns:

Measurement	a	b (dividing)	c
Length of body	180	124	152
Width of body	130	148	100
Nucleus length	------	25	20
Nucleus width	------	10	18.5
Cilia line interval	------	----------	3.9

Many of these Zelleriellas show numerous cytoplasmic parasites, the amoebae (Stabler and Chen, 1936), which were not studied. This species is thinner behind than in the front part of the body, but

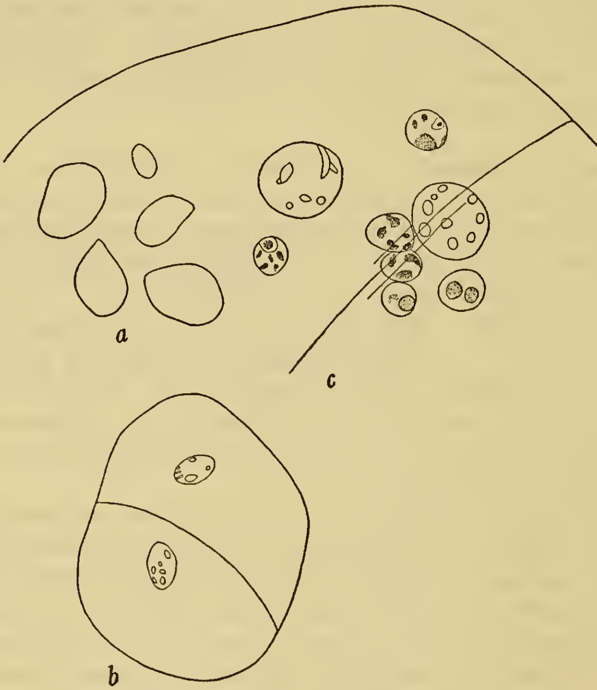


FIGURE 44.—*Zelleriella dubia*, new species: *a*, × 59; *b*, × 230; *c*, × 505. In *c* the six smaller bodies are parasites. Further work of Stabler and Chen (1936) shows that they are amoebae.

the posterior edge is not quite so conspicuously thin as in some forms of the genus *Opalina*, e. g., *O. ranarum* form *truncata* (Metcalf, 1923a).

This large *Zelleriella* is of different form from *Z. magna*. It differs from the *opisthocarya* group in the more anterior position of its nuclei. None of the specimens shows so definite a posterior point as does *Z. patagoniensis*. It is much larger and has relatively much larger nuclei than *Z. brasiliensis*. Studying whole infections, shape, size, and measurements, I am impressed that it is a distinct species, if indeed there be distinct species in this exasperating genus that refuses to play the Linnaean game, but it is difficult to give a diagnostic description. Yet, on the basis of the strong impression from the study of whole infections of this and other Zelleriellas it resembles, I am giving it a distinctive name, pending more detailed study of further material from this species of host.

ZELLERIELLA OVONUCLEATA, new species

FIGURE 45

Type: U.S.N.M. No. 22631.

Host: *Leptodactylus pentadactylus* (Laurenti). One specimen from Bello Horizonte, Brazil, 135 mm. long, was uninfected. A rectum of another specimen from the same locality, given me by Dr. Lauro Travassos, showed very few Zelleriellas.

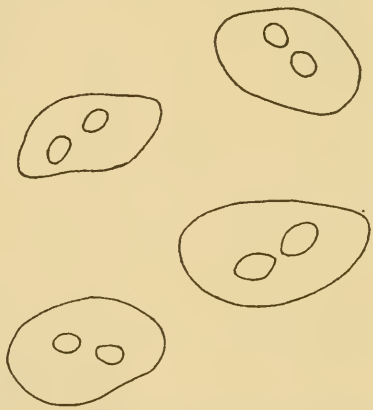


FIGURE 45.—*Zelleriella ovonucleata*, new species, × 249.

Measurements, in microns:

Measurement	Large	Small
Length of body	104	83
Width of body	58	42
Nucleus length	23	15.7
Nucleus width	18	9

In size and shape of body and of nuclei, and in relative size of body and nuclei, this form agrees with a *Zelleriella* from *Bufo sternostignotus* Keferstein (see Metcalf, 1923a). The nuclei of the latter form were never found so elongated as in the form from *Leptodactylus pentadactylus*, but the difference is slight. I am naming the species *Z. ovonucleata* and am naming the form formerly mentioned tentatively as *Z.* [of *Bufo sternostignotus*] as subspecies *bufonis* of the species *ovonucleata*.

ZELLERIELLA [of Eleutherodactylus miliaris]

FIGURE 46

Host: *Eleutherodactylus miliaris* (Spix), from Angra dos Reis, State of Rio de Janeiro, Brazil.

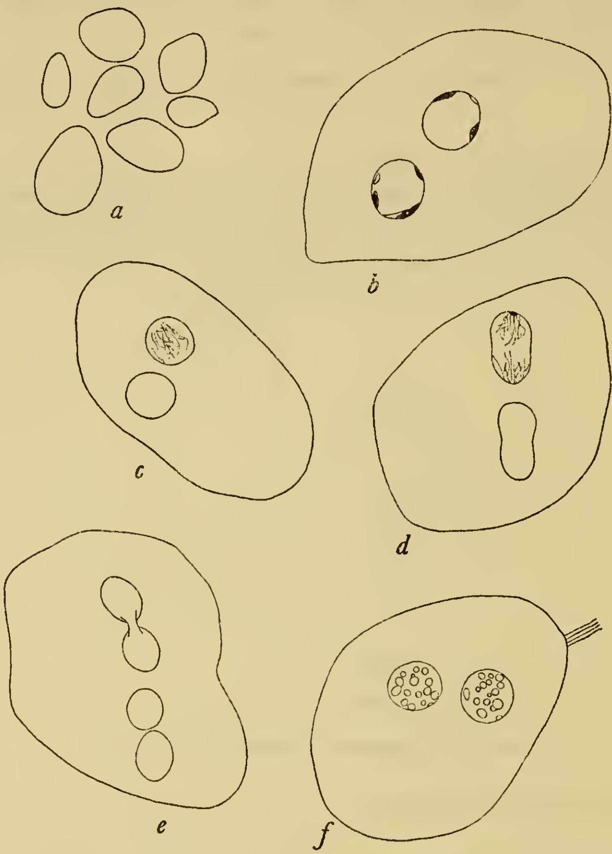


FIGURE 46.—*Zelleriella* [of *Eleutherodactylus miliaris*]: First group of figures (*a*) × 146; all others × 673.

Of three specimens, about 55 mm. long, one was very abundantly infected with a rather small *Zelleriella*. Measurements, in microns:

Measurement	*a*	*b*	*c*	*d*
Length of body	90	91	76	11. 7
Width of body	70	55	89	53
Nucleus length	------	15. 1	19	11. 7
Nucleus width	------	13. 1	13. 8	8. 7
Length of cilia	------	9	------	------

Nucleolus number undetermined. In many nuclei they are not seen at all, the nuclei being parasitized. In shape of body and large size of nuclei compared with the size of the body, this form is close to one I have referred to, without definitely naming, as *Z.* [*trinitatis*] (Metcalf, 1923a) and to *Z. hylaxena* Metcalf (op. cit.), but the dividing nuclei differ from those of the latter species. It should not be named without more detailed study of nonparasitized material.

ZELLERIELLA [TRINITATIS] Metcalf

FIGURE 47

Host: *Elosia lateristrigata* Baumann,[3] one specimen, from Angra dos Reis, State of Rio de Janeiro, Brazil.

FIGURE 47.—*Zelleriella* [*trinitatis*] Metcalf from *Elosia lateristrigata*: *a*, × 249; *b*, × 460.

Measurements, in microns:

Measurement	Large	Large (dividing)	Small
Length of body	147	130	80
Width of body	86	150	48
Length of nucleus	24. 5	50	12. 5
Width of nucleus	17. 2	16. 9	10

This form resembles *Z.* [*trinitatis*] Metcalf (1923a) from *Phyllobates trinitatis* Garman, from Venezuela, but the individuals from *Elosia* were larger. Detailed cytological study of infections from both hosts, which my material has not allowed, might well show diagnostic differences, so I am only provisionally assigning the present forms to the Venezuelan species, which itself was only provisional.

[3] Possibly a wrong identification.

ZELLERIELLA PISCICOLA Da Cunha and Penido

FIGURE 48

Da Cunha and Penido (1926) reported a *Zelleriella* in a "catfish" from the Paraguay River.

FIGURE 48.—*Zelleriella piscicola* Da Cunha and Penido: *a*, An ordinary individual; *b*, an individual in division; *c* and *d*, pairs of nuclei after division; *e*, a pair of resting nuclei. Magnification not indicated. (After Da Cunha and Penido.)

Measurements, in microns: Body length 70–110; body width 50–60; cilia 10–12, longer in front, shorter behind. Nucleoli, 4 in number, show individual constant differences from each other during mitosis, but there are not two of each kind. (See the discussion of *Protoopalina caccosterni*, p. 469, for interpretation.)

ZELLERELLA ORIENTALIS Nie

FIGURE 49

Host: *Microhyla ornata* Boulenger, from Nanking, China.

The outline of the body is roughly leaflike. It is broadest at the anterior, which is slightly curved and somewhat obliquely truncated. The posterior portion is the narrowest and terminates abruptly to a minute sharp point. The cilia are arranged in many longitudinal or slightly oblique rows. The cilia vary in length, those of the anterior end are 14.1μ, while posteriorly they average 11.7μ. The two large nuclei are ellipsoidal, one being located at the anterior half and the other near the middle or at the posterior portion of the body. Each nucleus contains eight (?) nucleoli in midanaphase. The chromosomes are very distinct and more numerous than the nucleoli. The endospherules are either rounded or dumbbell-shaped.

Measurements, in microns: In a number of individuals length of the body varies from 87.5 to 120, width of body 45.0 to 70, thickness of body 19.6 to 32.2; diameter of nucleus from 12.5 by 9.6 to 16.0. The measurement of the cilia line interval of one animal was 3.1 at the anterior end, 4.5 in the middle portion, and 6.3 at the posterior end.

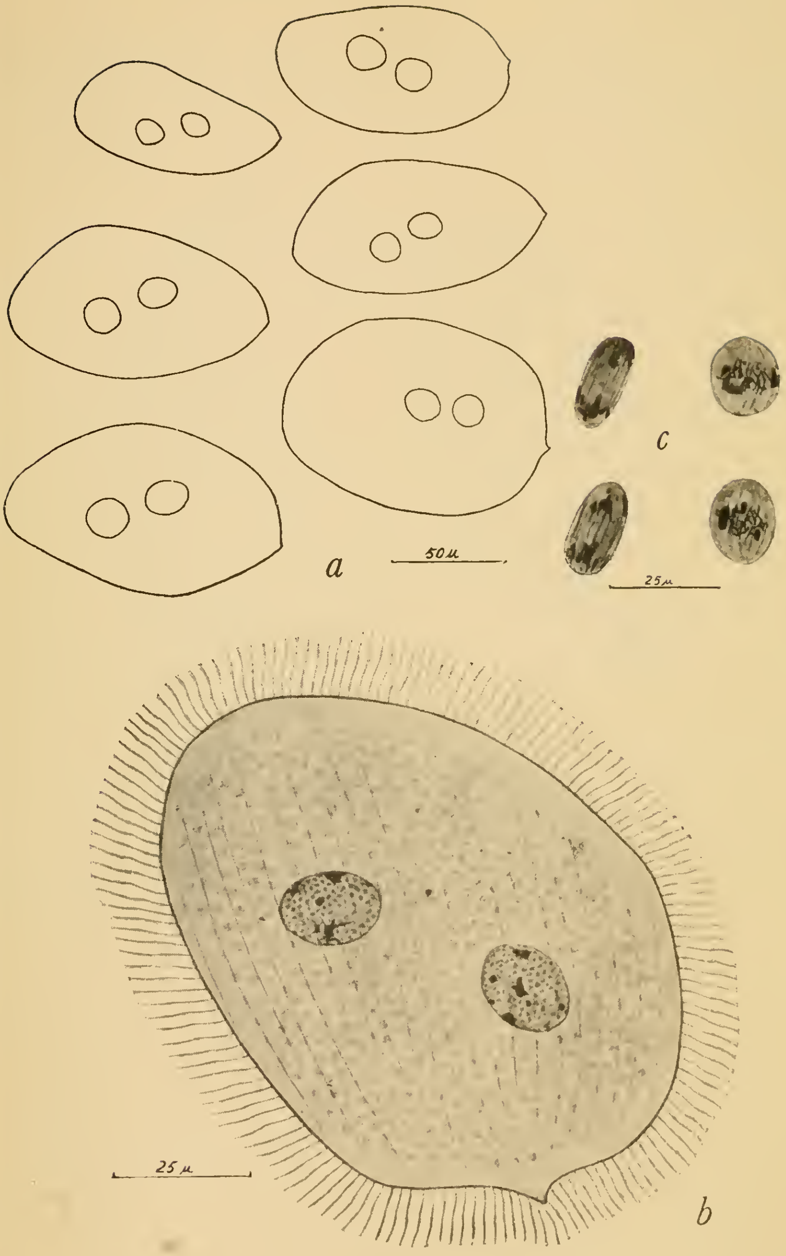


FIGURE 49.—*Zelleriella orientalis* Nie from *Microhyla ornata*: *a*, A group of animals showing the range of size and form; *b*, showing the structure of the animal; *c*, two pairs of dividing nuclei. (After Nie.)

ZELLERIELLA CORNUCOPIA Carini

FIGURE 50

Host: *Leptodactylus ocellatus* (Linnaeus), from Brazil.

The body is flattened and curved. The anterior end is much wider than the rest of the body. The outline of the animals appears to be

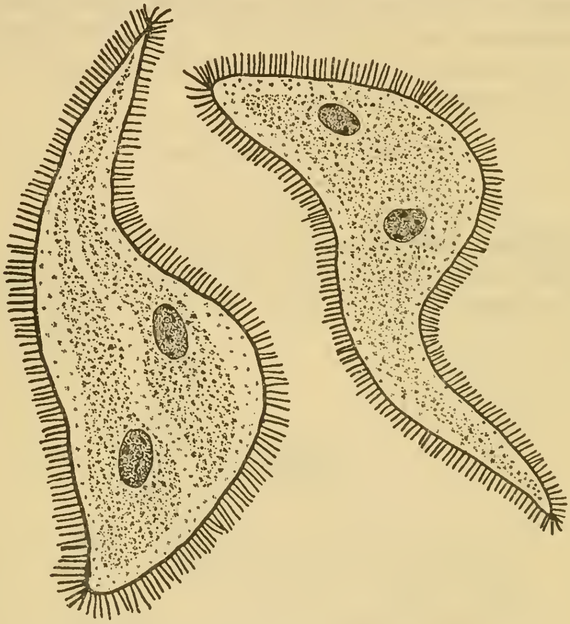


FIGURE 50.—*Zelleriella cornucopia* Carini from *Leptodactylus ocellatus*, × ca. 380. (After Carini.)

trumpet-shaped. The larger specimens measure 180–220μ in length; in these the anterior end is 75–100μ in width. The two spherical nuclei measure 20–22μ in diameter.

FIGURE 51.—*Zelleriella corniola* Carini from *Leptodactylus ocellatus*. (After Carini.)

ZELLERIELLA CORNIOLA Carini

FIGURE 51

Host: *Leptodactylus ocellatus* (Linnaeus), from Brazil.

The body is slightly flattened, long, and curved. This species measures 70–90μ in length, and the anterior end is the region of greatest width. From there, the animal gradually decreases in width toward the posterior end, which is pointed, and in some specimens twisted. Two nuclei, 8–10μ in diameter, are located about 5μ from each other in the anterior half of the body.

ZELLERIELLA FALCATA Carini

FIGURE 52

Host: *Engystoma ovale* Schneider, from Brazil.

This species of *Zelleriella* found in São Paulo is very much flattened and often presents a certain degree of twisting. It has a rather

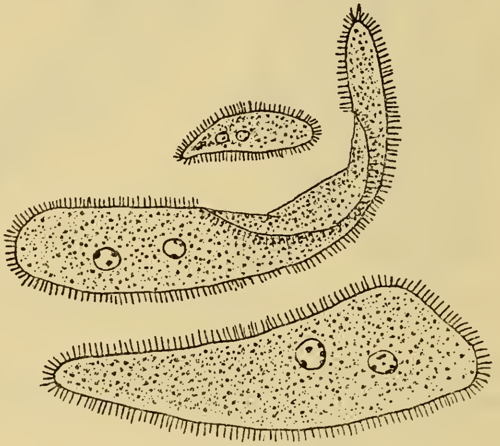


FIGURE 52.—*Zelleriella falcata* Carini from *Engystoma ovale*. No magnification given. (After Carini.)

variable form, sometimes spindle-shaped, sometimes cone-shaped; however, the form that has been observed most frequently and that appears to be the most typical is that of a comma, more or less elongated. The anterior end is large and obtuse, the posterior end slender.

The size is highly variable. The small forms are often fusiform and measure nearly 50–100μ in length and 20–30μ in width. The well-developed individuals, with the characteristic form of a comma, measure 200–300μ in length and 40–80μ in width.

The two spherical nuclei, about 15–17μ in diameter, are found at the anterior part of the animal. Each nucleus has nucleolar substance in the form of small irregular blocks. The two nuclei are situated obliquely to the axis of the body. The distance between the two nuclei is about 20–25μ.

ZELLERIELLA FOLIACEA Carini

FIGURE 53

Host: *Leptodactylus ocellatus* (Linnaeus), from Brazil.

This species of *Zelleriella* has an irregular, round outline. The body is very thin, having the appearance of a leaf. The body sometimes shows longitudinal folds. It resembles *Z. leptodactyli* Metcalf (1923a), which is much smaller. The majority of the animals belong-

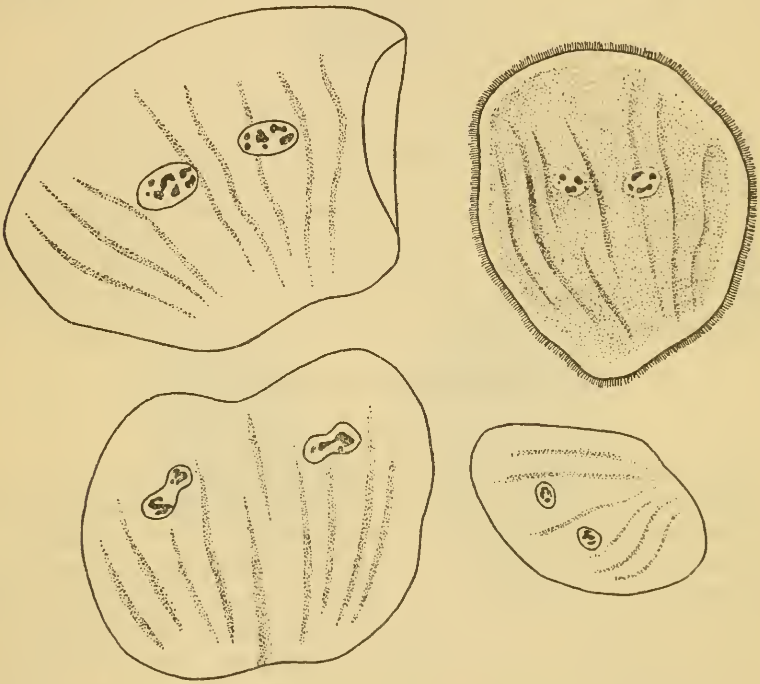


FIGURE 53.—*Zelleriella foliacea* Carini from *Leptodactylus ocellatus*. (After Carini.)

ing to *Z. foliacea* measure 200μ in diameter; some of them are over 300μ. The two spherical nuclei measure 25μ in diameter. Eight nucleoli have been observed in this species.

ZELLERIELLA TRUNCATA Carini

FIGURE 54

Hosts: *Leptodactylus ocellatus* (Linnaeus) and *L. sibilatrix* (Wied), from Brazil.

This species of *Zelleriella* is truncate in shape. These animals are found only rarely and almost always with other Zelleriellas that are regularly oval in shape. The anterior end of *Z. truncata* is rounded, the posterior end appearing as if cut off at the tip. The protoplasm at the posterior end is less dense and highly vacuolated. These

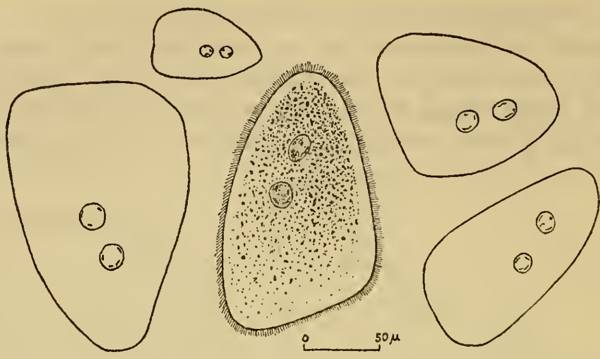


FIGURE 54.—*Zelleriella truncata* Carini from *Leptodactylus ocellatus*. (After Carini.)

animals measure 80–150μ in length and 45–65μ in width. The two nuclei located in the middle of the body are spherical, measuring 10–12μ in diameter. (A restudy of this species is desirable.)

ZELLERIELLA BOIPEVAE Carini

FIGURE 55

Host: A snake, *Ophis meremmii* (Wagler), from Brazil.

This species of *Zelleriella* was found in considerable number in the terminal portion of the intestine of the snake. These opalinids are irregularly oval in shape, the anterior part of the body being a little thinner than the posterior part. They measure 100–150μ in length and 60–90μ in width. The body is flattened and has a thickness of 25–35μ. There is a narrow zone of ectoplasm. The endoplasm is vacuolated and contains many endospherules. Two spherical nuclei,

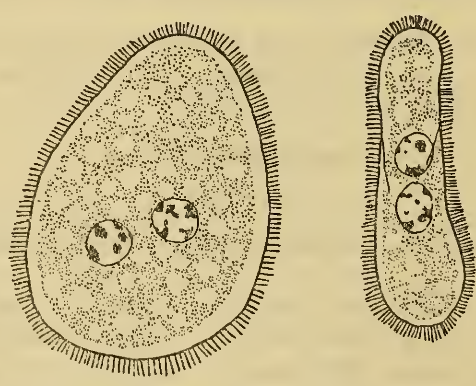


FIGURE 55.—*Zelleriella boipevae* Carini from *Ophis meremmii*, × ca. 335. (After Carini.)

located in the middle of the body, measure 12–15μ in diameter; they are 15–20μ apart. The nucleolar substance is either in the form of a compact block or oftener in the form of irregularly distributed blocks adjacent to the nuclear membrane.

This snake feeds on anurans, and it is possible that this is merely an adventitious infection. (The description of this species is not sufficient to allow comparison with other species and determination of its affinities.)

ZELLERIELLA JAEGERI Carini

FIGURE 56

Host: A snake, *Liophis jaegeri* (Günther), from Brazil.

The body is oval, greatly flattened. This species of *Zelleriella* averages 60–73μ in length and 34–42μ in width. Two spherical or slightly oval nuclei are found in the midregion of the body, measuring 10–12μ in diameter. They are 5–8μ apart.

FIGURE 56.—*Zelleriella jaegeri* from *Liophis jaegeri*, × ca. 560. (After Carini.)

ZELLERIELLA ARTIGASI Unti

Host: *Bufo marinus* (Linnaeus), from Brazil.

The body is oval and flattened, measuring 60–70μ in length and 30–40μ in width. The shape of the body in the majority of the specimens is that of an egg of *Schistosoma mansoni*. Characteristic of this species is the presence of a transparent tail, which is devoid of cilia. Both nuclei are spherical, measuring on the average 9–12μ; they are 6–7μ apart. Within each nucleus one, two, or three nucleoli of different shapes are found adjacent to the nuclear membrane.

ZELLERIELLA species (?)

FIGURE 57

Host: *Elosia lateristrigata* Baumann. Of six specimens from Angra dos Reis, State of Rio de Janeiro, Brazil, two were infected.

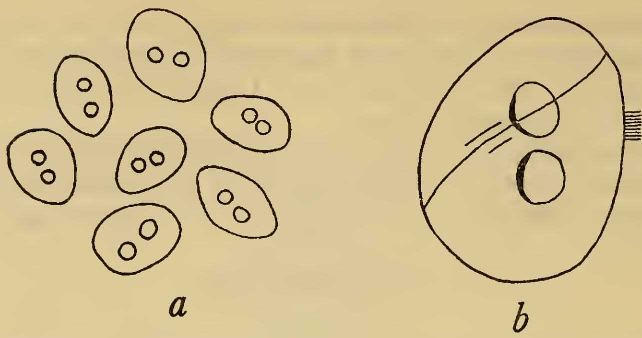


FIGURE 57.—*Zelleriella* sp. (?) from *Elosia lateristrigata: a*, A group of individuals from one infection, × 207; *b*, an individual × 750.

Genus CEPEDEA Metcalf

CEPEDEA SAHARANA Metcalf

Host: *Rana esculenta ridibunda* Pallas.

This *Cepedea* from this frog was first described from Algiers. Gourvitsch (1926) later reported it from Tashkent, Turkestan, under the name *Opalina elongata* (see Metcalf, 1927b). I have since found it in the same host from Beluchistan (U.S.N.M. No. 26194).

CEPEDEA BUERGERI SINENSIS Metcalf

FIGURE 58

Host: *Bufo gargarizans* Cantor, imported from China and given me by Dr. K. K. Chen, of Eli Lilly & Co.

Figures of these stocky specimens are given and some measurements, in microns, from the one shown in figure 52, *b*: Body 190 by

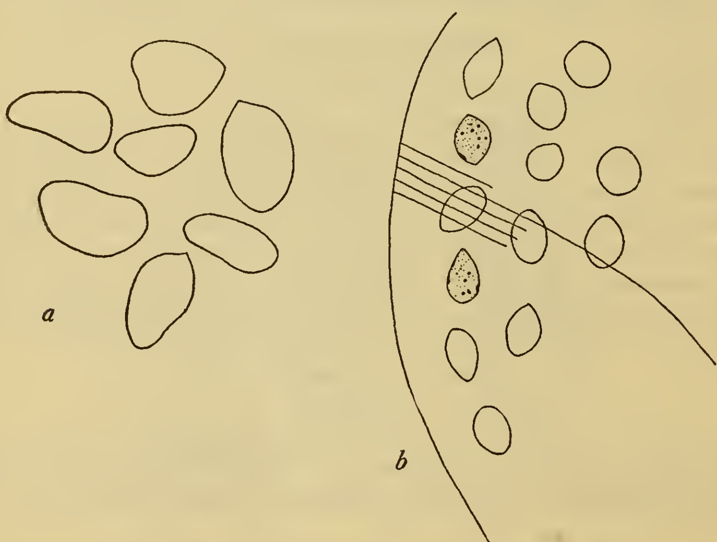


FIGURE 58.—*Cepedea buergeri sinensis* Metcalf: *a*, × 78; *b*, × 673.

120; nuclei 9.9 by 9.9, daughter nucleus 9.6 by 7, dividing nucleus 13.8 by 7.1; cilia line interval in front 2.2.

CEPEDEA BORNEONENSIS Metcalf

Figure 59

Host: *Bufo jerboa* Boulenger, from Trong, Lower Siam. One host (U.S.N.M. No. 24041), 28 mm. long, was abundantly infected.

The Siamese Cepedeas from this host are considerably flattened and are larger than the Bornean individuals. Their nuclei are for the

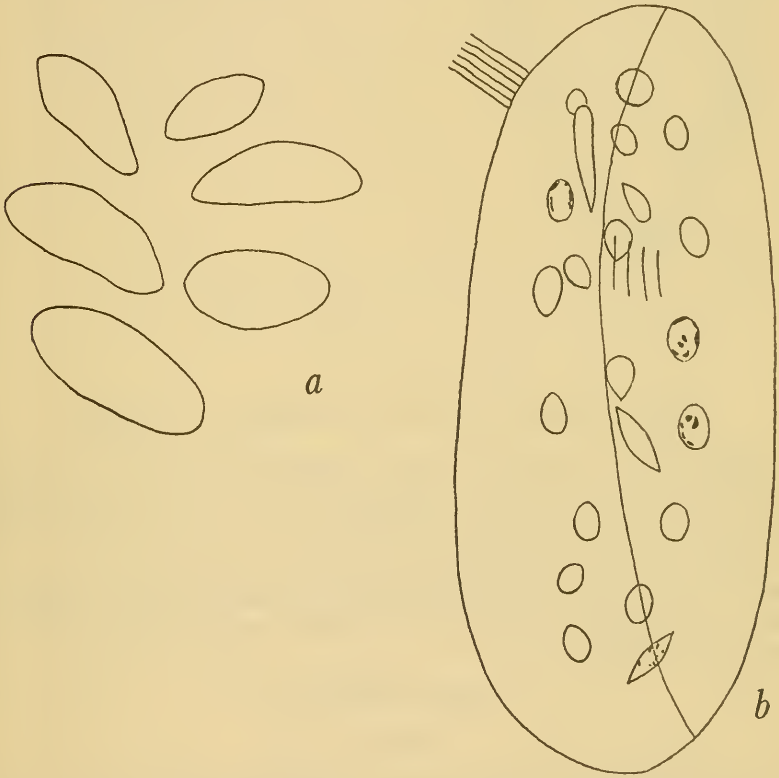


Figure 59.—*Cepedea borneonensis* Metcalf: *a*, × 117; *b*, × 1010.

most part elongated but less so than in the specimens from Borneo. In all the specimens from both localities the nuclei mostly lie with their long axis longitudinal. More or less flattening is not rare in the genus *Cepedea*, but this occurs in the elongated species more than in forms of this type.

Measurements, in microns: Body 100 by 38, 80 by 30, 60 by 29, 100 by 42; nuclei of last specimen 4.6 by 4.6, 6.3 by 2.9, 5 by 3.8, 9.9 by 3, 3.1 by 3.1; length of cilia in same specimen 9.8; cilia line interval 2.

CEPEDEA CELEBENSIS, new species

FIGURE 60

Type: U.S.N.M. No. 22632.

Host: *Bufo celebensis* Schlegel, from Teneboon, Celebes, East Indies, two specimens (U.S.N.M. Nos. 55395 and 55394), both infected, one very heavily.

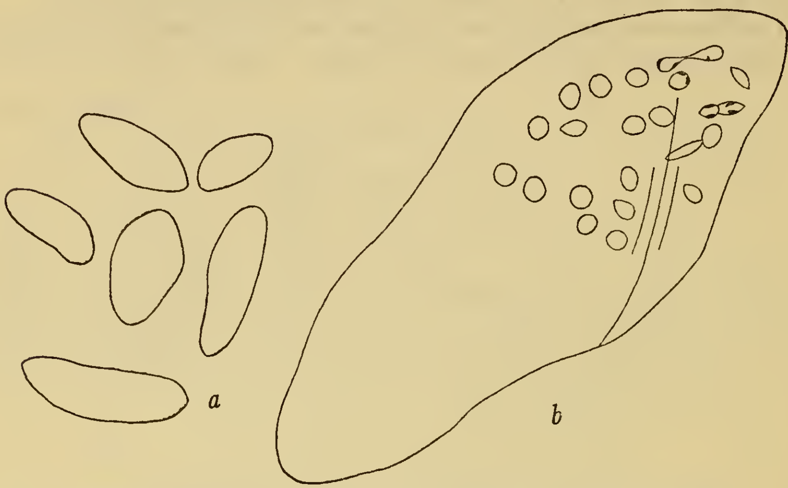


FIGURE 60.—*Cepedea celebensis*, new species, from *Bufo celebensis*: *a*, × 146; *b*, × 673.

Measurements, in microns: Body 134 by 40, 66 by 33, 120 by 50; nuclei spherical 4, 4.8, 3.9, dividing 9.9 by 2.1, 8.4 by 2.4, dumbbell-shaped 13 by 2.8; cilia line interval 2.5.

This species differs in shape and in range of shapes from *C. formosae* and *C. fujiensis*, and from *C. siamensis* in smaller size and relatively smaller nuclei and especially in the slender, much-elongated form of the dividing nuclei.

CEPEDEA CELEBENSIS

FIGURE 61

Host: *Bufo divergens* Peters, from Djambajan, Borneo, two specimens—U.S.N.M. No. 51727, 32 mm. long, uninfected, and No. 51725, abundantly infected.

Measurements, in microns: Body 131 by 45.3, 90 by 30, 107 by 36.6; nuclei 5 by 4.2, 4.7 by 3.2, half of dumbbell-shaped nucleus 7.4 by 2.8; length of cilia 8; interval between lines of cilia anteriorly 2.6; interval between cilia in a line 1.7.

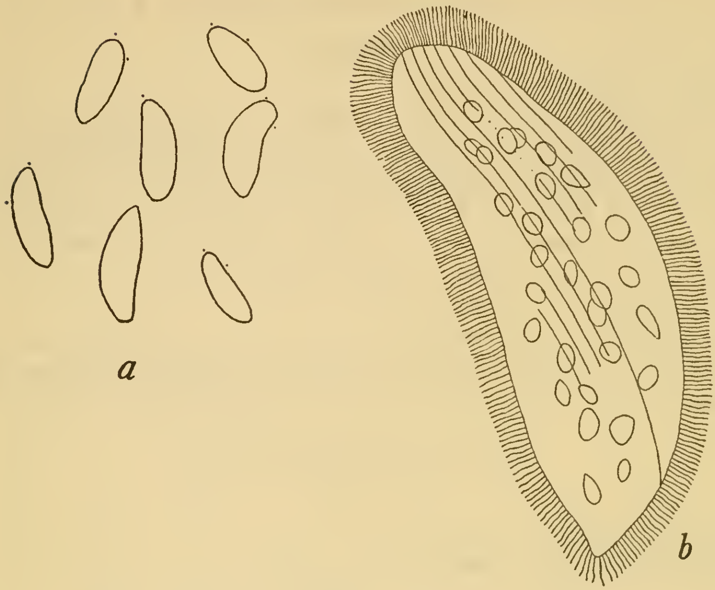


FIGURE 61.—*Cepedea celebensis*: From *Bufo divergens*: *a*, × 117; *b*, × 673.

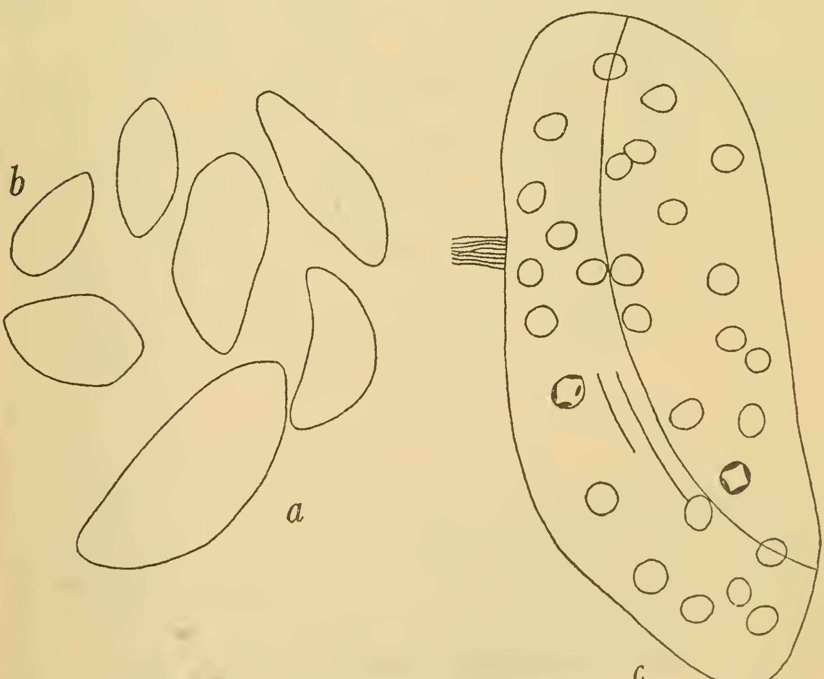


FIGURE 62.—*Cepedea hasseltii*, new species: *a* and *b* and others grouped with them, × 249; *c*, × 1010.

CEPEDEA HASSELTII, new species

FIGURE 62

Type: U.S.N.M. No. 22633.

Host: *Leptobranchium hasseltii* Tschudi (=*Megophrys*).

A specimen of this pelobatid from Tamandjaija, Bantam, Java, collected by Bryant on January 19, 1909 (U.S.N.M. No. 62366), 80 mm. long, was fairly well infected with a rather small, stocky *Cepedea* with small, spherical nuclei. Another host of the same species (U.S.N.M. No. 3097), from eastern Borneo, 53 mm. long, bore no opalinids except numerous cysts.

Measurements, in microns: Body (fig. 62, *a*) 100 by 62, (fig. 62, *b*) 63 by 30, (fig. 62, *c*) 92 by 36.9; other measurements from figure 62, *c:* Dividing nucleus 3.5 by 3.5, spherical 4, 3.2; cilia line interval 2.5.

CEPEDEA MICROHYLAE, new species

FIGURE 63

Type: U.S.N.M. No. 22634.

Host: *Microhyla leucostigma* Boulenger.

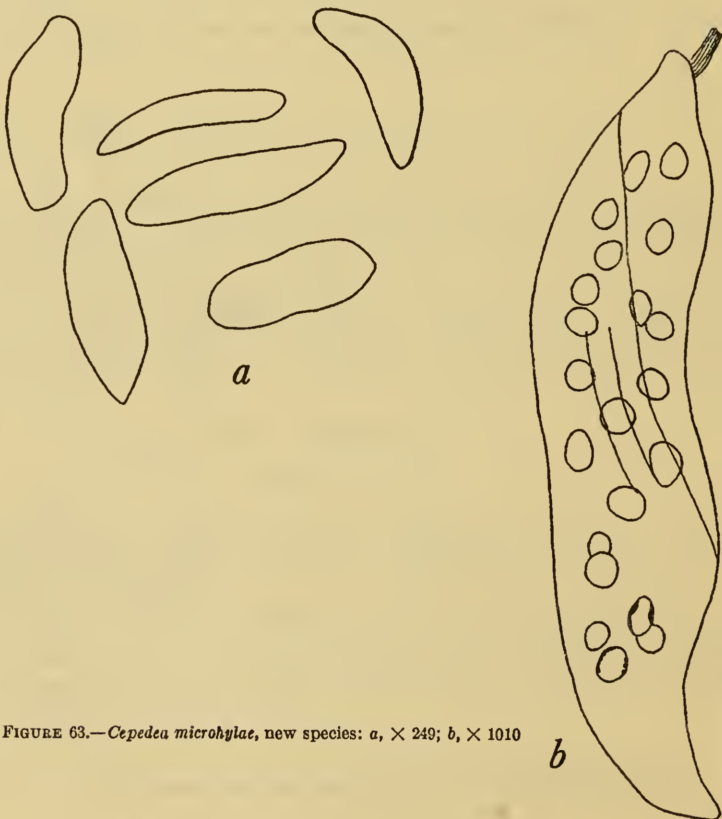


FIGURE 63.—*Cepedea microhylae*, new species: *a*, × 249; *b*, × 1010

A specimen of this gastrophrynid from Kuching, Sarawak, Borneo (U.S.N.M. No. 53650), 21 mm. long, bore numerous Cepedeas with rather small, spherical, or somewhat elongated nuclei and cilia of medium length in widely separated lines. They seem distinct.

Measurements, in microns: Body 130 by 36, 100 by 17, 100 by 20. Further measurements from last specimen: Nuclei 4, 5 by 3, 4 by 3.3, 5.8 by 2.3; length of cilia 6; interval between lines of cilia in anterior part of body 3.8.

Figure 64.—*Cepedea hosei*, new species: *a–c*, × 146: *d* and *e*, × 678.

CEPEDEA HOSEI, new species

Figure 64

Type: U.S.N.M. No. 22635.

Host: *Nectophryne hosei* Boulenger. Two specimens from the Landak River, western Borneo, found in copulation, the male (U.S. N.M. No. 36315), 67 mm. long, well infected, the female (U.S.N.M. No. 36314), 100 mm. long, with no opalinids; two other specimens from the Kendawangan River, southeastern Borneo, 73 and 103 mm. long, the larger a female with eggs and bearing many opalinid cysts only, the smaller animal with no opalinids.

This *Cepedea* has long cilia in lines unusually far apart. Some individuals have nearly all nuclei elongated and large, probably approaching division; others show most of the nuclei smaller and about spherical. In general appearance of an infection, in size and shape of individuals, and in the large nuclei they resemble the Asian-Malaysian group of species. About the only diagnostic distinction is the coarseness of the ciliation.

Measurements in microns:

Measurement	*a*	*b*	*c*	*d*	*e*
Body	116 by 34	80 by 29	100 by 70	100 by 70	100 by 43
Nucleus				10 by 5.7	5.8 by 5.8
Nucleus				9.8 by 6.4	5.1 by 5.1
Length of cilia				14.5	13.8
Cilia line interval				3	3.5

CEPEDEA SIAMENSIS, new species

FIGURE 65

Type: U.S.N.M. No. 22636.

Host: *Bufo asper* Gravenhorst, from Trong, Lower Siam, two specimens, one heavily infected. (U.S.N.M. No. 24033.)

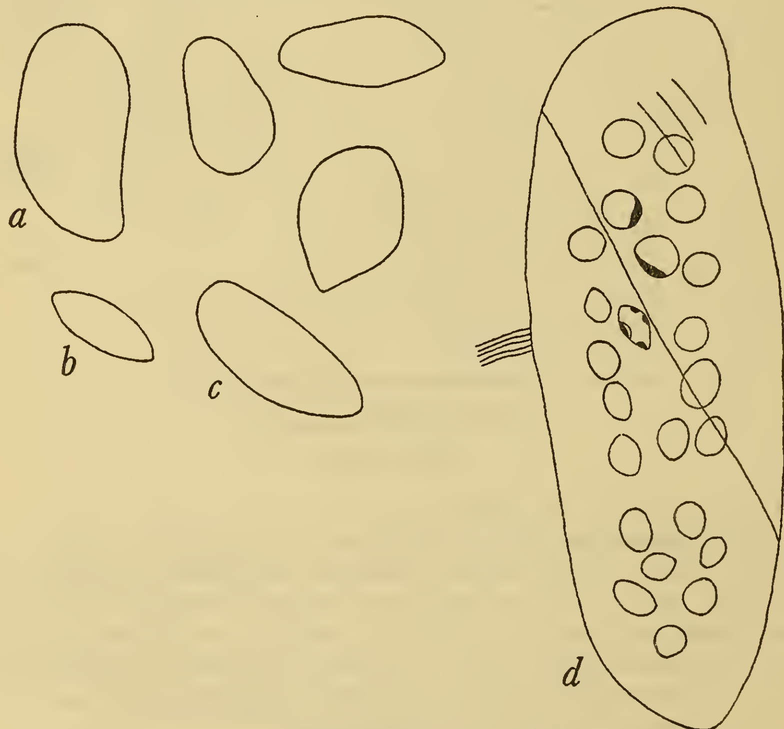


FIGURE 65.—*Cepedea siamensis*, new species: *a–c*, × 249; *d*, × 1010.

Measurements, in microns: Body (*a*) 116 by 58, (*b*) 64 by 24, (*c*) 100 by 40, (*d*) 94 by 32. Other measurements from *d*: Nuclei 5.2, 6 by 5, 6.5 by 4, 6.2 by 4.8, 4.8 by 3; length of cilia 7.1; interval between lines of cilia 2.6.

This *Cepedea* is somewhat like *C. fujiensis* but is only half as large, has nuclei a little smaller, and is more diverse in form. It also somewhat resembles *C. formosae* but is a third shorter, has nuclei of nearly twice the dimensions, and, again, is of more diverse shapes. It seems a distinct species but related to them both.

CEPEDEA VIRGULA (Dobell)

Opalina virgula Dobell, 1910.

Host: *Polypedates leucomystax* (Gravenhorst).

Dobell described as *Opalina virgula* opalinids from this host from Ceylon. He very kindly sent me a slide. I have infections in two specimens of this host from Tenasserim, Malay Peninsula (U. S. N. M. Nos. 34515 and 34516), each 41 mm. long, and one infection from Pulo Sianten, Anambas Islands (U. S. N. M. No. 26552), 70 mm. long, a tremendously heavy infection. Comparing these with Dobell's slide and description shows that they are the same and that they should be assigned to the genus *Cepedea*. This genus had not been created in the year 1910, when Dobell's paper appeared, and the wrong classification was my own error. These Cepedeas are mostly, but not always, unusually flat and might almost be regarded as Opalinas of the subgeneric group *Opalinae angustae*, but comparison with infections from other regions shows their affinities. A narrow *Opalina* from Ceylon was an anomaly, for the narrow species of this genus are North American or were derived from North America (e. g., *O. obtrigona* Metcalf, 1923a). The indications that this species is a *Cepedea* therefore solve a difficult puzzle.

CEPEDEA MOGYANA (Carini)

Figure 66

Opalina mogyana Carini, 1937.

Host: *Hyla leucophyllata* (Beiris), from Angra dos Reis, State of Rio de Janeiro, Brazil.

Of three specimens of this frog two were well infected with a *dimidiata*-like *Cepedea*. The lines of cilia are widely spaced, the nuclei of medium size. The nuclei contain spherical masses of nucleolar substance, which recall Weill's species *Opalina chattoni*, but no chromatin spireme, such as is in the latter species, was seen.

Measurements in microns: Body (*a*) 144 by 48, (*b*) 122 by 30. Other measurements from *a:* Nuclei 5.4, 4.5, 3.8; interval between lines of cilia in the anterior part of the body 3.1.

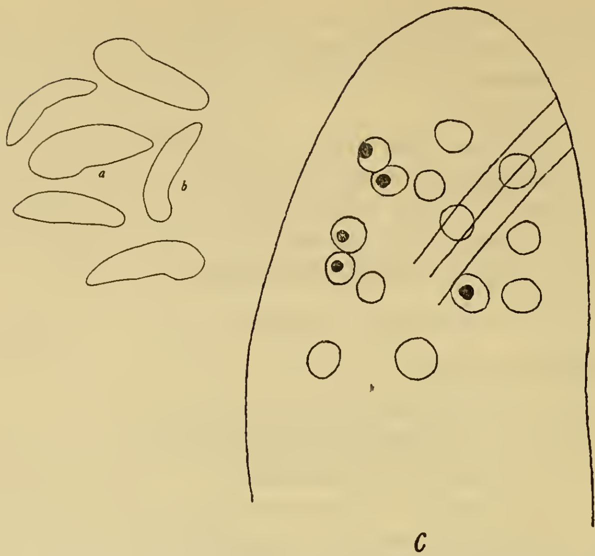


FIGURE 66.—*Cepedea mogyana* (Carini): *a* and *b*, × 117; *c*, × 1010.

CEPEDEA SPINIFERA Metcalf

Host: *Oxydozyga lima* (Tschudi).

This *Cepedea* in this host has been reported from Java (Metcalf, 1923a). The present abundant infections in the same species of host are from Baudon (U.S.N.M. No. 67244) and Lem Sing (U.S.N.M. No. 67313), Siam. Two other specimens from Siam were uninfected.

CEPEDEA LEMURIAE, new species

FIGURE 67

Type: U.S.N.M. No. 22637.

Host: *Polypedates rhodoscelis* (Boulenger).

A single specimen of this tree frog from Madagascar (U.S.N.M. No. 60658), 38 mm. long, a female with eggs, is abundantly infected with rather large Cepedeas, which, as in *C. dimidiata*, show small, slender individuals and also very much swollen larger individuals. These all have small nuclei. The individual marked *x* in the figure shows an irregularity of contour, indicating probably a thin pellicle and soft, flabby body. Such individuals are rather numerous in the infection, as they are in infections of *C. multiformis* (tropical America), *C. seychellensis* (Seychelles Islands), *C. hispanica* (Spain), *C. minor* (France), and some others. This species has a combination of characters not seen in any other *Cepedea* described and is named as a distinct species, after the former Indian Ocean continent of which Madagascar is reputed to have been a portion.

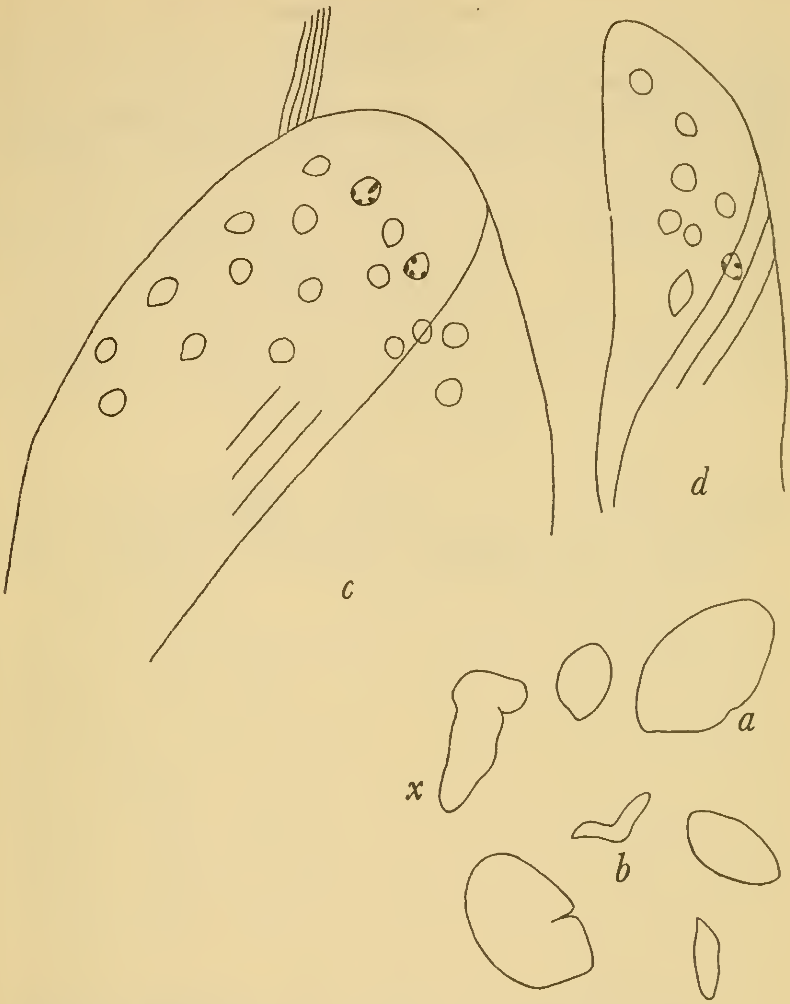


FIGURE 67.—*Cepedea lemuriae*, new species: *a*, *b*, and *x*, × 117; *c* and *d*, × 1010.

Measurements, in microns:

Measurement	*a*	*b*	*c*	*d*
Body	200 by 73	110 by 20		
Nucleus			3.3 by 3.3 3.9 by 3.9 3 by 3 (daughter nucleus) 5 by 3 (dividing nucleus)	6.5 by 2.8 3.7 by 3.7 3.5 by 2.3
Length of cilia			10	
Interval between lines of cilia			3.1	3

CEPEDEA RUBRA (Carini)

FIGURE 68

Opalina rubra CARINI, 1937.

Host: *Hyla minuta* Peters, from mountains near Rio de Janeiro, Brazil.

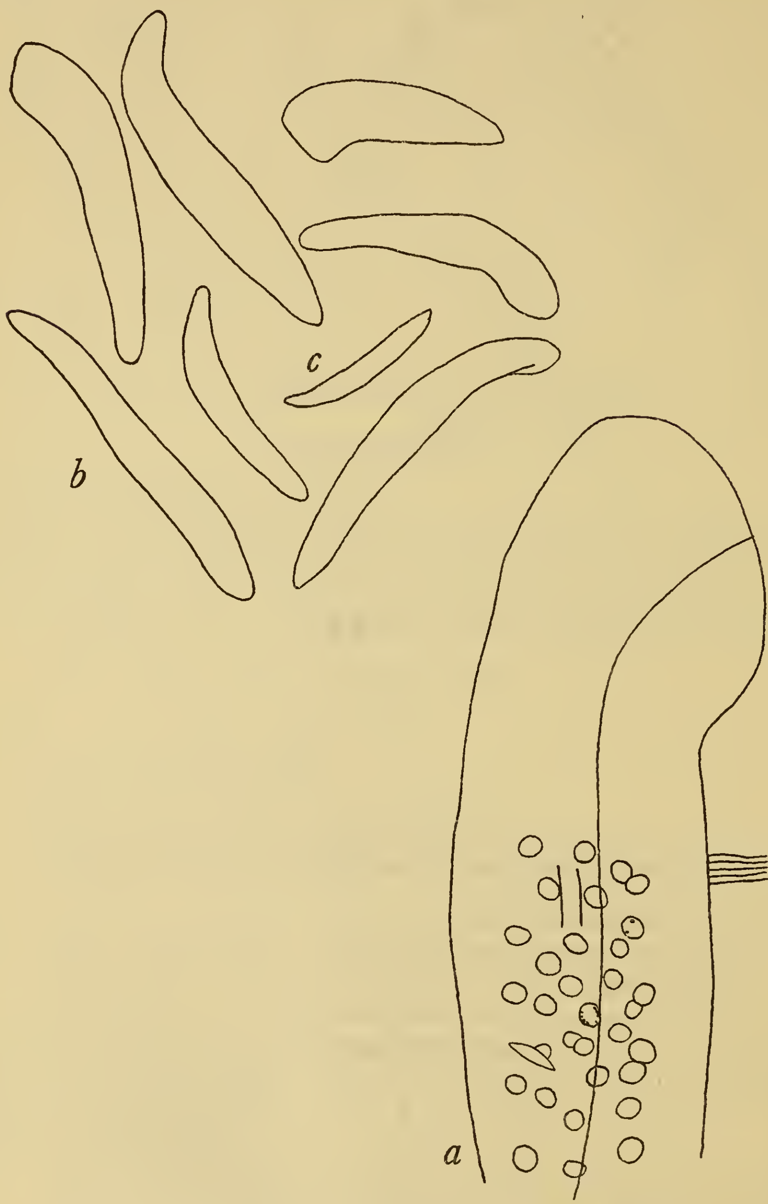


FIGURE 68.—*Cepedea rubra* (Carini) from *Hyla minuta*: *a*, × 1010; *b* and *c*, × 249.

Two out of five specimens, 22 mm. long, were infected with a rather flat *Cepedea*. Its nuclei are very small, their diameter about equal to the interspace between the lines of cilia. *C. rubra* is longer than *C. dimidiata* of any subspecies. In *C. paraguensis* (Metcalf's *C. dimidiata paraguensis*, 1923a) the smallest nuclei are about as large as the largest in *C. rubra*, but the larger are twice as large as the usual ones in the latter species. The appearance of the infections as a whole in the two species, the shapes, and the percentages of individuals of the several shapes, are different.

Measurements, in microns: Figure 68, *a*, width of body 34.6, nucleus 3.1, 2.1, dividing nucleus 7.6 by 1.7; length of cilia 7.7; cilia line interval 2.7. Figure 68, *b*, body 200 by 23. Figure 68, *c*, body 90 by 12.

CEPEDEA RUBRA (Carini)

FIGURE 69

Host: *Pseudopaludicola ameghini* (Cope), from Minas Geraes, Brazil, 7 specimens, 4 uninfected, 3 showing heavy infections.

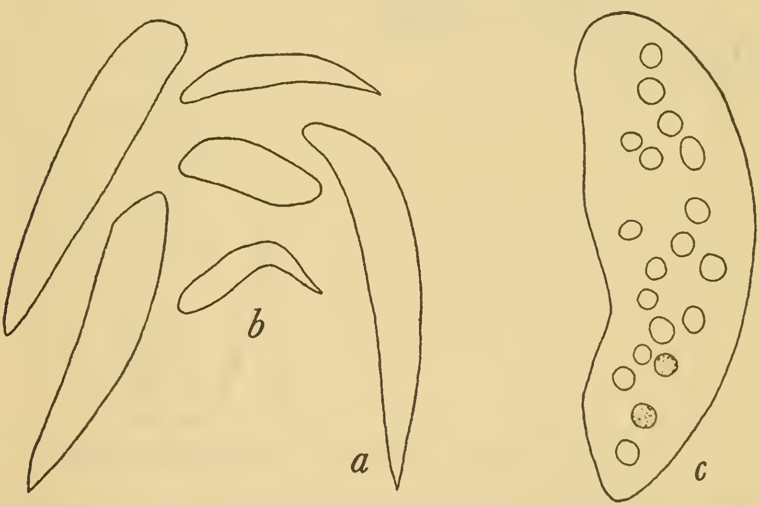


FIGURE 69.—*Cepedea rubra* (Carini) from *Pseudopaludicola ameghini*: *a* and *b*, × 249; *c*, × 1010.

These frogs were all dead, perhaps 18 hours or so, before they were opened. Probably in consequence of this, the Cepedeas were very slow in their movements and were much twisted spirally. These belong to the group of more or less elongated species with soft pellicle and soft bodies. They so intergrade as to be difficult to distinguish. The present specimens seem the same as the forms in *Hyla minuta*.

Measurements in microns: (*a*) Body 200 by 30; (*b*) body 90 by 17; (*c*) body 64 by 22; nuclei 3.4, 3, 2.7; dividing nuclei 4.9 by 3.

CEPEDEA RUBRA (Carini) (?)

Figure 70

Host: Tadpole of *Leptodactylus ocellatus* (Linnaeus), from Manguinhos, Rio de Janeiro, Brazil.

Three stages of development of this opalinid are shown in the drawings: The youngest, *a*, in a *Protoopalina axonucleata* condition; *b*, a somewhat older larva whose nuclei are beginning to be irregularly distributed through the cytoplasm; and *c*, approaching the adult

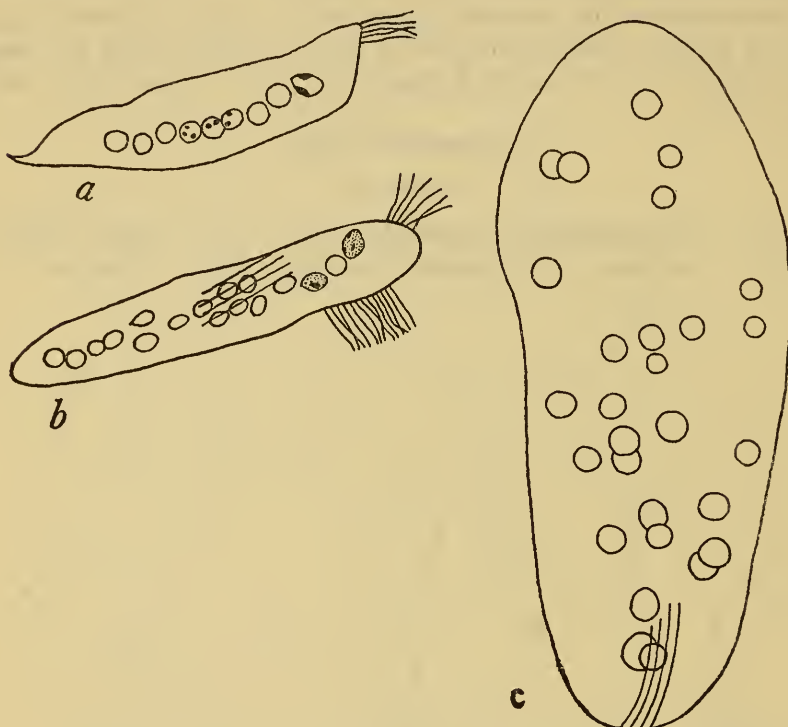


Figure 70.—*Cepedea rubra* (Carini) (?) from tadpole of *Leptodactylus ocellatus*, × 820.

condition. The small size of the nuclei suggests resemblance to *C. rubra* rather than to *C. longa*, and this is emphasized when we remember that in the development of *Cepedea* the young individuals have proportionally larger nuclei than the old. *C. dimidiata* [*paraguensis*] Metcalf has still smaller nuclei, much smaller. But the assignment of these larvae to the species *rubra* without seeing an adult is of most doubtful validity, but it seems the most probable of the three species known to occur in the region.

Measurements in microns:

Measurement	*a*	*b*	*c*
Body length	60	68	114
Body width	14	11	45
Diameter of nucleus	3. 6	2.4 to 3	3.6 to 5, average 4.6
Length of cilia	9. 7	-----	-----
Interval between lines of cilia	-----	1. 5	1. 5

CEPEDEA PHILIPPENSIS, new species

FIGURE 71

Type: U.S.N.M. No. 22638.

Host: *Bufo philippinicus* Boulenger, from Caiholo River, Ulugan Bay, Palawan, Philippine Islands (U.S.N.M. No. 39965).

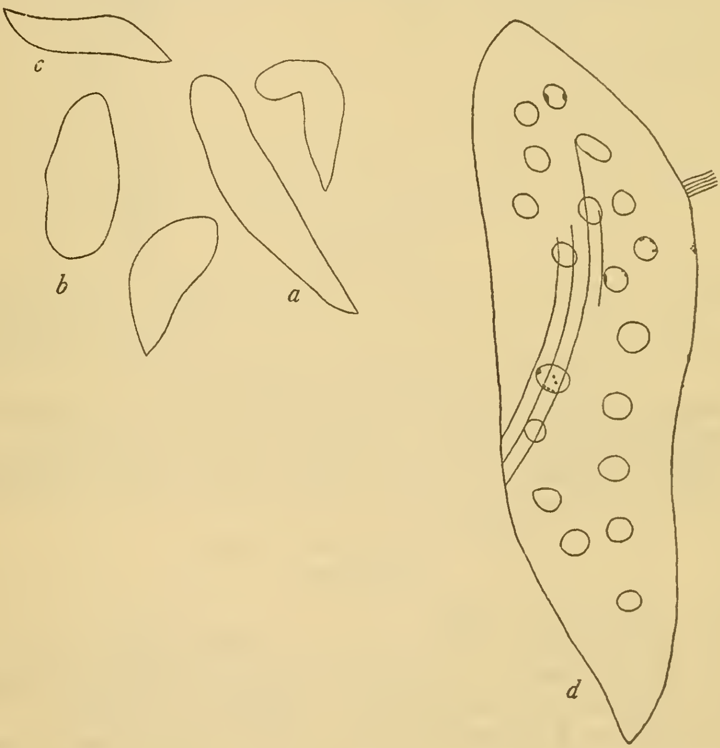


FIGURE 71.—*Cepedea philippensis*, new species, from *Bufo philippinicus: a–c*, × 146; *d*, × 673.

Measurements, in microns: Body (*a*) 230 by 48, (*b*) 138 by 57, (*c*) 140 by 30, (*d*) 140 by 40. Other measurements from *d:* Spherical nuclei, 4.7 to 5.7 in diameter, dividing 8.4 by 4; length of cilia 7.4; cilia line interval 2.3.

These Cepedeas seem to belong to the Asian-Malaysian group containing *C. formosae*, *C. fujiensis*, *C. siamensis*, and *C. celebensis.*

166877—40——4

They most resemble *C. formosae* in shape and size and in the dimensions of the nuclei, but the dividing nuclei are much more elongated, as they are in *C. celebensis*. It seems to be another case of intergrading species.

CEPEDEA PHILIPPENSIS

FIGURE 72

Host: *Bufo quadriporcatus* Boulenger, from Pulo Sugi, Rhio Archipelago, south of western Sumatra, 2 specimens (U. S. N. M. Nos. 30986 and 30987), both infected.

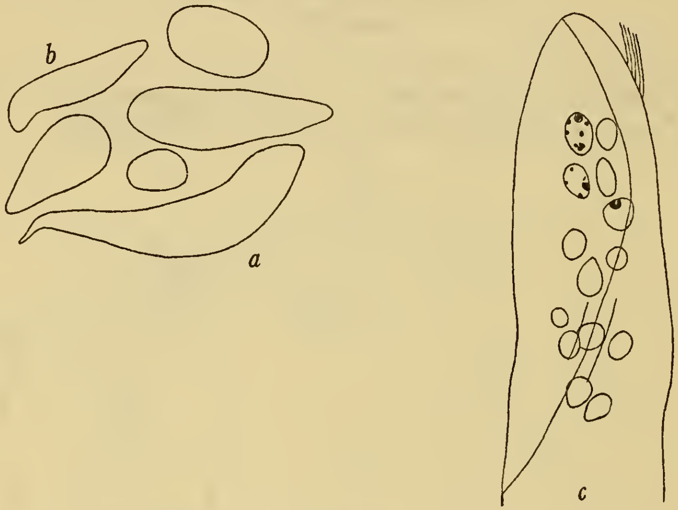


FIGURE 72.—*Cepedea philippensis:* *a* and *b*, × 146; *c*, × 673.

Measurements, in microns: Body (*a*) 229 by 50, (*b*) 128 by 29; (*c*) width of body 30. Other measurements from *c:* Nucleus 5.4 by 4.3, daughter nucleus 7.3 by 4.3, dividing nucleus 8 by 5; length of cilia 9.9; cilia line interval 2.5.

CEPEDEA LUZONENSIS, new species

FIGURE 73

Type: U.S.N.M. No. 22639.

Host: *Rana luzonensis* Boulenger, one specimen (U.S.N.M. No. 38047), 60 mm. long, from Benquet Province, Philippine Islands, collected July 1, 1907, and annotated "Heights in the Oaks."

This frog bore a generally slender *Cepedea* whose forms of body, forms and sizes of nuclei and ciliation do not agree with any other species described. The general impression from the appearance of an infection is distinct, and this is one of the most reliable indications even when indefinable.

Measurements, in microns: Body (*a*) 240 by 60, (*b*) 180 by 55, (*c*) 60 by 31, (*d*) width of body 36. Other measurements from *d:* Nuclei 4, 4.9 by 4, dividing nuclei 5.9 by 4, length of cilia 8.9, interval between lines of cilia 2.7. The number of nucleoli is probably 4.

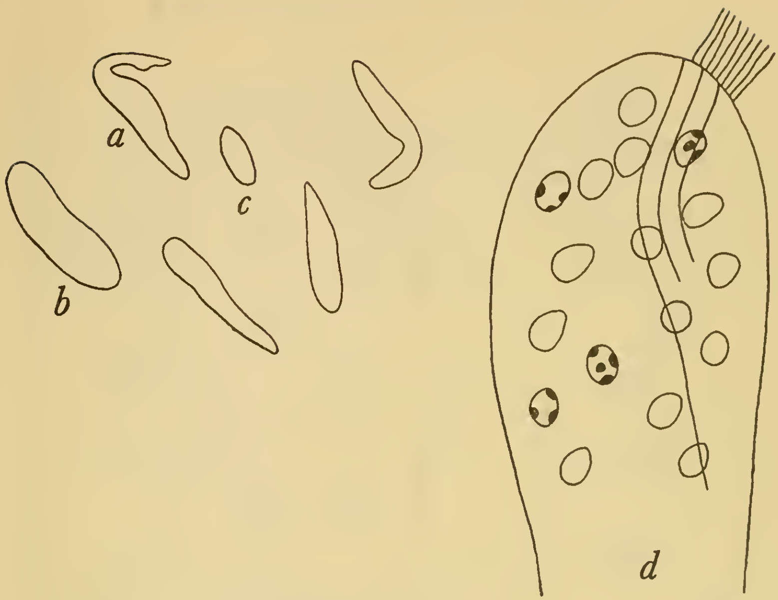


FIGURE 73.—*Cepedea luzonensis*, new species, from *Rana luzonensis:* *a-c*, ×117; *d*, ×1010.

CEPEDEA LUZONENSIS

FIGURE 74

Host: *Rana similis* Günther, one specimen, from Rizal, Philippine Islands, well infected.

These Cepedeas are evidently the same as those in *Rana luzonensis*.

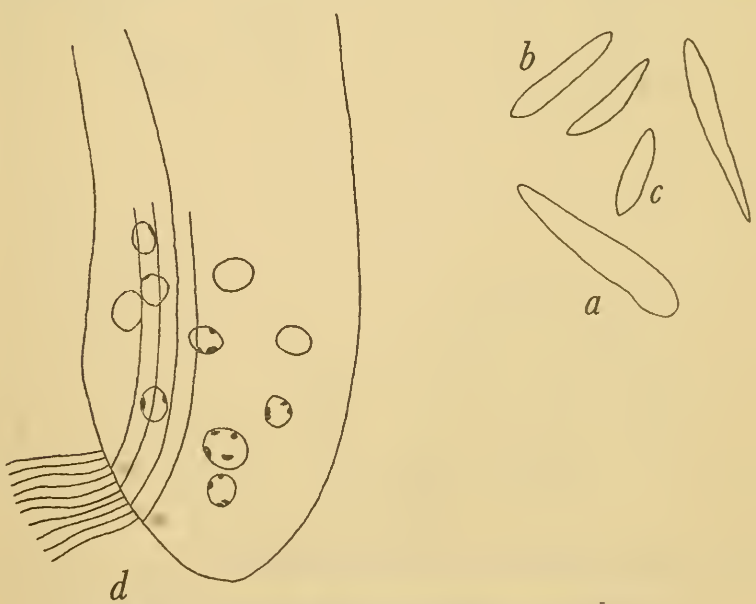


FIGURE 74.—*Cepedea luzonensis*, from *Rana similis:* *a-c*, ×117; *d*, ×1010.

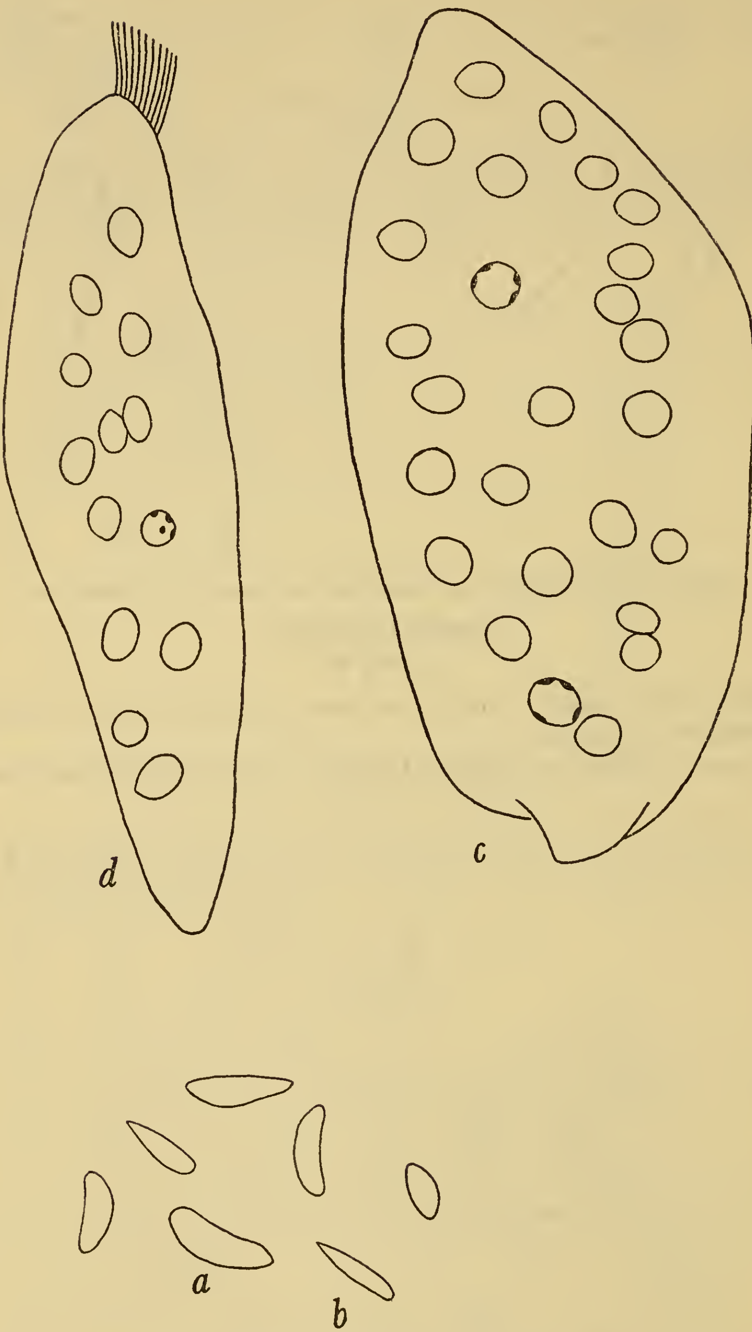


FIGURE 75.—*Cepedea luzonensis aponensis*, new subspecies, from *Rana magna*: *a* and *b*, $\times$ 117; *c* and *d*, $\times$ 1010.

CEPEDEA LUZONENSIS APONENSIS, new subspecies

FIGURE 75

Type: U.S.N.M. No. 22640.

Host: *Rana magna* Stejneger, two specimens, from Mount Apo, Mindanao, Philippine Islands (U.S.N.M. Nos. 34778 and 34780).

Both specimens of the host were well infected with a *Cepedea* smaller than *C. luzonensis*. The shapes of the individuals and the proportions of the different shapes in the infections remind one strongly of some infections of *C. dimidiata* in which the swollen

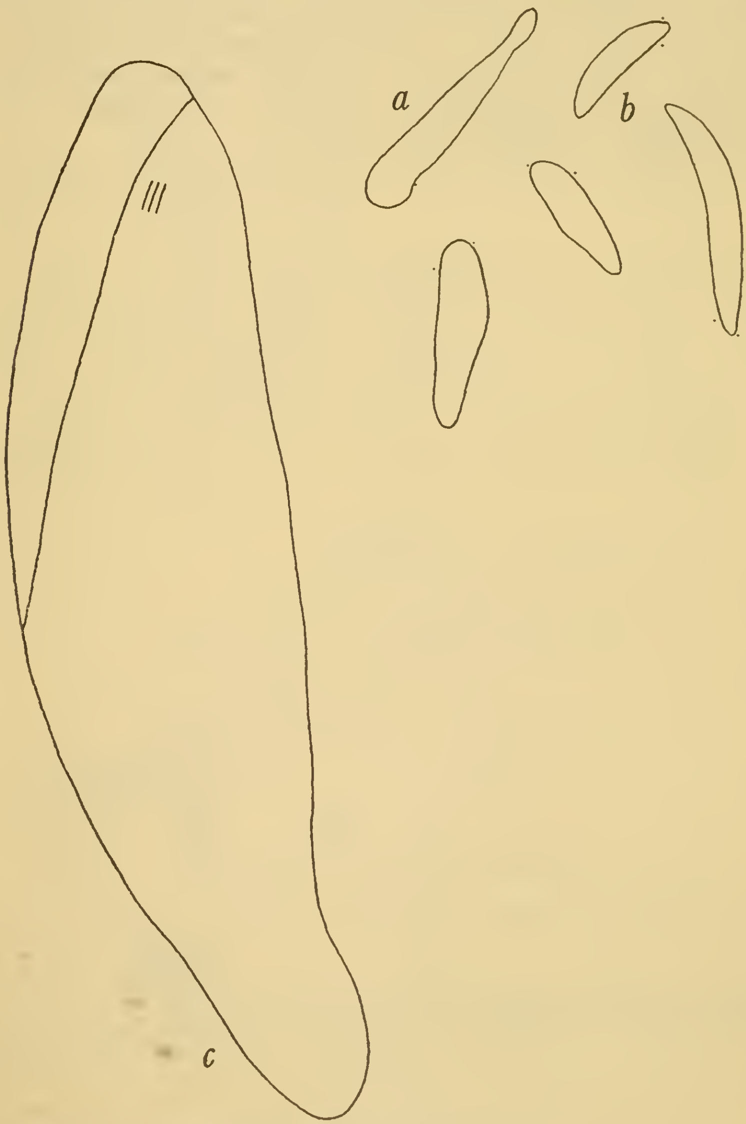


FIGURE 76.—*Cepedea ciliata*, new species, from *Hyla fuscovaria:* *a* and *b*, × 117; *c*, × 1010.

forma *zelleri* is not present. It apparently belongs with *C. dimidiata* in the same subgenus, as does also *C. luzonensis*. As good a treatment as I can suggest is to class it as a subspecies of *C. luzonensis*.

CEPEDEA CILIATA, new species

FIGURE 76

Type: U.S.N.M. No. 22641.

Host: *Hyla fuscovaria* Lutz, from the State of Minas Geraes, Brazil; two specimens, one uninfected.

The infected specimen of this frog bore myriads of Cepedeas intermediate in shape between the *longa* type and the *dimidiata* type. They are considerably flattened. The most marked character is a very dense ciliation, the spaces between the rows of cilia in the anterior portion of the body being only 1μ.

Body measurements, in microns: 30 by 44, 154 by 34, 140 by 36.

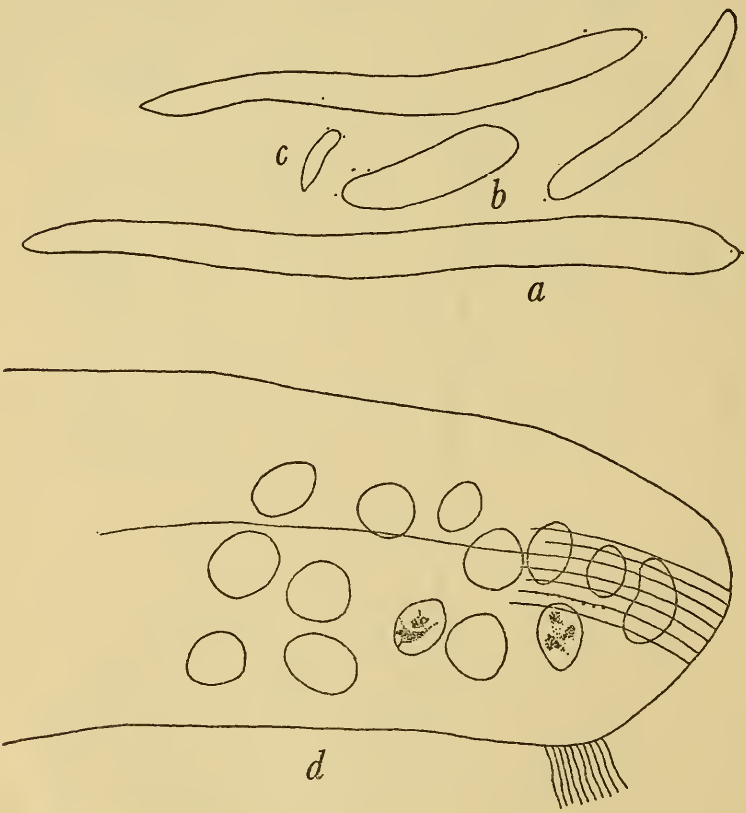


FIGURE 77.—*Cepedea longa macronucleata*, new subspecies, from *Rana vittigera*: *a–c*, ×117; *d*, ×1010.

CEPEDEA LONGA MACRONUCLEATA, new subspecies

FIGURE 77, 78

Type: U.S.N.M. No. 22642.

Host: *Rana vittigera* Wiegmann,[4] from Manila, Philippine Islands, four specimens, three uninfected, the fourth abundantly infected (U.S.N.M. No. 39175), 44 mm. long; also a specimen from Guijulugan, Negros Island (U.S.N.M. No. 68655), 44 mm. long, very heavily infected.

Measurements, in microns: Body (*a*) 800 by 60, (*b*) 166 by 55, (*c*) 70 by 18.8; other measurements (*d*): Width of body 46, nuclei 7.6,

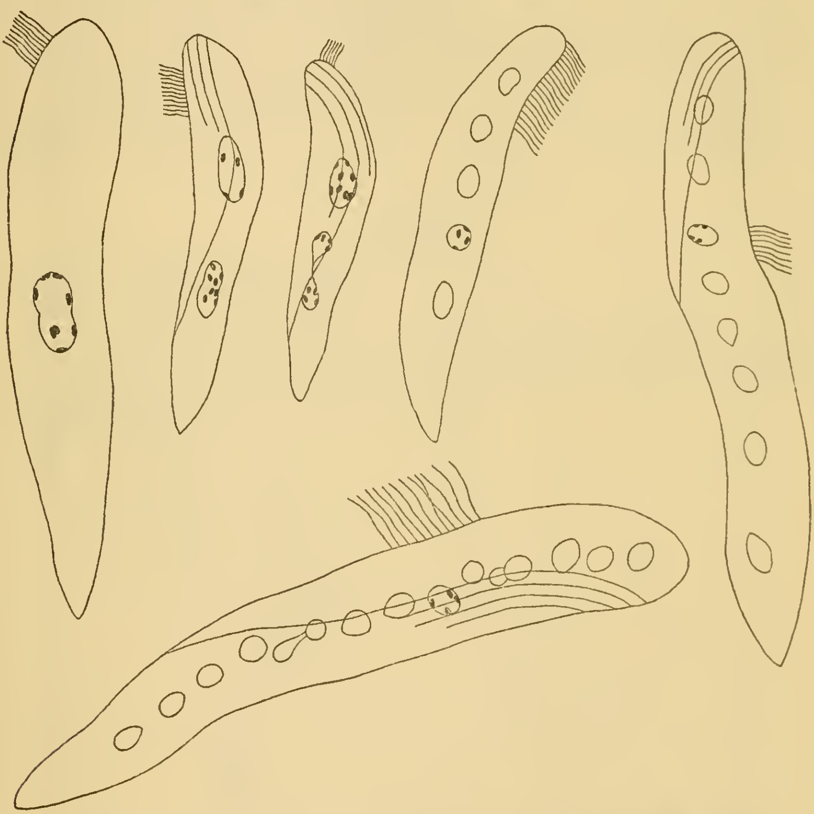


FIGURE 78.—Larvae of *Cepedea longa macronucleata*, from tadpoles of *Rana vittigera*, × 673.

9.7 by 7, 8.7 by 5.5, 6.9 by 5, cilia length 8.4, interval between cilia lines 1.7; nucleoli 4.

In two tadpoles (U.S.N.M. Nos. 39252A and 39252B), 11.5 and 12 mm. long, respectively, were found abundant larval Cepedeas (fig. 78) showing a series of stages in development. The uninucleate and binucleate ones are essentially Protoopalinas. As the nuclei increase in number they remain in a line down the axis of the body,

[4] Perhaps equivalent to *R. cancrivora* of the Malay Archipelago.

recalling *P. axonucleata* (Metcalf, 1923a). Later the nuclear arrangement becomes irregular. In the dividing nuclei the nucleolus number is clearly seen to be 4. In most of these larval nuclei, though not in division, the nucleolar masses are 4. No flattened larvae are seen, that is, there is no *Zelleriella* stage in the development of *Cepedea.* All this agrees with the phylogeny as I postulated it on the basis of comparative anatomy, deriving *Cepedea* from *Protoopalina* through forms like *P. axonucleata.*

CEPEDEA LONGA HISPANICA Metcalf

FIGURE 79

Cepedea hispanica METCALF, 1923a, p. 161.

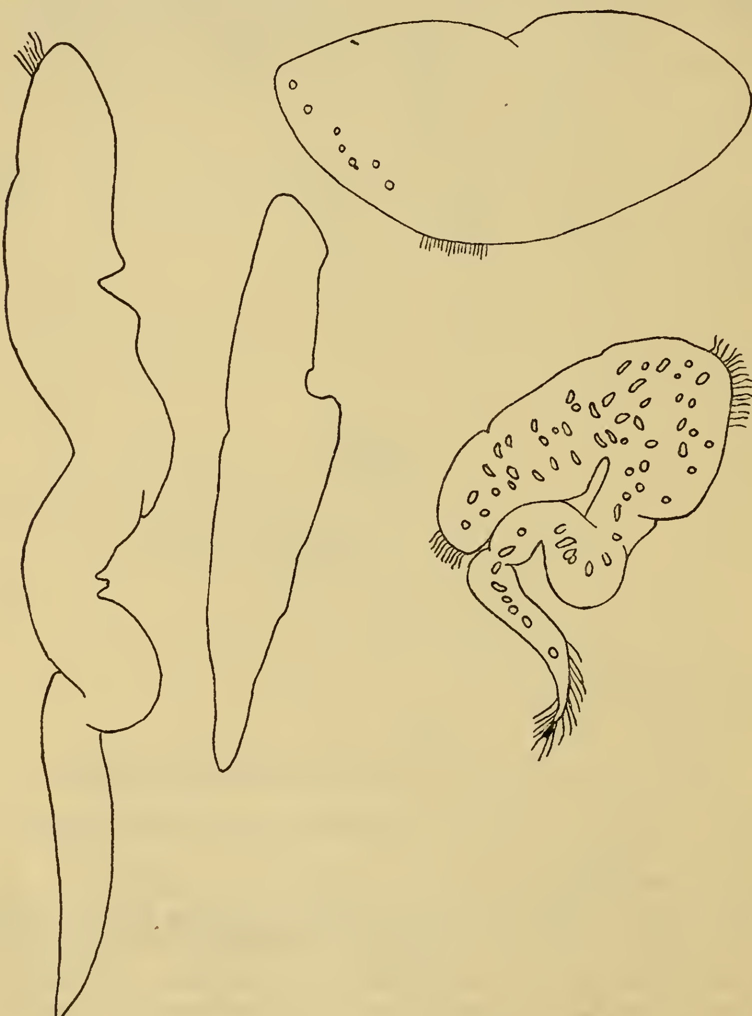


FIGURE 79.—*Cepedea longa hispanica* Metcalf from *Rana limnocharis*, × 460.

Host: *Rana limnocharis* Wiegmann, one specimen, from Sitong Ridge, Darjiling District, northern India, abundantly infected.

Both the Indian and the Spanish parasites are very similar to *C. longa* but are not nearly so long. The nuclei are elongated with their long dimension across the body, as in *C. longa*. Some of the Darjiling individuals show irregular shapes owing to repeated divisions, indicating approach to the time of formation of gametes. In the infection are a few much swollen individuals. It seems best to demote *C. hispanica* from specific rank (Metcalf, 1923a), to class it as a subspecies of *C. longa*, and to include the Darjiling specimens in spite of their having some peculiar, swollen individuals. Many species of *Cepedea* have occasional enlarged forms.

Measurements, in microns: Body (*a*) 166 by 21.7, (*b*) 315 by 26.1, (*d*) 370 by 26. Other measurements of *c:* Nucleus 5 by 1.6, 4 by 1.2, daughter nucleus 3, cross diameter of dividing nucleus 1.5; length of cilia 6.

CEPEDEA PLATA, new species

Figure 80

Type: U.S.N.M. No. 22643.

Host: *Hyla faber* Wied.

One of four specimens of this tree frog from Rio de Janeiro, Brazil, and each of two from Angra dos Reis, in the same State, bore enormous infections of this remarkably flat *Cepedea.*

Figure 80.—*Cepedea plata*, new species, from *Hyla faber:* *a* and *b*, × 117; *c*, × 505.

Measurements, in microns: Length of body (*a*) 350, (*b*) 240; interval between lines of cilia 1.7.

CEPEDEA (?)

FIGURE 81

Host: *Rana crassa* Jerdon.

In a rather young tadpole of this frog, 43 mm. long, body 13.5 mm. and hind legs 2 mm. long, collected in southern India, were opalinid larvae that, of course, could not be identified without a larger series

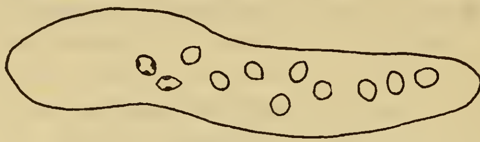


FIGURE 81.—*Cepedea* (?) from tadpole of *Rana crassa*, × 820.

of material. They seem to be *Cepedea*, though there is a possibility that they are *Opalina* in a *Cepedea* stage of the life history.

Measurements, in microns: Body length 77, width 16; nuclei 3.4 by 3.2, 4.7 by 2.6, 3.8 by 3.8.

CEPEDEA species (?)

FIGURE 82

Host: *Eleutherodactylus guentheri* (Steindachner), from Angra dos Reis, State of Rio de Janeiro, Brazil.

In tadpoles of this host, 46 mm. long, of which 17 mm. is length of body and the rest tail, there are very slender larvae of *Cepedea*, which

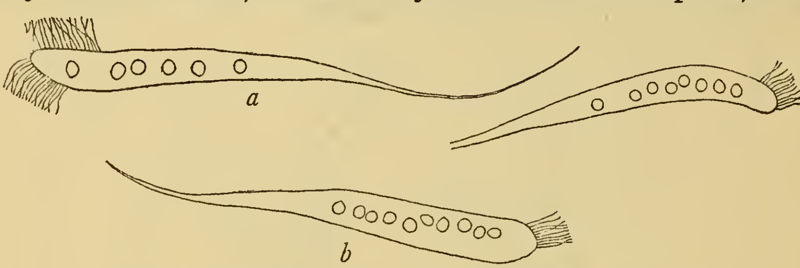


FIGURE 82.—*Cepedea* sp. (?) from tadpole of *Eleutherodactylus guentheri*, × 453.

cannot, from the material in hand, be assigned to any species. Note that, as is often the case in multinucleate opalinids, the nuclei are larger in the younger forms.

Measurements, in microns:

Measurement	*a*	*b*
Total length	160	130
Length of body	89	73
Length of tail	71	57
Length of cilia	11. 7	10
Width of body	10	13
Diameter of nucleus	5	3. 7

CEPEDEA species (?)

FIGURE 83

Host: Tadpoles of *Eleutherodactylus* sp. (?).

In a metamorphosing tadpole of an undetermined species of this frog, 56 mm. long and with hind legs 21 mm. and forelegs 11.5 mm. long, occurred Cepedeas as shown in figure 83.

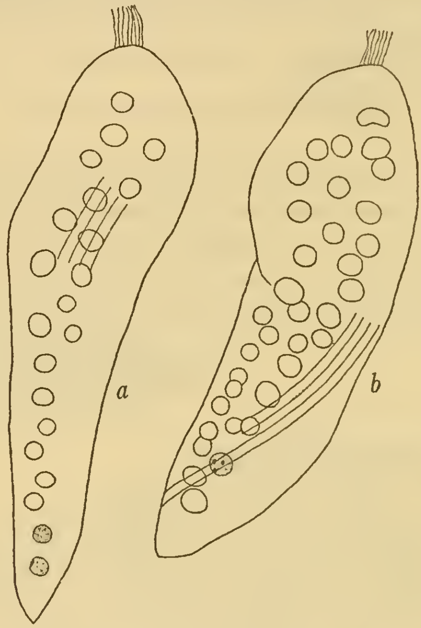


FIGURE 83.—*Cepedea* sp. (?) from tadpoles of *Eleutherodactylus* sp. (?), × 453.

Measurements, in microns:

Measurement	a	b
Length of body	183	120
Greatest width of body	44	50
Diameter of nuclei, average	2.4	2.4
Length of cilia	12	--------
Interval between lines of cilia	3.3	2.7
Interval between cilia in line	1.4	--------

CEPEDEA SCALPRIFORMIS Ghosh

FIGURE 84

Host: *Bufo melanostictus* Schneider, from India.

Resembles *C. dimidiata* in outline but quadrangular, wedge-shaped, and truncate in front. This seems a valid species.

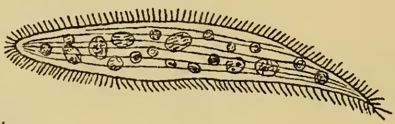
FIGURE 84.—*Cepedea scalpriformis* Ghosh.

CEPEDEA SIALKOTI Bhatia and Gulati

FIGURE 85

Host: *Bufo macrotis* Boulenger, from Punjab, India.

In their drawings of this and other opalinids, Bhatia and Gulati (1927) have shown the rows of cilia as converging to the two ends of the body. Others have not observed this arrangement in any species. Probably it is due to inadvertent error of observation.



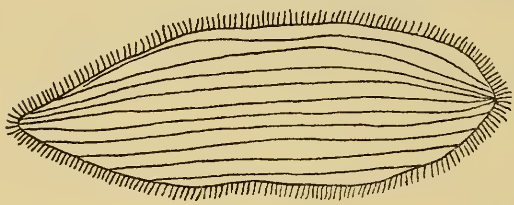


FIGURE 85.—*Cepedea sialkoti* Bhatia and Gulati.

Measurements, in microns, are recorded as follows: Body 89 by 31, 64 by 14, nucleus 7.

As in many other species, broad and narrow forms are found (cf. *C. dimidiata* and the forma *zelleri*). Without seeing specimens of this *Cepedea* I hesitate to discuss its affinities.

CEPEDEA METCALFI Bhatia and Gulati

FIGURE 86

Host: *Bufo melanostictus* Schneider, from India.

In this species, again, slender and stocky forms are found.

Measurements, in microns, are given as follows: Body 108 by 40, 85 by 35, 81 by 67, 71 by 17; interval between lines of cilia 2.5, apparently in the middle of the body. Nuclei spherical.

The description is not sufficient to distinguish this form from *C. sialkoti* or to allow determination of relationships.

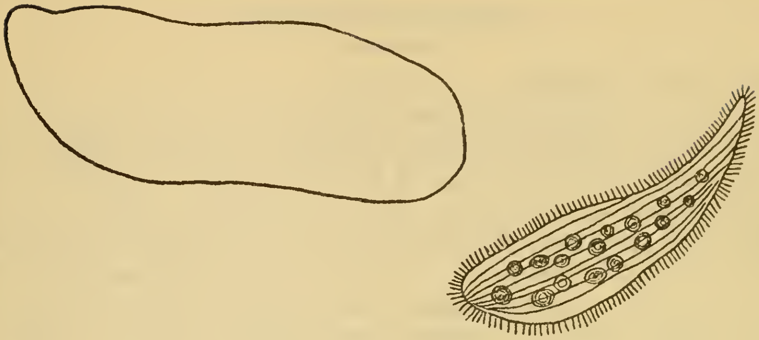


FIGURE 86.—*Cepedea metcalfi* Bhatia and Gulati.

CEPEDEA PUNJABENSIS Bhatia and Gulati

FIGURE 87

Host: *Bufo melanostictus* Schneider, from Punjab, India.

The triangular shape of the anterior part of the body and its anterior point indicate this as a distinct species.

Measurements, in microns, are given as follows: Body 82 by 53; nucleus 4.

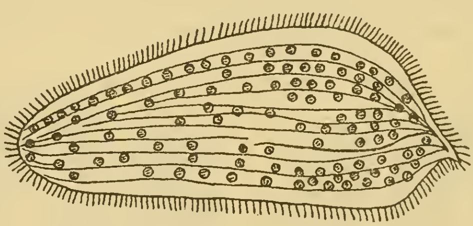


FIGURE 87.—*Cepedea punjabensis* Bhatia and Gulati.

The drawing shows the small nuclei in rows between the lines of cilia, an arrangement not before observed and difficult to understand, for the nuclei lie at a much deeper level. Probably the observation was not quite accurate.

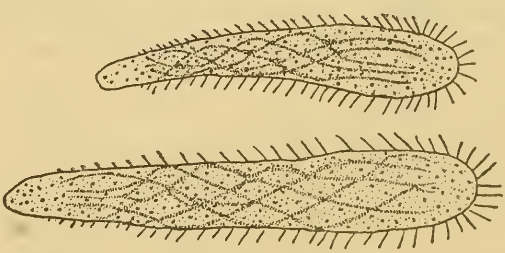


FIGURE 88.—*Cepedea rugosa* (Carini) from *Hyla nebulosa*, × ca. 220. (After Carini.)

CEPEDEA RUGOSA (Carini)

FIGURE 88

Opalina rugosa Carini, 1937.

Host: *Hyla nebulosa* Spix, from Brazil.

The body is generally straight or slightly bent, very slightly flattened, and measures 270–320μ in length by 30–45μ in width. The anterior end is a little larger than the posterior, which is blunt. This *Cepedea* has been found only once or twice in spite of numerous examinations. It presents on its surface a number of wrinkles, which begin near the anterior end and extend almost to the posterior end. In the anterior part the wrinkles have a linear longitudinal arrangement, but as they proceed toward the posterior end they intertwine. This wrinkled aspect is very characteristic of the species, seen in living condition immediately after they are removed from the intestine. It is not certain as yet whether this characteristic is a normal one. (A restudy of this species is desirable.)

CEPEDEA THIAGI de Mello

FIGURE 89

Host: *Rhacophorus maculatus* Gray, from Nova Goa.

One very distinct characteristic of this species of *Cepedea* is the alveolar appearance of the anterior end. The posterior end may be

FIGURE 89.—*Cepedea thiagi* de Mello from *Rhacophorus maculatus.* Magnification not given. (After de Mello.)

either rounded or pointed. Length of body varies from 125μ to 440μ. There are numerous nuclei having a diameter of 4–5μ.

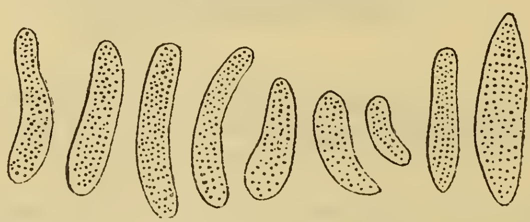


FIGURE 90.—*Cepedea subcylindrica* de Mello from *Bufo melanostictus.* Magnification not given. (After de Mello.)

CEPEDEA SUBCYLINDRICA de Mello

FIGURE 90

Host: *Bufo melanostictus* Schneider, from Nova Goa.

This multinucleate *Cepedea* is elongated and spindle-shaped; the anterior end is generally less pointed than the posterior end. Variations are found in some animals; both the anterior and posterior ends are blunt—they appear as cylinders. Several drawings are copied from de Mello's paper, and they are diagrammatic although made with the aid of a camera lucida.

The measurements of a number of individuals show that they vary in length from 35μ to 250μ and in width from 15μ to 80μ; the diameter of the nuclei is 2.5–3.5μ. (The description is too scant for specific identification.)

CEPEDEA species (?)

Cepedeas of an unidentified species were found in a Siamese specimen of *Rana cancrivora* Gravenhorst (U. S. N. M. No. 66550). It was a scant infection and no drawings were made. Another specimen (U. S. N. M. No. 66551) was uninfected.

CEPEDEA species (?)

FIGURE 91

Host: *Aelurophryne mammata* Günther, from Songpau, Szechwan, western China.

Specimens of this toad, 21 and 22 mm. long, were lightly infected with Cepedeas too poorly preserved for study. In one host the parasites averaged 66μ long; in the other they were mostly about 190μ in length by 36μ wide. In form both the large and the smaller Cepedeas resemble *C. dimidiata* (Stein). Staining proved peculiarly difficult, so that no further report, upon nuclei or any other features, can be made.

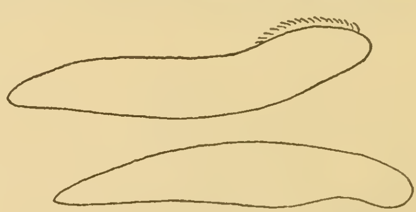


FIGURE 91.—*Cepedea* sp. (?) from *Aelurophryne mammata*, × 250.

Genus OPALINA Purkinje and Valentin

OPALINA RANARUM ORBICULATA, new subspecies

FIGURE 92

Type: U.S.N.M. No. 22644.

Host: *Rana glandulosa* Boulenger.

One specimen of this host from Singapore (U.S.N.M. No. 34514) was very heavily infected with large Opalinas of the general *ranarum* type, though its nuclei run somewhat smaller. In the great complex of *ranarum*-like forms it is difficult, probably impossible, to give any classification that will express relationship. Forms of similar appearance are not necessarily genetically close together.

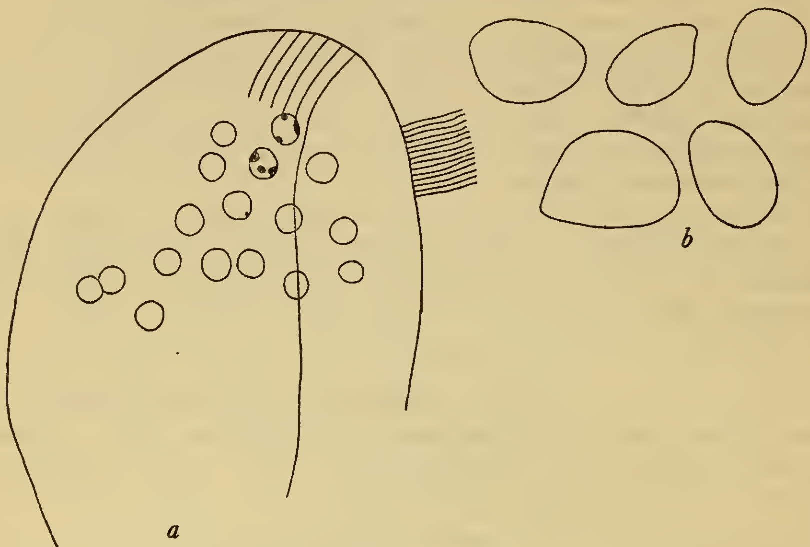


FIGURE 92.—*Opalina ranarum orbiculata*, new subspecies, from *Rana glandulosa: a*, × 673; *b*, × 78.

Measurements, in microns: Body 230 by 160, 180 by 100; width of body (in another specimen) 80; nuclei 6.4, 5.4, 4.9, 4.3; length of cilia 12.9; interval between lines of cilia 2.3.

FIGURE 93.—*Opalina ranarum orbiculata* from *Rana temporalis: a* and *b*, × 78; *c*, ×673.

OPALINA RANARUM ORBICULATA

Figure 93

Host: *Rana temporalis* Günther, from Bogawantalava, Ceylon, 4,000 feet altitude.

Of six individuals opened, two (U.S.N.M. Nos. 67057 and 67058) were well infected. The Opalinas were large and broad, almost orbicular, their nuclei spheroidal, of moderate size, their cilia sparse, the lines being widely spaced even at the anterior end. They resemble the *ranarum* group rather than *japonica* in the shape of their posterior ends.

Measurements, in microns: (*a*) Body 210 by 160; (*b*) body 60 by 40, (*c*) nuclei 6.9, 6.5, 5.8, 4.7, length of cilia 10, interval between lines of cilia 4. Nucleoli 4.

OPALINA ZEYLONICA, new species

Figure 94

Type: U.S.N.M. No. 22645.

Host: *Polypedates eques* (Günther).

Two out of five specimens (U.S.N.M. No. 6790, 37 mm. long, and No. 67902, 19 mm. long) from Bogawantalava, Ceylon, well infected with a large *Opalina* of unusually irregular shape and remarkably dense ciliation (cilia lines with narrow interspaces). Nuclei mostly somewhat pointed, usually at only one end, probably a reminder of their previous division.

Figure 94.—*Opalina zeylonica*, new species, from *Polypedates eques*: *a–c*, × 78; *d*, × 673

Measurements, in microns: Body (*a*) 200 by 100, (*b*) 183 by 100, (*c*) 85 by 38, (*d*) nuclei 5.9 by 3.3, 4.5 by 3.1, length of cilia 13.8, interval between lines of cilia 1.2.

OPALINA MALAYSIAE, new species

FIGURE 95

Type: U.S.N.M. No. 22646.

Host: *Rana labialis* Boulenger.

Two specimens of this frog from Trong, Lower Siam (U.S.N.M. Nos. 24040 and 24042), each 47 mm. long, were both infected with the same species of *Opalina*. These opalinids rather closely resemble those from *R. macrodactyla* and *R. macrodon*, except that the nucleolar substance is not aggregated into one or two subcaryothecal spheroidal

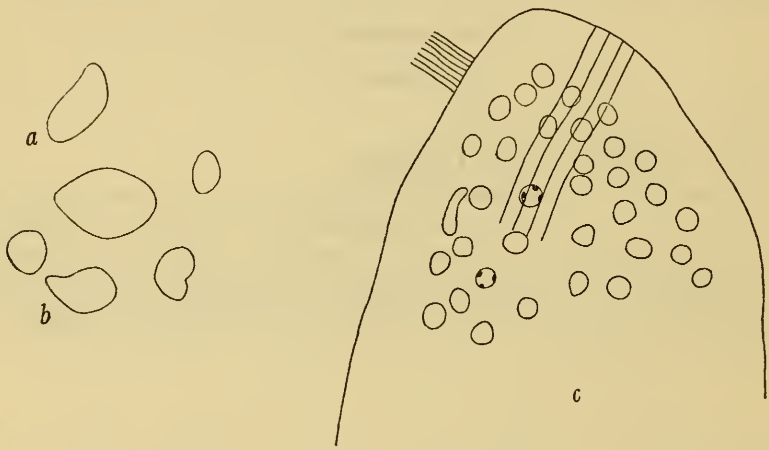


FIGURE 95.—*Opalina malaysiae*, new species, from *Rana labialis*: *a* and *b*, × 78; *c*, × 673.

disks but is in three or four or more masses as in many species. The *labialis* infections show animals half as large, or less, and they show a larger proportion of forms slender, especially behind. Their shape, too, is more irregular. They seem a distinct species.

Measurements, in microns: Body 180 by 118, 120 by 70, 67 by 42; width of body (another specimen) 81, nuclei 4.5, 3.8, 3.6, dividing nucleus 9.9 by 2.7, length of cilia 10, interval between lines of cilia 2.9.

OPALINA MALAYSIAE (?)

FIGURE 96

Host: *Microhyla ornata* Duméril and Bibron.

In a tadpole of this frog, 22 mm. long and with all four legs well developed, there was found a single *Opalina* with measurements, in microns, as follows: Body length 125, greatest width 49; length of oval nucleus 6, width 4.4; length of daughter nucleus in anaphase 6.4, width 3.4; dividing nucleus, length 9.7, width 2.9. These are from Rangoon, Burma.

In shape and size of body and in shape and size of resting and dividing nuclei the parasite agrees with *O. malaysiae* from *Rana labialis* from Siam, but the material is scant, and the preservation does not allow detailed study and I am not definitely assigning the Opalinas to this species though probably they are the same.

OPALINA JAPONICA Sugiyama

Figure 97

Host: *Cacopus systoma* (Schneider).

Two specimens of this gastrophrynid were sent me from Madras, India. Both were infected with a thin *Opalina* that resembles *O.*

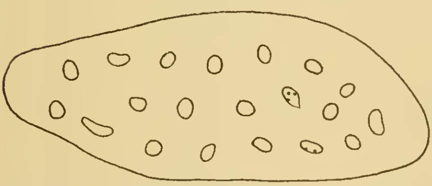


Figure 96.—*Opalina malaysiae* (?) from tadpole of *Microhyla ornata*, × 453.

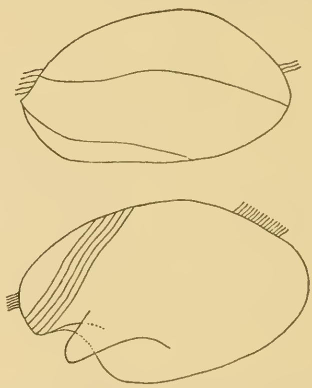


Figure 97.—*Opalina japonica* Sugiyama from *Cacopus systoma*, × 505.

japonica except that it is even thinner than this last species. This seems not a sufficient indication to justify even subspecific distinction. The host and the locality are new for this species.

Measurements, in microns: Body 110 by 60, 160 by 88; nuclei 3.7, 4, 4.5; length of cilia 7.2; very thin.

OPALINA JAPONICA Sugiyama

Figure 98

Host: *Rana limnocharis* Wiegmann, from Trihur, Cochin Province, southern India, sent by the Madras Museum. The animals of this abundant infection resemble the Java specimens, from the same frog, which I formerly doubtfully assigned to *O. japonica*. Study of this Indian infection confirms the conclusion, the posterior ends of the Japanese and the Indian forms, with their points and often exaggerated tails, forming a rather remarkable resemblance.

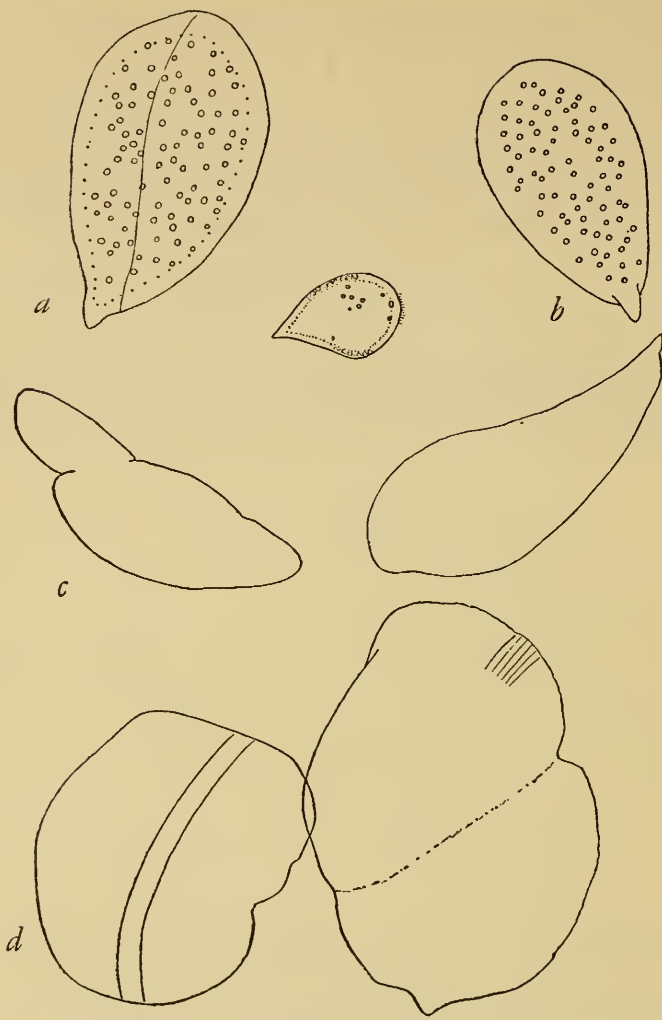


FIGURE 98.—*Opalina japonica* Sugiyama from *Rana limnocharis*, × 146 and 340.

Measurements, in microns: (*a*) body 178 by 104, cilia line interval 2.6; (*b*) body 148 by 78, nucleus 4 by 3.6; (*c*) body 158.7 by 60; (*d*) body 134 by 121.7, nuclei 4.2 by 3, 4.3 by 3.9, dividing nuclei 10 by 3.2, 15 by 4, length of cilia 8.

This is a new locality for this species but it is in the same host as before reported.

OPALINA JAPONICA JAVENSIS, new subspecies

FIGURE 99

Type: U.S.N.M. No. 22647.

Host: *Nyctixalus margaritifera* Boulenger.

A single specimen of this ranid (U.S.N.M. No. 62642), 28½ mm. long, from Mount Gade, Tjibodas, Java, was well infected with very large Opalinas pointed posteriorly like most specimens of *O. japonica* and of about the same shapes, but much larger and with larger nuclei.

Measurements, in microns: Body 300 by 170, nuclei 4, 5, 5.4, 5.8, length of cilia 11, interval between lines of cilia 2.1.

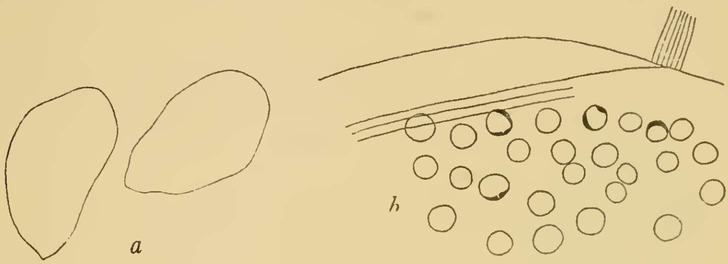


FIGURE 99.—*Opalina japonica javensis*, new subspecies, from *Nyctixalus margaritifera*: *a*, × 78; *b*, × 673.

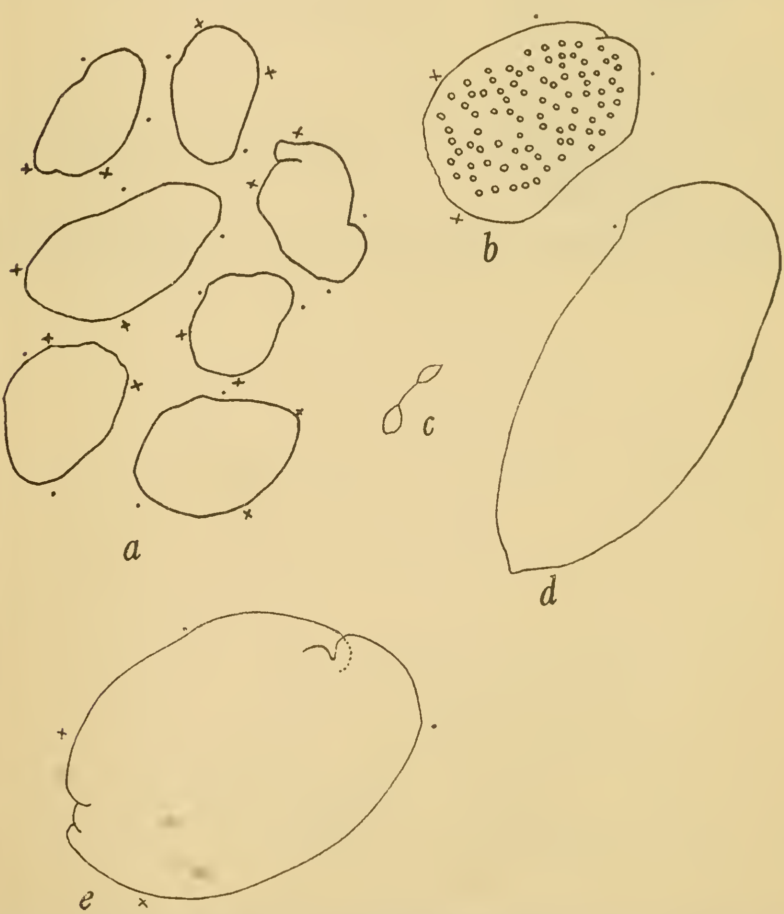


FIGURE 100.—*Opalina annandali*, new species, from *Rana tigrina*: *a*, A group, × 117; *b*, × 249; *c*, a dividing nucleus, × 1010; *d* and *e*, × 460. In these figures, as in some others, the limits of the anterior end of the body, right and left, are indicated each by a dot outside the body contour.

OPALINA ANNANDALI, new species

FIGURE 100

Host: *Rana tigrina* Daudin.

Of two freshly preserved specimens of this frog collected by Professor Annandale in the garden of the Indian Museum at Calcutta one bore many Opalinas of an undescribed species. The very thin posterior edge is indicated in the figures between two "x" marks. The infection shows a few individuals with abruptly sharp posterior points. Their irregular shapes are similar to those of *O. natalensis*, *O. rotunda*, and *O. zeylonica*.

Measurements, in microns: (*a*) Body 128 by 57, nuclei 3.1, 3.3, 3.8 by 2; (*b*) body 112 by 75, nuclei 3.5, 4 by 2.8.

This species resembles the *japonica* group in shape, and in dimensions of nuclei.

OPALINA CORACOIDEA Bezzenberger

FIGURE 101

Host: *Rana cyanophlyctis* Schneider.

From Tillimanti, southern India, 2 uninfected frogs; from Rhamnad, southern India, 2 frogs uninfected; from Bogawantalava, Ceylon, altitude 4,000 feet, 5 frogs, 3 infected. Bezzenberger's figure shows but one of a number of shapes. A posterior point may or may not be present. Frequently it may be exaggerated into a well-developed tail. Dividing or even fragmenting individuals (di-

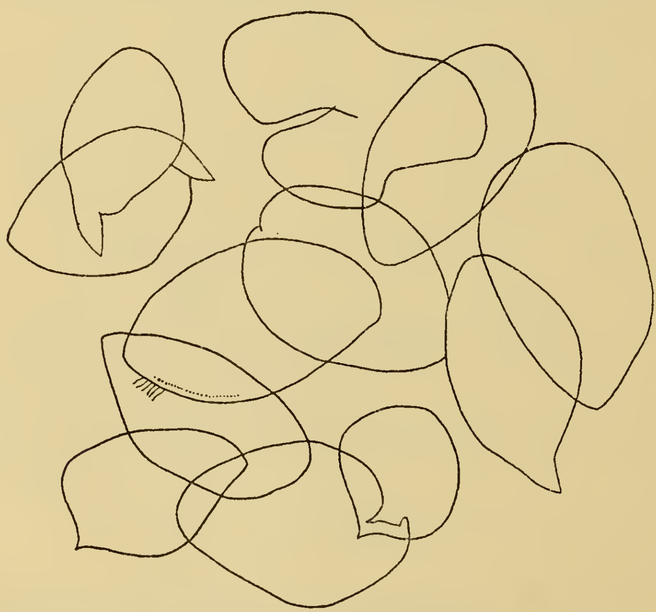


FIGURE 101.—*Opalina coracoidea* Bezzenberger, from *Rana cyanophlyctis*, × 117.

viding at the same time into more than two portions) were seen. The length of many a specimen is twice as great as in Bezzenberger's examples.

OPALINA CORACOIDEA LAHORENSIS Bhatia and Gulati

FIGURE 102

Host: *Bufo melanostictus* Schneider.

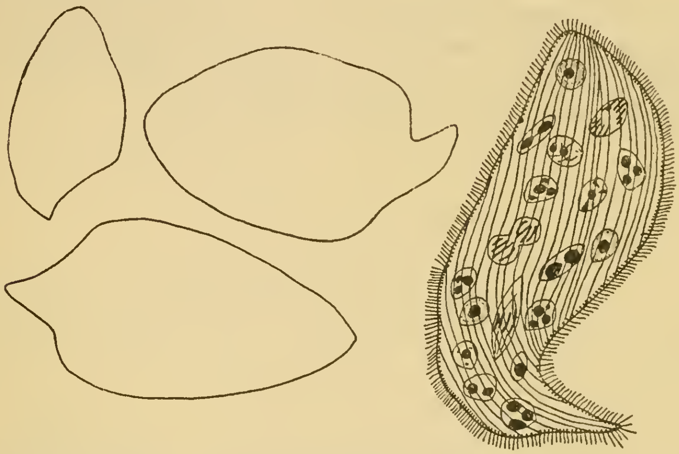


FIGURE 102.—*Opalina coracoidea lahorensis* Bhatia and Gulati from *Bufo melanostictus*. (After Bhatia and Gulati.)

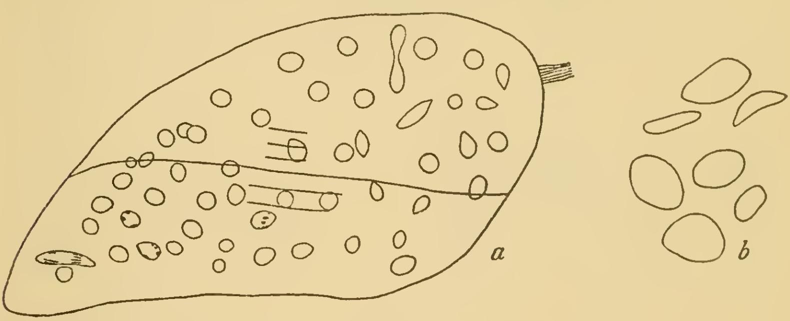


FIGURE 103.—*Opalina mantellae*, new species, from *Mantella baroni*: *a*, ×673; *b*, ×78.

OPALINA MANTELLAE, new species

FIGURE 103

Type: U.S.N.M. No. 22648.
Host: *Mantella baroni* Boulenger.

One specimen, 26 mm. long, from Madagascar (U.S.N.M. No. 60656), bore very abundant, small Opalinas with small nuclei. The sparse ciliation, lines of cilia rather widely spaced in front as well as in the middle of the body, is noticeable.

Measurements, in microns: Body 110 by 77, 125 by 64, 100 by 24, 70 by 26, 114 by 55; nuclei 3.3, 4, 4.2, dividing nucleus 10 by 2.2; length of cilia 6.1; interval between lines of cilia 2.8.

OPALINA species (?), probably of the JAPONICA group

FIGURE 104

Host: *Rana hexadactyla* Lesson, tadpole, a specimen from southern India in a late stage of metamorphosis, but with tail not absorbed (total length 46 mm., hind legs 19 mm. long, fore legs 6.5 mm.).

The drawings show: *a*, A *Cepedea* stage; *b*, an older *Cepedea* stage; *c*, an *Opalina*, probably not quite of mature form.

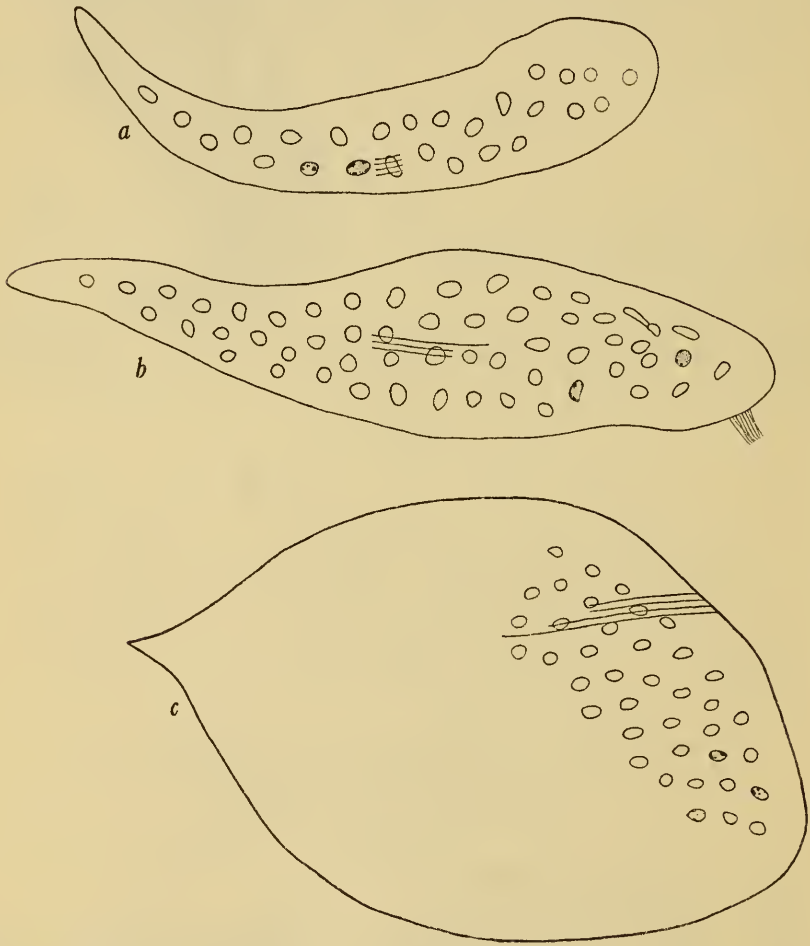


FIGURE 104.—*Opalina* sp. (?), probably of the *japonica* group, from tadpoles of *Rana hexadactyla*, × 410.

Measurements, in microns:

Measurement	a	b	c
Length	200	248	228
Width	36	60	170
Nucleus length	6	6	6. 7
Nucleus width	4	5. 7	4. 9
Dividing nucleus length	--------	9. 1	--------
Dividing nucelus width	--------	2. 3	--------
Length of cilia	--------	10	--------
Interval between lines of cilia	2. 5	--------	2. 5

In another, younger, tadpole of the same species from the same locality are larvae of apparently the same *Opalina.*

OPALINA CHATTONI Weill

FIGURE 105

Host: *Bufo melanostictus* Schneider, from Cochinchina.

This rather large *Opalina* with large nuclei is distinctively characterized, at least in the cysts and young stages, which Weill studied,

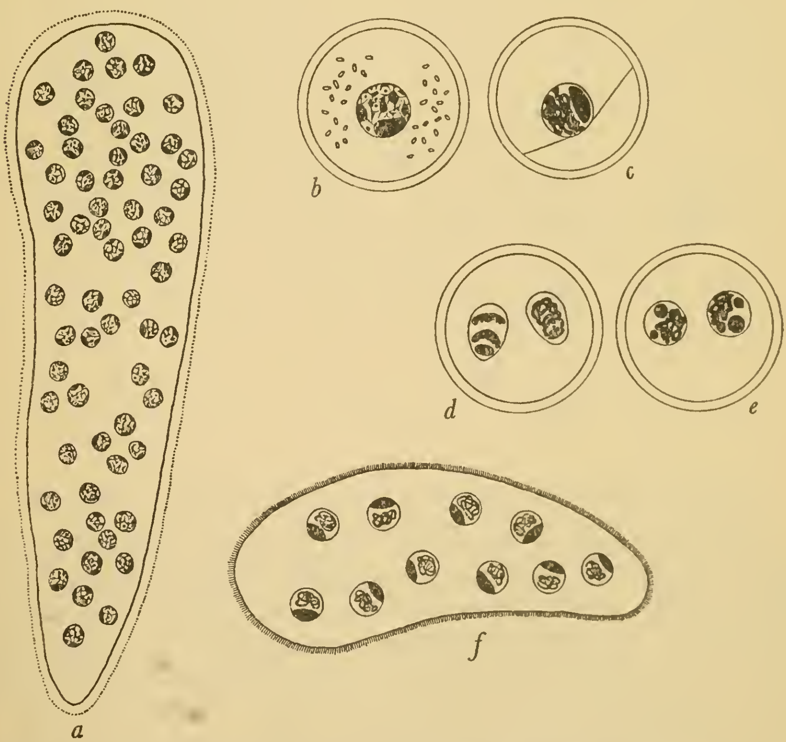


FIGURE 105.—*Opalina chattoni* Weill from *Bufo melanostictus: a*, Adult, × 427; *b–e*, cysts, × 1677; *f*, small individual hatched from cyst, × 1333. (After Weill.)

by having the nucleolar substance in a spherical mass and the chromatin in the form of a very well defined, rather coarse spireme. It is a very distinct species well described and well illustrated by Weill.

Measurements, in microns: Adult, body 210 by 56, nuclei 6.7, 7.4, 4.8 (daughter nucleus), length of cilia 4.3; cyst 13, with 2 nuclei 13.2, with 11 nuclei 24.6; nuclei (uninucleate) 4, (binucleate) 3.2, (4 nuclei) 3.2 by 2.4; animal just hatched from cyst, body 44.2 by 16.7, nucleus 3.2; "encysted adults," body 83, 100 by 47.

The slender form of this *Opalina* is an unusual thing for an Eastern Hemisphere species. It may be an unusually flat *Cepedea*, like *C. virgula*. There seems to be no likelihood of its being genetically related to the *Opalinae angustae* of the Western Hemisphere.

OPALINA NUCLEOLATA, new species

FIGURE 106

Type: U.S.N.M. No. 22649.

Host: *Rana chalconota* (Schlegel), from Buitenzorg, Java, three specimens.

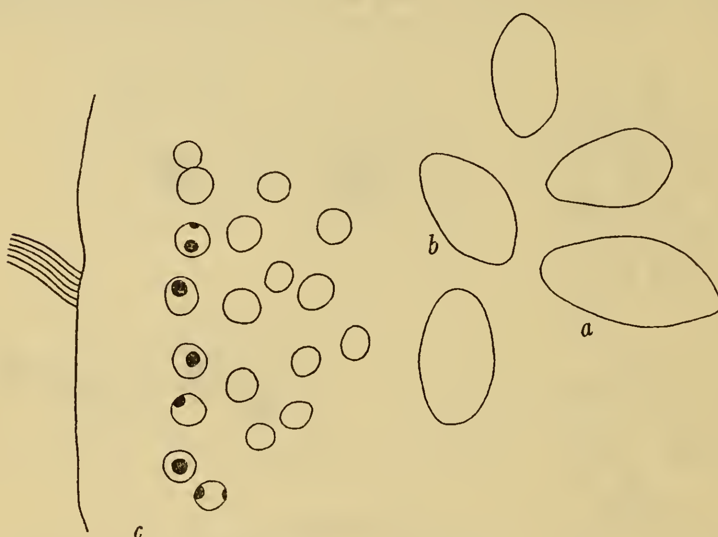


FIGURE 106.—*Opalina nucleolata*, new species, from *Rana chalconota*: *a* and *b*, × 78; *c*, × 673.

From the largest of these frogs (U.S.N.M. No. 43933), 54 mm. long, were obtained many very large Opalinas with large nuclei and of shapes rather uniform and about like those of some infections of *O. ranarum*, but their nuclei show a peculiarity that distinguishes them. Their nucleolar substance is gathered into one or two globular masses, slightly flattened against the nuclear membrane when in contact with it, apparently spherical when lying deeper in the nucleus. In my material the chromatin is scattered and not readily distinguished, not at all like the chromatin coil in young forms of Weill's

O. chattoni. Nucleolar masses, one to four in number, are found in the nuclei of many species of *Opalina*, but they are so pressed against the nuclear membrane as to be thin disks, often so thin as to escape casual observation in edge view. They are very different from these noticeable, almost spherical, bodies.

Measurements, in microns: Body (*a*) 300 by 155, (*b*) 220 by 120, (*c*) nuclei 6.9, 5.8, nucleolus up to 2.7, length of cilia 16.

OPALINA NUCLEOLATA SIAMENSIS, new subspecies

FIGURE 107

Type: U.S.N.M. No. 22650.

Host: *Rana macrodon* Duméril and Bibron.

A specimen of this host from Siam (U.S.N.M. No. 26225), 172 mm. long, bore many very large Opalinas with nuclei of only moderate size

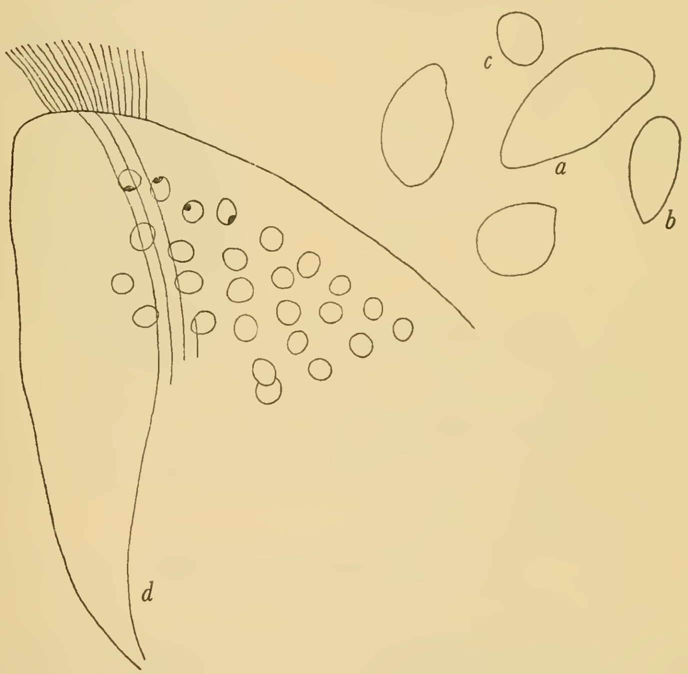


FIGURE 107.—*Opalina nucleolata siamensis*, new subspecies, from *Rana macrodon: a–c*, × 78; *d*, × 673.

and generally a single nucleolus in each nucleus. In size, in the range of shapes, and in the general appearance of the infection, as well as in the presence of these nucleoli, there is a resemblance to *O. nucleolata* from *Rana chalconota* from Java. The nuclei are smaller, a difference sufficient, perhaps, to justify recognition as a subspecies.

Measurements, in microns: Body (*a*) 300 by 140, (*b*) 200 by 90, (*c*) 100 by 68, (*d*) width of body 95, nuclei 4.7, 4, 4.2, dividing nucleus 5.9 by 4.9, length of cilia 10, interval between lines of cilia 2.9.

OPALINA NUCLEOLATA SIAMENSIS

FIGURE 108

Host: *Rana macrodactyla* (Günther), from Trong, Lower Siam (U.S.N.M. No. 22945), and Tonking (U.S.N.M. No. 33128), both specimens 44 mm. long.

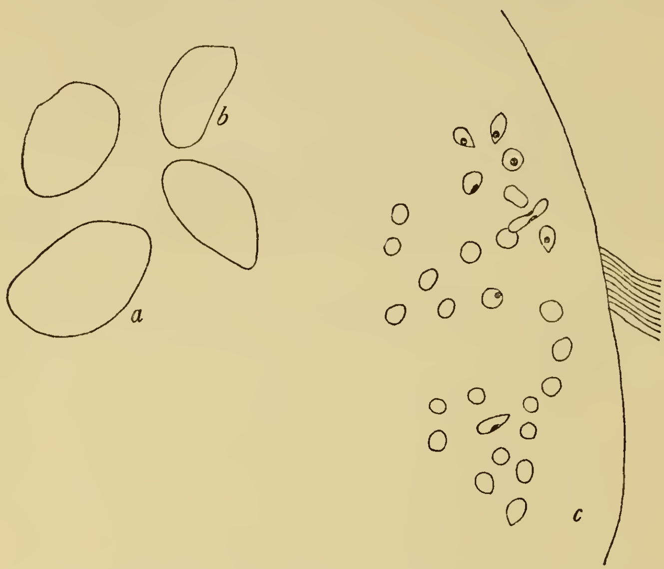


FIGURE 108.—*Opalina nucleolata siamensis* from *Rana macrodactyla: a* and *b*, × 75; *c*, × 673.

These Opalinas have still smaller nuclei than those from *R. macrodon* but in other regards resemble them.

Measurements, in microns: Body (*a*) 265 by 162, (*b*) 200 by 93, (*c*) nuclei 4.9, daughter nuclei 2.9, 3.1, dividing nuclei 4.9 by 3.3, 7 by 1.9, 9.7 by 2, length of cilia 12.8.

OPALINA OBTRIGONOIDEA Metcalf

FIGURE 109

Host: *Rana palustris* LeConte, tadpoles, from Woods Hole, Mass. Three examples of different ages, one with hind legs 6 mm. long, one with the hind legs 12 mm. long, a third having four legs and with the tail beginning to be absorbed, showed Opalinas in an *O. larvarum* stage, indicating that in this species also the narrow adults pass through a broad *Opalina* condition in their development.

Measurements, in microns: Body 120 by 96, 90 by 67, nucleus 8.7, dividing nucleus 12 by 4.5.

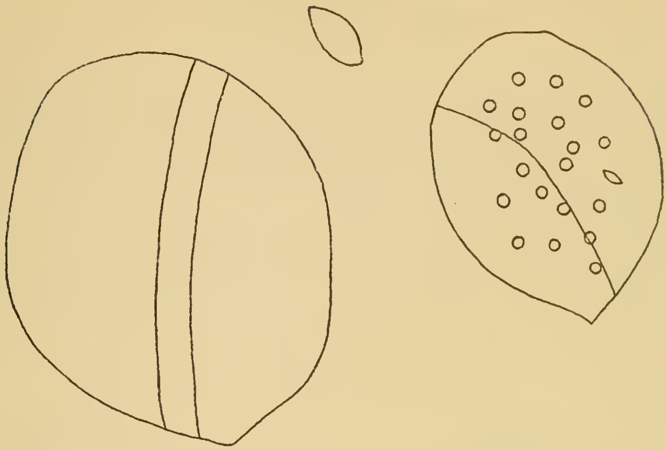


FIGURE 109.—*Opalina obtrigonoidea* Metcalf from *Rana palustris*, × 460 except the small figure, which is the outline of a nucleus in division × 1010.

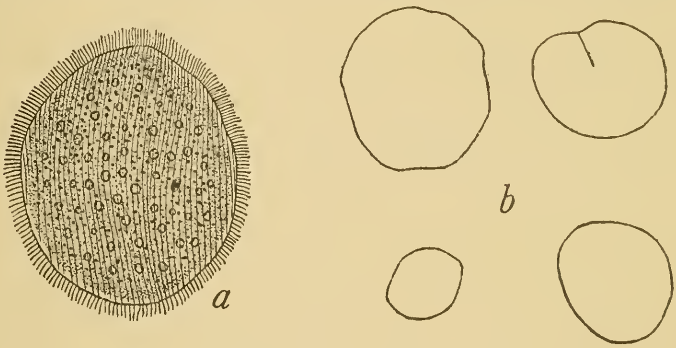


FIGURE 110.—*Opalina obtrigonoidea* forma *lata* Nie from *Kaloula borealis:* *a*, × 294; *b*, × 70.

OPALINA OBTRIGONOIDEA forma LATA Nie

FIGURE 110

Host: *Kaloula borealis* Barbour, from Nanking, China.

The body is orbicular in form and somewhat broader at the anterior end. It is almost as long as broad. The cilia are of moderate length and evenly arranged in numerous longitudinal rows. The pellicle is fairly thick and bears longitudinal grooves running throughout the length of the body. Beneath the pellicle is the layer of ectosarc, which has a vacuolar appearance.

Measurements, in microns, of a number of individuals: Body length varies from 80.6 to 245.0, width from 61.9 to 200, nucleus 4.1 to 4.2; the cilia line interval for one animal measured 3.3 anteriorly and 4.6 posteriorly.

The shape of the body of this forma is quite different from that of the type, although they are found in the same host and the size of the nuclei are nearly the same.

OPALINA LARVARUM Metcalf

FIGURES 111, 112

Opalinas of the *larvarum* type are found in tadpoles of *Rana clamitans* Latreille, *R. catesbeiana* Shaw, *R. palustris* LeConte, *R. pipiens* Schreber, *R. sylvatica* LeConte, and doubtless in the tadpoles of other frogs whose adults bear narrow species of *Opalina*. The changes in the *Opalinae* are, however, much more extensive than the final change from orbicular forms to definitely narrow *Opalinae*. I have followed the opalinids in *R. clamitans* and *R. catesbeiana* through their life history, and Miss Margaret Cowles has studied with me the life history of *O. virguloidea* in *R. sylvatica*, both tadpoles and adults.

In a paper before the National Academy of Sciences at its meeting in Washington in April 1925 (Metcalf, 1926), I reported that *O. larvarum*, after fertilization in the *R. clamitans* tadpole, started life as a uninucleate form pointed behind and resembling a *Protoopalina* with one nucleus, a condition that is found in daughter cells immediately after fission (fig. 111, *a*). The first division of the nucleus, unaccompanied by division of the body, establishes a typical *Protoopalina* condition, with two nuclei (fig. 111, *c* and *d*). Some at least of these *Protoopalina*-like young stages have a long, naked, posterior point and thus resemble adults of those species belonging to what I have regarded as the most archaic subgenus of *Protoopalina*. Nuclear division continues, occurring more often than fission, bringing about multinucleation (fig. 111). For a time, up to a condition with six to eight nuclei, the nuclei remain for the most part in a line along the longitudinal axis of the little animal and it then resembles *P. axonucleata* (fig. 111, *f*). As the nuclei become more and more numerous they no longer keep their axial alignment, assuming a *Cepedea* condition (fig. 111, *g*). Up to a stage with 10 or 12 nuclei their posterior ends are generally sharp-pointed. Those with about 20 nuclei are rounded behind. At an earlier or later stage of their development these *Cepedea*-like forms begin to broaden and flatten in front, the flattening gradually extending farther back until the cylindrical *Cepedea* is transformed into a broad, orbicular, flat *Opalina*. Some of these have as few as 8 nuclei (fig. 111, *h*). Others are found in which many nuclei are present when the flattening is beginning at the anterior end (fig. 111, *g*). In metamorphosing tadpoles with four legs, and perhaps with the tail beginning to be absorbed, some of these many-nucleate, very broad *Opalinae* become narrower and more elongated, *i. e.*, become *Opalinae angustae*. None of the broad, flat forms have been found of very large size. The opalinids all disappear at the time of metamorphosis, mostly before the narrow form is assumed.

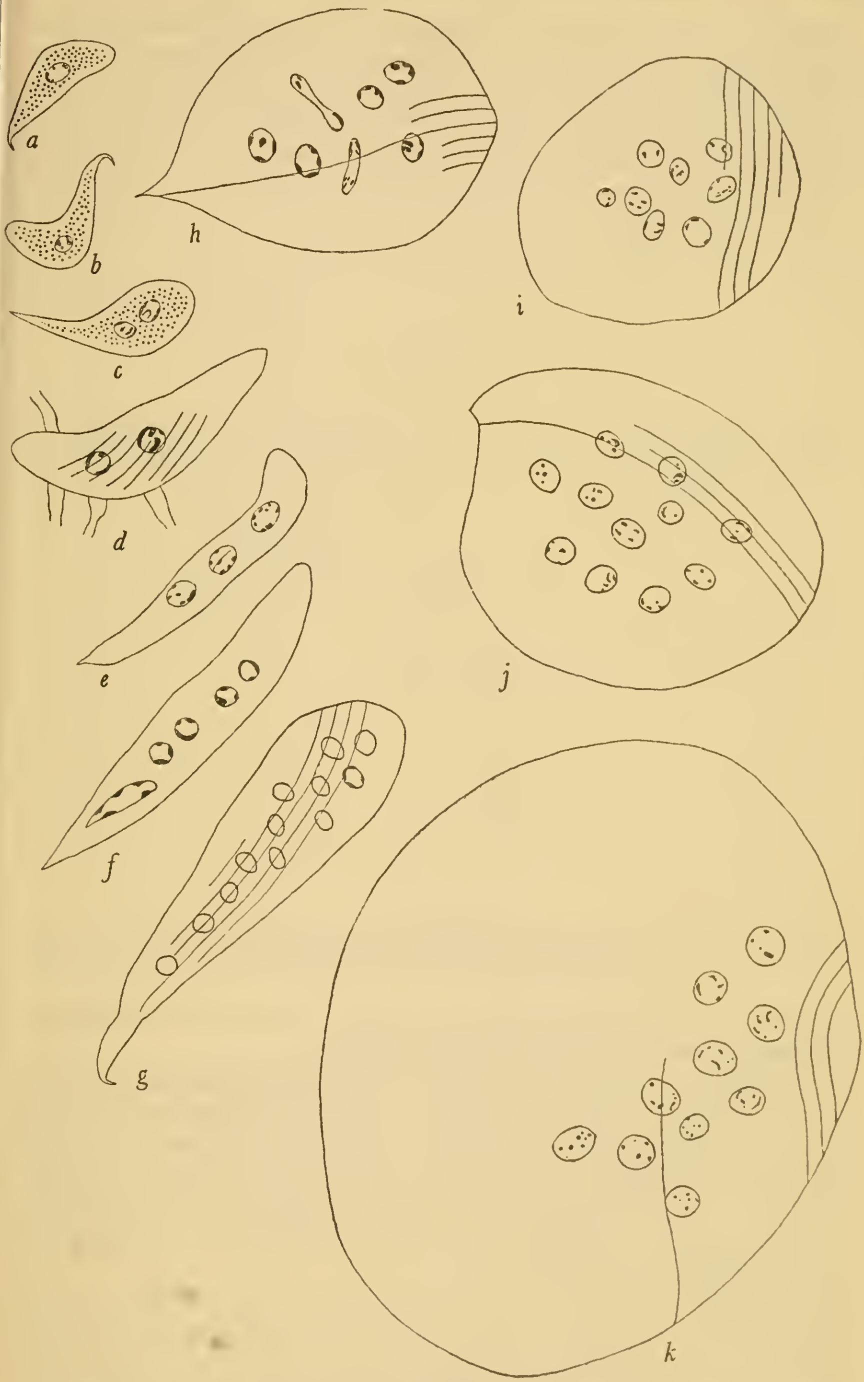


FIGURE 111.—*Opalina larvarum* Metcalf from tadpoles of *Rana clamitans*: *a–c*, × 340; *d–k*, × 674.

Adult *R. clamitans* have no opalinids.[5] The tadpoles live for more than a single year in the pools. The opalinids in last year's tadpoles divide and become small, encyst and pass out of the rectum into the water, and serve as infection cysts for young tadpoles of the new crop (Brumpt, 1915). The infection is thus from tadpole to tadpole, the narrow *Opalina* stage not being found in any adults, for they are not

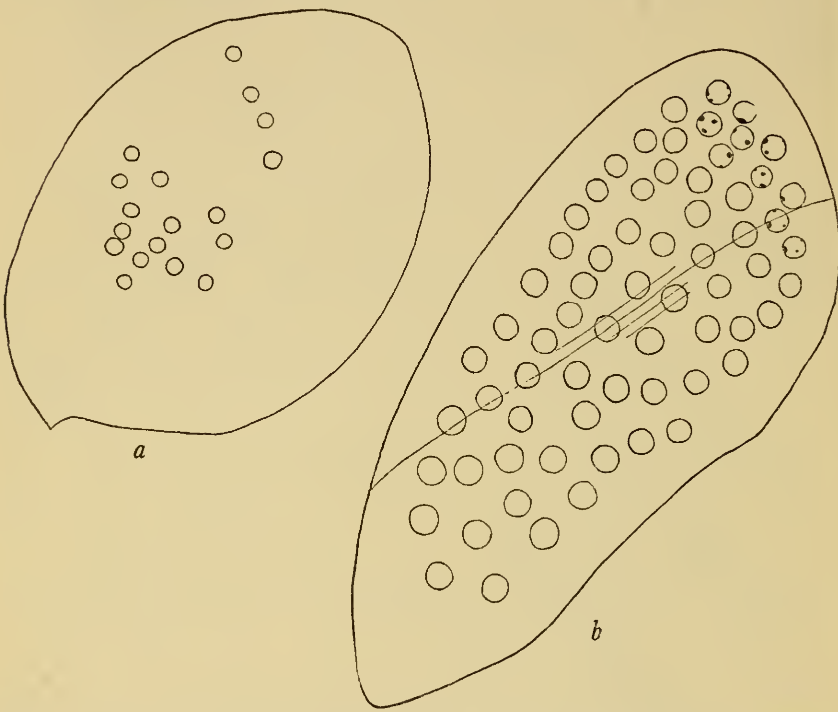


FIGURE 112.—*Opalina larvarum* Metcalf from Woods Hole, Mass. (*a*), and Philadelphia, Pa. (*b*), × 482; from a slide prepared by Prof. D. H. Wenrich.

infected, and being found only occasionally in the oldest tadpoles that have almost completed metamorphosis.

Similarly, the adult *R. catesbeiana* is uninfected, although its larvae are well infected. The large tree-frog *Hyla versicolor* shows a more delayed suppression of its *Opalinae*. I have never found a tadpole of this species uninfected and I have never found a full-grown adult infected, but small tree-frogs, less than half grown but completely past metamorphosis, show abundant narrow Opalinas of a species that I have described as *O. hylaxena*.

In tadpoles of *R. clamitans*, as I showed in 1923a, there are found many broad, flat Opalinas, generally with an abrupt, curved point

[5] There are a few reports of *Opalina* in adult *Rana clamitans* and *R. catesbeiana*. Some of these reports are of captive frogs fed on tadpoles; others are of artificial infections; a few others are of infections of adults in nature, but the infections may have been due to devouring tadpoles.

behind, named at that time *O. larvarum*. These flat, posteriorly pointed forms have 8 or more, generally less than 20, nuclei. They seem to be individuals precociously developed by flattening of "*Cepedea*-larvae" before they have lost their posteriorly pointed shape.

Brumpt (1915) desciibed retrogressive development of opalinids in the tadpoles, resulting in the formation of cysts that are capable of infecting tadpoles again. I have not traced out this process. Miss Cowles has described the course of development of *O. virguloidea* in *Rana sylvatica* (p. 556).

OPALINA (?)

FIGURE 113

In addition to undoubted *O. larvarum* from tadpoles of *R. clamitans* Latreille there are larval stages of what may be a distinct species or

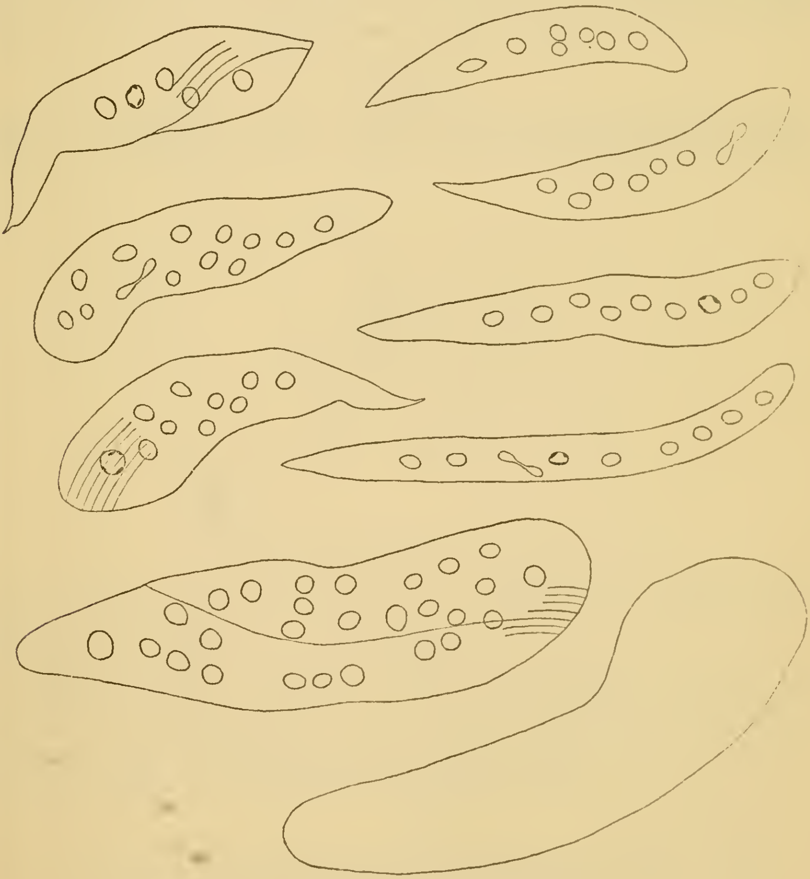


FIGURE 113.—*Opalina* (?) from tadpoles of *Rana clamitans*, × 673.

subspecies. The *Protoopalina* stages I have not distinguished from those of *O. larvarum*, although more intensive study might succeed in this. The *Cepedea* stages have smaller nuclei and narrower intervals between the lines of cilia. No broad *Opalina* stage has been seen nor any seemingly adult stage. Figure 113 shows the sorts of larval stages referred to here. It is not worth while to discuss them without further study.

In tadpoles of *R. catesbeiana* Shaw are found opalinids very similar to *O. larvarum* and showing similar developmental phenomena. The nuclei in general run smaller, and the orbicular shape, with short, usually curved, posterior point, is found less abundantly, but I am not able to find any specific or subspecific distinction between the forms in *R. catesbeiana* and those in *R. clamitans*.

The opalinids in *R. pipiens* Schreber and *R. palustris* LeConte are similar in their developmental phenomena.

OPALINA SEPTENTRIONALIS Metcalf

FIGURE 114

Host: *Hyla septentrionalis* Boulenger. Three specimens of this frog from Cuba (U.S.N.M. Nos. 7404, 7478, and 10304) and two

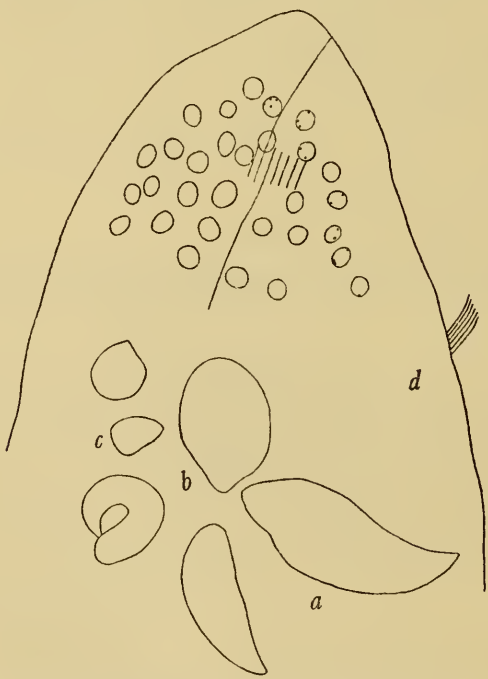


FIGURE 114.—*Opalina septentrionalis* Metcalf from *Hyla septentrionalis*: *a–c*, × 78; *d*, × 673.

out of three from Andros Island in the Bahamas (Nos. 64160 and 64163) were infected with moderately well preserved opalinas. They are evidently the same species as some seen in the same species of host in my former study, but not described because of unsatisfactory preservation.

Measurements, in microns: Body (*a*) 380 by 150, (*b*) 210 by 154, (*c*) 90 by 60, (*d*) nuclei 4.2, 4.6, 5 by 4.2, length of cilia 8.9, interval between lines of cilia 1.5. The body is large in full-sized specimens, the nuclei are small, and the lines of cilia close together.

OPALINA ELONGATA Carini

FIGURES 115, 116

Hosts: *Hyla rubra* Daudin; *H. albomarginata* (Spix).

Several years ago Prof. Adolpho Lutz, of the Oswaldo Cruz Institute, Rio de Janeiro, sent me a good slide of this interesting elongated *Opalina* from *Hyla rubra*. I have since found it in one *H. rubra*

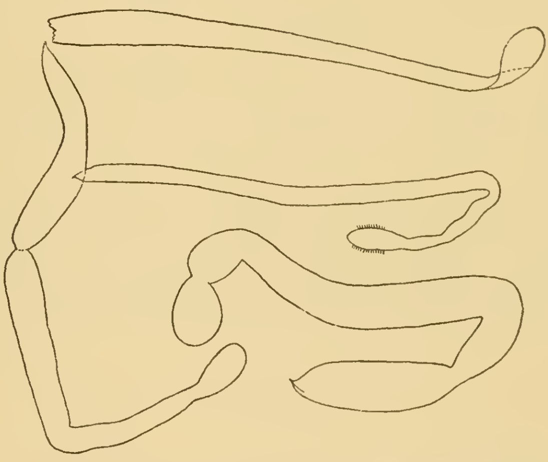


FIGURE 115.—*Opalina elongata* Carini from *Hyla rubra*, × 72.

and in six out of seven specimens of *H. albomarginata*. Especially in specimens from *H. albomarginata* they are pointed behind, often with a short spinelike point.

Measurements, in microns: From *H. rubra*, body 1,100 by 70, length of cilia 6.7; from *H. albomarginata*, body 980 by 50, 333 by 55, width of body 41.5, nuclei 7, 5.2, dividing nuclei 9 by 6, 8 by 4.5, length of cilia 6.7, interval between lines of cilia 2.

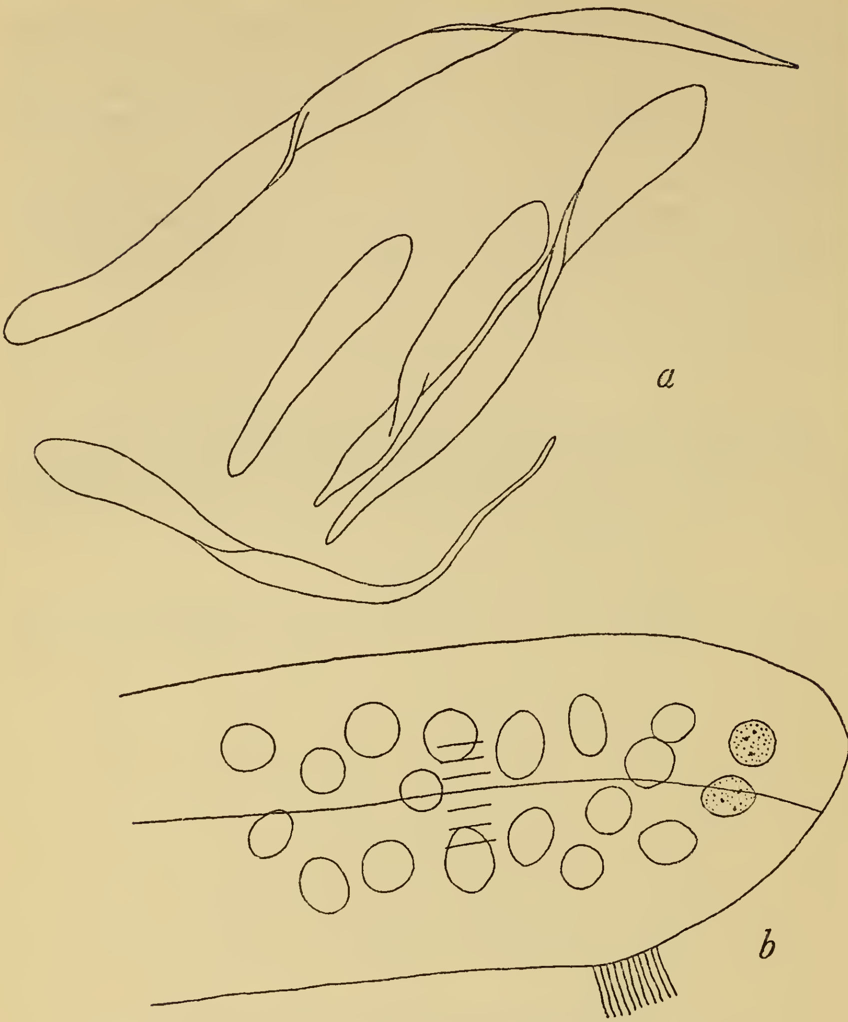


FIGURE 116.—*Opalina elongata* Carini from *Hyla albomarginata: a,* × 117; *b,* × 1010.

OPALINA CHENI Nie

FIGURE 117

Host: *Kaloula borealis* Barbour, from Nanking, China.

The body of *Opalina cheni* is roughly triangular, the base of the triangle being anterior and the apex posterior. The anterior border, however, is not straight but slightly curved, and it often inclines more to one side of the body than to the other. There are several longitudinal folds or ridges, which are gradually diminished in size as they extend from the anterior border to the posterior end. The posterior end is distinctly tapering and pointed at the extremity.

The cilia on the anterior part are much longer than the posterior ones. The pointed taillike end is deprived of cilia. The nuclei are ellipsoidal or rounded and almost of the same size. There are many spherical or elongate-oval endospherules in the endosarc. Measurements, in microns: In a number of individuals the body length varies from 73.1 to 107.8, the width from 55.9 to 93.7, the

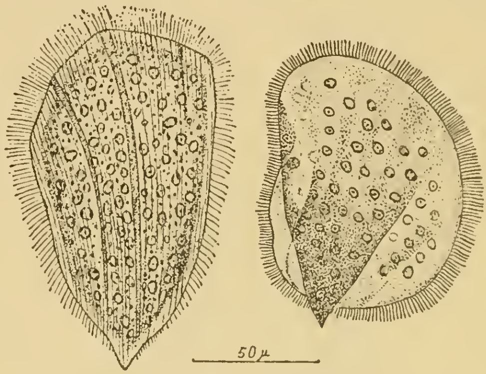


FIGURE 117.—*Opalina cheni* Nie from *Kaloula borealis*. (After Nie.)

diameter of the nucleus varies from 4.9 by 3.6 to 7.6. The measurement of the cilia line interval at the anterior end of one animal was 3.7.

This species is characterized by the permanent presence of several folds or ridges on the surface of the body. These folds closely resemble those found in *O. obtrigonoidea* forma *plicata* Metcalf (1923a). The present species, however, differs from the latter not only in the larger diameter of the nucleus but also in its ciliation and the smaller size of the body.

OPALINA ACUMINATA Nie

FIGURE 118

Host: *Kaloula borealis* Barbour, from Nanking, China.

The form of the body varies greatly from lanceolate to ellipsoidal. The anterior edge is obliquely truncated. The posterior extremity is drawn into a short sharply pointed spinelike process. The greatest width is recorded at the region anterior to the middle of the body. The nuclei are ellipsoidal or rounded, or elongate in form during mitosis.

The layer of ectosarc is fairly thin, but it is well marked off from the endosarc, which is vacuolated in appearance.

Measurements, in microns: In a number of specimens the length of the body varies from 59.5 to 131.6, the width from 29.7 to 56.0, the diameter of the nucleus from 5.3 to 5.8. The cilia-line interval on one animal measured 1.9 on the anterior end and 2.1 on the posterior end.

The number of nuclei in the majority of the individuals of *O. acuminata* has been estimated from 6 to 36, and they are arranged in the outer layer of the endosarc.

At a glance, *O. acuminata* resembles Metcalf's *O. carolinensis* (1923a) because of similarity in the shape of the body. The latter

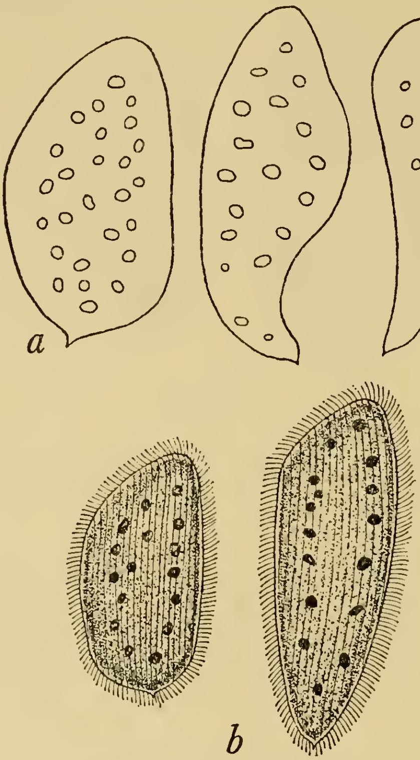


FIGURE 118.—*Opalina acuminata* Nie from *Kaloula borealis*: *a*, Three individuals showing range of size and form; *b*, two individuals showing structure. All × 340. (After Nie.)

differs from the present species in its larger size (400μ in length, 110μ in width), shorter cilia, thicker ectosarc, and smaller nuclei.

The abruptly acuminated posterior end serves to distinguish the species from *O. obtrigonoidea*.

OPALINA UNDULATA Nie

FIGURE 119

Host: *Rana limnocharis* Wiegmann, from Nanking, China.

The body is elongated and corkscrew-shaped. The anterior half is considerably broadened and flattened, while the posterior half is greatly narrowed and twisted or spirally plicated into three "undulating processes." It appears slightly truncated or rounded at the anterior end, and tapers gradually along the "undulating processes" toward the pointed posterior end. The length of the body is about 4 times the greatest width.

Cilia bordering the anterior part are slightly longer than those found at the posterior region. The ectosarc, which has a vacuolated appearance, is rather thick as compared with that of the other species of *Opalina*. In addition to the nuclei, there are many small spherical or elongate-oval endospherules in the endosarc.

Opalina undulata is quite different from *O. spiralis* Metcalf (1923a) in its plicated manner of the posterior half of the body. In the

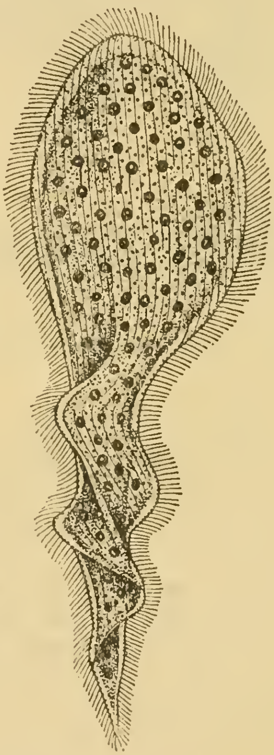


FIGURE 119.—*Opalina undulata* Nie from *Rana limnocharis*, × ca. 300. (After Nie.)

latter species the spirals are rather irregular in shape and number and it shows no "undulating processes" as observed in the present species. The broader anterior portion (130–140μ) and the smaller size of the nuclei (4.3–4.7μ) also serve to distinguish *O. spiralis* from *O. undulata*.

Measurements, in microns: The body length varies from 182 to 378, the width from 44.8 to 105; the average diameter of the nuclei is 5.7, and the average diameter of endospherules is 1.5.

OPALINA FABER Carini

FIGURE 120

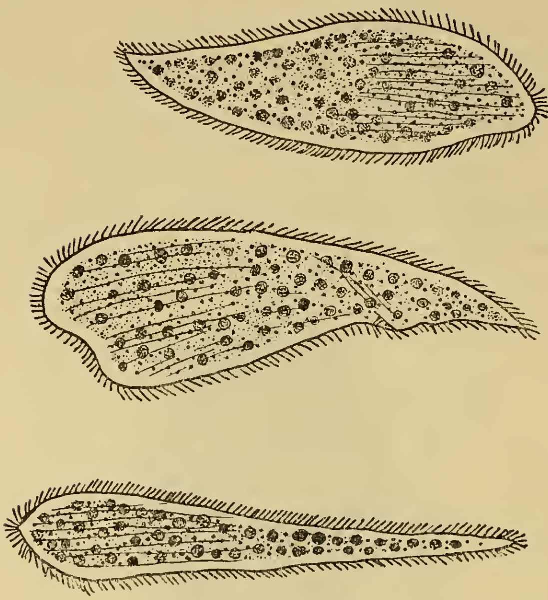


FIGURE 120.—*Opalina faber* Carini from *Hyla faber*, × ca. 230. (After Carini.)

Host: *Hyla faber* Wied, from Brazil.

The body is flat, elongated, and slightly bent. There is a great range of variation in size. Most of the fully grown individuals measure 150μ to 200μ in length, and the largest specimens measure 300μ. Some slender individuals measure 30μ to 40μ in width; the larger ones 60μ to 70μ or more.

The large specimens are fusiform, with maximum width in the middle; the posterior end generally tapers. In the large forms there are as many as 7 to 9 rows of spherical nuclei. Figure 120 shows three medium-sized specimens; a long and slender one measuring 285 by 44μ, a large and fusiform one measuring 228 by 80μ, and one showing the beginning of longitudinal division.

OPALINA NEBULOSA Carini

FIGURE 121

Host: *Hyla nebulosa* Spix, from Brazil.

The body is elongated, slightly bent, and comma-shaped. The maximum width is near the anterior end; the body becomes slenderer toward the posterior end, which is blunt. The contour of the anterior end is not round but appears as if cut obliquely on one side.

Measurements, in microns: The individuals that appear fully grown average 200 to 250 in length, but some measure 300. The width is 40 to 50, but there are some large forms that measure up to 70 and 80. There is frequently seen a border of clear ectoplasm. In the cytoplasm there are a number of spherical nuclei 3.5 to 5 in diameter, irregularly distributed in 4 to 6 longitudinal rows.

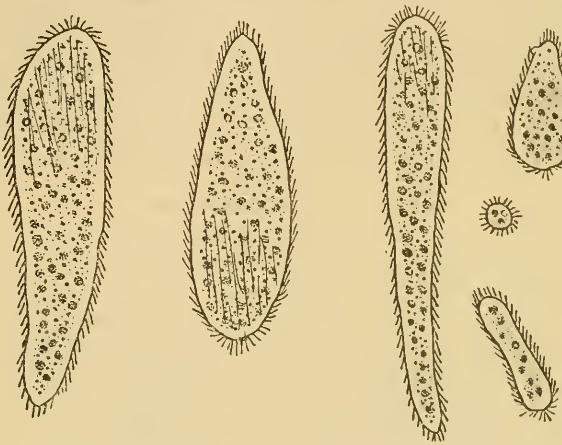


FIGURE 121.—*Opalina nebulosa* Carini from *Hyla nebulosa*, × ca. 200. (After Carini.)

Three fully grown animals and three smaller forms are shown in figure 121.

OPALINA RADDIANA Carini

Host: *Hyla raddiana* Fitzinger, from Brazil.

The body is greatly flattened, often bent.

Measurements, in microns: The average length is 300 to 500, but there are individuals that measure 450. The slender forms have a width of 40; most individuals are about 60 wide, the largest specimens measuring 80. The nuclei are spherical, 5 to 6 in diameter. The endospherules are large and numerous. The pellicle is thin. (Carini gives no drawings. There is insufficient description.)

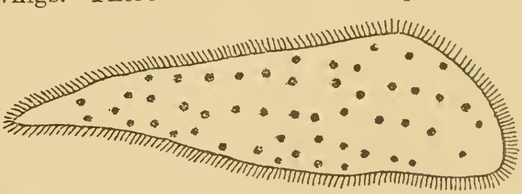


FIGURE 122.—"*Opalina sudafricana*" Fantham from *Bufo regularis*, × 300. (After Fantham.)

"OPALINA SUDAFRICANA" Fantham

FIGURE 122

Host: *Bufo regularis* Reuss.

Fantham's drawing and measurements, in microns, are given: Body length 106 to 287.5, width 25 to 87.

This seems either a narrow *Opalina* or an unusually flat *Cepedea*. Narrow Opalinas are not known from the Eastern Hemisphere except for less than half a dozen doubtful cases and except for *O. obtrigona*, which, with its hylid host, is a late immigrant from North America. But Fantham's drawing appears more that of an *Opalina* than a *Cepedea*. Restudy of fresh material would probably be worth while.

OPALINA TRIANGULARIS Ghosh

FIGURE 123

Host: *Bufo melanostictus* Schneider.

Ghosh's description (1918a), insufficient for certain identification, is as follows: "Body flattened, leaf-like, twice as long as broad or less, widest in the anterior body half; one side nearly straight, and the other strongly convex giving the appearance of two curved sides meeting at the widest part of the body; anterior end rounded and in the same line with the straight side; posterior end tapering and rounded; numerous nuclei. In the lower part of the intestine and upper part of the rectum of *Bufo melanostictus*."

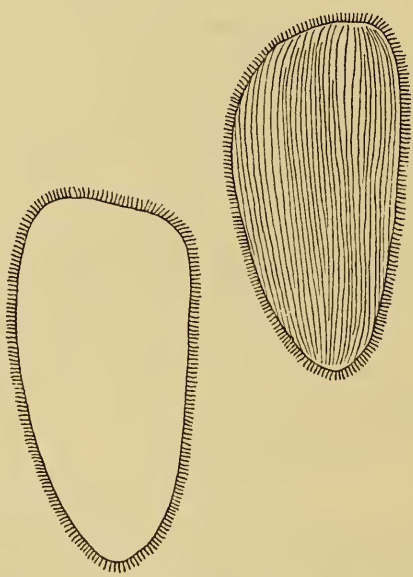


FIGURE 123.—*Opalina triangularis* Ghosh from *Bufo melanostictus*.

OPALINA species (?)

In a specimen of *Rana jerboa* Günther (U.S.N.M. No. 44013) from Tjiburrum, Java, Mount Gede, at 6,400 feet altitude, one specimen only of a large *Opalina* was found. It was not preserved.

OPALINA species (?)

Two examples of *Rana verrucosa* Gravenhorst, 32 and 36 mm. long, collected in September 1914 and sent by the Madras Museum from Parambikulam, Cochin State, southern India, showed a few remnants of a large *Opalina*, too poorly preserved for study.

"OPALINA TERMITIS" de Mello

FIGURE 124

Hosts: Two termites—*Leucotermes indicola* from India and *Caloptermes militaris* (?) from Daman, Portuguese India.

This form is somewhat like *Opalina*, yet one can but doubt its belonging to the Opalinidae. I have found only de Mello's reference

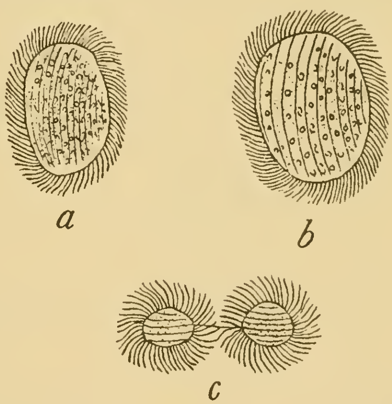


FIGURE 124.—"*Opalina termitis*" de Mello. (After de Mello.)

to the form in the Report of the Third Entomological Meeting at Pusa, India, and this and the accompanying figures (copied in our fig. 124) are insufficient for critical determination. Especially figure 124, *c*, a stage in what must, from the course of the lines of cilia, be a transverse division, is unlike any appearance hitherto found in a dividing *Opalina*. One cannot tell whether the animal is flat or spheroidal. Another major difficulty in classing this as an *Opalina* is the great difference between the aquatic reproductive habits of the Anura and the terrestrial reproduction of the termites. The life history of the opalinids includes encystment of minute individuals, their passing into pools of water where they lie upon the bottom until they are ingested by browsing, vegetarian, aquatic larvae of Anura in whose recta they hatch from the cysts and develop into male and female gametes, which fuse and grow to adult opalinids. One can imagine possible infection of a termite from cysts deposited by an anuran with its feces in, say, a hollow log, and the continued infection of termite from termite in the new environment by means of cysts in the feces. But before this is accepted it must be much better indicated than it now is, the presence in two termites of forms doubtfully resembling *Opalina* being all that we have to go upon.

THE GROWTH OF OPALINA VIRGULOIDEA METCALF IN THE TADPOLES OF RANA SYLVATICA LECONTE

By Margaret Cowles and Maynard M. Metcalf

The *Opalina* of the American wood frog was named *virguloidea* by Metcalf (1923a). In the same publication he described a species, *O. larvarum*, from the common green frog (*Rana clamitans*) and suggested that this very broad, orbicular opalinid belonged to the subgeneric group *Opalinae angustae* rather than to the *Opalinae latae*, this proposed classification based on the presence of a minute curved posterior point, now known to be sometimes found also in broad Opalinas. At that time late stages in the life history had not been seen. Material secured later showed that this guess, though based on a mistaken assumption, was correct, for the tadpoles ready for metamorphosis, with four legs present, though with the tail not yet absorbed, show Opalinas of narrow form.

On the basis of observations upon the development of *Opalina larvarum* in the tadpoles of *Rana clamitans* and of a similar species in the tadpoles of *Rana catesbeiana*, Metcalf reported in 1925 to the National Academy of Sciences that the *Opalinae angustae* pass through a series of larval stages recapitulating the evolution of the family Opalinidae. The *Opalinae angustae* are the most highly evolved members of the family, and it was found that their larval stages are, first, *Protoopalina*-like, then *Cepedea*-like, that then the *Cepedea* larvae flattened, first in front and then throughout the length of the body, becoming broad *Opalinae*, and that before metamorphosis these broad *Opalinae* changed to narrow forms. No drawings were published with this report, but charts of the phenomena in *Opalina larvarum* were shown to the American Society of Zoologists in Cleveland, Ohio, during the Christmas holidays in 1930. It was also reported that *Zelleriella* passes through a *Protoopalina* stage, *Cepedea* through a *Protoopalina* stage, the *Opalinae latae* through a *Protoopalina* stage followed by a *Cepedea* stage, and the *Opalinae angustae* through three larval stages, representing, first, *Protoopalina*, then *Cepedea*, then the *Opalinae latae*, finally assuming their definitive narrow form. It has seemed worth while to review here this remarkable life history for another narrow species of the genus *Opalina* and to give drawings of the larval stages in their sequence.

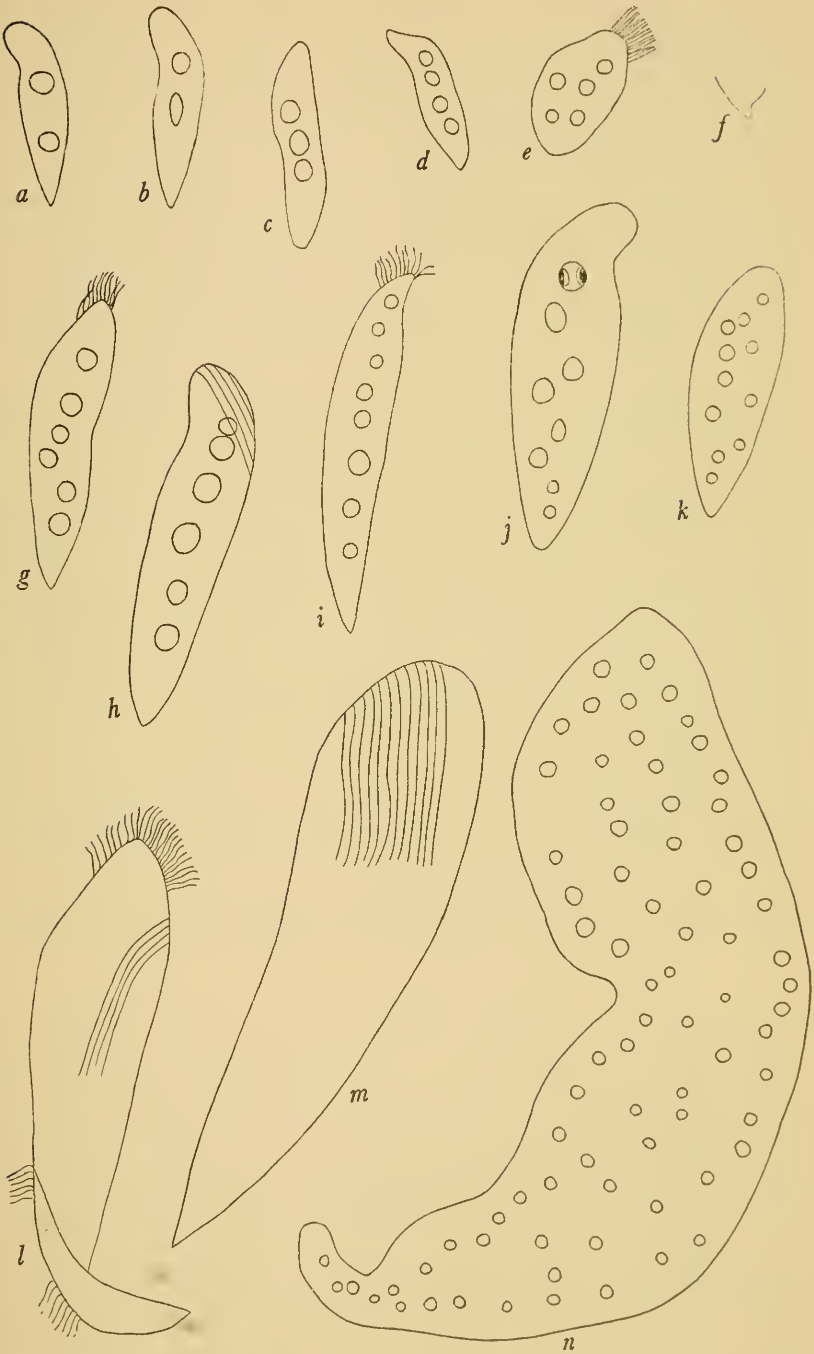


FIGURE 125.—*Opalina virguloidea* Metcalf: Development in the tadpoles of *Rana sylvatica*, × 505.

The drawings here published (fig. 125) are mostly self-explanatory and little description is needed. Figure 125, *a*, is a typically *Protoopalina*-like larva; *b* shows the posterior nucleus entering mitosis; *c* and *d* show stages with three and four nuclei, becoming *Cepedea*-like larvae; *e* and *f* depict individuals that have respectively five and six nuclei and that are much flattened and represent the *Opalinae latae* larvae, such as those in *O. larvarum* that are much more emphasized. In tadpoles of *O. virguloidea*, the broad stage is very brief and occurs in younger larvae with fewer nuclei. It seems quite possible that in some narrow species of *Opalina* it may be found to be wholly suppressed. Indeed it may perhaps be omitted from the life history of some individuals of *O. virguloidea*, for larvae in this stage are less numerous in our slides than *Cepedea* forms with five to eight nuclei.

Figure 125, *h* and *i*, resemble *P. axonucleata*. Larvae of this type, with about 6 to 10 nuclei arranged along the midline of the body, are very numerous and probably occur in the growth of every individual. As they get older and the nuclei increase in number, the linear arrangement of the nuclei is lost (fig. 125, *j* and *k*). By further multiplication of nuclei, by growth and elongation, and by flattening, first at the anterior end, then throughout the body, larvae resembling *O. obtrigona* arise (fig. 125, *m*). Comma-shaped forms with marked curvature, especially of the anterior end, then arise, giving the adult form (fig. 125, *n*), the further changes being increase in size and increase in number of nuclei.

The recapitulation of the phylogeny is remarkably complete, but the broadening of the body occurs in this species earlier than in *O. larvarum*. The trend toward increase in number of the nuclei and the trend toward flattening and broadening of the body are both present in both *O. virguloidea* and *O. larvarum*, but the emphasis upon broadening and flattening comes relatively a little earlier in the former species.

DIAGNOSTIC CHARACTERS IN OPALINIDAE

There is much divergence in form of the body between different genera, different species, and even different individuals of the same species in the Opalinidae, but still there is a schematic plan upon which they are built. *Protoopalina* is a spindle with a broad, rounded, anterior end and a more tapering posterior part of the body. The anterior end is bent and sometimes flattened; the posterior end may have a long, slender point, or a much more abrupt point, or may be rounded showing no point at all. There is much individual variation, and this is more marked in preserved specimens, which may have been killed in any of the diverse forms that the flexible bodies may assume in life. For example, the bend in the anterior part of the body may not appear.

But the variation in form is more than a matter of a flexible body assuming temporarily different shapes. This may account for only a small part of the variation. At the posterior end of the body there may be, for example, a slender, tapering, naked "tail," like a whiplash. In some species this seems to be always seen (fig. 21, *Protoopalina*, subgenus I) (cf. also figs. 12, 13, and 36 in Metcalf, 1923a). In other species it appears in some individuals but not in others. Compare *P. caudata*, in which, in the same individual host may sometimes be seen individuals with slender tails and others with rounded posterior ends (see fig. 19 in Metcalf, 1923a). Some infections of *P. caudata* may contain only posteriorly rounded individuals; other infections contain mostly tailed forms with some rounded ones; still others may show mostly rounded ones and a few with short, curved, posterior hook, either sharp or with a blunt point. These are not temporary conditions assumed by any individual at will, but are constant and characteristic for the individual. Furthermore, there are found, in addition to the comparatively slender individuals, others that are very broad and swollen (see fig. 17, *a*, in Metcalf, 1923a). One does not know how to regard the great divergence found. Is it an indication of races within the species? It may be. Probably only breeding experiments would solve the puzzles, and the peculiar parasitic habits make such experiments forbiddingly difficult. Another variety of posterior end, with a short spine, is found in *P. stevensoni* (Metcalf, 1923a, fig. 26), and this appears also, by the way, in *Cepedea spinifera* (Metcalf, 1923a, fig. 104).

Cepedea has the bent spindle form of its immediate ancestor *Protoopalina*, but we do not find the markedly divergent types of posterior end. We do, however, find some species with two types of body, one rather slender, the other stocky. Whenever a species of *Cepedea* or of *Protoopalina* shows these two types, intermediate forms in the same species, and usually in the same infections, will be found, the same individual host containing all three—slender, broad, and intermediate. More or less faint indications of a posterior hook or spine appear in some Cepedeas, for example, in *C. dimidiata* forma *zelleri* (see Metcalf, 1923a, fig. 105, middle, left-hand drawing). In some Opalinas a posterior spine or faintly indicated hook may appear, and in some Zelleriellas the asymmetrical, posterior hook may be greatly developed, for example, in *Z. antunesi* (fig. 42); and in the degree of development of any of these features individual opalinids as well as species differ.

This all makes taxonomic conclusions uncertain until after study of much material from many hosts. Without such intensive study, specific diagnosis must be tentative.

The two flattened genera, *Zelleriella* and *Opalina*, each show in many individuals of many species indication of a bend in the anterior part of the body, and a posterior point, or spine, or hook, either curved or straight, but not a tail, is seen (figs. 98, 99, 100, *d*). In some Opalinas, as also in some Cepedeas, it is evident that the posterior spine or hook is situated a little to one side of the posterior tip of the body. While no adult *Cepedea* or *Opalina* has been found with a slender, tapering tail, this is their regular condition in their early larval history.

One who is familiar with the family as a whole cannot but feel that the same schematic form underlies them all, though what are adult features in *Protoopalina* may appear only in the larvae of the multinucleate genera.

What has just been written shows that one must be cautious in evaluating conditions of form of body for purposes of taxonomic description. He must be cautious also in the use of other characters. There is much diversity in actual size of nuclei at different stages of the life history. In general the nuclei decrease in size as they increase in number during development in the multinucleate genera, but, perhaps, as Hegner and Wu (1921) have claimed, there is for each species a rather constant ratio between size of nucleus and the bulk of cytoplasm over which each nucleus presides. Whether within a species there are races that differ in the nucleocytoplasmic bulk relations is not determined.

Nuclear conditions, especially the chromosomes, their number, sizes, and forms, when carefully studied, can be relied upon for specific diagnosis. The mitotic phase of the nuclei at the time when division of the body begins might be constant and is possibly a usable character in the binucleate genera, especially in *Zelleriella*, whose species are, in many cases, so similar that any diagnostic possibility is eagerly seized upon. The interval between lines of cilia, if we remember the habit of interpolating secondary lines between the primary in the anterior part of the body, appears to be a more constant character than one might have anticipated, and there are a few cases of species with cilia unusually closely set in the lines. If one is careful to compare corresponding portions of the body, these apparently quite constant characters are useful.

All this emphasizes the fact that one must study much material from different sources and study it with minute attention, and that even after such extensive and minute study there will still be uncertainty because breeding experiments cannot be made to enable one to differentiate between species and intraspecific races. There is great probability that extreme races in one species may overlap extreme races in another species. After studying the Opalinidae for 25 years I am increasingly hesitant about positive specific diagnosis in numerous cases. In others, on the other hand, one has no such hesitation. The Opalinidae are an exasperating group taxonomically to one whose purpose is to place each species in its clearly distinct pigeonhole, but it is an instructive group. We have discussed the effect of the internal habitat in removing much of the struggle for existence and allowing all types that do appear to persist. This is very likely one of the chief keys to the conditions of speciation found in the family.

Mention might be made of the rotating, spiral progress of a swimming opalinid of any species, similar to the manner of swimming of euciliates. This pattern of swimming path in the Opalinidae seems to be influenced by several structural features: (1) The bend in the anterior portion of the body, (2) the insertion of the cilia in spiral lines, (3) the greater number and length of the cilia in front than behind. These all cooperate to produce rotation, progress, and the swinging of the anterior end of the body through a wider arc than that described by the posterior end. Note that the spiral position of the oral groove and its emphasized cilia in the euciliates cooperate in them to emphasize the spiral, rotating progress, but the mouthless, grooveless opalinids have the same pattern of motion. It is a fundamental feature, and an ancestral feature, seen in Flagellata, Protociliata, and Euciliata.

In many euciliates with an anterior bend in the body the oral groove and mouth is in the region of the bend. One gets the impression that the mouth of the ancestors of the Opalinidae may likely have been near the bend. Detailed study of the arrangement of the "neuromuscular" fibrillae would be worth while, to see if there is any asymmetry or any "center" in this region to make this interpretation probable.

In a previous publication (Metcalf, 1923a) I gave a table of the hosts of the known Opalinidae and of the geographic occurrence of the opalinids. The following table presents the new data since that publication.

166877—40——7

Species of opalinid	Host species	Family of host	Known geographic occurrence of the opalinid in the host named	Known geographic occurrence of host	Known geographic occurrence of genus of host
Protoopalina appendiculata Fantham.	*Rana fuscigula* Duméril and Bibron.	Ranidae.	Johannesburg, South Africa.	Western and southern Africa.	Cosmopolitan, except absent from Australia (one species in the northernmost tip), New Zealand, Tasmania, South America (except one species in northernmost parts), and oceanic islands.
bibronii, new	*Pseudophryne bibronii* Günther.	Bufonidae.	Southeastern Australia.	Australia.	Australia, Tasmania.
borneonensis, new	*Polypedates reinwardtii* (Boie).	Ranidae.	Borneo.	Sumatra, Borneo, Java.	Madagascar, Ceylon, India, China, Japan, Philippines, East Indies.
caccosterni Fantham	*Cacosternum boettgeri* (Boulenger).	Microhylidae.	Johannesburg, South Africa.	Kaffraria, Uganda.	South Africa.
[*capensis*, new]	*Heleophryne regis* Hewitt.	Leptodactylidae.	Cape Province, South Africa.	Cape Province, South Africa.	Southern and western Africa.
caudata microhyla Nie	*Microhyla ornata* Duméril and Bibron.	Microhylidae.	Southern India.	Southern China, Formosa, Tonkin, Hainan, Burma, Assam, Siam, Annam, Malay Peninsula, India, Ceylon.	China, Ceylon, various parts of East Indies, Sumatra, Java, Borneo.
luzonensis, new	*Kaloula picta* Eydoux and Souleyet.	Do.	Luzon, Philippine Islands.	Philippine Islands.	India, southeastern Asia, Philippines, East Indies.
meridionalis Fantham and Robertson.	*Rana delalandii* (Tschudi).	Ranidae.	Johannesburg, South Africa.	Southern and eastern Africa.	Cosmopolitan, except absent from Australia (one species in northernmost tip), Tasmania, New Zealand, South America (except one species in northernmost parts), and oceanic islands.
nyanza Lavier	*Varanus niloticus* Linnaeus.	Varanidae.	Shores of Lake Victoria Nyanza.		
octomixa Fantham	*Bufo carens* A. Smith.	Bufonidae.	Johannesburg, South Africa.	Eastern and southern Africa.	Cosmopolitan, except Australia, Madagascar, the Seychelles.
ovalis Fantham	*Rana fuscigula* Duméril and Bibron.	Ranidae.	Do.	Western and southern Africa.	Cosmopolitan, except absent from Australia (one species in northernmost tip), Tasmania, New Zealand, South America (one species in northernmost parts), and oceanic islands.

stejnegeri Metcalf	*Ascaphus truei* Stejneger.	Discoglossidae.	Olympic and Siskiyou Mountains, extreme northwestern United States of America.	Western Washington, northwestern California.	Only one species known.
transvaalensis Fantham	*Bufo regularis* Reuss.	Bufonidae.	Johannesburg, South Africa.	Africa south of Sahara Desert.	Cosmopolitan, except Australasia, Madagascar, the Seychelles.
xamachana, new	*Eleutherodactylus luteolus* (Gosse).	Leptodactylidae.	Jamaica, West Indies.	Jamaica, West Indies.	Tropical America.
xenopodos Metcalf	*Xenopus laevis* (Daudin).	Pipidae.	Johannesburg, South Africa.	Southern Africa.	Central and southern Africa.
yunnanensis, new	*Bombina maxima* (Boulenger).	Discoglossidae.	Yunnan, China.	Eastern Himalayan highlands.	Europe, north to the Baltic coast, to (not into) Russia, Korea, northeastern and southwestern China.
Zelleriella antunesi Pessôa	*Bufo crucifer* Wied.	Bufonidae.	Rio de Janeiro, Brazil; Montevideo, Uruguay.		Cosmopolitan (except Australasia, Madagascar, the Seychelles).
Do	*Bufo d'orbignyi* Duméril and Bibron.	Do.	Brazil, Uruguay.	Brazil, Uruguay.	Do.
Do	*Leptodactylus ocellatus* (Linnaeus).	Leptodactylidae.	Rio de Janeiro, Brazil; Montevideo, Uruguay.	Tropical America from Central America to Buenos Aires, West Indies.	Tropical America from Central America to Buenos Aires, West Indies.
brasiliensis (Pinto)	Do.	Do.	Do.	Do.	Do.
Do	*Crossodactylus gaudichaudii* Duméril and Bibron.	Do.	Rio de Janeiro, Brazil.	Rio de Janeiro, Upper Amazons.	Brazil.
dubia, new	*Eupemphix nana* Boulenger.	Bufonidae.	Angra dos Reis, State of Rio de Janeiro, Brazil.		
[of Eleutherodactylus miliaris].	*Eleutherodactylus miliaris* (Spix).	Leptodactylidae.	Do.	Brazil.	Tropical America.
ovonucleata, new	*Leptodactylus pentadactylus* (Laurenti).	Do.	Belle Horizonte, Brazil.	Lesser Antilles, Costa Rica, Tropical America.	Tropical America from Central America to Buenos Aires, West Indies.
ovonucleata bufonis, new	*Bufo sternosignatus* Günther.	Bufonidae.	Tehuantepec, Mexico.	Southern Mexico into northern South America.	Cosmopolitan (except Australasia, Madagascar, the Seychelles).
piscicola da Cunha and Penido.	A catfish (?). Name not given.	Teleost fish.	Paraguay River.		
trinitatis Metcalf	*Elosia lateristrigata* Baumann (?).	Leptodactylidae.	Angra dos Reis, State of Rio de Janeiro, Brazil.		Tropical America.
uruguayensis, new	*Bufo arenarum* Hensel.	Bufonidae.	Montevideo, Uruguay.	Southern Brazil to Buenos Aires.	Cosmopolitan (except Australasia, Madagascar, the Seychelles).
uruguayensis form *quadrata*, new.	*Bufo dorbignyi* Duméril and Bibron.	Do.	Brazil, Uruguay.	Brazil, Uruguay.	Do.
species ?	*Elosia lateristrigata* Baumann.	Leptodactylidae.	Angra dos Reis, State of Rio de Janeiro, Brazil.	Organ Mountains, eastern Brazil.	Brazil.

Species of opalinid	Host species	Family of host	Known geographic occurrence of the opalinid in the host named	Known geographic occurrence of host	Known geographic occurrence of genus of host
Cepedea rubra Carini	*Hyla minuta* Peters.	Hylidae.	Rio de Janeiro, Brazil	Eastern Brazil.	America, including West Indies; one species (several subspecies) in Euro-Asia and North Africa, Papua, Australia.
Do	*Pseudopaludicola ameghini* (Cope).	Leptodactylidae.	Rio de Janeiro, Minas Geraes, Brazil.		
Do	*Paludicola falcipes* Hensel.	Do.	Rio Grande do Sul, Brazil.	Rio Grande do Sul, Brazil.	Continental America from Central America to Patagonia.
Do	*Leptodactylus ocellatus* (Linnaeus).	Do.	Rio de Janeiro, Brazil.	Brazil, Argentina.	Tropical America from Central America to Buenos Aires, West Indies.
borneonensis Metcalf	*Bufo jerboa* Boulenger.	Bufonidae.	Siam, Borneo.	Siam, Borneo.	Cosmopolitan (except Australasia, Madagascar, the Seychelles).
celebensis, new	*Bufo celebensis* Schlegel.	Do.	Celebes.	Celebes.	Do.
Do	*Bufo divergens* Peters.	Do.	Borneo.	Natuna Islands, Borneo, Malay Peninsula, Palewan (?), Selangor.	Do.
ciliata, new	*Hyla fuscovaria* Lutz.	Hylidae.	Minas Geraes, Brazil.		America, including West Indies; one species (several subspecies in Euro-Asia and Northern Africa, Papua, Australia.
hasseltii, new	*Leptobrachium hasseltii* Tschudi (=*Megophrys*).	Pelobatidae.	Java.	Upper India and Malay Archipelago.	From the Himalayas to Java and Borneo.
hosei, new	*Nectophryne hosei* Boulenger.	Bufonidae.	Borneo.	Borneo, Malay Peninsula.	Africa, India, Malay Peninsula, Borneo.
lemuriae, new	*Polypedates rhodoscelis* (Boulenger).	Ranidae.	Madagascar.	Madagascar.	Madagascar, Ceylon, southern India, Singapore, Malaysia, Philippines.
longa hispanica Metcalf	*Rana esculenta hispanica* Michaelles.	Do.	Alicante Province, Spain.	Palearctic region.	Northern Hemisphere, Africa, Madagascar, Seychelles, East Indies, one species in northernmost Australia and another in northernmost South America.

Do.	*Rana limnocharis* Wiegmann.	Do.	Darjiling, India.	India, Japan, Formosa, Java.	Northern Hemisphere, Africa, Madagascar, Seychelles, East Indies, one species each in northernmost Australia and northernmost South America.
longa macronucleata, new.	*Rana vittigera* Wiegmann [=*R. cancrivora*].	Do.	Philippines.	Philippines (?), also Malay Archipelago.	Do.
luzonensis, new.	*Rana similis* Günther.	Do.	Rizal, Philippines.	Philippines.	Northern hemisphere, Africa, Madagascar, Seychelles, East Indies, one species each in northernmost Australia and northernmost South America.
Do.	*Rana luzonensis* Boulenger.	Do.	Benquet Province, Philippines.	Highlands of Lepanto, Luzon, Philippines.	Do.
luzonensis aponensis, new.	*Rana magna* Stejneger.	Do.	Mount Apo, Mindanao, Philippines.	Mindanao, Basilan, Mindoro, Luzon, Philippines.	Do.
metcalfi Bhatia and Gulati.	*Bufo melanostictus* Schneider.	Bufonidae.	Punjab, India.	India, southeastern Asia, Malay Archipelago.	Cosmopolitan (except Australasia, Madagascar, the Seychelles).
microhylae, new.	*Microhyla leucostigma* Boulenger.	Microhylidae.	Borneo.	Perak, Borneo.	India, Borneo.
mogyana (Carini).	*Hyla leucophyllata* (Beiris).	Hylidae.	Angra dos Reis, Brazil.	Nicaragua, Costa Rica, tropical South America.	America, including West Indies; one species (several subspecies) in Euro-Asia and northern Africa; Papua, Australia.
ophis Metcalf.	*Rana tigerina* Daudin.	Ranidae.	Punjab, India.	India, Formosa, Billeton Island near Sumatra.	Northern Hemisphere, Africa, Madagascar, Seychelles, East Indies, one species each in northernmost part of Australia and South America.
philippensis, new.	*Bufo quadriporcatus* Boulenger.	Bufonidae.	Sumatra.	Sumatra, Natuna Islands, Borneo, Malay Peninsula up to 240 meters altitude.	Cosmopolitan (except Australasia, Madagascar, the Seychelles).
Do.	*Bufo philippinicus* Boulenger.	Do.	Caihole River, Ulugan Bay, Palawan, Philippines.	Palawan and Balabec, Philippines.	Do.
plata, new.	*Hyla faber* Wied.	Hylidae.	State of Rio de Janeiro, Brazil.	Central and southern Brazil to northern Argentina.	America, including West Indies; one species (several subspecies) in Euro-Asia and northern Africa; Papua, Australia.

Species of opalinid	Host species	Family of host	Known geographic occurrence of the opalinid in the host named	Known geographic occurrence of host	Known geographic occurrence of genus of host
Cepedea pulchra javensis Metcalf.	*Bufo melanostictus* Schneider.	Bufonidae.	Punjab, India.	India, southeastern Asia, Malay Archipelago.	Cosmopolitan (except Australasia, Madagascar, the Seychelles).
punjabensis Bhatia and Gulati.	Do.	Do.	Do.	Do.	Do.
saharana Metcalf	*Rana esculenta ridibunda* Pallas.	Ranidae.	Turkestan.	Algiers, Turkestan, Beluchistan.	Northern Hemisphere, Africa, Madagascar, Seychelles, East Indies, one species each in northernmost parts of Australia and South America.
scalpriformis (Ghosh)	*Bufo melanostictus* Schneider.	Bufonidae.	India.	India, southeastern Asia, Malay Archipelago.	Cosmopolitan (except Australasia, Madagascar, the Seychelles).
sialkoti Bhatia and Gulati.	*Bufo macrotis* Boulenger.	Do.	Punjab, India.		Do.
siamensis, new	*Bufo asper* Gravenhorst.	Do.	Trong, Lower Siam.	Sumatra, Borneo, Java, Siam, Malay Peninsula up to 1,200 meters altitude.	Do.
spinifera Metcalf	*Oxydozyga lima* (Tschudi).	Ranidae.	Siam.	Eastern India, southern China, Siam, Java.	Southeastern Asia, Java.
virgula (Dobell)	*Polypedates leucomystax* (Gravenhorst).	Do.	Ceylon, southern India.	Ceylon, southeastern Asia.	Madagascar, Ceylon, India, China, Japan, Philippines, East Indies.
species ?	*Aelurophryne mammata* (Günther).	Bufonidae.	Szechwan, China.	Szechwan, China.	Szechwan, China.
species ?	*Eleutherodactylus guentheri* (Steindachner).	Leptodactylidae.	Brazil.	Brazil, Bolivia, Ecuador, Venezuela.	Tropical America.
species	*Rana chalconota* (Schlegel).	Ranidae.	Philippines.	Malay Archipelago.	Cosmopolitan (except Australasia, Madagascar, the Seychelles).
Opalina annandali, new	*Rana tigerina* Daudin	Do.	Calcutta, India	India, Formosa, Billeton Island near Sumatra.	Northern Hemisphere, Africa, Madagascar, Seychelles, East Indies, one species each in northernmost parts of Australia and of South America.
chattoni Weill	*Bufo melanostictus* Schneider.	Bufonidae.	Saigon, Cochinchina.	India, southeastern Asia, Malay Archipelago.	Cosmopolitan (except Australasia, Madagascar, the Seychelles).

caracoidea Bezzenberger.	*Rana cyanophlyctis* Schneider.	Ranidae.	"India."	Tillimanti and Rhamnad, southern India, Ceylon.	Northern Hemisphere, Africa, Madagascar, Seychelles, East Indies, one species each in northernmost part of Australia and of South America.
caracoidea lahorensis Bhatia and Gulati.	*Bufo melanostictus* Schneider.	Bufonidae.	Lahore, India.	India, southeastern Asia, Malay Archipelago.	Cosmopolitan (except Australasia, Madagascar, the Seychelles).
Do	*Rana tigerina* Daudin.	Do.	Do.	India, Formosa, Billeton Island near Sumatra.	Northern Hemisphere, Africa, Madagascar, Seychelles, East Indies, one species each in northernmost part of Australia and of South America.
japonica Sugiyama	*Cacopus systoma* (Schneider).	Microhylidae.	India.	India.	India.
japonica javensis, new	*Nyctixalus margaritifera* Boulenger.	Ranidae.	Java.	Java.	Java.
larvarum Metcalf	*Rana clamitans* Latreille.	Do.	Nova Scotia, Massachusetts, Philadelphia.	Eastern North America from Florida to Canada, westward into Mississippi Valley and the Great Lakes Basin.	Northern Hemisphere, Africa, Madagascar, Seychelles, East Indies, one species each in northernmost portion of Australia and of South America.
larvarum Metcalf ?	*Rana catesbeiana* Shaw.	Do.	Do.	North America east of the Rocky Mountains.	Do.
Do	*Rana pipiens* Schreber.	Do.	Ohio, Massachusetts.	Eastern North America, west to the Great Plains and north to Hudson Bay.	Do.
Do	*Rana palustris* LeConte.	Do.	District of Columbia, North Carolina, Michigan, Philadelphia.	North America east of Sierra Nevadas.	Do.
malaysiae, new	*Rana labialis* Boulenger.	Do.	Lower Siam.	Lower Siam, Molucca.	Do.
Do	*Microhyla ornata* Dumeril and Bibron.	Gastrophrynidae.	Rangoon, Burma.	South China, Formosa, Tonkin, Hainan, Burma, Assam, Siam, Annam, Malay Peninsula, India, Ceylon.	Do.
mantellae, new	*Mantella baroni* Boulenger.	Dendrobatidae.	Madagascar.	Madagascar.	Madagascar.
nucleolata, new	*Rana chalconota* (Schlegel).	Ranidae.	Java.	Malay Peninsula, Sumatra, Mentawi Island, Borneo, Java, Celebes, Philippines.	Northern Hemisphere, Africa, Madagascar, Seychelles, East Indies, one species each in northernmost part of Australia and of South America.

Species of opalinid	Host species	Family of host	Known geographic occurrence of the opalinid in the host named	Known geographic occurrence of host	Known geographic occurrence of genus of host
Opalina nucleolata siamensis, new.	*Rana macrodactyla* (Günther).	Ranidae.	Lower Siam, Tonkin, China.	South China, Tonkin, Burma, Siam, Malay Peninsula.	Nothern Hemisphere, Africa, Madagascar, Seychelles, East Indies, one species each in northernmost part of Australia and of South America.
Do.	*Rana macrodon* Tschudi.	Do.	Siam, Singapore, Natunas, Engano.	Singapore, Natunas, Engano, Borneo, Java, Sombak, Flores, Batjan.	Do.
obtrigonoidea Metcalf.	*Rana palustris* Schreber. Tadpole.	Do.	Massachusetts.	Eastern North America, west to the Great Plains, north to Hudson Bay.	Do.
ranarum (Ehrenberg).	*Rana cyanophlyctis* Schneider.	Do.	Punjab, India.	India.	Do.
ranarum orbiculata, new.	*Rana glandulosa* Boulenger.	Do.	Singapore.	Malay Peninsula, Borneo.	Do.
Do.	*Rana temporalis* Günther.	Do.	Ceylon.	Ceylon.	Do.
septentrionalis Metcalf.	*Hyla septentrionalis* Boulenger.	Do.	Cuba, Bahamas.	Cuba, Bahamas.	America, including West Indies, one species in Euro-Asia; Australia, Papua.
sudafricana Fantham.	*Bufo regularis* Reuss.	Bufonidae.	South Africa.	Africa, south of the Sahara Desert.	Cosmopolitan (except Australasia, Madagascar, the Seychelles).
(?) *termitis* de Mello.	*Caloptermes* sp. and *Leucotermes indicola*.	Termites.	India.		
triangularis Ghosh.	*Bufo melanostictus* Schneider.	Bufonidae.	Punjab, India.	India, southeastern Asia, Malay Archipelago.	Cosmopolitan (except Australasia, Madagascar, the Seychelles).
zeylonica, new.	*Polypedates eques* (Günther).	Ranidae.	Ceylon.	Malabar and Ceylon.	Northern Hemisphere, Africa, Madagascar, Seychelles, East Indies, one species in Australia and South America.
species ?	*Rana jerboa* Günther.	Do.	Java.	Burma, Siam, Malay Peninsula, Sumatra, Borneo, Java.	Do.
species.	*Rana verrucosa* Gravenhorst.	Do.	Southern India.	Malabar Hills, up to 7,000 feet in the Nilghiris, 4,000 feet in Travancore.	Do.

REVIEW OF THE CLASSIFICATION AND GEOGRAPHIC DISTRIBUTION OF THE OPALINIDAE

The relationships of the Ciliata may be expressed in the following classification, and the phylogeny of the Opalinidae is shown in figure 126.

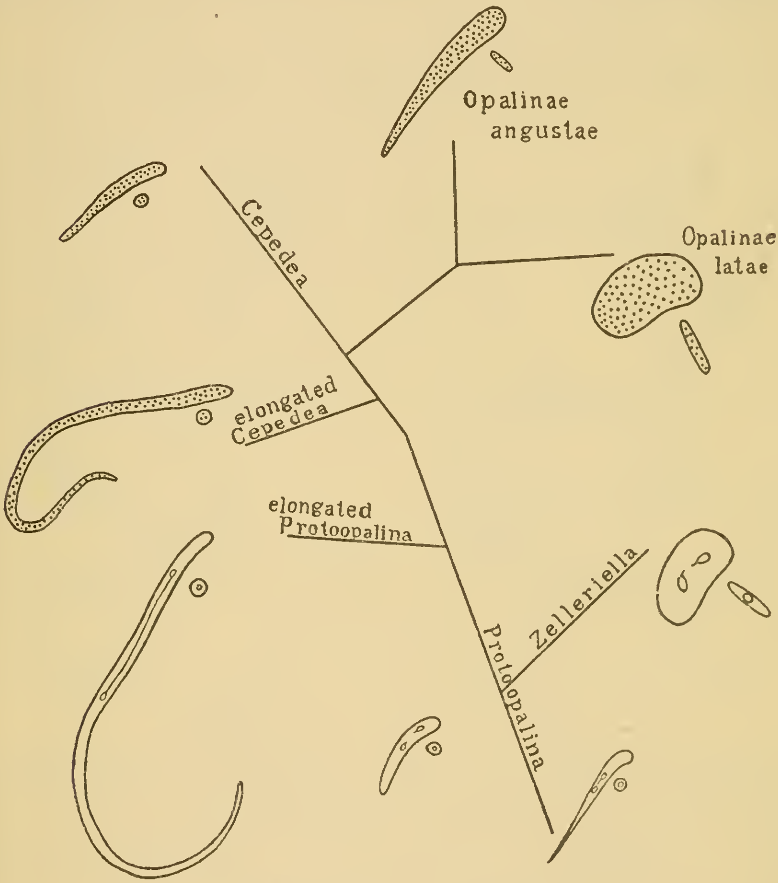


FIGURE 126.—Phylogeny of the Opalinidae

CILIATA
- PROTOCILIATA (Opalinidae)
  - Protoopalininae
    - *Protoopalina*
    - *Zelleriella*
  - Opalininae
    - *Cepedea*
    - *Opalina*
      - *Opalinae latae*
      - *Opalinae angustae*
- EUCILIATA

THE GENUS PROTOOPALINA

In this genus the several species are fairly distinct, more so than in any other genus of Opalinidae. This is in agreement with its archaic character, there having been time for gradual divergence to well-demarcated species. The archaic character of *Protoopalina* is indicated: (1) By its agreement in morphology with the first stages in development of each of the other three genera, *Zelleriella*, *Cepedea*, and *Opalina;* (2) by its wide geographical distribution, Euro-Asia (except southern India and the islands supposed to have been once

FIGURE 127.—Geographic distribution of *Protoopalina*.

parts of the Indian Ocean continent "Lemuria"), Africa, Malaysia, Australasia, South America, Central America and the Antilles, North America (except the northeastern portion) (fig. 127); (3) by the comparative morphology of the four genera, *Protoopalina* being less developed in structure and showing in its series of species how the other genera might readily have been derived from it; (4) by the agreement of the comparative morphological series, *Protoopalina*, *Cepedea*, *Opalina*, with the course of the larval development of the higher genera, complete and convincing evidence of phylogeny (Metcalf, 1923a); (5) by the resemblance of a group of *Protoopalinae* of southern, almost sub-Antarctic distribution (subgeneric group I) to the mother cells of the male gametes in *Protoopalina*, *Cepedea*, and *Opalina*, the only genera the sexual phases of whose development have been studied, and the similar character of the zygotes in *Opalina*. These elongated forms with slender tails, which are naked near the tip, are strikingly alike and seem to be archaic in character. I have regarded the tailed species in *Protoopalina* as constituting the most archaic subgenus. There is no sharp demarcation. Some species have formae less elongated and others slender and with naked spines (*P. caudata*) and so almost grade into this subgenus. The species that are undoubtedly of this archaic subgenus I are all of southern distribution, Patagonia, Australasia, and southern or tropical Africa. *P. saturnalis*, from Mediterranean fish, shows much resemblance.

Protoopalina, Subgeneric Group I (fig. 128)

P. diplocarya Metcalf, in a leptodactylid, Straits of Magellan.
P. papuensis Metcalf, in a *Hyla*, Dutch Papua.
P. acuta (Raff), in a leptodactylid, Australia.
P. xenopodos Metcalf, in *Xenopus*, Belgian Congo and South Africa.
P. [*capensis*, new species], in a doubtful leptodactylid, Cape Colony, South Africa.
P. appendiculata Fantham, in a *Rana*, South Africa.
P. australis, new species, in a *Hyla*, Australia.

P. africana Metcalf, in a ranid, the Cameroons.
P. nutti Metcalf, in a *Rana*, British East Africa.
P. saturnalis (Leger and Duboscq), in a teleost, Mediterranean Sea.
P. stevensoni Metcalf, in a *Bufo*, Sudan, Africa.

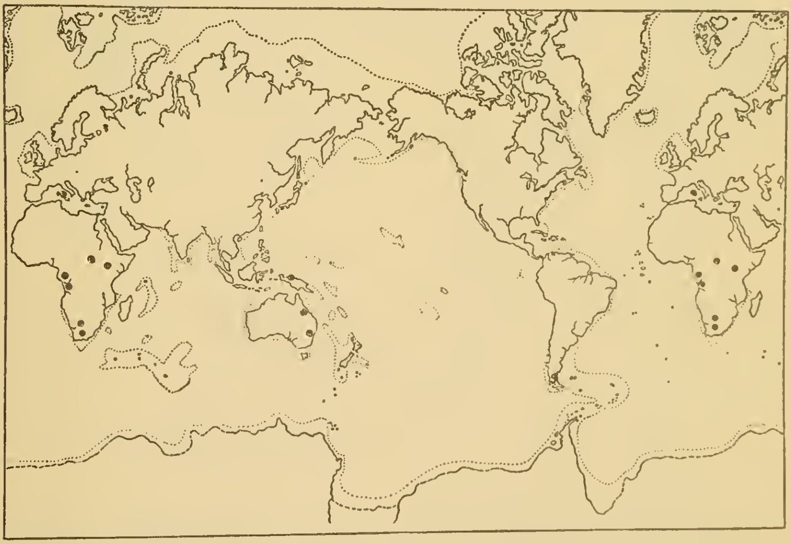


FIGURE 128.—Geographic distribution of *Protoopalina*, subgeneric group 1.

The last four species (Metcalf, 1923a, group 2) are less elongated posteriorly than the others, but resemble them. The sub-Antarctic and tropical African distribution of this subgenus indicates that the genus was of southern origin, doubtless in primitive Anura, in the Triassic, Southern Hemisphere, land mass that I have called Equatoria, including Gondwanaland and South America. This archaic subgenus has not spread beyond the limits of its ancestral home.

Protoopalina, Subgeneric Group II, Including Groups 2 and 3 of Metcalf, 1923a (*fig. 129*)

P. caudata (Zeller), in discoglossids, Europe.
P. c. discoglossi Metcalf, in *Discoglossus*, Europe.
P. c. microhyla Nie, in a gastrophrynid, southwest India.
P. macrocaudata Metcalf, in a discoglossid, eastern Asia.
P. orientalis Metcalf, in a discoglossid, eastern Asia.
P. yunnanensis, new species, in a discoglossid, eastern Asia.
P. caccosterni Fantham, in a gastrophrynid, South Africa.
P. luzonensis, new species, in a gastrophyrnid, Philippine Islands.
P. borneonensis, new species, in a ranid, Borneo.
P. peronii Metcalf, in a leptodactylid, eastern Australia.
P. dorsalis (Raff), in a leptodactylid, western Australia.
P. intestinalis (Stein), in discoglossids, Europe.
P. pelobatidis Metcalf, in *Pelobates*, Europe.
P. hylarum (Raff), in *Hyla*, eastern Australia.
P. bibronii, new species, in an archaic bufonid, southeastern Australia.
P. stejnegeri Metcalf, in a discoglossid, extreme northwestern United States.

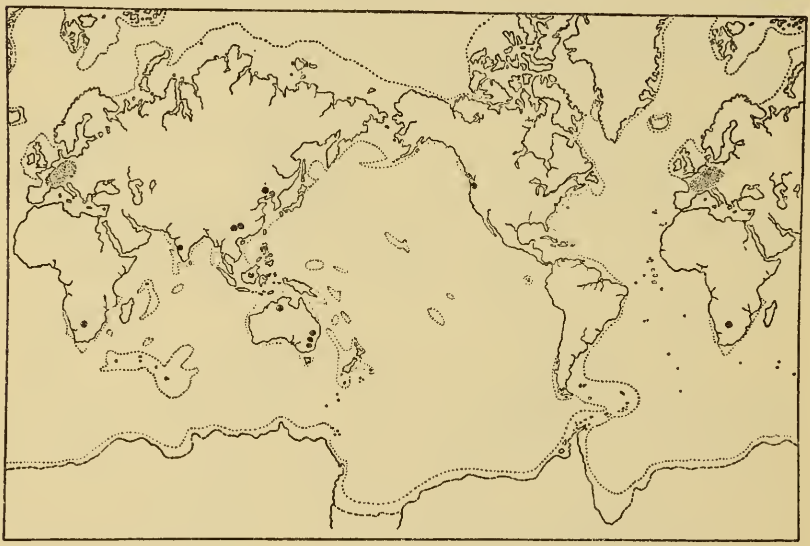


FIGURE 129.—Geographic distribution of *Protoopalina*, subgeneric group II.

The typical discoglossid parasites are included here. Through *P. caudata* form *attenuata* and *P. orientalis* the group approaches group I in form. From the archaic species of group I were derived group II, forms many of which have spread to Euro-Asia and are there parasitic in discoglossids, one pelobatid and three gastrophrynids, all but perhaps the last being ancient hosts. The species of this second subgenus that have remained in, or returned to, the sub-Antarctic habitat (Australia) are found in an archaic bufonid, two leptodactylids, and a *Hyla*. I have interpreted the presence of the Protoopalinas of group II in Australia as due to there having been discoglossids there formerly, *e. g.*, the ancestors of the New Zealand *Liopelma* (Metcalf, 1928a). The spread of *Ascaphus* to North America, with its *Protoopalina* of this subgenus, occurred in the Cretaceous period (*cf.* p. 592). The subgenus is as old as the Jurassic period, for it is in Australia, and *Liopelma*, a former host, now barren because of lack of an aquatic, larval stage, is in New Zealand.

Protoopalina, Subgeneric Group III (Group 5 of Metcalf, 1923a) (fig. 130)

P. montana Metcalf, in a pelobatid, Java.
P. adelaidensis Metcalf, in a *Hyla*, eastern Australia.

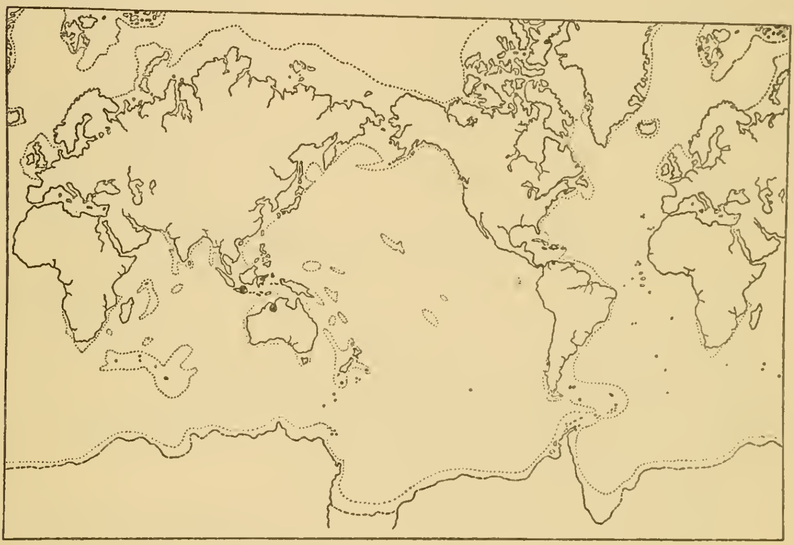


FIGURE 130.—Geographic distribution of *Protoopalina*, subgeneric group III.

These are very similar to each other and are but slightly demarcated from group II. Their occurrence, one in Java and one in Australia, agrees with Arldt's conclusion that Java and Australia remained connected through the early Cretaceous after they had separated from Asia and western Malaysia.

Protoopalina, Subgeneric Group IV (Group 6 of Metcalf, 1923a) (fig. 131)

P. filiformis Metcalf, in a *Rana*, Formosa.
P. tenuis (Raff), in a leptodactylid, eastern Australia.

These elongated forms show some resemblance to the less elongated species *P. africana* and *P. borneonensis*. They apparently evolved at a time before Formosa and Australia definitely parted company, which means probably in the Jurassic period. Tropical Africa and Borneo probably had connection with both Australia and Formosa at that time.

FIGURE 131.—Geographic distribution of *Protoopalina*, subgeneric group IV.

Protoopalina, Subgeneric Group V (Group 7 of Metcalf, 1923a) (fig. 132)

P. regularis Metcalf, in a *Bufo*, tropical Africa.
P. rhinodermatos Metcalf, in a gastrophrynid, South America.
P. longinucleata Metcalf, in a leptodactylid, South America.
P. xamachana, new species, in leptodactylid, Jamaica, West Indies.
P. bufonis Metcalf, in *Bufo*, Cuba, West Indies.
P. mossambicensis Metcalf, in *Rana*, tropical Africa.

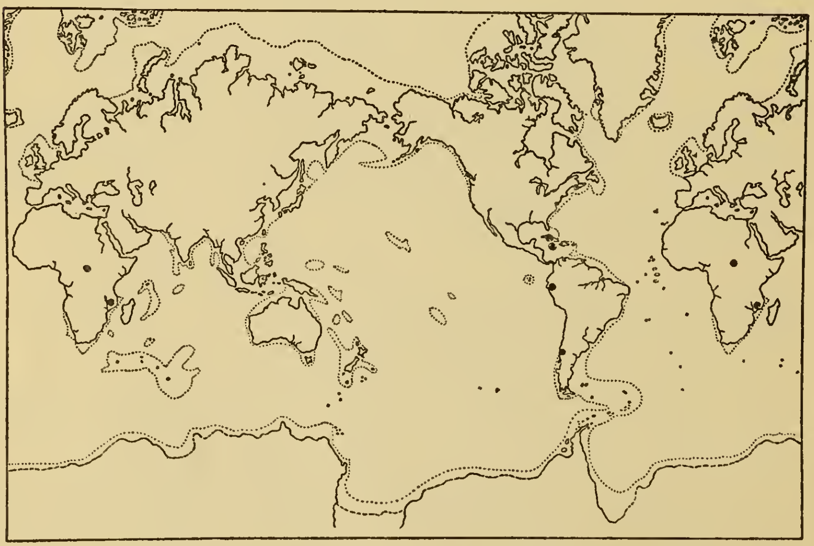


FIGURE 132.—Geographic distribution of *Protoopalina*, subgeneric group V.

These tropical species are closely alike. It would seem, then, that this group dates from a time when the American and African tropics were connected (Cretaceous, or more likely Jurassic, period).

Protoopalina, Subgeneric Group VI (Group 8 of Metcalf, 1923a) (fig. 133)

P. scaphiopodos Metcalf, in *Scaphiopus*, a pelobatid, southwestern United States.

P. hammondii Metcalf, in *Scaphiopus*, southwestern United States.

P. mexicana Metcalf, *in Scaphiopus*, northern Mexico.

P. mitotica (Metcalf), in *Ambystoma*, west-central United States.

FIGURE 133.—Geographic distribution of *Protoopalina*, subgeneric group VI.

This compact, sharply distinct, and highly evolved group of species have dumbbell-shaped nuclei. They doubtless evolved from a pelobatid parasite, like *P. pelobatidis*, when the pelobatid host, *Scaphiopus*, had reached North America during the Tertiary period. In the host genus they spread, east of the mountains, as far south as northern Mexico, and one species turning eastward reached the Atlantic coast. *Scaphiopus* is a genus of strange habits, burrowing and seldom seen. Once, in Woods Hole, Mass., where it had been almost unknown, *Scaphiopus holbrookii* appeared, breeding by the many hundreds in surface pools after a good rain. Perhaps this genus may be secretly present in other regions from which it has not been reported.

Protoopalina, Subgeneric Group VII (fig. 134)

P. ovalis Fantham, in *Rana*, South Africa.

P. ovoidea Metcalf, in a gastrophrynid, Texas.

These forms are probably distinct from each other, though they agree in form and dimensions. The nuclei of *P. ovalis* are much more

FIGURE 134.—Geographic distribution of *Protoopalina*, subgeneric group VII.

slenderly oval. The two species seem to form a natural group. *P. xyster* Metcalf, in *Gastrophryne*, from Central America may also belong here.

Protoopalina, Subgeneric Group VIII (Group 9 of Metcalf, 1923a) (fig. 135)

P. formosae Metcalf, in *Bufo*, Formosa.
P. quadrinucleata Metcalf, in *Rana*, Java.
P. axonucleata Metcalf, in *Rana* and *Bufo*, eastern Asia.

FIGURE 135.—Geographic distribution of *Protoopalina*, subgeneric group VIII.

These forms, grouped together to indicate the later steps in the development of *Protoopalina* into *Cepedea*, are of eastern Asian and Malaysian distribution, probably indicating the origin of *Cepedea* there or in some nearby, connected region.

There is one noteworthy feature of the distribution of *Protoopalina*. Only a single species is reported from any of the lands reputed to have been once united to form the Indian Ocean continent Lemuria (Madagascar, the Seychelles, Ceylon, southernmost India). The one instance is *P. caudata microhyla*, in *Microhyla ornata*, from Harnai, Ratnagiri District, south of Bombay, "among mountains." This location is about on the boundary line between the northern Indian and the southern Indian faunas. Its host belongs to a southern family, the Gastrophrynidae. This is the nearest approach to a record of a *Protoopalina* from Lemurian lands. Why are there no more Protoopalinas in these Indian Ocean lands? Study of paleogeographic maps by Arldt and others (fig. 142, *a*) shows Indian Ocean lands connected in Triassic times with Africa and Australia, not with Malaysia. Lemuria is shown connected with Ethiopia, but not with Asia-Malaysia during the Jurassic and early Cretaceous periods. Madagascar separated from Ethiopia after the early Cretaceous and probably did not join it again after this time (see Hewitt, 1922, who suggests temporary late Tertiary connection). The mid-Cretaceous island of India (fig. 143, *b*) is shown uniting with continental Asia late in the Tertiary (fig. 145, *a*) and retaining this connection until the present time. The only suggestion the author can make is that *Protoopalina* was once in Lemuria but was exterminated during the subsidences that broke it into several islands and island groups, but that, before the middle Cretaceous period, somewhat elongated Protoopalinas gave rise to *Cepedea* in Asia-Malaysia, which was in contact with Lemuria for a period long enough to allow Lemuria to become inhabited by *Cepedea* (fig. 143, *a*).

THE GENUS ZELLERIELLA (Fig. 136)

Species distinctions in this genus are difficult, though the genus itself is well demarcated from the other genera. Its origin from *Protoopalina* is indicated by a *Protoopalina* stage in its early development (*cf. Z. brasiliensis* from *Crossodactylus gaudichaudii*, fig. 38). Its geographical distribution, South America, Central America, and Australasia, indicates its origin in the Southern Hemisphere and in that land-complex which in late Cretaceous or early Tertiary times included Australasia, Antarctica, and southern South America, possibly also South Africa early in this period. Comparative numbers in the Australasian and South American regions suggest the origin of *Zelleriella* in the region of greater Antarctica connected with Patagonia and its migration westward from Patagonia to Australia.

If it arose at the eastern end of this Antarctic land-complex, there remains the question whether the place of its evolution was Patagonia or tropical America. Its hosts are leptodactylids, bufonids, hylas, and dendrobatids, predominantly leptodactylids. The bufonids other than *Bufo* carry *Zelleriella*, so far as known records go, only in South America. They can be left out of account. *Bufo* does not occur in Australia, so it could not have been the host in which *Zelleriella* wandered westward to Australia. *Bufo* was apparently not in Patagonia at the time of this migration. *Bufo* probably arose in southeastern Asia, entered North America, and probably Ecuador also,

FIGURE 136.—Geographic distribution of *Zelleriella*.

by way of the Cretaceous circum-Pacific land-strip (fig. 143, *a*). This land-strip became for the most part fused with North America during the Tertiary period (fig. 144, *b*), but the Isthmus of Panama was not formed until the middle Pliocene, and before that time the land-strip had apparently disintegrated, giving no passage between North and South America. Both *Bufo* and *Hyla*, but not *Zelleriella*, were probably in tropical South America before the leptodactylids, with *Zelleriella*, passed to Australia (see the discussion of the leptodactylids, p. 600).

Zelleriella, the dominant opalinid in leptodactylids, apparently evolved in them in Patagonia, or greater Antarctica of which it was a part, before Patagonia and Brazil united (middle Miocene?) (fig. 145, *a*). It passed to Australia, but not to Asia-Malaysia. This migration occurred, therefore, after the Jurassic, probably after the earliest Cretaceous, period, when Australia and Malaysia were permanently separated. This makes the date of *Zelleriella*'s origin between the early Cretaceous and the middle Miocene, during the mild climate in Antarctica, which we know from fossils prevailed during the early Miocene and probably earlier. We regard *Zelleriella*, therefore, as a leptodactylid parasite of Antarctic origin in early or middle Tertiary time. When the bar to northward spreading in South America (see discussion of the Leptodactylidae) disappeared, leptodactylids with their Zelleriellas passed northward to tropical America, infected Hylas (sparsely) and Bufos, both already there, with *Zelleriella*, and after the Isthmus of Panama was formed, in the middle Pliocene, they passed on across it in their original leptodactylid, and their new hylid, hosts to Central America and the Antilles which were at that time connected with Yucatan and probably also with Honduras. *Bufo* also may have passed north across the Isthmus at the same time.

Zelleriella is subject to attack from parasites, which are found in the cytoplasm, where they might be mistaken for stages in the nuclear phenomena of the *Zelleriellae* (see fig. 44, *c*; and Metcalf, 1923a, p. 135). I have observed these parasites from Brazil and Texas. Several investigators (Stabler, 1933; Carini and Reichenow, 1935; Chen and Stabler, 1935; Stabler and Chen, 1936; Chen and Stabler, 1936) have made detailed studies on these *Endamoeba* parasites.

THE OPALININAE, COMPRISING THE GENERA CEPEDEA AND OPALINA

We have already seen, while discussing *Protoopalina*, that there is comparative anatomical and developmental evidence to show beyond reasonable question that *Cepedea* developed from *Protoopalina* and that there is indication that this occurred in Asia-Malaysia and before communication of this region with Lemuria had been permanently shut off, for *Cepedea* is in Madagascar, the Seychelles, and Ethiopia, as well as in India and Ceylon. *Bufo* is not in Madagascar and the Seychelles today, so probably never was in Lemuria and could not have been the original host of *Cepedea*. Ranids are today the hosts of *Cepedea* in Madagascar and the Seychelles and probably were its original hosts (*Polypedates?*). They still carry in Asia-Malaysia Protoopalinas of subgeneric group VIII from which *Cepedea* evolved. We place the evolution of *Cepedea*, therefore, in Asia-Malaysia-Lemuria, early in the Cretaceous period, in ranid hosts. Metcalf (1923a) suggested origin in Lemuria, probably in gastrophrynids. *Cepedea* apparently entered South America from Asia and the north before its hosts for this migration had met *Opalina*, for *Opalina* is not in South America; neither is *Rana* in South America, except for one species, *R. palmipes*, which, probably since the middle Pliocene, has sparsely invaded the northernmost parts of the continent. *Opalina* is now abundant in North America and Central America, chiefly in *Rana*, *Bufo*, and hylids, but these have not passed south over the Isthmus with *Opalina*. The most probable explanation seems to be:

(1) That *Bufo*, having adopted *Cepedea* from its ranid hosts, possibly *Polypedates*, in Asia, entered South America from eastern Asia by some route not including North America and Central America, *i. e.*, by the circum-Pacific land-strip, before the close of the Cretaceous period; (2) that in Tertiary times, when this land-strip fused with western North America, *Bufo* entered that continent and later adopted *Opalina*, as it adopts any opalinid when it meets it; (3) that broad *Opalinae* evolved from *Cepedea* in some region not connected with eastern Asia-Malaysia before Bufo's migration to America, *i. e.*,

FIGURE 137.—Geographic distribution of *Cepedea*.

probably in Ethiopia-Lemuria; (4) that *Opalina*, late in the Tertiary, in ranid hosts, entered eastern Asia when the Indian island fused with Asia, and that it passed on, in *Rana*, to Siberia and Alaska and down the Pacific coast of North America, west of the mountains, as far as Central America, but did not go on to South America in spite of a route being open via the Isthmus after the middle Pliocene; (5) that the *Opalinae latae* met hylids for the first time in Central America after the middle Pliocene when they passed northward over the Isthmus of Panama, were then adopted by them, and were changed into the narrow form, *Opalinae angustae*, and were carried by these new hosts northward throughout North America, infecting on the way other Anura. One species, *Hyla arborea*, crossed to Siberia and more southern Asia and with its American, narrow *Opalina* (*obtrigona*) passed on to western Europe and even to northern Africa (see the discussion of the Hylidae). *H. arborea* has evolved several subspecies (usually recognized as species)

CEPEDEA (fig. 137).—The genus *Cepedea* can, perhaps, be divided into several groups, but few of these are sharply demarcated and the divisions are of little interest. As given, they express little more than the author's impressions and these in some cases vague and uncertain.

Subgeneric Group I

In group I Metcalf (1923a) included only Bezzenberger's *C. lanceolata*, in *Rana*, "Asia."

Subgeneric Group II (fig. 138)

Group II is a large group of eastern distribution, except for four species and one subspecies from tropical and subtropical America. I see no reason except their western habitat for separating the latter.

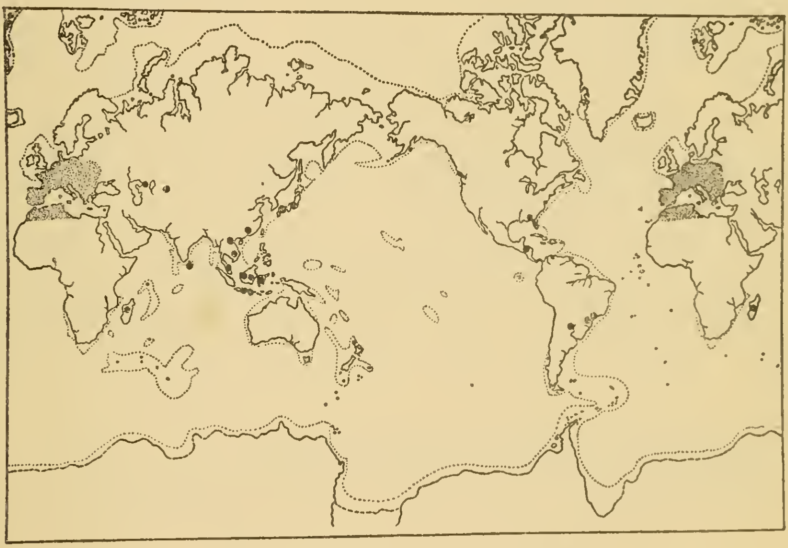


FIGURE 138.—Geographic distribution of *Cepedea*, subgeneric group II.

C. dimidiata (Stein), in *Rana* and *Bufo*, Europe, eastern Asia.
C. d. hawaiiensis Metcalf, in *Rana*, Hawaii, said to have been introduced.
C. d. orientalis Metcalf, in *Rana*, Japan.
C. d. [*paraguayensis*] Metcalf, in *Hyla*, Paraguay.
C. rubra (Carini), in *Hyla* and a leptodactylid, Rio de Janeiro, Brazil.
C. saharana Metcalf, in *Rana*, northern Africa, Turkestan, Beluchistan.
C. buergeri Metcalf, in a ranid, Japan.
C. b. sinensis Metcalf, in *Bufo*, southern China.
C. minor Metcalf, in a discoglossid, France.
C. borneonensis Metcalf, in *Bufo*, Borneo.
C. lemuriae, new species, in a ranid, Madagascar.
C. celebensis, new species, in *Bufo*, Celebes.
C. hasseltii, new species, in a pelobatid, Java.
C. microhylae, new species, in a gastrophrynid, Borneo.
C. siamensis, new species, in *Bufo*, Siam.

C. virgula (Dobell), in a ranid, Malay Peninsula, Ceylon.
C. hosei, new species, in a pelobatid, Java.
C. mogyana (Carini), in *Hyla*, Rio de Janeiro, Brazil.
C. occidentalis Metcalf, in *Rana*, tropical Central America.
C. floridensis Metcalf, in a pelobatid, Florida.
C. obovoidea Metcalf, in *Bufo*, Florida.

Subgeneric Group III

C. spinifera Metcalf, in a ranid, Java. Its well-defined posterior spine, shown in many but not all individuals, is noteworthy. A few Protoopalinas, *e. g.*, *P. stevensoni*, show the same thing.

Subgeneric Group IV

Group IV includes two species that resemble each other more than they do any other species:

C. globosa Metcalf, in a hylid, Central America.
C. baudinii Metcalf, in *Hyla*, Central America.

Subgeneric Group V

This group includes a single eastern species with two subspecies:

C. pulchra Metcalf, in a gastrophrynid, Cochinchina.
C. p. japonica Metcalf, in *Rana*, Japan.
C. p. javensis Metcalf, in *Bufo*, Java.

Subgeneric Group VI, A

These are species of more or less elongated form and irregular shape, the latter due, perhaps, to an unusually delicate pellicle. Many of them have their dividing nuclei of unusually slender and elongated shape.

C. phrynomantidis Metcalf, in a gastrophrynid, East Africa.
C. madagascariensis Metcalf, in a ranid, Madagascar.
C. madagascariensis [of *Hyperolius*] Metcalf, in a ranid, West Africa.
C. magna Metcalf, in Bufo, West Africa.

Subgeneric Group VI, B (fig. 139)

C. formosae Metcalf, in *Bufo*, China, Formosa.
C. philippensis, new species, in *Bufo*, Philippine Islands.
C. mexicana Metcalf, in *Rana*, Mexico.
C. luzonensis, new species, in *Rana*, Philippine Islands.
C. l. aponensis, new subspecies, in *Rana*, Philippine Islands.
C. ciliata, new species, in *Hyla*, southern Brazil.
C. cantabrigensis Metcalf, in *Rana*, northwestern North America.
C. multiformis Metcalf, in *Hyla*, Central America.
C. multiformis [of *Polypedates schlegelii*] Metcalf, in a ranid, Japan.
C. seychellensis Metcalf, in a ranid, Seychelles Islands.
C. dolichosoma Metcalf, in *Bufo*, Central America.
C. sp. ?, in *Hyla*, Texas.
C. longa (Bezzenberger), in *Rana*, "Asia."
C. l. hispanica Metcalf, in *Rana*, Spain, northern India.
C. ophis Metcalf, in *Rana*, Formosa, East Indies.
C. segmentata Metcalf, in a ranid, Cochinchina, East Indies.

FIGURE 139.—Geographic distribution of *Cepedea*, subgeneric group VI, B.

Elongated Cepedeas occur, on the one hand, in Africa and Madagascar, and on the other hand chiefly in lands once a part of or accessible from the Cretaceous circum-Pacific land-strip. The significance, if any, of this fact we do not discuss, for all grouping within the genus is too faintly indicated to be worth much emphasis.

Subgeneric Group VII

C. plata, new species, in *Hyla*, Rio de Janeiro, Brazil.

This species is so flat that it might be taken for an *Opalina*, but its narrowness and the impression from the general shapes in the infections indicate that it is *Cepedea*.

Species Not Assigned to Any Group

C. flava (Stokes) is omitted because of wholly inadequate description. Four species, described by others, I have not seen and so hesitate to place them in any of these groups:

C. scalpriformis (Ghosh), in *Bufo*, India.
C. sialkoti Bhatia and Gulati, in *Bufo*, Punjab, India.
C. metcalfi Bhatia and Gulati, in *Bufo*, Punjab, India.
C. punjabensis Bhatia and Gulati, in *Bufo*, Punjab, India.

OPALINA (figs. 140 and 141).—The genus *Opalina* we have divided into (1) broad species, found in the Eastern Hemisphere, with some emigrant species that have penetrated to North America and are now living on the Pacific coast, west of the mountains and in the tropical lands to the south, often called Central America, and (2) narrow species which I have suggested were developed in the Hylas after they arrived in the north, coming from South America in the middle Pliocene. These *Opalinae angustae* have been adopted by other North American hosts and are spread throughout the continent. This subgenus of narrow species, recently evolved, has developed few sharply demarcated species and its taxonomy is difficult, like that of the also comparatively modern genus *Zelleriella*. As to the *Opalinae latae*, I feel that one can recognize more or less vaguely some subgrouping. There seem to be at least *ranarum*-like forms and *japonica*-like forms,

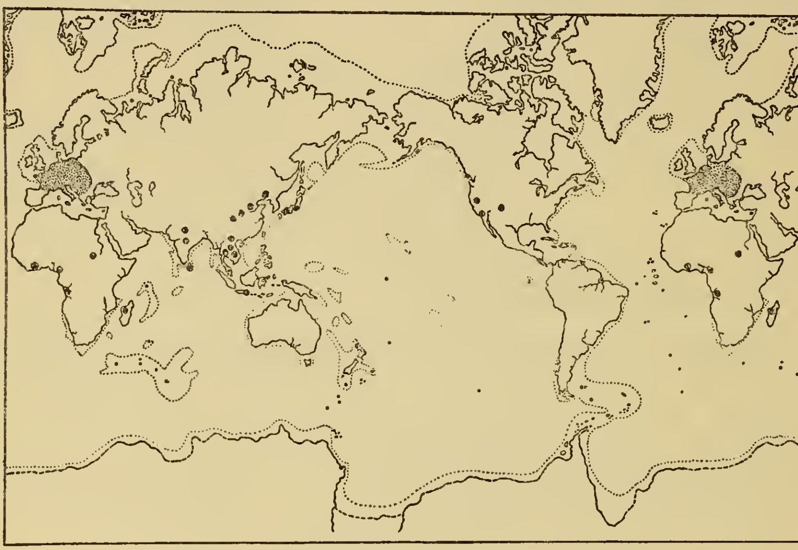


FIGURE 140.—Geographic distribution of the *Opalinae latae*.

the latter distinguished by curved and often abruptly pointed posterior ends and by smaller nuclei.

In the group of species resembling *O. ranarum* we may place the following:

O. ranarum (Ehrenberg), in *Rana* and secondary hosts, Europe.
O. r. smithi Metcalf, in *Bufo*, Japan.
O. r. orbiculata, new subspecies, in *Rana*, Ceylon, Singapore.
O. cincta Collin, in *Bufo*, Europe.
O. bufoxena Metcalf, in Bufo, Manchuria.

In the *japonica* group may be reckoned the following:

O. japonica Sugiyama, in *Rana*, Japan.
O. japonica (?) Metcalf, in *Rana*, Java.
O. coracoidea Bezzenberger, in *Rana*, "Asia," Ceylon.
O. c. lahorensis Bhatia and Gulati, in *Bufo*, India.
O. camerunensis Metcalf, in a ranid, Cameroons, Africa, and two species from the Pacific coast of North America.
O. draytonii Metcalf, in *Rana*, California.
O. panamensis Metcalf, in *Bufo*, Panama.

O. natalensis Metcalf, in a ranid from the Sudan, is almost intermediate between the *ranarum*-like species and the *japonica*-like species. The nuclei are large, but the shapes of some individuals are *japonica*-like. Other individuals are unique in form.

O. rotunda Metcalf, in *Rana*, from Siamese Cambodia, has numerous individuals that more or less resemble *O. japonica*, but its nuclei are a little larger.

O. annandali, new species, in *Rana*, from Calcutta, India, has small nuclei. Its posterior end is sometimes abruptly pointed. Its shape

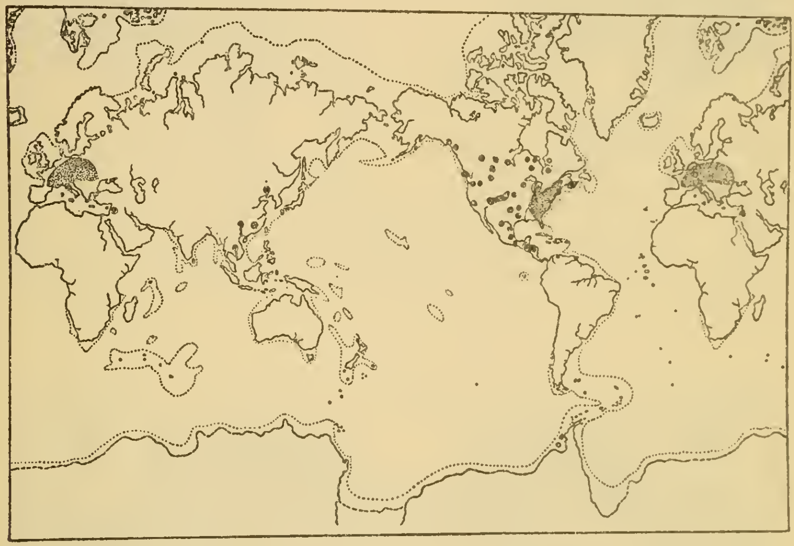


FIGURE 141.—Geographic distribution of the *Opalinae angustae*.

is frequently irregular, as is true also of *O. natalensis* and *O. rotunda*. These three might be regarded as related and as somewhat intermediate between the *japonica* group and the *ranarum* group. *O. zeylonica*, new species, in a ranid from Ceylon, with small nuclei and irregular shape, may also belong here.

O. mantellae, new species, in *Mantella* (one of the Ranidae) from Madagascar, has small nuclei, is *ranarum*-like in shape except for a few small, narrow individuals. Its possible relationships are not suggested.

O. chattoni Weill, in *Bufo*, from Cochinchina, has, in the cysts and young forms only, peculiar nuclei with each a single large nucleolar mass and a large, clear, chromatin skein. It seems a very distinct species. *O. nucleolata*, new species, in *Rana*, from Java, has usually a single nucleolar mass in its nucleus, though sometimes two are found. No such chromatin skein as in *O. chattoni* is found. These species are probably related. Their nuclei are large and their shape is like that of *O. ranarum*. Two species of *Rana* from

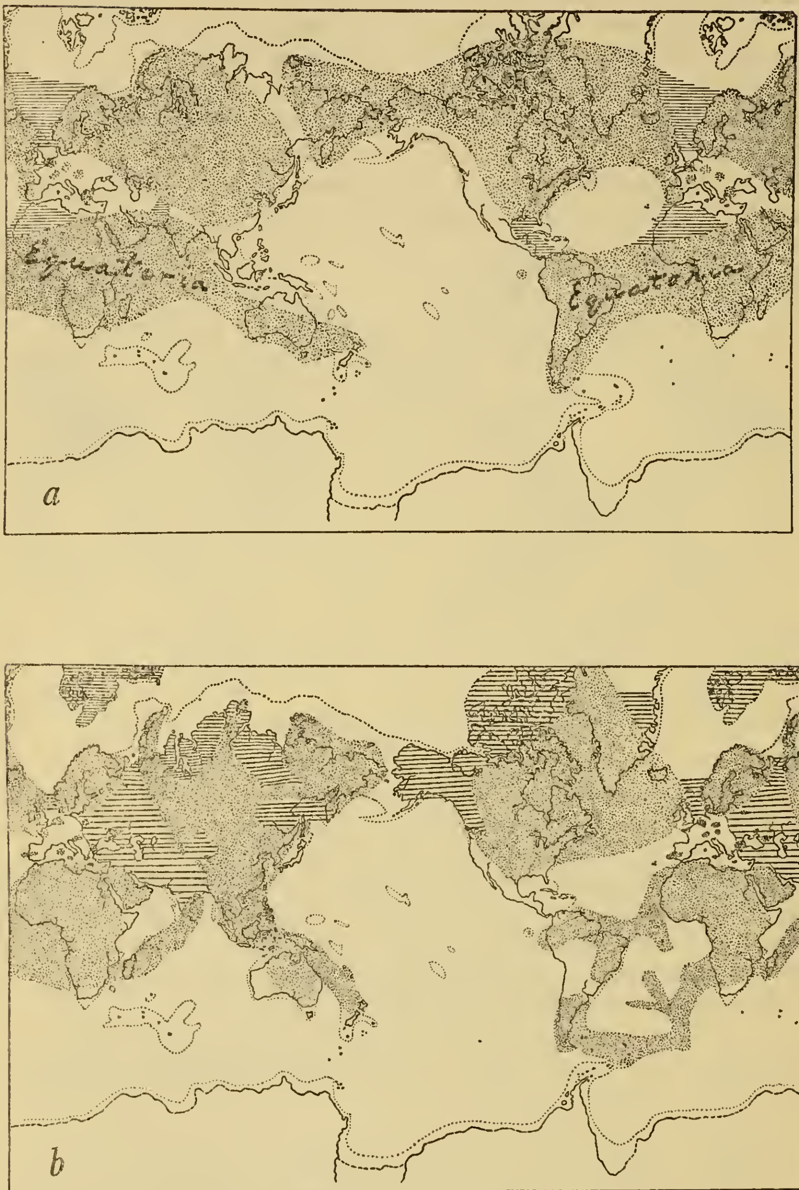


FIGURE 142.—*a*, Triassic continents (from Arldt): The stippled areas are late Triassic, the line shading indicating additional, earlier Triassic land; *b*, Jurassic continents: The stippled arcas are late Jurassic, the line shading indicating other, early Jurassic lands.

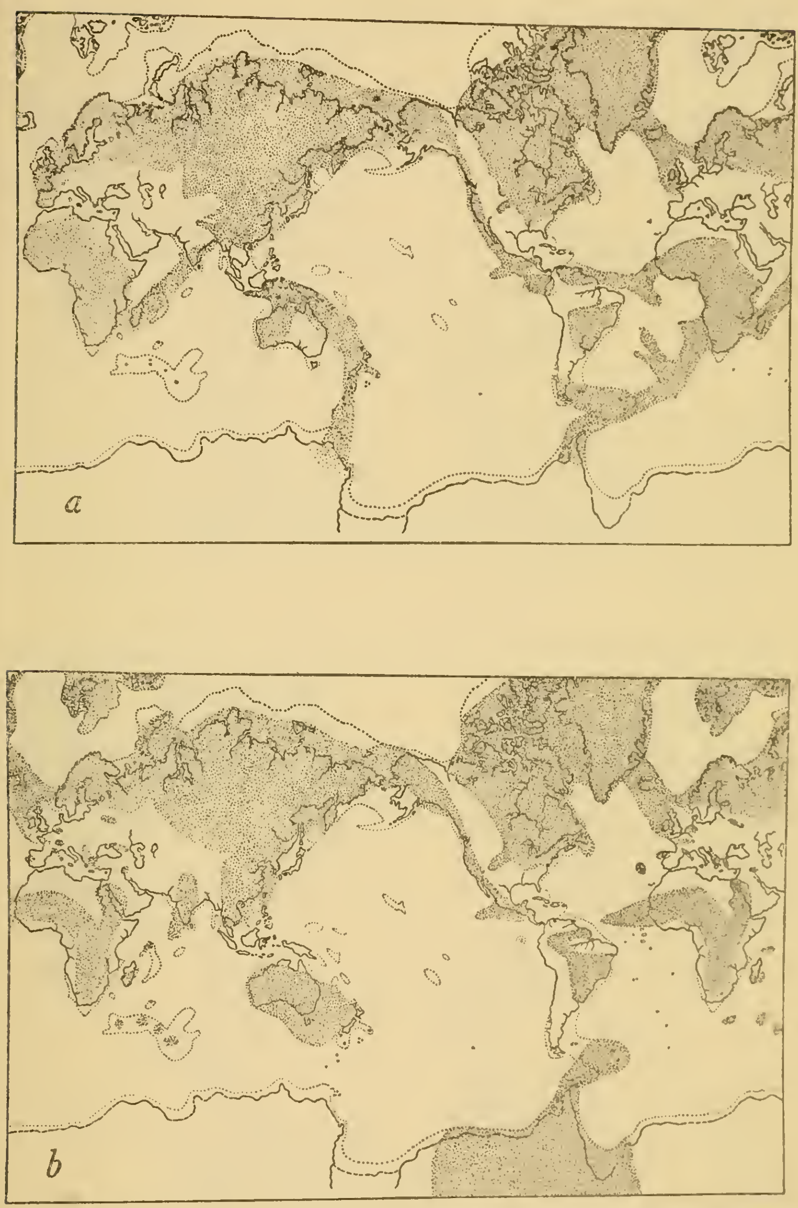


FIGURE 143.—*a*, Early Cretaceous continents; *b*, Middle Cretaceous continents. (After Schuchert.)

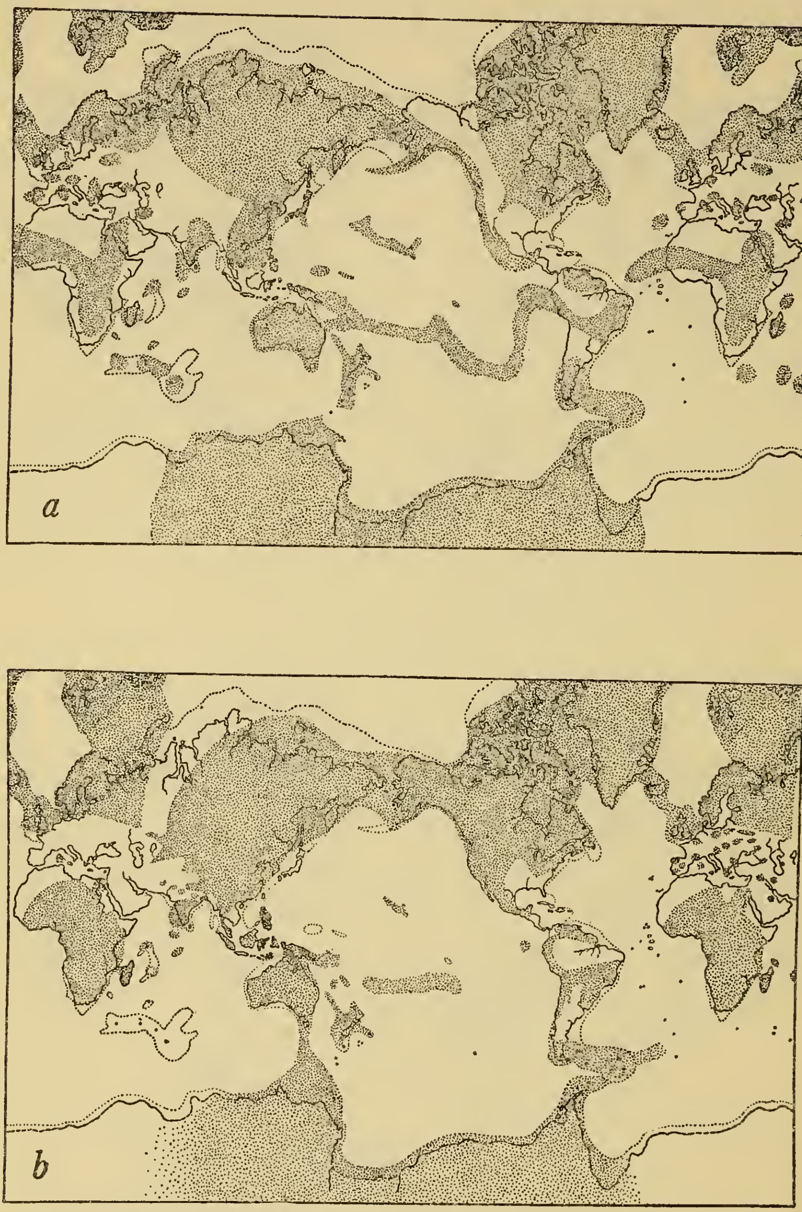


FIGURE 144.—*a*, Late Cretaceous lands (the southern Pacific may have been, instead or also, Eocene); *b*, Early Tertiary lands (after Arldt, modified). The trans-Pacific lands shown in *a* probably were present in the Eocene.

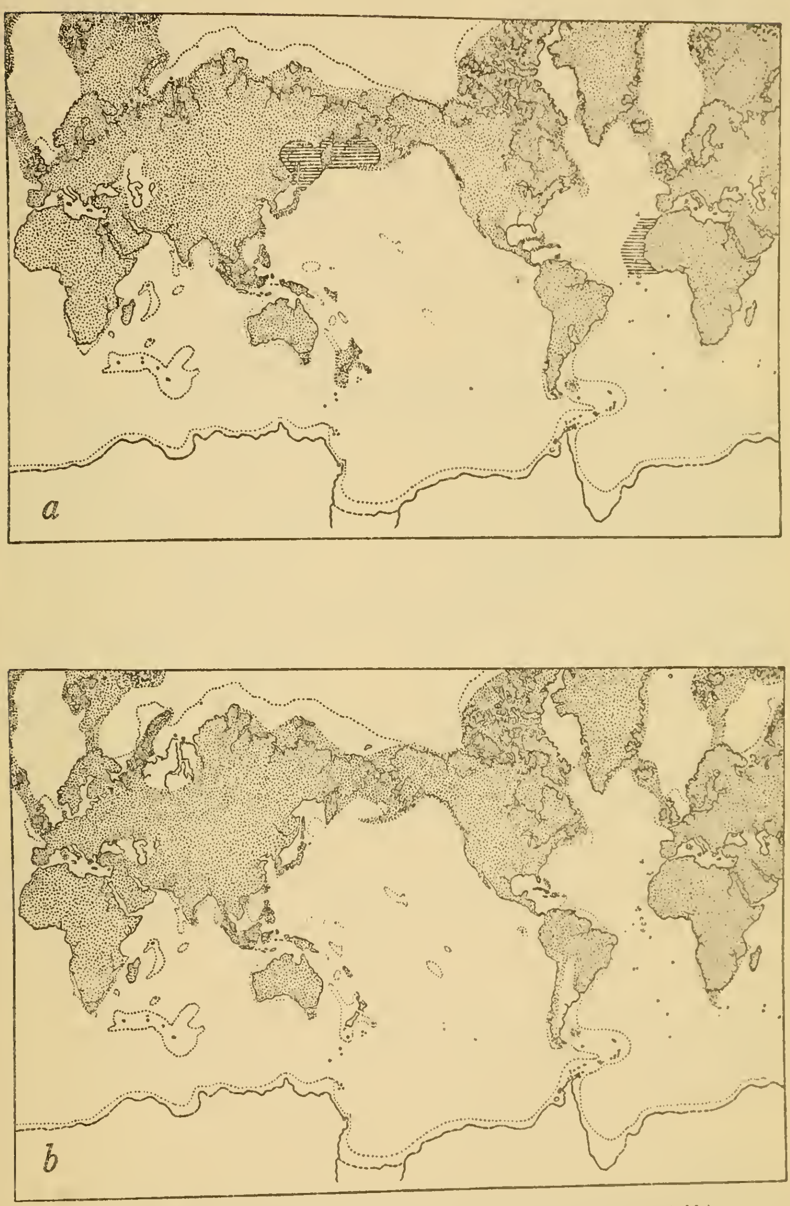


FIGURE 145.—*a*, Late Tertiary continents; *b*, Pleistocene continents (after Arldt).

southeastern Asia (Tonkin, China, and Lower Siam) bear Opalinas of similar shape to *O. nucleolata*, and their nuclei, much smaller, bear each a single nucleolar mass. They may be classed as *O. nucleolata siamensis*, new subspecies. *O. malaysiae*, new species, in a Siamese *Rana*, is in form intermediate between the *japonica* group and *O. nucleolata*. Its nuclei are small and show numerous small nucleolar disks, as is usual, instead of one or two overemphasized ones.

I make no attempt to suggest the affinities of the huge *O. lata*, described by Bezzenberger. Observation of many individuals in whole infections is necessary for this.

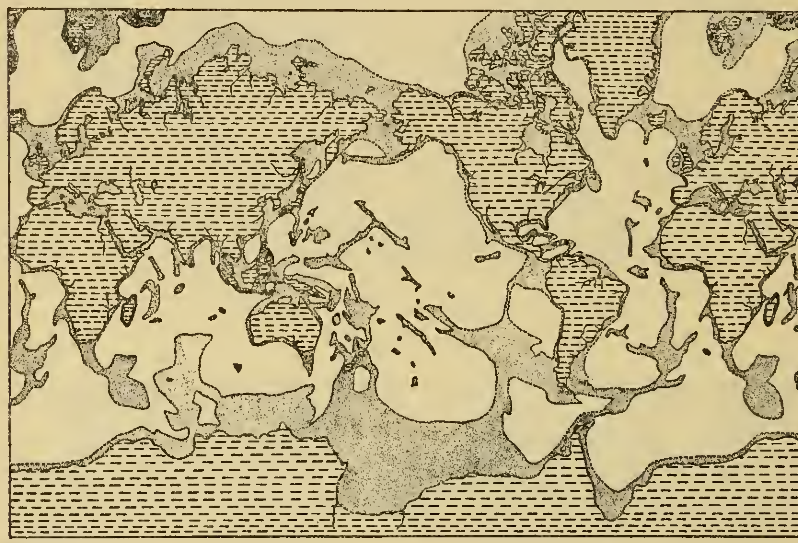


FIGURE 146.—Mercator's projection map showing land areas in dashed shading outlined by continuous line, except that unexplored shores of Antarctica have dashed lines; ocean shallows as stippled areas outlined by dashed lines on the deep-seaward side; deeper ocean areas unshaded and outlined by dashed lines.

THE CLASSIFICATION AND DISTRIBUTION OF THE ANURA

PIPIDAE:

Pipinae, the Guianas, no opalinids found.

Xenopodinae, tropical and southern Africa. *Protoopalinae* of subgenus I.

DISCOGLOSSIDAE:

Discoglossinae, Euro-Asia with northern Africa. *Protoopalinae* of subgenus II.

Ascaphinae, extreme northwestern United States. *Protoopalina* of subgenus II.

Liopelminae, New Zealand. No opalinids, because no larvae.

PELOBATIDAE: Western Europe, southern and southwestern Asia, Malaysia, Papuasia. *Protoopalinae* of subgenera II, III, and VI, and *Opalinae angustae* (lately evolved in North America).

ARCHAIC BUFONIDAE: Australia, Neotropics, Ethiopia, India, Java. Opalinids not studied, except one *Protoopalina* and two Zelleriellas, in South America.

Bufo, cosmopolitan, except Madagascar and Australasia including Papua and New Zealand. Host to all opalinids it meets.

HYLIDAE: America, Australasia, except New Zealand, one species (with several subspecies) in Europe and eastern Asia. *Protoopalina, Zelleriella, Cepedea, Opalinae angustae.*

LEPTODACTYLIDAE; Tropical America, Australasia (except New Zealand), Africa (?). *Protoopalina, Cepedea,* and especially *Zelleriella.*

GASTROPHRYNIDAE: Neotropics, Ethiopia, Madagascar, southern India, southeastern Asia, Amboina, Papua. *Protoopalina, Zelleriella, Opalina,* and especially *Cepedea.*

RANIDAE:

Ceratobatrachinae, Solomon Islands. Opalinids unknown.

Raninae, Eastern Hemisphere (except Australia, Tasmania, and New Zealand), North and Central America, one species each in the northernmost portions of Australia and South America, respectively. *Protoopalina, Zelleriella* (4 cases), and especially the multinucleate genera *Cepedea* and *Opalina.*

Dendrobatinae, Neotropics. *Zelleriella.*

Mantellinae, Madagascar. *Opalinae latae.*

Cardioglossa, classification doubtful, western Africa. Opalinids not studied,

The Opalinidae arose as *Protoopalinae* of subgenus I in archaic Anura, perhaps Pipidae, apparently in the Southern Hemisphere, and spread to all portions of the earth capable of supporting Anura, except possibly Lemuria where their present absence is unexplained. As the Anura evolved into their several families, their commensal opalinids evolved to their present diversity. The interrelationships and the course of the evolution of the families, subfamilies, genera, and species of the Anura are by no means understood, though some things are indicated. (Fig. 147.)

THE PIPIDAE (Fig. 148)

The Pipidae seem the most archaic of extant Anura, the African and South American genera having diverged to different subfamilies. The Papinae (Guianas) have not been found carrying opalinids, probably because of the absence of free-living, browsing, vegetarian, aquatic larvae, for it is in this stage of its life history that an anuran becomes infected with encysted opalinids from the recta of the hosts. The Xenopodinae (Africa) bear Protoopalinas belonging to the most ancient subgeneric group, I. It seems natural that the most archaic family of Anura should bear the most archaic opalinids, members of the most archaic subgenus of the most ancient genus.

THE DISCOGLOSSIDAE, OR BELL TOADS

The Discoglossidae, which, according to Stejneger, probably arose in southeastern Asia, near the eastern end of the Himalayan highlands, spread in three directions: (1) The Discoglossinae spread northward, inhabiting western Europe and northern Africa (*Bombina, Discoglossus, Alytes*) and also eastern Asia (*Bombina*). This was one migration, by routes north of the Himalayas, the eastern and western genera becoming separated by the development of desert conditions between. The opalinids of the subfamily Discoglossinae are Protoopalinas of subgenus II. (2) The Ascaphinae spread northeastward and across to extreme northwestern North America by way of the land-strip that in Cretaceous times stretched north from eastern Asia

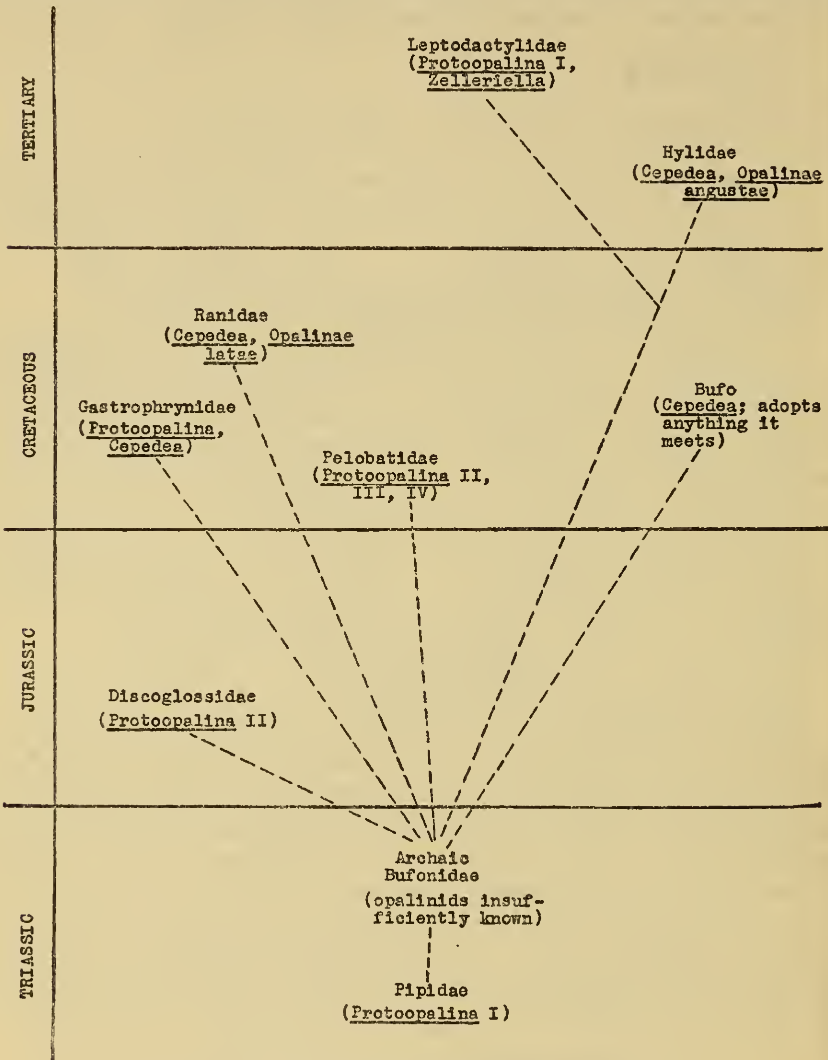


FIGURE 147.—Chart suggesting possible phylogeny of the Anura.

and east and then south, bounding the northern Pacific Ocean (fig. 143, *a*). Although this land-strip in Tertiary times united with North America (fig. 144, *b*) its discoglossids never passed farther east onto the main part of the North American continent even when the way opened, but they remained on the narrow land-strip, being already decadent, having retired to the mountains and living in and near the cold, glacial streams. Their tadpoles carry Protoopalinas of subgenus II brought from Asia, but in the cold water of these streams their metamorphosis is delayed until the second year, so that opalinid

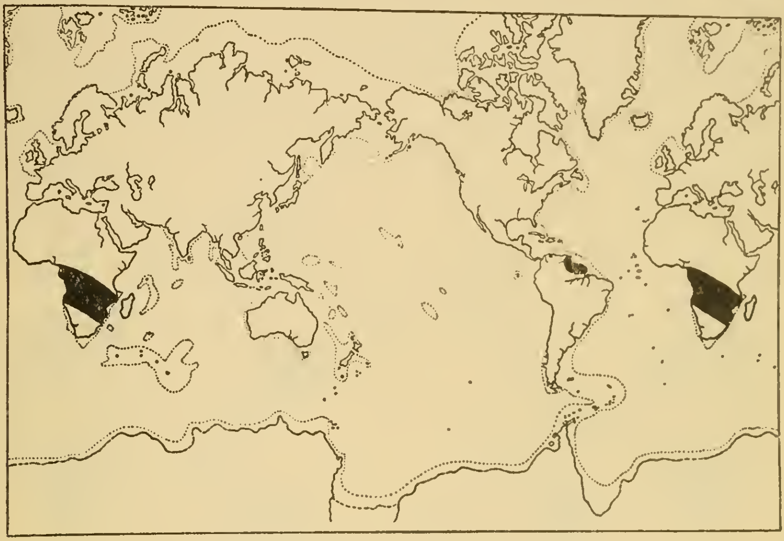


FIGURE 148.—Geographic distribution of the Pipidae.

FIGURE 149.—Geographic distribution of the Discoglossidae

infection is from the tadpoles of the former year to the young tadpoles of the later year. As is so often the case when tadpoles live into the second season, the adult anurans are not infected (cf. *Rana catesbeiana*, *R. clamitans*). The evolution of *Ascaphus* into its decadent character

166877—40——9

we thus consider to have started as early as the Cretaceous period and to have been completed before, in the early Tertiary union of the Pacific land-strip with the North American Continent occurred. (3) The Liopelminae spread southeastward across Malaysia, through Australia, to New Zealand. This wandering occurred before Australia and New Zealand separated from Malaysia and Asia, in other words, apparently in Jurassic times (fig. 142, *b*). *Liopelma*, another decadent genus, has completely lost its aquatic larvae and so has no opalinids.

FIGURE 150.—Geographic distribution of the Pelobatidae.

But its ancestors, in passing across Australia, left their Protoopalinas of subgenus II, and these are found there today resident in *Hyla*. There is a further point of considerable interest. *Hyla* came to Australia from South America and at a time later than the separation of Australia from Malaysia, for *Hyla* is unknown from Malaysia. It seems likely that the ancestors of *Liopelma* persisted in Australia long enough to meet and infect *Hyla*, though the infection might have been from *Liopelma* through a primitive bufonid or a leptodactylid (?) to *Hyla*.[6] The point of interest is that discoglossid Protoopalinas are still in Australia, though the discoglossids themselves are gone.

Discoglossids have come into contact with *Cepedea* but have not adopted it. Similarly they have been in contact with *Opalina*, but only in two or three instances have individuals infected with *Opalina* been reported (from Europe), probably temporary infections. Discoglossids have not been in contact with *Zelleriella*.

[6] It is not likely that the Hylidae and the Leptodactylidae entered Australia together, coming from Antarctica. The Hylidae may have taken a more northern trans-Pacific route from tropical South America. In this case the migration was probably earlier (late Cretaceous or, say, Eocene; fig. 144, *a*) than that of the leptodactylids (Tertiary; fig. 144, *b*). See p. 598.

THE PELOBATIDAE (Fig. 150)

These toads are found today in the lands north and east of the Mediterranean Sea, in Asia south and southwest of the Himalayas, in Malaysia and Papua, and in North America. Their origin and spread seems to parallel that of the Discoglossidae. They probably evolved in India or in southeastern Asia in Cretaceous times after Australia had separated from Asia. They seem to have passed to the Mediterranean lands by a route that lay either to the north or to the south of the Himalayas; to have passed to Malaysia and Papua during the

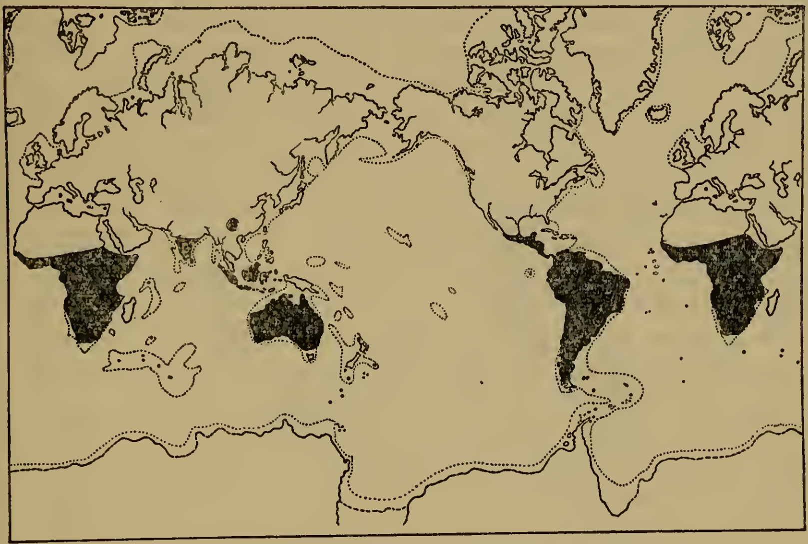


FIGURE 151.—Geographic distribution of the Bufonidae, other than *Bufo*.

time of fluctuations when the Malaysian and Papuan connections were repeatedly formed and broken (late Tertiary or Quaternary, fig. 145); to have passed during the earlier or later Tertiary by way of Siberia and Alaska to North America, this northeastward migration including only the one genus, *Scaphiopus*, or rather its ancestors. The opalinids of the Pelobatidae were originally Protoopalinas of subgenera II and III and they still are, except for the very compact group of species, subgenus VI, evolved in *Scaphiopus* since its migration to North America, and except also for certain adventitious, late Tertiary infections in *Scaphiopus* in North America by two species of *Zelleriella* and two species of narrow *Opalinae*. These infections were apparently since the middle Pliocene, *i. e.*, since the Isthmus of Panama was formed.

THE ARCHAIC BUFONIDAE (Fig. 151)

These genera I am discussing apart from the remarkable genus *Bufo*. Their present distribution indicates an origin in the Southern Hemisphere in pre-Cretaceous times, before Australia separated from

Malaysia. But these forms have not been sufficiently studied and their opalinids are unknown, except for one Australian species which carries *Protoopalina*, and except also for some few of the species from the highlands of western South America which carry the modern genus *Zelleriella*, indicating late infection through contact with leptodactylids. Full knowledge of their parasites might solve some of the puzzles that we now leave without discussion.

Bufo will be treated later.

THE HYLIDAE (Fig. 152)

The Hylidae apparently evolved in tropical America in the heavy forest area for which they are so well adapted. Their ancestors were probably archaic Bufonidae, since pelobatids are not today present in tropical America and apparently never were. What their opalinids were is not clear from any available evidence. The Australian Hylas today bear *Protoopalina* of subgenus II. The South American forms carry *Cepedea* and *Zelleriella*, the latter, I believe, a late introduction (see discussion of the Leptodactylidae). Their Cepedeas probably were introduced to South America by *Bufo* during the Cretaceous (cf. discussion of *Bufo*). No Hylas in South America bear *Opalina*. Apparently Hylas met *Opalinae* for the first time in the middle Pliocene period after the Isthmus of Panama had been formed and they had crossed into North America. Meeting there Bufos and Ranas, immigrant from Asia, with their Asiatic broad Opalinas, they adopted these and changed them into *Opalinae angustae*. Spreading over North America these Hylas in turn gave of their narrow *Opalinae* to certain Ranas and Bufos, to a pelobatid and to a gastrophrynid. The Isthmus of Panama was completed, apparently in the middle Pliocene (Vaughan, 1919), so that the colonization of North America by hylids and their subsequent wandering across Alaska, Siberia, and on to western Europe was accomplished within the late Pliocene and the Pleistocene periods, an extensive spread in what is geologically a rather brief time. Only a single species, *Hyla arborea*, with its half dozen or so subspecies, entered Euro-Asia bearing *Opalina obtrigona*, an American narrow *Opalina*. *Hyla arborea* is very closely related to northern North American Hylas. It is not closely similar to any species in Australia.

Hyla is a vigorous, dominant form to which such an extensive and comparatively rapid spread might be possible. Its behavior is in marked contrast to that of the decadent *Ascaphus* and the semidecadent *Scaphiopus*, both of which were in North America earlier than *Hyla* and merely managed to persist by hiding, one of them (*Ascaphus*) not having spread at all since the Cretaceous period, and the other (*Scaphiopus*) spreading east of the mountains only through Western United States and northern Mexico, except for one species, *solitarius*, which spread to the Atlantic coast. Examples of other vigorous, dominant Anura are *Bufo*, *Rana*, and the family Leptodactylidae. *Rana* is a vigorous genus of a vigorous family. *Bufo* is a vigorous genus in an otherwise seemingly decadent family.

The place of origin of the Hylidae deserves a little further comment. The comparative numbers of species in the different regions, two score in Australasia, rather more in North America, and very many in South America seem to indicate origin in South America. On the other hand, the diversity of species north of the Isthmus, forming a number of "genera," would seem to indicate a long period of evolution and would point to a longer residence in the north than

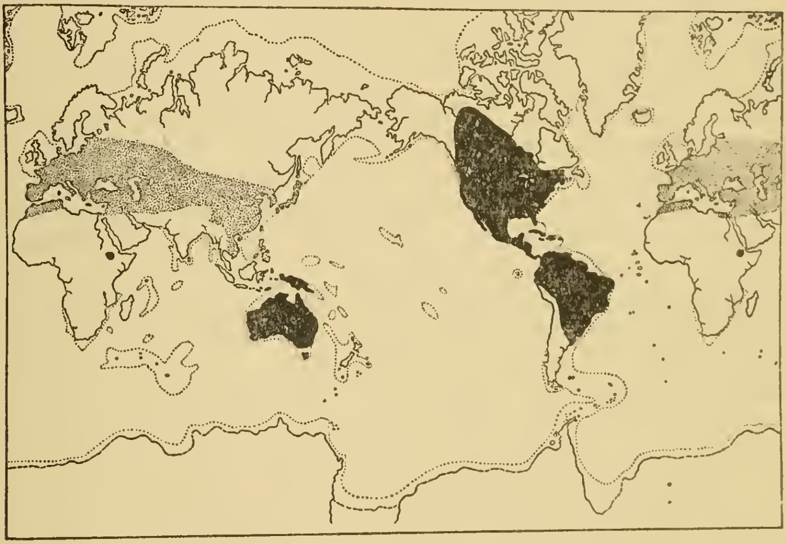


Figure 152.—Geographic distribution of the Hylidae. The stippled areas indicate the presence or former presence of one species, *H. arborea*, and closely related forms usually classed as a separate species, but their classification as subspecies of *H. arborea* would better express the true relationships. The dot in eastern Africa indicates the reputed but very doubtful occurrence in Abyssinia of *H. wachei*, not closely related to *H. arborea*.

in the South American forests. Two considerations, however, should be held in mind. North of the Isthmus hylids have been exposed to more varied environmental conditions than in the South American forests, especially during the climatic fluctuations of the successive periods of glaciation, and, in the second place, the distinctions between the genera of Hylidae are not worthy of much emphasis from the standpoint of evolution.

The complete absence of hylids in southern South America, especially when we remember that cold has not prevented their penetrating as far north as Great Slave Lake, is noteworthy and significant. It is in accord with the fact that in a good many other groups the central South American fauna is very distinct from that of southern South America, the dividing line being from about the mouth of the Rio de la Plata to north-central Chile. There is abundant faunal and floral evidence of a former bar to the spreading of species of animals and plants northward or southward across this line. It seems most likely that this obstacle to migration was salt water, an arm of the sea or an ocean channel, but satisfactory geologic evidence of this has not been presented. The bar, of whatever sort, was effective in many groups of animals and plants. South of this obstruction the fauna and flora show resemblance to those of Australia and New Zealand in very many items, more than they do to the animals and plants of central South America. Von Ihering made this point clearly, and it has since been confirmed by many others, *e. g.*, Eigenmann in his studies of teleosts.

By what route did *Hyla* pass between tropical America and Australia? Not by any Northern Hemisphere route, for hylids are not now in Euro-Asia except one species, with its several subspecies, a comparatively recent immigrant from North America; not by way of Patagonia and Antarctica, for no hylids are today in Patagonia. This restricts them to a trans-Pacific route across the southern Pacific Ocean, by way of the extensive lands present there during the Cretaceous period (Haug, 1907–1911; Scharff, 1911; Arldt, 1907; Berry, 1930; Joleaud, 1931; and many others). Study of the Pacific islands and the ocean bottom shows many branching ridges (fig. 146), interconnecting in many ways. Former rising and sinking of Pacific lands is indicated by several things. The coral islands indicate much depression; the Hawaiian ridge is today rising at one end and sinking at the other; volcanic action and earthquakes, frequently associated with changes of elevation, are and have been present through the Pacific area; it is generally recognized that repeated changes of elevation have occurred among the Malay islands, especially along their southwest-northeast axis (Merrill, 1931). The hypothesis of connection between the South American tropics and Australasia, probably northern Australasia, by means of land ridges, or perhaps land waves such as are illustrated today in Hawaii, is not a far-fetched one. But, if this was the migration route for the Hylidae from America to Australasia, why are there not at least some relic forms among the central and eastern Pacific islands? We find Hylas in the islands only of the Papuasian region of the extreme western Pacific. Nothing but subsidence of the southern Pacific lands seems adequate to account for such extermination of former Anura. The repeated formation, expansion, and shrinking of the Arctic (and Antarctic?) ice sheets are estimated to have caused fluctuations of ocean level of over 60 feet, but that could be, of course, only a minor factor for islands with mountains of considerable elevation. Evidence of a tropical trans-Pacific land route between South America and Malaysia or Australasia is furnished by corals, Crustacea, spiders, Mollusca, and Foraminifera, chiefly by fossils of these groups; and the paleontological evidence places the communication in the Eocene (see Berry, 1930). Joleaud (1931) routes the trans-Pacific land bridge via Papua, Bismarck Archipelago, Marshall Islands, New Hebrides, Fiji, and Cook Islands. With frequent changes in extent of its connections this bridge may have existed from the late Cretaceous through, or perhaps beyond, the Eocene.

THE LEPTODACTYLIDAE (Fig. 153)

Tropical America, both south and north of the Isthmus of Panama, abounds in leptodactylids. They are well represented, a score or more species, in Tasmania, Australia, and Papuasia, and are found nowhere else except for a couple of forms that have spread into southern Texas and perhaps one genus, two species, in South Africa. This form, *Heleophryne*, has primitive parasites, Protoopalinas of subgenus I, and these do not help solve the puzzle of the presence in South Africa of a single genus, a reputed leptodactylid, so far from the proper home of the Leptodactylidae. Stejneger is inclined to consider *Heleophryne* a ranid with arrested development. If it is a true leptodactylid its distribution is a serious puzzle.

Judged from the great number of species and genera in tropical America, that would seem the ancestral home of the family, but there are reasons for questioning this. *Hyla* is not in Patagonia. If *Hyla* and leptodactylids were together in Brazil, before the trans-Argentine sea (?) was present, why did they not pass together to Papua and Australia? Leptodactylids are in Patagonia today, and at some time since Australasia separated from Asia-Malaysia they entered Australasia. They are today an active, vigorous dominant family, taking, in Australia and South America, a place similar to that of the Ranas in other lands. *Rana* is not in these two continents, except for a single species in the extreme north in each continent. Leptodactylids were apparently the characteristic Anura of Antarctica and connected lands (Australia, Patagonia) during the early Miocene or earlier, when the Antarctic climate was mild and moist, as indicated by its fossil flora.

We may reconstruct the history of the Leptodactylidae about as follows: They arose from ancestors common with the Hylidae. The Hylidae evolved to the north of the trans-South American sea (or whatever it was), which effectively separated tropical South America from Patagonia, and became adapted to tropical rain-forest conditions. The Leptodactylidae evolved in Patagonia, or in lands farther south and west (Antarctica). Later, when they spread over all tropical and south-temperate South America, they gave rise to numerous genera of diverse character fitting their environment, more diverse than in the rain forest. During the time when Patagonia, Antarctica, and Australasia were connected, *Zelleriella* developed from *Protoopalina* originally present, this evolution being probably rapid, so that the leptodactylids carried *Zelleriella* wherever they spread, except for *Heleophryne* in South Africa, perhaps not a leptodactylid. When Patagonia became connected with tropical America, the leptodactylids passed northward with their Zelleriellas. At about the middle Pliocene the Isthmus of Panama was formed and leptodactylids and *Zelleriella* passed on to Central America and to the Antilles, which were then connected with Yucatan or Nicaragua or both. When

FIGURE 153.—Geographic distribution of the Leptodactylidae.

the leptodactylids reached Brazil they met Hylas and Bufos and gave them *Zelleriella*, *Hyla* receiving these sparingly, *Bufo* with more generous hospitality. The Australasian lands, after they were stocked by leptodactylids and *Zelleriella*, had no northern connections, and even New Zealand was no longer connected, so that leptodactylids and *Zelleriella* did not reach New Zealand, Malaysia, and Asia.

Leptodactylids have never been in Euro-Asia, for if they ever had been and had become exterminated in some strange way (a wholly improbable hypothesis) they would have given their Zelleriellas to at least the Asian Bufos, a genus always hospitable to any genus of opalinid. The leptodactylids and *Zelleriella* are of Antarctic origin, using the word Antarctic to cover, not only the present, restricted Antarctica, but the wider continent with its connected lands including Australasia and Patagonia. Of direct connection between Antarctica and South Africa the Opalinidae give us only little, if any, evidence.

Connection between South America and Africa, of which there is general faunal evidence, may have been in the equatorial or sub-Antarctic zone, rather than by way of Antarctica itself.

Other opalinids reported from leptodactylids are Protoopalinas, their original guests, and Cepedeas, both infections occurring in South America. The latter infection, by *Cepedea rubra* in three individuals of *Paludicola falcipes*, from Minas Geraes, Brazil, being the only report of *Cepedea* from a reputed leptodactylid, seems to cast doubt upon the status of *Paludicola* as a leptodactylid and to suggest its relegation to the Bufonidae where it was long classed, but I know no competent herpetologist who receives this suggestion kindly. (There was no error in identification of these specimens; they are now in the United States National Museum.) The leptodactylids never met *Opalina* until after the middle Pliocene in Central America, and they have not yet adopted it. *Cepedea* entered South America probably with *Bufo* (see discussion of *Bufo* later), but leptodactylids, though in contact with it, have not welcomed it. They are resistant to infection by any of the multinucleate opalinids.

THE GASTROPHRYNIDAE (Fig. 154)

The distribution of the Gastrophrynidae is puzzling. They are not a numerous family and seem to be rather feeble amphibians. They may at one time have had a wide distribution. Their presence in Africa and Madagascar indicates origin before the separation of these two lands, *i. e.*, before the middle Cretaceous.[7] Their presence in Ceylon and India agrees with this date of origin. Their absence from Australia is evidence (not conclusive, of course) that they were not in Asia-Malaysia much earlier than this, for Australia probably had Malaysian land connection earlier than the Cretaceous (in the Jurassic). But it is unsafe to rely upon negative evidence from such an apparently more or less decadent family. Australian climatic conditions have suffered great changes since the early Cretaceous and probably there was much subsidence and elevation, and forms without much vigor and adaptability might well have been exterminated. The presence of several genera of two subfamilies in the Papuan region would agree with a hypothesis of long residence there and perhaps of former residence in Australia, when Papua and Australia were connected. The fact that gastrophrynids are now in southern Siam, Borneo, the Philippines, and Papua would indicate former spread across the Malayan islands with later extermination in most of these islands during the frequent late Tertiary fluctuations in this region, especially during the Pleistocene. The presence of several genera of gastrophrynids in tropical America might be explained by the commonly postulated Afro-American land connection usually thought to

[7] See Hewitt, 1922, who suggests, for reasons not stated, that Ethiopia and Madagascar were again connected for a brief period in the late Tertiary.

have been not later than the early Cretaceous, if not in the Jurassic period. Migration from eastern Asia by way of the Cretaceous circum-Pacific land-strip, which Arldt (1907), Scharff (1911), and others think extended well to the south on both the Asian and American ends, is equally a possibility, but there are no eastern Asian or western North American species today to lend support to this hypothesis.

The opalinids of the gastrophrynids are: *Protoopalina* (North and South America, Africa, India, Philippine Islands), *Zelleriella* (Central

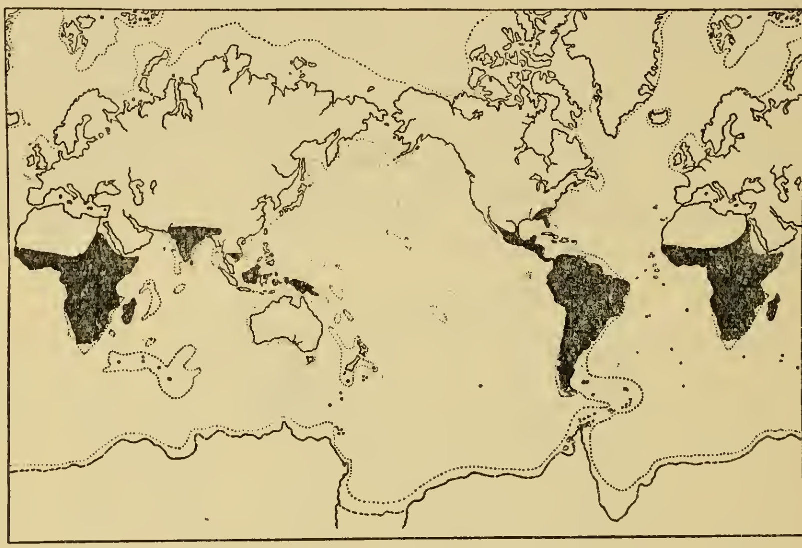


FIGURE 154.—Geographic distribution of the Gastrophrynidae.

America, southern South America), *Cepedea* (Cochinchina), *Opalinae latae* (India), *Opalinae angustae* (southeastern United States, adopted after the middle Pliocene from Hylas directly or indirectly). I do not see that they give evidence as to the place and time of origin of their hosts.

THE RANIDAE (Fig. 155)

This is a large family of many genera, found abundantly in all lands with suitable climate, except Australia, Tasmania, New Zealand, and South America. Australia has one *Rana* in the extreme north, and South America has one *Rana* and two other genera of Raninae represented in the northernmost regions. The family is a dominant one and *Rana*, wherever the family is well represented, is its chief genus.

The opalinid parasites of the family are: *Protoopalina* (tropical and southern Africa and Malay islands), *Zelleriella* (rare), *Cepedea*, and *Opalina*. *Zelleriella* is a guest recently adopted by one Californian *Rana*. It is also borne by *Prostherapis* and *Phyllobates* on the northernmost edge of South America. *Cepedea* and especially *Opalina* are the characteristic parasites.

The family, other than *Rana*, is tropical and east Asian in distribution and probably arose in some palaeotropical region before Africa and Madagascar separated, that is, before the mid-Cretaceous. The distribution of these ranids other than *Rana* is somewhat similar to that of the bufonids other than *Bufo*, except that the archaic bufonids are lacking in Madagascar and Papua and present in Australia, while the older (?) ranids are absent only from Australia. *Rana* seems to have been comparatively recently evolved, as is indicated by its representation in both Australia and South America only in the northernmost portions. *Rana* arose apparently in lands north of Australia and South America. It evidently entered Papua during the Tertiary period when Papua and Australia had become permanently separated. It probably arose in the Old World and entered America by way of the Siberia–Alaska route in Tertiary times reaching Central America before the Isthmus of Panama was formed (mid-Pliocene) and after the Cretaceous East Pacific land-strip had so changed as no longer to form a route to South America. Since the mid-Pliocene neither *Rana* nor *Bufo* has used the Isthmus with freedom for southward migration from Central America, for *Opalina* parasites, abundant in them in Central America, have not crossed the Isthmus. *Rana* carries both *Cepedea* and *Opalina*, especially the latter. It is a most vigorous genus and enters all lands to which the way is open. It probably reached Papua late in the Tertiary and from there passed by some accidental circumstance, very recently, across the narrow channel to the northernmost tip of Australia, Cape York, and has not been there long enough to spread to the south. It is abundant in North America and well represented in Central America. It seems strange that since the middle Pliocene, when the Isthmus was formed, it has not used it more freely for a bridge to South America. Only one species, *R. palmipes*, and possibly two other ranids, *Prostherapis* and *Phyllobates*, got across, spreading only a little way southward.[8] A geologic period and a half, Pleistocene plus late Pliocene, would seem enough to allow many ranids to cross southward, but neither the ranids nor *Bufo* have made use of this bridge, except for the one *Rana* and perhaps the two ranids mentioned. We know that *Bufo* did not cross going southward, for its opalinids are not found south of the Isthmus. At the same time that all bufos and almost all ranids were refusing to pass southward over the Isthmus of Panama, hylas and leptodactylids in abundance were going northward across this bridge. So far as I can see we have no data from hosts or parasites or geologic conditions or climatic influ-

[8] It is likely that *Prostherapis* and *Phyllobates* entered South America with *Dendrobatis*, coming from Africa by a trans-Atlantic route (fig. 143, *a*).

ences to suggest reason for this strange discrepancy between northward and southward migration. That pressure from overpopulation, which may have been greater in the south, could adequately account for this difference seems to me improbable. Note that the dry Sonoran region apparently was a deterrent to migration of moisture-loving Anura. It was effective in stopping the northward movement of leptodactylids, but the hylids swarmed by. But that does not solve the question of the bar to southward migration, for the frogs

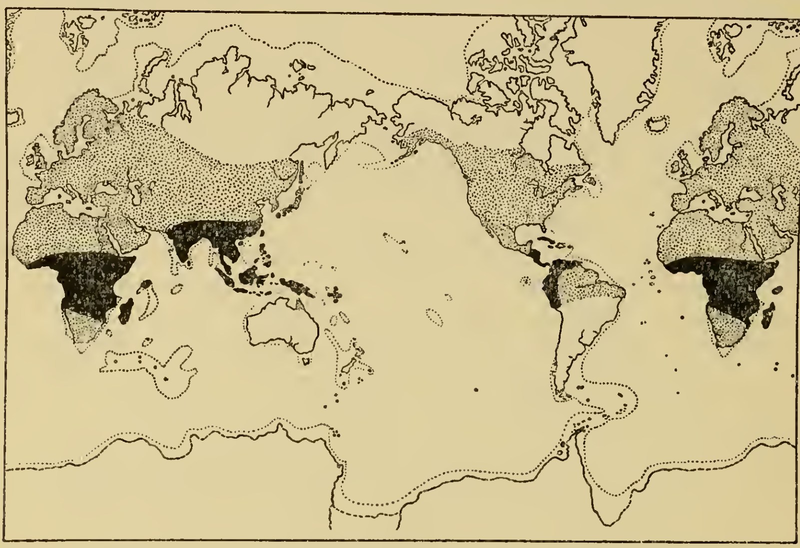


FIGURE 155.—Geographic distribution of the Ranidae. *Rana* occurs in all the stippled areas and in the blackened areas, except Madagascar and the Seychelles, but in South America its only representative is *R. palmipes*. Other genera than *Rana* occur in the areas indicated in black. The occurrence of *Ceratobatrachus* in the Solomon Islands is indicated by a black cross.

and toads, with their Opalinas, got by the desert going southward in numbers and were then stopped at the Isthmus.

Ranids other than *Rana* possibly came from eastern Asia-Malaysia to tropical America by way of the circum-Pacific land-strip, in the Cretaceous period, the route used by *Bufo*, though a trans-Atlantic route is more probable. They did not bring *Opalina*, which is not now in South America.[9] For the same reason *Rana* was not in this migration. *Rana* and *Opalina* apparently were in Asia-Malaysia too late to avail themselves of the Cretaceous Pacific land-strip. When, in the Tertiary period, they reached North America by the then opened Siberia-Alaska route, access to South America was shut off by interruption of the land-strip north of South America and, as the Isthmus of Panama was not yet formed, the way to further southward passage was barred.

[9] Since this was first written, knowledge of certain facts makes it questionable, e. g., Opalinas are said to be in South America (Carini, 1937).

Opalina is in tropical Africa, Madagascar, and India. *Rana* is in, but not abundant in, tropical Africa and is in India and Ceylon but not in Madagascar. This suggests that *Opalina* evolved in some form other than *Rana* in Lemuria (Indian Oceanland, including Madagascar, Seychelles Islands, Ceylon, and southern India) after Lemuria and Africa separated in the middle Cretaceous period, and that when it entered Asia proper in the Tertiary, *Rana* had evolved and was ready to serve as migrating host for *Opalina*'s trip to North America by way of Siberia and Alaska. The absence of *Rana* and *Opalina*

FIGURE 156.—Geographic distribution of the Dendrobatinae.

from Australia dates their origin later than the beginning of the Cretaceous. The indication, therefore, is that they arose in the Eastern Hemisphere, in lands north of Australia and separated from it, that is, in Ethiopia-Lemuria during the early Cretaceous. By the middle Tertiary they had a land route to Asia-Malaysia and on to North America, but not to South America. They were too late to catch the Cretaceous circum-Pacific land-strip. Late in the Tertiary there were transient connections with Papua, and *Rana* took advantage of this, but *Opalina* and for that matter *Cepedea* have not been found in Papua.

Of the Ranidae other than the Raninae: *Ceratobatrachus*, from the Solomon Islands, seems a late offshoot from the Raninae; the Dendrobatinae (northern Neotropics) including *Mantella* (Madagascar) suggest spread across the Atlantic (fig. 156). The *Zelleriella* parasites of the former are a late adoption from their American neighbors. The Opalinas of the Madagascar Mantellas were probably adopted from ranids, or vice versa, in early Cretaceous times. The classification of *Cardioglossa* is doubtful and its opalinids are unknown.

The Ranidae and their Cepedeas and Opalinas may have developed in either Ethiopia or Lemuria. Apparently the Protoopalinas of subgeneric group VIII (ancestors of *Cepedea*), found now in eastern Asia and Malaysia, passed from Asia-Malaysia to Lemuria. While *Cepedea* was evolving in ranid hosts and later giving rise to *Opalina* in the same hosts, the southward spread to Ethiopia may well have been in progress.

BUFO (Fig. 157)

The absence of *Bufo* from Madagascar and the Seychelles and from Australasia including Papuasia indicates (1) origin in Asia in Cretaceous times (no longer in communication with Australasia and Lemuria); or (2) origin in Ethiopia later than the early Cretaceous, after Ethiopia and Madagascar had separated; or (3) origin in South America, probably the northwestern highland region. Origin in Asia in the Cretaceous would leave the way open to South America by way of the circum-Pacific land-strip, but if *Bufo* carried *Cepedea* with it there would be certain difficulties, to be discussed later. If it arose in northwestern South America, the same circum-Pacific land-strip could have carried it to eastern Asia. If it arose in Ethiopia this must have been after the isolation of Madagascar in the middle Cretaceous. *Bufo* did not enter South America from North and Central America after *Rana* and its Opalinas were in these northern lands, or it would have carried *Opalina*, if indeed *Rana* itself would not have accompanied it, and neither *Opalina* nor *Rana* is in South America, except one species of *Rana* (*palmipes*), which seems to be a late Pliocene or Pleistocene immigrant.

A little discussion of the origin and distribution of *Cepedea* is necessary at this point. It is found today throughout the earth where climate is suitable, except in (1) Australasia, including Papua and New Zealand, (2) northeastern United States, and (3) northern South America (probably merely not yet reported here). *Cepedea* evolved from *Protoopalina* through species resembling those now found in Asia-Malayasia (*P. formosae*, *P. quadrinucleata*, *P. axonucleata*). This would seem to indicate Asia-Malaysia as its place of origin. If so, how did it reach Lemuria? No *Protoopalina* is today known from lands reputed to have been once a part of Lemuria (Madagascar, the Seychelles, Ceylon, southern India), except one species in a gastrophrynid from just about the boundary line between southern India and northern India. Similarly *Bufo* is not known from southern Lemurian lands (Madagascar, the Seychelles).

The data known seem to fit the following hypothesis: (1) Origin of *Cepedea* in Asia-Malaysia or Lemuria, before *Bufo* was present there, perhaps in the latest Jurassic or earliest Cretaceous, when

Lemuria and Malaysia were united but Australia and Malaysia were not; (2) the development of *Bufo* in eastern Asia, from some archaic bufonid already having *Cepedea;* (3) *Bufo* passed with its Cepedeas via the Cretaceous circum-Pacific land-strip to Ecuador and later it entered North America in the Tertiary when the land-strip fused with western North America, and its southern portion, between North America and South America, became interrupted; (4) either then or a little later *Rana* with its Opalinas had reached North America by way of Siberia and Alaska and *Rana* and *Bufo* each gave the other of their opalinid parasites, *Rana* giving *Opalina*

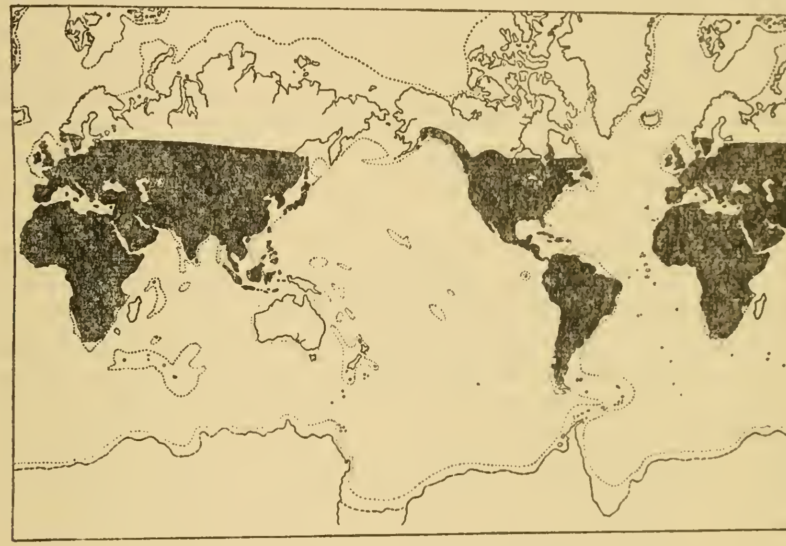


FIGURE 157.—Geographic distribution of *Bufo.*

to *Bufo* and *Bufo* giving *Cepedea* to *Rana;* but, the old route to South America being interrupted and the new isthmian route not yet being formed, neither *Rana* nor *Bufo* entered South America from the northern continent after their interchange of parasites. The one paleogeographic feature of this hypothesis that is possibly new is the suggestion that there was a brief time between the Jurassic and Cretaceous periods when Lemuria and Asia-Malaysia were united and Asia-Malaysia and Australasia were not. This involves only slight modification of conclusions by Arldt and others.

Bufo is a most hospitable host, accepting any opalinids it meets. It bears all kinds, its most common guests in any region being the ones most prevalent in that environment.

Bufos, not found in Madagascar and the Seychelles, probably did not enter Africa until the late Tertiary, coming southward from Euro-Asia and reaching Ethiopia by way of the Nile Valley. (*Rana* may have taken the same route at the same time.)

There are some features of the distribution that deserve the emphasis of special mention: (1) No multinucleate opalinids occur in Australasia; (2) *Cepedea* does not occur in eastern North America; (3) *Protoopalina* also is lacking in this area; (4) *Protoopalina* is wholly, or almost wholly, absent from lands once parts of Lemuria; (5) *Zelleriella* has never been in the Eastern Hemisphere north of Australasia. Reasons for these conditions can be given: (1) Multinucleate opalinids evolved in the Northern Hemisphere too late to find any route to Australasia; (2) no Anura, apparently, have crossed westward from Europe to America, the Greenland-Labrador strait not having been bridged, at least at any time when climatic conditions favored the presence of anurans in that region; (3) a far from wholly satisfactory reason for the absence of the primitive genus *Protoopalina* from Lemurian lands may be in the disturbances in land and ocean levels in the Indian Ocean and the final breaking up of Lemuria into several independent portions; (4) *Zelleriella* evolved in Patagonia too late to find a route to the Eastern Hemisphere, except to Australia.[10]

In former studies of the Opalinidae I have traced their evolution in two main lines: (1) From *Protoopalina* through *Cepedea* to *Opalinae latae* and finally to *Opalinae angustae*, and (2) from *Protoopalina* directly to *Zelleriella*. The former named evolution was in the Eastern Hemisphere, from *Protoopalina* to *Opalinae latae*, while the last step, from *Opalinae latae* to *Opalinae angustae*, was in the Western Hemisphere and occurred since the middle Pliocene. The second named evolution occurred in greater Antarctica and later in tropical America. Apparently the evolution of *Zelleriella* took place later than the evolution of *Cepedea* and *Opalinae latae*, but before that of *Opalinae angustae*. There is no indication of the derivation of *Opalina* from *Zelleriella*. In the first line of evolution, the development of multinucleation occurred first and then flattening was emphasized. In the second evolution only flattening is found, multinucleation not developing. No reason is apparent why multinucleation might not have followed rather than preceded flattening. That the phylogeny described is correct is confirmed by the geographic distribution of the several genera in the family: *Protoopalina* and *Cepedea* occur together in the Eastern Hemisphere; *Cepedea* and *Opalinae latae* also; *Opalinae latae* and *Opalinae angustae* occur together only in North America, excepting the late emigrant to Euro-Asia, *O. obtrigona*. On the other hand, *Zelleriella* and *Opalina* occur together only in southern North America which was invaded by *Zelleriella* long after *Opalina* had been evolved in Asia.

There is probably no group of organisms known in which the course of their evolution is more clearly, if as clearly, shown than it is in the

[10] Since this was first written, knowledge of certain facts makes it questionable, e. g., Zelleriellas are said to be in China (Nie, 1935).

Opalinidae. Comparative anatomy, comparative development, and geographic distribution combine to prove the phylogeny beyond reasonable doubt. But while this cannot be gainsaid, some of the hypotheses as to places of origin, times of origin, and routes and times of distribution of the parasites and of their hosts stand on a different basis. Some of the conclusions as to the latter are assured, but others are not. If we grant that the prevalent hypotheses of paleocartographers are correct, the suggestions as to the origins of anurans and opalinids seem to combine the available data in the most acceptable way. But paleogeography remains subject to revision. Realizing this, I have been surprised to find that the data as to anurans and opalinids fit so well the conclusions of Arldt and Schuchert and other paleogeographers. The only disagreement is that the data here studied seem to demand a connection at some time during the Jurassic or early Cretaceous period between Asia-Malaysia and Lemuria. It is the ability of paleogeographic data and conclusions from them to fit such data as the Anura and their parasites present that is one of the chief evidences of the probable accuracy of the paleogeographic conclusions.

But my chief interest in these studies is not in the conclusions established, but rather in the method of gathering and using concomitantly data from organisms and their parasites. This method should be used for very many groups of animals and plants and their parasites, and should always be in the thought of anyone monographing any group, to see if significant data are forthcoming. It will prove a major tool in reconstructing the ancient world and its faunas and floras. It is unfortunate that the paleontological data for the Anura are so scant. Except for this regrettable lack of fossils, the Anura and their Opalinidae give an almost ideal complex of significant phenomena. Some of the many groups having a distribution that is of especial interest as to the question of routes for eastward and westward dispersal in the Southern Hemisphere are the coeciliid, the characinid, and the cichlid fishes and the lungfishes, the ostrichlike birds, and the craneflies. Studies of the parasites of any of these southern groups might well give clinching evidence like that from *Zelleriella* and the South American and Australasian families Leptodactylidae and Hylidae (see Metcalf, 1923a and b; 1928c).

One further consideration should be noted—that the Pleistocene glacial period came too late to be of much significance in connection with the evolution and distribution of the Anura and their Opalinidae, most of this evolution having occurred long before Pleistocene times.

SPECIATION IN OPALINIDAE

The problem of speciation is fundamentally the same as that of evolution. The processes of speciation are different for various groups of organisms. Some species have been formed by sudden and extensive

166877—40——10

change from the ancestral condition. Such species are sometimes called sports. Numerous examples are known. One of the best known is that of the sudden appearance of hornless (mulley) cattle, a mutation worthy of recognition as of specific rank. But the distinction between the gradual development and summation of small divergencies and the sudden appearances of major differences is not the only one of interest. The degree to which natural selection affects the development of divergent organisms also is of importance. Speciation of Opalinidae has two noteworthy features: First, species in this family do not arise through the sudden appearance of markedly divergent individuals. This is indicated by the fact that species often so grade into one another as to make it well-nigh impossible to define boundaries between species. Second, natural selection has been less influential in the evolution of the Opalinidae than in the evolution of very many families. This is evidenced by the same phenomena of intergrading species, the struggle for existence not having destroyed the intergrades, but all persisting in apparently equally favorable relation to the environment. We see, then, that the Opalinidae diverge by origin of slight differences and that the slightly divergent forms, having appeared, are unusually free from the action of natural selection.

This freedom from control by natural selection is due to two factors: First, to the fact just mentioned that the divergences arising are very slight and so do not much, if at all, influence success in the struggle for existence. The several slightly diverse forms are all equally successful. The second factor is that the parasites live such secluded lives in so uniform an environment that they escape the stress of life; also there is no diversity of environment to provide peculiar conditions into which specially adapted organisms might fit. Such divergent evolution, speciation, as has occurred in the Opalinidae is, therefore, due less to natural selection and more to the nature of the animals themselves than in most other families. In the Opalinidae the internal factors of evolution are not prevented by environmental influences from expressing themselves. The Opalinidae are what they are through self-determination to an unwonted degree On this account their character is self-revealing and not due to molding by external influences.

Of course, there is one great exception to this statement. The Opalinidae are parasites, or, more properly, intestinal commensals, and so much of their character as is in adaptation to life within the intestine of a host is doubtless in response to this major condition of their environment. They live bathed in predigested, nutritive fluid, and probably in adaptation to this condition they have no mouth, no digestive vacuoles, and, so far as we know, no digestive fluids, and they have no organelles for the capture of prey. In such a secluded habitat they have no need of protective devices, such as trichocysts. No locomotor organs for rapid locomotion are needed in seeking prey or in escaping enemies, and so their cilia remain feeble. There seems to be no use for sense organelles and none seem to be found. With sensation and locomotion reduced to a minimum, the neuromotor organs are not emphasized. The excretory vacuoles in some Protoopalinas, on the other hand, give little indication of being reduced. The simplification of structure in correlation with the simplified life in the secluded habitat and with an abundance of predigested food furnished, itself allows less opportunity for the expression of divergent character, that is for specific differences. Partial removal of the animals from the action of natural selection allows such features as do develop through the outworking and self-expression of their own nature to persist. Natural selection does not suppress such slightly divergent individuals as do arise, and thus the whole family, especially the younger genera and subgenera, have but ill-defined species, *e. g.*, *Zelleriella* and the *Opalinae angustae*. In few, if any, other groups of organisms is there better opportunity to study the almost unrestricted outworking of the tendencies inherent in the organisms themselves.

Study of the family in the light of these considerations shows us that there are a number of such trends in them and their evolution could be described in terms of the outworking and interweaving of these trends. (See Metcalf, 1927a.) Some of these trends seem commonplace—a tendency toward flattening; a trend toward elongation; a trend toward posterior pointedness and even the development of a decided, pointed tail; a trend toward curvature of the body, always in the same direction; a tendency toward developing two types of form in the same species, one slender, the other stocky, the difference being in some cases so great as to have led to mistaking the two types for separate species. The very remarkable trend is toward delay in fission after the nucleus has divided, giving rise first to binucleation and later, by the further suppression of additional divisions, to multinucleation. The habit of delaying fission while characteristic of the whole family is developed only to the point of producing binucleation in the most archaic genus, *Protoopalina*, and in the Tertiary genus *Zelleriella*, while in the Jurassic or early Cretaceous *Cepedea* and in the Cretaceous *Opalina* the habit is emphasized to the point of producing multinucleation.

The Opalinidae, of course, are not the only organisms that show a habit of suppressing fissions. Many plants fail to separate their nuclei by cell walls, but this may not be a comparable phenomenon. Among Protozoa certain genera or larger groups are regularly binucleate, for example, *Arcella*, *Giardia*, the Euciliata. Some amoebae are usually binucleate and some are multinucleate (*Pelomyxa*). Some euciliates are multinucleate in certain phases of their life cycle.

In the genus *Protoopalina* one fission (most species), two fissions (*P. quadrinucleata*), or three or more fissions (*P. axonucleata*) may be suppressed; in *Zelleriella* only one; in *Cepedea* and *Opalina* many. *Zelleriella* arose from some species of *Protoopalina* in which multinucleation had not appeared. It arose in Patagonia or Antarctica where those species of *Protoopalina* that are approaching multinucleation (subgenus VIII) do not occur. These are eastern Asian or Malaysian species. The geographical distribution of *Zelleriella* and its ancestors thus agrees with the absence of any developed tendency toward multinucleation.

We have spoken of a trend toward suppression of one or more fissions. There are other trends in the family—a trend toward flattening, which receives two independent emphases, first, in the formation of *Zelleriella*, second, in the formation of *Opalina*; a trend toward elongation, which likewise received two independent (?) emphases, in the elongated Cepedeas, and in the elongated Protoopalinas; and others. I believe that the whole evolution can profitably be discussed from the standpoint of trends, their occurrence, their origin, their growth, their waning, their disappearance,[11] their independence, their interdependence (see Metcalf, 1927a). We find evidence as to the part of the earth and the geologic time in which appeared emphases upon certain trends: for example, emphasis upon flattening appeared once in southeastern Asia or in Lemuria in the Cretaceous period (*Opalina*), and once in Patagonia at some time between the middle Cretaceous and the middle Miocene, probably during the early Tertiary.

In no group of organisms is there better chance to study the nature of the organisms themselves as expressed in their evolution, relatively undisturbed by pressure of their environment. In the evolution of forms that have left even the fullest fossil record, it is very difficult to evaluate the environmental factors and the internal factors. The relative importance of the two classes of factors may be very different in various organisms. One should, therefore, be very cautious in drawing general conclusions from one group and applying them to another group.

One feature of the evolution of the Opalinidae seems of rather general application to internal parasites. The adaptations to parasitism, if they occur at all,[12] are likely to take place promptly, and the subsequent evolution to be comparatively slow and slight because of the removal of much of the pressure of the environment. We have

[11] Suppression might be a better word than disappearance to use here.

[12] Little structural adaptations to parasitism are observed in *Balantidium* and *Nyctotherus*, which live with the opalinids in the recta of Anura.

seen that the Opalinidae arose in southern, perhaps sub-Antarctic, lands as early as the Triassic period.[13] Some of these archaic forms are living in the same regions to-day and are almost unmodified. During at least part of the Triassic period and all the Jurassic, the Cretaceous, and the Tertiary periods, these primitive species (*Protoopalinae* of subgeneric group I) have persisted. The bell toad parasites (*Protoopalinae*, group II) are practically unmodified after persisting at least since the Jurassic period; and so on for other genera and species for different lengths of time. The widely evidenced general principle that evolution is rapid during periods of environmental change and is slow during periods of environmental uniformity receives added support from the Opalinidae. Evolution may proceed under the influence and control of internal factors, but it is likely to be speeded up when environmental pressure (change) and internal responses are operating together, but under such circumstances it is difficult to give proper relative credit to the two sets of factors.

The stream of protoplasm that was, in the Triassic period, and still is *Protoopalina* has formed many eddies, species, along its course. At least 48 of these eddies, and probably others not yet discovered, have persisted through many millions of years until the present time. Doubtless others have disappeared, but the persistence of such species, eddies, when once formed, is remarkable. Some of these eddies, *Protoopalinae* of subgenus I, arose in the Triassic period; others, subgenus II, probably at the time of the development of the bell toads, which may have been as late as the earliest Cretaceous, but not later, although they were probably of Jurassic origin. Still others, subgenus VIII, were present at a little later period in Asia-Malaysia when *Cepedea* evolved. The species of subgeneric group VI (parasites of *Scaphiopus*) did not form until some time in the Tertiary, perhaps late in the Tertiary. Through all this immense stretch of time from the Triassic into the Tertiary the stream was forming new eddies and occasionally an eddy divided forming two or more (4 in the case of *Protoopalina*, subgenus VI), and when formed they tended to persist, or at least many of them did. The successive eddies diverge from one another by slight increments of difference, the species now found forming a remarkably complete series with no great gaps. Speciation in *Protoopalina* has not been by sporting, by sudden, extensive mutation, but by changes that have been very gradual, almost every conceivable intergrade between the imperfectly binucleate *P. primordialis* and the multinucleate *P. axonucleata* being found. This series shows the changes in line with the trend to multiplication of nuclei. Especially in subgenus VI, very late in this series, the increments of change between species are slight. For further illustration of the very minute increments of change, mutation, by

[13] Probably not much, if any, earlier, for the Anura are not much older.

which the species of Opalinidae diverge from each other, see the genus *Zelleriella* and the subgeneric group *Opalinae angustae*, both of which we have regarded as comparatively modern. When once the adaptations to parasitism had been secured, there is no indication, at any point in the further development, of any speeding up of the processes of evolution.

A REVIEW OF THE LITERATURE OF THE OPALINIDAE SINCE 1923

In 1909 and 1923 I critically reviewed the literature of the Opalinidae. The present review is intended to bring the survey down to date. First let us mention a few papers that were omitted from the former reviews or received insufficient reference.

In 1891, L. and L. Zoya discussed the fuchsinophile plastids (bioplasts) of Altmann, briefly describing those of *Opalina ranarum*.

In 1904, Cobb, not mentioning the opalinids, used parasites to indicate genetic relationships between organisms, much as I (Metcalf, 1928c) used opalinids in discussing paleogeography and geographic distribution. Cobb's interesting paper should be mentioned in that connection.

In 1913, Poche, in discussing the taxonomy of Protozoa, mentions that in opalinids the "generative and morphological nuclei" are not separated.

In 1916, Mavor discussed *Myxidium lieberkühni*, a parasite of European and American pikes, much as Kellogg discussed the mallophagous parasites of birds to indicate descent from a common ancestor. This paper should have been mentioned in Metcalf, 1928a.

Ghosh, 1918, reports three new (?) species of opalinids from India: *O.* [*Cepedea*] *scalpriformis*, *O. plicata*, and *O. triangularis*. (With the exception of the first, the descriptions are too scant to allow specific identification.)

Ghosh, 1920, discusses the cytology of *Opalina* [*Cepedea*] *scalpriformis*, says it is abundant in winter, is comparatively rare at other seasons, that its "chromosomes" [nucleoli] are six in number, that its length is 24–57μ, its greatest width 8–15μ.

In 1920, Tönniges described the mitosis of *Opalina ranarum*, but it was not until seven years later (Tönniges, 1927) that he published the illustrations.

A paper by Chatton and Perard, in 1921, refers briefly to the Opalinidae and to the fact that their period of encystment corresponds to the breeding period of their hosts as significant in connection with the evolution of parasitism. It also mentions the absence of encystment in *Opalina* [*Protoopalina*] *saturnalis*, a rare condition among parasitic ciliates.

Two little notes by Metcalf (1922a and b) call attention to alcoholic specimens of Anura as a source for reasonably well preserved opalinids and suggest the utility of the Greek word for guest, ξένος, in forming names for parasites.

In the same year Kudo (1922) refers to Opalinas from adult *Rana clamitans* and *R. pipiens* as seemingly identical with *O. ranarum.* [*O. ranarum* has not been found in America. Adult *R. clamitans* is but very rarely infected.]

Konsuloff (1922) was inadequately referred to in Metcalf (1923a). His paper is based chiefly upon *O. ranarum* and *O.* [*Cepedea*] *dimidiata;* anisogamy is described, also encystment of quite large multinucleate individuals; division of endosarc spherules is described [confirmed by Horning, 1925]; *O. ranarum* has much-branched excretory canals in the posterior part of the body; the endosarc spherules are called macronuclei [erroneous, see Tönniges, 1927]; the author confirms the opinion that *O.* [*zelleri*] is a form of the species *dimidiata;* he describes many features of the cytology, also extracellular digestion [but gives no evidence]; in the adults, but not in the tadpoles, the opalinids are said to be positively geotactic; endogenous cysts were found within encysted adults; the agamonts hatching from these cysts are said to develop directly into adults with no interpolated sexual process [not shown but not improbable]; the encystment of zygotes is described as normal [the claim being founded, perhaps, on finding binucleate infection cysts, which are quite common]; the multiplication of nuclei of encysted zygotes is described [based perhaps on infection cysts with more than two nuclei, which are not unusual, as many as 12 or more sometimes being found. Cf. Brumpt, 1915. Reinfection cysts in the tadpoles, described by Brumpt, might be formed as early in the growth as the zygote stage]; Metcalf's classification is confirmed; there is no formation of nuclei from chromidia; crystalline excretory granules in the cytoplasm are mentioned.

Hegner, in 1922, reported that on a meat diet the tadpoles of *R. clamitans*, *R. pipiens*, and *Bufo lentiginosus americanus* [*B. americanus*] decrease the number of their opalinids.

Metcalf (1923a) described about 125 new species of opalinids, mostly from Anura long preserved upon the shelves of the United States National Museum; the geographic distribution of hosts and parasites was discussed, as well as the probable place and time of origin and the times and routes of dispersal with reference to paleogeographic maps of the successive geologic periods from the Triassic to the present; a critical chronological review of the opalinid literature not included in Metcalf, 1909, was given.

The same year Metcalf (1923b) discussed the origin and distribution of the Anura on the basis of their opalinid parasites and the geographic distribution of the hosts and parasites.

Spek, in 1923, described the effects of different salt solutions upon living *Opalina ranarum*, showing that with changes in the medium there were such changes in the structure of the protoplasm as to suggest caution in conclusions as to normal structure.

Fantham, in 1923, published the first of a series of six papers describing new species of opalinids from South Africa, chiefly from Johannesburg, as follows: 1923, *Protoopalina transvaalensis*, with notes upon *P. xenopodos* and *P. mossambicensis*; 1924, *Opalina sudafricana*; 1927, further notes on *P. transvaalensis* and *O. sudafricana*; 1929, *P. appendiculata*, *P. ovalis*, and *P. caccosterni*; 1930, *P. octomixa*; Fantham and Robertson, 1928, *P. meridionalis*. Measurements and drawings of all these forms are quoted in the taxonomic portion of the present paper.

In 1924, Metcalf called attention to the fact that his *Opalina japonica* had been previously described by Sugiyama and had been given the same name.

Hegner, in 1924, reported that in *Opalina* [*larvarum* (?)] from tadpoles of *Rana clamitans* and *R. catesbeiana* the nuclei are evenly distributed through the cytoplasm and probably control approximately equal masses of cytoplasm; that size of body and number of nuclei are very closely correlated; that by diminution in size of the older nuclei the ratio between volume of nuclei and volume of cytoplasm is maintained; that division of one nucleus (and only one) occurs when the proportion of cytoplasm becomes too great.

Cleveland, 1925, reported that oxygenation at 3.5 atmospheres pressure killed *Opalina* within the host in 18 minutes.

The same year, Larson, Van Epp, and Brooks reported the length of life of *Opalina* outside the host in 8 different liquids.

Horning, 1925, studied *Protoopalina* and described mitochondria and their different forms in all stages of the life cycle, regarding them as persistent, self-reproducing bodies and not as products of metabolism, "though the latter possibility has not been disproved." Synthesis of vegetative granules (storage products) may take place at the surface of the mitochondria.

Gatenby and King, 1925, regard *Opalina ranarum* as a flagellate, because the cilia "enter right into the substance of the organism and take their origin from the peculiar granules, 'blepharoplasts' [endosarc spherules] which exist in very large numbers" [mistaken observation (?)].

Wenyon, 1926, in his fine, 2-volume Protozoology, accepts Metcalf's (1923a) classification of the Opalinidae and gives adequate review of recent literature. He figures [original] encysted *Opalina ranarum* with 1, 4, 6, and 22 nuclei [cf. Konsuloff, 1922, and Metcalf, 1909].

In 1926, van Orden and Nelson reported as follows: One specimen of adult *Rana clamitans* was found well infected with *Opalina*; inoculations of *R. clamitans* with adult *Opalina* from adult *R. pipiens*

(5 inoculations) and *R. palustris* (2 inoculations), and secondary transfers from artificially infected *R. clamitans* (1) and *R. catesbeiana* (1), also inoculations of adult *R. catesbeiana* with adult *Opalina* from adult *R. pipiens* (3) and adult *R. palustris* (3) and from artificially inoculated *R. clamitans* were tried, and upon examination about once a month gave the following results: *R. clamitans*, 5 showed no infection; after inoculation from *R. pipiens* 2 showed good infections after 162 and 174 days; after inoculation from *R. palustris* 1 showed fair infection after 16 days, a second 82 days after secondary inoculation from an artificially infected *R. catesbeiana* showed fair infection. Experiments upon *R. catesbeiana*: 4 showed no infection after inoculation; 1 gave a good culture 35 days after inoculation from adult *R. pipiens*, but none after 71 days; 1 gave a fair culture 105 days after inoculation from *R. pipiens*; 3 inoculated from adult *R. palustris* and 1 secondarily inoculated from an artificially infected *R. clamitans* all were negative, none having established infections.

Ten Kate, in 1926, regarded the system of fibrils, described in detail, as having only a supporting function [an interpretation made doubly improbable by Taylor's (1920) microdissections of *Euplotes* and the destruction of coordination in the beat of the cilia by severing portions of the system of fibrils]. The endosarc spherules are [mistakenly] regarded as macronuclei.

Gourvitsch, 1926, redescribed under the [mistaken] name *O. elongata* n. sp. specimens of *Cepedea saharana* Metcalf from *R. esculenta ridibunda* from Tashkent, Turkestan [see Metcalf, 1927b].

Da Cunha and Penido, 1926, described *Zelleriella piscicola* from a catfish (?) from the Paraguay River.

Tyler, 1926, stated that *Opalina* may live 25 days without change of medium, in modified Pütter's fluid used according to Konsuloff, 1922.

Metcalf, 1926: In the tadpoles of the hosts the opalinid parasites start their development in the condition of *Protoopalinae* of the most primitive subgenus and pass through larval stages corresponding to the phylogeny of the family until they reach their definitive character. *Zelleriella* passes through a *Protoopalina* stage; *Cepedea* through successive *Protoopalina* stages, including at least subgenera I and VIII of the present paper; *Opalinae latae* add to this series the broad, flat stage characteristic of the adult; the *Opalinae angustae* pass through all these stages, then become definitively narrow, thus confirming the course of the phylogeny as I had before outlined it.

Klein, 1926, described and figured a very primitive "silver line system" in *Opalina ranarum*. The basal granules of the cilia and the longitudinal striae impregnate with the silver, the former being blacker.

Bhatia and Gulati, 1927, reported opalinids as follows from India: From *Rana tigerina*, *Opalina coracoidea lahorensis*, new subspecies, new host, new locality; from *R. cyanophlictis*, *O. ranarum*, new locality; from *R. hexadactyla*, *O. lata*, new host, new (?) locality; from *Bufo melanostictus*, *Cepedea metcalfi*, new species, *C. punjabensis*, new species, *C. sialkoti*, new species.

Metcalf, 1927a, discussed the evolution of the Opalinidae from the standpoint of certain trends (to flatness, to elongation, to posterior pointedness, to delay in division of the body, to delay in completion of mitosis), phenomena so distributed among the subdivisions of the family as to involve either repeated fortuitous appearance of these characters, a thing not to be believed, or trends resident in the germplasm. These conditions are compared with similar phenomena in the Ophryoscolecidae and the Salpidae, and the relation of trends to evolution is discussed.

Tönniges, 1927, described mitosis in *Opalina ranarum*, bringing it into line with that of other organisms. Eight "macrochromosomes" [nucleoli] are described, 24 "microchromosomes" [chromosomes]. The "nucleolus" disappears during mitosis [against Metcalf, 1909]. Amitotic division is described and figured by the author. Figures of mitosis and of direct division, prepared in 1897, are here published for the first time.

Metcalf, 1927b, points out that Gourvitsch's *Opalina elongata* is Metcalf's *Cepedea saharana*.

Lavier, 1927, describes four infections of *Protoopalina nyanza* from a lizard, *Varanus niloticus*, from the shores of Lake Victoria Nyanza. The description is quoted in the present paper.

Sokolska, 1927, reported for *Opalina ranarum* the Golgi apparatus and mitochondria as disk-shaped bodies strewn through the cytoplasm, consisting of a lipoid membrane and a weakly staining globule upon it [seeming from the illustrations to be the endosarc spherules], and also a line of granules down the axis of each cilium, figured and interpreted as mitochondria.

Larson, 1928, reported rearing *Opalina* in Cleveland's, Pütter's, Locke's, and Ringer's solutions, adding egg albumin or blood serum [not predigested], Pütter's fluid plus blood serum seeming the best [worth retesting to see if opalinids do use undigested food]. Adding a bit of rectal wall and subculturing every day or every second day make it possible to maintain a culture a month or more.

Metcalf, 1928a, discussed with the aid of their *Protoopalina* parasites the origin and spread of the bell toads, Discoglossidae. *P. stejnegeri*, new species, from *Ascaphus truei* is described.

Harrison, 1928, discussed host-parasite relations including those of the Opalinidae and their anuran hosts. Reference was made to

Metcalf's studies on the geographical distribution of the opalinids and their hosts.

Larson and Allen, 1928, reporting again upon rearing of *Opalina*, said that 80 out of 166 specimens of *Rana pipiens* were "sufficiently heavily parasitized for use" with *Opalina obtrigonoidea*.

Reichenow, 1928, reported that the granules of the nuclei give positive reaction with Feulgen's stain, while the endosarc spherules do not. [There is evidence, some of it unpublished, that nuclear structures which at times react strongly to Feulgen's stain, under other conditions do not.]

Swarzewsky, 1928, compared sexual and presexual phenomena in *Spirochona elegans* with those in Opalinidae and euciliates in general.

Metcalf, 1928b, discussed, in the light of Boveri's hypothesis as to the fundamental nature of cancer (Boveri, 1914), certain abnormal individuals of *Opalina obtrigona*, *Zelleriella*, and *Protoopalina caudata*.

Metcalf, 1928c, discussed, before the American Society of Parasitologists, parasites and the aid they give in problems of taxonomy, geographical distribution, and paleogeography. (This is but an abstract. See Metcalf, 1929a, for full publication.)

Thompson and Robertson, 1929, made no reference to the Opalinidae, except showing a good, original microphotograph of *Opalina ranarum* and making the [erroneous] statement that *Opalina* occurs in nearly every frog.

Doflein and Reichenow, 1929, give in the third volume of their textbook a full account of recent work by numerous students, with some original drawings. [Metcalf is erroneously reported as having described a *Zelleriella* stage in the development of *Opalina;* see p. 1164]. The nuclear nature of endosarc spherules is opposed.

Van Overbeek de Meyer, 1929, after a review of the literature of the Opalinidae, reported: (1) *Opalina* cysts from adult frogs develop in two ways, one with and the other without interpolation of the sexual process [this is probable but not yet established by sufficiently guarded, critical experiment]. (2) The term "ectoplast" is preferred to ectoplasma. (3) There are no neurofibrillae in the inner layer of the "ectoplast." (4) The basal granules of the cilia arise *in situ* from a fibril of ectoplast and independently of the nucleus. (5) A fibrillar system develops temporarily as a network of supporting elements. Its origin depends upon the state of development of the plasma. (6) The cytoplasm shows during the growth of the animal a definite development by which the number and size of spaces in the plasma slowly increase up to almost the adult condition. After this the cavities become again smaller and fewer, while the plasma connections between become thicker, the plasma thus becoming again compact. During encystment this process is reversed but goes more rapidly and with less evident stages. (7) In the adult there is no pellicula, but instead a tough, cheeselike condition of the plasma itself, which serves to retain form of the body. (8) Drying causes prompt gelation of the plasma. (9) There appears to be a centrum for cilia movement at the anterior end of the body, apparently in the growth zone of the cilia. (10) The ectoplasmic and entoplasmic inclusions seem to be stages of one and the same secretion process. (11) Bhatia's doubtful report of isogametes is quoted with approval [not confirmed by recent students]. (12) The fibrils associated with the rows of cilia on the upper side of the body are not continuous with those on the under side, but the two sets meet and join, at irregular intervals, a coarser transverse fiber at the anterior edge of the body. The paper contains important details of cytology and development not here mentioned. The author does not call attention to it, but one observes the fact that, in his careful detailed drawings, no single instance of apparent fission of endosarc spherules is shown [see Horning, 1937] [many statements of de Meyer need confirmation.]

Metcalf, 1929a, published in full the paper abstracted in Metcalf, 1928c. Cobb's paper, 1904, and Mavor's, 1916, should have been included in the discussion.

Metcalf, 1929b, pointed out that the Opalinidae are pivotal forms, instructive, first, as to the origin of the Euciliata, and, second, as parasites that, along with their anuran hosts, lend themselves with peculiar advantage to host-parasite studies of paleogeography.

Metcalf, 1929c: The occurrence of a reputed leptodactylid, *Heleophryne*, in South Africa, while the home of this family is in South America and Australia, is discussed as a bit of evidence that a South Africa–Patagonia connection was present and that it persisted until somewhat later than is usually thought, that is, into the Cretaceous period, or possibly the Tertiary, provided that *Heleophryne* is, indeed a leptodactylid.

Higgins (1929) quoted Metcalf's observations (1926) upon a succession of larval forms in the development of *Opalina larvarum*, forms that repeat the phylogeny of an *Opalinae latae*, and compares with these phenomena the very divergent forms of *Nyctotherus cordiformis* found in larvae of American frogs and toads.

Haye, 1930, quoted with disapproval van Overbeek de Meyer's [mistaken] suggestion that the "excretory canals" [not canals] of *Cepedea dimidiata* are artifacts. Haye found none present in *Opalina ranarum* [cf. Konsuloff to the contrary, 1922] He [mistakenly] calls the endosarc spherules macronuclei. The excretory apparatus he attributes to degeneration [error, though in individuals kept under unfavorable conditions it may increase in size]. He [mistakenly] interprets the cytomicrosomes as bacteria.

Konsuloff, 1930, discussing the nuclear nature of the endospherules, said that these disk-shaped bodies are macronuclei, are permanently formed structures, have an evident, thick membrane, divide without chromosome formation, disappear during the sexual process to reappear later. He [erroneously] says that de Meyer and also Metcalf would have accepted the macronuclear nature of the spherules if they had believed that the spherules divide, a conception for which Konsuloff and especially Horning (1937) give evidence. [Not so. The macronuclei of euciliates are true nuclei, derived from micronuclei. This cannot be true of the endospherules of opalinids. They may possibly be composed of, or derived from, metabolic chromatin, as Metcalf, 1909, suggested (cf. Reichenow, 1928), but they are not metamorphosed nuclei.]

At the Christmas meetings of the American Society of Zoologists in New York City in 1928 Kofoid and Dodds reported work upon *Opalina obtrigonoidea* and *O. virguloidea*. The abstract of their revolutionary paper is quoted here. "Mitosis in the two species has been studied. At nuclear division an extranuclear centrosome divides and the daughters migrate to the poles of the elongating nucleus, forming an extranuclear paradesmose, as in the flagellates. Each nucleus has a slender rhizoplast running from the centrosome on the periphery of the nuclear membrane to a basal granule—in reality the blepharoplast—from which the flagellum, the so-called cilium, emerges. From the blepharoplast another rhizoplast runs down to the so-called endoplasmic spherules, which are interpreted by us to be parabasal bodies. The unit of the neuromotor system in the species observed thus consists of the following parts: the flagellum, its blepharoplast, parabasal body and its rhizoplast, and, if attached to a nucleus, the rhizoplast running from the blepharoplast to the centrosome on the nuclear membrane. The blepharoplasts are arranged in spiral lines and the parabasal bodies are distributed below them less clearly showing the spiral arrangement. The neuromotor units are thus considerably in excess of the number of the nuclei. A similar relation has been evolved in a number of multicellular types of flagellates found in the termites, in which, as in the genus *Calonympha*, there are more neuromotor units than there are nuclei. The neuromotor system and the type of mitosis in the opalinid Protozoa are clearly homologous to that of the flagellates. In the light of these facts, it is logical to transfer the Opalininae from the Ciliata to the Flagellata." [Publication in full must precede adequate criticism, but we may note: (1) that no other students have shown centrosomes, even after prolonged search by a great variety of techniques; (2) that the appearance of a longitudinal fiber upon the caryotheca of the dividing nucleus is occasionally seen, especially in the living animal, but prolonged attempts to demonstrate this in stained material have failed; (3) that connection between basal granules and nuclei has not been demonstrated and if present would be exceedingly difficult to trace among the very numerous fibrils that permeate the cytoplasm in every direction; (4) that connection of endoplasmic spherules to the neuromotor system has not been seen by others, and Horning's and also Scott and Horning's studies indicate that the spherules are connected with a structurally and functionally different set of organs; (5) that the basal granules ("blepharoplasts") are much more numerous than the endoplasmic spherules ("parabasal bodies") and that there is no comparable spiral arrangement of the two sets of structures; (6) that relationship of both Protociliata and Euciliata to the Flagellata is altogether probable, and it seems perhaps possible that there may be a bit closer relationship between Protociliata and Trichonympha, but comparison of Ciliata and Protociliata is closer and more significant.]

Noble, 1931, referred to the evidence from *Zelleriella*, cited by Metcalf, that this genus and its leptodactylid hosts were never in northern continents and so must have passed between South America and Australia by some Southern Hemisphere route, and he demurs, saying, "It may well be, however, that the northern opalinids were not in existence at the time the present southern opalinids were being carried south by whatever species they happened to parasitize at the time" [a sentence whose meaning in this connection I cannot solve].

Hegner (1931) reported on August 29, 1930, to the Helminthological Society of Washington that of 10 adult *Rana clamitans* from Mount Desert Island, Maine, none were infected; that the opalinids are lost during the metamorphosis of the tadpoles, between the stages showing only hind legs and the stages with all four legs evident. Young green frogs could not be infected by mouth or by rectum with opalinids from green frog tadpoles [cf. van Orden and Nelson, 1926]. Opalinids were found in tadpoles of tree frogs [species not mentioned] during all stages of metamorphosis and also in the "young adult" tree frogs. He expresses the opinion that apparently some digestive secretion peculiar to the green frog appears during metamorphosis that renders the rectum of this species unfit as a habitat for opalinids.

Merrill, 1931, in a lecture before the Washington Academy of Sciences, discussed the relations of Philippine biota to the faunas and floras of Malaysia and Australasia and showed frequent changes in connections between lands in these areas during and since the Pliocene period. These affected the distribution of the opalinids and their anuran hosts and are referred to in the present paper.

Richardson and Horning, 1931, described, with adequate figures, "mitochondria" in *Protoopalina*, "together with associated, synthesized vegetative granules and Golgi bodies, as evidenced by their behavior, morphology and staining reactions."

De Mello, 1931, described parasitic infusorians in *Rhacophorus maculatus* in Nova Goa, among them *Opalina virgula* Dobell, *Cepedea longa* Bezzenberger, and *Cepedea thiagi* de Mello.

Scott and Horning, 1932, reported that Opalinas from the rectum of *Rana pipiens* [doubtless *O. obtrigonoidea*] when imbedded in paraffin and microincinerated according to the technique of Policard, and then examined by dark-field illumination, retained their distinctive cytoplasmic morphological characters in the ash deposited in the same topographic relations as those shown by the cell-inclusions in stained specimens. The coarse vegetative granules, the myonemata and the cilia were "perfectly preserved." The more or less abundant chromatin, however, left little or no ash, in marked contrast with Scott's findings with amphibian and mammalian nuclei.

Chen, 1932a and b (abstracts), described mitosis in a species of *Zelleriella*. He found that the behavior of chromosomes is essentially the same as that in the Metazoa and Metaphyta. Among the 24 chromosomes found in this species the six shortest ones could be recognized in every dividing nucleus. (See comments by Metcalf in Chen, 1932a.)

Patten, 1932a, a preliminary note.

Patten, 1932b, made a detailed study of the endoplasmic bodies in *Opalina ranarum*. The endospherules in this opalinid are said to be somewhat flattened disklike structures or dumbbell-shaped forms. Usually in sections cut parallel to the flattened surface of the organism these bodies are rounded or rather irregular in shape, while in sections cut transversely to the flattened surface they are mostly rod-shaped or frequently drawn out into dumbbell-shaped forms, while in oblique sections every form may be seen with gradations from rod-shaped to irregular shapes. Richardson and Horning had previously considered that two types of bodies are present: The irregular, faintly staining granules—the vegetative granules—and the rod-shaped or dumbbell-shaped mitochondria. According to Patten there is but one class of body in *Opalina ranarum*. The rod and irregular bodies are thought to be but two aspects of the same body. She furnished additional evidence supporting her view in that the dumbbell forms (mitochondria of Horning), as well as the irregular forms, are well shown by alcoholic fixatives that normally dissolve the mitochondria. Living material was also studied. It was her belief that these endoplasmic bodies are probably neither Golgi bodies nor mitochondria. She does not believe that they are identical with the macronuclei of other ciliates, as Konsuloff and others claimed. She was inclined to believe that the endospherules may be concerned with storage or synthesis of food materials. In addition to the bodies mentioned above, she found very fine granules in the endoplasm, which are always spherical and very similar in size, considered by her to be mitochondria.

De Mello, 1932, described among other opalinids from Malabar one new species: *Cepedea subcylindrica* from *Bufo melanostictus.* [The description is too scant.]

Nie, 1932, reported the presence of four species of opalinids in *Rana limnocharis* Gravenhorst, found in Nanking, China, three of which were new: *Protoopalina limnocharis*, *Opalina undulata*, and *O. acuminata.*

Carini, 1933b and c, described two new species of *Zelleriella* from Brazil: *Z. falcata* in *Engystoma ovale* and *Z. cornucopia* in *Leptodactylus ocellatus.*

Ivanic, 1933, described mitosis in *Cepedea dimidiata* Stein in *Bufo vulgaris* Laurenti. *C. dimidiata* has numerous typical vesicular nuclei and disk-shaped bodies. The vesicular nuclei have a membrane, a plastin karyosome, and a ball of linin on which are scattered chromatin granules. The chromatin granules are arranged in 6–8 longitudinal rows [chromosomes] on the spindle and divide. According to Ivanic the "macrochromosomes" are only clumps of plastin karyosome; the "microchromosomes" are the rows of chromatin granules on the spindle. Ivanic believes that the discoid bodies are small nuclei with the same structure and behavior in division as the large nuclei [probably a mistaken observation]. The discoid bodies divide by mitosis [an observation which needs to be confirmed] and are present throughout the life cycle.

Zingher, 1933, reported the presence of fat inclusions in *Opalina ranarum.* He noted that in the smaller individuals the fat bodies are much larger and more numerous than those in the larger specimens. In the larger specimens the fat bodies are more uniformly distributed, whereas in the smaller specimens there is an accumulation of these fat bodies at one end of the body. In the opalinids found in tadpoles these fat bodies are entirely lacking.

Stabler, 1933, was the first to identify correctly the endamoebae parasitic in the opalinids that had previously been erroneously thought to be a new genus—"*Brumptina*" by Carini (1933a). Stabler found both trophozoites and early cystic stages of this *Endamoeba* in the Zelleriellas from Arizona and Panama. The amoebae rest in small pockets in the endoplasm of the opalinid. In any one opalinid, all the amoebae were found in very nearly the same stage of development, i. e., all cysts or all trophozoites. [Stabler's report was independently confirmed by Carini and Reichenow, 1935; the latter two investigators described the amoebae in greater detail]. This is but an abstract. See Stabler and Chen, 1936, for full publication.

Metcalf, 1934a, gave a summary of the results of his concomitant studies of the taxonomy and geographical distribution of the Anura and their opalinids. Detailed data may be found in the present paper.

Ivanic, 1934a, stated that the endospherules are true nuclei. He found that in atypical infection cysts that lack vesicular nuclei the endospherules develop into vesicular nuclei [this report needs confirmation].

Ivanic, 1934b, stated that the vesicular nucleus of *O. obtrigona* carries on the linin network one or more plastin masses in addition to the chromatin granules. The chromosomes develop from a spireme at the time of nuclear division. The plastin karyosomes are distributed more or less irregularly to the daughter nuclei, but they may also divide into daughter karyosomes. The persistence of plastin material through the entire division process indicates that it is promitotic in origin. The endospherules described by Mayer in *O. ranarum* as being connected with nutritive processes are actually small vesicular nuclei. [Probably an erroneous belief.] The author believes that these can arise "de novo" and grow to normal size. [This needs confirmation.]

Valkanov, 1934, was of the opinion that the so-called "macrochromosomes" and nucleoli are homologous and that they are to be considered as trophic elements. He also believed that there is only one type of nuclei in the opalinids against Konsuloff and Ivanic.

Nie, 1935, described the opalinids found in the amphibians from Nanking, China. Among others the following new species and subspecies were described: *Protoopalina caudata microhyla* in *Microhyla ornata; P. pingi* in *Rana plancyi* Lataste; *Zelleriella orientalis* in *Microhyla ornata* Boulenger; *Opalina cheni* in *Kaloula borealis* Barbour; and *O. obtrigonoidea* forma *lata* in *Kaloula borealis* Barbour.

Wenrich, 1935, showed that host-parasite relationship in the Opalinidae is not specific, since each of the four genera of opalinids has species distributed through four families of anurans and two of the genera of these ciliates also have species in the tailed Amphibia. He also cited the experimental cross infections of opalinid hosts made by Metcalf (1909), indicating that there is no rigid host-parasite specificity.

Carini and Reichenow, 1935, described the endamoebae parasitic in *Zelleriella* from South America. The amoeba trophozoites measure 8–14μ, the cysts 8–12μ. The structure of the cysts and trophozoites of amoebae was described in some detail, and resemblance of this amoeba to *Endamoeba ranarum* was pointed out. They believe that this amoeba is either identical to *E. ranarum* or a species (or race) derived from it.

Carini, 1935, reported the presence of *Opalina* in Brazil.

166877—40——11

Chen and Stabler, 1935, found that the endamoebae parasitic in the opalinids have a very wide geographical distribution. This is but an abstract. See Chen and Stabler, 1936, for full publication.

Stabler and Chen, 1936, described in some detail the endamoebae parasitic in the opalinids. Trophozoites and cysts of *Endamoeba* were described in detail, variations noted. The endamoebae seem to produce no serious effect on the opalinids, as the latter swim actively in the saline solution and undergo binary fission even though heavily parasitized. The endamoebae in a species of *Zelleriella* from Chile were found invaded by a *Sphaerita*-like organism. No specific name was given to this *Endamoeba*, which closely resembles *E. ranarum*.

Chen and Stabler, 1936, found that the endamoebae parasitic in the opalinids have a very wide geographical distribution, being found in Egypt, China, Ceylon, the United States, Panama, Brazil, Uruguay, and Chile. Different species belonging to all the four genera of the family Opalinidae have been found parasitized by the amoebae. The amoebae were also found in cysts of opalinids, thus constituting an important method of transmission of amoebae from adult anurans to tadpoles.

Hegner, 1936, found that certain flagellates in the frog seem to live longer than certain ciliates, after the host is dead. *Opalina* lived for at least 4 days after the anuran host (frog) had died.

Ivanic, 1936, described the mitosis in *Opalina ranarum* and in *O. obtrigona*. According to him the resting nucleus contains "plastin" in one or more pieces. This "plastin" material may partly disappear during mitosis and may be irregularly distributed to the daughter nuclei. He believes [correctly] that there are no "macrochromosomes" and "microchromosomes" but only one type of chromosomes derived from the chromatin granules in the resting nucleus [no reference was made to the work of Pfitzner on *Opalina ranarum* in 1886 and to Tonniges' work on the same species in 1927].

Chatton and Brachon, 1936, on the basis of the arrangement and fate of cilia lines of opalinids during division suggested that opalinids are intermediate between the flagellates and ciliates.

Chen, 1936a and b, gave a detailed account of mitosis in *Zelleriella*. He reported that the behavior of chromosomes during mitosis is essentially the same as that found in multicellular organisms. He found, for the first time for opalinids, (1) that the chromosomes are of different sizes and shapes and can be individually recognized; (2) that there are two chromosomes of each size and shape, indicating diploidy; (3) that the nucleoli are constantly associated with certain portions of certain chromosomes: (*a*) Depending on the subspecies, there may be 4 or 6 nucleoli formed respectively on 4 or 6 (2 or 3 pairs) of the 24 chromosomes; (*b*) the location of the nucleolus is identical on the members of each chromosome pair; (*c*) the chromosome segment on which the nucleolus is located may undergo considerable structural modification; (*d*) the behavior of the nucleolus-bearing chromosomes during mitosis is the same as that of the other chromosomes; (*e*) when two nucleoli are close together they may fuse, thus giving rise to apparent variation in the number of nucleoli within the species which has been so often reported by other investigators; (*f*) in the resting nucleus the nucleoli are arranged at random and are located at the periphery; these nucleoli were mistaken for chromosomes by many previous investigators; (4) that the so-called "macrochromosomes" in the opalinids are not chromosomes but nucleolar regions of certain chromosomes; (5) that the so-called "mid-mitotic resting stages" in the opalinids as described by other investigators are misinterpretations. (Nucleoli in the resting nucleus were considered as chromosomes, while the chromatin reticulum was overlooked by them.)

Chen, 1937, described a new method for preserving and shipping smears of opalinids.

Carini, 1937, described seven new species of opalinids found in Brazil: *Opalina faber* in *Hyla faber; O. elongata* in *Hyla faber; O. nebulosa* in *Hyla nebulosa; O. rugosa* in *Hyla nebulosa; O. rubra* in *Hyla rubra; O. raddiana* in *Hyla raddiana;* and *O. mogyana* in *Hyla leucophyllata.* [The descriptions of some of these species are too scant to allow specific identification.]

Horning, 1937, reported some experimental studies on the cytoplasmic inclusions of opalinids. In addition to the Golgi bodies that Richardson and Horning (1931) described, Horning distinguishes two principal cytoplasmic components: the mitochondria and the vegetative granules of the endoplasm. The mitochondria react to experimental conditions such as alterations in the pH of the external medium and cellular injury. Under the influence of radium radiations the mitochondria are re-oriented so that they assume a transverse polarity to the longitudinal axis of the organism. Later the mitochondria are segregated by the radiations so that they lie apart from the vegetative granules with which they are closely associated in the normal organism.

Lavier, 1937, reported the absorption of bile pigments by the trophozoites and cysts of opalinids. The bile pigments may be deposited in the opalinids in the form of brownish-red crystals.

Sandon, 1938, reported the presence of *Zelleriella* in South Africa. *Z.* (*africana* A) and *Z.* (*africana* B) were found in the rectum of two species of *Rana* from the neighborhood of Capetown.

Carini, 1938b, revised the genus *Zelleriella* inhabiting *Leptodactylus ocellatus* in Brazil.

BIBLIOGRAPHY

ARCHEY, GILBERT.

1922. The habitat and life history of *Liopelma hochstetteri*. Rec. Canterbury Mus., vol. 2, pp. 59–71.

ARLDT, THEODOR.

1907. Die Entwicklung der Kontinente und ihrer Lebewelt, ein Beitrag zur vergleichenden Erdegeschichte. Leipzig.

BÊLAR, K.

1926. Der Formwechsel der Protistenkerne. Ergebn. Fortschr. Zool., vol. 6, pp. 235–654.

BHATIA, BIHARI LAL, and GULATI, AMAR NATH.

1927. On some parasitic ciliates from Indian frogs, toads, earthworms and cockroaches. Arch. für Protistenk., vol. 57, pp. 85–120.

BERRY, WILLARD.

1930. Evidence for the spread of East Indian forms to equatorial American during Eocene times. Bull. Geol. Soc. Amer., vol. 41, pp. 351–358.

BOVERI, THEODOR.

1914. Zur Frage der Entstehung maligner Tumoren. Jena. (English translation by Mrs. Boveri: "The Origin of Malignant Tumors": Baltimore, 1929.)

BRUMPT, E.

1915. Cycle évolutif des opalines. Paris Bull. Soc. Path. Exot., vol. 8, pp. 397–404.

CARINI, A.

1933a. Parasitisme des Zellerielles par des microorganismes nouveaux (*Brumptina* N. G.). Ann. Parasit., vol. 11, pp. 297–300.

1933b. Sur une nouvelle *Zelleriella* (*Z. falcata* n. sp.) de l'intestin d'une grenouille. Ann. Parasit., vol. 11, pp. 115–116.

1933c. Sur une nouvelle *Zelleriella* (*Z. cornucopia* n. sp.) du *Leptodactylus ocellatus*. Ann. Parasit., vol. 11, pp. 301–302.

1933d. Sobre uma nova *Zelleriella* (*Z. jaegeri* n. sp.) do intestino de uma cobra. Arch. Biol., anno 16, No. 174.

1933e. "*Zelleriella boipevae*" n. sp. do intestino de uma cobra. *Ibid.*

1935. Observations au sujet de la distribution géographique du genre *Opalina*. Compte Rendu Soc. Biol. Paris, vol. 120, p. 174.

1937. Contribution à l'étude des Opalinidae des batraciens du Brésil. Ann. Parasit., vol. 15, pp. 46–56.

1938a. *Zelleriella corniola* n. sp. do *Leptodactylus ocellatus*. Arch. Biol., anno 22, No. 210.

1938b. Contribuição ao conhecimento das "Opalinidae" dos batraaquios do Brasil. Bol. Biol., new ser., vol. 3, pp. 147–156.

CARINI, A., and REICHENOW, E.

1935. Über Amoebeninfektion in Zelleriellen. Arch. für Protistenk., vol. 84, pp. 175–185.

CHATTON, EDWARD, and PÉRARD, CHARLES.

1921. Les Nicollellidae, infusoires intestinaux des Gondis et des Damans; et le "Cycle Évolutif" des Ciliés. Bull. Biol. France et Belgique, vol. 55, pp. 87–151.

CHATTON, EDWARD, and BRACHON, SIMONE.

1936. Le cinétome de l'*Opalina ranarum* sa continuité génétique et son importance en égard a l'évolution des appareils ciliaires. Compte Rendu Acad. Sci. Paris, vol. 202, pp. 713–716.

CHEN, T. T.
1932a. Nuclear structure and mitosis in *Zelleriella* (Opalinidae). The Collecting Net, vol. 7, pp. 270–271.
1932b. Nuclear structure, mitosis and chromosome individuality in an opalinid (Protozoa, Ciliata). Anat. Rec., vol. 54, suppl. abstr. 98.
1936a. Observations on mitosis in opalinids (Protozoa, Ciliata). I. Behavior and individuality of chromosomes and their significance. Proc. Nat. Acad. Sci., vol. 22, pp. 594–601.
1936b. Observations on mitosis in opalinids. II. The association of chromosomes and nucleoli. Proc. Nat. Acad. Sci., vol. 22, pp. 602–606.
1937. A method for preserving and shipping smears of Protozoa. Journ. Parasit., vol. 23, pp. 112–113.
CHEN, T. T., and STABLER, ROBERT MILLER.
1935. Further studies on the amoebae parasitic in opalinid ciliate protozoans. Journ. Parasit., vol. 21, pp. 428–429.
1936. Further studies on the endamoeba parasitizing opalinid ciliates. Biol. Bull., vol. 70, pp. 72–77.
CLEVELAND, L. R.
1925. Toxicity of oxygen for Protozoa *in vivo* and *in vitro:* animals defaunated without injury. Biol. Bull., vol. 48, pp. 455–468.
COBB, NATHAN AUGUSTUS.
1904. Parasites as an aid in determining organic relationship. Agr. Gaz. New South Wales, vol. 15, pp. 7–12.
CUNHA, ARISTIDES MARQUES DA, and PENIDO, J. C. N.
1926. Nouveau protozoaire parasite des poissons: *Zelleriella piscicola* **n. sp.** Compte Rendu Soc. Biol. Paris, vol. 95, pp. 1003–1005.
DOBELL, C.
1910. On some parasitic Protozoa from Ceylon. Spolia Zeylanica, Columbo Museum, Ceylon, vol. 7, p. 65.
DOFLEIN, FRANZ, and REICHENOW, E.
1927–1929. Lehrbuch der Protozoenkunde, vol. 3, p. 1158 et seq.
EIGENMANN, CARL H.
1909. The fresh-water fishes of Patagonia and an examination of the Archiplata-Archihelensis theory. Rep. Princeton Univ. Exped. Patagonia 1896–1899, vol. 3 (Zoology), pp. 225–374.
FANTHAM, H. B.
1923. Some parasitic Protozoa from South Africa, VI. South African Journ. Sci., vol. 20, pp. 493–500.
1924. *Idem*, VII. *Ibid.*, vol. 21, pp. 435–447.
1927. *Idem*, X. *Ibid.*, vol. 24, pp. 441–447.
1929. *Idem*, XII. *Ibid.*, vol. 26, pp. 386–395.
1930. *Idem*, XIII. *Ibid.*, vol. 27, pp. 376–390.
FANTHAM, H. B., and ROBERTSON, K. G.
1928. Some parasitic Protozoa from South Africa, IX. South African Journ. Sci., vol. 25, pp. 351–358.
GATENBY, J. B., and KING, S. D.
1925. *Opalina ranarum:* a flagellate. Nature, vol. 116, p. 712.
GHOSH, E.
1918. On three new species of *Opalina*, Purk. et Val. Proc. Indian Assoc. Cult. Sci., vol. 4, p. 4.
1920. On the cytology of *Opalina scalpriformis* Ghosh. Indian Journ. Med., vol. 1, pp. 78–84.
GOURVITSCH, V.
1926. La faune de protozoaires de l'intestin des grenouilles des environs de Taskent. Bull. Gov. Univ. Central Asia, vol. 14, pp. 47–61.

HARRISON, L.

1928. Host and parasite. Proc. Linn. Soc. New South Wales, vol. 53, pp. 9–29.

HAUG, ÉMILE.

1907–1911. Traité de géologie, 2 vols. Paris.

HAYE, ANS.

1930. Über den Exkretionsapparat bei den Protisten, nebst Bemerkungen über einige andere feinere Strukturverhältnisse der untersuchten Arten. Arch. für Protistenk., vol. 70, pp. 1–86.

HEGNER, ROBERT WILLIAM.

1922. The effects of changes of diet on the incidence, distribution and numbers of certain intestinal Protozoa of frog and toad tadpoles. Journ. Parasit., vol. 9, pp. 51–67.

1924. The relations of cytoplasm and chromatin and their bearing on nuclear division and growth. Scientia, ser. 2, vol. 35, pp. 407–414.

1931. Helminthological Society of Washington, 131st to 134th meetings. Journ. Parasit., vol. 17, p. 232.

1936. Viability of parasitic Protozoa after death of the host. Amer. Journ. Hyg., vol. 24, pp. 309–317.

HEGNER, ROBERT WILLIAM, and HSIANG-FONG WU.

1921. An analysis of the relation between growth and nuclear division in a parasitic infusorian, *Opalina* sp. Amer. Nat., vol. 55, pp. 335–346.

HEWITT, J.

1922. On the zoological evidence relating to ancient land connections between Africa and other portions of the Southern Hemisphere. South African Journ. Sci., vol. 19, pp. 316–331.

HIGGINS, H. T.

1929. Variations in the *Nyctotherus* found in frog and toad tadpoles and adults. Trans. Amer. Micr. Soc., vol. 48, pp. 141–147.

HORNING, E. S.

1925. The mitochondria of a protozoan (*Opalina*) and their behavior during the life cycle. Australian Journ. Exp. Biol. and Med., vol. 2, pp. 167–171.

1937. Experimental observations on the opalinid infusorians with special reference to the influence of radium radiation upon the cytoplasmic inclusions. Journ. Morph., vol. 61, pp. 285–308.

HORNING, E. S., and SCOTT, G. H.

1933. Comparative cytochemical studies by micro-incineration of a saprozoic and an holozoic infusorian. Journ. Morph. and Physiol., vol. 54, pp. 389–397.

IHERING, HERMANN VON.

1900. The history of the Neotropical region. Science, new ser., vol. 12, pp. 857–864.

IVANIĆ, M.

1933. Zur Aufklärung der Kernverhältnisse und der Kernteilung bei der im Enddarme der gemeinen Erdkröte (*Bufo vulgaris* Laur.) lebenden Opaline, *Cepedea dimidiata* Stein. Arch. für Protistenk., vol. 80, pp. 1–35.

1934a. Ein neuer Beweis für die Kernnatur der sog. "scheibenförmigen Körperchen" bei Opalinen. Zool. Anz., vol. 108, pp. 326–330.

1934b. Ein Beitrag zur Kenntnis der im Enddarme des Laubfrosches (*Hyla arborea* L.) lebenden *Opalina*, *Opalina obtrigona* Stein. Zool. Anz., vol. 107, pp. 296–306.

1936. Die Kernteilung bei *Opalina ranarum* Stein und *Opalina obtrigona* Stein. Arch. für Protistenk., vol. 87, pp. 172–184.

Joleaud, L.
1931. L'histoire paléogéographique de l'Océan Pacifique. Compte Rendu Soc. Biogéogr., vol. 62, pp. 9–12.
Klein, B. M.
1926. Ergebnisse mit einer Silbermethode bei Ciliaten. Arch. für Protistenk., vol. 56, pp. 243–279.
Kofoid, Charles Atwood, and Dodds, M.
1928. Relationships of the Opalinidae. Anat. Rec., vol. 41, p. 51.
Konsuloff, S.
1922. Untersuchungen über *Opalina*. Arch. für Protistenk., vol. 44, pp. 285–345.
1930. Haben die Opaliniden zwei Kernarten wie die anderen Infusorien? Arch. für Protistenk., vol. 71, pp. 248–254.
Kudo, Richard Roksabro.
1922. On the Protozoa parasitic in frogs. Trans. Amer. Micr. Soc., vol. 41, pp. 59–76.
Larson, Mary E.
1928. Reaction of *Opalinae* to various laboratory media. Trans. Amer. Micr. Soc., vol. 47, pp. 1–10.
Larson, Mary E., and Allen, Fred William.
1928. Further studies on reaction of *Opalina* to various laboratory media. Univ. Kansas Sci. Bull., vol. 18, pp. 485–490.
Larson, Mary E.; Van Epp, M. H.; and Brooks, Stanley Truman.
1925. Reaction of Opalinas to various laboratory media. Science, vol. 62, pp. 289–290.
Lavier, G.
1927. *Protoopalina nyanza* n. sp., opaline parasite d'un reptile. Compte Rendu Soc. Biol. Paris, vol. 97, pp. 1709–1710.
1937. Sur l'absorption de pigments biliaires par les opalines. Compte Rendu Soc. Biol. Paris, vol. 124, pp. 1206–1208.
Mavor, James Watt.
1916. On the occurrence of a parasite of the pike in Europe, *Myxidium lieberkühni* Bütschli in the pike on the American Continent and its significance. Biol. Bull., vol. 31, pp. 373–378.
Mello, Froilano de.
1920. The trichonymphid parasites of some Indian termites. Rep. Proc. 3d Ent. Meeting, Puso, Feb. 3–15, 1919, vol. 3, pp. 1009–1022. Calcutta.
1931. Infusoires parasites de *Racophorus maculatus* Gray. Arch. Zool. Ital., vol. 16, pp. 1440–1446; Compte Rendu Soc. Biol. Paris, vol. 106, pp. 1184–1185.
1932. Contribution à l'étude des infusoires parasites des Anoures du Malabar. Rec. Indian Mus., vol. 34, pp. 89–124.
Merrill, Elmer Drew.
1931. Plants and animals of the Philippines and neighboring islands—how they came to be where they are. Journ. Washington Acad. Sci., vol. 21, pp. 443–445 (abstr. of paper presented before the Society May 31, 1931).
Metcalf, Maynard Mayo.
1909. *Opalina*, its anatomy and reproduction, with a description of infection experiments, and a chronological review of the literature. Arch. für Protistenk., vol. 13, pp. 195–375.
1922a. A source for material of protozoan and other parasites. Journ. Parasit., vol. 8, p. 148.

Metcalf, Maynard Mayo—Continued.
1922b. Specific names for parasites. Journ. Parasit., vol. 9, p. 108.
1923a. The opalinid ciliate infusorians. U. S. Nat. Mus. Bull. 120, 484 pp.
1923b. The origin and distribution of the Anura. Amer. Nat., vol. 57, pp. 385–411.
1924. *Opalina japonica* Sugiyama (not Metcalf). Science, vol. 59, p. 64.
1926. Larval stages in a protozoan. Proc. Nat. Acad. Sci., vol. 12, pp. 734–737.
1927a. Trends in evolution. Journ. Morph. and Physiol., vol. 45, pp. 1–45.
1927b. *Opalina elongata* Gourvitsch is *Cepedea saharana* Metcalf. Science, vol. 66, p. 170.
1928a. The bell toads and their opalinid parasites. Amer. Nat., vol. 62, pp. 5–21.
1928b. Cancer (?) in certain Protozoa. Amer. Journ. Trop. Med., vol. 8, pp. 545–557.
1928c. Parasites and the aid they give in problems of taxonomy, geographic distribution and paleogeography. Journ. Parasit., vol. 15, p. 142 (abstract).
1929a. *Idem.* Smithsonian Misc. Coll., vol. 81, No. 8, 36 pp.
1929b. The Opalinidae and their significance. Proc. Nat. Acad. Sci., vol. 15, pp. 448–452.
1929c. An African zoological puzzle. The Collecting Net, vol. 4, p. 16.
1934a. Frogs and Opalinidae. Science, vol. 79, p. 213.
1934b. Correction of an erroneous statement. Science, vol. 79, p. 506.

Nie, Dashu.
1932. On the intestinal ciliates from *Rana limnocharis* Gravenhorst. Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 8, pp. 183–199.
1935. Intestinal ciliates of Amphibia of Nanking. Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 11, pp. 66–95.

Noble, Gladwyn Kingsley.
1931. The biology of the Amphibia. New York.

Patten, Ruth.
1932a. Cytoplasmic inclusions of *Opalina* and *Nyctotherus*. Nature, vol. 130, pp. 311–312.
1932b. Observations on the cytology of *Opalina ranarum* and *Nyctotherus cordiformis*. Proc. Roy. Irish Acad., vol. 41, pp. 73–94.

Pessôa, S. B.
1934. Nova especie de *Zelleriella*, parasita do *Bufo marinus*. Ann. Paulist. Med. Cirurg. São Paulo, vol. 28, 3 pp.

Pfitzner, W.
1886. Zur Kenntnis der Kenntnis der Kernteilung bei den Protozoen. Morph. Jahrb., vol. 11, pp. 454–467.

Pinto, Cesar Ferreira.
1918. A contribution to the study of the parasitic Ciliata. Mem. Inst. Oswaldo Cruz, vol. 10, pp. 113–117.

Poche, Franz.
1913. Das System der Protozoa. Arch. für Protistenk., vol. 30, pp. 125–310.

Raff, J. W.
1911. Protozoa parasitic in the large intestine of Australian frogs, pt. 1. Proc. Roy. Soc. Victoria, vol. 23, pp. 586–594.
1912. *Idem*, pt. 2. *Ibid.*, vol. 24, pp. 343–352.

Reichenow, E.
1928. Ergebnisse mit der Nuclearfärbung bei Protozoen. Arch. für Protistenk., vol. 61, pp. 144–166.

RICHARDSON, K. C., and HORNING, E. S.
1931. Cytoplasmic structure in binucleate opalinids, with special reference to the Golgi apparatus. Journ. Morph. and Physiol., vol. 52, pp. 27–45.

SANDON, H.
1938. Occurrence of *Zelleriella*, an opalinid ciliate, in South Africa. Nature, vol. 141, p. 1143.

SCHARFF, ROBERT FRANCIS.
1909. On the early Tertiary land connection between North and South America. Amer. Nat., vol. 43, pp. 513–531.
1911. Distribution and origin of life in America. London.

SCHUCHERT, CHARLES.
1915. Part 2 of Pirsson and Schuchert's "A Textbook of Geology." New York.

SCOTT, G. H., and HORNING, E. S.
1932. The structure of opalinids as revealed by the technique of micro-incineration. Journ. Morph., vol. 53, pp. 381–388.

SOKOLSKA, J.
1927. Sur les composants lipoidifères du plasma du protozoaire parasite *Opalina ranarum* Purk. et Val. Compte Rendu Soc. Biol. Paris, vol. 96, pp. 570–572.

SPEK, J.
1923. Über den physikalischen Zustand von Plasma und Zelle der *Opalina ranarum*. Arch. für Protistenk., vol. 46, pp. 166–202.

STABLER, ROBERT MILLER.
1933. On an amoeba parasitic in *Zelleriella* (Protozoa, Ciliata). Journ. Parasit., vol. 20, p. 122.

STABLER, ROBERT MILLER, and CHEN. T. T.
1936. Observations on an endamoeba parasitizing opalinid ciliates. Biol. Bull., vol. 71, pp. 56–71.

STEJNEGER, LEONHARD.
1905. A résumé of the geographical distribution of the discoglossid toads in the light of ancient land connections. Bull. Amer. Geogr. Soc. New York, vol. 37, pp. 91–93.

STOKES, A.
1888. A preliminary contribution towards a history of the fresh-water Infusoria of the United States. Journ. Trenton Nat. Hist. Soc., vol. 1, p. 71.

SWARZEWSKY, B.
1928. Beobachtungen über *Spirochona elegans* n. sp. Arch. für Protistenk., vol. 61, pp. 185–222.

TAYLOR, CHARLES VINCENT.
1920. Demonstration of the function of the neuromotor apparatus in *Euplotes* by the method of microdissection. Univ. California Publ. Zool., vol. 19, pp. 403–470.

TEN KATE, C. G. B.
1926. Ueber das Fibrillen-system der Ciliaten. Dissertation, 85 pp. Zutphen.
1927. *Idem.* Arch für Protistenk., vol. 57, pp. 362–426.

THOMPSON, J. G., and ROBERTSON, ALEXANDER.
1929. Protozoology: A manual for medical men. New York.

TÖNNIGES, K.

1920. Weitere Mittheilungen über die feineren Bauverhältnisse und über die Fortpflanzung von *Opalina ranarum*. Sitz.-ber. Ges. Naturw. Marburg, 1919, pp. 32–47.

1927. Die Karyokinese von *Opalina ranarum*. Sitz.-ber. Ges. Naturw Marburg, vol. 62, pp. 345–380.

TYLER, A. R.

1926. The cultivation of *Opalina*. Science, vol. 64, p. 1659.

UNTI, O.

1935. Nova especie de *Zelleriella* (*Z. artigasi*) parasita do *Bufo marinus*. Rev. Biol. e Hyg., vol. 6, p. 39.

VALKANOV, A.

1934. III. Die Kernverhältnisse der Opaliniden. Arch. für Protistenk., vol. 83, pp. 356–366.

VAN ORDEN, F., and NELSON, T. C.

1926. On specificity of *Opalina* in the frog. Proc. Soc. Exper. Biol. and Med., vol. 24, pp. 253–255.

VAN OVERBEEK DE MEYER, G. A. W.

1929. Beiträge zu Wachstums- und Plasma-differenzierungs-Erscheinungen an *Opalina ranarum*. Arch. für Protistenk., vol. 66, pp. 207–284.

VAUGHAN, THOMAS WAYLAND.

1919. The biologic character and geologic correlation of the sedimentary formations of Panama in their relation to the geologic history ot Central America and the West Indies. U. S. Nat. Mus. Bull. 103, pp. 547–612.

WEILL, R.

1929. Notes protistologiques indochinoises (1st ser.). 3. Observations sur la morphologie nucleaire de *Opalina chattoni* n. sp. Notes and Rev., Arch. Zool. Exper. et Gen., vol. 69, pp. 12–37.

WENRICH, DAVID HENRY.

1935. Host-parasite relations between parasitic Protozoa and their hosts. Proc. Amer. Philos. Soc., vol. 75, pp. 605–650.

WENYON, C. M.

1926. Protozoology. London.

ZINGHER, J. A.

1933. Beobachtungen an Fetteinschlüssen bei einigen Protozoen. Arch. für Protistenk., vol. 81, pp. 57–87.

ZOJA, L. and L.

1891. Intorne ai plasti duli fucsinofili (bioplasti del Altman). Mem. R. Inst Lombardy Sci. e Litt., vol. 16, pp. 237–270.

U. S. GOVERNMENT PRINTING OFFICE: 1940

INDEX

(New genera, species, etc., are printed in *italics*)

○