REVUE SUISSE DE ZOOLOGIE

ANNALES

de la
SOCIÉTÉ SUISSE DE ZOOLOGIE
et du
MUSÉUM D'HISTOIRE NATURELLE
de la Ville de Genève

tome 102
fascicule 3
1995

GENÈVE SEPTEMBRE 1995 ISSN 0035 - 418X

REVUE SUISSE DE ZOOLOGIE

TOME 102 — FASCICULE 3

Publication subventionnée par l'Académie suisse des Sciences naturelles
et la Société suisse de Zoologie

La préférence sera donnée aux travaux concernant les domaines suivants: Biogéographie, systématique, écologie, éthologie, morphologie, et anatomie comparée, physiologie.

Administration

MUSÉUM D'HISTOIRE NATURELLE
1211 GENÈVE 6

PRIX DE L'ABONNEMENT:

SUISSE Fr. 225.— UNION POSTALE Fr. 230.—
(en francs suisses)

Les demandes d'abonnement doivent être adressées
à la rédaction de la *Revue suisse de Zoologie*,
Muséum d'histoire naturelle, C.P. 6434, CH-1211 Genève 6, Suisse

REVUE SUISSE DE ZOOLOGIE

ANNALES

de la
SOCIÉTÉ SUISSE DE ZOOLOGIE
et du
MUSÉUM D'HISTOIRE NATURELLE
de la Ville de Genève

tome 102
fascicule 3
1995

GENÈVE SEPTEMBRE 1995 ISSN 0035 - 418X

REVUE SUISSE DE ZOOLOGIE

TOME 102 — FASCICULE 3

Publication subventionnée par l'Académie suisse des Sciences naturelles
et la Société suisse de Zoologie

La préférence sera donnée aux travaux concernant les domaines suivants: Biogéographie, systématique, écologie, éthologie, morphologie, et anatomie comparée, physiologie.

Administration

MUSÉUM D'HISTOIRE NATURELLE
1211 GENÈVE 6

PRIX DE L'ABONNEMENT:

SUISSE Fr. 225.—

UNION POSTALE Fr. 230.—
(en francs suisses)

Les demandes d'abonnement doivent être adressées
à la rédaction de la *Revue suisse de Zoologie*,
Muséum d'histoire naturelle, C.P. 6434, CH-1211 Genève 6, Suisse

REVUE SUISSE DE ZOOLOGIE, 102 (3) : 539-552; septembre 1995

Oriental species of the genus *Biroina* Richards (Diptera: Sphaeroceridae)

László PAPP
Department of Zoology, Hungarian Natural History Museum,
Baross u. 13, Budapest, H-1088 Hungary.

Oriental species of the genus *Biroina* Richards (Diptera: Sphaeroceridae). - *Biroina burckhardti* sp. n. (Thailand), *B. orientalis* sp. n. (Pakistan, India, Nepal) and *B. topali* sp. n. (India) are described. The genus Biroina is reported from the Oriental Region for the first time. Synapomorphies (especially those of the male genitalia) for the species are summarized and the new species are compared with the type-species *B. myrmecophila* (Knab & Malloch, 1912).

Key-words: Diptera - Sphaeroceridae - *Biroina* - Taxonomy - Oriental region.

INTRODUCTION

DUDA (1925) described *Biroella* as a monotypic subgenus of *Leptocera* based on *Limosina myrmecophila* Knab & Malloch, from New South Wales. That name is homonymous, so RICHARDS (1973) gave a new name for *Biroella* Duda, and described 13 new species from Australia and one from New Zealand. MARSHALL (1989) elevated its rank to genus and listed all the 15 species, although the generic attribution of some of them is questionable (Marshall, pers. comm.). The species presently placed in Biroina would need a revision. In the course of our studies on sphaerocerid flies, three species of Biroina were found also in the Oriental Region (see ROHÁČEK & PAPP 1988). Below these three species are described with a re-description of the type-species, *B. myrmecophila*. It is hoped that the present paper could be regarded as a preparatory step for a revision of the genus Biroina.

The morphological terminology of ROHÁČEK & PAPP (1988) is followed here.

The types and other material are deposited in two museums: MHNG — Muséum d'histoire naturelle Genève (Switzerland); HNHM — Hungarian Natural History Museum, Budapest (Hungary).

Manuscript accepted 07.10.1994.

TAXONOMY

Biroina Richards, 1973

Biroella Duda, 1925: 74; type-species: *Limosina myrmecophila* Knab & Malloch, 1912 (by monotypy).

Biroina Richards, 1973: 330, new name for *Biroella* Duda, 1925, a junior homonym of *Biroella* Bolivar, 1903, as a subgenus of Leptocera Olivier, 1813. Type-species: *Limosina myrmecophila* Knab & Malloch, 1912.

Biroina Richards: Marshall, 1989: 602, as genus.

Based on the findings published below, the genus *Biroina* is defined as follows (possible synapomorphies are indicated by an asterisk, characteristics as given by Roháček (1982) and Roháček & Papp (1988): (1) *pvt* small or indistinct but *occe* and *occi* rather long; (2) 2 *ors*; (3) (3)-4-5 *ifr*; (4) frons with or without dark M-shaped mark; (5) 1-2 *dc*, if 2, anterior always short; (6) 8-12 tows of *ac* microsetae; (7) 1 katepisternal; (8) scutellum flat, semicircular or even broader; (9) male fore and hind femora not much thickened; (10)* t_2 chaetotaxy (dorsal side) characterized by 2 pairs of proximal bristles (though upper proximal *ad* more proximal than its *pd* pair in some species) and 3 very long distal bristles; ventral side without mid ventral seta; (11) wing with *C* not extending beyond apex of R_{4+5}; (12) R_{2+3} strongly sinuate; (13) discal cell short and broad, usually with extensions of M_{1+2} and M_{3+4}, one of them or both approximate wing margin in some species; (14) alula small and narrow; (15) preabdomen with large, heavily sclerotized terga, preabdominal sternites rather large and well sclerotized; (16) male sternite 5 without additional structures; (17) posteromedial part of sternite 5 less sclerotized with short setae; (18) epandrium (periandrium) mostly semiglobular; (19)* hypandrium without robust bifurcate ventral appendage but with a slipper-shaped cranioventral process, its ventral surface with or without small teeth; (19)* hypandrium with a caudally directed apodeme (Figs 20, 29, cf. Fig. 61 of Roháček & Papp 1988, Fig. 32 of Papp 1991); (20) male subanal plate distinct; (20a)* epandrium lateroventrally usually with a pair of lamelliform processes (Figs 22, 26), which are not fused with subanal plate, i.e. its derivation from subanal plate is questionable; (21) surstylus (gonostylus) bilobed, lateral lobe with numerous long to extremely long setae, medial lobe various; (22)* phallophore long digitiform or very long; (23) distiphallus complex with dorsal appendages; (24) postgonite of various shape but always simple; (25) ejaculatory apodeme well developed; (26)* female postabdomen fully telescopized and hidden in segment 5 when at rest; (27) female *T*6 and *T*7 divided into two, also *S*6 and *S*7 weakly sclerotized though they may be broad (e.g. in *orientalis*); (28)* female tergite 8 divided into 4 long narrow sclerites; (29) tergite 10 very short; (30) female sternite 8 narrow and weakly sclerotized; (31) sternite 10 small; (32) spectacles-shaped sclerites weakly sclerotized; (33) accessory glands not studied now; (34) spermathecae pear-shaped or spherical; (35) female cerci with or without sinuate hairs.

Roháček's (1982, 1983) revision of the limosinine genera, though its was not aimed at a complete revision of the World fauna, gave enough basis also for those genera not considered there to have them judged for their generic identity. Based on the synapomorphies hitherto considered, I think, *Biroina* deserves a generic rank indeed.

Remark. The genus *Apterobiroina* L. Papp, 1979 is not related to the genus *Biroina* as originally stated by PAPP (1979) but possibly to *Minilimosina* Roháček, 1983 (this will be discussed in a future paper).

Biroina burckhardti sp. n.

Holotype ♂ (MHNG): Thailande, Chang Mai, Doi Suthep, 1400 m, 5.XI.1985, D. Burckhardt - I. Löbl (No. 11).

Measurements in mm: body length 2.79, wing length 2.05, wing width 0.90.

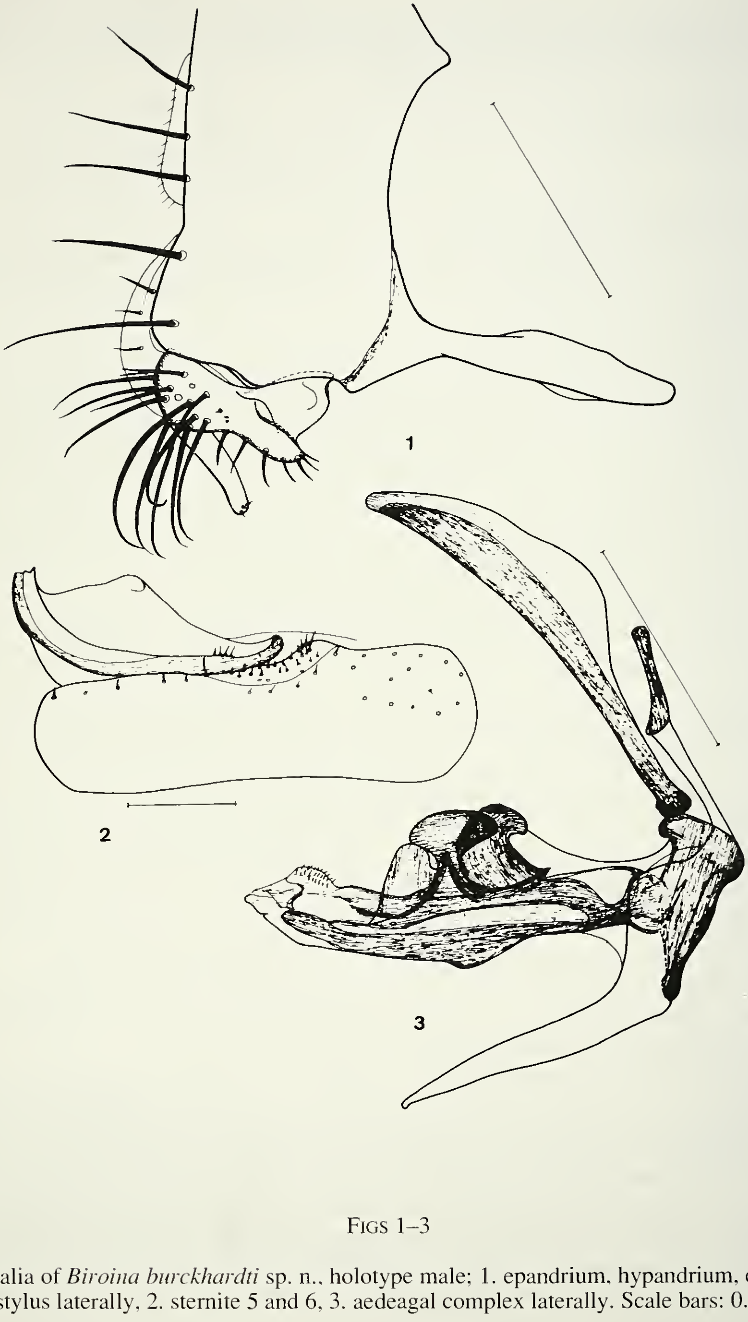
Body dark greyish brown, mesonotum subshining, pleura with thick grey microtomentum.

Frons light brown, face, genae and occiput light reddish brown. M-shaped mark, including orbits (fronto-orbital plates), interfrontalia, ocellar triangle and the sagittal line of frontal vitta silvery. Frontal lunule small, triangular, gena below eye at narrowest 0.175 mm and strongly widening posteriorad. Cephalic chaetotaxy: *pvt* minute and divergent; 2 *ors* but anterior one reduced to a short thin hair (1/4 length of posterior *ors*); ocellars large; 4 pairs of short and thin *ifr*. Eyes mangoe-shaped. Antennae large, antennal length 0.29 mm, pedicel reddish brown, flagellomere conical, light dirty red. Arista 0.725 mm with short cilia.

Thoracic chaetotaxy: 1 *h*, 2 superposed *np*, 2 very long *sa*, 1 *pa*. Two *dc* pairs but anterior one less than half length of the posterior one. Femora light, reddish, apices brown, tibiae dark brown, basitarsus and 2nd tarsomere of fore tarsi brown, tarsomeres 3-5 white; mid and hind tarsomeres dirty yellow. t_2 chaetotaxy: two short anterals at 23/38 and 28/38; *ad-s*: very short at 7/38, short at 9/38, long at 15/38, very long at 31/38 of tibia; *pd-s*: medium long at 9/38, long at 18/38, very long at 30/38 of tibia. Wings light browb, veins dark brown. R_1 extremely short and thick, upcurving to costa at the level of the tip of alula, R_{4+5} upcurving to costa on a wide arc, R_{2+3} very short and sinuate, approximates costa at its middle, distance in its apical third to C is little more than the diameter of C. mg_2/mg_3 0.34 mm to 0.775 mm (wing curved, i.e. not precisely measurable). M_{1+2} and M_{3+4} short, dark brown, former one parallel to R_{4+5}. t_a-t_p 0.207 mm, t_p 0.138 mm (i.e. ratio 1.50). Halteres waxy white.

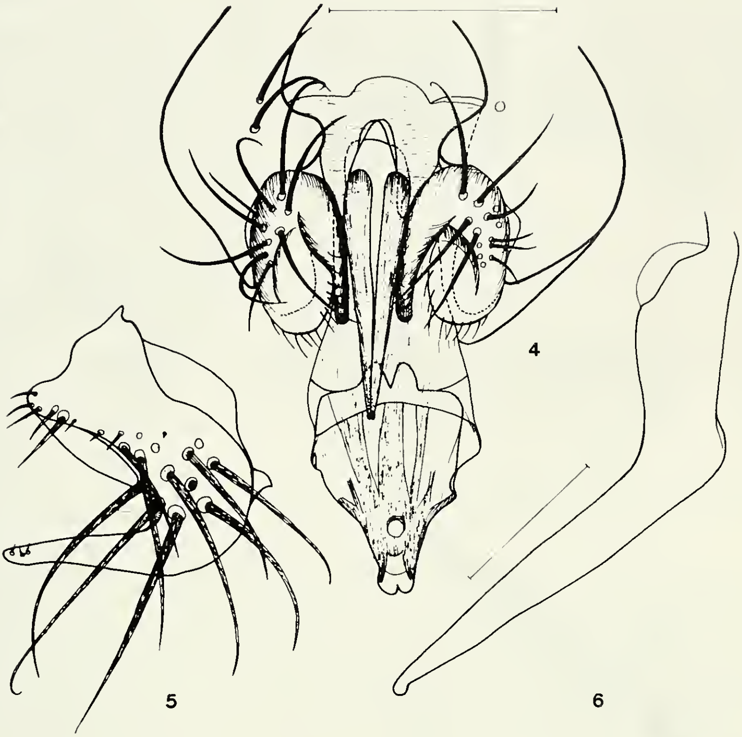
Preabdomen dull black, tergites with medium long and not thick discal and marginal bristles. Syntergite 1+2 nearly as long as tergite 3 and 4 combined. Male sternite 5 short, posteromedially with acute short setae (Fig. 2).

Genitalia: periandrium rather high (Fig. 1), slightly asymmetrical. Subanal plate is an intricate structure: its main part is a pair of wide caudal plates (Fig. 4) enlarged ventrally to the base of medial lobe of surstylus. Medial lobe of surstylus (Figs 4, 5) long, digitiform with minute setae only, lateral lobe with several extremely long setae. Aedeagal complex with comparatively short digitiform phallophore (Fig. 3). Postgonite (Figs 3, 6) geniculate, its basal part much shorter than its apical part. Ejaculatory apodeme distinct though small. Hypandrium strongly asymmetrical, its medial anterior part wide and well sclerotized.



Figs 1–3

Terminalia of *Biroina burckhardti* sp. n., holotype male; 1. epandrium, hypandrium, cercus and surstylus laterally, 2. sternite 5 and 6, 3. aedeagal complex laterally. Scale bars: 0.2 mm.



FIGS 4–6

Terminalia of *Biroina burckhardti* sp. n., holotype male; 4. genitalia in subventral (subcaudal) view, 5. surstylus laterally, 6. postgonite laterally. Scale bars: 0.1 mm, 0.2 mm (Fig. 4).

Female unknown.

Biroina burckhardti sp. n. may be readily distinguished from the other Oriental species of the genus (see key); it is not closely related to the other two species.

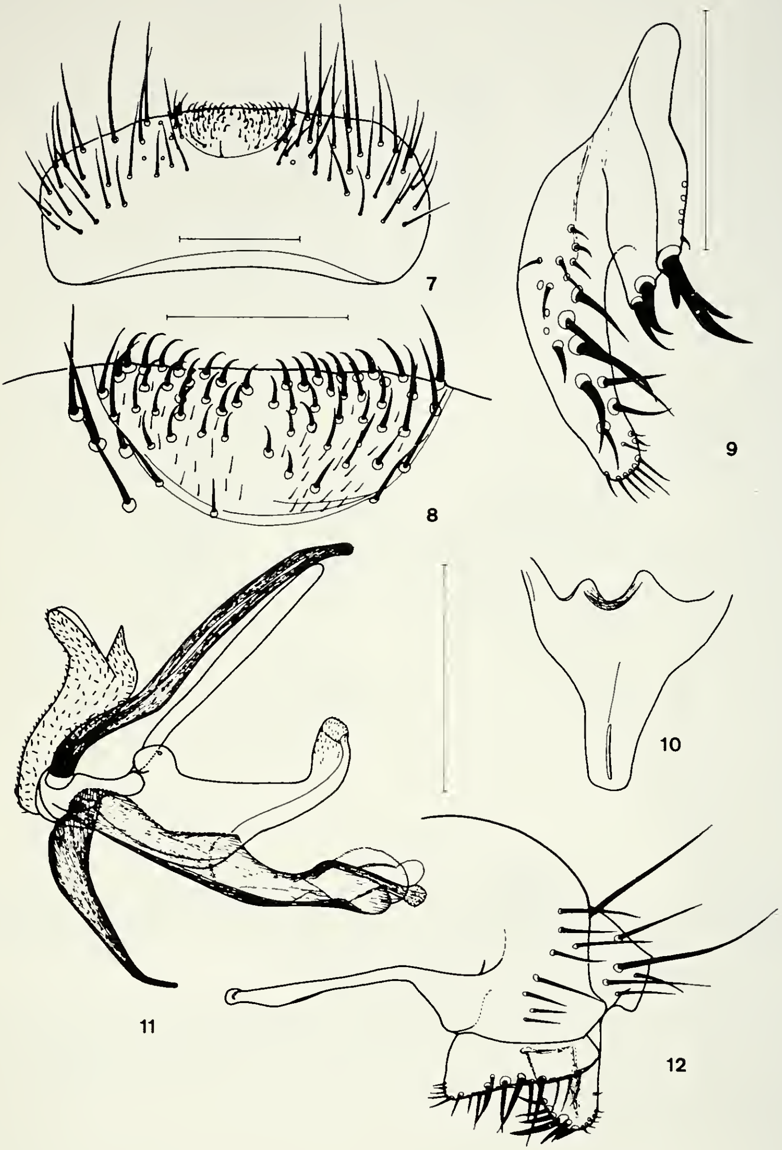
Etymology. This species is dedicated to Dr. Daniel Burckhardt (MHNG), one of the collectors of the holotype.

Biroina myrmecophila (Knab & Malloch)

Limosina myrmecophila KNAB & MALLOCH, 1912: 236.

Material studied: 1 ♂ 5 ♀ (HNHM): Australia Biró 1900. — N.S. Wales, Mt. Victoria (on the reverse side: "XI/12/") — "Biroella ♂♀: myrmecophila" Det. Dr. O. Duda.

Measurements in mm: body length 2.50–3.30, wing length 2.17–2.71, wing width 1.09–1.31.



Figs 7–12

Male terminalia of *Biroina myrmecophila* (Knab & Malloch); 7. male sternite 5, 8. posteromedial part of sternite 5 in higher magnification, 9. surstylus in ventral view, 10. main (medial) part of hypandrium, 11. aedeagal complex with a part of the subanal plate, 12. epandrium, cercus and surstylus laterally. Scale bars: 0.1 mm (Figs 8, 9), 0.2 mm (Figs 7, 10–12).

Body dark brown subshining.

Frons, face and genae reddish brown, frons without M-shaped mark. Frontal lunule subtriangular, gena as broad as width of eye, with very strong genal bristle below eye. Cephalic chaetotaxy: *pvt* minute but *occe* and *occi* very long; 1 short anterior and 3 very long pairs of *ifr*. Eyes small. Antennae reddish yellow, pedicel with extremely long btistles, flagellomere fuscous apically. Arista somewhat longer than width of head with very short cilia.

Thorax: mesonotum not granulated but very thinly microtomentose. Two *dc*, anterior one much shorter. Legs dark brown, tarsomeres somewhat lighter. t_2 chaetotaxy: *ad-s*: short at 12/49, long at 19/49, very long at 40/49; *pd-s*: short at 12/49, long at 19/49, very long at 40/49, a very long and thick anteral at 37/49. Wings tesselate with darker diffuse dark spots on lighter basic colour, veins light brown. Proximal section of *C* with very long setae. R_{2+3} much sinuate (strongly S-shaped, see Fig. 28 of RICHARDS 1973). R_{4+5} slightly upcurving. M_{1+2} and M_{3+4} distinct, former one approximates wing margin. ta-tp as long as or even shorter than hind crossvein. Halteres brown.

Male preabdomen with broad ans subshining terga, which bear medium long marginal and lateral setae, also sterna broad. Male sternite 5 posteromedially with rather long inclinate acute bristles (Figs 7, 8).

Male genitalia: Epandrium (periandrium) not high (Fig. 12). Subanal plate heavily sclerotized. Male cerci well-sclerotized with long setae (Fig. 12). Surstylus (gonostylus) with long lateral lobe which bears several long setae (Figs 9, 12), medial lobe very large and wide with numerous medium long but thick setae. Aedeagal complex with phallophore (Fig. 11) very long, proclinate and very thin apically. Postgonite (Fig. 11) rather broad in its basal half, tapering distally, apical part geniculately bent, apex blunt. Ejaculatory apodeme small but distinct.

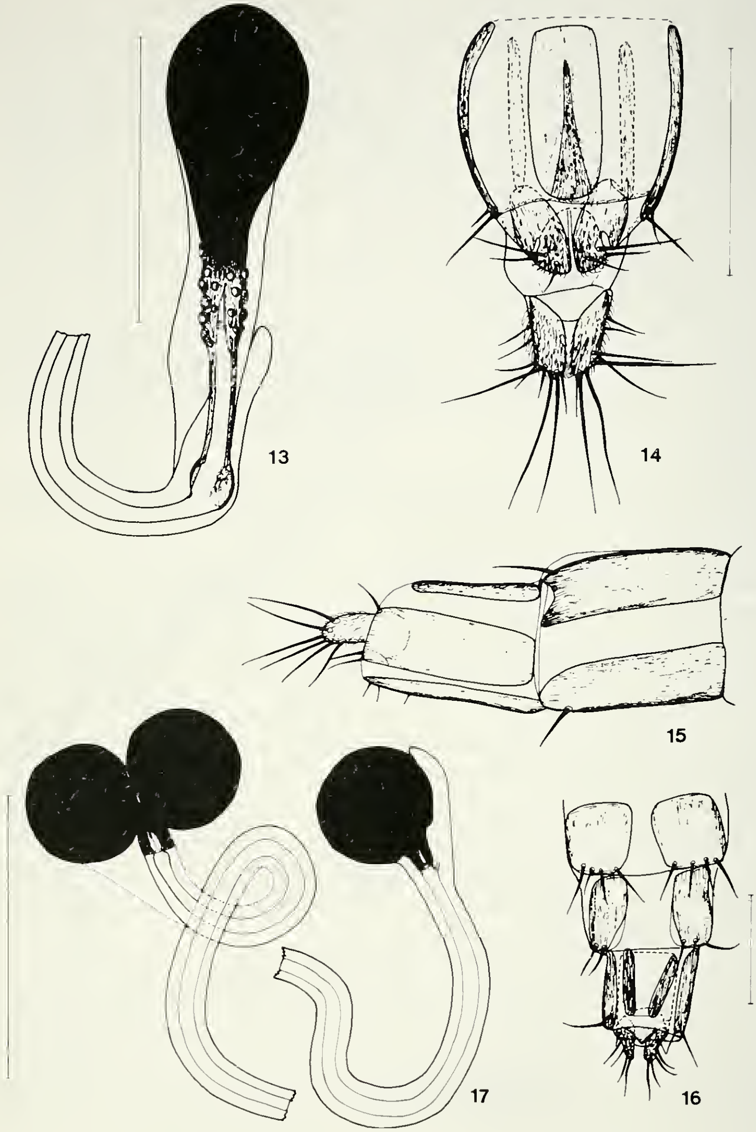
Female preabdomen as in male; postabdomen strongly telescopized. Tergite 8 in 4 parts (Fig. 14), sternite 8 long quadratic, sternite 10 in two parts. Cerci comparatively large (broad) with 3 pairs of very long and several shorter setae. Spermathecae (Fig. 13) pear-shaped, their sclerotized duct long, basally with small round mamillae; sclerotized duct distally with a small swelling.

Biroina myrmecophila (Knab & Malloch, 1912), the type-species of the genus, is markedly different from the three Oriental species (see key below). However, the generic characteristics (synapomorphies) listed above may serve as criteria for relegation to this genus when studying other species known as *Biroina*. RICHARDS (1973) although he did not see the holotype, depicted the same species as I do (cf. his Figs 40, 41); our specimens are from a site not far from the type-locality.

Biroina orientalis sp. n.

Holotype ♂ (MHNG): India, Uttar Pradesh, Kumaon, Chaubattia, 12–13.X.1979, I. Löbl (No. 10).

Paratypes: 4 ♂, 3 ♀ (MHNG, HNHM): same data as for the holotype; 5 ♂, 4 ♀ (MHNG, HNHM, 1 ♂ damaged, left wing lost): ibid., Ramgarh, 2000 m, O. Löbl, 9.X.1979 (No. 6/b.); 1 ♀ (MHNG): India, Uttar Pradesh, Gharwal, Dhanolti, I. Löbl (No. 19): 1 ♂, 1 ♀ (HNHM): India,



FIGS 13–17

Female terminalia of *Biroina* spp. 13–14. *B. myrmecophila* (Knab & Malloch); 13. spermatheca, 14. postabdomen in ventral view. 15–17. *B. orientalis* sp. n., paratype female; 15. postabdomen in lateral view, 16. same, dorsal view, 17. spermathecae. Scale bars: 0.1 mm (Figs 13, 17), 0.2 mm (Figs 14–15, 16).

Uttar Pradesh, Nainital, Sleepy Hollow, ca. 2080 m — sifted and singled from under stones, 4.XII.1989, leg. L. Papp; 1 ♂ (MHNG): Pakistan, Swat, Miandam, C. Besuchet-I. Löbl, 17.V.1983 (No. 15/b.): 1 ♂ (MHNG): ibid., 10.V.1983 (No. 6c.); 1 ♂, 2 ♀ (MHNG): Népal, Bagmati, Malemchi, 2800 m, 14.IV.81, I. Löbl-A. Smetana (No. 24); 1 ♀ (MHNG): Népal, Prov. Bagmati, Tarke Ghyang, 2750 m, 19.IV.81, I. Löbl (No. 32a.); 1 ♀ (MHNG): Népal: Kosi, Induwa Kola, 2100 m, 17.IV.81, I. Löbl-A. Smetana (No. 27); 1 ♂, 2 ♀ (MHNG, 1 ♀ damaged, left wing lost): Népal, Bagmati, Gul Bhanjyang, 2600 m, 6.IV.81, I. Löbl-A. Smetana (No. 9).

Measurements in mm: body length 2.21 (holotype); 1.67–2.58 (paratypes), wing length 1.85 (holotype), 1.50–1.96 (paratypes), wing width 0.88 (holotype), 0.71–0.96 (paratypes).

Body dark brown, mesonotum dull, abdomen subshining dorsally.

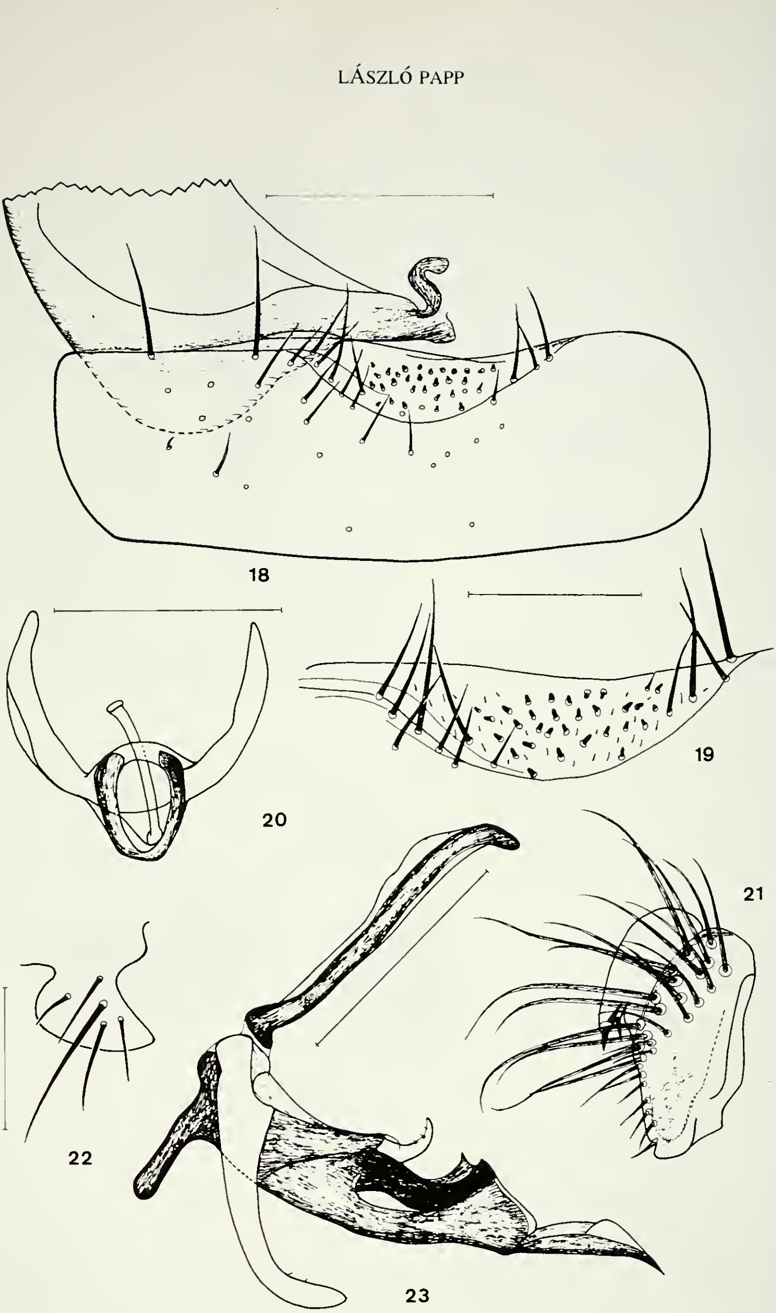
Frons dark reddish brown, orbitalia, vertex, interfrontal stripes and a sagittal line silvery microtomentose, so M-shaped mark well discernible. Frontal lunule subtriangular, light brown, gena bare in its dorsal two-thirds, face shining. Cephalic chaetotaxy: *pvt* small, *occe* and *occi* pairs comparatively long though thin; 2 *ors* close to each other; four pairs of *ifr* bristles; genal bristle less strong than in *myrmecophila*. Eyes not much reduced, gena below eye less broad than width of eye. Antennae long, reddish yellow, pedicel comparatively very long with very long bristles subapically, flagellomere long and pointed dorsoapically. Arista longer than width of head with medium long cilia.

Thorax dark brown with thick grey micromentum on mesonotum. Two *dc*, anterior one only half as long as posterior; 1 strong katepisternal. Legs dark brown but fore tarsomeres 2–5 whitish yellow, mid and hind tarsomeres 2–5 yellow. t_2 chaetotaxy: *ad-s*: short at 1/3, longer at 14/33, strong at 16/33, strong at 29/33 of tibia; *av-s*: short at 7/33, long at 17/33, very strong at 26/33 of tibia. Wings light brown without tesselate pattern, veins brown but not dark. R_{2+3} strongly S-curved but runs close to costal vein in its whole length, R_{4+5} upcurving to C along a wide arc. M_{1+2} and M_{3+4} rather short, not approximating wing margin. ta-tp as long as hind crossvein. Knob of halteres long and brown, stalk waxy yellow.

Male preabdomen dull black, tergites with medium long and not thick discal and marginal bristles. Sternite 1 reduced to a pair of minute round sclerites. Male sternite 5 posteromedially with blunt and somewhat flattened short setae (Fig. 19).

Male genitalia: periandrium only a little higher than long. Subanal plate similar to that of *topali* but lateroventral process of epandrium (Gig. 22) with less broad base. Ventral surface of slipper-shaped ventral process of hypandrium without small teeth (Fig. 20). Surstylus (gonostylus) with lateral lobe with numerous very long setae on its lateral surface but no long bristles in its cranial (apical) 2/5, medial lobe of surstylus (Fig. 21) lobate, with longer setae. Aedeagal complex with long digitiform phallophore. Postgonite (Fig. 23) curved in distal third, its basal part much longer than its apical part. Ejaculatory apodeme bacilliform.

Female preabdomen similar to that of male; postabdomen fully telescopized. Tergites 6 and 7 divided into two, tergite 8 into four (Figs 15, 16), but sternite 6 to 8 not divided; tergite and sternite 10 minute, partly hidden under tergite and sternite 8 (Fig. 15). Cerci short and pale yellow with comparatively short setae. Spermathecae sphaerical, their sclerotized duct short (Fig. 17).



FIGS 18–23

Terminalia of *Biroina orientalis* sp. n., paratype male; 18. sternite 5 with a part of sternite 6, 19. posteroventral part of sternite 5 in a higher magnification, 20. hypandrium in ventral view, 21. surstylus in its widest extension, 22. subanal process in its widest, 23. aedeagal complex laterally. Scale bars: 0.1 mm (Figs 19, 22), 0.2 mm (Figs 18, 20, 21, 23).

Biroina orientalis sp. n. is closely related to B. topali sp. n.; differentiating characteristics are given in the key.

Etymology. Derived from its distribution.

Biroina topali sp. n.

Holotype ♂ (HNHM): India, No. 925, Daitari, Orissa, 600-700 m — erdei avarból [from forest litter], 1967.XI.23, leg. [György] Topál.

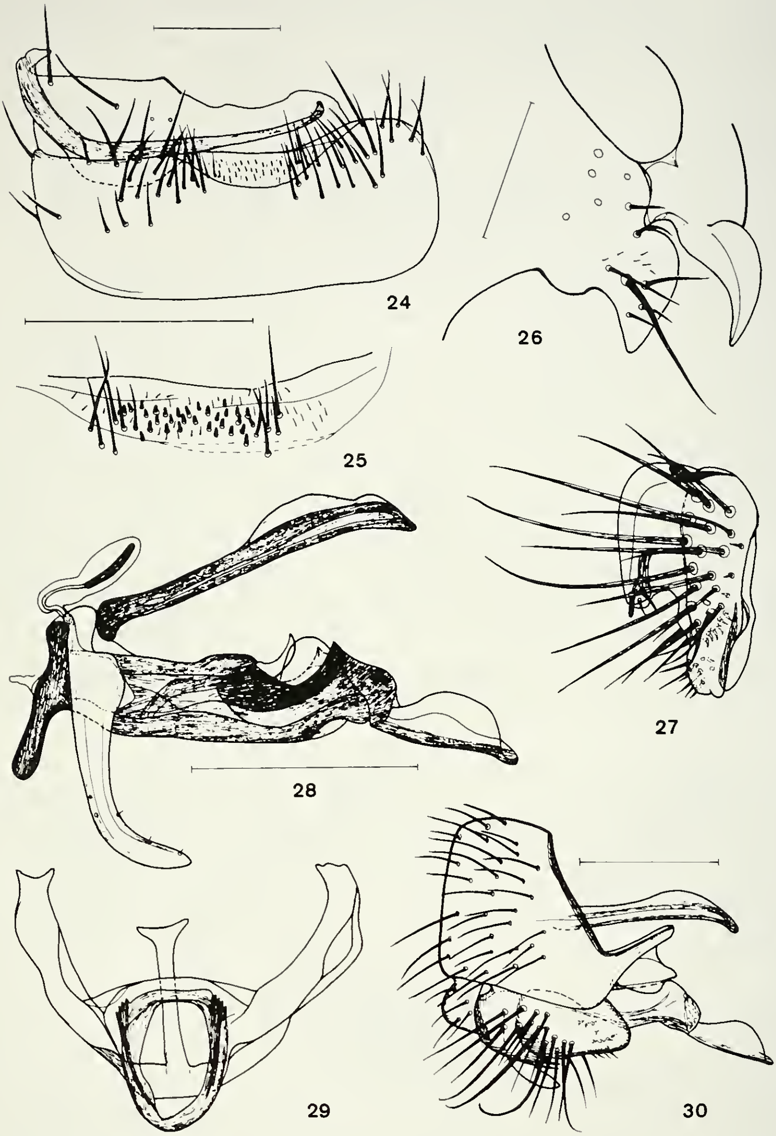
Measurements in mm: body length 2.96, wing length 2.18, wing width 1.05.

Body mainly dark brown, thinly microtomentose, i.e. not shining.

Frons rather flat and as head, very broad, though somewhat longer than wide. M-shaped mark distinct, ocellar triangle, vertex and occiput dark brown, orbits dark only to the base of ors, anterior parts of orbits, interfrontal and sagittal stripes yellowish silvery dusted, other parts of frons light brownish yellow. Frontal lunule triangular. Gena reddish yellow with honey shine, only peristomal area dusted with silvery microtomentum, gena at genal bristle 0.216 mm wide and strongly widening posteriorad. Face bright ochreous. Cephalic chaetotaxy: *pvt* minute, *occe* and *occi* rather long; 2 *ors* close to each other; 5 *ifr* comparatively long but thin, genal bristle long, ca. 3/5 of vibrissa in length, *vte*, *vti* and *oc* strong (ocellars lost but must be strong judged by their bases). Eyes long elliptical, longitudinal axis rather oblique, length/width 0.40/0.26 mm. Antennae light, reddish yellow, only scape brown, the latter with a long ventrally directed thick hair, pedicel with 6 very long and thick setae, flagellomere conical with long silvery cilia. Arista medium long with long hairs.

Thorax: mesonotum flat with numerous (up to 12) rows of small hairs. Two *dc* pairs but anterior pair less than half length of posterior one; only 1 katepisternal (anterior pair reduced to a small hair, which is less than 1/3 in length of the posterior one). Scutellum flat and very broad, nearly semicircular, 0.33 mm long, 0.585 mm wide (scutellars broken off). Legs brown, 3rd to 5th tarsomeres of fore tarsi white (yellowish white), mid and hind tarsi yellow. t_2 chaetotaxy: anterodorsals: two small ones at 7/39 and 9/39, one strong at middle, small at 30/39, one very strong and long at 33/39, 1 medium long dorsally directed and rather anteral one at 30/39; posterodorsals: strong at 8/39, very strong at 28/39, very long and thick at 32/39; no mid ventral but a row of thick and short setae along distal 3/4 of tibia; apicoventral thick but only 0.05 mm long. Wings definitely brown, veins dark brown. R_1 very thick and short, R_{2+3} strongly S-shaped (sinuate), runs close to C from its basal quarter, R_{4+5} upcurving to C along a wide arc. M_{1+2} distinct on a section of 0.38 mm only, i.e. diminishes halfway from t_p to wing margin. M_{3+4} distinct on a section of 0.095 mm only, duscal cell very broad. t_a-t_p only slightly longer (0.190 mm) than t_p (0.155 mm). Halteres rather small, knob ochreous, stalk waxy yellow.

Preabdomen comparatively long and flat without any conspicuous setae. Sternite 5 posteromedially with blunt and somewhat flattened short setae (Fig. 25).



FIGS 24–30

Terminalia of *Biroina topali* sp. n., holotype male; 24. sternite 5 with a part of sternite 6, 25. posteroventral part of sternite 5 in a higher magnification, 26. ventral part of epandrium with left subanal process in its widest, 27. surstylus in its widest extension, 28. aedeagal complex laterally, 29. hypandrium in ventral view, 30. male genitalia laterally. Scale bars: 0.1 mm (Fig. 26), 0.2 mm (Figs 24, 25, 27–29, 30).

Genitalia: epandrium (periandrium) not high (only a little higher than long), ventrocaudal part of epandrium with a pair of subanal processes (Fig. 26), which bear 1 long and several shorter setae. Lateroventral process of epandrium (Fig. 26) with broad base. Ventral surface of slipper-shaped ventral process of hypandrium with small teeth, serrate backwards (Fig. 29), hypandrial apodeme stronger than in *orientalis*. Lateral lobe of surstylus (gonostylus) with very long bristles also in its apical third, medial lobe of surstylus (Fig. 27) lobate, with setae longer than in *burckhardti*. Aedeagal complex with long digitiform phallophore. Postgonite (Fig. 28) curved in distal third (somewhat more curved than in *orientalis*), its basal part much longer than its apical part. Ejaculatory apodeme rather long but thin.

Female unknown.

Biroina topali sp. n. is closely related to *B. orientalis* but the holotype is bigger than any of the *orientalis* specimens measured, it possesses 5 pairs of *ifr* bristles (instead of 4) and it differs in some details of the male genitalia.

Etymology. The species is dedicated to Dr. György Topál (HNHM) in recognition of the invaluable materials collected by him in Argentina, India, Vietnam, etc.

KEY TO THE ORIENTAL SPECIES OF *Biroina*

1 Wings tesselate with darker diffuse dark spots on lighter basic colour. Male cerci well-sclerotized with long setae (Fig. 12) Male phallophore (Fig. 11) very long, proclinate and very thin apically. Postgonite (Fig. 11) rather broad in its basal half. Female spermathecae pearshaped with long sclerotized duct (Fig. 13). . . . . [*myrmecophila* (Knab & Malloch)]

– Wings light brown, veins darker brown. Male cerci weakly sclerotized with short hairs only. Male phallophore shorter, digitiform (e.g. Fig. 23). Postgonites (Figs 3, 23, 28) less broad. Female spermathecae spherical with short duct (Fig. 17; females of *burckhardti* and *topali* unknown). 2

2 Sternite 5 posteromedially with acute short setae (Fig. 2). Medial lobe of surstylus (Figs 4, 5) long, digitiform with minute setae only. Postgonite (Fig. 6) geniculate, its basal part much shorter than its apical part. . . . . *burckhardti* sp. n.

– Male sternite 5 posteromedially with blunt and somewhat flattened short setae (Figs 19, 25). Medial lobe of surstylus (Figs 21, 27) lobate, with longer setae. Postgonite (Figs 23, 28) curved in distal third, its basal part much longer than its apical part. 3

3 Four pairs of *ifr* bristles. Lateral lobe of surstylus with numerous very long setae on its lateral surface but no long bristles in its apical (cranial) 2/5 (Fig. 21). Ventral surface of slipper-shaped ventral process of hypandrium without small teeth (Fig. 20). Smaller (body length 1.67–2.58 mm). . . . . *orientalis* sp. n.

– Five pairs of *ifr* bristles. Lateral lobe of surstylus (gonostylus) with very long bristles also in its apical third (Fig. 27). Ventral surface of slipper-shaped ventral process of hypandrium serrate, i.e. with small teeth (Fig. 29). Bigger (body length 2.96 mm) . . . . *topali* sp. n.

ACKNOWLEDGEMENTS

My most sincere thanks are due to Drs Ivan Löbl and Daniel Burckhardt (MHNG) for the loan of numerous sphaerocerid material from the Oriental Region. Jindřich Roháček, Silesian Museum Opava is gratefully acknowledged for his comments.

REFERENCES

DUDA, O. 1925. Die aussereuropäischen Arten der Gattung Leptocera Olivier = Limosina Macquart (Dipteren) mit Berücksichtigung der europäischen Arten. *Arch. Naturgesch.* A 90(11): 5–215.

KNAB, F. & J.R. MALLOCH. 1912. New Australian Diptera from ants' nests. *Trans. R. Soc. South Austr.* 36: 233–237.

MARSHALL, S.A. 1989. 96. Family Sphaeroceridae. In: Evenhuis, N.L. (ed.): Catalog of the Diptera of the Australasian and Oceanian Regions/ Bishop Museum Press and E.J. Brill, Honolulu, 1155 pp. (pp. 601–607).

PAPP, L. 1979. On apterous and reduced-winged forms of the families Drosophilidae, Ephydridae and Sphaeroceridae (Diptera). *Acta zool. hung.* 25(3–4): 357–374.

PAPP, L. 1991. Oriental Limosininae: new species and records (Diptera, Sphaeroceridae). *Acta zool. hung.* 37(3–4): 225–251.

RICHARDS, O.W. 1973. The Sphaeroceridae (= Borboridae or Cypselidae); Diptera Cyclorrhapha) of the Australian Region. *Austr. J. Zool.*, Suppl. Ser. 22: 297–401.

ROHÁČEK, J. 1982. A monograph and re-classification of the previous genus Limosina Macquart (Diptera, Sphaeroceridae) of Europe. Part I. *Beitr. Ent. 32*: 195–282.

ROHÁČEK, J. 1983. ditto, Part II and III. *Beitr. Ent.* 33: 3–195, 203–255.

ROHÁČEK, J. & L. PAPP. 1988. A review of the genus Paralimosina L. Papp (Diptera, Sphaeroceridae), with descriptions of ten new species. *Annls hist. nat. Mus. natn. hung.* 80: 105–143.

REVUE SUISSE DE ZOOLOGIE, 102 (3) : 553-583; septembre 1995

New and little known taxa of Rhytidochrotinae (Acrididae, Orthoptera) from Costa Rica

C. Hugh F. ROWELL
Zoologisches Institut, Universität Basel,
Rheinsprung 9, CH-4051 Basel, Switzerland.

New and little known taxa of Rhytidochrotinae (Acrididae, Orthoptera) from Costa Rica. - Three new monospecific genera are described from montane areas of Costa Rica. Like the other three known Costa Rican rhytidochrotine genera (*Hylopedetes* Rehn, 1929, *Scirtopaon* Descamps & Rowell, 1984 and *Micropaon* Descamps & Rowell, 1984) they belong to the atympanate and apterous division of the subfamily. All are apparently confined to small geographical areas. *Exerythracris volcanica* n.sp. is a fern eater from the light gaps and edges of montane forest, and resembles in gross morphology the similarly specialised *Hylopedetes*. It is the most northerly representative of the subfamily so far described, extending almost to the Costa Rican/Nicaraguan border. *Brakeracris varablancensis* n.sp. is found in successional areas (landslips, anthropogenically altered habitats) in montane forest; its diet is unknown, but does not apparently include ferns; morphologically it is closest to *Scirtopaon*. *Talamancacris palustris* n.sp. is confined to a few relict subalpine swamps and appears to eat Asteraceae preferentially; it is not obviously closely allied to the other genera. Additionally, new morphological, ecological and biogeographic data are given for the three previously described genera.

Key-words: Orthoptera - Acrididae - Rhytidochrotinae - Costa Rica - Taxonomy.

INTRODUCTION

Last globally reviewed by DESCAMPS & AMÉDÉGNATO (1972b), the group Rhytidochrotinae was elevated to subfamily status by AMÉDÉGNATO (1975). It currently includes 17 genera and 35 species (DESCAMPS & AMÉDÉGNATO 1972b; DESCAMPS & ROWELL 1978; DESCAMPS & ROWELL 1984), to date known only from the northern half of South America and from the southern part of Central America

---

Manuscript accepted 06.11.1994.

(i.e., from Brasil to Costa Rica). The greatest number of genera and species is found in Colombia. With few exceptions (*Paropaon, Piezops, Lathacris, Hylopedetes mirandus*) the Rhytidochrotines are insects of montane forest (roughly 1000 m to 2500 m in altitude) and are patchily distributed. Some genera are behaviourally specialised to eat ferns (ROWELL *et al.* 1984). They are often brilliantly coloured, especially the males, sometimes in unusual shades of red.

The formal morphological characteristics of the subfamily were listed by DESCAMPS & AMÉDÉGNATO (1972b) and AMÉDÉGNATO (1977). All genera but one (*Driphilacris* Descamps & Amédégnato, 1972a) are completely apterous, and about half of them are also atympanate. The pronotum is characteristically short, exposing the entire meso- and metanota, and traversed dorsally by three sulci; the first of these is short with ends curved anteriorly, almost joining a further groove running just behind margin of pronotum, which is obsolete dorsally (*Lathacris* Descamps & Amédégnato, 1972a has only 2 transverse sulci). Males have a "furcula" (a notched and usually toothed posterior margin of the 10th abdominal tergite). Similar pronota and furculae are however seen in several Ommatolampine genera, e.g. *Tamnacris* Descamps & Amédégnato, 1972a. The male genitalia are characteristic and homogenous; the aedeagus is extremely short and completely sheathed, with very reduced inferior sclerites and very short superior ones. The only part of the male genitalia that is at all useful in distinguishing genera is the epiphallus (especially the shape and orientation of the lophi). The ventral ovipositor valves are typically slender distally and along their dorsal edge and lie largely between the dorsal valves. In the Central American genera both lower and upper valves are prominently toothed on their outer edges, though this is denied in previous characterisations of the subfamily. In all the genera I have examined Collins' tooth (COLLINS, 1991) is present on anterior margin of the third antennal segment from distal end.

The first rhytidochrotine genera described from Central America were *Piezops* Hebard, 1923 from southern Panama and *Hylopedetes* Rehn, 1929 from central Costa Rica. *Hylopedetes* originally included three species; DESCAMPS & ROWELL (1978) described 2 additional species, bringing the total to 5. *Scirtopaon* and *Micropaon*, also from Costa Rica, were added by DESCAMPS & ROWELL (1984). The present article describes three new genera from the uplands of Costa Rica, and provides additional morphological drawings and new localities for the previously described genera and species. A new artificial key to the atympanate genera of the Rhytidochrotinae (all the known Costa Rican taxa fall into this category) is provided. For the remaining (tympanate) genera the corresponding section of the key given by DESCAMPS & AMÉDÉGNATO (1972b) remains valid.

MATERIALS AND METHODS

In addition to the new taxa described, I had access while preparing this paper to material of the the following Rhytidochrotine genera: *Galidacris*; *Hylopedetes*; *Micropaon*; *Opaonella*; *Parapiezops*; *Paropaon*; *Piezops*; *Rhytidochrota*; *Scirtopaon*; *Trichopaon*. The other genera are known to me only from the literature.

Dimensions were measured with a graticule eyepiece at a total magnification of X25 (Wild M5 stereomicroscope) in conjunction with a moving stage fitted with a digital micrometer (Mitutoyo) reading to 0.01 mm. Measurements were repeatable to within 0.02 mm. The length of the pronotum was measured in the midline; as the posterior and anterior margins of the pronotum are mostly notched in midline in the Rhytidochrotinae, the measurements are from the bottom of these notches. Overall length is from the most anterior part of the frontal ridge to the posterior end of the subgenital plate (males) or the extremities of the ovipositor valves (females). The size of the rostrum is expressed as the ratio of the two distances illustrated in Fig. 1.

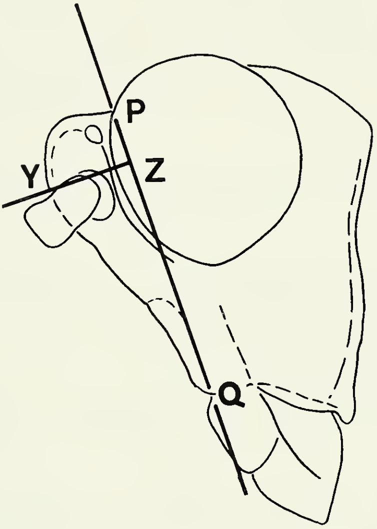


FIG. 1

Derivation of the rostrum index used in the text and Table 4. On a drawing of a side view of the head (here of *Hylopedetes mirandus*) a line is drawn from P, the junction of the outline of the compound eye and the upper surface of the fastigium, to Q, the notch of the frontoclypeal suture. A further line YZ is then drawn normal to PQ, passing through the furthest extremity of the rostrum, Y. The rostrum index is the ratio YZ / PQ.

Drawings of the male internal genitalia were made with a drawing tube fitted to a Leitz compound microscope, and of other parts via tracings from projected colour transparencies photographed with a Wild Photomacroscope.

Abbreviations of museums: ANSP, Academy of Natural Sciences, Philadelphia; INBio, Instituto Nacional de Biodiversidad, Santo Domingo de Heredia, Costa Rica; MNHNP, Muséum National d'Histoire Naturelle, Paris; RC, the author's collection, University of Basel.

KEY TO THE ATYMPANATE GENERA OF THE RHYTIDOCHROTINAE (Males only)

1 6 external spines on hind tibia (S. America). .... *Lathacris* Descamps & Amédégnato, 1972a

– 7 external spines on hind tibia. 2

2 Supraanal plate without black spots. 3

– Supraanal plate with black spots. 8

3 Interocular space more than 3X wider than frontal ridge (S. America). .... *Muyscacris* Hebard, 1923

– Interocular space less than 3X wider than frontal ridge. 4

4 Medial carina of pronotum at least partially present. 5

– Medial carina of pronotum absent. 6

5 Medial carina thin but entire, cut by sulci (Fig. 9B). .... *Scirtopaon* Descamps & Rowell, 1984

– Medial carina of pronotum present only in front of 1st sulcus and behind 3rd sulcus (Fig. 4C). .... *Brakeracris* n. gen.

6 Dorsal apical spine of hind knee longer than outer knee lobe (Fig. 6G). Paired tufts of sparse white hairs dorsolaterally on abdominal and thoracic segments. .... *Talamancacris* n. gen.

– Dorsal apical spine of hind knee equal to or shorter than outer knee lobe. ... 7

7 Meso- and metanota smooth, "epaulettes" (see p. 7) obsolete, anterior pronotal sulcus shallow (Figs. 8A & B); knee spine much shorter than outer knee lobe (Fig. 8D). .... *Hylopedetes* Rehn, 1929

– Meso- and metanota heavily pitted, "epaulettes" present, anterior pronotal sulcus deep and well marked (Figs. 2B & C). Dorsal apical spine of hind knee as long as outer lobe (Fig. 2G). .... *Exerythracris* n. gen.

8 Frontal ridge extends to clypeus. Face flat. Medial carina of pronotum present, cut by only 2 sulci. Supraanal plate with 2 black spots (S. America). .... *Lathacris* Descamps & Amédégnato, 1972a

– Frontal ridge absent below medial ocellus. Face concave. Medial carina of pronotum absent or very indistinct. 9

9 Supranal plate with 2 black spots. Points of furcula long and sharp (S. America). .... *Paropaon* Hebard, 1923

– Supranal plate with 1 medial black spot. Points of furcula short and blunt. Posterior margins of meso- and metanota thickened and raised in midline. .... *Micropaon* Descamps & Rowell, 1984

DESCRIPTIONS OF NEW TAXA

Exerythracris n. gen.

Type species: *Exerythracris volcanica* n. sp.

Male. (Figs. 2 & 3). Size small-medium (10mm<body length<20 mm). General form cylindrical, slender, long legged. Integument polished; dorsal surfaces of thorax, occiput, hind femora, and to a lesser extent of abdomen, heavily pitted.

Fastigium steeply inclined forwards, tapering, bearing a pair of low longitudinal ridges proximally, distally shallowly grooved medially, the groove not reaching the anterior margin of the fastigium (Fig. 2B, D). Frontal ridge narrow, not wider than interocular space, narrow at top and bottom, slightly wider opposite the upper margin of the antennal foramen, ending and diverging slightly above the very small medial ocellus (Fig. 2E). Profile of frons markedly concave, the frontal ridge forming a rounded rostrum, index 0.33 (Fig. 2B). Subantennal sutures thin and rather indistinct, the ventral sutures short and projecting laterally; ventral margin of frons at frontoclypeal suture distinctly concave (Fig. 2E). Preocular ridges of frons present. Eyes large and globose; interocular space narrow, 0.6 - 0.8X as wide as greatest width of antennal scape. Antennae long, filiform, slender, round in cross section, 17 segments in flagellum of adult, end of terminal segment obliquely pointed.

Prothorax (Fig. 2B,C) without medial carina. Transverse sulci deep. Dorsolateral area between 2nd and 3rd sulci inflated into a prominent bulge, bearing a matte-surfaced oval depression (this structure is characteristic of many rhytidochrotine genera, and is here referred to as an "epaulette" - see also the description of *Loepacris*, DESCAMPS & AMÉDÉGNATO 1972b: 1068 & their Fig. 20). Posterior ventral angle of lateral lobe of pronotum rounded, posterior margin above the ventral angle straight. Anterior ventral angle of lateral lobe of pronotum obtusely rounded. Both anterior and posterior margins of pronotum slightly notched in midline. Prosternal process short, abruptly conical, vertical or slightly angled forwards. Apterous. Posterior margins of meso- and metanotum somewhat raised, giving a saw-tooth dorsal profile to thorax in lateral view.

Hind femora very long (4.3X as long as pronotum) and slender; outer face of femur rounded. Dorsal carina of femur terminating in a short spine, which equals but does not not exceed the external upper lobe of the knee (Fig. 2G). Seven non-terminal spines on the dorsal external margin of hind tibia, 8 on the dorsal internal. Hind tarsi long, 0.34X as long as hind femur and 1.45X as long as pronotum. Third tarsal segment 1.5X as long as the first and second segments together. Claws long and widely separated.

Tympanum absent. Posterior margin of 10th abdominal tergite with a central notch and short lateral sclerotised teeth (Fig. 2F). Supraanal plate triangular, without sclerotised melanic markings, slightly rounded at apex and with a slight medial furrow at its base (Fig. 2F). Cerci short, conical, simple. Subgenital plate smoothly rounded, in dorsal view terminating in a short medial furrow. Internal genitalia (Fig. 3) of the type typical for the subfamily.

Female. Size, medium (20mm<body length<30 mm), 1.3-1.4X as long as the male. Differs from male as follows:

Integument less polished, more extensively pitted than in male. Interocular space slightly wider than in male, 0.9X as wide as antennal pedicel. Antennae slightly flattened dorsoventrally and relatively shorter than in male (3.1X pronotum).

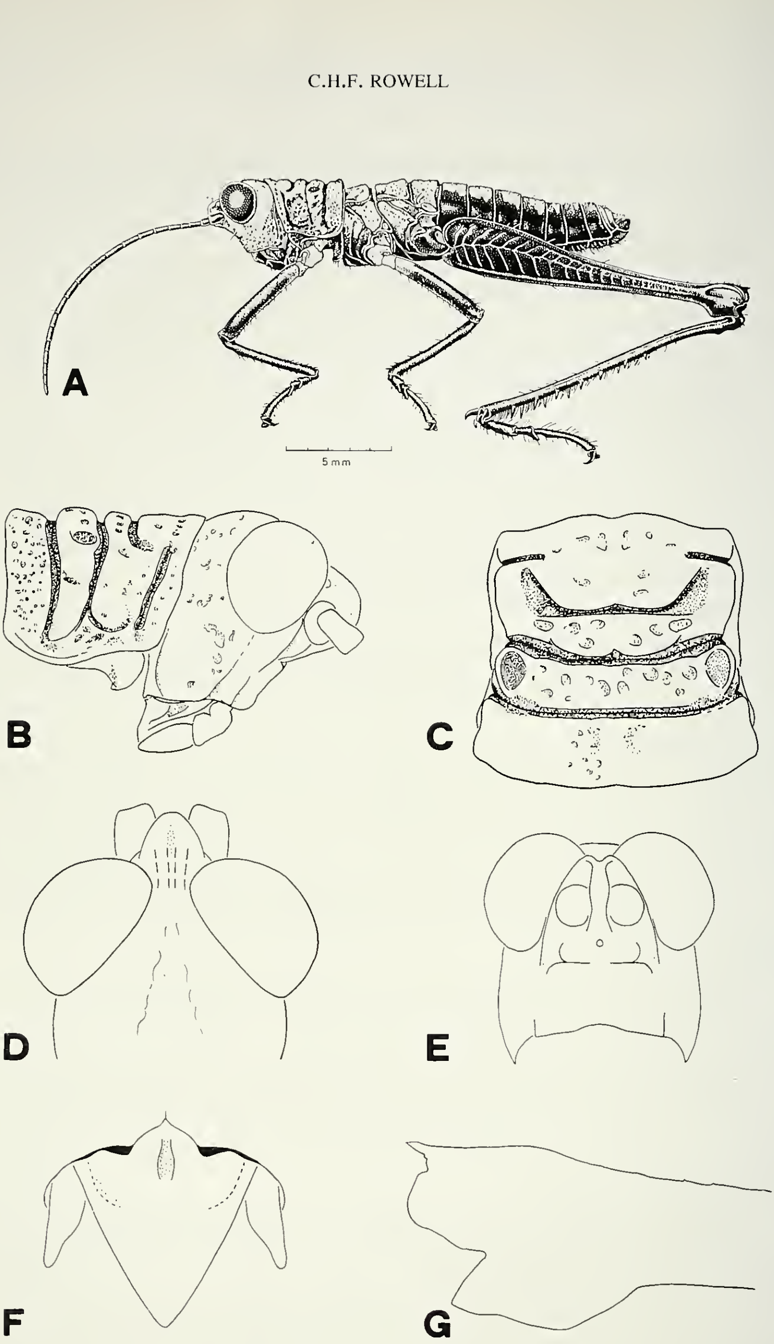


FIG. 2

Exerythracris volcanica n.sp. Male. A. Lateral view of entire insect. B. Lateral view of head and pronotum. C. Dorsal view of pronotum. D. Dorsal view of head. E. Frontal view of face. F. Dorsal view of furcula, supraanal plate and cerci. G. Lateral view of hind knee.

Fusiform in shape, posterior margin of pronotum, meso and metathorax, and the anterior segments of abdomen being relatively wider than in male. Pronotum with the merest suggestion of a median carina, defined more by local absence of pitting than by a raised ridge. Hind tarsus and femur relatively shorter than in male, the femur 3.9X as long as pronotum. Third segment of hind tarsus 1.4X length of 1st and 2nd segments together. Genitalia (Fig. 3H-K) typical for the subfamily. Spermatheca not examined.

Diagnosis. The dimensional comparison with other taxa is shown in Table 4. *Exerythracris* has one of the proportionately longest hind femora (4.3X pronotum) and both the longest last tarsal segment (approx. 1.5X the 1st & 2nd segments together) and the longest rostrum (index 0.33) of all the genera examined. The genus is superficially similar to *Hylopedetes* Rehn (Fig. 8) and shares with it the very elongate third tarsal segment. It differs from *Hylopedetes* in numerous details: lophi of epiphallus not convergent towards the midline as in all species of *Hylopedetes* (Fig. 8G); proportionately longer and more slender legs and antennae; more pronounced rostrum (index 0.28 in *H. mirandus*); deep anterior pronotal sulcus (rather weak in *Hylopedetes* (Fig. 8A)); presence of well developed "epaulettes" between 2nd and 3rd sulci (barely discernible in *Hylopedetes*, Fig. 8B); anterior ventral angle of pronotum obtusely rounded, and not with a ventrally directed projection as in *Hylopedetes* (Fig. 8A); relatively well developed dorsal spine on hind knee (minute in Hylopedetes (Fig. 8F)); furcula with relatively shorter teeth than in *Hylopedetes* (Fig. 8E).

Etymology: Exerythros, "very red", referring to the coloration of the type species; acris, conventionally used for "grasshopper".

Exerythracris volcanica n. sp.

Holotype ♂: COSTA RICA, Prov. Guanacaste: P.N. Guanacaste: Volcán Cacao, 1300 m, map ref. N323300, E375300, (H.E. Braker), 31 July 1987, specimen no. RC 87020. Allotype ♀: COSTA RICA, Prov. Guanacaste: P.N. Guanacaste: SW slope of Volcán Cacao, 1040 m, map ref. N323300, E375300, (C.H.F. Rowell, N. Elsner, C. Chavez), 24 July 1991, specimen no. RC 91184. Both in ANSP. Paratypes: COSTA RICA: 5 ♂♂ (specimen no.s 87016, 87017, 87018, 87019, 87021), data as holotype, RC. 1 ♂ (specimen no. 91183), data as allotype, RC. 1 ♀ (specimen no. 87022), data as holotype. 1 ♂ (specimen no. CRI001 013209), same locality, but 11 July, 1988 (D. Janzen & W. Hallwachs), INBio. 3 ♂♂ (specimen no.s CRI001 013226, CRI001 013227, CRI001 013229), same data, but 15 Feb 1989 (GNP Biodiversity Survey), INBio. 1 ♀ (specimen no. CRI000 384037), same locality, but 1 Mar 1989 (PNG Inventario de Biodiversidad), INBio. 1 ♂ (specimen no. CRI000 283607), same locality, but 15 June 1990 (II. curso parataxónomo INBio), INBio. 2 ♂♂ (specimen no.s 91124, 91125), Prov. Guanacaste, Volcán Tenorio, nr. summit of road from Tierras Morenas to Bajo Los Cartagos, 1040 m., map ref. N287250 E426500, 21 July 1991 (C.H.F. Rowell & N. Elsner), RC. 1 ♀ (specimen no. 80237), Prov. Alajuela, nr. Monteverde, Peñas Blancas, Vargas' pasture, edge of Elfin Forest, 1320-1370 m, map ref. N253300 E450500, 16 July 1980 (C.H.F. Rowell, M. Rowell-Rahier, C. Hyde, H.E. Braker), RC.

Male. The live male is bright red with shining jet-black eyes, legs, antennae and underside. In pinned specimens (described below) the colours become more dilute.

Antennae, blackish purple. Eyes beige to brown. Labrum and mandibles, dark purple. Palps green, suffused with black. Rest of head carmine red. Pro-, meso- and metanota, thoracic episterna and epimera, carmine red. Sulci blackish. First 6 abdominal tergites with a medial carmine spot, decreasing in size on the more posterior segments. Abdomen and thorax otherwise purplish black. All legs and feet purplish black. Coxa, trochanter, and basal part of femur of fore and mid legs yellowish green, especially on ventral surfaces. Spines of hind tibia greenish yellow tipped with black.

Internal genitalia: epiphallus sharply constricted and ventrally depressed in midline, bearing large conical sclerotized lophi, relatively widely spaced, the inner faces of which are slightly divergent in axial view (Fig. 3A). Lateral epiphallic sclerites present. Cingulum robust, almost completely enveloping the aedeagus (Fig. 3D, F). Aedeagus very short, upturned, sheathed: the inferior sclerites joined to the rest of the endophallus by a narrow, almost vertical flexure (Fig. 3E). Anterior apodemes of the endophallus flattened dorsoventrally, horizontal and markedly divergent (Fig. 3G).

Female. In life the general olive brown coloration is marbled with yellow, the band across the frons, genae and pronotal lobes is bright cream, abdominal segments are green laterally. Distal abdominal segments (5th onwards) are also green dorsally. Basal segments of all legs are green: the black hind femur has a greenish cast. Antennae dark brown. In pinned specimens (described below) the colours change.

Antennae purplish black. Eyes brown. Head olive brown, a paler stripe extending across genae and frons and continuing posteriorly on the lobes of the pronotum. Labrum and mandibles blackish purple. Palps green. Pronotum generally olive brown; anterior and posterior margins and anterior ventral part of lateral lobes olive green. Thorax and abdomen olive brown, tinged green on sides of abdominal segments 2-5. Ovipositor valves purplish brown.

Fore leg: as in male. Mid leg: coxa, trochanter, basal part of femur light brown; distal femur black; tibia greenish proximally, purplish distally; tarsus purple. Hind leg: femur olive brown dorsally, inner and outer faces black; knee, tibia and tarsus purple; spines of tarsus green tipped with black. Claws black.

Ovipositor valves long, extending 1.26 mm beyond end of supraanal plate (Fig. 3J). Lower ovipositor valves with a proximal shoulder on outer lateral face (Fig. 3I, J), laterally compressed, normally held between the dorsal valves (Fig. 3K). Both upper and lower ovipositor valves toothed on outer margins, inner faces bearing numerous long hair sensilla. Subgenital plate with concave posterior margins and a simple central apex (Fig. 3H).

(The single adult female from Peñas Blancas differs from those described above only in a) a slightly shorter pronotum and b) in coloration: the pale band on the face and prothorax is faint and restricted to the frons; antennae light brown, not purple-black; hind femora and tibia green-brown and green respectively, not black and purple. In the absence of a corresponding male it cannot be decided whether this specimen represents another species of the genus or a local colour variant. The latter is assumed here, but this individual is not included in the data of Table 1).

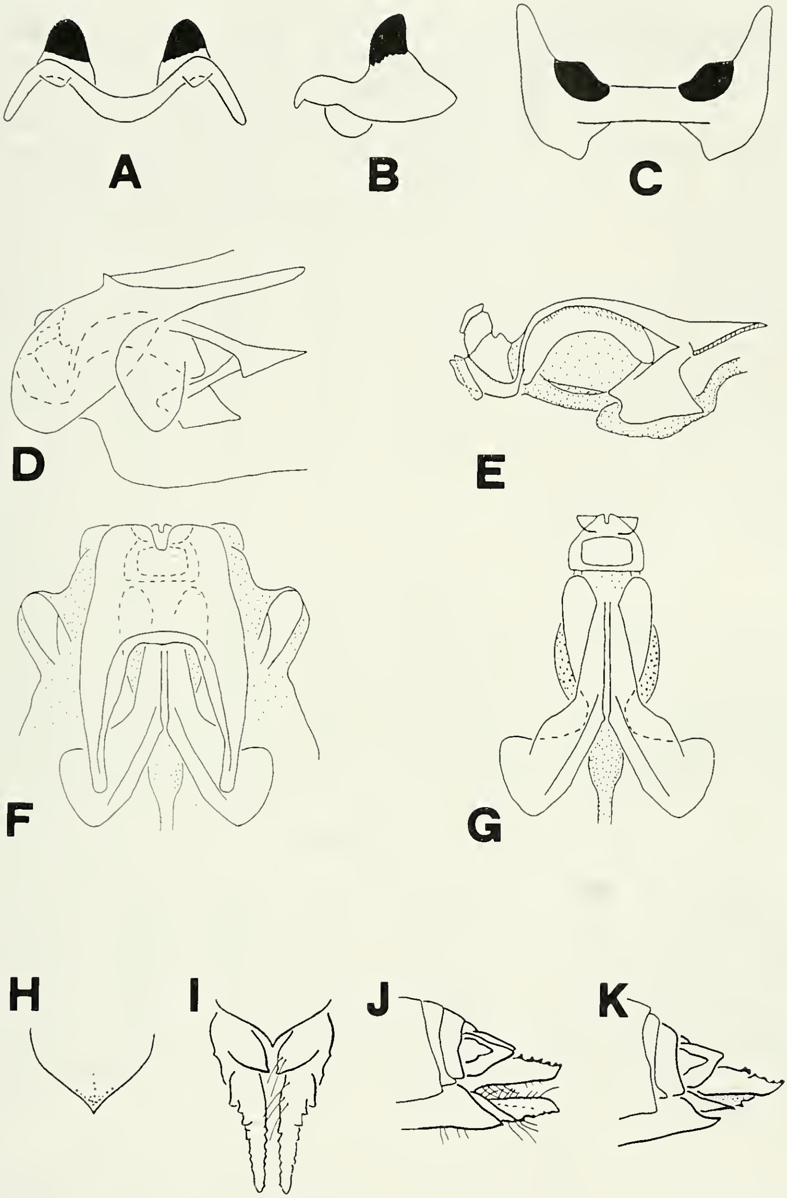


FIG. 3

Exerythracris volcanica n.sp. Figs. A-G, male. A-C, epiphallus: A, axial view, B, lateral view, C, dorsal view. D & F, endo- and ectophallus; D, lateral view, F, dorsal view. E & G, endophallus; E. lateral view, G, dorsal view. Figs H-K, female. H, posterior part of subgenital plate, ventral view. I, ovipositor valves, ventral view. J, tip of abdomen, lateral view, ovipositor valves open. K, as J, but valves shut.

Dimensions: See Table 1.

TABLE 1

Exerythracris volcanica n.sp.: dimensions.

	MEAN	S.D.	S.D./ MEAN	MAX	MIN	N
			Males			
Dimensions (mm)						
Hind femur (F)	13.76	0.42	0.03	14.61	13.27	14
Rostrum-subgen. plate (L)	17.52	0.71	0.04	19.00	16.01	14
Pronotum (midline) (P)	3.20	0.10	0.03	3.39	3.02	14
Interocular space	0.37	0.03	0.08	0.41	0.32	14
Antennal pedicel (width)	0.53	0.02	0.04	0.57	0.48	14
Antennal flagellum (width)	0.30					1
Antenna (length)	12.94	1.18	0.09	15.25	11.40	7
Hind tarsus, 1st + 2nd segments	1.87	0.11	0.06	1.99	1.62	13
Hind tarsus, 3rd segment	2.80	0.12	0.04	3.00	2.66	12
Ratios						
F/P	4.31	0.11	0.03	4.50	4.15	14
L/P	5.48	0.22	0.04	5.83	5.09	14
Interoc./P	0.12	0.01	0.10	0.13	0.10	14
Interocular/pedicel	0.71	0.07	0.10	0.81	0.60	14
Tarsus 3/1+2	1.51	0.08	0.06	1.64	1.39	12
Tarsus 1+2+3/F	0.34	0.01	0.04	0.36	0.32	12
Tarsus 1+2+3/P	1.45	0.06	0.04	1.57	1.36	12
Antennal width/length as %	2.32%					1
			Females			
Dimensions (mm)						
Hind femur (F)	15.21	0.61	0.04	15.95	14.65	4
Rostrum-ov. valves (L)	23.98	0.73	0.03	24.84	23.06	4
Pronotum (midline) (P)	3.87	0.23	0.06	4.16	3.66	4
Interocular space	0.55	0.04	0.07	0.58	0.51	4
Antennal pedicel (width)	0.60	0.04	0.07	0.65	0.56	4
Antenna (length)	12.03					1
Hind tarsus, 1st + 2nd segments	2.02	0.09	0.04	2.11	1.92	4
Hind tarsus, 3rd segment	2.86	0.29	0.10	3.12	2.45	4
Ratios						
F/P	3.93	0.07	0.02	4.00	3.83	4
L/P	6.21	0.45	0.07	6.66	5.80	4
Interoc./P	0.14	0.02	0.11	0.16	0.12	4
Interocular/pedicel	0.92	0.12	0.13	1.04	0.78	4
Tarsus 3/1+2	1.41	0.09	0.07	1.48	1.28	4
Tarsus 1+2+3/F	0.32	0.01	0.05	0.33	0.30	4
Tarsus 1+2+3/P	1.26	0.04	0.04	1.29	1.19	4

Larvae. The general coloration of the larvae is dull green and brown with reddish brown eyes and antennae. A number of larvae have been examined, but none reared throughout their development. Here I assume 5 larval instars:

I. Unknown.

II. Antennae with 8 flagellar segments, reddish brown. Eyes shining reddish brown. Legs and dorsal surfaces plain green, speckled reddish brown; ventral surface brown. Hind femora with 2 brown bands on inner and outer faces, knees brownish.

III. Antennae with 9 flagellar segments. Segments 2-6 bear an annulus, giving the impression of 14 segments in all. Eyes shining reddish brown. Well-marked medial dorsal carina on all thoracic and abdominal segments. Coloration as in instar II, except a) hind femoral bands fainter b) dark brown postocular stripe, more marked on head than on pronotum c) yellow flecks present on disc of pronotum.

IV. Antennae with 15 flagellar segments. Head bright green. Palps green. Dorsal surface of thorax and abdomen green flecked with brown. Yellow flecks on pronotum seen in III instar now enlarged to form a horizontal stripe below the postocular stripe, extending from pronotal lobes and around genae and frons (female only). Meso- and metathoracic epimera carmine red (male only). Underside black. Fore and mid legs black. Hind knees black, tibiae black.

V. Coloration as adult. 16 flagellar segments in antenna.

Etymology: "volcanica" of volcanoes, an allusion to both the distribution on the volcanoes of northern Costa Rica and the bright red colour.

Distribution, natural history. E. volcanica inhabits light gaps, path margins and woodland edges in wet montane forest between 1000 and 1200 m on the volcanic peaks of the Cordillera de Guanacaste and the Cordillera de Tilarán. Within the former it seems to have a disjunct distribution, being known from Volcán Tenorio (the Tierras Morenas site) in the South and from Volcán Cacao in the North, but not from the intervening peaks of Volcán Rincón de la Vieja or Volcán Miravalles. On Tenorio it is sympatric with *Hylopedetes surdus*, and in the Cordillera de Tilarán with both *H. surdus* and *H. gemmeus*, both of which belong to the same subfamily and have similar food preferences. Both *Exerythracris* and *Hylopedetes* are principally associated with and eat ferns, especially the secondary succession species *Hypolepis hostilis* (see also Rowell et al. 1983). A male *E. volcanica* has been seen attempting copulation with a female *H. surdus* and actively repelling males of the latter species while doing so.

Brakeracris n. gen.

Type species: *Brakeracris varablancensis* n. sp.

Male (Fig. 4 & 5). Size small to medium. Integument polished except on head, the integument of which is matte. Dorsal surfaces of occiput, pro-, meso- and metanota and 1st abdominal tergum heavily pitted. Legs, frons and remaining abdominal segments smooth. Integument with numerous white hairs, especially on hind tibiae, genital area and distal underside of abdomen, but also sparsely on the dorsal surface.

Fastigium subhorizontal, triangular, truncate anteriorly, bearing a pair of prominent longitudinal ridges proximally, distally grooved, the groove reaching the anterior margin of fastigium (Fig. 4B, D, E). Frontal ridge narrower (0.8X) than interocular space, straight and almost parallel sided, slightly tapering ventrally, irregularly pitted in midline, ending above medial ocellus. Medial and ventral arms of subantennal suture short and deeply incised, dorsal arms thin and curved (Fig. 4E). Frons concave, upper part of frontal ridge forming a blunt rostrum (Fig. 4B), index 0.30. Preocular ridges well marked. Eyes globose. Interocular space narrower (0.7X) than maximum width of antennal pedicel. Antennae of medium length (3.57X length of pronotum), slightly flattened dorsoventrally and rather thick (width 0.032X their length), 17 segments in flagellum of adult.

Thorax (Fig. 4B, C). Medial carina present on pronotum anterior to 1st sulcus and posterior to 3rd sulcus, but absent between 1st - 2nd and 2nd - 3rd sulci. "Epaulettes" present between 2nd and 3rd sulci, but less well developed than in *Exerythracris* or *Talamancacris*. Posterior ventral angle of lateral lobe of pronotum rounded, posterior margin of pronotum slightly concave. Anterior ventral angle of lateral lobe with a small anteriorly directed projection (Fig. 4B). Posterior margins of pronotum slightly concave in midline, anterior margin straight or slightly notched. Prosternal process short, abruptly conical, vertical. Medial carina absent on meso- and metanotum. Apterous.

Hind femur relatively long, 4.1 - 4.2X as long as pronotum. Dorsal carina of femur minutely toothed proximally, smooth distally, ending in a spine which is shorter than lateral lobes of knee (Fig. 4G). Ventral carina smooth, lateral carinulae absent or very slight, outer face of hind femur rounded. Seven non-terminal spines on the dorsal external margin of hind tibia, 8 on the dorsal internal. Hind foot long, 0.34X as long as femur; 3rd tarsal segment relatively short, 1.26X as long as 1st and 2nd tarsal segments together.

Tympanum absent. Medial carina absent from 1st abdominal segment, present on 2-6th segments. Posterior margin of last abdominal tergite with a central notch and short lateral sclerotised teeth (Fig. 4F). Supraanal plate triangular, without sclerotised melanic markings, with a short longitudinal medial furrow at its base. Cerci short, conical, simple. Subgenital plate bluntly pointed in lateral view, terminating in a short medial furrow in dorsal view. Internal genitalia (Fig. 5) of the usual type for subfamily.

Female. The female is so far known only from several last instar larvae. Comparison of these with similarly aged larvae of other rhytidochrotine genera for which the female is known indicates that the adult female is likely to be of conventional form for the group, somewhat larger and more fusiform than the male, and with the characteristic ovipositor valves.

Etymology: Named for Dr. H.E. Braker, for her contribution to the discovery and original collection of all three new genera described in this paper.

Diagnosis. Brakeracris seems to be related to the Costa Rican *Scirtopaon* (Fig. 9). It shares with this genus the presence of a weak medial carina on the anterior and

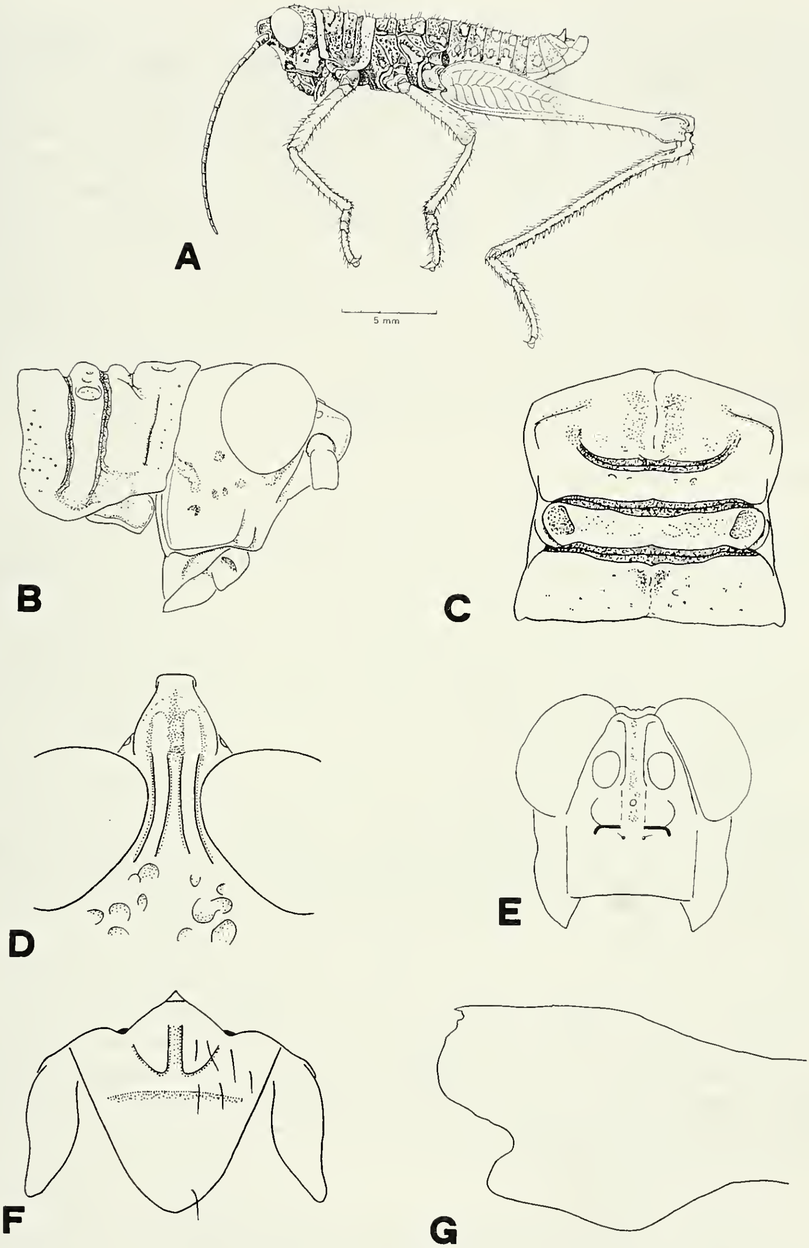


FIG. 4

Brakeracris varablancensis n.sp. Male. A, lateral view of entire insect. B, lateral view of head and pronotum. C, dorsal view of pronotum. D, dorsal view of head. E, frontal view of face. F, dorsal view of furcula, supraanal plate and cerci. G, lateral view of hind knee.

posterior sections of the pronotum (Fig. 9B) and on the posterior abdominal segments; the slight anterior projection of the anterior ventral angle of the pronotum (Fig. 9A); the size and shape of the terminal spine of the hind knee (Fig. 9H). It differs from *Scirtopaon* as follows: frontal ridge with subparallel margins, and not with a double constriction as in *Scirtopaon* (Fig. 9D); medial and ventral antennal sutures strongly excavated (medial and dorsal in *Scirtopaon* (Fig. 9D)); shorter and thicker antennae; more prominent rostrum (index 0.30, compared with 0.26 in *Scirtopaon*); in the detail of the rugosities of the pronotum (Fig. 9A, B); in the less well developed teeth of the furcula; in the shape of the lophi - in *Scirtopaon* (Fig. 9F, G) these have a prominent lateral ridge which is absent in *Brakeracris*, and are not tilted caudally as in *Brakeracris*. *B. varablancensis* shows none of the extreme values in the morphometric ratios (Table. 4), but has a rather larger rostrum than most other taxa and the relatively thickest antennae of all but *Talamancacris*.

Brakeracris varablancensis n. sp.

Holotype ♂ (specimen no. RC 86495a) COSTA RICA: Prov. Heredia, 3 km. E. of S. Rafael de Vara Blanca, 1800-2100 m., map ref. N239800, E524200, 13 April 1986, (C.H.F. Rowell & H.E. Braker), ANSP. Paratype: 1 ♂, same data as holotype (RC). Last instar larvae: 6 ♀♀, same data as holotype (2 in ANSP, otherwise RC).

Male. Alive a predominantly greenish-black insect with bright yellow markings and green legs. Antennae black; eyes, black; palps, green; suborbital band on frons and genae, yellow; remainder of head, black. Pronotum black with yellow border; thoracic and abdominal tergites olive green with yellow markings. Coloration otherwise as for pinned specimen.

Description of pinned specimens. Basal segments of antenna green, distal segments dark brown. Eyes reddish brown. Ventral half of frons and genae cream. Remainder of head blackish green. Thorax and abdomen olive green, underside olive brown. Entire margin of pronotum bordered in deep yellow apart from a short stretch dorsal to prothoracic coxal insertion. Metathoracic episternum yellow. Posterior margin of metanotum with 2 yellow marks. Terga of abdominal segments 1-8 each bear a pair of yellow chevrons in the midline and paired yellow spots laterally. Legs dark green, lunules of hind knee reddish, 3rd tarsal segments black.

Internal genitalia: lophi of epiphallus conical, sclerotised, minutely denticled, widely separated and with inner faces parallel or only slightly divergent in axial view (Fig. 5A), tilted slightly caudally in lateral view (Fig. 5B). Remainder of genitalia without particular distinguishing features.

Larval coloration (male):

I instar: unknown.

II instar: uniform dull reddish brown. Antennae slightly clubbed, pink at tip. Inner surface of hind femur with 3 weakly marked darker bands.

III. instar: Thoracic tegument more rugose than in II. Fore and mid legs green. Hind leg brown, femur with 3 dark bands.

IV. instar. Pattern similar to that of the adult, but expressed in pink on reddish brown instead of yellow on greenish black. Legs tinged green.

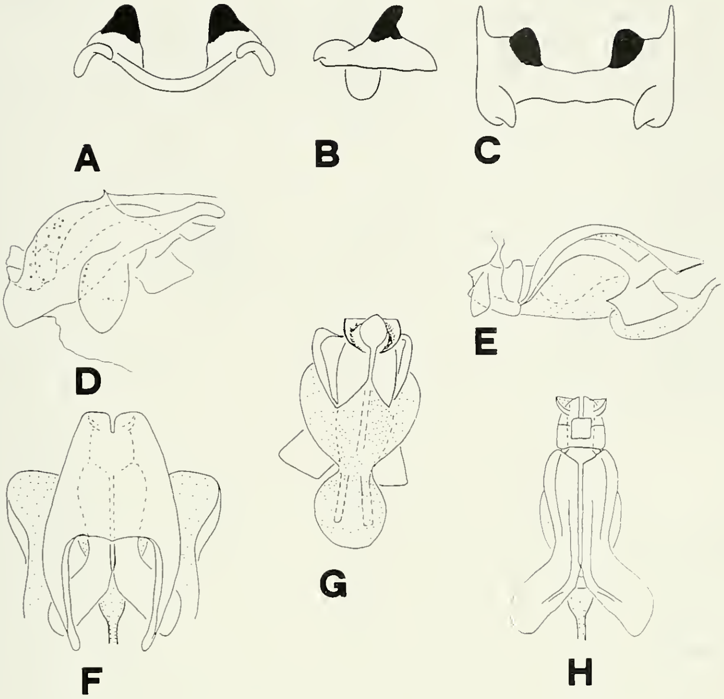


FIG. 5

Brakeracris varablancensis n.sp. Male. A-C, epiphallus: A, axial view, B, lateral view, C, dorsal view. D, F, endo- and ectophallus; D, lateral view, F, dorsal view. E, G & H, endophallus; E, lateral view, G, perspective view from below and to one side, H, dorsal view.

V instar: as adult.

Larval coloration (female):

The early instar female larvae do not differ from the males, the last instar larva differs from the adult and last instar male as follows: coloration duller, less contrasty. Lower half of pronotal lateral lobe yellow. Pronotum without the clear yellow border of the male. Abdominal terga with a single triangular yellowish patch, not with paired chevrons and spots as in the male.

Dimensions: See Table 2.

Etymology: varablancensis, of Vara Blanca, the type locality.

Distribution, natural history. B. varablancensis is known to date only from around S. Rafael de Vara Blanca, on the northern scarp of the Cordillera Central, in the headwaters of the Río Sarapiquí, altitude 1900 to 2200 m. In March 1986 it was found in regenerating scrub at the forest edge above the farmhouse (now situated in the Parque Nacional Braulio-Carrillo) and also on landslip areas bordering two stream

TABLE 2

Brakeracris varablancensis n.sp.: dimensions.

	MEAN	MAX	MIN	N
	Males			
Dimensions (mm)				
Hind femur (F)	12.92	13.11	12.73	2
Rostrum-subgen. plate (L)	15.99	16.61	15.36	2
Pronotum (midline) (P)	3.09	3.09	3.08	2
Interocular space	0.40	0.40	0.40	2
Antennal pedicel (width)	0.57	0.59	0.54	2
Antennal flagellum (width)	0.35			1
Antenna (length)	11.00			1
Hind tarsus, 1st + 2nd segments	1.95			1
Hind tarsus, 3rd segment	2.45			1
Ratios				
F/P	4.19	4.26	4.12	2
L/P	5.18	5.38	4.99	2
Interoc./P	0.13	0.13	0.13	2
Interocular/pedicel	0.71	0.74	0.68	2
Tarsus 3/ 1+2	1.26			1
Tarsus 1+2+3/F	0.34			1
Tarsus 1+2+3/P	1.43			1
Antennal width/length as %	3.18%			1

beds traversing dense montane wet forest 1-2 km north of the farmhouse. Most individuals seen were mid or late larval instars; only two adult males were found, and no adult females, despite intensive search. There was no obvious association between *B. varablancensis* and any particular plant species. In captivity it nibbled at a variety of plants from the habitat, but ate well from none of those tested, which included several species of ferns. In the same localities were found the acridids *Drymacris nebulicola* (Proctolabinae) on Solanaceous plants and *Silvitettix communis* (Gomphocerinae) on grasses.

Intensive search of the same areas under fine weather conditions in July 1991 produced only a single 3rd instar larva and no adults. This may indicate marked seasonality, or might be due to the extensive vegetational change seen, corresponding to 5 years of secondary succession. This larva ate various *Senecio* spp. from other parts of Costa Rica in the following days, suggesting that *B. varablancensis*, like *T. palustris* (below), may prefer Asteraceae.

Talamancacris n. gen.

Type species: *Talamancacris palustris* n. sp.

Male. (Figs. 6 & 7). Size small-medium. Integument highly polished except on head, which is matte. Frons, genae, dorsal surfaces of occiput, and of pronotum posterior to the last transverse sulcus, lightly pitted; remaining areas smooth and glossy, as though clear varnished. Integument with numerous white hairs, especially on the tibiae, proximal hind femora, genital area and meso- and metathoracic sterna, and also bilateral tufts dorsolaterally near anterior margin of each abdominal segment.

Fastigium inclined, triangular, truncate anteriorly, with two low longitudinal ridges proximally, shallowly grooved distally, lateral margins straight or slightly concave (Fig. 6B, D). Frontal ridge at its widest point narrower (0.6X) than interocular space, subparallel sided, somewhat narrower at dorsal and ventral extremities, extending to lower rim of antennal foramen, slightly divergent above medial ocellus; shallowly grooved medially for a short distance dorsal to medial ocellus, lightly pitted between this point and fastigium (Fig. 6E). Medial ocellus barely visible. Medial and ventral arms of subantennal suture short and rather deeply incised, dorsal arms thin and indistinct (Fig. 6E). Profile of frons concave, upper part of frontal ridge forming a short (index 0.30), vertically ended rostrum (Fig. 6B). Preocular ridges present. Eyes globose. Interocular space slightly wider (1.1X) than width of antennal pedicel. Antennae filiform, somewhat dorsoventrally flattened, short (2.8X as long as pronotum) and thick (0.042X their length), 17 segments in flagellum of adult.

Pronotum (Fig. 6B, C) slightly inflated in midline anterior to 1st sulcus, but no medial carina present. Sulci deep; well developed "epaulettes" present between the 2nd and 3rd sulci. Posterior ventral angle of lateral lobe of pronotum rounded, somewhat lobate, projecting ventrally and posteriorly (Fig. 6B). Anterior ventral angle rounded. Posterior margins of pronotum slightly concave in midline, anterior margin convex and minutely notched (Fig. 6C). Prosternal process short, abruptly conical, vertical. Medial carina absent from meso- and metanotum. Apterous.

Hind femur relatively short, 3.57X as long as pronotum. Dorsal carinae of femur well marked over most of its length, slightly toothed, obsolete immediately before the knee, terminating in a sharp spine which exceeds in length the outer lateral lobes of the knee (Fig. 6G). Ventral carina strongly developed, smooth, lateral carinulae absent or very slight, outer face of hind femur rounded in cross section. Seven non-terminal spines on external dorsal margin of hind tibia, 8 on internal dorsal margin. Hind tarsus long in relation to femur (0.32X), but smaller than in the other Costa Rican genera in relation to the pronotum (1.13X); 3rd tarsal segment of hind leg slightly (1.28 X) longer than 1st and 2nd tarsal segments together.

Tympanum absent. Medial carina absent from 1st but present on 2-6th abdominal segments. Posterior margin of last abdominal tergite with a central notch and short lateral sclerotised teeth (Fig. 6F). Supraanal plate triangular, without sclerotised melanic markings, with a short longitudinal medial furrow at its base (Fig. 6F). Cerci short, conical, simple. Subgenital plate bluntly pointed in lateral view, terminating in a short medial furrow behind the tip of the supraanal plate, glabrous in ventral and apical midline, pilose laterally. Internal genitalia (Fig. 7A-G) of the usual type for the subfamily. Epiphallus distinctive (Fig. 7A-C).

Female. Size, small to medium. Differs from male in following morphological characters: larger (1.38x in overall length) and more fusiform, wider in posterior thorax and anterior abdominal segments (Fig. 7K). Ovipositor valves (Fig. 7H-J) long,

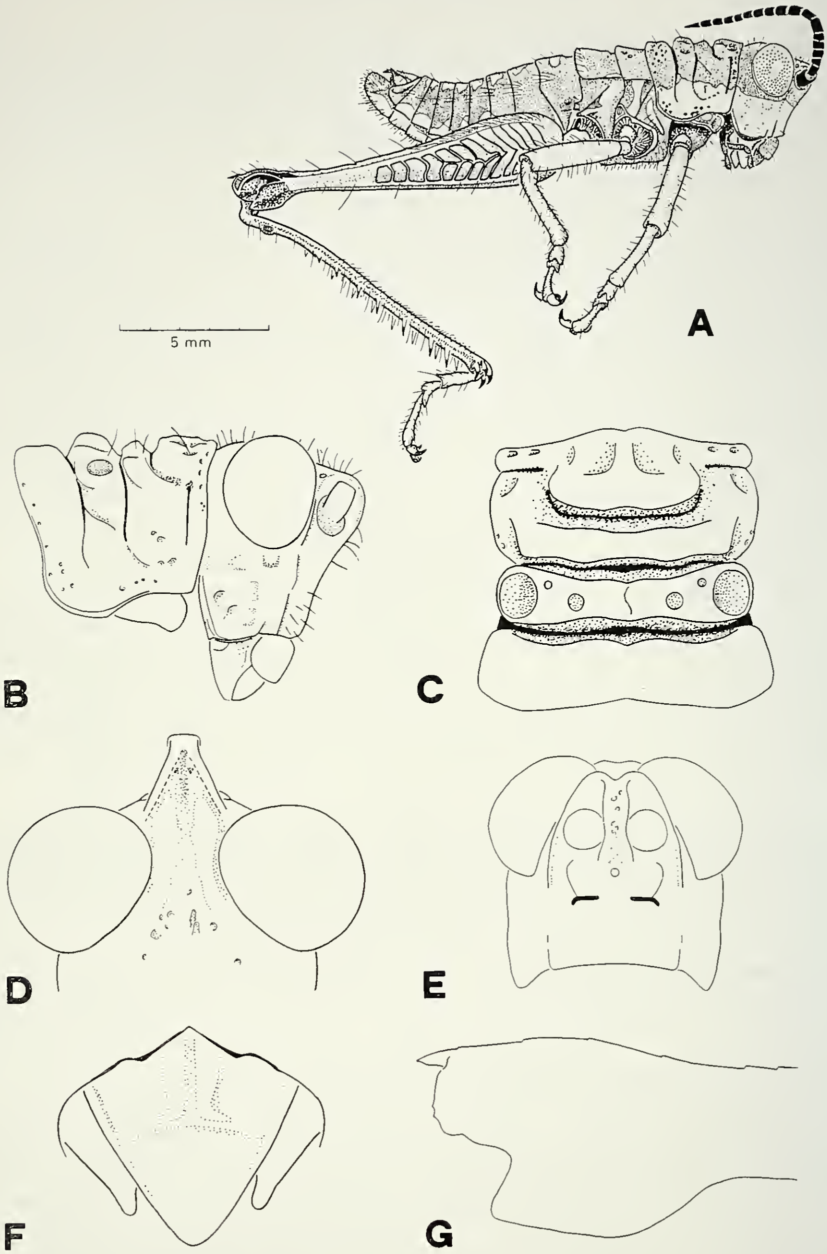


FIG. 6
Talamancacris palustris n.sp. Male. A, lateral view of entire insect. B, lateral view of head and pronotum. C, dorsal view of pronotum. D, dorsal view of head. E, frontal view of face. F, dorsal view of furcula, supraanal plate and cerci. G, lateral view of hind knee.

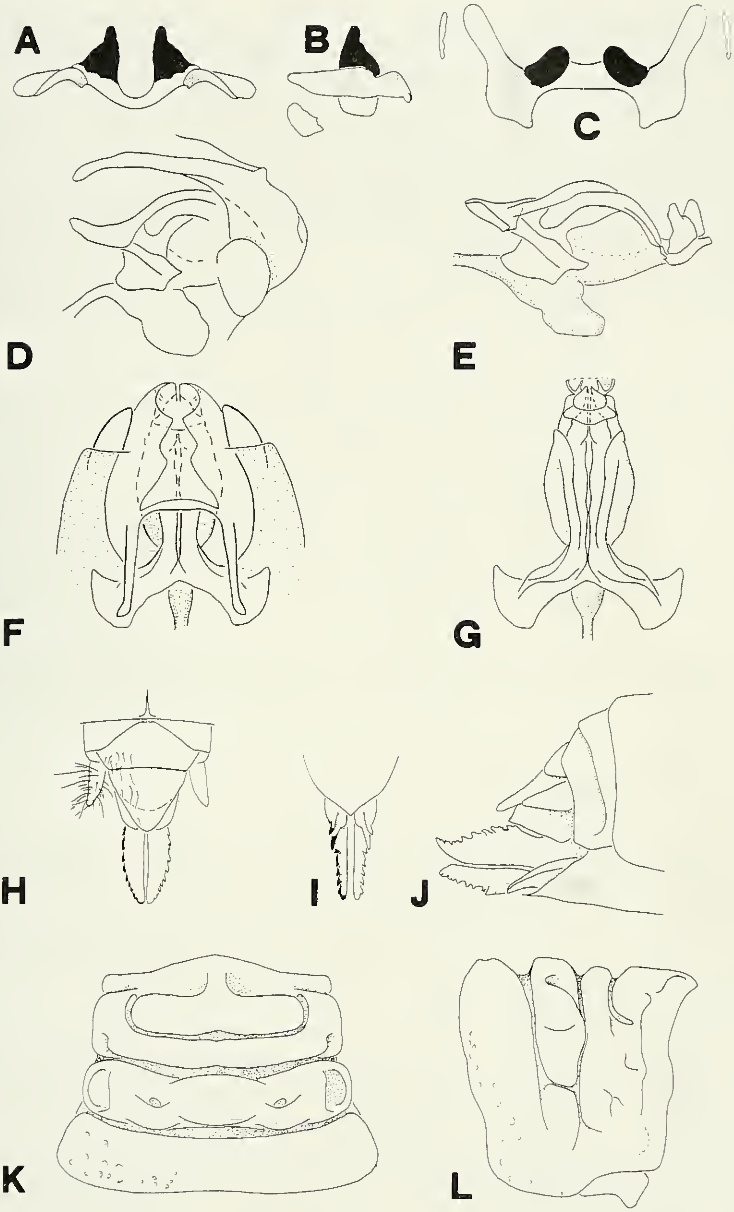


FIG. 7

Talamancacris palustris n.sp. Figs. A-G, male. A-C, epiphallus; A, axial view, B, lateral view, C, dorsal view. D & F, endo- and ectophallus, D, lateral view, F, dorsal view. E & G, endophallus; E, lateral view, G, dorsal view. Figs H-L, female. H, tip of abdomen, dorsal view. I, ovipositor valves and posterior end of subgenital plate, ventral view. J, tip of abdomen, lateral view, ovipositor valves open. K, pronotum, dorsal view. L, pronotum, lateral view.

projecting 1.12 mm beyond end of the subgenital plate. Both upper and lower ovipositor valves heavily toothed on exterior outer margins, smooth on inner margins. Lower valves narrow, normally held between upper valves, with a shoulder proximally on lateral ventral edge. Subgenital plate (Fig. 7I) with concave posterior edges, forming a medial point. Spermatheca not examined.

Diagnosis. Talamancacris differs from all other Costa Rican rhytidochrotines in that a) the terminal spine of the hind knee projects well beyond the lateral lobes b) the interocular space exceeds the maximum width of the first antennal segment and c) in the shape of the male epiphallus. It is also much more hirsute than the other genera. The dimensional comparison with other genera is shown in Table 4. *Talamancacris* has the highest number of extreme morphometric ratios of any of the taxa studied: the shortest overall length relative to the pronotum, the widest interocular space, the shortest hind tarsus relative to the pronotum, and the relatively shortest and thickest antennae. *Talamancacris* gives a first impression of a small, short legged version of *Brakeracris*; especially the profile of the head and the form of the frontal ridge and the antennal sutures are very alike in the two genera. The abdomen, legs and antennae are however relatively much shorter (relative to pronotum), the antennae are relatively thicker (0.042x their length, 0.032 in *Brakeracris*), the pronotum has no medial carina, its anterior ventral angle lacks projections, and the integument is glossy and smooth.

Etymology: Talamanca, the range of mountains in central Costa Rica where all known localities of the genus are located; acris, conventionally used for grasshopper.

Talamancacris palustris n. sp.

Holotype ♂ (specimen no. RC 93371): COSTA RICA, Prov. Cartago, Turbera "La Chonta", 2.7km SSE of El Empalme, 2'380 m, map ref. N188200, E542300, 20 Sep 1993, (C.H.F. Rowell & G. Vargas). Allotype ♀ (specimen no. RC 93372), same data. Both in ANSP. Paratype: 1 ♀ (specimen no. RC 79228): COSTA RICA, Prov. S. José, Puya bog, Km 67.5, Rta 2, nr. Salsipuedes, 2550 m, 25 August 1979 (H.E. Braker) (MNHNP). Last instar larvae: 2 ♂♂, 1 ♀, same data, but 16 July 1980 (C.H.F. Rowell & M. Rowell-Rahier); 2 ♂♂, same locality as holotype, but 25 January 1991 (G. Vargas & H.E. Braker); all RC.

Both sexes alive are dark metallic bluish green, with black antennae and eyes, a shining white facial and pronotal stripe, paired lighter green chevrons on each abdominal tergum, and reddish hind knees. The striking blue-green colour fades to brown an hour or two after death and is probably structural in origin.

Description of pinned specimens: Male. Antennae black, brown at tips. Eyes dark brown. Lower frons and genae yellow. Head otherwise dark blue green with yellow V-shaped marking on occiput and fastigium. Thorax and abdomen blackish brown shading to green at anterior and posterior margins of pronotum and around bases of anterior legs. Ventral half of lateral lobe of prothorax yellow. Pro- and mesothoracic epimera yellow. Legs dark olive brown. Tibial spines olive green tipped with brown. Hind knees blackish green. Abdominal segments 2-6 with a pair of yellow triangular marks tending to fuse in midline. Cerci brown.

Internal genitalia (Fig. 7A-G) of usual type for the group. Epiphallus distinctive: lophi (Fig. 7A-C) vertical in axial view, very slender at their tips, with a sloping lateral ridge, posterior margin of lateral processes slightly incised at the base of the lophi. Lateral sclerites present.

Female. Antennal basal segments green, distal segments dark brown. Eyes reddish brown. Ventral half of frons and genae cream. Remainder of head olive brown with a lighter V-shaped marking on the occiput. Thorax, abdomen and legs olive green with reddish brown mottle. Underside olive brown. Lower half of prothoracic lateral lobes pale yellow brown.

Dimensions: see Table 3.

TABLE 3

Talamancacris palustris n.sp.: dimensions.

	MEAN	MAX	MIN	N
	Males			
Dimensions (mm)				
Hind femur (F)	11.46			1
Rostrum-subgen. plate (L)	14.47			1
Pronotum (midline) (P)	3.21			1
Interocular space	0.60			1
Antennal pedicel (width)	0.54			1
Antennal flagellum (width)	0.38			1
Antenna (length)	9.00			1
Hind tarsus, 1st + 2nd segments	1.60			1
Hind tarsus, 3rd segment	2.04			1
Ratios				
F/P	3.57			1
L/P	4.51			1
Interoc./P	0.19			1
Interoc./pedicel	1.11			1
Tarsus 3/ 1+2	1.28			1
Tarsus 1+2+3/F	0.32			1
Tarsus 1+2+3/P	1.13			1
Antennal width/length as %	4.22%			1
	Females			
Dimensions (mm)				
Hind femur (F)	13.12	13.21	13.02	2
Rostrum-ov. valves (L)	19.97	21.53	18.41	2
Pronotum (midline) (P)	3.90	3.93	3.87	2
Interocular space	0.72	0.74	0.70	2
Antennal pedicel (width)	0.61	0.62	0.60	2
Antenna (length)	9.80	10.39	9.20	2
Hind tarsus, 1st + 2nd segments	2.00	2.03	1.97	2
Hind tarsus, 3rd segment	2.19	2.29	2.09	2
Ratios				
F/P	3.36	3.41	3.31	2
L/P	5.12	5.48	4.76	2
Interoc./P	0.18	0.19	0.18	2
Interoc./pedicel	1.18	1.23	1.13	2
Tarsus 3/ 1+2	1.10	1.16	1.03	2
Tarsus 1+2+3/F	0.32	0.33	0.31	2
Tarsus 1+2+3/P	1.07	1.08	1.06	2

Larvae:

I instar: unknown.

II instar: uniform dull reddish brown.

III - V instars: coloration similar to that of adults, but less contrasty. Some female larvae have 2 pale blotches on the dorsal edge of the hind femur.

Etymology: "palustris", of swamps, after the habitat of the species.

Distribution, natural history. T. palustris is known only from a few bogs lying between 2300 and 2600 m altitude on the Atlantic side of the north slope of the Talamanca range. All localities have a similar and very characteristic vegetation dominated at ground layer by *Sphagnum* moss and the rush-like *Xyris* (Xyriaceae); the main emergents are the large fern *Blechnum* and the terrestrial Bromeliad *Puya*. This characteristic plant assemblage, otherwise known only from the Andes, is confined to certain areas of restricted drainage which appear to date from after the end of the last glaciation (G. Vargas, pers. comm.). The only other acridoid found in or near these bogs is the Oedipodine *Chortophaga viridifasciata* (De Geer, 1773).

Phenology. Larvae have been found in January, July, August and September, but not in April; adults have been found in August and September. A third instar female larva captured 20th September and maintained in captivity became adult on 5th November. These data are compatible with the hypothesis that there is one generation per year and that eggs are laid in the first half of the year, as is common among Costa Rican acridids, but do not exclude the possibility that breeding takes place year round.

Foodplants. T. palustris is not obviously associated with any particular plant species in its habitat. It is found on the vegetation covering the bog surface, and not in the emergent shrubs, bromeliads or ferns. Consistent with this observation it refuses in captivity *Puya*, *Blechnum* and the Ericaceous shrub *Pernettya*. It also refuses *Sphagnum* and *Xyris* and a variety of other plants growing with them. The only plant from the native habitat which *Talamancacris* has accepted in captivity is *Hieracium stanleyi* (Asteraceae). In captivity it refuses all monocots and most exotic dicots, but accepts a variety of cultivated Asteraceae, including *Doronicum* and *Dahlia*, especially the latter. (*Dahlia imperialis* is indigenous to Costa Rica and grows within some kilometres of the bogs inhabited by *T. palustris*, but is not present within them). Some but not all individuals accept in captivity the fern *Hypolepis hostilis* (the commonest food of two other Costa Rican rhytidochrotine genera, *Hylopedetes* and *Exerythracris* (Rowell *et al.* 1983; this paper)) or *Rubus* nr. *glaucus* (eaten in the wild by the Costa Rican rhytidochrotine *Scirtopaon dorsatus* (pers. obs.)), but do not eat either of them in quantity. Neither plant is present in the natural habitat. These observations suggest a specialisation of *Talamancacris* on Asteraceae, perhaps normally *H. stanleyi*.

PREVIOUSLY DESCRIBED TAXA

The original descriptions of the remaining three Costa Rican genera (*Hylopedetes*, *Scirtopaon* and *Micropaon*) were not well provided with measurements or anatomical drawings. The following section is intended primarily to allow comparison of the newly described genera with those previously described.

Table 4 compare the dimensions of the known atympanate genera. The data for some are incomplete; in several cases only one of the two sexes is known.

Hylopedetes Rehn, 1929 (Fig. 8)

The genus is well differentiated from the remaining Costa Rican genera by the weak first pronotal sulcus, the ventrally directed process at the anterior angle of the pronotum (Fig. 8A), and the distinctive convergent lophi of the epiphallus (Fig. 8G). *Hylopedetes* has the smallest relative interocular distance of any of the genera examined, and (together with *Talamancacris*) the relatively shortest antennae. The pattern of the antennal sutures is similar to that of *Exerythracris*, with which it also shares a proportionately very long last segment of the hind tarsus. The male and female genitalia of *H. mirandus* were figured by DESCAMPS & AMÉDÉGNATO (1972b: Figs 2-8); Table 4 presents its dimensions. The 5 species of the genus are similar morphologically, the most different being *H. nigrithorax*. A key to the species was given by DESCAMPS & ROWELL (1978).

H. mirandus Rehn, 1929 (the type species) has previously been reported only from the type locality, La Emilia, Guápiles, which is now completely deforested and suburban. Four new localities are now known. Three lie in the valley of the Río Toro Amarillo, 15 and 10 km S. and 7 km W. of Guápiles, at 800, 540 and 305 m respectively, a fourth 8km SW of Guápiles in the valley of the Río Sucio at 550 m. It is probable that the species occurs in suitable places (at forest edges and in light gaps on ferns, especially on *Hypolepis hostilis*) at least throughout the intervening area, and perhaps further up the scarp beyond. Guápiles itself lies at 260 m. on the edge of the Caribbean plain at the foot of the scarp of the Cordillera Central, and the nature of the original forest vegetation changed sharply north of and below this point. The type locality probably represented the lower altitudinal limit of the species, the genus and (at least in Central America) of the subfamily.

H. nigrithorax Descamps & Rowell, 1978. This is to date the only rhytidochrotine known from the southwest of Costa Rica (contrary to the statement by DESCAMPS & AMÉDÉGNATO (1972b: 1058), the species of *Hylopedetes* described by Rehn are from the Atlantic and not the Pacific slope of the country). Originally described from a single locality on the Fila Cruces near the town of S. Vito de Coto Brus, *H. nigrithorax* is now known from several other nearby localities lying to the north and south along this same ridge, at altitudes between 1100 and 1700 m. The Fila Cruces forms the most southwesterly ridge of high ground before the Pacific plain of SW Costa Rica. It is not known whether the species extends south into Panama; it was not collected in the '30s by D.W. Bishop from El Volcán in Chirriquí, where he found several other species that in Costa Rica are sympatric with *H. nigrithorax*. The preference of *H. nigrithorax* at the type locality for certain species of ferns (including again *Hypolepis hostilis*) was documented previously (ROWELL *et al.* 1984); however, it can sometimes be found on Asteraceae.

Table 4A

Comparison of the mean dimensions of the type species of non-tympanate rhytidochrotine genera. Males.

	Exerythracris volcanica	*Hylopedetes mirandus*	*Micropaon lucens*	*Scirtopaon dorsatus*	*Brakeracris varablancensis*	*Talamancacris palustris*	*Paropaon laevifrons*	*Lathacris rubiventris*	*Muyscacris panchlora*	*Loepacris obscuripes*
N:	14	6	1-2	1	2	1	2	1*		
Mean dimensions in mm:										
Hind femur (F)	13.76	10.78	11.12	13.69	12.92	11.46	9.74	6.10	males	unknown
Rostrum-subgen. plate (L)	17.52	13.91	15.01	17.48	15.99	14.47	14.31			
Pronotum (midline) (P)	3.20	2.64	2.57	3.16	3.09	3.21	2.46	2.10		
Interocular space	0.37	0.26	0.32	0.45	0.40	0.60	0.41			
Antennal pedicel (width)	0.53	0.41	0.42	0.47	0.57	0.54	0.41			
Width of antennal flagellum	0.30	0.21	0.22	0.29	0.35	0.38				
Antenna (length) (A)	12.94	8.52	9.60	13.30	11.00	9.00	9.90			
Hind tarsus 1st & 2nd segments	1.87	1.33	1.69	2.15	1.95	1.60	1.57			
Hind tarsus 3rd segment	2.80	1.95	2.11	2.74	2.45	2.04	1.94			
Ratios										
F/P	4.31	4.09	4.32	4.33	4.19	3.57	3.96	2.90		
L/P	5.48	5.28	5.91	5.53	5.18	4.51	5.82			
Interoc./P	0.12	0.10	0.13	0.14	0.13	0.19	0.16			
Interoc./pedicel	0.71	0.65	0.76	0.96	0.71	1.11	1.00			
Tarsus 3/1+2	1.51	1.47	1.25	1.27	1.26	1.28	1.24			
Tarsus 1+2+3/F	0.34	0.30	0.35	0.36	0.34	0.32	0.36			
Tarsus 1+2+3/P	1.45	1.24	1.50	1.55	1.43	1.13	1.42			
A/P	4.05	3.23	3.78	4.21	3.57	2.80	4.03			
A/F	0.94	0.79	0.86	0.97	0.85	0.79	1.02			
Ant width/length as %	2.32	2.47	2.29	2.18	3.18	4.22	2.02			
Rostrum index (see Fig. 1)	0.33	0.28	0.23	0.26	0.30	0.30	0.29	0.23		

* data from original description.

TABLE 4B

Comparison of the mean dimensions of the type species of non-tympanate rhytidochrotine genera. Females.

	Exerythracris volcanica	*Hylopedetes miraudus*	*Micropaon lucens*	*Scirtopaon dorsatus*	*Brakeracris varablancensis*	*Talamancacris palustris*	*Paropaon laevifrons*	*Lathacris rubiventris*	*Muyscacris panchlora*	*Loepacris obscuripes*
Females:										
N:	4	6	1*	1*		2	2		1*	1*
Mean dimensions in mm:										
Hind femur	15.21	12.72	13.00	13.50	female	13.12	10.87	female	17.00	15.10
Rostrum-subgen. plate	23.98	18.20			not	19.97	17.99	not	28.30	
Pronotum (midline) (P)	3.87	3.31	3.00	3.60	known	3.90	2.97	known	4.70	3.70
Interocular space	0.55	0.34				0.72	0.57			
Antennal pedicel (width)	0.60	0.43				0.61	0.43			
Antenna (length) (A)	12.03	7.55				9.80	9.13			
Hind tarsus 1st &2nd segments	2.02	1.55				2.00	1.57			
Hind tarsus 3rd segment	2.86	2.17				2.19	2.05			
Ratios										
Femur/Pronotum	3.93	3.85	4.33	3.75		3.36	3.66		3.62	4.08
Length/Pronotum	6.21	5.51				5.12	6.06		6.02	
Interoc./Pronotum	0.14	0.10				0.18	0.19			
Interocular/pedicel	0.92	0.81				1.18	1.33			
Tarsus 3/ 1+2	1.41	1.40				1.10	1.30			
Tarsus 1+2+3/F	0.32	0.29				0.32	0.33			
Tarsus 1+2+3/P	1.26	1.13				1.07	1.22			
A/P	3.11	2.28				2.51	3.08			
A/F	0.79	0.59				0.75	0.84			

* data from original description.

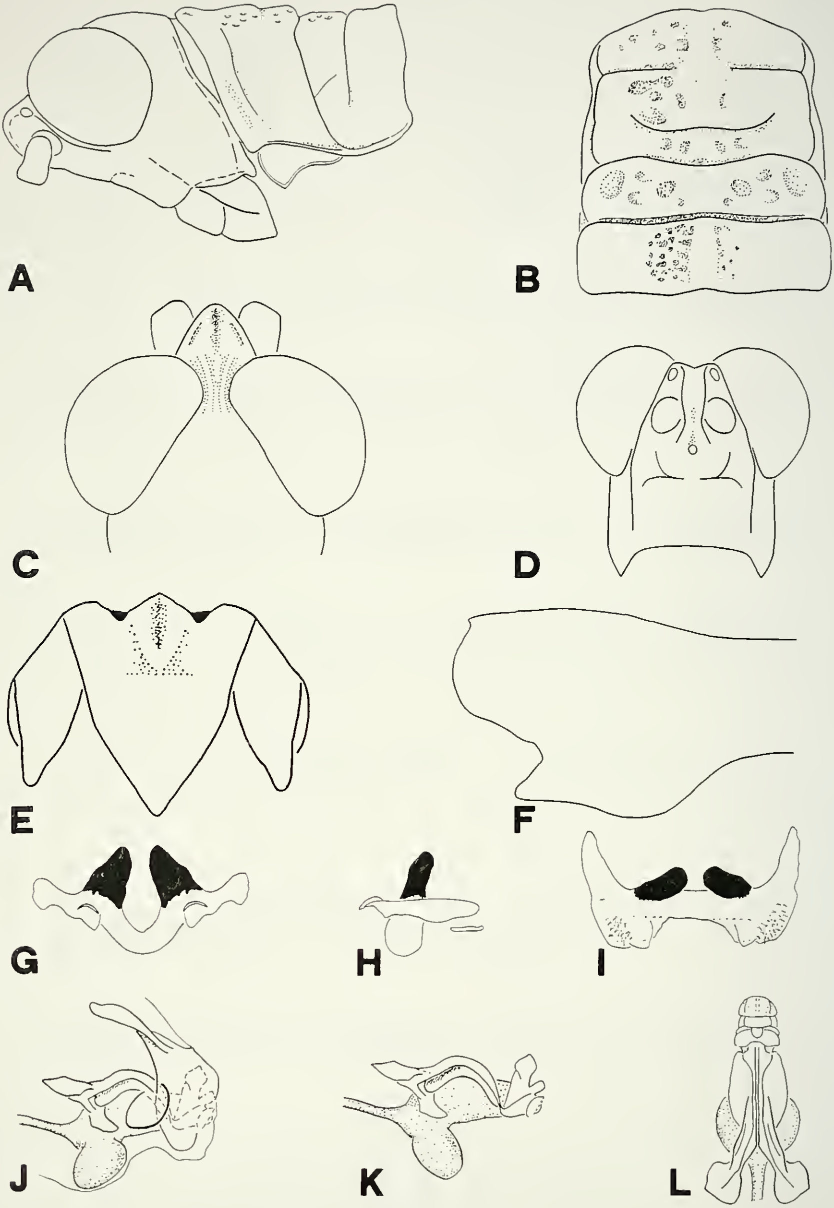


Fig. 8

Hylopedetes mirandus Rehn, 1929. Male. A, lateral view of head and pronotum. B, dorsal view of pronotum. C, dorsal view of head. D, frontal view of face. E, dorsal view of furcula, supraanal plate and cerci. F, lateral view of hind knee. G-I. epiphallus; G, axial view, H, lateral view, I, dorsal view. J, Endo- and ectophallus, lateral view. K & L, endophallus; K, lateral view. L. dorsal view. (The whole animal (both male and female) is figured in the original description. Descamps & Amédégnato (1972b, Figs. 2-8) give other drawings, including additionally the female genitalia).

The remaining three species of the genus are characteristic of the northern and central mountains of Costa Rica, and have rather wider distributions than *nigrithorax* and *mirandus*.

H. surdus Descamps & Rowell, 1978 has the largest range of any *Hylopedetes* sp. and is also the commonest. It is sympatric with *H. gemmeus* over almost the entire range of the latter and extends further north, at least as far as Volcán Tenorio, where it is sympatric with *E. volcanica*. It appears to be less shade tolerant than *gemmeus*, but like it is found on a variety of ferns, including *Hypolepis*. In the North and West of its range *H. surdus* has orange hind knees, whereas to the South and East the hind leg is entirely green. No other morphological difference can be discerned between these colour forms. Museum specimens of the northern form of *H. surdus* can at first be confused with *H. mirandus*, which also has pale knees. In life the true colours are distinctive and the two species cannot be confused.

H. cruentus Rehn, 1929 occurs principally in an arc open to the NE around the headwaters of the Rio Reventazón, between 1100 and 1700 m. The type locality (near Navarro) lies on the southern arm of this arc, and it is also found at other localities in the area between Cartago and Tapantí. Not apparently present on the Cerro de Carpintera on the Continental Divide between Cartago and San José, it occurs again on the southern slopes of Volcán Turrialba and is present on the north facing slope of Cerro Zurquí. *H. cruentus* will eat the usual ferns in captivity, but in nature shows no strong association with them. It is usually found in mixed vegetation at woodland edges, often basking on leaves of *Piper* spp.

H. gemmeus Rehn, 1929 is the species most likely to be found in thick forest at low light intensities. It too is usually found on ferns, especially members of the genera *Dryopteris* and *Pteris*. It is now known from the Cordillera de Tilarán in the north and from there south and east along the north slope of the Cordillera Central at least as far as the Río Frío. The type locality (the same as that of *H. cruentus*), however, lies well to the south of this, in the Talamanca foothills at Navarro, but the species has not been seen there since the original collection. This may be a consequence of the general forest degradation in that area.

Scirtopaon dorsatus Descamps & Rowell, 1984 (Fig. 9)

Readily distinguished by the combination of blunt rostrum, incomplete pronotal medial carina, and long, thin, filiform antennae, and by the pattern of the antennal sutures. Originally described from Monteverde, in the Cordillera de Tilarán, *S. dorsatus* is now additionally known from the head waters of the Río Sarapiquí, near Cinchona in the Cordillera Central. Patchy, never common, and rather cryptic, the species is easy to overlook, and probably will ultimately prove to have a range similar to that of *H. gemmeus*. It is not a fern or grass eater, but is associated with a variety of montane dicots.

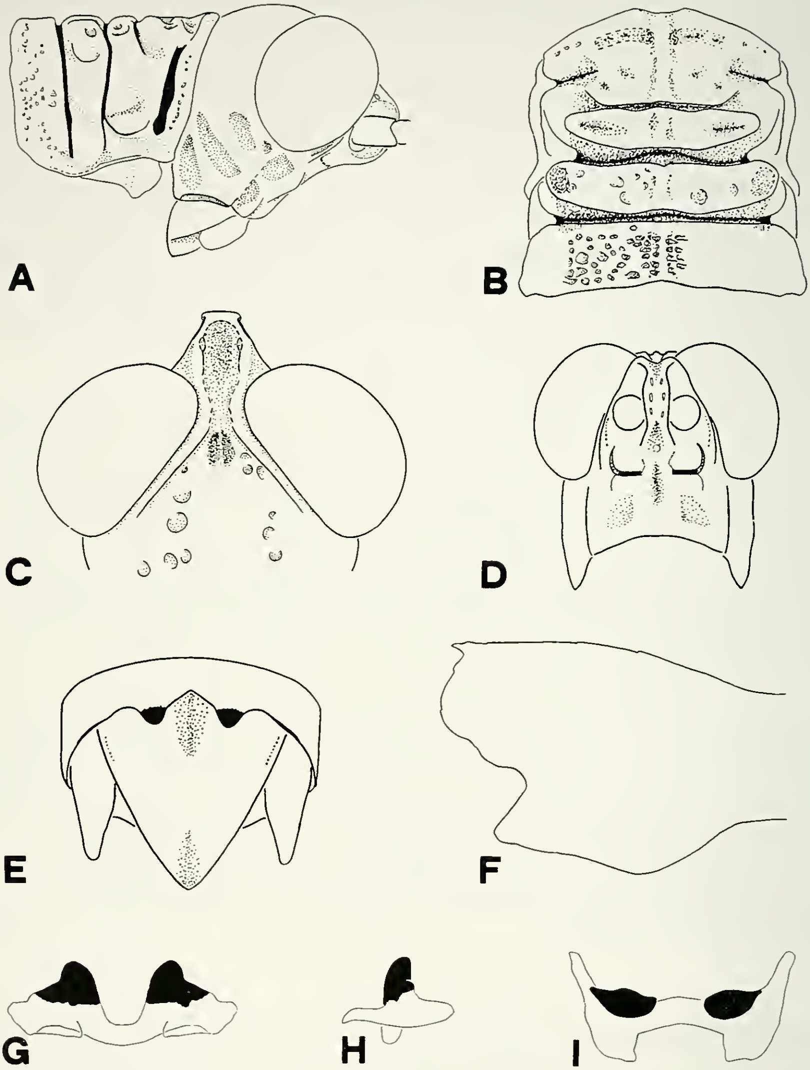


FIG. 9
Scirtopaon dorsatus Descamps & Rowell, 1984. Male. A, lateral view of head and pronotum. B, dorsal view of pronotum. C, dorsal view of head. D, frontal view of face. E, dorsal view of furcula, supraanal plate and cerci. F, lateral view of hind knee. G-I, epiphallus; G axial view, H, lateral view, I, dorsal view (The original description additionally figures the whole male, the male furcula and supraanal plate, the female fastigium and metanotum in dorsal view, and the female ovipositor valves in lateral view).

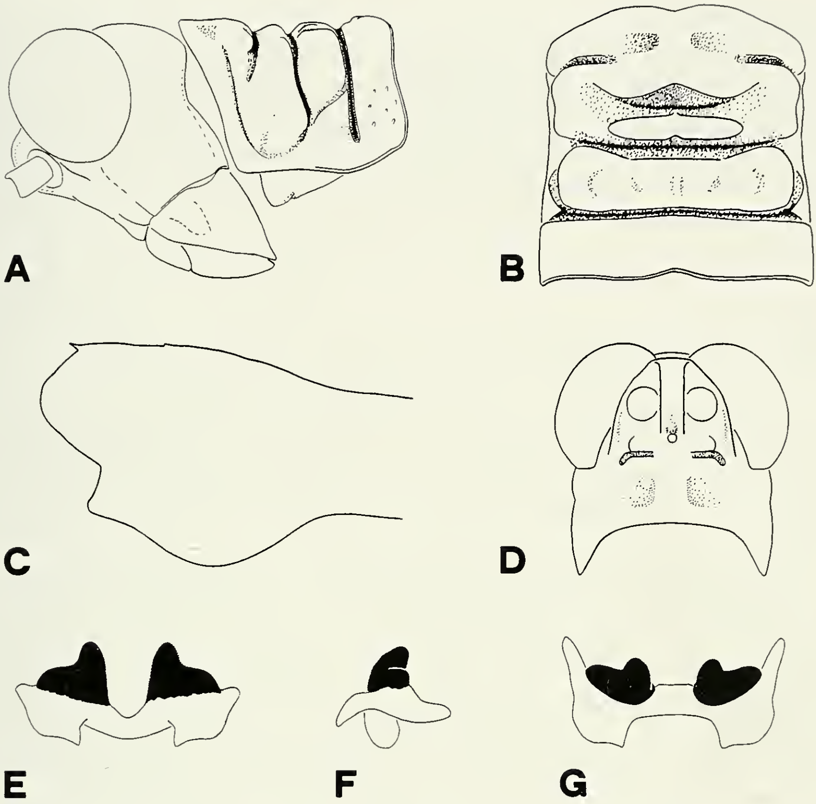


FIG. 10

Micropaon lucens Descamps & Rowell, 1984. Male. A, lateral view of head and pronotum. B, dorsal view of pronotum. C, lateral view of hind knee. D, frontal view of face. E-G, epiphallus; E, axial view, F, lateral view, G, dorsal view. (The original description additionally figures the whole male, the male furcula and supraanal plate, the female fastigium in dorsal view, and the female ovipositor valves in lateral view).

Micropaon lucens Descamps & Rowell, 1984 (Fig. 10)

The genus is well differentiated morphologically by the flat fastigium without grooves or ridges (Fig. 10D), the smooth, ungrooved frontal ridge (Fig. 10D), the short rounded rostrum, the thickened margin to the posterior margins of the meso- and metanotum, and the single medial black spot on the male supraanal plate. *Micropaon lucens* is a very local species of the Pacific slopes of the Talamanca range, so far known from only a few localities, all lying within a 3 km square on the hills above S. Isidro del General. It is found in marshes or where water seeps out of the ground, characteristically where *Polygonum* (Polygonaceae) and *Galinsoga* (Asteraceae) grow, though it does not appear to eat either of these plants. Its normal diet is unknown.

DISCUSSION

The Rhytidochrotinae is known as a very homogeneous group, and this holds for the six Costa Rican genera, which all comply to a basic morphological plan and are distinguished from each by rather small differences, as judged by the standards within other acridid subfamilies. Especially the uniformity of the male genitalia of the Rhytidochrotinae is unusual within the Acrididae, though the present work has shown that the male epiphallus offers some taxonomic possibilities (true also of the South American taxa examined). In spite of their formal similarities and the isolated geographic position of the Costa Rican taxa, it is not easy to speculate convincingly about their interrelationships. Only *Scirtopaon* and *Brakeracris* appear to share some possibly derived characters which may indicate a recent common ancestry. The other genera appear quite distinct from these two and from each other.

It is perhaps necessary to stress that despite formal morphological similarities, the Costa Rican rhytidochrotines have clearly different ecological requirements, very different colour patterns and usually do not overlap in distribution. They present no difficulties at all in field determination, it is merely the technical separation which is harder.

The Rhytidochrotinae, with its small number of taxa and interesting present day distribution (see also DESCAMPS & AMÉDÉGNATO 1972b) would be an interesting group for an independent study of phylogeny based on genomic sequence data. To date no rhytidochrotines are known from Central America north of Costa Rica (*Exerythracris*, extending to near the Nicaraguan border, is the most northerly known representative of the subfamily) and the only known Panamanian genus (*Piezops*) comes from the extreme South of that country near the Colombian border. All the remaining Central American rhytidochrotines are confined to Costa Rica. It is quite possible that some of the apparent isolation of the Costa Rican rhytidochrotines is an artifact of inadequate collecting or relatively recent human destruction of the habitat, particularly in Northern Panama. However, as all the Costa Rican rhytidochrotines are montane forms, it is equally possible that the lowlands of central and southern Panama are indeed a natural barrier to dispersal, at least under the present climatic conditions. The last Ice Age must have diminished this barrier very considerably, and the presence of numerous Andean elements on the páramos of the Talamanca Range of Costa Rica (see WEBER 1958, and for other acridological consequences, ROWELL & CARBONELL 1977) indicates that many organisms were able to disperse between these two habitats in the past, possibly including the rhytidochrotines. The *Puya*/*Blechnum* swamps of the Talamancas are a striking example, and *Talamancacris* (unless it might be discovered in the equivalent Andean habitats) would seem to be a relict taxon with a remarkably small range and population size and potentially extremely vulnerable to extinction by habitat alteration.

ACKNOWLEDGEMENTS

I am grateful to Dr. C. Amédégnato (Paris), Prof. C.S. Carbonell (Montevideo) and Dr. A. Solís and Dr. J. Jiménez (Instituto Nacional de Biodiversidad, Costa Rica) for the loan of material, to the Servicio de Parques Nacionales and other Costa Rican landowners for permission to collect on their land, and to Dr. H.E. Braker, Sr. C. Chavez, Prof. N. Elsner, Dr. L.D. Gómez, Prof. D. Janzen, Dr. M. Rowell-Rahier and Dr. G. Vargas for assistance in the field and for useful discussions. An anonymous reviewer provided helpful criticism of the manuscript. Some of the relevant field trips were supported financially by the National Science Foundation (USA), the National Geographical Society (USA) and the Freie Akademische Gesellschaft (Basel, Switzerland).

REFERENCES

Amédégnato, C. 1974. Les genres d'Acridiens neotropicaux, leur classification par familles, sous-familles, et tribus. *Acrida* 3: 193-204.

Amédégnato, C. 1977. Etude des Acridoidea Centre et Sud Americains (Catantopinae sensu lato): Anatomie des genitalia, classification, répartition, phylogenie. *Thèse, Université Pierre et Marie Curie, Paris.* 385 pp.

Collins, G.B. 1992. A specialised area of unknown function on the antennae of British grasshoppers (Orthoptera: Acrididae). *Entomologist* 111: 195-200.

Descamps, M. & C. Amédégnato. 1972a. Contribution à la faune des Acridoidea de Colombie (Missions M. Descamps). III. Diagnoses de Catantopinae (sensu lato). *Annls. Soc. entomol. Fr. (N.S.)* 8: 505-559.

Descamps, M., & C. Amédégnato. 1972b. Contribution à la faune des Acridoidea de Colombie (mission M. Descamps). IV. Le groupe Rhytidochrotae. *Bull. Mus. nat. d'Hist. nat., Paris*, 3° ser. Zool. 65: 1057-1096.

Descamps, M., & C.H.F. Rowell. 1978. Acridiens des clairiéres de Costa Rica: diagnoses, signalisations, notes biologiques, polymorphisme (Acridomorpha, Acrididae). *Annls Soc. entomol. Fr. (N.S.)* 14: 351-367.

Descamps, M., & C.H.F. Rowell. 1984. Diagnoses d'Acridoidea des forêts de Costa Rica. *Annls Soc. entomol. Fr. (N.S.)* 20: 143-161.

Rehn, J.A.G. 1929. Studies in Costa Rican Dermaptera and Orthoptera. II. New genera and species of Acrididae. *Trans. Am. entomol. Soc.* 55: 9-77.

Rowell, C.H.F. & C.S. Carbonell, C.S. 1977. *Baeacris talamancensis* (gen. and sp. nov.) (Acrididae, Melanoplinae), a neotropical montane grasshopper; its implication for the origin of the Dichroplini and of the Costa Rican páramo. *Acrida* 6: 55-74.

Rowell, C.H.F., M. Rowell-Rahier, H.E. Braker, G. Cooper-Driver & L.D. Gomez. 1983. The palatability of ferns and the ecology of two tropical forest grasshoppers. *Biotropica* 15: 207-216.

Weber, H. 1958. Die Paramos von Costa Rica und ihre pflanzengeographische Verkettung mit den Hochanden Südamerikas. *Abh. Akad. Wiss. Lit.* Jg. 1958: 116-194.

REVUE SUISSE DE ZOOLOGIE, 102 (3) : 585-608; septembre 1995

Regenwürmer aus Bolivien (Oligochaeta) [1]

András ZICSI
Bodenzoologische Forschungsgruppe der Ungarischen Akademie der Wissenschaften,
am Lehrstuhl für Tiersystematik und Ökologie der Eötvös-Loránd Universität,
Puskin utca 3, H-1088 Budapest, Ungarn.

Earthworms from Bolivia (Oligochaeta). - Twenty-eight species of terrestrial Oligochaeta from Bolivia were studied. They are distributed in 21 genera and 6 families. One new genera, Tamayodrilus and 6 new species Andiorrhinus (Amazonidrilus) bolivianus, Andiorrhinus (Andiorrhinus) montanus, Tamayodrilus roembkei, Inkadrilus hanagarthi, Martiodrilus silvestris, Belladrilus (Belladrilus) vaucheri are described.

Key-words: Earthworms - Glossoscolecidae - Acanthodrilidae - Octochaetidae - Ocnerodrilidae - Lumbricidae - Megascolecidae - Taxonomy - Bolivia.

EINLEITUNG

Da aus Bolivien nur vereinzelte Angaben über das Vorkommen von Regenwürmern vorliegen (BEDDARD, 1892; COGNETTI, 1902 a, b, 1905; MICHAELSEN, 1902, 1918; RIGHI & RÖMBKE, 1987; CSUZDI & ZICSI, 1991; ZICSI, 1992), ist es von Interesse, die im Rahmen der Ungarischen Bodenzoolologischen Expedition 1966-1967 (Teilnehmer: Dr. J. Balogh, Dr. S. Mahunka und Dr. A. Zicsi) vorwiegend in den Provinzen Beni und La Paz gesammelten terrestrischen Oligochaeten bekannt zu machen. Für die Überlassung einer kleineren Ausbeute von Regenwürmern aus Bolivien spreche ich den Herren Dr. J. Römbke (Frankfurt/Main)[2] und Dr. Cl. Vaucher (Genf) an dieser Stelle meinen besten Dank aus. Für einen Arbeitsplatz im Naturhistorischen Museum von Genf, wo die Bearbeitung des Materials z.T. erfolgte, wird der Direktion sowie Herrn Dr. Cl. Vaucher bestens gedankt. Ferner gebührt mein

---

[1] Regenwürmer aus Südamerika 23.

[2] Vor Abschluss des Manuskriptes wurde mir von Herrn Dr. J. Römbke weiteres, aus Bolivien vermitteltes, Material zur Bestimmung überlassen. Ferner übersandte mir Herr Dr. Römbke auch den Entwurf eines Manuskriptes in dem die bisherigen Funde terrestrischer Oligochaeten aus Bolivien zusammengefasst werden. Es wird die Bitte geäussert, die in meinem Manuskript enthaltenden Informationen über bolivianische Regenwürmer in sein Manuskript einbauen zu können. Der Bitte wird Folge geleistet, für die Zusendung neuen Materials sei auch an dieser Stelle gedankt.

Manuskript angenommen am 13.10.1994.

Dank für die Überlassung von Typenmaterial den Herren Prof. Dr. M. Dzwillo, Zoologisches Institut und Museum, Hamburg und Dr. A. Rolando, Museo ed Istituto di Zoologia Sistematica della Universita, Torino.

Die Buchstaben AF und Z beziehen sich auf die Sammlung des Zoosystematischen und Ökologischen Instituts der Eötvös Loránd Universität, Budapest und G auf die Sammlung des Naturhistorischen Museums, Genf.

BESCHREIBUNG DER ARTEN

Glossoscolecidae Michaelsen, 1900

Enantiodrilus Cognetti, 1902

Enantiodrilus borellii Cognetti, 1902

Von dieser hologynen Art (2 Paare Ovarien und Eitrichter im 12. und 13. Segment), die bisher nur aus Argentinien (COGNETTI, 1902a) und Brasilien (MICHAELSEN, 1902) von je einem Fundort erwähnt wurde, liegen mir über 100 Exemplare aus dem bolivianischem Guayaramerin (Prov. Beni) vor. Die Tiere sind in verschiedenen Entwicklungsstadien, die meisten sind jedoch adult und besitzen einen gut entwickelten Gürtel. Wie bekannt, ist es die einzige Art innerhalb der Glossoscolecidae, die über zwei Paare Ovarien und Eitrichter verfügt. Die Beschreibungen von COGNETTI (1902 a, b, 1905) und die ergänzenden Angaben von Michaelsen (1918) sind sehr ausführlich und ermöglichen eine sofortige Identifizierung dieser besonderen, phylogenetisch alleinstehenden Art.

Die von mir untersuchten Exemplare stimmen in allen wesentlichen Merkmalen mit der Originalbeschreibung überein und besitzen auch den von MICHAELSEN (1918) ausführlich beschriebenen handschuhfingerförmigen Anhang der Chylustaschen (Abb. 1). Dieser Anhang wird von COGNETTI (1902 b: Fig.12) weder erwähnt noch abgebildet.

Einen deutlichen Unterschied weist die Form der Samentaschen bei meinen Exemplaren auf, die bei den einzelnen Populationen eine verschiedene Ausbildung zeigt. Bei den Exemplaren aus der Umgebung der Ziegelbrennerei bei Guayaramerin weichen sie am meisten von denen der Originalbeschreibung (COGNETTI, 1902 b: Fig. 3) und denen vom Fundort Estancia Esperanza bei Guayaramerin ab. Hier sind es nur einfache Einstülpungen der Innenwand mit einem kleinen ampullenförmigen Anhang (Abb. 3). Dieser Anhang vergrössert sich bei anderen Tieren der Estancia Esperanza zu taschenförmigen Ampullen (Abb. 4) oder zu warzenförmigen Wucherungen, die genau das Aussehen der in der Originalbeschreibung angeführten Samentaschen besitzen (Abb. 5). Es könnte angenommen werden, dass die auf Abb. 3 angeführte Form der Samentaschen eine Rückbildung dieser Organe darstellt, da ansonst die Tiere mit einem deutlichen Gürtel versehen sind und die Ovarien mit Eiern besetzt sind. Dieser Annahme spricht jedoch die Beobachtung entgegen, dass bei juvenilen Tieren von der Estancia Esperanza, deren adulte Exemplare die typische Samen-

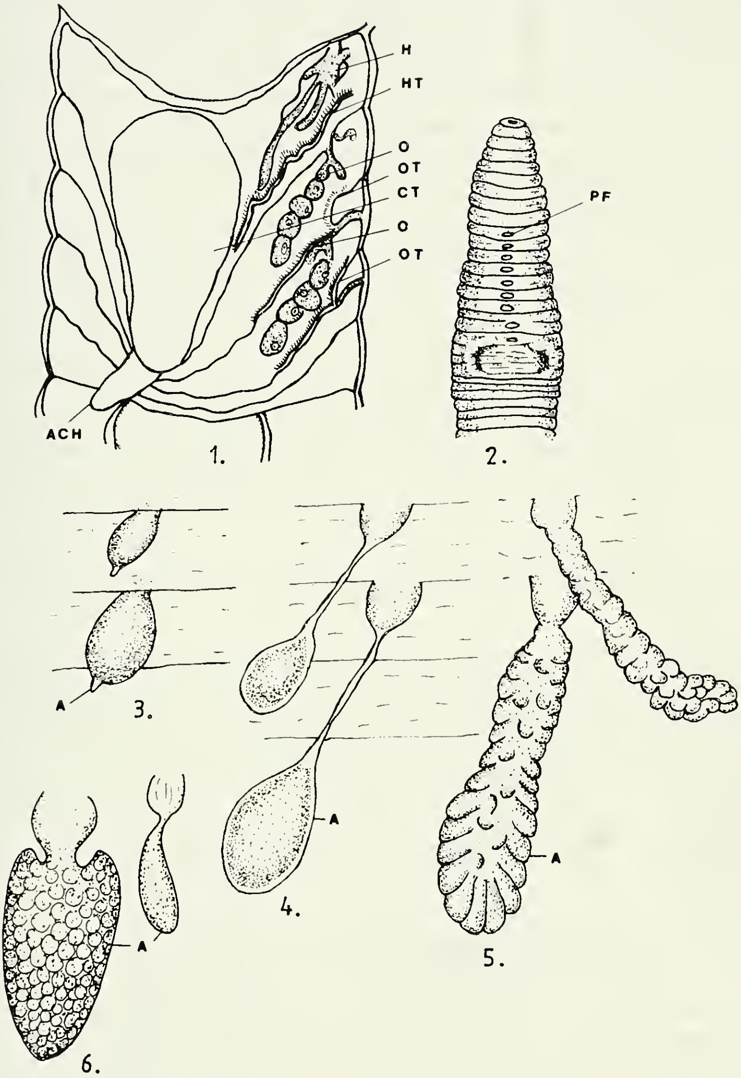


Abb. 1-6

Enantiodrilus borelli Cognetti, 1902. 1. Chylustasche mit weiblichen und männlichen Geschlechtsorgan. H = Hoden, HT = Hodentrichter, O = Ovarien, OT = Ovarientrichter, CT = Chylustasche, ACH = Handschuhförmiger Anhang der Chylustasche. 2.Ventralansicht mit dem Geschlechtsfeld.PF = Pubertätsflecke. 3-6.Verschiedene Entwicklungsstadienn der Samentaschen.A = Ampulle.

taschenform aufweisen, die Samentaschen das Aussehen der Abb. 3 besitzen. Die deutlichen Unterschiede der Samentaschenformen sind bloss ein verschiedenes Entwicklungsstadium dieser Organe und reichen, wie dies am Serienmaterial eindeutig nachgewiesen werden konnte, nicht zur Aufstellung neuer Taxa aus (Abb. 6).

Als weiterer Unterschied meiner Tiere können ausserdem die in der ventralen Medianlinie verlaufenden unpaarigen Pubertätsflecke vom 10., 11. - 15., 16.und 17. Segment erwähnt werden, die bei allen Exemplaren der 3 Fundorte erkannt werden konnten. Ferner konnte bei einigen Exemplaren eine deutliche Samenrinne nachgewiesen werden, mit der die beiden Kopulationstaschen verbunden sind.

Fundorte: AF/1189 32 adulte und 42 praead. Ex., G/INVE 17975 3 Ex., Prov. Beni, Guayaramerin Umgebung der Ziegelbrennerei, 4. XII. 1966, leg. Zicsi. - AF/2835, 2846, 2847 65 adulte, 23 praead. und 18 juv. Ex., G/INVE 17976 3 Ex., Guayaramerin, Estancia Esperanza, Galeriewald am Rande des Mamaore Flusses 30. XI. 1966, leg. Zicsi. AF/2851 14 juv. Ex., Prov. Beni, Guayaramerin, Insel Nicolas Suarez, 21. XI. 1966, leg. Zicsi. - AF/2860-61 33 juv. Ex., Prov. Beni, Insel Nicolas Suarez, 27. XI. 1966, leg. Zicsi. - AF/2882 7 Ex., Prov. Beni, Esperitu, Überschwemmungsgebiet, 10. V. 1985, leg. Römbke. - AF/2883 5 Ex., Esperitu, trockene Steppe, 10. V. 1985, leg. Römbke. - AF/2884 2 Ex., Esperitu, 16. IV. 1983, leg. Römbke. - AF/ 2886 6 Ex., AF/2887 4 Ex., Prov. Ballivian, Esperitu 170 m, 27. III. 1993, 16. IV. 1985, leg. Hanagarth. - AF/2888 2 Ex., Dept. Beni, Quiqusbey 300 m, 10. III. 1988, leg. Hanagarth.

Andiorrhinus Cognetti, 1908 emend. Righi, 1993

Neuerdings wurde diese artenreiche Gattung von Righi (1993) aufgrund der Zahl und Lage der Intestinalherzen in 4 Untergattungen geteilt (Amazonidrilus 4 Paare Intestinalherzen im 10.-13. Segment, Andiorrhinus 2 Paare Intestinalherzen im 11.-12. Segment, Turedrilus 2 Paare Intestinalherzen im 10. und 11. Segment und Meridrilus 2 Paare Intestinalherzen im 12. und 13. Segment).Bei der Typusart von Andiorrhinus, A.salvadori, wurde von Righi nur angenommen, dass sie über zwei Paare Intestinalherzen verfügt, da in der Originalbeschreibung die Lage der letzten Intestinalherzen im 12. Segment angegeben ist, ohne andere Intestinalherzen anzuführen.

Da es mir gelungen ist das Typenmaterial dieser Art im Museum von Torino (Inv. Nr. OL. 30) zu überprüfen, kann die Annahme von Righi an dieser Stelle bestätigt werden. Von den drei Exemplaren, liess sich bei einem aufgeschnittenen Tier die Lage der Intestinalherzen im 11. und 12. noch genau erkennen.

Da durch die Unterteilung der Gattungen ein Zurechtfinden erleichtert wird, schliesse ich mich der Einteilung Righis an.

Andiorrhinus (Amazonidrilus) bolivianus sp. n.

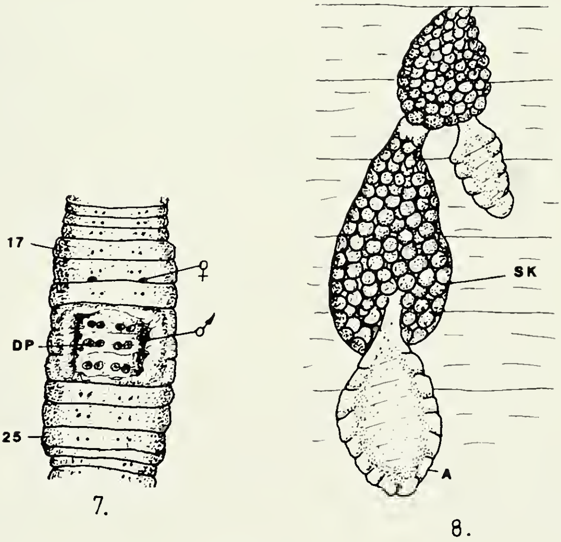
Länge des Holotypus 218 mm, Breite 9 mm, Segmentzahl 230. Länge der Paratypen, adultes Tier 220 mm, Breite 8,9 mm, Segmentzahl 235, Länge der juvenilen Tiere 55-120 mm, Breite 3,5 mm, Segmentzahl 169-189.

Farbe grau. Kopf eingezogen, 1.-2. Segment verwachsen. Vordere Segmente ungeringelt. Borsten gepaart, Borsten ab etwas grösser als cd, Borsten aa etwas grösser als bc. Borstendistanz hinter dem Gürtel aa: ab: bc: cd: dd wie 6,25: 1,25: 8,75: 1: 22,5. Borsten ab vom 6. Segment, Borsten cd vom 9. Segment zu erkennen. Dorsoventrale Borsten des 7. und 8. Segmentes zu Geschlechtsborsten umgewandelt. Ventrale Borsten des 20.-22. Segmentes ebenfalls zu Geschlechtsborsten umgewandelt und vor den Nephridialporen stehend. Nephridialporen am ganzen Körper in der Borstenlinie d.

Samentaschenporen in Intersegmentalfurche 7/8 und 8/9 in der Borstenlinie cd, deutliche Öffnungen die von einem Hof umrandet sind.

Gürtel sattelförmig vom 17.-24., 1/2 25. Segment. Pubertätsfeld vom 20.-22. Segment (Abb. 7). Weibliche Poren auf dem 18. Segment. Männliche Poren in Intersegmentalfurche 20/21.

Innere Organisation. Dissepimente 6/7-11/12 stark verdickt, 12/13-14/15 schwach verdickt. Schlunddrüsen bis ins 6. Segment reichend. Muskelmagen im 6. Segment. Kalkdrüsen im 7.-9. Segment, mit kurzem Stiel versehene Lamellentaschen ohne Anhang. Zahl der Lamellen über 30. Lateralherzen im 7.-9. Segment. Intestinalherzen im 10.-13. Segment. Hoden und Samentrichter im 10. und 11. Segment, frei. Samensäcke im 11. und 12. Segment, klein. Ovarien im 13. Segment, Ovarientrichter auf 13/14, Ovarienleiter die Dissepimente 14/15-17/18 durchbrechend im 18.



7.

8.

Abb. 7-8

Andiorrhinus (Amazonidrilus) bolivianus sp. n. 7.Ventralansicht mit dem Geschlechtsfeld. DP = Drüsenpapillen. 8.Samentaschen des 8. und 9. Segmentes. SK = Samenkämmerchen, A = Ampulle.

Segment ausmündend. Samenleiter verlaufen bis ins 20. Segment getrennt und verschwinden dann in der Muskelwand und treten in Intersegmentalfurche 20/21 hervor. Geschlechtsborsten des 20., 21. und 22. Segmentes in Borstensäcken. Länge der Geschlechtsborsten 2,20-2,22 mm, Dicke 0,44 mm. Die Borsten sind auf allen Seiten mit 19 Kerben. Geschlechtsborsten des 7. und 8. Segmentes kürzer, 16,64 mm lang und 0,41 mm dick, mit je 11 Kerben. Mitteldarm im 23. Segment beginnend und gleich mit einer Typhlosolis versehen. Nephridien mit Nephridialblasen.

Samentaschen 2 Paare im 8. und 9. Segment mit muskulösem Ausführungsgang der z.T. in der Muskelwand verborgen liegt. Diesem schliesst sich eine mit Samenkämmerchen gefüllte Vorkammer an. Aus dieser geht eine herzförmige Ampulle hervor. Die Ampulle scheint leer zu sein (Abb. 8).

Die neue Art steht *Andiorrhinus (Amazonidrilus) torquemadai* Righi, 1984, am nächsten. Unterscheidet sich jedoch von dieser durch die kürzere Ausdehnung des Gürtels, durch die Lage der weiblichen Poren, durch die Form der Samentaschen und die Zahl der Kerben der Geschlechtsborsten.

Fundort. Holotypus AF/2837 Prov. Beni. Guayaramerin Estancia Esperanza, 30. XI. 1966, leg. Zicsi. Paratypus AF/2838 1+3 juv. Ex., Fundort wie Holotypus.

Andiorrhinus (Amazonidrilus) c.f. **holmgreni** Michaelsen, 1918

Von dieser vorläufig zu holmgreni gestellten Art liegt mir ein sehr gut entwickeltes, mit Gürtel versehenes Exemplar vor. Wie aus der Literatur ersichtlich, soll *A. (A.) holmgreni* Michaelsen 1918, *A. (A.) paraguayensis* (Rosa, 1895) und *A. (A.) evelineae* Righi, 1986, nahe stehen. Leider sind jedoch *A. (A.) paraguayensis* und *A. (A.) holmgreni* aufgrund preadulter Tiere beschrieben worden, bei *A. holmgreni* fehlt sogar jegliche Angabe der vermutlichen Gürtelausdehnung. Mein Exemplar unterscheidet sich in einigen Kennzeichen von allen drei Arten, doch glaube ich, dass diese zur Aufstellung einer neuen Art nicht ausreichen. Da *holmgreni* ebenfalls aus Bolivien beschrieben wurde, leider jedoch ohne nähere Angaben des Fundortes, stelle ich mein Exemplar zu dieser Art und gebe eine ausführliche Beschreibung davon. Zum Vergleich werden auch einige Bestimmungsmerkmale der Art holmgreni erwähnt.

Länge 165 mm, Dicke 10 mm, Segmentzahl 179.

Farbe grau, Kopf eingezogen, 1.-2. Segment verwachsen. Segmente ungeringelt. Borsten eng gepaart. Ventralborsten am Vorderkörper vom 3.-4. Segment, cd-Borsten nur hinter dem Gürtel beginnend, erkannt. Bei holmgreni sind keine cd-Borsten beschrieben worden, bei paraguayensis sind ab und cd Borsten am ganzen Körper vorhanden, doch sollen diese sehr klein sein.

Borstendistanz hinter dem Gürtel aa: ab: bc: cd: dd: wie 12,5: 1,5: 20: 1: 60. Nephridialporen in der Borstenlinie cd, am Vorderkörper im vorderen Drittel der mutmasslichen Borstenlinie cd.

Samentaschenporen in Intersegmentalfurche 6/7-8/9 in der angenommenen Borstenlinie cd, vor der der Nephridialporen. Weibliche Poren auf dem 17. Segment, männliche Poren auf dem 20. Segment.

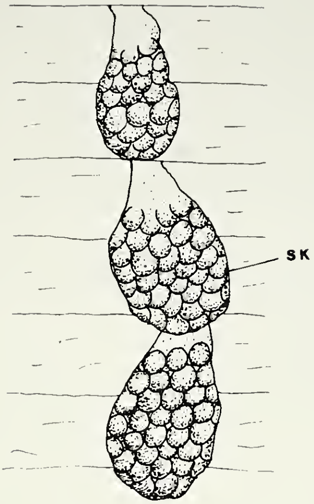
Gürtel sattelförmig, stark drüsig vom 16.-26. Segment; Segment 15 und ein Teil des 27. Segmentes ebenfalls verfärbt, doch nicht drüsig angeschwollen. Pubertätsstreifen vom 20.-24. Segment. Borsten ab des 17.-23. Segmentes von Papillen umgeben und in Geschlechtsborsten umgewandelt. Bei holmgreni stehen die ab Borsten des 18., 19.und 23. Segmentes auf Papillen und sind zu Geschlechtsborsten umgewandelt. Undeutlich begrenzte Drüsenverdickungen in der Region der Samentaschen, wie dies bei holmgreni erwähnt wurde, konnten nicht erkannt werden.

Innere Organisation. Dissepimente 6/7-14/15 deutlich verdickt. Pharingialer Bulbus ohne Schleimdrüsen, vorderer Teil des Oesophagus von Schleimdrüsen und mächtigen Peptonephridien umgeben. Peptonephridien bis ins 15. Segment, in jedem Segment vorhanden. Nephridien im hinteren Teil des Körpers mit Endblasen versehen. Mächtiger Muskelmagen im 6. Segment. Chylustaschen im 7.-9. Segment, entspringen dorsal und hängen lateral in die Körperhöhle. Es sind stiellose Lamellentaschen am Ende ohne Verschnürung. Es konnten ungefähr 30 Lamellen gezählt werden. Lateralherzen im 7.-9. Segment. Intestinalherzen im 10.-13. Segment. Hoden und Samentrichter im 10. und 11. Segment, sie sind in perioesophageale Testikelblasen eingeschlossen. Die Testikelblasen schliessen auch die Herzen des 10. und 11. Segmentes sowie die Samensäcke des 11. Segmentes ein. Zwei Paare Samensäcke im 11. und 12. Segment. Ovarien im 13. Segment, Ovarienleiter durchbrechen die zusammengedrückten und vom Muskelmagen nach hinten verschobenen Dissepimente 13/14-16/17 und treten im 17. Segment aus. Samenleiter sind in der Muskelwand eingebettet und verlaufen bis zum 20. Segment, wo sie dann austreten. Geschlechtborsten vom 17.-23. Segment. Die Borsten stehen in Borstensäcken, die an der Innenwand befestigt sind. Länge der Geschlechtsborsten 3-3,5 mm, sie sind mit in 4 regelmässigen Längsreihen angeordneten Narben ornamentiert. Es konnten bis 26-27 Narben gezählt werden. Mitteldarm beginnt im 23. Segment, Typhlosolis vorhanden.

Samentaschen im 7., 8. und 9. Segment, bestehen aus einem kurzen Ausführungsgang, der durch eine mässige Verengung in eine Ampulle übergeht. Die Ampulle ist mit Samenkämmerchen und Samenmassen gefüllt (Abb.9). Samentaschendrüsen, die bei holmgreni angegeben sind, konnten nicht erkannt werden. Pubertätsstreifen vom 20.-24. Segment. Borsten ab des 17.-23. Segmentes von Papillen umgeben und in Geschlechtsborsten umgewandelt. Bei *holmgreni* stehen die ab Borsten des 18., 19., 23. Segmentes auf Papillen und sind zu Geschlechtsborsten umgewandelt. Undeutlich begrenzte Drüsenverdickungen in der Region der Samentaschen, wie dies bei holmgreni erwähnt wurde, konnten nicht erkannt werden.

Aufgrund des vorliegenden Materials steht c.f. *holmgreni* dem *A. (A.) evelineae* Righi, 1986, am nächsten, unterscheidet sich jedoch von ihm deutlich in der Lage des Gürtels, in der Zahl der Geschlechtsborsten tragenden Segmente am Gürtel und zu einem gewissen Grade auch in der Form der Samentaschen. Es ist jedoch nicht ausgeschlossen, dass holmgreni, c.f. *holmgreni* und *evelineae* mit *paraguayensis* identisch sind und so mit dieser zu synonymisieren wären. Leider ist bei keiner der bisher beschriebenen drei Arten die Lage der weiblichen Poren angegeben, die bei c.f. *holmgreni* im 17. Segment erkannt werden konnten.

Fundort AF/2843 1 Ex., Prov. La Paz, Unduavi, 3800 m, 20. XII. 1966, leg. Zicsi.



9.

ABB. 9

Andiorrhinus (Amazonidrilus) c.f. holmgreni Michaelsen, 1918. 9.Samentaschen des 7., 8. und 9. Segmentes. SK = Samenkämmerchen.

Andiorrhinus (Andiorrhinus) montanus sp. n.

Von den 6 bisher bekannten Arten der Untergattung *Andiorrhinus* sind bisher 3 aus Venezuela und 3 aus Brasilien beschrieben worden. Soweit Höhenangaben vorliegen, stammt allein *A. (A.) venezuelanus* aus einer grösseren Höhe (3000 m). Das mir aus Bolivien vorliegende Tier wurde von mir ebenfalls in einer Höhe von 3900 m erbeutet.

Die in der Literatur angeführten Merkmale zur Unterscheidung der Arten sind sehr bescheiden. Der Gürtel erstreckt sich bei allen Arten vom 16., 17.-25. Segment und auch die Pubertätsstreifen sind auf dem 1/2 19., 20-22., 23. Segment gelegen. Weitere Merkmale, wie Geschlechtsborsten tragende Segmente sind im Bereich der Samentaschen und in der Gürtelregion bei allen Arten angeführt. Ob die Angaben über Fehlen oder Vorhandensein von Samensäcken richtig sind, ist fraglich, da diese mit den Testikelblasen verwachsen zu sein scheinen (*A. (A.) salvadori* Cognetti) und so nicht eindeutig erkannt werden können. Auch die 3 Paare Samentaschen scheinen bei allen Arten konstant zu sein, wenn auch bei *A. (A.) muku* Righi (1989) nicht im 7., 8. und 9. Segment sondern im 6., 7. und 8. Segment gelegen. Nur in der Form und Gestalt der Samentaschen lassen sich Unterschiede erkennen. Obwohl die Unterschiede meines Exemplares zu denen der bisher beschriebenen Arten gering sind, betrachte ich mein vollkommen entwickeltes Tier aufgrund seines von den anderen weit entfernten Fundorts als eine für die Wissenschaft neue Art.

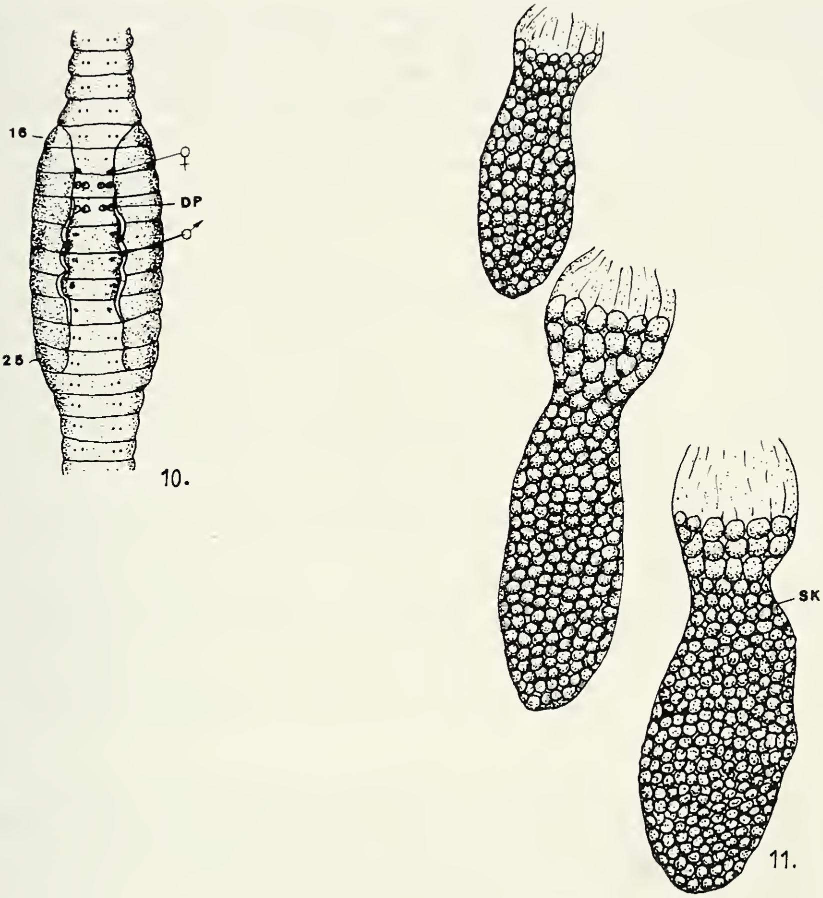


Abb. 10-11

Andiorrhinus (Andiorrhinus) montanus sp. n. 10. Ventralansicht mit Gürtel und Pubertätsstreifen. DP = Drüsenpapillen. 11. Samentaschen des 7., 8. und 9. Segmentes. SK = Samenkämmerchen.

Länge 140 mm, Dicke am Gürtel 10 mm, hinter dem Gürtel 6 mm, Segmentzahl 97 (einige Schwanzsegmente fehlen).

Farbe grau, auf der Dorsalseite vielleicht rot gewesen. Kopf rüsselförmig, 1-2. Segment verwachsen. Borsten ab vom 6. Segment, cd hinter dem Gürtel beginnend, erkannt. Borsten ab des 7. und 8. Segmentes zu Geschlechtsborsten verwandelt, sind von kleinen Papillen umgeben. Nephridialporen in der Borstenlinie cd.

Gürtel sattelförmig vom 16.-25. Segment, Pubertätsstreifen vom 19.-23. Segment. Borsten ab des 18. und 19. stehen auf kleinen Papillen, die des 20.-23.

Segmentes sind von drüsiger Struktur umgeben. Sämtliche Borsten der angeführten Segmente sind zu Geschlechtsborsten verwandelt. Die Gürtelregion ist stark ausgebreitet, Intersegmentalfurchen 19/20, 20/21 und 21/22 mit deutlichen Vertiefungen (Abb. 10.), die dem Geschlechtsfeld ein charakteristisches Aussehen verleihen. Weibliche Poren auf dem 17. Segment hinter der Borstenreihe ab, in Linie der Borste b. Männliche Poren auf Intersegmentalfurche 20/21 (bei *A. (A.) rubescens* Michaelsen (1926) konnten die von Michaelsen nicht erkannten weiblichen Poren ebenfalls auf dem 17. Segment nachgewiesen werden).

Innere Organisation. Dissepimente 6/7-12/13 deutlich ausgebildet, doch nicht verdickt. Schlund ohne Schlunddrüsen, Oesophagus langgestreckt, von zwei mächtigen Peptonephridien umgeben. Muskelmagen im 6. Segment, weit nach hinten verzogen und so im 14.-16. Segment liegend. Drei Paare Chylustaschen im 7.-9. Segment, dorsoventral mit einem kurzen Stiel an das Blutgefäss geheftet, ventral ebenfalls mit dem Blutgefäss verbunden, ohne abgeschnürtes Ende. Typische Lamellentaschen mit ungefähr 25 Lamellen ausgebildet. Lateralherzen im 7.-9. Segment, Intestinalherzen im 11. und 12. Segment. Hoden und Samentrichter im 10. und 11. Segment, in perioesophageale Testikelblasen eingeschlossen, die dorsal miteinander verschmolzen sind. Sie schliessen so die Herzen und Samensäcke des 11. Segmentes ein. Zwei Paare lappenförmige Samensäcke im 11. und 12. Segment. Ovarien länglich im 13. Segment, Ovarienleiter durchbrechen die zusammengedrängten Dissepimente 13/14-16/17 und münden im 17. Segment aus. Samenleiter verlaufen parallel vom 18. Segment an der Innenwand entlang und verschwinden in Höhe des 20/21 Segmentes in der Leibeswand. Mitteldarm im 23.-25. Segment beginnend, Typhlosolis vorhanden.

Die Geschlechtsborsten des 7. und 8. Segmentes sind nicht von Geschlechtsborstendrüsen umgeben wie dies bei *A. (A.) rubescens* Michaelsen, 1926, und *A. (A.) pictus Michaelsen*, 1926, der Fall ist. Es sind einfache, kleine Borstensäcke, die nicht an die Leibeswand angeheftet sind. Die Geschlechtsborsten der Gürtelregion sind in Borstensäcken und münden in einen länglichen Muskelstrang ein der ental an die Innenseite der Leibeswand angeheftet ist und lateral verschieden hoch sein kann, entsprechend den Einbuchtungen auf Intersegmentalfurche 19/20, 20/21 und 21/22. Es sind also nicht Drüsenzellen, die die Geschlechtsborstensäcke umgeben wie bei rubescens, sondern Muskelstränge wie von pictus beschrieben. Geschlechtsborsten des 7. Segmentes 2,2 mm lang, mit 11 Kerben, Geschlechtsborsten der Gürtelregion 5,0 mm lang, mit 20 Kerben. Nephridien im Vorderkörper Peptonephridien, im hinteren Teil des Körpers mit einer Endblase.

Samentaschen im 7., 8. und 9. Segment mit muskulösem breiten Ausführungsgang der in eine Ampulle übergeht. Ampulle mit kleinen Samenkämmerchen dicht besetzt. Ausführungsgang mit einigen kugelförmigen Kämmerchen versehen (Abb. 11.)

Wie vorher erwähnt, wurde das Typenmaterial von *A.(A.) salvadori* Cognetti, 1908, überprüft. An dieser Stelle sei erwähnt, dass auch das Typenmaterial von *A. (A.) rubescens* Michaelsen, 1926 (Inv. Nr. V.9809 Brasilien, Staat Manaus, Manacapuru am Rio Amazonas, VII.-VIII. 1924, leg. W. Ehrhardt) eingesehen wurde. Es konnte nachgewiesen werden, dass die von RIGHI (1993) als fraglich betrachtete Lage der Intestinalherzen im 11. und 12. Segment nun erwiesen wurde.

Die neue Art steht *A. (A.) rubescens* am nächsten, unterscheidet sich von diesem jedoch durch die inneren Geschlechtsdrüsen im 7., 8. und 18.-23. Segment sowie die Form und Gestalt der Samentaschen.

Fundort. Holotypus AF/2844 Prov. La Paz, Unduavi 3900 m, 20. XII. 1966, leg. Zicsi.

Andiorrhinus (Andiorrhinus) sp. juv.

Fundort AF/2890 1 Ex., Prov. Larecoja, Mapiri 1. VII. 1992, leg. Arce.

Tamayodrilus gen. n.

Typusart: *Tamayodrilus roembkei* sp. n.

Gattungsdiagnose. Normale Borsten in 8 Längslinien. Männliche Poren intraclitellial. Vordere Dissepimente schwach verdickt. 6 Paare Chylustaschen im 10.-15. Segment, verzogene Rispenschlauchtaschen. Geschlechtsapparat holoandrisch und metagyn. Samensäcke im 11. und 12. Segment, kurz. Samentaschen vorhanden.

Die Gattung *Tamayodrilus* unterscheidet sich von allen übrigen Gattungen mit holoandrischem und metagynem Geschlechtsapparat durch die Zahl und Anordnug der Chylustaschen.

Tamayodrilus roembkei sp. n.

Holotypus: Länge 200 mm, Dicke 10 mm, Segmentzahl 205. Paratypus: Länge 201 mm, Dicke 9,8 mm, Segmentzahl 2Ol.

Farbe grau, Kopf eingezogen, 1.-2. Segment verwachsen. Borsten ab vom 3. Segment, Borsten cd vom 6. Segment beginnend, erkannt. Borsten ab etwas grösser als cd, Borsten aa gleich bc. Borstendistanz hinter dem Gürtel aa: ab: bc: cd: dd wie 10: 1,3: 10: 1: 40. Segmente bis zum 8. Segment ungeringelt, vom 9. Segment doppelt geringelt. Borsten ab vom 13.-19. Segment auf Papillen angeordnet und zu Geschlechtsborsten umgewandelt.

Weibliche Poren auf dem 14. Segment zwischen der Borstenlinie bc. Männliche Poren auf dem 20. Segment. 3 Paare Samentaschenporen auf Intersegmentalfurche 6/7-8/9, in der Borstenlinie cd gelegen.

Gürtel sattelförmig vom 13.-25. Segment, auf dem 26. Segment nur dorsal eine dünne Verdickung zu erkennen. Pubertätsstreifen vom 1/4 19.-2/3 25. Segment (Abb. 12).

Innere Organisation. Dissepimente 6/7-10/11 mässig verdickt Schlund im 3-4. Segment ohne Speicheldrüsen. Diesem folgt ein gewundener Teil des Oesophagus der beiderseits mit Speicheldrüsen besetzt ist. Grosser Muskelmegen im 6. Segment. Lateralherzen im 7.-9. Segment, Intestinalherzen im 10. und 11. Segment. 6 Paare Chylustaschen im 10.-15. Segment, entspringen dorsolateral und sind der Bauchseite

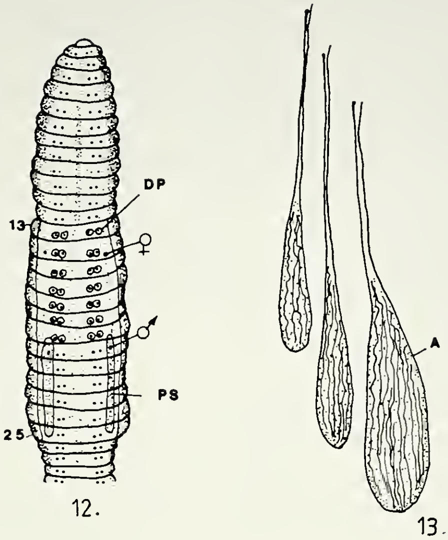


Abb. 12-13

Tamayodrilus roembkei sp. n. 12. Ventralansicht mit Gürtel und Pubertätsstreife. DP = Drüsenpapillen, PS = Pubertätsstreifen. 13. Samentaschen des 7., 8. und 9. Segmentes. A = Ampulle.

zu gerichtet. Es sind schinkenförmige Gebilde, die am Ende keine Verschnürung besitzen. Die innere Struktur der Chylustaschen deuten auf etwas verzogene Rispenschlauchtaschen hin. Hoden und Samentrichter im 10. und 11. Segment, Samensäcke im 11. und 12. Segment, klein. Der Mitteldarm beginnt im 17., Typhlosolis im 26. Segment. Peptonephridien bis ins 15. Segment reichend, von da Nephridien mit Blindsack und Nephridialblase.

Die Geschlechtsborsten sind innen von mächtigen drüsigen Zellen vom 13.-19. Segment umgehen, Pubertätsstreifen sind ebenfalls durch eine drüsige Struktur von innen markiert. Samenleiter verlaufen an der Innenwand deutlich bis zum 20. Segment.

Samentaschen 3 Paare im 7., 8. und 9. Segment. Es sind längliche Gebilde mit löffelartiger Ampulle, und sehr langem Stiel. Ampulle mit Samenmasse gefüllt (Abb. 13).

Die neue Art wird Herrn Dr. J. Römbke (Frankfurt am Main) zu Ehren benannt, der mir das Material zur Bestimmung überlassen hat.

Fundort. Holotypus AF/2885 Dpto. de La Paz, Prov. Franz Tamayo, Serrania Macho Pelechuco, 4060 m, 28. X. 1982, leg. J. P. Arce. Paratypus AF/2891 1 praead. Ex., Fundort wie Holotypus.

Goiascolex Righi, 1971

Goiascolex vanzolinii Righi, 1984

Obwohl nur gürtellose Tiere vorliegen, besteht kein Zweifel, dass es sich um eine Art der Gattung *Goiascolex* handelt. Die unpaarigen männlichen Poren, die drei Paare Chylustaschen (Kompositenschlauchtaschen), der holoandrische und metagyne Geschlechtsapparat sowie Kopulationstaschen und das Fehlen der Samentaschen, ermöglichen ein sicheres Einreihen zur Gattung *Goiascolex*. Von den bisher beschriebenen Arten *G. cabrelli* Righi, 1971, *G. pepus* Righi, 1972, *G. edgardi* Righi, 1986, und *G. vanzolinii* Righi, 1984, scheint sie der letzten am nähesten zu stehen. Da die Originalbeschreibung nur aufgrund eines Exemplars erfolgte, gebe ich eine Beschreibung meiner Tiere.

Länge 85-130 mm, Dicke 6-8 mm, Segmentzahl 148-178.

Kopf eingezogen rüsselförmig. 1.-2. Segment verwachsen. Borsten am ganzen Körper eng gepaart. Borstenverhältnis am 32. Segment aa: ab: bc: cd: dd wie 15: 2: 20 : 1: 47,5. Borsten ab vom 13. Segment, cd vom 23. Segment beginnend, erkannt. Borsten des 17. 18., 20., 21. und 29.-32. Segmentes auf kleinen Drüsenpapillen angeordnet, zu Geschlechtsborsten verwandelt. Bei G. vanzolinii Geschlechtsborsten vom 16.-18. und 20.-28. Segment vorhanden. Geschlechtsborsten mit Kerben in Reihen angeordnet, es konnten bis zu 7 Kerben gezählt werden. Weibliche Poren auf dem 14. Segment, männliche Poren auf dem 19. Segment, y-förmiger Schlitz (bei *vanzolinii* sind die weiblichen Poren nicht erkannt worden).

Innere Organisation. Verdickte Dissepimente 6/7-11/12 stark, 12/13-14/15 schwächer verdickt. Lateralherzen im 7.-9. Segment. Chylustaschen im 7.-9. Segment, dorsolateral mit kurzem Stiel angeheftet, schinkenförmig ohne Abschnürung am Ende. Kompositenschlauchtaschen. Hoden und Samentrichter im 10. und 11. Segment, frei. Samensäcke im 11. und 12. Segment. Ovarien im 13. Segment. Kopulationstaschen im 19. Segment, rundliche Gebilde die auch etwas auf das 18. und 20. Segment übergehen. Ventral sind sie durch ein verdicktes Drüsenfeld miteinander verbunden. Samenleiter treten hinter Dissepiment 14/15 hervor und laufen der Innenwand angeschmiegt bis zum 18. Segment wo sie in die Kopulationstaschen eintreten und dort im halbkreis verlaufend bis zur Mitte des 19. Segmentes weiter zu verfolgen sind. Mitteldarm im 15.-16. Segment beginnend, Typhlosolis und Nephridialblasen vorhanden. Samentaschen fehlen.

Obwohl meine praeadulten Tiere einige Abweichungen zu G. vanzolinii aufweisen, werden sie wegen Form und Lage der Kopulationstaschen und deren Geschlechtsborsten-Anordnung dieser Art zugeordnet. Die deutlichen Geschlechtsborsten des 29.-32. Segmentes wurden von Righi (1984b) nicht erwähnt.

Fundorte. AF/2839, AF/2840 2 praead. und 2 juv. Ex., Guayaramerin, Nueva Cuba, 24. und 28. XI. 1966, leg. Zicsi.

Diachaeta Benham, 1886

Sämtliche auf der Insel Nicolas Suarez bei Guayaramerin gesammelten Tiere von Diachaeta waren so jung, dass sie nicht zur Art bestimmt werden konnten.

Fundort. AF/2849, AF/2862 37 juv. Ex., Nicolas Suarez, 21. und 27. XI. 1966, leg. Zicsi.

Inkadrilus Michaelsen, 1918

Da es sich um den ersten Fund einer *Inkadrilus*-Art seit 1900 handelt, sollen hier die Kenntnisse über diese Gattung zusammengefasst werden.

MICHAELSEN (1918) ordnete der Untergattung *Inkadrilus* Arten aus der Sammelgattung *Thamnodrilus* (=*Martiodrilus*) mit Fachkapseltaschen und Saumleistentaschen zu. Wie bekannt besitzen die Arten der Gattung *Martiodrilus* 7-8 oder 6-8 Chylustaschen. Bei den meisten dieser Arten handelt es sich im Bau der Chylustaschen um Kompositenschlauchtaschen, die sich zu Wabentaschen vereinfachen können (MICHAELSEN, 1918). Später wurden von MICHAELSEN (1935) die der Untergattung *Inkadrilus* zugeordneten Arten in zwei selbstständige Gattungen gestellt. Für *Rhinodrilus (Thamnodrilus) cameliae* Michaelsen, 1913, mit 8 Paar im 7.-14. Segment liegenden Chylustaschen, Fachkapseltaschen, wurde die Gattung *Quimbaya* errichtet und für *Anteus aberratus* Michaelsen, 1900, und *Anteus octocystis* Michaelsen, 1900, mit 8 Paar Chylustaschen im 7.-14. Segment, Saumleistentaschen wurde die Untergattung *Inkadrilus* zur Gattung erhoben (MICHAELSEN, 1935). *Q. cameliae* wurde in Kolumbien gesammelt, *I. octocystis* in Peru. Für *I. aberratus* wurde von MICHAELSEN (1918, p. 57) die fragliche "Heimatsnote wahrscheinlich Peru" beigelegt und dies wegen seiner nahen Verwandtschaft mit der peruanischen *I. octocystis*. Bei der Revision der Gattung *Aymara* (Typusart *A. voogdi* Michaelsen) fand ich in der Sammlung des Zoologischen Instituts und Museums von Hamburg (Typenmaterial: Inv. Nr. 12305, Peru, Dept. Huànuco, 10-15 km N.O. von Chogosh, 9o20' S.B. 75o30'W.L.) auch zwei gut erhaltene Exemplare der *I. aberratus*. Durch diesen Fund ist das Vorkommen von *I. aberratus* in Peru einwandfrei erwiesen. Die mir zur Beschreibung vorliegende neue Art aus Bolivien (16o 4' 30'' S.) weist darauf hin, dass die Arten mit Saumleistentaschen und einer hohen Zahl von Chylustaschen eine südliche Verbreitung in den Kordilleren besitzen und die beiden schon bekannten Arten in Peru den nördlichsten Vorposten darstellen.

Inkadrilus hanagarthi sp. n.

Es liegt ein gut entwickeltes, adultes Exemplar dieser Art vor.

Holotypus: Länge 160 mm, Dicke 9 mm, Segmentzahl 154.

Farbe am Vorderkörper grau-rot. Kopf eingezogen. 1.-2. Segment verwachsen. Borsten am ganzen Körper eng gepaart. Borstenverhältnis hinter dem Gürtel aa : ab: bc : cd : dd wie 15 : 1,5 : 10 : 1 : 27. Borsten ab vom 5., bc vom 6. Segment erkannt. Borsten ab vom 19.-26. Segment von Drüsenpapillen umgeben und in Geschlechtsborsten verwandelt. Geschlechtsborsten 1,5 - 1,7 mm lang und mit 10-11 Kerben in jeder der 4 unregelmässigen Längsreihen. Nephridialporen in der Borstenlinie cd. Samentaschenporen in Intersegmentalfurche 6/7 - 8/9 etwas unterhalb der Borstenlinie cd.

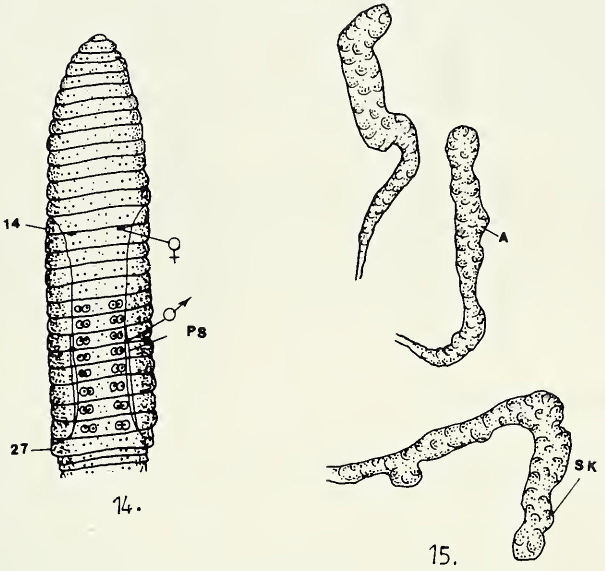


Abb 14-15

Inkadrilus hanagarthi sp. n. 14.Ventralansicht mit Gürtel und Pubertätsstreifen. DP = Drüsenpapillen, PS = Pubertätsstreifen. 15.Samentaschen des 7., 8. und 9. Segmentes. A = Ampulle, SK = Samenkämmerchen.

Gürtel sattelförmig, stark drüsig vom 14. - 1/2 27. Segment. Pubertätsstreifen vom 21. - 1/4 27. Segment. Weibliche Poren auf Intersegmentalfurche 14/15, auf der Innenseite des 14. Segmentes, männliche Poren auf dem 21. Segment (Abb. 14.). Die Poren konnten von Aussen nicht beobachtet werden, von Innen konnte der Eileiter und Samenleiter verfolgt und die Ausmündungen erkannt werden.

Innere Organisation. Dissepimente 6/7 - 9/10 sehr stark verdickt. 10/11 und 11/12 schwach angedeutet. Schlund bis ins 4. Segment reichend. Mächtige Peptonephridien im 5. Segment. Weitere Peptonephridien bis ins 12. Segment vorkommend, von da Nephridien mit Blindsack und Nephridialblase versehen. Mächtiger Muskelmagen im 6. Segment. Lateralherzen im 7. - 9. Segment, Intestinalherzen im 10. und 11. Segment. 9 Paare Chylustaschen im 7. - 15. Segment, die des 7.-9. Segmentes sehr klein, 10.-11. etwas grösser, vom 12. - 15. Segment gross, von fächerförmiger Gestalt, Saumleistentaschen die dorsolateral am Darm angeheftet sind. Hoden und Samentrichter im 10. und 11. Segment in oesophageale Testikelblasen eingeschlossen. Samensäcke im 11. und 12. Segment, klein. Ovarien im 13. Segment, mit grossem Ovariensack aus dem die Eileiter hervorgehen und im 14. Segment ausmünden. Samenleiter treten im 11. und 12. Segment hervor und verlaufen an der Innenwand bis zum 21. Segment. Mitteldarm im 16. Segment, Typhlosolis im 27. Segment beginnend.

Samentaschen drei Paare im 7., 8. und 9. Segment, es sind fadenförmige Gebilde, die am Ende verschiedenartig angeschwollen und mit Samenmasse gefüllt sind (Abb. 15).

Die neue Art steht *I. aberratus* und *I. octocystis* gleicherweise nahe, unterscheidet sich von beiden aber durch die 9 Paare Chylustaschen.

Die neue Art wird Herrn Dr. W. Hanagarth (Ökologisches Institut, La Paz), der mir einen Teil des Materials zur Bestimmung zugesandt hat, zu Ehren benannt.

Fundort. Holotypus AF/2892. Dept. La Paz Prov. Manco Capac, Comunidad Copacabana, Kusijata, 3812 m, 16o 4' 30 S 64o 4' 48 O, 16. VII. 1991, leg. Fecho.

Martiodrilus Michaelsen, 1936

Aus Bolivien wurde bisher nur eine Martiodrilus-Art (*M. bolivianus* Righi & Römbke, 1987) beschrieben. Bei dieser Art reichen die Chylustaschen, wie bei der jetzt zur Beschreibung vorliegenden Art, bis ins 15. Segment. Also ein Segment weiter nach hinten, als dies für die zahlreichen übrigen Martiodrilus-Arten der Fall ist. Im 7. Segment hingegen fehlen die Chylustaschen bei den beiden bolivianischen Arten. Ein Fehlen der Chylustaschen im 7. Segment ist auch bei einer Gruppe von *Martiodrilus*-Arten bekannt (*M. ecuadoriensis* und *M. savanicola*), doch besitzen diese Arten nur 7 Paar Chylustaschen. Vorläufig soll dieser Verschiebung kein supraspezifischer Wert beigemessen werden, da wir es in beiden Fällen nur mit je einem Exemplar zu tun haben. Weiteres Material aus Bolivien ist notwendig, um die phylogenetische Bedeutung der Verschiebung der Chylustaschen im südlichen Teil der Kordilleren beurteilen zu können.

Martiodrilus silvestris sp. n.

Von der neuen Art liegt nur ein sehr erweichtes Exemplar vor.

Holotypus: Länge 100 mm, Dicke 7 mm, Segmentzahl 117.

Farbe dunkelrot, irisierend. Kopf kolbenförmig, eingezogen. Borsten am ganzen Körper eng gepaart. Borstenverhältnis hinter dem Gürtel aa : ab : bc : cd : dd wie 10 : 1 : 12 : 1 : 37. Borsten ab vom 8. - 14. und vom 19. - 20. Segment auf Borstenpapillen angeordnet, zu Geschlechtsborsten verwandelt. Geschlechtsborsten mit 20-23 Kerben versehen. Die meisten Borsten sind wegen der Erweichung des Tieres ausgefallen. Nephridialporen in der Borstenlinie cd.

Weibliche Poren auf dem 14. Segment hinter der Borstenlinie b, männliche Poren auf dem 20. Segment. Samentaschenporen in Intersegmentalfurche 6/7 - 8/9 in der Borstenlinie cd.

Gürtel sattelförmig vom 14. - 26. Segment, Pubertätsstreifen vom 1/2 20. - 1/2 22. Segment (Abb. 16).

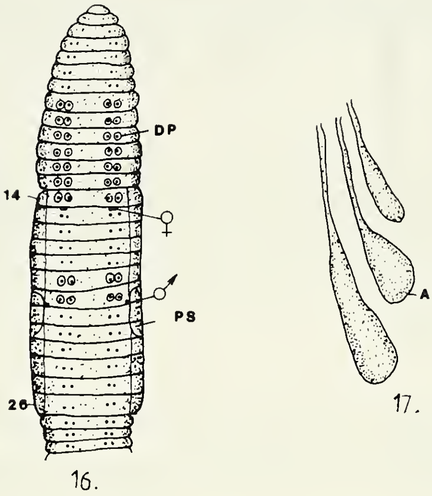


Abb. 16-17

Martiodrilus silvestris sp. n. 16. Ventralannsicht mit Gürtel und Pubertätsstreifen. DP = Drüsenpapillen, PS = Pubertätsstreifen. 17. Samentaschen des 7., 8. und 9. Segmentes. A = Ampulle.

Innere Organisation. Verdickte Dissepimente fehlen im vorderen Teil des Körpers, dadurch Muskelmagen stark nach hinten verschoben, im 6. Segment liegend. Chylustaschen im 7/8 - 14/15. Segment. Die im 8. und 9. Segment würstchenförmig, die übrigen am Basalteil immer breiter werdend. Die Chylustaschen sind dorsolateral am Darm angeheftet und besitzen einen kurzen Stiel. Es sind Kompositenschlauchtaschen mit Übergang zu Wabentaschen. Hoden und Samentrichter im 10. und 11. Segment in oesophageale Testikelblasen eingeschlossen aus denen die Samensäcke des 11. und 12. Segmentes hervorgehen. Die Samensäcke sind längliche Gebilde, die des 11. Segmentes nach vorne gerichtet und 3-4 Segmente einneimend, die des 12. Segmentes nach hinten gerichtet und 6-7 Segmente einnehmend. Intestinalherzen im 10. und 11. Segment. Ovarien im 13. Segment. Vom 8. - 14. Segment und vom 19. - 20. Segment sind die Geschlechtsborsten von mächtigen Drüsenzellen umgeben. Samenleiter verlaufen doppelt bis zum 20. Segment. Mitteldarm im 17. Segment beginnend. Nephridien mit Blindsack und Nephridialblase.

Samentaschen im 7., 8. und 9. Segment. Es sind löffelartige Gebilde mit langem Stiel. Ampulle voll mit Samenmasse (Abb. 17).

Die neue Art steht hinsichtlich der Form der Pubertätsstreifen *M. jordani* (Rosa, 1895) am nächsten. Hinsichtlich der männlichen Geschlechtsorgane erinnert sie an die Arten *M. savanicola* und *M. agricola*. Von allen unterscheidet sie sich jedoch durch die bis ins 15. Segment reichenden Chylustaschenpaare.

Fundort. Holotypus AF/289, Cota Pata Dpto. de La Paz, Caja de Montana, 2900 m, Urwald, 26. I. 1985, leg. Hanagarth.

Pontoscolex Schmarda, 1861

Pontoscolex corethrurus (F. Müller, 1857)

Fundorte. AF/2845, AF/2852 47+6 juv. Ex., Guayaramerin, 18. XI. und 2. XII. 1966, leg. Zicsi. - AF/2848 72 Ex., Guayaramerin, Insel Nicolas Suarez, 21. und 27. XI. 1966, leg. Zicsi. - AF/2864 2 Ex., Plantage am Ufer des Mamore Flusses, Guayaramerin, 24. XI. 1966, leg. Zicsi.

Periscolex Cognetti, 1905

Periscolex sp.

Die beiden winzigen Exemplare waren so erweicht, dass sie nicht bis zur Art bestimmt werden konnten.

Fundort: AF/2897 2 Ex., Dept. Beni, Prov. Ballivian, Esperitu Rio Yacuma, 18. X. 1980, leg. Hanagarth.

Acanthodrilidae Claus, 1880

Microscolex Rosa, 1887 emend. Pickford, 1937

Microscolex dubius (Fletcher, 1887)

Fundort. AF/2833 103 Ex., Prov. La Paz, La Paz 3600 m, 25. XII. 1966 leg. Zicsi.

Microscolex phosphoreus (Ant. Dügès, 1837)

Fundort. AF/2834 3 Ex., Prov. La Paz, La Paz, 3600 m, 25. XII. 1966, leg. Zicsi.

Yagansia Michaelsen 1899 emend. Zicsi, 1989

Yagansia peruana Cernosvitov, 1939

Es sind bisher 3 Arten mit zwei Divertikeln der Samentaschen beschrieben worden. Es sind dies *Y. peruana* Cernosvitov vom Titicaca-See, *Y. chiloensis* Michaelsen und *Y. parinacotana* Zicsi aus Chile. Für die Revision von Yagansia lagen mir keine Exemplare von *Y. peruana* vor und ich konnte auch das Typenmaterial dieser Art nicht einsehen (Zicsi, 1989). Obwohl bei den vorliegenden Exemplaren die muskulöse Kammer an der Ausführungsstelle der männlichen Poren nicht erkannt werden konnte, stelle ich die vorliegenden Tiere *Y. peruana* zu, da sie in der Ausdehnung der Gürtelorgane, in der Form der Samentaschen und auch in der Form Geschlechtsborsten mit dieser übereinstimmen.

Fundort. AF/721 4., Ex., Prov. La Paz, zwischen Unduavi und Cota 4654 m, 29. XII. 1966, leg. Zicsi. - AF/719-720 7 Ex., Titicaca-See, beim Jachtklub, 3800 m, 28. XII. 1966, leg. Zicsi - AF/2896 4 Ex. Prov. La Paz, Titicaca-See, 3850 m, 8. VIII. 1993, leg. Beck.

Octochaetidae Michaelsen, 1900

Dichogaster Beddard 1888

Dichogaster saliens (Beddard, 1893)

Fundorte. AF/2855, AF/2871 10 Ex., Prov. Beni, Guayaramerin, Park, 18. XI. und 2. XII. 1966, leg. Zicsi. - AF/2850 2 Ex., Guayaramerin, Insel Nicolas Suarez, 21. XI. 1966, leg. Zicsi. -AF/2865 5+9 juv. Ex., Guayaramerin, Plantage am Ufer des Mamore Flusses, 24. XI. 1966, leg. Zicsi.

Dichogaster affinis (Michaelsen, 1890)

Fundort. AF/2870 2 Ex., Prov. Beni, Guayaramerin, Park, 2. XII. 1966, leg. Zicsi.

Dichogaster modigliani (Rosa, 1886)

Fundort: AF/2889 2 Ex., Depto. de La Paz, Prov. Larecoja, Mapiri, 1. VII. 1982, leg. Arce.

Ocnerodrilidae Beddard, 1891

Eukerria Michaelsen, 1935

Da ich ausser der peregrin verbreiteten Art *E. saltensis* (Beddard, 1895) zum ersten Mal jetzt auch anderen in Südamerika vorkommenden Arten begegnet bin und diese aufgrund der Originalbeschreibungen auch identifizieren konnte, befasse ich mich an dieser Stelle nicht mit den zahlreichen, neuerdings beschriebenen Arten, die sich nur unwesentlich von den alten Arten unterscheiden. Es soll jedoch betont werden, dass die Verbreitung dieser im letzten Jahrhundert beschriebenen Arten durch Verschleppung eine bedeutend grössere Ausdehnung besitzen, als bisher angenommen worden ist. Ein Vergleich der neu beschriebenen Taxa mit den Typen der alten Arten ist unbedingt erforderlich.

Eukerria eiseniana (Rosa, 1895)

Fundorte. AF/2853 16 Ex., Prov. Beni, Guayaramerin, Garten, 18. XI. 1966. leg. Zicsi. - AF/2867 1 Ex., Guayaramerin, Park, 2. XII. 1966, leg. Zicsi.

Eukerria garmani (Rosa, 1895)

Fundorte. AF/2854 16 Ex., Prov. Beni, Guayaramerin, Garten, 18. XI. 1966, leg. Zicsi. - AF/2869 55 Ex., Guayaramerin, Park, 2. XII. 1966, leg. Zicsi.

Eukerria asuncionis (Rosa, 1895)

Fundort. AF/2863 30 Ex., Prov. Beni, Guayaramerin, Plantage am Ufer des Mamore Flusses, 24. XI. 1966, leg. Zicsi.

Eukerria saltensis (Beddard, 1896)

Fundorte. Prov. La Paz. Zwischen Teoponte und Alcoche, 550 m., 19. XII. 1966, leg. Zicsi. - AF/2881 1 Ex., G/INVE 17977 1 Ex., Prov. Tarija, km 15 Entre Rios nach Tarija, 4. XI. 1993, leg. Vaucher.

Ocnerodrilus Eisen, 1878

Ocnerodrilus occidentalis Eisen, 1878

Die Revisionen der Gattung *Ocnerodrilus* VON GATES (1973, 1979) und RIGHI (1994) berücksichtigend, ordne ich meine Exemplare *O. occidentalis* Eisen zu.

Fondorte: AF/2836 1 Ex., AF/2856 6 Ex., AF/2866 1 Ex., Prov. Beni, Guayaramerin und Umgebung, 18. XI- 2. XII. 1966, leg. Zicsi.

Ilyogenia Beddard, 1892

Ilyogenia tuberculatus Eisen, 1900

Fundorte: AF/2857 13 Ex., Prov. Beni, Guayaramerin Nueva Cuba, 26. XI. 1966, leg. Zicsi. - AF/2868 1 Ex., Guayaramerin, Park, 2. XII. 1966, leg. Zicsi.

Belladrilus Righi, 1984

Belladrilus (Belladrilus) vaucheri sp. n.

Belladrilus wurde von RIGHI (1994a) aufgrund der Chylustaschen-Struktur in 2 Untergattungen geteilt. *Belladrilus* s. s. besitzt keine Längsfurchen, während bei *Belladrilus (Santomeria)* im Querschnitt der Chylustaschen kein einziger Hohlraum sondern nur Längsfurchen zu erkennen sind. Meine zur Beschreibung vorliegenden Exemplare besitzen nur einen Hohlraum im Querschnitt der Chylustaschen und werden so zur Untergattung *Belladrilus* gestellt.

Länge des Holotypus 178 mm, Dicke 2 mm, Segmentzahl 157, Paratypen: Länge 55-168 mm, Dicke 1,5-1,8 mm, Segmentzahl 130-152. Farbe weiss, unpigmentiert. Kopf prolobisch-epilobisch, 1/3 zu. Borsten entlang des Körpers eng gepaart. Borsten ab am Vorderkörper etwas kleiner als cd; aa gleich bc. Borstenverhältnis hinter dem Gürtel aa : ab : bc : cd : dd wie 5 : 1 : 5,3 : 1 : 18,3.

Weibliche Poren auf dem 14. Segment vor der Borstenlinie b. Gürtel sattelförmig vom 13.-22. Segment, nur leicht angeschwollen; es ist anzunehmen, dass die Tiere einen zurückgebildeten Gürtel besitzen. Pubertätsfeld zwei grosse längliche Tuberkeln auf dem 17. und 18. Segment bildend, wo auch die Borsten ab fehlen. Prostataporen auf dem 17. Segment in einer kleinen Vertiefung, durch eine Samenrinne mit den männlichen Poren des 18. Segmentes verbunden (Abb. 18). Ein Paar Samentaschenporen auf Intersegmentalfurche 8/9 in der Borstenlinie cd, es sind kleine Schlitze zwischen den Borsten c und d.

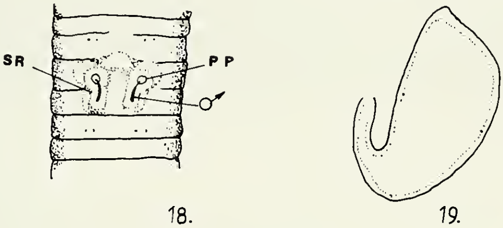


Abb. 18-19

Belladrilus (Belladrilus) vaucheri sp. n. 18. Ventralansicht mit dem Geschlechtsfeld. PP = Prostataporen, SR = Samenrinne. 19. Samentasche des 9. Segmentes.

Innere Organisation. Dissepimente 6/7-8/9 stark verdickt, 9/10-11/12 nur angedeutet, nicht verdickt. Schlunddrüsen reichen bis ins 7. Segment und überdecken den im 7. Segment liegenden, muskulösen Muskelmagen. Der Muskelmagen besitzt auch ein kragenförmiges Gebilde im 6. Segment. Kalkdrüsen im 9. Segment, sie sind nach vorne gerichtete, längliche Gebilde die am vorderen Teil mit einem seitlich verlaufenden Blutgefäss in Verbindung stehen. Innere Struktur mit einem Hohlraum ohne Längsfurchen. Hoden und Samentrichter im 10. Segment, Samensäcke im 9. und 11. Segment, klein. Mächtige Intestinalherzen im 10. und 11. Segment, Rückengefäss im 12. und 13. Segment perlschnurartig verdickt. Ovarien im 13. Segment, grosse mit Eiern gefüllte herzförmige Gebilde, Ovarientrichter in 13/14 Segment, Eileiter im 14.Segment ausmündend. Samenleiter durchbrechen im 11./12. Segment das Dissepiment und verlaufen der Innenwand angeschmiegt bis unter die Einmündung der Prostata ins 18. Segment, wo sie ohne Bildung einer Kopulationstasche ausmünden. Prostata im 17. Segment mit 4-5 Segmente einnehmendem muskulösen Ausführungsgang und einem langen gewundenen Drüsenteil, der bis ins 40. Segment reichen kann.

Mitteldarm im 13. Segment beginnend, ohne Typhlosolis. Nephridien ohne Nephridialblase.

Samentaschen im 9. Segment, mächtige Ampulle mit kurzem Ausführungsgang (Abb. 19)

Die neue Art steht *Belladrilus (B.) jimi* am nächsten. Unterscheidet sich jedoch von diesem durch die Samensäcke im 9. Segment, durch die Form der Samentaschen, die viel längeren Prostatadrüsen und durch das Vorhandensein von Ovarientrichtern.

Die neue Art wird zu Ehren des Sammlers, Dr. Cl. Vaucher (Naturhistorisches Museum Genf) benannt.

Fundort: Holotypus G/INVE 17978. Prov. Tarija, km 15 Entre Rios nach Tarija, 4. XI. 1993, leg. Vaucher. Paratypen: AF/2898 4 Ex., G/INVE 17079 2 Ex., Fundort wie Holotypus.

Lumbricidae Rafinesque-Schmaltz, 1815

Allolobophora Eisen, 1874

Allolobophora caliginosa trapezoides (Ant. Dugès, 1828)

Fundorte: Z/11411 75 Ex., La Paz, 3600 m, 25. XII. 1966, leg. Zicsi. - Z/11414 1+1 juv. Ex., Z/11422 8 Ex., Prov. La Paz, Titicaca-See, 3800 m, 28. XII. 1966, leg. Zicsi. - Z/11417 2 Ex., Prov. La Paz, Oberhalb Unduavi 4650 m, 19.XII. 1966, leg. Zicsi. - Z/12008 4 Ex., G/2510 12 Ex., Prov. Tarija, km 15 Entre Rios nach Tarija, 4. XI. 1993, leg. Vaucher. - Z/12012 2 Ex., Copacabana La Paz, Prov. Munco Capae 7. IV. 1991. leg. Gemio.

Allolobophora rosea (Savigny, 1826)

Fundorte: Z/11412 2 Ex., La Paz, 3600 m, 25. XII. 1966, leg. Zicsi. - Z/11413 23+8 juv. Ex., Z/11421 13 Ex., Prov. La Paz, Titicaca-See, 3800 m, 28. XII. 1966, leg. Zicsi. - Z/11416 8 Ex., Prov. La Paz, Oberhalb Unduavi 4654 m, 29. XII. 1966, leg. Zicsi. - Z/12013 2 Ex., Prov. Munco Capae, Copacabana La Paz, 7. IV. 1991, leg. Gemio.

Dendrodrilus Omodeo, 1956

Dendrodrilus rubidus (Savigny 1826)

Fundorte: Z/11415 2 Ex., Prov. La Paz, Titicaca-See, 3800 m, 28. XII. 1966, leg. Zicsi. - Z/11419 2 Ex., Prov. La Paz, Oberhalb Unduavi 4654 m, 29. XII. 1966, leg. Zicsi. - Z/11412 2 Ex., G/1511 7 Ex., Prov. Tarija, km 15 Entre Rios nach Tarija, 4. XI. 1993, leg. Vaucher.

Dendrobaena Eisen, 1874

Dendrobaena octaedra (Savigny, 1826)

Fundorte: Z/11420 18+8 juv. Ex., Prov. La Paz, Oberhalb Unduavi 4654 m, 29. XII. 1966, leg. Zicsi.

Octolasium Örley, 1885

Octolasium lacteum (Örley, 1881)

Fundort: Z/11418 9 Ex., Prov. La Paz, Oberhalb Unduavi, 4654 m, 29. XII. 1966, leg. Zicsi.

Megascolecidae Rosa, 1891

Amynthas Kinberg, 1867 emend. Easton, 1982

Amynthas corticis (Kinberg, 1867)

Fundort: AF/2894 7 Ex., Dept. La Paz, Prov. Murillo, Valle de Zongo, Est Cahura, 150 m, 26. XI. 1991, leg. Hanagarth.

LITERATUR

BALOGH, J. & S. MAHUNKA & A. ZICSI, 1969. The Scientific Results of the Hungarian Soil Zoological Expeditions to South America 14. A Report on the Collectings of the Second Expedition. Folia Ent. Hung. (Ser. nov.) 22: 453-474.

BEDDARD, F.E. 1892. On some new species of Earthworms from various parts of the world. *Proc. zool. Soc. Lond.* 666-706:45-46.

CERNOSVITOV, L. 1939. The Percy Sladen Trust Expedition to Lake Titicaca in 1937. VI. Oligochaeta. *Trans. Linn. Soc. London* 3:39-52.

COGNETTI DE MARTIIS, L. 1902 a. Terricoli boliviani ed argentini. *Boll. Mus. Torino* 17:1-11.

COGNETTI DE MARTIIS, L. 1902 b. Un nuovo genere della Fam. Glossoscolecidae. *Atti Acad. Torino* 37: 432-446.

COGNETTI DE MARTIIS, L. 1905. Gli Oligocheti della Regione Neotropicale. *Mem. R. Acad. Soc. Torino* 56:1-72.

COGNETTI DE MARTIIS, L. 1908. Lombrichi di Costa Rica e del Venezuela. *Atti Acad. Torino* 43: 913-926.

CSUZDI, CS. & A. ZICSI 1991. Über die Verbreitung neuer und bekannter Dichogaster und Eutrigaster Arten aus Mittel- und Südamerika (Oligochaeta; Octochaetidae) Regenwürmer aus Südamerika 15. *Acta Zool. Hung.* 37:177-192.

EASTON, E.G. 1982. Australian Pheretimoid Earthworms (Megascolecidae, Oligochaeta): A synopsis with the description of a new genus and five new species. *Aust. J. Zool.* 30: 711-735.

GATES, G.E. 1973. Contributions to North American earthworms (Annelida) 7. Contribution to a revision of the earthworm family Ocnerodrilidae IX. What is *Ocnerodrilus occidentalis? Bull. Tall. Timbers Res. Stat.* 14: 13-28.

GATES, G.E. 1979. A new genus of larger Ocnerodrilid earthworms in the American hemisphere. *Megadrilogica* 3: 162-164.

MICHAELSEN, W. 1900. Die Terricolen-Fauna Columbiens. *Arch. Naturg.* 66/1/: 231-266.

MICHAELSEN, W. 1902. Neue Oligochaeten und neue Fundorte altbekannter. *Mit. Mus. Hamburg* 19: 1-54.

MICHAELSEN, W. 1918. Die Lumbriciden, mit besonderer Berücksichtigung der bisher als Familie Glossoscolecidae zusammengefassten Unterfamilien. *Zool. Jb. Syst.* 41: 1-398.

MICHAELSEN, W. 1926. Zur Kenntnis einheimischer und ausländischer Oligochaeten. *Zool. Jb. Syst.* 51:255-328.

MICHAELSEN, W. 1935. Oligochaeten aus Peru. *Capita Zool.* 6/2/: 1-12.

MICHAELSEN, W. 1936. On the genus *Thamnodrilus* Beddard. *Proc. Zool. Soc. Lond.* 1171-1173.

PICKFORD, G.E. 1937. A Monograph of the Acanthodriline Earthworms of South Africa. Heffer and Sons, Cambridge. 612 pp.

RIGHI, G. 1968. Über die Oligochaetengattung *Eukerria. Beitr. zur. Neotrop. Fauna.* 5:178-185.

RIGHI, G. 1984 a. On a Collection of Neotropical Megadrili Oligochaeta I. Ocnerodrilidae, Acanthodrilidae, Octochaetidae, Megascolecidae. *Stud. Neotrop. Fauna.* 19(1):9-31.

RIGHI, G. 1984 b. On a Collection of Neotropical Megadrili Oligochaeta II. Glossoscolecidae, Lumbricidae. *Stud. Neotrop. Fauna.* 19(2): 73-78.

RIGHI, G. 1986. Sobre o genero Andiorrhinus (Oligochaeta, Glossoscolecidae). *Bolm Zool. Univ. S. Paulo.* 10: 123-151.

RIGHI, G. 1989. Adicao ao conhecimento dos Oligochaeta da Venezuela. *Rev. Brasil. Biol.* 49(4):1065-1084.

RIGHI, G. 1993. Venezuelan earthworms and consideration on the genus *Andiorrhinus* Cognetti 1908 (Oligochaeta, Glossoscolecidae). *Trop. Zool.* 1: 125-139.

RIGHI, G. 1994. On a new and old-known Oligochaeta genera from Paraiba State, Brasil. *Revue suisse Zool.* 101: 89-106.

RIGHI, G. & J. RÖMBKE 1987. Alguns Oligochaeta da Bolivia e do Peru. *Rev. Brasil.* 47(4):523-533.

ROSA, D. 1895. Terricoli Neotropicali. *Mem. Acad. Torino* 45(2):89-152.

ZICSI, A. 1989. Revision der Gattung *Yagansia* Michaelsen, 1899 (Oligochaeta, Acanthodrilidae) Regenwürmer aus Südamerika 11. *Acta zool. Hung.* 35:413-430.

ZICSI, A. 1992. Über weitere neue und bekannte Arten der Gattung *Periscolex* (Oligochaeta: Glossoscolecidae) Regenwürmer aus Südamerika 16. *Revue suisse Zool.* 99(1): 211-217.

REVUE SUISSE DE ZOOLOGIE, 102 (3) : 609-613; septembre 1995

Studio dei tipi di Tychiini di Henri Tournier custoditi presso il Museo di Storia Naturale di Ginevra (Coleoptera, Curculionidae)

Roberto CALDARA
Piazza Bolivar 7, 20146 Milano, Italia.

Study of the Tychiini types of Henri Tournier preserved at the Natural History Museum of Geneva (Coleoptera, Curculionidae). – The lectotypes of *Tychius depressicollis* Tournier and *Sibinia rudepilosa* Tournier are designated. Moreover, one holotype and paralectotypes of several *Tychius* and *Sibinia* species described by Tournier and housed at the MHNG are listed. The following new synonymies are proposed: *Tychius brisouti* Tournier, 1873 (= *T. galloprovincialis* Hustache, 1924, n. syn.); *T. fuscipes* Chevrolat, 1859 (= *T. depressicollis* Tournier, 1873, n. syn.); *T. seriepilosus* Tournier, 1873 (= *T. terrosus* Tournier, 1873, n. syn.); *Sibinia tibialis* (Gyllenhal, 1836) (= *S. rudepilosa* Tournier, 1873, n. syn.).

INTRODUZIONE

Sono più di 60 le descrizioni di Tychiini effettuate da Tournier e riportate per la maggior parte in un'unica pubblicazione (TOURNIER, 1873). Quando ho effettuato la revisione dei Tychiini paleartici, una delle parti più impegnative è stata proprio quella di rintracciare il numero più elevato possibile di tipi delle specie di tale autore. La collezione di curculionidi di Tournier è attualmente custodita per la massima parte al Museo di Storia Naturale di Parigi (MHNP), ove è tuttora conservata nelle scatole originali ed arrangiata secondo la sistematica seguita dall'autore e con le etichette per ogni specie. E' da notare però che prima di essere acquistata dal MHNP, essa era stata venduta a Maurice Pic nel 1894. Pic, oltre a mettere sugli esemplari delle serie tipiche dei cartellini rossi stampati o bianchi scritti a mano con l'indicazione di type (per quanto riguarda i Tychiini in modo solitamente molto accurato), ha spostato numerosi esemplari che ora si trovano sparsi confusamente in altre scatole. Nonostante questi rimaneggiamenti, dopo approfondite ricerche sono riuscito ad esaminare quasi tutti i tipi delle specie di Tournier. Tuttavia alcune di esse, mai prese in esame da nessun altro autore dopo la loro descrizione, mi sono rimaste sconosciute.

Per cercare di ovviare a ciò, visto che il Museo di Storia Naturale di Ginevra (MHNG) ha acquistato la parte rimanente della collezione Tournier alla sua morte ed anche la collezione Ernest Poncy, al quale Tournier aveva donato numerosi suoi

---

Manoscritto accettato il 09.11.1994.

esemplari, ho chiesto e ottenuto, grazie alla gentilezza del Dr. Claude Besuchet, di esaminare gli esemplari di *Tychius* e *Sibinia* presenti in tali collezioni. L'esame è stato molto fruttuoso, perchè mi ha permesso di stabilire lo stato tassonomico di tre specie di *Tychius* e una di *Sibinia* descritte da Tournier a me non note in precedenza e di rintracciare molti esemplari appartenenti alle serie tipiche di numerose specie dell'autore.

LISTA DELLE SPECIE

Tychius armatus Tournier

Tychius armatus Tournier, 1873: 495; Caldara 1990: 190 (lectotypus des.). (Syn. di *T. grandicollis* Desbrochers).

Paralectotypi MHNG: 1 ♂ e 1 ♀ "Algérie, Raffray" e 1 ♂ e 1 ♀ "Tanger".

Tychius brisouti Tournier

Tychius brisouti Tournier, 1873: 471; Caldara 1990: 203.

Specie descritta su esemplari della Svizzera (Giura bernese: Saint-Imier) e rimasta a me sconosciuta. La descrizione di Tournier è piuttosto precisa e ricca di particolari utili alla determinazione del taxon. Oltre a caratteristiche diagnostiche minori, i dati più importanti sono costituiti dal rivestimento elitrale, formato sia da squame strette grigio-dorate che da squame larghe biancastre, e dai femori posteriori inermi. Solo 4 specie in tale area geografica hanno un simile tipo di rivestimento: il *T. galloprovincialis* Hustache, il *T. tridentinus* Penecke, il *T. alpinus* Hustache e il *T. parallelus* (Panzer), ma solo la prima specie ha i femori posteriori senza dentino. Al MHNG è presente 1 esemplare ♀, perfettamente conservato e classificato come *T. brisouti*, che porta i seguenti cartellini "Thoiry, Jura. – Juin. (scritto a mano in inchiostro nero) / Collection E. Poncy. (scritto a stampa in nero)" e che corrisponde esattamente alla descrizione originale. Come ipotizzato, tale esemplare appartiene proprio alla specie chiamata attualmente *T. galloprovincialis* e nota di poche località della Francia meridionale e della Spagna sud-orientale (Caldara 1990). A questo punto non ho più dubbi che *T. brisouti* Tournier, 1873 sia la stessa cosa di *T. galloprovincialis* Hustache, 1924 che pertanto diventa suo sinonimo. Purtroppo, come risulta dal cartellino, l'esemplare sembra apparentemente raccolto in una località del Giura differente da quella riportata da Tournier e non mi è pertanto possibile designarlo come lectotypus, sebbene non si possa escludere un errore di citazione da parte dell'autore francese come avvenuto in altre circostanze (Besuchet, in litt.). La località Thoiry in questione (esistono altre due cittadine francesi con tale nome, una nella Savoia e l'altra nella Seine et Oise) si trova in territorio francese nel dipartimento dell'Ain, a pochi chilometri dal confine con la Svizzera. Essa risulta al momento la località più settentrionale in cui è stata trovata la specie ma, se fosse esatta l'indicazione Saint-Imier riportata da Tournier, la diffusione di *T. brisouti* a nord sarebbe ulteriormente estesa.

Tychius comptus Tournier

Tychius comptus Tournier, 1873: 497; Caldara 1990: 190 (lectotypus des.). (Syn. di *T. tibialis* Boheman).

Paralectotypi MHNG: 1 ♀ "Sicile/ *T. comptus*" e 2 ♂♂ "Tanger".

Tychius depressicollis Tournier

Tychius depressicollis Tournier, 1873: 468; Caldara 1990: 204.

Specie descritta su esemplari dell' Algeria senza più precise indicazioni e paragonata da Tournier a *T. fuscipes* Chevrolat dal quale differirebbe per la forma più appiattita, per il protorace a lati più arrotondati e per il rostro più lungo. Nella collezione Tournier al MHNP non ho trovato esemplari classificati con tale nome e la specie mi è rimasta sconosciuta. Al MHNG è custodita 1 ♀ classificata come *depressicollis* ed etichettata "Algérie", perfettamente corrispondente alla descrizione originale (lectotypus qui designato). Essa non mostra nessuna differenza sostanziale dai tipici esemplari di *T. fuscipes* e pertanto stabilisco che *T. depressicollis* Tournier, 1873 è sinonimo di *T. fuscipes* Chevrolat, 1859.

Tychius hypaetrus Tournier

Tychius hypaetrus Tournier, 1873: 469; Caldara 1990: 147 (lectotypus des.). (Syn. di *T. depressus* Desbrochers).

Paralectotypi MHNG: 1 ♀ "Bône".

Tychius kiesenwetteri Tournier

Tychius kiesenwetteri Tournier, 1873: 485; Caldara 1985 *b*: 88 (lectotypus des.); 1990: 138; (Syn. di *T. trivialis* Boheman).

Paralectotypi MHNG: 1 ♂ e 1 ♀ "Serbie".

Tychius ochraceus Tournier

Tychius ochraceus Tournier, 1873: 505; Caldara 1990: 199 (lectotypus des.).

Paralectotypi MHNG: 1 ♀ "Syrie".

Tychius olcesei Tournier

Tychius olcesei Tournier, 1873: 483; Caldara 1990: 90 (lectotypus des.).

Paralectotypi MHNG: 2 ♂♂ e 3 ♀♀ "Tanger, Olcèse" e 2 ♀♀ "Alger, Raffray".

Tychius sericatus Tournier

Tychius sericatus Tournier, 1873: 488; Caldara 1974: 178 (lectotypus des.); 1990: 177. (Syn. di *T. crassirostris* Kirsch).

Paralectotypi MHNG: 2 ♀♀ "Genève".

Tychius seriepilosus Tournier

Tychius seriepilosus Tournier, 1873: 460; Caldara 1990: 151 (lectotypus des.).
Paralectotypi MHNG: 2 ♀♀ "Egypte".

Tychius sharpi Tournier

Tychius sharpi Tournier, 1873: 506; Caldara 1990: 197 (lectotypus des.).
Paralectotypi MHNG: 1 ♀ "Peney, Genève".

Tychius similis Tournier

Tychius similis Tournier, 1873: 401; Caldara 1978: 29 (lectotypus des.). (Syn. di *T. multilineatus* Desbrochers).
Paralectotypi MHNG: 1 ♀ "Blidah, Algérie" e 1 ♂ "Algérie".

Tychius subsulcatus Tournier

Tychius subsulcatus Tournier, 1873: 470; Caldara 1990: 102 (lectotypus des.).
Paralectotypi MHNG: 1 ♂ e 2 ♀♀ "Hongrie".

Tychius terrosus Tournier

Tychius terrosus Tournier, 1873: 475; Caldara 1990: 205.

Specie descritta su 1 ♂ della Calabria, da me non reperito al MHNP. Dopo la descrizione nessun autore si è più occupato della specie, che pertanto è stata da me posta fra quelle incertae sedis (Caldara 1990). Al MHNG, sotto questo nome, è conservato 1 ♂ etichettato "Italie" perfettamente corrispondente alla descrizione originale. Il fatto che sul cartellino non sia riportata anche la dizione "Calabria" non è inusuale per gli esemplari di Tournier e pertanto ritengo tale esemplare l'holotypus della specie. Esso non mostra nessuna differenza dai tipici esemplari di *T. seriepilosus* Tournier (anche le due descrizioni, effettuate nella stessa pubblicazione a poche pagine di distanza, sono molto simili sebbene quella del *T. seriepilosus* sia molto più corta) e pertanto stabilisco che *T. terrosus* Tournier, 1873 (p. 475) è sinonimo di *T. seriepilosus* Tournier, 1873 (p. 460).

Questa risulta la prima segnalazione della specie per l'Italia, essendo *T. seriepilosus* noto in precedenza solo del Nord Africa e del Vicino Oriente dove è largamente distribuito (Caldara 1990). Pur rimanendo il dubbio che la località di raccolta riportata sul cartellino sia errata, la presenza di questa specie nell'Italia meridionale, vista la sua distribuzione, è verosimile.

Sibinia fusca Tournier

Sibinia fusca Tournier, 1873: 513; Caldara 1979: 84 (lectotypus des.).
Paralectotypi MHNG: 2 ♂♂ "Egypte".

Sibinia hopffgarteni Tournier

Sibinia hopffgarteni Tournier, 1873: 514; Caldara 1985*a*: 80 (lectotypus des.).
Paralectotypi MHNG: 1 ♂ e 1 ♀ "Hongrie".

Sibinia reichei Tournier

Sibinia reichei Tournier, 1873: 514; Caldara 1979: 83 (lectotypus des.).
Paralectotypi MHNG: 1 ♂ e 1 ♀ "Calabre, Huet".

Segnalo che, sempre al MHNG, 1 ♀ di *S. reichei* risulta raccolta in Sicilia senza più precise indicazioni. E' da notare che della specie non avero mai esaminato altri esemplari raccolti in Italia oltre ai tipi.

Sibinia rudepilosa Tournier

Sibinia rudepilosa Tournier, 1873: 520; Caldara 1985*a*: 93.

Specie descritta su esemplari della Turchia non presenti al MHNP e rimasta sconosciuta a tutti gli autori, me compreso. Tournier la paragona alla *S. pellucens* (Scopoli), dalla quale differirebbe essenzialmente per le tibie e i tarsi di colore rossastro. Sotto tale nome al MHNG ho trovato 1 ♂ etichettato "Turquie", ben corrispondente alla seppur sintetica descrizione originale e che designo come lectotypus della specie. Non esiste nessuna differenza fra questo e i tipici esemplari di *S. tibialis* (Gyllenhal) e pertanto stabilisco che *S. rudepilosa* Tournier, 1873 è sinonimo di *S. tibialis* (Gyllenhal, 1836). E' questa la prima segnalazione di *S. tibialis* per la Turchia. La specie comunque risultava largamente diffusa, seppure in modo sporadico, in Europa centrale ed orientale, con la località più a sud rappresentata da Deliblato (Serbia).

BIBLIOGRAFIA

Caldara, R. 1974. Note sinonimiche su alcune specie del genere *Tychius* Germar. *Boll. Soc. ent. ital.* 106: 178–181.

Caldara, R. 1978. I generi *Apeltarius* Desbrochers, *Xenotychius* Reitter e *Pseudolignyodes* Pic. *Boll. Soc. ent. ital.* 110: 23–34.

Caldara, R. 1979. Revisione delle specie paleartiche di *Sibinia* vicine a *sodalis* Germar ed *exigua* Faust. *Mem. Soc. ent. ital.* 57: 65–100.

Caldara, R. 1985*a*. Revisione delle *Sibinia* paleartiche. *Mem. Soc. ent. ital.* 62/63: 24–105.

Caldara, R. 1985*b*. Taxonomic notes on three little known species of *Tychius* Germ. from Siberia (USSR). *Reichenbachia* 23: 87–89.

Caldara, R. 1990. Revisione tassonomica delle specie paleartiche del genere *Tychius* Germar. *Mem. Soc. ital. Sci. nat. Mus. civ. Stor. nat. Milano* 25: 51–218.

Tournier, H. 1873. Observations sur les espèces européennes et circumeuropéennes de la tribu des Tychiides. *Annls Soc. ent. Fr.* 3(5): 461–509.

REVUE SUISSE DE ZOOLOGIE, 102 (3) : 615-627; septembre 1995

Contributi allo studio delle Crambinae (Lepidoptera: Crambidae). IX. Note sui generi *Sebrus* Błeszyński e *Alphacrambus* nov., con descrizione di nuove specie

Graziano BASSI
c/o Museo Regionale di Scienze naturali, Via Giolitti 36, I-10123 Torino, Italia.

Contribution to the study of the Crambinae (Lepidoptera, Crambidae). IX. Notes on genera *Sebrus* Błeszyński and *Alphacrambus* nov., with description of new species. - The genus *Sebrus* Błeszyński is revised; its differences towards related genera are discussed, its tympanal organs are shown; *S. perdentellus* (Hmps) n. comb. and *S. pseudosparsellus* (Błesz.) n. comb. are transferred from *Crambus* F.; a lectotypus is designated for *S. perdentellus* (Hmps.); *S. absconditus* n. sp. and *S. argus* n. sp. are described and illustrated. *Alphacrambus* gen. nov. is described based on differences in genitalia to *Crambus* F. and *Crambixon* Błesz.. Its tympanal organs are described. *A. prodontellus* (Hmps) n. comb., type species, and *A. razowskii* (Błesz.) n. comb., are transferred from *Crambus* F. and their females are correctly assigned; *A. phoeostrigellus* (Hmps.) n. comb. is transferred from *Crambixon* Błeszyński; *A. cristatus* n. sp. and *A. parvus* n. sp. are described and illustrated.

Key-words: Pyraloidea - Crambidae - Crambinae - new genus - new species.

INTRODUZIONE

Lo studio del cospicuo materiale africano appartenente alle Crambinae conservato nei Musei di Budapest, Copenaghen, Ginevra, Londra, Parigi, Pretoria e Tervuren, mi consente di esporre alcune considerazioni su specie finora assegnate al genere *Crambus* F. Quest'ultimo infatti ha da sempre accolto la maggior parte delle specie ascrivibili alle Crambinae, ed oggi, almeno per quel che riguarda la Fauna Afrotropicale, si rende necessaria un'accurata revisione tesa a garantire l'unità filetica dei taxa specifici all'interno dei gruppi di rango superiore. Questo lavoro segue ad altri (BASSI 1991, 1992 e 1995) e cerca di contribuire con uno studio che considera prioritaria la morfologia degli apparati genitali, ad una organica revisione della sistematica dei Crambini (sensu GASKIN 1975) della regione Etiopica.

Manoscritto accettato il 02.12.1994.

Abbreviazioni usate:

CB = Collezione Bassi, Torino.
GS...GB = Preparato microscopico .... G. Bassi.
GS...SB = Preparato microscopico .... S. Błeszyński.
MHNG = Muséum d'histoire naturelle, Genève.
MNHNP = Muséum National d'Histoire Naturelle, Paris.
NHML = Natural History Museum, London.
TM = Musée Royal de l'Afrique Centrale, Tervuren.
TMB = Magyar Termèszettudomànyi Mùzeum, Budapest.
TMP = Transvaal Museum, Pretoria.
ZMC = Zoologisk Museum København

Sebrus Błeszyński, 1970.

Specie-tipo: *Sebrus amandus* Błeszyński, 1970: 12, per designazione originale.

Il genere venne descritto per una specie, *S. amandus* Błesz., del Madagascar. Esso si caratterizza, nell'ambito dei Crambini, oltre per quanto evidenziato da Błeszyński (1970), per la peculiarità dell'anatomia del vinculum e del tipo di giunzione tra tegumen e vinculum nel genitale ♂. L'ostium bursae differenziato ma senza processi sporgenti dall' VIII segmento addominale, la presenza in quest'ultimo di una placca urosternale nell'area dell'ostium bursae, il ductus seminalis che si diparte sempre a livello dell'antrum e l'assenza di signa in una bursa copulatrix debolmente corrugata differenziano invece il genitale ♀ da quello dei generi più affini, che sembrano essere *Pediasia* Hb., *Caffocrambus* Błesz., *Catoptria* Hb. e *Crambus* F.

In tutte le specie conosciute vi è dimorfismo sessuale: Le ali posteriori del ♂ sono sempre molto più chiare di quelle della ♀.

Organi timpanali (Fig.24): Bulla tympani di medie dimensioni. Pons tympani ben sviluppato, come pure il processus tympani. Area subtimpanale inferiore, compresa tra pons tympani ed ala tympani, ampia e ben definita. Angolo tra sclerite tergo-sternale e base del pons tympani acuto. Placca sternale dell'addome subrettangolare e notevolmente sviluppata. Venulae secundae ridotte e ben visibili solo al centro della placca sternale. Le ♀♀ hanno la bulla tympani di dimensioni ridotte.

Geonemia: sud-est della regione Afrotropicale.

La revisione critica del materiale finora ascritto al genere *Crambus* F. mi permette di assegnare le seguenti specie al genere qui considerato.

TABELLA DELLE SPECIE

1	Specie bianco-brune.	*argus*
–	Specie bianco-grigie.	2
2	macchia grigio-nera al centro dell'ala anteriore che raggiunge il margine alare.	*pseudosparsellus*
–	non come sopra.	3

3 genitale ♂ con phallus senza denti apicali, genitale ♀ con ostium bursae sclerificato ed antrum membranoso. . . . . *amandus*

– genitale ♂ con phallus dotato di un solo grande dente apicale inferiore e minuti dentelli perimetrali; genitale ♀ con ostium bursae e antrum sclerificati, di medie dimensioni. . . . . *perdentellus*

– genitale ♂ con phallus dotato di molti aguzzi denti apicali, genitale ♀ con ostium bursae e antrum sclerificati, di piccole dimensioni. . . . . *absconditus*

Sebrus amandus Bleszyński, 1970: 7.

Holotypus ♂: [Madagascar] Station Perinet, 149km east of Tananarive, 20.X-10.XI.1930, (Mme N. d'Olsoufieff), GS 5586SB (11282BM Pyral.), nel NHML, esaminato. Altro materiale esaminato: 1 ♀, paratypus, Madagasc.[ar], GS 5822 SB (16176 BM Pyral.), nel NHML; 5 ♀♀, Madagascar, GS 2388, 2432, 2631 e 2628 GB (Fig. 21), nel MNHNP e in CB.

Sebrus perdentellus (Hampson, 1919). n. comb.

Crambus perdentellus Hampson, 1919: 287.

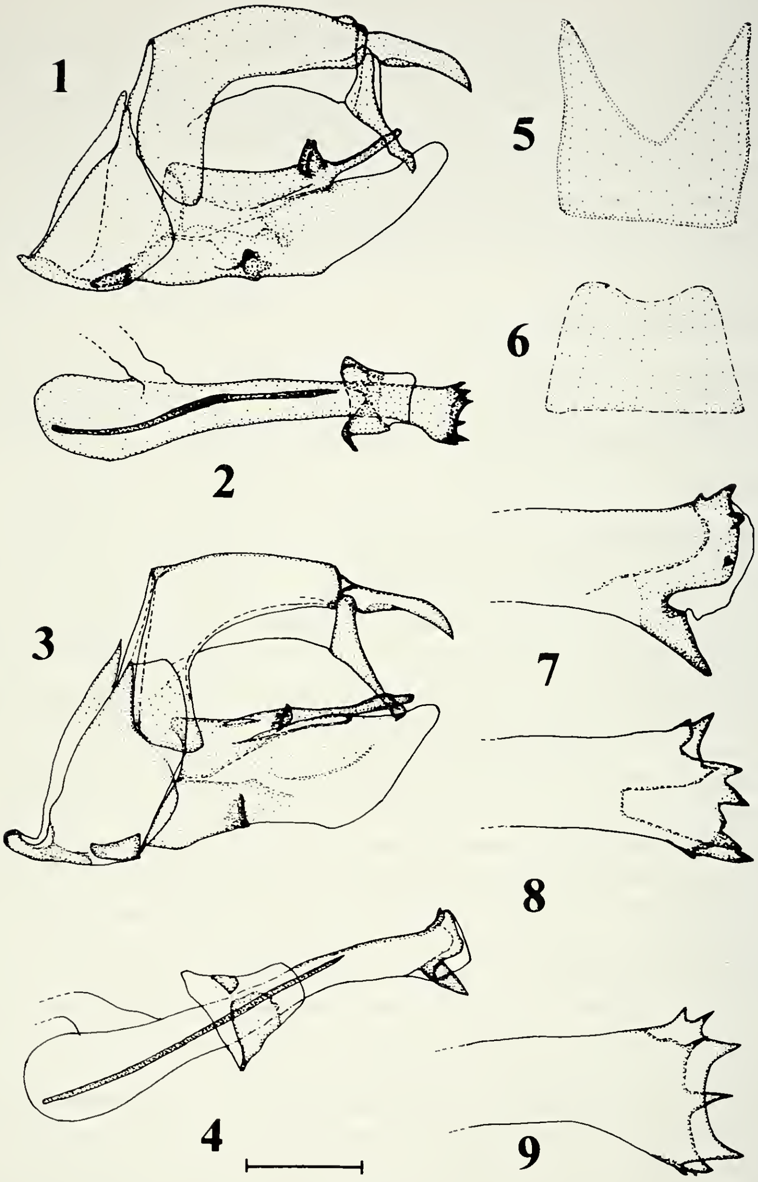
Lectotypus ♂ (qui designato): [Malawi] Nyasaland, Mlanje Plateau, 6500ft., 18.XII. 1913, S.A. Neave, 1914-171, "Crambus perdentellus, Type ♂, Hampson", GS3202GB (19481 BM Pyral.), nel NHML.

Altro materiale esaminato: Paralectotypi: 5♂♂, 2♀♀, stessa etichetta del lectotypus, GS3150 (19482 BM Pyral), 3228 e 3229GB, nel NHML; 1 ♂, Nyasaland ,Mlanje Plateau, 6500 ft., S.A. Neave, 14.XI. 1913, PG 1660 GB, NHML.

Cenni morfologici (Fig. B): ben descritto da Hampson, si può aggiungere che l'apertura alare varia da 15,5 a 22 mm; i palpi labiali sono lunghi 3 volte il diametro dell'occhio; gli ocelli e le chetosemae sono presenti; la fronte, tondeggiante, sporge appena oltre l'occhio; l'addome è bruno bronzeo con ciuffo anale bianco. Si ha un netto dimorfismo sessuale nella colorazione delle ali posteriori: nel ♂ sono bronzee fino alla venatura M2 esclusa, poi bianche e bronzee solo lungo il margine alare fino Cu2, indi interamente bianche; nella ♀ sono invece interamente brune.

Apparato genitale ♂ (Fig.3): Uncus e gnathos circa della stessa lunghezza. Tegumen ben sviluppato, nettamente separato dal vinculum. Vinculum con parte supero-distale che si sovrappone al tegumen e tozza protuberanza infero-distale. Juxta subconica, con due sclerificazioni indipendenti ed opposte. Pseudosaccus mediamente sviluppato. Valve simmetriche, con processo costale ben sviluppato, sia verso il cucullus che, con un processo secondario, verso l'interno della valva. Phallus (Fig. 4) di medie dimensioni, con un solo cornutus lungo e molto sottile. Il suo apice presenta un grande dente ventrale e minuti dentelli lungo il perimetro (Fig. 7). La sclerificazione dell'urosterno dell'VIII segmento addominale (Fig.6) è tozza e subconica.

Apparato genitale ♀ (Fig.19): Papillae anales di piccole dimensioni. Apophyses posteriores di media lunghezza, sottili. L'VIII segmento addominale, molto sottile, forma una placca urosternale dentellata al di sopra dell'ostium bursae. Apophyses anteriores subvestigiali. Ostium bursae tondeggiante. Antrum ampio e sclerificato, non



FIGG. 1-9

Sebrus spp., apparati genitali ♂♂. Scala: 0,5 mm. 1: S. absconditus n. sp., *paratypus*, GS3064GB, phallus e valva dx estratti. 2: idem, phallus. 3: *S. perdentellus* (Hmps.), lectotypus, phallus e valva dx estratti. 4: idem, phallus. 5: *S. absconditus* n. sp., *paratypus*, GS3064GB, placca urosternale dell'VIII segmento addominale. 6: *S. perdentellus* (Hmps.), lectotypus, placca urosternale dell'VIII segmento addominale. 7 - 9: variabilità nell' apice del phallus: 7- *S. perdentellus* (Hmps.), *lectoparatypus*, GS3229GB; 8 - *S. absconditus* n. sp., *paratypus*, GS3226GB; 9 - idem, *holotypus*.

differenziato dall'ostium. Il ductus bursae è lunghissimo, membranoso, interamente corrugato; a 2/3 della sua lunghezza è presente un caratteristico ispessimento debolmente sclerificato. Da qui il ductus si allarga via via fino a giungere alla bursa copulatrix, che si presenta piccola, lievemente corrugata e senza signa. Il ductus seminalis prende origine tra l'antrum e il ductus bursae.

Sebrus absconditus n. sp.

Holotypus ♂, [S. Africa, E. Transvaal] Woodbush, 1670m., 11.1.[19]25, A.J.T. Janse, GS3240GB, nel TMP.

Paratypi: 1♂, Pretoria, 11.3.'15, A.J.T. Janse; 1♂, Woodbush, 1670 m., 25.1.11, A.J.T. Janse, GS 3064 GB; 1♀, Blouberg, T[rans]v[aa]l, Motlakeng, 5-6,000 ft., 6.15.I.1955, Transv.Mus.Exp., GS 3336 GB; 1♂, Mazoe, S. Rhod.[esia] [Zimbabwe], 6-17 jan. 1920, A.J.T. Janse, GS3226GB; 1♀, idem, PG3225GB; 1♀, Salisbury, Rhod.[esia] [Zimbabwe], 31.12.'17, A.J.T. Janse, GS 3280 GB; 1♀, Chirindo Forest swimmert [Mt. Selinda, Zimbabwe], 12.'18, Coll. Janse, GS 2554 Janse, TMP e CB .

Cenni morfologici (Fig. C): Molto simile a *S. perdentellus* (Hmps.). Se ne differenzia, anche ad un esame superficiale, per la maggior nitidezza e definizione nel disegno delle ali e nei colori delle stesse, decisamente più grigiastre. Apertura alare 15,5-18 mm. Zampe argentee con articoli tarsali parzialmente dorati e speroni tibiali minuti. Permane il dimorfismo sessuale osservato in *perdentellus* (Hmps.).

Apparato genitale ♂ (Figg.1,2): Rispetto a *perdentellus* (Hmps.): processo infero-distale del vinculum meno sviluppato, processo costale interno e placca mediale del sacculus più sviluppati, apice del phallus sempre provvisto di processi lunghi e acuminati lungo tutto il suo perimetro (Figg. 8, 9). La sclerificazione urosternale dell'VIII segmento addominale (Fig.5) è significativamente diversa.

Apparato genitale ♀ (Fig. 20): La caratteristica che meglio differenzia la n. sp. da perdentellus (Hmps.) è il complesso ostium bursae-antrum. L'ostium bursae è più minuto, mentre l'antrum è evidentemente più piccolo e corto.

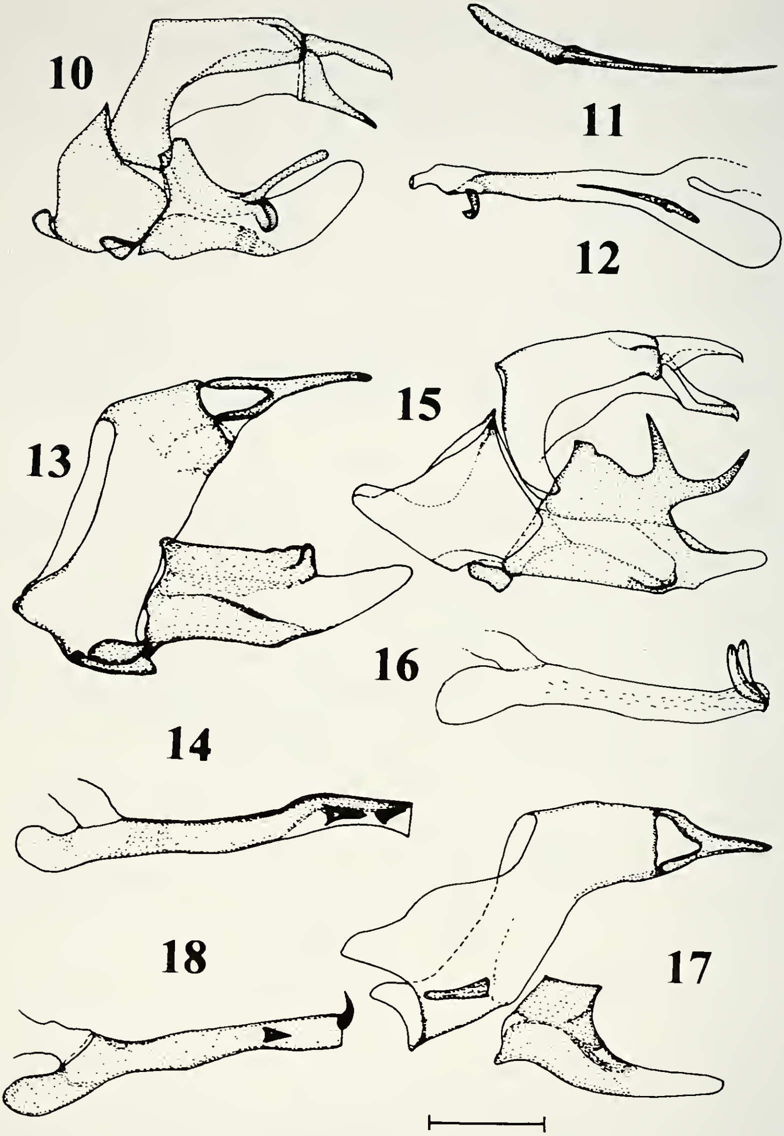
Derivatio nominis: da *absconditus* = nascosto, allusione alla facilità con cui la specie può venire confusa, senza l'esame degli apparati genitali, con *S. perdentellus* (Hmps.).

Sebrus argus n.sp.

Holotypus ♂, [Zaire] Ht. Katanga, Panda, 16.1.[19]30, J. Romieux, GS 2185 GB (1472 MHNG), nel MHNG.

Paratypi: 1♂, Musée du Congo, Elisabethville, 24.2.1935, Ch. Seydel, GS 2456 GB; 1♂, idem, 28.2.1935, GS 2450 GB; 1♂, idem, IV.1938, GS 6345 SB (15922B.M Pyral.), "*Crambus argus* Błeszyński 1969"; 1♀, idem, III.1935, GS 6377 SB "argus", nei TM, NHML e CB.

Cenni morfologici (Fig. A): Apertura alare 12-14 mm., palpi lunghi 3,5 volte il diametro degli occhi, bianchi con esternamente una macchia bruna prossimale ed una nera distale. Fronte bianca, tondeggiante, sporge appena oltre l'occhio. Antenne debolmente serrate, color crema. Ocelli e chetosemae presenti. Capo, collo, tegulae e torace bianco argentei. Ali anteriori bianco argentee con gruppi di scaglie bruno giallastre, che formano una delicata doppia banda submarginale. Vi sono inoltre un'ampia macchia



FIGG. 10-18

Sebrus e *Alphacrambus* spp., apparati genitali ♂♂. Scala: 0,5 mm. 10: *S. argus* n. sp., *holotypus*, phallus e valva dx estratti. 11: idem. cornutus ingrandito. 12: idem, phallus. 13: *A. prodontellus* (Hmps.), Zaire, Kyala, GS2233GB, phallus e valva dx estratti. 14: idem, phallus. 15: *S. pseudosparsellus* (Blesz.), Zaire, Elisabethville, GS2556GB, phallus e valva dx estratti. 16: idem, phallus. 17: *A. parvus* n.sp., *holotypus*, phallus e valva dx estratti. 18: idem, phallus.

tondeggiante bruno nerastra al centro dell'ala, due tacche nere traslucide submarginali tra le venature Cu1 e Cu2 e una sottile banda marginale nera. Frange argentee. Ali posteriori traslucide, bianco sporco con frange bianche nel ♂, brune con frange bianche a base bruna nella ♀. Zampe anteriori dorate anteriormente, argentee posteriormente; le mediali e le posteriori sono argentee con speroni tibiali minuti.

Apparato genitale ♂ (Fig. 10): E' tipico del genere. Si differenzia dalle altre specie per la forma del processo costale e del phallus (Fig.12), munito di un ricurvo dente apicale e di un lungo e sottile cornutus (Fig. 11).

Apparato genitale ♀ (Fig. 27): Differisce dalle altre specie nella conformazione della placca urosternale dell'VIII segmento addominale e nella forma dell'ostium bursae. Il ductus bursae è mediamente sclerificato. La bursa copulatrix è debolmente corrugata.

Derivatio nominis: specie dedicata al mitico figlio di Friso. Mantengo il nome a suo tempo indicato in litteris sui cartellini di determinazione da Błeszyński, che già aveva identificato il ♂ ora nel NHML e la ♀ ora nel TM come appartenenti ad una specie nuova.

Sebrus pseudosparsellus (Błeszyński, 1961) n. comb.

Crambus pseudosparsellus Błeszyński, 1961: 189.

Holotypus ♀: Salisbury, Mashonaland [Zimbabwe], 27.XII.[18]97, G.A.K. Marshall, 98-62, GS 1529 SB (5277 B.M.Pyral.), nel NHML, esaminato.

Altro materiale esaminato: Zaire: 1♂, Musée du Congo, Elisabethville, XI.1936, Ch. Seydel, GS 2556 GB, TM; 1♀, Ht. Katanga, Tshinkolobwe, 8.I.[19]31, J. Romieux, GS 2211 GB (1429 MHNG), MHNG; 1♀, idem, Panda, 14.1.[19]30, GS 2210 GB, CB.

Apparato genitale ♂ (Fig.15): E' caratterizzato dalla forma del processo costale, i cui due lobi terminano entrambe con punte aguzze, e dalla forma del phallus (Fig. 16), che presenta all'apice due ampi processi simmetrici. L'esemplare esaminato non è dotato di cornuti.

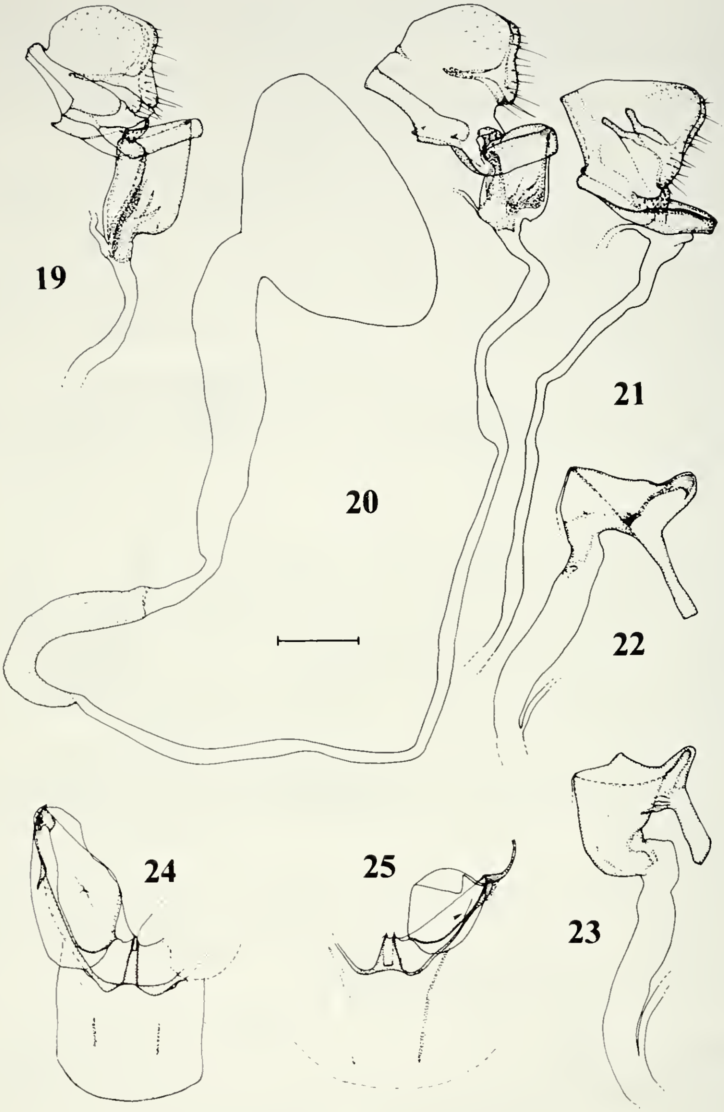
Apparato genitale ♀ (Fig.26): La bursa copulatrix "densamente corrugata" descritta per l'*Holotypus* è frutto di un'aberrazione del preparato microscopico. In realtà essa è lunga, stretta e solo debolmente corrugata. La placca urosternale posta al di sopra dell'ostium bursae è ben definita ma senza dentelli.

Alphacrambus gen. nov.

Specie-tipo: Crambus prodontellus Hampson, 1919. Genere maschile.

Genere caratterizzato dalle piccole dimensioni (mm. 12-15,5 di apertura alare). Antenne debolmente serrate nel ♂, lisce nella ♀. Ocelli e chetosemae ben sviluppati. Ali anteriori bianche o gialle variegate da strie e bande dorate e/o brune. Banda submarginale argenteo-dorata sempre presente. Il frenulum nella ♀ è semplice.

Apparato genitale ♂: si distingue per l'assenza dell'uncus e per la completa fusione tra tegumen e vinculum. Il vinculum è sempre più o meno profondamente bilobato, la costa alta e sclerificata, lo pseudosaccus ben sviluppato e vi è sempre la presenza di cornuti nella vesica.



Figg. 19-25

Sebrus e *Alphacrambus* spp., apparati genitali ♀♀ e organi timpanali. Scala 0,5 mm. 19: *S. perdentellus* (Hmps.), *lectoparatypus*, GS3228GB, fino a ductus bursae escluso. 20: *S. absconditus* n. sp., paratypus, GS3225GB. 21: *S. amandus* Błesz., Madagascar, GS2628GB, parte del ductus bursae e bursa copulatrix esclusi. 22-23: variabilità nel complesso ostium bursae - antrum in *A. prodontellus* (Hmps.). 22- GS2192GB, Sud Africa, Pretoria. 23- GS3191GB, Sud Africa, Magunde. 24-25: organi timpanali. 24- *S. absconditus* n. sp., ♂, *paratypus*, GS3064GB. 25- *A. prodontellus* (Hmps.), ♀, GS3191GB.

Apparato genitale ♀: VIII segmento addominale completamente membranoso; apophyses posteriores molto corte; apophyses anteriores assenti; ostium bursae formante ampi processi periostiali di supporto; antrum non differenziato; ductus bursae mediamente sclerificato nella sua prima metà, poi membranoso; ductus seminalis originantesi alla metà circa del ductus bursae; bursa copulatrix di media grandezza, dotata di un signum ed intensamente corrugata e/o cosparsa di microplacche regolarmente disposte.

Gli apparati genitali tendono ad avere lievi variazioni (Figg.22-23) non costanti anche all'interno di popolazioni simpatriche.

Organi timpanali (Fig.25): caratterizzati dalla bulla tympani, dal pons tympani e dal processus tympani minuti, dall'area subtimpanale inferiore ampia. Venulae secundae ben sviluppate. Nel ♂ sia il tympanum che la bulla tympani sono più sviluppati.

Il genere è molto vicino a *Crambixon* Błeszyński, nel cui genitale ♂ si osserva l'assenza di cornuti, tegumen esile e giunzione tegumen/vinculum evidente. Nel genitale ♀ la bursa copulatrix è priva di signa, ostium bursae ed area periostiale sono solo debolmente sclerificati. Il ductus seminalis origina nella seconda metà del ductus bursae.

Geonemia: Africa tropicale, India.

TABELLA DELLE SPECIE

1	Colore di fondo delle ali anteriori giallo	*phoeostrigellus*
–	Colore di fondo delle ali anteriori bianco	2
2	apice dell'ala anteriore acuto	3
–	apice dell'ala anteriore decisamente appuntito, banda submarginale stretta	*razowskii*
3	ala anteriore con 2 macchie nere marginali distanziate tra loro	*parvus*
–	ala anteriore con 4 macchie nere marginali in sequenza	4
4	fronte tondeggiante, appena sporgente oltre l'occhio	*prodontellus*
–	fronte subconica, decisamente sporgente oltre l'occhio	*cristatus*

Alphacrambus prodontellus (Hampson, 1919) n. comb.

Crambus prodontellus Hampson, 1919: 288.

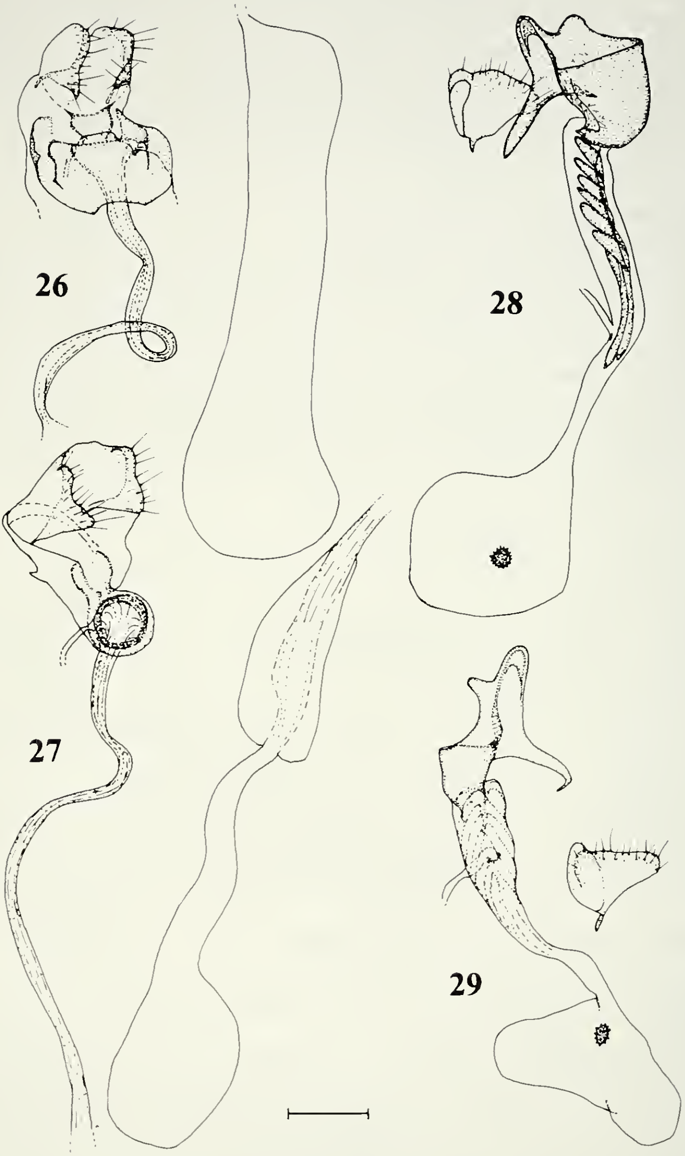
Holotypus ♂: [Sud Africa, Transvaal] Pretoria, 17.IX.[19]08, 11, A.J.T. Janse, GS5576BM Pyral., nel NHML, esaminato.

Altro materiale esaminato: Botswana: 1♀ Gaborone, XII. 1977, B. Skule, GS2883GB, ZMC. Kenya: 2 ♂♂, Naro Moru, m. 1950, 18.XI-3.XII.1984, lux, Leg. G. Bassi, GS 1965 e 1969 GB, CB. Nigeria: 1♂ Jos, 4000 ft., D.M. Roberts, 21. VII.1977, B.M. 1977:377, GS1650GB, NHML; Sud Africa:14 exx. ♂♂ e ♀♀,Pretoria, Magunde, I-III-VIII-X-XI-XII, TMP; 1♀, Pretoria, I.10.09, A.J.T. Janse, GS 1649 GB, NHML. Tanzania: 11 exx. ♂♂ e ♀♀, Lake Sereri, 3150 ft., VIII-IX.1965, leg. Dr. Szunyoghy, GS 3252, 3286 e 3296 GB, TMB. Zaire: 1♂,Ht. Katanga, Kyala, 29.VIII.29, J. Romieux ,GS2233GB, MHNG.

Alphacrambus razowskii (Błeszyński, 1961) n. comb.

Crambus razowskii Błeszyński, 1961: 191.

Holotypus ♂: Cape Province, Mossel Bay, XII.1934, S[outh] Africa, R. E. Turner, GS1561SB (5265BM Pyral.), nel NHML, esaminato.



Figg. 26-29

Sebrus e *Alphacrambus* spp., apparati genitali ♀♀. Scala 0,5 mm. 26: *S. pseudosparsellus* (Blesz.), Zaire, Panda, GS2210GB. 27: *S. argus* n. sp., *paratypus*, GS6677SB. 28: *A. prodontellus* (Hmps.), Sud Africa, Pretoria, GS1649GB. 29: *A. cristatus* n. sp., holotypus.

Altro materiale esaminato: Kenya: 11 exx. ♂♂ e ♀♀, Naro Moru, m. 1950, 18.XI-3.XII.1984, lux, Leg. G. Bassi, GS 1221, 1229, 1234 e 1970 GB, CB. Sud Africa: 6 ♀♀, Pretoria, Barberton, Umkomaas, XII e III, TMP; 1♀, Natal, Coll. Dumont, 10.04, GS 2604GB, MNHNP. Tanzania: 1 ♂, Mafinga, 20.XI-5.XII.1989, lux, Leg. Curletti, GS 2673 GB, CB. Zaire: 1♀, Ht. Katanga, Panda,12.X.29, J.Romieux, GS2234GB e 1♀, Ht. Katanga, Tshituru, 7.IV.29, J.Romieux, nel MHNG.

Nota sistematica: le ♀♀ e i ♂♂ delle due specie non furono correttamente accoppiati da Błeszyński (1961: 190-192, figg. 74-75). In realtà sia le descrizioni che le figure riguardanti le ♀♀ vanno, nel citato lavoro, invertite. Esaminando serie di esemplari in buone condizioni distinguere le due specie è facile: *prodontellus* (Hmps.) è leggermente più grande e più scuro, ha l'apice dell'ala anteriore meno appuntito, ha una grande macchia subtriangolare nera all'apice (bruno argentea in razowskii Błesz.), la banda subterminale è più ampia con colore di fondo bianco, vi sono 4 grandi tacche nere submarginali (in razowskii Błesz. la banda subterminale è stretta e con colore di fondo giallo argenteo, le 3-4 tacche submarginali sono più minute). La fronte è, in prodontellus (Hmps.), più tondeggiante e meno sporgente oltre l'occhio rispetto a razowskii Błesz.

Alphacrambus phoeostrigellus (Hampson, 1903) n. comb.

Crambus phoeostrigellus Hampson, 1903: 658.

Crambixon phoeostrigellus (Hmps.), Błeszyński 1965: 325.

Lectotypus ♂ (stabilito da Bleszynski, 1965:325): [India] Kashmir, Goorais Valley, VI.1887, J.H. Leech, nel NHML.

Materiale esaminato: 1♂ paralectotypo, stessa etichetta del lectotypus, sept. 1887, GS3411GB, NHML.

Per quanto sopra esplicitato la specie in questione è tipica rappresentante del genere qui trattato. Dall'apparato genitale (si conoscono solo ♂♂) appare vicina a *prodontellus* (Hmps.).

Alphacrambus cristatus n. sp.

Holotypus ♀: [Etiopia] Abyssinia, Kovács, Marako, 1912.III. 8, GS 3273 GB, nel TMB.

Cenni morfologici (Fig.D): apertura alare mm. 12,7. Fronte bianca, subconica, nettamente sporgente oltre l'occhio. Palpi lunghi 3,5 volte il diametro dell'occhio, bianchi superiormente ed internamente, bronzei esternamente. Antenne lisce, bianche e bronzee. Capo, collo e torace bianchi. Tegulae bronzee. Colore di fondo delle ali anteriori bronzeo. Ali posteriori bianche soffuse di bruno.

Apparato genitale ♀ (Fig.29): Simile a *prodontellus* (Hmps.) (Fig. 28), ma con placca periostiale molto alta e bilobata.

♂ sconosciuto.

Derivatio nominis: da *cristatus* = con cresta, in allusione al processo dell'ostium bursae, ad essa simile.

Alphacrambus parvus n. sp.

Holotypus ♂: Fort Crampel, (Congo français), 1920-1932, Coll. L. & J. de Joannis, Muséum Paris, GS 2436 GB, nel MNHNP.

Cenni morfologici (Fig. E): apertura alare mm. 12,1. Fronte tondeggiante, bianca, appena sporgente oltre l'occhio. Antenne brune, debolmente serrate. Capo e torace

Figg. A - E

Sebrus e *Alphacrambus* spp., imagini. A: *S. argus* n. sp., holotypus. B: *S. perdentellus* (Hmps.), paralectotypus ♀. C: *S. absconditus* n. sp., paratypus ♂. D: A. cristatus n. sp., holotypus. E: *A. parvus* n. sp., holotypus.

bianchi. Tegulae brune. Ali anteriori con un'ampia e irregolare stria bruna che attraversa medialmente l'ala in tutta la sua lunghezza. Due sole tacche nere submarginali, distanziate tra loro. Ali posteriori brune. Simile a *prodontellus* (Hmps.), ma più piccolo e più scuro.

Apparato genitale ♂ (Fig. 17, 18): Simile a prodontellus (Hmps.) (Fig. 13, 14), con gnathos più corto, vinculum lievemente più stretto e più ampiamente bilobato e costa molto più corta ed alta.

♀ sconosciuta.

Derivatio nominis: da *parvus* = piccolo, in allusione alle minute dimensioni dell'Holotypus.

RINGRAZIAMENTI

Sono grato ai Dott. V. Mahnert e D. Burckhardt del Muséum d'histoire naturelle di Ginevra, al Dott. U. dall'Asta del Musée Royal de l'Afrique Centrale di Tervuren, al Dott. L. Gozmany del Magyar Termèszettudomànyi Mùzeum di Budapest, al Sig. O. Karsholt dello Zoologisk Museum di Copenaghen, al Sig. M. Krüger del Transvaal Museum di Pretoria, al Dott. G. Luquet del Muséum National d'Histoire Naturelle di Parigi, ed al Sig. M. Shaffer del Natural History Museum di Londra per avermi concesso in studio il materiale a loro affidato. Un sentito ringraziamento anche al Prof. U. Parenti del Dipartimento di Biologia animale dell'Università di Torino per i preziosi consigli di cui è sempre prodigo.

BIBLIOGRAFIA

BASSI, G., 1991. Contributi alla conoscenza delle Crambinae (Lepidoptera, Crambidae). VI: Note sul genere *Aureocramboides* Błeszyński. *Boll. Mus. reg. Sci. nat. Torino*, 9 (2):391-396.

BASSI, G., 1992. Contributi alla conoscenza delle Crambinae (Lepidoptera, Crambidae). VII: Note sulle specie africane di *Crambus* Fabricius presenti nel Muséum d'Histoire Naturelle di Parigi. *Boll. Mus. reg. Sci. nat. Torino*, 10 (2): 221-235.

BASSI, G., 1995. Contributi allo studio delle Crambinae (Lepidoptera: Crambidae): VIII. Note sul genere *Caffocrambus* Błeszyński, con descrizione di nuove specie. *Boll. Mus. reg. Sci. nat. Torino*, 13 (1), in stampa.

BŁESZYŃSKI, S., 1961. Studies on the *Crambidae* (*Lepidoptera*). Part XXX. On several species of the generic group *Crambus* F. from the Ethiopian Region with the descriptions of new genera and species. *Pol. Pis. ent.*, 31: 165-218.

BŁESZYŃSKI, S., 1965. Crambinae. *In:* Amsel, H.G., Gregor, F., Reisser, H., *Microlepidoptera Palearctica*, 1: 1-553.

BŁESZYŃSKI, S., 1970. New genera and species of tropical Crambinae (Studies on the Crambinae, Lepidoptera, Pyralidae, Part 48). *Tijdschr. Ent.*,113, 1: 1-26.

GASKIN, D.E., 1975. Revision of the New Zealand *Crambini* (*Lepidoptera: Pyralidae: Crambinae*). N.Z. *Journal of Zoology*, 2 (3) :265-363.

HAMPSON, G.F., 1903. The moths of India. *J. Bomb. natur. Hist. Soc.*, 14: 639-659.

HAMPSON, G.F., 1919. Description of new *Pyralidae* of the subfamilies *Crambinae* and *Siginae*. *Ann. Mag. Nat. Hist.*, (9), 3:275-292, 437-457.

REVUE SUISSE DE ZOOLOGIE, 102 (3) : 629-634; septembre 1995

Un *Anapleus* Horn nouveau de l'Himalaya (Coleoptera, Histeridae)

Yves GOMY
116, rue Dalayrac, F-94120 Fontenay-sous-Bois, France.

A new species of *Anapleus* Horn from the Himalaya (Coleoptera Histeridae).- *Anapleus davidneelae* sp.n. is described from Nepal and North India. *Anapleus stigmaticus* (Schmidt) is revalided. A key to the Oriental species of *Anapleus* is provided. The relationships of *Anapleus* are discussed: the genus possesses a combination of characters of the Dendrophilinae and Onthophilinae.

Key-words: Coleoptera - Histeridae - *Anapleus* - Taxonomy - Oriental region.

INTRODUCTION

Dans une première note consacrée aux Histeridae du Népal, MAZUR (1987a) signale une espèces d'*Anapleus* Horn comme probablement nouvelle en plus d'*Anapleus cyclonotus* (Lewis, 1892). Dans sa seconde note sur cette région, le même auteur (MAZUR, 1991) signale de nouveau *A. cyclonotus* (Lewis) mais ne parle plus de l'existence possible d'une autre espèce. Par ailleurs, OLEXA (1982), dans sa révision des *Anapleus* paléarctiques ne mentionne pas *A. cyclonotus* et considère donc que cette espèce appartient, avec son synonyme *Abraeus stigmaticus* Schmidt, 1892, à la faune orientale. Cette synonymie, signalée par BICKHARDT (1913), ne paraît pas, à notre connaissance, avoir fait l'objet d'une nouvelle étude et si le Népal et l'Etat de Perak (Malaisie) nous semblaient assez éloignés géographiquement pour ne pas trop craindre la synonymie entre *Anapleus davidneelae* n.sp. et *Abraeus stigmaticus* Schmidt une vérification s'imposait cependant.

Ainsi, grâce à l'obligeance de notre collègue M. Uhlig du Zoologisches Museum de Berlin (Allemagne), nous avons reçu pour étude l'unique syntype d'*Abraeus stigmaticus* Schmidt conservé à Berlin, ce qui nous permet de désigner un lectotype. Il s'agit d'un mâle portant les étiquettes suivantes: / mâle (étiquette blanche, manuscrite). / *stigmaticus* Type Perak (étiquette blanche, manuscrite, de la main de J. Schmidt) / Type (petite étiquette orange, carrée, imprimée, caractéristique des types de la Coll. Schmidt-Bickhardt) / Coll. J. Schmidt (petite étiquette blanche, allongée et imprimée) / Zool. Mus. Berlin (étiquette jaune clair, imprimée).

Manuscrit accepté le 23.01.1995.

Ce Muséum possède un second mâle d'*Anapleus stigmaticus* (Schmidt) déterminé *A. stigmosus* (sic.) provenant d'Indonésie: Mentawei, Sipora, Sereinu, V.VI.1894 (Modigliani) ex. Mus. Civ. de Genova; un troisième exemplaire de même provenance est conservé au Muséum de Gênes (R. Poggi, comm. pers.). Ces exemplaires se différencient d'*Anapleus cyclonotus* (Lewis), par la forme générale moins globuleuse, la taille plus petite, la couleur moins sombre, la ponctuation et la forme de l'édéage. La synonymie proposée par BICKHARDT (1913) entre *A. cyclonotus* et *A. stigmaticus* n'est pas valable. *Anapleus stigmaticus* (Schmidt) est donc, à notre avis une espèce distincte. Nous donnons ci-dessous des figures permetttant de différencier ces deux espèces ainsi que celle que nous décrivons dans la présente note.

Anapleus davidneelae n.sp.

Espèce beaucoup plus proche d'*Anapleus stigmaticus* (Schmidt) que d'*A. cyclonotus* (Lewis). Elle se distingue immédiatement de ces deux espèces par la synthèse habituelle des caractères spécifiques distinctifs: taille, ponctuation générale forme du prosternum forme de l'édéage etc... Elle se rapproche aussi d'*A. jelineki* Olexa d'Iran et d'*A. monticola* Mazur du Pakistan mais s'en sépare principalement par sa ponctuation, la forme de son prosternum et celle de son édéage.

Corps en ovale large, convexe (beaucoup moins arrondi que chez *A. cyclonotus*). Noir, billant. Pattes, scape et funicule antennaire sensiblement de la même couleur, parfois très légèrement éclaircis: massues sombres, éclaircies superficiellement par une très fine pubescence claire. Scape renflé, environ trois fois plus long que large; premier article du funicule allongé, deux fois plus long que large: 2ème et 3ème articles très petits, les autres s'élargissant légèrement vers la massue.

Tête relativement petite. Front légèrement convexe à ponctuation forte, dense mais irrégulière car les points (séparés par 1/2 à 1 de leurs diamètres environ) ne sont pas de taille homogène (mélange de gros points et de points plus petits); marqué par une large impression au milieu; entaillé devant, de chaque côté au dessus des yeux par une petite encoche d'insertion antennaire. Epistome convexe, sans séparation visible avec le front, à ponctuation de même type mais plus petite, plus serrée, donnant un aspect rugueux. Yeux à peine bombés peu visibles de dessus.

Pronotum un peu plus de deux fois plus large que long à la base (1,14 mm / 0,53 mm); convexe, à ponctuation forte, dense mais irrégulière: les points sont plus petits et plus régulièrement denses sur le disque, plus gros et espacés à la base et surtout sur les côtés avec deux impressions post-oculaires qui lui donnent un aspect un peu plus bombé sur le disque; strie marginale large, complète derrière la tête et relevée en léger rebord émoussé jusqu'aux angles visibles puis se poursuivant de même jusqu'à la base en position d'épipleures. Les bords apparents du pronotum (visibles de dessus) ne correspondent, en fait, qu'à un bourrelet latéral caractéristique du genre pour les espèces que je connais. Base en arc large et bisinué.

Scutellum très visible, en triangle équilatéral.

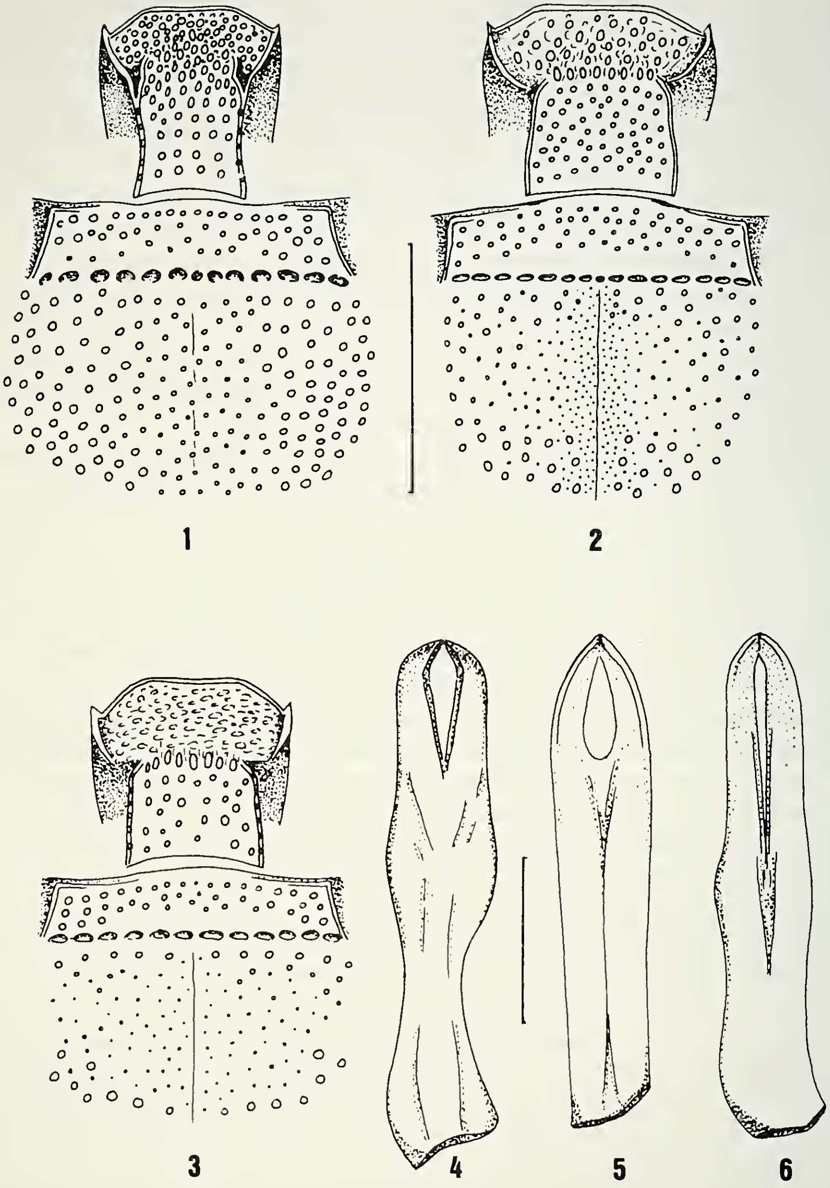
Elytres pris ensemble convexes, plus larges aux épaules que longs au milieu (1,40 mm / 1,14 mm); caractérisés par leur bourrelet latéral large et émoussé, plus fort dans la région humérale; à ponctuation forte et irrégulière (mélange de points plus ou moins gros) mais beaucoup plus lâche que celle du pronotum (points séparés par 1 à 4 de leurs diamètres environ) et plus fine dans la région périscutellaire. Stries dorsales élytrales obsolètes, réduites à des rudiments latéraux légèrement costiformes plus longs à l'extérieur qu'à l'intérieur. Apparemment, les deux stries subhumérales se sont transformées pour donner le bourrelet caractéristique. Strie marginale forte, très abaissée en position épipleurale, non visible de dessus, ponctuée nettement. Apex élytral avec une marge lisse précédée par quelques strioles longitudinales un peu plus visibles sur les côtés qu'au milieu (chez l'holotype mâle) un peu plus nettes et plus étendues chez le paratype femelle de l'Inde du Nord (dimorphisme sexuel). Epipleures avec une longue strie complète, ponctuée, bisinuée. Espace entre cette strie épipleurale et la strie marginale avec quelques points nets mais espacés.

Propygidium étroit, densément ponctué (points séparés par 1/2 à 1 de leurs diamètres environ). Pygidium à ponctuation du même type, mais nettement plus grosse.

Lobe prosternal court, à mentonnière trapézoïdale et nettement rebordée, grossièrement et rugueusement ponctuée. Prosternum proprement dit plus large que long (ce qui la sépare à première vue d'*A. cyclonotus* (fig.2). Stries prosternales subparallèles, très courtement convergentes au sommet, à ponctuation forte et rugueuse le long de la mentonnière, plus fine et espacée sur le disque et à la base. Séparé de la mentonnière par une ligne peu nette. Mésosternum (fig.2) très court, rectangulaire, à strie marginale forte sur les côtés et dans les angles antérieurs, interrompue derrière le prosternum; ponctué fortement et irrégulièrement dans les 2/3 apicaux, lisse dans le tiers basal. Suture méso-métasternale droite, ponctuée crénelée. Métasternum avec une fine ligne longitudinale médiane; à ponctuation forte et irrégulière: beaucoup plus forte et espacée sur les côtés et dans la moitié apicale, plus fine sur le disque et plus fine et serrée le long de la ligne longitudinale (fig.2). Strie métasternale latérale en deux tronçons: tronçon interne très fort, large et ponctué de très gros points, incomplet, ne marquant pas l'arrondi sous les hanches intermédiaires et s'arrêtant un peu avant de rencontrer le tronçon externe. Celui-ci rectiligne, oblique, très long, rejoignant presque les hanches postérieures. Ce tronçon délimite avec le bord épipleural une zone large et ponctuée de très gros points (séparés par 1/2 à 1 de leurs diamètres environ) et avec quelques points plus petits. Mésépiméron triangulaire avec une grosse ponctuation du même type. Plaque méso-postcoxale sans strie postcoxale, ponctuée de très gros points.

Premier sternite abdominal à ponctuation forte, dense et double; strie méta-postcoxale forte et ponctuée, ne marquant pas l'arrondi sous les hanches postérieures.

Tibias antérieurs caractéristiques du genre, à arêtes externes (supérieure et inférieure) subparallèles, doublement coudées, formant une sorte de gouttière. Cette disposition soulignant l'épaisseur du tarse se retrouve également pour les tarses intermédiaires et postérieurs. Toutes les arêtes sont frangées de courtes épines.



FIGS 1-6

1-3: Ponctuation et striation schématiques des régions pro-méso-métasternales chez *Anapleus cyclonotus* (Lewis) (1), *A. davidneelae* n.sp. (2) et *A. stigmaticus* (Schmidt) (3). Echelle = 0,5 mm. 4-6: Edéage (vue ventrale) chez les mêmes espèces et dans le même ordre. (4. sur un ex. du Népal, long: 0,36 mm); (5. sur holotype, long: 0,38 mm); (6. sur holotype, long: 0,47 mm). Echelle = 0,1 mm environ.

Edéage: long. 0,38 mm (fig. 5) bien différent de celui de *A. cyclonotus* (Lewis) qui est assymétrique (fig. 4) de celui de *A. stigmaticus* (Schmidt) (fig. 6) et de *A. monticola* (Mazur, 1987b).

Long: 1,67 mm (tête et pygidium exclus); large: 1,40 mm (holotype).

Derivatio nominis: Espèce d'altitude dédiée à la mémoire et aux exploits d'Alexandra David-Néel (1868-1969), l'une des grandes dames de ce siècle, aventurière de l'esprit, première européenne à pénétrer le Tibet interdit et sa capitale Lhassa. Elle fut, sa vie durant fascinée par les Himalayas, ses peuples et ses traditions et elle participa activement à répandre en France la connaissance du Bouddhisme tibétain.

Hototype ♂: Est Nepal: Kosi, Col N-E Mangmaya (2300 m), 6.IV.1984 (I. Löbl et A. Smetana). Muséum de Genève.

Paratypes: 2 mâles, Est Nepal: Kosi, Val Induwa Kola (2000 m.), 14.IV.1984 (I. Löbl et A. Smetana) Coll. Y Gomy; 1 femelle, Inde: Kumaon (U.P.), Rangarh no 68 (env. 2000m.), 9.X.1979 (I. Löbl), Muséum de Genève; 2 ex. W. Nepal, Dampa Pab, près de Chauta, région du lac Rara (Pa. 2294), (H. Franz), (Coll. H. Franz, Mödling et Y Gomy, Paris).

CLÉ DES *ANAPLEUS* DE LA FAUNE ORIENTALE

1 Prosternum plus long que large (fig. 1). Taille relativement grande (2 mm); forme très arrondie. Birmanie, Inde du Nord, Népal. . *cyclonotus* (Lewis)

– Prosternum plus large que long (fig. 2 et 3). Taille plus réduite (inférieure à 2 mm); forme un peu plus ovalaire. 2

2 Espèce noire. Ponctuation élytrale irrégulière, plus ou moins fine et espacée (points séparés par un à trois ou quatre de leurs diamètres environ). Ponctuation du métasternum fine et dense le long de la ligne médiane (fig. 2). Edéage symétrique (fig. 5). Inde du Nord, Népal . . . . *davidneelae* n.sp.

– Espèce brune. Ponctuation élytrale régulière, forte et dense comme chez *A. cyclonotus*. Ponctuation du métasternum fine mais espacée le long de la ligne médiane. Edéage avec un début de dissymétrie (fig. 6). Malaisie (Perak), Indonésie. . . . . *stigmaticus* (Schmidt)

CONSIDÉRATIONS SUR LA POSITION SYSTÉMATIQUE DE GENRE *ANAPLEUS* HORN

La description détaillée d'*Anapleus davidneelae* nous a permis de constater qu'un nombre non négligeable de caractères génériques rapproche les *Anapleus* Horn (1873) et les *Onthophilus* Leach (1817).

La forme générale du corps; l'encoche frontale d'insertion antennaire; la forme de la tête, de l'épistome et des yeux; la légère gibbosité du disque pronotal due aux fossettes post-oculaires; la configuration très particulière des bords du pronotum; la forme de la base du pronotum; la ponctuation générale; les rudiments de striation élytrale costiformes et les bourrelets latéraux des élytres; la forme de la mentionnière et du prosternum; la forme du mésosternum; la ligne longitudinale médiane du métasternum; la configuration des côtés du métasternum, du mésépiméron et de la plaque méso-postcoxale; la forme des tibias antérieurs; la forme de l'édéage et de sa pièce basale sont des caractères rapprochant *Anapleus* des Onthophilinae.

Si les *Anapleus* Horn ont été longtemps placés dans les Dendrophilinae à cause de leurs tibias antérieurs (entre autres), ce caractère ne résiste pas à un examen approfondi car l'on trouve chez les différentes espèces d'*Onthophilus* des tibias antérieurs grèles certes, mais dont la structure n'est pas foncièrement différente de celle des *Anapleus*. Par contre, le lobe prosternal des *Anapleus* possède une incision antennaire alors que celle-ci n'existe pas chez les *Onthophilus*. En fait, il semblerait que le lobe prosternal ait évolué chez les *Onthophilus* par tassement et élargissement de la mentonnière corrélés avec l'évolution d'une alvéole antennaire sous l'angle antérieur du pronotum. Il serait évidemment intéressant de vérifier ces hypothèses à partir d'une étude plus complète.

Le genre *Anapleus* Horn ne répond pas aux définitions des sous-familles des Dendrophilinae ni des Onthophilinae, telle qu'elles sont acceptées actuellement. Nous laissons à d'autres histéridologues le soin d'infirmer ou de confirmer nos présomptions et de redéfinir ces sous-familles.

REMERCIEMENTS

Nous remercions très cordialement nos amis I. Löbl et H. Franz pour le prêt du matériel ayant servi de base à cette note, ainsi que les Dr. M. Uhlig et R. Poggi respectivement du Zoologisches Museum de Berlin (Allemagne) et du Muséum de Gênes (Italie) pour nous avoir permis de vérifier les synonymies établies par H. Bickhardt.

RÉFÉRENCES

Bickhardt, H. 1913. Histeridenstudien (19. Beitrag zur Kenntnis der Histeriden). *Dt. ent. Z.:* 696-701.

Lewis, G. 1892. Viaggio di Leonardo Fea in Birmania e regioni vicine. XLII Histeridae (Part.2). *Annali Mus.civ. Stor.nat. Giacomo Doria* (2), 12 (32): 16-39.

Mazur, S. 1984. World catalogue of Histeridae. *Polskie Pismo ent.* 54 (3-4): 1-379.

Mazur, S.1987a. Histeridae from the Nepal Himalayas (Insecta: Coleoptera). *Cour. Forschungsinst. Senckenb.* 93: 463-470.

Mazur, S. 1987b. Contribution to the knowledge of the Histeridae of Pakistan (Coleoptera). *Revue suisse Zool.* 94(4): 659-670.

Mazur, S. 1991. Histeridae from the Nepal Himalayas, II. (Insecta: Coleoptera). *Stuttgarter Beitr. Naturk.*, Ser.A. 467: 1-12.

Olexa, A. 1982. Revision der paläarktischen Arten der Gattung Anapleus (Coleoptera, Histeridae). *Acta ent. bohemoslav.* 79: 37-45.

Schmidt, J. 1882. Neue Histeriden (Coleoptera). *Ent.Nachr.* 18: 17-30.

Revue suisse de Zoologie, 102 (3) : 635-653; septembre 1995

Oswaldocruzia (Nematoda, Trichostrongylina, Molineoidea) parasites d'Amphibiens du Brésil et de l'Équateur, avec redéfinition de l'espèce-type *O. subauricularis* (Rudolphi, 1819) et d'*O. mazzai* Travassos, 1935

Badreddine BEN SLIMANE & Marie-Claude DURETTE-DESSET
Laboratoire de Biologie parasitaire, Protistologie, Helminthologie, associé au C.N.R.S., Muséum national d'histoire naturelle, 61 rue de Buffon,
F-75231 Paris cedex 05, France.

***Oswaldocruzia* (Nematoda, Trichostrongylina, Molineoidea) parasitic in Brazilian and Ecuadorian Amphibians, with redefinition of the type species *O. subauricularis* (Rudolphi, 1819) and *O. mazzai* Travassos, 1935.-** *O. subauricularis* (Rudolphi, 1819), type species of *Oswaldocruzia* Travassos, 1937, parasite from Brazilian and Ecuadorian Bufonidae and *O. mazzai* Travassos, 1935, parasite from Argentinian Bufonidae are redescribed using new morphological characters, particularly the relative arrangement of the bursal rays 6,8 and 9 and the pattern of the synlophe in the oesophagal region. *Oswaldocruzia dlouhyi* n.sp. coparasite of *O. subauricularis* from *Bufo* sp. and *Oswaldocruzia taranchoni* n.sp. fom *Bufo marinus* are described from Brasil. *O. dlouhyi* belongs to the *Oswaldocruzia* species group having cervical alae and rays 8 arising on the dorsal ray and overlapped by rays 6 along their median part (type II).The species is characterised by a cephalic vesicle in two parts and by rays 4 longer than rays 5. *O. taranchoni* belongs to the *Oswaldocruzia* species group having no cervical alae and rays 8 arising on the root of the dorsal ray and joined to rays 6 along the two thirds (type III). The species is characterised by a cephalic vesicle in one part, by the spicular externo-lateral branch (blade) not divided on its tip and by rays 8 joined to the common trunk of rays 4 to 6. With just one exception, the neotropical *Oswaldocruzia* have spicula divided in three main branches: blade, shoe and fork as is the case in holarctic *Oswaldocruzia* but the division of the fork always occurs before the distal third of its length in neotropical species and beyond the distal third in holarctic ones. A new taxon is proposed: *Oswaldocruzia proencai* n.sp.(= *O. mazzai* sensu Lent et al., 1946 nec Travassos, 1935).

Key-words: *Oswaldocruzia* spp. - Nematoda - Trichostrongylina - Bufonidae - Neotropics - Taxonomy.

Manuscrit accepté le 12.12.1994.

INTRODUCTION

Le genre *Oswaldocruzia* parasite cosmopolite d'Amphibiens et de Reptiles a été créé par TRAVASSOS (1917) avec pour espèce type *Oswaldocruzia subauricularis*. Cette espèce avait été décrite du Brésil, de façon très succincte par Rudolphi (1819) chez "*Rana musica*", c'est-à-dire *Bufo americanus* dans la nomenclature actuelle. Les neuf espèces connues actuellement en zone néotropicale se répartissent en trois groupes d'après la disposition des côtes 6, 8 et 9 de la bourse caudale (DURETTE-DESSET *et al.*, 1992). L'objet principal de ce travail est d'identifier dans la faune néotropicale l'espèce correspondante à celle de Travassos, premier redescripteur moderne puisque comme nous le verrons dans la discussion, les spécimens types n'ont pas pu être localisés. Grâce à du matériel provenant de Bufonidae du Brésil et d'Équateur, il a été possible de trouver une espèce qui s'accorde avec la redescription d'*O. subauricularis* de Travassos. Celle-ci est redécrite ainsi que *O. mazzai* en utilisant de nouveaux critères morphologiques, en particulier les caractéristiques du synlophe dans la région oesophagienne. Enfin deux nouvelles espèces sont décrites chez des Bufonidae du Brésil.

MATÉRIEL ET MÉTHODES

Les Nématodes proviennent de l'intestin grêle d'un *Bufo* sp. originaire du Brésil et de 3 *Bufo marinus* dont l'un est originaire du Brésil et les 2 autres d'Équateur.

La nomenclature des Strongylida utilisée au-dessus du groupe famille est celle de DURETTE-DESSET & CHABAUD (1993).

Le synlophe est étudié selon la méthode de DURETTE-DESSET (1985); la nomenclature utilisée pour l'étude du synlophe dans la région oesophagienne est celle de BEN SLIMANE & DURETTE-DESSET (1993). En particulier, l'aile cervicale est définie comme formée d'une ou de plusieurs crêtes latéro-ventrales qui peuvent s'observer immédiatement en vue médiane lorsqu'elles sont très développées ou bien n'apparaître qu'en coupe transversale lorsqu'elles sont petites mais dans ce cas, elles sont toujours plus développées que les crêtes adjacentes.

La nomenclature utilisée pour l'étude de la bourse caudale est celle de DURETTE-DESSET & CHABAUD (1981); celle concernant la naissance et le trajet des côtes 8 par rapport à la côte dorsale et aux côtes 6 est celle suivie par DURETTE-DESSET, NASHER & BEN SLIMANE (1992) modifiée (fig. 1).

L'étude complète des spicules est faite sur du matériel disséqué et la nomenclature utilisée celle de BEN SLIMANE & DURETTE-DESSET (1993).

Le matériel étudié, conservé dans l'alcool à 70°, est déposé dans les Collections du Muséum national d'Histoire naturelle de Paris (MNHN), du Muséum d'Histoire naturelle de Genève (MHNG) et de l'Institut Oswaldo Cruz.

Les mensurations sont exprimées en micromètres.

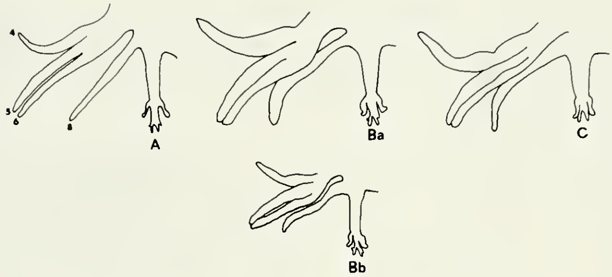


FIG. 1

Disposition relative des côtes 6, 8 et de la côte dorsale. A: type I, les côtes 8 naissent sur la côte dorsale et sont séparées des côtes 6 sur tout leur trajet; B: type II, les côtes 8 naissent apicalement sur la côte dorsale et apparaissent, en vue ventrale, chevauchées par les côtes 6 dans leur portion médiane (a) ou exceptionnellement sont légèrement écartées des côtes 6 et suivent un trajet parallèle à ces dernières (b); C: type III, les côtes 8 naissent à la racine de la côte dorsale et sont soit jointives aux côtes 6 soit chevauchées par ces dernières dans leur deux tiers proximaux (d'après Durette-Desset et al.1992, modifié).

Oswaldocruzia subauricularis (Rudolphi, 1819)

Matériel étudié: Un ♂ MNHN 882 MD parasite de l'intestin grêle de *Bufo* sp., Gavioes (134 km au Nord de Rio de Janeiro), Brésil, 10.09.1985, coparasite d'*O. dlouhyi* n.sp., leg. C.Dlouhy. Trois ♂, 4 ♀ MNHN 712 MD, 2 ♂, 4 ♀ MHNG 18768 INVE, parasites de l'intestin grêle d'un *Bufo marinus*, San Lorenzo (Esmaraldas), Équateur, 2.03.1987, leg. J.M. Touzet.

Pour permettre une éventuelle révaluation des caractères, les mensurations du mâle originaire du Brésil sont séparées de celles des mâles originaires d'Équateur.

Description: Nématodes ne présentant pas d'enroulement. Vésicule céphalique formée d'une partie antérieure enflée et d'une partie postérieure fine (fig. 2, A; 3, A). Pore excréteur toujours situé dans le tiers postérieur de l'oesophage. Deirides de forme triangulaire, situées postérieurement au pore excréteur (fig.3,A). Glandes excrétrices très développées. Séparation oesophage musculaire et glandulaire très nette (fig. 2, A; 3, A). Présence de minuscules ailes cervicales, visibles seulement en coupe transversale du corps. Crêtes cuticulaires pourvues d'un soutien chitinoïde (fig. 2, D; 3, E).

Tête: (fig.3,B). Bouche triangulaire, arrondie aux angles. En vue apicale, présence de 6 papilles labiales externes dont les latérales sont accolées aux 2 amphides et de 4 papilles céphaliques. Petite dent oesophagienne dorsale présente.

Synlophe: (étudié chez 3 mâles et une femelle. Les chiffres relatifs au mâle originaire du Brésil sont indiqués en premier, ceux d'Équateur entre parenthèses). Dans les deux sexes, corps parcouru longitudinalement par des crêtes cuticulaires continues. Chez le mâle, la grande majorité des crêtes dorsales et les deux tiers des crêtes ventrales naissent dans la région oesophagienne. Chez la femelle, les deux tiers des crêtes dorsales et la moitié des crêtes ventrales naissent dans cette région. Les autres crêtes naissent donc principalement sur la face ventrale puisqu'au milieu du

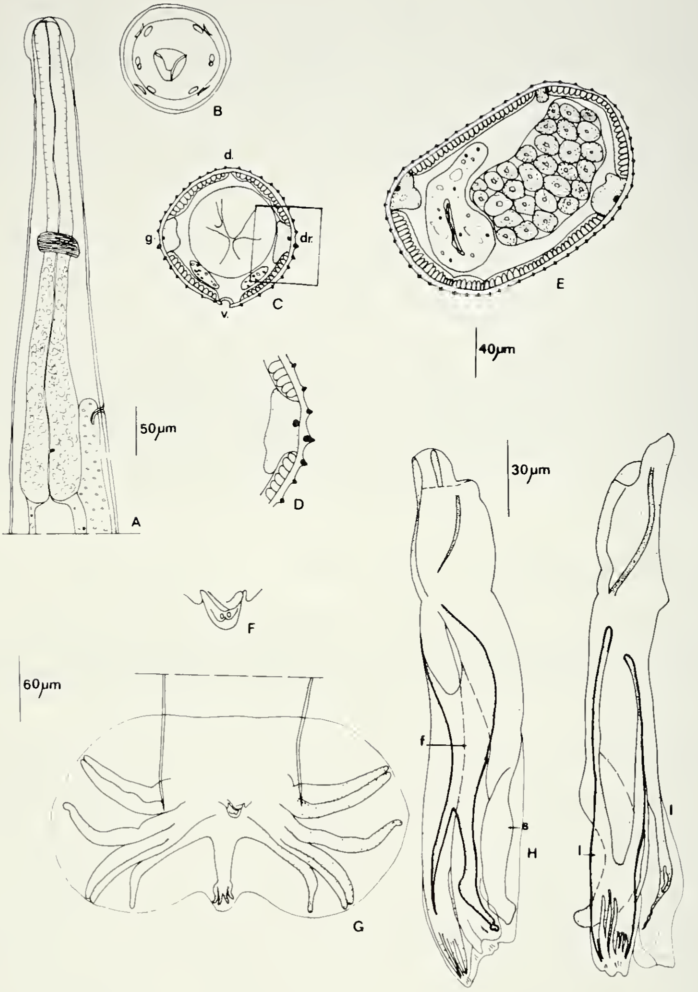


Fig. 2

Oswaldocruzia subauricularis (Rudolphi, 1819) chez *Bufo* sp. du Brésil. Mâle. A, extrémité antérieure, vue latérale droite. B, tête, vue apicale. C-E, coupes transversales du corps. C, au niveau du pore excréteur. D, id. détail de l'aile cervicale droite. E, au milieu du corps. F, détail du cône génital, vue ventrale. G, bourse caudale, vue ventrale. H, I, spicule droit disséqué, successivement vues ventrale et externo-latérale. Toutes les coupes sont orientées comme la figure 2, C. l: lame, f: fourche, s: sabot. A: éch. 50 µm. B, D, F, H, I: éch. 30 µm. C, E: éch. 40 µm. G: éch. 60 µm.

corps, le nombre de crêtes dorsales est sensiblement équivalent à celui des ventrales. Les crêtes disparaissent en avant de la bourse caudale chez le mâle (fig. 3, I) et progressivement en arrière de la vulve chez la femelle jusqu'au niveau des phasmides. (fig. 3, k).

Chez le mâle originaire du Brésil, le nombre de crêtes est de 33 (20 dorsales, 13 ventrales) au niveau du pore excréteur (fig. 1, C) de 41 (21 d, 20 v), au niveau de la jonction oesophago-intestinale et de 55 (28 d, 27 v) au milieu du corps (fig. 2, E). Chez les deux mâles originaires d'Équateur, le nombre de crêtes est de 39 (23 d, 16 v) et 40 (22 d, 18 v) au niveau du pore excréteur (fig. 3, C); de 40 (22 d, 18 v) et 43 (22 d, 21v) au niveau de la jonction oesophago-intestinale, de 47 (24 d, 23 v,) et 51 (26 d, 25 v) au milieu du corps (fig. 3, G). Chez la femelle, le nombre de crêtes est de 39 (23 dorsales, 16 ventrales) au niveau du pore excréteur (fig. 3, D), de 43 (25 d, 18 v) au niveau de la jonction oesophago-intestinale, de 61 (30 d, 31 v), au milieu du corps (fig. 3, F) et de 63 au niveau du vestibule (les cordons latéraux n'étant pas visibles à ce niveau, le nombre exact de crêtes dorsales et ventrales ne peut être donné).

Les crêtes sont espacées de façon régulière mais, dans la région du pore excréteur, elles sont plus serrées sur la face dorsale, puisque plus nombreuses.

Les crêtes sont de taille équivalente sauf dans la région oesophagienne où les deux crêtes ventrales adjacentes aux cordons latéraux sont légèrement plus grandes que les autres crêtes et forment des ailes cervicales (fig. 2, D; 3, E).

A l'exception des ailes cervicales, légèrement orientées ventralement, les autres crêtes sont orientées perpendiculairement à la paroi du corps.

Mâle: (les mensurations concernant le mâle originaire du Brésil sont données en premier, les extrêmes des mensurations concernant les 5 mâles originaires d'Équateur sont données entre parenthèses). Longueur: 8200 (8450-9600). Largeur dans la partie moyenne du corps: 170 (160-180). Vésicule céphalique haute de 85 (85-95) sur 40 (40-50) de large dans sa partie enflée et de 40 (40-45) dans sa partie fine. Anneau nerveux, pore excréteur et deirides situés respectivement à 230 (185-220), 425 (380-445) et 470 (420-495) de l'apex. Oesophage long de 520 (480-560). (fig. 2, A; 3, A).

Bourse caudale de type 2-3 à tendance 2-1-2 c'est-à-dire que les extrémités des côtes 4 étant coudées vers l'avant elles sont plus rapprochées de celles des côtes 3 que de celles des côtes 5 (fig. 2, G; 3, O). Côtes 2-3 d'une part, 5-6 de l'autre jointives. Côtes 6,8 et dorsale de type III avec côtes 8 chevauchées par les côtes 6 sauf dans leur tiers distal. Côte dorsale divisée distalement en 2 ou 3 rameaux, les rameaux externes (côtes 9) se détachant avant la division de la côte dorsale. Absence de gubernaculum. Cône génital haut de 15 (15-15) sur 17 (17-17) de large à sa base. Il porte sur sa lèvre antérieure une papille zéro bien développée et deux minuscules papilles 7 sur sa lèvre postérieure. (fig. 2, F; 3, 0). Spicules ailés, longs de 210 (190-205) à pointes complexes, se divisant au tiers proximal de leur hauteur en trois branches: lame, fourche et sabot. La lame se divise distalement en 8(7-7) rameaux; la fourche se divise en deux branches de longueur équivalente à 20 (25-25) % de sa hauteur. La branche externe est effilée, la branche interne est recourbée et enflée distalement. (fig. 2, H, I; 3, L, N).

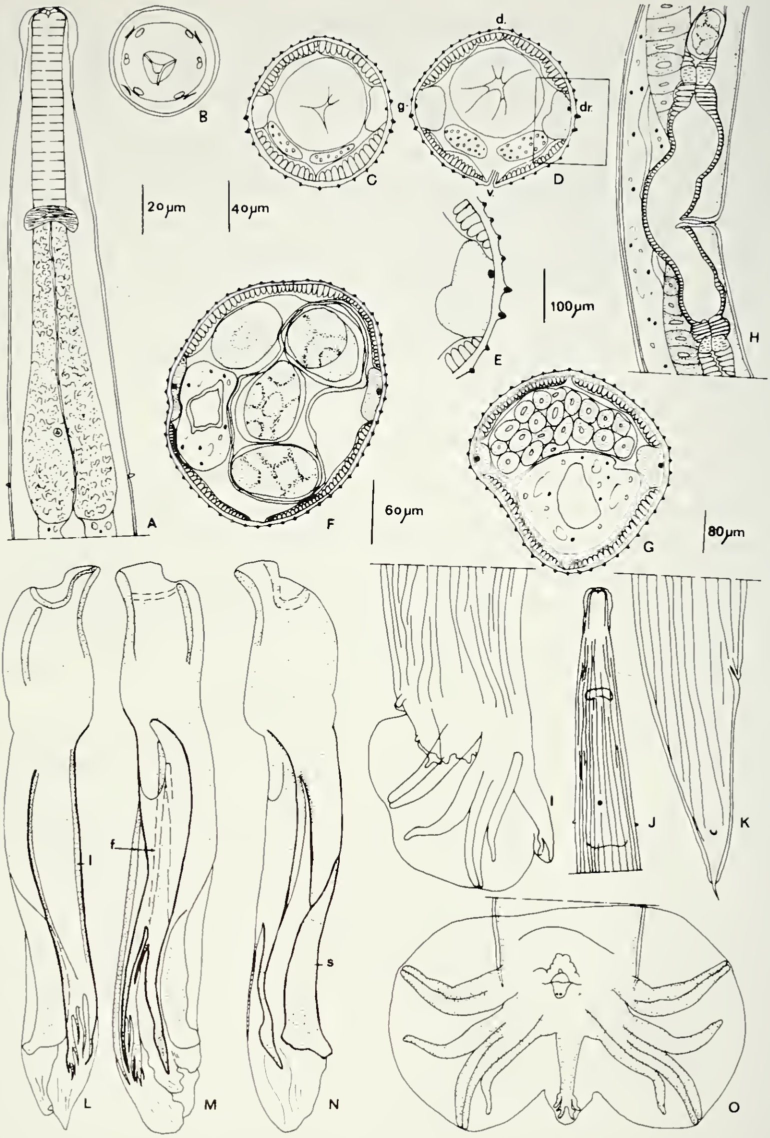


FIG. 3

Oswaldocruzia subauricularis (Rudolphi,1819) chez *Bufo marinus* d'Équateur. A, mâle, extrémité antérieure, vue ventrale. B, mâle, tête, vue apicale. C-G, coupes transversales du corps. C, mâle, au niveau du pore excréteur. D, femelle, id. E, femelle, détail de l'aile cervicale droite au niveau du pore excréteur. F, femelle, au milieu du corps. G, mâle, id. H, femelle, ovéjecteur, vue latérale droite. I, mâle, bourse caudale, vue latérale gauche. J, mâle, extrémité antérieure, naissance des crêtes cuticulaires, vue ventrale. K, femelle, queue, vue latérale droite. L-N, mâle, spicule droit disséqué. L, vue externo-latérale. M, vue ventrale. N, vue interne. O, mâle, bourse caudale, vue ventrale. Toutes les coupes sont orientées comme la figure 3,D. l: lame, f: fourche, s: sabot. A, I, K, O, éch.: 60 µm. B, E, L, M, N, éch.: 50 µm. C, D, F, G, éch.: 40 µm. H, éch: 100 µm. J, éch: 80 µm.

Femelle: (les mensurations concernent 8 spécimens originaires d'Équateur; le premier chiffre représente la moyenne, les chiffres entre parenthèses, les extrêmes): Longueur: 16025 (14450 - 18000). Largeur: 211 (190-230) dans leur partie moyenne. Vésicule céphalique haute de 104 (95-130) sur 52 (45-60) de large dans sa partie enflée et de 47 (45-50) dans sa partie fine. Anneau nerveux, pore excréteur et deirides situés respectivement à 244 (225-280), 459 (390-530) et 509 (420-580) de l'apex. Oesophage long de 590 (500-640).

Didelphie. La vulve s'ouvre à 5362 (4450-6500) de la pointe caudale soit dans le tiers postérieur du corps. Vagina vera long de 59 (50-75) divisant le vestibule long de 396 (310-470) en deux parties équivalentes. Sphincters et trompes longs respectivement de 49 (40-55) et de 36 (30-45). (fig. 3, H). Branche utérine antérieure longue de 3297 (2860-3700), contenant 119 (85-140) oeufs; branche utérine postérieure longue de 3420 (2550-4050) contenant 122 (98-140) oeufs. Oeufs au stade morula, hauts de 92,5 (85-100) sur 54 (50-60) de large. Queue longue de 196 (185-210) sur 86 (75-100) de large au niveau de l'anus. Pointe caudale longue de 17,6 (15-20) (fig. 3, K).

Discussion: O. subauricularis a été très brièvement décrite par RUDOLPHI (1819) chez "*Rana musicae*" au Brésil. La détermination de l'hôte parait eronnée puisque dans la nomenclature actuelle cette espèce est synonyme de *Bufo americanus* qui n'est connu que d'Amérique du Nord.

TRAVASSOS (1917) donne une description plus détaillée de l'espèce mais toujours sans illustration. Il signale la présence de l'espèce chez différents Amphibiens qui, dans la nomenclature actuelle, correspondent aux taxa suivants: *Ceratophrys cornuta*, *Leptodactylus ocellatus* (= *Cystignatus ocellatus*) pour les Leptodactylidae, *Bufo americanus* (= *Rana musica*), *Bufo ceratophrys*, *Bufo marinus* (= *Bufo agua*), *Bufo terrestris* (=*Bufo musica*, dont la distribution est uniquement nord-américaine) pour les Bufonidae. Il précise que sa description est basée sur le matériel récolté chez *Ceratophrys cornuta* et *Bufo agua*.

TRAVASSOS (1921) illustre l'espèce chez *Ceratophrys cornuta* et *Bufo agua* et reprend la description de 1917. D'après cette description, l'espèce est caractérisée par une vésicule céphalique en deux parties, un pore excréteur situé juste en arrière de l'annneau nerveux, une queue femelle tronquée avec une pointe fine, une vulve sans lèvres saillantes, un ovéjecteur relativement court (460µm) et une bourse caudale où les côtes 8 naissent à la racine de la côte dorsale et sont recouvertes par les côtes 6 sur les deux tiers antérieurs de leur trajet (type III). Aucune mention n'est faite du synlophe.

TRAVASSOS (1937) ajoute à la liste d'hôtes, *Bufo marinus*, *B. crucifer*, *Hyla faber*, *H. mesophaea*, et *Phyllomedusa burmeisteri*, tous du Brésil. Il redécrit l'espèce chez *Bufo crucifer* et donne des illustrations aussi bien de la bourse caudale que des spicules pour mettre en évidence la variabilité de l'anatomie de la côte dorsale et des pointes spiculaires chez différents hôtes. Il précise qu'il existe des crêtes cuticulaires espacées de 9 à 12 µm et qu'il n'existe pas d'ailes cervicales.

Le matériel original de l'Institut Oswaldo Cruz ne comporte pas d'*Oswaldocruzia* de *Ceratophrys cornuta* ni de *Bufo marinus* (= *Bufo agua*). Il s'agit de 4 spécimens provenant d'Angra dos Reis, Estado do Rio: un mâle et une femelle n° 5038, parasites de *Bufo crucifer*, un mâle n° 5008, parasite d'*Hyla faber* et une femelle n°4910 également parasite d'*Hyla faber*. Aucun des spécimens mâles ne correspond aux dessins de TRAVASSOS (1921). Le spécimen parasite du Bufo n'a pas une bourse caudale d'*Oswaldocruzia*; celui parasite d'*Hyla* a une bourse caudale de type II. En ce qui concerne les femelles, celle parasite du *Bufo* a une vésicule céphalique simple, celle parasite d'*Hyla* ne présente aucun élément contradictoire majeur avec la description de Travassos mais nous savons que dans le genre *Oswaldocruzia*, les femelles d'une région biogéographique déterminée sont morphologiquement très proches les unes des autres et que seule la connaissance du synlophe oesophagien permet de façon sûre de rapporter un spécimen femelle à une espèce déterminée. Dans le cas de la femelle parasite d'*Hyla*, l'état du matériel ne nous a pas permis de la déterminer.

En revanche, les spécimens que nous décrivons ci-dessus chez des Bufonidae, nous paraissent pouvoir être identifiés au matériel décrit par TRAVASSOS (1917, 1921) chez *Ceratophrys cornuta* et *Bufo marinus* (= *Bufo agua*) au Brésil. Tous les caractères concordent à l'exception de la position du pore excréteur plus postérieure chez nos spécimens mais nous savons par ailleurs (cf. BEN SLIMANE & DURETTE-DESSET, 1993) que ce caractère est dans ce genre très variable au sein de la même population, a fortiori chez un hôte différent. L'absence d'ailes cervicales signalée par Travassos peut s'expliquer par le fait que ces dernières sont minuscules et ne peuvent être observées qu'en coupe transversale du corps.

En tenant compte des critères actuels, *O. subauricularis* serait donc caractérisée par les éléments suivants:

- Ailes cervicales présentes mais minuscules et visibles seulement en coupe transversale du corps. Synlophe avec crêtes cuticulaires pourvues d'un soutien chitinoïde tout le long du corps. Nombreuses crêtes ventrales naissant en arrière de la région oesophagienne.
- Disposition des côtes bursales 6, 8 et dorsale de type III.
- Vésicule céphalique en deux parties.
- Vulve dépourvue de lèvres saillantes.
- Spicules formés de trois branches principales: lame, fourche, sabot. Lame divisée à son extrémité distale en "peigne"; fourche divisée en-deçà de son tiers postérieur en deux branches de longueur équivalente mais de forme différente.

La seule espèce néotropicale, sur les 9 espèces décrites, à posséder également des côtes 6 et 8 de type III, est *O. chambrieri* Ben Slimane & Durette-Desset, 1993. Cette espèce se distingue facilement par l'absence d'ailes cervicales, des crêtes dépourvues de soutien chitinoïde et une vésicule céphalique simple.

Le spectre d' hôtes d'*O. subauricularis* tel que nous l'identifions, serait actuellement réduit à *Ceratophrys cornuta* et *Bufo marinus*. En effet, la disposition des côtes bursales 6,8 et 9 décrites par TRAVASSOS (1937), chez *B. crucifer* et *Hyla faber* est clairement de type II, c'est-à-dire que les côtes 8 naissent à la racine de la côte dorsale mais ne sont recouvertes par les 6 que dans leur partie médiane. *Bufo americanus* (= *Rana musica*) et *Bufo musicus* (= *Bufo terrestris*) ne peuvent faire partie de la liste d'hôtes puisqu'il s'agit d'espèces strictement néarctiques. En ce qui concerne les parasites trouvés chez les autres hôtes par Travassos, nous manquons d'éléments pour les rattacher à une espèce donnée. Enfin, en accord avec TRAVASSOS (1937), nous pensons que les spécimens femelles parasites de *Rana pipiens* aux U.S.A et identifiés comme *O. subauricularis* par WALTON (1929), ne peuvent appartenir à cette espèce car le vagina vera est d'un type très particulier.

Oswaldocruzia dlouhyi n.sp.

Matériel étudié: ♂ holotype, ♀ allotype 715 MD a, 1 ♂, 4 ♀ paratypes 715 MD b, 1 ♂, 1 ♀ MHNG 18769 INVE, coparasites d'*O. subauricularis*, parasites de l'intestin grêle d'un *Bufo* sp., Gavioes (134 km au Nord de Rio de Janeiro), Brésil., 10.09.1985, leg. C. Dlouhy.

Description: Nématodes ne présentant pas d'enroulement. Vésicule céphalique formée d'une partie antérieure enflée et d'une partie postérieure fine (fig. 4, B). Pore excréteur toujours situé dans le tiers postérieur de l'oesophage. Deirides de forme triangulaire, situées postérieurement au pore excréteur (fig. 4, D). Glandes excrétrices très développées. Séparation oesophage musculaire et glandulaire très nette (fig. 4, A). Présence d'ailes cervicales (fig. 4, F, G). Crêtes cuticulaires dépourvues d'un soutien chitinoïde.

Tête: (fig. 4, C).Bouche triangulaire, arrondie aux angles. En vue apicale, présence de 6 papilles labiales externes dont les latérales sont accolées aux 2 amphides et de 4 papilles céphaliques. Petite dent oesophagienne dorsale présente.

Synlophe: (étudié à différents niveaux chez 1 mâle et 1 femelle et au milieu du corps chez un mâle et 3 femelles). Dans les deux sexes, corps parcouru longitudinalement par des crêtes cuticulaires continues. Chez le mâle, les quatre cinquièmes des crêtes dorsales et les trois cinquièmes des crêtes ventrales naissent dans la région oesophagienne. Chez la femelle, presque toutes les crêtes dorsales et les trois quart des crêtes ventrales naissent dans cette région. Au milieu du corps, le nombre de crêtes dorsales reste légèrement supérieur à celui des ventrales. Chez la femelle, il y a naissance de crêtes dorsales supplémentaires dans la région vestibulaire (fig. 4, J). Les crêtes disparaissent en avant de la bourse caudale chez le mâle (fig. 4, N) et progressivement en arrière de la vulve chez la femelle jusqu'au niveau des phasmides (fig. 4, P).

Chez le mâle, le nombre de crêtes est de 30 (18 dorsales,12 ventrales) au niveau du pore excréteur (fig. 4, F), de 31 (19 d,12 v) au niveau de la jonction oesophago-intestinale et de 32 (17 d, 15 v) au milieu du corps (fig. 4, H). Chez le deuxième mâle, le nombre de crêtes est de 32 au milieu du corps dont 17 dorsales et 15 ventrales.

Chez la femelle, le nombre de crêtes est de 34 (21 dorsales, 13 ventrales) au niveau du pore excréteur, de 35 (21 d et 14 v), au niveau de la jonction oesophago-

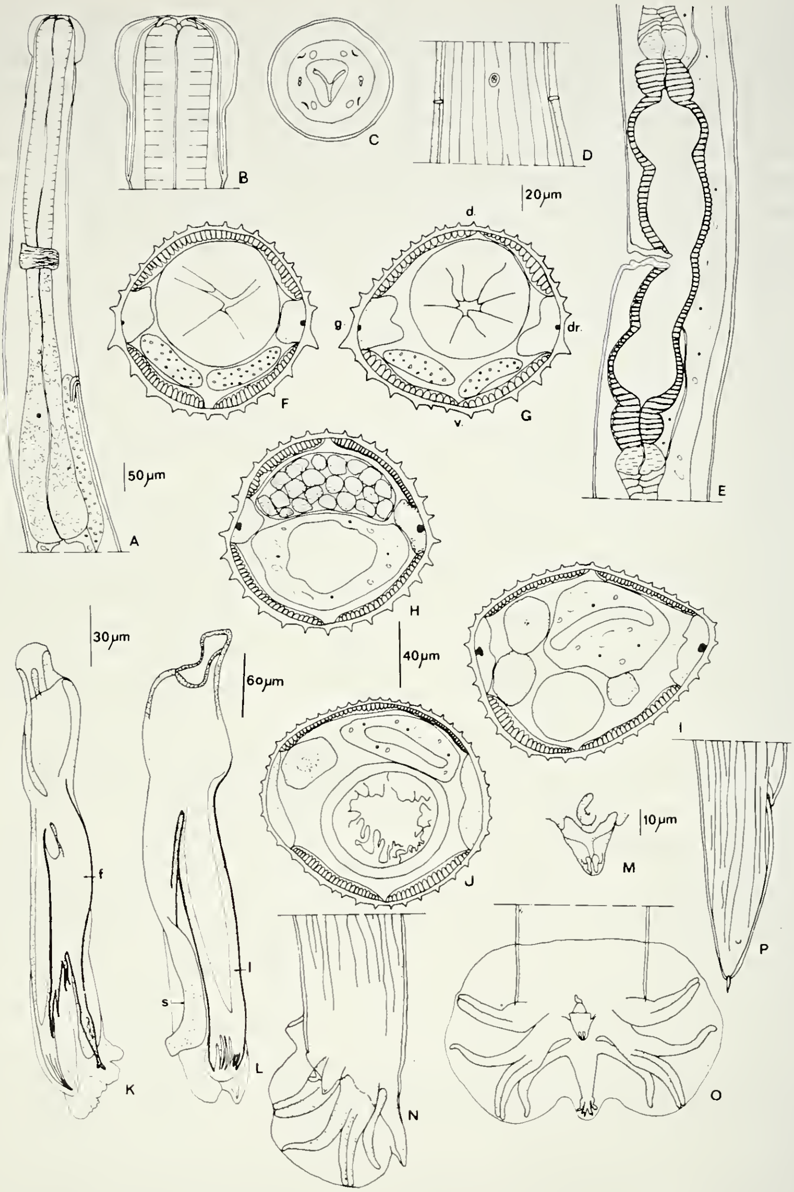


FIG. 4

Oswaldocruzia dlouhyi n.sp. A, mâle, extrémité antérieure, vue latérale droite. B, femelle, détail de la vésicule céphalique, vue ventrale. C, femelle, tête, vue apicale. D, femelle, détail du pore excréteur et des deirides, vue ventrale. E, femelle, ovéjecteur, vue latérale gauche. F-J, coupes transversales du corps. F, mâle, au niveau du pore excréteur. G, femelle, id. H, mâle, au milieu du corps. I, femelle, id. J, femelle, au niveau du vestibule. K-L, mâle, spicule droit disséqué. K, vue ventrale. L, vue externo-latérale. M, mâle, cône génital, vue ventrale. N-O mâle, bourse caudale. N, vue latérale gauche. O, vue ventrale. P, femelle, queue, vue latérale droite. Toutes les coupes sont orientées comme la figure 4.G. l: lame, f: fourche, s: sabot. A, E, éch.: 50µm. B, C, F-I, K, L, éch.: 30 µm. D, éch: 20 µm, J, éch: 40 µm, M, éch: 10 µm, N-P, éch: 60 µm intestinale, de 41 (22 d, 19 v) au milieu du corps (fig. 4, J) et de 47 au niveau du vestibule. (Les cordons latéraux n'étant pas visibles à ce niveau, le nombre exact de crêtes dorsales et ventrales ne peut être donné). Chez les trois autres femelles, le nombre de crêtes est de 29 (16 d, 13 v), 44 (24 d, 20 v) et 42 (23 d, 19 v) au milieu du corps.

Au milieu du corps, les crêtes sont espacées de façon régulière mais dans la région oesophagienne les crêtes latéro-ventrales sont plus espacées que les crêtes ventrales (fig. 4, F, G).

Les crêtes sont de taille équivalente sauf dans la région oesophagienne où les crêtes ventrales présentent un léger gradient décroissant chez le mâle (fig. 4, F). Les ailes cervicales sont formées d'une crête unique, de forme triangulaire et située ventralement juste en arrière du cordon latéral. Les ailes naissent à la base de la vésicule céphalique et disparaissent à environ 300 en arrière de la jonction oesophago-intestinale.

A l'exception des ailes cervicales, légèrement orientées ventralement, les autres crêtes sont orientées perpendiculairement à la paroi du corps (fig. 4, F-I).

Mâle holotype: Longueur: 6450. Largeur dans la partie moyenne du corps: 120. Vésicule céphalique haute de 90 sur 55 de large dans sa partie enflée et 45 dans sa partie fine. (fig. 4, B). Anneau nerveux, pore excréteur et deirides situés respectivement à 235, 390 et 420 de l'apex. Oesophage long de 55O (fig. 4, A).

Bourse caudale de type 2-3 à tendance 2-1-2 c'est-à-dire que les extrémités des côtes 4 étant coudées vers l'avant sont plus rapprochées de celles des côtes 3 que de celles des côtes 5 (fig. 4, O). Côtes 2-3 d'une part, 5-6 de l'autre jointives. Côtes 6,8 et dorsale de type II avec court tronc commun aux côtes 8 et 9; côtes 6 recouvrant les côtes 8 dans leur partie médiane. Côte dorsale divisée distalement en 3 rameaux, les rameaux externes (côtes 9) se détachant avant la division de la côte dorsale (fig. 4, 0). Absence de gubernaculum. Cône génital haut de 25 sur 25 de large à sa base. Il porte sur sa lèvre antérieure une papille zéro bien développée et deux minuscules papilles 7 sur sa lèvre postérieure (fig. 4, M). Spicules ailés, longs de 225 à pointes complexes, se divisant au tiers proximal de leur hauteur en trois branches: lame, fourche et sabot. Chez un paratype dont les spicules ont été disséqués, la lame se divise distalement en 9 rameaux; la fourche se divise en deux branches de longueur inégale à 27% de sa hauteur. La branche externe est nettement plus courte que la branche interne (fig. 4, K).

Femelle allotype: Longueur: 10200. Largeur: 200 dans sa partie moyenne. Vésicule céphalique haute de 100 sur 60 de large dans sa partie enflée et 50 dans sa partie fine. Anneau nerveux, pore excréteur et deirides situés respectivement à 265, 455 et 480 de l'apex. Oesophage long de 600.

Didelphie. La vulve s'ouvre à 3750 de la pointe caudale soit aux deux tiers postérieurs du corps. Vagina vera long de 55 divisant le vestibule long de 420 en deux parties inégales, l'antérieure étant légèrement plus longue. Sphincters et trompes longs respectivement de 50 et 30 (fig. 4, E). Branche utérine antérieure longue de 2200, contenant 64 oeufs, branche utérine postérieure longue de 2120 contenant 47 oeufs. Oeufs au stade morula, hauts de 85 sur 50 de large. Queue longue de 220 sur 80 de large au niveau de l'anus. Pointe caudale longue de 16 (fig. 4, P).

Discussion: Comme la grande majorité des espèces d'*Oswaldocruzia* néotropicaux, les spécimens ci-dessus possèdent des spicules à 3 branches principales dont la fourche est divisée dans son tiers postérieur et dont la lame se termine en "peigne" c'est-à-dire que son extrémité distale est divisée en plusieurs rameaux.

Parmi ces espèces, seules *O. touzeti* parasite d'*Eleutherodactylus variabilis* et *O. vaucheri* parasite d'*Ischnocnema quixensis* toutes deux décrites d'Équateur se rapprochent de nos spécimens par la présence d'ailes cervicales et une disposition des côtes bursales 6, 8 et 9 de type II.

O. dlouhyi n. sp. s'éloigne de *O. touzeti* par l'anatomie des ailes cervicales, des crêtes oesophagiennes dépourvues de soutien chitinoïde et des côtes 4 plus longues que les côtes 5. L'espèce la plus proche est *O. vaucheri* avec une forme identique des ailes cervicales et des crêtes cuticulaires dépourvues de soutien chitinoïde tout le long du corps. Les spécimens du Brésil se distinguent par une vésicule céphalique en deux parties, des crêtes oesophagiennes plus nombreuses et plus marquées et par des côtes 4 aussi longues que les côtes 3.

Nous dédions cette nouvelle espèce à Carlo Dlouhy, Correspondant du Muséum de Genève au Paraguay, qui a récolté le matériel.

Oswaldocruzia mazzai Travassos, 1935

Matériel étudié: Un ♂, 1 ♀ MNHN 714 MD, 1 ♂, 1 ♀ MNHG 18770 INVE et 1 ♀ MNHN 713 MD parasites de l'intestin grêle de deux *Bufo marinus*, San Pablo (Napo), Équateur., 23.02.1987, leg. J.M. Touzet

Description: Nématodes ne présentant pas d'enroulement. Mâles au moins deux fois plus petits que les femelles. Vésicule céphalique simple (fig. 5,A). Pore excréteur situé environ aux deux tiers de la hauteur de l'oesophage. Deirides de forme triangulaire, situées postérieurement au pore excréteur (fig. 5, A). Glandes excrétrices très développées. Séparation oesophage musculaire et glandulaire très nette. Présence de minuscules ailes cervicales, visibles seulement en coupe transversale du corps (fig. 5, E). Crêtes cuticulaires pourvues d'un soutien chitinoïde.

Tête: (fig. 5, B). Bouche triangulaire, arrondie aux angles. En vue apicale, présence de 6 papilles labiales externes dont les latérales sont accolées aux 2 amphides et de 4 papilles céphaliques. Petite dent oesophagienne dorsale présente.

Synlophe: (étudié chez 1 mâle et 2 femelles). Dans les deux sexes, corps parcouru longitudinalement par des crêtes cuticulaires continues. Les quatre cinquièmes des crêtes dorsales et les deux tiers des crêtes ventrales naissent dans la région oesophagienne. Au milieu du corps, le nombre de crêtes dorsales reste équivalent ou légèrement supérieur à celui des ventrales. Les crêtes disparaissent en avant de la bourse caudale chez le mâle (fig. 5, I) et progressivement en arrière de la vulve chez la femelle jusqu'au niveau des phasmides (fig. 5, J).

Chez le mâle, le nombre de crêtes est de 38 (22 dorsales, 16 ventrales) au niveau du pore excréteur (fig. 5, C), 44 (23 d, 21 v) au niveau de la jonction oesophago-intestinale et de 56 (29 d, 27 v) au milieu du corps (fig. 5, G). Chez les

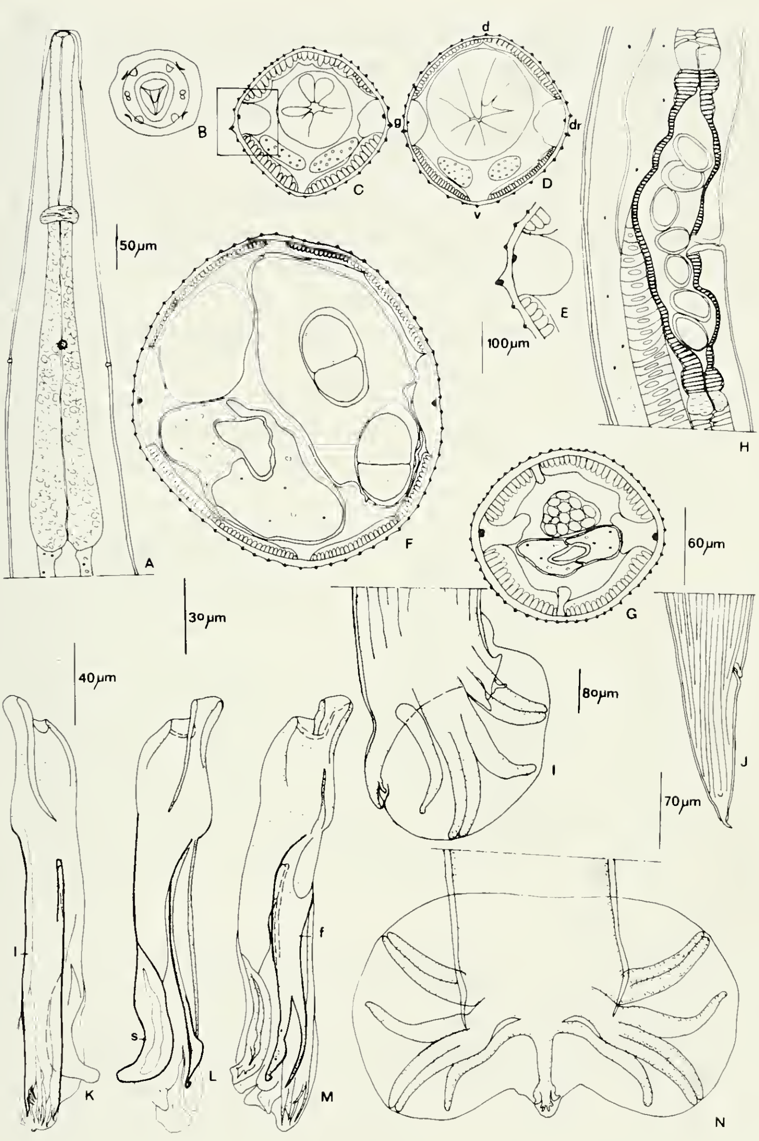


FIG. 5

Oswaldocruzia mazzai Travassos, 1935. A, mâle, extrémité antérieure, vue ventrale. B, femelle, tête, vue apicale. C-G, coupes transversales du corps.C, mâle, au niveau du pore excréteur. D, femelle, id. E, mâle, détail de l'aile cervicale gauche au niveau du pore excréteur. F, femelle, au milieu du corps. G, mâle, id. H, femelle, ovéjecteur, vue latérale droite. I, mâle, bourse caudale, vue latérale droite. J, femelle, queue, vue latérale droite. K-M, mâle, spicule gauche disséqué. K, vue externo-latérale. L, vue interne. M, vue sub-ventrale. N, mâle, bourse caudale, vue ventrale. Toutes les coupes sont orientées comme la figure 5,D. l: lame, f: fourche, s: sabot. A, éch.: 50 µm. B, E, éch.: 30 µm. C, D, F, G, éch: 60 µm, H, éch:100 µm, I, N, éch: 70 µm, J, éch: 80 µm, K, L, M, éch: 40 µm.

deux femelles, le nombre de crêtes est de 36 (21 d, 15 v) et 44 (25 d, 19 v) au niveau du pore excréteur, 46 (25 d, 21v) et 49 (27 d, 22 v) au niveau de la jonction oesophago-intestinale, 68 (34 d, 34 v) et 69 (36 d, 33 v) au milieu du corps (fig.5,F) et de 67, 64 (33 d, 31 v) au niveau du vestibule.

Les crêtes sont espacées de façon régulière mais dans la région du pore excréteur, elles sont plus serrées sur la face dorsale puisque plus nombreuses.

Les crêtes sont de taille équivalente sauf dans la région oesophagienne où la crête ventrale adjacente aux cordons latéraux est légèrement plus grande que les autres crêtes et forme une aile cervicale (fig. 5, E).

Toutes les crêtes sont orientées perpendiculairement à la paroi du corps y compris les ailes cervicales (fig. 5, C-G).

Mâle: (2 spécimens). Longueur: 7200-10650. Largeur dans la partie moyenne du corps: 170-180. Vésicule céphalique haute de 65-85 sur 45-45 de large. Anneau nerveux, pore excréteur et deirides situés respectivement à 175-200, 360-450 et 390-480 de l'apex. Oesophage long de 540-600 (fig. 5, A).

Bourse caudale de type 2-3 à tendance 2-1-2, les extrémités des côtes 4 étant coudées vers l'avant et plus rapprochées de celles des côtes 3 que de celles des côtes 5 (fig. 5, N). Côtes 2-3 d'une part, 5-6 de l'autre jointives. Côtes 6,8 et dorsale de type II avec court tronc commun aux côtes 8 et 9 ; côtes 6 recouvrant les côtes 8 dans leur partie médiane. Côte dorsale divisée distalement en 3 rameaux, les rameaux externes (côtes 9) se détachant avant la division de la côte dorsale (fig. 5, N). Absence de gubernaculum. Cône génital haut de 20-20 sur 20-20 de large à sa base. Il porte sur sa lèvre antérieure une papille zéro bien développée et deux minuscules papilles 7 sur sa lèvre postérieure. Spicules ailés, longs de 210-210 à pointes complexes, se divisant au tiers proximal de leur hauteur en trois branches: lame, fourche et sabot. La lame se divise distalement en 10 rameaux; la fourche se divise en deux branches de longueur équivalente à 23% de sa hauteur. La branche externe est effilée, la branche interne est enflée distalement (fig. 5, M).

Femelle: (3 spécimens. Les mensurations entre parenthèses correspondent à la femelle 713 MD, ce qui permet de donner les mensurations réelles de chaque spécimen étudié): Longueur: 19300-19350 (13800). Largeur: 260-260 (210) dans la partie moyenne. du corps. Vésicule céphalique haute de 80-90 (95) sur 55-55 (50) de large. Anneau nerveux, pore excréteur et deirides situés respectivement à 250-250 (255), 470-510 (470) et 570-580 (530) de l'apex. Oesophage long de 650-670 (620).

Didelphie. La vulve s'ouvre à 6000-6300 (4150) de la pointe caudale soit dans le tiers postérieur du corps. Vagina vera long de 55-65 (55) divisant le vestibule long de 500-520 (370) en deux parties inégales, la partie antérieure étant la plus longue. Sphincters et trompes longs respectivement de 40-60 (45) et 40-45 (35) (fig. 5, H). Branche utérine antérieure longue de 4150-4390 (2290) contenant 200-260 (85) oeufs, branche utérine postérieure longue de 4430-4650 (1950) contenant 190-250 (70) oeufs. Oeufs au stade morula, hauts de 85-85 (85) sur 50-50 (50) de large. Queue longue de 180-280 (180) sur 110-110 (80) de large au niveau de l'anus. Pointe caudale longue de 18 -18 (17) (fig. 5, J).

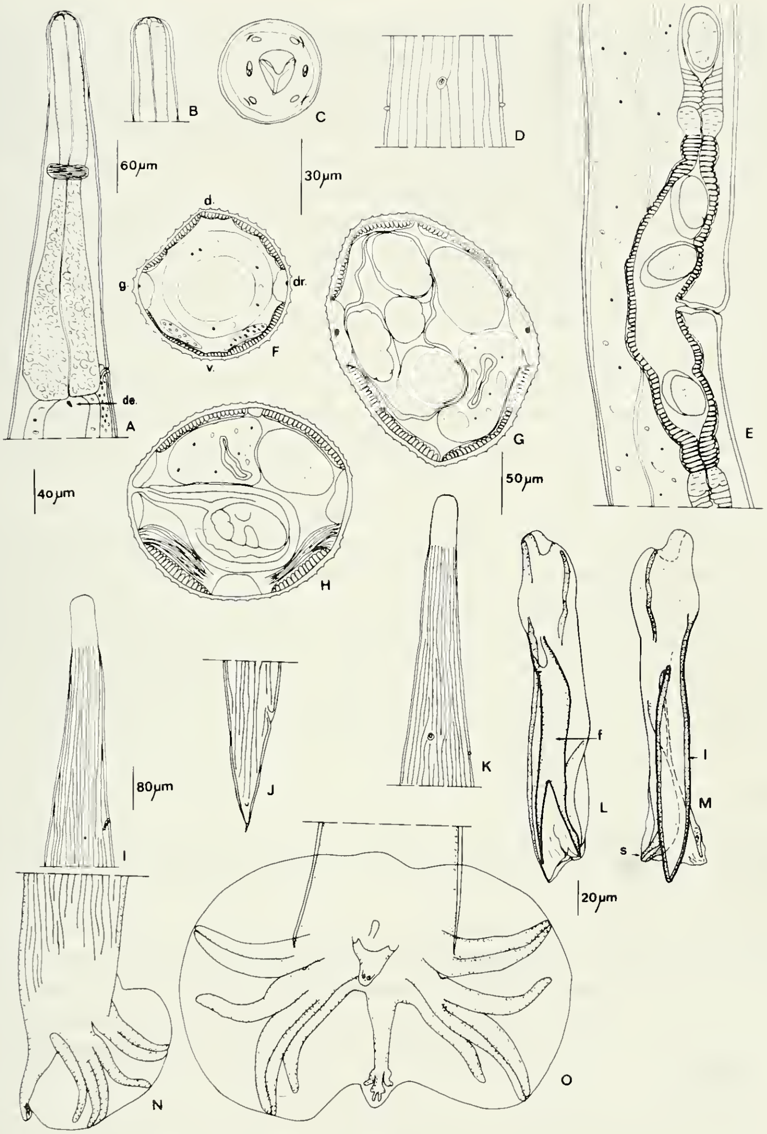


FIG. 6

Oswaldocruzia taranchoni n.sp. A, mâle, extrémité antérieure, vue latérale droite. B, femelle, vésicule céphalique, vue ventrale. C, femelle, tête, vue apicale. D, femelle, détail du pore excréteur et des deirides, vue ventrale. E, femelle, ovéjecteur, vue latérale droite. F-H, femelle, coupes transversales du corps. F, au niveau de la jonction oesophago-intestinale. G, au milieu du corps. H, au niveau du vestibule. I, mâle, naissance des crêtes cuticulaires, vue latérale droite. J, femelle, queue, vue latérale droite. K, id. naissance des crêtes cuticulaires, vue ventrale. L, M, mâle, spicule droit disséqué. L, vue ventrale. M, vue externo-latérale. N, O, mâle, bourse caudale. N, vue latérale droite. O, vue ventrale. Toutes les coupes sont orientées comme la figure 6, F. l: lame, f: fourche, s: sabot. A, E éch.: 60 µm. B, D, F-H, éch.: 50 µm. C, L, M, éch: 30 µm. I-K, éch: 80 µm. N, éch: 40 µm, O, éch: 20 µm.

Discussion: Parmi les espèces néotropicales, seuls *O. mazzai* Travassos (1935) parasite de Bufonidae d'Argentine et *O. bonsi* Ben Slimane & Durette-Desset, 1993 parasite de *Bolitoglossa equatoriana* et d'*Ischnonema quixensis* en Équateur, présentent comme nos spécimens une disposition des côtes bursales 6, 8 et 9 de type II. De plus, chez *O. bonsi*, le synlophe est dépourvu d'ailes cervicales et chez *O. mazzai*, au moins in toto, les ailes cervicales paraissent absentes.

Les spécimens décrits plus haut s'éloignent de *O. bonsi* par des crêtes cuticulaires pourvues de soutien chitinoïde tout le long du corps, une bourse caudale avec des côtes 2 et 3 d'une part, 5 et 6 de l'autre, jointives et par une lame spiculaire se divisant en un nombre plus élevé de rameaux. Par contre il nous paraît possible de les identifier à *O. mazzai* décrit pour la première fois par TRAVASSOS (1935) chez *Bufo* sp. et redécrit par le même auteur en 1937 chez *B. marinus*. Bien que nous n'ayons pas de certitude absolue concernant les caractères du synlophe (en particulier la présence d'un soutien chitinoïde), la vésicule céphalique est simple, les bourses caudales sont identiques et les branches de la fourche spiculaire ont la même forme.

Par contre, *O. mazzai* sensu LENT *et al.*, (1946) décrit chez *B. paracnemis*, *Leptodactylus ocellatus* et *L. bufonius* du Paraguay nous paraît être une autre espèce qui pourrait être rapprochée de *O. dlouhyi* par la présence d'une vésicule céphalique composée de deux parties. Elle s'en distingue cependant par des côtes 8 relativement courtes, par la division plus distale de la fourche spiculaire et par le fait que les deux branches de cette fourche sont de longueur équivalente. Nous proposons le nom de *Oswaldocruzia proencai* n.sp. (= *O. mazzai* sensu Lent, Freitas & Proença, 1946, nec Travassos, 1935) pour désigner les spécimens paraguayens.

Oswaldocruzia taranchoni n.sp.

Matériel examiné: ♂ holotype, ♀ allotype MNHN 317 U a, 1 femelle paratype MNHN 317 U b, 2 ♀♀ MHNG 18771 INVE., parasites de l'intestin grêle d'un *Bufo marinus*, Pernambuco, Brésil, 3.07.1967, leg. J. C. Quentin.

Description: Nématodes ne présentant pas d'enroulement. Vésicule céphalique simple (fig. 6, B). Pore excréteur situé au niveau de la région oesophago-intestinale. Deirides de forme triangulaire, situées postérieurement au pore excréteur (fig. 6, D). Glandes excrétrices très développées. Séparation oesophage musculaire et glandulaire très nette (fig. 6, A). Absence d'ailes cervicales. Crêtes cuticulaires dépourvues d'un soutien chitinoïde.

Tête: (fig. 6, C). Bouche triangulaire, arrondie aux angles. En vue apicale, présence de 6 papilles labiales externes dont les latérales sont accolées aux 2 amphides et de 4 papilles céphaliques. Petite dent oesophagienne dorsale présente.

Synlophe: (en coupe transversale, étudié chez 2 femelles). Dans les deux sexes, corps parcouru longitudinalement par des crêtes cuticulaires continues. Plus des deux tiers des crêtes dorsales et la moitié des crêtes ventrales naissent dans la région oesophagienne. Au milieu du corps, le nombre de crêtes dorsales reste très légèrement supérieur à celui des ventrales. Les crêtes disparaissent en avant de la bourse caudale chez le mâle (fig. 6, N) et progressivement en arrière de la vulve chez la femelle jusqu'au niveau des phasmides (fig. 6, J).

Chez les deux femelles, le nombre de crêtes est de 34 (17 dorsales, 17 ventrales), 29 (16 d, 13 v) au niveau du pore excréteur, de 43 (22 d, 21 v) 31 (18 d, 13 v) au niveau de la jonction oesophago-intestinale (fig. 6, F) de 75, (38 d, 37 v),53 (28 d, 25 v) au milieu du corps (fig.6,G) et de 59 (38 d, 26 v), 52 au niveau du vestibule (fig. 6, H).

Les crêtes sont de taille équivalente, espacées de façon régulière et orientées perpendiculairement à la paroi du corps (fig. 6, F-H).

Mâle holotype: Longueur: 6450. Largeur dans la partie moyenne du corps: 120. Vésicule céphalique haute de 80 sur 35 de large. Anneau nerveux, pore excréteur et deirides situés respectivement à 180, 370 et 390 de l'apex. Oesophage long de 405 (fig. 6, A).

Bourse caudale de type 2-3 à tendance 2-1-2, les extrémités des côtes 4 étant coudées vers l'avant et plus rapprochées de celles des côtes 3 que de celles des côtes 5 (fig. 6, O). Côtes 2-3 d'une part, 5-6 d'autre part jointives. Côtes 6,8 et dorsale de type III avec côtes 8 chevauchées par les côtes 6 sauf dans leur tiers distal. Côte dorsale divisée distalement en 3 rameaux, les rameaux externes (côtes 9) se détachant avant la division de la côte dorsale (fig.6,0). Absence de gubernaculum. Cône génital haut de 20 sur 25 de large à sa base. Il porte sur sa lèvre antérieure une papille zéro bien développée et deux minuscules papilles 7 sur sa lèvre postérieure (fig.6,0). Spicules ailés, longs de 175 à pointes complexes, se divisant au tiers proximal de leur hauteur en trois branches: lame, fourche et sabot. La lame est spatulée sans division distale; la fourche se divise en deux branches de longueur équivalente à 18% de sa hauteur (fig. 6, L, M).

Femelle allotype: Longueur: 7350. Largeur: 100 dans sa partie moyenne. Vésicule céphalique haute de 90 sur 40 de large. Anneau nerveux, pore excréteur et deirides situés respectivement à 180, 370 et 410 de l'apex. Oesophage long de 390.

Didelphie. La vulve s'ouvre à 2300 de la pointe caudale soit aux deux tiers postérieurs du corps. Vagina vera long de 30 divisant le vestibule long de 240 en deux parties équivalentes. Sphincters et trompes longs respectivement de 30 et 20 (fig. 6, E). Branches utérines de même longueur soit 1030, contenant 10 oeufs pour la branche antérieure, 14 pour la branche postérieure. Oeufs au stade morula, hauts de 85 sur 40 de large. Queue longue de 175 sur 50 de large au niveau de l'anus. Pointe caudale longue de 20 (fig. 6, J).

Discussion: Ces spécimens se distinguent de tous les *Oswaldocruzia* néotropicaux connus dont les spicules sont formés de trois branches, par une lame spiculaire ne se terminant pas en "peigne". Ils sont caractérisés par une vésicule céphalique simple, l'absence d'ailes cervicales et par une bourse caudale dont les côtes bursales 6, 8 et 9 sont de type III. Seule *O. chambrieri* Ben Slimane et Durette-Desset, 1993, décrite chez *Bufo typhonius* en Équateur présente l'ensemble de ces caractères mais peut être différenciée des spécimens brésiliens non seulement par sa lame spiculaire se terminant en "pinceau" mais également par la présence d'un tronc commun aux côtes 4 à 8 et par un sabot spiculaire possédant une branche supplémentaire.

Nous rangeons donc les spécimens brésiliens dans une nouvelle espèce que nous proposons de nommer *Oswaldocruzia taranchoni* n.sp. en hommage à Mr. Pierre Taranchon, Associé au Muséum, pour l'aide précieuse qu'il nous apporte.

CONCLUSION

A l'exception d'*O. neghmei* Puga, 1981, parasite de Leptodactylidae au Chili et dont les spicules seraient divisés en 2 et non pas 3 branches, les 11 autres espèces néotropicales actuellement connues possèdent la même anatomie spiculaire que les espèces holarctiques à savoir division du manche au tiers de sa hauteur proximale en 3 branches principales, lame (branche externo-latérale), sabot (branche interno-dorsale) et fourche (branche interno-ventrale). Mais les espèces néotropicales se différencient immédiatement des espèces holarctiques par deux éléments: la hauteur plus distale de division de la fourche, et par le fait que chez 10 espèces sur 11, la lame se divise en de nombreux rameaux ce que nous avons nommé une division en "peigne".

Dans la zone néotropicale, nous retrouvons les trois principaux types d'arrangement des côtes 8 par rapport à la côte dorsale et aux côtes 6, types déjà décrits dans la faune de l'Ancien Monde (Durette-Desset *et al.*, 1992):

O. brasiliensis, *O. lopesi* et *O. neghmei* appartiennent au type I qui peut être considéré comme le plus primitif puisque c'est celui rencontré chez la grande majorité des Trichostrongles.

O. bonsi, *O. dlouhyi*, *O. mazzai*, *O. proencai*, *O. touzeti* et *O. vaucheri* appartiennent au type II plus évolué que le précédent puisque le tronc commun aux côtes 8 et à la côte dorsale est très court et que les côtes 6 recouvrent où sont accolées aux côtes 8 sur une partie de leur trajet.

O. chambrieri, *O. taranchoni* et *O. subauricularis* appartiennent au type III le plus évolué puisqu'il n'existe plus de tronc commun entre les côtes 8 et la côte dorsale.

A l'intérieur de chaque groupe, les espèces sont morphologiquement très proches entre elles. Elles diffèrent par la présence ou l'absence d'ailes cervicales, l'anatomie de ces dernières (nombre de crêtes formant l'aile, forme de l'aile, hauteur, etc.), l'absence ou la présence de soutien chitinoïde des crêtes, la forme de la vésicule céphalique, la présence ou l'absence de becs vulvaires, les variations qui peuvent exister sur la lame et la fourche spiculaires.

La valeur des caractères spécifiques apparaît très différente de celle reconnue chez les autres Trichostrongles. Ainsi les spicules sont caractéristiques d'une région biogéographique déterminée et, à l'intérieur de cette zone varient peu d'une espèce à l'autre. A l'opposé, certains caractères comme la position du pore excréteur par rapport à la longueur de l'oesophage ou le nombre de crêtes cuticulaires au milieu du corps présentent une très grande variabilité. Ceci joint à une absence de spécificité étroite entre l'hôte et le parasite traduit probablement l'évolution très récente de ce groupe.

REMERCIEMENTS

Les auteurs remercient tout particulièrement Carlo Dlouhy, Ascuncion, Paraguay et Jean-Marc Touzet, Quito, Équateur qui ont récolté une partie de ce matériel mis à notre disposition par le Dr. Claude Vaucher, Muséum d'histoire naturelle de

Genève, que nous remercions également pour ses conseils. La nomenclature actuelle des Amphibiens néotropicaux a été mise à jour par le Dr. Annemarie Ohler du laboratoire des Reptiles et Amphibiens du Muséum national d'Histoire naturelle de Paris. L'Institut Oswaldo Cruz à Rio de Janeiro à mis à notre disposition le matériel original de *O. subauricularis*. Nous les en remercions très vivement.

BIBLIOGRAPHIE

BEN SLIMANE, B. & M.C. DURETTE-DESSET. 1993. Quatre nouvelles espèces du genre *Oswaldocruzia* Travassos,1917 (Nematoda: Trichostrongyloidea) parasites d'Amphibiens d'Équateur. *Revue suisse Zool.* 100: 113-136.

BEN SLIMANE, B., DURETTE-DESSET, M.C. & A.G. CHABAUD. 1993. *Oswaldocruzia* (Trichostrongyloidea) parasites d'Amphibiens des Collections du Muséum de Paris. *Annls Parasit. hum. comp.* 68:88-100.

DURETTE-DESSET, M.-C., 1985. Trichostrongyloid nematodes and their Vertebrate hosts: reconstruction of the phylogeny of a parasitic group. *Adv. Parasitol.*, 24: 239-306.

DURETTE-DESSET, M.-C. & A. G. CHABAUD. 1981. Nouvel essai de classification des Nématodes Trichostrongyloidea. *Annls Parasit. hum. comp.*, 56: 297-312.

DURETTE-DESSET, M.-C. & A. G. CHABAUD. 1993. Nomenclature des Strongylida au-dessus du groupe famille. *Annls Parasit. hum. comp.*, 68: 111-112.

DURETTE-DESSET, M.-C., K. NASHER & B. BEN SLIMANE. 1992. *Oswaldocruzia arabica* n.sp. (Nematoda, Trichostrongyloidea) parasite d'un Bufonidae de la péninsule arabique et remarque sur des espèces proches. *Bull. Mus. natl. Hist. nat., Paris, 4ème sér.*, 14, section A: 693-703.

LENT, H. TEIXEIRA DE FREITAS, J.F. & M.C. PROENCA. 1946. Alguns helmintos de batraquios colecionados no Paraguai. *Mems Inst. Oswaldo Cruz.* 44: 195-214.

PUGA, S.R. 1981. *Oswaldocruzia negmei* nov.sp. (Trichostrongylidae) un nuevo nematodo parasito del anuro chileno *Hylorina sylvatica* (Leptodactylidae). *Studies neotrop. Fauna Envir.* 16: 107-111.

RUDOLPHI, C.A. 1819. Entozoorum synopsis. Berolini, 811p.

TRAVASSOS, L. 1917. Trichostrongylinas brazileiras (5e nota previa). *Oswaldocruzia* n. gen. *Brazil medico*, 31: 9.

TRAVASSOS, L. 1921. Contribution à la faune helminthologique du Brésil XIII. Essai monographique sur la faune des Trichostrongylidae Leiper, 1909. *Mems Inst. Oswaldo Cruz.* 13: 5-135.

TRAVASSOS, L. 1935. Alguns novos generos e especies de Trichostrongylidae. *Revta Med. Cirurg. Brasil.* 43:345-361.

TRAVASSOS, L. 1937. Revisao da familia Trichostrongylidae Leiper, 1912. *Monogr. Inst. Oswaldo Cruz.* 1: 512p.

WALTON, A.C. 1929. Studies on some nematodes of North american frogs. *J. Parasitol.* 15: 227-240.

REVUE SUISSE DE ZOOLOGIE, 102 (3) : 655-761; septembre 1995

Revision of the Afrotropical rove-beetles of the genus *Megarthrus* (Coleoptera, Staphylinidae, Proteininae)[1]

Giulio CUCCODORO[2] & Ivan LÖBL[3]

[2, 3] Muséum d'histoire naturelle, Case postale 6434, CH-1211 Genève 6, Switzerland.
[2] The Natural History Museum, Cromwell Road, London SW7 5BD, UK.

Revision of the Afrotropical rove-beetles of the genus *Megarthrus* **(Coleoptera, Staphylinidae, Proteininae).** - *Megarthrus* species from Africa South of Sahara are revised. In addition to 11 species previously described, the following 27 new species are recognised: *M. bantu, M. clarkei, M. dominicae, M. falasha, M. horticola, M. hutu, M. magnicaudatus, M. mahnerti, M. major, M. maniwaata, M. merabet, M. mukankundiyeorum, M. mwami, M. nanus, M. negus, M. niloticus, M. panga, M. ras, M. rougemonti, M. scotti, M. selenitus, M. spinosus, M. stylifer, M. twa, M. vanschuytbroecki, M. watutsi* and *M. zulu*. Lectotypes are designated for *M. abessinus* Bernhauer and *M. africanus* Eichelbaum. Descriptions are provided and diagnostic characters are figured for all species, except for *M. kamerunensis* Bernhauer which is not represented in the collections. Keys to species are given separately for males and females. Most of these species occurs in the highlands and mountains of East Africa (27 spp.) and in Ethiopia (9 spp.). Only one species has been found South of 11°S latitude. The genus appears to be absent from Madagascar, the Mascarene Archipelago and Africa west of Cameroon.

Key-words: Staphylinidae - Proteininae - *Megarthrus* - taxonomy - Africa.

INTRODUCTION

The Proteininae are one of the staphylinoid taxa with a distinct bipolar distribution (NEWTON, 1985), though with several tropical members. With the Neophoninae, Micropeplinae, Dasycerinae and Pselaphinae, it shares atrophied spiracles on the abdominal segments 4 to 6, which suggests that these groups may form a monophyletic group. Neophoninae differ from the last three taxa and from the

---

[1] This paper forms part of the work by G. Cuccodoro towards the degree of Ph. D. at the University of Geneva, funded in part by the Swiss National Science Foundation, project no. 31-32331.91.

Manuscript accepted 20.03.1995.

Proteininae in the undivided male 9th tergite (THAYER, 1987). Thus the Proteininae are important for the understanding of the relationships within the other, more derived members of the omaliine group.

STEEL (1966) defined within the Proteininae the south temperate tribes Anepiini and Nesoneini with 10 species in 8 genera, and the predominantly north temperate Proteinini which go as far south as New Guinea and, in the New World, north Argentina. Apart from keys to genera and a few regionally restricted revisions of *Proteinus* Latreille and individual species descriptions (e.g. COIFFAIT, 1982; HAYASHI, 1988), no taxonomic work has been done recently on the Proteinini. The lack of taxonomic information is particularly striking in *Megarthrus* which may be the most diverse goup within the subfamily, in terms of species number, ecology and distribution.

Some 80 species of *Megarthrus* are recognised to date, from which 11 have been described from the Afrotropical region. The revision of unstudied material, however, shows that the diversity in this region (38 species) is much greater than previously estimated. The present paper diagnoses the Afrotropical species and provides keys and illustrations for identification. Phylogenetic and biogeographical relationships are briefly discussed.

MATERIALS AND METHODS

The present study is based exclusively on adults. Unless specified, all material (776 specimens) mentioned in the text has been examined. For detailed examination, specimens were dissected, cleared in 0.1 N potassium hydroxide and mounted in Eukit or Canada balsam on acetate slides. Drawings were made using a drawing tube. Detailed locality data are reproduced according to labels, except for elevations which are given in m. Major administrative units are given in English.

The term frons, as used in the present study refers to the area anterior of the U-shaped impression, the vertex to the area behind. Patches of sensilla on antennomeres 6 to 10 were detected by examining slide preparations. Abdominal sternites and tergites are counted from the first morphological segment. Measurements and ratios are defined as follows: length of specimens = interval from middle of anterior pronotal margin to inner apical angle of elytron; width of specimens = maximum pronotal width; AL = antennal length / pronotal length; EL = elytral sutural length / pronotal length; ET = elytral sutural length / shortest interval between sutural margin and lateral edge of elytron in dorsal view; EW = shortest interval between sutural margin and outer apical angle of elytron in dorsal view / shortest interval between sutural margin and lateral edge of elytron in dorsal view; EY = interval between posterior ocular margin and apex of frons in dorsal view / interval between anterior and posterior ocular margins in dorsal view; GT = posterior width of gula / median length of gula; GW = width of neck / posterior width of gula; HW = maximum pronotal width / interval between posterior ocular margins in dorsal view; ML = median metasternal length / median mesosternal length; MP = length of segment 4 of maxillary palpus / length of segment 3 of maxillary palpus; PT = maximum pronotal width / pronotal length; SP = maximum width of abdominal sternite 8 / width of the basal projection; TPF = interval between basal angle and tip of medioapical projection of female abdominal tergite 8 / lateral length of medioapical projection of female abdominal tergite 8. The absence of that projection is indicated as "abs".

Material examined is deposited in the following collections: BMNH = The Natural History Museum, London; CNCI = Canadian National Collection of Insects, Ottawa; FMNH = Field Museum of Natural History, Chicago; MHNG = Muséum d'histoire naturelle, Geneva; MRAC = Musée Royal de l'Afrique Centrale, Tervuren; SEMC = Snow Entomological Museum, University of Kansas, Lawrence; TMSA = Transvaal Museum, Pretoria; ZMHB = Museum für Naturkunde der Humboldt-Universität, Berlin.

NATURAL HISTORY AND ECOLOGY

Little is known about the life history and biology of *Megarthrus* spp. The water loading behaviour noted by CUCCODORO (1995) has been also observed in two Afrotropical species *M. horticola* and *M. spinosus*. The Afrotropical members of *Megarthrus* possess fully developed wings and are found in a wide range of habitats (savannas, forests, in leaf litter, humus, and under stones). According to locality labels they have been found in dung of various mammal species, in fungi and decaying vegetational matter. They also have been collected in carrion, meat and faeces traps.

TAXONOMY

Within the Proteinini, adult members of the genus *Megarthrus* may be distinguished by the absence of a vertexal ocellus, the pronotum medianly impressed or sulcate, and the lateral pronotal edges denticulate or crenulate. Compared to the so far examined congeners from other regions, the Afrotropical *Megarthrus* appear quite homogeneous. They share the following characters: mesal portion of frons with setae orientated backwards; pronotal and elytral pubescence recumbent; abdominal pubescence parallel, except for tergite 3 bearing short setae converging toward base; frons with mesal portion slightly arcuate anteriorly and straight posteriorly in lateral view; supra-ocular margin sinuate in dorsal view; occipital ridge indistinct; antennal scape not flattened; pronotal disc weakly convex in frontal view, with mesal portion almost straight in lateral view; hypomeral groove and median prosternal ridge absent; elytron with discal swellings low, lateral edge finely carinate; metasternum with the femoral line arcuate in middle; median apophysis of abdominal sternite 3 with apical portion straight; male sternite 9 lacking subbasal protuberance.

The keying of Afrotropical *Megarthrus* is difficult without reference to sexual characters. As several species are represented by are sex only, separate keys are provided for males and females. At this stage in our investigations of *Megarthrus* no attempt has been made to analyse phylogenetic relationships. Therefore, no species

FIG. 1

Distributional pattern of the Afrotropical species of *Megarthrus*. a: Ethiopian area (9 spp); b: Equatorial area (28 spp); c: South-African area (1 sp). Scale square = 63'550 km^2.

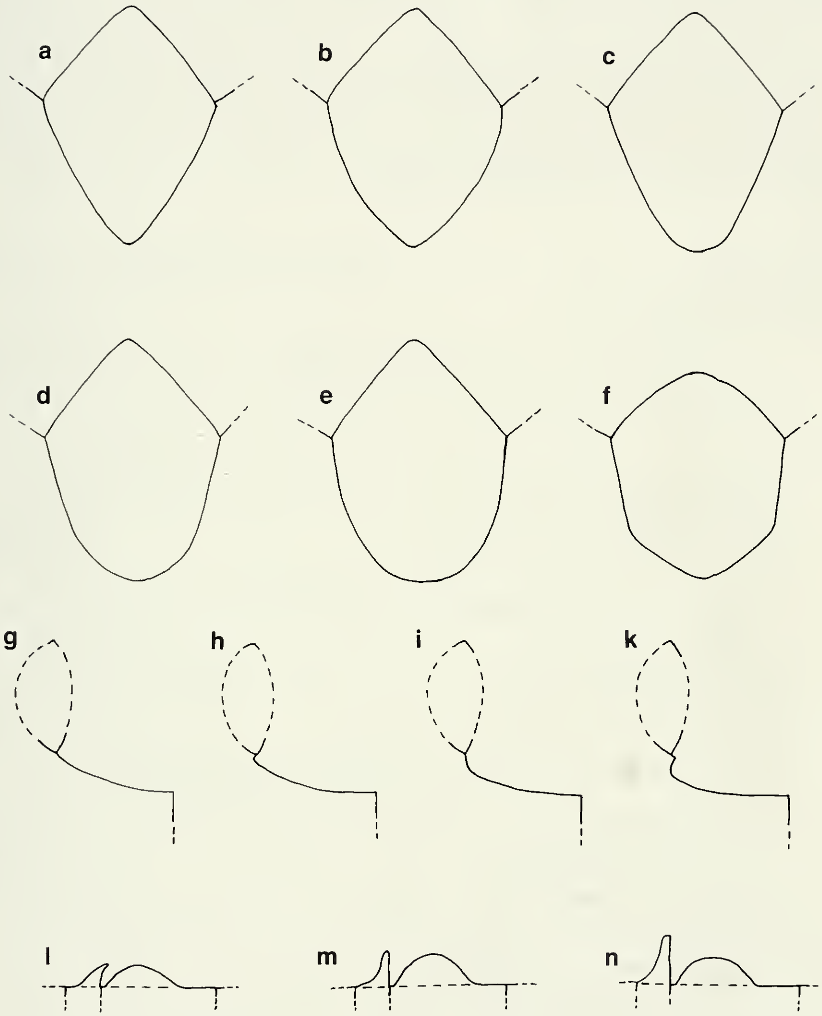


FIG. 2

Scutellum, a-f; Temple, g-k; Median processes of abdominal sternites 2-3 (left to right), l-n; schematic. *Megarthrus abessinus*: a, g, l; *M. africanus*: f, i, n; *M. clarkei*: c; *M. congoensis*: d, k; *M. falasha*: b, h; *M. gigas*: m; *M. mwami*: e.

groups are defined and the species are listed alphabetically. However, some of the species are linked by particularly noteworthy characters: 1) *M. nanus* and *M. zulu* possess a protrochanteral ridge; 2) *M. panga* and *M. stylifer* have a large ventral process on the male abdominal tergite 8; 3) *M. africanus*, *M. basilewskyi*, *M.gigas*, *M. major*, *M. mukandudiorum*, *M. selenitus*, and *M. spinosus* lack a medioapical projection of the female abdominal tergite 8 and adhesive setae on male protarsi. Among these species, *M. basilewskyi*, *M.gigas* and M. major have a conspicuously projecting inner apical angle of the elytra in the female; 4) *M. mahnerti* and *M. monticola* are linked by a bilobed apical margin of the female sternite 8.

Key to males

(not included are *M. apicicornis*, *M. major*, *M. scotti*, *M. selenitus*, and *M. spinosus* in which only females are known).

1 Apical margin of 6th abdominal sternite incised. . . . *M. kamerunensis* Bernhauer
– Apical margin of 6th abdominal sternite truncate. 2
2 Eighth abdominal tergite bearing a ventral process projecting ventrally (Fig. 59f) 3
– Eighth abdominal tergite lacking a ventral process projecting ventrally. 4
3 Tip of aedeagus broad (Fig. 59a). . . . . *M. stylifer* sp. n.
– Tip of aedeagus narrow (Fig. 49b). . . . . *M. panga* sp. n.
4 Protarsal segment 1 bearing adhesive setae (Fig. 3d). 8
– Protarsal segment 1 lacking adhesive setae (Fig. 22g). 5
5 Aedeagus symmetrical. . . . . *M. africanus* Eichelbaum
– Aedeagus asymmetrical. 6
6 Protibia lacking peg-like setae. . . . . *M. mukankundiyeorum* sp. n.
– Protibia bearing peg-like setae (Fig. 9g). 7
7 Ventral wall of aedeagal median lobe notched on the left side (Fig. 9b) . . . . *M. basilewskyi* Fagel
– Ventral wall of aedeagal median lobe not notched (Fig. 20c). . . . *M. gigas* Fagel
8 Aedeagus asymmetrical. . . . . *M. ovalis* Cameron
– Aedeagus symmetrical. 9
9 Tip of aedeagus hook-shaped (Fig. 63d). . . . . *M. vanschuytbroecki* sp. n.
– Tip of aedeagus not hook-shaped. 10
10 Protibia bearing peg-like setae (Fig. 3d). 11
– Protibia lacking peg-like setae. 12
11 Aedeagal median lobe, in ventral view, with apical portion slender, near tip somewhat narrower than middle (Fig. 3a). . . . . *M. abessinus* Bernhauer
– Aedeagal median lobe, in ventral view, with apical portion wide at base and evenly tapering (Fig. 27e). *M. magnicaudatus* sp. n.
12 Dorsoapical sclerite of aedeagal median lobe projecting proximally of level of parameres (Fig. 16c). 13
– Dorsoapical sclerite of aedeagal median lobe not projecting proximally of level of parameres (Fig. 18b). 23

13 Metatrochanter lacking peg-like setae. . . . . *M. rougemonti* sp. n.
– Metatrochanter bearing peg-like setae. 14
14 Metatibia lacking peg-like setae. 15
- Metatibia bearing peg-like setae. 16
15 Ventral wall of aedeagal median lobe notched basally (Fig. 16c)
. . . . *M. dominicae* sp. n.
– Ventral wall of aedeagal median lobe not notched (Fig. 23b). *M. horticola* sp. n.
16 Mesotrochanteral peg-like setae arranged in a single row 17
– Mesotrochanteral peg-like setae arranged in a double row or grouped in a field 19
17 Tip of aedeagus truncate obliquely (Fig. 29e). 18
– Tip of aedeagus rounded (Fig. 40b). . . . . *M. mwami* sp. n.
18 Aedeagus straight near tip (Fig. 29e). *M. mahnerti* sp. n.
– Aedeagus inflexed dorsally near tip (Fig. 36d). . . . . *M. monticola* Cameron
19 Tip of aedeagus broad (Fig. 45d). 20
– Tip of aedeagus narrow (Fig. 7a). 21
20 Metatibial peg-like setae partly arranged in a row (Fig. 45g). . *M. niloticus* sp. n.
– All metatibial peg-like setae grouped in a field (Fig. 65e). . . . . *M. watutsi* sp. n.
21 Metatibial peg-like setae grouped in area exceeding half of tibial length
(Fig. 14g). . . . . *M. congoensis* Cameron
– Metatibial peg-like setae grouped on area smaller than half of tibial length (Fig. 7d). 22
22 Internal sac of aedeagus with strongly sclerotized tooth-like structures.
(Fig. 7a). . . . . *M. bantu* sp. n.
– Internal sac of aedeagus lacking strongly sclerotized tooth-like structures
(Fig. 25b). . . . . *M. hutu* sp. n.
23 Metatrochanter lacking peg-like setae. 24
– Metatrochanter bearing peg-like setae. 27
24 Eighth abdominal sternite 4.5-7.0x as long as its median projection *M. twa* sp. n.
– Eighth abdominal sternite 2.0-4.0x as long as its median projection. 25
25 Mesotrochanteral peg-like setae arranged in a single row. 26
– Mesotrochanteral peg-like setae arranged in a double row. . . . . *M. clarkei* sp. n.
26 All metatibial peg-like setae arranged in a single row (Fig. 43d). *M. negus* sp. n.
– Some metatibial peg-like setae grouped in a field. . . . . *M. simienensis* Fagel
27 Mesotrochanteral peg-like setae arranged in a single row 28
– Mesotrochanteral peg-like setae arranged in a double row or grouped in a field 31
28 Mesotibia broader in middle than near tip (Fig. 69c). 30
– Mesotibia slender, near tip about as broad as in middle (Fig. 67c). 29
29 Apex of 8th abdominal tergite truncate (Fig. 51f). . . . . *M. ras* sp. n.
– Apex of 8th abdominal tergite pointed (Fig. 18e). . . . . *M. falasha* sp. n.
30 Aedeagal median lobe, in lateral view, with apical portion slender, near
tip somewhat narrower than in middle (Fig. 69b). . . . . *M. zulu* sp. n.
– Aedeagal median lobe, in lateral view, with apical portion wide at base
and evenly tapering (Fig. 42d). . . . . *M. nanus* sp. n.

31 Mesotrochanteral peg-like setae arranged in a double row. . . *M. wittei* Cameron
– Mesotrochanteral peg-like setae grouped in a field. 32
32 Ventral outline of apical portion of aedeagal median lobe straight to ventrally recurved tip (Fig. 34b). . . . . *M. merabet* sp. n.
– Ventral outline of apical portion of aedeagal median lobe sinuate (Fig. 32b). . . . . *M. maniwaata* sp. n.

KEY TO FEMALES

(not included are *M. africanus*, *M. kamerunensis*, *M. nanus*, *M. panga* and *M. ras* in which only males are known)

1 Eighth abdominal tergite lacking medioapical projection (Fig 10f). 2
– Eighth abdominal tergite bearing a medioapical projection (Fig. 33g). 7
2 Inner apical angle of elyton projecting conspicuously (Fig. 10b). 3
– Inner apical angle of elytron not projecting (Fig. 30g). .5
3 Mediodorsal suture of 9th abdominal sternite arcuate (Fig. 11b) . . . . *M. basilewskyi* Fagel
– Mediodorsal suture of 9th abdominal sternite angulate (Fig. 22b). 4
4 Eighth abdominal sternite 4.5-4.6x as wide as its median projection (Fig. 31i). . . . . *M. major* sp. n.
– Eighth abdominal sternite 3.0-3.5x as wide as its median projection (Fig. 21e). . . . . *M. gigas* Fagel
5 Eighth abdominal sternite 2.2-2.3x as long as width of its median projection (Fig. 55e). . . . . *M. selenitus* sp.n.
– Eighth abdominal sternite 1.7-1.9x as long as width of its median projection (Fig. 39f). 6
6 Antenna about 2.2x as long as pronotum. . . . . *M. spinosus* sp. n.
– Antenna about 2.6x as long as pronotum. . . . . *M. mukankundiyeorum* sp. n.
7 Apical margin of 8th abdominal sternite sinuate (Fig. 37b). 8
– Apical margin of 8th abdominal sternite straight or arcuate (Fig. 4c). 9
8 Dorsobasal edge of coxites V-shaped (Fig. 30c). . . . . *M. mahnerti* sp. n.
– Dorsobasal edge of coxites U-shaped (Fig. 37f). . . . . *M. monticola* Cameron
9 Eighth abdominal tergite 1.8-2.5x as long as its medioapical projection. 10
– Eighth abdominal tergite 3.2-10.0x as long as its medioapical projection. 11
10 Eighth abdominal tergite about 2.5x as long as its medioapical projection (Fig. 4f). . . . . *M. abessinus* Bernhauer
– Eighth abdominal tergite about 1.8 as long as its medioapical projection (Fig. 28b). . . . . *M. magnicaudatus* sp. n.
11 Antennomere 4 strongly asymmetrical (Fig. 48d). 12
– Antennomere 4 symmetrical or slightly asymmetrical (Fig. 44f). 14
12 Protrochanter with a transverse ridge. . . . . *M. zulu* sp.n.
– Protrochanter without a transverse ridge. 13
13 Elytron deeply depressed along lateral edge. . . . . *M. ovalis* Cameron
– Elytron flat along lateral edge. . . . . *M. twa* sp. n.

14 Eighth abdominal tergite 10.0x as long as its medioapical projection. 15
– Eighth abdominal tergite 3.2-7.0x as long as its medioapical projection. 17
15 Pronotum flat along apical portion of lateral edge. . . . . *M. merabet* sp. n.
– Pronotum depressed along entire lateral edge. 16
16 Dorsobasal edge of coxites V-shaped (Fig. 19e). . . . . *M. falasha* sp. n.
– Dorsobasal edge of coxites U-shaped (Fig. 68b). . . . . *M. wittei* Cameron
17 Head not widened behind the eyes (Fig. 2h). 18
– Head widened behind the eyes (Fig. 2k). 26
18 Body 1.8-2.0 mm long. . . . . *M. dominicae* sp. n.
– Body 0.9-1.7 mm long. 19
19 Eye, in frontal view, with highest point reaching the level of the vertex. 20
– Eye, in frontal view, with highest point below the level of the vertex. 22
20 Tip of scutellum pointed (Fig. 2b). . . . . *M. horticola* sp. n.
– Tip of scutellum rounded (Fig. 2e). 21
21 Dorsobasal edge of coxites V-shaped (Fig. 41c). . . . . *M. mwami* sp. n.
– Dorsobasal edge of coxites transverse, except for median portion pointed (Fig. 33a). . . . . *M. maniwaata* sp. n.
22 Scutellar tip rounded (Fig. 2c). 23
– Scutellar tip pointed (Fig. 2a). 24
23 Dorsobasal edge of coxites V-shaped (Fig. 54d). . . . . *M. scotti* sp. n.
– Dorsobasal edge of coxites transverse (Fig. 13d). . . . . *M. clarkei* sp. n.
24 Antennomere 5 shorter than antennomere 4 (Fig. 52c). . . . . *M. rougemonti* sp. n.
– Antennomere 5 as long as antennomere 4 (Fig. 44f). 25
25 Elytron 1.6-1.7x as long as wide. . . . .*M. negus* sp. n.
– Elytron 1.8-2.0x as long as wide. . . . . *M. simienensis* Fagel
26 Median metasternal ridge conspicuous. 27
– Median metasternal ridge fine or absent. 28
27 Eighth abdominal tergite with medioapical projection longer than wide (Fig. 6e). . . . . *M. apicicornis* Cameron
– Eighth abdominal tergite with medioapical projection wider than long (Fig. 64e). . . . . *M. vanschuytbroecki* sp. n.
28 Tip of 8th abdominal tergite pointed (Fig. 8g). 29
– Tip of 8th abdominal tergite rounded (Fig. 46a). 31
29 Eighth abdominal tergite, in lateral view, with apical projection of flat (Fig. 8e). . . . . *M. bantu* sp. n.
– Eighth abdominal tergite, in lateral view, with apical projection raised, horn-like (Fig. 26d). 30
30 Eighth abdominal tergite, in lateral view, with apical projection slightly raised (Fig. 26d). . . . . *M. hutu* sp. n.
– Eighth abdominal tergite, in lateral view, with apical projection strongly raised (Fig. 15b). . . . . *M. congoensis* Cameron
31 Dorsobasal edge of coxites V-shaped (Fig. 66a). . . . . *M. watutsi* sp. n.
– Dorsobasal edge of coxites U-shaped (Fig. 46c). 32
32 Eighth abdominal tergite 5.0x as long as its medioapical projection (Fig. 46a). . . . . *M. niloticus* sp. n.
– Eighth abdominal tergite 4.0x as long as its medioapical projection (Fig. 60g). . . . . *M. stylifer* sp. n.

Megarthrus abessinus Bernhauer (Figs 2a, g, l, 3a-i, 4a-g)

Megarthrus abessinus BERNHAUER, 1931: 566.
Megarthrus abessinicus; BERNHAUER, 1942: 349 (incorrect spelling).

Type material. Lectotype ♀: Ethiopia, Djem-Djem Forest (= Shewa prov., Jem Jem?), c.2700m, 24.ix.1926 (H. Scott) BMNH, by present designation.

Additional material (18): Ethiopia, Kefa prov., Foja, Mt. Bor, 2950m, iii.1971 (R. O. S. Clarke) 1♂ in BMNH; Gonder (= Simên) prov., Arghine, c. 3500m or higher, 24.xi.1952 (H. Scott) ex roots of tufted grass in ravine, 1♀ in BMNH (mislabelled paratype of *M. simienensis*); Lori, c. 3500m or higher, 27.xi.1952 (H. Scott) in precincts of church, ex tall yellow composite (*Senecio myriocephalus*), 1♀ in BMNH; near Mindigabsa, c. 3500m, 29.xii.1952 (H. Scott) 7♂, 1♀ in BMNH (mislabelled paratypes of *M. simienensis*); Shewa prov., Addis Abeba, 1971 (G. de Rougemont) 4♀ in BMNH and 1♂, 2♀ in MHNG.

Distribution. Ethiopia.

Description. Length 1.55-1.65 mm; width 1.05-1.15 mm. Head and metasternum dark brown; antenna, pronotum, elytron and abdomen yellow-brown or reddish-brown, except for antennomeres 1-4 paler and sutural margin of elytron darkened; mouth parts and legs paler than metasternum. Dorsal pubescence fairly uniform, on abdomen shorter, on humeral area of elytron denser. Metasternal setae becoming sparser medianly, shorter than prosternal setae. Pubescence of abdominal sternites 4-7 uniform, except for a pair of long setae near medioapical margins. Puncturation fine on anterior portion of hypomeron; medioposterior portion of metasternum impunctate. Frons on level with vertex. Anterior frontal edge not carinate, evenly convex. Entire frontal impression shallow or indistinct. Eye moderatly convex, with highest point below level of vertex. Temple as in Fig. 2g. Submentum flat. Antenna (Fig. 4g) without patches of sensilla; antennomeres 3 and 4 slightly asymmetrical. Pronotal disc (Fig. 4a) flat along lateral edge, shallowly depressed along median groove, latter shallow, parallel-sided. Anterior prosternal margin bordered by an irregular row of fine longitudinal ridges. Protrochanter without transverse ridge. Lateral portion of prepectal ridge straight. Scutellum as in Fig. 2a. Elytron not narrowed at base; base gradually inclined, overhanging. Elytral disc flat along lateral edge, latter straight in dorsal view; apical margin convex near suture; inner apical angle obtuse. Median metasternal ridge fine, low. Abdominal tergite 3 slightly vaulted transversally. Sternites 2 and 3 with median processes as in Fig. 2l. Sternite 4 flat at base, then slightly vaulted transversally.

Ratios: AL 2.5; EL 1.5; ET 1.65; EW 1.2; EY 2.8-2.9; GT 2.0; GW 1.8; HW 2.0; ML 1.4; MP 1.7; PT 2.0; SP 3.3-3.4; TPF 2.5.

♂. Protarsal segment 1 bearing adhesive setae (Fig. 3d). Mesofemur (Fig. 3g) as long as metafemur (Fig. 3h). Mesotibia (Fig. 3e) shorter than metatibia (Fig. 3f). Protibia (Fig. 3d) with one or two peg-like setae. Peg-like setae on mesotrochanter (Fig. 3g) and mesotibia arranged in a single row, on metatibia arranged in a double row, and grouped in a field on metatrochanter (Fig. 3h). Apex of abdominal tergite 8 as in Fig. 3i. Sternite 8 as in Fig. 3c. Aedeagus as in Fig. 3a, b.

♀. Abdominal tergite 8 (Fig. 4e, f) with medioapical projection. Sternite 8 as in Fig. 4c. Genital segment as in Fig. 4b, d.

Comments. The remaining paralectotypes examined are not conspecific; see under *M. falasha* and *M. rougemonti*. This species may be easily distinguished by the coloration, the elytral base not narrowed and the sexual characters. It resembles *M. magnicaudatus*, but has the number of protibial peg-like setae in male strongly reduced and a much shorter apical projection of the abdominal tergite 8 in female.

Megarthrus africanus Eichelbaum (Figs 2f, i, n, 5a-h)

Megarthrus africanus EICHELBAUM, 1913: 114.

Type material. Lectotype ♂: Tanzania, Tanga distr., E Usambara Range, Mt. Bomole, Amani, 11.x.1903 (F. Eichelbaum) ZMHB, by present designation.

Distribution. Tanzania: Usambara Range.

Description. Length 1.45 mm; width 1.0 mm. Body predominantly red-brown, with darkened head and sutural margin of elytron, and paler legs, mouth parts and antennomere 11. Dorsal pubescence fairly uniform, on abdomen shorter, sparser near lateral pronotal edge, and denser along sutural margin and on humeral areal. Metasternal setae becoming denser medianly, about as long as prosternal setae. Pubescence on abdominal sternites 4-7 becoming denser medianly. Puncturation coarse on anterior portion of hypomeron and on medioposterior portion of metasternum. Frons on level with or raised above level of vertex. Anterior frontal edge finely and evenly carinate, weakly convex in middle and oblique laterally. Entire frontal impression deep. Eye almost hemispherical, with highest point reaching level of vertex. Temple as in Fig. 2i. Submentum flat. Antenna (Fig. 5c) without patches of sensilla; antennomeres 3 and 4 symmetrical. Pronotal disc (Fig. 5a) shallowly depressed along entire lateral edge and flat along median groove; latter deep, parallel-sided. Anterior prosternal margin bordered by a regular row of conspicuous longitudinal ridges. Protrochanter without transverse ridge. Lateral portion of prepectal ridge sinuate. Scutellum as in Fig. 2f. Elytron not narrowed at base; base abruptly inclined, overhanging. Elytral disc flat along lateral edge; latter straight in dorsal view; apical margin convex near suture; inner apical angle obtuse. Metasternal median ridge absent. Abdominal tergite 3 strongly vaulted transversally. Abdominal sternites 2 and 3 with processes as in Fig. 2n. Sternite 4 flat at base, then strongly vaulted transversally.

Ratios: AL 2.6; EL 1.5; ET 1.8; EW 1.15; EY 2.85; GT 2.25; GW 1.8; HW 1.6-1.7; ML 1.5; MP 2.0; PT 1.9; SP 3.3.

♂. Protarsal segment 1 lacking adhesive setae. Mesofemur as long as metafemur. Mesotibia (Fig. 5b) shorter than metatibia. Peg-like setae grouped in a field on mesotrochanter (Fig. 5h) and mesotibia, absent from protibia, metatrochanter and metatibia. Apex of abdominal tergite 8 as in Fig. 5g. Sternite 8 as in Fig. 5d. Aedeagus as in Fig. 5e, f.

♀. Unknown.

Comments. Although the shape of the anterior portion of the frons is probably a male sexual character, in the absence of females it is listed among the general characters. This species share with *M. mukankundiyeorum*, *M. selenitus* and *M. spinosus* a regularly ridged prosternal margin. It is characterised by the presence of a symmetrical aedeagus in combination with the absence of protarsal adhesive setae.

Megarthrus apicicornis Cameron (Fig. 6a-g)

Megarthrus apicornis; CAMERON, 1950: 5 (incorrect spelling).
Megarthrus apicicornis CAMERON, 1950: 6.

Type material. Holotype ♀: Zaire, Kivu prov. (Albert NP) V. Mikeno, near Rweru, 2400m, 3.vii.1934 (G. F. de Witte) ex bamboo, #469, MRAC.

Distribution. Zaire: V. Mikeno.

Description. Length 1.55 mm; width 1.0 mm. Body uniformly red-brown or dark brown, except for paler legs, mouth parts and antennomeres 10 and 11, and somewhat darkened head and sutural margin of elytron. Dorsal pubescence fairly uniform, elytral sparser on disc and denser on humeral area. Metasternal setae becoming sparser medioposteriorly and longer anteriorly, shorter than prosternal setae. Pubescence of abdominal sternites 4-7 uniform, except for a pair of long setae near medioapical margins. Puncturation fine on anterior portion of hypomeron; median area of metasternum impunctate. Frons raised above level of vertex. Anterior frontal edge not carinate, strongly arcuate in middle, oblique laterally. Frontal impression indistinct in middle and shallow laterally. Eye moderatly convex, with highest point below level of vertex. Temple similar to that in Fig. 2k. Submentum weekly convex. Antenna (Fig. 6c) without patches of sensilla; antennomeres 3 and 4 slightly asymmetrical. Pronotal disc (Fig. 6f) shallowly depressed along basal portion of lateral edge and deeply depressed along median groove; latter deep, parallel-sided. Anterior prosternal margin not bordered by longitudinal ridges. Protrochanter without transverse ridge. Lateral portion of prepectal ridge straight. Scutellum similar to that in Fig. 2d. Elytron not narrowed at base; base gradually inclined, overhanging. Elytral disc flat along lateral edge; latter straight in dorsal view; apical margin slightly sinuate near suture; inner apical angle right-angled. Metasternal median ridge large, conspicuous. Abdominal tergite 3 slightly vaulted transversally. Sternites 2 and 3 with median processes similar to that in Fig. 2l. Sternite 4 flat at base, then slightly vaulted transversally.

Ratios: AL 2.1; EL 1.5; ET 1.7; EW 1.2; EY 2.8-2.9; GT 2.0; GW 2.0; HW 1.6-1.7; ML 1.5; MP 1.7; PT 1.8; SP 3.7; TPF 4.0.

♀. Medioapical projection of abdominal tergite 8 as in Fig. 6e, g. Sternite 8 as in Fig. 6d. Genital segment as in Fig. 6a, b.

♂. Unknown.

Comments. Nine species (*M. apicicornis*, *M. bantu*, *M. congoensis*, *M. hutu*, *M. niloticus*, *M. panga*, *M. stylifer*, *M. vanschuytbroecki* and *M. watutsi*) possess a head distinctly widened behind the eyes. Among these species, *M. apicicornis* is distinguished by its conspicuous metasternal median ridge and elongate, narrow apical projection of abdominal tergite 8. The former character is shared with *M. vanschuytbroecki*, which has the tergal projection much wider.

Megarthrus bantu sp. n. (Figs 7a-i, 8a-g)

Type material. Holotype ♂: Zaire, Ruwenzori Range (Albert NP) Kalonge, river Nyamwamba, tributary of Butahu, 2010m, 2-3.ii.1953 (P. Vanschuytbroeck & J. Kekenbosch) #2214-21, MRAC.

Paratypes (85): same data as holotype, 5♂, 5♀ in MHNG and 29♂, 19♀ in MRAC; Zaire, Ruwenzori Range (Albert NP) Kalonge, 2210m, 1.ix.1952 (P. Vanschuytbroeck & J. Kekenbosch) #846-51, 1♂ in MRAC; same data, but 7.viii.1952, ex humus in forest, #695, 1♀ in MRAC; Kalonge (Albert NP) Nyamwamba-Ihongero, 2480m, 25-29.viii.1952 (P. Vanschuytbroeck & J. Kekenbosch) ex humus in bamboo, #860-63, 1♂ in MRAC; same data, but 26-28.viii.1952, #874, 1♂ in MRAC; Kalonge (Albert NP) river Katauleko, tributary of Butahu, 2180m, 1.viii.1952 (P. Vanschuytbroeck & J. Kekenbosch) ex humus, #615, 1♂, 1♀ in MRAC; same data, but 1-2.viii.1952, #665-67, 1♂ in MRAC; Kalonge (Albert NP) river Katsambu, tributary of Butahu, 2000m, 26.i-19.ii.1953 (P. Vanschuytbroeck & J. Kekenbosch) #2155-2200, 1♀ in MRAC; Kalonge (Albert NP) river Kiondyo ya Kwnanza, tributary of Butahu, 2130m, 2.viii.1952 (P. Vanschuytbroeck & J. Kekenbosch) ex humus, #634-35, 1♂, 1♀ in MHNG and 1♂, 2♀ in MRAC; same data, but 5.viii.1952, under bark, #657, 1♀ in MRAC; Ruwenzori Range (Albert NP) Kyandolire, river Mulaku, tributary of Kakalari, 1750m, 14.x.1952 (P. Vanschuytbroeck & J. Kekenbosch) ex humus, #1241-43, 1♂, 2♀ in MHNG and 3♂, 4♀ in MRAC; Kivu, 39km S Lubero, Mombassa, 25.viii.1932 (L. Burgeon) R. Det. L2556, 1♂ in MRAC; Burundi, Bururi terr., Nyamurenbe, 900m, 7.iii.1953 (P. Basilewsky) 1♂ in MRAC; Uganda, Ruwenzori Range, Toro prov., Mahoma River, 2700m, 13-16.viii.1952 (D. S. Fletcher) 1♂ in BMNH.

Distribution. Burundi, Uganda and Zaïre.

Description. Similar to *M. congoensis* from which it may be distinguished as follows: Length 1.3-1.6 mm; width 0.85-1.05 mm. Antenna reddish-brown, antennomere 11 paler. Eye strongly convex. Antenna as in Fig. 8c. Pronotum as in Fig. 8f. Elytral disc shallowly depressed along lateral edge; apical contour somewhat convex near suture; inner apical angle obtuse. Metasternal median ridge fine, low. Abdominal tergite 3 almost flat. Ratios: AL 2.0-2.2; EL 1.5; ET 1.65-1.80; EY 2.8-2.9; GW 1.8; ML 1.4; SP 2.5-2.9; TPF 5.0-6.8.

♂. Protarsal segment 1 bearing adhesive setae. Mesofemur (Fig. 7g) longer than metafemur (Fig. 7h). Mesotibia (Fig. 7c) shorter than metatibia (Fig. 7d). Peg-like setae arranged in a double row on mesotrochanter (Fig. 7g), grouped in a field on mesotibia, metatrochanter (Fig. 7h) and metatibia, absent from protibia. Apex of abdominal tergite 8 as in Fig. 7e, i. Aedeagus as in Fig. 7a, b.

♀. Medioapical projection of abdominal tergite 8 as in Fig. 8e, g. Sternite 8 as in Fig. 8d. Genital segment as in Fig. 8a, b.

Comments. Megarthrus bantu differs from other species with the head widened behind the eyes (see discussion under *M. apicicornis*) by the strongly sclerotised tooth-like structures of the aedeagal internal sac and by the contour of the female abdominal tergite 8.

Megarthrus basilewskyi Fagel (Figs 9a-g, 10a-g, 11a-e)

Megarthrus basilewskyi Fagel, 1957: 27.

Type material. Holotype ♂: Rwanda, Kibuye terr., Yanina, 2300m, 12.ii.1953 (P. Basilewsky) MRAC.

Paratypes (4♀): Zaire, Kivu prov., Mwenga terr., Luiko, 2050m, 21.i.1952 (N. Leleup) ex humus in montane forest, 1 in MHNG and 3 in MRAC.

Distribution. Rwanda; Zaire: Kivu.

Description. Similar to *M. gigas* from which it may be distinguished as follows: Length 1.9 mm; width 1.4 mm. Body red-brown. Metasternal median ridge absent. Ratios: EL 1.6; ET 1.8; EY 2.5; GT 2.0; GW 2.0; TPF abs.

♂. Inner apical angle of elytron right-angled. Protarsal segment 1 lacking adhesive setae. Mesofemur (Fig. 9c) shorter than metafemur (Fig. 9a). Mesotibia (Fig. 9f) shorter than metatibia (Fig. 9e). Peg-like setae arranged in a single row on protibia (Fig. 9g) and mesotrochanter (Fig. 9c); grouped in a field on mesotibia, metatrochanter (Fig. 9a) and metatibia. Abdominal tergite 8 as in Fig 10d, e. Sternite 8 as in Fig. 11e. Aedeagus as in Fig. 9b, d.

♀. Apical contour of elytron as in Fig. 10b. Abdominal tergite 8 (Fig. 10f, g) without medioapical projection. Sternite 8 as in Fig. 11d. Genital segment as in Fig. 11a-c; mediodorsal suture of sternite 9 arcuate.

Comments. Megarthrus basilewskyi, *M. dominicae*, *M. gigas* and *M. major* may be distinguished by their large size. *Megarthrus basilewskyi* is characterised by the shape of the aedeagus and, in the female, the tergite 8 lacking apical projection in combination with the presence of the arcuate mediodorsal suture of the sternite 9.

Megarthrus clarkei sp. n. (Figs 2c, 12a-h, 13a-g)

Type material. Holotype ♂: Ethiopia, Shewa prov., Addis Abeba, 1971 (G. de Rougemont) BMNH.

Paratypes (10): same data as holotype, 2♂, 3♀ in BMNH and 2♂, 2♀ in MHNG; Shewa prov., Managasha Forest, c. 2900m, 9.i.1971 (R. O. S. Clarke) ex silt of dry stream bed, 1♀ in BMNH.

Distribution. Central Ethiopia.

Description. Length 1.45-1.60 mm; width 1.0-1.1 mm. Body red-brown or dark brown, with darkened head, metasternum and abdomen, and paler legs, mouth parts and antennomeres 1-4. Dorsal pubescence fairly uniform, becoming denser along median pronotal groove and near apical margin of abdominal tergite 7. Metasternal setae becoming sparser on median area; shorter than those on prosternum. Pubescence of abdominal sternites 4-7 uniform, except for a pair of long setae near medioapical margins. Puncturation fine on anterior portion of hypomeron; median area of metasternum impunctate. Frons raised above level of vertex. Anterior frontal edge not carinate, evenly arcuate. Entire frontal impression shallow. Eye strongly convex, with highest point below level of vertex. Temple similar to that in Fig. 2g. Submentum weakly convex. Antenna (Fig. 13b) without patches of sensilla; antennomeres 3 and 4 slightly asymmetrical. Pronotal disc (Fig. 13a) shallowly depressed along entire lateral edge and along median groove; latter usually deep, parallel-sided. Anterior prosternal margin not bordered by longitudinal ridges. Protrochanter without transverse ridge. Lateral portion of prepectal ridge straight. Scutellum as in Fig. 2c. Elytron abruptly narrowed at base; base gradually inclined, overhanging. Elytral disc shallowly depressed along lateral edge; latter slightly convex in dorsal view; apical margin somewhat sinuate near suture; inner apical angle obtuse. Metasternal median ridge fine, low. Abdominal tergite 3 almost flat. Sternites 2 and 3 with median processes similar to that in Fig. 2l. Sternite 4 flat at base, then slightly vaulted transversally.

Ratios: AL 2.0-2.1; EL 1.4; ET 1.5; EW 1.2; EY 2.8-2.9; GT 2.2; GW 1.8; HW 1.6-1.7; ML 1.4; MP 1.7; PT 1.9; SP♂ 2.5; SP♀ 3.4-3.9; TPF 4.0.

♂. Protarsal segment 1 bearing adhesive setae. Mesofemur (Fig. 12e) shorter than metafemur. Mesotibia (Fig. 12c) shorter than metatibia (Fig. 12d), with peg-like setae arranged in a single row, and grouped in a field near apex. Peg-like setae on metatibia arranged in a single row, and in a double row near apex; forming a double row on mesotrochanter (Fig. 12e); absent from protibia and metatrochanter. Apex of abdominal tergite 8 as in Fig. 12f, g. Sternite 8 as in Fig. 12g. Aedeagus as in Fig. 12a, b.

♀. Medioapical projection of abdominal tergite 8 as in Fig. 13c, f. Sternite 8 as in Fig. 13g. Genital segment as in Fig. 13d, e.

Comments. Megarthrus clarkei and *M. scotti* may be distinguished from other African congeners by the scutellar shape. The shape of the female abdominal tergite 8 is diagnostic for each of these two species.

The species is dedicated to one of the collectors, Mr. Robin O. S. Clarke.

Megarthrus congoensis Cameron (Figs 2d, k, 14a-i, 15a-g)

Megarthrus congoensis CAMERON, 1950: 4.

Type material. Holotype ♀: Rwanda, V. Visoke (Albert NP) Bishoke, 2800-3300m, 13-14.ii.1935 (G. F. de Witte) #1128, MRAC.

Paratypes (13): same data as holotype, 1♀ in MRAC; same data, but #1125, 3♀ in BMNH; same data, but #1127, 1♂ in MHNG and 1♀ in MRAC; same data, but #1129, 1♂, 1♀ in BMNH, 1♀ in MHNG and 2♂, 2♀ in MRAC.

Additional material (1♀): Rwanda (Albert NP) at foot of V. Karisimbi, Ilega, 2400m, 12.iii.1935 (G. F. de Witte) #1314, MRAC (paratype of *M. apicicornis*).

Distribution. Rwanda: V. Visoke and V. Karisimbi.

Description. Length 1.65-1.75 mm; width 0.95-1.05 mm. Body red-brown or dark brown, with darkened head, sutural margin of elytron, metasternum and abdomen, and paler legs, mouth parts and antennomeres 1-4. Dorsal pubescence fairly uniform; that on elytron sparser, but becoming denser on humeral area. Pubescence denser near posterior margin of abdominal tergite 7. Metasternal setae becoming sparser medioposteriorly and longer anteriorly; shorter than those on prosternum. Pubescence of abdominal sternites 4-7 uniform, except for a pair of long setae near medioapical margins. Puncturation fine on anterior portion of hypomeron; median area of metasternum impunctate. Frons raised above level of vertex. Anterior frontal edge not carinate, evenly arcuate. Entire frontal impression shallow. Eye moderatly convex, with highest point below level of vertex. Temple similar to that in Fig. 2k. Submentum weakly convex. Antenna (Fig. 15a) without patches of sensilla; antennomeres 3 and 4 slightly asymmetrical. Pronotal disc (Fig. 15c) shallowly depressed along basal portion of lateral edge and deeply depressed along median groove; latter shallow, parallel-sided. Anterior prosternal margin bordered by an irregular row of fine longitudinal ridges. Protrochanter without transverse ridge. Lateral portion of prepectal ridge straight. Scutellum as in Fig. 2d. Elytron not narrowed at base; base gradually inclined, overhanging. Elytral disc flat along lateral edge; latter straight in dorsal view; apical margin straight or convex near suture. Metasternal median ridge absent. Abdominal tergite 3 slightly vaulted transversally. Sternites 2 and 3 with median processes as in Fig. 2l. Sernite 4 flat at base, then slightly vaulted transversally.

Ratios: AL 1.9-2.0; EL♂ 1.5; EL♀ 1.9; ET 1.7-1.8; EW 1.2; EY 3.3-3.4; GT 2.0; GW 2.0; HW 1.6-1.7; ML 1.5-1.6; MP 1.7; PT 1.8; SP♂ 2.5-2.7; SP♀ 3.2-3.4; TPF 4.0.

♂. Inner apical angle of elytron obtuse. Protarsal segment 1 bearing adhesive setae. Mesofemur (Fig. 14h) as long as metafemur (Fig. 14i). Mesotibia (Fig. 14f) shorter than metatibia (Fig. 14g). Peg-like setae grouped in a field on mesotrochanter (Fig. 14h), mesotibia, metatrochanter (Fig. 14i) and metatibia; absent from protibia. Apex of abdominal tergite 8 as in Fig. 14a, e. Sternite 8 as in Fig. 14b . Aedeagus as in Fig. 14c, d.

♀. Inner apical angle of elytron right-angled. Medioapical projection of abdominal tergite 8 as in Fig. 15b, e. Sternite 8 as in Fig. 15g. Genital segment as in Fig. 15d, f.

Comments. Megarthrus congoensis differs from other species with the head widened behind the eyes (see discussion under *M. apicicornis*), *M. hutu* excepted, by the shape of the male and female abdominal tergite 8. It may be distinguished from *M. hutu* by the aedeagal shape and, in female, by the ratio of the elytral / pronotal lengths.

Megarthrus dominicae sp. n. (Figs 16a-i, 17a-f)

Type material. Holotype ♂: Uganda, Toro prov., Ruwenzori NP, John Mate Camp, 3350m, 14-15.v.1993 (G. Cuccodoro & D. Erne) ex decaying stems of giant *Lobelia*, MHNG.

Paratypes (10): same data as holotype, 1♂, 1♀ in BMNH, 3♂, 3♀ in MHNG and 1♂, 1♀ in MRAC.

Distribution. Uganda: Ruwenzori Range.

Description. Length 1.8-2.0 mm; width 1.1-1.3 mm. Head, metasternum and abdomen blackish; pronotum and elytron dark brown; sutural margin of elytron darkened; mouth parts and legs yellowish; antenna dark brown, antennomeres 1-4 somewhat paler. Dorsal pubescence fairly uniform; longer and denser along pronotal median groove and becoming longer and denser on humeral area of elytron; denser near posterior margin of abdominal tergite 7. Metasternal setae shorter than those on prosternum, becoming sparser medioposteriorly and longer anteriorly. Pubescence on abdominal sternites 4-7 uniform, except for a pair of long setae near medioapical margins. Anterior portion of hypomeron and median area of metasternum impunctate. Frons raised above level of vertex. Anterior frontal edge not carinate, evenly arcuate. Frontal impression indistinct in middle and shallow laterally. Eye moderatly convex, with highest point below level of vertex. Temple similar to that in Fig. 2g. Submentum convex. Antenna (Fig. 16a) without patches of sensilla; antennomeres 3 and 4 slightly asymmetrical. Pronotal disc (Fig. 17a) flat along lateral edge, shallowly depressed along median groove; latter shallow, widened at base. Anterior prosternal margin bordered by an irregular row of fine longitudinal ridges. Protrochanter without transverse ridge. Lateral portion of prepectal ridge straight. Scutellum similar to that in Fig. 2b. Elytron abruptly narrowed at base; base abruptly inclined, overhanging. Elytral disc deeply depressed along lateral edge; latter slightly convex in dorsal view; apical margin straight or arcuate near suture; inner apical angle obtuse. Metasternal median ridge fine, low. Abdominal tergite 3 flat. Sternites 2 and 3 with median processes as in Fig. 2l. Sternite 4 flat at base, then slightly vaulted transversally.

Ratios: AL 2.0; EL 1.8; ET 1.8; EW 1.2; EY 3.3-3.4; GT 2.2; GW 1.6-1.7; HW 1.6-1.7; ML 1.5; MP 1.8; PT 2.0; SP 2.5; TPF 5.0.

♂. Apical contour of elytron convex near suture. Protarsal segment 1 bearing adhesive setae. Mesofemur (Fig. 16e) longer than metafemur. Mesotibia (Fig. 16d) longer than metatibia. Peg-like setae arranged in a double row on mesotibia and metatrochanter (Fig. 16g), grouped in a field on mesotrochanter (Fig. 16e), absent from protibia and metatibia. Apex of abdominal tergite 8 as in Fig. 16f, h. Sternite 8 as in Fig. 16i. Aedeagus as in Fig. 16b, c.

♀. Apical contour of elytron somewhat sinuate near suture. Medioapical projection of abdominal tergite 8 as in Fig. 17b, c. Sternite 8 as in Fig. 17f. Genital segment as in Fig. 17d, e.

Comments. Megarthrus dominicae may be distiguished easily of the others species of similar size (see discussion under *M. basilewskyi*) by its uniformly dark colour and impunctate prothoracic hypomera.

The species is dedicated to Mrs Dominique Cuccodoro.

Megarthrus falasha sp. n. (Figs 2d,k, 18a-i, 19a-g)

Type material. Holotype ♂: Ethiopia, Gojam prov., 8km W Falega, Birham <10°46'N; 38°03'E> 2820m, xi.1972 (R. O. S. Clarke) BMNH.

Paratypes (7): same data as holotype, 1♀ in BMNH; Jimma (= Kefa prov., Jïma?) vi.1971 (R. O. S. Clarke) ex grass cuttings, 2♀ in BMNH and 1♀ in MHNG; Shewa prov., Addis Abeba, 1971 (G. de Rougemont) 1♂, 1♀ in MHNG; Mt. Zuquála (=Mt. Ziq'wala), in crater, c. 2700m, 26.x.1926 (J. Omer-Cooper) box 77, 1 ♀ in FMNH (paralectotype of *M. abessinus* Bernhauer).

Distribution. Central Ethiopia.

Description. Similar to *M. wittei* from which it may be distinguished as follows: Frons raised above level of vertex. Antenna as in Fig. 19a. Anterior prosternal margin not bordered by longitudinal ridges. Elytron with lateral contour somewhat convex and apical contour straight near suture. Ratios: AL 1.9; EL 1.45; ET 1.45-1.55; EY 2.8-2.9; GW 1.6-1.7; HW 1.6-1.7; ML 1.4; PT 1.9; SP♂ 2.8-2.9; SP♀ 3.3-3.4; TPF 10.0.

♂. Protarsal segment 1 bearing adhesive setae. Mesofemur (Fig. 18f) somewhat shorter than metafemur. Mesotibia (Fig. 18c) shorter than metatibia (Fig. 18d). Metatrochanter (Fig. 18h) bearing 1-3 peg-like setae. Peg-like setae on mesotibia arranged in a single row, and in a double row near apex; arranged in a single row on mesotrochanter (Fig. 18f) and metatibia; absent from protibia. Apex of abdominal tergite 8 as in Fig. 18e, g. Sternite 8 as in Fig. 18i. Aedeagus as in Fig. 18a, b.

♀. Medioapical projection of abdominal tergite 8 as in Fig. 19d, f. Sternite 8 as in Fig. 19g. Genital segment as in Fig. 19c, e.

Comments. Megarthrus falasha is one of the seven Afrotropical species (*M. falasha*, *M. nanus*, *M. ovalis*, *M. rougemonti*, *M. twa*, *M. wittei* and *M. zulu*) possessing moniliform antennomeres 7 to 10. It may be distinguished from these species, *M. wittei* excepted, by the almost uniformly brown color of the body in combination with the aedeagus symmetrical. The pattern of the mesotrochanteral peg-like setae is diagnostic for each of these two species.

Megarthrus gigas Fagel (Figs 2m, 20a-f, 21a-e, 22a-i)

Megarthrus gigas FAGEL, 1957: 29.

Type material. Holotype ♂: Burundi, Ngozi terr., Samutuku, 2600m, 24.ii.1953 (P. Basilewsky) MRAC.

Paratypes (2♀): Zaire, Kivu prov., Kabare terr., foothills SE Kahuzi, 2000m, vii.1951 (N. Leleup) ex humus in montane forest, MRAC.

Additional material (2♂): Zaire, Kivu prov., Mwenga terr., Lake Lungwe, 2700m, viii.1953 (N. Leleup) ex humus in forest of bamboo and *Hagenia*, MRAC (mislabelled paratype); Ruwenzori Range (Albert NP) Kalonge, stream Katsambu, tributary of Butahu, 2000m, 27.i-9.ii.1953 (P. Vanschuytbroeck & J. Kekenbosch) #2203-10, MHNG.

Distribution. Burundi; Zaire: Kivu, Ruwenzori Range.

Description. Length 2.0 mm long; width 1.4 mm wide. Body uniformly dark brown, with paler legs, mouth parts and antennomere 11. Dorsal pubescence fairly uniform, becoming sparser on lateral edges of pronotum. Humeral area of elytron with denser pubescence. Metasternal setae becoming denser near median area; about as long as those on prosternum. Pubescence of abdominal sternites 4-7 uniform. Puncturation coarse on anterior portion of hypomeron and on median area of metasternum. Frons on level with vertex. Anterior frontal edge finely carinate, evenly arcuate. Entire frontal impression indistinct. Eye almost hemispherical, raised above level of vertex. Temple similar to that in Fig. 2i. Submentum flat. Antenna (Fig. 21c) without patches of sensilla; antennomeres 3 and 4 symmetrical. Pronotal disc (Fig. 21a) deeply depressed along entire lateral edge, flat along median groove; latter shallow, widened at base. Anterior prosternal margin bordered by an irregular row of fine longitudinal ridges. Protrochanter without transverse ridge. Lateral portion of prepectal ridge sinuate. Scutellum similar to that in Fig. 2f. Elytron abruptly narrowed at base; base abruptly inclined, overhanging. Elytral disc deeply depressed along lateral edge; latter almost straight in dorsal view; apical margin sinuate near suture. Metasternal median ridge fine, low. Abdominal tergite 3 slightly vaulted transversally. Abdominal sternites 2 and 3 with median processes as in Fig. 2m. Sternite 4 flat at base, then slightly vaulted transversally.

Ratios: AL 2.6; EL 1.4; ET 1.6; EW 1.2; EY 2.7-2.8; GT 2.2; GW 1.6-1.7; HW 2.2-2.3; ML 1.4; MP 1.7; PT 2.0; SP 3.0-3.5; TPF abs.

♂. Inner apical angle of elytron right-angled. Protarsal segment 1 (Fig. 22g) lacking adhesive setae. Mesofemur (Fig. 20d) shorter than metafemur (Fig. 20a). Mesotibia (Fig. 22f) shorter than metatibia (Fig. 22e). Peg-like setae arranged in a single row on mesotrochanter (Fig. 20d), metatrochanter (Fig. 20a) and metatibia; grouped in a field on protibia (Fig. 22g) and mesotibia. Apex of abdominal tergite 8 as in Fig. 20e, f. Sternite 8 as in Fig. 21d. Aedeagus as in Fig. 20b, c.

♀. Apical contour of elytron and inner apical angle as in Fig. 21b. Abdominal tergite 8 (Fig. 22h, i) without medioapical projection. Sternite 8 as in Fig. 21d. Genital segment as in Fig. 22a-d; mediodorsal suture of sternite 9 forming an angle not projecting anteriorly.

Comments. *Megarthrus gigas* may be distinguished from other species of similar size (see discussion under *M. basilewskyi*) by the aedeagus lacking a lateral notch. This species shares with *M. major* the angulate median suture of the abdominal sternite 9, but differs by the much wider basal projection of that sternite.

Megarthrus horticola sp. n. (Figs 23a-h, 24a-g)

Type material. Holotype ♂: Uganda, Bugisu prov., Mt. Elgon, Sipi, 1750m, 31.v.1993 (G. Cuccodoro & D. Erne) ex moist leaf litter at foot of tree in banana plantation, MHNG.

Paratypes (8): same data as holotype, 1♀ in BMNH and 1♀ in MHNG; same data, but 1.vi.1993, ex moist vegetational debris in garden, 1♀ in MHNG and 1♀ in MRAC; Kenya, Central prov., Mt. Aberdares, near NP entrance, 2300m, 25.xi.1974, (V. Mahnert & J. -L. Perret) ex leaf litter and rotten wood, 1♂, 1♀ in MHNG; Rift Valley prov., Mau for., between Mau Saummit and Kedowa, near Londiani Rd., 7.xi.1974 (V. Mahnert & J. -L. Perret) under bark and stones, 1♀ in MHNG; Zaire, Kivu prov., Mt. Kahuzi, 2000m, 27.v.1985 (H. Mühle) ex *Lobelia*, 1♂ in ZMHB.

Distribution. Kenya: Mt. Aberdares; Uganda: Mt. Elgon; Zaire: Kivu.

Description. Similar to *M. monticola* from which it may be distinguished as follows: Length 1.35-1.45 mm; width 0.95-1.05 mm. Sutural margin of elytron darker than disc; antenna reddish-brown, antennomere 11 paler. Antenna as in Fig. 24a. Pronotal disc (Fig. 24f) flat along lateral edge. Elytron with apical contour arcuate near suture and inner apical angle obtuse. Abdomen with tergite 3 weakly convex and sternite 4 flat. Ratios: AL 2.2; EL 1.45; EW 1.2; HW 1.6-1.7; TPF 5.0.

♂. Protarsal segment 1 bearing adhesive setae. Mesofemur (Fig. 23f) as long as metafemur. Mesotibia (Fig. 23c) shorter than metatibia. Peg-like setae grouped in field on mesotrochanter (Fig. 23f), mesotibia and metatrochanter (Fig. 23h), absent from protibia and metatibia. Apex of abdominal tergite 8 as in Fig. 23d, e. Sternite 8 as in Fig. 23g. Aedeagus as in Fig. 23a, b.

♀. Medioapical projection of abdominal tergite 8 as in Fig. 24e, g. Sternite 8 as in Fig. 24d. Genital segment as in Fig. 24b, c.

Comments. This species is similar to *M. mahnerti* and *M. monticola*. It may be distinguished easily by the apex of the female sternite 8 truncate and, in the male, by the absence of metatibial peg-like setae.

The water loading behaviour has been reported in this species (*Megarthrus* sp. A in CUCCODORO, 1995).

Megarthrus hutu sp. n. (Figs 25a-h, 26a-h)

Type material. Holotype ♂: Rwanda (Albert NP) V. Visoke, Bishoke, 2800-3300m, 13-14.ii.1935 (G. F. de Witte) #1127, MRAC (paratype of *M. congoensis*).

Paratypes (13): same data as holotype, but #1128, 1♀ in MRAC (paratype of *M. congoensis*); same data, but #1129, 1♂ in MHNG and 2♀ in MRAC (paratypes of *M. congoensis*); at foot of V. Karisimbi (Albert NP) Lake n'Gando, 2400m, 6.iii.1935 (G. F. de Witte) #1243, 1♂ in BMNH (paratype of *M. apicicornis*); same data, but 8.iii.1935, #1216, 1♀ in MRAC (paratype of *M. congoensis*); Zaire, Kivu (Albert NP) Tshiaberimu sect., Kirungu, 2720m, 8-9.iii.1954 (P. Vanschuytbroeck & H. Synave) #7928-31, 1♀ in MHNG.

Distribution. Rwanda; Zaire: Kivu.

Description. Similar to *M. congoensis* from which it may be distinguished as follows: Length 1.35-1.60 mm; width 0.85-1.00 mm. Elytron with apical contour somewhat convex near suture and inner apical angle obtuse. Abdomen with pubescence uniform and tergite 3 weakly convex. Ratios: EL 1.4-1.5; ET 1.7-1.8; EY 2.8-2.9; GT 2.2; SP♂ 2.5; SP♀ 3.2-3.4; TPF 4.0.

♂. Protarsal segment 1 bearing adhesive setae. Mesofemur (Fig. 25e) as long as metafemur (Fig. 25h). Mesotibia (Fig. 25c) with peg-like setae arranged in a double row; somewhat shorter than metatibia (Fig. 25d). Peg-like setae grouped in a field on metatrochanter (Fig. 25h), mesotrochanter (Fig. 25e) and metatibia, absent from protibia. Apex of abdominal tergite 8 as in Fig. 25f, g. Sternite 8 as in Fig. 26f. Aedeagus as in Fig. 25a, b.

♀. Medioapical projection of abdominal tergite 8 as in Fig. 26b, d. Sternite 8 as in Fig. 26c. Genital segment as in Fig. 26e, g.

Comments. See discussion under *M. congoensis*.

Megarthrus kamerunensis Bernhauer

Megarthrus kamerunensis BERNHAUER, 1942: 348.

Type material. Type: Cameroon, SE Mt. Cameroun, 1800-2000m, 1939 (P. Lepesme, R. Paulian & A. Villiers) ex fungi, FMNH (except for the remains of tarsi, the type specimen is missing and was apparently lost in transit when returned to the FMNH after W. O. Steel's death in October 1969; A. F. Newton Jr., pers. com.).

Distribution. Cameroon: Mt. Cameroon.

Comments. According to the original desciption, *M. kamerunensis* is characterised by a rounded incision of the posterior margin of the male abdominal sternite 6. No material could be assigned to this species.

Megarthrus magnicaudatus sp. n. (Figs 27a-k, 28a-f)

Type material. Holotype ♂: Ethiopia, Balê prov., Adelay Forest, 3100m, 19.xii.1971 (R. O. S. Clarke) ex plant roots in *Juniper* wood, BMNH.

Paratypes (5♀): same data as holotype, 2 in BMNH and 2 in MHNG; Ethiopia, Gamo Gofa prov., Mt. Gughé, 3200-3350m, 20.xii.1948 (H. Scott) ex roots of fern, 1 in BMNH.

Distribution. Central and southern Ethiopia.

Description. Similar to *M. abessinus* from which it may be distinguished as follows: Length 1.6-1.7 mm; width 1.1-1.2 mm. Frons raised above level of vertex. Frontal impression indistinct in middle, shallow laterally. Antenna as in Fig. 28c and pronotum as in Fig. 27i. Ratios: AL 2.0; EL 1.4; ET 1.75; HW 1.6-1.7; TPF 1.8.

♂. Apical contour of elytron sinuate near suture. Protarsal segment 1 (Fig. 27f) bearing adhesive setae. Mesofemur (Fig. 27c) shorter than metafemur. Metatibia (Fig. 27h) with peg-like setae arranged in a double row; longer than mesotibia (Fig. 27g). Peg-like setae arranged in a single row on mesotrochanter (Fig. 27c); grouped in a field on protibia (Fig. 27f) and mesotibia; lacking on metatrochanter. Abdominal tergite 8 as in Fig. 27b, k. Sternite 8 as in Fig. 27a. Aedeagus as in Fig. 27d, e.

♀. Apical contour of elytron convex near suture. Abdominal tergite 8 as in Fig. 28b, f. Sternite 8 as in Fig. 28e. Genital segment as in Fig. 28a, d.

Comments. See discussion under *M. abessinus*.

Megarthrus mahnerti sp. n. (Figs 29a-i, 30a-g)

Type material. Holotype ♂: Kenya, Central prov., Mt. Aberdares, near NP entrance, 2300m, 25.xi.1974, (V. Mahnert & J. -L. Perret) ex leaf litter and rotten wood, MHNG.

Paratypes (8): same data as holotype, 1♂, 1♀ in BMNH, 1♂, 2♀ in MHNG and 1♂, 1♀ in MRAC; Kenya, Western prov., Mt. Elgon NP, slope of Koitobos Pk., c. 2700m, 15.xi.1974 (V. Mahnert & J. -L. Perret) ex litter under bamboo, 1♀ in MHNG;

Additionnal material (1♀). D. O. Afrika, Langenburg (= Tanzania, Iringa prov., Livingstone Range, Ukenju?) 19.vii.1899 (Fülleborn), ZMHB. The specimen is likely to be conspecific. It is smaller and differs in the pronotal relief.

Distribution. Kenya: Mt. Aberdares; Tanzania: Livingstone Range.

Description. Similar to *M. monticola* from which it may be distinguished as follows: Antenna as in Fig. 29d and abdominal sternite 4 flat. Ratios: AL 2.0; EL 1.8; ET 1.5; HW 1.8; TPF 5.0.

♂. Apical contour of elytron convex near suture; inner apical angle obtuse. Protarsal segment 1 bearing adhesive setae. Mesofemur (Fig. 29b) as long as metafemur. Mesotibia (Fig. 29g) shorter than metatibia (Fig. 29a), both with peg-like setae arranged in a single row, and grouped in a field near apex. Peg-like setae arranged in a single row on mesotrochanter (Fig. 29b) and metatrochanter (Fig. 29h), absent from protibia. Apex of abdominal tergite 8 as in Fig. 29c. Sternite 8 as in Fig. 29i. Aedeagus as in Fig. 29e, f.

♀. Apical contour of elytron and inner apical angle as in Fig. 30g. Medioapical projection of abdominal tergite 8 as in Fig. 30d, e. Sternite 8 as in Fig. 30b. Genital segment as in Fig. 30a, c.

Comments. This species is similar to *M. horticola* and *M. monticola*. As *M. monticola*, it differs from *M. horticola* by the bilobed apex of the female sternite 8. It may be distinguished easily from *M. monticola* by the shape of the apex of the aedeagus.

The species is dedicated to one of the collectors, Mr. Volker Mahnert.

Megarthrus major sp. n. (Fig. 31a-k)

Type material. Holotype ♀: Zaire, Kivu (Albert NP) Tshiaberimu sect., Kirungu, 2720m, 8-9.iii.1954 (P. Vanschuytbroeck & H. Synave) #7928-31, MRAC.

Distribution. Zaire: Kivu.

Description. Similar to *M. gigas* from which it may be distinguished as follows: Ratios: EW 1.3; EY 3.3-3.4; SP 4.5-4.6; TPF abs.

♀. Apical contour of elytron as in Fig. 31k. Abdominal tergite 8 (Fig. 31c, g) without medioapical projection. Sternite 8 as in Fig. 31i. Genital segment as in Fig. 31a, b, d, f; mediodorsal suture of sternite 9 forming an angle projecting anteriorly.

♂. Unknown.

Comments. See discussions under *M. basilewskyi* and *M. gigas*.

Megarthrus maniwaata sp. n. (Figs 32a-h, 33a-g)

Type material. Holotype ♂: Zaire, Ruwenzori Range (Albert NP) Kalonge, river Nyamwamba, tributary of Butahu, 2010m, 2-3.ii.1953 (P. Vanschuytbroeck & J. Kekenbosch) #2214-21, MRAC.

Paratypes (22): same data as holotype, 3♂, 2♀ in MHNG and 8♂, 4♀ in MRAC; Zaire, Ruwenzori Range (Albert NP) Kalonge, river Katsambu, tributary of Butahu, 2000m, 26.i-19.ii.1953 (P. Vanschuytbroeck & J. Kekenbosch) #2155-2200, 1♂ in MRAC; Ruwenzori Range (Albert NP) Kyandolire, river Mulaku, tributary of Kakalari, 1750m, 14.x.1952 (P. Vanschuytbroeck & J. Kekenbosch) ex humus, #1241-43, 1♂ in MRAC; same data, but #1302, 1♂ in MRAC; Kivu (Albert NP) Nyasheke, V. Nyamuragira, 1820m, 14-26.vi.1935 (G. F. de Witte) #1481, 1♂ in MRAC; Rwanda, Cyangugu pref., around Nyakabuye, 9.vi.1985 (H. Mühle) 1♂ in ZMHB.

Distribution. Rwanda; Zaire: Kivu, Ruwenzori Range.

Description. Similar to *M. mwami* from which it may be distinguished as follows: Length 1.15-1.40 mm; width 0.80-0.95 mm. Antenna as in Fig. 33c. Pronotum as in Fig. 33f. Elytron abruptly narrowed at base. Metasternal median ridge fine or absent. Ratios: EL 1.4-1.5; ET 1.6-1.7; EY 2.8-2.9; PT 1.9-2.0; SP 2.5-3.0; TPF 6.5-7.0.

♂. Protarsal segment 1 bearing adhesive setae. Mesofemur (Fig. 32d) as long as metafemur (Fig. 32f). Metatibia (Fig. 32e) with peg-like setae arranged in a double row; longer than mesotibia (Fig. 32c). Protibia not modified. Metatrochanter (Fig. 32f) with 1-3 peg-like setae. Mesotrochanter (Fig. 32d) and mesotibia with peg-like setae grouped in a field. Apex of abdominal tergite 8 as in Fig. 32h. Aedeagus as in Fig. 32a, b.

♀. Medioapical projection of abdominal tergite 8 as in Fig. 33e, g. Sternite 8 as in Fig. 33d. Genital segment as in Fig. 33a, b.

Comments. Megarthrus maniwaata, M. merabet and *M. mwami* have in commun an evenly and broadly rounded apical margin of the scutellum. They may be distinguished by the sexual characters, in particular by the shape of the apical portion of the aedeagal median lobe and of the basal portion of the female coxites.

Megarthrus merabet sp. n. (Figs 34a-h, 35a-g)

Type material. Holotype ♂: Rwanda, Cyangugu pref., around Nyakabuye, 9.vi.1985 (H. Mühle) ZMHB.

Paratypes (3): Zaire, Ruwenzori Range (Albert NP) Kyandolire, river Mulaku, tributary of Kakalari, 1750m, 14.x.1952 (P. Vanschuytbroeck & J. Kekenbosch) ex humus, #1241-43, 1♂, 1♀ in MRAC; Mutsora (Albert NP) river Katunda, 1600m, 10.ii.1953 (P. Vanschuytbroeck & J. Kekenbosch) #2432, 1♂ in MHNG.

Distribution. Rwanda; Zaire: Ruwenzori Range.

Description. Similar to *M. mwami* from which it may be distinguished as follows: Length 1.15-1.35 mm; width 0.80-0.95 mm. Antenna as in Fig. 35c and pronotum as in Fig. 35f. Elytron abruptly narrowed at base; apical contour convex near suture. Ratios: EL 1.4-1.5; ET 1.4-1.5; ML 1.4; SP 2.2-2.5; TPF 10.0.

♂. Protarsal segment 1 bearing adhesive setae. Mesofemur (Fig. 34e) somewhat longer than metafemur (Fig. 34f). Metatibia (Fig. 34d) longer than mesotibia (Fig. 34c). Metatrochanter (Fig. 34f) with 1-4 peg-like setae. Peg-like setae grouped in a field on mesotrochanter (Fig. 34e), absent from protibia; those on metatibia arranged in a single row, and in a double row near apex, on mesotibia forming in a double row, and grouped in a field near apex. Apex of abdominal tergite 8 as in Fig. 34h. Aedeagus as in Fig. 34a, b.

♀. Medioapical projection of abdominal tergite 8 as in Fig. 35e, g. Sternite 8 as in Fig. 35d. Genital segment as in Fig. 35a, b.

Comments. See discussion under *M. maniwaata*. The apical projection of the abdominal tergite 8 is particularly small in this species.

Megarthrus monticola Cameron (Figs 36a-i, 37a-h)

Megarthrus monticola CAMERON, 1942: 322.

Type material. Holotype ♂: Kenya, Rift Valley prov., Chyulu Hills, 1700m, vi.1938, BMNH.

Paratypes (10): same data as holotype, 1♂, 8♀ in BMNH and1♀ in MHNG.

Additional material (2): same data as holotype, but vii.1938, 1♂, 1♀ in MHNG.

Distribution. Kenya: Chyulu Hills.

Description. Length 1.6-1.7 mm; width 1.0-1.2 mm. Head, metasternum and abdomen dark brown; pronotum and entire elytron reddish-brown; mouth parts and legs yellowish-brown; antenna reddish-brown, antennomeres 1-4 and 11 paler. Pubescence on pronotum denser along median groove; elytral pubescence sparser, but becoming denser on humeral area; that on abdomen shorter. Metasternal setae shorter than those on prosternum, becoming sparser on median area. Pubescence of abdominal sternites 4-7 uniform, except for a pair of long setae near medioapical margins. Puncturation fine on anterior portion of hypomeron; median area of metasternum impunctate. Frons on level with vertex. Anterior frontal edge not carinate, evenly arcuate. Entire frontal impression indistinct. Eye strongly convex, with highest point reaching level of vertex. Temple similar to that in Fig. 2h. Submentum weakly convex. Antenna (Fig. 37a) without patches of sensilla; antennomeres 3 and 4 slightly asymmetrical. Pronotal disc (Fig. 37d) shallowly depressed along entire lateral edge, flat along median groove; latter shallow, parallel-sided. Anterior prosternal margin not bordered by longitudinal ridges. Protrochanter without transverse ridge. Lateral portion of prepectal ridge straight. Scutellum similar to that in Fig. 2b. Elytron abruptly narrowed at base; base abruptly inclined, overhanging. Elytral disc shallowly depressed along lateral edge; latter slightly convex in dorsal view. Metasternal median ridge fine, low. Abdominal tergite 3 slightly vaulted transversally. Sternites 2 and 3 with median processes as in Fig. 2l. Sternite 4 flat at base, then slightly vaulted transversally.

Ratios:AL 1.8; EL 1.5; ET 1.7; EW 1.3; EY 2.7; GT 2.2; GW 1.6-1.7; HW 2.0; ML 1.6; MP 1.8; PT 1.9; SP 2.5; TPF 5.0.

♂. Apical contour of elytron arcuate near suture; inner apical angle obtuse. Protarsal segment 1 bearing adhesive setae. Mesofemur (Fig. 36g) shorter than metafemur (Fig. 36h). Mesotibia (Fig. 36e) shorter than metatibia (Fig. 36f), both with peg-like setae arranged in a double row and grouped in a field near apex. Peg-like setae arranged in a single row on mesotrochanter (Fig. 36g), double row on metatrochanter (Fig. 36h); absent from protibia. Apex of abdominal tergite 8 as in Fig. 36a, i. Sternite 8 as in Fig. 36b. Aedeagus as in Fig. 36c, d.

♀. Apical contour of elytron and inner apical angle as in Fig. 37h. Medioapical projection of abdominal tergite 8 as in Fig. 37c, g. Sternite 8 as in Fig. 37b. Genital segment as in Fig. 37e, f.

Comments. See discussions under *M. horticola* and *M. mahnerti.*

Megarthrus mukankundiyeorum sp. n. (Figs 38a-i, 39a-g)

Type material. Holotype ♂: Rwanda, 25km N Kibuye, Kayove, 2100m, 15.v.1973 (P. Werner) ex vegetational debris in secondary forest, MHNG.

Paratypes (2♀): Rwanda, Cyangugu pref., around Nyakabuye, 22.ii.1985 (H. Mühle) in MHNG and ZMHB.

Distribution. Rwanda.

Description. Length 1.7-1.8 mm; width 1.1-1.2 mm. Body predominantly red-brown or dark brown, with darkened head and sutural margin of elytron, and paler legs, mouth parts and antennomere 11. Dorsal pubescence fairly uniform, shortened on abdomen, becoming sparser near lateral pronotal edge, denser along sutural margin and on humeral area of elytron. Metasternal setae about as long as those on prosternum, becoming denser near median area. Pubescence on abdominal sternites 4-7 becoming denser near medioapical margins. Puncturation coarse on anterior portion of hypomeron and on median area of metasternum. Frons raised above level of vertex. Anterior frontal edge finely carinate; frontal impression distinct. Eye almost hemispherical, with highest point reaching level of vertex. Temple similar to that in Fig. 2i. Submentum flat. Antenna (Fig. 39e) without patches of sensilla; antennomeres 3 and 4 symmetrical. Pronotal disc (Fig. 39g) slightly depressed along entire lateral edge, flat along median groove; latter deep, parallel-sided. Anterior prosternal margin bordered by a regular row of conspicuous longitudinal ridges. Protrochanter without transverse ridge. Lateral portion of prepectal ridge sinuate. Scutellum similar to that in Fig. 2f. Elytron not narrowed at base; base abruptly inclined, overhanging. Elytral disc flat along lateral edge; latter straight in dorsal view; apical margin somewhat sinuate near suture; inner apical angle almost right-angled. Metasternal median ridge absent. Abdominal tergite 3 slightly vaulted transversally. Sternite 4 flat at base, then slightly vaulted transversally.

Ratios: AL 2.6; EL 1.5; ET 1.7; EW 1.2; EY 2.8-2.9; GT 2.5; GW 1.8; HW 1.6-1.7; ML 1.5; MP 2.0; PT 1.9; SP 2.7-3.0; TPF abs.

♂. Anterior frontal edge subtruncate. Protarsal segment 1 lacking adhesive setae. Mesofemur (Fig. 38h) shorter than metafemur. Mesotibia (Fig. 38f) shorter than metatibia (Fig. 38g), both with peg-like setae grouped in a field. Metatrochanter (Fig. 38e) with a single peg-like seta. Peg-like setae arranged in a single row on mesotrochanter (Fig. 38h), absent from protibia. Apex of abdominal tergite 8 as Fig. 38c, d. Sternite 8 as Fig. 38i. Aedeagus as in Fig. 38a, b.

♀. Anterior frontal edge evenly arcuate. Abdominal tergite 8 (Fig. 39c, d) lacking medioapical projection, with dark tip. Sternite 8 (Fig. 38i) about 1.8x as long as width of its basal projection. Genital segment as in Fig. 39a, b.

Comments. Among the species possessing a ridged prosternal margin (see discussion under *M. africanus*), *M. mukankundiyeorum* may is characterised by the asymmetrical aedeagus, the long antennae and the length of the female abdominal sternite 8.

The species is dedicated to the family of our friend Miss Consolée Mukankundiye, who suffered recently in Rwanda.

Megarthrus mwami sp. n. (Figs 2e, 40a-i, 41a-g)

Type material. Holotype ♂: Burundi, Bururi terr., Nyamurenbe, 900m, 7.iii.1953 (P. Basilewsky) MRAC.

Paratype (2): same data as holotype, 1♀ in MRAC; Rwanda, Cyangugu pref., around Nyakabuye, 1-30.xii.1982 (H. Mühle) 1♂ in ZMHB.

Distribution. Burundi; Rwanda.

Description. Length 1.2-1.3 mm; width 0.9-1.0 mm. Head, metasternum and abdomen dark brown, pronotum and elytron somewhat paler; sutural margin of elytron darkened; mouth parts and legs yellowish-brown; antenna reddish-brown, antennomeres 11 paler. Dorsal pubescence fairly uniform, on pronotum denser along median groove. Elytral pubescence sparser, but becoming denser on humeral area. Abdomen with denser pubescence near posterior margin of tergite 7. Metasternal setae shorter than those on prosternum, becoming sparser medioposteriorly and longer anteriorly. Pubescence of abdominal sternites 4-7 uniform, except for a pair of long setae near each medioapical margin. Puncturation fine on anterior portion of hypomeron; median area of metasternum impunctate. Frons raised above level of vertex. Anterior frontal edge finely carinate, evenly arcuate. Entire frontal impression shallow. Eye strongly convex, with highest point reaching level of vertex. Temple similar to that in Fig. 2h. Submentum weakly convex. Antenna (Fig. 41a) without patches of sensilla; antennomeres 3 and 4 slightly asymmetrical. Pronotal disc (Fig. 41f) shallowly depressed along basal portion of lateral edge, deeply depressed along median groove; latter deep, parallel-sided. Anterior prosternal margin bordered by an irregular row of fine longitudinal ridges. Protrochanter without transverse ridge. Lateral portion of prepectal ridge straight. Scutellum as in Fig. 2e. Elytron somewhat narrowed at base; base abruptly inclined, overhanging. Elytral disc shallowly depressed along lateral edge; latter subangulate in dorsal view; apical margin straight or convex near suture; inner apical angle obtuse. Metasternal median ridge fine, low. Abdominal tergite 3 slightly vaulted transversally. Sternites 2 and 3 with median processes similar to that in Fig. 2m. Sternite 4 flat at base, then slightly vaulted transversally.

Ratios: AL 2.0; EL 1.45; ET 1.6; EW 1.2; EY 2.5; GT 2.0; GW 1.8; HW 1.6-1.7; ML 1.5; MP 1.7; PT 1.8-1.9; SP 2.0-2.5; TPF 6.5-7.0.

♂. Protarsal segment 1 bearing adhesive setae. Mesofemur (Fig. 40g) as long as metafemur (Fig. 40h). Mesotibia (Fig. 40c) shorter than metatibia (Fig. 40d). Metatrochanter (Fig. 40h) with 1-3 peg-like setae. Peg-like setae arranged in a single row on mesotrochanter (Fig. 40g); absent from protibia; those on mesotibia arranged in a single row, and in a double row near apex; those on metatibia arranged in a single row, and grouped in a field near apex. Apex of abdominal tergite 8 as in Fig. 40e,i. Aedeagus as in Fig. 40a, b.

♀. Medioapical projection of abdominal tergite 8 as in Fig. 41d, g. Sternite 8 as in Fig. 41e. Genital segment as in Fig. 41b, c.

Comments. See discussions under *M. maniwaata* and *M. merabet*.

Megarthrus nanus sp. n. (Fig. 42a-k)

Type material. Holotype ♂: Africa or., Katona (= Tanzania, Moshi prov.), Mt. Kilimanjaro, BMNH.

Distribution. Tanzania: Mt. Kilimanjaro.

Description. Similar to *M. zulu* from which it may be distinguished as follows: Length 1.0 mm; width 0.7 mm. Body dark brown, head blackish, elytron reddish-brown with darkened sutural margin; legs, mouth parts and antennomeres 1-4 paler. Antenna as in Fig. 42h. Pronotum as in Fig. 42a. Apical contour of elytron straight near suture. Ratios: EL 1.4; ET 1.5; EY 2.8-2.9; GT 2.0; GW 1.5-1.6; PT 1.8; SP 2.8-2.9.

♂. Protarsal segment 1 bearing adhesive setae. Mesofemur (Fig. 42i) longer than metafemur (Fig. 42k). Metatibia (Fig. 42f) with peg-like setae arranged in a single row, and in a double row near apex; shorter than mesotibia (Fig. 42e). Peg-like setae arranged in a single row on mesotrochanter (Fig. 42i), grouped in a field on metatrochanter (Fig. 42k) and mesotibia, absent from protibia. Apex of abdominal tergite 8 as in Fig. 42c. Aedeagus as in Fig. 42d, g.

♀. Unknown.

Comments. This species and *M. zulu* are the only African members of the genus possessing a transverse ridge on the protrochanter. The aedeagal characters are diagnostic for each of these two species.

Megarthrus negus sp. n. (Figs 43a-h, 44a-g)

Type material. Holotype ♂: Ethiopia, Balê prov., Dinshu, 3200m, 1971 (G. de Rougemont) BMNH.

Paratypes (6): same data as holotype, 1♂, 1♀ in BMNH and 1♂ in MHNG; Balê prov., Sabsebe Washa NP <07°03'N; 39°39'E> 3600m, 1971 (R. O. S. Clarke) under stones near stream, 1♀ in MHNG; Gamo Gofa prov., Gughé highlands, Mt. Tola, c. 3000m, 10-14.xii.1948 (H. Scott) 1♂ in BMNH and 1♂ in MHNG.

Distribution. Southern Ethiopia.

Description. Similar to *M. simienensis* from which it may be distinguished as follows: Anterior frontal edge not carinate and submentum weakly convex. Antenna as in Fig. 44f. Pronotum (Fig. 44g) with deep median groove. Elytron with apical contour straight or convex near suture, and inner apical angle obtuse. Metasternal median ridge absent. Ratios: EL 1.6-1.7; ET 1.6-1.7; HW 1.6-1.7; ML 1.5; SP 2.5-3.0; TPF 3.3-3.5.

♂. Protarsal segment 1 bearing adhesive setae. Mesofemur (Fig. 43f) as long as metafemur. Mesotibia (Fig. 43c) with peg-like setae arranged in a double row; shorter than metatibia (Fig. 43d). Peg-like setae arranged in a single row on mesotrochanter (Fig. 43f) and metatibia, absent from protibia and metatrochanter. Apex of abdominal tergite 8 as in Fig. 43e,h. Sternite 8 as in Fig. 43g. Aedeagus as in Fig. 43a, b.

♀. Medioapical projection of abdominal tergite 8 as in Fig. 44b, d. Sternite 8 as in Fig. 44e. Genital segment as in Fig. 44a, c.

Comments. Megarthrus negus, *M. ras*, *M. rougemonti* and *M. simienensis* share conspicuous dark colouration of the body, narrowed elytral base and well developed projection of the female abdominal tergite 8. *Megarthrus negus* differs notably in having a single row of metatibial peg-like setae.

Megarthrus niloticus sp. n. (Figs 45a-k, 46a-g)

Type material. Holotype ♂: Uganda, Bugisu prov., Mt. Elgon, Sipi, 1750m, 31.v.1993 (G. Cuccodoro & D. Erne) ex moist leaf litter at foot of tree in banana plantation, MHNG.

Paratypes (7): Rwanda, Cyangugu pref., around Nyakabuye, 16.x.1984, 1♂ in ZMHB; same data, but 3.x.1985, 1♀ in MHNG; same data, but 31.xii.1985, 1♀ in ZMHB; Zaire, Ruwenzori Range (Albert NP) Kyandolire, river Mulaku, tributary of Kakalari, 1750m, 14.x.1952 (P. Vanschuytbroeck & J. Kekenbosch) ex humus, #1241-43, 1♂ in MHNG and 3♂ in MRAC.

Distribution. Uganda: Mt. Elgon; Rwanda; Zaire: Ruwenzori Range.

Description. Similar to *M. apicicornis* from which it may be distinguished as follows: Length 1.5-1.6 mm; width 0.9-1.1 mm. Pronotum (Fig. 46g) and elytron brown or dark brown; head, metasternum and abdomen darker than pronotum; sutural margin of elytron darkened; mouth parts and legs yellowish-brown; antenna reddish-brown, antennomeres 11 somewhat paler. Eye strongly convex. Antenna as in Fig. 46e. Apical contour of elytron straight near suture; inner apical angle obtuse. Metasternal median ridge fine or absent. Ratios: AL 2.0; EL 1.5; ET 1,7; TPF 5.0.

♂. Protarsal segment 1 (Fig. 45f) bearing adhesive setae. Mesofemur (Fig. 45b) somewhat shorter than metafemur (Fig. 45c). Mesotibia (Fig. 45g) shorter than metatibia (Fig. 45h). Peg-like setae grouped in a field on mesotrochanter (Fig. 45b), mesotibia, metatrochanter (Fig. 45c) and metatibia, absent from protibia. Apex of abdominal tergite 8 as in Fig. 45a, k. Sternite 8 as in Fig. 45i. Aedeagus as in Fig. 45d, e.

♀. Medioapical projection of abdominal tergite 8 as in Fig. 46a, b. Sternite 8 as in Fig. 46f. Genital segment as in Fig. 46c, d.

Comments. Megarthrus niloticus differs from other species with the head widened behind the eyes (see discussions under *M. apicicornis* and *M. congoensis*) by the shape of the male mesotibia in combination with that of the aedeagal tip.

Megarthrus ovalis Cameron (Figs 47a-i, 48a-f)

Megarthrus ovalis CAMERON, 1950: 5.

Type material. Holotype ♂: Rwanda, V. Visoke (Albert NP) Bishoke, 2800-3300m, 13-14.ii.1935 (G. F. de Witte) #1125, MRAC.

Paratype (♀): same data as holotype, BMNH.

Additional material (4): Rwanda, S V. Visoke, Virungas, 2950m, 20.iii.1978 (I. M. Redmond) ex dung of *Gorilla. g. beringei*, 1♀ in BMNH and 1♀ in MHNG; Zaire, Kivu (Albert NP) Tshiaberimu sect., river Mbulikerere, tributary of river Kalivina, 2720m, 25.iii.1954 (P. Vanschuytbroeck & H. Synave) #8295, 1♂ in MHNG and 1♂ in MRAC.

Distribution. Rwanda; Zaire: Kivu.

Description. Length 1.35-1.45 mm; width 1.0-1.1 mm. Head blackish; pronotum, elytron and abdomen yellowish-brown; metasternum dark brown; sutural margin of elytron darkened; mouth parts and legs reddish-brown; antenna yellowish-brown, antennomeres 1-4 somewhat paler. Dorsal pubescence fairly uniform, denser on humeral area and along sutural margin of elytron. Metasternal setae shorter than those on prosternum, becoming sparser medioposteriorly and longer anteriorly. Pubescence of abdominal sternites 4-7 uniform, except for a pair of long setae near medioapical margins. Puncturation fine on anterior portion of hypomeron; median area of metasternum impunctate. Frons raised above level of vertex. Anterior frontal edge not carinate, evenly arcuate. Entire frontal impression shallow. Eye almost hemispherical, with highest point below level of vertex. Temple similar to that in Fig. 2g. Submentum weakly convex. Antenna (Fig. 48d) with patches of sensilla on antennomeres 6-10; antennomere 3 slightly asymmetrical, 4 strongly asymmetrical. Pronotal disc (Fig. 48f) deeply depressed along entire lateral edge, flat along median groove; latter deep, parallel-sided. Anterior prosternal margin not bordered by longitudinal ridges. Protrochanter without transverse ridge. Lateral portion of prepectal ridge straight. Scutellum similar to that in Fig. 2b. Elytron abruptly narrowed at base; base abruptly inclined, overhanging. Elytral disc deeply depressed along lateral edge; latter strongly convex in dorsal view; apical margin convex near suture; inner apical angle obtuse. Metasternal median ridge fine, low. Abdominal tergite 3 slightly vaulted transversally. Sternites 2 and 3 with median processes as in Fig. 2l. Sternite 4 almost flat.

Ratios: AL 1.8; EL 1.6-1.7; ET 1.6; EW 1.4; EY 2.9-3.0; GT 2.0; GW 1.6-1.7; HW 2.2-2.3; ML 1.6; MP 1.5; PT 2.2; SP 4.0-5.0; TPF 5.0.

♂. Protarsal segment 1 bearing adhesive setae. Mesofemur (Fig. 47f) as long as metafemur (Fig. 47g). Mesotibia (Fig. 47c) as long as metatibia (Fig. 47d), both with peg-like setae grouped in a field. Metatrochanter (Fig. 47g) with 2-3 peg-like setae. Peg-like setae arranged in a single row on mesotrochanter (Fig. 47f), absent from protibia. Apex of abdominal tergite 8 as in Fig. 47e, i. Sternite 8 as in Fig. 47h. Aedeagus as in Fig. 47a, b.

♀. Medioapical projection of abdominal tergite 8 as in Fig. 48b. Sternite 8 as in Fig. 48e. Genital segment as in Fig. 48a, c.

Comments. Megarthrus ovalis is characterised by presence of protarsal adhesive setae in combination with the aedeagus distinctly asymmetrical .

Megarthrus panga sp. n. (Fig, 49a-g; 50a-d)

Type material. Holotype ♂: Zaire, Kivu prov. (Albert NP) V. Mikeno, near Rweru, 2400m, 26-27.vii.1934 (G. F. de Witte) ex bamboo, #501, BMNH (mislabelled paratype of *M. apicicornis*).

Distribution. Zaire: V. Mikeno.

Description. Similar to *M. apicicornis* from which it may be distinguished as follows: Length 1.7 mm; width 1.1 mm. Elytral disc concolorous with sutural margin. Antenna as in Fig. 49d. Pronotum as in Fig. 50d. Elytron with apical contour convex near suture and inner apical angle obtuse. Metasternal median ridge fine, low. Ratios: AL 2.0; EL 1.4; ET 1.7; EW 1.3; EY 2.6-2.7; HW 2.0; SP 2.5.

♂. Protarsal segment 1 bearing adhesive setae. Mesofemur (Fig. 49f) as long as metafemur (Fig. 49g). Mesotibia (Fig. 49a) as long as metatibia (Fig. 49e), with peg-like setae arranged in a single row, and grouped in a field near apex. Peg-like setae grouped in a field on mesotrochanter (Fig. 49f), metatrochanter (Fig. 49g) and metatibia, absent from protibia. Abdominal tergite 8 (Fig. 50a, b) with subapical process projecting ventrally. Sternite 8 as in Fig. 50c. Aedeagus as in Fig. 49b, c.

♀. Unknown.

Comments. *Megarthrus panga* and *M. stylifer* may be distinguished from other species with the head widened behind the eyes (see discussion under *M. apicicornis*) by the shape of the male abdominal tergite 8. The shape of the aedeagal tip is diagnostic for each of these two species.

Megarthrus ras sp. n. (Fig. 51a-k)

Type material. Holotype ♂: Ethiopia, Gonder (= Simên) prov., Arghine, 3500m or higher, 24.xi.1952 (H. Scott) ex roots of tufted grass in ravine, BMNH (mislabelled paratype of *M. simienensis*).

Paratypes (3♂): same data as holotype, 2 in MHNG (mislabelled paratypes of *M. simienensis*); same data, but near torrent, ex peat soil, under boulders or at roots of plants, 1 in BMNH (mislabelled paratype of *M. simienensis*).

Distribution. Northern Ethiopia.

Description. Similar to *M. simienensis* from which it may be distinguished as follows: Length 1.3-1.4 mm; width 0.9-1.0 mm. Body predominantly blackish, elytron dark brown with darkened sutural margin; legs and mouth parts yellowish-brown; antenna reddish-brown, except for paler antennomeres 1-4. Frons raised above level of vertex. Anterior frontal edge indistinctly carinate; frontal impression shallow. Eye strongly convex. Submentum weakly convex. Antenna as in Fig. 51c. Pronotum as in Fig. 51h. Elytron slightly narrowed at base; apical contour convex near suture; inner apical angle obtuse. Ratios: EL 1.6; HW 1.8; ML 1.5; SP 2.5-3.0.

♂. Protarsal segment 1 bearing adhesive setae. Mesofemur (Fig. 51k) as long as metafemur (Fig. 51i). Mesotibia (Fig. 51d) shorter than metatibia (Fig. 51e), with peg-like setae arranged in a double row. Peg-like setae arranged in a single row on mesotrochanter (Fig. 51k), grouped in a field on metatrochanter (Fig. 51i) and metatibia, absent from protibia. Apex of abdominal tergite 8 as in Fig. 51f. Sternite 8 as in Fig. 51g. Aedeagus as in Fig. 51a, b.

♀. Unknown.

Comments. *Megarthrus ras* differs from similar species (see discussion under *M. negus*) by the male metatrochanter bearing peg-like setae.

Megarthrus rougemonti sp. n. (Figs 52a-h, 53a-g)

Type material. Holotype ♂: Ethiopia, Balê prov., Dinshu, 3200m, 1971 (G. de Rougemont) BMNH.

Paratypes (3): same data as holotype, 1♂, 1♀ in BMNH; Dinshu, 3200m, 14-28.xii.1971 (R. O. S. Clarke) under stones in *Juniper/Hagenia* woodland, 1♂ in MHNG.

Additional material (1♀). Ethiopia, Ârsî prov., Mt. Ch'ilalo, 3600-4000m, 21.xi.1926 (H. Scott) Box 113, in moorland, ex decaying stem of *Lobelia rhychopetalum* Hems., BMNH (paralectotype of *M. abessinus*). Possibly conspecific but the specimen differs by the 8th abdominal sternite bearing 8 long subapical setae.

Distribution. Southern Ethiopia.

Description. Similar to *M. simienensis* from which it may be distinguished as follows: Length 1.45-1.55 mm; width 0.95-1.05 mm. Head, pronotum, metasternum and abdomen blackish; elytron dark brown; sutural margin of elytron darkened; mouth parts and legs yellowish-brown; antenna reddish-brown, antennomeres 1-4 somewhat paler. Pronotal pubescence uniform. Anterior frontal edge not carinate; frontal impression shallow or indistinct. Frons on level with or slightly raised above level of vertex. Eye strongly convex. Submentum weakly convex. Antenna as in Fig. 52c. Pronotal disc (Fig. 53e) shallowly depressed along basal portion of lateral edge; median groove deep. Elytron slightly narrowed at base; not depressed along lateral edge; inner apical angle obtuse. Abdominal tergite 3 almost flat. Ratios: EL 1.5-1.6; ET 1.6-1.7; EY 2.6-2.7; HW 1.6-1.7; ML 1.4; PT 1.9; SP 3.0-3.5; TPF 3.2-3.5.

♂. Apical contour of elytron as in Fig. 53g. Protarsal segment 1 bearing adhesive setae. Mesofemur (Fig. 52f) as long as metafemur. Metatibia (Fig. 52e) longer than mesotibia (Fig. 52d), with peg-like setae arranged in a single row, and grouped in a field near apex. Peg-like setae arranged in a single row on mesotrochanter (Fig. 52f), grouped in a field on mesotibia, absent from protibia and metatrochanter. Apex of abdominal tergite 8 as in Fig. 52g. Sternite 8 as in Fig. 52h. Aedeagus as in Fig. 52a, b.

♀. Apical contour of elytron somewhat convex near suture. Medioapical projection of abdominal tergite 8 as in Fig. 53c, f. Sternite 8 as in Fig. 53b. Genital segment as in Fig. 53a, d.

Comments. Megarthrus rougemonti differs from similar species (see discussion under *M. negus*) by the short antennomere 5 in combination with the male metatrochanter lacking peg-like setae.

The species is dedicated to one of the collectors, Mr Guillaume de Rougemont.

Megarthrus scotti sp. n. (Fig. 54a-h)

Type material. Holotype ♀: Ethiopia, Gamo Gofa prov., Gughé highlands, Dita, c. 3000m, 4.xii.1948 (H. Scott) ex humus beneath *Kniphofia* plants, BMNH

Paratypes (2♀): same data as holotype, in BMNH and MHNG.

Distribution. Southern Ethiopia

Description. Similar to *M. clarkei* from which it may be distinguished as follows: Length 1.55-1.65 mm; width 1.05-1.15 mm. Frontal impression deep. Antenna as in Fig. 54a and pronotum (Fig. 54g) with median groove deep. Ratios: AL 2.0; ET 1.6; GT 2.3; PT 1.8; SP 3.3-4.0; TPF 4.0.

♀. Apical contour of elytron and inner apical angle as in Fig. 54h. Medioapical projection of abdominal tergite 8 as in Fig. 54c, e. Sternite 8 as in Fig. 54f. Genital segment as in Fig. 54b, d.

♂. Unknown.

Comments. See discussion under *M. clarkei.*

The species is dedicated to the collector, Mr Hugh Scott.

Megarthrus selenitus sp. n. (Fig. 55a-g)

Type material. Holotype ♀: Uganda, Ruwenzori Range, Toro prov., above Kilembe, 2000m, 4.v.1993 (G. Cuccodoro & D. Erne) ex moist vegetational debris near stream in patch of damaged forest, MHNG.

Distribution. Uganda: Ruwenzori Range.

Description. Similar to *M. mukankundiyeorum* from which it may be distinguished as follows: Length 1.6 mm; width 1.1 mm. Antenna as in Fig. 55a. Elytron with apical contour straight near suture and inner apical angle right-angled. Metasternal median ridge fine, low. Ratios: EW 1.15; GT 2.2; ML 1.6; PT 1.8; TPF abs.

♀. Abdominal tergite 8 (Fig. 55c, f) lacking medioapical projection, with dark tip. Sternite 8 (Fig. 55e) 2.2-2.3x as long as width of its median projection. Genital segment as in Fig. 55b, d.

♂. Unknown.

Comments. Among the species possessing a ridged prosternal margin (see comments under *M. africanus*), *M. selenitus* may be distinguished easily by the particularly elongate abdominal sternite 8.

Megarthrus simienensis Fagel (Figs 56a-g, 57a-g)

Megarthrus simienensis Fagel, 1957: 30.

Type material. Holotype ♂: Ethiopia, Gonder (= Simên) prov., E of Mindigabsa, over 3000m, 16.xi.1952 (H. Scott) ex dry soil in roots of tufted plants overhanging a stream, BMNH.

Paratypes (2♀): same data as holotype, BMNH.

Additional material (23): same data as holotype, 1♀ in MHNG; Ethiopia, Gonder (= Simên) prov., Arghine, 3500m or higher, 24.xi.1952 (H. Scott) near torrent, ex peat soil, under boulders or at roots of plants, 1♀ in BMNH (mislabelled as paratype); same data, but ex roots of tufted grass in ravine, 4♂, 10♀ in BMNH (mislabelled as paratypes), 2♂, 1♀ in MHNG and 2♀ in MRAC; near Mindigabsa, c. 3500m, 29.xii.1952 (H. Scott) 2♀ in BMNH (mislabelled as paratypes).

Distribution. Northern Ethiopia

Description. Length 1.45-1.65 mm; width 1.05-1.20 mm. Head, metasternum and abdomen blackish; pronotum and elytron dark brown; sutural margin of elytron darkened; mouth parts and legs yellowish-brown; antenna reddish-brown, antennomeres 1-4 somewhat paler. Dorsal pubescence fairly uniform, becoming somewhat denser along pronotal median groove and on humeral area of elytron. Abdomen with pubescence denser near posterior margin of tergite 7. Metasternal setae shorter than those on prosternum, becoming sparser medioposteriorly and longer anteriorly. Pubescence on abdominal sternites 4-7 uniform, except for a pair of long setae near medioapical margins. Puncturation fine on anterior portion of hypomeron; median area of metasternum impunctate. Frons raised above level of vertex. Anterior frontal edge not carinate, evenly arcuate. Entire frontal impression shallow or indistnct. Eye weakly convex, with highest point below level of vertex. Temple similar to that in Fig. 2g. Submentum almost flat. Antenna (Fig. 57c) without patches of sensilla; antennomeres 3 and 4 slightly asymmetrical. Pronotal disc (Fig. 57f) shallowly depressed along entire lateral edge, flat along median groove; latter shallow, parallel-sided. Anterior prosternal margin bordered by an irregular row of fine longitudinal ridges. Protrochanter without transverse ridge. Lateral portion of prepectal ridge straight. Scutellum similar to that in Fig. 2a. Elytron abruptly narrowed at base; base abruptly inclined, overhanging. Elytral disc slightly depressed along lateral edge; latter straight in dorsal view; apical margin somewhat sinuate near suture; inner apical angle right-angled. Metasternal median ridge fine, low. Abdominal tergite 3 slightly vaulted transversally. Sternites 2 and 3 with median processes as in Fig. 2l. Sternite 4 flat at base, then slightly vaulted transversally.

Ratios: AL 1.8; EL 1.7-1.8; ET 1.8-2.0; EW 1.2; EY 2.8-2.9; GT 2.0; GW 1.6-1.7; HW 2.0; ML 1.6; MP 1.7; PT 2.0; SP 2.5; TPF 3.3-3.4.

♂. Protarsal segment 1 bearing adhesive setae. Mesofemur (Fig. 56f) as long as metafemur. Metatibia (Fig. 56e) longer than mesotibia (Fig. 56c), with peg-like setae arranged in a double row, and grouped in a field near apex. Peg-like setae arranged in a single row on mesotrochanter (Fig. 56f), grouped in a field on mesotibia, absent from protibia and metatrochanter. Apex of abdominal tergite 8 as in Fig. 56d. Sternite 8 as in Fig. 56g. Aedeagus as in Fig. 56a, b.

♀. Medioapical projection of abdominal tergite 8 as in Fig. 57e, g. Sternite 8 as in Fig. 57d. Genital segment as in Fig. 57a, b.

Comments. Megarthrus simienensis differs from similar species (see discussion under *M. negus*) by the pattern of the metatibial peg-like setae and by the antennomere 5 which is as long as antennomere 4.

Megarthrus spinosus sp. n. (Fig. 58a-g)

Type material. Holotype ♀: Uganda, Bugisu prov., Mt. Elgon, Sipi, 1750m, 31.v.1993 (G. Cuccodoro & D. Erne) ex moist leaf litter at foot of tree in banana plantation, MHNG.

Paratypes (6♀): same data as holotype, 1 in BMNH, 3 in MHNG, 1 in MRAC and 1 in ZMHB.

Distribution. Uganda: Mt. Elgon.

Description. Similar to *M. mukankundiyeorum* from which it may be distinguished as follows: Antenna as in Fig. 58d. Pronotum as in Fig. 58g. Elytron with lateral contour somewhat concave and apical contour convex near suture. Ratios: AL 2.2; HW 1.6-1.7; TPF abs.

♀. Abdominal tergite 8 (Fig. 58b, f) lacking medioapical projection, with tip hyaline. Sternite 8 (Fig. 58e) about 1.8x as long as width of its median projection. Genital segment as in Fig. 58a, c.

♂. Unknown.

Comments. Among the species possessing a ridged prosternal margin (see comments under *M. africanus*). *M. spinosus* may be distinguished easily by the antennae which are only 2.2x as long as the pronotum.

The water loading behaviour has been recorded in this species (*Megarthrus* sp. B in Cuccodoro 1995).

Megarthrus stylifer sp. n. (Figs 59a-g, 60a-k)

Type material. Holotype ♂: Zaire, Ruwenzori Range (Albert NP) Kyandolire, river Mulaku, tributary of Kakalari, 1750m, 14.x.1952 (P. Vanschuytbroeck & J. Kekenbosch) ex humus, #1241-43, MRAC.

Paratypes (5): same data as holotype, 2♂ in MHNG and 2♂, 1♀ in MRAC.

Distribution. Zaire: Ruwenzori Range.

Description. Similar to *M. apicicornis* from which it may be distinguished as follows: Length 1.4-1.5 mm; width 0.9-1.1 mm. Eye strongly convex. Antenna as in Fig. 60d. Pronotum as in Fig. 60i. Metasternal median ridge fine, low. Ratios: AL 2.0; ET 1.5; SP 2.5; TPF 4.0.

♂. Protarsal segment 1 bearing adhesive setae. Mesofemur (Fig. 60b) shorter than metafemur (Fig. 60c). Mesotibia (Fig. 59b) shorter than metatibia (Fig. 59e). Protibia lacking peg-like setae. Mesotrochanter (Fig. 60b), mesotibia, metatrochanter (Fig. 60c) and metatibia with peg-like setae grouped in a field. Abdominal tergite 8 (Fig. 59c, f, g) with subapical process projecting ventrally. Sternite 8 as in Fig. 60a. Aedeagus as in Fig. 59a, d.

♀. Medioapical projection of abdominal tergite 8 as in Fig. 60g, k. Sternite 8 as in Fig. 60h. Genital segment as in Fig. 60e, f.

Comments. See discussion under *M. panga.*

Megarthrus twa sp. n. (Figs 61a-h, 62a-g)

Type material. Holotype ♂: Kenya, Katamayu river (= Rift Valley prov., Gatamayu river?) ix.1934 (A. F. J. Gedye) BMNH.

Paratypes (7): same data as holotype, 1♀ in BMNH and 2♂ in FMNH; Kenya, Central prov., Mt. Aberdares NP, Treetops Hotel, 17.viii.1960 (D. H. & A. C. Kistner & R. Banfill) ex sifted elephant manure, Field No. 618, 2♀ in BMNH and 1♀ in MHNG; Zaire, Kivu (Albert NP) Tshiaberimu sect., river Mbulikerere, tributary of river Kalivina, 2720m, 25.iii.1954 (P. Vanschuytbroeck & H. Synave) #8295, 1♂ in MRAC.

Distribution. Kenya: Mt. Aberdares; Zaire: Kivu.

Description. Similar to *M. zulu* from which it may be distinguished as follows: Length 1.1-1.4 mm; width 0.7-0.9 mm. Antenna (Fig. 62b) dark brown except for antennomeres 1-4 paler; antennomeres 6-8 with patches of sensilla. Pronotum as Fig. 62f and protrochanter without transverse ridge. Ratios: ET 1.7; GT 2.2; GW 1.8; ML 1.6; SP 4.5-7.0; TPF 5.0.

♂. Protarsal segment 1 bearing adhesive setae. Mesofemur (Fig. 61f) shorter than metafemur. Metatibia (Fig. 61e) longer than mesotibia (Fig. 61d), with peg-like setae arranged in a double row, and grouped in a field near apex. Peg-like setae arranged in a single row on mesotrochanter (Fig. 61f), grouped in a field on mesotibia, absent from protibia and metatrochanter. Apex of abdominal tergite 8 as in Fig. 61c, h. Aedeagus as in Fig. 61a, b.

♀. Medioapical projection of abdominal tergite 8 as in Fig. 62e, g. Sternite 8 as in Fig. 62a. Genital segment as in Fig. 62c, d.

Comments. Megarthrus twa may be distinguished by the conspicuously dark colouration of the body in combination with the presence of a particularly narrow projection of the abdominal sternite 8.

Megarthrus vanschuytbroecki sp. n. (Figs 63a-i, 64a-g)

Type material. Holotype ♂: Zaire, Ruwenzori Range (Albert NP) Kalonge, river Nyamwamba, tributary of Butahu, 2010m, 2-3.ii.1953 (P. Vanschuytbroeck & J. Kekenbosch) #2214-21, MRAC.

Paratypes (14): same data as holotype, 3♂, 1♀ in MHNG and 5♂, 2♀ in MRAC; Kalonge (Albert NP) river Katauleko, tributary of Butahu, 2060m, 28.viii.1952 (P. Vanschuytbroeck & J. Kekenbosch) ex humus, #873, 1♂ in MRAC; Kalonge (Albert NP) river Karambura, tributary of Katauleko, 2060m, 30.i.-21.ii.1953 (P. Vanschuytbroeck & J. Kekenbosch) #2225-59, 1♂ in MRAC; near Kalonge (Albert NP) Kikyo, 2180m, 30.viii.1952 (P. Vanschuytbroeck & J. Kekenbosch) #670-71, 1♂ in MRAC.

Distribution. Zaire: Ruwenzori Range.

Description. Similar to *M. apicicornis* from which it may be distinguished as follows: Length 1.5-1.8 mm; width 1.00-1.15 mm. Antenna as in Fig. 64c and pronotum as in Fig. 64g. Elytron with apical contour somewhat convex near suture and inner apical angle obtuse. Ratios: AL 2.0-2.2; EL 1.7-1.9; ET 1.6-1.8; ML 1.4; SP 2.8-3.4; TPF 4.0.

♂. Protarsomere 1 bearing adhesive setae. Mesofemur (Fig. 63e) shorter than metafemur (Fig. 63a). Mesotibia (Fig. 63g) shorter than metatibia (Fig. 63h), with peg-like setae grouped in a field. Peg-like setae arranged in a single row on mesotrochanter (Fig. 63e), arranged in a double row on metatibia, absent from protibia and metatrochanter (Fig. 63a). Abdominal tergite 8 as in Fig. 63b, f. Sternite 8 as in Fig. 63i. Aedeagus as in Fig. 63c, d.

♀. Medioapical projection of abdominal tergite 8 as in Fig. 64b, e. Sternite 8 as in Fig. 64a. Genital segment as in Fig. 64d, f.

Comments. This species is easily distinguished from other African congeners by the hook-shaped aedeagal tip. See also comments under *M. apicicornis.*

The species is dedicated to one of the collectors, Mr Paul Vanschuytbroeck.

Megarthrus watutsi sp. n. (Figs 65a-h, 66a-g)

Type material. Holotype ♂: Rwanda (Albert NP) at foot of V. Karisimbi, Lake n'Gando, 2400m, 8.iii.1935 (G. F. de Witte) #1216, BMNH (paratype of *M. apicicornis*).

Paratypes (4): same data as holotype, 1♀ in BMNH (paratype of *M. apicicornis*); same data, but 6.iii.1935 (G. F. de Witte) #1243, 1♂ in MHNG (paratype of *M. apicicornis*); at foot of V. Karisimbi (Albert NP) Ilega, 2400m, 12.iii.1935, #1315, 1♀ in MRAC (paratype of *M. apicicornis*); Mt. Tamira (Albert NP) Lake Gando, 2600m, ii-iii.1935 (G. F. de Witte) #1310, 1♀ in MHNG (mislabelled paratype of *M. apicicornis*).

Distribution. Rwanda: Mt. Tamira and V. Karisimbi.

Description. Similar to *M. apicicornis* from which it may be distinguished as follows: Length 1.5-1.6 mm; width 0.9-1.1 mm. Pronotum and elytron brown or dark brown; head, metasternum and abdomen darker; sutural margin of elytron darkened; mouth parts and legs yellowish-brown; antenna reddish-brown, antennomere 11 paler. Frons raised above level of vertex. Frontal impression shallow. Antenna as in Fig. 66d. Pronotum as in Fig. 66e. Metasternal median ridge fine or absent. Ratios: AL 2.0; EL 1.5; ET 1.8-1.9; TPF 5.0-6.7.

♂. Apical contour of elytron somewhat convex near suture; inner apical angle obtuse. Protarsal segment 1 bearing adhesive setae. Mesofemur (Fig. 65g) as long as metafemur (Fig. 65h). Mesotibia (Fig. 65e) shorter than metatibia (Fig. 65d), with peg-like setae arranged in a double row, and grouped in a field near apex. Peg-like setae grouped in a field on metatrochanter (Fig. 65h), mesotrochanter (Fig. 65g) and metatibia; absent from protibia. Apex of abdominal tergite 8 as in Fig. 65f. Sternite 8 as in Fig. 65a. Aedeagus as in Fig. 65b, c.

♀. Apical contour of elytron somewhat sinuate near suture; inner apical angle right-angled. Medioapical projection of abdominal tergite 8 as in Fig. 66b, g. Sternite 8 as in Fig. 66f. Genital segment as in Fig. 66a, c.

Comments. Megarthrus watutsi is one of the species with head widened behind the eyes (see discussions under *M. apicicornis* and *M. congoensis*). It is distinguished by the male sexual characters, notably abdominal tergite 8 lacking a ventral process, broad aedeagal tip and shape of the mesotibia.

Megarthrus wittei Cameron (Figs 67a-h, 68a-f)

Megarthrus wittei CAMERON, 1950: 5.

Type material. Holotype ♂: Zaire, Kivu prov. (Albert NP) Sake, 1960m, 19-22.ii.1934 (G. F. de Witte) #253, MRAC.

Paratypes (2): Zaire, Kivu prov. (Albert NP) Kabasha, Kanyabayongo, 1760m, 7.xii.1934 (G. F. de Witte) #877, 1♂, 1♀ in BMNH.

Additional material (2): Cameroon, Bamenda distr., Bamenda, 25.i.1957 (V. F. Eastop) 1♂ in MHNG; Kenya, Rift Valley prov., Molo, 13-15.x.1954 (V. F. Eastop) 4♂, 5♀ in BMNH and 1♂, 1♀ in MHNG; Zaire, Oriental prov., Nizi, Blukwa, 23.xii.1928 (A. Collart) 1♀ in BMNH.

Distribution. Cameroon: Mt. Bambouto; Kenya: Rift Valley prov.; Zaire: Kivu.

Description. Length 1.2-1.3 mm; width 0.8-1.0 mm. Head blackish; metasternum and abdomen dark brown; pronotal disc and entire elytron reddish-brown; mouth parts and legs reddish-brown; antenna entirely yellowish. Dorsal pubescence fairly uniform, denser on humeral area of elytron, shortened on abdomen. Metasternal setae shorter than those on prosternum, becoming sparser medioposteriorly and longer anteriorly. Pubescence of abdominal sternites 4-7 uniform, except for a pair of long setae near medioapical margins. Puncturation fine on anterior portion of hypomeron; median area of metasternum impunctate. Frons on level with vertex. Anterior frontal edge not carinate, evenly arcuate. Frontal impression shallow in middle and indistinct laterally. Eye almost hemispherical, with highest point below level of vertex. Temple similar to that in Fig. 2h. Submentum weakly convex. Antenna (Fig. 68c) without patches of sensilla; antennomeres 3 and 4 slightly asymmetrical. Pronotal disc (Fig. 68e) shallowly depressed along basal portion of lateral edge and along median groove; latter deep, parallel-sided. Anterior prosternal margin bordered with an irregular row of fine longitudinal ridges. Protrochanter without transverse ridge. Lateral portion of prepectal ridge straight. Scutellum similar to that in Fig. 2b. Elytron abruptly narrowed at base; base gradually inclined, overhanging. Elytral disc shallowly depressed along lateral edge; latter straight in dorsal view; apical margin convex near suture; inner apical angle obtuse. Metasternal median ridge fine, low. Abdominal tergite 3 slightly vaulted transversally. Sternites 2 and 3 with median processes as in Fig. 2l. Sternite 4 flat at base, then slightly vaulted transversally.

Ratios: AL 2.0; EL 1.5; ET 1.6; EW 1.2; EY 2.9-3.0; GT 2.0; GW 2.0; HW 2.0; ML 1.5; MP 1.7; PT 2.1; SP 2.5; TPF 10.0.

♂. Protarsal segment 1 bearing adhesive setae. Mesofemur (Fig. 67f) longer than metafemur (Fig. 67h). Metatibia (Fig. 67d) as long as mesotibia (Fig. 67c), with peg-like setae arranged in a single row, and grouped in a field near apex. Metatrochanter (Fig. 67h) with 1-3 peg-like setae. Peg-like setae arranged in a double row on mesotrochanter (Fig. 67f), grouped in a field on mesotibia, absent from protibia. Apex of abdominal tergite 8 as in Fig. 67g. Sternite 8 as in Fig. 67a. Aedeagus as in Fig. 67b, e.

♀. Medioapical projection of abdominal tergite 8 as in Fig. 68f. Sternite 8 as in Fig. 68d. Genital segment as in Fig. 68a, b.

Comments. See discussion under *M. falasha.*

Megarthrus zulu sp. n. (Figs 69a-h, 70a-g)

Type material. Holotype ♂: Republic of South Africa, Cape prov. S, Marathon <34°02'S; 23°19'E> 9.xii.1976 (S. Endrödy-Younga) ex cattle and horse dung, E-Y:1306, TMSA.

Paratypes (411): same data as holotype, 1♂, 1♀ in MHNG and 2♂, 1♀ in TMSA; Republic of South Africa, Cape prov. S, Harkeville Forest <34°04'S; 23°10'E> 7.xii.1976 (S. Endrödy-Younga) ex elephant dung, E-Y:1300, 4♂, 4♀ in MHNG and 12♂, 4♀ in TMSA; same data, but 13.xii.1976, groundtrap with meat bait, E-Y:1311, 1♂ in MHNG and 1♂ in TMSA; Keurboomstrand <34°00'S; 23°27'E> 8.xii.1976 (S. Endrödy-Younga) groundtraps, 8 days, E-Y:1301, 1♂ in TMSA; Cape prov. E, Katberg, 1300m, 1-15.i.1933 (R. E. Turner) 1♀ in BMNH; Cape prov., Amatole, Isidenge For. St. <32°41'S; 27°15'E> 1.xii.1986 (S. Endrödy-Younga) beating in forest, E-Y:2337, 1♂ in TMSA; same data, but 19.xi.1987, ex horse dung, E-Y:2527, 3♂, 3♀ in MHNG, 1♂, 1♀ in MRAC and 17♂, 11♀ in TMSA; same data, but ex *Quercus* forest litter, E-Y:2517, 1♂, 3♀ in TMSA; same data, but Isidenge For. St. B1 <32°41'S; 27°14'E> 15.xi.1987, ex *Pinus* bark, E-Y:2516, 1♂, 1♀ in TMSA; George, Kranshoek, 23.xii.1981 (S. Peck) ex forest litter under carrion, FMHD #81-728, 1♂ in MHNG and 2♂, 1♀ in FMNH; George, Gouna, 23.xii.1981 (S. Peck) ex forest log litter, berlese, FMHD #81-729, 2♀ in FMNH; George, Saasveld, 26.xii.1981 (S. Peck) ex forest litter under carrion bait, berlese, FMHD #81-731, 1♀, FMNH; Groenkop <33°57'S; 22°33'E> i.1985 (J. Koen) 1♂ in TMSA; Knysna, Buffelsnek, 25.xii.1981 (S. Peck) ex forest litter under bait trap, berlese, FMHD #81-633, 2♂, 2♀ in FMNH and 2♂, 1♀ in MHNG; same data, but 800m (S. & J. Peck) ex forest litter under carrion baits, fynbos. #81-187b, 5♂, 3♀ in FMNH; Knysna, Diepwalle, 450m, 12-30.xii.1981 (S. & J. Peck) ex mixed *Podocarpus* forest, window-malaise trap, 2♂, 2♀ in FMNH and 1♂, 1♀ in MHNG; same data, but (S. Peck) ex forest, malaise trough, FMHD #81-711, 1♂, 2♀ in FMNH and 1♂, 2♀ in MHNG; same data, but 12.xii.1981, ex elephant dung, berlese, FMHD #81-603, 30♂, 20♀ in FMNH, 4♂, 4♀ in MHNG and 1♂, 1♀ in MRAC; same data, but 23.xii.1981, ex forest litter, berlese, FMHD #81-629, 2♂, 2♀ in MHNG and 2♂, 3♀ in FMNH; same data, but 17.xii.1981, ex forest fungi litter, berlese, FMHD #81-721, 1♀ in FMNH; Plettenberg Bay Natures Vly., 29.xii.1981 (S. Peck) ex forest litter under dung, berlese, FMHD #81-641, 3♂, 1♀ in FMNH and 2♂, 1♀ in MHNG; Stormsrivier, Goesabos, 15-30.xii.1981 (S. Peck) ex forest, malaise trough, FMHD #81-704, 1♀ in FMNH; Natal prov. Middland, Doring Clark Nat. Res. <29°34'S; 30°17'E> 11.xii.1989 (S. Endrödy-Younga & J. Klimaszewski) ex river bank in forest, E-Y:2759, 1♂ in TMSA; Karkloof for. <29°18'S; 30°13'E> 11.xii.1989 (S. Endrödy-Younga & J. Klimaszewski) ex horse dung, E-Y:2762, 1♀ in TMSA; Northington <29°28'S; 30°01'E> 1420m, 12.xii.1989 (S. Endrödy-Younga & J. Klimaszewski) ex sifted forest litter, E-Y:2764, 2♂, 2♀ in MHNG and 3♂, 5♀ in TMSA; Natal prov., 75km WSW Estcourt, Cathedral Pks. For. Sta., 1400m, 26.xii.1979 (S. & J. Peck) ex *Eucalyptus* logs, frass, fungi and decaying bark, Ber 22, 1♀ in FMNH; same data, but berlese residue, FMHD 79-189, 1♂ in FMNH; same data, but 7-31.xii.1979, 4♂, 17♀ in FMNH and 3♂, 3♀ in MHNG; same data, but 2000m, 20.xii.1979 (S. & J. Peck) ex rotted *Boletus* litter in pine plantation, Ber 14, 1♂ in CNCI, 25♂, 34♀ in FMNH and 1♂, 1♀ in MHNG; same data, but B #14, FMHD #79-195, 1♂ in FMNH; same data, but berlese residue, FMHD #79-195, 7♂, 11♀ in FMNH, 2♂, 2♀ in MHNG and 1♂, 1♀ in MRAC; same data, but 1500m, 19.xii.1979, ex rotted *Boletus* bait station in podocarp forest, Ber 11, 12♂, 12♀ in FMNH and 2♂, 2♀ in MHNG; same data, but 31.xii.1979, ex podocarp forest, mini-carrion bait traps, Ber 32, 1♂ in FMNH; same data, but ex rotted *Boletus* bait, 3♂, 7♀ in SEMC; same data, but Catchment 2, 1760m, 21-31.xii.1979, ex stream side shrubs, malaise trap, 1♂, 1♀ in FMNH; same data, but Rainbow Gorge, 2000m, 8-31.xii.1979, ex Podocarp forest, malaise through, 1♂, 1♀ in FMNH; Weza Forest Station <30°36'S; 29°45'E> 22.xi.1989 (S. Endrödy-Younga & J. Klimaszewski) ex horse dung, E-Y:2711, 1♂, 2♀ in TMSA; Pietermaritzburg, Fort Napier, 1919, #127, eig. Nr. 36,1926, 1♀ in FMNH; Weza, Bangeni forest <30°38'S; 29°39'E> 21.xi.1989 (S. Endrödy-Younga & J. Klimaszewski) ex sifted forest litter, E-Y:2706, 1♂, in MHNG and 2♂ in TMSA; Weza, Ingeni forest <30°32'S; 29°41'E> 18.xi.1989 (S. Endrödy-Younga & J. Klimaszewski) ex forest floor litter, E-Y:2689, 1♀ in TMSA; same data, but ex bushbuck excrement, E-Y:2690, 1♂ in MHNG and 1♂, 1♀ in TMSA; same data, but 23.xi.1989, ex sifted grass in forest, E-Y:2714, 1♂ in TMSA; Weza, lower Stinkwood for. <30°34'S; 29°43'E> 17.xi.1989 (S. Endrödy-Younga & J. Klimaszewski) ex sifted forest litter, E-Y:2686, 1♂ in TMSA; Transkei prov., Port St. Johns, Pondoland, 10-31.vii.1923 (R. E. Turner) 1♂ in BMNH; Transvaal prov. E, Berlin For. St. <25°33'S; 30°44'E> 9.xii.1986 (S. Endrödy-Younga) ex horse dung, E-Y:2370, 1♂ in MHNG and 2♂ in TMSA; same data, but gorge <25°32'S; 30°44'E> 21.ix.1986, groundtraps, 32 days, E-Y:2281, 1♀ in MHNG and 1♂, 2♀ in TMSA; same data, but 23.x.1986, groundtraps, 42 days, E-Y:2303, 1♂ in TMSA; same data, but gorge-edge <25°32'S; 30°44'E> 5.ii.1987, ex mule dung, E-Y:2418, 1♂ in TMSA; same data, but Sinkhole <25°31'S; 30°46'E> 20.ix.1986 (S. Endrödy-Younga) groundtraps, 33 days, E-Y:2276, 1♂, 1♀ in TMSA; same data, but 23.x.1986, groundtraps, 42 days, E-Y:2300, 1♂ in MHNG and 2♂, 1♀ in TMSA; Blyderiver Canyon <24°35'S; 30°49'E> 5.v.1981 (S. Endrödy-Younga) groundtraps with faeces bait, 5 days, E-Y:1781, 1♂ in MHNG and 1♂ in TMSA; 30km W Trichardtsdal, 23-30.xii.1985 (S. Peck) downs podocarp forest, carrion trap, P#85-307, FMHD #85-874, 1♀ in FMNH; Pilgrims rest, 19-31.xii.1985 (S. Peck) ex relict nature forest dung trap, P#85-293, FMHD #85-860, 1♂, 2♀ in FMNH and 1♂, 1♀ in MHNG; Transvaal prov., Pietersburg dist., Helmekaar river, 23-30.ix.1961 (N. Leleup) ex humus, 1♀ in TMSA; Uitsoek, Grootkloof ind. forets <25°15'S; 30°33'E> 15.xii.1986 (S. Endrödy-Younga) groundtraps, 53 days, E-Y:2391, 1♂ in TMSA; same data, but 17.xii.1986, ex forest litter after rain, E-Y:2396, 1♂ in TMSA; Lesotho E, Sani Pass Valley, Drakensberg <29°39'S; 29°12'E> 8.iii.1976 (S. Endrödy-Younga & Breytenb.) ex dung collection, E-Y:1054, 2♂ in MHNG and 2♂, 2♀ in TMSA; same data, but (S. Endrödy-Younga) ex horse and cattle dung, E-Y:1054, 1♀ in MHNG and 1♀ in TMSA; Drakensberg, Vann Reenen <28°22'S; 29°23'E> xi.1926 (R. E. Turner) 1♂ in BMNH.

Distribution. Lesotho; Republic of South Africa.

Description. Length 0.9-1.3 mm; width 0.6-0.8 mm. Body usually entirely dark brown or blackish, with paler legs and mouth parts; pronotum and elytral disc sometimes paler. Dorsal pubescence fairly uniform, sparser on elytron, becoming denser near apical margin of abdominal tergite 7. Metasternal setae uniform, shorter than those on prosternum. Pubescence of abdominal sternites 4-7 uniform, except for a pair of long setae near medioapical margins. Puncturation fine on anterior portion of hypomeron; median area of metasternum impunctate. Frons slightly raised above level of vertex. Anterior frontal edge not carinate, evenly arcuate. Entire frontal impression shallow or indistinct. Eye strongly convex, with highest point below level of vertex. Temple similar to that in Fig. 2g. Submentum weakly convex. Antenna (Fig. 70a) without patches of sensilla; antennomere 3 slightly asymmetrical, 4 strongly asymmetrical. Pronotal disc (Fig. 70f) flat along lateral edge, deeply depressed along median groove latter deep, parallel-sided. Anterior prosternal margin not bordered by longitudinal ridges. Protrochanter with transverse ridge. Lateral portion of prepectal ridge straight. Scutellum similar to that in Fig. 2b. Elytron slightly narrowed at base; base abruptly inclined, overhanging. Elytral disc flat along lateral edge; latter straight in dorsal view; apical margin straight or convex near suture; inner apical angle obtuse. Metasternal median ridge fine, low. Abdominal tergite 3 slightly vaulted transversally. Sternites 2 and 3 with median processes as in Fig. 2l. Sternite 4 flat at base, then slightly vaulted transversally.

Ratios: AL 1.7; EL 1.5-1.6; ET 1.55-1.65; EW 1.2; EY 2.5; GT 2.1; GW 1.6-1.7; HW 1.6-1.7; ML 1.4; MP 1.7; PT 1.8-1.9; SP♂ 2.5-3.0; SP♀ 3.3-3.5; TPF 6.5-10.0.

♂. Protarsal segment 1 bearing adhesive setae. Mesofemur (Fig. 69f) longer than metafemur (Fig. 69d). Mesotibia (Fig. 69c) as long as metatibia (Fig. 69e), with peg-like setae arranged in a double row, and grouped in a field near apex. Peg-like setae arranged in a single row on mesotrochanter (Fig. 69f), metatrochanter (Fig. 69d) and metatibia; absent from protibia. Apex of abdominal tergite 8 as in Fig. 69h. Sternite 8 as in Fig. 69g. Aedeagus as in Fig. 69a, b.

♀. Medioapical projection of abdominal tergite 8 as in Fig. 70e, g. Sternite 8 as in Fig. 70d. Genital segment as in Fig. 70b, c.

Comments. See discussion under *M. nanus*.

DISCUSSION

The Afrotropical *Megarthrus* occur in three geographically separated areas (Fig. 1). Equatorial East Africa, especially the mountainous areas near Lake Victoria, has 27 species (71%). A second area with relatively high species diversity (9 species) is in Ethiopia. None of the latter species has been found outside of Ethiopia and none of the former occurs in Ethiopia. With two species from Cameroon and one species in the Republic of South Africa, the genus is depauperate in West and South Africa. The genus has not been found so far in Madagascar and Mascarene Islands.

The altitudinal records indicate highest diversity of the Equatorial East African *Megarthrus* between 1700-2700m (19 species); two species are present only above 2900m and three species at 900m; none below 900m. The Ethiopian species appear to be confined to higher altitudes, between 2700-4000m. The single South African species, *M. zulu*, has been found between 400-2000m.

ACKNOWLEDGMENTS

The present paper is part of a joint project between the Muséum d'histoire naturelle, Geneva and the Natural History Museum, London, funded by the Swiss National Science Foundation (Project no. 31-32331.91, awarded to I. Löbl, D. Burckhardt, MHNG, and P. M. Hammond, BMNH). The following colleagues have provided specimens for the present study: H. M. André, MRAC; J. S. Ashe, SEMC; S. Endrödy-Younga, TMSA; A. F. Newton Jr., FMNH; A. Smetana, CNCI; M. Uhlig, ZMHB. Mrs D. Cuccodoro assisted with the inking of drawings, and D. Erne, Geneva, made the field work in Uganda more pleasant. The field work in Uganda was supported by a travelling grant of the "Académie suisse des sciences naturelles".

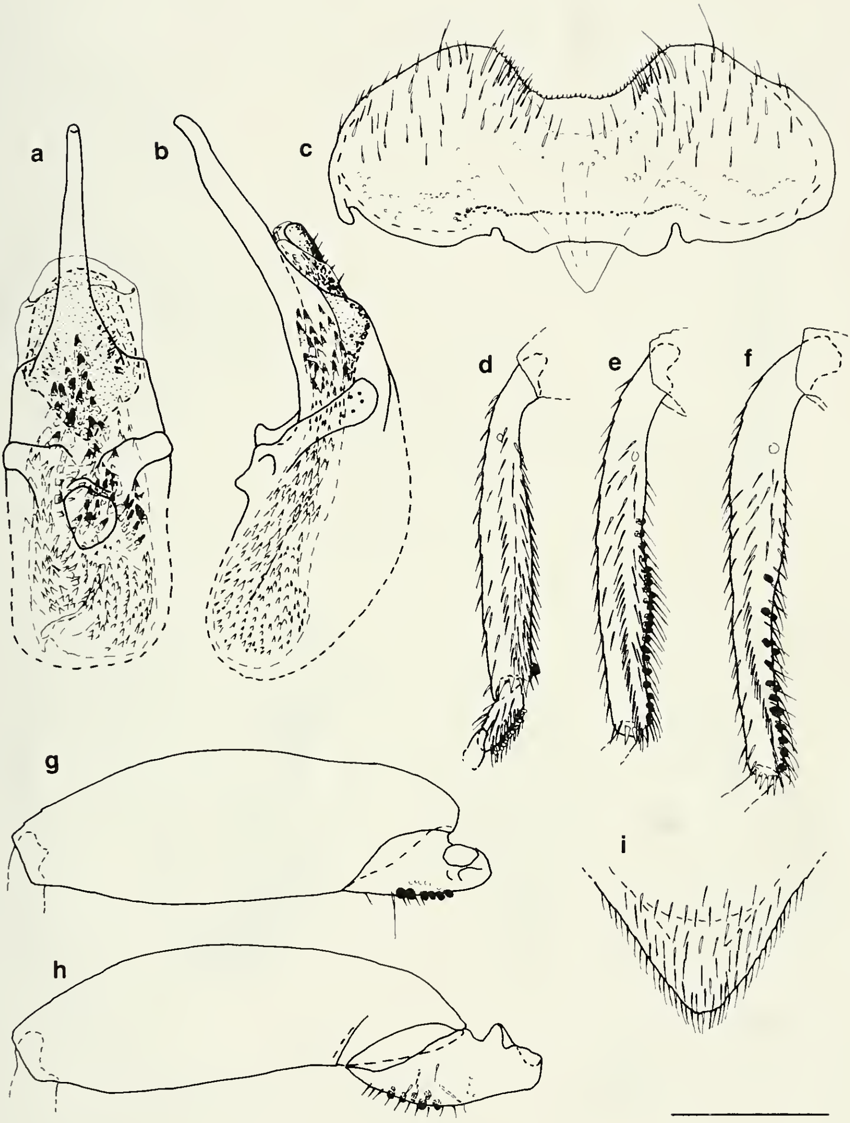


FIG. 3

Megarthrus abessinus, male; a, b: aedeagus, ventral and lateral; c: abdominal sternite 8; d: protibia and protarsomere 1; e: mesotibia; f: metatibia; g: mesofemur and mesotrochanter; h: metafemur and metatrochanter; i: apex of abdominal tergite 8, dorsal. Scale bar = 0.2 mm.

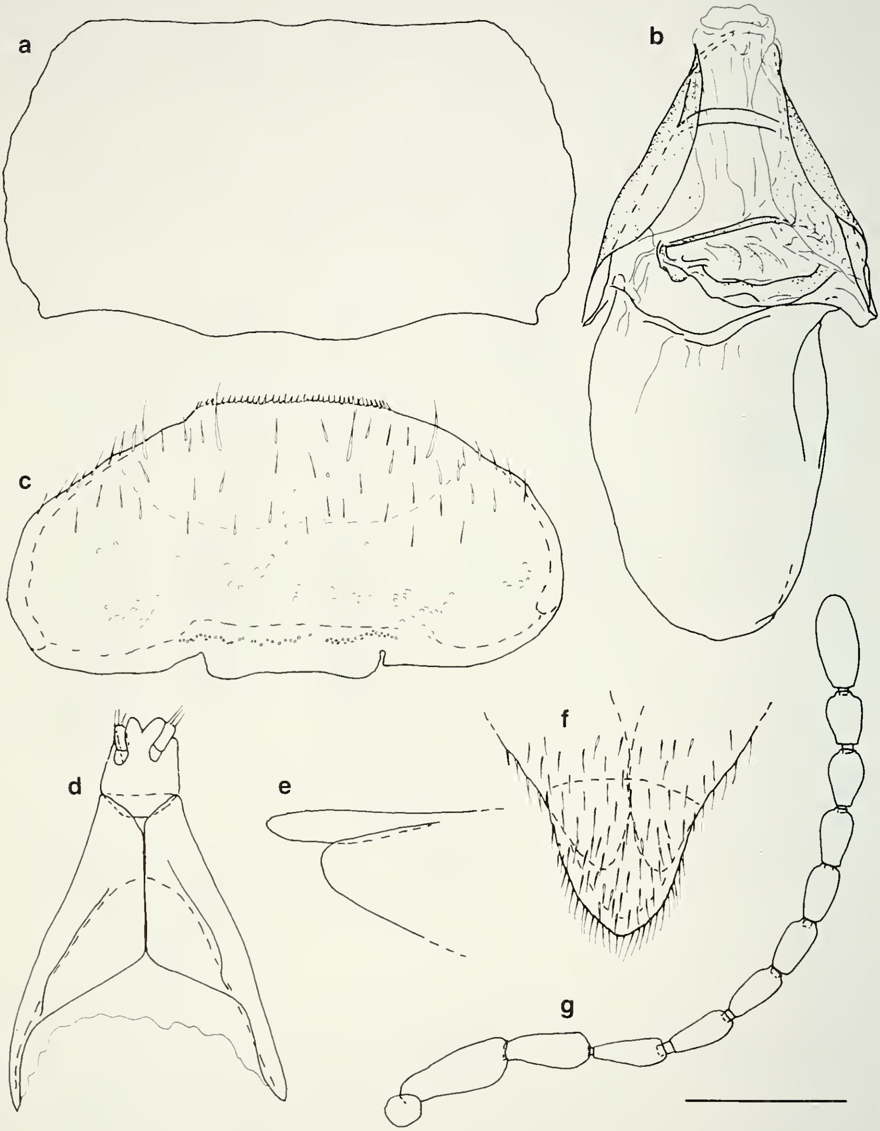


FIG. 4

Megarthrus abessinus; a: pronotum: b, d: female, genital segment, tergites (b) and sternites (d); c: female, abdominal sternite 8; e, f: female, apex of abdominal tergite 8, lateral and dorsal; g: antenna. Scale bar = 0.2 mm.

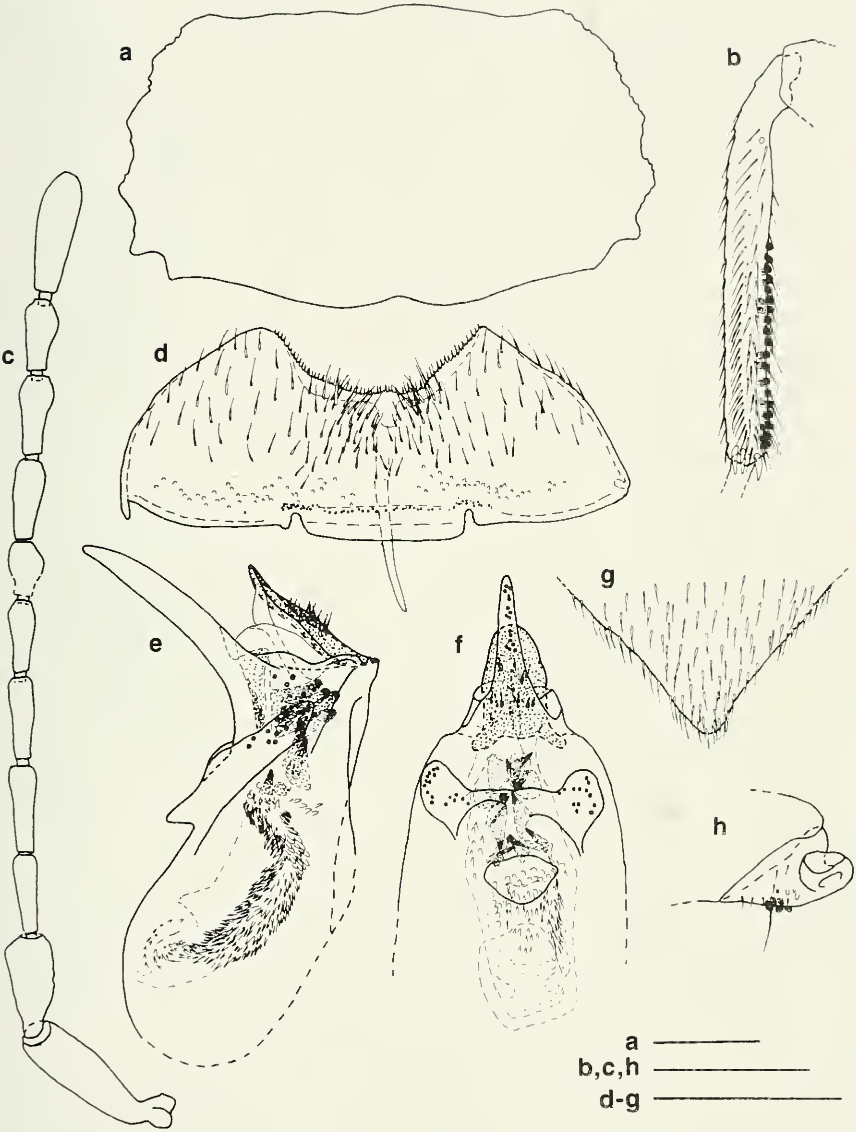


FIG. 5

Megarthrus africanus; a: pronotum; b: male, mesotibia; c: antenna (antennomere 7 deformed); d: male, abdominal sternite 8; e, f: aedeagus, ventral and lateral; g: male, apex of abdominal tergite 8, dorsal; h: male, mesotrochanter. Scale bars = 0.2 mm.

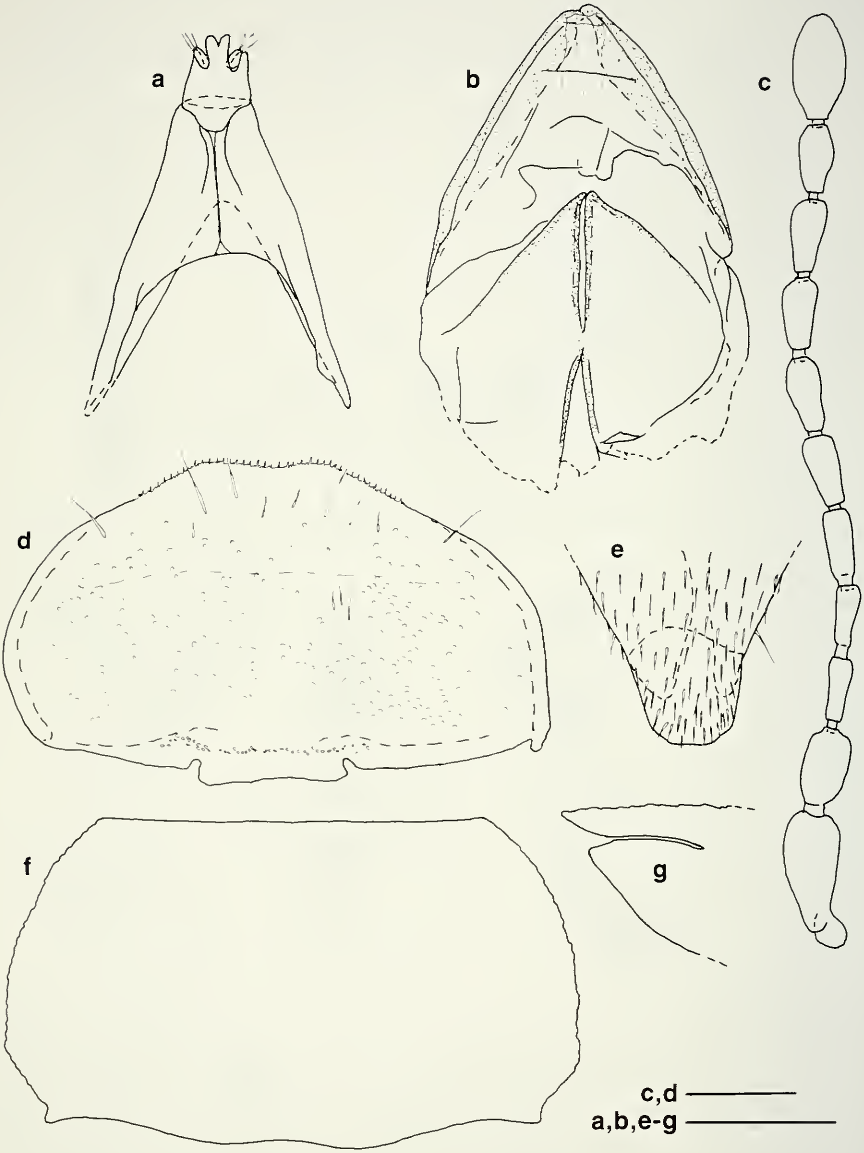


FIG. 6

Megarthrus apicicornis; a, b: female, genital segment, sternites (a) dorsal and tergites (b); c: antenna; d: female, abdominal sternite 8; e, g: female, apex of abdominal tergite 8, dorsal and lateral; f: pronotum. Scale bars = 0.2 mm.

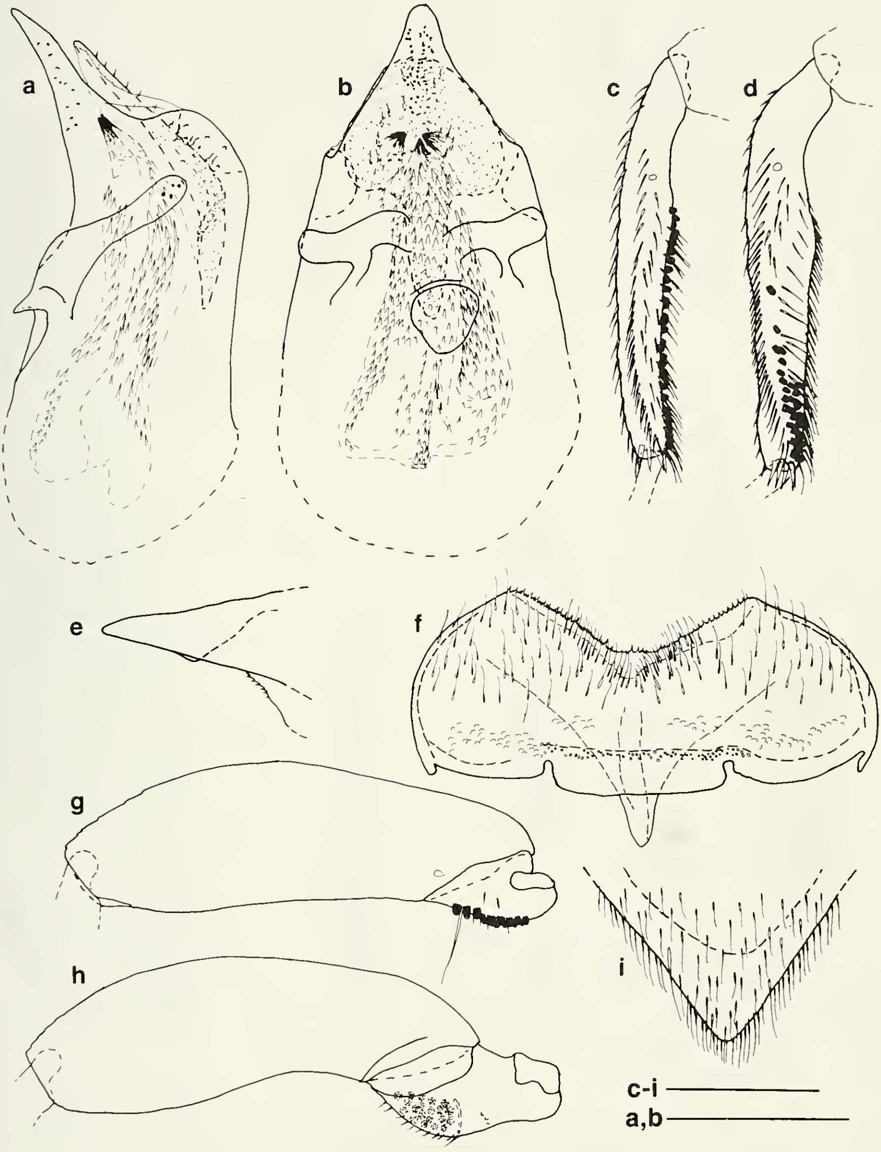


FIG. 7

Megarthrus bantu, male; a, b: aedeagus, lateral and ventral; c: mesotibia; d: metatibia; e, i: apex of abdominal tergite 8, lateral and dorsal; f: abdominal sternite 8; g: mesofemur and mesotrochanter; h: metafemur and metatrochanter. Scale bars = 0.2 mm.

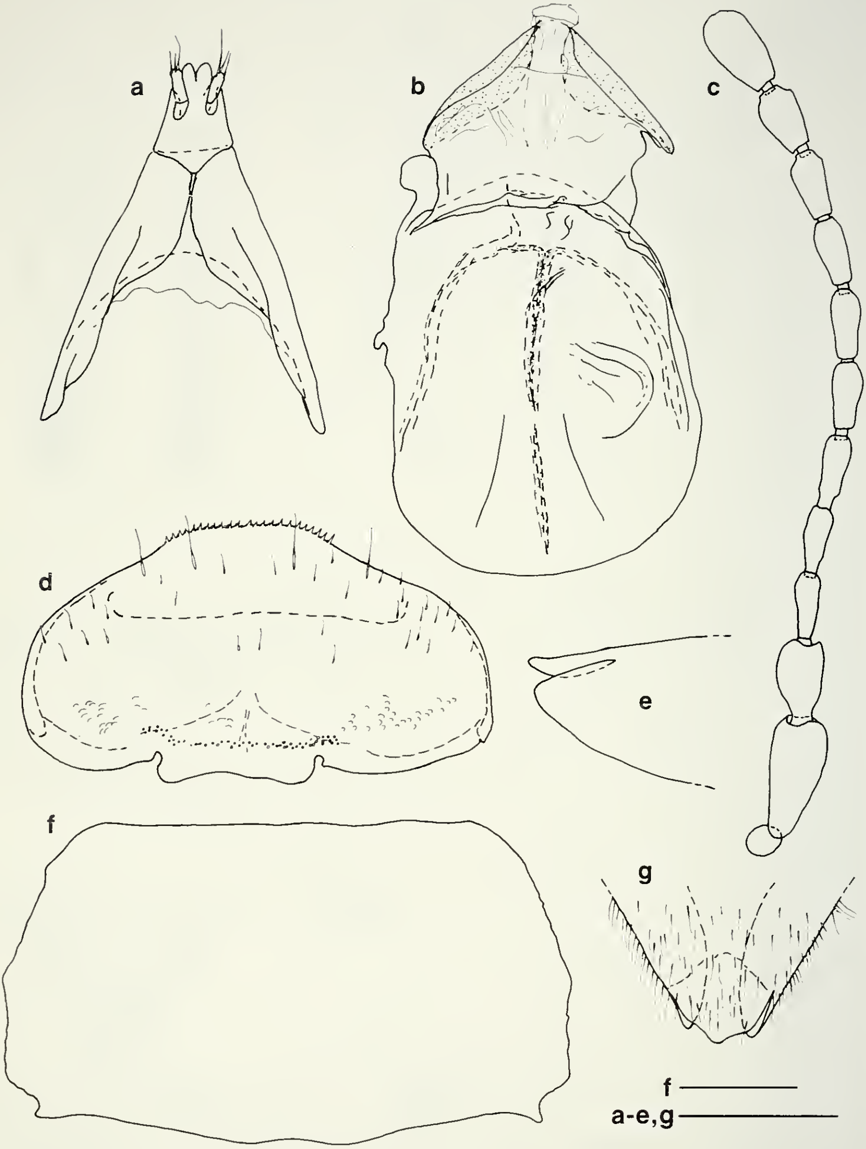


FIG. 8

Megarthrus bantu; a, b: female, genital segment, sternites (a) and tergites (b); c: antenna; d: female, abdominal sternite 8; e, g: female, apex of abdominal tergite 8, lateral and dorsal; f: pronotum. Scale bars = 0.2 mm.

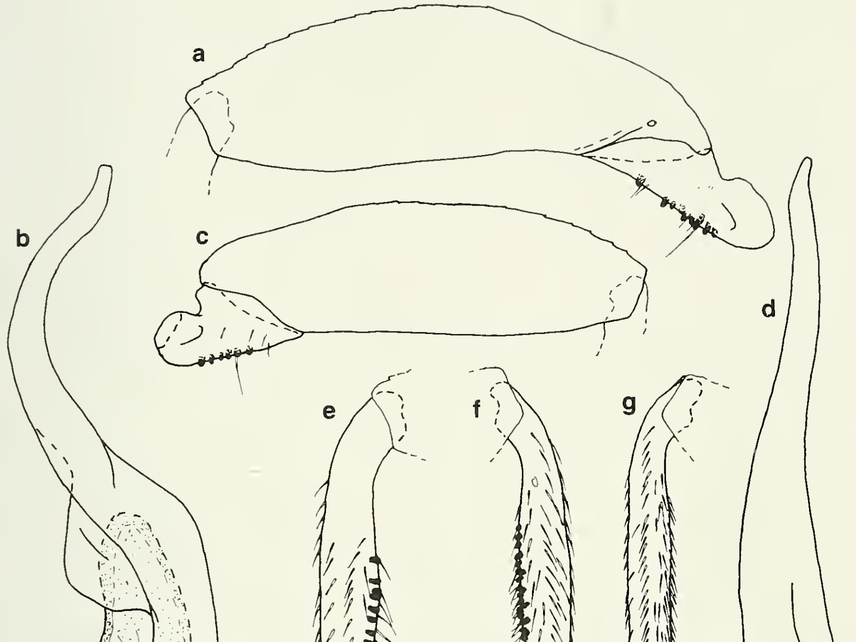


FIG. 9

Megarthrus basilewskyi, male; a: metafemur and metatrochanter; b, d: aedeagus, ventral and lateral; c: mesofemur and mesotrochanter; e: metatibia; f: mesotibia; g: protibia. Scale bar = 0.2 mm.

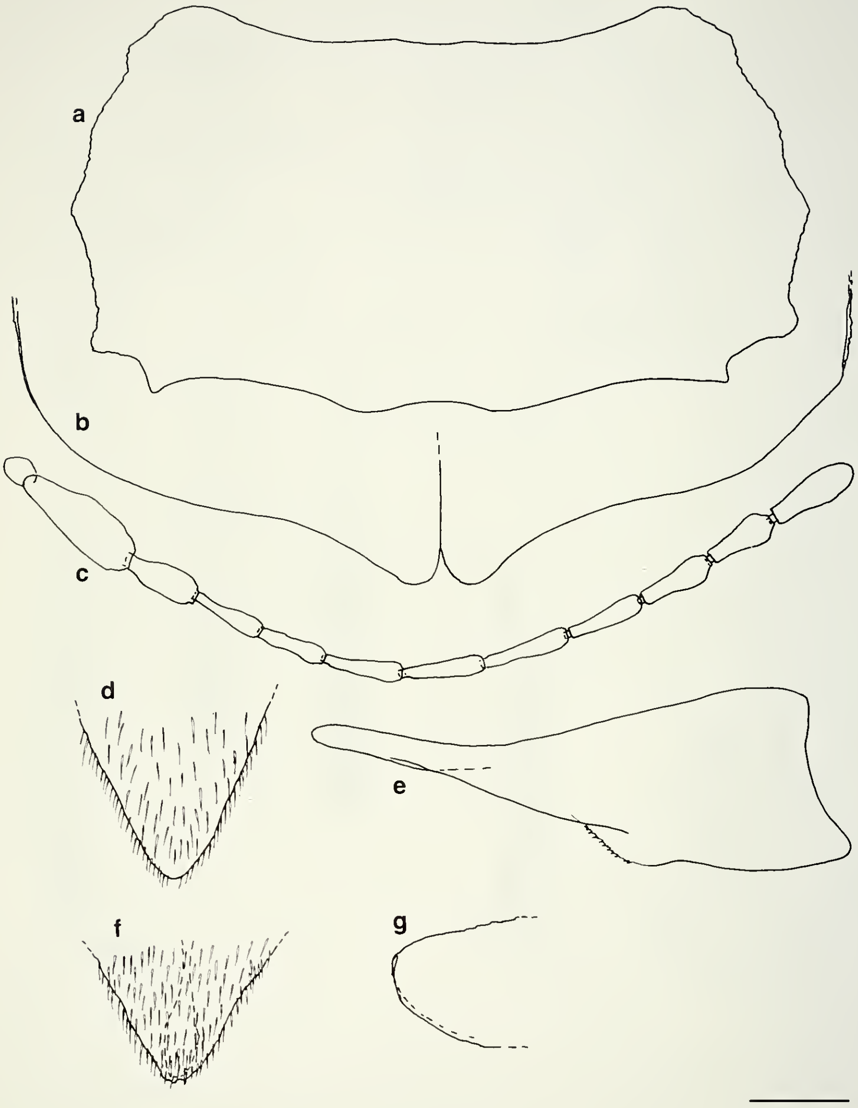


FIG. 10

Megarthrus basilewskyi; a: pronotum; b: female, apical contour of elytra; c: antenna; d, e: male, abdominal tergite 8, entire (e) lateral and apex (d) dorsal; f, g: female, abdominal tergite 8, dorsal and lateral. Scale bar = 0.2 mm.

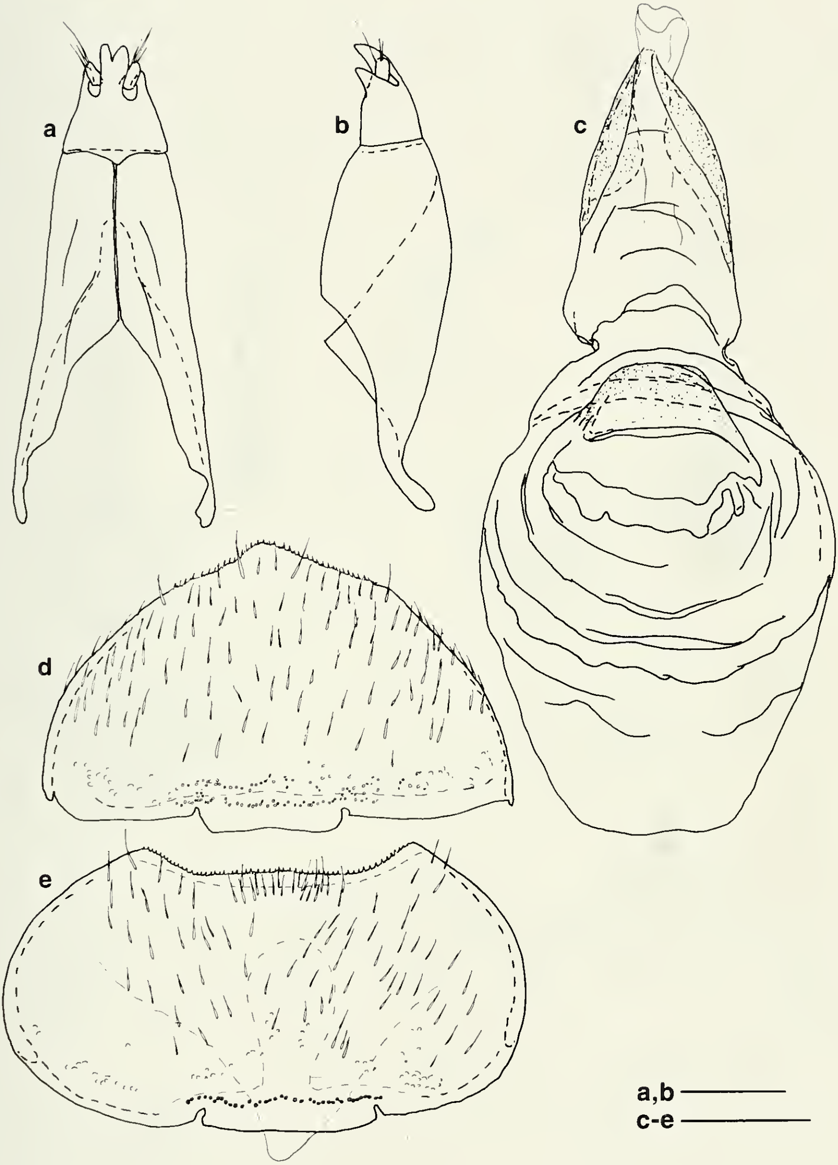


FIG. 11

Megarthrus basilewskyi; a-c: female, genital segment, sternites (a) dorsal, (b) lateral and tergites (c); d, e: abdominal sternite 8, female and male. Scale bars = 0.2 mm.

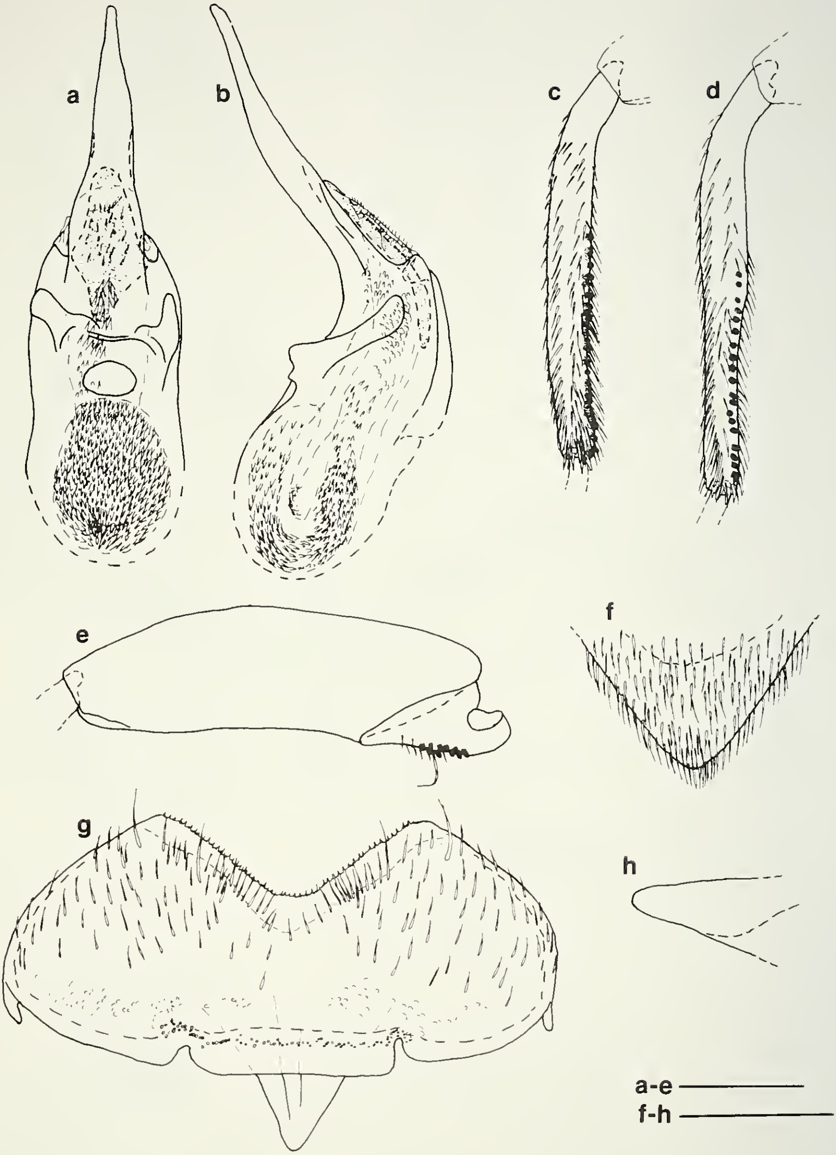


FIG. 12

Megarthrus clarkei, male; a, b: aedeagus, ventral and lateral; c: mesotibia; d: metatibia; e: mesofemur and mesotrochanter; f, h: apex of abdominal tergite 8, dorsal and lateral; g: abdominal sternite 8. Scale bars = 0.2 mm.

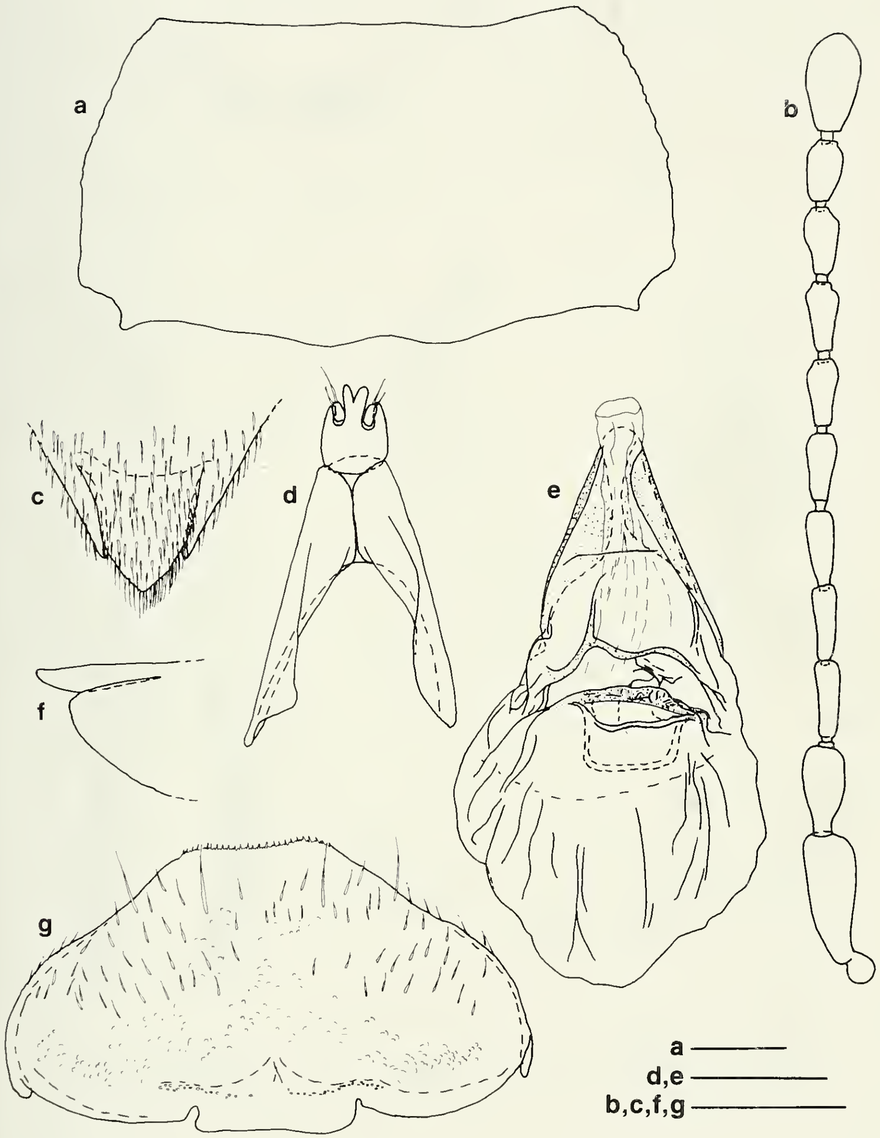


FIG. 13

Megarthrus clarkei; a: pronotum; b: antenna; c, f: female, apex of abdominal tergite 8, dorsal and lateral; d, e: female, genital segment, sternites (d) and tergites (e); g: female, abdominal sternite 8. Scale bars = 0.2 mm.

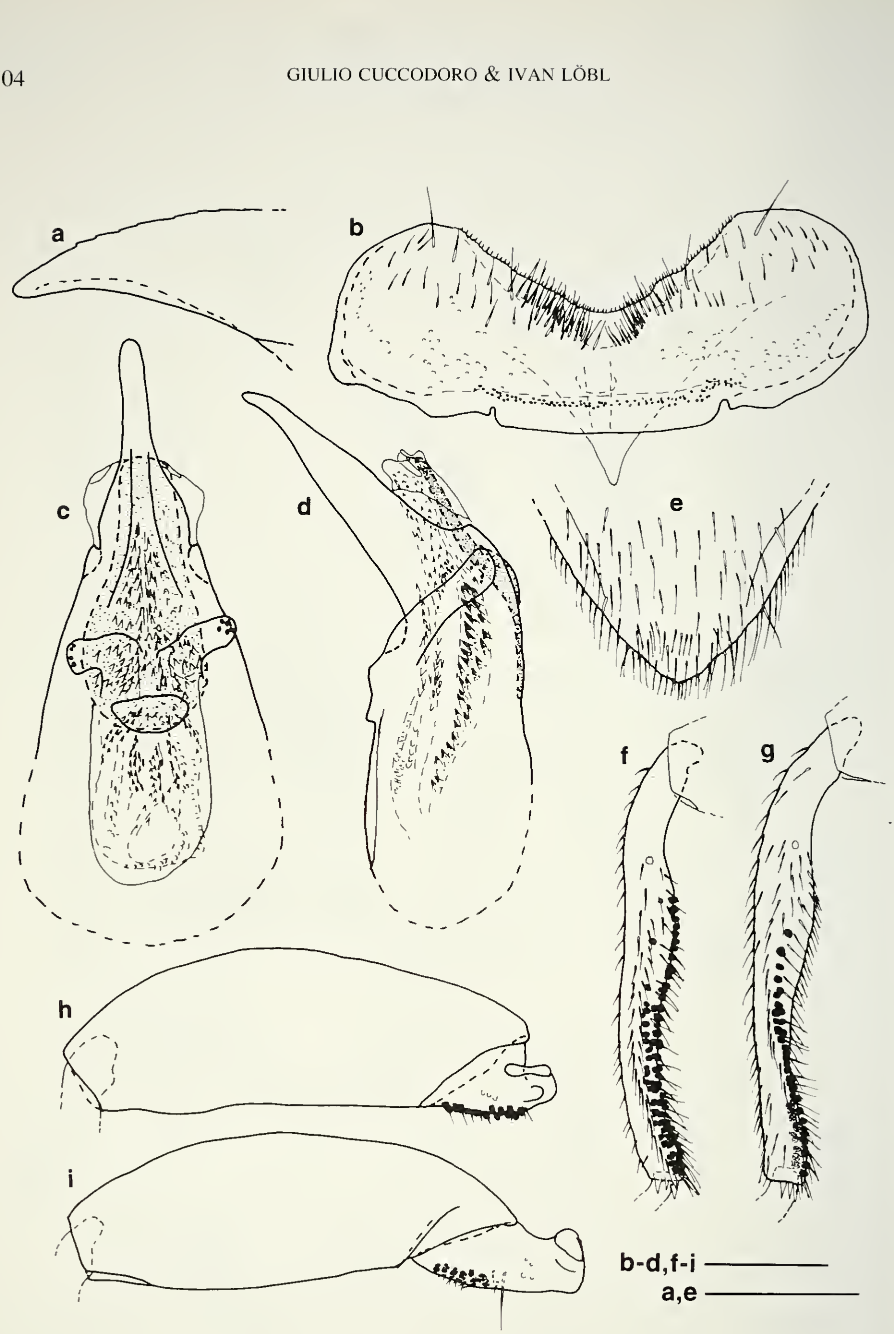


FIG. 14

Megarthrus congoensis, male; a-e: apex of abdominal tergite 8, lateral and dorsal; b: abdominal sternite 8; c, d: aedeagus, ventral and lateral; f: mesotibia; g: metatibia; h: mesofemur and mesotrochanter; i: metafemur and metatrochanter. Scale bars = 0.2 mm.

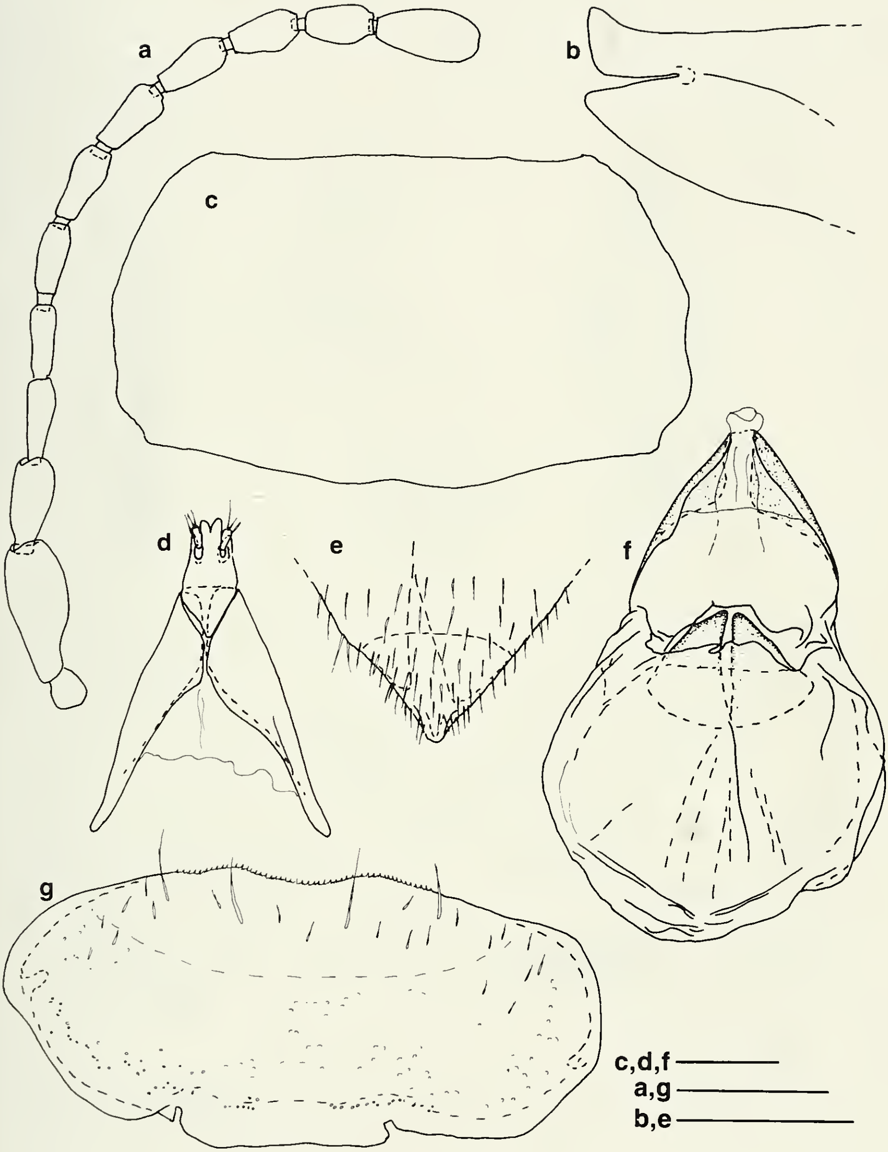


FIG. 15

Megarthrus congoensis; a: antenna; b, e: female, apex of abdominal tergite 8, lateral and dorsal; c: pronotum; d, f: female, genital segment, sternites (d) and tergites (f); g: female, abdominal sternite 8. Scale bars = 0.2 mm.

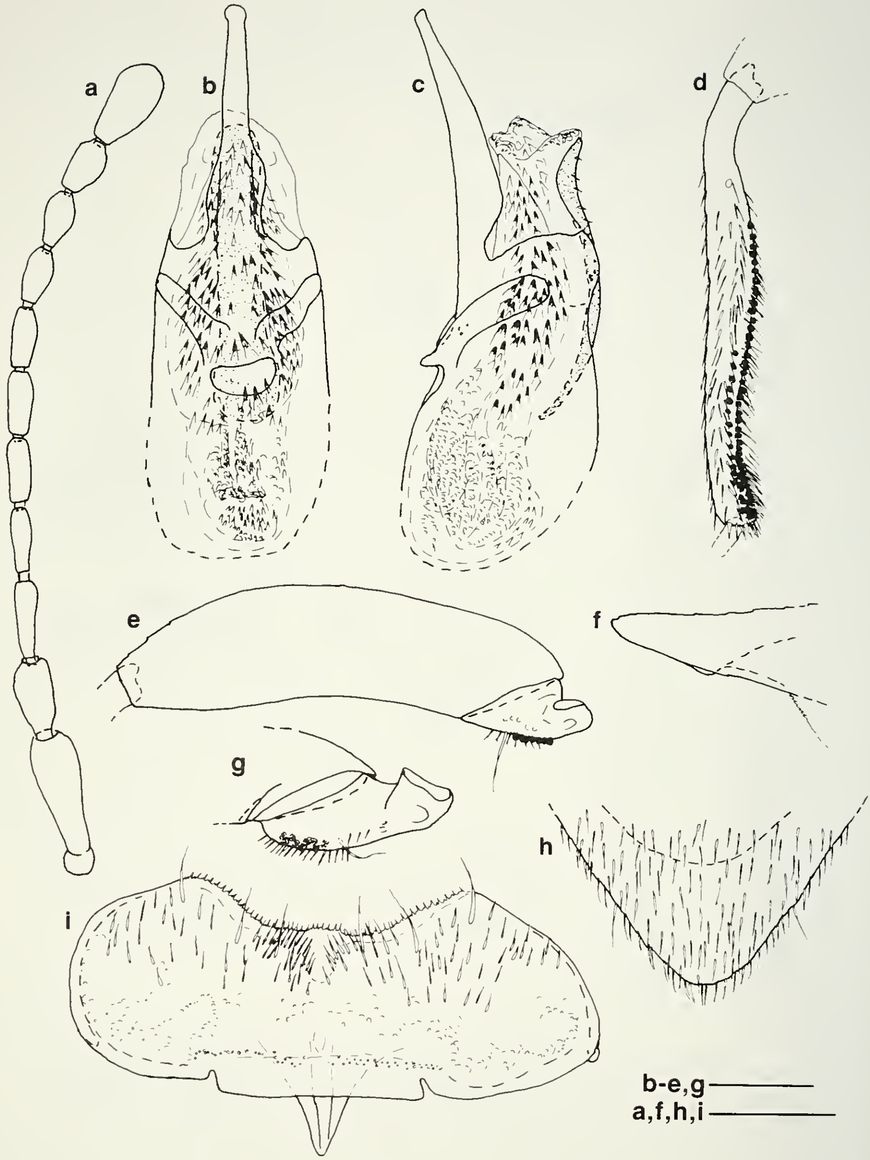


FIG. 16

Megarthrus dominicae; a: antenna; b, c: aedeagus, ventral and lateral; d: male, mesotibia; e: male, mesofemur and mesotrochanter; f, h: male, apex of abdominal tergite 8, lateral and dorsal; g: male, metatrochanter; i: male, abdominal sternite 8. Scale bars = 0.2 mm.

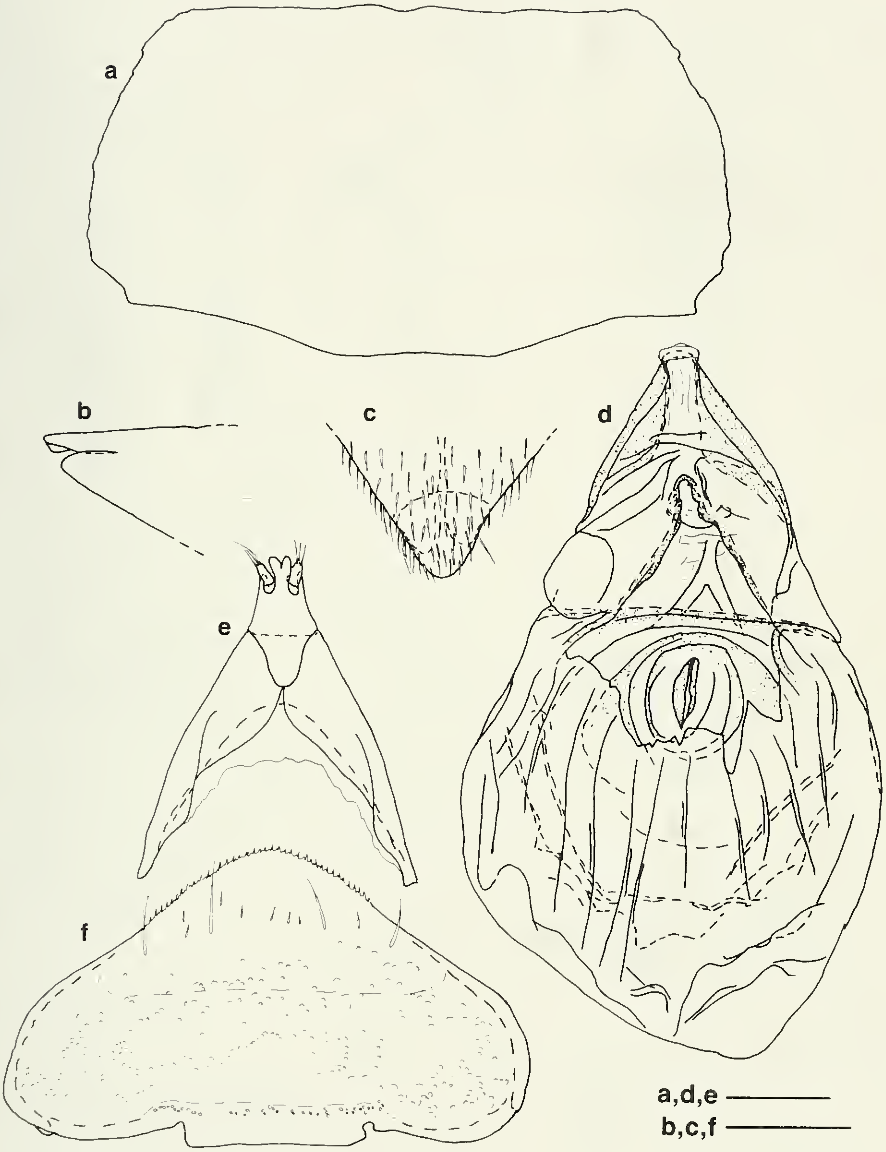


FIG. 17

Megarthrus dominicae; a: pronotum; b, c: female, apex of abdominal tergite 8, lateral and dorsal; d, e: female, genital segment, tergites (d) and sternites (e); f: female, abdominal sternite 8. Scale bars = 0.2 mm.

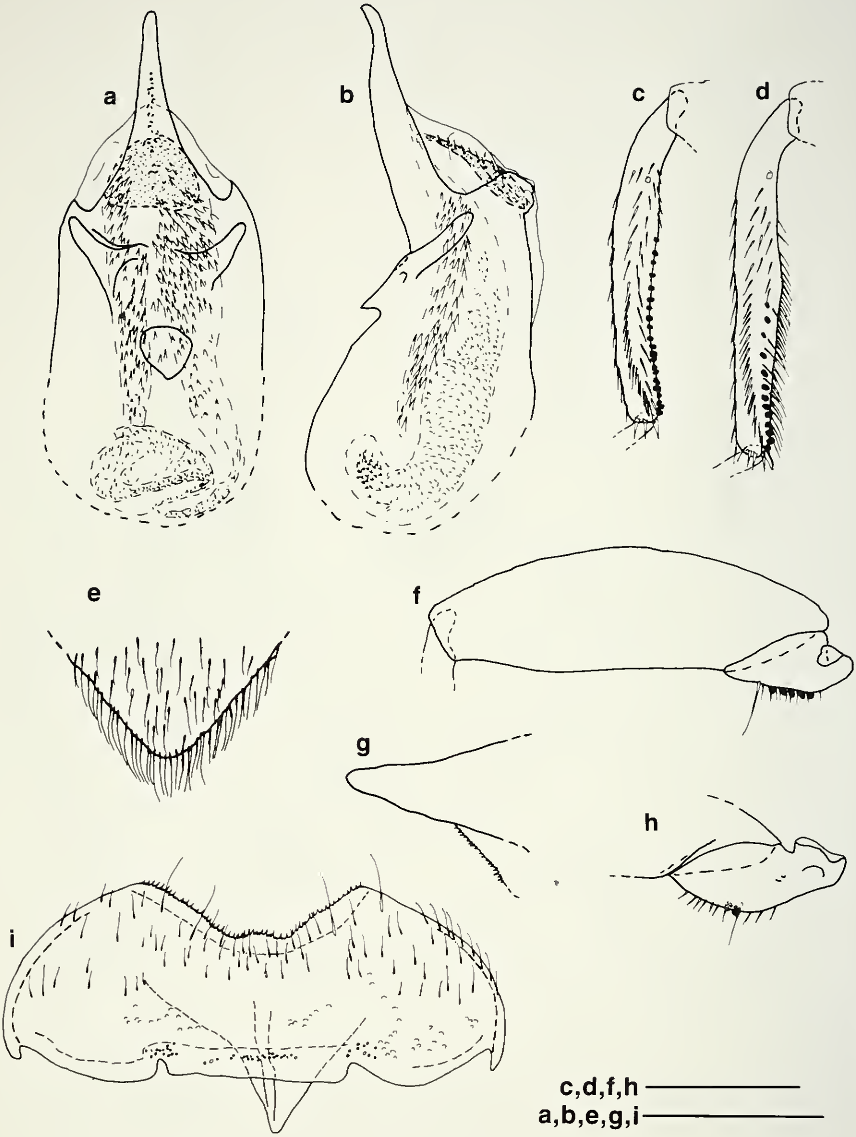


FIG. 18

Megarthrus falasha, male; a, b: aedeagus, ventral and lateral; c: mesotibia; d: metatibia; e, g: apex of abdominal tergite 8, dorsal and lateral; f: mesofemur and mesotrochanter; h: metatrochanter; i: abdominal sternite 8 . Scale bars = 0.2 mm.

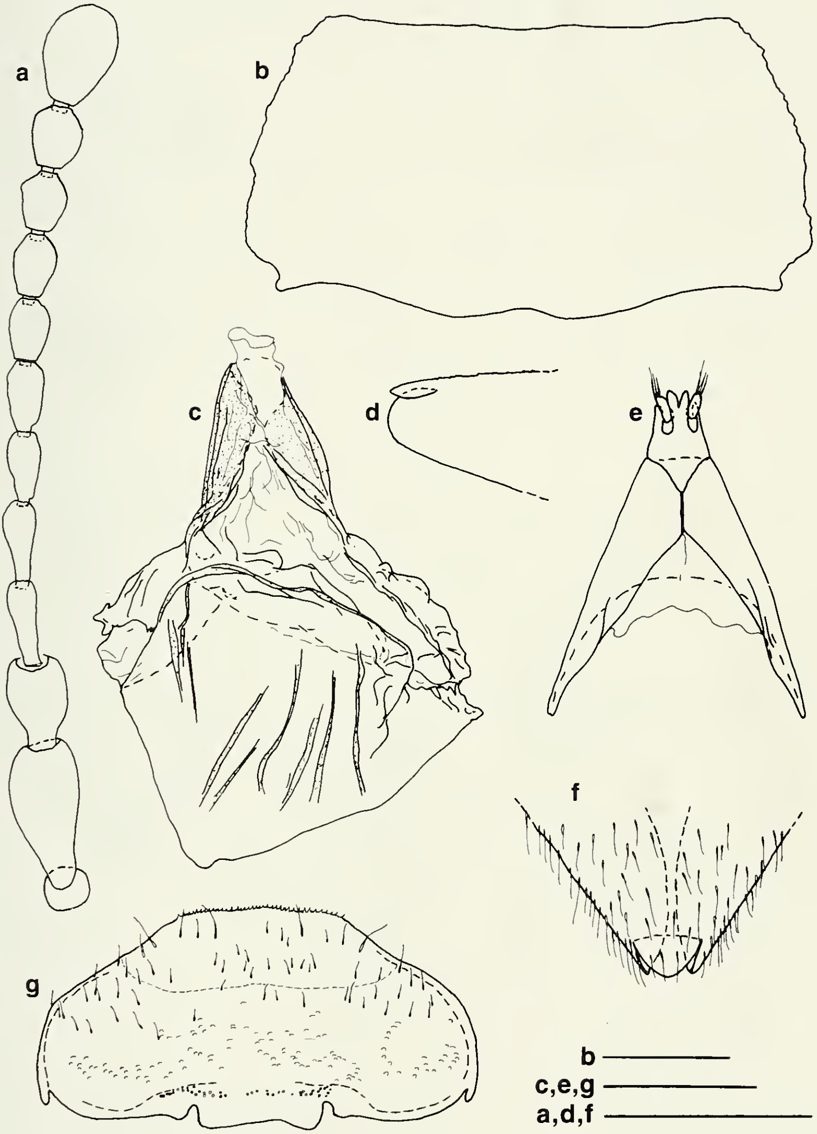


FIG. 19

Megarthrus falasha; a: antenna; b: pronotum; c, e: female, genital segment, tergites (c) and sternites (e); d, f: female, apex of abdominal tergite 8, lateral and dorsal; g: female, abdominal sternite 8. Scale bars = 0.2 mm.

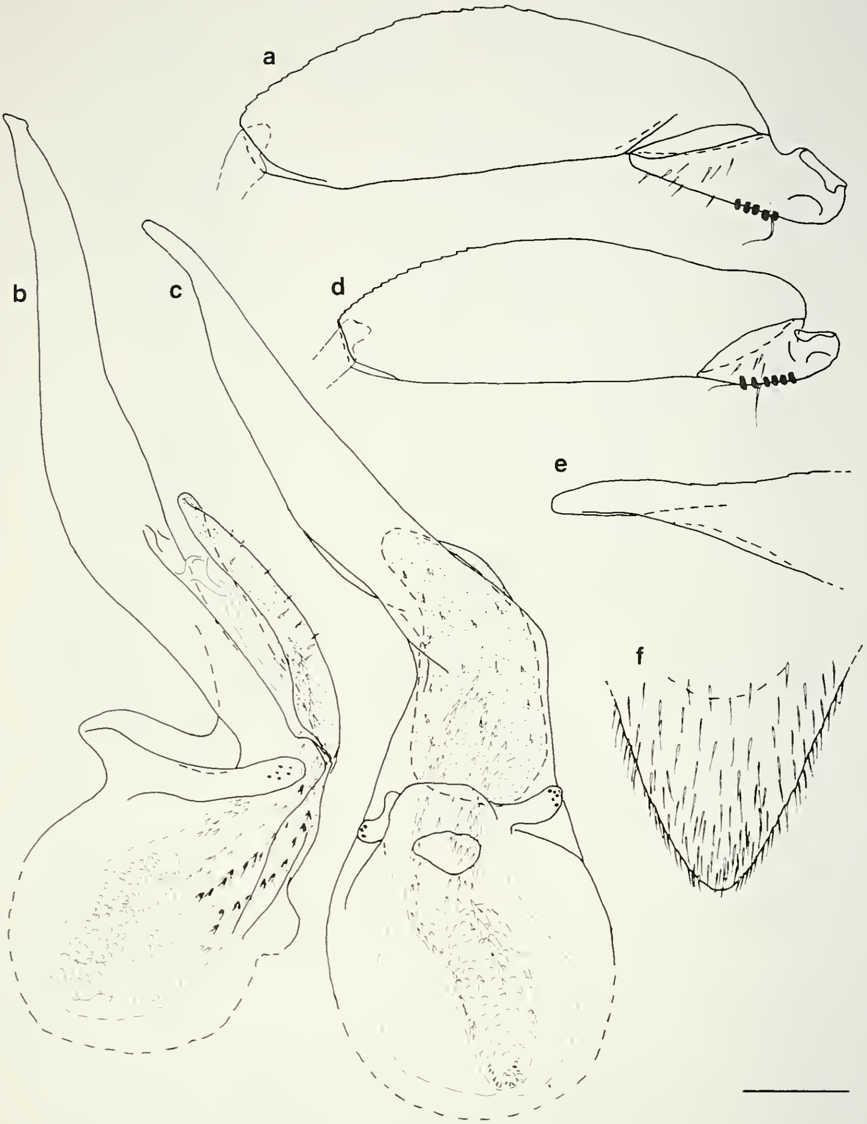


FIG. 20

Megarthrus gigas, male; a: metafemur and metatrochanter; b, c: aedeagus, lateral and ventral; d: mesofemur and mesotrochanter; e, f: apex of abdominal tergite 8, lateral and dorsal. Scale bar = 0.2 mm.

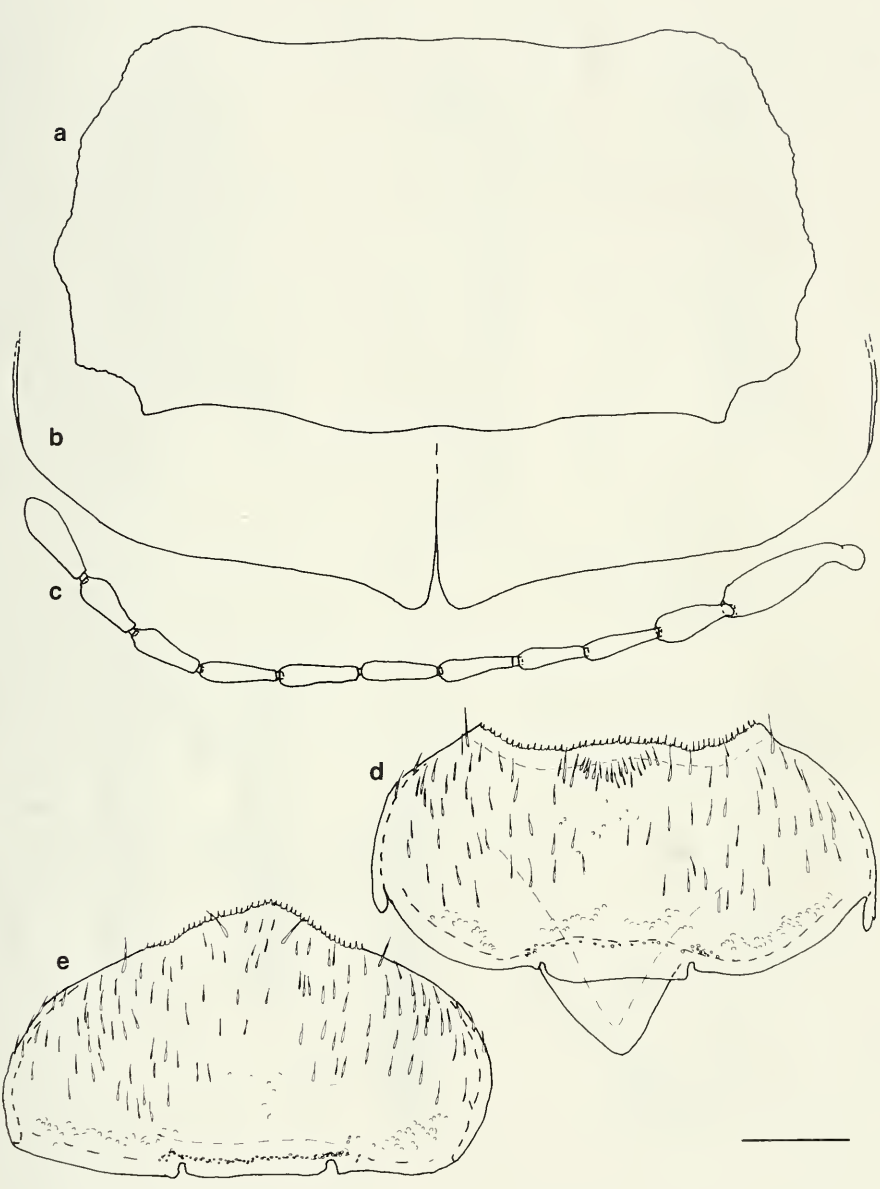


FIG. 21

Megarthrus gigas; a: pronotum; b: female, apical contour of elytra; c: antenna; d, e: abdominal sternite 8, male (d) and female (e). Scale bar = 0.2 mm.

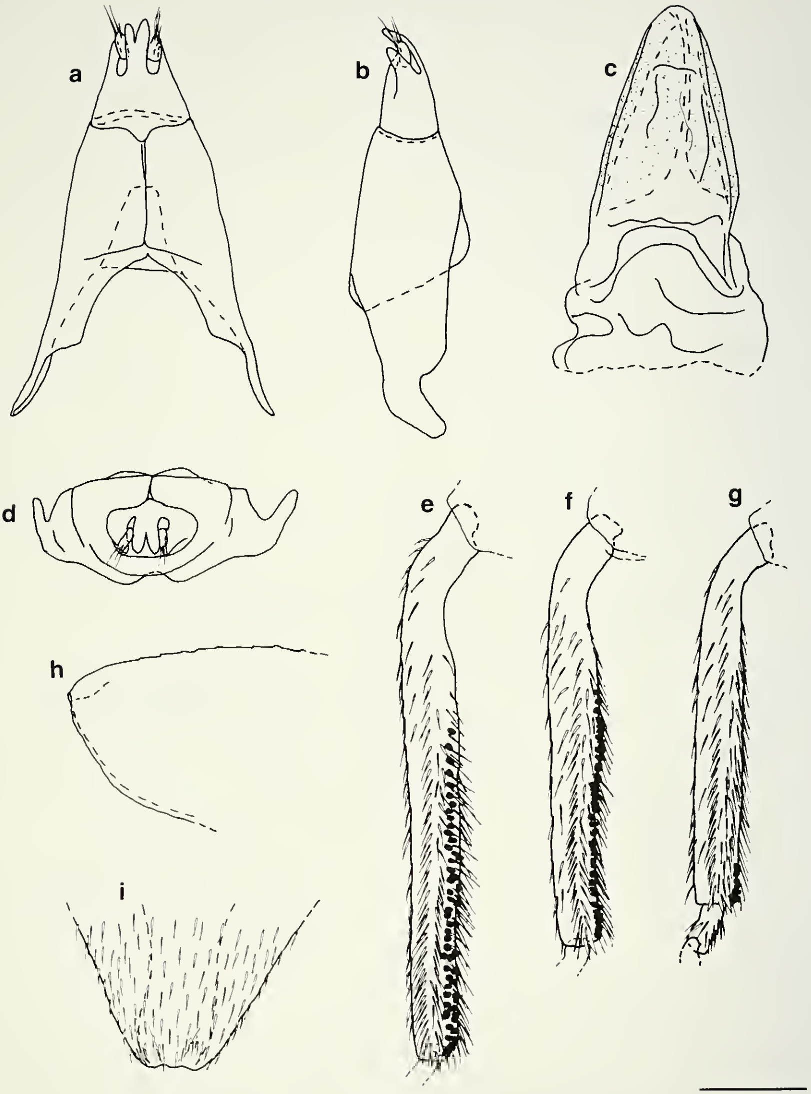


FIG. 22

Megarthrus gigas; a-d: female, genital segment, sternites (a) dorsal, (b) lateral, (d) posterior and tergites (c) ventral; e: male, metatibia; f: male, mesotibia; g: male, protibia and protarsomere 1; h, i: female, apex of abdominal tergite 8, lateral and dorsal. Scale bar = 0.2 mm.

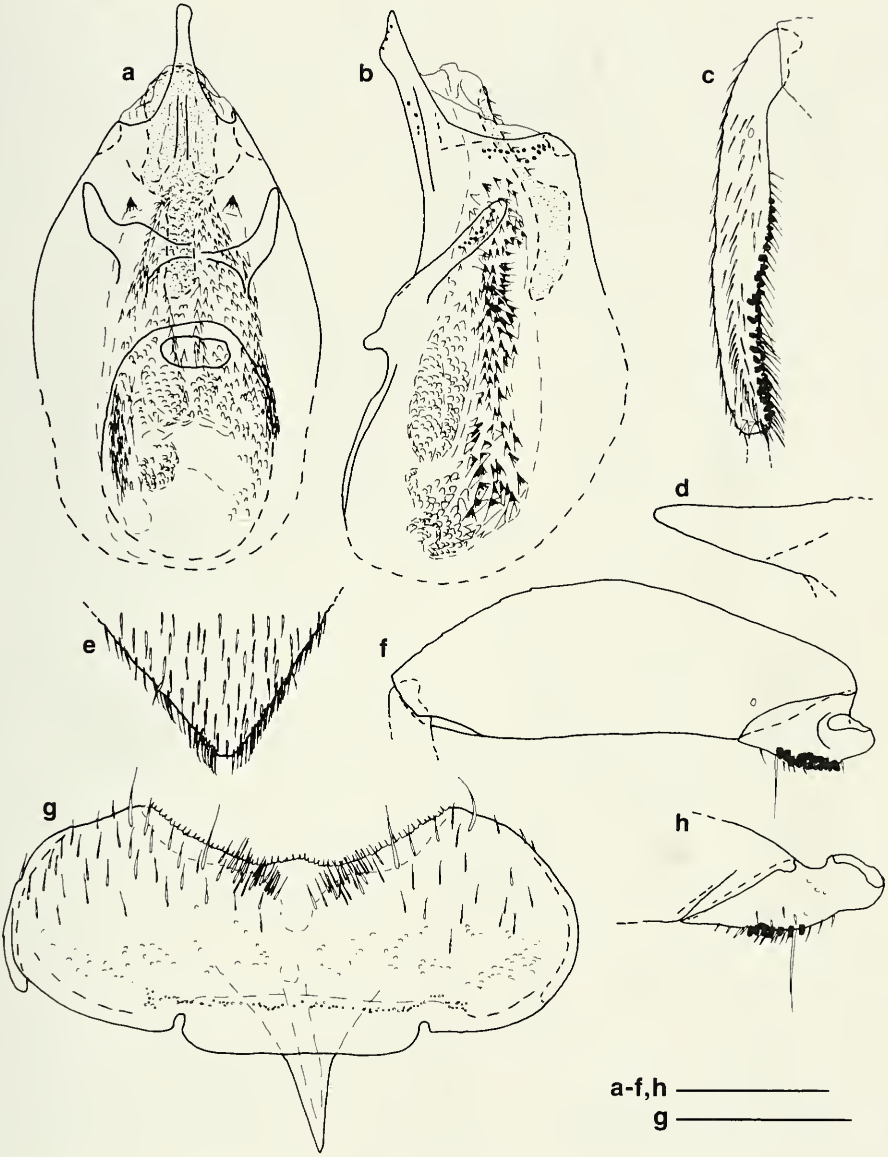


FIG. 23

Megarthrus horticola, male; a, b: aedeagus, ventral and lateral; c: mesotibia; d, e: apex of abdominal tergite 8, lateral and dorsal; f: mesofemur and mesotrochanter; g: abdominal sternite 8; h: metatrochanter. Scale bars = 0.2 mm.

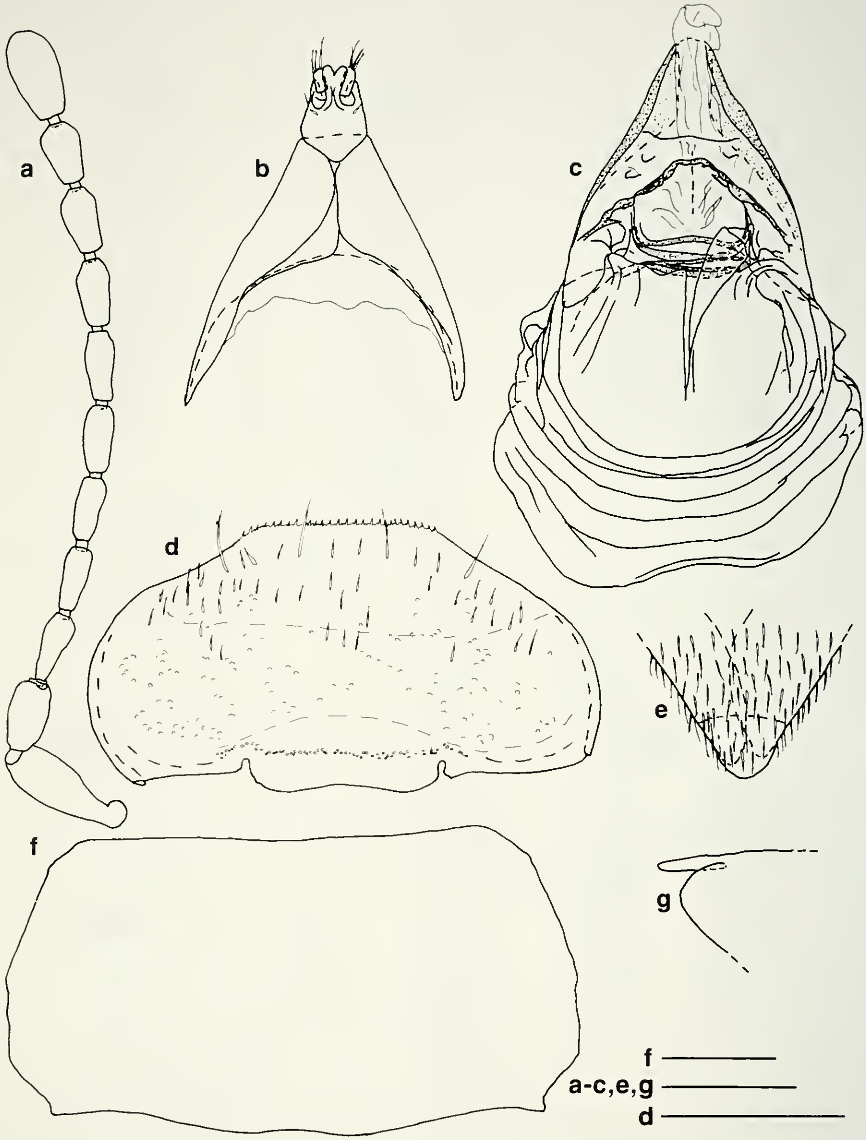


FIG. 24

Megarthrus horticola; a: antenna; b c: female, genital segment, sternites (b) and tergites (c); d: female, abdominal sternite 8; e, g: apex of abdominal tergite 8, dorsal and lateral; f: pronotum. Scale bars = 0.2 mm.

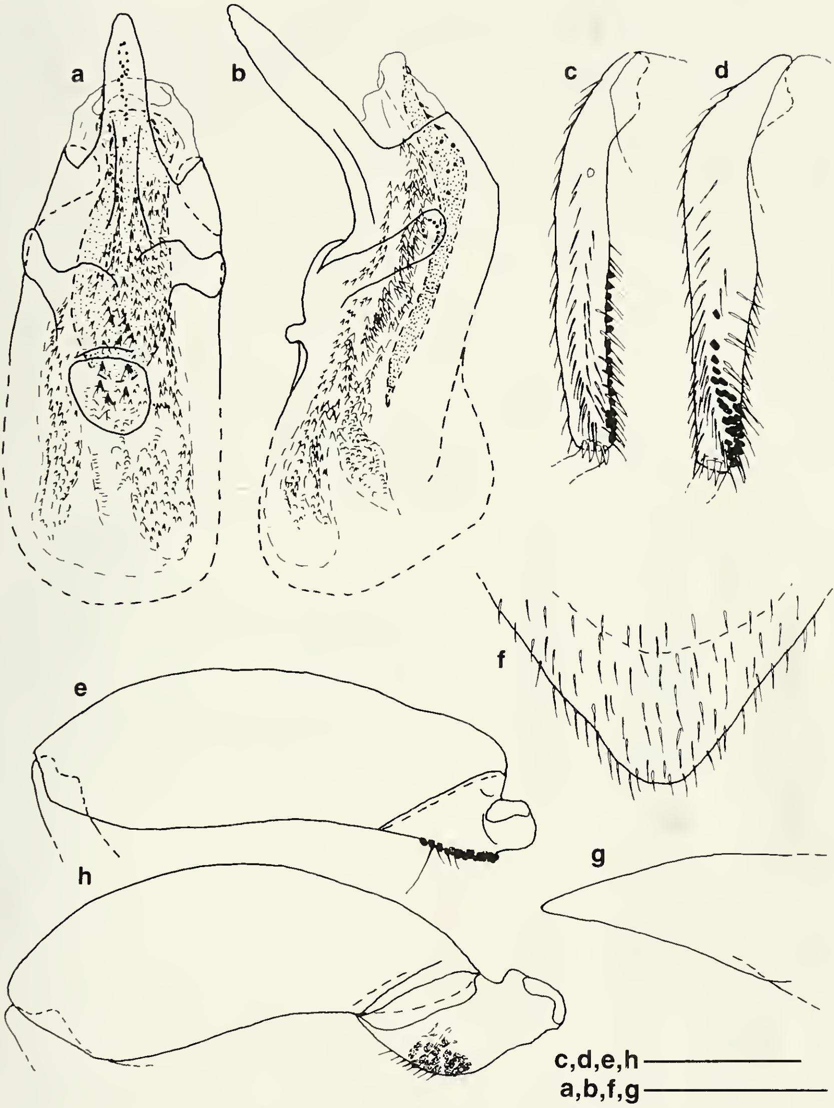


FIG. 25

Megarthrus hutu, male; a, b: aedeagus, ventral and lateral; c: mesotibia; d: metatibia; e: mesofemur and mesotrochanter; f, g: apex of abdominal tergite 8, dorsal and lateral; h: metafemur and metatrochanter. Scale bars = 0.2 mm.

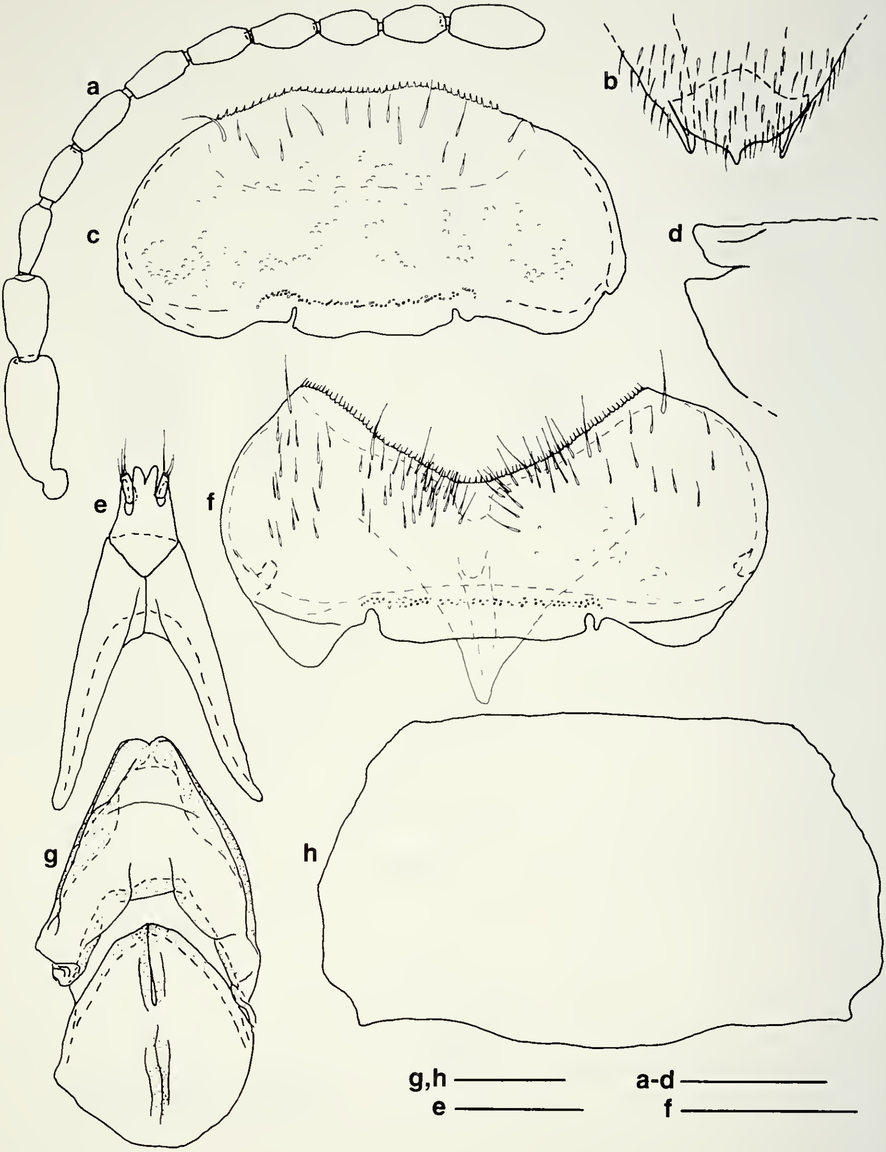


FIG. 26

Megarthrus hutu; a: antenna; b, d: female, apex of abdominal tergite 8, dorsal and lateral; c, f: abdominal sternite 8, female (c) and male (f); e, g: female, genital segment, sternites (e) and tergites (g); h: pronotum. Scale bars = 0.2 mm.

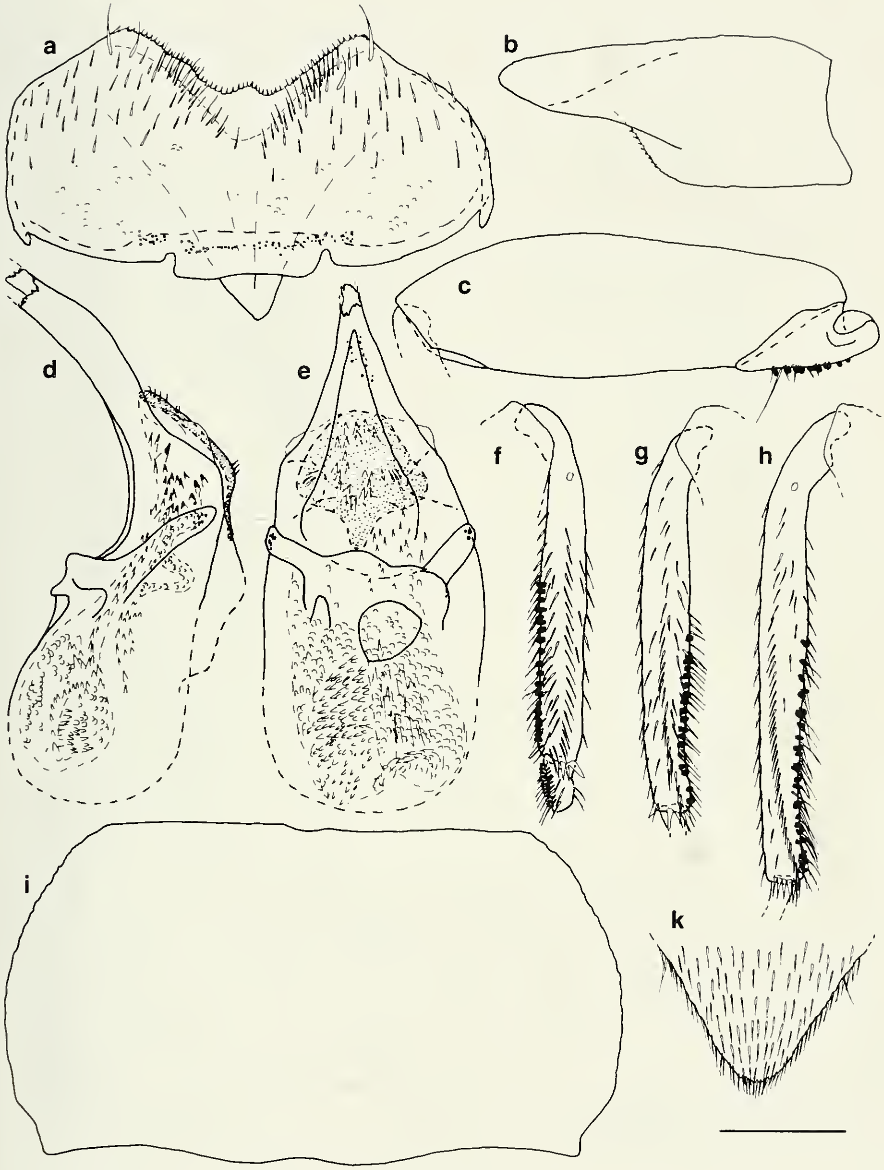


FIG. 27

Megarthrus magnicaudatus; a: male, abdominal sternite 8; b, k: male, abdominal tergite 8, entire (b) lateral and apex (k) dorsal; c: male, mesofemur and mesotrochanter; d, e: aedeagus, lateral and ventral (apex broken); f: male, protibia and protarsomere 1; g: male, mesotibia; h: male, metatibia; i: pronotum. Scale bar = 0.2 mm.

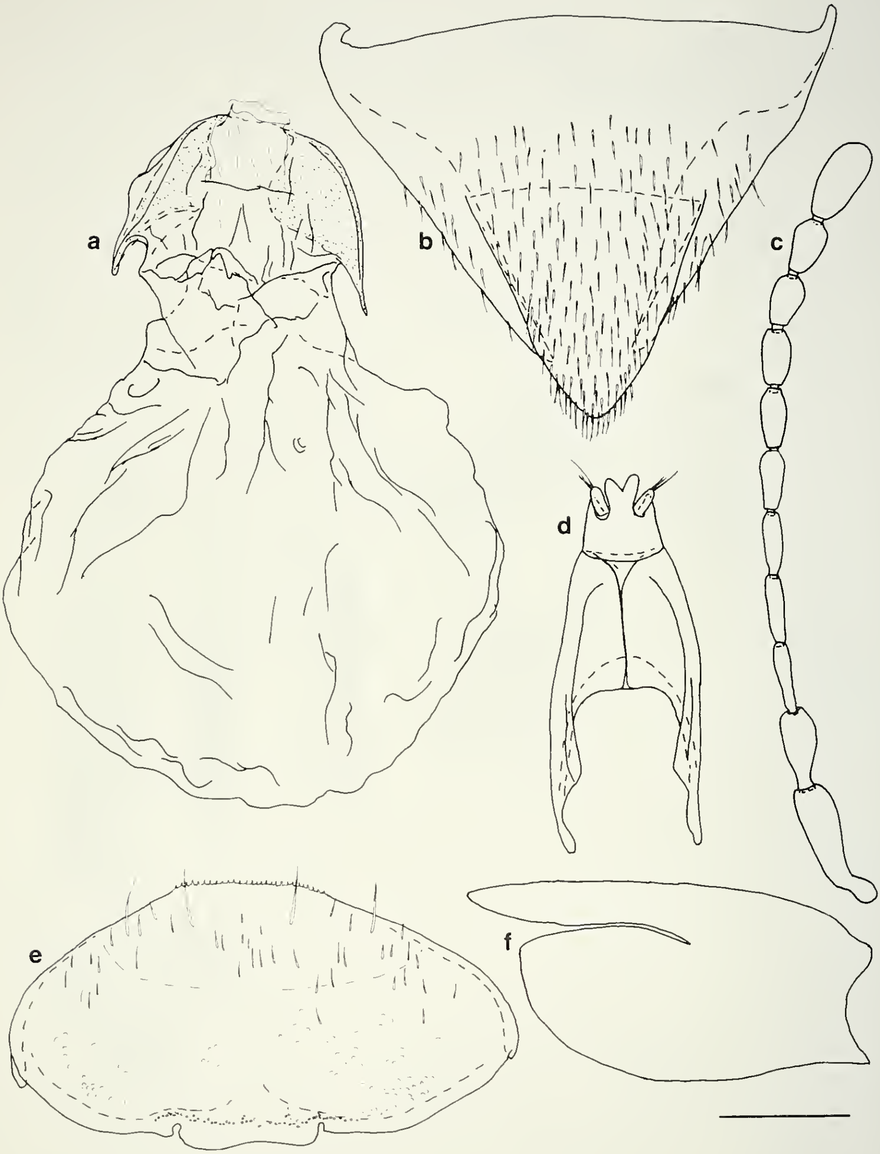


FIG. 28

Megarthrus magnicaudatus; a, d: female, genital segment, tergites (a) and sternites (d); b, f: female, abdominal tergite 8, dorsal and lateral; c: antenna; e: female, abdominal sternite 8. Scale bar = 0.2 mm.

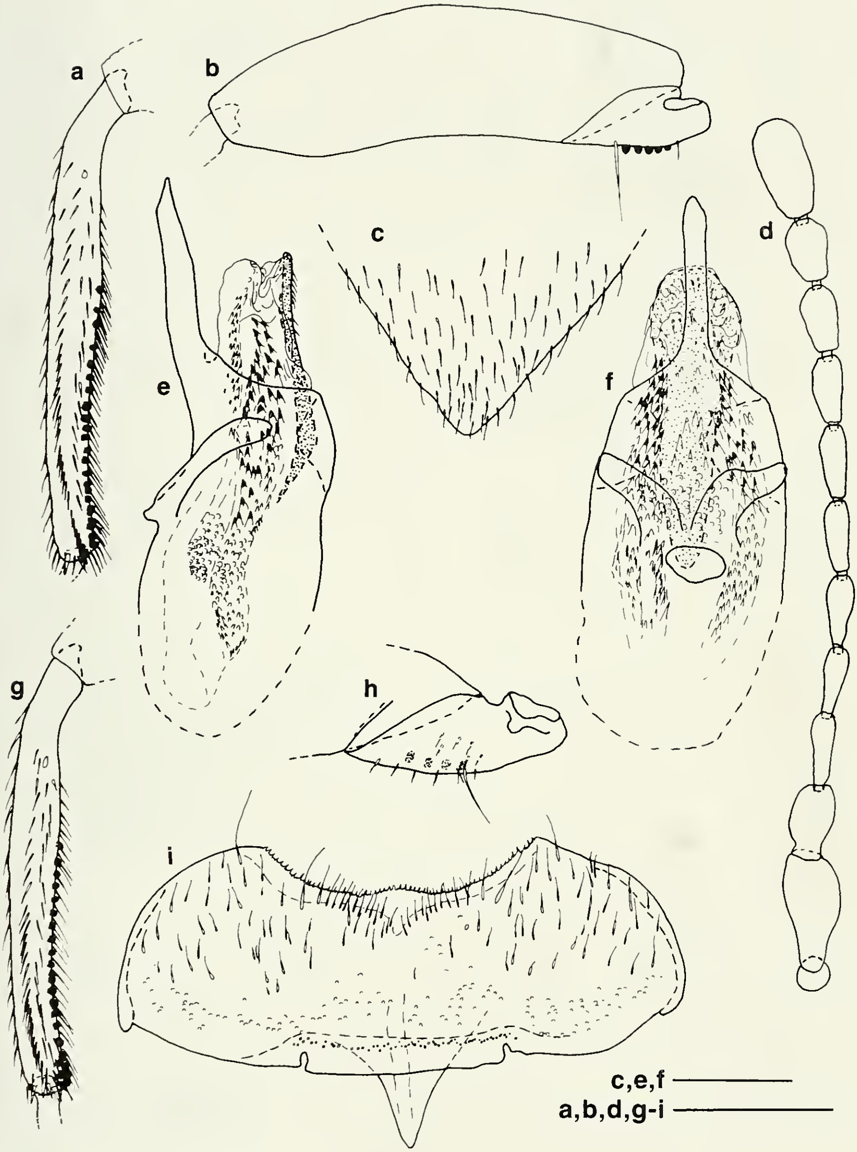


FIG. 29

Megarthrus mahnerti; a: male, metatibia; b: male, mesofemur and mesotrochanter; c: male, apex of abdominal tergite 8, dorsal; d; antenna; e, f: aedeagus, lateral and ventral; g: male, mesotibia; h: male, metatrochanter; i: male, abdominal sternite 8. Scale bars = 0.2 mm.

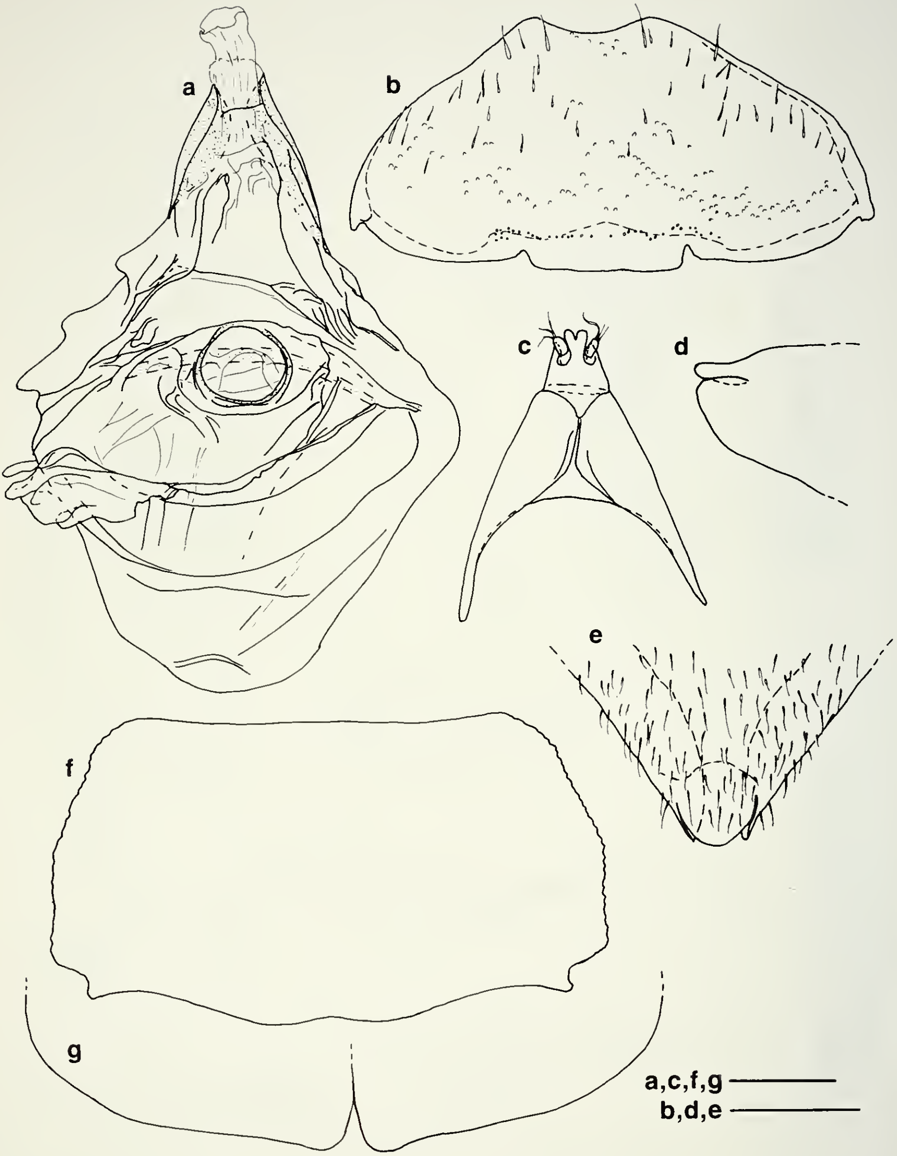


FIG. 30

Megarthrus mahnerti; a, c: female, genital segment, tergites (a) and sternites (c); b: female, abdominal sternite 8; d, e: female, apex of abdominal tergite 8, lateral and dorsal; f: pronotum; g: female, apical contour of elytra. Scale bars = 0.2 mm.

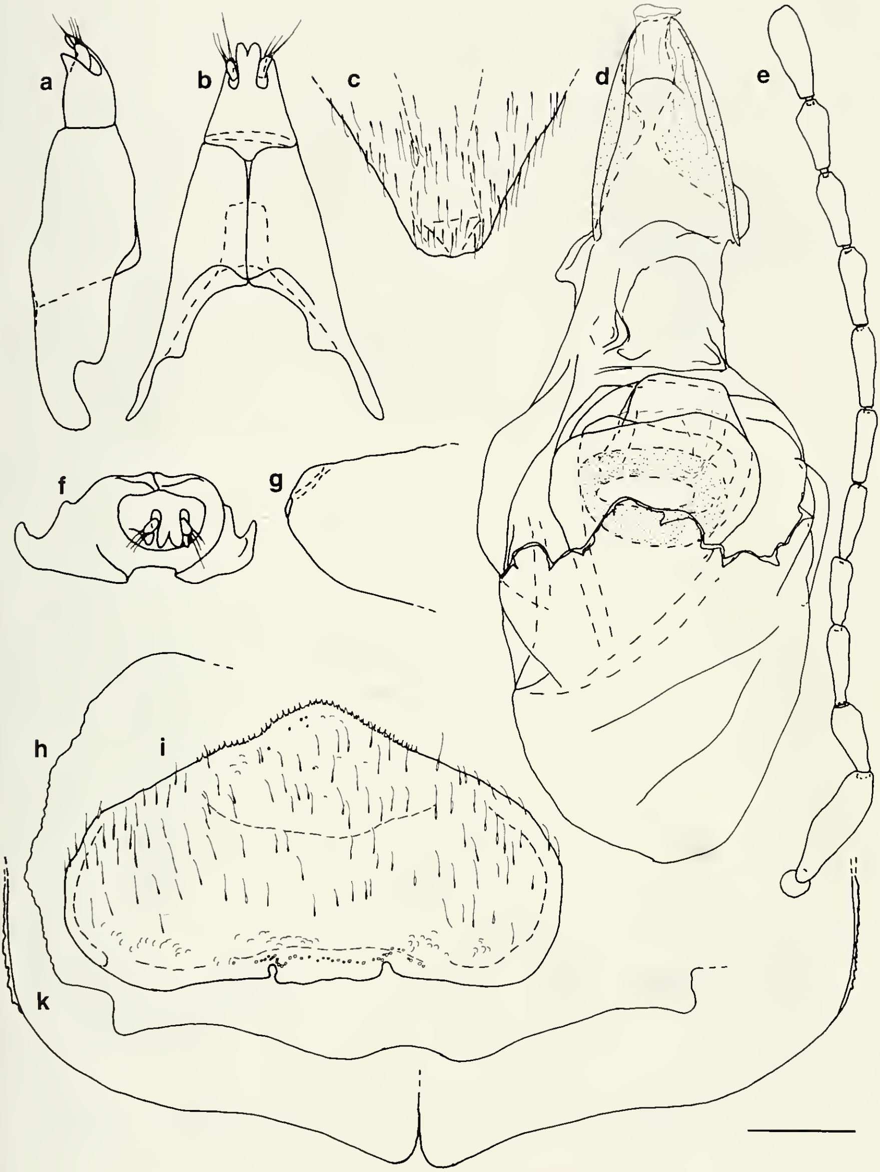


FIG. 31

Megarthrus major; a, b, d, f: female, genital segment, sternites, lateral (a), dorsal (b), posterior (f) and tergites (d); c, g: female, apex of abdominal tergite 8, dorsal and lateral; e: antenna; h: lateral and basal edges of pronotum; i: female, abdominal sternite 8; k: female, apical contour of elytra. Scale bar = 0.2 mm.

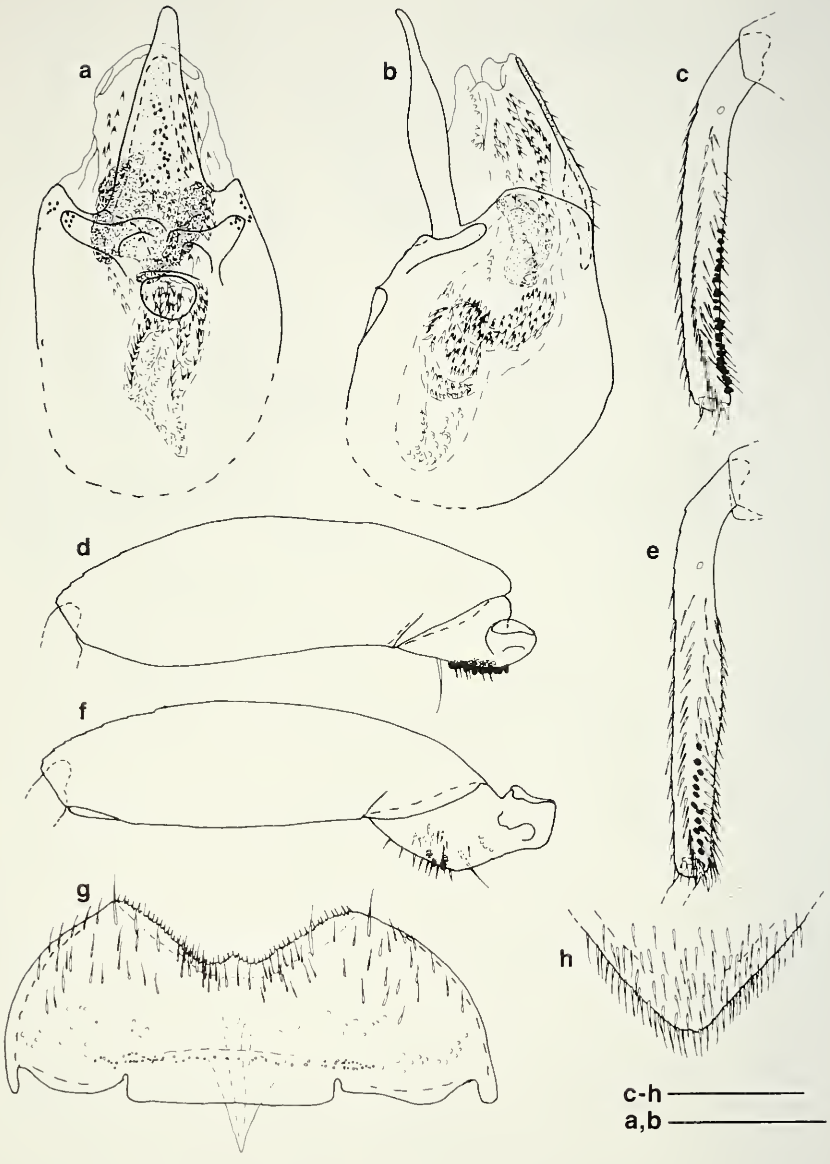


FIG. 32

Megarthrus maniwaata. male: a, b: aedeagus, ventral and lateral; c: mesotibia; d: mesofemur and mesotrochanter; e: metatibia; f: metafemur and metatrochanter; g: abdominal sternite 8; h: apex of abdominal tergite 8, dorsal view. Scale bars = 0.2 mm.

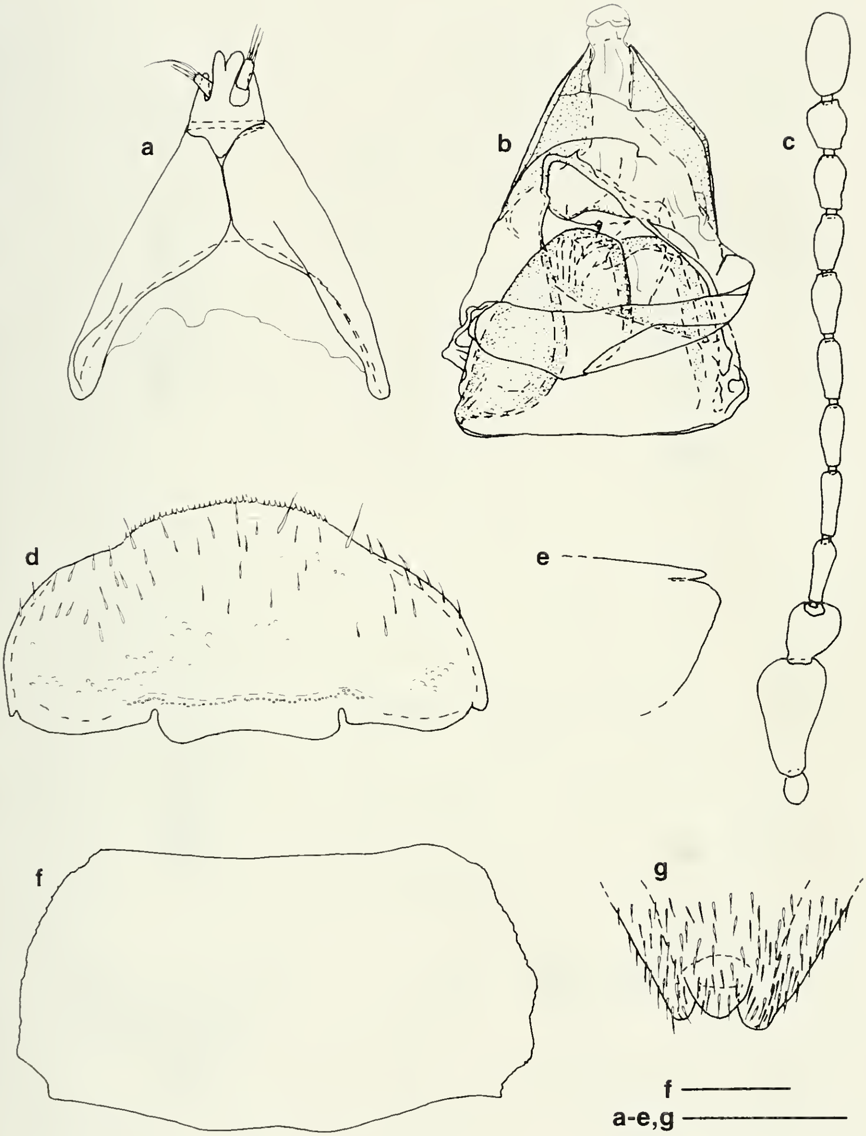


FIG. 33

Megarthrus maniwaata; a, b: female, genital segment, sternites (a) and tergites (b); c: antenna; d: female, abdominal sternite 8; e, g: female, apex of abdominal tergite 8, lateral and dorsal; f: pronotum. Scale bars = 0.2 mm.

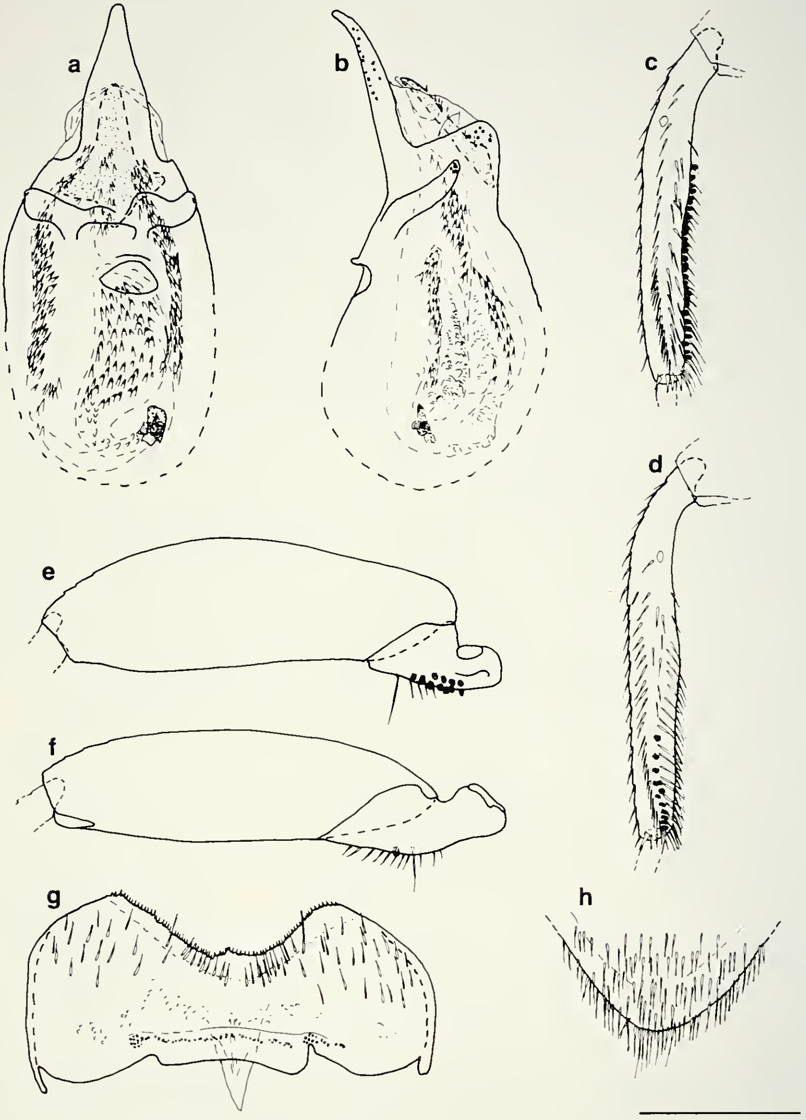


FIG. 34

Megarthrus merabet, male; a, b: aedeagus, ventral and lateral; c: mesotibia; d: metatibia; e: mesofemur and mesotrochanter; f: metafemur and metatrochanter; g: abdominal sternite 8; h: apex of abdominal tergite 8. Scale bar = 0.2 mm.

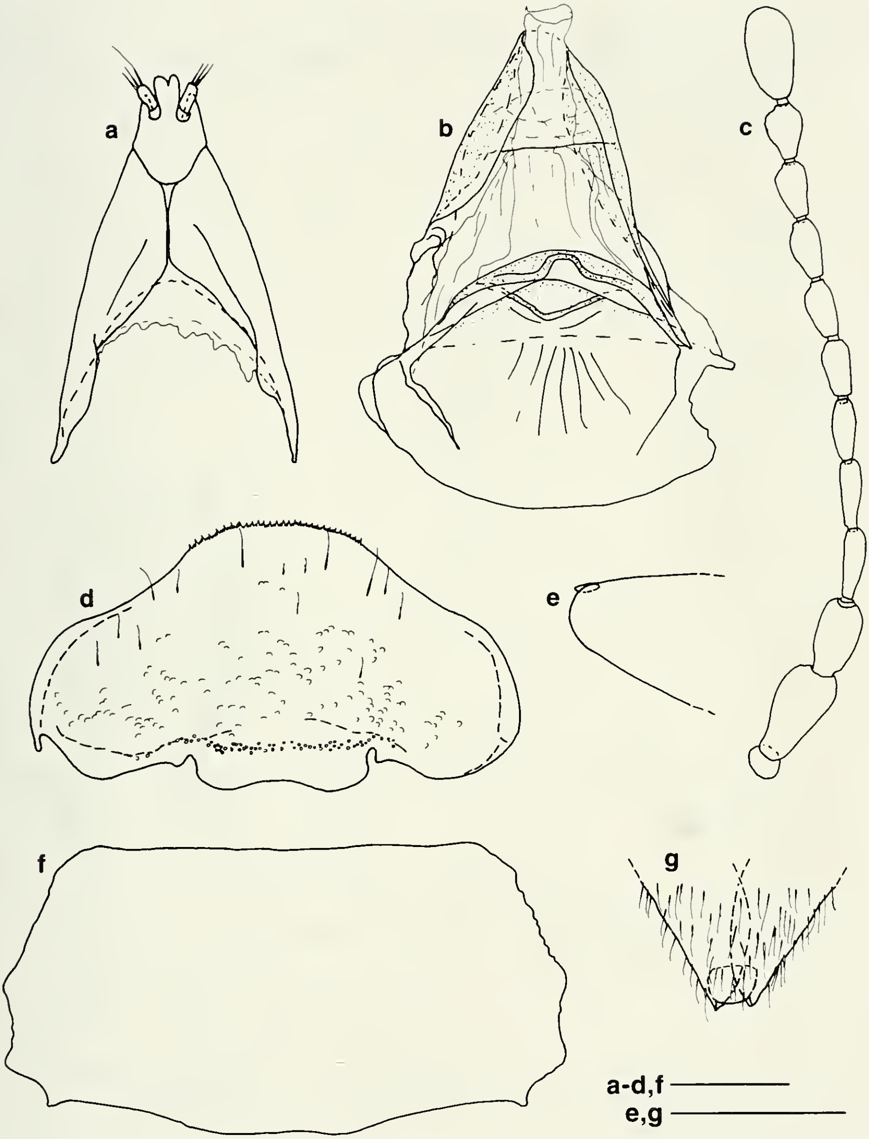


FIG. 35

Megarthrus merabet; a, b: female, genital segment, sternites (a) and tergites (b); c: antenna; d: female, abdominal sternite 8; e, g: female, apex of abdominal tergite 8, lateral and dorsal; f: pronotum. Scale bars = 0.2 mm.

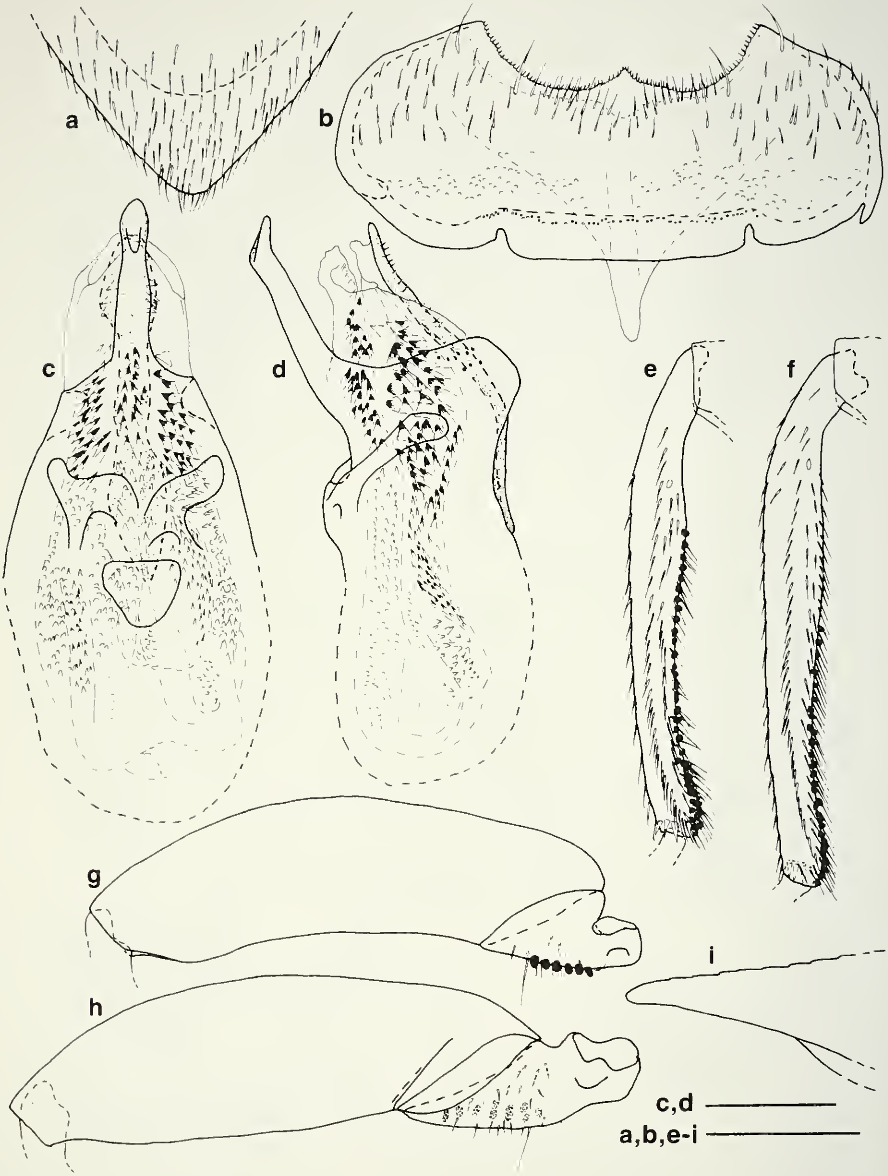


FIG. 36

Megarthrus monticola, male; a, i: apex of abdominal tergite 8, dorsal and lateral; b: abdominal sternite 8; c, d: aedeagus, ventral and lateral; e: mesotibia; f: metatibia; g: mesofemur and mesotrochanter; h: metafemur and metatrochanter. Scale bars = 0.2 mm.

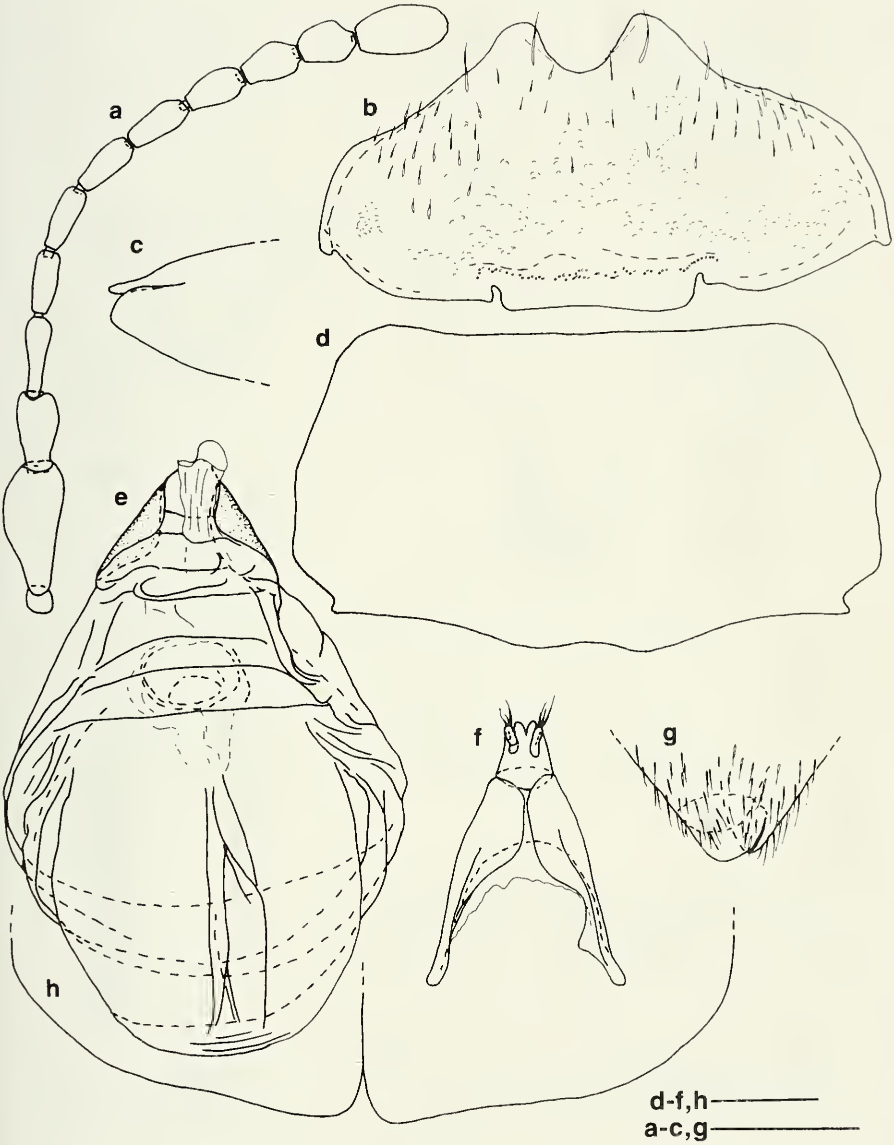


FIG. 37

Megarthrus monticola; a: antenna; b: female, abdominal sternite 8; c, g: female, apex of abdominal tergite 8, lateral and dorsal; d: pronotum; e: female, genital segment, tergites (e) and sternites (f); h: female, apical contour of elytra. Scale bars = 0.2 mm.

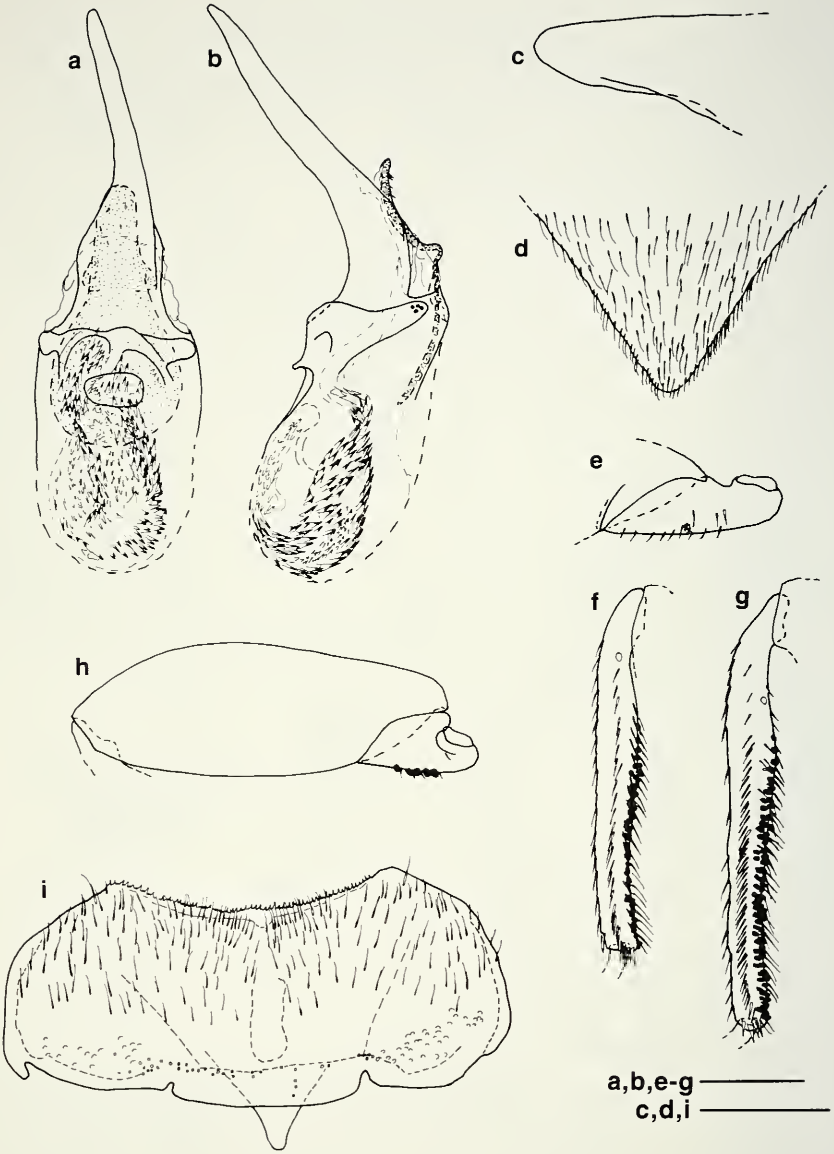


FIG. 38

Megarthrus mukankundiyeorum, male; a, b: aedeagus, ventral and lateral; c, d: apex of abdominal tergite 8, lateral and dorsal; e: metatrochanter; f: mesotibia; g: metatibia; h: mesofemur and mesotrochanter; i: abdominal sternite 8. Scale bars = 0.2 mm.

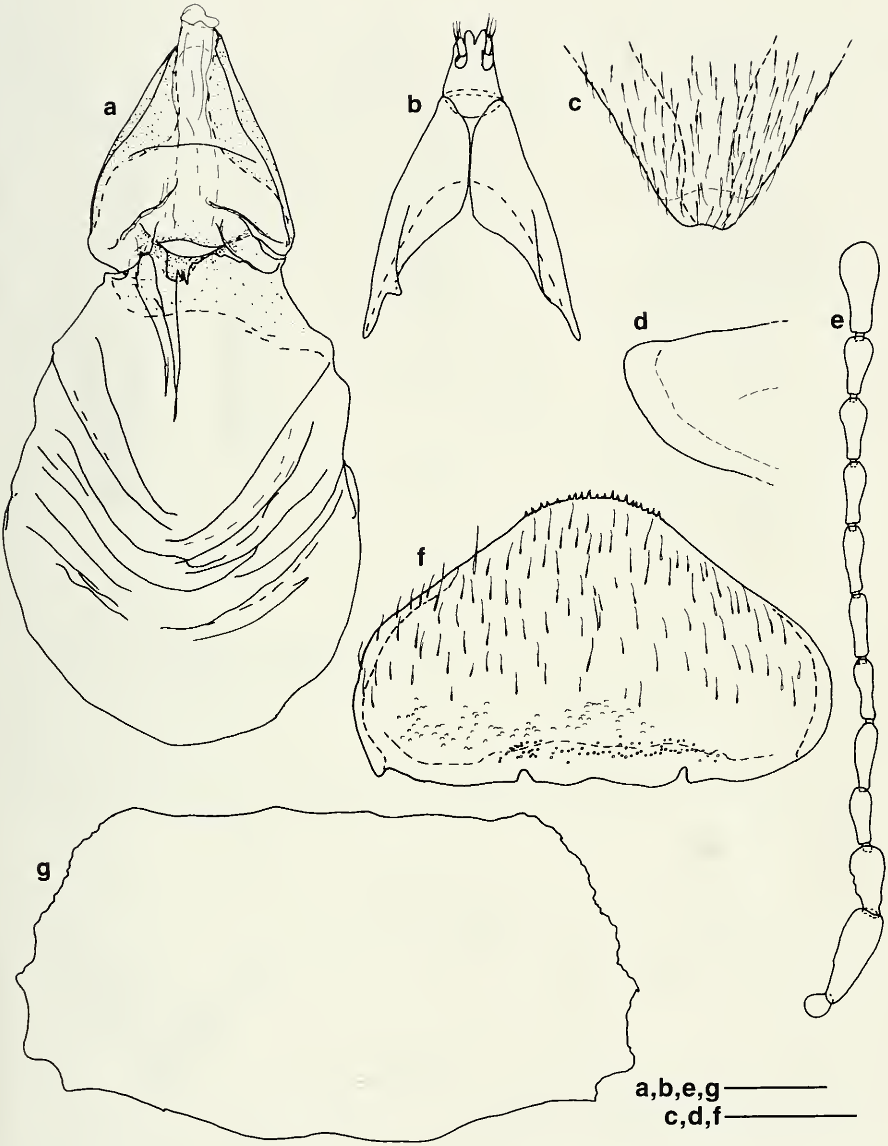


FIG. 39

Megarthrus mukankundiyeorum; a, b: female, genital segment, tergites (a) and sternites (b); c, d: female, apex of abdominal tergite 8, dorsal and lateral; e: antenna; f: female, abdominal sternite 8; g: pronotum. Scale bars = 0.2 mm.

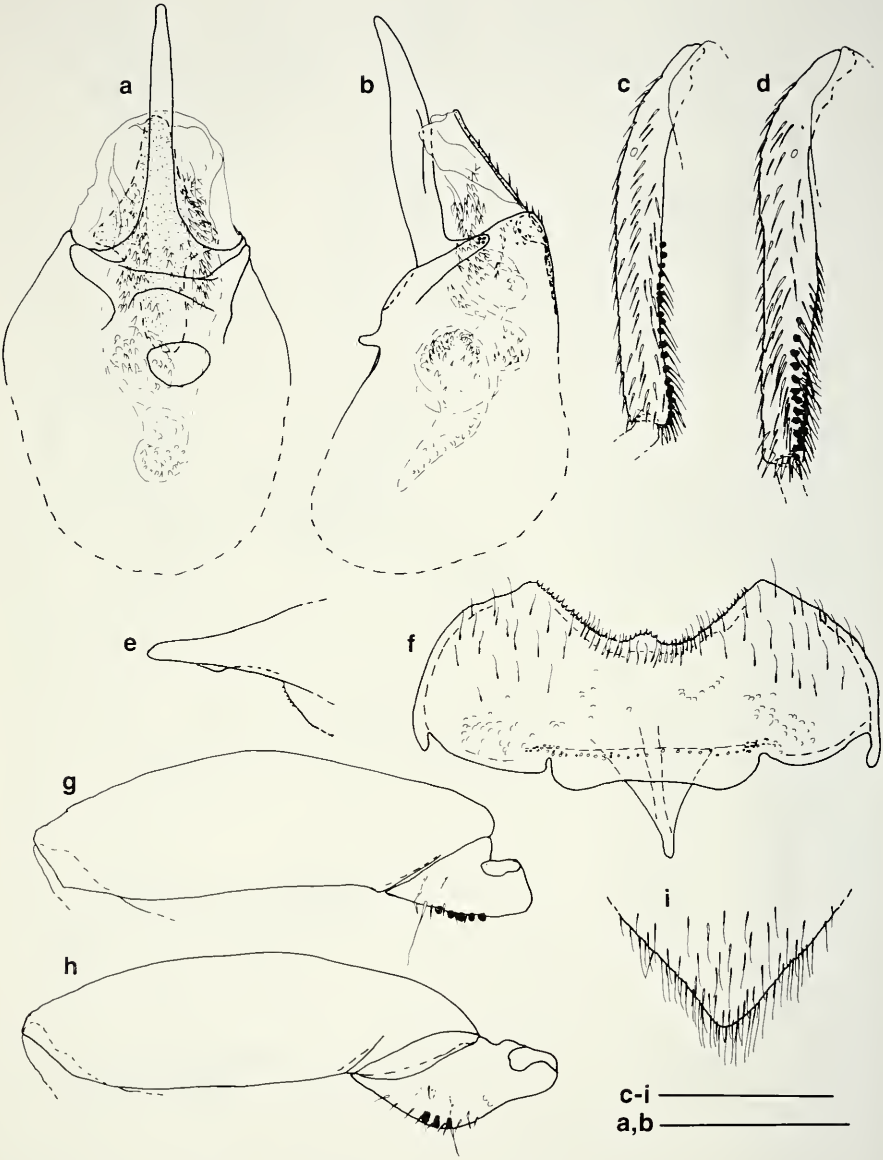


FIG. 40

Megarthrus mwami, male; a, b: aedeagus, ventral and lateral; c: mesotibia; d: metatibia; e, i: apex of abdominal tergite 8, lateral and dorsal; f: abdominal sternite 8; g: mesofemur and mesotrochanter; h: metafemur and metatrochanter. Scale bars = 0.2 mm.

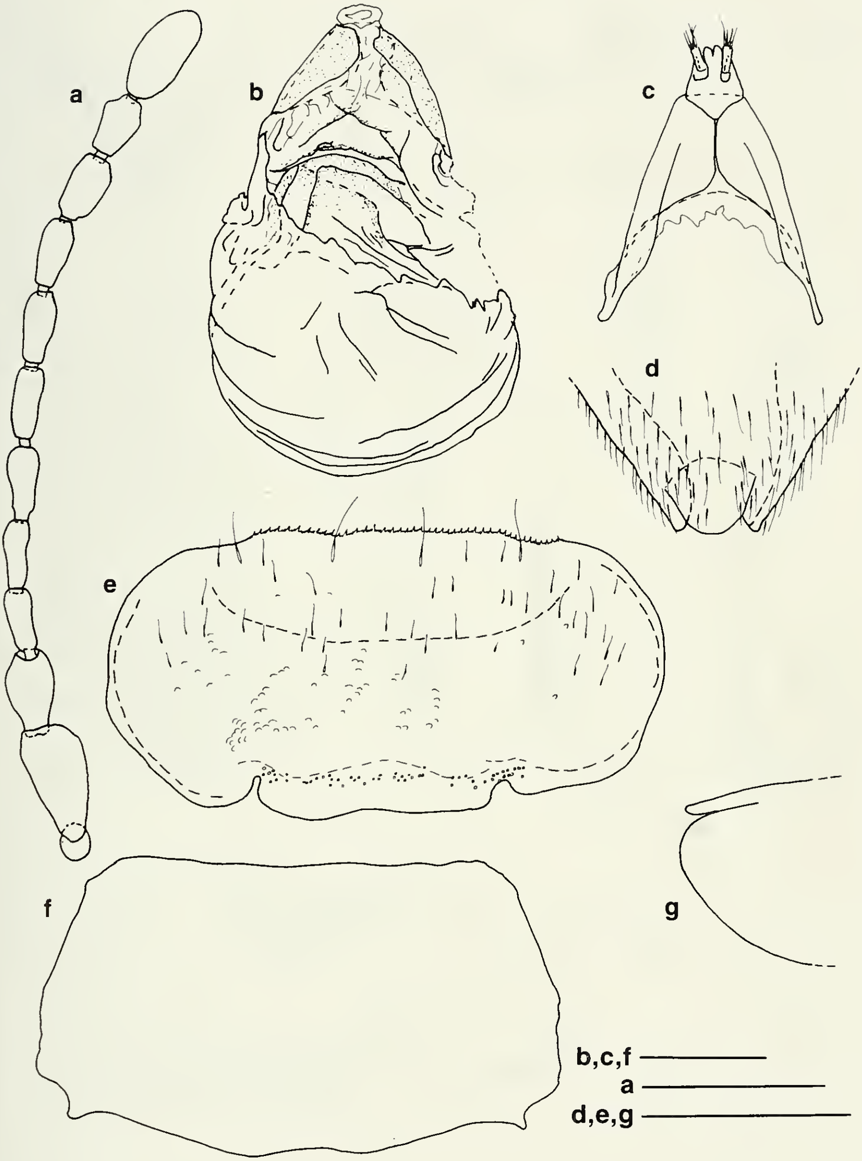


FIG. 41

Megarthrus mwami; a: antenna; b, c: female, genital segment, tergites (b) and sternites (c); d, g: female, apex of abdominal tergite 8, dorsal and lateral; e: female, abdominal sternite 8; f: pronotum. Scale bars = 0.2 mm.

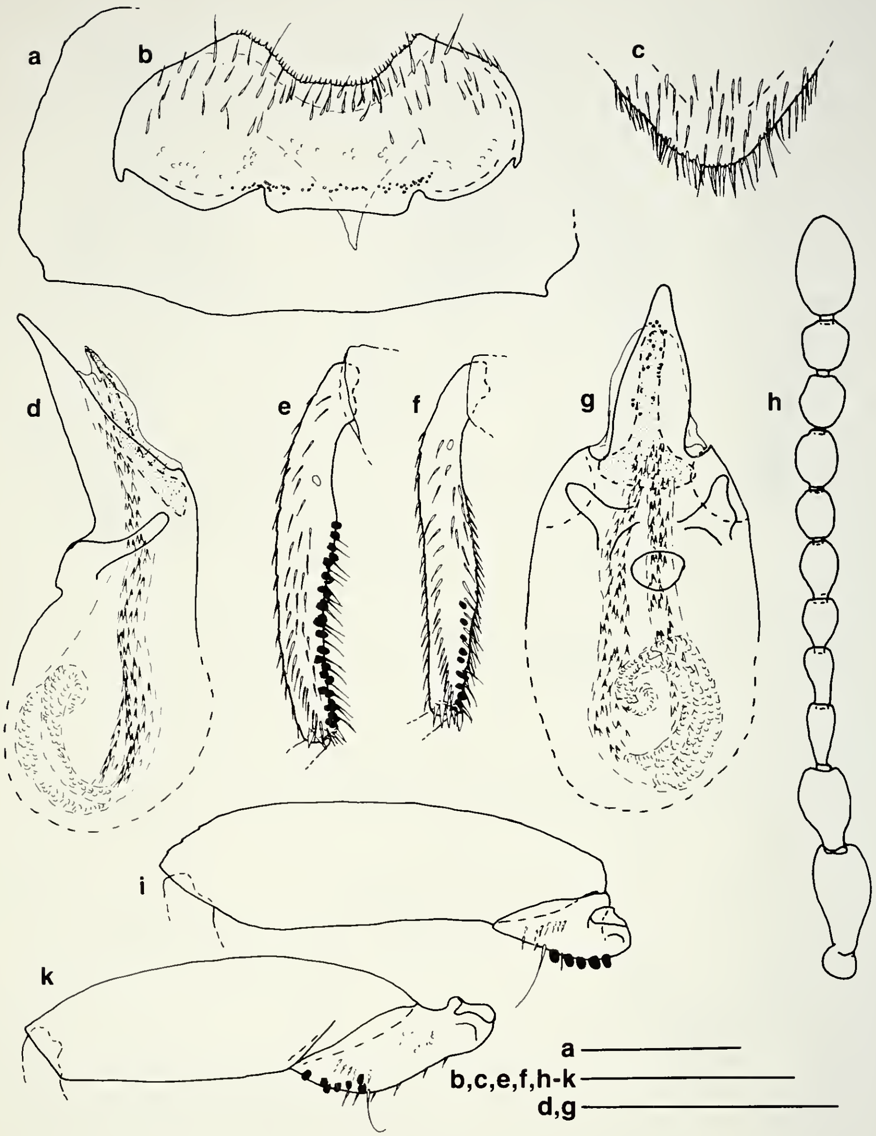


FIG. 42

Megarthrus nanus; a: lateral and basal edges of pronotum; b: male, abdominal sternite 8; c: male, apex of abdominal tergite 8, dorsal; d, g: aedeagus, lateral and ventral; e: male, mesotibia; f: male, metatibia; h: antenna; i: male, mesofemur and mesotrochanter; k: male, metafemur and metatrochanter. Scale bars = 0.2 mm.

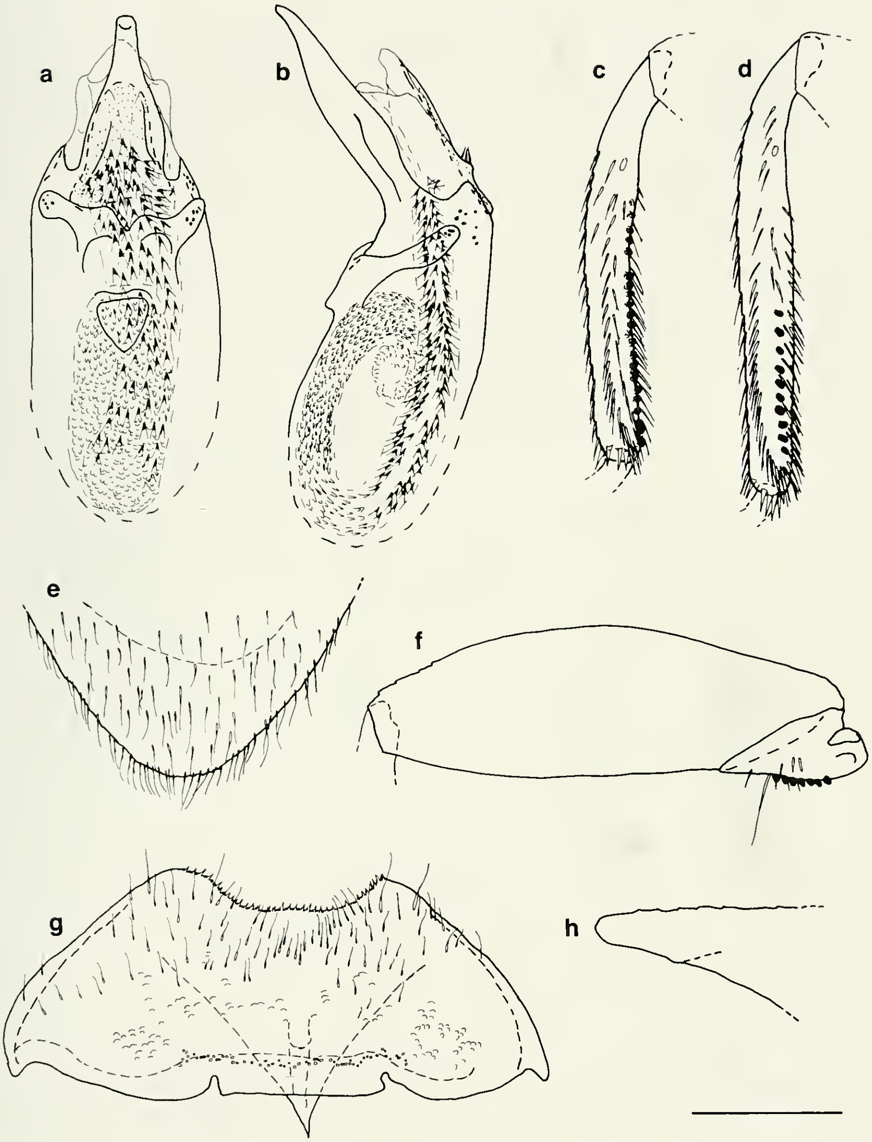


FIG. 43

Megarthrus negus, male; a, b: aedeagus, ventral and lateral; c: mesotibia; d: metatibia; e, h: apex of abdominal tergite 8, dorsal and lateral; f: mesofemur and mesotrochanter; g: abdominal sternite 8. Scale bar = 0.2 mm.

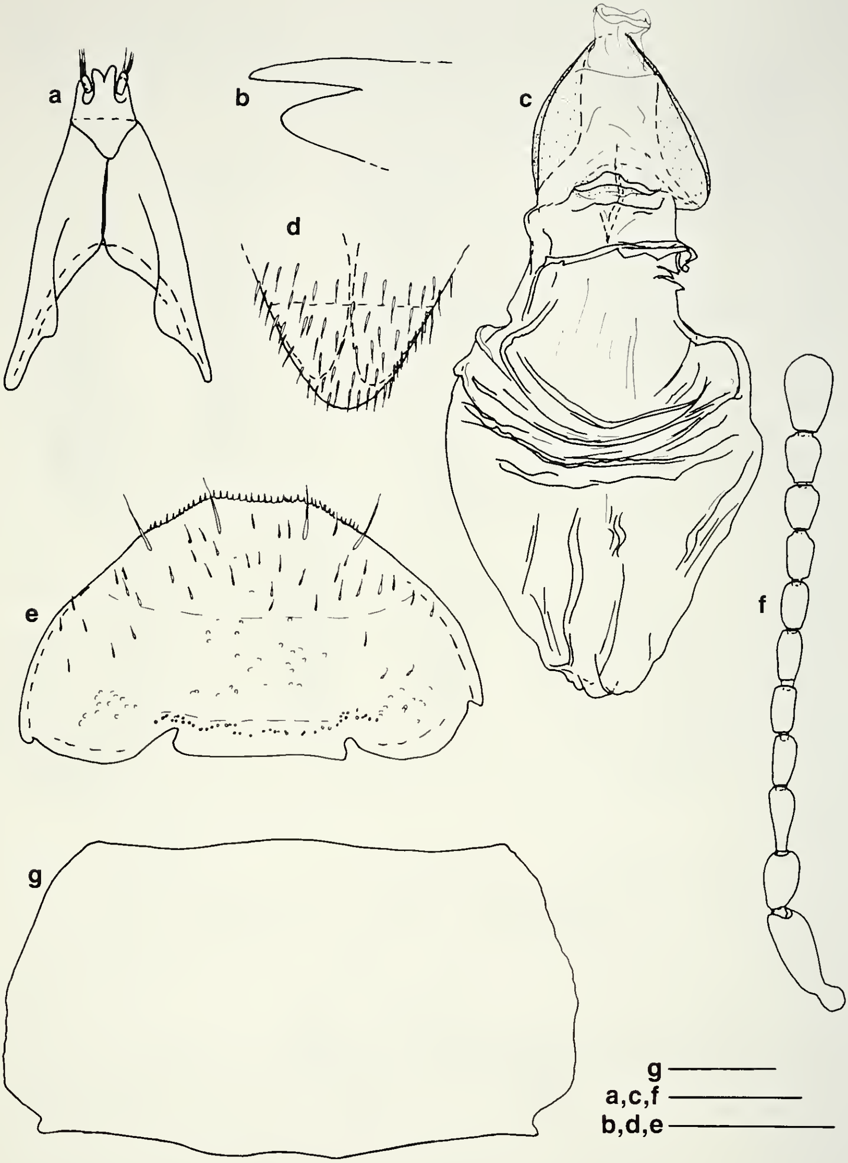


FIG. 44

Megarthrus negus; a, c: female, genital segment, sternites (a) and tergites (c); b, d: female, apex of abdominal tergite 8, lateral and dorsal; e: female, abdominal sternite 8; f: antenna; g: pronotum. Scale bars = 0.2 mm.

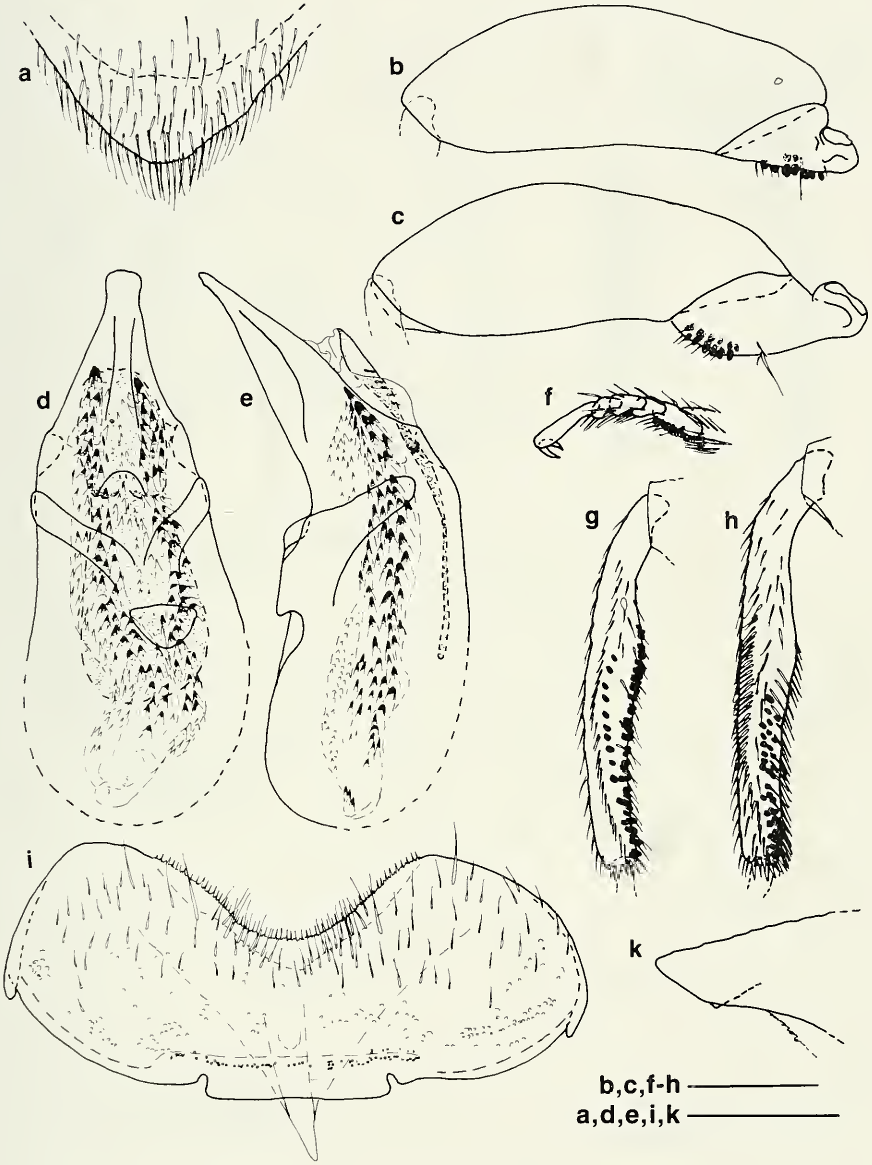


FIG. 45

Megarthrus niloticus, male; a, k: apex of abdominal tergite 8, dorsal and lateral; b: mesofemur and mesotrochanter; c: metafemur and metatrochanter; d, e: aedeagus, ventral and lateral; f: protarsi; g: mesotibia; h: metatibia; i: abdominal sternite 8. Scale bars = 0.2 mm.

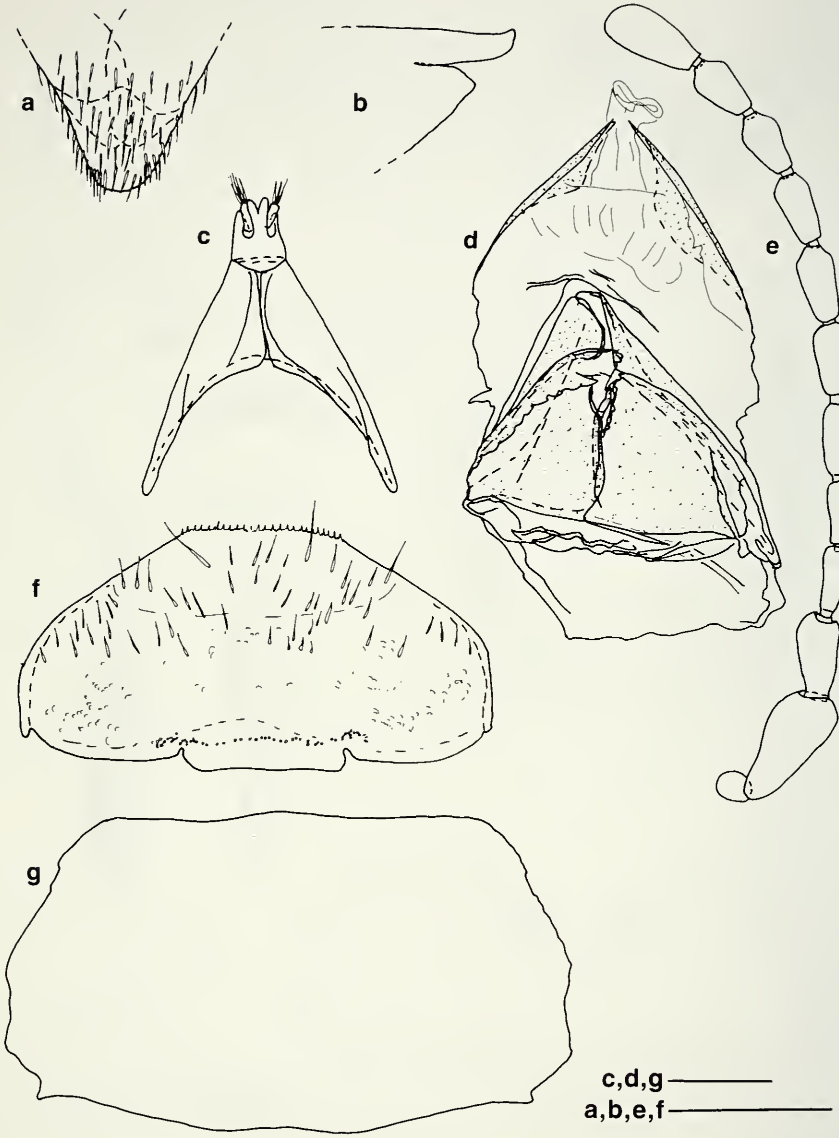


FIG. 46

Megarthrus niloticus; a, b: female, apex of abdominal tergite 8, dorsal and lateral; c, d: female, genital segment, sternites (c) and tergites (d); e: antenna; f: female, abdominal sternite 8; g: pronotum. Scale bars = 0.2 mm.

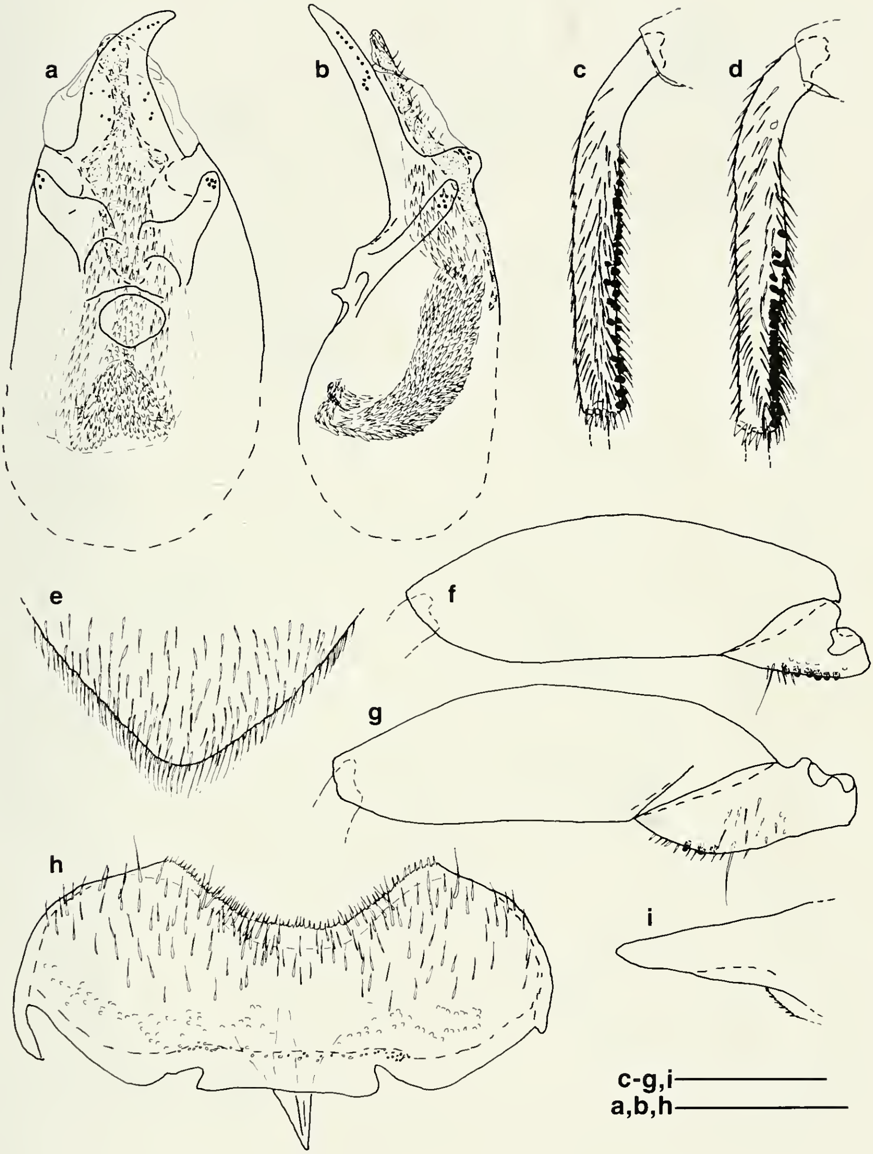


FIG. 47

Megarthrus ovalis, male; a, b: aedeagus, ventral and lateral; c: mesotibia; d: metatibia; e, i: apex of abdominal tergite 8, dorsal and lateral; f: mesofemur and mesotrochanter; g: metafemur and metatrochanter; h: abdominal sternite 8. Scale bars = 0.2 mm.

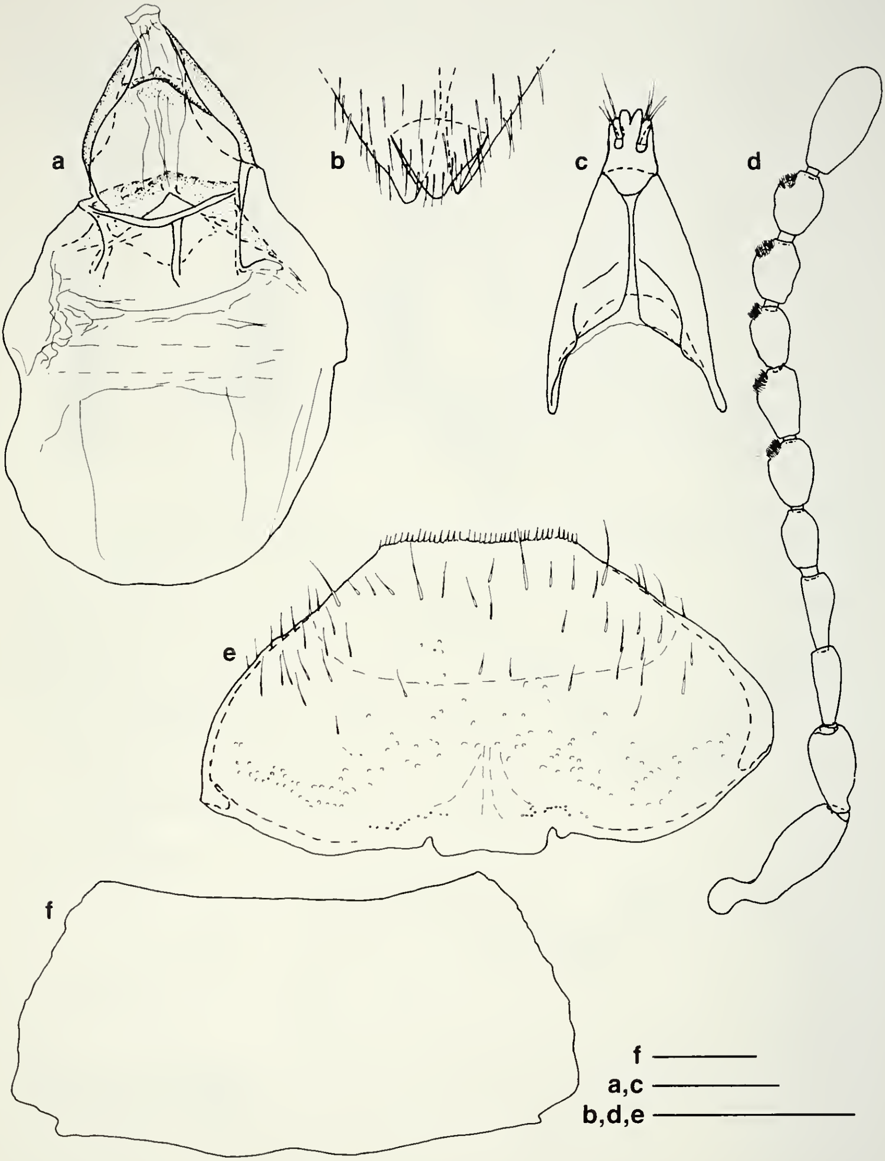


FIG. 48

Megarthrus ovalis; a, c: female, genital segment, tergites (a) and sternites (c); b: female, apex of abdominal tergite 8, dorsal; d: antenna; e: female, abdominal sternite 8; f: pronotum. Scale bars = 0.2 mm.

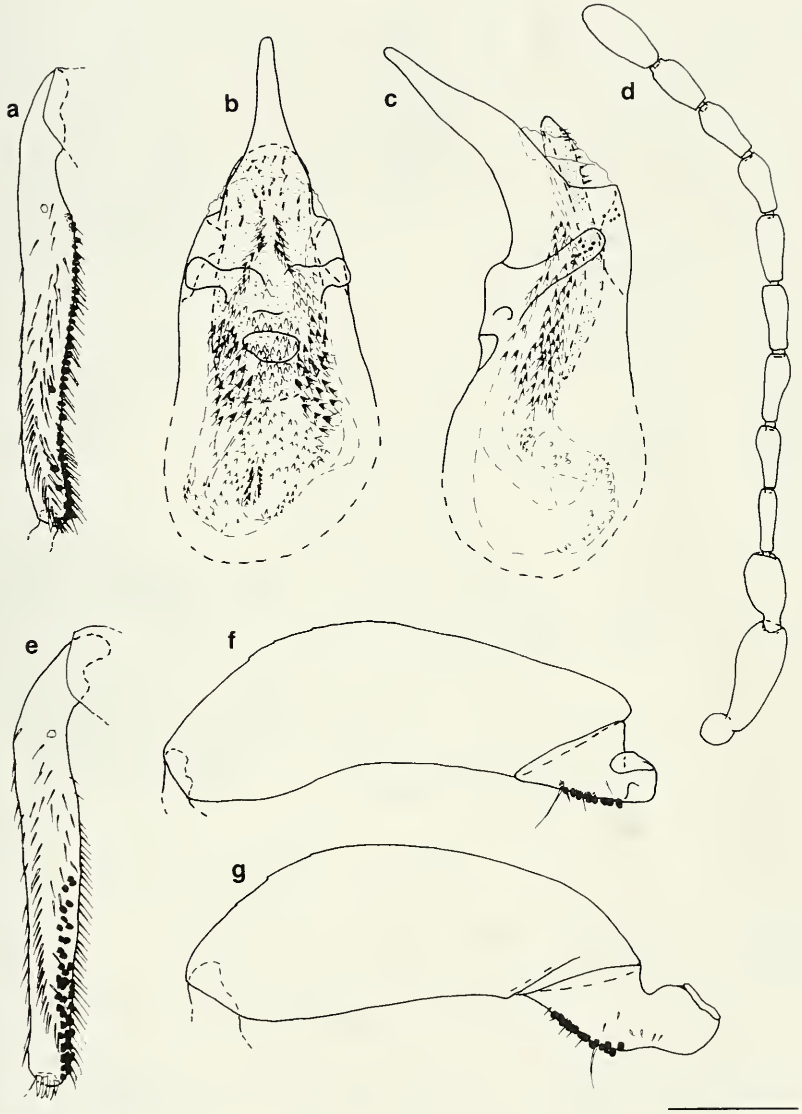


FIG. 49

Megarthrus panga; a; male, mesotibia; b, c: aedeagus, ventral and lateral; d: antenna; e: male, metatibia; f: mesofemur and mesotrochanter; g: metafemur and metatrochanter. Scale bar = 0.2 mm.

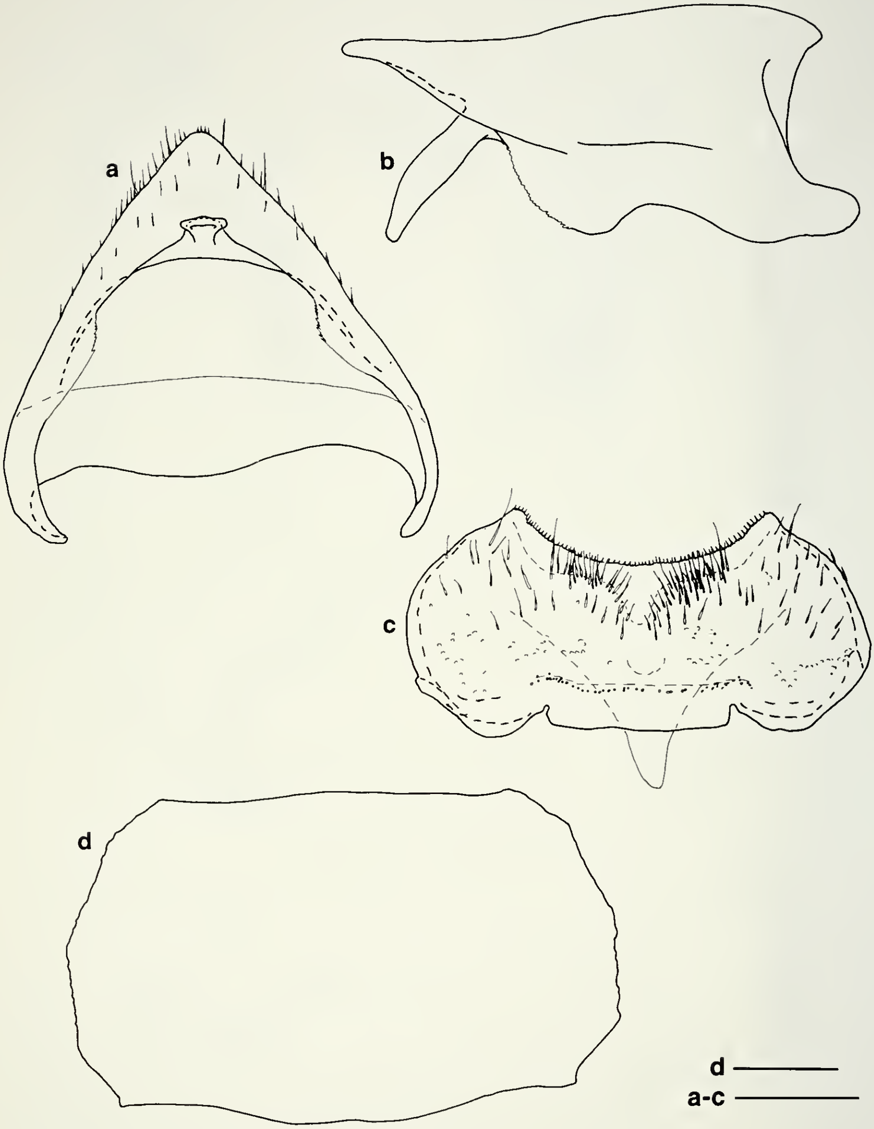


FIG. 50

Megarthrus panga; a, b: male, abdominal tergite 8, ventral and lateral; c: male, abdominal sternite 8; d: pronotum. Scale bars = 0.2 mm.

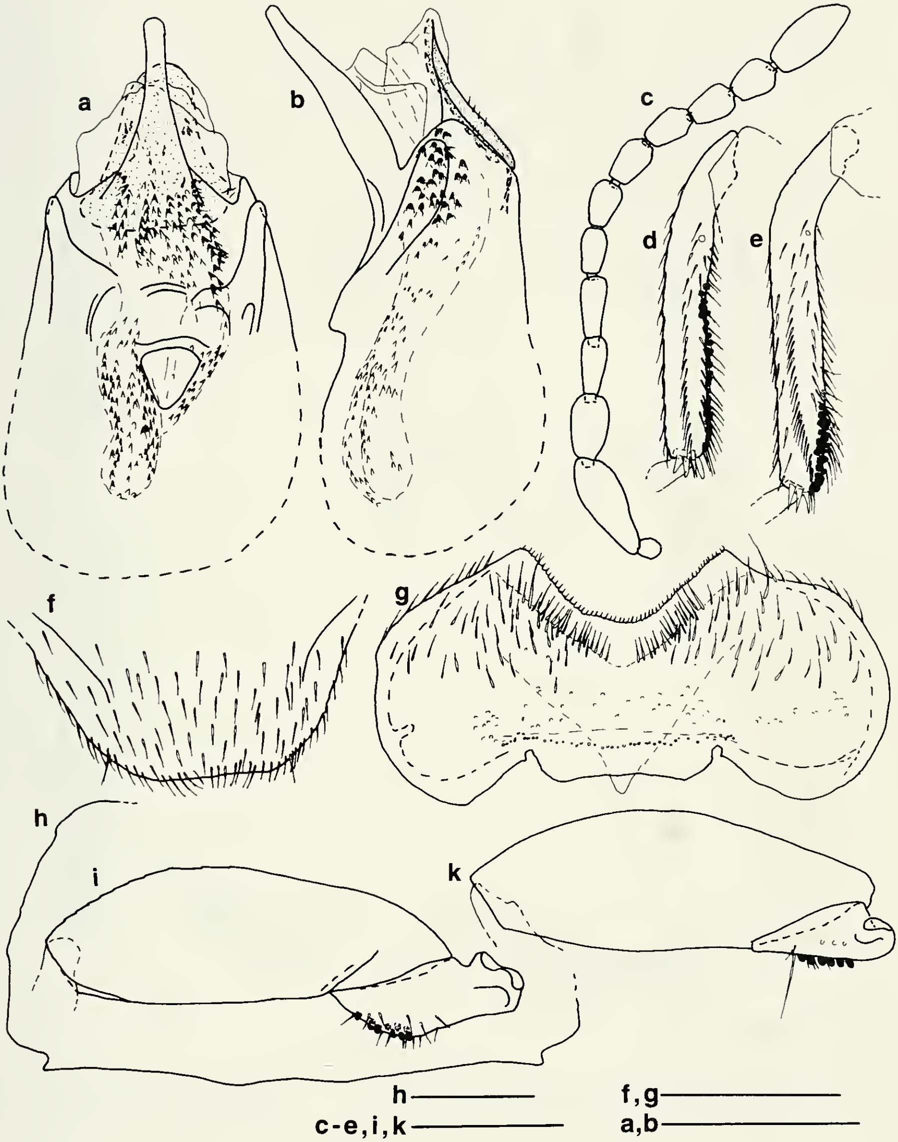


FIG. 51

Megarthrus ras; a-b: aedeagus, ventral and lateral; c: antenna; d: male, mesotibia; e: male, metatibia; f: male, apex of abdominal tergite 8, dorsal; g: male, abdominal sternite 8; h: lateral and basal edges of pronotum; i: male, metafemur and metatrochanter; k: male, mesofemur and mesotrochanter. Scale bars = 0.2 mm.

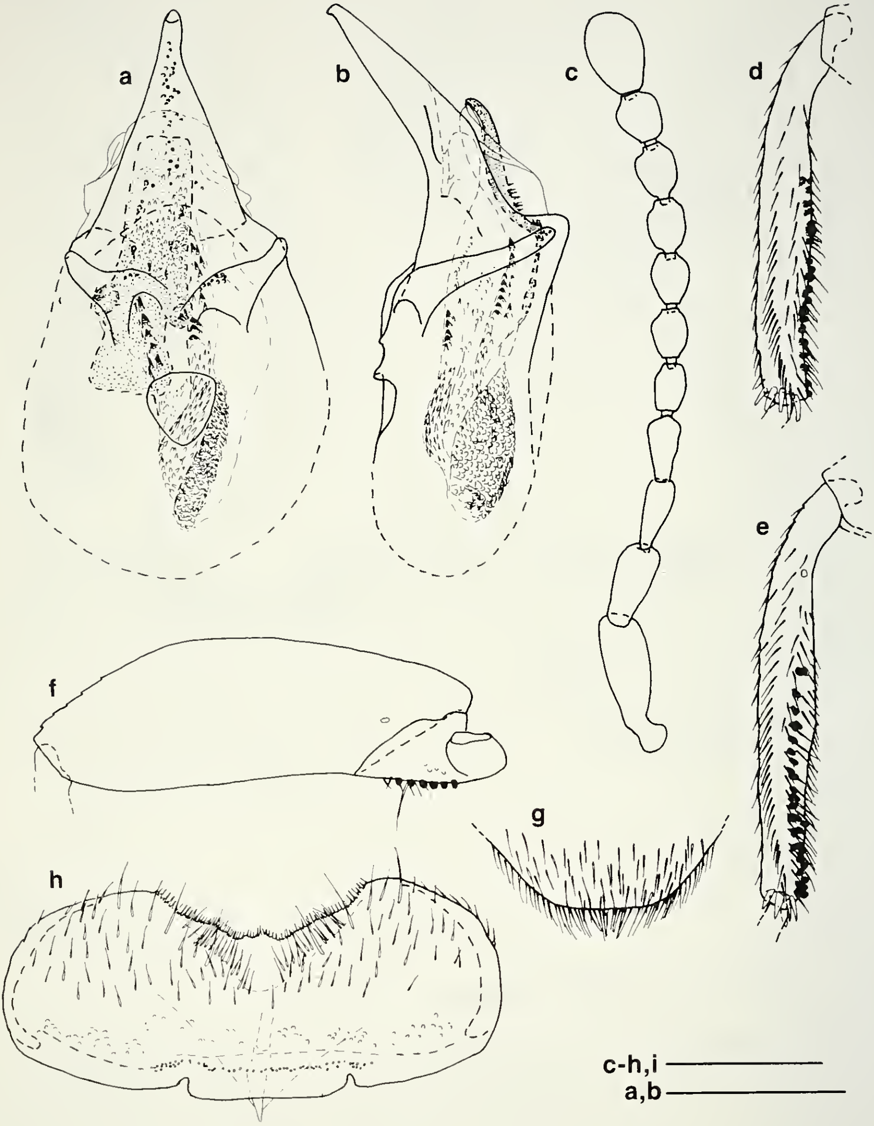


FIG. 52

Megarthrus rougemonti; a, b: aedeagus, ventral and lateral; c: antenna; d: male, mesotibia; e: male, metatibia; f: male, mesofemur and mesotrochanter; g: male, apex of abdominal tergite 8, dorsal; h: male, abdominal sternite 8. Scale bars = 0.2 mm.

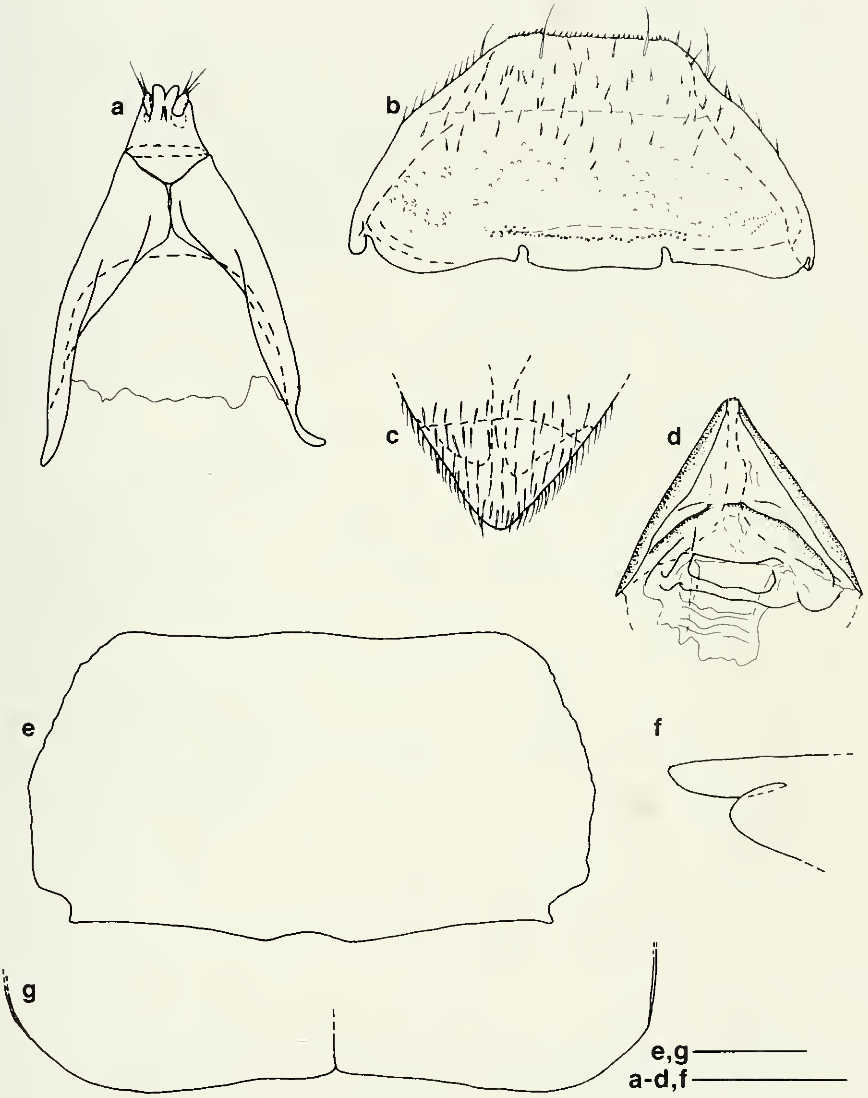


FIG. 53

Megarthrus rougemonti; a, d: female, genital segment, sternites (a) and tergites (d), basal portion broken; b: female, abdominal sternite 8; c, f: female, apex of abdominal tergite 8, dorsal and lateral; e: pronotum; g; male, apical contour of elytra. Scale bars = 0.2 mm.

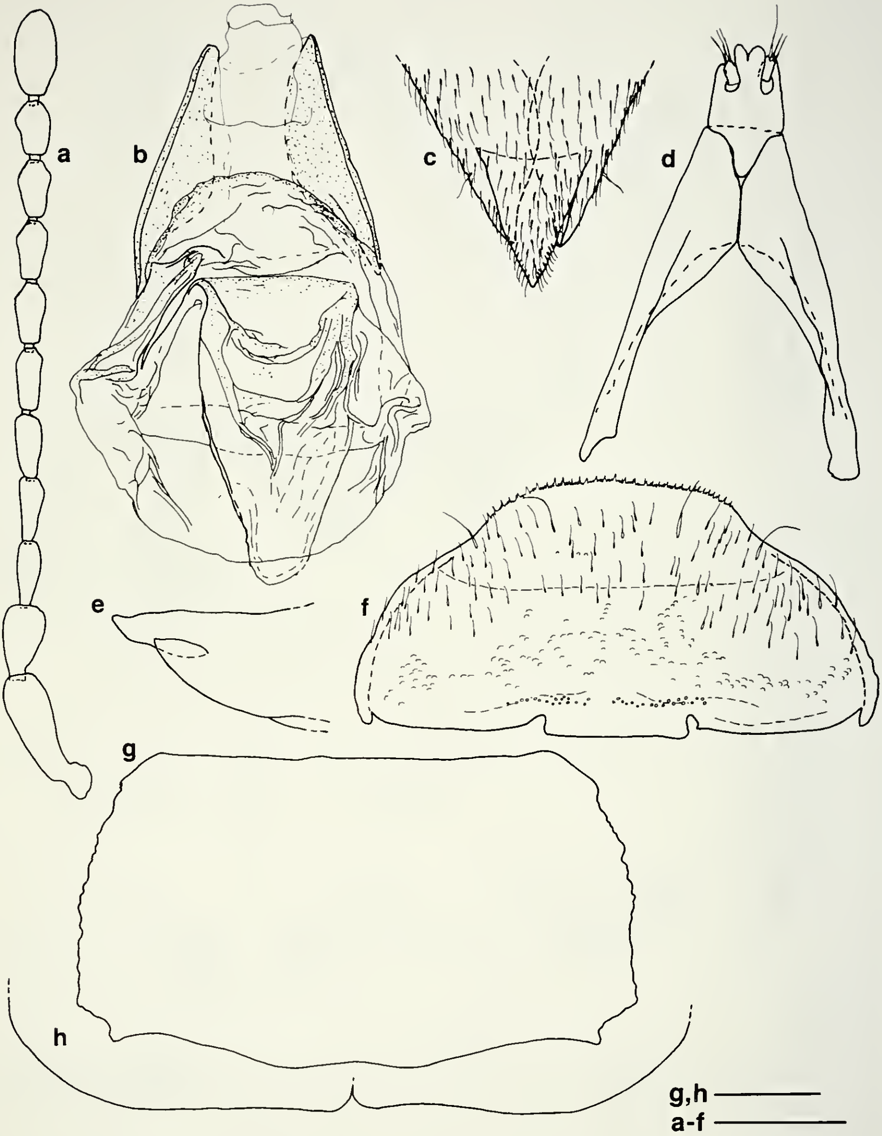


FIG. 54

Megarthrus scotti; a: antenna; b, d: female, genital segment, tergites (b) and sternites (d); c, e: female, apex of abdominal tergite 8, dorsal and lateral; f: female, abdominal sternite 8; g: pronotum; h: female, apical contour of elytra. Scale bars = 0.2 mm.

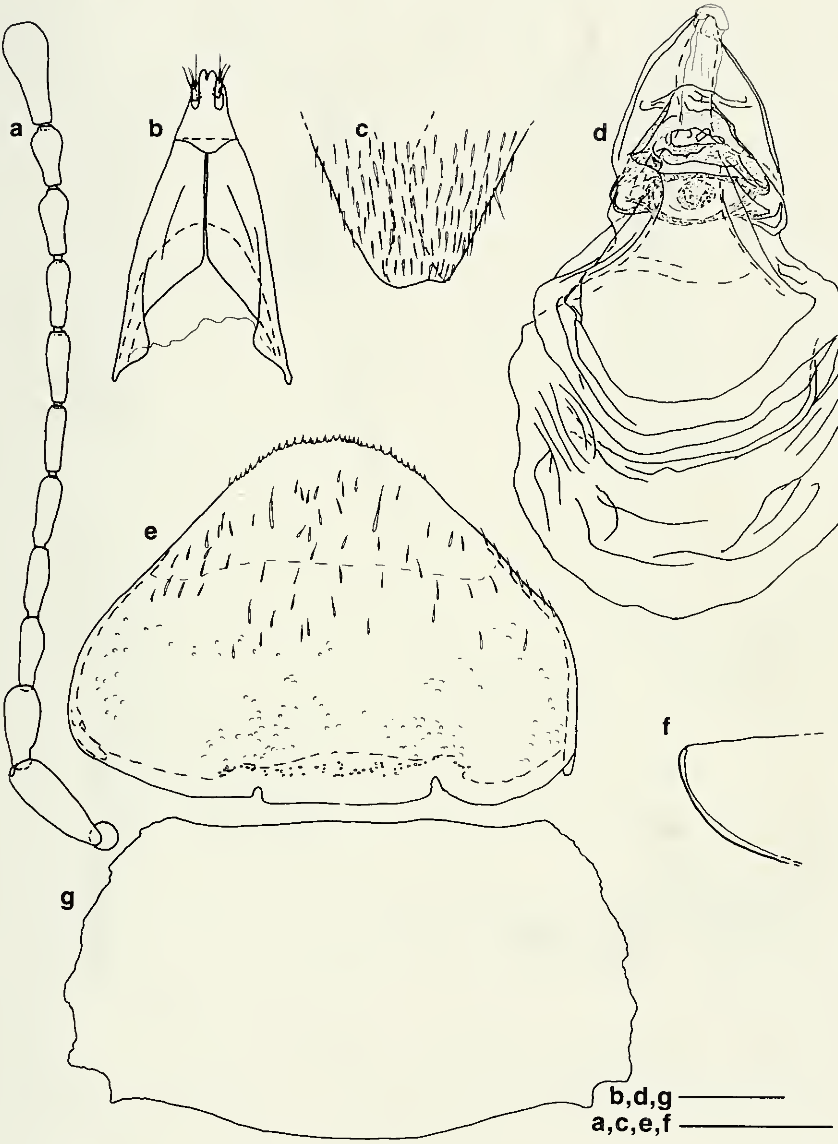


FIG. 55

Megarthrus selenitus; a: antenna; b, d: female, genital segment, sternites (b) and tergites (d); c, f: female, apex of abdominal tergite 8, dorsal and lateral; e: female, abdominal sternite 8; g: pronotum. Scale bars = 0.2 mm.

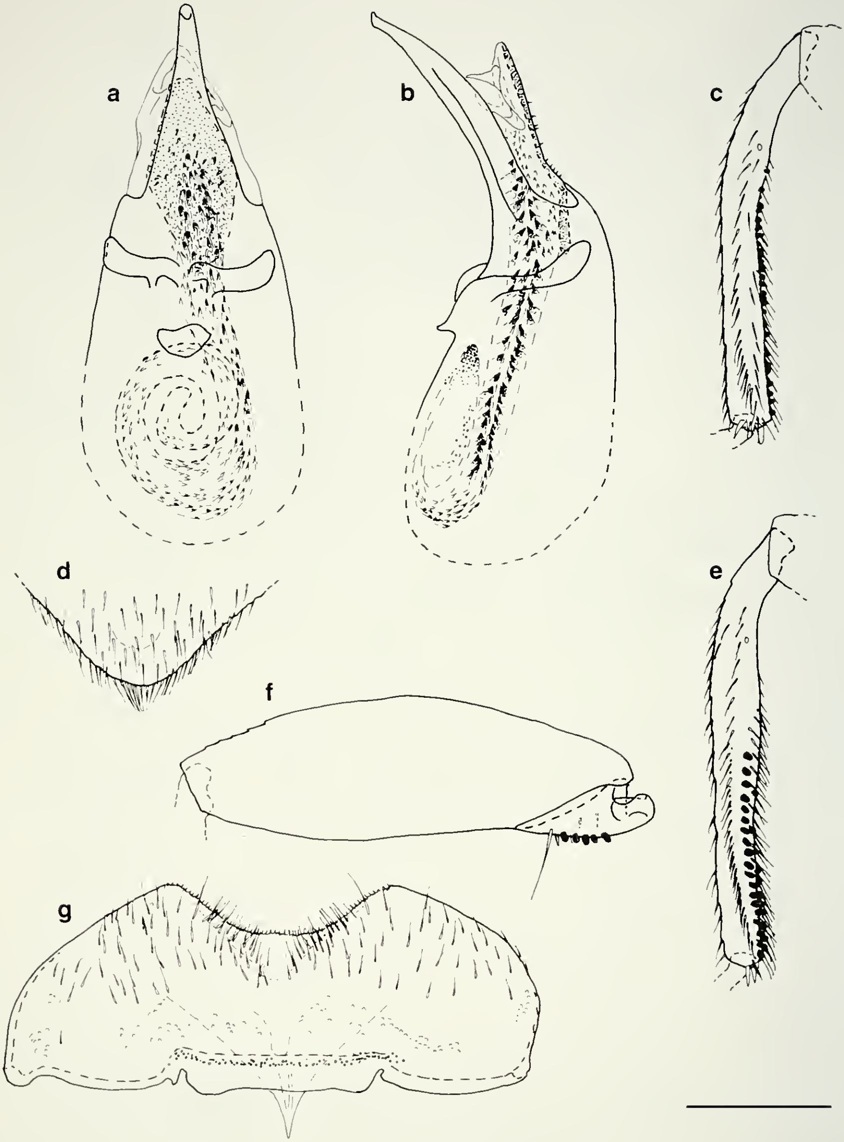


FIG. 56

Megarthrus simienensis, male; a, b: aedeagus, ventral and lateral; c: mesotibia; d: apex of abdominal tergite 8, dorsal; e: metatibia; f: mesofemur and mesotrochanter; g: abdominal sternite 8. Scale bar = 0.2 mm.

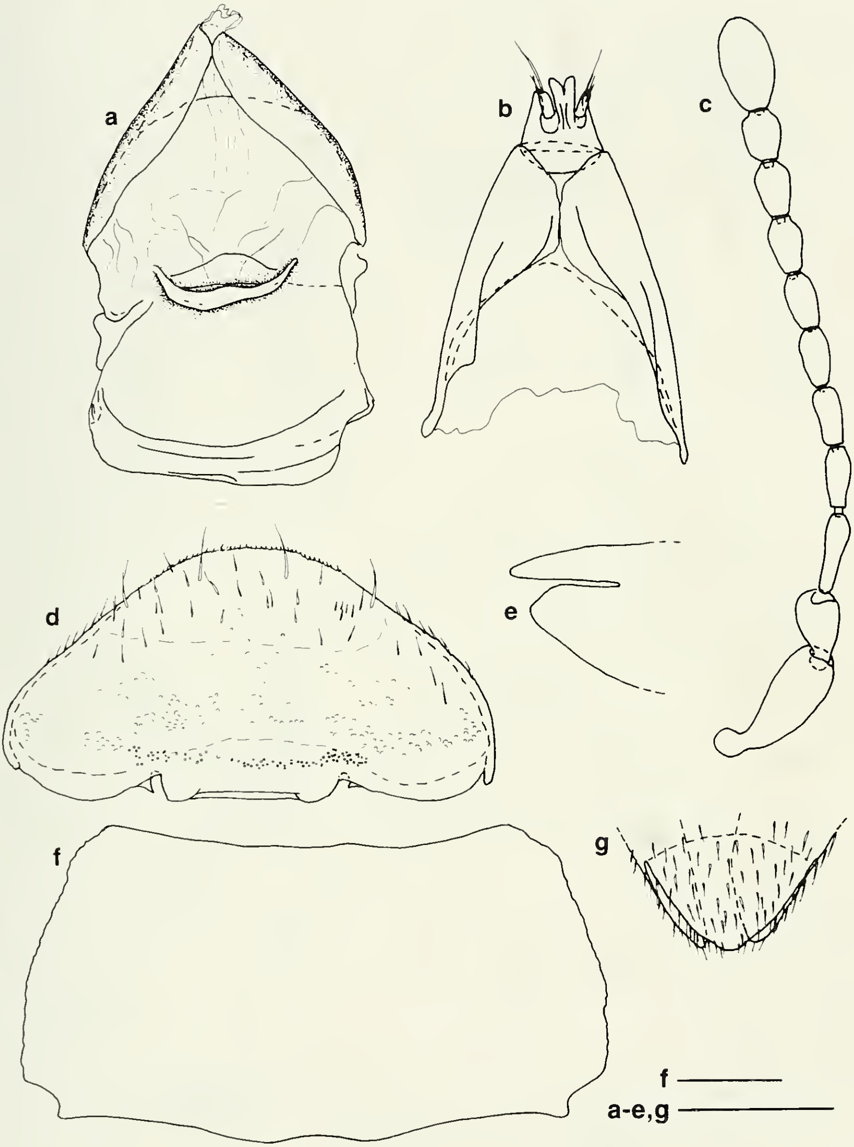


Fig. 57

Megarthrus simienensis; a, b: female, genital segment, tergites (a) and sternites (b); c: antenna; d: female, abdominal sternite 8; e, g: female, apex of abdominal tergite 8, lateral and dorsal; f: pronotum. Scale bars = 0.2 mm.

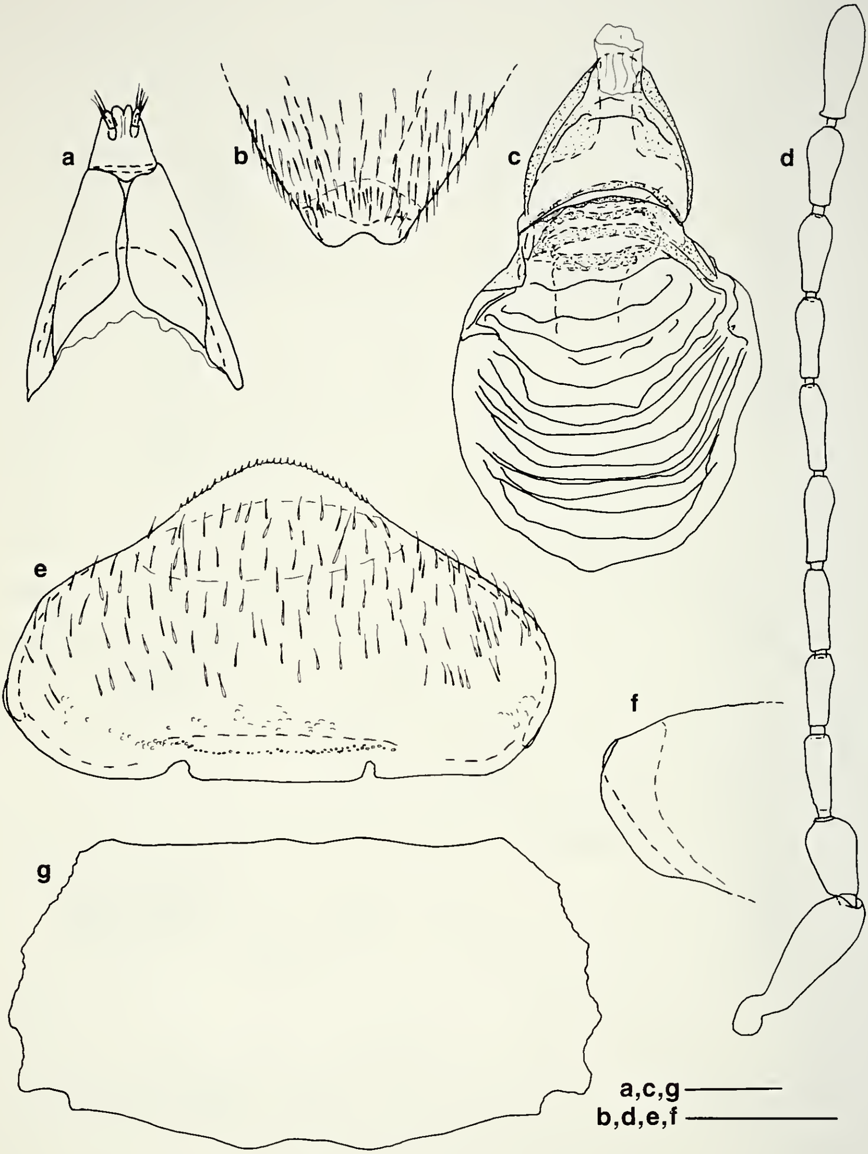


FIG. 58

Megarthrus spinosus; a, c: female, genital segment, sternites (a) and tergites (c); b, f: female, apex of abdominal tergite 8, dorsal and lateral; d: antenna; e: female, abdominal sternite 8; g: pronotum. Scale bars = 0.2 mm.

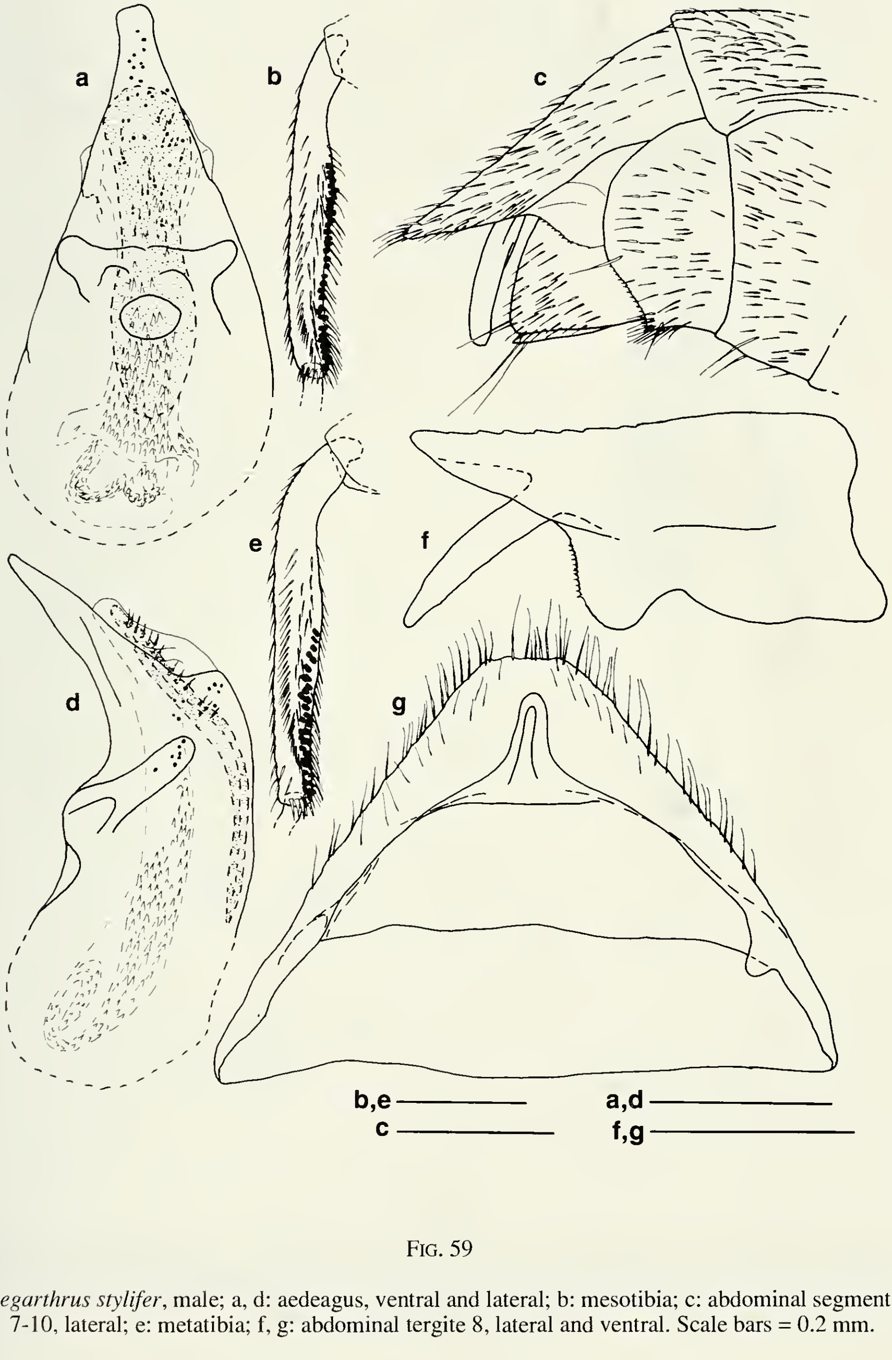


FIG. 59

Megarthrus stylifer, male; a, d: aedeagus, ventral and lateral; b: mesotibia; c: abdominal segments 7-10, lateral; e: metatibia; f, g: abdominal tergite 8, lateral and ventral. Scale bars = 0.2 mm.

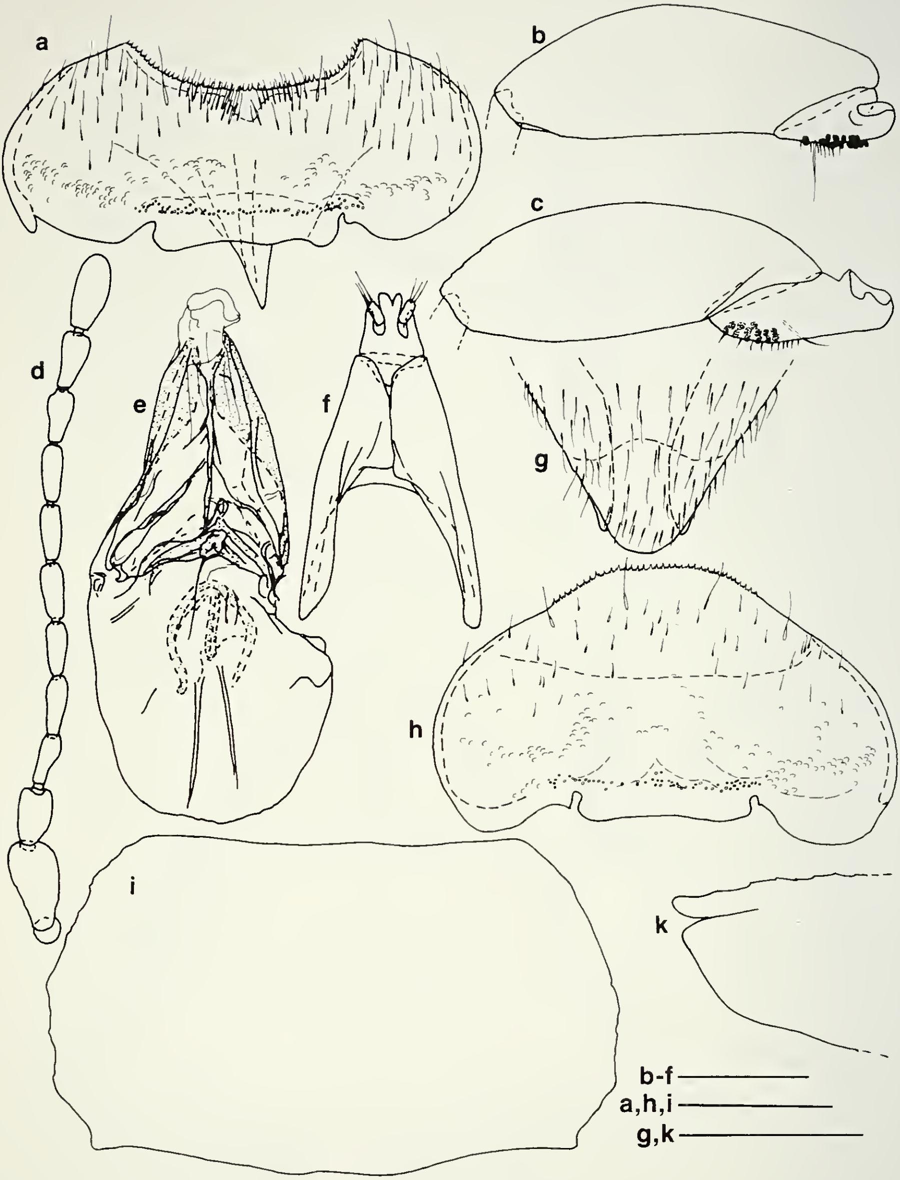


FIG. 60

Megarthrus stylifer; a, h: abdominal sternite 8, male (a) and female (h); b: male, mesofemur and mesotrochanter; c; male, metafemur and metatrochanter; d, antenna; e, f, female, genital segment, tergites (e) and sternites (f); g, k: female, apex of abdominal tergite 8, dorsal and lateral; i: pronotum. Scale bars = 0.2 mm.

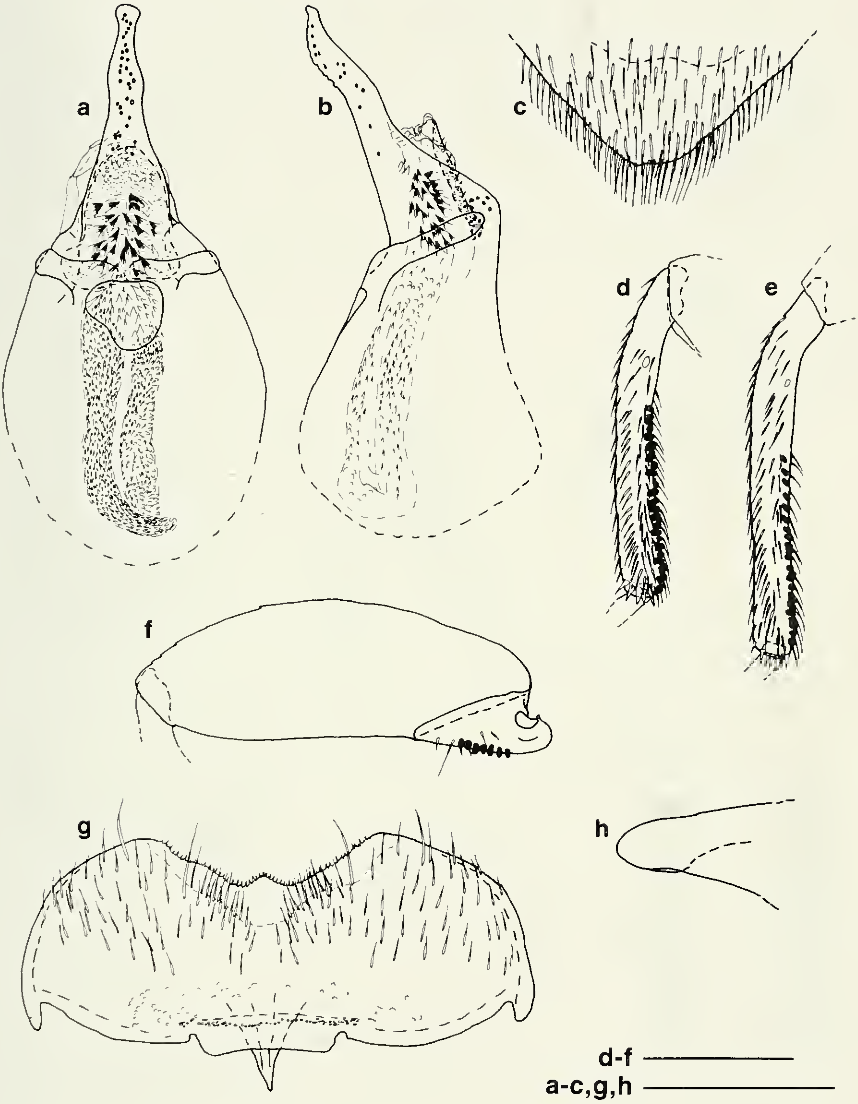


FIG. 61

Megarthrus twa, male; a, b: aedeagus, ventral and lateral; c, h: apex of abdominal tergite 8, dorsal and lateral; d: mesotibia; e: metatibia; f: mesofemur and mesotrochanter; g: abdominal sternite 8. Scale bars = 0.2 mm.

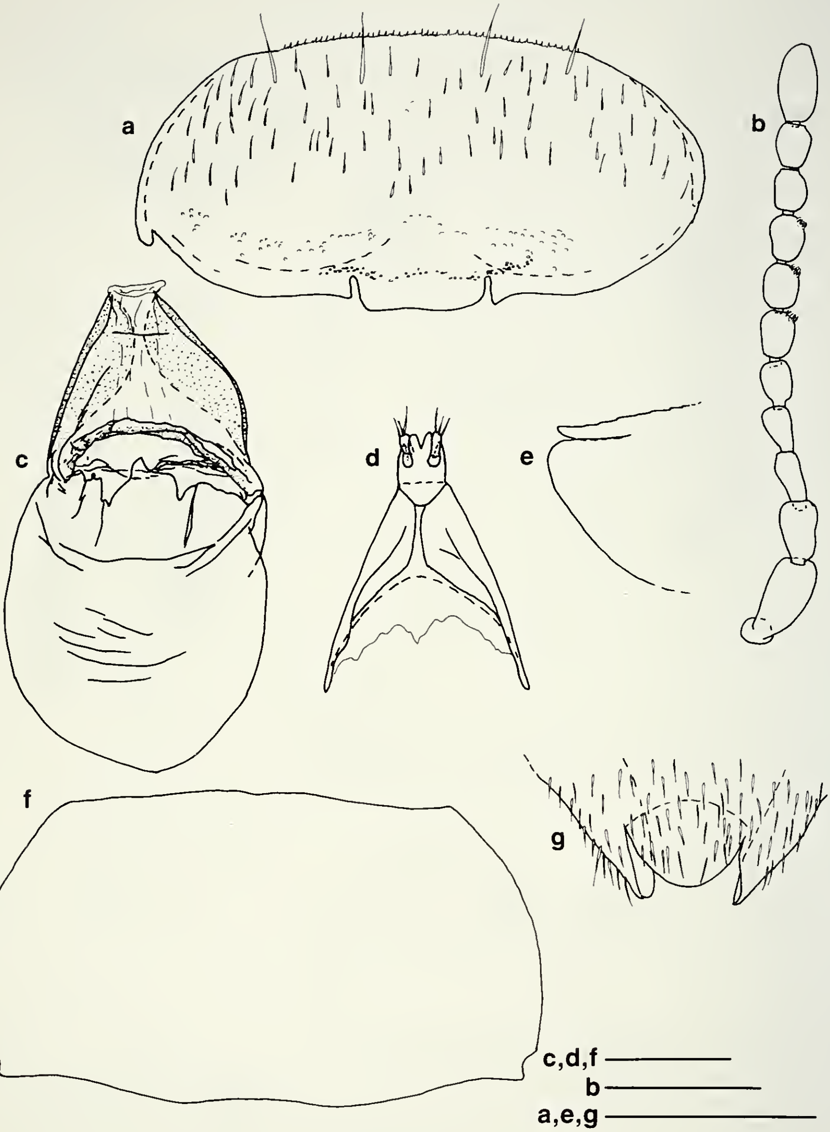


FIG. 62

Megarthrus twa: a: female, abdominal sternite 8; b: antenna; c, d: female, genital segment, tergites (c) and sternites (d); e, g: female, apex of abdominal tergite 8, lateral and dorsal; f: pronotum. Scale bars = 0.2 mm.

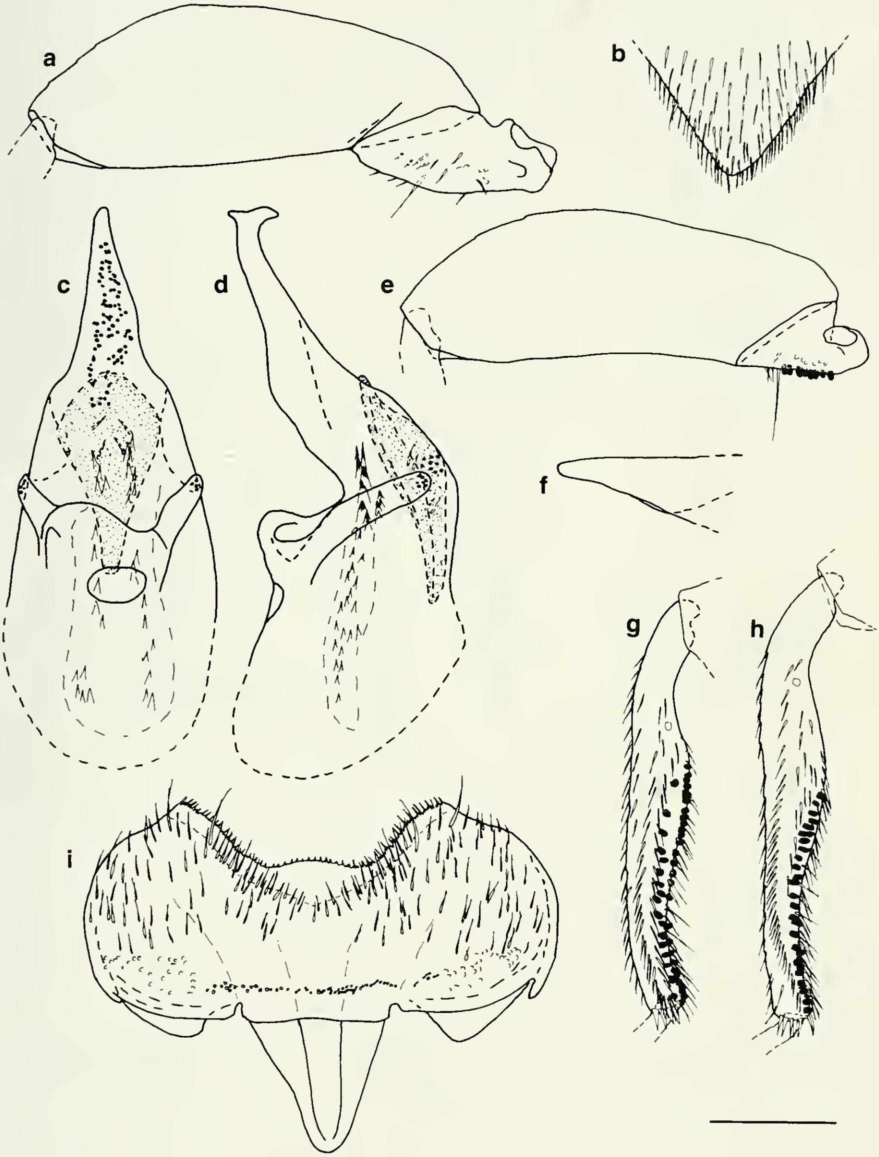


FIG. 63

Megarthrus vanschuytbroecki, male; a: metafemur and metatrochanter; b, f: apex of abdominal tergite 8, dorsal and lateral; c, d: aedeagus, ventral and lateral; e: mesofemur and mesotrochanter; g: mesotibia; h: metatibia; i: abdominal sternite 8. Scale bar = 0.2 mm.

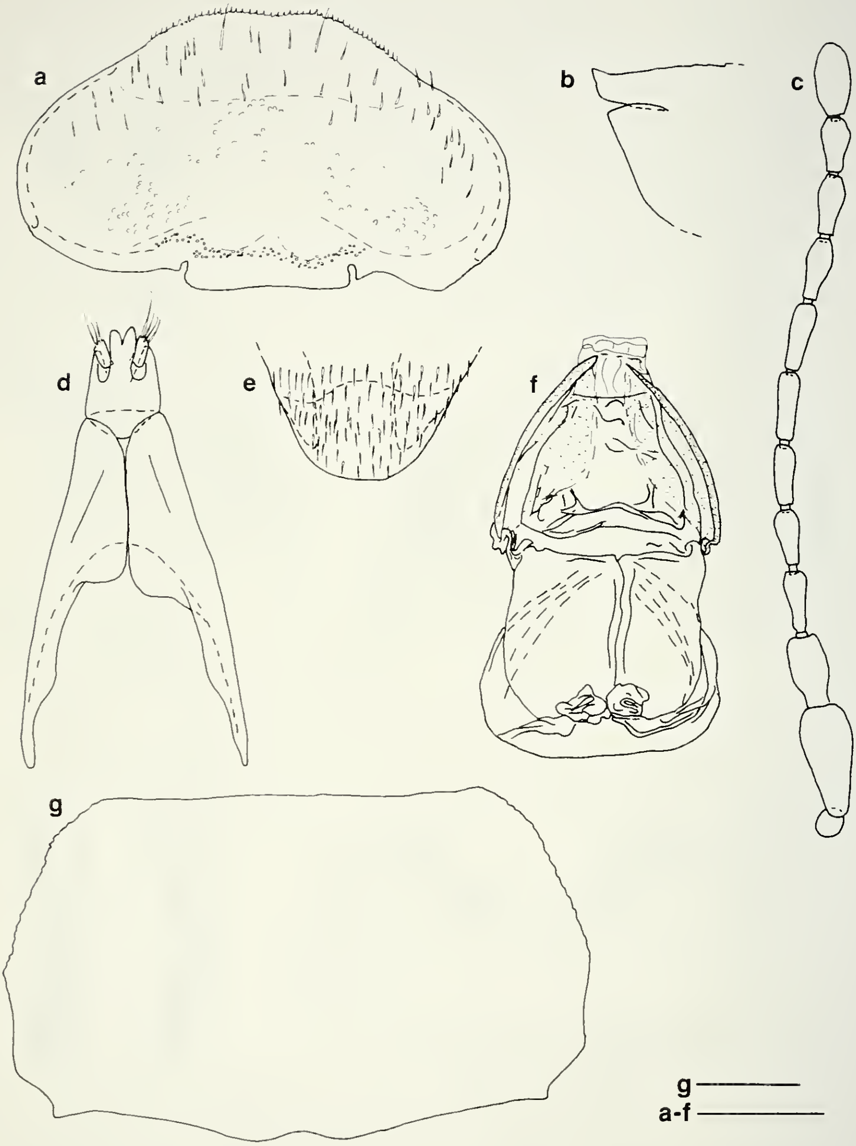


FIG. 64

Megarthrus vanschuytbroecki; a: female, abdominal sternite 8; b, e: female, apex of abdominal tergite 8, lateral and dorsal; c: antenna; d, f: female, genital segment, sternites (d) and tergites (f); g: pronotum. Scale bars = 0.2 mm.

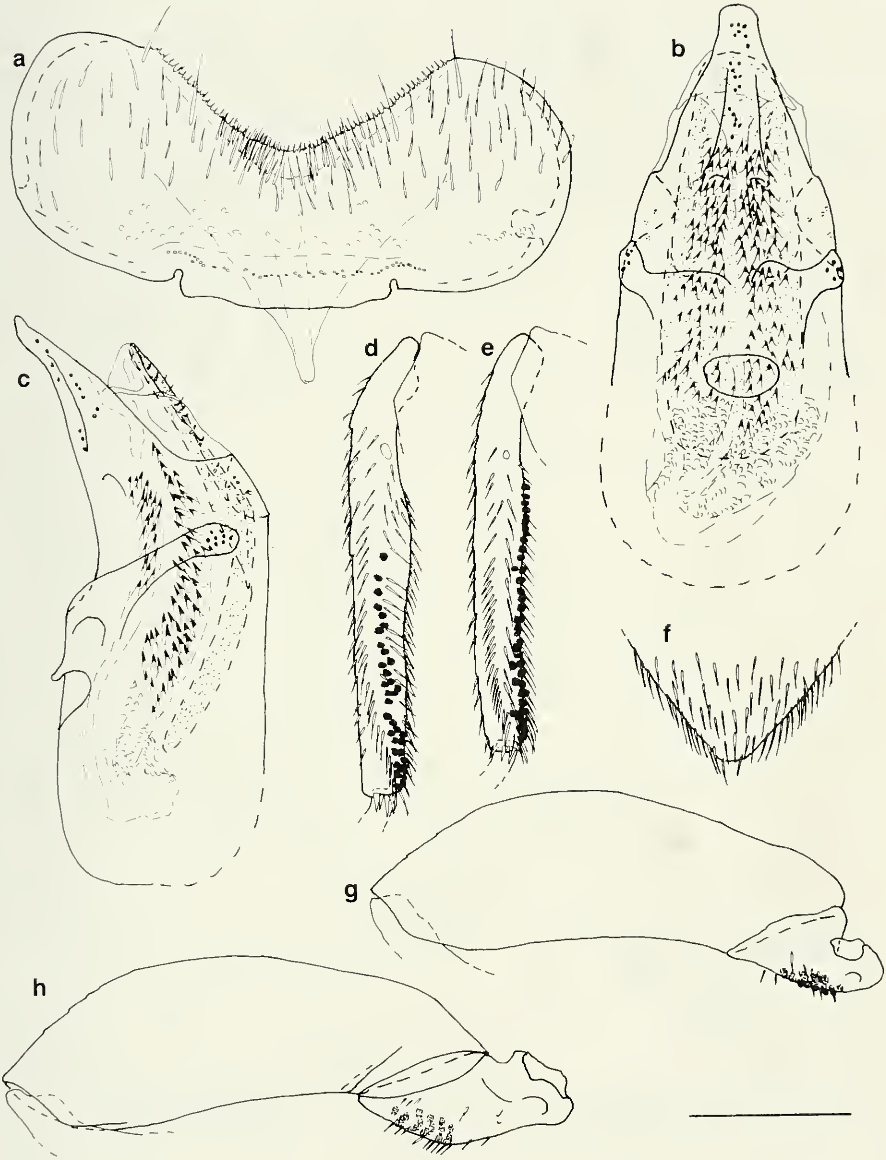


FIG. 65

Megarthrus watutsi, male; a: abdominal sternite 8; b, c: aedeagus, ventral and lateral; d: metatibia; e: mesotibia; f: apex of abdominal tergite 8, dorsal; g: mesofemur and mesotrochanter; h: metafemur and metatrochanter. Scale bar = 0.2 mm.

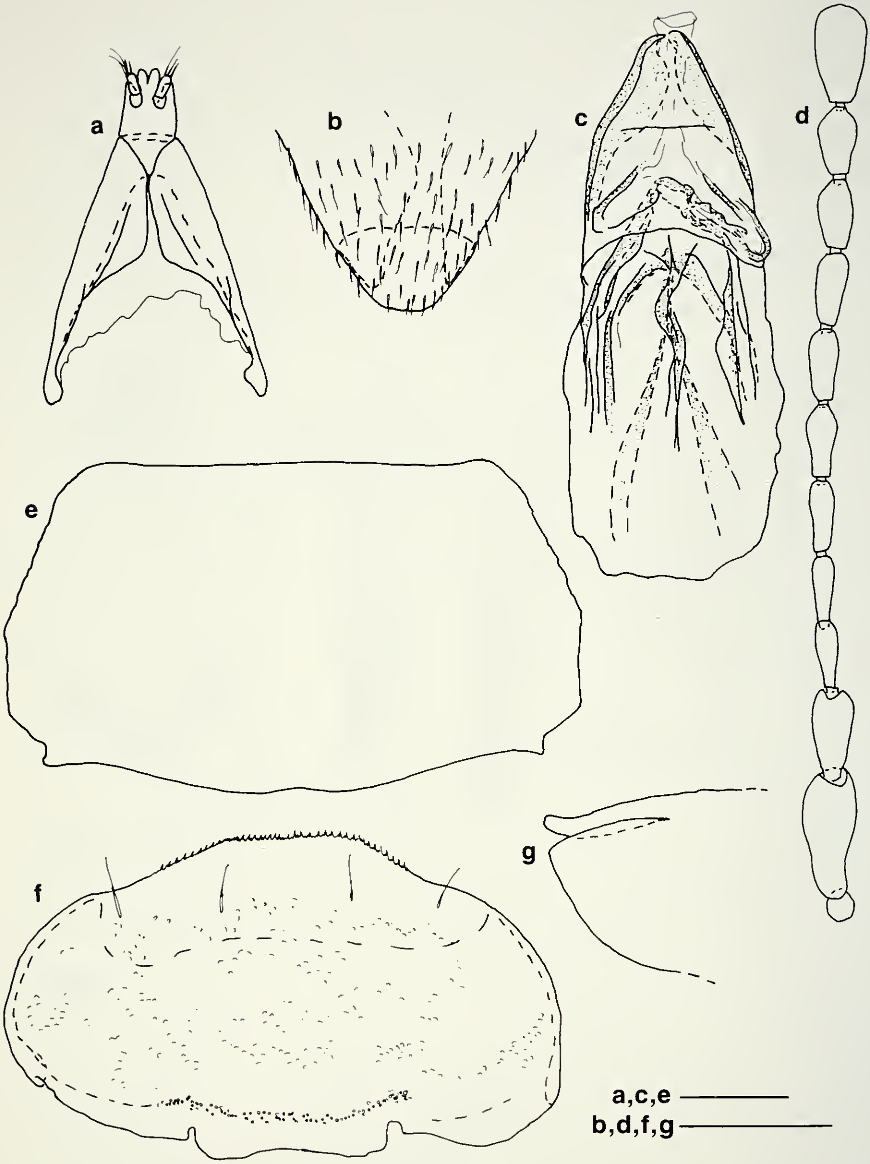


FIG. 66

Megarthrus watutsi; a, c: female, genital segment, sternites (a) and tergites (c); b, g: female, apex of abdominal tergite 8, dorsal and lateral; d: antenna; e: pronotum; f: female, abdominal sternite 8. Scale bars = 0.2 mm.

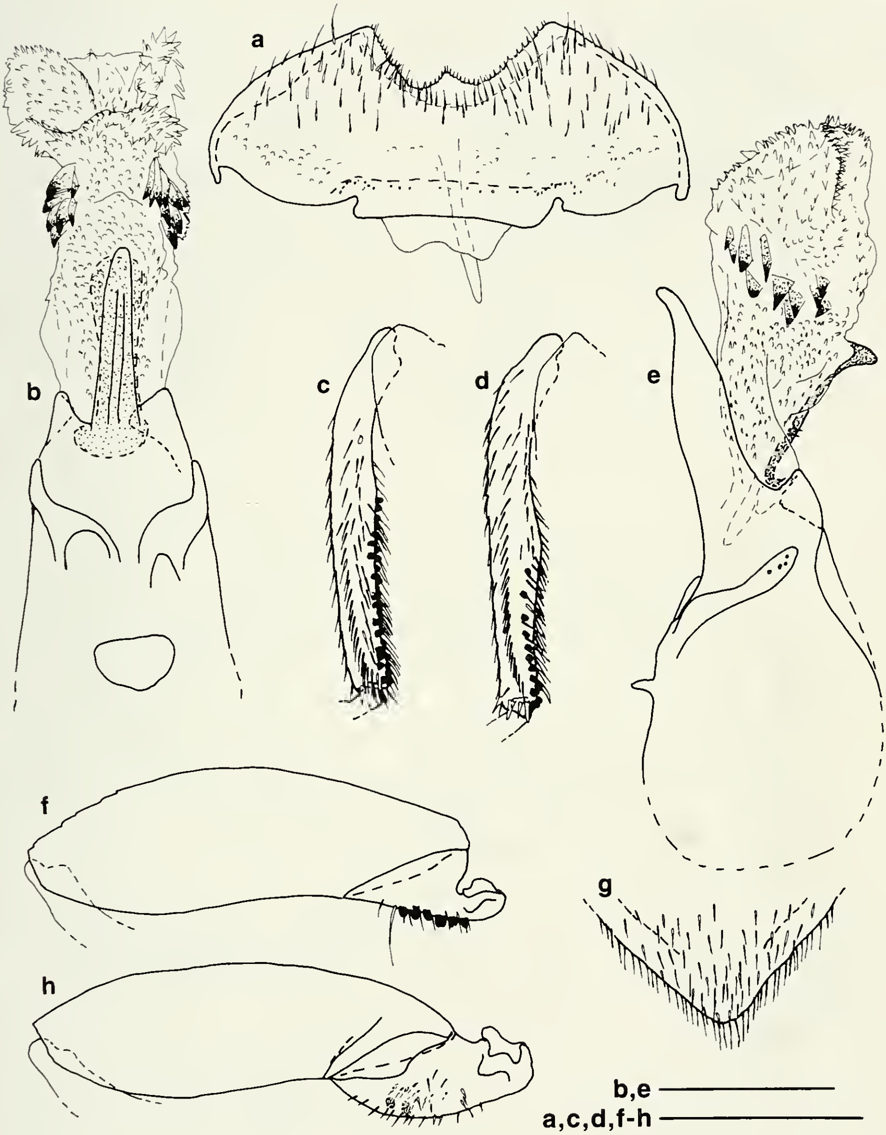


FIG. 67

Megarthrus wittei, male; a: abdominal sternite 8; b, e: aedeagus, ventral and lateral; c: mesotibia; d: metatibia; f: mesofemur and mesotrochanter; g: apex of abdominal tergite 8, dorsal; h: metafemur and metatrochanter. Scale bars = 0.2 mm.

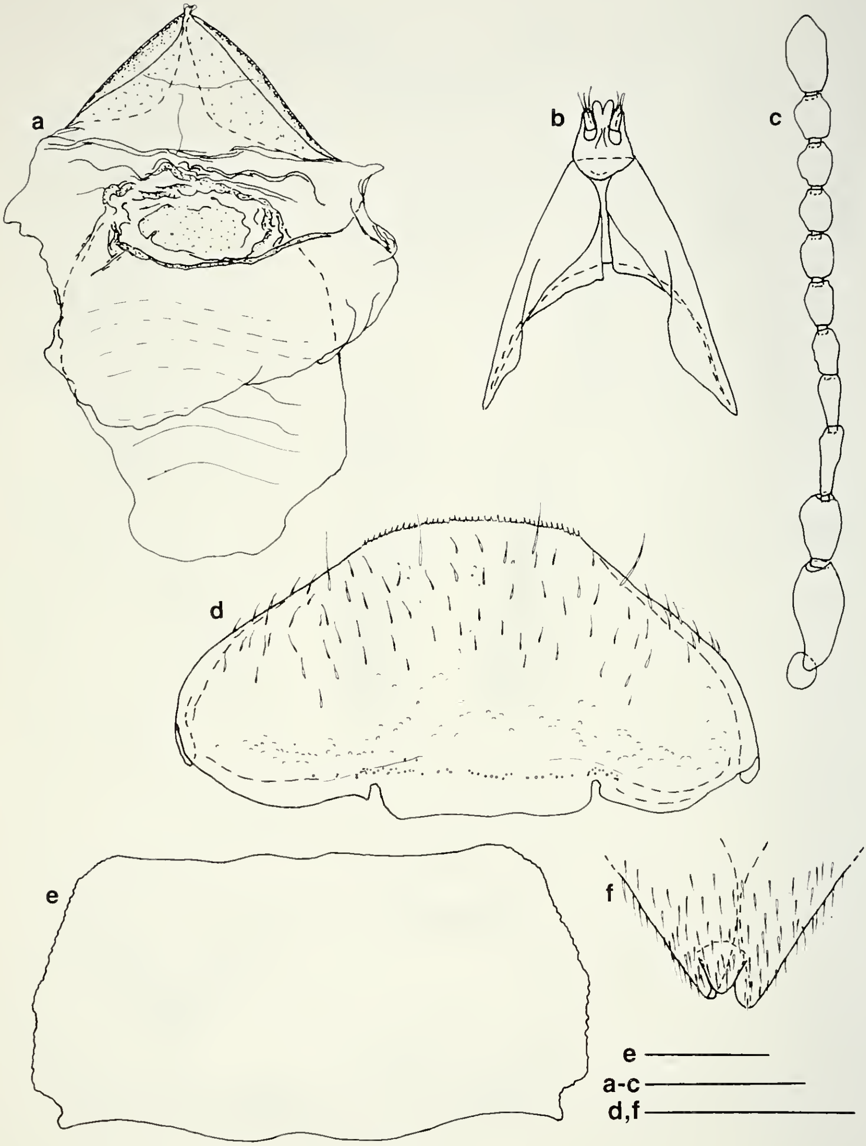


FIG. 68

Megarthrus wittei; a, b: female, genital segment, tergites (a) and sternites (b); c: antenna; d; f: female, abdominal sternite 8; e: pronotum; f: female, apex of abdominal tergite 8, dorsal. Scale bars = 0.2 mm.

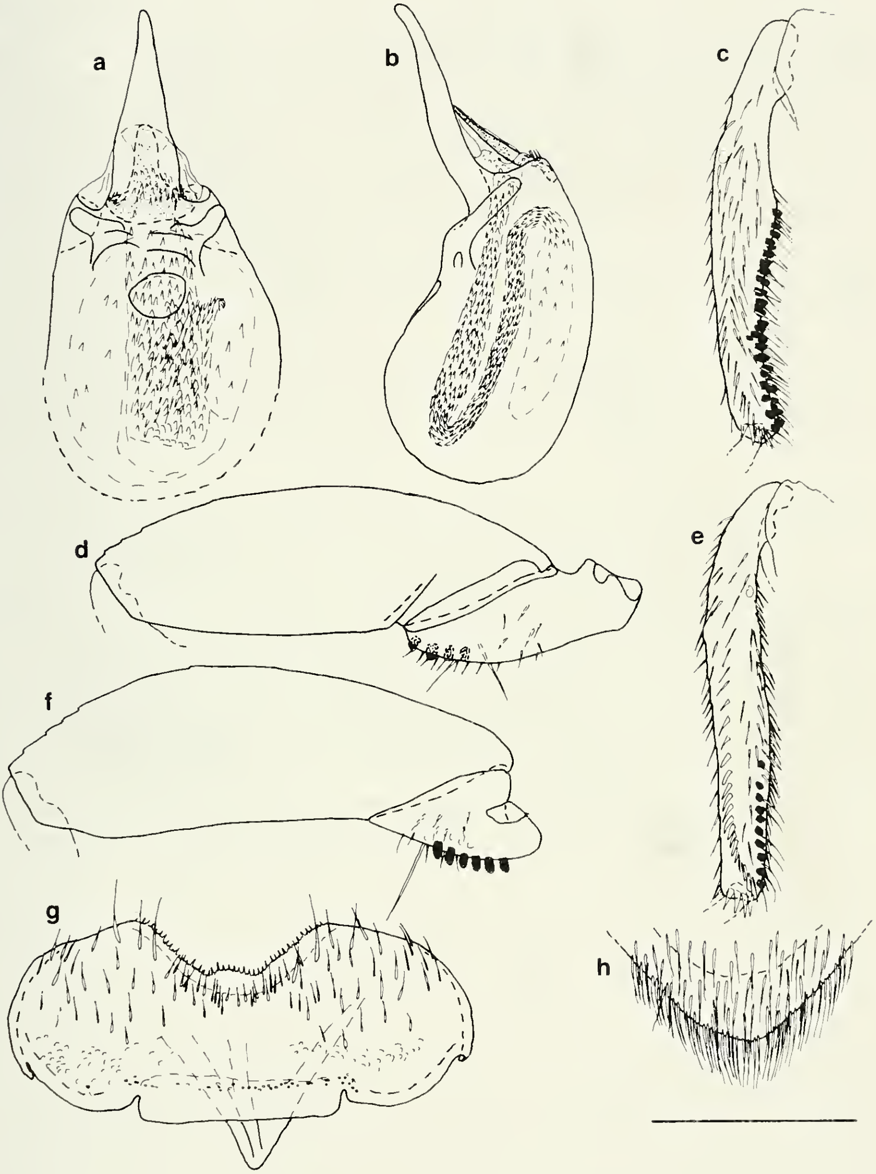


FIG. 69

Megarthrus zulu, male; a, b: aedeagus, ventral and lateral; c: mesotibia; d: metafemur and metatrochanter; e: metatibia; f: mesofemur and mesotrochanter; g: abdominal sternite 8; h: apex of abdominal tergite 8, dorsal. Scale bar = 0.2 mm.

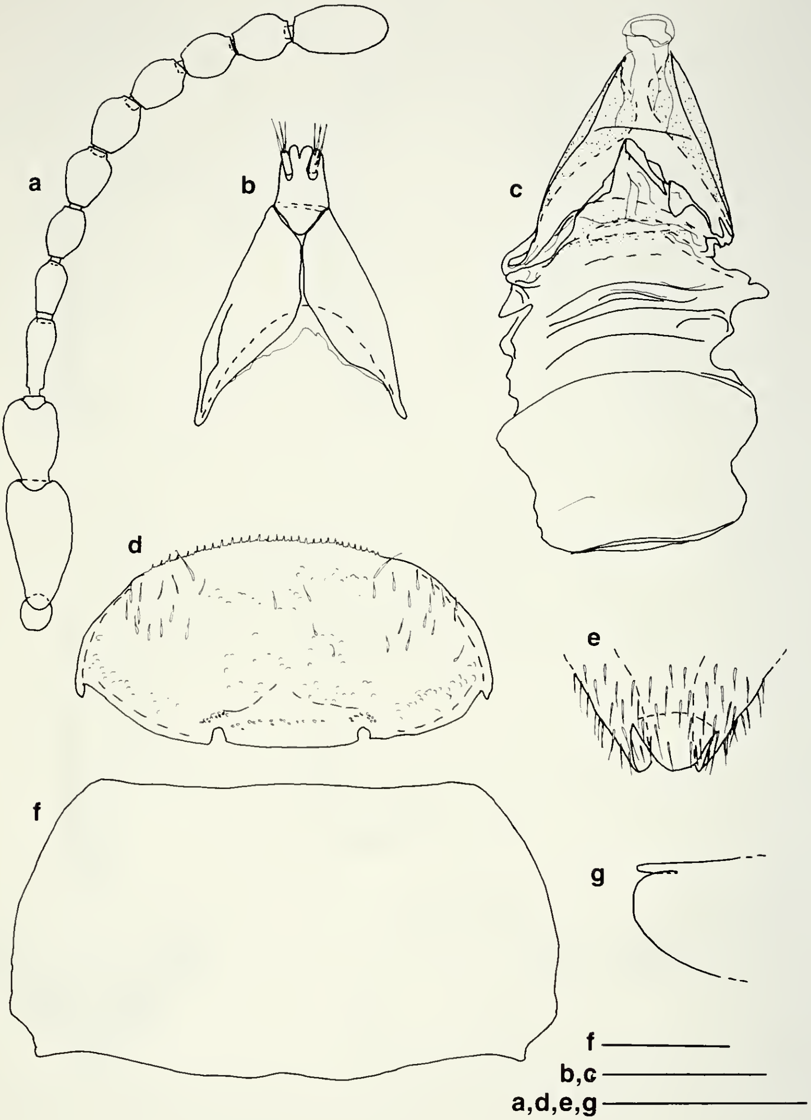


FIG. 70

Megarthrus zulu; a: antenna; b, c: female, genital segment, sternites (b) and tergites (c); d: female, abdominal sternite 8; e, g: female, apex of abdominal tergite 8, dorsal and lateral; f: pronotum. Scale bars = 0.2 mm.

REFERENCES

BERNHAUER, M. 1931. Entomological Expedition to Abyssinia, 1926-7: Coleoptera, Staphylinidae. *J. Linn. Soc., Zool.*, 37: 559-605.

BERNHAUER, M. & R. PAULIAN. 1942. Coléoptères Staphylinides du Cameroun (Mission P. Lepesme, R. Paulian et A. Villier, 1939). *Revue Zool. Bot. afr.*, 35: 344-375.

CAMERON, M. 1942. New Species of Staphylinidae (Col.) collected by the Coryndon Museum Expedition to the Chyulu Hills. *Ann. Mag. nat. Hist.*, 53: 321-332.

CAMERON, M. 1950. Staphylinidae (Coleoptera Polyphaga). *Explor. Park nat. Albert, Miss. de Witte (1933-1935)*, Brussels, fasc. 59: 85pp.

COIFFAIT, H. 1982. Contribution à la connaissance des Staphylinides de l'Himalaya (Népal, Ladakh, Cachemire) (Insecta: Coleoptera: Staphylinidae). *Senckenbergiana biol.* 62: 21-179.

CUCCODORO, G. 1995. Two new species of *Megarthrus* (Coleoptera, Staphylinidae, Proteininae) and a note on "water loading" behaviour. *J. Zool.*, 236: 253-264.

EICHELBAUM, F. 1913. Verzeichnis der von mir in den Jahren 1903 und 1904 in Deutsch- und Britisch-Ostafrika eingesammelten Staphylinidae. *Arch. Naturgesch.*, Abt. A (3): 114-168.

FAGEL, G. 1957. Contribution à l'étude de la faune entomologique du Ruanda-Urundi (Mission P. Basilewsky 1953). CXIX.Coleoptera Staphylinidae: Piestinae, Omaliinae, Proteininae, Osorinae, Oxytelinae. *Annls Mus. r. Congo belge, Sér. 8°, Zool.*, 58: 26-72.

HAYASHI, Y. 1988. Studies on Staphylinidae from Japan. 2. *Entomol. Rev. Japan*, 45: 17-23.

NEWTON, A. F. Jr. 1985. South temperate Staphylinoidea (Coleoptera): their potential for biogeografic analysis of austral disjunctions. In: G. E. Ball (ed.), Taxonomy, Phylogeny and Zoogeography of Beetles and Ants, pp. 179-220. Dordrecht.

NEWTON, A. F. Jr. & M. K. THAYER. 1992. Current Classification and Family-Group Names in Staphyliniformia (Coleoptera). *Fieldiana: Zool.*, 67: 1-92.

STEEL, W. O. 1966. A revision of the Staphylinid subfamily Proteininae (Coleoptera) I. *Trans. R. ent. Soc. Lond.*, 118: 285-311.

THAYER, M. K. 1987. Biology and phylogenetic relationships of *Neophonus bruchi*, an anomalous south Andean staphylinid (Coleoptera). *Syst. Ent.*, 12: 389-404.

REVUE SUISSE DE ZOOLOGIE, 102 (3) : 763-768; septembre 1995

Eine neue *Haroldius*-Art aus Borneo (Coleoptera, Scarabaeidae)

Joachim SCHEUERN
Westerwaldstr. 18, D-53489 Westum, BRD.

A new *Haroldius* species from Borneo (Coleoptera, Scarabaeidae).- *Haroldius pauliani* n. sp. is described and illustrated from Sabah. Some ecological aspects of *Haroldius* are briefly discussed, differences to similar species (*H. fleutiauxii* Paulian and *H. sumatranus* Paulian & Scheuern) are listed. A new key of the known species of the genus is provided.

Key-words: Coleoptera - Scarabaeidae - *Haroldius* - Taxonomy - Ecology - Borneo.

EINLEITUNG

BALTHASAR (1963) beschreibt die *Haroldius*-Arten als echte Myrmecophile mit unvollständigem Trutztyp, schließt auf Synoekie und führt *H. heimi* (Wasm.) (in Nestern von *Pheidole latinoda*) und *H. philippinensis* Per. (bei *Diacamma vagans*-Gruppe) an. *H. perroti* Paulian wurde zusammen mit der Histeride Bacanius Er. in faulendem Laub gefunden (PAULIAN, 1939). Bei Ameisen und Termiten hat JANSSENS (1949, 1953) afrotropische Arten der ehemaligen Gattung *Afroharoldius* Jans. (syn. zu *Haroldius* Bouc., PAULIAN, 1985) nachgewiesen.

Von Scarabaeidae werden stets nur einzelne Exemplare der Gattung *Haroldius*, dagegen häufiger *Panelus*-Arten aus Gesieben von faulenden Blättern, Ästen, manchmal von faulenden Früchten an Waldrändern oder in Wäldern gelesen (Löbl, in litt.). Zwar sind in diesen Habitaten auch Ameisen anzutreffen, doch ist eine generelle Myrmecophilie der Gattung *Haroldius* Bouc. nicht ableitbar.

Die neue Art *Haroldius pauliani* n. sp. wurde wie *H. sumatranus* Paulian & Scheuern und *H. thailandensis* Paulian & Scheuern (1994) aus Laubgesieben gelesen.

Der Bau der Mundwerkzeuge läßt auf eine saprophage, mycetophage oder myrmecophage Ernährung, die Fundumstände auf phyllicole und detriticole Lebensweise von Haroldius Bouc. schließen.

PAULIAN (1993) beschreibt *Haroldius discoidalis* und *H. borneensis* aus Borneo. Aus derselben Region "Sabah, Poring Hot Springs" liegt nun eine dritte, für die asiatische Region die achtzehnte Art dieser Gattung vor.

Manuskript angenommen am 12.01.1995.

Bestimmungstabelle der asiatischen Haroldius-Arten

1 Elytrenbasis deutlich zu einer Quergrube vertieft, Scheibe erhöht. 2

– Elytren gleichmäßig gewölbt, Basis nicht grubig vertieft. 3

2 Pronotumbasis scharf gekantet, ohne Kerben, Mitte in ein breites, längsgekieltes Dreieck ausgezogen. Scheibe sehr fein, sehr spärlich punktiert. Länge: 3,0 mm. Borneo. . . . . *pauliani* n. sp.

– Pronotumbasis lateral mit je 6 oder 7 kurzen, breiten, punktförmigen Kerben, Mitte einfach gekantet mit einigen längeren, zarten, nach vorn konvergierenden Streiten. Pronotumscheibe unpunktiert. 1,7–1,9 mm. Sumatra. . . . . *sumatranus* R. Paul. & Scheuern

– Pronotumbasis mit zahlreichen langen, schmalen Streifen, die fast die fein und spärlich punktierte Scheibenmitte erreichen. 2,0 mm. Thailand, Vietnam. . . . . *fleutiauxii* R. Paul.

– Pronotumbasis mit querer, unscharf begrenzter Impression, ohne Kerben oder Streifen. Pronotumscheibe unpunktiert, Seiten stark winkelig erweitert. 2,3 mm. Thailand. . . . . *thailandensis* R. Paul. & Scheuern

3 Pronotumbasis mit einer queren, vorn deutlich begrenzten Impression, daneben eventuell mit kerbenden Punkten. 4

– Probotumbasis mit einer queren, unscharf begrenzten Impression und sehr langen, sehr dicht stehenden, die Scheibenmitte erreichenden Streifen. 2,5–3,0 mm. Pakistan, Indien, Sri Lanka. 6

– Pronotumbasis ohne Impression, mit mehr oder weniger langen Streifen oder die Basis kerbenden Punkten. Ist die Basismitte schwach vertieft, dann stehen lateral kerbende Punkte. 7

– Pronotumbasis einfach gerundet, ohne Auszeichnungen. Clypeus neben der Ausrandung nicht geschweift. 11

4 Probotumbasis neben der Impression mit einer dichten Reihe kerbender Punkte. Vorderwinkel fein und spärlich, Scheibe groß, dicht, schwach oval, dazwischen sehr fein punktiert. Punktdurchmesser größer als die Zwischenräume, schwarz, kahl. 3,3–3,6 mm. Nepal, Darjeeling, Assam, Thailand, Tonkin. . . . . *stevensi* Arr.

– Kante der Pronotumbasis ohne kerbende Punkte. Mindestens der Vorderkörper gelbrot, Elytren fein behaart. 5

5 Körper oval, Pronotum mit verstreuten, ziemlich groben Punkten, Elytren lang und fein behaart. 1,5 mm. Singapore. . . . . *fairmairei* Bouc.

– Körper gerundet, Pronotum sehr fein, spärlich punktiert, Elytren sehr kurz und sehr spärlich behaart. 2,0–2,4 mm. Borneo. . . . . . *discoidalis* R. Paul.

6 Außenkante der Hinterschienen einfach konvex gebogen, äußere Apikalspitze kurz und wenig scharf. Oberseite, besonders der Vorderkörper, schwach, aber sichtbar chagriniert. 2,5 mm. Sri Lanka. . . . . *herrenorum* R. Paul.

– Außenkante der Hinterschienen konkav gegen den Apex gebogen, äußere Apikalspitze scharf und leicht ausgezogen. Vorderkörper nicht, Elytren erloschen chagriniert. 2,5–3,0 mm. Nordost-Indien, Pakistan. . . . *heimi* (Wasm.)

7 Innenkante der Hinterschienen knieförmig gebogen. Nepal. . . . *lassallei* Camb.
– Innenkante der Hinterschienen einfach konkav. 8
8 Pronotumbasis mit langen, dicht stehenden Streifen, die lateral die Scheibenmitte oder in Vorderwinkelnähe fast den Vorderrand erreichen. 2,5–2,8 mm. Singapore. . . . . *rugatulus* Bouc.
– Pronotumbasis mit kurzen, kräftigen Streifen. Arten aus Borneo oder den Philippinen. 9
– Die gekerbte Pronotumbasis mit groben Punkten. 2,5–3,0 mm. Arten aus Central-Indien. 10
9 2,0 mm, Oberseite chagriniert, Elytren lang behaart, Streifen ausgelöscht. Borneo. . . . . *borneensis* R. Paul.
– 2,0 mm, Oberseite glatt, kahl, Elytrenstreifen ausgelöscht. Philippinen. . . . . *globosus* Bouc.
– 3,5–4 mm, Oberseite glatt, Elytren mikroskopisch fein behaart, Streifen an der Basis deutlich, am Apex verschwindend. Philippinen. . *philippinensis* Per.
10 Scheitel deutlich chagriniert, dicht und doppelt punktiert, Punktdurchmesser größer als die Zwischenräume. Punktierung des Pronotums vorn und in der Basismitte dicht und kräftig, lateral bedeutend feiner und spärlicher. Basiskante lateral mäßig fein, bis zum Niveau des 1. Elytrenzwischenraumes grober crenuliert. Elytren sehr kurz, spärlich, kaum sichtbar beborstet. . . . . *annandalai* (Silv.)
– Scheitel glänzend, erloschen chagriniert, mit wenigen feinen und sehr feinen Punkten. Punktierung des Pronotums doppelt, fein und spärlich. Basismitte scharf gekantet, bis zum Niveau des 2. Elytrenstreifens schwach dreieckig eingedrückt, von den Hinterwinkeln bis zur Mitte des 5. Elytrenzwischenraumes fein crenuliert. Haare der Elytren spärlich, deutlich, ihre Länge beträgt ca. ein Viertel einer Zwischenraumbreite. . . . . *cardoni* Bouc.
11 Pronotum fein, relativ dicht punktiert, wie die Elytren kaum bemerkbar chagriniert. 1,9 mm. Tonkin, Taiwan. . . . . *perroti* R. Paul.
– Pronotum sehr fein, mäßig dicht punktiert, quermaschig, Elytren längsmaschig, deutlich chagriniert. 2,0 mm. Thailand. . . . . *loebli* R. Paul.

Haroldius pauliani n. sp. (Abb.: 1–8)

Holotypus ♂: Borneo: Sabah Mt. Kinabalu National Park, Poring Hot Springs, 510 m, 30.VIII.1988, A. Smetana leg. (B162); Muséum d'histoire naturelle, Génève.

Diagnose: Kenntlich durch die Genitalarmaturen des ♂, den starken Apikal- und sehr schwachen Basalzahn am Außenrand der Vorderschienen und die ventral fehlende subapikale Querleiste, den neben den Zähnen ausgeschweiften Clypeusrand und die breite, querovale, tiefe Depression von Elytren- und Pronotumbasis, die in der Mitte zu einem breiten, spitzen Dreieck ausgezogen ist. Mäßig gewölbt, Elytren stark gerundet, mäßig glänzend, Oberseite deutlich fein netzmaschig, Pronotumdepression und Pygidium erloschen chagriniert, sehr fein, sehr spärlich, einfach punktiert. Beine, Kopf, Pronotumvorderrand und -seiten und die Apikalrundung der Elytren rötlichbraun; Pronotumdepression und Elytren schwarzbraun; Nahtzwischenraum leicht aufgehellt; Pydigium, Sternite, Mundorgane und Fühler gelbbraun. Kahl, nur Elytrenseiten und -absturz mit winzigen, weißgelben Borsten. Augen schmal.

♂: Kopf 1,5 mal breiter als lang, Clypeus tief, parabelförmig ausgerandet, neben den beiden kräftigen, außen gerundeten Zähnen deutlich ausgeschweift, bis zu den stumpfen Wangenecken gerundet, nur an der fein eingeritzten Naht kurz ausgerandet und schwach gewinkelt.

Pronotum 2,3 mal breiter als in der Mitte lang, Pronotumvorderrand in der Mitte schwach nach vorn gebogen, lateral in Höhe der Augen und Wangenecken jeweils schwach winkelig in die fast geraden, zum Elytrenseitenrand schwach divergierenden Seiten übergehend. Hinter den deutlichen Hinterwinkeln sehr schwach konkav. Basis ab dem 6. bis zum 3. Elytrenstreifen konvex gerundet, dann stark konkav und in der Mitte in ein breites, spitz zulaufendes, hochgewölbtes, längsgekieltes, glänzendes Dreieck ausgezogen. Eine glänzende, querovale, tiefe Depression wird kurz hinter dem Pronotumvorderrand und auf Höhe des 6. Elytrenzwischenraumes durch die wulstartige Scheibe begrenzt. Seiten zu den Vorderwinkeln dachartig abfallend. Nur die Basis ungerandet, scharf gekantet, vor dem 5. Elytrenstreifen mit Randungsrudiment, ohne Längslinien oder Punkte.

Elytrenstreifen deutlich, seicht, mäßig breit, unpunktiert, an der Basis kaum vertieft, am Apex erlöschend.

Zwischenräume flach; Naht bis zur Mitte leicht gekielt, vor der Spitze mit sehr kurzem Streifen und kleinem Grübchen. 2. Zwischenraum an der ungerandeten Basis so breit wie der 3., Basis bis zum 5. vertieft, an der Naht dreieckig ausgeschnitten, kurz aufgebogen, scharf gekantet. Apex breit ausgerandet, Elytren nicht gemeinsam verrundet.

Pygidium doppelt so breit wie hoch, Scheibe kaum gewölbt, glänzend, rundum fein, Basis winkelig gerandet.

Vorderwinkel des Prosternum mit tiefer Grube, diese durch einen Querkiel und -wulst von einer Furche zum Einlegen der Vorderschenkel getrennt. Vorderhüften vorn scharf gekantet, dort mit einer Reihe kurzer, apikal mit einer Gruppe langer Borsten. Episternum hinten spärlich, am Seiten- und Hinterrand dicht und kurz, davor dicht und lang behaart. Scheibe des Metasternum im vorderen Drittel in ganzer Breite tief ausgehöhlt. Vorn doppelt und scharf gekantet, die Hinterkante bedeutend höher gelegen, in der Mitte kurz unterbrochen und fast die Vorderkante erreichend. Beide Kanten enden dicht bei den Mittelhüften. Scheibe sehr fein, kaum sichtbar punktiert, vorn glatt, nach hinten und zu den Seiten deutlich längs chagriniert. Zwischen den Mittel- und Hinterhüften deutlich, mäßig dicht, längs punktiert. Episterna und Epipleuren stark längs chagriniert, mit einigen Punkten. Epipleuren in Höhe der Hinterhüften mit runder Grube, nach hinten mit einigen flachen, kleineren Depressionen. Sternite quer chagriniert, an den Seiten deutlicher punktiert, nur das letzte in der Mitte nicht verengt und am Hinterrand mäßig dicht, deutlich punktiert und kurz behaart.

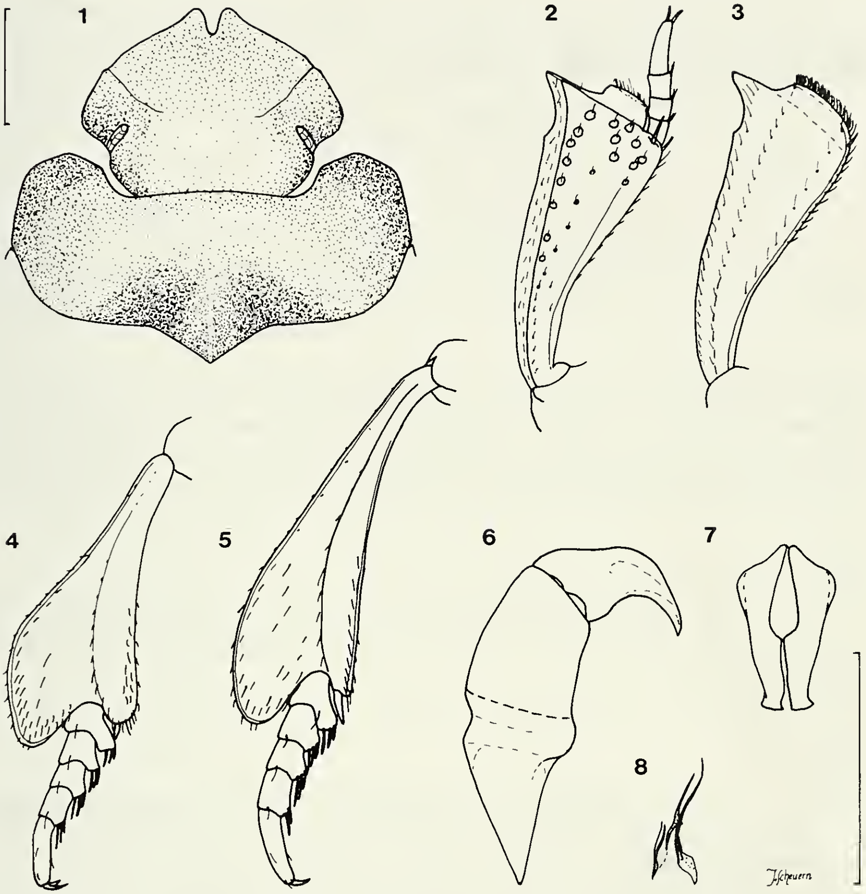


Abb. 1–8

Haroldius pauliani n. sp.: 1: Kopf und Pronotum dorsal, 2: Vorderschiene dorsal, 3: dto. ventral, 4: Mittelschiene dorsal, 5: Hinterschiene, dorsal, 6: Aedoeagus lateral; 7: Parameren dorsal, 8: Kopulationsspange. Maßstriche: 0,5 mm; kurzer Maßstrich: Abb. 1.

Vorderschienen zum Apex gleichmäßig verbreitert, dorsal mit scharfer, zum Außenrand parallel laufenden Kante; daneben kräftig, einreihig, in der Mitte feiner, am Apex unregelmäßig punktiert. Außen mit einem sehr kräftigen, spitzen Apikalzahn, zur Basis gerundet in ein sehr winziges, stumpfes Zähnchen auslaufend. Vorderrand ventral mit einem deutlichen, vorn behorsteten Querwulst, eine subapikale Querleiste fehlt. Vorderschenkel vorn mit einer Längsdepression zum Einlegen der Schiene, dorsal innen mit einem dichten Haarfeld.

Mittel- und Hinterschienen apikal nach außen stark gerundet erweitert, innen gleichmäßig, schwach gebogen. Mittel- und Hinterschenkel schmal, lang, die Epipleuren überragend, ohne Auszeichnungen.

Genitalarmaturen: Abb. 6, 7, 8.

Holotypus ♂: Länge; 3,0 mm, Elytrenbreite: 2,2 mm.

Derivatio nominis: Benannt zu Ehren des ausgezeichneten Scarabaeidae-Spezialisten Prof. Dr. R. Paulian, Bordeaux.

Beziehungen: Haroldius pauliani n. sp. bildet mit *H. fleutiauxii* R. Paul. und *H. sumatranus* R. Paul. & Scheuern eine gut definierte Artengruppe: Symmetrisch gebaute Parameren mit stumpfwinkelig abgeknickten Spitzen, Clypeus neben der Ausrandung ausgeschweift, Vorderschienen ventral ohne subapikale Querleiste. Die neue Art unterscheidet sich von den beiden genannten durch die Form der Kopulationsspangen, die querovale Depression der Pronotumbasis mit dem scharf ausgezogenen Dreieck, die unbeborstete Elytrenscheibe, den vorn nicht eingeengten 2. Elytrenzwischenraum, die Form der Schienen und die stattliche Größe. *H. sumatranus* R. Paul. & Scheuern weist am 4. Elytrenzwischenraum eine Basalrandung auf.

DANK

Herrn Prof. Dr. R. Paulian, Bordeaux, danke ich sehr für wertvolle Hinweise, Herrn Dr. I. Löbl, Genève, und Herrn Dr. Y. Cambefort, Paris, zudem für die Ausleihe von Typen.

LITERATUR

BALTHASAR, V. (1963). Monographie der Scarabaeidae und Aphodiidae der palaearktischen und orientalischen Region, Band 1. Verlag der Tschechoslowakischen Akademie der Wissenschaften, Prag.

JANSSENS, A. (1949). Un Scarabaeinae termitophile nouveau du Congo Belge. *Revue Zool. Bot. afr.*, 42(2): 183–184.

JANSSENS, A. (1953). Contribution à l'étude des Coléoptères Lamellicornes d'Afrique. II. Espèces nouvelles du genre Afroharoldius A. Janssens. *Revue Zool. Bot. Afr.*, 47(34): 344–347.

PAULIAN, R. (1939). Quelques nouvelles espèces des Coléoptères Lamellicornes coprophages. *Bull. Soc. Ent. Fr.*, 44: 68–74.

PAULIAN, R. (1945). Coléoptères Scarabaeides de l'Indochine. *Faune de l'Empire Français*, 3, Paris.

PAULIAN, R. (1985). Notes sur les Coléoptères Scarabaeidae du Muséum de Genève II. *Revue suisse Zool.*, 92(1): 189–203.

PAULIAN, R. (1993). Deux nouveaux *Haroldius* Boucomont de Bornéo (Coléoptères Scarabaeidae). *Revue suisse Zool.*, 100(1): 169–173.

PAULIAN, R. & SCHEUERN, J. (1994). *Haroldius* Boucomont nouveaux ou peu connus de la région Orientale (Coléoptères Scarabaeidae). *Revue suisse Zool.*, 101(2): 435–440.

REVUE SUISSE DE ZOOLOGIE, 102 (3) : 769-778; septembre 1995

Dichelyne moraveci n. sp., parasite de *Pseudoplatystoma fasciatum* et notes sur les Cucullanidae du Paraguay

Annie J. PETTER
Laboratoire de Biologie Parasitaire, Protistologie, Helminthologie,
associé au CNRS, Muséum National d'Histoire Naturelle, 61, rue Buffon,
F-75231 PARIS Cedex 05, France.

Dichelyne moraveci **sp. n. parasite of** *Pseudoplatystoma fasciatum*, **with remarks on Cucullanids from Paraguay. -** The following Cucullanids are recorded from freshwater fishes of Paraguay: *Dichelyne (D.) moraveci* sp. n. in *Pseudoplatystoma fasciatum*, *Luciopimelodus pati* and *Megalonema platanum*; *Cucullanus pinnai* in *Pseudoplatystoma coruscans* and *Megalonema platanum*; females of *Cucullanus* sp. in *Pimelodus maculatus*. *Dichelyne (D.) moraveci* differs from *D. (D.) leporini*, the other South American congener, by its very long spicules. A key to the 10 South American *Cucullanus* species is given.

Key-words: Nematoda - Cucullanidae - New species - Freshwater Fishes - Paraguay - South America.

INTRODUCTION

La famille des Cucullanidae est fondamentalement parasite de Poissons, avec quelques espèces chez les Chéloniens. Elle est actuellement représentée chez les Poissons d'eau douce sud-américains par 3 genres: 1 genre endémique, *Neocucullanus* avec 2 espèces, et 2 genres cosmopolites: *Cucullanus* avec 10 espèces et *Dichelyne* avec 1 espèce [voir PETTER (1989) et MORAVEC *& al.* (1993)]. Nous décrivons ici une nouvelle espèce du genre Dichelyne récoltée au Paraguay par l'Expédition Zoologique du Museum d'Histoire Naturelle de Genève en 1986; nous signalons également la présence au Paraguay d'une espèce du genre *Cucullanus*, *C. pinnai*, déja connue au Brésil et en Argentine.

MATÉRIEL ET MÉTHODES

Les viscères des Poissons sont fixés au formol à 4% sur le terrain; la recherche des parasites est effectuée au Laboratoire à Genève; les Nématodes recueillis sont conservés dans l'alcool à 70°C et éclaircis au lactophénol pour l'étude. Le matériel est

---

Manuscrit accepté le 16.12.1994.

déposé au Laboratoire de Biologie Parasitaire du Muséum National d'Histoire Naturelle de Paris (MNHN) et au Muséum d'histoire naturelle de Genève (MHNG).

Toutes les mensurations sont en µm.

Cucullanus pinnai Travassos, Artigas & Pereira, 1928 (fig.1)

Matériel étudié: 12 ♂ et 8 ♀ juvéniles n° MNHN 403 BC; hôte: *Pseudoplatystoma coruscans* (Agassiz) (Pimelodidae, Siluriformes) n° de terrain Py 4971. 6 ♂, 5 ♀ juvéniles et une région antérieure n° MHNG 18166 INVE; hôte: *Megalonema platanum* (Günther) (Pimelodidae) n° de terrain Py 4972 (co-parasites de *Dichelyne (D.) moraveci)*. Rio Parana, en face de Candelaria, prov. Itapua, 10 et 12.12.1986.

Dimensions (Extrêmes, moyenne entre parenthèses).

Mâles [dans l'ordre: parasites de *Pseudoplatystoma coruscans* (11 spécimens), parasites de *Megalonema platanum* (5 spécimens)].

Long. 3000-4000 (3490); 2450-5600 (3470). Oesophage 390-600 (509); 350-725 (474). Extrémité antérieure - anneau nerveux 180-250 (211); 140-250 (188). Extrémité antérieure - deirides 350-450 (389); 320-575 (425). Spicules 250-370 (325); 115-470 (307).

Femelles [dans l'ordre: parasites de *P. coruscans* (2 spécimens), parasites de *M. platanum* (5 spécimens)].

Long. 3700/4100 (3900); 2400-3300 (2700). Oesophage 520/600 (560); 360-500 (400). Extrémité antérieure - anneau nerveux 220/250 (235); 130-210 (165). Extrémité antérieure - deirides 380/450 (415); 300-400 (339). Queue 120/340 (230); 120-150 (125).

Les spécimens correspondent par l'ensemble de leurs caractères et de leurs dimensions à l'espèce *Cucullanus pinnai* décrite par TRAVASSOS *& al.* (1928) chez *Pimelodus clarias* et *Pseudoplatystoma* sp.; en particulier la disposition des papilles ad-cloacales, très constante chez tous nos spécimens, et la forme de l'extrémité distale des spicules sont tout-à-fait semblables à celles figurées par ces auteurs. Signalons que les spécimens juvéniles parasites de *Pseudoplatystoma coruscans* sont dépourvus de ventouse pré-cloacale.

L'espèce a été signalée ultérieurement par différents auteurs chez plusieurs espèces de Pimelodidae, Characidae et Anostomidae et redécrite par MORAVEC *& al.* (1993) chez *Pimelodus ornatus* et *Ageneiosus valenciennesi*. Ces auteurs décrivent chez *Pseudoplatystoma coruscans* une autre espèce, *Cucullanus pseudoplatystomae* et suggèrent que les spécimens trouvés précédemment chez des espèces du genre *Pseudoplatystoma* et attribués à *Cucullanus pinnai* pourraient appartenir en réalité à cette dernière espèce. *C. pseudoplatystomae* diffère de *C. pinnai* par la position des phasmides, par la longueur plus grande du corps, de l'oesophage et de la queue de la femelle, et par une position différente de l'anneau nerveux et des deirides par rapport à l'extrémité de l'oesophage. Si l'on excepte la position des phasmides qui sont situées antérieurement aux deux dernières paires de papilles postcloacales comme chez *C. pseudoplatystomae*, les dimensions de nos spécimens correspondent à *C. pinnai* (tableau I), le genre *Pseudoplatystoma* peut donc héberger les deux espèces.

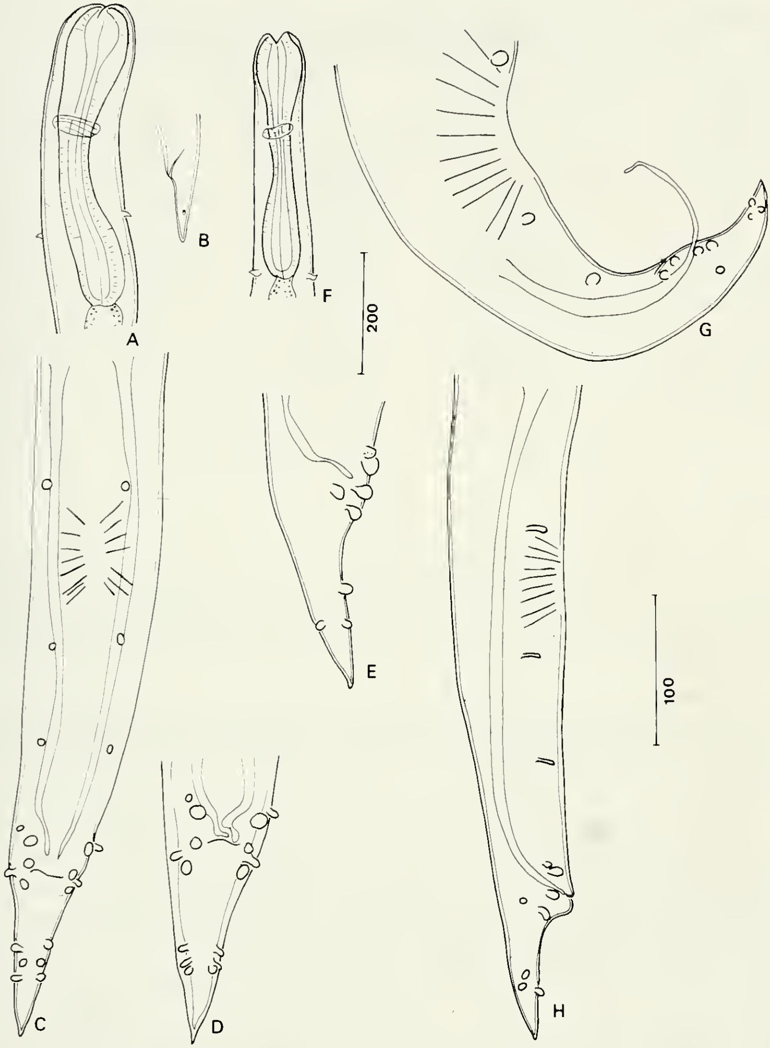


FIG. 1

Cucullanus pinnai Travassos, Artigas & Pereira, 1928. A à E: spécimens parasites de *Pseudoplatystoma coruscans*. A, femelle, région antérieure, vue médiane. B, femelle, queue, vue latérale. C, mâle, région postérieure, vue ventrale. D, mâle, extrémité postérieure, vue ventrale. E, mâle, extrémité postérieure, vue latérale. F à H: spécimens parasites de *Megalonema platanum*. F, mâle, région antérieure, vue médiane. G, H, mâles, régions postérieures, vues latérales. Echelles: A, B, J, K, L, N: 100 µm; C, D, G, H,I : 200 µm; E, 30 µm; F, 50 µm; O, 20 µm.

TABLEAU I

Dimensions comparées de *Cucullanus pseudoplatystomae* et *C. pinnai* suivant MORAVEC *& al.* (1993); comparaison avec le présent matériel.

Espèce	*C. pseudoplatystomae*	*C. pinnai*	*C. pinnai*	
Auteurs	Moravec & al.		présent matériel	
Hôtes	*Ps. coruscans*	*P. ornatus* *A. valenciennesi*	*Ps. coruscans*	*M. platanum*
long. totale	8570-15160	3700-9070	3000-4100	2400-5600
long. oesoph.	1090-1470	626-898	390-600	350-725
long. queue ♀	299-394	150-258	120-340	120-150
extr. ant. - an. nerveux /long. oesoph.	26-31%	35-40%	33-46%	34-46%
extr. ant. - deirides /long. oesoph.	41-65%	74-85%	60-96%	75-100%

Cucullanus sp. (fig.2)

Matériel étudié: 2 ♀ juvéniles n° MNHN 300 BC, une larve n° MNHN 311 BC, une femelle juvénile n° MNHN 395 BC. Hôte: *Pimelodus maculatus* Lacépède (Pimelodidae) n° de terrain Py 4964, Rio Parana, en face de Ouro Verde, prov. Alto Parana, 30.11.1986; Py 4767, San Lorenzo, prov. Central, 13.7.1986; Py 4980, Rio Parana en face de Candelaria, prov. Itapua, 15.12.1986.

Dimensions (dans l'ordre: 2 femelles 300 BC, une femelle 395 BC)

Long. 5300/4900/3850. Oesophage 750/775/700. Extrémité antérieure - anneau nerveux 300/280/280. - deirides 600/650/400. - vulve 3200/2900/2350. Queue 200/220/200.

La morphologie et les dimensions correspondent à celles de *C. pinnai*; en l'absence de mâles, nous préférons cependant ne pas faire d'identification spécifique.

Dix espèces parasites de Poissons d'eau douce sud-américains sont à présent connues dans le genre *Cucullanus*. La plupart sont parasites de Siluriformes, en particulier de Pimelodidae, et trois espèces ont été trouvées chez des Characiformes; l'espèce *C. pinnai* a été signalée à la fois chez des Siluriformes et des Characiformes, la spécificité parasitaire n'est donc pas très stricte. D'autre part, une même espèce hôte peut être parasitée par deux espèces différentes (ainsi, l'espèce *Zungaro zungaro* est parasitée à la fois par *Cucullanus oswaldocruzi* et par *C. zungaro*).

Plusieurs caractères ont été utilisés pour différencier les espèces:

1. La longueur du corps et celle des spicules; ce caractère doit être utilisé avec prudence car ces dimensions présentent de grandes variations dans une même espèce: ainsi, chez *Cucullanus pinnai*, la longueur varie de 2,4 mm à 8,5 mm et celle des spicules de 2,8 à 14% de la longueur du corps.
2. La présence d'ailes caudales: ce caractère signalé chez certaines espèces nécessiterait d'être vérifié car une légère saillie du corps de chaque côté du cloaque peut être prise pour des ailes.

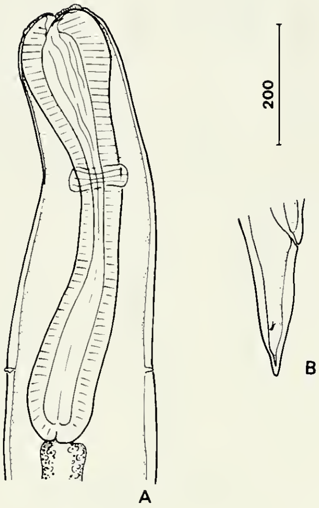


FIG. 2

Cucullanus sp. A, région antérieure, vue médiane. B, queue, vue latérale.

3. La présence ou l'absence d'une ventouse pré-cloacale; ce caractère est constant dans une espèce mais n'est pas applicable aux spécimens juvéniles (nous avons vu plus haut que chez *C. pinnai*, les mâles juvéniles sont dépourvus de ventouse).
4. La forme de l'extrémité distale des spicules: chez certaines espèces, l'extrémité distale des spicules est coudée; ce caractère est un bon caractère spécifique car il paraît constant dans une espèce (nous l'avons observé chez tous les mâles de *C. pinnai* examinés); cependant, il peut être difficile à observer chez les spécimens où les spicules ne saillent pas hors du cloaque, et a pu être omis par certains auteurs.
5. La disposition des papilles cloacales; ce caractère paraît également très constant dans une espèce d'après nos observations sur *C. pinnai*; cette disposition est cependant mal décrite chez certaines espèces.

Nous donnons une clé des espèces, en nous efforçant pour les raisons exposées ci-dessus d'indiquer dans la mesure du possible plusieurs caractères pour définir chaque espèce.

Nous avons utilisé pour désigner les papilles la terminologie de CHABAUD & PETTER (1961) et PETTER (1974) que nous rappelons brièvement: il existe généralement dans le genre *Cucullanus* 11 paires de papilles: 8 paires subventrales numérotées 1, 2, 3, 5, 6, 7, 9, 10, 2 paires latérales numérotées 4 et 8 (fig. 3) et une paire de

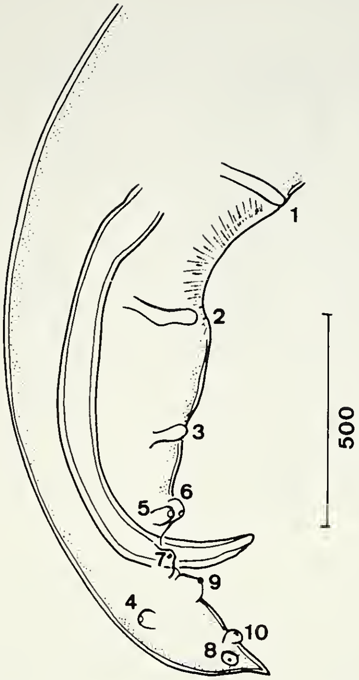


FIG. 3

Cucullanus colossomi Diaz-Ungria, 1968. Mâle holotype, extrémité postérieure, vue latérale. Les phasmides n'ont pas été vues.

phasmides latérales; les papilles 4, 5, 6, 7 et quelquefois 9 sont situées à proximité du cloaque [papilles ad-cloacales de Petter (1974)].

Chez les espèces sud-américaines *C. pseudoplatystomae* et *C. pimelodellae*, MORAVEC *& al.* (1993) signalent chez certains spécimens une paire pré-cloacale supplémentaire entre la 3ème et la 5ème paire.

CLÉ DES ESPECES SUD-AMÉRICAINES DU GENRE *Cucullanus*

1 Ventouse absente. 2
– Ventouse présente. 3
2 Spicules mesurant moins de 10% de la longueur du corps
. . . . *C. pimelodellae* Moravec *& al.*, 1993
– Spicules mesurant plus de 15% de la longueur du corps
. . . . *C. grandistomis* (Ferraz & Thatcher,1988)

3 Ailes latérales présentes; spicules mesurant moins de 2% de la longueur du corps. . . . . *C. brevispiculus* Moravec & al.,1993

– Ailes latérales absentes; spicules mesurant plus de 2,5 % de la longueur du corps 4

4 Spicules coudés à l'extrémité distale. 5

– Spicules simplement incurvés ventralement à l'extrémité distale. 7

5 Longueur des mâles supérieure à 12 mm; ailes caudales présentes; papilles n° 7 beaucoup moins grosses que les papilles n° 6 et n° 9 . . . . *C. pauliceae* Vaz & Pereira, 1934 (= *C. schubarti* Travassos, 1948)

– Longueur des mâles inférieure à 12 mm; ailes caudales absentes; papilles n° 7 à peu près de même taille que les papilles n° 6 et n° 9 6

6 Anneau nerveux légèrement antérieur au milieu de l'oesophage (situé entre 33 et 46 % de sa longueur); deirides légèrement antérieures ou au niveau de l'extrémité de l'oesophage (situées entre 60 et 100 % de sa longueur) . . . . *C. pinnai* Travassos et al., 1928

– Anneau nerveux nettement antérieur au milieu de l'oesophage (situé entre 26 et 31 % de sa longueur); deirides nettement antérieures à l'extrémité de l'oesophage (situées entre 41 et 65 % de sa longueur) . . . . *C. pseudoplatystomae* Moravec *& al.*, 1993

7 Longueur des mâles supérieure à 12 mm; ailes caudales absentes 8

– Longueur des mâles inférieure à 12 mm; ailes caudales présentes 9

8 Papilles n° 9 deux fois plus proches des papilles n° 7 que des papilles n° 10 . . . . *C. colossomi* Diaz-Ungria, 1968 [1]

– Distance entre les papilles n°7 et n° 9 à peu près égale à la distance entre les papilles n° 9 et n° 10 . . . . *C. oswaldocruzi* Santos *& al.*, 1979

9 Papilles n° 5 situées latéralement par rapport aux papilles n°6; papilles n°5 et 6 d'une part, 4, 7 et 9 d'autre part formant 2 groupes nettement séparés; papilles n° 7 nettement post-cloacales. . . . . *C. mogi* Travassos, 1947

– Papilles n° 5, 6, 7 et 9 alignées en 2 rangées subventrales à peu près régulièrement espacées; papilles n° 7 en position ad-cloacale. . . . . *C. zungaro* Vaz & Pereira, 1934

Dichelyne (Dichelyne) moraveci n. sp. (fig.4)

Matériel-type: ♂ holotype, ♀ allotype, une région postérieure ♂ et deux régions antérieures paratypes, n°MNHN 408 BC; un ♂ paratype n° MHNG 18167 INVE. Hôte: *Pseudoplatystoma fasciatum* (L.) (Pimelodidae, Siluriformes), n° de terrain Py 4958. Rio Parana, en face de Puerto El Dorado, prov. Itapua, 23.11.1986.

Autre matériel: - un ♂ juvénile et une vingtaine de larves n° MHNG 18168 INVE. Hôte: *Luciopimelodus pati* (Val.) (Pimelodidae) n° de terrain Py 4770. Même localité, 25.9.1986. - un ♂ et une région antérieure ♀ n° MHNG 18169 INVE. Hôte: *Megalonema platanum* (Günther), n° de terrain Py 4972. Même localité,12.12.1986. (Co-parasites de *Cucullanus pinnai*).

---

[1] Nous avons examiné le ♂ holotype de *C. colossomi* déposé au MNHN et pu ainsi préciser la disposition des papilles cloacales de cette espèce (fig. 3).

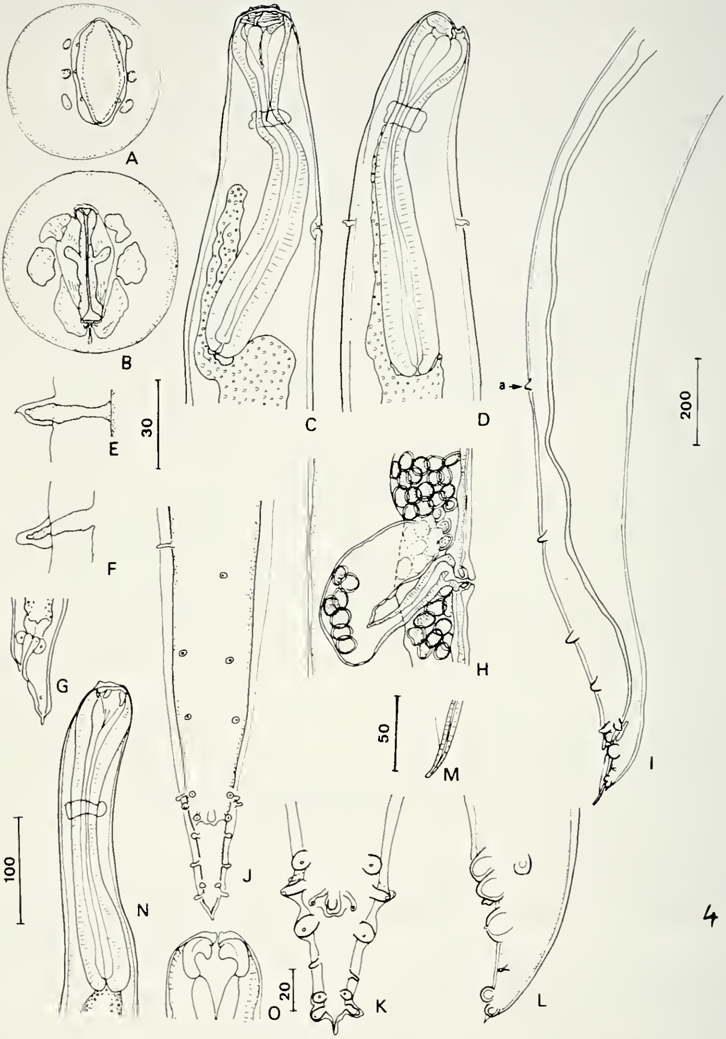


FIG. 4

Dichelyne (D) moraveci n. sp. A, vue apicale. B, coupe optique au niveau des pièces sclérotisées attachées au cadre péribuccal. C, femelle, région antérieure, vue latérale. D, mâle, région antérieure, vue médiane. E, deiride. F, mâle, post-deiride. G, femelle, extrémité postérieure, vue latérale. H, vulve et ovéjecteur. I, mâle, région postérieure, vue latérale (a: post-deiride gauche). J, mâle juvénile, région postérieure, vue ventrale. K, mâle, extrémité postérieure, vue ventrale. L, mâle, extrémité postérieure, vue latérale. M, extrémité distale du spicule. N, larve, région antérieure, vue latérale. O, larve, extrémité antérieure, vue médiane. Echelles: A, B, G, F: 200 µm; C, D, H, E: 100 µm.

Cucullanidae de petite taille, à corps robuste. Cuticule épaisse (15 à 20 µm). Collerette membraneuse denticulée entourant l'ouverture buccale comprenant une cinquantaine de dents de chaque côté. Pièces sclérotisées attachées au cadre péribuccal bien visibles. Oesophage avec renflement antérieur plus marqué que le renflement postérieur. Caecum intestinal dorsal présent, mesurant environ la moitié de la longueur de l'oesophage chez les spécimens parasites de *Pseudoplatystoma fasciatum*, plus court chez les spécimens parasites de *Luciopimelodus pati* et *Megalonema platanum*. Deirides terminées par une pointe fine, situées en avant de l'extrémité de l'oesophage. Post-deirides bien développées, arrondies à l'extrémité. Pore excréteur situé légèrement en arrière des deirides. Queue conique, terminée par une pointe fine dans les deux sexes.

Mâle: ventouse absente. 10 paires de papilles caudales: 3 paires pré-cloacales; 5 paires ad-cloacales (selon la terminologie de Petter, 1974) comprenant 3 grosses paires subventrales (2 antérieures au cloaque et une postérieure), une paire latérale située entre les 2 paires subventrales antérieures, et une paire de petites papilles ventrales pédonculées encadrant la lèvre supérieure du cloaque; 2 paires post-cloacales situées au voisinage de l'extrémité postérieure; phasmides situées antérieurement aux 2 paires post-cloacales. Lèvre supérieure du cloaque bilobée, surmontée par une protubérance papilliforme, mais dépourvue de terminaison nerveuse. Gubernaculum peu sclérotisé. Spicules très longs (de 40 à 53% de la longueur du corps), ailés, terminés en pointe fine.

Femelle: vulve à lèvres saillantes, légèrement post-équatoriale. Ovéjecteur impair comprenant un vagin à paroi musculaire épaisse de 350 µm et une trompe à paroi mince de 400 µm. Uterus opposés. Oeufs à coque mince, non embryonnés dans l'uterus.

Larves: les larves, vraisemblablement des 4èmes stades, sont dépourvues de collerette membraneuse denticulée; l'oesophagostome est muni de 2 dents subventrales proéminentes; le caecum intestinal est absent.

Dimensions: Mâles (dans l'ordre: holotype/paratypes)

Long. 4650/4750/1600/1750. Larg. maximale 400/350/100/350.

Oesophage 900/850/430/720.Caecum intestinal 560/500/150/260. Extrémité antérieure - anneau nerveux 250/250/170/240. - deirides 550/600/230/605. - pore excréteur 670/625/260/ non vu. Extrémité postérieure - post-deiride gauche 900/940/420/900. - post-deiride droite 2200/1770/ non vue . Queue 130/120/95/110. Spicules 2050/2500/700/1930.

Femelle: Long. 5400. Larg. maximale 400. Oesophage 960. Caecum intestinal 450. Extrémité antérieure - anneau nerveux 280. - deirides 530. - pore excréteur 600. - vulve 3100. Extrémité postérieure - post-deiride gauche 1300. Post-deiride droite non vue. Queue 140. Oeufs 60/50.

Discussion. Par la présence d'un caecum intestinal et l'absence de ventouse pré-cloacale, l'espèce se place dans le genre *Dichelyne* (sous-genre *Dichelyne*) suivant la classification de Petter (1974) et de Chabaud (1978). Une seule espèce appartenant au genre *Dichelyne* a été décrite chez les Poissons d'eau douce sud-américains:

D.(D.) leporini décrite par PETTER (1989) chez *Leporinus friderici* au Paraguay, et redécrite par MORAVEC *& al.* (1993) chez *Schizodon fasciatus* au Brésil. La nouvelle espèce s'en différencie par des spicules beaucoup plus longs (44 à 53% de la longueur du corps contre 7 à 11% chez *D. leporini*, une cuticule beaucoup plus épaisse (15 à 20 µm contre 4 à 5) et une disposition différente des papilles cloacales (les 2 paires situées immédiatement en avant du cloaque sont accolées ou sur un même niveau transversal chez *D. (D.) leporini*). La nouvelle espèce se différencie de toutes les autres espèces connues dans le sous-genre *Dichelyne* soit par des spicules plus longs par rapport à la longueur du corps, soit par une pointe caudale dépourvue d'épines, soit par une disposition différente des papilles cloacales.

BIBLIOGRAPHIE

CHABAUD, A.G. 1978. CIH keys to the nematode parasites of Vertebrates. 6. Keys to genera of the superfamilies Cosmocercoidea, Seuratoidea, Heterakoidea and Subuluroidea. *Commonwealth Agricultural Bureaux, Farnham Royal, Bucks, England*, 71 pp.

CHABAUD, A.G. & A.J. PETTER. 1961. Remarques sur l'évolution des papilles cloacales chez les Nématodes Phasmidiens parasites de Vertébrés. *Parassitologia* 3: 51-70.

DIAZ-UNGRIA, C. 1968. Helmintos de Peces de Venezuela, con descripcion de un genero y tres especies nuevas. *Boln Soc. venez. Cienc. nat.*, 27: 537-549.

FERRAZ, E. & V.E. THATCHER. 1988. *Bacudacnitis grandistomis* gen. et sp. nov. (Nematoda: Cucullanidae) parasita intestinal de µm bagre, *Pseudodoras niger* (Valenciennes) da Amazonia brasileira. Amazoniana 10: 249-253.

MORAVEC, F., A. KOHN & B.M.M. FERNANDES. 1993. Nematode parasites of fishes of the Parana River, Brazil. Part 2. Seuratoidea, Ascaridoidea, Habronematoidea and Acuarioidea. *Folia parasit.* 40: 115-134.

PETTER, A.J. 1974. Essai de classification de la famille des Cucullanidae. *Bull. Mus. natn. Hist. nat.*, 3e sér., 255, Zool. 177: 1469-1490.

PETTER, A.J. 1989. Nématodes de Poissons du Paraguay. V. Cucullanidae. Description de deux espèces nouvelles et redéfinition du genre *Neocucullanus* Travassos *et al. Revue suisse Zool.* 96: 591-603.

SANTOS E., J.J. VICENTE & C.R. JARDIM. 1979. Helmintos de peixes de Rios Amazonicos da coleçao helmintologica do Instituto Oswaldo Cruz. II. Nematoda. *Atas Soc. Biol. Rio de J.* 20: 11-19.

TRAVASSOS, L. 1948. Contribuiçao ao conhecimento dos helmintos dos peixes d'agua doce do Brasil. III. Duas novas espécies do genero Cucullanus Müller, 1877. *Mems Inst. Oswaldo Cruz* 45: 551-554.

TRAVASSOS, L., P. ARTIGAS & C. PEREIRA. 1928. Fauna helminthologica dos peixes de agua doce do Brasil. *Archos Inst. Biol. S. Paulo* 1: 5-68.

VAZ, Z. & C. PEREIRA. 1934. Contribuiçao ao conhecimento dos nematoides de peixes fluviais do Brasil. *Archos Inst. Biol. S. Paulo* 5: 89-103.

REVUE SUISSE DE ZOOLOGIE, 102 (3) : 779-846; septembre 1995

Aleocharinae della Sottoregione Africana Orientale al Museo di Ginevra (Coleoptera, Staphylinidae) Parte II *

Roberto PACE
Via Vittorio Veneto, 13. 37032 Monteforte d'Alpone (Verona), Italia.

Aleocharinae from the Eastern African Subregion in the Geneva Museum (Coleoptera, Staphylinidae). Part II. — Based on the study of 80 species of the tribes Tachyusini and Athetini, 54 species are described as new. A key to the species of the genus *Alomacrotona* Pace is given. Illustrations for fifteen holotypes or lectotypes of species described by Fauvel, Bernhauer, Eichelbaum and Cameron are given. One species, *Atheta mombassana* Bernhauer, 1934, is newly synonymised with *Atheta paludosa* Bernhauer, 1931. Three species are transferred to other genera. The new genus *Charicera* is described and illustrated, based on a new species. It is related to *Pelioptera* Kraatz. The new genus *Askeptoxenia*, erected for *Atheta acuticollis* Fauvel (= *A. fauveli* Fenyes) is illustrated.

Key-words: Coleoptera - Staphylinidae - Aleocharinae - Taxonomy - East Africa.

INTRODUZIONE

La prima parte dello studio sulle Aleocharinae dell'Africa orientale raccolte nel corso di missioni di ricerca, promosse dal Museo di Storia Naturale di Ginevra, è stata da me pubblicata sulla presente "Revue suisse de Zoologie" nel 1994. Il presente lavoro è la sua prosecuzione e riguarda due tribù: Tachyusini e Athetini.

La seconda di queste tribù comprende qui un maggior numero di specie, dato che le Aleocharinae della tribù Athetini prediligono il clima temperato e il clima temperato freddo e le ricerche del Museo di Ginevra si sono svolte prevalentemente in zone d'alta quota dei maggiori massicci dell'Africa orientale.

Anche nella presente Parte II, come nella Parte I, pubblico e illustro i tipi delle specie di Aleocharinae relative alle due tribù trattate e designo il lectotypus, quando necessario. Mi sono limitato a pubblicare solo quindici tipi: la pubblicazione di tutti i tipi di *Atheta* dell'Africa da me esaminati, avrebbe comportato un notevole aumento di pagine e avrebbe un po' fuorviato il fine principale del presente lavoro, quello cioè di

---

* 126° Contributo alla conoscenza delle Aleocharinae.

Manoscritto accettato il 23.12.1994.

rendere noto e mettere in ordine sistematico quanto scoperto nel corso delle ricerche promosse dal Museo di Ginevra.

Al materiale affidatomi in studio dal Museo di Ginevra ho aggiunto alcune specie datemi in esame dal Museo di Storia Naturale di Genova, dal D.E.I. di Eberswalde e dal Museo di Erfurt.

Gli holotypi delle nuove specie si conservano nel Museo di Storia Naturale di Ginevra (MG), nel Museo di Storia Naturale di Genova (MGE) e nel D.E.I. di Eberswalde. Paratypi sono custoditi nel Museo di Ginevra, in mia collezione e nel Museo di Erfurt.

ELENCO SISTEMATICO DEI GENERI E DELLE SPECIE E DESCRIZIONI

TACHUSINI

Amanota externa (Fauvel, 1907) (Figg. 1–2)

Tachyusa externa FAUVEL, 1907: 59.
Amanota externa, PACE, 1986: 95, 109.

Materiale esaminato: Lectotypus ♀, Nakuro (Rift-Valley), *externa* FVL, *Tachyusa*, presente designazione; 3 paralectotypi, stessa provenienza (Mus. Roy. Bruxelles).

La specie è qui illustrata per la prima volta.

Amanota interna sp. n. (Figg. 3–4)

Holotypus ♀, Kenya, Embu, pr. Ishiara, 900 m, 14.X.1977 (Mahnert & Perret leg., MG).

Descrizione. Lungh. 2,1 mm. Corpo lucido e bruno-rossiccio con uriti liberi 4° e 5° bruni; antenne bruno-rossicce con antennomero basale rossiccio e 11° giallo; zampe bruno-rossicce con base dei femori e tarsi giallo-rossicci. La punteggiatura del capo è quasi indistinta, su un fondo non reticolato. Tubercoletti fini e ben salienti sono presenti solo sulla metà posteriore del pronoto. La punteggiatura e la reticolazione delle elitre sono distinte. Gli uroterghi sono privi di reticolazione e hanno una punteggiatura superficiale. Spermateca fig. 4.

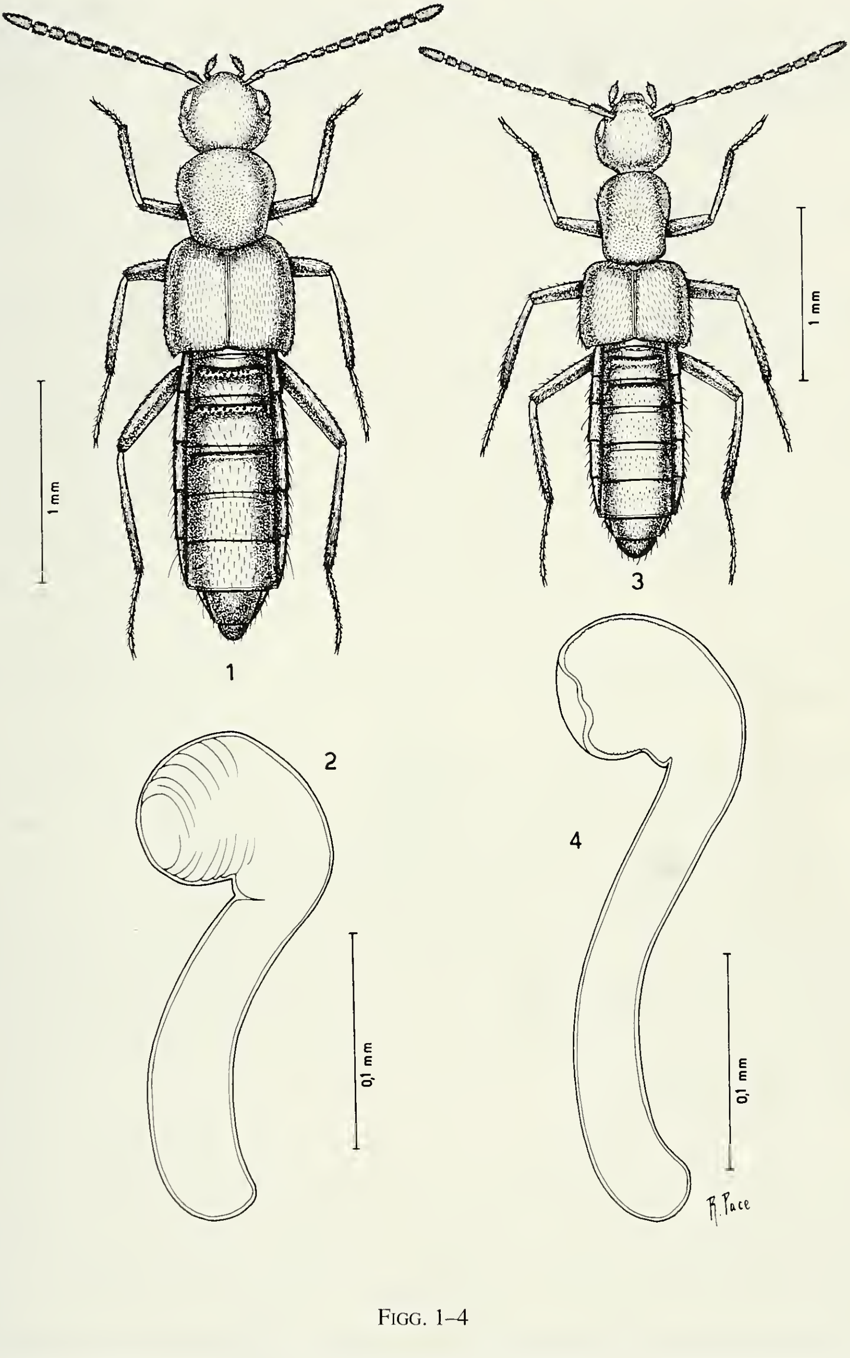
Comparazioni. E' da escludere che la nuova specie sia identica ad *A. eastopi* Tottenham, 1957 del Kenya o ad *A. albicornis* Tottenham, 1957 dell'Urundi, perché queste specie presentano l'11° antennomero e i due uriti liberi basali colorati di giallo pallido e le elitre sono più lunghe del pronoto, e non un po' più corte come quelle della nuova specie. Per il colore delle antenne e dell'addome, come per la forma della spermateca, la nuova specie sembra sistematicamente vicina ad *A. externa* (Fauvel, 1907) (Figg. 1–2) della "Rift-Valley", ma la spermateca nettamente più corta, le elitre più lunghe del pronoto e il pronoto più largo osservabili in *externa*, sono caratteri sufficienti a distinguere *externa* da *interna* sp. n.

Etimologia. Il nome della specie è dato in contrapposizione alla specie *A. externa* (Fauvel).

ATHETINI

Amischa kaszabi Pace, 1986

Amischa kaszabi PACE, 1986: 96.



FIGG. 1–4

Habitus e spermateca. 1–2: *Amanota externa* (Fauvel), lectotypus; 3–4: *Amanota interna* sp. n.

1 ♀, Kenya, Narok près de Narok, 200 m, 3.XI.1977 (Mahnert & Perret leg.); 2 ♀♀, Kenya, Lac Nakuru, Parc Nat., 6.XI.1974 (Mahnert & Perret leg.); 35 es., Kenya, Nakuru, Lac Naivasha près de Mundui Estate, 1950 m, 8.XII.1977 (Mahnert & Perret leg.); 1 ♀, Kenya, Nakuru, Lac Elmenteita, 1800 m, 7.XI.1977 (Mahnert & Perret leg.); 1 es., Kenya, L. Baringo env. Loruk, 1100 m (Mahnert & Perret leg.).

Specie già nota della Tanzania e di Kibosho.

Aloconota asymmetrica sp. n. (Figg. 5–6)

Holotypus ♀, Rhodésie, Umtali, II.1969 (R. Mussard leg., MG).

Descrizione. Lungh. 2,5 mm. Corpo lucido e bruno; margine posteriore degli uroterghi rossiccio; antenne brune con antennomero basale giallo-bruno; zampe gialle. La punteggiatura del capo e del pronoto è fine e distinta. Le elitre e l'addome sono coperti di tubercoletti distinti. Spermateca Fig. 6.

Comparazioni. Per avere le elitre lunghe quanto il pronoto, la nuova specie è chiaramente distinta da *A. praticola* (Fauvel, 1907) (Figg. 17–19) del Kilimangiaro, che presenta elitre più lunghe del pronoto. Inoltre il 5° antennomero della nuova specie è nettamente trasverso, mentre in *praticola* è lungo quanto largo; il pronoto di *praticola* è nettamente reticolato, mentre quello della nuova specie è privo di reticolazione. La nuova specie è pure distinta da *A. africana* (Bernhauer, 1934) (Figg. 7–10) per la forma della spermateca, per le elitre più corte e per gli antennomeri 5° e 6° nettamente trasversi.

Etimologia. La nuova specie prende nome da un carattere della spermateca: l'asimmetria del bulbo distale.

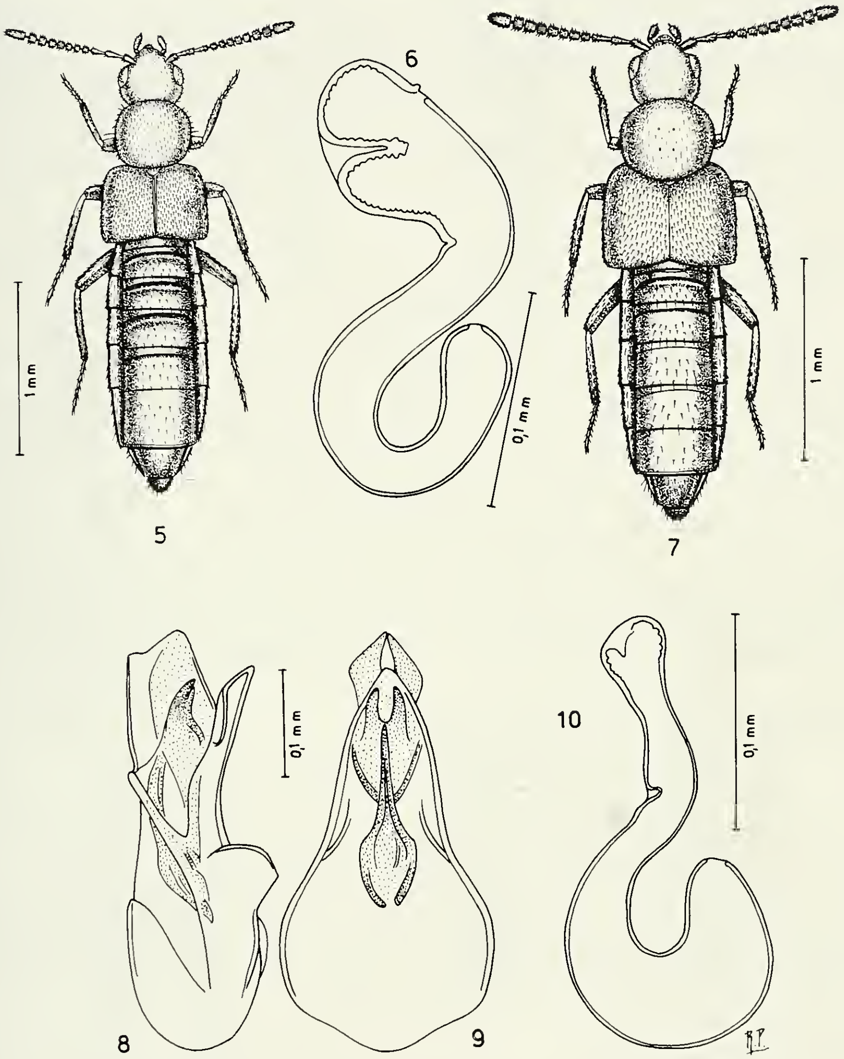
Aloconota africana (Bernhauer, 1934), **comb. n.** (Figg. 7–10)

Pelioptera africana Bernhauer, 1934: 214.

Materiale esaminato: Lectotypus ♂, W Riwenzori, Kalonge, myrmecophil avec *Dorylus*, 8.VIII.1932, Burgeon, *africana* BRNH, Typus, *Pelioptera* (Mus Chicago).

1 ♂ e 2 ♀♀, Kenya, Mt. Aberdares, Parc National, 2300 m, 25.XI.1974 (Mahnert & Perret leg.); 1 ♂, Kenya, Embu, Irangi for., 12.X.1977 (Mahnert & Perret leg.); 2 ♂♂, Kenya, Tambach, E Eldoret, 2000 m, 17.XI.1974 (Mahnert & Perret leg.); 3 es., Kenya, Nyandarua, 10 km SE Njabini, 2550 m, 9.XI.1977 (Mahnert & Perret leg.); 4 es., Kenya, Nyandarua, South Kingango, 2550 m, 9.XI.1977 (Mahnert & Perret leg.); 2 es., Kenya, Nakuru, Mau Esc. près Erangiperi, 2700 m, 6.X.1977 (Mahnert & Perret leg.); 1 es., Kenya, Nakuru, Elmenteita, 1800 m, 7.XI.1977 (Mahnert & Perret leg.); 3 es., Kenya, Embu, Irangi For. 2000 m, 11.X.1977 (Mahnert & Perret leg.); 3 es., Rwanda, Kayove, 2100 m, 29.IV.1973 (Werner leg.); 24 es., Rwanda, Rangiro, 1800 m, 1.1.1976, 26.III.1976, 14.IX.1976 (Werner leg.); 3 es., Rhodésie, Umtali, II.1969 (R. Mussard leg.).

Discussione. Il transferimento di questa specie dal genere *Pelioptera* Kraatz, 1857 al genere *Aloconota* Thomson, 1858, si è reso necessario allorché ho rinvenuto due femmine tra il materiale del Museo di Ginevra. La spermateca non ha la forma consueta al genere *Pelioptera*, cioè bulbo distale molto sviluppato e parte prossimale della spermateca stessa fortemente ricurva al lato sinistro e molto assottigliata, cioè al contrario di quanto è osservabile sulla spermateca di *africana* (fig.10). Effettivamente le mesocoxe in *africana* sono un po' scostate tra loro, carattere questo riconducibile a *Pelioptera* e che ha probabimente indotto Bernhauer all'attribuzione a *Pelioptera*.



FIGG. 5–10

Habitus, spermateca ed edeago in visione laterale e ventrale. 5–6: *Aloconota asymmetrica* sp. n.; 7–10: *Aloconota africana* (Bernhauer), lectotypus ♂.

Tuttavia non sempre questo carattere è costante nell'ambito di un genere, come ho constatato anche in altri generi di Athetini.

Al genere *Aloconota* appartengono specie per lo più ripicole. La raccolta di *A. africana* con formiche è da ritenersi occasionale. Infatti al Museo di Ginevra sono conservati numerosi esemplari di questa specie raccolti al di fuori dell'ambiente mirmecofilo.

Specie finora nota solo del Ruwenzori occidentale e ritenuta mirmecofila perché raccolta con *Dorylus* sp.

Aloconota mussardi sp. n. (Figg. 11–16)

Holotypus ♂, Rhodésie, Umtali, II.1969, Melsetter, 1700 m (R. Mussard Leg., MG).
Paratypi: 2 ♀♀, stessa provenienza (MG, CPA).

Descrizione. Lungh. 2,6 mm. Corpo lucido e bruno; margine posteriore degli uroterghi rossiccio; antenne brune; zampe giallo-rossicce. La reticolazione del capo è molto svanita, quella del pronoto è assente e quella delle elitre e dell'addome è distinta. La punteggiatura del capo è svanita, quella del pronoto fine. Le elitre sono coperte di tubercoletti distinti, l'addome di tubercoletti superficiali. Edeago figg. 12–13, spermateca figg. 14–15 e 6° urotergo libero del maschio Fig. 16.

Comparizioni. Specie simile ad *A. africana* (Bernhauer, 1934) (Figg. 7–10) del Kenya e del Ruwenzori, a motivo delle elitre più lunghe del pronoto e della forma dell'edeago. Tuttavia la nuova specie ha antenna più corte, edeago più ricurvo al lato ventrale e pezzi copulatori del sacco interno dell'edeago, nettamente più robusti.

Aloconota praticola (Fauvel, 1907), **comb. n.** (Figg. 17–19)

Atheta praticola Fauvel, 1907: 56.
Atheta (Microdota) praticola, Bernhauer & Scheerpeltz, 1926: 630.
Pelioptera praticola; Pace, 1986: 109.

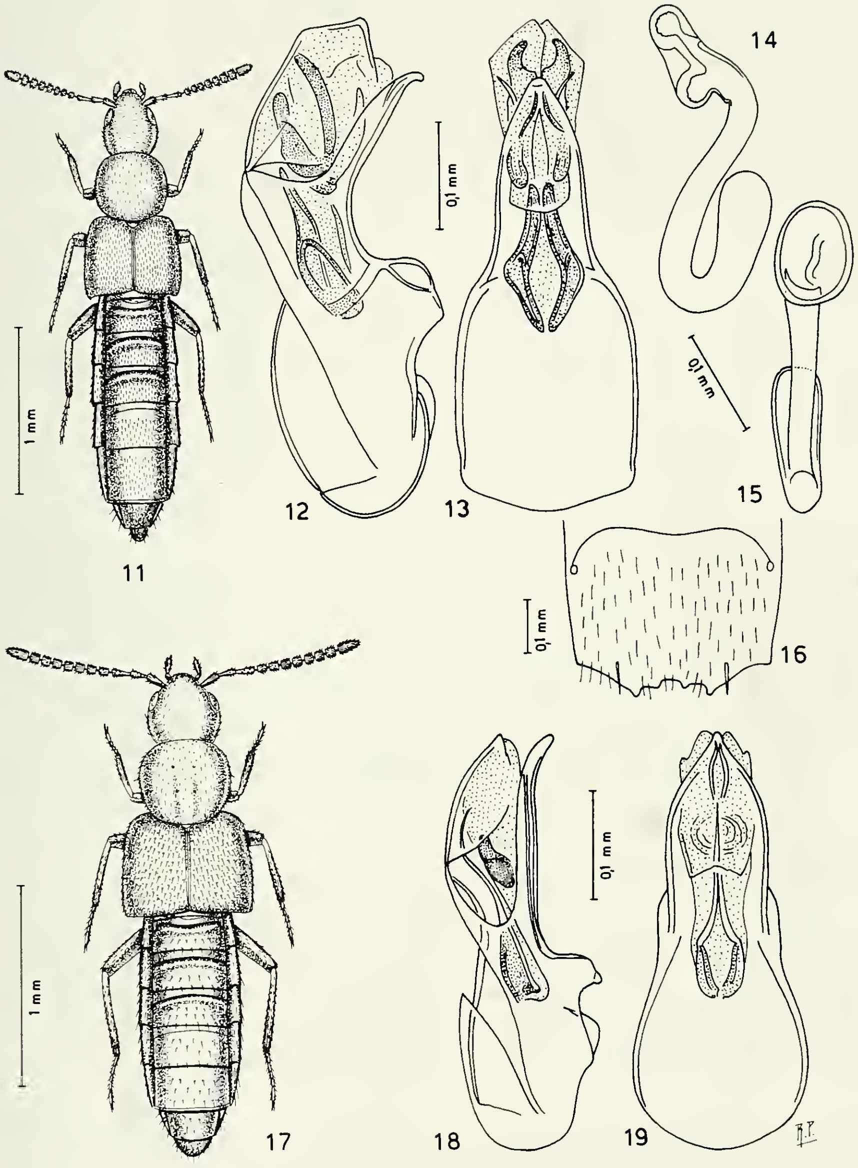
Materiale esaminato: Holotypus ♂, Afrique or. all., Kilimanjaro, zone des prairies, 3200 altit., Ch. Alluaud, 1904, *praticola* FVL, type (Mus. Bruxelles).

Discussione. Il rinvenimento nel materiale del Museo di Ginevra di una specie assai affine *a praticola* (*A. mauensis* sp. n.), che presenta spermateca tipica del genere *Aloconota* Thomson, 1858 e non spermateca simile alle specie del genere *Pelioptera* Kraatz, 1857, induce alla nuova attribuzione generica.

Aloconata mauensis sp. n. (Figg. 20–23)

Holotypus ♂, Kenya, Nakuru Mau Escarpment, S East Mau, 2850 m, 6.XI.1977 (Mahnert & Perret leg., MG).
Paratypus, 1 ♀, stessa provenienza.

Descrizione. Lungh. 2,9 mm. Corpo lucido e bruno con elitre e addome rossicci; antenne brune con antennomero basale bruno-rossiccio; rampe giallo-rossicce. La punteggiatura del capo è distinta, su un fondo non reticolato. Sul pronoto sono presenti tubercoletti salienti, sulle elitre tubercoletti molto salienti e sull'addome tubercoletti distinti. La reticolazione del pronoto è distinta. Edeago figg. 21–22, spermateca Fig. 23.



FIGG. 11–19

Habitus, edeago in visione laterale e ventrale, spermateca e 6° urotergo libero del maschio. 11–16: *Aloconota mussardi* sp. n.; 17–19: *Aloconota praticola* (Fauvel), Holotypus ♂.

Comparazioni. Specie affine ad *A. praticola* (Fauvel, 1907) (Figg. 17–19), del Kilimangiaro, a motivo della forma dell'edeago. Tuttavia la nuova specie presenta elitre più corte, pronoto debolmente reticolato (nettamente reticolato in *praticola*); tubercoletti delle elitre del maschio molto salienti presso la sutura (poco salienti e fini in *praticola*) e 5° urotergo libero del maschio con una carena mediana (senza carena in *praticola*). L'edeago delle due specie presenta il seguente carattere differenziale più evidente: la piastra basale interna del sacco interno dell'edeago della nuova specie ha uno stiletto corto, mentre quello corrispondente di *praticola* è lunghissimo.

Charicera gen. n. (Figg. 24–29)

Typus generis. Charicera ruandensis sp. n.

Diagnosi. Il nuovo genere si colloca tra i generi *Aloconota* Thomson, 1858 e *Pelioptera* Kraatz, 1857, a motivo della presenza di una ligula divisa in due lembi a base larga, ma questi lembi sono nettamente più stretti e molto distanziati tra loro (tra loro contigui in *Aloconota* e *Pelioptera*). Inoltre le antenne sono cortissime (generalmente lunghe in *Aloconota*) e la spermateca è di tipo diverso.

Descrizione. Habitus di *Atheta* Thomson, 1858, con antenne molto corte. Capo più stretto del pronoto, con tempie marginate; palpi mascellari (Figg. 28–29) di 4 articoli; lobo interno delle "maxillae" con lunghe e fitte spine al margine apicale interno; lobo esterno pubescente all'estremità; palpi labiali di 3 articoli (fig.26); ligula divisa in due lembi tra loro largamente distanziati; paraglosse nulle; mento (fig.27) trapezoidale con margine anteriore arcuato verso l'interno; processo mesosternale acuto, insinuato fino a metà delle mesocoxe che tra loro sono contigue; formula tarsale 4-5-5; primo tarsomero posteriore corto. Spermateca fig. 25.

Etimologia. Il nome del nuovo genere significa "Antenne graziose".

Charicera ruandensis sp. n. (Figg. 24–29)

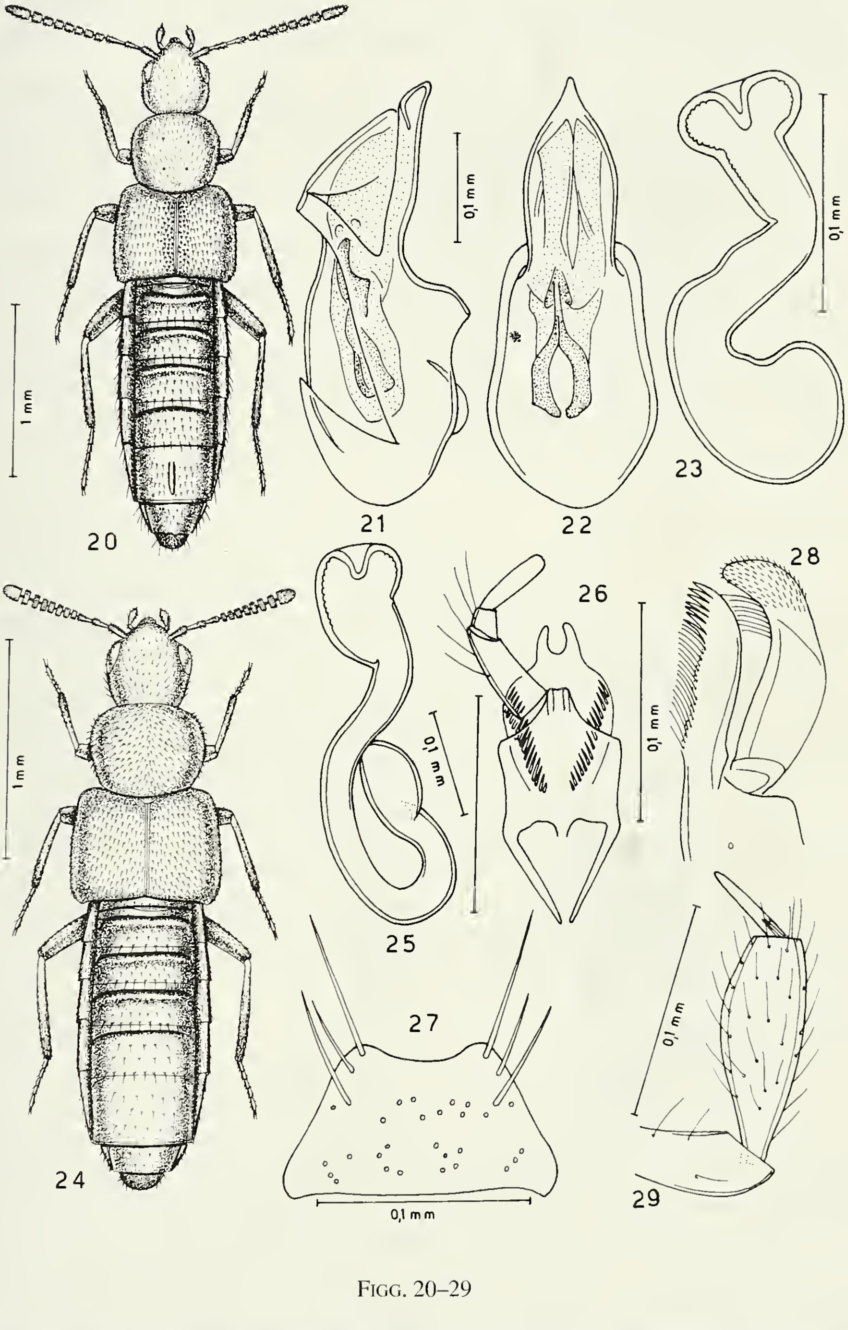
Holotypus ♀, Rwanda, Kayove, 2100 m, 29.IV.1973 (Werner leg., MG).

Descrizione. Lungh. 2,6 mm. Corpo lucido e giallo-rossiccio sporco; antenne bruno-rossicce con i due antennomeri basali giallo-rossicci; zampe giallo-rossicce. La reticolazione del capo e del pronoto è svanita, quella delle elitre assente e quella dell'addome estremamente svanita. Il capo presenta punteggiatura fine e netta, il resto del corpo è coperto di tubercoletti fini e distinti. Spermateca fig. 25.

Parapodoxya jeanneliana (Bernhauer, 1944)

Oxypoda (Podoxya) jeanneliana BERNHAUER, 1944: 20.
Oxypoda (Parapodoxya) jeanneliana, JEANNEL & PAULIAN, 1945: 96.
Parapodoxya jeanneliana, PACE, 1986: 109.
23 es., Kenya, Mt. Elgon, env. 2650 m, 14.XI.1974 (Mahnert & Perret leg.).

Specie già nota del Mt. Elgon (località tipica) (JEANNEL & PAULIAN, 1944) e del Mt. Meru (PACE, 1986). Specie infeudata nei nidi di *Tachyoryctes splendens*.



FIGG. 20–29

Habitus, edeago in visione laterale e ventrale, spermateca, labio con palpo labiale, maxilla, palpo mascellare e mento. 20–23: *Aloconota mauensis* sp. n.; 24–29: *Charicera ruandensis* gen. n., sp. n.

Pelioptera aberdarensis sp. n. (Figg. 30–32)

Holotypus ♂, Kenya, Mt. Aberdares, Parc National, 2300 m, 25.XI.1974 (Mahnert & Perret leg., MG).

Descrizione. Lungh. 2,6 mm. Corpo lucido e bruno, con uriti liberi 1°, 2° e 6° giallo-rossicci; antenne brune con i due antennomeri basali giallo-bruni; zampe gialle. La reticolazione del capo e del pronoto è netta, quella delle elitre quasi vigorosa e quella dell'addome assente. L'avancorpo è coperto di tubercoletti poco distinti o superficiali, l'addome presenta invece tubercoletti distinti. Edeago figg. 31–32.

Comparazioni. Le specie del genere *Pelioptera* Kraatz, 1857, della sottoregione africana orientale sono: *P. polita* (Eichelbaum, 1913), *P. abyssinorum* Pace, 1986, *P. quaesita* Pace, 1986 e *P. consors* Pace, 1986. E' da escludere l'affinità della nuova specie con *polita*, poiché questa specie ha pubescenza dell'avancorpo molto rada. La restanti specie hanno pubescenza fitta come della nuova specie, ma esse presentano edeago molto largo nella regione subapicale, in visione ventrale, carattere, questo, sufficiente a distinguere la nuova specie dalle altre dell'Africa orientale.

Pelioptera ruandensis sp. n. (Figg. 33–35)

Holotypus ♂, Rwanda, Kayove, 2100 m, 12.VIII.1973 (Werner leg., MG).

Descrizione. Lungh. 2,7 mm. Corpo lucido e bruno; antenne brune con antennomero basale e apice dell'11° giallo-bruni; zampe giallo-rossicce. Il capo presenta un'ampia concavità discale, punteggiatura assai distinta e reticolazione evidente solo sul disco: al di fuori di esso è assente. Sul pronoto è visibile un appiattimento mediano posteriore diviso sulla linea mediana da una carena superficiale, punteggiatura distinta e reticolazione assai svanita. Le elitre presentano tubercoletti distinti, reticolazione evidente e una carena alla sutura, presso l'angolo posteriore interno. Edeago figg. 33–34.

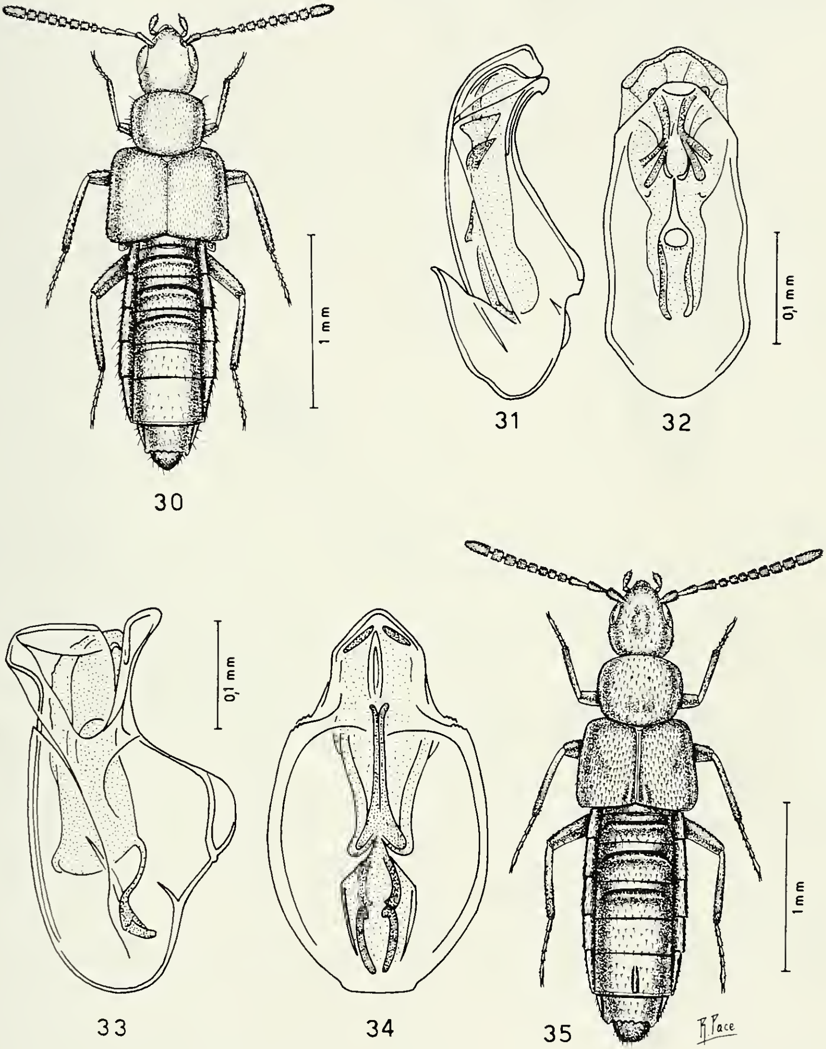
Comparazioni. La presenza di una carena mediana sul 5° urotergo libero del maschio e la forma dell'edeago, permettono di riconoscere l'affinità della nuova specie con *P. consors* Pace, 1986, della Tanzania. Tuttavia la nuova specie ha la regione presso la "crista apicalis" dell'adeago, molto saliente e le elitre del maschio hanno una plica all'angolo posteriore interno (assente in *consors*, che ha invece tubercoletti molto salienti sulla regione suturale delle elitre).

Pelioptera dimidiata sp. n. (Figg. 36–38)

Holotypus ♀, Rwanda, Rangiro, 1800 m, 6.VIII.1973 (Werner leg., MG).

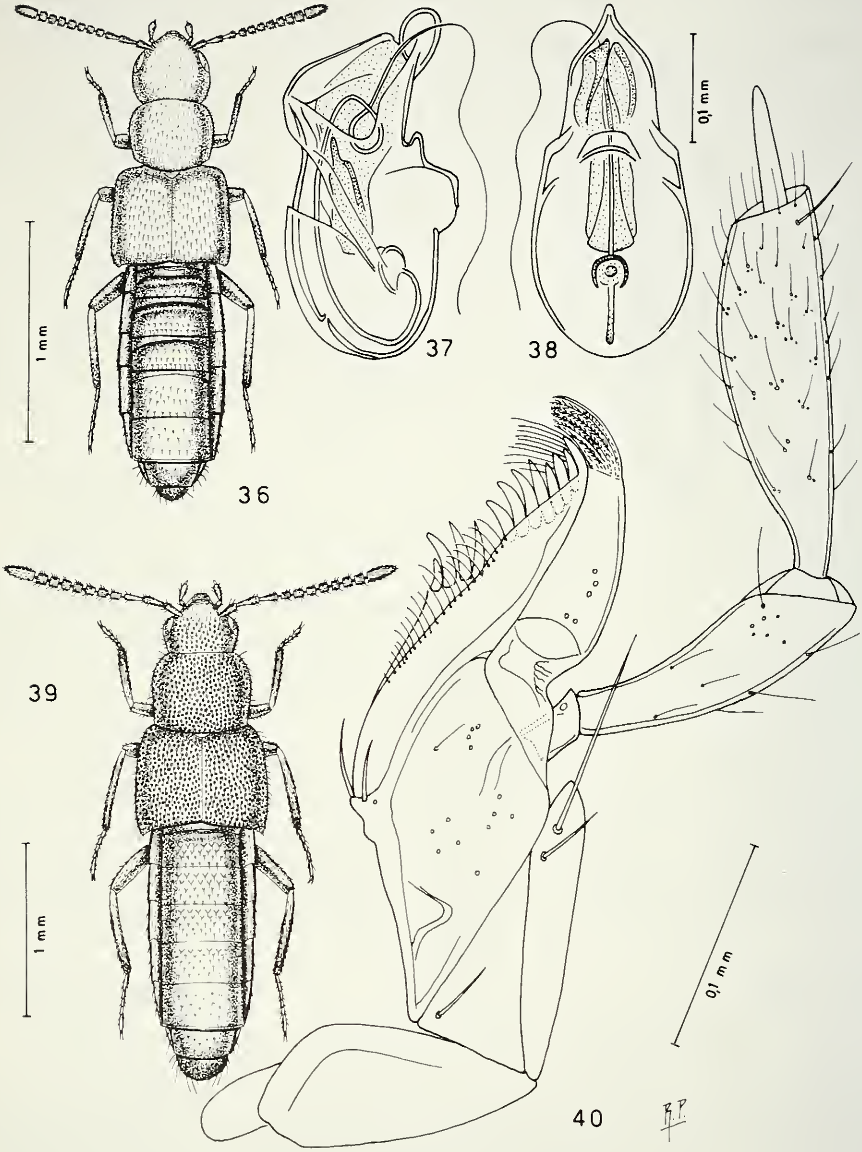
Descrizione. Lungh. 2,1 mm. Corpo lucido e giallo-rossiccio con elitre e addome bruno-rossicci e uriti liberi 4° e 5° bruni; antenne bruno-rossicce con i due antennomeri basali e l'11° giallo-rossicci; zampe gialle. Il capo e il pronoto sono lucidi, cioè senza reticolazione e hanno punteggiatura finissima. Le elitre e l'addome presentano tubercoletti distinti e non sono reticolati. Edeago figg. 37–38.

Comparazioni. La forma dell'edeago della nuova specie appare un po' simile a quella di *P. abyssinorum* Pace, 1986. Infatti entrambe le specie presentano una plica presso la "crista apicalis" dell'edeago e l'apice dell'edeago termina a punta di lancia. La più vistosa differenza tra le due specie consiste nella presenza di un flagello lungamente



Figg. 30–35

Habitus ed edeago in visione laterale e ventrale. 30–32: *Pelioptera aberdarensis* sp. n.; 33–35: *Pelioptera ruandensis* sp. n.



FIGG. 36–40

Habitus, edeago in visione laterale e ventrale e maxilla con palpo mascellare. 36–38: *Pelioptera dimidiata* sp. n.; 39–40: *Askeptoxenia acuticollis* (Fauvel), gen. n., holotypus ♂.

sporgente dall'orifizio apicale dell'edeago della nuova specie, mentre in *abyssinorum* non è presente e l'edeago di *abyssinorum* è molto più sviluppato di quello della nuova specie.

Askeptoxenia gen. n. (Figg. 39–44)

Typus generis: Askeptoxenia acuticollis (Fauvel, 1907).

Diagnosi. Per la forma della ligula, per le antenne allungate e per il primo tarsomero posteriore lungo quanto i due seguenti tarsomeri considerati insieme, il nuovo genere può essere collocato accanto al genere *Aloconota* Thomson, 1858. Tuttavia il pronoto sinuato davanti agli angoli posteriori, la presenza di un solo solco trasverso basale dell'addome (e non due o tre), la presenza di scultura squamiforme sugli uroterghi basali e la profonda flessione al lato ventrale dell'edeago, che ha apice diviso in due lembi, sono caratteri che distinguono il nuovo genere da *Aloconota*, come da altri generi affini: *Pelioptera* Kraatz, 1857, *Geostiba* Thomson, 1859, ecc.

Descrizione. Capo più stretto del pronoto, con tempie robustamente marginate; mandibole molto allungate, con dente interno alla base della terebra, assai poco sporgente; terebra acuta all'apice; lobo interno delle "maxillae" (fig. 40) più corto e più stretto dell'esterno, con una fila interna di robuste spine e di fini setole; lobo esterno con estremità pubescente: palpi mascellari composti di 4 articoli: il terzo è stretto e molto lungo; mento (fig. 44) trasverso, con margine anteriore quasi rettilineo; palpi labiali di 3 articoli (fig. 43): il primo articolo è assai lungo e il secondo è brevissimo; ligula a base molto larga, divisa in due lembi che si restringono verso l'apice; paraglosse non sporgenti in avanti; antenne di 11 articoli; con undicesimo antennomero lungo quanto i tre antennomeri precedenti compresi insieme, nel maschio.

Elitre molto più lunghe e più larghe del pronoto. Addome lievemente ristretto all'indietro; i tre uroterghi liberi basali presentano microscultura squamiforme; il primo urotergo libero è trasversalmente solcato alla base. Formula tarsale 4-5-5; tarsomero basale posteriore lungo quanto i due tarsomeri contigui considerati insieme. Processo mesosternale acuto: esso raggiunge la metà delle mesocoxe, che tra loro sono contigue. Edeago figg. 41–42. Femmina sconosciuta.

Etimologia. Il nome del nuovo genere significa "Ospite non riconosciuto". Infatti la specie *acuticollis* è ospite di Termiti e il nuovo genere non è stato riconosciuto da Fauvel quando descrisse la specie, dato che non ha esaminato ligula ed edeago, avendo disponible un solo esemplare che non ha osato dissezionare.

Askeptoxenia acuticollis (Fauvel, 1907), **comb. n.** (Figg. 39–44)

Atheta (Dimetrota) acuticollis FAUVEL, 1907: 52.

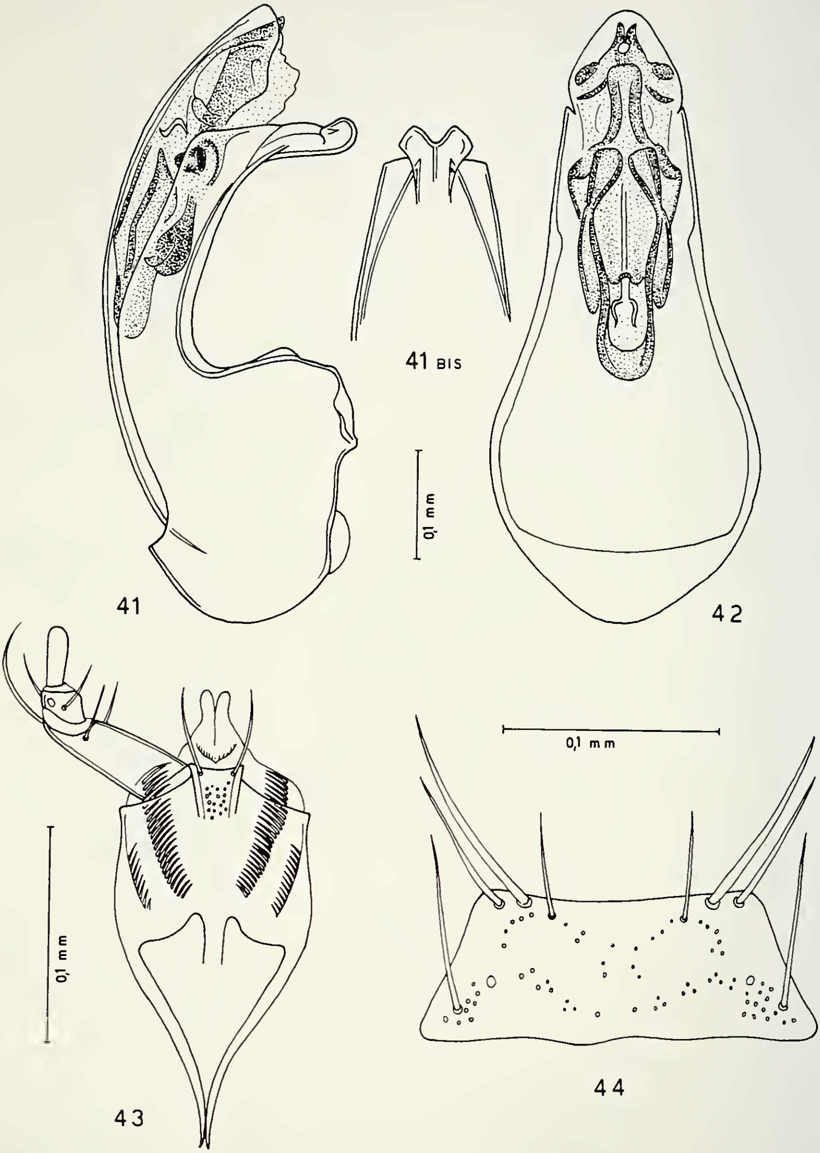
Atheta (Dimetrota) fauveli FENYES, 1920: 205 ("nomen novum" non necessario): BERNHAUER & SCHEERPELTZ, 1926: 663.

Materiale esaminato: Holotypus ♂, Kilimanjaro, Kibonoto, 12, Termites, *acuticollis* FVL, *Atheta*, (Mus. Bruxelles).

Geopora aequinoctialis (Fauvel, 1900) (Figg. 45–48)

Atheta aequinoctialis, Fauvel, 1900: 73.

Atheta (s. str.) *aequinoctialis*, BERNHAUER & SCHEERPELTZ, 1926: 638.



FIGG. 41–44

Edeago in visione laterale, ventrale (solo l'apice) e dorsale, labio con palpo labiale e mento. 41–44: *Askeptoxenia acuticollis* (Fauvel), gen. n., holotypus ♂.

Geopora aequinoctialis, Pace, 1986: 109.

Materiale esaminato: Lectotypus ♂, Congo, Kinchassa, 11, *Atheta aequinoctialis* FVL, type, presente designazione (Mus. Bruxelles); paralectotypi: 1 ♂ e 2 ♀♀, stessa provenienza (Mus. Bruxelles).

La specie è qui illustrata per la prima volta.

Geopora umtaliensis sp. n. (Figg. 49–50)

Holotypus ♀, Rhodésie, Umtali, II.1969 (R. Mussard leg., MG).

Descrizione. Lungh. 2,0 mm. Corpo lucido e giallo con 4° urite libero giallo-rossiccio; antenne giallo-rossicce; zampe gialle. Il capo e il pronoto hanno punteggiatura confusa nell'evidente reticolazione. Le elitre presentano punteggiatura poco evidente e reticolazione svanita. Reticolazione netta e tubercoletti fini coprono l'addome. Spermateca fig. 50.

Comparazioni. Il corpo molto stretto della nuova specie e la forma inconsueta della spermateca (con gibbosità preapicale), non permettono di avvicinare sistematicamente la nuova specie ad altre specie note.

Leptoporodota tambachensis sp. n. (Figg. 51–52)

Holotypus ♀, Kenya, Tambach, E Eldoret, 2000 m, 17.XI.1974 (Mahnert & Perret leg., MG).

Descrizione. Lungh. 2,1 mm. Corpo lucido e giallo rossiccio con elitre e uriti liberi 4° e base del 5° rossicci; antenne giallo-rossicce con i due antennomeri basali gialli; zampe gialle. La reticolazione del capo e del pronoto è distinta, quella delle elitre e dell'addome è netta. La punteggiatura del capo è estremanente svanita. Tubercoletti molto svaniti coprono le elitre. Spermateca fig. 51.

Comparazioni. Per la forma della spermateca (a S rovesciata), la nuova specie può essere avvicinata sistematicamente a *L. kiboensis* Pace, 1985, del Kilimangiaro, ma questa specie non presenta una profonda introflessione apicale del bulbo distale della spermateca, nè il bulbo prossimale dilatato come nella nuova specie. Esternamente la nuova specie ha elitre più lunghe del pronoto e occhi poco ridotti, mentre in *kiboensis* le elitre sono più corte del pronoto e gli occhi sono ridottissimi.

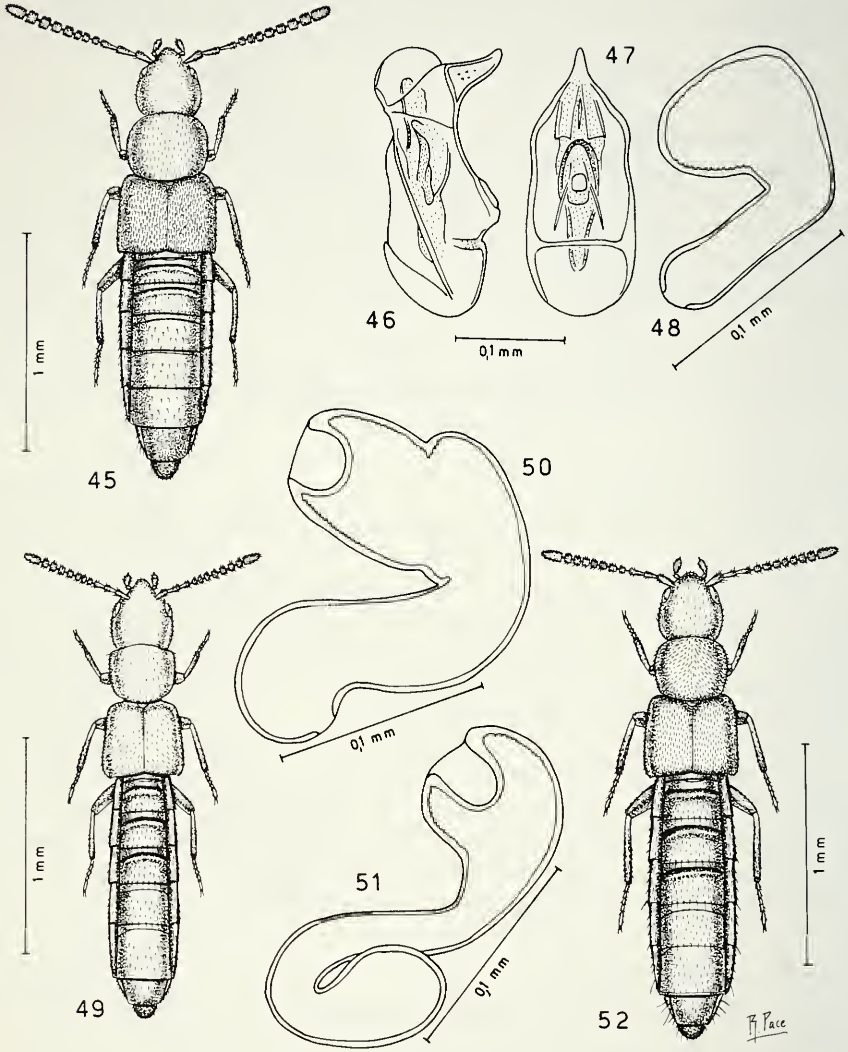
Atheta (Microdota) tapina sp. n. (Figg. 53–57)

Holotypus ♂, Kenya, Narok, Loita Hills, sous Morijo, 2050 m, 5.XI.1977 (Mahnert & Perret leg., MG).

Paratypus: 1 ♂, stessa provenienza.

Descrizione. Lungh. 1,9 mm. Corpo lucido e bruno, comprese le antenne; zampe gialle. La reticolazione del capo e del pronoto è distinta, quella delle elitre è netta e quella dell'addome superficiale. Il capo presenta punteggiatura svanita. Il pronoto e le elitre sono coperti di tubercoletti distinti. Edeago figg. 54–55, maxille e palpo mascellare fig. 56, labio con palpo labiale fig. 57.

Comparazioni. L'edeago della nuova specie è simile a quello di *A. eichelbaumi* Bernhauer, 1915, della Tanzania, per i suoi lati paralleli nella regione subapicale, in visione ventrale, ma l'edeago della nuova specie è più sviluppato di quello di



FIGG. 45–52

Habitus, edeago in visione laterale e ventrale e spermateca. 45–48: *Geopora aequinoctialis* (Fauvel), lectotypus ♂ e paralectotypus ♀; 49–50: *Geopora umtaliensis* sp. n.; 51–52: *Leptoporodota tambachensis* sp. n.

eichelbaumi e ha un distinto pezzo copulatore arcuato del sacco interno, assente in *eichelbaumi*.

Atheta (Microdota) kisumuensis sp. n. (Figg. 58–62)

Holotypus ♂, Kenya, Miss. Kaimosi, NE Kisumu, 1650 m, 11.XI.1974 (Mahnert & Perret leg., MG).

Paratypi: 5 es., stessa provenienza.

Descrizione. Lungh. 1,7 mm. Corpo debolmente lucido e nero, comprese le antenne; zampe giallo-rossicce. Solo il capo e l'addome mostrano reticolazione estremamente svanita: il resto del corpo è privo di reticolazione. I tubercoletti che coprono la superficie del capo sono superficiali, quelli sul resto del corpo sono distinti. Edeago figg. 59–60, spermateca fig. 61 e 6° urite libero del maschio fig. 62.

Comparazioni. Per la forma simile dell'habitus e della spermateca, la nuova specie si colloca sistematicamente vicina ad *A. kiboshoana* Bernhauer, 1915, della Tanzania (nota solo sull'holotypus femmina). Le due specie sono separate dai seguenti più evidenti caratteri: introflessione apicale del bulbo distale della spermateca molto profonda nella nuova specie e poco profonda in *kiboshoana*; pronoto meno trasverso nella nuova specie e più trasverso in *kiboshoana*.

Atheta (Microdota) mussardi sp. n. (Figg. 63–66)

Holotypus ♂, Rhodésie, Umtali, II.1969 (R. Mussard leg., MG).

Paratypi: 4 ♂♂, stessa provenienza.

Descrizione. Lungh. 1,7 mm. Corpo lucido e bruno, comprese le antenne; zampe giallo-rossicce. La reticolazione del capo e dell'addome è distinta, quella del pronoto e delle elitre è svanita. Tutto il corpo è coperto di tubercoletti salienti. Edeago figg. 64–65, 6° urotergo libero del maschio fig. 66.

Comparazioni. La nuova specie è differente da *A. eichelbaumi* Bernhauer, 1915, della Tanzania, per l'edeago più sviluppato e per i lati dell'edeago (in visione ventrale) convergenti verso l'apice e non paralleli come in *eichelbaumi*.

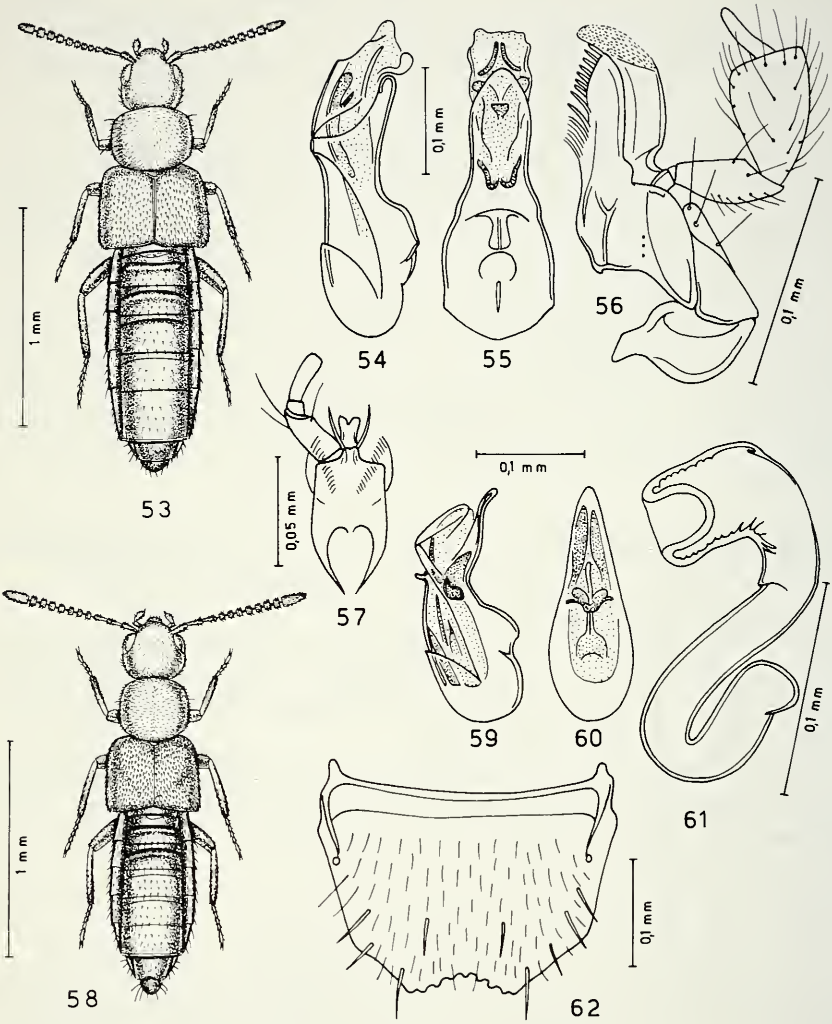
Atheta (Microdota) acusifera sp. n. (Figg. 67–70)

Holotypus ♂, Rhodésie, Umtali, II.1969 (R. Mussard leg., MG).

Descrizione. Lungh. 2,1 mm. Corpo lucido e bruno con uriti liberi 3°, 4° e 5° nero-bruni; antenne brune; zampe giallo-rossicce. Il capo e il pronoto presentano punteggiatura superficiale e reticolazione distinta. Il capo ha una larga concavità discale. La reticolazione delle elitre è superficiale, quella degli uroterghi svanita e a maglie trasverse. Tubercoletti svaniti coprono le elitre. Edeago figg. 68–69, 6° urotergo libero del maschio fig. 70.

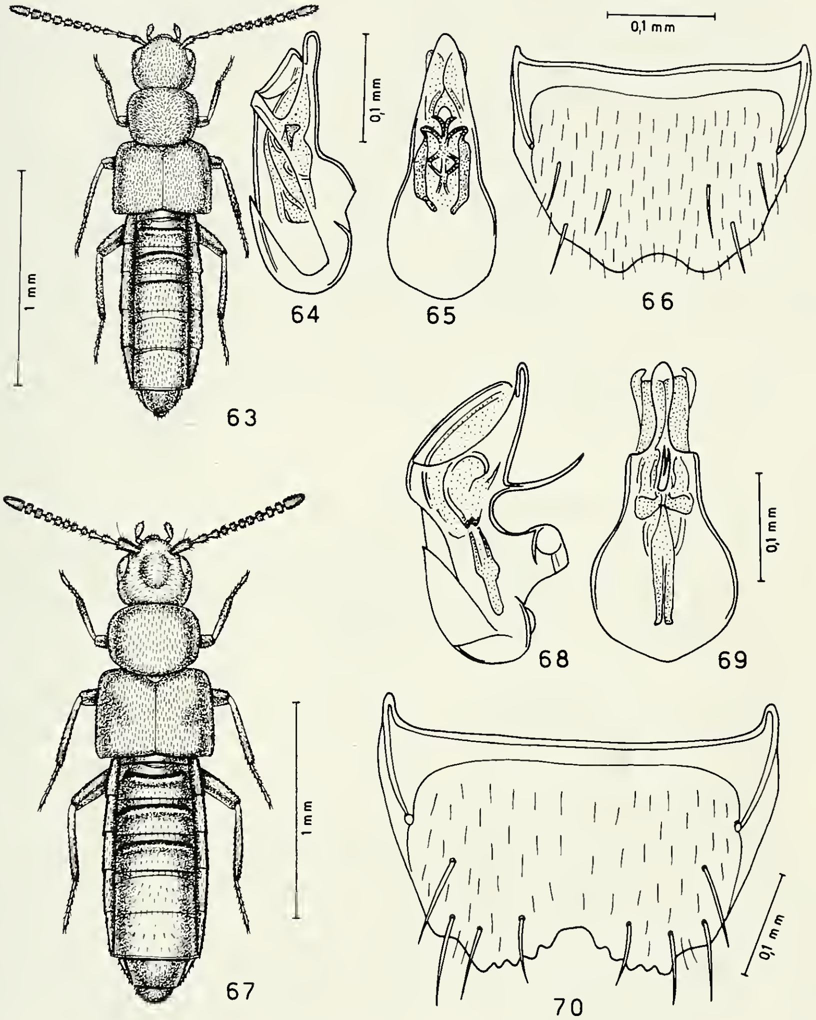
Comparazioni. L'edeago della nuova specie presenta alcuni caratteri riscontrabili nell'edeago di *A. dilaticollis* Pace, 1986, della Tanzania. Tuttavia l'appendice aghiforme ventrale dell'edeago, rende la specie finora unica.

Etimologia. Il nome della nuova specie significa "Portatrice d'ago"; infatti l'edeago porta un'appendice aghiforme ventrale.



FIGG. 53–62

Habitus, edeago in visione laterale e ventrale, maxilla con palpo mascellare, labio con palpo labiale, spermateca e 6° urotergo libero del maschio. 53–57: *Atheta (Microdota) tapina* sp. n.; 58–62: *Atheta (Microdota) kisumuensis* sp. n.



FIGG. 63–70

Habitus, edeago in visione laterale e ventrale, 6° urotergo libero del maschio. 63–66: *Atheta (Microdota) mussardi* sp. n.; 67–70: *Atheta (Microdota) acusifera* sp. n.

Atheta (Microdota) kipsigia sp. n. (Figg. 71–74)

Holotypus ♂, Kenya, Mt. Elgon, env. 2650 m, 24.XI.1974 (Mahnert & Perret leg., MG). Paratypi: 5 es., stessa provenienza, ma 2700 m e 15.XI.1974.

Descrizione. Corpo lucido e bruno con elitre bruno-rossicce e addome nero; antenne interamente brune; zampe giallo-brune. L'avancorpo è coperto di tubercoletti e di reticolazione netti. L'addome presenta reticolazione molto svanita e tubercoletti distinti. Edeago figg. 72–73, spermateca fig. 74.

Comparazioni. In base alla forma della spermateca, simile a quella di *A. kiboshoana* Bernhauer, 1915, della Tanzania, la nuova specie è attribuita al sottogenere *Microdota* Mulsant & Rey, 1873, nonostante la taglia del corpo maggiore e le antenne allungate. L'introflessione apicale del bulbo distale della spermateca della nuova specie, è profonda e triangolare e non breve e a semicerchio come in *kiboshoana*. Inoltre la dimensione della spermateca della nuova specie è nettamente maggiore rispetto quella di *kiboshoana*. Il 4° antennomero della nuova specie è più lungo che largo, mentre quello corrispondente di *kiboshoana* è nettamente trasverso.

Etimologia. La nuova specie prende nome dalla tribù nilotica dei Kipsigi, stanziata a SE del M. Elgon, località tipica.

Atheta (Traumoecia) reptabunda Pace, 1986

Atheta (Traumoecia) reptabunda Pace, 1986: 101.

12 es., Kenya, Mt. Aberdares, Parc National, 2300 m, 25.XI.1974 (Mahnert & Perret leg.); 1 ♀, Kenya, Taita Hills, 1400 m, env. Wundanyi (Mahnert & Perret leg.).

Specie finora nota solo dell'Africa orientale.

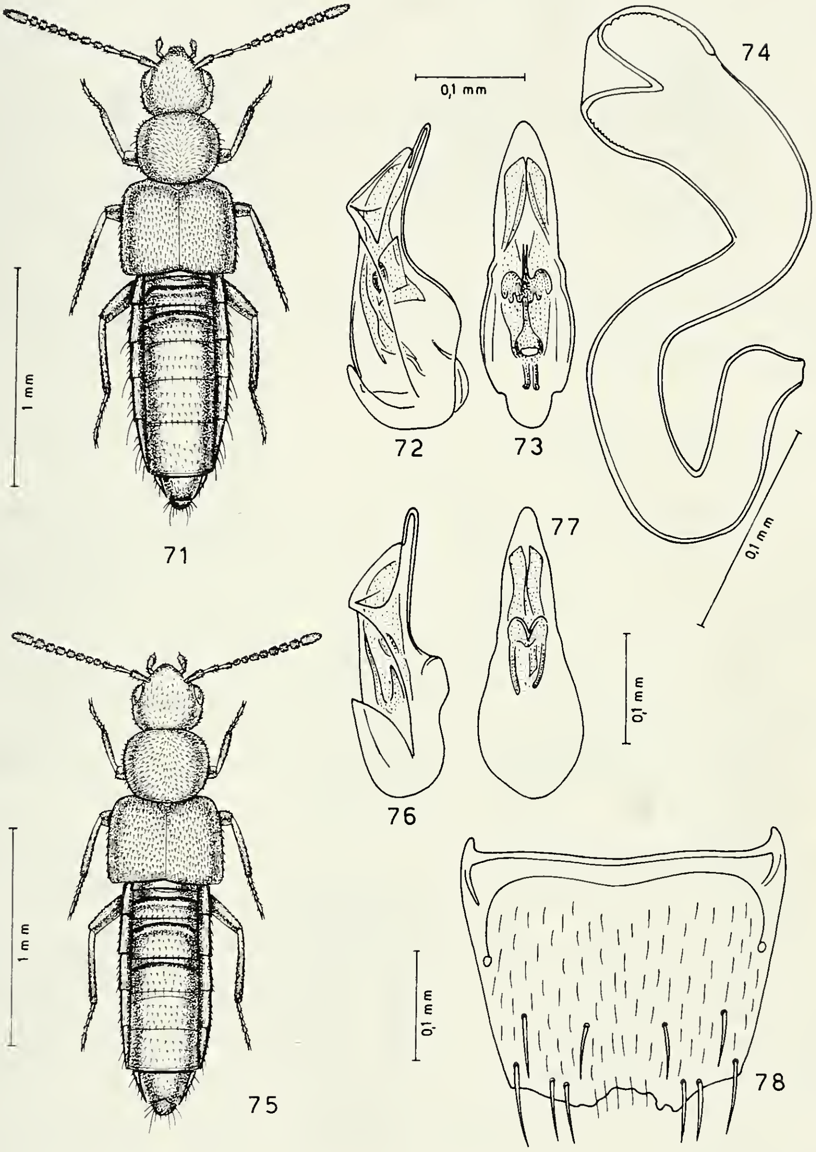
Atheta (Traumoecia) irangicola sp. n. (Figg. 75–78)

Holotypus ♂, Kenya, Embu, Irangi forest St., 2100 m, 12.X.1977 (Mahnert & Perret leg., MG).

Paratypus: 1 ♀, stessa provenienza.

Descrizione. Lungh. 2,0 mm. Corpo debolmente lucido e giallo-bruno con 4° urite libero bruno; antenne brune con i due antennomeri basali giallo-rossicci; zampe giallo-rossicce. La reticolazione del capo e delle elitre è netta, quella del pronoto è distinta. Tubercoletti nettamente salienti coprono l'avancorpo. Sull'addome i tubercoletti sono svaniti, posti su un fondo a reticolazione distinta e a maglie appena trasverse. Edeago figg. 76–77, sesto urotergo libero del maschio fig. 78. Spermateca simile a quella di *A. kipsigia* sp. n. (fig. 74), ma più breve, con una dilatazione presso il bulbo prossimale.

Comparazioni. L'edeago della nuova specie è simile per grandezza e per aspetto generale a quello di *A. reptabunda* Pace, 1986, della Tanzania, tuttavia nel sacco interno dell'edeago della nuova specie è assente una larga spina ricurva, presente invece in *reptabunda* e le "bretelle" dell'edeago sono strettissime nella nuova specie e larghissime in *reptabunda*. Inoltre la nuova specie ha elitre nettamente più lunghe del pronoto e occhi ben sviluppati, mentre in *reptabunda* le elitre sono lunghe quanto il pronoto e gli occhi sono molto ridotti.



FIGG. 71–78

Habitus, edeago in visione laterale e ventrale, spermateca e 6° urotergo libero del maschio. 71–74: *Atheta (Microdota) kipsigia* sp. n.; 75–78: *Atheta (Traumoecia) irangicola* sp. n.

Atheta (Tropatheta) shimbaensis sp. n. (Figg. 79–82)

Holotypus ♂, Kenya, Shimba Hills, Madakara For., 30.XI.1974 (Mahnert & Perret leg., MG).

Paratypi: 7 es., stessa provenienza.

Descrizione. Lungh. 2,3 mm. Corpo lucido e bruno; antenne bruno-rossicce con i tre antennomeri basali giallo-rossicci; zampe rossicce. La reticolazione del capo e del pronoto è vigorosa, quella delle elitre è svanita. La punteggiatura del capo è ombelicata e netta, quella del pronoto è superficiale e quella delle elitre è altrettanto netta. Il pronoto ha uno stretto e superficiale solco mediano. Edeago figg. 80–81, spermateca fig. 82.

Comparazioni. L'appendice stiliforme ventrale dell'edeago della nuova specie è carattere unico e ben distinto che, insieme ad altri numerosi caratteri differenziali, sia dello stesso edeago, che della spermateca, permette una netta distinzione da *A. gestroi* Bernhauer, 1915, dell'Eritrea.

Atheta (Tropatheta) savanicola sp. n. (Figg. 83–85)

Holotypus ♂, Usambara, coll. Kraatz (D.E.I.).

Descrizione. Lungh. 2,9 mm. Corpo lucido e bruno; antenne giallo-brune con i quattro antennomeri basali giallo-rossicci; zampe giallo-rossicce con femori rossicci. La reticolazione del capo e del pronoto è netta, quella delle elitre è distinta e quella dell'addome è assente. La punteggiatura del capo è svanita, quella delle elitre è distinta. Tubercoletti poco salienti coprono il pronoto. Edeago figg. 84–85.

Comparazioni. L'edeago della nuova specie, rispetto quello di *A. gestroi* Bernhauer, 1915, dell'Eritrea, è nettamente meno sviluppato (1/3 di meno) e più profondamente ricurvo al lato ventrale. E' assente, nel sacco interno dell'edeago della nuova specie, un lungo flagello, presente invece nel sacco interno dell'edeago di *gestroi*. I caratteri dell'esoscheletro sono invece simili.

Atheta (Tropatheta) loitensis sp. n. (Figg. 86–89)

Holotypus ♂, Kenya, Narok Morijo, Loita Hills, 2300 m, 4.XI.1977 (Mahnert & Perret leg., MG).

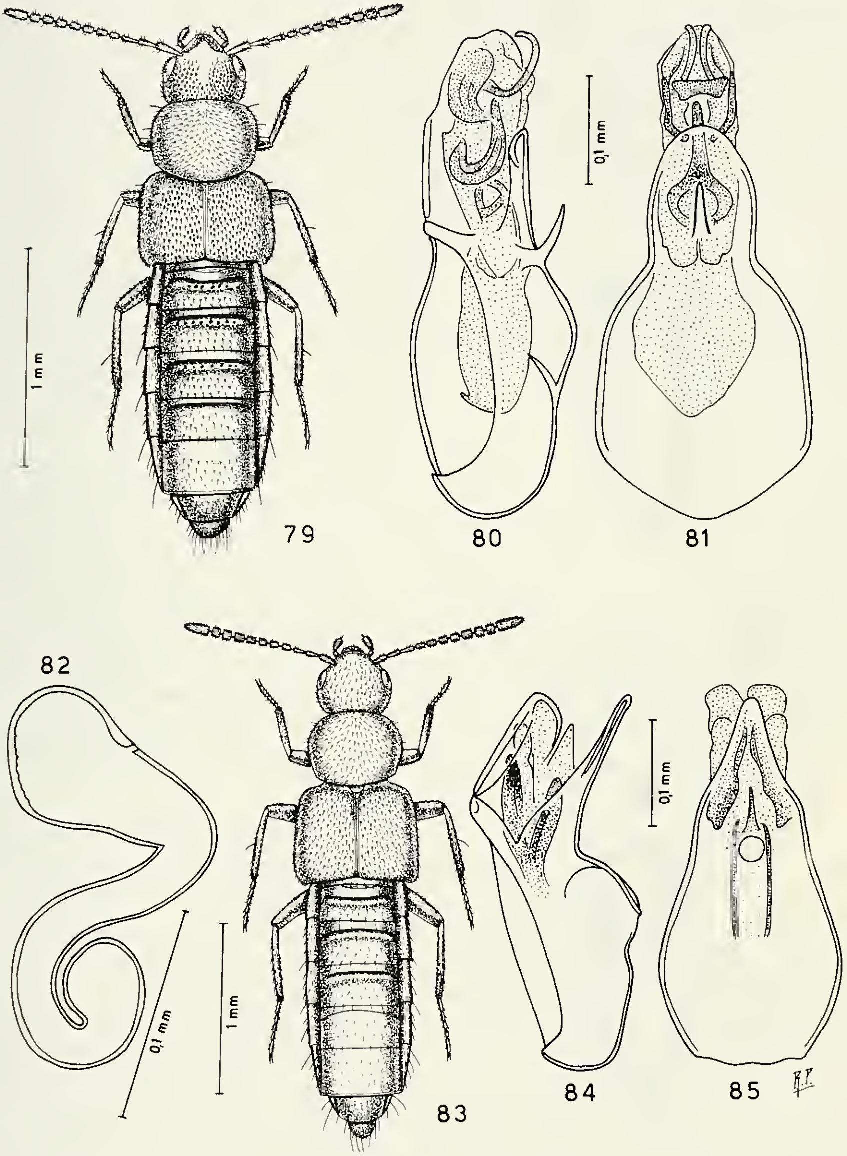
Paratypi: 71 es., stessa provenienza, ma anche in data 5.XI.1977 e altitudine 2050-2200 m.

Descrizione. Lungh. 2,2 mm. Corpo lucido e bruno-rossiccio con pronoto giallo-rossiccio; antenne bruno-rossicce con i due antennomeri basali giallo-rossicci; zampe giallo-rossicce. La reticolazione dell'avancorpo è svanita, quella degli uroterghi è estremamente svanita. La punteggiatura del capo i tubercoletti che coprono il pronoto e le elitre sono superficiali. Edeago figg. 87–88, spermateca fig. 89.

Comparizioni. Le elitre lunghe quanto il pronoto e la forma dell'edeago e della spermateca, sono caratteri sufficienti a distinguere la nuova specie da *A. gestroi* Bernhauer, dell'Eritrea.

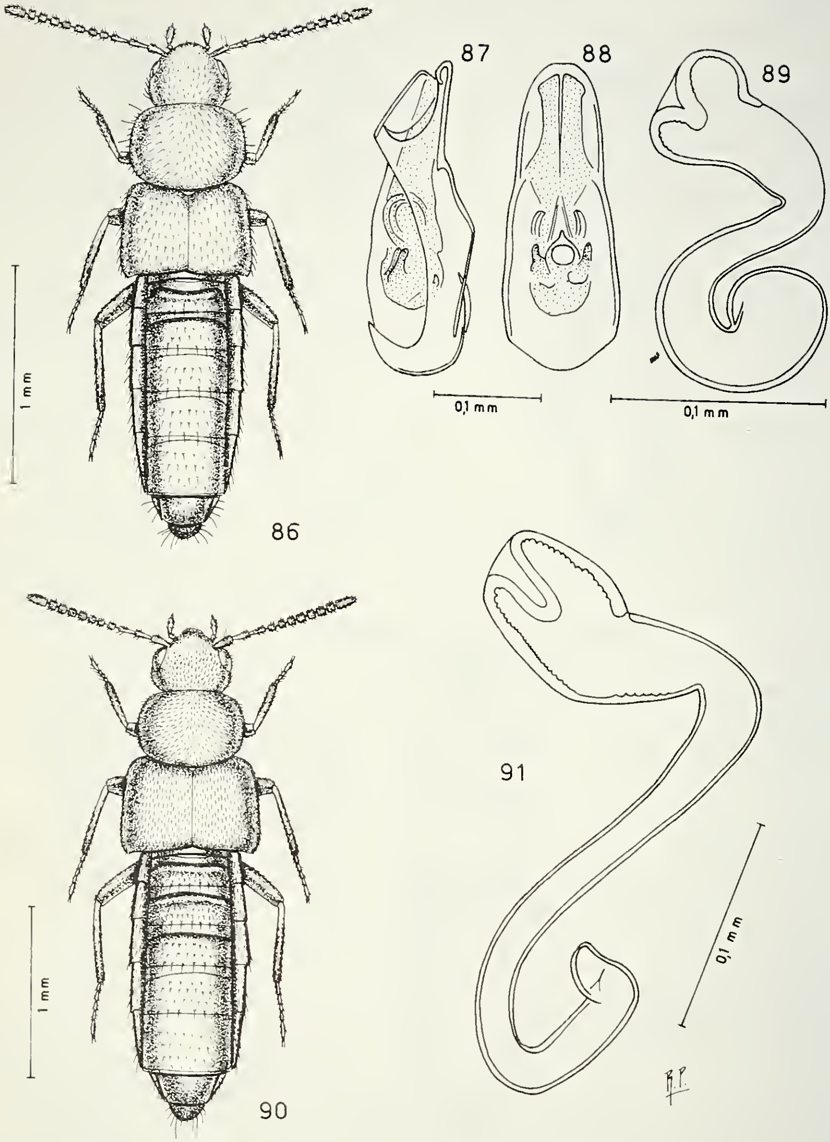
Atheta (Tropatheta) embuicola sp. n. (Figg. 90–91)

Holotypus ♀, Kenya, Embu, Kirimiri Forest, O de Runyenje, 1550 m, 13.X.1977 (Mahnert & Perret leg., MG).



FIGG. 79–85

Habitus, edeago in visione laterale e ventrale e spermateca. 79–82: *Atheta (Tropatheta) shimbaensis* sp. n.; 83–85: *Atheta (Tropatheta) savanicola* sp. n.



FIGG. 86–91

Habitus, edeago in visione laterale e ventrale e spermateca. 86–89: *Atheta (Tropatheta) loitensis* sp. n.; 90–91: *Atheta (Tropatheta) embuicola* sp. n.

Descrizione. Lungh. 2,9 mm. Corpo lucido e bruno-rossiccio con uriti liberi 3°, 4° e 5° bruni; antenne bruno-rossicce con i due antennomeri basali giallo-rossicci; zampe giallo-rossicce. La reticolazione dell'avancorpo è distinta, quella dell'addome assente. Una fina e distinta punteggiatura è sul capo. Pronoto ed elitre sono coperti di tubercoletti svaniti. Distinti sono invece i tubercoletti addominali. Spermateca fig. 91.

Comparazioni. L'habitus della nuova specie è molto simile a quello di *A. gestroi* Bernhauer, 1915, dell'Eritrea, ma la spermateca è molto differente, per avere bulbo distale non sferico come in *gestroi* e parte prossimale della stessa spermateca molto allungata.

Atheta (Tropatheta) nanyukensis sp. n. Figg. 92–95)

Holotypus ♂, Kenya, env. Nanyuki, 1900 m, 22.XI.1974 (Mahnert & Perret leg., MG).

Paratypi: 6 es., stessa provenienza; 25 es., Kenya, Mau Escarpment, S-East Mau, 2850 m; 6.XI.1977 (Mahnert & Perret leg.); 7 es., Kenya, Taita Hills, env. Wundanyi, 1400 m, 2.XII.1974 (Mahnert & Perret leg.).

Descrizione. Lungh. 2,6 mm. Corpo lucido e bruno, con estremità addominale bruno-rossiccia; antenne bruno-rossicce con i due antennomeri basali giallo-rossicci; zampe giallo-brune con tarsi giallo-rossicci. La reticolazione del capo è vigorosa, quella del pronoto è distinta, quella delle elitre è estremanente svanita e quella dell'addome è assente. La punteggiatura del capo e delle elitre è distinta, quella del pronoto è superficiale. Edeago figg. 93–94, spermateca fig. 95.

Comparazioni. La forma dell'edeago della nuova specie ricorda molto da vicino quella dell'edeago di *A. gestroi* Bernhauer, 1915, dell'Eritrea, sia per dimensione che per aspetto generale. Tuttavia la nuova specie presenta elitre più corte del pronoto e non più lunghe del pronoto come in *gestroi* e l'edeago, in visione ventrale, ha apice arcuato, mentre quello di *gestroi* è acuto.

Atheta (Tropatheta) mashonarum sp. n. (Figg. 96–99)

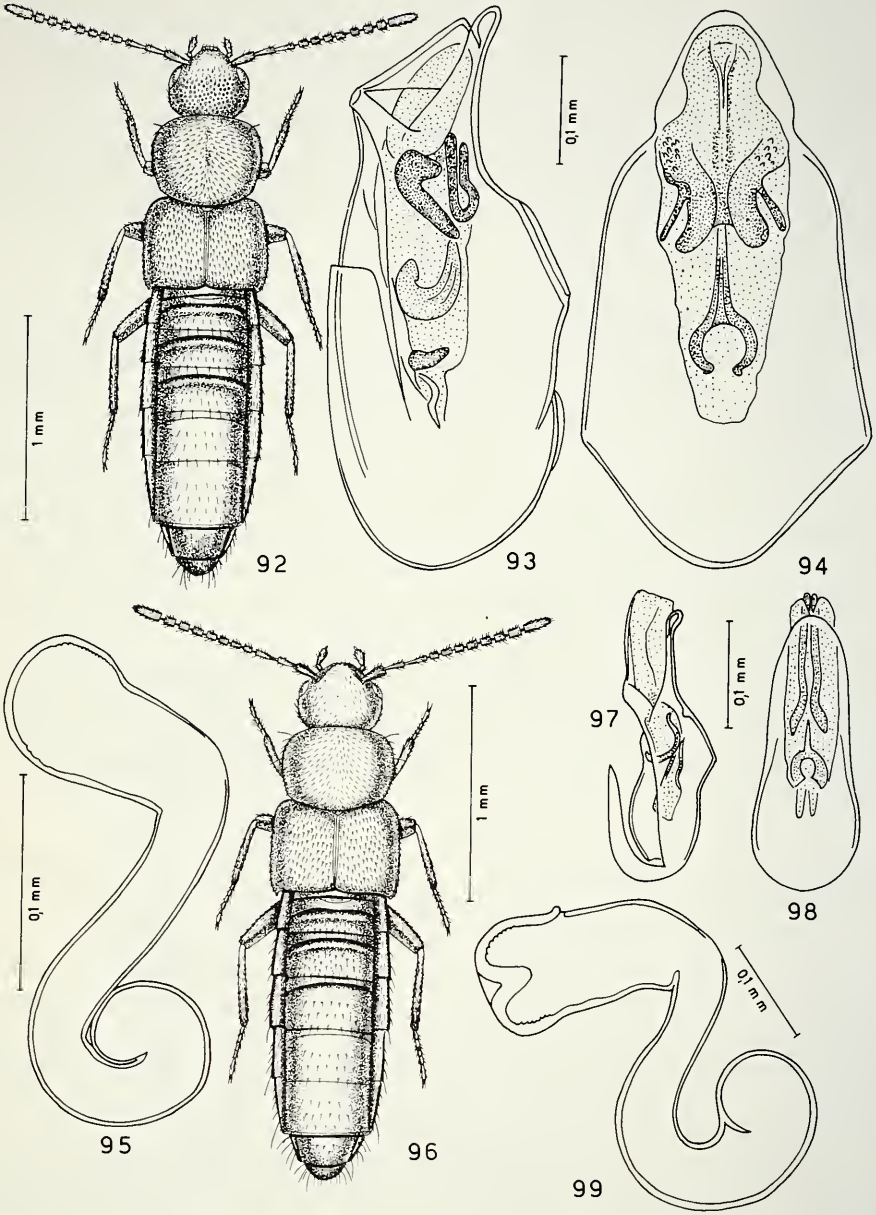
Holotypus ♂, Rhodésie, Umtali, II.1969 (R. Mussard leg., MG).

Paratypi: 12 es., stessa provenienza.

Descrizione: Lungh. 2,4 mm. Capo e pronoto opachi, resto del corpo lucido. Corpo bruno-rossiccio con 4° urite libero bruno; antenne rossicce con i due antennomeri basali e la base del 3° giallo-rossicci; zampe giallo-rossicce. La reticolazione del capo e del pronoto è vigorosa, quella delle elitre e dell'addome è distinta, trasversa sull'addome. La punteggiatura del capo e del pronoto è assai superficiale. Tubercoletti svaniti coprono le elitre. Edeago figg. 97–98, spermateca fig. 99.

Comparazioni. Le elitre lunghe quanto il pronoto, gli antennomeri 4° a 8° più lunghi che larghi, l'edeago di dimensione molto ridotta e il bulbo distale della spermateca di ridotta grandezza, distinguono la nuova specie da *A. gestroi* Bernhauer, 1915, dell'Eritrea, che presenta elitre più lunghe del pronoto, antennomeri 7° e 8° trasversi, l'edeago molto sviluppato e il bulbo distale della spermateca ipertrofico.

Etimologia. La nuova specie prende nome dai Mashona, popolazione stanziata ad oriente dello Zimbabwe.



FIGG. 92–99

Habitus, edeago in visione laterale e ventrale e spermateca. 92–95: *Atheta (Tropatheta) nanyukensis* sp. n.; 96–99: *Atheta (Tropatheta) mashonarum* sp. n.

Atheta (Taxicera) suprema Bernhauer, 1934 (Figg. 100–103 bis)

Atheta (Plataraea) suprema Bernhauer, 1934: 244.
Materiale esaminato: Lectotypes ♂, Ruwenzori, 4200 m, VII.1932, Burgeon, *Atheta (Bessobia) suprema* BRNH, typus, *suprema* BRNH, typus (*Plataraea* (Mus. Chicago), presente designazione; paralectotypi: 5 es., stessa provenienza (Mus. Chicago).
1 ♂ e 1 ♀, Ruwenzori, Bujuko Hut, 1350 ft., I.1984 (L. Lengeler leg.).

Nota. La presenza di una lunga setola su ciascun lembo della ligula (fig. 103 bis), permette di attribuire la specie preferibilmente a *Taxicera* Mulsant & Rey, 1873, sottogenere che include specie presentanti due lunghe setole sulla ligula, mentre nel sottogenere *Plataraea* Thomson, 1858, le specie sono prive di dette setole sulla ligula.

Specie già nota del Ruwenzori (località tipica) e della "Nyamgazani Valley" (inedito del "Field Museum" di Chicago).

Rinvenuta su *Senecio erioneuron* (annotazione inedita del "Field Museum" di Chicago).

Atheta (Taxicera) lacrymalis Fauvel, 1907

Atheta lacrymalis Fauvel, 1907: 54.
Atheta (Acrotona) lacrymalis, Bernhauer & Scheerpeltz, 1926: 675.
1 ♀, Mt. Kenya, 3050 m, St. Lodge, 25.XI.1974 (Mahnert & Perret leg.).

Specie finora nota solo sull'holotypus ♀ dell'Escarpment (Wa-Kikouyou), raccolto nell'agosto del 1904.

Esemplare comparato con l'holotypus. Grazie all'esame della ligula la specie va attribuita al sottogenere *Taxicera* Mulsant & Rey, 1973. Infatti su ciascum lembo della ligula è presente una lunga setola, carattere questo tipico del sottogenere *Taxicera*.

Atheta (Dimetrota) malevestita sp. n. (Figg. 104–107)

Holotypus ♂, Rwanda, Kayove, 2100 m, 29.IV.1973 (Werner leg., MG).
Paratypi: 6 es., stessa provenienza.

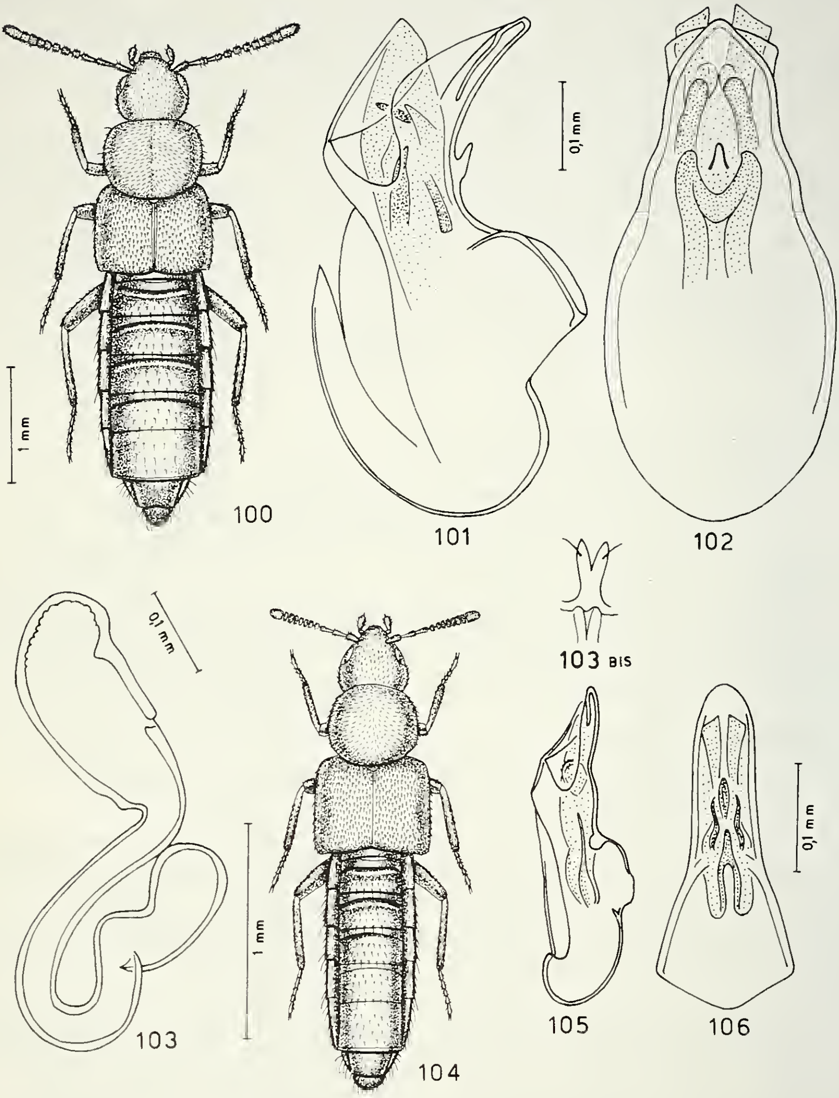
Descrizione. Lungh. 2,1 mm. Corpo lucido e bruno-rossiccio con pronoto ed estremità addominale rossicci; antenne brune con i due antennomeri basali giallo-rossicci; zampe giallo-rossicce. La reticolazione è distinta, tranne sul pronoto dove è svanita. La punteggiatura del capo è distinta. I tubercoletti che coprono il pronoto sono superficiali, quelli delle elitre sono ben salienti. Edeago figg. 105–1067, spermateca fig. 107.

Comparazioni. Per la forma della spermateca e dell'edeago, la nuova specie è ben distinta da *A. convexula* Eichelbaum, 1913, della Tanzania (figg. 118–121).

Atheta (Dimetrota) mandibularis sp. n. (Figg. 108–111)

Holotypus ♂, Rwanda, Kayove, 2100 m, 29.IV.1973 (Werner leg., MG).

Descrizione. Lungh. 2,0 mm. Corpo lucido e bruno con estremità addominale bruno-rossiccia; antenne bruno-rossicce; zampe gialle. La reticolazione del capo è assente, quella del pronoto è molto svanita, quella delle elitre e dell'addome è netta. Il capo presenta punteggiatura svanita. Il pronoto e le elitre non mostrano distinti tubercoletti. Edeago figg. 109–110, mandibola fig. 111.



FIGG. 100–106

Habitus, edeago in visione laterale e ventrale, ligula e spermateca. 100–103: *Atheta (Taxicera) suprema* Bernhauer, lectotypus ♂ e paralectotypus ♀; 104–106: *Atheta (Dimetrota) malevestita* sp. n.

Comparazioni. Specie che per la forma dell'edeago appare simile ad *A. malevestita* sp. n. sopra descritta. Si distingue per avere mandibole molto lunghe (fig. 111) e acute (tozze in *malevestita*), per la netta reticolazione delle elitre, per l'11° antennomero più lungo e per l'edeago più sviluppato.

Atheta (Datomicra) rudicollis (Bernhauer, 1915) (Figg. 112–115)

Oxypoda rudicollis Bernhauer, 1915: 188.
Atheta (Datomicra) rudicollis, Pace, 1986: 109.
Materiale esaminato: Holotypus ♀, Arusha, Ju, 1905.XII, Africa or., Katona, Oxypoda rudicollis BRNH, typus (Mus. Budapest).
22 es., Kenya, Narok, Loita Hills, sous Morija, 5.XI.1977 (Mahnert & Perret leg.).

L'holotypus è qui illustrato per la prima volta.

Specie già nota della Tanzania e Zaire. Nuova per il Kenya.

Atheta (Datomicra) kiboensis Pace, 1985

Atheta (Datomicra) kiboensis Pace, 1985: 140.
1 ♀, Kenya, Narok, Loita Hills, sous Morijo, 5.XI.1977 (Mahnert & Perret leg.).

Specie finora nota solo del Kilimangiaro.

Atheta (Datomicra) ferrugata Fauvel, 1907 (Figg. 116–117)

Atheta ferrugata Fauvel, 1907: 53.
Atheta (Acrotona) ferrugata, Bernhauer & Scheerpeltz, 1926: 673.
Atheta (Datomicra) ferrugata, Pace, 1986: 86.
Materiale esaminato: Holotypus ♀, Afrique allemande, *ferrugata* FVL (Mus. Bruxelles).

La specie è qui illustrata per la prima volta.

Atheta (Dimetrota) convexula Eichelbaum, 1913 (Figg. 118–121)

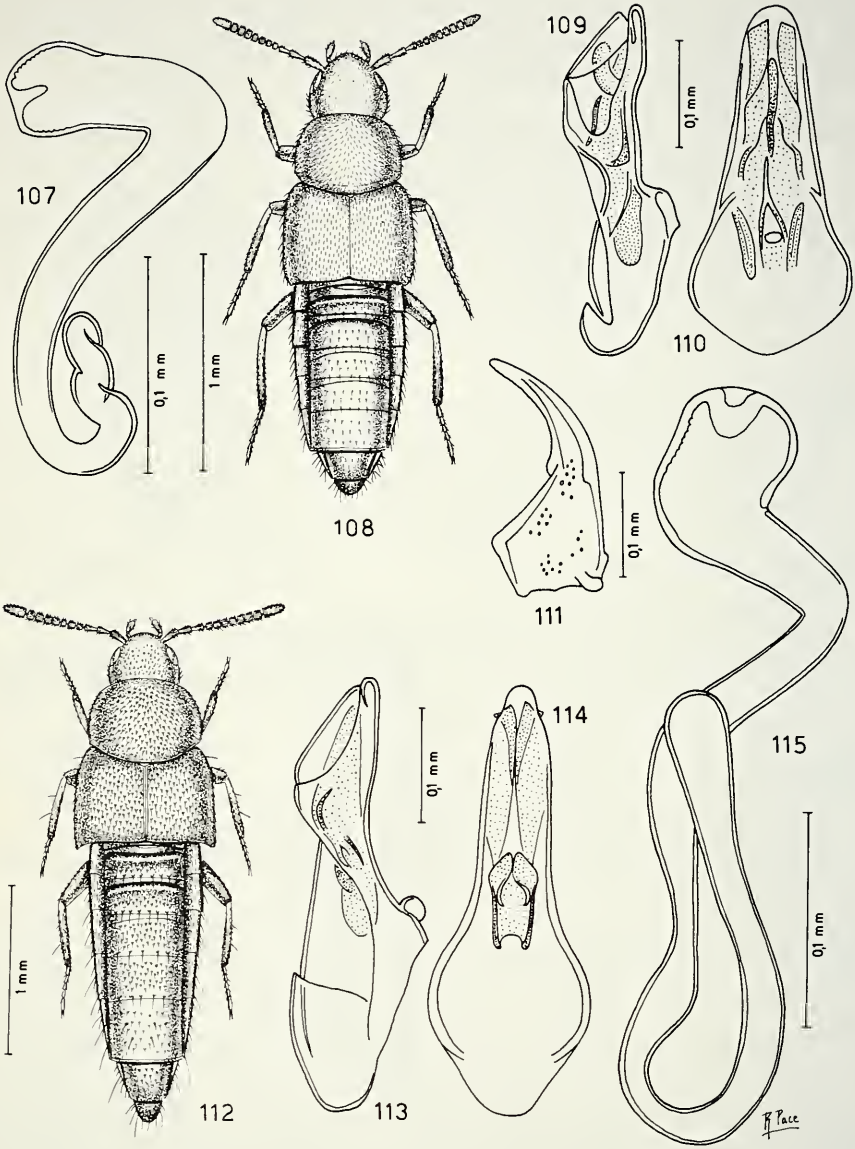
Atheta (Coprothassa) convexula Eichelbaum, 1913: 146.
Atheta (Acrotona) convexula, Pace, 1986: 109.
Materiale esaminato: Lectotypus ♂, Amani, *Atheta convexula* Eichelbaum, type, presente designazione (D.E.I.).

Atheta (Datomicra) ferrugatoides sp. n. (Figg. 122–123)

Holotypus ♀, Kenya, Mau For., Mau Saumit Kedowa, 7.XI.1974 (Mahnert & Perret leg., MG).
Paratypus: 1 ♀, Kenya, env. Endebess pr. Kitale, 14.XI.1974 (Mahnert & Perret leg.).

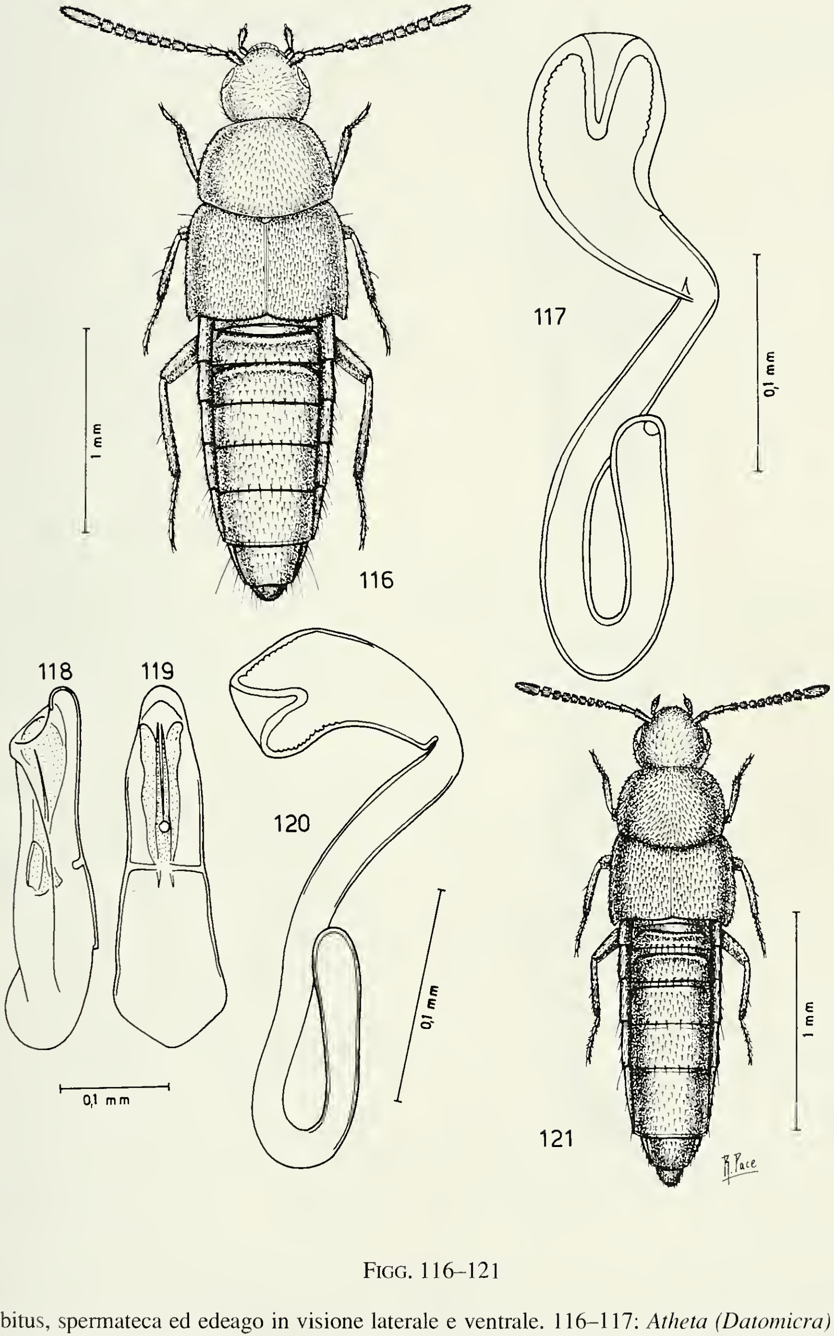
Descrizione. Lungh. 2,7 mm. Corpo lucido e bruno-rossiccio; antenne brune con i due antennomeri basali gialli; zampe giallo-rossicce. I tubercoletti della superficie del capo e delle elitre sono poco salienti, quelli del pronoto e dell'addome sono molto salienti. Non vi è traccia di reticolazione sulla superficie del corpo. Spermateca fig. 123.

Comparazioni. Specie simile ad *A. ferrugata* Fauvel, 1907, della Tanzania (figg. 116–117). Se ne distingue soprattutto per i caratteri della spermateca. L'introflessione apicale del bulbo distale della spermateca della nuova specie è corta, mentre in *ferrugata* è profonda e il bulbo prossimale della spermateca della nuova specie è nettamente più largo di quello di *ferrugata*.



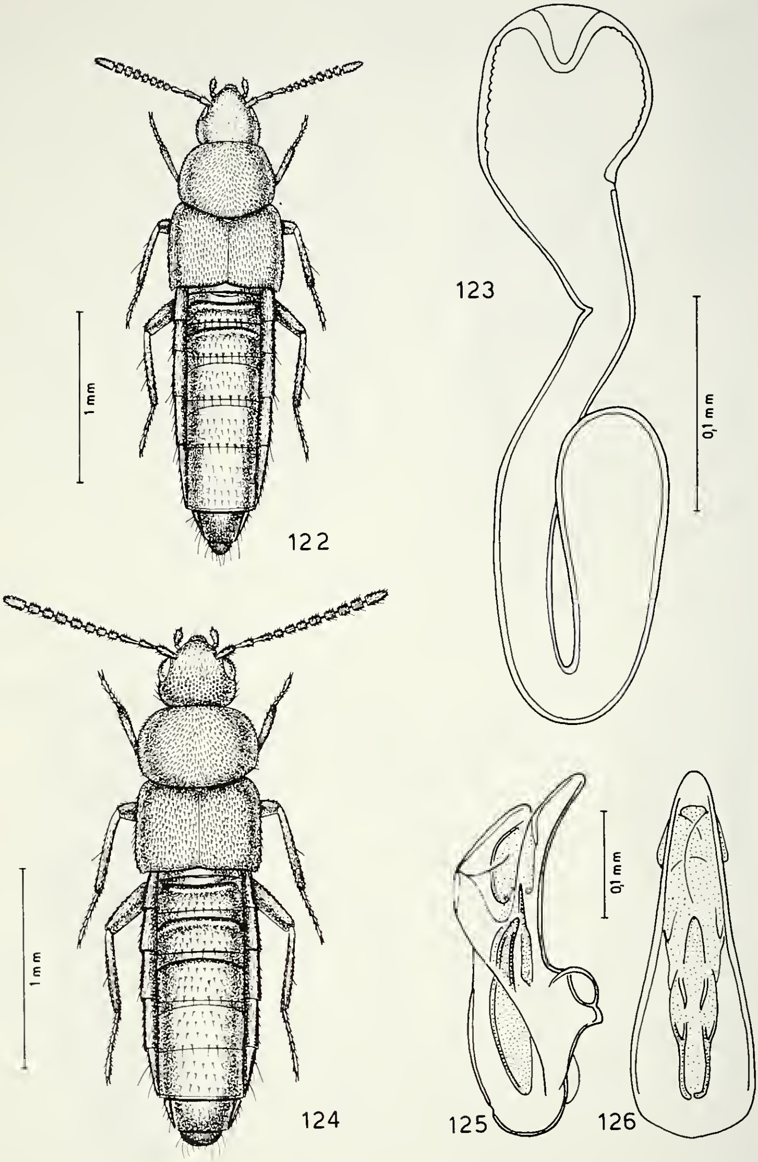
FIGG. 107–115

Spermateca, habitus, edeago in visione laterale e ventrale e mandibola. 107: *Atheta (Dimetrota) malevestita* sp. n.; 108–111: *Atheta (Dimetrota) mandibularis* sp. n.; 112–115: *Atheta (Datomicra) rudicollis* (Bernhauer), holotypus ♀.



Figg. 116–121

Habitus, spermateca ed edeago in visione laterale e ventrale. 116–117: *Atheta (Datomicra) ferrugata* Fauvel, holotypus ♀; 118–121: *Atheta (Dimetrota) convexula* Eichelbaum, lectotypus ♂.



FIGG. 122–126

Habitus, spermateca ed edeago in visione laterale e ventrale. 122–123: *Atheta (Datomicra) ferrugatoides* sp. n.; 124–126: *Atheta (Acrotona) semifura* Cameron, esemplare della Rodesia.

Atheta (Phanerosphaena) kenyensis Pace, 1985

Atheta kenyensis PACE, 1985: 149.

2 ♂♂ e 4 ♀♀, Kenya, Narok, Loita Hills, 4.XI.1977, Morijo, 2200 m (Mahnert & Perret leg.); 1 ♂ e 1 ♀, Kenya, Embu, pr. Ishiara, 900 m, 14.X.1977 (Mahnert & Perret leg.).

Specie già nota solo dei dintorni di Nairobi.

Atheta (Acrotona) parasita Bernhauer, 1945

Atheta (Acrotona) parasita BERNHAUER, 1945: 19; Pace, 1986: 86.

1 ♂ e 1 ♀, Kenya, Mt. Elgon, 2800 m, 14.XI.1974 (Mahnert & Perret leg.).

Specie già nota del M. Meru e dell'Elgon.

Atheta (Acrotona) nigricola Pace, 1986

Atheta (Acrotona) nigricola PACE, 1986: 100.

1 ♂, Kenya, Lac Nakuru, Parc Nat., 6.XI.1974 (Mahnert & Perret leg.); 1 ♂, Rhodésie, Umtali, II.1969 (R. Mussard leg.).

Specie nota dell'Abissinia, Tanzania, Natal e Città del Capo. Nuova per il Kenya.

Atheta (Acrotona) armentorum Pace, 1985

Atheta (Acrotona) armentorum PACE, 1985: 142.

20 es., Kenya, Narok, Loita Hills, sous Morijo, 5.XI.1977 (Mahnert & Perret leg.); 12 es., Kenya, Narok, près de Narok, 2000 m, 3.XI.1977 (Mahnert & Perret leg.); 1 ♀, Kenya, Lac Nakuru, 6.XI.1974 (Mahnert & Perret leg.); 14 es., Kenya, Kikuyu Escar., 2000 m, 3.XI.1977 (Mahnert & Perret leg.); 1 ♀, Kenya, Tambach, E Eldoret, 2000 m, 17.XI.1974 (Mahnert & Perret leg.); 2 ♀♀, Rwanda, Kayove, 2100 m, 15.V.1973 (Werner leg.).

La specie finora era nota solo del M. Meru.

Atheta (Acrotona) semirufa Cameron, 1950 (Figg. 127-129)

Atheta (Acrotona) semirufa Cameron, 1950: 64.

Materiale esaminato: Paratypus ♂, Congo Belge, P.N.A., Kanyabayondo (Kabasha), 1760 m, 7.XII.1934, G. F. de Witte: 878, *A. rufonigra* Cam. (cancellato), *A. (Acrotona) semirufa* n. n. Cam. (British Museum).

3 ♂♂, Rhodésie, Umtali, II.1969 (R. Mussard leg.)

Specie finora nota solo dello Zaire. Esemplari comparati con un syntypo.

Edeago e habitus qui illustrati per la prima volta.

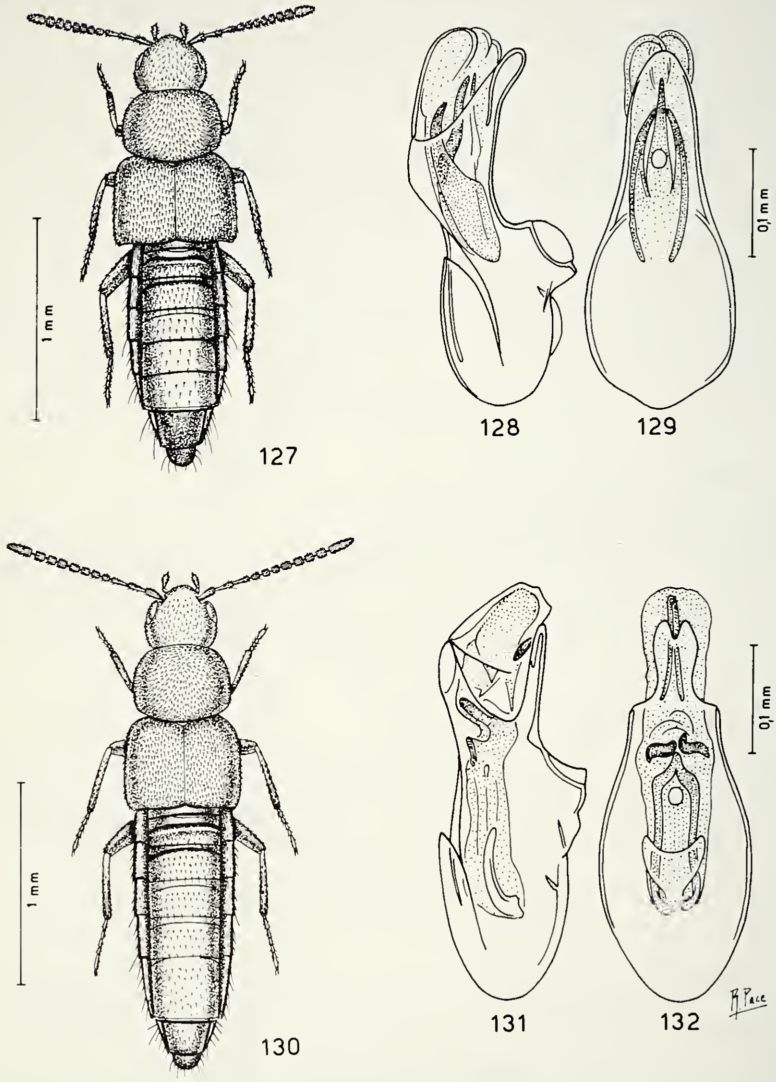
Atheta (Acrotona) tugen sp. n. (Figg. 130-132)

Holotypus ♂, Kenya, Mt. Elgon, 2400 m, Mt. Elgon For. Res., 14.XI.1974, Mahnert & Perret leg., MG).

Descrizione. Lungh. 2,4 mm. Corpo lucido e rossiccio scuro; antenne bruno-rossicce con i due antennomeri basali giallo-rossicci; zampe giallo-rossicce. La superficie del corpo non è reticolata ed è coperta di tubercoletti fitti e poco salienti. Edeago figg. 131-132.

Comparazioni. Specie simile ad *A. basipennis* Fauvel, 1907, della Tanzania, a motivo della forma dell'edeago e dell'habitus. Se ne distingue tra l'altro per avere l'apice dell'edeago diviso (in *basipennis* apice intero).

Etimologia. La nuova specie prende nome dai Tugen, gruppo etnico del Kenya.



FIGG. 127–132

Habitus ed edeago in visione laterale e ventrale. 127–129: *Atheta (Acrotona) semirufa* Cameron, paratypus ♂; 130–132: *Atheta (Acrotona) tugen* sp. n.

Atheta (Acrotona) creticornis sp. n. (Figg. 133-136)

Holotypus ♂, Rwanda, Kayove, 2100 m, 15.V.1973, (Werner leg., MG).

Paratypi: 3 ♂♂, stessa provenienza; 2 ♂♂ e 1 ♀, Rwanda, Rangiro, 1800 m, 6.VIII.1973, (Werner leg.).

Descrizione. Lungh. 2,5 mm. Corpo lucido e bruno-rossiccio; antenne bruno-rossicce con base del primo antennomero gialla; zampe gialle. La reticolazione del capo e del pronoto è distinta, quella delle elitre e dell'addome è assente. I tubercoletti che coprono la superficie del capo e delle elitre sono poco distinti, quelli del pronoto sono salienti. Edeago figg. 134-135, spermateca fig. 136.

Comparazioni. In base alla forma della spermateca, la nuova specie sembra affine ad *A. kibatiana* Cameron, 1950, dello Zaire, ma la nuova specie ha la spermateca nettamente più sviluppata e l'edeago ha apice a foggia di spatola, in visione ventrale (stretto in *kibatiana*).

Etimologia. Il nome della nuova specie significa «Antenne cresciute».

Atheta (Acrotona) promissionum sp. n. (Figg. 137-138)

Holotypus ♀, Kenya, env. Nanyuki, 1900 m, 22.XI.1974, (Mahnert & Perret leg., MG).

Descrizione. Lungh. 2,5 m. Corpo lucido e bruno, comprese le antenne; zampe giallo-rossicce. La reticolazione del capo è svanita, quella del pronoto assente e quella delle elitre è distinta. Tubercoletti nettamente salienti coprono l'avancorpo. Spermateca fig. 138.

Comparazioni. Specie affine alla precedente *A. creticornis* sp. n. in base alla forma della spermateca. Ne differisce perché la parte prossimale delle spermateca descrive una sola spira (una spira e mezza in *creticornis*), le elitre sono coperte di reticolazone distinta nella nuova specie, mentre in *creticornis* le elitre sono prive di reticolazione e il 4° antennomero della nuova specie è più lungo che largo, mentre quello corrispondente di *creticornis* è trasverso.

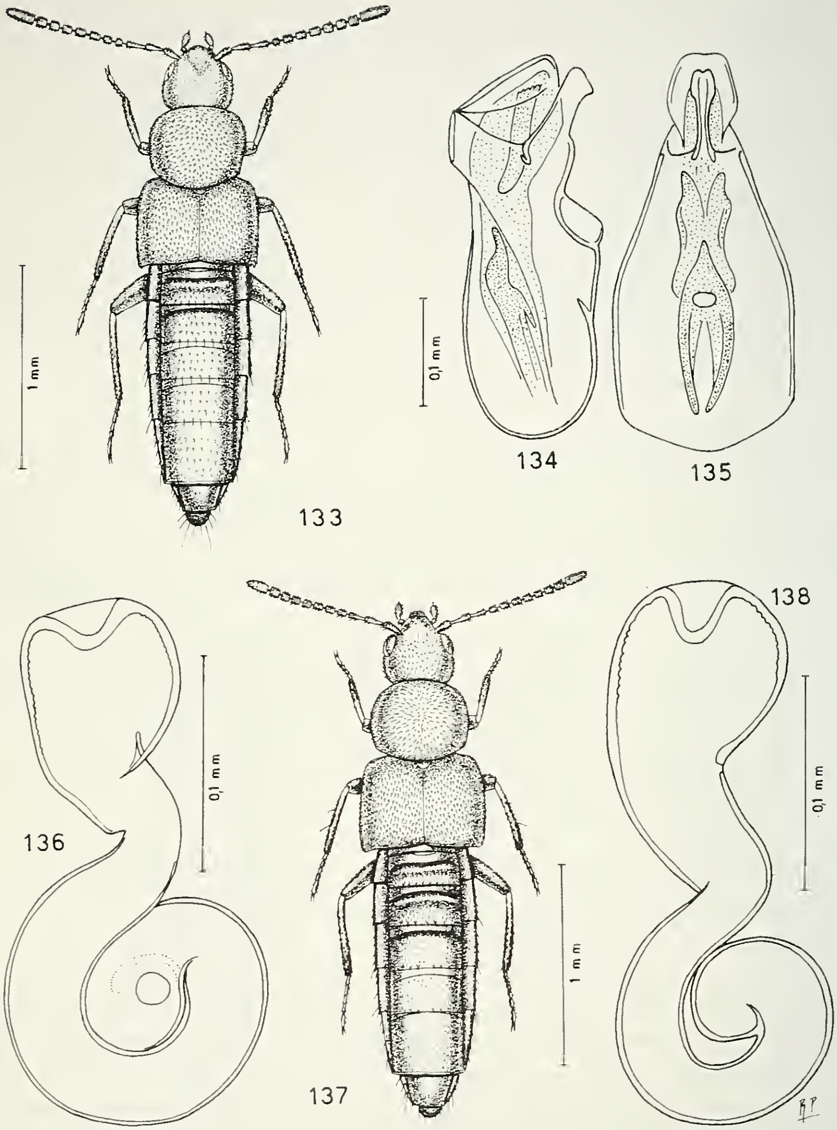
Atheta (Acrotona) zimbabwensis sp. n. (Figg. 139-142)

Holotypus ♂, Rhodésie, Umtali, II.1969, (R. Mussard leg. MG).

Paratypi: 13 es., stessa provenienza.

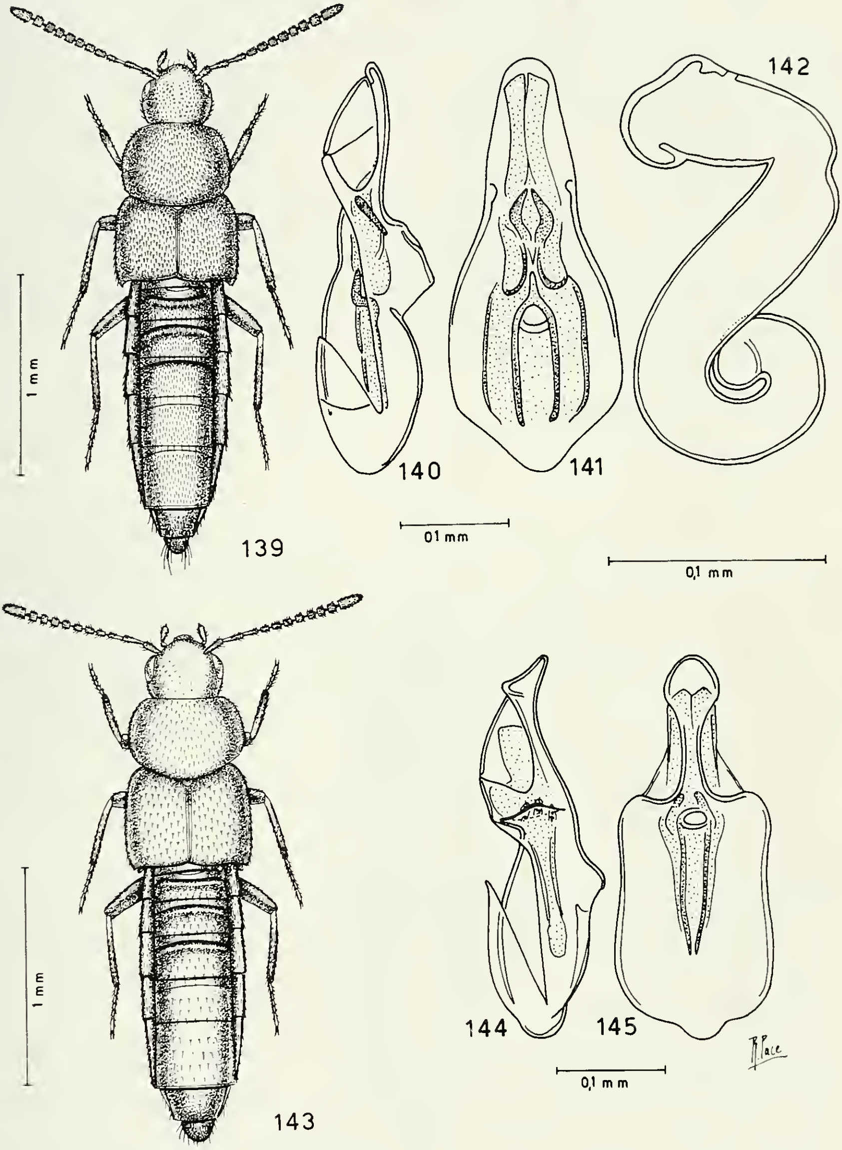
Descrizione. Lungh. 2,4 mm. Corpo lucido e giallo-rossiccio con capo, elitre e uroterghi rossicci; margine posteriore degli uroterghi giallo-rossiccio; antenne bruno-rossicce con i due antennomeri basali giallo-rossicci; zampe giallo-rossicce. La reticolazione del capo è distinta, ma assente sul disco; assente pure sul pronoto e sulle elitre; la punteggiatura del capo è distinta e fitta, ma assente sul disco. Il pronoto e le elitre sono coperti di tubercoletti salienti. Edeago figg. 140-141, spermateca fig. 142.

Comparazioni. Per la forma dell'edeago e per l'habitus, la nuova specie può essere sistematicamente avvicinata ad *A. parasita* Bernhauer, 1845, del Kenya, ma l'ultimo antennomero del maschio della nuova specie è chiaramente più corto del corrispondente di *parasita*; l'edeago è più largo e ha lati convergenti verso l'apice nella nuova specie, mentre in *parasita* i lati sono tra loro paralleli e la spermateca è priva di introflessione apicale del bulbo distale (robusta e profonda in *parasita*).



FIGG. 133–138

Habitus, edeago in visione laterale e ventrale e spermateca. 133–136: *Atheta (Acrotona) creticornis* sp. n.; 137–138: *Atheta (Acrotona) promissionum* sp. n.



FIGG. 139–145

Habitus, edeago in visione laterale e ventrale e spermateca. 139–142: *Atheta (Acrotona) zimbabwensis* sp. n.; 143–145: *Atheta (Acrotona) umtaliensis* sp. n.

Atheta (Acrotona) umtaliensis sp. n. (Figg. 143-145)

Holotypus ♂, Rhodésie, Umtali, II.1969, (R. Mussard leg., MG).

Descrizione. Lungh. 2,3 mm. Corpo lucido e bruno, comprese le antenne; zampe di un giallo sporco. La reticolazione del capo è molto svanita, quella del pronoto è distinta e quella delle elitre e dell'addome è netta. La punteggiatura del capo è fine, rada e superficiale. Il pronoto presenta tubercoletti distinti e le elitre hanno tubercoletti netti. Edeago figg. 144-145.

Comparazioni. Specie con habitus simile a quelle di *A. parasita* Bernhauer, 1945, del Kenya, ma la taglia è lievemente minore (2,3 mm invece di 2,5 mm) et l'11° antennomero del maschio non è lunghissimo come quello corrispondente in *parasita*. L'edeago ha caratteri differenziali più accentuati: tra l'altro la regione preapicale dell'edeago della nuova specie è fortemente ristretta, in visione ventrale, mentre la corrispondente porzione dell'edeago di *parasita* è molto larga e a lati paralleli.

Atheta (Acrotona) nyeriensis sp. n. (Figg. 146-149)

Holotypus ♂, Kenya, Mt. Aberdares, Parc National, 2300 m, 25.XI.1974, (Mahnert & Perret leg., MG).

Paratypi: 2 ♂♂ e 1 ♀, stessa provenienza.

Descrizione. Lungh. 2,7 mm. Corpo lucido e bruno; antenne brune con i due antennomeri basali gialli; zampe giallo-rossicce. La reticolazione è distinta sul capo e sugli uroterghi, è molto svanita sulle elitre e assente sul pronoto. L'intero corpo è copèrto di tubercoletti fitti e distinti. Edeago figg. 147-148, spermateca fig. 149.

Comparazioni. Per la forma della spermateca, è possibile che la nuova specie sia affine ad *A. parasita* Bernhauer, 1945, tuttavia l'habitus della nuova specie è chiaramente più snello di quello di *parasita* e l'edeago ha parte apicale cortissima, mentre quella di *parasita* è lunga.

Etimologia. La nuova specie prende nome dalla città di Nyeri, la più vicina al M. Aberdare, località tipica.

Atheta (Acrotona) kawaensis Cameron, 1932 (Figg. 150-151)

Atheta (Acrotona) kawaensis CAMERON, 1932: 144.

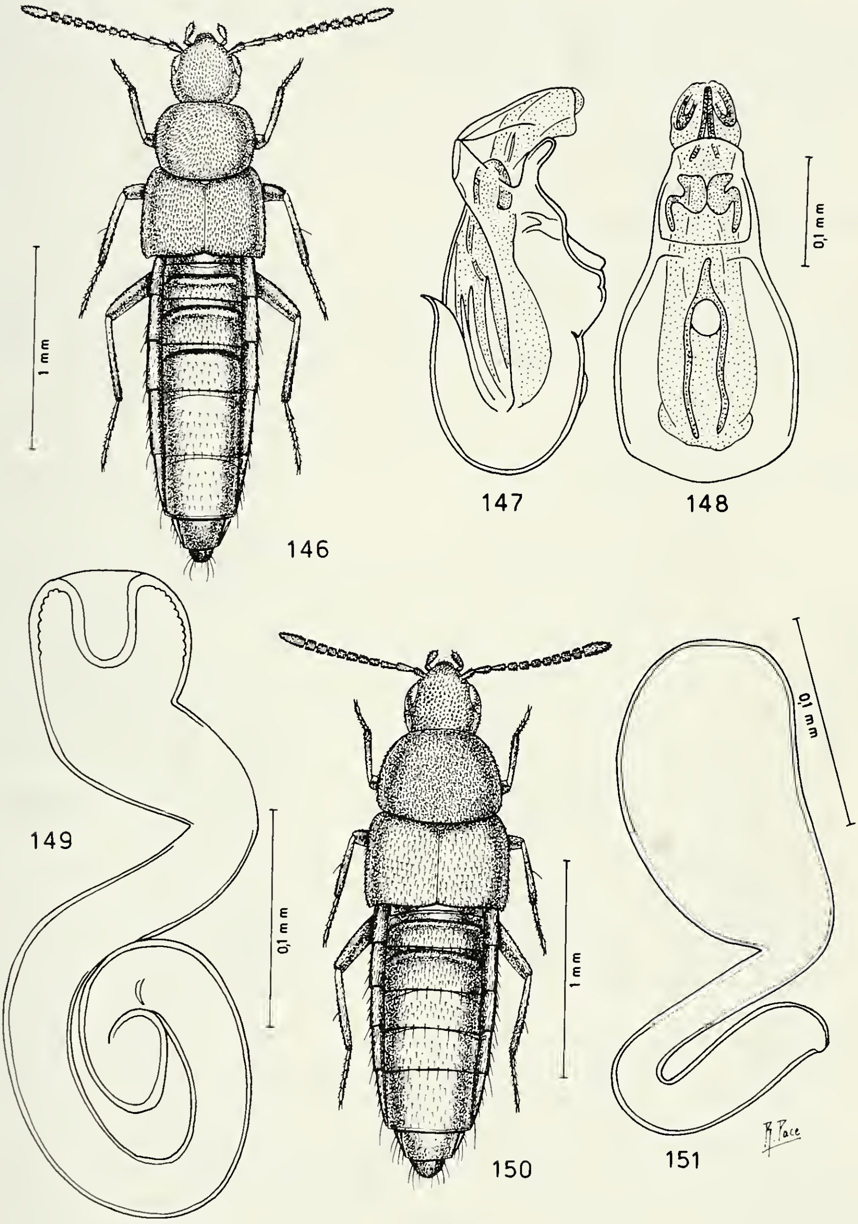
Materiale esaminato: Paratypus ♀, Forêt de Kawa, 23.IV.1929, A. Collart, *Atheta kawaensis*.

Habitus e spermateca qui illustrati per la prima volta.

Atheta (Acrotona) embuorum sp. n. (Figg. 152-153)

Holotypus ♀, Kenya, Embu, près Kogari, 800 m, 15.X.1977. (Mahnert & Perret leg., MG).

Descrizione. Lungh. 2,5 mm. Corpo lucido e bruno-rossiccio con uriti liberi 3°, 4° e 5° bruni; antenne bruno-rossicce con i due antennomeri basali giallo-rossicci; zampe giallo-rossicce con femori bruno-rossicci. La reticolazione del capo e del pronoto è netta e fine, quella delle elitre è distinta, quella dell'addome assente. La punteggiatura del capo è superficiale e assente sul disco, quella del pronoto è svanita e quella delle elitre è distinta. Spermateca fig. 153.



FIGG. 146–151

Habitus, edeago in visione laterale e ventrale e spermateca. 146–149: *Atheta (Acrotona) nyeriensis* sp. n.; 150–151: *Atheta (Acrotona) kawaensis* Cameron, paratypus ♀.

Comparazioni. In base alla forma della spermateca, la nuova specie potrebbe essere affine ad *A. kawaensis* Cameron, 1932, (figg. 150-151) dello Zaire, ma l'habitus non è simile, dato che l'addome è divergente all'indietro, per cui l'attribuzione sottogenerica è dubbia.

Etimologia. Il nome della nuova specie deriva dagli Embu, gruppo etnico famoso per le danze.

Atheta (Xenota) interrogativa Pace, 1985

Atheta (Xenota) interrogativa Pace, 1985: 144.

2 ♀♀, Kenya, Narok,, Loita Hills, 2050 m, 5.XI.1977, (Mahnert & Perret leg.); 9 es., Kenya, Nairobi, 2-3.XI.1974, (Mahnert & Perret leg.); 1 ♀, Kenya, Embu, Kirimiri For., 13.X.1977, (Mahnert & Perret leg.); 25 es., Nenya, Miss. Kaimosi, NE Kisumu, 11.XI.1974, (Mahnert & Perret leg.); 1 ♂, Kenya, Tambach, E Eldoret, 2000 m, 17.XI.1974, (Mahnert & Perret leg.).

Specie già nota del Kenya meridionale: Kajido.

Atheta (Xenota) riftensis Fauvel, 1907 (Figg. 154-156)

Atheta riftensis Fauvel, 1907: 54.

Atheta (Xenota) riftensis, Pace, 1986: 87.

1 ♂, Kenya, Tambach, E. Eldoret, 2000 m, 17.XI.1974, 2000 m, (Mahnert & Perret leg.); 3 es.; Kenya, Mt. Aberdares, 2300 m, 25.XI.1974, (Mahnert & Perret leg.); 14 es., Kenya, Nairobi, 2-3.XI.1974, (Mahnert & Perret leg.); 38 es., Kenya, Embu, Kirimiri For., 1550 m, 13.X.1977, (Mahnert & Perret leg.); 1 es., Kenya, Embu, Irangi For., 2000 m, 11.X.1977, (Mahnert & Perret leg.); 1 ♂, Kenya, Embu, 20 Km 0 Ishiara, 900 m, 14.X.1977, (Mahnert & Perret leg.); 22 es., Kenya, Kiambu, Kikuyu Escarp., 2000 m, 3.XI.1977, (Mahnert & Perret leg.); 1 ♀, Kenya, Lac Nakuru, près dee Mundu Estate, 1950 m, 8.XII.1977, (Mahnert & Perret leg.); 6 es., Kenya, env. Endebess, pr. Kitale, 14.XI.1974, (M. Perret leg.); 3 es., Rhodésie, Umtali, II.1969, (R. Mussard leg.).

Specie largamente diffusa nella Tanzania e nel Kenya. Nuova per la Rhodesia.

Atheta (Xenota) coriaria (Kraatz, 1858)

Homalota coriaria Kraatz, 1858: 282.

Atheta (Xenota) coriaria, Pace, 1984: 263.

1 ♀, Kenya, Nairobi, 3.XI.1974, (Mahnert & Perret leg.).

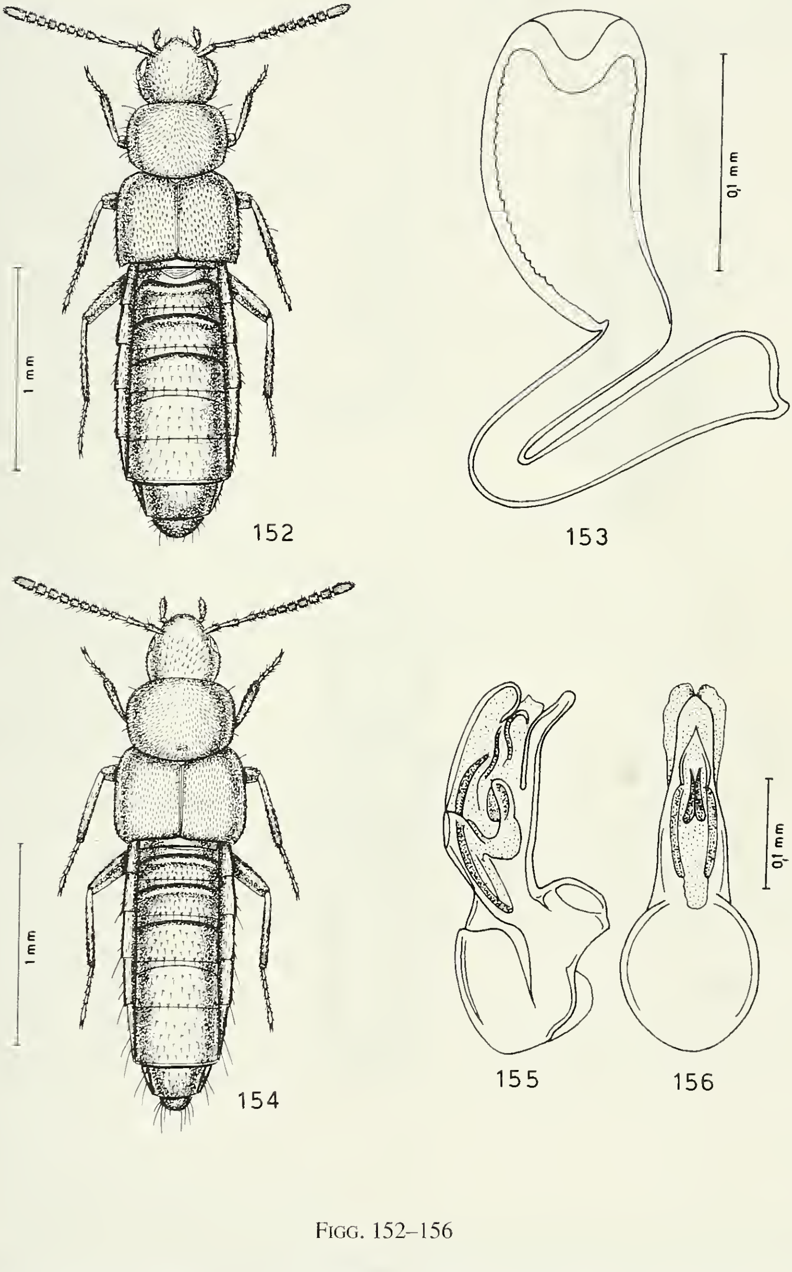
Specie cosmopolita.

Atheta (Xenota) kitalensis sp. n. (Figg. 157-160)

Holotypus ♂, Kenya, Mt. Elgon, 2700-2800 m, 15.XI.1974, (Mahnert & Perret leg., MG).
Paratypi: 8 es., stessa provenienza, ma anche 14.XI.1974.

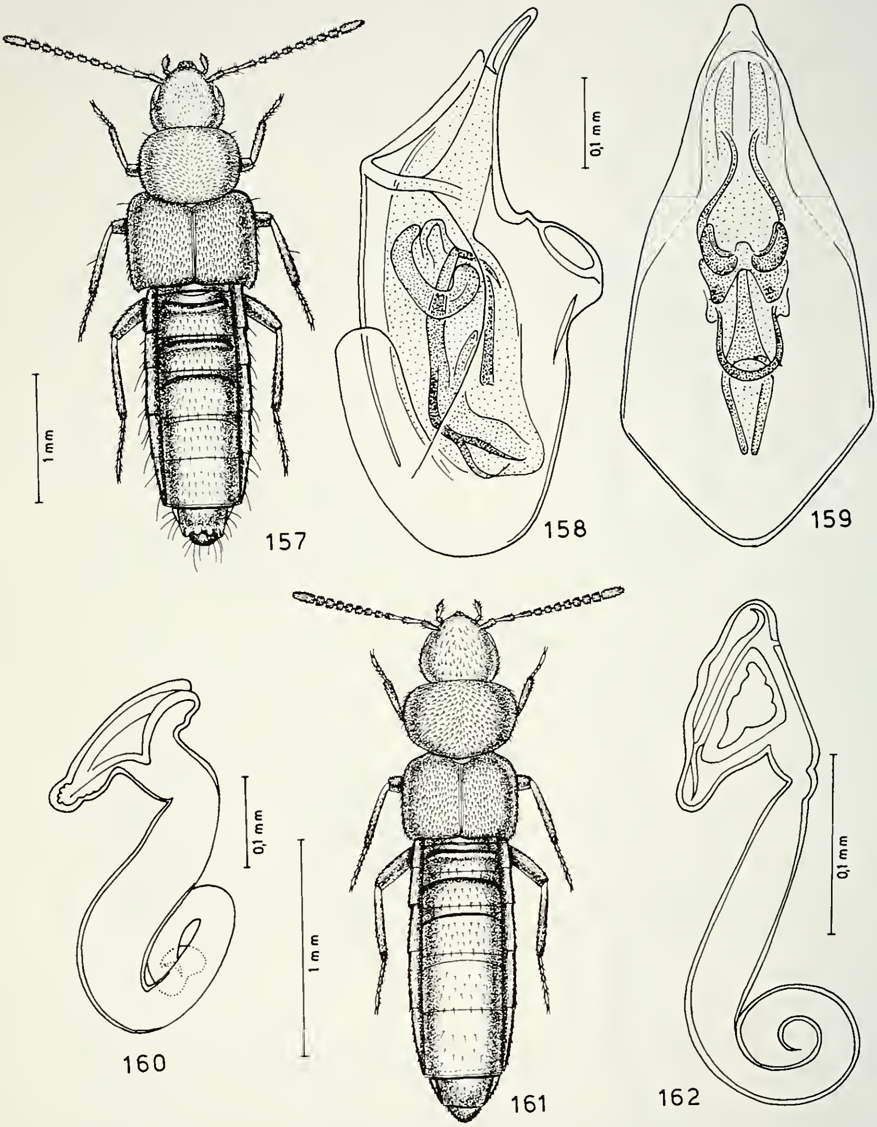
Descrizione. Lungh. 3,8 mm. Corpo lucido e bruno con margini laterali del pronoto bruno-rossicci e margine posteriore degli uroterghi liberi 1°, 2. et 3° ed estremità addominale giallo-rossicci; antenne brune con i due antennomeri basali giallo-rossicci; zampe giallo-rossicce. Tutto il corpo è coperto di reticolazione netta. I tubercoletti della superficie del capo e del pronoto sono distinti, quelli delle elitre sono svaniti. Edeago figg. 158-159, spermateca fig. 160.

Comparazioni. Per la forma dell'edeago, la nuova specie sembra più affine ad *A. scotti* Bernhauer, 1931 che ad *A. euphorbiae* Bernhauer, 1931, entrambe dell'Abissinia.



FIGG. 152–156

Habitus, spermateca ed edeago in visione laterale e ventrale. 152–153: *Atheta (Acrotona) embuorum* sp. n.; 154–156: *Atheta (Xenota) riftensis* Fauvel.



FIGG. 157–162

Habitus, edeago in visione laterale e ventrale e spermateca. 157–160: *Atheta (Xenota) kitalensis* sp. n.; 161–162: *Atheta (Xenota) cincta* sp. n.

La nuova specie differisce da *A. scotti* perché ha l'apice dell'edeago smussato e più largo (apice acuto in *scotti*), la «crista apicalis» poco sviluppata (molto sviluppata in *scotti*), i pezzi copulatori del sacco interno molto sviluppati e robusti (poco sviluppati ed esili in *scotti*), la parte prossimale della spermateca esile e non descrivente regolari spire come in *scotti* e il penultimo antennomero più lungo che largo (trasverso in *scotti*).

Etimologia. La nuova specie prende nome da Kitale, capoluogo del distretto agricolo di Trans-Nzoie situato presso il M. Elgon e punto di partenza per una visita al parco nazionale del M. Elgon.

Atheta (Xenota) cincta sp. n. (Figg. 161-162)

Holotypus ♀, Rhodésie, Umtali, II.1969, (R. Mussard leg., MG).

Descrizione. Lungh. 2,2 mm. Corpo lucido e giallo-rossiccio con 4° urotergo libero bruno; antenne bruno-rossicce con i tre antennomeri basali e l'11° giallo-rossicci; zampe gialle. La reticolazione del capo, del pronoto e dell'addome è molto svanita, quella delle elitre è assente. Tutto il corpo è coperto di tubercoletti più o meno salienti. Spermateca fig. 162.

Comparazioni. Solo un'altra specie del sottogenere *Xenota* Mulsant & Rey, 1874, presenta elitre molto accorciate e pronoto molto trasverso come nella nuova specie: *A. humidula* Pace, 1985, delle Tanzania. La nuova specie si distingue da essa per avere spermateca esile e più allungata rispetto quella di *humidula* e l'11° antennomero della femmina nettamente piú lungo nella nuova specie che in *humidula*.

Atheta (Xenota) tanensis sp. n. (Figg. 163-164)

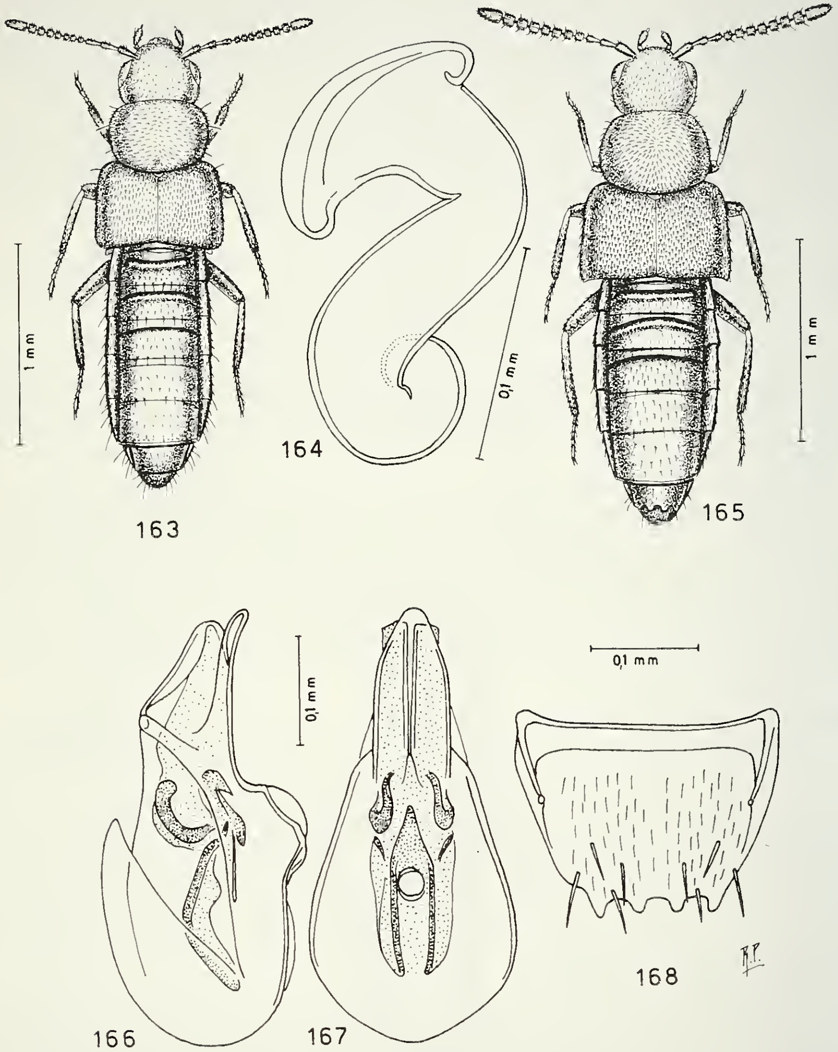
Holotypus ♀, Kenya, Tana River, Galole Hola, 60 m, 20.X.1977, (Mahnert & Perret leg., MG).

Descrizione. Lungh. 2,1 mm. Corpo lucido e bruno con elitre giallo-brune aventi margini laterali, posteriore e suturale bruni; antenne brune con i due antennomeri basali gialli; zampe gialle. La reticolazione del capo e del pronoto è distinta, quella delle elitre è netta, quella dell'addome a maglie molto trasverse e superficiali. I tubercoletti della superficie del capo sono distinti, quelli del pronoto sono fini e salienti, quelli delle elitre sono svaniti. Spermateca fig. 164.

Comparazioni. Per la struttura della spermateca, la nuova specie sembra affine ad *A. riftensis* Fauvel, 1907, della Rift-Valley, ma la parte prossimale della spermateca non è sottile, nè descrive un'ampia spira come in *riftensis*. Inoltre il pronoto della nuova specie è molto più trasverso di quello di *riftensis* e le elitre più larghe e più lunghe.

Atheta (Oxypodera) densiventris Fauvel, 1907 (Figg. 165-168)

Atheta densiventris FAUVEL, 1907: 54.
Atheta (s. str.) *densiventris*, BERNHAUER & SCHEERPELTZ, 1926: 64.
Materiale esaminato: Holotypus ♂, Afrique or. allemande, *densiventris* FVL, type (Mus. Bruxelles).
1 ♂, Kenya, Nairobi, 3.XI.1974, Mahnert & Perret leg.).



FIGG. 163–168

Habitus, spermateca, edeago in visione laterale e ventrale e 6° urotergo libero del maschio. 163–164: *Atheta (Xenota) tanensis* sp. n.; 165–168: *Atheta (Oxypodera) densiventris* Fauvel, holotypus.

Habitus, edeago e quinto urotergo libero del maschio qui per la prima volta illustrati.

Specie finora nota su un maschio di località imprecisata dell'Africa orientale.

Atheta (Oxypodera) andreinii Bernhauer, 1927 (Figg. 169-172)

Atheta (Acrotona) andreinii Bernhauer, 1927: 80.

Materiale esaminato: Lectotypus ♂, Eritrea, Adi-Caie, 10.IV.1902, Dr. Andreini, 243, Atheta andreinii BRNH, Typ., presente designazione, (Mus. La Specola, Firenze, N° 7789); paralectotypi: 35 es., stessa provenienza e Museo.

Nota. La spermateca e l'edeago di *A. andreinii* indicano senza dubbio l'appartenenza della specie al sottogenere *Oxypodera* Bernhauer, 1915 e non al sottogenere *Acrotona* Thomson, 1859.

La specie è qui illustrata per la prima volta. Essa è estremamente affine ad *A. densiventris* Fauvel, 1907, sopra illustrata. I caratteri differenziali sono esposti nella seguente chiave:

1 Occhi sporgenti; 11° antennomero del maschio lungo come i due precedenti antennomeri considerati insieme; reticolazione del pronoto svanita; elitre piú larghe; 6° urotergo libero del maschio dentellato al margine posteriore (fig. 168); apice dell'edeago piú stretto, in visione ventrale. Lungh. 2,2 mm. Africa orientale. . . . . *densiventris* Fauvel

– Occhi meno sporgenti; 11° antennomero del maschio lungo come i tre precedenti antennomeri considerati insieme; reticolazione del pronoto estremamente svanita; elitre piuttosto strette; 6° urotergo libero del maschio con margine posteriore non dentellato; apice dell'edeago più largo, in visione ventrale. Lungh. 2,7 mm. Eritrea. . . . . *andreinii* Bernhauer

Atheta (Oxypodera) chyuluensis Cameron, 1942 (Figg. 173-176)

Atheta (Acrotona) chyuluensis CAMERON, 1942: 331.

Atheta (Xenota) chyuluensis, PACE, 1986: 87.

Materiale esaminato: Lectotypus ♂, Coryndon Museum Expedit., Chyulu Hills, june 38, alt. 5660, *Atheta chyuluensis* Cam., presente dseignazione (Brit. Mus.); paralectotypi: 2 ♂♂ e 2 ♀♀, stessa provenienza, (Brit. Mus.).

1 ♀, Kenya, Nairobi, 3.XI.1974, (Mahnert & Perret leg.); 1 ♂, Kenya, Narok, Loita Hills, 4.XI.1977, (Mahnert & Perret leg.); 3 ♂♂, Kenya, Tambach, E Eldoret, 2000 m, 17.XI.1974 (Mahnert & Perret leg.).

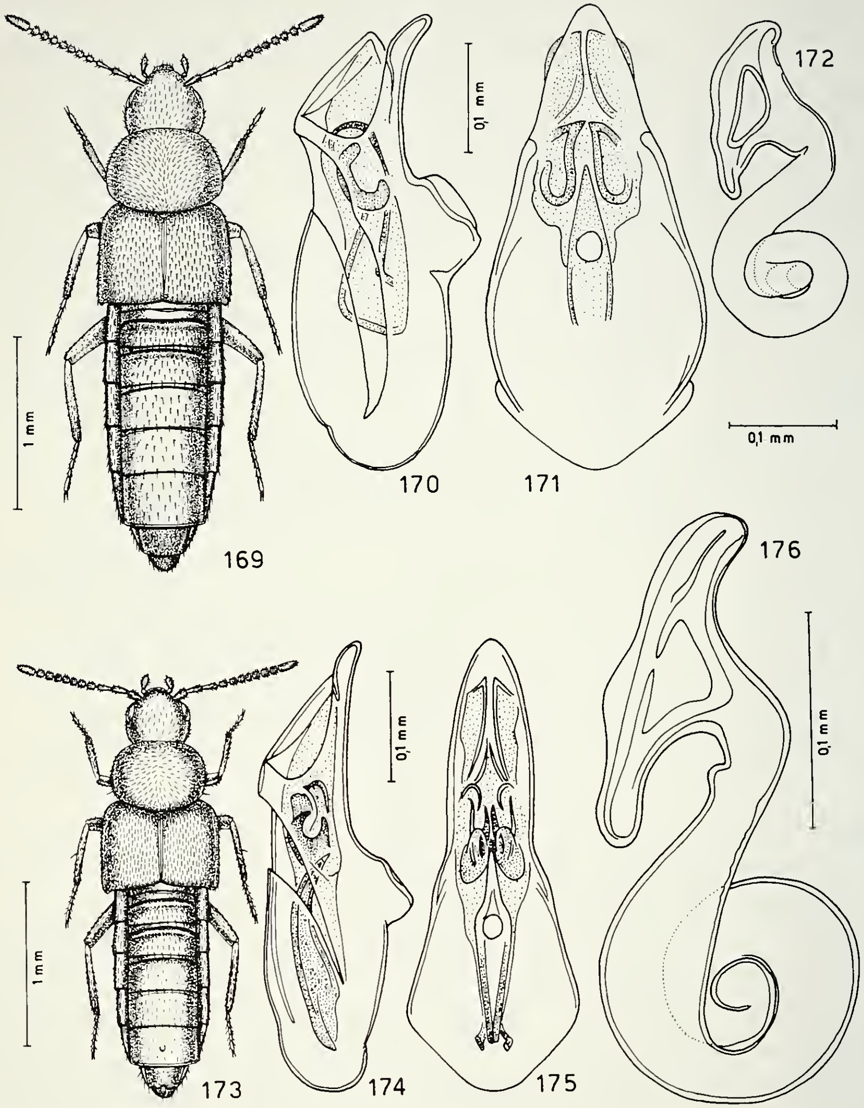
Specie diffusa dal Kenya alla Tanzania, la specie é qui illustrata per la prima volta.

Atheta (Oxypodera) nairobianorum Pace, 1985

Atheta (Oxypodera) nairobianorum Pace, 1985: 144.

1 ♀, Kenya, Embu, Kirimiri Forest, 1550 m, 13.X.1977, (Mahnert & Perret leg.); 1 ♀, Kenya, Nakuru, Mau Escarpment, 2700 m, 6.XI.1977, (Mahnert & Perret leg.).

Specie già nota del Kenya.



FIGG. 169–176

Habitus, edeago in visione laterale e ventrale e spermateca. 169–172: *Atheta (Oxypodera) andreinii* Bernhauer, lectotypus ♂ e paralectotypus ♀; 173–176: *Atheta (Oxypodera) chyuluensis* Cameron, lectotypus ♂ e paralectotypus ♀.

Atheta (Oxypodera) fugata Pace, 1985

Atheta (Oxypodera) fugata PACE, 1985: 146.
10 es., Mt. Kenya, 3250 m, S Met St. Lodge, 23.XI.1974, (Mahnert & Perret leg.).

Specie finora nota solo del M. Meru.

Atheta (Oxypodera) mombasana Bernhauer, 1934 (Figg. 177-179)

Atheta (Oxypodera) mombasana BERNHAUER, 1934: 246.
Atheta (Oxypodera) mombasana, PACE, 1986: 109, sp. bona.
Materiale esaminato: Lectotypus ♂, Mombasa, 36 Km Sud Lubero, fin VIII.1932, L. Burgeon, mombasana BRNH, Type, *mombasana* BRNH, Type, presente designazione (Mus. Chicago).

Specie qui illustrata per la prima volta.

Nota. Per un mio errore di trascrizione, nel 1986 ho posto in sinonimia di *Atheta paludosa* Bernhauer, 1931, *A. mombasana* Bernhauer, 1934, in luogo di *A. mombassana* Bernhauer, 1932. Pertanto stabilisco la corretta sinonima come segue:

Atheta (Oxypodera) paludosa Bernhauer, 1931

Atheta (Coprothassa) paludosa BERNHAUER, 1931: 602.
Atheta (Coprothassa) mombassana BERNHAUER, 1934: 214, **syn. n.** (nec *Atheta mombasana* BERNHAUER, 1934: 246).

Atheta (Oxypodera) pseudomombasana sp. n. (Figg. 180-182 e 198-194)

Holotypus ♂, Kenya, Nairobi, 3.XI.1974, (Mahnert & Perret leg., MG).
Paratypus: 1 ♀, stessa provenienza.

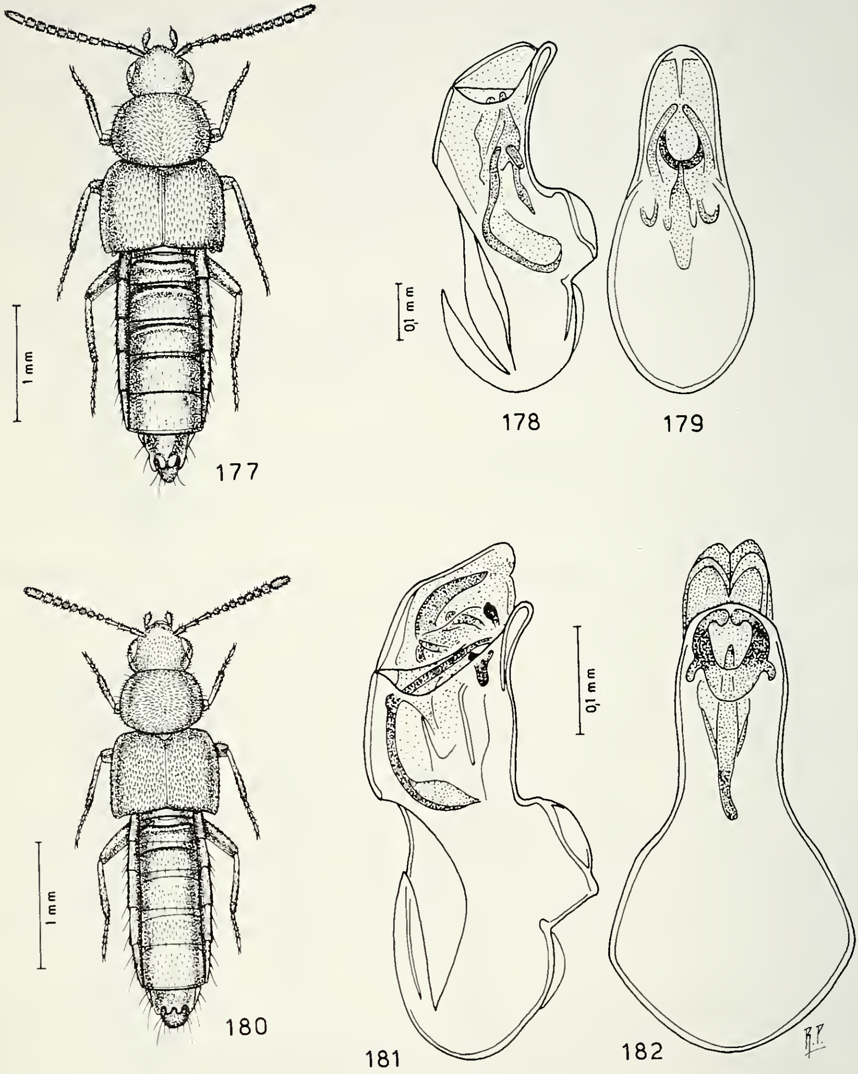
Descrizione. Lungh. 3,0 mm. Corpo lucido e bruno-rossiccio; antenne brune con i due antennomeri basali giallo-rossicci; zampe giallo-rossicce. La reticolazione del capo, delle elitre e dell'addome è distinta, quella del pronoto è assente. I tubercoletti sono distinti o salienti su tutto il corpo. Edeago figg. 181-182.

Comparazioni. Specie affine ad *A. mombasana* Bernhauer, 1934, per la forma dell'edeago, ma quello della nuova specie ha taglia minore (figg. 178-179 e 181-182), non è profondamente arcuato al lato ventrale come quello di *mombasana*. Inoltre gli occhi della nuova specie sono più sporgenti e i denti del margine posteriore del 6° urotergo libero del maschio sono più distanziati tra loro nella nuova specie che in *mombasana*.

Atheta (Oxypodera) kayovensis sp. n. (Figg. 183-186)

Holotypus ♂, Rwanda, Kayove, 2100 m, 15.V.1973, (Werner leg., MG).
Paratypi: 2 ♀♀, stessa provenienza; 1 ♂ e 1 ♀, Rwanda, Rangiro, 1800 m, 20.VIII.1976, (Werner leg.).

Descrizione. Lungh. 3,0 mm. Corpo lucido e giallo rossiccio con capo e uriti liberi 3°, 4° e 5° bruni ed elitre rossicce; antenne bruno-rossicce, con i due antennomeri basali giallo-rossicci; zampe gialle. La reticolazione del corpo è distinta, tranne sulle elitre dove è molto svanita. La punteggiatura del capo è distinta. I tubercoletti sul pronoto sono netti, quelli sulle elitre sono superficiali. Edeago figg. 184-185, spermateca fig. 186.



Figg. 177–182

Habitus ed edeago in visione laterale e ventrale. 177–179: *Atheta (Oxypodera) mombasana* Bernhauer, lectotypus ♂; 180–182: *Atheta (Oxypodera) pseudomombasana* sp. n.

Comparazioni. Alla grande taglia del corpo di questa specie non corrisponde un edeago proporzionalmente grande, come è osservabile in tutte le specie del sottogenere *Oxypodera* Bernhauer, 1915. Una sola specie possiede edeago di taglia uguale a quello della nuova specie: *A. haramayana* Bernhauer, 1931, dell'Abissinia, ma *haramayana* ha corpo di lunghezza minore (2,1 mm). Inoltre nella nuova specie è assente la "crista apicalis", mentre in *haramayana* è presente e il sacco interno dell'edeago presenta una formazione chitinosa rivestita di setole nella nuova specie, mai osservata in altre specie del sottogener *Oxypodera.*

Atheta (Oxypodera) nakuruensis sp. n. (Figg. 187-189)

Holotypus ♂, Kenya, lac Nakuru, Parc Nat., (Mahnert & Perret leg., MG).

Descrizione. Lungh. 2,7 mm. Corpo lucido e rossiccio con capo, elitre e uriti liberi 1°, 2°, 3° e 4° bruno-rossicci; antenne rossicce con i due antennomeri basali e l'11° giallo-rossicci; zampe giallo-rossicce. La reticolazione del capo è superficiale, quella del pronoto e dell'addome è assente, quella delle elitre è netta. Tutto il corpo è coperto di tubercoletti distinti. Edeago figg. 188-189.

Comparazioni. La nuova specie presenta elitre più corte del pronoto. Specie del sottogenere *Oxypodera* Bernhauer, 1915, con questo stesso carattere, sono da citare *A. kenyamontis* Pace, 1986, *A. montanella* Bernhauer, 1934, del Kivu, *A. burgeoniana* Bernhauer, 1934, del Ruwenzori e *A. complicans* Pace, 1985, del Kilimangiaro. Nessuna di esse ha edeago identico a quello della nuova specie. Prendendo in esame il solo apice dell'edeago, in visione ventrale, *A. kenyamontis* lo ha tronco, *A. burgeoniana* e *A. complicans* lo hanno acuto. La sola specie che presenta l'apice dell'edeago smussato come quello della nuova specie, è *A. montanella*, ma questa specie ha edeago molto più sviluppato, con pezzi copulatori del sacco interno che sembrano molto differenti (purtroppo l'edeago dell'holotypus di *montanella* ha il sacco interno evaginato). Inoltre l'habitus di *montanella* è stretto, le antenne sono proporzionalmente più lunghe e gli occhi sono sporgenti.

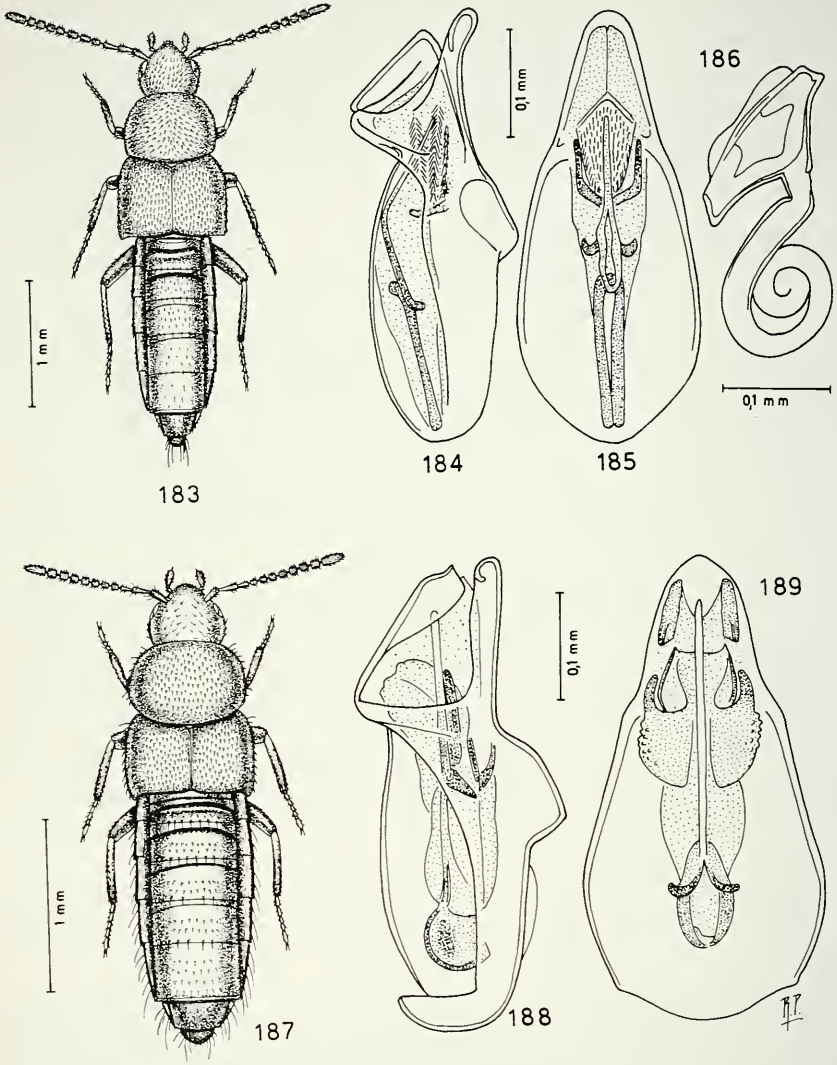
Atheta (Oxypodera) kaimosensis sp. n. (Figg. 190-193)

Holotypus ♂, Kenya, Miss. Kaimosi, NE Kisumu, 1650 m, 11.XI.1974, (Mahnert & Perret leg., MG).

Paratypi: 5 es., stessa provenienza.

Descrizione. Lungh. 2,3 mm. Corpo lucido e rossiccio con pronoto giallo-rossiccio e uriti liberi 2°, 3°, 4° e 5° bruni; Antenne brune con i due antennomeri basali giallo-rossicci; zampe giallo-rossicce. La reticolazione del capo è distinta, quella del pronoto e dell'addome assente, quella delle elitre è svanita. La punteggiatura del capo è distinta. Tubercoletti fini e distinti coprono il resto del corpo. Edeago figg. 191-192, spermateca fig. 193.

Comparazioni. La nuova specie per molti caratteri dell'edeago e della spermateca si presenta sistematicamente vicina ad. *A. chyuluensis* Cameron, 1942 (figg. 173-176), del Kenya e della Tanzania. Infatti il sacco interno dell'edeago delle due specie mostra due lame chitinose ricurve e a punta acuta, ma mentre in *chyuluensis* una



FIGG. 183–189

Habitus, edeago in visione laterale e ventrale e spermateca. 183–186: *Atheta (Oxypodera) kayovensis* sp. n.; 187–189: *Atheta (Oxypodera) nakuruensis* sp. n.

è lunghissima e l'altra cortissima e tozza, nella nuova specie dette lame chitinose sono simmetriche, con base molto larga. La spermateca ha bulbo distale molto stretto in *chyulueusis*, largo nella nuova specie.

Atheta (Oxypodera) rangirensis sp. n. (Figg. 194-197)

Holotypus ♂, Rwanda, Rangiro, 1800 m, 6.VIII.1973, (Werner leg., MG).

Descrizione. Lungh. 2,7 mm. Corpo lucido e bruno con elitre giallo-brune; antenne bruno-rossicce con i due antennomeri basali giallo-rossicci; zampe giallo-rossicce. Su tutto il corpo la reticolazione è distinta. La punteggiatura del capo è evidente. I tubercoletti che coprono pronoto ed elitre sono svaniti. Edeago figg. 196-197, 6° urotergo libero del maschio fig. 194.

Comparazioni. L'edeago delle specie del sottogenere *Oxypodera* Bernhauer, 1915, ha la regione della "crista apicalis" per lo più poco sporgente al lato ventrale. Fa eccezione l'edeago della nuova specie che ha la regione della "crista apicalis" vistosamente sporgente. Per questo carattere e per altri, come l'apice dell'edeago in visione ventrale con lati preapicali paralleli e il 3° e il 4° degli antennomeri compressi lateralmente, la nuova specie è chiaramente distinta dalle altre note del sottogenere.

Atheta (Oxypodera) implicatoides sp. n. (Figg. 200-201)

Holotypus ♀, Rhodésie, Umtali, II. 1969, (R. Mussard leg., MG).

Descrizione. Lungh. 2,9 mm. Corpo lucido e bruno-rossiccio con uriti liberi 4° e 5° bruni; antenne brune con i tre antennomeri basali giallo-rossicci; zampe giallo-rossicce. La reticolazione del capo è distinta, quella del pronoto e dell'addome è svanita, quella delle elitre è vigorosa. La punteggiatura del capo è distinta, quella del pronoto è svanita e quella delle elitre è netta. Spermateca fig. 201.

Comparazioni. Specie simile ad *A. implicata* Pace, 1985, del Kilimangiaro, ma la spermateca ha parte prossimale molto sottile (parte prossimale larga in *implicata*). La nuova specie è pure distinta da *A. pseudomombasana* sp. n. sopra descritta perché la parte prossimale della spermateca non è foggiata a spirale.

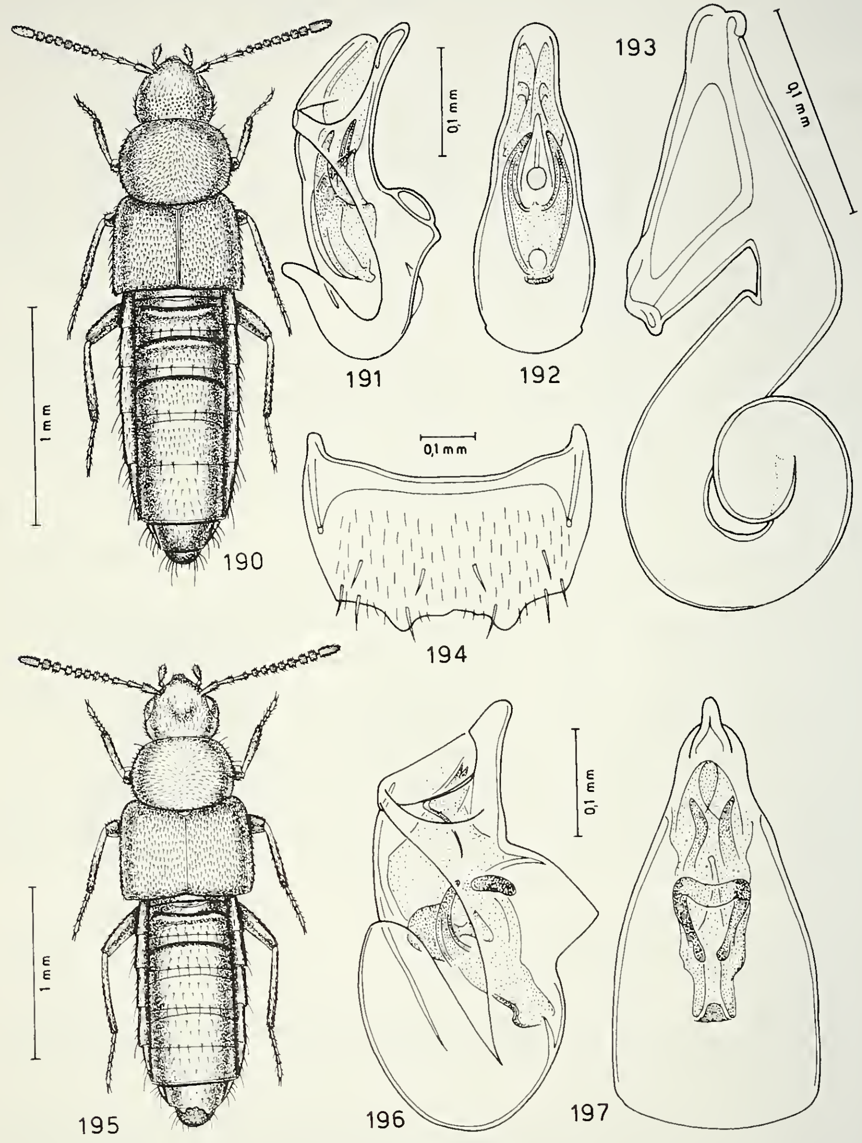
Atheta (Oxypodera) mahnerti sp. n. (Figg. 202-205)

Holotypus ♂, Kenya, Narok, Loita Hills, SO Morijo, 2050 m, 4-5.XI.1977, (Mahnert & Perret leg., MG).

Paratypi: 14 es., stessa provenienza; 3 es., Kenya, Thomson's Falls, 2350 m, 20.XI.1974, (Mahnert & Perret leg.); 1 ♂ e 2 ♀♀, Kenya, Nakuru, Mau Escarp. près Enangiperi, 2700 m, 6.XI.1977, (Mahnert & Perret leg.).

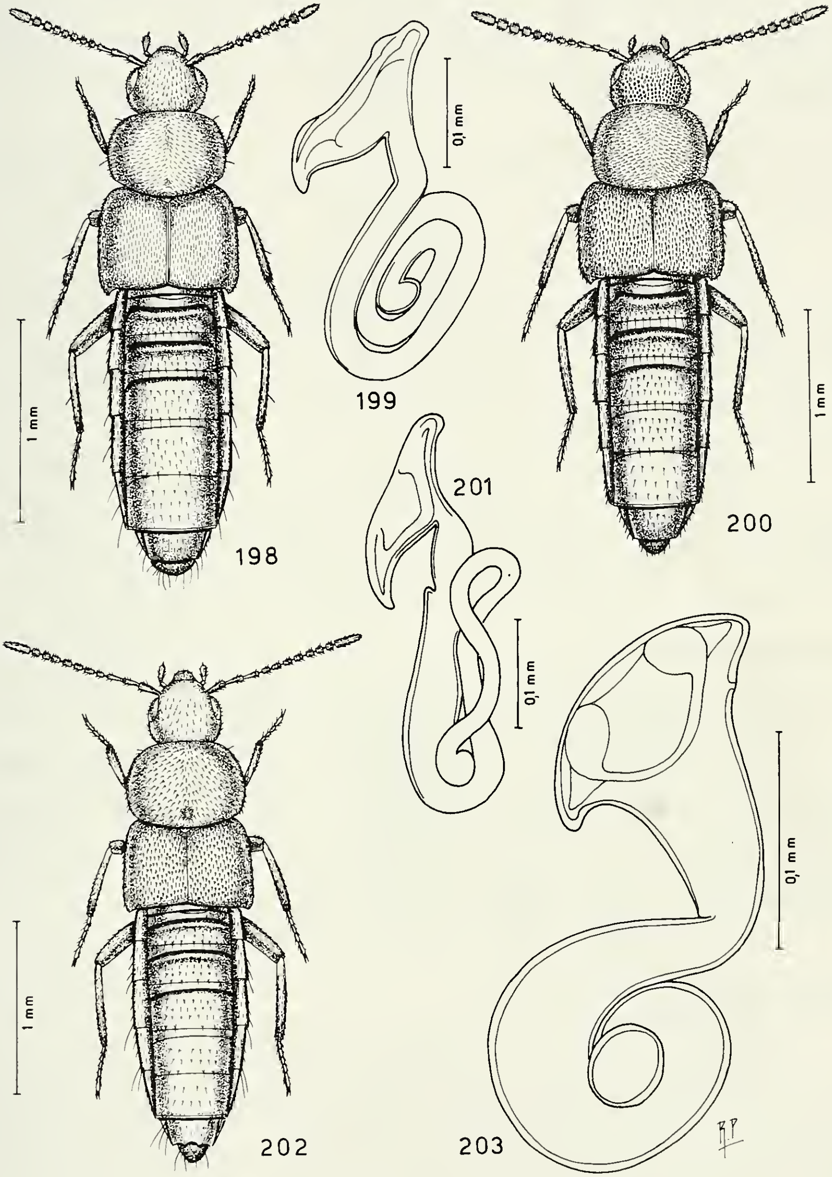
Descrizione. Lungh. 2,9 mm. Corpo lucido e bruno-rossiccio con capo e uriti liberi 3°, 4° e 5° bruni; antenne bruno-rossicce con antennomero basale giallo-rossiccio; zampe giallo-rossicce. La reticolazione del capo è svanita, quella del pronoto molto superficiale e quella delle elitre e dell'addome è netta. La punteggiatura del capo è svanita. I tubercoletti che coprono il pronoto sono distinti e quelli delle elitre poco salienti. Edeago figg. 204-205, spermateca fig. 203.

Comparazioni. La nuova specie, per la forma dell'edeago e della spermateca, è sistematicamente vicina ad *A. paludosa* Bernhauer, 1931, dell'Abissinia, ma un robus-



FIGG. 190–197

Habitus, edeago in visione laterale e ventrale, spermateca e 6° urotergo libero del maschio. 190–193: *Atheta (Oxypodera) kaimosensis* sp. n.; 194–197: *Atheta (Oxypodera) rangirensis* sp. n.



FIGG. 198–203

Habitus e spermateca. 198–199: *Atheta (Oxypodera) pseudomombasana* sp. n.; 200–201: *Atheta (Oxypodera) implicatoides* sp. n.; 202–203: *Atheta (Oxypodera) malmerti* sp. n.

tissimo pezzo copulatore del sacco interno dell'edeago della nuova specie e la parte apicale dell'edeago della nuova specie chiaramente stretto, sono alcuni caratteri differenziali più evidenti. La spermateca della nuova specie è maggiore, con introflessione apicale del bulbo distale largo, robusto e fortemente slerificato (non sclerificato in *paludosa*).

Atheta (Oxypodera) atopotheca sp. n. (Figg. 206-209)

Holotypus ♂, Kenya, Kiambu, près de Limuru, 2300 m, 2.XI.1977, (Mahnert & Perret leg., MG).

Paratypi: 2 ♂♂ e 1 ♀, stessa provenienza.

Descrizione. Lungh. 3,2 mm. Corpo lucido e bruno-rossiccio con capo e uriti liberi 3°, 4° e 5° bruni; antenne brune con i due antennomeri basali giallo- rossicci; zampe giallo-rossicce. La reticolazione del capo e dell'addome è distinta, quella del pronoto è svanita e quella delle elitre è netta. La punteggiatura del capo è distinta. I tubercoletti del pronoto sono molto salienti, quelli delle elitre sono distinti. Edeago figg. 207-208, spermateca fig. 209.

Comparazioni. La nuova specie risulta straordinaria e unica nel numero delle specie del sottogenere *Oxypodera* Bernhauer, 1915, a motivo dell'eccezionale forma allungata del bulbo distale della spermateca. Anche l'allungatissimo 11° antennomero distingue la nuova specie dalle altre specie del sottogenere.

Etimologia. Il nome della nuova specie significa "Spermateca assurda".

Alomacrotona ruandensis sp. n. (Figg. 210-213)

Holotypus ♀, Rwanda, Kayove, 2100 m, 15.V.1973, (Werner leg., MG).

Paratypi: 1 ♀, Burundi, Kigwena Res., 11.II.1992, (Arndt leg., Mus. Erfurt); 1 ♀, Kenya, env. Endebess, pr. Kitale, 14.XI.1974, (Mahnert & Perret leg.).

Descrizione. Lungh. 3,4 mm. Corpo lucido e giallo-rossiccio sporco; antenne bruno-rossicce con i tre antennomeri basali e l'11° rossicci; zampe gialle. La reticolazione del capo e delle elitre è netta, quella del pronoto è svanita e quella degli uroterghi è assente. La punteggiatura del capo è distinta e quella delle elitre è svanita. Tubercoletti salienti coprono la superficie del pronoto.

Comparazioni. Si veda sotto la chiave delle specie.

Alomacrotona curticornis sp. n. (Figg. 214-215)

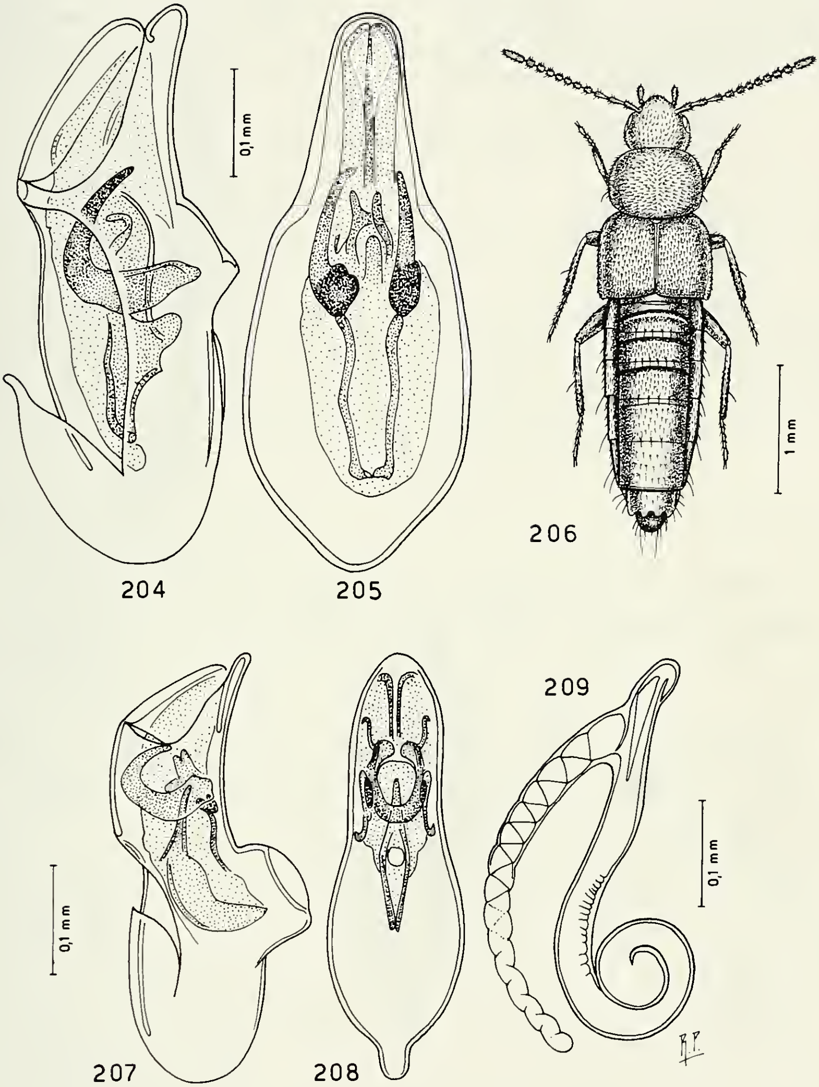
Holotypus ♀, Rwanda, Kayove, 2100 m, 15.V.1973, (Werner leg., MG).

Descrizione. Lungh. 2,2 mm. Corpo lucido e giallo rossiccio con capo ed elitre di un giallo-rossiccio sporco; antenne rossicce; zampe gialle. Il capo è privo di reticolazione. La reticolazione del pronoto e delle elitre è molto svanita. Gli uroterghi liberi 1° a 4° presentano una scultura squamiforma netta. La punteggiatura del capo è svanita. Tubercoletti distinti stanno sul pronoto e sulle elitre. Spermateca fig. 215.

Comparazioni. Si veda sotto la chiave delle specie.

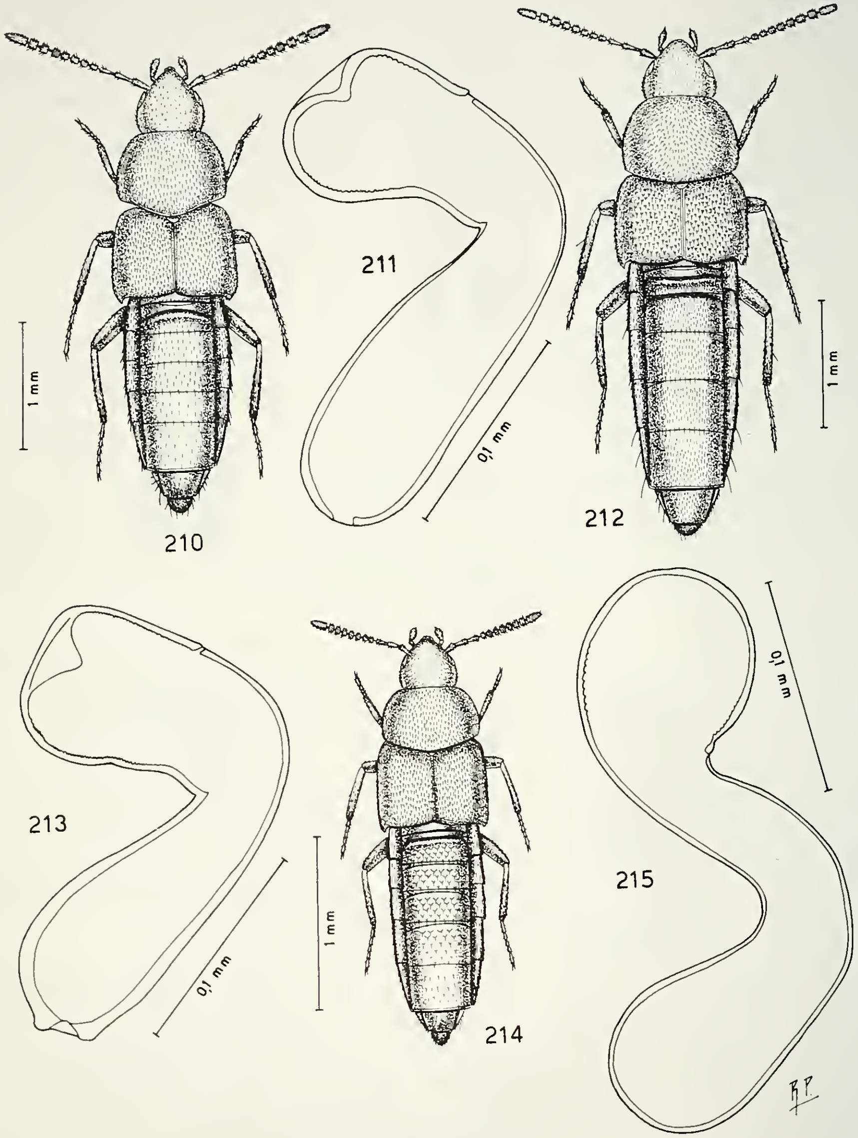
Alomacrotona kenyensis sp. n. (Figg. 216-217)

Holotypus ♀, Kenya, Miss. Kaimosi, NE Kisumu, 1650 m, 10.XI.1974, (Mahnert & Perret leg., MG).



FIGG. 204–209

Edeago in visione laterale e ventrale, habitus e spermateca. 204–205: *Atheta (Oxypodera) mahnerti* sp. n.; 206–209: *Atheta (Oxypodera) atopotheca* sp. n.



FIGG. 210–215

Habitus e spermateca. 210–211: *Alomacrotona ruandensis* sp. n. del Rwanda; 212–213: *Alomacrotona ruandensis* sp. n., esemplare del Kenya; 214–215: *Alomacrotona curticornis* sp. n.

Descrizione. Lungh. 3,2 mm. Corpo lucido e bruno con estremità addominale rossiccia; antenne brune con antennomero basale giallo rossiccio e secondo antennomero basale rossiccio; zampe giallo-rossicce. La reticolazione del capo è svanita, quella del pronoto e dell'addome è assente e quella delle elitre è distinta. La punteggiatura del capo è superficiale. I tubercoletti del pronoto e delle elitre sono salienti. Spermateca fig. 217.

Comparazioni. Si veda sotto la chiave delle specie.

Alomacrotona tambachensis sp. n. (Figg. 218-219)

Holotypus ♀, Kenya, Tambach, E Eldoret, 2000 m, 17.XI.1974, (Mahnert & Perret leg., MG).

Descrizione. Lungh. 3,8 mm. Corpo lucido e bruno-rossiccio con addome bruno; antenne brune con antennomero basale giallo e 2° antennomero rossiccio; zampe giallo-rossicce. Il capo e il pronoto sono privi di reticolazione. La reticolazione delle elitre è svanita. La punteggiatura del capo è distinta. I tubercoletti che coprono il pronoto sono salienti, quelli delle elitre sono superficiali. Spermateca fig. 219.

Alomacrotona remota Pace, 1986 (Figg. 220-221)

Alomacrotona remota PACE, 1986: 103.

2♀♀, Kenya, Tana River, Lac Shakababo, près de Ngao, 28.X.1977, (Mahnert & Perret leg.); 1 ♀ Kenya, Galole Hola, 60 m, 21.X.1977, (Mahnert & Perret leg.).

Specie finora nota solo di Shibati, Africa orientale. Si rinviene anche tra foglie morte di papiro.

CHIAVE DELLE SPECIE DEL GENERE *Alomacrotona* PACE, 1986

1 Antenne molto lunghe: il 10° antennomero è più lungo che largo; addome fortemente ristretto all'indietro. Lungh. 3,9 mm. Madagaskar. .... *termitophila* (Bernhauer, 1901)

– Antenne moderatamente lunghe o corte; il 10° antennomero debolmente o fortemente trasverso; addome debolmente ristretto all'indietro. Africa Orientale. 2

2 Terzo antennomero fortemente o debolmente trasverso e 10° antennomero fortemente trasverso. 3

– Terzo antennomero più lungo che largo e 10° antennomero più o meno debolmente trasverso. 5

3 Bulbo prossimale della spermateca indistinto perché largo quanto la parte mediana della stessa spermateca. Lungh. 3,1 mm. Nairobi. .... *invicta* (Fauvel, 1907), comb. n. (olim *Atheta invicta* FAUVEL, 1907: 54)

– Bulbo prossimale della spermateca distinto, più largo della parte mediana della stessa spermateca. 4

4 Addome coperto di microscultura squamiforme; spermateca grande quasi il doppio di quella di *remota*; bulbo distale della spermateca privo di introflessione apicale (fig. 215). Lungh. 2,2 mm. Rwanda. .... *curticornis* sp. n.

– Addome coperto di tubercoletti salienti, così da dare un aspetto rugoso alla superficie; spermateca quasi della metà rispetto quella di *curticornis*; bulbo distale della spermateca con introflessione apicale (fig. 221). Lungh. 2,1-2,3 mm. Kenya, Tanzania, Namibia. .... *remota* Pace, 1986

5 10° antennomero debolmente trasverso; introflessione apicale del bulbo distale della spermateca, robustissima, cioè a parete spessa. 6

– 10° antennomero appena trasverso; introflessione apicale del bulbo distale della spermateca, esile. 7

6 Pronoto meno trasverso; spermateca esile, con introflessione apicale del bulbo disale, subconica. Lungh. 3,0 mm. Tanzania. .... *grandicollis* (Bernhauer, 1915)

– Pronoto più trasverso; spermateca robustissima e tozza con introflessione apicale del bulbo distale emisferica (fig. 219). Lungh. 3,8 mm. Kenya. .... *tambachensis* sp. n.

7 Occhi molto sviluppati, più lunghi delle tempie; parte prossimale della spermateca più corta della distale (fig. 217). Lungh. 3,2 mm. Kenya. .... *kenyensis* sp. n.

– Occhi ridotti, più brevi delle tempie; parte prossimale della spermateca più lunga della parte distale. Lungh. 3,4 mm. .... *ruandensis* sp. n.

Brachysipalia imbellis Pace, 1985

Brachysipalia imbellis Pace, 1985: 130.
1 ♀, Kenya, Embu, près de Kogari, 800 m, 6.XI.1974, (Mahnert & Perret leg.).

Specie finora nota solo del M. Aberdare.

Brachysipalia crassa Pace, 1985

Brachysipalia crassa Pace, 1985: 125.
5 es., Kenya, Mt. Kenya, 3050 m, Met St. Lodge, 23.X.1974, (Mahnert & Perret leg.).

Specie finora nota solo del M. Aberdare.

Brachysipalia aberdarensis Pace, 1985

Brachysipalia aberdarensis Pace, 1985: 127.
1 ♂, Kenya, Mt. Aberdares, Parc National, 25.XI.1975, (Mahnert & Perret leg.); 8 es. Kenya, Mt. Kenya, 3200 m, Met St. Lodge, 23.X.1974, (Mahnert & Perret leg.).

Specie finora nota solo del M. Aberdare.

Brachysipalia meruensis Pace, 1985

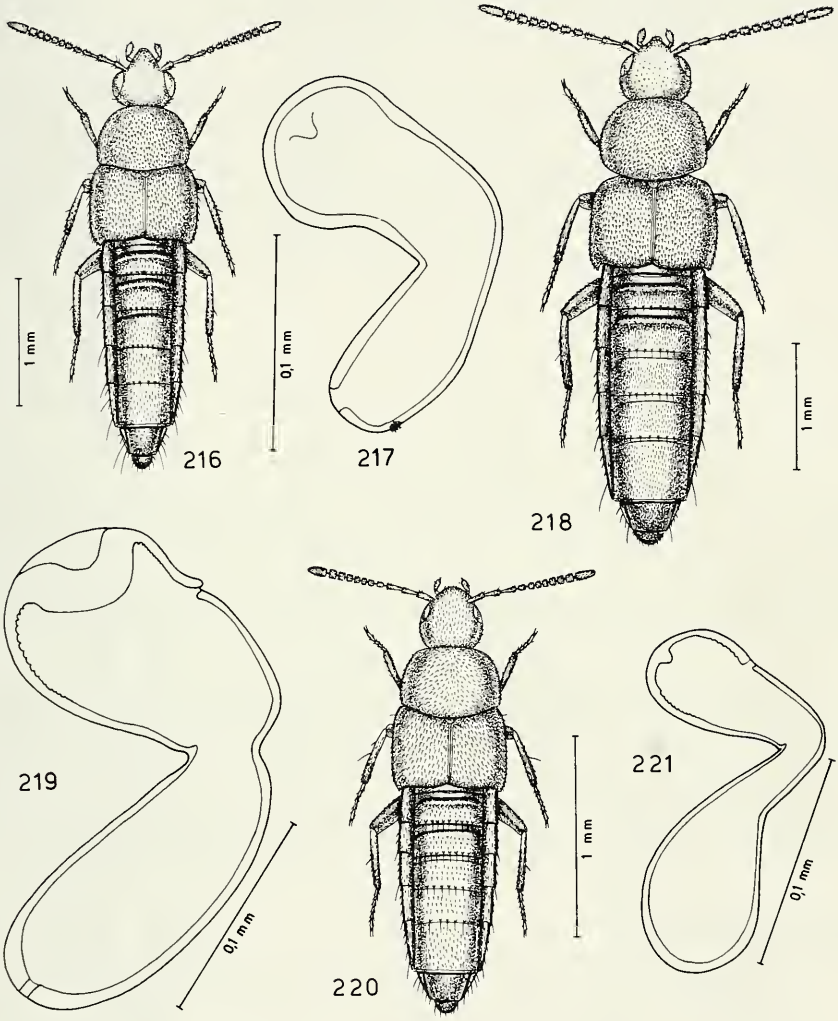
Brachysipalia meruensis Pace, 1985: 130.
42 es., Kenya, Mt. Kenya, 3050 m, Met St. Lodge, 23.X.1974, (Mahnert & Perret leg.).

Specie finora nota solo del M. Meru.

Brachysipalia irangensis sp. n. (Figg. 222-225)

Holotypus ♂, Kenya, Embu, Irangi Forest St., 2000 m, 11.X.1977, (Mahnert & Perret leg., MG).

Paratypi: 9 es., stessa provenienza.



FIGG. 216–221

Habitus e spermateca. 216–217: *Alomacrotona kenyensis* sp. n.; 218–219: *Alomacrotona tambachensis* sp. n.; 220–221: *Alomacrotona remota* Pace.

Descrizione. Lungh, 3,4 mm. Capo e pronoto opachi, resto del corpo lucido. Corpo rossiccio; antenne giallo-rossicce con i due antennomeri basali gialli; zampe giallo-rossicce. La reticolazione del capo e del pronoto è vigorosa, quella delle elitre e dell'addome è trasversa e distinta. La punteggiatura del capo e del pronoto è assai svanita. Tubercoletti salienti stanno sulle elitre. Edeago figg. 223-224, spermateca fig. 225.

Comparazioni. In base alla forma della spermateca, la nuova specie sembra sistematicamente vicina a *B. meruensis* Pace, 1985, del M. Meru, ma la spermateca presenta una debole introflessione apicale del bulbo distale (profondissima in *meruensis*) e il bulbo distale della stessa spermateca, nettamente meno trasverso. L'edeago della nuova specie è molto più sviluppato, meno profondamente ricurvo al lato ventrale e molto meno appuntito all'apice, in visione ventrale.

Brachysipalia elgonensis sp. n. (Figg. 226–229)

Holotypus ♂, Kenya, Mt. Elgon, 2700 m, Nat. Park, 15.XI.1974 (Mahnert & Perret leg., MG).

Paratypi: 20 es., stessa provenienza, ma anche 14.XI.1974.

Descrizione. Lungh. 2,7 mm. Capo e pronoto debolmente opachi, resto del corpo lucido. Corpo giallo-rossiccio con uriti liberi 3° e 4° bruno-rossicci; antenne e zampe interamente rossicce. Il capo e il pronoto presentano reticolazione vigorosa e punteggiatura svanita. La reticolazione delle elitre è distinta, quella dell'addome è trasversa e netta. Le elitre sono coperte di tubercoletti distinti. Edeago figg. 227–228, spermateca fig. 229.

Comparazioni. Specie simile a *B. kenyamontis* Pace, 1985, se si compara la forma dell'edeago e della spermateca. La nuova specie differisce da *kenyamontis* perché l'edeago è più esile in visione ventrale, meno profondamente ricurvo al lato ventrale e per la presenza di un robustissimo pezzo copulatore del sacco interno tronco all'apice (terminante in un'appendice filiforme in *kenyamontis*). L'introflessione apicale del bulbo distale della spermateca è chiaramente più profonda nella nuova specie.

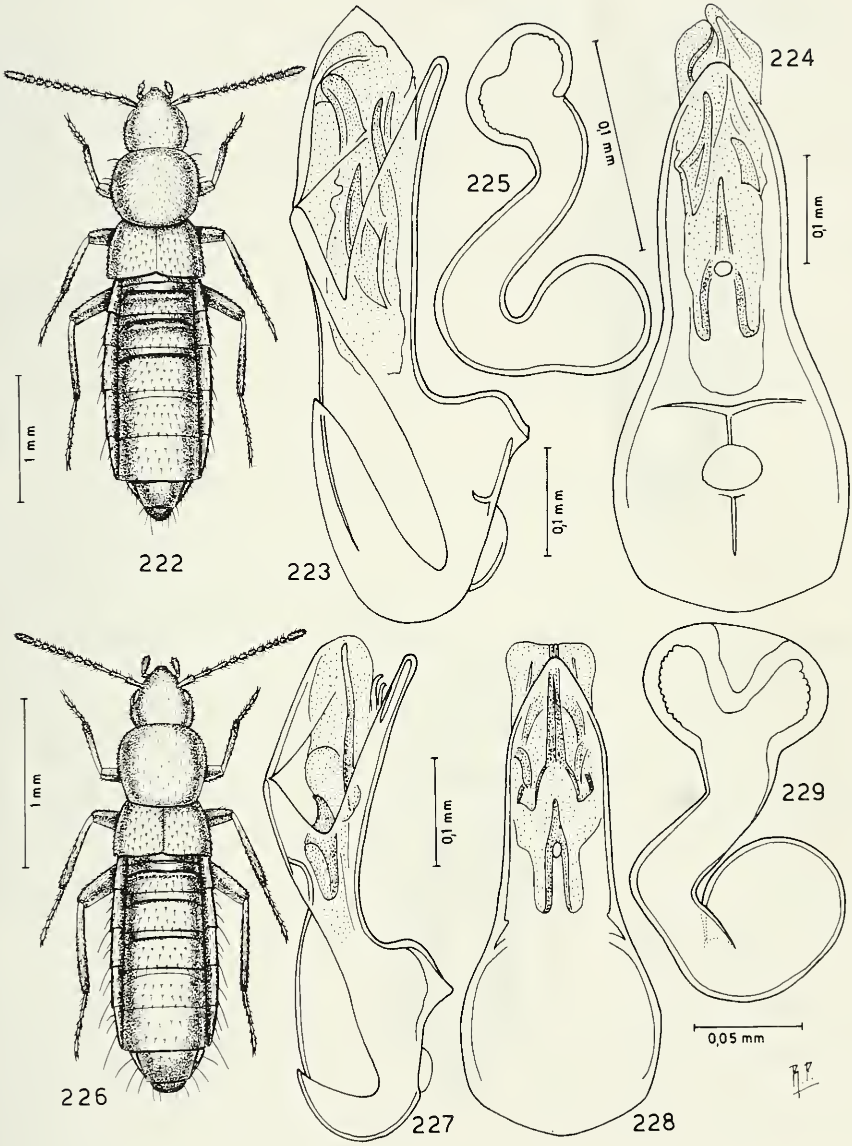
Brachysipalia elgonicola sp. n. (Figg. 230–233)

Holotypus ♂, Kenya, Mt. Elgon, 2700 m. 15.XI. 1974 (Mahnert & Perret leg., MG).

Paratypi: 27 es., stessa provenienza.

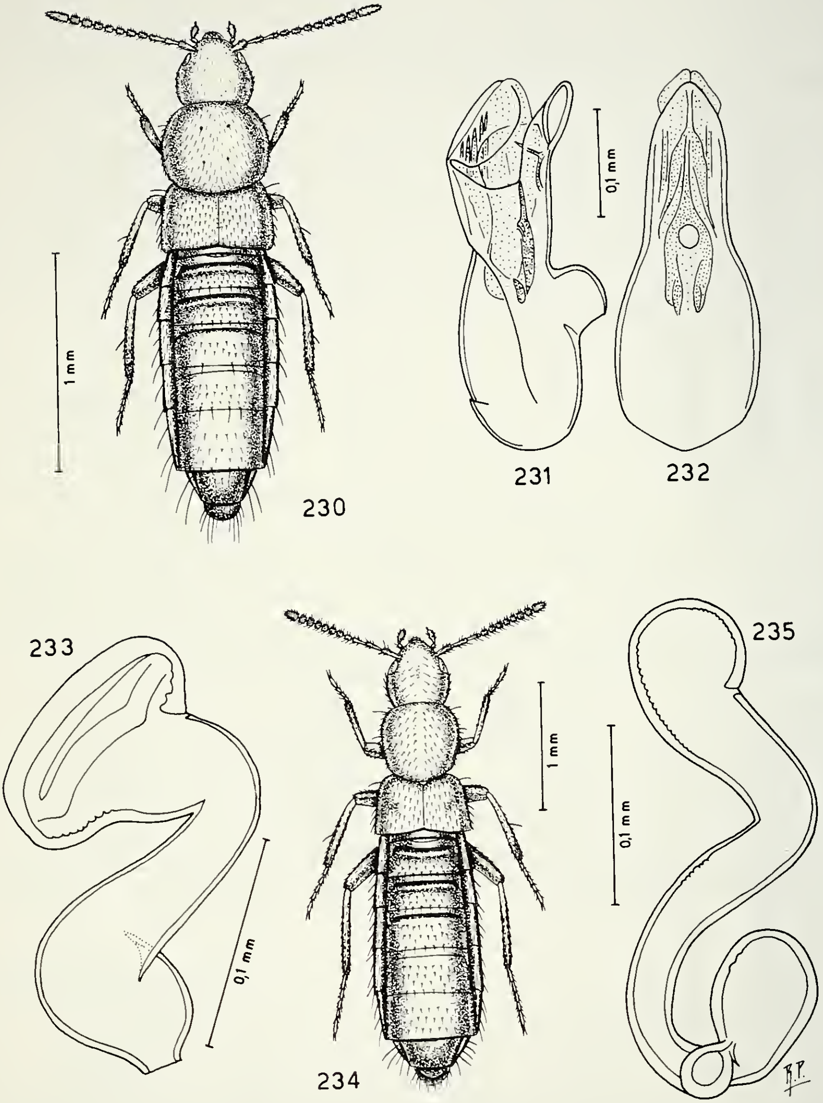
Descrizione. Lungh. 2,2 mm. Corpo lucido e giallo-rossiccio; antenne giallo-brune con i due antennomeri basali gialli; zampe gialle. La reticolazione del capo e del pronoto è molto svanita, quella delle elitre e dell'addome netta. La punteggiatura del capo e del pronoto è molto superficiale. Tubercoletti svaniti coprono le elitre. Edeago figg. 231–232, spermateca fig. 233.

Comparazioni. L'edeago e la spermateca della nuova specie hanno forma cosi differente rispetto quella delle altre specie del genere, che non è possibile avvicinare sistematicamente la nuova specie ad altre simili.



Figg. 222–229

Habitus, edeago in visione laterale e ventrale e spermateca. 222–225: *Brachysipalia irangensis* sp. n.; 226–229: *Brachysipalia elgonensis* sp. n.



FIGG. 230–235

Habitus, edeago in visione laterale e ventrale e spermateca. 230–233: *Brachysipalia elgonicola* sp. n.; 234–235: *Brachysipalia ruwenzorensis* sp. n.

Brachysipalia ruwenzorensis sp. n. (Figg. 234–235)

Holotypus ♀, Ruwenzori, Kitandara Hut, 13200 ft, I. 1984 (C. Lengeler leg., MG).

Descrizione. Lungh. 3,4 mm. Corpo lucido e rossiccio scuro con uriti liberi 2°, 3°, 4° e metà basale del 5° bruni; antenne rossicce con i tre antennomeri basali giallo-rossicci; zampe rossicce. La reticolazione del pronoto è vigorosa, quella sul resto del corpo è netta. Il capo è coperto di tubercoletti distinti. Il pronoto presenta tubercoletti salienti, ma sono assenti sulla linea mediana. Le elitre hanno tubercoletti poco salienti. spermateca fig. 235.

Comparazioni. La forma della spermateca indica anche per questa specie come la precedente, distanza sistematica rispetto le altre specie del genere, per cui non è comparabile con nessuna.

Brachysipalia sanfilippoi sp. n. (Figg. 236–239)

Holotypus ♂, M. te Kenya, Met. Station, 3050 m, 22.IX.1976 (N. Sanfilippo leg., Mus. Genova).

Paratypi: 9 es., stessa provenienza.

Descrizione. Lungh. 2,1 mm. Corpo lucido e giallo, comprese antenne e zampe. La reticolazione del corpo è netta sul disco e svanita al lati e nella zona occipitale. Sul resto del corpo la reticolazione è netta. La punteggiatura ombelicata del capo è distinta. Il pronoto è coperto di punteggiatura finissima: vi sono 4 punti più sviluppati. Le elitre sono coperte di tubercoletti nettamente salienti.

Comparazioni. La nuova specie presenta la spermateca con bulbo prossimale indistinto, mentre in tutte le restanti specie note è da distinto a molto sviluppato. L'edeago mostra reminiscenze con quello di *B. kenyamontis* Pace, 1985, ma è nettamente meno svilupatto e proporzionalmente più largo in visione ventrale.

Etimologia. Specie dedicata al suo raccoglitore: il noto entomologo genovese Nino Sanfilippo, studioso di Hydrophilidae e per tanti anni segretario della Società Entomologica Italiana.

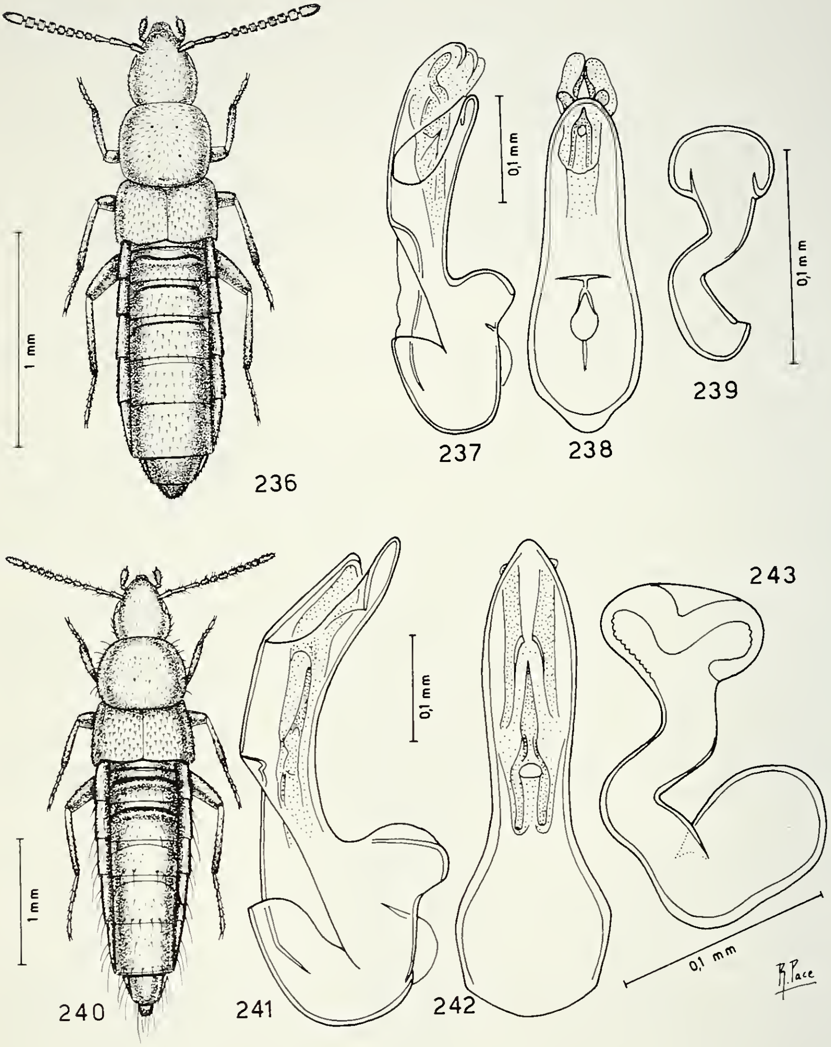
Brachysipalia viatica sp. n. (Figg. 240–243)

Holotypus ♂, Kenya, Mt. Elgon, 2800 m, 14.XI.1974 (Mahnert & Perret leg., MG).

Paratypi: 5 es., stessa provenienza.

Descrizione. Lungh. 3,4 mm. Corpo lucido e giallo-rossiccio con uriti liberi 2°, 3°, 4° e 5° bruni; antenne giallo-rossicce con i tre antennomeri basali e l'11° gialli; zampe giallo-rossicce. La reticolazione del capo è distinta, quella del pronoto è svanita e quella delle elitre e dell'addome è netta. La punteggiatura del capo é superficiale, quella del pronoto è indistinta. Tubercoletti nettamente salienti stanno sulle elitre. Edeago figg. 241–242, spermateca fig. 243.

Comparazioni. Specie simile a *B. crassa* Pace, 1985, del M. Kenya e a *B. kenyamontis* Pace, 1985. Se ne distingue da entrambe per avere l'edeago ampiamente ricurvo al lato ventrale, con "crista apicalis" e "crista proximalis" nettamente più svilupatte. La spermateca ha bulbo prossimale non così ipertrofico come quello delle due specie citate sopra.



FIGG. 236–243

Habitus, edeago in visione laterale e ventrale e spermateca. 236–239: *Brachysipalia sanfilippoi* sp. n.; 240–243: *Brachysipalia viatica* sp. n.

Brachysipalia embuensis sp. n. (Figg. 244–249)

Holotypus ♂, Kenya, Embu, Irangi Forest, 2100 m, 12.X.1977 (Mahnert & Perret leg., MG).

Paratypus: 1 ♀, stessa provenienza.

Descrizione. Lungh. 2,2 mm. Corpo lucido e rossiccio con 4° urite libero bruno; antenne brune con i due antennomeri basali e l'11° bruno-rossicci; zampe gialle. La reticolazione del capo è assente, quella del pronoto è distinta. I tubercoletti delle elitre sono molto salienti verso la sutura. Addome non reticolato. Edeago figg. 245–246, spermateca fig. 247.

Comparazioni. La nuova specie ha edeago simile a quello di *B. franzi* Pace, 1985, del Kilimangiaro, ma ha dimensione ridotta e pezzi copulatori del sacco interno di forma diversa: pezzo a uncino assente in *franzi*. Inoltre la spermateca è meno sviluppata nella nuova specie, sebbene di forma simile a quella di *franzi*, ha però l'introflessione apicale del bulbo distale, stretta, mentre in *franzi* è larghissima.

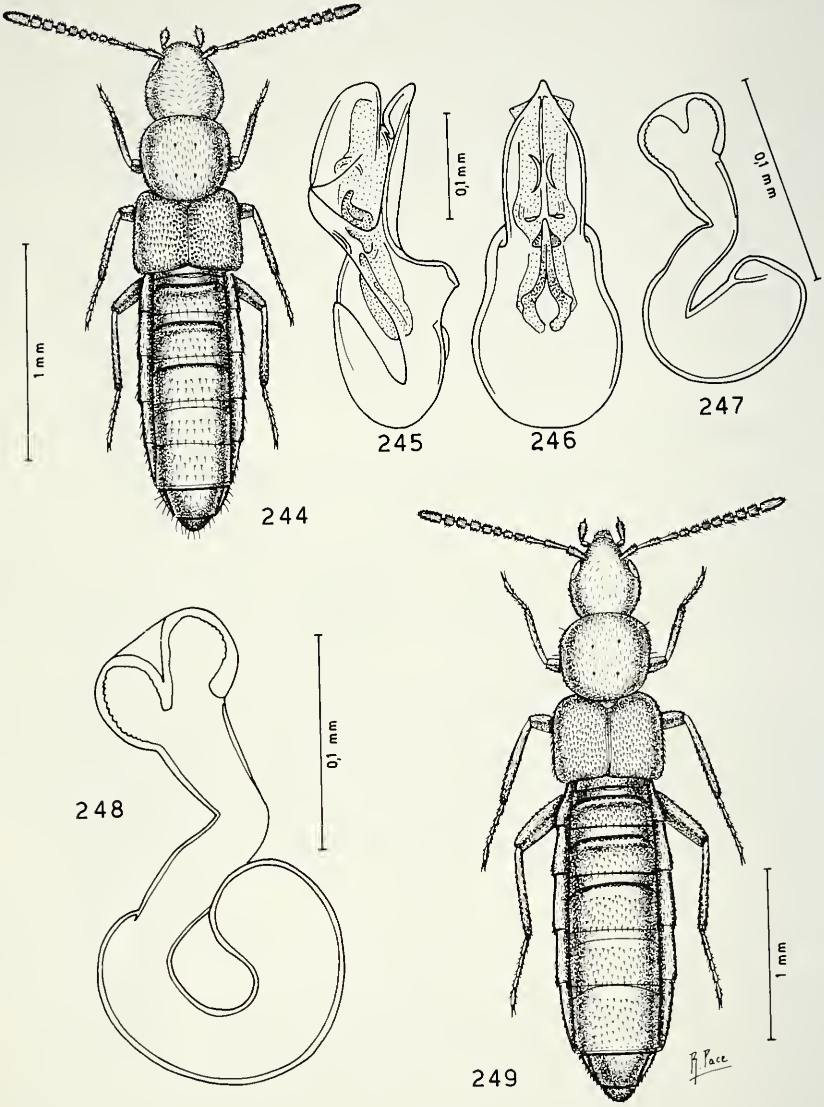
Brachysipalia volans sp. n. (Figg. 248–249)

Holotypus ♀, Kenya, Mt. Elgon, 2700 m, 15.XI.1974 (Mahnert & Perret leg., MG).

Paratypi: 2 ♀♀, stessa provenienza, ma 2650 m e 14.XI.1974.

Descrizione. Lungh. 2,2 mm. Corpo lucido e rossiccio scuro; antenne bruno-rossicce con antennomero basale rossiccio; zampe giallo-rossicce. Il capo, il pronoto e l'addome sono privi di reticolazione. La reticolazione delle elitre è svanita. La punteggiatura del capo e del pronoto è molto superficiale. Netti tubercoletti stanno sulle elitre.

Comparazioni. La spermateca della nuova specie ha forma e grandezza simili alla spermateca di *B. franzi* Pace, 1985, del Kilimangiaro, ma l'introflessione apicale del bulbo distale della spermateca stessa della nuova specie, è stretta e profonda, mentre quella di *franzi* è larghissima e meno profonda. Inoltre le elitre della nuova specie sono appena più corte del pronoto, mentre in *franzi* sono molto più corte del pronoto. Il pronoto della nuova specie presenta 4 punti discali, assenti in *franzi*.



FIGG. 244–249

Habitus, edeago in visione laterale e ventrale e spermateca. 244–247: *Brachysipalia embuensis* sp. n.; 248–249: *Brachysipalia volans* sp. n.

RINGRAZIAMENTI

Ringrazio molto cordialmente il Dr I. Löbl e il Dr C. Besuchet del Museo di Storia Naturale di Ginevra per avermi affidato in studio il materiale pubblicato nel presente lavoro. Ringrazio per lo stesso motivo il Dr R. Poggi e il Sig. N. Sanfilippo del Museo di Storia Naturale di Genova e il Dr L. Zerche del D.E.I. di Eberswalde. Per il prestito di tipi rigrazio vivamente il Dr L. Baert dell'Institut Royal des Sciences Naturelles de Belgique di Bruxelles, il Dr A.F. Newton del "Field Museum of Natural History" di Chicago e il Dr L. Bartolozzi del Museo Zoologico dell'Università di Firenze.

BIBLIOGRAFIA

BERNHAUER, M. 1901. Ein neuer Termitengast aus Madagaskar. *Deutsche ent. Z.* 1901: 252.

BERNHAUER, M. 1915. Zur Staphylinidenfauna des tropischen Afrika. *Annls. hist.-nat. Mus. natn. hung.* 13: 95–189.

BERNHAUER, M. 1927. Materiali per lo studio della fauna Eritrea raccolti nel 1901–1903 dal Dr A. Andreini, Staphylinidae. *Boll. Soc. ent. Ital.* 59: 79–81.

BERNHAUER, M. 1931. Entomological Expedition to Abyssinia, 1926–1927: Coleoptera, Staphylinidae. Systematic report by Dr Max Bernhauer. *J. Linn. Soc. Lond. Zool.* 37: 559–605.

BERNHAUER, M. 1934. Neue Kurzflüger von Ruwenzori-Zivu-Gebiet. XXXIV. Beitrag zur afrikanischen Staphylinidenfauna. *Rev. Zool. Bot. afr.* 25: 206–217.

BERNHAUER, M. 1944. Phleophile Staphyliniden aus Ostafrika (Coleoptera). *Rev. franç. Ent.* 11: 17–21.

BERNHAUER, M. & SCHEERPELTZ, O. 1926. Coleopterorum Catalogus. Staphylinidae 4: 499–988, *Berlin.*

CAMERON, M. 1932. New species of Staphylinidae from the Belgian Congo. *Bull. Ann. Soc. Ent. Belg.* 72: 131–146.

CAMERON, M. 1939. The fauna of British India. Coleoptera Staphylinidae 4: 691 pp., *London.*

CAMERON, M. 1942. New species of Staphylinidae (Col.) collected by the Coryndon Museum Expedition to the Chyulu Hills. *Ann. Mag. Nat. Hist.* 9: 321–332.

CAMERON, M. 1950. Staphylinidae (Coleoptera Polyphaga). *Explor. Parc natn. Albert Miss. G. F. de Witte* 59: 1–85.

EICHELBAUM, F. 1913. Verzeichnis der von mir in den Jahren 1903 und 1904 in Deutsch- und British-Ostafrika eingesammelten Staphylinidae. *Arch. Naturg.* 79: 114–168.

FAUVEL, A. 1900. Staphylinidae nouveaux de Kinchassa (Congo). *Rev. Ent.* 19: 66–74.

FAUVEL, A. 1907. Voyage de M. Ch. Alluaud dans l'Afrique Orientale. *Rev. Ent.* 26: 10–70.

FENYES, A. 1920. Coleoptera: Fam. Staphylinidae, subfam. Aleocharinae. *Genera Insectorum* 173: 111–414.

JEANNEL, R. & PAULIAN, R. 1945. Mission scientifique de l'Omo. Faune des terriers des rats-taupes, IV: Coléoptères. *Mem. Mus. Nat. Hist.* 19: 51–147.

KRAATZ, G. 1857. Beiträge zur Kenntniss der Termitophilen. *Linnaea Ent.* 11: 44–56.

MULSANT, M.E. & REY, C. 1873. Description de divers coléoptères brévipennes nouveaux ou peu connus. *Opusc. Ent.* 15: 147–189.

PACE, R. 1984. Aleocharinae delle Mascarene. Parte II. *Rev. suisse Zool.* 91: 249–280.

PACE, R. 1985. Aleocharinae raccolte dal Prof. Franz sul Kenya, Kilimangiaro e Monti Aberdare. *Fragm. Ent.* 18: 115–159.

PACE, R. 1986. Aleocharinae dell'Africa Orientale (Coleoptera, Staphylinidae). *Ann. hist.-nat. Mus. Natn. hung.* 78: 83–143.

PACE, R. 1994. Aleocharinae della Sottoregione Africana Orientale al Museo di Ginevra (Coleoptera, Staphylinidae) Parte I. *Rev. suisse Zool.* 100: 117–193.

SCHEERPELTZ, O. 1968. Coleoptera Staphylinidae. Cat. faun. Austriae 15. *Wien Akad. Wiss.*: 1–124.

THOMSON, C.G. 1858. Försök till uppställning af Sveriges Staphyliner. *Öfv. Kön. Vet.-Akad. Förh.* 15: 27–40.

TOTTENHAM, C.E. 1957. Coleoptera Staphylinidae: Tachyporinae, Pygosteninae (cont.) and Aleocharinae (part.). *Ann. Mus. Congo Tervuren* 58: 73–135.

REVUE SUISSE DE ZOOLOGIE, 102 (3) : 847-850; septembre 1995

Chaerilus sabinae, nouvelle espèce de Scorpion anophthalme des grottes de Matampa en Inde (Scorpiones, Chaerilidae)

Wilson R. LOURENÇO
Société de Biogéographie, 57, rue Cuvier, F-75005 Paris, France.

Chaerilus sabinae, **a new species of anophthalmous scorpion from the caves of Matampa in India (Scorpiones Chaerilidae).-** A new species of anophthalmous, troglobite scorpion, *Chaerilus sabinae* is described from the Matampa caves, in the region of Gua Atas in India. This species is the second genuine troglobite scorpion known for the genus *Chaerilus* and the number of known troglobite scorpions in now raised to 14.

INTRODUCTION

Le genre *Chaerilus* Simon, 1877, appartient à la famille monotypique des Chaerilidae Pocock, 1900. Le nombre total des espèces n'est pas exactement connu à l'heure actuelle car plusieurs d'entre elles ont été pauvrement caractérisées et leurs statuts d'espèce voire de sous-espèce demeurent obscurs. Un nombre approximatif peut être néanmoins estimé entre 15 et 23. La répartition connue de ce genre recouvre l'Inde, le Sri Lanka, l'Asie du sud-ouest, les Philippines, Bornéo, les Célèbes, Java, Sumatra et plusieurs autres îles indonésiennes (SISSOM, 1990).

Les descriptions des espèces appartenant au genre *Chaerilus* sont anciennes et datent des années entre 1877 et 1913, exceptée celle de *Chaerilus chapmani*, par VACHON & LOURENÇO (1985), à partir des spécimens collectés dans les grottes du Parc National Gunong Mulu au Sarawak (Bornéo).

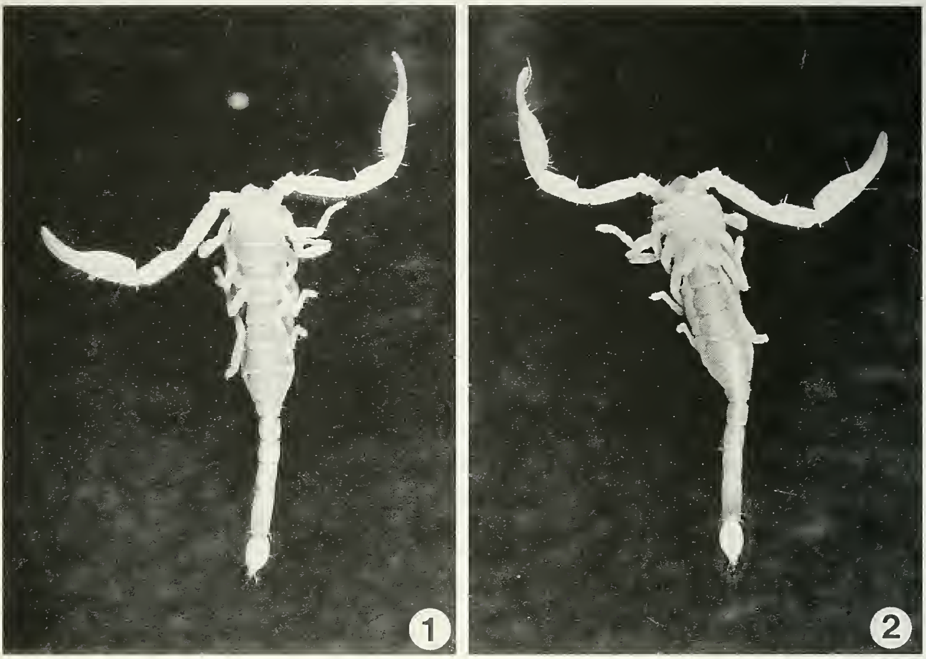
Chaerilus sabinae n. sp. (Figs 1 à 9)

Holotype: ♂ immature, provenant des grottes de Matampa dans la région de Gua Atas (22°12' N/85°23' E), Inde, leg. Mards, 12/VIII/1985 (Muséum d'histoire naturelle, Genève).

Etymologie: Le nom spécifique est attribué en hommage au Dr Sabine Jourdan, Paris, France.

Description. Coloration. La couleur de base de l'ensemble du corps, pattes et pédipalpes est jaunâtre; aucune tache n'est présente. Vésicule jaune-clair; aiguillon légèrement rougeâtre. Sternites jaunâtres. Peignes et opercule génital jaune très clair.

Manuscrit accepté le 30.01.1995.

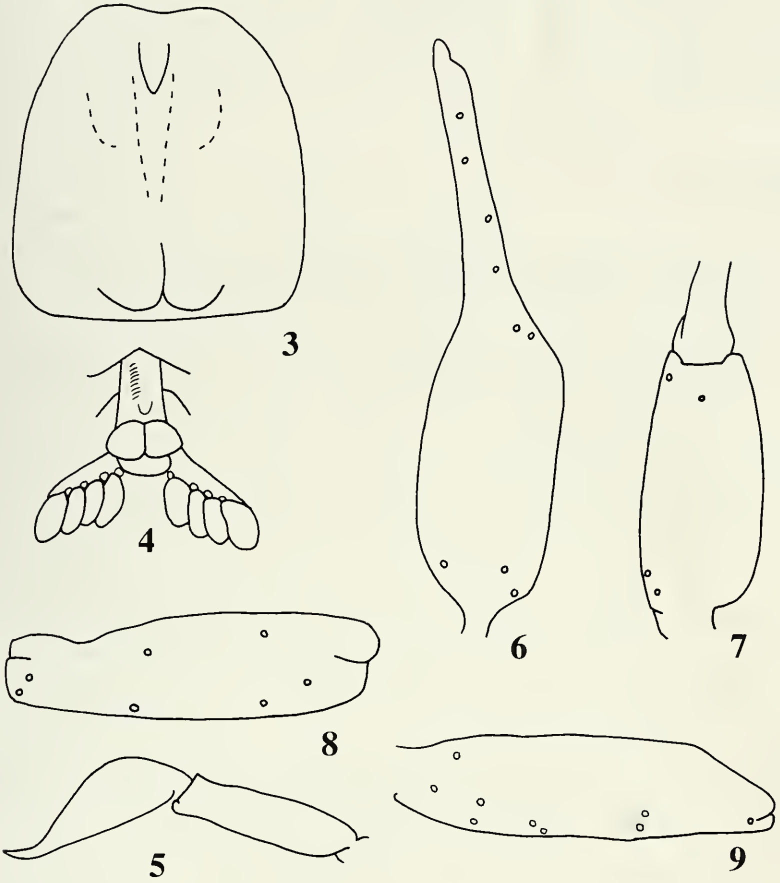


Figs 1 et 2

Chaerilus sabinae, holotype ♂, vues dorsale et ventrale.

presque blanc; sternum, hanches et processus maxillaires jaunâtres. Pattes, pédipalpes et chélicères jaunâtres.

Morphologie. Prosoma: plaque prosomienne à bord frontal légèrement échancré, divisé par un sillon longitudinal très discret; région antérieure aplatie et lisse; deux sillons présents dans les régions latéro-postérieures; tubercule oculaire, yeux médians et yeux latéraux absents. Mesosoma, dorsalement chagriné; tergites sans carènes apparentes; face ventrale: sternum pentagonal nettement plus haut que large; opercule génital formé de deux plaques plus ou moins ovales; peignes avec 4–4 dents; fulcres bien distincts; stigmates petits et arrondis. Metasoma: anneaux I à V avec des carènes très discrètes, pratiquement absentes. Vésicule aplatie et allongée, chagrinée; aiguillon long, à peine courbé. Chélicères avec la dentition caractéristique de la famille. Pédipalpes avec des carènes très faiblement marquées; tranchant des doigts des pinces avec quelques séries de granules (4 ou 5) suivies de séries peu distinctes à la base des doigts; présence de quelques granules accessoires. Trichobothriotaxie du type B (VACHON, 1973), numériquement constante dans toute la famille des Chaerilidae. Tarses pourvus de soies disposées en deux séries latérales avec, ventralement, une série de petites épines.



FIGS 3 À 9

Chaerilus sabinae, holotype ♂. 3. Plaque prosomienne. 4. Sternum, opercule génital et peignes. 5. Cinquième anneau du metasoma et telson. 6. Pince, vue externe. 7. Pince, vue ventrale. 8. Tibia, vue dorsale. 9. Fémur, vue dorsale.

Mensurations (en mm) de l'exemplaire décrit. Plaque prosomienne longueur, 1,1. Mesosoma longueur, 2,4. Metasoma + telson longueur, 3,9. Fémur longueur, 0,9. Tibia longueur, 1,2. Pince longueur, 2,3. Doigt mobile longueur, 1,3.

Ainsi que *Chaerilus chapmani*, *Ch. sabinae* fait partie du groupe des *Chaerilus* ayant les pinces des pédipalpes longues et effilées, ayant des doigts au moins deux fois la largeur de la pince. Cette espèce peut être distinguée des autres espèces du genre *Chaerilus* par l'absence totale des yeux médians et latéraux. Chez *Ch. chapmani* subsiste un œil médian réduit et un œil latéral de chaque côté. Ces deux espèces sont de toute évidence des troglobies véritables au sein des Chaerilidae. (Vachon & Lourenço, 1985). Le nombre de scorpions troglobies s'élève ainsi à 14 (Lourenço & Francke, 1985).

REFERENCES

Lourenço W.R. & O.F. Francke. 1985. Révision des connaissances sur les Scorpions cavernicoles (troglobies) (Arachnida, Scorpiones). *Mém. Biospéol.*, 12: 3–7.

Sissom, W.D. 1990. Systematics, Biogeography, and Paleontology. In: *The Biology of Scorpions*. Polis, G.A. (ed.). Stanford Univ. Press, Stanford, pp. 64–160.

Vachon, M. 1973. Etude des caractères utilisés pour classer les familles et les genres de Scorpions (Arachnides). 1. La trichobothriotaxie en arachnologie. Sigles trichobothriaux et types de trichobothriotaxie chez les Scorpions. *Bull. Mus. natn. Hist. Nat., Paris*, 3e sér., n° 140, Zool., 104: 857–958.

Vachon, M. & W.R. Lourenço. 1985. Scorpions cavernicoles du Sarawak (Bornéo). *Chaerilus chapmani* n. sp. (Chaerilidae) et *Lychas hosei* (Pocock, 1890) (Buthidae). *Mém. Biospéol.*, 12: 9–18.

REVUE SUISSE DE ZOOLOGIE

Tome 102 — Fascicule 3

REVUE SUISSE DE ZOOLOGIE

Volume 102 — Number 3

Indexed in Current Contents

PUBLICATIONS DU MUSÉUM D'HISTOIRE NATURELLE DE GENÈVE

CATALOGUE DES INVERTÉBRÉS DE LA SUISSE

Fasc.	1.	SARCODINÉS par E. Penard	Fr. 12.—
	2.	PHYLLOPODES par Th. Stingelin	12.—
	3.	ARAIGNÉES par R. de Lessert	42.—
	4.	ISOPODES par J. Carl	8.—
	5.	PSEUDOSCORPIONS par R. de Lessert	5.50
	6.	INFUSOIRES par E. André	18.—
	7.	OLIGOCHÈTES par E. Piguet et K. Bretscher	18.—
	8.	COPÉPODES par M. Thiébaud	18.—
	9.	OPILIONS par R. de Lessert	11.—
	10.	SCORPIONS par R. de Lessert	3.50
	11.	ROTATEURS par E.-F. Weber et G. Montet	38.—
	12.	DÉCAPODES par J. Carl	11.—
	13.	ACANTHOCÉPHALES par E. André	11.—
	14.	GASTÉROTRICHES par G. Montet	18.—
	15.	AMPHIPODES par J. Carl	12.—
	16.	HIRUDINÉES, BRANCHIOBDELLES et POLYCHÈTES par E. André	17.50
	17.	CESTODES par O. Fuhrmann	30.—

REVUE DE PALÉOBIOLOGIE — Echange

LE RHINOLOPHE — par fascicule
(Bulletin du centre d'étude des chauves-souris) — Fr. 10.—

CATALOGUE ILLUSTRÉ DE LA COLLECTION LAMARCK
APPARTENANT AU MUSÉUM D'HISTOIRE NATURELLE DE GENÈVE
1re partie – Fossiles – 1 vol. 4° avec 117 planches — Fr. 300.—

COLLEMBOLENFAUNA EUROPAS von H. Gisin
312 Seiten, 554 Abbildungen — Fr. 30.—

THE EUROPEAN PROTURA
THEIR TAXONOMY, ECOLOGY AND DISTRIBUTION
WITH KEYS FOR DETERMINATION
by J. Nosek
346 pages, 111 figures in text, 1973 — Fr. 30.—

CLASSIFICATION OF THE DIPLOPODA
par Richard L. Hoffman
237 pages, 1979 — Fr. 30.—

LES OISEAUX NICHEURS DU CANTON DE GENÈVE
par P. Géroudet, C. Guex et M. Maire
351 pages, nombreuses cartes et figures — Fr. 45.—

CATALOGUE COMMENTÉ DES TYPES D'ECHINODERMES ACTUELS
CONSERVÉS DANS LES COLLECTIONS NATIONALES SUISSES,
SUIVI D'UNE NOTICE SUR LA CONTRIBUTION DE LOUIS AGASSIZ
À LA CONNAISSANCE DES ECHINODERMES ACTUELS
par Michel Jangoux
67 pages, 11 planches — Fr. 15.—

RADULAS DE GASTÉROPODES LITTORAUX DE LA MANCHE
(COTENTIN-BAIE DE SEINE, FRANCE)
par Y. Finet, J. Wüest et K. Mareda
62 pages, nombreuses figures, 1991 — Fr. 10.—

GASTROPODS OF THE CHANNEL AND ATLANTIC OCEAN;
SHELLS AND RADULAS
by Y. Finet, J. Wüest and K. Mareda, 1992 — Fr. 30.—

O. SCHMIDT SPONGE CATALOGUE
par R. Desqueyroux-Faundez & S.M. Stone, 1992 — Fr. 40.—

ATLAS DE RÉPARTITION DES AMPHIBIENS
ET REPTILES DU CANTON DE GENÈVE
par A. Keller, V. Aellen et V. Mahnert, 1993 — Fr. 15.—

THE MARINE MOLLUSKS OF THE GALAPAGOS ISLANDS:
A DOCUMENTED FAUNAL LIST
par Yves Finet, 1995 — Fr. 30.—

NOTICE SUR LES COLLECTIONS MALACOLOGIQUES
DU MUSEUM D'HISTOIRE NATURELLE DE GENEVE
par Jean-Claude Cailliez, 1995 — Fr. 22.—

Instructions pour les auteurs

1. INSTRUCTIONS GÉNÉRALES

La Revue suisse de Zoologie publie les travaux des membres de la Société suisse de Zoologie ou ceux concernant l'activité du Muséum d'Histoire naturelle de Genève.

Chaque manuscrit est soumis à un comité de lecture.

Tout manuscrit reconnu comme non conforme aux «Instructions pour les auteurs» sera renvoyé pour mise au point.

Langue: les travaux proposés à la R.S.Z. peuvent être rédigés en français, allemand, italien ou anglais.

Frais: la R.S.Z. n'assume les frais d'impression et de clichage que dans la mesure de ses possibilités financières.

Tirés à part: les auteurs reçoivent gratuitement 25 exemplaires sans couverture; ceux commandés en plus ou avec couverture seront facturés.

2. TEXTE

Manuscrits: l'original et deux copies prêts pour l'impression doivent être dactylographiés en double interligne, sans corrections ni surcharges. Le «titre courant» et l'emplacement désiré des figures doivent être indiqués.

Abstract: chaque travail doit comporter la traduction de son titre, un court «abstract» ainsi que 5 «mots-clé» au maximum, le tout en anglais.

Nombre de pages: les travaux présentés aux assemblées de la Société suisse de Zoologie ne dépasseront pas 8 pages imprimées, illustrations comprises. Les autres travaux n'excèderont pas 20 pages et les thèses de doctorat, 30 pages.

Indications typographiques importantes:

Nous recommandons que les textes soient fournis sur disquette 3,5" pour Macintosh ou 5 1/4" IBM-compatible, en utilisant le logiciel «Microsoft Word».

Les disquettes ne seront retournées que sur demande de l'auteur.

Quel que soit le moyen utilisé, **machine à écrire ou ordinateur**, les auteurs se conformeront aux instructions suivantes:

- L'adresse sera placée sous le(s) nom(s) d'auteur(s). Le(s) prénom(s) seront écrits en toutes lettres.
- Le choix des caractères est du ressort de la rédaction. Tout le texte des manuscrits doit être composé en romain («standard» des traitements de texte), y compris les titres et sous-titres.
- Les mots qui doivent apparaître en italique à l'impression seront soulignés au crayon.
  (Uniquement les noms de genres et catégories inférieures ainsi que les locutions latines; les noms de catégories supérieures et les termes anatomiques sont en romain.)
- Dans tous les cas ne pas utiliser de codes spéciaux de mise en page, de fin de page ou de format.
- Ne pas couper les mots (césure).
- Les notes infra-paginales, numérotées à la suite, doivent être groupées en fin d'article.
- Pour la bibliographie, ne pas séparer les références par une «ligne blanche».

Bibliographie: la liste des références ne devra comprendre que celles citées dans le texte et sa présentation sera conforme au modèle suivant (les soulignages sont à effectuer au crayon):

Penard, E. 1888. Recherches sur le Ceratium macroceros. Thèse, Genève, 43 pp.
– 1889. Etudes sur quelques Héliozoaires d'eau douce. Archs.Biol. Liège, 9:1-61.
Mertens, R. & H. Wermuth. 1960. Die Amphibien und Reptilien Europas, Kramer, Frankfurt am Main, XI + 264 pp.
Handley, C.O. Jr. 1966. Checklist of the mammals of Panama, pp. 753-795. In: Ectoparasites of Panama (R.L. Wenzel & V.J. Tipton, eds.). Field Mus. Nat. Hist. Chicago, XII+ 861 pp.

Les abréviations doivent être citées conformément à la "World List of Scientific Periodicals" (Butterworths, London).

3. ILLUSTRATIONS

Toutes les illustrations – numérotées de 1 à n – et les tableaux doivent être fournis en trois exemplaires: les originaux et 2 copies réduites au format A4.

Les originaux ne seront retournés aux auteurs que sur leur demande.

Réduction: les lettres et chiffres dans les figures (photos ou dessins au trait) doivent avoir au moins 1 mm après réduction. L'échelle sera indiquée sur les figures, les indications de grandissement ou de réduction (x 1000 par exemple) ne sont pas admis.

Dimensions: les figures ou les photos, groupées ou isolées, doivent être calculées de manière à ne pas dépasser **122 x 160 mm** après réduction. Le non respect de cette règle implique le renvoi du manuscrit.

Légendes: les légendes des figures seront réunies sur une page séparée.

4. CORRESPONDANCE

Toute correspondance est à adresser à:

Revue suisse de Zoologie – Muséum d'Histoire naturelle
Route de Malagnou – C.P. 6434
CH – 1211 GENÈVE 6
Tél. (022) 735 91 30 – Fax (022) 735 34 45

REVUE SUISSE DE ZOOLOGIE

ANNALES

de la
SOCIÉTÉ SUISSE DE ZOOLOGIE
et du
MUSÉUM D'HISTOIRE NATURELLE
de la Ville de Genève

tome 102
fascicule 4
1995

GENÈVE DÉCEMBRE 1995 ISSN 0035 - 418 X

REVUE SUISSE DE ZOOLOGIE

TOME 102 — FASCICULE 4

Publication subventionnée par l'Académie suisse des Sciences naturelles
et la Société suisse de Zoologie

La préférence sera donnée aux travaux concernant les domaines suivants: Biogéographie, systématique, écologie, éthologie, morphologie, et anatomie comparée, physiologie.

Administration

MUSÉUM D'HISTOIRE NATURELLE
1211 GENÈVE 6

PRIX DE L'ABONNEMENT:

SUISSE Fr. 225.— UNION POSTALE Fr. 230.—
(en francs suisses)

Les demandes d'abonnement doivent être adressées
à la rédaction de la *Revue suisse de Zoologie*,
Muséum d'histoire naturelle, C.P. 6434, CH-1211 Genève 6, Suisse

REVUE SUISSE DE ZOOLOGIE

ANNALES

de la
SOCIÉTÉ SUISSE DE ZOOLOGIE
et du
MUSÉUM D'HISTOIRE NATURELLE
de la Ville de Genève

tome 102
fascicule 4
1995

GENÈVE DÉCEMBRE 1995 ISSN 0035 - 418 X

REVUE SUISSE DE ZOOLOGIE

TOME 102 — FASCICULE 4

Publication subventionnée par l'Académie suisse des Sciences naturelles
et la Société suisse de Zoologie

La préférence sera donnée aux travaux concernant les domaines suivants: Biogéographie, systématique, écologie, éthologie, morphologie, et anatomie comparée, physiologie.

Administration

MUSÉUM D'HISTOIRE NATURELLE
1211 GENÈVE 6

PRIX DE L'ABONNEMENT:

SUISSE Fr. 225.— UNION POSTALE Fr. 230.—
(en francs suisses)

Les demandes d'abonnement doivent être adressées
à la rédaction de la *Revue suisse de Zoologie*,
Muséum d'histoire naturelle, C.P. 6434, CH-1211 Genève 6, Suisse

Revue suisse de Zoologie, 102 (4) : 853-867; décembre 1995

ZOOLOGIA 95
Zürich, 15-17 March 1995
(Annual Conference of the Swiss Zoological Society)

Interactions between genetics and ecology

MAIN CONFERENCES

A. Meyer (Dept. of Ecology and Evolution, State University of New York, Stony Brook, NY 11794-5245, USA): Examples of the use of DNA sequences in population biology and phylogenetics.

Morphology and molecules both should provide congruent information about the evolutionary history of organisms. In terms of ease of analyses, and data collection, molecular data have some advantages for phylogeny reconstruction over morphological data. Some of those advantages but also potential pitfalls of molecular data for the purpose molecular systematics are discussed. Our understanding of the phylogenetic relationships among vertebrates and the evolution of DNA, particularly mitochondrial DNA, has increased rapidly since the recent invention of the polymerase chain reaction (PCR). This cloning technique together with direct sequencing of PCR-amplified DNA has simplified and dramatically accelerated the accumulation of DNA sequence information for phylogenetic work. Methods of data collection and data analysis for phylogenetic studies on vertebrates with particular emphasis on fish and mitochondrial DNA are outlined. General aspects of the biology of mitochondrial DNA that pertain to phylogenetic reconstruction are reviewed and advantages of DNA sequences over alternative DNA-based genetic markers are highlighted. Examples of phylogenetic work based on mitochondrial and nuclear DNA sequences are used to illustrate the methods, advantages and potential problems with techniques, choice of genes and phylogenetic analyses. These examples dealt with (1) The evolution of cichlid fish species flocks in the East African lakes, (2) the systematics and evolutionary history of cetaceans based on DNA sequences, (3) the evolution of a sexually selected trait, the sword, in swordtail fishes (genus *Xiphophorus*) as inferred from a DNA-based phylogeny of the genus.

In each of these examples, DNA phylogenies resulted in different phylogenetic hypotheses than had traditionally been believed in. Potential reasons for the differences in the DNA-based and the traditional morphology-based phylogenies might have to do with morphological convergence and non-independence of morphological traits that had been used to construct the phylogenetic hypotheses. Those are potential phylogenetic pitfalls that are more easily dealt with in molecular than in morphological data sets. In the first case study the DNA data suggested, contrary to traditional assumptions, that the Lake Victoria and Lake Malawi cichlid species flocks are both monophyletic and hence morphological similarities found in both have independently evolved. In the phylogenetic study of the evolutionary history of whales it was concluded that baleen whales are the sistergroup to one group of toothed whales, the sperm whales. Based on the DNA-phylogeny we concluded that baleen whales are evolutionarily younger and all whales had a different evolutionary history than previously assumed. The sword of males in swordtail fishes, based on the DNA-phylogeny is likely to be as old as the preference of females to mate with males with swords. During the evolution of the species in this genus, the sword was probably lost and re-evolved twice independently. This interpretation is in conflict with the hypothesis that the sword evolved after the females "pre-exisiting bias".

W. Watt (Stanford). Allozymes in evolutionary biology: beyond the twin pitfalls of "neutralism" and "selectionism".

A. Pomiankowski (London). Continuous change in mate preferences.

H. Hofer (Seewiesen). Genes, behaviour and anatomy: female penises are an adaption for... what?

ABSTRACTS

SHORT PAPERS

A. Aebischer (Fribourg): Territory choice, mate choice and breeding success in the Savi's Warbler *Locustella luscinioides.*

We investigated how territory quality, settlement date and morphometry (size, weight, condition) affected the several components of yearly breeding success (mating success, clutch sizes and numbers, fledging success) in male and female Savi's Warblers (*Locustella luscinioides*) from a Swiss population.

Territories occupied by males differed from unoccupied sites of similar size and localisation by higher and denser reeds, an extensive straw litter and a thick cover of dead sedge leaves. Availability of suitable nesting sites seemed an important choice criterion. Territories that most closely matched this ideal were also the first chosen by males upon arrival from migration. These males however did not differ from those that arrived later on the basis of morphometry.

Male breeding success decreased with the date of territory occupancy, due to a decrease in mating success. Female breeding success decreased with the date of first-clutch laying, mainly due to a decrease in clutch numbers. Breeding success did not correlate with morphometry. Its positive correlation with territory quality was indirect, and mediated through their common dependence on occupancy date (males) and first-clutch laying date (females).

Our results thus provide clear support for territory choice by males, but not for mate choice, and show the crucial role played by settlement date on many important parameters of the breeding cycle of both sexes. We propose a parsimonious model to account for our observations, and discuss it with respect to the breeding biology of better-known warbler species.

P. Agnew (ETH Zürich): Sex ratio distortion in the mosquito *Aedes aegypti* caused by a microparasite.

B. Anholt (Zürich) & **R. Trembath** (Toronto): Predator induced phenotypic plasticity in tadpoles of *Hyla versicolor.*

Organisms often display variation in phenotype in response to variation in their environment. A classic example of this phenotypic plasticity is predator induced defenses. Larvae of anurans that breed in temporary ponds experience highly variable predation regimes and also display differences in phenotype that are correlated with predator presence. To test this possibility we raised larvae of *Hyla versicolor* in the presence and absence of caged dragonfly larvae. In the non-lethal presence of a predator, tadpoles developed brightly coloured as opposed to clear tails and the tails were deeper with thicker tail musculature. Observations of activity showed that animals were also less active in the presence of the predators. Measurements of burst speed could not distinguish between animals raised with and without predators. In predation trials, animals with the predator-induced phenotype had a higher probability of survival than the non-induced phenotype. It is not yet clear what disadvantages are associated with the predator-induced phenotype. Two possibilities are reduced competitive ability, and susceptibility to other, perhaps avian, predators.

C. Bender (Johann Wolfgang Goethe-Universität, Zoologisches Institut, Siesmayerstr. 70, D-60054 Frankfurt a.M.): Demographic and genetic studies in isolated populations of wall lizards.

The wall lizard, *Podarcis muralis*, inhabits locations which are considerably influenced by human activities. During the past decades most populations became reduced or isolated in Central Europe, where the species is considered endangered. In fact, population reductions followed by habitat destruction may lead to loss of genetic variation, with possible negative consequences on the demography and survival of these populations.

In the present study, wall lizard populations sizes were estimated. Several populations of *Podarcis muralis* were examined for genetic variability, using PCR based RAPD fingerprinting. Based on data from one population of approximately 100 specimens, a computer model has been developed, predicting an average survival time of ca. 36 years. Because differences in population size may have consequences for genetic structure of the populations, future management efforts should incorporate demographic, as well as genetic information.

L.F. Bersier, G. Sugihara & A. Hobday (UC San Diego): A correspondence between two classical notions of community structure: species abundances and dendrograms of niche similarities.

We examined a possible relationship between two different descriptions of community structure. The first is the niche overlap dendrogram that describes the ecological similarities of species and groups or guilds of species. The second is the pattern of the relative abundances of those species. Specifically, we shall examine the particular way in which this relationship follows from the niche hierarchy model. This model can be viewed either as sequential invasions of species or, more generally, to represent hierarchical organization of the kind represented in the dendrogram, we shall focus here on this latter aspect of community structure. Viewing the model in this way, the organization of the community is reckoned to be self-similar, with individual species partitioning resources in the same way that large sets of species partition resources. Moreover the organization is hierarchical in the exact sense depicted by the niche overlap dendrogram. The physical metaphor for this type of self-similar decomposition is a sequential, binary, breakage process applied directly to abundances, or population biomasses. Thus one can imagine the total biomass of species in a community that is sequentially divided so that break points correspond to the branching structure in niche similarities. We tested two predictions of this model using studies that provide both dendrograms and relative abundances. First, we showed that the relative abundances at the break points differ significantly from what one would predict if the actual abundances were allocated at random to the known dendrogram. Second, we showed that species residing at terminal branches of the dendrogram that are highly split (more highly subdivided lines) are on average less abundant than species from branches that are less highly subdivided.

U. Bircher, H. Jungen, R. Burch & E. Hauschteck-Jungen (Zürich): Multiple morphs of sperm were required for the evolution of the Sex Ratio trait in *Drosophila*.

In Sex Ratio males of *D. subobscura* Y sperm degenerate. Nevertheless, Sex Ratio males can produce as many offspring as non-Sex Ratio males. In order to find an explanation for the high number of offspring of Sex Ratio males we analysed spermatogenesis and sperm storage in females. Because *D. subobscura* has two morphs of sperm, short and long ones, we connected the sperm heteromorphism with the Sex Ratio trait in this species.

Spermatids of both lengths developed simultanously in the testes. The first mature sperm produced by a young male were nearly all short sperm. This result indicates that short cysts need less time to mature than long cysts. Thus in a given time more short than long cysts can mature. In the testes of Sex Ratio males more short cysts on the cost of long cysts were formed than in testes of non-Sex Ratio males. Thus in a unit time Sex Ratio males can produce as many or more sperm than non-Sex Ratio males.

Females mated to Sex Ratio males have more sperm in their storage organs than those which mated to non-Sex Ratio males. From the sperm transfered females stored selectively more long than short sperm after mating to a Sex Ratio male than after mating to a non-Sex Ratio male.

The effect of the high amount of sperm in Sex Ratio males is twofold: the loss of Y sperm is compensated, and probably in nature a second copulation is prevented by the complete filling of the female storage organs.

From these results we conlude that the arising and persistence of the Sex Ratio trait in natural populations depends on the presence of sperm heteromorphism.

M. Chapuisat (Lausanne): Number of matings, genetic relatedness and population viscosity in polygynous *Formica* ants.

Estimating genetic relatedness among nestmates is important to assess the role of kin selection in the evolution of social behaviour. In social insects, intranest genetic relatedness is shaped by the reproductive structure of the colony, particularly the number of reproducing individuals, and by the local population structure.

I studied number of matings, intranest genetic relatedness and local population genetic structure in *Formica lugubris*. This red wood ant has hundreds of queens per nest, and therefore genetic relatedness is expected to decrease to virtually 0. I used microsatellites, which are highly polymorphic DNA markers well suited for this kind of detailed studies.

Mother-offsping analyses and direct typing of the sperm stored in the spermatheca of the queens revealed that about one fifth of the queens did mate multiply. This low level of multiple mating, corresponding to an effective mate number of 1.15, will have little effect on the kin structure of the colony.

Genetic relatedness among nesmate workers, measured over a sample of 20 nests along a 1.2 km transect, was 0.17 ± 0.04. This value is surprisingly high given the high number of queens per nest, but a positive inbreeding coefficient (Fis = 0.07 ± 0.03) indicates that local population structure and/or inbreeding boost this relatedness estimate.

The microgeographic population structure is viscous, with a positive correlation between geographical distance and genetical differentiation. This local population structure is probably due to dispersal by nest budding and restricted gene flow between existing nests.

O. Daniel (ETH Zürich): Earth worms and soil fertility.

P. Flook (Zoologisches Institut der Universität Basel): Sequence Variation in Orthopteran Mitochondrial Ribosomal RNA Genes.

Sections of the large and small subunit mitochondrial ribosomal genes have been sequenced in over eighty species of Orthoptera. The taxonomic sample contains representatives from nearly all of the caeliferan families and two thirds of the subfamilies of the large family Acrididae, as well as representatives of Ensifera, Phasmida and Grylloblattodea. The wide range of divergence dates between the different taxa presents a good opportunity to examine patterns of sequence variation in the mitochondrial rRNA genes and the findings of a comparative analysis of primary and secondary structures are presented. The results indicate that these sequences are useful for reconstructing deep levels of phylogeny, though filtering of the sequences is necessary in order to remove sites where multiple hits have occurred. The application of this information to phylogeny reconstruction is also demonstrated.

A. Freitag (Lausanne): Ants availability and the decline of the Wryneck in Switzerland.

Beginning of the fifties, populations of the wryneck (*Jynx torquilla* L., Picidae) showed a steady decrease in Europe and particularly in Switzerland (Glutz von Blotzheim & Bauer, 1980). This bird, who is the only migrant species of the Picidae family in Europe, is mostly dependent on ants (mainly larvae and pupae) of the genera *Lasius*, *Tetramorium*, *Myrmica* and *Formica* for rearing his progeny (Hölzinger, 1992; Bitz & Rohe, 1993). Two hypotheses are proposed to explain this decline: the first one postulates that due to agricultural practices within the foraging territory of the bird (who is living in agricultural areas like orchards, meadows with scattered trees) ant populations also declined gradually. The second one assumes that ant populations are not declining but food accessibility is reduced because epigaeic nests are rare. Before testing these hypotheses, we have studied the diet of the wryneck in two areas. Preliminary results are presented and discussed.

References:

BITZ, A. & ROHE, W., 1993. Nahrungsökologische Untersuchungen am Wendehals (*Jynx torquilla*) in Rheinland-Pfalz. *Beih. Veröff. Naturschutz Landschaftspflege Bad.-Württ.* 67, 83-100.

GLUTZ VON BLOTZHEIM, U.N. & BAUER, K.M., 1980. Handbuch der Vögel Mitteleuropas. Bd 9: Columbiformes - Piciformes. - 1148 p., Wiesbaden.

HÖLZINGER, J., 1992. Zur Nestlingsnahrung des Wendehalses (*Jynx torquilla*). *Beih. Veröff. Naturschutz Landschaftspflege Bad.-Württ.* 66, 47-50.

B. Hägele & M. Rowell-Rahier (Université de Neuchâtel, Institut de Zoologie, rue Emile Argand 11, 2007 Neuchâtel): The performance of three generalist herbivores in a single/mixed diet treatment.

The generalist herbivores *Miramella alpina* (Caelifera, Acrididae), *Callimorpha dominula* (Lepidoptera, Arctiidae) and *Cylindrotoma distinctissima* (Diptera, Tipulidae) all differ in mobility and crypsis. For their last instar five groups of twelve individuals were reared on five different single food plants and one group of twelve individuals was reared on a mixture of these food plants. For each individual growth rate, duration of last instar, consumption rate, digestibility of food and the efficiency of conversion of digested food was calculated and compared between experimental groups. All three herbivores performed best when they could feed on a mixture of plants. For certain performance parameters however some single plant groups performed nearly as good as the mixed diet group. Evidence for detoxification costs could only be found for three plant species in *C. dominula*. Neither the nutrient complementation hypothesis nor the noninteractive toxin hypothesis alone could explain the outcome of the experiment. A combination of both hypotheses could explain the results for *M. alpina*, but still failed to explain all results for *C. dominula* and *C. distinctissima*.

L. Heer (Zool. Inst. Univ. Bern, Ornitho-Ökologie, Prof. U. Glutz von Blotzheim; Zell- und Entwicklungsbiologie, Prof. D. Schümperli): Cooperative Breeding by Alpine Accentors (*Prunella collaris*): Polygynandry, Territoriality and Parentage.

The composition of breeding groups, territoriality, parentage and parental care were examined in a population of Alpine Accentors in the Swiss Alps. Five (1993) to six (1994) breeding groups were located on a southward hillside between 2500 and 2850 m above sea level. 3-5 males had almost fully overlapping territories, wherein 2-3 females hold their exclusive territory (separate nesting, polygynandry). Males competed in long and intense chases for the access to fertile females within their group territory. The females copulated promiscuously with all or several males of the same breeding group. The α- and β-males had more access than other subordinate males. They combined frequent copulations and mate guarding as types of paternity guards. The female performed most of the parental care. 1-4 males helped feeding the young. Results of DNA-profiling showed that members of one group were seldom closely related. In three out of five sampled broods, multiple paternity occurred with up to three males siring offspring within one clutch.

B. Imhoof & P. Schmid-Hempel (Zürich): Within-Host Dynamics of a Single-Celled Parasite (*Trypanosomatidae*) in the Intestine of the Bumblebee *Bombus terrestris*.

One of the predictions from theory of virulence is that a fast growing parasite should be more virulent than a slowly growing one. Also, parasites occurring in mixed infections should display different dynamics than parasites occurring singly inside a host.

To test these hypotheses bumblebees (*Bombus terrestris*) of four different colonies were infected with the Tripanosome *Crithidia bombi*: one group with a fast growing strain, one group with a slowly growing strain, a further group with both strains and one group was left uninfected as a control. The bumblebees were kept individually for 22 days, faeces were sampled every second day and the number of *Crithidia* cells in these samples were counted.

An infection developed to a peak level between 4-6 days after infection and decreased to zero around day 16-18. However, the course of the infection was not significantly different among the different treatments but differed among colonies. Neither "treatment" nor "colonies" had a significant effect on the lifespan of the bumblebees.

These findings suggest that *Crithidia bombi* generally is not a virulent parasite. Probably because it has to assure the production and mating of young infected queens, as well as their survival of hibernation and egg-laying, to start a new colony next spring. The virulence of *Crithidia bombi* does not seem to depend on its growth rate. Furthermore, it seems that its within-host dynamics could depend on the genetic background of the host.

P. Jeanneret (Station fédérale de Recherches agronomiques de Changins, 1260 Nyon): Landscape influence on insects flying at the interface between two ecosystems.

Landscape quality and structure should be an important factor to explain insects distribution and activity, at a regional (e.g. 20km^2) or local sécale (e.g. 1km^2). The measurement of faunal exchanges occuring between an agroecosystem and its surrounding habitats is relevant to test landscape influence on it. In addition, management practices of the cultivated landscapes may be an important factor influencing the exchanges between ecosystems. The activity of tortricids (Lepidoptera), flying between apple orchards and their surrounding habitats were used to test this hypothesis in the region of Nyon - La Côte. A Malaise trap was placed on each of the North, East, South and West margins of six apple orchards of two types (three were managed with an integrated pest control program and three were abandonned for many years). Two collectors were placed on top of the traps to separate emigrant from immigrant individuals. From the beginning of Jjune to October 1992 and 1993, 48 samples were collected on 14 successive weeks. There were a high similarity (Mantel test) between emigrant and immigrant tortricid captures, if they were caught by the same Malaise trap (Jeanneret and Charmillot, 1995). We conclude that there were neither emigration nor immigration but an activity of tortricids at the interface of habitats.

The hypothesis of the landscape influence on tortricids activity at the interface was tested at two scales. The first concerned the proximate surroundings of the orchard and the second the distant surroundings (300m). Proximate and distant surroundings were assigned to 6 categories including woodland, vineyard, cereal crop, orchard, garden and meadow. At both scales, multivariate analysis (Correspondence analysis, Canonical correspondence analysis) and associated statistics (multiple regression and canonical coefficients, Monte Carlo permutations test), showed that landscape explained a significant part of the variation of tortricids caught at the interface between both types of apple orchards.

M. Katoh & G. Ribi (Zürich): Genetic variation of sympatric and allopatric populations of hybridizing freshwater snail species.

We studied genetic structure of sympatric and allopatric populations of hybridizing freshwater snail species *Viviparus ater* and *V. contectus* in central Europe. Six allozyme loci which were informative in Lake Garda, Italy in the previous study (*bGAL*, *GPI*, *MDH-1*, *PGM*, and *PNP* were diagnostic between the two species and PGDH was highly polymorphic in *V. contectus*) were analyzed from nine sympatric populations and four allopatric populations each for the two species. A total of 900 newly collected snails from Italy, Switzerland, and Germany was examined electrophoretically. *V. ater* had low genetic variation (the jacknifed mean of Wright's F_{ST} ± S.E. over four loci was 0.041 ± 0.004), and *contectus*-like alleles were found at low frequencies in both allopatric and sympatric populations. On the other hand, V. contectus showed high genetic differentiation especially at four loci (*GPI*, *PGM*, *PGDH*, and *PNP*; the jacknifed mean of F_{ST} ± S.E. over the six loci was 0.546 ± 0.166), and no clear differences between allopatric and sympatric populations were observed. These results indicate that high allelic substitution rates in *V. contectus* seem to be responsible for the high genetic differentiation. The high substitution rates can be obtained by high mutation rates, introgression, or small population sizes.

S. Knoll & M. Rowell-Rahier (Neuchâtel): Population structure of *Oreina cacaliae* (Coleoptera, Chrysomelidae).

The population structure of *O. cacaliae* was investigated by means of allozyme-electrophoresis. The sampling was done in a hierarchical design, patches within localities (distances < 5km), localities within regions (distances 20 - < 400 km) and regions within the western species range (from the Pyrenees to Czechia). Analyses of 23 presumptive loci encoded by 17 enzyme system revealed that most differentiation already occurs between patches (hierarchical F-statistics, F_{ST} =0.121 between patches compared to an F_{ST} of 0.042 between localities and of 0.036 between regions). Correlation of genetic distances (Nei's genetic distance) with geographical distances was weak, but significant. Nm (as an indirect measure of gene flow) calculated from F_{ST} and from private alleles was smaller than 1, suggesting restricted gene flow. In summary, *O. cacaliae* shows considerable genetic differentiation at a very small scale with evidence for restricted gene flow and isolation by distance.

B. Koch (Zool. Museum Universität Zürich-Irchel, 8057 Zürich): Immigration and Emigration in a Population of Dippers *Cinclus c. aquaticus*

From November 91 to October 93 the population dynamics of the Dipper *Cinclus c. aquaticus* was investigated in the Sihltal near Zürich, Switzerland. The total number of individuals changed seasonally. The density varied from 2.7 ind./km at breedingtime to 5.0 ind./km in winter. The sex ratio was 1.63 males to 1 female. 56% of the immigrating and emigrating Dippers were juveniles. Females started migrating earlier and moved further than males.

C. König and P. Schmid-Hempel (ETH Zürich): Immunocompetence and foraging activity in bumble bees, *Bombus terrestris* L. (Hymenoptera Apidae)

A general assumption of host-parasite interactions is that resistance is costly.

We tested in our experiments whether foraging activity by workers of the bumble bee, *Bombus terrestris* L., is costly in terms of resistance against a parasite. Specifically, we investigated the cellular immune response of the bumble bees against an artificial parasite inside the hemocoel. We prevented some workers from foraging by clipping their wings. These workers had a higher immune response then the unmanipulated workers.

A. Köpf and N. Rank (Experimental Ecology, ETH Zürich, ETH Zentrum - NW, 8092 Zürich): Species boundaries and geographic variation in host use.

Allopatric populations of the two leaf beetle species *Phratora tibialis* and *Ph. polaris* (Col.: Chrysomelidae) are specialized on two different willow hosts. *Ph. tibialis* is described to feed exclusively on *Salix purpurea* throughout Central Europe, a willow species that does not occur in Scandinavia. *Ph. polaris* is usually found on *S. phyllicifolia* in Scandinavia.

However males and females from different populations from both species mate readily when given the change and in 3 way choice tests the variability in host preference is large in all populations.

Morphological comparisons and sequence data from a mitochondrial gene are currently being gathered to clarify the host use patterns and the status of both species.

H. Krättli & M. Haffner (Zoologisches Museum der Universität Zürich, Winterthurerstrasse 190, CH-8057 Zürich, Schweiz): Comparative morphological and microanatomical investigations on the integument of the feet of the edible dormouse *Glis glis* Linné and the laboratory rat *Rattus norvegicus* Berkenhout.

Because the integument of the feet has direct contact to the ground, it is expected to be adapted to an animal's locomotion. We have chosen two representatives of Rodentia habitating completely different living spaces, and used gross morphology and microanatomy on their feet to find functional adaptations. While the laboratory rat as a typical terrestrial animal is moving on a mainly horizontal ground, the climbing edible dormouse is a typical inhabitant of trees. Our investigations were restored by observations and simple experiments in enclosures in the edible dormouse.

Locomotion on inclined branches requires a bigger frictional force F than on horizontal ground to avoid slipping. Frictional force F can be increased by increasing the coefficient of static friction μ or by increasing the normal force N, because $F = \mu * N$ (Amotons' first law). In the edible dormouse we found several adaptations which increase these parameters. In comparison with the laboratory rat the footpads of the edible dormouse are large and densely arranged and dimensionally unstable with numerous, specially arranged epidermal ridges on their surfaces and abundant eccrine glands, whereby the coefficient of static friction μ is increased. Frictional force can also be increased by the force of adduction, if the diameters of the climbed branches allow to be gripped with the extremities. To avoid problems on balancing on thin branches the first and the fifth digit of the hind foot can be splayed and a giant double-pad on the forefoot and an enlarged first tarsal pad project out of the remaining sole of the feet and increase therefore the area of contact against the ground. In comparison with the rat the small, pointed claws of the edible dormouse are used for climbing on plain vertical surfaces, fast locomotion and jumping to eliminate the increased force of repulsion in these situations. The revolved points of the second and third claw of the hind foot are used as climbing hooks on round branches.

In both species the forefeet are adapted to manipulate food for example. Because the pads opposite to the digits contain muscles and cartilage, they are an abutment against the force of the gripping digits.

R. Maurer (Laboratoire d'éthologie, Genève): Connectionist modelling of behavioural data: the example of path integration.

The modelling of behaviour has traditionally been grounded on mathematical primitives. In spite of the success of some such models, they have one inherent limitation: they are more a description of the process to be modelled, than an explanation for it. The trouble lies in the discrepancy between the building blocks of the models (functions) and those of behaviour (which may more adequately be described by neural primitives).

The relatively recent theoretical framework of neural networks provides a new set of primitives for modelling. Coming in different flavours, some of them including genetic (mutation/selection) algorithms, this framework may give, in a number of cases, new answers to (or at least insights into) why behaviour displays particular properties. The target domains for connectionist modelling include topics as widely different as signal processing in the retina, place navigation in rats, or female preference for symmetrical males.

A simple example is discussed here, which pertains to path integration (the process by which an animal uses self-generated signals to keep track of its position). We created limited-power neural networks that had to compute path integration for a simulated animal. The way the networks configured themselves in order to realize the computation reflects theoretical findings about path integration; and the computation, when carried out by the simulated animals, resulted in a pattern of errors reminiscent of those we had observed in real hamsters.

M. Moeckli & M. Haffner (Zoologisches Museum Universität Zürich-Irchel, Winterthurerstr. 190, CH-8057 Zürich): Grobmorphologische und histologische Untersuchungen der Mundschleimhaut im Vertibulum oris einheimischer Fledermausarten (Mammalia, Chiroptera).

Für einzelne Individuen aus verschiedenen Fledermausarten wurde eine bilateralsymmetrische, polsterartige Struktur im Vestibulum oris beschrieben, die je nach Autor und der von ihm untersuchten Fledermausart verschieden benannt wurde. In der vorliegenden Arbeit wurde mit grobmorphologischen und histologischen Methoden eine vergleichende Untersuchung über das Vorkommen, die Grobmorphologie und die Mikroanatomie dieses "Buccal pad" bei männlichen *Myotis myotis*, *Pipistrellus pipistrellus*, *Nyctalus noctula*, *Vespertilio murinus* und *Plecotus auritus* durchgeführt. Es zeigte sich, dass alle untersuchten Vertreter der Gattungen *Pipistrellus*, *Nyctalus* und *Vespertilio* ein "Buccal pad" besitzen, während es den bisher untersuchten Vertretern der Gattungen *Myotis*, *Eptesicus* und *Plecotus* fehlt. Der Aufbau des "Buccal pad" ist bei allen Arten im wesentlichen identisch. Es handelt sich um einen Bereich der Mundschleimhaut, der durch Vergrösserung des Stratum germinativum und durch Einlagerung von Lipiden in die Zellen des Stratum superficiale eine spezielle sekretorische Funktion ausübt. Von rostral nach caudal erstreckt sich das "Buccal pad" von der Höhe des letzten Prämolaren bzw. ersten Molaren bis auf die Höhe bzw. einige µ hinter den letzten Molaren. Caudal stülpt es sich von der Mundhöhle weg in das umgebende Gewebe ein. Aufgrund verschiedener Hinweise wird eine olfaktorische Funktion des "Buccal pad" in Betracht gezogen und ein Zusammenhang mit dem Balzverhalten und der Partnerfindung und -wahl, im Sinne einer individuellen Erkennung, vermutet.

C. Mühlhäuser, W. Blanckenhorn & P.I. Ward (Zürich): The genetic component of copula duration in the yellow dung fly.

We assessed the heritability of copula duration (h^2=0.39) plus its genetic covariances and the heritability of body size (h^2=0.76), development time (h^2=0.23) and fluctuating asymmetry (h^2=0.00; n.s.) in the yellow dung fly *Scathophaga stercoraria* (*L.*) using full sibling analysis. The relative order of magnitude of the values agrees with that of other data: morphological>behavioural>life history characters. No genetic variation of fluctuating asymmetry, which is often interpreted as the degree of developmental instability, suggests strong canalisation. Triply repeated measures of copula duration for each male revealed a general increase with date or age. The individual pattern of this change ("flexibility") in copula duration, an expression of phenotypic plasticity, was itself heritable (h^2=0.19). Significant positive phenotypic and genetic covariance was only evident between flexibility of copula duration and body size, and between flexibility of copula duration and copula duration itself. All other correlations were nil, including that between development time and body size and that between copula duration and body size. We suggest that in *S. stercoraria* populations there is some averaging stabilizing selection towards a mean optimal copula duration which can serve as a behavioural "rule of thumb". At the same time, there is selection for phenotypic plasticity that allows the individuals to adapt their behaviour to their immediate environment. Both effects together are consistent both with the assumptions of optimality models and the classic results on copula duration in yellow dung flies.

J. Pawlowski*, I. Bolivar*, J. Fahrni*, L. Zaninetti* & J.P. Debenay**: (*Département de Zoologie et Biologie Animale, Université de Genève; 154, route de Malagnou, CH-1224 Chêne-Bougeries; ** Laboratoire de Géologie, Université d'Angers, 49045 Angers Cedex, France): Taxonomy of the Foraminifera *Ammonia*: a molecular approach.

DNA was extracted from living foraminifera belonging to the genus *Ammonia* and identified as *A. parkinsoniana*, *A. tepida*, *A. beccarii*, and *A. batava*. The cells were collected at Camargue and Vendée (France), North Harbour (Long Island, USA), Hamana Lake (Japan), and Plimoth Sound (England).

A 5'-terminal fragment of the large subunit ribosomal DNA (LSU rDNA) was amplified by PCR using specific *Ammonia* primers. The region of about 400 nucleotides, corresponding to the LSU rDNA divergent domain D1 was sequenced and analysed. According to the ribosomal sequences the specimens identified as *A. beccarii* and *A. tepida* form a group composed of several genetically different "species". Taxonomic identification of these "species", based on morphological characters and sequence data, is proposed. The phylogenetic relationships of these "species" and other *Ammonia* species are examined.

J. Pawlowski*, I. Bolivar*, J. Fahrni*, L. Zaninetti*, H. Kitazato & M. Tsuchyia**** (*Département de Zoologie et Biologie Animale, Université de Genève; 154, route de Malagnou, CH-1224 Chêne-Bougeries; **Institute of Geosciences, Shizuoka University, Oya, 836, Shizuoka 422, Japan): Taxonomc revision of some Glabratella (Forminifera) based on the sequence of LSU rDNA divergent domain D1.

DNA was extracted from 14 different morphotypes of *Glabratella* spp., including *G. erecta*, *G. elegantissima*, *G. patelliformis*, *G. nakamurai*, and *G. opercularis*. The cells were collected on the French littoral zone of the Mediterranean Sea and on the coast of the Japanese Islands. A 5'-terminal fragment of the large subunit ribosomal DNA (LSU rDNA) was PCR-amplified using specific foraminiferal primers, then sequenced.

In examined species, the analysis of D1, the divergent domain of the LSU rDNA shows a genetic similarity between *G. elegantissima* and *G. patelliformis*. It allows also to identify the morphotypes representing the sexual and asexual life cycle generations; of each species and to determine the seasonal morphological variations. This study of each species and to determine the seasonal morphological variations. This study demonstrates that the ribosomal DNA sequences can be used for identification of foraminifera species, providing a new taxonomic criterion which is independent from the morphological characters of the tests.

M. Pfenninger & B. Streit (Zoologisches Institut, Johann Wolgang Goethe Universität, Siesmayerstr. 70, D-60054 Frankfurt am Main): The impact of habitat-size, life-history and mobility on the genetic structure of populations of *Trochoidea geyeri* (Helicidae, Gastropoda).

T. geyeri (Soós, 1926) is a small, endangered terrestrial gastropod of the subfamily Helicellinae. We have investigated the genetic structure of two different sized populations by the use of RAPD-fingerprinting. The genetic structure seems to be determined by ecological factors, especially life-cycle, mobility and habitat-structure. The habitat-size showed no effects on the genetic variability of the two populations investigated.

G. Ribi (Zoologisches Museum, Winterthurerstr. 190, 8057 Zürich, Switzerland): Barriers to gene flow between the hybridizing freshwater snails *Viviparus ater* and *V. contectus*.

Allozyme patterns of *Viviparus* ater and *V. contectus* in Lake Garda, Italy, are consistent with the hypothesis of introgression in both directions. Here I present data on several mechanisms influencing the amount of introgression going on, such as hybrid fecundity, species assortative mating or differential fertilization of eggs. In captivity, *V. ater* and *V. contectus* produce hybrids with a male biased sex ratio (84% males) and a high survival rate (99% in the first year). Hybrids are fertile inter se and in backcrosses with both parental species. Most backcrosses have a high fecundity (50-100% of intraspecific control crosses), and backcross offspring have a 1:1 sex ratio and a survival rate of >80% in the first year. Heterospecific matings are frequent in nature. Preliminary results of an interspecific sperm competition experiment indicate that *V. contectus* sperm have only a slight disadvantage in fertilizing *V. ater* eggs as compared to *V. ater* sperm. All these results taken together would suggest that interspecific hybrids should be common at places where the two species coexist. However, hybrids are rare in nature (<1%). The possible role of segregation in space or time as isolating mechanisms is discussed.

C.H.F. Rowell & P. Flook (Basel): The phylogeny and classification of the Caelifera (Orthoptera): first results of a molecular systematic investigation.

We have used the 12S and 16S mtrRNA genes of some 80 taxa from 37 different subfamilies to construct a preliminary phylogeny of the caeliferan Orthoptera (short horn grasshoppers and their allies) at the subfamily level. The results support at the superfamily level one of the standard morphological classifications, viz. Tridactyloidea (Tetrigoidea (Eumastacoidea (Pneumoroidea (Pamphagoidea (Acridoidea))))). The traditional grouping of the sampled genera into subfamilies or families is also largely confirmed. The Eumastacoidea is probably paraphyletic; its different lines are genetically distant from each other, suggesting old, well differentiated families. The Pamphagoidea also appears to be a paraphyletic grouping; the Pyrgomorphidae is the oldest branch, the Pamphagidae more recent, while the Lentulidae may be polyphyletic. The Acridoidea sensu strictu is monophyletic, but the divergence of the different taxa within it is mostly poorly resolved. This may indicate either that the mtrRNA genes are unsuitable for this purpose, or that the Acridoidea underwent a very rapid early radiation.

L. Rüber[1] **& E. Verheyen**[2] ([1]Zoological Museum of the University of Zürich; [2]Royal Belgian Institute of Natural Sciences, Brussels): Convergent evolution of trophic specializations within the endemic Tanganyikan cichlid tribe Eretmodini, inferred from mtDNA sequences (Pisces: Cichlidae).

The Tanganyikan cichlid species flocks contain more than 170 species assigned to 49 genera and represent one of the most spectacular examples to study the evolutionary mechanisms involved in adaptive radiation and 'explosive' speciation among living vertebrates. Based upon morphological features, these species assemblages have recently been classified into 12 tribes. In an attempt to unravel the phylogenetic interrelationships among and within these tribes a number of recent studies implement molecular techniques, mainly mtDNA sequencing, to study the rates and modes of speciation within these speciesassemblages.

Two mitochondrial gene segments from 51 Eretmodini specimens from 32 localities were amplified and direct sequenced. The obtained mtDNA phylogeny is in partial conflict with the current generic classification of the Eretmodini that is mainly based on dental morphology. In contrast to previous studies the present data suggest that the species originally assigned to the three genera *Eretmodus*, *Spathodus* and *Tanganicodus* represent more than three genetically and morphologically distinct lineages that show a high degree of intralacustrine endemism. Our data suggest that the taxonomy of the Eretmodini should be reinvestigated and that in this tribe, trophic specializations may be particularly prone to convergent evolution.

F. Saucy & J. Studer (Fribourg): Preference for acyanogenic white clover in the vole, *Arvicola terrestris*.

A strong emphasis has been recently put on the potential role of plant secondary metabolites as a force driving the population cycles exhibited by small rodents. In this study we focus on the reciprocal interactions between the vole, *Arvicola terrestris*, and white clover, *Trifolium repens* (one of the few preferred food items of the vole). The production of cyanogenic glycosides (liberating HCN when the plant is attacked) as a defence against various herbivores (insects, slugs, snails and mammals) is controlled by a single genetic system involving two genes. The maintenance of a polymorphism for cyanogenesis in natural populations of white clover is poorly understood and could be maintained by a selective pressure of herbivores on different cyanotypes. In this study, we report a marked preference of the voles for an acyanogenic white clover cultivar which was preferentially eaten during tests conducted in cages and in outdoor enclosures. Preliminary field data gathered under low and high vole population densities are also presented.

V. Séguinot (Laboratoire d'éthologie, Genève): Path integration across species: mechanism and ecological implications.

Path integration (or dead reckoning) is an innate navigational strategy by which an animal that has left some known place (generally its nest or a food source) can return to the starting-point of its trip. Being entirely based on signals self-generated during locomotion, this process occurs whether or not visual landmarks or a directional reference from the environment can be used.

Although path integration has been evidenced both in invertebrates and vertebrates, little is known concerning the mechanism that lies at the core of this short-distance navigation system in animals and humans. Since biological systems do not work with infinite precision but involve errors, one possible way to investigate the rules of the mechanism of path integration is to analyse the nature and the shape of its errors. Biases observed after an asymmetrical (e.g. L-shaped) journey are discussed.

Moreover, random and systematic errors alike provide us with some hints about the functional aspects of the mechanism underlying path integration: ecological implications are proposed. Indeed, the fact that errors are a widespread phenomenon among species and that there was no selective pressure to correct them leads us to consider such errors as being the result of adaptative selection.

R. Spaar (Schweizerische Vogelwarte, Sempach): Flight behaviour of Steppe Buzzards (*Buteo buteo vulpinus*) during spring migration in Southern Israel.

Raptor migration was studied in Israel by tracking radar in the Arava Valley near Hazeva (150 m below sea level) and in the Negev Highlands near Sede Boqer (470 m above sea level). Entire gliding and soaring phases were recorded. The flight altitude of the Steppe Buzzards *Buteo buteo vulpinus* depended on the time of day. It increased from morning (first birds were tracked at about 8 a.m.) until mid afternoon when maximum altitudes, about 2000 m above ground level in the Arava and 1000 m in the Negev, were reached. Flight altitudes decreased only during the last two hours before sunset. Migration was lifted slightly higher above ground and lasted longer towards sunset in the warmer Arava Valley than in the Negev Highlands. The relatively low mean climbing rate while soaring in thermals of 2 m/s can be explained by the fact that the whole diurnal circle is included in this average and that the observation sites were not situated at the edge of large rocky slopes, where strong thermal updrafts occur, but rather on flat surfaces. Climbing rates ranged from 0.5 up to 4.5 m/s. Strong thermals were used longer for soaring than weak ones. The climbing rate in thermals was a decisive trait when explaining the flight behaviour of migrating Steppe Buzzards: the flight altitude, the airspeed while gliding, and consequently the cross-country speed increased with increasing climbing rate. Thus, the birds adjusted the airspeed while gliding to the actual climbing rate in order to maximise the cross-country speed. The average cross-country speed was 9.8 m/s and was considerably enhanced by tail wind.

H.-P. Stauffer, P. Schmid-Hempel (ETH Zürich): Parasitic larvae of conopid flies alter flower choice of Bumblebees.

Bumblebees (Apidae, Hymenoptera) are among the most important pollinators of crop plants. They are also host of a wide range of parasites. In the study presented here, we show that the flower choice of bumblebees is affected by the larvae of the parasitoid conopid fly (Conopidae, Diptera), which develops in the abdomen of bees. We offered unparasitised and parasitised bumblebees different plant species in cages, and noted the behav iour and flower choice of the bees. Parasitised bees visited the most common plant species *T. pratense* (Fabaceae) less often than unparasitised ones. it might be that the parasite impairs the sensory capabilities of the bees or that parasitised bees avoid *T. pratense*, because of its complex morphology.

L. Sundström (University of Bern, Ethologische Station Hasli, Wohlenstrasse 50a, 3032 Hinterkappelen): Sex allocation in ants - the impact of kinship and environment.

Hamilton's rule and the concept of inclusive fitness provide a theoretical basis for predicting reproductive characteristics of social insect colonies. Conversely sex allocation studies in social insects can be used to test inclusive fitness theory itself, the most powerful test being the analysis of individual colonies where the predicted sex allocation varies due to differences in worker fitness functions. The optimal sex allocation ratios may differ for queens and workers, causing a worker-queen conflict over sex allocation. The degree on conflict is highest in colonies headed by one singly mated queen and decreases with the presence of multiple queens as well as multiple mating of queens. However, also other factors, such as differential dispersal of the sexes and variations in resource availability, can affect sex allocation. This study analyses simultaneously the impact of kin structure, colony productivity and mating pattern on sex allocation under high vs low levels of worker-queen conflict. The results show that the kin structure is the main (but not the only) determinant of sex allocation under high levels of worker-queen conflict, whereas ecological factors best explain the allocation pattern under low levels of conflict.

C. Wedekind°, M. Chapuisat°°, E. Macas* & T. Rülicke** (°Abt. Verhaltensökologie, Zoologisches Institut, Universität Bern, 3032 Hinterkappelen; °°Musée Zoologique and Institut de Zoologie et d'Ecologie Animale, Université de Lausanne; *Departement für Frauenheilkunde, Universitätsspital Zürich; **Biologisches Zentrallabor, Universitätsspital Zürich): Condition-dependent choice for MHC combinations during fertilization in mice.

One evolutionary explanation for the success of sexual reproduction assumes that sex is an advantage in the coevolutionary arms race between pathogens and hosts. Accordingly, an important criteria in mate choice and maternal selection thereafter is expected to be the allelic specificity on polymorphic loci involved in parasite-host interactions, e.g. the MHC (major histocompatibility complex). The MHC has been found to influence mate choice and selective abortions in mice. However, it could also influence the fertilization process itself, i.e. 1) the oocyte's choice for the fertilizing sperm and 2) the outcome of the second meiotic division after the sperm has entered the egg. We tested both hypotheses in an *in vitro* breeding experiment with two inbred mouse strains congenic for their MHC. The genotypes of the resulting blastocysts were determined by polymerase chain reaction. We found non-random MHC combinations resulting from both possible choice mechanism. The outcome changed over time, indicating that choice for certain MHC-combinations is influenced by one or several conditional factors, too.

C. Wedekind°, T. Seebeck*, F. Bettens# & A. J. Paepke° (°Abt. Verhaltensökologie, Zool. Institut, Universität Bern, 3032 Hinterkappelen; *Institut für Allg. Mikrobiologie, Universität Bern; # Institut für Immunologie und Allergologie, Inselspital Bern): MHC-dependent mate preferences in humans.

One substantial benefit of sexual reproduction could be that it allows animals (or humans) to rapidly react to a continuously changing environmental selection pressure such as coevolving parasites. This counteraction would be most efficient if the females were able to provide their progeny with certain allele combinations on loci which may be crucial in the parasite-host arms race, e.g. the MHC (major histocompatibility complex). Here, we show that the MHC influences both body odours and body odour preferences in humans, and that the women's preferences depend on their hormonal status. Female and male students were typed for their HLA-A, -B and -DR. The men weared a T-shirt during two nights. On the following day, the women were asked to judge the odours of six T-shirts each. They scored male body odours as more pleasant when they differed from the men in their MHC than when they were more similar. This difference in odour assessment was reversed when the judging women were taking oral contraceptives. Furthermore, the odours of MHC-dissimilar men remind the test women more often of their own actual or former mates than do the odours of MHC-similar men. This suggests that the MHC influence human mate choice today. (*in press: Proc. R. Soc. Lond. B*, 1995)

E. Wullschleger, N. Zambelli & P.I. Ward (Zürich): Differences in habitat choice and life history traits in two shell forms of the freshwater snail *Lymnaea peregra*.

The freshwater pulmonate snail *Lymnaea peregra* (Müller) shows two shell forms which are favoured in different habitats. Forma *peregra* with its long and narrow shell can relatively easily retreat into mud when a water body dries. Forma *ovata* on the other hand has a wider and more compact shell which allows it to withstand strong water movements, an important environmental factor on shores where waves and currents are not reduced by vegetation.

We compared growth and reproduction of *ovata* and *peregra* at constant and at declining water depth. Reproduction was reduced in both forms by declining water level, while growth of the form *peregra* was less affected by this treatment than growth of *ovata*. *Peregra* grew faster also by contstant water level.

To measure their habitat choice, snails were kept in containers with two substrate types at a number of water depths. Additionally, abundance data of both forms were determined along the shore gradient of water depth in a sedge reed at Seealpsee (Appenzell, Switzerland) where they occur sympatrically. *Ovata* avoided shallow waters compared to *peregra* in the field as in the laboratory. *Peregra* preferred muddy substrate whith vegetation to stones, while *ovata* from the same origin habitat showed no substrate preference. Allozyme differences between the forms suggest that shell form and thus possibly also life history traits or habitat choice are at least partially determined genetically.

A. Wyttenbach & L. Favre (Lausanne): Genetic polymorphism as revealed by microsatellite DNA in *Sorex araneus* (*Insectivora, Mammalia*) and its use for population genetic studies

Studying the interactions between genetics and ecology one frequently needs to measure genetic variation in a population. Often low variation is found due to the population history (bottlenecks, founder effects), due to the reproduction modus of the species (selfing species) or due to the genetic marker applied in the study. Low levels of genetic variation can also result from low density populations or from small effective population sizes.

The common shrew (*S.araneus*) is a case where classical genetic markers such as allozymes revealed very low genetic polymorphism on a intra/interpopulation level. Because of its spectacular chromosomal evolution which lead to the existence of more than 30 chromosomal races *S. araneus* became a model species to study the link between genetic and karyotypic evolution, the formation of new races and their underlying ecological mechanisms. The lack of polymorphic markers on a intra/interpopulation level however made it impossible to study the population structure and its implication in the chromosomal evolution of this species (e.g. fixation of chromosomal mutants). Similarly, studies in hybrid zones between different chromosomal races investigating the effects of chromosomes to diminish gene flow and thus playing a role in speciation processes were hindered. For these reasons microsatellite markers were developed.

Species specific primer sequences were designed for 10 microsatellite loci. In a first step 5 microsatellites were tested for their polymorphism on a intra/interpopulation level. Depending on the locus the number of alleles per locus ranged from 2- 20 and the observed heterozygosity varied between 0.50- 0.90. Individuals from each side of 2 hybrid zones between different chromosomal races were also tested in order to look at the level of differentiation of microsatellite DNA on a racial scale. Preliminary results suggest that microsatellite loci can also be applied in population genetic studies on a racial scale.

Microsatellites are the first highly polymorphic, nuclear markers on a population level in *S. araneus.* Therefore microsatellite loci will be an important tool to get insight about the role of the population genetic structure on the chromosomal evolution in *S. araneus.* A more detailed testing of microsatellite polymorphism between different chromosomal races will show to what extend this kind of genetic marker can be used for studying the fine structure of hybrid zones.

S. Zschokke (Basel): Early stages of orb web construction by *Araneus diadematus.*

The first stage of orb web construction is the least studied and the most poorly understood one, partly because the behaviour of the spider at that stage lacks the repetitiveness of later stages, partly because the timing is unpredictable and partly because the moves of the spider cannot be deduced from the finished web.

In our study, we recorded all moves of the spider during web construction using computerised image analysis. From these recordings and from direct observations we could then reconstruct the exact and complete web construction for several webs.

We analysed these constructions quantitatively (how long did the spider take and how long did the spider walk to build a web) and qualitatively (how did the spider build the web).

The first stage (the so called exploration stage) proved to be the more variable in all respects than the later stages.

We could not find a clear strategy the spider uses to explore a new site, but we found several behavioural patterns we could observe repeatedly. This lead us to the hypotheses that the exploring phase of a spider consists of a series of fixed behavioural patterns in random order. These patterns are ‘designed’ in a way to make it very likely that a proto-hub will emerge. The proto-hub then forms the basic framework of the web. As soon as a proto-hub had been established, the behaviour of the spider became more stereo-typed and predictable.

Revue suisse de Zoologie, 102 (4) : 869-882; décembre 1995

Allozymes in evolutionary genetics: beyond the twin pitfalls of "Neutralism" and "Selectionism"*

Ward B. WATT
Dept. of Biological Sciences, Stanford University,
Stanford, CA 94305-5020 USA,
and
Rocky Mountain Biological Laboratory, P.O. Box 519,
Crested Butte, CO 81224-0519 USA.

Allozymes in evolutionary genetics: beyond the twin pitfalls of "Neutralism" and "Selectionism". - Population genetics arose as the algebraic study of genetic transmission in Mendelian populations, showing the genetic feasibility of Darwinian evolution by natural selection. At the same time, it established a tradition of bypassing study of the biological mechanisms by which evolution proceeds. This view of evolutionary dynamics as a primarily algebraic, statistical matter led directly to the "neutralist-selectionist" controversy over the meaning of extensive allozyme variation in the wild. Much argument failed to resolve this controversy, demonstrating that population genetics by itself is necessary but insufficient for full understanding of evolution, due to inherent limitations in the scope of its analysis. A broader concept of evolutionary genetics is proposed, using allozymes and/or other natural genetic variants as biologically specific probes of putatively adaptive, constrained, or neutral phenotypic states, and analyzing the translation of resulting genotypic differences in organismal performance into fitness consequences. This approach includes informed use of population-genetic concepts, but does not ask them to do more than they can do. Diverse examples are cited in support of the feasibility and productivity of this approach. Evolutionary biologists are challenged to bring mechanistic biology into Darwinian context, to move beyond the remains of the "neutralist-selectionist" controversy and of purely formal approaches to evolution, to seek biologically based generalities about the evolutionary process.

Key-words: Allozymes - Biological specificity - Evolutionary genetics - Evolutionary mechanisms - Fitness differences.

---

* Main lecture presented at Zoologia 95.

ALLOZYMES AND POPULATION GENETIC HISTORY

POPULATION GENETICS: AN ABSTRACT ELEMENT IN EVOLUTIONARY STUDY

Population genetics, as is well known (PROVINE 1971), developed in the first part of this century through the joint efforts of FISHER (1930), HALDANE (1932), and WRIGHT (1931). Its first great success was showing that even small selection pressures could be effective in evolution, given sufficient effective population size, N_e, and time in which to work (FISHER 1930). Another success was explaining the population-level interaction of causal and non-causal elements – natural selection *vs*. genetic drift and/or inbreeding – in evolution (WRIGHT 1931), as in the loss of deleterious but meiotic-drive-maintained *t*-alleles in mice, a "helpful" effect of genetic drift in small populations (LEWONTIN & DUNN 1960). There has even been success in explaining *constraints* on evolution which arise from the genetic transmission system – e.g., in the failure of the favorable hemoglobin CC homozygote to predominate in human populations under malarial selection, because of the disadvantage of C-carrying heterozygotes, unless genetic drift and/or inbreeding intervene (TEMPLETON 1982).

However, population genetics by itself has little explanatory power other than *via* properties of the transmission system. It does not have language or, facts to probe the phenotypic bases of *why* genotypes differ in Darwinian fitness, if indeed they do. The maintenance of human hemoglobin polymorphism was explained by mechanistic biology outside population genetics (INGRAM 1962) – which may be part of why some regard it as an atypical "special case", rather than simply a specially striking one. Indeed, population genetics has come to support an a-, or even anti-, mechanistic tradition in evolutionary study, traceable to FISHER. His "Fundamental Theorem of Natural Selection" – "the rate of increase in fitness is equal to the genetic variance in fitness at that time" (1930) – is a base of this tradition, implying as it does that the control of evolution is *primarily* a matter of statistics. This trend was reinforced by the terms in which the "Modern Synthesis" of Neo-Darwinian evolutionary concepts was expressed (JEPSEN *et al.* 1949). There, genes were treated as abstracted agents within a formalized phenotypic architecture, despite a discussion of genotype→ phenotype transformations by STERN (1949) which seems insightful even now. Later, we find MAYR (1958) writing, admittedly speculatively, about genes as "jacks-of-all-trades" or "good mixers", irrespective of what functions those genes might actually support.

Evolutionists' reluctance to consider the specificity of gene action in evolution has continued. The last two decades of evolutionary study have seen strong emphasis on classical quantitative genetics (FALCONER 1989), which bypasses study of most phenotypic mechanisms by assuming that nearly all traits are governed by many polygenes whose alleles are of very small individual effect. This is an extension of Fisher's "micromutationism", and in some respects a heuristic one (cf. ENDLER 1986), but in other respects an overemphasis which goes beyond the evidence (ORR & COYNE 1992). Happily, leading quantitative geneticists are now asserting the need for more mechanistic research strategies, and for evaluation of alleles with large effects at small numbers of loci, as complements to or extensions of the classical quantitative-genetics program, e.g. LAI *et al.* (1994), TRAVIS (1994), VIA (1994 and pers. comm.).

THE "NEUTRALIST-SELECTIONIST" DEBATE: HEAT WITHOUT LIGHT

Among the three founders of population genetics, HALDANE may have been the most consistently mechanistic in his thinking, though highly committed to the use of mathematical reasoning about evolution (1932). (WRIGHT was not far behind, though, given his insight into metabolic organization: 1934). This is not surprising, as HALDANE helped found the theory of enzyme kinetics and thus laid one important corner of the foundation of all modern molecular biology. PAULING *et al.* (1949) identified the first of what came to be called allozymes, hemoglobin S; by 1954, HALDANE wrote:

> "... a number of enzymes have been found... to consist of several constituents separable in an electric field. Such a mixed enzyme would be a definite advantage in an organism either subjected to a wide range of environments or with a variety of chemically differentiated tissues."

At one stroke, HALDANE here anticipated study of tissue-specific isozymes in development, physiology, and systematics (e.g. MARKERT *et al.* 1975, WHITT 1987) and study of allozyme variants as probes of putative adaptive interactions between phenotypic mechanisms and the environments in which they evolve (e.g. WATT 1985a, b, POWERS *et al.* 1991). Ironically, population genetics, dominated by formal theory as it became in part through HALDANE's advocaty, was for a long time quite uninterested in his empirical foresight. HUBBY & LEWONTIN (1966), finding much natural genetic variation in enzymes of digestion, intermediary metabolism, etc., nonetheless held a view of allozymes as being a "random sample of the genome", which from a functional viewpoint was absurd. Often, studies of function and fitness impacts of allozymes were met by population geneticists with disinterest ("Oh, that's just physiological ecology, not evolution!"). If human hemoglobin variation was seen as a special case, then the mindset of the field was such as to avoid recognizing evidence which might threaten that view. This empirical indifference led to the "neutralist-selectionist debate", which consumed the attention of many evolutionists for an unproductively long time.

While admitting the clarity of hindsight, one must see this "debate" as empirically ill founded from the outset. The power of KIMURA's theory of neutral allele evolution (1983) cannot be doubted, as a null model in the same sense that the Hardy-Weinberg distribution or linkage equilibrium are null models at simpler levels of study. But whether it describes a given class of variants in the wild is an empirical question, and neither data nor biological knowledge at large fared well at the hands of extreme neutralist-selectionist debaters. The distributions of fitnesses asserted by both extreme positions reveal their failings (GILLESPIE 1991, TURNER 1992; Fig. 1). What, in phenotypic terms, could cause the absence of genotypes with relative fitnesses of $1.0 \pm 1/N_e$, as demanded by extreme "selectionism" (Fig. 1a)? Equally, only a naive optimalist – holding that this is already the best of all evolutionary worlds – could

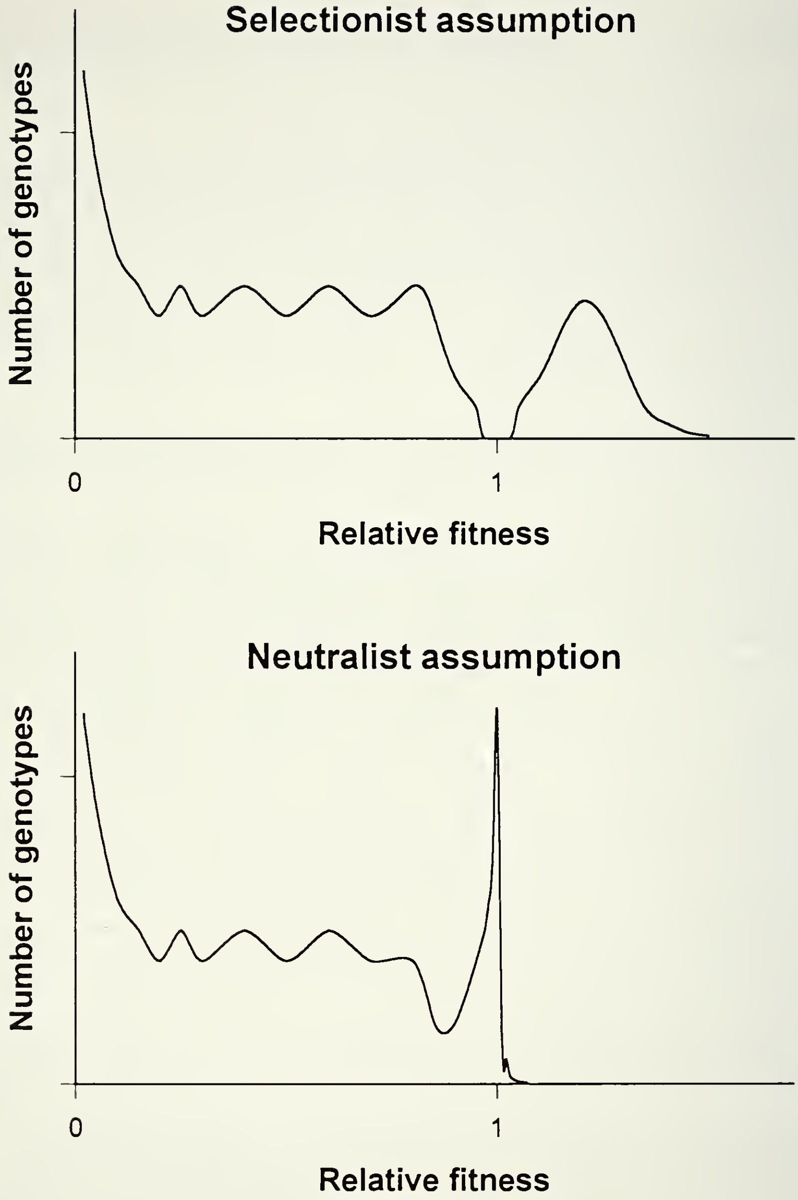


Fig. 1

Alternative distributions of genotypic fitnesses according to the extreme views at issue in the "neutralist-selectionist" debate, as redrawn from Gillespie (1991) and Turner (1992). "Selectionist assumption" shows essentially no genotypes with relative fitness within ± $1/N_e$ of the value 1.0. "Neutralist assumption" includes the possibility of the "nearly neutral, slightly deleterious" variation of the neutral theory. Fitnesses substantially less than 1 of course represent the "victims" of stabilizing or purifying selection.

justify the extreme neutralist view that almost no genetic variants have relative fitness larger than 1.0 + $1/N_e$ (Fig. 1b). Whatever the shape of the actual distribution may prove to be for any class of genes, there is no biological basis *a priori* for hypothesizing either extreme truncation at arbitrary relative fitness, OR extreme discontinuity to "avoid" neutrality.

It soon became clear that, given feasible sample sizes, even quite different models of allozyme variation could not be resolved with any statistical power (EWENS & FELDMAN 1976, WATT 1985a). Indeed, models with opposed assumptions (e.g. the infinite-alleles neutral model, KIMURA 1983, and the SAS-CFF fluctuating-environment selection model, GILLESPIE 1978), which share the statistical property of exchangeability among genotypes studied, generate closely similar genetic frequency distributions as a result (ROTHMAN & TEMPLETON 1980, GILLESPIE 1978, 1991, 1994). For example, SKIBINSKI & WARD (1982) claimed support for applying the infinite-alleles neutral model to an allozyme data set, because substitution rate was positively correlated with heterozygosity as that model predicts. But, GILLESPIE (1994) showed that selection-based models also predict a very similar correlation, and that by choice of coefficients, models of quite contradictory assumptions can coincide in predictions of frequency distribution! Thus there seems little point in such efforts as, e.g., SKIBINSKI *et al.*'s (1993) further elaboration of the correlation between intraspecific heterozygosity and interpopulation or interspecies genetic distances, and claim of "support" from this for the explanation of allozyme variation by the neutral theory. "Support" here is ambiguous at best, because exchangeable variation will also "support" diverse selection models. What is needed for any *real* test is the ability to REJECT alternatives, but this is just what the common presence of exchangeability seems to deny to this entire approach.

KUHN's (1970) view of science, as dominated by scientists' commitment to paradigms and hence their resistance to diverging views, describes this disappointing history very well. Some biologists or philosophers object to Kuhn's seeming insistence that science *must* work this way, but this cannot undermine the observation that it often *does* work this way, though it need not do so. It is now clear that the a- or anti-mechanist paradigm for evolutionary study, explaining natural variation and evolutionary processes in purely statistical-population-genetic terms as in the neutralist-selectionist debate, has only limited power. It cannot answer some clear questions about clashing views, and cannot even INCLUDE certain kinds of evolutionarily important, mechanism-oriented questions. Such problems are clear signs of paradigm crisis (KUHN 1970). A broader, less-self-limiting, more inclusive evolutionary genetics is needed.

WHAT ALTERNATIVES DO WE HAVE?

FEDER & WATT (1992) argued that population genetics is necessary, but insufficient, for understanding evolution, because it covers only the last of four stages in the recursive evolutionary process: **fitness → genotypes**, wherein fitness coefficients, effective population sizes, and inbreeding coefficients interact to yield the next generation's starting genotype array. By inquiring what rules might govern the first three stages – **genotypes → phenotypes, phenotypes → performances, performances → fitnesses** – we may approach a truly *evolutionary*-genetic theory within which population genetics is indispensable, but not predominant.

With respect to allozymes, we should expect a wide range of evolutionary impacts, in terms of kind and strength of effects on phenotype, hence on organismal performance – from behavior as "major genes", down through behavior as part of "oligo-genic" and polygenic systems (which should be highly "exchangeable", cf. above), to some truly null effects. These should produce a corresponding range of fitness component values. Even "neutrality" itself may have different meanings. To put the matter in terms of absolute fitnesses (= net reproductive rates, R_0), a genotype with mean $R_0 = 1.6000$ and another with mean $R_0 = 1.6001$ would be neutral with respect to one another unless N_e is > 10,000, yet either would still be favored compared to a genotype with $R_0 = 1.0$, even if N_e were only 50! This is a very different situation from that envisioned by the classic neutralist view (Fig. 1b).

Thus, to seek *biological* generality about evolution, we must study the specific biology of gene action and phenotype-environment interaction, in ecological and evolutionary context, more carefully. We cannot ask "population genetics" to do more than it can. It is indispensable in integrating fitness differences with population-structure and genetic transmission rules to yield new distributions of genotype frequencies. The origins of the elements to be integrated must be studied with other tools.

ALLOZYMES AND THE SCALE OF THE GENE ACTION IN THE WILD

Allozymes as major locus-specific probes of putative adaptive states

In *Colias* butterflies of lowland North America, 10 allozyme genotypes of phosphoglucose isomerase, PGI, differ markedly in kinetics and thermal stability (e.g. Watt 1983, 1992). These properties are negatively correlated, i.e. they "trade off", in homozygotes. Some but not all heterozygotes are superior in kinetics. Phenotypic "neutrality" may occur even in the midst of major differences, e.g. genotypes 4/4 and 4/5 are equally kinetically poorand thermally stable, while they differ by up to 4-fold in these properties from sister genotypes (cf. above). The biochemical differences *predict* genotype-specific differences in flight capacity in the wild (Watt *et al.* 1983), as this enzyme is central to energy resupply for flight (see Watt 1992 for a review of this metabolic context). The flight capacity differences in turn lead to genotype-specific differences, again up to several-fold in size, in survivorship, male mating success, and female fecundity (Watt 1983; Watt *et al.* 1985, 1986; Watt 1992, and Table 1 as an example.) More fitness component studies in extreme environments will complete our understanding of this selection regime, which appears now to be a mix of simple heterozygote advantage with patchy-environment selection such as studied by Levene (1953), Gillespie (1978), or Haldane & Jayakar (1963).

TABLE 1

Temperature and fecundity of female *Colias* vs. PGI Genotype

Comparative daily fecundities of PGI genotypes of female *Colias philodice eriphyle* Edwards in August 1989 and August 1990 in an outdoor cage assay at Gothic, Colorado, elevation 2900 m, with monitoring of thermal balance in the cages, re-tabled from WATT (1992). Genotypic differences were significant with $P < 0.001$ in a General Linear Model analysis which also included significant effects of available flight time per day, increasing fecundity, and female age, decreasing it.

% time in T_b range				Mean eggs/day ± std. error of mean						
flight possible	optimum	overheat		PGI genotypes						
				2/3	2/4	3/3	3/4	3/5	4/4	4/5
29–40°C	35–39°C	> 40°C								
6.3-89.7	0-60.3	0-1.4		8.6	17.8	12.0	16.1	19.4	6.4	6.6
				± 1.9	± 7.2	± 1.1	± 1.7	± 4.5	± 1.4	± 4.1
			n=	54	16	391	258	29	123	28

We have extended this work to an alpine congener, *C. meadii* Edwards of the Rocky Mountains (WATT *et al.* 1995), which is also highly polymorphic for PGI. Though *C. meadii* PGI alleles have similar electrophoretic mobilities to those of lowland Colias on ordinary-resolution gels, they are electrophoretically distinct in high-resolution gels. Moreover, while there is heterozygote advantage in kinetics and a tradeoff of kinetics vs. stability in homozygotes, just as in the lowland species, “similar” genotypes are not closely similar in function between the taxa. Other North American *Colias* taxa are also polymorphic at this allozyme gene. Is this divergence from ancestral polymorphism, or is it of recent and parallel origin? Whichever answer emerges from future phylogenetic study, this is an anti-adaptationist, constraint oriented result: it implies that there are severe limits, perhaps at the level of protein structure, on the ability of alternative alleles to maximize functional properties when homozygous.

A number of other allozyme case studies, on diverse creatures, have also found major genotypic effects on organismal performance and thence on fitness components (BURTON & FELDMAN 1983, POWERS *et al.* 1991, WATT 1994). One which has been pursued by several research groups over the years is that of polymorphism in *Drosophila* pentose shunt enzymes (e.g. BIJLSMA & VAN DELDEN 1977, CAVENER & CLEGG 1981). LABATE & EANES (1992) demonstrated that a 40% difference in kinetics among G6PD genotypes results in a 32% difference in *in vivo* pentose shunt flux, establishing a very specific mechanistic basis for observed functional differences at higher phenotypic levels. EANES *et al.* (1993) have now found molecular-level evidence that not only G6PD allozyme polymorphisms, but also interspecifically different amino acid substitutions in G6PD, are due to the action of selection. Allozymes can find their main effects in diverse phenotypic subsystems: for example, phosphoglucomutase, PGM, genotypes interact strikingly with social structure alternatives in fire ants (KELLER & ROSS 1993). It has been said that allozymes "may affect metabolism, but not complex traits of interest to evolutionists" – but look here! the referenced cases include major allozymic effects, *via* metabolism, on traits as complex as flight capacity, swimming speed, osmoregulation, even reproductive caste development – all of which, *in turn*, have effects on fitness components such as survivorship, mating success or egg ooutput.

ALLOZYMES AND "EXCHANGEABILITY" IN THE MIDDLE RANGE OF EFFECTS

We do not expect all allozymes to have such dramatic effects as those discussed above. Moderate magnitudes of genotypic functional differences, intermediate roles in pathways, and relative peripherality to the energy budget (WATT 1985b) should cause many variants to fall into the oligogene/polygene range of functional differences and of fitness consequences. One example studied on a single-locus basis is that of *Drosophila* α-glycerophosphate dehydrogenase, whose natural polymorphs have detectable effects, but rather small ones (BARNES *et al.* 1989). More such cases are undoubtedly included in findings of multilocus heterozygosity correlations with organismal performances of various kinds – oxygen consumption, growth rate, etc. (e.g. KOEHN & SHUMWAY 1982). In the case of the oyster *Crassostrea gigas*, an allozyme locus contributing to such a multilocus pattern has later been examined genotype-by-genotype, and heterozygote advantage in specific activity was found (POGSON 1991). Sometimes, of course, such multilocus-heterozygosity correlations with organismal performance have not been found (e.g. SAVOLAINEN & HEDRICK 1995). Which test organisms, habitat structures or stringencies, and allozyme loci do or do not display such correlations may, if considered thoughtfully, yield new insight into the whole phenomenon. This can only hapen if interested workers avoid the trap of arguing for exclusive generality of their own findings, such as plagued the neutralist-selectionist debate. If biological specificity is as important as this review contends, then different allozymes in different creatures may show a diversity of potentially general patterns, but not simple uniformity.

Another way to test the meaning of such "rank-and-file" allozyme variation is to compare its biogeographic OR organismal-performance patterns against those of unrelated groups of genes which can be identified at the molecular level. Thus KARL & AVISE (1992), studying the oyster *Crassostrea*, found that uniform distributions or shallow clines of allozyme frequencies along the Florida coast contrasted to both nuclear and mitochondrial DNA restriction fragment data showing low gene exchange between Atlantic and Gulf Coast oysters; they inferred that the allozymes must be subject to significant selection. POGSON & ZOUROS (1994) restudied the correlation of allozyme heterozygosity with organismal performances as above. When found, this has been ascribed to direct allozyme effects, or else to associative effects of genes closely linked to the allozymes. If the latter were so, the performance correlation should also occur with heterozygosity of other molecular markers, not just allozymes.

When tested in the scallop *Placopecten*, it does *not*; it is uniquely tied to the allozymes, arguing clearly in this case for the direct-effect view.

Allozymes of small, albeit consistent, individual impact should certainly make contributions, to phenotypic variances or to resulting fitness components, which cannot, because of small size, be distinguished from truly "exchangeable" effects in statistical analysis. If these are indeed the majority of selectively maintained allozymes, they would show the ambiguities of multilocus frequency distributions on which the neutralist-selectionist debate foundered. Such data would fit either to neutral models or to diverse models of molecular evolution under positive selection, as summarized by GILLESPIE (1991). Only test strategies which use biological specificity in one way or another, whether with single gene variants' specific properties or in multilocus comparison to other classes of variants, will be able to resolve these possibilities.

ALLOZYMES AND APPROACHES TO NEUTRALITY

We saw that some *Colias* PGI variants are equivalent in function and fitness components, hence neutral with respect to one another, even while they differ greatly from, and are strongly selected relative to, other genotypes in the same polymorphism. In *E. coli*, some allozymes of the same gene, PGI, do NOT differ detectably in function at 37°C, and as one would therefore expect are the same in fitness evaluations at that temperature, to a precision of ±0.2% (DYKHUISEN & HARTL 1983). Two alleles of phosphogluconate dehydrogenase in *E. coli* differ in kinetics by about 30%; they moved from effective neutrality, on one genetic background in which their enzyme was peripheral to the overall cellular energy budget, to strong selective difference when on a second genetic background which made their enzyme central to the cellular energy budget (DYKHUISEN & HARTL 1980, HARTL & DYKHUISEN 1981). This strongly supported the use of bioenergetics as a context for evaluating evolutionary impact of genetic variants (WATT 1985b). DEAN (1989) analyzed other bacterial enzymes in relation to their placement in metabolic organization, showing which may be subject to strong selection when variable, and which are more likely to show neutrality for the same magnitude of allelic functional differences. Once again, *biological specificity*, far from causing evolutionary study to bog down in details, is the key to sorting out patterns of what actually causes neutrality OR selectedness. It appears that generalizations are waiting to be found, but they must be searched for with mechanistic tools.

ALLOZYMES AS TOOLS FOR OTHER KINDS OF EVOLUTIONARY STUDY

ARE ALLOZYMES USEFUL AS "MARKERS"?

Diverse workers have used allozymes as "markers" for studies of paternity, "gene flow", and other aspects of population structure in the wild. What are the implications for this practice of the above results?

For proximate measurement of paternal identities in specific offspring cohorts, and the like, neutrality or selectedness of the "marker" allozymes usually makes very little difference to the measurement. For inference of population structure, on the other hand, distinct or even opposed explanations of any given initial finding are often possible, though others will very likely be ruled out.

For example, in a very careful and thoughtfully executed study, COSTA & ROSS (1994) studied population structure in the eastern N. American moth *Malacosoma*. There is only minor differentiation of allele frequencies, indicated by Wrightian F-statistics calculated on 11 varying allozyme loci, at either 100 km deme separation scale, or 200-1000 km scale. The authors comment that this shows either major migrational gene exchange on the scale of hundreds of km, or uniformity of selection regime over that same scale despite climate and biome differences, or some combination of the two. Further work, as they say, will be needed to resolve these alternatives. Other possibilities (local drift under restricted migration, or local selective habitat specialization), which could have explained local differences if found, are ruled out for these characters, so much has already been learned. In ecological/evolutionary contrast, RANK (1992), studying a much less vagile leaf beetle, found substantial local allozyme frequency differentiation, even among adjacent drainages in the same mountain range. Rank's results could be due to local drift, local microhabitat specialization, or a combination, subject to further study – though gene-specific variation in the extent of frequency differences led him to postulate local selection, at least on the PGI gene. In each case, use of allozymes to probe population structure has ruled out some possibilities, while leaving the need for further specific work to distinguish among other causal scenarios – as the authors have been careful to state. These authors properly avoided the temptation to make "simplifying assumptions" about either selectedness OR neutrality of allozyme probes of population structure; such assumptions could thoroughly obscure the actual explanations of genetic patterns seen.

HOW RELIABLE ARE ALLOZYMES AS SYSTEMATICS CHARACTERS?

There is a large literature on the use of allozymes, usually with calculation of genetic distances (e.g. NEI 1987), as input to systematic analysis. For example, BURNS (1975) found that the hypervariable Esterase-D gene in *Colias* (some populations segregate 20 alleles or more) shows patterns of variation consistent with putative species complexes among North American taxa. Some of this variation among complexes seems to covary with larval food plant use, suggesting a cause of the pattern which further study can test. GEIGER (1980), in an initial study of Pieridae (*Colias*' family) as a whole, obtained genetic-distance data using 20 allozyme loci, which provide the only independent support thus far for subgeneric distinctions within the genus *Colias*, proposed later by BERGER (1986). But what would be the impact on such work if, as seems likely, ordinary-resolution electrophoresis gels OVERestimate the extent of allelic identity among relatives (COYNE 1976, WATT *et al.* 1995)? Or what if, contrary to the assumptions of most genetic distance models (e.g. NEI 1987), many allozymes are subject to at least moderate natural selection? The effects of such deviations from "simple" assumptions are not clear. Caution is indicated, and other types of molecular characters may often be more prudent choices for systematics work.

THE FUTURE OF EVOLUTIONARY GENETICS

The task before us can be stated simply, though much effort will be needed to accomplish it. It is to bring mechanistic biology fully into the Darwinian rubric, and to put it to work asking and answering those questions about evolutionary genetics and the course of evolutionary change or stasis which only mechanistic study can approach: the three initial stages of Feder and Watt's recursive evolution concept, which complement the fourth stage where "population genetics" holds sway. Allozyme variants can be major tools for this effort – major probes of organismal energy budgets, putatively adaptive features of metabolic organization, etc. Some fear that this strategy requires evolutionary geneticists to stretch their knowledge and efforts too far. The success of diverse research groups, recorded here, at implementing mechanistic strategies for studying evolution suggests these fears are needless. While it is true that some further effort may be needed to master more diverse scientific concepts and techniques, this will yield great returns. Individually and collaboratively, evolutionary geneticists now have the opportunity to move beyond the remains of the "neutralist-selectionist" controversy in search of new and more general understanding.

ACKNOWLEDGEMENTS

I thank Paul Ward and the Swiss Zoological Society for their kind invitation to present these remarks, numerous members of the Society for stimulating discussions, and Michael Dohm and Michael Kohane for helpful comments on the draft manuscript. I thank the U.S. Dept. of Energy (grant DE FG 03-93-ER-61667) and the U.S. National Science Foundation (grants DEB 91-19411 and IBN 92-20583) for research support.

REFERENCES

Barnes, P.T., B. Holland, E V. Courreges. 1989. Genotype-by-environment and epistatic interactions in *Drosophila melanogaster*: the effects of *Gpdh* allozymes, genetic background, and rearing temperature on larval development time and stability. *Genetics* 122, 859-868.

Berger, L. 1986. Systématique du genre *Colias* F. (Lepidoptera – Pieridae). *Lambillionea* 86 suppl., 1-68.

Bijlsma, R. & W. van Delden. 1977. Polymorphism at the G6PD and 6PGD loci in *Drosophila melanogaster*. I. Evidence for selection in experimental populations. *Genet. Res.* 30, 221-236.

BURNS, J.M. 1975. Isozymes in evolutionary systematics. In MARKERT, C.L., ed., *Isozymes IV: Genetics and Evolution, Academic Press, NY.*

BURTON, R.S. & M.W. FELDMAN. 1983. Physiological effects of an allozyme polymorphism: glumate pyruvate transaminase and response to hyperosmotic stress in the copepod *Tigriopus californicus. Biochem. Genet.* 21, 239-251.

CAVENER, D.R. & M.T. CLEGG. 1981. Evidence for biochemical and physiological differences between enzyme genotypes in *Drosophila melanogaster. Proc. Natl. Acad. Sci. USA* 78, 4444-4447.

COSTA, J.T., & K.G. ROSS. 1994. Hierarchical genetic structure and gene flow in macrogeographic populations of the eastern tent caterpillar (*Malacosoma americanum*). *Evolution* 48: 1158-1167.

COYNE, J.A. 1976. Lack of genic similarity between two sibling species of Drosophila as revealed by varied techniques. *Genetics* 84, 593-607.

DEAN, A.M. 1989. Selection and neutrality in lactose operons of *Escherichia coli. Genetics* 123, 441-454.

DYKHUISEN, D.E. & D.L. HARTL. 1980. Selective neutrality of 6PGD allozymes in E. coli and the effects of genetic background. *Genetics* 96, 801-817.

DYKHUISEN, D.E., & D.L. HARTL. 1983. Functional effects of PGI allozymes in *E. coli. Genetics* 105, 1-18.

EANES, W.F., M. KIRCHNER, & J. YOON. 1993. Evidence for adaptive evolution of the G6pd gene in the *Drosophila melanogaster* and *Drosophila simulans* lineages. *Proc. Natl. Acad. Sci. USA* 90, 7475-7479.

ENDLER, J.A. 1986. *Natural selection in the wild. Princeton Univ. Press, Princeton*, NJ.

EWENS, W.J., & M. W. FELDMAN. 1976. The theoretical assessment of selective neutrality. In KARLIN, S., & E. NEVO, eds., *Population genetics and ecology, Academic Press, NY*, pp. 303-337.

FALCONER, D.S. 1989. *Introduction to quantitative genetics*, 3rd. ed. *Longmans, London*, UK.

FEDER, M.E., & W.B. WATT. 1992. Functional biology of adaptation. In BERRY, R.J., R.J. CRAWFORD & G.M. HEWITT, eds., *Genes in ecology, Blackwell's, London*, UK, pp. 365-392.

FISHER, R.A. 1930. *The genetical theory of natural selection. Clarendon Press, Oxford*, UK.

GEIGER, H.J. 1980. Enzyme electrophoretic studies on the genetic relationships of pierid butterflies (Lepidoptera, Pieridae). I. European taxa. *J. Res. Lepid.* 19, 181-195.

GILLESPIE, J. H. 1991. *The causes of molecular evolution. Oxford Univ. Press., Oxford*, UK.

GILLESPIE, J. H. 1994. Substitution processes in molecular evolution, II. Exchangeable models from population genetics. *Evolution* 48, 1101-1113.

HALDANE, J.B.S. 1932. *The causes of evolution. Longmans, Green, London*, UK.

HALDANE, J.B.S. 1954. *The biochemistry of genetics. Allen & Unwin, London*, UK.

HALDANE, J.B. S., & S.D. JAYAKAR. 1963. Polymorphism due to selection of varying direction. *J. Genet.*, 58, 237-242.

HARTL, D.L., & D.E. DYKHUISEN. 1981. Potential for selection among nearly neutral allozymes of 6-phosphogluconate dehydrogenase in *Escherichia coli. Proc. Nat'l. Acad. Sci. USA* 78, 6344-6348.

HUBBY, J.L., & R.C. LEWONTIN. 1966. A molecular approach to the study of genic heterozygosity in natural populations. I. The number of alleles at different loci in *Drosophila pseudoobscura. Genetics* 54, 577-594.

INGRAM, W.I. 1962. *The hemoglobins in genetics and evolution. Columbia Univ. Press*, NY.

JEPSEN, G.L., G.G. SIMPSON, & E. MAYR, eds. 1949. *Genetics, palaeontology, and evolution. Princeton Univ. Press, Princeton*, NJ.

KARL, S., & J.C. AVISE. 1992. Balancing selection at allozyme loci in oysters: implications from nuclear RFLPs. *Science* 256, 100-102.

KELLER, L., & K.G. ROSS. 1993. Phenotypic basis of reproductive success in a social insect: genetic and social determinants. *Science* 260, 1107-1110.

KIMURA, M. 1983. *The neutral theory of molecular evolution. Cambridge Univ. Press, Cambridge*, UK.

KOEHN, R.K, & S. R. SHUMWAY. 1982. A genetic/physiological explanation for differential growth rate among individuals of the American oyster *Crassostrea virginica* (Gmelin). *Mar. Biol. Letters* 3, 35-42.

KUHN, T.S. 1970. *The structure of scientific revolutions*, 2nd ed. *Univ. of Chicago Press, Chicago* IL.

LABATE, J., & W.F. EANES. 1992. Direct measurement of *in vivo* flux differences between electrophoretic variants of G6PD from *Drosophila melanogaster*. *Genetics* 132, 783-787.

LAI, C., R.F. LYMAN, A.D. LONG, C.H. LANGLEY, & T.F.C. MACKAY. 1994. Naturally occurring variation in bristle number and DNA polymorphisms at the *scabrous* locus of *Drosophila melanogaster*. *Science* 266, 1697-1702.

LEVENE, H. 1953. Genetic equilibrium when more than one niche is available. *American Naturalist* 87, 331-333.

LEWONTIN, R.C., & L.C. DUNN. 1960. The evolutionary dynamics of a polymorphism in the house mouse. *Genetics*, 45, 705-722.

MARKERT, C.L., J.B. SHAKLEE, & G.S. WHITT. 1975. Evolution of a gene. *Science* 189, 102-114.

MAYR, E. 1958. Change of genetic environment and evolution. In HUXLEY, J., A.C. HARDY, & E.B. FORD, eds., *Evolution as a process*, 2nd. ed., *Allen & Unwin*, London, pp. 188-213.

NEI, M. 1987. Molecular evolutionary genetics. *Columbia University Press*, NY.

ORR, H.A., & J.A. COYNE. 1992. The genetics of adaptation: a reassessment. *American Naturalist* 140, 725-742.

PAULING, L., H.A. ITANO, S.J. SINGER, & I.C. WELLS. 1949. Sickle-cell anemia, a molecular disease. *Science* 110, 543.

POGSON, G.H. 1991. Expression of overdominance for specific activity at the phosphoglucomutase-2 locus in the Pacific oyster, *Crassostrea gigas*. *Genetics* 128, 133-141.

POGSON, G.H., & E. ZOUROS. 1994. Allozyme and RFLP heterozygosities as correlates of growth rate in the scallop *Placopecten magellanicus*: a test of the associative overdominance hypothesis. *Genetics* 137, 221-231.

POWERS, D.A., T. LAUERMAN, D. CRAWFORD, & L. DIMICHELE. 1991. Genetic mechanisms for adapting to a changing environment. *Ann. Rev. Genet.* 25: 629-659.

PROVINE, W.B. 1971. *The origins of theoretical population genetics. University of Chicago Press, Chicago* IL.

RANK, N. 1992. A hierarchical analysis of genetic differentiation in a montane leaf beetle *Chrysomela aeneicollis* (Coleoptera: Chrysomelidae). *Evolution* 46, 1097-1111.

REAL, L. A., ed. 1994. *Ecological genetics. Princeton Univ. Press, Princeton*, NJ.

ROTHMAN, E.D., & A.R. TEMPLETON. 1980. A class of models of selectively neutral alleles. *Theor. Pop. Biol.* 18, 135-150.

SKIBINSKI, D.O.F., & R.D. WARD. 1982. Correlations between heterozygosity and evolutionary rate of proteins. *Nature* 298, 490-492.

SKIBINSKI, D.O.F., M. WOODWARD, & R.D. WARD. 1993. A quantitative test of the neutral theory using pooled allozyme data. *Genetics* 135, 233-248.

STERN, C. 1949. Gene and character. In JEPSEN *et al.*, eds., *op. cit.*, pp. 13-22.

SAVOLAINEN, O., & P. HEDRICK. 1995. Heterozygosity and fitness: no association in Scots pine. *Genetics* 140, 755-766.

TEMPLETON, A.R. 1982. Adaptation and the integration of evolutionary forces. *In* R. MILKMAN (ed.), *Perspectives on evolution, Sinauer, Sunderland*, MA, pp. 15-31.

TRAVIS, J. 1994. Ecological genetics of life-history traits: variation and its evolutionary significance. *In* REAL, L.A., ed., *op. cit.*, pp. 171-204.

TURNER, J.R.G. 1992. Stochastic processes in populations: the horse behind the cart? In BERRY, R.J., T.J. CRAWFORD & G.M. HEWITT, eds., *Genes in ecology, Blackwell's, London*, UK, pp. 29-53.

VIA, S. 1994. Population structure and local adaptation in a clonal herbivore, pp. 58-85 in REAL, L.A., ed., 1994, *op. cit.*

WATT, W.B. 1983. Adaptation at specific loci II. Demographic and biochemical elements in the maintenance of the *Colias* PGI polymorphism. *Genetics* 103, 691-724.

WATT, W.B., R. C. CASSIN & M. S. SWAN. 1983. Adaptation at specific loci III. Field behavior and survivorship differences among *Colias* PGI genotypes are predictable from *in vitro* biochemistry. *Genetics* 103, 725-739.

WATT, W.B. 1985a. Allelic isozymes and the mechanistic study of evolution. *Isozymes: Current Topics in Biological and Medical Research* 12, 89-132.

WATT, W.B. 1985b. Bioenergetics and evolutionary genetics – opportunities for new synthesis. *American Naturalist* 125, 118-143.

WATT, W.B. 1992. Eggs, enzymes, and evolution – natural genetic variants change insect fecundity. *Proc. Nat'l. Acad. Sci. USA* 89, 10608-10612.

WATT, W.B. 1994. Allozymes in evolutionary genetics: self-imposed burden or extraordinary tool? *Genetics* 136, 11-16.

WATT, W.B., K. DONOHUE, & P.A. CARTER. 1995. Adaptation at specific loci. VI. Divergence vs. parallelism of polymorphic allozymes in molecular function and fitness-component effects among *Colias* species (Lepidoptera, Pieridae). MS in review.

WHITT, G.S. 1987. Species differences in isozyme tissue patterns: their utility for systematic and evolutionary analyses. *Isozymes: Current Topics in Biological and Medical Research* 15, 1-26.

WRIGHT, S. 1931. Evolution in Mendelian populations. *Genetics* 16, 97-159.

WRIGHT, S. 1934. Physiological and evolutionary theories of dominance. *American Naturalist* 34, 24-53.

REVUE SUISSE DE ZOOLOGIE, 102 (4) : 883-894; décembre 1995

What causes diversity in male sexual characters?*

Andrew POMIANKOWSKI** & Yoh IWASA***
** Department of Genetics and Biometry, University College London,
4 Stephenson Way, London NW1 2HE, UK.
*** Department of Biology, Faculty of Science, Kyushu University,
Fukuoka 812, Japan.

What causes diversity in male sexual characters? - Closely related species often differ markedly in sexual morphology and courtship display. Here we show that Fisher's runaway process of sexual selection is a good explanation for this diversity. The runaway process is intrinsically unstable if selection on the male trait is weak around the natural selection optimism but increases rapidly beyond a certain limit. Runaway can often result in continuous change in sexual characters.

Key-words: Sex - Speciation - Courtship - Runaway - Mate choice - Sexual selection.

INTRODUCTION

Secondary sexual characters are often highly variable between closely related species (DARWIN 1871; ANDERSSON 1994). This diversity contrasts with morphological traits that show far less variability over the same taxonomic range. There are few studies of the comparative rates of change of sexual and non-sexual traits but there are some notorious cases: the species flocks of the Great Lakes in Africa (FRYER & ILES 1980), the Hawaiian *Drosophila* (CARSON 1986), male insect genitalia (EBERHARD 1985) and the birds of paradise (COATES 1990). These examples suggest that sexual traits are highly labile and can change very guickly in evolutionary time.

Variation is even seen between sub-populations. A good detailed example is an isolated, sub-population of sage grouse, from Gunnison, Colarado (YOUNG *et al.* 1994). The Gunnison birds are smaller than those in the main range from the west coast to central USA. This has not lead to any apparent ecological divergence (Young pers. comm.). However, male birds differ markedly in their secondary sexual characters. Certain elements of the male display are identical - for example strut and song components. Others have quantitatively diverged - Gunnison males strut at a lower rate, their tail feather plumes are whiter and their rate of air sac inflation is higher. Two novel elements are also present - Gunnison males wag their tails from side to

---

* Main lecture presented at Zoologia 95.

side and, more dramatically, toss their neck plumes over their heads. Neither of these behaviours is seen in sage grouse from the main range (YOUNG *et al.* 1994). Preliminary call playback experiments show concomitant divergence in female preference; Gunnison females prefer calls of Gunnison males than those made by males from the main range (Young, pers. comm.).

How has sexual selection lead to the evolution of diverse sexual characters? Why do some sexual characters remain constant, others show minor quantitative change, whilst other sexual traits appear to be novel elements? A traditional answer is that diversity arises to maintain the identity of newly diverged populations or species (PATERSON, 1985). There is scant theoretical or empirical support that this occurs through reinforvement to stop hybridization (BUTLIN 1987), though a recent reanalysis suggests a greater role for reinforcement (HOWARD 1993). Species recognition cannot be a general explanation as it does not explain divergence in allopatric populations (eg, sage grouse). High divergence of sexual traits also occurs in island species where encounters between populations or species are minimal (EBERHARD 1985). But present distributions may hide past associations. We do not rule out a role for species identity but will not pursue this matter further here.

Another general approach has stressed the importance of random genetic drift in triggering sexual selection in newly founded populations (TEMPLETON 1980). In the 1980s this view was reinforced by models of Fisher's runaway process of sexual selection. These showed that runaway led to an infinite set of outcomes, the so-called 'line of equilibria' (LANDE 1981). Divergence from one equilibrium causes runaway evolution to a novel endpoint. This suggests that allopatric populations will quickly diverge through the exaggeration of random differences. The problem with this interpretation is that several studies have shown that 'lines of equilibria' collapse to single points when more realistic model assumptions are made (POMIANKOWSKI 1987; BULMER 1989; POMIANKOWSKI *et al.* 1991). Under these conditions drift no longer plays a significant role in initiating divergence (see below). As it stands, current models of sexual selection are inadequate to explain diversity.

In this paper we re-examine the basic assumptions behind models of Fisher's runaway process. We show that Fisher's runaway process is intrinsically unstable and naturally leads to continual change in sexual traits (IWASA & POMIANKOWSKI 1995). Female preferences for exaggerated male traits are only semi-stable. Strong preference slowly decays until runaway is triggered again in a different direction. The only change we make to previous models is to assume male survival decreases dramatically once male sexual traits become extreme. This is a general and plausible assumption. It is akin to Fisher's (1930) original description of the costs of male sexual traits.

DRIFT AND ENVIRONMENTAL DIFFERENCES

First we investigate the effect of drift and environmental differences in allopatric populations, between which there is no gene flow. Using a simple sexual selection model of Fisher's runaway we show to what degree divergence is expected.

Let t be a male trait used by females in mate choice and p be the strength of female preference. We assume that both t and p are sex-limited and have a polygenic basis. The standard model of runaway follows the change per generation of the mean values.

$$\begin{pmatrix} \Delta\bar{t} \\ \Delta\bar{p} \end{pmatrix} = \frac{1}{2}\begin{pmatrix} G_t & B \\ B & G_p \end{pmatrix}\begin{pmatrix} \beta_t \\ \beta_p \end{pmatrix} + \begin{pmatrix} -u \\ 0 \end{pmatrix}, \tag{1}$$

where G_t and G_p are additive genetic variances of t and p respectively, B is the additive genetic covariance between these two traits and u measures mutation bias acting on the male trait (POMIANKOWSKI *et al.* 1991; IWASA *et al.* 1991). The additive genetic covariance is responsible for the coevolution of the two traits. The covariance arises through non-random mating; females with stronger preference (larger p) tend to mate with males with larger sexual traits (larger t). Given a positive covariance, selection for larger male traits causes a correlated increase in female preference.

The effect of selection is given by the selection gradients β_t and β_p, for the male trait and female preference respectively. Male fitness is the product of mating success and survivorship. Mating success is determined by female mate preference. If the mean female preference is positive $\bar{p}>0$, female preference favours males with larger than average trait values (POMIANKOWSKI *et al.* 1991). The reverse is true if $\bar{p}<0$, which favours males with smaller than average trait values. When $\bar{p}=0$ females exert no selective pressure on males, as they mate at random. The second component of male fitness is survivorship. The optimal expression of the male trait under natural selection is set at $t = 0$, with survival chances declining for larger or smaller values. The coefficients a and c calibrate these two selective effects. Female fitness is determined by the strength of preference. We assume that female costs are minimised when there is no discrimination ($p = 0$) and increase symmetrically with the strength of preference at a rate b.

The following equations describe the standard mathematical interpretation of these assumptions (LANDE 1981; POMIANKOWSKI *et al.* 1991), selection differentials being evaluated at the population means,

$$\begin{aligned} \beta_t &= \frac{\partial}{\partial t} \ln W_m = \frac{\partial}{\partial t}\left(a\bar{p}(t-\bar{t}) - ct^2\right) = a\bar{p} - 2c\bar{t}\ , \\ \beta_p &= \frac{\partial}{\partial p} \ln W_f = \frac{\partial}{\partial p}\left(-bp^2\right) = -2b\bar{p}\ , \end{aligned} \tag{2}$$

where W_m and W_f are the lifetime reproductive success of males and females. The equations can be substituted into Eq(1) and solved for equilibrium ($\Delta\bar{t} = 0$, $\Delta\bar{p} = 0$). We simplify the results by noting that the additive genetic covariance between the male trait and female preference converges quickly to $B = aG_t G_p / 2$ (POMIANKOWSKI & IWASA 1993; for a full discussion of the model assumptions see IWASA *et al.* 1991). A single equilibrium exists,

$$\bar{p}_{\mathrm{E}} = \frac{ua}{2b}, \tag{3a}$$

$$\bar{t}_{\mathrm{E}} = \frac{a}{2c}\bar{p}_{\mathrm{E}}. \tag{3b}$$

This is a simple result. Equilibrium is given by the benefits and costs of mate choice. Female benefits are given by the mutation parameter u which determines the advantage of mating with males bearing a larger trait, multiplied by a the effectiveness of preference in generating non-random mating. Female choice costs are given by b. The male trait equilibrium follows the strength of female preference factored by the benefit to cost ratio of the male trait, a/c.

We can now see that drift has no effect on equilibrium. If this equilibrium is stable it is globally stable (POMIANKOWSKI, *et al.* 1991). All deviations caused by drift always lead back to the same equilibrium point. (If the equilibrium is unstable then perpetual runaway occurs, an unrealistic model outcome). So we do not expect drift to be a major cause of divergence in secondary sexual traits. Drift is only important if b, u=0 and $\bar{p}_{\mathrm{E}}$ can trake any value along a line of equilibrium given by Eq(3b), as was originally pointed out by LANDE (1981). Such a requirement is highly restrictive and not likely to be met in nature.

We can also see the effect of environmental change. This will affect the three parameters a, b and c. Let us suppose that the environments of two allopatric populations differ in predation pressure and this alters the cost of the male trait. This will increase the value of c and reduce the equilibrium exaggeration of the male trait. If predation also affects the cost of female choice b, then both preference and the male trait will be reduced. The parameter a is harder to interpret as it is a function of both male and female behaviour and the environment. From the female's view point a reflects the efficiency of preference in identifying males with larger ornaments. From the male's view point a reflects the effectiveness of male signalling in causing increased mating success. a also varies with life history and ecology. For instance, lower values of a will be common in monogamous species because there are fewer mating opportunities compared to polygamous species. Another cause of reduced values of a could be a densely wooded environment which restricts the efficacy of visual or auditory signals compared to more open habitats. If two allopatric populations differ in any of these properties this will cause differences in secondary sexual characters.

Environmental differences predict divergence in sexual traits. If changes in the environment are small, divergence in sexual traits will not be dramatic or that much greater than in non-sexually selected traits, though larger divergence is possible because sexual selection has an amplifying effect (LANDE 1982). Environmental change can quantitatively shift the equilibrium values. But it is not obvious how this relates to the kind of divergence seen in sage grouse populations discussed above. The magnitude of these effects requires a different explanation.

A NEW FISHERIAN MODEL

An assumption common to previous models is that male survival chances decrease with the quadratic power ($-ct^2$ in Eq(2a)). This follows LANDE's (1981) original analysis which assumed normality of the fitness functions. However this need not be the case. We now examine a more extreme fitness function that fits better with FISHER's (1930) original assumption. Fisher supposed that stabilizing selection on the male trait was weak around the optimum, thereby permitting runaway to get started. But once the male trait exceeded a certain limit the cost of further exaggeration increased very quickly. This behaviour can be captured by making fitness decline with the fourth power rather than the quadratic (IWASA & POMIANKOWSKI 1995). Rewriting Eq(2a).

$$\beta_t = \frac{\partial}{\partial t}\left(a\bar{p}(t-\bar{t}) - ct^4\right) = a\bar{p} - 4c\bar{t}^3 \tag{4}$$

Evolutionary change can be followed by substituting this equation and Eq(2b) for female fitness into Eq(1). The result is cyclic evolution (Fig. 1). A population starting near the origin evolves away in a runaway process. The runaway is brought to a halt once selection on the male trait becomes extreme. The system converges to a curve, on which evolutionary change slows down. Here the male trait is exaggerated and females show corresponding strong preference. Female preference then slowly declines. This decline continues until runaway is triggered again but this time in a negative direction. The negative runaway stops when selection on the male trait becomes extreme. At this point both traits are negatively exaggerated. Then a very slow movement in a positive direction occurs towards p=0 due to the cost of choice. Eventually runaway starts again toward positive values and the whole process repeats itself.

The underlying reasons for this evolutionary behaviour are easy to understand. We assume that the costs to female preference b and mutation bias u are very much smaller than the other parameters (IWASA *et al.* 1991). This seems a reasonable assumption as it has proved difficult to measure b and u compared to other parameters (ie, b, u $\ll a, c, G_t, G_p$). So to follow the gross behaviour of the model we can initially neglect β_p and u. This leaves selection on the male triat β_t which causes runaway. During runaway the male trait and female preference evolve together as $\Delta\bar{p} / \Delta\bar{t} = B / G_t = aG_p / 2$. Runaway ceases when $\Delta\bar{p} = \Delta\bar{t} = 0$ which yields a curve of the equilibria which is flat around the origin but steeply increases once the male trait becomes exaggerated (Fig. 2). Part of the curve is stable (solid) and part unstable (dashed). Stability depends on the slope of the evolutionary trajectory $aG_p / 2$ being less than the slope of the curve of equilibria.

Once runaway ceases near the curve of equilibria, further evolution is determined by the costs to female preference b and mutation bias u. First we discuss the case in which mutation bias is negligibly small ($u = 0$), which is likely to be the case for many sexual traits. After runaway, female preference simply decays towards $\bar{p} = 0$ because of the cost of choice. The population never reaches the origin because a

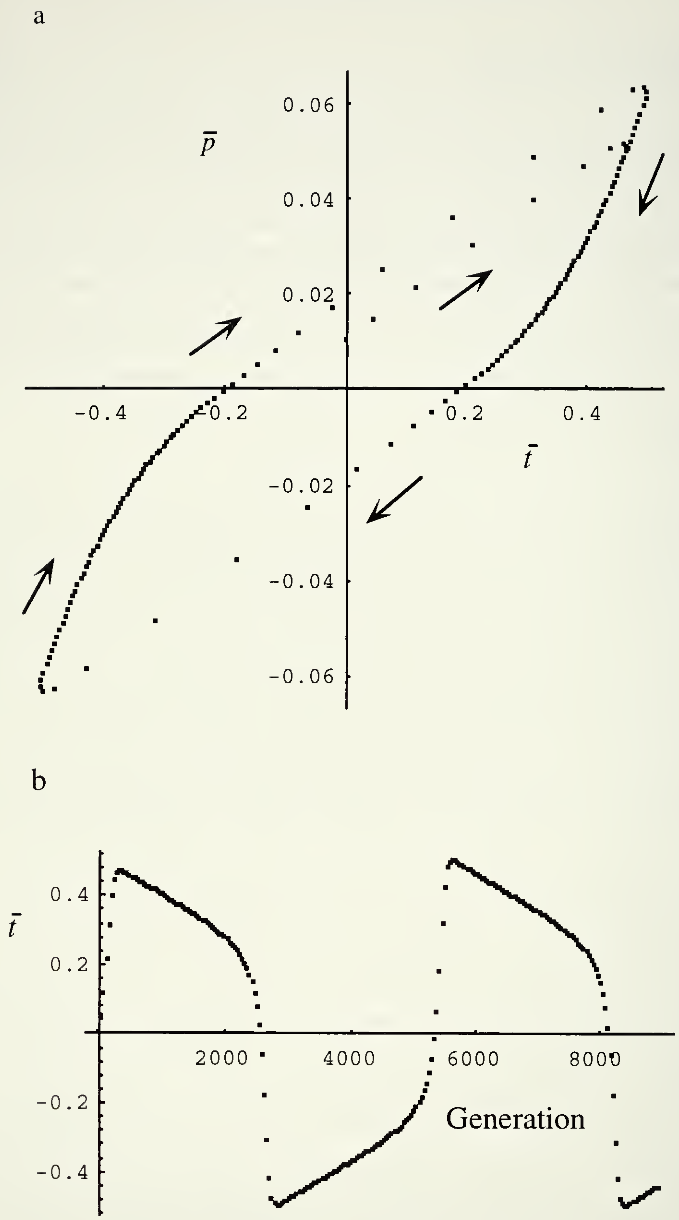


FIG. 1

Cyclic evolution caused by Fisher's runaway process is plotted as a) the joint evolution of the mean female preference ($\bar{p}$) and mean male trait ($\bar{t}$) and b) as change in the mean male trait ($\bar{t}$) per generation. The population is plotted every 20 generations. Parameter values are a=0.4, b=0.001, c=0.05, G_t=0.5 G_p=0.5, u=0.

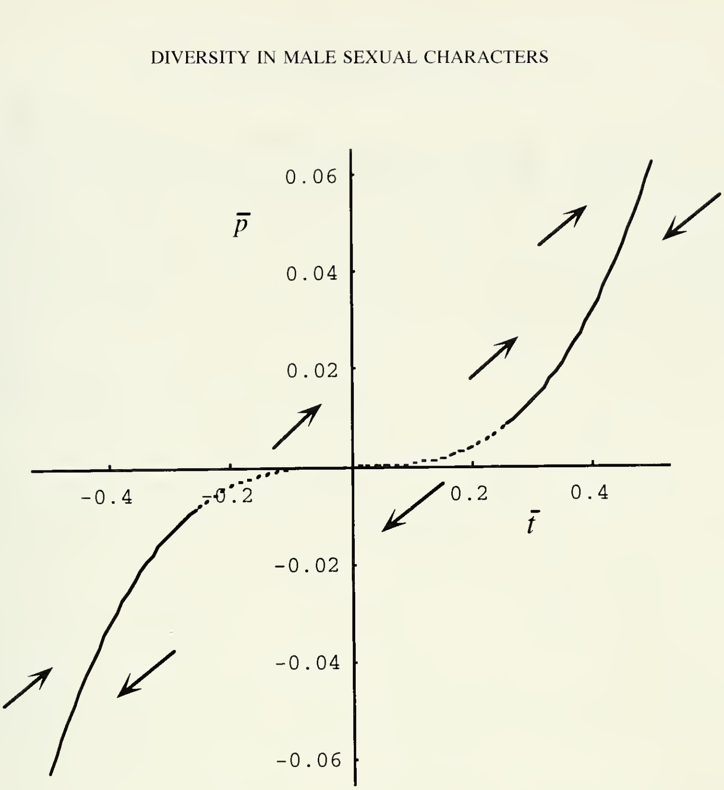


FIG. 2

The curve of equilibria, showing stable (solid) and unstable (broken) regions.

second runaway is initiated once the population reaches the unstable part of the curve (Fig. 1). The speed of movement around the cycle is determined by the time the population remains on the semistable arc of the curve of equilibria (runaway in comparison is very rapid) which is mainly determined by b. Thus cycle time increases if the cost of choice b is small.

If mutation bias is negligibly small, there is an unstable equilibrium at the origin. If there is significant mutation bias $u>0$, the equilibrium lies at,

$$\bar{p}_E = \frac{ua}{2b}, \tag{5a}$$

$$\bar{t}_E = \left(\frac{a}{4c}\bar{p}_E\right)^{1/3}. \tag{5b}$$

If $\bar{p}_E$ lies in the unstable region of the curve, the population evolves in a cycle as with $u=0$. But if mutation bias is strong enough $\bar{p}_E$ lies in the stable region of the curve and the population smoothly converges on the equilibrium which is globally stable (Fig. 3). Stability is more likely if mutation bias (u) is large and the cost of choice (b) is small.

This model helps to understand the evolution of diversity in sexually selected characters. It suggests that perpetual change in sexual characters is a simple outcome of Fisher's runaway process. Runaway exaggeration of a particular male trait is only semi-stable. In our model this leads to cycles, but this result reflects the model's constraint to a single dimension. If we allow multiple preferences for different male traits (eg, song, colour, tail length), the population evolves in a more complex manner and only cycles over a very long period (IWASA & POMIANKOWSKI, unpub). This means that slight ecological differences between allopatric populations quickly cause them to fall out of phase and evolve different sexual phenotypes.

The model also helps us to understand why some sexual traits remain unchanged. Traits which are subject to large mutation bias (u) will tend to be stable as will those which are cheap for females to choose (b). This result is of interest to the debate over the importance of Fisher's runaway and the handicap process. Mutation bias is a simple measure of how mutation or environmental change cause a deterioration in mean trait values. We have argued that Fisher traits (sexual traits that do not act as indicators of good genes) can be subject to mutation bias when they are exaggerated or elaborate because most mutations will tend to reduce trait values (POMIANKOWSKI *et al.* 1991). But this effect is likely to be small. In contrast sexual traits that are handicaps are predicted to show large mutation bias because most mutations are known to reduce viability (MUKAI & COCKERHAM 1977; CHARLESWORTH 1987). This leads to the prediction that sexual traits common to members of a clade are more likely to be handicaps that indicate good genes. Whereas sexual traits which vary greatly within a clade are more likely to be Fisher traits.

DISCUSSION

Fisher's runaway model of sexual selection has had a chequered history. In the reemergence of interest in handicap models there has been a tendency to overlook its importance (eg, GRAFEN 1990). Others have suggested that runaway is unlikely because additive genetic variance/covariance in preference and sexual traits are non-existent or not maintained in the face of strong selection (TAYLOR & WILLIAMS 1982, KIRKPATRICK & RYAN 1991). But empirical surveys suggest this pessimism is unfounded. Both traits have been shown to be genetically variable and genetic covariances have now been demonstrated in a number of species (BAKKER & POMIANKOWSKI 1995; POMIANKOWSKI & MØLLER 1995).

In this paper we have considered how Fisher's runaway may contribute to the diversity of sexual traits. Our model shows that runaway is intrinsically unstable and naturally leads to continual change in sexual traits (IWASA & POMIANKOWSKI 1995). This result emerges from a simple and non-restrictive change to the standard model that makes it more consistent with FISHER's (1930) view. It is assumed that stabilising selection on the male trait is weak around the natural selection optimum but beyond a

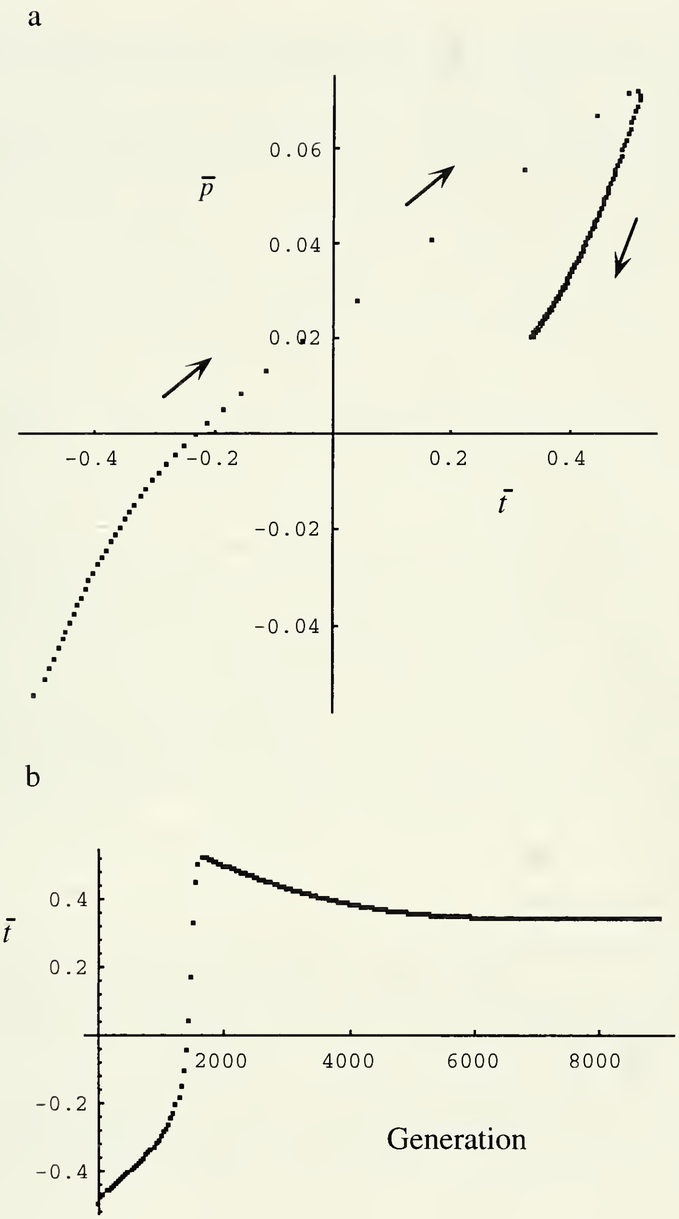


FIG. 3

Stable evolution caused by Fisher's runaway process. In this example mutation bias on the male trait u is large enough and the cost of choice b small enough for the equilibrium point to lie on the stable arc of the curve of equilibria. Parameter values are a=0.4, b=0.001, c=0.05, G_t=0.5, G_p=0.5, u=0.001.

certain value it increases rapidly. The implication to draw from this result is that traits exaggerated by runaway will change rapidly in time and quickly diverge in allopatric populations.

It is possible for runaway to cause the stable exaggeration of sexual characters. This occurs if there is strong mutation bias and weak choice costs. These conditions are restrictive. Mutation bias on Fisher traits, which only signal attraction to females, is unlikely to be very strong - though this has yet to measured. It is more likely that these conditions are fulfilled by sexual traits acting as indicators of good genes.

Other explanations of the diversity of sexually selected traits have stressed the importance of random genetic drift about a line of equilibrium (LANDE 1981). We can rule out the importance of drift in this context because its effect will be dominated by other weak forces with a directional component, especially choice costs. These reduce lines of equilibria to single endpoints that are globally stable. At a more general level we can not rule a role for drift as our model is deterministic. But drift's general importance is unproven.

Another explanation has focused on distinct selective pressures in geographically separated populations as a cause of diversity (LANDE 1982). This is entirely likely as the exaggeration of sexual traits is a balance between the strength of female preference and natural selection on the male trait. ENDLER (1980) has shown that this balance typifies Trinidadian guppy coloration, different populations' colour patterns varying with natural selection caused by predation pressure. Recently it has been established that female preference in the guppy is also constrained by predation pressure (GODIN & BRIGGS 1995). This may explain quantitative differences in the expression of sexual traits but is not sufficient to explain the extensive diversity of sexual traits seen in closely related species.

ACKNOWLEDGEMENTS

This research was supported by the Royal Society (AP) the Japanese Ministry of Education, Science and Culture (YI) and the NERC Centre for Population Biology, Imperial College at Silwood Park (YI). We are grateful for this support and also thank Hiroyuki Matsuda, Mark Pagel and Akira Sasaki for their helpful comments. Thanks to Jessica Young for providing unpublished information about sage grouse. This paper was originally given as a talk at the Swiss Zoological Society's meeting in 1995, and I extend my warm thanks to Paul Ward for his encouragement.

REFERENCES

ANDERSSON, M. 1994. *Sexual Selection*. Princeton University Press, Princeton, New Jersey.

BAKKER, T.C.M. & A. POMIANKOWSKI, 1995. The genetics of female mate preferences. *J. Evol. Biol.* 8: 129-171.

BULMER, M. 1989. The structural instability of sexual selection models. *Theoret. Pop. Biol.* 36: 195-206.

BUTLIN, R.K. 1987. Speciation by reinforcement. *Trends Ecol. Evol.* 2: 8-13.

CARSON, H.L. 1986. Sexual selection and speciation. In S. KARLIN & E NEVO (eds). *Evolutionary Processes and Theory*, pp. 391-409. Academic Press, Orlando.

CHARLESWORTH, B. 1987. The heritability of fitness. In J. W. BRADBURY & M.B. ANDERSSON (eds) *Sexual Selection: Testing the Alternatives*, pp. 21-40. Wiley, Chichester.

COATES, B. 1990. *The Birds of Papua New Guinea. Volume II Passerines*. Dove, Alderley, Queensland.

DARWIN, C.R. 1871. *The Descent of Man and Selection in Relation to Sex*. John Murray, London.

EBERHARD, W.G. 1985. *Sexual Selection and Animal Genitalia*. Havard University Press, Cambridge, Mass.

ENDLER, J.A. 1980. Natural selection on color patterns in *Poecilia reticulata*. *Evolution* 34: 76-91.

GODIN, J.-G. J. & S.E. BRIGGS. Female mate choice under predation risk in the guppy. *Anim. Behav.* In press.

GRAFEN, A. 1990. Biological signals as handicaps. *J. Theoret. Biol.* 144: 517-546.

FISHER, R.A. 1930. *The Genetical Theory of Natural Selection*. Clarendon Press, Oxford.

FRYER, G. & T.D. ILES. 1980. *The Clichlid Fishes of the Great Lakes of Africa*. Oliver & Boyd, Edinburgh.

HOWARD, D.J. 1993. Reinforcement: the origin, dynamics and fate of an evolutionary hypothesis. In HARRISON, R.G. (ed.) *Hybrid Zones and the Evolutionary Process*, pp. 118-142. Oxford University Press.

IWASA, Y. & A. POMIANKOWSKI.1995. Continual change in mate preferences. *Nature* 377: 420-422.

IWASA, Y., A. POMIANKOWSKI & S. NEE. 1991. The evolution of costly mate preference II. The 'handicap' principle. *Evolution* 45: 1431-1442.

KIRKPATRICK, M. & M.J. RYAN 1991. The evolution of mating preferences and the paradox of the lek. *Nature* 350: 33-38.

LANDE, R. 1981. Models of speciation by sexual selection on polygenic traits. *Proc. Natl. Acad. Sci. USA* 78: 3721-3725.

LANDE, R. 1982. Rapid origin of sexual isolation and character divergence in a cline. *Evolution* 36: 213-223.

MUKAI, T. & C.C. COCKERHAM 1977. Spontaneous mutation rates at enzyme loci in *Drosophila melanogaster*. *Proc. Natl. Acad. Sci. USA* 74: 2514-2517.

PATERSON, H.E.H. 1985. The recognition concept of species. In E.S. VRBA (ed.) *Species and Speciation* pp. 21-29. Transvaal Museum, Pretoria, South-Africa.

POMIANKOWSKI, A. 1987. The costs of choice in sexual selection. *J. theoret. Biol.* 128: 195-218.

POMIANKOWSKI, A. 1988. The evolution of female mate preferences for male genetic quality. *Oxford Surv. Evol. Biol.* 5: 136-184.

POMIANKOWSKI, A. & Y. IWASA. 1993. Evolution of multiple sexual ornaments by Fisher's process of sexual selection. *Proc. Roy. Soc. Lond. B* 253: 173-181.

POMIANKOWSKI, A. Y. IWASA & S. NEE. 1991. The evolution of costly mate preference I. Fisher and the biased mutation. *Evolution* 45: 1422-1430.

POMIANKOWSKI, A. & A.P. MØLLER. 1995. A resolution of the lek paradox. *Proc. Roy. Soc. Lond. B* 260: 21-29.

TAYLOR, P.D. & G.C. WILLIAMS. 1982. The lek paradox is not resolved. *Theor. Pop. Biol.* 22: 392-409.

TEMPLETON, A.R. 1980. The theory of speciation via the founder principle. *Genetics* 94: 1011-1038.

YOUNG, J.R., J.W. HUPP, J.W. BRADBURY & C.E. BRAUN. 1994. Phenotypic divergence of secondary sexual traits among sage grouse, *Centrocercus urophasianus*, populations. Anim. Behav. 47: 1353-1362.

REVUE SUISSE DE ZOOLOGIE, 102 (4) : 895-906; décembre 1995

Virilized sexual genitalia as adaptations of female spotted hyaenas*

Heribert HOFER & Marion L. EAST
Max-Planck-Institut für Verhaltensphysiologie,
D-82319 Seewiesen Post Starnberg, Germany.

Virilized sexual genitalia as adaptations of female spotted hyaenas. - The study of traits as adaptations is reviewed using virilized female sexual genitalia of spotted hyaenas as an example. Female spotted hyaenas lack a vagina, have completely fused outer labiae and a clitoris ('pseudo-penis') that closely mirrors the male penis in size and erectability. The evolutionary origin and adaptive value of these structures have eluded scientists for centuries. The example of virilized genitalia of female spotted hyaenas demonstrates that questions about the evolutionary origin of a trait benefit from adopting non-adaptive hypotheses: the virilized genitalia are most likely a non-adaptive by-product of selection pressures related to the evolution of siblicide. Field studies suggest that virilized genitalia have fitness costs in the context of parturition and convey benefits in communication (greeting ceremonies) and mating. The virilized genitalia of spotted hyaenas highlight the need to pay attention to three aspects in the study of adaptive processes. First, it is important to study current use and fitness consequences in the field. Second, an important empirical question is whether an observed trait is evolutionarily simple or complex in the sense that the trait may be composed of a number of sub-traits subjected to independent selection events. In this context comparative studies may be useful. Third, the evolutionary history of a trait may be strongly influenced by interactions with other traits.

INTRODUCTION

The study of adaptation is one of the most fundamental aspects of the study of evolution (WILLIAMS 1966). Adaptation is the process by which the adaptedness of an organism (its ability to live and reproduce in a given set of environments) improves over evolutionary time by natural selection (DOBZHANSKY 1968, ENDLER 1986). The term adaptation has also been used to describe the end-product of this process. Studying the process of adaptation in the most comprehensive sense requires the

---

* Main lecture presented at Zoologia 95.

investigation of the recursive interaction of allele frequencies, the morphological or physiological design of a trait, its performance, the fitness consequences of performance, and the genetic response to selection in the next generation (FEDER & WATT 1992). Studies with more modest aims focus on the adaptive value of a trait or its evolutionary origins. Whatever the purpose, the study of adaptation faces a number of difficult issues. The purpose of this contribution is to highlight some of these difficulties and discuss them using the virilized genitalia of female spotted hyaenas as an example.

Female spotted hyaenas have a pseudo-'penis' formed by the clitoris which closely resembles the male penis in shape and size (FRANK *et al.* 1990) and can be erected (MATTHEWS 1939, NEAVES *et al.* 1980, FRANK *et al.* 1990). There is no vulva, the labiae are fused and the urogenital tract passes through the clitoris. In other words, female spotted hyaenas urinate, copulate and give birth through their pseudo-'penis'. The penis and pseudo-'penis' play a special role during greeting ceremonies for both sexes. Greetings typically involve two hyaenas standing parallel, facing in opposite directions. The hind leg nearest the animal being greeted is usually raised while each animal sniffs or licks the erect 'penis' (WICKLER 1964, KRUUK 1972, MILLS 1990).

Early ideas were unanimous in that spotted hyaenas were considered to be hermaphrodites (Table 1). More recent debates about the evolution, ontogenetic development and function of the pseudo-'penis' of spotted hyaenas, on both proximate and ultimate levels, has centered around the role of the 'penis' in greeting ceremonies (WICKLER 1964, KRUUK 1972, RACEY & SKINNER 1979, GOULD 1981, GOULD & VRBA 1982, LINDEQUE & SKINNER 1982, HAMILTON *et al.* 1986, LINDEQUE *et al.* 1986, VAN JAARSVELD & SKINNER 1987, SHERMAN 1988, FRANK *et al.* 1991, EAST *et al.* 1993).

TABLE 1

Early ideas about the pseudo-penis of spotted hyaenas.

Idea	Source
Spotted hyaenas are simultaneous hermaphrodites	Aristotle, Ovid
Spotted hyaenas are sequential hermaphrodites and change sex every year	Plinius
'The laugh of the hyaena represents mischievous delight over its ability to change sex'	WILSON 1975, citing classic sources

TESTING HYPOTHESES ABOUT ADAPTATIONS

When we ask whether a trait is an adaptation, we ask whether it evolved because ancestrally there was selection for this trait and the trait conferred a fitness advantage because it performed a specific task (SOBER 1993). Hence we need to show that the trait conveyed a fitness advantage and that this fitness advantage arose from design rather than chance (WILLIAMS 1966). The study of adaptation is then partly a historical reconstruction. Hence, there can be several difficulties in testing the hypothesis that a trait is the result of the process of adaptation (the Alternative Hypothesis) against the null hypothesis that a trait is not the result of the process of adaptation. Difficulties may arise in several ways:

1. The 'false negatives': a trait may have historically served as an adaptation but lacks current utility (i.e. it has no current adaptive value). Lack of current adaptive value is consistent with the null hypothesis. However, the Alternative Hypothesis is not falsified by demonstrating a lack of current adaptive value (SOBER 1993).
2. The 'false positives': the trait originated as a by-product of selection for something else but possesses current utility (e.g. the 'exaptation' of GOULD & VRBA 1982). While current adaptive value is consistent with the Alternative Hypothesis it is insufficient to reject the null hypothesis (GOULD & LEWONTIN 1979).
3. If the trait has gone to fixation, i.e. there is no genotypic or phenotypic variation amongst the members of a population or a taxon, the adaptedness of such a trait may be difficult to determine because there is no agreed fitness measure (FEDER & WARD 1992). It may also be difficult to decide which task was associated with selection on the trait.
4. A trait may be complex in that it fulfills several tasks and may consist of subcomponents subject to independent selection pressures. This may be a common empirical problem because a trait is by definition identified as an adaptation by reference to a task while the study of a trait begins with a structure or behaviour whose task(s) are initially not known.
5. Selection on the trait may depend on interactions with other traits over evolutionary time.

Faced with these difficulties, a research program could proceed along the following lines. First, study current use and assess the fitness consequences of the trait in the field. If it is difficult to quantify fitness benefits directly, investigate whether individuals incur a cost due to its presence. The plausibility argument would then be that there must be fitness benefits compensating for these costs, otherwise the trait would have been selected against. Second, construct a non-adaptive scenario that explains the evolution of the trait without invoking specific tasks that the trait may have been selected for. The non-adaptive argument is important; it states that we do not require an adaptive explanation if we can identify a mechanism that creates the trait as an incidental by-product of selection operating on a different trait. Third, derive predictions from such a non-adaptive scenario and test them using field and laboratory studies of single species, or by using the comparative method (HARVEY & PAGEL 1991) on data from several species. Finally, compare the results with tests of predictions derived from adaptive hypotheses.

CURRENT USE

An extensive field study of greeting ceremonies in Serengeti spotted hyaenas demonstrated the prominent role of the erect 'penis' in animals of both sexes (EAST *et al.* 1993). Spotted hyaena greetings are a ritualized, active form of submission that confirm asymmetries in status between greeting partners (EAST *et al.* 1993). In mammals, submissive greeting gestures are often derived from behavioral traits typical of subordinate members of social groups, such as juveniles or females in male-dominated societies (wolf, *Canis lupus*: MECH 1970; elephant, *Loxodonta africana*: DOUGLAS-HAMILTON 1972; brown hyaena, *Parahyaena brunnea*: MILLS 1990; primates: WICKLER 1966, 1967, SUGIYAMA 1971, JOLLY 1972, STAMMBACH 1978, COLMENARES 1990). The result that in the female-dominated society of spotted hyaenas a typically male trait, the erect 'penis', is used as a signal of *submission* during greetings is compatible with this line of thought. In all other mammalian species that use penile displays during interactions, males are dominant over females, and the erect 'penis' is used as a display of dominance (PLOOG & MACLEAN 1963, WICKLER 1967, ANTHONEY 1968, JOLLY 1972, WEIGEL 1979). Even among platyrrhine species (*Ateles* sp., *Alouatta* sp.) in which females have an enlarged clitoris, the enlarged clitoris is used by females to display dominance (PLOOG 1967).

FITNESS CONSEQUENCES

Here we ask first whether anatomical components of the pseudo-'penis' or behavioural features of its use are inexplicable unless we postulate selection pressures that operate directly on the pseudo-'penis'. We then review evidence on fitness consequences of the pseudo-'penis' in three contexts.

One plausibility argument considers that large functionless organs are usually selected against. As the pseudo-'penis' comprises circa 1% of adult body mass (NEAVES *et al.* 1980) it is a large organ and unlikely to persist if it conveyed no fitness benefits (HAMILTON *et al.* 1986). HAMILTON *et al.* (1986) also pointed out that experimental induction of virilization of female genitalia in a variety of species did not produce a penile structure equivalent to that of the male.

Parturition. When female spotted hyaenas give birth, the pseudo-'penis' ruptures on the caudal side, causing a large wound (several centimeters) that may be a source of infection. Unusually many primiparous females produce stillbirths while subsequent deliveries are easier (GLICKMAN *et al.* 1992a, unpublished data). Primiparous females in the Serengeti also have a significantly smaller litter size than multiparous females (unpublished data). Losing the whole first litter at parturition imposes a loss in terms of lifetime reproductive success of at least 5% (unpublished data). These points suggest that maintenance of the pseudo-'penis' in spotted hyaenas entails a cost and that direct selection pressures operate to maintain the pseudo-'penis' in its current form.

Communication. No direct assessment of the fitness consequences of invoking the pseudo-'penis' during greeting ceremonies is available. However, a plausibility argument for fitness benefits may be constructed as follows. The erect 'penis' is the only gesture that reliably signals rank as well as rank difference in greetings between adult females and cubs (EAST *et al.* 1993). Thus, cubs can assess the social status of their mother in relation to that of adult female greeting partners. The erection of the 'penis' therefore provides a mechanism which permits the enforcement of 'rank inheritance' (HOLEKAMP & SMALE 1991), a notable benefit at least to offspring of higher ranking mothers.

Mating system. EAST *et al.* (1993) proposed a selective advantage for females that have the opening to their reproductive tract (the urogenital meatus) displaced to a position forward of their hind legs at the tip of their hypertrophied clitoris. We discuss this in more detail below.

VIRILIZED FEMALE GENITALIA: NON-ADAPTIVE HYPOTHESES

The evolutionary origins of the pseudo-'penis' in spotted hyaenas have been accredited to both non-adaptive processes and adaptive selection pressures. We begin with null models.

The first non-adaptive hypothesis states that female virilization was a consequence of a punctuated genetic translocation (VAN JAARSVELD & SKINNER 1987). This scenario does not explain how the trait would have gone to fixation and makes no predictions about trait design.

A second scenario suggests that female virilization was an incidental by-product of selection for elevated prenatal androgen levels leading to large size and social dominance of females over males (GOULD 1981, GOULD & VRBA 1982). HAMILTON *et al.* (1986) thought that the initial virilization of female genitalia evolved as a by-product of selection for larger body size and aggressiveness to obtain a competitive feeding advantage. The second scenario predicts

1. species with virilized females are more likely to have female-dominated societies than those without;
2. females are larger than males in female-dominated societies;
3. large, aggressive individuals become dominant;
4. virilized females have higher concentrations of androgens than non-virilized females.

Virilization of female external genitalia is rare in mammalian species and where it occurs it is not associated with female dominance in any species other than the spotted hyaena (e.g. European moles *Talpa europaea*: MATTHEWS 1935, platyrrhine monkeys: PLOOG 1967, OPPENHEIMER 1977). In mammalian species, female dominance is also uncommon, but does occur in a wide variety of species (RALLS 1976, HRDY 1981) and is typical for Lemuriformes (JOLLY 1984, RICHARD 1987, KAPPELER 1990, YOUNG *et al.* 1990). Masculinization of female external genitalia has not been recorded in any female-dominated species except for the spotted hyaena. Female dominance in mammals is not dependent on females being larger than males, and dominance is not a function of aggressiveness (ROWELL 1974). Even in spotted hyaenas, females are not necessarily larger than males (HAMILTON *et al.* 1986, unpublished data) and body size in males and females is not related to social rank in our Serengeti population nor in captive animals (FRANK *et al.* 1989). In several primate species (*Saimiri, Cebus, Cercopithecus talapoin, Macaca mulatta, Erythrocebus patas*) coalitions of females can successfully challenge dominance of larger males (HALL 1967, KAPLAN & ZUCKER 1980, HARVEY *et al.* 1987, ROBINSON *et al.* 1987, SMUTS 1987), while in spotted hyaenas coalitions are important in the maintenance of female rank (see above), and may have been important in the development of female dominance (FRANK *et al.* 1989). Adult female spotted hyaenas do not have significantly higher levels of androgens than adult males (RACEY & SKINNER 1979, FRANK *et al.* 1985, LINDEQUE *et al.* 1986, VAN JAARSVELD & SKINNER 1991; GLICKMAN *et al.* 1992b). Androgen levels in female spotted hyaenas are not elevated in relation to androgen levels in female brown or striped hyaenas (VAN JAARSVELD & SKINNER 1987). The striking aspect of the hormonal profile of adult spotted hyaenas are the low androgen levels of adult males compared with males of other hyaena species (VAN JAARSVELD & SKINNER 1987, 1991). In summary, neither comparative evidence nor current knowledge of spotted hyaena behavior and endocrinology appear to support the non-adaptive scenario that links selection for social dominance with elevated pre-natal androgen levels via body size or aggressiveness.

A third scenario links pre-natal androgen levels to *siblicide* (HOFER & EAST 1992, EAST *et al.* 1993) as there is frequent fatal neonatal aggression between members of a twin litter (FRANK *et al.* 1991). The third scenario predicts that

1. spotted hyaenas have higher androgen concentrations during the period of siblicide (several weeks beginning shortly after birth) than species without siblicide;
2. patterns of maternal investment favour strong neonatal aggression leading to siblicide;
3. species with neonatal siblicide have traits that undergo accelerated foetal development compared to species without;
4. species with neonatal siblicide are more likely to be virilized than those without.

Siblicide is associated with extremely high neonatal aggression and high androstenedione levels at birth and during ontogeny (FRANK *et al.* 1991, LICHT *et al.* 1992). FRANK *et al.* (1991) proposed that siblicide is "another phenomenon that may have originated as a by-product of selection for female androgenization". In contrast, we suggested that the exceptionally high (GITTLEMAN & OFTEDAL 1987) investment in lactation and long nursing period in spotted hyaenas (EAST *et al.* 1989, HOFER & EAST 1993) favours strong selection for high neonatal aggression leading to siblicide (HOFER & EAST 1992). Following this line of argument, the elevated levels of androgens (androstenedione in females, testosterone in males) recorded during foetal development, at birth, and during the initial months of life (GLICKMAN *et al.* 1987, FRANK *et al.* 1991, LICHT *et al.* 1992) have been selected for to produce neonates primed for severe agonistic encounters with fully erupted teeth and open eyes. Spotted hyaenas are the only species of carnivores currently known to be born with fully erupted teeth and open eyes. Developmental acceleration of siblicide-relevant anatomical structures and behaviours appear to place spotted hyaenas on the borderline between altricial and precocial species (MARTIN & MACLARNON 1985, VAN JAARSVELD *et al.* 1988). Spotted hyaenas are currently the only mammalian species known with frequent neonatal siblicide (FRANK *et al.* 1991), and the only species with such elaborately virilized genitalia. We conclude that current evidence is consistent with the Hofer & East hypothesis.

VIRILIZED FEMALE GENITALIA: ADAPTIVE HYPOTHESES

The first adaptive hypothesis attributed the evolution of the pseudo-'penis' directly to selective advantages of a structure that becomes conspicuous through erection, focussing the attention of greeting partners and keeping them together over a longer period, thereby facilitating the re-establishment of social bonds (WICKLER 1965, KRUUK 1972). The second adaptive hypothesis attributed the evolution of the pseudo-'penis' indirectly to a two-stage process where after the initial evolution of virilization (see above) a penile signal was incorporated into greetings, favouring selection for the enlargement and erectile nature of the pseudo-'penis' (HAMILTON *et al.* 1986). These two adaptive hypotheses predict:

1. Adults that meet infrequently should display an erect penis more often than adults that meet frequently. This means that males should erect their penises in all-male greetings more often than females in all-female greetings (HOFER & EAST 1993).
2. Greetings should last longer and be more likely to be asymmetric with respect to 'penis' erection in cases where the benefits of greetings are likely to be larger. This means that greetings ought to last longer and be more likely to be asymmetric in greetings between adult females than other age/sex categories (EAST *et al.* 1993).
3. The erection of the penis provides information not available through other gestures during the greeting ceremony.

All three predictions were confirmed by EAST *et al.*'s (1993) field study. Greetings between immigrant males comprised a substantially higher proportion of cases with both individuals erecting their 'penis' than greetings between adult females. Greetings between adult females lasted significantly longer and comprised a higher proportion of asymmetric greetings with respect to 'penis' erection than greetings between males. There are gestures besides the erect 'penis' that are available to signal submission. However, the erect 'penis' is the only gesture that reliably signals absolute rank as well as rank difference in greetings between adult females and cubs. This emphasizes the influence of the rank of a cub's mother on the socialization of the cub because it permits cubs to assess the social status they obtain from their mother in relation to that of an adult female greeting partner. Thus, it provides a mechanism that permits the enforcement of 'rank inheritance' (HOLEKAMP & SMALE 1991).

The third adaptive hypothesis proposed that after the initial virilization a selective advantage accrued to those females that had the opening to their reproductive tract displaced to a position forward of their hind legs because they gained control over the mechanics of copulation and male mating success now depended on the goodwill of the females (EAST *et al.* 1993). The third hypothesis predicts that

1. males expend extensive effort on courting females;
2. aggression amongst contemporary males is low;
3. male spotted hyaenas have unusually low androgen levels;
4. asymmetries in gestures in greetings between males are less common than in greetings between females;
5. number of forced greetings between immigrant males is low.

The structure and position of the pseudo-'penis' dictates that males have considerable difficulty locating and penetrating the clitoris opening (KRUUK 1972, own observations). Although the pseudo-'penis' is not erect during mating, its presence and position prevent males from achieving intromission without the complete cooperation of the female, i.e. forced copulations are impossible. Females thus gain control over the mechanics of copulation and male mating success becomes dependent on the relationships they develop with females. Then, the importance of sexual selection for male fighting prowess would be minimal because an amicable relationship with a female is a non-transferrable resource. As males achieve little by fighting with each other game theory predicts that fights should be rare and/or fighting intensity low (MAYNARD SMITH 1982, HARPER 1991). Androgen levels of males are unusually low and aggression amongst contemporary males is low (FRANK 1986, EAST & HOFER 1991). Males do expend extensive effort on courting females (EAST & HOFER 1991). Asymmetries in gestures in greetings between males are less common than in greetings between females and the number of forced greetings between immigrant males was low (EAST *et al.* 1993). In short, maintenance of the pseudo-'penis' may have facilitated the evolution of male submission by providing females with control over mating in a species where males do not contribute to parental care.

A SIMPLE OR A COMPLEX TRAIT?

Several lines of evidence suggest that the pseudo-'penis' may represent a complex trait comprising different components subjected to independent selection events. For instance, while parturition in primiparous spotted hyaenas is associated with unusually high litter losses, there are no reports that parturition is impeded in primiparous primates with virilized genitalia. Female European moles have a separate vaginal opening at the base of their pseudo-'penis' (MATTHEWS 1935, NIETHAMMER

1990) which facilitates both mating and parturition. There are no reports that females of species with virilized genitalia can fully erect the enlarged clitoris other than spotted hyaenas. This is probably a consequence of the sexual dimorphism found in Onuf's nucleus, the area in the sacral spinal chord responsible for erecting the 'penis' which is well-developed in males but not in females in all species studied so far (Breedlove & Arnold 1980, Forger & Breedlove 1986). We predict that in spotted hyaenas, Onuf's nucleus is monomorphic in structure. If this is the case, then the ability to erect the pseudo-'penis' might be another trait unexplained by the current non-adaptive scenarios.

CONCLUSIONS

The example of virilized genitalia of female spotted hyaenas shows that the study of adaptations benefits from carefully considering non-adaptive scenarios on the evolutionary origins of a trait. What was initially considered one trait (the virilized genitalia) may well turn out to be a complex of several sub-traits subjected to different selection pressures. Here the analysis of comparative data plays a crucial role in deciding whether the trait is simple or complex in this sense. This difficulty is likely to arise frequently because a trait is identified as an adaptation by reference to a task while the study of a trait begins with a structure or behaviour whose task(s) are initially not known. We have argued that the pseudo-'penis' has negative fitness consequences in the context of parturition but the argument is less tight than it could be if hyaena populations consisted of females with and without pseudo-'penises'. In other words, lack of variation in a trait because it has gone to fixation makes it difficult to assess the adaptedness of a trait. Several arguments suggest that the virilized genitalia possess current utility as well as specificity in the sense that this trait evolved (after its initial origination) to fulfill two specific tasks in communication and mating.

The discussion of one trait has led us to use arguments from many disciplines dedicated to questions about both proximate and ultimate causes. It also became important to consider the possible links and interactions to other anatomical, behavioural and life history traits. While the reconstruction of a historical process will remain incomplete without a complete fossil record, careful formulation of hypotheses and predictions can take us some way to establishing traits as adaptations.

REFERENCES

Anthoney, T.R. 1968. The ontogeny of greeting, grooming, and sexual motor patterns in captive baboons (superspecies *Papio cynocephalus*). *Behaviour* 31: 358–372.

Breedlove, S.M., A.P. Arnold. 1980. Hormone accumulation in a sexually dimorphic motor nucleus of the rat spinal cord. *Science* 210: 564–566.

Colmenares, F. 1990. Greeting behaviour in male baboons, I: Communication, reciprocity and symmetry. *Behaviour* 113: 81–114.

Dobzhansky, T. 1968. On some fundamental concepts of Darwinian biology. *Evol. Biol.* 2: 1–34.

DOUGLAS-HAMILTON, I. 1972. On the ecology and behaviour of the African elephant: the elephants of Lake Manyara. *DPhil. thesis, Oxford University.*

EAST, M.L., H. HOFER, A. TÜRK. 1989. Functions of birth dens in spotted hyaenas (*Crocuta crocuta*). *J. Zool. Lond.* 219: 690–697.

EAST, M.L., H. HOFER. 1991. Loud calling in a female-dominated mammalian society: II. Behavioural contexts and functions of whooping of spotted hyaenas, (*Crocuta crocuta*). *Anim. Behav.* 42: 651–669.

EAST, M.L., H. HOFER, W. WICKLER. 1993. The erect 'penis' is a flag of submission in a female-dominated society: greetings in Serengeti spotted hyenas. *Behav. Ecol. Sociobiol.* 33: 355–370.

ENDLER, J.A. 1986. *Natural selection in the wild.* Princeton University Press, Princeton.

FEDER, M.E., W.B. WATT. 1992. Functional biology of adaptation. *In:* BERRY R.J., CRAWFORD T.J., HEWITT G.M. (eds), Genes in ecology. *Blackwell Scientific*, Oxford, pp. 365–392.

FORGER, N.G., S.M. BREEDLOVE. 1986. Sexual dimorphism in human and canine spinal cord: role of early androgen. *Proc. Nat. Acad. Sci. USA* 83: 7527–7531.

FRANK, L.G. 1986. Social organisation of the spotted hyaena (*Crocuta crocuta*). II. Dominance and reproduction. *Anim. Behav.* 34: 1510–1527.

FRANK, L.G., J.M. DAVIDSON, E.R. SMITH. 1985. Androgen levels in the spotted hyaena *Crocuta crocuta:* the influence of social factors. *J. Zool. Lond.* A206: 525–531.

FRANK, L.G., S.E. GLICKMAN, P. LICHT. 1991. Fatal sibling aggression, precocial development and androgens in neonatal spotted hyaenas. *Science* 252: 702–704.

FRANK, L.G., S.E. GLICKMAN, I. POWCH. 1990. Sexual dimorphism in the spotted hyaena (*Crocuta crocuta*). *J. Zool. Lond.* 221: 308–313.

FRANK, L.G., S.E. GLICKMAN, C.J. ZABEL. 1989. Ontogeny of female dominance in the spotted hyaena: perspectives from nature and captivity. *Symp. zool. Soc. Lond.* 61: 127–146.

GITTLEMAN, J.L., O.T. OFTEDAL. 1987. Comparative growth and lactation energetics in carnivores. *Symp. zool. Soc. Lond.* 57: 41–77.

GLICKMAN, S.E., L.G. FRANK, J.M. DAVIDSON, E.R. SMITH, P.K. SIITERI. 1987. Androstenedione may organize or activate sex-reversed traits in female spotted hyaena. *Proc. Nat. Acad. Sci. USA* 84: 3444–3447.

GLICKMAN, S.E., L.G. FRANK, P. LICHT, T. YALCINKAYA, P.K. SIITERI, J. DAVIDSON. 1992a. Sexual differentiation of the female spotted hyena. *Ann. New York Acad. Sci.* 662: 135–159.

GLICKMAN, S.E., L.G. FRANK, S. PAVGI, P. LICHT. 1992b. Hormonal correlates of 'masculinization' in female spotted hyaenas (*Crocuta crocuta*). I. Infancy to sexual maturity. *J. Reprod. Fert.* 95: 451–462.

GOULD, S.J. 1981. Hyena myths and realities. *Nat. Hist.* 90: 16–24.

GOULD, S.J., R.C. LEWONTIN. 1979. The spandrels of San Marco and the Panglossian paradigm: a critique of the adaptionist program. *Proc. Roy. Soc. Lond.* B205: 581–598.

GOULD, S.J., E.S. VRBA. 1982. Exaptation — a missing term in the science of form. *Paleobiol.* 8: 4–15.

HALL, K.R.L. 1967. Social interactions of the adult male and adult females of a patas monkey group. *In:* ALTMANN S.A. (ed.), Social communication among primates. *University of Chicago Press, Chicago*, pp. 261–280.

HAMILTON, W.J., R.L. TILSON, L.G. FRANK. 1986. Sexual monomorphism in spotted hyaenas, *Crocuta crocuta. Ethology* 71: 63–73.

HARPER, D.G.C. 1991. Communication. *In:* KREBS J.R., DAVIES N.B. (eds), Behavioural ecology: an evolutionary approach. *Blackwell Scientific, Oxford*, pp. 374–397.

HARVEY, P.H., R.D. MARTIN, T.H. CLUTTON-BROCK. 1987. Life histories in comparative perspectives. *In:* SMUTS B.B., CHENEY D.L., SEYFARTH R.M., WRANGHAM R.W., STRUHSAKER T.T. (eds), Primate societies. *University of Chicago Press, Chicago*, pp. 181–196.

Harvey, P.H., M.D. Pagel. 1991. The comparative method in evolutionary biology. *Oxford University Press*, Oxford.

Hofer, H., M.L. East. 1992. Siblicide of spotted hyaenas is a consequence of allocation of maternal effort and a cause of skewed litter sex ratios. *Abstracts Fourth Int. Behav. Ecol. Congr. Princeton, New Jersey.*

Hofer, H., M.L. East. 1993. The commuting system of Serengeti spotted hyaenas: how a predator copes with migratory prey. III. Attendance and maternal care. *Anim. Behav.* 46: 575–589.

Holekamp, K.E., L. Smale. 1991. Dominance acquisition during mammalian social development: The "inheritance" of maternal rank. *Am. Zool.* 31: 306–317.

Hrdy, S.B. 1981. The woman that never evolved. *Harvard University Press, Cambridge.*

Jaarsveld, A.S. van, J.D. Skinner. 1987. Spotted hyaena monomorphism: an adaptive 'phallusy'? *S. Afr. J. Sci.* 83: 612–615.

Jaarsveld, A.S. van, J.D. Skinner, M. Lindeque. 1988. Growth, development and parental investment in the spotted hyaena *Crocuta crocuta. J. Zool. Lond.* 216: 45–53.

Jaarsveld, A.S. van, J.D. Skinner. 1991. Plasma androgens in spotted hyaenas (*Crocuta crocuta*): influence of social and reproductive development. *J. Reprod. Fert.* 93: 195–201.

Jolly, A. 1972. The evolution of primate behaviour. *Macmillan, New York.*

Jolly, A. 1984. The puzzle of female feeding priority. In: Small M. (ed.), Female Primates: studies by women primatologists. *Alan R. Liss, New York.*

Kaplan, J.R., E. Zucker. 1980. Social organization of a group of free-ranging Patas monkeys. *Folia Primatol.* 34: 196–213.

Kappeler, P.M. 1990. Female dominance in *Lemur catta*: more than just female feeding priority? *Folia Primatol.* 55: 92–103.

Kruuk, H. 1972. The spotted hyena. *University of Chicago Press, Chicago.*

Licht, P., L.G. Frank, S. Pavgi, T.M. Yalcinkaya, P.K. Siiteri, S.E. Glickman. 1992. Hormonal correlates of 'masculinization' in female spotted hyaenas (*Crocuta crocuta*) 2. Maternal and fetal steroids. *J. Reprod. Fert.* 95: 463–474.

Lindeque, M., J.D. Skinner. 1982. Fetal androgens and sexual mimicry in spotted hyaena (*Crocuta crocuta*). *J. Reprod. Fert.* 65: 405–410.

Lindeque, M., J.D. Skinner, R.P. Millar. 1986. Adrenal and gonadal contribution to circulating androgens in spotted hyaenas (*Crocuta crocuta*) as revealed by LHRH, hCG and ACTH stimulation. *J. Reprod. Fert.* 78: 211–217.

Martin, R.D., A.M. MacLarnon. 1985. Gestation period, neonatal size, and maternal investment in placental mammals. *Nature* 313: 220–223.

Matthews, L.H. 1935. The oestrus cycle and intersexuality in the female mole *Talpa europaea. Linn. Proc. zool. Soc. Lond.* 106: 347–383.

Matthews, L.H. 1939. Reproduction in the spotted hyaena (*Crocuta crocuta* Erxleben). *Phil. Trans. Roy. Soc. Lond.* B230: 1–78.

Maynard Smith, J. 1982. Evolution and the theory of games. *Cambridge University Press, Cambridge.*

Mech, L.D. 1970. The wolf. *University of Minnesota Press, Minneapolis.*

Mills, M.G.L. 1990. Kalahari hyaenas. The comparative behavioural ecology of two species. *Unwin Hyman, London.*

Neaves, W.B., J.E. Griffin, J.D. Wilson. 1980. Sexual dimorphism of the phallus in spotted hyaena (*Crocuta crocuta*). *J. Reprod. Fert.* 59: 509–513.

Niethammer, J. 1990. *Talpa europaea Linnaeus, 1758* – Maulwurf. *In:* Niethammer J., Krapp F. (eds), Handbuch der Säugetiere Europas 3/I: Insektenfresser, Primaten. *Aula Verlag, Wiesbaden*, pp. 99–133.

OPPENHEIMER, J.R. 1977. Communication in New World monkeys. *In:* SEBEOK T.A. (ed.), How animals communicate. *Indiana University Press, Bloomington*, pp. 851–889.

PLOOG, D.W. 1967. The behaviour of squirrel monkeys (*Saimiri sciureus*) as revealed by sociometry, bioacoustics, and brain stimulation. *In:* Altmann S.A. (ed.), Social communication among primates. *University of Chicago Press, Chicago*, pp. 149–184.

PLOOG, D.W., P.D. MACLEAN. 1963. Display of penile erection in squirrel monkeys (*Saimiri sciureus*). *Anim. Behav.* 11: 32–39.

RACEY, P.A., J.D. SKINNER. 1979. Endocrine aspects of sexual mimicry in spotted hyaenas (*Crocuta crocuta*). *J. Zool. Lond.* 187: 315–326.

RALLS, K. 1976. Mammals in which females are larger than males. *Quart. Rev. Biol.* 51: 245–276.

RICHARD, A.F. 1987. Malagasy prosimians: female dominance. *In:* SMUTS B.B., CHENEY D.L., SEYFARTH R.M., WRANGHAM R.W., STRUHSAKER T.T. (eds), Primate societies. *University of Chicago Press, Chicago*, pp. 25–33.

ROBINSON, J.G., P.C. WRIGHT, W.G. KINZEY. 1987. Monogamous cebids and their relatives: intergroup calls and spacing. *In* SMUTS B.B., CHENEY D.L., SEYFARTH R.M., WRANGHAM R.W., STRUHSAKER T.T. (eds), Primate societies. *University of Chicago Press, Chicago*, pp. 44–53.

ROWELL, T.H. 1974. The concept of social dominance. *Behav. Biol.* 11: 131–154.

SHERMAN, P.W. 1988. The levels of analysis. *Anim. Behav.* 36: 616–618.

SMUTS, B.B. 1987. Gender, aggression, and influence. *In:* SMUTS B.B., CHENEY D.L., SEYFARTH R.M., WRANGHAM R.W., STRUHSAKER T.T. (eds), Primate societies. *University of Chicago Press, Chicago*, pp. 400–412.

SOBER, E. 1993. Philosophy of biology. *Oxford University Press, Oxford.*

STAMMBACH, E. 1978. On social differentiation in groups of captive female hamadryas baboons. *Behaviour* 67: 322–338.

SUGIYAMA, K. 1971. Characteristics of the social life of bonnet macaques (*Macaca radiata*). *Primates* 12: 247–266.

WEIGEL, R.M. 1979. The facial expression of the brown capuchin monkey (*Cebus apella*). *Behaviour* 68: 250–276.

WICKLER, W. 1964. Vom Gruppenleben einiger Säugetiere Afrikas. *Mitt. Max-Planck-Ges.* 5-6: 296–309.

WICKLER, W. 1965. Die Evolution von Mustern der Zeichnung und des Verhaltens. *Naturwiss.* 52: 335–341.

WICKLER, W. 1966. Ursprung und biologische Deutung des Genitalpräsentierens männlicher Primaten. *Z. Tierpsychol.* 23: 422–437.

WICKLER, W. 1967. Socio-sexual signals and their intra-specific imitation among primates. *In:* MORRIS D. (ed.), Primate ethology. *Weidenfeld & Nicolson. London*, pp. 69–147.

WILLIAMS, G.C. 1966. Adaptation and natural selection. *Princeton University Press, Princeton.*

WILSON, E.O. 1975. Sociobiology. *Harvard University Press, Cambridge Mass.*

YOUNG, A.L., A.F. RICHARD, L.C. AIELLO. 1990. Female dominance and maternal investment in strepsirrhine primates. *Am. Nat.* 135: 473–488.

REVUE SUISSE DE ZOOLOGIE, 102 (4) : 907-912; décembre 1995

Recovery from eutrophication delayed in the profundal of Lake Neuchâtel: evidence from the oligochaete communities

Claude LANG & Olivier REYMOND
Conservation de la faune, Marquisat 1,
CH-1025 St-Sulpice, Switzerland.

Recovery from eutrophication delayed in the profundal of Lake Neuchâtel: evidence from the oligochaete communities.- In Lake Neuchâtel (Switzerland), total phosphorus (TP) concentrations decreased from 42 mg m^{-3} in 1982 to 18 mg m^{-3} in 1994. In 1994, responses of oligochaete communities to this decrease were analysed in the deepest area (74 m–139 m) of the northern basin. Mean relative abundance of oligotrophic species (mostly *Spirosperma velutinus* and *Stylodrilus heringianus*) was around 14%, as in a meso-eutrophic lake, and well below 39%, the value predicted from TP. In contrast, at a depth of 40 m, mean relative abundance of oligotrophic species increased from 16% in 1984 to 33% in 1992, as predicted from TP. In Lake Neuchâtel as in Lake Geneva, responses of oligochaete communities to the abatement of eutrophication were slower and less clear in the deepest areas than in the sublittoral.

Key-words: Biomonitoring - Eutrophication - Indicator species - Lake - Zoobenthos.

INTRODUCTION

In Lake Neuchâtel (Switzerland), mean total phosphorus concentrations decreased from 42 mg m^{-3} in 1982 to 18 mg m^{-3} in 1994 (POKORNI, 1994). At a depth of 40 m, oligochaete communities responded clearly to the increase (LANG & REYMOND, 1993): mean relative abundance of oligotrophic species increased from 16% in 1984 to 33% in 1992. At the same depth, the same trend was observed in Lake Geneva between 1982 and 1991 (LANG & REYMOND, 1992) but, at a depth of 150 m, the response of worms was slower and less clear (LANG & REYMOND, 1995).

In the present study, we analyse the response of oligochaete communities to the abatement of eutrophication in the deepest area (74 m - 139 m) of the northern basin of Lake Neuchâtel. Our goal is to determine if the recovery, observed at a depth of 40 m, has extended its effects down to the profundal. In this case, the observed relative abundance of oligotrophic species will be close to the value predicted from total phosphorus concentrations (LANG, 1990).

Manuscript accepted 03.04.1995.

STATIONS AND METHODS

Sixty-five sampling sites were visited in June 1994 in the northern basin of Lake Neuchâtel (Fig. 1). Sites, located with a GPS (Global Positioning System) receptor, were regularly spaced (500 m apart) on 5 parallel transects. These five transects (500 m apart) covered the whole profundal (depth of sites: 74 - 139 m, mean 127 m), forming a regular grid system.

In each site, one 16 cm^2 sediment core (30 cm long) was taken from the surface with a gravity corer. In the laboratory, the sediment was sieved (mesh size: 0.2 mm) and the retained material preserved in 5% formalin. The collected macrofauna consisted mainly of tubificid and lumbriculid worms which were picked and counted. Worms whose diameter was greater than 0.29 mm were mounted (REYMOND, 1994) and identified to species. Juvenile worms (diameter less than 0.3 mm) were excluded to decrease the effects of seasonal variability on species abundance (LANG, 1991). The biological analysis was based on 48 cores in which adult worms were present. Seventeen cores were excluded because macrofauna was absent (7 cores) or only a few juvenile worms were present.

Species whose numerical dominance in tubificid and lumbriculid communities indicates, respectively, oligotrophic, mesotrophic or eutrophic conditions (LANG, 1991) were designated oligotrophic, mesotrophic and eutrophic species in Table 1. Relative abundance (%) of oligotrophic species (OS), calculated as a percentage of the total number of tubificid and lumbriculid worms present in each core, was predicted from total phophorus (TP) concentrations (mg m^{-3}) recorded in the water during the five years preceding the sampling of worms (LANG, 1990):

$$\text{Equation 1} \qquad OS = 80.29 - 8.35\ TP^{0.5}$$

where TP = 51.5 mg m^{-3} (mean for 1979 - 1983), TP = 29.4 mg m^{-3} (mean for 1987–1991), TP = 24.6 mg m^{-3} (mean for 1989 - 1993), (POKORNI, 1994).

The area studied in 1994 has not been visited previously, except in part by MONARD (1919) in 1918. Therefore, we used the area visited in 1984 and 1992, at a depth of 40 m, as a reference (Fig. 1).

RESULTS

Sampling sites visited in 1994 were located deeper (127 m) than those studied in 1984 and 1992 (40 m). Therefore some of the differences recorded in 1994 can be attributed to depth rather than to eutrophication. For instance, abundance of species 5 to 8 of table 1 tends to decrease with depth, even in oligotrophic lakes (LANG, 1990). *Potamothrix vejdovskyi*, absent from Lake Neuchâtel in 1984, was relatively frequent in 1992 (LANG & REYMOND, 1993). In Lake Geneva, the abundance of this species decreases below 100 m, probably because its reproduction is limited by low temperature (LANG & REYMOND, 1995). Therefore its scarcity in 1994 can also be ascribed to depth, as indicated by its distribution (Fig. 1).

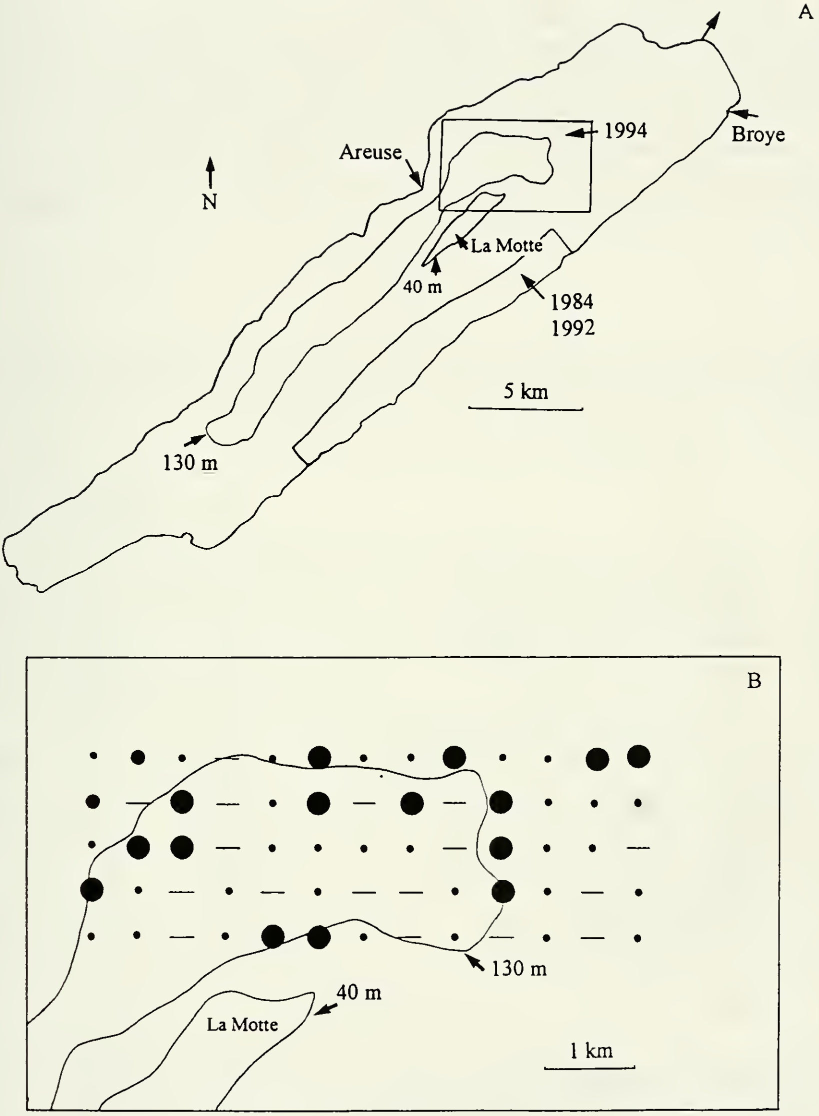


FIG. 1

A. Location of sampling areas (with sampling years indicated) in Lake Neuchâtel. Area: 215 km^2, mean depth: 64 m, max. depth: 153 m, volume: 13.8 km^3 (SOLLBERGER, 1974). La Motte is an underwater hill whose top is 10 m under the surface. B. Location of the sampling sites visited in 1994. Presence of oligotrophic worm species (large circle), of mesotrophic species (intermediate circle), and of eutrophic species only (small circle), site without macrofauna (dash).

In 1994, oligotrophic species, which are not limited by depth in oligotrophic lakes (LANG, 1990), were mainly present on the edge of the deepest area (Fig. 1). In contrast, sites in which only eutrophic species were present or sites without macrofauna were mostly located in the deepest area. These different distributions could be explained by a deterioration of oxygen conditions with depth.

Occurence of oligotrophic species indicated that the 1994 situation, expressed in terms of trophic state, was closer to that of 1984 than to that of 1992 (Tab. 1). Indeed, mean relative abundance of oligotrophic species was the same in 1984 and in 1994, but it was higher in 1992 (Tab. 2).

TABLE 1

Changes recorded between 1984 and 1994 in lumbriculid and tubificid communities of Lake Neuchâtel. For species 1 and 2, results pooled together. Samples collected at a mean depth of 40 m in 1984 and 1992, of 127 m in 1994. Values for species 6 to 10 based only on mature individuals.

		Occurrence (%)		
Code	Species	1984 (n = 64)	1992 (n = 171)	1994 (n = 48)
1	*Bichaeta sanguinea* Bretscher			
2	*Stylodrilus heringianus* Claparède	37.5	46.8	6.2
3	*Spirosperma velutinus* (Grube)	17.2	19.3	25.0
4	*Potamothrix vejdovskyi* (Hrabe)	0	23.4	4.2
5	*Spirosperma ferox* (Eisen)	1.6	13.5	0
6	*Potamothrix moldaviensis* (Vejdovsky, Mrazek)	0	9.3	0
7	*Limnodrilus hoffmeisteri* (Claparède)	6.2	4.1	0
8	*Limnodrilus profundicola* (Verrill)	7.8	0	0
9	*Potamothrix hammoniensis* (Michaelsen)	10.9	15.2	2.1
10	*Tubifex tubifex* (Müller)	25.0	7.6	8.3
	Species 7–8 (immatures included)	40.6	28.1	2.1
	Species 9–10 (immatures included)	100.0	67.3	91.7
	Oligotrophic species 1–3	43.8	59.1	31.3
	Mesotrophic species 4–6	1.6	32.7	4.2
	Eutrophic species 7–10	100.0	77.2	91.7

TABLE 2

Changes recorded in oligochaete communities of Lake Neuchâtel between 1984 and 1994. Significantly (P = 0.05) different means underlined. Right of the mean: standard error.

		Species					
Mean abundance	Year	Oligotrophic		Mesotrophic		Eutrophic	
Absolute (No. per core)	1984	1.01	0.19	0.02	0.02	4.97	0.39
	1992	1.15	0.10	0.58	0.08	1.89	0.15
	1994	0.33	0.07	0.04	0.03	2.50	0.38
Relative (%)	1984	15.8	2.8	0.3	0.3	83.9	2.8
	1992	33.0	2.7	14.6	1.9	52.4	2.9
	1994	14.4	3.9	3.1	2.3	82.5	4.3

DISCUSSION

Around 1900, Lake Neuchâtel was oligotrophic as most of the large and deep lakes of Switzerland (FRICKER, 1980). As in these other lakes (PIGUET & BRETSCHER, 1913), oligotrophic species (mostly *Spirosperma velutinus* and *Stylodrilus heringianus*) were present in most (90%) samples collected in 1918 in the northern basin of Lake Neuchâtel (MONARD, 1919). In this first study, *Spirosperma velutinus* demonstrates already its indicator value: this species was absent from areas receiving heavy organic inputs (dead leaves) from the Areuse river.

Mean relative abundance of oligotrophic species was not computed for this first study because individuals were not counted. Instead, the mean abundance of these species, observed in Lake Superior (North America), was used as a reference for oligotrophic conditions (LANG, 1990). According to results from several lakes (LANG, 1979, 1990), mean values decrease from 70% in oligotrophic lakes to around 35% in mesotrophic lakes, to around 17.5% in meso-eutrophic lakes, and to zero in the profundal of eutrophic lakes. These values were used as references to interpret results from Lake Neuchâtel.

Following the increase of phosphorus concentrations from 12 mg m^{-3} in 1962 to 67 mg m^{-3} in 1980 (LANG, 1989), mean relative abundance of oligotrophic species decreases to 9% in 1980 in the whole Lake Neuchâtel, i.e. close to zero, the value indicative of eutrophic conditions. In the deepest area (150 m), the abundance was as low as 2.4%, but on the Motte, an underwater hill swept by currents (Fig. 1), mean values higher than 30% persisted.

After the decrease of phosphorus concentrations, mean abundance of oligotrophic species, recorded at a depth of 40 m, indicated that the lake was meso-eutrophic in 1984, but mesotrophic in 1992 (Tab. 2). In contrast, the lake remained meso-eutrophic in 1994, at a mean depth of 127 m, according to oligotrophic species. Mean relative abundance of these species, predicted from total phosphorus concentrations (Equation 1, see Stations and methods), was 20.4% for 1984, 35% for 1992, and 38.9% for 1994 respectively. Predicted and observed values were close in 1984 and 1992, but the difference was large in 1994 (Tab. 2). The low abundance observed in 1994 indicated that the recovery from eutrophication was delayed in the profundal of Lake Neuchâtel. The same trend was observed in Lake Geneva (LANG & REYMOND, 1995).

A shortage of oxygen at the interface between sediment and water could explain this delay. Mortality of whitefish (*Coregonus* sp.) eggs, a species typical of oligotrophic lakes, was high in some Swiss lakes (MÜLLER, 1992) even if, as in Lake Neuchâtel (POKORNI, 1994), oxygen concentrations, measured 1 m above the bottom, were always higher than 7 mg l^{-1}. However, oxygen uptake by the sediment was large enough in these previously productive lakes to create a thin but almost anoxic layer at the interface. Hence, embryogenesis of fish eggs was inhibited. If such an anoxic layer exists above the deep sediments of Lake Neuchâtel, it could also affect oligotrophic species, especially juveniles, which respire at the interface level.

In conclusion, the recovery of Lake Neuchâtel will be complete only if the sediments, especially those of the profundal, are recolonized by the oligotrophic species which prevailed therein, before the onset of eutrophication. This recolonization will indicate that the sediment has recovered its pristine state, as far as this goal is realistic.

ACKNOWLEDGEMENTS

Raymond Ducret helped to collect samples.

REFERENCES

FRICKER, HJ. 1980. Eutrophication programme regional project, alpine lakes. *Swiss Federal Board for environmental Protection*, Bern.

LANG, C. 1989. Eutrophication of Lake Neuchâtel indicated by the oligochaete communities. *Hydrobiologia* 174: 57–65.

LANG, C. 1990. Quantitative relationships between oligochaete communities and phosphorus concentrations in lakes. *Freshw. Biol.* 24: 327–334.

LANG, C. 1991. Decreasing phosphorus concentrations and unchanged oligochaete communities in Lake Geneva: how to monitor recovery? *Arch. Hydrobiol.* 122: 305–312.

LANG, C. & O. REYMOND. 1992. Reversal of eutrophication in Lake Geneva: evidence from the oligochaete communities. *Freshw. Biol.* 28: 145–148.

LANG, C. & O. REYMOND. 1993. Recovery of Lake Neuchâtel (Switzerland) from eutrophication indicated by the oligochaete communities. *Arch. Hydrol.* 128: 65–71.

LANG, C. & O. REYMOND. 1995. Contrasting responses of oligochaete communities to the abatement of eutrophication in Lake Geneva. *Hydrobiologia* 308: 77–82.

MONARD, A. 1919. La faune profonde du Lac de Neuchâtel. *Thèse Univ. Neuchâtel.* 176 pp.

MÜLLER, R. 1992. Trophic state and its implications for natural reproduction of salmonid fish. *Hydrobiologia* 243/244: 261–268.

PIGUET, E. & K. BRETSCHER. 1913. Oligochètes. Catalogue des invertébrés de la Suisse. *Georg. & Cie, Genève*, 215 pp.

POKORNI, B. 1994. Surveillance des eaux de surface. Rapport annuel du Département de la gestion du territoire. *Service cantonal de la protection de l'environnement*, CH–2034 Peseux.

REYMOND, O. 1994. Préparations microscopiques permanentes d'oligochètes: une méthode simple. *Bull. Soc. Vaud. Sc. Nat.*, 83: 1–3.

SOLLBERGER, H. 1974. Le Lac de Neuchâtel (Suisse). Ses eaux, ses sédiments, ses courants sous-lacustres. *Thèse Univ. Neuchâtel.* 415 pp.

REVUE SUISSE DE ZOOLOGIE, 102 (4) : 913-942; décembre 1995

Oribatids from Brunei I (Acari: Oribatida).

New and interesting mites from the Geneva Museum LXXV

Sándor MAHUNKA
Zoological Department, Hungarian Natural History Museum, Baross utca 13,
H-1088 Budapest, Hungary.

Oribatids from Brunei I (Acari: Oribatida). New and interesting mites from the Geneva Museum LXXV. - Eleven species from Brunei are discussed; nine of them are new to science, one of them representing a new genus: *Teraja* gen. n. (Microzetidae). Extended description of *Temburongia* Mahunka, 1990 is given. The following new combinations are proposed: *Sellnickochthonius planus* (Chinone) comb.n = *Brachychthonius planus* Chinone, 1974; *Teraja fimbriata* (Mahunka) comb.n. = *Microzetes fimbriatus* Mahunka, 1989.

Key-words: Acari - Oribatida - Taxonomy - New species, new genera - Brunei.

INTRODUCTION

Oribatids are a major group of soil microarthropods with a high degree of diversity. Over 6000 described species in more than 1000 genera have been described (BALOGH & BALOGH 1992). They occur in many habitats, occupying a variety of niches, and their widespread distribution affords great scope for biogeographical studies (e.g. BERNINI, AVANZATI & BERNINI 1988; SUBIAS, ARILLO & GIL-MARTIN 1992; MAHUNKA 1993a).

Oribatida is an ancient group (150 - 200 million years) and the global distribution patterns of the species need to be interpreted within the context of continental drift. The oribatid fauna of South-East Asia is partly of Gondwanan and partly of Laurasian origin which makes zoogeographical interpretations somewhat problematic (HAMMER & WALLWORK 1979). A more thorough knowledge of the fauna of Borneo is critical for a clearer understanding of these matters.

Few data have been available for the North Bornean territories Sabah and Brunei (e.g. AOKI 1967; RAMSAY & SHEALS 1969), and none at all for Sarawak, until, in 1982. Dr. Bernd Hauser, Head of the Arthropod Department of the Museum d'Histoire naturelle, Geneva, began a systematic exploration of the soil fauna,

---

Manuscript accepted 30.09.1995.

especially Microarthropoda, of the rain forests of South-East Asia and surrounding areas. Subsequently, 121 species records for Sabahn oribatids were published from his material, 94 of which were new to science (MAHUNKA 1987a, b, 1988, 1991, 1994b). Other published results on oribatids from this research programm have been those from Singapore (MAHUNKA 1989a), Sumatra (MAHUNKA 1989b) and Madagascar (MAHUNKA 1993b, 1994a).

In the present paper[1], oribatids collected from Brunei in 1988 by Dr. B. Hauser during his 1988 expedition to Brunei, organized together with Dr. Charles Lienhard, Research Officer at the same Department, are catalogued. Eleven species are listed, nine of them new to science.

I would like to thank Dr. M. Luxton for critically reading of the manuscript and for his valuable recommandations.

LIST OF LOCALITIES

Bru-88/12: Brunei (Brunei-Muara District): près du pont sur le ruisseau "Sungai Lubang Barus" sur la route venant de Tutong, à 33 km de Bandar Seri Begawan, prélèvement de sol dans les angles formés sur les contreforts de deux grands arbres proches des habitations, env. 20 m; 16.XI.1988; leg. B. H. (B)[2]

Bru-88/21: Brunei (Belait District): "Andulau Forest Reserve", à 3,5 km au sud de Sungai Liang (= à 39,5 km de Labi), forêt primaire ("Mixed dipterocarp forest"), K-7 ("Kompartment 7"), prélèvement de sol dans les angles formés par les contreforts de grands arbres, 50 m; 19.XI.1988; leg. B. H. (B)[2]

Bru-88/24: Brunei (Brunei-Muara District): "Berakas Forest Reserve" au nord de Bandar Seri Begawan sur la route, à 19,5 km de Muara (= à 102,5 km de Kuala Belait), forêt "Kerangas"(= "Tropical heath forest"), prélèvement de sol au pied de *Casuarina nobilis* Whitmore (*Casuarinaceae*), 30 m; 20.XI.1988; leg. B. H. (B)[2]

Bru-88/29: Brunei (Belait District): Sungai Liang, "Arboretum Forest Reserve", forêt primaire ("Mixed dipterocarp forest"), prélèvement de sol dans les angles formés par les contreforts de deux arbres appelés "Nyatho", 90 m; 21.XI.1988; leg. B. H. (B)[2]

Bru-88/32: Brunei (Belait District): "Labi Hills Forest Reserve", "Teraja", à 42 km au sud de Sungai Liang (= 12 km au Sud de Labi), environs de "Rumah Panjang" (= Longhouse du Kampong Teraja), forêt primaire ("Mixed dipterocarp forest"), prélèvement de sol dans les angles formés par les contreforts d'un très grand arbre, 40 m; 22.XI.1988; leg. B. H. (B)[2]

Bru-88/34: Brunei (Belait District): "Badas Forest Reserve", à env. 10 km sur la route secondaire qui bifurque, à 32 km de Kuala Belait, vers le sud, forêt "Kerangas" (= "Tropical heath forest") formée presque exclusivement par *Agathis dammara* (Lambert) L.G. Rich. (*Araucariaceae*), sur et sous écorces, 10 m; 23.XI.1988; leg. B. H.

Bru-88/35: Brunei (Belait District): "Badas Forest Reserve", à env. 10 km sur la route secondaire qui bifurque, à 32 km de Kuala Belait, vers le sud, forêt "Kerangas" (="Tropical heath forest") formée presque exclusivement par *Agathis dammara* (Lambert) L.G. Rich. (*Araucariaceae*), prélèvement de sol au pied de *Agathis dammara*, 10 m; 23.XI.1988; leg. B. H. (B)[3]

Bru-88/38: Brunei (Temburong District): "Peradayan Forest Reserve" (="Bukit Patoi"), à 14,5 km de Bangar (= 2,5 km de Labu) forêt primaire ("Mixed dipterocarp forest"), prélèvement de sol dans les angles formés par les contreforts de grands arbres morts, 80 m; 24.XI.1988; leg. B. H. (B)[3]

---

[1] Partly sponsored by the Hungarian National Scientific Research Fund (OTKA 17629).

[2] (B) = extraction par appareil Berlese à Bandar Seri Begawan (Brunei).

[3] (B) = extraction par appareil Berlese à Hong Kong.

LIST OF IDENTIFIED SPECIES

Brachychthoniidae Thor, 1934
Sellnickochthonius muara sp. n.
Localities: Bru-88/12; Bru-88/24.
Sellnickochthonius planus (Chinone, 1974) comb. n.
Locality: Bru-88/24: 2 specimens.
Phthiracaridae Perty, 1841
Hoplophthiracarus (Plonaphacarus) aculeatus sp. n.
Locality: Bru-88/38.
Notophthiracarus hauseri sp. n.
Locality: Bru-88/21.
Temburongiidae Mahunka, 1990
Temburongia patoi Mahunka, 1990
Localities: Bru-88/21; Bru-88/38.
Sabahtritiidae Mahunka, 1988
Sabahtritia lienhardi sp. n.
Locality: Bru-88/29.
Eremaeozetidae Balogh, 1972
Eremaeozetes maculosus sp. n.
Locality: Bru-88/24.
Microzetidae Grandjean, 1936
Teraja wongi gen. n., sp. n.
Locality: Bru-88/32
Carabodidae C. L. Koch, 1837
Hardybodes flabellatus sp. n.
Locality: Bru-88/21; Bru-88/32; Bru-88/38.
Hardybodes penicillatus sp. n.
Locality: Bru-88/35.
Pasocepheus eremaeozetoides sp. n.
Locality: Bru-88/32

DESCRIPTIONS AND IDENTIFICATIONS

Sellnickochthonius muara sp. n. (Figs 1-4)

Material examined: Holotype: Bru-88/24, 2 paratypes from the same sample; 3 paratypes: Bru-88/12. Holotype and 3 paratypes: MHNG[4], 2 paratypes (1364-PO-89): HNHM[5].

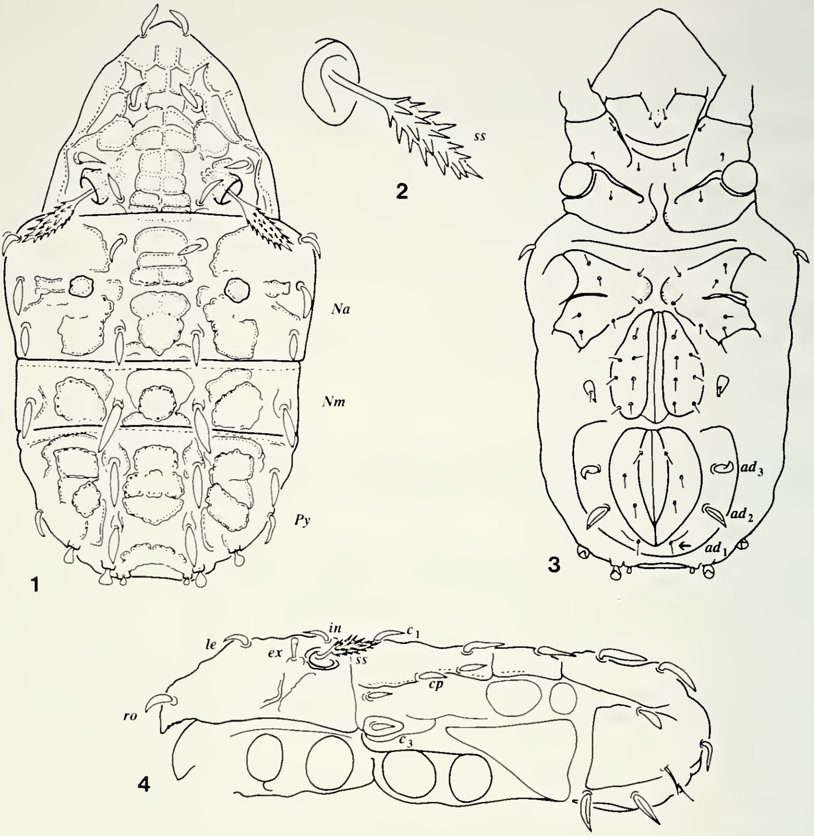
Measurements. - Length: 140-148 µm; width: 70-75 µm.

Prodorsum: Rostrum conical, rostral teeth not visible in dorsal view. Prodorsal surface well sclerotized, ornamented by conspicuously outlined areolar patches, typical for the genus, as shown in Fig. 1. Prodorsal setae phylliform, essentially subequal. Interlamellar setae arising far from each other, near to the bothridium. Head of sensillus (Fig. 2) symmetrical, covered with large spines arranged in longitudinal rows.

---

[4] MHNG = deposited in the Muséum d'histoire naturelle, Genève.

[5] HNHM = deposited in the Hungarian Natural History Museum, Budapest, with identification number of the specimens in the Collection of Arachnida.



FIGS 1-4
Sellnickochthonius muara sp. n. - 1: body in dorsal view, 2: sensillus, 3: body in ventral view, 4: body in lateral view.

Notogaster: Border of notogastral shield *Na* partly reduced or absent (Fig. 1). In the midline of shield *Na* the first, second and fifth pair of patches completely fused; borders of some fields sinuous. Border of ring-spot strong, also sinuous.

Ventral region: Form and position of ventral setae as shown in Fig. 3.

Remarks: The new species belongs to the "*zelawaiensis*" - group [containing e. g. also *S. zelawaiensis* (Sellnick, 1928), *S. foliatus* (Hammer, 1958), *S. elsosneadensis* (Hammer, 1958), *S. hauserorum* (Mahunka, 1979), *S. elisabethae* Mahunka, 1973 and *S. griseus* (Hammer, 1958). The group is characterized by the foliate notogastral setae, the symmetrical sensillus and the medially partly fused patches on the notogastral shield *Na*.

The species is named after the city Muara.

Sellnickochthonius planus (Chinone, 1974) comb.n. (Figs 5-8)

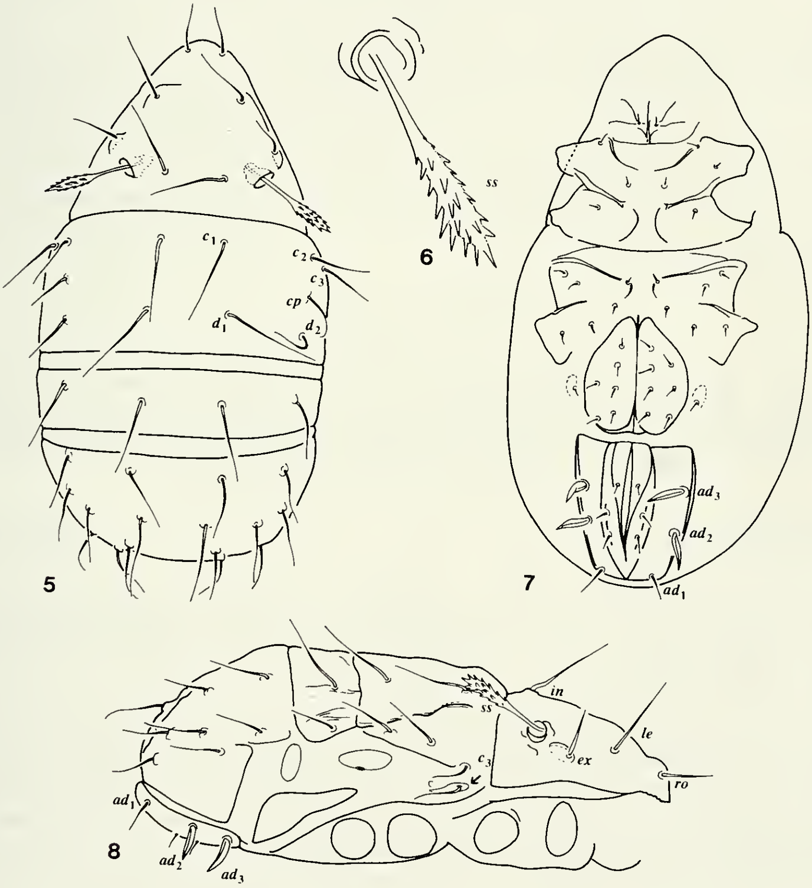
= *Brachychthonius planus* Chinone, 1974.

Material examined: Bru-88/24: 2 specimens.

The species was described by CHINONE from Japan. The newly collected specimens entirely correspond to the description and figures given by CHINONE (1974). This species is particularly characterized by the basally curved prodorsal and dorsal setae (Figs 5-8).

On the basis of the form of adanal setae this species belongs to the genus *Sellnickochthonius* Krivolutzky, 1964.

Measurements. - Length: 155-157 µm; width: 85-89 µm.



FIGS 5-8

Sellnickochthonius planus (Chinone, 1974) - 5: body in dorsal view, 6: sensillus, 7: body in ventral view, 8: body in lateral view.

Hoplophthiracarus (Plonaphacarus) aculeatus sp. n. (Figs 9-15)

Material examined: Holotype: Bru-88/38; 4 paratypes from the same sample. Holotype and 2 paratypes: MHNG, 2 paratypes (1365-PO-89): HNHM.

Measurements: - Length of aspis: 290-335 µm; length of notogaster: 526-729 µm; height of notogaster: 364-567 µm.

Aspis: Dorsal outline gradually convex, but rostrum clearly incised in lateral view. Median crista absent, lateral carina short, not reaching beyond the sinus line and not directed to the lateral rim (Fig. 12). Dorsal surface ornamented by weak alveoli, but near to the posterior margin some stronger ones exist (Fig. 11). All prodorsal setae - excepting seta *ex*-thick and finely ciliate.

Notogaster (Fig. 9): Surface always covered by cerotegument with debris. Cuticle ornamented by alveoli. Forty (!) pairs of mostly straight and erect notogastral setae present. Setae c_1 slightly longer than the others, but no essential difference existing between them. The lyriffisures and the alveoli of the vestigial setae (*f*) hardly observable, but two lyriffisures (*ia*, *im*) and the alveoli of setae f_1 visible.

Anogenital region: The position of the genital setae (Fig. 10) is typical for the subgenus *Plonaphacarus*. All four pairs of setae on the ano-adanal plates roughened or finely ciliate. Setae ad_3 somewhat shorter than the anal ones.

Legs: Seta *d* on femur I hooked (Fig. 13). Seta *l* missing on tarsus I (Fig. 14). The setal fomulae are:

I: 1-4-2+2-5+1-16+3-1
IV: 2-1-1-2+1-10-1 (Fig. 15).

Remarks: The large number of notogastral setae is unique in this family. Considering the other features, the new species is correctly placed in the genus *Hoplophthiracarus* Jacot, 1933, and therein in the subgenus *Plonaphacarus* Niedbala, 1986.

The species is named after the form of the notogastral setae.

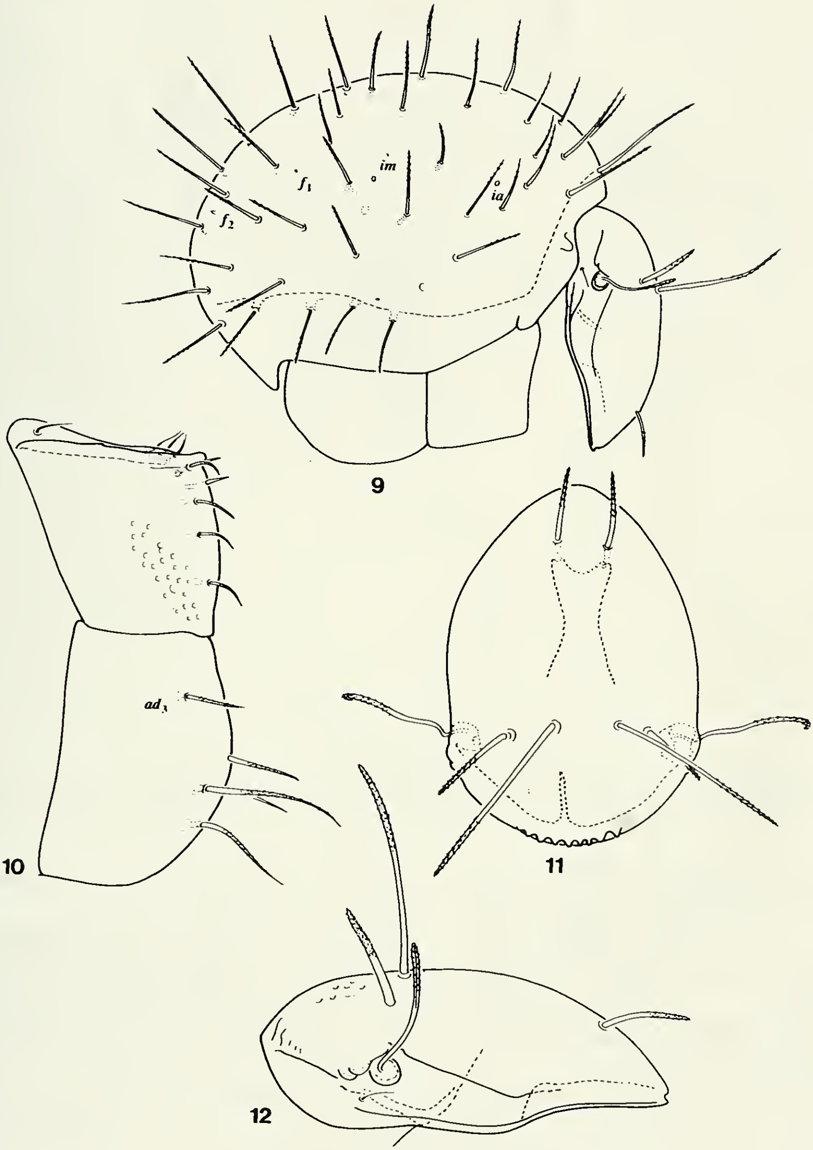
Notophthiracarus hauseri sp. n. (Figs 16-24)

Material examined: Holotype: Bru-88/21: 5 paratypes from the same sample. Holotype and 3 paratypes: MHNG, 2 paratypes (1366-PO-89): HNHM.

Measurements. - Length of aspis: 162-221 µm; length of notogaster: 315-433 µm; height of notogaster: 207-261 µm.

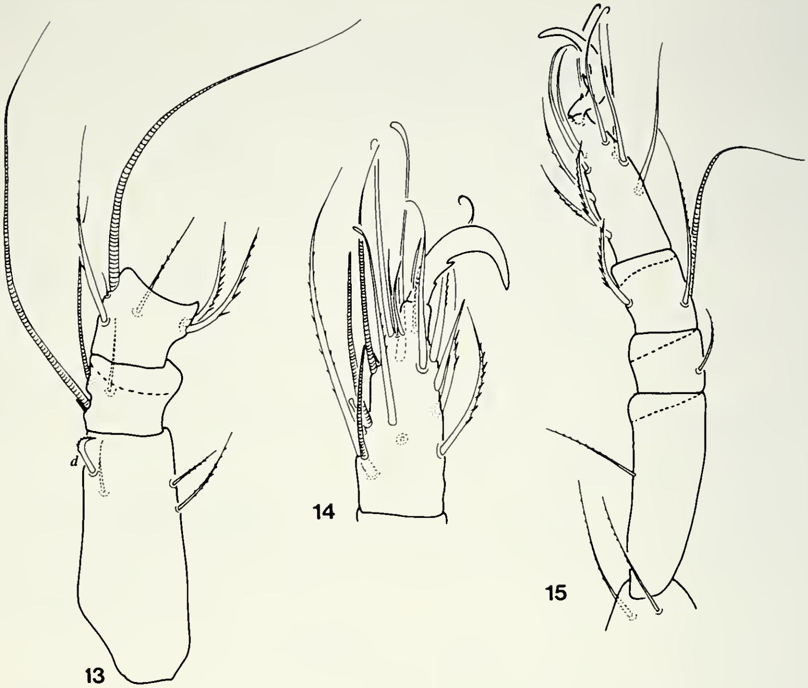
Aspis: Its outline angulate in lateral view (Fig. 16), median crista strong, distinctly protruding from the surface; a weaker lateral crista also present. Anterior surface areolate, aspis basally ornamented by longitudinal rugae amongst which are oblong spots (Fig. 19). Lateral carina absent, lateral rim very short, sinus-line distinct. All prodorsal setae (excepting setae *ex*) phylliform. Sensillus long, thin, approximately setiform, distinctly spinose; spines arranged in two longitudinal rows.

Notogaster: Anterior part of notogaster very wide, protruding forward, in dorsal view covering the basal part of aspis (Fig. 18). Surface of notogaster with large protuberances and three longitudinal ribs gradually disappearing anteriorly (Fig. 18). Fifteen pairs of phylliform notogastral setae present, their distal end sharply pointed.



FIGS 9-12

Hoplophthiracarus (Plonaphacarus) aculeatus sp. n. - 9: body in lateral viw, 10: anogenital region, 11: aspis in dorsal view, 12: aspis in lateral view.



FIGS 13-15

Hoplophthiracarus (Plonaphacarus) aculeatus sp. n. - 13: basal articles of leg I, 14: tarsus of leg I, 15: leg IV.

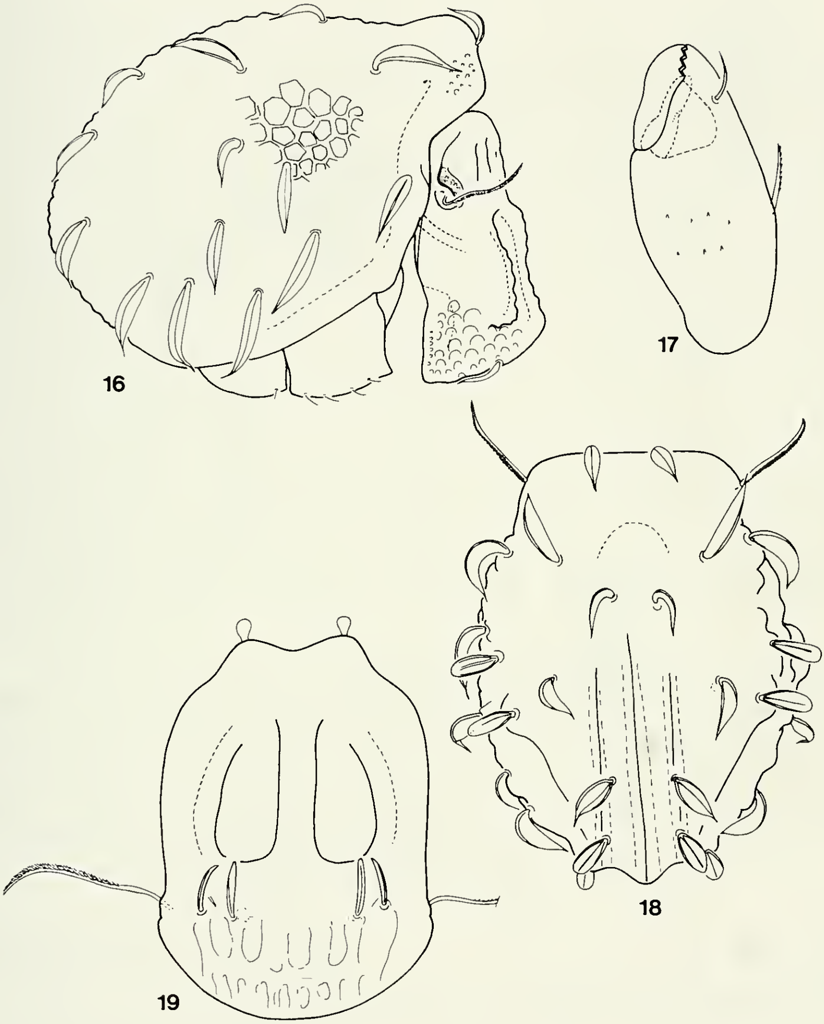
Gnathosoma: Chelicera and palp as shown in Figs 17, 24. Palp three-segmented, its setal formula: 2-2-8+1.

Anogenital region (Fig. 22): Genital plate hollowed laterally, its surface areolate. Posterior five pairs of genital setae much longer than the others, the anterior 2-3 pairs minute, hardly discernible (Fig. 23). Among the setae of the ano-adanal plates 4 pairs are reduced so much as to be represented only by their alveoli, only setae ad_3 visible.

Legs: The legs chaetotaxy is of the "complete type" showing the subsequent setal formulae:

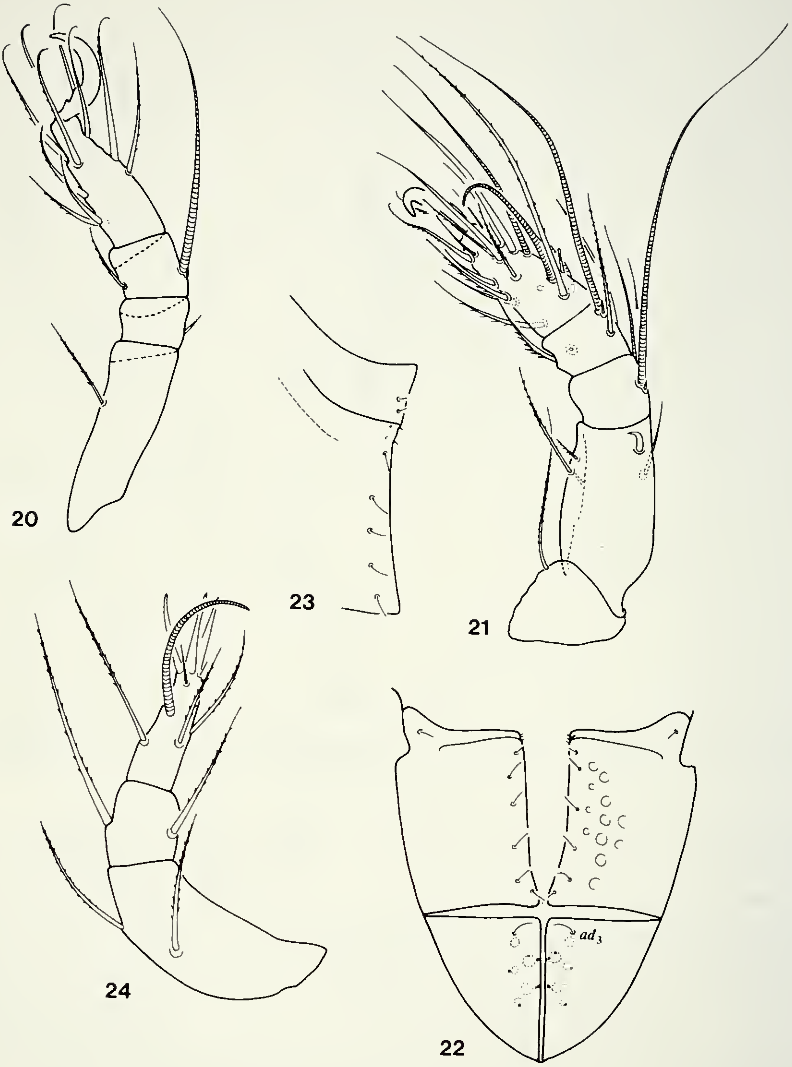
I: 1-4-2+2-5+1-16+3-1 (Fig. 21)
II: 1-3-2+1-3+1-12+2-1
III: 2-2-1+1-2+1-10-1
IV: 2-1-1-2+1-10-1 (Fig. 20)

Remarks: The new species corresponds well with the genus *Notophthiracarus* Ramsay, 1968, and belongs to a species group characterized by the phylliform notogastral setae [(e.g. *N. multituberculatus* (Balogh & Mahunka, 1966)].



Figs 16-19

Notophthiracarus hauseri sp. n. - 16: body in lateral view, 17: chelicera, 18: notogaster in dorsal view, 19: aspis in dorsal view.



FIGS 20-24

Notophthiracarus hauseri sp. n. - 20: leg IV, 21: leg I, 22: anogenital region, 23: genital plate, 24: palp.

I dedicate the new species to my friend Dr. Bernd Hauser, the collector of this very important and interesting material.

Temburongia Mahunka, 1990

Diagnosis[6]: Aspis with two pairs of median (!) and one pair of lateral (divided) cristae. One lateral carina and a sinus-line on both sides long, well developed. All three pairs of median notogastral setae modified, setae *ro* originating far from the rostrum. Notogastral shield much extended ventrally and passing between the genito-aggenital and ano-adanal plates, dividing them on the surface. The two ventral lobes of the notogaster independent (not fused), but touching medially. Fourteen pairs of notogastral setae present, the vestigial setae (f_1) are behind setae h_1, neither lyriffisures nor opening of glandules observable. Genital and aggenital plates, like anal and adanal plates, completely fused with each other. The genito-aggenital plates also fused basally with each other, only a short division between them anteriorly, the narrowed basal part arched and forming a deep sinus with the similar part of the ano-adanal plates inside the body, covered by the ventral lobes of the notogaster. Seven pairs of genital (aggenital) setae present. Ano-adanal plates forming a semicircle, six pairs of setae arising on them, all arranged in longitudinal rows along the inner margin of the plates. Chelicerae well developed, both the fixed and the movable digits are dentate. Palp four-segmented. Legs: monodactylous. Setae on femur I display characteristic reduction, otherwise, the legs belong to a characteristic chaetotaxy group.

Type species: *Temburongia patoi* Mahunka, 1990.

Remarks: On the basis of the above features the new taxon is so far from all distinct groups of the superfamily *Euphthiracaroidea*, that it could not be accomodated in any of the heretofore known families; therefore, a new family (*Temburongiidae* Mahunka, 1990) was established. It represents a so far unknown line of evolution within the "phtiracaroid" oribatids shedding some light on how the "ventral plate" of the higher oribatids could have developed.

The genus is named after the Temburong District.

Temburongia patoi Mahunka, 1990 (Figs 25-36)

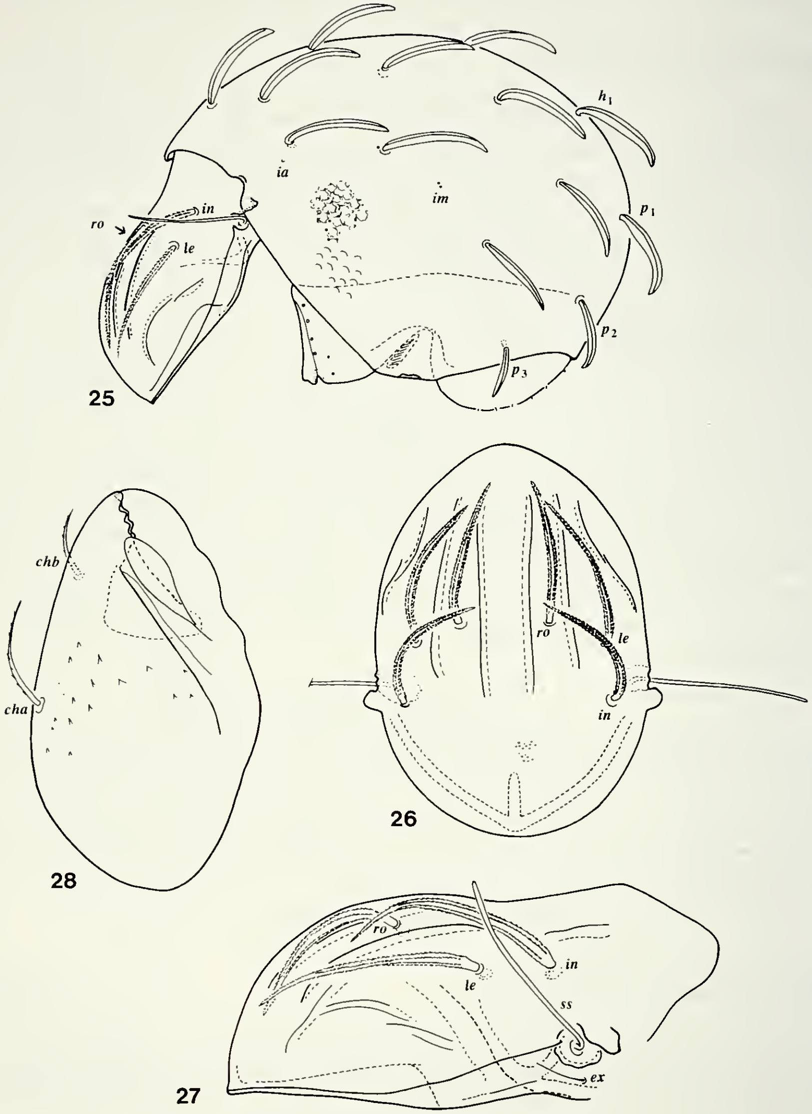
Material examined: Holotype: Bru-88/21, 19 paratypes from the same sample; 16 paratypes: Bru-88/38. Holotype and 22 paratypes: MHNG, 13 paratypes (1367-PO-89): HNHM.

Measurements. - Length of aspis: 182-276 µm: length of notogaster: 276-448 µm; height of notogaster: 197-335 µm.

Aspis: Its outline concave medially and strongly convex anteriorly. Whole surface finely granulate. Two pairs of median cristae long, the third, outer one is

---

[6] This description completes a preliminary one in MAHUNKA (1990).

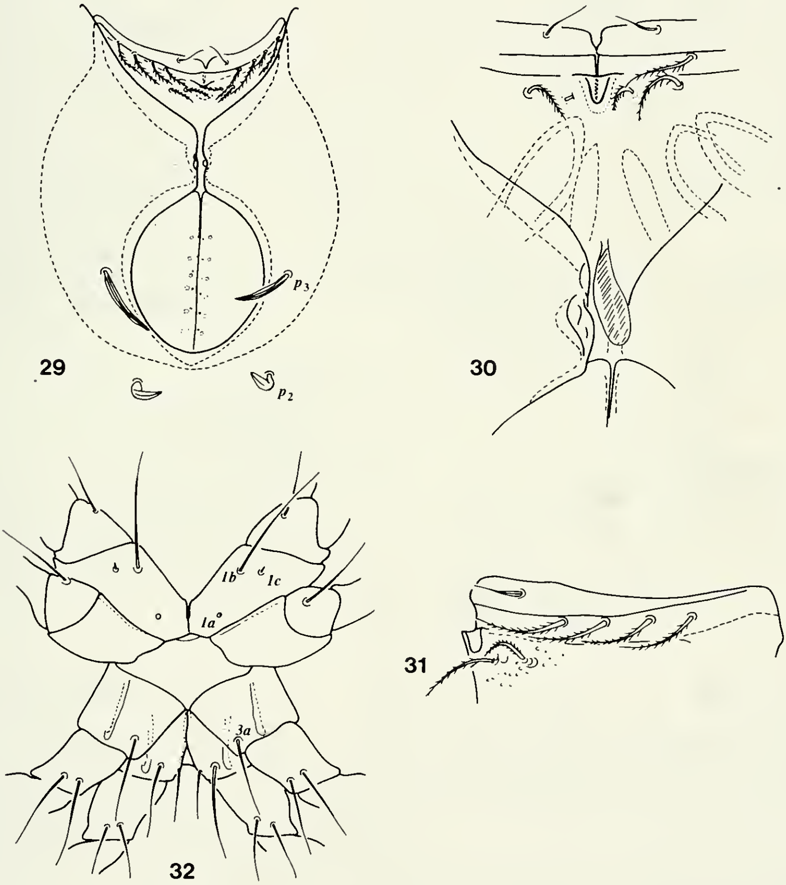


Figs 25-28

Temburongia patoi Mahunka, 1990 - 25: body in lateral view, 26: aspis in dorsal view, 27: aspis in lateral view, 28: chelicera.

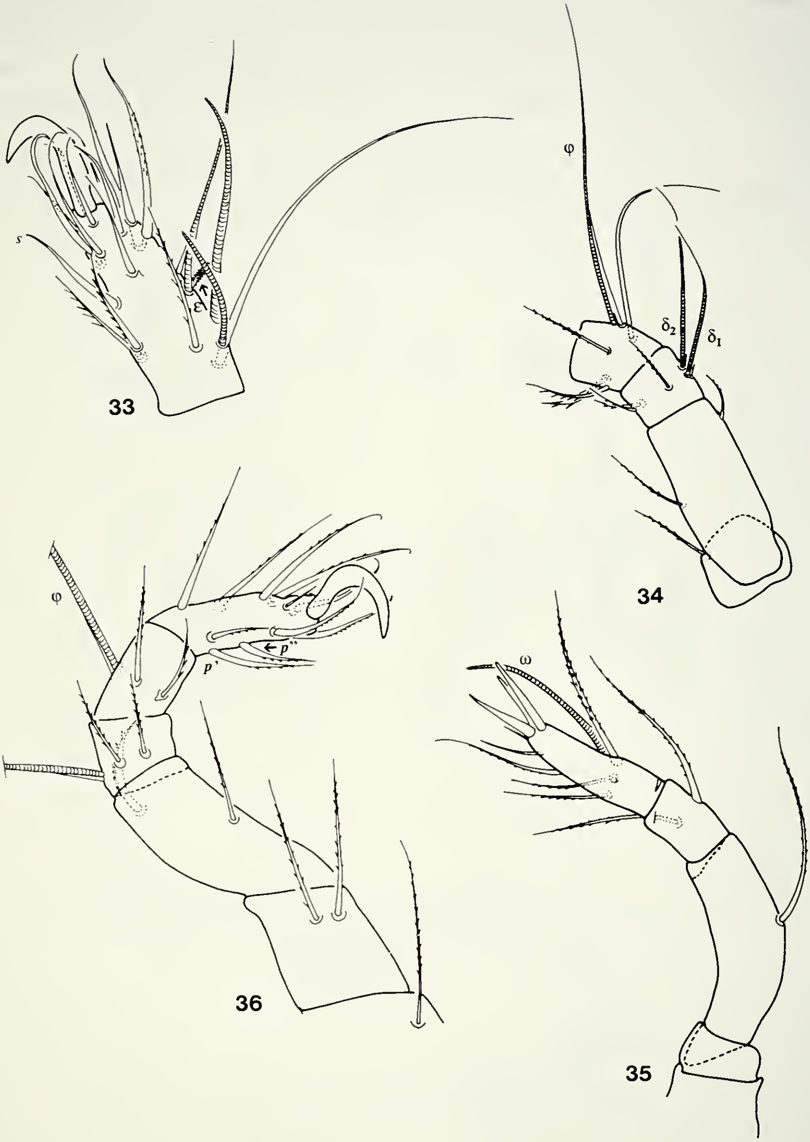
divided into two arched parts (Fig. 26). Lateral carina long, running along lateral margin anteriorly, instead of the lateral rim. This lateral rim very short, hardly observable; sinus-line very long and strong. Three pairs of strong, sabre-shaped, distinctly spiculate and one pair (*ex*) of thin, simple, prodorsal setae present. Sensillus long, stick-shaped, only slightly arched (Fig. 27). Bothridial squama large, approximately guttiform.

Notogaster: Whole surface covered by a cerotegument layer mostly forming granules imitating alveoli. Collar line not observable. Fourteen pairs of



FIGS 29-32

Temburongia patoi Mahunka, 1990 - 29: anogenital region, 30: genital plates, 31: anterior margin of genital plate, 32: coxisternal region.



FIGS 33-36

Temburongia patoi Mahunka, 1990 - 33: tarsus of leg I, 34: basal articles of leg I, 35: palp, 36: leg III.

notogastral setae present, all highly similar, but setae p_1, p_2, and especially p_3, shorter than the others. All setae phylliform, with median vein, their surface and margin smooth. Lyrifissures *ia* and *im* present, other lyrifissures absent (?). Ventral lobes of notogaster approximate medially, ending very near to each other (Fig. 29), their margin slightly emarginate medially.

Gnathosoma: Chelicera as shown in Fig. 28. Palpal setal formula: 0-1-2-9+1.

Epimeral region (Fig. 32): Epimeral setal formula: 3-0-1-2, but one pair of setae on epimere 1 (perhaps *1a*) reduced, represented only by alveoli, and far removed posteriorly from the other two setae.

Anogenital region: Genital plates fused basally, but anteriorly separated from each other, in front of a sacculiform structure (Fig. 30). The narrowed posterior part of genito-aggenital plates arched and delving into deeper layers of the body and not directly connected with the similarly arched anterior part of ano-adanal plages (Fig. 29). Seven pairs of genital setae present, one of them smooth and arising on the anterior border of genital plates (Fig. 31); four pairs of these conspicuously ciliate and originating in a more or less transverse furrow, two pairs arising near to the sacculiform structure. Six pairs of identical ano-adanal setae observable, all six arranged in a longitudinal row; all short, thin and simple.

Legs: Claw of legs thick but simple, without ventral teeth. Setation of legs characteristic, and different from all related taxa. Setal formulae:

I: 1-2(!)-5+2-5+1-17+3-1
II: 1-3-4+1-5+1-12+2-1
III: 2-2-3+1-3+1-11-1
IV: 2-2-2-3+1-11-1

On tarsus I a single seta arises near the basis of ω_2 (Fig. 33). Setae *p*' and *p*" on tarsi III (Fig. 36) and IV are of different type.

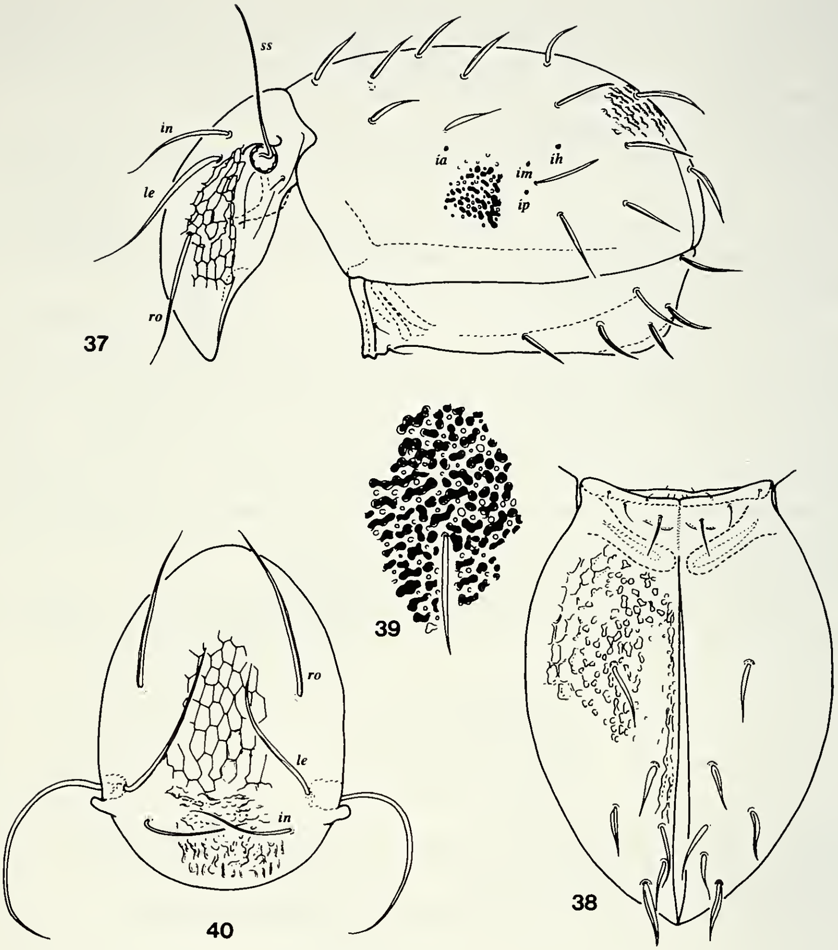
Remarks: The species is named after the hill of Bukit Patoi.

Sabahtritia lienhardi sp. n. (Figs 37-43)

Material examined: Holotype: Bru-88/29, 23 paratypes from the same sample. Holotype and 15 paratypes: MHNG, 10 paratypes (1368-PO-89): HNHM.

Measurements. - Length of aspis: 133-169 µm; length of notogaster: 194-266 µm; height of notogaster: 97-163 µm.

Aspis: Its outline gradually convex in lateral view (Fig. 37). Surface ornamented by a conspicuous network dorsally and by irregular wrinkles basally; a narrow lateral part smooth. Lateral rim inconspicuous, a weak, short lateral carina and a sinus line on each side observable. Median prodorsal setae slightly dilated, with a thin velum. Sensillus setiform, long. Setae *in* the shortest of all prodorsal setae. Bothridium small, but protruding conspicuously from the outline in dorsal view (Fig. 40).

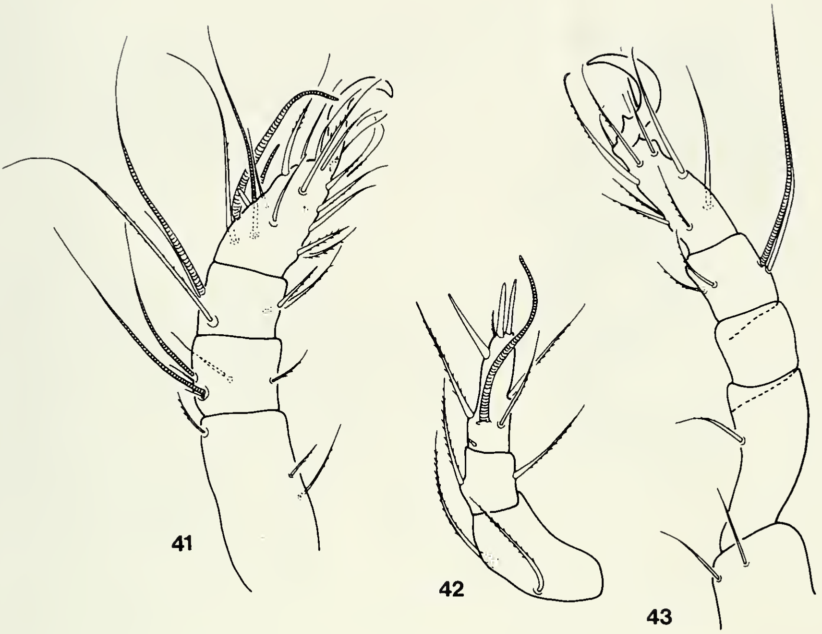


Figs 37-40

Sabahtritia lienhardi sp. n. - 37: body in lateral view, 38: anogenital region, 39: sculpture of notogaster, 40: aspis in dorsal view.

Notogaster: Cuticle foveolate, cerotegument layer consisting of small tubercles arranged so as to form a rugose, almost reticulate, pattern (Fig. 39) around the foveolae. 14 pairs of phylliform notogastral setae present. Four pairs of lyrifissures (*ia*, *im*, *ih*, *ip*) visible; no vestigial setae observable.

Anogenital region (Fig. 38): Anogenital plates typical for the genus, ornamented by a polygonal reticulation. Seven pairs of genito-aggenital, 3 pairs of adanal setae visible.



Figs 41-43

Sabahtritia lienhardi sp. n. - 41: leg I, 42: palp, 43: leg IV.

Gnathosoma: Chelicera normal, both digits equally strong. Palp (Fig. 42) three-segmented, setal formula: 2-2-7+1.

Legs: Chaetotaxy of the "complete type", with following setal formulae:

I: 1-3-5+2-4+1-19+3-1 (Fig. 41)
II: 1-2-2+1-3+1-13+2-1
III: 2-1-0-(3+1)-12-1 (Fig. 43)

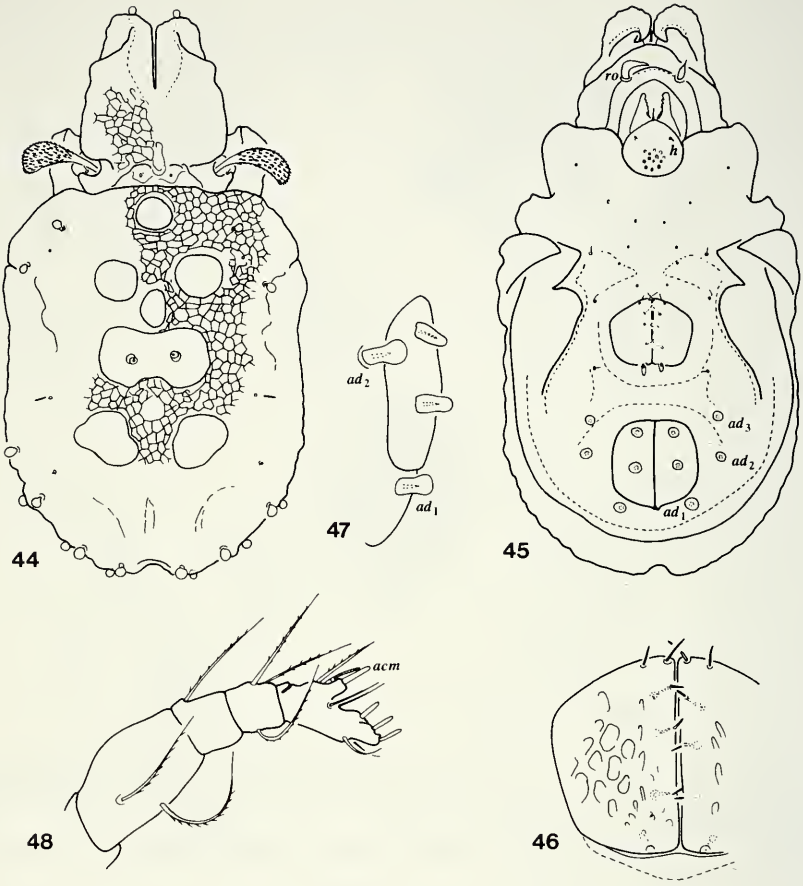
Remarks: *S. lienhardi* is the third species of this genus. It is clearly distinguished from both known species by the shape of its notogastral setae (also phylliform but much broader in *S. hauseri*) or the shape of ano-adanal setae (serrated, very long in *S. mirabilis*).

I dedicate the new species to Dr. Charles Lienhard for his continous help in correcting my manuscripts and for his collaboration with Dr. B. Hauser's field activity.

Eremaeozetes maculosus sp. n. (Figs 44-52)

Material examined: Holotype: Bru-88/24, deposited in the MHNG.

Measurements. - Length: 403 µm: with: 216 µm.



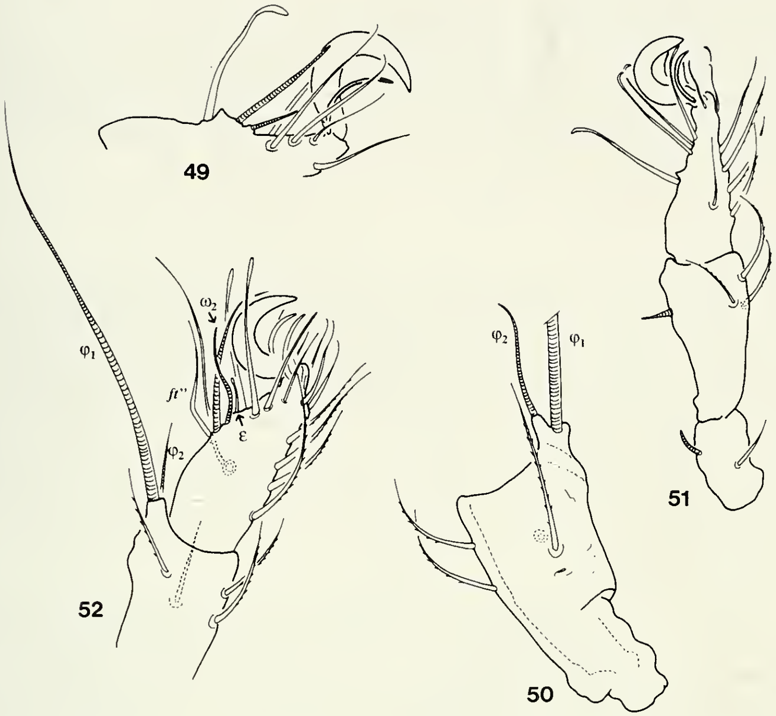
FIGS 44-48

Eremaeozetes maculosus sp. n. - 44: body in dorsal view, 45: body in ventral view, 46: genital plate, 47: anal plate in lateral view, 48: palp.

Prodorsum: Surface (as the whole surface of the body) covered by reticulate cerotegument, which mostly reflects the sculpture of the cuticular surface. Lamellae wide, fused basally and covering the whole prodorsum, excepting the basal region (Fig. 44). Lamellar setae dilated, originating on the bent distal end of lamellae. Rostral setae (*ro*) horn-shaped[7]. Interlamellar and exobothridial setae well developed, like small spines. Sensillus very large, flabellate, with spiculate surface.

---

[7] Some setae (*ro*, *ge*, *an* and *ad*) of the body are robust. Il seems to me, that they only consist of secretions or are covered by a thick secretion layer. When these "setae" were broken during preparation, no "real" setae could be found inside.



Figs 49-52

Eremaeozetes maculosus sp. n. - 49: tarsus of leg II, 50: tibia of leg II, 51: leg. III, 52: leg. I.

Notogaster: Humeral process well developed, bent downwards to the epimeral surface. Lenticulus round. Some irregular, partly fused smooth areas medially, over them the cerotegument layer lost (Fig. 44), all other surfaces areolate. Ten pairs of dilated, round notogastral setae, the lyrifissures *im* and the glandular openings visible in dorsal view.

Ventral region: Epimeral setal formula: 3-1-2-2. All setae short, spiniform, hardly observable because of the thick cerotegument. Genital (Fig. 46) and anal plates also areolate and covered by cerotegument. Anogenital setal formula: 6-1-2-3. The posterior pair of genital setae and all anal and adanal setae (*ad*), robust but their form varying (Fig. 47).

Gnathosoma: Mentum foveolate, seta *h* bending backwards, originating laterally. Palpal eupathidium *acm* arising on a large apophysis, palpal setal formula: 2-1-3-9+1 (Fig. 48).

Legs: All legs tridactylous, with strong heretodactyly. Tarsus of legs II-IV (Fig. 49) with a triangular dorsal spur, e.g. leg III (Fig. 51). Solenidium φ_1 originating on a long apophysis, the latter giving rise to a smaller anteriorly directed apophysis on which φ_2 is situated. Seta *ft*" on tarsus I (Fig. 52) strongly and characteristically curved, famulus (ϵ) long, arising in front of ω_2.

Remarks: The new species is clearly characterized by the special formation of the dorsal cerotegument and the form and position of the genital and anal setae. On the basis of these characters the new species is quite distinct from all other members of the genus.

Teraja gen. n.

Diagnosis: Family *Microzetidae*. Rostrum conical. Lamellae wide with long, horn-shaped, outer, and, completely reduced, inner cuspis; their median borders partly touching medially, excavated basally and at their basal ends connected by an arched transversal band. Lamellar setae spiniform, the phylliform interlamellar seta arising on the dorsal surface of the lamellae. Tutorium with a velum-like formation anteriorly. Sensillus setiform, directed backwards. Pteromorphae small, triangular. Epimeral setal formula 3-1-3-3. A strong x-shaped sejugal formaton present in front of the genital aperture. Ano-adanal setal formula: 6-1-2-2. Lyrifissures *iad* very long. All legs monodactylous.

Type species: *Teraja wongi* sp. n.

Remarks: The new taxon is related to *Microzetes* Berlese, 1913 and *Megazetes* Balogh, 1959, but both are distinguished from the new genus by the lack of the characteristic velum-like formation of the tutorium. Only *Microzetes fimbriatus* Mahunka, 1989 shows the some velum-lke formation of the tutorium and consequently has to be transferred to the new genus: *Teraja fimbriata* (Mahunka, 1989) comb.n.

The new genus is named after the village of Teraja.

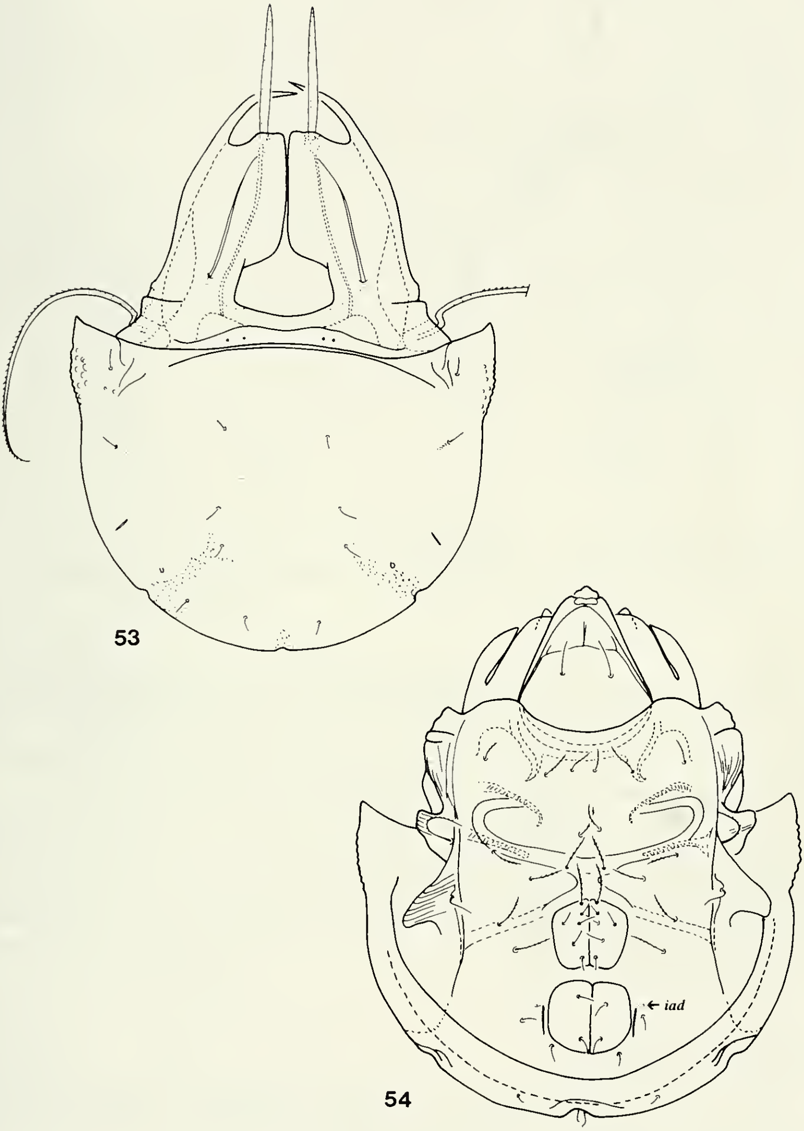
Teraja wongi sp. n. (Figs 53-56)

Material examined: Holotype: Bru-88/32; 6 paratypes from the sample. Holotype and 4 paratypes: MHNG, 2 paratypes (1370-PO-89): HNHM.

Measurements. - Length: 242-251 µm; width: 197-202 µm.

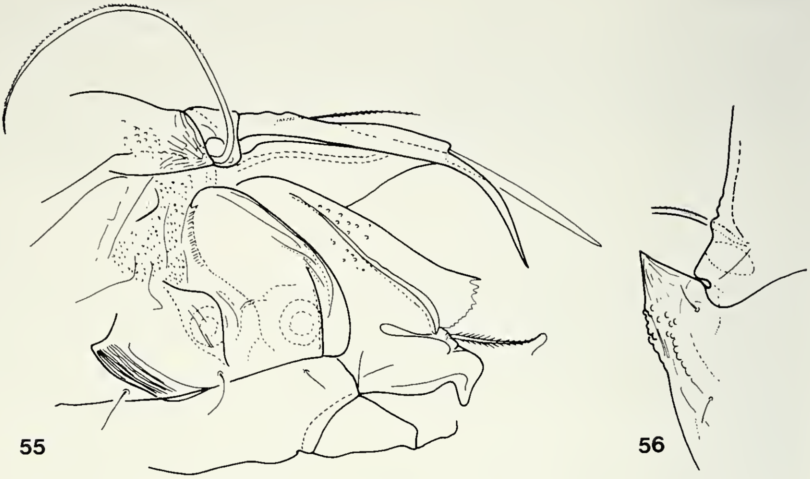
Prodorsum: Rostrum conical in dorsal, beak-shaped in lateral view. Rostral setae long, distinctly pilose. Lamellae wide, covering prodorsum in dorsal view. Outer lamellar apex very long, strongly curved inwards and always reaching beyond lamellar seta (Fig. 55). Interlamellar setae fine and densely pilose. Sensillus long, setiform, its outer margin distinctly pilose, excepting basal part. Distal end of tutorium with some (3-4) digitiform extensions.

Notogaster: Pteromorphae (Fig. 56) small, approximately triangular, anterior surface wrinkled, basally ornamented by some small tubercles. Posterior outline incised medially and laterally; these hollows continue in a flat furrow, directed medially. These parts are densely granulate (Fig. 53). Nine pairs of fine, short notogastral setae present.



FIGS 53-54

Teraja wongi gen. n., sp. n. - 53: body in dorsal view, 54: body in ventral view.



FIGS 55-56

Teraja wongi gen. n., sp. n. - 55: prodorsum in lateral view, 56: pteromorpha.

Ventral region (Fig. 54): Pedotecta 1, 2-3 and discidium with transversal rugae, surface of the epimeres and the ventral plate smooth. Epimeral setae fine, pilose. Epimeral region divided by a strong x-shaped band only. Genital and aggenital setae pilose. Epimeral region divided by a strong x-spahed band only. Genital and aggenital sera pilose, anal and adanal setae simple and very short.

Remarks: The new species stands very near to *T. fimbriata* (Mahunka, 1989) comb. n.: it is distinguished by the shape of its lamellar cuspis (much shorter in *T. fimbriata*) and the number of the digitiform extensions (9-10 in *T. fimbriata*).

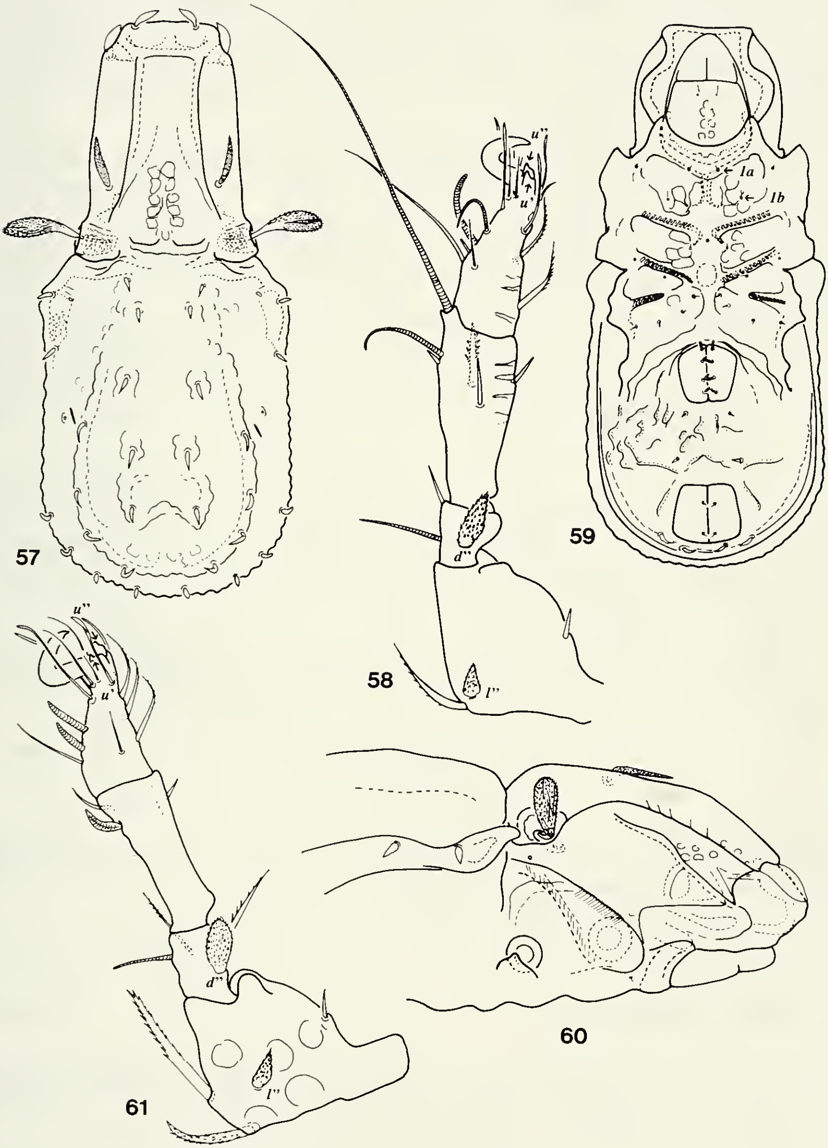
I dedicate the new species to Dr. K. M. Wong from the Forest Research Centre, Sungai Liang in recognition of this great assistance to the Geneva Expedition.

Hardybodes flabellatus sp. n. (Figs 57-61)

Material examined: Holotype: Bru-88/38, 3 paratypes from the same sample; 2 paratypes: Bru-88/32; 4 paratypes: Bru-88/21. Holotype and 6 paratypes: MHNG, 3 paratypes (1371-PO-89): HNHM.

Measurements. - Length: 266-319 µm; width: 123-153 µm.

Prodorsum: Whole surface (as whole surface of the body) covered by a granular layer of secretions. Rostrum very wide, its anterior margin nearly straight or slightly convex medially. Rostral and lamellar setae phylliform, both pairs smooth, the latter larger than the former. Rostral setae originating very far from each other, near to the lamellar setae. Lamellae running parallel, thus prodorsum, approximately



FIGS 57-61

Hardybodes flabellatus sp. n. - 57: body in dorsal view, 58: leg I, 59: body in ventral view, 60: prodorsum in lateral view, 61: leg II.

rectangular in dorsal view (Fig. 57). No sharp lamellar cuspides, anterior outer margin of lamellae with some alveoli and with some weak rugae. Interlamellar region with some spots. Basal part of prodorsum with a strong transversal rib. Interlamellar setae lanceolate, originating on the lamellar surface, directed forwards, their surface spiculate. Sensillus large, spatulate (Fig. 60), directed outwards, its surface distinctly barbed.

Notogaster: No dorsosejugal suture observable medially. Median part well framed and protruding from notogastral surface. In this part some pairs of additional elevations present and on the posterior part some large light spots. Fifteen pairs of notogastral setae present, all dilated distinctly spiculate, similar in shape to the intelamellar setae, but all are much smaller than the latter. Two pairs of setae arising in humeral, 4 pairs in posteromarginal, position (Fig. 57).

Coxisternal region: Epimeral borders and apodemes perceptible, as are some irregular spots and ribs. All epimeral setae minute, but their alveoli readily observable. Epimeral setal formula: 3-1-3-3. Setae *1a* originating characteristically in front of *1b* (Fig. 59).

Anogenital region: Shorter in longitudinal direction than the epimeral region. Surface between the genital and anal aperture, and also lateral parts, with some wrinkles. Genital and aggenital setae slightly pilose, adanal setae dilated (similarly to the notogastral setae), anal setae minute. Setae ad_3 originating very far anteriorly from the anal aperture.

Legs: Femur of leg I and II areolate, seta *l"* phylliform. Seta *d"* on genu also wide, dilated, their surface distinctly spiculate. Seta *u* on all legs modified, short, no other spiniform seta on tarsi I and II (Figs 58, 61). Setal formulae:

I: 1-4-3+1-4+2-16+2-1
II: 1-4-3+1-2+1(!)-15+2-1

Femur III with thinner, femur IV with broader ventral edge, femur III dilated dorsally. Legs III and IV with no special characteristics.

Remarks: See the remarks after the next *Hardybodes* species.

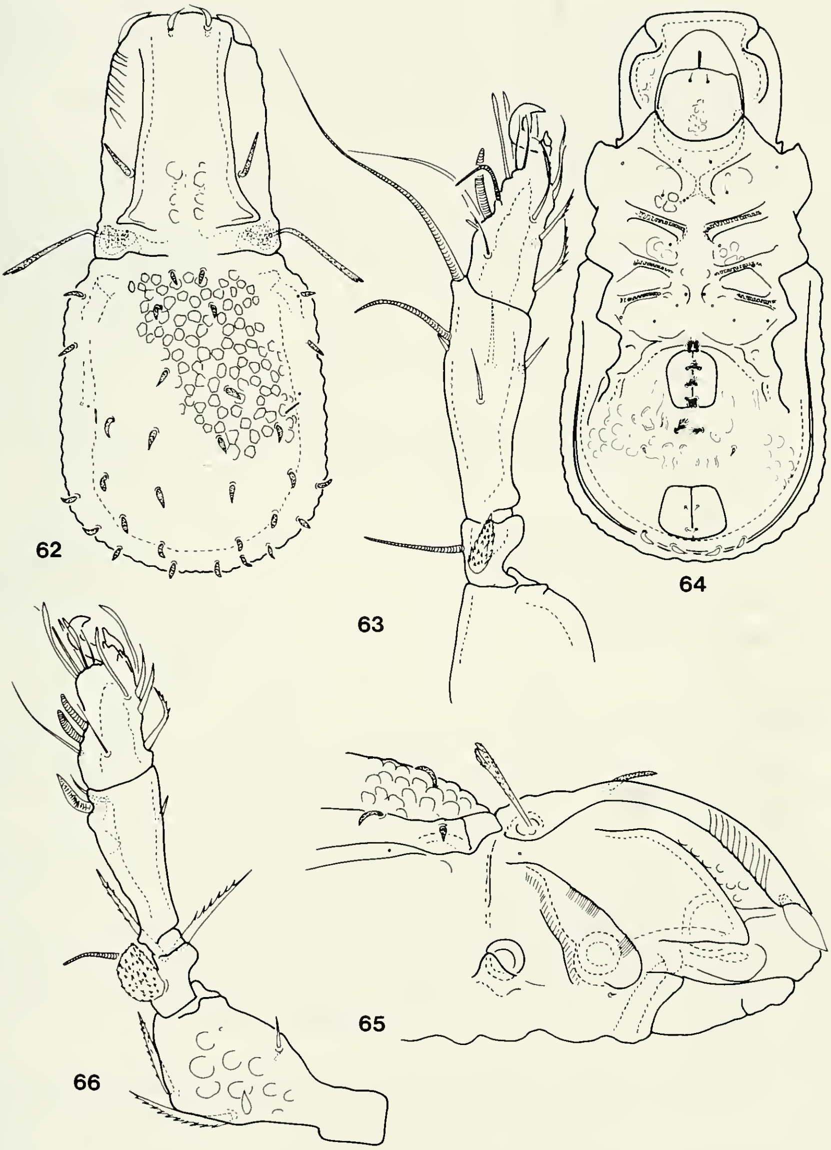
Hardybodes penicillatus sp. n. (Figs 62-66)

Material examined: Holotype: Bru-88/35, 6 paratypes from the same sample. Holotype and 3 paratypes: MHNG, 3 paratypes (1371-PO-89): HNHM.

Measurements. - Length: 295-379 µm; width: 138-167 µm.

Prodorsum: Rostrum wide, anterior margin approximately straight. Prodorsum oblong in dorsal view, lamellae narrow. Outer margin of lamellae distinctly rugose. Prodorsal setae similar to the preceding species, but sensillus much longer and thinner, distal end not spatulate (Fig. 65).

Notogaster: Ornamented by large tubercles, forming a polygonal network (Fig. 62). Fifteen pairs of notogastral setae present, similar to the preceding species.



FIGS 62-66

Hardybodes penicillatus sp. n. - 62: body in dorsal view, 63: leg I, 64: body in ventral view, 65: prodorsum in lateral view, 66: leg II.

Coxisternal region (Fig. 64): Similar to *H. flabellatus*.

Anogenital region: Surface between the genital and anal apertures and lateral parts with some round tubercles and short wrinkles. Genital and aggenital setae plumose, adanal setae phylliform and spiculate, anal setae minute.

Legs: The form and the chaetotaxy of all legs (leg. I, II: figs 63, 66) are exactly the same as those of *Hardybodes flabellatus*.

Remarks: These two new species were easy to place in the genus *Hardybodes* Balogh, 1970, altough some corrections and additions to the generic diagnosis are necessary. Consequently, the peculiar form of the rostrum and the rostral setae is characteristic only for the type species (*H. mirabilis* Balogh, 1970). The notogaster is not always flat, in the new species its median part distinctly projects.

The three species may be separated by the following key:

1 Rostral part of prodorsum elongated, rostral and lamellar setae T-shaped; interlamellar region with a complex structure. . *mirabilis* Balogh, 1970
– Rostral part of prodorsum normal, wide, almost straight anteriorly. 2
2 Sensillus very wide, spatulate; notogaster without tubercles; genital setae with some short cilia. . . . . *flabellatus* sp. n.
– Sensillus long, narrow, without a spatulate head; notogaster with tubercles; genital setae plumose. . . . . *penicillatus* sp. n.

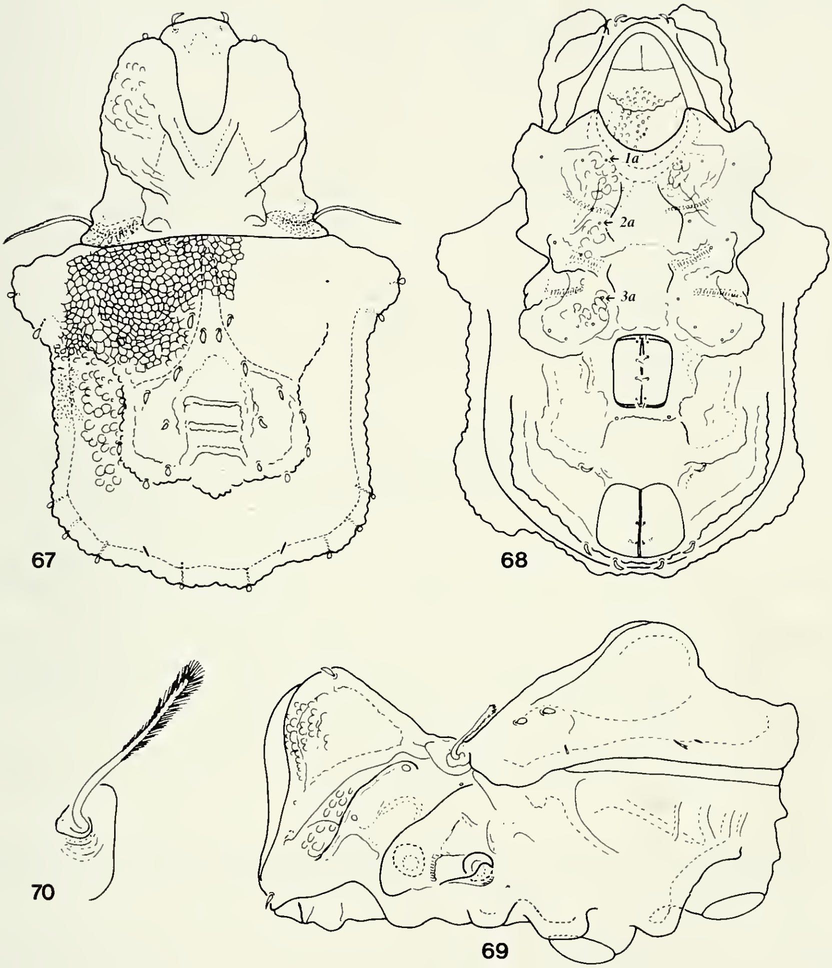
Pasocepheus eremaeozetoides sp. n. (Figs 67-73)

Material examined: Holotype: Bru-88/32; 3 paratypes from the same sample. Holotype and 1 paratype: MHNG, 2 paratypes (1373-PO-89): HNHM.

Measurements. - Length: 379-482 µm; width: 261-335 µm.

Prodorsum: Lamellae conspicuously protruding above the prodorsal surface; their basal parts fused into a typical U-shaped formation in dorsal view (Fig. 67). Prodorsal surface coarsely wrinkled anteriorly and (in common with the rest of the prodorsal surface) finely granulate basally. Lateral part of prodorsum and surface between lamella and tutorium ornamented by some areolae. Basal part of prodorsum with two depressions. Sensillus (Fig. 70) long, distinctly ciliate, directed outwards and slightly backwards.

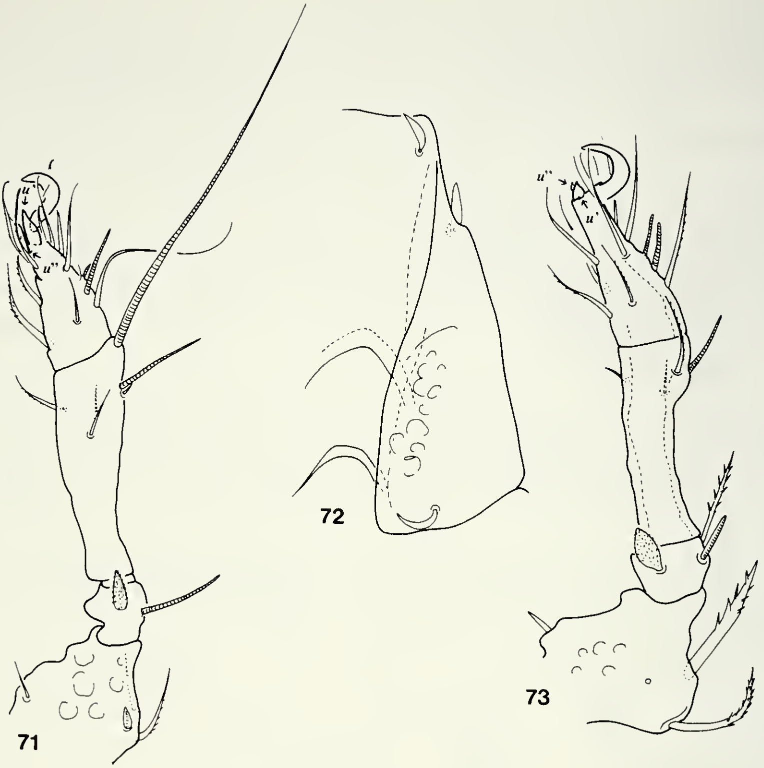
Notogaster: Dorsosejugal suture clearly visible. Median part of notogaster distinctly protruding (Fig. 69); this part consists of two elevations, between them there is a hollow divided by three transversal costulae, and from these elevations three gradually decreasing cristae are directed forward. Whole surface ornamented, anteriorly and anterolaterally polygonated, with symmetrically arranged tubercles around the irregularly wrinkled median elevation. Posterolateral margin granulate. Fifteen pairs of small, but slightly dilated, phylliform notogastral setae present, two pairs of them arising from the humeral apophysis, four of them in a posteromarginal position and the rest arising on the median elevation.



FIGS 67-70

Pasocepheus eremaeozetoides sp. n. - 67: body in dorsal view, 68: body in ventral view, 69: body in lateral view, 70: sensillus.

Ventral region: Mentum with a wide transverse crest, its surface coarsely foveolate. Apodemes and epimeral borders short, with a wide median hollow between the epimeral surfaces (Fig. 68). Three pairs of large tubercles present on epimeres 1 and 4 in the sejugal region, being clearly visible also in lateral view. Epimeral setal formula: 3-1-3-3, but setae *3a* originating on fourth epimeres; all setae minute. The distance between the median setae (*1a-1a*, *2a-2a*, etc.) is great, due to the



Figs 71-73

Pasocepheus eremaeozetoides sp. n. - 71: leg I, 72: lamella in lateral view, 73: leg II.

presence of the median hollow. Anogenital region framed by two strong, distinct crests, the inner one running around the genital aperture and continuing to the anal aperture, the other one running far laterally. Surface of the genital and anal apertures wrinkled. Anogenital setal formula: 4-1-2-3. Adanal lyrifissures were not observed. Adanal setae phylliform, all the other setae simple and minute.

Legs: All trochanters and femora pitted with areolae, the other segments smooth. Chaetotaxy of all legs typical for the family, setae *u*' on every tarsus bigger than *u*". The position of the setae of legs I and II is shown in Figs 71 and 73.

Remarks: On the basis of the characteristic structure of the body the new species is easily classifiable into the until now monotypical genus *Pasocepheus* Aoki, 1976. According to the original description this genus is characterized by 13 pairs of notogastral setae, but possibly (type specimens not seen) two pairs of setae in the anterior part of notogaster were overlooked by Aoki. The new species is readily distinguished from the type species of *Pasocepheus* (*P. triarcuatus* Aoki, 1976) by the form of its notogastral elevation (three elevations exist in *P. triarcuatus*) and by its very large humeral apophysis (absent in *P. triarcuatus*).

REFERENCES

AOKI, J. 1967. A preliminary revision of the family Otocepheidae (Acari, Cryptostigmata) II. Subfamily Tetracondylinae. *Bull. natn. Sci. Mus. Tokyo* 10: 297-359.

AOKI, J. 1976. Oribatid mites from the IBP Study Area, Pasoh Forest Reserve, West Malaysia. *Nature Life S.E. Asia* 7: 39-59.

BALOGH, J. 1970. New Oribatids (Acari) from New Guinea II. *Acta zool. hung.* 30: 291-344.

BALOGH, J. & P. BALOGH, 1992. The Oribatid mites genera of the world. *Hungarian Natural History Museum, Budapest*, vol.1: 263 pp., vol. 2: 375 pp.

BALOGH, J. & S. MAHUNKA. 1966. New Oribatids (Acari) from South Africa. *Acta zool. hung.* 12: 1-23.

BERNINI, F., A. M. AVANZATI & S. BERNINI, 1988. Notulae Oribatologicae XXXVII. Gli Acari Oribatei del Massiccio del Pollino (Italia Meridionale): aspetti faunistici e biogeografici. *Lav. Soc. ital. Biogeogr.* N.S. 10 (1987): 379-488.

CHINONE, S. 1974. Further contribution to the knowledge of the family Brachychthoniidae from Japan. *Bull. biogeogr. Soc. Japan* 30: 1-28.

GRANDJEAN, F. 1936. Les Microzetidae n. fam. (Oribates) *Bull. Soc. zool. Fr.* 61: 60-93.

HAMMER, M. 1958. Investigations on the Oribatid Fauna of the Andes Mountains I. The Argentine and Bolivia. *Biol. Skr.* 10: 1-129.

HAMMER, M. & J. A. WALLWORK. 1979. A review of the world distribution of Oribatid Mites (Acari: Cryptostigmata) in relation to Continental Drift. *Biol. Skr.* 22: 1-31.

MAHUNKA, S. 1973. Neue und interessante Milben aus dem Genfer Museum. XI. Neue und wenig bekannte Oribatiden aus Rhodesien (Acari). *Archs Sci. Genève* 26: 205-225.

MAHUNKA, S. 1979. Neue und interessante Milben aus dem Genfer Museum XLI. Vierter Beitrag zur Kenntnis der Oribatiden-Fauna Griechenlands (Acari: Oribatida). *Revue suisse Zool.* 86: 541-571.

MAHUNKA, S. 1987a. Neue und interessante Milben aus dem Genfer Museum LV. Oribatids from Sabah (East Malaysia) I (Acari: Oribatida). *Archs Sci. Genève* 40: 293-305.

MAHUNKA, S. 1987b. Neue und interessante Milben aus dem Genfer Museum LX. Oribatids from Sabah (East Malaysia) II. (Acari: Oribatida) *Revue suisse Zool.* 94: 765-817.

MAHUNKA, S. 1988. New and interesting mites from the Geneva Museum LXI. Oribatids from Sabah (East Malaysia) III (Acari: Oribatida). *Revue suisse Zool.* 95: 817-888.

MAHUNKA, S. 1989a. New and interesting mites from the Geneva Museum LXIV. Oribatids from Singapore (Acari: Oribatida). *Revue suisse Zool.* 96: 381-402.

MAHUNKA, S. 1989b. New and interesting mites from the Geneva Museum LXV. Oribatids of Sumatra (Indonesia) I (Acari: Oribatida). *Revue suisse Zool.* 96: 673-696.

MAHUNKA, S. 1990. A survey of the superfamiliy Euphthiracaroidea Jacot, 1930 (Acari: Oribatida). *Folia ent. hung.* 51: 37-80.

MAHUNKA, S. 1991. New and interesting mites from the Geneva Museum LXVIII. Oribatids from Sabah (East Malaysia) IV (Acari: Oribatida). *Revue suisse Zool.* 98: 185-206.

MAHUNKA, S. 1993a. Hungaromotrichus baloghi gen. et sp. n. (Acari: Oribatida), and some suggestions to the faunagenesis of the Carpathian Basin. *Folia ent. hung.* 54: 75-83.

MAHUNKA, S. 1993b. Oribatids from Madagascar I. (Acari: Oribatida) - New and interesting mites from the Geneva Museum LXXVI. *Revue suisse Zool.* 100: 289-315.

MAHUNKA, S. 1994. Oribatids from Madagascar II. (Acari: Oribatida). (New and interesting mites from the Geneva Museum LXXIX.) *Revue suisse Zool.* 101: 47-88.

MAHUNKA, S. 1995. Oribatids from Sabah (East Malaysia) V (Acari: Oribatida: Parakalummoidea stat. n. and Galumnoidea). *Trop. Zool.* 8: 269-308.

NIEDBALA, W. 1986. Catalogue des Phthiracaroidea (Acari), clef pour la détermination des espèces et descriptions d'espèces nouvelles. *Annls zool. Warsz.* 40: 309-370.

RAMSAY, G. W. & J. G. SHEALS. 1969. Euphthiracaroid mites (Acari, Cryptostigmata) from North Borneo. *Bull. Br. Mus. nat. Hist. Zoology* 18: 91-115.

SELLNICK, M. 1928. Formenkreis: Hornmilben, Oribatei. *In:* P. Brohmer, P. Ehrmann & G. Ulmer (eds.) *Tierwelt Mitteleur.* 3 (IX): 1-42.

SUBIAS, L. S., A. ARILLO & J. GIL-MARTIN. 1992. Consideraciones biogeograficas sobre los Oribatidos (Acari, Oribatida) de Marruecos y Sahara Occidental. *In:* A. Alemany (ed.): *Historia Natural '91* (Biologia de Organismos y Sistemas) p. 189-202.

REVUE SUISSE DE ZOOLOGIE, 102 (4) : 943-959; décembre 1995

Sur les Euthiini et Cephenniini (Coleoptera, Scydmaenidae) de l'Extrême-Est de la Russie et du Japon

Serguei A. KURBATOV
Severodvinskaya 9-84, Moscou 129224, Russie.

On the Euthiini and Cephenniini (Coleoptera, Scydmaenidae) from Russian Far East and Japan. - Following new species are described: *Veraphis fatiloquus* n. sp. (South Primorje), *Cephennodes vafer* n. sp. (South Kuriles), *Chelonoidum pullatum* n. sp. (South Kuriles, Shikoku), *Chelonoidum moderatum* n. sp. (South Primorje), *Chelonoidum besucheti* n. sp. (Shikoku), *Chelonoidum loebli* n. sp. (Shikoku) and *Chelonoidum torosum* n. sp. (Honshu). *Cephennodes graeseri* Reitter is transferred to *Chelonoidum* Strand. Keys to the Palaearctic *Veraphis* and East Palaearctic *Chelonoidum* are given.

Key-words: Coleoptera - Scydmaenidae - Taxonomy - Far East of Russia - Japan.

INTRODUCTION

Les Scydmaenidae sont des prédateurs des acariens répandus dans le monde entier. Toutefois, ils sont encore peu étudiés, sauf en Europe. Les tribus des Euthiini et Cephenniini, placées à la base de la famille, sont restées presque inconnues dans l'est de la région paléarctique. Ainsi, cette étude basée sur les récoltes récentes faites dans l'Extrême-Est de la Russie et au Japon, porte le nombre des espèces recensées de 3 à 4 pour les *Veraphis* et de 2 à 9 pour les Cephenniini. Les données disponibles sur la diversité et la distribution du groupe reflètent actuellement plus l'activité des récolteurs que la réalité biologique.

L'auteur remercie vivement Monsieur C. Besuchet qui lui a remis le matériel du Muséum d'histoire naturelle de Genève (MHNG) et qui lui a permis d'utiliser les données non-publiées relatives à *Cephennodes japonicus* Sharp. Le matériel typique est déposé également au Muséum zoologique de l'Université de Moscou (MZUM) et dans la collection de l'auteur (SK)

Manuscrit accepté le 22.12.1994.

Veraphis Casey

Genre holarctique avec 7 espèces aux Etats-Unis (Casey, 1897) et 4 espèces de la taïga paléarctique (Franz, 1971; Hisamatsu, 1985), toutes très rares dans les collections. Les *Veraphis* montrent un dimorphisme sexuel secondaire bien accusé affectant surtout la proportion des articles antennaires.

Veraphis fatiloquus n. sp.

Matériel. Holotype ♂: Russie: Primorsky Kray, à l'est d'Oussouriisk, environs de Kamenouchka, Abies pourri, 22.VI.1990, leg. S. Kurbatov (MZUM).

Paratypes: Russie: Primorsky Kray, au sud de Spassk-Dalnij, environs de Merkouchevka, *Pinus coreanus* pourri, 18.VI.1990, 1 ♂ (SK); pente occidentale du mont Olkhovaya, conifère pourri, 29.VI.1990, 1 ♂ (SK); même localité, *Abies* pourri, 30.VI.1990, 1 ♀ (MZUM); 25 km au nord-ouest de Terney, *Abies* pourri, 3.VII.1992, 1 ♀ (SK); tous leg. S. Kurbatov.

Longueur 1,25-1,30 mm. Brun, coloration des élytres parfois un peu plus claire.

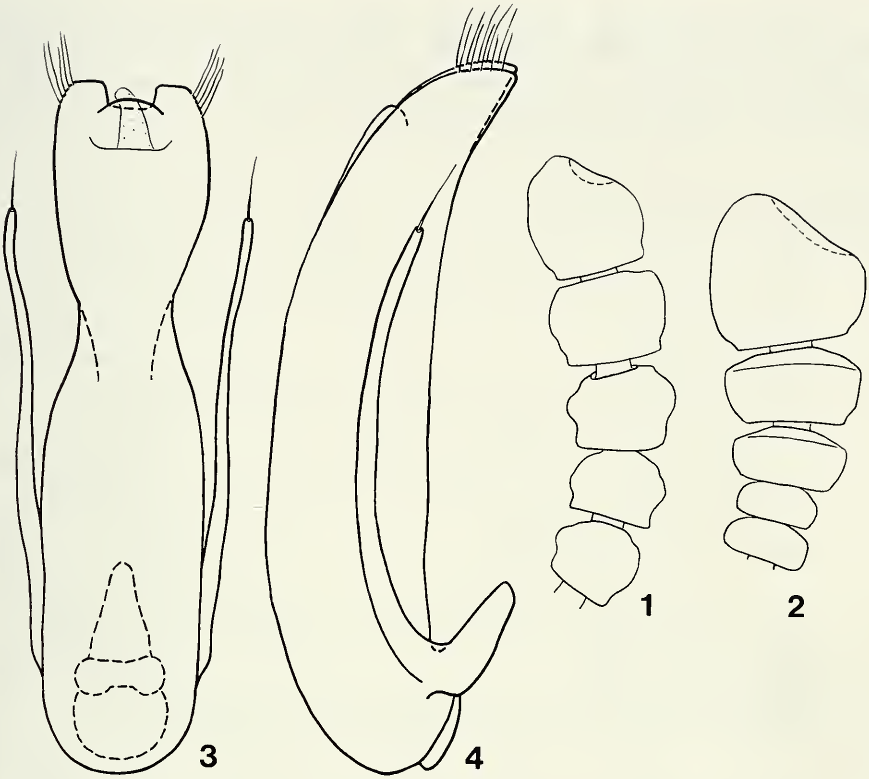
Tête (yeux compris) large de 0,26 mm, nettement déprimée entre les yeux, dépression prolongée en avant jusqu'au bord antérieur du front, progressivement plus large et moins marquée; téguments lisses sauf sur la partie antérieure de la dépression, pourvue d'une ponctuation floue; bord antérieur du front nettement anguleux; yeux grands, peu saillants; tempes en vue dorsale aussi longues que les 2/3 du diamètre des yeux; tubercules antennaires petits; antennes sans massue nette, s'élargissant progressivement vers le sommet.

Pronotum long de 0,30-0,33 mm, large de 0,33-0,35 mm, bord basal légèrement et régulièrement convexe, bords latéraux faiblement élargis jusqu'au niveau du quart antérieur puis arrondis vers le bord antérieur; pas de ponctuation; centre du disque muni d'un sillon longitudinal très faible.

Elytres sur la suture longs de 0,69-0,74 mm, larges de 0,50-0,53 mm, à ponctuation effacée, régulièrement arrondis sur les côtés, disque faiblement convexe, non aplati.

Mâle. Article 1 de l'antenne au moins 2 fois plus long que large; article 2 un peu plus étroit, allongé; 3 un peu transverse, plus étroit que 2; 4 de la même largeur, isodiamétrique; 5 isodiamétrique ou légèrement transverse, nettement plus large que 4; 6 à peine plus large que 5, presque isodiamétrique; 7 plus large que 6, faiblement transverse; 8 encore plus large, faiblement transverse; 9 plus large que 8, faiblement transverse; 10 plus large que 9, aussi faiblement transverse; 11 plus long que large, de la même largeur que l'article précédent, faiblement concave à l'extrémité de son côté extérieur (Fig. 1). Métasternum à carène médiane prolongée du bord antérieur au centre et munie sur toute sa longueur d'une rainure fine mais nette; cette carène est suivie postérieurement par une large et faible dépression longitudinale. Edéage (Figs 3, 4) long de 0,24-0,25 mm.

Femelle. Articles 1 à 3 de l'antenne de même grandeur que chez le mâle; 3 et 4 égaux; 5 et 6 de la même longueur, mais un peu plus larges; 7 encore plus large, fortement transverse; 8 de la même longueur, à peine plus étroit que 7, fortement



FIGS 1-4

Veraphis fatiloquus n. sp.; 1 : extrêmité de l'antenne mâle; 2 : idem, antenne femelle; 3 et 4 : édéage, face dorsale et latérale.

transverse; 9 bien plus large et long que 8, transverse; 10 transverse, plus volumineux que 9; 11 aussi long que large, plus large que 10, muni d'une vaste échancrure dans la moitié distale du côté extérieur (Fig. 2); carène métasternale longitudinale moins accusée que chez le mâle, bien marquée seulement jusqu'au niveau du bord postérieur des hanches 2, s'atténuant peu à peu; dépression longitudinale moins accusée que chez le mâle.

Par la forme de l'édéage, *V. fatiloquus* est proche à *V. engelmarki* Franz. Il en diffère par la structure de la partie apicale de l'édéage et par les proportions des articles antennaires, ainsi que par le disque élytral non aplati. *Veraphis ishikawai* Hisamatsu du Japon (Hokkaïdo) dont une seule femelle est connue, diffère de l'espèce nouvelle par sa grande taille, par les proportions de l'article antennaire 6 et par le pronotum aussi long que large.

Quatre femelles, trouvées dans la même région et déterminées comme Veraphis irkutensis Reitter (Kurbatov, 1990), sont très semblables aux femelles de la nouvelle espèce, mais plus petites (longues de 1,2 mm au maximum) et présentent la dépression du vertex lisse sur sa partie antérieure.

CLÉ DES *Veraphis* PALÉARCTIQUES

1 Mâles 2
– Femelles 4
2 Articles antennaires 4 à 7 plus longs que larges. Longueur 1,35-1,40 mm. Suède boréale .... *engelmarki* Franz
– Articles antennaires 4 à 7 isodiamétriques ou légèrement transverses 3
3 Articles antennaires 8 à 10 bien plus larges que longs. Longueur 1,0-1,1 mm. Massif Sayan oriental, Mongolie boréale .... *irkutensis* Reitter
– Articles antennaires 8 à 10 à peine plus larges que longs. Longueur 1,25-1,30 mm. Primorsky Kray .... *fatiloquus* n. sp.
4 Article antennaire 6 plus étroit que 5. Longueur 1,8 mm. Hokkaïdo .... *ishikawai* Hisamatsu
– Article antennaire 6 au moins aussi large que 5. Longueur maximale 1,4 mm. . 5
5 Articles antennaires 7 à 10 au moins 3 fois plus larges que longs. Longueur 1,0-1,1 mm .... *irkutensis* Reitter
– Articles antennaires 7 à 10 au maximum 2 fois plus larges que longs 6
6 Articles antennaires 3 à 5 isodiamétriques. Longueur 1,35-1,4 mm .... *engelmarki* Franz
– Articles antennaires 3 à 5 légèrement transverses. Longueur 1,25-1,3 mm .... *fatiloquus* n. sp.

Cephennodes Reitter

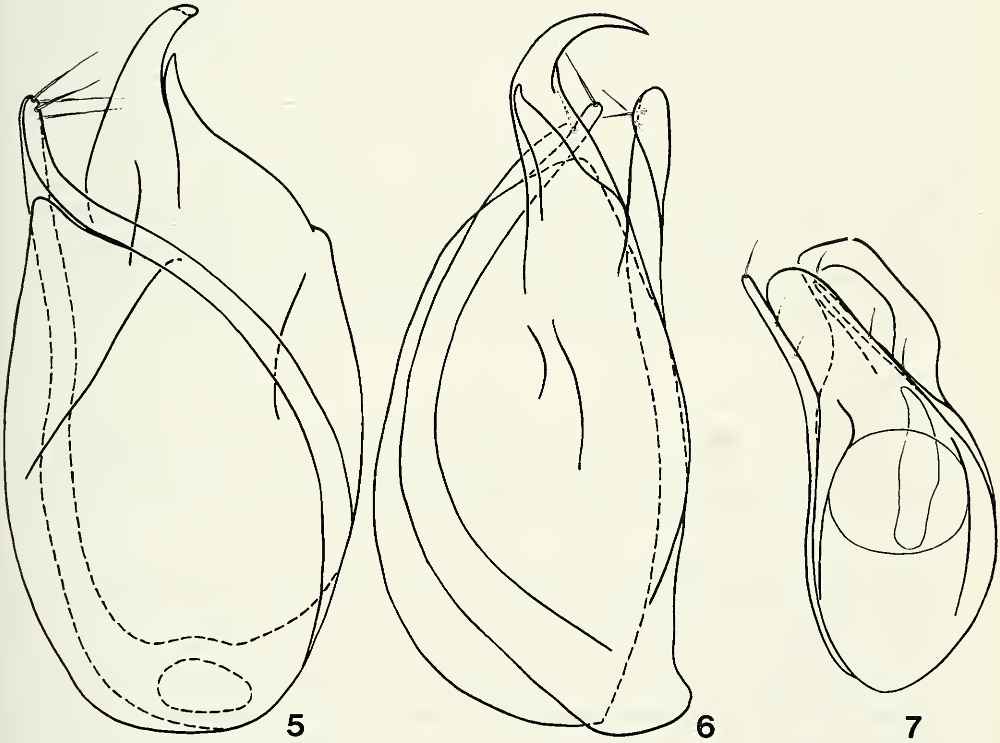
Ce genre est caractérisé par la présence d'une carène parallèle au bord latéral du pronotum et par la structure de l'édéage plat aux paramères asymétriques. 16 espèces de l'Asie méridionale et orientale, de l'Afrique orientale et des îles Hawaïi.

Cephennodes vafer n. sp.

Matériel. Holotype, ♂: Russie, Kuriles du Sud, île de Kounachir, environs de Tretjakovo, litière près d'un ruisseau, 2-5.VII.1991, leg. S. Kurbatov (MZUM).

Paratypes: Russie: Kuriles du Sud, comme l'holotype, 18 ex. et même données mais du 18-21.VII.1990, 26 ex. (MZUM, MHNG et SK).

Longueur 0,95-1,05 mm. Coloration brun rougeâtre, pubescence dense, longue, oblique, jaunâtre. Front aplati, à ponctuation très fine, reste de la tête non ponctué; tubercules antennaires nets, séparés du front par les dépressions longitudinales légères; la partie centrale de la tête convexe longitudinalement; yeux bien accusés, en vue dorsale bien plus longs que l'article antennaire 1; ce dernier plus long que large; 2 aussi plus long que large, plus petit que 1; 3 à 7 de même largeur, un peu plus étroits que 2; 3 à 4 aussi longs que larges; 5 à 6 à peine plus longs que les précédents; 7 encore plus long; article 8 plus large que 7, à peu près isodiamétrique; massue formée par les articles 9 à 11, comprimée; 9 en vue latérale à peine plus long que large, nettement plus large que 8; 10 un peu plus large que long, environ 1,5 fois plus large que 9; 11 environ 1/5 plus large que 10, 1,7 fois plus long que large, à peine plus long que 9 et 10 réunis; en vue dorsale 9 plus long que large, 10 également plus long que large, 11 à peine plus large que 10, presque 2 fois plus long que large.



FIGS 5-7

Cephennodes vafer n. sp.; 5 et 6 : édéage, face dorsale et latérale. Cephennodes japonicus (Sharp); 7 : édéage, face dorsale.

Pronotum long de 0,35-0,36 mm, large de 0,48-0,51 mm, à points petits, ronds et denses, à proximité des angles antérieurs plus fortement ponctué; côtés du pronotum très légèrement élargis des angles basaux jusqu'un peu en avant du milieu, puis arrondis vers le bord antérieur; carène latérale faiblement visible, étendue presque de l'angle postérieur au tiers antérieur du pronotum; fossette latérale aussi éloignée du bord latéral que du bord postérieur.

Elytres longs de 0,59-0,67 mm sur la suture, larges de 0,50-0,54 mm, leur plus grande largeur située au quart antérieur; disque légèrement déprimé dans sa partie antérieure; ponctuation nettement plus grosse que celle du pronotum; carène humérale très courte, plus courte que l'article antennaire 7; carène subhumérale dépassant le niveau du quart antérieur des élytres et aussi éloignée de la carène humérale que du centre de la fossette basale.

Brachyptère, aile un peu plus courte et 4 fois plus étroite que l'élytre; métasternum régulièrement convexe, finement ponctué; apophyse métasternale antérieure prolongée en arrière par deux carènes courtes et divergentes, formant un angle de 60° environ.

Pas de caractères sexuels secondaires visibles. Edéage (Figs 5, 6) long de 0,20-0,22 mm.

La seule espèce paléarctique orientale connue de ce genre, *C. japonicus* (Sharp, 1886) de Nagasaki, diffère par les caractères suivants : taille plus grande (longueur 1,25 mm), ponctuation élytrale nulle, pronotum ponctué dans sa partie centrale seulement, par des points elliptiques, orientés longitudinalement. Edéage (Fig. 7) long de 0,17-0,18 mm, plus petit et de forme distincte (Besuchet, com. pers.).

Chelonoidum Strand

Diffère du genre précédent par l'absence de la carène latérale du pronotum et par l'édéage à capsule basale volumineuse et aux paramères symétriques ou légèrement asymétriques. Une douzaine d'espèces holarctiques.

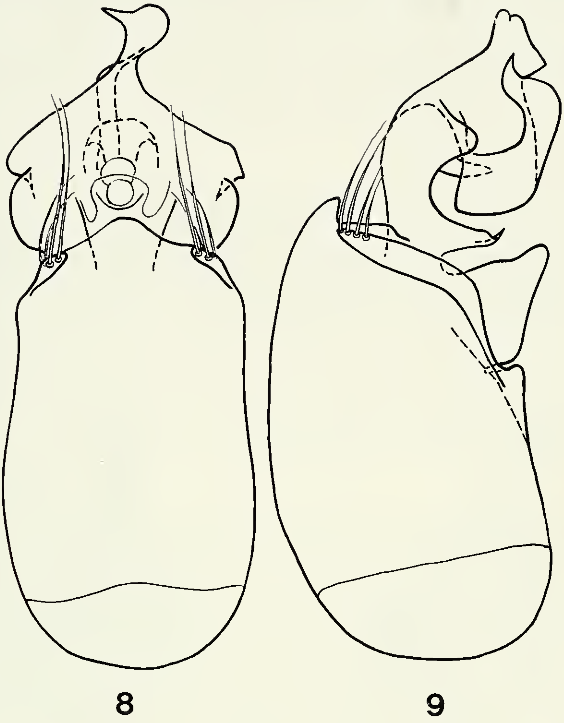
Chelonoidum graeseri (Reitter), comb. nov.

Cephennodes graeseri Reitter, 1887:270.

Cette espèce, d'un brun rougeâtre, présente un pronotum dépourvu de carène latérale et l'édéage typique des vrais *Chelonoidum* (Figs. 8, 9). Macroptère, aile 2 fois plus longue et environ 1,5 fois plus large que l'élytre. Répandue en Extrême-Est de la Russie, du Territoire Autonome Juif à l'extrême sud du Primorsky Kray. Vit dans la litière forestière et dans le bois pourri, parfois en compagnie de *Lasius* spp.

Chelonoidum pullatum n. sp.

Matériel. Holotype ♂: Russie, Kuriles du Sud, île de Kounachir, environ de Tretjakovo, litière près d'un ruisseau, 2-5.VII.1991, leg. S. Kurbatov (MZUM).



FIGS 8-9

Chelonoidum graeseri (Reitter); édéage, face dorsale et latérale.

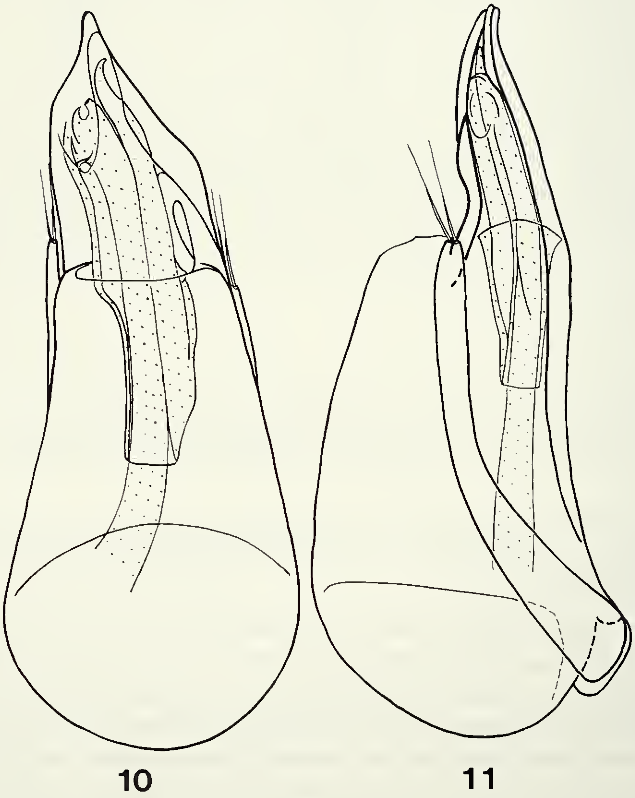
Paratypes: Russie, Kuriles du Sud, même données que l'holotype, 6 ex. (SK); même données mais du 19-21.VII.1990, 24 ex.(SK, MHNG, MZUM); environs de Mendeleevo, 10.VII.1985, 1 ex., leg. V. Belov (SK); Japon, Ehime, via Mt. Ishizuchi, 1000 m, 14.VIII.1980, 1 ex., leg. I. Löbl (MHNG).

Longueur 1,25-1,30 mm. Trapu; coloration brun foncé à brun noirâtre, pubescence dense, courte, couchée, à soies isolées plus longues et plus dressées près des angles postérieurs du pronotum, sur les côtés et dans la moitié postérieure des élytres.

Front et vertex densément mais très finement ponctués; tubercules antennaires nets; yeux bien développés, en vue dorsale nettement plus longs que l'article antennaire 1; ce dernier à peine plus long que large; 2 environ 1,5 fois plus long que large, plus étroit que l'article 1; 3 plus étroit que 2, plus long que large; articles 4 à 6 de même largeur que 3, mais moins longs, chacun plus long que large; 7 à peine plus large et nettement plus long que 6; 8 plus large que le précédent, aussi long ou un peu plus long que large; 9-11 comprimés, formant une massue pas très nette car la taille de 8 est intermédiaire entre celle de 7 et 9; 9 à peine plus long que large, 10 aussi long que large, un peu plus large que 9; article 11 à peine plus large que 10, presque 2 fois plus long que large, aussi long que 9 et 10 réunis.

Pronotum long de 0,46-0,49 mm, large de 0,65-0,70 mm, à ponctuation dense et fine, plus forte sur les côtés; ceux-ci très légèrement élargis des angles basaux jusqu'au milieu, puis arrondis vers le bord antérieur; fossette latérale aussi éloignée du bord latéral que du bord postérieur.

Elytres longs de 0,76-0,79 mm sur la suture, larges de 0,72-0,76 mm, très convexes, à largeur maximale située au niveau du tiers antérieur; ponctuation effacée; carène humérale très courte, pas plus longue que l'article antennaire 2, carène subhumérale dépassant le niveau du tiers antérieur des élytres, aussi éloignée de la carène humérale que du centre de la fossette basale.



Figs 10-11

Chelonoidum pullatum n. sp.; édéage, face dorsale et face latérale.

Macroptère, aile plus que 2 fois plus longue et 1,5 fois plus large que l'élytre; métasternum régulièrement convexe, finement ponctué; apophyse métasternale antérieure comme chez *Cephennodes vafer*.

Pas de caractères sexuels secondaires visibles. Edéage (Figs 10, 11) long de 0,33-0,34 mm.

Chelonoidum moderatum n. sp.

Matériel: holotype ♂: Russie, Kuriles du Sud, île de Kounachir, environs de Mendeleevo, 15ème km, litière près d'un ruisseau, 3.VII.1991, leg. S. Kurbatov (MZUM).

Paratypes: Russie, Kuriles du Sud, même données, 1 ♀; environ de Tretjakovo, litière près d'un ruisseau, 20.VII.1990, 1 ♀, leg. S. Kurbatov (SK); Primorsky Kray, à l'est d'Oussouriisk, environs de Kamenouchka, *Abies* pourri, 2.VI.1990, 1 ♀, leg. S. Kurbatov (SK); environs du cap Gamov, litière dans la chênaie, 30.VII.1988, 1 ♂, 1 ♀, leg. S. Kurbatov (SK); réserve "Kedrovaya pad'", tilleul pourri, 2.VI.1991, 1 ♀, leg. S. Kurbatov (SK); Japon, Gunma, Onioshadashi Rock Garden, 21.VII.1980, 1 ♂, leg. I. Löbl (MHNG); Ehime, via Mt. Ishizuchi, 1000 m, 14.VIII.1980, 2 ♂ et 3 ♀, leg. I. Löbl (MHNG, SK); Ishizuchi N. Park, Mt. Ishizuchi, 1550 m, 13.VIII.1980, 1 ♂ et 2 ♀, leg. I. Löbl (MHNG); Ishizuchi N. Park, Omogo, 900 m, 2.VIII.1980, 1 ♂, leg. I. Löbl (SK); Gifu, 8 km SE Osaka, 750 m, 1.VIII.1980, 4 ♂ et 22 ♀, leg. I. Löbl (MHNG).

Longueur 1,05-1,15 mm. Trapu, coloration brun rougeâtre, pubescence courte, couchée, à soies isolées plus longues et plus dressées dans la moitié basale du bord latéral du pronotum, sur les côtés et sur la moitié postérieure des élytres.

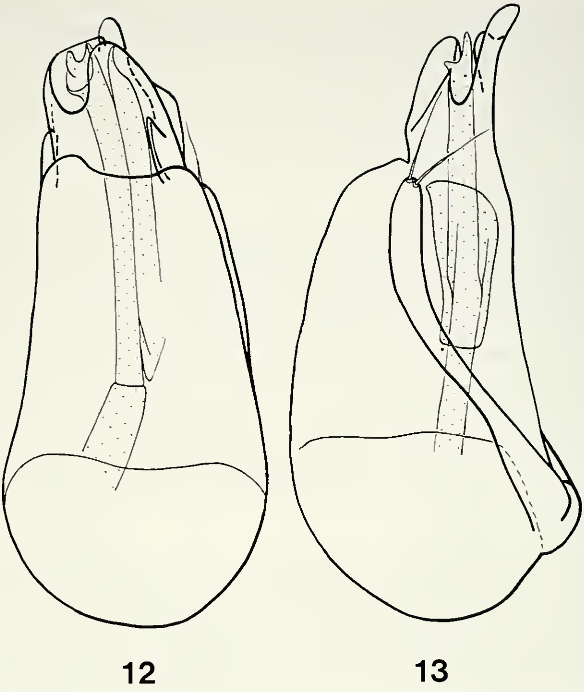
Front à ponctuation dense et fine, vertex ponctué plus éparsement; tubercules antennaires nets; article antennaire 1 un peu plus long que large, nettement moins long que l'oeil en vue dorsale; 2 plus étroit que le prédécent, 1,5 fois plus long que large; 3 à 6 de même largeur, plus étroits que 2, chacun un peu plus long que large; 7 un peu plus large que 6, aussi long ou un peu plus court que 2; 8 un peu plus large que 7, aussi long ou légèrement plus long que large; 9 à 11 légèrement comprimés, en vue latérale 9 aussi long que large, plus large que 8; 10 aussi long que large, un peu plus grand que 9, en vue dorsale 9 et 10 à peine plus longs que larges; 11 à peine plus large que 10, moins de 2 fois plus long que large, aussi long que 9 et 10 réunis.

Pronotum long de 0,38-0,43 mm, large de 0,54-0,58 mm; finement ponctué; ponctuation sur les angles antérieurs nettement plus dense; côtés du pronotum légèrement élargis des angles postérieurs jusqu'au milieu puis arrondis vers le bord antérieur; fossette latérale aussi éloignée du bord latéral que du bord postérieur.

Elytres longs de 0,67-0,70 mm sur la suture, larges de 0,59-0,63 mm; très convexes, leur largeur maximale située au niveau du tiers antérieur; ponctuation effacée; carène humérale très courte, pas plus longue que l'article antennaire 2; carène subhumérale atteignant plus ou moins le niveau du milieu de l'élytre, aussi éloignée de la carène humérale que du centre de la fossette basale.

Macroptère, aile comme chez l'espèce précédente; métasternum régulièrement convexe, finement ponctué; apophyse métasternale antérieure comme chez Cephennodes vafer.

Pas de caractères sexuels secondaires visibles. Edéage (Figs 12, 13) long de 0,28-0,29 mm.



FIGS 12-13

Chelonoidum moderatum n. sp.; édéage, face dorsale et latérale.

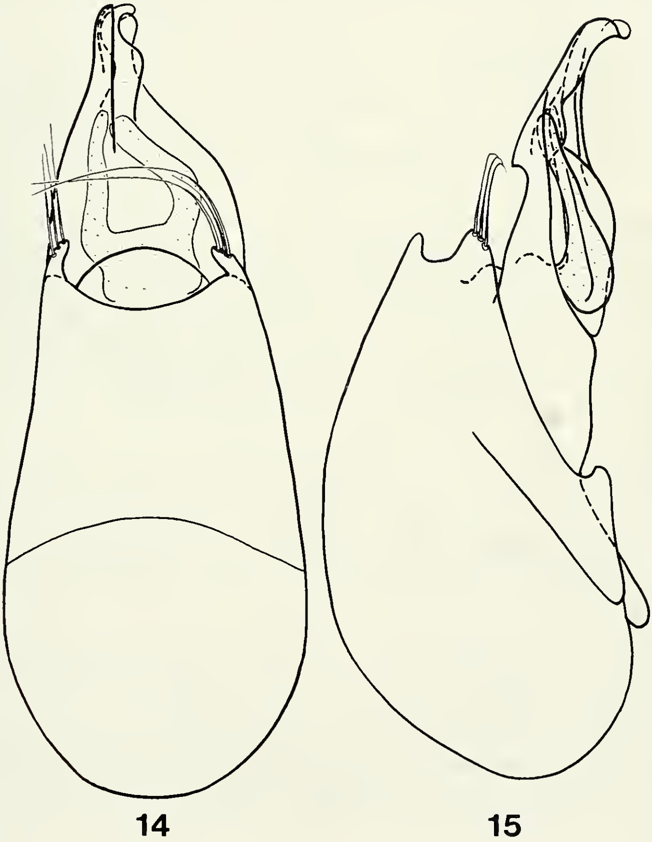
Chelonoidum ussuricum n. sp.

Matériel. Holotype ♂: Russie, Primorsky Kray, réserve "Kedrovaya pad'", bois vermoulu et litière près d'un vieux tilleul, 2.VI.1991, leg. S. Kurbatov (MZUM).

Paratypes: Russie, Primorsky Kray, mêmes données, 1 ♀ (SK); mêmes données mais litière dans la forêt de la vallée, 24.VII.1987, 3 ex. (SK, MHNG); mêmes données mais litière, 26.VII.1987, 1 ex. (MHNG); mêmes données mais litière parmi les pierres, 1.VIII.1987, 1 ex. (MHNG); mêmes données mais 8.IX.1964, 1 ex., leg. Dlusski (MHNG); environs du cap Gamov, litière près d'un tilleul au bord d'un ruisseau desséché, 30.VII.1988, 1 ex., leg. S. Kurbatov (SK); à l'ouest de Nezhino, sources de la rivière Malaya Ananjevka (anciennement Malaya Eldouga), litière dans la forêt, 6.VIII.1988, 2 ex., leg. S. Kurbatov (SK); à l'est d'Oussouriisk, environs de Kamenouchka, souche pourrie d'un feuillu, 3.VI.1989, 2 ex., leg. S. Kurbatov (SK); même localité, *Abies* pourri, 10.VI.1989, 7 ex., leg. S. Kurbatov (SK, MZUM); mêmes données mais tilleul pourri, 6.VI.1990, 7 ex., leg. S. Kurbatov (SK, MHNG, MZUM); mêmes données, tilleul pourri, 9.VI.1991, 1 ex. leg. S. Kurbatov (SK); mêmes données, litière dans la forêt de la vallée, 21.VI.1992, 2 ex., leg. S. Kurbatov); 60 km à l'ouest de Partisansk, environs Anissimovka, forêt de la vallée, litière près d'un peuplier, 21.VII.1988, 2 ex., leg. S. Kurbatov (SK); pente occidentale du mont Olkhovaya, bois vermoulu et litière près d'un peuplier, 29.VI.1990, 1 ex., leg. S. Kurbatov (MHNG).

Longueur 1,0-1,10 mm. Coloration brun rougeâtre clair, pubescence assez courte, couchée, à soies isolées plus longues et plus dressées dans la moitié basale du bord latéral du pronotum, sur les côtés et dans la moitié postérieure des élytres.

Front à ponctuation dense et fine, vertex lisse, non ponctué; tubercules antennaires nets; yeux petits, à peine plus courts que l'article antennaire 1, celui-ci nettement plus long que large; article 2 allongé, plus court et plus étroit que 1; 3 à 6 de même largeur, nettement plus étroits que 2; 3 un peu plus long que large; 3 à 6 progressivement raccourcis; 6 et 7 isodiamétriques, 7 plus grand que 6, plus long et un peu plus large que 8 (en vue latérale); 8 plus large que long; 9 à 11 formant une massue nette, 9 et 10 à peu près de même taille, à peine plus larges que longs, 11 de la même largeur, un peu plus court que 9 et 10 réunis.



FIGS 14-15

Chelonoidum ussuricum n. sp.; édéage, face dorsale et latérale.

Pronotum long de 0,36-0,37 mm, large de 0,50-0,51 mm; ponctuation très légère, presque invisible; côtés du pronotum faiblement élargis des angles postérieurs jusqu'au milieu puis arrondis vers le bord antérieur; fossette latérale plus près du bord postérieur que du bord latéral.

Elytres longs de 0,36-0,37 mm sur la suture, larges de 0,50-0,51 mm, assez convexes; largeur maximale située un peu en arrière du tiers antérieur; ponctuation effacée; carène humérale très courte, plus courte que l'article antennaire 2; carène subhumérale atteignant le niveau du tiers antérieur de l'élytre, plus près de la carène humérale que du centre de la fossette basale.

Brachyptère, aile de la même longueur que l'élytre; métasternum régulièrement convexe, pratiquement sans aucune ponctuation; apophyse métasternale antérieure comme chez Cephennodes vafer.

Pas de caractères sexuels secondaires visibles. Edéage (fig. 14, 15) long de 0,44-0,45 mm.

Chelonoidum besucheti n. sp.

Matériel. Holotype ♂: Japon, Ehime, Ishizuchi N. Park, Mt Ishizuchi, 13-14.VIII.1980, leg. C. Besuchet (MHNG).

Longueur 1,15 mm. Coloration brun rougeâtre, pubescence assez courte, couchée.

Tête densément chagrinée, clypéus lisse; vertex un peu aplati entre les yeux; tubercules antennaires nets; grands yeux, en vue dorsale aussi longs que l'article antennaire 1; celui-ci à peine plus long que large; 2 à peine plus long que large, un peu moins large que 1; 3 à 6 de même taille, isodiamétriques, nettement plus étroits que 2; 7 allongé, plus long et un peu plus large que 6, à peine plus long que 8; celui-ci carré; 9-11 formant une massue nette, 9 et 10 isodiamétriques, 10 à peine plus grand que 9; 11 plus large que 10, aussi long que 9 et 10 réunis.

Pronotum long de 0,37 mm, large de 0,56 mm, à ponctuation extrêmement fine, presque invisible, plus forte près des angles antérieurs; côtés du pronotum faiblement élargis des angles basaux jusqu'à peu près au milieu, puis arrondis vers le bord antérieur; fossette latérale également éloignée des bords latéral et basal.

Elytres longs de 0,71 mm sur la suture, larges de 0,60 mm, assez convexes; à points assez grands mais effacés; largeur maximale située au niveau du tiers antérieur; carène humérale très courte, de la même longueur que l'article antennaire 2; carène subhumérale atteignant le niveau du tiers antérieur de l'élytre, située un peu plus près de la carène humérale que du centre de la fossette basale.

Métasternum dépourvu de ponctuation, régulièrement convexe; apophyse métasternale antérieure comme chez *Cephennodes vafer*. Ailes non examinées.

Pas de caractères sexuels secondaires visibles. Edéage (Figs 16, 17) long de 0,44 mm.

Chelonoidum loebli n. sp.

Matériel. Holotype ♂: Japon, Ehime, via Mt. Ishizuchi, 1000 m, 14.VIII.1980, leg. I. Löbl (MHNG).

Paratype: mêmes données que l'holotype, 1 ex. (MHNG).

Figs 16-17

Chelonoidum besucheti n. sp.; édéage, face dorsale et latérale.

Longueur 1,10 mm. Coloration brun rougeâtre, pubescence oblique, plus longue que chez l'espèce précédente.

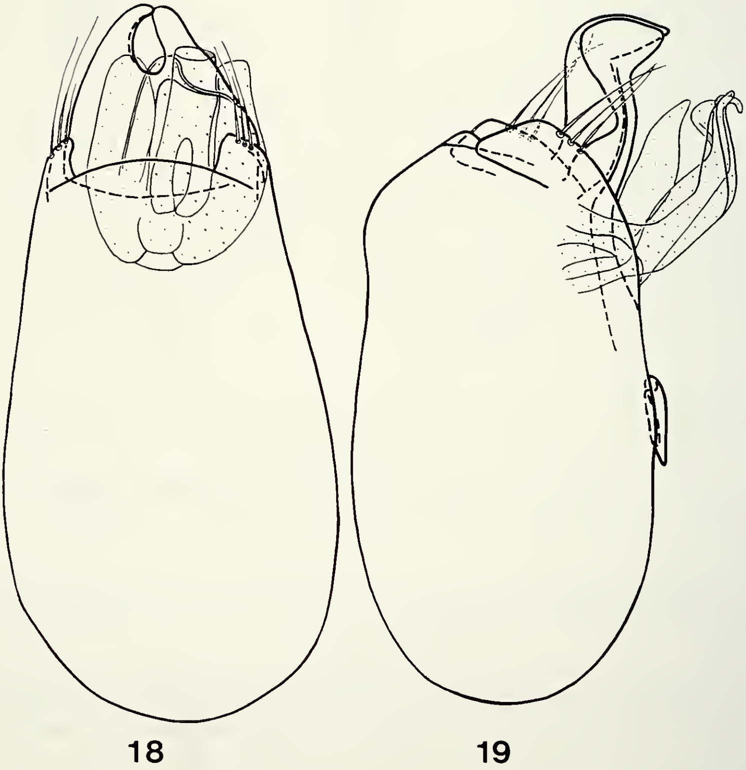
Tête très finement ponctuée, clypéus lisse; vertex entre les yeux régulièrement convexe; tubercules antennaires nets; yeux en vue dorsale aussi longs que la largeur de l'article antennaire 1; celui-ci à peine plus long que large; article 2 allongé, nettement moins large que 1; 3 à 6 subégaux, allongés, nettement plus étroits que 2; 7 nettement plus long et aussi large que 6 ou (en vue latérale) un peu plus large; article 8 à peine plus large et moins long que 7, à peine plus long que large; 9-11 formant une massue nette, 9 et 10 isodiamétriques ou à peine plus longs que larges, 10 plus grand que 9, 11 plus large que 10, aussi long que 9 et 10 réunis.

Pronotum long de 0,39 mm, large de 0,57 mm, à ponctuation formée de points minuscules, plus forte près des angles antérieurs; côtés du pronotum légèrement élargis des angles basaux jusqu'au milieu, arrondis après vers le bord antérieur; fossette latérale aussi éloignée du bord latéral que du bord basal.

Elytres longs de 0,69-0,71 mm sur la suture, larges de 0,61-0,63 mm, convexes, à ponctuation effacée, largeur maximale située au niveau du tiers antérieur; carène humérale plus courte que l'article antennaire 2; carène subhumérale atteignant le niveau du tiers antérieur de l'élytre, également éloignée de la carène humérale et du centre de la fossette basale.

Métasternum lisse, sans aucune ponctuation; apophyse métasternale antérieure comme chez *Cephennodes vafer*. Ailes non examinées.

Pas de caractères sexuels secondaires visibles. Edéage (Figs 18, 19) long de 0,43 mm.



FIGS 18-19

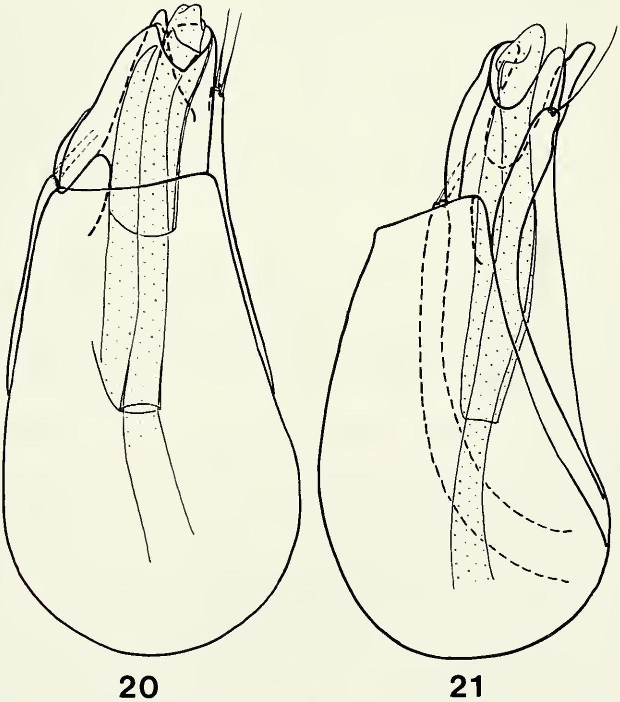
Chelonoidum loebli n. sp.; édéage, face dorsale et latérale.

Chelonoidum torosum n. sp.

Matériel. Holotype ♂: Japon, Gunma, J.E. Kogen N Park, Shirane, 1750 m, 22.VII.1980, leg. I. Löbl (MHNG).

Longueur 1,3 mm. Coloration brun rougeâtre, pubescence de longueur moyenne, couchée, avec quelques soies isolées plus longues et plus dressées sur la moitié postérieure des élytres.

Front à ponctuation très fine, effacée; clypéus et vertex lisses; tubercules antennaires nets; en vue dorsale, oeil plus court que l'article antennaire 2; article 1 à peine plus long que large; 2 allongé, nettement moins large que 2; 3 à 6 de même taille, à peine plus longs que larges, un peu moins larges que 2; 7 plus long et aussi large que le précédent ou, en vue latérale, à peine plus large; 8 nettement plus large que 7, à peine plus long que large; 9-11 formant une massue pas très nettement limitée, 9 nettement plus large que 8, isodiamétrique, 10 à peine plus large que long, plus large que 9, 11 à peine plus large que 10, aussi long que 9 et 10 réunis (l'exemplaire unique est difforme: son antenne droite est raccourcie, composée de dix articles, à cause de 9 et 10 non-séparés; tous les autres articles anormalement raccourcis; la description est basée sur l'antenne gauche).



FIGS 20-21

Chelonoidum torosum n. sp.; édéage, face dorsale et latérale.

Pronotum long de 0,53 mm, large de 0,76 mm, volumineux, pratiquement sans aucune ponctuation y compris sur les angles antérieurs; côtés du pronotum nettement élargis des angles basaux jusqu'au milieu, puis arrondis vers le bord antérieur; fossette latérale aussi éloignée du bord latéral que du bord basal.

Elytres longs de 0,75 mm sur la suture, larges de 0,77 mm (mais semblant moins larges que le pronotum), convexes, à ponctuation effacée, leur largeur maximale située avant le niveau du tiers antérieur; carène humérale très petite, de la même longueur que l'article antennaire 2; carène subhumérale n'atteignant pas le niveau du tiers antérieur de l'élytre, aussi éloignée de la carène humérale que du centre de la fossette basale.

Métasternum à ponctuation indistincte; apophyse métasternale antérieure comme chez *Cephennodes vafer*. Ailes non examinées.

Pas de caractères sexuels secondaires visibles. Edéage (Figs 20, 21) long de 0,36 mm, très semblable à celui de *Chelonoidum moderatum*, mais inversé.

CLÉ DES *Chelonoidum* DE LA RÉGION PALÉARCTIQUE ORIENTALE

1 Pronotum à ponctuation fine mais nette 2

– Pronotum pratiquement sans aucune ponctuation 4

2 Articles antennaires 3 à 6 isodiamétriques, 7 plus court que 6, 11 un peu plus court que 9 et 10 réunis. Elytres à pubescence dense, longue et oblique, composée de soies uniformément orientées. Carène subhumérale n'atteignant pas le niveau du tiers antérieur de l'élytre. Longueur 1,5-1,6 mm. Sud de Khabarovsky Kray, Primorsky Kray .... *graeseri* (Reitter)

– Articles antennaires 3 à 6 nettement plus longs que larges, 7 plus long que 6, 11 aussi long que 9 à 10 réunis. Elytres à pubescence assez courte, couchée, munis d'une vingtaine de soies plus longues et plus dressées sur les côtés et sur la moitié postérieure. Carène subhumérale dépassant le niveau du tiers antérieur de l'élytre. Longueur ne dépassant pas 1,3 mm. 3

3 Coloration brun noirâtre, longueur 1,25-1,30 mm. Kuriles du Sud, Shikoku .... *pullatum* n. sp.

– Coloration brun rougeâtre, longueur 1,05-1,15 mm. Primorsky Kray, Kuriles du Sud, Honshu, Shikoku. .... *moderatum* n. sp.

4 Articles antennaires 4 à 6 et 8 isodiamétriques ou légèrement transverses, 7 un peu plus large que 8 (surtout en vue latérale) 5

– Articles antennaires 4 à 6 et 8 plus longs que larges, 7 moins large que 8 6

5 Front à ponctuation dense et fine, vertex lisse, régulièrement convexe; article antennaire 8 plus large que long, article 11 plus court que 9 et 10 réunis. Longueur 1,0-1,1 mm. Sud de Primorsky Kray ...... *ussuricum* n. sp.

– Front et vertex densément chagrinés, vertex entre les yeux un peu aplati; article antennaire 8 carré, 11 aussi long que 9 et 10 réunis. Longueur 1,15 mm. Shikoku .... *besucheti* n. sp.

6 Elytres 1,8 fois plus longs et un peu plus larges que le pronotum; carène subhumérale atteignant le niveau du tiers antérieur de l'élytre. Longueur 1,1 mm. Shikoku .... *loebli* n. sp.

– Elytres 1,4 fois plus longs, apparemment plus étroits que le pronotum; carène subhumérale dépassant à peine le niveau du quart antérieur de l'élytre. Longueur 1,3 mm. Honshu central .... *torosum* n. sp.

BIBLIOGRAPHIE

CASEY, T.L. 1897. Coleopterological Notices. VII. *Annals N. Y. Acad. Sci.* 9: 285-684.

FRANZ, H. 1971. Untersuchungen über die paläarktischen Arten der Gattungen *Euthia* Steph. und *Veraphis* Casey (Col. Scydmaenidae). *EOS* 46: 57-84.

HISAMATSU, S. 1985. Notes on some Japanese Coleoptera, I. *Trans. Shikoku Ent. Soc.* 17: 5-13.

KURBATOV, S.A. 1990. More on the tribe Euthiini (Coleoptera, Scydmaenidae) in the USSR Far East. *Zool. Zhurnal, Moscow.* 69: 136-140 (in Russian).

REITTER, E. 1887. Neue Coleopteren aus Europa, den angrenzenden Ländern und Sibirien, mit Bemerkungen über bekannte Arten. III Theil. *D. ent. Z.* 31: 241-288.

SHARP, D. 1886. The Scydmaenidae of Japan. *Ent. Monthly Mag.* 23: 46-51.

REVUE SUISSE DE ZOOLOGIE, 102 (4) : 961-968; décembre 1995

The types of some species of *Lathrobium* Gravenhorst and of *Xantholinus sejugatus* G. Benick (Coleoptera: Staphylinidae)

Volker ASSING
Gabelsbergerstr. 2, D-30163 Hannover, Germany.

The types of some species of *Lathrobium* **Gravenhorst and of** *Xantholinus sejugatus* **G. Benick (Coleoptera: Staphylinidae).** - An examination of the types of *Lathrobium microps* L. Benick, *L. patris* G. Benick, *L. dilutum* Erichson, *L. longulum* Gravenhorst, *Xantholinus sejugatus* G. Benick and *X. longiventris* Heer yielded the following synonymies: *Lathrobium dilutum* Er. = *L. microps* L. Benick syn. n., *L. longulum* Grav. = *L. patris* G. Benick syn. n. and *Xantholinus longiventris* Heer = *X. sejugatus* G. Benick syn. n. Lectotypes are designated for *L. dilutum* Er., *L. longulum* Grav. and *X. longiventris* Heer. The male sexual characters of *L. longulum* Grav. and the female terminalia of *L. pallidum* Nordm. and *L. dilutum* Er. are figured.

Key-words: Coleoptera - Staphylinidae - *Lathrobium* - *Xantholinus* - Germany - Taxonomy.

INTRODUCTION

Among the numerous species of Central European Staphylinidae there are, not only in the Aleocharinae, several taxa which never or only once or twice have been recorded again since their description. The density of coleopterologists and their collecting activity in this region are among the highest in the world. Such utmost rarity is, therefore, remarkable and could have the following reasons: a) extinction, b) strongly restricted areas of distribution (endemics) and/or special bionomics or life-histories (e.g. subterraneous species or those with very short-lived adults), c) confusion with similar, more common species (particularly in groups whose species are difficult to identify) and d) the description is based on artefacts.

In the case of *Lathrobium microps* L. Benick, *L. patris* G. Benick and *Xantholinus sejugatus* G. Benick no records exist after their description, with one exception: HABERMANN (1983) reported *L. patris* from Estland. Even so, they were considered and treated in major taxonomic studies on Paederinae and Xantholininae (e.g. COIFFAIT 1972, 1982; LOHSE 1964), red data books (ZIEGLER *et al.* 1994) etc. It is

---

Manuscript accepted 30.01.1995.

rather unlikely that the reasons stated above under a), b) and c) apply to these species. The island of Spiekeroog or the surroundings of Lübeck, their type localities, are regions where no endemics are likely to be found. Furthermore, the externally and presumably also ecologically most similar species (*L. pallidum* Nordm./*L. dilutum* Er., *L. longulum* Grav. and *X. linearis* (Ol.)/*X. longiventris* Heer/*X. rhenanus* Coiff., respectively) are widely distributed, mostly occur also in seminatural and agricultural habitats and, except for the partially subterraneous *L. pallidum* and *L. dilutum*, are epigeically active. Considering the relatively long tradition of pitfall trapping – *L. pallidum* and *L. dilutum*, too, can be collected with pitfall traps – and other quantitative and semiquantitative sampling methods in Northern Germany, it appeared doubtful that such species should have been overlooked. In addition, the type locality of the two species described by G. Benick, the Schellbruch near Lübeck, has repeatedly, yet unsuccessfully, been visited by coleopterologists (Ziegler, pers. comm.).

Strikingly all of the three species in question have in common that their descriptions are not only based on single specimens but they also lack references to the genitalia, either because the type was erroneously believed to be a female (*L. patris*, *X. sejugatus*) or because it was in fact a female (*L. microps*).

In order to solve the problem it was necessary to examine the types, which was kindly made possible by Dr Ivan Löbl (Muséum d'histoire naturelle, Genève), who arranged the loan of L. microps, and by Mr Heinrich Meybohm (Stelle) and Mr Wolfgang Ziegler (Rondeshagen), who helped in locating and providing me with the types of *L. patris* and *X. sejugatus*. Furthermore, I am indebted to Dr Manfred Uhlig (Museum für Naturkunde, Berlin) for the loan of the types of *L. dilutum* and *L. longulum*, and to Dr Bernhard Merz (Eidgenössische Technische Hochschule Zürich) for those of *X. longiventris*.

All the types of the species described by L. and G. Benick and dealt with in this paper are now deposited in the Muséum d'histoire naturelle, Genève.

Lathrobium patris G. Benick, 1949

Holotype ♂, labels: Lübeck, Schnellbruch, 12.XI.44, Überschwemmung, Dr G. Benick leg., *Lathrobium patris* G. Ben., Typus ♀ [sic!].

Benick (1949) and Lohse (1964) state that *L. patris* is very similar to *L. longulum* (together with which it was collected!), but can be separated from the latter by the following characters: the more oblong and narrower head, the posteriorly narrowed pronotum and the shorter elytra. Bordoni (1980a) examined the type, which turned out to be a ♂. Apparently Benick mistook it for a ♀ because of the shape of sternite VIII, whose hind margin is projecting (Fig. 2–4) and not incised, as in most *Lathrobium* spp.. In his study of Lathrobiini Bordoni (1980a) figures the aedeagus and the sternites VII and VIII, the latter with concave posterior margin and conspicuous patterns of black hairs. These additional diagnostic characters are also pointed out in Lohse (1989).

The examination of the external morphology of the holotype showed that the head was indeed rather narrow, whereas the shape of the pronotum and the length of the elytra are of little significance. I have seen some 600 specimens of *L. longulum* so far, and these characters are subject to considerable variability. The study of the aedeagus and sternites VII and VIII after microscopic preparation, with a compound microscope at magnifications of 200–400 x held some surprises in store: the general shape of the aedeagus as well as the characteristic structures in the internal sac were clearly identical with those of *L. longulum*, both in ventral and in lateral view (Fig. 1a–b). The impression of a stouter and apparently more strongly bent apex of the median lobe is in fact an artefact caused by damage; part of the apex is missing (Fig. 2). Finally, the sternites VII and VIII show no trace of conspicuous patterns of hairs and their shapes are completely different from those depicted in BORDONI (1980a). On the contrary, apart from the abnormal asymmetry of sternite VIII, they were the same as in *L. longulum* (Figs 2–4). Hence, since the holotype of *L. patris* doubtlessly represents an aberrant specimen of *L. longulum*, *L. patris* G. Benick must be considered a junior synonym of *L. longulum* Grav.

Lathrobium longulum Gravenhorst, 1802

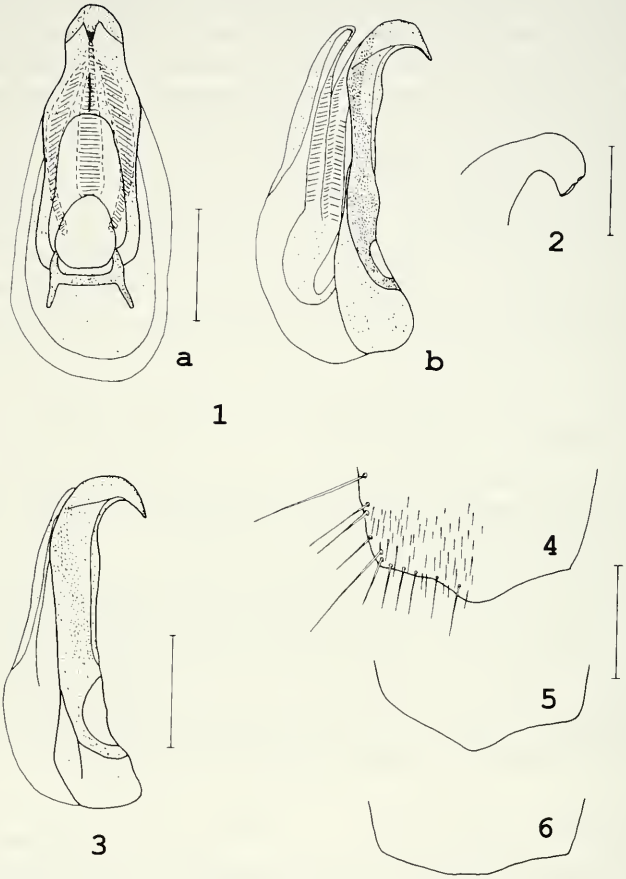
Lathrobium longulum GRAVENHORST, 1802: 53.
Lectotype ♂, here designated. Germania, Nr. 6346, Zool. Mus. Berlin. Paralectotypes: 2 ♂♂, 3 ♀♀, here designated. Same data as lectotype.
Lathrobium patris G. BENICK, 1949: 16 ff., syn. n.

From the series of 6 syntypes of *L. longulum* a ♂ was chosen as lectotype and remounted. Its aedeagus (Fig. 3) and its sternite VIII (Fig. 6) were examined with a compound microscope and subsequently glued next to the specimen. The internal sac contained structures identical to those in Fig. 1a–b. Since there has been no recent confusion regarding the identity of the species and since descriptions and diagnoses are abundant in the literature, no detailed redescription is given here.

Lathrobium microps L. Benick, 1942

Holotype ♀, labels: Spiekeroog, Dünen, VI.39, Microt. arv.-Nest, *Lathrob. microps* L.B. Typus.

According to BENICK (1942) and LOHSE (1964) *L. microps* differs from *L. pallidum* in its smaller size, uniform light colour, the coarser punctation of the abdomen and the more distinct microsculpture on head and pronotum, and from *L. dilutum* primarily in its slightly reduced length, shorter antennomeres and shorter head. These differential characters are rather vague or even inadequate: from what the considerably damaged type specimen had to offer, it was well within the range of intraspecific variability of *L. dilutum*. In order to support this impression the female terminalia, which have been shown to be highly useful for the identification of many other Staphylinidae (see e.g. UHLIG 1989), of *L. dilutum*, *L. pallidum* and the holotype of *L. microps* were examined (Figs 7–12). The striking differences in shape, proportions, pubescence and number and position of long setae between *L. dilutum* and *pallidum* indicate that the significance of the female terminalia may indeed be at



FIGS 1–6

Lathrobium longulum Grav.: Aedeagus (1a, b) and hind margin of ♂ sternite VIII (4) of a specimen from the Lüneburger Heide, Northwestern Germany; apex of median lobe (2) and hind margin (outline) of ♂ sternite VIII (5) of the holotype of *L. patris* G. Benick; aedeagus in lateral view (3) and hind margin (outline) of ♂ sternite VIII (6) of the lectotype of *L. longulum* Grav. Scale: 1, 3–6: 0.25 mm; 2: 0.10 mm.

least as great for the identification, taxonomy and also phylogenetics of *Lathrobium* species as the aedeagus. Against this background, the obvious similarity between *L. microps* (Fig. 11) and *L. dilutum* (Figs 10, 12) leaves little doubt that they are in fact conspecific. Hence *L. microps* L. Benick must be considered a junior synonym of *L. dilutum* Er.

Lathrobium dilutum Erichson, 1839

Lathrobium dilutum ERICHSON, 1839: 509.

Lectotype ♀, here designated. Berolin, Nr. 6348, Zool. Mus. Berlin. Paralectotypes, here designated: 1 ♀, Berolin, Nr. 6348, Zool. Mus. Berlin; 1 ♀ (abdomen missing!), Pommern, Nr. 6348, Zool. Mus. Berlin; 1 ♀ (head missing, abdomen glued on separate label), 6348, *dilutum* Er., Pomer. Er., Zool. Mus. Berlin.

Lathrobium microps L. BENICK, 1842: 168 ff., syn. n.

From the 4 syntypes of *L. dilutum*, a ♀ in fairly good condition was selected as lectotype and remounted. Its terminalia were examined with a compound microscope (Fig. 12) and subsequently glued next to the specimen. The hind margin of its sternite VIII is rounded as in Fig. 9. For further details concerning the external morphology of the species the abundant diagnoses and keys in the literature should be consulted.

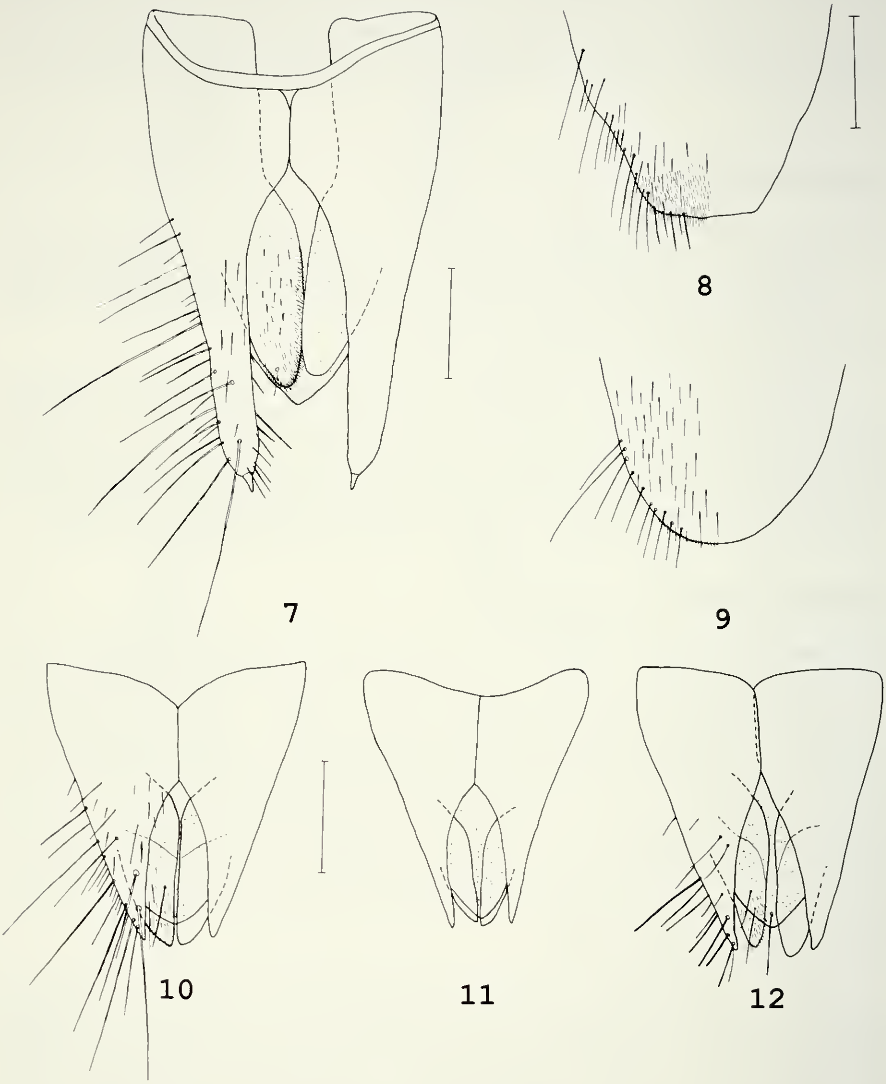
Xantholinus sejugatus G. Benick, 1953

Holotype ♂, labels: Lübeck, Schnellbruch, 10.XI.45, Überschwemmung, Dr. Benick, *Xantholinus sejugatus* G. Bck., Typus.

According to the original description (BENICK 1953) – which places the species near *X. linearis* (Ol.) and erroneously claims the type to be a ♀ – and LOHSE (1964) *X. sejugatus* is distinguished from related species by the shape of the head with its sides strongly diverging posteriorly. In addition, the gular sutures are completely separated, whereas in the other species they are fused in the middle. As the aedeagus, which is of particular taxonomic significance in this genus, was unknown, *X. sejugatus* has been treated in major studies on Palaearctic *Xantholinus* as a species of incertae sedis (e.g. BORDONI 1980b; COIFFAIT 1972).

Since the holotype is in fact a ♂, it was possible to examine the structures in the internal sac. The aedeagus had been dissected and the internal sac glued on a separate label prior to the present study. After microscopic preparation and slight squeezing, the contents of the internal sac was examined with a compound microscope and compared with the related species. It was clearly identical with that of *X. longiventris* Heer, which means that the holotype of *X. sejugatus* represents an externally aberrant specimen of *X. longiventris*. As far as the characters on the head are concerned, it looks as though the gular sutures failed to fuse during ontogenesis, which resulted in an abnormally widened head. Therefore, *X. sejugatus* G. Benick is to be regarded as a junior synonym of *X. longiventris* Heer.

Like *L. patris* and *L. microps* the example of *X. sejugatus* demonstrates that the intraspecific variability of a species is easily underestimated. In regions like



Figs 7–12

♀ terminalia (urites IX and X) (7) and hind margin of ♀ sternite VIII (8) of *L. pallidum* Nordm.; hind margin of ♀ sternite VIII (9) and ♀ terminalia (10) of *L. dilutum* Er. (Hannover, Germany); ♀ terminalia (11) of the holotype of *L. microps* L. Benick (pubescence and setae omitted); ♀ terminalia (12) of the lectotype of *L. dilutum* Er. Tergites X dotted. Scale: 0.25 mm.

Central Europe with high collecting activity and abundance of available material species descriptions should be based on series of specimens, and the genitalia should always be considered. In the course of ecological field work I have seen more than 10,000 *Xantholinus* (Assing 1993), among them numerous specimens with aberrations of various body parts. After all, malformations during ontogenesis occur in all forms of living organisms, as the late renowned coleopterologist Dr G.A. Lohse has repeatedly pointed out.

Xantholinus longiventris Heer, 1839

Xantholinus longiventris Heer, 1839: 247.

Lectotype ♂, here designated (remounted, aedeagus dissected and examined): red triangular label [= Switzerland, Museum Escher] (coll. Heer, ETH Zürich). Paralectotypes, here designated: 1♀, same labels as lectotype; 1♀, blue label "b" [= Matt, Kanton Glarus, leg. Heer] (coll. Heer, ETH Zürich).

Xantholinus sejugatus G. Benick, 1953: 39f., syn. n.

REFERENCES

Assing, V. 1993. Zur Bionomie von *Xantholinus rhenanus* Coiff. und anderen bodenbewohnenden Xantholininen (Col., Staphylinidae) in Nordwestdeutschland. *Zool. Jb. Syst.* 120: 13–38.

Benick, G. 1949. Eine neue deutsche *Lathrobium*-Art. *Entomol. Blätter* 45–46 (1949–50): 16–18.

Benick, G. 1953. Ein neuer *Xantholinus* (Col. Staphyl.) aus Norddeutschland. *Verh. Ver. naturwiss. Heimatforsch. Hamburg* 31: 39–40.

Benick, L. 1942. Eine neue deutsche *Lathrobium*-Art. *Lathrobium microps* n. sp.. *Entomol. Blätter* 38: 168–170.

Bordoni, A. 1980a. Studi sui Paederinae — V — Intorno ad alcuni Lathrobiini poco noti, revisione dei tipi e descrizione di una nuova specie italiana (Col. Staphylinidae). *Frustula Entomol. (N.S.)* 2: 1–26.

Bordoni, A. 1980b. Stato attuale della conoscenza degli *Xantholinus* W-Palearctici: un esempio significativo della necessita dello studio del sacco interno in alcuni coleotteri stafilinidi. *Atti XII Congr. Naz. Ital. Entomol., Roma* 2: 37–43.

Coiffait, H. 1972. Coléoptères Staphylinidae de la région paléarctique occidentale. I. Généralités; sous-fam. Xantholininae et Leptotyphlinae. *Nouv. Rev. Ent. Suppl.* 2(2): 1–651.

Coiffait, H. 1982. Coléoptères Staphylinidae de la région paléartique occidentale. IV. Sous-famille Paederinae. Tribu Paederini 1 (Paederi, Lathrobii). *Nouv. Rev. Ent., Suppl.* 12(4): 1–440.

Erichson, W.F. 1837–39. Die Käfer der Mark Brandenbourg, I. *Berlin*, 740 pp; 1839: 385–740.

Gravenhorst, J. 1802. Coleoptera Microptera Brunsvicensia. *Brunsvigae*: 206 pp.

Haberman, H. 1983. Beitrag zu "Enumeratio Coleopterorum Fennoscandiae et Daniae" (1979) über die Staphyliniden Estlands. *Notul. Entomol.* 63: 97–110.

Heer, O. 1839. Fauna Coleopterorum Helvetica. Pars 1. *Turici [Zürich]*, 145-364.

LOHSE, G.A. 1964. Fam. Staphylinidae I (Micropeplinae bis Tachyporinae). In: FREUDE, H., HARDE, K.W. & G.A. LOHSE: *Die Käfer Mitteleuropas*. Bd. 4, Krefeld, 1–264.

LOHSE, G.A. 1989. 23. Familie Staphylinidae (I) (Piestinae bisTachyporinae). In: LOHSE, G.A. & W.H. LUCHT: *Die Käfer Mitteleuropas*. 1. Supplementband mit Katalogteil, Krefeld, 121–183.

UHLIG, M. 1989. Zur Morphologie der weiblichen Terminalia einiger Staphylinidenarten (Coleoptera). *Verh. XI. SIEEC Gotha* 1986: 227–37.

ZIEGLER, W. & R. SUIKAT. 1994. Rote Liste der in Schleswig-Holstein gefährdeten Käferarten. *Landesamt für Naturschutz und Landschaftspflege Schleswig Holstein*: 1–96.

REVUE SUISSE DE ZOOLOGIE, 102 (4) : 969-978; décembre 1995

Espèces nouvelles ou mal connues de Cholevidae (Coleoptera)

Michel PERREAU
Laboratoire de Magnétisme des surfaces, Université Paris 7,
2, place Jussieu, F-75251 Paris cedex 05, France.

New or poorly known species of Cholevidae (Coleoptera). - New data are given on the morphology and the distribution of *Choleva gabriellae* Giachino, and *Attaephilus scheuerni* Perreau. The descriptions of the following new species are given: *Ptomaphaginus balazuci* n. sp., *Ptomaphaginus baliensis* n. sp., *Ptomaphaginus riedeli* n. sp., and *Choleva (Protocatops) medvedevi* n. subgen., n. sp. With the latter species the distribution of *Choleva* is extended to Vietnam. Some apomorphic characters shared with *Choleva henroti* Szymczakowski, lead to the description of a new subgenus: *Protocatops*.

Key-words: Coleoptera - Cholevidae - Taxonomy - Distribution.

INTRODUCTION

Nous regroupons dans cet article un certain nombre d'observations sur des Cholevidae originaires de la région méditerranéenne et de l'Asie du sud-est. L'aire de répartition de certaines espèces se trouve précisée, c'est le cas pour *Choleva gabriellae* Giachino, dont seul le mâle était jusqu'à présent connu. *Attaephilus scheuerni* Perreau, n'avait fait l'objet que d'une diagnose préliminaire, et nous complétons ici sa description. D'autres espèces sont nouvelles: *Ptomaphaginus balazuci* n. sp., *Ptomaphaginus baliensis* n. sp., *Ptomaphaginus riedeli* n. sp., et une espèce présentant un intérêt particulier, du point de vue phylogénétique et biogéographique: *Choleva (Protocatops) medvedevi* n. subgen., n. sp., première espèce de *Choleva* vietnamienne.

Le genre *Choleva*, essentiellement paléarctique, n'était connu de l'Asie du sud-est que par une seule espèce distribuée au Népal et en Assam. La présence d'une nouvelle espèce au Vietnam, d'ailleurs apparentée à l'espèce himalayenne repousse donc encore vers le sud-est l'aire de répartition du genre *Choleva*, les caractères particuliers communs à ces deux espèces sont la raison de la séparation du sous-genre *Protocatops* n. subgen.

Manuscrit accepté le 23.01.1995.

Abbréviations utilisées: MHNG: Muséum d'histoire naturelle de Genève; MNHNP: Muséum National d'Histoire Naturelle de Paris; SMNS: Staatliches Museum für Naturkunde Stuttgart; CMP: collection Michel Perreau.

DESCRIPTIONS

Le genre *Ptomaphaginus* est un groupe très homogène dont il est souvent bien difficile de distinguer les espèces sur la seule morphologie externe. Certaines espèces présentent, exceptionnellement des particularités bien marquées constituant d'intéressants caractères distinctifs: échancrures entourées ou non de dents sur les ventrites VII et VIII du mâle (*P. franki* Perreau, *P. trautneri* Perreau), touffe de poils à l'extrémité des élytres (*P. pilipennis* Perreau, *P. pilipennoides* Perreau), soies particulièrement longues à la base des fémurs... Toutefois, la plupart des espèces ne peuvent être distinguées que par les caractères sexuels, édéage chez le mâle, et spermathèque chez la femelle. Même les mensurations ne donnent que de vagues indications qui ne permettent plus de reconnaître le nombre croissant d'espèces. C'est la raison pour laquelle les descriptions que nous donnons des nouvelles espèces de *Ptomaphaginus* sont très courtes, et n'insistent que sur les vraies particularités.

Ptomaphaginus balazuci n. sp.

Holotype ♂: Indonésie, Ngalam Kamang près de Tinngo, le 20-7 1979, J. Balazuc leg. (MNHNP).

Description: Longueur: 3,2 mm. Coloration générale brun foncé, les antennes uniformément plus claires. Tout le corps recouvert d'une fine pubescence dorée.

Bord postérieur du pronotum rectiligne, non sinué.

Bord apical du ventrite VIII sinué (fig. 4).

Edéage presque rectangulaire en vue dorsale, (figs 1 et 2), segment IX représenté sur la figure 3.

Femelle inconnue.

Cette espèce se reconnaît facilement par la forme de l'édéage et la sinuosité du bord postérieur du ventrite VIII.

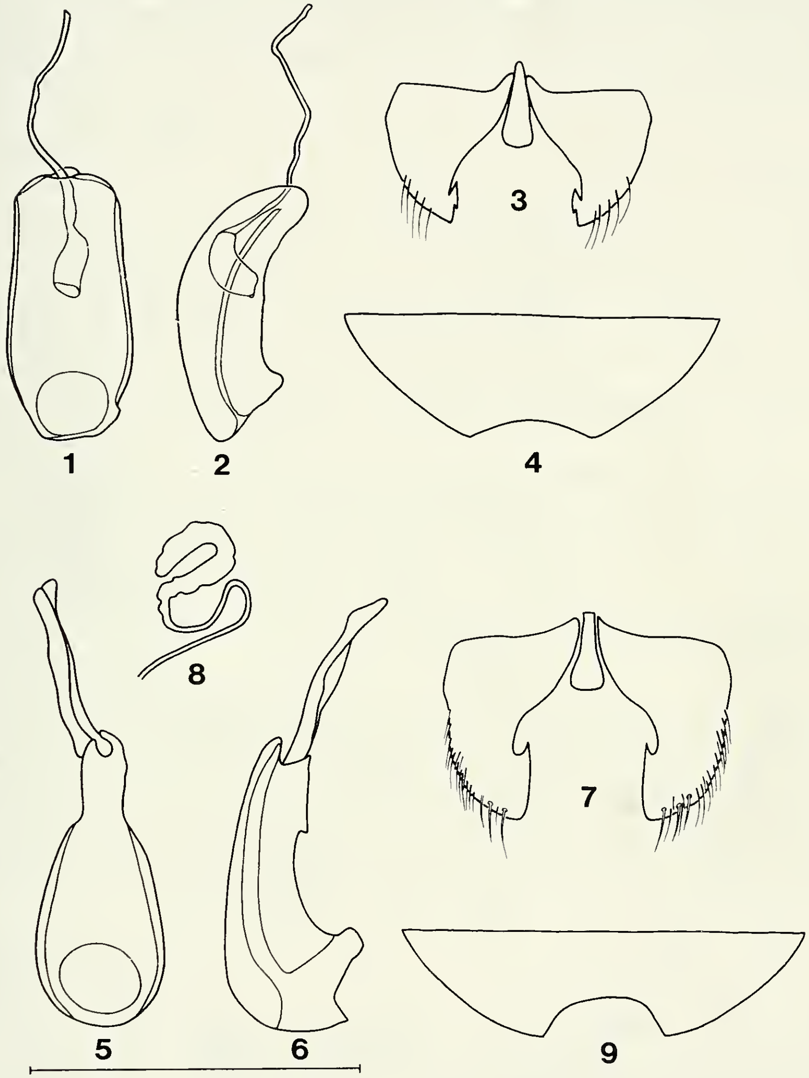
Ptomaphaginus baliensis n. sp.

Holotype ♂: Indonésie, Bali, Mt Batukao, 500–700 m, 28–29/10/1991, I. Löbl (MHNG). Paratypes: 1 ♂, même origine (MHNG), 1 ♂ et 2 ♀, Bali, Mt Agung, Besahik au-dessus du temple, 31/10–1/11/1991, I. Löbl (MHNG et CMP).

Description du mâle: longueur: 2,5 mm. Coloration générale brune, les antennes brun clair. Tout le corps est recouvert d'une fine pubescence.

Bord postérieur du pronotum légèrement sinué vers l'arrière au niveau des angles.

Ventrite VIII avec une très faible sinuosité du bord postérieur.

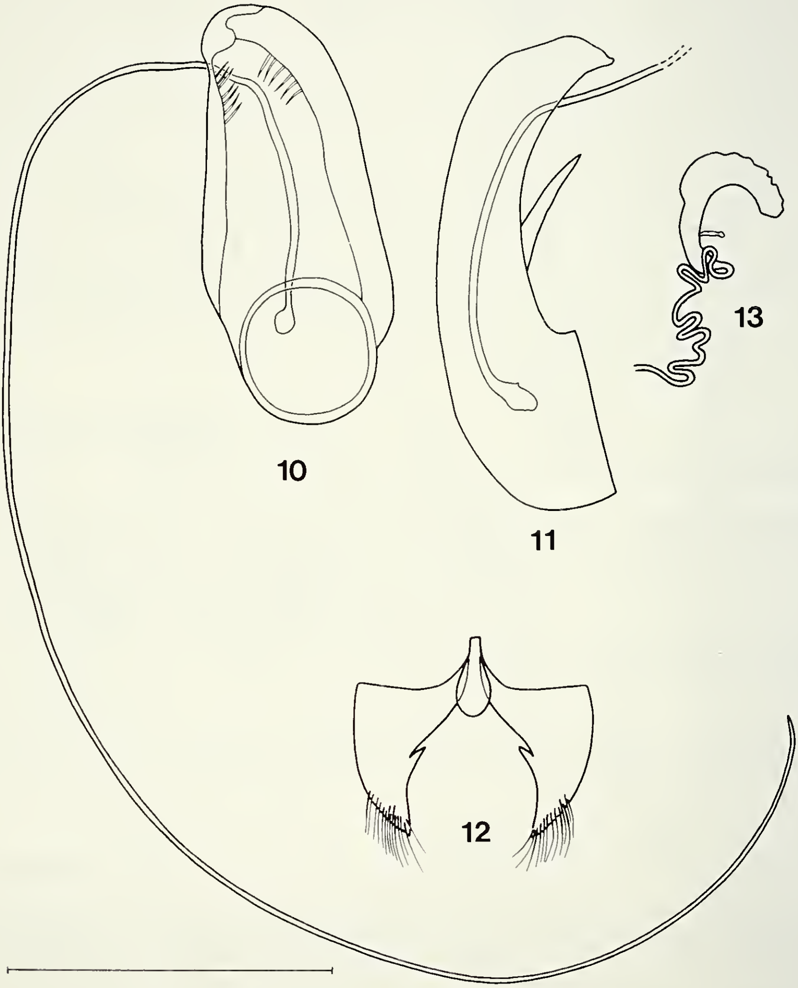


FIGS 1–9

1–4: *Ptomaphaginus balazuci* n. sp., holotype. 1. Edéage face dorsale; 2. Edéage face latérale; 3. Segment IX; 4. Ventrite VIII du mâle. 5–9: *Ptomaphaginus riedeli* n. sp. 5. Edéage face dorsale; 6. Edéage face latérale; 7. Segment IX; 8. Ventrite VIII du mâle; 9. Spermathèque. L'échelle représente 0,5 mm.

Edéage particulièrement robuste, présentant un stylet interne très fin et très long, près de trois fois plus long que le lobe médian et des soies sur les côtés de la face inférieure, 6 du côté droit, et 7 du côté gauche (Figs 10 et 11). Segment IX représenté sur la fig. 13.

Femelle sans dilatation des tarses antérieurs. Spermathèque représentée sur la fig. 12.



Figs 10–13

Ptomaphaginus baliensis n. sp. 10. Edéage face ventrale; 11. Edéage face latérale; 12. Segment IX; 13. Spermathèque. L'échelle représente 0,5 mm.

La morphologie externe ne présente pas d'autre caractère spécial permettant la distinction des autres espèces. *P. baliensis* n. sp. se reconnaît facilement au stylet interne de l'édéage particulièrement long, le plus long connu au sein du genre *Ptomaphaginus*.

Ptomaphaginus riedeli n. sp.

Holotype ♂: Inde, Tamil Nadu, Ooticamund, Pytara Mysore, 22–8–89, Riedel leg. (SMNS). Paratypes: 4 ♂ et 3 ♀, de même provenance (SMNS et CMP).

Description du mâle: longueur: 4 mm. Coloration générale brun foncé à l'exception des trois derniers articles antennaires très éclaircis, comme chez *P. piraster* Szymczakowski et *P. apiculatus* Szymczakowski.

Elytres avec une touffe de poils épais, comme celle existant chez *P. pilipennis* Perreau, et à un moindre degré chez *P. pilipennoides* Perreau.

Ventrite VIII du mâle présente une échancrure semi-elliptique le long du bord postérieur (figure 9).

Tarses antérieurs fortement dilatés, plus larges que l'apex des tibias.

Edéage large à la base, piriforme comme celui du *P. piraster*, mais avec l'apex effilé et les côtés parallèles aux extrémités, non arrondis. Stylet interne grêle (figs 5 et 6). Segment IX abdominal représenté sur la fig. 7.

Femelle différente du mâle par l'absence de la dilatation des tarses antérieurs, et l'absence de l'échancrure sur le bord postérieur du ventrite VIII. Spermathèque représentée sur la fig. 8.

Cette espèce fait partie d'un groupe caractérisé par une forme commune de l'édéage en poire, et qui comprend aussi *P. piraster*, *P. apiculatus*, *P. pilipennis* et *P. pilipennoides*. *P. riedeli* n. sp. se distingue de ces quatre espèces par la taille nettement plus grande, la présence de l'échancrure du ventrite VIII chez le mâle, et la forme de l'édéage. Il se distingue aussi plus spécifiquement de *P. pilipennis* et de *P. pilipennoides* par la couleur claire des trois derniers antennomères et de *P. piraster* par la présence de la touffe de poils sur l'apex des élytres.

Choleva Latreille

Protocatops n. subgen.

Espèce-type: *Choleva (Cholevopsis) henroti* Szymczakowski

Ce sous-genre est caractérisé par sa forme large et convexe, la rugosité de la ponctuation élytrale, le segment génital non sclérifié, la disparition des stries élytrales.

Szymczakowski (1961) décrivait *Choleva (Cholevopsis) henroti* récoltée en Assam. Il attribua cette espèce au sous-genre *Cholevopsis* à cause de la rugosité de la ponctuation élytrale, et du segment IX de la femelle non sclérifié. Il insistait toutefois sur les différences importantes existant avec les autres espèces du sous-genre. Aujourd'hui, la découverte d'une seconde espèce étroitement apparentée mais bien distincte du Vietnam nous conduit à la conclusion que *Ch. henroti* n'est pas une espèce isolée, mais la première représentante d'une lignée asiatique de *Choleva* bien différente de toutes les autres lignées de ce genre.

En fait, l'habitus de ces espèces rappelle étrangement celui du genre *Catops*:

- les stries élytrales longitudinales ont totalement disparu (sauf la suturale),
- les élytres présentent une microréticulation, plus prononcée que celle des Cholevopsis, mais n'allant pas toutefois jusqu'à la teinte cendrée des élytres des *Catops*,
- la forme est large et très convexe,
- la coloration générale est très foncée,
- le dernier antennomère de la *Ch. medvedevi* est éclairci, comme chez certains *Catops*.

Plusieurs caractères montrent sans ambiguïté l'appartenance aux Cholevini et non aux Catopini:

- l'édéage de la *Ch. henroti* présente des styles larges et épais (celui de la *Ch. medvedevi* est inconnu),
- l'épistome est très nettement séparé du front par une suture clypéo-frontale très profonde,
- le ventrite VIII des femelles ne présente pas de fossette en arrière du spiculum ventrale, alors qu'il en existe une chez tous les Catopini.

Ces deux espèces constituent donc une lignée ayant conservé certains caractères ancestraux (segment IX de la femelle non sclérifié), mais présentant aussi un certain nombre d'apomorphies: absence de stries élytrales exceptée la suturale, rugosité de la ponctuation élytrale. Toutes ces raisons nous ont conduit à créer ce nouveau sous-genre.

En plus de ces caractéristiques morphologiques, cette lignée de *Choleva* présente une autre particularité. Les espèces semblent présenter une affinité particulière pour des zones tropicales ou subtropicales, ce qui n'est le cas d'aucune espèce des autres sous-genres.

Choleva (Protocatops) medvedevi n. sp.

Holotype ♀: Vietnam, province de Vinh-Phu, Tamdao, 800–1200 m, 12/22–4–1966, leg. Medvedev, Golovatch (SMNS).

Description: longueur: 4,3 mm. Forme large et convexe. Coloration générale brun très foncé, presque noir, les 6 premiers antennomères et l'extrémité du dernier plus clairs. Tout le corps couvert d'une fine pubescence dorée dressée. Tête, pronotum et élytres entièrement et très finement microréticulés.

Antennes très élancées, les longueurs de chaque antennomère en microns (± 10) sont les suivantes: 200, 140, 120, 130, 150, 130, 120, 120, 170, 170, 200.

Pronotum ovale, 1,8 fois plus large que long, avec tous les angles très largement arrondis, et nettement plus étroit que les élytres. Ponctuation beaucoup plus fine, mais la microréticulation semblable à celle des élytres.

Elytres très larges et très convexes, seulement 1,23 fois plus longs que larges, et 1,5 fois plus larges que les pronotum. Stries longitudinales totalement absentes excepté la strie suturale. La ponctuation est rugueuse entremêlée d'une fine microréticulation.

Tibias intermédiaires légèrement arqués.

Segment IX abdominal non sclérifié.

Spiculum ventrale étroit, les côtés parallèles, arrondi en avant (fig. 19).

Mâle inconnu.

Cette espèce est très semblable à *Choleva henroti* Szymczakowski décrite d'Assam (Szymczakowski 1961, 1964), et retrouvée par la suite au Népal (Perreau, 1988). Elle s'en distingue par les caractères suivants:

– taille plus grande,

– huitième antennomère moins allongé, à peu près carré au lieu de 1,4 fois plus long que large,

– tibias postérieurs moins arqués,

– le caractère le plus important est la forme très différente du spiculum ventrale, étroit, parallèle et arrondi à l'extrémité chez *Ch. medvedevi*, triangulaire à base large, et anguleux à l'extrémité chez *Ch. henroti* (Figs 18 et 19).

Choleva gabriellae Giachino

Algérie: Atlas de Blida, Chréa sur Blida, 1400 m, 3–5–1988, Besuchet, Löbl et Burckhardt, 1 ♂ et 1 ♀ (MHNG).

La femelle était inconnue jusqu'alors. Le ventrite VIII et le spiculum ventrale sont représentés sur la fig. 20 et le segment IX sur la fig. 21.

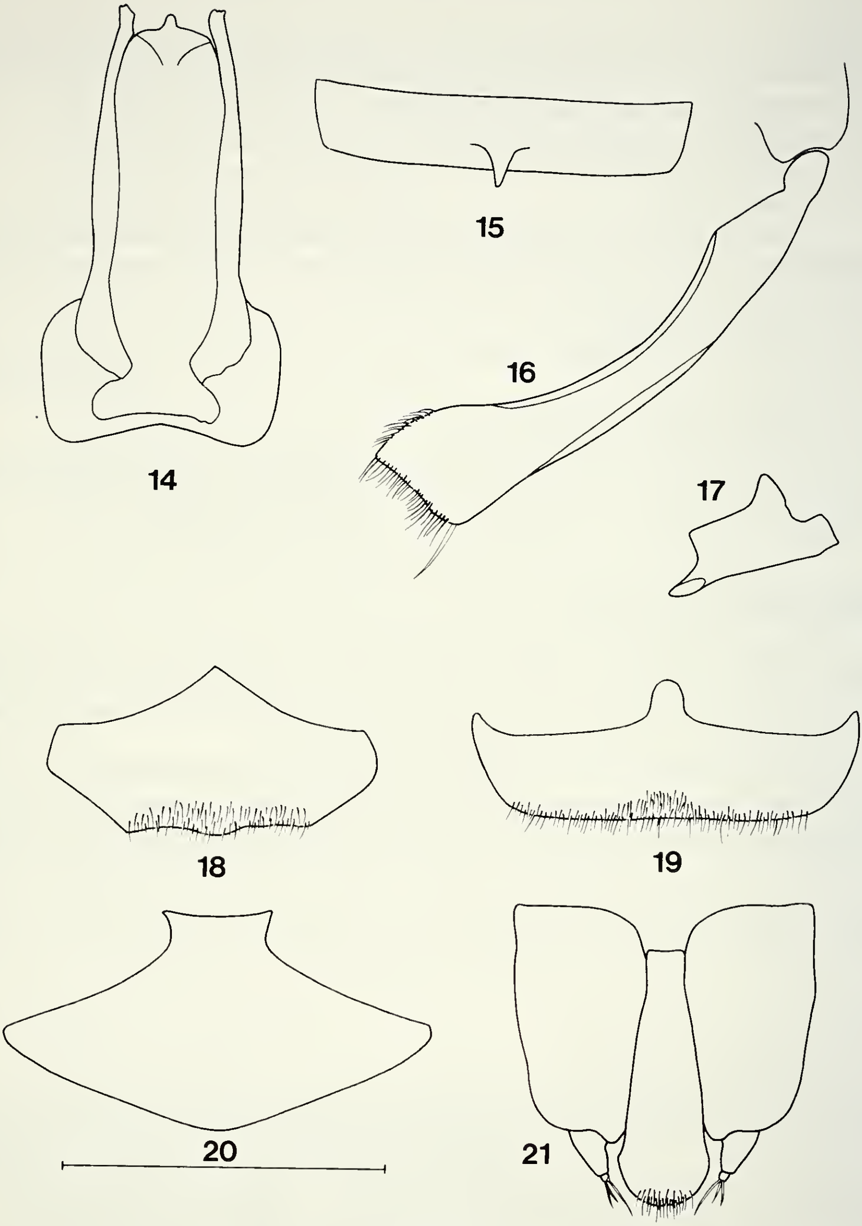
Lors de sa description, Giachino n'a pas tranché entre l'appartenance au groupe "*cisteloides*" ou au groupe "*reitteri*". Cette espèce présente en effet des caractères intermédiaires, la structure du sac interne de l'édéage la rapproche du groupe "*cisteloides*" et la forme générale du corps, la forme des trochanters postérieurs mâles et la présence de soies dressées sur les élytres la rapprochent du groupe "*reitteri*". Les deux groupes sont étroitement apparentés, et les caractères utilisés par Jeannel pour les séparer ne sont pas clairement des apomorphies.

Attaephilus scheuerni Perreau

Seule avait été publiée une diagnose préliminaire de cette espèce (Perreau, 1994). Nous en donnons ici une description plus détaillée. La série typique ne se trouve plus dans la collection Scheuern comme indiqué dans la diagnose. Le matériel qui a servi à la description est le suivant: holotype ♂: Paxos, Corfu (Kerkira), 2 km NW Gaios, 17–4–81, J. Scheuer (SMNS); paratype: 1 ♂ même provenance (CMP).

Description: longueur: 3,2 mm. Coloration générale brun-jaune clair. Tout le corps recouvert d'une double sétulation dorée, l'une composée de soies courtes et couchées, l'autre de soies longues et dressées.

Pronotum 1,8 fois plus large que long, les angles postérieurs très étroitement arrondis, la base saillante en arrière, arrondie en son milieu. Côtés régulièrement rétrécis de l'arrière vers l'avant, la plus grande largeur à la base. Soies dressées du



Figs 14–21

14–18: *Attaephilus scheuerni* Perreau. 14. Edéage face dorsale; 15. Ventrite V du mâle; 16. Tibia intermédiaire mâle; 17. Trochanter intermédiaire droit du mâle, face ventrale. 18. *Choleva (Protocatops) henroti* Szymczakowski, ventrite VIII femelle et spiculum ventrale. 19: *Choleva (Protocatops) medvedevi* n. sp. holotype, ventrite VIII femelle et spiculum ventrale. 20 et 21: *Choleva (s. str.) gabriellae* Giachino. 20. ventrite VIII femelle et spiculum ventrale; 21. Segment IX face dorsale. L'échelle représente 0,5 mm. pour les figs 14, 16, 17, 19, 20, 21, et 1 mm pour les figs 15, 18, 19, 20, 21.

pronotum particulièrement bien visibles à la base le long de laquelle un certain nombre d'entre elles s'alignent.

Elytres à ponctuation rugueuse et irrégulière. Pubescence dressée alignée longitudinalement.

Ventrite V avec une très forte dent médiane (fig. 15). Trochanters intermédiaires aplatis en une palette épaisse perpendiculaire au plan du corps (fig. 17).

Face interne des tibias intermédiaires très échancrée. Face supérieure ornée de deux carènes, l'une sur le bord interne s'étendant sur toute la longueur du tibia excepté une très courte distance à la base, l'autre sur le bord externe, s'étendant sur le tiers médian. Tibia représenté sur la figure 16. Tarses antérieurs peu dilatés, à peine plus larges que le tibia.

Edéage large, rétréci très brusquement à l'apex, avec un petit bouton apical. Sac interne armé de deux phanères latérales constituées de dents fines et d'une rangée centrale de dents nettement plus épaisses. Paramères épais sauf à l'apex, et divergents aux extrémités (fig. 14).

La conformation des tibias intermédiaires rapproche cette espèce de *A. arenarius* Hampe. Par contre, l'édéage ressemble à celui de *A. funebris* Reitter.

Le genre *Attaephilus* peut être divisé en trois groupes d'espèces. L'un caractérisé par un édéage effilé et pointu à l'apex, et avec des antennes courtes à massue compacte. Il comprend *Attaephilus laticornis* Frank & Perreau, *A. weisi* Reitter, et *A. servati* Coiffait. Ce groupe ressemble aux *Catopomorphus* sauf la pubescence beaucoup plus longue. Le second groupe présente aussi un édéage du même type que le groupe précédent, mais les antennes sont plus longues et plus déliées. Il comprend *Attaephilus arenarius* Hampe, *punctipennis* Jeannel, *paradoxus* (Motschoulsky) et *weiratheri* Jeannel. Le troisième groupe est caractérisé par un édéage quadrangulaire en vision dorsale, rétréci très brusquement à l'apex, terminé ou non par un petit bouton apical. Les antennes sont également longues et grèles. Il comprend les *Attaephilus funebris* Reitter, *rambouseki* Jeannel, *illyricus* Jeannel, *angustus* (Reitter), *persicus* Szymczakowski, *niger* Karaman. Les mâles d'*A. molitori* Scheerpeltz et *reitteri* Jeannel sont inconnus et ne peuvent être situés actuellement dans ces groupes. *A. scheuerni* n. sp. se place dans le troisième groupe et se distingue des autres espèces par la forme des tibias intermédiaires mâles.

Les deux exemplaires connus ont été récoltés dans une fourmilière de *Messor structor*.

REMERCIEMENTS

Je tiens à remercier toutes les personnes qui m'ont confié l'étude du matériel figurant dans cet article ainsi que celles qui m'ont permis d'accéder aux collections pour effectuer les comparaisons nécessaires aux déterminations et aux descriptions: J. Balazuc (Nogent sur Marne), N. Berti (Muséum National d'Histoire Naturelle, Paris), I. Löbl (Muséum d'histoire naturelle de Genève), W. Schawaller (Staatliches Museum für Naturkunde, Stuttgart), J. Scheuern (Sinzig-Westum). Je remercie aussi J.

Weulersse (Muséum National d'Histoire Naturelle, Paris), pour la détermination de la fourmi hôte de l'*Attaephilus scheuerni*, et I. Ruzicka (Prague) pour ses intéressantes remarques.

RÉFÉRENCES

GIACHINO, P.M. 1985. *Choleva* (s. str.) *gabriellae* e *Sciodrepoides casalei* nuove specie della Kabylia e note corologiche sui Catopidi d'Algeria (Coleoptera, Catopidae). *Boll. Mus. Reg. Sc. Nat., Torino*, 3: 337–348.

PERREAU, M. 1988. Les Cholevidae himalayens du Muséum d'Histoire naturelle de Genève. *Revue Suisse Zool.*, 95: 1005–1018.

PERREAU, M. 1994. Diagnose préliminaire d'une nouvelle espèce d'*Attaephilus* de Grèce (Coléoptères, Cholevidae). *Bull. Soc. ent. France*, 99: 384.

SZYMCZAKOWSKI, W. 1961. Eléments paléarctiques dans la faune orientale des Catopidae (Coleoptera). *Acta zool. cracov.*, 6: 123–136.

SZYMCZAKOWSKI, W. 1974. Nouvelles remarques sur les Catopidae (Coleoptera) de la région orientale. *Acta zool. cracov.*, 19: 197–216.

SZYMCZAKOWSKI, W. 1975. Catopidae (Coleoptera) récoltés dans le sud de l'Inde par l'expédition du Muséum de Genève en 1972. *Acta zool. cracov.*, 20: 121–149.

REVUE SUISSE DE ZOOLOGIE, 102 (4) : 979-988; décembre 1995

Two remarkable afromontane Theridiidae: *Proboscidula milleri* n. sp. and *Robertus calidus* n. sp. (Arachnida, Araneae)

Barbara KNOFLACH
Institute of Zoology, University of Innsbruck,
Technikerstraße 25, A-6020 Innsbruck, Austria.

Two remarkable afromontane Theridiidae: *Proboscidula milleri* n. sp. and *Robertus calidus* **n. sp. (Arachnida, Araneae).** - Two new minute theridiid species are described from montane forests in Rwanda and Zaire and their genital morphology and relationships are discussed. *P. milleri* is the second species in this genus after the type species from Angola. *R. calidus* is the first afrotropical species in an otherwise holarctic genus. It is closely related to the western palaearctic species *R. neglectus* (O.P.-Cambridge).

Key-words: Araneae - Theridiidae - Taxonomy - Afromontane - *Proboscidula* - *Robertus*.

INTRODUCTION

In the linyphiid spider fauna of the African mountains both afrotropical elements as well as species with palaearctic relatives are present (HOLM 1962, SCHARFF 1992). Two minute theridiid species collected by E. Heiss in montane forests in Rwanda and Zaire which are described in the following pages show analogous relationships. The first one belongs clearly to the attractive genus *Proboscidula*, which was previously known only from Angola. The second species, *Robertus calidus*, is the first African representative of a hitherto holarctic genus.

ABBREVIATIONS

C conductor, E embolus, f tegular fold, Pc paracymbium, ST subtegulum, T tegulum, TA tegular apophysis. — MHNG Muséum d'histoire naturelle, Genève.

DESCRIPTIONS

Proboscidula milleri n. sp. (Figs 1–16)

Types: Rwanda, Nyakabuye, montane rain forest Cyamudongo, ca. 2000 m, 1 ♂ holotype, 1 ♀ paratype, early February 1986; 1 ♀ paratype, 20.–25. January 1984, leg. E. Heiss (MHNG).

Manuscript accepted 16.05.1995.

Diagnosis: ♂ carapace with characteristic clypeal knob (Figs 1, 3, 5), legs I with conspicuous ventral spines (Fig. 4), abdomen with dorsal and ventral scutum, sternum covered with numerous glandular hairs (Fig. 2). ♂ palp with projecting tegular apophysis (Fig. 14). Females can be recognised by their epigyne/vulva (Figs 11, 12). *P. milleri* is separated clearly from the type species *P. loricata* Miller, 1970.

Etymology: This striking species is named in honour of Prof. F. Miller, Brno (1902–1983).

♂: Measurements (mm): carapace 0.53 long, 0.46 wide. Length of abdomen 0.71. Posterior end of sternum 0.14 wide.

Colour, pattern: Carapace brown, sides reticulate, lateral margins with dark seam, median area dark grey. Legs brown, trochanters, tibiae and distal part of femora light brown. Dorsum of abdomen dusky brown, light median band continuous with anterior light belt (Fig. 1). Sides of abdomen pale with a dark longitudinal stripe (Fig. 10). Venter pale, epigaster darkened. Spinnerets light brown.

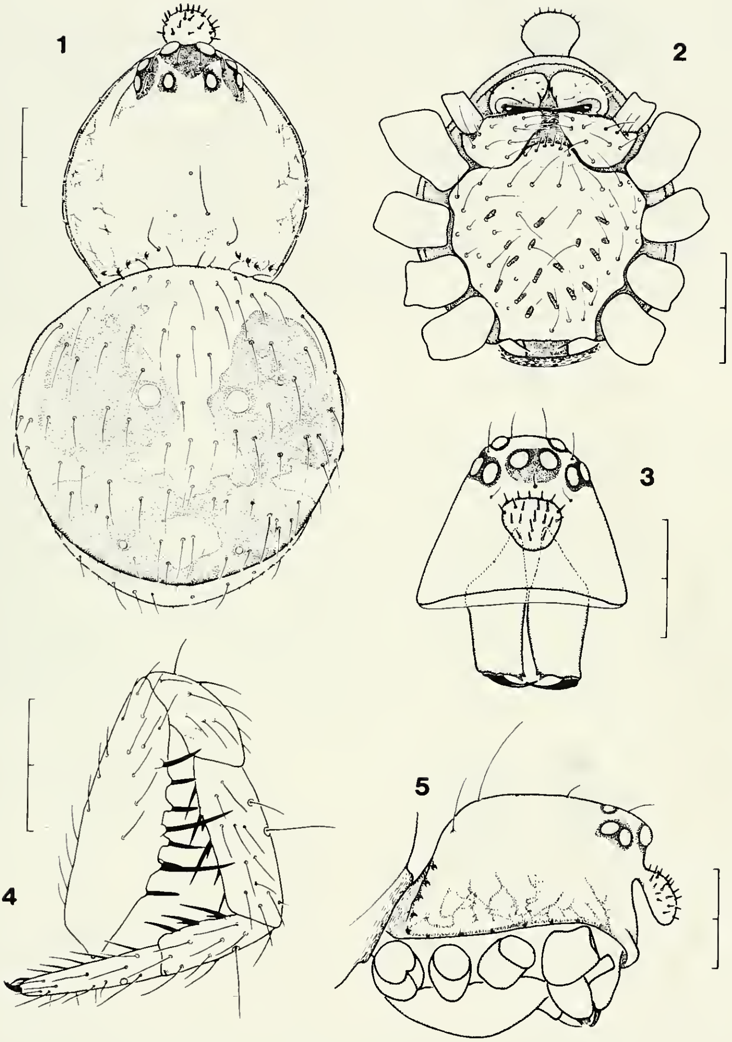
Carapace with conspicuous curved clypeal knob covered with stout spines (Figs 1–3, 5). Lateral margins of carapace with a row of very short hairs, median area with 5 long bristles. Eye region (Fig. 1) as in *P. loricata* (MILLER 1970). Chelicerae typically theridiid, with basal extension, anterior margin with two teeth (Fig. 3). Carapace elevated, posterior declivity steep (Fig. 5). Stridulatory organ well developed, not divided in midline, similar to *Robertus*. Anterior to stridulatory ridges at each side a row of 5–6 warts which form the bases of short hairs. Sternum vaulted, broadly truncate behind, twice as wide as diameter of coxa IV. Numerous modified hairs present, which may be glandular, for their bases show conspicuous tubes (Fig. 2). Labium not separated.

Abdomen with large dorsal scutum covering > 2/3 of its length and with ventral scutum from pedicel to epigastric furrow (Fig. 10). Dorsum smooth, with 3 pairs of impressed dots (Fig. 1). Branchial opercula and stigmata sclerotised. Spinnerets (Fig. 9) surrounded by small sclerotised ridges. Colulus large, 3 setae present. The two modified spigots of the posterior lateral spinnerets of the females could not be recognised.

Leg measurements (mm):

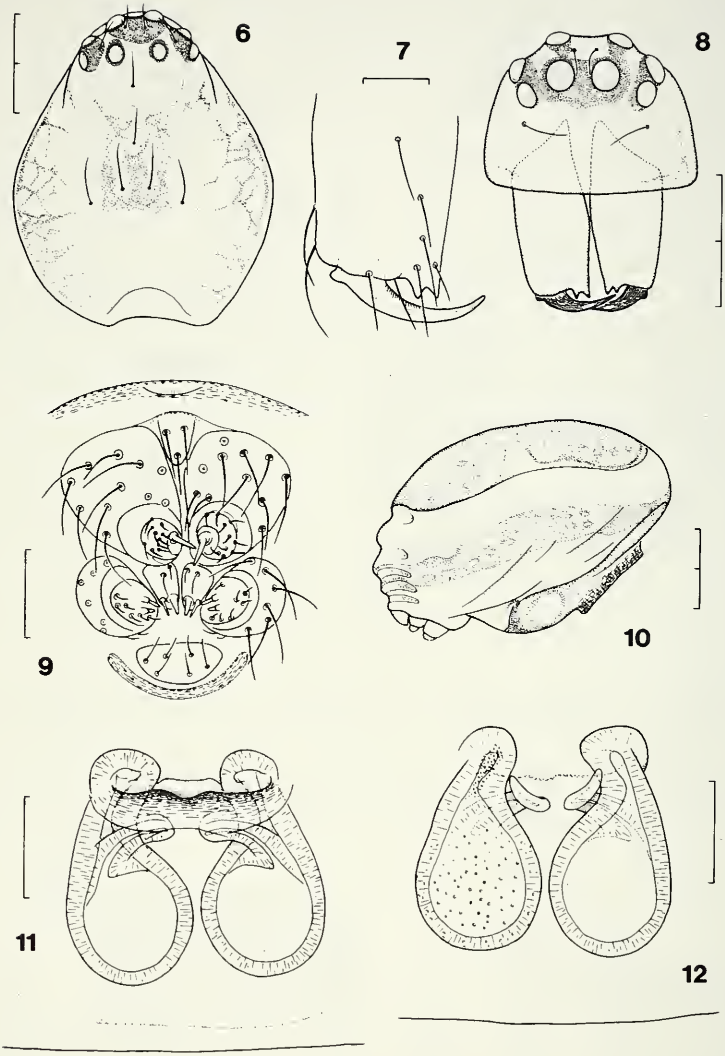
	Fe	Pa	Ti	Mt	Ta	Total
Palp	0.20	0.11	0.09	–	0.19	0.59
I	0.40	0.18	0.25	0.19	0.24	1.25
II	0.34	0.16	0.21	0.16	0.24	1.10
III	0.30	0.14	0.16	0.14	0.22	0.95
IV	0.44	0.17	0.26	0.20	0.27	1.33

Legs: 4123. Femora, tibiae and metatarsi of first leg ventrally with two rows of conspicuous spines (Fig. 4), their bases conical. Numbers of prodorsal/retrodorsal trichobothria of tibiae I–III 1/2, IV 2/2, their position on I 0.18/0.24;0.42, on IV 0.16;0.36/0.29;0.47. Metatarsi I–II with 1 trichobothrium (0.39; 0.32). Tarsal organ I–IV 0.25. Tarsi I–IV 1.3–1.5 times longer than metatarsi. Tarsal claws with ca. 3 minute teeth.



FIGS 1–5

Proboscidula milleri n. sp. Male. Dorsal view (1). Sternum and mouthparts (2). Carapace and chelicerae, frontal (3) and lateral view (5). Leg I (4). Scale lines 0.2 mm.



Figs 6–12

Proboscidula milleri n. sp. Female (6–8, 11, 12). Male (9, 10). Carapace, dorsal (6) and frontal view with chelicerae (8). Right chelicera, frontal view (7). Spinnerets (9). Abdomen, lateral view (10). Epigyne/vulva, ventral (11) and dorsal view (12). Scale lines 0.2 mm (6, 8, 10), 0.05 mm (7, 9, 11, 12).

♂ Palp: Figs 13–16. Patella slightly widened. Tibia with 1 retrolateral trichobothrium. Cymbium plate-shaped, distally broad, not tapering (Figs 14, 16). Paracymbium in retrolateral-distal position, hook-like, locking with tegular apophysis (Figs 14, 15). Subtegulum large, at dorsal side of bulb. Tegulum in retrolateral-ventral position, with wide retrolateral concavity which holds a projection of embolar base and is hidden by the cymbium (arrow, Fig. 13). Conductor and tegular apophysis present. Conductor: dorsal, transparent, bandlike, supporting tip of embolus (Figs 13–15). Tegular apophysis elongate, attached to tegulum on ventral side (M, Fig. 14) and enormously developed. Its characteristic prolateral angle extends beyond the cymbium (Figs 14, 16), retrolateral end with concavity into which fits the paracymbium. At the base of the tegular apophysis a further small process is discernible beside the embolus (arrow, Fig. 14). Embolus: Fig. 14. Embolar base broad, rounded, attached to tegulum retrolaterally. Distal part very short, sperm duct with subterminal coil.

♀: Measurements (mm): Carapace 0.56 long, 0.52 wide. Length of abdomen 0.94. Posterior end of sternum 0.15 wide.

Colour, pattern: Coloration of carapace slightly stronger than in ♂, legs as in ♂. Abdomen dark, median light band clear, no lateral markings. Venter pale except one median greyish patch behind epigastric furrow.

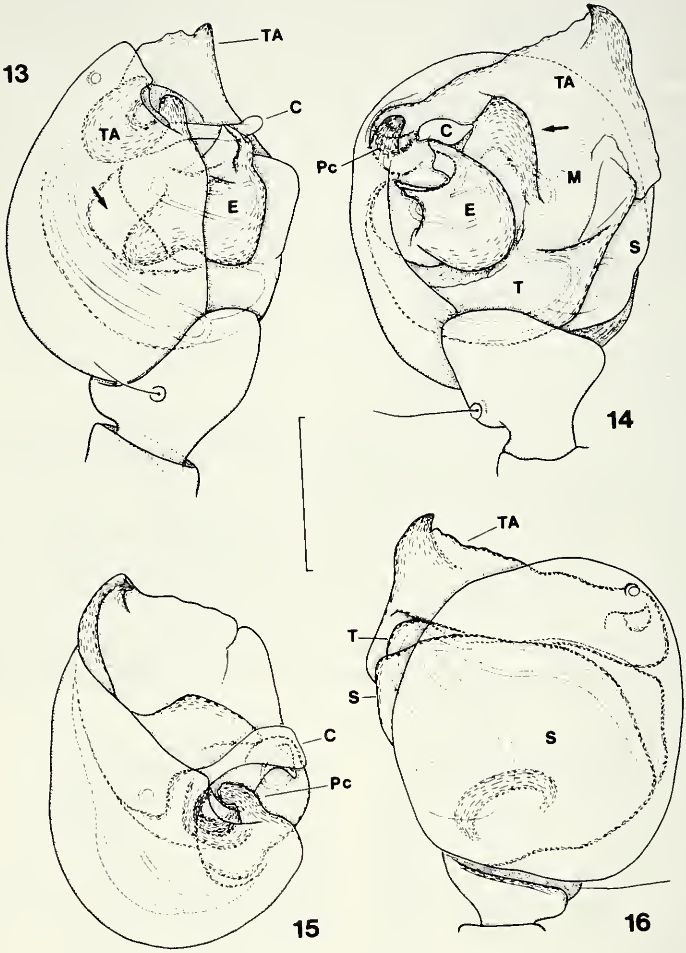
Carapace without knob (Figs 6, 8), stridulatory ridges on posterior declivity reduced. Chelicerae as in ♂ (Figs 7, 8). Sternum broadly truncate as in ♂, but without glandular hairs. Abdomen evenly and strongly sclerotised, regularly covered with small indentations, but without definite scutum. Branchial opercula and stigmata sclerotised, sclerotised ridges also present around spinnerets. Colulus as in ♂, posterior lateral spinnerets with two modified cylindrical spigots as is typical for theridiids.

Leg measurements (mm):

	Fe	Pa	Ti	Mt	Ta	Total
Palp	0.17	0.09	0.08	–	0.19	0.52
I	0.40	0.18	0.24	0.19	0.27	1.27
II	0.36	0.16	0.22	0.18	0.26	1.17
III	0.30	0.15	0.18	0.15	0.25	1.02
IV	0.41	0.18	0.30	0.19	0.28	1.35

Legs: 4123. Leg I without ventral spines. Trichobothria of tibiae as in ♂, position on I 0.18/0.24;0.43, on IV 0.19;0.36/0.38;0.58. Trichobothrium of metatarsi I–II 0.37;0.42. Tarsal organ I–IV 0.27–0.31. Leg IV with tarsal comb of 5 serrate bristles. Tarsal claws as in ♂.

Epigyne/vulva: Figs 11, 12. Epigyne with transverse, sclerotised edge, in front of which are the orifices of the copulatory ducts (Fig. 11). Receptacula seminis posterior to epigynal edge. Copulatory ducts short, leading straight backwards into the receptacula (Fig. 12). Fertilization ducts start on ventral side of receptacula and turn to the midline. Glandular pores present in receptaculum and copulatory duct (Fig. 12).



FIGS 13–16

Proboscidula milleri n. sp. Male palp, retrolateral (13), ventral (14), frontal (15) and dorsal view (16). Scale line 0.1 mm.

Affinifies: The generic placement of *P. milleri* seems to be unambiguous as most characters mentioned in the diagnosis of MILLER (1970) are present, especially the peculiar clypeal projection of the ♂. Even the "glandular" hairs of the ♂ sternum were seen by MILLER (1970, "Doppeldellen"). Only the following hardly discernible characters differ: In *P. loricata* the colulus is said to be replaced by two setae, the chelicerae are not armed and the tarsal claws smooth.

P. milleri is smaller than *P. loricata*, its clypeal knob directed ventrally and bearing short setae. In *P. loricata* the knob is bent forwards and bears long hairs. The strong ventral spines of leg I of *P. milleri* were not mentioned for *P. loricata*. The tegular apophysis is long also in *P. loricata*, but extends laterally. Distal part of embolus and conductor are much longer. Therefore the copulatory ducts in the female of *P. loricata*, which is still unknown, can be expected to be longer than in *P. milleri*.

Distribution, habitat: Known only from the montane rain forest at Rwanda, Nyakabuye at about 2000 m. All specimens came from sieving bark and litter. The type species was likewise found under bark of *Brachistegia manga* in gallery forest of the river Luachimo, Dundo, Angola, at the end of February.

Discussion: *P. milleri* belongs to the group of theridiids with locking system A in the male palp (SAARISTO 1978), with hook-like paracymbium which anchors the tegular apophysis, the latter contains the sperm duct. Its colulus is relatively large and the stridulatory organ well developed as in most genera of this group which includes the former "Asageneae".

As already pointed out by MILLER (1970) and LEVI (1972) there are affinities to the South American genus *Wirada*. However, *Wirada* lacks a proboscis (LEVI 1963) and shows differences in the male palp: embolus strongly developed, conductor absent, two tegular apophyses discernible. The female's receptacula are anterior to the epigynal ridge. Similar modifications of the ♂ carapace are present also in *Craspedisia* (LEVI & LEVI 1962, LEVI 1963) and *Carniella* (THALER & STEINBERGER 1988), both of which have a large colulus, but their palpal structures are quite different. LEVI (1972) supports the generic rank of *Proboscidula*.

Robertus calidus n. sp. (Figs 17–20)

♂ Holotype: Zaire, Prov. Kivu, Mt. Kahuzi, sieving bark and litter in bamboo zone (*Arundinaria alpina*) ca. 2300 m, early February 1986, leg. Heiss (MHNG).

Diagnosis: *R. calidus* is closely related to *R. neglectus* (O.P.-Cambridge). It differs by the following palpal structures: tegular apophysis distinct, embular base large, distal part of embolus long and slender, its tip narrow. ♀ unknown.

Etymology: Latin *calidus, a, um* = hot (german: heiß). The specific name refers to both the occurrence of the species in a warm region as well as to its collector.

♂: Measurements (mm): Carapace 0.94 long, 0.73 wide. Length of abdomen 0.89.

Colour: Carapace and legs light brown, abdomen grey. Ocular area as in its congeners, fig. 260 in WIEHLE (1937). Stridulatory organ well developed, not divided in midline. Anterior margin of chelicerae with 3 teeth. Colulus large, 2 setae present.

Leg measurements (mm):

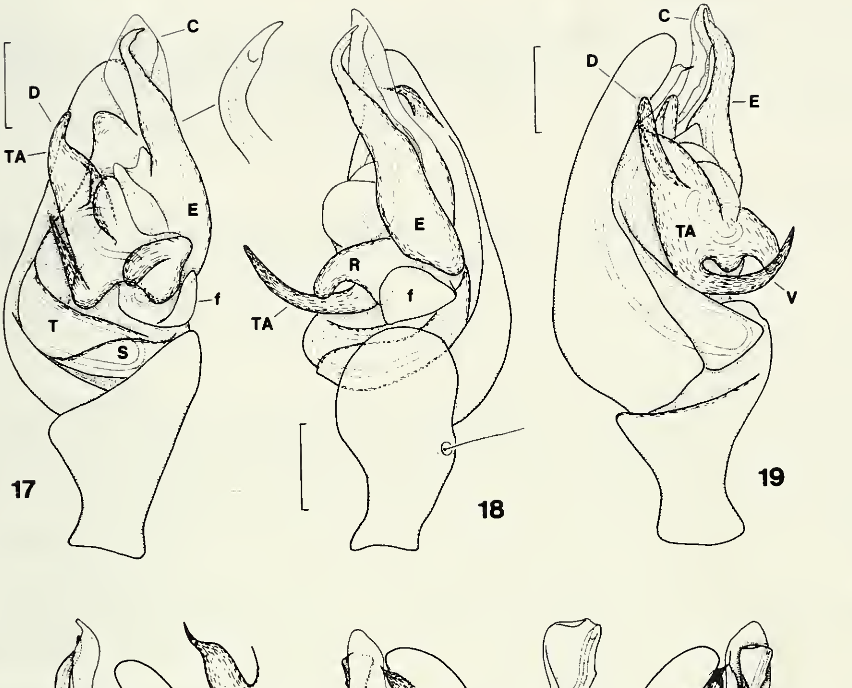
	Fe	Pa	Ti	Mt	Ta	Total
Palp	0.44	0.19	0.11	–	0.32	1.06
I	0.75	0.31	0.57	0.42	0.38	2.42
II	0.57	0.30	0.40	0.36	0.35	1.97
III	0.50	0.24	0.35	0.31	0.31	1.70
IV	0.78	0.30	0.58	0.40	0.38	2.44

Legs: 4123. Legs IV and I almost equal. Numbers of prodorsal/retrodorsal trichobothria of tibiae I–IV: 1/3, 1/2, 2/2, 2/3, their respective positions (0.34/0.26; 0.43;0.66), (0.29/0.30;0.58), (0.16;0.33/0.33;0.53), (0.25;0.42/0.41;0.54;0.73). Metatarsi I–III with trichobothrium, 0.45/0.42/0.44. Tarsal organ I (0.31), IV (0.26). Tarsi almost as long as metatarsi, I 0.90, IV 0.95. Tarsal claws I with 6 teeth.

♂ Palp: Figs 17–20, similar to *R. neglectus* (Figs 21, 22). Tibia with 1 retrolateral trichobothrium. Cymbium distally tapering, paracymbium retrolateral-subterminal and hook-like (Fig. 20). Tegulum with conductor, tegular fold and one tegular apophysis only. Dorsal part of tegulum bulging beside conductor (Fig. 17), which is a retrolateral projection of the tegulum (Fig. 20), membranous and lobe-like. Tegular fold (f): Figs 17, 18, transparent, lamelliform, as in *R. neglectus* (Fig. 21). Tegular apophysis situated prolaterally, with three branches diverging in dorsal, ventral and retrolateral directions (Figs 17, 18, 19; D, V, R). Dorsal branch with concavity which tilts over the paracymbium in the expanded palp. Ventral branch taxonomically important, long and curved, not straight as in *R. neglectus*. Retrolateral branch short and blunt. Sperm duct runs in a loop through tegular apophysis. Embolar base larger than in *R. neglectus* (Figs 18 vs. 21), distal part of embolus long and slender, its tip narrow (Figs 17 vs. 22). Sperm duct orifice terminal. In *R. neglectus* the embolar tip broadens and the sperm duct runs along one side.

Discussion: *Robertus* species occur mainly in Europe and North America and centres of endemism are in Europe, North America and East Siberia (Eskov 1987). *R. calidus* is the first African representative. In palpal structure and trichobothriotaxy it is closely allied to the western palaearctic *R. neglectus*. They both belong, together with *R. scoticus* Jackson and *R. kuehnae* Bauchhenss & Uhlenhaut, to a species group with only 1 tegular apophysis which is strongly branched, and with a small and hyaline conductor.

Comparative characters of *R. neglectus*: Carapace 0.94 mm long, 0.69 mm wide. Legs 1423. Numbers of prodorsal/retrodorsal trichobothria of tibiae I–IV: 1/3, 1/2, 2/2, 2/3, their respective positions (0.38/0.25;0.46;0.67), (0.34/0.40;0.68), (0.17; 0.40/0.40;0.63), (0.24;0.43/0.45;0.62;0.82). Metatarsi I–III with trichobothrium (0.50/ 0.49/0.42). Tarsi almost as long as metatarsi, I 0.88, IV 0.92. Tarsal claws I with 6 teeth. ♂ palp: Figs 21, 22.



Figs 17–22

Robertus calidus n. sp. (17–20). *Robertus neglectus* (O.P.-Cambridge) (21, 22). Left male palp, ventral (17), ventral-retrolateral (18), retrolateral (20, 21) and prolateral view (19, 22). Scale lines 0.1 mm.

ACKNOWLEDGEMENTS

I am grateful to Dr E. Heiss for collecting the material and for information. Many thanks are due to Dr K. Thaler for discussion and literature and to Dr P. Merrett for linguistic revision.

LITERATURE

Eskov, K.Y. 1987. The spider genus *Robertus* O. Pickard-Cambridge in the USSR, with an analysis of its distribution (Arachnida: Araneae: Theridiidae). *Senckenbergiana biol.* 67: 279–296.

Holm, Å. 1962. The spider fauna of the east African mountains. *Zool. Bidr. Uppsala* 35: 19–204, pl. 1–6.

Levi, H.W. 1963. The spider genera *Cerocida*, *Hetschkia*, *Wirada* and *Craspedisia* (Araneae: Theridiidae). *Psyche* 70: 170–179.

Levi, H.W. 1972. Taxonomic-nomenclatural notes on misplaced theridiid spiders (Araneae: Theridiidae), with observations on *Anelosimus*. *Trans. Am. Micros. Soc.* 91: 533–538.

Levi, H.W. & L.R. Levi. 1962. The genera of the spider family Theridiidae. *Bull. Mus. comp. Zool.* 127: 1–71, Figs 1–334.

Miller, F. 1970. Spinnenarten der Unterfamilie Micryphantinae und der Familie Theridiidae aus Angola. *Publcoes cult. Co. Diam. Angola* 82: 75–166.

Saaristo, M.I. 1978. Spiders (Arachnida, Araneae) from the Seychelle Islands, with notes on taxonomy. *Ann. Zool. Fennici* 15: 99–126.

Scharff, N. 1992. The linyphiid fauna of eastern Africa (Araneae: Linyphiidae) – distribution patterns, diversity and endemism. *Biol. J. Linn. Soc.* 45: 117–154.

Thaler, K. & K.H. Steinberger. 1988. Zwei neue Zwerg-Kugelspinnen aus Österreich (Arachnida: Aranei, Theridiidae). *Revue suisse Zool.* 95: 997–1004.

Wiehle, H. 1937. Spinnentiere oder Arachnoidae VIII. 26. Familie: Theridiidae oder Haubennetzspinnen (Kugelspinnen). - *Tierwelt Dtl.* 33: 119–222.

REVUE SUISSE DE ZOOLOGIE, 102 (4) : 989-994; décembre 1995

Redescription and lectotype designation of *Aploparaxis pseudofilum* (Clerc, 1902) (Cestoda: Hymenolepididae)

Josef K. MACKO* & Claude VAUCHER**
* Parasitological Institute of the Slovak Academy of Sciences, Hlinkova 3,
040 01 Kosice, Slovak Republic.
** Muséum d'histoire naturelle, Case postale 6434, CH-1211 Genève 6, Switzerland.

Redescription and lectotype designation of *Aploparaxis pseudofilum* **(Clerc, 1902) (Cestoda: Hymenolepididae. -** *A. pseudofilum* (Clerc, 1902) is redescribed from original material stored in the Geneva Natural History Museum and a lectotype is designated. Various cestodes previously named *A. pseudofilum* are not conspecific with this species, characterized by a short cirrus pouch.

Key-words: *Aploparaxis pseudofilum* - Cestodes - Hymenolepididae - Taxonomy - Bird parasite.

INTRODUCTION

Aploparaxis pseudofilum (Clerc, 1902) is a relatively common parasite of the woodcock *Scolapax rusticola*. Various authors (SPASSKIJ, 1963; SPASSKAYA, 1968; DEBLOCK & RAUSCH, 1968) have treated under this name different hymenolepidids from a wide range of hosts. According to BONDARENKO (1990a, 1990b), *A. pseudofilum* may represent a species complex. *A. pseudofilum* has been thoroughly redescribed from new material which was compared with syntypes (BONDARENKO, 1990b). CLERC's (1902) description was based on several specimens, a single slide conserved in the Geneva Museum contains two or three species. CLERC's (1902) drawing of a transverse section suggests that this is only a part of the original type series. It is therefore important to designate a lectotype.

MATERIAL

Some of the syntypes are preserved in MHNG, the rest is probably lost. Following information is available: slide No 13/78 "*Haploparaxis filum* (Goeze, 1782), *Scolopax rusticola*, Oural, M.G.V 5/8". The geographic origin (Ural) of the label authenticates this slide as original material of Clerc, who was at that time a

---

Manuscript accepted 13.04.1995.

student of O. Fuhrmann at the Zoological Institute of Neuchâtel University (see Clerc 1902, 1903), whose collection is deposited in the Geneva Museum. The slide bears the following identifications made by Dr. S. Bondarenko in 1980: *A. pseudofilum*, *A. filum* and *A. ? parafilum*.

The lectotype of *A. pseudofilum* designated berein is a specimen 48 mm long and max. 660 µm wide. It lacks the scolex and is not fully gravid. The pregavid extremity has been slightly damaged when Clerc mounted the slide. The other specimens are 58 mm long and max. 980 Mm wide (*A. parafilum* ?) and 13 mm long and max. 290 Mm wide (*A. filum*), respectively. The slide contains two additionnal fragments of *A. pseudofilum*, and two fragments which are unidentifiable.

Measurement are given in µm unless otherwise stated.

DESCRIPTION OF THE LECTOTYPE

Coiled strobila without scolex and without gravid segments, ca 48 mm long. In posterior portion, anteriorly to slightly deformed end, it is up to 660 wide. Young proglottides show stained primordia of the reproductive organs. In the next portion of strobila, 180 wide, testis and distal genital ducts start to differentiate. Testis 38-61x103-128, transversely elongate, more or less constricted. In some segments separating into 2 (Fig. 1). Cirrus pouch (CP) 17-24x72-113, exceptionally 121 long, in male segments reaching or slightly exceeding beyond poral excretory ducts. In hermaphroditic and postmature proglottids, CP not reaching excretory ducts (Figs 2, 3). Dorsal excretory ducts ca 4 in diameter, ventral ca 16. Vesicula seminalis interna 51-55 in longer diameter. Vesicula seminalis externa pyriform.

Genityl atrium situated on the margin in mid-portion of proglottis or at the beginning of the second half of segment margin.

Cirrus cylindrical to club-shaped, 16-21x39-42, attenuated at base to 9-11. Maximum width of not fully protuberant cirri ranging between 14.5 and 21. Distal portion of cirrus ca 13 long, without observable ornamentation. Middle portion of cirrus (ca 12 long) covered with distinct spines, 2-3 long. Spines at the basal portion of cirrus very fine and poorly visible (Fig. 4).

Ovary more or less lobate, transversely elongate up to 159. Vitellarium 25-28x34-41 (Fig. 2). Distal female ducts not observable. Uterus initially a transversely elongate tube irregularly thick, saccular in the last segments (Fig. 5). Eggs undeveloped in the examined specimen.

Other two fragments of *A. pseudofilum* are no more than 5 mm long. Bursa cirri as in lectotype. Width of cirrus up to 23. Uterus saccular, as in lectotype. Embryophore indistinctly outlined, ca 51x43. Lateral embryonic hooks 16.

DISCUSSION

Clerc (1902) differenciated *Aploparaxis pseudofilum* from *A. filum* (Goeze, 1782) by the shorter cirrus pouch. Clerc (1903) considered *A. pseudofilum* a variety of *A. filum* but pointed out the cirrus itself is longer in A. filum. Clerc did not mention

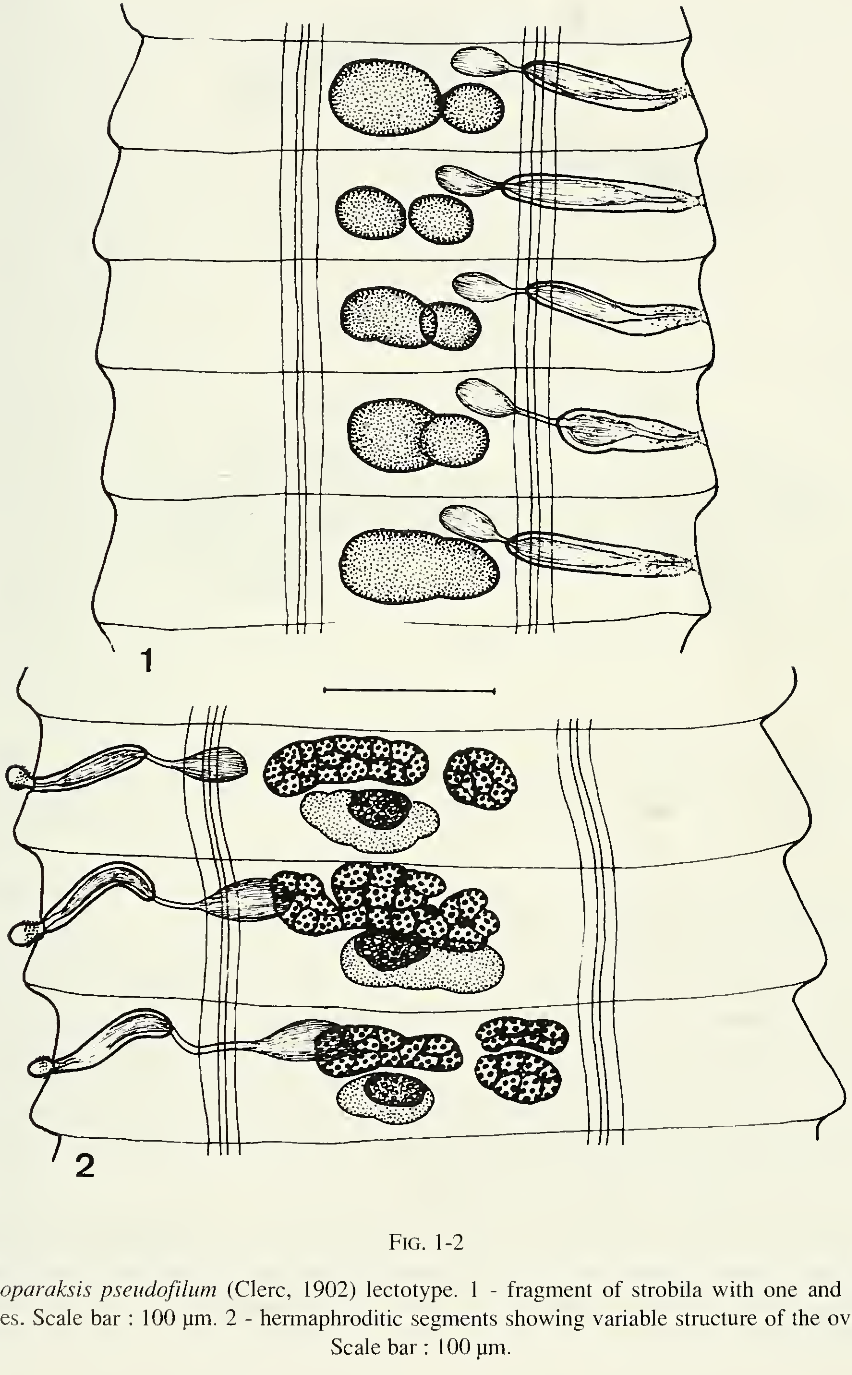


FIG. 1-2

Aploparaksis pseudofilum (Clerc, 1902) lectotype. 1 - fragment of strobila with one and two testes. Scale bar : 100 µm. 2 - hermaphroditic segments showing variable structure of the ovary. Scale bar : 100 µm.

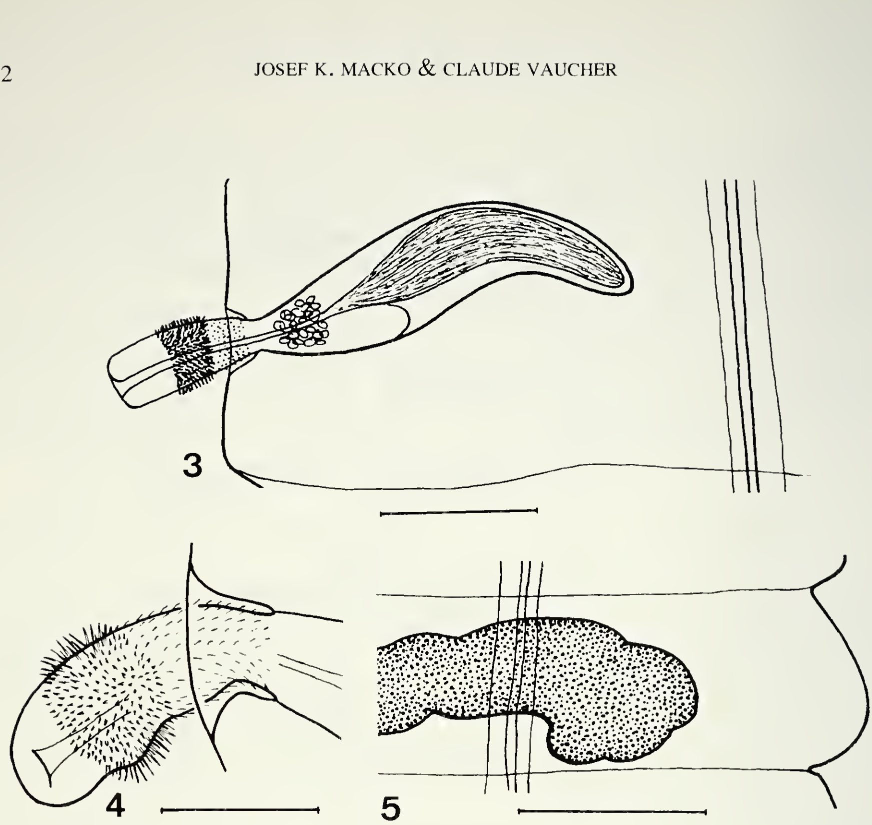


FIG. 3-5

Aploparaksis pseudofilum (Clerc, 1902) lectotype. 3 - opening of the cirrus pouch with protuberant cirrus. Scale bar: 40 µm. 4 - cirrus. Scale bar: 20 µm. 5 - portion of saccular uterus. Scale bar : 100 µm.

a host species but noted that the parasite was found together with *A. filum*. There is no subsequent information on type-host.

Until recently, the name *A. pseudofilum* has been attributed to different species (BONDARENKO, 1990b). According to this author, the taxon of Clerc was known in the Soviet literature as *A. sanjuanensis* Tubangui & Masilungan, 1937, described from *Gallinago megala* in the Philippines. Unfortunately, the type material of *A. sanjuanensis* is lost and the synonymy proposed by BONDARENKO (loc. cit.) cannot be checked. Moreover, this author states that *A. clerci* Yamaguti, 1935, from Europe and *A. speudofilum* are identical though without having examined material from *A. clerci* due to unavailability of Japanese specimens.

From CLERC's (1902) type material, probably only specimens from *Scolopax rusticola* have been preserved; we select as lectotype of *A. pseudofilum* the 48 mm long specimen on slide No 13/78. The specimen has the characteristic short cirrus pouch, which extends slightly beyond the poral excretora ducts only in young proglottides.

ACKNOWLEDGEMENTS

This research was financed by the Slovak Grant Agency No 2/1364/95.

REFERENCES

BONDARENKO, S.K. 1990a. Type species of the genus *Aploparaksis* (Cestoda, Hymenolepididae), *A. filum*, and its life cycle. *Parazitologia* 24: 379-389. (In Russian).

BONDARENKO, S.K. 1990b. *Aploparaksis pseudofilum* (Clerc, 1902) non Gasowska, 1931 and its postembryonal development. *Parazitologia* 24: 509-517. (In Russian).

CLERC, W. 1902. Contribution à l'étude de la faune helminthologique de l'Oural. *Zool. Anz.* 25: 569-575.

CLERC, W. 1903. Contribution à l'étude de la faune helminthologique de l'Oural. *Rev. suisse Zool.* 11: 241-368.

DEBLOCK, S. & R. L. RAUSCH. 1968. Dix *Aploparaksis* (Cestoda) de Charadriiformes d'Alaska, et quelques autres d'ailleurs. *Annls Paras. hum. comp.* 43: 429-448.

SPASSKAYA, L.P. 1966. Cestodes of birds in the USSR (Hymenolepididae). Moscow Izdalstvo Akademya Nauk SSSR, 98 pp. (In Russian).

SPASSKY, A.A. 1963. Hymenolepdidae - tapeworms of free living domestic birds (Part 1). In "Skrjabin, K.I. (Ed.): Essentials of Cestodology. Moscou, Izdavatelstvo Akademya Nauk SSSR 2, 417 pp. (In Russian).

REVUE SUISSE DE ZOOLOGIE, 102 (4) : 995-1044; décembre 1995

A review of the Passandridae of the world (Coleoptera, Cucujoidea). IV. Genus *Ancistria*

Daniel BURCKHARDT* & Stanislaw Adam SLIPINSKI**
* Muséum d'histoire naturelle, Case postale 6434, CH-1211 Genève 6, Switzerland.
** Museum and Institute of Zoology, Wilcza 64, 00-679 Warszawa, Poland.

A review of the Passandridae of the world (Coleoptera, Cucujoidea). IV. Genus *Ancistria*. - The genus *Ancistria* is revised to include 32 valid species, 14 of which are described as new. One genus, 3 subgenera, 15 species and 1 variety are synonymised, and 1 primary junior homonym at species group level is replaced by a new name. The species are diagnosed with external morphological, genital and meristic characters, keyed and illustrated. *Ancistria* is restricted to the Old World where it is most speciose in the tropics. *Ancistria retusa* (Fabricius), the only common species, has a distribution almost congruent with that of the genus; the other species are much more restricted. The biogeographical relationships are briefly discussed.

Key-words: Coleoptera - Passandridae - *Ancistria* - taxonomy - Old World tropics.

INTRODUCTION

The Passandridae or Passandrinae (of Cucujidae) constitute a small taxon of some 100 species placed in 9 genera. The present paper is the ultimate in a series revising its taxonomy (SLIPINSKI, 1987, 1989; BURCKHARDT & SLIPINSKI, 1991, 1995). It deals with the Old World genus *Ancistria* which is predominantly tropical. GROUVELLE (1913a) revised the genus recognising 29 species and 1 variety. He described each species in detail, listed distributional data and provided a key to species. Based on differences on the head, he subdivided the genus into the four subgenera *Obancistria*, *Anancistria*, *Ancistria* s. str. and *Parancistria*. Little has been added since. GROUVELLE (1913b, 1919) published the descriptions of *A. sauteri*, *A. emarginata* and *A. africana*, KESSEL (1921) that of *A. bakeri* and HELLER & GÜNTHER (1936) that of *A. tenera*. HETSCHKO (1930) summarised published information up to that date. Not mentioned, neither by GROUVELLE (1913a) nor by HETSCHKO (1930), is *Bostrichoides angulatus* described by MONTROUZIER (1855) from Woodlark Island; the species belongs, as the

---

Manuscript accepted 16.05.1995.

study of type material showed, to *Ancistria* and is conspecific with *Ancistria retusa* (Fabricius).

Despite this relatively good base, it remains currently difficult, if not impossible, to identify *Ancistria* species. Grouvelle had only a very limited material at hand which led him to overestimate the taxonomic value of some external morphological characters. His species concept is typological and does not take into account the considerable morphological variability which, as in related genera, is to expect in *Ancistria*.

The biology of *Ancistria* spp. is largely unknown. They are probably parasitic, as other passandrids, and may be specialised on bark and wood boring Coleoptera. Several adults have been extracted from tunnels in various trees. HAWKESWOOD (1987) mentions that, in Australia, adults of *A. retusa* may be attracted to light in summer.

The present study is based on extensive material, including types of all described taxa. For the first time, the genitalia are examined and it is concluded that, as in other passandrid genera, they provide good characters for defining species. Other important characters are the relative lengths of head and pronotum, the shapes of the lateral frontal processes and frontoclypeal depression, the relative length of the mesofemur and details on the antennae and the elytral apex. The last is sometimes subjected to sexual dimorphism. A key for species identification and illustrations are provided to supplement the descriptions which diagnose the species.

MATERIAL AND METHODS

Material from following institutions and collections was examined and/or is mentioned in the text:

ANIC	Australian National Insect Collection, CSIRO, Canberra (J. F. Lawrence);
BMNH	Natural History Museum, London (R.J.W. Aldridge, M. Kerley, R.D. Pope, S. L. Shute);
BPBM	Bernice P. Bishop Museum, Honolulu (J.A. Samuelson);
DEIC	Deutsches Entomologisches Institut, Eberswalde (L. Zerche);
HNHM	Hungarian Natural History Museum, Budapest (O. Merkl);
ISNB	Institut Royal des Sciences Naturelles de Belgique, Bruxelles (R. Damoiseau);
KYUN	Kyushu University, Kyushu (T. Ueno);
MCSN	Museo Civico di Storia Naturale "Giacomo Doria", Genova (R. Poggi);
MHNG	Muséum d'histoire naturelle, Genève;
MNHN	Muséum National d'Histoire Naturelle, Paris (N. Berti);
MRAC	Musée royal de l'Afrique centrale, Tervuren (J. Decelle);
NHMB	Naturhistorisches Museum, Basel (M. Brancucci, R. Heinertz);
QMBA	Queensland Museum, Brisbane (G. Monteith);
RMNH	Rijksmuseum van Natuurlijke Historie, Leiden (J. Krikken);
SAMC	South African Museum, Cape Town (R. Whitehead);
SMTD	Staatliches Museum für Tierkunde, Dresden (R. Krause, O. Jäger);
USNM	National Museum of Natural History, Smithsonian Institution, Washington, D.C. (J. Pakaluk);
ZMHB	Zoologisches Museum, Humboldt-Universität, Berlin (M. Uhlig);
ZMPA	Museum and Institute of Zoology, Polish Academy of Sciences, Warszawa;
ZMUC	Zoological Museum, University of Copenhagen (O. Martin).

Measurements were made using a filar micrometer as follows: body length, from apical margin of clypeus to elytral apex, excluding the mandibles; head length, from apical margin of clypeus to occipital groove; head width, maximum width across the eyes; joint width of lateral frontal processes, cf. figs 96, 150: B + B'; width of frontoclypeal depression, cf. figs 96, 150: A; temple length, maximum length, in profile, in a line parallel to the dorsal head margin, from occipital groove to posterior eye margin; eye diameter, maximum length along same axis as temple length; pronotal length, from base to apex along the middle; pronotal width, across maximum width; elytral length, along suture including scutellum; elytral width, across maximum width of both elytra together. Where many specimens were available measurements were taken from a selection of specimens representing both sexes and exhibiting maximum range of size and form.

Ancistria Erichson

Ancistria ERICHSON, 1845: 305. Type species *Colydium retusum* Fabricius, by monotypy.

Prionophora WESTWOOD, 1848: 85. Type species *Prionophora cylindrica* Westwood, by monotypy. Synonymised with *Ancistria* by GEMMINGER & VON HAROLD, 1868: 870.

Bostrichoides MONTROUZIER, 1855: 17. Type species *Bostrichoides angustatus* Montrouzier, by monotypy. Syn. n.

Ancistria (Anancistria) GROUVELLE, 1913a: 436. Type species *Ancistria beccarii* Grouvelle, here designated. Syn. n.

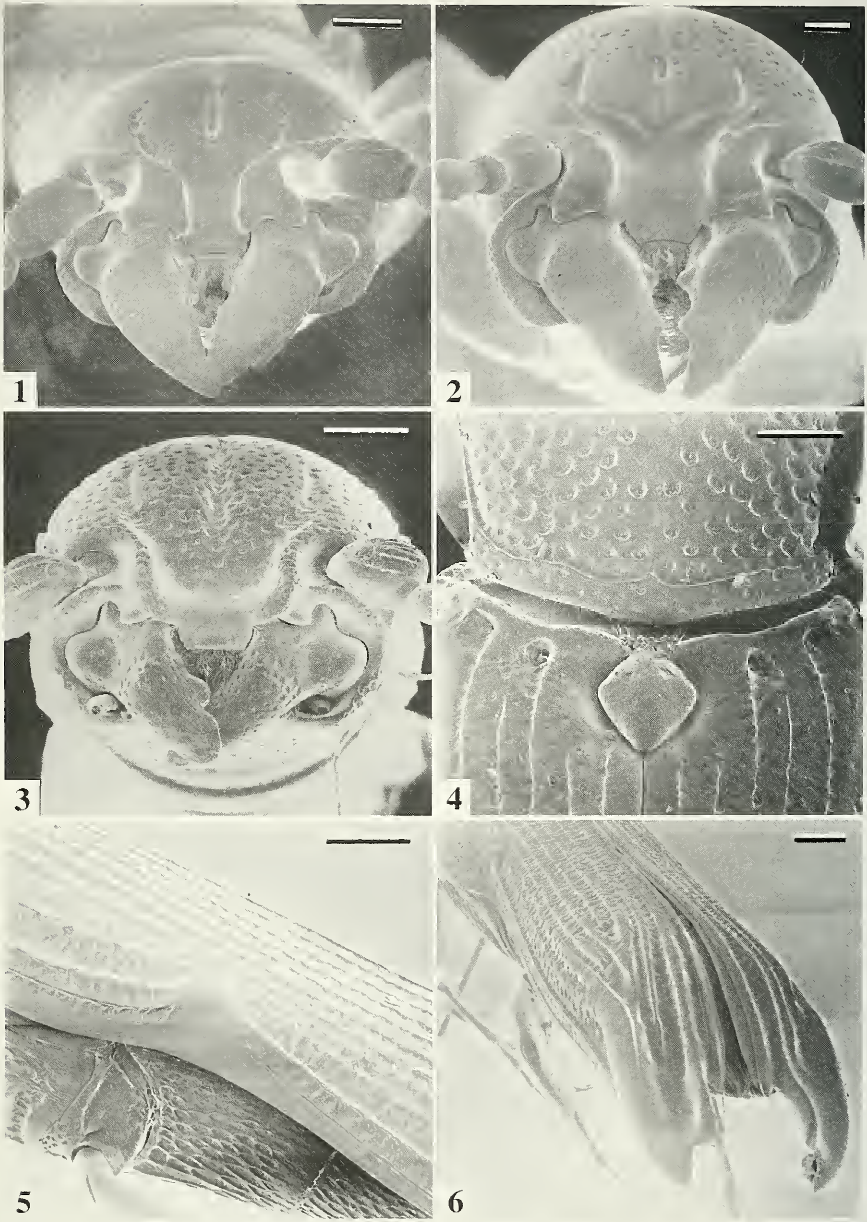
Ancistria (Obancistria) GROUVELLE, 1913a: 436. Type species *Ancistria (Obancistria) longior* Grouvelle, by monotypy. Syn. n.

Ancistria (Parancistria) GROUVELLE, 1913a: 437. *Ancistria (Parancistria) bouchardi* Grouvelle, here designated. Syn. n.

Diagnosis. Small to medium sized, cylindrical, elongate Passandridae (3.4-14.6 mm long). Head with distinct median and admedian grooves and more or less depressed frontoclypeus. Jugular plates widely separated, mentum large, triangular. Antenna 11-segmented, segment 1 bearing 1 to several dorsal grooves; apical 5 or 6 segments flattened, asymmetrical, forming a saw-shaped, sometimes indistinct club. Basal tarsal segment very long, sometimes longer than tibia; tibiae bearing a long hooked apical spur. Elytra with costa 3 more or less strongly inflated subapically; interval 1 present, grooved, complete, intervals 2-6 grooved when present, often incomplete.

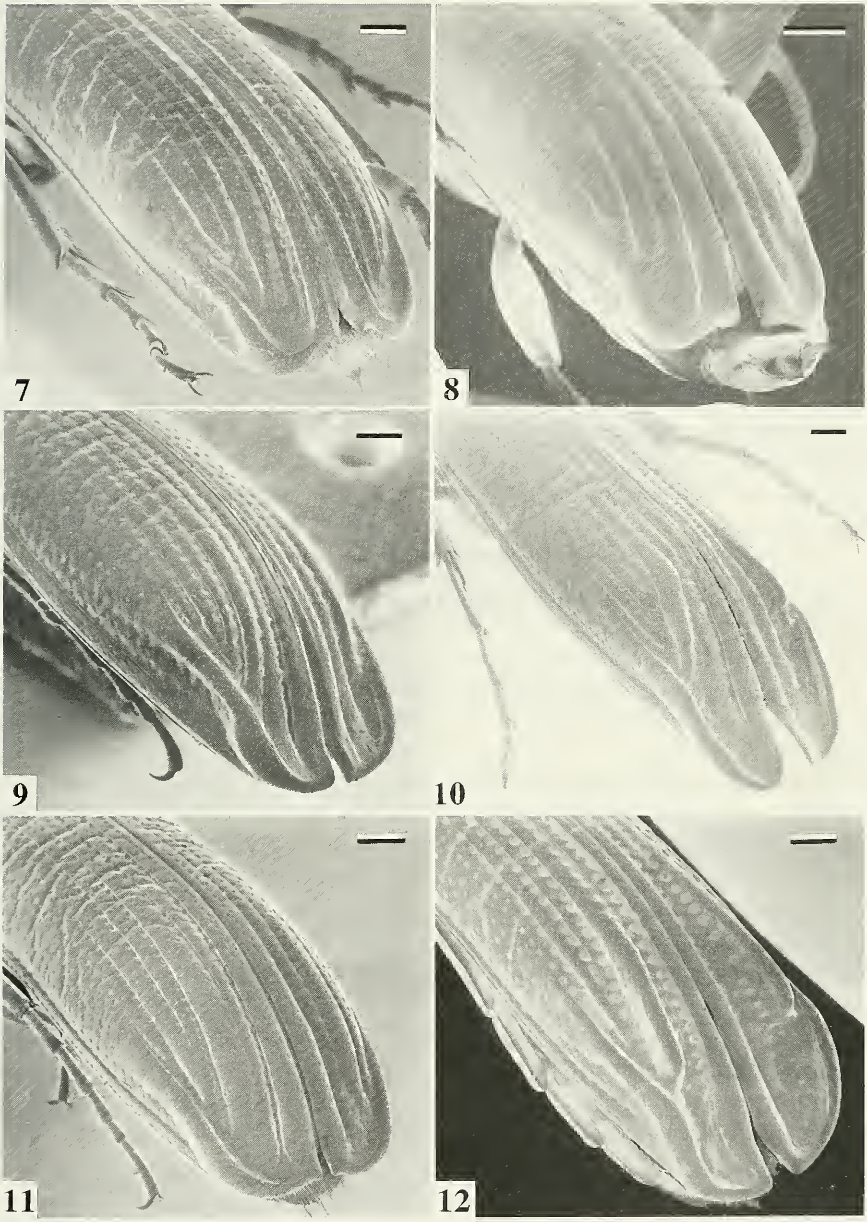
Description. Colour light, reddish or chestnut brown to almost black, sometimes bicoloured; surface shiny or mat. Usually glabrous, in *A. pilosa* head with very short, pronotum and elytra with fine erect setae.

Head weakly convex or almost flat, bearing a shallow or deep frontoclypeal depression which is delimited laterally by the lateral frontal processes which can be careniform or flattened; mid line partly or completely grooved; admedian lines short to moderately long, almost straight to strongly curved or bent; admedian lobes short to moderately long, narrowly triangular to almost lamellar, parallel-sided; occipital transverse groove wide and deep; punctation fine to coarse, laterally often strigose. Eye moderate-sized to large. Antenna 11-segmented; segment 1 usually flattened dorsally



FIGS 1-6

Ancistria spp. 1, *A. apicalis*; 2, *A. brancuccii*; 3, 4, *A. retusa*; 5, 6, *A. bakeri*. 1-3, head, frontal view; 4, bases of pronotum and elytra; 5, elytra, lateral view; 6, elytra, oblique rear view. (Scale bars 1, 3-6 = 0.2 mm; 2 = 0.1 mm).



FIGS 7-12

Ancistria spp., oblique rear view of elytra. 7, *A. apicalis* ♀; 8, *A. brancuccii* ♂; 9, *A. nicolettae* ♀; 10, *A. tarsalis* ♀, 11, *A. retusa* ♂; 12, *A. retusa* ♀. (Scale bars = 0.2 mm).

with 1 to several dorsal grooves which can be more or less distinct; segment 2 normally subglobular, sometimes oval; segment 3 oval or clavate; segments 4 and 5 symmetrically or asymmetrically oval; segments 6 or 7 to 11 flattened, asymmetrical, forming saw-shaped club, in some species club very indistinct; segments 3-11 irregularly setose, club segments in addition apico-ventrally with well-defined region bearing very short setae producing felt-like appearance; segment 11 subrectangular, irregularly rounded apically.

Pronotum longer than wide, distinctly narrowed basally, widening towards the middle or almost the apex, always margined laterally; border at base absent, or partly or fully developed. Prosternum with sternopleural sutures fully developed; prosternal process parallel-sided, strongly curved towards mesosternum, flat.

Elytra with costa 3 very weakly to very strongly inflated subapically, sometimes in females more than in males, costae 7 and 8 merging subapically forming a lateral rim which fuses with the apical margin; interval 1 completey grooved, 2-6 completely or partly grooved, 6 sometimes obsolete, intervals 2-6 usually reduced apically; apex truncate or emarginate, sometimes with V or U-shaped incision along suture, with or without sutural tooth.

Ventral side of head with widely separated jugular plates, mentum large, triangular. Punctation on ventral side usually coarse. Mesosternum small, foveolate or flat, smooth or punctate. Metasternum with long median groove apically, irregularly punctate. Abdominal ventrites simple, punctate; last ventrite without apical groove.

The male genitalia provide useful means of species identification, even though there is a certain amount of variation. The aedeagus has an elongate median lobe with ventral strut and flagellum, and the tegmen which consists of a moderately sclerotised dorsal plate and ventral, setose parameres. The apical piece (in ventral view) of the median lobe, the parameres, and sternite and tergite VIII are figured for all species where males are known. Females have a moderately sclerotised, strongly convoluted spermatheca which is figured were known.

Comments. *Ancistria* shares with *Passandrella*, *Taphroscelidia* and *Scalidiopsis* the presence of a grooved median line on the head and the basal metatarsomere which is longer than tarsomere 2. Without a phylogenetic analysis of the whole family (in prep.) it is, however, not possible to say whether these characters express close phylogenetic relationship. *Ancistria* differs from the 3 other genera in the absence of a pair of setal brushes on the lower head surface, the absence of deep pits anterior to the procoxae, the absence of a transverse groove on the last abdominal ventrite, and the presence of transversely rugose costae on the elytra.

Based on the structure of the anterior portion of the head GROUVELLE (1913a) divided Ancistria into the four subgenera *Obancistria*, *Anancistria*, *Ancistria* s. str. and *Parancistria*. These characters are, however, not as clear-cut and stable as indicated by Grouvelle. The subdivision is therefore not adopted in the following and the subgenera are synonymised.

At present, 32 species are recognised within *Ancistria*.

Key to species of *Ancistria* Erichson

1 Pronotal length/width ratio less than 1.4. 2

- Pronotal length/width ratio more than 1.4. 3

2 Frontoclypeus flattened, admedian lines on head widened anteriorly to form circular to oval depressions (fig. 43). Genitalia as in figs 44, 45, 47-49. New Guinea, Sumatra, Malaysia. . . . . *beccarii*

- Frontoclypeus horn-shaped, admedian lines on head not markedly widened anteriorly (Fig. 74). Genitalia as in figs 75-77. Laos. . . . . *cornuta*

3 Mesotibia about 0.8 times as long as or shorter than first tarsomere of mid-legs. 4

- Mesotibia as long as or longer than first tarsomere of mid-legs. 6

4 Frontoclypeal depression deep, well-delimited, admedian lines short and deep, admedian lobes short, acutely triangular (figs 90, 96). Genitalia as in figs 91-94. Java, Sumatra, New Guinea. . . . . *foraminifrons*

- Frontoclypeal depression shallower, admedian lines longer and shallower, admedian lobes long (figs 33, 175). 5

5 Lateral margin of elytra notched in the middle (figs 5, 6). Genitalia as in figs 34-38. Borneo, Sumatra. . . . . *bakeri*

- Lateral elytral margin not notched in the middle. Genitalia as in figs 173, 176, 177. Sumatra, Borneo. . . . . *tarsalis*

6 Pronotum and elytra covered in erect, fine setae (clearly visible at 10 x magnification). Genitalia as in figs 140, 141. Taiwan. . . . . *pilosa*

- Pronotum and elytra without setae. 7

7 Admedian lines strongly curved or angular, admedian lobes, therefore, lamellar and suddenly narrowing towards apex (figs 2, 55). 8

- Admedian lines straight or weakly curved, admedian lobes, therefore, regularly or irregularly cuneate gradually narrowing towards apex (figs 1, 3, 51). 12

8 Large species, body length 8.0 mm. Pronotum less than 1.5 times as long as wide. Genitalia as in figs 56, 57. Sikkim. . . . . *bostrychoides*

- Small species, body shorter than 7.0 mm. Pronotum more than 1.7 times as long as wide. 9

9 Mesotibial apex angular externally lacking a spiniform process. Head more than 1.7, and pronotum more than 2.2 times as long as wide. Genitalia as in figs 113-115. New Guinea. . . . . *longicapitata*

- Mesotibial apex with distinct external spine. Head less than 1.6, and pronotum less than 2.0 times as long as wide. 10

10 Pronotum bordered at base, less than 1.8 times as long as wide. Genitalia as in figs 135-137. New Guinea. . . . . *papuana*

- Pronotum not or incompletely bordered at base, more than 1.8 times as long as wide. 11

11 Body black. Elytral length/width ratio less than 3.8. Lateral frontal processes on head flattened (figs 2, 63). Genitalia as in figs 64-66. Nepal. . . . . *brancuccii*

- Body chestnut brown. Elytral length/width ratio more than 4.0. Lateral frontal processes on head careniform (fig. 107). Genitalia as in figs 108-110. Japan. . . . . *lewisi*

12 Lateral frontal processes of head careniform, subcareniform or rarely flattened, narrow, their joint width less than 0.9 times that of frontoclypeal depression (figs 3, 143, 178). 13

- Lateral frontal processes of head flattened, wide, their largest joint width, in dorsal view, more than 0.9 times that of frontoclypeal depression (fig. 1). 18

13 Admedian lobes subcarinate anteriorly, ending level with clypeal base and lateral frontal processes (fig. 51). Elytra reddish with bases and median transverse band black. Genitalia as in figs 52, 53. Vietnam. . . *bicolorata*

- Admedian lobes sometimes raised but not carinate anteriorly, always much shorter than lateral frontal processes anteriorly. Elytral colour different. 14

14 Elytra with interval 4 shorter than 5 (fig. 11, 12). 15

- Elytra with apical length of intervals decreasing gradually from 3 to 6 (fig. 9). 17

15 Lateral frontal process of head careniform (figs 3, 146, 148, 150). Costa 3 on elytra strongly inflated subapically (figs 11, 12). Genitalia as in figs 151-164. Widely distributed from Australia, through tropical Asia to Africa. . . . . *retusa*

- Lateral frontal process of head flattened (figs 143, 179). Costa 3 on elytra very weakly inflated subapically. 16

16 Antennae 6-segmented (fig. 142). Pronotum not bordered basally. Genitalia as in fig. 144. Japan. . . . . *reitteri*

- Antennae 5-segmented (fig. 178). Pronotum bordered basally. Genitalia as in figs 180-182. Java. . . . . *tenera*

17 First tarsomere of mid-leg long, as long as tarsomeres 2-5. Large, body longer than 9.0 mm, black. Elytra never emarginate apically. Genitalia as in fig. 172. New Guinea, Ambon, Ceram, Solomon Island. . . . . *strigosa*

- First tarsomere of mid-leg short, as long as tarsomeres 2-3. Small, body shorter than 8.5 mm, brown. Elytra with apical tooth in females. Genitalia as in figs 129-132. Malaysia, Palawan, Borneo, Sumatra. . . . . . . *nicolettae*

18 Lateral frontal processes with large anterior tubercle (fig. 98). Genitalia as in fig. 99. New Guinea. . . . . *grouvellei*

- Lateral frontal processes without large anterior tubercle (fig. 87). 19

19 Pronotum more than 1.9 times as long as wide. 20

- Pronotum less than 1.8 times as long as wide. 22

20 Antennal club 6-segmented (fig. 86). Genitalia as in fig. 88. "Southeast Asia". . . . . *fabricii*

- Antennal club 5-segmented (fig. 183). 21

21 Body colour brown. Body length shorter than 4.0 mm. Genitalia as in fig. 185. New Guinea. . . . . *tenuis*

- Body colour almost black. Body length more than 5.0 mm. Genitalia as in figs 125, 126. Nepal. . . . . *nepalensis*

22 Antennal segment 1 with 2 wide, subequal, dorsal grooves, delimited by 3 subparallel ridges (figs 58, 59). Genitalia as in figs 60, 61. Sumatra. .... *bouchardi*

- Antennal segment 1 different. 23

23 Temple length/eye diameter ratio more than 1.7. 24

- Temple length/eye diameter ratio less than 1.3. 25

24 Large species, body longer than 12.0 mm. Pronotum slender, 1.8 times as long as wide, with narrow puncture-free median longitudinal stripe. Genitalia as in figs 15-18. Philippines. .... *alternans*

- Small species, body shorter than 6.0 mm. Pronotum wide, 1.5 times as long as wide, evenly covered in punctures. Genitalia as in figs 167-169. Borneo, Singapore. .... *stricta*

25 Antennal club 5-segmented (fig. 100). Pronotum bordered at base, bordering distinct laterally and medially. 26

- Antennal club 6-segmented (fig. 67). Pronotum not, indistinctly or incompletely bordered at base. 29

26 Mandibles strongly transversely rugose dorsally (fig. 101). Genitalia as in figs 102-105. India. .... *indica*

- Mandibles not rugose but punctured dorsally (fig. 79). 27

27 Body longer than 6.0 mm. Genitalia as in figs 80, 81. "British Bootang". *costata*

- Body shorter than 5.0 mm. 28

28 Frontoclypeal depression with small tubercle (fig. 28). Elytra bicoloured. Genitalia as in figs 29-31. India. .... *assamensis*

- Frontoclypeal depression without tubercle (fig. 40). Elytra completely black. Genitalia as in figs 40, 41. New Guinea. .... *basseti*

29 Antennal segment 11 distinctly longer than wide (fig. 67). 30

- Antennal segment 11 about as long as wide (fig. 24). 31

30 Elytral apex emarginate. Genitalia as in figs 69-72. Philippines, Sumatra. .... *concava*

- Elytral apex truncate. Genitalia as in figs 118-122. Malaysia, Borneo. . . . *micros*

31 Mandibles punctate (fig. 19). Elytra entirely or apically dark chestnut brown, weakly emarginate apically. Genitalia as in figs 20-23, 25, 26. Japan, China, Vietnam. .... *apicalis*

- Mandible strongly transversely rugose (fig. 83). Elytra uniformly dark brown or black, strongly emarginate apically. Genitalia as in figs 84, 85. Taiwan, China. .... *emarginata*

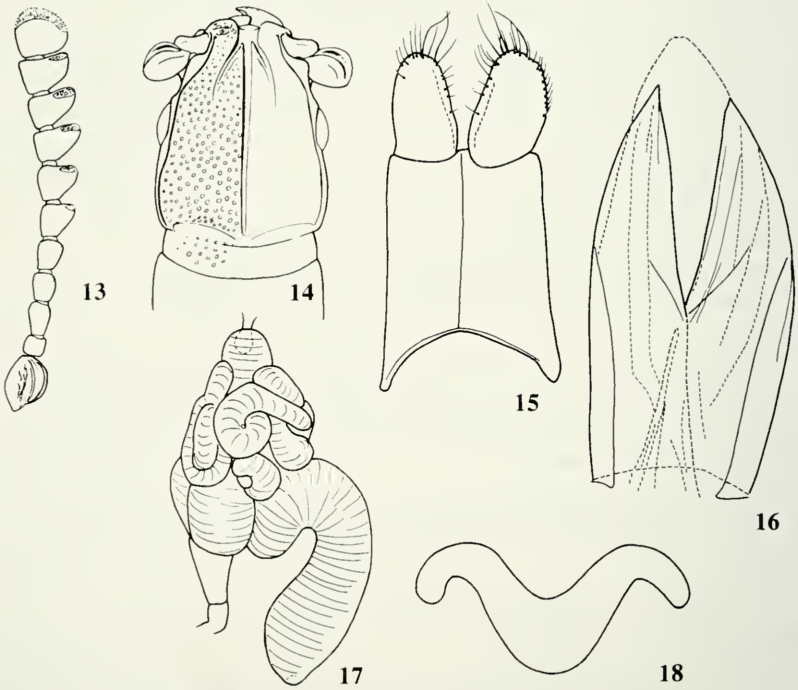
Ancistria alternans Grouvelle (Figs 13-18)

Ancistria (Ancistria) alternans GROUVELLE, 1913a: 472. Holotype ♂, without locality data (Castelnau) (MNHN); (examined).

Description. Length 12.6-14.6 mm. Dark brown to almost black, apical half of elytra in ♂ dark chestnut brown, in ♀ almost black; surface mat. Head (fig. 14) 1.3-1.4

times as long as wide, coarsely, irregularly punctured; median line completely or almost impressed to base; admedian lines moderately short, only weakly curved; admedian lobes narrowly triangular; lateral frontal lobes flattened, their joint width 2.3-2.8 times that of frontoclypeal depression. Eye relatively small; temple length/eye diameter ratio as 1.8-2.4. Antenna (fig. 13) with segment 1 bearing 1 deep and 1 or 2 shallow grooves; segment 2 subglobular; segments 3-5 oval; segments 6-11 strongly flattened, forming a distinct club; segment 11 wider than long. Pronotum 1.7-1.8 times as long as wide, not bordered at base, widening in basal third, with subparallel margins in apical third; punctation coarser than on head, leaving a puncture-free longitudinal median stripe. Elytra 3.2-3.5 times as long as wide; 2.0-2.1 times as long as pronotum; costa 3 more, costa 5 less inflated subapically; intervals gradually shortened from 3 to 6; apex in ♂ weakly, in ♀ strongly emarginate, bearing a smaller or larger sutural tooth. Genitalia as in figs 15-18.

Distribution. The only recorded specimen has no locality data (GROUVELLE, 1913a); HETSCHKO (1930) mentions the species questionably from Australia for which is no evidence.
Material examined. Holotype ♂, without locality data (MNHN). Philippines: 1♀, Masbate Island, Aroroy, 28.viii.1917, Böttcher (ZMHB).



FIGS 13-18

Ancistria alternans. 13, antenna; 14, head, dorsal view; 15, parameres; 16, median lobe, apical piece; 17, spermatheca; 18, ostium bursae.

Ancistria apicalis Reitter (Figs 1, 7, 19-26)

Ancistria apicalis Reitter, 1889: 314. Lectotype ♂, Japan: Yuyama in Higo, 1883, G. Lewis, labelled "Nagasaki, 22.v.-3.vi.1881, G. Lewis" (BMNH); here designated (examined).
Ancistria (Parancistria) apicalis Reitter; Grouvelle, 1913a: 479.
Ancistria (Parancistria) fouqueti Grouvelle, 1913a: 481. Holotype ♀, Vietnam: Tonkin, Pha-Vi, Fouquet (MNHN); (examined). Syn. n.

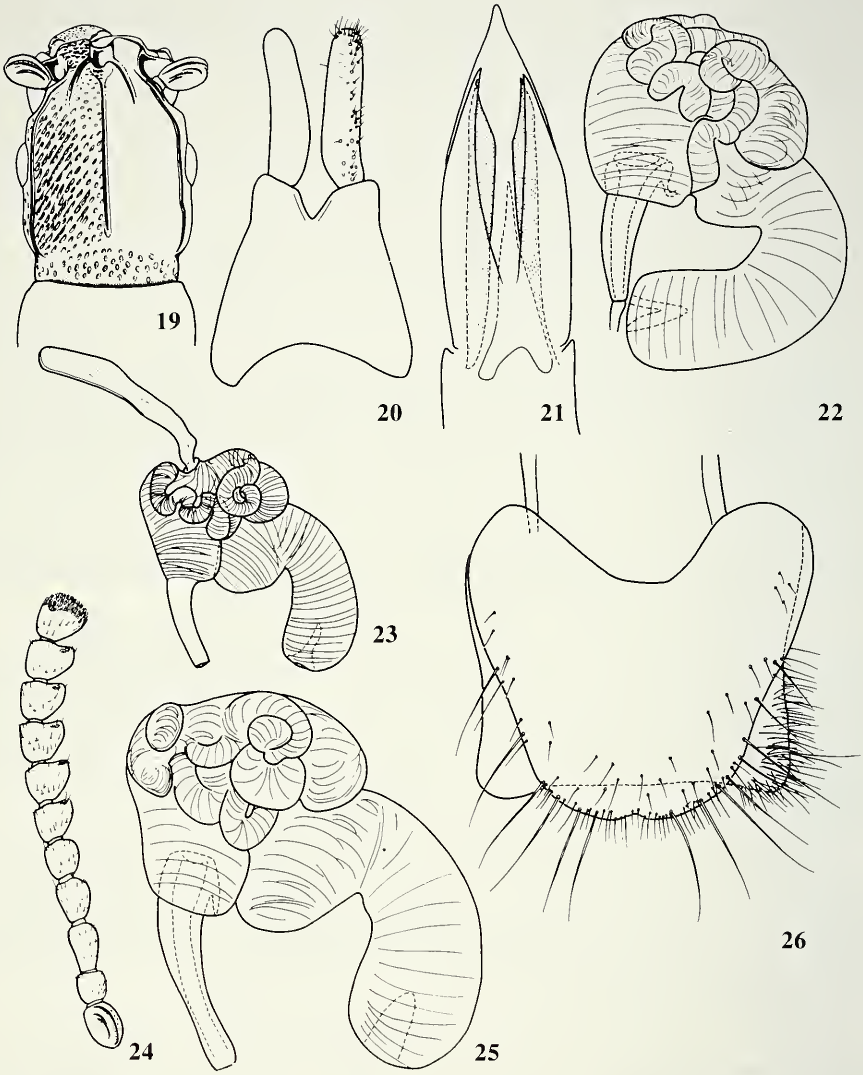
Description. Length 5.3-7.2 mm. Black, legs dark brown, elytra entirely or partly chestnut brown towards the apex; surface mostly mat. Head (figs 1. 19) 1.2-1.3 times as long as wide; finely, laterally strigosely punctured; median line impressed almost to base; admedian lobes narrowly triangular; lateral frontal processes flattened, their joint width 2.6-3.4 times that of frontoclypeal depression. Dorsal surface of mandibles punctate. Eye moderately large; temple length/eye diameter ratio as 0.9-1.3. Antenna (fig. 24) with segment 1 bearing 2 distinct grooves; segment 2 subglobular; segment 3 clavate; segments 4 and 5 asymmetrically oval; segments 6-11 flattened, forming indistinct club; segment 11 as long as wide. Pronotum 1.7 times as long as wide, incompletely or indistinctly bordered at base, strongly widened in basal half, with subparallel margins in apical half; punctation coarser than on head, density uneven leaving a puncture-free longitudinal band in basal two thirds. Elytra 2.8-3.0 times as long as wide, 1.8-2.0 times as long as pronotum; costa 3 weakly inflated subapically; interval 3 longer than 4 which is shorter than 5; weakly emarginate apically with small sutural tooth (fig. 7). Genitalia as in figs 20-23, 25, 26.

Distribution. Recorded as *A. apicalis* from Japan (Reitter, 1889; Grouvelle, 1913a; Hetschcko, 1930) and as *A. fouqueti* from Vietnam (Grouvelle, 1913a; Hetschko, 1930). Material examined. Japan: lectotype and paralectotype 1♂, 1♀ (BMNH, HNHM) of *A. apicalis*; 1♂, Koike, Nakayama-chô; Ehime Prefecture, 10.v.1964, S. Hisamatu (ANIC); 1 specimen, Kyushu, Kagoshima Pref., Mount Hoyoshidake, 1-2.v.1991, T. Ueno (KYUN). Vietnam: holotype ♀ of *A. fouqueti* (MNHN); 1♂, 1♀, Tonkin, area of Hoa-Binh, 1928, A. de Cooman (BMNH, MNHN), 2 specimens, Tonkin, Thanh Moi, M. Perrot (MHNG). China: 2♀, Sichuan, Mount Emei, 600-1050 m, 5-19.v.1889, L. Bocàk (ZMPA).

Comments. According to Reitter's (1889) description of *A. apicalis* the type material was collected at Yuyama in Higo. The lectotype in the BMNH is labelled "Nagasaki"; this label has been added subsequently and is certainly wrong (cf. comments to *A. reitteri*). A paralectotype in HNHM bears the same data as mentioned in the original description (Reitter, 1889).

Ancistria assamensis sp. n. (Figs 27-31)

Description. Length 4.9-6.2 mm. Dark chestnut brown to black with apical half of elytra light brown to brown; surface mostly mat. Head (fig. 28) 1.2 times as long as wide, finely punctate; median line impressed almost to base; admedian lines long, impressed, weakly curved, admedian lobes long, narrowly triangular; lateral frontal processes flattened, their joint width 1.4-1.7 times that of frontoclypeal impression which bears a small tubercle in the middle. Eye moderately large, temple length/eye diameter ratio as 1.0-1.2. Antenna (fig. 27) with segment 1 bearing 2 fine dorsal

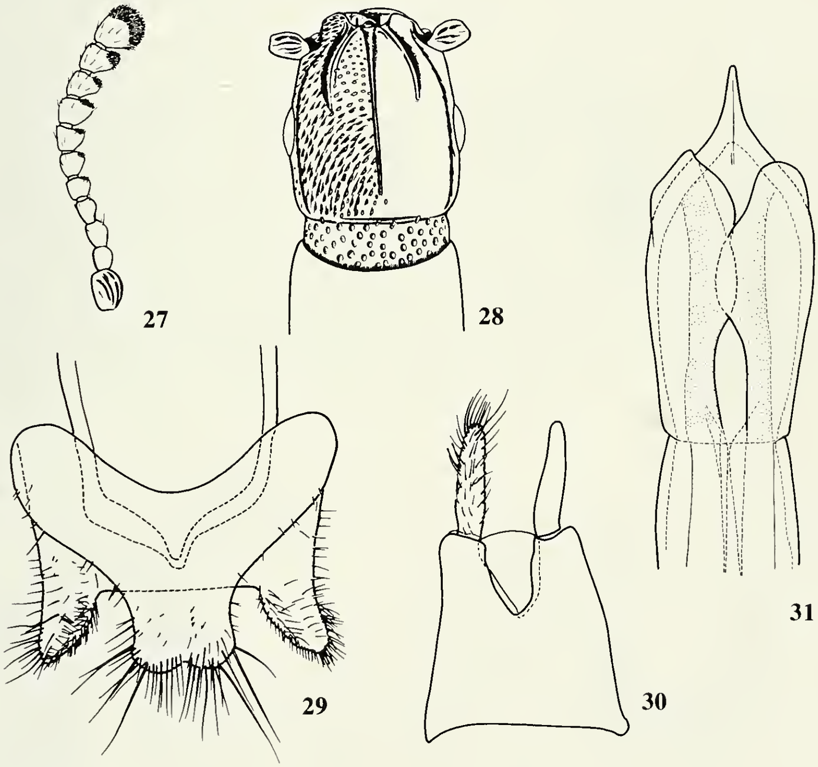


FIGS 19-26

Ancistria apicalis. 19, head, dorsal view; 20, parameres; 21, median lobe, apical piece; 22, 23, 25, spermatheca; 22, holotype of *A. fouqueti*; 23, with developed gland, which is usually missing in KOH treated specimens; 24, antenna; 26, sternite and tergite VIII.

grooves; segment 2 subglobular; segments 3 and 4 oval; segments 5 and 6 asymmetrically widened towards apex; segments 7-11 flattened, forming club; segment 11 slightly longer than wide. Pronotum 1.7 times as long as wide, entirely bordered at base, strongly widened to middle, apical half with subparallel margins; punctation coarser than on head, sparser on disk. Elytra 3.3-4.1 times as long as wide, 2.1-2.2 times as long as pronotum; costa 3 inflated subapically, costae 7 and 8 fused and inflated subapically; intervals 4 and 6 subequal, both shorter than intervals 3 and 5; apex emarginate with small sutural tooth. Genitalia as in figs 29-31.

Material examined. Holotype ♂, India: Assam, Sadiya Division, 10.vi.1932, ex *Terminalia myriocarpa*, Dehra Dun collection (BMNH). Paratype ♂, India: same data as holotype but 10.ix.1932 (MHNG).



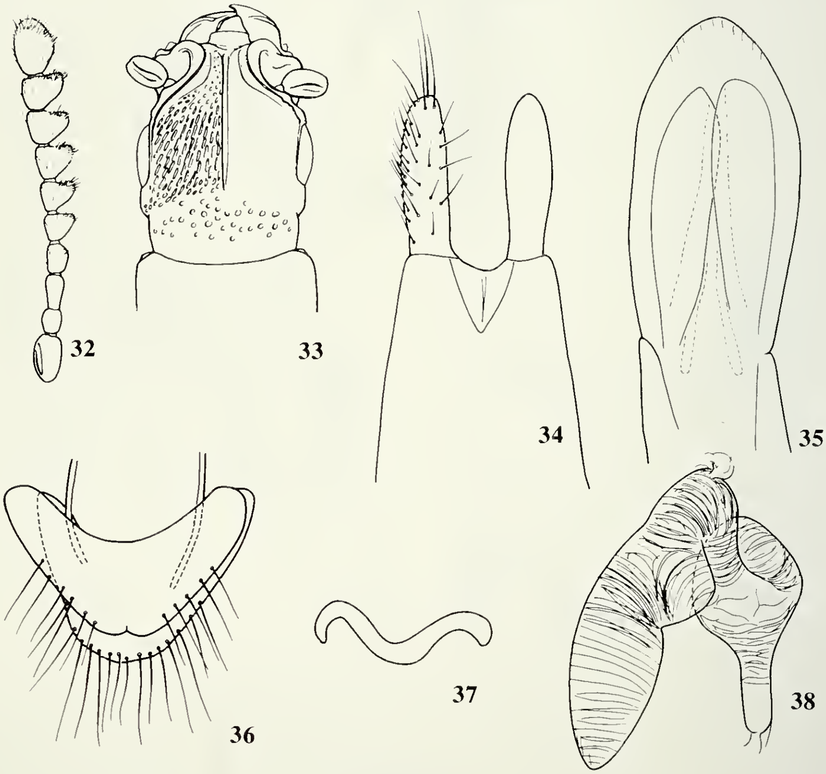
FIGS 27-31

Ancistria assamensis. 27, antenna; 28, head, dorsal view; 29, sternite and tergite VIII; 30, parameres; 31, median lobe, apical piece.

Ancistria bakeri Kessel (Figs 5, 6, 32-38)

Ancistria (Obancistria) bakeri Kessel, 1921: 32. Holotype ♀, East Malaysia: Borneo, Sabah, Sandakan, F. Baker (USNM); (examined).

Description. Length 4.9-5.4 mm. Dark brown to almost black, legs lighter brown, abdominal venter sometimes light brown; medio-lateral notch on elytra semi-transparent, light brown, strongly contrasted from remainder of elytra; surface mostly mat. Head (fig. 33) 1.0-1.1 times as long as wide, densely covered in fine strigose punctures; basal line indistinct at base, well-defined at apex; admedian lines moderately long, shallow, almost straight, admedian lobes large, triangular; lateral frontal processes flattened, their joint width 0.5-0.8 times that of frontoclypeal depression, which is very shallow. Eye large, temple length/eye diameter ratio as 0.3-0.4. Antenna (fig. 32) with segment 1 bearing 2 fine dorsal grooves; segment 2 oval; segment 3 clavate; segment 4 oval; segments 5-11 flattened, forming club; segment 11 distinctly longer than wide.



Figs 32-38

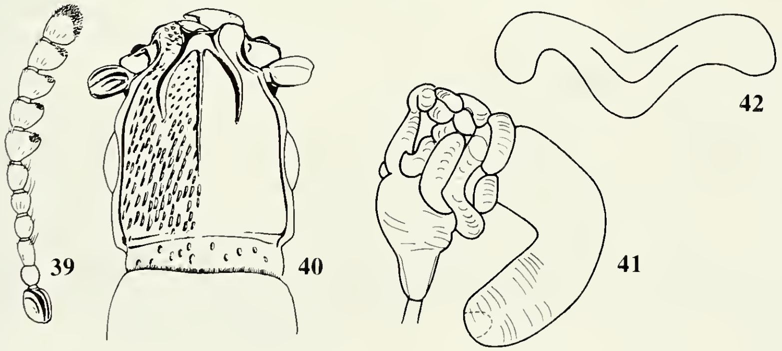
Ancistria bakeri. 32, antenna; 33, head, dorsal view; 34, parameres; 35, median lobe, apical piece; 36, sternite and tergite VIII; 37, ostrium bursae: 38, spermatheca.

Pronotum 1.8-2.0 times as long as wide, not bordered at base, relatively narrow at base, widening towards apical third, from there to apex narrowing; punctation coarser and more spaced than on head, not markedly sparser on disk. Elytra 3.9-4.5 times as long as wide, 2.2-2.3 times as long as pronotum; costal margin notched in the middle (fig. 5), with a circular area membranous; costae 3 and 4 fused subapically, inflated, fused costae 7 and 8 ending in a tooth; intervals 3-6 increasing in length apically; strongly emarginate apically with a sutural tooth (fig. 6). Genitalia as in figs 34-38.

Distribution. Reported from Borneo (Kessel, 1921; Hetschko, 1930). Material examined. Borneo: 1♂, 5♀, including holotype, Sabah, Sandakan (USNM, MHNG). Sumatra: 5♂, Sinabang, Sima, ii.1913, E. Jacobson (RMNH, MHNG, ZMPA).

Ancistria basseti sp. n. (Figs 39-42)

Description. Length 4.2-4.9 mm. Dark brown, tibiae and tarsi brown; surface mostly mat. Head (fig. 40) 1.2 times as long as wide; relatively densely somewhat strigosely punctate; median line impressed becoming indistinct towards base; admedian lines moderately short, weakly curved, admedian lobes triangular, pointed apically; lateral frontal processes flattened, their joint width 1.9-2.4 times that of frontoclypeal depression. Eye large, temple length/eye diameter ratio as 0.8-1.0. Antenna (fig. 39) with segment 1 bearing 2 distinct dorsal grooves; segment 2 subglobular; segments 3-6 oval; segments 7-11 flattened, forming a well-defined club; segment 11 distinctly longer than wide. Pronotum 1.7 times as long as wide, distinctly bordered at base, strongly widened towards the middle from there to apex weakly narrowing; coarsely, slightly irregularly punctured. Elytra 3.4 times as long as wide, 2.2 times as long as pronotum; costa 2 longer than 3 apically, costa 3 weakly swollen subapically; intervals



Figs 39-42

Ancistria basseti. 39, antenna; 40, head, dorsal view; 41, spermatheca; 42, ostium bursae.

5 and 6 subequal, longer than 4 but shorter than 5; apex not emarginate, bearing an indistinct sutural tooth. Genitalia as in figs 41, 42.

Material examined. Holotype ♀, Papua New Guinea: Morobe Province, Wau, Mount Kaindi, 1150-2300 m, 11-25.ii.1993, flight intercept trap in *Caldcluvia*, Y. Basset (MHNG). Paratype ♀, Papua New Guinea: Morobe District, Kunai Creek, 1250 m, 26.viii.1963, Malaise trap, J. Sedlacek (BPBM).

Ancistria beccarii Grouvelle (Figs 43-49)

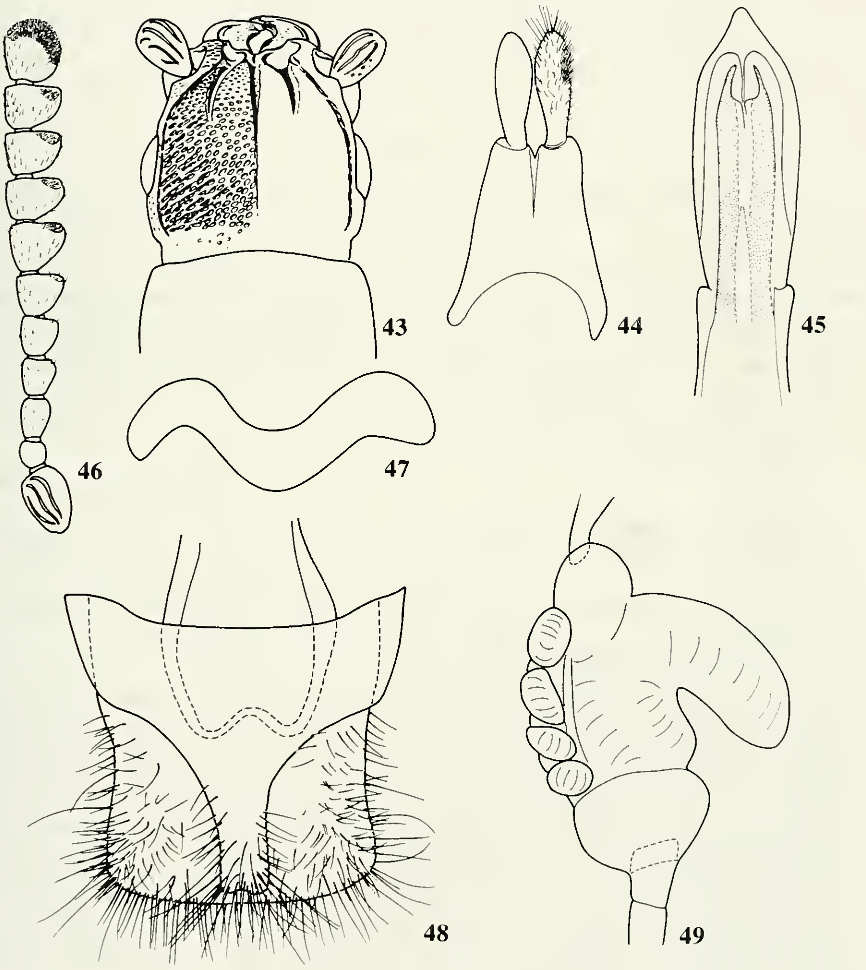
Ancistria beccarii GROUVELLE, 1883: 277. Lectotype ♀, Aru Island: Wokan, 1873, O. Beccari (MCSN); here designated (examined).
Ancistria (Anancistria) beccarii Grouvelle; GROUVELLE, 1913a: 439.
Ancistria (Anancistria) arrowi GROUVELLE, 1913a: 437. Holotype, Moluccas: Makian and Kajoa Islands, J. Wallace, Kai, Pascoe collection 93-60 (BMNH); (examined). Syn. n.
Ancistria (Anancistria) castelnaui GROUVELLE, 1913a: 441. Holotype ♂, Malacca, Castelnau (MNHN); (examined). Syn. n.

Description. Length 8.2-11.4 mm. Black, elytra sometimes chestnut brown apically; surface mostly shiny. Head (fig. 43) 0.8-0.9 times as long as wide, finely to coarsely punctate; median line basally weakly, apically strongly impressed, admedian lines moderately long, anteriorly suddenly widened to form circular or oval impressions; admedian lobes narrowly triangular anteriorly; lateral frontal processes flattened, their joint width 1.1-1.3 times that of frontoclypeal depression. Eye large, temple length/eye diameter ratio as 0.5-0.8. Antenna (fig. 46) with segment 1 bearing 2 large dorsal grooves; segment 2 small, subglobular; segments 3-5 elongate, widest subapically, each segment wider than preceding one; segments 6-11 strongly flattened, forming an indistinct club; segment 11 slightly longer than wide. Pronotum 1.3 times as long as wide, distinctly bordered at base, strongly widening towards apex; punctation coarse, sparser on disk with punctation-free longitudinal band in the middle. Elytra 2.5-2.8 times as long as wide, 2.1-2.2 times as long as pronotum; in male costa 3 forming large ridge subapically, female similar but ridge of costa 3 more inflated and oblique subapically; interval 3 longer than intervals 5 and 6 which are both longer than 4 apically; apex not emarginate. Genitalia as in figs 44, 45, 47-49.

Distribution. Recorded as *A. beccarii* from Aru Island and New Guinea: Ramoi (GROUVELLE, 1883), as *A. arrowi* from the Moluccas: Makian and Kajoa Islands, and as *A. castelnaui* from Malaysia (GROUVELLE, 1913a; HETSCHKO, 1930). Material examined. Malaysia: holotype ♂ of *A. castelnaui*, Malacca; 1♀, Perat, Chenderoh, 16.ii.1935, ex Myrtaceae (BMNH). Sumatra: 1♂, Tjinta Radja, T. Nevermann (USNM). Aru Island: lectotype ♀ of *A. beccarii* (MCSN); 1♀, same, Unreiuning, 1884, C. Ribbe (ZMHB). New Guinea: paralectotypes of *A. beccarii* 2♀, Ramoi, ii. O. Beccari (MCSN, MNHN); 2♀, Papua New Guinea, Stony L. A., 17.iv.1969, 24,vii.1976, ex *Toona* and unknown host, H. Roberts (BMNH); 1♂, same, Fly River, Kiunga, viii.1969, J. Sedlacek (BPBM); 1 specimen, same, Lae, 11.xi.1978, N-311, L. Deharveng (MHNG).

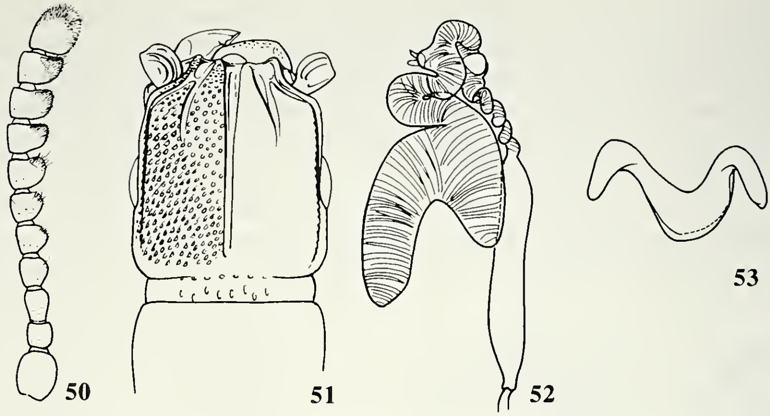
Ancistria bicolorata sp. n. (Figs 50-53)

Description. Length 7.5 mm. Black, tibial spurs and apical tarsal segments reddish brown, apical 4 abdominal sternites brown, elytra reddish brown with narrow black transverse bands at base and in the the middle; surface mostly mat. Head (fig. 51) 1.2 times as long as wide, coarsely punctate laterally, slightly finer on disk; midline impressed; admedian lines moderately long, almost straight, admedian lobes narrowly triangular, ending anteriorly almost level with lateral frontal processes which are careniform and whose combined width is 0.4 times that of frontoclypeal depression. Eye large, temple length/eye diameter ratio as 0.9. Antenna (fig. 50) with segment 1 bearing 2 to 3 indistinct dorsal grooves; segment 2 subglobular; segment 3 oval; segments 4 and 5 asymmetrically oval; segments 6-11 flattened, forming an indistinct club; segment 11 as long as wide. Pronotum 1.6 times as long as wide, bordered at base,



FIGS 43-49

Ancistria beccarii. 43, head, dorsal view; 44, parameres; 45, median lobe, apical piece; 46, antenna; 47, ostium bursae; 48, sternite and tergite VIII; 49, spermatheca.



Figs 50-53

Ancistria bicolorata. 50, antenna; 51, head, dorsal view; 52, spermatheca; 53, ostium bursae.

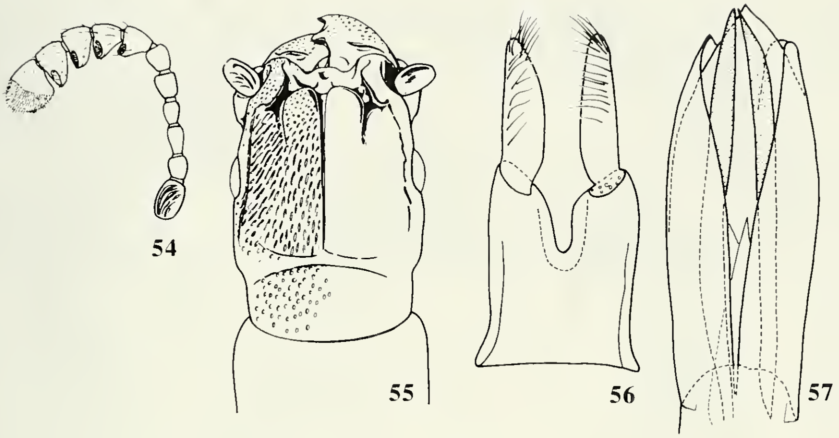
strongly widened in basal third, subparallel in apical two thirds; punctation coarser than on head, sparser on disk. Elytra 3.5 times as long as wide, 2.3 times as long as pronotum; costa 3 strongly, costa 5 weakly inflated subapically; interval 4 shortest followed by 6, 5 and 3 which is longest; apex with V-shaped emargination, without tooth at suture. Genitalia as in figs 52, 53.

Material examined. Holotype ♀, Vietnam: East Tonkin, region of Hoa Binh, 1918, R. P. A. de Cooman (MNHN).

Ancistria bostrychoides Grouvelle (Figs 54-57)

Ancistria bostrychoides Grouvelle, 1908: 454. Lectotype ♂, Sikkim: (MNHN); here designated (examined).
Ancistria (Ancistria) bostrychoides Grouvelle: Grouvelle, 1913a: 444.

Description. Length 8.0 mm. Black, venter of abdomen dark brown; surface mostly shiny. Head (fig. 55) 1.2 times as long as wide, strigosely punctate; median line impressed, except for base; admedian lines short, strongly curved, admedian lobes short, their largest width near apex which is obliquely truncate; lateral frontal processes flattened, their joint width 0.5 times that of frontoclypeal depression. Eye small, temple length/eye diameter ratio as 1.7. Antenna (fig. 54) with segment 1 bearing 1 distinct and 1-2 indistinct dorsal grooves; segment 2 subglobular; segment 3 clavate; segments 4-6 oval; segments 7-11 flattened, forming distinct club; segment 11 distinctly longer than wide. Pronotum 1.5 times as long as wide, bordered at base, evenly widening almost to apex; punctation somewhat coarser than on head, leaving indistinct longitudinal puncture-free stripe in the middle. Elytra 2.8 times as long as their joint width, 2.2 times as long as pronotum; costa 3 strongly swollen and oblique subapically; interval 3



Figs 54-57

Ancistria bostrychoides. 54, antenna; 55, head, dorsal view; 56, parameres; 57, median lobe, apical piece.

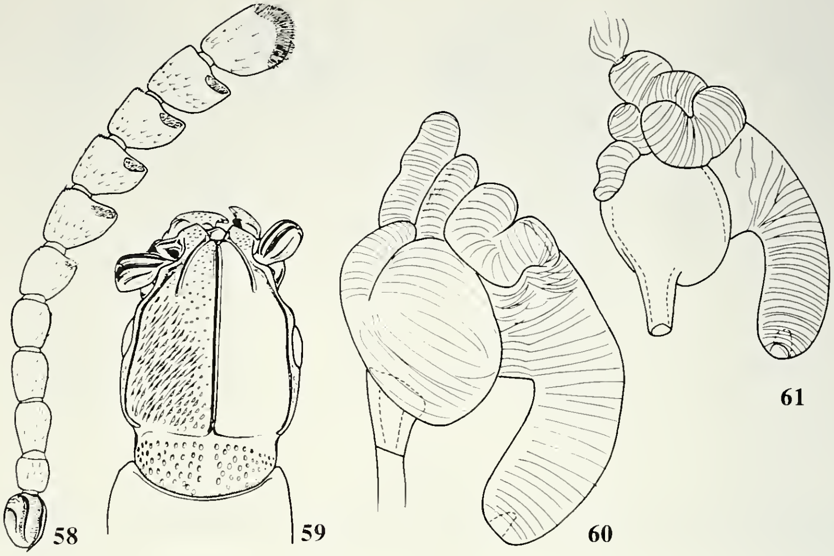
longest, 4 shortest and 5 intermediate; apex with V-shaped emargination, without sutural tooth. Genitalia as in figs 56, 57.

Distribution. Recorded from Sikkim (Grouvelle, 1908, 1913a; Hetschko, 1930). Material examined. India: lectotype ♂, Sikkim (MNHN).

Ancistria bouchardi Grouvelle (Figs 58-61)

Ancistria (Parancistria) bouchardi Grouvelle, 1913a: 474. Lectotype ♀, Sumatra: Palembang, Bouchard (MNHN); here designated (examined).

Description. Length 5.7-8.9 mm. Dark brown, apical half of elytra light or chestnut brown except for apex which has a dark spot along the suture; surface mostly mat. Head (fig. 59) 1.2 times as long as wide, finely, laterally strigosely punctate; median line impressed, admedian lines moderately short, almost straight, admedian lobes narrowly triangular; lateral frontal processes flat, their joint width 1.8-2.3 times that of frontoclypeal depression. Eye moderately large, temple length/eye diameter ratio as 1.2-1.6. Antenna (fig. 58) with segment 1 bearing 2 distinct wide dorsal grooves, delimited by 3 subparallel ridges; segment 2 subglobular; segment 3 clavate, segments 4 and 5 irregularly oval; segments 6-11 strongly flattened, forming club; segment 11 longer than wide. Pronotum 1.6-1.7 times as long as wide, incompletely bordered at base, widening in basal half, with subparallel margins in apical half; punctation much coarser than on head, somewhat irregularly spaced, leaving narrow longitudinal median puncture-free band in basal three quarters. Elytra 3.0-3.2 times as long as wide, 2.0-2.1 times as long as pronotum; costa 3 weakly inflated subapically, weakly oblique, costae 4 and 6 merging subapically; intervals 3 and 6 subequal, longer than subequal intervals



Figs 58-61

Ancistria bouchardi. 58, antenna; 59, head, dorsal view; 60, 61, spermatheca; 60, lectotype.

4 and 5; apex truncate, without or with indistinct tooth at suture. Genitalia as in figs 60, 61.

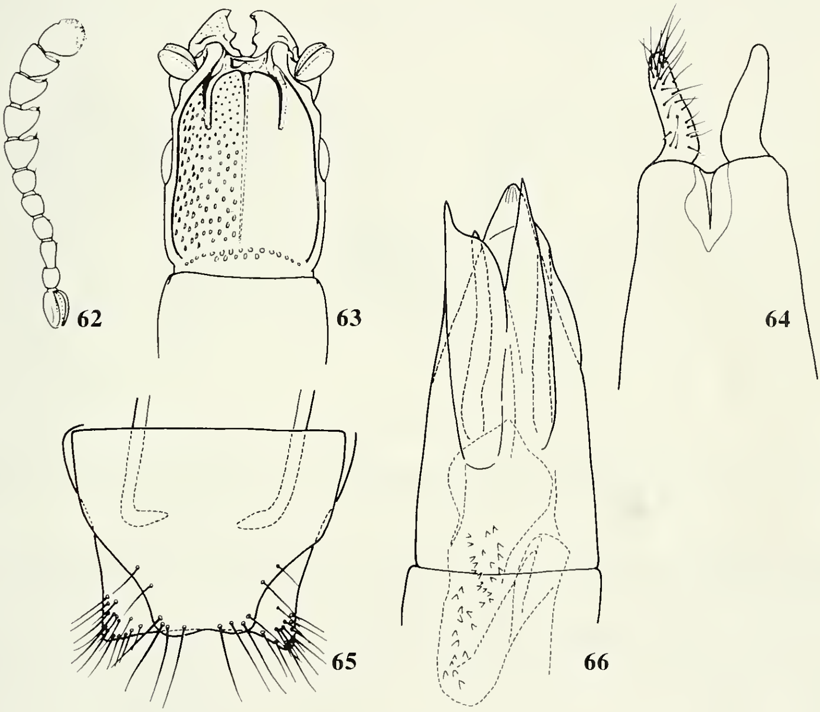
Distribution. Recorded from Sumatra (Grouvelle, 1913a; Hetschko, 1930). Material examined. Indonesia: lectotype ♀, Sumatra (MNHN). Without locality data: 1♀ (ZMPA).

Comments. The type series includes, apart from the lectotype, 1♂ paralectotype from the same locality which is similar to *A. micros* (cf. comments on *A. micros*).

Ancistria brancuccii sp. n. (Figs 2, 8, 62-66)

Description. Length 5.1-6.6 mm. Dark brown to black, legs chestnut brown; surface shiny. Head (figs 2, 63) 1.4-1.6 times as long as wide, finely punctate; median line impressed, weak in basal third, evanescent at base, admedian line moderately long, strongly curved or bent, admedian lobes short, their largest width near apex, apex obliquely truncate; lateral frontal processes flattened, their joint width 0.9-1.2 times that of frontoclypeal depression. Eye small, temple length/eye diameter ratio as 1.7-1.9. Antenna (fig. 62) with segment 1 bearing 2 shallow dorsal grooves; segment 2 subglobular; segment 3 clavate; segments 4-6 irregularly oval; segments 7-11 moderately flattened forming a distinct club; segment 11 distinctly longer than wide. Pronotum 1.8-2.0 times as long as wide, not bordered at base, widening in basal half, with subparallel margins in apical half; punctation coarser than on head, in the middle leaving puncture-free longitudinal band. Elytra 3.5-3.8 times as long as their joint width, 1.9-2.1 times as long as pronotum; costa 3 weakly inflated subapically, costae 4 and 5 merging subapically; interval 3 longer than 4 which is shorter than 5, interval 6 not impressed; apex truncate with V-shaped incision at suture, with small sutural tooth (fig. 8). Genitalia as in figs 64-66.

Material examined. Holotype ♂, East Nepal: Arun Valley, Mure - Num, 1550-2000 m, 4-7.vi.1983, M. Brancucci (NHMB). Paratypes. Nepal: 18♂, same data as holotype (NHMB, MHNG, ZMPA); 2♂, same but Chichila, 1950 m, 31.v.1983 (NHMB); 1♂, same but Num - Hedanga, 800- 1500 m, 7.vi.1983; 1♂, Num, 1550 m, 5-6.vi.1983; 2♂, East Nepal, Koshi, Lumbughat - Saiseghat, 450 m, 15.vi.1985, M. Brancucci (NMHB).

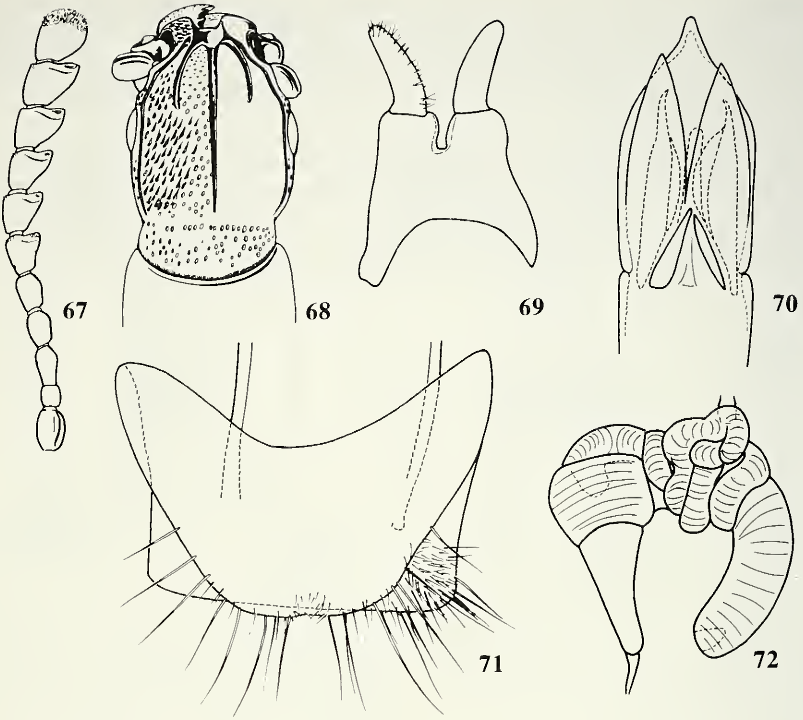


Figs 62-66

Ancistria brancuccii. 62, antenna; 63, head, dorsal view; 64, parameres; 65, sternite and tergite VIII; 66, median lobe, apical piece.

Ancistria concava sp. n. (Figs 67-72)

Description. Length 4.6-5.4 mm. Almost black, legs and abdominal venter dark brown, elytra black at base, irregularly dark brown in apical two thirds; head mat, pronotum and elytra shiny. Head (fig. 68) 1.2 times as long as wide; punctation fine,



FIGS 67-72

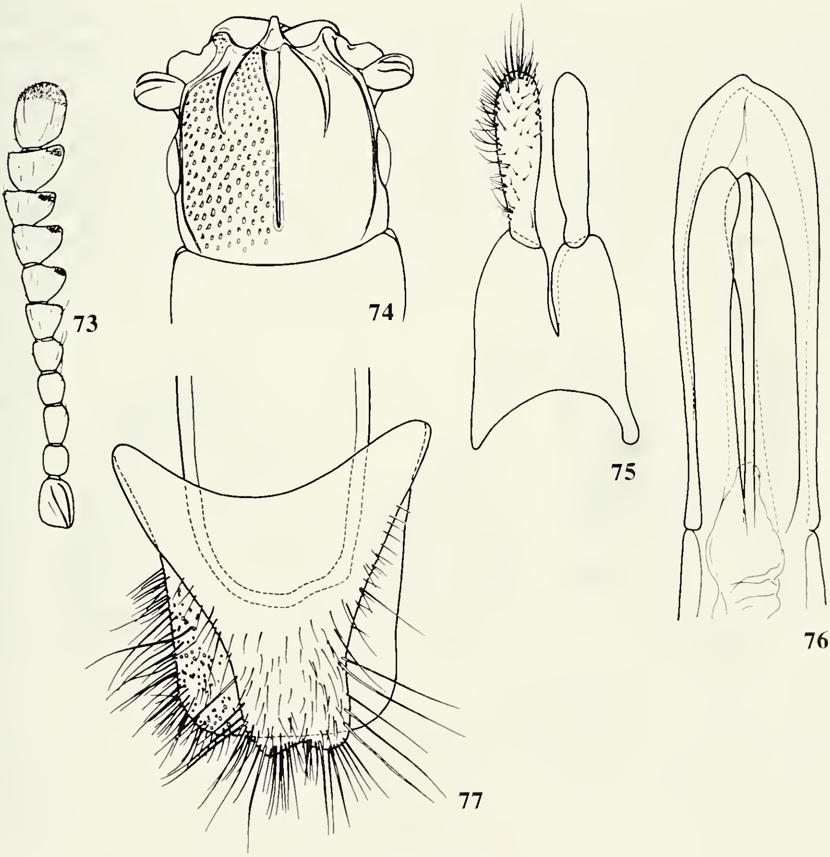
Ancistria concava. 67, antenna; 68, head, dorsal view; 69, parameres; 70, median lobe, apical piece; 71, sternite and tergite VIII; 72, spermatheca.

slightly strigose; median line strongly impressed in apical half gradually getting weaker towards base, absent from basal part; admedian lines moderately long, weakly curved, admedian lobes narrowly triangular; lateral frontal processes flattened, their joint width 2.4-3.4 times that of frontoclypeal depression. Eye moderate in size, temple length/eye diameter ratio as 0.8-1.3. Antenna (fig. 67) with segment 1 bearing 2-3 grooves, 1 distinct, the other ones fine; segment 2 subglobular; segments 3-5 asymmetrically oval to clavate; segments 6-11 strongly flattened, forming distinct club; segment 11 distinctly longer than wide. Pronotum 1.7-1.8 times as long as wide, not bordered basally, widening in apical half, with subparallel margins in most of apical half; punctures as on head, slightly coarser at base, sparser on disk leaving puncture-free area in the middle. Eyltra 2.8-3.1 times as long as wide, 1.8 times as long as pronotum; costae 2 and 3 subequal, 4 shorter; intervals 3 and 5 subequal, 4 shorter; apex weakly emarginate with indistinct sutural tooth. Genitalia as in figs 69-72.

Material examined. Holotype ♀, Sumatra: Babahrot, 100 m, 15.viii.1983, J. Klapperich (MHNG). Paratype ♂, Philippines: Luzon, Laguna, Mount Makiling, 400 feet elevation, 26.viii.1930, ex branches of *Toona calentas*, F. C. Hadden (BPBM).

Ancistria cornuta sp. n. (Figs 73-77)

Description. Length 5.7 mm. Dark brown to black; surface mostly mat. Head (fig. 74) 1.0 times as long as wide, moderately punctate; median line impressed except for base; admedian lines long, impressed, weakly curved; admedian lobes narrowly triangular; lateral frontal processes careniform, their joint width 0.5 times that of frontoclypeal depression which bears a small horn in the middle. Eye large, temple width/eye diameter ratio as 0.6. Antenna (fig. 73) with segment 1 bearing 2 shallow dorsal grooves; segment 2 subglobular; segment 3 clavate; segments 4-6 asymmetrically widening towards apex, gradually enlarged from segment 4 to 6; segments 7-11 flattened, forming an indistinct club; segment 11 sightly longer than wide. Pronotum 1.3 times as long as wide, distinctly bordered at base, strongly widening in basal half,



Figs 73-77

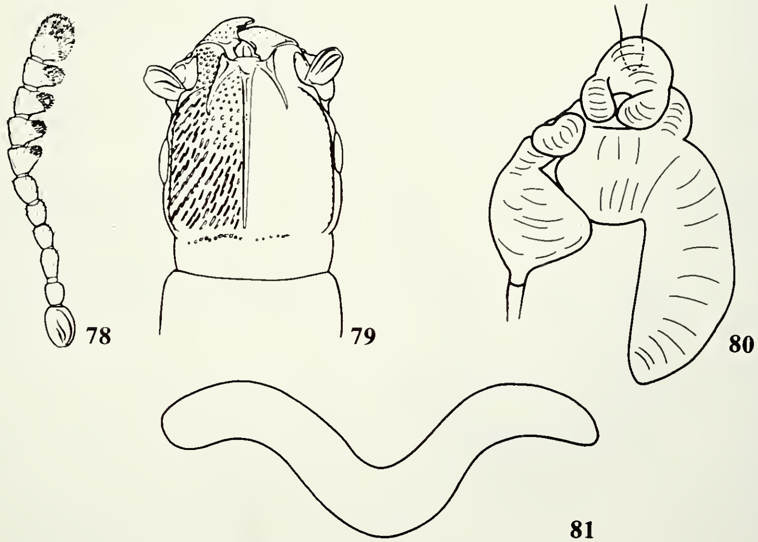
Ancistria cornuta. 73, antenna; 74, head, dorsal view; 75, parameres; 76, median lobe, apical piece; 77, sternite and tergite VIII.

with subparallel margins in apical half; punctation coarser than on head. Elytra 3.0 times as joint width, 2.3 times as long as pronotum; costa 3 swollen and oblique subapically; intervals getting gradually longer from 3 to 6; apex with V-shaped incision at suture, without sutural tooth. Genitalia as in figs 75-77.

Material examined. Holotype ♂, Laos: Monhot, G. Lewis collection B.M. 1910-248 (BMNH).

Ancistria costata sp. n. (Figs 78-81)

Description. Length 6.9 mm. Head and thorax black, elytra very dark brown; surface moderately shiny. Head (fig. 79) 1.1 times as long as wide, relatively convex dorsally, with strigose punctation; median line impressed; admedian lines moderately long, straight, admedian lobes narrowly triangular; lateral frontal processes flattened, their joint width 1.1 times that of frontoclypeal depression. Eye large, temple length/eye width ratio as 0.9. Antenna (fig. 78) with segment 1 bearing 2 distinct, unequal dorsal grooves; segment 2 subglobular; segments 3-6 oval; segments 7-11 flattened, forming a distinct club; segment 11 distinctly longer than wide. Pronotum 1.6 times as long as wide, bordered at base, widening in basal quarter from there to apex with subparallel margins; punctation slightly coarser than on head, denser at base, leaving longitudinal median puncture-free stripe. Elytra 3.1 times as long as wide, 2.1 times as long as



Figs 78-81

Ancistria costata. 78, antenna; 79, head, dorsal view; 80, spermatheca; 81, ostium bursae.

pronotum; costa 3 strongly raised forming oblique ridge which reaches subapically the fused costae 7 and 8 which form a ridge, costa 5 merging with costa 3; intervals 3 and 4 merging subapically, shorter than merging intervals 5 and 6; with V-shaped incision at suture, without sutural tooth. Genitalia as in figs 80, 81.

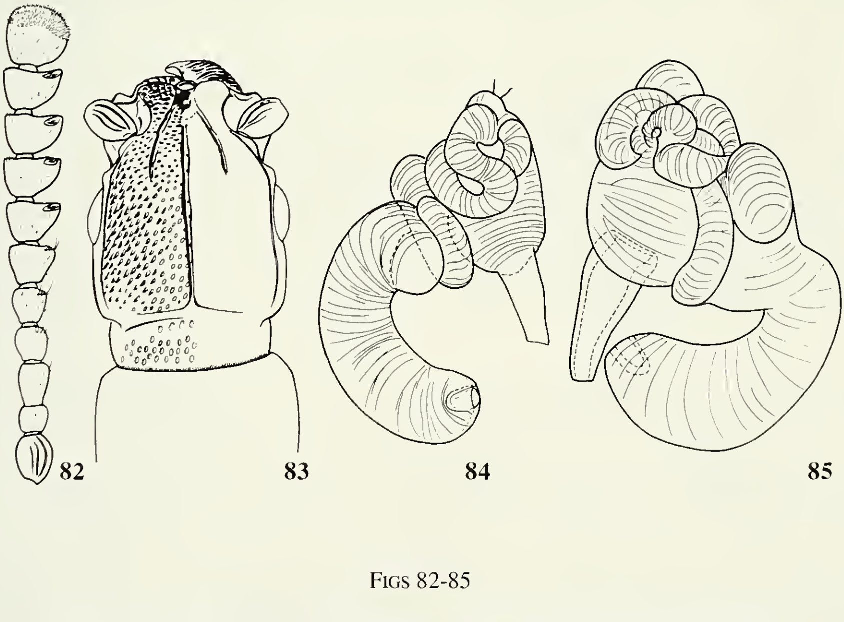
Material examined. Holotype ♀, "British Bootang": 1899, M . Basti (MNHN).

Comments. We were unable to locate "British Bootang". In the MNHN are other passandrids with the same locality labels, or with "British Bootan, Padong".

Ancistria emarginata Grouvelle (Figs 82-85)

Ancistria emarginata GROUVELLE, 1913b: 56. Holotype ♀, Taiwan: Hoozan, 1908-1910, H. Sauter (DEIC); (examined).

Description. Length 5.7-7.9 mm. Black, legs dark brown; surface mostly mat. Head (fig. 83) 1.2 times as long as wide; finely, laterally strigosely punctured; median line impressed almost to base; admedian lobes narrowly triangular; lateral frontal processes flattened, their joint width 4.5-5.0 times that of frontoclypeal depression. Dorsal surface of mandibles transversely rugose (fig. 83). Eye moderately large; temple length/eye diameter ratio as 1.1-1.2. Antenna (fig. 82) with segment 1 bearing 2 distinct grooves; segment 2 subglobular; segment 3 clavate; segments 4 and 5 asymmetrically oval; segments 6-11 flattened, forming club; segment 11 as long as wide. Pronotum 1.6-1.7 times as long as wide, base not distinctly bordered, strongly widened in basal half,



FIGS 82-85

Ancistria emarginata. 82, antenna; 83, head, dorsal view; 84, 85, spermatheca.

with subparallel margins in apical half; punctation coarser than on head, unevenly spaced leaving a puncture-free longitudinal band in basal two thirds. Elytra 3.2-3.4 times as long as wide, 2.1-2.3 times as long as pronotum; costa 3 weakly inflated subapically; interval 3 longer than 4 which is shorter than 5; apex distinctly emarginate, sutural apex with tooth. Genitalia as in figs 84, 85.

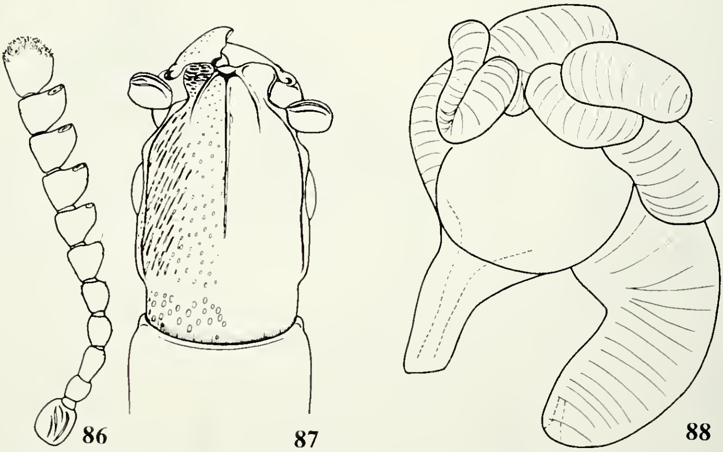
Distribution. Recorded from Taiwan (Grouvelle, 1913b; Hetschcko, 1930). Material examined. Taiwan: holotype ♀ (DEIC). China: 3♀, Sichuan, Mount Emei, 600-1050 m, 5-19.v.1889, L. Bocàk (ZMPA, MHNG).

Ancistria fabricii Reitter (Figs 86-88)

Ancistria fabricii Reitter, 1877: 134. Lectotype ♀, Southeast Asia [India orientalis] (MNHN); here designated (examined).

Ancistria (Ancistria) fabricii Reitter; Grouvelle, 1913a: 494.

Description. Length 4.5 mm. Head and thorax dark chestnut brown, elytra and legs somewhat lighter; surface mostly mat. Head (fig. 87) 1.2 times as long as wide, with very fine, laterally slightly strigose punctation; median line evenly impressed from base to apex; admedian lines moderately long, almost straight, admedian lobes narrowly triangular; lateral frontal processes flattened, their joint width 3.0 times that of frontoclypeal depression. Eye large, temple length/eye diameter ratio as 1.0. Antenna (fig. 86) with segment 1 bearing each 1 distinct and 1 indistinct dorsal groove; segment 2 subglobular; segment 3 clavate; segments 4-5 oval; segments 6-11 flattened, forming distinct club; segment 11 longer than wide. Pronotum 2.0 times as long as wide, not



Figs 86-88

Ancistria fabricii. 86, antenna; 87, head, dorsal view; 88, spermatheca.

bordered at base, widening towards the middle, apical half with subparallel margins; punctation much coarser than on head, covering whole surface, slightly denser anteriorly. Elytra 3.2 times as long as wide, 2.0 times as long as pronotum; costa 3 slightly thickened and weakly oblique subapically, costae 4 and 5 merging apically; interval 3 longer than 5, which is longer than 4; apex truncate with V-shaped incision at suture, without sutural tooth. Genitalia as in fig. 88.

Distribution. Reported from Southeast Asia (REITTER, 1877; GROUVELLE, 1913a; HETSCHKO, 1930). Material examined. Southeast Asia: lectotype ♀ (MNHN).

Ancistria foraminifrons sp. n. (Figs 89-96)

Ancistria tarsalis sensu GROUVELLE, 1913a: 453, nec WATERHOUSE, 1876: 121.

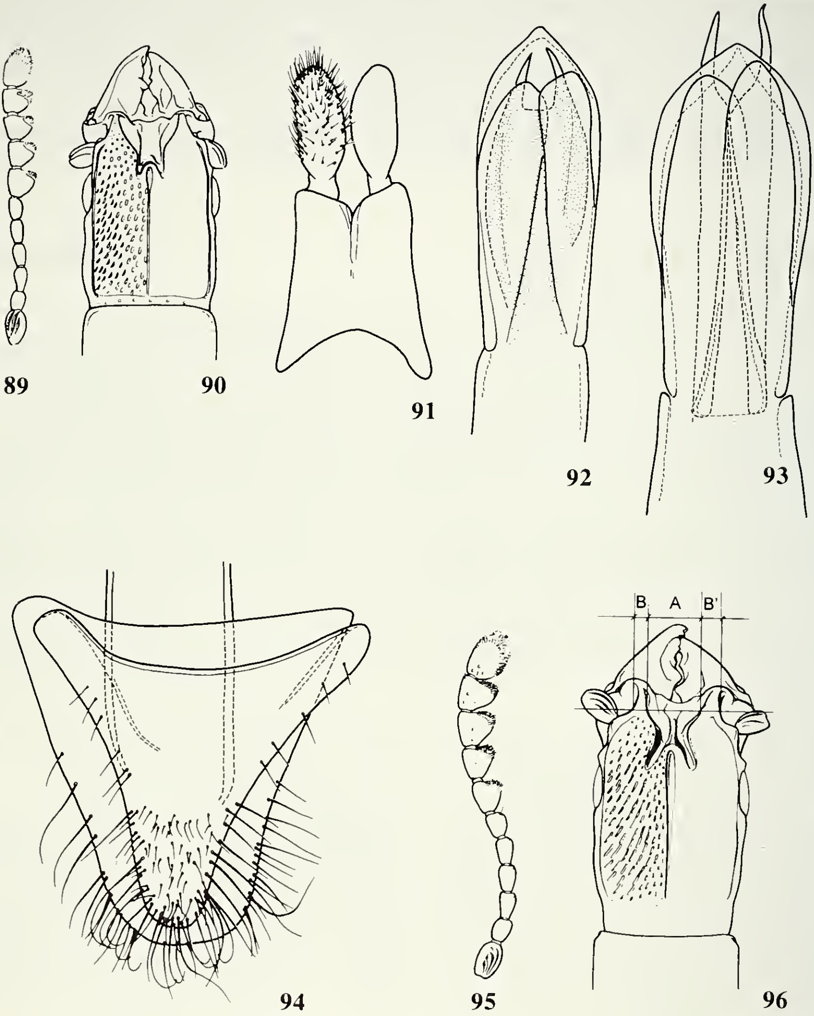
Description. Length 6.9-8.9 mm. Dark brown to black; surface shiny. Head (figs 90, 96) 1.2-1.5 times as long as wide, covered in moderately fine strigose punctation; median line indistinct in basal two thirds, grooved in apical third; admedian lines very short and deep, admedian lobes short, triangular; lateral frontal processes careniform, their joint width 0.7-1.2 times that of frontoclypeal depression. Eye small, temple length/eye diameter ratio as 1.7-2.0. Antenna (figs 89, 95) with segment 1 bearing 2 shallow dorsal grooves; segment 2 oval; segments 3-6 oval to shortly clavate; segments 7-11 flattened, forming a distinct club; segment 11 distinctly longer than wide. Pronotum 1.8-2.0 times as long as wide, entirely bordered at base, strongly narrowed in basal third; punctation coarser than on head, sparser medially in basal two thirds. Elytra 4.2-4.6 times as long as wide, 2.3-2.5 times as long as pronotum; costa 3 inflated subapically, costae 4-6 merging together at level of inflated portion of costa 3; interval 3 longer than intervals 4 to 6 which are gradually increasing in length apically; apex with V-shaped incision at suture, lacking a sutural tooth. Genitalia as in figs 91-94.

Distribution. Recorded as *A. tarsalis* from Sumatra (GROUVELLE, 1913a). Material examined. Holotype ♂, Papua New Guinea: EH Province, region of Kainantu Onerunka, 18.xii.1979, W. G. Ullrich (MHNG). Paratypes. Papua New Guinea: 1♂, same as holotype but 4.ii.1980; NE New Guinea, S Garaina, 900 m, 15-21.i.1968, J. & M. Sedlacek (BPBM); 1♂, West New Guinea, Star Mountains, Sibil Valley, 1245 m, 18.x.-8.xi.1961, S. Quate (BPBM). Java: 1♂, Mount Preanger, 1400 m, 24.vi.1927, L. G. E. Kalshoven (RMNH). Sumatra: 4♂, Si-Rambé, xii.1890-iii.1891, E. Modigliani (MCSN, MNHN) (specimens identified as *A. tarsalis* by Grouvelle).

Ancistria grouvellei nomen nov. (Figs 97-99)

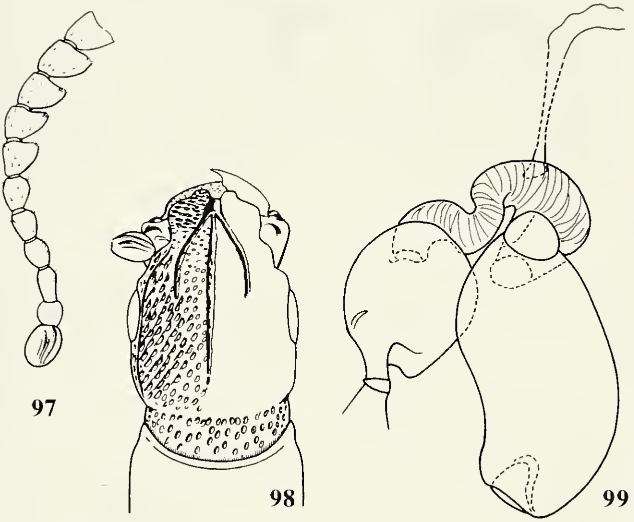
Ancistria (Parancistria) filum GROUVELLE, 1913a: 484. Holotype ♀, New Guinea: Dorey, Pascoe collection 93-60 (BMNH); (examined). Junior primary homonym of *Ancistria filum* REITTER, 1876: 39 (= *Taphroscelidia filum* (Reitter); BURCKHARDT & SLIPINSKI, 1991).

Description. Length 5.1 mm. Dark brown to almost black, antennae and legs somewhat lighter, apical half of elytra reddish brown, abdominal venter brown; surface mostly mat. Head (fig. 98) 1.2 times as long as wide; punctation strigose laterally; median line distinct in apical half, very fine in basal half; admedian lines moderately



FIGS 89-96

Ancistria foraminifrons. 89, 95, antenna; 90, 96, head, dorsal view; 91, parameres; 92, 93, median lobe, apical piece; 94, sternite and tergite VIII.



FIGS 97-99

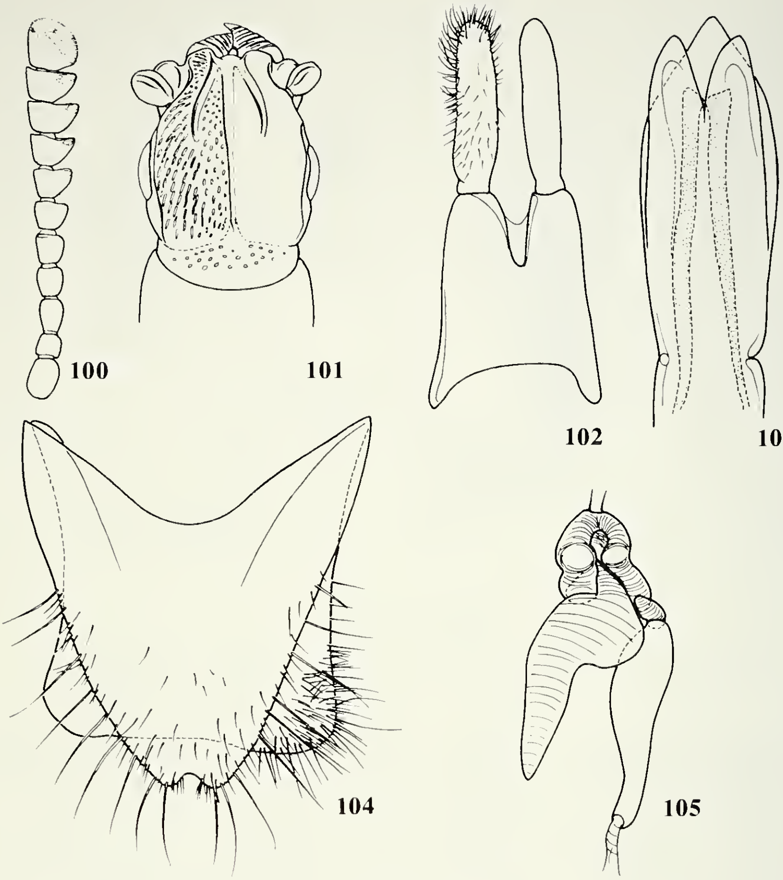
Ancistria grouvellei. 97, antenna; 98, head, dorsal view; 99, spermatheca.

long, straight, admedian lobes narrowly triangular; lateral frontal processes flattened, bearing a blunt, foreward directed tubercle antero-medially, their joint width 9.5 times that of frontoclypeal depression. Eye large, temple length/eye diameter ratio as 0.9. Antenna (fig. 97) with segment 1 bearing 2 fine dorsal grooves; segment 2 subglobular; segments 3-6 oval; segments 7-11 flattened, forming a distinct club; segment 11 longer than wide. Pronotum 1.9 times as long as wide, not bordered at base, widening in basal half, apical half mostly with subparallel margins; sparsely punctate, sparser at base and on disk. Elytra 3.4 times as long as wide, 1.9 times as long as pronotum; costa 3 not markedly inflated subapically, costae 4-6 merging subapically; interval 3 long, intervals 4 and 5 much shorter; apex weakly emarginate, hardly incised at suture, with indistinct sutural tooth. Genitalia as in fig. 99.

Distribution. Recorded from New Guinea (GROUVELLE, 1913a; HETSCHKO, 1930). Material examined. New Guinea: holotype ♀ (BMNH); 1♀, Koitaki, 1500 feet, xi-xii.1928, Pemberton (BPBM).

Ancistria indica sp. n. (Figs 100-105)

Description. Length 6.0-6.6 mm. Black; surface shiny. Head (fig. 101) 1.1 times as long as wide, with coarse strigose punctation; median line impressed from base to apex; admedian lines straight, long, admedian lobes narrowly triangular, lateral frontal processes flattened, their combined width 1.7-2.0 times that of frontoclypeal



Figs 100-105

Ancistria indica. 100, antenna; 101, head, dorsal view; 102, parameres; 103, median lobe, apical piece; 104, sternite and tergite VIII; 105, spermatheca.

depression. Mandibles transversely rugose dorsally. Eye large, temple length/eye diameter ratio as 0.6-0.7. Antenna (fig. 100) with segment 1 bearing 1-2 indistinct dorsal grooves; segment 2 subglobular; segment 3 clavate; segments 4-6 short, asymmetrically widening towards apex; segments 7-11 flattened, forming an indistinct club; segment 11 slightly longer than wide. Pronotum 1.6-1.7 times as long as wide, bordered at base, strongly widening in basal half, weakly narrowing toward apex in apical half; anteriorly finely, otherwise coarsely punctured as on head, a narrow longitudinal, median band without punctures. Elytra 3.1 times as long as wide, 2.0-2.2 times as long as pronotum: costa 3 distinctly inflated subapically, costae 4 merging with 5 and both together with 6; intervals increasing in length apically from 3 to 6; apex with U-shaped incision at suture, sutural tooth indistinct. Genitalia as in figs 102-105.

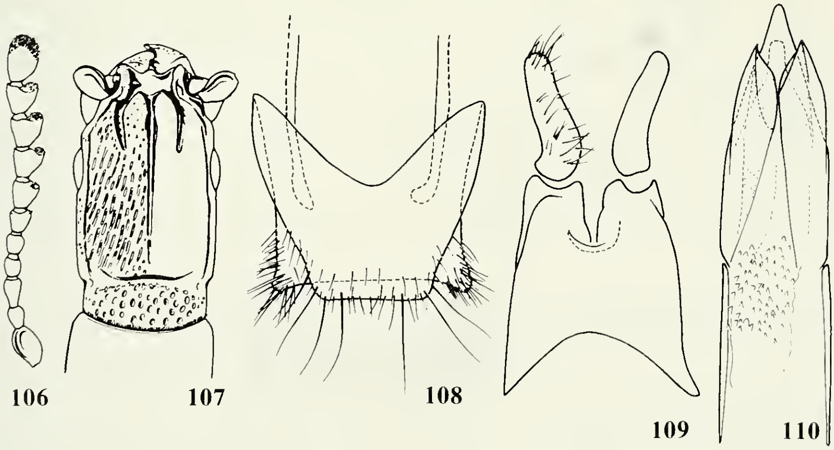
Material examined. Holotype ♂, India: Dehra Dun Coll. B. M. 1932-26 (BMNH). Paratypes. India: 2♂, 1♀, same data as holotype, 1♂ in addition with following information: Tamil Nadu, Anamalai hills, 2400, Madras, 15.iii.1930, J. C. M. Gardner (BMNH, MHNG).

Comments. Even though only one specimen bears a label, indicating that it was collected in Southern India, it is likely that the whole type series has the same origin. The series came probably via the Dehra Dun collection to the BMNH were the "Dehra Dun coll." labels were added .

Ancistria lewisi Reitter (Figs 106-110)

Ancistria lewisi Reitter, 1889: 315. Lectotype, Japan: Yuyama in Higo, 1.vi.1881, G. Lewis, labelled "Nagasaki, 22.v.-3.vi.1881, G. Lewis" (BMNH); here designated (examined).
Ancistria (Parancistria) lewisi Reitter; Grouvelle, 1913a: 488.

Description. Length 4.8 mm. Dark chestnut brown, elytra in subapical quarter lighter; surface mostly mat. Head (fig. 107) 1.5 times as long as wide, with fine strigose punctation; median line basally weakly, apically distinctly impressed; admedian lines moderately long, strongly curved, admedian lobes widest subapically and then suddenly narrowing towards apex; lateral frontal processes careniform, their joint width 0.9 times that of frontoclypeal depression. Eye small, temple length/eye diameter ratio as 1.9. Antenna (fig. 106) with segment 1 bearing 2 weak dorsal grooves; segment 2 subglobular; segment 3 clavate; segments 4-6 irregularly oval; segments 7-11 flattened, forming a distinct club; segment 11 distinctly longer than wide. Pronotum 2.0 times as long as wide, not bordered at base, strongly widening in basal two thirds, with almost subparallel margins in apical third; punctation coarser than on head, slightly sparser on disk. Elytra 4.1 times as long as wide, 2.0 times as long as pronotum; costa 3 hardly



Figs 106-110

Ancistria lewisi. 106, antenna; 107, head, dorsal view; 108, sternite and tergite VIII; 109, parameres; 110, median lobe, apical piece.

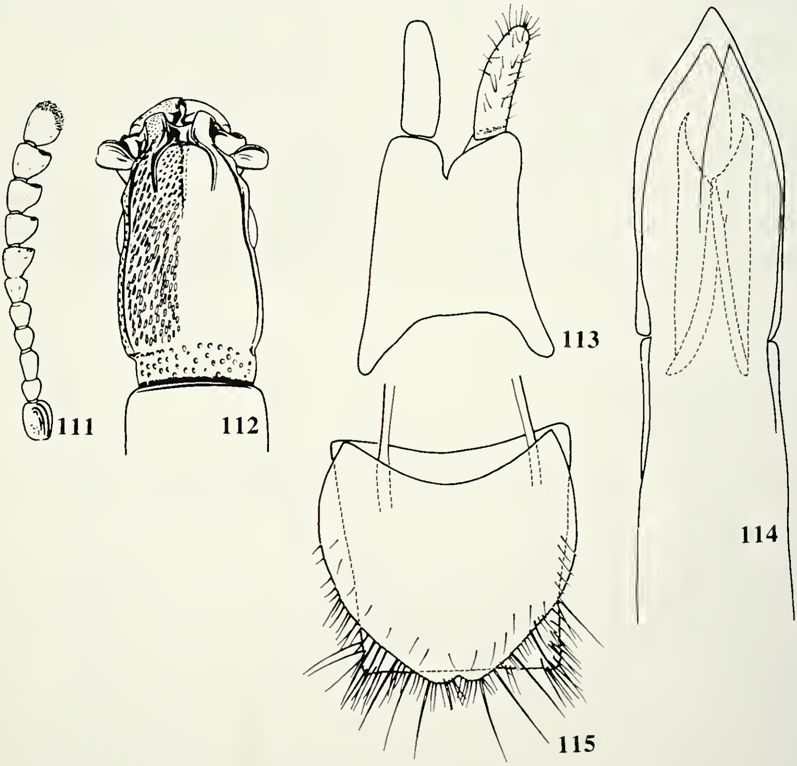
inflated subapically; interval 5 shorter than 3 but longer than interval 4, interval 6 indistinct; apex weakly emarginate, small sutural tooth present. Genitalia as in figs 108-110.

Distribution. Recorded from Japan (Reitter, 1889; Grouvelle, 1913a; Hetschko, 1930). Material examined. Japan: holotype, Nagasaki (BMNH); 1♂ paralectotype, Higo (HNMH).

Comments. According to Reitter's (1889) indications the type material was collected at Yuyama in Higo. The lectotype in the BMNH is labelled "Nagasaki"; this label has been added later and is certainly wrong. A paralectotype in the HNHM bears the same data as mentioned in the original description (Reitter, 1889) (cf. comments to *A. reitteri*).

Ancistria longicapitata sp. n. (Figs 111-115)

Description. Length 5.8 mm. Black, apical half of elytra chestnut brown; surface mostly mat. Head (fig. 112) 1.7 times as long as wide, with strigose punctation laterally; median line finely impressed in apical third, indistinct in basal two thirds;



Figs 111-115

Ancistria longicapitata. 111, antenna; 112, head, dorsal view; 113, parameres; 114, median lobe, apical piece; 115, sternite and tergite VIII.

admedian lines short, strongly angular, admedian lobes widest near apex, obliquely truncate apically; lateral frontal processes flattened, their joint width 1.1 times that of frontoclypeal impression. Eye small, temple length/eye diameter ratio as 1.9. Antenna (fig. 111) with segment 1 bearing 2-3 shallow dorsal grooves; segment 2 subglobular; segment 3 shortly clavate; segments 4-6 oval; segments 7-11 strongly flattened, forming a well-defined club; segment 11 slightly longer than wide. Pronotum 2.3 times as long as wide, not bordered at base, widened in basal half, with subparallel margins in apical half. Elytra 3.7 times as long as their joint width, 1.9 times as long as pronotum; costa 3 weakly thickened subapically, costae 4, 5 and 6 merging apically; intervals 4 and 5 subequal, shorter than 3 and 6; apex truncate, without sutural tooth. Genitalia as in figs 113-115.

Material examined. Holotype ♂, Papua New Guinea: Morobe Province, Wau, Mount Kaindi, 1150-2300 m, 20.i.-1.ii.1993, flight intercept trap in *Cordia*, Y. Basset (MHNG).

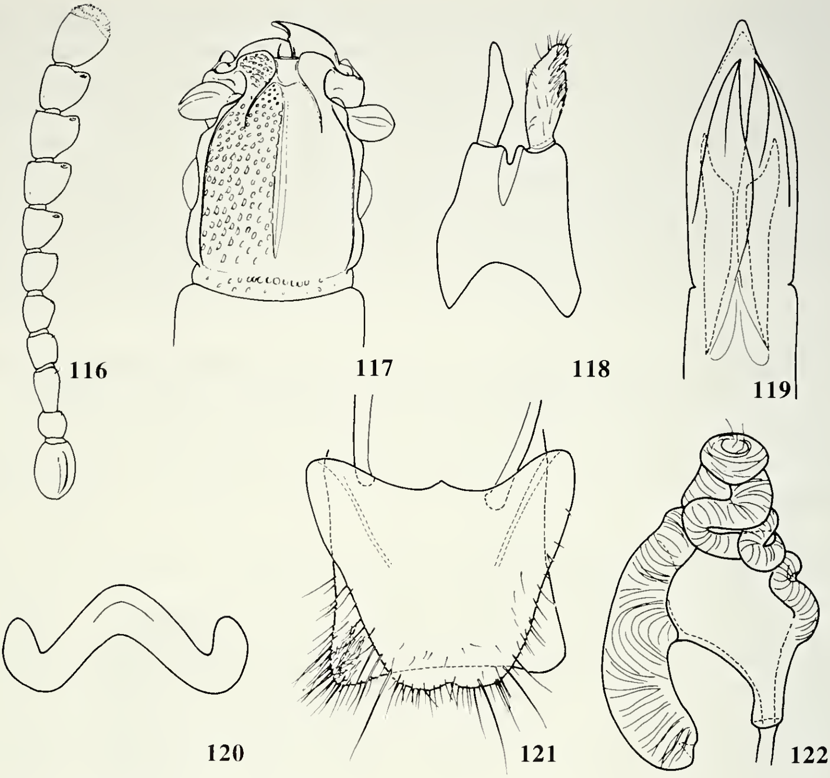
Ancistria micros Grouvelle (Figs 116-122)

Ancistria (Parancistria) micros GROUVELLE, 1913a: 482. Holotype ♀, Malaysia: Perak, Doherty (MNHN); (examined).

Description. Length 3.4-3.9 mm. Brown to dark chestnut brown, elytra somewhat lighter; surface mostly mat. Head (fig. 117) 1.2 times as long as wide; finely to coarsely punctate, sometimes strigose; median line impressed, fine; admedian lines moderately long, more or less straight, admedian lobes narrowly triangular; lateral frontal lobes flattened, their joint width 2.8-4.0 times that of frontoclypeal depression. Eye more or less convex, temple length/eye diameter ratio as 1.0-1.1. Antenna (fig. 116) with segment 1 bearing 1 distinct dorsal groove; segment 2 subglobular; segment 3 clavate; segments 4 and 5 oval; segments 6-11 flattened, forming a club; segment 11 longer than wide. Pronotum 1.6-1.8 times as long as wide, not bordered at base, widening in basal half, weakly narrowing towards the apex or with subparallel margins in apical half; punctation coarser than on head, sparser on disc, leaving puncture-free longitudinal band in the middle. Eyltra 3.1-3.2 times as long as wide, 2.0-2.1 times as long as pronotum; costa 3 weakly inflated subapically, costae 4 to 6 merging apically; intervals 3 and 6 longer than 4 and 5; apex truncate, without sutural tooth. Genitalia as in figs 118-122.

Distribution. Recorded from Malaysia (GROUVELLE, 1913a; HETSCHKO, 1930). Material examined. Malaysia: Holotype ♀, Perak (MNHN). Borneo: 1♂, Sabah, Tenompok, 10-19.ii. 1959, T. C. Maa (BPBM); 1 specimen, same, near Keningau, 20.iii.1989, M. Ito (KYUN); 1♂, Sarawak, Bau, Lake area, 29-30.viii.1958, T. C. Maa (BPBM).

Comments. A ♂ specimen from Sumatra: Palembang (MNHN), paralectotype of *A. bouchardi* Grouvelle) keys out with *A. micros*, but differs in following taxonomically relevant characters: the relatively wider and more impressed frontoclypeal depression, the narrower lateral frontal processes and the genitalia. The specimen may represent a new species but more material is necessary to confirm this.

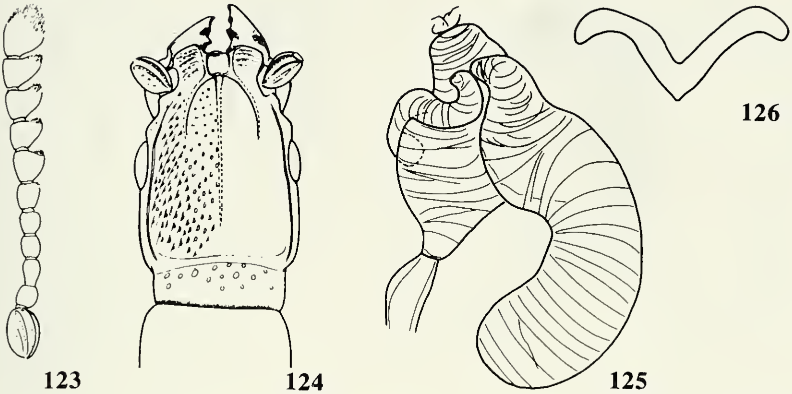


FIGS 116-122

Ancistria micros. 116, antenna; 117, head, dorsal view; 118, parameres; 119, median lobe, apical piece; 120, ostium bursae; 121, sternite and tergite VIII; 122, spermatheca.

Ancistria nepalensis sp. n. (Figs 123-126)

Description. Length 5.7-6.0 mm. Dark brown to black, legs brown; surface mostly shiny, head mat. Head (fig. 124) 1.3-1.4 times as long as wide, with strigose punctation; median line impressed apically getting weaker towards base; admedian lines moderately long, gently curved, admedian lobes narrowly triangular; lateral frontal processes flattened, their joint width 2.5-3.2 that of frontoclypeal depression. Eye large, temple length/eye diameter ratio as 1.2-1.6. Antenna (fig. 123) with segment 1 bearing 1 distinct and 1 indistinct dorsal grooves; segment 2 subglobular; segment 3 clavate; segments 4-6 oval, segments 7-11 flattened, forming distinct club; segment 11 longer than wide. Pronotum 2.0-2.1 times as long as wide, not or indistinctly bordered at base, widening towards middle, apical half with subparallel margins; punctation somewhat coarser than on head, absent from a longitudinal patch in the middle towards



Figs 123-126

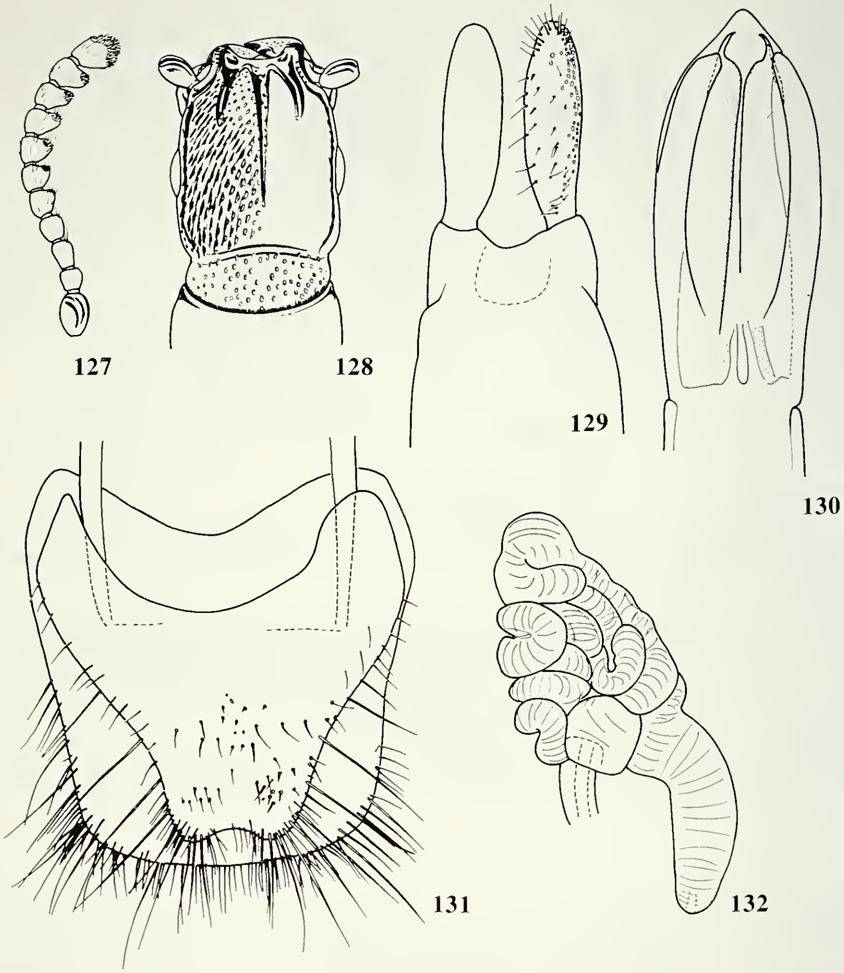
Ancistria nepalensis. 123, antenna; 124, head, dorsal view; 125, spermatheca; 126, ostium bursae.

the base. Elytra 3.6-4.1 times as long as wide, 2.0-2.1 times as long as pronotum; costa 3 slightly thickened subapically, costae 4 and 5 merging apically; interval 3 longer than 6, intervals increasing in length from 4 to 6; apex truncate, with V-shaped incision at suture, without sutural tooth. Genitalia as in figs 125, 126.

Material examined. Holotype ♀, Nepal: East Nepal, Arun Valley, Mure - Num, 1550-2000 m, 4-7.vi.1983, M. Brancucci (NHMB). Paratypes 4♀, same data as holotype (NHMB, MHNG).

Ancistria nicolettae sp. n. (Figs 9, 127-132)

Description. Length 6.9-7.4 mm. Dark chestnut brown to almost black, distal third of elytra sometimes lighter; surface mostly shiny. Head (fig. 128) 1.3 times as long as wide; moderately strigosely punctate; median line impressed except for apical quarter; admedian lines moderately long, weakly curved, admedian lobes narrowly triangular; lateral frontal processes careniform, their joint width 0.3-0.6 times that of frontoclypeal depression. Eye large, temple length/eye diameter ratio as 0.6-1.0. Antenna (fig. 127) with segment 1 bearing 2 indistinct dorsal grooves; segment 2 subglobular; segment 3 shortly clavate; segments 4 and 5 asymmetrically oval; segments 6 to 11 weakly flattened, forming an indistinct club; segment 11 slightly longer than wide. Pronotum 1.9-2.0 times as long as wide, distinctly bordered at base, strongly widening from base almost to apex; relatively evenly punctured, coarser than on head. Elytra 3.8-4.1 times as long as wide, 2.2 times as long as pronotum; costa 3 weakly inflated subapically, slightly oblique; intervals getting gradually shorter from 3 to 5; in males apex emarginate with small sutural tooth, in females apex truncate or weakly convex without sutural tooth (fig. 9). Genitalia as in figs 129-132.



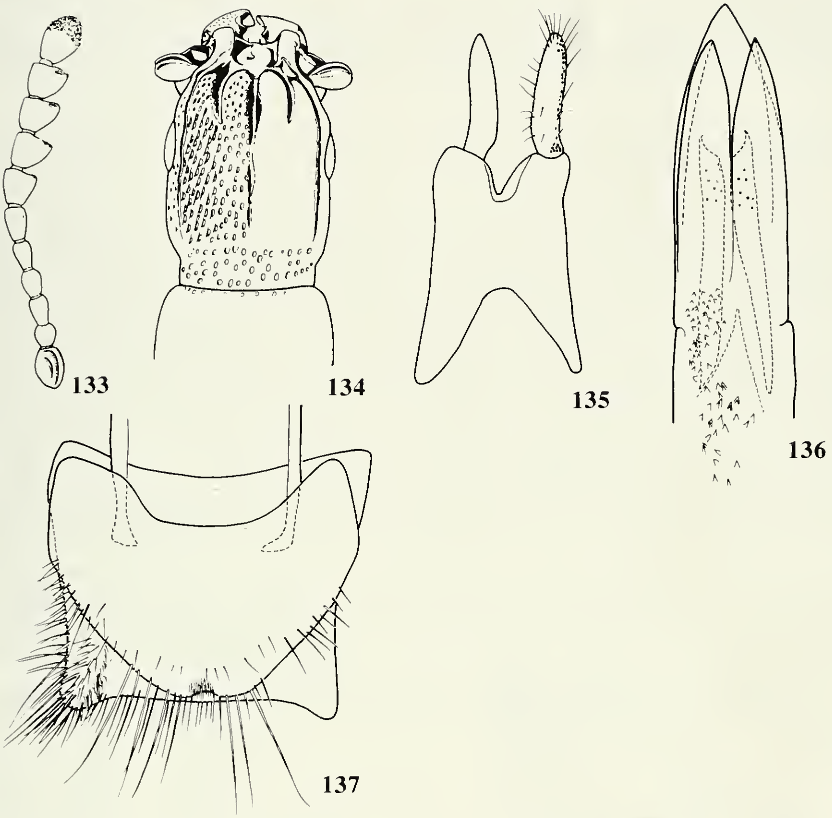
Figs 127-132

Ancistria nicolettae. 127 antenna; 128, head, dorsal view; 129, parameres; 130, median lobe, apical piece; 131, sternite and tergite VIII; 132, spermatheca.

Material examined. Holotype ♀, Philippines: N Palawan, Binaluan, xi-xii.1913, G. Boettcher (ZMHB). Paratypes. Philippines: 1♂, 1♀, same data as holotype (ZMHB, MHNG). Malaysia: 1♀, Selangor, Sg, Baloh F. R., 22.vi.1936, ex gallery of *Xyleborus* in *Dipterocarpus baudii*, F. G. Browne (BMNH). Borneo: 1♂, Sabah, Kalabakan, 10-19.xi.1958, T. C. Maa (BPBM). Sumatra: 1♂, North Brastagi, G. Sibayak, 1450-1900 m, 19-23.ii.1991, Bocák & Bocákova (NHMB).

Ancistria papuana sp. n. (Figs 133-137)

Description. Length 6.0 mm. Black, legs, apical 2-3 abdominal sternites and apical half of eyltra brown; surface shiny. Head (fig. 134) 1.3 times as long as wide,



FIGS 133-137

Ancistria papuana. 133, antenna; 134, head, dorsal view; 135, parameres; 136, median lobe, apical piece; 137, sternite and tergite VIII.

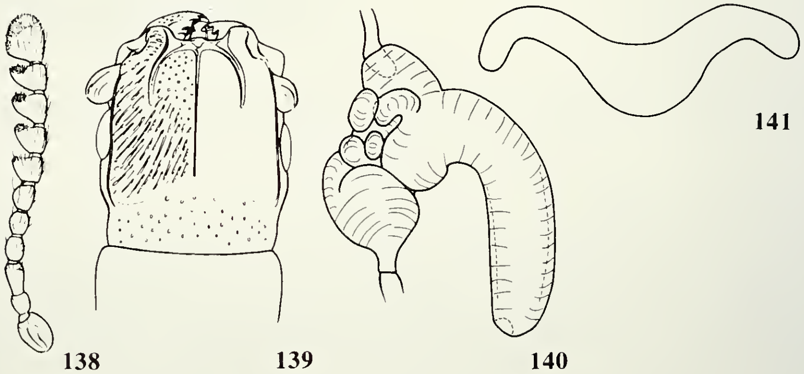
punctate; median line deeply impressed in apical half, indistinct in basal half; admedian lines relatively short, impressed and strongly curved, admedian lobes broadest near apex, obliquely trunctae apically; lateral frontal processes flattened dorsally, their combined width 1.1 times that of frontoclypeal depression. Eye small, temple length/eye diameter ratio as 1.6. Antenna (fig. 133) with segment 1 bearing 2 distinct dorsal grooves; segment 2 subglobular; segments 3-6 increasing in size, oval; segments 7-11 strongly flattened, forming a dinstinct club; segment 11 longer than wide. Pronotum 1.7 times as long as wide, bordered at base, widening to the middle, margins of apical half subparallel; punctation somewhat coarser than on head, partly absent from longitudinal stripe in the middle. Elytra 3.5 times as long as wide, 2.2 times as long as pronotum; costa 3 inflated; intervals getting shorter from 3 to 6; apex with V-shaped incision at suture, with small sutural tooth. Genitalia as in figs 135-137.

Material examined. Holotype ♂, Papua New Guinea: Wau, 15.ix., J. & M. Sedlacek (BPBM).

Ancistria pilosa sp. n. (Figs 138-141)

Description. Length 4.9 mm. Dark brown, legs slightly lighter; surface shiny; head covered in very short setae, pronotum and elytra in light, 0.1 mm long erect setae. Head (fig. 139) 1.0 times as long as wide, with fine sparse, strigose punctation; median line fine, slightly more impressed apically; admedian lines moderately long, weakly curved, admedian lobes indistinctly delimited anteriorly, blunt; lateral frontal processes flattened, their joint width 1.0 times that of frontoclypeal depression. Eye large, temple length/eye diameter ratio as 0.7. Antenna (fig. 138) with segment 1 bearing 2 dorsal grooves; segment 2 subglobular; segments 3-6 oval; segments 7-11 weakly flattened, forming club; segment 11 slightly longer than wide. Pronotum 1.6 times as long as wide, bordered at base, weakly widening towards apex; punctation sparser and coarser than on head, with punctation-free longitudinal band in the middle. Elytra 3.4 times as long as wide, 2.3 times as long as pronotum; costa 3 strongly raised and oblique subapically; intervals 3 and 4 merging apically, 5 slightly longer but shorter than interval 6; apex with large V-shaped incision at suture, without sutural tooth. Genitalia as in figs 140, 141.

Distribution. Holotype ♀, Taiwan: Fenchihu, 1400 m, iv-vi.1977, J. & S. Klapperich (MHNG).



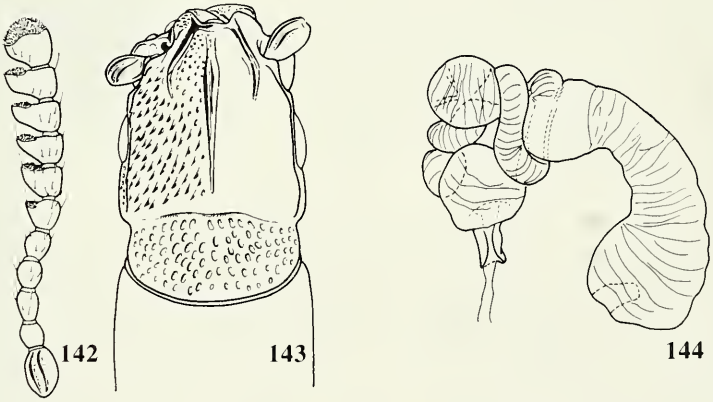
FIGS 138-141

Ancistria pilosa. 138, antenna; 139, head, dorsal view; 140, spermatheca; 141, ostium bursae.

Ancistria reitteri Lewis (Figs 142-144)

Ancistria reitteri Lewis, 1893: 83. Lectotype ♀, Japan: Yuyama in Higo, labelled "Nagasaki, 22.v.-3.vi.1881", G. Lewis (BMNH); here designated (examined).

Description. Length 4.5 mm. Dark brown, tarsi brown; surface shiny. Head (fig. 143) 1.1 times as long as wide; finely, laterally strigosely punctured; median line impressed almost to base; admedian lobes narrowly triangular, blunt anteriorly; lateral frontal processes flattened, their joint width 0.8 times that of frontoclypeal depression. Dorsal surface of mandibles punctate. Eye moderately large; temple length/eye diameter ratio as 1.0. Antenna (fig. 142) with segment 1 bearing 2 distinct grooves; segment 2 subglobular; segment 3 shortly clavate; segments 4 and 5 asymmetrically oval; segments 6-11 flattened, forming indistinct club; segment 11 as long as wide. Pronotum 1.6 times as long as wide, not bordered at base, strongly widened in basal two thirds, with subparallel margins in apical third; punctation coarser than on head, density uneven leaving a puncture-free median longitudinal band in the middle. Elytra 2.6 times as long as wide, 1.8 times as long as pronotum; costa 3 hardly inflated subapically; interval 3 longer than 4 which is shorter than 5; straight apically without sutural tooth. Genitalia as in fig. 144.



Figs 142-144

Ancistria reitteri. 142, antenna; 143, head, dorsal view; 144, spermatheca.

Distribution. Recorded from Japan (Lewis, 1893). Material examined. Japan: lectotype ♀ of *A. reitteri* (BMNH).

Comments. According to Lewis' (1893) description of *A. reitteri* the type material was collected at Yuyama in Higo. The lectotype in the BMNH is labelled "Nagasaki". The specimen at hand is the only representative known of the species and is without any doubt the same specimen examined by Lewis. The label with "Nagasaki" has been added subsequently and is wrong.

Ancistria retusa (Fabricius) (Figs 3, 4, 11, 12, 145-164)

Colydium retusa Fabricius, 1801: 555. Lectotype ♂, Sumatra, Daldorff (ZMUC); here designated (examined).

Bostrichoides angulatus Montrouzier, 1855: 17. Lectotype, Woodlark Island, X. Montrousier (ISNB); here designated (examined). Syn. n.

Ancistria retusa (Fabricius); Gemminger & von Harold, 1868; Grouvelle, 1882.

Prionophora cylindrica Westwood, 1848: 85. Lectotype, India (BMNH); here designated (examined); synonymised with *A. retusa* by Gemminger & von Harold, 1868: 870.

Ancistria (Ancistria) albertisi Grouvelle, 1913a: 446: Lectotype ♀, New Guinea, Ramoi, vi.1892, L. M. D'Albertis (MCSN); here designated (examined). Syn. n.

Ancistria (Ancistria) atra Grouvelle, 1913a: 455. Lectotype ♀, New Guinea, Allem? (MNHN); here designated (examined). Syn. n.

Ancistria (Ancistria) brevis Grouvelle, 1913a: 469. Lectotype, Southeast Borneo (BMNH); here designated (examined). Syn. n.

Ancistria (Ancistria) excavata Grouvelle, 1913a: 464. Lectotype ♀, East Java: Sukabumi, 2000', 1893, H. Fruhstorfer (MNHN); here designated (examined). Syn. n.

Ancistria (Ancistria) filiformis Grouvelle, 1913a: 458. Holotype ♂, Australia: Cook Town (MNHN); (examined). Syn. n.

Ancistria (Ancistria) gestroi Grouvelle, 1913a: 449. Lectotype ♂, Sulawesi: Kandari, vii. 1874, O. Beccari (MCSN); here designated (examined). Syn. n.

Ancistria (Ancistria) leai Grouvelle, 1913a: 462. Lectotype ♀, Australia: Morton Bay, H. Deyrolle (MNHN); here designated (examined). Syn. n.

Ancistria (Ancistria) magna Grouvelle, 1913a: 470. Lectotype ♀, Singapore, Wallace (BMNH); here designated (examined). Syn. n.

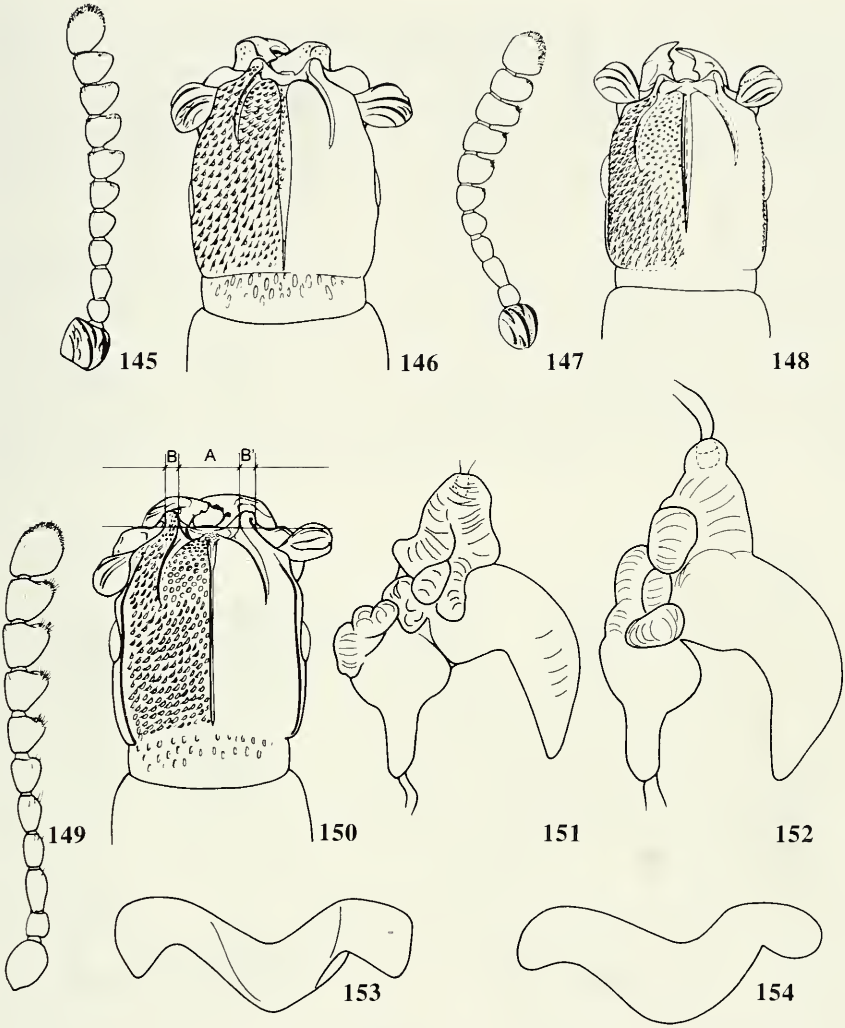
Ancistria (Ancistria) retusa (Fabricius); Grouvelle, 1913a: 467.

Ancistria (Ancistria) retusa var. *propinqua* Grouvelle, 1913a: 469. Lectotype ♂, Philippines: Palawan (MNHN); here designated (examined). Syn. n.

Ancistria sauteri Grouvelle, 1913b: 54. Lectotype ♀, Taiwan: Taihorin, Fuhosho, H. Sauter (DEIC), here designated (examined). Syn. n.

Ancistria (Ancistria) africana Grouvelle, 1919: 56. Holotype, Rhodesia: Sebakove, D. Dods (SAMC); (examined). Syn. n.

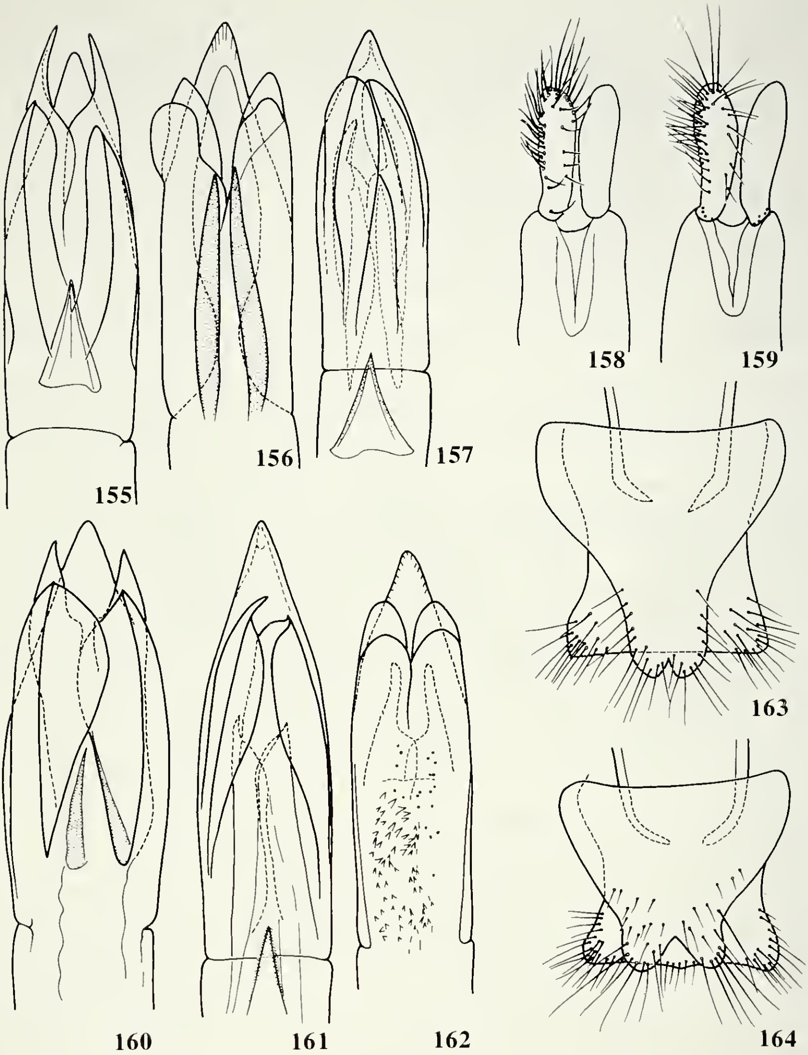
Description. Length 4.8-8.6 mm. Dark brown to black with elytra sometimes partly lighter, ranging from light brown to dark chestnut brown; surface mostly mat on head and shiny on pronotum and elytra. Head (figs 3, 146, 148, 150) 1.2-1.4 times as long as wide; finely, laterally strigosely punctate; median line impressed except for base; admedian lines moderately short, weakly curved, admedian lobes narrowly triangular; lateral frontal processes careniform, their joint width 0.5-0.7 times that of frontoclypeal depression. Eye large, temple length/eye diameter ratio as 1.2-1.3. Antenna (figs 145, 147, 149) with segment 1 bearing 2 dorsal grooves; segment 2 subglobular; segment 3 clavate; segments 4 and 5 asymmetrically oval; segments 6 to 11 flattened forming club; segment 11 slightly longer than wide. Pronotum 1.7-1.8 times as long as wide, bordered at base (fig. 4); widening in basal half, apical half with subparallel margins or narrowing weakly to apex; punctation coarser than on head leaving a puncture-free median stripe. Elytra 3.1-3.5 times as long as wide, 2.0-2.4 times as long as pronotum; carina 3 strongly inflated and oblique, in ♀ more than in ♂; interval 4 shorter than 3 and 5 which merge apically; apex truncate or weakly emarginate with V-shaped incision at suture, without sutural tooth (figs 11, 12). Genitalia as in figs 151-164.



Figs 145-154

Ancistria retusa. 145, 147, 149, antenna; 146, 148, 150, head, dorsal view; 151, 152, spermatheca; 153, 154, ostium bursae.

Distribution. Reported from Sumatra, India, New Guinea, Borneo, Java, Australia, Sulawesi, Singapore, Palawan, Taiwan and Zimbabwe (Hetschko, 1930, and literature cited therein) as *A. retusa*, *A. cylindrica*, *A. albertisi*, *A. atra*, *A. brevis*, *A. excavata*, *A. filiformis*, *A. gestroi*, *A. leai*, *A. magna*, *A. retusa* var. *propinqua* and *A. africana*, from Woodlark Island (Montrouzier, 1855) as *Bostrichoides angulatus*, and as *A. retusa* from Australia (Queensland, New South Wales) (Hawkeswood, 1987). Material examined: 236 specimens from Cameroon (Biyan), Zaire, Zimbabwe, South Africa, India (Assam, Chambaganor, Madura), Sri Lanka,



Figs 155-164

Ancistria retusa. 155-157, 160-162, median lobe, apical piece; 158, 159, parameres; 163, 164, sternite and tergite VIII.

China (Hainan), Taiwan, Thailand, Laos, Vietnam (Tonkin), Philippines (Mindoro, Negros, Mindanao, Luzon, Calapan, Palawan), Borneo (Sabah, Brunei, Sarawak), Singapore, Sumatra, Java, Sulawesi, Kapulauan Tukanbesi, Moluccas, Aru Island, New Guinea, Australia (Queensland, Victoria, possibly Tasmania) (ANIC, BMNH, BPBM, DEIC, ISNB, MCSN, MHNG,

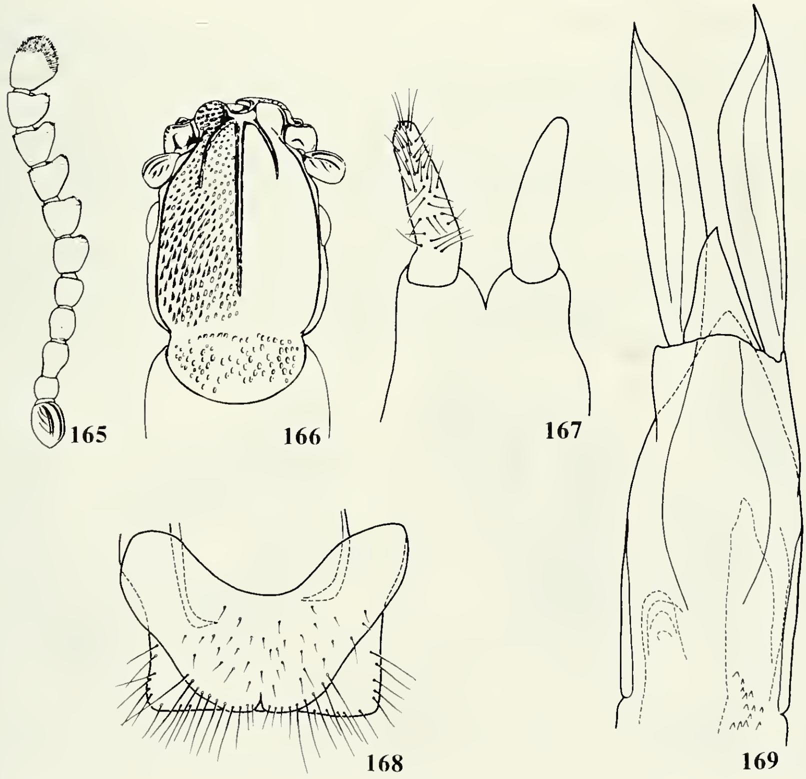
MNHN, MRAC, NHMB, QMBA, SMTD, USNM, ZMHB, ZMPA, ZMUC). A single specimens bears following data: Brazil (Coll. L. W. Schaufuss, ZMHB).

Comment. Some specimens bear the indication "Somerset" which may refer to a locality in Queensland or in Tasmania. The occurence of *A. retusa* in Tasmania should be confirmed with additional material. The single specimen from Brazil may have been mislabelled or may be an introduction.

Ancistria stricta Grouvelle (Figs 165-169)

Ancistria (Parancistria) stricta GROUVELLE, 1913a: 477. Lectotype, Singapore (BMNH); here designated (examined).

Description. Length 5.7 mm. Brown, apical half of elytra light brown; surface mostly mat. Head (fig. 166) 1.3 times as long as wide; punctation fine, laterally slightly strigose; median line distinctly impressed in apical half, finer in basal half fading



FIGS 165-169

Ancistria stricta. 165, antenna; 166, head, dorsal view; 167, parameres; 168, sternite and tergite VIII; 169, median lobe, apical piece.

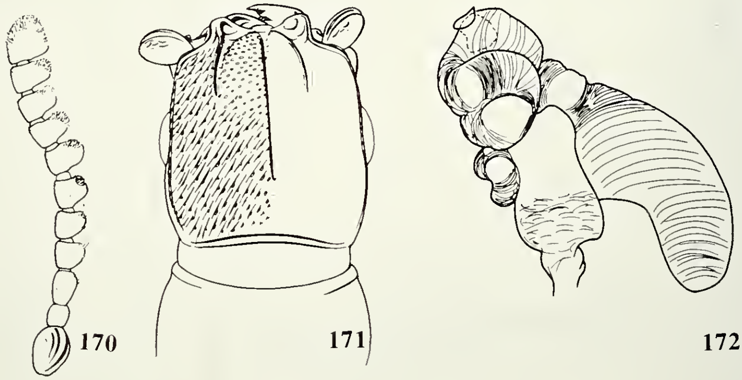
towards base; admedian lines weakly curved to almost straight, admedian lobes narrowly triangular; lateral frontal processes flattened, their joint width 1.6 times that of frontoclypeal depression. Eye small, temple length/eye diameter ratio as 1.7. Antenna (fig. 165) with segment 1 bearing 1 distinct dorsal groove; segment 2 subglobular; segments 3-5 oval; segments 6-11 flattened, forming well-defined club; segment 11 slightly longer than wide. Pronotum 1.5 times as long as wide, bordered at base, widening from base to apical third, from there weakly narrowing to apex; punctation slightly coarser than on head, relatively evenly spaced. Elytra 2.6 times as long as wide, 1.9 times as long as pronotum; costa 3 hardly inflated subapically, costae 4 and 6 merging subapically; intervals 3 and 6 subequal, longer than subequal intervals 4 and 5; apex truncate, no distinct sutural tooth developed. Genitalia as in figs 167-169.

Distribution. Singapore (Grouvelle, 1913a; Hetschko, 1930). Material examined. Singapore: Lectotype and paralectotype ♀ (BMNH, MNHN). Borneo: 1♂, West Sarawak, Quop, ii-iii.1914, G. E. Bryant (BMNH).

Ancistria strigosa Grouvelle (Figs 170-172)

Ancistria (Ancistria) strigosa Grouvelle, 1913a: 451. Lectotype ♀, New Guinea: Amberbaki (MCSN); here designated (examined).

Description. Length 9.4-14.6 mm. Chestnut brown to almost entirely black; surface mostly shiny. Head (fig. 171) 1.2 times as long as wide, relatively strongly convex; punctation coarse, strigose laterally; median line in basal quarter reduced, impressed otherwise; admedian lines moderately long, weakly curved, admedian lobes narrowly triangular; lateral frontal processes careniform, their joint width 0.3-0.8 times that of frontoclypeal depression. Eye large, temple length/eye diameter ratio as 0.8-1.3.



Figs 170-172

Ancistria strigosa. 170, antenna; 171, head, dorsal view; 172, spermatheca.

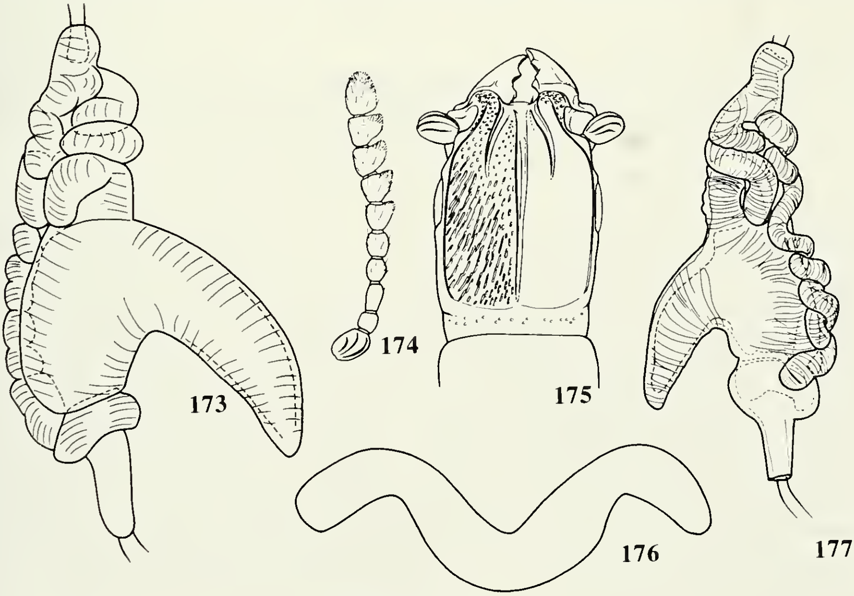
Antenna (fig. 170) with segment 1 bearing 2 dorsal grooves; segment 2 subglobular; segments 3 oval; segments 4-11 gradually enlarged from 4 to 11, flattened; segment 11 about as long as wide. Pronotum 1.7-1.8 times as long as wide, distinctly bordered at base, strongly widening from base to the middle, from there weakly narrowing to apex; punctures much coarser than on head, absent from a longitudinal median stripe. Elytra 3.5-4.1 times as long as wide, 2.3-2.5 times as long as pronotum; costa 3 moderately thickened subapically, fused costae 7 and 8 in ♂ weakly, in ♀ strongly inflated apically; intervals getting gradually shorter from 3 to 6; apical margin incised at suture, ♂ with small, ♀ with large sutural tooth. Genitalia as in fig. 172.

Distribution. Recorded from New Guinea (Grouvelle, 1913a; Hetschko, 1930). Material examined. New Guinea: Lectotype ♀, paralectotypes 1♂, 1♀ (MCSN, MNHN): 1♀, Papua New Guinea, Klunga, Fly River, 17.viii.1957, W. W. Brandt (BPBM). Solomon Islands: 1♀, Santa Ysabel, Hageulu, 600-650 m, 11.ix.1964, R. Straatman (BPBM). Indonesia: 1♀, Ceram, Jilo, 1884, C. Ribbe (MNHN); 1♀, Vanikoro, François (MNHN); 2♀, Amboina, Doll. (MNHN). Southeast Asia: 1♀ (MNHN).

Ancistria tarsalis Waterhouse (Figs 10, 173-177)

Ancistria tarsalis WATERHOUSE, 1876: 121. Lectotype, Java: Bowring (BMNH); here designated (examined).

Ancistria (Obancistria) longior GROUVELLE, 1913a: 442. Lectotype ♀, Sumatra, Si-Rambe, xii.1890-iii.1891, E. Modigliani (MCSN); here designated (examined). Syn. n.



FIGS 173-177

Ancistria tarsalis. 173, 177, spermatheca; 174, antenna; 175, head, dorsal view; 176, ostium bursae.

Description. Length 8.1 mm. Dark brown; surface shiny. Head (fig. 175) 1.4 times as long as wide, strigosely punctate; admedian line fine in basal fifth, strongly impressed in apical four fifth; admedian lines moderately long, relatively straight, admedian lobes narrowly triangular; lateral frontal lobes flattened, their joint width 1.9 times that of frontoclypeal depression. Eye moderate in size, temple length/eye diameter ratio as 1.3. Antenna (fig. 174) with segment 1 bearing 2 distinct dorsal grooves; segment 2 subglobular; segment 3 clavate; segments 4-6 asymmetrically oval; segments 7-11 strongly flattened, forming a well-defined club; segment 11 slightly longer than wide. Pronotum 2.1 times as long as wide, distinctly bordered at base, widened in basal third, with subparallel margins in apical two thirds; punctation slightly coarser on head, less dense on disk. Elytra 3.1 times as long as wide, 2.1 times as long as pronotum; costa 3 strongly inflated and oblique subapically, fused costae 7 and 8 strongly thickened apically; intervals 3 and 6 long, merging apically, interval 4 shorter, interval 5 intermediate; apex with V-shaped incision at apex, without sutural tooth (fig. 10). Genitalia as in figs 173, 176, 177.

Distribution. Recorded as *A. tarsalis* from Java (WATERHOUSE, 1876), and as *A. longior* from Sumatra (GROUVELLE, 1913a; HETSCHKO, 1930). Material examined. Java: lectotype of *A. tarsalis* (BMNH). Sumatra, lectotype and paralectotype of *A. longior*, Si-Rambe, xii.1890-iii.1891, E. Modigliani (MCSN, MNHN). Borneo: 1 ♀, Sabah, Mount Kinabalu National Park, head quarters, Liwagu river, 1500 m, 21.v.1987, A. Smetana (MHNG).

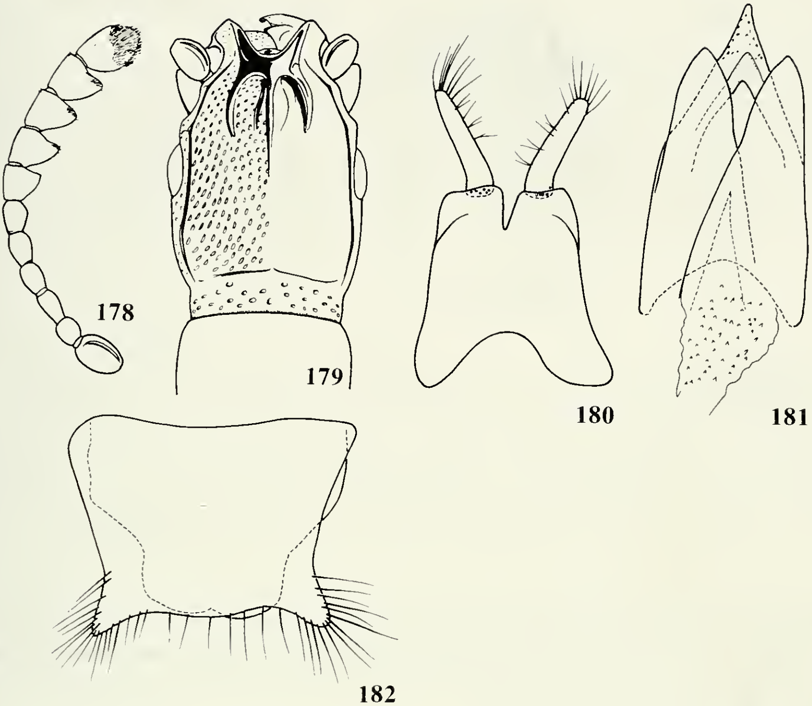
Comment. *Ancistria (Ancistria) tarsalis* sensu GROUVELLE, 1913a, nec Waterhouse, is the species described here as *A. foraminifrons* sp. n.

Ancistria tenera Günther (Figs 178-182)

Ancistria (Obancistria) tenera Günther, in HELLER & GÜNTHER, 1936: 65. Holotype ♂, Indonesia: West Java, Kamodjan, Southern slope of Mount Guntur, 1350 m, Garoet, iii.1934, H. Overbeck (SMTD); (examined).

Description. Length 6.0 mm. Almost black, legs brown, elytra irregularly dark chestnut brown; surface mostly shiny. Head (fig. 179) 1.3 times as long as wide; finely punctured; median line impressed in apical half, indistinct basally; admedian lines relatively short, weakly curved, admedian lobes narrowly triangular; lateral frontal processes narrow, flattened, their joint width 0.7 times that of frontoclypeal depression. Eye relatively small; temple length/eye diameter ratio as 1.7. Antenna (fig. 178) with segment 1 weakly flattened dorsally, bearing 1 distinct and 1 indistinct grooves; segment 2 subglobular; segments 3-6 oval to clavate; segments 7-11 strongly flattened, forming distinct club; segment 11 distinctly longer than wide. Pronotum 1.7 times as long as wide, indistinctly bordered at base, strongly widened in basal two thirds and weakly narrowing in apical third; punctation slightly coarser than on head, leaving a puncture-free longitudinal band in basal two thirds. Elytra 3.1 times as long as wide, 2.1 times as long as pronotum; costa 3 very weakly inflated subapically; interval 3 longer than 4 which is shorter than 5; weakly emarginate apically with small sutural tooth. Genitalia as in figs 180-182.

Distribution. Recorded from Java (HELLER & GÜNTHER, 1936). Material examined. Java: holotype ♂, Kamodjan, Southern slope of Mount Guntur, 1350 m, Garoet, iii.1934, H. Overbeck (SMTD).



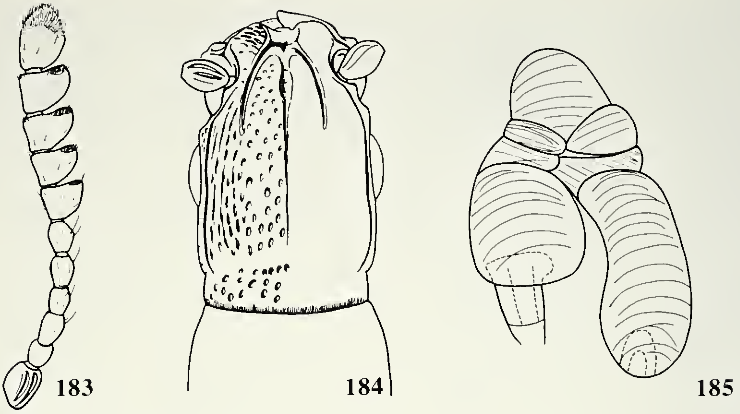
FIGS 178-182

Ancistria tenera. 178, antenna; 179, head, dorsal view; 180, parameres; 181, median lobe, apical piece; 182, sternite and tergite VIII.

Ancistria tenuis Grouvelle (Figs 183-185)

Ancistria (Parancistria) tenuis GROUVELLE, 1913a: 486. Holotype ♀, Southeast New Guinea: Mount Astrolabe, ii.1893, Loria (MCSN); (examined).

Description. Length 3.7 mm. Head and thorax chestnut brown, antennae legs, elytra and apex of abdominal venter lighter brown; surface on head mat, on pronotum and elytra mostly shiny. Head (fig. 184) 1.3 times as long as wide, with fine, laterally strigose punctation; median line impressed apically getting weaker towards base; admedian lines moderately long, gently curved, admedian lobes narrowly triangular; lateral frontal processes flattened, their joint width 2.5 times that of frontoclypeal depression. Eye large, temple length/eye diameter ratio as 1.8. Antenna (fig. 183) with segment 1 bearing 1 distinct and 1 indistinct dorsal grooves; segment 2 subglobular; segment 3 clavate; segments 4-6 oval; segments 7-11 flattened, forming distinct club; segment 11 longer than wide. Pronotum 2.0 times as long as wide, not bordered at base, widening towards the middle, from there weakly narrowing to the apex; punctation



FIGS 183-185

Ancistria tenuis. 183, antenna; 184, head, dorsal view; 185, spermatheca.

somewhat coarser than on head, irregular. Elytra 4.2 times as long as wide, 2.1 times as long as pronotum; costa 3 slightly thickened and weakly oblique subapically, costae 4 and 5 merging apically; interval 3 longer than intervals 4 and 5; apex truncate, without sutural tooth. Genitalia as in fig. 185.

Distribution. Reported from New Guinea (GROUVELLE, 1913a; HETSCHKO, 1930). Material examined. New Guinea: holotype ♀ (MCSN).

BIOGEOGRAPHY

Most of the 32 currently recognised species of *Ancistria* occur in the Old World tropics. One species, *A. retusa*, has a very large range and has been recorded also from Africa and Australia in addition to many localities in Asia. One specimen of *A. retusa* may even originate from Brazil, a record which needs confirmation. The other 31 species, on the contrary, are restricted in their distribution and may be of use in examining historical relationships among areas of endemism. For this, however, formal hypotheses of the phylogenetic relationships of *Ancistria* are required.

The number of species with restricted distribution is relatively high (18 spp.), suggesting that the available faunistic information is very incomplete. Particularly, with the exception of *A. retusa*, the absence of species shared between the North Indian/ Himalayan region and continental Southeast Asia (excluding the Malayan Peninsula) on one hand and the isolated position of the Philippines (excluding Palawan) on the other hand indicate this lack of material. The most species rich area is New Guinea (9 spp.), followed by Sumatra (7 spp.) and Borneo (6 spp.). The endemism is seemingly high on New Guinea but virtually absent from Sumatra, Borneo and the Malayan Peninsula.

ACKNOWLEDGEMENTS

We thank all the persons who kindly provided material for our study or were helpful in various ways during our visits to their institutions (cf. material and methods). For useful comments on the manuscript draft we are very grateful to J. Pakaluk (USNM) and I. Löbl (MHNG). The drawings of the heads and antennae were executed by N. Lavoyer, Geneva, the other figures were inked by G. Roth, Geneva, and the SEM pictures prepared by J. Wüest, Geneva. To all we extend our sincerest thanks.

NOTE ADDED IN PROOF

SASAJI (1993) described *Ancistria kurosawai* and gave additional records of *A. apicalis* from Japan. This publication came to our attention only when the present paper was already submitted for publication. It was, therefore, too late to include this information in the present revision. According to the description of SASAJI (1993) *Ancistria kurosawai* keys out with *A. costata* from which it can be differentiated as follows:

27bis Body length 6.9 mm. Head 1.1 times as long as wide. "British Bootang" .... *costata*
– Body length 7.1-8.0 mm. Head 1.4 times as long as wide. Japan. . . . *kurosawai*

REFERENCES

BURCKHARDT, D. & S. A. SLIPINSKI. 1991. A review of the Passandridae (Coleoptera, Cucujoidea) of the world. III. Genera *Anisocerus, Aulonosoma, Passandrella, Passandrina, Scalidiopsis* and *Taphroscelidia*. *Revue suisse Zool.* 98: 453-497.

BURCKHARDT, D. & S. A. SLIPINSKI. 1995. *Catogenus klapperichorum* sp. n. and nomenclatoral remarks on *Catogenus carinatus* Newman (Coleoptera, Passandridae). *Ent. Probl.* 26: 79-84.

ERICHSON, W. F. 1845. Naturgeschichte der Insecten Deutschlands. Erste Abteilung. Coleoptera, vol. 3, Berlin, Verlag der Nicolaischen Buchhandlung.

FABRICIUS, I. C. 1801. Systema Eleutheratorum, 2. Kiel, 687 pp.

GEMMINGER, M. & E. VON HAROLD. 1868. Catalogus Coleopterorum, 3: 753-978.

GROUVELLE, A., 1883. Cucujides nouveaux du Musée civique de Gênes. *Annali Mus. civ. Stor. nat. Genova* 18: 275-296.

GROUVELLE, A., 1908. Coléoptères de la région indienne. Rhysodidae, Trogositidae, Nitidulidae, Colydiidae, Cucujidae. *Annls Soc. ent. Fr.* 77: 315-495.

GROUVELLE, A., 1913a. Etude sur les *Ancistria* (Col. Passandridae). *Annls Soc. ent. Fr.* 81: 433-494.

GROUVELLE, A., 1913b. H. Sauter's Formosa-Ausbeute. Rhysodidae, Nitidulidae, Ostomidae, Colydiidae, Passandridae, Cucujidae, Cryptophagidae, Diphyllidae, Lathridiidae, Mycetophagidae, Dermestidae. *Arch. Naturgesch.* 79(11): 33-76.

GROUVELLE, A. 1919. Descriptions d'espèces nouvelles de Clavicornes de l'Afrique australe. *Mém. ent.* 2: 47-60.

HAWKESWOOD, T. 1987. Beetles of Australia. Angus & Robertson Publishers, North Ryde, 248 pp.

HELLER, K. M. & K. GÜNTHER. 1936. Ueber einige von H. Overbeck 1933/34 auf Java gesammelte Insekten. *Tijdschr. Ent.* 79: 64-76.

HETSCHKO, A. 1930. Cucujidae, Thorictidae (Suppl.), Cossyphodidae (Suppl.), in Junk, W. & S. Schenkling. Coleopterorum Catalogus, 109. Berlin, Junk, 124 pp.

KESSEL, F. 1921. Neue Monotomiden, Cucujiden u. Passandriden aus der Sammlung des Deutschen Entomologischen Museums in Berlin. *Arch. Naturgesch.* 87 (6): 24-33.

LEWIS, G. 1893. Japanese Coleoptera - two new species. *Entomologist's mon. Mag.* 29: 83.

MONTROUZIER, X. 1855. Essai sur la faune de l'île de Woodlark ou Moiou. *Annls Soc. Agric. Lyon* (2) 7 (1): 1-114.

REITTER, E. 1876. Neue Gattungen und Arten aus der Familie der Cucujidae. *Coleopterologische Hefte* 15: 37-64.

REITTER, E. 1877. Beiträge zur Kenntisse aussereuropäischer Coleopteren. *Mitt. münch. ent. Ver.* 1: 126-140.

REITTER, E. 1889. Verzeichnis der Cucujiden Japans mit Beschreibung neuer Arten. *Wien. ent. Ztg.* 8: 313-320.

SASAJI, H. 1993. Contribution to the taxonomy of the superfamily Cucujoidea (Coleoptera) of Japan and adjacent districts, VII. *Mem. Fac. Educ. Fukui University, series II (Nat. Sci.)* 44(2): 17-25.

SLIPINSKI, S. A. 1987. A review of the Passandridae of the world (Coleoptera, Cucujoidea). I. Genus *Passandra* Dalman. *Annali Mus. civ. Stor. nat. Genova* 86: 553-603.

SLIPINSKI, S. A. 1989. A review of the Passandridae (Coleoptera, Cucujoidea) of the world. II. Genus *Catogenus* Westwood. *Polskie Pismo ent.* 59: 85-129.

WATERHOUSE, C. O. 1876. Descriptions of new Cucujidae and Cleridae. *Entomologist's mon. Mag.* 13: 118-126.

WESTWOOD, J. O. 1848. The Cabinet of Oriental Entomology, 86 pp.

Revue suisse de Zoologie, 102 (4) : 1045-1064; décembre 1995

Review of the Pseudoscorpion Fauna of China (Arachnida: Pseudoscorpionida)

Wolfgang SCHAWALLER
Staatliches Museum für Naturkunde
Rosenstein 1
D-70191 Stuttgart, Germany.

Review of the Pseudoscorpion Fauna of China (Arachnida: Pseudoscorpionida). - The known pseudoscorpions from China (including Tibet, excluding Mongolia and Taiwan) and new material are compiled. 47 species are listed, remarks on taxonomy and distribution are added. New species: *Centrochthonius sichuanensis* n.sp., *Stenohya chinacavernicola* n.sp. New records for China: *Lagynochthonius tonkinensis*, *Tyrannochthonius japonicus*, *Tyrannochthonius pachythorax*, *Tyrannochthonius robustus*, *Ditha proxima*, *Geogarypus javanus*, *Bisetocreagris annamensis*, *Bisetocreagris indochinensis*, *Bisetocreagris thailandica*, *Bisetocreagris* cf. *ussuriensis* (only a single tritonymph), *Microbisium brevifemoratum*, *Anatemnus orites*, *Chernes hahni*, *Allochernes tropicus* n.comb., *Lamprochernes savignyi*, *Megachernes* cf. *titanius*, *Megachernes* cf. *vietnamensis*, *Verrucachernes oca*, *Hyperwithius tonkinensis*.

Key-words: Arachnida - Pseudoscorpiones - China - Review - Taxonomy.

INTRODUCTION

Although China covers a huge area within the Palaearctic and Oriental region, only few records of pseudoscorpions are scattered in different papers (see citations in the catalogue of Harvey 1990). New collections at my disposal from that country, mostly from the southern provinces, induced me to prepare a review of all known pseudoscorpions (47 species) from China. It is not the purpose of this paper to figure all morphological details of all species and/or to provide an identification key. Of course this compilation is only a first step and far away from completeness. Some series (for example in *Bisetocreagris*, *Megachernes*) remained unidentified or can be determined only with some doubts. Further knowledge of pseudoscorpion taxonomy and further investigations with special collecting techniques in vast and remote areas of China may enlarge this first review in many aspects.

Manuscript accepted 10.06.1995.

The Chinese pseudoscorpion fauna is composed of different elements. Records from southern tropical and subtropical regions show a closer relation to the fauna of Indochina (REDIKORZEV 1938, BEIER 1951), Thailand (SCHAWALLER 1994) and Nepal (SCHAWALLER 1991). The fauna of the northeastern provinces has a palaearctic character similar to eastern Siberia (SCHAWALLER 1995). The species from the northwestern arid regions of China might have affinities with the Mongolian fauna. The pseudoscorpions from Korea have been treated recently (HONG & KIM 1993, KIM & HONG 1994).

In this review, "China" covers the area of the Peoples Republic of China including Tibet, but without Mongolia and Taiwan.

Not included in this review are: *Microcreagris japonica* Ellingsen, 1907 from Japan, which was recorded by CHAMBERLIN (1930) from China: Chofu; this seems to be an error, because Chofu is a city near Tokyo. CHAMBERLIN (1930) described 3 further species of "*Microcreagris*" with doubtful origin, which are treated here as nomina dubia. *Geogarypus irrugatus* (Simon, 1899) was recorded from China (Amoy = Xiamen) by CHAMBERLIN (1930); the genus needs a revision and probably the herein recorded species *javanus* (Tullgren, 1905) is a synonym of *irrugatus* (Simon, 1899).

MATERIAL

CGG	Collection G. Gardini, Genova.
MHNG	Muséum d'Histoire Naturelle, Genève.
MSF	Museo La Specola, Firenze.
MSNV	Museo Civico di Storia Naturale, Verona.
SMNS	Staatliches Museum für Naturkunde, Stuttgart.
ZISB	Zoological Institute of the Academia Sinica, Beijing.

SPECIES LIST

Chthoniidae (7 species)

1. **Centrochthonius kozlovi** (Redikorzev, 1918) (Fig. 6)

Material: Not seen.

Remarks: The single specimen published from Nepal is not a tritonymph, but an adult male, thus in the figures given in SCHAWALLER (1991) two additional trichobothria are missing.

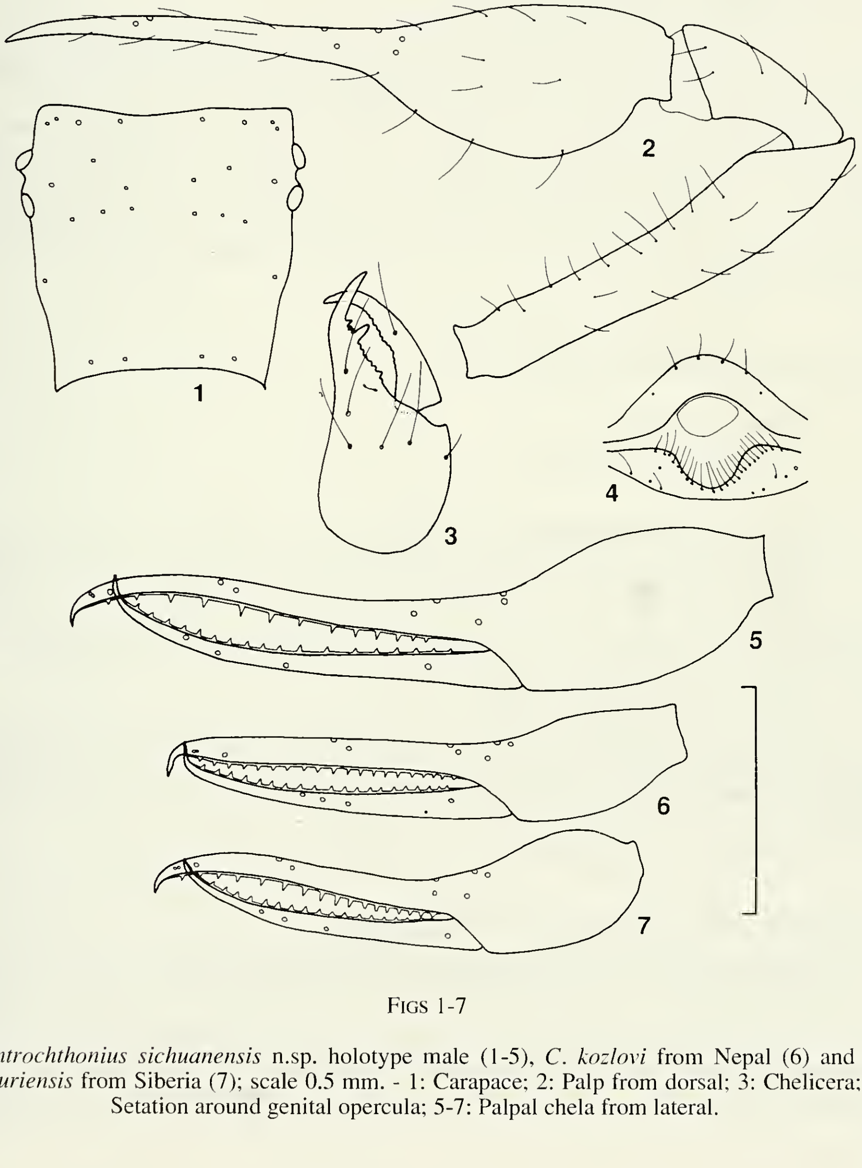
Distribution: Tibet (locus typicus), Nepal Himalayas.

2. **Centrochthonius sichuanensis** n.sp. (Figs 1-5)

Holotype (♂): China. Sichuan Prov., Wolong Nature Reserve, 1500 m, 21.V.1994, MHNG.

Paratypes: Together with holotype, 1 ♂ 3 ♀ MHNG. Sichuan Prov., Wolong Nature Reserve, 1700 m, 18.V.1994, 2 ♂ MHNG. Sichuan Prov., Wolong Nature Reserve, 1000 m, 24.V.1994, 2 ♂ 1 ♀ SMNS 3509. Sichuan Prov., Mt. Emei, 1500 m, 21.IX.1994, 1 ♀ MHNG.

Description (♂): Carapace (Fig. 1) (0.57/0.59 mm) with the basal margin somewhat narrower than the anterior margin, anterior margin without epistome, each side with 2 distinct lense eyes; carapace with 26 setae, anterior margin with 8 (4 long and on each side with 2 shorter) setae, basal margin with 4 setae. Setation on tergites 4-8-9-8-10-10-10-8-8-6-4, setation around the genital opercula see Fig. 4. Palpal coxa with 3 setae, coxa I with 1+4 setae and with 9-10 serrate coxal spines on a single socle, coxa II with 2+3 setae, coxa III with 3+3 setae, coxa IV with 4+3 setae.



Figs 1-7

Centrochthonius sichuanensis n.sp. holotype male (1-5), *C. kozlovi* from Nepal (6) and *C. ussuriensis* from Siberia (7); scale 0.5 mm. - 1: Carapace; 2: Palp from dorsal; 3: Chelicera; 4: Setation around genital opercula; 5-7: Palpal chela from lateral.

Chelicera (Fig. 3): 6 setae on the hand, movable finger with 1 seta; flagellum with 8 feathered blades; serrula exterior with 22, serrula interior with 17 blades; fixed finger with a striking long tooth and distally with additional 3 teeth, movable finger with a row of indistinct teeth. Palp (Figs 2, 5): Femur (1.00/0.18 mm) 5.6x, patella (0.45/0.18 mm) 2.5x, chela without pedicel (1.55/0.33 mm) 4.7x longer than wide; finger 1.6x longer than hand; trichobothriotaxie see Fig. 5; fixed finger with 13 errect and acute teeth, movable finger with 18 errect and acute teeth. Leg IV: Tibia 0.66 mm, basitarsus 0.34 mm, telotarsus 0.64 mm long; basitarsus and telotarsus each with a long seta distally. Body length 2.6 mm.

Description (♀): No distinct sexual dimorphism. Palp: Femur (1.10/0.20 mm) 5.5x, patella (0.50/0.20 mm) 2.5x, chela without pedicel (1.74/0.42 mm) 4.15x longer than wide; finger 1.3x longer than hand. Body length 3.0 mm.

Discussion: The new material from China distinctly differs from the 3 known species of that genus (*kozlovi* (Redikorzev, 1918), *schnitnikovi* (Redikorzev, 1934) and *ussuriensis* Beier, 1979) by the combination of the following characters: striking body size, the absence of an epistome, the high number of setae on the carapace, few and distant teeth on the palpal chela (Figs 5-7) and the striking tooth on the fixed cheliceral finger.

3. **Lagynochthonius sinensis** (Beier, 1967)

Material: Not seen.

Distribution: China (Hupeh).

4. **Lagynochthonius tonkinensis** (Beier, 1951)

Material: Zhejiang Prov., Mt. Tianmu, 5.IX.1989, 8 ex. ZISB, 3 ex. SMNS 2898. Yunnan Prov., Xishuangbanna, IV.-VII.1993, 110 ex. ZISB, 5 ex. SMNS 3427, 6 ex. SMNS 3429. Yunnan Prov., Mengleng Tropical Garden, 9.IV.1992, 22 ex. ZISB, 4 ex. SMNS 3437. Yunnan Prov., Mengla-Mengleng, 10.IV.1992, 6 ex. ZISB. Yunnan Prov., Mengyang Nature Reserve, 500 m, 10.-14.IX.1994, 4 ex. MHNG.

Remarks: These specimens possess the same chelal proportions and dentations as material from Thailand (SCHAWALLER 1994); the chelal hand has about the same length as the fingers. In the previous congener *sinensis* the hand is significantly shorter.

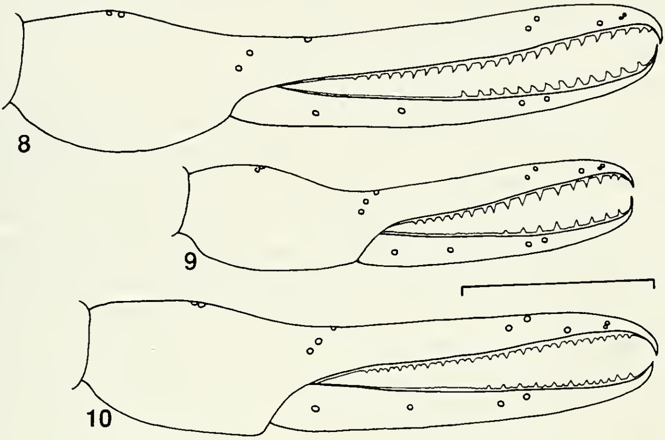
Distribution: Vietnam (locus typicus), Thailand, China (new records).

5. **Tyrannochthonius japonicus** (Ellingsen, 1907) (Fig. 8)

Material: Yunnan Prov., Xishuangbanna, IV.-VII.1993, 1 ex. ZISB, 1 ex. SMNS 3431. Yunnan Prov., Mengleng Tropical Garden, 9.IV.1992, 2 ex. SMNS 3439.

Remarks: Both males and females have a very distinct epistome and a dentation on the palpal fingers (Fig. 8), which is characteristic for *japonicus* (SATO 1979). The genus *Tyrannochthonius* urgently needs revision to clarify, which characters are species-specific and which are not. The species differs significantly from the both following congeners, which have no distinct epistomes and a different chelal dentation (Figs 9-10).

Distribution: Japan (locus typicus), Taiwan, China (new records).



FIGS 8-10

Palpal chela from lateral, scale 0.2 mm. - 8: *Tyrannochthonius japonicus*, SMNS 3431; 9: *Tyrannochthonius pachythorax*, SMNS 3428; 10: *Tyrannochthonius robustus*, SMNS 2897.

6. **Tyrannochthonius pachythorax** Redikorzev, 1938 (Fig. 9)

Material: Yunnan Prov., Xishuangbanna, IV.-VII.1993, 19 ex. ZISB, 3 ex. SMNS 3428, 3 ex. SMNS 3430. Yunnan Prov., Kunming, 4.IV.1992, 2 ex. ZISB. Yunnan Prov., Mengleng Tropical Garden, 9.IV.1992, 2 ex. ZISB. Yunnan Prov., Mengla-Mengleng, 10.IV.1992, 1 ex. ZISB. Yunnan Prov., Mengla, 10.IV.1992, 1 ex. SMNS 3440. Yunnan Prov., Mengyang Nature Reserve, 500 m, 10.-14.IX.1994, 2 ex. MHNG. Yunnan Prov., Kunming, montagne de l'ouest (Xi Shan), 17.IV.1982, leg. M. Freiburghaus, 3 ex. MHNG. Sichuan Prov., Wolong Nature Reserve, 1500 m, 21.V.1994, 2 ex. MHNG. Sichuan Prov., Wolong Nature Reserve, 1700 m, 18.V.1994, 1 ex. MHNG. Fujian Prov., Mt. Wuyi, 31.VII.-13.VIII.1983, leg. H.F. Wang, 5 ex. ZISB, 2 ex. SMNS 3444.

Remarks: Dentation on palpal fingers of the Xishuangbanna specimens see Fig. 9. The length of the palpal fingers and the number of the teeth are variable to a certain extent but without distinct differences, thus I hope not to fail in assigning all series to a single species.

Distribution: Vietnam (locus typicus), Cambodia, Thailand (SCHAWALLER 1994), China (new records).

7. **Tyrannochthonius robustus** Beier, 1951 (Fig. 10)

Material: Zhejiang Prov., Mt. Tianmu, V.-IX.1987, 36 ex. ZISB, 6 ex. SMNS 2896. Hunan Prov., Mt. Hengshan, 1988, 1 ex. SMNS 2897. Sichuan Prov., Wolong Nature Reserve, 1000 m, 24.V.1994, 2 ex. MHNG. Sichuan Prov., Wolong Nature Reserve, 1500 m, 21.V.1994, 6 ex. MHNG, 3 ex. SMNS 3502. Sichuan Prov., Wolong Nature Reserve, 1700 m, 18.V.1994, 9 ex. MHNG. Sichuan Prov., Mt. Emei, 1500 m, 21.IX.1994, 5 ex. MHNG, 2 ex. SMNS 3508. Sichuan Prov., Mt. Emei, 1800 m, 24.IX.1994, 6 ex. MHNG. Sichuan Prov., Dege County, 3500 m, 14.VIII.1983, leg. H.F. Wang, 1 ex. ZISB. Shaanxi Prov., E Xian, Mt. Huashan, 1000 m, 9.-11.V.1994, 2 ex. MHNG. Beijing, no date, leg. H.F. Wang, 1 ex. ZISB, 1 ex. SMNS 3442. Beijing, 18.IX.1985, leg. H.F. Wang, 2 ex. ZISB.

Remarks: The pedipalp chela has a heterodentate dentation on both fingers (Fig. 10), which is characteristic for this species. An epistome is lacking, in contrary to the type material which is said to have a small epistome. The above cited specimens possess on the medial side of the chelal hand a spine-like seta, which is also figured by HARVEY (1988) for other congeners from the Krakatau Islands. Such a thicker seta is lacking (or broken ?) in the preceding 2 species from China. Probably this is a character which could help in a natural classification of the genus *Tyrannochthonius*.

Distribution: Vietnam (locus typicus), China (new records).

Tridenchthoniidae (1 species)

8. **Ditha proxima** (Beier, 1951)

Material: Yunnan Prov., Mengyang Nature Reserve, 500 m, 10.-14.IX.1994, 3 ex. MHNG, 1 ex. SMNS 3504.

Remarks: These specimens have the palpal chela somewhat more slender than Himalayan populations (nearly as in *laosana* Beier, 1951), but all other characters show no differences (for example: trichobothrium *st* closer to *sb* and not just in the middle between *sb* and *t* as in *laosana*).

Distribution: Vietnam, Thailand, Bhutan, Nepal, China (new record).

Geogarypidae (1 species)

9. **Geogarypus javanus** (Tullgren, 1905)

Material: Yunnan Prov., Kunming, montagne de l'ouest (Xi Shan), 17.IV.1982, leg. M. Freiburghaus, 2 ex. MHNG. Yunnan Prov., Mengyang Nature Reserve, 500 m, 10.-14.IX.1994, 1 ex. MHNG.

Remarks: This species has been redescribed by HARVEY (1988). Probably this species is a synonym of *irrugatus* (Simon, 1899), which was recorded from China by CHAMBERLIN (1930).

Distribution: Southeastern Asia, China (new record), Taiwan, New Guinea, Salomon Islands.

Olpiidae (1 species)

10. **Euryolpium agniae** Redikorzev, 1938

Material: Not seen.
Distribution: Vietnam (locus typicus), China (BEIER 1967).

Neobisiidae (13 species)

11. **Bisetocreagris** sp. A (Fig. 16)

Material: Shaanxi Prov., E Xian, Mt. Huashan, 1000 m, 9.-11.V.1994, 3 ex. MHNG.

Remarks: In general, the identification of *Bisetocreagris* species is quite doubtful and nearly impossible without a revision. So I avoid in creating new names, even if it seems quite sure that the herein not named material represents undescribed species. A lot of species are described only under a typological point of view without the knowledge of morphological variability or sexual dimorphic pattern. Even the splitting of the old paraphyletic *Microcreagris* in some genera (CURCIC 1983) should be revised. Furthermore, CHAMBERLIN (1930) described 3 species from China (exact localisations doubtful, even China is given with a question mark), which cannot be recognized and which are treated herein as nomina dubia: *Microcreagris lampra* Chamberlin, 1930, *Microcreagris orientalis* Chamberlin, 1930 and *Microcreagris silvestrii* Chamberlin, 1930. See also remarks under 20. *Chinacreagris nankingensis*.

These specimens from the Huashan mountains have the palpal proportions (Fig. 16) similar to *annamensis* (Figs. 14-15), but the patella is significantly shorter. The granulation on the palps is quite weak and can easily be overlooked.

12. **Bisetocreagris** sp. B (Figs 17-18)

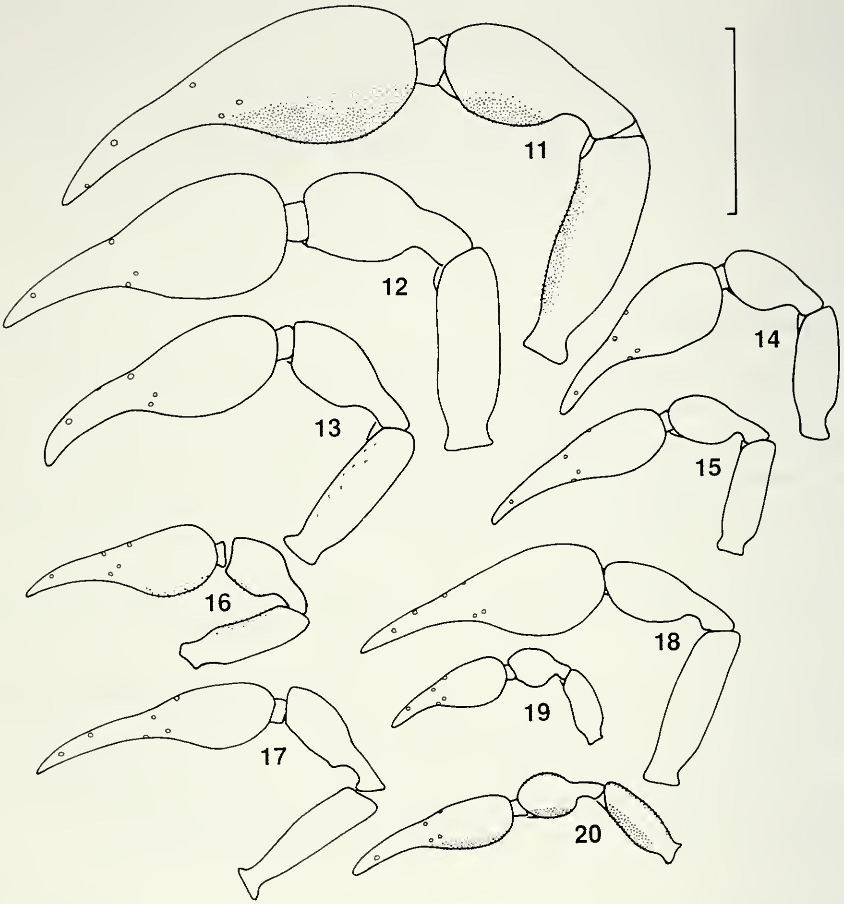
Material: Sichuan Prov., Mt. Emei, 1500 m, 21.IX.1994, 6 ex. MHNG. Sichuan Prov., Mt. Emei, 1800 m, 24.IX.1994, 4 ex. MHNG.

Remarks: These specimens have quite sexual dimorphic palps with a long patella (Figs 17-18), all segments have no granulation.

13. **Bisetocreagris annamensis** (Beier, 1951) (Figs 14-15)

Material: Yunnan Prov., Xishuangbanna, IV.-VII.1993, 2 ex. ZISB, 2 ex. SMNS 3433. Yunnan Prov., Mengyang Nature Reserve, 500 m, 10.-14.IX.1994, 5 ex. MHNG, 2 ex. SMNS 3505.

Remarks: Both series shows no significant differences to material just published from Thailand (SCHAWALLER 1994). Proportions of the sexually dimorphic palps of the Xishuangbanna specimens see Figs 14-15.



Figs 11-20

Palpal proportions from dorsal, scale 1.0 mm. - 11: *Microcreagris gigas*, SMNS 2893; 12: *Chinacreagris chinensis*, female, SMNS 2895; 13: *Chinacreagris chinensis*, male, SMNS 2894; 14: *Bisetocreagris annamensis*, female, SMNS 3433; 15: *Bisetocreagris annamensis*, male, SMNS 3433; 16: *Bisetocreagris* sp. A, MHNG; 17: *Bisetocreagris* sp. B, male, SMNS 3511; 18: *Bisetocreagris* sp. B., female, MHNG; 19: *Bisetocreagris thailandica*, SMNS 3432; 20: *Bisetocreagris indochinensis*, male, SMNS 3434.

Distribution: Vietnam (locus typicus), Thailand (SCHAWALLER 1994), China (new record).

14. **Bisetocreagris indochinensis** (Redikorzev, 1938) (Fig. 20)

Material: Yunnan Prov., Xishuangbanna, IV.-VII.1993, 1 ex. ZISB, 1 ex. SMNS 3434.

Remarks: This material is characterized by a distinct granulation on the palpal femur, furthermore the club of the palpal patella is distinctly separated externally from the stick. The palps are sexually dimorphic and somewhat more slender in males (Fig. 20).

Distribution: Vietnam (locus typicus), Thailand (SCHAWALLER 1994), China (new record).

15. **Bisetocreagris kaznakovi** (Redikorzev, 1918)

Material: Not seen.

Distribution: Tibet (locus typicus), Nepal (SCHAWALLER 1987, 1991), Sikkim (1 ex. CGG).

16. **Bisetocreagris thailandica** Schawaller, 1994 (Fig. 19)

Material: Yunnan Prov., Xishuangbanna, IV.-VII.1993, 11 ex. ZISB, 3 ex. SMNS 3432. Yunnan Prov., Kunming, 4.IV.1992, 2 ex. ZISB. Yunnan Prov., Mengleng Tropical Garden, 9.IV.1992, 5 ex. ZISB, 2 ex. SMNS 3438. Yunnan Prov., Mengla-Mengleng, 10.IV.1992, 5 ex. ZISB.

Remarks: The Chinese series show no significant differences to the type series from Thailand. This species is characterized by a relatively small body size, smooth palps and short palpal fingers (Xishuangbanna specimens see Fig. 19) among other characters. The specimens from Kunming, however, have an indistinctly granulated palpal femur.

Distribution: Thailand (locus typicus), China (new records).

17. **Bisetocreagris** cf. **ussuriensis** (Redikorzev, 1934)

Material: Ilin Prov., Mt. Changbai, no date, leg. H.F. Wang, 1 ex. ZISB.

Remarks: This single record from the northeastern province is represented by a tritonymph only, which probably belongs to *ussuriensis* (Redikorzev, 1934). Without having adults a sure identification is impossible.

Distribution: Eastern Siberia (SCHAWALLER 1995), ? China (Ilin, new record).

18. **Chinacreagris chinensis** (Beier, 1943) (Figs 12-13)

Material: Zhejiang Prov., Mt. Tianmu, 1987-1989, 7 ex. ZISB. Hunan Prov., Mt. Hengshan, 1988-1989, 1 ex. ZISB, 1 ex. SMNS 2894, 1 ex. SMNS 2895. Fujian Prov., Mt. Wuyi, 31.VII.1983, leg. H.F. Wang, 3 ex. ZISB, 1 ex. SMNS 3445. Guizhou Prov., Huaxi, X.1986, leg. G.M. de Rougemont, 7 ex. MHNG, 2 ex. SMNS 3460. Sichuan Prov., Mt. Emei, 1800 m, 24.IX.1994, 3 ex. MHNG.

Remarks: The measurements, the palpal proportions and the smooth palpal femur coincide with the original description. A single specimen (SMNS 2894) possesses a few tubercles (not an even granulation as in *gigas*) on the palpal femur. The series from Mt. Wuyi is represented by tritonymphs only but could fit to the adults from the other adjacent localities. Proportions of the slightly sexually dimorphic palps of the Mt. Hengshan specimens see Figs 12-13.

Distribution: China (locus typicus: Kiangsu).

19. **Chinacreagris kwantungensis** (Beier, 1967)

Material: Not seen.

Distribution: China (Kwangtung)

20. **Chinacreagris nankingensis** Curcic, 1983

Material: Not seen.

Remarks: The status of the genus *Chinacreagris* seems doubtful to me, because the separation from *Bisetocreagris* by a somewhat different shape of the flagellum and a somewhat different setation of the abdominal tergites is typological and far away from scientific argumentation (see remarks under 11. *Bisetocreagris* sp. A).

Distribution: China (Kiangsu).

21. **Microcreagris gigas** Balzan, 1892 (Fig. 11)

Material: Zhejiang Prov., Mt. Tianmu, 1988-1989, 4 ex. ZISB, 2 ex. SMNS 2893. Hunan Prov., Mt. Hengshan, I.1988, 1 ex. ZISB. Sichuan Prov., Wolong Nature Reserve, 1000 m, 24.V.1994, 7 ex. MHNG, 4 ex. SMNS 3512. Sichuan Prov., Wolong Nature Reserve, 1700 m, 18.V.1994, 3 ex. MHNG. Sichuan Prov., Mt. Emei, 1500 m, 21.IX.1994, 2 ex. MHNG.

Remarks: The species, typus generis of *Microcreagris*, is redescribed by MAHNERT (1979). The specimen from Mt. Hengshan coincides well by the distinct even granulation, by the measurements and by the distinct epistome, the specimens from Sichuan and from Mt. Tianmu, however, are partly quite smaller (palpal femur 1.2 mm minimum, Fig. 11) and the epistome is reduced. I hope not to fail in considering these differences as infraspecific variations.

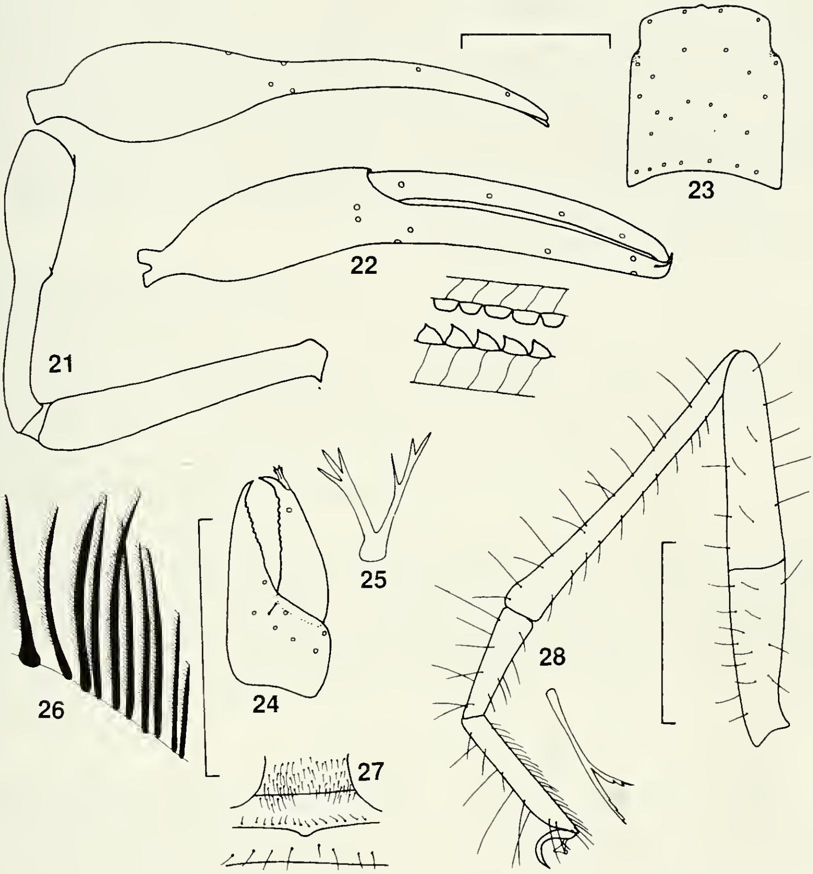
Distribution: China.

22. **Stenohya chinacavernicola** n.sp. (Figs 21-28)

Holotype (♂): China, Sichuan Prov., Huaying, cave "Dei" (="Xian Nin"), 1065 m, 17.VIII.1993, leg. "Centro Ybleo Ricerche Speleo-Ydrogeoliche", CGG.

Paratype (♀): China, Sichuan Prov., Huaying, cave "Chao-Tian", 930 m, 18.VIII.1993, leg. "Centro Ibleo Ricerche Speleo-Idrogeologiche", CGG.

Description (♂): Carapace (Fig. 23) smooth, (1.12/1.09 mm) 1.10x longer than wide, epistome rounded and indistint, a single small eye spot without lense on each side; carapace with 26 setae, anterior margin with 4, posterior margin with 7. Setation



FIGS 21-28

Stenohya chinacavernicola n.sp. holotype male, scales 1.0 mm - 21: Palp from dorsal; 22: Palpal chela from lateral with trichobothriotaxie and dentation in the middle of the fingers; 23: Carapace; 24: Chelicera; 25: Galea from lateral; 26: Flagellum; 27: Setation around genital opercula, 28: Leg IV IV with subterminal seta.

on tergites 9-8-10-10-12-12-13-14-13-12-10, on sternites x-x-18-18-18-19-18-18-16-10, setation around the genital opercula see Fig. 27. Chelicera (Fig. 24): 7 setae on the hand, movable finger with 1 seta; galea deeply bifurcated, each branch with 3 subbranches (Fig. 25); flagellum with 10 pinnate blades (Fig. 26); serrula with about 35 blades; both fingers each with about 8 small and rounded teeth. Pedipalp (Figs 21-22): all segments smooth, without granulation; femur (2.04/0.34 mm) 6.0x, patella (2.06/ 0.44 mm) 4.7x, chela without pedicel (3.30/0.68 mm) 4.86x longer than wide; pedicel of patella as long as club; finger somewhat longer than hand; trichobothriotaxie see Fig. 22, *ist* at the base of the fixed finger, *b* and *sb* separated; both palpal finger with about 120 equal and closely situated teeth, teeth on the fixed finger acute and pointing backwards. Medial process of the palpal coxa with 5+1 long setae. Leg IV (Fig. 28): femur and patella 2.18 mm, tibia 1.95 mm, basitarsus 0.66 mm, telotarsus 0.89 mm long; telotarsus 1.35x longer than basitarsus; subterminal seta bifurcated and with serrate branches. Body length 4.5 mm.

Description (♀): Sexual dimorphism indistinct. Flagellum and galea as in the male. Trichobothriotaxie and setation as in the male. Palpal proportions similar to those in the male: femur (2.02/0.36 mm) 5.7x, patella (1.90/0.40 mm) 4.75x, chela without pedicel (3.00/0.68 mm) 4.4x longer than wide. Body length 4.8 mm.

Discussion: This first cavernicolous species of the genus can easily be separated from the "free" living congeners by the palpal proportions with a long pedicel of the patella, by a relatively high number of setae on the carapace (which might be an adaption to cave life) and mainly by the trichobothriotaxie: *sb* just between *b* and *st* and not close to *b*, *ist* at the base of the fixed finger. This trichobothrial pattern is quite unusual within the genus and it could be necessary to place this species in an own genus after having revised the genus validity around "*Microcreagris*". The number of the flagellar blades seems variable in the genus: for example in *martensi* and *mahnerti* 8, in *hamatus* 7-10 and in *chinacavernicola* n.sp. 10 pinnate blades.

23. **Microbisium brevifemoratum** (Ellingsen, 1903)

Material: Ilin Prov., Mt. Changbai, no date, leg. H.F. Wang, 1 ex. ZISB. Shaanxi Prov., E Xian, Mt. Huashan, 1000 m, 9.-11.V.1994, 9 ex. MHNG, 3 ex. SMNS 3510. Beijing, no date, leg. H.F. Wang, 1 ex. ZISB. Beijing, 18.IX.1985, leg. H.F. Wang, 2 ex. SMNS 3443.

Remarks: These Chinese specimens show no differences to eastern Siberian records.

Distribution: Wider distribution in the Palaearctic region from Europe to eastern Siberia including Sakhalin and Kuriles, China (Ilin, Qinling, Beijing, new records).

Cheiridiidae (1 species)

24. **Cheiridium minor** Chamberlin, 1938.

Material: Not seen.

Remarks: The status of this species seems doubtful, probably it is a synonym of *museorum* (Leach, 1817).

Atemnidae (4 species)

25. **Anatemnus orites** (Thorell, 1889)

Material: Yunnan Prov., Xishuangbanna, IV.-VII.1993, 2 ex. ZISB, 1 ex. SMNS 3435. Yunnan Prov., Mengyang Nature Reserve, 500 m, 10.-14.IX.1994, 5 ex. MHNG.

Remarks: The species taxonomy within the genus *Anatemnus* is doubtful (SCHAWALLER 1994). This Yunnan material coincides with material from Thailand, which originates from an area close to the locus typicus of *orites* (Burma).

Distribution: Burma (locus typicus), southeastern Asia, China (new record).

26. **Atemnus politus** (Simon, 1878)

Material: Not seen.

Distribution: Widely distributed in the Palaearctic region, known also from Mongolia, Bhutan and China (BEIER 1967 sub *turkestanicus*).

27. **Diplotemnus insolitus** Chamberlin, 1933

Material: Not seen.

Remarks: *Miratemnus piger sinensis* Schenkel, 1953 is transferred by HARVEY (1990) to *Diplotemnus ophthalmicus* Redikorzev, 1949, which is synonymized by DASHDAMIROV & SCHAWALLER (1993) with *insolitus* Chamberlin, 1933.

Distribution: Wider distribution in the Palaearctic region from Algeria to Middle Asia, Sudan, Himalayas (locus typicus of *insolitus*) and China ("Süden des Ordos", localisation ?).

28. **Paratemnoides sinensis** (Beier, 1932)

Material: Not seen.

Distribution: China (Kwangtung).

Cheliferidae (6 species)

29. **Dactylochelifer gansuensis** Redikorzev, 1934

Material: Not seen.

Distribution: China (Kansu).

30. **Eremochernes secundus** Beier, 1937

Material: Not seen.

Remarks: This genus belongs to the Cheliferidae near *Rhacochelifer* (BEIER 1973) and includes 2 species (*gracilipes* Redikorzev, *secundus* Beier) from Mongolia and northwestern China respectively. *Eremochernes tropicus* Beier, 1967 from Thailand and Sichuan is transferred herein provisionally to the chernetid genus *Allochernes* Beier, 1932 (see 36.).

Distribution: China (Liaoning).

31. **Lophochernes gracilis** Beier, 1943

Material: Not seen.
Distribution: China (Fujian).

32. **Lophochernes tibetanus** Beier, 1943

Material: Not seen.
Distribution: Tibet.

33. **Macrochelifer tibetanus** (Redikorzev, 1918)

Material: Not seen.
Distribution: China (Chinghai).

34. **Sinochelifer kwantungensis** Beier, 1967

Material: Not seen.
Distribution: China (Kwangtung).

Chernetidae (10 species)

35. **Allochernes asiaticus** (Redikorzev, 1922)

Material: Not seen.
Distribution: Middle Asia, Nepal, Tibet.

36. **Allochernes tropicus** (Beier, 1967) n.comb.

Material: Sichuan Prov., Xiangcheng County, 2800 m, 7.VII.1982, leg. H.F. Wang, 1 ex. SMNS 3459.

Remarks: This single male coincides well with the description of *tropicus* Beier, 1967 (sub *Eremochernes* Beier, 1932), concerning for example the proportions of the palps and in having 3 flagellar setae, the serrula with 19 lamellae (description: 22), the tarsus IV distally with a tactile seta and the palpal chela with several accessory teeth. However, *Eremochernes* (see 30.) belongs to the Cheliferidae (Beier 1973), thus *tropicus* must be transferred to a chernetid genus. Because of the unsatisfactory taxonomic situation concerning the genus separation in this family, *tropicus* Beier, 1967 can be assigned only provisionally to the genus *Allochernes* Beier, 1932. The presence of a tarsal tactile seta is quite "unusual" among the congeners, but *Allochernes liwa* Harvey, 1988 from Sumatra also possesses such a seta.

Distribution: Thailand, China (Sichuan).

37. **Chernes hahni** (Koch, 1873)

Material: Beijing, no date, leg. H.F. Wang, 2 ex. ZISB, 1 ex. SMNS 3441.

Remarks: This series shows no differences in the palpal proportions, the setation, the granulation and in the form of the galea to European and eastern Siberian specimens.

Distribution: Europe, Caucasus, northern Iran, Kasakhstan, Siberia, Sakhalin, China (Beijing, new record).

38. **Chernes sinensis** Beier, 1932

Material: Not seen.

Remarks: The status of this species seems doubtful. The description point to a short tactile seta on the tarsus IV, which is unusual for *Chernes* but characteristic for *Dinocheirus*.

Distribution: China (Kwangtung).

39. **Lamprochernes savignyi** (Simon, 1881)

Material: Guizhou Prov., Huaxi, X.1986, leg. G.M. de Rougemont, 1 ex. MHNG.

Distribution: Cosmopolitan, China (new record).

40. **Megachernes himalayensis** (Ellingsen, 1914)

Material: Not seen.

Distribution: Himalayas, China (Sichuan, BEIER 1932 sub *sinensis*).

41. **Megachernes** cf. **himalayensis** (Ellingsen, 1914)

Material: Guangxi Prov., Contea Gongcheng, cave "Hei Yan", VIII.1994, leg. R. Zorzin, 1 ex. MSNV.

Remarks: This single male is very similar in many characters (specially palpal proportions) to the few specimens which I know from the Himalayas. However, the body is somewhat smaller, the last coxa is not swollen and the setation on the tergites and sternites is somewhat different, so probably we face a different (? new) species. Without having both sexes and without a revision of the Asian congeners I avoid in describing this form/species. In this connection it should be checked in the type material if *sinensis* Beier, 1932 is really a synonym of *himalayensis* (Ellingsen, 1914).

Distribution: see 40.

42. **Megachernes** cf. **titanius** Beier, 1951

Material: Yunnan Prov., Mengyang Nature Reserve, 500 m, 10.-14.IX.1994, 3 ex. MHNG, 1 ex. SMNS 3506.

Remarks: This series consists of 1 male and 3 females, which are somewhat smaller (body length about 4 mm) than noted in the description of *titanius* (♂ 4.5 mm, ♀ 5 mm), but distinctly bigger than *himalayensis*. Both sexes show no distinct dimorphism concerning the setation on the carapace and the palps but a distinct dimorphism concerning the proportions of the palpal patella and fingers. The palpal patella in males is round and thick (as figured in the original description) and in females distinctly more slender; the fingers are somewhat longer in females than in males.

Distribution: Vietnam, China (new record).

43. **Megachernes** cf. **vietnamensis** Beier, 1967

Material: Hubei Prov., Xing Shan, cave "Da Dang", 1992, leg. J. Lips, 1 ex. MHNG. Hubei Prov., Yishang, cave "Cygne", 1992, leg. J. Lips, 1 ex. MHNG. Sichuan Prov., Huaying, cave "Chao-Tian", 930 m, 18.VIII.1993, leg. "Centro Ibleo Ricerche Speleo-Idrogeologiche", 1 ex. CGG.

Remarks: *Megachernes vietnamensis* is significantly different from the congeners by its slender palps (in particular the femur) without distinct sexual dimorphism. The above listed specimens also possess such slender palps, but the palpal hand is somewhat more convex both on the lateral and on the medial side. Without further material it seems impossible to decide, whether this is a infraspecific variation or a character for separating different biospecies.

Distribution: Vietnam, China (new record).

44. **Verrucachernes oca** Chamberlin, 1947

Material: Yunnan Prov., Xishuangbanna, IV.-VII.1993, 2 ex. ZISB, 1 ex. SMNS 3436. Yunnan Prov., Mengyang Nature Reserve, 500 m, 10.-14.IX.1994, 10 ex. MHNG. Sichuan Prov., Wolong Nature Reserve, 1700 m, 18.V.1994, 5 ex. MHNG, 2 ex. SMNS 3503.

Remarks: The species is redescribed by HARVEY (1988). Probably, *Pselaphochernes indicus* Beier, 1974 is a synonym of *Verrucachernes oca*, at least the material which I recorded from Nepal (SCHAWALLER 1991) and Thailand (SCHAWALLER 1994) belongs to *Verrucachernes oca* and shows no differences to the new Chinese records.

Distribution: Wide distribution in southeastern Asia, China (new record), New Guinea, Solomon Islands.

Withiidae (3 species)

45. **Hyperwithius tonkinensis** Beier, 1951

Material: Sichuan Prov., Mt. Emei, 1700 m, 23.IX.1994, 1 ex. MHNG, 1 ex. SMNS 3507.

Remarks: This genus contains 3 "species": *annamensis* (Redikorzev, 1938), *dawydoffi* Beier, 1951 and *tonkinensis* Beier, 1951, which are mainly separated by the proportions of the palps and the setation on tergites and sternites. This might be only a typological separation, furthermore variability of the characters is unknown. The above listed 2 females fit quite well with the description of *tonkinensis*, based on 1 female and 1 male. In comparison with *Metawithius spiniventer*, which can be expected also in that region, the congeners of *Hyperwithius* are smaller, the form of the carapace is different and the trichobothrium on tarsus IV inserts somewhat distally and not just in the middle of the tarsus.

Distribution: Vietnam, China (new record).

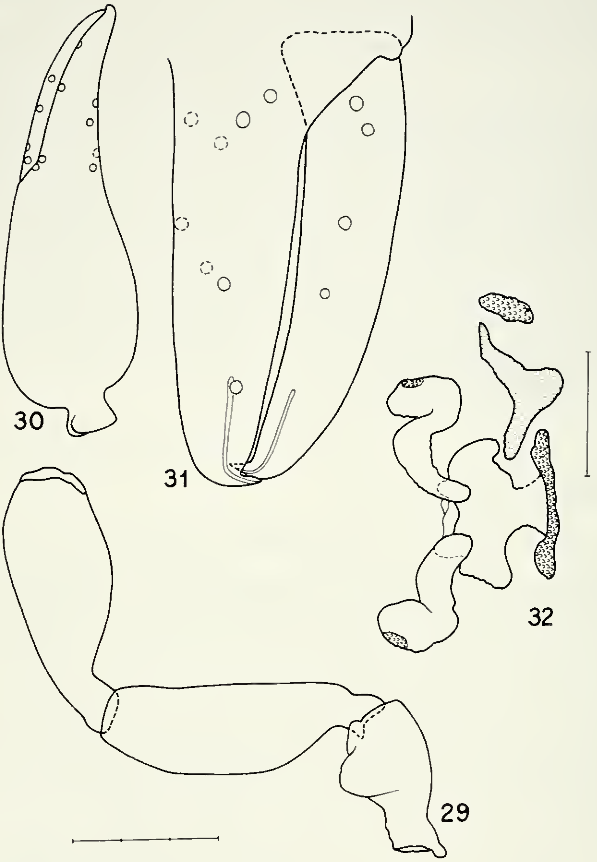
46. **Withius pekinensis** (Balzan, 1892) (Figs 29-32)

Material: China, Peking, 1 ♀ (holotype) MSF.

Description (by V. Mahnert): Carapace coarsely granulate (0.69/0.49 mm), 1.4x longer than wide, with 2 distict transverse furrows, 2 eyes present; setae of carapace and tergites clavate, mostly broken; tergites and sternites divided, tergal chaetotaxy not noted; setation of half-sternites 4/5-4-7-6/7-7-8-7-6, with 2 and 3 suprastigmal setae and 1 anterior lateral seta, a few sensory (?) setae present: VI 1, VII 2-3, VIII 2, IX 1 (?); anterior genital operculum with 12 setae. Spermatheca (Fig. 32) with paired short tubes. Chelicera: 5 setae on the hand (*db* and *ib* dentate), movable finger with 1 seta, galea broken (on both fingers), serrula with 16 blades, flagellum with 4 setae, fixed finger with 3 teeth, movable finger with cone-like subapical lobe. Pedipalp (Fig. 29): all segments granulate; trochanter with pointed dorsal hump, femur (0.55/0.18 mm) 3.0x, patella (0.55/0.21 mm) 2.7x, chelal hand with pedicel (0.54/0.28 mm) 1.9x longer than wide and 1.35x longer than finger, length of finger 0.40 mm, chela with pedicel (length 0.88 mm) 3.1x longer than wide; trichobothriotaxie see Figs 30-31, *ist* dorsal, *it* internal. Leg I: femur (0.13/0.12 mm) 1.0 x, patella (0.27/0.11mm) 2.3x longer than wide and 2.1x longer than femur, tibia (0.27/0.07 mm) 3.7x, tarsus (0.24/0.05 mm) 4.7x longer than wide; leg IV: femur and patella (0.51/0.17 mm) 3.0x, tibia (0.41/0.10 mm) 4.1x, tarsus (0.30/0.06 mm) 4.7x longer than wide; all setae broken, arolia broken, claws smooth.

Remarks: The trichobothrial pattern and the pedipalpal measurements are quite similar to those of *Withius piger* (Simon, 1878), but the spermatheca seems to be different. Males should be available before the specific identity of this species can be established.

Distribution: China (Hopeh).



FIGS 29-32

Withius pekinensis, holotype female, scales 0.3 mm (29, 30), 0.1 mm (32). - 29: Palp from dorsal; 30: Palpal chela with trichobothriotaxie; 31: Palpal fingers; 32: Spermatheca.

47. **Withius piger** (Simon, 1878)

Material: Not seen.
Distribution: Cosmopolitan, China (Kwangtung).

ACKNOWLEDGMENTS

Many thanks are due to Prof. Dr. Song Daxiang (Beijing), who trusted me with the valuable material for study, who allowed me to keep duplicates and who helped in transscribing Chinese labels into English. Dr. Giulio Gardini (Genova) transferred to me a few cavernicolous species from the Verona museum and from his own collection. Dr. Volker Mahnert (Geneva) loaned me the material from the Geneva museum, allowed me to use his redescription of *Withius pekinensis* and helped with the identification of *Stenohya chinacavernicola* n.sp. and *Allochernes tropicus*.

REFERENCES

BEIER, M. 1932. Pseudoscopionidea II. Subord. Cheliferinea. *Das Tierreich* 58: 1-294.

BEIER, M. 1951. Die Pseudoscorpione Indochinas. *Mém. Mus. natn. Hist. nat.* (ser. A) 1: 47-123.

BEIER, M. 1967. Pseudoscorpione vom kontinentalen Südost-Asien. *Pacific Insects* 9: 341-369.

BEIER, M. 1973. Pseudoskorpione aus der Mongolei. *Ann. naturhist. Mus. Wien* 77: 167-172.

CHAMBERLIN, J.C. 1930. A synoptic classification of the false scorpions or chela-spinners, with a report on a cosmopolitan collection of the same. - Part II. The Diplosphyronida (Arachnida, Chelonethida). *Annals Mag. nat. Hist.* (ser. 10) 5: 1-49, 585-620.

CURCIC, B.P.M. 1983. A revision of some Asien species of *Microcreagris* Balzan, 1892 (Neobisiidae, Pseudoscorpiones). *Bull. Br. arachnol. Soc.* 6: 23-36.

DASHDAMIROV, S. & W. SCHAWALLER, 1993. Pseudoscorpions from Middle Asia, Part 3 (Arachnida: Pseudoscorpiones). *Stuttgarter Beitr. Naturk.* (A) 497: 1-16.

HARVEY, M.S. 1988. Pseudoscorpions from the Krakatau Islands and adjacent regions, Indonesia (Chelicerata: Pseudoscorpionida). *Mem. Mus. Victoria* 49: 309-353.

HARVEY, M.S. 1990. *Catalogue of the Pseudoscorpionida*. 1-726. Manchester, Manchester University Press.

HONG, Y. & T.H. KIM, 1993. A check list and key to the order Pseudoscorpiones of Korea with description of one new species from the genus *Tyrannochthonius*. *Korean J. Ent.* 23: 1-4.

KIM, T.H. & Y. HONG, 1994. Two new species of Chthoniidae (Arachnida: Pseudoscorpiones) from Korea. *Korean J. syst. Zool.* 10: 47-53.

MAHNERT, V. 1979. The identity of *Microcreagris gigas* Balzan (Pseudoscorpiones, Neobisiidae). *Bull. Br. arachnol. Soc.* 4: 339-341.

REDIKORZEV, V. 1938. Les pseudoscorpions de l'Indochine francaise recueillis par M.C. Dawydoff. *Mém. Mus. natn. Hist. nat.* (NS) 10: 69-116.

SATO, H. 1979. Pseudoscorpions from Mt. Takao, Tokyo. *Mem. Educ. Inst. Priv. Schools Japan* 64: 79-105.

SCHAWALLER, W. 1987. Neue Pseudoskorpion-Funde aus dem Nepal-Himalaya, II (Arachnida: Pseudoscorpiones). *Senckenbergiana biol.* 68: 199-221.

SCHAWALLER, W. 1991. Neue Pseudoskorpion-Funde aus dem Nepal-Himalaya, III (Arachnida: Pseudoscorpiones). *Revue Suisse Zool.* 98: 769-789.

SCHAWALLER, W. 1994. Pseudoskorpione aus Thailand (Arachnida: Pseudoscorpiones). *Revue Suisse Zool.* 101: 725-759.

SCHAWALLER, W. 1995. Review of the pseudoscorpion fauna of the Far East of Russia (Arachnida: Pseudoscorpionida). *Arthropoda Selecta* 3: 123-126.

REVUE SUISSE DE ZOOLOGIE

Tome 102 — Fascicule 4

REVUE SUISSE DE ZOOLOGIE

Volume 102 — Number 4

Indexed in CURRENT CONTENTS

PUBLICATIONS DU MUSÉUM D'HISTOIRE NATURELLE DE GENÈVE

CATALOGUE DES INVERTÉBRÉS DE LA SUISSE

Fasc.	1.	SARCODINÉS par E. PENARD	Fr. 12.—
	2.	PHYLLOPODES par Th. STINGELIN	12.—
	3.	ARAIGNÉES par R. DE LESSERT	42.—
	4.	ISOPODES par J. CARL	8.—
	5.	PSEUDOSCORPIONS par R. DE LESSERT	5.50
	6.	INFUSOIRES par E. ANDRÉ	18.—
	7.	OLIGOCHÈTES par E. PIGUET et K. BRETSCHER	18.—
	8.	COPÉPODES par M. THIÉBAUD	18.—
	9.	OPILIONS par R. DE LESSERT	11.—
	10.	SCORPIONS par R. DE LESSERT	3.50
	11.	ROTATEURS par E.-F. WEBER et G. MONTET	38.—
	12.	DÉCAPODES par J. CARL	11.—
	13.	ACANTHOCÉPHALES par E. ANDRÉ	11.—
	14.	GASTÉROTRICHES par G. MONTET	18.—
	15.	AMPHIPODES par J. CARL	12.—
	16.	HIRUDINÉES, BRANCHIOBDELLES et POLYCHÈTES par E. ANDRÉ	17.50
	17.	CESTODES par O. FUHRMANN	30.—

REVUE DE PALÉOBIOLOGIE — Echange

LE RHINOLOPHE — par fascicule
(Bulletin du centre d'étude des chauves-souris) — Fr. 10.—

CATALOGUE ILLUSTRÉ DE LA COLLECTION LAMARCK
APPARTENANT AU MUSÉUM D'HISTOIRE NATURELLE DE GENÈVE
1re partie – Fossiles – 1 vol. 4° avec 117 planches — Fr. 300.—

COLLEMBOLENFAUNA EUROPAS von H. GISIN
312 Seiten, 554 Abbildungen — Fr. 30.—

THE EUROPEAN PROTURA
THEIR TAXONOMY, ECOLOGY AND DISTRIBUTION
WITH KEYS FOR DETERMINATION
by J. NOSEK
346 pages, 111 figures in text, 1973 — Fr. 30.—

CLASSIFICATION OF THE DIPLOPODA
par Richard L. HOFFMAN
237 pages, 1979 — Fr. 30.—

LES OISEAUX NICHEURS DU CANTON DE GENÈVE
par P. GÉROUDET, C. GUEX et M. MAIRE
351 pages, nombreuses cartes et figures — Fr. 45.—

CATALOGUE COMMENTÉ DES TYPES D'ECHINODERMES ACTUELS
CONSERVÉS DANS LES COLLECTIONS NATIONALES SUISSES,
SUIVI D'UNE NOTICE SUR LA CONTRIBUTION DE LOUIS AGASSIZ
À LA CONNAISSANCE DES ECHINODERMES ACTUELS
par Michel JANGOUX
67 pages, 11 planches — Fr. 15.—

RADULAS DE GASTÉROPODES LITTORAUX DE LA MANCHE
(COTENTIN-BAIE DE SEINE, FRANCE)
par Y. FINET, J. WÜEST et K. MAREDA
62 pages, nombreuses figures, 1991 — Fr. 10.—

GASTROPODS OF THE CHANNEL AND ATLANTIC OCEAN;
SHELLS AND RADULAS
by Y. FINET, J. WÜEST and K. MAREDA, 1992 — Fr. 30.—

O. SCHMIDT SPONGE CATALOGUE
par R. DESQUEYROUX-FAUNDEZ & S.M. STONE, 1992 — Fr. 40.—

ATLAS DE RÉPARTITION DES AMPHIBIENS
ET REPTILES DU CANTON DE GENÈVE
par A. KELLER, V. AELLEN et V. MAHNERT, 1993 — Fr. 15.—

THE MARINE MOLLUSKS OF THE GALAPAGOS ISLANDS:
A DOCUMENTED FAUNAL LIST
par Yves FINET, 1995 — Fr. 30.—

NOTICE SUR LES COLLECTIONS MALACOLOGIQUES
DU MUSEUM D'HISTOIRE NATURELLE DE GENEVE
par Jean-Claude CAILLIEZ, 1995 — Fr. 22.—

Instructions pour les auteurs

1. INSTRUCTIONS GÉNÉRALES

La Revue suisse de Zoologie publie les travaux des membres de la Société suisse de Zoologie ou ceux concernant l'activité du Muséum d'Histoire naturelle de Genève.

Chaque manuscrit est soumis à un comité de lecture.

Tout manuscrit reconnu comme non conforme aux «Instructions pour les auteurs» sera renvoyé pour mise au point.

Langue: les travaux proposés à la R.S.Z. peuvent être rédigés en français, allemand, italien ou anglais.

Frais: la R.S.Z. n'assume les frais d'impression et de clichage que dans la mesure de ses possibilités financières.

Tirés à part: les auteurs reçoivent gratuitement 25 exemplaires sans couverture; ceux commandés en plus ou avec couverture seront facturés.

2. TEXTE

Manuscrits: l'original et deux copies prêts pour l'impression doivent être dactylographiés en double interligne, sans corrections ni surcharges. Le «titre courant» et l'emplacement désiré des figures doivent être indiqués.

Abstract: chaque travail doit comporter la traduction de son titre, un court «abstract» ainsi que 5 «mots-clé» au maximum, le tout en anglais.

Nombre de pages: les travaux présentés aux assemblées de la Société suisse de Zoologie ne dépasseront pas 8 pages imprimées, illustrations comprises. Les autres travaux n'excèderont pas 20 pages et les thèses de doctorat, 30 pages.

Indications typographiques importantes:

Nous recommandons que les textes soient fournis sur disquette 3,5" pour Macintosh ou 5 1/4" IBM-compatible, en utilisant le logiciel «Microsoft Word».

Les disquettes ne seront retournées que sur demande de l'auteur.

Quel que soit le moyen utilisé, **machine à écrire ou ordinateur**, les auteurs se conformeront aux instructions suivantes:

- L'adresse sera placée sous le(s) nom(s) d'auteur(s). Le(s) prénom(s) seront écrits en toutes lettres.
- Le choix des caractères est du ressort de la rédaction. Tout le texte des manuscrits doit être composé en romain («standard» des traitements de texte), y compris les titres et sous-titres.
- Les mots qui doivent apparaître en italique à l'impression seront soulignés au crayon.

(Uniquement les noms de genres et catégories inférieures ainsi que les locutions latines; les noms de catégories supérieures et les termes anatomiques sont en romain.)

- Dans tous les cas ne pas utiliser de codes spéciaux de mise en page, de fin de page ou de format.
- Ne pas couper les mots (césure).
- Les notes infra-paginales, numérotées à la suite, doivent être groupées en fin d'article.
- Pour la bibliographie, ne pas séparer les références par une «ligne blanche».

Bibliographie: la liste des références ne devra comprendre que celles citées dans le texte et sa présentation sera conforme au modèle suivant (les soulignages sont à effectuer au crayon):

Penard, E. 1888. Recherches sur le Ceratium macroceros. Thèse, Genève, 43 pp.
– 1889. Etudes sur quelques Héliozoaires d'eau douce. Archs.Biol. Liège, 9:1-61.
Mertens, R. & H. Wermuth. 1960. Die Amphibien und Reptilien Europas, Kramer, Frankfurt am Main, XI + 264 pp.
Handley, C.O. Jr. 1966. Checklist of the mammals of Panama, pp. 753-795. In: Ectoparasites of Panama (R.L. Wenzel & V.J. Tipton, eds.). Field Mus. Nat. Hist. Chicago, XII+ 861 pp.

Les abréviations doivent être citées conformément à la "World List of Scientific Periodicals" (Butterworths, London).

3. ILLUSTRATIONS

Toutes les illustrations – numérotées de 1 à n – et les tableaux doivent être fournis en trois exemplaires: les originaux et 2 copies réduites au format A4.

Les originaux ne seront retournés aux auteurs que sur leur demande.

Réduction: les lettres et chiffres dans les figures (photos ou dessins au trait) doivent avoir au moins 1 mm après réduction. L'échelle sera indiquée sur les figures, les indications de grandissement ou de réduction (x 1000 par exemple) ne sont pas admis.

Dimensions: les figures ou les photos, groupées ou isolées, doivent être calculées de manière à ne pas dépasser **122 x 160 mm** après réduction. Le non respect de cette règle implique le renvoi du manuscrit.

Légendes: les légendes des figures seront réunies sur une page séparée.

4. CORRESPONDANCE

Toute correspondance est à adresser à:

Revue suisse de Zoologie – Muséum d'Histoire naturelle
Route de Malagnou – C.P. 6434
CH – 1211 GENÈVE 6
Tél. (022) 735 91 30 – Fax (022) 735 34 45