

NOMENCLATORIAL NOTES ON AMERICAN FRESH WATER MOLLUSCA*

FRANK COLLINS BAKER

During the preparation of a monograph of the fresh water mollusks of Wisconsin for the Wisconsin Geological and Natural History Survey, certain new genera and other groups have been observed and some changes in current nomenclature have been noted. As the publication of this monograph will be somewhat delayed it has seemed advisable to publish the salient points in nomenclature brought out by the investigation, as well as certain notes concerning other matters of interest observed. A full discussion, with illustrations of the anatomical features, will appear in the monograph mentioned.

PLEUROCERIDAE

Since the time of William Stimpson (1864) apparently no additional observations have been made concerning the genitalia of the snails belonging to this family. Half a hundred specimens of *Goniobasis livescens* and *Pleurocera acuta* have been examined without finding any notable features not recorded by Stimpson. There is no external organ of generation and there appears to be no external feature for determining the sexes, excepting the pit or sinus on the neck between the right tentacle and the operculigerous lobe, which appears to be present only in the female. There is a long canal on the right side of the rectum, formed by two narrow laminae, about as broad as the rectum, placed close together. This canal opens into the mantle cavity at the angle formed by the mantle and body wall. Posteriorly the two laminae become a single tube which enters the gonads (ovaries or testes) which lie near the stomach. The study of this family is worthy of serious attention, the anatomical features offering novelties of interest and value.

*Contribution from the Museum of Natural History, University of Illinois, No. 35.

VIVIPARIDAE

Many years ago, Gill divided the Viviparidae into two groups which he later distinguished as subfamilies, the distinctions being based on the difference in the lingual teeth. The genitalia also give additional characters and the division seems to be a natural one. They are redefined below.

Subfamily VIVIPARINAE Gill, 1871

Shell usually large with rounded or carinated whorls; operulum wholly concentric, the inner margin folded in some groups; foot not much longer than shell, not extending beyond the tentacles; cervical lappets large, forming tubular conduits for respiratory purposes, the right lappet the larger; radula with broad central tooth, the reflection broad and multicuspid, the center cusp usually wide and blunt; lateral and marginal teeth longer than wide, the reflections wide and multicuspid; penis forming an elongated, thick, sausage-shaped sac, behind which the prostate is placed, without a long intervening vas deferens, the latter being short and narrow.

This subfamily includes the typical genera, *Viviparus*, *Tulotoma*, *Taia*, *Margarya*, and perhaps some other groups which agree in genitalia, radula, and general form.

Subfamily LIOPLACINAE Gill, 1871

Shell turreted, whorls rounded or subcarinated; aperture sub-angulated, sinuous or incurved at the base; operculum wholly concentric or with subspiral nucleus; cervical lappets small, not forming tubular conduits for respiratory purposes; foot very large, truncated before, rounded behind; radula with narrower teeth than in the Viviparinae, the reflection with sharp cusps, none being wide or blunt, the marginals very long and narrow, wide at the base; penis forming a long, narrow, more or less convoluted tube opening at the end of the right tentacle, which is larger than the left tentacle; prostate placed immediately behind the penis (*Lioplax*), or midway of the vas deferens (*Campeloma*), either sac-like (*Campeloma*), or made up of several large convolutions (*Lioplax*).

The narrow, sharp-pointed cusps of the radula, the large foot, the thin, tube-like penis, the differentiation in the position and form of the prostate, the absence of the conduit form of cervical lappets, together with the more or less sinuated aperture, are sufficient characteristics for separating these snails as a sub-family of Viviparidae. Gill separated these shells on account of the supposed absence of cusps on the reflection of the radula teeth, but an examination of these with high powers shows that cusps are present in all species, though they are small and difficult to see. The group appears to be wholly American, and of more or less restricted distribution. Hannibal's family Lioplacidae is wholly untenable, being founded on a mistaken assumption that the operculum of *Campeloma* has the same sub-spiral nucleus as *Lioplax*. There are but two genera, *Lioplax* and *Campeloma*.

Family AMNICOLIDAE

Genus AMNICOLA Gould and Haldeman

Subgenus MARSTONIA nov.

Apex of shell acute, nuclear whorl not flat-topped, emerging well above the second whorl; the nuclear whorl is only half the size of that of typical *Amnicola*. Central tooth of radula about two-thirds as large as that of *Amnicola*; basal ridge with but one large denticulation; reflection usually with more than 9 denticulations; lateral teeth without a distinct lobe at the inner ventral border which is replaced by a broad swelling. All cusps usually longer and sharper than in typical *Amnicola*. The second marginal is peculiarly expanded on the lower part of the body of the tooth, differing from that in *limosa*. This group will include *Amnicola lustrica*, *gelida*, *oneida*, *walkeri*, *pilsbryi*, and *winkleyi*, and possibly others not examined. Named in honor of Mr. Geo. T. Marston, who lived for many years in eastern Wisconsin and accumulated a large collection of state mollusks.

Type: *Amnicola lustrica* Pilsbry.

Genus HOYIA nov.

The genus is based on the peculiarities of the radula. The teeth are all very small, about a third the size of those of

Amnicola limosa; center tooth with 7 denticulations and 4 basal denticulations; lateral tooth with a quadrangular-shaped body from which a rather narrow peduncle, almost twice as long as the body, extends laterally in an almost straight direction, but slightly bent downward; reflection very wide and low with about 30 very small cusps of equal size; first marginal falcate, with a rather wide body and a heavy central ridge, reflection wide and low with about 30 denticulations, which are twice as large as those of the lateral; second marginal narrower than first with about 40 very small, equal cusps.

Type: *Amnicola sheldoni* Pilsbry.

The radula of *Amnicola sheldoni* is quite unlike that of any other American amnicoloid observed or published. The genus most nearly resembling *Hoyia* is *Potamopyrgus* Stimpson, in which the central tooth has four basal denticles and the reflection is 9-cuspid. However, the lateral teeth of *Hoyia* differ from the type of *Potamopyrgus* in the far greater number of cusps. The genus is dedicated to Dr. P. R. Hoy, a pioneer naturalist and molluscan student of Wisconsin.

GENUS BIRGELLA NOV.

The characteristics of the genus are based on the animal. Verge compressed, the penis being much longer than the flagellum sheath which is short and conical or compressed; head wide, tentacles rather short and flattened, pointed; rostrum wide, squarely truncated. Central tooth of radula with a long, pointed central cusp which reaches nearly to the base of the tooth, the lateral ridge with but one large denticle and two smaller ones below; lateral teeth with a large rounded lobe on the inner base of the body, with a wide peduncle and a reflection with about 8 denticulations; marginal teeth with relatively few denticulations (10-12).

Type: *Paludina subglobosa* Say.

Birgella differs from *Somatogyrus* in the denticulation of the center and second marginal teeth, and in the form of the lateral. It is nearest to *Gillia* in the denticulation of the lateral ridge of the center tooth, but differs in other respects, as well as in the form of the verge.

The genus is dedicated to Dr. Edward A. Birge, President Emeritus of the University of Wisconsin and Director of the Wisconsin Geological and Natural History Survey.

Family POMATIOPSIDAE Stimpson

Pomatiopsinae would seem to rank as a family rather than as a subfamily of Amnicolidae. The sinuses of the foot, the radula with its few cusps of large size and the two large denticles on the base of the central tooth, as well as its terrestrial habits, all mark this genus as separable taxonomically from the Amnicolidae. The verge, also, is simple without flagellum sheath, and is of large size. Gill in 1871 and Pilsbry in 1906 raised the group to family rank, but without indicating the reasons for so doing.

Family PHYSIDAE Dall

A study of the animals of Physa from Europe and America indicate that the name Physa cannot be applied to the American forms of these shells. The type of Physa is the *Bulla fontinalis* of Linn. The animal of this species has a mantle which partly envelops the shell, not only on the parietal and columella side, but on the outer lip area as well. The mantle of the left side extends well over the shell to the center of the dorsal side; the lower part is composed of one large lobe, while the upper part, which is digitate, covers the spire. The part of the mantle over the lip is digitate and extends well over this side of the shell. In the mantle of the American Physae the digitate mantle is reflected only over a small part of the parietal wall and columella region, and the outer lip mantle is simply thickened and is not digitate or extended over the shell. The center tooth of *fontinalis* is also different from that of the American species, having a large number of small denticulations on each side of the center cusp, and the reflection is also wider than in the American species.

In view of this difference between the type of the genus Physa and the American species, it seems necessary to place these species in a separate genus. Rivicola Fitzinger, 1833, is founded on the same type, *Physa fontinalis*.

In 1842, Haldeman defined two groups of Physa; Physella, with the type *P. globosa*, and Physodon, the type being *P. microstoma*. While the characters given by Haldeman are trivial, the names seem available for the division of the group with a digitate mantle partly covering the shell on the columella

side and without any sign of digitations on the outer lip side. Haldeman's first generic name, *Physella*, is therefore here redefined to include these American species. *Physodon* is reserved for a group of *Physae* which differ somewhat from *Physella* in the genitalia and in the form of the shell.

Before giving the diagnosis of this and other groups of fresh water pulmonates it seems desirable to briefly discuss some of the features of the male genital system in this suborder of the Pulmonata. The male organ consists of a more or less cylindrical, sac-like body, the proximal end of which contains the male penial aperture; back of this is a smaller, more or less tube-like body which contains the male intromittent organ; the vas deferens enters the distal end of this body. Simroth (Bronn's Tier-Reich, III, Mollusca, p. 502, 1912), following Buchner, advances a nomenclature of the male organ for the different types of Planorbis, and it would seem feasible to enlarge this to include all of the fresh water pulmonates, as the same types are found in all genera thus far examined. Modifying the German names to the needs of English readers, the following terms may be employed: lower cylindrical body, the praeputium, or 'grosse penisscheide'; the smaller body above, the penis sheath or 'kleine penisscheide'; the intromittent organ within this body is the penis; in some groups there may be a large papilla surrounding the penial stylet. In all groups there are one or more accessory organs or appendages, such as a flagellum, a sarcobellum, etc.

Pilsbry (*Nautilus*, XXV, p. 10, 1911) has suggested that the penis-sac (penis sheath) of the writer's *Lymnaea* monograph is comparable to the epiphallus of the land Pulmonata. An examination of sections of the male organ of that and other families would seem to indicate that the name is not quite synonymous. The epiphallus is described as an enlarged portion of the vas deferens before that tube enters the cavity containing the male intromittent organ. As the body called the penis sheath contains the male organ and is retracted by a powerful muscle it cannot be comparable to the epiphallus of the land snails. In all of the groups of fresh water snails thus far examined (*Physella*, *Planorbis*, *Lymnaea*, *Ferrissia*) the combination of parts of the male system indicated above have been found. In some *Lymnaeas* and *Planorbis*, the vas deferens has been noted to be rather enlarged before entering the penis

sheath, and this may be homologous with the epiphallus of the land shells. The function of this organ, however, appears to be performed by other organs in the fresh water snails.

Subgenus *PHYSELLA* (Haldeman 1842) Baker, emend. 1926

The male system of the genitalia of *Physella* consists in part of a large, cylindrical praeputium and a longer, narrower, cylindrical penis sheath, which contains the very long and slender penis. The penis sheath may be modified to form a lower part which is very thick-walled, in which the penis is very slender, almost needle-like, and an upper part with very thin walls in which this part of the penis is much thicker and even the vas deferens canal is of larger diameter. At the distal end of the praeputium there is always a rounded, more or less heart-shaped body which seems to be comparable to the sarcobellum of land snails and performs the office of an excitatory organ. It is cleft in the center for the passage of the male intromittent organ. There is, also, near the center or upper part of the praeputium a peculiar gland-like body, hollow, with its open end facing the cavity of the praeputium. This may be a blind sac comparable to the flagellum of land snails and used to form the spermatophore. There are two retractor muscles.

The genus *Physella* appears divisible into two groups or subgenera.

Subgenus *PHYSELLA* *Sensu stricto*

The genitalia as described above. The shell is usually thin, with a distinct plait on the columella.

There are two longitudinal muscular pillars in the praeputium one of which connects with the large gland.

Type: *Physa globosa* Haldeman.

Subgenus *PHYSODON* (Haldeman 1842) Baker, emend. 1926

In this group the shell is usually thick and solid, the columella smooth and without a distinct plait, although there may be one or two small denticles on the columella; male system with a large praeputium and a penis sheath somewhat shorter than in *Physella*, which is not divided into a thin-and thick-walled por-

tion. There is but one large longitudinal muscular pillar extending the whole length of the praeputium, there being none to connect with the gland.

Type: *Physa microstoma* Haldeman.

The group of Physellae typified by *integra* and *walkeri* appears to form a natural subdivision of the genus. The genitalia only of *integra* and *walkeri* are known, but the form of the shell suggests the inclusion of *microstoma* and *anatina* in the same assemblage, thus avoiding the coining of an additional group name. The approximation must necessarily be tentative until the anatomy of *microstoma* is known.

Family PLANORBIDAE H. & A. Adams

It is believed that the family should be restricted to include the orb-like snails. Pompholaginae and Isidorinae should probably be raised to family rank, based on peculiarities of genitalia, shell, and radula. Simroth, in Bronn's Tier-Reich, 1912, p. 502 has divided the male organ of Planorbis into four types, all but one of which are totally unlike any of the types founded in America (thus far examined). If it be conceded that Montfort, in 1810, was the first author to definitely assign the type of Müller's genus Planorbis (*Helix cornea* Linn.), and it would seem that under the rules of the code this is perfectly clear, then the typical genus is not found in America, as far as known. Certainly the large species typified by *trivolvis* cannot be included. In this group the male system consists of a large sac-like praeputium and a penis sheath about half as long, roundly swollen at the summit and containing a cylindrical, pyriform penis. There are two retractor muscles. In addition there is a large gland-like body situated at the upper part of the praeputium, in a large swelling. A long, folded duct leads from this gland to the base of the penis sheath.

Nothing like this combination is recorded for any group of *Planorbis* at present known and its presence marks these large American species as belonging to a very distinct group of the family. Indeed, should the division prove to include only these large snails, it might be considered of higher group value and constitute a subfamily HELISOMINAE. This organ was first noted in 1911 (Lymnaeidae of North and Middle America, p. 121) in the discussion concerning the separation of the Planor-

bidæ from the Lymnaeidae. The genital system was not at that time sufficiently well studied to make out the true character of the organ, though the figure (plate xiii, fig. A) indicates the gland on the praeputium (called penis) and the duct which is shown as entering the base of the penis sheath (called penis appendage). A section of the male system shows the gland to be a somewhat cup-shaped organ, the opening of the 'cup' facing the interior of the praeputium. The duct leads from the hinder end of this 'cup' through the wall of the praeputium, and after coiling somewhat on the outside of the praeputium, enters the lower part of the penis sheath at a point above the muscular ring (sarcobellum) separating praeputium from penis sheath. The section is totally unlike anything figured by Simroth or any other author.

Just what is the function of this peculiar gland and its duct is not perfectly clear. It may be homologous with the flagellum of the land snails, and may be for the purpose of forming the spermatophore, as in this group of snails. It is probably also to be correlated with the flagellum of the Ancyliidae. That it should be present in some groups of the family and not in others is noteworthy. It has been found in all of the species of the large planorbes examined (*trivolvis*, *pseudotrivolvis*, *truncatus*, *binneyi*, *antrosus* and varieties, *campanulatus*). The peculiar gland like body has been observed in all groups excepting Gyraulus.

The aggregation of characters embraced in the large planorbes of America is quite different from typical Planorbis of Europe, and the group should be known as :

Genus HELISOMA Swainson, 1840

The shell is usually sinistral, few whorled, the whorls are carinate above and often below, the base funicular, and the aperture suddenly expanded and thickened; the lateral teeth of the radula are tricuspid while those of *Planorbis corneus* are bicuspid, and there are more teeth in a row than in any American species. Genitalia with a large gland-like body in the praeputium connecting with the penis sheath by a long duct. Two retractor muscles, placed on opposite sides of praeputium. The genus is divisible into three groups or subgenera.

Subgenus HELISOMA s. s.

Shell ultra dextral with funicular base and spire, the whorls carinated above and below. Genitalia with large praeputium and short, very wide penis sheath; the penis is strikingly pyriform, extending well into the praeputium; gland large but duct very short and thin. The shell is carried at right angles, tilted to the left side.

Type: *Planorbis bicarinatus* Say (= *antrosus* Conrad).

Subgenus PIEROSOMA Dall, 1905

Shell sinistral, large, high, with few whorls, the early ones carinated and flattened above, funicular below, in the adult shell the apical whorls are slightly depressed below the upper plane of the spire; the aperture is suddenly expanded and thickened within. Genitalia with very large praeputium and small, narrow penis sheath attached to the distal end of the praeputium or on the side between base and summit; penis short, not entering the praeputium; gland very large and duct very long and of large diameter. The shell is carried almost perpendicularly by the animal in life.

Type: *Planorbis trivolvis* Say.

Subgenus PLANORBELLA Haldeman, 1842

Shell sinistral, depressed, whorls more numerous than in *Helisoma*; apex not depressed below the level of the spire; base funicular; body whorl constricted behind the campanulate aperture; genitalia with a large praeputium and a small penis sheath as in *Pierosoma*. The shell is carried perpendicularly by the animal.

Type: *Planorbis companulatus* Say.

The genitalia of *Planorbella* and *Pierosoma* are almost identical and the only reason for the separation of the two groups is in the form of the aperture. There are also, some small differences in the radula. In these two groups, the penis sheath may be placed at the distal end of the praeputium or it may be found on the side between base and summit. This latter condition is usually found during the breeding season, at which time the upper part of the praeputium is much swollen and the gland

distended. A specimen of *trivolvus* examined in July had the gland filled with a flocculent mass of mucus-like material, among which were many objects resembling spermatophores.

Genus PLANORBULA Haldeman, 1842

In both genitalia and radula the Planorbula group differs rather radically from the Segmentina of Europe and Asia. The penis sheath lacks the wing-like blind sac shown in Simroth's figure, besides possessing the peculiar gland present in Helisoma, though lacking the duct of that genus. The radula is also different, the laterals being as in Gyraulus and some Helisoma, tricuspoid, not multicuspoid, as in the European Segmentina. The jaw is also segmented in Segmentina, while it is in three pieces in Planorbula, a large superior and two small lateral pieces. These differences are sufficiently well marked to remove Planorbula from Segmentina and give it a generic place in the family. The shell is carried almost flat by the animal, much as in Gyraulus, which the animal greatly resembles.

Type: *Planorbis armigerus* Say.

It is to be noted that Germain, in his Catalogue of the Planorbidae in the Indian Museum (Records of Indian Museum, XXI, p. 179), raised this group to generic rank, but based the distinction entirely on shell characters, principally those of the lamellae in the aperture.

Genus MENETUS H. & A. Adams, 1855

The genitalia of *Menetus exacuus* most nearly resemble those of *Planorbula armigera*. There is a conspicuous gland but no duct, the penis is very long, narrow, and extends well into the space of the praeputium. There are two vertical muscular ridges in the lower part of the praeputium, the latter being divided into two compartments by a muscular ring, the upper part containing the gland and the lower part the vertical ridges. There is one large retractor muscle at the distal end of the praeputium, which is bifurcated, one branch attached to the penis sheath and one to the upper part of the praeputium, and another on the side of the praeputium. There appears to be a small, triangular stimulating body or appendage at the end of the penis, just below the outlet of the sperm canal.

Type: *Planorbis opercularis* Gould.

If Anandale's remarks on *Hippeutis* (Records Indian Museum, XXIV, p. 359, 1922) are correct, *Menetus* cannot be included in it, if *opercularis* is like *exacuous* in its genitalia and radula. The praeputium is not sharply differentiated from the penis sheath in *Hippeutis*, the whole male organ forming a long cylindrical apparatus narrowing toward the distal end, as shown in Simroth's type III. The lateral teeth, also, are arranged in pairs in *Hippeutis*, a feature not observed in *exacuous*. The group seems quite distinctive enough to stand as a separate genus.

Genus *GYRAULUS* Agassiz, 1837

In the absence of a gland or duct on the praeputium, the presence of a horny stilet at the end of the long, narrow penis, which is surrounded in the head of the praeputium by a fleshy papilla (sarcobellum), and in the strongly fragmented jaw, this group of planorbes stands easily as a well recognizable genus. There are two well developed vertical muscular pillars in the praeputium, similar to those in *Physella* and *Lymnaea*. The genus is divisible into several subgroups, more or less well characterized.

It is to be noted that Annandale and Prashad in 1919 (Records Indian Museum, XVIII, p. 52) gave the anatomical characteristics of this group and indicated its right to hold generic rank.

Subgenus *GYRAULUS* s. s.

In the typical group the penis sheath is longer than the praeputium and much swollen toward the distal end. The shell is usually more or less hirsute and strongly spirally marked. The American *Planorbis deflectus* is the same in structure of genitalia as the European *Planorbis albus* Müller, the type of the genus.

Subgenus *TORQUIS* Dall, 1905

Whorls of shell less distinctly striated, not hirsute, the base deeply and regularly excavated; male system with penis sheath and praeputium forming a regularly cylindrical shape, the penis

sheath much longer than the praeputium, not swollen at the distal end. There is a single retractor muscle attached to the distal end of the praeputium.

Type: *Planorbis parvus* Say.

Subgenus ARMIGER Hartmann, 1840

This group is characterized by the costate whorls, the costae projecting at the periphery. Fresh material has not been available for anatomical examination and it is not now known how closely this feature may approximate with the other groups mentioned.

Type: *Nautilus crista* Linn.

Family ANCYLIDAE

Subfamily FERRISSINAE Walker 1917

The genitalia of *Ferrissia* differs radically from those of *Pseudancylus (Ancylus) fluviatilis* as figured by Simroth. The praeputium is long and cylindrical, the penis sheath smaller but cylindrical and a trifle more than half as long as the praeputium, the flagellum enters the praeputium at the junction of the penis sheath with that body, and is short, enlarging at its distal end to form a large, more or less fan-shaped, gland-like organ. The genitalia seem to differ from the other members of this family to the same degree that the radula and shell do, showing that the whole organism agrees in the characteristics which separate this genus from the other groups of the family Ancyliidae.

