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TOME 114 — FASCICULE 4

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Chargés de recherche au Muséum d'histoire naturelle de Genève

Comité de lecture

Il est constitué en outre du président de la Société suisse de Zoologie, du directeur du Muséum de Genève et de représentants des instituts de zoologie des universités suisses.

Les manuscrits sont soumis à des experts d'institutions suisses ou étrangères selon le sujet étudié.

La préférence sera donnée aux travaux concernant les domaines suivants: taxonomie, systématique, faunistique, phylogénie, évolution, morphologie et anatomie comparée.

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Morphological analysis of the adult and juvenile instars of *Scutovertex minutus* (Acari, Oribatida, Scutoverticidae)

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Morphological analysis of the adult and juvenile instars of *Scutovertex minutus* (Acari, Oribatida, Scutoverticidae). - Individuals of *Scutovertex minutus* (Koch, 1836) were investigated originating from different regions of eastern Austria, Italy (Southern Tyrol), and Switzerland. Because of the fragmentary descriptions and scattered morphological data of this species it is necessary to redescribe it in detail. Characteristics for adult *S. minutus* are: Granular cerotegument; rounded rostrum; prodorsal median ridges, which converge early and do not reach the translamella; notogastral setae h_{2-3} and ps_1 distally slightly lanceolate, h_1 mostly a little broadened distally, blunt, and spinose; mentum with irregularly interrupted sclerotized transverse rib; leg chaetome (without solenidia): I (1-4-3-4-18), II (1-4-3-4-15), III (2-2-1-3-15), IV (1-2-2-3-12). Intraspecific morphological variation was observed in the shape of lamellar cusps and translamella, and in the length of prodorsal median ridges, in the shape of lenticulus and in the number of notogastral setae (10-12 pairs). Breeding experiments produced all juvenile instars which are here described in detail for the first time. Larva and nymphs in general show conformity in their habitus. Basic characteristics in juveniles are the plicate surface of the hysterosoma, larva with 12 and nymphs with 15 pairs of short gastronotic setae, reddish lateral opisthosomal glands, short lamellar, interlamellar and exobothridial setae. Conspicuous characters in the larval stage are the long and thick setae h_2 and in the nymphs the knife-shaped lateral setae l' and l'' on tibia I.

Keywords: Taxonomy - morphology - postembryonic development - intra-specific variation.

INTRODUCTION

Scutovertex minutus (Koch, 1836) is the earliest described and apparently the most common representative of the genus *Scutovertex* Michael, 1879. The reported findings show a Palearctic distribution. Although this species is known since 171 years, no detailed description or redescription is available. In spite of that, this species is often mentioned in papers dealing with the ecology and distribution of oribatid mites living in extreme environments as rocks, roofs, salt marshes or inundation meadows (e.g., Franz & Beier, 1948; Willmann, 1951; Weigmann, 1973).

Moreover, our knowledge of the juvenile stages is very poor. Only Grandjean (1946, 1949) and Haarløv (1957) gave some information on morphological characters and Smrž (1992) described some histological features of the juveniles of *S. minutus*.

The goal of this paper is to redescribe the adults of *S. minutus* and to describe the juvenile stages of this species in detail. These results should provide basic data of external morphology for further comparative investigations on other species of Scutoverticidae.

MATERIAL AND METHODS

COLLECTING: Adults and juveniles of *Scutovertex minutus* can be found throughout the year. They were extracted with Berlese-Tullgren funnels from mosses and lichens collected on sun exposed rocks and roofs in the eastern parts of Austria.

COLLECTING SITES (numbers in parentheses refer to the numbers of specimens examined):

Lower Austria: Asparn / Zaya: Eastern outskirts of the village; mosses and lichens on a tiled roof; 230 m; 16.11.1996; leg. E. Ebermann – (8). Traunstein: “Wachtstein-Camp”; mosses from rocks on the border of the parking site; 930 m; 31.05.2004 – (1). Türkensturz, Pittental: Mosses in rock crevices; 310 m; 17.10.1997; leg. R. Schuster – (2).

Upper Austria: Urfahrer Wänd: W Linz; mosses and lichens of a rock; 300 m; 02.05.1997; leg. R. Schuster – (1).

Styria: Frauental, near the castle; mosses and lichens of a tiled roof; 340 m; May 1996; leg. E. Ebermann – (10). Gleichenberger Kogel: Quarry; lichens from rocks; 570 m; 15.06.1991; leg. R. Schuster – (2); 11.02.2007 – (2). Stiwill: Mosses of the graveyard wall; S- and SW-exposed; 500 m; 23.08.2004 – (2). Öblarn: Mosses from a wall on the riverbank of the river Enns; S-exposed; 670 m; 05.04.2006 – (2). Pogier near Kapfenberg: Mosses from roof of an old hut; 680 m; 02.10.2006 – (6).

Carinthia: Laas: NW Hermagor; near the parking site of the hospital; mosses from rocks; SW-SE-exposed; 830 m; 02.09.2004; leg. P. Horak – (1).

Italy, Southern Tyrol: Lüsen, 23.08.1998; ex Coll. Schatz – (7)

44 individuals from these samples were analyzed morphologically and about 50 adults were taken for breeding experiments to get larvae and nymphs.

MICROSCOPIC SLIDES FROM MUSEUM COLLECTIONS : Museum of Natural History, Basel; Coll. Schweizer: Switzerland, Neuenstadt; slide no. 1477 (labelled as *Scutovertex sculptus*) – (8 specimens in one slide).

Bavarian State Collection of Zoology Munich (ZSM); Coll. Willmann: Switzerland, Grindelwald, 03.10.1913, slide no. A20041022 – (1 specimen).

REFERENCE MATERIAL: 10 adult specimens, collected in Styria, stored in ethanol, deposited in the Muséum d’histoire naturelle, Genève.

BREEDING: Adults were put in cylindrical polystyrol-boxes (diameter about 1.5 cm) with a bottom of moistened plaster of Paris. Mosses and lichens taken from the bark of trees served as food source. To avoid the growth of fungi in the boxes, hyphae were removed with a fine, soft paintbrush every day.



FIGS 1-4

S. minutus, adult. (1) Habitus, dorsal aspect; arrowheads indicate the position of notogastral saccules S_1 , S_2 , S_3 . (2) Lateral part of prodorsum and rostrum; arrowheads point to the two projecting rostral ridges; arrow indicates the 'V-shaped' tutorium. (3) Pedipalp in lateral view. (4) Habitus, ventral aspect (legs omitted).

PREPARATION: The collected specimens were preserved in 70% ethanol. A differential interference contrast microscope (Olympus BH-2, equipped with a drawing tube) was used for investigation in transmitted light. Some specimens were embedded in lactic acid (as clearing agent) using concavity slides, others were mounted in Swan-medium (a mixture of arabic gum, aqua dest., glucose, chloral hydrate and glacial ethanoic acid) as permanent slides. Micrographs were taken with a digital camera (Olympus Camedia C4040 zoom). For scanning electron microscopy the specimens were dehydrated in ascending ethanol concentrations, dried in air, mounted on aluminium-stubs with double sided adhesive tape and coated with gold. SEM-micrographs were taken at the Research Institute for Electron Microscopy, Technical University Graz with a Zeiss Leo Gemini DSM 982.

ABBREVIATIONS used in figures: *a* = anterior subcapitular seta; *ad* = adanal seta; *ag* = aggenital seta; *an* = anal seta; *bo* = bothridium; *bS* = sensillus; *Ch* = chelicere; *c*₁₋₃, *da*, *la*, *dm*, *lm*, *dp*, *lp*, *h*₁₋₃, *ps*₁₋₃ = notogastral setae; *ex* = exobothridal seta; *ε* = famulus on tarsus I; *ft*' = fastigial seta; *g* = genital seta; *G* = gena; *gla* = opening of lateral opisthosomal gland; *h* = hysteroostomatic seta; *in* = interlamellar seta; *im*, *iad* = lyrifissures; *le* = lamellar seta; *Le* = lenticulus; *lg* = labiogenal articulation; *M* = mentum; *m* = median subcapitular seta; *Pdp* = pedipalp; *ro* = rostral seta; *RU* = rutellum; *ω*_{1,2} = solenidia on tarsus; *1a*, *1b*, *1c*, *2a*, *3a*, *3b*, *4a*, *4b* = epimeral setae.

RESULTS

ADULTS

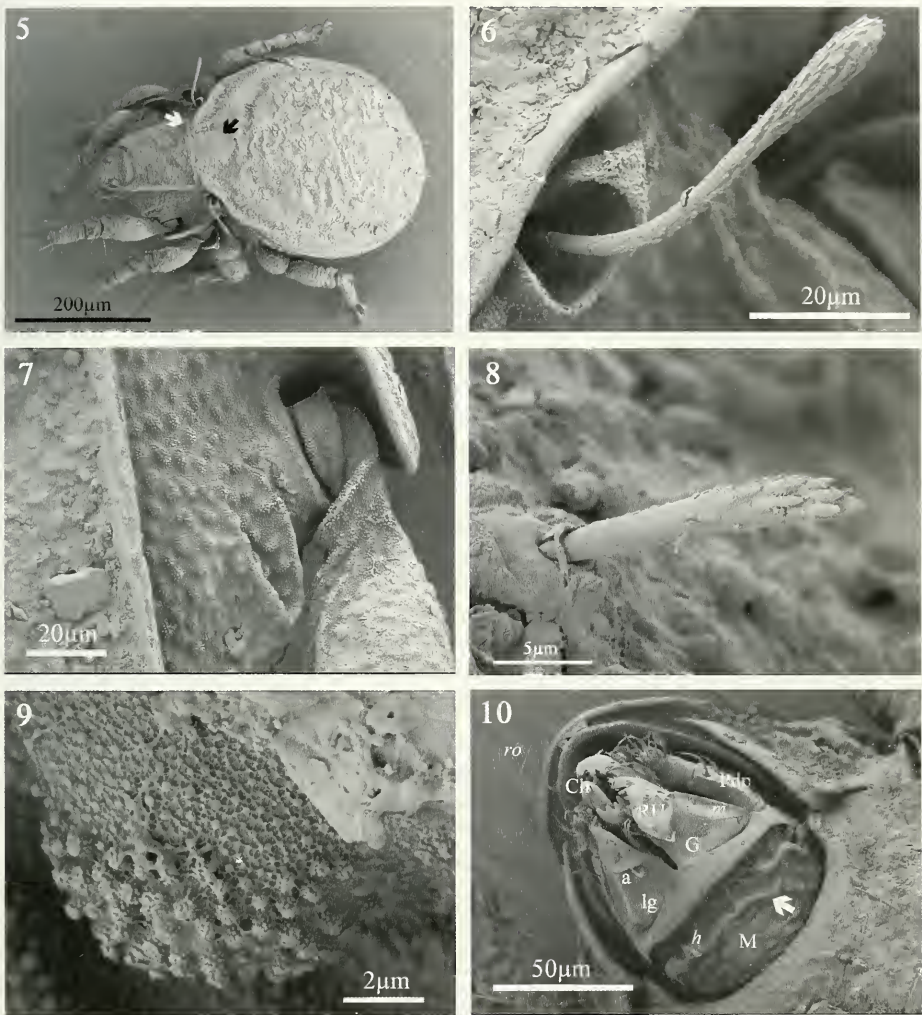
DIAGNOSIS: Habitus corresponding to a typical *Scutovertex*. Cerotegument (on notogaster) granulate, cuticle dark and heavily sclerotized, without foveae. Median converging ridges of prodorsum not reaching translamella. Rostrum anterior of translamella with circular ridge. Sensillus clavate, spinose. Mentum with irregularly interrupted sclerotized transverse rib. 10-12 pairs of notogastral setae; setae *h*_{2,3} and *ps*₁ distally slightly lanceolate, *h*₁ often a little broadened distally, blunt, and spinose. Leg chaetome (excluding solenidia): I (1-4-3-4-18), II (1-4-3-4-15), III (2-2-1-3-15), IV (1-2-2-3-12).

DESCRIPTION: *Habitus* (Figs 1, 5): Body contour oval in dorsal view; colour dark brown to black (in living individuals), in lactic acid and ethanol more light-coloured.

Measurements (n=40): Mean total length: 589 μm (range 550-659 μm). Mean notogastral width: 347 μm (range 325-380 μm).

Integument (Fig. 5): Cerotegument granulate, covering entire body and leg segments; some granules fused to irregular bars. Whole cerotegument giving the specimens a rough surface. Granules in cavities and protected areas of the body smaller and interconnected, forming a reticulate pattern (Fig. 9). Cuticle without foveae.

Prodorsum (Figs 1, 2): Rostrum in dorsal view characterised by a circular ridge, its anterior part visible in lateral view (Fig. 2) as a projecting ridge. Additionally, on the outermost part of the rostrum a second ridge projecting beyond the anterior part of the circular one and looking like a narrow rostral lobe. Rostral setae inserting near lateral end of this distal ridge. Distinct lamellae; lamellar cusps mostly short and broad, sometimes long. Lamellar setae originating at the top of cusps and curving towards



FIGS 5-10

S. minutus, adult. (5) Habitus, dorsal aspect; black arrow points to the lenticulus; white arrow indicates the cuticle bar on the border between prodorsum and notogaster. (6) Sensillus and bothridium in dorsal view. (7) Dorsal view of left lateral part of prodorsum with V-shaped tutorium and base of leg I. (8) Notogastral seta h_3 , slightly lanceolate and spinose distally. (9) Nodule in the humeral region containing lyrifissure *ia* covered with reticulated cerotegument. (10) Camerostome and subcapitulum in ventral view; arrow indicates transverse rib of mentum.

each other. Translamella broad and straight or narrow and slightly bent caudad connecting lamellae. Between bothridia two convergent ridges fused in the middle of prodorsum and running rostrad, not reaching translamella. Interlamellar setae absent.

Sensillus (Fig. 6) flat, clavate and spinose. Bothridium wide and cup-like, margin without incision; antiaxial side showing a small apophysis with a ridge running ventrally.

A V-shaped cuticular elevation (Figs 2, 7) rostrad of leg I placed as the tutorium.

Notogaster (Figs 1, 5): Oval; suture between notogaster and prodorsum incomplete medially. Lateral borders of lenticulus concave or parallel or slightly convex. No pteromorpha, only humeral projections. Octotaxic system represented by three pairs of very small saccules (S_1 - S_3). 10-12 pairs of setae: c_2 , da , dn , dp , la , lp , h_{1-3} and ps_{1-3} ; da and/or dp reduced in most cases (12 pairs observed only once); sometimes setae reduced one sided. Setae h_{2-3} and ps_1 distally slightly lanceolate and spinose (Fig. 8), h_1 often a little broadened distally, blunt, and spinose. Other setae acute; setae lp the longest, rest of setae decreasing in length rostrad and caudad. A small, projecting cuticular nodule under the humeral projection (Fig. 9) with a weak slit (lyrifissure ia) visible in transmitted light. Lyrifissure im latero-median on the notogaster, ip dorsally of the line seta ps_1 and ps_2 ; ih and ips on the posterior lateral border of the notogaster. Openings of lateral opisthosomal glands located in line of lyrifissures im and setae h_3 ; reservoir of the gland narrow but elongated.

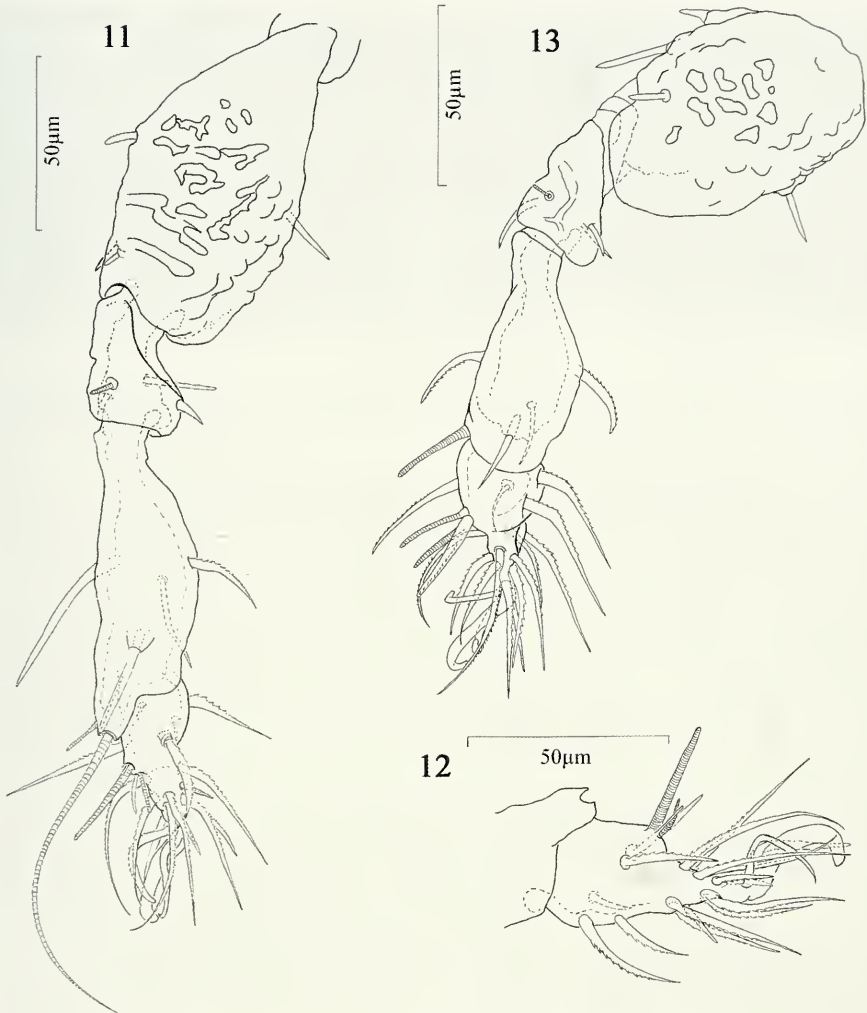
Rostrum and *camerostome* (Fig. 4): Rostrophragma forming inner margin of camerostome (Fig. 10). A longish triangular lamella originating from the posterolateral corner of the camerostome running parallel to the inner border of the camerostome rostrad; distal end of lamella overlapped by rostral lobe. No genal incision.

Gnathosoma: Subcapitulum diarthric (Fig. 10); rutellum pantelebasic, distally with four teeth, first one the strongest. Genae possessing sharp lateral edges, one pair of anterior subcapitular setae (a) and median subcapitular setae (m), both finely serrate. An irregularly interrupted sclerotised rib running across the mentum; the simple hysterostomatic setae (h) inserting on it. Pedipalp with five articles (Fig. 3); chaetome: 0-2-1-3-9. Solenidia: 0-0-1. Setae on each segment (femur to tarsus) spiniform and of different lengths. The four tarsal eupathidia bacilliform, with slightly broadened basis. Solenidion recumbent, distal end touching the basis of eupathidium acm . Porous axillary sacculus at basis of pedipalp. Chelicerae with two setae: cha longer than chb . Trägårdh's organ of same length as moveable digit of chela.

Epimeral region (Fig. 4): Setal formula: 3-1-2-2. All setae acute, slim and smooth, seta $1c$ located at basis of pedotectum I. Pedotectum I large, completely hiding acetabulum I. Pedotectum II strongly developed, in horizontal plane "Y-shaped". Apodemata different, either reaching median axis or shorter, depending on the degree of sclerotization of the individuals. Apodemata IV always absent.

Anogenital region (Fig. 4): Genital valves approximately trapezoid. Genital setae: Six pairs; the two foremost pairs inserting next to each other, the median pair about twice as long as the lateral pair. One pair of aggenital setae, latero-caudally of genital opening. A transversal furrow situated closely behind genital opening, whose ends directed towards the acetabula IV. Anal valves long, posteriorly broadened. A ridge running along axial border of the valves, between those a groove. A shallow groove antiaxially of this ridge. Preanal organ cup-like. Two pairs of anal setae inserting antiaxially of the ridges; setae smooth, acute and slim, an_1 longer than an_2 . Lyrifissures iad situated laterally near front edge of anal orifice. Adanal setae ad_1 and ad_2 located posterior to anal orifice, ad_3 lateral to it; all of these setae short and spiniform, inserting on small cuticular bumps.

Legs (Figs 11-18): Tarsi with fine-grained cerotegument except on distal end. Apotele tridactyl; median claw dorsally weakly spinose, crescent-shaped and stronger



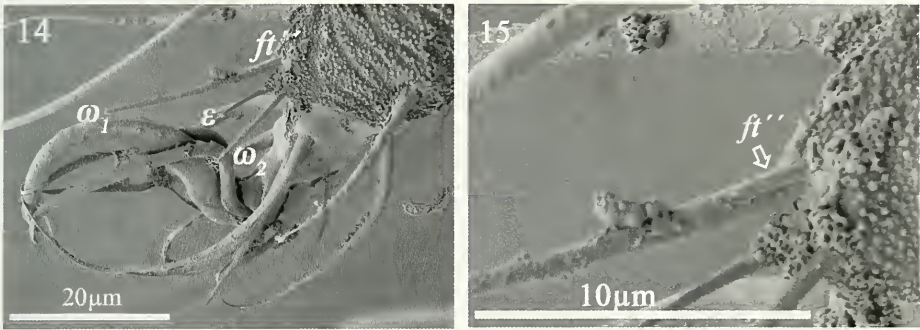
FIGS 11-13

S. minutus, adult. (11) Left leg I (tarsus to femur), antiaxial, ventrolateral aspect. (12) Right tarsus I, antiaxial aspect. (13) Left leg II, antiaxial aspect.

than the two lateral, clearly spinose claws. All femora with one dorsal stigma, from there one trachea running to distal part of tibia (legs I-III) or to proximal part of tarsus (leg IV); in legs I and II a second short trachea running in opposite direction and ending within femur. Additionally, one trachea within trochanter of legs III and IV; stigma opening proximally paraxially. Chaetome and solenidia of legs see Table 1. Leg I (Figs 11, 12): Femur elongated, with short irregular ridges. Genu shortest segment with a conspicuous ridge; solenidion (σ) on a small bump. Solenidia of the tibia inserting on a strong apophysis distally; φ_1 very long, whip-shaped, φ_2 short and straight. Tarsal solenidia (ω_1 and ω_2 – second one thinner and shorter than first one), famulus (ϵ) and

TABLE 1. *Scutovertex minutus*; leg setation of all instars. First development of setae characterised by letters, if in parentheses () = pairs of setae; - = no change with regard to the preceding stage. α , q , ω = solemlidia. Numbers in | = individual variation.

Instars	Trochanter	Femur	Genu	Tibia	Tarsus	Chaetome	Solemlidia
Leg I							
Larva		$d\ b\ v''$	$(l)\ d\ \sigma$	$(l)\ v''\ d\ q_1$	$(ft)\ (tc)\ (p)\ (tu)\ s\ (a)\ (pv)\ (pl)\ \varepsilon\ \omega_1$	0-2-3-4-16	1-1-1
Protonymph		-	-	-	-	0-2-3-4-16	1-1-2
Deutonymph		(l)	-	-	ω_2	0-4-3-4 5 1-16	1-2-2
Tritonymph	v''	-	v'	$v'\ q_2$	(it)	1-4-4-5-18	1-2-2
Adult	-	-	$d\ \text{lost}$	$d\ \text{lost}$	-	1-4-3-4-18	1-2-2
Leg II							
Larva		$d\ b\ v''$	$(l)\ d\ \sigma$	$l''\ v''\ d\ \varphi$	$(ft)\ (tc)\ (p)\ (tu)\ s\ (a)\ (pv)\ \omega_1$	0-2-3-3-13	1-1-1
Protonymph		-	-	-	-	0-2-3-3-13	1-1-1
Deutonymph		-	-	l'	ω_2	0-4-3-4-13	1-1-2
Tritonymph	v''	(l)	v'	v'	(it)	1-4-4-5-15	1-1-2
Adult	-	-	$d\ \text{lost}$	$d\ \text{lost}$	-	1-4-3-4-15	1-1-2
Leg III							
Larva		$d\ e\ v'$	$l'\ d\ s$	$v\ d\ j$	$(ft)\ (tc)\ (p)\ (tu)\ s\ (a)\ (pv)$	0-2-2-2-13	1-1-0
Protonymph		-	-	-	-	0-2-2-2-13	1-1-0
Deutonymph	v'	-	-	-	-	1-2-2-2 3 1-13	1-1-0
Tritonymph	l'	-	-	(l)	(it)	2-2-2-4-15	1-1-0
Adult	-	-	$d\ \text{lost}$	$d\ \text{lost}$	-	2-2-1-3-15	1-1-0
Leg IV							
Protonymph					$ft''\ (p)\ (tu)\ (pv)$	0-0-0-0-7	0-0-0
Deutonymph		$d\ e\ v'$	$d\ l'$	$v'\ d\ j$	$(tc)\ s\ (a)$	0-2-2-2-12	0-1-0
Tritonymph	v'	-	-	$l'\ v''$	-	1-2-2-4-12	0-1-0
Adult	-	-	-	$d\ \text{lost}$	-	1-2-2-3-12	0-1-0



FIGS 14-15

S. minutus, adult; distal part of tarsus I. (14) Solenidia and famulus. (15) Basal part of solenidion ω_1 with short companion seta ft'' .

seta ft'' close to each other (Figs 14, 15). Leg II (Fig. 13): Femur stocky, with thick cerotegument. Solenidion of genu (σ) short and delicate. Tibial solenidion (φ) long and situated distally. Tarsus with two slim and long solenidia. Leg III (Figs 16, 17): Trochanter with approximately triangular shape. Femur broad, with ribbed surface, ventrally with lamella. Solenidion of genu (σ) on an inconspicuous bump. Tibial solenidion (φ) short. Seta ft'' of tarsus long, spiniform. Leg IV (Fig. 18): Trochanter big, broad. Femur elongated, ventrally with lamella; cuticle with conspicuous short irregular ridges. Tibia long, slim; solenidion (φ) short. Seta ft'' of tarsus long, spiniform.

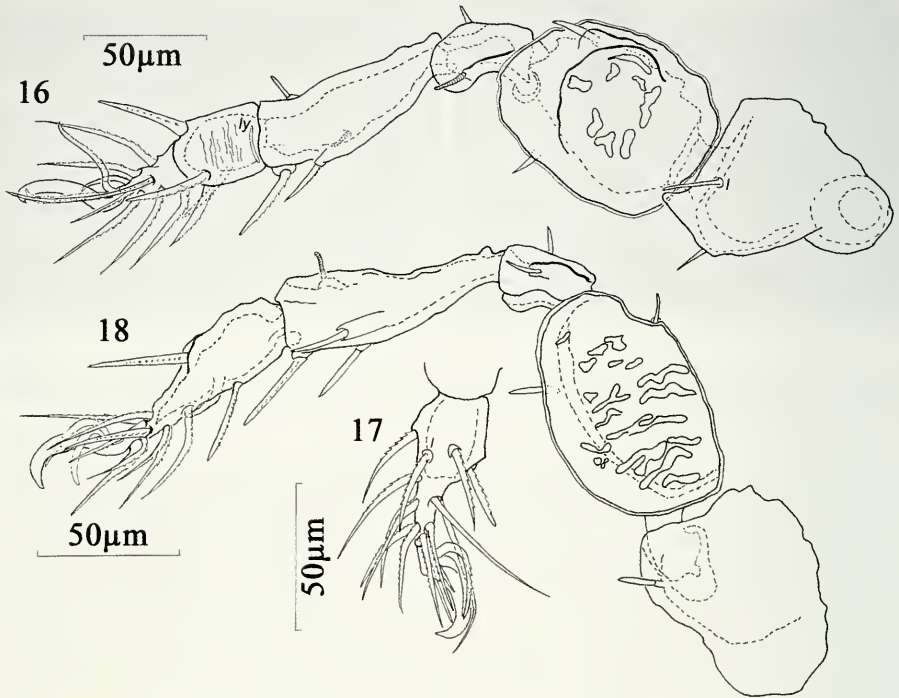
JUVENILE INSTARS

In general larva, proto-, deuto- and tritonymphs show conformity in their habitus and they just vary in measurements depending on their postembryonic stage. Therefore characters that are the same in all stages are mentioned first. Subsequently, typical features of each juvenile stage will be described.

Habitus: Oval with irregular plication in dorsal view (Fig. 19). Cuticle grey in permanent slides, only variation in different stages from light grey to dark grey. Living individuals also grey with silver glimmer. Weakly sclerotised, especially on notogaster and legs. Cerotegument shows various structures in different body regions (Figs 20, 22, 23).

Prodorsum: Rostrum different from that of adults. Rostral setae long, but lamellar setae primarily very short, acute and inserting on small bumps. The latter not in same position as in adults, situated more caudally and more medially in the first third of prodorsum. No lamellar cusps present. Sensillus relatively long, clavate and spinose. Bothridium cup-like and big. One pair of interlamellar setae (*in*) located between bothridia; very short and acute in larval stage, tip cone-shaped in nymphal stages (Fig. 21). Exobothridal setae near bothridium, often hardly visible because of wrinkled cuticle. Lenticulus not distinct as in adults; a rectangular slight elevation situated between bothridia in front of the plicate notogastral area (see Fig. 19).

Hysterosomatic region: Conspicuous prodorsum and hysterosomatic region separated by an almost straight suture. Circular reservoirs of lateral opisthosomal



Figs 16-18

S. minutus, adult. (16) Right leg III, antiaxial aspect. (17) Left tarsus III, antiaxial aspect. (18) Right leg IV, antiaxial aspect.

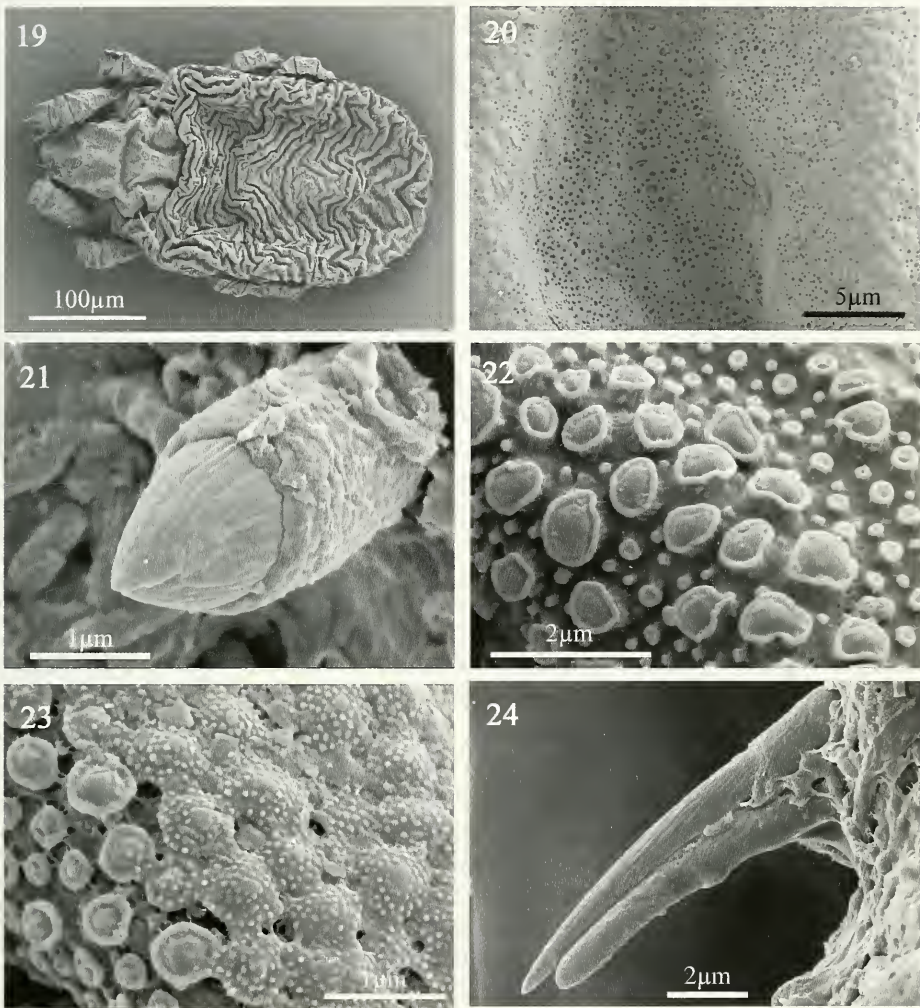
glands situated postero-laterally; their reddish content shining through the cuticle of living individuals but this stain disappearing on permanent slides. Cupules (lyri-fissures) always developed as faint disk-like structures; their number corresponding to the stages (see below).

Gnathosoma: Nymphal subcapitulum with axillary saccules on basis of palps as in adults.

Epimeral region: Number of setae different between juvenile stages. Median area of epimera covered with fine wrinkles. Apodemata not reaching median axis.

Anogenital region: Whole anogenital region wrinkled like dorsal part of hysterosoma.

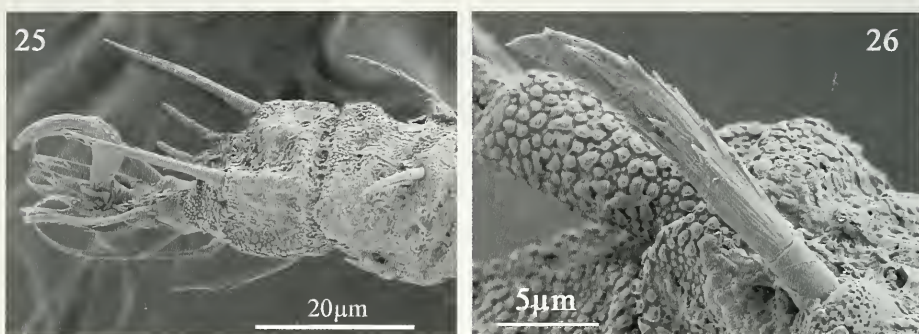
Legs: Cerotegumental structure (Fig. 22) consisting of mushroom-like structures. Most of these formations coated with another fine granulated layer (Fig. 23). No tracheae in legs, but at least femora showing porose areas in the deuto- and tritonymphal stage. Number of setae increasing from stage to stage. Chaetome and solenidia of legs, see Table 1. Dorsal setae on genu and tibia paired with the solenidium (Fig. 24). Various setae differing in length, thickness and serration (e.g., Fig. 25). Lateral setae (*l'* and *l''*) on tibia I of nymphs of special form: Thick, knife-shaped and serrate (Fig. 26).



FIGS 19-24

S. minutus. (19-21) Deutonymph. (19) Habitus, dorsal view. (20) Fine structure of cerotegument between two wrinkles of notogastral cuticle. (21) Right interlamellar seta. (22-24) Tritonymph. (22) Cerotegument of right tarsus I, axial aspect, near *ft*". (23) Cerotegument of leg III. (24) Solenidion φ with companion seta *d* of tibia II.

LARVA (Figs 27, 31): Body length (n=3): 247-250 μm . Body width: 156-163 μm . Translamella not discernible in this stage. Rostral setae straight and forward-directed. 12 pairs of gastronomic setae: *c*₁₋₃, *da*, *la*, *dm*, *lm*, *dp*, *lp*, *h*₁₋₃. Cupules *ia* and *im* in dorsal aspect visible; *ih* anterior and *ip* posterior to anal orifice. Epimeral setae: 2-1-2; seta *lc* on epimeron I not developed. Anal valves hardly visible because of wrinkled cuticle. Two pairs of notogastral setae *h*₂ and *h*₃ near anal valves. Setae *h*₃ short and acute, inserting lateral of the valves; *h*₂ remarkably long and thick, located



FIGS 25-26

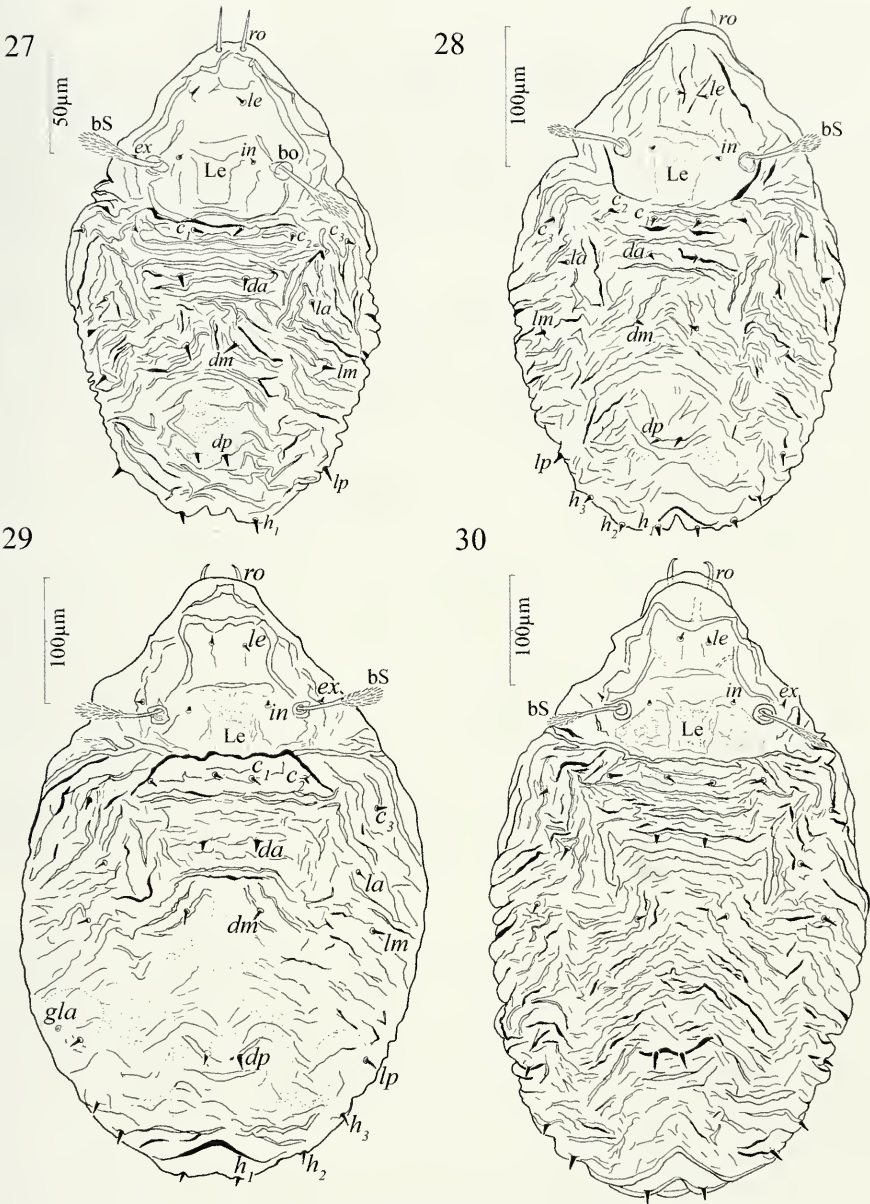
S. minutus, tritonymph. (25) Left tarsus II, antiaxial aspect. (26) Right tibia I, lateral seta *l'*.

caudally (see Fig. 31). Legs (Figs 35-37). Apophysis on leg I approximately as long as tibia. Claparède organs dome-shaped.

PROTONYMPH (Figs 28, 32): Body length (n=2): 350-375 µm. Body width: 219-231 µm. No distinct lamellae and translamella. 15 pairs of short gastronotic setae, *c*₁₋₃ thin, the remaining ones thicker. Cupules *ips* lateral near front edge of anal valves; *ih* and *ip* displaced laterally. Formula of epimeral setae: 3-1-2-1; seta *4a* in the middle of epimeron IV. One pair of genital setae on genital valves. Aggenital, anal and adanal setae not developed. Legs (Figs 38-41).

DEUTONYMPH (Figs 29, 33): Body length (n=6): 450-500 µm. Body width: 281-325 µm. Rostral setae slightly curved towards each other. Cuticular ridges extending rostrad from bothridium, apically transversally connected. The short and acute lamellar setae close behind this transversal ridge. 15 pairs of short and slim gastronotic setae inserting on bumps of different height; location same as in protonymphs. Cupules *iad* situated in same position as in adults; *ips* dislocated next to *ih*. Formula of epimeral setae: 3-1-2-2; seta *4b* situated near the median axis. Genital valves clearly outlined; still narrow and almond-shaped in closed condition. Two or three pairs of genital setae present. One pair of aggenital setae lateral of genital valves. Anal valves already well-developed but without anal setae. Three pairs of adanal setae (first appearance in juveniles), situated laterally of anal valves. Legs (Figs 42-45). Two of the raised individuals showing intraspecific variation in their leg chaetotaxy: One specimen with five setae on right tibia I and four on left tibia I; another one with three setae on both tibiae III.

TRITONYMPH (Figs 30, 34): Body length (n=3): 531-613 µm. Body width: 338-406 µm. Prodorsal ridges resembling lamella and translamella of adults; short and acute lamellar setae behind ridges. Rostral setae long and curved towards median axis. Lateral opisthosomal gland poorly shining through the cuticle because of darker colour of individuals. 15 pairs of short and acute gastronotic setae. Cupules *ips* displaced posteriorly in line of *ih* and *ip*. Formula of epimeral setae: 3-1-2-2. Each genital valve with five setae. One pair of aggenital setae latero-caudally of valves. Anal valves



FIGS 27-30

S. minutus, juveniles; habitus in dorsal view. (27) Larva. (28) Protonymph. (29) Deutonymph. (30) Tritonymph.

narrow and elongated. Valves surrounded by two adanal plates, each of them with three adanal setae. Setae *ps*₁, *ps*₂ and *ps*₃ laterally and caudally of anal region inserting on short bumps. Legs (Figs 46-49): Tibia I longer than in previous stages, therefore apophysis relatively shorter.

DISCUSSION

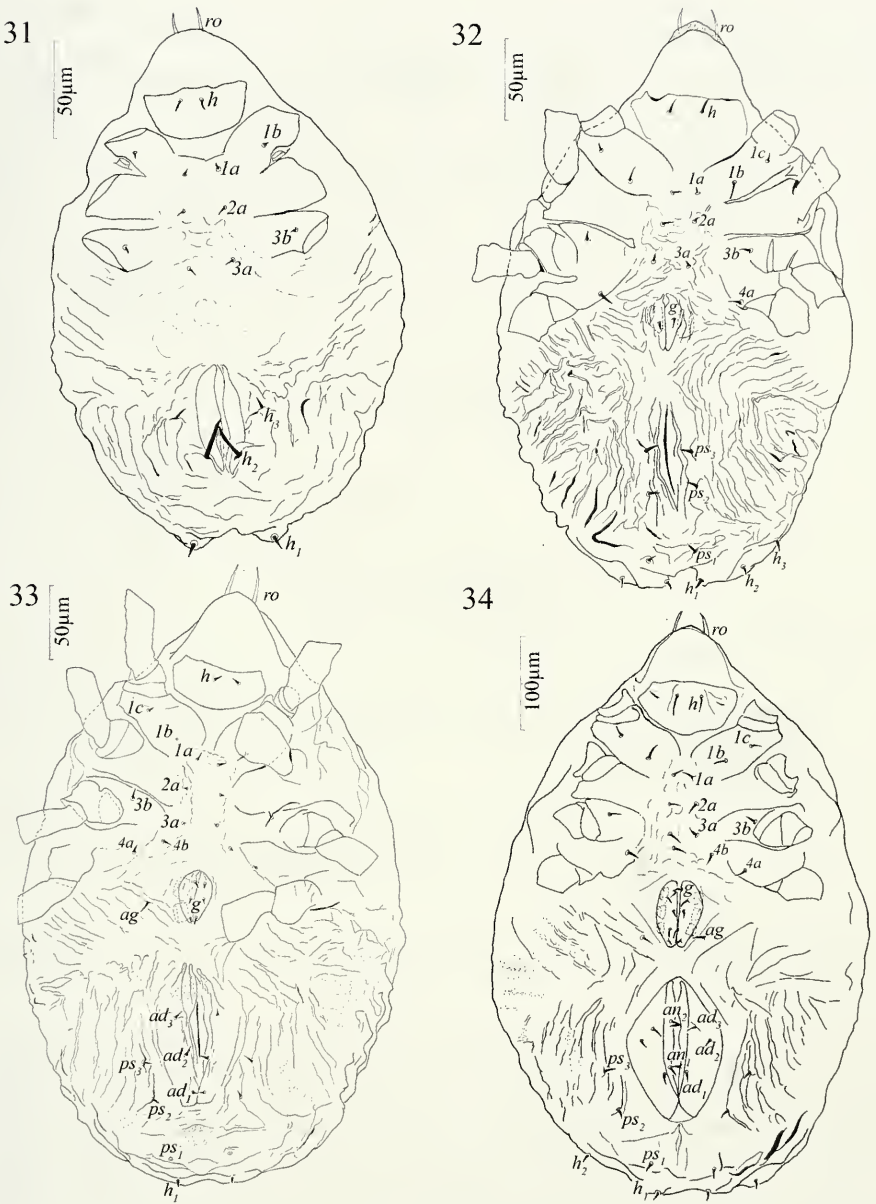
ADULTS

We decided to morphologically analyse the adults of *Scutovertex minutus* in detail, because of the many not yet examined features on the one hand and because of the existence of different figures of this “species” in oribatid papers and keys on the other hand. Drawings of the dorsal view of “*S. minutus*” show diverging body shapes, various sensilli, and homologous notogastral setae of different length and shape (compare Strenzke, 1943; Schweizer, 1956; Ghiljarov & Krivolutsky, 1975; Balogh, 1972, 1992; Pérez-Iñigo, 1993).

The types on which the original description by C. L. Koch is based were collected from the moat of Regensburg (Bavaria). Our two attempts to collect additional *S. minutus* material in Bavaria (Großer Arber, Neu Schwanstein) were not successful. Unfortunately, no *Scutovertex*-specimens of the collection of C. L. Koch are still available for comparison; requests addressed to the Museum of Natural History, Berlin, and to the Museum of Natural History of London brought no positive results. The short descriptions of *S. minutus* (Koch, 1836) and *S. ovalis* (Koch, 1841) and Koch’s tiny illustrations of these species allowed a free and broad interpretation of their characters in the past. The description of *S. sculptus* Michael, 1879 seems not to have been helpful for most acarologists in the first half of the 20th century. In 1928 Sellnick presumed that *S. minutus* and *S. sculptus* are synonyms. Van der Hammen (1952) reported on incorrectly labelled microscopic slides of *Scutovertex*-species in the collections of Berlese and Oudemans. We also found that phenomenon in three different collections: Schweizer identified at least once *S. minutus* as *S. sculptus* (slide no. 1477). Furthermore, most *Scutovertex*-slides of the collection Willmann are labelled as *S. ovalis*, although Willmann only mentioned *S. minutus* and *S. sculptus* in his key of 1931. However, in our investigation of his slides we could not find any noticeable differences between the specimens of *S. minutus* and *S. ovalis*. Some vials of the collection Moritz are labelled as *S. minutus*, others as *S. sculptus* – none of them contain *S. minutus*.

Although Strenzke (1943) already demonstrated some clear differences between *S. minutus* and *S. sculptus*, his work was neglected by many authors, resulting in different opinions on the characteristics of this species (see above). Later, Strenzke relativised his work in a note sent to Haarløv (1957: 47) mentioning the problem of determination based on variation of characters and asking for an investigation of specimens originating from a wide area and from different habitats to clarify this problem. Haarløv himself regarded *S. minutus* and *S. sculptus* as synonymous because of “intermediate forms”.

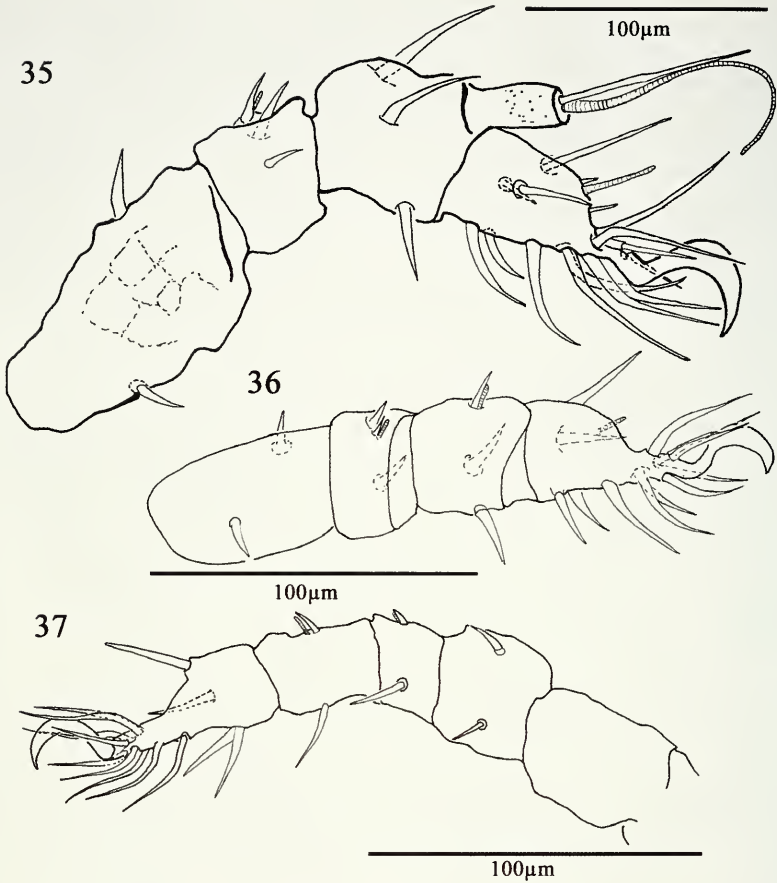
In our study, which refers to material from eastern Austria, supplemented by specimens from S-Tyrol and Switzerland, we restrict the limits of the species *S. minutus* according to our diagnosis. Intraspecific variation includes the number of notogastral setae, shape of lamellar cusps, and of prodorsal ridges. In general our results correspond to the characters and figures given in the key of Weigmann (2006). He reported on facultative problems to distinguish between *S. minutus* and other species caused by a relatively high intraspecific variation (see also Pérez-Iñigo, 1993). We do not agree with the hypothesis of such a high extent of intraspecific variation assumed



FIGS 31-34

S. minutus, juveniles; habitus in ventral view (subcapitulum not drawn). (31) Larva (note the strong setae *h₂*). (32) Protonymph. (33) Deutonymph. (34) Tritonymph.

by the authors mentioned above. Even though we have also found specimens not completely corresponding to our diagnosis, we want to exclude these “diverging specimens” from determination or description at the present state of knowledge. We

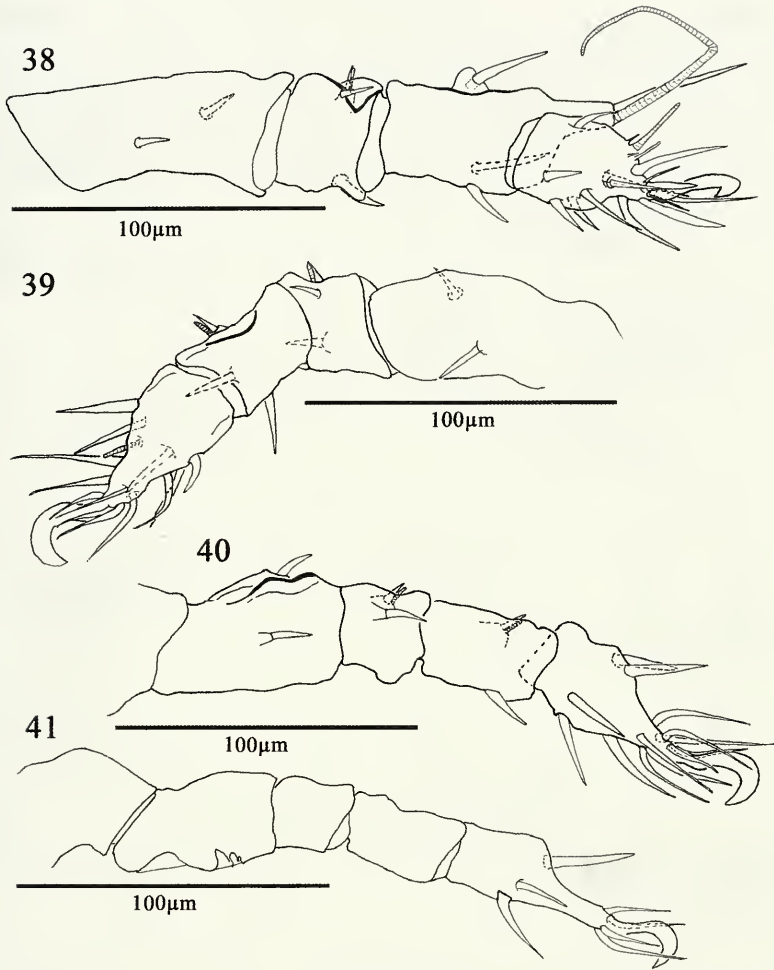


FIGS 35-37

S. minutus. Larva. (35) Right leg I, anti-axial aspect. (36) Left leg II, axial aspect. (37) Right leg III, anti-axial aspect.

assume that future results of an ongoing detailed morphological and molecular genetic study of other European species (e.g., *S. sculptus*, *S. alpinus*) collected from various places will clarify the taxonomic status of these “intermediate forms”. Therefore, and due to the limited knowledge on morphological characters and their intraspecific variation in other species, we omit a detailed comparison between *S. minutus* and the remaining *Scutovertex*-species in order to avoid the false impression that these species are already well-defined.

Morphological characters as camerostome, lyrifissure *ia* and tracheae of legs, could play an important role in the classification of genera of Scutoverticidae: Although Grandjean (1952) already stated that *Scutovertex* does not possess a genal incision, Ghilarov & Krivolutsky (1975) as well as Sitnikova (1980) reported on an aberrant notch on the border of the camerostome. SEM investigations of the lateral

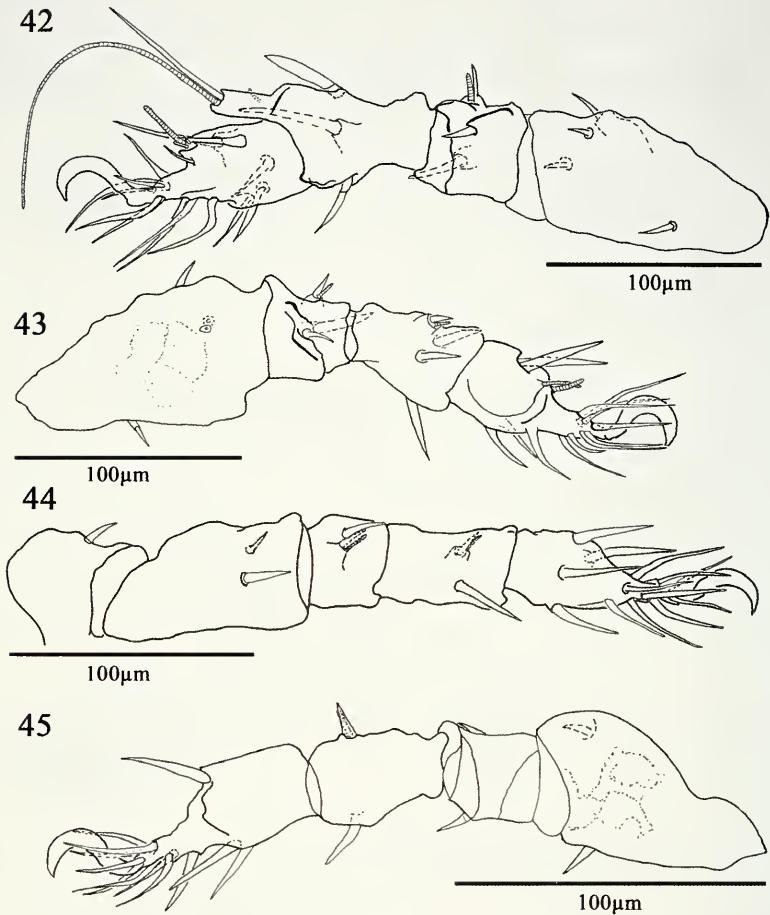


FIGS 38-41

S. minutus. Protonymph. (38) Right leg I, antiaxial aspect. (39) Left leg II, antiaxial aspect. (40) Left leg III, antiaxial aspect. (41) Left leg IV, antiaxial aspect.

parts of the podosoma have shown that there is no (genal) incision or cleft in the rostral margin. Nevertheless, these morphological details of the border of the camerostome might be important in studying the relationships of Scutoverticidae.

The cuticular nodule (see Fig. 9) under the humeral projection shows in transmitted light a small slit which represents the lyrifissure *ia*; otherwise the *ia* would be missing. This nodule probably has its equivalent in a similar disc-like structure described in *Argentinovertex coineau* Fernandez & Cleva, 2002. In this case the authors have neither found a slit on the disc-like structure, nor the lyrifissure *ia*. The position and the form of this organ might be comparable to the humeral organ of other Poronota, but histological investigations are necessary to clarify this problem.



FIGS 42-45

S. minutus. Deutonymph. (42) Left leg I, anti-axial aspect. (43) Right leg II, anti-axial aspect. (44) Left leg III, anti-axial aspect. (45) Right leg IV, anti-axial aspect.

Saccules and brachytracheae can be found in different leg segments of several taxa of oribatid mites, but the occurrence of true tracheae in legs is very rare. They are known only from the ameronothroid genus *Aquanothrus* Engelbrecht, 1975 (Norton *et al.*, 1997) and from the here investigated licneremaeoid genus *Scutovertex*. This character might be useful for the diagnosis of the genus *Scutovertex*, as assumed by Grandjean (1940), but further comparative investigations are necessary to verify that.

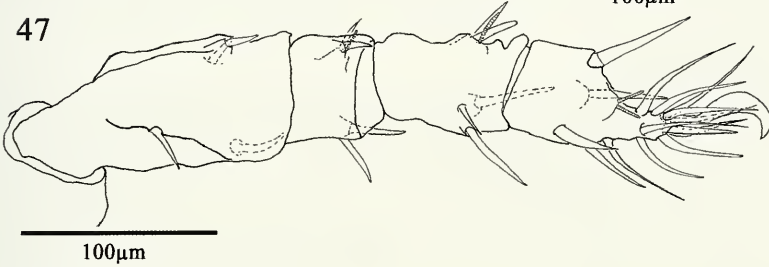
JUVENILE INSTARS

Data on the external morphology of the juvenile stages of Scutoverticidae are available only in few cases. Michael (1884) gave a general description of a nymph of *Scutovertex sculptus* without information on the stage. Grandjean (1954) mentioned some characters of nymphs of an undetermined species of *Scutovertex*. Our

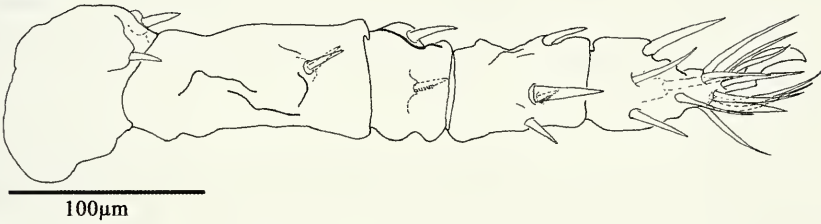
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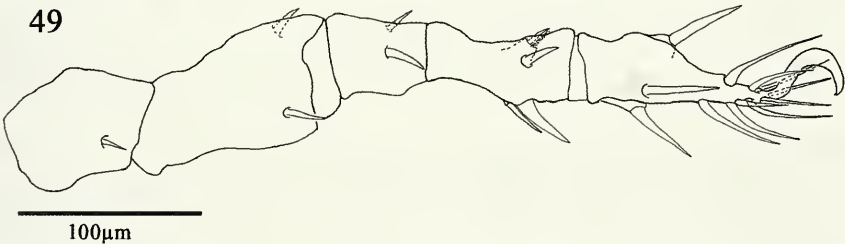
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48



49



FIGS 46-49

S. minutus. Tritonymph. (46) Left leg I, antiaxial aspect. (47) Right leg II, antiaxial aspect. (48) Left leg III, antiaxial aspect. (49) Left leg IV, antiaxial aspect.

investigations on juveniles of *S. minutus* generated morphological features comparable with those described by Grandjean; therefore we assume that the latter author had used juvenile individuals of *S. minutus* in his study. Haarløv (1957) published an illustration of a tritonymph of *S. minutus* showing the dorsal side, the anal and genital region. The depicted rostral setae seem to be slimmer than those the specimens we examined.

Furthermore the tritonymphs of *Arthrovertex* (= *Argentinovertex*) *coineaui* (see Fernandez & Cleva, 2002) and of *Provertex delamarei* Travé, 1962 are known.

Due to the lack of knowledge on the morphology of juvenile Scutoverticidae it is difficult to compare *S. minutus* with congeners and other species and to decide which of their characters are typical for the family or a certain genus and which are species specific. This matter becomes complicated if one follows the opinion of Woas (2002), who stated that on the basis of characters in adults the genera *Provertex* and *Lamellovertex* belong to the family Cymbaeremacidae. In our opinion the available data on juveniles (and adults) are too poor to make a clear decision on this systematic question at the moment.

ACKNOWLEDGEMENTS

The authors thank Prof. Dr F. Hofer, head of the Research Institute for Electron Microscopy, and his team for the realisation of the SEM micrographs. We are grateful to Prof. Dr R. Schuster, Dr E. Ebermann, Dr H. Schatz and Dr P. Horak providing samples and specimens. Furthermore, we want to express our thanks to the following museums for loaning slides and specimens: Bavarian State Collection of Zoology (Munich) (ZSM), collection Willmann; Museum of Natural History, Humboldt-University (Berlin), collection Moritz; Natural History Museum Basel, collection Schweizer. This work was supported by the Austrian Science Foundation (FWF, project number P19544-B16).

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Description of the male of *Hersilia vicina* Baehr & Baehr, 1993 from northeastern Thailand, with notes on the *albomaculata*-group (Araneae, Hersiliidae)

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Description of the male of *Hersilia vicina* Baehr & Baehr, 1993 from northeastern Thailand, with notes on the *albomaculata*-group (Araneae, Hersiliidae). - New material of *Hersilia vicina* Baehr & Baehr, 1993 has become available from Pa Hin Ngam and Nam Nao National Parks, northeastern Thailand. From that material the male of *Hersilia vicina* is described and illustrated for the first time. It can be recognized by the curved embolus gradually tapering towards its tip and differs from other males of the *albomaculata*-group by the presence of strong dorsal spines on the slightly elevated ridge of the palpal tibia, and by the hook-shaped basally excavated tegular apophysis. The newly discovered male of *H. vicina* confirms that the *albomaculata*-group is a distinct species-group.

Keywords: Taxonomy - conspecific sex - *albomaculata*-group - Pa Hin Ngam National Park - Khao Yai National Park - Nam Nao National Park.

INTRODUCTION

The hersiliid fauna of Thailand is poorly known. *Hersilia* Audouin 1826 is the largest and most diverse genus within the Hersiliidae, comprising approximately 75 described species distributed over the tropics of Africa and Asia, and in parts of Australia (Baehr & Baehr, 1993; Foord & Dippenaar-Schoeman, 2006; Platnick, 2007). Baehr & Baehr (1993) published a taxonomic revision of the hersiliid spiders of the Oriental Region that included the Thai species and their known distributions at that time. Foord & Dippenaar-Schoeman (2006) recently revised the Afrotropical species of the genus *Hersilia* and added fourteen new species to the genus. Five valid species are currently known from Thailand. These are *H. vicina* Baehr & Baehr, 1993 (Khao Yai National Park), *H. asiatica* Song & Zheng, 1982 (Phu Kradung National Park, Khao Yai National Park), *H. simplicipalpis* Baehr & Baehr, 1993 (Doi Suthep-Pui National Park, Khao Yai National Park), *H. striata* Wang & Yin, 1985 (Doi Inthanon National Park, Erawan National Park, Sam Roi Yod National Park) and *H. clypealis* Baehr & Baehr, 1993 (Khao Yai National Park). The first described species from

Thailand, *Hersilia siamensis* Simon, 1886, collected at a 'Canal de Bangkok, Siam' is regarded as a nomen dubium (Baehr & Baehr, 1993: 78) because the female type was presumably lost (not found in MNHN nor MSNG) and because the original description given by Simon (1886) did not include satisfactory taxonomic information on the female genitalia. *Hersilia asiatica* has a relatively broad distributional range covering the southern part of China and extending into the mountainous areas of northeastern Thailand through the Luang-Prabang Range, which is a natural boundary between Thailand and Laos (Baehr & Baehr, 1993; Song & Zheng, 1982; Song, Zhu & Chen, 1999). *Hersilia striata* occurs in China, Thailand, Myanmar and beyond the Malay Peninsula on the islands of Sumatra and Java (Baehr & Baehr, 1993; Song, 1987; Song, Zhu & Chen, 1999; Wang & Yin, 1985). *Hersilia vicina* and *H. clypealis* appear to be endemic to Thailand; each is known only from a single locality and no further information has become available after their descriptions (Baehr & Baehr, 1993). *Hersilia vicina* undoubtedly represents a species of its own but its exact placement in the species-group required further taxonomic scrutiny because of the lack of males at that time. *Hersilia simplicipalpis* has been reported from northern and northeastern Thailand. Dankittipakul (2002) collected males of another hersiliid genus from Doi Inthanon National Park but they do not belong in *Hersilia* because they possess relatively short PLS comparing to the *Hersilia* species (terminal segment of PLS 1.1-1.3 times longer than the basal one). Of the nominal species reported from Thailand, four have been recorded from the Khao Yai National Park. This indicates not only the species richness of the Thai hersiliid fauna, it also reveals that this fauna is superficially known and that more taxonomic work needs to be undertaken.

MATERIAL AND METHOD

External morphology was examined, measured and drawn with an Olympus SZX-9 stereomicroscope equipped with a drawing tube. Measurements of leg segments were taken from the dorsal side. All measurements are in millimeters. Identifications were made by examination of male and female genitalia. Epigynes were drawn in natural and cleared state (after immersing them in lactic acid for 10-20 minutes). Male palps were drawn in lateral and ventral view. Sizes of eyes are given as proportions of AME (= 1.00) in the following order: AME: ALE: PME: PLE.

The material examined will be deposited in the collections of the Muséum d'histoire naturelle de la Ville de Genève, Switzerland (MHNG) and in the collections of the Thailand Natural History Museum (TNHM) of the National Science Museum, Pathumthani Province, Thailand. Other museum acronyms: MNHN, Muséum National d'Histoire Naturelle, Paris, France; MSNG, Museo Civico di Storia Naturale "Giacomo Doria", Genova, Italy.

Abbreviations used in text and in the figures are as follows: ALE, anterior lateral eyes; AME, anterior median eyes; BS, basal segment of posterior spinneret; CO, copulatory orifices; DMP, dorsal muscular pits; DS, dorsal spine; E, embolus; EP, median epigynal projection; ID, insemination ducts; PLS, posterior lateral spinnerets; PME, posterior median eyes; PLE, posterior lateral eyes; SC, socket of spine (removed); SD, sperm ducts; SR, seminal receptacle; ST, subtegulum; T, tegulum; TA,

tegular apophysis; TB, trichobothrium; TC, tarsal spines; TS, terminal segment of posterior spinneret.

In the text 'Fig.' refers to a figure herein, while 'fig.' refers to a figure published elsewhere.

TAXONOMY

Hersiliidae Thorell, 1870

Hersilia Audouin, 1826

Hersilia vicina Baehr & Baehr, 1993

Figs 1-9

Hersilia vicina Baehr & Baehr (1993: 22, figs 18e-f), description of ♀.

HOLOTYPE: ♀, THAILAND, Nakhon Ratchasima Province, Khao Yai National Park, creek at field of Siam tulip (*Curcuma alismatifolia*, Zingiberaceae), in mixed deciduous forest with pines, 15° 38.391'N 101° 23.609'E, 750 m alt., Malaise trap, 12-18.vii.2006, P. Dankittipakul & N. Likhitrakarn leg. [MHNG, TH-HS001; TNHM].

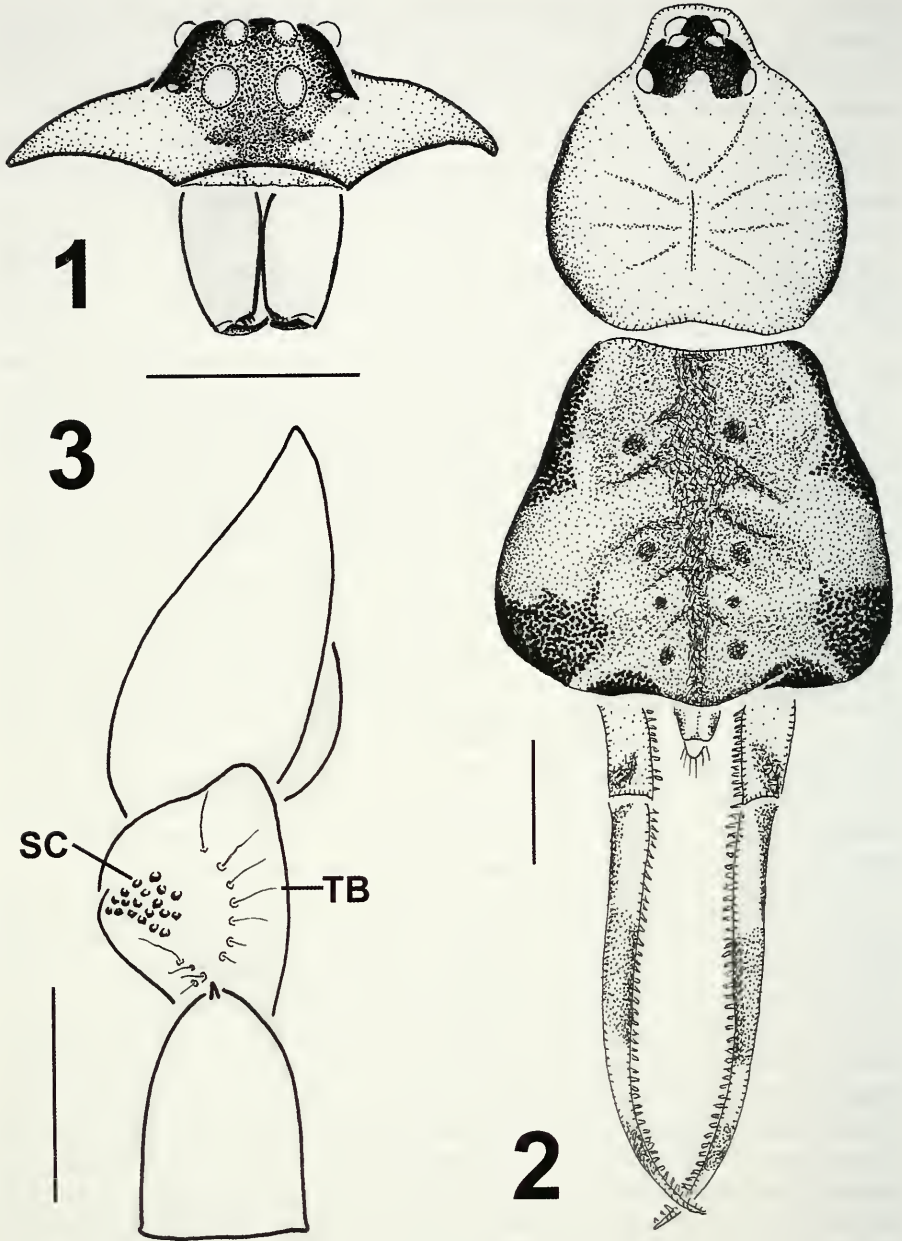
OTHER MATERIAL EXAMINED: 2 ♂, Chaiyaphum Province, Pa Hin Ngam National Park, creek at field of Siam tulip (*Curcuma alismatifolia*, Zingiberaceae), in mixed deciduous forest with pines, 15° 38.391'N 101° 23.609'E, 750 m alt., Malaise trap, 12-18.vii.2006, P. Dankittipakul & N. Likhitrakarn leg. [MHNG, TH-HS001; TNHM]. 2 ♀, Phetchabun Province, Lom Sak and Lom Kao Districts, Nam Nao National Park, 890 m, evergreen gallery forest near national park headquarters, 17.-18.vii.2005, P. Dankittipakul leg. [MHNG, TH-HS002; TNHM].

EXTENDED DIAGNOSIS: Males of *H. vicina* resemble those of *H. albomaculata* (see Baehr & Baehr, 1993: figs 16c, d) and *H. martensi* (Baehr & Baehr, 1993: figs 17c, d) by the curved embolus gradually tapering towards its extremity (Figs 4-6). *Hersilia vicina* males can be distinguished from other males of the *albomaculata*-group by: The presence of strong dorsal spines on the palpal tibia (Fig. 3); tegular apophysis hook-shaped and basally excavated (Fig. 6) (thin and membranous, with dorsal excavation in *H. albomaculata* and *H. martensi*). Females of *H. vicina* can be easily recognized by: The digitiform median extension of the epigyne (Fig. 7); the elongated and curved insemination ducts with a globular anterior part (Figs 8, 9); two spherical seminal receptacles clearly separated and arising posteriorly on both sides (Figs 8, 9).

DESCRIPTION: MALE. Total length (excluding spinnerets) 5.09. Carapace length 2.38, width 2.50. Opisthosoma length 2.71, width 3.24. PLS length 4.19; BS length 0.84; TS length 3.35. Eye ratios: 1.0: 0.46: 0.86: 0.93. Clypeus 0.32 high.

Prosoma (Figs 1, 2) dorsoventrally flattened, with slightly elevated eye area and low clypeus, pars thoracica widest. Carapace yellow, with greenish brown radial striae radiating from deep longitudinal fovea; lateral margins black, widest posteriorly, clothed with conspicuous setae. Clypeus (Fig. 1) pale grey, with a cross-shaped marking medially; clypeal margin with faint black stripe. Chelicerae (Fig. 1) basally yellow, distal part with irregular dark greenish patches; three reddish brown promarginal teeth on cheliceral furrow. Sternum, labium and maxillae yellow. Eight eyes arranged in two strongly recurved rows (Figs 1, 2); MOQ wider than long, wider in front than behind (Fig. 1); eye area with distinct dark reddish brown pigmentation, with red pigment encircling ALE; a red longitudinal band running between PME and fovea. Patellae brown, other leg articles greenish brown, with green annulations on femora; distal part of tibiae dark brown.

Opisthosoma (Fig. 2) widest in posterior third, with four pairs of dorsal muscular pits, the second ones largest. Dorsum mottled with irregular white patches;



FIGS 1-3

Hersilia vicina Baehr & Baehr, male from Pa Hin Ngam National Park: (1) Prosoma, frontal view. (2) habitus, dorsal view. (3) right palpus, dorsal view. Scale bars = 1.0 mm (1, 2), 0.5 mm (3).

cardiac impression dark brown, forming folium, extending to caudal area; anterolateral and posterolateral borders dark. Venter pale green, mottled with small, white irregularly-shaped patches, marked with a series of muscular pits arranged in a V-shaped pattern. Posterior lateral spinnerets long; terminal segment more than two times longer than basal one; numerous aciniform gland spigots on entire length of terminal segment; basal segment with dorsal patch of reddish pigment distally; terminal segment with two disconnected reddish bands.

Leg measurements:

	I	II	III	IV
Femur	5.08	5.36	1.64	4.61
Patella	1.12	1.05	0.50	0.85
Tibia	5.23	5.42	0.98	2.71
Metatarsus	7.93	7.90	1.20	3.02
Tarsus	0.85	0.91	0.63	0.87
Total	20.21	20.64	4.95	12.06

Male palp (Figs 3-6): Palpal tibia provided with a slightly elevated dorsal ridge carrying 17-20 relatively long spines (Figs 3, 6, SC, DS) with reddish basal and white distal part; dorsal side with a row of seven retrodorsal trichobothria (TB) arranged in a bent line and with a group of four short prodorsal-basal trichobothria (Fig. 3). Cymbium relatively short, with two apical spines (Figs 4-6, TC). Tegulum (T) round, pale yellow, with distinct dark brown sperm duct (Figs 4-6). Embolus (E) filiform, curved to 3/4 of a circle, laterally with a small triangular denticule near its tip (Figs 4-6). Tegular apophysis (TA) hook-shaped, apically inserted, pointed distally, basally excavated (Fig. 4), visible as a dark anteriorly curved spine rising from a round membranous base when viewed from the lateral sides (Figs 5, 6).

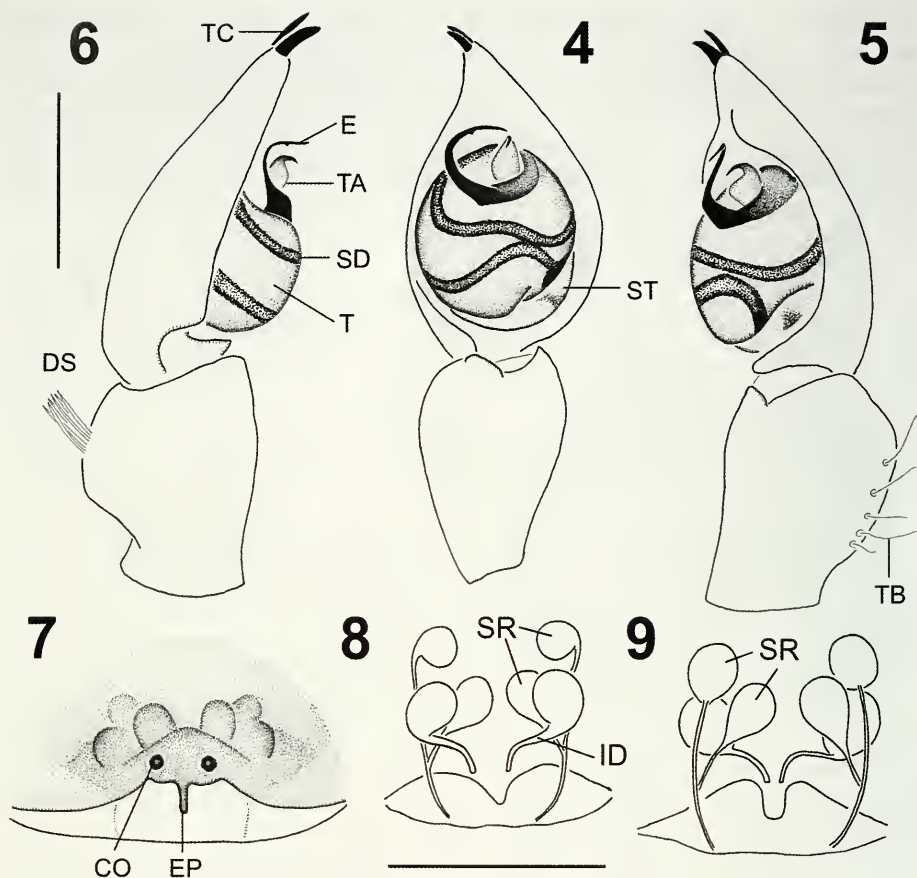
FEMALE (holotype). Total length 4.86. Carapace length 2.11, width 2.15. Opisthosoma length 3.05, width 2.58. PLS length 3.75; BS length 0.82; TS length 2.93. Eye ratios: 1.0: 0.37: 0.96: 0.95. Clypeus 0.38 high.

As the male but darker in color. Opisthosoma widest in the middle. Dorsum greenish black; cardiac impression dark green, occupying 3/4 of opisthosoma length. DMP variable in size, third and fourth pairs circular, relatively small, second ones largest.

All legs broken behind trochanter or femur.

Epigyne and vulva (Figs 7-9): Epigyne (Fig. 7) posteriorly excavated; epigynal plate lightly sclerotized, with slightly elevated triangular median ridge and digitiform posterior projection (EP); lateral borders invaginated. Copulatory orifices (CO) anterior to epigynal projection, clearly marked with red pigmentation. Vulva (Figs 8, 9) with insemination ducts (ID) coiled and tubular, widened anteriorly to form spherical structures. Two globular seminal receptacles (SR) lying dorsally of spherical portion of insemination duct; thin, long receptacular stalks basally running into a single thin fertilization duct on each side.

NEW FEMALE (from Nam Nao National Park). Total length (excluding spinnerets) 5.57. Carapace length 2.24, width 2.18. Opisthosoma length 3.19, width



FIGS 4-9

Hersilia vicina Baehr & Baehr, male (4-6) and female holotype (7-9): Right male palpus, (4) ventral, (5) retrolateral and (6) prolateral view. Epigyne, (7) ventral view. Vulva, (8) ventral and (9) dorsal view. Scale bars = 0.5 mm (4-6), 0.25 mm (7-9).

2.63. PLS length 4.59; BS length 0.94; TS length 3.65. Eye ratios: 1.0: 0.35: 0.89: 0.97. Clypeus 0.35 high.

Coloration and pattern as in the male but generally darker.

Leg measurements:

	I	II	III	IV
Femur	5.40	5.03	2.91	4.80
Patella	0.98	0.82	0.65	0.81
Tibia	?	5.16	1.50	?
Metatarsus	?	7.53	1.72	?
Tarsus	?	0.86	0.71	?
Total	?	19.4	7.49	?

DISTRIBUTION: Northeastern Thailand: The provinces of Nakhon Ratchasima (type locality), Chaiyaphum (new locality) and Phetchabun (new locality). Baehr & Baehr (1993: 23) erroneously stated that the female holotype of *H. vicina* was collected from southern Thailand.

DISCUSSION

Baehr & Baehr (1993) established the *albomaculata*-group to accommodate three *Hersilia* species from Nepal, southeastern China and Thailand. The species-group comprises *H. albomaculata* (male and female known), *H. martensi* (only male known) and *H. vicina* (female and now also male known). The following characteristics of this species-group were given by Baehr & Baehr (1993). Members of the *albomaculata*-group are generally small, extremely long-legged species, with leg I slightly longer than leg II, eye area and clypeus are relatively low. The males of this group are distinguishable by: The embolus narrowed and curved; the simple tegular apophysis excavated, situated distally on the tegulum; and by the absence of a spinose ridge on the male palpal tibia. The females are distinguished by a simple epigyne without peculiarity, the vulva with coiled insemination ducts and one or two pairs of well separated seminal receptacles.

Previously the taxonomic affinity of the *albomaculata*-group was obscure. The female of *H. vicina* was only tentatively included in this species-group because the female of *H. martensi* has not yet been described and the female of *H. albomaculata* from China was not known to Baehr & Baehr (1993), who obtained their information from the original description and illustration given by Wang & Yin (1985). With the discovery of the male of *H. vicina* described in here, the *albomaculata*-group is sufficiently distinguishable from other species-groups. The putative monophyly of the species-group is here supported by morphological characters of males which are considered synapomorphic. These characteristics are the curved and narrowed embolus which forms a twisted circle, and the simple tegular apophysis which is situated distally on the tegulum.

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Redescription of *Proteocephalus sulcatus* (Klaptocz, 1906) (Cestoda: Proteocephalidea), a poorly known parasite of *Clarotes laticeps* (Pisces: Siluriformes) in the Sudan

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Redescription of *Proteocephalus sulcatus* (Klaptocz, 1906) (Cestoda: Proteocephalidea), a poorly known parasite of *Clarotes laticeps* (Pisces: Siluriformes) in the Sudan.- The proteocephalidean cestode *Proteocephalus sulcatus* (Klaptocz, 1906), a poorly known parasite described from widehead catfish *Clarotes laticeps* (Rüppell) and saddled bichir *Polypterus endlicheri* Heckel from the White Nile in the Sudan, Africa, is redescribed on the basis of new material collected in *C. laticeps* caught near the type-locality. New data on the morphology of *P. sulcatus* are provided, based on the first scanning electron microscopical observations and histological sections. The most characteristic features of *P. sulcatus* are: (i) pyriform embryophore; (ii) scolex in form of a four-side truncated cone, with four suckers deeply embedded within lobes with wrinkled posterior margins; (iii) no apical organ; (iv) a low number (1-3) of mature proglottides; (v) a high number (115-171) of testes. *Clarotes laticeps* is considered the only suitable host for *Proteocephalus sulcatus*.

Keywords: *Proteocephalus* - Proteocephalidae - cestodes - catfish parasite - *Clarotes laticeps* - Africa - taxonomy.

INTRODUCTION

Klaptocz (1906) described *Ichthyotaenia sulcata* [(= *Proteocephalus sulcatus* (Klaptocz, 1906) La Rue, 1911)] from several tapeworms found in the intestine of widehead catfish *Clarotes laticeps* (Rüppell, 1829) (Siluriformes: Bagridae) and saddled bichir *Polypterus endlicheri* Heckel, 1847 (Polypteriformes: Polypteridae) from the White Nile in the Sudan. The author provided a morphological description supplemented by 10 not very detailed illustrations (one sketch of the total view of the

tapeworm, three figures of the scolex in dorsoventral view, three figures of the scolex in apical view, one sketch of the oval eggs, one figure of the cirrus-sac and one illustration of the last three proglottids, with details of internal morphology of the two last ones). However, differential diagnosis of *P. sulcatus* from any other species of *Ichthyotaenia* (= *Proteocephalus*) was not included in the original description (Klaptocz, 1906).

Although Khalil (1963) provided some additional data on *P. sulcatus* (see Table 1), the morphology of *P. sulcatus* remains insufficiently known (Freze, 1965) and no data based on histological sections and scanning electron microscopy (SEM) are available. New specimens of *P. sulcatus* found in the intestine of *C. laticeps* from the Sudan made it possible to redescribe the tapeworm and to provide new data on its morphology.

MATERIALS AND METHODS

Widehead catfish (vernacular name in the Sudan "abu misaika"), *Clarotes laticeps*, were caught by local fishermen in the White Nile at Kostí, about 265 km south of Khartoum, Sudan, on 25-27 March 2006 (other two *C. laticeps* from the fish market in Khartoum examined on 21 March 2006 were free of infection). The fish were examined immediately after their capture, the parasites found were isolated from the host intestine and fixed with hot 4% neutral formaldehyde solution and subsequently

TABLE 1. Comparative measurements (in millimetres unless otherwise stated) of *Proteocephalus sulcatus* from the Sudan.

Host	<i>Polypterus endlicheri</i>	<i>Clarotes niloticus</i>	<i>Clarotes niloticus</i>	<i>Clarotes niloticus</i>
Reference	Klaptocz (1906)	(1906)	Khalil (1963)	Present study
Total length	48-68	60	65-95	36-57
Maximum width	-	-	1.2-1.8	1.48
Scolex				
length	-	-	1.2-1.3	0.66-1.07
width	0.75-1.72	0.67-1.28	1.4-2.0	0.80-1.26
Diameter of suckers	0.25	-	-	0.28-0.45
Mature proglottids				
length	2	1.54	1.6-2.3	0.47-1.31
width	1.5	1.9	1.0-1.9	0.92-1.41
Number of testes	about 200		117-130	115-171
Cirrus-sac (in μm)				
length	-	-	290-310	190-300
width	-	-	160-180	120-150
Uterine diverticula	-	-	11-13	15-22
Eggs (in μm)				
length	29	-	-	26-28
width	16	-	-	16-18

stored in 70% ethanol. The specimens were then stained with Mayer's hydrochloric carmine solution, dehydrated in an ethanol series, cleared with eugenol (clove oil) and mounted in Canada balsam.

Pieces of strobila were embedded in paraffin wax, sectioned at 12-15 μm (cross sections of the strobila and longitudinal and sagittal sections of two scoleces), stained with Weigert's haematoxylin and counterstained with 1% eosin B (Scholz & Hanzelová, 1998; de Chambrier, 2001). Eggs were studied in distilled water. Three specimens (scolex with the anterior part of the strobila) were used for SEM observations using the procedure outlined by de Chambrier *et al.* (2008).

All measurements are given in micrometres unless otherwise indicated. Abbreviations used in descriptions are as follows: \bar{x} = mean, n = number of measurements, OV = ratio of ovary width versus proglottis width (in %), PP = position of genital pore (cirrus pore) in % of proglottis length, PC = ratio of cirrus-sac length versus proglottis width (in %). MHNG INVE = Natural History Museum, Invertebrate Collection, Geneva, Switzerland; IPCAS = Institute of Parasitology, České Budějovice, Czech Republic.

***Proteocephalus sulcatus* (Klaptocz, 1906) La Rue, 1911**

Figs 1-21

Syn.: *Ichthyotaenia sulcata* Klaptocz, 1906

Redescription: Proteocephalidea, Proteocephalidae. Testes, ovary, vitelline follicles, uterus with uterine stem and diverticula medullary. Strobila with slightly craspedote proglottides (Fig. 7), 36-57 mm long and up to 1.48 mm wide (Table 1).

Proliferative zone about 700-1100 long and 360-775 wide. Strobila consisting of 94-120 proglottides: 43-70 immature (up to appearance of spermatozoa in vas deferens), only 1-3 mature (up to appearance of eggs in uterus), 24-36 pregravid (up to appearance of hooks in oncospheres) and 26-38 gravid.

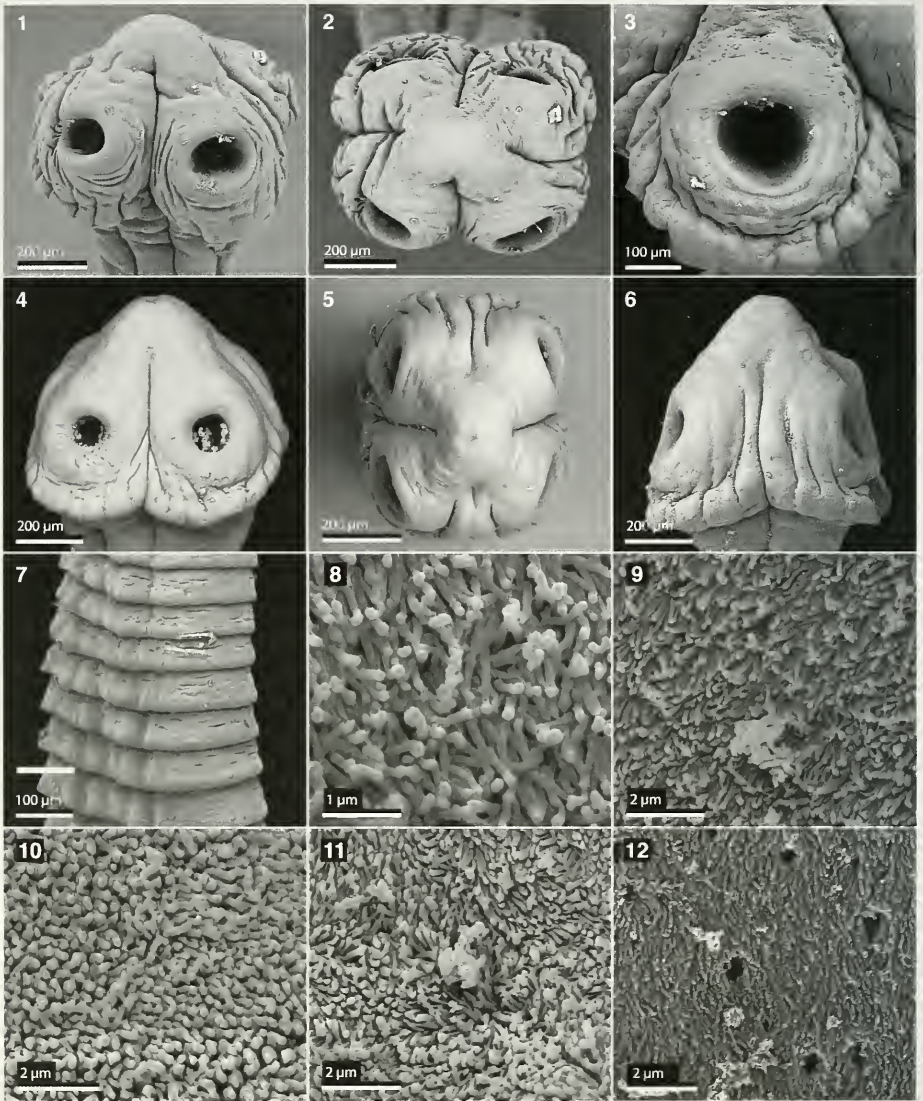
Scolex unarmed, wider than neck, about 810-1260 in diameter, and about 665-1070 long. Scolex a four-sided truncated cone. Suckers uniloculate, 280-450 in diameter, paired on opposite sides of cone, separated by deep incisions; two sides without sucker also divided by deep incisions. Distinct apron of tissue posterior to suckers, longitudinally wrinkled (Figs 1-6). Apical organ absent (Figs 13-15).

Scolex, proliferative zone and anterior proglottides covered uniformly with relatively short and wide filiform microtriches, only slightly differing from each other in their shape, length and density (Figs 8-12), except for those of proliferation zone, which are notably smaller.

Longitudinal internal musculature well developed, anastomosing, forming wide band of dense muscle bundles; muscle bundles becoming slightly wider near lateral margins, at level of lateral vitelline follicles (Figs 19, 20). Numerous dorsoventral muscle fibres present. Subtegumental muscles well developed.

Ventral osmoregulatory canals wide, thin-walled, without anastomoses, overlapping lateralmost testes. Dorsal osmoregulatory canal thick-walled, overlapping dorsally vitelline follicles (Figs 16, 20).

Testes medullary, spherical to oval, 55-120 in diameter, numbering 115-171 ($n = 9$, $\bar{x} = 143$; about 200, according to Klaptocz, 1906), in two or three incomplete layers, forming two fields confluent anteriorly, with more testes laterally (Figs 16, 19).



FIGS 1-12

Proteocephalus sulcatus (Klaptocz, 1906) from *Clarotes laticeps*, Kostí, Sudan (MHNG INVE 54146: 1, 2, 12; MHNG INVE 54141: 3-5; MHNG INVE 54140: 6-11). Scanning electron micrographs. (1) Scolex, dorsoventral view. (2) Scolex, apical view. (3) Scolex, detail of a sucker, showing the plicated tissue posterior to sucker. (4) Scolex, dorsoventral view. (5) Scolex, apical view. (6) Scolex, lateral view. (7) First immature, markedly craspedote proglottides. (8) Filiform microtriches on apex of scolex. (9) Filiform microtriches on anterior external margin of suckers. (10) Filiform microtriches on internal surface of suckers. (11) Filiform microtriches between suckers. (12) Filiform microtriches on external surface of proliferation zone (neck). Scale bars: 1, 2, 4-6 = 200 μm ; 3, 7 = 100 μm ; 8 = 1 μm ; 9-12 = 2 μm .

External vas deferens strongly coiled, reaching midline of proglottis, never crossing it aporally. Internal vas deferens thin-walled, very short; ejaculatory duct thick-walled, long, forming several loops; cirrus long, may occupy complete length of cirrus-sac. Cirrus-sac elongate, thick-walled, 190-300 ($x = 242 \pm 22$; $n = 42$; $CV = 9\%$), 120-150 wide (L/W ratio = 1.65-2.15, $x = 1.85$). PC = 16-23% ($x = 20 \pm 1.5\%$; $n = 42$; $CV = 8\%$). Genital pore irregularly alternating, pre-equatorial, situated at 27-46% ($x = 36 \pm 4\%$; $n = 42$; $CV = 11.4\%$) of proglottis length. Genital atrium present (Figs 16, 17).

Ovary bilobed, medullary, with numerous lobules extending ventrally (Figs 16, 20). OV = 64-71% ($x = 68 \pm 2\%$; $n = 42$; $CV = 3\%$). Mehlis' glands about 100-180 in diameter, representing 8-17% of proglottis width. Vagina thick-walled, always posterior to cirrus-sac ($n = 150$), with higher concentration of chromophilic cells in its distal (terminal) part, with terminal ring-like vaginal sphincter, difficult to observe in mature proglottides. Vitelline follicles in two longitudinal bands on both sides of proglottis, occupying almost its total length; bands interrupted at level of terminal genitalia on ventral side, with few follicles on dorsal side (Figs 16-18).

Uterus medullary, with development of type 1 according to de Chambrier *et al.* (2004), defined as follows: In immature proglottides, uterine stem present as longitudinal concentration of chromophilic cells along median line. Lumen of uterus appears in last premature proglottides, gradually extending to form tubular structure. Eggs appear simultaneously with formation of lateral, thick-walled diverticula lined with chromophilic cells. In gravid proglottides, lateral diverticula remain thick-walled, 15-22 in number on each side, occupy up to 77% of proglottis width (Fig. 18).

Eggs with hyaline, ring-like outer envelope, about 35-42 in diameter; thick, pyriform embryophore 26-28 long by 16-18 wide, consisting of two layers; outer layer thicker than nuclei-containing envelope; oncospheres spherical to oval, 9-10 by 12-13 in diameter, with six embryonic hooks 5-6 long (Fig. 21).

TAXONOMIC SUMMARY

Type-host: not designated (see Discussion).

Type-locality: White Nile, between Khartoum and Fachoda (Kodok).

Definitive hosts: widehead catfish *Clarotes laticeps* (Rüppell) and saddled bichir *Polypterus endlicheri* Heckel.

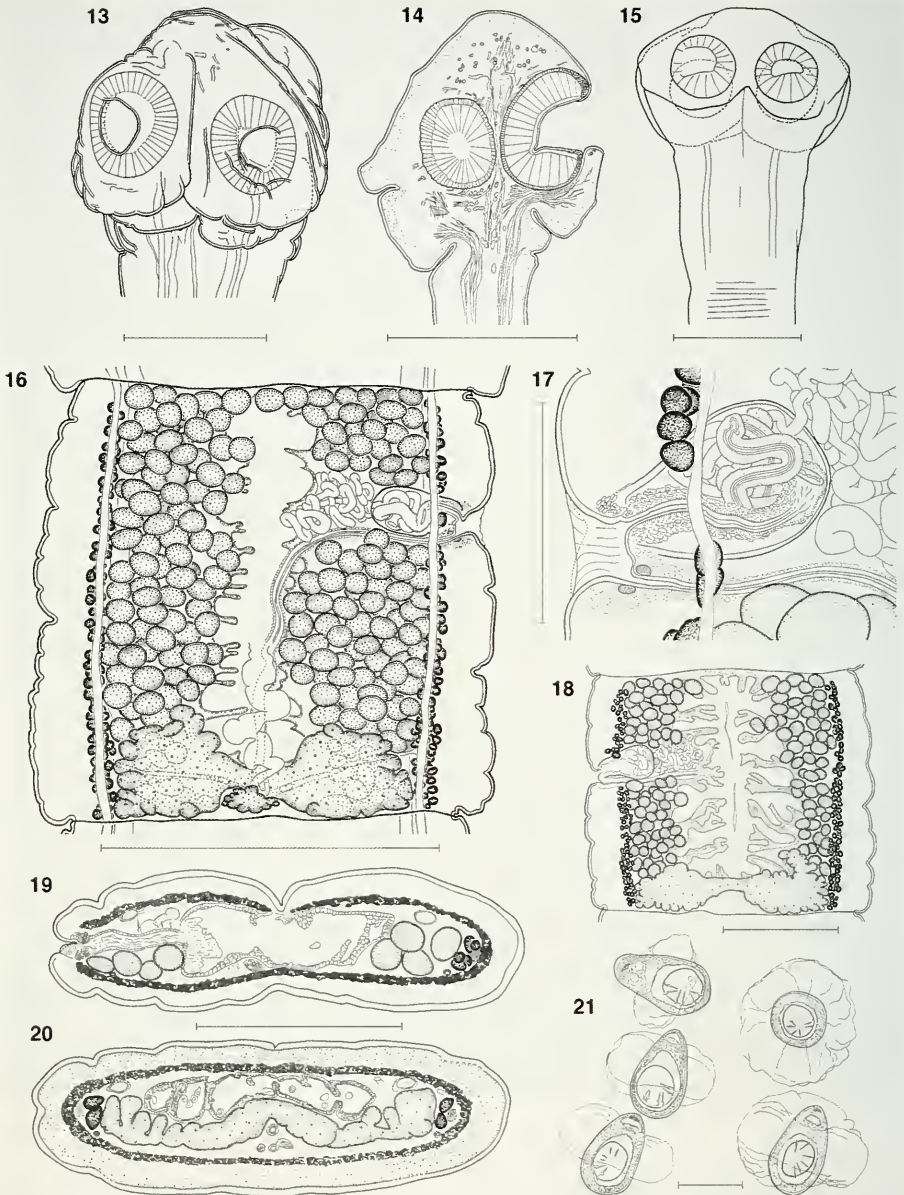
Material studied: 35 specimens collected by A. de C. & T. S. in 8 *C. laticeps* from the White Nile at Kostí, Sudan (MHNG INVE 54139, 54140, 54141, 54145, 54146, 54147; IPCAS C-470/1). Five specimens from *C. laticeps* from the Sudan (Khartoum) collected by L. F. Khalil in 1959 (MHNG INVE 34798).

Site of infection: intestine.

Prevalence: 73% (infected 8 of 11 fish examined).

Intensity of infection: 1-10 tapeworms (mean 4.4).

Distribution: White Nile in the Sudan. Reports of *P. sulcatus* from *Chrysichthys* sp. from Belgian Congo (now Democratic Republic of the Congo – de Beauchamp, 1914; Mahon, 1954) represent in fact *Proteocephalus beauchampi* Fuhrmann & Baer, 1925 (Fuhrmann & Baer, 1925; Khalil, 1971).



FIGS 13-21

Proteocephalus sulcatus (Klaptocz, 1906) from *Clarotes laticeps*, Kostí, Sudan (MHNG INVE 54145: 13; MHNG INVE 54147: 14; MHNG INVE 34798: 15; IPCAS C 470/1: 16, 17; MHNG INVE 54139: 18; MHNG INVE 54140: 19-21). (13, 15) Scolex, dorsoventral view. (14) Scolex, sagittal section. (16) First pregravid proglottis, dorsal view. (17) Terminal genitalia, dorsal view. (18) Gravid proglottis, dorsal view. (19, 20) Cross sections. (21) Eggs (egg on the right of the upper line figured from *en face* view). Scale bars: 13-15, 18-20 = 500 μm ; 16 = 1000 μm ; 17 = 250 μm ; 21 = 20 μm .

DISCUSSION

The present study, which included for the first time SEM observations and histological sections, confirmed the validity of *Proteocephalus sulcatus*. The species possesses several characteristics missing or rare in other proteocephalideans, including those parasitic in African freshwater fish (Beauchamp, 1914; Fuhrmann & Baer, 1925; Khalil, 1960, 1963; Lynsdale, 1960; Freze, 1965; Jones, 1980; de Chambrier *et al.*, 2008). The most typical characters of *P. sulcatus* are: (i) pyriform embryophore of the eggs; (ii) scolex a four-sided truncated cone, with deep incisions between suckers and posterior longitudinal wrinkles; and without apical organ; (iii) only 1-3 mature proglottides present; (iv) a fairly high number of testes (115-171), arranged in 2-3 incomplete layers.

De Beauchamp (1914) reported *P. sulcatus* from *Chrysichthys* sp. from Kilewa Bay of Lake Tanganyika, Belgian Congo (currently Democratic Republic of the Congo), but a new species, *Proteocephalus beauchampi*, was proposed to accommodate this tapeworm (Fuhrmann & Baer, 1925). Mahon (1954) also reported *P. sulcatus* from *Chrysichthys* sp. from Congo, but it is possible that she probably found *P. beauchampi* as well, because *P. sulcatus* has not been found in congeneric fish hosts (*Chrysichthys* sp.) from the White Nile, examined by the present authors in 2006 (unpublished data). Khalil (1963) provided a brief description of the morphology of several specimens of *P. sulcatus* he found in *Clarotes laticeps* from Khartoum area in the Sudan (Table 1) and illustrated rather schematically an allegedly mature proglottis (possibly pregravid or gravid one – see fig. 1 in Khalil, 1963). The present study confirmed most of Khalil's (1963) measurements (see Table 1), except for the number of uterine diverticula, which is in fact much higher than reported by Khalil (1963) (15-22 vs 11-13 on each side).

Besides *P. sulcatus*, only two proteocephalidean cestodes possess pyriform embryophores similar to those of *P. sulcatus*, namely *Proteocephalus beauchampi* Fuhrmann & Baer, 1925 from *Chrysichthys* catfishes in Africa and *Amphoteromorphus piriformis* Carfora, de Chambrier & Vaucher, 2003, a parasite of pimelodid catfish *Brachyplatystoma flavicans* (Lichtenstein) in the Neotropical Region (de Beauchamp, 1914 – as *P. sulcatus*; Freze, 1965; Carfora *et al.*, 2003). Morphology of the eggs has been proved suitable for species differentiation in some proteocephalidean tapeworms (Scholz, 1999; Gil de Pertierra & de Chambrier, 2000; Carfora *et al.*, 2003) and we strongly recommend that morphological descriptions contain detailed data on egg morphology.

Proteocephalus beauchampi, a parasite of bagrid catfish of the genus *Chrysichthys* in Africa, resembles *P. sulcatus* in possessing a somewhat similar scolex without an apical organ, but it differs in the absence of posterior longitudinal wrinkles (Fuhrmann & Baer, 1925). De Beauchamp (1914) observed in his material of *P. beauchampi* (designated as *P. sulcatus*) also pyriform embryophores of similar shape and size (25 by 18 μ m). However, the two taxa differ from one another in strobilar morphology, especially position of the vagina [always posterior in *P. sulcatus* and anterior (44%) and posterior (56%) in Khalil's material of *P. beauchampi*] and the number of testes (57 figured according to fig. 1 of de Beauchamp, 1914). We were not able to locate the type material of both species. Previous records of *P. sulcatus* from

other catfish, such as *Chrysichthys brachynema* and *Chrysichthys* sp. (Prudhoe, 1951; Mahon, 1954; Khalil & Polling, 1997), are so considered to belong to *P. beauchampi*.

SEM observation of the surface of the scolex, neck and anterior part of the strobila of *P. sulcatus* has shown the presence of relatively short and wide filiform microtriches, with only slight differences in their shape, size and density between individual body regions. Only the anterior part of the strobila shows somewhat smaller filiform microtriches, but of the same shape. This uniformity in the shape of microtriches differs from that found mainly in Neotropical members of the Proteocephalidea studied using SEM, such as species of the genera *Nomimoscolex* Woodland, 1934 and *Monticellia* La Rue, 1911 (de Chambrier & Vaucher, 1999; Rego *et al.*, 1999; Gil de Perterra, 2002, 2004, 2005; de Chambrier *et al.*, 2005, 2006).

Proteocephalus sulcatus was described on the basis of tapeworms from two unrelated fish hosts, a catfish and a bichir, because Klapotocz (1906) considered slight differences between them, especially in the shape of the scolex, to be accounted for by intraspecific variability. The type-host was not designated, although Khalil (1963 – p. 309) considered saddled bichir *Polypterus endlicheri* to be the type-host because it was listed first in the text of Klapotocz' (1906) original description. However, the following data indicate that widehead catfish *Clarotes laticeps* should be considered the actual type-host of *P. sulcatus*: (i) the original description was mainly based on larger tapeworms from widehead catfish *Clarotes niloticus* (see Klapotocz, 1906 – p. 123); (ii) saddled bichir harboured less and smaller tapeworms (Klapotocz, 1906 – p. 123); (iii) Khalil (1963) did not find any *P. sulcatus* tapeworms in 322 *P. endlicheri*, *P. bichir* Lacépède and *P. senegalus* Cuvier from the White Nile in the Sudan (see also Jones, 1980); (iv) the present authors also did not find *P. sulcatus* in eight specimens of *Polypterus*, mainly *P. senegalus*. On the other hand, eight out of nine widehead catfish *Clarotes laticeps* examined in Kosti were infected.

On the basis of the above-listed facts, *Clarotes laticeps* is considered to be the type- and most probably the only actual definitive host of *P. sulcatus*. Klapotocz' (1906) finding of *P. sulcatus* in saddled bichir may have represented an accidental infection via predation of widehead catfish and the bichir served as a postcyclic host (see Odening, 1976 for terminology of host categories). This latter assumption is supported by the fact that saddled bichir is essentially piscivorous and that the infected *P. endlicheri* specimen was extremely large (total length 622 mm according to Klapotocz, 1906, thus reaching to the maximum standard length reported for the species, which is 630 mm – Froese & Pauly, 2007).

Klapotocz (1906) described another species of *Proteocephalus*, *P. pentastoma* (syn. *Ichthyotaenia pentastoma* Klapotocz, 1906), from Nile bichir, *Polypterus bichir* Lacépède, 1803, from the White Nile in the Sudan. This cestode is a specific and relatively common parasite of bichirs in the Sudan (Jones, 1980), but it is markedly different from *P. sulcatus*, especially in possessing a muscular apical sucker and vitelline follicles arranged in a transverse band posterior to the ovary with anterior longitudinal arms along the lateral margins of proglottides (Jones, 1980).

Proteocephalus sulcatus, which is considered here to be a specific parasite of *Clarotes niloticus*, has hitherto been found only in the Nile River in the Sudan. However, it probably also occurs in the Nile River basin in other countries of north-eastern Africa.

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Description of *Ambanus jaegeri* sp. n. and of the male of *A. euini* (Paik) from Korea (Arachnida: Araneae: Amaurobiidae)

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Description of *Ambanus jaegeri* sp. n. and of the male of *A. euini* (Paik) from Korea (Arachnida: Araneae: Amaurobiidae). - Two species of the genus *Ambanus* from Korea are described and illustrated in detail. *Ambanus jaegeri* sp. n. and the male of *Ambanus euini* (Paik, 1976) are described for the first time. The new species is distinguished by its male palp with cymbial furrow longer than half the cymbium length, dorsal apophysis of conductor elongated and bent distally, median apophysis small, semi-circular, with sharp apical edge, and by its epigynum with widely triangular atrium and broadly curved copulatory ducts with transparent membranes.

Keywords: Taxonomy - Coelotinae - new species - Korea.

INTRODUCTION

The Holarctic spider subfamily Coelotinae is one of the most common spider taxa in the region from North America to East Asia. Wang (2002) revised the Coelotinae at the generic level based on 31 characters and 22 taxa, together with two outgroup taxa (*Tamgrinia*, *Amaurobius*). The subfamily comprises at least 373 species (Platnick, 2007; Wang, 2002, 2007). Of these, the genus *Ambanus* Ovtchinnikov, 1999 includes 18 species from several Asian countries (Korea, 10 species; Russia, 4; China, 3; Japan, 1). These taxa are characterized by the absence of a femoral apophysis, the presence of dorsal apophysis of the conductor, a large epigynal atrium, and broadly expanded, posteriorly originating copulatory ducts. More than nine species of *Ambanus* were described only from male or female specimens and they have been previously included in the genus *Coelotes* Blackwall, 1841 (Paik, 1974, 1976, 1978; Song *et al.*, 1993; Kim & Jung, 1993; Ovtchinnikov, 1999). Although Namkung (2001, 2003) presented simple illustrations of nine *Ambanus* species (*A. bifidus* [Paik, 1976], *A. dimidiatus* [Paik, 1974], *A. euini* [Paik, 1976], *A. kayasanensis* [Paik, 1972], *A. kini* [Paik, 1974], *A. lunatus* [Paik, 1976], *A. ovatus* [Paik, 1976], *A. paikwunensis* [Kim & Jung, 1993], *A. quadrativulvus* [Paik, 1974]), these cannot be reliably identified from his illustrations. Kim & Lee (2006) revised two poorly known species, *A. lunatus* and *A. coreana*, and the latter was transferred to become the type species of the monotypic genus *Alloclubionoides* Paik, 1992 (Clubionidae). Furthermore, the female paratype of *Ambanus paikwunensis* and female specimens identified as *A. lunatus* from Korea are in fact the females of *A. coreana*. Kim & Lee (2007) transferred *A. kayasanensis* to the

genus *Draconarius* on the basis of several characters: The presence of a patellar apophysis, the hooked dorsal apophysis of the conductor, the position of the spermathecal head, etc.

During a survey of the spider fauna of Korea spiders of the genus *Ambanus* were collected by means of pitfall traps in natural forests and caves. In this paper the male of *Ambanus euini* is described for the first time and *Ambanus jaegeri* is described as a new species. The main goal of this paper is to provide data for a future revisional study of the endemic Korean spider genus *Ambanus*.

MATERIAL AND METHODS

The Korean National Park of Mt Odae (KNPO) is situated in Pyungchang-gun and Hongcheon-gun, Gangwon-do. Three collection sites (Woljeong temple, GPS: N 37°43'48", E 128°35'43"; Sangwon temple, GPS: N 37°47'00", E 128°34'10"; and Maebong mountain peak, GPS: N 37°45'34.7", E 128°42'57.4") were chosen. All are located beside small streams, with vegetation characterized by a mixture of dead trees, giant fir trees (*Abies holophylla*) and broadleaf species (*Quercus mongolica*). At each station two pitfall traps (plastic cups, height 6.3 cm, diameter 8 cm) were set 10 m apart and filled with ethylene glycol (see Greenslade & Greenslade, 1971). Specimens were preserved in 70% ethanol. Measurements of all parts are in millimeters unless noted otherwise and are given for one specimen of each sex. Specimens examined in this paper will be deposited in the National Institute of Biological Resources (NIBR), in the collections of the Arachnological Institute of Korea (AIK), the Laboratory of Biodiversity, Hanyang University (LBHU) and in the Muséum d'histoire naturelle, Genève (MHNG).

The descriptive terminology follows that of Kim & Lee (2006, 2007). Abbreviations: a, apical; AER, anterior eye row; ALE, anterior lateral eye; ALS, anterior lateral spinneret; AME, anterior median eye; CDA, dorsal apophysis of conductor; d, dorsal; ITA, intermediate tibial apophysis; KNPO, Korean National Park of Mt Odae; p, prolateral; PER, posterior eye row; PLE, posterior lateral eye; PLS, posterior lateral spinneret; PME, posterior median eye; PMS, posterior median spinneret; r, retrolateral; RTA, retrolateral tibial apophysis; I, II, III, IV, first, second, third, fourth legs.

TAXONOMY

Ambanus euini (Paik, 1976)

Figs 1-3, 7A-C

Coelotes euini Paik, 1976: 78, figs 6-8 (description of female); Paik 1978: 341, fig. 151.1-2.

Ambanus euini: Ovtchinnikov 1999: 64 (transferred from *Coelotes*).

MATERIAL EXAMINED: 1 female, 1 male (AIK), 3 November, 1984, Mt Yebong, Gyeonggi-do, leg. K.S. Lee; 1 female (LBHU), 13 October, 2001, Mt Gyebang, Gangwon-do, leg. T.S. Kwon; 1 male, 1 female (NIBR), 1 May, 2005, Woljeong temple, 1 male (NIBR), 10 June, 2005, Gwangmijang, 55 males, 3 females (LBHU), 11 June, 2005, Sangwon temple, 100 males, 12 females (LBHU), 11 June, 2005, Mabong mountain peak, 5 males (NIBR), 22 July, 2005, Woljeong temple, 2 males (NIBR), 4 September, 2005, Woljeong temple, female (NIBR), 28 September, 2005, Sangwon temple, 10 males, 7 females (LBHU), 11 October, 2005, Woljeong temple, 2 females, 2 males (MHNG), 8 November, 2005, Woljeong temple, KNPO, Gangwon-do, leg. B.W. Kim.

DIAGNOSIS: This species is similar to *A. jaegeri* sp. n., *A. ovatus* and *A. quadrativulvus* in having the epigynal atrium very broadly oval and situated posteriorly near the epigastric furrow; atrial septum and atrial hood absent or indistinct; epigynal teeth absent; copulatory ducts broadly curved with transparent membranes on both lateral margins; male palpal organ with large embolus with curved distal part; dorsal apophysis of conductor present; conductor hook-like, with a rounded distal end. The female of *Ambanus euini* can be distinguished by its long oval genital atrium expanded to both spermathecal stalks, 3.5 times as wide as long (length 0.2 mm, width 0.7 mm); copulatory ducts broadly curved, with transparent membranes, overlapped slightly for one third of the outline of the longest duct. Males are distinguished by patellar apophysis being very small; cymbial furrow (1.1 mm) shorter than half of cymbium length (2.5 mm); dorsal apophysis of conductor horn-like, expanded to conductor and situated on the side of conductor; median apophysis developed as a small thin semicircular projection.

MEASUREMENTS: Male (female in parentheses): Body length 9.3 (11.5); chelicera length 2.3 (2.9), chelicera width 1.2 (1.6), cheliceral fang length 1.2 (1.5); clypeus height 0.5 (0.4); carapace length 4.9 (5.9), carapace width 3.4 (3.6), carapace height 2.6 (2.9); maxillae length 1.6 (1.8), maxillae width 0.8 (1.0); labium length 0.8 (1.0), labium width 0.7 (0.9); sternum length 2.5 (2.7), sternum width 2.0 (2.2); AER 0.9 (1.0), PER 1.2 (1.4), AME 0.2 (0.1), ALE 0.3 (0.3), PME 0.2 (0.2), PLE 0.2 (0.3). Eye formula ALE>PLE=PME=AME (ALE=PLE>PME>AME). Palp 5.3 (5.6) [1.7 (1.9), 0.7 (0.8), 0.4 (1.1), 2.5 (1.8)]. First leg 13.0 (13.2) [3.6 (3.7), 1.6 (1.7), 2.9 (3.0), 3.1 (3.0), 1.8 (1.8)], second leg 12.2 (12.2) [3.4 (3.4), 1.6 (1.8), 2.5 (2.5) 3.0, (2.9), 1.7 (1.6)], third leg 11.7 (11.6) [3.2 (3.2), 1.5 (1.6), 2.1 (2.1), 3.2 (3.1), 1.7 (1.6)], fourth leg 15.4 (15.4) [4.0 (4.1), 1.6 (1.7), 3.3 (3.3), 4.5 (4.4), 2.0 (1.9)]. Leg formula IV I II III (IV I II III). Abdomen length 4.7 (6.0), abdomen width 2.9 (3.8), abdomen height 2.6 (3.5).

DESCRIPTION OF MALE (from Woljeong temple, KNPO, 1 May, 2005 [NIBR]): Medium-sized spider, shorter than female. Carapace elongate, 1.4 times as long as wide, moderately narrowed in thorax area, with distinctly longitudinal fovea (Fig. 1A). AER straight and PER slightly procurved in frontal view; ALE larger than other eyes, AME separated by slightly less than their diameter, and longest eye row width to carapace width ratio 35 (Fig. 1A). Clypeus height 2.5 times as long as AME diameter; a pair of eyebrow-shaped chila present (Fig. 1B). Chelicerae with numerous long setae; lateral condyle yellowish brown; three promarginal teeth on groove, middle one largest, and two retromarginal teeth of subequal size (Fig. 1C). Maxillae reddish brown, widest at mid-part. Labium rectangular, slightly longer than wide (Fig. 1D). Sternum shield-shaped, widest between second coxae, not produced between fourth coxae (Fig. 1E). Palp, see Figure 1G-J; tibia with 12 trichobothria in three rows (5d-6d-2r), tarsus with five trichobothria in one row (5d); femur with three spines, tibia with four spines (one, 1-0 dorsally; three, 2-1 prolaterally), tarsus with eight spines (one, 1-0-0 dorsally; three, 1-1-1 prolaterally; two, 0-2 retrolaterally; two, 0-2 ventrally). Legs (Fig. 1F) yellowish brown; patella + tibia of first leg always shorter than carapace length; trochanters not notched; tibiae with 20-23 trichobothria in four rows

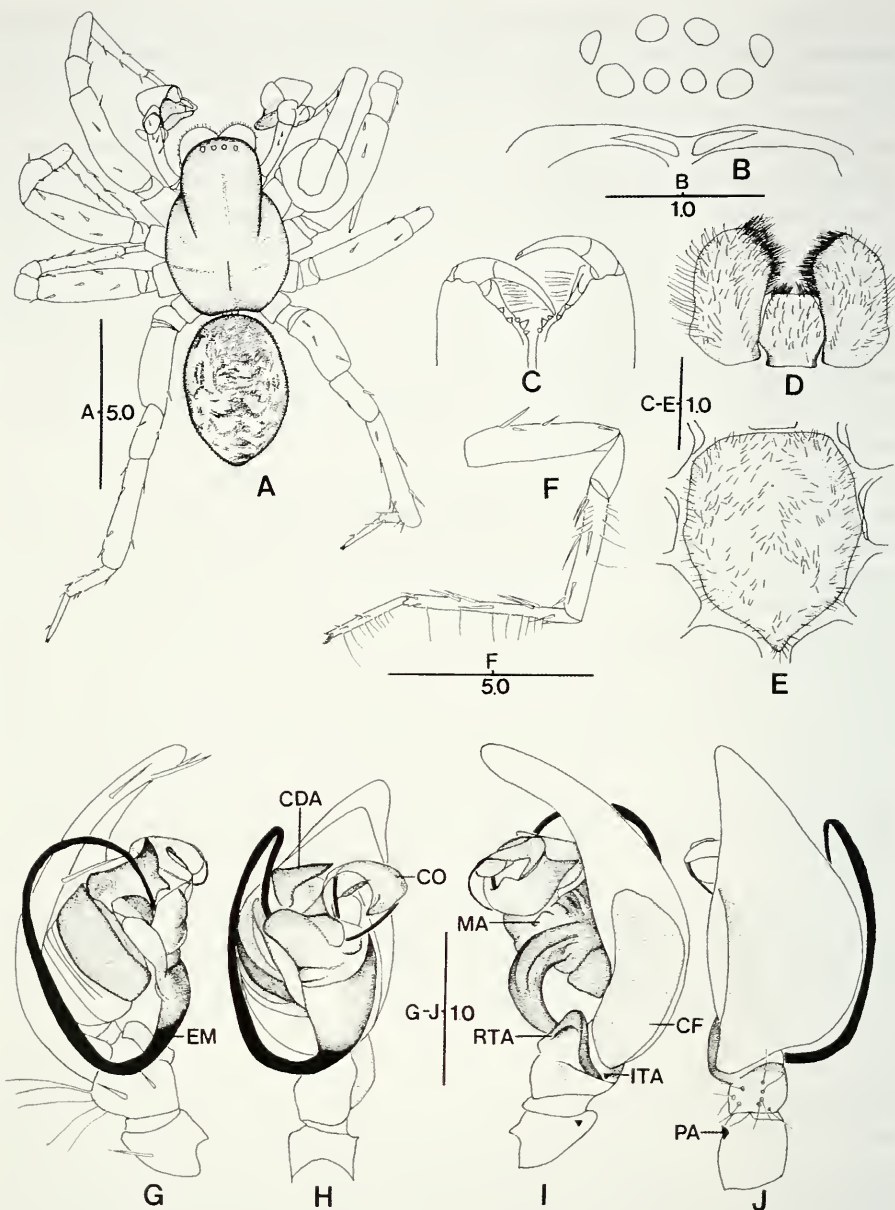


FIG. 1

Ambanus euini (Paik, 1976), male (NIBR; 1 May, 2005) from Woljeong temple, KNPO. (A) Habitus, dorsal view. (B) Eye area and clypeus, frontal view. (C) Chelicerae, posterior view. (D) Maxillae and labium, ventral view. (E) Sternum, ventral view. (F) Left leg IV, prolateral view. (G-J) Left palp, prolateral view (G), ventral view (H), retrolateral view (I), dorsal view (J).

Note: CDA, dorsal apophysis of conductor; CF, cymbial furrow; CO, conductor; EM, embolus; ITA, intermediate tibial apophysis; MA, median apophysis; PA, patellar apophysis; RTA, retrolateral tibial apophysis.

(5p-6d-5d-6r on first leg, 5p-6d-6d-6r on second, 4p-6d-5d-5r on third, 5p-6d-6d-6r on fourth), metatarsi with seven to eight trichobothria in one row (eight on first and fourth leg, seven on second and third leg), tarsi with eight to nine trichobothria in one row (nine on first and fourth leg, eight on second and third leg); tarsal organ situated close to distal end of tarsus, slightly anteriorly part of distal trichobothrium; tarsi with three claws, upper claws with 9-13 teeth (13 on first leg, 12 on second, nine on third, 10 on fourth), lower claw with zero to one tooth (zero on first, second and third leg, one on fourth). Leg spination (see Table 1): Leg I: Femur with four spines, tibia with seven spines (one, 0-0-1 prolaterally; six, 2-2-2a ventrally), metatarsus with seven spines (one, 0-0-1 prolaterally; six, 2-2-2 ventrally), tarsus without spine; leg II: Femur with four spines, tibia with five spines (one, 0-0-1 prolaterally; four, 1-1-2a ventrally), metatarsus with nine spines (three, 1-0-2 prolaterally; six, 2-2-2 ventrally), tarsus without spine; leg III: Femur with six spines, tibia with 10 spines (four, 1-1 prolaterally and retrolaterally; six, 2-2-2a ventrally), metatarsus with 16 spines (ten, 1-2-2 prolaterally and retrolaterally; six, 2-2-2 ventrally), tarsus with three spines (two, 0-1-1 prolaterally; one, 0-1-0 retrolaterally); leg IV: Femur with five spines, tibia with 11 spines (one, 1-0-0 dorsally; four, 1-1 prolaterally and retrolaterally; six, 2-2-2a ventrally), metatarsus with 17 spines (one, 1-0-0 dorsally; ten, 1-2-2 prolaterally and retrolaterally; six, 2-2-2 ventrally), tarsus with six spines (six, 0-1-1 prolaterally, retrolaterally and ventrally). Abdomen ovoid, with scattered brownish yellow spots and chevrons on dorsal side (Fig. 1A). Cribellum absent.

Palp (Figs 1G-J, 7A-B): Patellar apophysis very small; RTA modified with small ITA; cymbial furrow (1.1 mm) shorter than half the cymbium length (2.5 mm); tegular sclerite weakly sclerotized and situated longitudinally on tegulum; conductor broadly hook-like, bent in a clockwise direction (left palp), its distal end rounded; dorsal apophysis of conductor horn-like, expanded towards and facing the conductor; embolus long slender, broadly wound clockwise (left palp) and penetrating into the middle of the tegulum; median apophysis a small thin semicircular projection.

TABLE 1. Spination of leg segments in *Ambanus euini* (Paik, 1976) from Korea. Male (female in parentheses). Note: a, apical part; metat., metatarsus; [], according to original description by Paik (1976).

		dorsal	ventral	prolateral	retrolateral
1st leg	femur	110 (1 1)	0 (0)	002 (002)	0 (0)
	tibia	0 (0)	222 (222a)	001 (001)	0 (0)
	metat.	0 (0)	222 (222)	001 (011)	0 (0)
	tarsus	0 (0)	0 (0)	0 (0)	0 (0)
2nd leg	femur	1 1 (1 1)	0 (0)	011 (011)	0 (0)
	tibia	0 (0)	112a (222a)	001 (011)	0 (0)
	metat.	0 (0)	222 (222)	102 (012)	0 (010)
	tarsus	0 (0)	0 (0)	0 (0)	0 (0)
3rd leg	femur	121 (121)	0 (0)	1 1 (1 1)	0 (0)
	tibia	0 (0 [1 1])	222a (222a)	1 1 (1 1)	1 1 (0 1 [1 1])
	metat.	0 (0)	222 (222)	122 (122)	122 (122)
	tarsus	0 (0)	0 (0)	011 (011)	010 (010)
4th leg	femur	111 (111)	0 (0)	101 (1 1)	0 (0)
	tibia	100 (101)	222a (222a)	1 1 (1 1)	1 1 (1 1)
	metat.	100 (110)	222 (222)	122 (112)	222 (122)

DESCRIPTION OF FEMALE (from Woljeong temple, KNPO, 1 May, 2005 [NIBR]): Medium-sized spider, longer than male. Carapace elongate, 1.6 times longer than wide, moderately narrowed in thorax area, with distinctly longitudinal fovea on middle (Fig. 2A). AER almost straight and PER slightly procurved in frontal view; AME smaller than other eyes, separated by as much as their diameter, and longest eye row width to carapace width ratio 28 (Fig. 2A). Clypeus height four times as long as AME diameter; distinct chilum present (Fig. 2B). Chelicerae with numerous long setae; lateral condyle yellowish brown; with three promarginal teeth on groove, middle one largest, and two retromarginal teeth of subequal size (Fig. 2C). Maxillae reddish brown, widest at mid-part. Labium rectangular, slightly longer than wide (Fig. 2D). Sternum shield-shaped, widest between second coxae, 1.2 times as long as wide and slightly projecting between 4th coxae (Fig. 2E). Palp: Claw with seven teeth; tibia with 15 trichobothria in three rows (6d-6d-3r), tarsus with six trichobothria in one row (5d); femur with three spines, tibia with five spines (two, 1-1 dorsally; three, 0-1-2 prolaterally), tarsus with 16 spines (one, 1-0 dorsally, six, 3-2-1 prolaterally; five, 2-2-1 retrolaterally; four, 0-0-4 ventrally). Legs (Fig. 2F) yellowish brown, without ring patterns; patella + tibia of first leg always shorter than carapace length; trochanters not notched; tibiae with 22-25 trichobothria in four rows (6p-6d-6d-7r on first leg, 6p-6d-6d-6r on second, 5p-6d-6d-5r on third, 5p-7d-6d-6r on fourth), metatarsi with seven to nine trichobothria in one row (seven on first leg, eight on second and third, nine on fourth), tarsi with eight to 10 trichobothria in one row (nine on first and second leg, eight on third, 10 on fourth); tarsal organ situated close to distal end of each leg tarsus, slightly anteriorly of distal trichobothrium; tarsi with three claws, upper claws with 9-12 teeth (12 on first leg, 12 on second, 10 on third and nine fourth), lower claw with one to two (one on first and second leg, two on third and fourth leg). Leg spination (see Table 1): Leg I: Femur with three spines, tibia with seven spines, one small spine on inner ventral side half as long as others (one, 0-0-1 prolaterally; six, 2-2-2a ventrally), metatarsus eight (two, 0-1-1 prolaterally; six, 2-2-2 ventrally), tarsus without spine; leg II: Femur with four spines, tibia with eight spines, one small spine on inner ventral side half as long as others (two, 0-1-1 prolaterally; six, 2-2-2a ventrally), metatarsus with 10 spines (three, 0-1-2 prolaterally; one, 0-1-0 retrolaterally; six, 2-2-2 ventrally), tarsus without spine; leg III: Femur with six spines, tibia with nine spines (two, 1-1 prolaterally; one, 0-1 retrolaterally; six, 2-2-2a ventrally), metatarsus with 16 spines (ten, 1-2-2 prolaterally and retrolaterally; six, 2-2-2 ventrally), tarsus with three spines (two, 0-1-1 prolaterally; one, 0-1-0 retrolaterally); leg IV: Femur with five spines, tibia with 12 spines, two slender spines on dorsal (two, 1-0-1 dorsally; four, 1-1 prolaterally and retrolaterally; six, 2-2-2a ventrally), metatarsus with 17 spines, two spines on dorsal side (two, 1-1-0 dorsally; four, 1-1-2 prolaterally; five, 1-2-2 retrolaterally; six, 2-2-2 ventrally), tarsus with six spines (six, 0-1-1 prolaterally, retrolaterally and ventrally respectively). Abdomen ovoid, with scattered brownish yellow spots and chevrons on dorsal side (Fig. 2A). Cribellum absent.

Epigynum (Figs 2G, H, 3A-B, 7C): Epigynal teeth absent; epigynal opening long oval, expanded to both spermathecal stalks, 3.5 times as wide as long (length 0.2 mm, width 0.7 mm); atrial septum indistinct, originating on posterior plate; copulatory pores deep, round on both sides; without atrial hood; copulatory ducts broadly

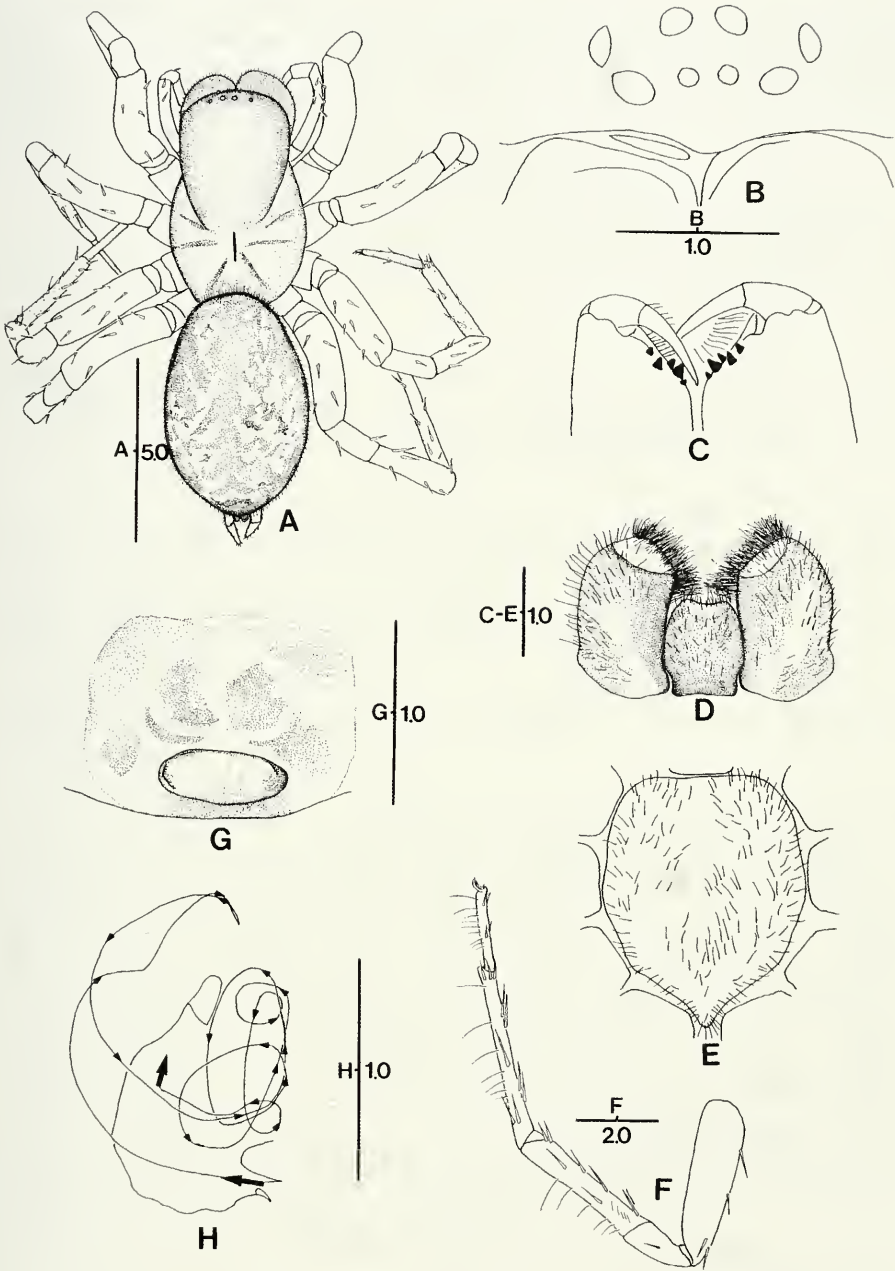


FIG. 2

Ambanus euini (Paik, 1976), female (NIBR; 1 May 2005) from Woljeong temple, KNPO. (A) Habitus, dorsal view. (B) Eye area and clypeus, frontal view. (C) Chelicerae, posterior view. (D) Maxillae and labium, ventral view. (E) Sternum, ventral view. (F) Left leg IV, prolateral view. (G) Epigynum, ventral view. (H) Corse of copulatory duct, right part, ventral view.

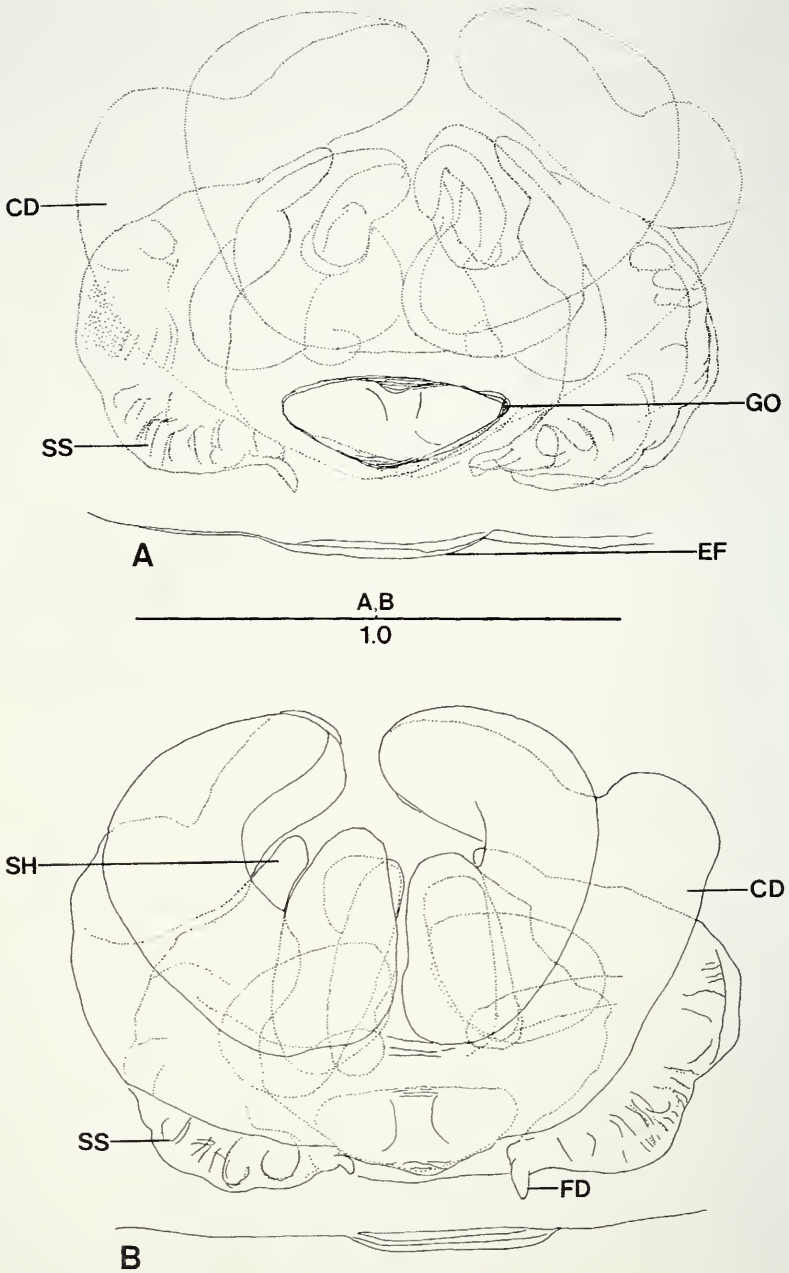


FIG. 3

Ambanus euini (Paik, 1976), female (NIBR; 1 May 2005) from Woljeong temple, KNPO. (A) Epigynum, ventral view. (B) Vulva, dorsal view.

Note: CD, copulatory duct; EF, epigastric furrow; FD, fertilization duct; GO, genital opening; SH, spermathecal head; SS, spermathecal stalk.

curved, with transparent membranes, slightly overlapped for one third of the outline of the longest duct (from genital opening to upper returning part); spermathecal heads developed as small cylindrical processes situated at anterior end of spermathecae; spermathecae large, curved inwards, with distinct stalks and bases; fertilization ducts small, arising from the posterior ends of the spermathecae.

DISTRIBUTION: Korea (Mt Gyebang, Mt Odae, Mt Yebong).

REMARKS: The female of *A. euini* collected from Mt Odae is redescribed with a multitude of characters (leg spination, trichobothrial patterns, etc.) neglected in the original description. The specimens examined were found wandering on the ground among stones and leaf litter.

Ambanus jaegeri sp. n.

Figs 4-6, 7D-F

Ambanus euini: Namkung, 2002: 398, fig. 28.12a-b (description of female), 2003: 400, fig. 28.12a-b; Kim and Cho, 2002: 176, photos 355-360 (description of male and female). Misidentification.

MATERIAL EXAMINED: Male holotype (NIBR), 11 June, 2005, Sangwon temple, KNPO, Gangwon-do, leg. B.W. Kim. Paratypes: 1 female (NIBR), 11 June, 2005, Sangwon temple, KNPO, Gangwon-do; 1 male (AIK), 23 August, 2003, Mt Samak, Gangwon-do, B.W. Kim; 1 female (MHNG), 1 male (MHNG), 11 males (LBHU), 2 females (LBHU), 11 June, 2005, Sangwon temple, 1 male (LBHU), 11 June, 2005, Woljeong temple, 1 female (LBHU), 11 June, 2005, Maebong mountain peak, 1 female (LBHU), 3 September 2005, Dongpi valley, 1 female (AIK), 4 September, 2005, Sangwon temple, KNPO, Gangwon-do, leg. B.W. Kim.

ETYMOLOGY: The specific name is a patronym in honor of Dr Peter Jäger, the German arachnologist who supported the early stages of my taxonomic studies with dedicated assistances and encouragement.

DIAGNOSIS: This species is similar to *A. euini*, *A. ovatus* and *A. quadrativulvus* in having the epigynal atrium very broadly oval, situated posteriorly near the epigastric furrow; atrial septum and atrial hood absent or indistinct; epigynal teeth absent; copulatory ducts broadly curved, with transparent membranes on both lateral margins; male palpal organ with large embolus with curved distal part; dorsal apophysis of conductor present; conductor hook-like, with a rounded distal end situated in centre of papal organ. The female of *Ambanus jaegeri* sp. n. can be distinguished by its triangular epigynal atrium which is heart-shaped and two times as wide as long (length 0.3 mm, width 0.6 mm); copulatory ducts broadly curved, with transparent membranes, slightly overlapped for half of the outline of the longest duct. Males are distinguished by patellar apophysis absent; cymbial furrow (1.6 mm) longer than half the cymbium length (2.8 mm); dorsal apophysis of conductor slender, horn-like, expanded, curving towards top of cymbium and facing the conductor; median apophysis developed as a small, thin, semicircular projection with sharp apical part.

MEASUREMENTS: Male (female in parentheses): Body length 9.4 (11.2); chelicera length 2.6 (2.7), chelicera width 1.2 (1.3), cheliceral fang length 1.4 (1.4); clypeus height 0.3 (0.3); carapace length 5.5 (5.3), carapace width 3.6 (3.4), carapace height 1.9 (1.7); maxillae length 1.8 (1.6), maxillae width 0.8 (0.9); labium length 1.0 (0.9), labium width 0.8 (0.8); sternum length 2.7 (2.6), sternum width 2.0 (2.1); AER 0.8 (0.9), PER 1.2 (1.3), AME 0.1 (0.1), ALE 0.2 (0.2), PME 0.1 (0.2), PLE 0.2 (0.2).

TABLE 2. Spination of leg segments of *Ambanus jaegeri* sp. n. from Korea. Male (female in parentheses). Note: a, apical part; metat., metatarsus.

		dorsal	ventral	prolateral	retrolateral
1st leg	femur	110 (2 1)	0 (0)	002 (002)	0 (0)
	tibia	0 (0)	222a (222a)	001 (011)	0 (0)
	metat.	0 (0)	222 (222)	011 (101)	0 (001)
	tarsus	0 (0)	0 (0)	0 (0)	0 (0)
2nd leg	femur	110 (110)	0 (0)	1 1 (011)	0 (0)
	tibia	0 (0)	222a (112a)	011 (011)	0 (0)
	metat.	0 (0)	222 (222)	012 (012)	0 (011)
	tarsus	0 (0)	0 (100)	0 (0)	0 (0)
3rd leg	femur	122 (122)	0 (0)	101 (101)	0 (0)
	tibia	0 (100)	222 (222a)	1 1 (1 1)	1 1 (011)
	metat.	0 (0)	222 (222)	122 (122)	122 (122)
	tarsus	0 (0)	010 (010)	011 (011)	010 (010)
4th leg	femur	112 (112)	0 (0)	1 0 (0)	0 (0)
	tibia	0 (0)	222 (222a)	1 1 (1 1)	1 1 (1 1)
	metat.	100 (0)	222 (222)	122 (122)	122 (122)
	tarsus	0 (0)	010 (010)	011 (013)	011 (011)

Eye formula ALE=PLE>PME=AME (ALE=PLE>PME>AME). Palp 5.8 (5.1) [1.9 (1.7), 0.7 (0.7), 0.4 (1.0), 2.8(1.7)]. First leg 15.5 (12.1) [4.3 (3.3), 1.7 (1.6), 3.5 (2.8), 3.8 (2.8), 2.2 (1.6)], second leg 14.2 (11.3) [3.9 (3.2), 1.7 (1.6), 3.0 (2.3), 3.5 (2.6), 2.1 (1.6)], third leg 13.3 (10.9) [3.5 (3.0), 1.7 (1.4), 2.4 (1.9), 3.7 (2.9), 2.0 (1.5)], fourth leg 17.4 (14.4) [4.6 (3.5), 1.7 (1.7), 3.6 (3.1), 5.2 (4.2), 2.3 (1.9)]. Leg formula IV I II III (IV I II III). Abdomen length 4.9 (6.5), abdomen width 2.9 (4.1), abdomen height 2.8 (3.9).

DESCRIPTION OF MALE (holotype): Medium-sized spider, shorter than female. Carapace elongate, 1.3 times as long as wide, moderately narrowed in thorax area, with distinctly longitudinal fovea (Fig. 4A). AER straight and PER slightly procurved in frontal view; AME smaller than other eyes, separated by slightly less than their diameter, longest eye row width to carapace width ratio 33 (Fig. 4B). Clypeus height three times as long as AME diameter; a pair of eyebrow-shaped chila present (Fig. 4B). Chelicerae with numerous long setae; lateral condyle yellowish brown; three pro-marginal teeth on groove, middle one largest, and two retromarginal teeth of subequal size (Fig. 4C). Maxillae reddish brown, widest at mid-part. Labium rectangular, slightly longer than wide (Fig. 4D). Sternum shield-shaped, widest between second coxae, not produced between fourth coxae (Fig. 4E). Palp, see Figure 4G-J; tibia with 14 trichobothria in three rows (5d-3d-6r), tarsus with five trichobothria in one row (5d) and femur with three spines, tibia with three spines (1-2 prolaterally), tarsus with four spines (four, 0-0-0-2 prolaterally and retrolaterally). Legs (Fig. 4F) yellowish brown; patella + tibia of first leg always shorter than carapace length; trochanters not notched; tibia with 20-24 trichobothria in four rows (5p-6d-5d-6r on first leg, 6p-6d-6d-6r on second, 4p-6d-5d-5r on third, 5p-7d-6d-4r on fourth), metatarsi with seven to nine trichobothria in one row (nine on first and fourth leg, eight on second, seven on third), tarsi with seven to nine trichobothria in one row (nine on first, third and fourth leg, seven on second); tarsal organ situated close to distal end of tarsus, slightly anteriorly

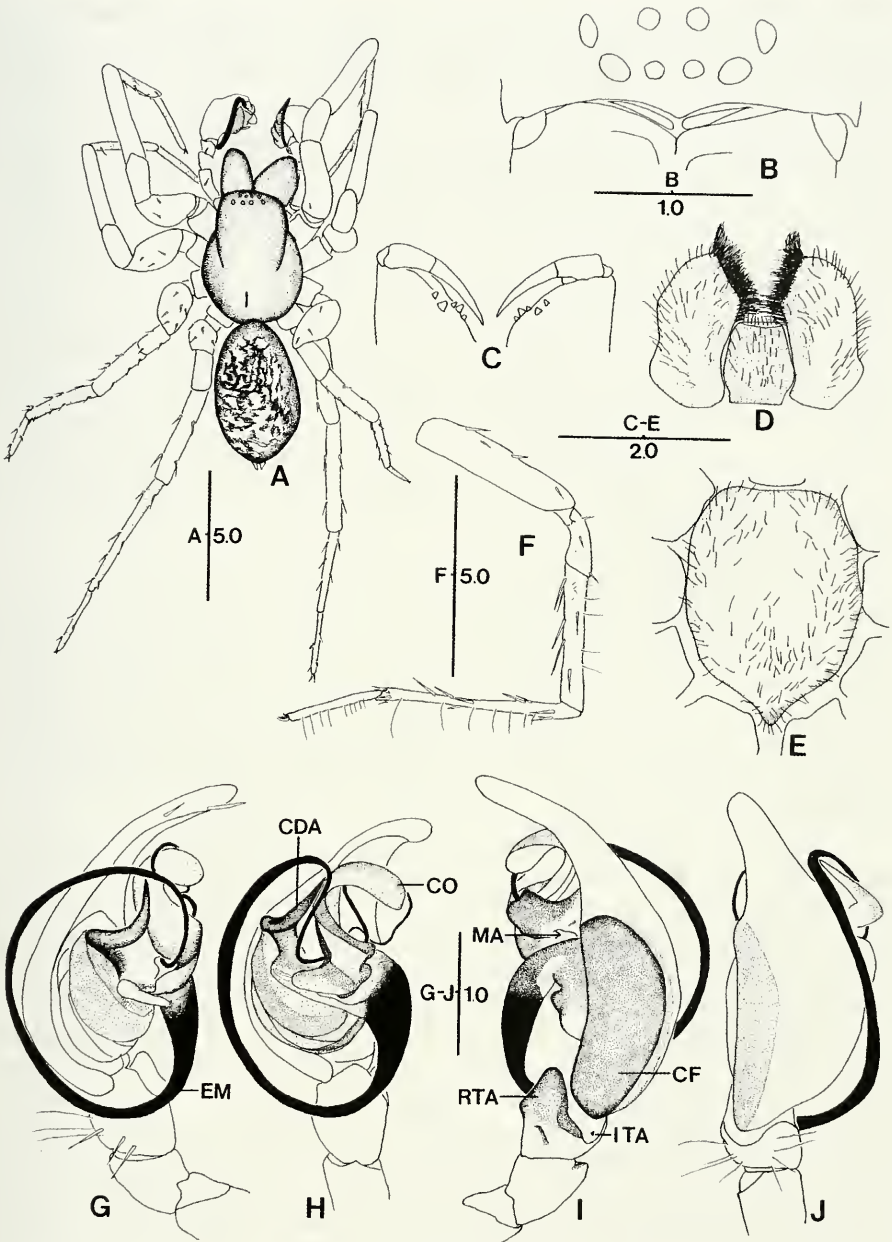


FIG. 4

Ambanus jaegeri sp. n., male holotype. (A) Habitus, dorsal view. (B) Eye area and clypeus, frontal view. (C) Chelicerae, posterior view. (D) Maxillae and labium, ventral view. (E) Sternum, ventral view. (F) Left leg IV, prolateral view. (G-J) Left palp, prolateral view (G), ventral view (H), retrolateral view (I), dorsal view (J). Note: CDA, dorsal apophysis of conductor; CF, cymbial furrow; CO, conductor; EM, embolus; ITA, intermediate tibial apophysis; MA, median apophysis; RTA, retrolateral tibial apophysis.

of distal trichobothrium; tarsi with three claws, upper claws with 10-13 teeth (13 on first and second leg, 12 on third, 10 on fourth), lower claw without tooth. Leg spination (see Table 1): Leg I: Femur with four spines, tibia with seven spines, one small spine on inner ventral side half as long as others (one, 0-0-1 prolaterally; six, 2-2-2a ventrally), metatarsus with eight spines (one, 0-1-1 prolaterally; six, 2-2-2 ventrally), tarsus without spine; leg II: Femur with four spines, tibia with eight spines, one small spine on inner ventral and median prolateral side half as long as others (two, 0-1-1 prolaterally; four, 2-2-2a ventrally), metatarsus with nine spines (three, 0-1-2 prolaterally; six, 2-2-2 ventrally), tarsus without spine; leg III: Femur with seven spines, tibia with 10 spines (four, 1-1 prolaterally and retrolaterally; six, 2-2-2a ventrally), metatarsus with 16 spines (ten, 1-2-2 prolaterally and retrolaterally; six, 2-2-2 ventrally), tarsus with four spines (two, 0-1-1 prolaterally; two, 0-1-0 retrolaterally and ventrally); leg IV: Femur with five spines, tibia with 10 spines (four, 1-1 prolaterally and retrolaterally; six, 2-2-2 ventrally), metatarsus with 17 spines (one, 1-0-0 dorsally; ten, 1-2-2 prolaterally and retrolaterally; six, 2-2-2 ventrally), tarsus with five spines (four, 0-1-1 prolaterally and retrolaterally; one, 0-1-0 ventrally). Abdomen ovoid, with scattered brownish yellow spots and without distinct chevrons on dorsal side (Fig. 4A). Cribellum absent.

Palp (Figs 4G-J, 7D-E): Patellar apophysis absent; RTA modified with ITA; cymbial furrow (1.6 mm) longer than half the cymbium length (2.8 mm); tegular sclerite weakly sclerotized and situated longitudinally on tegulum; conductor broadly hook-like, bent in a clockwise direction (left palp), distal end rounded; dorsal apophysis of conductor slender, horn-like, expanded towards top of cymbium and facing the conductor; embolus long, slender, broadly wound clockwise (left palp) and penetrating the middle of the tegulum; median apophysis a small thin semicircular projection with sharp apical part.

DESCRIPTION OF FEMALE (paratype from Sangwon temple, KNPO, 11 June, 2005 [NIBR]): Medium-sized spider, longer than male. Carapace elongate, 1.4 times longer than wide, moderately narrowed in thorax area, with distinctly longitudinal fovea (Fig. 5A). AER straight and PER slightly procurved in frontal view; AME smaller than other eyes, separated by as much as their diameter, and longest eye row width to carapace width ratio 38 (Fig. 5B). Clypeus height three times as long as AME diameter; a pair of eyebrow-shaped chila present (Fig. 5B). Chelicerae with numerous long setae; lateral condyle yellowish brown; three promarginal teeth on groove, middle one largest, and two retromarginal teeth of subequal size (Fig. 5C). Maxillae reddish brown, widest at mid-part. Labium rectangular, 1.1 times as long as wide (Fig. 5D). Sternum shield-shaped, widest between second coxae, 1.2 times as long as wide, and slightly projecting between 4th coxae (Fig. 5E). Palp: Claw with seven teeth; tibia with 15 trichobothria in three rows (6d-6d-3r), tarsus with seven trichobothria in one row (7r); femur with three spines, tibia with five spines (three, 1-2 prolaterally; two, 1-1 retrolaterally), tarsus with 14 spines (one, 1-0-0 dorsally; six, 3-2-1 prolaterally; five, 2-2-1 retrolaterally; four, 0-0-4 ventrally). Legs (Fig. 5F) yellowish brown, without annulation; patella + tibia of first leg always shorter than carapace length; trochanters not notched; tibia with 22-25 trichobothria in four rows (5p-2-3d-6r on first leg, 5p-6d-5d-6r on second, 4p-6d-5d-5r on third, 5p-4d-5d-5r on fourth), metatarsi with six to

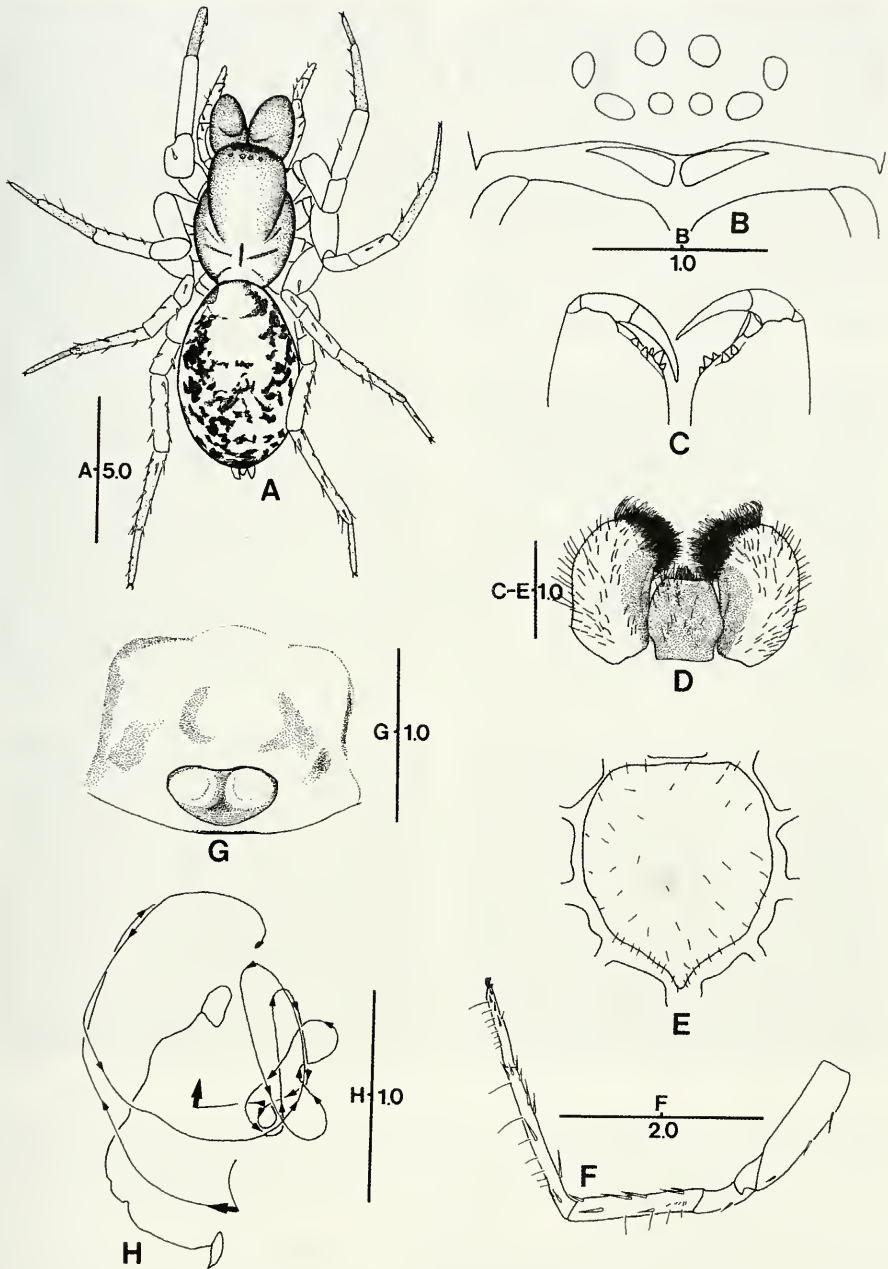


FIG. 5

Ambanus jaegeri sp. n., female paratype (NIBR; 11 June, 2005) from Sangwon temple, KNPO. (A) Habitus, dorsal view. (B) Eye area and clypeus, frontal view. (C) Chelicerae, posterior view. (D) Maxillae and labium, ventral view. (E) Sternum, ventral view. (F) Left leg IV, prolateral view. (G) Epigynum, ventral view. (H) Course of copulatory duct, right part, ventral view.

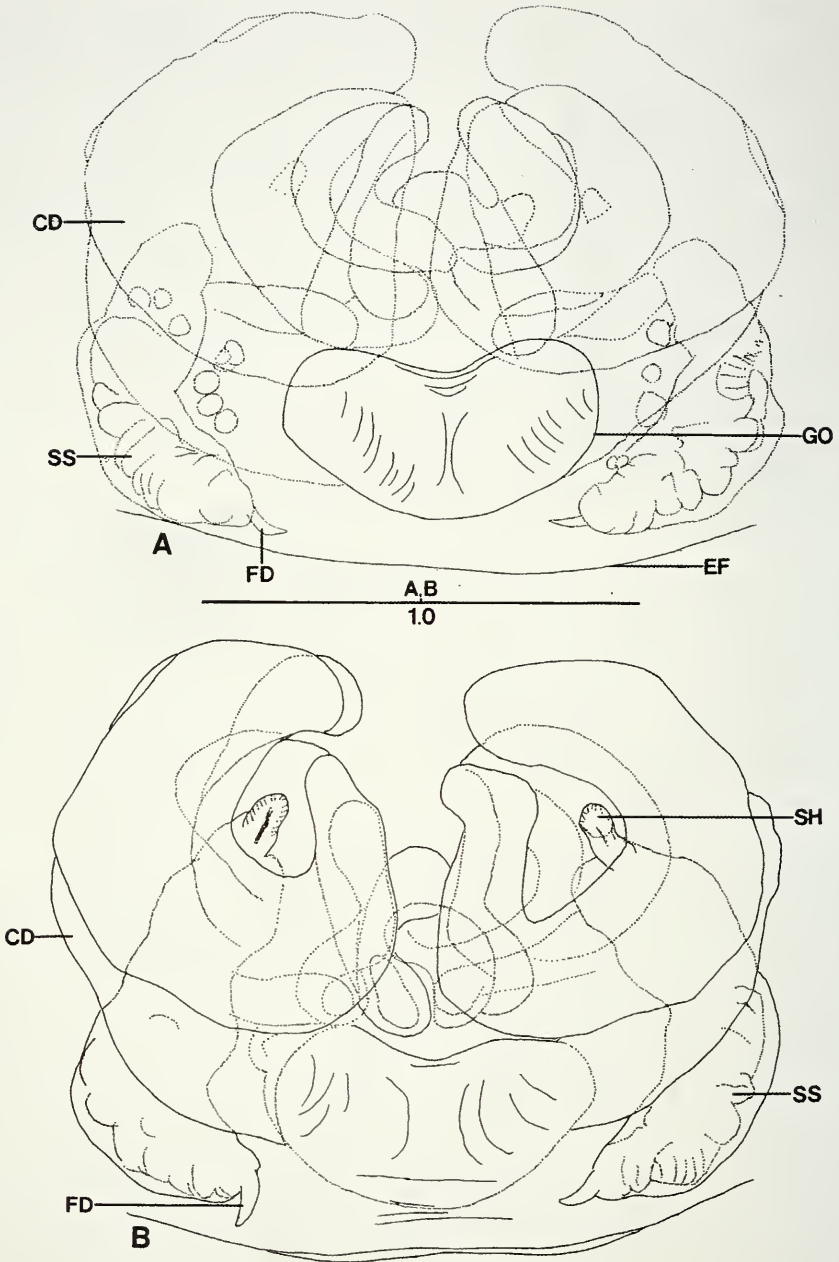


FIG. 6

Ambanus jaegeri sp. n., female paratype (NIBR; 11 June, 2005) from Sangwon temple, KNPO. (A) Epigynum, ventral view. (B) Vulva, dorsal view.

Note: CD, copulatory duct; EF, epigastric furrow; FD, fertilization duct; GO, genital opening; SH, spermathecal head; SS, spermathecal stalk.

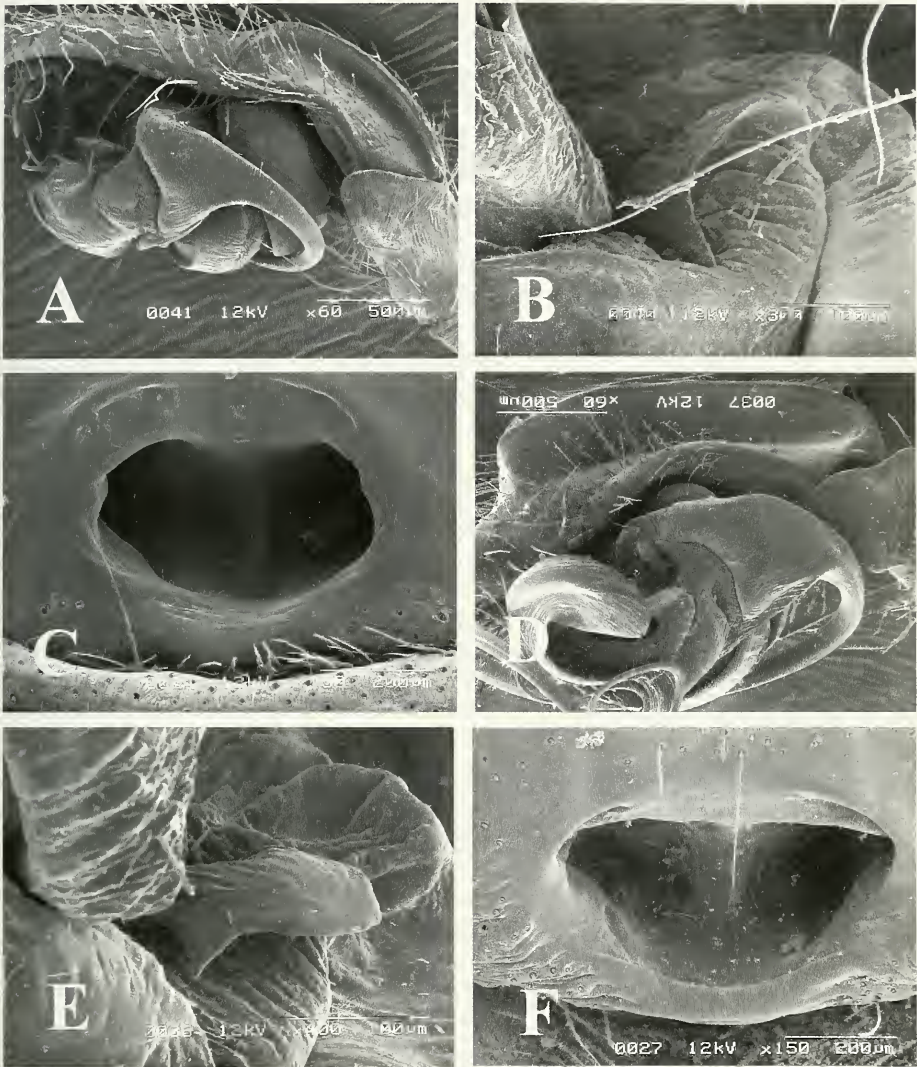


FIG. 7

SEM photographs of *Ambanus euini* (Paik, 1976) (A-C) and *A. jaegeri* sp. n. (D-F) from Korea. (A, D) Left male palp, retrolateral view. B, E. Median apophysis of left palpal organ, retrolateral view. (C, F) Epigynum, ventral view.

eight trichobothria in one row (eight on first, second and fourth leg, six on third), tarsi with seven to nine trichobothria in one row (nine on first and fourth leg, eight on second, seven on third); tarsal organ situated close to distal end of tarsus, slightly anteriorly of distal trichobothrium; tarsi with three claws, upper claws with 9-12 teeth (12 on first and second leg, 10 on third, nine on fourth), lower claw with two teeth (on all legs). Leg spination (see Table 2): Leg I: Femur with five spines, tibia with eight

spines, one small spine on inner ventral side half as long as others (two, 0-1-1 prolaterally; six, 2-2-2a ventrally), metatarsus with nine spines (two, 1-0-1 prolaterally; one, 0-0-1 retrolaterally; six, 2-2-2 ventrally), tarsus without spine; leg II: Femur with four spines, tibia with six spines (two, 0-1-1 prolaterally; four, 1-1-2a ventrally), metatarsus with nine spines (three, 0-1-2 prolaterally; six, 2-2-2 ventrally), tarsus without spine; leg III: Femur with seven spines, tibia with 11 spines (one, 1-0-0 dorsally; two, 1-1 prolaterally; two, 0-1-1 retrolaterally; six, 2-2-2a ventrally), metatarsus with 16 spines (ten, 1-2-2 prolaterally and retrolaterally; six, 2-2-2 ventrally), tarsus with four spines (two, 0-1-1 prolaterally; one, 0-1-0 retrolaterally; one, 0-1-0 ventrally); leg IV: Femur with four spines, tibia with 10 spines (four, 1-1 prolaterally and retrolaterally; six, 2-2-2a ventrally), metatarsus with 16 spines (10, 1-2-2 prolaterally and retrolaterally; six, 2-2-2 ventrally), tarsus with seven spines (four, 0-1-3 prolaterally; two, 0-1-1 retrolaterally; one, 0-1-0 ventrally). Abdomen ovoid, with scattered brownish yellow spots and without distinct chevrons on dorsal side (Fig. 5A). Cribellum absent.

Epigynum (Figs 5G, H, 6A-B, 7F): Epigynal teeth absent; genital opening heart-shaped, two times as wide as long (length 0.3 mm, width 0.6 mm); atrial septum indistinct, originating on posterior plate; copulatory pores deep, round on both sides; atrial hood absent; copulatory ducts broadly curved, with transparent membranes, slightly overlapped for half of the outline of the longest duct (from genital opening to upper returning part); spermathecal heads developed as small cylindrical processes situated at anterior end of spermathecae; spermathecae large, curved inwards, with distinct stalks and bases; fertilization ducts small, arising from the posterior ends of the spermathecae.

DISTRIBUTION: Korea (Mt Odae, Mt Samak).

REMARKS: The specimens examined were found wandering on the ground among stones and leaf litter.

ACKNOWLEDGEMENTS

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Some new earthworms of the genus *Amyntas* (Oligochaeta: Megascolecidae) with male discs from Bogildo Island, Korea

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Some new earthworms of the genus *Amyntas* (Oligochaeta: Megascolecidae) with male discs from Bogildo Island, Korea. - Three new *Amyntas* are described from Bogildo Island, Korea: *Amyntas angulatus* sp. nov., *Amyntas jamesi* sp. nov., and *Amyntas yunseondo* sp. nov. *Amyntas angulatus* sp. nov. have two pairs of spermathecal pores intersegmental in 5/6, and 6/7. The other 2 species have three pairs of spermathecae in VI, VII, and VIII, the former with spermathecal pores intersegmental in 5/6, 6/7, and 7/8, the latter intrasegmental in VI, VII, and VIII. These species have disc-shaped male pore region and simple intestinal caeca. Descriptions of the new species are provided.

Keywords: Earthworms - *Amyntas* - Megascolecidae - Oligochaeta - Korea - taxonomy.

INTRODUCTION

Amyntas has been long known to have more species than any other genus of the *Pheretima*-complex (Sims & Easton, 1972). Korean Megascolecidae also belong to *Amyntas* and many new species have been described recently further expanding this large genus (Hong & James, 2001ab; Hong & Lee, 2001; Hong *et al.*, 2001). Beginning with Kobayashi (1934), Korean earthworms have been studied repeatedly, but the work is not yet completed since much area remains to be collected. There is little overlap between the area sampled for this paper and areas covered by previous studies of Korean *Amyntas*. In all probability, other mountains and other islands have diverse faunas, thus the number of endemic species known in Korea will increase even more.

Genital papillae of the male pore region, especially the male disc, are useful for classification of *Amyntas* and have been used throughout the history of the genus. However, not many species have male discs, a particularly large form of genital papillae or male porophore. Species with male discs are also represented by small numbers of individuals. In this paper, I describe 3 species with male discs: *Amyntas angulatus* sp. nov., *Amyntas jamesi* sp. nov., and *Amyntas yunseondo* sp. nov. Material was found from litter layers and soils in forests by hand sorting.

The Bogildo Island, one of the six major counties, is located at the southern end of Wando-gun. Among its big mountains are Jeogja peak (435 m), Gwangdae peak

(311 m), and Mangwol peak (350 m), while most areas have an altitude less than 300 m. The mean temperature during the coldest winter month January was 0.5 °C. Summer temperatures reach a mean of 28.8 °C in August and thereafter decrease. The annual mean precipitation is 1456.8 mm (by Korea Meteorological Administration). Holotype and paratypes are deposited in the Korean Bioresources Collection (KB), National Institute of Biological Resources.

DESCRIPTIONS

Amyntas angulatus sp. nov.

Figs 1A-C

MATERIAL: Holotype: Clitellate specimen: Korea, Jeollanam-do province, Wando-gun, Bogildo Isl., litter layers in forest, 19 July 2000, Y. Hong coll. Paratype: one clitellate: Same data as for holotype. Other material: Same data as for holotype, 1 a clitellate specimen.

ETYMOLOGY: The name *angulatus* is Latin for "angular" here referring to the shape of the genital papillae.

DIAGNOSIS: Paired spermathecal pores in 5/6, 6/7; male pores XVIII at posterior corner of large angular papillae, each pad extending to 17/18 and 18/19, each papilla hardened.

DESCRIPTION: Worm unpigmented. Dimensions 86 (a clitellates 71-86) mm by 4.5 mm at segment X, 5.2 mm at XXX, 4.7 mm at clitellum; body cylindrical throughout, segments 85. Setae regularly distributed around segmental equators, numbering 71 at VII, 92 at XX; 2-3 between male pores; setal formula AA:AB:YZ:ZZ = 1:1:1.5:2 at XIII. Female pore single in XIV, 0.3 mm. First dorsal pore in 12/13. Clitellum annular in XIV-XVI; setae visible externally.

Male pores in XVIII at posterior corner of large angular papillae with dimensions 1.7 x 2.0 mm with big ring 2.0-3.0 mm outer dimensions, each pad extending to 17/18 and 18/19, each papilla hardened, with seminal groove of variable shape in clitellates, oval, round. Paired spermathecal pores in 5/6 and 6/7, unrecognizable. Genital markings lacking.

Septa 5/6 thin, 6/7 thick, 7/8 thin, 8/9, 9/10 absent, 10/11-13/14 thin. Gizzard in VIII-X. Intestine begins in XV. Typhlosole as simple fold from XXVII. Intestinal caeca simple, originating in XXVII, and extending anteriorly about to XXIII, each consisting of a finger-shaped sac. Esophageal hearts four pairs in X-XIII. IX lateral.

Ovaries in XIII. Paired spermathecae in VI, VII; each ampulla as a flattened, blunt, oval pouch, duct shorter than ampulla, diverticulum coiled and kinked with short muscular stalks; no nephridia on spermathecal ducts. Male sexual system holandric, testes and funnels enclosed in ventral paired sacs in X and XI. Seminal vesicles, two pairs in XI and XII; those of XI enclosed in testis sacs. Prostates in XVIII extending to XVII-XXI; both glandular portions consist of three main lobes, deeply divided in slender leaflets; vas deferens not muscular. Genital papillae glands lacking.

REMARKS: *Amyntas angulatus* sp. nov. keys to the *morrissi* group in Sims & Easton (1972), which is composed of 30 species. Among them, the following Korean species are reported: *A. fibulus fibulus* (Kobayashi, 1936), *A. fibulus ranunculus* (Kobayashi, 1936), *A. kobayashii* (Kobayashi, 1938), and *A. koreanus* (Kobayashi, 1938). In the shape of the male discs *Amyntas angulatus* sp. nov. is similar to *A.*

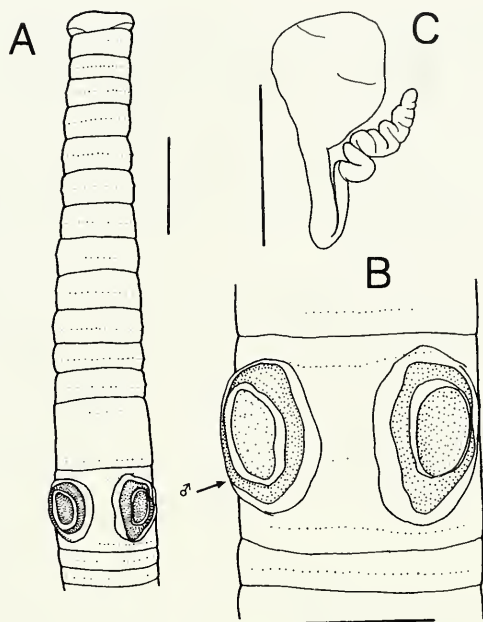


FIG. 1

Amynthus angulatus sp. nov. (A) Ventral view. (B) Male pore region in XVIII. (C) Spermathecae. Scale bars = 5 mm (A), 2 mm (B, C).

kobayashii, but it differs in the male pore region. *A. kobayashii* has clear male pore, but in *Amynthus angulatus* sp. nov. it is unrecognizable on the male discs. *A. fibulus fibulus* and *A. fibulus ranunculus* have different male discs. After Sims & Easton (1972), two species of the *morrisoni* group were recorded from Korea, *A. geojeinsulae* (Song & Paik, 1970b) and *A. draconis* Hong & James, 2001. The new species appears to be related to *A. draconis*, but is distinguishable easily by the shape of the male pore region. Its male discs are angular, while *A. draconis* has round discs. Also, *Amynthus angulatus* sp. nov. differs from *A. draconis* in having more setae in VII and XX, shorter body, more closely spaced ventral and dorsal gap, and coiled diverticula.

Chen (1933, 1936, 1938, 1946) recorded 12 species of *morrisoni* group from China. Among them, two species have discs-shaped male pore regions: *A. hainanicus* (Chen, 1938) and *A. oculus* (Chen, 1938), but these discs are quite differently shaped than in *Amynthus angulatus* sp. nov.

Amynthus jamesi sp. nov.

Figs 2A-C

MATERIAL: Holotype: Clitellate specimen: Korea, Jeollanam-do province, Wando-gun, Bogildo Isl., Buyong-ri, Jeokjabong, litter layers in forest, 19 July 2000, Y. Hong coll. Other material: Same data as for holotype, 1 acitellate specimen.

ETYMOLOGY: Named after Dr Samuel W. James, who made great contributions to systematics of earthworms.

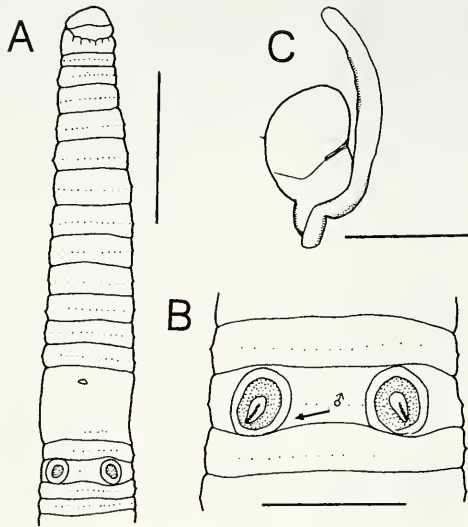


FIG. 2

Amynthus jamesi sp. nov. (A) Ventral view. (B) Male pore region in XVIII. (C) Spermathecae. Scale bars = 5 mm (A), 3 mm (B, C).

DIAGNOSIS: Three pairs of spermathecal pores in 5/6-7/8; male pores at lateral margins of ventrum in XVIII; disc shape resembles a droplet placed with its narrow end laterally, central axis with a diagonal seminal groove; distance between male pores 1.8 mm.

DESCRIPTION: Worms unpigmented. Dimensions 59-63 by 2.5-2.8 mm at segment X, 3.0-3.5 mm at XXX, 2.8-3.0 mm at clitellum; body cylindrical throughout, segments 88-102. Setae regularly distributed around segmental equators, numbering 32 at VII, 46 at XX; 3-5 between male pores; setal formula AA:AB:YZ:ZZ = 2:1:2:3.5 at XIII. Female pore single in XIV, 0.3 mm, oval. First dorsal pore in 12/13. Clitellum annular in XIV-XVI; setae at XVI visible externally within clitellum.

Male pores at lateral margins of ventrum in XVIII, as superficial bright spots near lateral margins at the median ends of seminal grooves within small male discs; disc shape resembles droplet placed with narrow end laterally, their central axis with a diagonal seminal groove, distance between male pores 1.8 mm. Three pairs of spermathecal pores in 5/6-7/8, inconspicuous, small, ventral. Genital markings absent.

Septa 5/6-7/8 thin, 8/9 absent, 9/10 present as sac enclosing testes and funnels; 10/11-13/14 thin. Gizzard globular in VIII-IX. Intestine begins in XV. Typhlosole medium, from XXVII. Intestinal caeca simple, originating in XXVII, extending anteriorly to about XXV, each consisting of one finger-shaped lobe. Hearts X-XIII esophageal, IX lateral.

Ovaries in XIII. Three pairs of spermathecae in VI, VII and VIII; each ampulla as a small broad oval pouch, ducts shorter than ampulla; diverticula slender, stalked, with long sausage-shape chamber, longer than ampulla; no nephridia on spermathecal

ducts. Male sexual system holandric, testes and funnels in paired sacs in X and XI. Seminal vesicles, 2 pairs in XI and XII, slightly developed. Prostates in XVIII, extending to XVII-XXII; ducts long, muscular, both glandular portions consisting of two main lobes, each lobe divided into leaflets.

REMARKS: The present species keys to *hawayanus* (*gracilis*) group by the three spermathecal pores in 5/6-7/8. After Sims & Easton (1972), the Korean species of this group are *A. acinctus* (Goto & Hatai, 1899), *A. agrestis* (Goto & Hatai, 1898), *A. carnosus* (Goto & Hatai, 1899), *A. hilgendorfi* (Michaelson, 1892), *A. kamitai* (Kobayashi, 1934), *A. serratus* (Kobayashi, 1936), and *A. vallis* (Kobayashi, 1936). These species all have quite different characters from *Amyntas jamesi* sp. nov., such as manicate caecae and different male field configurations. Later on, two more species of the group were recorded in Korea, *A. palgongensis* Hong, 2001 and *A. minjae* Hong, 2001.

The new species is similar to *A. minjae* Hong, 2001 in the male pore region and number of spermatheca, but has a different shape of the spermathecal diverticulum, a longer diverticulum relative to the ampulla, obvious seminal grooves on male discs, and fewer setae per segment at VII and XX.

Chen (1933, 1936, 1938, 1946) recorded 10 species of this group in China. *Amyntas jamesi* sp. nov. is similar to the Chinese *A. muticus* (Chen, 1938) and *A. magnificus* (Chen, 1936) by the male pore region, but is separated easily by the disc-shape and diverticulum.

Amyntas yunseondoi sp. nov.

Figs 3A-C

MATERIAL: Holotype: Clitellate specimen: Korea, Jeollanam-do province, Wando-gun, Bogildo Isl., Buyong-dong, Bojuksan, litter layers in forest, 19 July 2000, Y. Hong coll.

ETYMOLOGY: Yun Seon-Do (1587-1671) who was the master of the Korean literary circle in the age of Chosun Dynasty built a pavilion at his place of residence in Bogildo Island.

DIAGNOSIS: Spermathecal pores in VI, VII and VIII close to 5/6, 6/7 and 7/8; male pores superficial at median ends of seminal grooves within paired discs; disc shape resembles droplet placed with its narrow end posterior, central axis with longitudinal seminal groove; distance between male pores 6.5 mm.

DESCRIPTION: Worm unpigmented. Dimensions 156 mm by 7.0 mm at segment X, 7.0 mm at XXX, 8.2 mm at clitellum; body cylindrical throughout, segments 126. Setae regularly distributed around segmental equators, numbering 51 at VII, 69 at XX; 14 between male pores, size and distance regular; setal formula AA:AB:YZ:ZZ = 5:3:4:5 at XIII. Female pore single in XIV, 1.0 mm wide, oval, slightly invaginated. First dorsal pore in 12/13. Clitellum annular in XIV-XVI; setae invisible externally in the clitellum.

Male pores superficial at median ends of seminal grooves within paired, elevated hardened male discs; disc shape resembles droplet placed with narrow end posterior, raised above body wall level, central axis with longitudinal seminal groove, lateral end posterior to medial end, distance between male pores 6.5 mm. Spermathecal pores in VI, VII and VIII close to 5/6, 6/7 and 7/8, above mid-lateral level, on slightly elevated conspicuous small bumps, pore opening appears black.

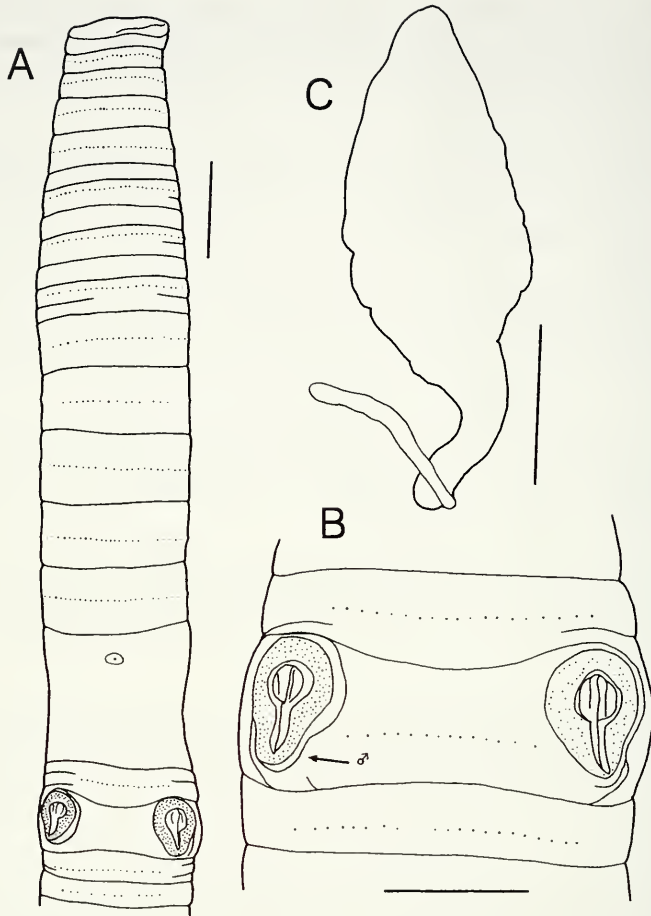


FIG. 3

Amynthus yunseondoi sp. nov. (A) Ventral view. (B) Male pore region in XVIII. (C) Spermathecae. Scale bars = 5 mm (A), 3 mm (B), 2 mm (C).

Septa 5/6-7/8 thick, 8/9, 9/10 absent, 10/11 moderately muscular, 11/12, 12/13 thick, 13/14 thin. Gizzard globular in VIII-X. Intestine begins in XV, small paired lymph glands from XXVIII along dorsal vessel. Typhlosole medium as a simple fold from XXVII. Hearts in X-XIII esophageal; in IX lateral, on the left side larger. Intestinal caeca simple, originating in XXVII, and extending anteriorly about to XXIV, each consisting of a finger-shaped sac with many small pouches on vertical margin.

Ovaries in XIII. Paired spermathecae in VI, VII and VIII; ampulla as a small pouch, ducts shorter than ampulla, of medium thickness; diverticula slender, consisting of digitate chamber with narrow stalk, shorter than ampulla. Male sexual system holandric, testes and funnels in ventral paired sacs in X and XI. Seminal vesicles two pairs in XI and XII, well developed. Prostates in XVIII, divided in many long slender

lobes extending to XVII-XIX, many pieces; vas deferens muscular, clearly single. Genital marking glands lacking.

REMARKS: The species is similar to *A. deogyusanensis* Hong & James, 2001, with respect to the shape of male pore region. It differs from *A. deogyusanensis* in the orientation of the male disc's droplet shape head direction and location of the male pores. *Amyntas yunseondoi* sp. nov. also differs from *A. deogyusanensis* in having more setae per segment at VII and XX, greater length, and more widely spaced ventral and dorsal gap. *Amyntas yunseondoi* sp. nov. has three pairs of spermathecal pores in VI-VIII, but *A. deogyusanensis* has two pairs of spermathecal pores in VI-VII, also lacks genital markings but has conspicuous genital patches, while the new species has neither genital markings nor genital patches. The sampling locality of *Amyntas yunseondoi* sp. nov. is an island of southern Korea, but *A. deogyusanensis* was collected from Mt. Deogyu of the central mainland Korea.

Amyntas yunseondoi sp. nov. keys to the *bournei* group with three pairs of spermathecal pores intrasegmental in VI-VIII. This group is composed of four species; *A. bournei* (Rosa, 1890), *A. domosus* (Chen, 1946), *A. mucrorimus* (Chen, 1946), and *A. sulcatus* (Gates, 1932). After Sims & Easton (1972), one species recorded in Korea, *A. payeiensis* Hong, 2001, but it differs by the seminal grooves within the male discs (Hong *et al.*, 2001).

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A taxonomic revision of the family Oncopodidae VII. A new *Oncopus* species (Opiliones, Laniatores) from eastern Kalimantan

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A taxonomic revision of the family Oncopodidae VII. A new *Oncopus* species (Opiliones, Laniatores) from eastern Kalimantan. - *Oncopus kaltim* sp. n. is described from males collected in the Indonesian part of Borneo. This species belongs to the *Oncopus hosei* species-group and further supports the assumption that *O. expatriatus* Schwendinger & Martens, 2004 occurs on Borneo and not in Thailand.

Keywords: Taxonomy - penis morphology - Borneo - Indonesia.

INTRODUCTION

After having completed a revision of the available *Oncopus* Thorell material in co-operation with Jochen Martens (see Schwendinger & Martens, 2004), I received two additional male specimens collected by Louis Deharveng and Anne Bedos in the eastern part of Borneo. These specimens are presumably conspecific with five juveniles earlier reported from the same area (Schwendinger & Martens, 2004: 171) and represent a new species that is described and illustrated here.

METHODS

Methods and terminology follow Martens & Schwendinger (1998: fig. 1) and Schwendinger & Martens (2004: 140). All measurements are in mm. Leg and palp measurements are here given as: Total length (length of trochanter + femur + patella + tibia + [metatarsus +] tarsus).

TAXONOMY

Oncopus kaltim sp. n.

Figs 1-15

MATERIAL: INDONESIA, East Kalimantan Province, Sangkulirang, Pengadan, Baai Forest, ♂ holotype (deposited in the Museum Zoologicum Bogoriense, Cibinong, Java, Indonesia) and ♂ paratype (deposited in the Muséum National d'Histoire Naturelle, Paris, France), collected by hand from forest litter by L. Deharveng, A. Bedos, C. Rahmadi & Y. Suhardjono on 14.-16.VIII.2004.

ETYMOLOGY: The specific epithet, a noun in apposition, refers to the Indonesian name of the province in which the types were collected. "Kaltim" is the locally used short form of Kalimantan Timur.

DIAGNOSIS: Similar to *O. megachelis* Schwendinger, 1992, distinguished by: Smaller size; interocular area less rounded; paramedian tubercles present on dorsal scutal area VIII; anteroproximal processes on coxae III shorter, stouter, parallel to each other; genital operculum narrower; truncus penis with narrower, widely notched distal margin; median plate of glans penis shorter and with straight distal margin; lateral sclerites of glans longer, with truncate tips.

DESCRIPTION: ♂ (holotype, except for penis morphology). Colouration: Body amber, with dark reticulation on carapace region, chelicerae and palps; dark margin on dorsal scutum and dark pattern on its opisthosomal part (Fig. 1); legs mostly dark, except for lighter distal portion of metatarsi I-IV, lighter metatarsus III and tarsi III-IV, and cream tarsi I-II.

Dorsal scutum 7.3 long and 4.6 wide, its carapace region large and raised, 2.4 long and 2.9 wide, interocular area a low, rounded, slightly forward-directed hump (Figs 1-2). Opisthosomal areas of dorsal scutum indistinctly keeled, with pairs of small paramedian tubercles on areas VI-VIII, the latter slightly protruding from posterior margin of scutum (Figs 1-3); ventral scutal areas distinctly keeled, with transversal bands of white enclosures (Figs 2-3). Palpal coxa with small, conical ventral process; ventral side of leg coxa I with small anterolateral process, low central mound and subproximal bulge; coxa II with small scale-like anteroproximal apophysis and low rounded process posterior to it; coxa III with fairly large anteroproximal process. Genital operculum rounded, slightly longer than wide (Fig. 10).

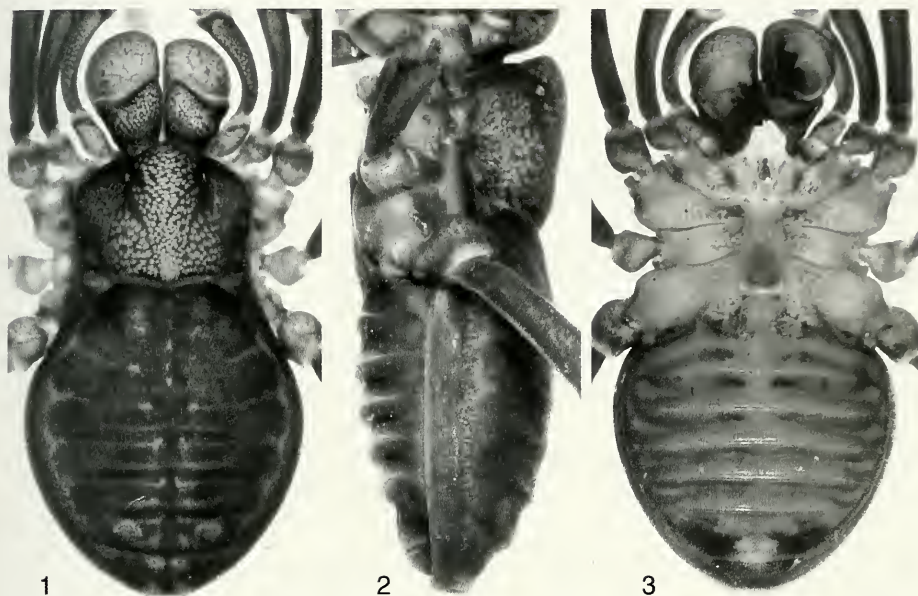
Chelicerae (Figs 1, 11-12) strong; proximal article with small, rounded retroventral tubercle and anteriorly-inclined prodorsal boss (Fig. 12); second article with small ventrodistal tubercle, mobile finger without ventral process; cutting edge of mobile finger with one rounded proximal tooth situated slightly more distally than indistinct proximal tooth on cutting edge of fixed finger; both cutting edges slightly worn (Fig. 11).

Palps (Fig. 13): Trochanter with small ventral process; femur with only an indistinct ventroproximal hump, otherwise unarmed; patella without proventral process; tibia with low retroventral proximal process. Measurements: 6.1 (0.9 + 1.8 + 0.9 + 0.8 + 1.7).

Legs 3124 (from shortest to longest). Measurements: Leg I 8.1 (0.8 + 2.5 + 1.1 + 1.2 + 2.1 + 0.4); leg II 11.3 (1.0 + 3.3 + 1.5 + 1.9 + 3.2 + 0.4); leg III 8.0 (0.9 + 2.0 + 1.2 + 1.2 + 2.3 + 0.4); leg IV 11.8 (1.0 + 2.8 + 1.7 + 2.0 + 3.8 + 0.5). Femur II with small dorsoproximal tubercle. All leg tarsi with dorsal pore organ (see Schwendinger, 2006).

Penis of paratype (Figs 4-7): Truncus fairly stout, proximal half narrower than distal half, widened between glans and distal margin, there carrying subterminal lateral setae arranged in an irregular recurved row on each side; distal margin of truncus with a widely V-shaped indentation forming two triangular sockets carrying one seta on one side and two setae on the other. Glans penis narrower than truncus at that point; membranous socket flanked by two setae on each side; lateral sclerites bent outwards and away from the truncus, their bases with knee-like lateral projections, their apices truncate; median plate short, with wide and straight distal margin; membranous tubes distinctly protruding beyond median plate.

♀. Unknown.



FIGS 1-3

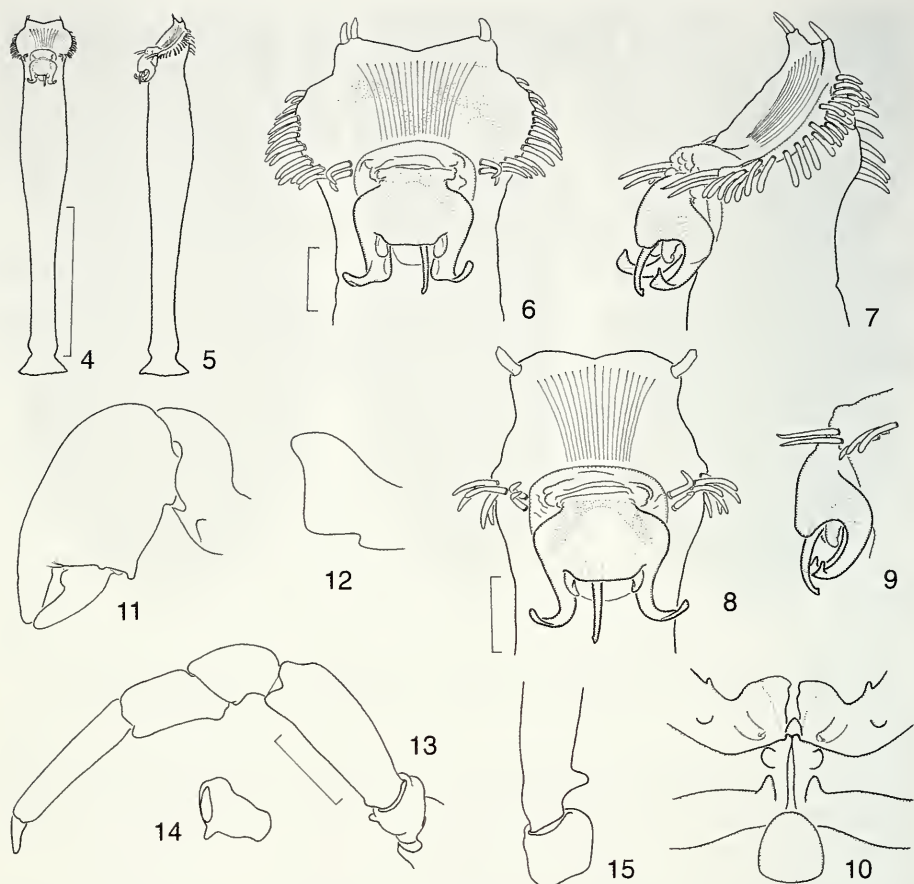
Oncopus kaltim sp. n., ♂ holotype. - Habitus, (1) dorsal, (2) ventral and (3) lateral view.

REMARKS: The penis of the holotype (Fig. 8) has collapsed below the glans, which gives the apex penis a narrower appearance than in the paratype (Fig. 6). The penis of the paratype is therefore described above.

VARIATION: Measurements of ♂ paratype: Dorsal scutum 7.4 long and 4.4 wide, its carapace region 2.3 long and 2.9 wide. Interocular area of paratype slightly more pointed, cheliceral fingers shorter and their cutting edges more strongly worn (without teeth), ventral process on palpal trochanter longer (Fig. 14), dorsoproximal tubercle on femur II larger (Fig. 15) than in holotype. The holotype penis has only one seta on each side of its distal margin (Fig. 8), which is presumably normal (as in all other *hosei*-group species), whereas the paratype has two setae on one side (Fig. 6). Other differences between the illustrations of both penes (Figs 6-7, cf. Figs 8-9) are due to the collapsed state of the holotype penis.

RELATIONSHIPS: Genital and somatic characters clearly show that the new species belongs to the *hosei*-group (see Schwendinger & Martens, 2004: 165), which now comprises *O. hosei* Pocock, 1897 (eastern Sarawak), *O. megachelis* (eastern Sabah), *O. kaltim* sp. n. (eastern Kalimantan) and *O. expatriatus* (doubtful record from Bangkok, Thailand). The discovery of a third species in this group in eastern Borneo is another piece of circumstantial evidence that Roewer's locality data for the holotype of *O. expatriatus* are incorrect (see Schwendinger & Martens, 2004: 170).

DISTRIBUTION: Known only from the type locality.



FIGS 4-15

Oncopus kaltim sp. n., (8-13) ♂ holotype and (4-7, 14-15) ♂ paratype. - Total penis, (4) dorsal and (5) lateral view. Apex of penis, (6, 8 [partly collapsed]) dorsal and (7) lateral view. (9) Glans penis, lateral view. (10) Anterior part of body, ventral view. (11) Left chelicera, retrolateral view. (12) Proximal article of left chelicera, retrodorsal view. (13) Left palp, retrolateral view. (14) Left palpal trochanter, retrolateral view. (15) Left trochanter II and proximal part of femur II, retrolateral view. - Scale lines: (4-5; 10-15) 1.0 mm, (6-7; 8-9) 0.1 mm.

ACKNOWLEDGEMENTS

Louis Deharveng and Anne Bedos (Muséum National d'Histoire Naturelle, Paris) kindly provided the material examined, Jochen Martens (Universität Mainz) commented on the manuscript, John Hollier checked the English and helped scan the drawings, and Florence Marteau (Muséum d'histoire naturelle, Genève) helped compose the figure plates.

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Description of a new species of *Entedonomphale* (Hymenoptera: Eulophidae) from Bulgaria, with notes on *E. carbonaria*

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Description of a new species of *Entedonomphale* (Hymenoptera: Eulophidae) from Bulgaria, with notes on *E. carbonaria*. - A new distinctive species of the genus *Entedonomphale* Girault (Hymenoptera: Eulophidae: Entedoninae), *E. bulgarica* Boyadzhiev & Triapitsyn sp. n., is described from the mountains of southwestern and southeastern Bulgaria. The European species *E. carbonaria* (Erdös) is newly recorded from the Nearctic region (USA). An identification key to both sexes of the Palaearctic species of *Entedonomphale* is provided.

Keywords: Hymenoptera - Eulophidae - Entedoninae - *Entedonomphale* - taxonomy - Bulgaria - screen-sweeping net.

INTRODUCTION

The rarely collected genus *Entedonomphale* Girault, 1915 (Hymenoptera: Eulophidae: Entedoninae) was recently revised on a worldwide basis by Triapitsyn (2005). The species of *Entedonomphale* are larval parasitoids of Phlaeothripidae (Thysanoptera: Tubulifera) (Triapitsyn, 2005). In Europe, this genus is represented by two species, *E. bicolorata* (Ishii, 1933) and *E. carbonaria* (Erdös, 1954) (Triapitsyn, 2005).

Here we diagnose, describe, and illustrate a new, very distinctive species of *Entedonomphale* that was collected by the senior author first by screen sweeping at low elevation on the Pirin Mt. in southwestern Bulgaria; later 3 males of the same species were collected on the Sakar Mt. in southeastern Bulgaria. Additionally, we provide new information on the distribution of *E. carbonaria*, which was recently discovered in the Nearctic region (Oregon, USA). An identification key to both sexes of the Palaearctic species of *Entedonomphale* is also provided.

MATERIAL AND METHODS

The type specimens were collected with a modified net (Fig. 10) for screen sweeping (after Noyes, 1982) and fixed in 96% alcohol. In laboratory they were dried from ethanol using a critical point drier and point-mounted, and then the female and one of the males (from the same locality as the female) were cleared in 10% KOH,

dissected, and slide-mounted in Canada balsam. The slide-mounted specimens were examined under a Zeiss Axioskop 2 plus compound microscope (using Nomarski differential interference contrast optics) and photographed using a Sony DSC-S75 digital still camera. Morphological terminology follows Gibson (1997); measurements (as length or length:width for the wings) are given in micrometers (μm). The examined specimens are deposited in the collections indicated by the following acronyms: MHNG, Muséum d'histoire naturelle, Geneva, Switzerland; PUPB, Department of Zoology, University of Plovdiv "Paisii Hilendarski", Plovdiv, Bulgaria; UCDC, The R.M. Bohart Museum of Entomology, Department of Entomology, University of California, Davis, California, USA; and UCRC, Entomology Research Museum, Department of Entomology, University of California, Riverside, California, USA. An abbreviation used in the key and description is: F = antennal funicular segment.

RESULTS

Genus *Entedonomphale* Girault

KEY TO THE PALAEARCTIC SPECIES

[male of *E. bicolorata* (Ishii) is unknown]

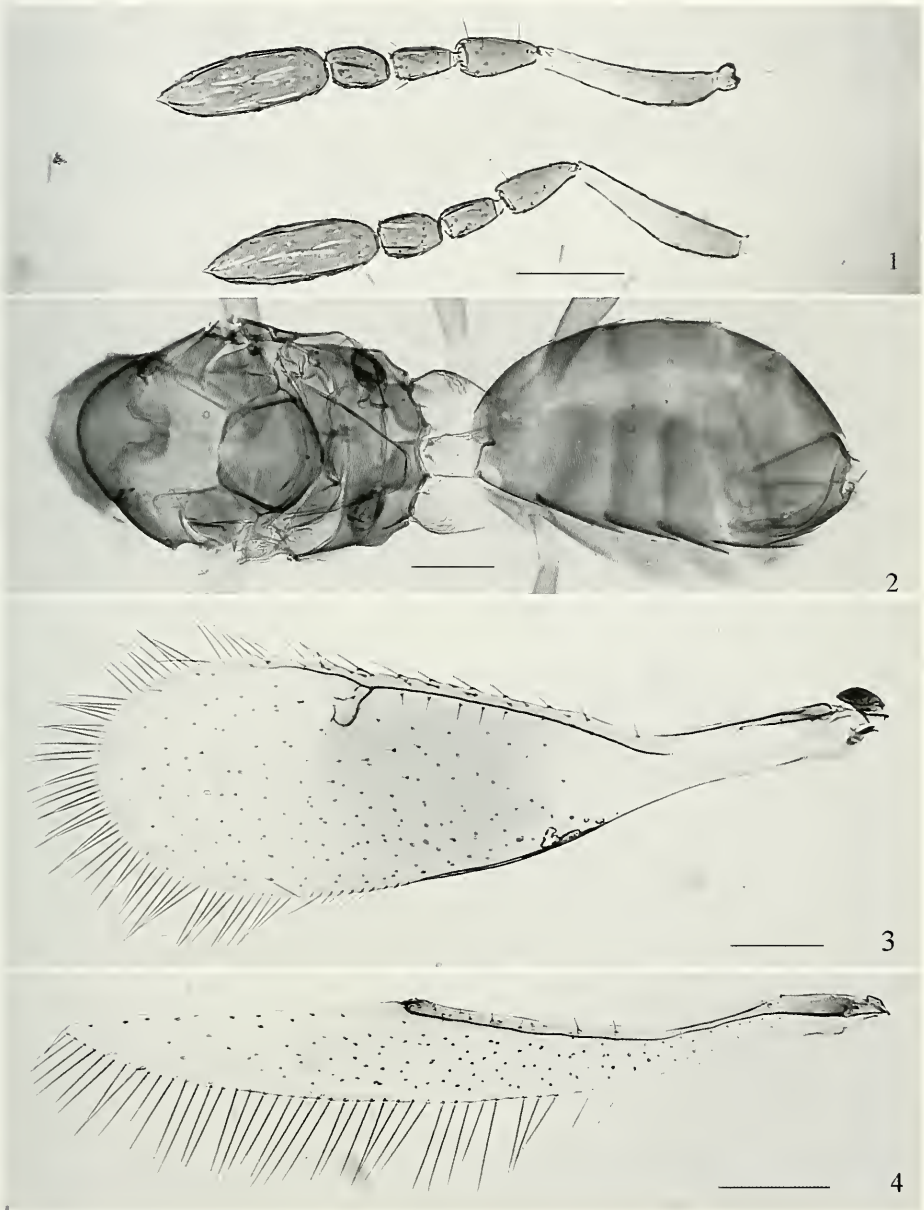
- 1 Female (antenna with a 2-segmented funicle and an entire clava) 2
- Male (antenna either with a 3-segmented funicle and an entire clava or with a 2-segmented funicle and a 3-segmented clava) 4
- 2(1) Forewing disc completely hyaline, without a transverse dark band in the middle *E. bicolorata* (Ishii)
- Forewing disc with a conspicuous transverse dark band in the middle 3
- 3(2) F1 almost as long as F2 (only slightly shorter); postmarginal vein 2.4-2.6 x length of stigmal vein; ovipositor 0.6 x length of metatibia *E. bulgarica* Boyadzhiev & S. Triapitsyn sp. n.
- F1 markedly shorter than F2; postmarginal vein about as long (1.0 x) as stigmal vein; ovipositor 1.1 x length of metatibia *E. carbonaria* (Erdös)
- 4(1) Antenna with a 2-segmented funicle and a 3-segmented clava *E. bulgarica* Boyadzhiev & S. Triapitsyn sp. n.
- Antenna with a 3-segmented funicle and an entire clava . *E. carbonaria* (Erdös)

Entedonomphale bulgarica Boyadzhiev & S. Triapitsyn, sp. n.

Figs 1-9

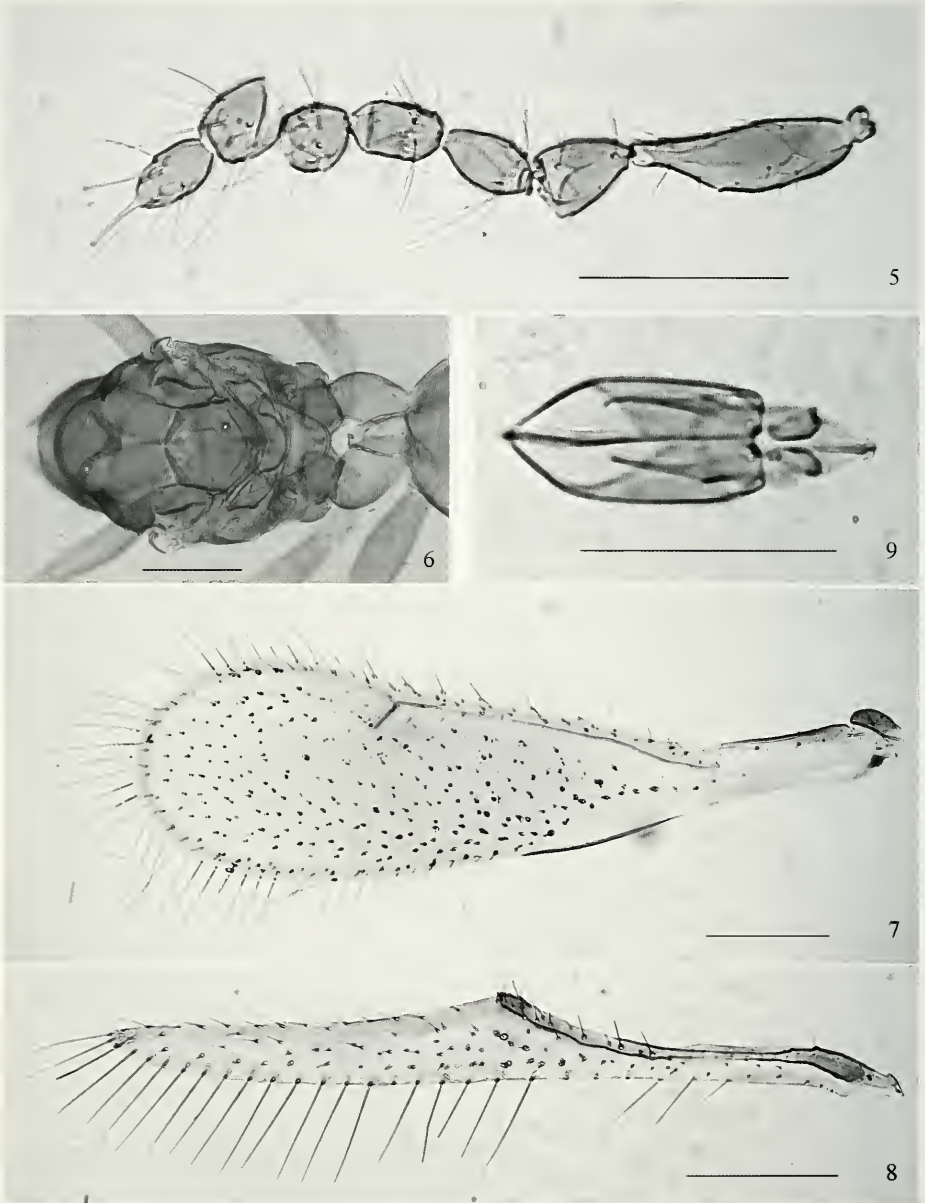
TYPE MATERIAL: *Holotype*: female on slide [MHNG]: BULGARIA, Blagoevgrad Region, Pirin Mt., 2 km W of Hadzhidimovo, 41°31'15"N, 23°50'40"E, 495 m, 8.ix.2006, P.S. Boyadzhiev. *Paratypes*: 1 male on slide [PUPB], same data as the holotype. 3 males on points: BULGARIA, Stara Zagora Region, Sakar Mt., 1 km NE of Madrets Village: 42°07'55"N, 26°05'38"E, 140 m, 26.iv.2007, P.S. Boyadzhiev [2 males, PUPB, UCRC]; 42°08'06"N, 26°06'11"E, 160 m, 26.iv.2007, A.M. Stojanova [1 male, PUPB].

DIAGNOSIS: Both sexes of this new species can be easily distinguished from the other two Palaearctic species of *Entedonomphale* using the morphological characters indicated in the key above. The male of *E. bulgarica* sp. n. is somewhat similar to that of the Australian species *E. zakavyka* Triapitsyn, 2005 as both taxa have the funicle 2-segmented and the clava 3-segmented. However, the male forewing of *E. zakavyka*



FIGS 1-4

Entedonomphale bulgarica sp. n. (holotype female): (1) Antennae. (2) Mesosoma and metasoma. (3) Forewing. (4) Hind wing. Scale lines = 0.1 mm.



FIGS 5-9

Entedonomphale bulgarica sp. n. (paratype male from Pirin Mt., Bulgaria): (5) Antenna. (6) Mesosoma and petiole. (7) Forewing. (8) Hind wing. (9) Genitalia. Scale lines = 0.1 mm.

10

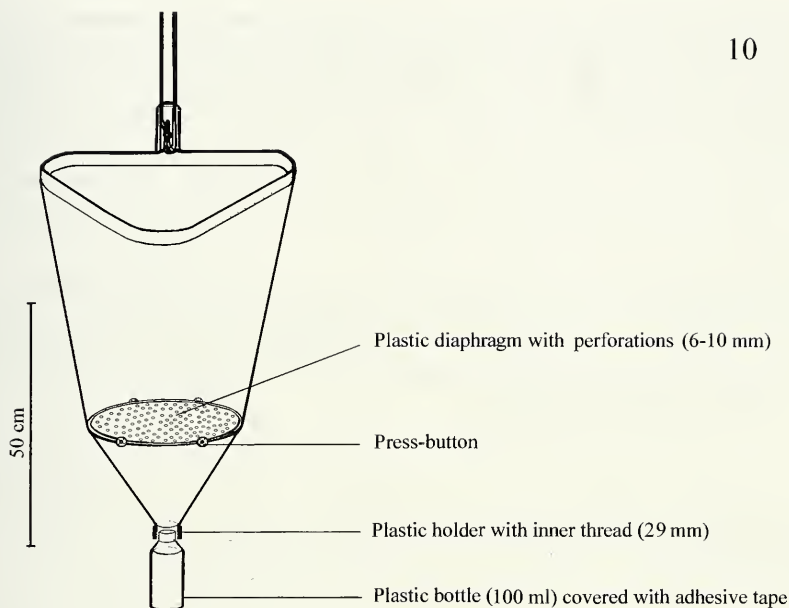


FIG. 10

Schematic diagram of the modified net for screen sweeping.

has a conspicuous transverse dark band in the middle, and F2 of its female antenna is slightly wider than long (Triapitsyn, 2005), whereas the male forewing of *E. bulgarica* sp. n. is only slightly infumate, and F2 of its female antenna is distinctly longer than wide.

DESCRIPTION: FEMALE (holotype): Body shining black with a slight violet tinge except petiole whitish (particularly distally) to light brown. Scape light brown (distally) to brown (basally), pedicel and flagellum brown to dark brown. Coxae and trochanters whitish to light brown, femora and tibiae brown to dark brown, tarsi mostly light brown.

Vertexal suture faint. Antenna (Fig. 1) with numerous setae, these denser on flagellar segments; scape slender, about 6 x as long as wide, only a little expanded in basal half; both funicular segments longer than wide, F1 slightly shorter and much narrower than F2, F1 with 1 longitudinal sensillum, F2 with at least 3 (possibly with 4) longitudinal sensilla; clava much longer than funicle, about 3 x as long as wide, with numerous (at least 12) longitudinal sensilla.

Mesosoma a little shorter than gaster (Fig. 2), mostly smooth (except pronotum lightly sculptured). Midlobe of mesoscutum with 1 pair of setae; anterior margin of scutellum almost straight. Scutellum shorter than mesoscutum, with 1 pair of setae and placoid sensilla at lateral margins. Forewing (Fig. 3) 3.2 x as long as wide; post-marginal vein very long for the genus, much longer than stigmal vein (2.4-2.6 x); longest marginal setae a little less than two fifths of maximal forewing width; disc with

a dark, transverse band behind stigmal and most of marginal vein (reaching posterior margin), more or less evenly setose in apical three fifths of forewing (setae short). Hind wing (Fig. 4) 8.0 x as long as wide; longest marginal setae about 1.1 x maximal hind wing width; disc with short setae, slightly infumate at apex of venation. Coxae weakly sculptured (hind coxa more so).

Petiole conspicuous, more or less cylindrical, 1.2 x as long as wide. Ovipositor short, occupying a little more than one third length of gaster, not exerted beyond gastral apex; ovipositor 0.6 x length of metatibia.

Measurements: Body (length of the dry specimen before slide-mounting): 859; head (length of the dry specimen before slide-mounting): 150; mesosoma: 455; petiole: 64; gaster: 470; ovipositor: 170. Antenna: scape (including radicle): 200; pedicel: 77; F1: 55; F2: 58; clava: 162. Forewing: 861:267; longest marginal seta: 100. Hind wing: 750:94; longest marginal seta: 106.

MALE (paratypes): Body length (of the dry specimens before slide-mounting): 673-863. Head and mesosoma shining dark brown to black, petiole light brown, antenna and gaster brown, legs light brown to brown. Antenna (Fig. 5) with a 2-segmented funicle (F1 subequal to F2, both a little longer than wide) and a 3-segmented clava with a long apical spicula, claval segments more or less subequal to funicular segments in size; scape 3.1 x as long as wide; all flagellar segments with numerous long setae exceeding each segment's width and without longitudinal sensilla. Midlobe of mesoscutum with 2 pairs of setae (Fig. 6). Forewing (Fig. 7) 3.5 x as long as wide; longest marginal setae about three fifths maximal forewing width; disc considerably less pigmented in the middle, only slightly infumate (more so behind stigmal and marginal veins), with cubital row of setae sinuate. Hind wing (Fig. 8) 9.3 x as long as wide; longest marginal setae about 1.6 x maximal forewing width; disc slightly infumate. Petiole more or less trapezoidal, 1.2 x as long as wide. Genitalia as in Fig. 9, typical for the genus.

ETYMOLOGY: The specific name (an adjective, gender feminine) refers to the country (Bulgaria) where this species occurs.

HOST: Unknown.

NOTE: The type specimens were collected on boggy grass communities and at the edge of a mowed agricultural field.

COMMENTS: The female of the new species was also compared with a recently identified specimen of *E. zakavyka* with the following label data: Australia, Queensland, car net between Goomeri and Petris on Hwy 17 87, 9.i.1986, E.A. Sugden [1 female, UCDC].

Entedonomphale carbonaria (Erdős)

Entedonomphale carbonaria (Erdős): Triapitsyn 2005: 285-286 (taxonomic history, diagnosis, figures, distribution).

MATERIAL EXAMINED: USA, Oregon, Tillamook Co., 4 km W of Sandlake, 2.vii.1991, S.L. Heydon [1 female, UCDC].

DISTRIBUTION: Europe (records from Bulgaria, Germany, Hungary, Russia, Slovakia, Slovenia, Sweden) (Triapitsyn, 2005) and North America (USA) [new record].

COMMENTS: As noted by Triapitsyn (2005), the Nearctic species *E. kaulbari* (Yoshimoto) might be a wingless (female only) form of *E. carbonaria*, as their other morphological features are identical; besides, their fully winged males are also identical. The discovery of the fully winged *E. carbonaria* in Oregon, USA, is puzzling. Further research using molecular methods will be necessary to address the limits of these species.

ACKNOWLEDGEMENTS

We thank Vladimir V. Berezovskiy (UCRC) for making excellent slide-mounts of the type specimens of the new species described in this communication, Dr Anelia M. Stojanova (PUPB) for collecting one of the specimens, and Dr Steve L. Heydon (UCDC) for the loan of material. The collecting trips in Bulgaria were supported by the Fund of the Scientific Research, University of Plovdiv "Paisii Hilendarski".

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Le specie del genere *Orphnebius* Motschulsky, 1858, nel Borneo (Coleoptera, Staphylinidae)*

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The species of the genus *Orphnebius* Motschulsky, 1858, from Borneo (Coleoptera, Staphylinidae). - This study on the genus *Orphnebius* from Borneo contains the illustration and the revision of the followings six holotypes or lectotypes: *O. bigladius* (Bernhauer), *O. bakerianus* Bernhauer, *O. splendens* Bernhauer, *O. anguliceps* Cameron, *O. antennarius* Bernhauer and *O. bakeri* Bernhauer. The lectotypes of *O. bakeri* Bernhauer and of *O. bakerianus* Bernhauer, are designated. The genus *Deroleptus* Bernhauer and the subgenus *Mesocephalobius* Bernhauer have been synonymized with *Orphnebius* and *Orphnebius quadrigladius* Pace, 1986, with *Orphnebius quadricuspidatus* Bernhauer, 1929. *Deroleptus bigladius* (Bernhauer) and *Deroleptus arachnoides* Bernhauer are transferred to *Orphnebius*. The followings 13 species are described as new: *O. borneanus*, *O. scalaris*, *O. directus*, *O. minor*, *O. biapicalis*, *O. ideogramma*, *O. penangensis*, *O. bajauorum*, *O. curticornis*, *O. uniformis*, *O. perpenetrans*, *O. krypticola* and *O. crassus*. Habitus and male and female genitalia of the new species are illustrated. A key to the species is provided.

Keywords: Coleoptera - Staphylinidae - Aleocharinae - taxonomy - Borneo.

INTRODUZIONE

Il genere *Orphnebius* Motschulsky, 1858, è stato descritto per una specie della Colombia (*O. ventricosus* Motschulsky, 1858). Pochi decenni dopo è stato riconosciuto essere presente anche nella regione orientale, sottoregione malese compresa, in cui rientra il Borneo. Cinque sono le specie note del genere *Orphnebius* per il Borneo: *O. anguliceps* Cameron, 1943, del Brunei, e *O. bakeri* Bernhauer, 1929, *O. bakerianus* Bernhauer, 1929, *O. quadricuspidatus* Bernhauer, 1929, *O. splendens* Bernhauer, 1929 e *O. antennarius* Bernhauer, 1929, tutti di Sandakan. Gli holotipi e i sintipi di tutte queste cinque specie sono stati da me esaminati e dissezionati per disegnare edeago e/o la spermateca. Nel 1915 Bernhauer descrisse il genere *Deroleptus* per la specie *D. bigladius* (Bernhauer, 1915), del Borneo. Anche questa specie è stata da me esaminata e dissezionata. I risultati di questo mio esame sono esposti nel presente studio.

* 210° Contributo alla conoscenza delle Aleocharinae.

Manoscritto accettato il 07.08.2007

MATERIALE E METODO

La presente revisione delle specie note del genere *Orphnebius* e *Deroleptus* del Borneo si è resa necessario al fine di determinare gli esemplari adulti raccolti prevalentemente nel Parco Nazionale del Monte Kinabalu dal Dr. Aleš Smetana di Ottawa durante le sue spedizioni nel 1987 e 1988, dalla spedizione Burckhardt & Löbl del Museo di Storia Naturale di Ginevra del 1987-1988 e Bright del 1988 e dal materiale riconosciuto nell'esame delle serie tipiche di Bernhauer al Field Museum of Natural History di Chicago, da un esemplare del DEI e da esemplari affidatimi in esame dal collega Dr. Volker Assing di Hannover.

La tassonomia delle nuove specie del Borneo viene qui mutata grazie all'esame dei caratteri dell'organo copulatore maschile e della spermateca. Prima della pubblicazione del presente studio nessun esame a fini tassonomici di questi importanti organi è stato portato a termine da vecchi autori. Gli holotipi delle specie note sono stati da me disegnati dopo esame e inseriti nella chiave qui data dopo quella del 1929 data da Bernhauer. Tutti gli esemplari sono stati dissezionati. Gli organi genitali sono stati montati in balsamo del Canada su piccoli rettangoli trasparenti di materiale plastico, infilzati sullo spillo dell'esemplare. Le strutture genitali sono state studiate usando un microscopio composto e disegnate mediante oculare a reticolo. Gli habitus sono stati disegnati con l'uso di un oculare micrometrico di un microscopio binoculare. Tutti i disegni sono dell'autore fino alla fase finale. Il sicuro riconoscimento dei generi e delle specie da parte del lettore è qui affidato prevalentemente alla parte illustrativa che ha linguaggio internazionale. Per questo motivo le descrizioni sono brevi, limitate a porre in evidenza ciò che non è riproducibile graficamente come il colore, la reticolazione e la granulosità. D'altronde per le specie della sottofamiglia Aleocharinae la sola descrizione anche molto accurata e lunga non dà quasi mai la certezza di un'esatta identificazione delle varie specie. È l'osservazione del disegno dell'edeago e/o della spermateca insieme a quello dell'habitus che aiuta molto a risolvere problemi interpretativi dati dalla sola descrizione.

Gli holotipi delle nuove specie sono depositati nel Museo di Storia Naturale di Ginevra (MHNG), nel Field Museum of Natural History di Chicago (FMNH), in collezione del D.E.I di Eberswalde (DEI) e all'Institut Royal des Sciences Naturelles de Belgique di Bruxelles (IRSB).

Paratipi sono conservati in collezione Smetana e nell'Institut Royal des Sciences Naturelles de Belgique di Bruxelles.

ESAME DI MATERIALE TIPICO

Orphnebius bigladius (Bernhauer, 1915), **comb. n.**

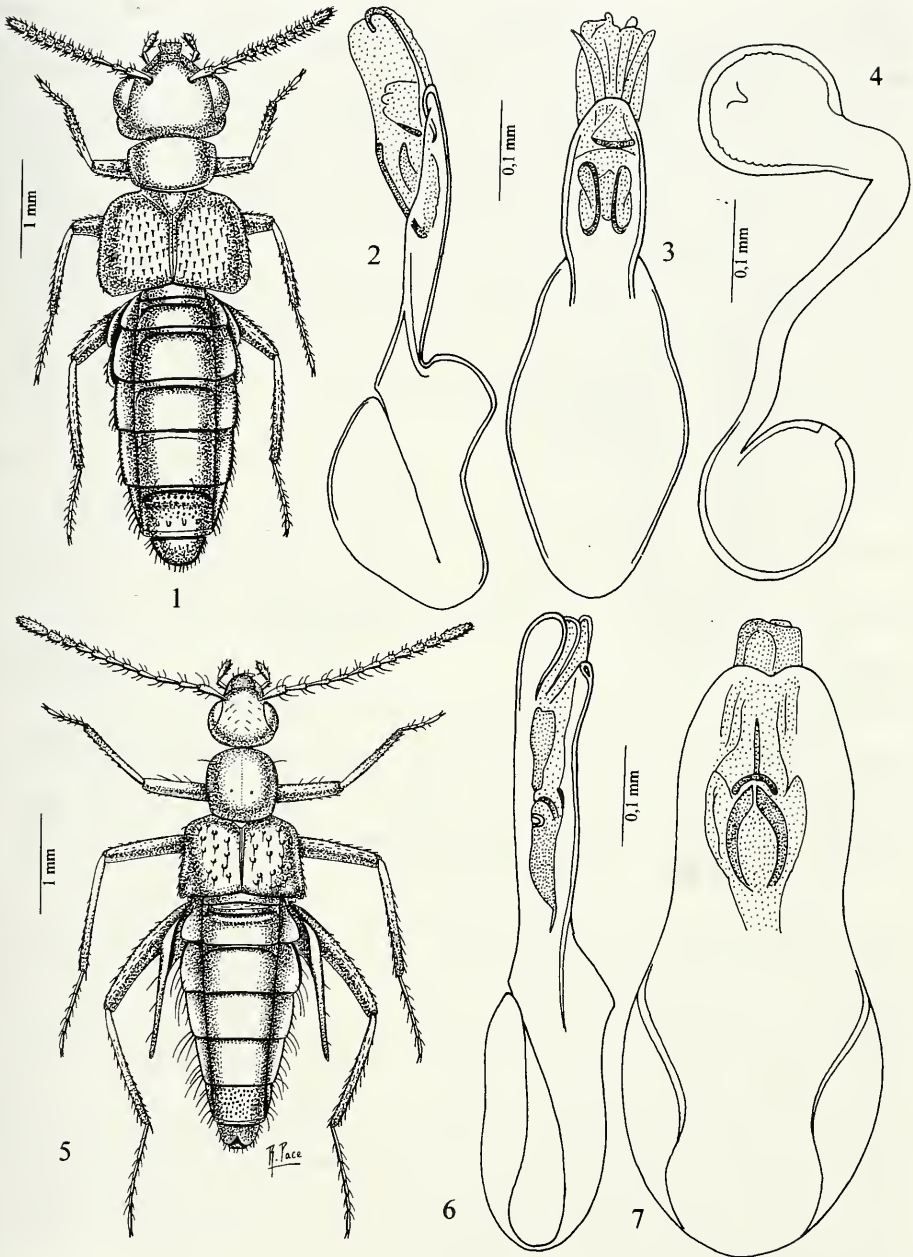
Figg. 5-7

Astilbus (*Deroleptus*) *bigladius* Bernhauer, 1915: 150

Deroleptus bigladius; Bernhauer, 1929: 143; Hammond, 1984: 209

Holotypus maschio etichettato come segue. I° Cartellino: Madang 1000 F., 2.11.19, Sarawak, ded. Moulton, II°: 41. III°: *Deroleptus bigladius* Brnh. TYPUS, IV°: Chicago NH Mus., M. Bernhauer collection.

NOTA: Quando nel 1915 Bernhauer descrisse *bigladius* probabilmente non conosceva il genere *Orphnebius*. Se lo avesse conosciuto non avrebbe attribuito questa



FIGG. 1-7

Habitus, edeago in visione laterale e ventrale e spermateca. (1-4) *Orphnebius borneanus* sp. n. (5-7) *Orphnebius bigladiosus* (Bernhauer), holotypus maschio.

specie ad *Astilbus*, ma a *Orphnebius*. La netta differenza della forma dell'addome di *bigladiusus* lo ha indotto a creare *Deroleptus*, sottogenere di *Astilbus*. Nel 1929 Bernhauer dimostra di conoscere il genere *Orphnebius*. Dà una chiave per separare, tra l'altro, *Deroleptus* da *Orphnebius*. Il carattere distintivo dato è «Hals höchstens ein Fünftel so breit als der Kopf» per *Deroleptus* e «Hals mindestens ein Viertel so breit als der Kopf» per *Orphnebius*. Un po' poco per separare i due generi, tanto più che il capo nelle specie di *Orphnebius* varia molto in larghezza sicché il rapporto larghezza collo/larghezza del capo varia molto anche se si è in presenza di specie tra loro assai affini, così riconosciute in base all'esame dell'edeago e della spermateca. L'edeago di *bigladiusus* ha struttura che si ritrova in molte specie di *Orphnebius*. Risulta evidente che Bernhauer si è arrampicato sugli specchi al fine di salvare dalla sinonimia il suo *Deroleptus*. L'esame dell'holotypus mi ha permesso di constatare, soprattutto nella forma dell'edeago, l'appartenenza di *bigladiusus* al genere *Orphnebius*. Pertanto viene qui stabilita la seguente sinonimia:

Orphnebius Motschulsky, 1858: 253 (genotypus: *O. ventricosus* Motschulsky, 1858, della Colombia)

Deroleptus Bernhauer, 1915: 150 (genotypus: *Deroleptus bigladiusus* (Bernhauer, 1915), del Borneo), **syn. n.**

Un mio esame di diverse specie di *Orphnebius* della Colombia, mi permette di confermare la presenza di questo genere anche nella regione orientale.

***Orphnebius bakeri* Bernhauer, 1915**

Figg. 39-41

Orphnebius (Mesocephalobius) bakeri Bernhauer, 1915: 150; Hammond, 1984: 211

Lectotypus maschio etichettato come segue. Cartellino I°: Singapore, Coll. Baker (a stampa), II°: *Orphnebius bakeri* Brnh. TYPUS, III°: Chicago NH Mus., M. Bernhauer collection. Figg. 39-41.

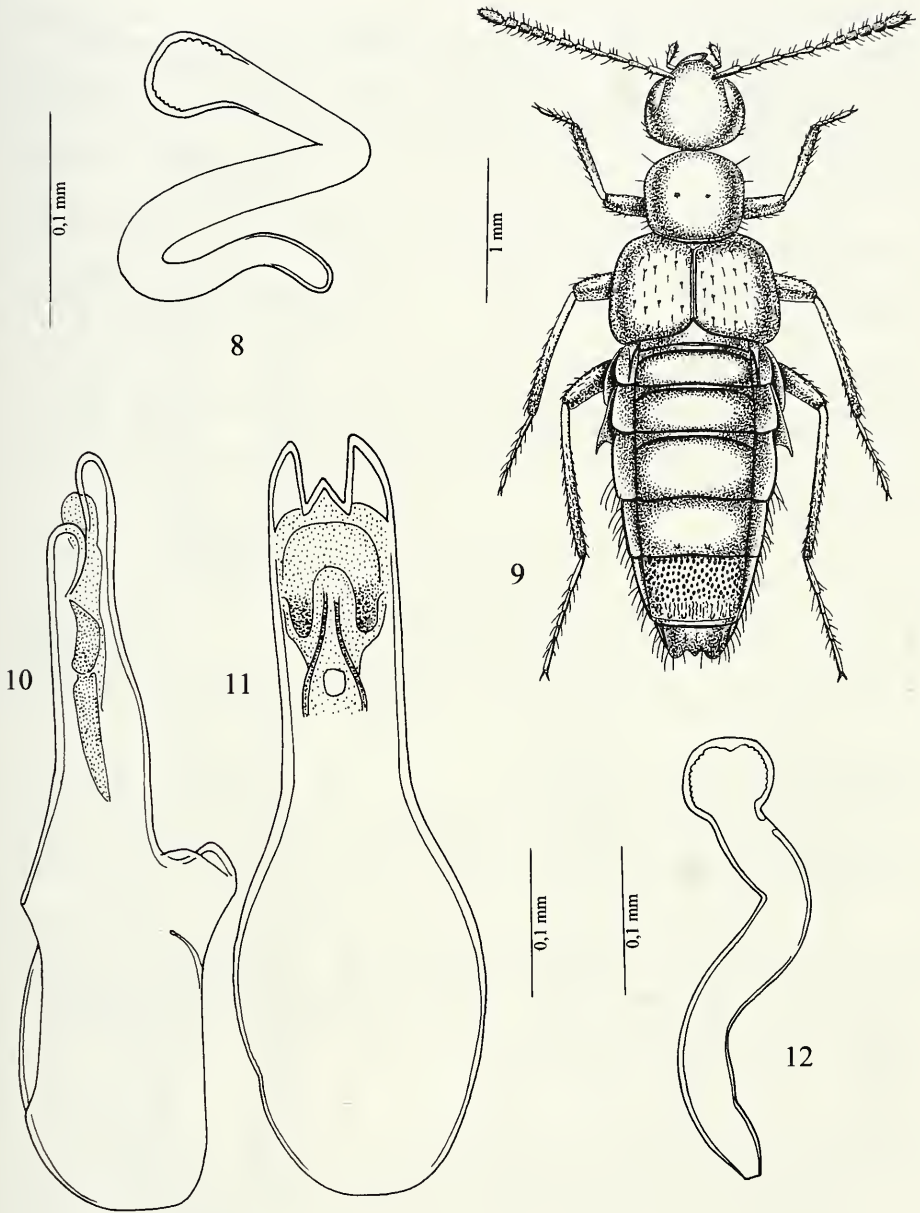
Paralectotipi: 1 maschio, Singapore, Coll. Baker, 12006, *Orphnebius bakeri* Brnh., Cotypus, Chicago Mus., 1 maschio, Sandakan, Borneo, Baker, *Orphnebius bakeri* Brnh., Cotypus, Chicago NH Mus., M. Bernhauer collection.

NOTA: *Orphnebius bakeri* Bernhauer è il genotypus del sottogenere *Mesocephalobius* Bernhauer, 1929, designato da Blackwelder (1952). Unico carattere distintivo è la presenza di capo largo quanto il pronoto o poco più stretto. Grazie all'esame dell'edeago questa distinzione non ha alcun significato tassonomico. Una specie con capo molto più largo del pronoto, *O. borneanus* sp. n., ha l'edeago con caratteri simili a quelli dell'edeago di *bakeri*. Il medesimo grado di differenziazione morfologica esterna si verifica nel genere *Strabocephalium* Bernhauer, 1911, che presenta edeago simile a molte specie di *Orphnebius*. Il capo molto più largo del pronoto anche in questo caso non è motivo sufficiente per mantenere ancora il genere, che provvisoriamente va considerato sottogenere di *Orphnebius* a motivo della presenza di occhi molto ridotti, mentre in *Orphnebius* gli occhi sono molto sviluppati. *Strabocephalium* è inserito come sottogenere nella chiave data in seguito.

Va stabilita pertanto la seguente sinonimia:

Orphnebius Motschulsky, 1858: 253 (genotypus *O. ventricosus* Motschulsky, 1858, della Colombia)

Mesocephalobius Bernhauer, 1929: 146 (subgenotypus *O. bakeri* Bernhauer, 1929), **syn. n.**



FIGG. 8-12

Spermateca, habitus e edeago in visione laterale e ventrale. (8) *Orphnebius bigladiosus* (Bernhauer). (9-12) *Orphnebius bakerianus* Bernhauer, lectotipus femmina e paralectotipus maschio.

***Orphnebius bakerianus* Bernhauer, 1915**

Figg. 9-12

Orphnebius (Mesocephalobius) bakerianus Bernhauer, 1915: 148; Hammond, 1984: 211

Lectotypus femmina che porta i seguenti cartellini. I°: Sandakan, Borneo, Baker, II°: *Bakerianus* Brnh Typ, III°: *Astilbus*, IV: *Orphnebius bakerianus* Brnh Typus, IV°: Chicago NH Mus., M. Bernhauer collection. Presente designazione, Fig. 12.

Paralectotipi: 2 maschi, stessa provenienza, cotypi, Chicago NH Mus., M. Bernhauer collection.

NOTA: Sia il maschio sia la femmina presentano il margine posteriore del quinto urotergo libero trilobato.

Questa specie è stata attribuita al sottogenere *Mesocephalobius*, sinonimo di *Orphnebius*.

Orphnebius quadricuspidatus* Bernhauer, 1929Orphnebius (Mesocephalobius) quadricuspidatus* Bernhauer, 1929:149; Hammond, 1984: 211*Orphnebius quadrigladius* Pace, 1986: 222, Figg. 247-249, **syn. n.**

Holotypus maschio, così etichettato. I° cartellino: Sandakan, Borneo, Baker. II° cartellino: *Orphnebius quadricuspidatus* Brnh., TYPUS, III° cartellino: Chicago NH Mus., M. Bernhauer collection.

NOTA: L'edeago dell'holotypus differisce di poco da quello di *O. quadrigladius* Pace, 1986. Presenta una lieve gibbosità della lama ventrale, assente in *quadrigladius*. Poiché l'armatura genitale interna dell'edeago di *quadricuspidatus* è estroflessa e quella di *quadrigladius* no, è difficile stabilire confronti. L'apice dell'edeago di *quadricuspidatus* e di *quadrigladius* sono ugualmente assai stretti in visione ventrale. Questo carattere mi ha permesso di proporre la sinonimia.

***Orphnebius splendens* Bernhauer, 1929**

Figg. 19-20

Orphnebius (Mesocephalobius) splendens Bernhauer, 1929: 150; Hammond, 1984: 211

Holotypus femmina, etichettato come segue. I° Cartellino: Sandakan, Borneo, Baker. II°: 13453, III°: *Astilbus splendens* B., IV°: *Orphnebius splendens* Brnh. TYPUS, V°: Chicago NH Mus., M. Bernhauer collection.

NOTA: Nella descrizione Bernhauer si riferisce a un holotypus maschio, in base agli sterniti liberi primo e secondo protratti all'indietro come spine, carattere normalmente riscontrabile nei maschi. Ho constatato che non è un maschio. Nonostante i caratteri sessuali secondari maschili, la presenza della spermateca, Fig. 20, permette di stabilire il corretto sesso dell'holotypus.

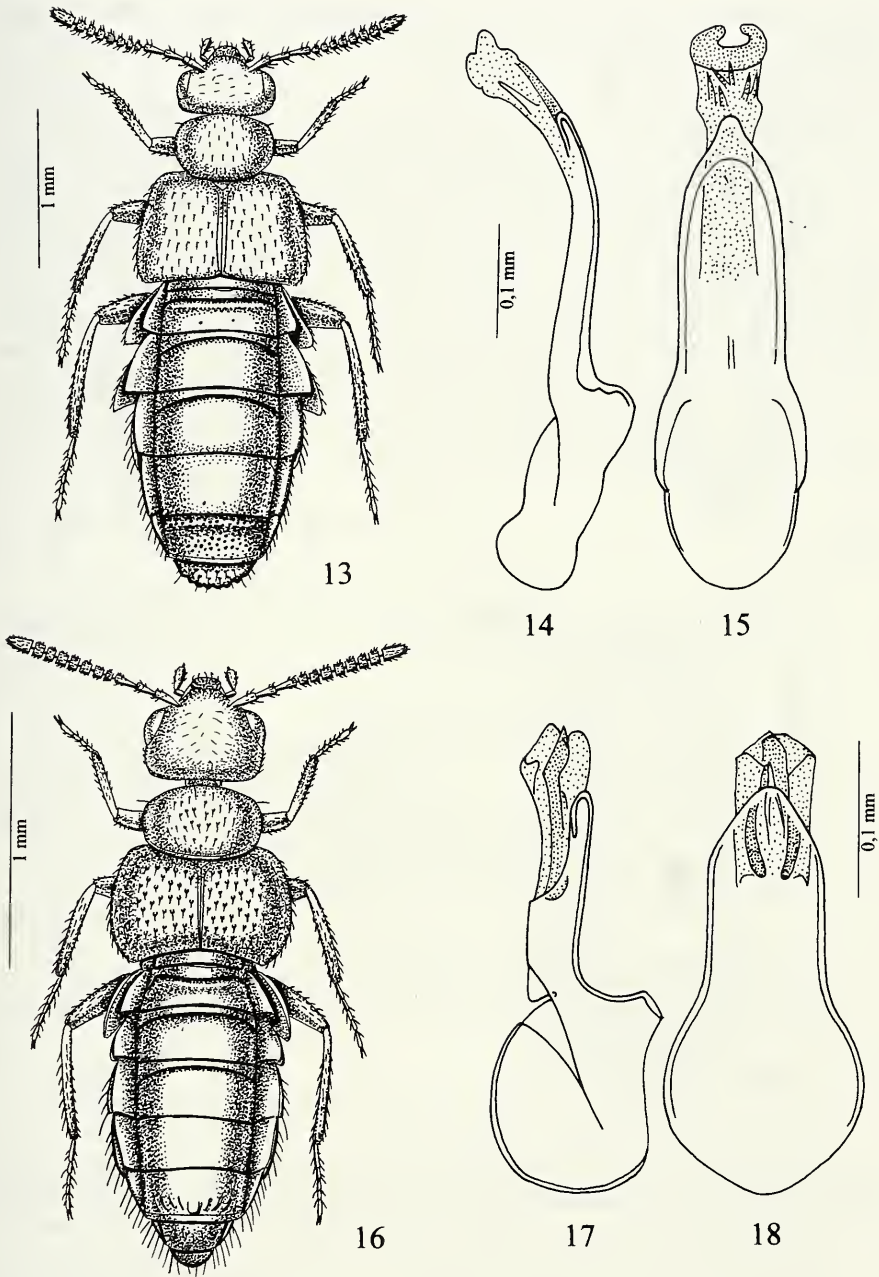
***Orphnebius anguliceps* Cameron, 1943**

Figg. 24-25

Orphnebius (Megalcephalobius) anguliceps Cameron, 1943: 140; Hammond, 1984: 211

Holotypus femmina, Brunei. N. Borneo, *Orphnebius anguliceps* Cam. TYPE, (BMNH).

NOTA: Nella sua descrizione Cameron non fa cenno del sesso dell'holotypus, che da mio esame è una femmina, spermateca Fig. 25. Cameron attribuisce *anguliceps* al sottogenere *Megalcephalobius* Bernhauer, 1929, per il capo più largo del pronoto. La sua spermateca tuttavia ha forma simile a quella di specie che presentano capo più stretto del pronoto come *O. curticornis* sp. n. e *O. uniformis* sp. n. Il subgenotipus di *Megalcephalobius* è *O. falagrioides* Bernhauer, 1929, che non ho esaminato e di cui Bernhauer non cita la località di provenienza. Cita e descrive questa specie nella



FIGG. 13-18

Habitus e edeago in visione laterale e ventrale. (13-15) *Orphnebius scalaris* sp. n. (16-18) *Orphnebius directus* sp. n.

chiave, facendola però figurare descritta in altro lavoro, risultato inesistente anche per Scheerpeltz (1934) e sconosciuta la sua località tipica.

***Orphnebius antennarius* Bernhauer, 1929**

Figg. 29-31

Orphnebius (Microcephalobius) antennarius Bernhauer, 1929: 153; Hammond, 1984: 211

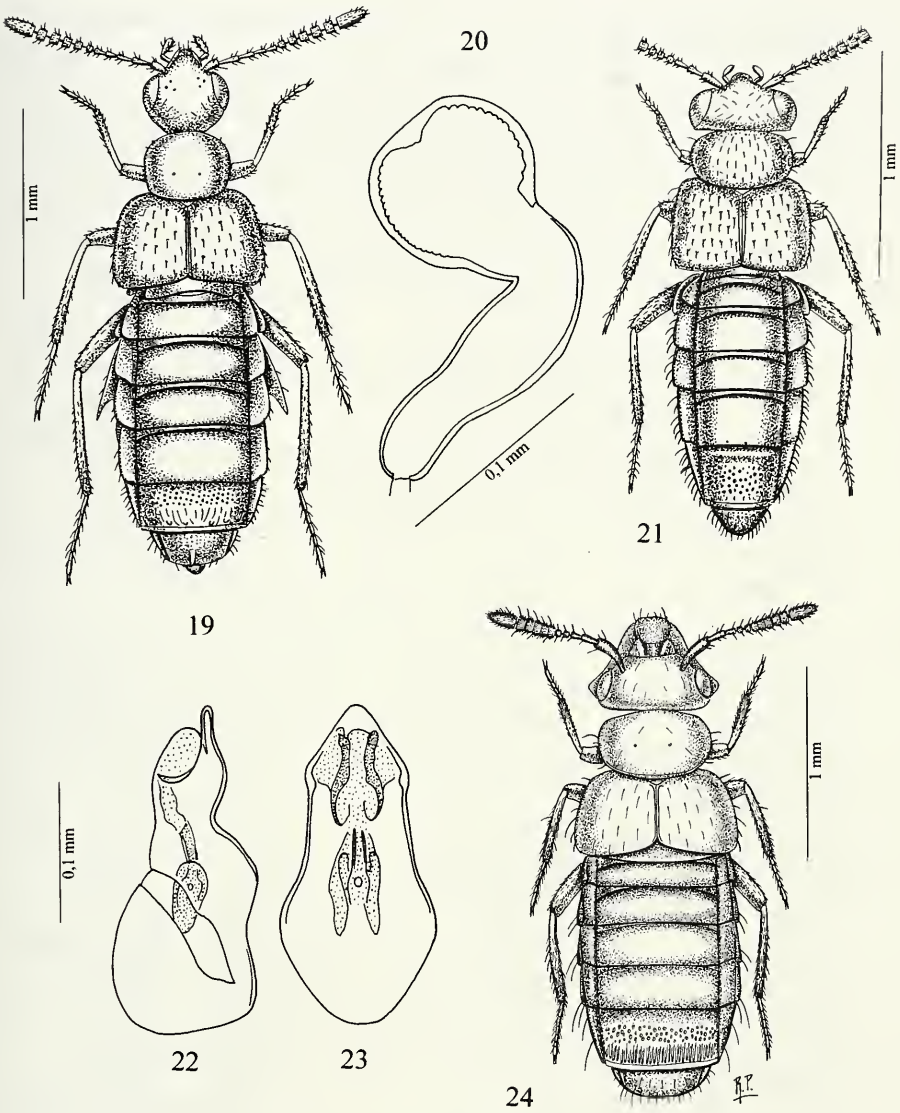
Holotypus maschio, etichettato come segue. I° Cartellino: Sandakan, Borneo, Baker, II°: *Orphnebius antennarius* Bernh., TYPUS UN., III°: Chicago NH Mus., M. Bernhauer collection.

NOTA: Il sottogenere *Microcephalobius* Bernhauer, 1929, ha come subgenotipus *O. miricornis* Bernhauer, 1926, delle Filippine. Non ho esaminato questa specie, ma l'attribuzione di *antennarius* mi risulta ingiustificata se si confrontano gli edeagi. Quello di *antennarius* ha struttura simile a quello di *O. ideogramma* sp. n. o di *O. penangensis* sp. n. Queste specie presentano pronoto non trasverso come in *antennarius*. Di conseguenza dovrebbero essere collocati in sottogeneri differenti.

Nelle chiavi che seguono non è compresa la specie *O. arachnoides* Bernhauer, 1929, **comb. n.** (da *Deroleptus*), affine a *O. bigladiosus* (Bernhauer, 1915), e della sua stessa località tipica.

CHIAVE DEI MASCHI DELLE SPECIE DEL GENERE *ORPHNEBIUS* MOTSCHULSKY, 1858, NEL BORNEO

- | | | |
|---|---|--|
| 1 | Apice dell'edeago, in visione ventrale, con una spina a ciascun lato, Fig. 28. Lunghezza 3,3 mm (senza capo) | <i>O. biapicalis</i> sp. n. |
| - | Apice dell'edeago privo di spine laterali | 2 |
| 2 | Capo più largo del pronoto | 3 |
| - | Capo largo quanto il pronoto o più stretto | 5 |
| 3 | Occhi ridotti, molto più corti delle tempie; capo molto più largo del pronoto. Lunghezza 5 mm | <i>O. (Strabocephalum) mirabilis</i> (Bernhauer) |
| - | Occhi più lunghi delle tempie; capo poco più largo del pronoto | 4 |
| 4 | Corpo rossiccio; antenne uniformemente giallo-rossicce; pronoto più sviluppato; edeago sinuato al lato ventrale. Lunghezza 3,7 mm | <i>O. platycephalus</i> Pace |
| - | Avancorpo rossiccio, addome giallo-rossiccio, antenne rossicce con base e apice giallo-rossicci; pronoto meno sviluppato, Fig. 1; edeago arcuato al lato ventrale, Figg. 2-3. Lunghezza 5 mm | <i>O. borneanus</i> sp. n. |
| 5 | Capo largo quanto il pronoto | 6 |
| - | Capo più stretto del pronoto | 13 |
| 6 | Antenne molto lunghe, con decimo antennumero più lungo che largo o lungo quanto largo, Figg. 13 e 16 | 7 |
| - | Antenne corte, con decimo antennumero fortemente trasverso, Figg. 13 e 16 | 8 |
| 7 | Decimo antennumero più lungo che largo; capo e pronoto rossicci; granulosità delle elitre forte; margine posteriore del sesto urotergo libero del maschio con due denti a ciascun lato del lobo mediano. Lunghezza 4,7 mm | <i>O. bigladiosus</i> (Bernhauer) |
| - | Decimo antennumero lungo quanto largo; capo e pronoto giallo-rossicci; granulosità delle elitre superficiale; margine posteriore del sesto urotergo libero del maschio senza denti laterali al lobo mediano. Lunghezza 5,1 mm | <i>O. bakerianus</i> Bernhauer |

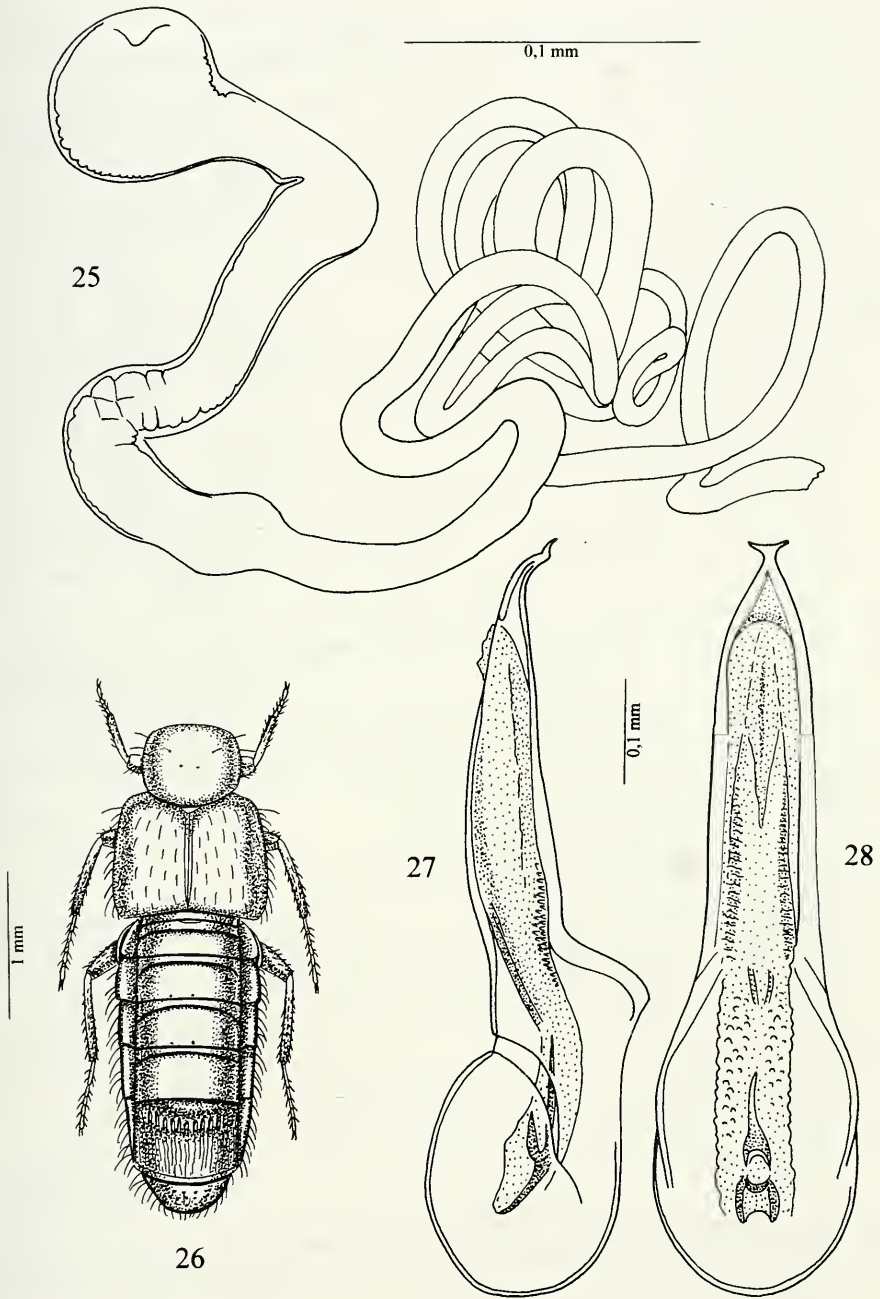


FIGG. 19-24

Habitus, spermatheca e edeago in visione laterale e ventrale. (19-20) *Orphnebius splendens* Bernhauer, holotypus. (21-23) *Orphnebius minor* sp. n. (24) *Orphnebius anguliceps* Cameron, holotypus.

- 8 Capo e pronoto neri; ciascun lato dell'addome con due spine; apice dell'adeago strettissimo e lunghissimo, in visione ventrale. Lunghezza 3,2 mm *O. quadricuspидatus* Bernhauer
- Capo e pronoto bruni o giallo-rossicci, apice dell'edeago mai contemporaneamente stretto e lungo 9

- 9 Addome bruno-rossiccio; undicesimo antennumero totalmente o parzialmente giallo-rossiccio 10
- Addome giallo-rossiccio; undicesimo antennumero bruno 11
- 10 Undicesimo antennumero giallo-rossiccio solo nella porzione distale; quinto urotergo libero fortemente punteggiato; granulosità delle elitre superficiale; edeago lungo e stretto, Figg. 14-15. Lunghezza 3,4 mm *O. scalaris* sp. n.
- Undicesimo antennumero interamente giallo-rossiccio; quinto urotergo libero senza punteggiatura, ma con tubercoli posteriori; granulosità delle elitre saliente; edeago corto e largo, Figg. 17-18. Lunghezza 2,2 mm *O. directus* sp. n.
- 11 Capo e pronoto giallo-rossicci; sutura delle elitre più corta del pronoto; apice dell'edeago, in visione ventrale, stretto, Figg. 30-31. Lunghezza 4 mm *O. antennarius* Bernhauer
- Capo bruno, pronoto giallo-rossiccio o bruno-rossiccio; sutura delle elitre più lunga del pronoto; apice dell'edeago largo, in visione ventrale . . . 12
- 12 Pronoto bruno-rossiccio e poco trasverso; edeago Figg. 33-34: Lunghezza 3,4 mm *O. ideogramma* sp. n.
- Pronoto giallo-rossiccio e fortemente trasverso; edeago Figg. 22-23. *O. minor* sp. n.
- 13 Corpo nero-bruno con addome marginato di rossiccio; granulosità delle elitre forte e fitta; edeago a lati paralleli, in visione ventrale. Lunghezza 3 mm *O. derougemonti* Pace
- Corpo bruno e giallo-rossiccio; granulosità delle elitre fine: edeago a lati paralleli, in visione ventrale 14
- 14 Addome giallo-rossiccio 15
- Addome bruno o bruno-rossiccio 18
- 15 Antenne giallo-rossicce; quarto urotergo libero del maschio sinuoso al margine posteriore; edeago Figg. 54-55. Lunghezza 3,8 mm *O. perpenetrans* sp. n.
- Antenne bruno-rossicce con base rossiccia o giallo-rossiccia; quarto urotergo libero del maschio rettilineo al margine posteriore 16
- 16 Capo e pronoto bruni, elitre rossicce; porzione posteriore del quinto urotergo libero del maschio con quattro tubercoli salienti; edeago Figg. 40-41. Lunghezza 4 mm *O. bakeri* Bernhauer
- Capo, pronoto ed elitre giallo-bruni o bruno-rossicci; porzione posteriore del quinto urotergo libero del maschio senza tubercoli: al loro posto vi è una rugosità longitudinale 17
- 17 Pronoto più trasverso; edeago non sinuato ai lati, in visione ventrale, Figg. 58-59. Lunghezza 4 mm *O. krypticola* sp. n.
- Pronoto meno trasverso; edeago sinuato ai lati, in visione ventrale, Figg. 43-44. Lunghezza 3,7 mm *O. bajauorum* sp. n.
- 18 Undicesimo antennumero uniformemente bruno; pronoto lievemente trasverso; pigidio giallo-rossiccio; edeago Figg. 37-38. Lunghezza 3,2 mm *O. penangensis* sp. n.



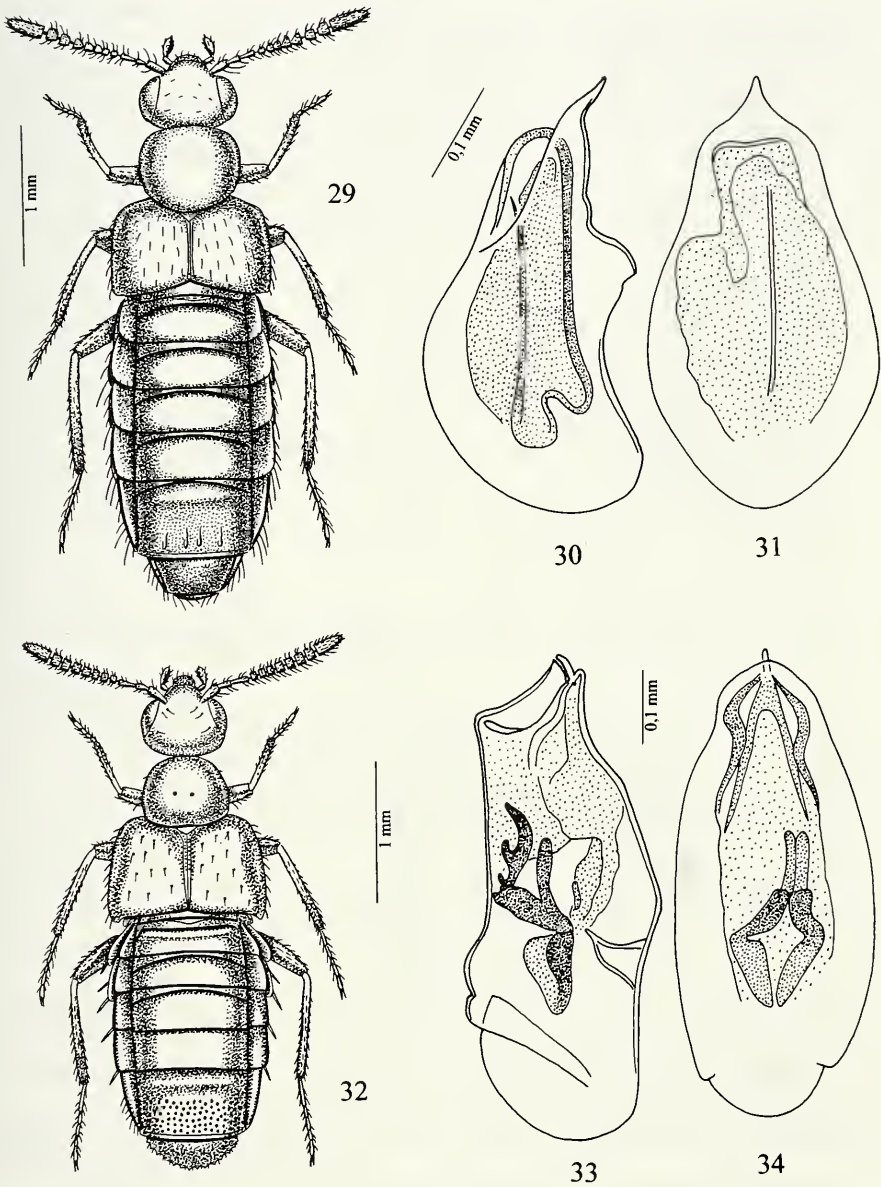
FIGG. 25-28

Spermateca, habitus e edeago in visione laterale e ventrale. (25) *Orphnebius anguliceps* Cameron, holotipus (26-28) *Orphnebius biapicalis* sp. n.

- Undicesimo antennomero bicolore bruno e giallo-rossiccio; pronoto nettamente trasverso; pigidio bruno-rossiccio 19
- 19 Corpo uniformemente rossiccio; pronoto poco trasverso; quinto urotergo libero del maschio senza tubercoli lungo il margine posteriore; edeago Figg. 50-51. Lunghezza 3,2 mm *O. uniformis* sp. n.
- Avancorpo bruno, addome bruno-rossiccio; pronoto molto trasverso; quinto urotergo libero del maschio con tubercoli lungo il margine posteriore; edeago Figg. 46-47. Lunghezza 2,7 mm *O. curticornis* sp. n.

KEY TO MALES OF THE SPECIES OF THE GENUS *ORPHNEBIUS* MOTSCHULSKY, 1858, FROM BORNEO

- 1 Apex of the aedeagus, in ventral view, with a thorn to every lateral margin, Fig. 28. Length 3.3 mm (without head) *O. biapicalis* sp. n.
- Apex of the aedeagus deprived of lateral thorns 2
- 2 Head wider than the pronotum 3
- Head as wide as the pronotum or more narrow 5
- 3 Eyes reduced, very more courts of the temples; head very broader than the pronotum. Length 5 mm *O. (Strabocephalium) mirabilis* (Bernhauer)
- Eyes longer than the temples; head a little more breadth than the pronotum . . 4
- 4 Body reddish; antennae uniformly yellow-reddish; pronotum more developed; aedeagus sinuous to the ventral margin. Length 3.7 mm *O. platycephalus* Pace
- Fore-parts reddish, abdomen yellow-reddish, antennae reddish with their base and apex yellow-reddish; pronotum less developed, Fig. 1; aedeagus arched to the ventral side, Figs 2-3. Length 5 mm *O. borneanus* sp. n.
- 5 Head as broad as the pronotum 6
- Head narrower than the pronotum 13
- 6 Antennae very long, with tenth antennomere longer than wide or as long as wide, Figs 13 and 16 7
- Antennae short, with tenth antennomere strongly transverse, Figs 13 and 16.. 8
- 7 Tenth antennomere longer than wide; head and pronotum reddish; granularity of the elytra strong; posterior border of the sixth free urotergum of the male with two teeth to every lateral margin of the median lobe. Length 4.7 mm *O. bigladius* (Bernhauer)
- Tenth antennomere as wide as long; head and pronotum yellow-reddish; granularity of the elytrae superficial; posterior border of the sixth free urotergum of the male without teeth lateral to the median lobe. Length 5.1 mm *O. bakerianus* Bernhauer
- 8 Head and pronotum black; every lateral margin of the abdomen with two thorns; apex of the aedeagus narrow and long, in ventral view. Length 3.2 mm *O. quadricuspидatus* Bernhauer
- Head and pronotum brown or yellow-reddish, apex of the aedeagus never contemporarily narrow and long 9
- 9 Abdomen brown-reddish; eleventh antennomere totally or partially yellow- reddish 10

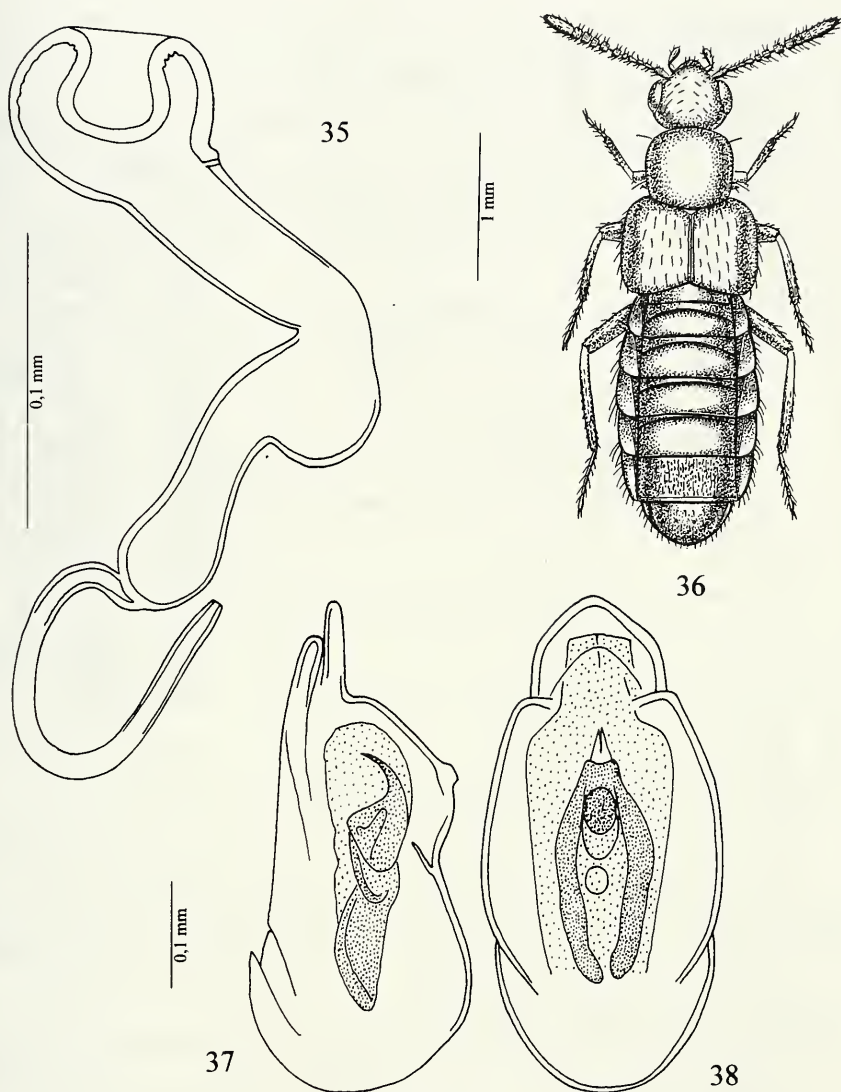


FIGG. 29-34

Habitus e eedeago in visione laterale e ventrale. (29-31) *Orphnebius antennarius* Bernhauer, holotipus maschio. (32-34) *Orphnebius ideogramma* sp. n.

- Abdomen yellow-reddish; eleventh antennomere brown 11
- 10 Eleventh antennomere yellow-reddish only in the distal portion; fifth free urotergum deeply punctured; granularity of the elytra superficial; aedeagus long and narrow, Figs 14-15. Length 3.4 mm *O. scalaris* sp. n.

- Eleventh antennomere entirely yellow-reddish; fifth free urotergum without punctuation, but with posterior tubercles; granularity of the elytra salient; aedeagus short and wide, Figs 17-18. Length 2.2 mm . *O. directus* sp. n.
- 11 Head and pronotum yellow-reddish; suture of the elytra shorter than the pronotum; apex of the aedeagus narrow, in ventral view, Figs 30-31. Length 4 mm *O. antennarius* Bernhauer
- Head brown, pronotum yellow-reddish or brown-reddish; suture of the elytra longer than the pronotum; apex of the aedeagus broad, in ventral view 12
- 12 Pronotum brown-reddish and few transverse; aedeagus Figs 33-34: length 3.4 mm *O. ideogramma* sp. n.
- Pronotum yellow-reddish and strongly transverse; aedeagus Figs 22-23. Length 2 mm *O. minor* sp. n.
- 13 Body black-brown with abdomen margined of reddish; granularity of the elytra strongly sharp and close; lateral margins of the aedeagus parallel, in ventral view. Length 3 mm *O. derougemonti* Pace
- Body brown and yellow-reddish; granularity of the elytra fine: lateral margins of the aedeagus parallel, in ventral view 14
- 14 Abdomen yellow-reddish 15
- Abdomen brown or brown-reddish 18
- 15 Antennae yellow-reddish; fourth free urotergum of the male sinuous to the posterior border; aedeagus Figs 54-55. Length 3.8 mm *O. perpenetrans* sp. n.
- Antennae brown-reddish with reddish or yellow-reddish base; fourth free urotergum of the male to the posterior border rectilinear 16
- 16 Head and pronotum brown, elytra reddish; posterior portion of the fifth free urotergum of the male with four salient tubercles; aedeagus Figs 40-41. Length 4 mm *bakeri* Bernhauer
- Head, pronotum and elytra yellow-brown or brown-reddish; posterior portion of the fifth free urotergum of the male without tubercles: to their place there is a longitudinal roughness 17
- 17 Pronotum transverse; aedeagus not sinuous to the lateral margins, in ventral view, Figs 58-59. Length 4 mm. Brunei *O. krypticola* sp. n.
- Pronotum less transverse; aedeagus sinuous to the lateral margins, in ventral view, Figs 43-44. Length 3.7 mm *O. bajauorum* sp. n.
- 18 Eleventh antennomere uniformly brown; pronotum slightly transverse; pigidium yellow-reddish; aedeagus Figs 37-38. Length 3.2 mm *O. penangensis* sp. n.
- Eleventh antennomere bicolorous brown and yellow-reddish; pronotum clearly transverse; pigidium brown-reddish 19
- 19 Body reddish uniformly; pronotum a little transverse; fifth free urotergum of the male without tubercles along the posterior border; aedeagus Figs 50-51. Length 3.2 mm *O. uniformis* sp. n.
- Foreparts brown, abdomen brown-reddish; pronotum very transverse; fifth free urotergum of the male with tubercles along the posterior border; aedeagus Figs 46-47. Length 2.7 mm *O. curticornis* sp. n.



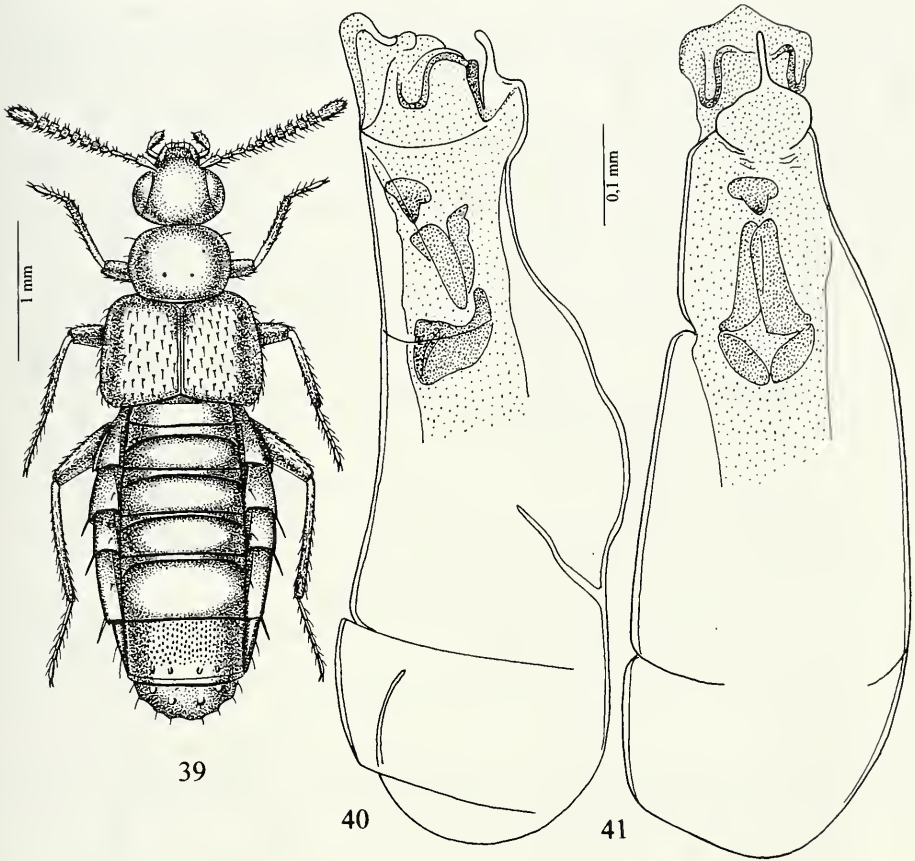
FIGG. 35-38

Spermateca, habitus e edeago in visione laterale e ventrale. (35) *Orphnebius ideogramma* sp. n.; (36-38) *Orphnebius penangensis* sp. n.

CHIAVE DELLE FEMMINE DELLE SPECIE DEL GENERE *ORPHNEBIUS* MOTSCHULSKY, 1858, NEL BORNEO

- 1 Base delle mandibole sporgente di sotto agli occhi, Fig. 24; spermateca Fig. 25. Lunghezza 2,6 mm *O. anguliceps* Cameron
- Base delle mandibole non sporgente di sotto agli occhi 2
- 2 Capo più largo del pronoto; spermateca con bulbo prossimale sub-sferico, Fig. 4. Lunghezza 5 mm *O. borneanus* sp. n.

- Capo largo quanto il pronoto o più stretto 3
- 3 Capo largo quanto il pronoto 4
- Capo più stretto del pronoto 8
- 4 Antenne molto lunghe, con decimo antennumero più lungo che largo o lungo quanto largo Figg. 13 e 16 5
- Antenne corte, con decimo antennumero fortemente trasverso 6
- 5 Decimo antennumero più lungo che largo; capo e pronoto rossicci; granulosità delle elitre forte; spermateca piegata a Z, Fig. 8. Lunghezza 4,7 mm *O. bigladiosus* (Bernhauer)
- Decimo antennumero lungo quanto largo; capo e pronoto giallo-rossicci; granulosità delle elitre superficiale; spermateca piegata a 7, Fig. 12. Lunghezza 5,1 mm *O. bakerianus* Bernhauer
- 6 Addome rossiccio o bruno-rossiccio; bulbo distale della spermateca fortemente flesso. Lunghezza 2,7 mm *O. laetus* Pace
- Addome giallo-rossiccio; bulbo distale della spermateca non flesso 7
- 7 Pronoto meno trasverso; base delle antenne rossiccia; bulbo distale della spermateca con profonda introflessione apicale Fig. 35. Lunghezza 3,4 mm *O. ideogramma* sp. n.
- Pronoto più trasverso; base delle antenne giallo-rossiccia; bulbo distale della spermateca con debole introflessione apicale, Fig. 20: Lunghezza 2,8 mm *O. splendens* Bernhauer
- 8 Corpo giallo-rossiccio; bulbo distale della spermateca molto sviluppato, Fig. 60. Lunghezza 2,1 mm *O. crassus* sp. n.
- Corpo unicolore o bicolore nero-bruno, rossiccio o bruno-rossiccio; bulbo distale della spermateca poco sviluppato 9
- 9 Antenne uniformemente giallo-rossicce; addome giallo-rossiccio; spermateca Fig. 56. Lunghezza 3,8 mm *O. perpenetrans* sp. n.
- Antenne bicolori brune o rossicce con base o apice distale giallo-rossicci . . 10
- 10 Undicesimo antennumero bruno, avancorpo nero-bruno; parte intermedia della spermateca molto lunga. Lunghezza 3 mm . . . *O. derougemonti* Pace
- Undicesimo antennumero interamente o parzialmente giallo-rossicce; parte intermedia della spermateca breve 11
- 11 Corpo uniformemente rossiccio; parte prossimale della spermateca descrivente numerosi meandri, Fig. 52. Lunghezza 3,2 mm . . . *O. uniformis* sp. n.
- Corpo bicolore bruno e rossiccio; parte prossimale della spermateca descrivente due sinuosità 12
- 12 Solo l'apice dell'undicesimo antennumero è giallo-rossiccio; avancorpo bruno; quinto urotergo libero della femmina con rugosità longitudinali; bulbo distale della spermateca privo di introflessione apicale, Fig. 48. Lunghezza 2,7 mm *O. curticornis* sp. n.
- Undicesimo antennumero interamente giallo-rossiccio; capo e pronoto bruni, elitre rossicce; quinto urotergo libero della femmina con forte punteggiatura; bulbo distale della spermateca con profonda introflessione apicale. Lunghezza 2,8 mm *O. silvarum* Pace



FIGG. 39-41

Habitus e edeago in visione laterale e ventrale. (39-41) *Orphnebius bakeri* Bernhauer, holotypus.

KEY TO FEMALES OF THE SPECIES OF THE GENUS *ORPHNEBIUS* MOTSCHULSKY, 1858, FROM BORNEO

- 1 Base of the mandibles protruding under the eyes, Fig. 24; spermatheca Fig. 25. Length 2.6 mm *O. anguliceps* Cameron
- Base of the mandibles non protruding under the eyes 2
- 2 Pronotum wider than the head; spermatheca with proximal bulb sub-spherical, Fig. 4. Length 5 mm *O. borneanus* sp. n.
- Pronotum as wide as the head or more narrow 3
- 3 Head as wide as the pronotum 4
- Head narrower than the pronotum 8
- 4 Antennae very long, with tenth antennomere longer than wide or as long as wide Figg. 13 and 16 5
- Antennae short, with tenth antennomere strongly transverse 6

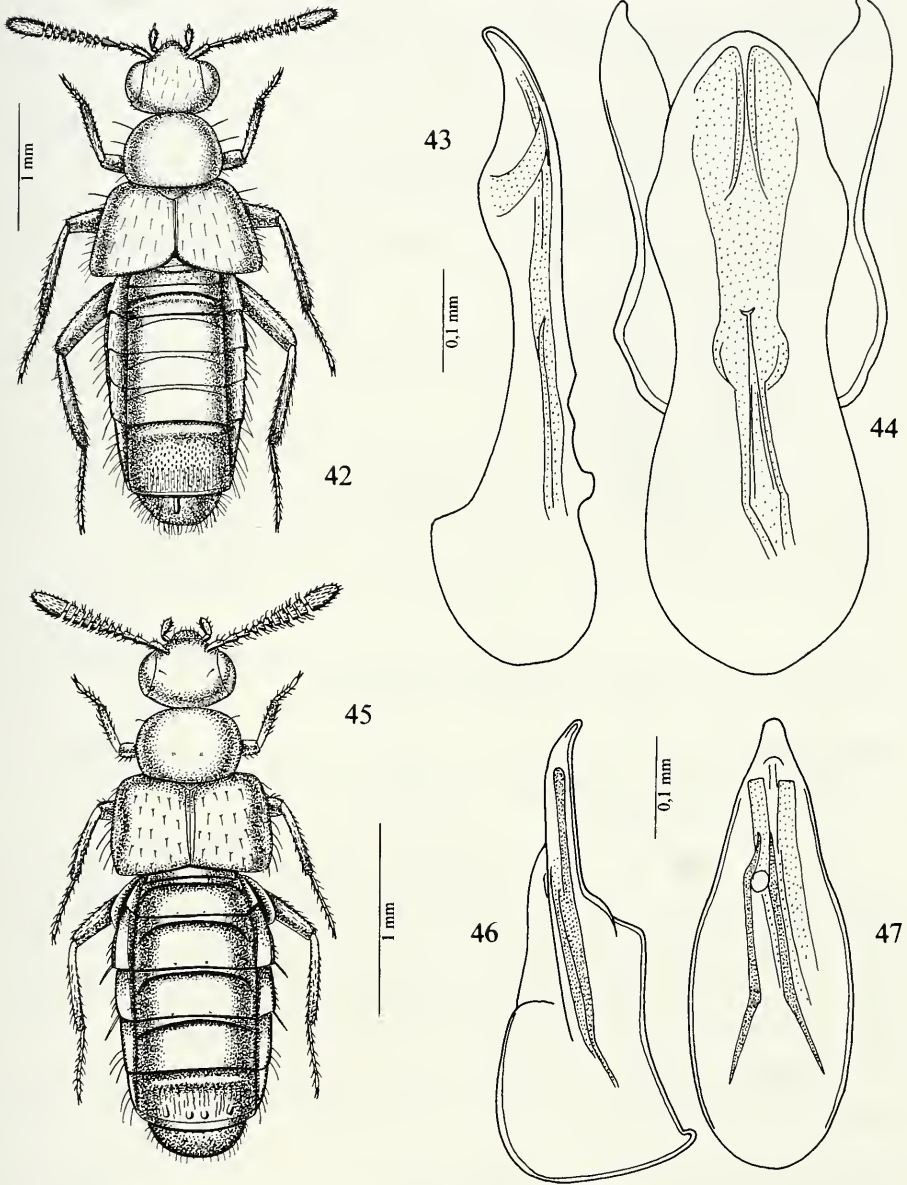
- 5 Tenth antennomere longer than wide; head and pronotum reddish; granularity of the elytra strong; spermatheca folded up as Z Fig. 8. Length 4.7 mm *O. bigladiosus* (Bernhauer)
- Tenth antennomere as wide as long; head and pronotum yellow-reddish; granularity of the elytra superficial; spermatheca folded up as 7 Fig. 12. Length 5.1 mm *O. bakerianus* Bernhauer
- 6 Abdomen reddish or brown-reddish; distal bulb of the spermatheca strongly flex. Length 2.7 mm *O. laetus* Pace
- Abdomen yellow-reddish; distal bulb of the spermatheca not flex 7
- 7 Pronotum less transverse; base of the antennae reddish; distal bulb of the spermatheca with apical umbilicus deep Fig. 35. Length 3.4 mm *O. ideogramma* sp. n.
- Pronotum transverse; base of the antennae yellow-reddish; distal bulb of the spermatheca with apical umbilicus weak, Fig. 20; length 2.8 mm *O. splendens* Bernhauer
- 8 Body yellow-reddish; distal bulb of the spermatheca very developed, Fig. 60. Length 2.1 mm *O. crassus* sp. n.
- Body unicoloured or bicoloured black-brown, reddish or brown-reddish; distal bulb of the spermatheca a little developed 9
- 9 Antennae uniformly yellow-reddish; abdomen yellow-reddish; spermatheca Fig. 56. Length 3.8 mm *O. perpenetrans* sp. n.
- Antennae bicoloured brown or reddish with base or distal apex yellow-reddish 10
- 10 Eleventh antennomere brown, fore-parts black-brown; intermediary portion of the spermatheca very long. Length 3 mm *O. derougemonti* Pace
- Eleventh antennomere entirely or partially yellow-reddish; intermediary portion of the spermatheca short 11
- 11 Body uniformly reddish; proximal portion of the spermatheca that describes numerous meanders, Fig. 52. Length 3.2 mm *O. uniformis* sp. n.
- Body bicoloured brown and reddish; proximal portion of the spermatheca that describes two sinuosity 12
- 12 Only the apex of the eleventh antennomere is yellow-reddish; fore-parts brown; fifth free urotergum of the female with longitudinal roughness; distal bulb of the spermatheca without apical umbilicus, Fig. 48. Length 2.7 mm *O. curticornis* sp. n.
- Eleventh antennomere entirely yellow-reddish; head and pronotum brown, elytra reddish; fifth free urotergum of the female with strong punctuation; distal bulb of the spermatheca with deep apical umbilicus. Length 2.8 mm *O. silvarum* Pace

***Orphnebius borneanus* sp. n.**

Fig. 1-4

Holotypus maschio, Borneo-Sabah, Crocker Ra., 1550-1650 m, 16.V.1987, leg. Burckhardt & Löbl (IRSB).

Paratypi: 1 femmina, Borneo, Sabah, Mt. Kinabalu Nat. Pk., HQ 1560 m, 30.IV.1987, leg. A. Smetana; 1 femmina, Sabah, Mt. Kinabalu, 1450-1550 m, 23.IV.1987, leg. Burckhardt & Löbl.



FIGG. 42-47

Habitus e edeago in visione laterale e ventrale. (42-44) *Orphnebius bajauorum* sp. n. (45-47) *Orphnebius curticornis* sp. n.

DESCRIZIONE: Lunghezza 5 mm. Corpo lucido e rossiccio con addome giallo-rossiccio; antenne rossicce con i due antennomeri basali e la base del terzo giallo-rossicci e apice dell'undicesimo giallo; zampe rossicce con femori giallo-rossicci. Il corpo non è coperto di reticolazione. Il capo e il pronoto non presentano punteggiatura,

né granulosità. La granulosità delle elitre è ben visibile. Gli uroterghi sono nudi, tranne il quinto libero con punteggiatura evidente e profondo solco basale trasverso. Il capo è molto più largo del pronoto, Fig. 1. Edeago Figg. 2-3, spermateca Fig. 4.

Orphnebius bigladius (Bernhauer, 1915)

Figg. 5-7

Astilbus (Deroleptus) bigladius Bernhauer, 1915: 150

Deroleptus bigladius; Bernhauer, 1929: 143; Hammond, 1984: 209

Orphnebius bigladius; Pace, hoc opus

1 maschio e 1 femmina, Sabah, Mt. Kinabalu Nat. Pk., Poring Hot Springs, 480-510 m, 30.VIII.1988, leg. A. Smetana.

Orphnebius scalaris sp. n.

Figg. 13-15

Holotypus maschio, Sabah, Poring Hot Springs, 500 m, 8.V.1987, leg. Burckhardt & Löbl (MHNG).

DESCRIZIONE: Lunghezza 3,4 mm. Corpo lucido e bruno-rossiccio con metà posteriore delle elitre bruna; antenne brune con i tre antennomeri basali e la metà apicale dell'undicesimo giallo-rossicci; zampe rossicce. Il corpo non è coperto di reticolazione. La punteggiatura del capo e del pronoto e la granulosità delle elitre sono superficiali. Gli uroterghi sono nudi, tranne il quinto libero con punteggiatura evidente e profondo solco basale trasverso. Il capo è largo quanto il pronoto. Edeago Figg. 14-15.

DERIVATIO NOMINIS: Il nome della nuova specie deriva dalle espansioni laterali basali dell'addome disposte come i gradini di una scala.

Orphnebius directus sp. n.

Figg. 16-18

Holotypus maschio, Sabah, Mt. Kinabalu Nat. Pk., Poring Hot Springs, 480 m, 10.V.1987, leg. A. Smetana (MHNG).

DESCRIZIONE: Lunghezza 3,4 mm. Corpo lucido e bruno-rossiccio con elitre giallo-brune; antenne brune con i tre antennomeri basali e l'undicesimo giallo-rossicci; zampe giallo-rossicce. Il corpo è privo di reticolazione. La punteggiatura del capo è fine e distinta. La granulosità del pronoto è molto saliente sul disco: sul resto dello stesso pronoto è superficiale. La granulosità delle elitre è molto saliente e forte. Il quinto urotergo libero del maschio presenta un tubercolo mediano posteriore. Il capo è largo quanto il pronoto. Edeago Figg. 17-18.

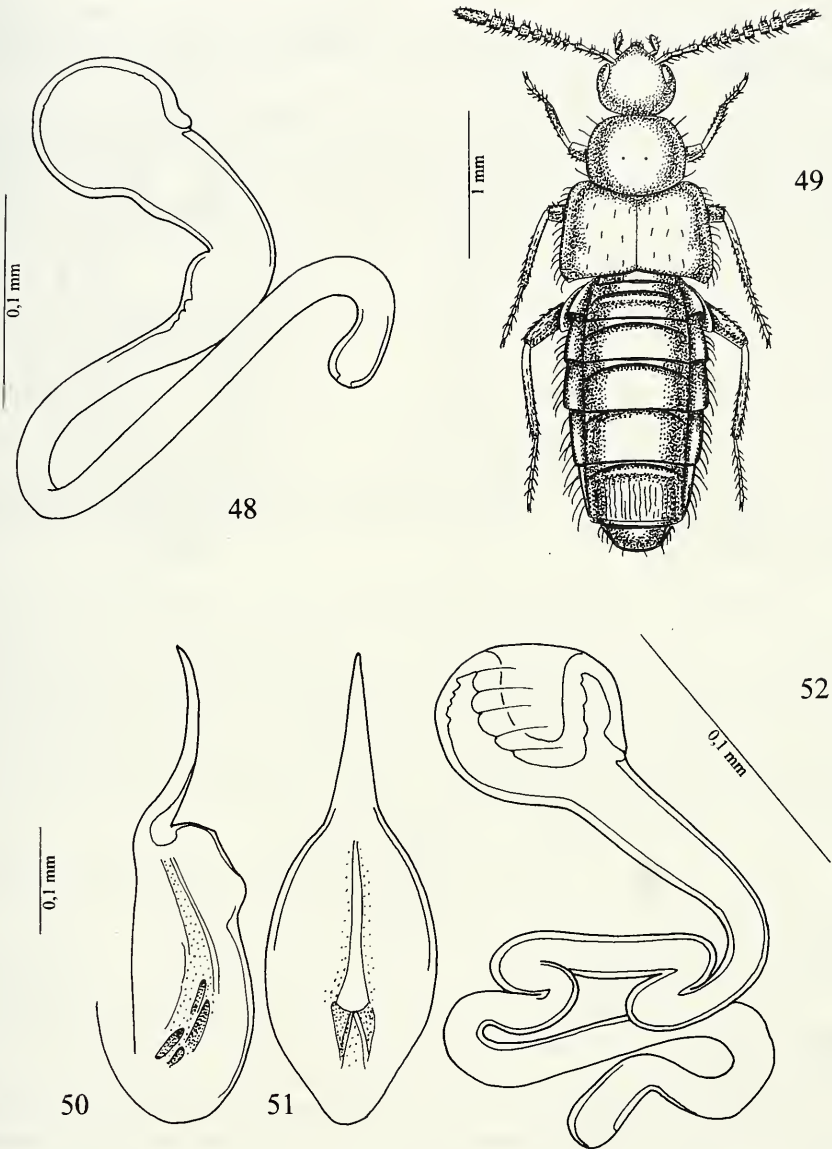
DERIVATIO NOMINIS: Il nome della nuova specie deriva dalla parte distale dell'edeago retta ventralmente, in visione laterale.

Orphnebius minor sp. n.

Figg. 21-23

Holotypus maschio, Borneo-Sabah, Poring Hot Springs, 500 m, 13.V.1987, leg. Burckhardt & Löbl (MHNG).

DESCRIZIONE: Lunghezza 2 mm. Corpo lucido e giallo-rossiccio, con capo bruno-rossiccio ed elitre rossicce; antenne rossicce con i due antennomeri basali e la base del terzo giallo-rossicci; zampe rossicce con femori giallo-rossicci. Sul corpo non è presente una reticolazione. Il capo e il pronoto non sono punteggiati, né granulosi. Il capo è largo quanto il pronoto. Gli ommatidi sono grossolani. La granulosità delle



FIGG. 48-52

Spermateca, habitus e edeago in visione laterale e ventrale. (48) *Orphnebius curticornis* sp. n. (49-52) *Orphnebius uniformis* sp. n.

elitre è distinta e moderatamente fitta. Il quinto urotergo libero del maschio è coperto di forte punteggiatura, tranne che alla sua base dove è assente. Edeago Figg 22-23.

DERIVATIO NOMINIS: Il nome di «più piccola» della nuova specie deriva dalla taglia corporea esigua a confronto con altre grandi specie del Borneo.

***Orphnebius biapicalis* sp. n.**

Figg. 26-28

Holotypus maschio, Borneo, Sabah, Mt. Kinabalu Nat. Pk., HQ Silau-Silau Tr., 1540 m, 14.VIII-1.IX.1988, leg. A. Smetana (MHNG).

DESCRIZIONE: Lunghezza 3,3 mm. Corpo lucido e rossiccio; zampe giallo-rossicce. Il capo manca perché perduto nella raccolta. Il pronoto presenta punti isolati superficiali disposti come da Fig. 26. Le elitre non presentano punteggiatura o granulosità. Il quinto urotergo libero del maschio mostra strie longitudinali, assai profonde verso la base dello stesso urotergo libero. Edeago con due appendici apicali, Figg. 27-28.

DERIVATIO NOMINIS: Il nome di «due apici» della nuova specie deriva da quelli dell'edeago, in visione ventrale.

***Orphnebius ideogramma* sp. n.**

Figg. 32-35

Holotypus maschio, Sabah, Mt. Kinabalu Nat. Pk., Poring Hot Springs, 510 m, 12.V.1987, leg. A. Smetana (MHNG).

Paratipi: 1 femmina, Sabah, Mt. Kinabalu Nat. Pk., Poring Hot Springs, 480-510 m, 30.VIII.1988, leg. A. Smetana; 1 femmina, Sabah, Mt. Kinabalu Nat. Pk., Poring Hot Springs, 510 m, 13.V.1987, leg. A. Smetana; 1 femmina, Sabah, Poring Hot Springs, 500 m, 6.V.1987, leg. Burckhardt & Löbl.

DESCRIZIONE: Lunghezza 3,3 mm. Corpo lucido e giallo-rossiccio con capo bruno, pronoto bruno-rossiccio, elitre rossicce; antenne brune con i tre antennomeri basali rossicci; zampe rossicce con femori giallo-rossicci. Il capo mostra tre punti, in cui è inserita una setola, presso gli occhi. Il pronoto presenta due punti disposti come da Fig. 32. La granulosità delle elitre è fine e distinta. Il quinto urotergo libero del maschio è coperto di netta punteggiatura fitta solo sulla metà posteriore. Presenta una profonda impressione basale trasversa. Il capo è largo quanto il pronoto che è poco trasverso, Fig. 32. Edeago Figg. 33-34, spermateca Fig. 35.

DERIVATIO NOMINIS: L'armatura genitale interna dell'edeago, in visione laterale, ha una forma che ricorda vagamente un ideogramma cinese, Fig. 33. Da esso la nuova specie prende nome.

***Orphnebius penangensis* sp. n.**

Figg. 36-38

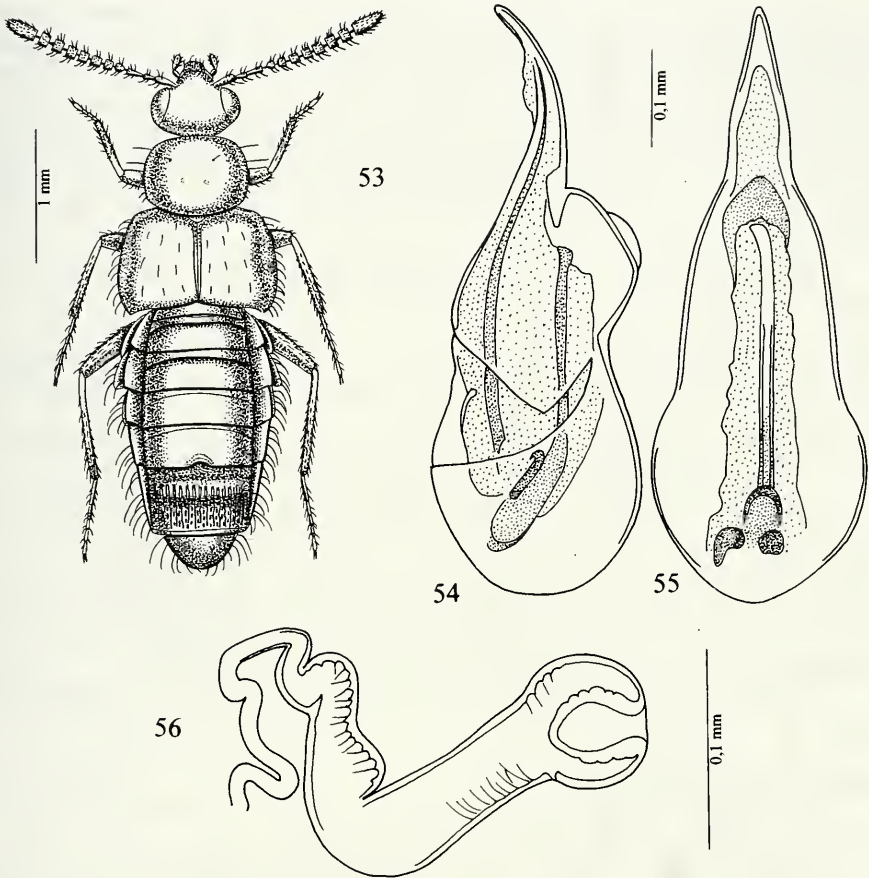
Holotypus maschio, Island of Penang, Baker, cotypus di *Orphnebius bakeri* Bernhauer (FMNH). Designato il lectotipus di *O. bakeri*, grazie all'esame dell'edeago ho isolato la presente specie.

DESCRIZIONE: Lunghezza 3,3 mm. Corpo lucido e bruno con addome bruno-rossiccio e pigidio rossiccio; antenne brune con i tre antennomeri basali rossicci; zampe bruno-rossicce con tarsi rossicci. Sul corpo la reticolazione è assente, tranne che alla base degli uroterghi liberi. Il capo e il pronoto sono privi sia di punteggiatura che di granulosità. La granulosità delle elitre è così fine che è poco visibile. Il quinto urotergo libero del maschio è coperto di rugosità longitudinale tra cui si trovano dei punti. Il capo è poco più stretto del pronoto che è lungo quanto largo. Edeago Figg. 37-38.

***Orphnebius bajauorum* sp. n.**

Figg. 42-44

Holotypus maschio, N. Borneo, Sabah, Bunsit Keningan, 31.VII.1985, leg. K. Maruyama (DEI).



FIGG. 53-56

Habitus, eedeago in visione laterale e ventrale e spermateca. (53-56) *Orphnebius perpenetrans* sp. n.

DESCRIZIONE: Lunghezza 3,7 mm. Corpo lucido con l'avancorpo bruno-rossiccio e l'addome giallo-rossiccio; antenne brune con i quattro antennomeri basali giallo-rossicci; zampe gialle. Nessuna traccia di reticolazione sul corpo. Il capo e il pronoto sono privi di punteggiatura. Solo il primo urotergo libero è coperto di granulosità molto superficiale, gli altri non hanno granulosità. La punteggiatura del quinto urotergo libero è distinta, posteriormente confusa in una rugosità. Eedeago Figg. 43-44.

DERIVATIO NOMINIS: La nuova specie prende nome dal gruppo etnico dei Bajau del Borneo.

Orphnebius curticornis sp. n.

Figg. 45-48

Holotypus maschio, Sabah, Poring Hot Springs, 500 m, 7.V.1987, leg. Burckhardt & Löbl (MHNG).

Paratypi: 2 maschi e 1 femmina, stessa provenienza dell'holotypus.

DESCRIZIONE: Lunghezza 2,7 mm. Corpo lucido e bruno con addome bruno-rossiccio; antenne nero-brune con i tre antennomeri basali, base del quarto e apice dell'undicesimo giallo-rossicci; zampe rossicce. Il corpo non ha reticolazione. Il capo presenta un solo punto presso l'orbita di ciascun occhio. Il pronoto presenta due punti post-discali molto superficiali. La granulosità delle elitre è distinta. Il quinto urotergo libero del maschio è coperto di strie superficiali, assenti alla base dello stesso urotergo libero, e mostra alcuni granuli forti lungo il margine posteriore. Edeago Figg. 46-47, spermateca Fig. 48.

DERIVATIO NOMINIS: La nuova specie prende nome di «antenne corte» per averle appunto corte rispetto quelle di altre specie del Borneo.

Orphnebius uniformis sp. n

Figg. 49-52

Holotypus maschio, Borneo, Sabah, Crocker Range, 1600 m, 18.V.1987, leg. Burckhardt & Löbl (MHNG).

Paratypi: 6 femmine, stessa provenienza dell'holotypus; 1 femmina, Sabah, Crocker Range, 1600 m, km 51 road Kota Kinabalu- Tambunan, 18.V.1987, leg. Burckhardt & Löbl.

DESCRIZIONE: Lunghezza 3,2 mm. Corpo lucido e rossiccio; antenne rossicce con i tre antennomeri basali giallo-rossicci e apice dell'undicesimo giallo; zampe rossicce. Corpo senza reticolazione. Sul capo e sulle elitre la punteggiatura o la granulosità è assente. Il pronoto presenta solo due punti discali, Fig. 49. Il quinto urotergo libero del maschio è coperto di strie longitudinali fino al solco trasverso basale. Il capo è più stretto del pronoto. Edeago Figg. 50-51, spermateca Fig. 52.

DERIVATIO NOMINIS: La nuova specie prende nome dal colore uniforme del corpo.

Orphnebius perpenetrans sp. n.

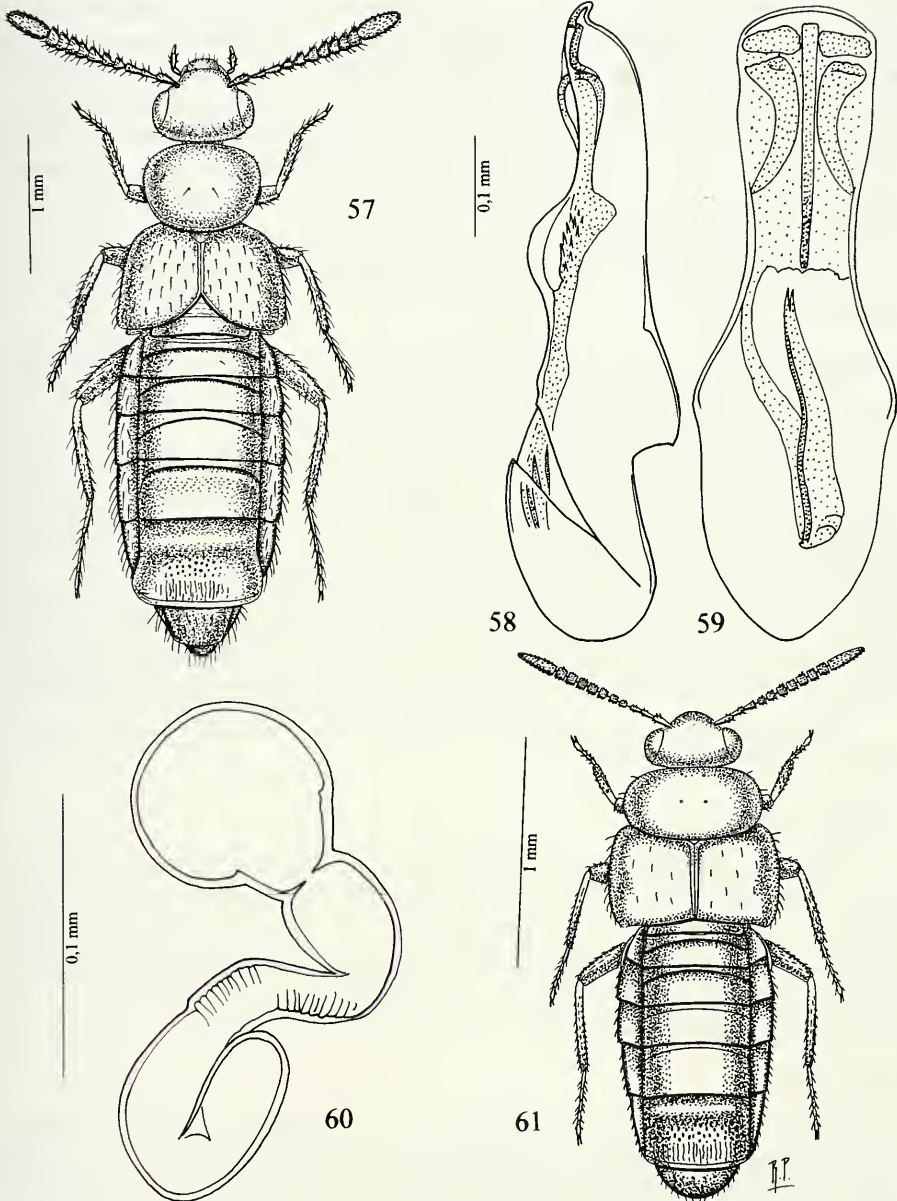
Figg. 53-56

Holotypus maschio, Borneo-Sabah, Mt. Kinabalu Nat. Pk., HQ Silau-Silau Tr., 1565 m, 3.VIII.1988, leg. A. Smetana (MHNG).

Paratypi: 2 maschi, Borneo-Sabah, Mt. Kinabalu Nat. Pk., HQ Silau-Silau Tr., 1540 m, 14.VIII-1.IX.1988, leg. A. Smetana; 2 maschi, Borneo-Sabah, Mt. Kinabalu Nat. Pk., HQ 1500 m, 8-16.IV.1987, leg. A. Smetana; 3 es., Sabah, Crocker Ra., 1550-1650 m, 16.V.1987, leg. Burckhardt & Löbl; 6 es., Borneo, Sabah, Mt. Kinabalu N.P., 1550 m, 29.IV.1987, leg. Burckhardt & Löbl; 6 es., Borneo, Sabah, Crocker Ra., 1600 m, Km 51 rte. Kinabalu-Tambunan, 18.V.1987, leg. Burckhardt & Löbl; 6 es., Sabah, Mt. Kinabalu, 1500 m, 21.V.1987, leg. Burckhardt & Löbl; 3 es., 12 es., Sabah, Mt. Kinabalu, 1550 m, 28.IV.1987, leg. Burckhardt & Löbl; 3 es., Sabah, Mt Kinabalu, 1500m, 21.V.1987, leg. Burckhardt-Löbl; 1 es., Sabah, Mt Kinabalu, 1500m, 25.V.1987, leg. Burckhardt-Löbl.

DESCRIZIONE: Lunghezza 3,2 mm. Corpo lucido. Avancorpo bruno, addome giallo-rossiccio; antenne e zampe giallo-rossicce. Sul corpo non vi è traccia di reticolazione. Il capo è senza punteggiatura. il pronoto presenta due deboli punti discali e due con setola, Fig. 53. La punteggiatura delle elitre è fine. Il margine posteriore del quarto urotergo libero del maschio è incavato a metà. Il quinto urotergo libero del maschio e della femmina è coperto di strie longitudinali punteggiate che non raggiungono la base dello stesso urotergo libero che ha un solco basale trasverso. Il capo è più stretto del pronoto che è poco trasverso. Edeago Figg. 54-55, spermateca Fig. 56.

DERIVATIO NOMINIS: La nuova specie prende nome dalla punta acuta e ricurva dell'edeago che ha la funzione di penetrare agevolmente nel dotto vaginale della femmina.



FIGG. 57-61

Habitus, edeago in visione laterale e ventrale e spermateca. (57-59) *Orphnebius krypticola* sp. n. (60-61) *Orphnebius crassus* sp. n.

Orphnebius krypticola sp. n.

Figg. 57-59

Holotypus maschio, Borneo, Brunei, Temburong, Kuala Belalong (West), 14.II.1995, leg. Borchering (IRSN).

DESCRIZIONE: Lunghezza 4 mm. Corpo lucido senza reticolazione. Avancorpo giallo-bruno, addome giallo-rossiccio; antenne nero pece con i tre antennomeri basali giallo-rossicci; zampe gialle. Il capo e il pronoto non presentano punteggiatura o granulosità, tranne quattro punti isolati sul pronoto distribuiti come da Fig. 57. La granulosità delle elitre è rada e distinta. Il quinto urotergo libero del maschio presenta punteggiatura anteriore e una rugosità posteriore mediana assenti ai lati dello stesso urotergo libero e alla sua base che è profondamente incavata. Il capo è più stretto del pronoto. Edeago Figg. 58-59.

DERIVATIO NOMINIS: La nuova specie prende nome di «abitatrice dei luoghi nascosti».

Orphnebius crassus sp. n.

Figg. 60-61

Holotypus femmina, Sabah, Poring Hot Springs, 600 m, nr. Bat Cave, 10.V.1987, leg. Burckhardt & Löbl (MHNG).

DESCRIZIONE: Lunghezza 2,1 mm. Corpo lucido e giallo-rossiccio; antenne giallo-rossicce con i tre antennomeri basali gialli; zampe gialle. Manca una reticolazione sulla superficie del corpo. Il capo non possiede punteggiatura. Il pronoto presenta solo quattro punti distinti distribuiti come da fig. 61. La punteggiatura delle elitre è molto superficiale. Il quinto urotergo libero della femmina è punteggiato anteriormente e striato longitudinalmente nella porzione distale. Alla base di questo urotergo libero manca la punteggiatura ed è presente un largo solco basale. Il capo è molto più stretto del pronoto che è fortemente trasverso, Fig. 61. Spermateca Fig. 60.

DERIVATIO NOMINIS: La nuova specie prende nome di «pingue» a motivo del suo corpo tozzo che simula pinguedine.

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RÉSUMÉ

Les espèces du genre *Orphnebius* Motschulsky, 1858, de Bornéo (Coleoptera, Staphylinidae). - La présente étude sur le genre *Orphnebius* de Bornéo contient l'illustration et la révision des holotypes ou lectotypes des six espèces suivantes de Bornéo: *O. bigladius* (Bernhauer), *O. bakerianus* Bernhauer, *O. splendens* Bernhauer, *O. anguliceps* Cameron, *O. antennarius* Bernhauer et *O. bakeri* Bernhauer. Le lectotype de *O. bakeri* Bernhauer et celui de *O. bakerianus* Bernhauer sont désignés. Les sous-genres *Deroleptus* Bernhauer et *Mesocephalobius* Bernhauer ont été mis en synonymie avec *Orphnebius* et *Orphnebius quadrigladius* Pace, 1986, avec *Orphnebius quadricuspidatus* Bernhauer, 1929. *Deroleptus bigladius* (Bernhauer) et *Deroleptus arachnoides* Bernhauer sont transférés dans le genre

Orphnebius. Les 13 espèces suivantes sont décrites comme nouvelles: *O. borneanus*, *O. scalaris*, *O. directus*, *O. minor*, *O. biapicalis*, *O. ideogramma*, *O. penangensis*, *O. bajauorum*, *O. curticornis*, *O. uniformis*, *O. perpenetrans*, *O. krypticola* et *O. crassus*. L'habitus et les organes génitaux masculins et féminins des nouvelles espèces sont illustrés. Une clé des espèces est fournie.

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Le specie di Oligotini, Leucocraspedini, Hygronomini, Placusini, Bolitocharini e Diestotini nel Borneo (Coleoptera, Staphylinidae)*

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The species of Oligotini, Leucocraspedini, Hygronomini, Placusini, Bolitocharini and Diestotini from Borneo (Coleoptera, Staphylinidae).

Forty-five new species of the subfamily Aleocharinae collected in the Mt Kinabalu National Park, Borneo, are described and illustrated. For the first time from Borneo are reported genera and species of the following tribes: Oligotini, Hygronomini, Bolitocharini and Diestotini. Three new species belong to the genus *Oligota* (*densa*, *kinabaluensis* and *borneensis*), one to the genus *Cypha* (*sabahensis*), nineteen to the genus *Leucocraspedum* (*sinuatum*, *pilosellum*, *obliquum*, *spirasferum*, *occultum*, *biguttatae*, *mimantaticula*, *divisum*, *anaticula*, *fugitivum*, *directum*, *hamifer*, *dilatatiapex*, *lamelliferum*, *audax*, *cacuminum*, *anguineatheca*, *nehamifer* and *ventriosatheca*), four to the genus *Hygrochara* (*micropallida*, *microkinabaluicola*, *spiniventris* and *kinabaluensis*), six to the genus *Placusa* (*robustipes*, *superba*, *recensita*, *falcifera*, *evoluta* and *subspinigera*), four to the genus *Erastriusa* (*masculina*, *borneensis*, *minima* and *lobifera*), three to the genus *Pseudatheta* (*borneensis*, *kinabaluensis* and *sedtitosa*), one to the genus *Neoleptusa* (*kinabaluensis*), two to the genus *Chledophila* (*parallela* and *borneensis*) and two to the genus *Diestota* (*plicae* and *pellita*). A key of all species known to Borneo of the aforesaid genera is provided. Lectotype is designated for *Placusa acuminata* Kraatz, whose aedeagus and spermatheca for the first time are illustrated.

Keywords: Coleoptera - Staphylinidae - Aleocharinae - taxonomy - Borneo.

INTRODUZIONE

Il presente lavoro ha lo scopo di esporre il risultato dell'esame degli Staphylinidae della sottofamiglia Aleocharinae raccolti nel Parco Nazionale del Monte Kinabalu e altrove nel Borneo, dal Dr. Aleš Smetana di Ottawa, dal Dr. Burckhardt e dal Dr. Ivan Löbl del Museo di Storia Naturale di Ginevra e dal Prof. Herbert Franz. Le 46 specie appartengono alle tribù degli Oligotini, Leucocraspedini, Hygronomini, Placusini, Bolitocharini e Diestotini. I generi e le specie di queste tribù nel Borneo sono

* 209° Contributo alla conoscenza delle Aleocharinae.

assai poco noti. Hammond (1984) nella sua checklist sugli Staphylinidae del Borneo non elenca i seguenti generi, nel presente lavoro rappresentati da una o più specie: *Oligota* Mannerheim, 1831, *Cypha* Leach, 1819, *Hygrochara* Cameron, 1939, *Erastriusa* Pace, 1990, *Pseudatheta* Cameron, 1920, *Neoleptusa* Cameron, 1939, *Chledophila* Cameron, 1920 e *Diestota* Mulsant & Rey, 1870.

MATERIALE E METODO

L'esame è basato sugli esemplari adulti raccolti prevalentemente nel Parco Nazionale del Monte Kinabalu dal Dr. Aleš Smetana di Ottawa durante le sue spedizioni nel 1987 e 1988, dalla spedizione Burckhardt & Löbl del Museo di Storia Naturale di Ginevra del 1987 e Bright pure del 1987 e dal materiale raccolto dal Prof. H. Franz (senza anno).

La tassonomia delle nuove specie del Borneo presenta serie difficoltà, in molti casi superate grazie all'esame dei caratteri dell'organo copulatore maschile, dei segmenti genitali maschili e femminili e della spermateca. Prima della pubblicazione del presente lavoro nessun esame a fini tassonomici di questi importanti organi e strutture è stato compiuto dagli autori del lontano passato. Gli holotipi delle specie note sono stati da me esaminati e disegnati, quando disponibili, e inseriti nelle chiavi qui date per la prima volta. Le recenti restrizioni riguardo ai prestiti di materiale tipico imposte dal Museo di Storia Naturale di Londra, tuttavia mi hanno impedito di esaminare alcuni esemplari tipici. L'etimologia delle nuove specie è omessa quando evidente come *borneensis* o *kinabaluensis*.

Quasi tutti gli esemplari sono stati dissezionati per le serie di pochi individui. Le strutture genitali sono state montate in balsamo del Canada su piccoli rettangoli trasparenti di materiale plastico, infilzati sullo spillo dell'esemplare. Le strutture genitali sono state studiate usando un microscopio composto e disegnate mediante oculare a reticolo. Gli habitus sono stati disegnati con l'uso di un oculare micrometrico di un microscopio binoculare. Tutti i disegni sono dell'autore fino alla fase finale. Il sicuro riconoscimento dei generi e delle specie è qui affidato soprattutto alla parte illustrativa che ha linguaggio internazionale. Per questo motivo le descrizioni sono brevi, limitate a porre in evidenza ciò che non è riproducibile graficamente come il colore, la reticolazione e la granulosità. D'altronde per le specie della sottofamiglia Aleocharinae la sola descrizione anche molto accurata e lunga non dà quasi mai la certezza di un'esatta identificazione delle varie specie. È l'osservazione del disegno dell'edeago e/o della spermateca insieme a quello dell'habitus che aiuta molto a risolvere problemi interpretativi dati dalla sola descrizione.

Gli holotipi delle nuove specie sono depositati nel Museo di Storia Naturale di Ginevra (MHNG) e in collezione Franz al Naturhistorisches Museum di Vienna (Austria) (NHMW). Paratypi sono conservati in collezione Smetana e nell'Institut Royal des Sciences Naturelles de Belgique di Bruxelles.

OLIGOTINI

Specie di questa tribù erano finora sconosciute per il Borneo (Hammond, 1984).

CHIAVE DELLE SPECIE DEL GENERE *OLIGOTA* MANNERHEIM, 1831, NEL BORNEO

- 1 Tutti gli uroterghi liberi senza carene; corpo uniformemente bruno-rossiccio, Fig. 1; edeago Figg. 2-3. Lunghezza 0,95 mm *O. densa* sp. n.
 - Alcuni uroterghi liberi con carene; corpo bicolore 2
- 2 Corpo tozzo, Fig. 4; sutura delle elitre più lunga della linea mediana del pronoto; base delle antenne rossiccia; carene del secondo urotergo libero lunghe; edeago Figg. 5-6; porzione prossimale della spermateca lunga quanto la lunghezza del bulbo distale della stessa spermateca, Fig. 7. Lunghezza 1,2 mm *O. kinabaluensis* sp. n.
 - Corpo snello Fig. 8; sutura delle elitre più corta della linea mediana del pronoto; base delle antenne gialla; carene del secondo urotergo libero corte; porzione prossimale della spermateca molto più corta della lunghezza del bulbo distale della stessa spermateca, Fig. 9. Lunghezza 1,1 mm *O. borneensis* sp. n.

KEY TO SPECIES OF THE GENUS *OLIGOTA* MANNERHEIM, 1831, FROM BORNEO

- 1 All the free uroterga without carina; body uniformly brown-reddish, Fig. 1; aedeagus Figs 2-3. Length 0.95 mm *O. densa* sp. n.
 - Some free uroterga with carinae; body bicolorous 2
- 2 Body stumpy, Fig. 4; suture of the elytra longer than the median line of the pronotum; base of the antenna reddish; carinae of the second free urotergum long; aedeagus Figs 5-6; proximal portion of the spermatheca as long as the length of the distal bulb of the same spermatheca, Fig. 7. Length 1.2 mm *O. kinabaluensis* sp. n.
 - Body slender Fig. 8; suture of the elytra shorter than the median line of the pronotum; base of the antennae yellow; carinae of the second free urotergum court; proximal portion of the spermatheca shorter than the length of the distal bulb of the same spermatheca, Fig. 9. Length 1.1 mm *O. borneensis* sp. n.

Oligota densa sp. n.

Figg. 1-3

Holotypus maschio, Sabah, Kibongol V., 7 Km N Tambunan, 700 m, 20.V.1987, leg. Burckhardt & Löbl, (MHNG).

DESCRIZIONE: Lunghezza 0,95 mm. Corpo lucido e bruno-rossiccio; antenne bruno-rossicce con i tre antennomeri basali gialli; zampe gialle. La reticolazione è assente su tutto il corpo. La punteggiatura del capo e del pronoto è superficiale. La granulosità delle elitre è poco saliente, quella dell'addome è netta. Il primo urotergo libero presenta una debole scultura squamiforme. Edeago Figg. 2-3.

DERIVATIO NOMINIS: La nuova specie prende nome dal carattere dell'edeago denso di pezzi copulatori dell'armatura interna.

Oligota kinabaluensis sp. n.

Figg. 4-7

Holotypus maschio, Sabah, Poring Hot Springs, 550-600 m, 9.V.1987, leg. Burckhardt & Löbl (MHNG).

Paratypi: 3 maschi e 1 femmina Sabah, Kibongol V., 7 Km N Tambunan, 700 m, 20.V.1987, leg. Burckhardt & Löbl; 1 maschio, Sabah, Poring Hot Springs, 500 m, 13.V.1987, leg. Burckhardt & Löbl; 1 femmina, Sabah, Poring Hot Springs, 550-600 m, 9.V.1987, leg. Burckhardt & Löbl.

DESCRIZIONE: Lunghezza 1,2 mm. Corpo lucido, molto convesso e bruno con addome bruno-rossiccio e pigidio giallo sporco; antenne e zampe rossicce. La reticolazione è assente su tutto il corpo. Capo e pronoto privi di granulosità e punteggiatura. La punteggiatura delle elitre è ben visibile. Gli uroterghi liberi, tranne il quinto, presentano carene basali, Fig. 4. Edeago Figg. 5-6, spermateca Fig. 7.

NOTE: La nuova specie è simile a *O. rougemontiana* Pace, 1993, di Celebes, ma questa specie presenta gli antennomeri quarto, quinto e sesto più lunghi che larghi (trasversi nella nuova specie) e la spermateca ha la porzione mediana chiaramente più lunga di quella della nuova specie. Non è noto il maschio di *O. rougemontiana*.

Oligota borneensis sp. n.

Figg. 8-9

Holotypus femmina, Sabah, Poring Hot Springs, 550-600 m, 9.V.1987, leg. Burckhardt & Löbl (MHNG).

DESCRIZIONE: Lunghezza 1,1 mm. Corpo lucido e bruno, con pigidio bruno-rossiccio; antenne rossicce con i tre antennomeri basali gialli e undicesimo bruno-rossiccio. La reticolazione è assente su tutto il corpo. Capo e pronoto privi di granulosità e punteggiatura. La granulosità delle elitre è saliente. Il secondo urotergo libero presenta corte carene basali mentre *O. kinabaluensis* sp. n. le presenta lunghe. Spermateca Fig 8.

Cypha sabahensis sp. n.

Figg. 10-11

Holotypus femmina, Sabah, Poring Hot Springs, Langanan Falls, 900-950 m, 12.V.1987, leg. Burckhardt & Löbl (MHNG).

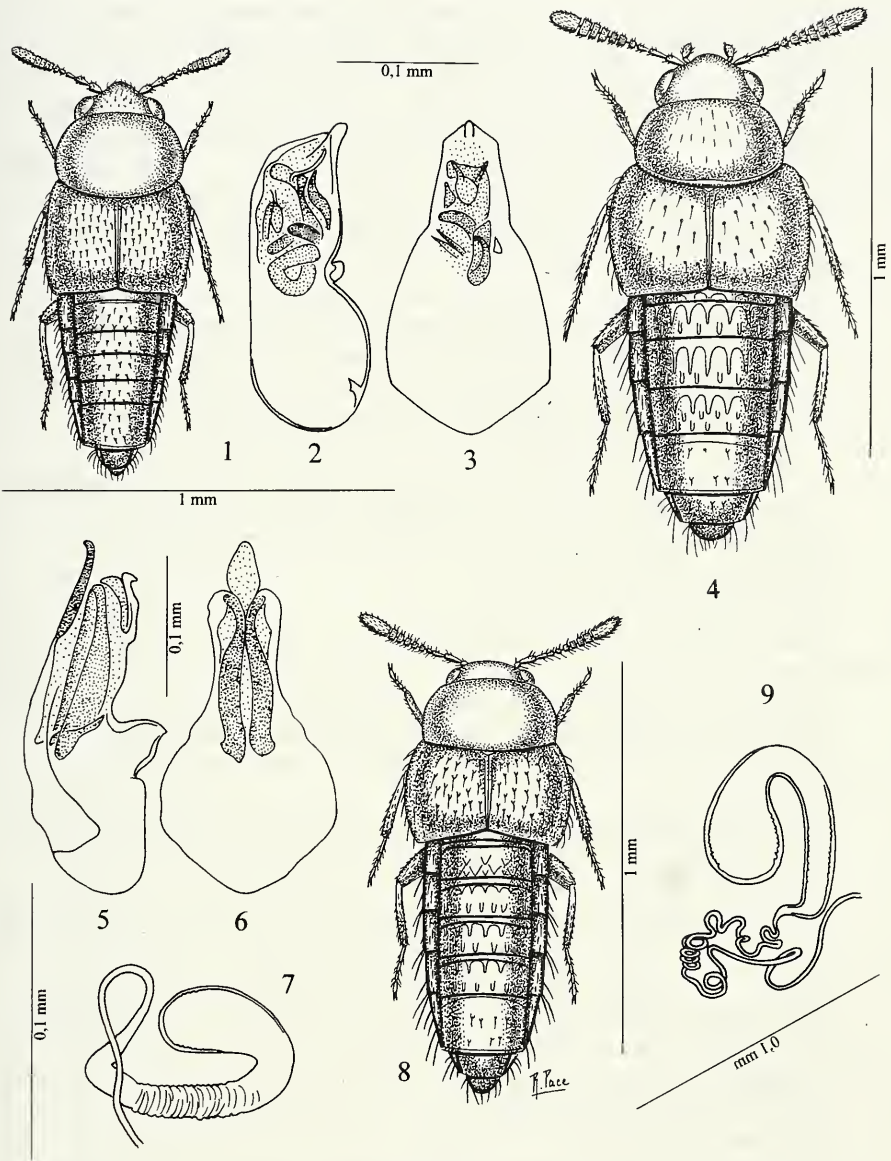
Paratypus: 1 femmina, Borneo, Sabah, Crocker Ra., 1270 m, Km 60 rte. Kota Kinabalu-Tambunan, 17.V.1987, leg. Burckhardt & Löbl.

DESCRIZIONE: Lunghezza 1,4 mm. Corpo lucido, molto convesso e bruno; antenne e zampe giallo-rossicce. La parte anteriore del corpo è privo di punteggiatura, di granulosità e di reticolazione. L'addome presenta una distinta reticolazione che sul quinto urotergo libero è trasversa. Spermateca Fig. 11.

NOTE: Per la forma della spermateca la nuova specie si rivela tassonomicamente affine a *C. besuchetiella* (Pace, 1985), del Bengala, ma questa specie presenta occhi assai ridotti. La nuova specie per la forma della spermateca è tassonomicamente affine anche a *C. rougemonti* (Pace, 1986) della Malaysia, ma questa specie presenta la clava antennale composta di tre antennomeri, mentre nella nuova specie è composta di due. *C. rougemonti* ha l'introflessione apicale del bulbo distale della spermateca meno lunga di quella della nuova specie ed è divisa in quattro settori.

LEUCOCRASPEDINI

La sola specie *Leucocraspedum robustum* Cameron, 1928 era finora nota del Borneo, non del Mt Kinabalu, ma del Mt Dulit. Questa specie è compresa nella seguente chiave.



FIGG. 1-9

Habitus, edeago in visione laterale e ventrale e spermateca. (1-3) *Oligota densa* sp. n. (4-7) *Oligota kinabaluensis* sp. n. (8-9) *Oligota borneensis* sp. n.

CHIAVE DELLE SPECIE DEL GENERE *LEUCOCRASPEDUM* KRAATZ, 1859 NEL BORNEO

- 1 Corpo rossiccio con pigidio e margine posteriore degli uroterghi giallo-rossicci. Lunghezza 2,5 mm *L. robustum* Cameron
- Corpo diversamente colorato; margine posteriore degli uroterghi liberi mai rossiccio 2

- 2 Sutura delle elitre più corta della linea mediana del pronoto, Figg. 12 e 15 . . . 3
 - Sutura delle elitre lunga quanto il pronoto, poco più corta o molto più lunga 5
- 3 Corpo bicolore giallo-rossiccio e bruno; pronoto più largo delle elitre, Fig. 12; edeago largo e bisinuato, in visione ventrale, Fig. 14. Lunghezza 1,7 mm *L. sinuatum* sp. n.
 - Corpo unicolore giallo-rossiccio; pronoto poco più largo delle elitre o appena più stretto, Figg. 15 e 18; edeago stretto e non sinuato in visione ventrale 4
- 4 Pronoto largo quanto le elitre e arcuato al margine anteriore, Fig. 15; elitre più ridotte, Fig. 15; armatura genitale interna dell'edeago con un cespuglio di setole, Fig. 16. Lunghezza 1,7 mm *L. pilosellum* sp. n.
 - Pronoto poco più largo delle elitre, obliquamente ristretto al margine anteriore, Fig. 18; elitre meno ridotte, Fig. 18; armatura genitale interna dell'edeago senza un cespuglio di setole. Lunghezza 1,7 mm *L. obliquum* sp. n.
- 5 Sutura delle elitre poco più corta della linea mediana del pronoto 6
 - Sutura delle elitre lunga quanto la linea mediana del pronoto, lievemente più corta o molto più lunga 18
- 6 Pronoto giallo-rossiccio o bruno 7
 - Pronoto rossiccio o bruno 16
- 7 Corpo unicolore giallo-rossiccio, talvolta il pigidio è giallo 8
 - Corpo bicolore giallo-rossiccio e bruno o bruno-rossiccio 11
- 8 Undicesimo antennumero lungo quanto i quattro antennumeri immediatamente precedenti riuniti; spermateca Fig. 22. Lunghezza 2,2 mm *L. spirasferum* sp. n.
 - Undicesimo antennumero lungo quanto i tre antennumeri immediatamente precedenti riuniti o poco meno 9
- 9 Corpo giallo-bruno; bulbo distale della spermateca a forma di due lobi simili a gocce Fig. 24. Lunghezza 1,8 mm *L. biguttæ* sp. n.
 - Corpo giallo-rossiccio 10
- 10 Pigidio giallo-rossiccio chiaro; pronoto regolarmente arcuato al margine anteriore, Fig. 25; edeago Figg. 26-27 *L. occultum* sp. n.
 - Pigidio giallo-rossiccio; pronoto obliquamente ristretto al margine anteriore, Fig. 28; spermateca Fig. 29 *L. mimanaticula* sp. n.
- 11 Elitre giallo-rossicce o giallo-brune 12
 - Elitre brune o rossicce 13
- 12 Pronoto ed elitre giallo-rossicci, addome giallo-rossiccio con base degli uroterghi liberi rossiccia o bruna; edeago Figg. 32-33. Lunghezza 1,8 mm *L. divisum* sp. n.
 - Pronoto ed elitre giallo-bruni; addome bruno con pigidio giallo-rossiccio; spermateca Fig. 35. Lunghezza 1,9 mm *L. anaticula* sp. n.
- 13 Undicesimo antennumero lungo quanto i due antennumeri immediatamente precedenti riuniti che sono lunghi quanto larghi; edeago bruscamente ristretto presso la «crista apicalis», in visione ventrale, Figg. 37-38. Lunghezza 2,6 mm *L. fugitivum* sp. n.

- Undicesimo antennumero lungo quanto I tre antennumeri immediatamente precedenti riuniti che sono trasversi; edeago non come sopra 14
- 14 Addome bruno-rossiccio con base giallo-rossiccia; pronoto con quattro punti disposti in rettangolo; edeago profondamente e ampiamente arcuato al livello della «crista apicalis», Figg. 41-42. Lunghezza 1,9 mm
 *L. directum* sp. n.
- Addome bruno-rossiccio, senza base giallo-rossiccia 15
- 15 Pigidio giallo-rossiccio; pronoto obliquamente ristretto al margine anteriore, Fig 45; apice dell'edeago a forma di piccolo gancio in visione laterale, Figg. 43-44. Lunghezza 2,1 mm *L. hamifer* sp. n.
- Pigidio bruno-rossiccio; pronoto arcuato al margine anteriore, Fig. 46; apice dell'edeago terminante a paletta circolare, in visione ventrale, Figg. 47-48. Lunghezza 1,8 mm *L. dilatatiapex* sp. n.
- 16 Margini laterali del pronotum rossicci; addome unicolore bruno; edeago Figg. 51-52; spermateca Fig. 53. Lunghezza 1,9 mm *L. lamelliferum* sp. n.
- Pronoto unicolore; addome bicolore bruno e rossiccio 17
- 17 Undicesimo antennumero lungo quanto i sette antennumeri immediatamente precedenti riuniti, Fig. 54; edeago Figg. 55-56. Lunghezza 2,7 mm *L. audax* sp. n.
- Undicesimo antennumero lungo quanto i due antennumeri immediatamente precedenti riuniti, Fig. 58; spermateca Fig. 57. Lunghezza 2,7 mm
 *L. cacuminum* sp. n.
- 18 Sutura delle elitre molto più lunga della linea mediana del pronoto; pronoto con quattro punti discali in quadrato; addome giallo-rossiccio con una fascia bruna; spermateca Fig. 60. Lunghezza 2 mm
 *L. anguineatheca* sp. n.
- Sutura delle elitre lunga quanto la linea mediana del pronoto o lievemente più corta; pronoto mai con quattro punti discali in quadrato; addome senza fascia bruna 19
- 19 Undicesimo antennumero lungo quanto i sette antennumeri precedenti riuniti, Fig. 61; elitre giallo-rossicce; addome tricolore rossiccio con pigidio giallo-rossiccio e base degli uroterghi liberi bruna; bulbo basale dell'edeago stretto, in visione ventrale, Figg. 62-63. Lunghezza 2,7 mm
 *L. nehamifer* sp. n.
- Undicesimo antennumero lungo quanto i tre antennumeri immediatamente precedenti riuniti, Fig. 67; elitre bruno-rossicce, addome unicolore bruno-rossiccio; bulbo basale dell'edeago assai dilatato, in visione ventrale, Figg. 64-65; spermateca Fig. 66. Lunghezza 1,8 mm
 *L. ventriosatheca* sp. n.

KEY TO SPECIES OF THE GENUS *LEUCOCRASPEDUM* KRAATZ, 1859, FROM BORNEO

- 1 Body reddish with pigidium and basal border of the uroterga yellow-reddish. Length 2.5 mm *L. robustum* Cameron
- Body otherwise colored; basal border of the free uroterga never reddish 2
- 2 Suture of the elytra shorter than the median line of the pronotum, Figs 12 and 15 3

- Suture of the elytra as long as the pronotum, a little shorter or very longer . . . 5
- 3 Bicolorous body, yellow-reddish and brown; pronotum wider than the elytra, Fig. 12; aedeagus wide and bisinuous, in ventral view, Fig. 14. Length 1.7 mm *L. sinuatum* sp. n.
- Body yellow-reddish unicolorous; pronotum a little wider than the elytra or scarcely more narrow, Figs 15 and 18; aedeagus narrow and not sinuous in ventral view 4
- 4 Pronotum as wide as the elytra and arched to the anterior border, Fig. 15; elytra more redoubts, Fig. 15; inside genital armour of the aedeagus with a bush of bristles, Fig. 16. Length 1.7 mm *L. pilosellum* sp. n.
- Pronotum a little wider than the elytra, obliqually narrow to the anterior border, Fig. 18; elytra less reduced, Fig. 18; inside genital armour of the aedeagus without a bush of bristles. Length 1.7 mm *L. obliquum* sp. n.
- 5 Suture of the elytra a little shorter than the median line of the pronotum 6
- Suture of the elytra as long as the median line of the pronotum, slightly shorter or very longer 18
- 6 Pronotum yellow-reddish or brown 7
- Pronotum reddish or brown 16
- 7 Body yellow-reddish unicolorous, sometimes the pigidium is yellow 8
- Body yellow-reddish and brown or brown-reddish bicolorous 11
- 8 Eleventh antennomere as long as the four immediately precedents reunited antennomere; spermatheca Fig. 22. Length 2.2 mm *L. spirasferum* sp. n.
- Eleventh antennomere as long as the three immediately precedents reunited antennomere or few less 9
- 9 Body yellow-brown; distal bulb of the spermatheca to form of two lobes similar to drops Fig. 24. Length 1.8 mm *L. biguttiae* sp. n.
- Body yellow-reddish 10
- 10 Pigidium clear yellow-reddish; pronotum arched regularly to the anterior border, Fig. 25; aedeagus Figs 26-27. Length 1.7 mm *L. occultum* sp. n.
- Pigidium yellow-reddish; pronotum obliqually narrow to the anterior border, Fig. 28; spermatheca Fig 29. Length 1.7 mm . . . *L. mimanaticula* sp. n.
- 11 Elytra yellow-reddish or yellow-brown 12
- Elytra brown or reddish 13
- 12 Pronotum and elytra yellow-reddish, abdomen yellow-reddish with base of the free uroterga reddish or brown; aedeagus Figs 32-33. Length 1.8 mm *L. divisum* sp. n.
- Pronotum and elytra yellow-brown; abdomen brown with yellow-reddish pigidium; spermatheca Fig. 35. Length 1.9 mm . . . *L. anaticula* sp. n.
- 13 Eleventh antennomere as long as the two immediately precedents reunited antennomere that are as long as wide; aedeagus brusquely narrow near the «crista apicalis», in ventral view, Figs 37-38. Length 2.6 mm *L. fugitivum* sp. n.
- Eleventh antennomere as long as the three immediately precedents reunited antennomere that are transverse; aedeagus not as above 14

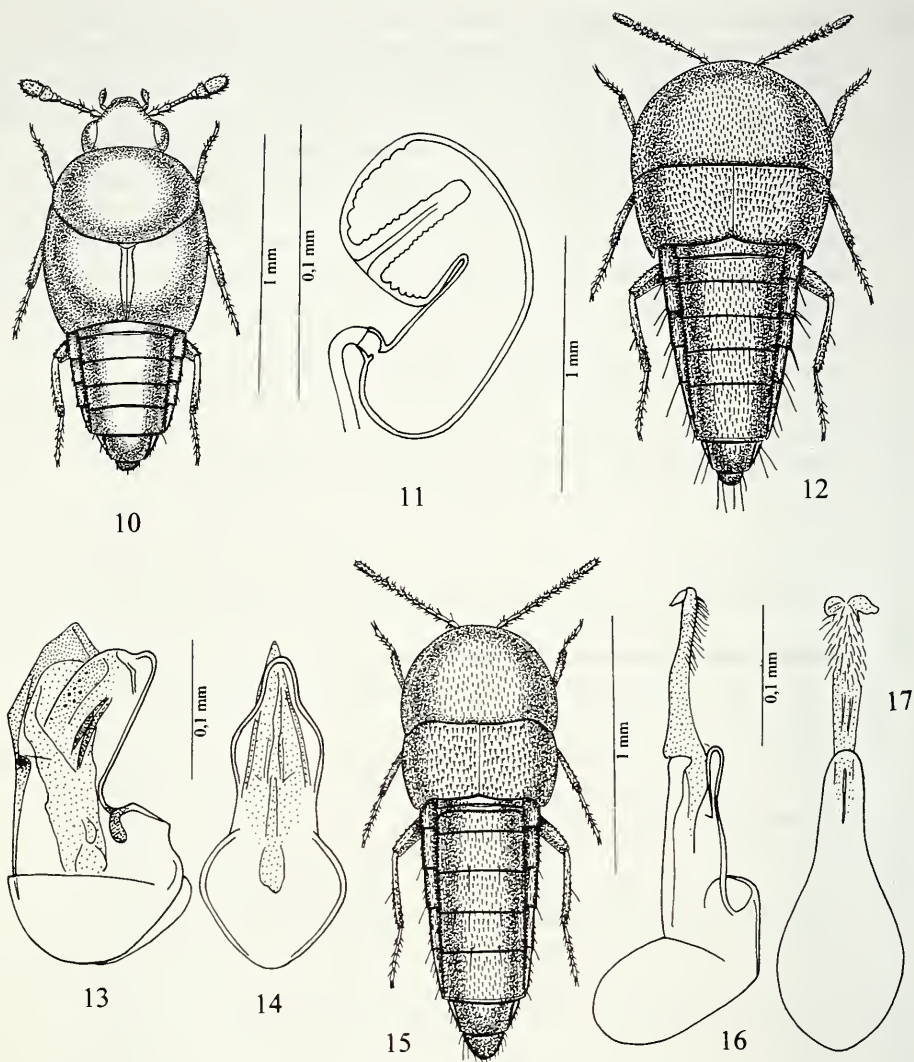
- 14 Abdomen brown-reddish with yellow-reddish base; pronotum with four points set in rectangle; aedeagus deeply and broadly arched to the level of the «crista apicalis», Figs 41-42. Length 1.9 mm *L. directum* sp. n.
 - Abdomen brown-reddish, without yellow-reddish base 15
- 15 Pigidium yellow-reddish; pronotum obliquely narrow to the anterior border, Fig 45; apex of the aedeagus to form of small hook in lateral view, Figs 43-44. Length 2.1 mm *L. hamifer* sp. n.
 - Pigidium brown-reddish; pronotum arched to the anterior border, Fig. 46; apex of the aedeagus finished like circular shovel, in ventral view, Figs 47-48. Length 1.8 mm *L. dilatatiapex* sp. n.
- 16 Side borders of the pronotum reddish; abdomen brown unicoloured; aedeagus Figs 51-52; spermatheca Fig. 53. Length 1.9 mm
 *L. lamelliferum* sp. n.
 - Pronotum unicoloured; bicoloured abdomen brown and reddish 17
- 17 Eleventh antennomere as long as the seven immediately precedents reunited antennomere, Fig. 54; aedeagus Figs 55-56. Length 2.7 mm
 *L. audax* sp. n.
 - Eleventh antennomere as long as the two immediately precedents reunited antennomere, Fig. 58; spermatheca Fig. 57. Length 2.7 mm
 *L. cacuminum* sp. n.
- 18 Suture of the elytra longer than the median line of the pronotum; pronotum with four discal points in square; abdomen yellow-reddish with a brown band; spermatheca Fig. 60. Length 2 mm *L. anguineatheca* sp. n.
 - Suture of the elytra as long as the median line of the pronotum or slightly shorter; pronotum never with four discal points in square; abdomen without brown band 19
- 19 Eleventh antennomere as long as the seven preceding reunited antennomere, Fig. 61; elytra yellow-reddish; tricoloured abdomen reddish with yellow-reddish pigidium and brown base of the free uroterga; basal bulb of the aedeagus narrow, in ventral view, Figs 62-63. Length 2.7 mm
 *L. nechamifer* sp. n.
 - Eleventh antennomere as long as the three immediately precedents reunited antennomere, Fig. 67; elytra brown-reddish, unicoloured abdomen brown-reddish; basal bulb of the aedeagus a great deal dilated, in ventral view, Figs 64-65; spermatheca Fig. 66. Length 1.8 mm
 *L. ventriosatheca* sp. n.

***Leucocraspedum sinuatum* sp. n.**

Figg. 12-14

Holotypus maschio, Sabah, Mt. Kinabalu Nat. Pk., Poring Hot Springs, 510 m. 12.V.1987, leg. A. Smetana, (MHNG).

DESCRIZIONE: Lunghezza 1,7 mm. Corpo lucido e bruno con pronoto e metà posteriore del quinto urotergo libero del maschio giallo-rossicci; antenne e zampe gialle. La reticolazione è assente su tutto il corpo. Il pronoto è coperto di granulosità molto superficiale, le elitre e l'addome di granulosità distinta. Le elitre sono cortissime, più corte e più strette del pronoto. Edeago Figg. 13-14.



FIGG. 10-17

Habitus, spermatheca e eedeago in visione laterale e ventrale. (10-11) *Cypha sabahensis* sp. n. (12-14) *Leucocraspedum sinuatum* sp. n. (15-17) *Leucocraspedum pilosellum* sp. n.

DERIVATIO NOMINIS: La nuova specie prende nome dai lati sinuosi del suo eedeago.

Leucocraspedum pilosellum sp. n.

Figg. 15-17

Holotypus maschio, Borneo-Sabah, Mt. Kinabalu Nat. Pk., Poring Hot Springs, 510 m, 13.V.1987, leg. A. Smetana (MHNG).

DESCRIZIONE: Lunghezza 1,7 mm. Corpo lucido e giallo-rossiccio, comprese antenne e zampe. La reticolazione del pronoto e dell'addome è assente, quella delle

elitre è superficiale. La granulosità del pronoto e dell'addome è fine, quella delle elitre è distinta. Edeago Figg 15-16.

DERIVATIO NOMINIS: La nuova specie prende nome dal ciuffo di peli dell'armatura genitale interna dell'edeago.

Leucocraspedum obliquum sp. n. Figg. 18-20

Holotypus maschio, Sabah, Poring Hot Springs, 500 m, 13.V.1987, leg. Burckhardt & Löbl (MHNG).

DESCRIZIONE: Lunghezza 1,7 mm. Corpo lucido e giallo-rossiccio, comprese antenne e zampe. La reticolazione manca su tutto il corpo. La granulosità del pronoto è molto superficiale, quella delle elitre è saliente e quella dell'addome è ben distinguibile. Edeago Figg. 19-20.

DERIVATIO NOMINIS: La nuova specie prende nome dai lati obliqui in avanti del pronoto.

Leucocraspedum spirasferum sp. n. Figg. 21-22

Holotypus femmina, Borneo, Sabah, Poring Hot Springs, 500 m, 6.V.1987, leg. Burckhardt & Löbl (MHNG).

Paratypus: 1 femmina, Borneo, Sabah, Mt. Kinabalu N.P., Poring Hot Springs, 550 m, 7.V.1987, leg. Burckhardt & Löbl

DESCRIZIONE: Lunghezza 2,2 mm. Corpo lucido e giallo-rossiccio; antenne rossicce con i tre antennomeri basali rossicci; zampe gialle. La reticolazione del capo e dell'addome è assente, quella delle elitre è superficiale. La granulosità del pronoto è superficiale, quella delle elitre è saliente e quella dell'addome è ben visibile. Spermateca Fig. 22.

DERIVATIO NOMINIS: La nuova specie prende nome dalla porzione distale della spermateca che descrive diverse spire, perciò è chiamata «portatrice di spire».

Leucocraspedum biguttiae sp. n. Figg. 23-24

Holotypus femmina, Sabah, Mt. Kinabalu Nat. Pk., Poring Hot Springs, area blw Langanan Fall, 850-900 m, 14.V.1987, leg. A. Smetana (MHNG).

DESCRIZIONE: Lunghezza 1,8 mm. Corpo lucido e giallo sporco; antenne brune con i tre antennomeri basali gialli; zampe giallo-rossicce. La reticolazione è assente su tutto il corpo. La granulosità del pronoto è molto superficiale, quella delle elitre e dell'addome è superficiale. Spermateca Fig. 24.

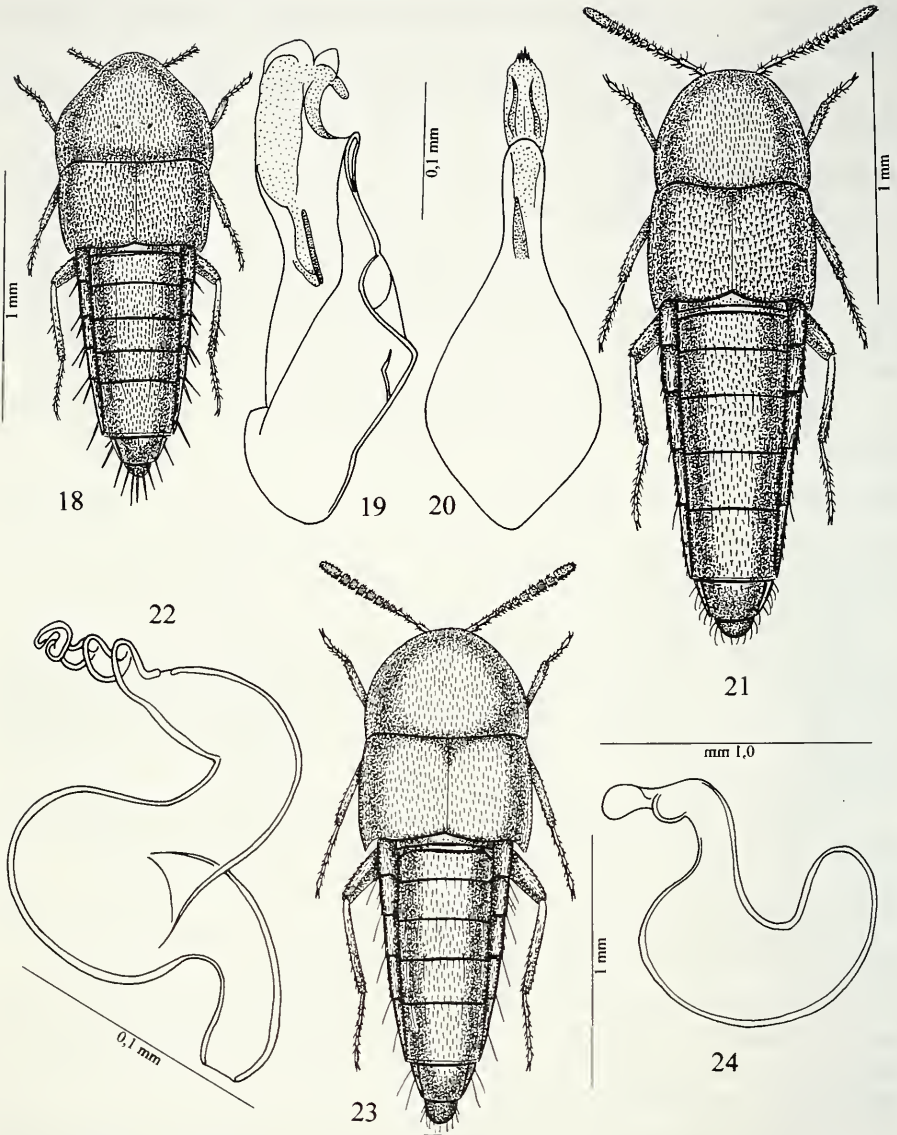
DERIVATIO NOMINIS: La nuova specie prende nome dalla porzione distale della spermateca che ha forma di due gocce.

Leucocraspedum occultum sp. n. Figg. 25-27

Holotypus maschio, Sabah, Mt. Kinabalu Nat. Pk., Poring Hot Springs, 510 m, 12.V.1987, leg. A. Smetana, (MHNG).

Paratypus: 1 maschio, Sabah, Poring Hot Springs, 550-600m, 9.V.1987, leg. Burckhardt & Löbl.

DESCRIZIONE: Lunghezza 1,7 mm. Corpo lucido e giallo sporco con pigidio giallo-rossiccio chiaro; antenne giallo-rossicce con i cinque antennomeri basali gialli;



FIGG. 18-24

Habitus, edeago in visione laterale e ventrale e spermateca. (18-20) *Leucocraspedum obliquum* sp. n. (21-22) *Leucocraspedum spirasferum* sp. n. (23-24) *Leucocraspedum biguttata* sp. n.

zampe gialle. La reticolazione del pronoto e dell'addome è assente, quella delle elitre è superficiale. La granulosità del pronoto è molto superficiale, quella delle elitre e dell'addome è ben visibile. Edeago Figg. 26-27.

DERIVATIO NOMINIS: La nuova specie prende nome dal fatto che era occultata o nascosta tra gli esemplari di *L. sinuatum* sp. n. e *L. pilosellum* sp. n.

Leucocraspedum mimanaticula sp. n.

Figg. 28-29

Holotypus femmina, Sabah, Crocker Ra., 1200 m, Km 63 r.te Kota Kinabalu-Tambunan, 19.V.1987, leg. Burckhardt & Löbl. (MHNG).

DESCRIZIONE: Lunghezza 1,7 mm. Corpo lucido e giallo-rossiccio; antenne rossicce con i quattro antenomeri basali gialli; zampe giallo-rossicce. La reticolazione del corpo è assente. La granulosità del pronoto è superficiale, quella delle elitre e dell'addome è saliente. Spermateca Fig. 29.

DERIVATIO NOMINIS: La nuova specie prende nome di «imitatrice di *anaticula*» poiché la sua spermateca è simile a quella di *L. anaticula* sp. n.

Leucocraspedum divisum sp. n.

Figg. 30-33

Holotypus maschio, Sabah, Poring Hot Springs, 500 m, 8.V.1987, leg. Burckhardt & Löbl.

Paratypi: 1 maschio e 1 femmina, Sabah, Poring Hot Springs, Langanan Falls, 900-950 m, 12.V.1987, leg. Burckhardt & Löbl.

DESCRIZIONE: Lunghezza 1,8 mm. Corpo lucido e giallo-rossiccio con base degli uroterghi liberi secondo e terzo rossiccia e base degli uroterghi liberi quarto e quinto bruna; antenne rossicce con i tre antenomeri basali gialli; zampe gialle. La reticolazione del corpo è assente. La granulosità del pronoto e dell'addome è superficiale, quella delle elitre è saliente. Edeago Figg. 32-33, spermateca Fig. 31.

DERIVATIO NOMINIS: La nuova specie prende nome di «divisa» poiché il suo edeago ha la lamina ventrale separata dal tubulo che contiene l'armatura genitale interna.

Leucocraspedum anaticula sp. n.

Figg. 34-35

Holotypus femmina, Sabah, Mt. Kinabalu Nat. Pk., Poring Hot Springs, 485 m, 29.VIII.1987, leg. A. Smetana, (MHNG).

DESCRIZIONE: Lunghezza 1,9 mm. Corpo lucido. Capo e pronoto gialli, elitre giallo-brune e addome bruno con pigidio giallo-rossiccio; antenne giallo-rossicce; zampe gialle. La reticolazione del pronoto e delle elitre è molto superficiale, quella dell'addome è assente. La granulosità del pronoto è indistinta, quella delle elitre è superficiale e quella dell'addome è ben visibile. Spermateca Fig. 35.

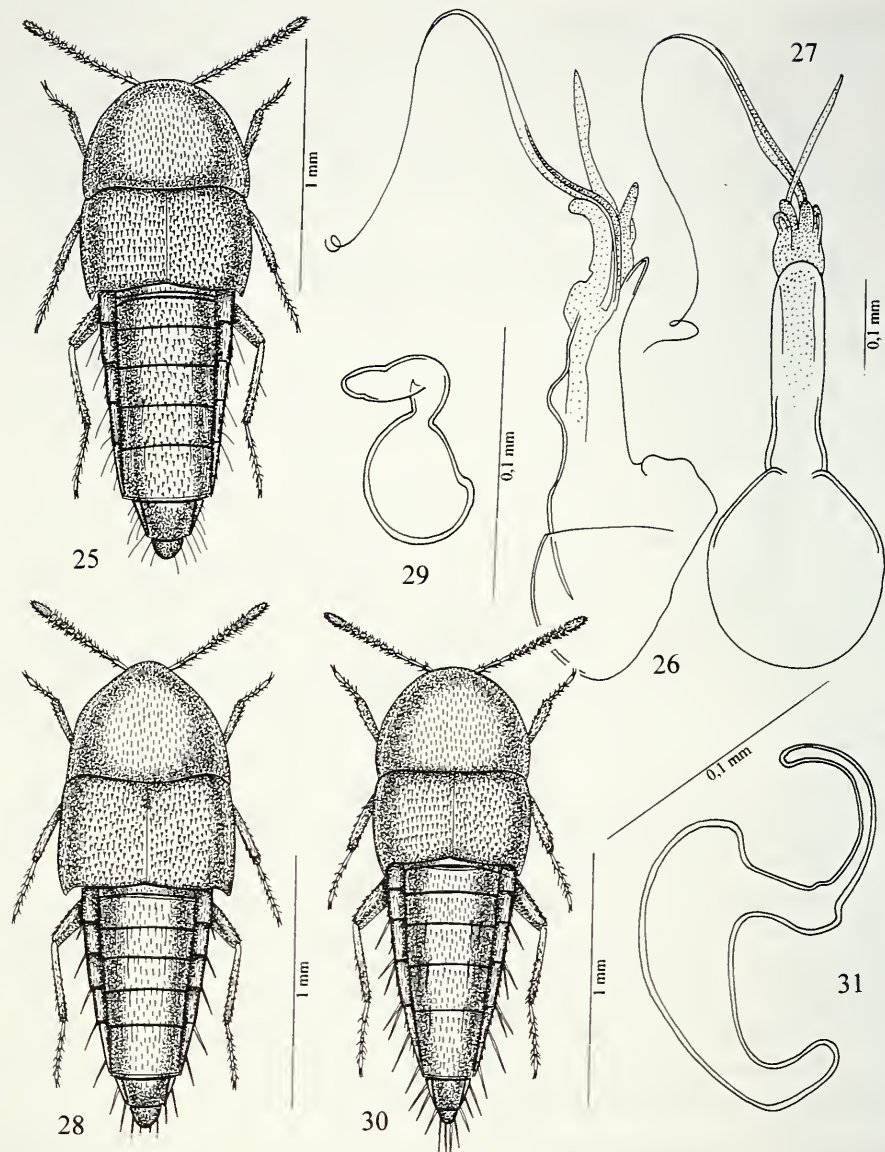
DERIVATIO NOMINIS: La nuova specie prende nome di «anatroccolo» perché la sua spermateca ricorda il profilo di una piccola anitra.

Leucocraspedum fugitivum sp. n.

Figg. 36-39

Holotypus maschio, Borneo, Sabah, Mt. Kinabalu Nat. Pk., HQ at Liwagu Rv., 1500 m, 4.VIII.1988, leg. A. Smetana (MHNG).

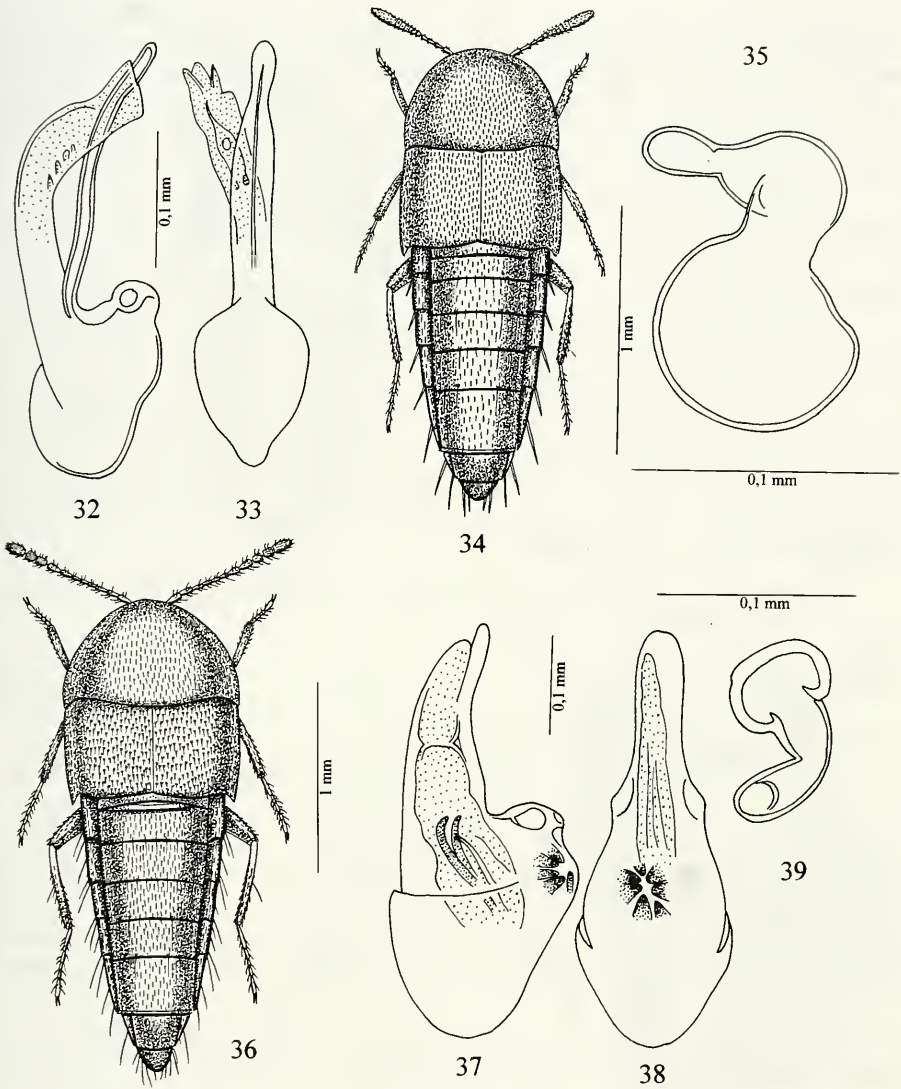
Paratypi: 10 esemplari, Borneo, Sabah, Mt Kinabalu Nat. Pk., HQ at Livagu Rv., 1500m, 17.V.1987, leg. A. Smetana; 8 es., Borneo, Sabah, Mt Kinabalu Nat. Pk., Silau-Silau Trail, 1558m, 2.IX.1988, leg. D.E. Bright; 1 es, Borneo-Sabah, Mt Kinabalu Nat. Pk. HQ, Silau-Silau Trail, 1560m, 23.V.1987, leg. A. Smetana; 2 es., Borneo, Sabah, Mt Kinabalu Nat. Pk., Headquarters, 1550m, 3-12.VIII.1988, beating foliage, leg. D.E. Bright; 2 es., Borneo-Sabah, Mt Kinabalu Nat. Pk., Headquarters, 1560m, 24.IV.1987, beating foliage, leg. D.E. Bright; 1 maschio, Borneo, Sabah, Mt Kinabalu Nat. Pk., Poring Hot Springs, 486m, 14.VIII.1988, leg. D.E. Bright.



FIGG. 25-31

Habitus, edeago in visione laterale e ventrale e spermateca. (25-27) *Leucocraspedum occultum* sp. n. (28-29) *Leucocraspedum mimanaticula* sp. n. (30-31) *Leucocraspedum divisum* sp. n.

DESCRIZIONE: Lunghezza 2,6 mm. Corpo lucido. Capo, pronoto e pigidio giallo-rossicci, elitre e addome rossicci; antenne giallo-rossicce con i tre antenomeri basali gialli; zampe giallo-rossicce. La reticolazione del corpo è assente. La granulosità del pronoto manca, quella delle elitre è ben visibile e quella dell'addome è fine. Edeago Figg. 37-38, spermateca Fig. 39.



FIGG. 32-39

Eedeago in visione laterale e ventrale, habitus e spermatheca. (32-33) *Leucocraspedum divisum* sp. n. (34-35) *Leucocraspedum anaticula* sp. n. (36-39) *Leucocraspedum fugitivum* sp. n.

DERIVATIO NOMINIS: La nuova specie poiché è presente in differenti località ha suggerito il nome di «fuggitiva».

Leucocraspedum directum sp. n.

Figg. 40-42

Holotypus maschio, Sabah, Mt. Kinabalu Nat. Pk., Poring Hot Springs, 510 m, 12.V.1987, leg. A. Smetana, (MHNG).

Paratypus: 1 maschio, Sabah, Poring Hot Springs, 500 m, 7.V.1987, leg. Burckhardt & Löbl.

DESCRIZIONE: Lunghezza 1,9 mm. Corpo lucido e giallo-rossiccio con elitre e uroterghi liberi terzo, quarto, quinto e sesto bruno-rossicci; antenne rossicce con i tre antennomeri basali gialli; zampe gialle. Sul pronoto e sull'addome la reticolazione manca, sulle elitre è ben visibile. La granulosità del pronoto è fine e superficiale, quella delle elitre e dell'addome è saliente. Il pronoto presenta sul disco quattro punti disposti in quadrato. Edeago Figg. 41-42.

DERIVATIO NOMINIS: La nuova specie prende nome di «rettilinea» poiché la parte distale dell'edeago è appunto rettilinea, in visione laterale.

***Leucocraspedum hamifer* sp. n.**

Figg. 43-45

Holotypus maschio, Borneo-Sabah, M. Kinabalu N.P., Summit Trail, 1890 m, leg. A. Smetana, (MHNG).

DESCRIZIONE: Lunghezza 1,9 mm. Corpo lucido. Capo, pronoto e pigidio giallo-rossicci, resto del corpo bruno-rossiccio; antenne giallo-rossicce con i tre antennomeri basali gialli e l'undicesimo bruno-rossicci. La reticolazione del pronoto è assente, quella delle elitre è superficiale e quella dell'addome è molto svanita. La granulosità del pronoto è fine e molto superficiale, quella delle elitre è ben visibile e quella dell'addome è saliente. Edeago Figg. 43-44.

DERIVATIO NOMINIS: La nuova specie prende nome di «portatrice di amo» perché l'apice dell'edeago ha forma di amo.

***Leucocraspedum dilatatiapex* sp. n.**

Figg. 46-49

Holotypus maschio, Sabah, Mt. Kinabalu Nat. Pk., Poring Hot Springs, 510 m, 12.V.1987, leg. A. Smetana, (MHNG).

Paratypus: Sabah, Poring Hot Springs, 550-600 m, 9.V.1987, leg. Burckhardt & Löbl.

DESCRIZIONE: Lunghezza 1,8 mm. Corpo lucido. Capo e pronoto giallo-rossicci, elitre e addome bruno-rossicci; antenne rossicce con i tre antennomeri basali gialli e l'undicesimo bruno-rossiccio; zampe gialle. Solo le elitre presentano una reticolazione che però è molto superficiale, sul resto del corpo non è visibile alcun tipo di reticolazione. La granulosità del pronoto è fitta, fine e superficiale, quella delle elitre e dell'addome è saliente. Apice dell'edeago a paletta circolare Figg. 47-48, spermateca Fig. 49.

DERIVATIO NOMINIS: La nuova specie prende nome di «apice dilatato». L'apice dilatato è quello dell'edeago.

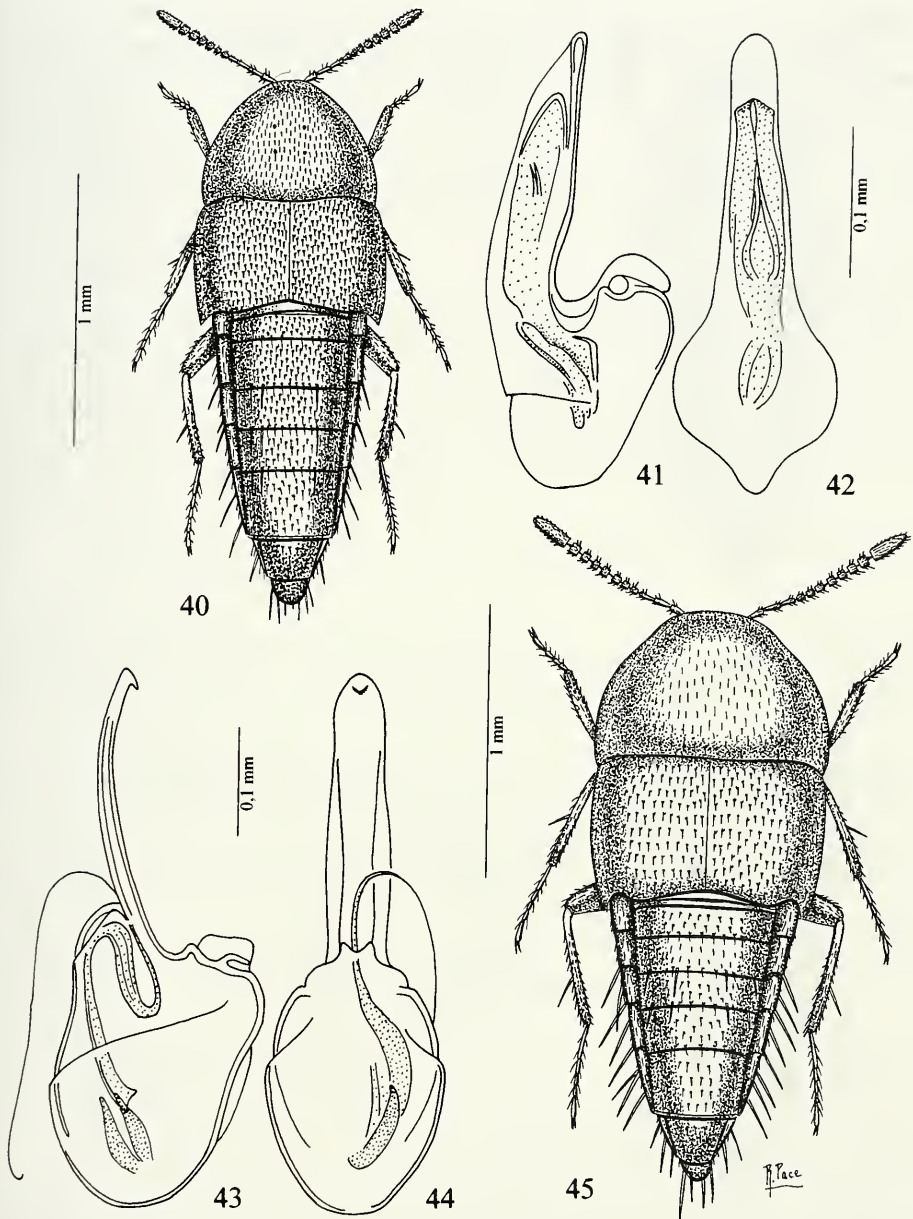
***Leucocraspedum lamelliferum* sp. n.**

Figg. 50-53

Holotypus maschio, Borneo-Sabah, Mt. Kinabalu, Poring Hot Springs, 500 m, 13.V.1987, leg. A. Smetana (MHNG).

Paratypi: 1 femmina, Borneo-Sabah, Mt. Kinabalu, Poring Hot Springs, 490 m, 16.VIII.1988, leg. A. Smetana; 1 femmina, Sabah, Poring Hot Springs, 500 m, 7.V.1987, leg. Burckhardt & Löbl.

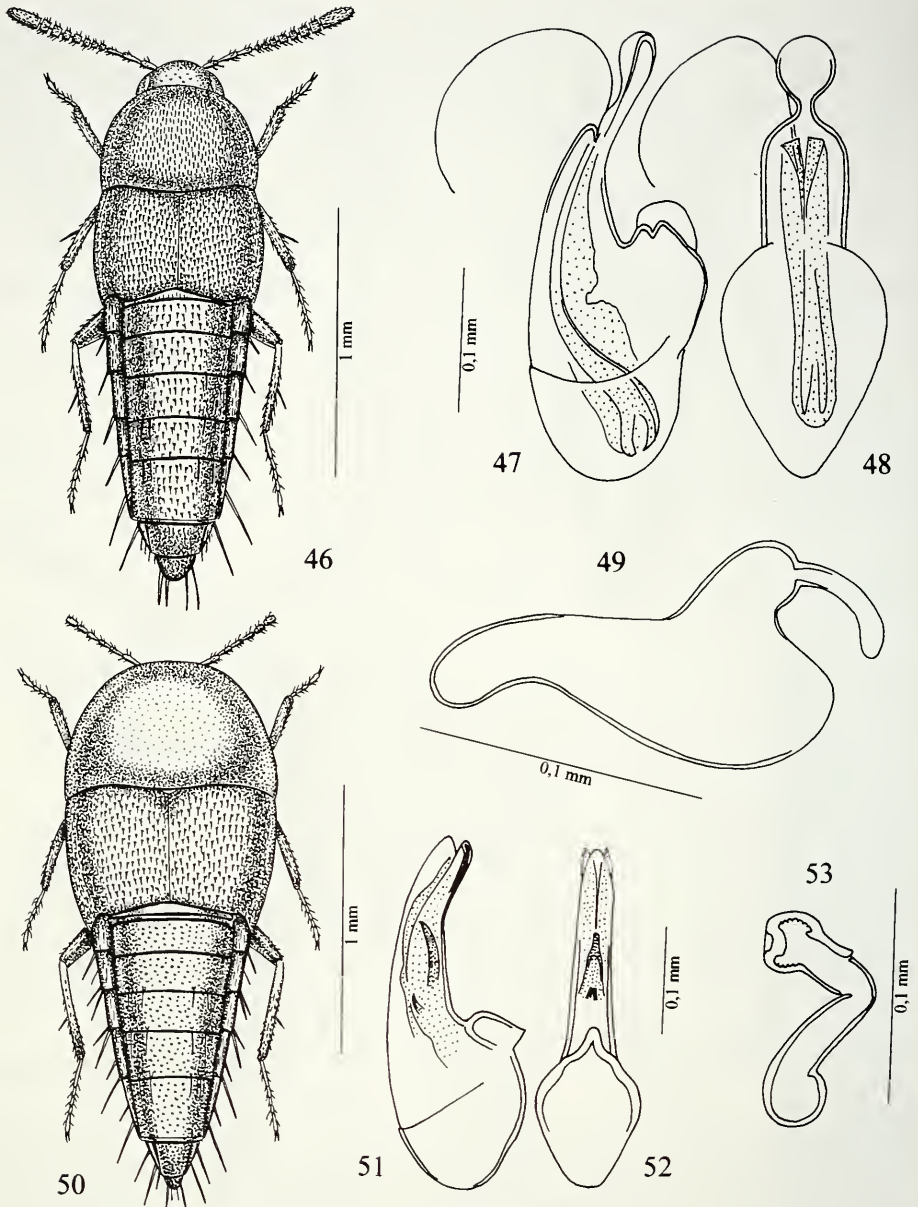
DESCRIZIONE: Lunghezza 1,9 mm. Corpo lucido. Capo e pronoto bruno-rossicci con margini laterali rossicci, resto del corpo bruno; antenne gialle; zampe giallo-rossicce. La reticolazione del corpo manca. La granulosità del pronoto è finissima e fitta, quella delle elitre e dell'addome è saliente. Edeago Figg. 51-52, spermateca Fig. 53.



FIGG. 40-45

Habitus e edeago in visione laterale e ventrale. (40-42) *Leucocraspedum directum* sp. n. (43-45) *Leucocraspedum hamifer* sp. n.

DERIVATIO NOMINIS: Il nome della nuova specie significa «portatore di lamella». La lamella è quella dell'armatura genitale interna dell'edeago.



FIGG. 46-53

Habitus, edeago in visione laterale e ventrale e spermateca. (46-49) *Leucocraspedum dilatatiapex* sp. n. (50-53) *Leucocraspedum lamelliferum* sp. n.

Leucocraspedum audax sp. n.

Figg. 54-56

Holotipus maschio, Borneo Sabah, Mt. Kinabalu Nat Pk., HQ 1560 m, 24.IV.1987, Beating foliage, D.E Bright collector (MHNG).

DESCRIZIONE: Lunghezza 2,7 mm. Corpo lucido e bruno-rossiccio con pigidio rossiccio; antenne gialle; zampe giallo-rossicce. La reticolazione è presente solo sulle elitre dove è superficiale. La granulosità del pronoto è fine e distinta, quella delle elitre è saliente. Gli uroterghi liberi sono coperti di scultura squamiforme. Edeago Figg. 55-56.

DERIVATIO NOMINIS: Il nome della nuova specie di «audace» è stato suggerito dall'aggressiva armatura genitale interna dell'edeago a forma di gancio.

Leucocraspedum cacuminum sp. n.

Figg. 57-58

Holotypus femmina, Borneo, Sabah, Mt. Kinabalu N.P., summit trail Pondok-Ubah, 2050 m, 26.IV.1987, leg. A. Smetana (MHNG).

DESCRIZIONE: Lunghezza 2,7 mm. Corpo lucido e rossiccio con gli uroterghi liberi secondo, terzo e quarto bruni; antenne brune con i tre antennomeri basali gialli; zampe giallo-rossicce. La reticolazione del corpo è assente. La granulosità del pronoto è fine e distinta, quella delle elitre è molto saliente e quella dell'addome è squamiforme. Spermateca Fig. 57.

DERIVATIO NOMINIS: Il nome della nuova specie significa «delle vette». È stata infatti raccolta ad alta quota.

Leucocraspedum anguineatheca sp. n.

Figg. 59-60

Holotypus femmina, Borneo, Sabah, M. Kinabalu, 2600 m, 2.V.1987, leg. A. Smetana (MHNG).

DESCRIZIONE: Lunghezza 2 mm. Corpo lucido e giallo-rossiccio con elitre e base degli uroterghi liberi primo, secondo e terzo rossicci, quarto e base del quinto bruni; antenne rossicce con i quattro antennomeri basali giallo-rossicci; zampe giallo-rossicce. La reticolazione del pronoto è assente, quella delle elitre è superficiale. La granulosità del pronoto è molto superficiale, quella delle elitre è saliente. Spermateca Fig. 60.

DERIVATIO NOMINIS: Il nome della nuova specie significa «spermateca a forma di serpente». La parte distale di quest'organo, infatti, ha la figura di serpente.

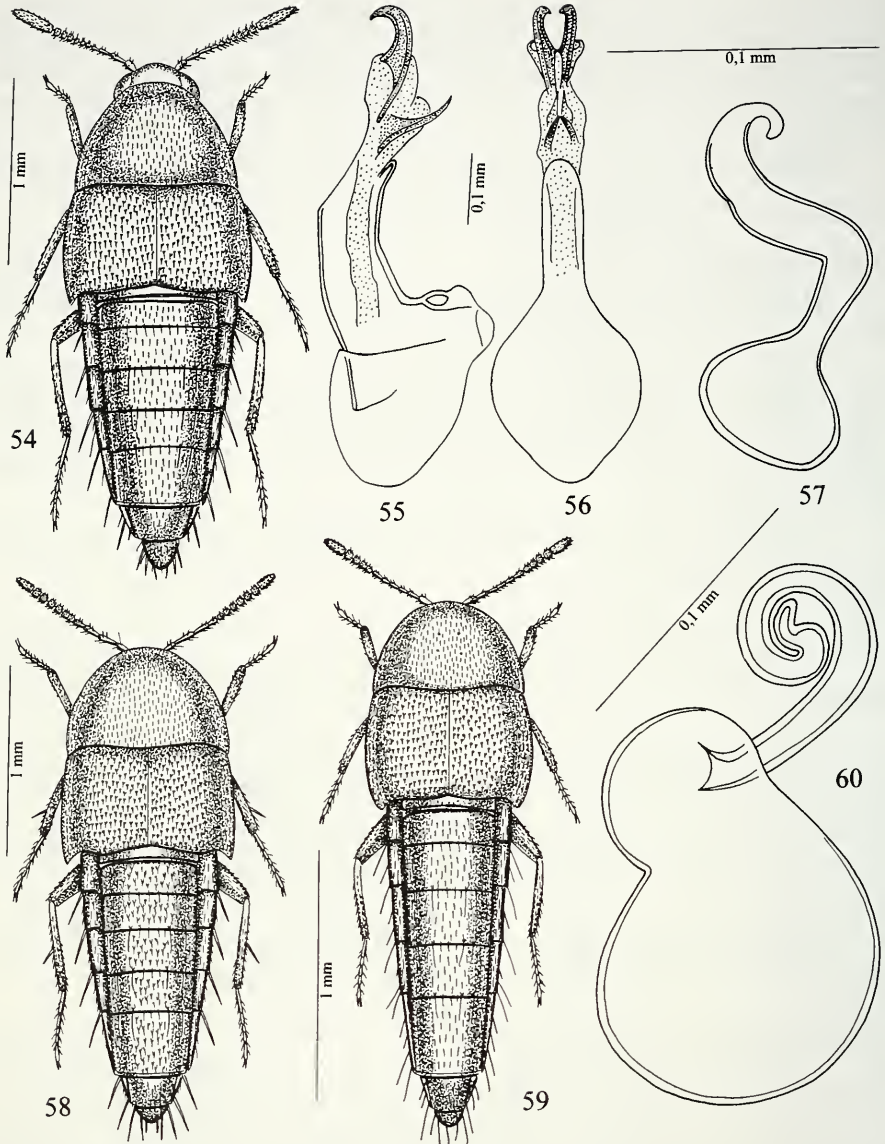
Leucocraspedum nehamifer sp. n.

Figg. 61-63

Holotypus maschio, Borneo, Sabah, Mt. Kinabalu N.P., Liwagu River tr., 1495-1550 m, 12.VIII.1988, leg. A. Smetana (MHNG).

DESCRIZIONE: Lunghezza 2,7 mm. Corpo lucido. Capo e pronoto bruni, margine posteriore del pronoto giallo-rossiccio, elitre giallo-rossicce, addome rossiccio con base di ciascun urotergo libero bruna, pigidio giallo-rossiccio; antenne gialle con i tre antennomeri distali giallo-rossicci; zampe brune con femori giallo-rossicci. La reticolazione è assente su tutto il corpo. La granulosità del pronoto è fitta e finissima, quella delle elitre e dell'addome è saliente. Edeago Figg. 62-63.

DERIVATIO NOMINIS: Il nome della nuova specie significa «non portatrice di amo». Prima di dissezionare l'esemplare, secondo mia ipotesi provvisoria l'avevo determinato come *L. hamifer* sp. n., sopra descritto.



FIGG. 54-60

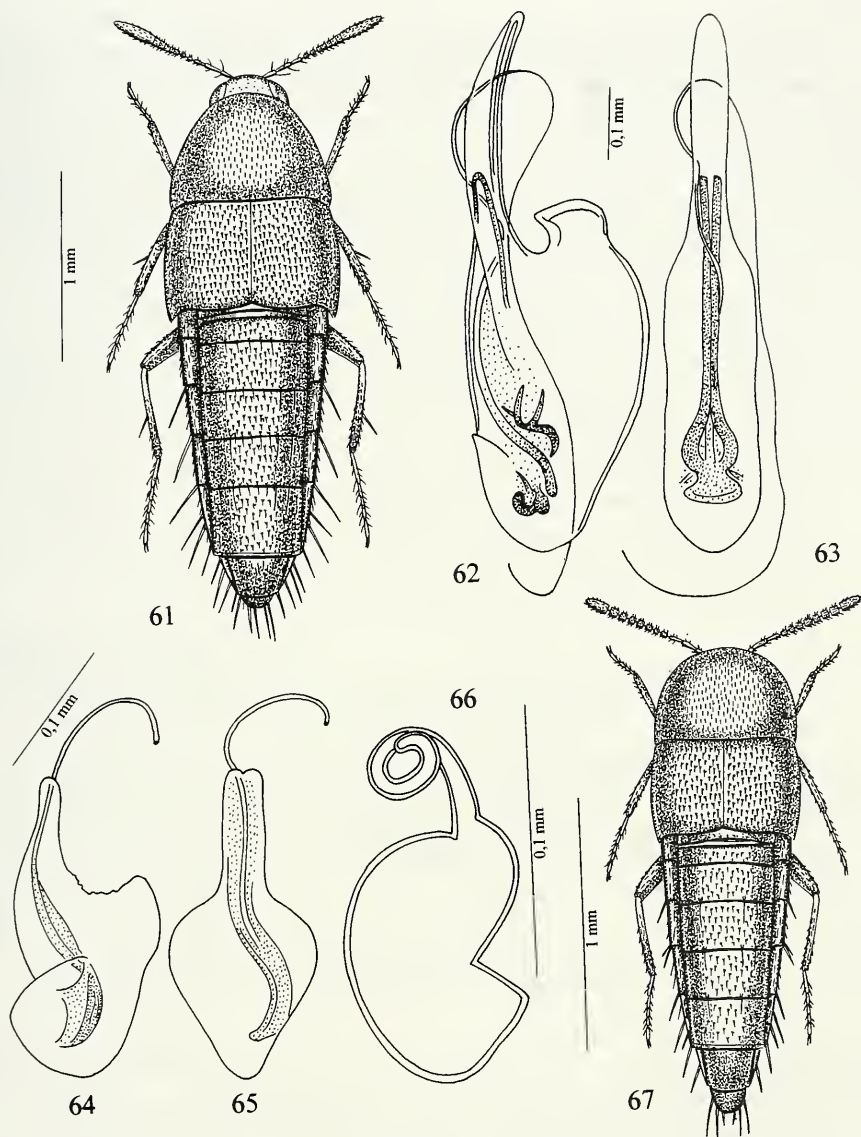
Habitus, edeago in visione laterale e ventrale e spermatheca. (54-56) *Leucocraspedum audax* sp. n. (57-58) *Leucocraspedum cacuminum* sp. n. (59-60) *Leucocraspedum anguineatheca* sp. n.

Leucocraspedum ventriosatheca sp. n.

Figg. 64-67

Holotypus maschio, Borneo-Sabah, Mt. Kinabalu. Poring Hot Springs, 500 m, 13.V.1987, leg. Burckhardt & Löbl (MHNG).

Paratypus: 1 femmina, Sabah, Poring Hot Springs, Langanan Falls, 900-950 m, 12.V.1987, leg. Burckhardt & Löbl.



FIGG. 61-67

Habitus, edeago in visione laterale e ventrale e spermateca. (61-63) *Leucocraspedum nechamifer* sp. n. (64-67) *Leucocraspedum ventriosatheca* sp. n.

DESCRIZIONE: Lunghezza 1,8 mm. Corpo lucido. Capo e pronoto giallo-rossicci, elitre e addome bruno-rossicci; antenne bruno-rossicce con i tre antenomeri basali gialli; zampe gialle. La reticolazione è assente su tutto il corpo. La granulosità del pronoto e dell'addome è ben visibile, quella delle elitre è saliente. Edeago Figg. 64-65, spermateca Fig. 66.

DERIVATIO NOMINIS: Il nome della nuova specie significa «spermateca panciuta».

HYGRONOMINI

Nessuna specie di questa tribù era finora nota per il Borneo (Hammond, 1984). Per i caratteri della spermateca e a motivo della taglia corporea e dell'habitus, le specie del genere *Hygrochara* Cameron, 1939, si rivelano tassonomicamente affini al genere *Apimela* Mulsant & Rey, 1874. I due generi sono collocati in due tribù differenti a motivo della formula tarsale: 4-4-4 per *Hygrochara* e 5-5-5 per *Apimela* (Oxypodini). Pertanto l'attribuzione di *Hygrochara* alla tribù Hygronomini è qui del tutto provvisoria in attesa di una revisione delle specie di altri generi affini appartenenti a questo gruppo.

CHIAVE DELLE SPECIE DEL GENERE *HYGROCHARA* CAMERON, 1939, NEL BORNEO

- 1 Occhi molto ridotti; sutura delle elitre più corta della linea mediana del pronoto 2
- Occhi grandi; sutura delle elitre lunga quanto la linea mediana del pronoto o più lunga 3
- 2 Corpo snello, Fig. 68; undicesimo antennumero giallo; elitre e quarto urotergo libero rossicci; edeago poco arcuato al lato ventrale, Figg. 69-70; spermateca minore, Fig. 71. Lunghezza 1,3 mm . *H. micropallida* sp. n.
- Corpo tozzo, Fig. 72; undicesimo antennumero bruno; elitre e quarto urotergo libero giallo-rossicci; edeago molto arcuato al lato ventrale, Figg. 73-74; spermateca maggiore, Fig. 75. Lunghezza 1,28 mm
..... *H. microkinabaluicola* sp. n.
- 3 Quarto antennumero trasverso; sutura delle elitre lunga quanto la linea mediana del pronoto; pigidio giallo-rossiccio; edeago con due spine ventrali, Figg. 77-78; spermateca Fig. 79. Lunghezza 2 mm . . *H. spiniventris* sp. n.
- Quarto antennumero più lungo che largo; sutura delle elitre più lunga della linea mediana del pronoto; pigidio bruno-rossiccio; edeago senza spine ventrali, Figg. 73-74; spermateca Fig. 75. Lunghezza 2,1 mm
..... *H. kinabaluensis* sp. n.

KEY TO SPECIES OF THE GENUS *HYGROCHARA* CAMERON, 1939, FROM BORNEO

- 1 Eyes distinctly reduced; suture of the elytra shorter than the median line of the pronotum 2
- Eyes large; suture of the elytra as long as the median line of the pronotum or longer 3
- 2 Body slender, Fig. 68; eleventh antennomere yellow; elytra and fourth free uroterga reddish; aedeagus a little arched to the ventral side, Figs 69-70; spermatheca smaller, Fig. 71. Length 1.3 mm . . . *H. micropallida* sp. n.
- Body stumpy, Fig. 72; eleventh antennomere brown; elytra and fourth free uroterga yellow-reddish; aedeagus very arched to the ventral side, Figs 73-74; spermatheca larger, Fig. 75. Length 1.28 mm
..... *H. microkinabaluicola* sp. n.
- 3 Fourth antennomere transverse; suture of the elytra as long as the median line of the pronotum; pigidium yellow-reddish; aedeagus with two ventral thorns, Figs 77-78; spermatheca Fig. 79. Length 2 mm
..... *H. spiniventris* sp. n.

- Fourth antennomere longer than wide; suture of the elytra longer than the median line of the pronotum; pigidium brown-reddish; aedeagus without ventral thorns, Figs 73-74; spermatheca Fig. 75. Length 2.1 mm
 *H. kinabaluensis* sp. n.

***Hygrochara micropallida* sp. n.**

Figg. 68-71

Holotypus maschio, Sabah, Mt. Kinabalu Nat. Pk., Poring Hot Springs, 485 m, 29.VIII.1988, leg. A. Smetana (MHNG).

Paratypi: 4 esemplari, stessa provenienza dell'holotpus; 1 maschio e 1 femmina, Sabah, Poring Hot Springs, 600 m, 10.V.1987, leg. Burckhardt & Löbl.

DESCRIZIONE: Lunghezza 1,3 mm. Corpo lucido e giallo-rossiccio con elitre e uroterghi liberi quarto e base del quinto rossicci; antenne bruno-rossicce con i tre antennomeri basali e l'undicesimo gialli; zampe gialle. La reticolazione è assente su tutto il corpo. La punteggiatura del capo è fine, fitta e distinta, quella del pronoto è superficiale. La granulosità delle elitre è superficiale e quella dell'addome è ben visibile. Edeago Figg. 69-70, spermateca Fig. 71.

DERIVATIO NOMINIS. Il nome della nuova specie significa «piccolissima e pallida».

***Hygrochara microkinabaluicola* sp. n.**

Figg. 72-75

Holotypus maschio, Borneo, Sabah, Mt. Kinabalu N. P., Poring Hot Springs, area Eastern Ridge tr., 850 m, 28.VIII.1988, leg. A. Smetana, (MHNG).

Paratypi: 1 maschio e 1 femmina, stessa provenienza dell'holotpus.

DESCRIZIONE: Lunghezza 1,28 mm. Corpo lucido e giallo-rossiccio con pigidio giallo; antenne brune con i tre antennomeri basali gialli; zampe gialle. La reticolazione del capo e del pronoto è superficiale, quella delle elitre e dell'addome manca. La punteggiatura del capo e del pronoto è quasi indistinta. La granulosità delle elitre è fitta e superficiale, quella dell'addome è svanita e meno fitta di quella delle elitre. Edeago Figg. 73-74, spermateca Fig. 75.

DERIVATIO NOMINIS: Il nome della nuova specie significa «piccolissima abitatrice del Kinabalu».

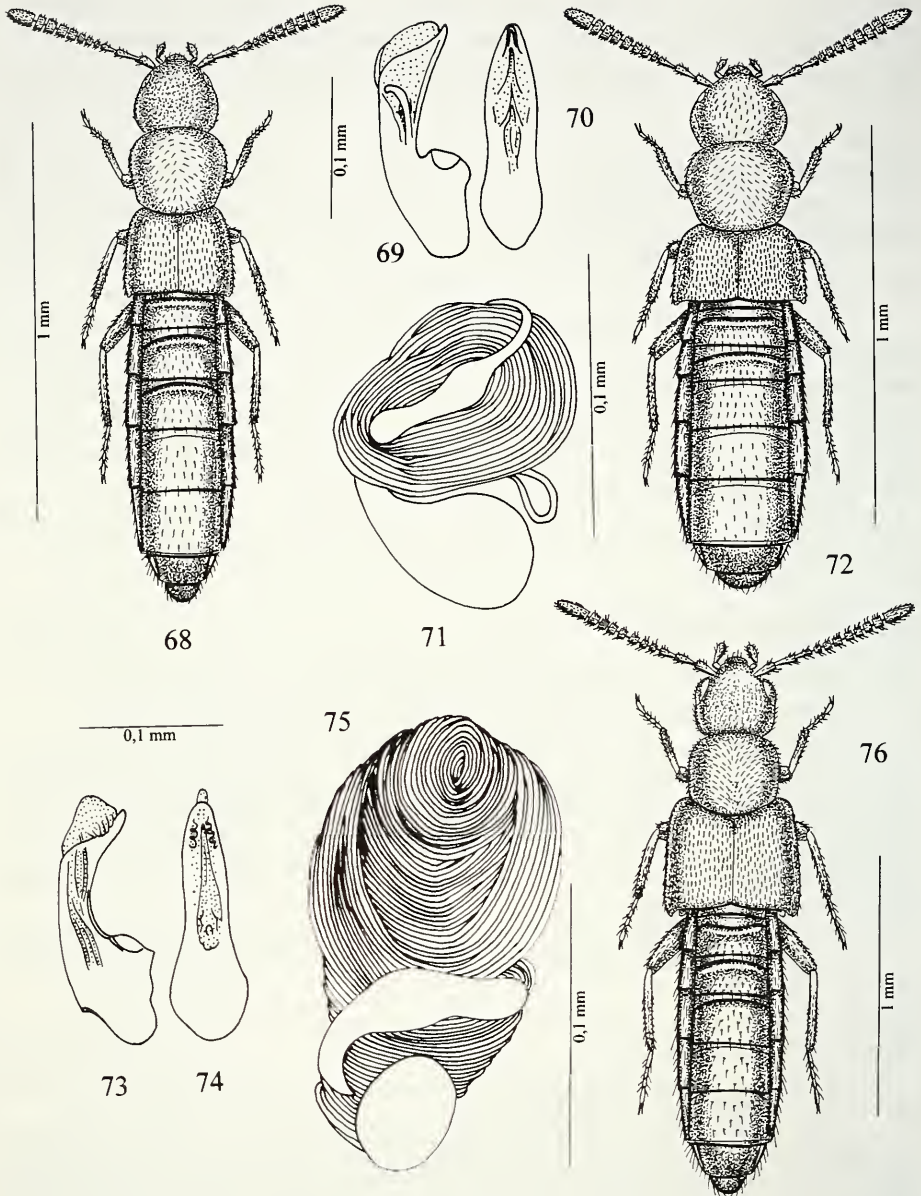
***Hygrochara spiniventris* sp. n.**

Figg. 76-79

Holotypus maschio, Borneo, Sabah, Mt. Kinabalu N.P., HQ Liwagu Rv. tr., 1655 m, 11.VIII.1988, leg. A. Smetana (MHNG).

Paratypi: 9 esemplari, stessa provenienza dell'holotpus; 2 es., Borneo, Sabah, Mt. Kinabalu N.P., HQ Liwagu Rv. tr., 1485 m, 10.VIII.1988, leg. A. Smetana; 1 maschio, Borneo, Sabah, Mt. Kinabalu N.P., HQ Liwagu Rv. tr., 1495 m, 22.V.1987, leg. A. Smetana; 1 maschio, Borneo, Sabah, Mt. Kinabalu N.P., HQ at Liwagu River, 1505 m, 14.VIII.-1.IX.1988, leg. A. Smetana

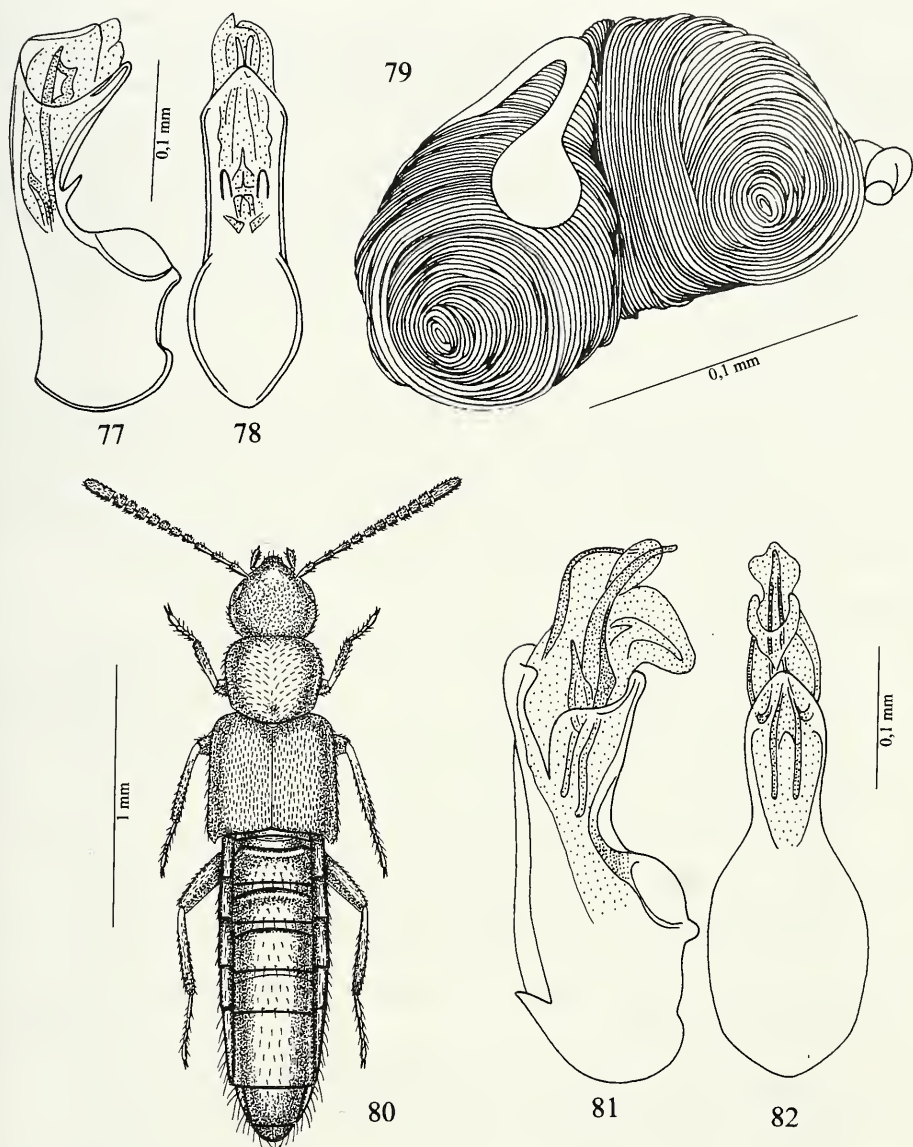
DESCRIZIONE: Lunghezza 2 mm. Corpo lucido e bruno-rossiccio con gli uroterghi liberi quarto e quinto bruni; antenne bruno-rossicce con i due antennomeri basali gialli e l'undicesimo rossiccio; zampe gialle. L'avancorpo è privo di reticolazione, quella dell'addome è a maglie trasverse fini e ben visibili. La punteggiatura del capo è fine e distinta, quella del pronoto è superficiale e quella delle elitre è finissima, fit-



FIGG. 68-76

Habitus, edeago in visione laterale e ventrale e spermateca. (68-71) *Hygrochara micropallida* sp. n. (70-75) *Hygrochara microkiabaluicola* sp. n. (76) *Hygrochara spiniventris* sp. n.

tissima e nettamente visibile. L'addome è coperto di granulosità fine, più fitta sui tre uroterghi liberi basali. Il disco del capo è impresso. Edeago Figg. 77-78, spermateca Fig. 79.



FIGG. 77-82

Edeago in visione laterale e ventrale, spermateca e habitus. (77-79) *Hygrochara spiniventris* sp. n. (80-82) *Hygrochara kinabaluensis* sp. n.

DERIVATIO NOMINIS: Il nome della nuova specie significa «spine ventrali», quelle dell'edeago.

Hygrochara kinabaluensis sp. n.

Figg. 80-83

Holotypus maschio, Borneo, Sabah, Mt. Kinabalu N.P., HQ Liwagu Rv. tr., 1655 m, 11.VIII.1988, leg. A. Smetana (MHNG).

Paratypi: 19 esemplari, stessa provenienza.

DESCRIZIONE: Lunghezza 2,1 mm. Corpo lucido e bruno-rossiccio con capo e uroterghi liberi quarto e base del quinto bruni, pigidio giallo-rossiccio; antenne brune con i due antennomeri basali gialli il terzo e l'undicesimo bruno-rossicci; zampe gialle. L'avancorpo è privo di reticolazione, l'addome è coperto di reticolazione trasversa ben visibile. La punteggiatura del capo e del pronoto è fitta, fine e distinta. La granulosità delle elitre è così fitta da simulare una reticolazione. La granulosità dell'addome è più fitta sugli uroterghi liberi basali che sui posteriori. Il capo presenta una debole impressione discale e il pronoto una debole fossetta mediana posteriore. Edeago Figg. 81-82, spermateca Fig. 83.

PLACUSINI

Del Borneo è citata (Hammond, 1984) una specie considerata largamente diffusa nel Sudest Asiatico, *Placusa acuminata* Kraatz, 1859. Nel materiale in esame non ho riconosciuto questa specie. Ho esaminato 8 esemplari della serie tipica di *Placusa acuminata* così etichettati: Ceylon, J. Nietner, *Placusa acuminata* Kr. (DEI). Ho scelto come lectotipo un maschio il cui edeago è illustrato alle Figg. 88-89. Presente designazione. La spermateca di un paralectotipo è quella di Fig. 90.

CHIAVE DELLE SPECIE DEL GENERE *PLACUSA* ERICHSON, 1837, NEL BORNEO

- 1 Pronoto con due fossette discali; elitre con reticolazione obliqua molto trasversa; femori robusti; edeago Figg. 85-86, spermateca Fig. 87. Lunghezza 1,9 mm *P. robustipes* sp. n.
- Pronoto senza fossette discali; elitre senza reticolazione o con reticolazione superficiale, ma non obliqua o trasversa; femori esili 2
- 2 Pronoto notevolmente più ristretto in avanti che all'indietro, Fig. 91 3
- Pronoto poco ristretto in avanti 4
- 3 Antennomeri nono e decimo molto trasversi; occhi più corti delle tempie; sutura delle elitre lunga quanto la linea mediana del pronoto; margine posteriore del sesto urotergo libero del maschio con quattro corti denti a ciascun lato dell'incavatura mediana; edeago con un lunghissimo tubulo dell'armatura genitale interna, Figg. 88-89; spermateca Fig. 90. Lunghezza 2,5 mm *P. acuminata* Kraatz
- Antennomeri nono e decimo lunghi quanto larghi; occhi più lunghi delle tempie; sutura delle elitre più corta della linea mediana del pronoto; margine posteriore del sesto urotergo libero del maschio rettilineo; edeago con corto tubulo dell'armatura genitale interna, Figg. 92-93. Lunghezza 2,2 mm *P. superba* sp. n.
- 4 Antennomeri nono e decimo lunghi quanto larghi; sesto urotergo libero del maschio con margine posteriore plurilobato tra due spine, Fig. 97; edeago Figg. 95-96. Lunghezza 2,1 mm *P. recensita* sp. n.
- Antennomeri nono e decimo molto trasversi; sesto urotergo libero del maschio con margine posteriore rettilineo o monolobato tra due spine, Fig. 105 5
- 5 Corpo unicolore nero; edeago Figg. 99-100. Lunghezza 2,1 mm *P. falcifera* sp. n.

- Corpo bicolore bruno e rossiccio 6
- 6 Pronoto con punti isolati allineati a ciascun lato della linea mediana; edeago Figg. 103-104; spermateca Fig 102. Lunghezza 2 mm . *P. evoluta* sp. n.
- Pronoto senza punti come sopra; spermateca Fig. 107. Lunghezza 1,7 mm *P. subspinigera* sp. n.

KEY TO SPECIES OF THE GENUS *PLACUSA* ERICHSON, 1837, FROM BORNEO

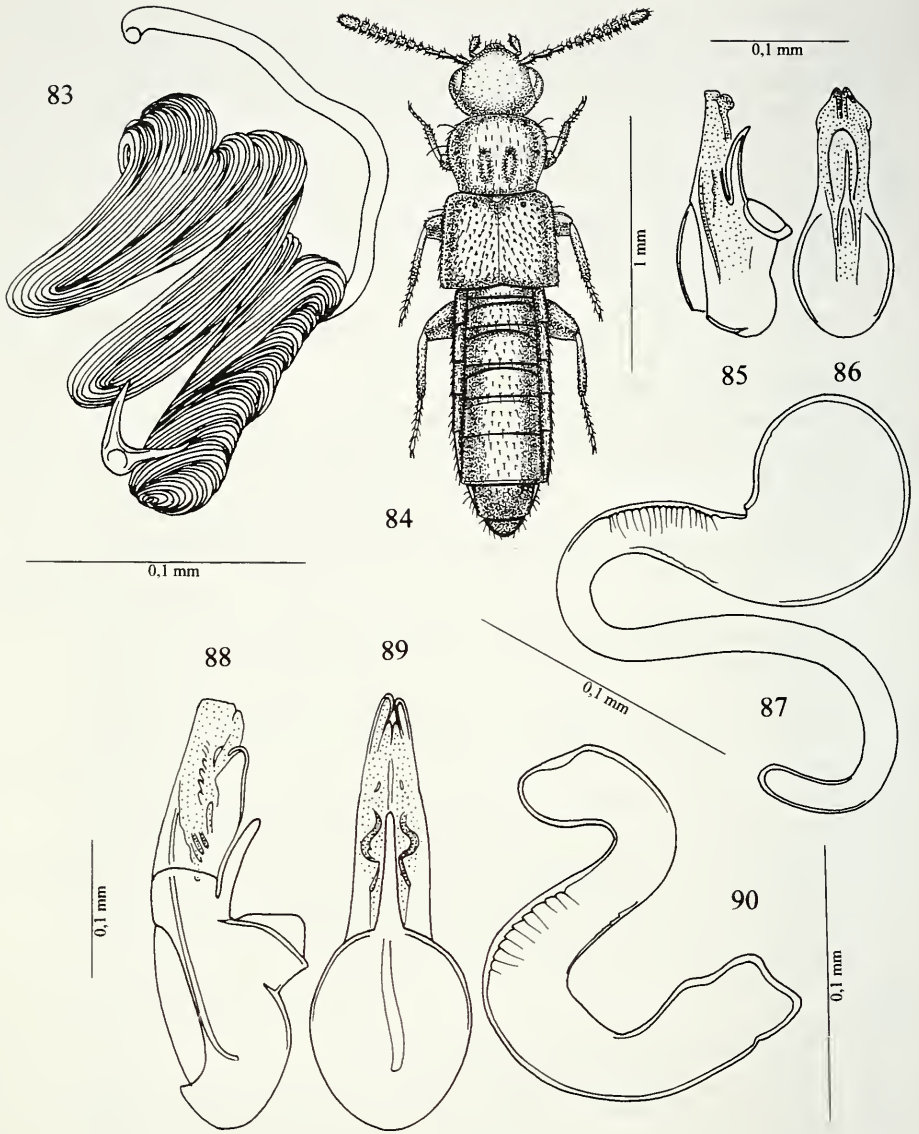
- 1 Pronotum with two impressions on the disc; elytra with very transverse oblique reticulation; femurs strong; aedeagus Figs 85-86, spermatheca Fig. 87. Length 1.9 mm *P. robustipes* sp. n.
- Pronotum without impressions on the disc; elytra without reticulation or with superficial reticulation, but not oblique or transverse; femurs slender . . . 2
- 2 Pronotum more retracted in front, Fig. 91 3
- Pronotum a little retracted in front, Fig. 94 4
- 3 Ninth and tenth antennomeres very transverse; eyes shorter than the temples; suture of the elytra as long as the median line of the pronotum; distal border of the sixth free urotergum of the male with four short teeth to every side of the median hollow; aedeagus with a long tubule of the inside genital armour, Figs 88-89; spermatheca Fig. 90. Length 2.5 mm *P. acuminata* Kraatz
- Ninth and tenth antennomeres as long as wide; eyes longer than the temples; suture of the elytra shorter than of the median line of the pronotum; distal border of the sixth free urotergum of the male rectilinear; aedeagus with short tubule of the inside genital armour, Figs 92-93. Length 2.2 mm *P. superba* sp. n.
- 4 Ninth and tenth antennomeres as long as wide; sixth free urotergum of the male with distal border plurilobed among two thorns, Fig. 97; aedeagus Figs 95-96. Length 2.1 mm *P. recensita* sp. n.
- Ninth and tenth antennomeres very transverse; sixth free urotergum of the male with rectilinear distal border or monolobed between two thorns, Fig. 105 5
- 5 Body unicolourous black; aedeagus Figs 99-100. Length 2.1 mm *P. falcifera* sp. n.
- Body bicolourous brown and reddish 6
- 6 Pronotum with isolated points lined up to every side of the median line; aedeagus Figs 103-104; spermatheca Fig 102. Length 2 mm . . *P. evoluta* sp. n.
- Pronotum without points as above; spermatheca Fig. 107. Length 1.7 mm *P. subspinigera* sp. n.

Placusa robustipes sp. n.

Figg. 84-87

Holotypus maschio, Borneo, Sabah, Mt. Kinabalu Nat.Pk., HQ at Liwagu Rv., 1500 m, 21.V.1987, D.E Bright collector (MHNG).

Paratypi: 1 maschio e 2 femmine, stessa provenienza dell'holotypus; 4 es., Borneo Sabah, Mt. Kinabalu Nat Pk., HQ 1560 m, 24.IV.1987, D.E Bright collector; 1 maschio, Borneo, Sabah, Mt Kinabalu Nat. Pk., HQ at Livagu Rv., 1500m, 21.V.1987, beating foliage, leg. D.E. Bright.



FIGG. 83-90

Spermateca, habitus e edeago in visione laterale e ventrale. (83) *Hygrochara kinabaluensis* sp. n. (84-87) *Placusa robustipes* sp. n. (88-90) *Placusa acuminata* Kraatz, lectotypus maschio e paralectotypus femmina.

DESCRIZIONE: Lunghezza 1,9 mm. Corpo bruno e lucidissimo con addome debolmente opaco; antenne brune con i due antennomeri basali bruno-rossicci; zampe giallo-rossicce. La reticolazione del capo e dell'addome manca, quella del pronoto è obliqua, ondulata e superficiale, quella delle elitre è pure obliqua, molto trasversa e

netta. La punteggiatura del capo è superficiale e rada, quella del pronoto manca tranne per forti punti isolati distribuiti come da Fig. 84, quella delle elitre è netta. L'addome è coperto di granulosità fitta. Edeago Figg. 85-86, spermoteca Fig. 87.

DERIVATIO NOMINIS: Il nome della nuova specie significa «zampe robuste».

Placusa superba sp. n.

Figg. 91-93

Holotypus maschio, Borneo, Sabah, Mt. Kinabalu Nat.Pk., Poring Hot Springs, 485 m, 24.VIII.1988, leg. A. Smetana (MHNG).

DESCRIZIONE: Lunghezza 2,2 mm. Corpo bruno e opaco con addome debolmente lucido. Antenne brune con antennumero basale giallo-rossiccio; zampe giallo-rossicce. La reticolazione del capo è superficiale, quella del resto del corpo manca. La granulosità dell'avancorpo è saliente, quella dell'addome è superficiale. Edeago Figg. 91.

Placusa recensita sp. n.

Figg. 94-97

Holotypus maschio, Borneo, Sabah, Mt. Kinabalu Nat. Pk., Poring Hot Springs, 480 m, 15.V.1987, leg. A. Smetana (MHNG).

DESCRIZIONE: Lunghezza 2,1 mm. Corpo lucido e bruno con pronoto e addome giallo-bruni; antenne brune con i due antennumeri basali rossicci; zampe giallo-rossicce. La reticolazione del capo è ben visibile, quella del pronoto manca, quella delle elitre e dell'addome è superficiale. La granulosità del capo e delle elitre è distinta, quella del pronoto e dell'addome è superficiale. Edeago Figg. 95-96, sesto urotergo libero del maschio Fig. 97.

DERIVATIO NOMINIS: Il nome della nuova specie significa «passata in rassegna».

Placusa falcifera sp. n.

Figg. 98-100

Holotypus maschio, Borneo, Sabah, Mt. Kinabalu N.P., Poring Hot Springs, 500 m, 6.V.1987, leg. Burckhardt & Löbl (MHNG).

DESCRIZIONE: Lunghezza 1,7 mm. Corpo lucido e nero pece; antenne nere con i tre antennumeri basali gialli e i tre seguenti rossicci; zampe gialle. La reticolazione del capo e dell'addome è ben visibile, quella del pronoto manca e quella delle elitre è superficiale. La granulosità del capo è poco distinta, quella del pronoto e dell'addome è saliente, quella delle elitre è superficiale. Edeago Figg. 99-100.

DERIVATIO NOMINIS: Il nome della nuova specie significa «portatrice di falce». La lama ventrale dell'edeago, infatti, ha forma di falce.

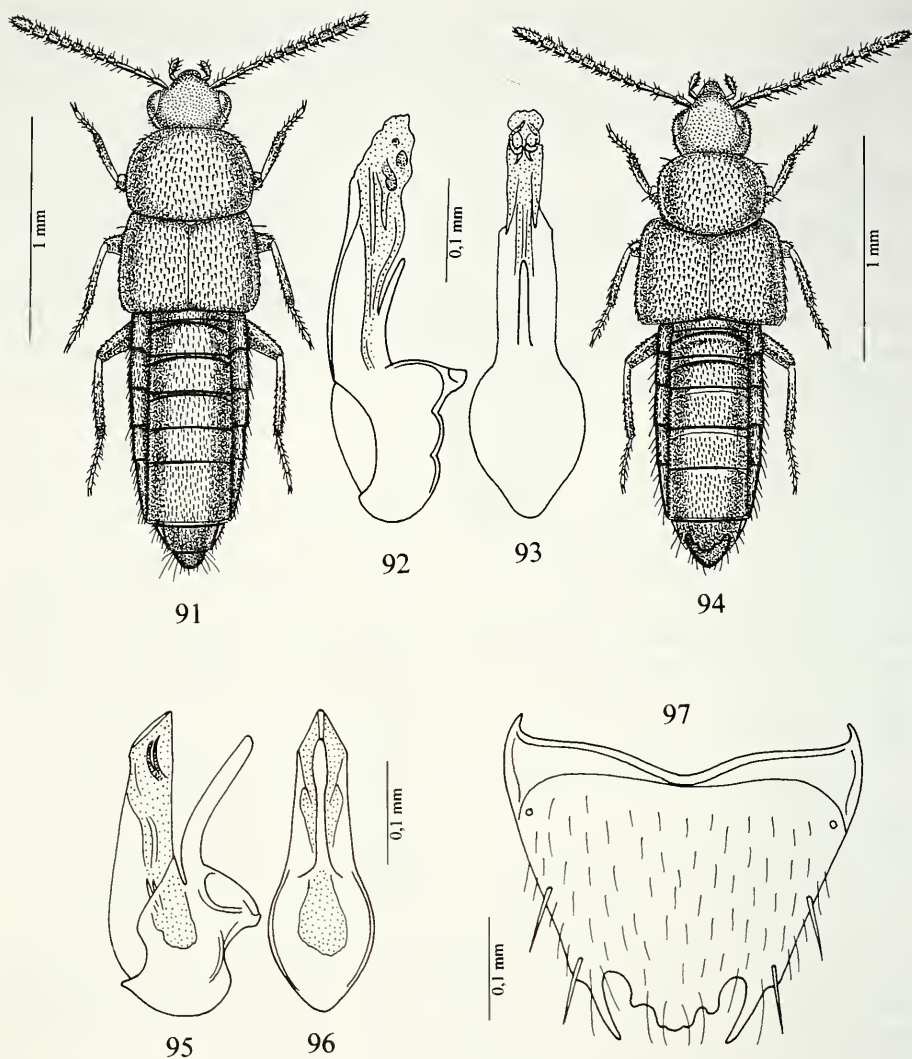
Placusa evoluta sp. n.

Figg. 101-105

Holotypus maschio, Sabah, Poring Hot Springs, nr. Bat Cave, 600 m, 10.V.1987, leg. Burckhardt & Löbl (MHNG).

Paratypus: 1 femmina, Borneo, Sabah, Poring Hot Springs, 500 m, 6.V.1987, leg. Burckhardt & Löbl.

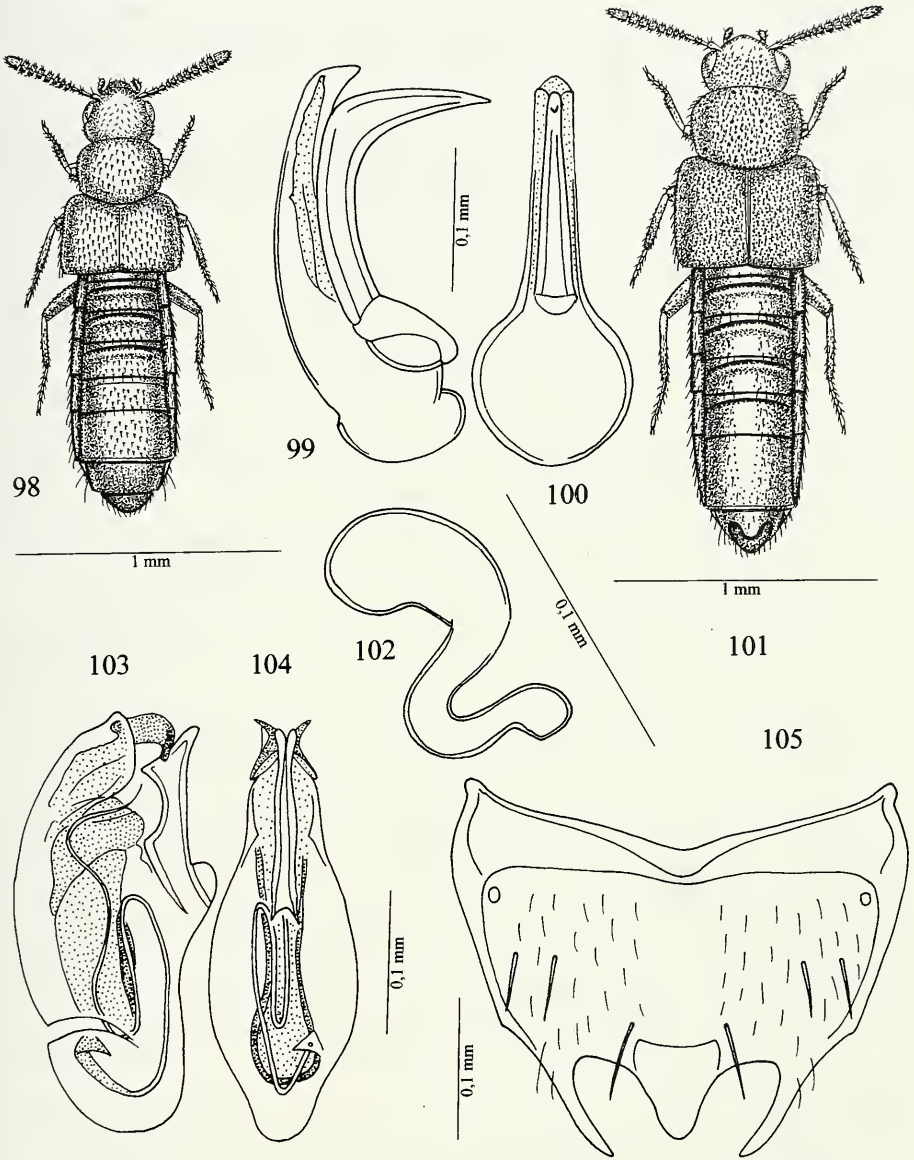
DESCRIZIONE: Lunghezza 2 mm. Corpo lucido e bruno con pronoto rossiccio e addome nero-bruno con pigidio rossiccio; antenne rossicce con i tre antennumeri basali gialli e l'undicesimo bruno-rossiccio; zampe brune con tibie e tarsi giallo-bruni.



FIGG. 91-97

Habitus, edeago in visione laterale e ventrale e sesto urotergo libero del maschio. (91-93) *Placusa superba* sp. n. (94-97) *Placusa recensita* sp. n.

L'avancorpo non è reticolato, l'addome presenta una reticolazione molto superficiale. La punteggiatura del capo è fitta e ben visibile, quella del pronoto è superficiale tranne che per i punti forti distribuiti come da Fig. 101. La granulosità delle elitre è fitta e distinta, quella dell'addome è ben visibile, ma assente sulla linea mediana di ciascun urotergo libero. Edeago Figg. 103-104, spermateca Fig. 102, sesto urotergo libero del maschio Fig. 105.



FIGG. 98-105

Habitus, edeago in visione laterale e ventrale, spermatheca e sesto urotergo libero del maschio. (98-100) *Placusa falcifera* sp. n. (101-105) *Placusa evoluta* sp. n.

DERIVATIO NOMINIS. La nuova specie prende nome di *evoluta* perché il suo edeago si presenta complesso rispetto alla semplicità dell'edeago di altre specie di *Placusa*.

Placusa subspinigera sp. n.

Figg. 106-107

Holotypus maschio, Borneo, Sabah, Mt. Kinabalu N.P., HQ Liwagu Riv. trail, 1500-1550 m, 27.IV.1987, leg. A. Smetana (MHNG).

DESCRIZIONE: Lunghezza 1,7 mm. Corpo lucido e bruno con pronoto bruno-rossiccio; antenne brune con i due antennomeri basali giallo-bruni; zampe gialle. Il corpo è privo di reticolazione. La granulosità dell'avancorpo è finissima, fitta ed evidente, quella dell'addome è ben visibile. Spermateca Fig. 107.

DERIVATIO NOMINIS: La nuova specie prende nome di «vicina a *spinigera*» perché dal confronto con la spermateca degli esemplari della serie tipica da me esaminati (8 maschi e 2 femmine etichettati Ceylon, J. Nietner, *Placusa spinigera* Kr), la nuova specie si mostra sicuramente e tassonomicamente vicina.

BOLITOCCHARINI

I generi *Erastriusa*, *Pseudatheta* e *Neoleptusa* erano finora sconosciuti per il Borneo (Hammond, 1984).

CHIAVE DELLE SPECIE DEL GENERE *ERASTRIUSA* PACE, 1990, NEL BORNEO

- 1 Pronoto con depressioni laterali; sutura delle elitre lunga quanto la linea mediana del pronoto; spermateca Fig. 109; sesto urotergo libero della femmina Fig. 110. Lunghezza 2 mm *E. masculina* sp. n.
- Pronoto senza depressioni laterali; sutura delle elitre più lunga della linea mediana del pronoto 2
- 2 Capo largo quanto il pronoto; corpo bruno con addome nero-bruno; edeago Figg. 112-113; sesto urotergo libero del maschio Fig. 114. Lunghezza 2,2 mm *E. borneensis* sp. n.
- Capo più stretto del pronoto; corpo prevalentemente giallo-rossiccio 3
- 3 Corpo interamente giallo-rossiccio; pronoto con una plica posteriore a ciascun lato del solco mediano; undicesimo antennomero giallo; edeago senza lamella ventrale Figg. 116-117; spermateca Fig. 118. Lunghezza 1,25 mm *E. minima* sp. n.
- Corpo tricolore giallo-rossiccio, rossiccio e bruno; pronoto senza plica; undicesimo antennomero bruno-rossiccio; edeago con lamella ventrale Figg. 120-121; spermateca Fig. 122. Lunghezza 2 mm *E. lobifera* sp. n.

KEY TO SPECIES OF THE GENUS *ERASTRIUSA* PACE, 1990, FROM BORNEO

- 1 Pronotum with lateral depressions; suture of the elytra as long as the median line of the pronotum; spermatheca Fig. 109; sixth free urotergum of the female Fig. 110. Length 2 mm *E. masculina* sp. n.
- Pronotum without lateral depressions; suture of the elytra longer than the median line of the pronotum 2
- 2 Head as wide as the pronotum; body brown with black-brown abdomen; aedeagus Figs 112-113; sixth free urotergum of the male Fig. 114. Length 2.2 mm *E. borneensis* sp. n.
- Head narrower than the pronotum; body predominantly yellow-reddish 3

- 3 Body entirely yellow-reddish; pronotum with a back fold to every side of the median furrow; eleventh antennomere yellow; aedeagus without ventral thin plate Figs 116-117; spermatheca Fig. 118. Length 1.25 mm
 *E. minima* sp. n.
- Body tricolorous yellow-reddish, reddish and brown; pronotum without fold; eleventh antennomere brown-reddish; aedeagus with ventral thin plate Figs 120-121; spermatheca Fig. 122. Length 2 mm . . . *E. lobifera* sp. n.

Erastriusa masculina sp. n.

Figg. 108-110

Holotypus femmina, Borneo-Sabah, Mt. Kinabalu N. P., Headquarters, 1558 m, 2.IX.1988, D.E. Bright collector (MHNG).

Paratypus: 1 femmina, stessa provenienza dell'holotypus.

DESCRIZIONE: Lunghezza 2 mm. Corpo lucido e rossiccio con pronoto e pigidio giallo-rossicci, elitre bruno-rossicce; antenne bruno-rossicce con i due antennomeri basali giallo-rossicci e i tre successivi rossicci; zampe gialle. Corpo senza reticolazione. La punteggiatura del capo è evidente e quella del pronoto è superficiale. La granulosità delle elitre è superficiale quella dell'addome è saliente. Il capo presenta un solco longitudinale discale, il pronoto mostra una depressione a ciascun lato del solco mediano. Spermatheca Fig. 109, sesto urotergo libero della femmina Fig. 110.

DERIVATIO NOMINIS: La nuova specie presenta il sesto urotergo libero della femmina con caratteri del margine posteriore che si trovano normalmente nei maschi. Per questo prende nome di «dotata dei caratteri del maschio».

Erastriusa borneensis sp. n.

Figg. 111-114

Holotypus maschio, Borneo-Sabah, Mt. Kinabalu N. P., Layang Layang, 2610 m, 2.V.1987, D.E. Bright collector (MHNG).

Paratypus: 1 maschio, stessa provenienza.

DESCRIZIONE: Lunghezza 2,2 mm. Corpo lucido e bruno con addome nero-bruno; antenne bruno-rossicce con i due antennomeri basali rossicci e apice dell'undicesimo giallo-rossiccio; zampe giallo-rossicce. La reticolazione del capo e delle elitre è netta, quella del pronoto è vigorosa e quella dell'addome è distinta. La punteggiatura del capo è ombelicata, superficiale e assente sulla fronte. La granulosità del pronoto e delle elitre è assai poco visibile, quella dell'addome è saliente sui tre uroterghi liberi basali e superficiale sui restanti. Edeago Figg. 112-113, sesto urotergo libero del maschio Fig. 114.

Erastriusa minima sp. n.

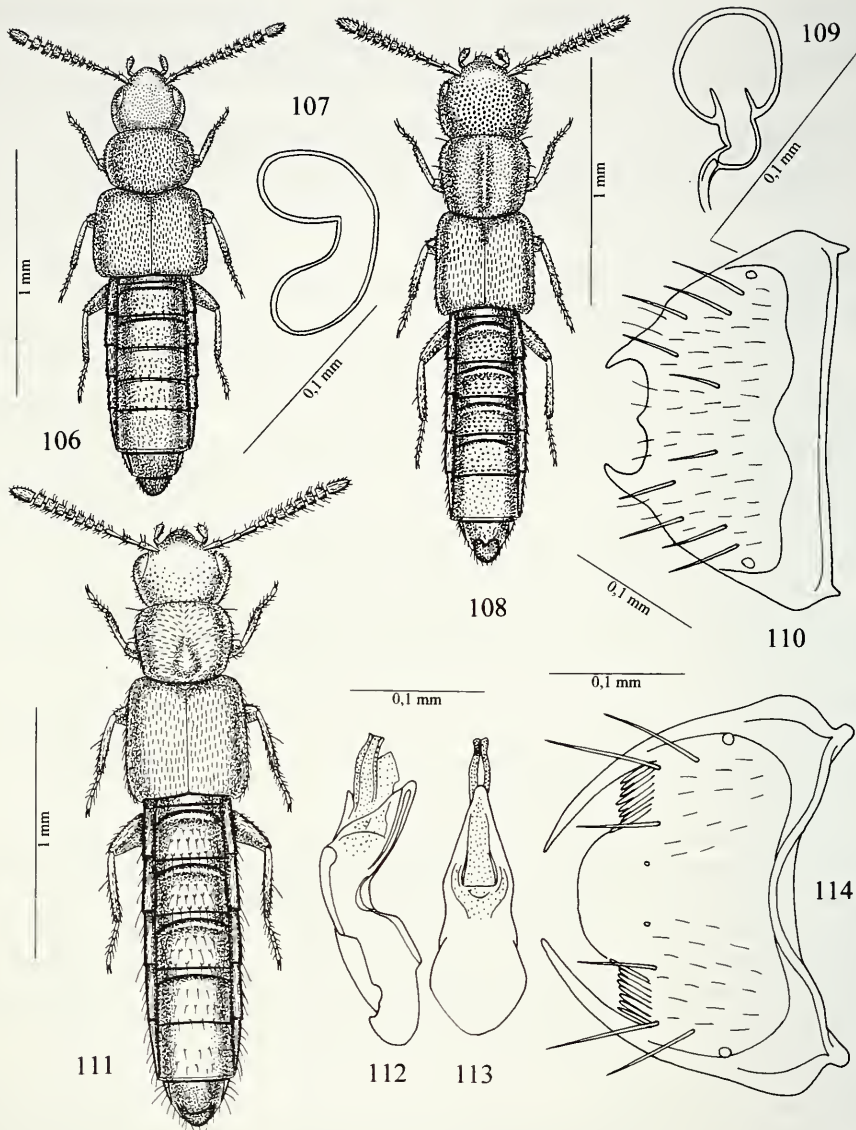
Figg. 115-118

Holotypus maschio, Sabah, Poring Hot Springs, 550-600 m, 9.V.1987, leg. Burckhardt & Löbl (MHNG).

Paratypi: 2 femmine, Sabah, Mt. Kinabalu, 1550 m, 28.IV.1987, leg. Burckhardt & Löbl.

DESCRIZIONE: Lunghezza 1,25 mm. Corpo lucido e giallo-rossiccio; antenne giallo-rossicce con i due antennomeri basali e l'undicesimo gialli; zampe gialle. Corpo senza reticolazione. La granulosità del corpo è superficiale. La fronte è solcata longitudinalmente. Il pronoto presenta una plica posteriore a ciascun lato del solco mediano. Edeago Figg. 116-117, spermatheca Fig 118.

DERIVATIO NOMINIS. Il nome della nuova specie significa «piccolissima» a motivo della taglia corporea assai ridotta.



FIGG. 106-114

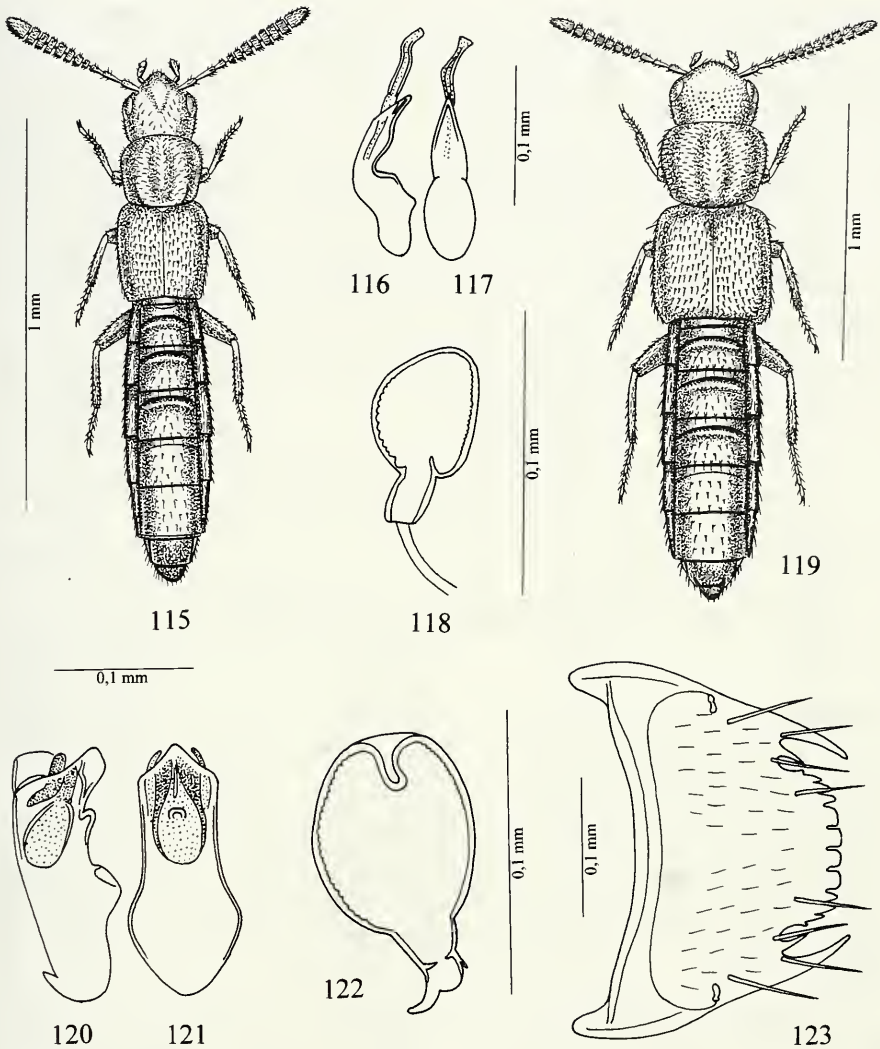
Habitus, spermateca, edeago in visione laterale e ventrale e sesto urotergo libero della femmina (110) e del maschio (114). (106-107) *Placusa subspinigera* sp. n. (108-110) *Erastriusa masculina* sp. n. (111-114) *Erastriusa borneensis* sp. n.

***Erastriusa lobifera* sp. n.**

Figg. 119-123

Holotipus maschio, Sabah, Mt. Kinabalu, 1750 m, 21.IV.1987, leg. Burckhardt & Löbl (MHNG).

Paratypi: 1 maschio e 1 femmina, stessa provenienza; 1 maschio, Sabah, Mt. Kinabalu, 1500 m, 21.V.1987, leg. Burckhardt & Löbl; 1 femmina, Borneo, Sabah, Mt. Kinabalu N. P., Headquarters, 1558 m, 9.VIII.1988, D.E. Bright collector.



FIGG. 115-123

Habitus, edeago in visione laterale e ventrale, spermateca e sesto urotergo libero del maschio. (115-118) *Erastriusa minima* sp. n. (119-123) *Erastriusa lobifera* sp. n.

DESCRIZIONE: Lunghezza 2 mm. Corpo lucido. Capo rossiccio, pronoto giallo-rossiccio, elitre brune con base giallo-bruna, addome giallo-rossiccio con quarto urotergo libero bruno; antenne bruno-rossicce con i due antenomeri basali giallo-rossicci; zampe giallo-rossicce. La reticolazione del capo è superficiale, quella del pronoto è netta e quella delle elitre e dell'addome è ben visibile. La punteggiatura del capo è distinta. La granulosità del pronoto è confusa nell'evidente reticolazione, quella delle elitre è ben visibile e quella dell'addome è saliente. Edeago Figg. 120-121, spermateca Fig. 122, sesto urotergo libero del maschio Fig. 123.

CHIAVE DELLE SPECIE DEL GENERE *PSEUDATHETA* CAMERON, 1920, NEL BORNEO

- 1 Corpo prevalentemente nero: solo gli omeri, il pigidio e l'undicesimo antennumero giallo-rossicci. Edeago Figg. 125-126, spermateca Fig. 127. Lunghezza 2,1 mm *P. borneensis* sp. n.
 - Nessuna parte del corpo è nera; undicesimo antennumero bruno 2
- 2 Pronoto rossiccio, addome unicolore giallo-bruno. Edeago Figg. 129-130, spermateca sinuosa, Fig. 127. Lunghezza 1,7 mm . . . *P. kinabaluensis* sp. n.
 - Pronoto giallo-rossiccio, addome giallo-rossiccio con una fascia giallo-bruna. Spermateca non sinuosa Fig. 133. Lunghezza 1,8 mm . *P. seditiosa* sp. n.

KEY TO SPECIES OF THE GENUS *PSEUDATHETA* CAMERON, 1920, FROM BORNEO

- 1 Body predominantly black: only the humeruses, the pigyidium and the eleventh antennumere yellow-reddish. Aedeagus Figs 125-126, spermatheca Fig. 127. Length 2.1 mm *P. borneensis* sp. n.
 - No portion of the body is black; eleventh antennumere brown 2
- 2 Pronotum reddish, abdomen unicolorous yellow-brown. Aedeagus Figs 129-130, spermatheca sinuous, Fig. 127. Length 1.7 mm *P. kinabaluensis* sp. n.
 - Pronotum yellow-reddish, abdomen yellow-reddish with a yellow-brown band. Spermatheca not sinuous Fig. 133. Length 1.8 mm *P. seditiosa* sp. n.

Pseudatheta borneensis sp. n.

Figg. 124-127

Holotypus maschio, Borneo, Sabah, Mt. Kinabalu Nat.Pk., HQ at Liwagu Rv., 1500 m, 25.IV.1987, leg. A. Smetana (MHNG).

Paratypi: 3 es., stessa provenienza; 3 esemplari, Borneo, Sabah, Mt Kinabalu Nat. Pk., HQ at Livagu Rv., 1500m, 30.V.1987, leg. A. Smetana; 17 es., Borneo, Sabah, Mt Kinabalu Nat. Pk., Silau-Silau Trail, 1560 m, 3.VIII.1988, leg. A. Smetana; 4 es., Borneo, Sabah, Mt Kinabalu Nat. Pk., Silau-Silau Trail, 1550m, 2.VIII.1988, leg. A. Smetana; 4 es., Sabah, Mt Kinabalu, 1750 m, 27.IV.1987, leg. Burckhardt & Löbl; 1 es., Sabah, Mt Kinabalu, 1750 m, 21.IV.1987, leg. Burckhardt & Löbl; 56 es., Sabah, Mt Kinabalu, 1500 m, 25.IV.1987, leg. Burckhardt & Löbl; 1 es., Sabah, E Mt Kinabalu, road Ranau-Kota Kinabalu, 1150 m, 24.V.1987, leg. Burckhardt & Löbl.

DESCRIZIONE: Lunghezza 2,1 mm. Corpo lucido e nero con omeri e pigidio giallo-rossicci; antenne bruno-rossicce con i tre antennumeri basali e l'undicesimo giallo-rossicci; zampe gialle. L'avancorpo è privo di reticolazione, l'addome è coperto di reticolazione trasversa e superficiale. La punteggiatura del capo è ben visibile ed è assente sulla fascia longitudinale mediana e sulla fronte. La granulosità del pronoto e delle elitre è ben visibile, quella dell'addome è superficiale. Edeago Figg. 125-126, spermateca Fig. 127.

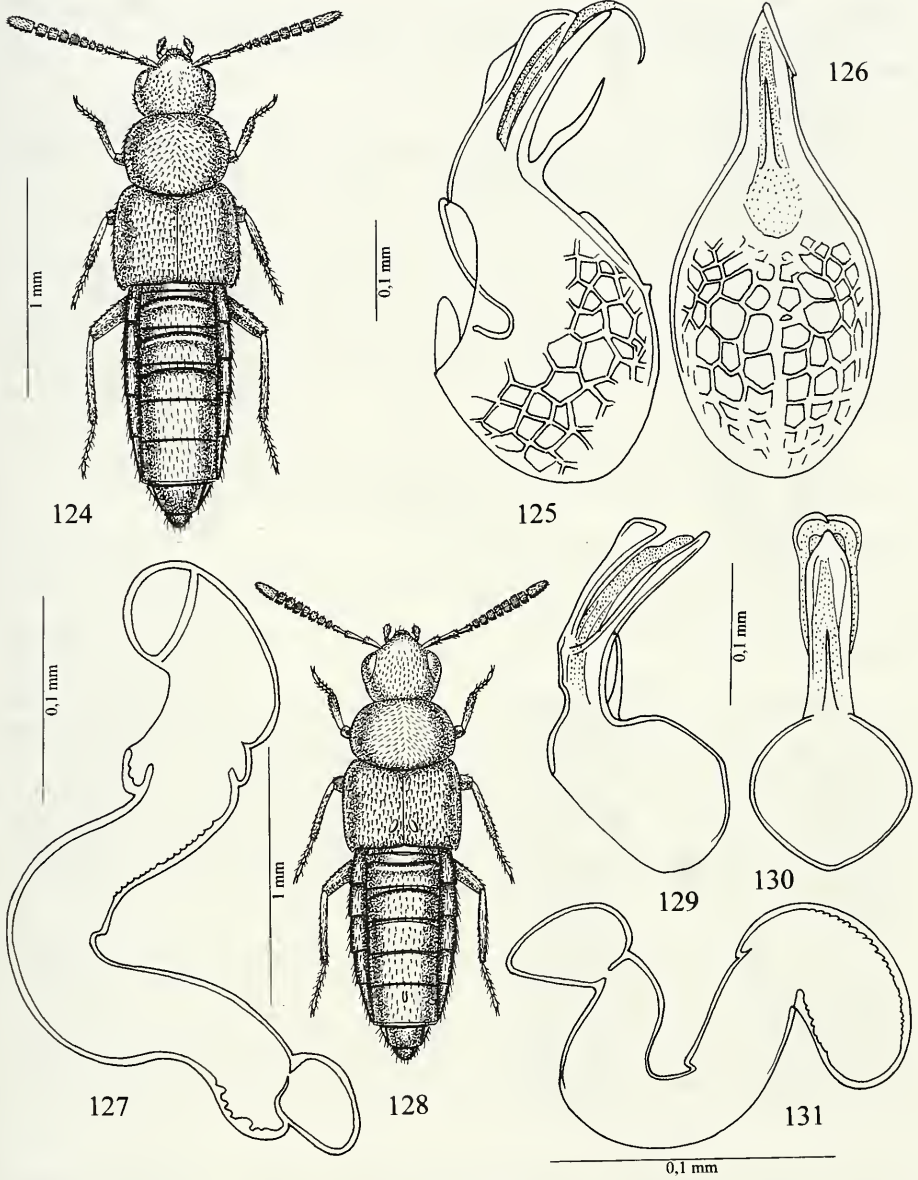
Pseudatheta kinabaluensis sp. n.

Figg. 128-131

Holotypus maschio. Sabah, Poring Hot Springs, 550-600 m, 9.V.1987, leg. Burckhardt & Löbl (MHNG).

Paratypi: 19 es., Sabah, Poring Hot Springs, 550-600 m, V.1987, leg. Burckhardt & Löbl.

DESCRIZIONE: Lunghezza 1,7 mm. Corpo lucido e rossiccio con elitre brune a base giallo-bruna, addome giallo-bruno; antenne rossicce con i due antennumeri basali



FIGG. 124-131

Habitus, eedeago in visione laterale e ventrale e spermateca. (124-127) *Pseudatheta borneensis* sp. n. (128-131) *Pseudatheta kinabaluensis* sp. n.

gialli; zampe gialle. L'avancorpo è privo di reticolazione, l'addome è coperto di reticolazione superficiale. La punteggiatura del capo è fitta e superficiale. La granulosità del pronoto e delle elitre è fine, fitta e ben visibile e quella dell'addome è superficiale e fitta. Le elitre del maschio presentano un tubercolo allungato molto saliente presso

l'angolo posteriore interno. Dietro di esso la sutura è saliente. Il quinto urotergo libero del maschio mostra un tubercolo allungato mediano basale. Edeago Figg. 129-130, spermateca Fig. 131.

Pseudatheta seditiosa sp. n.

Figg. 132-133

Holotypus femmina, Borneo, Sabah, Mt. Kinabalu N.P., Por. H. S., area Kipungit Crk., 1530 m, 26.VIII.1988, leg. A. Smetana (MHNG).

Paratypus: 1 femmina, Borneo, Sabah, Mt. Kinabalu N.P., Poring Hot Springs, 550-600 m, 9.V.1987, leg. Burckhardt & Löbl.

DESCRIZIONE: Lunghezza 1,8 mm. Corpo lucido e giallo-rossiccio con capo giallo-bruno, elitre brune con uroterghi liberi quarto e base del quinto giallo-bruni; zampe gialle. L'avancorpo è privo di reticolazione, l'addome è coperto di reticolazione molto superficiale. La punteggiatura del capo è distinta. La granulosità del pronoto è saliente, quella delle elitre è ben visibile e quella dell'addome è fine e superficiale. Spermateca Fig. 133.

DERIVATIO NOMINIS: La spermateca della nuova specie ha forma unica nel genere *Pseudatheta*, pertanto la nuova specie prende nome di sediziosa o ribelle.

Neoleptusa (Physetotoma) kinabaluensis sp. n.

Figg. 134-137

Holotypus femmina, Borneo, Sabah, Mt. Kinabalu N.P., HQ at Liwagu River, 1505 m, 14.VIII-1.IX.1988, leg. A. Smetana (MHNG).

Paratypus: 1 maschio, Sabah, Mt. Kinabalu, 3300 m, Panar Laban, 4.V.1987, leg. Burckhardt & Löbl.

DESCRIZIONE: Lunghezza 2,1 mm. Corpo lucido e giallo-rossiccio con metà posteriore delle elitre e il quarto urotergo libero bruni; antenne giallo-rossicce; zampe gialle. La fronte è nettamente reticolata. La reticolazione del pronoto, delle elitre e dei tre uroterghi liberi basali è assente, quella del quarto urotergo libero è superficiale e quella del quinto urotergo libero è netta, tranne alla sua base. La punteggiatura del capo è fittissima, ben visibile e assente sulla fronte, quella del pronoto è simile a quella del capo. La granulosità dell'addome è superficiale. Spermateca Fig. 135, edeago Figg. 136-137.

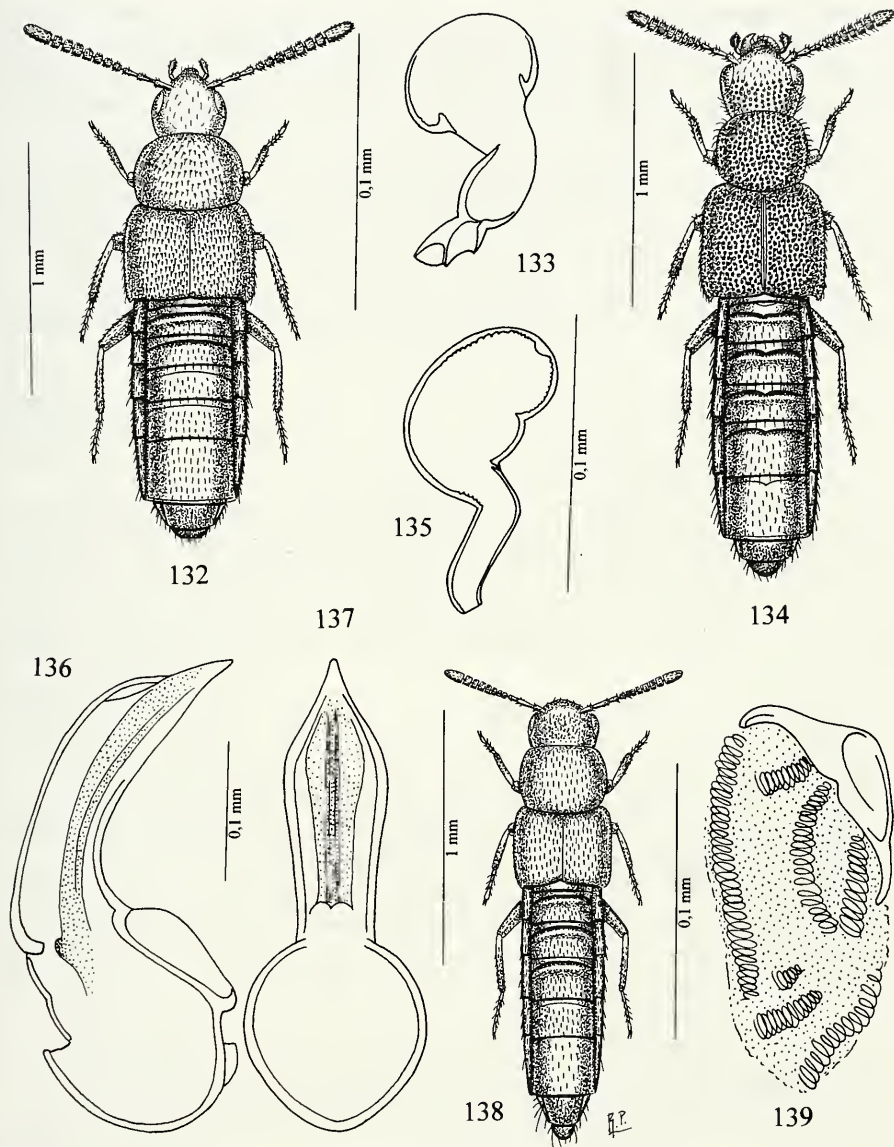
NOTA: Il genere *Neoleptusa* era finora sconosciuto per il Borneo (Hammond, 1984). L'habitus e la forma generale della spermateca della nuova specie sono simili a quelli di *N. luzonensis* Pace, 1990, delle Filippine. La nuova specie ne è distinta per il differente colore del corpo e delle antenne, per il pronoto meno trasverso e distintamente punteggiato e per la spermateca priva di lunghe docce alla base del bulbo distale. Di *N. luzonensis* non è noto l'edeago.

DIESTOTINI

I generi *Chledophila* e *Diestota* erano finora sconosciuti per il Borneo (Hammond, 1984).

CHIAVE DELLE SPECIE DEL GENERE *CHLEDOPHILA* CAMERON, 1920, NEL BORNEO

- 1 Corpo unicolore; pronoto reticolato; antenne bicolori rossicce con base gialla; spermateca Fig. 139. Lunghezza 1,7 mm *C. borneensis* sp. n.
- Corpo bicolore; pronoto non reticolato; antenne unicolori giallo-brune; spermateca Fig. 141. Lunghezza 1,8 mm *C. parallela* sp. n.



FIGG. 132-139

Habitus, spermatheca e edeago in visione laterale e ventrale. (132-133) *Pseudatheta seditiosa* sp. n. (134-137) *Neoleptusa (Physetotoma) kinabaluensis* sp. n. (138-139) *Chledophila borneensis* sp. n.

KEY TO SPECIES OF THE GENUS *CHLEDOPHILA* CAMERON, 1920, FROM BORNEO

- 1 Body unicolorous; pronotum reticuled; antennae bicolorous reddish with yellow base; spermatheca Fig. 139. Length 1.7 mm *C. borneensis* sp. n.
- Body bicolorous; pronotum not reticuled; antennae unicolorous yellow-brown; spermatheca Fig. 141. Length 1.8 mm *C. parallela* sp. n.

Chledophila borneensis sp. n.

Figg. 138-139

Holotypus femmina, Borneo, Sabah, Mt. Kinabalu Nat.Pk., HQ Liwagu River tr., 1495 m, 12.VIII.1988, leg. A. Smetana (MHNG).

Paratypus: 1 femmina, Borneo-Sabah, Mt. Kinabalu N.P., blw Layang Layang, 2600 m, 2-8.V.1987, leg. A. Smetana.

DESCRIZIONE: Lunghezza 1,7 mm. Corpo lucido e bruno-rossiccio; antenne rossicce con i tre antennumeri basali giallo-rossicci; zampe gialle. La reticolazione del capo e delle elitre è assente, quella del pronoto è distinta e quella dell'addome è superficiale. La punteggiatura del capo è fittissima. La granulosità del pronoto e dell'addome è poco saliente, quella delle elitre è ben visibile. La granulosità degli uroterghi liberi quarto e quinto è più rada di quella degli uroterghi liberi basali. Spermateca Fig. 139.

Chledophila parallela sp. n.

Figg. 140-141

Holotypus femmina, Borneo-Sabah, Crocker Ra., 1550-1650 m, 16.V.1987, leg. Burckhardt & Löbl (MHNG).

DESCRIZIONE: Lunghezza 1,7 mm. Corpo debolmente lucido e giallo-bruno, con capo ed elitre bruno-rossicce; antenne bruno-rossicce; zampe gialle. La reticolazione del corpo è indistinta. La punteggiatura del capo è fine, fitta e profonda. La granulosità del pronoto e delle elitre è saliente, quella dell'addome è fitta sui quattro uroterghi liberi basali, sul quinto è rada alla base e assente sul resto dell'urotergo libero. Spermateca Fig. 141.

DERIVATIO NOMINIS: Il nome della nuova specie deriva dai lati del suo corpo che sono paralleli.

CHIAVE DELLE SPECIE DEL GENERE *DIESTOTA* MULSANT & REY, 1870, DEL BORNEO

- 1 Pronoto con due impressioni mediane posteriori; elitre con forti punti assai radi; armatura genitale interna dell'edeago robusta Figg. 147-148; spermateca Fig. 149. Lunghezza 2,1 mm *D. plicae* sp. n.
- Pronoto con una fossetta mediana posteriore; elitre con punteggiatura forte e fitta o assai superficiale e fitta; armatura genitale interna dell'edeago esile, Figg. 143-144 2
- 2 Corpo unicolore giallo-rossiccio; punteggiatura delle elitre superficiale; quarto antennumero trasverso; margine posteriore del quinto urotergo libero del maschio con quattro lunghi denti smussati tra due spine laterali; edeago a lati paralleli, in visione ventrale. Lunghezza 2,5 mm *D. testacea* (Kraatz)
- Corpo bicolore rossiccio e bruno; punteggiatura delle elitre forte; quarto antennumero lungo quanto largo; margine posteriore del quinto urotergo libero del maschio rettilineo; edeago a lati fortemente convergenti verso l'apice, in visione ventrale. Lunghezza 2,4 mm *D. pellita* sp. n.

KEY TO SPECIES OF THE GENUS *DIESTOTA* MULSANT & REY, 1870, FROM BORNEO

- 1 Pronotum on the disc with two medians impressions; elytra strongly and sparingly punctured; internal genital armour of the aedeagus strong, Figs 147-148; spermateca Fig. 149. Length 2.1 mm *D. plicae* sp. n.

- Pronotum with a posterior median fovea; elytra strongly and closely punctured or superficially and closely punctured; internal genital armour of the aedeagus slender, Figs 143-144 2
- 2 Body yellow-reddish unicolorous; punctuations of the elytra superficial; fourth antennomere transverse; posterior border of the fifth free urotergum of the male with four long teeth bevelled among two side thorns; sides of the aedeagus parallel, in ventral view. Length 2.5 mm *D. testacea* (Kraatz)
- Body bicolorous reddish and brown; punctuation of the elytra strong; fourth antennomere as wide as long; posterior border of the fifth free urotergum of the male rectilinear; sides of the aedeagus strongly convergent toward the apex, in ventral view. Length 2.4 mm . . . *D. pellita* sp. n.

***Diestota testacea* (Kraatz, 1859)**

Bolitochara testacea Kraatz, 1859: 7

Diestota testacea; Fauvel, 1905: 86; Cameron, 1939: 164; Pace, 1984: 15

MATERIALE DA AGGIUNGERE: 15 es., Sabah, Mt. Kinabalu Nat. Pk., Poring Hot Springs, 485 m, 29.VIII.1988, leg. A. Smetana; 1 es., Sabah, Mt. Kinabalu Nat. Pk., Poring Hot Springs, 495 m, 30.VIII.1988, leg. A. Smetana; 3 es., Borneo-Sabah, Mt. Kinabalu, Poring Hot Springs, 500 m, 13.V.1987, leg. Burckhardt & Löbl; 1 es., Sabah, Mt. Kinabalu Nat. Pk., Poring Hot Springs, 495 m, 25.VIII.1988, leg. A. Smetana.

DISTRIBUZIONE: Specie distribuita dalle Mascarene alla Regione Orientale, Cina e Papua Nuova Guinea comprese. Nuova per il Borneo.

***Diestota pellita* sp. n.**

Figg. 142-145

Holotypus maschio, Sarawak, Borneo, Mulu Nat. Park, (senza data), leg. H. Franz (NHMW).

Paratypi: 11 es., Borneo, Sabah, Mt. Kinabalu N.P., Poring Hot Springs, 510 m, 30.VI-II.1988, leg. A. Smetana; 3 es., Sabah, Mt. Kinabalu Nat. Pk., Poring Hot Springs, 495 m, 27.VI-II.1988, leg. A. Smetana; 13 es., Borneo, Sabah, Crocker Rge. N.P., Hwy. A 3, Km 48 cca, 1000 m, 5.IX.1988, leg. A. Smetana; 7 es., Borneo, Sabah, Poring Hot Springs, 500 m, 6.V.1987, leg. Burckhardt & Löbl; 4 es., Sabah, Crocker Range, 1270 m, Km 60 r.te Kota Kinabalu-Tambunan, 17.V.1987, leg. Burckhardt & Löbl; 15 es., Sabah, Poring Hot Springs, 550-600 m, 9.V.1987, leg. Burckhardt & Löbl; 3 es., Sabah, E Mt. Kinabalu, 1150 m, rte. Ranau-Kota Kinabalu, 24.V.1987, leg. Burckhardt & Löbl; 5 es., Sabah, Poring Hot Springs, 500 m, 13.V.1987, leg. Burckhardt & Löbl; 1 maschio e 1 femmina, Sabah, Mt. Kinabalu, Poring Hot Springs, 480 m, 10.V.1987, leg. A. Smetana.

DESCRIZIONE: Lunghhezza 2,4 mm. Corpo lucido e rossiccio con elitre brune tranne la base rossiccia, quarto urotergo libero bruno; antenne bruno-rossicce con i due antennomeri basali e l'undicesimo giallo-rossiccio; zampe giallo-rossicce. La punteggiatura del capo e del pronoto è fitta e distinta, quella delle elitre è profonda e irregolarmente distribuita. L'addome presenta una granulosità saliente. Il pronoto mostra una fossetta mediana posteriore e una laterale. La reticolazione delle elitre è assai superficiale. Edeago Figg. 143-144, spermateca Fig. 145.

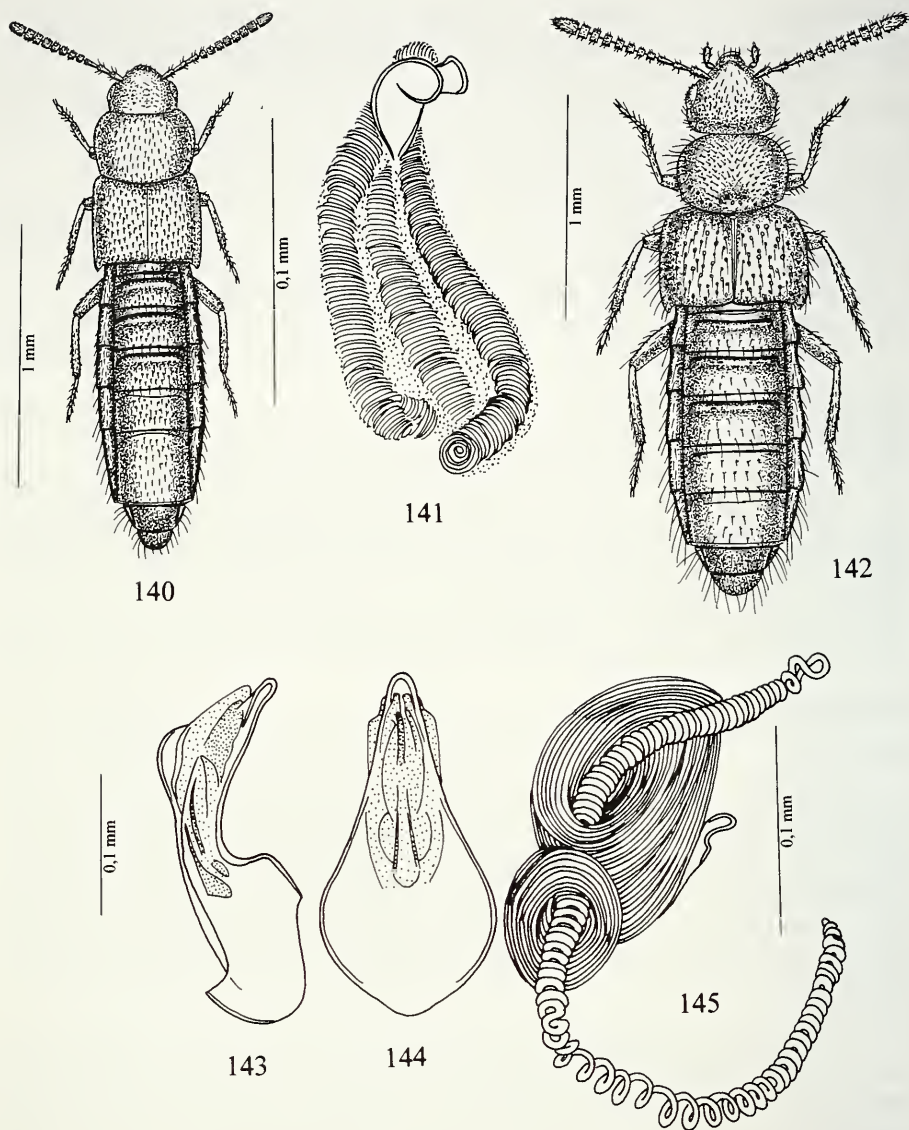
DERIVATIO NOMINIS. Il nome della nuova specie significa «coperta di pelliccia», a motivo della pubescenza del corpo.

***Diestota plicae* sp. n.**

Figg. 146-150

Holotypus maschio, Borneo, Sabah, Mt. Kinabalu N.P., HQ Liwagu Riv. trail, 1500-1550 m, 27.IV.1987, leg. A. Smetana (MHNG).

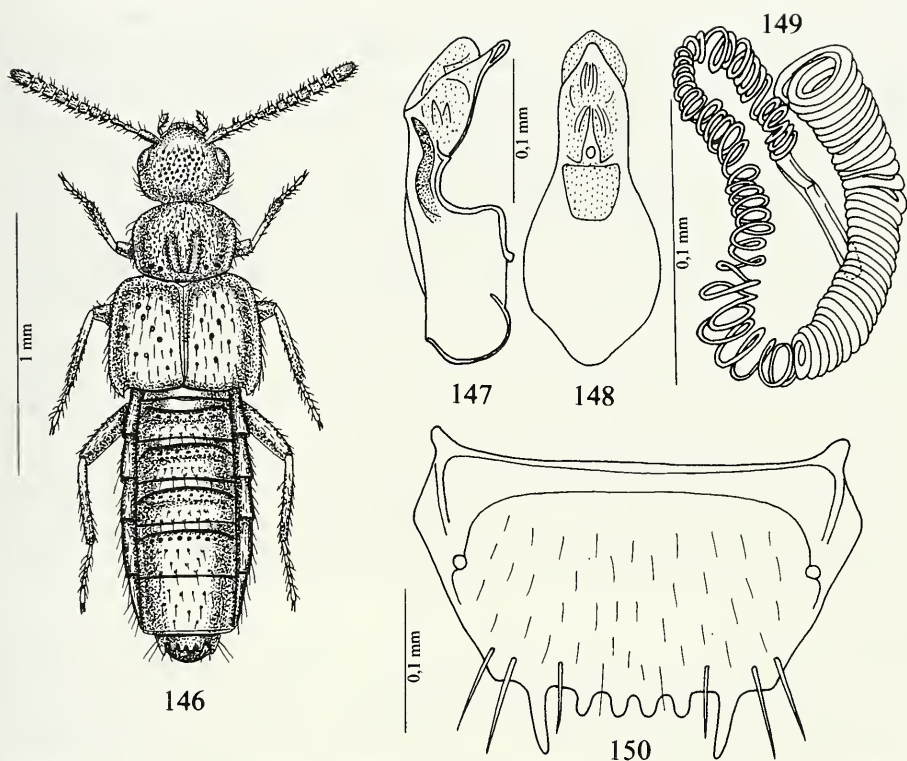
Paratypi: 7 es., stessa provenienza.



FIGG. 140-145

Habitus, spermatheca e edeago in visione laterale e ventrale. (140-141) *Chledophila parallela* sp. n. (142-145) *Diestota pellita* sp. n.

DESCRIZIONE: Lunghezza 2,1 mm. Corpo lucido e giallo-rossiccio; antenne rossicce con i tre antenomeri basali e l'undicesimo giallo-rossicci; zampe giallo-rossicce. La punteggiatura del capo è profonda solo sul disco, sul resto del capo è fine e superficiale. La punteggiatura del pronoto è ben visibile e quella delle elitre è composta di punti forti isolati e irregolarmente distribuiti. La reticolazione delle elitre



FIGG. 146-150

Habitus, edeago in visione laterale e ventrale, spermateca e sesto urotergo libero del maschio. (146-150) *Diestota plicae* sp. n.

è molto superficiale. Edeago con una plica ventrale a ciascun lato, Figg. 147-148, spermateca Fig. 149, sesto urotergo libero del maschio Fig. 150.

DERIVATIO NOMINIS. Il nome della nuova specie significa «della plica», quella ventrale dell'edeago.

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Rivolgo i miei più cordiali ringraziamenti a coloro che mi hanno affidato in studio il materiale oggetto del presente lavoro: il Dr. Aleš Smetana di Ottawa, il Dr. Ivan Löbl, già del Museo di Storia Naturale di Ginevra e il defunto Prof. Dr. H. Franz di Mödling (Austria). Per il prestito di tipi ringrazio il Dr. P.M. Hammond e il Dr. Brendell del Museo di Storia Naturale di Londra, il Dr. L. Zerche del DEI di Eberswalde (Berlino) e il Dr. A.F. Newton del *Field Museum of Natural History* di Chicago.

RÉSUMÉ

Les espèces d'Oligotini, Leucocraspedini, Hygronomini, Placusini, Bolitocharini et Diestotini de Bornéo (Coleoptera, Staphylinidae). - Quarante-cinq nouvelles espèces de la sous-famille Aleocharinae recueillies dans le Parc National du Mt Kinabalu, Bornéo, sont décrites et illustrées. Les espèces décrites appartiennent aux tribus suivantes: Oligotini, Hygronomini, Bolitocharini et Diestotini. Trois nouvelles espèces appartiennent au genre *Oligota* (*densa*, *kinabaluensis* et *borneensis*), une au genre *Cypha* (*sabahensis*), dix-neuf au genre *Leucocraspedum* (*sinuatum*, *pilosellum*, *obliquum*, *spirasferum*, *occultum biguttatae*, *mimanaticula*, *divisum*, *anaticula*, *fugitivum*, *directum*, *hamifer*, *dilatatiapex*, *lamelliferum*, *audax*, *cacuminum*, *anguineatheca*, *nechamifer*, *ventriosatheca*) quatre au genre *Hygrochara* (*micropallida*, *microkinabaluicola*, *spiniventris*, *kinabaluensis*), six au genre *Placusa*, (*robustipes*, *superba*, *recensita*, *falcifera*, *evoluta* et *subspinigera*), quatre au genre *Erastriusa* (*masculina*, *borneensis*, *minima*, *lobifera*), trois au genre *Pseudatheta* (*borneensis*, *kinabaluensis*, *seditiosa*), une au genre *Neoleptusa* (*kinabaluensis*), deux au genre *Chledophila*, (*parallela* et *borneensis*) et deux au genre *Diestota* (*plicae* et *pellita*). Une clé de toutes les espèces connues des genres susmentionnés est fournie. Le lectotype est désigné pour *Placusa acuminata* Kraatz dont l'édéage et la spermatèque sont illustrés pour la première fois.

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***Imparfinis mishky* (Siluriformes, Heptapteridae) a new species from the ríos Paraná and Uruguay basins in Argentina**

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***Imparfinis mishky* (Siluriformes, Heptapteridae) a new species from the ríos Paraná and Uruguay basins in Argentina.** - *Imparfinis mishky* sp. n. is described from the río Paraná and río Uruguay basins in Argentina. *Imparfinis mishky* sp. n. is distinguished from other species of the genus by the following combination of characters: pectoral-fin spine with smooth anterior and posterior margins; caudal fin deeply forked with dorsal lobe longer than ventral lobe; adipose fin not reaching caudal fin; body with six dark saddles across the dorsum, and without a mid-lateral band. It was found inhabiting well oxygenated, neutral pH, flowing waters, with sandy or cobble covered bottom.

Keywords: Freshwaters - Siluriformes - Heptapteridae - *Imparfinis* - new species - systematics - habitat.

INTRODUCTION

Some years ago several specimens similar to *Imparfinis cochabambae* (Fowler, 1940) were collected in the ríos Paraná and Uruguay basins. The study of these specimens showed that they belong to a new species described below.

The genus *Imparfinis* includes eighteen species (Bockmann & Guazzelli, 2003). Two of these species have been recorded from La Plata basin in Argentina: *Imparfinis cochabambae* from a single specimen taken from the río Paraguay basin, and *I. hollandi* Haseman, 1911, which was described from and is apparently restricted to the río Iguazú basin.

The genus *Imparfinis* Eigenmann & Norris, 1900 was erected for a group of South American catfishes that possess, among other characters, a tooth patch on vomer, a head that is longer than wide, a short supraoccipital process, and a long cranial fontanel that extends posteriorly to the base of the supraoccipital process and bears a bridge behind the eyes. Later on, Mees (1974) re-diagnosed *Imparfinis* by having “the

posterior border of skull as if cut off straight, with but a rudimentary postoccipital process; fontanel a long slit, reaching to the occiput; dorsal and pectoral spines present but very inconspicuous, continued as soft rays, the soft part usually longer than the bony part; maxillary barbells short to moderate in length, varying from scarcely reaching pectoral base, to reaching to the end of the anal fin; no pectoral pore; adipose fin comparatively short; eye-rim free". The presence of a free eye-rim was later considered of limited generic value by Mees & Cala (1989).

In the last years the genus *Imparfinis* was not revised, and a phylogenetic diagnosis of the genus is still pendant. For this reason, there is no consensus about the species included in this genus (Mees, 1974; Mees & Cala, 1989).

The aim of this paper is to describe a new species collected in the ríos Paraná and Uruguay basins and placing it in the genus *Imparfinis* following the generic diagnoses given by Eigenmann & Norris (1900) and Mees (1974).

MATERIAL AND METHODS

Measurements were taken using digital calliper to the nearest 0.1 mm. Counts include holotype, and 13 paratypes (1 ex. cleared and stained). Values of the holotype are indicated by an asterisk. Vertebral counts were taken from specimens that were cleared and counterstained following Taylor & Van Dyke (1985); counts excludes vertebrae corresponding to the Weberian apparatus and the caudal complex centrum. Institutional abbreviations are as listed in Leviton *et al.* (1985) with the addition of Asociación Ictiológica, La Plata, Argentina (AI).

In each cite some of the water quality variables were recorded with calibrated electrodes, including temperature, pH, conductivity (Hanna, Italy), and dissolved oxygen (YSI, USA). Water velocity was registered using a digital flowmeter (Global Water, USA). Transparency was measured using a Secchi disk. Alkalinity was measured *in-situ* by titration and colorimetric methods (Hach kit Model FF-2, USA).

Comparative material examined (SL in mm): *Imparfinis hollandi* Haseman, 1911: AI 211, 3 (1 C&S) ex., 69.4-135.2, Argentina, río Iguazú basin, arroyo Deseado (25°47'8.1"S - 54°02'21.1"W). *Imparfinis cochabambae* (Fowler, 1940): ANSP 69066, holotype, 59.5, Bolivia, Cochabamba, Boca Chapare (figured in <http://acsi.acnatsci.org/>). *Imparfinis* cf. *cochabambae*: MACN-ict 6971, 1 ex., 83.4, Argentina, Salta, río Paraguay basin, río Bermejo.

RESULTS

Imparfinis mishky sp. n.

Figs 1-3, Tables 1-2

HOLOTYPE: MACN-ict 8973, 56.6 mm SL, Esteros del Iberá, río Corriente, Capitá Miní (28°53'15.3"S - 58°22'02.7"W), Río Paraná basin, Argentina, coll: F. Ruíz Díaz, April 2006.

PARATYPES: All from Argentina. MHNG 2690.011, 2 ex., 40.5-43.7 mm SL, río Uruguay basin, río Timboy (30°14'20.7"S - 57°47'05.3"W), coll: P. García Tartalo, S. D'Ambrosio, C. Bruno & P. Solimano, July 2003. AI 207, 3 ex., 40.6-42.5 mm SL, río Uruguay basin, río Timboy (30°14'20.7"S - 57°47'05.3"W), coll: P. García Tartalo, S. D'Ambrosio, C. Bruno & P. Solimano, December 2003. AI 208, 1 ex., 47.0 mm SL, río Paraná at Ituzaingó (27°29'54.5"S - 56°42'47.0"W), coll: F. Ruíz Díaz, March 2003. AI 209, 1 ex., 41.2 mm SL, río Paraná at Yahapé (27°22'12.1"S - 57°39'14.6"W), coll: F. Ruíz Díaz, February 2006. AI 210, 17 (1 C&S) ex., 21.5-65.6 mm SL. same data as holotype.

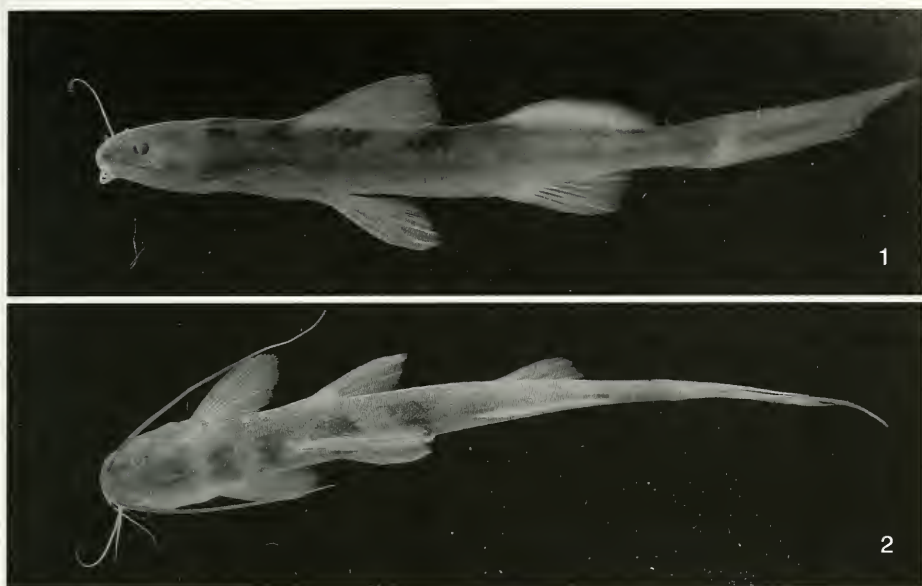


FIG. 1-2

Imparfinis mishky sp. n., (holotype) 56.6 mm SL, Esteros del Iberá, río Corriente, Capitá Miní. (1) lateral view. (2) dorsal view.

DIAGNOSIS: *Imparfinis mishky* sp. n. is diagnosed by the following combination of characters: Pectoral-fin spine with smooth anterior and posterior margins; caudal fin deeply forked with dorsal lobe longer than ventral lobe; adipose fin not reaching caudal fin; body with six dark saddles across the dorsum, and without a mid-lateral band.

DESCRIPTION: Morphometrics of holotype and 13 paratypes are presented in Table 1. Body elongated, posterior part of the body behind the adipose fin, compressed. Greatest body depth at adipose-fin origin (Fig. 1). Head 4.2-4.7 times in standard length. Supraoccipital process short, fontanel long and narrow, continued to the base of the occipital process, interrupted by a narrow bridge at the rear part of orbits. Snout tip rounded in dorsal view, upper jaw slightly longer than lower jaw. Teeth of both jaws in narrow bands, upper tooth band rounded, without posterior projection; lower tooth band interrupted at symphysis and laterally curved posteriorly. Nostrils on snout almost form corners of square, posterior nostrils closer to eye rim than anterior ones. Barbels long and slender; maxillary barbels surpass pelvic-fin origin; outer mental barbels reach middle of pectoral fin; inner mental barbels inserted only slightly in advance of outer barbels and extend past pectoral-fin origin. Eyes dorsolateral, with free rim only along dorsal-rostral part of orbit (Fig. 2). Lateral line complete and straight, without branches, continued onto base of caudal fin. Dorsal fin with one weak, smooth spine, extended distally as filament, filamentous portion longer than spinous part, and 6 branched rays; first branched ray longest. Adipose fin well developed, its base 6.6-7.1 times in SL. Adipose-fin origin anterior of anal-fin origin; adipose-fin base extends to posterior of anal-fin base. Anal-fin margin rounded, with

TABLE 1. Morphometric data of the holotype and 13 paratypes of *Imparfinis mishky* sp. n. SD: standard deviation.

	Holotype 56.6	Range 32.3-57.1	Mean	SD
Standard length (mm)				
Percents of SL				
Predorsal distance	33.1	32.0-34.7	33.6	0.80
Preventral distance	39.8	39.4-45.7	42.4	1.53
Preanal distance	66.2	63.8-69.0	67.3	1.45
Prepectoral distance	21.6	20.0-25.9	23.3	1.76
Body depth	12.7	12.6-15.1	13.8	1.06
Dorsal-fin base	15.6	12.8-15.6	14.0	0.86
Anal-fin base	15.0	13.1-16.3	14.6	0.86
Pectoral-fin length	19.7	16.9-20.1	18.6	1.02
Pelvic-fin length	19.3	15.8-20.2	18.1	1.26
Distance between dorsal and adipose fins	18.5	16.6-20.4	18.4	0.96
Adipose-fin base	26.5	23.4-26.5	24.7	0.90
Caudal peduncle depth	6.9	6.4-7.8	7.2	0.44
Caudal peduncle length	20.0	17.7-20.1	18.8	0.75
Head length	21.3	21.0-23.6	22.4	0.77
Snout length	8.0	7.7-9.0	8.4	0.36
Horizontal eye diameter	3.9	3.9-4.9	4.5	0.31
Interorbital width	4.4	4.3-5.1	4.7	0.27
Percents of HL				
Snout length	37.5	34.9-40.4	37.4	1.86
Horizontal eye diameter	18.5	18.5-22.1	20.2	1.14
Interorbital width	20.6	18.5-23.1	20.9	1.22

iv-v, 7-8 (iv,8*) rays. Pectoral fin not reaching ventral-fin origin; fin composed of well developed, smooth spine continued as slender filament, with filamentous portion longer than spinous portion; i,8 rays. Ventral fin with i,5 rays, rounded in outline, ventral-fin origin at level of fourth branched dorsal-fin ray. Caudal fin long and deeply forked; dorsal lobe longer than ventral lobe; i+7/9+i principal rays. Vertebrae 36. Gill rakers on first branchial arch, 9.

Coloration of specimens upon capture very similar to those preserved in alcohol. Ground color of dorsolateral body surface pale gray, sprinkled all over with minute dark dots; ventrolateral and ventral surface of body whitish. Dorsal surface of head, cheek, and maxillary barbel with scattered minute dark spots. Six dark saddles over dorsum, four anterior saddles larger than others. Anterior most saddle placed just behind occipital process; second saddle at dorsal-fin origin; third saddle at end of dorsal-fin base; fourth saddle midway between end of dorsal-fin base and adipose-fin origin; fifth saddle at adipose-fin origin, and the posterior most at end of adipose-fin base. Dorsal, pectoral, and adipose fins with many minute spots on surface. Pelvic and anal fin with scattered chromatophores on rays. Caudal fin with scattered minute dark spots, more concentrated on ventral lobe.

ETYMOLOGY: The specific epithet *mishky* is a Quichua word that means sweet. The epithet was dedicated to Patricia García Tartalo, our friend and student who died tragically in February, 2006.

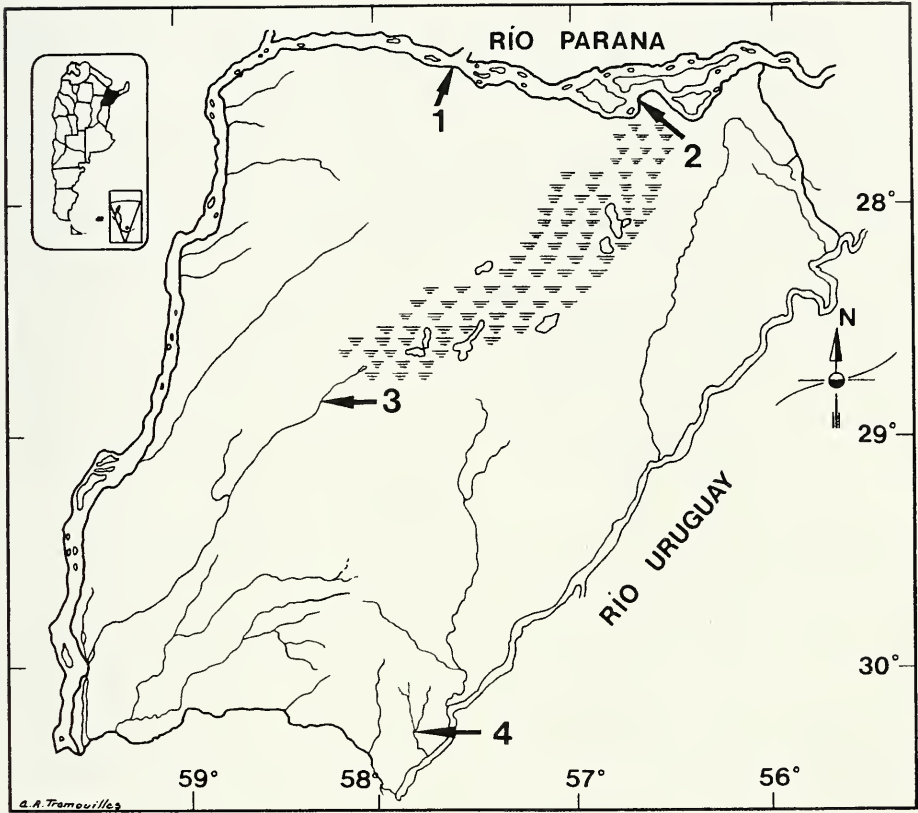


FIG. 3

Geographical distribution of *Imparfinis mishky* sp. n. (1) río Paraná at Yahapé. (2) río Paraná at Ituzaingó. (3) río Corriente at Capitá Miní (type locality). (4) río Timboy, río Uruguay basin.

DISTRIBUTION: *Imparfinis mishky* sp. n. is known from the río Paraná above the confluence with the río Paraguay; río Corriente, río Paraná basin below the confluence with the río Paraguay; and río Timboy, río Uruguay basin, all localities are within Corrientes Province, Argentina (Fig. 3).

HABITAT: *Imparfinis mishky* sp. n. was only collected in marginal areas of lotic habitats with high current speeds (Table 2). In the portions of the ríos Paraná and Corriente where the species was taken, the bottom was generally sandy with variable content of gravel or silt, whereas cobble predominated in río Timboy. The pH fluctuated little around the neutral value. Conductivity was generally low, also although exceptionally high values were found in río Corriente, a condition that is not common in this river and occurs only during pronounced droughts in summer (Casciotta *et al.*, 2005). Dissolved oxygen concentration was always high, slightly below saturation or supersaturated (Table 2).

TABLE 2. Description of some environmental variables of the habitat at the four sampling sites inhabited by *Imparfinis mishky* sp. n. n/d = no data available

Sampling site	Depth (m)	Water velocity ($m s^{-1}$)	Bottom type	Secchi disk transparency (m)	Water Temp. ($^{\circ}C$)	pH	Conductivity ($\mu S cm^{-1}$)	Dissolved Oxygen ($mg l^{-1}$)	D.O. (% saturation)	Alkalinity ($mg l^{-1}$)
Río Timboý	0.6-1.0	0.57	cobble	n/d	14.0-24.0	7.2-7.4	n/d	8.6-10.4	104-110	n/d
Río Paraná (Yahapé)	1.7	0.60	gravelly-sand with boulders	2.35	29.2	7.2	55.7	7.7	100.0	14.0
Río Paraná (Ituzaingó)	2.5	0.27	silty-sand	1.08	25.7	6.6	52.5	7.7	93.2	n/d
Río Corriente	0.9	0.19	sand	0.59	25.7	7.3	1302.0	7.8	95.0	25.0

REMARKS: Only two species belonging to the genus *Imparfinis* were previously recorded from freshwater in Argentina: *Imparfinis hollandi* and *I. cochabambae* (cited by Castello *et al.*, 1978 as *Pimelodella cochabambae*).

Imparfinis hollandi is quite different from *I. mishky* in several characters; *I. hollandi* has an asymmetrical caudal fin with an oblique posterior margin and a long adipose fin that reaches the caudal fin. In contrast, *I. mishky* has a nearly symmetrical forked caudal fin with the upper lobe longer than the lower one, and a short adipose fin that does not reach the caudal fin. *Imparfinis hollandi* is restricted to the río Iguazú basin (Gómez & Somay, 1989, as *Pariolius hollandi*; and personal observations) whereas *I. mishky* was found in the río Paraná and río Uruguay basins.

The only other species recorded from Argentina was *Imparfinis cochabambae*. Based on information in the original description (Fowler, 1940), this species differs from *I. mishky* in having the outer edge of the first pectoral-fin ray serrated (vs. smooth) and the interorbital distance 4 times in the head length (vs. 4.5-5.1 times). In addition, *I. cochabambae* has chromatophores concentrated along lateral line forming a lateral band that is absent in *I. mishky*.

The single specimen examined by Castello *et al.* (1978) that was identified as *Pimelodella cochabambae* (MACN-ict 6971) appears to be neither *I. mishky* nor *I. cochabambae*. This specimen differs from *I. mishky* in having the outer edge of the pectoral-fin spine serrated (vs. smooth) a deeper caudal peduncle (9.6 vs. 6.4-7.8% of SL); and a shorter adipose-fin base (20.0 vs. 23.4-26.5% SL). This specimen also differs from *Imparfinis cochabambae* in having a greater body depth (6.4 vs. 7.2 in SL), a smaller eye (6.0 vs. 5.0 in head length, 2.3 vs. 1.8 in snout length, and 1.6 vs. 1.2 in interorbital distance). Thus, although we were unable to assign this specimen to any named species of *Imparfinis*, it appears not to be *I. cochabambae*. Therefore, following Bockmann & Guazzelli (2003), the presence of *I. cochabambae* in freshwaters environments of Argentina has not been established.

ACKNOWLEDGEMENTS

We greatly benefited from comments on the manuscript by C. Ferraris (USA). Also we would like to express our gratitude to C. Tremouilles (UNLP) for help with figures. M. Sabaj (ANSP), allowed us to see the holotype figures of *Imparfinis cochabambae* in <http://acsi.acnatsci.org/>. M. Batistón, gave us lodging in Capitá Miní. J. Casciotta is a researcher of CIC, Buenos Aires Province. This work was partially financed by Entidad Binacional Yacyretá (EBY) through an agreement with the Facultad de Ciencias Veterinarias, UNNE (Complementary Acts 16 and 17) and the Agencia Nacional de Promoción Científica y Tecnológica (ANPCyT) from Argentina, through the project PICT 2003 N°1-13307.

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Larval morphology of reed frogs, *Hyperolius kivuensis* and *H. viridiflavus*, from western Kenya (Amphibia, Hyperoliidae)

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Larval morphology of reed frogs, *Hyperolius kivuensis* and *H. viridiflavus*, from western Kenya (Amphibia, Hyperoliidae).- We describe external characters, oral disc and oral cavity structures of larval *Hyperolius kivuensis* and *H. viridiflavus*, i.e. exotrophous lentic benthic type IV tadpoles. External morphology of both is comparable and matches descriptions of other *Hyperolius* species. Differences among the two taxa were noted in the keratinized labial teeth. In *H. kivuensis*, the spoon-shaped cusped tooth type is frequent and represented by two different subtypes: (i) "cusped" with four cusps, the two distal of which only slightly larger than the lateral cusps; (ii) "pointed" with the two distal cusps larger than the two lateral cusps forming a bifurcation. The latter subtype is rare in *H. kivuensis*, while most frequent in *H. viridiflavus*. In this species, also another type occurs, characterized by two long distal cusps, forming a bifurcation, and two small lateral cusps; the cusped type with cusps of the same size as in *H. kivuensis* is rare. Both species show similar oral cavity structures except for the choanae position, i.e. arranged in a V that is opened posteriorly in *H. kivuensis* versus a V opened anteriorly in *H. viridiflavus*. Choanae position and keratinized labial teeth structure may provide diagnostic features for these and other species of *Hyperolius*.

Keywords: Anura - labial teeth - oral cavity - tadpoles.

INTRODUCTION

There are approximately 120 described species of Afrotropical reed frogs, genus *Hyperolius* (Schjøtz, 1999). However, detailed descriptions of the larvae exist for less than 20 of them (Rödel, 1999; Schjøtz, 1999; Channing, 2001; Channing & Howell, 2006). During field surveys in western Kenya, adults and larvae of five syntopic reed frog species were collected (Löppers *et al.*, 2004). The larvae of *Hyperolius kivuensis* Ahl, 1931 and *H. viridiflavus* (Duméril & Bibron, 1841), for which a large series of positive species allocation could be obtained (see below), are described here. The former species is known from eastern and central Africa, while the latter is distributed in eastern Africa. (Schjøtz, 1999; Löppers *et al.*, 2004).

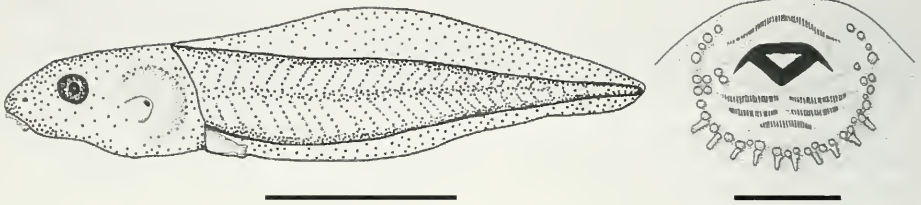


FIG. 1

Views of lateral body and oral disc of a *Hyperolius kivuensis* larva from western Kenya, stage 36 (MHNG 2661.31). Lines equal 1 cm and 1 mm, respectively. Illustration by A. and J. Channing.

Larval morphology may provide useful characters for species diagnoses and for assessment of phylogenetic relationships (Orton, 1953, 1957; Starrett, 1973). However, the known larvae of *Hyperolius* are similar in external morphology. Differences in size, body proportions, and colors between the species are apparently too minor for unambiguous identification or systematic purposes (e.g. Channing, 2001).

More than 100 years ago Heron-Royer & van Bambeke (1889) and Boulenger (1891) introduced the oral disc morphology including the oral teeth as diagnostic tadpole characters. The morphology of the oral cavity was also used by Wassersug (1980, 1984), Viertel (1982), and Wassersug & Heyer (1988) for the diagnosis of anuran larvae. Oral disc and oral cavity morphology has yet not been studied in *Hyperolius* larvae.

The goal of the present study is (i) to describe and to discuss the external, oral disc, and oral cavity morphology of *H. kivuensis* and *H. viridiflavus* larvae, and (ii) to discuss their utility for *Hyperolius* taxonomy.

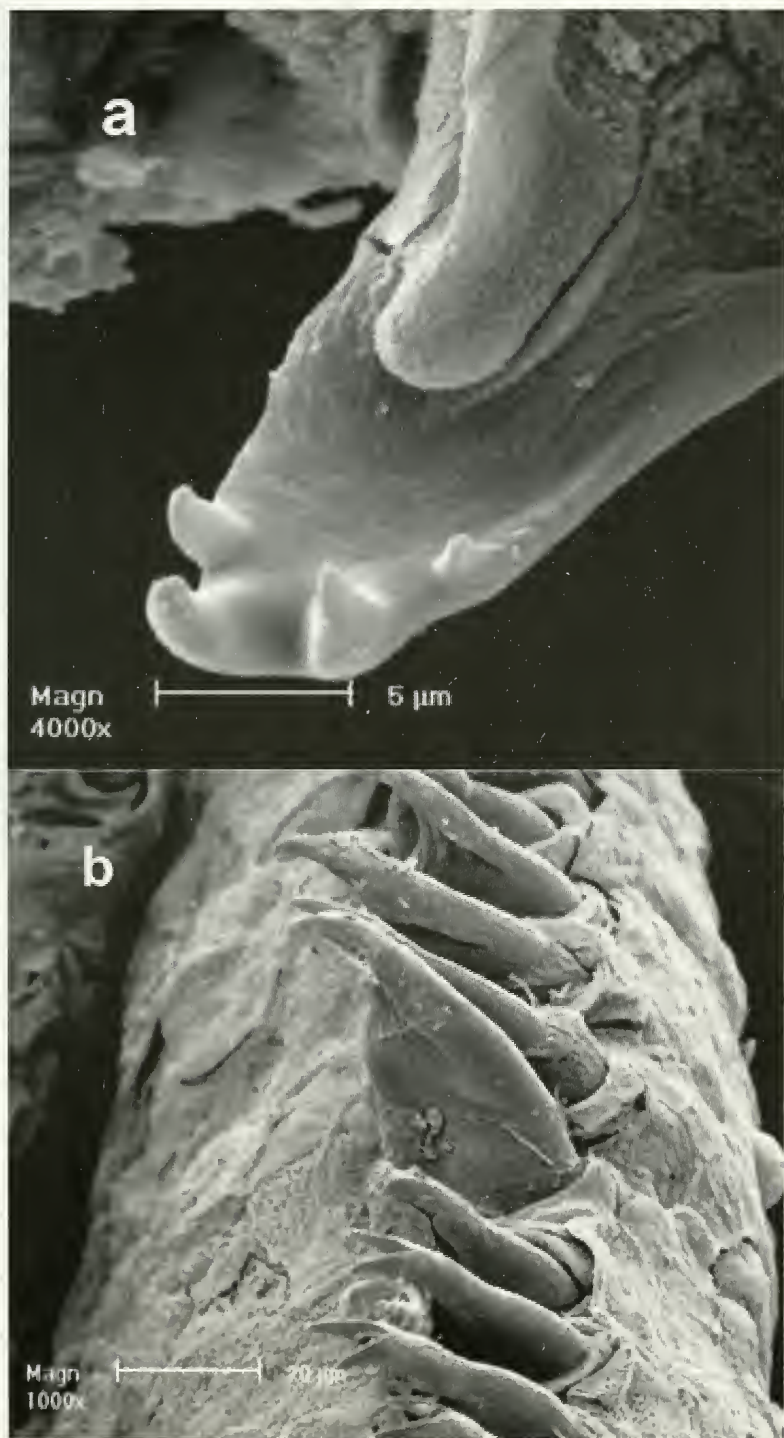
MATERIAL AND METHODS

Egg clutches were obtained from amplexed pairs collected in the field between 16 March and 5 April 2003 in the Kakamega Forest (0°21' N, 34°51' E; 1650 m above sea level), Western Province, Kenya. The adults were diagnosed according to Lötters *et al.* (2004). Their tadpoles were reared in captivity, and different developmental stages were fixed and stored in 4% formaldehyde. Voucher specimens have been deposited at the Muséum d'histoire naturelle, Geneva (*Hyperolius kivuensis*: MHNG 2661.31, N = 23; *H. viridiflavus*: MHNG 2661.42, N = 50).

Larval stages were diagnosed according to Gosner (1960). Body measurements were taken using the primary landmarks of Altig & McDiarmid (1999a). A W-PL 10x/23 ocular attached to a Zeiss Stemi 2000-C stereomicroscope was applied. The labial tooth row formula (LTRF) was defined by Altig & Johnston (1989). Photographs of live larvae were taken with a Contax Aria digital camera to obtain life color information.

FIG. 2

The labial teeth of *Hyperolius kivuensis* in stage 36: (a) cusped teeth of the anterior (upper) labium (posterior view). (b) non-cusped (pointed) teeth and cusped (bifurcated) teeth (at the bottom of the micrograph) of the posterior (lower) labium. LDC = long distal bifurcated cusps.



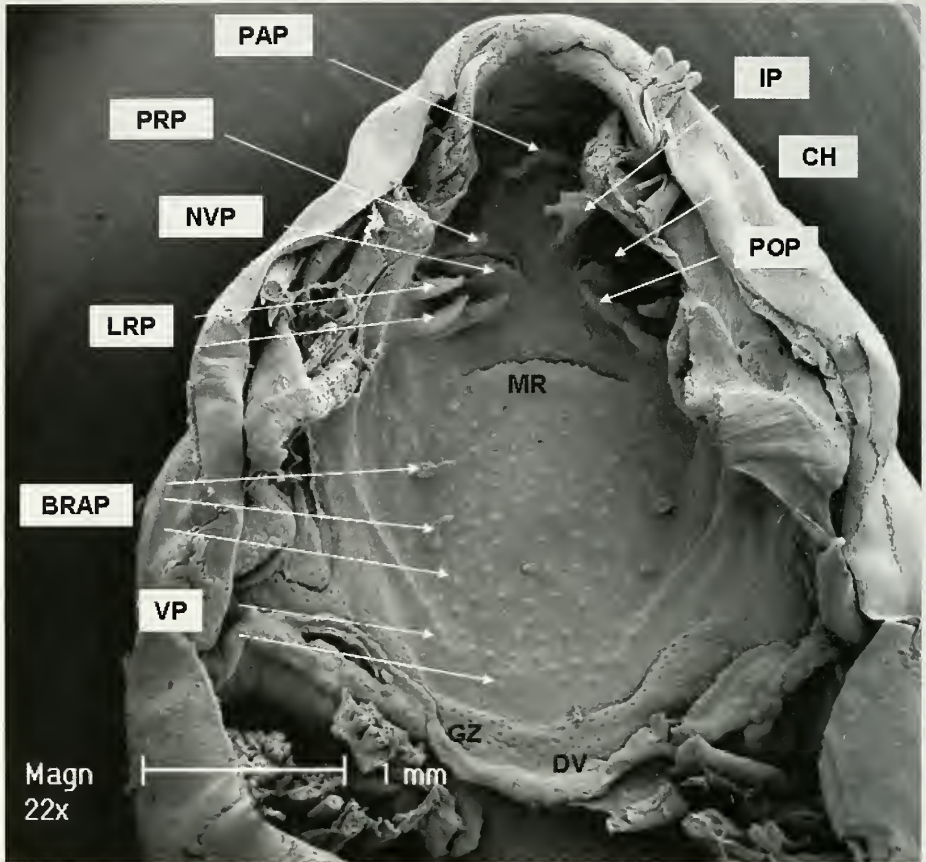


FIG. 3

The oral cavity of *Hyperolius kivuensis* in stage 36: the roof of the mouth. PAP = prenarial arena pustulations, POP = postnarial papillae, PRP = prenarial papillae, IP = infralabial papillae, CH = choanae, internal nares, NVP = narial valve projection, LRP = lateral ridge papillae, MR = median ridge, BRAP = buccal roof arena papillae or pustulations (smaller than the height twice the diameter of the base), VP = prevelar pustulations, GZ = glandular zone, DV = dorsal velum (terminology according to Wassersug, 1980; Viertel, 1982).

The heads of 25 tadpoles (stage 36) from each species were dissected under the binocular microscope (carcasses were not maintained as vouchers) to describe the oral cavities. For scanning electron microscopy (SEM) twelve specimens from each species were dehydrated in 70%, 80%, 96%, and 100% acetone. After desiccation with liquid CO₂ in a critical-point drying apparatus (BAL-TEC CPD 030) the specimens were coated with gold (sputter coater BAL-TEC SPD 005). A Philips ESEM XL 30 scanning electron microscope was used.

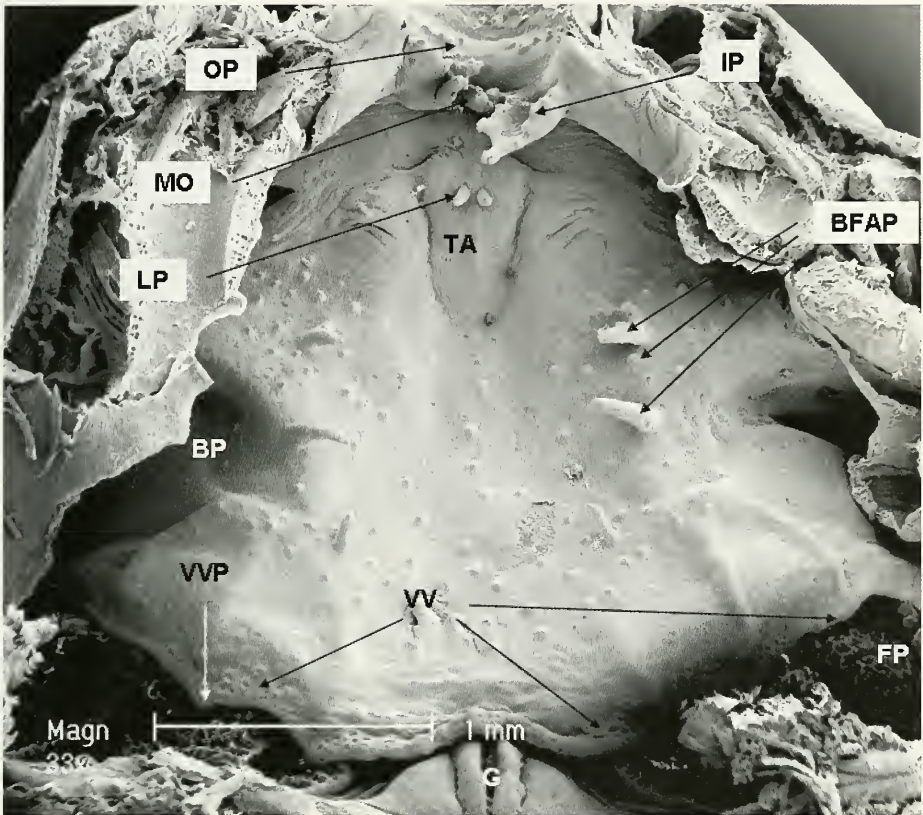


FIG. 4

The oral cavity of *Hyperolius kivuensis* in stage 36: the floor of the mouth. OP = pustulations in the oral orifice, MO = median papilla in the oral orifice, TA = tongue anlage, LP = lingual papilla, IP = infralabial papillae, BFAP = buccal floor arena papillae or pustulations (smaller than the height twice the diameter of the base), BP = buccal pocket, VV = ventral velum, VVP = velar papilla, FP = filter plate, G = glottis (terminology according to Wassersug, 1980; Viertel, 1982)

RESULTS

THE TADPOLE OF *HYPEROLIUS KIVUENSIS* AHL, 1931

External morphology: Measurements are as follows (mm): stage 36 (N = 14), total length (TL) = 34.9 (range 28.8-40.7), body length (BL) = 11.6 (range 10.6-13.1), BL/TL = 0.33 (range 0.31-0.38). The following description is based on a larva stage 36 as shown in Figure 1 (MHNG 2661.31, individual number W19). In dorsal view the body is elongated and ovoid and is widest at mid-body. The snout is rounded both in lateral and dorsal views. The eyes are relatively large, somewhat bulging, and not visible in ventral view. The interorbital distance is equal to the shortest distance to the tip of the snout. The eyes are positioned laterally and are directed dorsolaterally. The external nares are ovoid (horizontally elongated), small, and positioned laterally. They

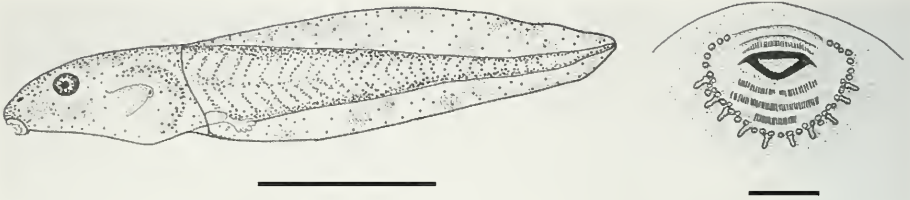


FIG. 5

Views of lateral body and oral disc of a *Hyperolius viridiflavus* larva from western Kenya, stage 36 (MHNG 2661.42). Lines equal 1 cm and 1 mm, respectively. Illustration by A. and J. Channing.

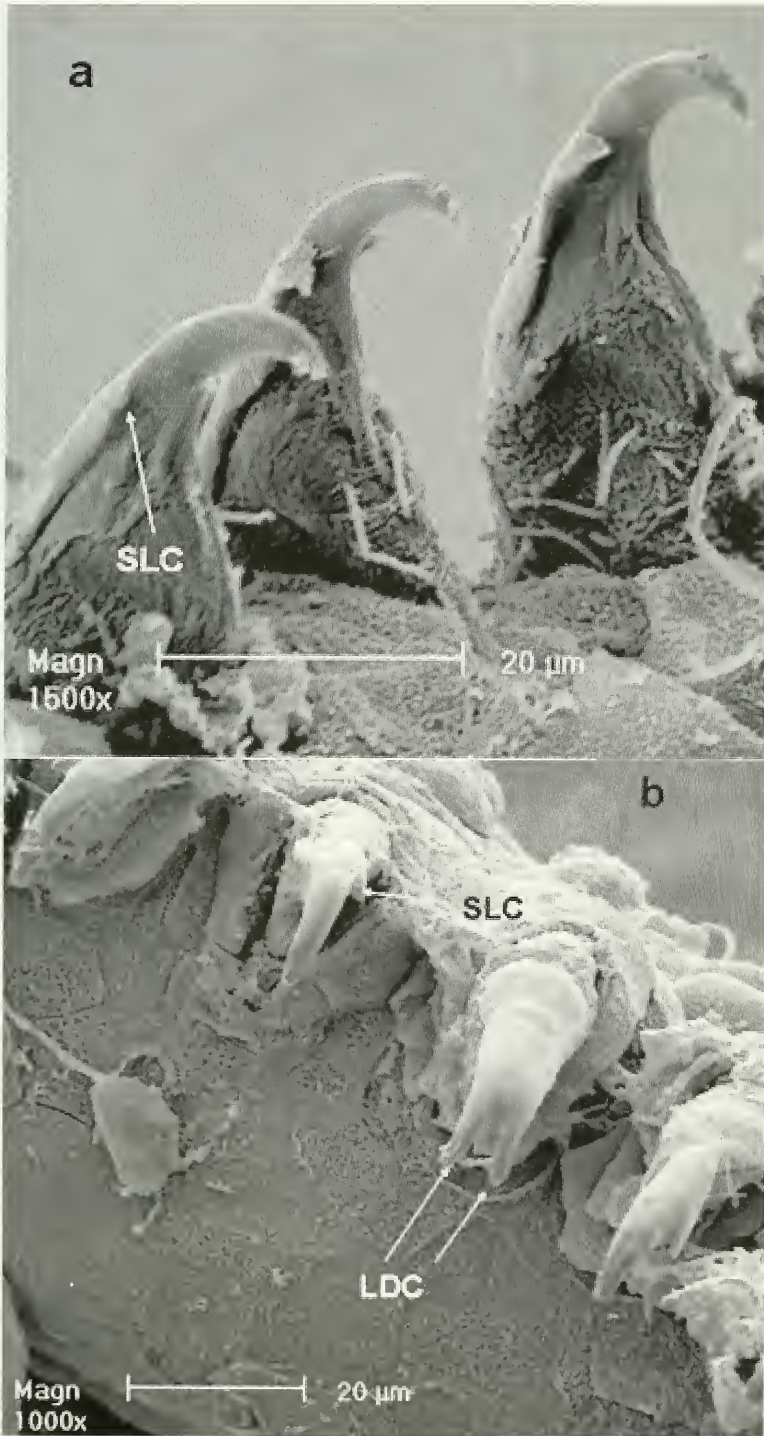
are more closely positioned to the snout than to the eyes. In lateral view the body is highest at the posterior half. The height is about one half of the body length. The spiracle is single, sinistral, and attached to the body wall. Its shape is cylindrical and in length it equals half eye diameter to eye diameter. The spiracle opening is rounded, directed posteriorly, and located slightly anterior to the mid-axis of eye and vent tube. The length of the tail represents approximately two thirds of the total length and is highest at about mid-tail. The total tail height is about three quarters of the body length. The tail fin height is greater than that of the body. The upper tail fin is larger in height than the lower. The dorsal fin is highest from mid tail to the posterior quarter of the tail. The ventral fin is almost as high just before the rounded tip of the tail. The height of the tail musculature is about half of the maximum tail height. The dorsal fin does not extend onto the body. The vent tube is short, dextral, posteriorly directed, and linked to the tail musculature. The oral disc is anteroventral, not emarginated, and entirely bordered by a row of short round papillae. Few submarginal papillae are present. The LTRF is $1/3(1, 2)$. The tooth rows are equal in length, occupying nearly the entire width of the oral disc except the shorter, most posterior one. Jaw sheaths are finely serrated. The upper jaw sheath is inversely U-shaped and the lower V-shaped and shorter.

The variation in external morphology of 23 larvae between stages 32 and 40 is limited to size (Table 1) and LTRF including $1/3$, $1/3(1)$, $1/3(1, 2)$, $1/3(2)$, $1/3(1, 3)$, and $1/3(3)$. LTRF observed in specimens in stages 25 and 26 (tadpoles not preserved) was $1/2$, $1/2(1)$, $1/2(1, 2)$, and $1/2(2)$. Gaps occurred in the centers or more to the periphery of tooth rows.

Two different types of keratinized labial tooth are found. The spoon-shaped cusped type is often seen and is represented in two different morphological subtypes. One has four cusps and the two distal cusps were only slightly larger than the lateral cusps (Fig. 2a). In the other subtype, the two distal cusps are clearly larger than the one or two lateral cusps (Fig. 2b) and form a bifurcated fork. The non-cusped (pointed) type is rarely found.

FIG. 6

The labial teeth of *Hyperolius viridiflavus* in stage 36: (a) pointed teeth with small lateral cusps in the anterior (upper) labium. (b) bifurcated type of the anterior (upper) labium. LDC = long distal bifurcated cusps, SLC = small lateral cusp.



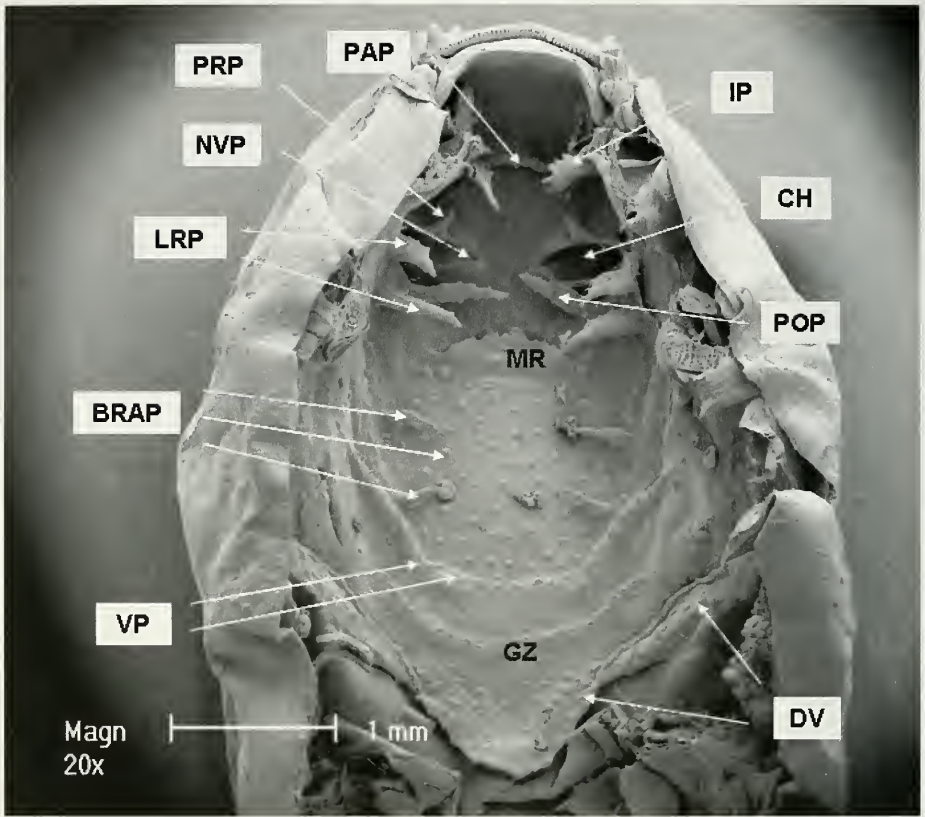


FIG. 7

The oral cavity of *Hyperolius viridiflavus* in stage 36: the roof of the mouth. For abbreviations see Figure 3.

In preservative, the larvae are entirely light gray to tan. They are darker on the dorsal body from dense scattered melanophores and are translucent on the posterior venter. Melanophores on the tail musculature and the fins are almost uniformly arranged. The margins of the fins are dark gray and melanophores are observed on the spiracle. The coloration in life of the body was dorsally tan and ventrally translucent whitish. The tail musculature was tan and the fins were translucent tan with irregular dark marbling. A dark line occurred on the tail musculature along one third of tail length beginning at the base of the tail. The pupil coloration was black and the iris was bronze with a bright ring around the pupil.

Oral cavity: The description of the roof and floor of the mouth is based on Figures 3 and 4, respectively. The buccal roof is divided into three areas. The prenarial arena is positioned in the anterior region of the upper beak. The small prenarial arena postulations (PAP) are arranged in a horseshoe shape, sometimes in a V. The central PAP are fused at their base, the lateral PAP are not. The prenarial arena is bordered caudally by the choanae (CH) or internal nares. They are arranged in a posteriorly open

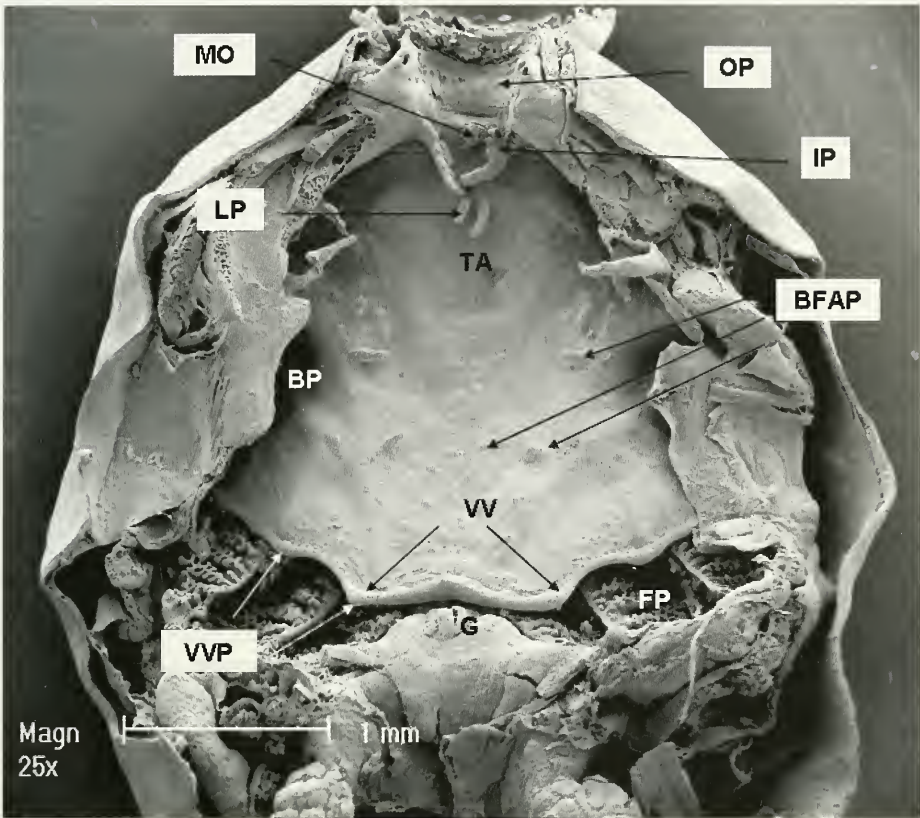


FIG. 8

The oral cavity of *Hyperolius viridiflavus* in stage 36: the floor of the mouth. For abbreviations see Figure 4.

V forming an obtuse angle. The CH is surrounded anteriorly by the PAP and posteriorly by the narial valve projection (NVP). There is one large prenarial papillae (PRP) per CH which is flanked by one or two small pustulations and also one small and lobed NVP on the median margin of each CH. The CH are joined caudally to the postnarial arena with the single large postnarial papilla (POP) positioned dorsolaterally on each side. Close to the POP but more laterally are two large lateral ridge papillae (LRP) equal in size with a separated base, found on each side. The largest of the arenas is the buccal roof arena which is bordered anteriorly by the flat and broadly based median ridge (MR) with a serrated margin, and laterally by two buccal roof arena papillae (BRAP). Around 50 small pustulations are on the buccal roof arena. The buccal roof arena is bordered caudally by the glandular zone (GZ) and the dorsal velum (DV) with 15-20 small pustulations (VP).

The buccal floor arena is the largest region of the buccal floor. It is bordered laterally by the buccal pockets (BP) and anteriorly by the tongue anlage (TA). Three large buccal floor arena papillae (BFAP) on each side are arranged in the form of an

anteriorly open horseshoe and around 60 pustulations cover the buccal floor arena. Two large lingual papillae (LP) are positioned on the TA. The ten small pustulations of the oral orifice (OP) are close to the ventral oral beak anterior to the TA. A single large blunt or pointed lancet-shaped median papilla of the oral orifice (MO) with a broad base and sometimes serrated apex is seen between the OP and the TA. One flat and shovel-like infralabial papilla (IP) with large surface and small pustulations on the margin is positioned laterally on each side in the level of the MO. The buccal floor arena is bordered caudally by the ventral velum (VV) of the pitted type with two broad-based velar papillae (VVP) on each side. Spot-tests with larval stage 32 demonstrated the same arrangement of oral cavity structures as described for stage 36.

Remarks: Wild-caught larvae attributed to *H. kivuensis* from the same pond at the Kakamega Forest (MHNG 2661.32-41, N = 60) well coincide with the external description given above.

THE TADPOLE OF *HYPEROLIUS VIRIDIFLAVUS* (DUMÉRIL & BIBRON, 1841)

External morphology: Measurements are as follows (mm): stage 36 (N = 38), total length (TL) = 35.4 (range 30.0-39.6), body length (BL) = 11.5 (range 10.3-12.9), BL/TL = 0.33 (range 0.31-0.36). The following description is based on a larva stage 36 as shown in Figure 5 (MHNG 2661.42, individual number D14): In dorsal view the body is elongated, ovoid, and widest behind the eyes. The snout is rounded in dorsal and ventral view. The eyes are relatively large and somewhat bulging. The interorbital distance is larger than the shortest distance to the tip of the snout. The eyes are positioned laterally, directed dorsolaterally, and not visible in ventral view. The nares are slit-like (horizontally), small, and positioned dorsolaterally. They are more closely positioned to the snout than to the eyes. In lateral view the body is highest at the posterior half. The height is about one half of the body length. The spiracle is single, sinistral, and not attached to the body wall. Its shape is cylindrical and the length equals the eye diameter. The spiracle opening is rounded, directed posteriorly, and located on the mid-axis of eye and vent tube. The length of the tail represents about two thirds of the total length and is highest at the anterior half. The total tail height is about two thirds of the body length. The tail fin height is greater than that of the body. The upper tail fin is taller than the lower. The dorsal fin is highest from mid tail to the posterior quarter of the tail. The ventral fin is almost as high just before the rounded tip of the tail. The height of the tail musculature is less than half of the maximum tail height. The dorsal fin does not extend onto the body. The vent tube is short, dextral, posteriorly directed, and linked to the tail musculature. The oral disc is anteroventral, not emarginated, and entirely bordered by a row of short round papillae. Submarginal papillae are absent. The LTRF is 1/3(1). The tooth rows are equal in length occupying nearly the entire width of the oral disc except for the shorter, most posterior one. Jaw sheaths are finely serrated. The upper jaw sheath has an arched, inverted U-shape, the lower is V-shaped and is shorter.

The variation in external morphology of 50 larvae between stages 30 and 40 is limited to size (Table 1) and LTRF including 1/3, 1/3(1), 1/3(1, 2), 1/3 (1, 2, 3), 1/3(1, 3), 1/3(2), and 1/3(3). LTRF observed in specimens in stages 25 and 26 (tadpoles not preserved) is 1/2, 1/2(1), 1/2 (1, 2), and 1/2(2). Gaps are observed in the centers or more to the periphery of tooth rows.

TABLE 1. Measurements (mm) and ratios of 23 larvae of *Hyperolius kivuensis* and 50 larvae of *H. viridiflavus* from western Kenya in different stages. In $N > 2$, the mean is given, followed by one standard deviation, and the range in parentheses.

stage	N	total length	body length	body length/total length
<i>Hyperolius kivuensis</i>				
32	1	32.5	11.1	0.34
34	2	31.0, 32.4	10.6, 11.2	0.34, 0.35
35	1	33.5	11.4	0.34
36	14	34.9 ± 3.1 (28.8-40.7)	11.6 ± 0.6 (10.6-13.1)	0.33 ± 0.1 (0.31-0.38)
37	2	36.1, 36.6	12.0, 12.7	0.33, 0.35
38	1	38.2	12.2	0.32
39	1	38.6	13.7	0.36
40	1	40.4	13.4	0.33
<i>Hyperolius viridiflavus</i>				
30	1	27.1	9.4	0.35
33	1	32.9	10.2	0.31
34	1	30.8	11.1	0.36
35	2	35.4, 36.8	10.5, 11.5	0.30, 0.31
36	38	35.4 ± 2.2 (30-39.6)	11.5 ± 0.6 (10.3-12.9)	0.33 ± 0.01 (0.31-0.36)
37	3	36.2 ± 2.5 (33.5-38.4)	11.7 ± 0.3 (11.5-12.0)	0.30 ± 0.1 (0.30-0.34)
38	2	33.4, 40.0	12.7, 13.3	0.33, 0.38
39	1	40.6	12.8	0.31

Two different types of keratinized labial tooth are found. A pointed type with small lateral cusps (Figs 6a, b) is the most common type. The second type is characterized by two long distal cusps forming a bifurcated fork and two small lateral cusps (Fig. 6b). The cusped type with cusps of the same size as seen in *H. kivuensis* is rare. All these types are seen in one individual tadpole. There is no difference between stages 32 and 36.

In preservative, larvae are entirely translucent gray. They are darker on the dorsal body from dense scattered melanophores. Melanophores on the tail musculature are almost uniformly arranged while on the fins they are arranged in patches. On the spiracle the melanophores are distally missing. The coloration in life of the body was dorsally brownish with tiny dark brown and occasionally cream spots and ventrally translucent cream. The tail musculature was tan and the fins were translucent tan with dark blotches. The pupil coloration was black and the iris was bronze with a bright ring around the pupil.

Oral cavity: The description of the roof and floor of the mouth is based on Figures 7 and 8, respectively. The structures and their number are the same as in *H. kivuensis* with the exception of the choanae. These are arranged in an anteriorly open V forming an obtuse angle, in contrast to the latter species with a posteriorly open V. There is no difference between stages 32 and 36.

Remarks: Wild-caught larvae attributed to *H. viridiflavus* from the same pond at the Kakamega Forest (MHNG 2661.43-51, N = 54) well coincide with the external description given above.

DISCUSSION

External features in the two species are similar and both are comparable with other *Hyperolius* (Rödel, 1999; Schiøtz, 1999; Channing, 2001; Channing & Howell, 2006). *Hyperolius kivuensis* and *H. viridiflavus* differ in the frequency of occurrence of the two morphological types of teeth. The main type in the former is the cusped type with four cusps of nearly the same size. This type is rare in *H. viridiflavus*, while in larvae of this species the pointed type with or without small lateral cusps is the main type. Oral cavity structures of the two species are similar. Only the position of the choanae shows a clear difference. In *H. kivuensis*, they are arranged in a V which is opened posteriorly forming an obtuse angle, while in *H. viridiflavus* the V is open anteriorly in an obtuse angle. In some larvae of the latter species, the choanae do not form an angle.

The external morphology, including the oral disc, the keratinized labial teeth, and the oral cavity structures characterize both *H. kivuensis* and *H. viridiflavus* as extrophous lentic benthic generalized tadpoles (Altig & McDiarmid, 1999a, b). The ventral velum of the pitted type and the oral disc are in connection with the sinistral position of the spiracle criteria of the larval type IV (Starrett, 1973). This is corroborated by the repertoire of structures in the oral cavity that are comparable to those from European larvae of *Bufo bufo*, *Epidalea calamita*, and *Rana temporaria* of the same larval type (Viertel, 1985, 1987). These tadpoles are known to filter suspended particles such as phytoplankton and detritus from the water (Viertel, 1990, 1992). They also scrape food off the substrate with the keratinized labial teeth in connection with the oral disc, suspend it in the water current and filter it. We expect larvae of both *Hyperolius* species to share this generalized feeding behavior.

Our analyses clearly show that morphological differences between tadpoles of these two syntopic *Hyperolius* species are restricted to a few characters only and at best visible when applying REM technology. We expect many ecologically equivalent *Hyperolius* species to have ecologically – and hence morphologically – similar tadpoles. This casts doubts that external larval morphology will enable field researchers to discriminate between all ca. 120 *Hyperolius* species, even though only a few always occur sympatrically (e.g. Schiøtz, 1999; Channing, 2001; Channing & Howell, 2006). DNA barcoding may therefore become the future method of choice to identify *Hyperolius* tadpoles, although inevitably after fieldwork.

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Abstract. The abstract is in English, composed of the title and a short text of up to 200 words. It should summarise the contents and conclusions of the paper and name all newly described taxa. The abstract is followed by up to 10 keywords, separated by hyphens, which are suitable for indexing. Some of the terms used in the title may be omitted from the list of keywords in favour of significant terms not mentioned in the title.

Introduction. A short introduction to the background and the reasons for the work.

Material and methods. Sufficient experimental details must be given to enable other workers to repeat the work. The full binominal name should be given for all organisms. The International Code of Zoological Nomenclature must be strictly followed. Cite the authors of species on their first mention.

Results. These should be concise and should not include methods or discussion. Text, tables and figures should not duplicate the same information. New taxa must be distinguished from related taxa. The abbreviations gen. n., sp. n., syn. n. and comb. n. should be used to distinguish all new taxa, synonymies or combinations. Primary types must be deposited in a museum or similar institution. In taxonomic papers the species heading should be followed by synonyms, material examined, description, distribution, and comments. All material examined should be listed in similar, compact and easily intelligible format; the information should be in the same language as the text. Sex symbols should be used rather than "male" and "female" (text file: ♂ = ♂, ♀ = ♀).

Discussion. This should not be excessive and should not repeat results nor contain new information, but should emphasize the significance and relevance of the results reported.

References. The author-date system (name-year system) must be used for the citation of references in the text, e.g. White & Green (1995) or (White & Green, 1995). For references with three and more authors the form Brown *et al.* (1995) or (Brown *et al.*, 1995; White *et al.*, 1996) should be used. In the text authors' names have to be written in standard type face. However, in the list of references they should be formatted in SMALL CAPITALS (see below). The list of references must include all publications cited in the text and only these. References must be listed in alphabetical order of authors, in the case of several papers by the same author, the name has to be repeated for each reference. The title of the paper and the name of the journal must be given in full in the following style:

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MERTENS, R. & WERMUTH, H. 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: WENZEL, R. L. & TIPTON, V. J. (eds). *Ectoparasites of Panama. Field Museum of Natural History, Chicago*, XII + 861 pp.

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