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A GENERIC REVISION OF THE WORLD MYRMICINAE RELATED TO *SOLENOPSIS* AND *PHEIDOLOGETON* (HYMENOPTERA: FORMICIDAE)*

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CONTENTS

Summary

Current classifications of subfamily Myrmicinae stem from the work of Emery, most recently formulated in 1922. With the exception of a few well-defined tribes, the remainder (and bulk) of the Myrmicinae is composed of a large group of genera exhibiting close phyletic relationships and many bewildering series of convergences. These genera previously have not been clearly defined and classified due to the too-frequent use of superficial habitus characters. The present paper examines new, as well as old disused, taxonomic characters, especially meristic ones, and applies these to a critical analysis of tribes Solenopsidini and Pheidologetini of authors. The old conventional tribal groupings prove to have little utility, and pending a re-examination of the remainder of the Myrmicinae, the use of informal genus groups is recommended. Replacing the two traditional tribes are four genus groups, related respectively to *Monomorium*, *Megalomyrmex*, *Solenopsis*, and *Pheidologeton*, and a number of genera are excluded from these groups. All the genera are redefined with extensive synonymies. All the currently unchallenged species-level names in these genera are listed with bibliographic citations, and a brief review is given of the present status of larval taxonomy.

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I. Introduction and History of Classification

The family Formicidae was traditionally divided into eight subfamilies, this arrangement being the cumulative work of Mayr, Forel, Emery, and Wheeler. To these, Clark (1952) proposed to add seven further subfamilies. Most modern ant taxonomists recognize eight or nine subfamilies; Brown (1954) discusses the phylogeny and subfamilial classification of the Formicidae in a broader and more comparative way than in the following discussion, which is simply a brief historical account of the classification of the Myrmicinae.

The publication of Emery's Formicidae sections of Wytsman's Genera Insectorum was a milepost in the higher classification of the family. The fascicle on the Myrmicinae was ready for publication in 1915, but wartime delays postponed its appearance until 1921–22. Emery had, however, outlined his ideas in earlier papers (Emery 1914*c*, 1915*a*).

Forel (1917) modified the classification proposed by Emery in 1915 by adding two further sections, the Rhagomyrmicinae for tribes Cataulacini, Cryptocerini, and Dacetini, and the Mycetomyrmicinae for tribes Proattini and Attini. Members of the Rhagomyrmicinae were characterized (p. 231) by "the flattening of the head and often of the entire body, as well as the numerous lateral appendages of the latter". Common to the Mycetomyrmicinae were the "horns, spines or tubercules of the body as well as . . . their fungus-eating mode of life".

Wheeler (1922*d*) added into the system the genera erected since 1915 (when Emery had virtually completed his manuscript for Genera Insectorum). Wheeler also proposed another tribe, Stegomyrmicini, synonymized the Pheidologetini with the Solenopsidini, and provided a collective key to all the known workers of genera in the tribes Pheidolini, Myrmecinini, Solenopsidini, Leptothoracini, and Tetramoriini.

These three classifications, arising from the common source of Emery's earlier papers, are concordant and do little violence to one another. Of the traditional tribes, only the Crematogastrini, Dacetini, Cephalotini, Attini, and a few other smaller ones are relatively homogeneous and clearly definable. The remaining genera, which constitute the bulk of the Myrmicinae, are not so easy to group into tribes. Not only are most of these genera closely related phyletically, but there exists also a bewildering series of convergences among the different lines. As Brown has found also among the Ponerinae, many myrmicine genera were originally raised on more or less clear-cut characters that were ignored later in favour of placements based largely on habitus. Emery's compilations of the Genera Insectorum were not sufficiently critical to keep the genera pure and clean-cut even 40 years ago, and the accretion of species and genera since then has too often gone forward in haste and without an appreciation of the real relationships or the problems involved in defining tribes or genera. Furthermore, descriptions, even many published since 1940, are too frequently imprecise, incomplete, or irrelevant to allow of reforms in classification based in large part on the literature.

Subfamily Myrmicinae is now so numerous a group that practical attempts at its revision must first be aimed at subgroups of more manageable size, such as the collective genera considered in the present work. Even with such a reduced target,

the problems are formidable. Much more emphasis must be laid on finding useful classificatory characters, especially those about which quantitative, rather than merely vaguely comparative, statements can be made. Meristic characters such as the number of Malpighian tubules, antennal and palpal segments, and the use of proportion indices and setal patterns are obvious examples. We require a higher degree of precision and analysis before a workable, clear-cut classification of the bulk of the members of the Myrmicinae will be attained. A cursory glance at the infraspecific chaos of genera such as *Monomorium* indicates that application of this philosophy of precision to description at the levels of both the genus and species is long overdue.

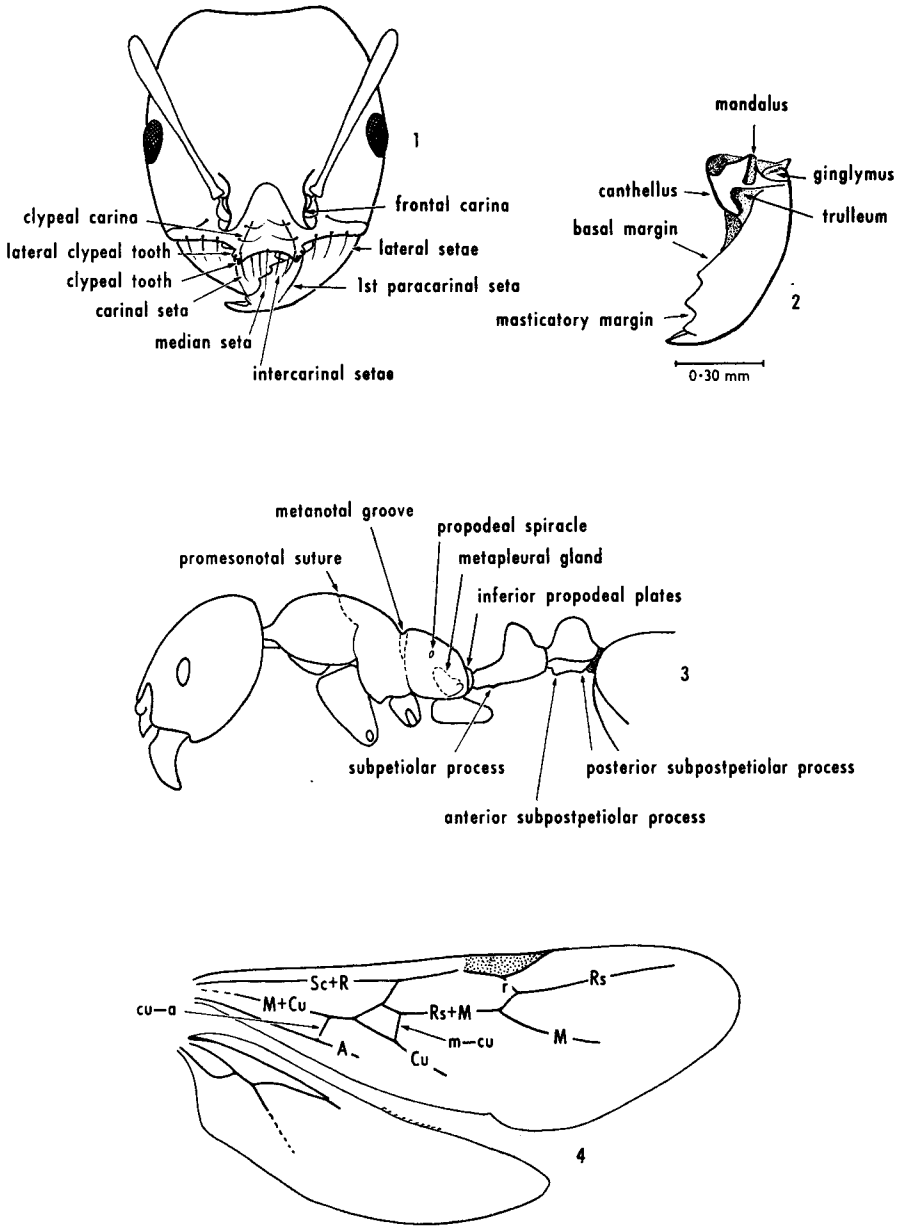
The defined purpose of the present study was to ascertain new characters and re-examine older, neglected ones, and to apply these at the generic level to a critical revision of the tribes Solenopsidini and Pheidologetini of authors. This paper is not intended to be complete in itself but represents the first of a series on the analysis and reclassification of the Myrmicinae.

II. Materials and Methods

The greater part of the specimens studied were from the collections housed in the Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts. The smaller collections of the Department of Entomology, Cornell University, and the American Museum of Natural History, New York, were drawn upon, and further specimens were loaned by Rev. Fr. W. W. Kempf, O.F.M., of São Paulo, Brazil, and by the Instituto Miguel Lillo of the Universidad Nacional de Tucumán, Argentina, through the courtesy of the Director of its Departamento de Zoologia, Dr. Kenneth Hayward. Alcohol-preserved material from Australasia, the Pacific area, South America, and Africa was donated by Dr. W. L. Brown, Dr. E. O. Wilson, and Dr. R. W. Taylor.

It is necessary to remove the trophi completely for study at high magnification. The following method is reasonably rapid and does not cause excessive damage or discoloration to the specimens. Materials required are saturated ammonia solution, glycerine, Barber's or Ward's fluid, glass genitalia vials, a small hypodermic syringe for inserting glycerine, and dissection equipment.

The specimen is removed from the pin and placed in ammonia in a rubber-stoppered vial of suitable size. Dependent on the size of the specimen, it will be flexible and workable in 3–30 min. The specimen is removed to Barber's or Ward's fluid and examined at suitable magnification; the head is grasped with forceps, and the mandibles pried up and out; the labiomaxillary complex can now be removed, and finally the labrum after its basal articulation has been severed. One antenna is dissected off, and all the parts except one mandible are removed to glycerine in a cavity slide. One mandible is air-dried and mounted on the point with the specimen; the mandible should be mounted with the trulleum (q.v.) in an exposed position. The parts in glycerine are stored, after examination, in a genitalia vial in the absolute minimum of glycerine inserted with a syringe. The vial should be mounted on the same pin as the dissected specimen, the vial being pinned through the cork at an angle of about 45° to prevent the glycerine running up to the cork.



Figs. 1–4.—Explanation of terminology used in the text. 1, *Solenopsis saevissima*; full-face dorsal view of head of worker. 2, *S. saevissima*; dorsal view of mandible of worker. 3, *S. saevissima*; lateral view of worker. 4, *S. geminata*; wing venation of gyne.

Delicate material may be restored by soaking for about 12 hr in a warm 1% solution of tribasic sodium phosphate. Such rehydrated specimens often regain a great deal of fine anatomical detail; for example, in a few cases it was possible to determine the number of Malpighian tubules in such material. Wings of alates are mounted in Canada balsam on slides under coverslips. If the wings of dried specimens are undistorted, they may be wetted with xylene and mounted immediately. Distorted wings may be softened by one of the techniques described, dried on a slide, rewetted with xylene *in situ*, and mounted.

III. Definition of Characters and Terminology used in this Classification

In the following section, the terms used in description and characterization of the genera are defined; only those terms which are new or are restricted to myrmecological usage are explained in detail. New terms are marked with an asterisk (*) where first defined; the application of these terms is illustrated in Figures 1–3. Abbreviations used for measurements are explained fully by Brown (1953*c*); reference may also be made to the glossary supplied by Wilson (1955). The abbreviations for wing veins are the standard ones, specifically as applied to the ants by Brown and Nutting (1955).

Clypeus

The clypeus may be divided arbitrarily into two parts; the *median area* is that part that lies between and below the frontal carinae, it is usually rather abruptly elevated above the *lateral areas*, which form the sides of the clypeus, lie below the frons and genae, and are bounded laterally by an excavation which accommodates the abductor swelling of the mandible (see below). In many cases, the median area takes the form of a pair of rounded or sharp *clypeal carinae* separated by a longitudinal *median sulcus*.

The clypeal carinae are often extended past the anterior margin of the clypeus as the central axes of a pair of *clypeal teeth*; these may be flanked by a pair of flattened projections, the *lateral clypeal teeth* (see Fig. 1).

The clypeus also bears a characteristic set of setae which are shown in Figure 1. The *median seta** originates close to the anterior margin and is directed downward toward the tips of the mandibles. Between the median seta and the carinal teeth are 1 or more *intercarinal setae**, directed obliquely anteroventrad. At the anterior end of each clypeal carina is a single short *carinal seta**. Just laterad of the clypeal carina on each side are 2 or more anteriorly directed *paracarinal setae**; the first (anterior) pair originates close to the anterior margin (just above the lateral clypeal teeth when these are present) and the setae often meet and cross in front of the median area; the second and further paracarinal setae are found between the first and the level of the antennal sockets. The anterior margin of the lateral areas of the clypeus frequently bears a series of *lateral setae**. These various setae are most easily seen on a large species of *Solenopsis* (Fig. 1).

Mandible

The various parts of the mandible are shown in Figure 2. The most distal tooth is termed the *apical*, and the rest are the *subapical teeth*; dental formulae are quoted in the form, e.g. "1 + 3", indicating the apical plus three subapical teeth.

The basal shaft of the mandible bears several characters of classificatory importance. The *mandalus** is a small, unpigmented, apparently membranous lacuna which may contain the orifice of the duct from the mandibular gland; this contrasts sharply with the surrounding sclerotized areas of the mandibular base. In shape, the mandalus may be linear, keyhole-shaped, or even triangular in cases where its basal portion is occluded by encroachment of cuticle. Distal to the mandalus is a large, more or less basin-shaped depression, the *trulleum**, bounded laterally and distally by the blade of the mandible, and medially by the *canthellus**, a raised ridge running distad from the base of the mandible. The canthellus may meet and fuse with the basal margin of the mandibular blade (= trulleum closed) or may fail to attain the basal margin by a greater or lesser distance (= trulleum open).

On the lateral basal margin of the shaft is a rounded knob, just behind the ginglymus, which marks the point of attachment of the abductor ligament, and also apparently functions to prevent the mandible being opened too far. Michener (1944) refers to this structure in bees as the "abductor swelling".

Labrum

The labrum (Fig. 14) is movably articulated below the median area of the clypeus and folds up under the closed mandibles, forming with the exposed plates of the labiomaxillary complex a tight seal over the more delicate mouthparts and the buccal opening. The straight proximal margin of the labrum bears two lateral sclerotized apodemes (tormae) to which the retractor muscles attach. The lateral margins are parallel or subparallel, while the distal margin may be straight, concave, bilobed, or cleft (the latter term being used where the lobes are separated by a distinct, narrowly excised cleft).

Maxillary and Labial Palpi

The palpal formula is a valuable character. Although some earlier authors regularly quoted the number of palpal segments (e.g. even Frederick Smith), the potentiality of the palpal formula as a classificatory tool has not been fully utilized (with a few limited exceptions) and certainly not in the Myrmicinae, where meristic characters are most badly needed, again with the exception of some modern work.

A variable amount of fusion between segments which cannot be seen in dried material is obvious in immersed preparations (see Kusnezov 1954*b*, 1954*c*). As this fusion is important for phylogenetic reasoning, the palpal formula is quoted in a way that indicates three degrees of fusion: *s*, or separate segments; *p*, or partial fusion; and *c*, or "complete" fusion. A completely fused articulation may be indicated by a slight notch in silhouette or a ring of setae where a joint is reasonably expected by

reference to allied species or genera. Note that there never seems to be fusion at the basal articulation. The numbers of visible segments in the maxillary and labial palpi are quoted, separated by a comma; if no qualifying statement enclosed in parentheses follows, the segments are freely articulated. If they are not, a formula enclosed in parentheses follows in which numbers, representing the respective segments of each palp (basal is 1), are separated by the code letters given above indicating the degree of fusion. Thus, "4,3" represents four freely articulated maxillary segments, and three freely articulated labial segments, "3, 3(1*p*2*s*3*s*4, 1*s*2*s*3)" means that the maxillary palp, while effectively three-segmented, actually has a basal segment composed of two partially fused segments, while the labial palp is composed of three freely articulated segments.

Other Terms

The *inferior propodeal plates** (Fig. 3) are a pair of flanges or plate-like structures placed vertically on either side of the foramen of the petiole. Synonymous terms are "lamellae" (Brown [in part]), "rounded lamella (of *Amblyopone*)", "metapleural lobes", and "metasternal lobes" (Kempf). At the base of each plate at its inner aspect is an acetabulum to receive the condyle of the anterior end of the petiole. Each of these plates is the lower extension of a *propodeal carina* (or *lamella*) which sometimes connects the propodeal teeth to the inferior propodeal plates; the carina also marks the boundary between the pleuron and the declivity. The *levator foramen** (Fig. 46) is a partially separated channel in the roof of the propodeal foramen into which fits a ligament that elevates the petiole. The *subpetiolar process** (Fig. 3) is a structure originating from the ventral surface of the petiole, usually nearer the anterior end; its form may vary from simple dentiform to cultrate, or it may be variously decorated or elaborated. The process when present is received between the hind coxae, either into a median metasternal pit, or else it fits against a *median metasternal process* when the gaster is swung forward between the legs. The *median metasternal process** (Fig. 122) is heavily sclerotized and consists of a longitudinal, raised base surmounted posteriorly by a forked or grooved extension, variously shaped and sculptured so as to receive the subpetiolar process. Functionally, the conjunction of the two processes serves to align the petiole and the attached gaster along the midline when the ant is stinging; the contact may also trigger the stimulus to operate or terminate the stinging motion. The *median mesosternal process** (Fig. 122) is a ventrally and posteriorly directed elaboration of the anterior margin of the mesosternum. It may be variously sculptured; its function, if any, is unknown. From an examination of the papers of Matsuda (1960*a*, 1960*b*), it is apparent that the sclerites here referred to as "sternal" should properly be termed "pleurosternal". I have chosen, however, to use the former term in order to retain some continuity with the older myrmecological literature until such time as the morphology of the ant alitrunk can be reviewed with Matsuda's work in mind.

The *subpostpetiolar processes** (Fig. 3) consist of (1) an anterior ventral transverse ridge, and (2) a posterior ventral transverse ridge, which is actually an elaboration of the posterior sternal margin of the postpetiolar segment; either or both

processes may be developed to a greater or lesser degree. The postpetiole articulates by a ball-and-socket joint with the gaster, the "ball" of the gaster generally being concealed within the "socket" of the postpetiole. In some groups the ball is greatly expanded, and its ventral edge takes on a resemblance to the posterior subpetiolar process, which in these cases is generally reduced.

IV. Definition, Characterization, and Synonymies of the Genera

The following tabulation lists the genera of Emery with later additions; indented beneath the generic names are the subgeneric names of various authors. The tribal arrangement follows that of Emery, and includes genera new since 1915 and up to 1957.

List of Genera and Subgenera of the Tribes Solenopsidini and Pheidologetini

Tribe Solenopsidini Forel (Auct.)

Vollenhovia Mayr
Heteromyrmex Wheeler
Dorothea Donisthorpe
Huberia Forel
Monomorium Mayr
  Monomorium s.s.
  Chelaner Emery
  Notomyrmex Emery
  Protholcomyrmex Wheeler
  Corynomyrmex Viehmeyer
  Syllophopsis Santschi
  Xeromyrmex Emery
  Parholcomyrmex Emery
  Isolcomyrmex Santschi
  Holcomyrmex Mayr
  Equestrimessor Santschi
  Adlerzia Forel
  Oxyepoecus Santschi
    (= *Martia* Forel)
  Lampromyrmex Mayr
  Anillomyrma Emery
Schizopelta McAreavey
Xenhyboma Santschi
Ireneidris Donisthorpe
Epixenus Emery
Trichomyrmex Mayr
Hagioxenus Forel
Wheeleriella Forel
Phacota Forel
Paraphacota Santschi
Xenomyrmex Forel
  (= *Myrmecinella* Wheeler)
Allomerus Mayr
Megalomyrmex Forel
  Megalomyrmex s.s.
  Wheelerimyrmex Mann
  Cepobroticus Wheeler
Liomyrmex Mayr
Tranopelta Mayr
Tranopeltoides Wheeler
Brownidris Kusnezov
Carebarella Emery
  Carebarella s.s.
  Carebarelloides Borgmeier
Diplomorium Mayr
  Diplomorium s.s.
  Bondroitia Forel
Solenopsis Westwood
  Solenopsis s.s.
  Diplorhoptrum Mayr
  Synsolenopsis Forel
  Diagyne Santschi
  Euophthalma Creighton
  Oedaleocerus Creighton
  Solenops Karawajew
  Crateropsis Patrizi
  Granisolenopsis Kusnezov
Labauchena Santschi
Bisolenopsis Kusnezov
Paranamyrma Kusnezov
Lilidris Kusnezov
Epoecus Emery
Anergates Forel

Tribe Pheidologetini Emery (Auct.)

Pheidologeton Mayr
Amauromyrmex Wheeler
Idrisella Santschi
Aneleus Emery
  Aneleus s.s.
  Lecanomyrma Forel
Erebomyrma Wheeler
Spelaeomyrmex Wheeler
Oligomyrmex Mayr
  (= *Sporocleptes* Arnold)
  Oligomyrmex s.s.
  Aeromyrma Forel
  Octella Forel
Nimbamyrma Bernard
Carebara Westwood
Paedalgus Forel
Lophomyrmex Emery
Trigonogaster Forel

Anisopheidole Forel
(Tribe Pheidolini)

Dyomorium Donisthorpe
(Tribe Tetramoriini)

Before going on to the detailed analyses of the genera, a synopsis of the changes effected in this revision is displayed in the following tabulation which should be compared with the tabulation above. The arrangement of genus groups, with synonyms, used in this paper is shown but full synonymies are given later.

MONOMORIUM GENUS GROUP

Monomorium
= *Phacota* (syn. nov.)
= *Trichomyrmex* (syn. nov.)
= *Lampromyrmex* (syn. nov.)
= *Holcomyrmex* (syn. nov.)
= *Epoecus* (syn. nov.)
= *Wheeleria* (nom. preocc.)
= *Wheeleriella* (syn. nov.)
= *Epixenus*
= *Xeromyrmex* (syn. nov.)
= *Parholcomyrmex* (syn. nov.)
= *Cornomyrmex* (syn. nov.) (provisional)
= *Isolcomyrmex* (syn. nov.)
= *Paraphacota* (syn. nov.)
= *Equestrimessor* (syn. nov.)
= *Xenhyboma* (syn. nov.)
= *Ireneidris* (syn. nov.)
Chelaner (status nov.)
= *Notomyrmex* (syn. nov.)
= *Protholcomyrmex* (syn. nov.)
= *Schizopelta* (syn. nov.)
Anillomyrma (status nov.)
Hagioxenus
Diplomorium
= *Bondroitia* (syn. nov.)
Syllophopsis

MEGALOMYRMEX GENUS GROUP

Megalomyrmex
= *Wheelerimyrmex* (syn. nov.)
= *Cepobroticus* (syn. nov.)
Nothidris (gen. nov.)
Tranopelta
Brownidris
Allomerus
Carebarella
= *Carebarelloides* (syn. nov.)

SOLENOPSIS GENUS GROUP

Solenopsis
= *Diplorhoptrum* (syn. nov.)
= *Synsolenopsis* (syn. nov.)
= *Diagyne* (syn. nov.)
= *Labauchena* (syn. nov.)
= *Euophthalma* (syn. nov.)
= *Oedaleocerus* (syn. nov.)
= *Bisolenopsis* (syn. nov.)
= *Paranamyrma* (syn. nov.)
= *Lilidris* (syn. nov.)
= *Granisolenopsis* (syn. nov.)
Oxyepoecus

PHEIDOLOGETON GENUS GROUP

Pheidologeton
= *Amauromyrmex* (syn. nov.)
= *Idrisella* (syn. nov.)
Oligomyrmex
= *Aeromyrma* (syn. nov.)
= *Aneleus* (syn. nov.)
= *Erebomyrma* (syn. nov.)
= *Lecanomyrma* (syn. nov.)
= *Octella* (syn. nov.)
= *Spelaeomyrmex* (syn. nov.)
= *Hendecatella* (syn. nov.)
= *Solenops* (syn. nov.)
= *Crateropsis* (syn. nov.) (provisional)
= *Nimbamyrma* (syn. nov.) (provisional)
Carebara
Paedalgus
Anisopheidole (tribal transfer)
Lophomyrmex

GENERA RECOGNIZED BUT PROPERLY EXCLUDED FROM THESE GENUS GROUPS

Vollenhovia
= *Heteromyrmex* (syn. nov.)
= *Dyomorium* (syn. nov.)
= *Dorothea* (syn. nov.)
Xenomyrmex
Liomyrmex
Huberia
Anergates
Trigonogaster

MISCELLANEOUS DISPOSALS

Crematogaster
= *Tranopeltoides*, Kempf 1960*a*
Adlerzia (Pheidolini, Brown 1952*a*, 1952*b*)

In the following sections, the generic synonyms are first listed together with their type species. This listing does not include those synonymies already dealt with by Dalla Torre (1893) and Emery (1921, 1922). Each genus is redefined using the characters described earlier. A brief discussion is then followed by a list of the available specific and infraspecific names; in the case of infraspecific names, the species under which they were described and the status originally assigned by the original author is given. This does not indicate that the validity of infraspecific categories is acknowledged; most of these subspecies and varieties (plus stirps, races, etc.) were erected on flimsy evidence, and many will be found synonymous when the necessary direct comparisons of types are made. In this matter the views of Wilson and Brown (1953) and Brown and Wilson (1954) are followed.

References to the species group names have been checked as far as possible against the original papers, and also in Emery (1921, 1922) and Wheeler (1922*d*).

(*a*) Monomorium *Genus Group*

Diagnosis

Antennae of worker and gyne 12-, 11-, or 10-segmented, with a more or less distinct club of more than 2 segments. Clypeus weakly to strongly bicarinate; median seta always present. Anterior tentorial pit lying close to the antennal socket. Malpighian tubules 4 in all species examined. Wings of the *Solenopsis* type, though venation often modified or reduced.

Genus MONOMORIUM Mayr

> *Monomorium* Mayr, 1855, p. 452. Type *Monomorium minutum* Mayr; monobasic.
> *Phacota* Roger, 1862, p. 260. Type *Phacota sicheli* Roger; monobasic. Syn. nov.
> *Trichomyrmex* Mayr, 1865, p. 19. Type *Trichomyrmex rogeri* Mayr; monobasic. Syn. nov.
> *Lampromyrmex* Mayr, 1868*b*, p. 92. Type *Lampromyrmex gracillimus* Mayr = *Monomorium mayrianum* Wheeler (nom. substit.); monobasic. Syn. nov.
> *Holcomyrmex* Mayr, 1878, p. 671. Type *Holcomyrmex scabriceps* Mayr, by designation of Bingham (1903). Syn. nov.
> *Epoecus* Emery, 1892*b*, p. 272. Type *Epoecus pergandei* Emery; monobasic. Syn. nov.
> *Wheeleria* Forel, 1905*b*, p. 171. Type *Wheeleria santschii* Forel; monobasic (nom. preocc.).
> *Wheeleriella* Forel, 1907*e*, p. 145. (Nom. substit. for *Wheeleria*, nom. preocc.). Type *Wheeleriella santschii* (Forel) (= *Wheeleria santschii* Forel); monobasic. Syn. nov.
> *Epixenus* Emery, 1908, p. 556. Type *Epixenus andrei* Emery, by designation of Wheeler (1911). Synonymy by Brown and Wilson (1957).
> *Monomorium* subgenus *Xeromyrmex* Emery, 1915*a*, p. 190. Type *Formica salomonis* Linn., by original designation. Syn. nov.
> *Monomorium* subgenus *Parholcomyrmex* Emery, 1915*a*, p. 190 (= *Paraholcomyrmex*, variant spelling). Type *Myrmica gracillima* Fr. Smith, by original designation. Syn. nov.
> *Monomorium* subgenus *Corynomyrmex* Viehmeyer, 1916, p. 134. Type *Monomorium* (*Corynomyrmex*) *hospitum* Viehmeyer; monobasic. Syn. nov. (provisional).
> *Monomorium* subgenus *Isolcomyrmex* Santschi, 1917*b*, p. 296 (= *Isholcomyrmex*, variant spelling). Type *Holcomyrmex santschii* Forel, by original designation. Syn. nov.
> *Paraphacota* Santschi, 1919*b*, p. 91. Type *Phacota noualhieri* Emery, by original designation. Syn. nov.
> *Monomorium* subgenus *Equestrimessor* Santschi, 1919*b*, p. 92 (= *Equesimessor*, variant spelling). Type *Holcomyrmex chobauti* Emery, by designation of Donisthorpe (1943). Syn. nov.
> *Xenhyboma* Santschi, 1919*c*, p. 405. Type *Xenhyboma mystes* Santschi; monobasic. Syn. nov. (provisional).
> *Ireneidris* Donisthorpe, 1943, p. 81. Type *Ireneidris myops* Donisthorpe; monobasic. Syn. nov.

Disposal of other subgeneric names in *Monomorium* (*sensu* Emery); *Adlerzia* Forel: transferred to Pheidolini by Brown (1952*a*, 1952*b*); *Syllophopsis* Santschi: elevated to generic rank by Santschi (1921*b*); *Anillomyrma* Emery: elevated tentatively to generic rank, affinities uncertain, apparently near *Monomorium* (see later).

Diagnosis (*worker and gyne*)

Antennae 12- or 11-segmented, rarely 10-segmented. Clypeus more or less distinctly bicarinate, carinae sharp or rounded. Median clypeal seta always present. Propodeum never with distinct teeth, rarely angulate, usually rounded. Petiole always distinctly pedunculate. Radial cell of wing always open.

Worker

TL between 1 and 7·5 mm.; polymorphic or monomorphic, size variation within species slight to considerable, with the *scabriceps* group tending towards dimorphism. Eyes well developed, generally more than 15 facets. Antennae 12-segmented except in the *orientale* group, where the antennae are 11-segmented (in a few species in this group, e.g. *sydneyense*, *nigellum*, individuals in a nest series may have 10-, 11-, or 12-segmented antennae). Antennal club 3-segmented, but in some members of the *scabriceps* group the club may be 4- (*M. santschii*) or 5-segmented (*M. evansi*), or without a clearly defined club (*M. criniceps*, *M. scabriceps*) (see Figs. 9, 13, and 15). Palpal formula 2,2 in larger species (*scabriceps* group, most of *salomonis* group) with gradations to 1,2 in the smaller species, e.g. *M. sordidum*, 1,2(1*p*2, 1*s*2); the smaller members of the *salomonis* group probably lose the basal segment of the maxillary palp, which is comparatively small even in the larger species of this group (Fig. 16). Basic dental formula 1+3, but the last subapical tooth is generally small and variable in development, so that 1+2 is not uncommon. Trulleum open and well developed in the *scabriceps* group, canthellus distinct. In the other groups the trulleum is closed by the canthellus fusing to the basal margin of the blade, and the basal margin encroaches on and reduces the trulleum, this being progressively more obvious through the *minutum* group, where the trulleum is more or less partially occluded, to the *salomonis* group, where the trulleum is almost eliminated. Species in the *orientale* group show the full range from open trulleum (*M. nigellum*) to strongly occluded (*M. orientale*). Labrum variable, distal border straight to bilobed, never cleft.

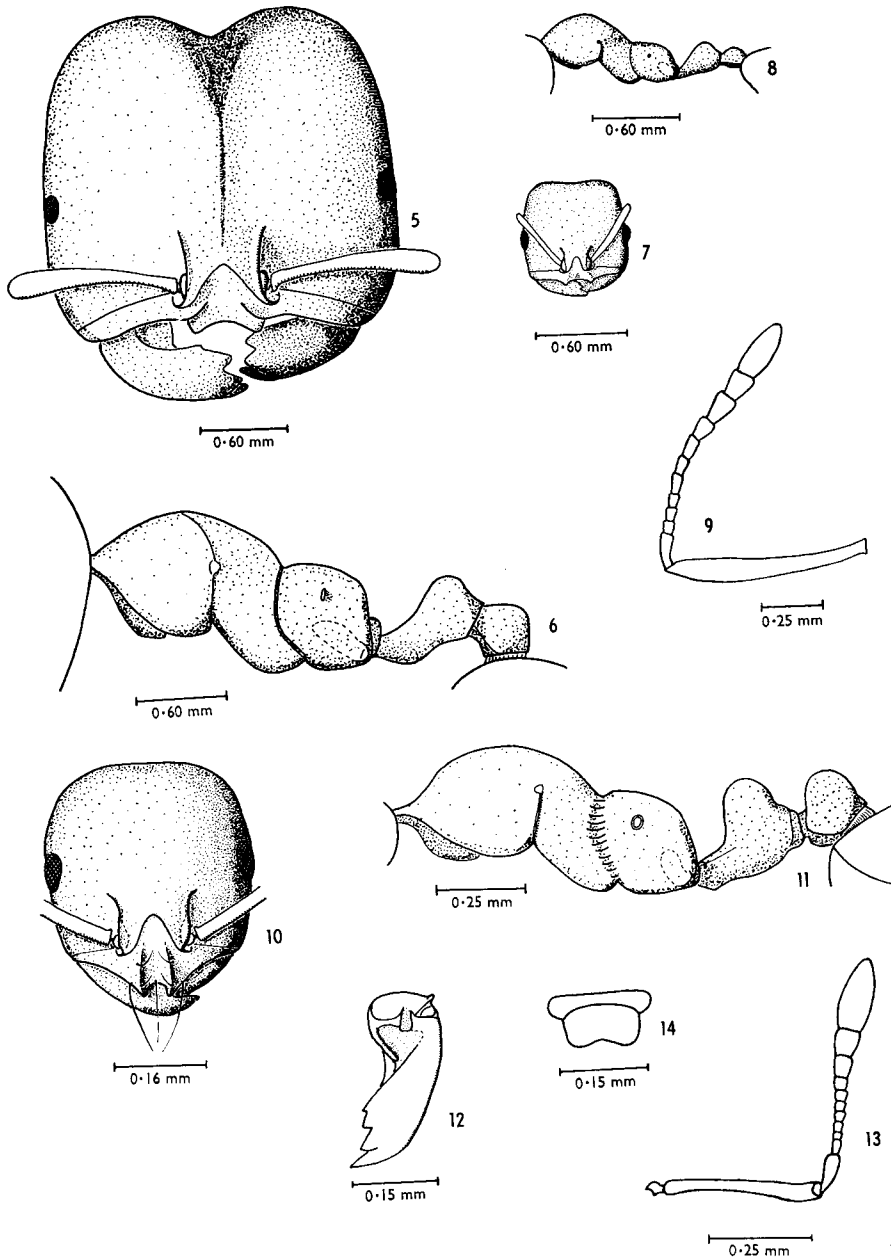
Clypeus with carinae usually distinct, slightly diverging, either sharp or rounded, with or without clypeal teeth (*minutum*, *salomonis*, and *orientale* groups); in the *scabriceps* group, the carinae become more strongly diverging as the depth of the clypeus shortens in the major workers. Median seta, first and second (and often further) paracarinal setae always present, and a variable number of intercarinal and lateral setae.

Promesonotal suture distinct on the pleura only to the height of the spiracle, faintly defined on the dorsum on larger specimens of larger species only. Metanotal groove always distinct, often deeply impressed on the dorsum. Propodeum rounded to angulate, never dentate. Propodeal spiracle round, or ovoid to slit-shaped in large species of the *scabriceps* group, opening posteriorly at about 45°, but never opening into a vestibule as in *Chelaner*. Metapleural gland well developed (but not checked in some parasitic species). Inferior propodeal plates usually well developed, somewhat reduced in the *scabriceps* group. Levator foremen narrowly open below.

Petiole strongly pedunculate, nodes of petiole and postpetiole rather high and rounded. Subpetiolar process usually present but generally small, cultrate; subpostpetiolar processes variable at the species level, but posterior process always well developed.

Sculpture variable, smooth and shining, punctate, striate or rugose, often reticulate.

Malpighian tubules 4, tips attached to the rectum (cryptonephric), in the species examined (*minimum*, *pharaonis*, *floricola*, *orientale*, *salomonis*, *ebeninum*, *criniceps*,



Figs. 5–14.—*Monomorium*: 5, *M. scabriceps*, full-face dorsal view of head of major worker; 6, *M. scabriceps*, lateral view of major worker; 7, *M. scabriceps*, full-face dorsal view of head of minor worker; 8, *M. scabriceps*, lateral view of minor worker; 9, *M. scabriceps*, antenna of worker; 10, *M. minimum*, full-face dorsal view of head of worker; 11, *M. minimum*, lateral view of worker; 12, *M. minimum*, dorsal view of mandible of worker; 13, *M. minimum*, antenna of worker; 14, *M. minimum*, labrum of worker

scabriceps). Diploid chromosome number 22 in *M. pharaonis* (Smith and Peacock 1957) and *M.* nr. *orientale* (Hauschteck, personal communication).

Gyne

Size distinctly to much larger than conspecific worker; TL 3–12 mm. Winged forms often present, but sometimes a strong tendency for ergatogyne and other worker–gyne intergrades to be developed, particularly in the *minutum* and *orientale* groups (e.g. see Tulloch 1930). Wings of the *Solenopsis* type, venation usually well developed, although it may be reduced in the smaller species (Figs. 17–20). *Forewing*: *Rs* never meeting *R* (radial cell open); *r* always present; *M* branching off from *Rs*+*M* before, at or after *r*; *m-cu* variable, so that cell *M*1 may be open or closed; *A* always continued past *cu-a*, which meets it almost at a right angle. *Hindwing*: venation usually strongly reduced, veins mostly unsclerotized.

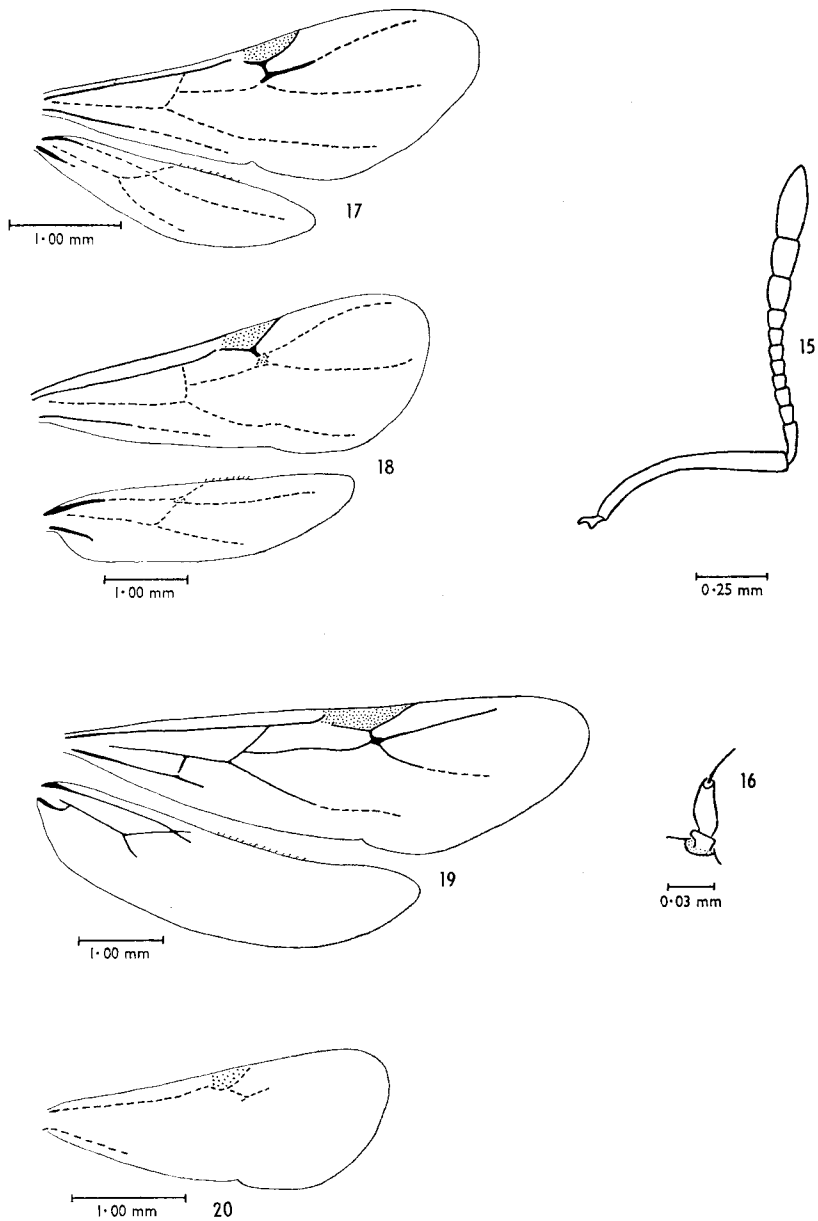
Male

Size somewhat smaller than conspecific gyne. Clypeus not bicarinate; median seta present. Mandibles opposable, dentition 1+2 or 1+3 (edentate in *M. hospitum*). Palpal formula as for gyne. Antennae 13-segmented in all species examined; in *salomonis*, *minutum*, and *orientale* groups the antennal pedicellus is cylindrical, as long as broad, and equal in diameter to the scape, which is equal in length to the first two or three funicular segments; in the *scabriceps* group, the pedicellus is globular and twice the diameter of the scape, which is rather short and stout. Notauli and parapsidal furrows not developed. Postpetiole not broadly attached to the gaster. Genitalia partially to fully exserted. Wing venation as in gyne.

Comments

Most of the generic synonymy in the genus *Monomorium* is a result of the habit of earlier workers of erecting new genera for parasitic, supposedly parasitic, or otherwise unusual species (see discussion by Brown and Wilson 1957). These "genera" cannot be distinguished from *Monomorium* by sound morphological criteria and have been synonymized. The genus *Trichomyrmex* was based on a single gyne of the *scabriceps* group. The boundaries between the subgeneric groups are indistinct and are of no assistance in classification. The subgenera have been synonymized, and the use of equivalent informal species groups is recommended. Even Forel (1917) pointed out that the subgenus *Xeromyrmex* was "insufficiently established".

The biology of the members of the genus is quite varied. Several species are cosmopolitan tramp ants and common house pests; many species are generalized scavengers, and some are apparently lestobiotic, while some species harvest seeds. Several species are social parasites on closely related species; in the *salomonis* group, such species tend to show an increase in the development of the occipital lobes in both worker and gyne; in the gyne the mesonotum is also extended anteriorwards to cover and protect the vulnerable neck against the gnawing of host workers. Broadening and thickening of the petiole and postpetiole of the gyne is also quite common in these "parasitic" species for the same protective reason. Despite the range of habitats



Figs. 15–20.—*Monomorium*: 15, *M. salomonis*, antenna of worker; 16, *M. salomonis*, maxillary palp of worker; 17, *M. minimum*, wing of gyne; 18, *M. salomonis*, wing of gyne; 19, *M. gracillimum*, wing of gyne; 20, *M. ilia*, wing of gyne.

utilized by this genus, from the dry Sahara to wet rain-forests throughout the world, the literature contains only scattered accounts of their biology; about most species there is no biological information. A series of outstanding studies by Peacock and his associates is a noteworthy exception (Peacock *et al.* 1949, 1950, 1951, 1954; Hall and Smith 1951, 1952, 1953, 1954; Smith and Peacock 1957). In a series of papers on laboratory studies of *Monomorium pharaonis*, these authors cover the rearing of colonies, life-history, egg-production, sex-ratio, morphology, parthenogenetic production of males, and cytology.

List of Monomorium Species

abeillei Ern. Andre, 1881, p. 67. Syria
aberrans Forel, 1902*b*, p. 209. India
abyssinicum (Forel), 1894*b*, p. 83. (*Holcomyrmex*). Ethiopia
adoneum Santschi, 1934*d*, p. 277. (var. of *subopacum*). Lebanon
adulatrix (Santschi), 1913*b*, p. 229. (*Wheeleriella*). Tunisia
advena Brown and Wilson, 1957, p. 244. (nom. nov. pro *Epixenus andrei* Emery, 1908, p. 557). Syria
aequatoriale Santschi, 1926*b*, p. 240. (var. of *bicolor*). Cameroon
aequum Santschi, 1928*d*, p. 195. Congo
affabile Santschi, 1926*b*, p. 235. Congo
afrum Ern. André, 1884, p. 540. Africa
aharonii Forel, 1913*f*, p. 438. (var. of *atomus*). Israel
ajjer Bernard, 1953*b*, p. 47. (subsp. of *chobauti*). Sahara
albopilosum Emery, 1895*d*, p. 24. S. Africa
algiricum (Bernard), 1955, p. 274. (*Epixenus*). N. Africa
altinodis Santschi, 1910, p. 359. (var. of *rhopalocerum*). Congo
anceps Emery, 1895*d*, p. 24. (var. of *subopacum*). S. Africa
andrei Saunders, 1890, p. 204. Western Mediterranean lands
angusticlavum Donisthorpe, 1947*a*, p. 389. W. New Guinea
angustinode Forel, 1913*c*, p. 334. Congo
annamense Donisthorpe, 1941*c*, p. 238. S.E. Asia
antipodum Forel, 1901*b*, p. 377. New Zealand, ? Australia
apuleii Santschi, 1927, p. 243. (var. of *subopacum*). Tunisia
arboreum Weber, 1943*a*, p. 360. (subsp. of *minutum*). Sudan
areniphila Santschi, 1911, p. 84. (var. of *salomonis*). Tunisia
arnoldi Forel, 1913*b*, p. 137. S. Rhodesia
asmarensis Forel, 1910*b*, p. 250. (var. of *afrum*). Somalia
atomus Forel, 1902*b*, p. 210. India
australe Emery, 1886, p. 363. (subsp. of *subopacum*). S. Africa
australicum Forel, 1907*a*, p. 20. Australia
baal Wheeler and Mann, 1916, p. 171. (var. of *dentigerum*). Middle East
banksii Forel, 1910*d*, p. 123. Philippine Is.
barbatulum Mayr, 1877*a*, p. 17. Central Asia
barretti Santschi, 1928*b*, p. 467. (var. of *fraterculus*). Australia
bedui Santschi, 1935*b*, p. 50. (var. of *salomonis* subsp. *areniphilum*) Morocco
belli Forel, 1914, p. 245. (var. of *salomonis* subsp. *herero*). S. Africa
bequaerti Forel, 1913*c*, p. 334. Congo
bernardi, nom. nov. pro *Monomorium* (*Equesimessor*) *andrei* subsp. *ajjer* Bernard, 1953*b*, p. 51, nec Bernard, op. cit. Sahara
bevisi Arnold, 1944, p. 10. S. Africa
bicolor Emery, 1877, p. 368. Somalia
bimaculatoides, nom. nov. pro *Monomorium* (*Xeromyrmex*) *bicolor* subsp. *personatum* var. *bimaculatum* Santschi, 1937*d*, p. 221, nec. Wheeler, 1928*b*, p. 19. Angola

bimaculatum Wheeler, 1928*b*, p. 19. China
biroi Forel, 1907*a*, p. 19. India
biroi (Forel), 1910*a*, p. 21. (*Epixenus*) (possibly gyne of *M. creticum*, see Brown and Wilson 1957, p. 244). Crete
bodenheimeri Menozzi, 1929*a*, p. 125. Sinai
boerorum Forel, 1910*a*, p. 442. (var. of *minutum*). S. Africa
bondroiti Santschi, 1920*a*, p. 10. (var. of *altinode*). Congo
borlei Santschi, 1937*d*, p. 225. (var. of *springvalense*). Angola
brasiliense Forel, 1908*b*, p. 361. (var. of *minutum*). Brazil
braunsi Mayr, 1901, p. 7. S. Africa
broomense Forel, 1915*a*, p. 74. (var. of *leve* (!)). Australia
brunnea Emery, 1893*b*, p. 25. (var. of *latinode*). Ceylon
bulawayense Forel, 1913*d*, p. 217. (var. of *exiguum*). S. Rhodesia
butteli Forel, 1913*e*, p. 54. Sumatra
buxtoni Crawley, 1920, p. 165. Middle East
cabrerae Santschi, 1919*c*, p. 405. (*Paraphacota*). Canary Is.
captator Santschi, 1932, p. 385. Congo
carbo Forel, 1910*b*, p. 251. (subsp. of *salomonis*). Somalia
carbonarium (Fr. Smith), 1858*a*, p. 127. Tropical tramp
chinense Santschi, 1925*c*, p. 86. (var. of *minutum*). China
chobauti (Emery), 1897*b*, p. 418. (*Holcomyrmex*). Algeria
clarithorax Santschi, 1919*d*, p. 235. (var. of *albopilosum*). S. Africa
clarum (Forel), 1902*b*, p. 219. (var. of *Holcomyrmex glaber*). India
clavicorne Ern. Andre, 1881, p. 68. Syria
compressum Wheeler, 1914*b*, p. 43. (subsp. of *minimum*). Mexico
cooperi Donisthorpe, 1942*a*, p. 29. (subsp. of *atomus*). Egypt
crawleyi Santschi, 1930*a*, p. 66. Ethiopia
creticum Emery, 1895*a*, p. 298. Crete
creticum (Emery), 1908, p. 558. (*Epixenus*) (possibly male of *M. creticum*, see Brown and Wilson 1957, p. 245). Crete
criniceps (Mayr), 1878, p. 672. (*Holcomyrmex*). India, Burma
crinicipitoscabriceps (Forel), 1902*a*, p. 220. (*Holcomyrmex*). India
cupidum Santschi, 1936*b*, p. 59. (var. of *salomonis* subsp. *sommieri*). Tunisia
cyaneum Wheeler, 1914*b*, p. 43. (subsp. of *minimum*). Mexico
dakarense Santschi, 1914*b*, p. 353. (subsp. of *bicolor*). Senegal
damarense Forel, 1910*c*, p. 17. (subsp. of *salomonis*). S.W. Africa
delagoense Forel, 1894*b*, p. 87. (subsp. of *salomonis*). E. Africa
demisum Santschi, 1936*b*, p. 36. Central Asia
demochrum Viehmeyer, 1916, p. 131. (subsp. of *butteli*). Malaya
dentigerum (Roger), 1862, p. 259. Asia Minor
despectum Forel, 1910*b*, p. 252. (var. of *destructor* spp. *kalahariense*). Somalia
destructor (Jerdon), 1851, p. 107. (*Atta*). Pantropical tramp
dichroum Forel, 1902*b*, p. 212. India
dictator Santschi, 1937*d*, p. 222. (subsp. of *bicolor*). Angola
didonis Santschi, 1921*a*, p. 425. (var. of *salomonis*). Tunisia
disertum Forel, 1913*d*, p. 216. (var. of *salomonis*). S. Rhodesia
dispar Emery, 1895*d*, p. 24. S. Africa
distinctum Arnold, 1944, p. 11. Central Africa
dolichops Santschi, 1928*d*, p. 194. (var. of *setuliferum*). S. Rhodesia
donisthorpei Crawley, 1915, p. 134. N. Australia
ebangaense Santschi, 1937*d*, p. 223. (subsp. of *bicolor*). Angola
ebininum Forel, 1891*a*, p. 165. (var. of *minutum*, later of *carbonarium*). Caribbean Is.
ebraicum Menozzi, 1933*b*, p. 62. (var. of *subopacum*). Israel
egens Forel, 1910*a*, p. 443. Cameroon
emeryi Mayr, 1895, p. 132. Mozambique

epinotale Santschi, 1923*b*, p. 281. Congo
estherae Weber, 1943*a*, p. 361. Sudan
evansi Donisthorpe, 1918, p. 166. Middle East
= *pietschmanni* Viehmeyer, m.s. name?
excelsius Arnold, 1926, p. 227. (var. of *tchelichofi*). S. Africa
excensurae Forel, 1914, p. 342. (var. of *oscaris*). S. Africa
exchao Santschi, 1926*b*, p. 235. S. Africa
exiguum Forel, 1894*b*, p. 85. Ethiopia.
explorator Santschi, 1920*a*, p. 12. Congo
fasciatum Santschi, 1920*a*, p. 10. Tanganyika
faurei Santschi, 1915*a*, p. 260. Gabon
fezzanense Santschi, 1936*b*, p. 50. (var. of *salomonis* subsp. *areniphilum*). Libya
fieldi Forel, 1910*e*, p. 30. Central Australia
fingo Arnold, 1946, p. 61. (subsp. of *albopilosum*). S. Africa
firmum Santschi, 1926*b*, p. 231. S. Rhodesia
flavescens Forel, 1916, p. 418. (subsp. of *exiguum*). Congo
flavum Collingwood, 1960, p. 62. Afghanistan
floreanum Stitz, 1932, p. 368. Galapagos Is.
floricola (Jerdon), 1851, p. 107. Pantropical tramp
fossulatum Emery, 1894*d*, p. 465. Burma
fraterculus Santschi, 1919*a*, p. 328. (subsp. of *laeve*). Australia
fridae Forel, 1905*b*, p. 183. (subsp. of *medinae*). S. Africa
fultor Forel, 1913*c*, p. 332. (var. of *afrum*). Congo
fulvum Mayr, 1862, p. 754. New Zealand
fur Forel, 1894*c*, p. 19. (subsp. of *andrei*). Algeria
furina Forel, 1911*c*, p. 221. (var. of *floricola*). Ceylon
furunculus Emery, 1924*b*, p. 165. (var. of *andrei*). Gibraltar
gabrielense Forel, 1916, p. 418. (var. of *rhopalocerum*). Congo
glabrum (Ern. André), 1883, p. 345. (*Holcomyrmex*). S.E. Asia
glabrocriniceps (Forel), 1902*a*, p. 220. (*Holcomyrmex*). India
glyciphilum (Fr. Smith), 1858*a*, p. 125. Ceylon
gracilicornis Stitz, 1917, p. 346. (var. of *venustum* subsp. *niloticum*). Algeria
gracillimum (Fr. Smith), 1861, p. 34. Syria
grahamstownense Forel, 1914, p. 245. (var. of *salomonis* subsp. *delagoense*). S. Africa
grande Forel, 1910*a*, p. 6. (var. of *venustum* ssp. *niloticum*). Arabia
guillarmodi Arnold, 1946, p. 63. S. Africa
guineense (Bernard), 1953*a*, p. 238. (*Epixenus*) (see Brown and Wilson, 1957, p. 245). W. Africa
hanneli Forel, 1907*a*, p. 18. E. Africa
hannonis Santschi, 1910, p. 358. Congo
havilandi Forel, 1910*a*, p. 443. S. Africa
hercules Viehmeyer, 1923, p. 91. (subsp. of *salomonis*). Sudan
herero Forel, 1910*c*, p. 16. (subsp. of *salomonis*). S.W. Africa
hesperium Emery, 1895*a*, p. 298. Canary Is.
hildebrandti Forel, 1892*c*, p. 256. (subsp. of *minutum*). Madagascar
hirsutum Forel, 1910*b*, p. 251. (subsp. of *bicolor*). Somalia
hospitum Viehmeyer, 1916, p. 133. Malaya
hottentotum Emery, 1895*d*, p. 26. (subsp. of *minutum*). S. Africa
ilia Forel, 1907*d*, p. 277. Central Australia
ilgi Forel, 1894*b*, p. 84. Ethiopia
imerinense Forel, 1892*c*, p. 257. (subsp. of *minutum*). Madagascar
impexum Wheeler, 1928*b*, p. 18. China
impuriceps Santschi, 1937*d*, p. 222. (var. of *bicolor* subsp. *personatum*). Angola
indicum Forel, 1902*b*, p. 213. (subsp. of *salomonis*). India, Burma
inquietum Santschi, 1926*b*, p. 233. Congo
insidiosum (Santschi), 1926*c*, p. 233. (spp. of *Wheeleriella santschii*). Tunisia

integrius Forel, 1902*b*, p. 210. (var. of *atomus*). India
intermedium Wheeler, 1927*a*, p. 108. (var. of *salomonis* subsp. *subopacum*). Canary Is.
javanum Forel, 1909*c*, p. 225. (var. of *minutum* subsp. *lilliuokalanii*). E. Indies
jucundum Santschi, 1926*b*, p. 232. Congo
judaicum Menozzi, 1933*b*, p. 63. (subsp. of *bicolor*). Middle East
junodi Forel, 1910*a*, p. 441. (subsp. of *salomonis*). S. Africa
kalahariense Forel, 1910*c*, p. 18. (subsp. of *destructor*). S. Africa
karawajewi Forel, 1913*a*, p. 437. (var. of *destructor* subsp. *gracillimum*). Sudan
kineti Weber, 1943*a*, p. 359. (subsp. of *minutum*). Sudan
kusnezowi Santschi, 1928*c*, p. 42. Central Asia
lacrymans Arnold, 1944, p. 15. (var. of *delagoense*). Natal
laeve Mayr, 1876, p. 101. E. Australia
laevius Mayr, 1897, p. 427. (subsp. of *emeryi*). Ceylon
lameerei (Forel), 1902*c*, p. 150. (*Holcomyrmex*). Algeria
lamingtonense Forel, 1915*b*, p. 73. (var. of *ilia*). E. Australia
latinode Mayr, 1872, p. 152. Borneo
latinodoides Wheeler, 1928*b*, p. 17. China
latius Santschi, 1928*d*, p. 195. (var. of *setuliferum*). Angola
lanzarotense Wheeler, 1927*a*, p. 107. (var. of *hesperium*). Canary Is.
leimbachi Forel, 1914, p. 246. S. Africa
lene Santschi, 1920*a*, p. 11. S. Rhodesia
leopoldinum Forel, 1905*b*, p. 179. (var. of *minutum*). Congo
lepineyi Santschi, 1934*b*, p. 34. (var. of *salomonis*). Sudan
leviceps Arnold, 1958, p. 119. (var. of *distinctum*). S. Africa
liberta Santschi, 1921*c*, p. 170. (var. of *salomonis* subsp. *subopacum*). Senegal
liliuokalanii Forel 1899, p. 119. (subsp. of *minutum*). Hawaii
longi Forel, 1902*b*, p. 211. Assam
longiusculum Santschi, 1926*b*, p. 237. Congo
luisae Forel, 1904*c*, p. 25. Kashmir
luteum Emery, 1881, p. 532. S. Arabia
madecassum Forel, 1892*c*, p. 255. (spp. of *minutum*). Madagascar
major Bernard, 1953*b*, p. 50. (var. of *santschii*). Sahara
mayri Forel, 1902*b*, p. 209. (var. of *gracillimum*). India
mayrianum Wheeler, 1914*a*, p. 45. (fossil). Baltic amber
macrops Arnold, 1944, p. 11. (subsp. of *mediocre*). S. Africa
medinae Forel, 1892*b*, p. 454. Canary Is.
mediocre Santschi, 1919*f*, p. 376. Rhodesia
micron Crawley, 1925*a*, p. 593. W. Australia
mictile Forel, 1910*b*, p. 252. (subsp. of *atomus*). Somalia
minimum (Buckley), 1867, p. 338 (*Myrmica*). N. America
= *metoecus* Brown and Wilson, 1957, p. 239. Syn. nov.*
minus Stitz, 1923*a*, p. 156. (var. of *salomonis*). S.W. Africa
minutissimum Santschi, 1937*d*, p. 225. Angola
minutum Mayr, 1855, p. 453. S. Europe
mirandum Arnold, 1955, p. 734. Kenya
moestum Santschi, 1914*a*, p. 74. Tanganyika
molestum Santschi, 1936*b*, p. 55. (var. of *salomonis* subsp. *didonis*). Algeria
monardi Santschi, 1937*d*, p. 224. Angola

* W. L. Brown (personal communication) notes that he has seen a single isolated specimen of *Monomorium minimum* from Georgia that is intermediate in size and other characters between the workers of *M. metoecus* and *M. minimum*. Thus it is clear that *M. metoecus*, despite its seeming distinctness, is based on a rarely occurring series of ergatoid forms of *M. minimum*. The apparently aberrant "parasitic" behaviour of *metoecus* is now to be interpreted as essentially the normal behaviour of *M. minimum* workers.

musicum Forel, 1910*a*, p. 442. (subsp. of *oscaris*). Natal
muticum (Emery), 1887*b*, p. 457. (*Holcomyrmex*). Burma
mystes (Santschi), 1919*c*, p. 405. (*Xenhyboma*). Teneriffe
mzabicum Santschi, 1936*b*, p. 54. (var. of *salomonis* subsp. *targui*). Algeria
nigellum Emery, 1914*a*, p. 184. (var. of *sydneyense*). E. Australia
nigrum Forel, 1902*a*, p. 220. (var. of *Holcomyrmex criniceps*). India
nigrius Forel, 1915*b*, p. 74. (var. of *laeve*). E. Australia
niloticoides Forel, 1910*a*, p. 6. (var. of *venustum*). Israel
niloticum Emery, 1881, p. 531. Egypt
nipponense Wheeler, 1906*b*, p. 310. Japan
nitidiventre Emery, 1893*b*, p. 256. (subsp. of *bicolor*). Africa, Arabia
notulum Forel, 1910*a*, p. 441. (var. of *setuliferum*). S. Africa
noualhieri (Emery), 1895*a*, p. 299. (*Phacota*). Algeria
nuptiale Forel, 1913*d*, p. 216. (var. of *oscaris*). Rhodesia
nyasae Arnold, 1946, p. 63. Nyasaland
obscuratum Stitz, 1917, p. 346. (var. of *salomonis*). Algeria
obscuriceps Santschi, 1921*c*, p. 169. (var. of *salomonis*). Morocco
= *Monomorium* (*Xeromyrmex*) *salomonis* subsp. *pestiferum* Santschi, 1936*a*, p. 57; objective synonym, name unnecessarily proposed for *M. obscuriceps*. Syn. nov.
occidentale Bernard, 1953*a*, p. 236. W. Africa
opacius Forel, 1913*b*, p. 136. (var. of *salomonis* subsp. *junodi*). Rhodesia
opacum Forel, 1913*c*, p. 333. Congo
ophthalmicum Forel, 1894*b*, p. 87. Ethiopia
orangiae Arnold, 1956, p. 67. S. Africa
orientale Mayr, 1878, p. 670. Tropical tramp
oscaris Forel, 1894*b*, p. 86. Ethiopia
osiridis Santschi, 1915*a*, p. 258. Tanganyika
pacis Forel, 1914, p. 343. S. Africa
pallidum Donisthorpe, 1918, p. 166. (var. of *destructor*). Asia Minor
pallidipes Forel, 1910*b*, p. 252. (var. of *minutum*). Somalia
papuasiae Emery, 1900, p. 326. (var. of *fossulatum* subsp. *sechellensis*). New Guinea
parvinode Forel, 1894*b*, p. 88. (var. of *salomonis*). Ethiopia
paternum Forel, 1914, p. 248. (var. of *oscaris* subsp. *springvalense*). S. Africa
paucipilosum Santschi, 1919*d*, p. 235. (subsp. of *albopilosum*). S. Africa
peninsulatum Gregg, 1945, p. 63. Florida, U.S.A.
pergandei (Emery), 1895*b*, p. 273. (*Epoecus*). Washington, D.C., U.S.A.
personatum Santschi, 1937*d*, p. 220. (subsp. of *bicolor*). Angola
petulans Santschi, 1928*d*, p. 194. (var. of *termitarium* subsp. *disertum*). S. Rhodesia
pharaonis (Linnaeus), 1758, p. 580. (*Formica*). Cosmopolitan tramp
philippinense Forel, 1910*d*, p. 123. (var. of *floricola*). Philippine Is.
phoenicia Emery, 1908, p. 677. (var. of *salomonis* subsp. *subopacum*). N. Africa, Middle East
pictum Santschi, 1936*b*, p. 57. (var. of *salomonis* subsp. *didonis*). Tunisia
pieli Santschi, 1925*c*, p. 87. China
pilipes Mayr, 1868*b*, p. 91. (fossil). Baltic amber
planidorsum Emery, 1915*b*, p. 378. (subsp. of *salomonis*). Libya
pretoriense Arnold, 1944, p. 15. (var. of *delagoense*). S. Africa
procax Forel, 1911*f*, p. 23. (var. of *atomus*). Malaya
prossae Forel, 1916, p. 418. (subsp. of *amblyops*). Rhodesia
pulchrum Santschi, 1926*b*, p. 238. S. Rhodesia
pullulum Santschi, 1919*d*, p. 235. (var. of *salomonis*). Senegal
punicum Santschi, 1915*b*, p. 58. (var. of *clavicorne*). Tunisia
rhopalocerum Emery, 1895*d*, p. 25. S. Africa
robustius Forel, 1892*a*, p. 352. (var. of *gracillimum*). Somalia
rogeri (Mayr), 1865, p. 19. (*Trichomyrmex*) (type seen). Ceylon
rosae Santschi, 1920*a*, p. 13. Cgoon

rotundatum Santschi, 1920*a*, p. 14. S. Africa
rubrum (Forel), 1902*a*, p. 220. (var. of *Holcomyrmex criniceps*). Ceylon
rufescens (Santschi), 1926*c*, p. 233. (var. of *Wheeleriella santschii*). Tunisia
rufulum Stitz, 1923*a*, p. 156. (var. of *salomonis*). W. Africa
sagei Forel, 1902*b*, p. 211. India
sahlbergi Emery, 1898, p. 8. Israel
sakalavum Santschi, 1928*d*, p. 196. Madagascar
salaco Santschi, 1936*b*, p. 52. (var. of *salomonis* subsp. *areniphilum*). Tunisia
salomonis (Linnaeus), 1758, p. 580. (*Formica*). Asia Minor–N. Africa
samoanum Santschi, 1928*a*, p. 46. (var. of *minutum*). Samoa
santschianum, nom. nov. pro *Holcomyrmex santschii* Forel, 1907*f*, p. 203, nec *M. santschii* (= *Wheeleria santschii*) Forel, 1905*b*, p. 171. Tunisia
santschii (Forel), 1905*b*, p. 171. (*Wheeleria*). Tunisia
scabriceps (Mayr), 1878, p. 672. (*Holcomyrmex*). India
schultzei Forel, 1910*c*, p. 18. S. Africa
schurri Forel, 1902*b*, p. 212. India, Burma
scipionis Santschi, 1921*c*, p. 169. (var. of *salomonis*). Tunisia
sechellense Emery, 1894*c*, p. 69. (subsp. of *fossulatum*) (*seychellense* = variant spelling). Seychelle Is.
senegalense Roger, 1862, p. 294. Senegal
serenum Santschi, 1928*d*, p. 192. (var. of *delagoense* subsp. *junodi*). S. Rhodesia
setuliferum Forel, 1910*c*, p. 16. S. Africa
shilohense Forel, 1913*d*, p. 217. (var. of *braunsi*). S. Rhodesia
shuckardi Forel, 1895*a*, p. 251. Madagascar
sicheli (Roger), 1862, p. 262. (*Phacota*). Spain
silvestrii Wheeler, 1927*b*, p. 87. S.E. Asia
solleri (Forel), 1910*a*, p. 430. (*Rhoptromyrmex*). Synonymy by Ettershank and Brown, 1964. Senegal
sommieri Emery, 1908, p. 676. (var. of *salomonis*). Tunisia
spatulicorne Kuznetzov-Ugamskij, 1926, p. 20. Central Asia
speculiceps Santschi, 1928*d*, p. 191. S. Africa
speluncarum Santschi, 1914*a*, p. 72. (subsp. of *rhopalocerum*). Tanganyika
springvalense Forel, 1913*b*, p. 136. (subsp. of *oscaris*). S. Rhodesia
stauderi Wolf, 1914, p. 39. (var. of *lameerei*). Algeria
strangulatum Santschi, 1921*a*, p. 121. E. Africa
subcoecum Emery, 1894*b*, p. 150. Antilles
subedentatum Forel, 1913*c*, p. 332. Congo
subnitidum Emery, 1895*a*, p. 298. (var. of *salomonis*). Algeria
subopacum (Fr. Smith), 1858*a*, p. 127. (*Myrmica*). N. Africa, S. Europe
sudanicum Santschi, 1930*a*, p. 67. (var. of *exiguum* subsp. *mictile*). Sudan
surcoufi (Santschi), 1919*b*, p. 91. (*Paraphacota*). Algeria
sydneyense Forel, 1902*b*, p. 442. (*sidneyense* = variant spelling). E. Australia
tablense Santschi, 1932, p. 384. (subsp. of *altinode*). S. Africa
talpa Emery, 1911, p. 252. Melanesia
= *Ireneidris myops* Donisthorpe. 1943*b*, p. 81. Syn. nov.
tanit Santschi, 1936*b*, p. 58. (var. of *salomonis* subsp. *sommieri*). Tunisia
taprobanae Forel, 1913*e*, p. 53. (var. of *minutum*). Ceylon
targui Santschi, 1936*b*, p. 53. (subsp. of *salomonis*). Sahara
tchelichofi Forel, 1914, p. 244. S. Africa
termitarium Forel, 1910*c*, p. 17. (subsp. of *salomonis*). S. Africa
termitobium Forel, 1892*b*, p. 522. Madagascar
thales Forel, 1913*b*, p. 136. (var. of *albopilosum*). Rhodesia
thorense Mayr, 1862, p. 753. Egypt
transversale Santschi, 1921*c*, p. 169. (var. of *salomonis*). Morocco
triviale Wheeler, 1906*a*, p. 311. Japan
tropicale Santschi, 1926*b*, p. 240. (var. of *bicolor*). Congo
tuneticum Santschi, 1936*b*, p. 52. (var. of *salomonis* subsp. *areniphilum*). Tunisia

turkmenicum Santschi, 1928*c*, p. 43. (subsp. of *venustum*). Central Asia
uelense Santschi, 1926*b*, p. 239. (var. of *bicolor*). Congo
unicolor Stitz, 1923*a*, p. 156. (var. of *salomonis*). S.W. Africa
vaguum Santschi, 1930*a*, p. 68. Congo
venustum (Fr. Smith), 1858*a*, p. 126. Syria
viator Santschi, 1923*b*, p. 280. S.E. Africa
viridum Brown, 1943, p. 243. N. America
vitiense Mann, 1921, p. 444. Fiji
voeltzkowi Forel, 1907*b*, p. 78. E. Africa
volubile Santschi, 1936*b*, p. 56. (var. of *salomonis* subsp. *didonis*). Morocco
willowmorense Forel, 1914, p. 245. (var. of *salomonis* subsp. *herero*). S. Africa
wroughtoni Forel, 1902*b*, p. 209. India
wroughtoni (Forel), 1910*a*, p. 7. (*Wheeleriella*) (probable synonym of *Monomorium indicum*). India
wroughtonianum, nom. nov. pro *Trichomyrmex wroughtoni* Forel, 1911*f*, p. 453, nec. Forel, 1902*b*, p. 209. India
xanthognathum Arnold, 1944, p. 9. S. Africa
zanoni Emery, 1924*a*, p. 9. (var. of *salomonis* subsp. *subopacum*). Libya
zulu Santschi, 1914*c*, p. 18. S. Africa

Genus CHELANER, status nov.

> *Monomorium* subgenus *Chelaner* Emery, 1914*b*, p. 410. Type *Monomorium* (*Chelaner*) *forcipatum* Emery, by designation of Emery (1921).
> *Monomorium* subgenus *Notomyrmex* Emery, 1915*a*, p. 190. Type *Monomorium* (*Notomyrmex*) *antarcticum* (= *Formica antarctica* White), by original designation, monobasic. Syn. nov.
> *Monomorium* subgenus *Protholcomyrmex* Wheeler, 1922*d*, p. 162. Type *Monomorium rothsteini* Forel, by original designation. Syn. nov.
> *Schizopelta* McAreavey, 1949, p. 14. Type *Schizopelta falcata* McAreavey, by original designation, monobasic. Syn. nov.

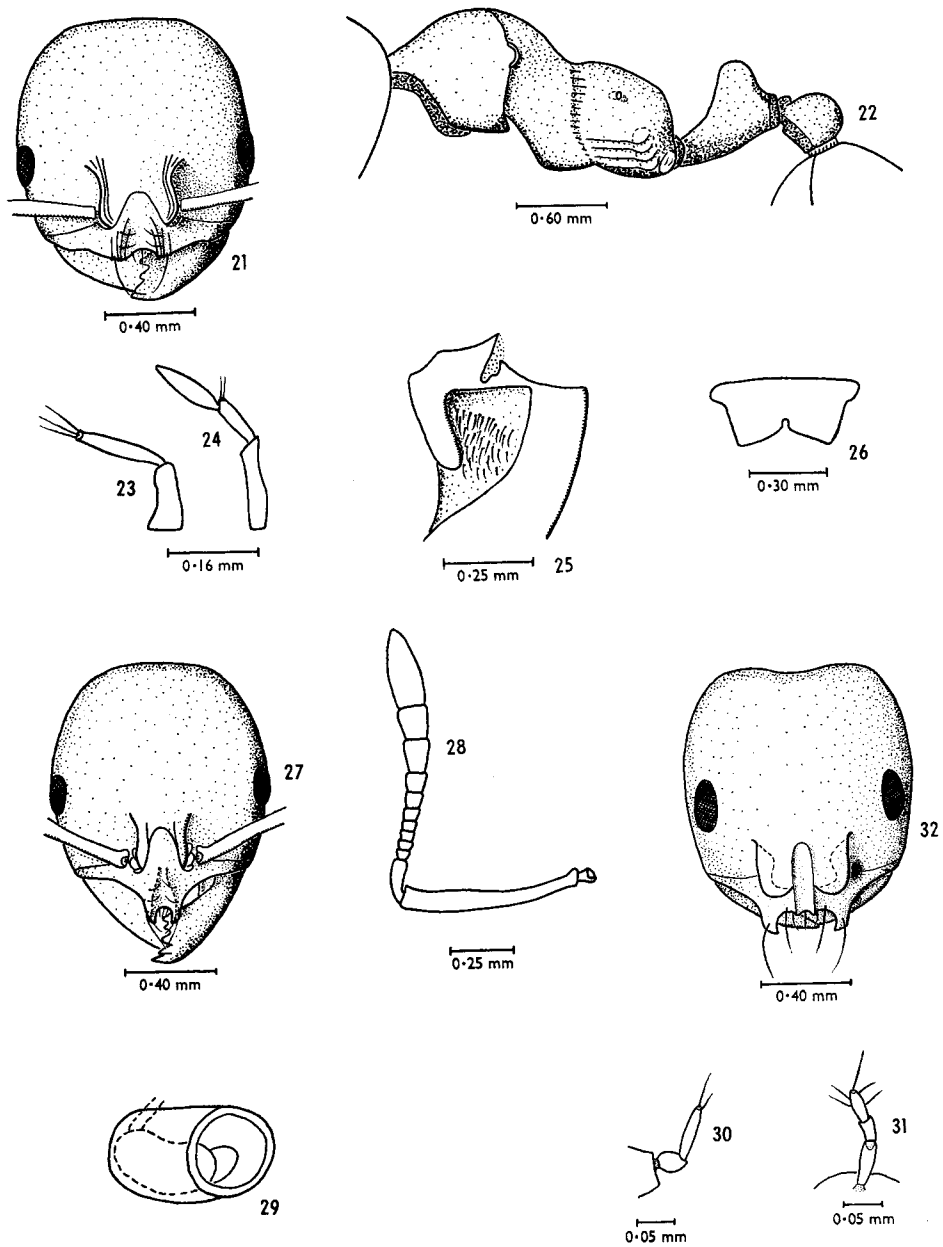
Diagnosis (*worker and gyne*)

Clypeus more or less bicarinate, carinae sharp, rounded or composed of subparallel rugae; clypeus partly overhanging mandibles in front; median clypeal seta always present. Antennae 12-segmented, club variable. Palpal formula 2,3; rarely 2,2. Propodeum stoutly dentate, angulate or rounded, spiracle vestibulate (see Fig. 29). Petiole always strongly pedunculate. Radial cell always open.

Worker

TL 2–7 mm.; monomorphic, size variable within species. Eyes well developed. Antennae always 12-segmented, club 3-, 4-, or 5-segmented, usually not pronounced. Palpal formula 2,3 (Figs, 23, 24, 30, 31) or more rarely 2,2(1*s*2, 1*s*2*c*3), but in the latter case propodeal spiracle vestibulate (*rothsteini*, *subapterum*, *leae* ♀). Dental formula 1+4, 1+3, or 1+2; canthellus variable, from straight and two-thirds complete (*antarcticum*), curved and nearly meeting the basal margin (*cinctum*, *edentatum*), to intimately fused to the basal margin (*rothsteini*). Labrum variable, distal margin concave, bilobed or cleft.

Clypeus with carinae which may be subparallel, converging or strongly diverging. Carinae may be sharp or rounded, or may consist of subparallel rugae. Clypeal margin may bear a pair of clypeal teeth, with or without lateral teeth, may be strongly excavated between the clypeal teeth, or may be rounded and lack teeth. Median seta,



Figs. 21–32.—*Chelaner*: 21, *C. edentatus*, full-face dorsal view of head of worker; 22, *C. whitei*, lateral view of worker; 23, *C. whitei*, maxillary palp of worker; 24, *C. whitei*, labial palp of worker; 25, *C. whitei*, base of mandible of worker; 26, *C. whitei*, labrum of worker; 27, *C. antarcticus*, full-face dorsal view of head of worker; 28, *C. antarcticus*, antenna of worker; 29, *C. antarcticus*, propodeal spiracle of worker showing vestibule; 30, *C. antarcticus*, maxillary palp of worker; 31, *C. antarcticus*, labial palp of worker; 32, *C. falcatus*, full-face dorsal view of head of worker.

usually one pair of intercarinal setae, carinal and 2–5 paracarinal setae present (the position of the carinae may be determined, where these are not simple, by the position of the inflexed carinal setae).

Promesonotal suture distinct only to the height of the spiracle, sometimes complete. Metanotal groove always distinct, usually well impressed on the dorsum. Propodeum usually rounded, less often angulate or stoutly dentate; spiracle round, directed posteriorly, but the visible spiracle is the external aperture of a longitudinally extended vestibule, lying directly below the cuticle, which is about twice as long as high (see Fig. 29). This vestibule may be seen clearly in those species with translucent cuticles; in those with an opaque cuticle, the palpal formula is 2,3. Metapleural gland well developed. Inferior propodeal plates mostly well developed. Levator foramen open below, the opening about half greatest diameter of the foramen.

Petiole strongly pedunculate, nodes of pedicel generally high and rounded, but variable. Subpetiolar process present or absent, often varying with absolute size of individuals. Subpostpetiolar processes variable, both anterior and posterior ridges generally present, though anterior ridge may be absent or rounded.

Sculpture highly variable; smooth and shining, punctate, striate or rugose, often reticulate.

Malpighian tubules 4 and cryptonephric in species examined (*antarcticus*, *smithii*).

Gyne

Size distinctly larger than conspecific worker. Winged forms often present, but as in *Monomorium* there is a strong tendency for worker–gyne intergrades (see Wilson 1953*a*; p. 149, Fig. 9). Wings of the *Solenopsis* type, venation usually well developed, though veins often partially desclerotized (Figs. 33–36); *Rs* never meeting *R* (radial cell open); *M* branching off *Rs*+*M* at or before *r*; *m-cu* present or absent, so that cell *M*1 may be open or closed; *cu-a* always meeting *A* approximately at a right angle, and *A* continued past this point. Hindwing venation reduced, desclerotized.

Male

Size subequal to smaller than conspecific gyne. Clypeus not carinate, strongly convex; median seta present. Mandibles with 1+3 dental formula, opposable. Palpal formula as for gyne. Antennae 13-segmented; scape rather long and cylindrical, pedicellus short and cylindrical, funicular segments long and cylindrical. Mesonotum with parapsidal furrows faint to distinct; notauli heavily impressed to faint, sometimes obscured by sculpturation of the dorsum. Postpetiole rather broadly attached to gaster. Wing venation as for gyne. Genitalia never fully enclosed, usually partly exserted; parameres much thickened, often produced and hanging pendant from the tip of the abdomen.

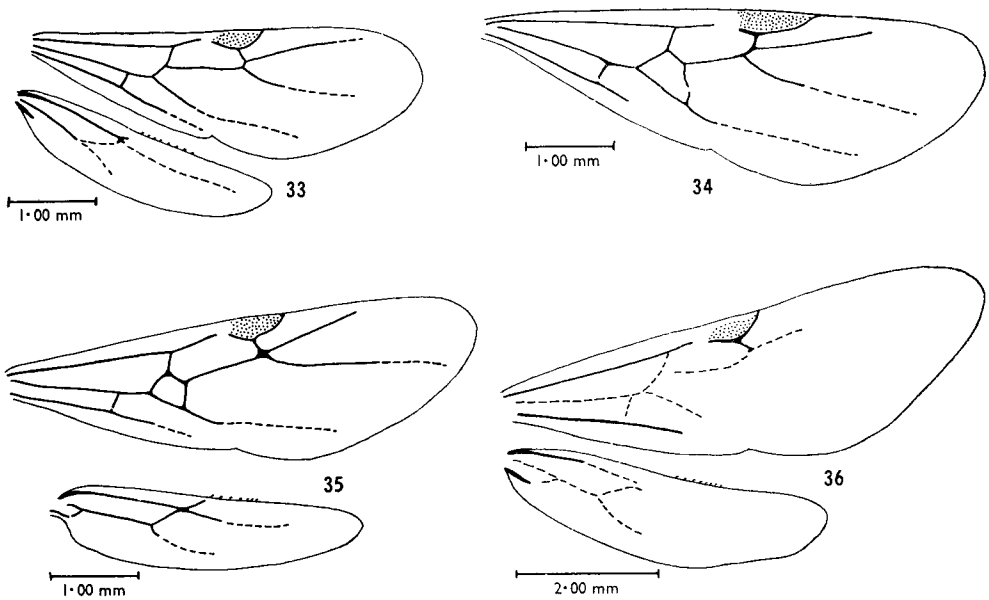
Comments

This genus encompasses the Australasian ants formerly loosely referred to as *Notomyrmex*; unfortunately, *Chelaner* is the senior synonym, and must replace the better known name. Not included are the South American species formerly included in the subgenus *Notomyrmex* by authors, most recently by Kusnezov, who assigned the group full generic status; these species are related to *Megalomyrmex*, and form a

new genus *Nothidris* (q.v.). Wheeler's ill-defined subgenus *Protholcomyrmex* and McAreavey's *Schizopelta* are also clear synonyms of *Chelaner*.

Accounts of the biology of this group are scanty. Most species are probably scavengers, but some (e.g. *falcatus*) have the clypeal teeth modified as though for seed-collecting. Brown (personal communication) found *C. rothsteini*, *C. cinctus*, and *C. whitei* actively collecting and storing seeds.

The group is present throughout Australia, and extends into New Guinea, New Caledonia, and New Zealand.



Figs. 33–36.—*Chelaner*: 33, *C. rubrus*, wing of gyne; 34, *C. antarcticus*, wing of gyne; 35, *C. rubriceps*, wing of gyne; 36, *C. rothsteini*, wing of gyne.

List of Chelaner Species

antarcticus (White), 1848, p. 17. New Zealand
= *Tetramorium nitidum* Fr. Smith, 1876, p. 480. Synonymy by Brown (1958, p. 29).
= *Monomorium suteri* Forel, 1892*a*, p. 340. Synonymy by Brown (1958, p. 29).
aper (Emery), 1914*b*, p. 409. (*Monomorium*). New Caledonia
armstrongi (McAreavey), 1949, p. 10. (*Monomorium*). E. Australia
bicornis (Forel), 1907*d*, p. 276. (*Monomorium*). W. Australia
bogischi (Wheeler), 1917, p. 112. (var. of *Monomorium subapterum*). S. Australia
centralis (Forel), 1910*e*, p. 28. (*Monomorium*). Central Australia
cinctus (Wheeler), 1917, p. 113. (var. of *Monomorium rubriceps*). S.E. Australia
croceiventris (Emery), 1914*b*, p. 407. (*Monomorium*). New Caledonia
doddi (Santschi), 1919*a*, p. 328. (subsp. of *Monomorium rothsteini*). N.E. Australia
dubius (Emery), 1914*b*, p. 410. (var. of *Monomorium aper*). New Caledonia
edentatus (Emery), 1897*a*, p. 562. (*Monomorium*). New Guinea
extreminigrus (Forel), 1915*b*, p. 73. (subsp. of *Monomorium rubriceps*). E. Australia
falcatus (McAreavey), 1949, p. 15. (*Schizopelta*). E. Australia
flavipes (Clark), 1938, p. 369. (*Monomorium*). S. Australia
forcipatus (Emery), 1914*b*, p. 410. (*Monomorium*). New Caledonia

foreli (Viehmeyer), 1914*b*, p. 32. (*Monomorium*). S. Australia
gilberti (Forel), 1902*b*, p. 440. (*Monomorium*). N.E. Australia
howensis (Wheeler), 1927*a*, p. 138. (*Monomorium*). Lord Howe I.
humilior (Forel), 1910*e*, p. 27. (var. of *Monomorium rothsteini*). Central Australia
insolescens (Wheeler), 1934, p. 145. (*Monomorium*). W. Australia
insularus (Clark), 1938, p. 368. (*Monomorium*). S. Australia
kiliani (Forel), 1902*b*, p. 441. (*Monomorium*). E. Australia
leae Forel, 1913*a*, p. 185. (*Monomorium*). Tasmania
= *Monomorium* (*Notomyrmex*) *hemiphaeum* Clark, 1934, p. 61. Syn. nov.
leda (Forel), 1915*b*, p. 71. (var. of *Monomorium rothsteini*). N. Australia
longiceps (Wheeler), 1934, p. 146. (*Monomorium*). W. Australia
longipes (Emery), 1914*b*, p. 411. (*Monomorium*). New Caledonia
macareaveyi, nom. nov. pro *Monomorium* (*Holcomyrmex*) *niger* McAreavey, 1949, p. 12, nec Forel, 1902*a*, p. 220. E. Australia
mediorubrus (Forel), 1915*b*, p. 72. (var. of *Monomorium gilberti*). N.E. Australia
melleus (Emery), 1914*b*, p. 408. (*Monomorium*). New Caledonia
nigriventris (Forel), 1910*e*, p. 29. (var. of *Monomorium sordidum*). E. Australia
obscurellus (Viehmeyer), 1925, p. 27. (var. of *Monomorium kiliani*). E. Australia
occidaneus (Crawley), 1922*a*, p. 447. (*Monomorium*). W. Australia
rapaensis (Wheeler), 1936*a*, p. 10. (*Monomorium*). Austral Is.
rothsteini (Forel), 1902*b*, p. 444. (*Monomorium*). E. Australia
rubrus (Forel), 1915*b*, p. 72. (var. of *Monomorium rubriceps*). E. Australia
rubiceps (Mayr), 1876, p. 101. (*Monomorium*). E. Australia
sanguinolentus (Wheeler), 1927*a*, p. 135. (*Monomorium*). Lord Howe I.
sculpturatus (Clark), 1934, p. 59. (*Monomorium*). S.E. Australia
smithii (Forel), 1892*a*, p. 342. (*Monomorium*). New Zealand
sordidus (Forel), 1902*b*, p. 443. (*Monomorium*). E. Australia
squamigena (Viehmeyer), 1925, p. 28. (var. of *Monomorium rothsteini*). E. Australia
subapterus (Wheeler), 1917, p. 112. (*Monomorium*). W. Australia
tambourinensis (Forel), 1915*b*, p. 71. (var. of *Monomorium kiliani*). E. Australia
tostum (Wheeler), 1915*b*, p. 806. (var. of *Monomorium rothsteini*). S. Australia
tricolor (Emery), 1914*b*, 407. (*Monomorium*). New Caledonia
turneri (Forel), 1910*e*, p. 26. (*Vollenhovia*). E. Australia
whitei (Wheeler), 1915*b*, p. 807. (*Monomorium*). S. Australia

Genus ANILLOMYRMA, status nov.

= *Monomorium* subgenus *Anillomyrma* Emery, 1913*a*, p. 261. Type *Monomorium decamerum* Emery, monobasic.

Diagnosis

Blind, monomorphic, colourless workers; antennae 10-segmented, 3-segmented club comparatively large, ring segments very small. Postpetiole attached high, almost dorsal on the gaster.

Worker

TL 1·7–1·8 mm., monomorphic. Eyes completely lacking. Antennae 10-segmented with a relatively very large 3-segmented club, ring segments very small. Palpal formula 2,1(1*s*2, 1*p*2). Dental formula 1+3, trulleum small and closed; blades crossing at tips and flexed inwards towards the alitrunk at the tips. Labrum membranous, distal margin slightly concave. Clypeus not bicarinate, swollen medially; median seta directed downwards towards tips of mandibles; carinal setae directed forward, slightly downcurved and converging; first paracarinal setae long, slightly

incurving, directed forward of clypeus, not crossing. Promesonotal suture distinct on pleura to height of spiracle; metanotal groove distinct, complete, but not impressed on the dorsum; entire notum and propodeum flat above, pinched in somewhat in front of the propodeum. Propodeum rounded, spiracle round and directed posteriorly; metapleural gland and inferior propodeal plates only moderately well developed. Petiole strongly pedunculate, lacking a subpetiolar process; of the subpostpetiolar processes, anterior process lacking and posterior process moderately well developed. Postpetiole attached high on the anterior face of the gaster, almost on the dorsum.

Head and dorsum covered with relatively coarse punctures; propodeum, petiole, postpetiole and gaster smooth, shining. Gyne and male unknown.

LIST OF ANILLOMYRMA SPECIES

continentis (Wheeler), 1927*b*, p. 96. (subspecies of *decamera*). S.E. Asia
decamera (Emery), 1901*b*, p. 117. (*Monomorium*). Ceylon

Genus DIPLOMORIUM Mayr

> *Diplomorium* Mayr, 1901, p. 16. Type *Diplomorium longipenne* Mayr, monobasic.
> *Diplomorium* subgenus *Bondroitia* Forel, 1911*b*, p. 398. Type *Diplomorium lujae* Forel, monobasic. Syn. nov.

Diagnosis

Clypeus not or very weakly bicarinate; median seta present. Palpal formula 2,2 in worker, 2,2(1*s*2*c*3, 1*s*2) in gyne. Antennae 11-segmented with 3-segmented club.

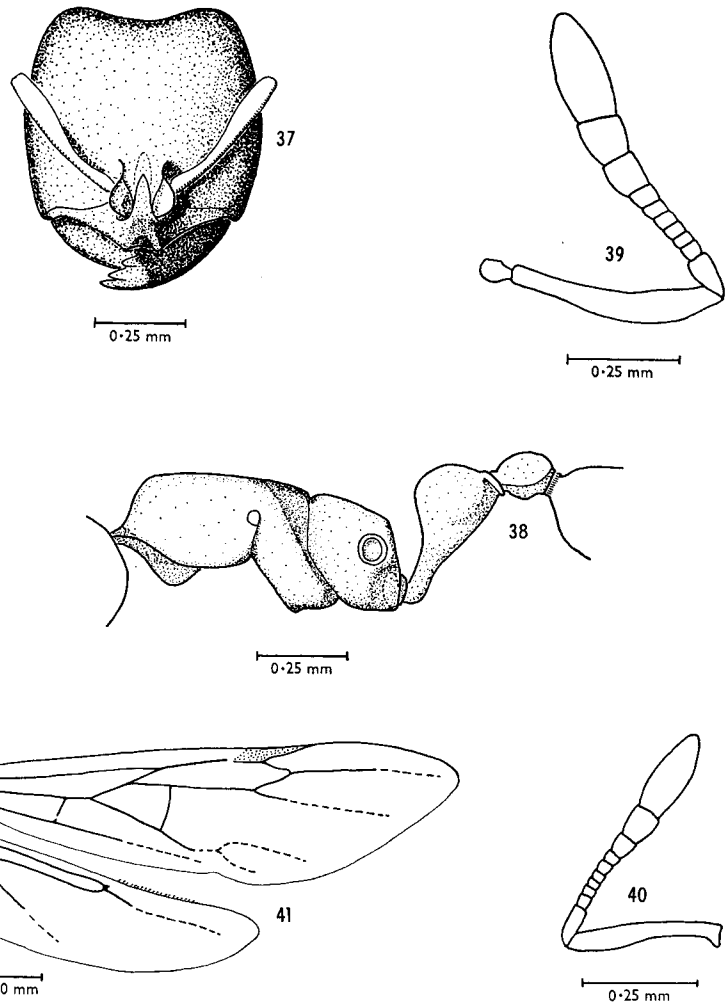
Worker

TL rather small, 1·9–2·8 mm, monomorphic, with some size variation. Eyes moderately developed to absent. Antennae 11-segmented (Emery (1921) states that some workers have 10-segmented antennae); club 3-segmented, antepenultimate segment may be quite small but still larger than ring segments (see Figs. 39, 40). Palpal formula 2,2; dental formula 1+3, last tooth may be quite small. Trulleum closed, may be partially occluded; canthellus complete and broadly fused to basal margin, or secondarily absorbed in the process of occlusion of the trulleum. Labrum deeply cleft.

Median area of clypeus strongly swollen, sharply raised above lateral areas, suggesting weak carinae; in *lujae* a weak median sulcus is developed at the anterior margin only (intermediate to *Syllophopsis*?), and in this species the frontal carinae are convergent anteriorly (Fig. 37). Median, carinal and strong first paracarinal setae present, with 2 or 3 further paracarinal and 1 to 3 intercarinal setae.

Promesonotal suture extending only to the spiracle; metanotal groove strongly impressed dorsally; the anteriorly broad notum narrows sharply and is pinched in at the metanotal groove. Propodeum rounded; spiracle round, directed posteriorly, and very large in *lujae*. Declivity slightly concave, propodeal carinae marked and continuous with the small but distinct inferior propodeal plates. Metapleural glands small in *lujae*, moderately well developed in *longipenne*.

Petiole strongly pedunculate; subpetiolar process represented by a weak ridge (*longipenne*) or absent; anterior subpostpetiolar process a pronounced, transverse rounded ridge, tapering back to a rather weak posterior ridge (Fig. 38).



Figs. 37–41.—*Diplomorium*: 37, *D. lujae*, full-face dorsal view of head of worker; 38, *D. lujae*, lateral view of worker; 39, *D. lujae*, antenna of worker; 40, *D. longipenne*, antenna of worker; 41, *D. lujae*, wing of gyne.

Smooth and shining except for reticulate punctures on the mesokatepisternum in *longipenne*, and a few weak striae above the frontal carinae, and on the genae above the lateral clypeus.

Gyne

Size much larger than worker, TL 9–10 mm. Palpal formula 2,2(1*s*2*c*3, 1*s*2), leading to a very long apical maxillary palpal segment. Dental formula reduced in

lujae (1+2), trulleum more occluded than in worker. Labrum with a median lobe on the distal margin that overlies the cleft distal margin. Propodeum rounded; spiracle D-shaped, directed posteriorly and slightly ventrad. Postpetiole in *longipenne* expanded posteriorly and very broadly attached to the gaster; petiole and postpetiole missing in the one *lujae* gyne seen (but Emery (1921) notes that *lujae* is not "subgenerically" distinct from *longipenne*). Wings of the *Solenopsis* type, forewing with radial cell open; *M* branching from *Rs*+*M* before *r*; cell *M*1 closed; *A* continued past *cu-a*, which meets it at a high angle. Venation of hindwing well developed (Fig. 41).

Male (*based on* D. lujae *only*)

Antennae of 12 segments only; scape similar in length to individual funicular segments, pedicellus short and not swollen; second funicular segment nearly twice the length of the following ones since it is a fusion segment. Median seta strongly developed. Metanotum without notauli, parapsidal furrows faint. Postpetiole broadly attached. Genitalia strongly exserted; parameres long, narrow, covered with long setae, pendant.

Comments

The gynes of the two species examined are similar, most of the differences between these species are those also seen in the workers. I am of the opinion that *lujae* is congeneric with *longipenne*, although *lujae* is more modified than *longipenne*. More information on the biology of these interesting species would be of great value. *D. longipenne* was originally collected by Dr. Hans Brauns in a nest of *Messor braunsi* in Cape Province (Union of South Africa). No other biological data is recorded in the literature.

The status of *coecum* is rather dubious; the type locality, Geneva (Switzerland), is too far from the range of the other species to be entirely credible. The remaining species are African.

LIST OF DIPLOMORIUM SPECIES

coecum (Forel), 1911*a*, p. 299. (*Monomorium*). Switzerland
cotterelli Donisthorpe, 1942*b*, p. 217. W. Africa
longipenne Mayr, 1901, p. 18. S. Africa
lujae Forel, 1909*b*, p. 72. Congo
saharense Santschi, 1923*b*, p. 278. Sahara

Genus SYLLOPHOPSIS Santschi

> *Monomorium* subgenus *Syllophopsis* Santschi, 1915*a*, p. 259. Type *Monomorium modestum* Santschi, monobasic.

I have not seen any material referable to this genus; however, W. L. Brown (personal communication) has reviewed the relevant types, and he considers that *S. modestum* is probably related to *Diplomorium*, a conclusion consistent with the available descriptions. Until the trophi of *modesta* have been examined, however, it is prudent to retain *Syllophopsis* as a separate genus. Differing from the characterization for *Diplomorium* only in that the antennae are stated to be 12-segmented with a 3-segmented club.

LIST OF SYLLOPHOPSIS SPECIES

arnoldi Santschi, 1921*b*, p. 120. Natal
= *Monomorium* (*Syllophopsis*) *jonesi* Arnold, 1952, p. 465, objective synonym, name unnecessarily proposed for *Syllopsis* (!) *arnoldi* Santschi, op. cit. p. 120. Syn. nov.
cryptobia Santschi, 1921*b*, p. 119. Congo
elgonensis Santschi, 1935*a*, p. 267. Kenya
modesta (Santschi), 1914*c*, p. 17. (*Monomorium*). Natal
transwaalensis (Emery), 1921, p. 175. (Nom. substit. pro *Monomorium modestum* var. *boerorum* Santschi, 1915*a*, p. 260, nec. Forel, 1910*a*, p. 442). (*Monomorium*). S. Africa
= *Monomorium* (*Syllophopsis*) *modestum* var. *smutsi* Wheeler, 1922*d*, p. 867, objective synonym, name unnecessarily proposed for *Monomorium modestum* var. *boerorum* Santschi, loc. cit. Syn. nov.

Genus HAGIOXENUS Forel

> *Hagioxenus* Forel, 1910*a*, p. 8. Type *Hagioxenus schmitzi* Forel, monobasic.

No material referable to this genus has been seen by me. The available descriptions do not allow even a calculated guess at its correct placement, so I have left it with the *Monomorium* genus group for the present. W. L. Brown (personal communication) notes that *H. schmitzi* is a "nondescript thing, probably near *Monomorium*" and confirms some points of Forel's original characterization. He adds that *H. schmitzi* has a couple of punctures near the anterior border of the clypeus, and that the petiole is deeply convex and compressed below. Brown also notes that "*Rhoptromyrmex mayri* Forel seems somewhat similar to *schmitzi*, but is more hairy and has other minor differences". See Brown (1964) for formalization of the *Hagioxenus mayri* combination. *H. schmitzi* was originally said to have been taken in a nest of *Tapinoma erraticum*, and is assumed to be parasitic. The type locality is Jerusalem. The species *mayri* came from a nest of *Pheidole latinoda* taken in India.

LIST OF HAGIOXENUS SPECIES

mayri (Forel), 1912*d*, p. 57 (note). (*Rhoptromyrmex*). India
schmitzi Forel, 1910*a*, p. 8. Israel

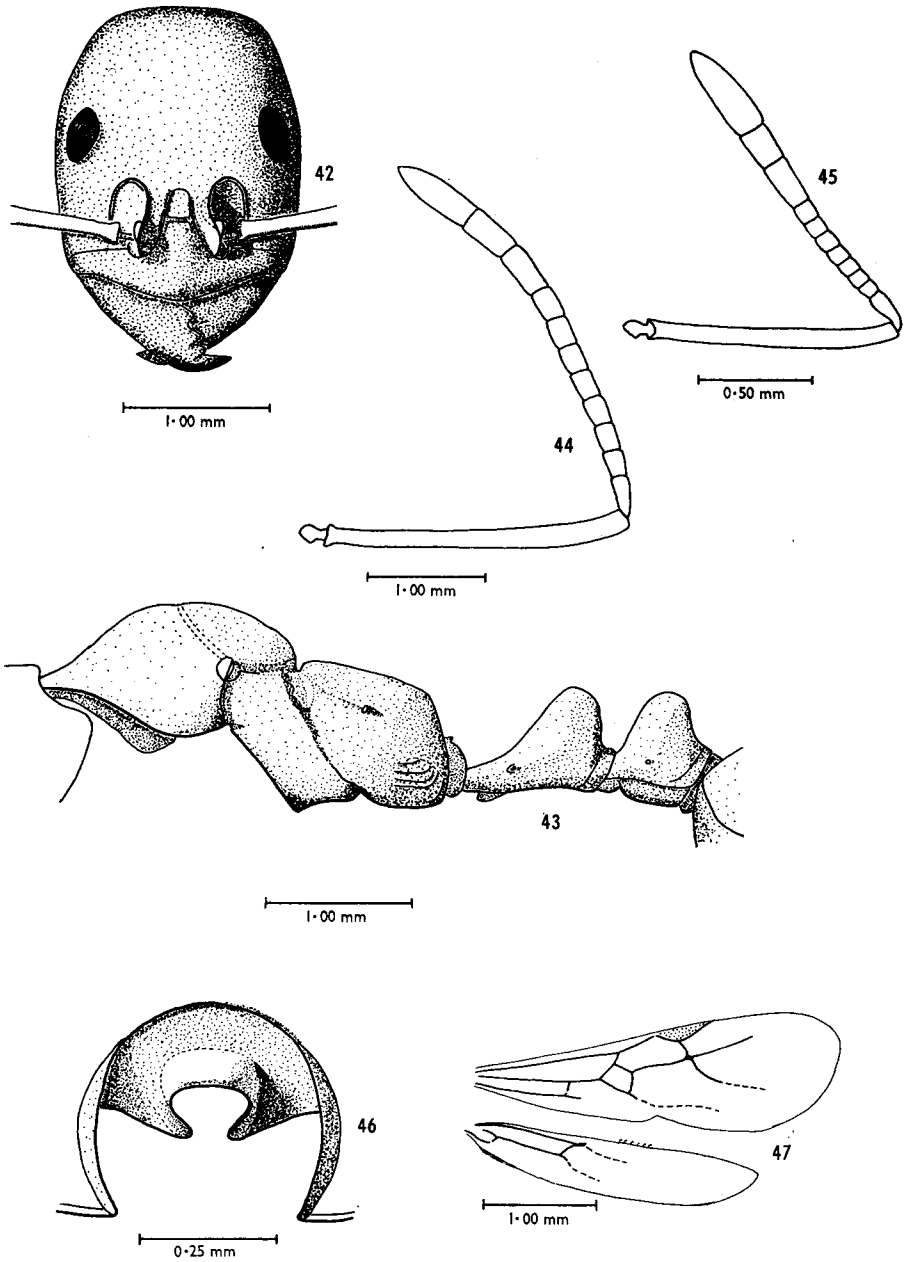
(*b*) Megalomyrmex *Genus Group*

Diagnosis

Antennae generally 12- to 10-segmented, more uncommonly 10- to 7-segmented, always clubbed, though number of segments involved is variable. Clypeus generally with median area clearly defined, either swollen and smooth, carinate, or the entire clypeus shield-like (*Allomerus*). Median seta present or absent. Anterior tentorial pits about halfway between the antennal sockets and lateral margins of clypeus. Petiole distinctly pedunculate. Venation of the *Solenopsis* type, more or less strongly modified.

Genus MEGALOMYRMEX Forel

> *Megalomyrmex* Forel, 1884, p. 371. Type *Megalomyrmex leoninus* Forel, monobasic.
> *Megalomyrmex* subgenus *Wheelerimyrmex* Mann, 1922, p. 29. Type *Megalomyrmex silvestrii* Wheeler, monobasic. Syn. nov.
> *Megalomyrmex* subgenus *Cepobroticus* Wheeler, 1925*b*, p. 161, 168. Type *Megalomyrmex* (*Cepobroticus*) *symmetochus* Wheeler, monobasic. Syn. nov.



Figs. 42–47.—*Megalomyrmex*: 42, *M. duckei*, full-face dorsal view of head of worker; 43, *M. duckei*, lateral view of worker; 44, *M. bituberculatus*, antenna of worker; 45, *M. brasiliensis*, antenna of worker; 46, *M. bituberculatus*, posterior view of propodeum showing levator foramen and ridge connecting inferior propodeal plates above foramen; 47, *M. goeldii*, wings of gyne.

Diagnosis

Antennae 12-segmented, with a 3-segmented club, the segments of which are longer but not necessarily thicker than those preceding the club. Palpal formula 4,3 or 3,2. Clypeus usually swollen and smooth, may be weakly bicarinate. Propodeum rounded, never sharply angulate. Inferior propodeal plates connected above the foramen by a fine curved carina. Posterior end of petiole collar-like. Wing venation of the *Solenopsis* type, *M* separating from *Rs*+*M* at *r*.

Worker

TL 2·3–10 mm, monomorphic, size variation within species slight. Eyes well developed. Antennae 12-segmented; in the *goeldii* group (Fig. 44) the club is 3-segmented, and is demarcated only by these segments being longer and slightly thicker than the preceding; in the *modestus* group (Fig. 45) there is a distinct 3-segmented club, although *M. symmetochus* tends towards the *goeldii* type. Palpal formula 4,3 in the *goeldii* group, 3,2 in the *modestus* group. Dental formula basically 1+4, as in the *goeldii* group, but strongly modified in the *modestus* group, by reduction of the size of the subapical teeth, or by proliferation of up to 15 subapical teeth; canthellus not meeting the basal margin; trulleum distinct, open; mandalus linear, close to ginglymus. Labrum more or less distinctly cleft to bilobed, more distinctly cleft in the *goeldii* group.

Clypeus usually swollen, bearing a slight median tooth in the *goeldii* group (Fig. 43), but this is more variable in the *modestus* group, where some species have a bicarinate clypeus (best developed in *M. drifti*). A median clypeal seta is fairly consistently developed in the smaller species, but in the larger species some individuals may lack this seta. Paracarinal setae well developed.

Promesonotal suture distinct in the larger species of the *goeldii* group (Fig. 43), faint in the smaller members of this group and in the *modestus* group. Metanotal groove well developed, deeply impressed dorsally. In *M. goeldii* and *M. iheringi* the suture between the metepimeron and the propodeum is also quite distinct. Propodeum gently to quite sharply rounded, but never angulate; spiracle ovoid and somewhat constricted in the larger species, simple and rounded in the smaller ones. Inferior propodeal plates well developed, connected above the foramen by a distinct, curved carina (Fig. 46). Levator foramen narrowly open below. *M. bituberculatus* bears elongate mesosternal and metasternal processes, but such processes have not been seen in other species examined.

Petiole strongly pedunculate, nodes of the petiole and postpetiole high and rounded. Posteriorly, the petiole terminates in a distinct, rounded collar, within which the postpetiole articulates. Subpetiolar process small, simple and dentiform, merging into a slight ridge in the *goeldii* group; in the *modestus* group, this tooth-like anterior end of the process may be double or recurved posteriorly, and terminates in a distinct ridge. Subpostpetiolar processes variable between species.

Malpighian tubules 5 in a series of an unidentified *modestus* group species (Benjamin Constant, Amazonas, Brazil, W. L. Brown accession number M-72); in a

single live specimen of *Megalomyrmex* sp. from Chile, there were 5 tubules, all of which were loosely attached to the rectum at their tips.

Sculpture variable, but usually predominantly smooth and shining.

Gyne

Size similar to or slightly larger than worker, and generally closely resembling the worker except in possessing gyne alitruncal segmentation. Wings of the *Solenopsis* type; *M* separating from *Rs*+*M* at or just after *r*; *m-cu* present; *cu-a* meeting *A* approximately at a right angle, and *A* continued past this junction. Hindwing venation reduced (Fig. 47).

Male

Size similar to that of worker. Clypeus strongly convex; mandibles with well-developed teeth, fully opposable. Antennae 13-segmented; scape long and cylindrical, equal in length to the first 2 funicular segments after the pedicellus; pedicellus short, no wider than the scape or funicular segments; funicular segments all similar, very long and narrow. Mesonotum lacking notauli, parapsidal furrows distinct to faint. Wings as for gyne. Petiole pedunculate; nodes of petiole and postpetiole rather low, almost obsolete in the *goeldii* group, more normally developed in the *modestus* group. Genitalia fully retractile, but often partially exserted; parameres somewhat thickened, with rounded ends.

Comments

This genus is distributed through Central American and the wetter tropical part of South America, but reaches its greatest development in the Amazon basin. One species, *bicolor*, is found in the Chilean Andes, where the nests are made under rocks.

The traditional subgenera cannot be validly maintained at the generic level; there is some reality, however, to the species groups suggested earlier. The *goeldii* group are larger, free-living species which forage in the open, and are most abundant in the Amazon Basin (W. L. Brown, personal communication); these species have a more or less indefinitely clubbed antenna, and the palpal formula is 4,3. The *modestus* group species are generally smaller, and some of them may have more or less intimate lestobiotic relations with other ant species and perhaps with termites (see below); in these species, the antenna is generally more definitely clubbed, and the palpal formula is usually 3,2.

Mann (1916) notes that *M. bituberculatus* tends membracids on shrubs in the rainforest around Manaus (Amazonas). Wheeler (1925*b*) gives copious notes on the relationship between *M. symmetochus* and *Sericomyrmex amabilis* (Attini) on Barro Colorado I. (Canal Zone, Panama); the colonies of *symmetochus* usually contained around 40–50 workers with a single gyne, and never exceeded 75 workers. The larvae were scattered in small groups, each attended by a few workers, in the crypts of the fungus gardens, often with *amabilis* larvae. Wheeler observed the *symmetochus* workers eating the fungal mycelia, but their larvae were never fed this material, and were presumably fed by regurgitation.

W. L. Brown (personal communication) confirmed the association of *symmetochus* with *Sericomyrmex* on Barro Colorado, where he also found *M. silvestrii* in

a cavity measuring *c.* 1·5 × 1 cm in clay soil, which also contained termite galleries. He observed *M. wheeleri* foraging in a clearing in the rainforest on Barro Colorado, and found *M. modestus* in hollow twigs on the ground at Cerro Campana, Panama. In Amazonas, Brown found *M. goeldii* under logs and foraging in the open; other *goeldii* group species were commonly observed foraging in the open and on shrubs in the forest around Belém do Pará, Manaus, and Benjamin Constant, Amazonas.

LIST OF MEGALOMYRMEX SPECIES

balzani Emery, 1894*b*, p. 153. Bolivia
bicolor Ettershank, 1965, p. 55. Chile
bituberculatus (Fabricius), 1798, p. 280. (*Formica*). Amazonia
brasiliensis Borgmeier, 1930, p. 34. Brazil
drifti Kempf, 1961, p. 504. Surinam
duckei Forel, 1912*a*, p. 13. Brazil
emeryi Forel, 1904*a*, p. 174. Surinam
foreli Emery, 1888, p. 53. Costa Rica
goeldii Forel, 1912*a*, p. 14. Brazil
iheringi Forel, 1911*a*, p. 304. Brazil
incisus M. R. Smith, 1947, p. 102. Panama
langi Wheeler, 1925*b*, p. 31. (var. of *sjoestedti*). Br. Guiana
latreillei Emery, 1890, p. 47. Peru
leoninus Forel, 1884, p. 372. Colombia
misionensis Santschi, 1936*a*, p. 405. (var. of *brasiliensis*). N. Argentina
modestus Emery, 1896, p. 94. Central America
myops Santschi, 1925*b*, p. 237. Brazil
nasutus Forel, 1912*a*, p. 13. (subsp. of *leoninus*). Brazil
pusillus Forel, 1912*a*, p. 15. Brazil
silvestrii Wheeler, 1909, p. 236. Mexico
sjoestedti Wheeler, 1925*b*, p. 30. Peru
staudingeri Emery, 1890, p. 47. Peru
symmetochus Wheeler, 1925*b*, p. 161. Panama
wallacei Mann, 1916, p. 445. Brazil
wheeleri Weber, 1940, p. 425. Panama

Genus NOTHIDRIS, gen. nov.

< *Monomorium* subgenus *Notomyrmex* Emery, 1915*a*, p. 190. (Neotropical species group only).

Diagnosis

Possessing the general habitus of the Australasian genus *Chelaner* (q.v.), from which it may readily be distinguished by:

(1) The palpal formula in *Nothidris* is 4,3, 3,2 or 2,2(1*s*2*p*3, 1*s*2); in *Chelaner* this is 2,3 or more rarely 2,2(1*s*2, 1*s*2*c*3).

(2) The anterior tentorial pits in *Nothidris* are about halfway between the antennal sockets and the lateral margins of the clypeus; in *Chelaner*, the anterior pits are situated very near the antennal sockets.

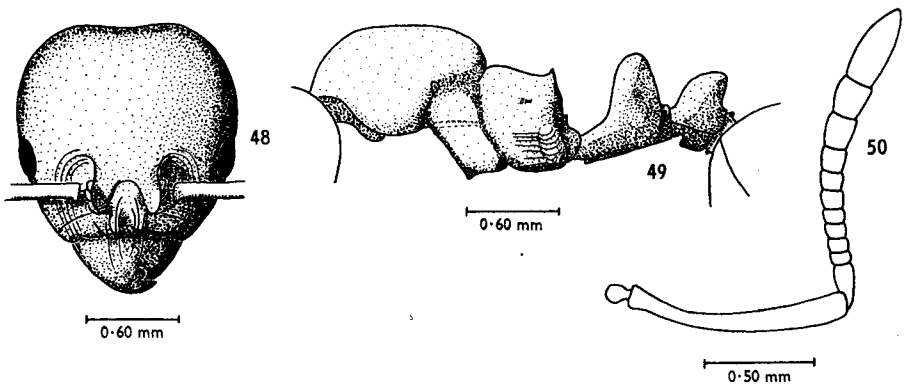
Distinguished from *Megalomyrmex*, to which this genus is obviously related, by its sharply angulate to distinctly dentate propodeum, and by its bicarinate clypeus, resembling that of some *Chelaner* species (only *M. drifti* has a strongly bicarinate

clypeus, and in this species the propodeum is rounded; *M. drifti* is of much smaller size).

Type species *Nothidris latastei* (= *Monomorium latastei* Emery, 1895*c*, p. 10) by present designation.

Worker

TL 3·5–7·0 mm, monomorphic, size variation within species small. Eyes well developed. Antennae 12-segmented with a well defined 3-segmented club (Fig. 50). Palpal formula variable, 4,3 in *latastei* to 2, 2(1*s*2*p*3, 1*s*2) in *denticulatus* and *bidentatus*. Dental formula 1+4, mandible of normal form except in *bidentatus*, in which the masticatory margin is modified and the second to fourth subapical teeth are reduced and clustered. Canthellus not meeting the basal margin, trulleum distinct and open except in the modified mandible of *bidentatus*, where both structures are strongly reduced in size. Labrum cleft.



Figs. 48–50.—*Nothidris*: 48, *N. latastei*, full-face dorsal view of head of worker; 49, *N. latastei*, lateral view of worker; 50, *N. latastei*, antenna of worker.

Clypeus bicarinate, strikingly similar to some species of *Chelaner* (Fig. 48). Median clypeal seta and paracarinal setae present.

Promesonotal suture distinct on the pleura to the spiracle, very faintly impressed on the dorsum as in the *modestus* group of *Megalomyrmex*. Metanotal groove distinct to faint, impression on the dorsum deep to slight. Propodeum sharply angulate and slightly produced posteriorly to distinctly dentate (Fig. 49). Propodeal spiracle round. In some species there is a suggestion of a carina connecting the well-developed inferior propodeal plates above the foramen as in *Megalomyrmex*.

Petiole strongly pedunculate, petiole and postpetiole both with high rounded nodes. Subpetiolar process variable, either simple–dentiform or trailing posteriorly into a low ridge; both anterior and posterior subpostpetiolar processes distinct. Posterior end of petiole collar-like as in *Megalomyrmex*.

Smooth, shining, slightly hairy ants, with the meso- and meta-pleurae coarsely rugose and sides of the petiole often sculptured.

Gyne and Male

No material seen. Mayr (1887) describes the gynes of *bidentatus* and *denticulatus*; these are apparently rather like their workers as in *Megalomyrmex*. Kusnezov (1954*c*) found the palpal formula in the males of bidentatus was 3,2.

Comments

This genus has its range in South America generally farther south and at much higher altitudes than the related *Megalomyrmex*, mostly on the slopes of the Chilean and Argentinean Andes and foothills.

Kusnezov (1949, 1959) discusses the two forms found in Argentina, *bidentatus* and *denticulatus*. He records (1949) collections of these two species, which are usually taken together in mixed colonies and usually with *bidentatus* predominating in numbers over *denticulatus*. Kusnezov 1959 reviews the subject again, and concludes that (1) as *bidentatus* has modified mandibles (but not as modified as shown in Kusnezov 1959, Fig. 2), and (2) as *bidentatus* numbers 80–88% of the workers in the mixed collections, then *bidentatus* might be incipiently dulotic on *denticulatus*. However, as actual raiding of *denticulatus* colonies has not been observed, it is safer to assume a parasitic relationship, or an ambiguous association of the type seen in certain North American *Formica* (King and Sallee 1957, and contained references).

LIST OF NOTHIDRIS SPECIES

bidentatus (Mayr), 1887, p. 616. (*Monomorium*). Chile
denticulatus (Mayr), 1887, p. 614. (*Monomorium*). Chile
latastei (Emery), 1895*c*, p. 10. (*Monomorium*). Chile
navarinensis (Forel), 1904*b*, p. 7. (var. of *Monomorium denticulatum*). Patagonia
piceus Emery, 1905, p. 120. (var. of *Monomorium denticulatum*). Chile

Genus TRANOPELTA Mayr

> *Tranopelta* Mayr, 1866*a*, p. 514. Type *Tranopelta gilva* Mayr, monobasic.

Diagnosis

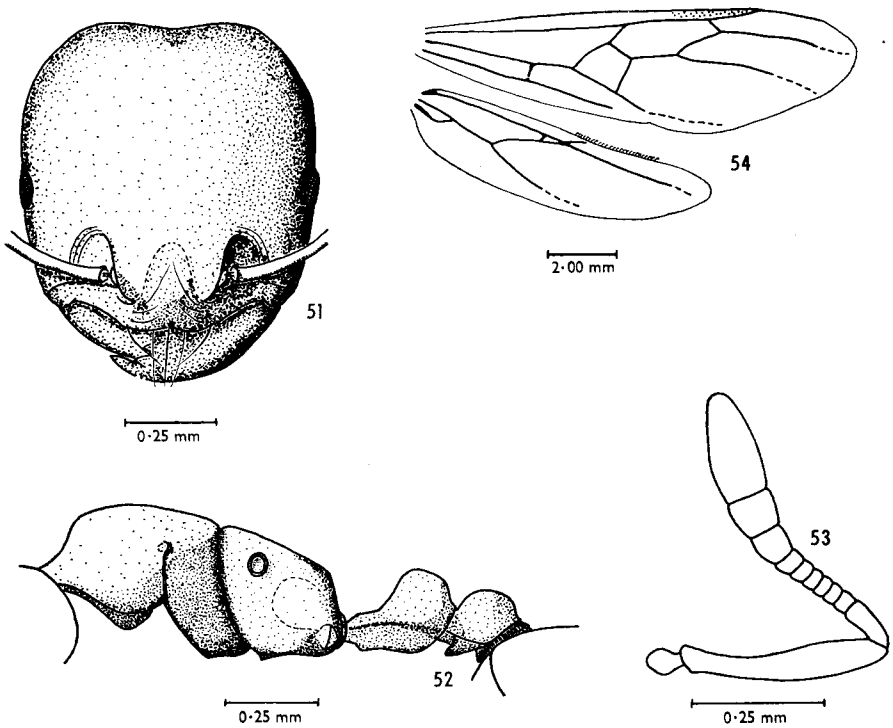
Worker with 11-segmented antennae, club 3-segmented and distinct. Palpal formula 3,2 in most species, but 4,3 in major workers. Posterior end of petiole with sides produced down as distinct carinae which meet in the middle of the posteroventral face; not collar-like. Postpetiole more or less broadly attached to the gaster. Gyne much larger than worker; palpal formula 4,3; wing venation of the *Solenopsis* type, often with adventitious vein stubs on *Rs* and *Rs+M*; postpetiole very broadly attached to the gaster.

Worker

TL 2·3–6·4 mm; monomorphic, but some species exhibiting allometry leading to large-headed major workers which also show some slight differentiation toward gyne alitruncal segmentation. Eyes poorly to moderately developed, 7–22 facets. Antennae 11-segmented with a distinct 3-segmented club (Fig. 53). Palpal formula generally 3,2; but 4,3 in the major worker of *subterranea* (as in gyne). Dental formula 1+3, 1+4, or 1+5; canthellus just meeting the basal margin, trulleum distinct and closed. Labrum cleft, distal edge of lobes straight or rounded.

Clypeus swollen, often with a slight median sulcus, but not clearly bicarinate (Fig. 51). The lateral face of the clypeus, lying below the gena, bears a smooth, shiny area of transparent cuticle, within which an ovoid cavity may be seen. Median seta absent, intercarinal and paracarinal setae present.

Promesonotal suture distinct laterally to the height of the spiracle, faint to distinct dorsally. Metanotal groove clearly defined, deeply impressed on the dorsum. Propodeum gently rounded: its spiracle round to ovoid, partly constricted in the larger species. Inferior propodeal plates sometimes connected above the foramen by a faint carina suggestive of the condition in *Megalomyrmex*. Metapleural gland strikingly well developed (Fig. 52).



Figs. 51–54.—*Tranopelta*: 51, *T. gilva*, full-face dorsal view of head of worker; 52, *T. gilva*, lateral view of worker; 53, *T. gilva*, antenna of worker; 54, *T. gilva*, wing of gyne.

Petiole strongly pedunculate, nodes distinct and rounded. Petiole bearing a dentiform or cultrate subpetiolar process. Posterior end of petiole not collar-like as in *Megalomyrmex*, but sides produced downward as distinct carinae to meet on the posteroventral face of the petiole. Postpetiole with a distinct anterior subpostpetiolar process, posterior process small or absent; postpetiole more or less broadly attached to the prominent anterior articulation of the gaster.

Workers strongly to sparsely hairy; sculpturation variable, from smooth and shining to finely striate.

Gyne

Size much larger than conspecific worker, TL around 12 mm. Antennae 11-segmented with a scarsely differentiated, 3-segmented club. Palpal formula 4,3. Wing venation of the *Solenopsis* type (Fig. 54); adventitious vein stubs on *Rs* and *Rs+M* quite common. Petiole pedunculate and more strongly modelled than in worker; posterior face of postpetiolar node lost due to very broad attachment to the gaster.

Male

Rather smaller than conspecific gyne, but still much larger than worker. Antennae 13-segmented; pedicellus about half length of funicular segments and one third length of scape. Mandibles weak and probably unopposable; dental formula 1+2. Ocelli very prominent, raised on a distinct eminence. Clypeus strongly convex, not inserted between the antennae. Petiole with a distinct longitudinal ridge below, terminating anteriorly in a tooth; postpetiole broadly attached to the gaster as in gyne. Wings as in gyne. Genitalia only partially retractile, prominent; parameres greatly thickened, rounded, enclosing the inner valves and aedeagus.

Comments

This genus is recorded from various localities in Central and South America. Emery (1921) notes that *T. heyeri* was found in the nest of *Eutermes fulviceps*. Wheeler (1922*c*) collected *T. gilva* at Kartabo, British Guiana, in small chambers 30–45 cm below the surface of a *Paraponera clavata* nest, the *gilva* nests being connected by small tunnels to the *Paraponera* nest; he also notes that *T. gilva* has been collected under the bark of living trees, where the workers were tending a coccid, *Ripersia subcorticus* Morrison, and was here apparently independent of other ant species. Wheeler also records the collection of a colony of *T. columbica* at the bottom of a nest of *Mycocepurus smithii* (Attini).

The genus *Tranopeltoides*, founded by Wheeler (1922*c*) on a unique gyne described by Forel at *Tranopelta huberi*, has been shown by Kempf to be a synonym of *Crematogaster* (for full details see Kempf 1960*a*, pp. 173, 175).

LIST OF TRANOPELTA SPECIES

amblyops (Emery), 1894*b*, p. 148. Brazil–Paraguay
columbica Forel, 1912*a*, p. 3. (var. of *heyeri*). Colombia, Brazil
gilva Mayr, 1866*a*, p. 514. Colombia–Central America
heyeri (Forel), 1901*b*, p. 389. Brazil
subterranea (Mann), 1916, p. 444. Brazil

Genus BROWNIDRIS Kusnezov

> *Brownidris* Kusnezov, 1957, p. 270. Type *Brownidris argentinus* Kusnezov, monobasic.

Diagnosis

Worker with the characters of *Tranopelta* (q.v.). Gyne with the characters of *Tranopelta*, but with a floating cross-vein arising from the posterior side of *Rs* (see Fig. 55); gaster lacking the dense pubescence of *Tranopelta* gynes. Colour of workers yellow, of gynes yellow and brown bicolorous.

Worker

Indistinguishable from those of *Tranopelta.*

Gyne

Generally with the characters of the gynes of *Tranopelta*, but somewhat smaller; the posterior 3 mandibular teeth are more reduced, the frontal carinae are better developed, lamellate and more diverging, and the ocelli less prominent than in *Tranopelta.* The propodeum is armed with a pair of small to stout teeth. Wings with a floating cross-vein, curving apicad on the posterior side of *Rs* (see Fig. 55). Gaster smooth, shining, with sparse long setae only, in strong contrast to the densely pubescent, dull gaster of *Tranopelta.*

Male

Only one male assigned to this genus. This specimen, included in the type series of *B. argentinus* by Kusnezov, was taken in 1947 at Trancas, Province of Tucumán, Argentina, at least 600 miles from Loreto, Province of Misiones, Argentine,

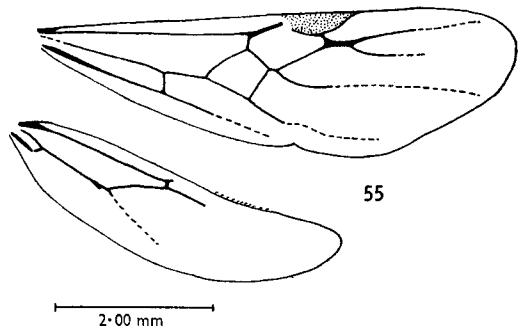


Fig. 55.—*Brownidris*: Wing of gyne of *B. argentinus.*

where the workers and gyne of the type series were collected in 1922–23; the unique gyne of *B. bolivianus* was collected in Santa Cruz, Bolivia, in 1958. Under the circumstances, the association must be viewed with some doubt.

The unique male has a wing venation similar to the *B. argentinus* gyne, but somewhat foreshortened. It is black in colour, the dorsum of the alitrunk is densely striolate–punctulate, and the ocelli are not large and prominent; otherwise it resembles the males of *Tranopelta* in its general characters, although it is somewhat smaller than the *Tranopelta* males seen. The alitruncal dorsum of *T. amblyops* is lightly striolate–punctulate, but this species, like the other males of *Tranopelta*, is light brown in colour. Parapsidal furrows present in both genera, but inconspicuous in *Brownidris* and hidden by the colour and sculpturation of the dorsum.

LIST OF BROWNIDRIS SPECIES

argentinus Kusnezov, 1957, p. 276. Argentina
bolivianus Kusnezov, 1962, p. 155. Bolivia
tucumanus Kusnezov, 1958, p. 190. (nomen nudum)

Genus ALLOMERUS Mayr

> *Allomerus* Mayr, 1877*b*, p. 873. Type *Allomerus decemarticulatus* Mayr, by designation of Wheeler (1911).

Diagnosis

Worker with antennae 7- to 10-segmented, with a distinctive 3-segmented club in which each segment is constricted proximally into a distinct neck (see Fig. 58). Clypeus gently rounded and shield-like, anterior margin downflexed into a distinct arc. Gyne with 10-segmented antennae, club as in worker. Wing venation reduced from *Megalomyrmex* pattern.

Worker

TL about 2·5 mm, size variation slight. Eyes quite well developed. Antennae 7- to 10-segmented, with a distinctive 3-segmented club in which the proximal end of each segment is abruptly and strongly constricted into a distinct neck (Fig. 58). Palpal formula 3,2. Dental formula 1+3, the masticatory border continuing after the last tooth for a short distance before meeting the basal border at a sharp angle. Labrum cleft, each lobe with a straight distal edge.

Clypeus gently rounded, shield-like, with the anterior margin strongly downflexed, forming a distinct arc inserted between the mandibles; clypeus only extending weakly between the frontal carinae, which are, however, widely spaced (Fig. 56). Lateral face of clypeus below the gena bearing a structure similar to that described for *Tranopelta* (q.v.). Median seta present, other regular setae either reduced or absent.

Promesonotal suture distinct to level of spiracle only. Metanotal groove distinct laterally, not impressed dorsally, although its position is clearly indicated where the strongly convex dorsum meets the propodeum almost at right angles. Propodeum rounded, its spiracle round.

Petiole elongate, but not obviously pedunculate, since the dorsum rises more or less directly from the anterior end to the top of the node; subpetiolar process a rather weak longitudinal ridge. Posterior end of petiole having the same form as in *Tranopelta*. Postpetiole rounded above, anterior and posterior subpostpetiolar processes well developed.

Rather smooth and shining ants, usually with meso- and meta-pleura and sides of petiole finely striate or reticulate-punctate; entire body covered with fine decumbent hairs, sparsely but evenly distributed, and a few longer, erect setae.

Gyne

Much larger than worker, but possessing the same general characters. Wing venation modified from that of *Megalomyrmex*, i.e. *M* diverging from *Rs*+*M* at or immediately after its junction with 1*r*, and a partial 2*r* often present (as in Fig. 61); *m-cu* absent. The junction of *cu-a* with *A* may occur in three ways:

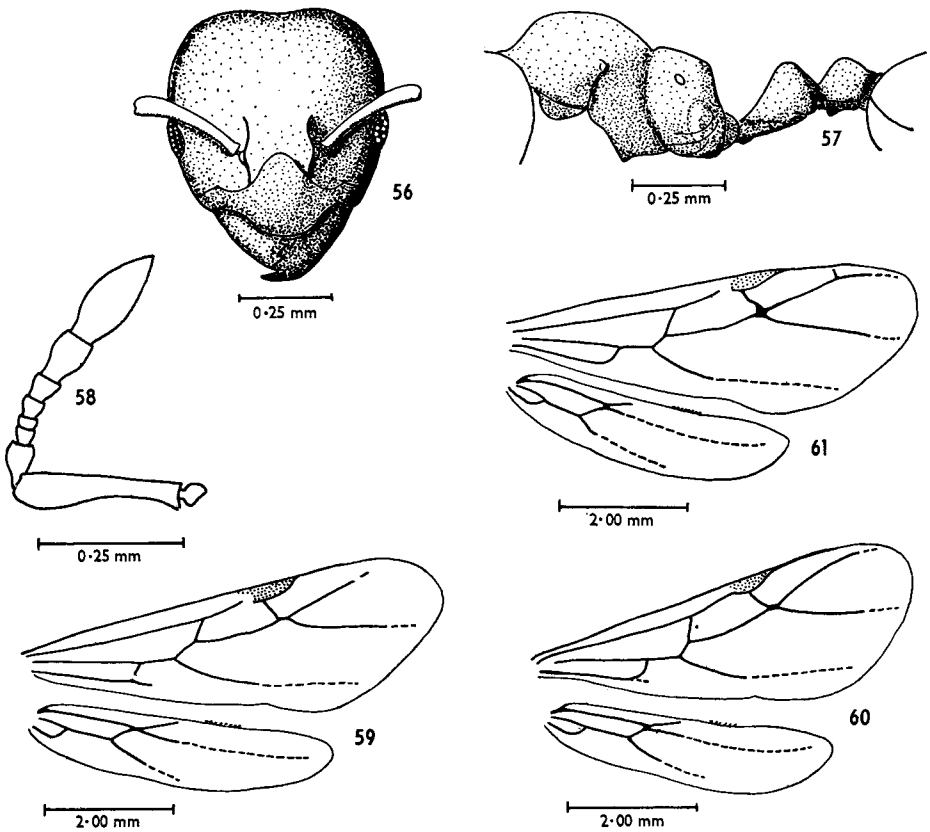
(1) *cu-a* meets *A* approximately at a right angle, and *A* is continued past this point (*melanoticus*; Fig. 59).

(2) *cu-a* not fused to *A*, and *A* terminates at this point; the included angle between *cu-a* and *A* somewhat more than a right angle (*demerarae*; Fig. 60).

(3) *cu-a* fused to *A* in such a way that *A* appears to curve smoothly forward and terminate on *M*+*Cu* (*octoarticulatus*; Fig. 61).

These are obviously three stages in a single trend.

Petiole as in worker, but postpetiole broadly attached to gaster.



Figs. 56–61.—*Allomerus*: 56, *A. angulatus*, full-face dorsal view of head of worker; 57, *A. angulatus*, lateral view of worker; 58, *A. angulatus*, antenna of worker; 59, *A. melanoticus*, wing of gyne; 60, *A. demerarae*, wing of gyne; 61, *A. octoarticulatus*, wing of gyne.

Male

Slightly larger than gyne. Antennae as in *Tranopelta*. Mandibles rather weak, barely opposable; dental formula 1+3. Clypeus swollen, not extending between the frontal carinae, anterior margin downcurved. Notauli absent, parapsidal furrows faint. Wings, petiole, and postpetiole as in gyne. Genitalia not fully retractile, partially exserted; parameres thickened, tapering to a rounded point, hirsute, frequently pendant; tips of digiti terminally swollen, globular; edge of aedeagus not serrate.

Comments

The genus *Allomerus* has been taken in the Amazon basin of Brazil and Bolivia, and in British Guiana. The nests are always associated with preformed plant cavities—cauline swellings on *Cordia*, leaf-sacs of *Tococa* and *Duroia*, or dilated peduncles of *Hirtella*. Wheeler (1942) records his observations on *A. demerarae* associated with *Cordia nodosa* in British Guiana. Here all, or nearly all, the cauline swellings on a plant were inhabited by a single colony of *demerarae*, consisting of thousands of workers and many gynes. The various swellings were linked together by covered galleries, built of small particles of earth and supported by the long red hairs which cover the bark and leaves of *C. nodosa*. These galleries were extended down the trunk of the bush to the forest floor, where the workers forage. Wheeler observed *Pseudococcus brevipes* in some of the domatia of the ants, but did not consider these an appreciable source of food. Wheeler (1942; pp. 198–203) gives the species of plants from which collections of *Allomerus* have been made.

LIST OF ALLOMERUS SPECIES

angulatus Wheeler & Mann, 1942, p. 201. (var. of *decemarticulatus* subsp. *octoarticulatus*). Bolivia
decemarticulatus Mayr, 1877*b*, p. 874. Amazonia
demerarae Wheeler, 1942, p. 200. (var. of *decemarticulatus* subsp. *octoarticulatus*). British Guiana
exsanguis Wheeler & Mann, 1942, p. 200. (var. of *decemarticulatus* subsp. *octoarticulatus*). Bolivia
melanoticus Wheeler & Mann, 1942, p. 202. (var. of *decemarticulatus* subsp. *octoarticulatus*). Bolivia
novemarticulatus Wheeler & Mann, 1942, p. 199. (subsp. of *decemarticulatus*). Bolivia
octoarticulatus Mayr, 1877*b*, p. 874. Amazonia
septemarticulatus Mayr, 1877*b*, p. 874. Amazonia
tuberculatus Forel, 1912*a*, p. 2. (var. of *octoarticulatus*). Amazonia

Genus CAREBARELLA Emery

> *Carebarella* Emery, 1905, p. 137. Type *Carebarella bicolor* Emery, monobasic.
> *Carebarella* subgenus *Carebarelloides* Borgmeier, 1937, p. 236. Type *Carebarella* (*Carebarelloides*) *condei* Borgmeier, monobasic. Syn. nov.

Diagnosis

Clypeus bicarinate, the margins between the median clypeus and the frontal carinae being continued as strong, parallel carinae nearly to the anterior margin, just before which they turn abruptly to the midline and meet; this forms a characteristic oblong, raised, flat median area (Fig. 62). Alates with reduced and modified *Tranopelta* venation.

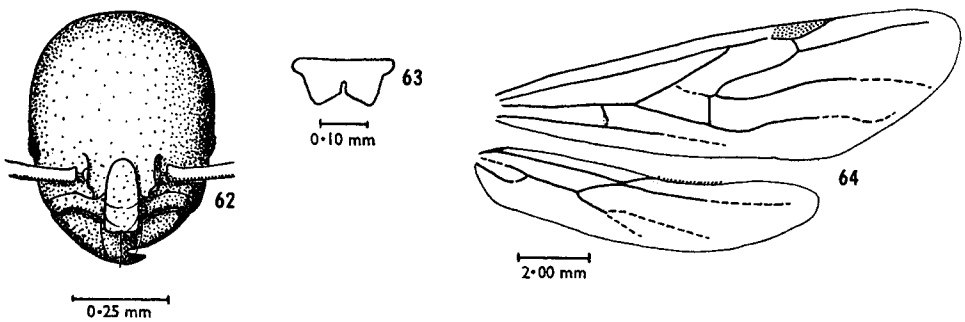
Worker (*based on* C. bicolor *only*)

TL about 2·4 mm, size rather uniform. Eyes poorly developed, about 8 facets. Antennae 10-segmented with a distinct 2-segmented club; although the antepenultimate segment is almost twice as long and slightly thicker than the other funicular segments, it is much smaller than either club segment. Palpal formula 1,2(1*c*2, 1*s*2); the maxillary palp is geniculate and closely resembles that characteristic of the *Solenopsis* genus group. Dental formula 1+3; canthellus meeting the basal margin; trulleum distinct, closed; mandalus spoon-shaped. Labrum cleft, distal margin of each lobe straight (see Fig. 63).

Clypeus with median area sharply defined by parallel carinae formed by the continuation of the margins which separate the clypeus from the frontal carinae, almost to the anterior margin where the carinae turn abruptly and meet on the centre line, forming a characteristic, raised, oblong, flat median area (Fig. 62). Outer margin of the clypeus with a shiny area overlying a cavity as described for *Tranopelta* (q.v.). Median seta present, paracarinal setae well developed.

Promesonotal suture distinct on the pleura to the level of the spiracle; metanotal groove well defined, deeply impressed on the dorsum. Propodeum rounded; spiracle round, aperture slightly constricted.

Petiole pedunculate, node high with steep anterior and posterior faces; posterior end of petiole with lateral carinae as in *Tranopelta*. Subpetiolar process a rounded tooth trailing a longitudinal ridge which bears further cusps. Postpetiolar node distinct but lower than that of petiole; anterior and posterior subpostpetiolar processes well developed; gaster rather cordate, partially receiving posterior end of postpetiole.



Figs. 62–64.—*Carebarella*: 62, *C. bicolor*, full-face dorsal view of head of worker; 63, *C. bicolor*, labrum of worker; 64, *C. punctatorugosa*, wing of gyne.

Gyne

Much larger than conspecific worker. Eyes well developed, but small in comparison to size of head. Antennae 10-segmented with distinct 3-segmented club. Palpal formula 3,2. Mandibles with dental formula 1+4, the last 2 teeth rather small; canthellus meeting basal margin, trulleum distinct and closed. Labrum cleft.

Clypeus with median area as in worker, but covered with long, irregular setae. In addition, *C. condei* has a median sulcus, resulting in a distinctly *Solenopsis*-like facial appearance. Lateral face of clypeus below the gena bearing a structure similar to that described for *Tranopelta* (q.v.).

Propodeum rounded; spiracle ovoid to subcircular and constricted. Wing venation reduced and modified from that of *Tranopelta*; *Rs* diverging from *M* before, at or after the junction of *M* and *m-cu*; *m-cu* may be present or absent, and the base of *Rs*+*M* may be lost (Fig. 64); different combinations of these modifications may be found in the opposite wings of the same individual, demonstrating the inadvisability of maintaining the subgenus *Carebarelloides* on the basis of a slight venational difference.

Petiole pedunculate, node very high, posterior end of petiole as in *Tranopelta*. Postpetiole with well developed node, broadly attached to the gaster; anterior subpostpetiolar process the more strongly developed.

Male

Size about half that of conspecific gyne. Antennae as in *Tranopelta*. Clypeus having a similar form to that of gyne, but less strongly modelled. Mandibles atrophied to mere rudiments. Notauli absent, parapsidal furrows distinct. Wings, petiole and postpetiole as in gyne. Genitalia not fully retractile, usually partly exserted; parameres broadened dorsoventrally, rather flat in side view; aedeagus strongly flattened.

Comments

This genus has been recorded only in Southern Brazil and the Argentine. Eidmann (1936) records the collection of colonies of *C. punctatorugosa* in the nests of *Nasutitermes* (*Diversitermes*) sp. and *Acromyrmex subterraneus*, presumably indicating a lestobiotic relationship.

LIST OF CAREBARELLA SPECIES

bicolor Emery, 1905, p. 138. Argentina
condei Borgmeier, 1937, p. 236. Brazil
punctatorugosa Emery, 1905, p. 139. Argentina

(*c*) Pheidologeton *Genus Group*

Diagnosis

Antennae 12- to 8-segmented, with a 2- or (less commonly) 3-segmented club. Palpal formula 3,2; 2,2; or 1,2. Workers may be polymorphic, dimorphic, or monomorphic. Clypeus weakly or not at all bicarinate, shape variable, median seta always lacking. Anterior tentorial pits always close to the antennal sockets. Workers often with propodeum sharply angulate to dentate, often with propodeal carinae distinct or even produced as lamellae, continuous with the inferior propodeal plates. Gyne larger to very much larger than the worker caste; wings with radial cell closed by *Rs* curving to meet *R*; rarely with an *r-m* crossvein, but in this case *r-m* is not continuous with *r*.

Genus PHEIDOLOGETON Mayr

> *Pheidologeton* Mayr, 1862, p. 750. Type *Phidologiton* (!) *diversus* (= *Oecodoma diversa* Jerdon, 1851), by designation of Bingham (1903).
> *Amauromyrmex* Wheeler, 1929*b*, p. 1. Type *Amauromyrmex speculifrons* Wheeler, monobasic. Syn. nov.
> *Idrisella* Santschi, 1937*c*, p. 372. Type *Pheidologeton dentiviris* Forel, monobasic. Syn. nov.

Diagnosis

Antennae 11-segmented, with a 2-segmented club. Workers strongly polymorphic, with a graded series connecting minor workers with the large majors, which show allometric enlargement of the head and increasing expression of gyne-alitruncal segmentation with increase in size. Metasternal process lacking. Inferior propodeal

plates small or lacking. Propodeal teeth dentate to spiniform. Subpetiolar process lacking or inconspicuous.

Worker

TL 2–16 mm exhibiting striking allometry over a considerable size range. This is indicated in a rough way by the following measurements of the largest major and smallest minor workers of a single series of *P. diversus* from Rangoon, Burma.

	HW (mm)	WL (mm)	TL (mm)	HW^3 (mm^3)	WL^3 (mm^3)
Major ☿	4·11	2·92	15·64	69·33	24·77
Minor ☿	0·55	0·69	2·39	0·16	0·33

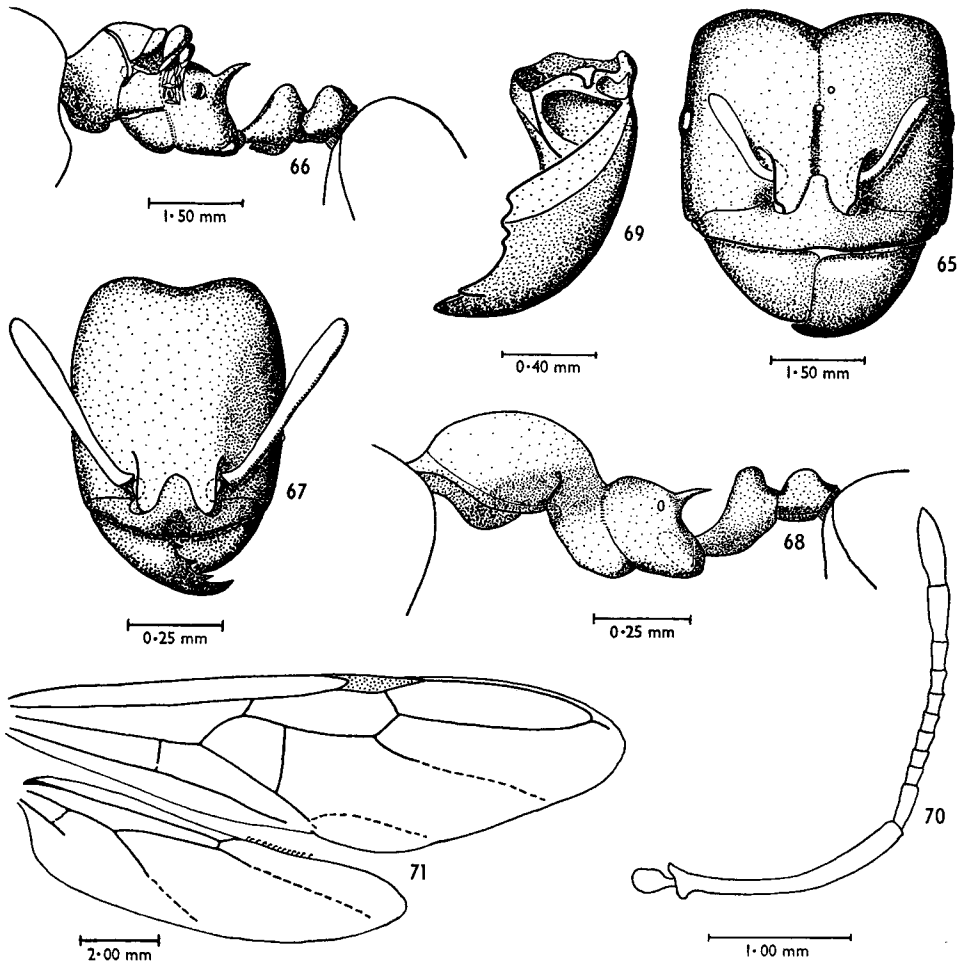
It will be seen that while the head width (HW) increases by a factor of 9·25, the diagonal length of the alitrunk (WL) increases by a factor of 4·24, and the total length (TL) measured by tagmata by a factor of 6·54. The volumetric relations of the head and alitrunk, respectively, of the major and minor worker are compared by the ratio of HW^3 or WL^3. Thus, the head of the major increases in volume by a ratio of the order of 423, but allowing for the fact that the head of the minor is more rounded, this factor is probably around 500. The alitrunk by the same reckoning increases by a factor of the order of 76.

Eyes small, but well developed in the large workers; 14–75 ommatidia. Antennae 11-segmented with a clearly defined 2-segmented club (Fig. 70). Palpal formula 2,2. Mandibles with dental formula 1+4 or 1+5 in the minor workers; with increase in body size the crowns of the teeth become lower, more rounded and spaced apart, until the teeth are often completely lost in the majors. The canthellus meets and fuses broadly to the basal margin of the blade just beneath its edge (Fig. 69); trulleum very pronounced, deep, lined with long setae; mandalus distinct, linear, immediately adjacent to the ginglymus. Labrum distinctly to very distinctly bilobed, but not actually cleft.

Clypeus more or less flat, median area in profile slightly convex; posterior margin rather deeply impressed into the head behind the antennal sockets at the site of the anterior tentorial pits (Figs. 65, 67). Median seta always lacking; paracarinal and intercarinal setae moderately developed in the minor workers, but increasingly lost in the medias and majors.

In the minor worker (Fig. 68), promesonotal suture distinct only to the height of the spiracle, metanotal groove complete and deeply impressed on the dorsum. With increasing size, the degree of gyne segmentation of the alitrunk increases, and is almost complete in the largest major workers (Fig. 66) (see also Tulloch 1946; p. 92). In a few species, the humeral angle of the pronotum is strongly angulate to stoutly dentate. Propodeum bearing a pair of strong, diverging, often slightly downcurved (rarely upcurved), spiniform teeth; spiracle round in the minor workers, D-shaped in medias and narrowly D-shaped in majors (due to backward growth of the anterior lip of the spiracle). Inferior propodeal plates very weakly developed or absent. Metasternum lacking processes, at best slightly convex, with a slight median cleft between the coxae.

Petiole more or less distinctly pedunculate, nodes high and smooth in minors and increasingly modelled and sculptured in medias and majors; subpetiolar process lacking or simple, cultriform, becoming more thickened with size increments. Postpetiole simple, nodiform, lacking subpostpetiolar processes in the minors; becoming



Figs. 65–71.—*Pheidologeton*: 65, *P. diversus*, full-face dorsal view of head of major worker; 66, *P. diversus*, lateral view of major worker; 67, *P. diversus*, full-face dorsal view of head of minor worker; 68, *P. diversus*, lateral view of minor worker; 69, *P. diversus*, dorsal view of mandible of media worker; 70, *P. diversus*, antenna of worker; 71, *P. diversus*, wing of gyne.

increasingly modelled and sculptured with increase in size, but with subpostpetiolar processes at best weakly developed. Red or red-brown to brown-black ants; sculpture variable, major workers often with head and alitrunk rugose, gaster smooth and shining; sculpture less intense in smaller workers.

Gyne

Much larger than the worker, TL 16–17 mm. With the characters of the major worker except as follows: palpal formula 2,2(1*s*2*p*3, 1*s*2); dental formula 1+6, trulleum very distinct and closed. Wing venation (Fig. 71) characterized by *Rs* curving gently forward to meet *R* and close the radial cell; apical end of *CuA* distinctly dividing into a longer, curved CuA_1 and a shorter stub, CuA_2; *cu-a* meeting *A* at a right angle, *A* continuing past this point.

Male

Antennae comparatively short, 13-segmented; scape long and cylindrical, about 2·5 times the length of a funicular segment; pedicellus short, inconspicuous. Mandibles rather weak, barely opposable, dental formula 1+3. Clypeus strongly swollen medially, just extending between the antennal sockets. Alitrunk and wings as in gyne. Notauli lacking, parapsidal furrows present, often obscured by setae. Petiole as in major worker, postpetiole expanded posteriorly and very broadly attached to the gaster. Genitalia strongly retracted; parameres small, tapering; aedeagus large, flattened, ventral edge bearing recurved, spinose teeth.

Comments

This genus is distributed from Africa through India and Ceylon to south-east Asia and the East Indies, and a single species has been recorded from northern Australia. The species are highly variable and closer study will doubtless reduce the appended list considerably. *Amauromyrmex speculifrons* is based on the smaller workers of *P. silenus*. Santschi quite unnecessarily erected a new genus, *Idrisella*, for the species *P. dentiviris*, which was described on the male only; Emery (1922) had suggested that *dentiviris* was probably the male of *P. yanoi*, the only other member of the genus occurring on Formosa.

Rothney (1889) and Bingham (1903) give accounts of the biology of *P. diversus* in India. This species builds populous nests under "bricks, stones, flower-pots, rock-works or any spot offering shelter and shade of this nature", as well as under logs and in building foundations. The workers are evidently general arthropod predators and scavengers, and Bingham states that his house was periodically invaded by swarms which cleared out food and living or dead insects; Emery (1922) states that grain is also collected.

LIST OF PHEIDOLOGETON SPECIES

aberrans Santschi, 1937*d*, p. 229. W. Africa
affinis (Jerdon), 1851, p. 110. (*Oecodoma*). S.E. Asia, E. Indies
albipes Emery, 1893*b*, p. 266. (var. of *pygmaeus*). Philippine Is.
australis Forel, 1915*b*, p. 68. (var. of *affinis*). N.E. Australia
bugnioni Forel, 1915*a*, p. 28. (var. of *pygmaeus*). Ceylon
ceylonicus Forel, 1911*c*, p. 220. (subsp. of *pygmaeus*). Ceylon
densistriatus Stitz, 1923*b*, p. 120. (var. of *pygmaeus*). Malaysia
dentiviris Forel, 1913*g*, p. 192. Formosa
= *Idrisella dentiviris* Santschi, 1937*c*, p. 372
diversus (Jerdon), 1851, p. 109. (*Oecodoma*). S.E. Asia
draco Santschi, 1920*b*, p. 163. (subsp. of *diversus*). S.E. Asia
fictus Forel, 1911*b*, p. 386. (var. of *diversus*). Hong Kong

hammoniae Stitz, 1923*a*, p. 157. S.W. Africa
hostilis (Fr. Smith), 1858*a*, p. 165. (*Atta*). Natal
javana Emery, 1893*a*, p. 212. Java
kunensis, nom. nov., pro *Pheidologeton arnoldi* Santschi, 1928*d*, p. 198, nec Forel, 1914, p. 242 (see under *Oligomyrmex*). S.W. Africa
laotina Santschi, 1920*b*, p. 162. Laos
maccus Wheeler, 1929*a*, p. 52. Philippine Is.
macgregori Wheeler, 1929*a*, p. 50. (subsp. of *diversus*). Philippine Is.
mayri Santschi, 1928*d*, p. 201. (nom. substit. pro *hostilis* Mayr, 1862, nec Fr. Smith, 1858*a*). S. Africa
melanocephalus Donisthorpe, 1948*a*, p. 134. W. New Guinea
minor Emery, 1900, p. 326. (var. of *affinis*). New Guinea
mjoebergi Forel, 1918, p. 723. (var. of *australis*). N.E. Australia
nanus Roger, 1863*a*, p. 191. Ceylon
obscurus Viehmeyer, 1914*b*, p. 37. Java
petulens Santschi, 1920*b*, p. 164. S.E. Asia
philippinus Wheeler, 1929*a*, p. 46. (subsp. of *diversus*). Philippine Is.
pilosior Wheeler, 1929*a*, p. 45. (var. of *diversus* subsp. *fictus*). Philippine Is.
pullatus Santschi, 1920*b*, p. 165. Java
pygmaeus Emery, 1887*b*, p. 465. E. Indies
rubrobrunnea Dalla Torre, 1892, p. 91. E. Indies
rugosus Karawajew, 1935, p. 95. Java
silenus (Fr. Smith), 1858*a*, p. 176. (*Pheidole*). S.E. Asia, E. Indies
= *Amauromyrmex speculifrons* Wheeler, 1929*b*, p. 1. Syn. nov. (Types compared by W. L. Brown.)
silvestrii Wheeler, 1929*a*, p. 51. Philippine Is.
solitarius Stitz, 1910, p. 141. W. Africa
spinosior Forel, 1911*b*, p. 373. (var. of *affinis*). Sumatra
standfussi Forel, 1911*b*, p. 386. (subsp. of *diversus*). W. Africa
sumatrensis Forel, 1913*e*, p. 55. (var. of *affinis*). Sumatra
tagalus Santschi, 1933*b*, p. 1. (var. of *diversus* subsp. *macgregori*). Philippine Is.
taprobanae (Fr. Smith), 1858*a*, p. 175. (*Pheidole*). Ceylon
tenuirugosus Wheeler, 1929*a*, p. 44. (subsp. of *diversus*). Philippine Is.
transversalis (Fr. Smith), 1860, p. 74. (*Pheidole*). E. Indies
varius Santschi, 1920*b*, p. 163. S.E. Asia
vespillo Wheeler, 1921*a*, p. 533. China
volsellatus Santschi, 1937*b*, p. 100. W. Africa
williamsi Wheeler, 1929*a*, p. 49. (subsp. of *diversus*). Philippine Is.
yanoi Forel, 1912*e*, p. 57. Formosa

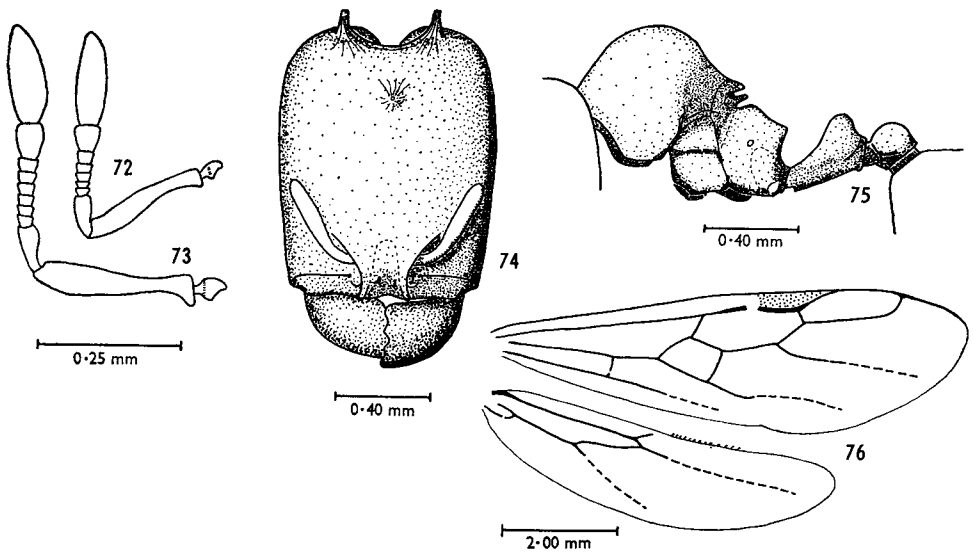
Genus OLIGOMYRMEX Mayr

> *Oligomyrmex* Mayr, 1867, p. 110. Type *Oligomyrmex concinnus* Mayr, monobasic.
> *Aeromyrma* Forel, 1891*a*, p. 307. Type *Aeromyrma nosindambo* Forel, monobasic. Syn. nov.
> *Pheidologeton* subgenus *Aneleus* Emery, 1900, p. 327. Type *Solenopsis similis* Mayr, by designation of Wheeler (1911). Syn. nov.
> *Erebomyrma* Wheeler, 1903, p. 138. Type *Erebomyrma longi* Wheeler, monobasic. Syn. nov.
> *Pheidologeton* subgenus *Lecanomyrma* Forel, 1913*e*, p. 56. Type *Pheidologeton* (*Lecanomyrma*) *butteli* Forel, monobasic. Syn. nov.
> *Oligomyrmex* subgenus *Octella* Forel, 1915*b*, p. 69. Type *Oligomyrmex* (*Octella*) *pachycerus* Forel, monobasic. Syn. nov.
> *Spelaeomyrmex* Wheeler, 1922*a*, p. 9. Type *Spelaeomyrmex urichi* Wheeler, by original designation. Syn. nov. (= *Erebomyrma*, Wilson 1962*b*).
> *Oligomyrmex* subgenus *Hendecatella* Wheeler, 1927*b*, p. 93. Type *Oligomyrmex* (*Hendecatella*) *capreolus* Wheeler, monobasic. Syn. nov.
> *Solenopsis* subgenus *Solenops* Karawajew, 1930, p. 207. Type *Solenopsis* (*Solenops*) *weyeri* Karawajew, monobasic. Nec *Solenops* L. Dufour, 1820 (Arachnida). Syn. nov.

> *Sporocleptes* Arnold, 1948, p. 219. Type *Sporocleptes nicotiana* Arnold, monobasic. Synonymy by Consani (1951).
> *Solenopsis* subgenus *Crateropsis* Patrizi, 1948, p. 174. Type *Solenopsis* (*Crateropsis*) *elmenteitae* Patrizi, monobasic. Syn. nov. (provisional).
> *Nimbamyrma* Bernard, 1953*a*, p. 240. Type *Nimbamyrma villiersi* Bernard, monobasic. Syn. nov. (provisional).

Diagnosis

Antennae usually 11- to 9-segmented, rarely 8-segmented; with a distinct 2-segmented club. Markedly dimorphic. Clypeus often more or less carinate due to the prolongation of the rugae on the frontal carinae to the anterior margin of the clypeus. Metasternal process well developed. Subpetiolar process present. Radial cell of wing closed.



Figs. 72–76.—*Oligomyrmex*: 72, *Oligomyrmex* sp., 9-segmented antenna of minor worker; 73, *Oligomyrmex* sp., 10-segmented antenna of major worker; 74, *O. corniger*, full-face dorsal view of head of major worker; 75, *O. corniger*, lateral view of major worker; 76, *O. longi*, wing of gyne.

Worker

TL between 1 and 4·5 mm; dimorphic, allowing a division of the worker caste into a smaller, minor group and a larger, major group, without intermediates; size of individuals in each group may vary to a greater or lesser extent. Eyes generally weakly developed, from 0 to 28 ommatidia; one or more ocelli occasionally developed in the largest majors. Antennae 11-, 10-, or 9-segmented, rarely 8-segmented, with a clearly defined 2-segmented club. In some species, the majors may have one more antennal segment than minors in the same nest series (Figs. 72, 73). Palpal formula 2,2 (or 1,2(1*c*2, 1*s*2) in the minor workers of a few small species). Mandible with dental formula 1+5, 1+4, or 1+3; the mandible in the minor tends to be comparatively slimmer than that of the major, in which the mandible is heavy and subtriangular

with a strongly arched outer border, and the teeth are more rounded; the major may also have more teeth than the conspecific minor. Canthellus meeting and broadly fusing with the basal margin, the junction being somewhat undershot; trulleum deep and often lined with setae; mandalus linear, distinct, lying close to the ginglymus. Labrum very distinctly bilobed; median junction of the lobes sometimes covered by a projecting median lobe in the major worker and gyne, in which case the two lobes are bent orally and thickened.

Clypeus with median area well defined, inserted between the frontal carinae; often with a median sulcus and carinae, with rugae on the frontal carinae continued to the anterior margin of the clypeus. Lateral areas of the clypeus with posterior margin deeply depressed into the head behind the antennal sockets at the sites of the anterior tentorial pits; this margin often obscured by heavy rugae passing longitudinally down the head to the anterior margin; the innermost of these rugae often circle the antennal sockets and pass forward down the frontal carinae (Fig. 74). Median seta absent; paracarinal and intercarinal setae fairly well developed. Frontal carinae covering the antennal sockets and often the base of the scape to a greater or lesser extent. Head of the major worker often bearing a pair of short, forwardly directed cornicles or transverse ridges on the dorsal extremities of the occipital lobes.

In the minor workers, the promesonotal suture is definite only laterally to the height of the spiracle; the metanotal groove is distinct and deeply impressed on the dorsum; propodeum sharply angulate to dentate, tooth flattened laterally and usually connected by the lamellar propodeal carinae to the inferior propodeal plates, which are distinct and semicircular to subtriangular; declivity usually concave. In the major worker (Fig. 75), gyne alitruncal segmentation is developed to a fairly high degree, although this is allometrically variable; propodeum rounded, sharply angulate or dentate, in the latter case the tooth is heavier and not flattened as in the minor; propodeal carina lamellar, but not always attaining the base of the propodeal tooth. Propodeal spiracle usually round, anterior lip sometimes flattened in the majors of the larger species. Metasternal process well developed (though often weaker in the minor worker), usually well sclerotized and darkly pigmented.

Petiole pedunculate; node distinct, generally rather smooth and rounded in minor workers, but modelled and ornamented in majors, often with complex systems of transverse dorsal and longitudinal lateral ridges and rugae. Subpetiolar process stoutly dentate, often continued posteriorly as a cultrate ridge. Postpetiole with node distinct but low in profile in minors, more pronounced and more elaborate in majors; degree of development of subpostpetiolar processes varies among species. Anterior end of first gastric segment sometimes concave and thus produced forward as small lateral lobes on each side of the postpetiole. Gaster of minor workers usually small, compact.

Yellow to deep brown ants, usually with sparse, long, pale hairs over much of the head and body; sculpture variable, but meso- and meta-pleura generally coarsely punctate, at least anteriormost part of head usually longitudinally rugose; sculpturation of remainder of body variable.

Malpighian tubules 4 in species examined (three undetermined species from Ivory Coast, W. Africa; one undetermined species from Australia).

Gyne

Generally with the characters of the major worker, from which it differs principally by being much larger (except for the head), having the alitrunk fully segmented (and winged in virgins) and in having sculpturation of the petiole and postpetiole more fully developed. The gaster is long and robust. Wing venation with *Rs* curving anteriorly to meet *R* and close the radial cell; *CuA* may have a short posterior stub representing CuA_2, with CuA_1 continuing for some distance toward the apical margin in a gentle curve (Fig. 76); adventitious veins on *Rs*+*M*, or slight abnormal variations (such as a partially double *m-cu*) not uncommon.

Male

Antennae 13-segmented, moderately long; pedicellus short, inconspicuous; scape short, subcylindrical to barrel-shaped. Clypeus slightly to distinctly swollen, not or only just inserted between the antennal sockets. Notauli absent, parapsidal furrows distinct to faint. Petiole and postpetiole similar to that of the major worker, rather more broadly attached. Wing venation as in gyne. Genitalia not fully retractile, about half exserted; parameres small, tapering, tips setose; aedeagus flattened, deep, ventrally dentate; digiti rod-like, tips hooked, heavily sclerotized.

Comments

The genus *Oligomyrmex*, as here constituted, is virtually cosmopolitan in the tropics and subtropics. The generic synonymy is extensive, but since there are no reliable characters on which to divide the group, a single large, somewhat variable genus results. It is now possible to clear up the mass of species group synonymies that have been generated as a result of the use of the number of antennal segments as a generic character. *Aneleus* has 11-jointed, *Aeromyrma* 10-jointed, *Oligomyrmex* 9-jointed, and *Octella* 8-jointed antennae. Yet when Wheeler found an obvious *Oligomyrmex* with 11-jointed antennae, he erected a new subgenus *Hendecatella* for it (see Wheeler 1922*b*; p. 95). Part of this confusion arose because some of the species allotted to *Aneleus* (*pygmaeus* and its various subspecies and varieties) actually belonged to *Pheidologeton*, while the remainder have a distinctly *Oligomyrmex* facies.

Colonies of *Oligomyrmex* are generally either small, or are often broken up into small subcolonies. Collections are usually made under the bark of logs, in rotten wood, in leaf litter, or in other generally humid places. There is some evidence that most of the species are (at least facultatively) lestobiotic. In the case of *O. urichi*, Wilson (1962*b*) found that workers foraging in a cave in Trinidad returned to the nest with a freshly killed mite and an entomobryid collembolan, and two unidentified arthropod eggs; in captivity, the same colony fed readily on a wide range of larger moths and flies if these were killed and cut up. In the original nest, "over a hundred unidentified globular objects resembling arthropod eggs were found piled with the brood" (Eidmann (1936) records finding (and figures) the array of presumably arthropod eggs found in the nest of *O. eidmanni*). Wilson also found an *urichi* colony in Surinam adjacent to a large colony of *Amitermes minutus* Emerson; in interconnected artificial nests of the two species, *urichi* workers carried off *A. minutus* eggs only. Finally, in the course of this study, I have observed in alcohol-preserved samples of many species of *Oligomyrmex* that the major workers frequently have the midgut distended with a

yellow, lipidic, Sudan black B-positive material which resembles insect egg yolk; this may be a storage mechanism.

List of Oligomyrmex Species

aborensis (Wheeler), 1913*c*, p. 234. (*Pheidologeton*). Japan
acutus Weber, 1952, p. 12. Congo
aeolius Forel, 1911*b*, p. 338. (var. of *oertzeni*). Turkey
africanus (Forel), 1910*c*, p. 15. (*Aeromyrma*). S. Africa
alluaudi Santschi, 1913*a*, p. 459. Tanganyika
alpha Forel, 1905*c*, p. 21. Java
amia (Forel), 1913*g*, p. 191. (*Solenopsis*). Formosa
angolensis Santschi, 1914*b*, p. 358. Angola
antiquus (Mayr), 1868*b*, p. 93. (*Pheidologeton*) (fossil). Baltic amber
armatus (Donisthorpe), 1947*a*, p. 596. (*Aneleus*). W. New Guinea
arnoldianus, nom. nov., pro *Pheidologeton perpusillum* subsp. *arnoldi* Forel, 1914, p. 242, nec *Oligomyrmex arnoldi* Forel, 1913*b*, p. 123.
arnoldiellus Santschi, 1919*a*, p. 340. S. Africa
asinus Forel, 1902*b*, p. 214. India
atomus Emery, 1900, p. 328. S.W. Pacific
bengalensis Forel, 1902*b*, p. 217. India
beta Forel, 1905*c*, p. 22. Java
bouvardi Santschi, 1912*a*, p. 457. S.E. Asia
bruchi Santschi, 1933*a*, p. 116. Argentina
butteli (Forel), 1913*e*, p. 56. (*Pheidologeton*). Ceylon
capreolus Wheeler, 1927*b*, p. 93. S.E. Asia
cataractae Santschi, 1919*a*, p. 337. (var. of *alluaudi*). Rhodesia
concinnus Mayr, 1867, p. 111. Malaya
condecens (Santschi), 1914*a*, p. 77. (subsp. of *Aneleus perpusillum*). Tanganyika
congolensis Forel, 1916, p. 417. (subsp. of *angolensis*). Congo
convexus Weber, 1950, p. 6. Uganda
corniger Forel, 1902*b*, p. 449. E. Australia
crassiusculus (Emery), 1900, p. 328. (*Pheidologeton*). New Guinea
cribriceps (Wheeler), 1927*b*, p. 90. (*Aneleus*). S.E. Asia
debilis Santschi, 1913*a*, p. 459. W. Africa
diabolus Santschi, 1913*a*, p. 459. W. Africa
donisthorpei Weber, 1950, p. 7. Central Africa
eidmanni (Menozzi), 1936*a*, p. 47. (*Erebomyrma*). Brazil
elmenteitae (Patrizi), 1948, p. 174. (*Solenopsis* subgenus *Crateropsis*). Kenya
erythraeus Emery, 1915*d*, p. 14. Somalia
frontalis Weber, 1950, p. 10. Congo
grandidieri Forel, 1891*b*, p. 201. Madagascar
hewitti Santschi, 1919*a*, p. 341. S. Africa
incertus Santschi, 1919*a*, p. 340. Rhodesia
jacobsoni Forel, 1911*e*, p. 199. Java
jeanneli Santschi, 1913*a*, p. 459. Tanganyika
kenyensis, nom. nov. pro *Oligomyrmex alluaudi* Santschi, 1914*a*, p. 81, nec Santschi, op. cit. p. 459. Kenya
khamiensis Arnold, 1952, p. 463. Rhodesia
laeviceps Wheeler, 1928*b*, p. 24. (subsp. of *capreolus*). S. China
lamellifrons (Forel), 1902*b*, p. 219. (*Pheidologeton*). India
latro Santschi, 1937*a*, p. 81. Congo
leei Forel, 1902*b*, p. 216. India
longii (Wheeler), 1903, p. 140. (*Erebomyrma*). Texas
longiceps Santschi, 1929, p. 295. Argentina

lucidus Santschi, 1916*b*, p. 284. Rhodesia
lusciosus Wheeler, 1928*b*, p. 22. China
manni Donisthorpe, 1941*a*, p. 134. E. New Guinea
menozzii, nom. nov. pro *Aneleus eidmanni* Menozzi 1942, p. 170, nec *Erebomyrma eidmanni* Menozzi, 1936*a*, p. 47. W. Africa
minimus (Emery), 1900, p. 327. (*Aneleus*). New Guinea
mjoebergi Forel, 1915*b*, p. 69. N.E. Australia
morai (Menozzi), 1931, p. 271. (*Erebomyrma*). Costa Rica
nanus Santschi, 1919*a*, p. 338. Mozambique
nevermanni (Mann), 1926, p. 103. (*Erebomyrma*). Central America
nicotianae (Arnold), 1948, p. 219. (*Sporocleptes*). S. Rhodesia
norfolkensis Donisthorpe, 1941*c*, p. 92. (var. of *manni*). Norfolk I.
nosindambo (Forel), 1891*b*, p. 199. (*Aeromyrma*). Madagascar
oertzeni Forel, 1886, p. 165. Greece
overbecki Viehmeyer, 1916, p. 136. Malaya
pachycerus Forel, 1915*b*, p. 69. N.E. Australia
paetus (Santschi), 1937*d*, p. 228. (*Aneleus*). Angola
panamensis Wheeler, 1925*b*, p. 175. Panama
parvicornis Forel, 1915*b*, p. 70. N.E. Australia
perpusillum (Emery), 1895*d*, p. 26. (*Pheidologeton*). S. Africa
peruvianus (Emery), 1905, p. 139. (*Erebomyrma*). Peru
petulcus (Wheeler), 1922*d*, p. 166. (*Aeromyrma*). Congo
politus (Santschi), 1914*a*, p. 79. (*Aneleus*). Tanganyika
polyphemus Wheeler, 1928*b*, p. 21. China
punctatus (Karawajew), 1930, p. 43. (*Aneleus*). E. Africa
raja Forel, 1902*b*, p. 216. India
rothneyi Forel, 1902*b*, p. 218. India
rugatus Forel, 1913*c*, p. 60. Java
santschii Weber, 1943*a*, p. 363. Sudan
sarasinorum (Emery), 1901*c*, p. 578. (*Aneleus*). Celebes
satanus Karawajew, 1935, p. 96. Sumatra
sauteri Forel, 1912*e*, p. 56. Formosa
semilaevis (Mayr), 1901, p. 15. (*Solenopsis*). S. Africa
silvestrii (Santschi), 1914*b*, p. 357. (*Aneleus*). W. Africa
simalurensis (Forel), 1915*a*, p. 27. (*Aneleus*). India
similis (Mayr), 1862, p. 751. (*Solenopsis*). E. Indies
sodalis Emery, 1914*b*, p. 412. (subsp. of *corniger*). New Caledonia
stenopterus Kusnezov, 1952, p. 184. Argentina
sublatro Forel, 1913*e*, p. 59. Java
subreptor Emery, 1900, p. 329. New Guinea
sundaicus (Forel), 1913*e*, p. 63. (*Aeromyrma*). Sumatra
tahitiensis Wheeler, 1936*a*, p. 11. Tahiti
taiponicus Wheeler, 1928*b*, p. 24. (subsp. of *silvestrii*). China
taprobanae Forel, 1911*c*, p. 219. Ceylon
thoracicus Weber, 1950, p. 13. Uganda
traegaordhi (Santschi), 1914*c*, p. 20. (*Aeromyrma*). S. Africa
ugandanus (Santschi), 1923*b*, p. 279. (*Aeromyrma*). Uganda
urichi (Wheeler), 1922*a*, p. 9. (*Spelaeomyrmex*). Surinam
viehmeyeri Mann, 1919, p. 331. S.W. Pacific
villiersi (Bernard), 1953*a*, p. 241. (*Nimbamyrma*). W. Africa
voeltzkowi Forel, 1907*b*, p. 77. Madagascar
vorax (Santschi), 1913*b*, p. 145. (*Aeromyrma*). Gold Coast
weyeri (Karawajew), 1930, p. 207. (*Solenopsis* subgenus *Solenops*). E. Indies
wheeleri, nom. nov., pro *Oligomyrmex silvestrii* Wheeler, 1928*b*, p. 23, nec *Aneleus silvestrii* Santschi, 1914*b*, p. 357. S. China
wroughtoni (Forel), 1902*b*, p. 214. (*Solenopsis*). India

Genus CAREBARA Westwood

> *Carebara* Westwood, 1841, p. 86. Type *Carebara lignata* Westwood, monobasic.

Diagnosis

Workers small, monomorphic; antennae 9-segmented, with a distinct 2-segmented club; palpal formula 2,2; dental formula 1+4 or 1+5, the first two subapical teeth followed by two or three minute teeth. Gyne enormously larger than worker, antennae 10-segmented without a distinct club; palpal formula 3,2, with basal segment of maxillary palp having its distal articulation transversely displaced (see Fig. 80); gaster very broadly attached.

Worker

TL 1·8–2·6 mm; monomorphic, size variation within species slight. Antennae 9-segmented with a distinct 2-segmented club (Fig. 79). Eyes lacking. Palpal formula 2,2. Mandibles with dental formula 1+4 or 1+5, but the teeth after the first 2 subapical teeth are strongly reduced; canthellus not meeting the basal margin, trulleum distinct but open; mandalus linear, close to ginglymus. Labrum moderately bilobed, lateral margins often converging strongly apicad.

Clypeus with median area strongly swollen, carinae gently rounded or distinct but never strongly marked, either separated by a distinct sulcus or nearly flat between (Fig. 77). Median seta absent, first pair of intercarinal setae long, often reaching almost to the tips of the mandibles; paracarinal setae present.

Promesonotal suture distinct only to the level of the spiracle; metanotal groove well developed, deeply impressed on the dorsum (Fig. 78). Propodeum rounded in profile, the concave declivity meeting the pleurae at the distinct propodeal carinae, which are continuous with and incorporate the small inferior propodeal plates, above which the carinae may be rounded and quite short to lamellate and extending up onto the dorsum. Spiracle of the propodeum large and round; metapleural gland well developed.

Petiole strongly pedunculate, node rounded to subcuboidal; subpetiolar process small, cultrate to indistinct. Postpetiole rounded, subpostpetiolar processes slight to nil.

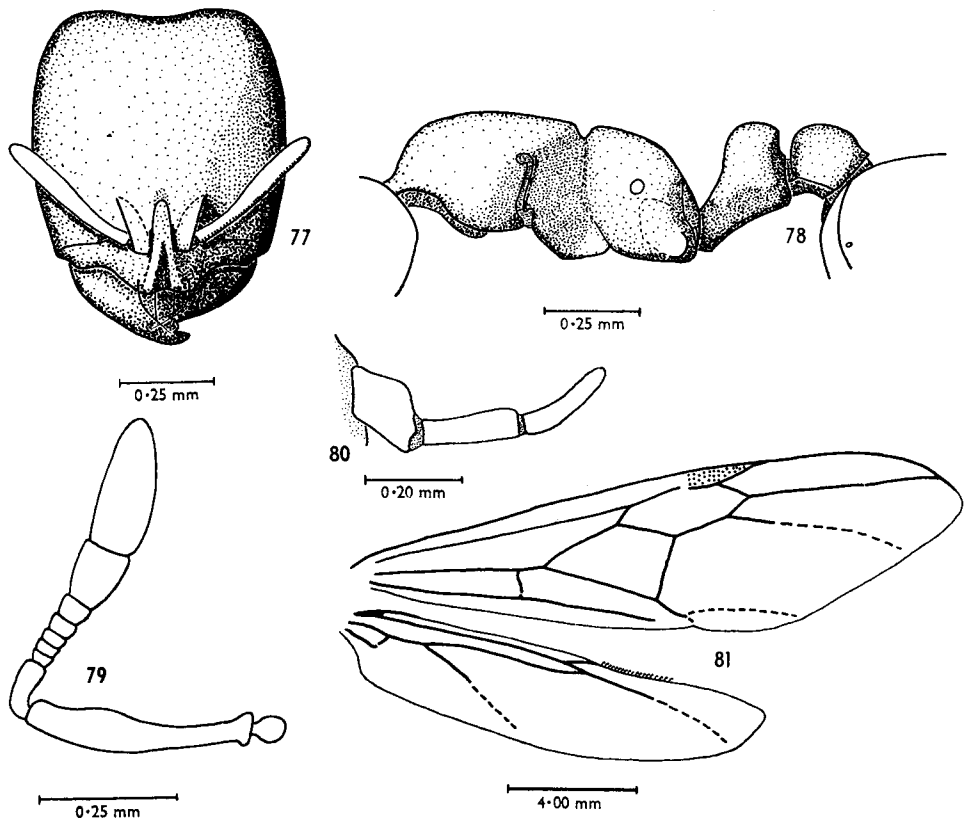
Yellow-brown ants, lightly sclerotized, covered by fine, decumbent setae and more sparsely by long, erect setae; sculpturation lacking except that the meso- and meta-pleurae may be finely punctate.

Gyne

TL 12–22 mm, much larger than conspecific worker. Antennae 10-segmented; funicular segments somewhat longer and thicker from the basal to the apical, the increments being most noticeable in the last three segments, but not sufficiently pronounced to be termed a club. Palpal formula 3,2; basal segment of the maxillary palp elongated laterally so that the distal articulation is displaced from the axis of the proximal articulation, as shown in Figure 80. Dental formula 1+3 to 1+6, often with one more tooth on one mandible than on the other; canthellus not or only just meeting the basal margin, trulleum distinct. Propodeum rounded, spiracle slit- to

D-shaped and directed posteriorly. Petiole pedunculate, node pronounced, subpetiolar process dentiform. Postpetiole nodiform, expanded posteriorly and very broadly attached to the gaster.

Wings (Fig. 81) similar to those of *Pheidologeton* but differing in that *Rs* curves posteriorly before meeting *R*, not anteriorly as in *Pheidologeton*, *Oligomyrmex*, etc.; cell *M*1 (median cell) as large as or larger than cell 1*R*1 (submarginal cell).



Figs. 77–81.—*Carebara*: 77, *C. winifredae*, full-face dorsal view of head of worker; 78, *C. winifredae*, lateral view of worker; 79, *C. winifredae*, antenna of worker; 80, *C. vidua*, maxillary palp of gyne; 81, *C. lignata*, wing of gyne.

Male

Considerably smaller than conspecific gyne, and of similar but lighter build, but still very much larger than worker. Antennae 13-segmented; scape short, pedicellus very small; funicular segments each longer than the scape. Clypeus with median area semi-globular, not or only very slightly inserted between the antennal sockets. Notauli absent, parapsidal furrows distinct. Genitalia prominently exserted; parameres massive, semicircular in section, subtriangular in side view, curving in to meet on the midline; tenth tergite and ninth sternite produced to cover the bases of the parameres; digiti long, narrow, flattened; aedeagus small, not serrate ventrally.

Comments

The genus *Carebara* is circumtropical in distribution; the major part of the genus is in the Old World tropics (Africa, S.E. Asia, E. Indies), while at least two species occur in the northern part of South America.

The biology of this group has received some attention due to the oddity of the great size disparity between the gyne and the worker. All the species are obligatorily termitolestic, commonly building their nests in the dry clay walls of termitaria. Wheeler (1922*d*, pp. 168–72) has compiled some information on their biology. Some speculation was generated by the finding of workers attached to the setaceous tarsi of gynes in collections; it was considered impossible for the huge gynes to rear a first brood of minute workers, hence the hairy tarsi were an adaptation to carry "nurse" workers on the nuptial flight. Lowe (1948) has published some observations that indicate that transported workers are not required as nurses. He placed a recently fecundated, dealated gyne in a plaster nest without workers; the gyne laid a group of eggs after 4 days, and successfully reared a group of 16 workers. Lowe suggests that the long hairs are sensory, to prevent the gyne stepping on and squashing the comparatively minute brood. Both the gyne and workers killed and fed on termites, but did not feed on the fungus grown by the termite.

Carebara has always been taken in association with termites, except where specimens were taken at light. Lowe (1948) does not identify the species with which *C.* ? *lignata* was taken except as "a fungus-growing termite". Bequaert (1913) describes the flight of *C. junodi* from the mounds of *Acanthotermes spiniger*; Forel (1901*b*) cites Haviland's discovery of *C. vidua* in the masonry of *Termes natalensis* nests; and Wheeler (1922*d*) gives *Termes natalensis* as the host of *C. osborni.*

LIST OF CAREBARA SPECIES

ampla Santschi, 1912*a*, p. 284. Congo
anophthalma (Emery), 1905, p. 138. (*Oligomyrmex*). Amazonia
arnoldi (Forel), 1913*b*, p. 123. (*Oligomyrmex*). Rhodesia
augustata Santschi, 1920*b*, p. 162. (var. of *castanea*). S.E. Asia
bartrumi Weber, 1943*a*, p. 364. Sudan
bicarinata Santschi, 1912*a*, p. 139. Fr. Guiana
castanea Fr. Smith, 1858*a*, p. 178. S.E. Asia
cincta Santschi, 1926*b*, p. 230. (var. of *ampla*). Congo
fur Santschi, 1928*d*, p. 198. (var. of *vidua*). Congo
incerta Santschi, 1923*c*, p. 66. Brazil
junodi Forel, 1904*a*, p. 154. S. Africa
langi Wheeler, 1922*d*, p. 173. Congo
lignata Westwood, 1841, p. 82. S.E. Asia
mayri (Forel), 1901*c*, p. 61. (*Tranopelta*). S. America
obscurithorax Santschi, 1926*b*, p. 230. (var. of *ampla*). Congo
osborni Wheeler, 1922*d*, p. 174. Congo
patrizii Menozzi, 1927*b*, p. 357. Somalia
rugosa Santschi, 1928*d*, p. 197. (var. of *ampla*). Congo
sicheli Mayr, 1862, p. 754. Senegal
silvestrii Santschi, 1914*b*, p. 362. W. Africa
sudanica Santschi, 1933*c*, p. 103. Sudan
vidua Fr. Smith, 1858*a*, p. 179. S. and E. Africa
winifredae Wheeler, 1922*c*, p. 2. Br. Guiana

Genus PAEDALGUS Forel

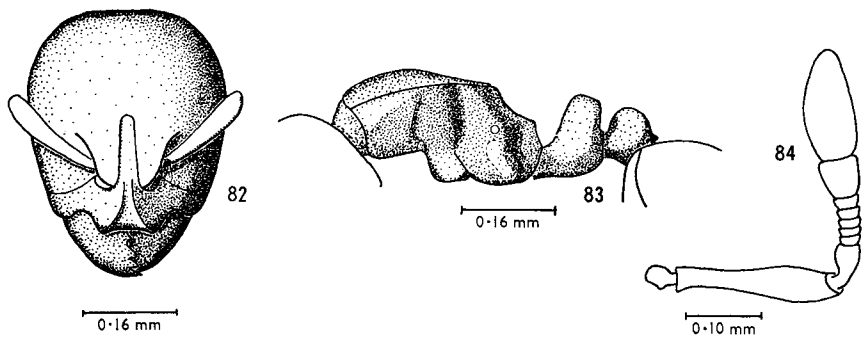
> *Paedalgus* Forel, 1911*c*, p. 217. Type *Paedalgus escherichi* Forel, monobasic.

Diagnosis

Antennae 9-segmented with a large, 2-segmented club, ring segments very small; clypeus carinate; propodeal carinae prominent, subparallel, continued onto the dorsum, which is flat and not indented by the promesonotal suture or the metanotal groove.

Worker

TL around 1·5 mm; monomorphic. Eyes with only 2 ommatidia. Antennae 9-segmented with a predominant 2-segmented club, the ring segments very small. Palpal formula 2,2; basal segment of the maxillary palp modified as described for the gyne of *Carebara* (see Fig. 80). Dental formula 1+3; canthellus not meeting basal margin, trulleum distinct and open; mandalus *not* close to ginglymus. Labrum bilobed.



Figs. 82–84.—*Paedalgus*: 82, *Paedalgus* sp., full-face dorsal view of head of worker; 83, *Paedalgus* sp., lateral view of worker; 84, *Paedalgus* sp., antenna of worker.

Clypeus bicarinate, median area long, narrow, inserted deeply between the frontal carinae and overhanging the mandibles anteroventrally. Median seta absent, first intercarinal setae long and directed towards the tips of the mandibles; paracarinal setae long.

Promesonotal suture and metanotal groove distinct only on the pleurae. Dorsum rather flat and with distinct lateral margins; pronotum wide, but tapering rapidly in front of the propodeum. Propodeal carinae sharp, lamellate, continuous with and incorporating the inferior propodeal plates, and continuous dorsally with the margins of the dorsum. Declivity concave; propodeal angle obscured by the lamellate carinae; spiracle small, round.

Petiole pedunculate, node very high and flat or rounded on top; subpetiolar process small and dentiform. Postpetiole much smaller, nodiform, lacking processes.

Malpighian tubules 4 in a single undetermined species from the Ivory Coast, W. Africa.

Head and alitrunk coarsely punctate, petiole and postpetiole less so, gaster smooth and shining; entire head and body covered with fine, suberect hairs.

Gyne and Male

No material seen; brief descriptions of the gyne are given by Forel (1911*c*), Emery (1922), Wheeler (1922*d*), and Weber (1943*a*); male unknown.

Comments

The distribution of *Paedalgus* is probably much more extensive than the present records, from Central Africa and Ceylon, would indicate. Three of the four described species were taken from cavities in the masonry of termitaria, suggesting that this genus also is termitolestic (the fourth species, *sudanensis*, is based on the gyne only). *P. termitolestes* was taken at Malela, Congo Republic (Belgian Congo) in a termitarium of *Acanthotermes militaris*, while *P. escherichi* was discovered in a small cavity in a termitarium of *Odontotermes* (*Hypotermes*) *obscuriceps* at Peradenyia, Ceylon. W. L. Brown (personal communication) collected *Paedalgus* sp. at the Niecky Plantation (40 km west of Abidjan, Ivory Coast) in a tall red-rotten stump; the workers were in small scattered chambers *c.* 1 cm in diameter, and the chambers were lined with a grey, sheer, fungus-like substance; although five or six of these chambers were found, no gynes were seen. I would expect that the stump was also infested with termites.

The larvae of *P. termitolestes* have been described and figured by Wheeler (1918, p. 301; 1922*d*, p. 179); the larvae have unusual, hypertrophied salivary glands.

LIST OF PAEDALGUS SPECIES

escherichi Forel, 1911*c*, p. 218. Ceylon
infimus (Santschi), 1913*a*, p. 459. (*Oligomyrmex*). W. Africa
sudanensis Weber, 1943*a*, p. 365. Sudan
termitolestes Wheeler, 1918, p. 301 (larva), 1922*d*, p. 177. Congo

Genus ANISOPHEIDOLE, tribal transfer

= *Pheidole* subgenus *Anisopheidole* Forel, 1914, p. 616 (note). Type *Pheidole froggatti* Forel, monobasic.

Diagnosis

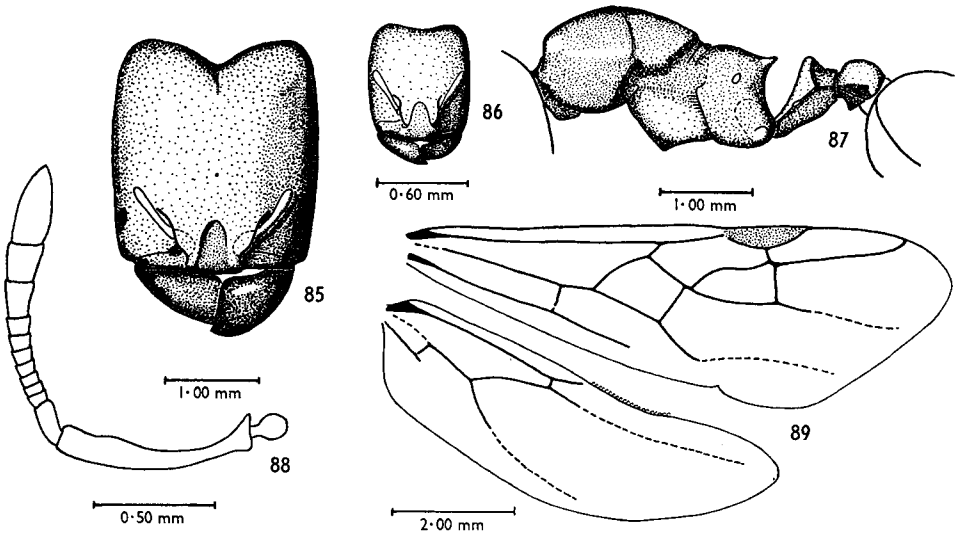
Strongly allometric with a complete size range between minors and majors, the latter with alitrunk partially gyne-segmented. Wings with venation similar to *Pheidologeton*, but having in addition a more or less incomplete *r-m* crossvein. Antennae in gyne and workers 12-segmented with a 3-segmented club.

Worker

TL between 3 and 9 mm; showing complete monophasic allometry with a continuous series between the smallest minor and the largest major worker. Eyes moderately developed 3–4 ommatidia in the smallest worker to 29 (also a single median ocellus) in the large majors. Antennae 12-segmented with a distinct 3-segmented club (Fig. 88). Palpal formula 2,2. Dental formula inconstant; in the smaller workers, it is apparently 1+8 originally, but presumably the very small

subapical teeth are rapidly abraded, and workers in the same size range may be 1+1; in media and major workers, the dental formula is basically 1+5, but similarly any number from 1 to 5 small rounded subapical teeth may remain on any particular specimen. Canthellus thick at its base, tapering and curving inwards and almost meeting the basal margin; trulleum very distinct; mandalus abutting the ginglymus. Labrum cleft.

Clypeus in the minor worker (Fig. 86) smooth, with the median area strongly swollen; bearing a pair of intercarinal setae, 4 paracarinal setae and a well-developed series of lateral setae. In the major worker (Fig. 85), the relative length of the clypeus is reduced compared to its width, and the lateral margins of the median area are strongly emphasized by longitudinal rugae continuous with those on the frontal



Figs. 85–89.—*Anisopheidole*; 85, *A. froggatti*, full-face dorsal view of head of major worker; 86, *A. froggatti*, full-face dorsal view of head of minor worker; 87, *A. froggatti*, lateral view of major worker; 88, *A. froggatti*, antenna of worker; 89, *A. froggatti*, wing of gyne.

carinae; the setae are comparatively reduced and not in such an orderly arrangement—about 6 may be designated as intercarinal and 4 as paracarinal. The frontal carinae barely cover the antennal sockets in the small minors, but in the larger majors the frontal carinae are extended laterally to cover part of the scapes as well. The head of the minors is rounded; that of the majors has pronounced, separated occipital lobes. Workers of intermediate size are intermediate in all these characters. Anterior tentorial pits close to the antennal sockets, rather superficial in minors, increasingly impressed in larger workers.

Alitrunk of minor workers with promesonotal suture distinct only to the height of the spiracle, obsolescent on the dorsum; metanotal groove distinct, deeply impressed; propodeum angulate, with dorsum and slightly concave declivity meeting the pleurae at the distinct propodeal carinae, which are continued from the inferior propodeal plates onto the dorsum to the metanotal groove. In the major worker

(Fig. 87), the alitrunk is partially gyne segmented, with accentuated humeral angles; the propodeum is stoutly dentate, the distinct teeth being directed posteriorly and divergently; the propodeal carinae are continuous from the inferior propodeal plates to the propodeal teeth and forward on the dorsum to the metanotal–propodeal suture, although the carinae are somewhat disrupted in the largest majors by the heavy rugose sculpturation.

Petiole distinctly pedunculate; node in the minor workers simple, rounded in profile, strongly transverse and flat on top when viewed from behind. In the smallest workers the node shows a tendency to be transversely binodal, this being very strongly developed in the majors, where the petiole is also strongly modelled and sculptured. Subpetiolar process longitudinally cultrate. Postpetiole simple, nodiform, bearing lateral conules in the majors; anterior subpostpetiolar process cuneate, posterior process not developed.

The minor workers are yellow-brown and rather hairy, and are unsculptured except for a few faint rugae on the genae below the eyes, rather faint, wavy rugae on the metapleurae, and shallow but intense puncturation on the ventral petiole. The majors are brown with yellow-brown gaster, heavily sclerotized and hairy; the genae to slightly above the eyes, the frons to the ocellus, the frontal carinae and the lateral areas of the clypeus are all densely rugose, and the pleurae of the alitrunk are moderately to heavily rugose; the ventral part of the petiole is strongly punctate and the petiole bears a strong lateral longitudinal ridge and a pronounced transverse dorsal ridge; the postpetiole also bears pronounced transverse ridges.

Gyne

Much larger than the major worker (12·8 mm) but generally with the characters of the major except that the occipital margin of the head is straight; the alitrunk is gyne segmented but without pronounced humeral angles (bearing wings in virgins); and the petiole is stouter, more elaborately sculptured and the node is more strongly transverse than in the major worker. Postpetiole expanded posteriorly, very broadly attached to the gaster. Wings (Fig. 89) as in *Pheidologeton* except for a more or less incomplete *r-m* crossvein just distad of *r*.

Male

Smaller than the gyne, slightly larger than the larger major worker. Antennae 13-segmented; scape short and subcylindrical, pedicellus small and rounded, flagellar segments rather short and barrel-shaped. Clypeus strongly swollen medially, shallowly inserted between the antennal sockets. Mandibles weakly developed, spatulate, not opposable, only apical tooth present. Notauli absent, parapsidal furrows distinct. Petiole and postpetiole as in gyne, though not as strongly modelled. Wings as in gyne. Genitalia as in *Pheidologeton*.

Comments

This genus apparently lies at the lower stem of the *Pheidologeton* genus group, but its wing venation and other characters clearly indicate that its affinities are with this group rather than with *Pheidole*. The distribution of the single species, *froggatti*, lies from Western Australia through to the McDonnell Ranges of central Australia

and south-west into the Mallee District of Victoria (see Brown 1953*b* for further label data). It is essentially a dry-country species, as its distribution indicates, but there is no detailed information on its biology. One might conjecture that it probably harvests grass seeds as well as being a general feeder, although Wheeler (1936*b*) suggests it may be termitolestic.

Brown (1953*b*) conjectures that "it may prove advisable to combine [the monotypic genera *Anisopheidole*, *Machomyrma*, and *Adlerzia*] into one genus in spite of notable differences in the form of the clypeus and petiole now serving to separate them", after thoroughly comparing the sexual phases. A detailed morphological examination, however, shows that this is not possible. Neither *Machomyrma* nor *Adlerzia* possesses pheidologetine wing venation; that of *Machomyrma* is distinctly pheidoline, while the venation of *Adlerzia* is broadly solenopsidine, but differently derived. Finally, the palpal formula in the worker of *Machomyrma* is 2,2, and in *Adlerzia* it is 4,3. I feel the differences between these genera are irreconcilable, even at the tribal or genus group level.

The single species of *Anisopheidole* is:

antipodum (Fr. Smith), 1858*a*, p. 166
= *Pheidole froggatti* Forel, 1902*b*, p. 414. Syn. nov.
= *Pheidole myops* Forel, 1902*b*, p. 421. Syn. nov.
= *Monomorium lippulum* Wheeler, 1927*b*, p. 89. Synonymized with *A. froggatti* by Brown (1953*b*, p. 7). Australia

Genus LOPHOMYRMEX Emery

> *Lophomyrmex* Emery, 1892*c*, p. 112. Type *Lophomyrmex quadrispinosus* (= *Oecodoma quadrispinosa* Jerdon, 1851), monobasic.

Diagnosis

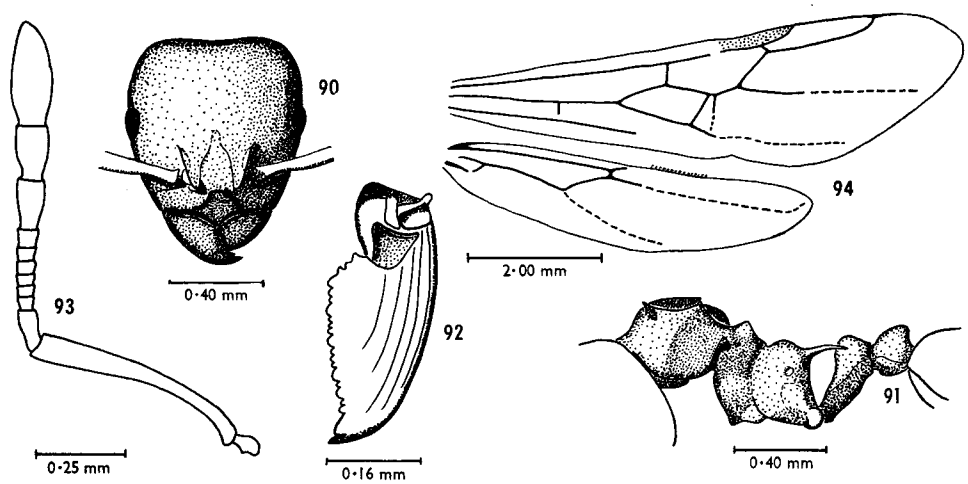
Antennae 11-segmented with a 3-segmented club. Mandible subtriangular with masticatory margin of blade irregularly crenulate (Fig. 92), bearing 2 normal and about 9–16 small, rounded teeth. Wings as in *Oligomyrmex*, often with adventitious veins.

Worker

TL 2·7–3·9 mm; monomorphic, size variation slight. Eyes well developed, with about 50 ommatidia. Antennae (Fig. 93) 11-segmented, with a 3-segmented club. Palpal formula 2,2. Mandibles subtriangular, masticatory margin irregularly crenulate (Fig. 92); apical and first subapical teeth well developed, followed by about 9–16 small, rounded teeth, slightly larger teeth being interspersed with slightly smaller ones. Canthellus meeting the basal margin beneath the extended masticatory margin; trulleum small but distinct; mandalus linear, adjacent to the ginglymus. Apex of the mandible downcurved and bent posteriorly. Labrum cleft.

Clypeus (Fig. 90) smooth, swollen, produced anteroventrally into a small median tooth, and inserted posteriorly between the frontal carinae; median seta absent, first pair of intercarinal setae long and directed towards the tips of the closed mandibles, outside of which there is a series of irregular setae on each side extending to the lateral margin; 2 or 3 paracarinal setae present.

Pronotum (Fig. 91) smooth and shining, strongly arched, with the humeral angles projecting, subconical to dentiform, sometimes bearing a few sinuous, fine rugae; promesonotal suture distinct only on the pleurae. Mesonotum and mesopleurae finely punctate; the dorsum may bear a smooth, subtriangular area bordered by fine carinae and with small denticles on the two anterior corners; metanotal groove broad, distinct, deeply impressed dorsally. Propodeum finely punctate, armed with a pair of long, spiniform teeth, directed posteriorly, diverging and slightly downcurved; inferior propodeal plates distinct, connected by carinae to bases of teeth; spiracles large, circular, situated at the bases of teeth; declivity concave.



Figs. 90–94.—*Lophomyrmex*: 90, *L. quadrispinosus*, full-face dorsal view of head of worker; 91, *L. quadrispinosus*, lateral view of worker; 92, *L. quadrispinosus*, dorsal view of mandible of worker; 93, *L. quadrispinosus*, antenna of worker; 94, *L. quadrispinosus*, wing of gyne.

Petiole strongly pedunculate, node comparatively small and rounded, uniformly punctate, often bearing a few fine sinuous rugae on the node; subpetiolar process small, longitudinally cultrate. Postpetiole with node slightly larger than the node of the petiole; punctate and variously sculptured; anterior subpostpetiolar process strongly developed, cuneate; posterior process not developed.

Gyne

Differing from the worker in size (*c.* 6·8 mm); in possessing complete gyne alitruncal segmentation; propodeum bearing a pair of stout, blunt teeth and slit-shaped spiracles; postpetiole very broadly attached to the gaster; head and body not strongly sculptured, dull, densely pubescent. Wings (Fig. 94) with venation as in *Oligomyrmex*, with some adventitious veins, e.g. occasionally *r* or *m-cu* is double.

Male

Very similar to the gyne in size and general habitus. Antennae 13-segmented; scape short, subcylindrical; pedicellus short and conical; funicular segments long, narrow and cylindrical. Clypeus strongly swollen medially, barely penetrating between the antennal sockets. Mandibles weakly developed, not opposable, only the

apical tooth weakly developed. Notauli absent, parapsidal furrows weak but distinct. Wings as in gyne. Genitalia comparatively small, well retracted into the abdomen.

Comments

The genus *Lophomyrmex* is recorded from India, Ceylon, Formosa, Burma, Malaya, and Sumatra. I have been unable to locate any biological data on any species. E. O. Wilson (personal communication) collected a sample at Udawaddatekele Sanctuary, near Kandy, Ceylon, at an altitude of *c.* 2000 ft; the workers were foraging on the ground and on herbaceous bushes in the afternoon; one worker carried an entomobryid collembolan.

LIST OF LOPHOMYRMEX SPECIES

bedoti Emery, 1893*a*, p. 192. E. Indies
birmanus Emery, 1893*a*, p. 192. Burma
javanus Karawajew, 1933, p. 270. (var. of *quadrispinosus*). Java
lucidus Menozzi, 1929*b*, p. 328. (var. of *bedoti*). Malaya
quadrispinosus (Jerdon), 1851, p. 111. (*Oecodoma*). India
taivanae Forel, 1912*e*, p. 55. Formosa
taprobanae Forel, 1911*c*, p. 223. Ceylon

(*d*) Solenopsis *Genus Group*

Diagnosis

Size small to medium, monomorphic to polymorphic. Antennae 10- to 11-segmented with a 2- or 3-segmented club. Palpal formula 2,2; 1,2(1*p*2, 1*s*2); or 1,2(1*c*2, 1*s*2); maxillary palp characteristically geniculate. Clypeus usually strongly bicarinate, median seta always present. Anterior tentorial pits placed near the antennal sockets.

Genus SOLENOPSIS Westwood

> *Solenopsis* Westwood, 1841, p. 87. Type *Solenopsis mandibularis* Westwood (= *Atta geminata* Fabricius), monobasic.
> *Diplorhoptrum* Mayr, 1855, p. 449. Type *Formica fugax* Latrielle, monobasic. Syn. nov.
> *Solenopsis* subgenus *Synsolenopsis* Forel, 1918, p. 155. Type *Solenopsis bruchiella* Emery, nom. substit. pro *Solenopsis bruchi* Forel, monobasic. Syn. nov.
> *Solenopsis* subgenus *Diagyne* Santschi, 1923*a*, p. 267. Type *Solenopsis succinea* Emery, monobasic. Syn. nov.
> *Labauchena* Santschi, 1930*b*, p. 81. Type *Labauchena daguerrei* Santschi, monobasic. Syn. nov.
> *Solenopsis* subgenus *Euophthalma* Creighton, 1930, p. 43. Type *Myrmica globularia* Fr. Smith, by original designation. Syn. nov.
> *Solenopsis* subgenus *Oedaleocerus* Creighton, 1930, p. 43. Type *Solenopsis angulata* Emery, by original designation. Syn. nov.
> *Bisolenopsis* Kusnezov, 1953, p. 1. Type *Bisolenopsis sea* Kusnezov, monobasic. Syn. nov.
> *Paranamyrma* Kusnezov, 1954*a*, p. 9. Type *Paranamyrma solenopsidis* Kusnezov, monobasic. Syn. nov.
> *Lilidris* Kusnezov, 1957, pp. 268, 274. Type *Lilidris metatarsalis* Kusnezov, monobasic. Syn. nov.
> *Solenopsis* subgenus *Granisolenopsis* Kusnezov, 1957, pp. 270, 277. Type *Solenopsis* (*Granisolenopsis*) *granivora* Kusnezov, monobasic. Syn. nov.

Diagnosis

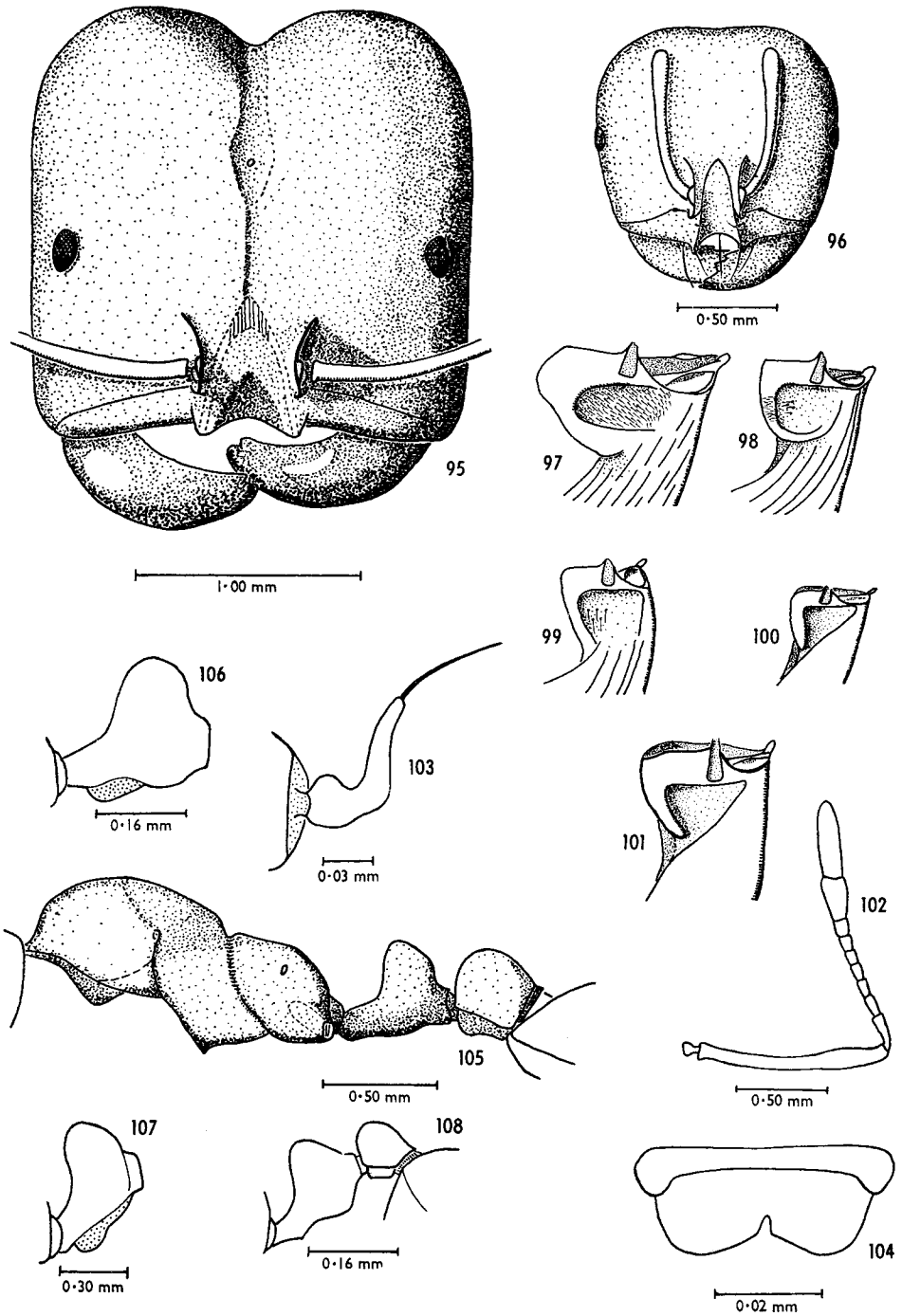
TL very small (about 1 mm) to medium (about 9 mm), usually monomorphic but in a few species polymorphic. Antennae 10-segmented in workers, 11-, or less commonly, 10-segmented in gynes, with a clearly defined 2-segmented club. Palpal formula 2,2, 1,2(1*p*2, 1*s*2) or 1,2(1*c*2, 1*s*2), maxillary palp characteristically geniculate. Labrum cleft. Clypeus bicarinate, carinae usually strongly defined and terminating in a pair of clypeal teeth, often flanked by a pair of lateral clypeal teeth. Median clypeal seta always present. Anterior tentorial pits near the antennal sockets. Colour pale yellow to black.

Worker

TL about 1–7·5 mm; polymorphic or monomorphic. Allometry in this genus appears to be monophasic, but where size range is large a very marked polymorphism occurs. In such cases the head increases in size allometrically, together with changes in the size and form of the mandibles and the number of ommatidia in the eyes (see Wilson 1953*a*, p. 141, fig. *D*, and particularly the discussion on p. 152). Development of the eyes very variable; the major workers of the large species that forage freely in the open have eyes with up to 100 or more ommatidia, and the smallest workers of these species, while the eyes are less developed, generally have 20 or more ommatidia. On the other hand, the minute cryptic species may have no eyes at all, though usually a few ommatidia remain.

Antennae (Fig. 102) 10-segmented with a 2-segmented club; ring segments variable in length, generally longer than broad in the larger species and broader than long in the smaller species; this is not consistent, however, and is not concordant with any other character that could be used to divide the genus (see further discussion below). Palpal formula 1,2(1*c*2, 1*s*2), occasionally 1,2(1*p*2, 1*s*2) in major workers of a few large species; the maxillary palp is characteristically geniculate (Fig. 103). Mandibles (Figs. 2, 100, 103) with dental formula generally 1+3, but the most basal subapical tooth may be strongly reduced or absent, so that the dental formula is 1+2; in the major worker of some species, the mandible assumes the form of the heavy, curved "crusher" type as in *Pheidole*, and the teeth may be more or less completely lost (e.g. *geminata*, *granivora*). Canthellus straight to incurved, not attaining the basal margin and separated by a distinct gutter when viewed from the side, except in a few species with modified mandibles, in which the basal margin encroaches on and occludes the trulleum to a greater or lesser extent (e.g. *S. geminata*), as seen in Figures 97, 98, and 99. Trulleum distinct, generally open; mandalus distinct, linear or slightly expanded at its distal end, lying immediately adjacent to the ginglymus. Labrum deeply cleft (Fig. 104).

Clypeus (Figs. 1, 95, 96) with median area sharply elevated above the lateral areas and deeply inserted between the frontal carinae. Median area bounded by a pair of slightly to strongly diverging clypeal carinae, usually sharply marked, but rounded in some species; median sulcus varying from very shallow to deep; carinae usually terminating in a pair of weak to very strong carinal teeth, often flanked by a pair of lateral teeth; in a few species, a slight to pronounced median clypeal tooth is developed. Median area of clypeus overhanging the mandibles in front and bearing a



[*For legend to Figures* 95–108, *see opposite page.*]

strong median seta (on the median tooth when present), a pair of intercarinal setae in the larger species (usually absent in the smaller species), a pair of carinal setae on the tips of the carinae, 2 or 3 paracarinal setae on each side (the lowest originating on the lateral clypeal teeth when present), and none to several lateral setae.

Promesonotal suture complete on the pleurae only to the height of the spiracle in the smaller species and in the minor workers of the larger species, but this suture may be complete in the major workers of the larger species. Metanotal groove broad, complete, deeply impressed on the dorsum. Propodeum generally rounded, less commonly sharply angulate; declivity flat to gently concave; propodeal carinae usually obsolescent, but sharply defined in some species; spiracle generally round, in the major workers of a few larger species ovoid or D-shaped and directed posteriorly. Inferior propodeal plates distinct and rounded as seen from the side. Metapleural glands well developed.

Petiole always distinctly pedunculate, node rather high and rounded in the small species and the smaller workers of the larger species, tending to be strongly transverse in the major workers of the larger species; ventral surface of the petiole below the node distinctly to strongly swollen in profile (see Figs. 106–108 for variation in form); subpetiolar process variable. Postpetiole subglobular, ranging from smaller to larger than the petiolar node; postpetiole not usually very broadly attached to the gaster; subpostpetiolar processes negligible to moderately well developed.

Malpighian tubules 4, cryptonephric in the species examined (*S. saevissima, molesta, punctaticeps, stricta, globularia, granivora*). Diploid chromosome number in *Solenopsis fugax* is 22 (Hauschteck 1961).

Mostly pale yellow to reddish brown ants, a few species dark brown to black, the larger species often with the posterior borders of the gastric segments infuscated. Not markedly sculptured, most species predominently smooth and shining, usually bearing sparse, rather long setae.

Gyne

Larger to much larger than the conspecific worker, with the same general features. Antennae usually 11-segmented, less often 10-segmented, sometimes 10- and 11-segmented antennae on the same individual; club 2-segmented, distinct. Palpi as in worker, 2,2 or 1,2(1*p*2, 1*s*2). Mandible having the same form as in the worker, dental formula usually 1+3; in some species that are apparently parasitic on congeneric species, the form of the mandible is modified, e.g. *S. nicai* (Fig. 110) or *S. daguerrei* (Fig. 109). Labrum generally strongly cleft, weakly so in parasitic species. Head of generalized form, but in the parasitic species the head is broadened anteriorly

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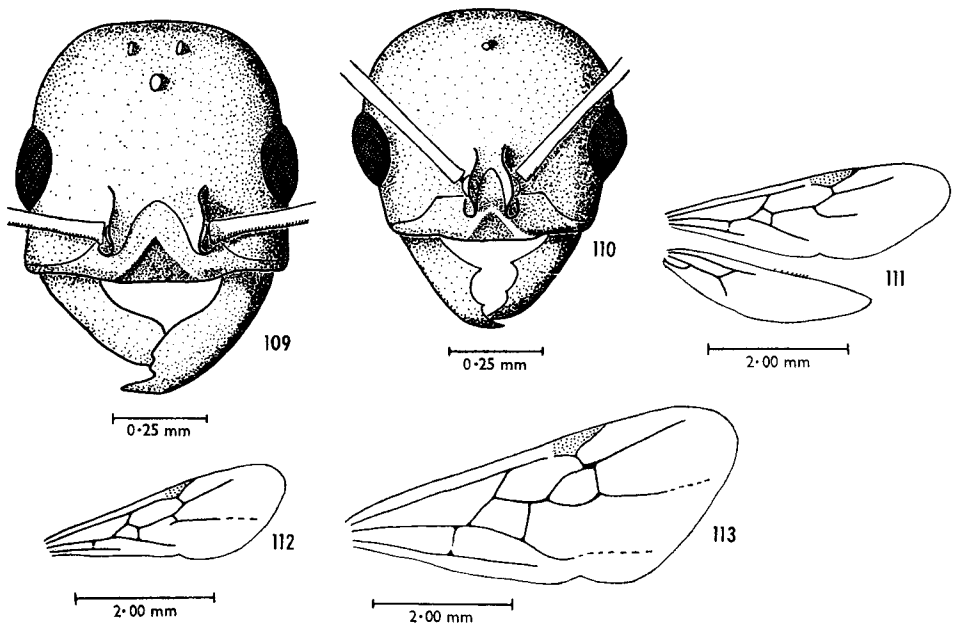
Figs. 95–108.—*Solenopsis*: 95, *S. geminata*, full-face dorsal view of head of major worker; 96, *S. geminata*, full-face dorsal view of head of minor worker; 97, *S. geminata*, base of mandible of major worker; 98, *S. geminata*, base of mandible of media worker; 99, *S. geminata*, base of mandible of minor worker; 100, *S. molesta*, base of mandible of worker; 101, *S. tenuis*, base of mandible of gyne; 102, *S. saevissima*, antenna of worker; 103, *S. saevissima*, maxillary palp of worker; 104, *S. saevissima*, labrum of worker; 105, *S. saevissima*, lateral view of worker; 106, *S. krockowi*, lateral view of petiole of worker; 107, *S. aurea*, lateral view of petiole of worker; 108, *S. castor*, lateral view of petiole and postpetiole of worker.

at the level of the clypeus (Fig. 109), so that the clypeal carinae becomes strongly diverging. Propodeum generally rounded, but in *S. bruchiella* and *S. egregia* the propodeum is stoutly dentate.

Petiole heavier, node broader, less markedly pedunculate than in the worker, subpetiolar process negligible or small; postpetiole more broadly attached to the gaster. Wing venation basically as shown in Figures 4 and 111, but with many variations both within and among species. Thus, in *S. tridens*, one winged male shows a



Figs. 109–113.—*Solenopsis*: 109, *S. daguerrei*, full-face dorsal view of head of gyne; 110, *S. nicai*, full-face dorsal view of head of gyne; 111, *S. tenuis*, wing of gyne; 112, *S. angulata*, wing of gyne; 113, *S. tridens*, wing of male.

complete *r-m* contiguous to *r* (Fig. 113). In one specimen of *S. angulata* the free abcissa of *M* (*Mf*3) is connected to *R* by a short *r-m* proximal to *r*, and a distal part of *Mf*3 is still present (Fig. 112). *M* may be strongly reduced and *m-cu* may be reduced or absent. Finally, the distal part of the entire venation may be partially or wholly desclerotized.

Male

Antennae usually 12-segmented (occasionally 13-segmented); first funicular segment beyond the pedicellus frequently showing signs of being a fusion segment, that is it may be nearly twice as long as the remaining funicular segments, it is always distinctly longer than these, and it often has the line of fusion of the original 2 segments only partially obscured. Scape rather short and barrel-shaped, pedicellus globular and about twice the diameter of the remaining funicular segments. Clypeus rounded and swollen, only shallowly inserted between the antennal sockets; clypeal setae not

in clear patterns. Mandibles weakly developed, with only 1 or 2 teeth, but capable of being closed together. Palpi as in worker. Petiole and postpetiole as in gyne, postpetiole more broadly attached to the gaster. Mesonotum without notauli, parapsidal furrows very faint; wings as in gyne. Genitalia strongly retracted.

Comments

This genus is virtually cosmopolitan except in the coldest parts of the world. A more or less arbitrary division may be made of three natural groups in the genus. Firstly there are the large species commonly called "fire ants" (*S. saevissima, geminata,* etc.), which are free-living, and forage openly for grain, living and dead insects and other foods; these are endemically New World in their distribution, but have been spread elsewhere by commerce. Due to their extensive spread in the south-eastern United States and their supposed economic importance there, the biology of this group has received considerable attention (see Wilson 1953*b*, 1958*a*, 1958*b*, 1959*a*, 1962*a*, 1963, and contained references). The second group contains the numerous small species that are often lestobiotic in the nests of other ants, but may be independent of ants or termites on occasion (see Wheeler 1936*b*). Attached to various species in both these groups are socially parasitic species, the gynes of which show structural adaptations parallel to those of the parasitic species of *Monomorium*; as in the case of that genus, the separate generic and subgeneric names of the parasitic species have been synonymized.

Creighton (1930) elevated *Synsolenopsis* to generic rank, on the evidence of Santschi's description, and particularly his drawing, of *S. photophila.* I have seen a type of *S. photophila*, and it is obvious that Santschi's drawing grossly exaggerates the eyes and propodeal angle of *photophila.* Until its type species can be examined, *Synsolenopsis* has been synonymized with *Solenopsis.*

In the following listing, synonymies cited by Creighton (1930, 1950) have not been repeated here.

LIST OF SOLENOPSIS SPECIES

abjecta Emery, 1905, p. 128. (subsp. of *decipiens*). Argentina
abjectior Forel, 1909*a*, p. 266. (var. of *decipiens* subsp. *abjecta*). Argentina
africana Santschi, 1914*a*, p. 81. (subsp. of *fugax*). Tanganyika
albidula Emery, 1905, p. 129. Argentina
alecto Santschi, 1934*a*, p. 575. Tunisia
altinodis Forel, 1912*a*, p. 10. Venezuela
amazonensis Forel, 1904*d*, p. 681. (subsp. of *corticalis*). Peru
amblychila Wheeler, 1915*a*, p. 394. (subsp. of *aurea*). Arizona
andina Santschi, 1923*a*, p. 262. Argentina
angulata Emery, 1894*a*, p. 393. Brazil, Argentina, Uruguay
antoniensis Forel, 1912*a*, p. 5. (var. of *laeviceps*). Colombia
ardua Santschi, 1929, p. 298. (var. of *angulata* subsp. *carettei*). Amazonia
argus Santschi, 1923*a*, p. 260. (var. of *metanotalis*). Argentina
atlanta Santschi, 1934*a*, p. 573. Tunisia
atticola Forel, 1912*a*, p. 7. (var. of *westwoodi*). Argentina
aurata Karawajew, 1912, p. 11. (subsp. of *latro*). Algeria
aurea Wheeler, 1906*b*, p. 336. (var. of *geminata*). S.W. United States of America, northern Mexico
azteca Forel, 1893*a*, p. 390. W. Indies
balachowskyi Bernard, 1959, p. 346. S. France

banyulensis Bernard, 1946, p. 6. (subsp. of *emeryi*). France
barbara Santschi, 1934*a*, p. 572. (var. of *longiceps*). Tunisia
basalis Forel, 1895*b*, p. 44. Brazil, Argentina
belisaria Forel, 1907*d*, p. 278. S.W. Australia
bondari Santschi, 1925*b*, p. 236. Brazil
brasiliana Santschi, 1925*b*, p. 235. E. Brazil
brevicornis Emery, 1887*a*, p. 356. S. Brazil
brevipes Emery, 1905, p. 135. Argentina
bruchi Forel, 1912*a*, p. 6. (subsp. of *clytemnestra*). Argentina
bruchiella Emery, 1921, p. 199. Argentina
bruesi Creighton, 1930, p. 52. (subsp. of *gayi*). Peru
caffra Forel, 1894*b*, p. 99. (var. of *punctaticeps*). S. Africa
canariensis Forel, 1893*b*, p. 466. (var. of *orbuloides*). Canary Is.
capensis Mayr, 1866*b*, p. 905. S. Africa
carettei Forel, 1913*a*, p. 223. (subsp. of *angulata*). Argentina
carhuensis Forel, 1912*a*, p. 8. (var. of *hammari*). Argentina
carolinensis Forel, 1901*b*, p. 345. (subsp. of *texana*). E. United States of America
castor Forel, 1893*a*, p. 391. W. Indies
catalinae Wheeler, 1904, p. 269. (subsp. of *texana*). W. United States of America
clarki Crawley, 1922*b*, p. 16. W. Australia
cleptis Mann, 1919, p. 330. S.W. Pacific
cleptomana Santschi, 1914*a*, p. 80. Tanganyika
clytemnestra Emery, 1896, p. 87. Argentina
congolensis Santschi, 1935*b*, p. 263. (subsp. of *ugandensis*). Congo
conjurata Wheeler, 1925*b*, p. 178. Panama
cooperi Donisthorpe, 1947*b*, p. 110. Libya
corticalis Forel, 1881, p. 13. W. Indies
crivellarii Menozzi, 1936*b*, p. 284. Aegean Is.
cuspisior Santschi, 1923*a*, p. 254. (var. of *joergenseni*). Argentina
cypridis Santschi, 1934*a*, p. 584. (var. of *fugax*). Cyprus
daguerrei (Santschi), 1930*b*, p. 81. (*Labauchena*). Argentina
= *Labauchena acuminata* Borgmeier, 1949, p. 208. Synonymy by Borgmeier (1959, p. 318)
dahlii Forel, 1902*d*, p. 14. S.W. Pacific
debilior Santschi, 1934*a*, p. 583. (var. of *fugax*). Corsica
decipiens Emery, 1905, p. 126. Argentina
delfinoi Forel, 1913*a*, p. 222. (subsp. of *tenuis*). Argentina
desecheoensis Mann, 1920, p. 428. (var. of *globularia*). Puerto Rico
deserticola Ruzsky, 1905, p. 515. Central Asia
dolichops Emery, 1905, p. 123. (var. of *angulata*). Argentina
duboscqui Bernard, 1946, p. 6. S. France
edentula Santschi, 1933*a*, p. 115. (var. of *joergenseni*). Argentina
eduardi Forel, 1912*a*, p. 12. Tropical S. America
egregia (Kusnezov), 1953, p. 342. (*Synsolenopsis*). Argentina
emeryi Santschi, 1934*a*, p. 579. N. Africa
emiliae Santschi, 1912*d*, p. 526. (subsp. of *metanotalis*). Uruguay
erythraea Emery, 1915*d*, p. 12. (subsp. of *punctaticeps*). Somalia
eximia (Kusnezov), 1953, p. 346. (*Synsolenopsis*). Argentina
fairchildi Wheeler, 1926, p. 3. (subsp. of *latro*). W. Mediterranean
flava Santschi, 1929, p. 298. (var. of *albidula*). Argentina
flaveolens Forel, 1901, p. 300. Brazil
foederata Santschi, 1923*a*, p. 255. (subsp. of *stricta*). Brazil
franki Forel, 1908*b*, p. 364. Brazil
froggatti Forel, 1913*a*, p. 187. Tasmania
fugax (Latrielle), 1798, p. 46. (*Formica*). Central and southern Europe
fur Santschi, 1926*b*, p. 230. (subsp. of *punctaticeps*). S. Rhodesia

furtiva Santschi, 1934*a*, p. 584. (var. of *fugax*). France
fusciventris Clark, 1934, p. 62. S.E. Australia
gaetula Santschi, 1936*b*, p. 201. (subsp. of *lusitanica*). Morocco
galapageia Wheeler, 1919*b*, p. 272. (var. of *geminata*). Galapagos Is.
gallardoi Santschi, 1925*a*, p. 160. Argentina
gallica Santschi, 1934*a*, p. 581. S. France
gayi (Spinola), 1851, p. 242. Chile, Peru
geminata (Fabricius), 1804, p. 423. Tropical tramp.
= *rufa* (Jerdon), 1851, p. 106. (*Atta*)
gensterblumi Forel, 1901*a*, p. 298. (subsp. of *picta*). Brazil, Argentina
georgica Menozzi, 1942, p. 169. W. Africa
germaini Emery, 1895*c*, p. 12. Chile
globularia (Fr. Smith), 1858*a*, p. 131. Amazonia, Caribbean countries
gnomula Emery, 1915*d*, p. 13. Somalia
goeldii Forel, 1912*a*, p. 9. Brazil
granivora Kusnezov, 1957, p. 278. (subgenus *Granisolenopsis*). W. Argentina
hammari Mayr, 1903*b*, p. 400. Brazil
hayemi Forel, 1908*a*, p. 45. Costa Rica
helena Emery, 1895*c*, p. 14. Chile
hermione Wheeler, 1921*b*, p. 157. (subsp. of *helena*). Br. Guiana
hoffmanni Forel, 1912*a*, p. 7. (var. of *latastei*). Argentina
hostilis (Borgmeier), 1959, p. 318. (*Labauchena*). Brazil
huachucana Wheeler, 1915*a*, p. 393. S.W. United States of America
huasanensis, Forel, 1912*a*, p. 8. (subsp. of *angulata*). Argentina
idae Forel, 1908*b*, p. 365. (subsp. of *franki*). Brazil
ignobilis Forel, 1913*a*, p. 220. (var. of *decipiens* subsp. *abjecta*). Brazil
iheringi Forel, 1908*b*, p. 362. Brazil
ilinei Santschi, 1936*b*, p. 202. (nom. substit. pro *S. orbula* var. *oculata* Karawajew, 1926, p. 162, nec Santschi, 1925*a*, p. 161). Central Asia
indagatrix Wheeler, 1928*b*, p. 20. China
indocilis Santschi, 1914*b*, p. 355. (var. of *punctaticeps*). W. Africa
insculpta Clark, 1938, p. 370. S. Australia
insinuans Santschi, 1933*c*, p. 103. Uganda
interrupta Santschi, 1916*a*, p. 397. (var. of *saevissima*). Argentina
itinerans Forel, 1911*d*, p. 276. (var. of *pylades*). Mozambique
jacoti Wheeler, 1923, p. 2. China
japonica Wheeler, 1928*a*, p. 113. (var. of *fugax*). Japan
joergenseni Santschi, 1919*e*, p. 42. Argentina
juba Weber, 1943*a*, p. 362. (subsp. of *punctaticeps*). Sudan
kabylica Santschi, 1934*b*, p. 572. Algeria
kasalinensis Ruzsky, 1905, p. 513. (var. of *fugax*). Central Asia
kibaliensis Wheeler, 1922*d*, p. 164. (subsp. of *punctaticeps*). Congo
kochi Finzi, 1936, p. 178. (subsp. of *orbula*). Egypt
krockowi Wheeler, 1908, p. 428. S.W. United States of America
laevis Fr. Smith, 1864, p. 75. E. Indies
laeviceps Mayr, 1870*b*, p. 406. Colombia
laevithorax Bernard, 1946, p. 6. France
latastei Emery, 1895*c*, p. 13. Chile
latro Forel, 1894*c*, p. 21. N. Africa
latroides Ruzsky, 1905, p. 514. (var. of *orbula*). Central Asia
leda Forel, 1913*b*, p. 221. (var. of *clytemnestra*). Brazil
lehmannitschei Santschi, 1916*a*, p. 378. N. Argentina
leptanilloides Santschi, 1925*a*, p. 159. Argentina
littoralis Creighton, 1930, p. 113. (subsp. of *globularia*). S. United States of America
longiceps Forel, 1907*f*, p. 202. Tunisia

loretana Santschi, 1936*a*, p. 406. Argentina
lotophaga Santschi, 1911, p. 81. Tunisia
lou Forel, 1902*c*, p. 152. Tunisia
lucayensis Wheeler, 1908, p. 131. (subsp. of *globularia*). Bahamas
lusitanica Emery, 1915*e*, p. 259. (subsp. of *latro*). Portugal
macrops Santschi, 1917, p. 280. Argentina
madara Roger, 1863*a*, p. 200. N. America
major Forel, 1913*b*, p. 220. (var. of *basalis*). Argentina
maligna Santschi, 1910, p. 359. Congo
mameti Donisthorpe, 1945, p. 777. Mauritius
margotae Forel, 1908*b*, p. 364. (subsp. of *corticalis*). Brazil
marxi Forel, 1915*c*, p. 354. Java
masora Forel, 1912*a*, p. 7. (var. of *latastei*). ?Argentina
maxillosa Emery, 1900, p. 329. N.E. New Guinea
medeis Forel, 1912*a*, p. 10. (subsp. of *patagonica*). Brazil
medioclara Santschi, 1923*a*, p. 254. (var. of *brevicornis*). S. Brazil
medusa Mann, 1916, p. 447. (subsp. of *geminata*). Brazil
megera Santschi, 1934*a*, p. 576. Tunisia
mendozensis Forel, 1913*a*, p. 223. (var. of *angulata* subsp. *carettei*). Argentina
metanotalis Emery, 1896, p. 86. Argentina
metatarsalis (Kusnezov), 1957, p. 274. (*Lilidris*). Argentina
minuiscens Forel, 1912*a*, p. 8. (var. of *tenuis*). Brazil
minutissima Emery, 1905, p. 133. Argentina
moerens Wheeler, 1915*a*, p. 393. (var. of *picta*). S.W. United States of America
molesta (Say), 1836, p. 293. N. America
monticola Bernard, 1946, p. 6. France
msilana Forel, 1894*c*, p. 22. (var. of *oraniensis*). Algeria
nicaeensis Bernard, 1946, p. 6. S. France
nicai Forel, 1913*a*, p. 222. (subsp. of *succinea*). Brazil, Argentina
nigella Emery, 1887*a*, p. 255. Brazil, Argentina
nigelloides Forel, 1913*a*, p. 223. (subsp. of *angulata*). Argentina
nitens Bingham, 1903, p. 160. Ceylon
normandi Santschi, 1934*a*, p. 568. Tunisia
novemmaculata Wheeler, 1925*a*, p. 35. Bolivia
oblongior Karawajew, 1926, p. 161. (subsp. of *orbula*). Central Asia
occipitalis Santschi, 1911, p. 83. Tunisia
oculata Santschi, 1925*a*, p. 161. (subsp. of *angulata*). Argentina
oculatior Forel, 1913*a*, p. 220. (subsp. of *basalis*). Argentina
oraniensis Forel, 1894*c*, p. 22. Algeria
orbula Emery, 1875, p. 472. Mediterranean countries
orbuloides Ern. André, 1890, p. 321. W. Africa
orestes Forel, 1903, p. 256. (subsp. of *clytemnestra*). Brazil
overbecki Viehmeyer, 1916, p. 135. Malaya
pacifica Wheeler, 1919*b*, p. 273. (subsp. of *globularia*). Galapagos Is.
papuana Emery, 1900, p. 330. New Guinea
parabiotica Weber, 1943*b*, p. 90. Br. Guiana
parva Mayr, 1868*a*, p. 175. Argentina
patagonica Emery, 1905, p. 132. S. Chile
= *Solenopsis thoracica* Santschi, 1923*a*, p. 261. Synonymy by Kusnezov (1960, p. 338)
pawaensis Mann, 1919, p. 329. S.W. Pacific
pekingensis Wheeler, 1923, p. 2. (subsp. of *jacoti*). China
pelotana Forel, 1912*a*, p. 5. (var. of *metanotalis*). Brazil
pergandei Forel, 1901*b*, p. 343. E. United States of America
petropelotana Borgmeier, 1928, p. 35. (var. of *brevicornis*). Argentina
photophila Santschi, 1923*a*, p. 251. Argentina

picea Emery, 1896, p. 89. Costa Rica
picquarti Forel, 1900, p. 80. Costa Rica
picta Emery, 1895*b*, p. 278. S.E. United States of America
picturata Santschi, 1931, p. 6. (var. of *metanotalis*). Argentina
pieli Santschi, 1925*c*, p. 86. (subsp. of *soochowensis*). China
pilosula Wheeler, 1908, p. 426. S.W. United States of America
platensis Emery, 1905, p. 125. (var. of *westwoodi*). Argentina
pollux Forel, 1893*a*, p. 393. W. Indies
pontica Santschi, 1934*a*, p. 584. (var. of *fugax*). S. Russia
postbrunnea Forel, 1913*a*, p. 220. (var. of *albidula*). Brazil
provincialis Bernard, 1946, p. 6. France
punctaticeps Mayr, 1865, p. 109. S. Africa
pygmaea Forel, 1901*b*, p. 345. W. Indies
pythia Santschi, 1934*c*, p. 30. Argentina
raptor Santschi, 1919*e*, p. 42. (var. of *basalis*). Argentina
reducta Menozzi, 1927*a*, p. 276. (subsp. of *picea*). Costa Rica
reichenspergeri Santschi, 1923*a*, p. 256. Brazil
richardi Bernard, 1946, p. 8. Monaco
robusta Bernard, 1946, p. 6. France
robustior Santschi, 1923*a*, p. 265. (var. of *wasmanni* subsp. *transformis*). Argentina
rubida Wheeler, 1919*b*, p. 273. (var. of *globularia* subsp. *pacifica*). Galapagos Is.
rugiceps Mayr, 1870*b*, p. 406. Colombia
rugosa Bernard, 1946, p. 8. France
saevissima (Fr. Smith), 1855, p. 166. N. and S. America.
= *richteri* Forel, 1909*a*, p. 267
salina Wheeler, 1908, p. 427. S. United States of America
santschii Forel, 1905*b*, p. 174. Tunisia
scelesta Forel, 1908*b*, p. 364. (var. of *decipiens*). Brazil
schedingi Forel, 1905*c*, p. 21. (subsp. of *germaini*). Chile
schilleri Santschi, 1923*a*, p. 263. Argentina
schmalzi Forel, 1901*a*, p. 299. Brazil
scipio Santschi, 1911, p. 80. Tunisia
scythia Santschi, 1934*a*, p. 585. Central Asia
sea (Kusnezov), 1953, p. 1. (*Bisolenopsis*). Argentina
seychellensis Forel, 1909*b*, p. 55. Seychelle Is.
shiptoni Forel, 1914, p. 267. Argentina
sicula Emery, 1915*e*, p. 259. (subsp. of *latro*). Sicily
silvestrii Emery, 1905, p. 120. Uruguay
solenopsidis (Kusnezov), 1954*a*, p. 12. (*Paranamyrma*). Argentina
soochowensis Wheeler, 1921*a*, p. 531. China
specularis Santschi, 1923*a*, p. 256. (var. of *stricta* subsp. *foederata*). Brazil
spei Forel, 1912*a*, p. 11. Colombia
steigeri Santschi, 1916*a*, p. 378. Argentina
steinheili Forel, 1881, p. 11. W. Indies
strangulata Forel, 1913*a*, p. 221. (subsp. of *clytemnestra*). S. Brazil
stricta Emery, 1896, p. 90. Bolivia
subadpressa Forel, 1903, p. 257. (subsp. of *picea*). Brazil
substituta Santschi, 1925*b*, p. 236. (var. of *tridens*). Brazil
subtilis Emery, 1896, p. 90. Paraguay, Brazil
succinea Emery, 1890, p. 52. W. Indies
sulfurea (Roger), 1862, p. 296. (*Diplorhoptrum*). Colombia
targuia Bernard, 1953*b*, p. 53. Sahara
tennesseensis M. R. Smith, 1951, p. 814., nom. substit. pro *S. longiceps* M. R. Smith, 1942, p. 210, nec. Forel, 1907*f*, p. 202. S.E. United States of America
tenuis Mayr, 1877*b*, p. 874. Amazonia

terniensis Forel, 1905*b*, p. 175. (var. of *orbula*). Tunisia
terricola Menozzi, 1931, p. 267. Costa Rica
tertialis, nom. nov., pro *Solenopsis pygmaea* Bernard, 1946, p. 8, nec. *S. pygmaea* Forel, 1901*b*, p. 345, nec. *S. pygmaea* Forel, 1905*c*, p. 21. France
tetracantha Emery, 1905, p. 131. Argentina
texana Emery, 1895*b*, p. 278. (var. of *pollux*). E. United States of America–S. Canada.
= *Solenopsis rosella* Kennedy, 1938, p. 232. Synonymy by Creighton (1950, p. 238)
tipuna Forel, 1912*e*, p. 56. Formosa
tisiphone Santschi, 1934*a*, p. 586. (subsp. of *fugax*). Tunisia
transformis Forel, 1911*a*, p. 298. (subsp. of *wasmanni*). Paraguay
tridens Forel, 1911*a*, p. 298. Brazil
trihasta Santschi, 1923*a*, p. 252. Argentina
truncorum Forel, 1901*b*, p. 346. (subsp. of *texana*). E. United States of America
tucumana Forel, 1914, p. 278. (var. of *clytemnestra* subsp. *orestes*). Argentina
ugandensis Santschi, 1933*c*, p. 102. Uganda
ultrix Wheeler, 1921*b*, p. 157. (subsp. of *helena*). Br. Guiana
urichi Forel, 1912*a*, p. 6. (var. of *basalis*). W. Indies
validiuscula Emery, 1895*b*, p. 278. (var. of *molesta*). S.W. United States of America
videns Forel, 1912*a*, p. 4. (var. of *tetracantha*). Argentina
vittata Forel, 1912*a*, p. 6. (var. of *basalis*). N. Brazil
virgula Forel, 1904*a*, p. 172. (var. of *corticalis*). S. America
virulens (Fr. Smith), 1858*a*, p. 132. Brazil
vitiensis Mann, 1921, p. 444. (var. of *cleptes*). Fiji
vorax Santschi, 1934*a*, p. 580. Central Asia
wasmanni Emery, 1894*b*, p. 151. Paraguay, Bolivia
weiseri Forel, 1914, p. 278. Argentina
westwoodi Forel, 1894*b*, p. 100. Brazil
wolfi Emery, 1915*e*, p. 259. Yugoslavia
xyloni MacCook, 1879, p. 188. S. United States of America
zambesiae Arnold, 1926, p. 232. Central Africa
zeteki Wheeler, 1942, p. 204. Panama

Genus OXYEPOECUS Santschi

> *Oxyepoecus* Santschi, 1926*a*, p. 6. Type *Oxyepoecus bruchi* Santschi, monobasic.
> *Martia* Forel, 1907*a*, p. 20. Type *Monomorium* (*Martia*) *vezenyii* Forel, monobasic. Nec *Martia* Ragonot.
= *Forelifidis* M. R. Smith, 1954, p. 17, nom. substit. pro *Martia* Forel. Synonymy by Brown (1955, p. 68).

Diagnosis

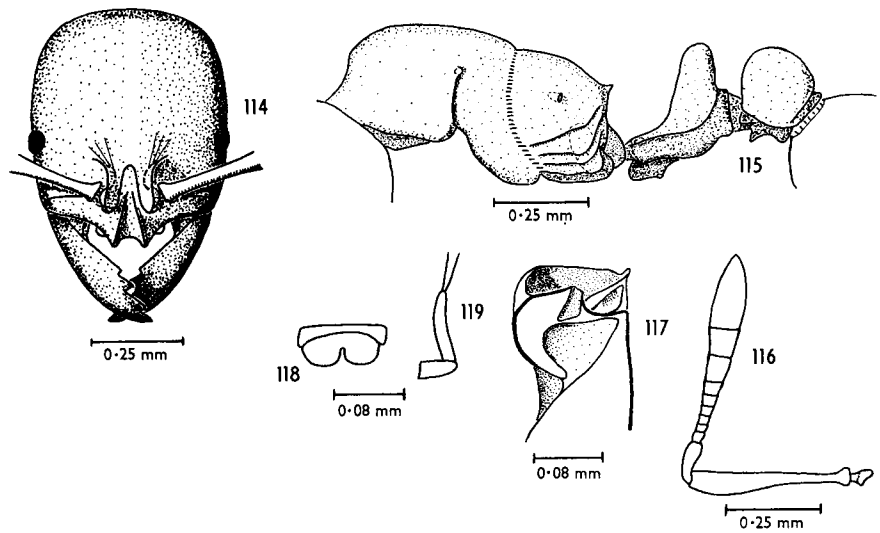
Antennae 11-segmented with a 3-segmented club; palpal formula 2,2; maxillary palp geniculate; propodeum dentate; alitruncal pleurae striate to rugose; remaining characters as for *Solenopsis*.

Worker

TL 1·8–2·7 mm. Eyes fairly well developed, 8–30 ommatidia. Antennae 11-segmented with a distinct, 3-segmented club (Fig. 116). Palpal formula 2,2, the maxillary palp geniculate as in some *Solenopsis* gynes (Fig. 118). Mandible (Fig. 117) with dental formula 1+3; canthellus tapering and curving inwards around the trulleum, but not attaining the basal margin of the blade; trulleum distinct, open; mandalus broadly expanded near the trulleum, being almost anvil-shaped in *O. punctifrons*, and lying next to the ginglymus. Labrum cleft.

Clypeus (Fig. 114) and clypeal setae as in *Solenopsis*, except that the median area is elevated above the lateral areas somewhat more than is usual in *Solenopsis*, hence the anterior tentorial pits are not as close to the antennal sockets as in *Solenopsis*.

Promesonotal suture distinct on the pleura only to the height of the spiracle; metanotal groove complete and reasonably distinct, but only faintly impressed on the dorsum (Fig. 115). Dorsum sloping rather evenly from the pronotum to the propodeum, pronotum rather high and often with pronounced humeral angles. Propodeum sharply angled to stoutly dentate, propodeal carinae distinct and elevated, connecting the propodeal teeth to the inferior propodeal plates, which are well developed and semicircular. Propodeal spiracle round, vestibulate and directed posteriorly.



Figs. 114–119.—*Oxyepoecus*: 114, *O. vezenyii*, full-face dorsal view of head of worker; 115, *O. vezenyii*, lateral view of worker; 116, *O. vezenyii*, antenna of worker; 117, *O. vezenyii*, base of mandible of worker; 118, *O. vezenyii*, labrum of worker; 119, *O. vezenyii*, maxillary palp of worker.

Petiole strongly pedunculate, node high and rounded, quite broad in some species; subpetiolar process dentiform, elongated into a longitudinal ridge and in some species somewhat elaborate (Fig. 115). Postpetiole nodiform, not as high as the petiole but always broader, being laterally produced into bulky lobes; both anterior and posterior subpostpetiolar processes well developed, in the form of pronounced transverse ridges, the anterior process being somewhat hollowed on its anterior face.

Ferruginous to brown, rather hairy ants, sculpture somewhat variable but usually with transverse striae or rugae on the propodeum, meso- and meta-pleurae striate or punctate to striate.

Gyne

I have not seen any material; from the original description of *O. bruchi*, it would appear that the gyne is rather similar to the worker in appearance (Santschi 1926*a*; p. 6).

Male

Not known.

Comments

This genus is exclusively South American, having been collected in Bolivia, Southern Brazil, and Argentina.

Kusnezov (1952) considers that *Oxyepoecus* is an inquiline in the nests of other ant species, and lists the following associations:

Host	Inquiline
Pheidole radoszkowskii	*O. inquilinus*
Pheidole silvestrii	*O. minutus*
Pheidole obtusopilosa	*O. bruchi*
Solenopsis ?metanotalis	*O. daguerrei*
Solenopsis ?tetracantha	

In the case of the *Solenopsis* species, Kusnezov was unsure of their specific identity. Kusnezov was unable to give any detailed information on the biology of *Oxyepoecus*.

LIST OF OXYEPOECUS SPECIES

bruchi Santschi, 1926*a*, p. 6. Argentina
daguerrei (Santschi), 1933*a*, p. 111. (*Martia*). Argentina
inquilinus (Kusnezov), 1952, p. 720. (*Martia*). Argentina
luederwaldti (Forel), 1913*a*, p. 219. (var. of *Monomorium rastratum*). S. Brazil
mandibularis (Emery), 1913*a*, p. 261. (*Monomorium*). Bolivia
minutus (Kusnezov), 1952, p. 721. (*Martia*). Argentina
punctifrons (Borgmeier), 1927, p. 63. (*Monomorium*). Brazil
rastratus (Mayr), 1887, p. 615. (*Monomorium*). Brazil
vezenyii (Forel), 1907*a*, p. 20. (*Monomorium*). Paraguay

(*e*) *Genera Properly Excluded from the* Monomorium, Solenopsis, Megalomyrmex, *and* Pheidologeton *Genus Groups*

The genera *Vollenhovia*, *Xenomyrmex*, *Liomyrmex*, *Huberia*, and *Anergates* were included by authors in the Solenopsidini, while *Trigonogaster* was placed by Emery in the Pheidologetini, but with expressed doubt. While the correct placement of these genera must await further detailed work on the phylogeny of the myrmicine genera, it is believed that they are not closely related to the four genus groups discussed above.

Genus VOLLENHOVIA Mayr

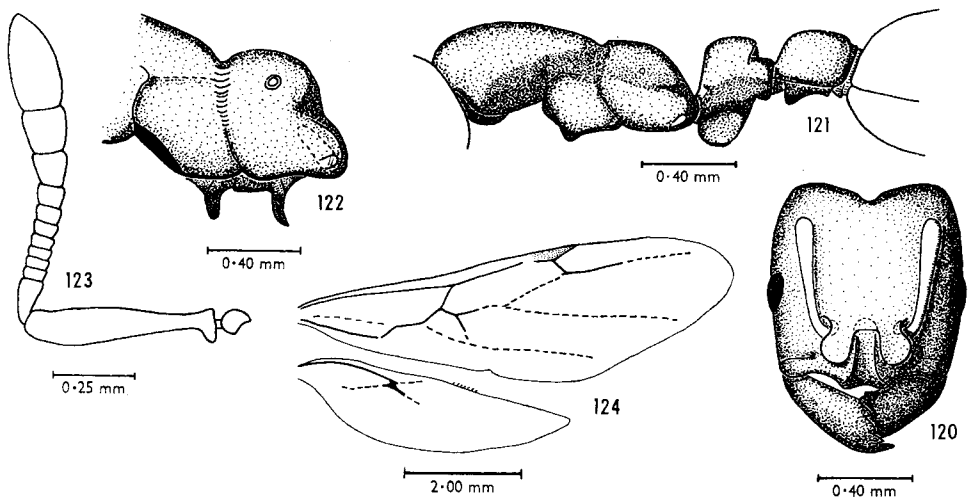
> *Vollenhovia* Mayr, 1865, p. 21. Type *Vollenhovia punctatostriata* Mayr, monobasic.
> *Heteromyrmex* Wheeler, 1920, p. 53. Type *Vollenhovia rufiventris* Forel, monobasic. Syn. nov.
> *Dyomorium* Donisthorpe, 1947*a*, p. 191. Type *Dyomorium ireneum* Donisthrope, monobasic. Syn. nov.
> *Dorothea* Donisthorpe, 1948*b*, p. 65. Type *Dorothea novobritainae* Donisthrope, monobasic. Syn. nov.

Diagnosis

Antennae 12-segmented with a 3-segmented club. Clypeus bicarinate, carinae often partially obscured by longitudinal rugae; median seta usually absent. Meso- and meta-sternal processes strongly developed. Petiole not or only weakly, pedunculate, bearing an extensive blade-like subpetiolar process; anterior subpostpetiolar process cuneiform, its concave anterior face fitting a corresponding convex face on the posteroventral corner of the petiole. Colour yellow, red-brown to brown-black, usually concolorous.

Worker

TL 2–5·5 mm, size within species usually quite variable, extremely so in *V. rufiventris*. Eyes always well developed, with at least 25 ommatidia. Antennae 12-segmented (rarely 11-segmented) with a distinct 3-segmented club (Fig. 123). Palpal



Figs. 120–124.—*Vollenhovia*: 120, *V. pedestris*, full-face dorsal view of head of worker; 121, *V. pedestris*, lateral view of worker; 122, *V. rufiventris*, lateral view of posterior alitrunk to show mesosternal and metasternal processes; 123, *V. brevicornis*, antenna of worker; 124, *V. rufiventris*, wing of gyne.

formula 2,2; the apical segment of the maxillary palp often slightly or sharply bent near its base. Mandibles subtriangular, with masticatory margins closely opposable; dental formula variable, with 4–7 distinct, even, subapical teeth. Canthellus straight to curved, meeting and fusing with the basal margin of the blade, trulleum distinct and closed; mandalus linear, lying above the middle of the trulleum and close to the ginglymus; ginglymus very deep and extensive. Labrum bilobed.

Clypeus (Fig. 120) with median area sharply elevated above the lateral areas and inserted deeply between the frontal carinae; bicarinate, carinae usually distinct and separated by a smooth median sulcus or more or less obscured by longitudinal rugae; median area always overhanging the mandibles. Anterior margin of median area of clypeus usually concave, sometimes straight or produced into a slight median

tooth, which may bear a single seta, otherwise median seta absent. One or two pairs of intercarinal setae may be present. Carinal setae well developed, directed anteroventrad and slightly incurved; a series of paracarinal setae always present.

Promesonotal suture distinct on the pleura only to the height of the spiracle, sometimes a faint sutural line is seen on the dorsum. Anterior edge of mesokatepisternum bearing a characteristic lamellar plate (Figs. 121, 122). Metanotal groove always distinct, usually deeply impressed on the dorsum, but dorsal impression sometimes quite shallow. Propodeum rounded to angulate or dentate; inferior propodeal plates very small to moderately developed, largely hidden by the posterior prolongation of the metapleurae and basal propodeum; propodeal carinae distinct, often elevated, continued onto the dorsum of the propodeum. Median meso- and meta-sternal processes large and well developed, though simple in form (Fig. 122).

Femora of the second and third pairs of legs bulbous and grooved on their ventral surfaces to receive the tibiae partially.

Petiole very weakly or not pedunculate, node high and usually rather flat on top in profile. Ventral surface of petiole bearing a very large, longitudinally oriented, suboblong to subtriangular lamellate plate, which engages the metasternal process when the gaster is swung forward. In front of this process, and hidden unless the petiole is lifted high up, is a small denticle that may represent the subpetiolar process seen in other groups. Postpetiole nodiform, rounded above, as broad as, or usually broader than the petiolar node. Anterior subpostpetiolar process cuneiform, its anterior face concave to receive the posterior ventral corner of the petiole (which is correspondingly rounded) when the gaster is swung forward; posterior subpostpetiolar process usually rather reduced, leaving free the anteroventral articulatory surface of the first gastric segment.

Yellow, or more usually red-brown to brown-black ants, most commonly concolorous, rarely conspicuously bicolorous. Sculpture variable, smooth, punctate, striate, or rugose.

Gyne

Somewhat larger to much larger than conspecific worker, TL 5·5–10·5 mm. With the general characters of the worker, alitrunk showing full alate segmentation. Wings with venation usually extensively desclerotized; venation of the type shown in Figure 124; one alate of *V. oblonga* showed an extra vein intercalated between *R* and *M* and originating from the stem of *R*.

Male

Smaller to much smaller than gyne, sometimes smaller than conspecific worker. Antennae generally 13-segmented, less commonly 12-segmented, sometimes showing a fusion segment; scape rather long and cylindrical, as long as the second to fourth funicular segments together; pedicellus somewhat conical, not expanded, the funicular segments mostly short and cylindrical, but the terminal segment rather long. Clypeus rounded, deeply inserted between the antennal sockets. Mesonotum lacking notauli, parapsidal furrows ill-defined or absent. Petiole as in worker, but lacking the pronounced subpetiolar process; postpetiole expanded posteriorly, and very broadly attached to the gaster. Wing venation as in gyne. Genitalia strongly retracted.

Comments

The genus *Vollenhovia* is represented from Malaya, the Seychelles, and through the East Indies to Melanesia, Queensland, and western Polynesia.

Heteromyrmex was distinguished mainly by the higher expression of polymorphism in the worker caste of the single species, *rufiventris*; this is not, however, a suitable generic character unless supported by more than the inconsequential differences in sculpture that Wheeler used. The type of the monobasic genus *Dorothea* was examined by E. O. Wilson in 1953; he states (personal communication) that this is a simple *Vollenhovia* species. I have seen the unique type of Donisthorpe's monobasic genus *Dyomorium*, and this also is clearly a *Vollenhovia*.

Species of *Vollenhovia* are usually collected from hollow twigs, in rotten logs at the *Zoraptera* stage of decomposition (see Wilson 1959*b*) or other natural woody cavities. They are predatory, attacking insects and insect larvae, probably including termites. E. O. Wilson collected a species of *Vollenhovia* at the Lower Busu River, New Guinea, workers of which were carrying dipterous larvae in their mandibles.

LIST OF VOLLENHOVIA SPECIES

affinis Emery, 1887*b*, p. 454. New Guinea
agilis Santschi, 1928*a*, p. 44. Samoa
alluaudi Emery, 1894*c*, p. 68. (subsp. of *laevithorax*). Seychelles Is.
ambitiosa Menozzi, 1925, p. 446. Philippine Is.
bandarensis Forel, 1913*e*, p. 67. (var. of *pedestris*). Sumatra
banksi Forel, 1910*d*, p. 126. Philippine Is.
beyrichi (Mayr), 1868*b*, p. 84. (*Macromisha*) (fossil). Baltic amber
brachycera Emery, 1914*b*, p. 407. New Guinea
brevicornis (Emery), 1893*a*, p. 203. (*Monomorium*). Sumatra
brunnea Donisthorpe, 1946, p. 582. New Guinea
butteli Forel, 1913*e*, p. 68. Malaya
chosenica Wheeler, 1928*a*, p. 113. (subsp. of *emeryi*). Korea
dentata Mann, 1919, p. 325. Solomon Is.
denticulata Emery, 1914*b*, p. 405. New Caledonia
dispar Forel, 1910*d*, p. 125. (subsp. of *oblonga*). Philippine Is.
duodecimalis Donisthorpe, 1947*a*, p. 595. New Guinea
elysii Mann, 1919, p. 327. Solomon Is.
emeryi Wheeler, 1906*a*, p. 312. Japan
escherichi Forel, 1911*e*, p. 198. Ceylon
foveaceps Mann, 1919, p. 328. Solomon Is.
fridae Forel, 1913*e*, p. 65. Sumatra
hewitti Wheeler, 1919*a*, p. 82. Borneo
ireneum (Donisthorpe), 1947*a*, p. 191. (*Dyomorium*). W. New Guinea
jacobsoni Forel, 1915*a*, p. 25. (var. of *butteli*). Malaya
kappa Forel, 1915*a*, p. 25. (subsp. of *oblonga*). E. Indies
kuchingensis Wheeler, 1919*a*, p. 83. (subsp. of *banksi*). Borneo
laevithorax Emery, 1889, p. 501. Burma, E. Indies
loboii Mann, 1919, p. 324. Solomon Is.
longiceps Emery, 1893*a*, p. 205. Sumatra
magna Viehmeyer, 1914*a*, p. 525. (subsp. of *subtilis*). New Guinea
marginata Mann, 1919, p. 327. (subsp. of *dentata*). Solomon Is.
minuta Viehmeyer, 1916, p. 129. (var. of *brevicornis*). Malaya
modiglianii Emery, 1901*a*, p. 679. Sumatra

moesta (Fr. Smith), 1863, p. 21. (*teste* Donisthorpe, 1932, p. 471). E. Indies
ngoko Forel, 1912*c*, p. 108. (var. of *piroskae*). Java
nigrescens Forel, 1913*e*, p. 69. (subsp. of *subtilis*). Java, Summatra
novobritainae (Donisthorpe), 1948*b*, p. 65. (*Dorothea*). New Britain
oblonga (Fr. Smith), 1860, p. 107. E. Indies
opacinoda Forel, 1913*e*, p. 66. Sumatra
overbecki Viehmeyer, 1916, p. 129. Malaya
papuana Viehmeyer, 1914*a*, p. 527. N.E. New Guinea
pedestris (Fr. Smith), 1862*b*, p. 46. S.W. Pacific
pertinax (Fr. Smith), 1862*b*, p. 46. (teste *Donisthorpe*, 1932, p. 468). Celebes
piroskae Forel, 1912*b*, p. 162. Celebes, Seychelle Is.
prisca (Ern. André), 1895, p. 83. (*Macromischa*?) (fossil)
punctata Viehmeyer, 1914*a*, p. 526. New Guinea
punctatostriata Mayr, 1865, p. 21. Malaya
reepeni Forel, 1913*e*, p. 65. (var. of *oblonga* subsp. *rufescens*). E. Indies
rufescens Emery, 1894*c*, p. 69. (var. of *laevithorax*). E. Indies
rufipes Donisthorpe, 1949, p. 409. W. New Guinea
rufiventris Forel, 1901*b*, p. 374. Borneo
samoensis Mayr, 1876, p. 99. Samoa
satoi Santschi, 1937*c*, p. 373. Formosa
seeliebi Forel, 1913*e*, p. 69. (subsp. of *butteli*). Malaya
simalurana Forel, 1915*a*, p. 23. (var. of *rufiventris*). Sumatra
simoides Emery, 1897*a*, p. 561. New Guinea
soleaferrea Donisthorpe, 1942*a*, p. 66. Philippine Is.
subtilis Emery, 1887*b*, p. 454. New Guinea
taipingensis Forel, 1913*e*, p. 64. (var. of *piroskae*). Malaya
umbilicata Donisthorpe, 1941*b*, p. 56. W. New Guinea
undecimalis Donisthorpe, 1947*a*, p. 594. N.E. New Guinea

Genus XENOMYRMEX Forel

> *Xenomyrmex* Forel, 1884, p. 369. Type *Xenomyrmex stolli* Forel, monobasic.
> *Myrmecinella* Wheeler, 1922*b*, p. 1. Type *Myrmecinella panamana* Wheeler, monobasic. Synonymy by Wheeler (1931, p. 133).

Diagnosis

Antennae 11-segmented with a distinct 3-segmented club. Palpal formula 4,2. Size small, body form slender, flattened, petiole virtually non-pedunculate, postpetiole bent almost at a right angle. Colour yellow to brown-black.

Worker

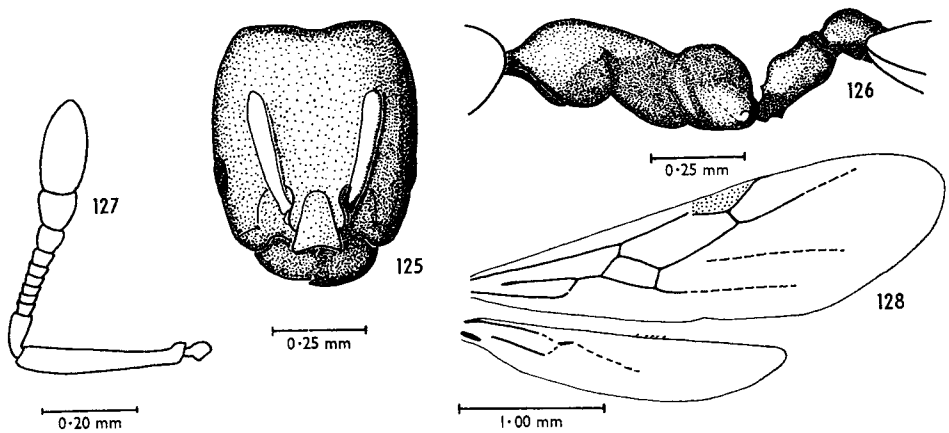
TL 1·8–2·2 mm, monomorphic, some slight size variation within species. Eyes well developed, with 40–50 ommatidia. Antennae (Fig. 127) 11-segmented with a well-defined 3-segmented club. Palpal formula 4,2. Mandibles heavy, masticatory margin long, outer margin strongly convex; dental formula 1+5; canthellus meeting the basal margin; trulleum small, closed; mandalus narrow, linear, not close to the ginglymus; ginglymus deep and extensive, similar to that in *Myrmecina*. Labrum with distal margin concave.

Median area of clypeus sharply elevated above the lateral areas, bordered by a pair of sharp carinae which are continuous with the margins separating the median area from the frontal carinae and frons, and protruding anteriorly to overhang the mandibles (Fig. 125); median area generally flat, but bearing a sharply margined

median longitudinal sulcus in *panamanus*; bearing a close resemblance to the clypeus in *Myrmecina*. Median seta absent, 2 or 3 pairs of well-developed intercarinal setae and a pair of long, anteriorly directed carinal setae present.

Promesonotal suture distinct on the pleura only to the height of the spiracle; metanotal groove pronounced, bridged by close, parallel, longitudinal rugae and deeply impressed on the dorsum (Fig. 126). Propodeal dorsum high, convex; spiracle placed high and far forward on the propodeal pleuron, almost onto the dorsum; inferior propodeal plates small.

Petiole more or less cylindrical, narrowed abruptly at its anterior end into a very short peduncle; the anterior end of the "node" thus formed may bear pronounced dorsolateral angles or small denticles; subpetiolar process small, dentiform. Posterior



Figs. 125–128.—*Xenomyrmex*: 125, *X. mexicanus*, full-face dorsal view of head of worker; 126, *X. mexicanus*, lateral view of worker; 127, *X. mexicanus*, antenna of worker; 128, *X. skwarrae*, wing of gyne.

end of the petiole terminating on a plane perpendicular to the median longitudinal axis of the petiole. Postpetiole tubular, abruptly bent almost to a right angle as in Figure 126; in its natural position, the petiole is carried so that it is directed postero-dorsally at a high angle; the abrupt bend in the postpetiole then restores the gaster to an attitude approximately parallel to the substrate. The form of the petiole and postpetiole is close to that of *Myrmecina* and *Gauromyrmex*.

Femora of second and third pairs of legs incrassate, grooved ventrally to receive the tibiae.

Colour yellow to brown-black, often with the gaster infuscated in the lighter samples; sculpture of head and alitrunk variable, striate-rugose or punctate; gaster smooth and shining.

Gyne

Larger than the worker, TL 4·2–4·7 mm. General characters as in worker; alitrunk bearing wings in virgin gynes, but sutures reduced and entire alitrunk rather smooth and streamlined, gaster rather large, reminiscent of the form of the gynes in

some small species of the *minutum* group in *Monomorium*. Postpetiole broadly attached to the gaster. Wings with venation reduced, as shown in Figure 128. A curving forward at *cu-a*, but often with a minute stub of *A* continuing past the junction with *cu-a*.

Male

Of similar size to the worker. Antennae 12-segmented, scape very short, equal in length to the second to fourth funicular segments together. Pedicellus globular, its diameter similar to that of scape; remaining funicular segments thick, cylindrical, densely covered with short setae, the last 4 segments longer than the more basal ones. Mandibles very small, opposable, similar in form to that of the worker. Clypeus semiglobular, only slightly inserted between the antennal sockets. Eyes very large, occupying most of the side of the head. Alitrunk lacking notauli or parapsidal furrows, but bearing a prominent transverse furrow on the mesonotum which Creighton (1957; p. 5) states to be present in living males also. Wings with venation strongly reduced compared to that of gyne. Petiole and postpetiole as in worker. Genitalia apparently large and delicate, badly shrivelled in dried material.

Comments

This genus is apparently related to *Myrmecina*; the clypeus, the petiole and postpetiole are remarkably similar, and the wing venation of *Xenomyrmex* is easily derived from that of *Myrmecina*. The similarity of the petiole and postpetiole was probably overlooked because the petiole and postpetiole of mounted specimens of *Xenomyrmex* are always pushed out straight into a totally unnatural position.

These minute ants live in cavities in living and dead plants, a habit for which they are admirably adapted structurally. Creighton (1957) gives some observations and speculations on their biology. He fed colonies on sugar syrup from canned peaches, and also on termites, which the workers cut up and fed to the larvae. Creighton postulates that the species are termitolestic; this seems inconsistent with the large eyes, which are usual in the genus, and the fact that Wheeler collected *panamanus* as strays on tree trunks. The genus is restricted to Florida, the West Indies, Mexico, and probably Central America at least as far as Panama. For discussion and key, see Creighton (1957).

LIST OF XENOMYRMEX SPECIES

floridanus Emery, 1895*b*, p. 275. (subsp. of *stolli*). Florida, W. Indies
panamanus (Wheeler), 1922*b*, p. 1. Panama
skwarrae Wheeler, 1931, p. 137. (subsp. of *stolli*). Mexico
stolli Forel, 1884, p. 370. Mexico, Central America

Genus LIOMYRMEX Mayr

>*Liomyrmex* Mayr, 1865, p. 23. Type *Myrmica coeca* Fr. Smith, monobasic.

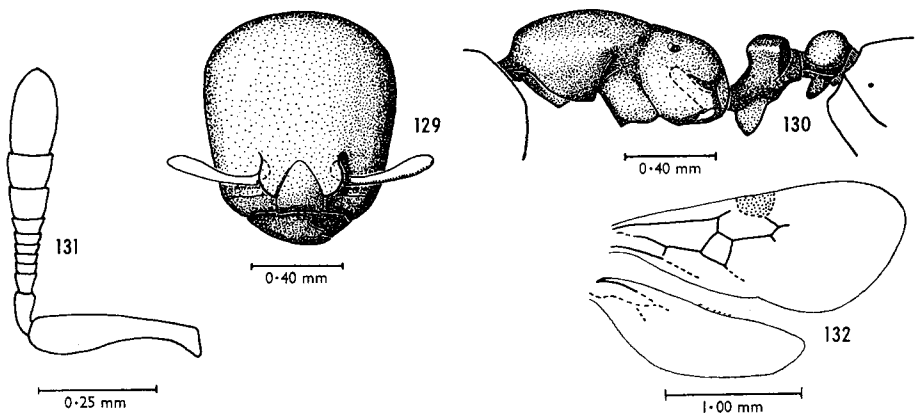
Diagnosis

Antennae 10- or 11-segmented with a well-defined 3-segmented club. Eyes apparently always absent in worker, well developed in gyne. Head subquadrate; body compressed dorsoventrally; nodes of petiole and postpetiole massive and

strongly transverse; petiole with a very short peduncle and a very large, keel-shaped, lamellate subpetiolar process; anterior subpostpetiolar process heavy, lobate; metasternal process weakly developed; propodeal spiracle vestibulate. Colour clear yellow-red, brown to dark brown.

Worker

TL 3·0–3·9 mm in *L. aurianus* (only species seen); monomorphic. Eyes apparently always absent. Antennae (Fig. 131) 10- or 11-segmented with a well-defined 3-segmented club. Palpal formula 2,2. Mandibles at rest crossed and clasped together tightly, the apices extending more than one-third the length of the mandible past the midline; dental formula 1+3; canthellus sharply inflexed before it meets the basal margin of the blade, almost eliminating the trulleum; mandalus short and broad, lying next to the extensive ginglymus. Labrum with distal margin concave.



Figs. 129–132.—*Liomyrmex:* 129, *L. aurianus*, full-face dorsal view of head of worker; 130, *L. aurianus*, lateral view of worker; 131, *L. aurianus*, antenna of worker; 132, *L. aurianus*, wing of male.

Clypeus (Fig. 129) with median area sharply elevated above the lateral areas, median area itself flat from side to side, curving smoothly in profile from the frons to the anterior margin, and very broad in front view; lateral areas abbreviated, anterior tentorial pits lying close behind the antennal sockets.

Alitrunk (Fig. 130) compressed dorsoventrally; promesonotal suture distinct only on the pleura to the height of the spiracle; metanotal groove distinct, impressed on the dorsum; entire dorsum rather flat, pronotum wider anteriorly, narrowing evenly to the metanotal groove. Propodeum smoothly rounded; spiracle placed high on the pleuron, with a distinct vestibule visible through the transparent cuticle. Metapleural gland rather long, narrow and parallel-sided when viewed through the cuticle; metasternum bearing a distinct but simple process to receive the subpetiolar process.

Petiole very briefly pedunculate, node large, subquadrate, much broader than long in dorsal view; subpetiolar process very large, keel-shaped, lamellate. Postpetiolar node lower than the petiolar node in profile, rounded, strongly transverse, subreniform viewed from above; anterior subpostpetiolar process large, lobate,

pendant in side view, and rounded and conical in front view, its anterior face not excavated as in *Vollenhovia*. Posterior subpostpetiolar process strongly reduced, exposing the anterior articulation of the first gastric segment, which simulates the posterior process in side view (Fig. 130).

Second and third pairs of legs incrassate, shallowly grooved ventrally to receive the tibiae.

Smooth, shining ants, lacking any strong sculpturation; colour clear yellow-red, brown to dark brown; a few long setae may be found on the humeral angles, on the petiolar node and around the apex of the gaster.

Gyne

About twice the length of the worker, TL 8·0–9·3 mm. With the characters of the worker; alitrunk more or less fully segmented, but profile low and smooth, ergatogynous. Petiolar node broad, flat and subrectangular dorsally with the anterior margin strongly excavated; node of postpetiole subreniform in dorsal view; processes of petiole and postpetiole as in worker but even more strongly produced. Anterior articulation of gaster prominent; gaster very long, narrow, subcylindrical.

Male

Size equal to or slightly smaller than worker. Antennae 12-segmented, all segments rather short and stout. Clypeus slightly swollen, acute posteriorly and separating the antennal sockets. Mandibles very small, opposable, dental formula 1+1. Alitrunk lacking notauli, parapsidal furrows very faint, segmentation complete; wings present, venation of the generalized solenopsidine type, considerably desclerotized (Fig. 132). Petiole stoutly pedunculate, node rounded, subpetiolar process stoutly dentate and produced posteriorly as a stout ridge. Postpetiole simple, nodiform; anterior subpostpetiolar process small, rounded, posterior process lacking. Colour in *L. aurianus* brown-black, with emerald green iridescence. Genitalia strongly retracted, parameres thickened.

Comments

Liomyrmex is a small compact genus; the species are confined to Burma, Malaya, the Philippine Is., and New Guinea. Very little is known of their biology. Wheeler (1914*d*) received a sample of *L. aurianus* collected by C. F. Baker at Mt. Makaling, Luzon, Philippine Is. Baker wrote to Wheeler that these were found in the forest "abundant with termites—living in the same chamber with these in entire amity". The termite was stated by Wheeler to be *Termes* (*Macrotermes*) *gilvus* Hagen. Wheeler concluded from this that *Liomyrmex* is a termitophile and it has so long been regarded by others; however, in 1936 he decided it was probably termitolestic (Wheeler 1936*b*). In actual fact, no amount of speculation is very satisfactory, and some clear field evidence is needed.

LIST OF LIOMYRMEX SPECIES

aurianus Emery, 1889, p. 504. Philippine Is., Malaya
carinatus Stitz, 1911, p. 366. New Guinea
coecus (Fr. Smith), 1860, p. 108. New Guinea
froggatti Donisthorpe, 1940, p. 40. New Guinea
gestroi (Emery), 1887*b*, p. 461. New Guinea

major Donisthorpe, 1941*a*, p. 204. (subsp. of *froggatti*). New Guinea
reneae Donisthorpe, 1947*c*, p. 293. W. New Guinea
tagalanus Menozzi, 1925, p. 445. Philippine Is.

Genus HUBERIA Forel

> *Huberia* Forel, 1890, p. 105. Type *Aphaenogaster striatum* Fr. Smith, monobasic.

Diagnosis

Antennae 11-segmented, with a poorly defined 3- or 4-segmented club. Palpal formula 5,3. With the general habitus of *Chelaner*, but median area of clypeus bordered behind by a broad and deeply impressed suture, and with moderate or elaborate meso- and meta-sternal processes. Malpighian tubules 8 in both species. Colour reddish-yellow, reddish-brown, or black.

Worker

TL 2·8–5·0 mm. Eyes large and well developed; also 1–3 ocelli in large specimens in both species. Antennae (Fig. 136) 11-segmented with an indefinite 3- or 4-segmented club; funicular segments rather moniliform. Palpal formula 5,3; basal segment of maxillary palp with distal articulation displaced laterally. Mandibles with dental formula 1+9 or 1+5; canthellus not attaining the basal margin of the blade, leaving a distinct gutter between the end of the canthellus and the basal margin of the blade; trulleum distinct and open; mandalus linear, abutting the ginglymus which extends about halfway across the basal edge of the trulleum. Labrum cleft.

Clypeus with median area strongly arched as seen in profile, with a distinct median sulcus, bearing strong longitudinal rugae on each side of the sulcus, and bordered behind by a broad and deeply impressed suture (Fig. 133). Median seta absent in the smaller species, *H. brounii*, but in *H. striata* there are 2 median setae, a longer one nearer the oral margin of the clypeus and a shorter one just behind and above the first (note that a median seta is not present in the gyne of either species); first pair of intercarinal setae long and directed toward the tips of the closed mandibles, often crossing and reaching halfway down the masticatory margin of the closed mandible. Carinal setae long, directed forward and often crossing at their tips in front of the clypeus; several paracarinal setae present.

Promesonotal suture complete in *striata*, complete only to the spiracle in *brounii*. Metanotal groove deeply impressed on the dorsum; propodeum bearing a pair of stout spiniform teeth directed posteriorly and dorsally at about 45° (Fig. 134). Propodeal carinae slightly raised, connecting the ventral bases of the propodeal teeth to the inferior propodeal plates, which are well developed and semicircular. Propodeal spiracle round, directed strongly posteriorly. Meso- and meta-sterna bearing elaborate processes in *striata* (Fig. 135), but only very simple processes in the smaller *brounii*. Metapleural glands well developed.

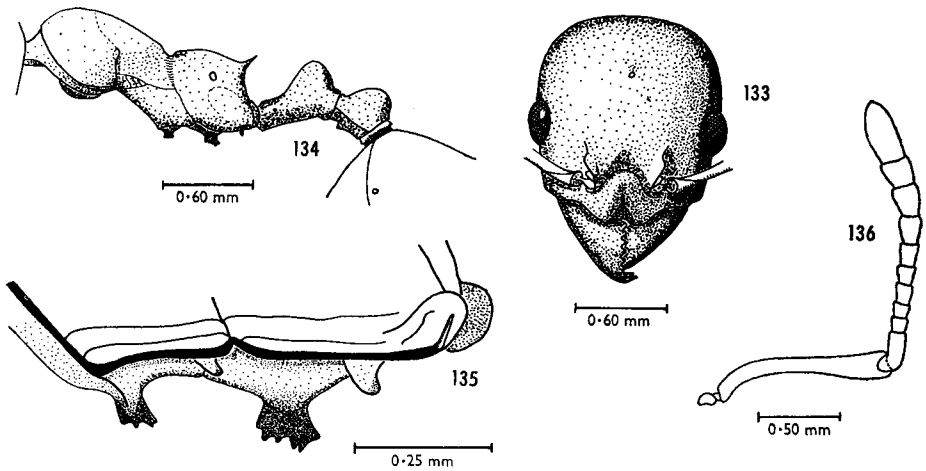
Petiole strongly pedunculate, node rounded, anteriorly bearing a small, sharp, isolated dentiform subpetiolar process, but the entire ventral surface rather keel-like. Postpetiole with a rather low node, but considerably wider than the petiolar node in dorsal view; both subpostpetiolar processes distinct in *striata*, obsolete in *brounii*.

Malpighian tubules definitely 8 in *H. striata*, probably 8 in *brounii*.

Reddish-yellow to black ants, strongly sculptured, rugose or rugose striate on head and alitrunk, ventral parts of petiole and most of postpetiole punctate, gaster smooth and shining. Sparsely covered with rather long, pale setae.

Gyne

TL 4–9 mm. Antennae 11-segmented, club poorly defined; with the characters of the worker, but the alitrunk fully segmented and subpetiolar process poorly developed. Wing venation of *Solenopsis* type, often with *Mf*3 partially developed as a short stub on *Rs*+*M*; alates of only one species, *H. striata*, have been seen by me.



Figs. 133–136.—*Huberia*: 133, *H. striata*, full-face dorsal view of head of worker; 134, *H. striata*, lateral view of worker; 135, *H. striata*, lateral view of posterior alitrunk of worker, showing mesosternal and metasternal processes; 136, *H. striata*, antenna of worker.

Male

The male of *H. striata* only is known with certainty; similar in size and general form to the gyne; antennae 12-segmented, scape long, pedicellus short and conical, remainder of the funicular segments long and narrow. Alitrunk with notauli complete and strongly indented on the dorsum, parapsidal furrows rather faint but extending anteriorly to the junction of the notauli. Petiole thickened, not constricted anteriorly into a peduncle, postpetiole also thickened, both segments much larger than the corresponding parts of the gyne. Wings as in gyne; in the one winged specimen seen, *Mf*3 is represented by a stub on the junction of *Mf*4 and *r-m*. Genitalia strongly retracted, parameres swollen.

Comments

This small genus is restricted to New Zealand, and may perhaps represent a relic of an ancient myrmicine stock. Brown (1958) summarizes the available, rather meagre data on the genus. *H. striata* inhabits populous, large, ill-defined nests in the soil, or under rocks in the cooler parts of the range, or in rotting wood in the north; *striata* is a general feeder, and keeps Homoptera in its nests (see Moore 1940). *H.*

brounii forms small colonies, usually in leaf litter, but little else is known of its biology; Brown (1958) points out the similarity in habitus of this species and *Stenamma* spp. in the northern hemisphere, and queries whether *brounii* might not also feed on small soil arthropods.

LIST OF HUBERIA SPECIES

brounii Forel, 1895*a*, p. 41. New Zealand
striata (Fr. Smith), 1876, p. 481. New Zealand
= *Huberia striata* var. *rufescens* Forel, 1892*d*, p. 339. Synonymy by Brown (1958, p. 26)

Genus ANERGATES Forel

= *Anergates* Forel, 1874, p. 32. Type *Myrmica atratula* Schenck, monobasic.

Diagnosis

Degenerate workerless parasite of *Tetramorium caespitum*. Gyne winged when virgin, wing venation modified and reduced; clypeus with anterior median border deeply excavate; mandibles reduced, bearing only an apical tooth; petiole and postpetiole broadly sessile. Gaster with a deep longitudinal median furrow in the winged gyne; strongly physogastric in the gravid gyne. Males pupoidal, with relatively large, strongly extruded genitalia.

Gyne

TL around 2·7 mm. Eyes well developed, hemispherical; 3 ocelli present, elevated on an eminence of the occiput. Antennae 10- or 11-segmented, with fusion of the second to fourth funicular segments to a greater or lesser extent; median aspect of the free segments serrate. Palpal formula 1,1; palpi reduced and globular. Mandibles strongly reduced, subconical, with only the apical tooth remaining. Labrum reduced, distal margin concave, lateral margins converging.

Clypeus with median area broadly separating the antennal sockets, anterior margin deeply emarginate; lateral areas short, not attaining the genae. Frontal carinae not developed.

Alitrunk fully segmented, dorsum strongly arched, bearing wings in the virgin gyne. Metapleural glands strongly reduced; inferior propodeal plates small, curved, continuous with the propodeal carinae which are raised as welts; carinae terminating in a pair of rounded protuberances in the normal position of the propodeal teeth. Declivity concave, very broad. Wings with venation reduced (Fig. 137).

Petiole grossly thickened and broadened, the entire structure capable of being closely applied into the declivity, and between the protuberances of the propodeum mentioned above. Postpetiole much broader than the petiole, very broadly sessile on the gaster. Gaster in virgin gynes bearing a deep, longitudinal furrow; in gravid gynes, the intersegmental membranes of the gaster are extended, allowing for physogastry.

Virgin gyne uniformly dark brown, densely punctulate. Physogastric gyne with head, alitrunk and segmentalia of gaster as in virgin gyne, intersegmentalia mustard yellow.

Male

Same size as gyne. Body pupoidal, in general with the characters of the gyne but even further reduced. Antennae 10- or 11-segmented, basal funicular segments more or less fused, all segments irregular in shape and size. Mouthparts as in gyne, but mandibles rounded, lobate, not opposable. Alitrunk partially segmented, apterous. Propodeum with declivity very broad and concave; inferior propodeal plates carried out to the level of the thoracic pleura, very large, propodeal carinae reduced. Petiole and postpetiole broadly sessile, anteroventrally compressed and rounded above; postpetiole very large, completely fused to the gaster; apex of gaster strongly flexed ventrally. Genitalia enormous, strongly extruded, directed anteriorly by the flexure of the gaster; parameres broad and thickened; volsellae reduced, apically rod-like, not reaching the tips of the parameres; aedeagus large, flattened, ventral margin not serrate.

Colour testaceous depigmented; very finely punctulate over the entire head and body.

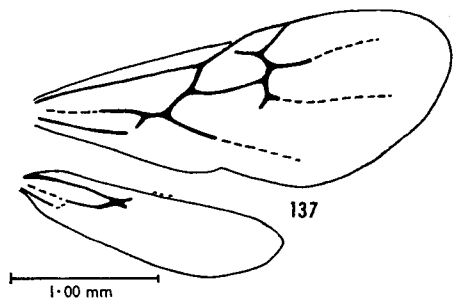


Fig. 137.—*Anergates*: Wing of gyne of *A. atratulus*.

Comments

This genus contains only one species, *Anergates atratulus*, parasitic on *Tetramorium caespitum*; this species was thought to be confined to Europe until Creighton found it with the same host in the United States of America. Numerous collections of *A. atratulus* have been made from the nests of *T. caespitum* and the adoption of *atratulus* by *caespitum* workers duly observed. The pupoidal form of the male precludes the usual "nuptial flight", and adelphogamic mating takes place in the nest before the gynes emerge. Creighton (1950) deals with the matter more fully.

The reduced number of antennal segments, the wing venation—easily derived from that of *Tetramorium*—and the close parasitic relationship to *caespitum*, all suggest that *A. atratulus* should be placed in the Tetramoriini.

The single *Anergates* species is *atratulus* (Schenck), 1852, p. 91. Europe, N. America.

Genus TRIGONOGASTER Forel

= *Trigonogaster* Forel, 1890, p. 109. Type *Trigonogaster recurvispinosa* Forel, monobasic.

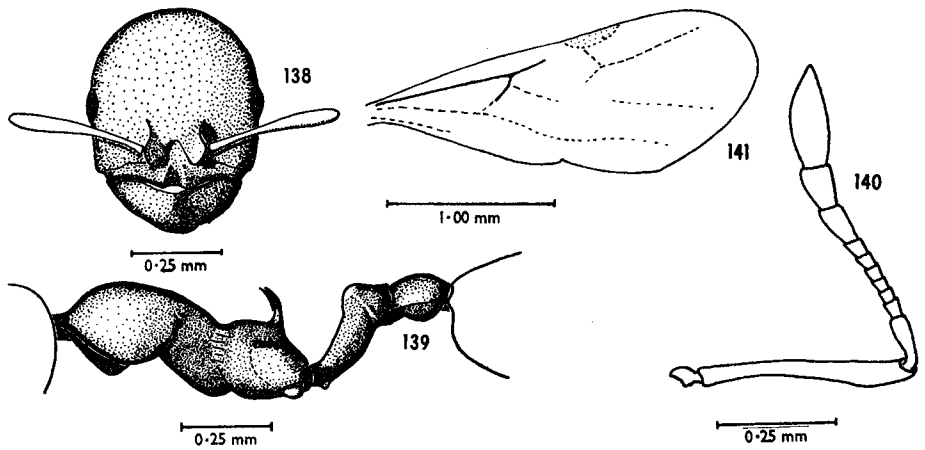
Diagnosis (worker only)

Antennae 11-segmented with a distinct 3-segmented club; palpal formula 4,3; propodeum with a pair of spiniform, anteriorly recurved teeth; petiole subclavate

(see Fig. 139), node low; postpetiole subcylindrical; articulation of gaster strongly transverse, at the anterodorsal margin; dorsum of gaster rather flat, ventral surface strongly convex; sting spatulate; colour yellow.

Worker

TL 2·1–2·2 mm, slender, monomorphic. Eyes well developed, about 32 ommatidia. Antennae (Fig. 140) 11-segmented with a distinct 3-segmented club. Palpal formula 4,3. Mandibles rather long and narrow, dental formula 1+3 or 1+4, the last subapical tooth just distad of the middle of the basal margin well separated from the remainder, or absent. Canthellus meeting and very broadly fusing with the basal margin of the mandible; trulleum small but quite distinct, white in contrast to the yellow of the surrounding cuticle; mandalus small, linear, separated from the ginglymus. Labrum bilobed.



Figs. 138–141.—*Trigonogaster*: 138, *T. recurvispinosa*, full-face dorsal view of head of worker; 139, *T. recurvispinosa*, lateral view of worker; 140, *T. recurvispinosa*, antenna of worker; 141, *T. recurvispinosa*, wing of male.

Clypeus (Fig. 138) bicarinate, anterior margin gently curved; mouthparts lying well under head, so that median area overhangs mandibles anteriorly; median and intercarinal setae lacking; carinal setae curving dorsad and directed anteriorly, paracarinal setae thin and short; two pairs of strong lateral setae directed anteroventrad.

Promesonotal suture distinct on the pleura only to the height of the spiracle (Fig. 139). Pronotum and propodeum moderately arched, both sloping to the distinct metanotal groove; alitrunk also somewhat constricted laterally at the metanotal groove, which thus appears somewhat saddle-like. Propodeum bearing a pair of strong, spiniform, compressed teeth, directed strongly dorsad and diverging at their bases, then curving gently anteriad. Inferior propodeal plates small but distinct, connected by lamellate propodeal carinae to the ventral bases of the propodeal teeth. Propodeal spiracle small, round, carried far forward and high up on the propodeal pleura. Metapleural glands well developed.

Petiole subclavate, with a low node; in life normally held pressed into the declivity, between the propodeal teeth; the petiole curves gently anterodorsad and then turns abruptly posteriad to align the gastric axis approximately parallel to the substrate; subpostpetiolar process dentiform, long, narrow, directed ventrally; posterior ventral side of petiole at the abrupt bend bearing 2 short, parallel, longitudinal, lamellate ridges (Fig. 139). Postpetiole simple, subcylindrical, dorsoventrally compressed at the posterior end, communicating with the gaster through a transversely elliptical foramen; the postpetiolar dorsum is produced posteriorly for a short distance beyond the foramen, so that the gastric articulation is strongly transverse. Gaster small, with dorsum almost flat; ventrally strongly convex, even subangulate, and bilaterally compressed; sting very thin, distinctly spatulate, curving dorsally.

Colour yellow. Frons above the lateral areas of the clypeus to the level of the eyes and the dorsal end of the frontal carinae striate; margins of the meso- and metapleurae, petiole and anterior half of the postpetiole punctate; remainder of the head and body smooth and shiny, bearing sparse long, white setae.

Gyne

Not known.

Male

Size comparable to that of worker. Eyes very well developed. Antennae 12-segmented, scape moderately long and thick, pedicellus globular, remainder of funicle long, filiform, very thin. Mandibles aborted, palpi as in worker. Clypeus swollen, just barely penetrating between the antennal sockets posteriorly, produced forward over the trophi anteriorly. Alitrunk fully segmented; notauli complete but faintly impressed; parapsidal furrows indistinct. Petiole not pedunculate, thickened, lacking a distinct node; postpetiole and gastric articulation as in worker. Gaster subcylindrical, genitalia deeply retracted. Wings with reduced venation, as shown in Figure 141; *Rs* not meeting *R*, *m-cu* and *cu-a* absent. Pale, lightly sclerotized ants, testaceous, unsculptured.

Comments

There is no data in the literature on the biology of this interesting ant; one collection from Java is labelled "under stones". The spatulate terebra, so far known otherwise only in *Crematogaster*, suggests that this ant uses a defense posture similar to that of *Crematogaster*, in which genus the workers orient their gasters toward a stimulus and exude a droplet of toxin onto the tip of the spatulate sting—however, this adaptation precludes hypodermic injection of the toxin.

Emery (1922) places this genus in his Pheidologetini, but it is unlike these genera in the following characters: form of mandibles, palpal formula, strange form of petiole, postpetiole and gastric articulation, and the spatulate sting.

The single *Trigonogaster* species is *recurvispinosa* Forel, 1890, p. 110. S.E. Asia, E. Indies.

V. Taxonomy of the Larvae

The larvae of the Formicidae have not been used to any extent in taxonomic studies, although numerous descriptions and figures of scattered genera and species occur in the literature. The only wide-scale comparative larval study that has been attempted is the series of papers by G. C. Wheeler (later with J. Wheeler), which constitute a fundamental contribution to the subject that will be used for a long time.

Table 1

CLASSIFICATION OF LARVAL TYPES OF MYRMICINAE BY GENERA

Genus	Body Profile	Mandible Shape	Types of Setae (for key to numbers see text)
Monomorium	Solenopsidiform	Leptothoraciform	3, 4
Chelaner	Allomeriform*	Huberiform, but with two subapical teeth	1, 5
Megalomyrmex	Solenopsidiform	Leptothoraciform	1
Tranopelta	Not classified	Tranopeltiform	3
Allomerus	Allomeriform	Allomeriform	Some 15 types of complex, denticulate setae
Pheidologeton	Strumigeniform	Pheidologetiniform	1, 2, 3
Oligomyrmex	Strumigeniform	Carebariform	1, 2, 3
Carebara	Strumigeniform	Carebariform	1, 2, 3
Paedalgus	Strumigeniform	Carebariform	1, 2, 3
Lophomyrmex	Strumigeniform†	Lophomyrmeciform	Setae short, tip denticulate, "without alveolus and articular membrane except on the prothorax"
Solenopsis	Solenopsidiform	Leptothoraciform	1, 2, 3
Vollenhovia	Vollenhoviform	Vollenhoviform	1, 2
Xenomyrmex	Crematogastriform	Paracryptoceriform	1, 4, 5
Liomyrmex	Liomyrmeciform	Liomyrmeciform	5, 6
Huberia	Not classified	Huberiform	1, 2, 3
Anergates	Solenopsidiform	Anergatiform	5, 6, and special type multibranched with branches converging apicad
Trigonogaster	Trigonogastriform‡	Lophomyrmeciform	Setae very short, short-bifid tip, "with alveolus and articular membrane"

* Not classified in the Wheelers' papers, but description or descriptions correspond to this type.

† Not classified in the Wheelers' papers but description or descriptions correspond to this type, in which the entire thorax is bent ventrally, cf. *Trigonogaster*.

‡ Only the prothorax is bent ventrally in this type, cf. *Lophomyrmex*.

The Wheelers have followed rather closely the "classic" system of Emery and W. M. Wheeler in making their own framework for larval comparisons, and they have not tried to change the system even where the larval evidence clearly weighs against it. The need for change in ant classification is thus shown as much by the larvae as by the adults.

References to all the publications by the Wheelers on myrmicine ants are contained in a summary article (G. C. and J. Wheeler 1960). In this paper, the authors conclude that three characters are of major importance: body profile, mandible shape, and setal form. They recognize 22 body profile and 30 mandibular shape categories, all of which are explained and illustrated.

Table 1 is based on data from the Wheelers' papers, but the genera are split or regrouped as required by the present classification. The setal classification is newly introduced here: simple hairs (1); apically bifid (2); deeply bifid (3); multifid (4); anchor-tipped (5); and denticulate (6).

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