Contributions toward a Reclassification of the Formicidae. Part VI. Ponerinae, Tribe Ponerini, Subtribe Odontomachiti. Section B. Genus Anochetus and Bibliography. [1]

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(With 9 text-figures and 12 Tables)

Dedication

This section is dedicated to the memory of Rev. Fr. Walter W. Kempf, O.F.M., whose death at the peak of his scientific labors has deprived the entomological world — particularly the New World — of one of its key figures. For formicid systematists, the loss is probably the most important one since the death of Carlo Emery in 1925, even though Frei Walter limited his research almost entirely to the neotropical fauna. For myself, the departure of a brilliant colleague and warm friend is a calamity. As I wind up this section of the reclassification, I realize how important to me was Frei Walter's role as critic and appreciator, and I keenly regret that this time, there will arrive no more the wise and friendly reaction from Brazil to which I have so looked forward.

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1. A Report of Research from the Cornell University Agricultural Experiment Station.
2. E.N.: The Tables were printed in the U.S.A. on March, 1978.

Introduction

This continues directly from Section VIA (Studia Entomologica 19: 67-171, 1976). Before entering upon the taxonomy of *Anochetus,* a few supplementary sources of material and additional valued assistance should be acknowledged.

The U.S. National Science Foundation, through grant No. DEB 7522427, has continued its support of the reclassification project, and a John Simon Guggenheim Memorial Fellowship made a large part of the research possible during a sabbatical leave.

Dr. Klaus Rohlfien and Prof. Dr. G. Morge deserve thanks for their help in locating and lending specimens from the Hans Sauter Taiwanese collections, now deposited in the Institüt für Pflanzenschutzforschung (BZA) der Akademie der Landwirtschaftswissenschaften der Deutsche Demokratik Republik in Eberswalde.

The illustrations were nearly all drawn by Susan Poulakis.

Mr. Ian Hayes helped in the final stages of the research and preparation of the manuscript.

To Dr. J. Decelle I owe the loan of types and other material from the Musée Royale de l'Afrique Centrale (MRAC-Tervuren). Dr. R. W. Taylor (ANIC-Canberra) has furnished records and other information for the Australian *Anochetus* species, which he had been studying independently.

A Note on Measurements

«Measurements and Indices» are treated in Section A, p. 95-96 for *Odontomachus,* and are the same for *Anochetus,* except that for head width (HW). In *Odontomachus,* HW is taken across the vertex, but in *Anochetus,* the head is generally shorter and wider, and there is no convenient place to measure width along the vertex. In *Anochetus,* therefore, measurement is made at the *widest part of the cranium,* which comes *across the eyes and ocular prominences.* The *cephalic index* (CI, or 100 × HW/HL) is thus not strictly comparable between the two genera.

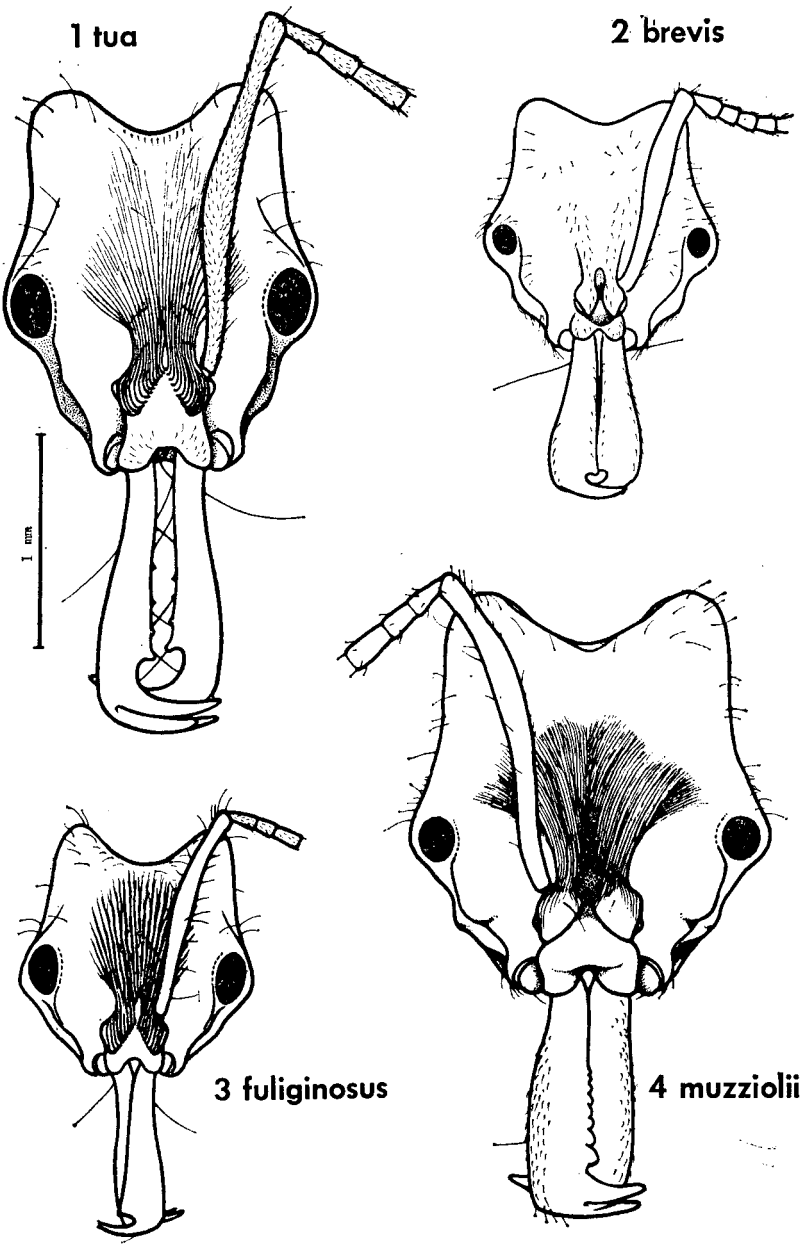
Counts of facets in the compound eyes are subject to wide error, and in the future these will have to be done in many cases with the help of a scanning electron microscope; for the present, this is too expensive and time-consuming.

Anochetus

> *Anochetus* Mayr, 1861, Die Europäischen Formiciden, Wien, p. 53-54. Type species: *Anochetus ghilianii* = *Odontomachus ghilianii* Spinola, 1853, monobasic.

≦ *Myrmecia* Fabricius, 1805, Systema Piezatorum, p. 423.

≦ *Odontomachus,* Illiger, 1807, Mag. Insectenk., 6: 194.



Figs. 1-4, heads of *Anochetus* spp. workers, full-face (dorsal) view. Fig. 1, *A. tua* paratype. Fig. 2, *A. brevis* holotype. Fig. 3, *A. fuliginosus,* Monrovia, Liberia. Fig. 4, *A. muzziolii?,* Langkat, E. coast Sumatra. All to same scale.

≦ *Odontomachus,* F. Smith, 1858: 79.

≦ *Odontomachus,* Brown, 1973: 178, 183.

> *Stenomyrmex* Mayr, 1862: 711-712. Type species: *Stenomyrmex emarginatus* = *Myrmecia emarginata* Fabricius, by designation of Emery, 1911: 110; also Wheeler, 1911: 173. New synonymy.

> *Anochetus* subgenus *Stenomyrmex,* Emery 1890: 63-65. — Emery, 1911: 110. — Wheeler, 1925: 8-10, key. — Kempf, 1964: 237-246, Brasil, key. Kempf, 1972, 20-22, catalog of species.

> *Myrmapatetes* Wheeler, 1929b: 6. Type species *Myrmapatetes filicornis* Wheeler, by original designation, monobasic. Synonymized by Brown, 1953: 2. [13]

> *Anochetus,* reviews and catalogs, etc., mostly regional: Emery, 1894: 185-188, New World, key. — Forel, 1900: 58-63, India, Burma, Ceylon, key. — Bingham, 1903: 38-45, India, Burma, Ceylon, key. — Emery, 1911: 107-111, world catalog of species. — Arnold, 1915: 103-108, southern Africa, key; 1926: 214-218, southern Africa, supplement. — Wheeler, 1922a: 96-99, Congo; 1922c: 790-792, Africa, catalog of species; 1922: 1012-1013, Malagasy catalog of species. — Wilson, 1959: 502-510, Melanesia, key. — Kempf, 1972: 20-22, New World tropics, catalog of species.

Worker: Similar to *Odontomachus* and with the characters of subtribe Odontomachiti (see Part VI, Section A, p. 72-74); size small (TL 2,9 mm in *A. pupulatus*) to moderately large (TL nearly 12 mm in *A. inca*). Color usually dull; brown, blackish, red, or yellow, sometimes bicolored.

Cranium basically as in *Odontomachus,* but often shorter; always without the complex relief of the vertex in that genus, so that antennal fossa, ocular ridge, extraocular furrow and temporal prominence are all lacking, or at least poorly developed; median furrow replaced by a shallow and fairly broad *posteromedian impression,* more or less well developed in most species; nuchal carina rounded and continuous, or forming an obtuse, round-pointed V across the posterodorsal margin of the vertex, not forming an acute V on the midline; apophyseal lines not present on occipital face (see fig. 4, p. 94 of Section A). Eyes varying from large and with many fine facets to dot-like, with as few as 5 indistinct facets, each eye situated in a shallow, elliptical *orbital fossa* in the usual position for the subtribe, most apparent when the eye is small (fig. 11).

Mandibles linear, but varying from long and slender, with slender teeth in a series along the inner margins, as in *A. horridus* (fig. 9), to rather stumpy, thickened apicad, and armed only with the apical triad of stout teeth, in some small forms (fig. 13) such as *A. subcoecus.* Intercalary tooth of apical triad reduced to a small tubercle on the inside of the ventral apical tooth in a few species, or even obsolete. Under mouthparts much as in *Odontomachus;* maxillary palpi apparently always 4-merous, rather short in most species; labial palpi short, 3- or 4-merous.

Trunk with well-marked promesonotal and mesometanotal sutures; metanotal spiracles present in many species, indistinct or absent in the smallest ones. Propodeum rounded into declivity, or biangulate, or bidentate according to the species. Petiolar node varying in the extreme among species, ranging from conical, with an acutely tapered apical spine (*A. gladiator*) to merely conical (*A. risii*) to erect barrel-shaped (*A. sedilloti*), thick bidentate (*A. faurei*), thin squamiform (axially compressed, *A. katonae*), and so on, in all gradations. The squamiform nodes may be narrowly rounded at the apex in side view, or sharply cultrate, and in front view may have convexly rounded apical margins, or be truncate, emarginate or sharply bidentate.

Gaster ranging from compact to slender; first segment (postpetiole) large, and usually separated from second by a distinct constriction, which, however, is not developed in some species (e.g., *emarginatus, gladiator, altisquamis*).

Legs with simple tarsal claws; apical spurs of tibiae 1, 2, 2 or 1, 1, 2 or 1, 1, 1 or 1, 0, 1; at least one spur on the hind tibiae always pectinate.

Sculpture varying from almost completely striate or rugose with gastric dorsum densely reticulate and opaque, to almost completely smooth and shining. The fanwise striation of the frons is present, at least in abbreviated form, in all known species. Mandibles, antennae and legs usually smooth or finely and densely punctulate.

Pilosity varies widely; erect hairs simple, usually fine, abundant on body and appendages, to very sparse and limited; the small cryptobiotic forms often have reclinate pubescence developed at the expense of longer standing pilosity.

Ergatoid: Fairly common, and may possibly be the only functional queen in some groups (e.g., *emarginatus*). Like the corresponding worker, but often with 1 or 3 ocelli present; compound eyes usually larger; scutellum usually differentiated as a small, transversely elliptical sclerite.

Queen: With wings, or dealate, and the usual other differences from the worker; size only slightly larger in most species. Petiolar node often more strongly axially compressed. Eyes usually much larger than in the worker. Anal lobe of hind wing present in larger species, lost in some of the smaller ones.

Male: Habitus typical of small to medium-sized male Ponerini. *Anochetus* males are usually distinguished by their habitus, by large to very large compound eyes, and especially by the form of the petiolar node, which is usually a low, muted version of that of the female castes of the particular species. Most male nodes are either subconical or triangular in side view, the triangular ones being biangular above, often with the upper border weakly emarginate in front view; extreme forms are squamiform and apically emarginate.

The most remarkable thing about *Anochetus* males is the extreme variation of their terminalia from one species to the next. This is in contrast to *Odontomachus,* in which the known males have very similar terminal structures, at least as seen in the undissected state. In *Anochetus,* all of the basic ponerine structures are usually present: pygidium (tergum VIII), hypopygium (sternum IX), cerci (on membranous segment X, the proctiger), and the parts of the genital capsule proper: parameres (gonocoxites), volsellae (with digitus and cuspis), and aedeagus (penis valves). All of these parts may vary strikingly among species, even species that seem closely related judging form worker-queen traits.

Unfortunately, males found associated in the nest with the female castes are known only for a minority of the species. Additional kinds of males are known from collections at light or by Malaise trap, but it has not yet been possible to link any of these securely to worker-based species. As it stands, 3 described species are based on single male holotypes: *pangens* and *consultans* from Sri Lanka, and *filicornis* from Larat Island off West Irian. Probably some or all of these belong to species described under different names from the worker caste, so that synonymy will eventually result from the correct association of the sexes.

The most primitive terminalia known appear to be those of *A. isolatus* (figs. 60, 61) from New Guinea; this has the pygidium drawn out into a stout, downcurved spine, and the hypopygium is a broad linguiform piece;

the parameres are simple, with narrowly rounded apices. These conditions are as in *Odontomachus,* which can be regarded as either the sister-genus of *Anochetus,* or a line descended from such primitive *Anochetus* as *A. isolatus* or *A. gladiator.* These same traits are also found in the presumptive ancestral Ponerini (of subtribe Poneriti). The most primitive *Anochetus* species on worker-queen characters is *A. gladiator,* but the *gladiator* male remains unknown.

From the condition of *A. isolatus,* one finds transitions to forms in which each paramere is constricted apicad into a ventrally-directed digitiform process (*A. graeffei,* fig. 77; *A. consultans; A. sedilloti*) that becomes separated from the main body of the paramere by a more or less complete and flexible suture, or in which the body divides into two lobes in a complex way (*chirichinii,* figs. 56-59). The linguiform hypopygium tends to be narrowed, probably convergently, into a median, narrow, rodlike piece in some species of both Old World and New World groups, or, unexpectedly, into slender, bilaterally arranged, twin rods (*madaraszi,* figs. 64, 65), or a deeply cleft plate (*chirichinii,* fig. 58). In some New World species, the parameres develop fancy lobes, sometimes with grotesquely sculptured extremites (figs. 72, 73), but it is not completely certain that these are *Anochetus.*

Volsellae and aedeagus vary considerably also, although these variations do not show so well in undissected material, and they are not dealt with in detail here (figs. 75 and 76; 72 and 78).

Unassociated males representing about 10 different species have been reviewed for this work, but I believe that nothing is gained by assigning new names to undescribed forms, all of which will eventually be tied to their respective female castes. The rearing of live colonies or colony fragments of *Anochetus* is to be encouraged, for in this way we are most likely to make the necessary male-female associations.

Probably a knowledge of the male terminalia is needed to resolve completely the difficulties of species distinction existing in such complexes as those of *A. inermis, A. mayri, A. traegaordhi* and *A. graeffei.*

Distribution and Bionomics

There topics have been touched upon for *Anochetus* in the respective summaries for subtribe Odontomachiti (A 77-88; the *A. inermis* of p. 80 is assigned to *A. simoni* in the present section). *Anochetus* colonies of all groups appear to contain fewer (usually < 100 adult) individuals than do those of *Odontomachus,* and this together with their usually smaller body size tends to adapt them to living in cryptic sites of low volume, such as are available in rotten twigs in humus or forest litter, crevices in bark or rotten logs, hollow twigs in trees, palm leaf-base interstices, or small excavations in the soil.

Compared to *Odontomachus,* then, *Anochetus* species tend to be «interstitial» and more specialized in their microhabitat selection and lifeways; their environment is coarse-grained. We should recognize, meanwhile, that many of the species forage rather widely for their size, and ground- or rotten wood-nesting species often can be found well above ground level on forest or savanna woodland tree trunks, but in most cases after dark (e.g., *africanus*). Other species (e.g., *levaillanti*) may nest in the soil in arid areas, and forage over the

ground surface near midday in only scanty shade. Probably, though, most species are nocturnal foragers.

Still other species, perhaps including *emarginatus, pellucidus, fuliginosus* and *faurei,* appear to be more or less arboreal nesters and foragers, though we have scanty, merely suggestive data on this point.

Anochetus species are all certainly predaceous; the natural extent of their feeding on honeydew and other sugar sources is totally unknown. The mechanism of their trap-mandible is similar to that of *Odontomachus* (Marcus, 1944, 1945), and like that genus, they can «jump» backwards by snapping the jaw-apices against smooth, unyielding objects. As befits their prevailingly small body size, *Anochetus* species tend to respond to massive disturbances with lethisimulation rather than the aggressive biting and stinging reactions of *Odontomachus*. On the whole, *Anochetus* species are slower and more deliberate in their hunting behavior than are *Odontomachus,* and more often tend to employ waiting-and-ambush tactics in securing their prey. Nothing substantial is known about their possible prey specificity. In fact, the biology of *Anochetus* is a subject wide open to all kinds of investigation.

Anochetus ranges about as far south as *Odontomachus* in South America (to northern Argentina) and Australia (to arid inland parts of Victoria and southwestern Australia), but reaches farther south in South Africa (at least to Port Elizabeth in the eastern Cape Province). In the Northern Hemisphere, it gets to Morocco, Tunisia, and even the extreme southern point of Spain, beyond the range of *Odontomachus,* and in the Middle East, *A. evansi* occurs in Kurdistan, but, like *Odontomachus, Anochetus* is limited northward in India and Pakistan by the Himalayas and Pamirs. In China, *Anochetus* is still known only from Kwangtung and Hainan, in the far south, whereas *Odontomachus monticola* ranges far to the north, even beyond Peking. In the Pacific, *A. graeffei* is widespread, undoubtedly through the agency of human commerce, and it reaches central Polynesia and Micronesia with *Odontomachus simillimus.*

In North America, *Anochetus* fails to extend northward beyond tropical Mexico and the Bahamas, while *Odontomachus* reaches Arizona, central Texas and southern Georgia. The differences in distribution between these two genera indicate that *Odontomachus* does somewhat better than *Anochetus* at producing species that can penetrate colder climates, but that *Anochetus* may have the edge in evolving species adapted to aridity. Both genera, of course, are predominantly tropical and forest-inhabiting.

ANOCHETUS Species List

(The list follows the same format as the *Odontomachus* species list in Section A, p. 100-106).

abstracta Santschi = *bequaerti*

(T) *africanus* Mayr 1865: 11 ☿ W & C Africa [29]
= *camerunensis* Mayr 1896: 236 ☿ ♂ (syn. Emery 1899)
= *pasteuri* Santschi 1923: 265 ☿ ♀ n. syn.
(T) *agilis* Emery 1901b: 52 ☿ Borneo, Malaya [6]
(T) *altisquamis* Mayr 1887: 529 ☿ S Brasil, N Argentina [42]
= *fumata* Luederwaldt 1918: 54 ☿ (syn. Kempf and Lenko, 1976)
amati Karawajew = *graeffei*
(T) *angolensis* Brown n. sp. ☿ N. Angola [27]
(T) *angusticornis* Arnold = *traegaordhi*
(T) *armstrongi* McAreavey 1949: 1 ☿ ♀ Australia [25]
(T) *aurifrons* Santschi = *pellucidus*
australis Emery = *neglectus*
(T) *beccarii* Emery = *rugosus*
(T) *bequaerti* Forel 1913c: 309 ☿ W Africa to Natal [30]
= *abstracta* Santschi 1914a: 12 ☿ n. syn.
= *estus* Wheeler 1922a: 98 ☿ n. syn.
= *opaciventris* Wheeler 1922a: 98 ☿ n. syn.
(T) *bierigi* Santschi = *diegensis*
(T) *bispinosus* F. Smith 1858: 199 ☿ hylean S America [39]
(T) *brevis* Brown n. sp. ☿ Mindanao: Mt. Apo [10]
(T) *butteli* Forel = *longifossatus*
(T) *cameroni* Forel = *ghilianii*
(T) *camerunensis* Mayr = *africanus*
(T) *cato* Forel 1901a: 6 ☿ Melanesia [13]
= *subfasciatus* Mann 1919: 301 ☿ ♀ ♂ (syn. Wilson 1959)
= *rossi* (Donisthorpe) 1947: 186 ☿ ♀ (syn. Wilson 1959)
(T) *chirichinii* Emery 1897b: 597 ☿ N. Guinea [16]
(T) *concinnus* Santschi = *katonae*
(T) *consultans* Walker 1859: 373 ♂ n. comb. ex *Formica* Sri Lanka [15]
diabolus Forel = *rectangularis*
(T) *diegensis* Forel 1912a: 29 ☿ Panama to hylean S. America, wet forest [40]
= *bierigi* Santschi 1931: 268 ☿ ♀ (syn. Brown 1964)
durbanensis Arnold = *katonae*
emarginatus (Fabricius) 1805: 426 ☿ Amazon Basin to N Colombia & Trinidad [36]
= *quadrispinosus* F. Smith 1858: 78 ☿ (syn. Roger 1861)
= *rugosus* Emery 1890b: 63 ☿ (syn. Kempf 1964)
(T) *estus* Wheeler = *bequaerti*
(T) *evansi* Crawley 1922: 85 ☿ NW Iran [23]
(T) *faurei* Arnold 1948: 215 ☿ Zululand [35]
(T) *filicornis* (Wheeler) 1929: 6 ♂ Larat I. near N. Guinea [13]
(T) *fricatus* Wilson 1959: 506 ☿ N. Guinea [16]
(T) *friederichsi* Forel = *madagascarensis*
fuliginosus Arnold 1948: 214 ☿ W Africa, Natal [31]
(T) *fumata* Luederwaldt = *altisquamis*
ghilianii (Spinola) 1853: 71 ☿ N & C Morocco; S Spain [26]
= *cameroni* Forel 1915b: 352 ☿ (syn. Brown 1964)
(T) *gladiator* Mayr 1862: 712 ☿ Celebes, Moluccas [1]
= *tyrannicus* (F. Smith) 1862: 44 ☿ (not 1859)
= *smithii* Roger 1863: 21 ☿ n. syn.
= *gladiator* Donisthorpe 1932: 467 ☿ n. syn.
(T) *gnomulus* Bernard = *katonae*
(T) *gracilicornis* Viehmeyer = *traegaordhi*
(T) *gracilis* Karawajew = *risii*
(T) *graeffei* Mayr 1870: 961 ☿ S India to Australia & C Polynesia [14]

= *punctiventris* Mayr 1878: 659 ☿ (syn. Wilson 1959)
= *rudis* Emery 1889: 499 ☿ n. syn.
= *taylori* Forel 1900a: 63 ☿ n. syn.
= *oceanicus* Emery
= *amati'* Karawajew 1925: 285 ♀ (syn. Wilson 1959)
= *minutus* Karawajew 1925: 288 ☿ ♀ (syn. Wilson 1959)
= *ruginotus* Stitz 1925: 114 ☿ n. syn.
(T) *grandidieri* Forel 1891: 108 ☿ Madagascar [32]
= *madecassus* Santschi 1928: 54 ♀ n. syn.
(T) *haytianus* Wheeler & Mann 1914: 15 ☿ Haiti & Dominican Rep. [37]
(T) *horridus* Kempf 1964: 239 ergatoid ♀ ☿ hylean S America [38]
(T) *inca* Wheeler 1925: 8 ☿ N. Peru [38]
(T) *incultus* Brown n. sp. ☿ ♀ Luzon [7]
(T) *indicus* Forel = *sedilloti*
(T) *ineditus* Baroni Urbani = *rugosus*
(T) *inermis* Ern. André 1889: 221 ☿ Colombia, Venezuela to Lesser Antilles [40]
= *meinerti* Forel 1905: 156 ☿ n. syn.
(T) *isolatus* Mann 1919: 302 ☿ ♂ Melanesia, Philippines [13]
= *splendens* Karawajew 1925: 289 ♀ n. syn.
= *rossi* Donisthorpe 1949: 747 ☿ ♀ n. syn.
(T) *jacobsoni* Forel = *princeps*
jacobsoni Menozzi = *rugosus*
(T) *jonesi* Arnold 1926: 216 ☿ ♀ ♂ Zululand [34]
(T) *kanariensis* Forel 1900a: 62 ☿ S India [22]
(T) *katonae* Forel 1907a: 1 ☿ W & C Africa to Natal [32]
= *occidentalis* Santschi 1914b: 330 ☿ n. syn.
= *parvus* Santschi 1914b: 330 ☿ n. syn.
= *longiceps* Santschi 1914b: 331 ♀ n. syn.
= *punctatus* Santschi 1914a: 13 ☿ n. syn.
= *concinnus* Santschi 1920: 9 ♀ n. syn.
= *durbanensis* Arnold 1926: 215 ☿ n. syn.
= *lamottei* Bernard 1952: 212 ☿ n. syn.
= *gnomulus* Bernard 1952: 214 ☿ n. syn.
(T) *kempfi* Brown n. sp. ☿ Puerto Rico [37]
(T) *laetus* Forel = *princeps*
(T) *laeviusculus* Wheeler = *mayri*
(T) *lamottei* Bernard = *katonae*
latunei Forel = *turneri*
(T) *levaillanti* Emery 1895: 21 ☿ S Africa, Eritrea [21]
(T) *longiceps* Santschi = *katonae*
(T) *longifossatus* Mayr 1897: 425 ☿ Sri Lanka [18]
= *butteli* Forel 1913a: 18 ☿ n. syn.
(T) *longispina* Wheeler 1936: 196 ☿ Haiti: Massif La Hotte [37]
(T) *madagascarensis* Forel 1887: 382 ☿ Madagascar [29]
= *friederichsi* Forel 1918: 155 ☿ n. syn.
(T) *madaraszi* Mayr 1897: 424 ☿ Sri Lanka, India [15]
(T) *madecassus* Santschi = *grandidieri*
(T) *maynei* Forel 1913d: 347 ♀ W & C Africa [28]
mayri Emery 1884: 378 ☿ tropical America [41]
= *laeviusculus* Wheeler 1911: 22 ☿ n. syn.
(T) *meinerti* Forel = *inermis*
(T) *menozzii* Donisthorpe = *rugosus*
(?) *micans* Forel 1908a: 36 ☿ [36]
(T) *minans* Mann 1922: 17 ☿ C. America [43]
(T) *minutus* Karawajew = *graeffei*

(T) *modicus* Brown n. sp. ☿ Java, Borneo, Philippines [12]
(T) *mordax* Donisthorpe = *rufus*
(P) *muzziolii* Menozzi 1932: 4 ☿ Nias I., Malaya, Sumatra [3]
myops Emery 1893b: 201 ☿ Malaya [18]
(T) *natalensis* Arnold 1926: 215 ☿ S. Africa: Natal [29]
neglectus Emery 1894: 188 ☿♀ SE Brasil to N Argentina [41]
= *australis* Emery 1905: 117 ☿ n. syn.
= *nobilis* Santschi 1925: 155 ☿ («♂» in error) n. syn.
(T) *nietneri* (Roger) 1861: 23 ☿ Sri Lanka [19]
(T) *nobilis* Santschi = *neglectus*
(T) *obscuratus* Santschi 1910b: 351 ☿♀ E & C Africa [29]
= *schoutedeni* Santschi 1923: 264 ☿ n. syn.
= *ustus* Santschi 1923: 265 ☿ n. syn.
(T) *obscurior* Forel 1900a: 62 ☿ S India [22]
(T) *occidentalis* Santschi = *katonae*
(T) *oceanicus* Emery = *graeffei*
(T) *opaciventris* Wheeler = *bequaerti*
(T) *orchidicola* Brown n. sp. ☿ Mexico: Veracruz [43]
(T) *oriens* Kempf 1964: 240 ☿ Brasil: N Espirito Santo [39]
(T) *orientalis* André 1887: 291 ☿ Viet Nam [22]
(T) *pangens* Walker 1859: 371 ♂ n. comb. ex *Formica* Sri Lanka [15]
(T) *paripungens* Brown n. sp. ☿ Australia: N N. Terr. [24]
parvus Santschi = *katonae*
(T) *pasteuri* Santschi = *africanus*
(T) *pellucidus* Emery 1902b: 33 ☿ W & C Africa [31]
= *aurifrons* Santschi 1910a: 351 ☿ n. syn.
(T) *peracer* Brown n. sp. ☿ NE New Guinea [8]
(T) *princeps* Emery 1884: 379 ☿ Burma to Java & Celebes [4]
= *laeta* Forel 1910b: 27 ☿ (syn. Brown 1964)
= *jacobsoni* Forel 1911a: 193 ☿ (syn. Brown 1964)
= *taipingensis* Forel 1913a: 18 ☿♂ (syn. Brown 1964)
= *serratus* Stitz 1925: 113 ☿ (syn. Brown 1964)
(T) *pubescens* Brown n. sp. ☿ E Rhodesia [33]
(T) *punctaticeps* Mayr 1901: 4 ☿ S. Africa: Cape Prov. [32]
(T) *punctatus* Santschi = *katonae*
(T) *punctiventris* Mayr = *graeffei*
(T) *pupulatus* Brown n. sp. ☿ S India [18]
(T) *quadrispinosus* F. Smith = *emarginatus*
(T) *rectangularis* Mayr 1876: 86 ☿ E & N Australia [25]
= *diabolus* Forel 1915a: 35 ☿ n. syn.
(T) *risii* Forel 1900a: 60 ☿ SE China, Java [5]
= *gracilis* Karawajew 1925: 286 ☿♀ n. syn.
(T) *rossi* (Donisthorpe) 1947 = *cato*
(T) *rossi* Donisthorpe 1949 = *isolatus*
(T) *rothschildi* Forel 1908b: 129 ☿♂ Somalia, E Ethiopia [26]
(T) *rudis* Emery = *graeffei*
rufus Jerdon 1851: 116 ☿ S. India [20]
= *mordax* Donisthorpe 1942: 452 ☿ n. syn.
(T) *ruginotus* Stitz = *graeffei*
(T) *rugosus* Emery = *emarginatus*
(T) *rugosus* (F. Smith) 1857: 65 ☿ Malaya, Sumatra, Borneo [2]
= *beccarii* Emery 1884: 379 ☿ (syn. Brown 1964)
= *jacobsoni* Menozzi 1939: 178 ☿ (not Forel 1911) (syn. Brown 1964)
= *menozzii* Donisthorpe 1941: 237 n. syn.
= *ineditus* Baroni Urbani 1971: 360 n. syn.
(T) *schoutedeni* Santschi = *obscuratus*

(T) *sedilloti* Emery 1884: 377 ☿ circum-Saharan Africa, India [21]
= *indicus* Forel 1900a: 61 ☿ ♀ ♂ n. syn.
(T) *seminiger* Donisthorpe 1943: 170 ☿ W. Irian: Waigeu I. [13]
(T) *serratus* Stitz = *princeps*
(T) *silvaticus* Bernard = *traegaordhi*
(T) *simoni* Emery 1890b: 64 ☿ N. Venezuela, SE Colombia, W Ecuador [40]
(T) *siphneus* Brown n. sp. ☿ W Africa [34]
(T) *smithii* Roger = *gladiator*
splendens Karawajew = *isolatus*
(T) *splendidulus* Yasumatsu 1940: 313 ☿ ♀ Caroline Is.: Rul, Yap I. [13]
(T) *striatulus* Emery 1890b: 64 ☿ Costa Rica: Atlantic lowlands [36]
(T) *strigatellus* Brown n. sp. ☿ Malaya [11]
(T) *subcoecus* Forel 1912b: 46 ☿ Taiwan [17]
(T) *subfasciatus* Mann = *cato*
(T) *taipingensis* Forel = *princeps*
(T) *talpa* Forel 1901: 351 ☿ S. Africa: Natal [34]
(T) *targionii* Emery 1894: 187 ☿ Amazon Basin [40]
(T) *taylori* Forel = *graeffei*
(T) *testaceus* Forel 1893b: 356 ☿ ♂ W. Indies: St. Vincent, Grenada [36]
(T) *traegaordhi* Mayr 1904: 2 ☿ W Africa, Sudan & Eritrea S to Rhodesia [26]
= *gracilicornis* Viehmeyer 1923: 87 ☿ n. syn.
= *sudanicus* Weber 1942: 47 ☿ n. syn.
= *angusticornis* Arnold 1946: 56 ☿ ♀ n. syn.
= *silvaticus* Bernard 1952: 212 ☿ ♀ n. syn.
(T) *tua* Brown n. sp. ☿ Malaya [9]
(T) *turneri* Forel 1900b: 55 ☿ tropical E & N Australia [25]
= *latunei* Forel 1915a: 35 ☿ n. syn.
(T) *tyrannicus* F. Smith 1862 (not 1859) = *gladiator*
(T) *ustus* Santschi = *obscuratus*
(T) *variegatus* Donisthorpe 1938: 597 ☿ New Guinea [8]
(T) *vexator* Kempf 1964: 243 ☿ C Brasil [39]
(T) *yerburyi* Forel 1900a: 62 ☿ Sri Lanka, India [14]

Species-groups and Phylogeny

After early confusion about the constitution and distinctness of *Stenomyrmex,* Emery (1890: 63-65, and finally 1911: 110) compromised on the issue by continuing to recognize it as a neotropical subgenus of *Anochetus* containing only *A. emarginatus* and its infraspecific forms — rather large, slender ants with long, thin mandibles, serially dentate along the inner margins, not thickened apicad, and lacking a preapical recession and angle of the inner margins just proximal to the apical teeth; the posterior margin of the head not or only weakly concave. A few species were added one at a time to this subgenus, and in 1964 Kempf added 3 more and reviewed and keyed the species, all from the New World tropics. In this paper, as well as in his catalog (1972), Kempf expressed no analytical opinion about the distinctness of «the group *Stenomyrmex*», but simply accepted it as a taxon of convenience to receive those more-

than-ordinarily slender neotropical forms with long, conspicuously serially dentate mandibles and bidentate or bicuspid petiolar nodes with long, sloping anterior faces. From conversations with him, I understand that he was awaiting the completion of my studies of the odontomachites before making up his own mind about *Stenomyrmex.* Be that as it may, the characters marking *Stenomyrmex* are all matters of degree, and for each of them, a morphocline exists connecting the group to more «typical» *Anochetus* species, such as *A. mayri* and *A. altisquamis. A. inermis, A. targionii,* and *A. simoni,* for example, provide intermediate stages in head shape and in mandibular shape and dentition, as recognized already by Emery explicitly in 1890: 65. *A. bispinosus* has a petiolar node intermediate in form between those of *A. («Stenomyrmex») horridus* and *A. mayri.*

It appears from collection records and my own experience that *A. emarginatus* is an arboreal or semiarboreal forager that often nests in hollow branches or in epiphytes or between palm leaf bases well above ground level. *A. horridus,* in spite of its habitus, has only been taken on the ground in humus or leaf litter [38], but it may well be an epigaeic forager, in consonance with its large eyes and long mandibles. (Here one thinks of certain ground-dwelling, hylean *Strumigenys* and *Acanthognathus* with very long, strongly dentate mandibles, or the Indo-Malayan formicine genus *Myrmoteras,* similarly equipped and, as far as I have seen in the field, a dweller and forager in ground-level forest situations). In any case, there seems to exist no secure basis for distinguishing the *Stenomyrmex* species from the rest of the neotropical *Anochetus* as more than an arbitrarily-delimited species group.

One more datum weighing against the recognition of *Stenomyrmex* as a formal subgenus is the existence of *A. faurei* [35], a species in most ways formally deserving to be placed in *Stenomyrmex,* far away in southeastern Africa. It is hard to know how many of its shared characters are in a condition primitive for *Anochetus,* and how many are the result of convergence to such New World species as *A. emarginatus,* perhaps based on a shared arboreal foraging lifeway. I would guess that the weak, serially-arranged teeth along its inner mandibular margins are not the primitive armament, but instead represent a new development, or at least the secondary enlargement of vestigial denticulation found in several of the other Old World species.

Perhaps the most striking evolutionary trend within *Anochetus* is the tendency to produce cryptobiotic (soil- or rotten log-dwelling), mainly forest life forms, the most extreme of which share most or all morphological traits of an adaptive syndrome in which body size is reduced, compound eyes are diminished to dot-like remnants within the shallow crater-like orbital fossa, mandibles are shortened, partly disarmed and apically thickened, the integument is depigmented (yellow), antennal segments and leg parts are shortened and thickened, coarse rugosity or striation gives way to fine or smooth, merely punctate sculpture, erect pilosity is suppressed or largely

replaced by reclinate pubescence, and the petiolar node is compressed axially in the direction of becoming a flattened scale with a sharp (emarginate or rounded) apical margin.

This life form is exemplified more or less perfectly by such species as *siphneus, jonesi,* and *talpa* in sub-Saharan Africa, by *subcoecus, pupulatus* and *myops* in tropical Asia, and by *minans* in Central America. In each case, morphoclinal intermediates are present: in Africa, the *grandidieri* group and *pubescens* represent the intermediates; in Asia, *longifossatus* is a likely candidate; and in tropical America, *mayri* makes a reasonable pre-*minans* stock.

It seems likely that the morphocline leading to these myopic life forms is really 2 or more independent ones; at least, the morphocline *bispinosus — targionii — diegensis — mayri — minans* in the New World tropics pretty surely represents an evolutionary sequence (chronocline) distinct from the one or more in the Old World. The Old World series are less clearly separated into African and Asian morphoclines, and it may be that one or more stocks with reduced eyes are shared by these major faunas, just as *A. sedilloti,* and perhaps the *ghilianii* group, are shared from the larger-eyed stocks. However, Asia apparently lacks the *grandidieri* group or its counterpart; *A. longifossatus* is perhaps an alternative step in the morphocline represented by *yerburyi — graeffei — longifossatus — subcoecus — pupulatus. A. myops,* with its rounded nodal summit, does not fit into this series, and could well represent an alternative morphocline rising in some other species with the requisite nodal form.

In Africa, *A. talpa* also has a rounded nodal summit, and complicates morphocline models in the same way. Finally, we should recall *A. evansi,* isolated in the mountains of Iran, which also has reduced eyes and a rather bluntly rounded petiolar node; this could well be a cryptobiotic offshoot of the *ghilianii* lineage.

Whatever the origins and relationships of all the depigmented small-eyed forms, it seems sure that convergence is involved, and it is worth noting how faithfully concordant are the traits that make up their adaptive syndrome. It is not hard to imagine what current methods in numerical taxonomy would reveal about the phylogeny of this particular guild! I do not think, though, that we should despair of learning more about the processes of convergence in examples such as this one. More good samples, subjected to really detailed analysis of all available traits, will undoubtedly shed light on this and other phylogenetic problems.

In considering the intrageneric phylogeny of *Anochetus,* the first question is about which species or species-group is most primitive. We have already seen that *Odontomachus* is a sister group, or, perhaps more likely, a lineage derived from primitive *Anochetus.* In any case, the characters shared by *Odontomachus* species and *Anochetus* species reach a maximum in the related groups of *A. gladiator* and *A. cato,* centered now in Melanesia and nearby peripheral islands of the Oriental Region (Philippines, Celebes).

Of particular interest is the spiniform apex of the petiolar node in *gladiator,* copied in more or less reduced versions in certain other

species of the related *cato, risii* and *nietneri* groups. Not only is *gladiator* itself most similar to *Odontomachus* in petiolar form, but it is also large enough to belong to that genus, and has the prominent serial dentition of the inner mandibular margins that is characteristic of primitive *Odontomachus*. The male of *gladiator* remains unknown to me, but *A. filicornis,* still represented only by a male specimen from Larat, may well belong to the *gladiator* or *cato* groups; *filicornis* has a modestly-developed, downcurved, pygidial tooth (figs. 68, 69), probably homologous to that of *Odontomachus*. *A. isolatus,* the only *cato* group species known from worker-associated males, has a well-developed, downcurved pygidial spine (figs. 60, 61). I venture the prediction that the downcurved spiniform process of the pygidium — possibly a false sting — is present in the males of *gladiator* and at least some other members of the *gladiator* and *cato* groups. This is an ancient ponerine trait.

I think that the evidence drawn from different characters all points to the *gladiator* group as the closest to the stem Odontomachiti. It should also be pointed out, however, that *A. gladiator* is as thoroughly typical a representative of its subtribe as can be found. The Odontomachiti have made a clean break, based on the general-adaptive snap jaw mechanism, from their presumably ponerite ancestors, and the intermediate evolutionary steps are extinct.

From the *gladiator* group, close relationships extend to the *cato, rugosus, nietneri* and *risii* groups, all from the Oriental and Melanesian regions. Of these, *rugosus, nietneri* and *risii* groups tend to be more derivative, and are also more western (and more Asian-continental) in their distribution. All of the above groups tend to have the petiolar node more or less pointed or conical apicad as seen both from the front and the side.

The remaining groups of *Anochetus* show a prevailing tendency towards axial compression of the node, particularly to a condition in which the node is reduced to a squamiform condition with transverse apical margin that is concave or bidentate. This «bidentate squamification» of the node is expressed to varying degrees in different groups, and it is hard to say how much of it is the product of convergent evolution working independently in the Americas, Africa and Australia, in all of which it occurs. I hypothesize instead that this widespread tendency is most likely the result of one or two pantropical waves of colonization that spread one or more stocks during the Tertiary.

The neotropical *Anochetus* fauna — groups *emarginatus, bispinosus* and *altisquamis* — could well have arisen from a single founding stock that radiated there during a modestly long period of time in the Tertiary.

In Africa and Asia, indications are clear that several waves of radiation involved these continents jointly, perhaps late in the Tertiary, when their land masses were continuous and better-watered than they are now. The shared groups of *sedilloti* and *ghilianii,* with some differences not even reaching species level *(sedilloti),* represent this

time. The small, myopic cryptobionts of the *grandidieri* and *longifossatus* groups may also be descendants of a single paleotropical radiation, or they could have resulted from convergent specialization, as already discussed above.

The *chirichinii* group in New Guinea and the *rectangularis* group in Australia perhaps represent parallel developments from the same wave that gave rise to the New World stock. The *ghilianii* and *africanus* stocks could well be descended from earlier and later waves of this same radiation. Related to these is the *sedilloti* group, and, perhaps through *madaraszi,* the *graeffei* group. This last group appears to be the chief evolutionary growing point of the genus today, and is certainly its most active colonist.

Some smaller or unispecific groups are probably descended from the above groups. The groups are next listed in rough order from primitive to putatively derivative. It should be understood that the bounds of most groups are arbitrary, and that the groups themselves have very unequal phenetic and phylogenetic values.

Group of *gladiator*: Large or medium-sized forms. Mandibles each with a single, serially dentate inner margin; mesonotal disc with a sharply raised anterior rim; petiole produced as a spine or tooth. Male certainly associated with workers is unknown, but *filicornis* is tentatively assigned here. The species *gladiator* and *variegatus* fit here. Celebes, Moluccas, W. New Guinea.

Group of *cato*. Medium-sized forms with 2 inner margins: upper margin edentate, lower, smooth or crenulate, preapical angle subrectangular; mesonotal disc with blunt anterior rim; petiolar node bluntly pointed or nipple-like. Male (of *isolatus*) with pygidial spine. Species are: *cato, isolatus, seminiger, splendidulus*. Melanesia, Caroline Is., Philippines.

Group of *rugosus*. Large to medium-sized forms with single, serially dentate inner margins; mesonotal disc with a raised anterior rim; petiole bluntly pointed or narrowly rounded at apex. Male (of *princeps*) without pygidial spine. Species: *princeps, rugosus, muzziolii.*

Group of *nietneri*. A single known aberrant species from Sri Lanka, with 2 large submedian teeth on inner mandibular border, and a curved, stout tooth on petiolar apex. *A. consultans* could be the male of *nietneri*.

Group of *risii*. Mandibles each with distinct dorsal and ventral margins, the upper edentate (except for preapical angle), the lower one with small, serial, spaced teeth, or crenulate, or smooth. Intercalary tooth of mandibular apex arises from well beyond midlength of ventral apical tooth. Preapical angle usually well marked. Mesonotal disc with a blunt anterior rim, or none. Petiolar node pointed or narrowly rounded at apex. This seems to be a rapidly speciating group centered in SE Asia, but extending to the Philippines and mainland New Guinea; species are *risii, tua, agilis, brevis, incultus, modicus, strigatellus* and *peracer*.

Group of *rectangularis*. Australian species of medium size with more or less axially compressed petiolar node; in 3 of the species, nodal summit transverse and concave in the middle, the free angles

forming teeth in one of these species *(paripungens, rectangularis, armstrongi).* In the fourth species *(turneri)* the node is thick and rounded above (fig. 33), but this species seems otherwise related to *rectangularis.*

Group of *chirichinii.* Two modest-sized species from mainland New Guinea with stout mandibles having a single prominent submedian tooth on each inner border. Petiolar node axially compressed (subsquamiform) and with transverse, often concave crest: *chirichinii* and *fricatus.*

Group of *longifossatus.* Small forms with reduced eyes and light pigmentation, axially compressed petiolar node, and smooth, shining pronotal disc, S and E Asia, from S India and Sri Lanka to Taiwan, Philippines and Malaya: *longifossatus, myops, pupulatus, subcoecus,* and possibly one or more undescribed species.

Group of *pubescens.* Contains only one known species *(pubescens),* a modest-sized depigmented form from the Vumba Mts. in E. Rhodesia with sculptured vertex and pronotum, reduced eyes and axially compressed petiolar node. May be related to *graeffei* group, and could be a forerunner of the *grandidieri* (and/or the *longifossatus* group).

Group of *graeffei:* Contains *graeffei* and the ill-defined species *yerburyi,* possibly also *pangens,* an isolated male from Sri Lanka. Size modest, eyes small to medium-sized, petiolar node axially compressed. Sculpture, color, eye size, scape length, nodal shape variable. S and SE Asia, extending to Melanesia. Australia and Oceania.

Group of *grandidieri.* The Ethiopian-Malagasy counterpart of the *longifossatus* group, to which it may be related. Consists of *grandidieri* (on Madagascar) and *katonae, punctaticeps, jonesi* and *siphneus,* widely distributed in sub-Saharan Africa. Petiolar node strongly axially compressed, eyes small.

Group of *talpa.* A single small-eyed species with a compressed, but still rather bluntly rounded, petiolar node. Sculpture more or less reduced, shining. May be related to *grandidieri,* or could be a convergent species descended from *ghilianii* group. Natal, S. Africa.

Group of *ghilianii.* Medium-sized and large species with medium-sized or large eyes. Frontal striation of head not extending to nuchal carina, vertex largely smooth and shining. Petiolar node variable, in most species somewhat axially compressed, but often fairly thick as seen from the side. African (and southern Spanish) species *ghilianii, traegaordhi, angolensis, maynei,* and *rothschildi,* plus the peninsular Indian species, *rufus.* Needs further revision of species.

Group of *evansi.* One modest-sized species *(evansi)* with reduced eyes and compressed but rounded petiolar node, and reduced sculpture, largely smooth, from eastern Iran. Probably derived from the *ghilianii* group.

Group of *africanus.* Similar to *ghilianii* group, but distinguished by having the middle of the vertex striate to or nearly to the nuchal carina. Petiolar node axially compressed, but summit usually blunt in side view, often concave in front view. The subgroup of *africanus*

proper has vertex finely striate and gaster smooth: *africanus, natalensis, obscuratus* and *madagascarensis; bequaerti* also has fine striation on vertex, but gaster is reticulate or punctulate; the *pellucidus* subgroup (*pellucidus* and *fuliginosus*) features a coarsely striate vertex and more or less distinct reticulation or rugulosity of part of first (or first and second) gastric terga. These are tropical African species, ranging south in some cases to Natal; *madagascarensis* is in the Malagasy Republic.

Group of *sedilloti.* Medium-sized species with large eyes and thick, often barrel-shaped petiolar nodes, subtruncate or broadly rounded above. Antennal scapes short to moderate in length, sometimes not surpassing «occipital» lobes in repose. Strong tendency to develop abundant pubescence (appressed or decumbent) and widespread sculpture. Of the 2 widespread African species, *sedilloti* is circum-Saharan and extends through the western length of the Indian Peninsula, and *levaillanti* is in arid southern and northeastern Africa. The other tropical Asian species are *madaraszi, kanariensis, orientalis* and *obscurior* from India, Viet Nam and Sri Lanka.

Group of *faurei:* One large species known, *A. faurei* from Zululand. Could be a relict related to the *emarginatus* group, but perhaps more likely a convergent derivative of the *ghilianii* group. Node elongate and bicuspidate.

Group of *emarginatus.* Neotropical species of large size and slender build; mandibles serially dentate; petiolar node short or long, bicuspidate or bidentate. Contains superspecies *emarginatus, testaceus, striatulus, micans, inca* and perhaps *oriens*), superspecies *horridus* (*horridus* and *vexator*), and superspecies *haytianus (haytianus, longispina* and *kempfi).*

Group of *bispinosus.* A single medium-sized species *(bispinosus)* with axially compressed petiolar node capped by 2 acute, divergent teeth; teeth of inner mandibular border obsolete, except for preapical angle; trunk rugose. S. America: tropical lowland forests.

Group of *inermis.* Medium-sized species, mandibles with inner margins serially dentate to smooth; petiolar node axially compressed, its crest emarginate to bidentate. Panama, tropical S. America, Trinidad, Lesser Antilles: *inermis, diegensis, simoni, targionii.*

Group of *mayri.* Small species with squamiform, emarginate or bicuspidate petiolar nodes. S Mexico to Bolivia and N Argentina, West Indies: *mayri, neglectus, minans.*

Group of *altisquamis.* Modest-sized species with large head and short, robust body; petiolar node squamiform, high, crest rounded, sometimes slightly emarginate. S Mexico, S Brasil to NW Argentina: *altisquamis* and *orchidicola.*

KEY TO THE ANOCHETUS SPECIES OF ASIA, MELANESIA AND THE PACIFIC REGION — WORKERS

1. Mesial edge of mandible for much of its length with a single margin bearing 1 or 2 prominent teeth near midlength, or a close series of coarse denticles or teeth on apical half or more (figs. 4, 50) 2

— Mesial edge of mandible with 2 margins up to preapical tooth or angle: dorsal margin edentate (except for the single preapical tooth or angle, when this is present); ventral margin denticulate, crenulate, or smooth (figs. 1-3, 14-15) 8

2. Mandible with 2 large submedian teeth on mesial margin, the distal tooth larger than the proximal (Sri Lanka) ..... *nietneri* [19]

— Mandible with a single large submedian tooth (fig. 50; New Guinea) 3

— Mandible with a close series of 4 or more teeth along the mesial edge .. 4

3. Striation of vertex reaching nuchal carina; central part of pronotum striate or rugulose, though the sculpture may sometimes be weak and nearly smooth in the anterior part of the disc; free corners of petiolar node rounded to sub-rectangular (Papua New Guinea) ..... *fricatus* [16]

— Striation of vertex separated from nuchal carina by a smooth, shining strip; disc of pronotum completely smooth and shining in the middle (except for small, scattered punctures); free corners of petiolar node produced as acute teeth (NE New Guinea; fig. 34) ..... *chirichinii* [16]

4. Apex of petiole produced as a tooth or spine (figs. 27, 39) 5

— Apex of petiole narrowly rounded, not toothed (figs. 26, 31) 6

5. Large species, length (TL) > 8 mm (Celebes, Moluccas, fig. 27) ..... *gladiator* [1]

— Smaller species, length (TL) < 7 mm (New Guinea: W. Irian, fig 39) ..... *variegatus* [8]

6. Coarse striation of vertex continuous to nuchal carina; pronotum completely and boldly rugulose (fig. 26; Sumatra, Malaya, Borneo) .... *rugosus* [2]

— Vertex striate only in the central part, behind this smooth and shining (fig. 4); pronotum smooth and shining on the disc (fig. 31) 7

7. Mandibles longer (MI > 60); antennal scapes longer, surpassing posterior borders of «occipital» lobes by distinctly more than length of first funicular segment when head is seen in perfect full-face view; head narrower (CI < 90) (Burma to Celebes and Philippines) ..... *princeps* [4]

— Mandibles shorter (MI < 60); antennal scapes surpassing posterior borders of «occipital» lobes at most by length of first funicular segment when head is seen in perfect full-face view; head wider (CI 90 or more; figs. 4, 31; Malaya, Sumatra, Nias I.) ..... *muzziolii* [3]

8. Intercalary tooth of mandibular apex small (sometimes worn to an indistinct tubercle, or even missing completely), rising from the dorsal side of the ventral apical tooth well beyond its midlength (measuring length from crotch with dorsal apical tooth; fig. 53) ..... (*risii* group) 9

— Intercalary tooth present; (center of its base) arising from near the base of the ventral apical tooth, or from near its midlength (figs. 54, 55) 15

9. Pronotum sculptured over the entire disc 10

— Pronotum smooth and shining over at least the large central part of its disc 11

10. Size large, combined length of head and closed mandibles (HL + ML) > 2.5 mm; frontal striation spread over a wide area of the central vertex (figs. 1, 29; Malaya) ..... *tua* [9]

— Size smaller, HL + ML < 2.2 mm; frontal striation confined to the space between frontal carinae (fig. 37; Luzon) ..... *incultus* [7]

11. Very slender, elongate, CI < 83; petiole of particular form (figs. 41, 51); perhaps 2 different species included (Borneo, Malaya) ..... *agilis* [6]

— Head broader; CI > 83; petiolar form otherwise (figs. 28, 40) 12

12. Petiolar apex tapered gradually into a slender, spiniform tip (fig. 40; NE New Guinea) ..... *peracer* [8]

— Petiolar apex narrowly rounded or nipple-like, not spiniform (figs. 28, 29) 13

13. Center of vertex extensively striate, the striation extending to within 0.2 mm of the nuchal carina (Malaya: Trengganu) ..... *strigatellus* [11]
— Frontal striation obsolete or restricted to, or nearly to, space between frontal carinae 14

14. Mandibles long (ML > 1.0 mm; MI > 68); worker eye L > 0.25 mm (fig. 28; SE China, Viet Nam, Java) ..... *risii* [5]
— Mandibles of medium length (ML 0.70-0.90 mm; MI 57-63); worker eye L 0.16-0.21 mm (Java, Borneo, Philippines) ..... *modicus* [12]
— Mandibles short (ML < 0.70 mm; MI about 50); worker eye L 0.13-0.14 mm (Mindanao) ..... *brevis* [10]

15. As seen from front view, petiolar node tapered to a bluntly pointed (narrowly rounded or even nipple-like) apex (fig. 38; Melanesia and Philippines) ..... *cato* group [13] 16
— Petiolar node as seen from front view with summit broadly rounded, transverse or concave, more or less as in figs. 21-23, 30 or 33 18

16. Frontal striation nearly confined to space between frontal carinae, and not or only slightly extending posteriad beyond the level of the compound eyes ..... *isolatus* superspecies 17
— Frontal striation extending over a wide area of central vertex and reaching halfway or more of the distance between level of eyes and postero-median excision of head (figs. 38, 55; N. Guinea, Bismarck Arch., Solomon Is.) ..... *cato*

17. Body color dark reddish-brown to yellowish brown (in callows?); HL + ML rarely if ever > 3.0 mm (Melanesia, Philippines) ..... *isolatus*
— Head, trunk and node piceous; gaster and appendages reddish-brown; HL + ML slightly > 3.0 mm (Waigeo I., W. Irian; doubtfully distinct from *isolatus*) ..... *seminiger*
— Head dark brown or piceous; rest of body light ferruginous to ferruginous yellow; propodeal costulae partly effaced, the surface here smooth and shining (Caroline Is.: Yap) ..... *splendidulus*

18. Pronotal disc (at least a broad central field) and all of first gastric tergum smooth and shining when clean, with at most fine, spaced punctures 19
— Pronotal disc coarsely striate or punctate-rugulose; smooth interspaces, if any, narrow and usually coarsely punctate; first gastric tergum rugulose, striate or smooth, with or without coarse punctures 25

19. Modest- or small-sized, lightly pigmented species with reduced eyes: compound eye L < 0.15 mm, their greatest diameter < maximum W of a mandible (figs. 14, 15) 20
— Larger species with large eyes: eye L > 0.25 mm and > maximum W of a mandible 24

20. Propodeal angles produced as a pair of short teeth or tubercles (figs. 21-24) 21
— Propodeal angles rounded, unarmed; trunk with sculpture effaced, smooth and shining except for the delicately cross-striate propodeal declivity (W Iran) ..... *evansi* [23]

21. HL + ML > 1.55 mm 22
— HL + ML < 1.55 mm 23

22. Mesonotal disc > twice as wide as long; mesonotal suture deeply impressed, more so than in fig. 23 (Malaya: Perak) ..... *myops* [18]
— Mesonotal disc not more than twice as wide as long; meso-metanotal suture distinct, but not deeply impressed (figs. 15, 23; Sri Lanka) ..... *longifossatus* [18]

23. Tiny species: HL + ML < 1.25 mm; mesonotal disc > twice as wide as long (figs. 14, 21, 22; S India) ..... *pupulatus* [18]
— Slightly larger species: HL + ML of holotype about 1.5 mm; mesonotal disc not > twice as wide as long (fig. 24; Taiwan) .... *subcoecus* [17]

24. Petiolar node axially compressed above; anterior slope concave, and summit rather bluntly rounded as seen from the side (much as in fig. 47), but strongly transverse as seen from above; body with very numerous short, fine, erect hairs, much as in fig. 47; appressed pubescence scarcely developed on head, trunk, petiole and gaster; in full-face view of head, antennal scapes surpass posterior borders of «occipital» lobes by at least an apical scape width (S India: Madras State) ..... *rufus* [20]
— Petiolar node thick, erect, barrel-shaped; anterior slope convex, summit broadly rounded in both directions and only slightly broader than long; body with few or no erect hairs, except for those on apex and underside of gaster (0-9 standing hairs on trunk and first gastric tergum), but with abundant and conspicuous appressed pubescence; when head is viewed fullface, antennal scapes do not reach, or at least do not dstinctly surpass, posterior borders of «occipital» lobes (W peninsular India; see also key to species of Africa, etc.) ..... *sedilloti* [21]

25. Petiolar node as seen from the side thin, tapered to a very narrowly rounded, or even sharp, apex, shape much as in figs. 23 or 24, or even fig. 22; scale-like part near its base not more than 0.20 mm long .... *graeffei* group [14] 26
— Petiolar node as seen from the side thick, with broadly rounded summit, about as thick as in fig. 30, and L > 0.25 mm near base of erect part of node ..... *orientalis* group 27

26. HL + ML < 1.75 mm; eye L maximum 0.20 mm, usually much less (see key to Australian species; India to Melanesia, N & E Australia and S Polynesia) ..... *graeffei*
— HL + ML < 1.75 mm; eye L > 0.20 mm; most of vertex smooth and shining, the frontal striation extending only a short distance beyond the level of the eyes (Sri Lanka) ..... *yerburyi*
— HL + ML 1.75 mm or more; eye L 0.20 mm or more; frontal striation reaching all the way to nuchal carina (Java), or most of the way (Sikkim, Hainan I.) ..... problem samples: «large *graeffei*», etc. [14]

27. First gastric tergum densely and more or less opaquely sculptured over at least the anterior half 28
— First gastric tergum smooth and shining, with only scattered, fine piligerous punctures (Sri Lanka, India) ..... *madaraszi* [15]

28. Anterodorsal margin of petiolar node slightly produced anteriad, overhanging the anterior slope, which tends to be concave, trunk red; first gastric tergum black or piceous, coarsely punctate-striate and opaque to near posterior border (fig. 30; SW India) ..... *kanariensis* [22]
— Anterodorsal margin of petiolar node broadly rounded, like posterodorsal margin; anterior slope of node convex or straight as seen from the side; trunk, petiole and gaster piceous or blackish, often with bluish opalescence, the first gastric tergum with punctate-rugulose sculpture thinning to nearly smooth and shining on posterior half or third of the segment. ..... [22]
(S Viet Nam) ..... *orientalis*
(S India) ..... *obscurior*
(The distinction between *orientalis* and *obscurior*, if any, is not clear, and the two may well be synonymous).

KEY TO ANOCHETUS SPECIES OF AUSTRALIA — WORKERS

1. Petiolar node surmounted by a pair of acute, divergent teeth (fig. 35; upper N. Territory) ..... *paripungens* [24]
— Petiolar node rounded, truncate or emarginate above, but not armed with acute teeth 2
2. Disc of pronotum completely or nearly completely sculptured, or, if disc shining, then coarsely punctate; eye L < 0.20 mm (tropical Australia .... *graeffei* [14]
— Pronotal disc smooth, strongly shining, sometimes finely punctate; eye L > 0.20 mm 3
3. Petiolar node as seen from the side thick at base, then tapering abruptly to a rounded summit from a point near mid-height; apical margin broadly convex as seen from in front (fig. 33; Queensland, mainly high- or medium-rainfall areas) ..... *turneri* [25]
— Petiolar node in side view narrow to moderately thick, tapering gradually to apex; as seen from front, apex truncate or emarginate (figs. 32, 36) 4
4. Propodeum, metapleura and sides of pronotum rugulose or striate-rugulose, opaque or nearly so; size smaller, HW < 1.15 mm (fig. 36; N. S. Wales, Queensland, sporadic) ..... *rectangularis* [25]
— Sides of pronotum smooth and shining; metanotum and propodeum smooth and shining, or with restricted or widespread striation; size larger, HW > 1.15 mm (fig. 32) S and central Queensland, W N. S. Wales, NW Victoria, W Australia, mainly in arid or semiarid areas) .... *armstrongi* [25]

KEY TO ANOCHETUS SPECIES OF AFRICA, SPAIN AND MADAGASCAR — WORKERS

1. When head is seen in perfect full-face view, antennal scapes extend beyond posterior margins of «occipital» lobes, and/or worker compound eyes > 0.15 mm long 2
— When head is seen in perfect full-face view, antennal scapes fail to reach, or reach but do not distinctly surpass, posterior margins of «occipital» lobes; compound eyes of worker < 0.15 mm long 17
2. Nearly all of upper surfaces of body covered with conspicuous, uniform appressed or subappressed pubescence; standing hairs absent or extremely sparse on trunk (limited to 0-4 on pronotum) and first gastric tergum (0-4) 3
— Upper surfaces of body with little or no conspicuous appressed pubescence; standing hairs usually (but not always) more abundant on trunk and first gastric tergum 5
3. Smaller species (HL + ML < 1.9 mm) with reduced eyes (eye L < 0.18 mm); petiolar node strongly compressed axially, tapered to a narrow apex as seen from the side (figs. 10, 16; E Rhodesia) .... *pubescens* [33]
— Larger species (HL + ML > 1.9 mm) with short scapes and large eyes (eye L > 0.22 mm); petiolar node as seen from the side thick, only slightly tapered to a broadly rounded apex (*sedilloti* group) [21] 4
4. First gastric tergum smooth and shining with spaced fine punctures; upper half of vertex usually so, but some samples have patchy striation over part of this surface; at least the anterior half of the pronotum smooth and shining (Tunisia, Eritrea, and dry inland parts of W and C Africa; also in W peninsular India; see key to Asian, etc. species) ..... *sedilloti*

— First gastric tergum with rugulose sculpture in addition to the punctures over much of its anterior and discal surfaces, rendering it opaque, or at most only weakly shining; vertex continuously striate and opaque to nuchal carina over a wide median area of vertex; pronotal disc entirely striate and opaque (Eritrea, Rhodesia, S Africa) ..... *levaillanti*

5. Frontal striation of head distinct, prevailingly longitudinal, and continuous (coarse, fig. 3, or fine) to or very nearly to (within 0.1 mm of) nuchal carina in the middle 6

— Frontal longitudinal striation of head not reaching nearly to nuchal carina in the middle, the vertex largely smooth and shining, sculpture much as in fig. 4 (rarely, the «smooth» part of the vertex may be partly covered with fine, superficial striation, much of it oblique or transverse laterad, but the surface generally is shining) 12

6. Gastric terga I and II completely glassy smooth and shining when clean, with only scattered piligerous punctures; frontal striation always fine, 7 or more striae/0.1 mm transect; head broad, CI > 87 (*africanus* group) [29] 7

— Gastric terga I and/or II with some reticulate, rugulose or densely punctulate sculpture, at least on the anterior disc of I; frontal striation coarse (fig. 3) or fine; head varying in width, CI 80-89 10

7. Pronotal disc sculptured 8

— Pronotal disc smooth and shining 9

8. Sculpture of truncal dorsum variable, but showing at least moderate relief and roughness; eyes 0.18-0.26 mm long (W & C Africa) .... *africanus*

— Truncal dorsum finely and very superficially striate, on pronotal disc nearly smooth, weakly shining; eye L 0.27-0.28 mm (S. Africa: C Natal) .. .. *natalensis*

9. Sculpture of propodeal dorsum obsolete or nearly so, reduced to fine, superficial striation, smooth or nearly smooth on posterior half of this surface (fig. 46; E & C Africa) ..... *obscuratus*

— Sculpture of propodeal dorsum fine, but not effaced (Madagascar) .... *madagascarensis*

10. Frontal striation of vertex fine and regular, 7 or more grooves per 0.1 mm transect in center; head usually more or less red in color, contrasting with blackish or piceous trunk and gaster, but in rare (and problematic) samples the body may be largely red, or even dull yellow (W & C Africa to Natal) ..... *bequaerti* [30]

— Frontal striation of vertex usually coarse and uneven (fig. 3), < 7 grooves per 0.1 mm transect in center; head, trunk, petiole and gaster concolorous or nearly so (fig. 42; *pellucidus* group) [31] 11

11. Color tawny yellow, with lighter appendages, having a somewhat translucent appearance; propodeum usually densely punctulate, opaque; rarely partly rugulose (W & C Africa) ..... *pellucidus*

— Color black or piceous, with brownish-yellow mandibles, antennae and tarsi; propodeum rugulose (figs. 3, 42; W Africa, Natal) ..... *fuliginosus*

12. Petiole elongate, its summit bidentate (fig. 48; S. Africa: Zululand) .... *faurei* [35]

— Petiolar summit unarmed (figs. 25, 45, 47, 49; *ghilianii* group) [26] 13

13. Petiolar node more or less axially compressed, with transverse summit (figs. 25, 45, 47); eye L < 0.35 mm) 14

— Petiolar node not axially compressed, L and W subequal, sides converging in front to a blunt, sloping ridge; eye L > 0.36 mm (fig. 49; NW Angola) ..... *angolensis* [27]

14. Propodeum sculptured 15

— Propodeum entirely smooth and shining (Somalia, E Ethiopia) .... *rothschildi*

15. Petiolar node of a particular shape (fig. 25), as seen from side, anterior slope concave, summit bluntly rounded, not or only weakly tapered; as seen from above lunate (W & C Africa) ..... *maynei* [28]
— Petiolar node varying in shape; anterior slope as seen from the side usually convex or straight, or if slightly concave, then the summit is strongly tapered (figs. 45, 47) 16
16. Compound eyes 0.18-0.22 mm in greatest diameter (fig. 45; Morocco, S Spain) ..... *ghilianii*
— Compound eye L 0.20 mm or more in greatest diameter (fig. 47, but shape of propodeum and petiole very variable); W Africa, Sudan and Eritrea S to Angola and Rhodesia) ..... *traegaordhi*
(*A. ghilianii* and *A. traegaordhi* may well be variants of a single species).
17. Petiolar node with nearly vertical and parallel anterior and posterior slopes as seen from the side, the apex broadly rounded (apex thicker and less strongly tapered than in any of the species shown in figs. 16-20); small, shining yellow species with tiny eyes (eye L about 0.05 mm (Natal) ..... *talpa* [34]
— Petiolar node strongly tapered apicad as seen from the side (figs. 17-20) 18
18. Longitudinal striation of frontal region extending fanwise far posteriad on vertex, embracing front and sides of the posteromedian impression (Madagascar) ..... *grandidieri* [32]
— Longitudinal striation much shorter, not reaching posteromedian fossa, or at least not extending back on each side of it; striation largely or entirely replaced on middle of posterior half of head by distinct small punctures with shining interspaces 19
19. Petiolar node as seen from the side tapered to a sharp apex (figs. 18, 19); punctures of first gastric tergum usually coarse and conspicuous .. 20
— Petiolar node as seen from the side with apex narrowly rounded (figs. 17, 20); punctures of first pastric tergum fine, inconspicuous (S. Africa) 21
20. Eyes reduced to dots 0.10 mm or less in greatest diameter, filling half or less of the length of the orbital fossa; mesonotal disc straplike, about 3 times as wide as long; color clear yellow (figs. 11, 19; W Africa) .... *siphneus* [34]
— Eyes usually larger (0.07-0.12 mm long) filling more than half the length of the orbital fossa; mesonotum $<$ 2.5 times as wide as long; color brownish-yellow to dark brown, often with head lighter than trunk (figs. 12, 18; tropical Africa) ..... *katonae* [32]
21. Size larger (HL + ML $>$ 1.50 mm); mesonotal disc $<$ 2 times as wide as long (figs. 13, 17; Zululand) ..... *jonesi* [34]
— Size smaller (HL + ML $<$ 1.50 mm); mesonotal disc $>$ twice as wide as long (fig. 20; E Cape Prov.) ..... *punctaticeps* [32]

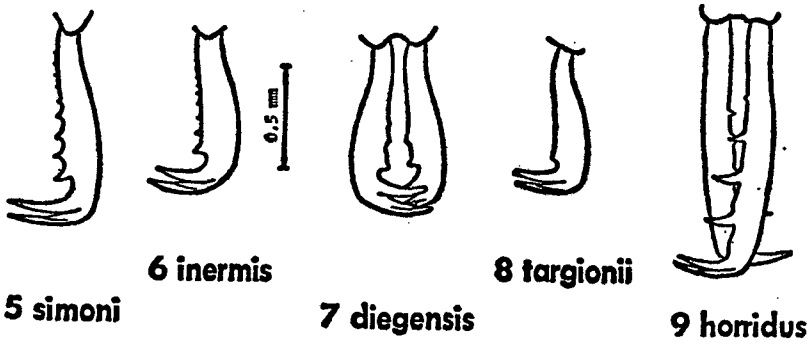
KEY TO NEOTROPICAL SPECIES OF ANOCHETUS — WORKERS

1. Large species with long mandibles, combined L of head and closed mandibles (HL + ML) $>$ 2.2. mm; medial borders of mandibles with 2 or more prominent, serially arranged teeth (in addition to the 3 teeth at apex, fig. 9) 2
— Species either with HL + ML $<$ 2.2. mm, or else medial borders of mandibles without prominent teeth proximal to the single preapical tooth or angle (fig. 8) 10

2. Mandibles with > 10 *preapical* teeth and denticles 3
— Mandibles with < 10 *preapical* teeth and denticles 6
3. Petiolar node low, the anterior slope as seen from side view rising at an angle of only about 30° to the main axis of the petiole; petiolar apex forming a blunt double point that strongly overhangs the receding posterior face of the node; first gastric segment (postpetiole) bell-shaped as seen from the side or from above, both dorsal and ventral faces concave in outline for much of their lengths, but the segment abruptly and strongly constricted just before its caudal margin (N Peru; Marañon Valley, ca. 1500 m) ..... *inca* [38]
— Petiolar node high, main anterior slope rising at an angle of ca. 45°; petiolar apex more or less acutely double-pointed, the points directed dorsad, and not overhanging posterior face of node, which is vertical and usually convex as seen from the side; first gastric segment evenly convex above and laterally as seen from the side or from above, ventral surface straight or nearly so; caudal margin only slightly and gradually constricted 4
4. Smaller species (HL + ML < 2.80 mm); pronotum very finely and densely punctate, opaque, without striation (SE Brasil: N Espirito Santo) ..... *oriens* [39]
— Larger species (HL + ML > 2.80 mm); pronotum with fine or coarse striation, or its disc sometimes partly or largely smooth and shining (*emarginatus* superspecies) 5
5. Yellow, trunk ferruginous yellow; most of vertex, disc of pronotum and upper front half of petiolar node smooth and shining; petiolar teeth short and not very sharp (aedeagus of male genitalia as in fig. 76; W. Indies: St. Vincent, Grenada) ..... *testaceus* [36]
— Trunk, petiole and node ferruginous to piceous, head and legs paler, yellowish; pronotum varying from transversely rugose or striate to largely smooth and shining, but upper front face of petiolar node usually rugulose and opaque; petiolar teeth short (male genitalia as in fig. 74; Amazon Basin N to N. Colombia & Trinidad) ..... *emarginatus* [36]
— Body dark reddish-brown, including head (corners of head slightly paler), legs brownish-yellow; frontal area, front and sides of pronotal disc, and upper front face of petiolar node finely striolate, sericeous; posterior center of pronotal disc smooth and shining; petiolar teeth long (L 0.1 mm or more) and sharp (Costa Rica: Atlantic lowlands) ..... *striatulus* [36]
— Body light ferruginous; pronotum striate at least over front half; sculpture and petiolar teeth varying with locality (locally in C. America, Bahamas, see discussion) ..... *micans* [36]
6. Mesial borders of mandibles each with 7-9 teeth and denticles (excluding apical trio; W. Indies) ..... (*haytianus* superspecies) 7
— Mesial borders of mandibles each with 3-5 teeth and denticles (excluding apical trio; Amazon-Orinoco Basins) 9
7. Propodeal teeth small but well developed, acute, erect (fig. 52; Puerto Rico, including Culebra I.) ..... *kempfi* [37]
— Propodeal teeth absent, or at most low, inconspicuous and obtuse (Hispaniola) 8
8. Mandibles longer, MI > 61; paired teeth of petiolar apex very long (L > 0.2 mm) and slender (Haiti: La Hotte Massif, 1000+ m) ..... *longispina* [37]
— Mandibles shorter, MI < 61; petiolar teeth shorter, L not over 0.15 mm (E Central Haiti) ..... *haytianus* [37]

9. Mandibles nearly as long as head, MI > 85 (fig. 9); 3 of the teeth on each inner preapical mandibular border large and spiniform when unbroken (Brasil: Pará, Amazonas) ..... *horridus* [38]
— Mandibles shorter, MI < 80; 2 of the teeth on each inner preapical mandibular border large and spiniform when unbroken (Brasil: NE Mato Grosso) ..... *vexator* [39]
10. Petiolar node as seen from front or rear with apical margin rounded, slightly flattened, or very weakly emarginate in the middle, but in this case, the free corners are always broadly rounded .... *altisquamis* group 11
— Petiolar node as seen from front or rear with apical margin distinctly concave, the 2 free corners forming angles or produced as teeth (figs. 43, 44) 12
11. Pronotum smooth only in the middle of the disc, its sides striolate and scarcely shining; size larger, HW > 1.3 mm; vertex mostly striolate and vaguely roughened, with inconspicuous punctulae in the narrow posterior smoother zone (S Brasil, N Argentina) ..... *altisquamis* [42]
— Pronotum smooth and shining on disc and sides, with spaced punctures; HW < 1.3 mm; vertex mostly smooth and shining, thickly sown with separate, conspicuous punctures (SE Mexico) ..... *orchidicola* [43]
12. Small species, combined length of head and closed mandibles (HL + ML) < 1.75 mm; second segment of antennal funiculus less than twice as long as broad ..... *mayri* complex; see discussion [41] 13
— Larger species, HL + ML > 1.75 mm; second segment of antennal funiculus at least twice as long as broad 14
— Some specimens in the intermediate size range, HL + ML 1.60-1.75 mm, may possibly belong in couplet 14. (coastal mts. of SE Brasil) .... problem specimens, *inermis* group
13. Head and trunk very finely striolate, sericeous-opaque (pronotum sometimes densely punctulate rather than striolate but still opaque), mesopleura completely sculptured; eyes usually 0.13-0.16 mm in greatest diameter; color usually uniform reddish- or yellowish-brown, rarely somewhat infuscated (SE and C Brasil S to N Central Argentina) ..... *neglectus*
— Sculpture and color variable; head striate for varying distances; pronotum striate or smooth, in part or entirely; eyes usually 0.09-0.13 mm in greatest diameter; male terminalia as in figs. 70 and 71 (S Mexico and W. Indies S through Amazon Basin to Bolivia; W of Andes to S Ecuador) ..... *mayri*
14. Modest-sized species, HW < 1.20 mm; pronotum smooth or variously sculptured, but not coarsely rugose; petiolar teeth undeveloped or shorter, rarely longer than as shown in fig. 44 15
— Larger species, HW > 1.2 mm; pronotum coarsely reticulate-rugose; petiolar teeth long, acute and strongly diverging (hylean S. America) .... *bispinosus* [39]
15. Compound eyes < 0.08 mm greatest diameter (Central America) .... *minans* [43]
— Eyes > 0.08 mm greatest diameter .... *inermis* group; see discussion [40] 16
16. Dorsum of head and most or all of trunk finely and densely punctulate and matt; pronotum with a single pair of long standing hairs (one or both of which may be missing); color uniform light brownish-yellow (fig. 43) 17
— Head and trunk with varied sculpture: striate, costulate or rugulose, and partly smooth; pronotum with more than 4 standing hairs; color variable, often variegated (fig. 44) 18

17. Inner mandibular borders each with a single margin bearing a series of coarse teeth (fig. 5); teeth at apex of petiolar node strong and acute, like those shown in fig. 44 (N Venezuela, SW to Ecuador, in forest) .... *simoni*
— Inner mandibular borders each with 2 margins; dorsal margin unarmed except for the preapical angle; ventral margin with variably distinct denticles, or unarmed (fig. 6); corners of apical margin of petiole not acutely dentiform (fig. 43; N S. America, Trinidad, sporadic in Lesser Antilles, mainly in savanna or thin woodlands) ..... *inermis*
18. Mesonotum and propodeum with several to many standing (mostly inclined) hairs; mandibles (fig. 8) only slightly broadened apicad, their ventral inner margins usually unarmed (Hylea to Bolivia) ..... *targionii*
— Mesonotum and propodeum with at most 1 or 2 standing hairs; mandibles broadened apicad, their inner margins with or without low teeth or denticles (N S. America, Panama) ..... *diegensis*



Figs. 5-9, mandibles of *Anochetus* spp. workers, dorsal view. Fig. 5, *A. simoni,* Rancho Grande, Aragua, Venezuela. Fig. 6, *A. inermis,* Calabozo, Guarico, Venezuela. Fig. 7, *A. diegensis?* (atypical), near Belém, Pará, Brasil. Fig. 8, *A. targionii,* Limoncocha, Napo, Ecuador. Fig. 9, *A. horridus,* near Belém, Pará, Brasil. All to same scale.

APPENDIX

[1] The nomenclature of *A. gladiator* has caused trouble since Frederick Smith confused it with his *Odontomachus tyrannicus* in 1862 (not 1859). He apparently noticed the mistake early, and labeled certain of his specimens as *O. gladiator,* including some later sent to other collections. Mayr and Roger evidently had such specimens, and Mayr (1862: 712) listed «*S. gladiator* Smith» as one of the two included species in his then new genus *Stenomyrmex,* remarking of it, «Von Herrn Smith in meiner Sammlung aus Mysol in Australasien».

In 1863, Roger listed in his catalog (p. 21) an *Odontomachus smithii* as a replacement name for the *O. tyrannicus* of Smith 1862, not 1859, and in the same year, Mayr (1863: 454) published a brief but formal description of *Stenomyrmex gladiator* «Sm. in litt.» from Mysol. I have expended much effort trying to find out which of the

two 1863 papers, both synonymic lists of the ants described up to that time, was published first during that year, Roger's or Mayr's. Dr. Max Fischer of the Naturhistorisches Museum in Vienna has also gone to some trouble on my account to try to determine the exact dates of these papers. The results of our researches, without going into the tiresome details (mostly evidence internal to the articles themselves and the volumes in which they were published) were not conclusive, although it seems most likely that Roger's paper appeared first. If this were true, we would have *Odontomachus smithii* as the prior name for the species, which would be unfortunate, because the name *gladiator* has much more frequently been applied to it.

Happily, a rereading of the 1862 reference of Mayr now reveals a solution to the problem that will allow us to reserve priority for the name *gladiator*. Although Mayr himself, as well as later authors, regarded the 1862 *Stenomyrmex gladiator* as without a description, and therefore a *nomen nudum*, the context of that entry can reasonably be held to furnish descriptive material that applies unequivocally to the *S. gladiator* combination. On page 711 of Mayr's 1862 paper appears the beginning of the diagnosis of his «*Stenomyrmex* n.g.». This continues on the top of page 712; the diagnosis concludes, «Das Stielchen trägt einen dicken oder dünnen Kegel, der oben in einen Dorn endet oder Zweizähnig ist». Mayr includes only two species in his genus: *S. emarginatus* and *S. gladiator*. It is clear that the generic diagnosis applies to both species except for the part about the petiole; *S. emarginatus* has the «zweizähnig» node, and the node of *S. gladiator* (fig. 27) is the one ending in the «Dorn». This, then, is the original description, and Mayr is the author of the species.

Donisthorpe (1932: 467) named this species again, but fortunately he used the label name *gladiator* that he found on Smith's (British Museum) specimen, so the name falls harmlessly as both a synonym and a homonym.

Smith originally had samples collected by Wallace in northern Celebes and on the island of Mysol. I collected this striking species again in northern Celebes in wet forest on the lower slopes of Mt. Klabat. The nest contained approximately 50 workers and was made in a rotten stump at about 500 m elevation. Another small colony came from a rotten branch lying on the forest floor of a steep slope at Silea, 28 km west of Kendari, southeastern Celebes.

[2] Brown (1964) showed that *Anochetus jacobsoni* Menozzi (preoccupied by *A. jacobsoni* Forel = *princeps*) is a subjective synonym of *A. rugosus* F. Smith. Donisthorpe already had needlessly proposed a new name, *A. menozzii*, for the homonym, and Baroni Urbani did it again in 1971 when he published the replacement name *A. ineditus*. The summary synonym of this distinctive species is thus:

Anochetus rugosus (F. Smith) 1857 (not 1858)
= *A. beccarii* Emery 1884
= *A. jacobsoni* Menozzi 1939, not Forel 1911
= *A. menozzii* Donisthorpe 1941
= *A. ineditus* Baroni Urbani 1971.

I took this species in lowland rain forest about 21 km west of Batulitjin, southeastern Kalimantan (Borneo). The nest was a small one, consisting of a dealate queen, 5 or 6 workers, and meager brood under the loose bark of a tall rotten stump from which were growing mosses, liverworts and other small plants.

[3] Two short series of workers (figs. 4 and 31) from Sumatra, E. Coast: Langkat, Namoe Dengas Estate (Jourin); and Malaya: 26 km NE of Kuala Lumpur, about 300 m (E. S. Ross & D. Q. Cavagnaro) are referred to *A. muzziolii,* originally described from a single worker from Soliga, on Nias Island in the Indian Ocean off Sumatra. Menozzi's original description is incomplete and partly confusing, and his figure shows the head narrower than in my samples, and the mandibles too slender and with too long a preapical excision, but the antennal scapes and mandibles are shown as nearly the same lengths as in my series. I have not been able to study the *A. muzziolii* type directly myself; it is kept in the Menozzi Collection in the Instituto di Entomologia of the University of Bologna, and it cannot be borrowed. Prof. Maria M. Principi has kindly compared figs. 4 and 31 with the type, and she confirms the present determination.

The workers from Sumatra (figs. 4, 31) are uniform bright orange-ferruginous and smaller in size than the Malayan series; the smallest of 4 workers has TL 7.2, HL 1.81, HW 1.63, ML 1.02, WL 2.14, scape L 1.47, eye L 0.23 mm; CI 90, MI 56.

The Malayan sample includes 2 workers chosen for their large size: TL 8.5, 8.6; HL 2.07, 2.12; HW 1.96, 1.97; ML 1.15, 1.20; WL 2.48, 2.52; scape L 1.66, 1.70; eye L 0.27, 0.27 mm; CI 95, 93; MI 56, 57. Color uniform clear brownish-red.

A. muzziolii is closely allied to *A. princeps,* but has a slightly more compact body, with shorter appendages. The head appears especially large (wide) in comparison with *A. princeps,* especially the vertex, and the mandibles and antennae are relatively shorter and thicker; even the apical teeth of the mandibles are notably shorter and thicker. Posterior excision deeper and wider. The petiolar node is very slightly thicker and a trifle more broadly rounded above than in *princeps,* but this is an average difference instead of an absolute one. The gaster is also shorter and less strongly downcurved than in *princeps.* Otherwise, in form and sculpture, the two species are very similar, and even the same variation in details is shared. For example, the amount and extent of striation or rugulosity on the sides of the pronotum varies in both species, although the sculpture is usually more extensive and distinct in *princeps.* The same goes for the «saddle» area of the truncal dorsum (including parts of mesonotum, metanotum and anterior propodeum), which can be smooth and shining or longitudinally or diagonally rugulose or vaguely costulate, or merely minutely roughened in the middle.

Menozzi's comparisons of the sizes of the trunks of the two species should be ignored, because he did not realize how variable in size either species is.

The queen and male of *muzziolii* remain unknown.

[4] I have already dealt with the synonymy of *A. princeps* (Brown, 1964), which is widespread in forested parts of southeastern Asia and the Greater Sunda Islands. Much of the material in MCZ comes from North Borneo: Tutu River; Mt. Poi, Sarawak, 5000 ft.; Mt Penrissen, 4000 ft.; Tobang; all collected by E. Mjöberg. I have also reviewed specimens from the Andaman Is.: Peel Islands, B. Osmaston; and Mt. Makiling, Lagunas Prov., Luzon (F. X. Williams, «low alt.»), and new series from SE Celebes: Silea, 28 km W of Kendari, rotten wood in wet forest, W. L. Brown; 1-2 km E of Wolasi, 42 km S of Kendari, rotten wood in wet forest (Brown). At Silea, *A. princeps* was taken within 100 m of *A. gladiator* nests, also made in rotten wood on the forest floor.

Male: With the sample from Mt. Penrissen, North Borneo (MCZ) there is a male mounted on the same pin with a worker, and almost certainly of the same species. TL 5.6, HL 1.00, HW including eyes 1.13, WL 2.20.

Ocelli large (greatest diameter 0.14 mm); compound eyes large, very convex, taking up most of sides of head, but separated from lateral ocellus by a gap 0.20 mm long. Mandibles very small, subtriangular, their dorsal surfaces each bearing a conspicuous whitish, subcircular basin — perhaps an evaporation basin for pheromones. Maxillary palpi apparently 4-merous, 2 basal segments wide. Sides of trunk strongly convex. Petiolar node forming a blunt cone, much like that of worker, but back-tilted.

Terminalia rather ordinary. Pygidium with entire, narrowly-rounded free margin. Cerci prominent. Hypopygium tapered-linguiform, with convex ventral surface. Parameres rather narrow, tapered toward narrowly rounded apices, obtusely bent mesad and ventrad beyond midlength, with convex outer surfaces. Digitus and cuspis of volsella subequal in length; aedeagus without prominent lateral expansions or processes.

Body generally covered with abundant, mostly decumbent, brown, short hair (or long pubescence), through which can be seen the moderately shining, densely punctulate integument. Color warm tan; vertex and scutum partly darker brown; lower meso- and metapleura, mouthparts, legs and terminalia pale, dull, yellowish.

Wings (forewing L 4.8 mm) pale brownish, with «full» venation of tribe Ponerini. Hind wing with well-developed anal lobe and 10 submedian hamuli.

[5] *A. risii* (fig. 28) is known from several samples collected along the South China coast: Hong Kong (type locality); Repulse Bay, Hong Kong (F. Silvestri); Kusang (Silvestri); Taipo (Silvestri), and from Viet Nam; Yen Bay (Silvestri). The species is ferruginous yellow in color, with pale yellow legs; the pronotum is striate or

rugulose in front and around the sides of the disc, but the center of the disc is smooth and shining. In *A. risii* and related species, the dorsal inner margin of the mandible is nearly straight and is edentate with a smooth margin, the preapical angle tends to be acute and is directed somewhat apicad as well as mesad, and the intercalary tooth of the apical trio is reduced and situated far out on the ventral apical tooth near its apex, which may thus appear furcate in young specimens. In older specimens, the intercalary tooth may be worn to a nub, or broken off, and scarcely detectable. A representative worker from Kusang, China has HL 1.62, HW 1.44, ML 1.19, scape L 1.58, eye L 0.28 mm; CI 89, MI 73. The form of a topotypic worker trunk and petiole is shown in fig. 28.

A syntype of *A. gracilis,* from Bogor, Java (Karawajew), appears to belong to *A. risii,* though it has relatively long mandibles: HL 1.48, HW 1.27, ML 1.14, scape L 1.48, eye L 0.29 mm; CI 86, MI 77, and the apex of the petiolar node is more laterally compressed. This sample was taken in the great Botanical Gardens at Bogor, and may represent an introduction to Java with nursery stock.

[6] *A. agilis* is represented in collections by Emery's type (MCSN-Genoa), a worker from «Banguey, Borneo». Unfortunately, this example has a shriveled petiolar node, so that the original shape is unknown. A worker specimen taken inland from Batulitjin, Kalimantan Selatan (SE Borneo) in rain forest (W. L. Brown) is larger (TL 11.5, HL 2.37, HW 1.76, ML 1.58, WL 3.60, scape L 2.56, eye L 0.46 mm; CI 74, MI 67) than the type, and has a blunt petiolar node of a particular form (fig. 41). Forel assigned to *A. agilis* 2 workers from Sarawak (Haviland); one of these is portrayed in fig. 51. These examples are smaller than Emery's type: HL 1.64, HW 1.32, ML 1.32, eye L 0.32 mm; CI 80, MI 80; and have shorter, pointed petiolar nodes.

All 3 of these samples, whether they collectively represent one, two or three different species, are attenuated versions of *A. risii* that recall in a general way the *emarginatus* group of tropical America, and *A. faurei* of southern Africa. The eyes are very large, and the head behind the eyes is narrowed.

[7] **Anochetus incultus** new species
(fig. 37)

Worker, holotype: TL 5.2, HL 1.20, HW 1.07, ML 0.81, WL 1.66, scape L 1.08, eye L 0.17 mm; CI 89, MI 68.

Similar to *A. risii,* but smaller and darker: deep reddish-brown, with mandibles, antennae, legs, cheeks and gastric apex lighter, more yellowish. Also the following differences:

1. Eyes smaller; EL/HL 0.14-0.16, vs. 0.17-0.20 in *risii.* Ocular prominences strongly projecting laterad.

2. Mandibles long, but not quite as long relatively as in *risii,* which has MI 72-77 in the few samples examined. Denticles on mesal ventral margins of mandibles small and blunt, ordinarily hidden beneath edentate dorsal margin when head is viewed full-face.

3. Pronotal disc behind anterior transverse costulation is shining but thickly covered discad with fairly coarse, vermiculate, predominantly longitudinal rugulae or costulae. Sides of pronotum obliquely to vertically rugulo-striate more finely, except for a variable lower posterior section that tends to be smooth and shining. (Pronotal sculpture not shown in fig. 37). Mesonotum vaguely transversely rugulose, but longitudinally costulate behind, continuing into metanotal saddle (fig. 37). Mesopleura smooth and shining, except for striate posterior end.

4. Petiolar node in side view tapering evenly to a narrowly rounded summit (fig. 37); convex-sided in front view, then tapering to a rounded summit. Petiole with a longer anterior pedunculate section than in *risii*. Node (and gaster) smooth and shining.

5. Funicular antennomeres shorter than in *risii;* II through IV only about twice as long as broad, or slightly less (in *risii* L 2-3 times breadth for the same antennomeres).

6. Erect pilosity somewhat less abundant and shorter than in *risii*. Pubescence nearly obsolete except on appendages.

Worker paratypes (4): TL 4.9-5.2, HL 1.13-1.22, HW 1.01-1.09, ML 0.78-0.82, WL 1.53-1.70, scape L 1.01-1.09, eye L 0.16-0.20 mm; CI 89, MI 67-69.

Intercalary tooth of mandibular apex (on ventral apical tooth) may be missing or nearly so, apparently due to wear or breakage; fine and acute in one young specimen. Pronotal sculpture variable in orientation on pronotum; in one worker the rugulae form a transverse band across the posterior end of the disc.

Queen, dealate: TL 5.6, HL 1.24, HW 1.16, ML 0.82, WL 1.76, scape L 1.09, eye L 0.27 mm; CI 93, MI 66. Pronotum shining, transversely rugose or costate. Mesonotum smooth and shining. Frontal striation weak, fine, confined to space just inside frontal carinae; this striation more delicate in both worker and queen than in *risii* of corresponding castes. Petiolar node slightly thinner in side view than in workers; i.e., it is axially compressed, with anterior and posterior surfaces converging very gradually. Gaster larger than in worker.

Male: See discussion under *A. madaraszi* [15].

Holotype (MCZ) and 4 paratype workers (MCZ, BMNH-London), plus one dealate queen, all labeled as from Mt. Makiling, near Los Baños, Laguna Prov., Luzon, Philippines. A single paratype was collected (date not recorded) by F. X. Williams; the remainder of the specimens, including the holotype, came from two samples of leaf litter collected near the summit of the mountain in February and March 1968, run through the Berlese funnel by R. A. Morse.

[8] **Anochetus peracer** new species
(figs. 40, 53)

Worker, holotype: TL 5.8, HL 1.43, HW 1.29, ML 0.90, WL 1.83, scape L 1.26, eye L 0.21 mm; CI 90, MI 63 .

Similar to *A. risii* in form, color and sculpture; yellowish-brown, with corners of head and appendages more yellowish, but the petiole gradually attenuated to a very sharp apical tooth (fig. 40), and the mandibles shorter (and broader in the apical half) and with ventral mesal margin of shafts only vaguely crenulate near the preapical angle, which is acute and directed mesad. Antennal scapes also shorter; surpassing posterior lobes of head by only about the length of the first funicular segment when the head is viewed perfectly full-face. Pronotum smooth and shining, except for the usual transverse striation of the cervix; frontal striation confined to the area between the frontal carinae. Eyes relatively smaller than in *A. risii*. Queen and male unknown.

Holotype (MCZ) from Didiman Creek, Lae, New Guinea, 29 March 1955, taken in the early evening from lower trunk of a tree in lowland rain forest, E. O. Wilson, No. 711. Wilson (1959) assigned this specimen, along with another worker taken at the same time and place, to *A. variegatus,* but noted differences in frontal sculpture and petiolar form (compare figs. 39 and 40) between the Lae specimens and a paratype of *A. variegatus* in MCZ. The frontal striation in the *A. variegatus* types is strong, and extends well beyond the frontal carinae to fan out widely over the center of the vertex.

He says nothing about the differences in mandibular dentition that in my opinion are at least as important. The mesial edges of the mandibles in *A. variegatus* have the dorsal and ventral margins fused into one coarsely denticulate margin beyond midlength for nearly half the preapical length of the shaft; the most distal (preapical) denticle does not form an acute angle as in *A. risii, A. peracer* and related species.

A. variegatus, though similar to *A. peracer* in size and color, seems to me to represent a separate species that links the *gladiator* and *risii* groups, but is probably more comfortably placed in the former.

The second specimen of collection No. 711, mentioned by Wilson (1959: 509) and presumably belonging to *A. peracer,* is not now to be found in the MCZ collection, and I do not know where it is.

[9] **Anochetus tua** new species
(figs. 1, 29)

Holotype, worker: TL 8.2, HL 1.77, HW 1.47, ML 1.22, WL 2.54, scape L 1.68, eye L 0.32 mm; CI 83, MI 69.

A moderately larger (longer) relative of *A. risii,* with the following additional differences from that species:

1. Color much darker: body dark reddish-brown to piceous, appearing black to the naked eye (trunk and petiole lighter reddish-brown in presumably partly teneral paratype examples); posterior and often anterior corners of head reddish; gastric apex, mandibles, antennae and legs predominantly light ferruginous to dull yellow.

2. Sculpture more extensive and coarser. Frontal striation occupies most of the central vertex (fig. 1), and faint traces sometimes even reach the nuchal carina on each side of the midline; «occipital» lobes and sides of head behind eyes smooth and shining. Pronotum completely sculptured and opaque to subopaque, though sculpture may be weak discad, consisting here of fine, indefinite rugulosity with shagreening, mostly inverted U- or V-like in pattern; front of pronotum transversely costulate, the costulae continuing around onto the sides of the pronotum as fine reticulo-striation. Mesonotum irregularly transversely striolate, the sculpture more or less effaced mesad. Mesopleura mainly smooth and shining, with traces of rugulae toward the ends; metapleura shining, with traces of oblique costulation and some shallow punctures. Petiolar node very finely reticulate, but moderately shining. Coxae and gaster smooth and shining. Mandibles, legs and antennae very finely punctulate-shagreened, moderately shining to nearly opaque.

3. Petiolar node (fig. 29) thicker, not pointed above, but narrowly rounded, and only slightly laterally compressed toward the apex.

4. Mandibles long and in general shaped like those of *risii,* but the series of denticles springing from the inner ventral margins sharper and more prominent (fig. 1) as the distinction between dorsal and ventral margins tends to disappear apicad along the shaft. The denticles also tend to be spaced farther apart, and most of them are visible, even in full-face view.

Intercalary denticle small, sharp when unworn and situated near the end of the ventral tooth as in *risii,* but often broken off or worn to a blunt remnant.

Queen and male unknown.

Holotype (MCZ) and 6 paratype workers (MCZ, BMNH-London) from Malaysia, Pahang: Fraser's Hill, ca. 1300 m, wet hill forest, 16 August 1967, R. H. Crozier, No. CJ 16.

The paratypes, aside from color variation already mentioned, vary moderately in dimensions: TL 7.6-8.2, HL 1.73-1.80, HW 1.44-1.48, ML 1.16-1.21, WL 2.42-2.56, scape L 1.65-1.72, eye L 0.31-0.33 mm; CI 82-83, MI 67-68. Variation occurs in size, number and spacing of the denticles on the inner mandibular borders, and details of sculpture on head and trunk vary in minor ways.

A. tua takes its name from the Malay word meaning «elder» or «senior», and also meaning «darker in color», in reference to its size and hue. Among the larger *risii* group species with long mandibles, only *risii* and *agilis* might be confused with *tua,* especially *A. agilis,* with its even more slender head, elongate body, and variable petiolar shape. But the sculptural differences, which are about the same as for the comparison against *A. risii,* and the much darker color of mature workers, will serve to distinguish *A. tua* with ease.

[10] **Anochetus brevis** new species
(fig. 2)

Worker, holotype: TL 5.0, HL 1.20, HW 1.08, ML 0.61, WL 1.52, scape L 0.94, eye L 0.13 mm; CI 90, MI 50.

Paratype worker: TL 5.2, HL 1.21, HW 1.07, ML 0.60, WL 1.53, scape L 0,96, eye L 0.14 mm; CI 88, MI 50.

With the general characters of the *risii* group, but mandibles very short, relatively broad toward apices; light brownish-red in color, mandibles and antennae more yellowish. In body form and sculpture like a short-mandibulate *A. modicus,* but the following additional differences from *modicus:*

1. Frontal striation obsolete, even inside frontal carinae. Pronotum completely smooth and shining, except for finely transversely striate cervix.

2. Mesonotal disc longer, elliptical, only twice as broad as long, convex, smooth and shining. Anterior edge blunt. Mesonotal saddle only a brief shallow groove, with longitudinal costulae represented only by tiny, indistinct, raised tubercles; area behind this, grading onto propodeal dorsum, vaguely diagonally costulate; propodeal dorsum transversely striate (about 20 striae).

3. Crenulation of ventral mesial margin of mandible reduced, fine, developed only near preapical tooth or angle.

4. Petiolar node like that of *modicus,* tall and slender, with narrowly rounded apex, but the anterior and posterior slopes in side view nearly perfectly straight in the upper 2/3. As seen from front, lower halves of node nearly parallel, upper halves convexly rounded and rapidly tapered to narrowly rounded apex, with just a hint of nippling near apex. Brief anterior peduncle present.

Meso- and metapleura smooth and shining except for borders of short striae along the anteroventral edges and posterior ends of the metapleura; mesopleuron with distinct transverse suture. Head, mandibles, legs (except finely punctulate tibiae and tarsi), node and gaster smooth and shining. Standing hairs numerous, fine and generally distributed over dorsal surfaces of body, underside of gaster, scapes and legs, mostly about 0.05 mm long, but 0.1 mm or longer on pronotum and gastric dorsum (many longer in *A. modicus*). Underside of head with moderately abundant suberect pubescence;

mandibles with fine appressed pubescence; antennae and legs with fine, dense, decumbent pubescence (sparse on femora).

Holotype (MCZ) and a paratype (BMNH-London) very similar workers taken together on Mt. Apo, Mindanao Island, southern Philippines at «5-6000 ft», or about 1520-1830 m, by C. F. Clagg.

[11] **Anochetus strigatellus** new species

Worker, holotype: TL 5.4, HL 1.28, HW 1.17, ML 0.80, WL 1.67, scape L 1.11, eye L 0.21 mm; CI 91, MI 63.

A slender, dark reddish-brown species resembling *A. incultus* from the Philippines but with extensive frontal striation fanning out over the central vertex, with the disc of the pronotum smooth and shining (inside some peripheral striation), and with the propodeal dorsum longitudinally sulcate and transversely, distinctly but finely striate (ca. 40 striae, plus several more on the propodeal declivity).

The frontal striation reaches back to within 0.2 mm of the nuchal carina. Cervix and front slope of pronotal disc transversely striate; lateral margins of disc diagonally striate; lower sides of pronotum smooth and shining. Mesonotal disc about 3x as wide as long, convex in side view, with a moderately distinct anterior rim, transversely striate. Metanotal saddle with brief but coarse, mainly longitudinal costulae. Mesopleura smooth and shining, with a nearly complete transverse suture. Metapleura smooth and shining except for short diagonal striation along anteroventral and posterodorsal borders. Scapes surpass posterior borders of «occipital» lobes by about 0.1 mm when head is viewed in perfect full-face.

Petiole with node slender, evenly tapered to a narrowly rounded apex in side view; anterior slope nearly perfectly straight, posterior slope feebly convex. In front view, node with weakly convex sides, but tapered rapidly and convexly above mid-height to a blunt, narrowly rounded apex, with just a hint of nippling near apex; almost no anterior peduncle. Gaster slender, not constricted behind first segment.

Standing hairs fairly abundant, fine, 0.1 to 0.2 mm long on gaster and pronotum, but mostly shorter elsewhere; fairly long hairs on anterior underside of head and anterior procoxae; some oblique hairs on scapes and legs. Mandibles and femora with short, sparse, appressed to decumbent pubescence; antennae and extremities of legs with shorter but dense pubescence.

Holotype (BMNH-London) and 5 paratype workers (BMNH and MCZ) taken together, labeled «Trengganu, Malaya, II 1974, T. Clay». The paratypes are similar to the holotype, but are very slightly smaller; discrepancies in TL are due to different shrinkage of the gaster. TL 5.2-5.5, HL 1.24-1.26, HW 1.13-1.15, ML 0.79 in all, WL 1.57-1.64, scape L 1.10-1.11, eye L 0.20 mm in all; CI 90-91, MI 63-64.

This species is also similar to *A. modicus*, but can be distinguished at once by the expanded frontal striation and the less reduced (longer) mesonotal disc, as well as by the fine, crisp propodeal striation and the darker body color.

[12] **Anochetus modicus** new species

Worker, holotype: TL 5.9, HL 1.45, HW 1.25, ML 0.84, WL 1.90, scape L 1.17, eye L 0.21 mm; CI 86, MI 58.

Color rich, bright, brownish-red; corners of head, mandibles, antennae, legs, petiole and gastric apex lighter, more yellowish. A member of the *A.*

risii group in habitus, mandibular form and armament, and body sculpture, but differing from *risii,* apart from smaller size and darker color, in the relatively shorter mandibles, scapes and eyes, as well as the following:

1. Scapes surpass posterior margins of «occipital» lobes by an amount less than the length of the first funicular segment.

2. Mesonotal disc reduced to a mere smooth, transversely straplike, raised strip, 4 times or more wider than long, limiting the strong longitudinal costulae of the metanotal saddle anteriorly.

3. Petiolar node smooth, moderately stout, almost perfectly erect, narrowly rounded at apex, but more broadly so than in *risii,* and not nippled; as seen in side view outline, both anterior and posterior slopes gently convex; base of petiole horizontally costulate, and with a brief anterior peduncle.

Body shining. Frontal striation weak, extending only a short way beyond frontal carinae caudad, not fanning out widely, leaving most of central vertex smooth and shining. Pronotum smooth and shining, the only distinct sculpture, aside from occasional faint traces of lateral striae, and some piligerous punctures, is the usual transverse striation of cervix, becoming coarser, more costulate, on base of anterior slope of pronotal disc. Meso- and metapleura smooth and shining, the former with distinct transverse suture. Propodeal dorsum transversely costulate, the costulae irregular and about 30 in number, with 4-5 more on declivity. Gaster smooth and shining, narrowed behind basal segment, but not noticeably constricted.

Long, fine, erect and inclined hairs fairly numerous and generally distributed over dorsal surfaces, undersides of head and gaster, anterior side of front coxae, and scapes and legs; up to 0.25 mm long on pronotum and gastric dorsum, but mostly not much over 0.1 mm elsewhere. Pubescence fine, mostly restricted to appendages.

Worker variation, paratypes: Of the 9 workers available, 5, including the holotype, are from Moaratoa I., Borneo; 3 are from Tjibodas, Java; and 1 is from the Cuernos Mts., Negros I., Philippines. The combined measurements and indices for these are: TL 4.8-5.9, HL 1.21-1.45, HW 1.06-1.29, ML 0.71-0.87, WL 1.50-1.80, scape L 1.01-1.21, eye L 0.16-0.21 mm; CI 84-90, MI 58-62. The Moaratoa workers average larger (TL 5.7-5.9, HL 1.40-1.45, HW 1.22-1.24 mm; CI 86-90, MI 58), but have slightly shorter trunks (WL 1.73-1.74) than do the Javanese workers (WL 1.77-1.80), even though in other dimensions the latter are smaller: TL 5.5-5.7, HL 1.37-1.40, HW 1.15-1.18 mm; CI 84-86, MI 58-62.

The single Philippine worker is small (TL 4.8, HL 1.21, HW 1.06, WL 1.50 mm; CI 88, MI 59) and pale brownish-red in color, with the head slightly darker. Its petiolar node is a little more slender in side view than in the other 2 series.

While the Moaratoa series has fairly regular transverse costulation of the propodeal dorsum, the Tjibodas sample has the propodeal dorsum covered with mainly disoriented rugulation, showing only weak and partial organization into transverse costulae.

Queen, paratypes: Two specimens, one a callow alate taken with the Moaratoa series, the other a dealate taken alone in the Cuernos Mts. of Negros I. at «4000 ft.» (about 1220 m). Moaratoa I.: TL 6.9, HL 1.54, HW 1.40, ML 0.84, WL 2.00, scape L 1.17, eye L 0.32 mm; CI 91, MI 55. Cuernos Mts., Philippines: TL 5.9, HL 1.31, HW 1.22, ML 0.78, WL 1.88, scape L 1.10, eye L 0.29 mm; CI 93, MI 60.

The Moaratoa queen is winged (forewing L about 4 mm) and dull, light reddish-brown in color (callow); the Philippine specimen is dealate and light brownish-yellow. Pronotum and mesonotum smooth and shining (faint traces of diagonal striation on side of pronotum in Moaratoa queen).

Male: single specimen mounted on same pin with worker from Cuernos Mts., Philippines: TL 4.4, HL 0.71, HW (including eyes) 0.92, ML (closed mandibles) 0.11, WL 1.62, forewing L 3.3 mm.

Color dark brown, gaster slightly paler, especially toward apex; antennae tan; legs, mouthparts and genital capsule sordid yellowish. Eyes taking up about 2/3 of sides of head. Lateral ocelli separated from eye by about 0.2 mm, and distant from anterior ocellus by about the diameter of the latter. Mandibles small, cuneiform as seen from above, acute, with conspicuous circular white basin at base.

Trunk robust, with convex dorsum and pleura; notauli obsolete, except for shallow longitudinal sulcus at rear of scutum; scutellum prominent, hemispherical; metanotum short, convex; propodeum convex, dorsum rounded into declivity; its spiracle very small, elliptical. Petiolar node subsquamiform; bluntly cuneiform as seen from side, with both anterior and posterior slopes slightly convex; sides convex, and apex rather broadly rounded as seen from in front. Gaster almost imperceptibly constricted after postpetiolar segment.

Terminalia unremarkable; pygidium folded, lightly sclerotized, and thus forming a barely acute beak; hypopygium narrow-linguiform, tapered to a truncate apex, its ventral surface convex. Parameres broadly subcuneiform in side view, with rounded apices; outer surfaces convex; bent slightly mesad just beyond their midlength as seen from dorsal view. Aedeagus thick; volsellae each with digitus and cuspis.

Tibial apices each with two spurs on middle and hind legs, of which the mesial spur of the hind leg is large and broadly pectinate. Hind wing with a well-developed anal lobe.

Entire body weakly to moderately shining, mostly smooth, with numerous fine piligerous punctures; additional fine shagreening around the periphery of the scutum, on anterolateral faces of propodeum, etc.

Virtually the entire, normally-exposed body surface and appendages covered with a short, dense, pubescence-like investiture, decumbent on extremities of appendages, but becoming erect or suberect on mesonotum and elsewhere. A few longer (but still short and fine) hairs on ocellar triangle (otherwise nearly bare, and very smooth), on anterior cheeks, on metanotum, on apex of petiolar node, and toward gastric apex.

Holotype worker (MCZ) and 4 paratype workers with one callow alate queen from «Moaratoa Isl[and], Borneo, [E.] Mjöberg». I have not been able to find a locality with this exact name on maps, charts, or gazetteers of the Borneo area. «Moara» in Malay means «mouth of river». The most similar island name I located is Maratua Island, for an atoll including a hill in the Celebes Sea southeast of Tarakan, off the east coast of Kalimantan Timur (Indonesian Borneo), but I am not at all certain whether this is the same as Mjöberg's locality. Other paratypes (MCZ) are 3 workers from Tjibodas, Java, 1400 m (without collector's name, but one specimen carrying the label «jumping ant»; also the single worker with one male from Chapman's Camp, at about 1100 m in the Cuernos Mts., near Dumaguete, Negros Oriental, Philippines (J. W. Chapman). A single dealate queen also comes from «4000 ft.» (about 1220 m) in the Cuernos Mts. (Chapman).

This species is similar to several species of the *risii* group; in fact, it is as nearly «average» a form for the group as one could hope to find. The very short, straplike, mesonotal disc is one distinctive feature; the mandibles are longer than in *A. brevis,* and its much more restricted frontal striation will distinguish *modicus* from *A. strigatellus;* the smooth, shining pronotum separates it from the similar-sized *A. incultus.* Probably *A. modicus* will be found eventually to be a widespread species in wet upland forests of the Sunda islands.

[13] Wilson (1959: 504-505, 508-509, fig. 2) outlined the largely complementary distributions of *A. cato* (New Guinea, Bismarck Archipelago, and all but the most easterly Solomons Islands) and the *A. isolatus* superspecies (peripheral to *cato* in the eastern Solomons-Santa Cruz Group, Waigeo I., Aru Is., and Yap I. in the Carolines). He also mentioned my interpretation of this central-peripheral pattern as one more case of a derived animal species replacing an older, related one from the middle of the range outward, a sequence that I feel is readily inferred from a number of distributional patterns seen in insects, birds and mammals of the Melanesian region. As so often happens, the accumulation of additional material in the *cato-isolatus* group complicates the picture as we saw it in 1959. (See figs. 38 and 55).

In the first place, we now know that *isolatus* occurs in the Philippines (several collections from the Cuernos Mts., near Dumaguete, Negros Oriental, by J. W. Chapman, and an alate queen from Mt. Banahao, S Luzon, collector unknown), on Guadalcanal I. in the Solomons (Honiara, Kukum, by P. J. M. Greenslade; Ilvbush, by Greenslade, workers and a dealate queen); and on the mainland of New Guinea.

Donisthorpe's *A. rossi* of 1947 was synonymized by Wilson under *A. cato,* but Wilson neglected to determine the identity of Donisthorpe's *A. rossi* of 1949 from Finschafen, except to say that the 1947 and 1949 forms represent different species. In fact, the 1949 *A. rossi* types are *isolatus.*

Members of the «*isolatus* superspecies» vary in color; the head, or head and trunk, usually are darker than, or concolorous with, the petiole and gaster. Wilson (1959: 503, couplet 7), described *A. isolatus* thus: «Head and alitrunk dark reddish brown, petiole and gaster dark yellowish brown...», while in the same couplet (p. 504), he characterized *A. splendens* as: «Head and alitrunk light yellowish brown, petiole and gaster light reddish brown». Since he did not see the type of *splendens,* the color had to be divined from Karawajew's original description, which, however, reads: «Kopf und Thorax kastanien-braun... Beine, Petiolus, und Abdomen gelblich rostfarben». From this I judge that *splendens* really differs little if at all from average specimens of *isolatus* from the Solomons, or from the types of *Anochetus rossi* Donisthorpe 1949 (not 1947) (Finschafen, New Guinea, E. S. Ross; worker specimen, CAS-San Francisco, No. 6977, is hereby designated as lectotype, while the queen with the same data and number is considered as paralectotype). This second *A. rossi* matches well with *A. isolatus, a*nd I have accordingly placed it in synonymy. Donisthorpe's description of the color of the worker as «reddish yellow» is misleading; I would call the lectotype brownish-red, with the gaster slightly lighter, more yellowish-red.

Karawajew's figures and description of *splendens* are reasonably good, but reveal no characters that will separate this species from *A. isolatus,* so I consider these two to be synonyms as well.

Integrating these new facts and interpretations into our old pattern, we can see that the main trends are still the same. *A. cato*

is the predominant, and in most localities, apparently, the only species of the pair occupying most of «central» Melanesia, while *isolatus* prevails in extralimital lands to the east and west. The two known surviving «species» of the *isolatus* superspecies are essentially color forms: *seminiger,* from Waigeo I., and *splendidulus,* from Yap. From our present information, we cannot tell objectively whether these two forms are separate from *isolatus* as species, or as mere geographical races. This is the circumstance that haunts all attempts to distinguish superspecies from «polytypic» species. No harm will be done if we continue to treat them arbitrarily as species.

It remains to point to the male of *A. isolatus* (figs. 60, 61) as having the most primitive terminalia thus far known in *Anochetus.* The pygidial spine is a particularly archaic character linking the genus to both *Odontomachus* and the subtribe Poneriti of Ponerinae. Perhaps other *Anochetus* species *(gladiator?)* of the Indo-Australian area have males with even more primitive terminalia. *A. filicornis,* still unassociated with the female castes, is also pretty close to the archetypal pattern.

[14] *A. graeffei* is a widespread species showing variation surpassing that of the African species *africanus, bequaerti,* and even *traegaordhi.* The samples reviewed by Wilson (1959) and Wilson and Taylor (1967) from Melanesia and Polynesia have been restudied along with other series from Queensland (Brisbane, Kirrama Range near Cardwell, Cape Pallarenda near Townsville, Kuranda, Herberton, Silver Plains and Bamaga on Cape York); Howard Springs near Darwin, Northern Territory of Australia; Timor, Flores, N. Celebes, Kalimantan, Sumba and «Kl. Kombuis, Java-see» in Indonesia; and various localities in Malaya, Burma, Indochina and India. Included were types of *A. rudis* («Mandalay») and *A. punctiventris taylori* (Coonoor, now in Madras State). All of these seem to represent one variable species. It should be noted that Forel, in his original description of *taylori* (1900: 60, 63), considered *oceanicus, rudis* and *taylori* all to be races of *punctiventris,* and said of *taylori* that it was intergradient between *punctiventris* on the one hand, and races *oceanicus* and *rudis* on the other.

I have recently reviewed the 4 specimens in the type series of *A. graeffei* (courtesy of Dr. Max Fischer, NHM-Vienna), and have indicated my choice of lectotype by a yellow label. This is the light-colored (brownish-yellow) variant of the species, though somewhat faded. The gastric dorsum has the coarse punctures smaller than in Indian samples.

The type of *Anochetus ruginotus* («Luzon») in Berlin is just the lightly-sculptured variant of *graeffei;* the pronotal sculpture is looser than usual, and has some shining interspaces. This variant is found sporadically through Queensland and elsewhere within the range of the species, and intergrades to more opaquely-sculptured forms are common. Karawajew's *A. minutus* («Segamat, Johore, Malaya») was provisionally synonymized with *graeffei* by Wilson (1959), and

I am able to confirm this synonymy after examining *minutus* syntypes in the Santschi Collection.

Terminalia of a male of *graeffei,* accompanied by workers, from the southern Philippines are shown in fig. 77; the specimen is somewhat shrivelled and otherwise slightly damaged, but the main features of the paramere and hypopygium are preserved in the undissected terminal portion of the gaster preserved in MCZ. The «dog-leg» paramere, with the narrowed terminal digitus rooted partly in a membranous area of the broad, convex parameral base, is distinctive, and is seen elsewhere in Oriental samples of the genus [15], in more or less modified form.

The bounds of *graeffei* variation, and whether or not the species divides into sibling species, are ripe subjects for future gamma-taxonomic studies. These studies are certainly warranted, considering the outstanding success the species has had as a colonist through the Indo-Australian area.

One particular problem concerns some populations of inland north Queensland in Australia. Samples of workers from 42 km SW of Mt. Garnet, 650 m, and Conjuboy, 500 m (E. S. Ross and D. Cavagnaro) differ from most coastal samples in their light yellowish color and smooth, shining pronotal discs with coarse punctures, the most extreme reduction of pronotal sculpture I have seen in this species. The possibility exists that this form is a sibling species of *graeffei,* but on the present information, I am still referring it to *graeffei.*

Larger specimens (N = 4) from Prinsen Island, off the SW tip of Java, and from Jakarta, Java (Dammerman) have HL 1.15-1.32, HW 1.03-1.22, ML 0.60-0.69, eye L 0.17-0.22 mm; CI 88-93, MI 52-54, eye L/HW = 0.17-0.19, so are transitional to a syntype of *A. yerburyi* from «Ceylon», which has HL 1.11, HW 1.02, ML 0.57, (eye L 0.23 mm; CI 92, eye L/HW = 0.23. A worker from «Sikkim, 4000 ft., Bingham» (about 1220 m), determined by Forel as «*A. yerburyi,* var.», has HL 1.15, HW 1.09, ML 0.64, eye L 0.20 mm; CI 95, MI 56, eye L/HW = 0.18, and is thus more like the «large *graeffei*» from Java. A dealate queen [MCZ] from Ta Hian, Hainan Island, China, 15-18 June 1935, J. L. Gressitt, also fits the pattern of «large *graeffei*».

The Javanese samples have the vertex finely striate in the middle right to the nuchal carina, while the Sikkim and Hainan specimens have coarse frontal striation, replaced over the last 0.10 mm or so before the nuchal carina by a strip of smooth, shining surface. The syntypes of *yerburyi,* on the other hand, have only about the anterior quarter or third of the vertex behind the eyes striate, while the rest of the vertex (about 0.3 mm) is smooth and shining. Thus the differences between Sri Lankan *yerburyi* and «large *graeffei*» are still apparent, though not very dramatic. The lack of *graeffei* collections from Sri Lanka may be significant in this regard. Perhaps *yerburyi* is a geographical form representing *graeffei* on this island, but I choose to consider it provisionally as a separate but closely related species.

The real problem is where to place the Sikkimese and Hainanese samples, and also the «large *graeffei*» from Java. In view of the extraordinary variation shown in the rest of its range by *graeffei*, I think it would be best to consider all of these specimens as belonging to *graeffei* for the time being, until we can get more material from the critical areas, especially workers accompanied by males.

[15] The *Anochetus* species known to occur in Sri Lanka (Ceylon) are *nietneri* [19], *yerburyi* [14], *madaraszi*, and *longifossatus* [18], based on workers and queens, and the two Walker species *pangens* and *consultans*, based on males taken independently — presumably at light.

We might reasonably expect that other species found in southern India would also inhabit Sri Lanka, e.g., *rufus, obscurior, kanariensis, sedilloti*, and especially the widespread *graeffei* [14], but despite rather intensive ant collecting there over the years, only the 6 species listed above have been found so far as I am aware.

A. consultans, placed by Donisthorpe in *Euponera* subgenus *Brachyponera*, is known only from the type [BMNH-London], labeled «Ceylon». It seems to be an *Anochetus*. TL 4.7, HL 0.73, HW (including eyes) 0.95, WL 1.82, forewing L 3.8 mm.

Compound eyes very large, occupying the sides of the head from near mandibular insertions almost to lateral ocelli. Ocelli very large, situated on strong eminence; median ocellus W about 0.16 mm. Mandibles very small, triangular, L about 0.05 mm, difficult to distinguish from other mouthparts.

Trunk bulky, with high, rounded scutellum; scutum with notauli forming a distinct Y, but shallow; parapsidal lines distinct; surface finely rugose like most of the rest of the upper parts of the trunk; lower mesopleura swollen, smooth and shining.

Petiolar node low, with converging anterior and posterior slopes and an obliquely subtruncate summit as seen from the side, but as seen from in front subquadratic, slightly wider than high, with blunt, sub-rectangular dorsolateral angles and a low, blunt median tubercle or process.

Gaster very robust, only weakly constricted. Terminalia prominent, largely exserted; pygidium short, shallowly emarginate in the middle; hypopygium broad, narrowed apicad to a broad, rounded-edged, linguiform apex that is somewhat scoop-shaped and densely fringed with short hairs. Paramere shaped much as in *graeffei* (fig. 77), with broad, convex basal part and slender, digitiform apical process attached to the basal part at a mainly membranous articulatory area; the 2 apical processes bowed laterad, their apices are directed mesad. Aedeagus large, with a sharp, convex dorsal crest, in side view the valves tapering to cuneiform points with narrowly rounded apices that are pressed together as seen from dorsal view. Volsellae large, but unremarkable; hidden from view except for apices of digitus and cuspis.

Body color dark ferruginous; gaster lighter reddish; antennae, mouthparts, legs and terminalia yellowish.

Among the worker-based species known from Sri Lanka, *consultans* may match up best with *A. nietneri* because of the median tubercle of the petiolar summit, possibly a shadow trait of the worker's petiolar spine. The size of the *consultans* male is, however, a bit on the small side to match the TL of approximately 6.4 mm of the *nietneri* type worker.

A. pangens is another species described from a single male [BMNH-London] from «Ceylon», and assigned later by Donisthorpe to *Euponera (Brachyponera),* I believe in error.

TL 3.9, HL 0.63, HW (across compound eyes) 0.80, WL 1.40, W middle ocellus 0.01 mm.

Eyes very large, taking up most of sides of head, but each separated from the nearest lateral ocellus by a space of 0.12 mm. Mandibles minute (L 0.06 mm), triangular, pointed at apex, basidorsal pocket or basin present. Frontal sulcus conspicuous. Head minutely shagreened but shining. Ocelli spaced 0.09 mm between median and laterals.

Trunk moderately bulky, with high-domed scutellum; scutum with only the stem of the notaular Y discernible; parapsidal lines moderately distinct. Dorsum of trunk minutely rugulose, opaque to subopaque; sides of pronotum and mesopleura smooth and shining, as are also node and gaster.

Petiolar node as seen from the side low, triangular, with slightly convex anterior and posterior slopes, and narrowly rounded apex; seen from front, the node is sub-rectangular, wider than high, with wide, straight apical margin and blunt dorsolateral angles. Gaster not noticeably constricted behind first segment in either side view or dorsal view.

Legs slender; apical spurs of middle and hind tibiae 2,2, the median spurs both pectinate, but the one on the middle tibia much smaller than that on the hind tibia; lateral spurs minute on both legs. Femora and coxae shining, with fine appressed pubescence; tibiae and tarsi finely and densely punctulate, opaque or nearly so.

Forewings about 3.2 mm long, with all «ponerine veins» present.

Terminalia partly retracted; pygidium broadly rounded, but arched in the middle over the proctiger; hypopygium transverse, short, broadly emarginate; parameres narrowly triangular, entire, tapering each to an acute apex, and as seen in end-on view, weakly curved mesad. Aedeagus with a strongly rounded dorsal crest and narrow lateral flanges, each flange ending in a short, sharp point apicad. Volsellae long, surpassing apices of aedeagal valves, the digiti directed ventrad and conspicuous in side view beneath parameres; each cuspis oblique, directed more or less caudo-dorsad and resting in the inside curve of its respective paramere. The most unusual feature is the reduced and emarginate hypopygium.

Color of body dull yellow, head and anterior half of gaster more brownish.

Of the species known from Sri Lanka in the worker caste, the *pangens* male might best correspond to *longifossatus.*

A. madaraszi, originally described from Sri Lanka, was later reported by Forel (1900a) from India: Kanara (Bell) and Orissa (Taylor). The Kanarese specimens were apparently accompanied by males bearing the same label data, but since males and workers (at least those in MCZ) are on different pins, the association is not confirmed as far as I am concerned. The uncertainty is compounded by the finding of 2 males closely resembling the Kanarese males, but this time from southern Luzon. These 2 males were taken from a Berlese funnel sample of leaf litter and humus run by R. A. Morse in the College of Agriculture at Los Baños, Laguna Prov., Philippines. The litter samples were brought down off nearby Mt. Makiling, and this particular sample yielded the type series (all but one specimen) of *A. incultus* [7].

Although these males are about the right size (TL 4.4, HL 0.80, HW (including eyes, 0.96, WL 1.75 mm) to match the workers of *A. incultus,* it is felt that they are so much like the Indian *madaraszi* males that their correspondence to *incultus* is questionable. In any case, most winged ants taken in berlesates usually do not come from the litter sample, but instead are night-fliers attracted to the light over the funnel while the sample is being extracted.

Thus the association of these males (figs. 64, 65), having the hypopygium produced as paired, long, thin, hairy rods; and the parameres slender, tapered apicad, and curving mesad so that their tips are opposed) with the workers of either *madaraszi* or *incultus,* must be considered doubtful. This case points up the importance in *Anochetus* of having workers and males securely associated in the living colony.

[16] *A. chirichinii* and *A. fricatus* are very close species, but the differences described by Wilson (1959) appear to hold in the material available, which is the same he had. The two species are sympatric in NE New Guinea, but *fricatus* was found additionally at Brown River, near Karema, Papua. The male terminalia labeled as *A. chirichinii* are those of a male taken at light at Nadzab, NE New Guinea, a locality at which Wilson took workers of both species. The male is the right size to be either species, and could even belong to some other species from this locality remaining uncollected. At any rate, the determination of this male must be considered uncertain.

[17] The unique worker type of *Anochetus subcoecus* was finally located in that part of the Hans Sauter Collection now on deposit in the Institüt für Pflanzenschutzforschung der Akademie der Landwirtschaftswissenschaften der Deutsche Demokratische Republik, Abteilung Taxonomie der Insekten, Eberswalde.

The specimen is one of the depigmented, minute-eyed forms; it came from Kosempo (= Wu Ching Pao, near Nan T'ou), central Taiwan, H. Sauter. TL 3.8, HL 1.02, HW 0.88, ML 0.47, WL 1.10, scape L 0.70, eye L 0.03 mm; CI 86, MI 46.

Color ferruginous yellow. Scape fails to reach posterior corner of head by slightly more than length of pedicel (basal funicular segment). Compound eyes each with 7-10 indistinct facets; occupying

about 1/5 length of orbital fossa. Funicular segments II, III, IV short, together subequal in L to I (pedicel); II about as broad as long, shorter than III and IV, which are each a little longer than broad. Mandibles broad and thick toward apex, without preapical excision or angle. Striation of frons rather fine, mixed with punctures and reaching back in the middle of the vertex to embrace the posterior impression, but not quite reaching the nuchal carina; «occipital» lobes smooth and shining, with spaced fine punctures. Trunk convex in side view outline, but with well-marked promesonotal and meso-metanotal sutures; propodeal angles (fig. 24) small but acute (sub-rectangular), low. Pro- and mesonotum smooth and shining, the pronotum with dorsum of cervix and anterior margin of disc finely, transversely striate or rugulose. Sides of trunk smooth and shining, except extreme posterior sides of propodeum, which, like propodeal dorsum, is finely and densely punctulate-rugulose and opaque; declivity of propodeum, both surfaces of petiolar node, and gaster smooth and shining, with only fine and inconspicuous punctures.

Petiolar node convex in side-view outline front and rear; apical margin convex in front view (fig. 24).

Erect hairs short, fine and sparse: 1 pair on frontal lobes, 1 pair on middle vertex and 4 hairs along posterior border of vertex; 1 pair on pronotum, and about 8 hairs scattered over rest of truncal dorsum; gastric dorsum with more numerous, but still sparse, fine erect hairs on both upper and lower surfaces of all segments, a few inclined hairs on anterior coxae and mandibular apices. Pubescence moderately dense, appressed and decumbent on head, decumbent on pronotum and rest of truncal dorsum, as well as antennae; sparse and mostly appressed on mandibles, legs and gastric dorsum; not as well developed as in *A. pubescens*.

[18] **Anochetus pupulatus** new species
(figs. 14, 21, 22)

Holotype, worker: TL 3.0, HL 0.77, HW 0.69, ML 0.36, WL 0.87, scape L 0.54, eye L 0.06 mm; CI 90, MI 47.

Color clear light yellow throughout.

The smallest member of the genus, with compound eyes greatly reduced (to about 12-14 facets), filling only about half the length of the orbital fossae. Convergent to *A. siphneus* of West Africa, but with the frontal striation better developed, fine, and reaching back to embrace the posteromedian impression, but not extending all the way to the nuchal carina. Dorsal surfaces of head behind eyes densely and coarsely punctate, punctures mixed with striation mesad, and surface here opaque, but the punctures becoming spaced out a little on the sides and pasterolateral corners of the head, where the interspaces are smooth and shining.

Antennal scapes fail to reach posterior corners of head seen full-face by less than the apical thickness of a scape; funicular segments II, III, IV short, not or scarcely longer than broad, together shorter than I (pedicel). Mandibles nearly twice as thick in apical third as at their insertions; apical triad of teeth short and conical; preapical excision and angle absent to rather weakly developed; ventral mesial margins subcrenulate as seen from dorsal oblique view. Maxillary palpi 4-merous.

Trunk compact, gently convex in outline, the promesonotal and meso-metanotal sutures broad and impressed, so that really 3 separate convexities, pronotal, mesonotal, and fused metanoto-propodeal, exist, the anterior part of the last rising slightly above the others. Propodeal teeth in the form of prominent but bluntly rounded, laterally compressed tubercles. Cervix and anterior margin of pronotum finely, transversely rugulose; metanoto-propodeum with dorsum finely transversely rugulose; pronotal disc and sides of trunk predominantly smooth and shining, as are also the propodeal declivity, petiolar node and gaster.

Petiolar node thin in side view, tapered to a sharp apex; in front view, the sides are vertical and only weakly convex; apical edge truncate and concave in the middle, leaving a subacute point on each side. Gaster thick, the first segment (postpetiole) slightly larger than second, and without a distinct constriction between. Middle tibiae without apical spurs.

Short, fine erect hairs, mostly paired bilaterally, often difficult to distinguish from background pubescence: 1 pair on frontal lobes, 1 pair on middle vertex, 1 pair on posterior vertex, 1 pair on humeri, another pair on anteromedian pronotum, 1 pair on posterior pronotum, 2 pairs on mesonotum; numerous, but still sparse, hairs generally distributed on both upper and lower surfaces of all gastric segments. Pubescense fine, appressed or decumbent, fairly abundant and conspicuous on head, dense but very short and fine on mandibles and appendages (which are mostly smooth and shining, though finely punctulate), dilute on trunk dorsum and gaster. The paratypes sometimes have an extra pair of erect hairs on the frontal carina, or an extra pair on the upper vertex or on the pronotal disc; the hairs are extremely delicate, and probably are easily lost to rubbing.

Queen and male unknown.

Holotype worker (MCZ) one of a series (M-228) dug from dry soil at the base of a large tree in disturbed, open, dry-season deciduous woodland near Punnapuzha, at the western base of the Western Ghats, east of Nilambur, Kerala State, India, 10 April 1969 (A. B. Soans and W. L. Brown).

Paratypes, 18 workers (MCZ, BMNH-London, MHN-Geneva, and elsewhere), all from southern peninsular India: Kottiyoor, Wynaad Taluk, Kerala State (Soans and Brown), evergreen forest litter berlesate; Valara Falls, 46 km SW Munnar, 450+ m, Cardamon Hills, Kerala State, team of Besuchet, Löbl, and Mussard, No. 49; 39 km E Kodaikanal, 650 m, Palni Hills, Madras State, Besuchet-Löbl-Mussard, No. 20; plus type nest series.

TL 2.9-3.1, HL 0.74-0.81, HW 0.68-0.71, ML 0.34-0.39, WL 0.86-0.88, scape L 0.54-0.57, eye L 0.06-0.07 mm; CI 88-92, MI 45-49.

A. pupulatus is the smallest of the minute-eyed *Anochetus* species. *A. myops* (Malaya), *A. longifossatus* (Ceylon) and *A. subcoecus* (Taiwan) are all larger in body size, the first 2 of these considerably so. In addition, *myops* has a bluntly rounded petiolar node.

A. longifossatus from Ceylon is similar, but larger and has a longer and straighter dorsal truncal profile, especially in the metanoto-propodeal area; this last is feebly concave in the front half, and gently convex in the posterior half, just before the propodeal teeth (which are small, but acute and erect in the specimen I have from Kandy, 600-700 m, E. O. Wilson). *A. pupulatus,* by contrast, has the front half of the metanoto-propodeum distinctly convex, and it becomes weakly concave only in the posterior part. *A. longifossatus* also has the mandibles still more strongly thickened apicad, and

longer, and the funicular segments II-IV are longer, collectively = or > I. The eyes are a bit larger in *longifossatus* (eye L 0.10 mm, with about 18-20 facets), and the petiolar node is thicker in side view, with convex front and rear slopes, especially the rear. In front view, the apical crest is nearly straight, and the sides are more strongly convex than in *pupulatus*. The mesonotum in *longifossatus* is minutely roughened in part, but still shining, as are also the sides of the metanotum, and the gastric pubescence is rather dense and decumbent; color ferruginous yellow, gaster brown.

The digm from Kandy was compared with a paratype of *longifossatus* (BMNH-London) and the type of var. *butteli* (MNK-Berlin); the last is a small specimen (WL 1.11 mm) with eye L only 0.07 mm, but it agrees well with the digm. The Kandy specimen has TL 4.2, HL 1.13, HW 0.99, ML 0.55, WL 1.27, scape L 0.85, eye L 0.10 mm; CI 88, MI 49. Middle tibiae lacking apical spurs.

A pair of badly damaged specimens from «Camp» (1100 m) in the Cuernos Mts. of southern Negros Island in the Philippines, J. W. Chapman (MCZ), are similar to *A. pupulatus* in size and sculpture, but are darker (brownish ferruginous) in color, have shorter scapes, have fine sculpture on the sides of the pronotum and propodeum, and have the posterior truncal dorsum forming a single convexity, only slightly interrupted by the meso-metanotal suture; propodeal angles low and obtuse, not forming teeth or tubercles.

While the Philippine sample may well represent yet another local small-eyed species, it seems prudent to wait for more adequate material before adding a new name to this group.

[19] The type worker of *A. nietneri* in MNK-Berlin is strongly distinct from all congeners I have seen. HL 1.54, HW across ocular prominences 1.37, ML 1.03, greatest diameter of eye 0.23, WL 2.09 mm; CI 89, MI 67. Body bright ferruginous, head smooth and shining except for striation between frontal carinae. Propodeum, taking up about half of truncal dorsum, transversely striate. Sides and discs of pro- and mesonotum almost completely smooth and shining; pronotal cervix transversely striate. Petiolar node narrowly dome-shaped, surmounted by a stumpy, curved, apical tooth that points backward.

Mandibles curved; inner margin of each armed with just 2 prominent teeth near midlength; a distal long, slender tooth that is more than half as long as the dorsal apical tooth, and a smaller proximal one.

[20] *A. rufus*, originally placed by Jerdon in *Odontomachus*, was accepted by Emery as an *Anochetus*. Though there is little in the description of diagnostic value, the size («1-4th of an inch») and color, «head, thorax and legs rufous; abdomen dark brown», fit fairly well the type series of *A. mordax*, of which the type locality is Dohnavur, 300 feet, «Tinnevelly» (Tirunelveli) District, now in Madras State, India. The type locality for *rufus* as here restricted is Salem District, Madras State, about 300 km N of Tirunelveli. Jerdon also says of *rufus* that the petiole is «raised, pointed and conic», which

applies better to a side view of *A. mordax* than to such other large *Anochetus* species from peninsular India as *kanariensis* or *sedilloti.*

Jerdon also refers to a larger (11/24 inch) ant from Wynaad District (Kerala State) with finely striated thorax and «teeth of the jaw blunt» as a possible «warrior» caste of *rufus,* but this description evidently refers to *Odontomachus simillimus,* which I found to be abundant in Wynaad in 1969.

While it seems impossible to be certain that *rufus* and *mordax* refer to the same biological species, acceptance of this synonymy does no violence to the known facts, and it settles a nomenclatorial problem that has persisted in the literature for many years.

[21] *A. sedilloti* and *A. levaillanti* are closely related species with thick petiolar nodes, rounded at the summit. The former has long been thought of as a Tunisian ant with a variety *(indicus)* in peninsular India, while *A. levaillanti* has been known from southern Africa and from Eritrea (Emery 1911: 109; Finzi 1939: 154). *A. sedilloti* is, however, widespread in Africa, as indicated by worker samples I have seen from Legon, Ghana (D. Leston) and Khor, near Umm Dorein, Sudan (C. Sweeny), as well as a dealate queen from Ailet, Eritrea (G. Müller) from the collection of Bruno Finzi, undoubtedly the same sample identified by Finzi (loc. cit.) as *A. levaillanti.* Santschi (1923: 267) recorded *sedilloti* from Senegal, Chad, and Timbuktu.

In India, *A. sedilloti* is known from all along the western side of the Peninsula, from Gujerat south at least through the Nilgiri Hills (Forel 1900: 62). Although Forel distinguished the Indian populations as var. *indicus,* the differences cited were admittedly feeble, and I am unable to find any of them that seem constant in the worker material now available. The differences in the length of the first 2 antennomeres of the male cited by Forel (1907d: 201) are detectable best in the second segment (pedicel), but even here are trivial in direct comparison, especially when one notes that only a single nest sample is involved from each region. There are no obvious differences between these male samples in the form of the complicated terminalia, at least as seen partly extended and undissected. On the basis of the evidence at present available, I see no reason to make a nomenclatorial distinction of the African and Indian populations, and I think it entirely possible that intervening relict populations of *A. sedilloti* will eventually be found in Yemen and perhaps elsewhere in SW Asia.

The extension of the range of *A. sedilloti* to Eritrea indicates a likely area of sympatry there with *A. levaillanti.* So far, the differences between these species in cephalic and pronotal sculpture (given in the key) appear to hold well, but the distinction in gastric sculpture may be weaker; samples from Ladismith, Natal, H. Brauns, have the fine sculpture between the punctures of the first gastric segment weakly developed and in part feebly shining.

[22] It seems to me that of the 2 peninsular Indian forms, subsp. *kanariensis* (fig. 30) and var. *obscurior,* that Forel assigned to *A.*

orientalis, at least the first one has a good chance of being a species apart, and I have raised it to species rank provisionally.

A. kanariensis has a bright to dark red trunk and node, contrasting with the piceous or black gaster; the head may be red or infuscated. In *kanariensis,* the front part of the petiolar nodal summit is more or less produced cephalad, and overhangs the anterior slope of the node, so that the slope is usually more or less distinctly concave, unfortunately a character not very well developed in the particular specimen drawn for fig. 30. The types of *A. obscurior* and *A. orientalis* are black or nearly so, with partly ferruginous appendages, and the head may be lighter brownish around the corners; the nodes of these forms are broadly rounded above, not noticeably produced anteriorly, and the anterior slope is straight or convex as seen from the side. In *kanariensis,* the first gastric tergum is coarsely and distinctly striate almost to the posterior margin, with coarse superimposed punctures, whereas in *obscurior,* at least, the punctures predominate, and the striae are indefinite or obsolete on the anterior first gastric tergum, while the posterior half of this tergum becomes more or less smooth and shining (satiny blue reflections on the gastric dorsum may often be seen in all 3 taxa).

The *A. orientalis* type (MNHN-Paris), from Cochin China, has never been compared directly with the Indian forms. My brief notes made on it in 1963 indicate that *orientalis* is much like the *obscurior* types before me in color and form, but that the sculpture in *orientalis may* be more opaque over a wider area of the gastric dorsum than in *obscurior.* The wide geographic separation of the two forms (as presently known) dictates that they both be kept as provisional separate species, at least until we can compare them directly. More samples of these forms from SE Asia would of course also help in determining their status.

[23] *A. evansi* is remarkable for its isolated distribution in extreme western Iran at «Sar-i-Pat» (Sar-i-Pal) in or near the Zagros Mts., west of Kermanshah. I have not been able to learn anything about the altitude, vegetation, etc. of this locality.

The type [BMNH-London] is a small, light orange-ferruginous worker, almost completely smooth and shining (some frontal striation along frontal carinae, continuing mixed with punctures along postero-median edges of antennal fossae; fine vestigial cross-striation also on cervix and propodeal declivity, and some weak, superficial shagreening on propodeal dorsum, which is shining, however). TL 5.1, HL 1.16, HW 1.03, ML 0.59, WL 1.45, scape L 0.89, eye L 0.12 mm; the small eyes are nearly circular, and occupy less than half the orbital fossa. Mandibles short, broadened apicad; preapical excision weak and angle rounded. Inner margins of mandibles edentate, smooth.

Mesonotal disc about 0.42 mm W and 0.24 mm L, its posterior margin poorly defined and not impressed; metanotum and propodeum completely fused, forming one gentle dorsal convexity; propodeal angles almost perfectly rounded. Metapleural suture obsolete. Petiolar node shaped much like that of *A. ghilianii,* but even a little lower

and relatively thicker from front to rear, with summit rounded in both directions. Gaster slightly but distinctly constricted behind segment I; sting exceptionally long and strong, exserted.

Spurs of middle tibiae still 2 on each apex, but reduced almost to short setae; lateral spur of hind tibia also setiform, but inner spur short, broad and pectinate.

Body almost hairless, the few short, fine, decumbent and suberect hairs mainly confined to sides of head and eyes, to pronotum and to upper and lower surfaces of gaster, longest ones near apex.

[24] **Anochetus paripungens** new species
(fig. 35)

Worker, holotype: TL 5.2, HL 1.28, HW 1.18, ML 0.70, scape L 1.05, eye L 0.22, WL 1.64 mm; CI 92, MI 55.

Worker paratypes: TL 5.0-5.2, HL 1.24-1.31, HW 1.13-1.20, ML 0.70-0.72, scape L 1.01-1.07, eye L 0.21-0.22, WL 1.55-1.64 mm; CI 91-92, MI 55-56.

Head with mandibles and antennae much as in *A. rectangularis,* but the eyes a little smaller, more nearly circular, strongly convex. Antennal scapes just barely surpassing posterior margin of «occipital» lobe in full-face view. Frontal striation more extensive than in *rectangularis,* reaching a bit more than halfway from the eyes to the nuchal carina in the middle. Mandibles with straight, cultrate dorsomedial margin and obscurely crenulate ventromedial margin; preapical angle present but weak; preapical excision small; intercalary apical tooth conical, arising from near base of ventral apical tooth. Upper inner temporal areas, just beyond oblique field of frontal striation, with numerous small punctures; head otherwise generally smooth and shining.

Antennae slender; funicular segments II, III and IV together about twice as long as I; IV about twice as long as broad, and slightly longer than II. Scapes surpassing posterior border of «occipital» lobe by only about their apical thickness when the head is seen in perfect full-face view.

Trunk, petiole and gaster shown in fig. 35; notable are the small but sharp teeth on the propodeal angles and the strong, divergent teeth extending the free corners of the petiolar node, as shown in fig. 35. Pronotum with 5 sharp costulae running around anterior slope, otherwise smooth and shining, with numerous small, separated punctures on disc. Mesonotal disc more than twice as broad as long, nearly smooth, shining. Propodeum coarsely, transversely striate (or costulate) over dorsal surface, its sides smooth and shining, as are petiolar node and gaster. Mandibles and femora smooth, shining, sparsely punctulate; scapes and tibiae more densely, but very finely punctulate, moderately shining; tarsi and funiculi densely punctulate and opaque or nearly so.

Pubescente sparse on dorsal surfaces of body and undersides of head and fore coxae, especially sparse on gaster, consisting of fine, inconspicuous, appressed and decumbent hairs. Erect hairs fine, tapered, sparsely arranged along median third of head, anterior underside of head, posterior vertex, and frontal carinae; about 14 on pronotum and mesonotum (10-18 in paratypes); more and longer hairs on upper and lower surfaces of gaster (few on sides of gaster); a few scattered erect hairs on scapes, anterior sides of fore coxae, and flexor surfaces of femora, as well as inner ventral margins and apices of mandibles.

Color castaneous (dull brownish-orange); middle of vertex, mesopleura and gaster darker reddish-brown; posterior corners of head, mandibles, petiole and legs ferruginous yellow.

Queen and male unknown.

Holotype one of 13 workrs selected from a small nest series taken in a rotten log in shady gallery forest at Howard Springs, Darwin area, Northern Territory, Australia, 7-8 July 1951, by W. L. Brown, Jr. and W. Bateman. In the same log we found a colony of *A. graeffei.* The type locality, on the Howard River, was at the Darwin water supply source in 1951. I returned to this place in 1972, but found that it had been transformed into a public park and campground, so that the habitat was largely destroyed.

R. W. Taylor has sent me the following localities at which he collected *A. paripungens,* all in the Northern Territory: Holmes Jungle and Coconut Grove, near Darwin; Baroalba Spring (12.47S, 132.51E) and Sawcut Gorge (12.55S, 132.56E) in Arnhem Land.

A. paripungens is evidently most closely related to *A. armstrongi,* from which it can be distinguished at once by the acutely produced propodeal and petiolar teeth, as well as by its smaller body size, relatively smaller eyes and shorter scapes.

[25] Samples of *A. armstrongi* from eastern Australia usually have the striate sculpture of metanotum and propodeum very restricted, and the integument here mostly smooth and shining; the petiolar node tends to be thick at the apex, and in front view, the apical margin is only just barely emarginate, and the corners are broadly rounded. The largest specimens (HW up to 1.50 mm) are from the mallee country of northwestern Victoria (Duddo Wells, north of Murrayville, C. Barrett; Ultima, J. C. Goudie); the smallest eastern ones (HW 1.30-1.40 mm) are from Queensland (Roma, F. H. Taylor; 80-100 miles south of Sarina, P. F. and P. J. Darlington). The type series (ANIC-Canberra, MCZ, BMNH-London) is from Nyngan, central New South Wales (fig. 32).

Western Australian samples tend to be smaller (HW down to 1.20 mm, or even slightly less), the striation is more extensive on the sides of the posterior trunk, and the petiolar node is thinner and more distinctly emarginate, thus raising the question as to whether the western populations may not represent a species separate from *armstrongi.* The samples vary so widely one to the next that I feel such a separation would be premature. This is a question that needs much more material. Present western series available: Toodyay, A. Douglas; Northam, P. McMillan; Mullewa, W. M. Wheeler. All of the localities appear to lie in zones now agriculturally modified, but originally in dry sclerophyll woodland or mallee.

The samples of *A. rectangularis* available (MCZ) are from New South Wales: Warrah, W. W. Froggatt. Queensland: Townsville, separate collections by F. P. Dodd and W. M. Wheeler; north of Mareeba, P. F. and P. J. Darlington; Lynd, 500 m, E. S. Ross and D. Q. Cavagnaro; 40 miles SW of Mt. Garnet, 750 m, Ross and Cavagnaro. The samples vary in color from light brownish-yellow to dark brown with blackish gaster. The head is often lighter and more yellowish than is the trunk.

The variety *diabolus* as described by Forel corresponds to those samples with the petiolar emargination distinct, rendering the upper corners more marked; this condition is found in several series, and seems to be part of the infraspecific variation.

Of *A. turneri,* I have studied only the types, from Mackay, Queensland (MHN-Geneva, MCZ), but the variety *latunei* described by Forel seems to be only a slightly smaller, more lightly sculptured variant, not likely to be a distinct species. R. W. Taylor *(in litt.)* tells me that he has found *A. rectangularis* and *A. turneri* to be «widespread in northern Australia», but relatively uncommonly collected. He has independently confirmed the synonymy of their two varieties.

Taylor sends additional records of collections of this group in ANIC-Canberra: *A. rectangularis* (fig. 36); Queensland: near Dimbulah, 10 miles W of Charters Towers, 14 miles S of Maryborough, Homestead, Brisbane. Northern Territory: 5 km S of Cahills Crossing (12.23S, 132.51E), slopes above Baroalba Spring (12.47S, 132.51E). New South Wales: Bombala. Torres Strait: Prince of Wales Island. *A. turneri* (Fig. 33): Queensland: Hinchinbrook Island. Torres Strait: Prince of Wales Island. *A. armstrongi:* Victoria: Patho, Marysville, Bogan River. New South Wales: Euston, Riverina, Broken Hill, Finlay, 14 miles NW of Leeton, Callubri Station, Talbita, 14 miles N of Quambone. Queensland: St. George, Toobeah, Nindigully, Fletcher, 4 miles WNW of Yelarbon, Helenslee. Western Australia: Mt. Jackson, Weira. South Australia: Mt. Lofty, 25 miles WSW of Mulga Park Head Station.

Taylor also writes of another possibly undescribed species from northwestern Australia, previously placed in the ANIC collection with *armstrongi.* He says this form is «rather like *paripungens*» in structure and sculpture of trunk, «but is as big as *armstrongi,* with large eyes. It has longer scapes and more generally dispersed and abundant pilosity than do southwestern Australian *armstrongi*». This form has been taken at localities in the Hamersley Range, the Kimberleys, and in the Northern Territory: Johnston's Lagoon, 23 miles SE of Newcastle Waters, Darwin). Taylor proposes and then rejects the hypothesis that these samples could be character-displaced *armstrongi* under the influence of partly sympatric populations of *paripungens* in the Darwin area, and perhaps elsewhere in the northwest. *A. armstrongi* in Western Australia as here defined is a southwestern species, not yet known to occur north of the Geraldton-Mullewa area. We must await samples from the vast reach of arid land between Mullewa and the Hamersleys in order to find out how *armstrongi* and the possibly undescribed species are related to each other and to *paripungens.*

[26] *A. ghilianii,* long known to collectors, is restricted to north and central Morocco and the Algeciras region of extreme southern Spain, but it belongs to a species complex that ranges widely in Africa, up until now mostly known under the names *A. traegaordhi* and *A. gracilicornis* (and *A. angusticornis*). The available samples of this complex, mostly each consisting of one or a very few workers

and a very few ergatoid and dealate queens, shown a bewildering range of variation in a number of traits, including body size, eye size, gracility of antennae, abundance and erectness of pilosity and pubescence, sculpture of vertex and pronotum, and size and shape of petiolar node. In fact, in the light of this variation, *ghilianii* itself appears to be just a local form of the complex with eyes (EL 0.16-0.22 mm) smaller than average (EL 0.20-0.35 in *traegaordhi*) and antennal funicular segments II-IV only about twice as long as broad (vs. 2.5 or more times as long as broad). Specimens approaching *ghilianii* in these respects are found in 3 nest series from Eritrea, especially in a sample from Agordat (G. Müller) that I had determined earlier as *A. gracilicornis*. For the time being, I am recognizing the slight differences between *ghilianii* and the trans-Saharan populations as still marking a species-level separation, but this separation is largely an arbitrary formality that future systematists may well not recognize.

Of the samples from south and east of the Sahara, some with pronotum transversely or concentrically rugulose or striate completely or in part, and with the petiolar node in side view slender and tapered to a rather narrow apex (fig. 47) agree best with the type of *A. traegaordhi* in NM-Vienna: Diani Beach, Kenya, N. L. H. Krauss; Balla Balla, S. Rhodesia, G. Arnold, 2 paratype workers of *A. angusticornis* (BMNH-London); 11 miles S Maktau, 1000 m, Teita Prov., Kenya, E. S. Ross and R. E. Leech; Stanleyville, Zaire, F. Kohl, 1 worker determined as *A. traegaordhi* by Forel. Other African samples are more like syntypes of *gracilicornis* and its synonym *sudanicus* in MCZ: Isiolo, 1250 m, Kenya, 4 workers, E. S. Ross and R. E. Leech; Tafo, Ghana, 3 workers from rotten log, B. Bolton. The Tafo specimens have rather narrow heads (CI in one worker 84, MI 54, as compared with a *ghilianii* worker from Boulhaut, Morocco, R. and C. Koch, CI 89, MI 54; a *traegaordhi* worker from Isiolo, Kenya, has CI 88, MI 52) and rather small eyes (EL 0.20 mm in the Tafo worker measured, HL + ML = 2.24 mm), but are otherwise like the *traegaordhi* type. In these samples, the pronotum is at least partly smooth and shining, on the disc; petiole in side view thick, gently tapered to a blunt apex, with anterior slope convex. The thickening of the node reaches an extreme in 2 samples from NW Angola (fig. 49); these very large specimens are described below as *A. angolensis* n. sp. [27].

Because the *traegaordhi* and *gracilicornis* patterns grade into one another more and more completely as the pool of material grows, I consider them as a single species, and here place *gracilicornis* and *sudanicus* in the synonymy of *traegaordhi*. One series, from Agordat, Eritrea, has already been mentioned as *gracilicornis* approaching *ghilianii*, but an ergatoid (with 3 weak ocelli) pinned with workers in the lot, and presumably a nestmate, has the *traegaordhi* pronotal sculpture and nodal form.

Another set of 4 Ghanaian workers, 3 of them also from Tafo, apparently belong to the *ghilianii* group, but have divergent pronotal sculpture and nodal form (fig. 25) that seem to place them in the little-known species *A. maynei* [28].

Another set of scattered samples from: Salazar, Angola, Southern African Expedition, BMNH 1972, 1 worker; Kawanda, Uganda, N. A. Weber, 1 worker; Makokou, Gabon, W. H. Gotwald, 2 workers, is notable because of the development of rather large but bluntly rounded teeth or tubercles at the junction of the dorsum and declivity of the propodeum on each side. These individuals also tend to be rather smooth; the pronotum and pleura are shining, often with faint bluish reflections, and even the posterior propodeal dorsum has the transverse rugules somewhat reduced; the propodeal dorsum is also distinctly sulcate longitudinally. Only more material will tell us whether such forms are part of the variation of *A. traegaordhi,* or whether they represent a related undescribed species.

Finally should be considered the status of *A. rothschildi,* a large (HL + ML = 2.60 mm) member of the *ghilianii* complex that is ferruginous tan in color and has the entire body smooth and shining, except for the short, fan-shaped area of striation between and just behind the frontal carinae. This species, from Ethiopia and Somalia, is much like *traegaordhi,* and could be an extreme variant of that species.

[27] **Anochetus angolensis** new species
(fig. 49)

Worker, holotype: TL 9.1, HL 1.99, HW 1.62, ML 1.16, WL 2.80, scape L 1.86, eye L 0.40 mm; CI 81, MI 58.

Paratype workers: TL 8.3-9.1, HL 1.74-2.02, HW 1.45-1.63, WL 2.48-2.90, scape L 1.60-1.90, eye L 0.38-0.41 mm; CI 81-83, MI 57-62 (based on 7 specimens from 2 localities).

A large slender, big-eyed species resembling the larger *A. traegaordhi* variants with smooth pronotum, but differing in form of petiole and gaster.

1. Petiolar node (fig. 49) longer than broad (excluding brief anterior and posterior peduncles, dorsal-view W is about 0.82 of L); lateral faces flat, converging cephalad to meet in a blunt median anterior ridge (see inset, fig. 49); finely striate in a horizontal direction, sericeous-opaque, with some shallow, indistinct punctures. Posterior face flat, with a feeble vertical sulcus, smooth and shining.

2. Gaster relatively slender, subcylindrical, deeply and broadly constricted (fig. 49) in the anterior part of the second segment; first segment smaller in diameter than second (larger than or equal to second in *traegaordhi*). Color dull brownish-yellow; appendages slightly more yellowish.

Pronotum with the usual transversely striate cervix, a fine curved ruga forming an anterior margin, and behind this a few fine striae arched parallel to the margin; disc and sides otherwise smooth and shining. Head with distinct but fine frontal striation fanning out posteriad and becoming finer, to disappear into extremely fine opalescent roughening of the surface that ends in a smooth, shining zone about 0.2 mm wide in front of the nuchal carina.

Mesonotal disc about 0.5 mm wide and a little less than 0.3 mm long, depressed but convex, mainly smooth or opalescent, shining. Propodeal dorsum and declivity transversely striate. Meso- and metapleura smooth and shining, with bluish opalescence clouding these surfaces in certain lights. Gaster, coxae and sides of head smooth and shining.

Dorsal surfaces of head and body with numerous, short, fine, erect and suberect hairs, extending to coxae, legs and scapes, but sparse on underside of head and gaster. Fine, short pubescence abundant, decumbent to suberect, on mandibles, antennae, anterior head, legs and mandibles; legs and mandibles shining, very finely punctulate; antennae densely punctulate, subopaque.

Queen and male unknown.

Holotype (CAS-San Francisco) and 6 paratypes (CAS, MCZ, BMNH-London) from 20 km NW of Muxima, Angola, 200 m, E. S. Ross and R. E. Leech, and 1 paratype worker from 20 km E of Luanda, Angola, B. Malkin.

This form seems sufficiently distinctive and constant in its known range in the Luanda area of Angola to be recognized as a separate species.

[28] *A. pellucidus* var. *maynei* was based by Forel on a single dealate queen from Congo da Lemba, Zaire, near the mouth of the Congo River. It is clear at a glance that this specimen does not belong to the species *pellucidus,* because the habitus is completely different, and the frontal striation comes nowhere near reaching the nuchal carina; the vertex is largely smooth and shining. Measurements: HL 1.50, HW 1.38, ML 0.81, EL 0.30 mm; CI 92, MI 54. The compound eye is only about the size of those of large *pellucidus* workers. The pronotum and propodeal dorsum are distinctly rugulose, but the mesonotum is only minutely roughened and almost smooth, shining. Propodeal angles obtuse. Petiolar node (fig. 25) tapered apicad in side view, lunate in dorsal view, with a thick emarginate crest. Head, petiole, gaster and appendages dull yellow, trunk darker, brownish-orange.

I tentatively associate with this species 4 specimens from Ghana (D. Leston, BMNH-London, MCZ). One of these is an ergatoid from Kade (HL 1.42, HW 1.23, ML 0.81, EL 0.29 mm; CI 87, MI 57) with 3 ocelli and a differentiated scutellum, but otherwise worker-like; the trunk is piceous contrasting with the yellowish of the rest of the body. The petiolar node is thick in side view, with a concave anterior face overhung by the apex; the apex is lunate in dorsal view, convex in front and broadly concave behind, much as in the worker shown in fig. 25. The 3 workers are from Tafo in Ghana; 2 have dark trunks, but in one, the trunk is sordid yellow, only slightly darker than the rest of the body; the trunk is rugulose dorsally except for the mesonotum, which varies from smooth to very finely and superficially cross-striolate or shagreened. The propodeal angles are distinct and rectangular; the petiolar node is concave anteriorly in side view, and lunate in dorsal view (fig. 25). Measurements: HL 1.46-1.50, HW 1.22-1.27, ML 0.84-0.90, EL 0.23-0.24 mm; CI 84-85, MI 58-60.

The nodes of the queen on the one hand, and the ergatoid and 3 workers on the other, are not a perfect match, even considering the usual differences of caste, but the general habitus, head shape, truncal sculpture, and the lunate top of the petiolar node as seen from above, all point to this association. But when all is said and done, *A. maynei* may still prove to be just another of the variant forms of *A. traegaordhi.* Label notes on the Ghana specimens indicate that the workers were «active at night»; the ergatoid from Kade was taken on the ground.

[29] The group of *A. africanus* includes fairly large-sized (worker HL + ML 2.15-2.60 mm) species with frontal striation fine, straight, regular, and reaching to or very nearly to the nuchal carina; eyes fairly large (EL 0.18-0.28 mm), but usually not as big relatively as in *bequaerti, pellucidus,* or *sedilloti* (for examples); gastric dorsum completely smooth and shining, with only scattered piligerous punctures, thus excluding the closely related *bequaerti* complex. Second funicular segment shorter than third, not very much longer than broad (L $<$ 2W).

I include in the *africanus* group 4 nominal species (with their synonyms): *africanus, obscuratus, madagascarensis* and *natalensis.* In general, *africanus* has the pronotum densely sculptured and opaque to weakly shining, *natalensis* has the pronotum strongly shining, but with faint discal striato-punctulation, and *obscuratus* and *madagascarensis* have the pronotum smooth and shining, with only fine, scattered punctures. The oft-collected *A. africanus* appears to range throughout the forested regions of West and Central Africa as far south as northern Angola (gallery forest of R. Kahingo, 7.39 S, 20.51 E, Mwaoka) and the Kasai River area of southern Zaire; east into Uganda (Mabira Forest, G. Anold) and the Imatong Mts. of southernmost Sudan (N. A. Weber); and northwest to Liberia (Gibi, W. M. Mann) at least. The pronotum is covered with sculpture, ranging from wavy-costulate to striate-punctulate in an inverted U- or V-shaped or oval pattern; in some samples (e.g., Cameroun and 12 miles of Kasaji, Zaire, E. S. Ross and R. E. Leech) the pronotal sculpture is weak, and the surface is shining and much more nearly smooth than usual.

The more lightly-sculptured East African counterpart, *A. obscuratus,* is poorly known, and is only barely distinguishable from the island isolate, *A. madagascarensis.* These two may in fact be only slight geographical variants of one species. *A. obscuratus* has the posterior truncal dorsum even less strongly sculptured (more strongly shining) than in the 8 Malagasy locality samples now available, though direct comparison is needed to appreciate the distinction. *A. obscuratus* samples are also much less uniform; var. *ustus* has the posterior trunk almost completely smooth and shining, an extreme of the trend in *obscuratus.* The samples of *A. obscuratus* I have seen are the type of *schoutedeni* from Dumbi, Kasai district, Zaire; the type worker of *ustus,* from Makumbi in the same district; the types of *A. obscuratus,* from Kiboschi, Kilimanjaro, Tanganyka; and a series

of 6 workers and alate queens from 11 miles S. Maktau, Teita Prov., Kenya, E. S. Ross and R. E. Leech. A worker chosen at random from the last sample has HL + ML = 2.55 mm, while the eye is 0.26 mm long.

A. natalensis is based on the type series, from Pietermaritzburg, Natal, and I know of no other samples. It is intermediate in sculpture between the more lightly-sculptured *africanus* mentioned above (Kasaji, Cameroun) and *obscuratus,* but the eyes are a little larger than in either relative: EL 0.28 mm in a worker in which HL + ML = 2.25. The petiolar node is a bit sharper at the summit in side view than in most *africanus* samples. This species may just be a slightly extreme variant of *africanus* or *obscuratus,* or it may really represent an extralimital, independent species. We need more material of the complex, especially from Rhodesia, Zambia and Mozambique, in order to understand what *natalensis* is.

The relationship between *africanus* and *obscuratus* is still open to question, although it does appear that the two remain reasonably distinct in areas (such as southern Zaire and Uganda) where they may be sympatric or nearly so. Otherwise, we could be dealing with conspecific forest and savanna ecotypes that intergrade sharply in ecotonal districts, a possible interpretation also of the *inermis* complex [40].

The types of *A. pasteuri* are large examples of *africanus,* the worker with eyes no larger (EL 0.25) than in members of the latter species of the same size (EL 0.25-0.26). The other characters cited by Santschi in his comparison with *africanus* are all ones of slight degree and variable in the *africanus* material available.

[30] *A. bequaerti* is an extremely variable species that is closely related to *africanus,* and shares with it the same fine striation of the vertex reaching from the frontal lobes to the nuchal carina in the middle. Usually the trunk in *bequaerti* is black or piceous (more rarely red), with more or less coarse sculpture covering all of its dorsal surface. In the holotype, the pronotum is deeply and densely punctulate and opaque, with a few concentric rugulae superimposed around the disc, while in other samples it can be irregularly rugulose-striate (e.g., CNRS Research Station, near Makokou, Gabon, I. Lieberburg, rain forest), or reticulate-rugose, as in the *opaciventris* syntypes, discussed below, or in specimens from Lamto Field Station, south-central Cote d'Ivoire (J. Lévieux).

The propodeal angles vary, but are often prominent, blunted subacute or sub-rectangular; the summit of the petiolar node as seen from the front is truncate or concave. Gaster brown or piceous, the first 2 terga covered at least over their anterior halves, with fine sculpture, varying from delicate, shallow reticulation to dense, moderately deep punctulation, and from shining to opaque.

Head usually red in color, varying from light yellowish-red, to mahogany with infuscated middle vertex; most often contrasting with darker trunk; mandibles and legs tend to be lighter, more yellowish.

Size ranges from about HL 1.25 to HL 1.75 mm. The larger specimens (HL > 1.50 mm)correspond to the *opaciventris* phenon.

A syntype worker from Akenge, Zaire (H. O. Lang) has HL 1.73, HW 1.37, ML 1.02, scape L 1.44, eye L 0.25 mm; CI 79, MI 59. A worker from 39 km S of Walikale, 700 m, Zaire (E. S. Ross and R. E. Leech) measures HL 1.63, HW 1.39, ML 1.04, scape L 1.45, eye L 0.26 mm; CI 85, MI 64. Other samples agreeing with the *opaciventris* pattern also come from NE Zaire and the neighboring Imatong Mts. of S Sudan: above Lotti Forest, 1040 m, J. G. Myers. Besides large size and coarse sculpture — especially the opaquely punctulate gastric sculpture — *opaciventris* workers tend to have very abundant fine standing pilosity on the dorsum of head and trunk (little apparent in the *opaciventris* types, which were damaged samples taken from toad stomachs), whereas the smaller-sized «typical» *bequaerti* have only a few (6-20) coarse hairs on the trunk.

I am following the hypothesis that the *opaciventris* phenon amounts to a localized (central) allometric variant of the species *A. bequaerti,* noting that that species' size variation (HW 1.25 to 1.75 mm) is not very different from that of *africanus* workers (HL 1.36 to 1.70 in MCZ material); pilosity variation is paralleled by *A. traegaordhi.*

The species *estus* was raised by Wheeler on a single specimen [AMNH-New York] from Akenge, NE Zaire: TL 5.3, HL 1.37, HW 1.22, ML 0.76, WL 1.63 mm; CI 89, MI 55. The type looks like some of the *africanus* samples from Cote d'Ivoire, but the gastric dorsum is shallowly reticulate (not as Wheeler described it, «very smooth and shining»). This specimen might be viewed as an intergrade (hybrid?) between *africanus* and *bequaerti,* but I believe it is more likely just another variant of *bequaerti.*

Very noticeable variation also involves the length and width of the mandibles and the size of the compound eyes. Short mandibles (MI 60 or less) and large eyes (eye L 0.25 or more) seem to go together, and the reverse, and it is possible that a very rough negative correlation exists between these structures. Bolton (personal communication) has suggested a possible sorting of large-eyed samples into savanna habitats and smaller-eyed ones into forest zones, but the available material is equivocal in this point. In view of similar variation in some other *Anochetus* species and groups, though, it would be worth further study when the samples and ecological data become adequate.

One puzzling variant, very small in size (HL 1.10, HW 1.00, ML 0.67 mm), with relatively large eyes (L 0.25 mm), is testaceous with slightly darker (yellowish-brown) gaster. The vertex is finely striate back to the nuchal carina, and even over all but the posterolateral parts of the «occipital» lobes, as in many *bequaerti* workers. The habitus, because of the light color, somewhat recalls *pellucidus,* but the «translucent look» of the head and mandibles is lacking. The gastric tergum is shining but reticulate over the anterior halves of the first 2 segments.

This anomalous worker could be a hybrid, or an undescribed species, but it is most likely just another manifestation of the extreme variability of *A. bequaerti.*

[31] Emery named *Anochetus pellucidus* well; the female castes are light tawny yellow, with pale yellow appendages, and the ants have a translucent look about them, especially the head and mandibles. The eyes are large and finely facetted (EL 0.27 mm in a specimen with HL + ML = 2.02 mm). The frontal striation is coarser than in the *africanus* and *bequaerti* groups, and reaches to, or very nearly to the nuchal carina in the middle, and the mandibles are relatively long and slender (fig. 3). The pronotum is coarsely rugose or reticulate-rugose in an inverted V- or U-shaped pattern, while the propodeum is densely punctulate (rarely also rugulose). The first gastric tergum is delicately reticulate or transversely rugulose over varying areas centered on the anterior disc; sometimes this fine sculpture is scarcely developed, so that practically the entire gastric dorsum is smooth and shining, with scattered dark punctures bearing sparsely distributed, long, fine, erect hairs, which are also distributed over the rest of the body and appendages.

A form ranging widely in West Africa, and apparently occurring elsewhere on the continent as well, is like *pellucidus* in almost all details except in its black or piceous body color (antennae, mandibles and tarsi light brownish-yellow) and its mainly rugulose propodeal dorsum (propodeal rugulosity is developed in only one *pellucidus* worker, from near Epulu, in the Ituri Forest of Zaire, T. E. Gregg, MCZ).

This dark form corresponds so well to Arnold's description of *A. fuliginosus* (type locality St. Lucia Lake, Zululand) that I do not hesitate to assign this name, in spite of the fact that St. Lucia Lake is far away from the West African locatities whence all of the other samples have come. Although at first one is tempted to consider *fuliginosus* as a color morph of *pellucidus*, the usual difference between them in propodeal sculpture, at least in sympatric situations in West Africa, makes it seem more likely that we are dealing with distinct species. The holotype of *A. fuliginosus* is in NMR-Bulawayo.

The records indicate that both species are arboreal or subarboreal foragers. Possibly Faure took the type of *A. fuliginosus* from an arboreal situation in Zululand, because he spent much time collecting thrips and other insects by beating branches of trees, vines and shrubs. The other available records for the species follow, based on samples examined:

A. pellucidus: Gabon, Makokou, CNRS, 1 worker, W. H. Gotwald. Ghana, 6 miles N of Takoradi, 2 workers, E. S. Ross and R. E. Leech. Ghana, Adeiso, pyrethrum knockdown, 3 workers, D. Leston. Ghana, Tafo, 1 worker under cocoa tree bark, B. Bolton. Nigeria, Gambari, in cocoa tree trunk, 1 worker, B. Bolton. Cameroun, Ekok, 24 miles E of Tekmo, 650 m, E. S. Ross and K. Lorenzen. Ivory Coast, Banco Forest, near Abidjan, 1 worker running on large rotten log in primary forest, W. L. Brown. Zaire, near Epulu, T. E. Gregg. Zaire, Mongende, H. Schouteden.

A. fuliginosus: Liberia, Monrovia, E. S. Ross and R. E. Leech, a small nest series. Ghana, Aburi, P. Room, 2 workers. Ghana, Mampong, D. Leston, 1 worker. Nigeria, Gambari, on cocoa tree trunk, 1 worker, B. Bolton.

[32] The small African species related to *A. grandidieri* were multiplied mercilessly by Santschi and Bernard. These forms have short, stout mandibles and small, but not minute eyes (worker EL 0.07-0.12 mm), and the antennal scapes usually fail to reach the posterior corners of the head; funicular segments II, III, IV short, hardly longer than broad. The petiolar node is narrow in side view and tapered apicad to a sharp, or at least very narrow apex; in front view, the petiolar margin varies from convex to emarginate, and is often merely flattened in the middle. The vertex, pronotal disc and gastric dorsum are mostly smooth and shining, with spaced punctures of varying coarseness.

Only in *A. grandidieri* of Madagascar do the frontal striae reach far back on the vertex, where they overrun some of the punctures and surround the front and sides of the posteromedian impression. This is the commonly-collected small *Anochetus* of Madagascar in leaf litter and forest soil, including the soil about the roots of epiphytes: Andasibé (= Périnet), 950-980 mm, several collections in forest, March 1969 and February 1977; W. L. and D. E. Brown; Imerintsiatosika, about 34 km W of Tananarive, pasture with eucalyptus, W. L. Brown; above Sakaramy on road to Joffreville, 500 m, litter of disturbed forest, Browns; 84 km SW Sambava on road to Andapa, disturbed forest, Browns. 8 km W of Maroantsetra, degraded forest with vanilla, Browns.

M. A. Peyrieras has found this species in forest litter and humus berlesates from: Causse de Kelifely, west-central Madagascar, litter of dry limestone forest; route d'Anosibé (from Moramanga); Beforona, 500 m.

A. madecassus is just the queen of *grandidieri.* The only other *Anochetus* at present known from Madagascar is *A. madagascarensis* [29], also represented by repeated collections.

On the African mainland, the *grandidieri* complex groups into two entities that differ by minor, but possibly constant characters. One of these entities occurs in the eastern Cape Province of South Africa, where it corresponds to the type of *A. punctaticeps,* the first name available for it. This form is concolorous ferruginous yellow and has a smooth and shining first gastric tergum, with only fine and inconspicuous punctures; the propodeal angles are low and obtuse, and the petiolar node as seen from the side tapers to a narrowly-rounded apex (fig. 20). The type locality of *A. punctaticeps* is Port Elizabeth, eastern Cape Province. I took samples at Walmer, a western suburb of Port Elizabeth, in thin eucalypt litter along a roadside strip; at Alexandria Forest, near Alexandria; at Beggar's Bush, near Grahamstown, in ravine forest; and on Signal Hill, near Grahamstown, under a rock in thin forest.

In eastern, central and western sub-Saharan Africa, *punctaticeps* is replaced by a rather common, more variable form, corresponding to a group of available names, the earliest of which is *A. grandidieri* var. *katonae* Forel 1907, so that I am calling the species *A. katonae*. The types of the worker-based species and varieties *concinnus, punctatus, punctatus* var. *occidentalis, lamottei* and *gnomulus* all seem to be minor variants of this same species. The type of *A. parvus* is missing from its mount and presumably lost, but there is nothing about its description to suggest that it belongs to a different species. *A. parvus* var. *longiceps* is based partly on a queen from Cameroun, so I cannot be sure that it is not one of the species with minute worker eyes, such as *siphneus,* but in the absence of queen samples of *siphneus* there appears to be no way to decide this problem; I am provisionally listing *longiceps* as a synonym of *katonae*.

[33] **Anochetus pubescens** new species
(figs. 10, 16)

Holotype, worker: TL 4.9, HL 1.13, HW 1.02, ML 0.60, WL 1.45, scape L 0.91, eye L 0.14 mm; CI 90, MI 53.

Castaneous (medium orange-brown); posterior corners of head, antennae and legs lighter, more yellowish-brown; gaster very slightly darker brown.

Resembling the largest specimens of *A. grandidieri,* but with the following differences:

1) In full-face view, antennal scapes at rest surpass posterior borders of «occipital» lobes by nearly the apical scape thickness.

2) Eyes, though modest in size, distinctly larger than in *grandidieri* and related species. There seem to be about 33 ommatidia in each eye.

3) The frontal striation is very fine and close, giving the surface there a sericeous appearance at magnifications of about 25X; it extends all the way to the nuchal carina in a median band, but extends only part way out onto the «occipital» lobes, which are otherwise smooth and shining.

4) Pronotum densely rugulose-punctate in an ellipse around a very narrow median strip that is nearly smooth, with coarse punctures, and shining. Mesonotum finely transversely striolate, subopaque; propodeal dorsum rugulose in a more or less transverse direction. Gaster smooth and shining, without conspicuous punctures.

5) Erect pilosity largely suppressed, consisting only of a few fine erect hairs on anterior part of head, on mandibles, on underside of gaster, and near posterior margins of the second and succeeding gastric terga. Dorsal surfaces of body with abundant and conspicuous, short, appressed and subappressed pubescence, which also extends to appendages as a short, appressed to decumbent fuzz.

Funiculus rather robust, segments II through VIII thick, scarcely longer than broad; II and III together are slightly shorter than I, and II-IV are subequal in length; apical segment very long. The petiolar node, while narrow and sharply tapered as seen from the side, has the tip more blunt (fig. 16) than in *grandidieri,* and about as in *punctaticeps.*

Holotype (MCZ) the only known specimen, taken in the Vumba Mountains, near Umtali on the eastern border of Rhodesia, 11 March 1969 (W. L. Brown). The specimen came from under a rock in a grassy cleared sloping

area along the main road through the mountains; a forest remnant was farther down the slope nearby.

This species should probably be counted as belonging to the *grandidieri-punctaticeps* group because of its modest size, compact build and the proportions of the funicular segments. In some ways, particularly the habitus of the head and mandibles, it resembles *A. graeffei.*

[34] **Anochetus siphneus** new species
(figs. 11, 19)

Holotype, worker: TL 4.4, HL 1.12, HW 0.96, ML 0.52, WL 1.27, scape L 0.84, eye L 0.06 mm; CI 86, MI 46.

Medium yellow; middle of dorsum of head slightly darker.

A small member of the *grandidieri* group with eyes reduced to dots of only about 7-15 facets, filling less than half the length of the orbital fossa. Scape fails to reach posterior border of «occipital» lobe by about the length of the first funicular segment (less in 2 paratypes); segments II, III and IV of funiculus longer than broad, subequal in length, together longer than I. Mandibles robust; preapical excision feeble, preapical angle low, rounded. Posteromedian impression wide and deep, shining, almost impunctate; nuchal carina in full-face view broadly V-shaped, with rounded apex.

Frontal striation continuing back onto the vertex for only a short distance beyond the midlength of the head, but replaced on the posterior disc of the vertex by dense, sometimes contiguous, coarse and fine punctures that surround the posteromedian impression; head otherwise smooth and shining.

Trunk compact, with the 2 sutures deeply impressed and longitudinally costulate at bottom (fig. 19). Pronotum with the usual fine margin around its anterior slope, paralleled by a narrow belt of fine, iregular rugulation or striation. Mesonotal disc narrow, straplike, about 3 times as broad as long. Dorsum of propodeum finely rugulose, weakly shining anteriad, otherwise opaque; discs of pro- and mesonotum and sides of trunk generally smooth and shining, as are also petiolar node and gastric dorsum. Node as in fig. 19; the paratypes are like this also except for the specimen from Gambari, Nigeria, which has the apical margin almost straight, with only a faintly concave tendency as seen from the front.

Pubescence short, appressed, moderately abundant on head, appendages and gaster, sparse and dilute on pronotum; the usual pair of erect hairs on the front of the pronotum, also 4 pairs of short, erect hairs straddling the cephalic midline: 2 pairs on frontal carinae, and 2 pairs on vertex. Gaster with up to about 25 coarse, stiff, pasteriorly-inclined, pointed hairs on the dorsum, 6-8 of these on first tergum.

Queen and male unknown.

Holotype a single worker (MCZ) from the gallery forest of the Bandama River at the Station Scientifique de Lamto, south central Ivory Coast, in a berlesate of leaf litter and humus, W. H. Gotwald and R. Schaefer.

Paratypes (MCZ, BMNH-London) 3 workers: Ivory Coast, Banco Forest, near Abidjan, W. L. Brown; Ghana, Tafo, on mud under dead leaf, B. Bolton; Nigeria, Gambari, under fallen banana stem, B. Bolton. TL 4.0-4.5, HL 1.04-1.14, HW 0.92-1.00, ML 0.50-0.55, WL 1.24-1.35, scape L 0.80-0.86, eye L 0.06-0.10 mm; CI 86-91, MI 46-49.

So far as known, *A. siphneus* is restricted to the West African forest belt, where it is found in the leaf litter or humus of the forest floor, and in rotten wood on the ground. Formerly, I had thought

this species might be the same as *A. jonesii,* but a direct comparison of type material shows that *jonesii* is larger, has relatively larger eyes, and has a blunter, more narrowly rounded petiolar apex as seen from the side. Perhaps *A. siphneus* has been confused in the past also with *A. talpa;* I suspect that the *A. talpa* recorded by Santschi 1914b: 331 from Ibadan, Nigeria, may really be *A. siphneus,* but I have not studied Santschi's specimen. *A. talpa* (syntypes in MHN-Geneva) is likewise a very small yellow species with dot-like eyes of perhaps 7 facets, but the petiolar node is only feebly tapered apicad as seen from the side, and its summit is considerably more broadly rounded even than in *A. jonesi.*

A. siphneus is perhaps most closely related to *A. grandidieri* and allies, but within this group, ties are obscure. It differs from *punctaticeps,* which is similar in color, by its smaller eyes, slightly larger body size, narrow transverse mesonotal disc, emarginate nodal apex, and by the more abundant erect hairs on the gastric dorsum.

[35] *A. faurei* remains known only from the type series from Nongoma, N Natal, South Africa. The collector was J. C. Faure, who customarily beat branches of trees and shrubs while searching for thrips, so it seems possible that *faurei* is at least partly an arboreal forager, like the somewhat similar members of the *emarginatus* group in the New World. It is not easy to decide whether the similarities are convergent ones, due mainly to evolution in similar niches, or are shared primitive traits retained from a distant common ancestor.

In Arnold's description, no mention is made of the small denticles, 3-12 in number, often acute and oblique, that beset the inner margins of the mandibles in an irregular manner.

This is the largest of the African *Anochetus* species; it seems to have no really close relatives on that continent.

[36] So far, *A. emarginatus* is known only from the Amazon Basin and northward in South America to the Caribbean Coast of Colombia (Parque Tayrona, Magdalena, C. Kugler, and Serrania de Macuira, Guajira Peninsula, W. L. Brown and C. Kugler) and to Trinidad in the east (numerous collections, mainly by N. A. Weber). Although I have taken it several times N and NE of Manaus, I have never found it in the far west of Brasil, in the Tingo Maria area of Amazonian Peru, or the Villavicencio region of cisandean Colombia, and I think it must be rare or local there, if it occurs at all in the western Amazon. Kempf (1972: 21) does record it from as far west as the state of Rondonia in Brasil: Porto Velho (W. M. Mann).

It is very variable in color and sculpture, but the head is always lighter than the trunk and gaster, contrasting with them. The pronotum may be coarsely or finely striate, usually in a transverse direction, or arched around the front of the disc, but often a greater or lesser part of the disc is smooth and shining (virtually the entire pronotum in a specimen from the Guajira Peninsula of Colombia).

I agree with Kempf (1964: 238) that Emery's subsp. *rugosus* does not represent a separate population in this welter of variation.

Outside of continental South America, in the Caribbean area, the *emarginatus* complex is represented by a few variants that seem to be distributed allopatrically or parapatrically to one another; i.e., they may behave as unit species of a superspecies. The trouble is that we have very poor samples of most of these forms, and their status remains vague and uncertain in some cases. I am treating them more or less arbitrarily as species here.

A. testaceus: That this is a species apart from *emarginatus* is indicated by the sharp distinction between their male aedeagi (figs. 74 and 76), at least as shown in worker-associated samples from Grenada Island, which are assumed to be conspecific with the types from nearby St. Vincent. The real problem with *testaceus* concerns how many of the circum-Caribbean samples that are more or less similar to it in worker characters really belong to it.

The Culebra I. sample assigned by Wheeler (1908) to *testaceus* is really a distinct species, described [37] as *A. kempfi.* The variety *nicans,* described by Forel from the mountains, of Costa Rica, is similar to *A. testaceus* in its light ferruginous color, but has more complete striation; its male is unknown. Similar forms from Belize (former British Honduras) in MCZ may belong with very small males, only about half the size of the Grenadan males, but with somewhat similar terminalia. However, these males (from light traps at Hummingbird Gap) are not securely associated with workers, and I do not see what we can safely conclude from them until we know their workers.

Two large workers from the Bonacca Islands, Honduras (M. Bates) have smooth centers to their pronotal discs and smooth upper front faces to the petiolar nodes, and much like typical *testaceus* from Grenada, but we do not have their males. Likewise, a short series of workers from Nassau, New Providence, Bahamas, are rather extensively striate and have slightly smaller eyes than the Grenada series, but we do not have their males.

Thus, the relationship of *testaceus* to its Central American and Bahamian vicariants is unknown. My provisional «solution» to this problem is to treat the St. Vincent-Grenada *testaceus* as one relatively secure species with known male characters. The rest of the Costa Rican, Belizean, Hondurian and Bahamian samples are arbitrarily assigned to *A. micans,* which is considered as a «form-species» of temporary convenience.

The name *A. striatulus* is also provisionally applied to the dark brown, very finely striolate form described by Emery under that name as a subspecies of *A. emarginatus* from Jimenez, in the Atlantic lowlands of Costa Rica. This form, with posterior pronotal disc smooth and shining, has been recaptured in the forest at Rio Toro Amarillo, near Guapiles (W. L. Brown), which is also in the Atlantic lowlands of Limon Province. It may be a separate species; further collections, especially of nests with males, are needed to assess its status.

Possibly some or all of the Central American forms here discussed (at least the workers) are actually geographical variants of *A. emarginatus* or *A. testaceus,* but it is clear that we cannot settle this problem without more evidence.

[37] *A. haytianus, A. longispina* and the new species *A. kempfi,* described below, comprise a probable superspecies. These are distinguished from the *emarginatus* superspecies and other species of the same group by their relatively shorter mandibles (MI < 67) with fewer teeth and denticles along their inner preapical margins (less than 10, and usually 7 or 8 per mandible). Like *A. testaceus,* they are more or less yellow in color. The only known queens are highly ergatoid forms, distinguished from workers by their slightly more voluminous gasters. Males are still unknown. Probably all three species are nocturnal foragers.

A. haytianus is known from Manneville in eastern Haiti, and *A. longispina* from the northeastern foothills of the Massif de La Hotte on the southwestern peninsula of Haiti at an elevation of about 1000 m or more. *A. haytianus* (4 syntype workers) measures HL 1.59-1.64, HW 1.26-1.33, ML 0.93-0.95 mm; CI 79, MI 58-59. A worker syntype of *A. longispina* measures HL 1.68, HW 1.34, ML 1.08 mm; CI 80, MI 64. *A. longispina* has very slender petiolar teeth over 0.25 mm long. *A. haytianus* has acute teeth, but these are not slender and are not much more than 0.1 mm long. *A. haytianus* has the head slightly broader across the vertex, and the outline of the anterior slope of the petiolar node more convex in side view, but these characters vary somewhat in both species.

Possibly both of these forms are more widespread on Hispaniola than we now know, but I failed to find them in the Dominican Republic during 3 weeks of intensive collecting there in 1976. The samples available are really inadequate to indicate the real status of these two forms, but I have chosen the hypothesis that they represent different species that replace each other geographically (and altitudinally?).

The following new species appears to be the Puerto Rican member of the superspecies:

Anochetus kempfi new species
(fig. 52)

Worker, holotype: TL 8.4, HL 1.61, HW 1.31, ML 1.05, WL 2.49, scape L 1.70, eye L 0.33 mm; CI 81, MI 65.

Paratype workers: TL 7.4-8.1, HL 1.52-1.62, HW 1.25-1.31, ML 0.97-1.05, WL 2.30-2.54, scape L 1.61-1.80, eye L 0.31-0.32 mm; CI 81-82, MI 64-65 (based on 4 workers from Culebra I. and Cataño, Puerto Rico).

Belonging to the the *A. haytianus* superspecies, and very similar to *A. longispina,* but differing from it and from *A. haytianus* in possessing well-developed, erect, acute propodeal teeth (fig. 52). The spines atop the petiolar node (L about 0.20 mm) are not quite as long and slender as those of *longispina,* but are much longer than those of *haytianus.* The striation is also finer and more opaque (sericeous in some lights) than in *longispina* or *haytianus,* especially on pronotum.

Ferruginous yellow in color; mandibles, appendages and petiole pale yellow.

Queen and male unknown; queen almost certainly will prove to be ergatoid.

Holotype (MCZ) and 5 paratype workers, 2 of them headless (MCZ, BMNH-London), from Culebra Island, Puerto Rico (W. M. Wheeler). According to the collector (Wheeler, 1908: 125), the Culebra samples, which he assigned to *A. testaceus*, came from «Several colonies nesting under stones in the shade of trees along the dry arroyos on the higher part of the island (Monte Resaca). The number of individuals in a colony varies from about thirty to one hundred». Probably more Culebra specimens exist in AMNH-New York. An additional paratype worker, slightly darker than the (possibly faded) Culebra sample, comes from Cataño, near San Juan, Puerto Rico (S. Peck), «from epigaean carrion trap # 10».

[38] *A. horridus* is a distinctive, gracile, testaceous species with very long, slender, sparsely toothed mandibles. The type, an ergatoid queen, was collected by Karol Lenko during our joint 1962 trip in Brasilian Amazonia, but only one of the other samples taken by our group on that excursion was mentioned by Kempf in the original description. Additional samples are from Pará, near Belém: Pirelli Rubber Plantation, Iriboca (Brown). Reserva Guamá (P. Dias). Instituto Agronomico do Norte (F. G. Werner). Amazonas, N and E of Manaus: Manaus-Itacoatiara Highway (Ruta 1), km 49 (Brown). Reserva Ducke (Brown). All localities were in lowland rain forest.

Workers were found singly in leaf litter, in or under a small rotten log, and in a small nest or nest fragment in a rotten branch in the leaf litter, with larvae.

Despite intensive collecting of the same kind we practiced at Belém and Manaus, Lenko and I failed to collect *A. horridus* during 3 weeks in the Benjamin Constant area of western Amazonas, and the species has yet to be collected in the Guyanas.

A. inca, the largest of all known *Anochetus* species, remains represented in collections only by the type series, from the Marañon Valley in northern Peru. It seems possible that more isolated species may await discovery in other Andean valleys and foothills.

[39] *A. bispinosus* is a distinct species of the hylean region that is relatively rare in collections. The MCZ has samples from Guyana: Kaow I. (W. M. Wheeler); Forest Settlement, Rio Mazaruni (N. A. Weber); King Frederick William IV Falls (Weber). Brasil: Belém, Pará (P. Dias). Porto Velho, Rondonia (W. M. Mann). Colombia: Valle Dept., 19 km E Buenaventura (E. I. Schlinger and E. S. Ross). Kempf (1972) lists it also from the Brasilian states or territories of Amazonas and Amapá, and from Bolivia.

Kempf's 1964 species *vexator* (northeastern Mato Grosso) is still known only from the types. The paratype has been reviewed, and my measurements agree well with Kempf's, except that I make ML 1.10 mm instead of his 1.07 mm; the MI is thus 74, while CI is 79.

A. oriens, from Parque Sooretama in northern Espirito Santo State, Brasil, is known only from the holotype. My measurements

differ slightly from Kempf's: HL 1.53, HW 1.18, ML 1.11 mm (CI 77, MI 73).

[40] *A. inermis* is found in its «typical» form in Trinidad and the Lesser Antilles (Martinique, Grenada, St. Vincent), and is known from widely separated localities in the Venezuelan llanos. Samples from the Guajira Peninsula, Cartagena and near Santa Marta, Colombia, indicate a range extending much farther west into the northern lowlands of Colombia. This form is a nearly uniform tawny to yellowish-red in color, with the forebody prevailingly opaque, especially the trunk, which is densely punctulate. The eyes are large (greatest diameter 0.20-0.24 mm), the propodeal teeth or angles are low and obtuse, and the upper edge of the petiolar node is only weakly emarginate, with bluntly angulate or even rounded corners (fig. 43) as seen from in front.

The mandibles are gradually enlarged from the base toward the apex until the inside preapical angle; the ventral of the two inner margins is furnished with 1-7 low, irregular teeth, denticles or serrations, increasingly coarse apicad. In some specimens, the denticulation is not developed, and the preapical masticatory border may appear edentate, particularly when the mandibles are completely closed. This mandibular variation is due partly to wear and partly to congenital differences among individual adults and populations (fig. 6).

The gastric dorsum is minutely roughened and subopaque basad, and its erect hairs are sparse and often coarse; gastric pubescence sparse, appressed and inconspicuous. The pronotal disc has a single anterior pair of long, posteriorly inclined standing hairs, but one or both hairs are missing in some specimens, and may have been rubbed off.

A. simoni combines features of *inermis* and *diegensis,* but has 3 or more coarse, irregular teeth along the inner border of each mandible in addition to the preapical tooth or angle (fig. 5). These teeth are broad-based and involve the whole medial border, not just the ventral medial margin, and they are larger, sharper, and more regular than in any other form in the *inermis* group. Color, size and pilosity-pubescence are as in *inermis.* Sculpture is intermediate between that of *inermis* and *diegensis:* head very finely longitudinally striolate, dull-sericeous nearly back to nuchal carina; pronotum opaque to feebly shining, finely and densely punctate-striate or rugulose-striate, arched anteriorly and becoming longitudinal or oval-concentric behind, interspersed are numerous fairly coarse punctures and sometimes the sculpture is a bit weaker and feebly shining in the middle of the disc. Mesopleura either smooth and shining or dull in the middle; propodeum finely and densely punctate, with superimposed transverse costulation crossing the dorsum. Gastric dorsum usually smooth and shining (rarely roughened and dull).

Propodeal teeth small, but acute; upper corners of petiolar node produced as definitely acute teeth, though these are usually rather short. Compound eyes 0.17-0.20 mm greatest diameter.

Samples fitting this description are found along the rim of northern South America, mostly in or near mountainous regions, from Venezuela to Ecuador. In the last country, the available records are all from the Pacific side of the Andes. The type locality is Caracas, Venezuela. Other records from: Venezuela: Aragua State, Rancho Grande, 110 m, wet forest litter (W. L. & D. E. Brown). Rancho Grande to Ocumare, 700 m, wet forest litter (Browns). Colombia: Valle Dept., Municipio Buenaventura, Plantation of Palmeras del Pacifico, wet lowland forest litter (W. L. Brown). Ecuador: Pichincha Prov.: 4 km E Santo Domingo, rain forest litter (S. & J. Peck, B-304); 3 km E of Tandapi, 1300 m, wet ravine (Pecks, 1975). Manabí Prov.: 75 km NE of Chone, 300 m (Pecks, B-346). Guayas Prov.: 3 km S of Bucay, lowland rain forest in rotten stick in litter (Brown, E-21).

Two samples from Colombia: 7 km N of Leticia, forest litter, (S. & J. Peck, B-230), 2 workers; and Ecuador, Pastaza Prov.: 22 km SW of Puyo, forest litter (Pecks, B-362), one worker, are deep brownish-orange in color and have the sculpture and pilosity of *inermis,* but the propodeal and petiolar teeth are well-developed and acute.

In the specimen from SW of Puyo, the punctulae of the anterior pronotum tend to form arched striation, and the inner mandibular borders are irregularly, coarsely, serially toothed (much as in fig. 5), the teeth involving the dorsal inner margin, which is not distinguishable from the ventral inner margin in this case. This specimen probably should be assigned to *simoni;* its eyes are about 0.17 mm in greatest diameter.

The two workers from near Leticia, on the other hand, are essentially like *inermis* in all traits except the acute propodeal and petiolar teeth, and in slightly smaller eye diameter (0.17-0.18 mm). In any case, these two cisandean samples make plausible intergrades between *inermis* and *simoni,* and lead to the hypothesis that *simoni* is just a peripheral forest ecotype of the essentially savanna species *inermis.* Another hypothesis is that *inermis* and *simoni* are hybridizing at points of parapatry. More samples from the western edge of the Hylea and from the Hylea-savannah boundary would probably be helpful in deciding among various possible relationships.

A. diegensis (fig. 44) has been collected at or near the type locality, Rio Don Diego (and Quebrada Guacoche), Guajira Dept., Colombia, in lowland rain forest leaf litter at the seaward base of the Sierra Nevada de Santa Marta (W. L. Brown & C. Kugler), and also near Santa Marta, Magdalena Dept., at the hamlet of Digrera in a shady creek bed at the base of the same sierra (Brown & Kugler). These «typical» members of the species have the sculpture more «normal» for *Anochetus* than does *A. inermis;* that is, the sculpture is more rugged and rugose where it occurs, and smooth or nearly smooth, shining areas are more extensive. Pronotum smooth and shining to indistinctly striate and subopaque discad, but even in the smoothest specimens, some fine rugosity or striation usually exists along the front and sides of the pronotum. Mesopleura usually

smooth and shining, except for striate or rugulose ends of the sclerite. Vertex finely longitudinally striate in the middle for varying distances, but the posterior fifth, more or less, is smooth, or nearly smooth, and shining, including much of «occipital» lobes. Propodeum punctulate-rugulose or punctulate-costulate, the individual rugules or costules usually distinct, at least on the upper sides and transversely across the dorsum. Petiolar node often finely reticulate-rugulose basad, shining above; gaster smooth and shining, but with numerous fine punctures from which arise the fine appressed and decumbent hairs of the abundant and conspicuous pubescence. Standing longer pilosity more abundant than in *inermis,* and usually finer; at least 6, and usually more than 10, standing hairs on pronotal disc, but usually none on mesonotum or propodeum (rarely 1 on propodeum).

Propodeal angles each with a small, acute tooth; free angles of petiolar node produced as acute teeth, varying in length and angle of divergence (fig. 44). Mandibles with edentate inner dorsal margins basad of preapical angle, but ventral margins often have low teeth or denticles, and the most distal of these may protrude beyond the dorsal margins even in perfect full-face view of head (as in figs. 6, 7 or 8). Compound eyes of worker 0.15-0.20 mm greatest diameter.

The northern Colombian samples tend to be dark in color, with deep reddish-brown trunk and gaster, and head and petiole usually somewhat lighter and more reddish. Samples from Panama (Barro Colorado Island, Zetek, Brown and other collectors; Quipo, J. Zetek) are much lighter in color, light yellowish-brown with yellow legs, but otherwise resemble *diegensis;* thus the species *bierigi* was synonymized by Brown (1964: 215) with the former species. Samples of the same color as the Panamanian ones occur, interestingly, in Trinidad at the localities listed below, where they must be nearly sympatric with *inermis* in the Northern Range, yet no intergradient specimens are known among the extensive collections from this island. Trinidad: Morne Bleu, Northern Range (N. A. Weber, No. 209.2). Northern Range, Tucuragua R., 100 m (Weber, No. 155). Northern Range (Weber, No. 252.2). Mile 10 to 12, Arima-Blanchisseuse Road (Weber, No. 207.5). Caparo (P. B. Whelpley).

Specimens from other scattered localities in northern South America are further light-colored examples of typical *diegensis:* Venezuela, Carabobo State: San Esteban, disturbed lowland forest (W. L. and D. E. Brown). Ecuador, Napo Prov.: 20 km S of Tena, forest litter (S. and J. Peck). Surinam: Dirkshoop and La Poulle, soil and litter samples (I. van der Drift).

Another form, very similar to the yellowish-brown variant of *diegensis,* is represented by a few samples (6 workers) from the eastern Hylea. This form differs from *diegensis* in having smaller eyes (greatest diameter 0.12-0.13 mm) and the inner mandibular borders each effectively single, with 2-4 broad, vague preapical teeth forming a variable, crooked margin (fig. 7). Brazil, Pará State, near Belém: Utinga Tract, 3 stray workers from forest litter berlesates (W. L. Brown and P. F. Darlington). Icoaraci, forest litter berlesate, 1 worker (Brown). Guyana: Dunoon 2 workers (F. M. Gaige).

Still another entity, corresponding to the type of *A. targionii,* comes from widely separated parts of the Amazon drainage; the lone type is labeled simply «Bolivia». Other localities: Brazil, Amazonas State: Reserva Ducke, Mun. Manaus, rain forest, 1 worker from rotten log (W. L. and D. E. Brown). Pará State: Belém vicinity, 1 worker (K. Lenko). Icoaraci, near Belém, 1 worker (W. L. Brown). Pirelli Rubber Plantation, Iriboca, near Belém, 1 worker (P. F. Darlington); the Pará samples are all strays from leaf litter during August 1962. Mato Grosso State: Sinop, in N part of the state, several dealate queens (M. Alvarenga). Bolivia, Beni Prov.: Tumupasa, 1 dealate queen (W. M. Mann). Huachi, 1 worker (Mann). Ecuador, Napo Prov.: Limoncocha, 2 workers from forest litter berlesate (S. and J. Peck).

A. targionii is essentially like *diegensis,* and has two corresponding color forms; the eyes are similar in size (greatest diameter 0.14-0.17 mm). The mandibles (fig. 8) are edentate along both upper and lower margins of the inner borders, and even the preapical angle is usually reduced to a rounded corner, and the preapical excision is therefore sometimes, poorly marked. The mandible is thus less strongly broadened apicad than in related species; this is especially true of the type and the other Bolivian samples. A notable trait correlated with the edentate mandibles, at least in the meager material available, is the extreme hairiness of the body. There are more standing hairs on the pronotum than can easily be counted, and numerous posteriorly-inclined fine hairs grace the mesonotum and propodeal dorsum, as well as the gastric dorsum. The appressed-to-decumbent pubescence is also well-developed on the head, and fairly well on the gaster, except in 2 exceptionally hairy individuals (yellowish in body color) with rugulose-punctulate pronotum; the sculpture concentric around a small median strip that is smooth or nearly so, and shining. In these hairy specimens, not only are the longer standing hairs more numerous, but the pubescence apparently is increased and slightly lengthened and assumes an obliquely erect posture, even on the head and anterior surface of the petiolar node; the type itself appears to belong to this phenon, although it is somewhat rubbed (Tumupasa, Bolivia, and Belém, Pará).

Thus it is not impossible that even nominal *targionii* itself consists of two closely related Amazonian forms, but the available material is much too scanty to decide this question, and I am including all the samples with edentate inner mandibular borders and pilose mesonotum and propodeum provisionally in *targionii.*

The *diegensis*-like form from Pará and Guyana, previously discussed above, is sympatric with *targionii,* at least in the vicinity of Belém. It could represent a form of *diegensis* suffering character displacement in the presence of *targionii,* or it could be a completely separate species. We need more material, including nest series, to help decide these questions. Unfortunately, *Anochetus* of the *inermis* group do not seem to be very common in the Amazonian forests, so it may take a long time to gather the evidence.

The entire set of problems involving *inermis* and its relatives is complex and tantalizing. We are dealing with possibly as many as 6 different species, yet almost every conceivable combination and degree of intermediacy among them occurs somewhere in South America. It is not even beyond all possibility that all of the forms belong to one extremely plastic species that readily engenders ecotypes (or ecophenotypes) to fit different environments, as many plants and animals are known to do. That at least some real species gaps exist in this complex, however, is indicated by two circumstances.

The first of these circumstances is the known sympatry, or parapatry, apparently without hybridization, of several forms, particularly of «typical» *inermis* and *diegensis* in Trinidad and northern Colombia.

The second circumstance is the presence in collections of a number of males, mostly taken at light or in Malaise traps, that are about the right size to belong to the *inermis* group; at least some of them — perhaps as many as 4 or 5 different species — may correspond to the workers and queens, known or unknown, of this group. These males differ markedly among themselves in genitalic structure; only one of them *(inermis)* is reasonably securely associated with the worker-queen castes (figs. 66, 67). Several of these males are known from a restricted area of Pichincha Province in western Ecuador; terminalia of one of these are shown in figures 72 and 73. The characters of the terminalia suggest that capture of colonies with males, or the rearing of males in artificial nests, will likely lead to a clearer understanding of species limits and variation in worker-queen characters in these and other species-groups of *Anochetus*.

The species of this group live in the litter and upper soil layers, where they hunt small soft-bodied arthropods. In the llanos of central Venezuela, I found *inermis* in grass roots and litter in the shade of trees and shrubs; in wet forest, the nests of *simoni* are often found in rotten twigs in the litter. Nests seem usually to contain 30-50 workers. Although normal dealate queens occur in some nests, ergatoid queens also may serve as apparent reproductives. The ergatoid queen is like the worker, with slightly larger compound eyes and a single median ocellus, and the trunk is more convex in side-view outline, especially the propodeum.

When disturbed, *O. inermis* can press its body against the substrate and remain motionless for long periods, but it is also a fast and agile runner when danger presses.

[41] *Anochetus* of the *mayri* complex are the common small members of the genus in the New World, corresponding to *A. katonae* in Africa, and perhaps to *A. graeffei* in the Indo-Australian region. Like these species, *A. mayri* is variable in body size, eye size, antennal scape length, color and sculpture, as well as size and details of form and dentition of the mandibles. It is not always easily separated from smaller specimens of the *inermis* complex on the one hand, or from *neglectus* on the other, and some of the variation raises the suspicion that *mayri* may include two or more sibling species.

A. mayri was first proposed in a key, without a proper description, from a specimen from St. Thomas in the West Indies. It was never described in full by Emery, so when Wheeler described the subspecies *laeviuscula,* he did not know what the «typical» *mayri* was like. In fact, we still have no clear idea of what the color, sculpture, etc, of the *mayri* type really are, owing to the present difficulties of studying the material of the Emery Collection in Genoa. But we do know that the *mayri* complex is widespread in the West Indies and shows there wide variation in size, color and sculpture, including samples with predominantly smooth and some with completely striate pronota, as well as intermediates. After prolonged study of this material, I cannot find any way to separate it into two species, or even into reasonably clearcut geographical forms, so I assume that *mayri* and *laeviusculus* are synonyms.

On the mainland, the situation is more complex, because the variation is more extensive. The Atlantic lowland forest of Costa Rica, for example, contains a larger, dark brown form (HL 1.05-1.08, HW 0.92-0.94, ML 0.57-0.58, eye L 0.13 mm) with punctulate-striate sculpture weak in the middle of the pronotum, and weakly shining, but still not completely smooth. Sympatric in this area (for instance, at Rio Toro Amarillo, near Guapiles, Limon Prov.) is a smaller (HL 0.93, HW 0.82, ML 0.48, eye L 0.10-0.11 mm) brownish-yellow phenon with completely longitudinally striate pronotum. Whether these forms are conspecific or not cannot be decided without more evidence from this locality, but there are available intermediates among samples from elsewhere in the range, which extends from the Veracruz lowlands of Mexico through Central America and the West Indies to hylean South America, at least as far south as the Beni River drainage of Bolivia, and on the west slope of the Andes to southern Ecuador.

South and east of the Amazon drainage in Brazil occurs a rather uniform *mayri*-complex phenon that is usually dull yellowish-brown in color, has finely striolate cephalic dorsum and sericeous-striolate or densely punctulate pronotum (the striation barely resolved at 50X). This form, which closely resembles certain variants from the West Indies, corresponds to the named varieties or subspecies *neglectus, australis* and *nobilis,* which I regard as synonyms. My instincts are to extend the synonymy by placing all 3 names under *mayri,* since no satisfactory characters have been found to separate *neglectus* from all samples of *mayri,* and this would be the preferred action here were it not for two stubborn facts:

First, the *neglectus* phenon is widespread and the only form over a wide area of central and southern Brazil, Uruguay and northern Argentina (and presumably Paraguay). It ranges at least from Pernambuco (Caruaru, B. Pickel), [central?] Mato Grosso, and Minas Gerais (Belo Horizonte, J. C. Bradley) southward to Santa Fé Prov. in N central Argentina. Over this range, the eyes are relatively fairly large (eye L 0.13-0.16 mm), and the mesopleura are sculptured throughout, though their lower middle portions are slightly shining. Most similar samples from the Caribbean area have smooth, shining areas on the mesopleura, and the eyes are smaller.

Second, several males of undoubted *Anochetus* taken at light on 14 Nov. 1964 at Piracicaba, São Paulo State (C. Triplehorn), and about the right size to match *mayri*-complex workers, have terminalia radically different from those of males (figs. 70, 71) associated with *mayri*-complex workers taken in a nest from near Turrialba, Costa Rica (W. L. Brown). Males taken at light during June 1975 at Tinalandia, on the western slope of the Andes in Pichincha Prov., Ecuador (S. and J. Peck) are very similar to the Turrialba sample, at least as seen undissected. The Piracicaba males have broad-based, convex parameres that are suddenly constricted near midlength, and then each is continued as a slender, lanceolate, apical blade that is weakly concave facing laterad, so that when the terminalia are viewed end-on, the parameral apices are curved slightly away from the midline. The volsellae are also longer in the Piracicaba males, but the sharp apices of the aedeagal valves are shorter than those of the northern males.

We do not know for sure, of course, what kind of workers belong with the Piracicaba males, but the only right-sized workers that we know to occur in the area are those I call here *neglectus*. As long as there is a chance that these southern males do belong with *neglectus* workers, it will be necessary to recognize the latter name, even in the absence of absolute diagnostic characters for workers and queens.

As in other groups of *Anochetus*, the *mayri* complex will not be completely clarified until we have adequate samples of workers or queens associated in the nest with males.

A. mayri is found mostly in forests under stones, in moss on rocks or logs, in rotten twigs on the forest floor, or in larger bodies of rotten wood. The workers and queen feign death, and are difficult to see.

[42] *A. altisquamis* is a short, thickset species occurring in wet coastal and montane forests in SE Brazil and N Argentina. The SW limit of the range appears to fall in the Andean foothills W and SW of Tucumán. I took it there at Horco Molle and Cerro San Xavier in 1967, under stones in wet myrtaceous forest. A male taken separately at Horco Molle by L. Stange 3-10 April 1966, now in MCZ (figs. 62, 63) is almost certainly correctly associated with the female castes, since no other *Anochetus* species has been found in the area.

The workers of *A. altisquamis* have the subapical mandibular tooth rather short and thick, and it is sometimes worn down to a subtruncate condition somewhat resembling that of *A. orchidicola*. A detailed listing of localities is given by Kempf and Lenko (1976).

[43] **Anochetus orchidicola** new species

Worker, holotype: TL 4.8, HL 1.29, HW 1.11, ML 0.58, WL 1.45, scape L 0.91, eye L 0.12 mm; CI 86, MI 45.

Body short, robust; head almost as broad behind as across eyes (HW across vertex 1.05 mm). Eyes small, with about 22-25 facets, each occupying about 2/3 of an indistinct orbital fossa. Antennal scapes fail to reach posterior borders of «occipital» lobes by about the length of the first funicular segment, or pedicel, which is about 0.17 mm long, distinctly longer than combined funicular segments II + III, which are each almost as broad as long. Apical antenal segment tapered to a very slender, acute point.

Mandibles very short and thick, convex, gradually broadened apicad; shining, finely punctate and sparsely pubescent; inner margins approximately straight, and not excised or sinuate before apex. Apical teeth short; ventral and intercalary teeth subconical, with rounded apices, the ventral tooth slightly longer than the intercalary; dorsal apical (subapical) tooth broad, only slightly longer than broad, and truncate, much as in the *Odontomachus rixosus* group, or large workers of *O. ruficeps*, its apex even with that of intercalary tooth.

Antennal fossae rather deep, indistinctly bounded behind, extending to about cephalic midlength. Center of dorsum of head with a conspicuous fossa or narrow impression, perhaps corresponding to the anterior ocellus in the unknown queen of this species. Posteromedian impression of vertex distinct but narrow, round-bottomed, receiving the rather narrow, but rounded, anterior curve of the nuchal carina. «Occipital» lobes very broad, rounded posteriad, with gently convex sides.

Head basically smooth and shining; frontal carinae finely striate, the striation extending caudad and fanning out somewhat, sericeous-opaque, but becoming indistinct a short way beyond the central fossa, and then replaced on the vertex by numerous coarse punctures, crowded, but mostly with narrow, shining interspaces, each puncture bearing a fine, short, appressed or decumbent hair, these collectively forming the fairly conspicuous cephalic pubescence. The rest of the body and appendages mostly bear similar pubescence, especially well developed and dense on gastric dorsum, but it is sparser or absent on underside of head, on center of pronotal disc, on sides of trunk, on coxae and on petiolar node.

Sparse, short, fine standing hairs are also found on mandibular apices, on pronotum, on both upper and lower surfaces of gaster (longer at apex), and a single inconspicuous pair on vertex.

Trunk robust, with broadly convex pronotum having a very short cervix and a fine, raised, transversely reticulate-striolate anterior margin. Mesonotal disc moderately convex in both directions, about 1 1/2 times as broad as long, slightly raised above both pronotum and metanotum, its surface sloping gently caudad; pronotum and mesonotum smooth and shining, with scattered small punctures. Metanotum also convex, subequal in length to mesonotum but only half as wide. It is separated by a distinctly impressed sutural line from mesonotum, and by a deeper and wider saddle from propodeal dorsum; propodeal dorsum short, weakly concave, subequal in length to declivity, into which it rounds as seen from the side; as seen from above, the propodeum is constricted cephalad, the declivity is concave, and the concavity extends cephalad nearly to the metanoto-propodeal suture between blunt, anteriorly-converging ridges that form the dorsolateral margins of the propodeum. Metanotal disc and propodeum transversely striate, very finely in front, but more coarsely behind, especially on declivity. Sides of pronotum, mesopleura and metapleura smooth and shining, except area of metapleural gland and its bulla, which are rugulose. Mesopleura without obliquely transverse suture. Legs weakly to strongly shining, finely punctulate and pubescent, especially toward apices.

Petiolar node strongly axially compressed, cuneiform in side view, with extremely sharp apical rim; as seen from in front, the rim is convex on the sides, entire and rounded above, but with a slight tendency toward flattening

at the extreme apex. The anterior slope as seen from the side is feebly sinuate, almost straight, while the posterior slope is weakly convex. Gaster broad and deep, only modestly constricted between first and second segments; second segment slightly longer than first; upper part of anterior face of first gastric segment overhangs receding lower part. Terminal segments of gaster almost wholly retracted into second segment in this specimen, but sting extended.

Legs short and thick, the anterior femora and all 3 pairs of tibiae distinctly incrassate; 2 fine spurs on each mesotibial apex; one large pectinate spur and a smaller spiniform lateral spur on the hind tibial apex.

Color castaneous (dull orange-brown); trunk and legs perhaps a trifle lighter than head and gaster; mandibles darker, more brownish.

Holotype worker (USNM-Washington) a unique intercepted in quarantine at Laredo, Texas, 20 June 1944, «with orchid root» originating at Orizaba, Veracruz, Mexico. The Laredo quarantine number is 33930, and the «Lot No.» is 44-15848. Queen and male unknown.

This interesting species apparently is closest to *A. altisquamis* [42], but it is smaller and differs in sculpture, in the sharper apical margin of the petiolar node, and in having smaller eyes. The small size of the eyes invites comparison with *A. minans,* but *minans* is a less robust species with even smaller eyes; thicker, apically bicuspid petiolar node; trunk less convex, much as in *mayri;* and conical subapical mandibular teeth. Also, the mandibles in *A. minans* are slightly more than half the head length (HL $>$ 50), and the antennal scapes are longer, very slightly overreaching posterior borders of «occipital» lobes as seen in perfect full-face view. *A. minans* is more extensively and opaquely sculptured on vertex and sides of pronotum and anterior mesopleura, and especially sides of metanotum and propodeum, which are finely and densely reticulo-punctulate. The propodeal teeth of *minans,* while low and blunt, are much more dentiform than are the rounded «angles» of *orchidicola.*

My comparison is based on a specimen of *minans* taken by myself in rotten wood in rain forest near the bridge over the Rio Toro Amarillo, west of Guapiles, Limon Prov., Costa Rica, in early March 1966. This specimen agrees well with Mann's description of *minans,* except for the length of the scapes, which Mann says do not reach the occipital lobe margins. It may be that Mann viewed his specimen from a slightly different position, or did not actually hold the scapes back to the lobes, or perhaps the scape length varies. I have not reviewed the *minans* holotype recently enough to be sure of this point. The *minans* type is from Lombardia, Honduras, and the Costa Rican collection is only the second record so far as I know.

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The Roman capital letters «A» and «B» refer to Part VI, Sections A and B respectively. The capital *A.* in *italics* stands for *Anochetus, O.* for *Odontomachus.* Where there are multiple page references, the principal ones are printed in *italics.*

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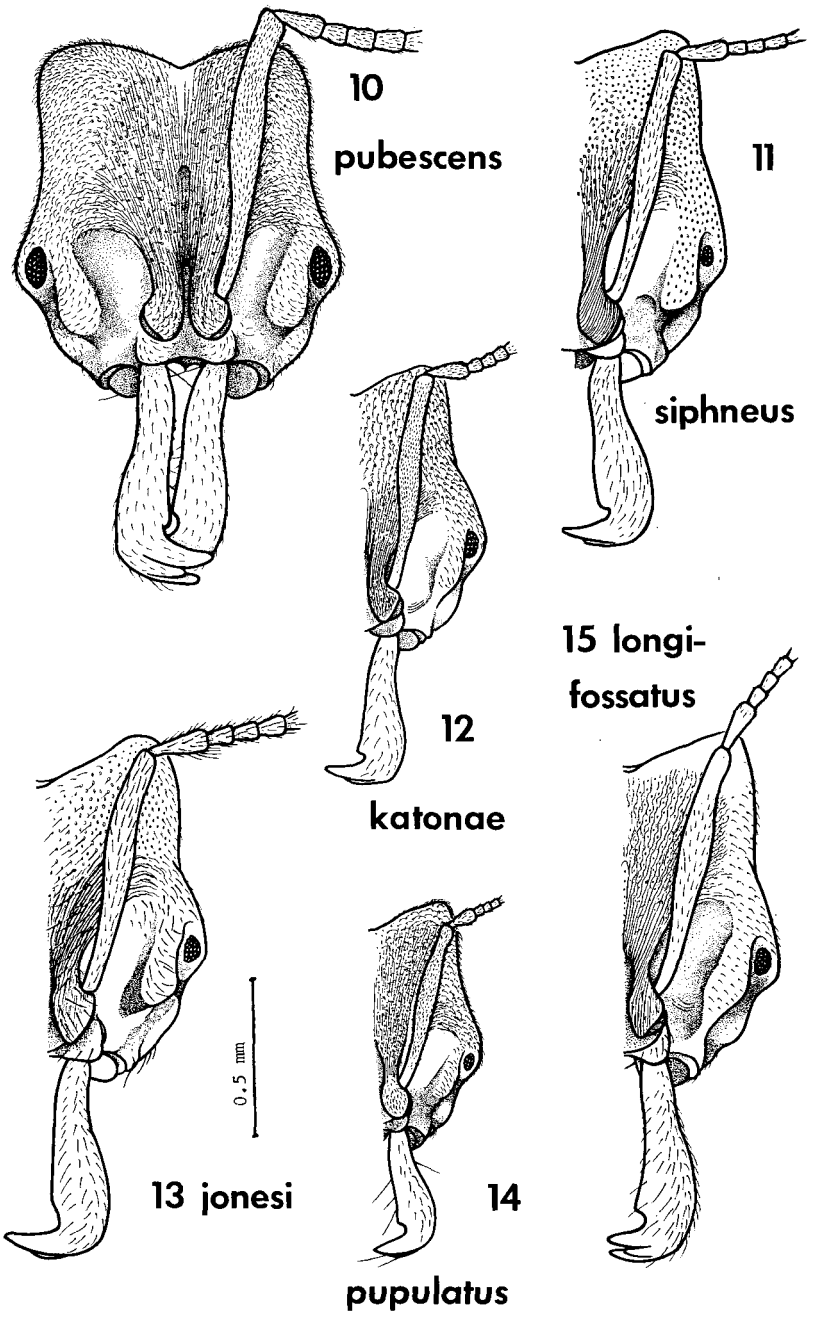

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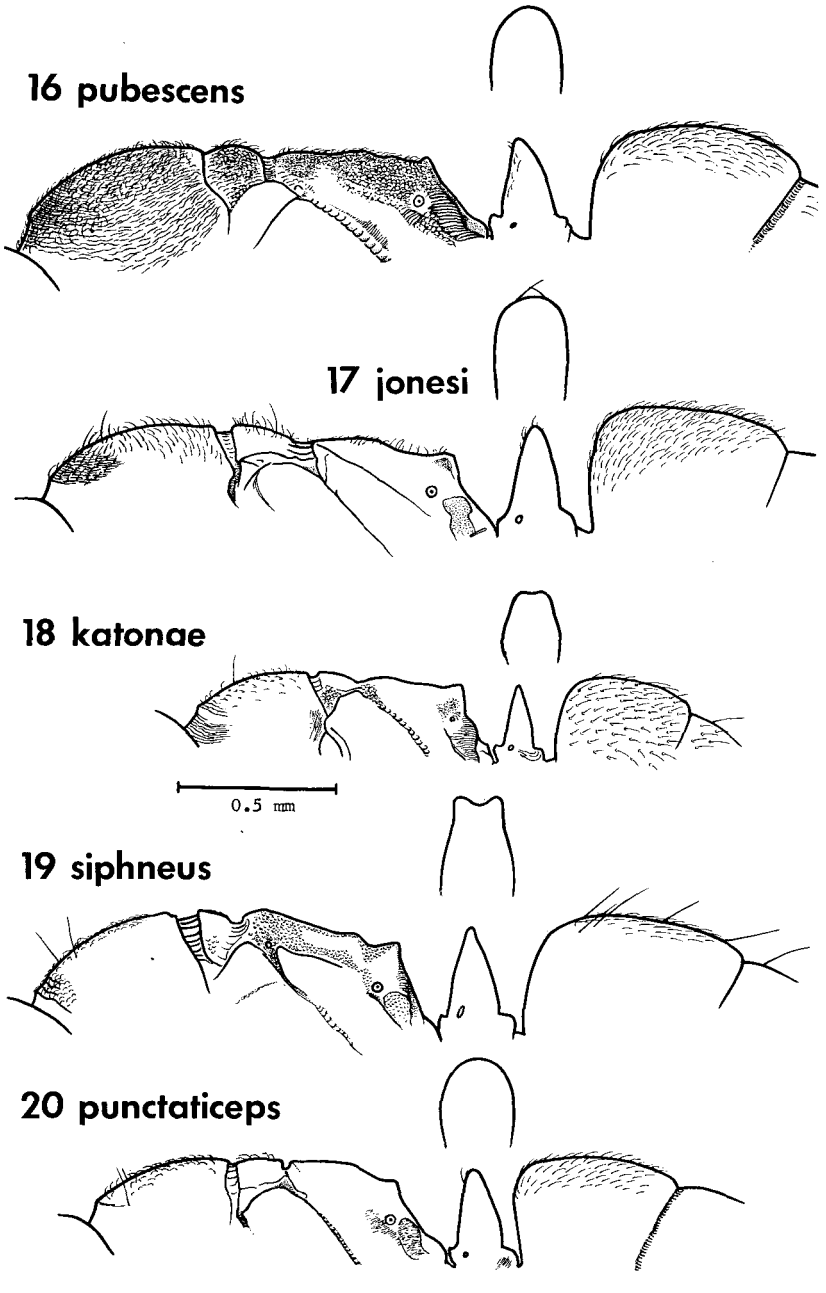

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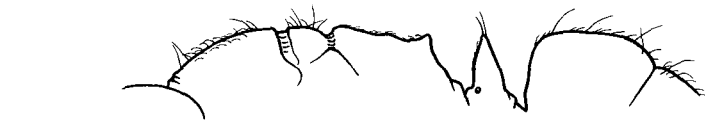

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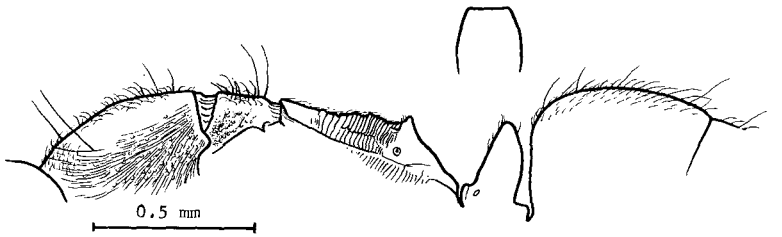
22 pupulatus



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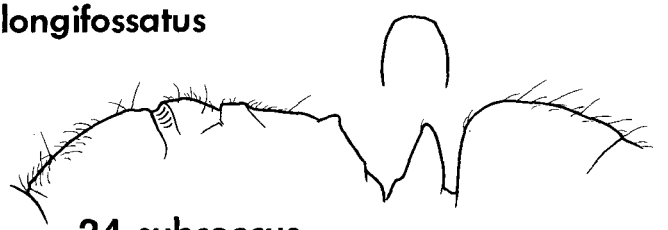

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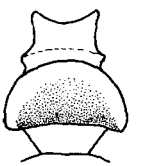

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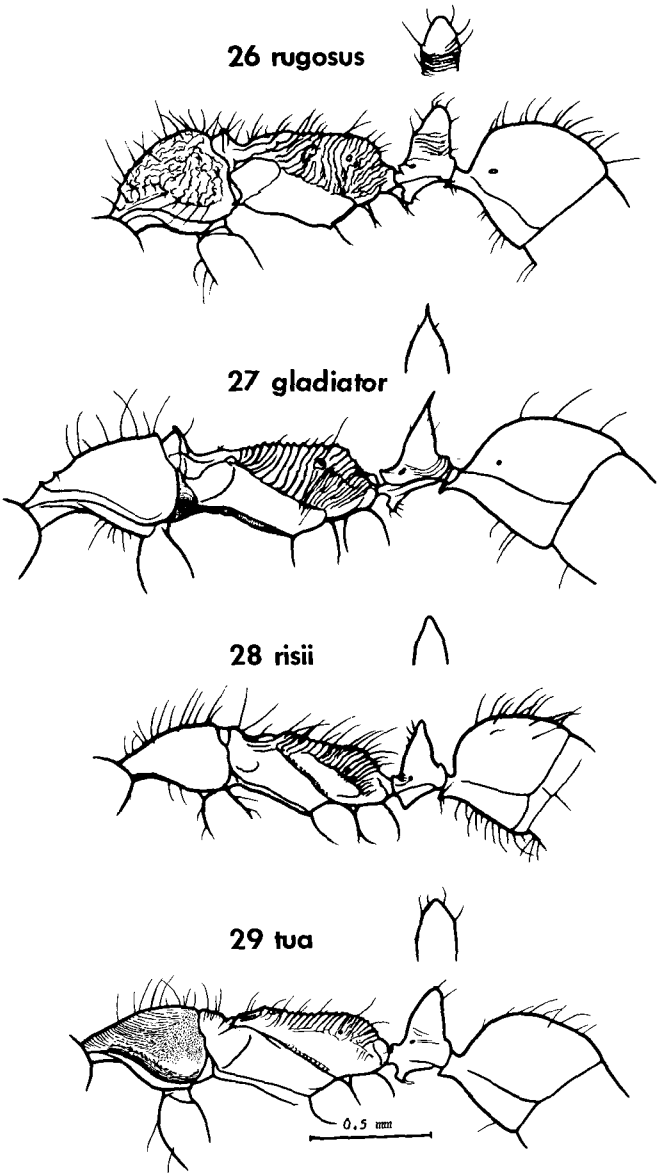

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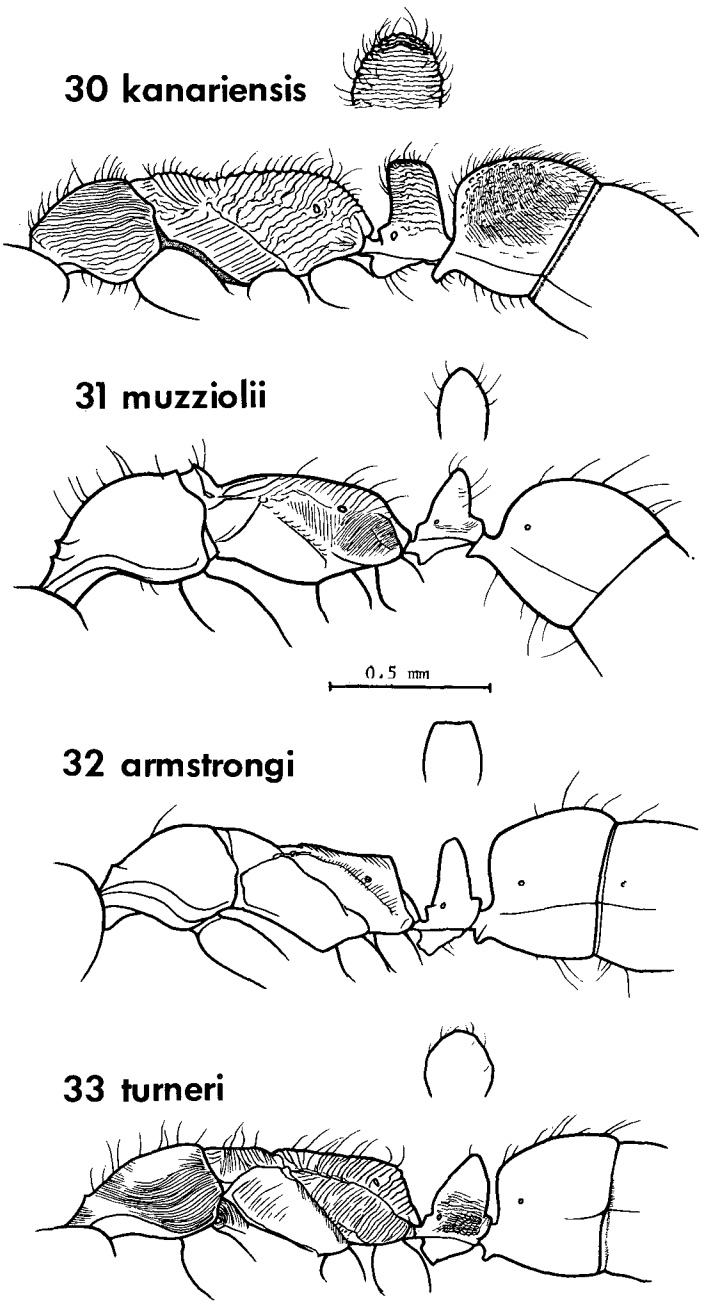

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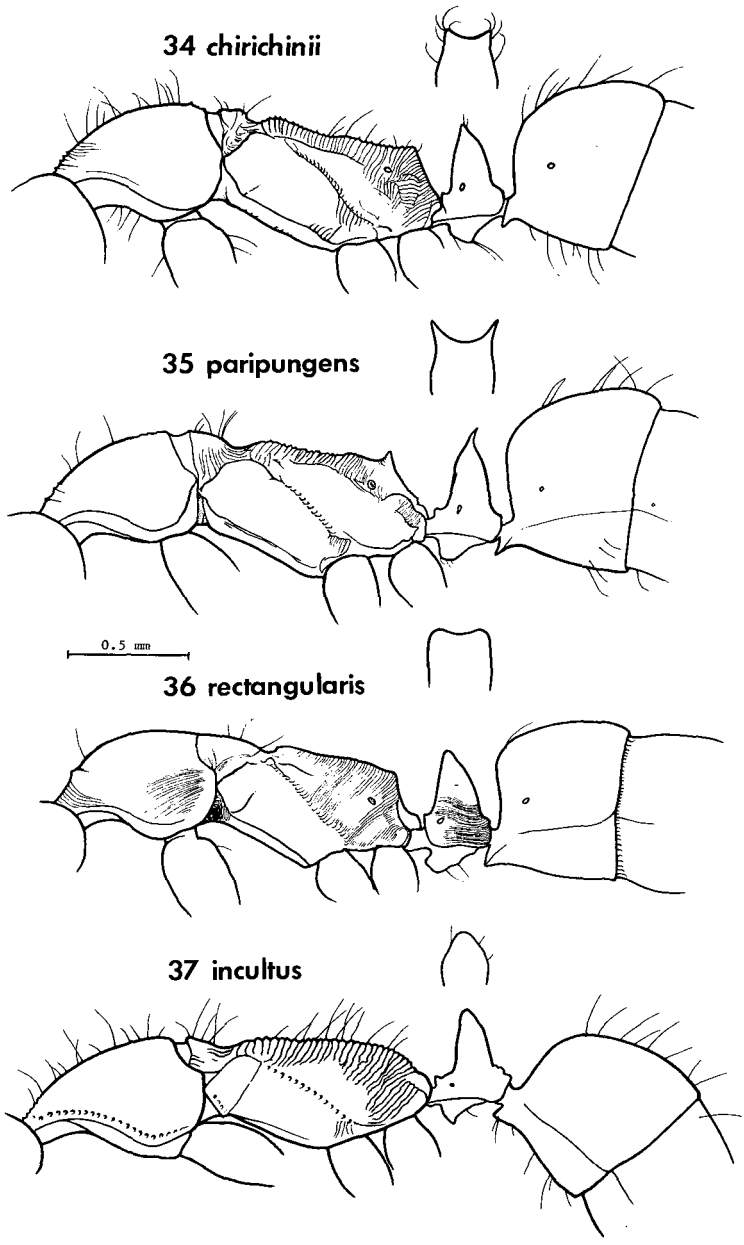

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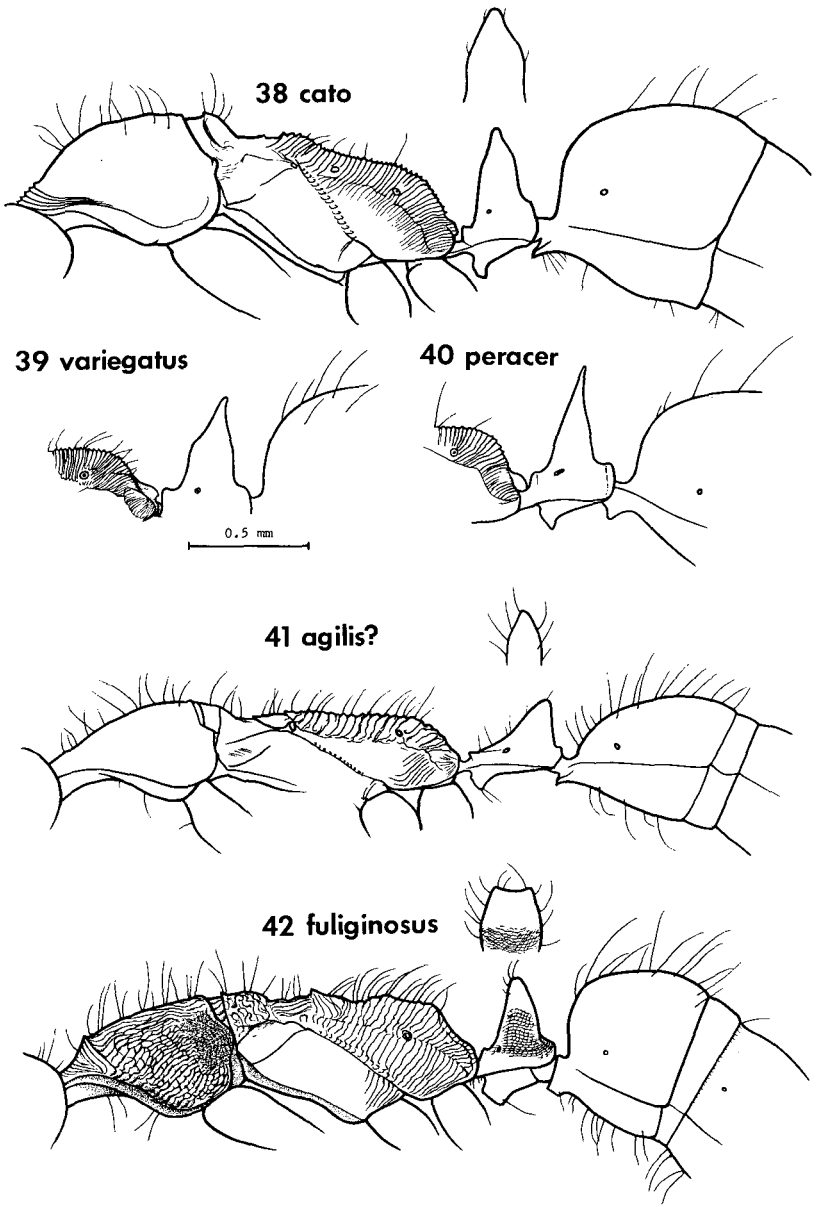

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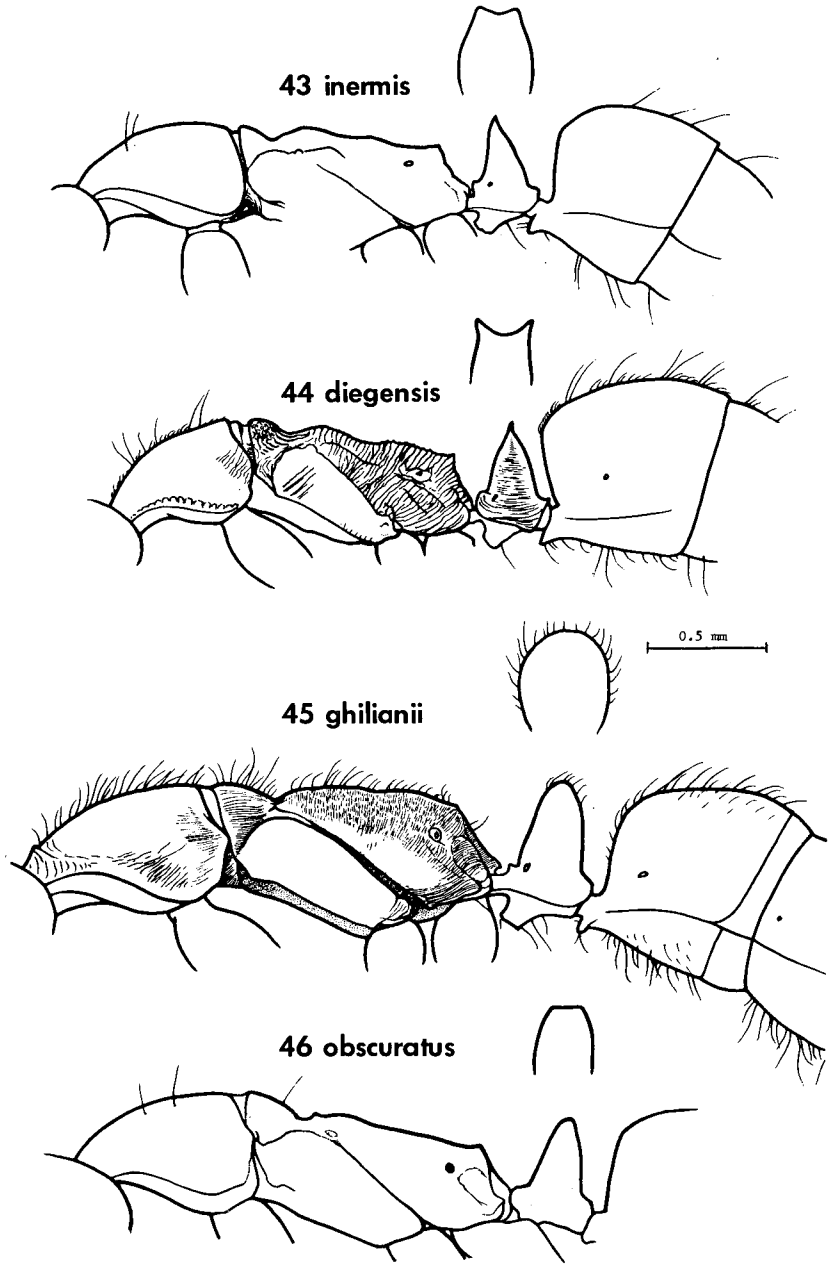

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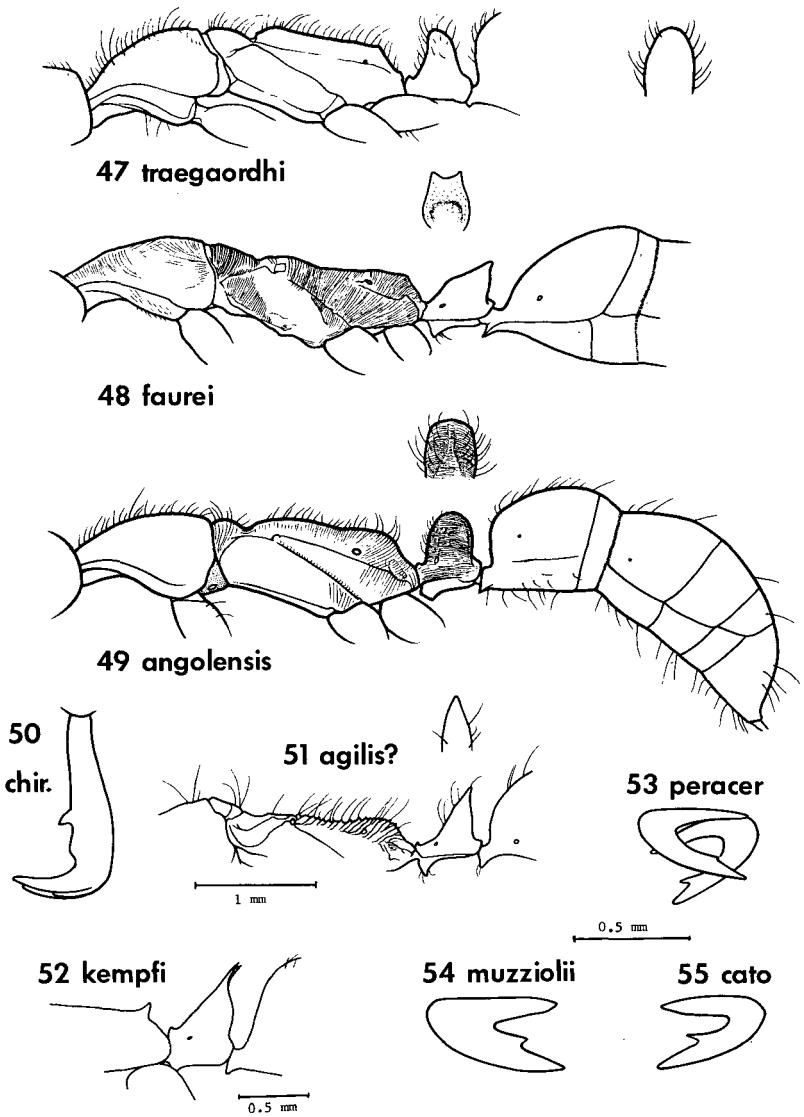

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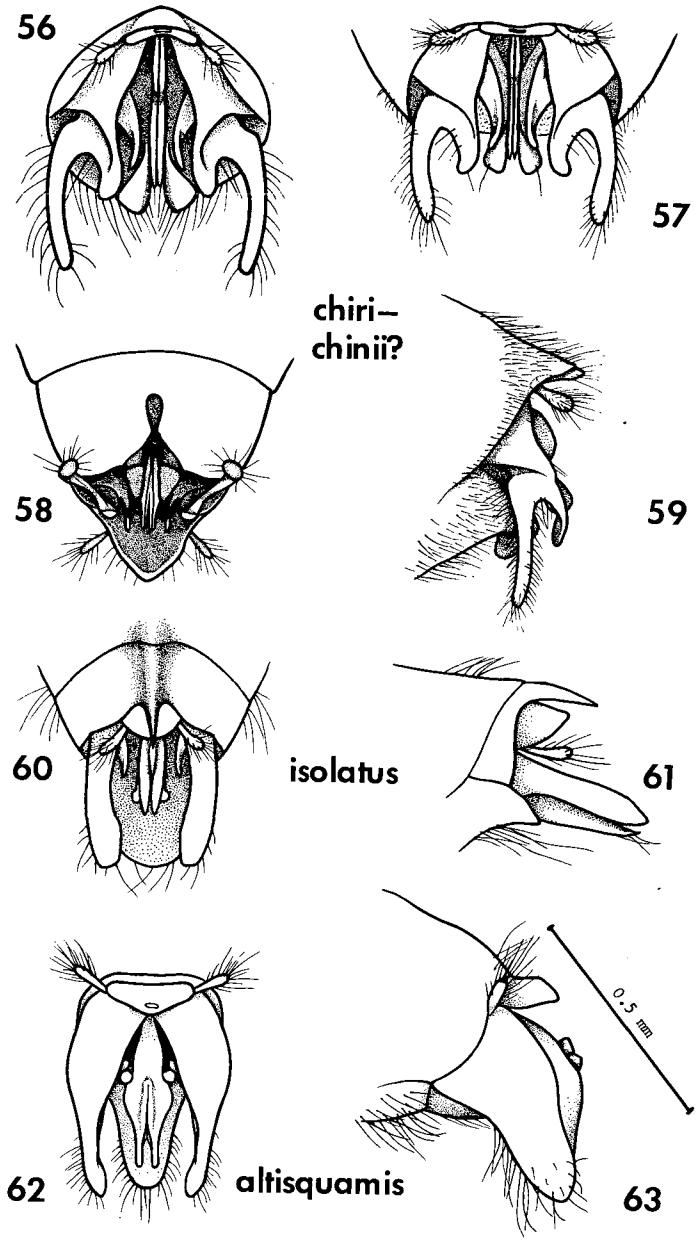

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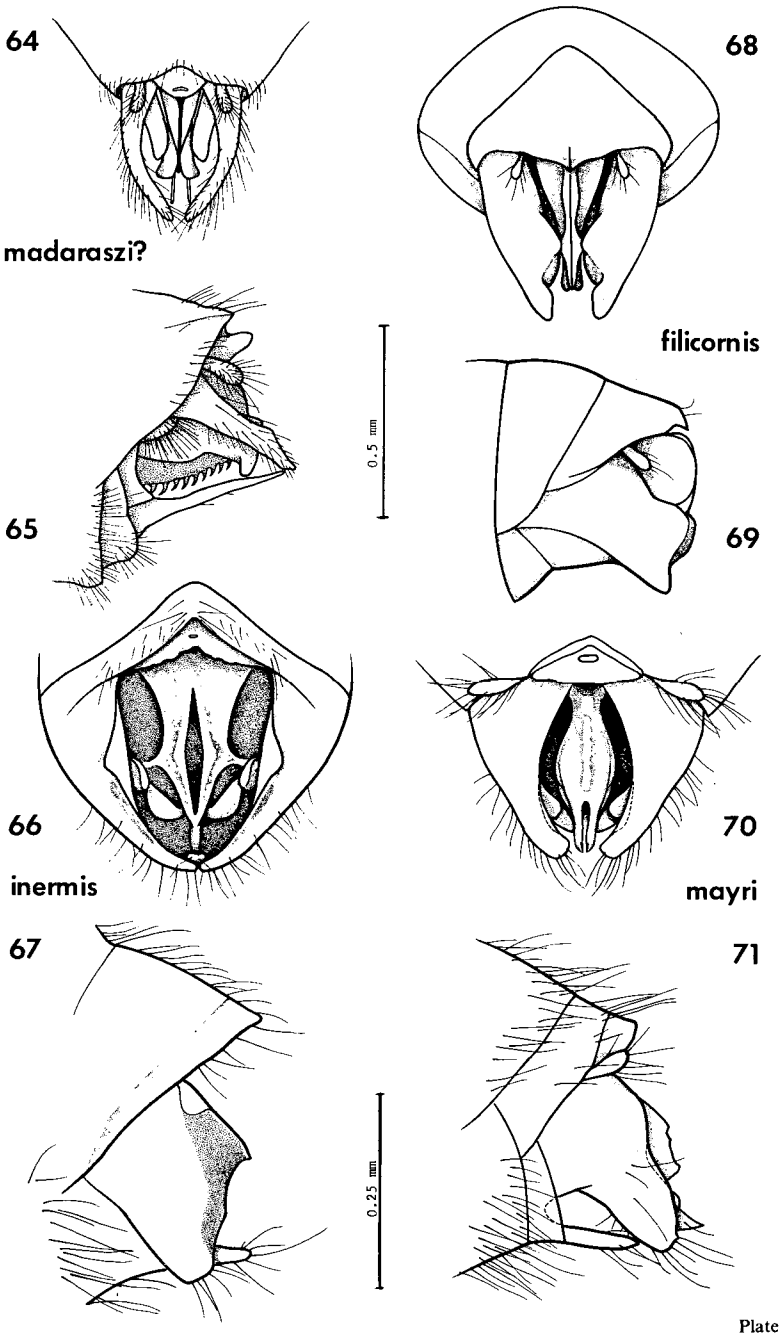

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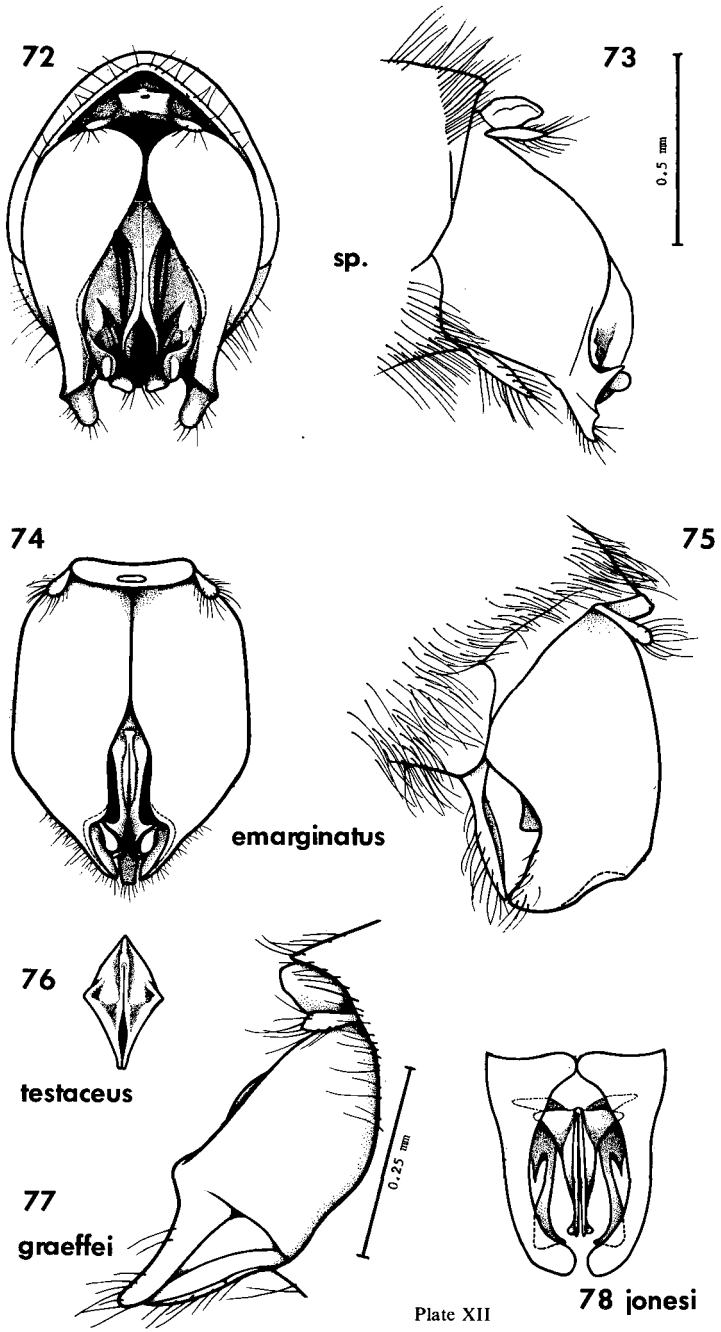

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