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LES

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

tome 110
fascicule 4
2003

SWISS JOURNAL OF ZOOLOGY

REVUE SUISSE DE ZOOLOGIE



GENÈVE DÉCEMBRE 2003 ISSN 0035 - 418 X

REVUE SUISSE DE ZOOLOGIE

TOME 110—FASCICULE 4

Publication subventionnée par:
ACADÉMIE SUISSE DES SCIENCES NATURELLES ASSN
VILLE DE GENÈVE
SOCIÉTÉ SUISSE DE ZOOLOGIE

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Directeur du Muséum d'histoire naturelle de Genève

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Internet: <http://www.ville-ge.ch/musinfo/mhng/page/rsz.htm>

PRIX DE L'ABONNEMENT:

SUISSE Fr. 225.—

UNION POSTALE Fr. 230.—

(en francs suisses)

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

REVUE SUISSE
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ISSN 0035-418X

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New species and records of *Microphorella* Becker (Diptera: Empidoidea, Dolichopodidae) from the Mediterranean region

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New species and records of *Microphorella* Becker (Diptera: Empidoidea, Dolichopodidae) from the Mediterranean region. - Two new species of *Microphorella* Becker, *M. ulrichi* sp. n. from Morocco and Tunisia, and *M. merzi* sp. n. from Cyprus, Malta and Turkey are described. Two additional species from Turkey and Israel are not described because of inadequate material. *M. curtipes* (Becker) is newly recorded from Sardinia, and the genus is newly recorded from North Africa, Sardinia, Malta, Turkey, Cyprus and Israel.

Key-words: Diptera - Dolichopodidae - Parathalassiinae - *Microphorella* - new species - new records - Mediterranean region.

INTRODUCTION

Microphorella Becker is a little known genus of basal Dolichopodidae which, together with *Parathalassius* Mik, *Amphithalassius* Ulrich, *Plesiothalassius* Ulrich and *Thalassophorus* Saigusa, has tentatively been placed in a subfamily - Parathalassiinae Chvála 1981 - tentatively only, because the subfamily may be a paraphyletic assemblage. Originally, the then known genera were included in the former Empididae. They were subsequently transferred to the Microphoridae when the Empididae was divided into four distinct families by Chvála (1981-1988). However, phylogenetic evidence is very strong that the Parathalassiinae are more closely related to the Dolichopodidae s. auct. than to the Microphorinae, forming a monophylum with the former, not the latter (Ulrich, 1990, 1991 and in litt.; Cumming & Sinclair, 2000).

The genus, as currently defined, is known from 5 Nearctic (Melander, 1928), 1 Australian (Colless, 1963) and 3 Palearctic (Chvála, 1988) species. More species, both extant and fossil, doubtlessly occur. Shamshev & Grootaert (2002) recently erected a new genus, *Chimerothalassius*, for a new species of the *Microphorella* group from New Zealand.

Likewise, two fossil species of *Microphorella*-like flies have recently been described from Baltic amber by Cumming & Brooks (2002) who erected a new genus, *Electrophorella*, for them.

Species of *Microphorella* are minute flies with inconspicuous habits, and are thus easily overlooked. Consequently, they are not commonly found in collections.

They have been collected by sweeping on sandy beaches, gravel and sand in river beds, and on moist rocks in streams. The small flies are very difficult to spot while resting on sand, and will only be caught if deliberate, slow, sweeping movements are employed, with the mouth of the net held very close to the ground.

The three Palaearctic species have been reviewed by Chvála (1988) who also figured male and female genitalia. They include *M. praecox* (Loew, 1864) from central and northern Europe, *M. beckeri* (Strobl, 1910) from Austria and northern Yugoslavia, and *M. curtipes* (Becker, 1910) from northern Italy and Corsica. The Palaearctic species known so far are therefore exclusively distributed in Europe from the Mediterranean in the south, north to the arctic circle (Chvála 1988, Fig. 1). Only one species, *M. curtipes*, is known from the Mediterranean (Corsica). Since that time, the genus has received scant attention. No new species have been described, and no new records have been added from the Mediterranean. It is therefore of interest to describe two new mediterranean species, and to record the genus for the first time from the coast of North Africa (Tunisia and Morocco), the mediterranean islands of Sardinia, Malta and Cyprus, and the mediterranean coasts of Turkey and Israel. A further two new species from Turkey and Israel are not described because of lack of adequate material.

MATERIAL AND METHODS

The material available for this study was collected in large part by the author. Valuable material was also contributed by Dr Bernhard Merz (Geneva), Dr Martin Ebejer (Cardiff) and Dr John Deeming (Cardiff).

Dissected specimens on which the drawings are based are stored in glycerine microvials mounted on pins in the author's collection. Slide mounts of wings, antennae, and legs were prepared in Berlese fluid, as described by Disney (1983). Drawings were made with the aid of a x250 stereomicroscope and drawing tube. For some figures (Figs 2-3, 6-8, 11, 17, 21) a compound microscope with built in ocular grid was employed. Drawings of complex structures made from slide mounts studied in transmitted light (eg. Fig. 7) fail to make a clear distinction between internal and external structures, and cannot show how the various parts are interconnected.

The following abbreviations are used in the figures 1-21:

Ae	aedeagus	Mt	metatarsus
C	cercus	OH	opisthypandrium
d	digitiform process	PST	pigmented spinulated tubercle
fo	foramen from segment 8	s5-s7	abdominal sternites 5-7
HA	hypandrium	t5-t8	abdominal tergites 5-8
ht8,		T	tibia
ht10	abdominal hemitergites 8 and 10	TC	tibial comb
LPL	left periandrial lamella	vp8	ventral plate of segment 8

Labels of types are cited verbatim. The text of each separate label is enclosed in quotation marks, whilst individual lines on each label are separated by slashes.

The depositories of all specimens are indicated by the following abbreviations or initials in brackets at the end of each citation under 'material examined':

- MHNG Muséum d'histoire naturelle, Genève, Switzerland
 MJEB Private collection of M. J. Ebejer, Cardiff, Wales
 NMGW National Museum and Galleries of Wales, Cardiff
 PGR Private collection of P. Gatt, Rabat, Malta
 ZFMK Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn, Germany

The terminology used in this account follows Chvála (1988) and Ulrich (1974, 1991) except for the parts of the antennae which is after Stuckenberg (1999).

TAXONOMIC TREATMENT

Microphorella ulrichi sp. n.

Figs 1-11

MATERIAL EXAMINED (31 ♂♂, 16 ♀♀)

Holotype male: "MOROCCO: Tangier, / Ksar Sghir, Oued Araml, / Beach & Dunes, / 13.IV.2001, P. Gatt", "HOLOTYPUS / *Microphorella* / *ulrichi* sp. n. / det. P. Gatt 2003" (ZFMK). The holotype is preserved in alcohol and is in good condition.

Paratypes: 12 ♂♂, 9 ♀♀, same data as holotype (ZFMK, PGR); 1 ♀, "TUNISIA: Ain Draham / Al Furnan, 900m / *Quercus*, 13.V.1995 / P. Gatt" (ZFMK); 1 ♂, "TUNISIA / J. C. Deeming / NMW.Z / 1995:026", "Atlas Mts., / Ain Draham, / Al Furnan, / 12v.1995" (NMGW); 1 ♀, "TUNISIA: Jendouba / Fernana, *Pinus*, / 14.V.1995, P. Gatt" (ZFMK); 1 ♂, "TUNISIA, Tabarka / Ain Sobah, dunes / eucalyptus, pine, bog / 15.V.1995 M. J. Ebejer" (MJEB); 13 ♂♂, 3 ♀♀, "TUNISIA: Tabarka / Tamra, *Quercus*, / Stream, meadows, / 19.III.2001; P. Gatt" (ZFMK, MHNG, PGR).

Other material: 1 ♂, same data as holotype (PGR); 1 ♂, 2 ♀♀, Tunisia, Ain Draham, Al Furnan, 900m, *Quercus*, 13.V.1995, P. Gatt (PGR); 1 ♂, Tunisia, Tabarka, Tamra, *Quercus*, stream, meadows, 19.III.2001, P. Gatt (PGR).

ETYMOLOGY

This species is dedicated to Dr Hans Ulrich in recognition of his expertise on the Parathalassiinae, and in gratitude for his assistance throughout the preparation of this paper.

DIAGNOSIS

Small, greyish dusted, sexually dimorphic species with strongly infuscated wings, 'pigmented spinulated tubercles' (see below) on fore and hind metatarsi, dilated fore tarsi (male) and a digitiform process at base of hind femur (male).

DESCRIPTION

Male

Head. Higher and wider than deep, grey dusted; eyes widely separated on frons, all facets equally small, covered with short, white, hairs, longer towards ventral pole of eye; occiput only narrowly projecting beyond posterior margin of eye, concave above neck, convex below, greyish-brown dusted, with some metallic reflections; jowls narrow; face long and narrow, narrowest in middle and widening both above and below,

silvery grey dusted, narrower than frons above antennae; clypeus grey. Chaetotaxy: cephalic bristles blackish; anterior pair of ocellar bristles strong, diverging, almost as strong as one pair of fronto-orbitals; posterior pair of ocellar bristles minute; 3 pairs of strong vertical bristles, the inner converging, the outer 2 diverging, all almost as strong as anterior ocellars; an additional, very short bristle present between the two lateral pairs; postocular cilia long, dark, and strictly uniserial above neck, becoming paler, longer and irregularly multiserial below. Antennae (Fig. 1) placed well above middle of head in profile; scape (segment 1) small, bare and orange brown in colour; pedicel (segment 2) globular, with greyish micropubescence, and subapical collarette of longer, whitish hairs; postpedicel (segment 3) dark brown, roughly symmetrical in profile, tear-drop shaped, covered with both micropubescence and with long, whitish hairs; postpedicel ending in very long, uniaarticulate stylus (arista) clothed with microscopic pubescence; proboscis short, narrow, directed forwards, dark brown and lustrous; palps one-segmented, yellow, broadly triangular in profile, each bearing a sensory pit and one long, white, subapical bristle in addition to some shorter hairs.

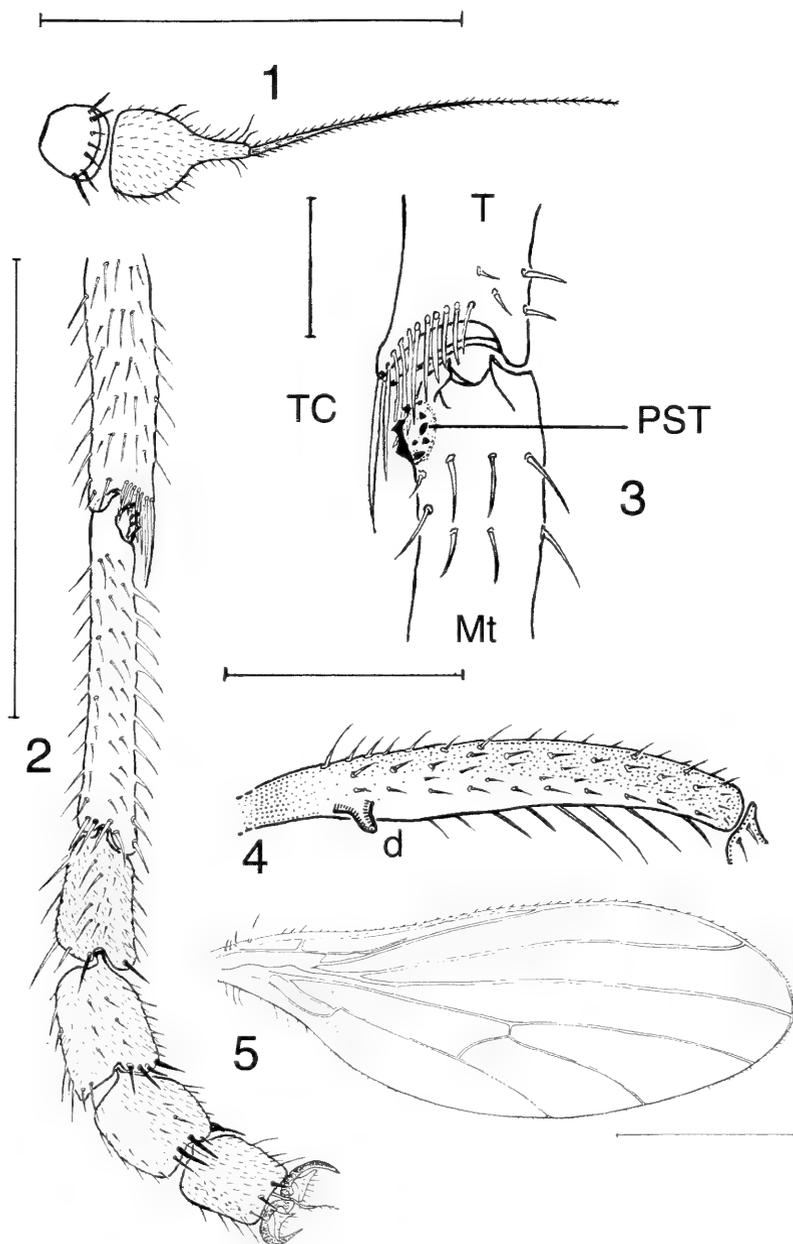
Thorax. Black in ground colour; dorsal surface of mesoscutum arched: anterior slope behind neck vertical; posterior slope with flattened prescutellar area. Mesoscutum: viewed from in front and above, grey dusted anteriorly and posteriorly, central part subshining and clothed with golden brown micropubescence; viewed from behind and above, dusted before suture, subshining behind. Complete prothoracic precoxal bridge present. Chaetotaxy: thoracic bristles black; acrostichals very short, piliform, widely separated and biserial anteriorly, converging posteriorly, disappearing shortly behind transverse suture, preceded anteriorly by a longer pair arising from anterior slope of mesoscutum; dorsocentrals 2+3, uniserial, long, bristle-like, more or less equally strong, except for prescutellar pair, which is longer, wider apart, and almost as strong as scutellars; some short, accessory bristles, the size of acrostichals, inserted before, between and both inside and outside the anterior 2 dorsocentrals; humeral callus with two very short setae but no strong humeral bristle; 1 long posthumeral inserted far from humeral callus, 2 notopleural, 3 supra-alar (the anterior very weak), 1 postalar and 1 pair of long, converging, scutellar bristles. Pleura bare, grey dusted.

Legs. Long and slender, yellow in ground colour, greyish dusted, finely bristled with short, generally whitish hairs except on coxae and trochanters; fore coxae mostly yellow, grey dusted; mid and hind coxae brown, more heavily dusted; trochanters yellowish brown, hind trochanters the darkest; femora infuscated dorsally, more strongly bristled dorsally and apically; fore and mid femora equally strong; hind femora longer, more bristled; tibiae yellow, covered with blackish hairs; tarsi yellow, but fifth segment of fore tarsus, and fourth and fifth segments of mid and hind tarsi distinctly darkened; all tarsi, but especially the middle, with short, spine-like setae on ventral surface, and at apices of segments; tarsal claws large, pulvilli large and ventrally haired, empodium setiform, forked, haired. Fore leg: coxa sparsely covered with short pale hairs anteriorly, longer near apex; trochanter with a short dorsal apical bristle; femur with a posteroventral row of bristly hairs, longer towards the apex; ventrally, at base, with a group of curved hairs; tibia (Fig. 2, 3) with an apical, anterior comb of close set spinules. Tarsus (Fig. 2) modified: metatarsus long and slender, as long as following 3 segments together, yellow in ground colour, sparsely clothed with

short, blackish hairs; anteriorly, at base, and overlapped by fore-tibial comb, with a minute, pigmented tubercle, the surface of which bears a number of short, sclerotised blunt spinules and sharp thornlets (Fig. 2, 3); tarsal segments 2-5 broadened and dorsoventrally flattened, densely clothed with minute, white, adpressed hairs and with some longer, whitish setulae; middle 3 tarsal segments thus with a distinct silvery-white sheen, contrasting strongly with the yellow metatarsus proximally, and the darkened fifth tarsal segment distally. Mid leg: coxa with 1 strong downcurved apical bristle and a vertical row of 3 bristles on lateral surface, the lower much stronger; trochanter with a strong dorsal bristle and a series of short, curved, fine, ventral hairs; femur, ventrally at base, with some longer, curved hairs; posteroventrally, near apex, with 1-2 long bristles; tibia with a strong, dark, ventral pre-apical bristle, together with a few spine like bristles near apex; metatarsus not much shorter than rest of tarsus, ventral surface with a double row of short, spine-like bristles; short spines at apices of tarsal segments in groups of four. Hind leg: coxa with a short apical bristle and a vertical row of 2 longer bristles on lateral surface near posterior margin, the upper the stronger; trochanter with single bristles apically and laterally; femur (Fig. 4), posteriorly near base, with a shiny, embossed area bearing a short, digitiform process, which, at high magnification ($\times 250$) under the compound microscope appears finely haired and circumferentially and superficially grooved; femur, anteroventrally, on apical three quarters, with a fringe of long, pale, hairs, some of which are longer than femur is deep; tibia slightly, but distinctly, dilated towards apex, and with a posterior apical comb of setulae; ventral surface of tibia conspicuously haired; hind metatarsus as long as segments 2-4; posteriorly, at base, with a pigmented spinulated tubercle overlapped by hind tibial comb; posteriorly, at apex, with a comb of very short hairs.

Wing (Fig. 5). Narrow at base, axillary lobe hardly developed, as in congeners; wing membrane covered with microtrichia, distinctly infuscated yellowish-brown; base of wing paler, more yellowish, including cells *c*, *bm*, *cu*, and the proximal end of cell r_1 ; hind marginal fringe longest at base of wing; wing veins brown, stigma absent; costa continued around wing as 'ambient vein'; anterior margin of costa with short, spine-like bristles in addition to the usual fine hairs; a strong costal bristle present, preceded by 3 shorter, finer ones, all black; *Sc* pale and indistinct, first narrowing, then abruptly widening as it approaches R_1 , fading into costa; R_s originating opposite humeral cross vein; R_1 ending in *C* beyond tip of discal cell; R_{2+3} sinuous, upcurved at its junction with costa; R_{4+5} ending in *C* at tip of wing; crossvein *r-m* distinct; basal cells short, discal cell incompletely separated from second basal cell by M_{3+4} interrupted at base, as in all Parathalassiinae, closed distally by crossvein *m-m* and emitting three veins to wing margin; base of M_2 complete, rather pale in some specimens, although always discernible along its entire length; crossvein *m-m* complete in holotype male, incomplete in some specimens (see 'female' below); CuA_2 curved, as in congeners, $CuA_2 + A_1$ short and indistinct, visible only as a linear, faint shadow on wing membrane; squamae yellowish brown with darker margins, fringe of marginal hairs long and brownish; halteres yellow.

Abdomen. Cylindrical, black in ground colour, less densely grey dusted than thorax, subshining in some lights; tergites sparsely clothed with short, whitish hairs which lengthen towards lateral margins; tergites 1-4, and sternites 1-3 simple, sym-



FIGS 1-5

Microphorella ulrichi sp. n.: 1, ♂, antenna, lateral view; 2, ♂, right fore leg: tarsus and apex of tibia, dorsal view; 3, ♂, left fore leg: apex of tibia and base of metatarsus, dorsal view; 4, ♂, right hind leg: femur and base of tibia, posterior view; 5, wing. Scales: 0.5 mm except for Fig. 3 (0.07 mm) and Fig. 5 (1.0 mm). Abbreviations explained in the text.

metrical, sternites reduced; postabdomen beginning with sternite 4, rotated and lateroflexed to the right, as in congeners; tergites 5 and 6 narrowed and excavated on the right hand side, accomodating hypopygium; tergite 7 normal, tergite 8 vestigial; sternite 4 broad, short, depigmented medially and indented at its hind margin. Sternite 5 (Fig. 6) short, brown and lustrous, modified, with a median, robust, keel-shaped process which is bifid in profile and projecting ventrad; sternite 6 (Fig. 6) broad and angular, more heavily pigmented in middle third; sternite 7 large, quadrangular in side view, dusted except for a polished, roughly triangular area on posterior half; sternite 8 large, clothed with long, white hairs. Hypopygium (Fig 7) of very intricate structure, large, globose, lying on right side of abdomen as in congeners, reaching up to tergite 4; cerci soft, bifid, densely setulose. Opisthyandrium, aedeagus, and associated structures as in Figure 8; opisthyandrium conspicuously ridged along posterior surface; aedeagus with bevel-edged, pointed tip.

Length. Body 1.6 mm, wing 2.5 mm

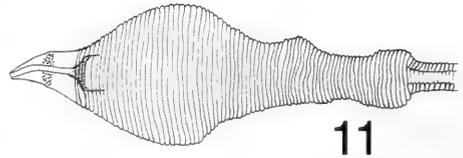
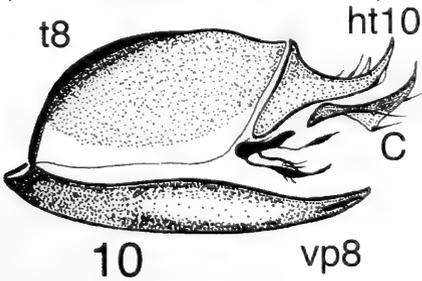
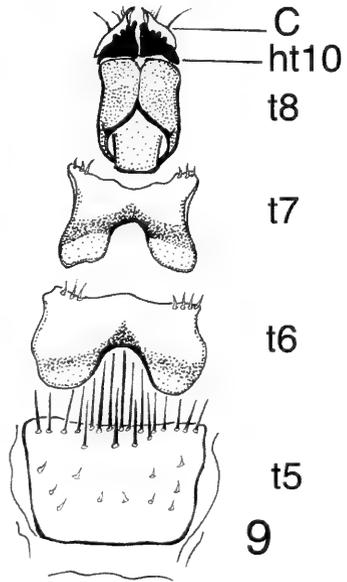
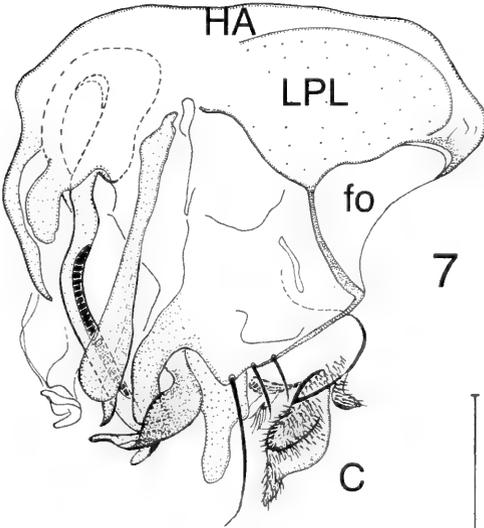
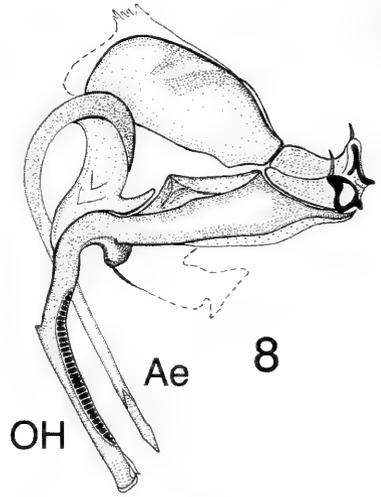
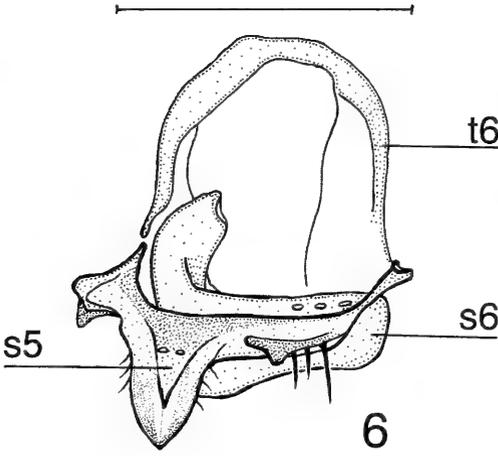
Female

Resembling male in many respects. Body and wings generally longer; face wider, parallel sided; antennae darker, postpedicel less produced apically, stylus somewhat longer; palpi brownish grey; legs more slender, darker, especially coxae; hairs shorter; pigmented spinulated tubercles overlapped by tibial combs present on fore and hind metatarsi as in male, but fore tarsus not dilated. Anteroventral fringe on apical three quarters of hind femur inconspicuous; hind femur without digitiform process. Posterior section (ie. that adjacent to M_3) of cross-vein m-m reduced, and therefore cross-vein m-m incomplete, in one wing only, of each of two female specimens examined. Abdomen (Fig. 9 and 10) of the 'acanthophorous intruded' type (Chvála, 1986), more dorsoventrally flattened, sparsely brownish dusted, shinier, terminalia shining black; hairs on tergites longer, darker, and more numerous. Segments 1-5 simple, forming preabdomen; tergite 5 with a hind marginal fringe of very long black bristles; postabdomen slender, retracted into preabdomen; tergites 6 and 7 butterfly shaped, anteriorly more pigmented, and posteriorly with a few short spines near apices of lateral margins; tergite 8 completely or incompletely divided by a median cleft, deeply emarginate anteriorly, pale and weakly sclerotised posteriorly - when completely cleft, the medial borders of the two halves meet in the median line (as in Fig. 9). Tergite 10 cleft into a pair of hemitergites (acanthophorites), as in congeners, each bearing, at its posterior margin, 4 spines with rounded ends; the two medial ones long and thick, the two lateral ones less than half as long and correspondingly weaker. In dorsal view (Fig. 9), the 4 spines look like blunt pegs. In lateral view (Fig. 10) they appear flattened, pointed, and curved dorsad. Sternite 6 narrow, evenly pigmented, with some long, black hairs on posterior margin; sternite 7 longer, heavily pigmented on lateral margins but very pale centrally; ventral plate of segment 8 long, boat shaped, with distinct, short, longitudinal, parallel, pigmented ridges at tip; one spermatheca (Fig. 11).

Length. Body 1.9 mm, wing 2.6 mm

BIOLOGY

This species has been collected from the marine coast (beach and dunes). It has also been swept from a wet meadow, a pine forest and an oak forest at altitude (900m)



and is therefore clearly not exclusively coastal in habitat. The spines of the female's hemitergites 10 are shaped like curved gutters, suitable for digging into sand and similar soft substrates.

DISTRIBUTION

Hitherto known from the mediterranean coast of North Africa (Tunisia and Morocco).

REMARKS

This species can easily be distinguished from its Palaearctic congeners by the characters given under 'diagnosis'. Other characters of taxonomic importance include: the black thoracic bristles; the short biserial acrostichals; the bristle-like, uniserial dorsocentrals; the two strong supra-alar bristles; and the conspicuous anteroventral fringe of long hairs on the male hind femur.

Pigmented spinulated tubercles have not hitherto been observed in any species of *Microphorella*. They are absent in the two Palaearctic species I have examined (*M. praecox* and *M. curtipes*). The modified fore tarsi and hind femora in the male of this species are also unique. Melander (1928) described dilated hind, but not fore, tarsi in the males of some Nearctic species of the genus.

Combs of spinules on fore and hind tibiae and on hind metatarsi may be more common in members of this, and related, genera, than has hitherto been appreciated. Melander (1928) and Chvála (1988) make no mention of this character in any of the species that they treat. Colless (1963), however, describes it in *M. iota* from Australia and Ulrich (1991) records it also in the parathalassiine genera *Plesiothalassius* and *Amphithalassius* from South Africa. Combs are present in the two Palaearctic species of *Microphorella* I have examined (*M. praecox* and *M. curtipes*).

Reduction of the base of vein M_2 is not rare as an individual aberration in species of *Microphorella*, both recent and fossil in Baltic amber (Ulrich, 2002). The base of M_2 though always complete, is pale in several specimens of this species. It is speculated that loss of melanization, and perhaps sclerotization, may precede reduction of this section (Ulrich, in. litt.). The development of cross-vein m-m is also subject to individual variation in this species.

Microphorella merzi sp. n.

Figs 12-21

MATERIAL EXAMINED (21 ♂♂, 12 ♀♀)

Holotype male: "CYPRUS: Akamas Peninsula / Lara Beach, 34.58N/32.19E / 28.IV.2002, P. Gatt". "HOLOTYPE / *Microphorella merzi* sp. n. / det. P. Gatt 2003" (ZFMK). The holotype is preserved in alcohol and is in good condition.

FIGS 6-11

Microphorella ulrichi sp. n.: 6, ♂, sternite 5 and segment 6 detached from remaining parts of abdomen and membranes omitted, anterior view; 7, ♂, hypopygium, left lateral view; 8, ♂, opisthyandrium, aedeagus and associated structures, left lateral view; 9, ♀, abdomen, macerated and stretched, membranes omitted, dorsal view; 10, ♀, terminalia, left lateral view; 11, ♀, spermatheca. Scales: 0.5 mm except for Fig. 11 (0.05mm). Abbreviations explained in the text.

Paratypes: Cyprus: 6 ♂♂, 2 ♀♀, same data as holotype (ZFMK); 1 ♂, 3 ♀♀, "CYPRUS / Akamas peninsula / Lara beach / 28.IV.2002 St. 28", "34.58N/32.19E / dunes, meadow / leg. Merz, Deeming / Ebejer & Gatt St. 28" (ZFMK, MHNG, PGR); 9 ♂♂, 2 ♀♀, "CYPRUS: beach, / 6 km E of Zygi, / 34°44'44"N, 32°44'55"E / 24.IV.2002, P. Gatt" (ZFMK, MHNG, PGR); 2 ♂♂, 1 ♀, "CYPRUS 0m / Lemasos / Pegasus beach hotel / 1.V.2002 St.38", "34.42N/33.06E / beach / leg. Merz, Deeming / Ebejer & Gatt St. 38" (ZFMK, MHNG); 1 ♀, "CYPRUS 0m / 10 km W Pissouri / , Petra tou Romiou / , 23.IV.2002 St. 4", "34.41N/32.35E / beach / leg. Merz, Deeming / Ebejer & Gatt St. 4" (MHNG); 1 ♀, "MALTA 0m / Ghajn Tuffieha Bay / 35.56N/14.21E / 1.V.2001 B. Merz" (PGR); 1 ♂, "TK Antalya Prov. / Phaselis / 10km S Kemer / 27.IV.2000 0m / leg. Merz & Senay" (MHNG).

Other material: 1 ♀, data as holotype (PGR); 2 ♂♂, 1 ♀ Cyprus, beach, 6 km E of Zygi, 34°44'44"N, 32°44'55"E, 24.IV.2002, P. Gatt (PGR).

ETYMOLOGY

This species is dedicated to Dr Bernhard Merz who collected and generously made available valuable material for this study.

DIAGNOSIS

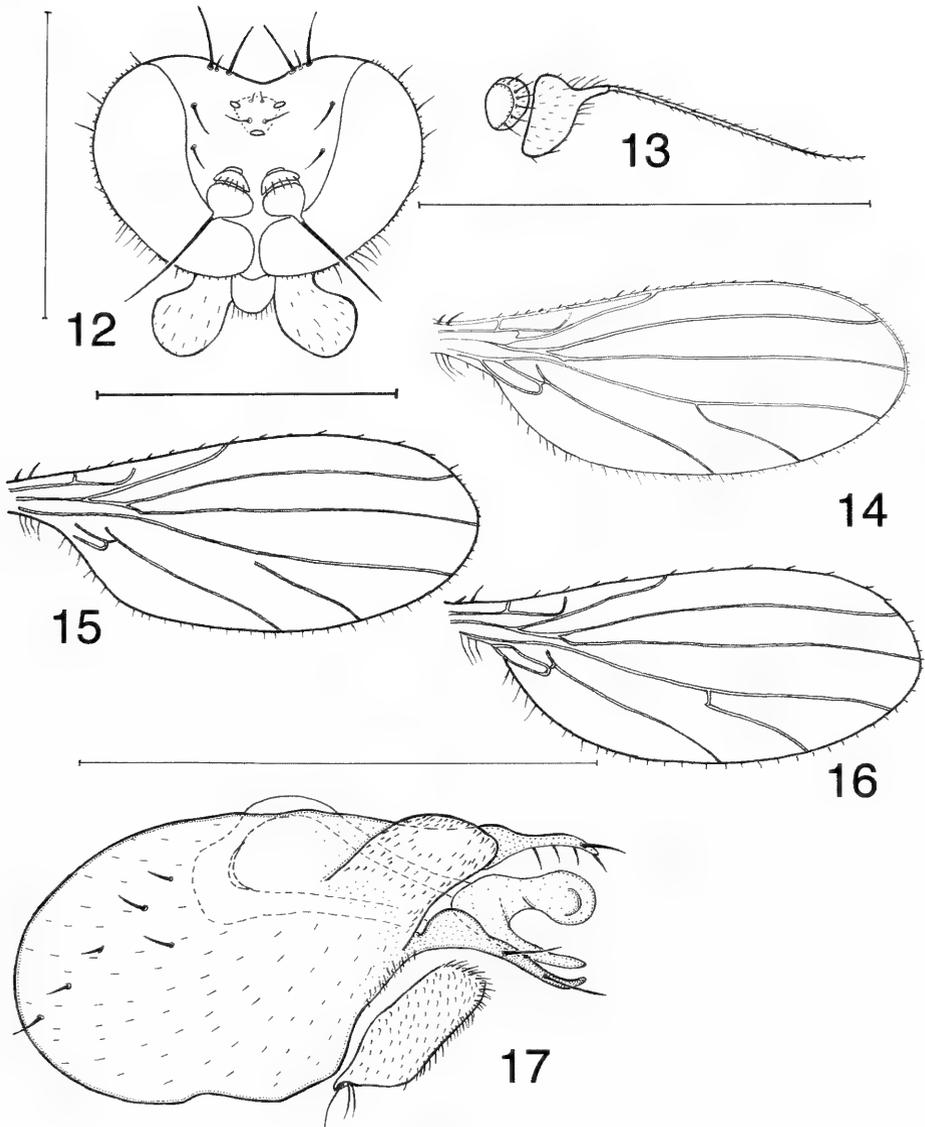
Very small, greyish dusted species with greyish wings; sexually dimorphic, males with enormously dilated palpi and with a row of minute, blunt, ventral spinules on fore tibiae.

DESCRIPTION

Male

Head (Fig. 12). Very broad, about 1.5 times as broad as high, silvery grey dusted; eyes widely separated on frons, all facets equally small, covered with very short, white, hairs; occiput concave above neck, convex below, greyish dusted, subshining, projecting well beyond posterior margin of eye; jowls very narrow, linear; face very short and narrow, eyes almost touching below antennae, widening towards clypeus, much narrower than frons above antennae; clypeus grey. Chaetotaxy: cephalic bristles blackish; 2 pairs of strong fronto-orbitals; ocellar tubercle distinct; anterior pair of ocellar bristles shorter than fronto-orbitals, diverging; posterior ocellar bristles short; 3 pairs of vertical bristles, the inner strong, converging, the outer strong, diverging, the middle short; post-ocular cilia pale, short, sparse and uniserial above neck, becoming denser and irregularly multiserial below. Antennae (Fig. 13) inserted at about middle of head in profile; scape yellow, small, concealed; pedicel yellowish brown, sparsely grey dusted, large, globular, with subapical collarette of hairs; postpedicel dark brown in ground colour, strikingly asymmetrical, onion-shaped, sparsely covered with grey micropubescence and some longish white hairs; postpedicel ending in very long, unarticulate stylus clothed with microscopic pubescence; proboscis yellowish brown, very short, directed downwards and forwards; palps (Fig. 12) one segmented, very large, spatulate and concave on lateral surface; yellow in ground colour and densely covered with minute glistening white hairs, in addition to some sparse longer setulae; palps without sensory pit or subapical bristle.

Thorax. Black in ground colour; mesoscutum rather long and narrow, dorsal surface not much arched, posteriorly with well defined, prescutellar depression commencing behind suture; mesoscutum covered with greyish micropubescence, more brownish dusted around prescutellar depression and on scutellar apex; complete



FIGS. 12-17

Microphorella merzi sp. n.: 12, ♂, head, anterior view; 13, ♂, antenna, lateral view; 14, wing; 15-16, paratypes, wings, variations in venation; 17, ♂, hypopygium, right lateral view. Scales: 0.5 mm except for Figs 14-16 (1.0 mm) Abbreviations explained in the text.

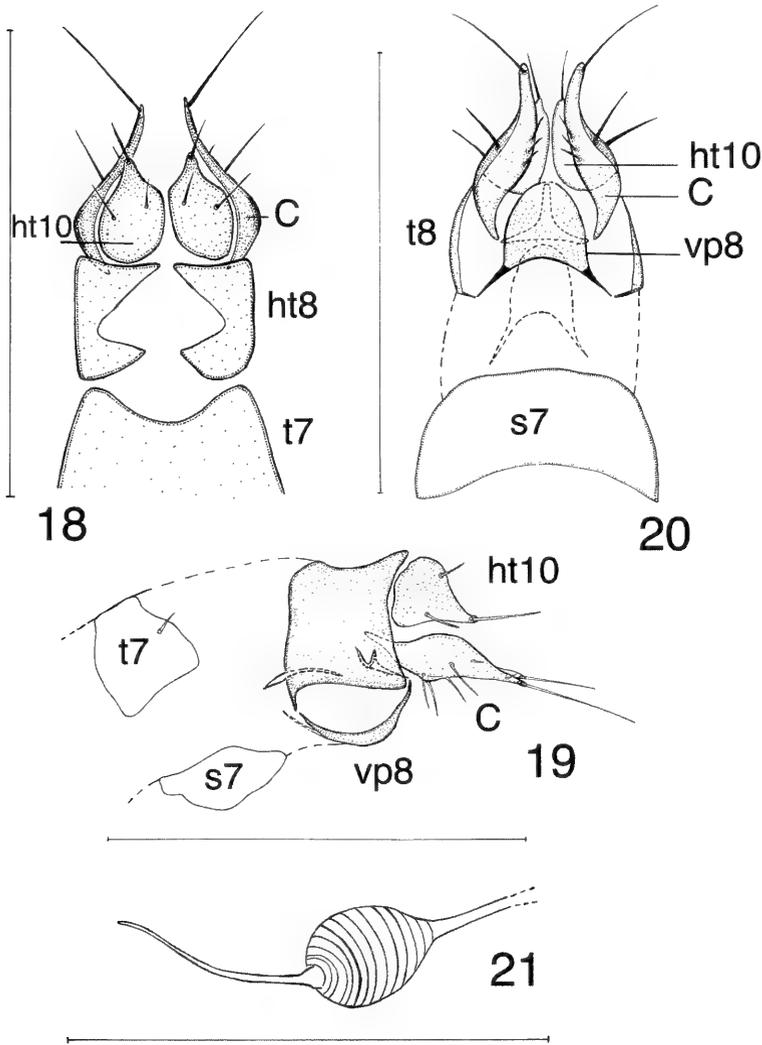
prothoracic precoxal bridge present. Chaetotaxy: large thoracic bristles black, short bristles pale; 3 pairs of acrostichals, very short, biserial, disappearing at transverse suture, preceded anteriorly by a stronger, darker, pair arising from anterior slope of mesoscutum; dorsocentrals 2 + 6, uniserial, short, longer than acrostichals, presutural

and prescutellar pairs long, bristle like; humeral callus with 1 short seta but no strong humeral bristle; 1 - 2 short accessory bristles, the size of acrostichals, between fore-most dorsocentral and posthumeral bristles; 2 notopleurals; 3 short supra-alar bristles, the anterior (post-sutural) the longest; 1 postalar and 1 pair of long, converging, scutellar bristles. Pleura bare, grey dusted.

Legs. Long and slender, yellowish-brown in ground colour, sparsely greyish dusted, finely bristled with very short white hairs, except on coxae; fore coxae yellow, grey-dusted at base; mid and hind coxae brown, more heavily dusted; trochanters yellow; femora brown, yellow at base and apex, more strongly bristled dorsally and apically; fore and mid femora equally strong, hind femora longer, more bristled; knees yellow; tibiae brown, slender, darker than femora; tarsi yellow, fifth segment distinctly darkened and broadened; all tarsi, but especially the middle, with short, spine-like bristles on ventral surface at apices of segments in groups of four; tarsal claws small, simple, pulvilli small, ventrally haired, empodium setiform, haired. Fore leg: coxa with some long white hairs anteriorly, longer near apex; trochanter with a short dorsal apical bristle and a row of short, curved hairs on ventral surface; femur with anterodorsal and anteroventral rows of bristly hairs; tibia with a row of minute, blunt, dark spinules on ventral surface, and with an apical, anterior comb of close set spines; tarsus simple, metatarsus without pigmented spinulated tubercle. Mid leg: coxa with a vertical row of 2 bristles on lateral surface; tibia with a distinct, short, ventral pre-apical bristle. Hind leg: coxa with a single bristle on lateral surface and another at apex; femur with an anteroventral row of longish hairs, shorter than femur is deep; tibia slightly, but distinctly, dilated towards apex, and with a posterior apical comb of setulae; hind metatarsus posteriorly, at apex, with a comb of very short setulae, but without pigmented spinulated tubercle.

Wing (Fig. 14). Narrow at base, axillary lobe hardly developed; wing membrane covered with microtrichia, greyish, opalescent; hind marginal fringe longest at base of wing; wing veins yellowish, stigma absent; costa continued around wing as 'ambient vein'; anterior margin of costa with short, spine-like bristles in addition to the usual fine hairs; 2 to 3 strong bristles present at base of costa; Sc pale and short, strongly curved in its apical section, fading into costa; Rs originating opposite humeral cross vein; R_1 ending in C before base of M_2 ; crossvein r-m faint, narrow, incompletely developed, visible only as a swelling on basal section of vein R_{4+5} ; basal cells short; base of M_2 faint, generally complete (Fig. 14), sometimes reduced so that M_2 appears disconnected at base (Fig. 15); crossvein m-m absent (Fig. 14), in some specimens present but greatly reduced, appearing as a tiny stump or as a short 'hang-vein' (Fig. 16); discal cell open by virtue of absence of crossvein m-m; M_{3+4} interrupted at base, as in all Parathalassinae; CuA_2 curved, as in congeners, $CuA_2 + A_1$ absent. Squamae small, pale; fringe of marginal setulae short, pale; halteres greyish.

Abdomen. Cylindrical, black in ground colour, more shining than thorax, grey and brown dusted; segments 1-4 simple, forming preabdomen; postabdomen rotated and lateroflexed to the right, as in congeners; tergites sparsely clothed with short, whitish hairs, longer towards lateral margins; tergites 1-4 symmetrical; tergite 1 narrow, desclerotised medially; tergites 5 and 6 with right lateral margin sharply infolded; tergite 7 small, tergite 8 vestigial; sternite 1 membranous, very narrowly scler-



FIGS 18-21

Microphorella merzi sp. n.: 18-20: ♀, postabdomen, macerated and stretched: 18, dorsal view, membranes omitted; 19, left lateral view; 20, ventral view; 21, ♀, spermatheca. Scales: 0.5 mm except for Fig. 20 (0.25 mm). Abbreviations explained in the text.

rotised only at posterior and lateral margins; sternites 2-4 narrow, symmetrical; sternite 5 not developed as a sclerite; sternites 6 and 7 narrow, sternite 8 small, moderately convex and covered with some short, pale hairs. Hypopygium (Fig 17) large, globose, lying on right side of abdomen and reaching up to tergite 4; hypandrium and periantrium fused without any suture to form a genital capsule.

Length. Body 1.1 mm, wing 1.25 mm.

Female

Resembling male. Body, and wings, longer; antennal segments all black, postpedicel less produced apically; palpi brown, not spatulate, much smaller, long oval and apically pointed, with some long hairs on lateral surface. Legs more slender, darker, especially coxae, hairs shorter; fore tibiae without a row of ventral spinules; tibial combs present on fore and hind tibiae and hind metatarsi as in male. Wings, including veins, darker. Abdomen dorsoventrally flattened, more greyish dusted, brownish in some lights, dorsally with 6 visible segments; segments 1-5 simple, forming preabdomen. Postabdomen (Figs 18-20) slender, tapering, retracted into preabdomen; terminalia not acanthophorous. Tergite 1 reduced, desclerotised medially; tergites 6 and 7 normal; tergite 8 cleft completely into two hemitergites. Sternite 1 not developed, sternites 2-7 normal. Tergite 10 cleft into pair of shiny brown, broad, triangular hemitergites each bearing bristles instead of the usual peglike spines. Cerci long, sinuous; each cercus with one very long subapical bristle in addition to some shorter setae on both lateral and ventral surfaces; 1 spermatheca (Fig. 21).

Length. Body 1.3 mm, wing 1.4 mm.

BIOLOGY

All specimens were caught sweeping very close to the sand on coastal beaches.

DISTRIBUTION

Hitherto known from the mediterranean islands of Cyprus and Malta, and the mediterranean coast of Turkey.

REMARKS

This is an aberrant species which does not resemble any other described species of *Microphorella* known to me to any great extent. I have, however, preferred to include it in the genus *Microphorella*, rather than erect a new genus for it, pending a revision of both recent and fossil species of this group, based on the principles of phylogenetic systematics (Ulrich, in prep.). Such a revision will probably lead to the subdivision of *Microphorella* into several genera (Ulrich, in litt.).

The hypopygium of this species is unique amongst the Parathalassinae as currently defined, in that the hypandrium and periandrium have apparently fused without any suture to form a genital capsule as in the Dolichopodidae s. str. (Ulrich, 1974). This may be a synapomorphy with the Dolichopodidae s. str., and, if confirmed, will be important for a reconstruction of the group's phylogeny, and a justification for erecting a new genus for this species (Ulrich, in litt.).

Cross vein m-m is entirely absent, or at least greatly reduced, in this species. In those specimens where it is absent, the condition is the same as in the type of the Lower Cretaceous *Avenaphora* recently described by Grimaldi & Cumming (1999).

OTHER RECORDS

Microphorella curtipes (Becker, 1910)

Material examined: Italy: Sardinia, 4 ♀♀, Dorgali reg. 350 m, Rio Flumineddu, Gola di Gorropu, sweeping over moist sand near stream, 40.11N/9.29E, 15.VI.2002, B. Merz. (MHNG).

Distribution: Hitherto known only from two localities in north Italy (Rapallo and Vallombrosa) and from Corsica, this species is now also recorded from Sardinia.

***Microphorella* sp. aff. *praecox* (Loew, 1864)**

Material examined: Israel: 1 ♂, Bor Mashash, inland sand-dunes, 16.III.1995, B Merz; 1 ♀, Tel Aviv Country Club, beach, 14.III.1995, B. Merz (MHNG).

A small (male body length 1.6mm) grey dusted species, very similar to *praecox*, but with postpedicel much shorter, and antennal stylus much longer and bristle like, about as long as postpedicel in the male, longer in the female. The species is probably new, but not described for lack of adequate material. The genus is newly recorded from Israel.

***Microphorella* sp.**

Material examined: Turkey: 2 ♂♂, 2 ♀♀ (1 headless), Antalya Province, Kursunlu Selalesi, 15 km NNE of Antalya, 150m, 29.IV.2000, forest, waterfall, B. Merz (MHNG).

A very small (male body length 1.2mm), black, lightly brownish dusted species with infuscated wings, yellow legs and apex of antennal postpedicel conspicuously hairy and produced, antennal stylus 1.5 times length of postpedicel. The species is probably new, but not described for lack of adequate material.

ACKNOWLEDGEMENTS

I am indebted to Dr Hans Ulrich (Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn) for his detailed and critical analysis of the manuscript, which resulted in several corrections and improvements. For this, and for the gift of specimens and literature, I am extremely grateful. My gratitude is also extended to Dr Bernhard Merz (Muséum d'histoire naturelle, Genève), Dr Martin Ebejer (Cardiff) and Dr John C. Deeming (National Museum and Galleries of Wales, Cardiff) who generously contributed valuable material towards this study. Dr Merz and Dr Ebejer are thanked for reading the manuscript and making useful suggestions. I am grateful to Ms Florence Marteau (Muséum d'histoire naturelle, Genève) for assistance in the preparation of the plates. I wish to thank Mr Louis F. Cassar (International Environment Institute, University of Malta) who introduced me to the type locality of *M. ulrichi* in Morocco, and Prof Carmelo Agius (Department of Biology, University of Malta) and Dr George Georgiou (Department of Fisheries, Cyprus) who facilitated my trip to Cyprus.

I am also grateful to the MECO Project (Baseline research for the integrated sustainable management of Mediterranean sensitive coastal ecosystems) coordinators, particularly Prof.essa Felicita Scapini (Dipartimento di Biologia Animale e Genetica 'Leo Pardi', University of Florence) for involving me in the project. My trips to Morocco and Tunisia in 2002 were funded by the European Commission INCO-DC Programme (MECO Project ERB-IC-18-CT98-0270).

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Un nuovo *Caulomorphus* Faust, 1886 d'Anatolia (Coleoptera, Curculionidae, Molytinae)

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A new *Caulomorphus* Faust, 1886 from Anatolia (Coleoptera, Curculionidae, Molytinae). - *Caulomorphus hittita* sp. n. (Coleoptera, Curculionidae, Molytinae) related to the "*lederi*" Chevrolat group (sensu Osella), was collected in the mountains of N-E Anatolia (Tunceli district), probably in litter of meso-hygrophil forests. The species is easily distinguishable by interstriae shape, lengthened protibiae and male foveolate urosternite 5 (figs 1, 2). An identification key to all species of the genus and new faunistic data about some other *Caulomorphus* species are added.

Key-words: Curculionidae - Molytinae - *Caulomorphus* - new species - Turkey.

INTRODUZIONE

L'esame dei Coleoptera Curculionidae di lettiera (del Muséum d'histoire naturelle de Genève) raccolti in varie regioni mediterranee ci ha permesso di scoprire una nuova specie di *Caulomorphus* Faust, 1886 della Turchia nord-orientale. La scoperta ci ha indotti ad esaminare i materiali ancora indeterminati del genere a nostra disposizione. Riteniamo quindi utile rendere noti anche questi dati perchè accrescono le nostre conoscenze su questo raro e poco studiato genere di Molytinae. Trattandosi di entità legate alla lettiera di boschi mesoigrofilici (i "boschi colchici" dei botanici) (Pignatti, 1979; Brandmayr & Pizzolotto, 1990) è urgente il problema dello studio di questi ambienti prima che siano distrutti dall'apparente inarrestabile deforestazione delle montagne pontiche attualmente in pieno svolgimento.

Caulomorphus lederi venne diagnosticato da Chevrolat (1880) per una specie del Caucaso che l'Autore ritenne appartenere al genere *Styphlus* Schönherr, 1826 (Erihriniinae). A questo primo inquadramento seguì quello di Bergroth (1884) che lo attribuì invece ai *Cotaster* Motschulsky, 1851 (Cossoninae) finchè Faust (1886) non credè per essa il genere *Caulomorphus* Faust (Molytinae Anchonini). Quest'ultimo inquadramento è rimasto immutato sino al 1999 allorché Alonso-Zarazaga & Lyal (1999) non spostarono il genere dagli Anchonini ai Plintini (sottotribù Plinthina) sempre nell'ambito dei Molytinae.

Al genere *Caulomorphus* furono attribuite, prima del 1912, solo quattro specie: *C. lederi* (Chevrolat, 1880), *C. talyschensis* Reitter, 1897, *C. muelleri* Reitter, 1911 e

C. reitteri Müller, 1912. Osella (1970, 1976) ne aggiunse altre sei: *C. besucheti* Osella, 1970, *C. bithynicus* Osella, 1970, *C. giocoae* Osella, 1970, *C. amaseianus* Osella, 1970, *C. inopinatus* Osella, 1970, *C. wittmeri* Osella, 1976, nonchè un taxon di incerto valore specifico (*C. sp. pr. bithynicus*). Attualmente, con l'entità qui descritta [ma togliendo *C. reitteri* Müller attualmente attribuito ad *Absoloniella* Formanek, 1913 (Eriirrhinidae Eriirrhinini) (Alonso-Zarazaga & Lyal, 1999)] le specie di *Caulomorphus* ammontano a 10, numero cospicuo ma verosimilmente di molto inferiore alla realtà.

PARTE SISTEMATICA

DESCRIZIONE DELLA NUOVA SPECIE

Caulomorphus hittita sp. n.

Figg. 1a, b; 2 a, b

Loc. typ.: Turchia, Tunceli (Monti Munzur)

Materiale esaminato: Holotypus maschio etichettato "Turquie, Tunceli, Tunceli – Ovacik, 1100 m, 5.VI.1986/ Besuchet, Löbl & Burckhardt" (conservato nelle collezioni del Muséum d'histoire naturelle de Genève - MHNG).

Descrizione. Corpo slanciato, subparallelo (fig. 1a), rosso ferrugineo, pronoto ed elitre con punteggiatura superficiale, con piccolissime setole di difficile osservazione. Rostro subcilindrico, a lati paralleli, debolmente ricurvo, con una larga carena mediana resa evidente dai solchi profondi che la fiancheggiano. I margini laterali del rostro presentano anch'essi una modesta carena di lunghezza pari a quella mediana. Scrobe profonde, a fondo debolmente brillante che raggiungono, all'indietro, il capo. Antenne snelle, inserite nel primo quarto distale del rostro; scapo cilindrico, appena ingrossato nella parte terminale (che raggiunge, all'indietro, la parte inferiore del rostro); funicolo gracile, con i primi due articoli allungati (il 1° è lungo circa quanto 2° + 3°), 3° e 4° subquadrati, 5°, 6° e 7° sferici (ma il 7° più largo del 6°); clava ovale con setole corte e sporadiche setole evidenti su tutti gli articoli. Occhi vestigiali con un solo ommatidio biancastro. Pronoto all'incirca largo quanto lungo, regolarmente arcuato ai lati, massima ampiezza a metà, fittamente punteggiato con punti non variolosi, rotondi, separati da spazi di diametro variabile, brillanti e, a loro volta, con minuta punteggiatura. La carena mediana è sostituita da una linea non punteggiata, liscia e brillante. Scutello brillante, allo stesso livello delle elitre. Elitre a base leggermente arcuata, subparallele, saldate alla sutura, strie evidenti con punti rotondi (una trentina per stria), superficiali, ordinati regolarmente, svaniti nella declività posteriore. Interstrie piane, lisce, debolmente brillanti, larghe quanto le strie, a margini irregolari (perché intaccate dai punti delle strie), con piccoli punti regolarmente disposti e con setole piccolissime, appena visibili di profilo ed ai lati. Zampe superficialmente punteggiate e setolose; protibie medialmente allargate. Tarsi gracili con 1° articolo conico-allungato, 2° trasverso, 3° bilobo, onichio allungato (fig. 1a). Procoxe evidenti, rotondegianti, subcontigue; mesocoxe, separate da uno spazio pari a 1/2 del diametro della coxa stessa, rotondegianti, meno elevate delle procoxe. Nello spazio che le separa è presente un piccolo rilievo a forma di bottone; metacoxe di modeste dimensioni rotondegianti distanziate da uno spazio doppio rispetto al diametro della coxa stessa. Mesosterno superficialmente punteggiato, lievemente incavato medialmente. Urosterniti 1 e 2 fortemente incavati medialmente, tra di loro saldati con sutura obso-

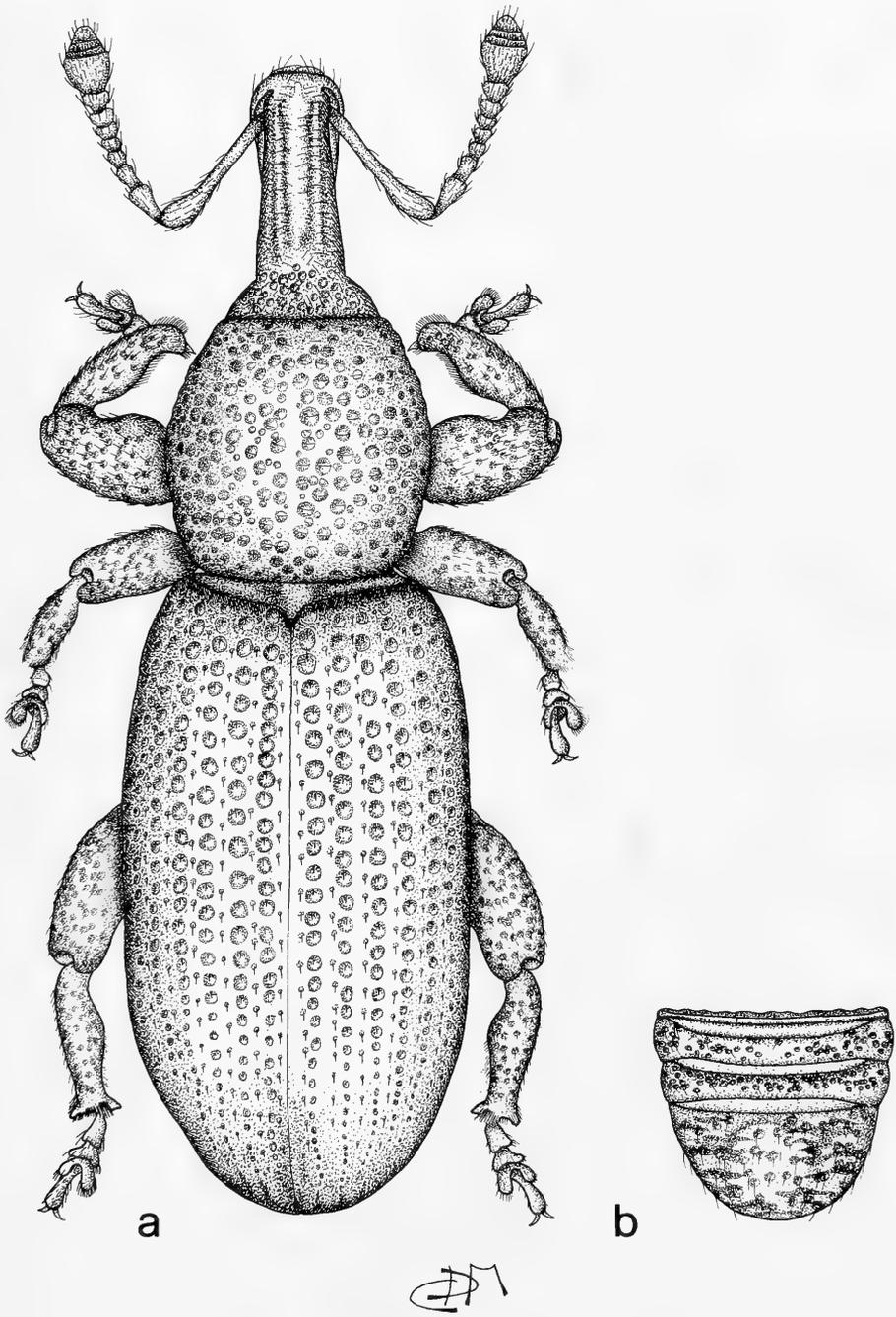


FIG. 1

Caulomorphus hittita sp. n. (Holotypus maschio): habitus (a); 5° urosternite (b) (Scala 1 mm).

leta; sommati insieme sono circa due volte piú lunghi dei restanti urosterniti; urosterniti 3 e 4, stretti, subeguali; urosternite 5 arrotondato con punteggiatura grande, variolosa e profonda, con fossetta circolare mediana. In questo urosternite sono presenti setole piú evidenti di quelle degli urosterniti 3 e 4 (fig. 1b).

Edeago: apice appuntito (Lunghezza lobo mediano: 0,60 mm; Lunghezza totale: 1,49 mm); lobo mediano a lamina ventrale sclerificata e con canale dorsale esteso dalla base all'apice; in visione dorsale presenta lati subparalleli; apice estremo non allungato, triangolare con corte setole su ciascun lato in prossimità della punta; in visione laterale robusto, uniformemente e moderatamente curvato. Apodemi robusti, di larghezza piú o meno uniforme, lunghi circa 1,5 volte il lobo mediano. Sacco interno con distinti scleriti nell'orifizio basale. Edeago e spiculum ventrale: fig. 2 a, b.

Misure dell'Holotypus: Lunghezza del rostro: 0,75 mm; Larghezza del rostro incluse le scrobe: 0,30 mm; Larghezza del rostro sotto le scrobe: 0,26 mm; Larghezza del capo: 0,50 mm; Lunghezza del capo: 0,11 mm; Lunghezza del pronoto: 0,92 mm; Larghezza del pronoto: 0,94 mm; Larghezza del pronoto/Lunghezza del pronoto: 1,02; Larghezza del margine anteriore del pronoto: 0,57 mm; Lunghezza delle elitre: 2,26 mm; Larghezza delle elitre: 1,23 mm; Lunghezza delle elitre/Larghezza delle elitre: 1,84; Larghezza della base delle elitre: 0,81 mm; Lunghezza totale: 4,04 mm; Lunghezza delle tibie anteriori: 0,72 mm; Lunghezza delle tibie posteriori: 0,60 mm; Lunghezza dello scapo: 0,55 mm; Lunghezza del funicolo: 0,46 mm; Lunghezza della clava: 0,24 mm.

I rapporti di lunghezza degli articoli del funicolo sono i seguenti: 7:5:2,5:2,5:2,5:3:3.

Il rapporto Lunghezza/Larghezza nei singoli antenomeri è, invece, il seguente: 1° = 2,3; 2° = 2,5; 3°, 4°, 5°, 6°, 7° = 1,0.

Derivatio nominis. Dal popolo ittita che, anticamente, abitava quest'area.

Note comparative. La nuova specie, per la conformazione dell'edeago, sembra rientrare nel gruppo "*lederi*" Chevrolat (sensu Osella, 1970, 1976); se ne distingue per le dimensioni leggermente maggiori, le interstrie piane, lisce e brillanti, larghe quanto le strie (opache e piú o meno carenate e, di norma, piú strette delle strie nelle altre specie), per la presenza sulle stesse di setole microscopiche (sempre ben visibili nelle altre specie), per le protibie medialmente piú allargate nonché per il 5° segmento con una profonda fossetta (assente o meno evidente nelle altre). Per il pronoto privo di carena mediana, per la punteggiatura delle elitre e per le interstrie non rilevate, si avvicina in particolare a *C. besucheti* Osella, da cui si differenzia per i molteplici caratteri elencati nella diagnosi e, in particolare, per la struttura dell'edeago ad apice brevemente appuntito (fig. 2a) (vedi Osella, 1970).

Ecologia e biologia. Non disponiamo di informazioni né per l'ecologia né per la biologia. E' indubbio si tratti di una entità della lettiera superficiale di boschi a latifoglie come le altre specie del genere. Tra i Curculionoidea della catena pontica che, di norma si rinvencono insieme ai *Caulomorpha*, ricordiamo: *Ubychia mingrelica* (Reitter, 1894), *Ubychia stygia* Rost, 1893; *Otiorhynchus (Namertanus) argus* (Reitter, 1896), *Anchonidium ulcerosum* Aubè, 1850, *Anchonidium perpensum* Faust, 1886, *Aparopion costatum* (Fåhræus, 1843).

NUOVI DATI SU *CAULOMORPHUS*

I materiali qui elencati sono conservati nelle collezioni del Museo di Ginevra (MHNG) e nella collezione G. Osella (cOS).

***Caulomorphus besucheti* Osella, 1970**

Turchia, Rize, Valle di Firtina m 1900, 8.VII.1976, 1 ex., leg. Besuchet (MHNG). Turchia, Aydin, 15.VII.1976, 1 ex., leg. Vit (MHNG). Turchia, Borçka (Artvin), 15.VI.1969, 1 ex., leg. Osella (cOS). Turchia, Artvin, 13.V.1967, 1 ex. leg. Besuchet (MHNG). USSR, Caucasus, Batumi, 13.VI.1975, 2 maschi, 1 ex., leg. R. Raus (cOS).

***Caulomorphus giocoae* Osella, 1970**

Borcka, (Artvin), 15.VI.1969, 2 ex. leg. Osella (cOS). Turchia, Artvin, VI.1976, 1 ex., leg. Bohac (cOS). Idem, 15.VII.1976, 1 ex., leg. Bohac (cOS). Turchia, Artvin, m 1500, 9.VI.1986, 1 ex. legg. Besuchet, Löbl & Burckhardt (MHNG). Idem, 800 m, 7. VI.1986, 9 exx., legg. Besuchet, Löbl & Burckhardt (MHNG). Idem, 1500 m, 9.VI.1986, 2 exx., legg. Besuchet, Löbl & Burckhardt (MHNG). Turchia, Artvin, 8 Km da Borçka, 350 m, 8.VI.1986, 3 exx., legg. Besuchet, Löbl & Burckhardt (MHNG). Turchia, Artvin, Col entre Borçka Hopa, 700 m, 8.VI.1986, 1 ex., legg. Besuchet, Löbl & Burckhardt (MHNG).

***Caulomorphus wittmeri* Osella, 1976**

Iran 7553, Tang-i-Rah, 16.VII.1975, 3 exx. leg. S. Senglet (cOS). Iran, Mazanderan, Naharkovan, Gorgan 36° 44' N -54°29' E, 20.VII.1975, 1 ex. leg. S. Senglet (cOS). Iran, Guilan, route Masuleh, m 1000, 37°11' N-49° 07' E, 10.IX.1973, 1 ex., leg. S. Senglet, (cOS). Iran, Guilan s/Asalem, 300-600 m, 37° 41' N-48°51' E, 30.VI.1973, 1 ex., leg. Senglet, (cOS). Iran, Mazanderan, route Chorteh, 100-1300 m, 36°49' N-50° 38' E, 8.VII.1973, 1 ex., leg. Senglet (cOS). Iran, Mazanderan, Kyasar, 22.VII.1973, 36° 22' N-53° 16' E, 1 ex., leg. Senglet (cOS). Iran, Mazanderan, Naharkoran/Borgan 36°44' N-34°29' E, 20.VII.1973, 11 exx., leg. Senglet (cOS). Iran, Mazanderan, Delasum, 4.VIII.1974, 1 ex., leg. Senglet (cOS). Iran, Mazanderan, Tshorteh, 800 m, 5.VIII.1974, 1 ex., leg. Senglet (cOS). Iran, Kyasar, 11.VII.1975, 1 ex., leg. Senglet (cOS). Iran, 7518, s/Asalem, 450 m, 10.VI.1975, 1 ex., leg. Senglet (cOS).

***Caulomorphus lederi* (Chevrolat, 1880)**

USSR, Caucasus, Batumi, Botanickei sad, 1 ex., leg. Raus (cOS). Idem, 13.VI.1971, 1 ex., leg. R. Raus (cOS).

***Caulomorphus* spec. 1**

Turchia, Tekkiraz (Ordu), 900 m, 18.V.1967, 2 exx., leg. Besuchet (MHNG). Idem, 500 m, 1 ex., leg. Besuchet (MHNG).

***Caulomorphus* spec. 2**

Turchia, Samsun, Kavak, 20.V.1967, 2 exx., leg. Besuchet (MHNG, cOS).

Per quanto riguarda gli esemplari delle due specie di *Caulomorphus* indeterminate sopra riportate, riteniamo si tratti di entità inedite, entrambe caratterizzate da setole evidenti. Gli esemplari di Tekkiraz (*Caulomorphus* specie 1) sono contraddistinti da tegumenti opachi con interstrie alterne leggermente più rilevate delle pari, con pronoto medialmente carenato e strie elitrali con punti grandi. Quelli di Samsun (*Caulomorphus* specie 2) presentano, invece, tegumenti leggermente più lucidi, con interstrie uniformemente rilevate, pronoto non medialmente carenato e leggermente più ristretto anteriormente.

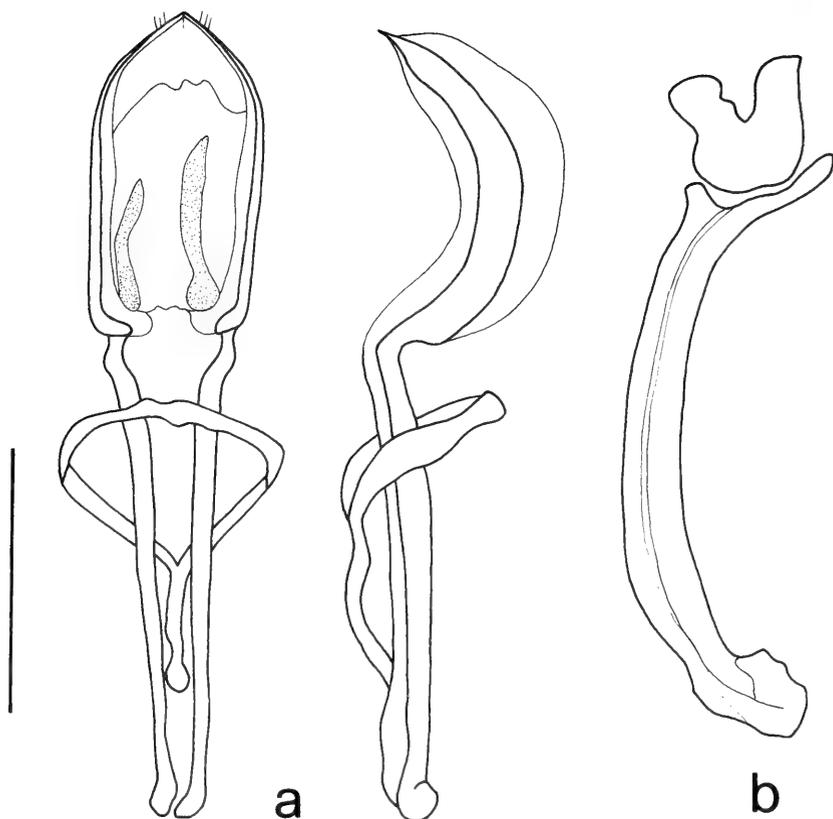


FIG. 2

Caulomorphus hittita sp. n.: Edeago in visione dorsale e laterale (a); spiculum gastrale (b) (Scala 0,5 mm).

TABELLA DICOTOMICA DEI *CAULOMORPHUS* FAUST, 1886

Modifichiamo come segue la tabella dicotomica dei *Caulomorphus* (Osella 1970, 1976), per includervi *C. hittita* sp. n. e per escludere *C. reitteri* (Müller, 1912).

- 1 Elitre oblunco-ovali con maggiore ampiezza verso la metà; interstrie impari (in particolare 5 e 7) più rilevate delle pari, careniformi. Lunghezza mm 3,00-3,50. Svanezia (Caucaso) *muelleri* Reitter, 1911
- Elitre subparallele; interstrie sia piane sia rilevate (talora solo le impari). Catena pontica, Caucaso, Iran settentrionale 2
- 2 Corpo (fig. 1a) con setole piccolissime, debolmente brillante; pronoto non variolosamente punteggiato, senza carena mediana; interstrie piane, larghe quanto le strie, quest'ultime con piccoli punti regolarmente disposti; edeago cilindrico, ricurvo, ad apice appuntito (fig. 2a). Lunghezza mm 4,04. Tunceli-Ovacik (Turchia) *hittita* sp. n.

- Corpo con setole piú o meno evidenti, non brillante; pronoto a punteggiatura piú o meno variolosa, con o senza carena mediana; interstrie sia piane sia rilevate, talvolta alternativamente 3
- 3 Edeago largo, appiattito, poco ricurvo (visto di profilo) 4
- Edeago stretto, cilindrico o subcilindrico, fortemente ricurvo 8
- 4 Edeago asimmetrico; pronoto privo di carena mediana evidente. Lunghezza mm 2,90-3,10. Turchia nord-orientale *giocoe* Osella, 1970
- Edeago simmetrico 5
- 5 Carena mediana del pronoto piú o meno evidente 6
- Carena mediana del pronoto assente 7
- 6 Interstrie elitrali uniformemente rilevate; strie con punti molto grandi tra di loro separati da uno spazio posto a livello inferiore alle interstrie; funicolo con 1° articolo di poco piú lungo del 2°; edeago ad apice estremo debolmente appuntito. Lunghezza mm 3,40-3,70. Passo di Suram (Caucaso) *lederi* (Chevrolat, 1880)
- Interstrie elitrali alterne piú rilevate delle pari; strie con punti piú piccoli a confronto con *lederi*, separati da intervalli posti allo stesso livello delle interstrie; funicolo con 1° articolo due volte piú lungo del 2°; edeago piú lungo che in *lederi* e a lati convergenti anteriormente. Lunghezza mm 2,80-3,60. Düzce (Turchia) sp. pr. *bithynicus* Osella, 1970
- 7 Solo le interstrie impari (e sutura) leggermente piú rilevate delle pari, piú strette delle strie e con setole evidenti; edeago a lati subparalleli, apice estremo subtroncato o largamente arrotondato. Lunghezza mm 3,40-3,80. Lazistan e regioni costiere dell' Armenia *besucheti* Osella, 1970
- Tutte le interstrie elitrali (e sutura) ugualmente rilevate; edeago a lati subparalleli, apice estremo ristretto in avanti e brevemente arrotondato. Lunghezza mm 3,40-3,90. Bolu (Turchia) *bithynicus* Osella, 1970
- 8 Edeago a lati subparalleli con apice brevemente arrotondato, appuntito; pronoto fortemente punteggiato 9
- Edeago strozzato medialmente con apice alquanto allungato; pronoto disordinatamente punteggiato, con traccia di carena mediana, setole elitrali ben evidenti, semicornate. Lunghezza mm 3,75-3,90. Geyve (Turchia) *inopinatus* Osella, 1970
- 9 Edeago ad apice appuntito, fortemente ricurvo; pronoto punteggiato con setole evidenti. Lunghezza mm 3,00-3,30. Regioni montuose del Mar Caspio iraniano *wittmeri* Osella, 1976
- Edeago ad apice arrotondato, poco ricurvo (visto di profilo). Regioni caspiche e costiere del Mar Nero 10
- 10 Elitre con setole molto evidenti semirilevate; strie con punti grandi, di diametro maggiore di quello degli spazi che li separano; edeago piccolo, subparallelo, poco ricurvo. Lunghezza mm 3,60-4,10. Monti Talysch *talyschensis* Reitter, 1911
- Elitre con setole piú brevi, aderenti al tegumento; strie con punti di diametro ridotto rispetto agli spazi che li separano; edeago simile a quello di *talyschensis*, con apice arrotondato. Lunghezza mm 3,40-3,80. Ak Dag (Amasya) *amaseianus* Osella, 1970

KEY TO SPECIES OF *CAULOMORPHUS* FAUST 1886

- 1 Elytra oblong-oval, widest in the middle; interstriae unequal (particularly 5 and 7) more prominent than equal, with carina. Length mm 3,00-3,50. *Svanezia* (Caucasus) *muelleri* Reitter, 1911
- Elytra subparallelsided; interstriae either flattened or elevated (sometimes only unequal). Pontic mountains, Caucasus, North Iran 2
- 2 Body (fig. 1a) without distinct setae, weakly shiny; pronotum not variolously punctured, without median carina; interstriae flattened, as wide as striae, these last with small regular punctures; aedeagus cylindrical, curved, with extreme apex pointed (fig. 2a). Length mm 4,04. *Tunceli-Ovacik* (Turkey) *hittita* sp. n.
- Body with more or less distinct setae, mat; pronotum more or less variolous, with or without median carina; interstriae either flattened or elevated sometimes alternately 3
- 3 Aedeagus wide, flattened, in lateral view moderately curved 4
- Aedeagus narrow, cylindrical or subcylindrical, in lateral view strongly curved 8
- 4 Aedeagus asymmetrical; pronotum without evident median carina. Length mm 2,90-3,10. Nord-oriental Turkey *giocoe* Osella, 1970
- Aedeagus symmetrical 5
- 5 Pronotum with more or less evident median carina 6
- Pronotum without median carina 7
- 6 Interstriae evenly elevated; striae with very large punctures with interspaces in basal area; segment I of antennal funicle little longer than 2; extreme apex of aedeagus weakly pointed. Length mm 3,40-3,70. *Suram Pass* (Caucasus) *lederi* (Chevrolat, 1880)
- Odd interstriae more prominent than even ones; striae with punctures smaller than *lederi*, with interspaces in same interstriae level; segment I of antennal funicle twice longer than 2; aedeagus larger than *lederi*, sides anteriorly convergent. Length mm 2,80-3,60. *Düzce* (Turkey) sp. pr. *bithynicus* Osella, 1970
- 7 Odd interstriae slightly more prominent than even ones; narrower than striae, with evident setae; aedeagus subparallelsided, extreme apex subtruncate or very widely rounded. Length mm 3,40-3,80. *Lazistan* and *Armenia* coastal regions *besucheti* Osella, 1970
- Interstriae equally prominent; aedeagus subparallelsided, extreme apex narrow, shortly rounded. Length mm 3,40-3,90. *Bolu* (Turkey) *bithynicus* Osella, 1970
- 8 Aedeagus subparallelsided, extreme apex shortly rounded, pointed; pronotum strongly pointed 9
- Aedeagus narrowed in the middle, extreme apex elongated; pronotum confusely punctured, weak median carina, distinct elytral setae, half-recumbent. Length mm 3,75-3,90. *Geyve* (Turkey) . . . *inopinatus* Osella, 1970
- 9 Aedeagus with extreme apex pointed, strongly curved; pronotum punctured with distinct setae. Length mm 3,00-3,30. *Caspic Iranian Mountains* *wittmeri* Osella, 1976

- Aedeagus with extreme apex rounded, in lateral view moderately curved. Caspic regions and Black Sea coastal regions 10
- 10 Elytra with distinct half-recumbent setae; interspaces between striae punctures very wide; aedeagus small, subparallelsided, moderately curved. Length mm 3,60-4,10. Talysch Mountains *talyschensis* Reitter, 1911
- Elytral setae short and recumbent; striae punctures smaller than separating interspaces; aedeagus similar to *talyschensis*, extreme apex rounded. Length mm 3,40-3,80. Ak Dag (Amasya) *amaseianus* Osella, 1970

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Nomenclatural amendments concerning Chinese Psocoptera (Insecta), with remarks on species richness

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Nomenclatural amendments concerning Chinese Psocoptera (Insecta), with remarks on species richness. - After having analysed the most recent literature on Chinese Psocoptera, in particular the important monograph published by Li Fasheng in 2002, the following 174 nomenclatural acts are proposed, as a contribution to stabilize the nomenclature of Chinese Psocoptera. New genus names (replacement names for junior homonyms): *Lifashengia* nom. nov. (Amphientomidae) for *Obeliscus* Li Fasheng, 2002 nec Beck, 1837, nec Popofsky, 1913, nec Graybill, 1923; *Licaecilius* nom. nov. (Caeciliusidae) for *Neocaecilius* Li Fasheng, 2002 nec Li Fasheng, 2000; *Fashengocaecilius* nom. nov. (Pseudocaeciliidae) for *Calocaecilius* Li Fasheng, 2002 nec Mockford, 1974; *Fashenglianus* nom. nov. (Psocidae) for *Lativalva* Li Fasheng, 2002 nec Amsel, 1956; *Lipsocus* (Psocidae) nom. nov. for *Cyclotus* Li Fasheng, 2002 nec Edwards, 1852. New species name (replacement name for junior homonym): *Peripsocus lifashengi* nom. nov. for *P. orientalis* Li Fasheng, 2002 nec *P. orientalis* Garcia Aldrete, 1999 (Peripsocidae). New synonymies: *Lachesilla* Westwood, 1840 (Lachesillidae) (= *Dicrolachesillus* Li Fasheng, 2002), *Ectopsocus* McLachlan, 1899 (Ectopsocidae) (= *Ectotrichus* Li Fasheng, 2002), *Smithersia* Thornton, 1992 (Myopsocidae) (= *Polygonomyus* Li Fasheng, 2002). Re-established synonymies: *Heterocaecilius* Lee & Thornton, 1967 (Pseudocaeciliidae) (= *Orbocaecilius* Li Fasheng, 1999), *Trichadenotecnum* Enderlein, 1909 (Psocidae) (= *Trichadenopsocus* Roesler, 1943). 43 new combinations are proposed and 30 combinations are re-established. For 19 genus names and 71 species names the correct original spelling is selected. Incorrect subsequent spellings are only mentioned in some particular cases, concerning 25 genus names and 46 species names. Up to the end of the year 2002 a total of about 5470 valid species and 440 valid genera of Psocoptera have been described worldwide. 2600 species (almost half of the known world fauna) have been recorded from Asia, in particular due to the activity of the Chinese entomologist Li Fasheng, who described himself about 1500 of the approximately 1530 species known from China.

Key-words: Psocoptera - nomenclature - China - species richness.

INTRODUCTION

The World Catalogue and Bibliography of Psocoptera (Lienhard & Smithers, 2002) only took into account the literature published up to the end of the year 2000. Therefore, the following most recent publications on Chinese Psocoptera had not been analysed for the World Catalogue: Li Fasheng, 2001, 2002a, 2002b. In the meantime they have been analysed in detail in Part 2 (analysis of Li Fasheng, 2002a) and Part 3 (analysis of Li Fasheng, 2001, 2002b) of the "Additions and Corrections to Lienhard & Smithers, 2002" (Lienhard, 2003b, 2004). The bibliographical reference to Li's monumental monograph on Chinese Psocoptera (Li Fasheng, 2002a) had already been presented in the first Part of the "Additions" (Lienhard, 2003a). These "Additions" are published in three different issues of "Psocid News" (cf. PsocoNet Homepage: <http://insect3.agr.hokudai.ac.jp/psoco-web/psoco-net/index.html>), a series of Newsletters, where no nomenclatural acts are published (cf. disclaimer in the Editorial of Yoshizawa, 2003). Only mandatory changes in spelling (ICZN, 1999: art. 34) or corrections of evident subsequent misspellings are proposed in the "Additions".

After having analysed Li's papers in detail, I am convinced that a certain number of proper nomenclatural acts, beyond mandatory changes, are necessary to stabilize the nomenclature of Chinese Psocoptera, which have to be published under the rules of the International Code of Zoological Nomenclature (ICZN, 1999). Therefore I decided to prepare the present paper. Before proposing these nomenclatural acts below, the three above mentioned publications by Li Fasheng are briefly commented in the following:

Li Fasheng, 2001 (published in December 2001, cf. Li Fasheng *in litt.*, 2003): 75 Chinese species are listed in this paper, 27 of them explicitly described as new. Some genus names and species names mentioned in this paper are nomina nuda, they only became available with the explicit description of the new taxa concerned in Li's monograph on Chinese psocids (Li Fasheng, 2002a, see below). In the following, these nomina nuda are only mentioned in a few cases which are of nomenclatural interest (e. g. *Mecampsis multimacularis*, *Trichadenotecnum multangulare*); for the complete list of the names used by Li Fasheng (2001) see Lienhard (2004). The fact that certain names of species explicitly described as new by Li Fasheng (2001) are originally combined with unavailable genus names does not affect the availability of these species names (ICZN, 1999: art. 11.9.3.1.). These species are listed in Lienhard (2004) (e. g. *Conomesopsocus meniscatus* Li Fasheng, 2001).

Li Fasheng, 2002a (published in July 2002, cf. Li Fasheng *in litt.*, 2003): This is the first comprehensive monograph on Chinese Psocoptera (cf. Lienhard, 2003c). The about 1500 Chinese species examined by the author are keyed, diagnosed and figured. About 920 species and 64 genera are new to science, some of their names having already mentioned before (Li Fasheng, 2001) or simultaneously (Li Fasheng, 2002b) as nomina nuda (see comments on these two papers). The about 550 Chinese species described by Li Fasheng from 1987 up to the end of 2000 (see bibliography given by Lienhard & Smithers, 2002), and treated again in his monograph, are all also listed in the World Catalogue (Lienhard & Smithers, 2002) published in June 2002, preceding Li's 2002-publications (Li Fasheng, 2002a, 2002b) by one month. The

nomenclatural acts concerning these species and published in the World Catalogue are not mentioned in the following, except in some nomenclatural discussions.

Li Fasheng, 2002b (published in July 2002, cf. Li Fasheng *in litt.*, 2003): 67 Chinese species are listed, no new taxon is described. Throughout this paper, the references to “Li, 2001” as the author of species names have to be replaced by “Li, 2002”. These species have only been described in Li’s monograph on Chinese psocids (Li Fasheng, 2002a, see above). Because of the simultaneous publication of Li Fasheng (2002a) and Li Fasheng (2002b) on July 31, 2002 (ICZN, 1999: art. 21.3.1.), the names used by Li Fasheng (2002b) have to be considered as *nomina nuda*. Therefore the possible use, by Li Fasheng (2002b), of one of multiple original spellings proposed by Li Fasheng (2002a) could not be considered as a selection of the correct original spelling in the sense of article 24.2.4. of the Code (ICZN, 1999). My checking of both publications didn’t in fact reveal such a hypothetical case of spelling selection which would only have been valid if the indication of the specific day of publication would have shown that Li Fasheng (2002b) had been published later in July 2002 than Li’s monograph (2002a). In this case the following names would not have to be considered as *nomina nuda* but as incorrect subsequent spellings: *Caecilius latermacularis* (see below: *Caecilius laterimacularis*), *Caecilius qiongshanicus* (see below: *Caecilius qiongshanensis*), *Peripsocus varidentus* (see below: *Peripsocus varidentatus*), *Polygonomyus* (see below: *Smithersia sexangula*).

In general, incorrect or multiple spellings of taxa names are very frequent in Li’s publications. In many cases the correct original spelling has already been selected by Lienhard & Smithers (2002) (e. g. *Ectopsocus equidentus*). All cases of multiple original spellings encountered in the above mentioned most recent publications on Chinese Psocoptera (Li Fasheng, 2001, 2002a, 2002b) are listed in the following. Incorrect subsequent spellings of genus or species names are usually only mentioned if they are related to nomenclatural acts proposed by Li Fasheng (i. e. description of new taxa, proposal of new combinations or new synonymies) or if they are used by Li throughout at least one of these publications. Exceptionally, some other cases of particularly striking subsequent misspellings are also mentioned, to avoid any misunderstanding.

In the following, families are listed according to Lienhard & Smithers (2002: Table 1) and Yoshizawa (2001b), without taking account of the new classification proposed by Li Fasheng (2002a), which has been summarized in detail by Lienhard (2003b). All Chinese genera mentioned by Li Fasheng (2001, 2002a, 200b) are assigned to the families recognized by Lienhard & Smithers (2002) and Yoshizawa (2001b, cf. Amphipsocidae). Genera are listed alphabetically within each family, except for Psocidae, where they are grouped according to the subfamilies recognized by Lienhard & Smithers (2002). Species are listed alphabetically within each genus.

For genus and species names already mentioned in the World Catalogue (Lienhard & Smithers, 2002) only the author is cited, for new names proposed by Li Fasheng (2001, 2002a, 200b) the complete reference is given [author, year (with suffix according to list of references) and page of main entry]. In cases where these papers are cited as secondary references, the page of the main entry for the taxon (name) is always indicated. Bibliographic references already listed in the World Bibliography

(Lienhard & Smithers, 2002) are here cited with the suffixes used there, to facilitate comparison with the World Catalogue.

Abbreviations used in the text of the present paper: F = feminine (grammatical gender of genus name); ICZN = International Commission on Zoological Nomenclature; M = masculine (grammatical gender of genus name); N = neuter (grammatical gender of genus name).

REMARKS ON SPECIES RICHNESS

Lienhard & Smithers (2002) listed a total of 4408 valid species of Psocoptera belonging to 371 genera. In the "Additions and Corrections to Lienhard & Smithers, 2002" (Lienhard, 2003a, 2003b, 2004) a certain number of species and genera have been added, so that at the end of the year 2002 totally about 5470 valid species and 440 valid genera were known worldwide.

This impressive increase of the total number of known species and genera is essentially due to Li's monograph on Chinese psocids (Li Fasheng, 2002a), where about 920 new species and 64 new genera are described. About 1530 species are presently known from China. Even if a relatively important number of synonyms will probably be discovered during future revisions of the Chinese fauna (only 36 species not described by Li himself are mentioned from China in Li's monograph!), this shows the exceptionally high species richness of Psocoptera in Asia, from where about 2600 species have now been recorded, almost half of the presently known psocid fauna of the world. For the other continents or biogeographical regions approximately the following numbers of species were known at the end of the year 2002 [cf. Lienhard & Smithers, 2002 (Table 1) and Lienhard, 2003a, 2004]: Western Palaearctic (including Macaronesian Islands): 250; North America: 300; Central America: 610; South America: 770; Africa (except North Africa) including Madagascar: 740; Australia and New Zealand: 320; Pacific Islands: 370.

NOMENCLATURAL PART

TROGIIDAE

Helminotrogia Li Fasheng, 2002a: 52. Gender: F. Type species: *Helminotrogia bipunctata* Li Fasheng. Alternative original spelling: *Heliminotrogia* (on p. 1765); *Helminotrogia* is here selected as the correct original spelling.

Helminotrogia bipunctata Li Fasheng, 2002a: 52. Alternative original spellings: *bipunctatia* (on pp. iv, 52, 53), *bipuctata* (on p. 1765); *bipunctata* (on p. 1765) is here selected as the correct original spelling.

Phlebotrogia Li Fasheng, 2002a: 54. Gender: F. Type species: *Phlebotrogia chinensis* Li Fasheng. Alternative original spellings: *Philebotrogia* (on p. 1766), *Phlebotrogius* (on plate V); *Phlebotrogia* is here selected as the correct original spelling.

PSYLLIPSOCIDAE

Pseudopsyllipsocus Li Fasheng, 2002a: 58. Gender: M. Type species: *Pseudo-psyllipsocus gangliigerus* Li Fasheng. Alternative original spelling: *Pseudo-*

psyllipsous (on p. 58); *Pseudopsyllipsocus* is here selected as the correct original spelling.

Pseudopsyllipsocus gangliigerus Li Fasheng, 2002a: 58. Misspelled with feminine ending (*gangliigera*) on p. 58, in legend to fig. 32.

Psocathropos domesticus Li Fasheng, 2002a: 65 (incorrect subsequent spelling of genus name on pp. 65, 66: *Psocothropos*).

Psocathropos dyadoclemus Li Fasheng, 2002a: 66 (incorrect subsequent spelling of genus name on p. 66: *Psocothropos*).

AMPHIENTOMIDAE

Amphientomum ectostriolate Li Fasheng. Li Fasheng, 2002a: 119 (as *A. ectostriolatum*, incorrect subsequent spelling). NOTE: The original spelling is *ectostriolatis*; this name should be considered as an adjective (cf. etymological remarks in Lienhard, 2003b), with the neuter ending “-e”. Lienhard & Smithers (2002) erroneously also use the misspelling with the ending “-is”.

Ancylentomus Li Fasheng, 2002a: 121. Gender: M. Type species: *Ancylopsocus fortuosus* Li Fasheng. Replacement name for *Ancylopsocus* Li Fasheng, 1997 nec *Ancylopsocus* Tillyard, 1926 (Tillyard, 1926b: 344; Permopsocidae). Alternative original spelling: *Ancylentomius* (appearing several times); *Ancylentomus* is here selected as the correct original spelling.

Ancylentomus macrurus (Li Fasheng). Li Fasheng, 2002a: 124 (as new combination, from *Ancylopsocus*; misspelled *A. macrourus* and *A. maecrorurus*, incorrect subsequent spellings).

Biocellientomia bitrigata Li Fasheng, 2002a: 117. Alternative original spelling: *bitrigala* (on p. 117); *bitrigata* is here selected as the correct original spelling.

Cornutientomus Li Fasheng, 2002a: 167. Gender: M. Type species: *Nephax chinensis* Li Fasheng. Alternative original spelling: *Cornutientomius* (on p. 111, in key); *Cornutientomus* is here selected as the correct original spelling.

Diamphipsocus magnimanubrus (Li Fasheng). Li Fasheng, 2002a: 179 (as new combination, from *Paramphientomum*; misspelled *D. magnimanbrus*, incorrect subsequent spelling).

Lifashengia nom. nov.

Lifashengia Lienhard, **nom. nov.** (replacement name). Gender: F. Type species: *Obeliscus zhongshani* Li Fasheng.

Obeliscus Li Fasheng, 2002a: 120. Gender: M. Type species: *Obeliscus zhongshani* Li Fasheng.

[Not *Obeliscus* Beck, 1837 (Mollusca)].

[Not *Obeliscus* Popofsky, 1913 (Protozoa)].

[Not *Obeliscus* Graybill, 1923 (Nematoda)].

NOTE: For bibliographic references concerning these homonyms, see Neave (1940).

Lifashengia zhongshani (Li Fasheng), **comb. nov.**

Obeliscus zhongshani Li Fasheng, 2002a: 120.

Seopsis longisquama Li Fasheng, 2002a: 132. Alternative original spelling: *longisquamis* (on p. 130, in key); *longisquama* is here selected as the correct original spelling.

Seopsis multisquama Li Fasheng, 2002a: 131. Alternative original spelling: *multi-quama* (on p. 132, in legend to fig. 97); *multisquama* is here selected as the correct original spelling.

Yunientomia Li Fasheng, 2002a: 115. Gender: F. Type species: *Yunientomia ditaenia* Li Fasheng. Alternative original spelling: *Yunaphientomia* (on p. 110, in key); *Yunientomia* is here selected as the correct original spelling.

LIPOSCELIDIDAE

Embidopsocus zhouyaoi Li Fasheng, 2002a: 76 (incorrect subsequent spelling of genus name on p. 76: *Embidopsoues*).

Liposcelis naturalis Li Zhihong & Li Fasheng, in: Li Fasheng, 2002a: 88. Alternative original spelling: *natiuralis* (on p. 78, in key); *naturalis* is here selected as the correct original spelling.

Liposcelis sculptilimacula Li Zhihong & Li Fasheng. Li Fasheng, 2002a: 99 (as *L. sculptilis*, incorrect subsequent spelling). NOTE: Lienhard & Smithers (2002: 95) mention this species as *L. sculptimacula*, an incorrect subsequent spelling.

EPIPSOCIDAE

Bertkauia reticularis Li Fasheng & Mockford. Li Fasheng, 2002a: 221 (incorrect subsequent spelling of genus name on plate VI: *Bertkallis*).

Cubitiglabra Li Fasheng. Li Fasheng, 2002a: Genus name several times misspelled *Cubitiglabrus* or *Cubitiglatrus* (incorrect subsequent spellings).

Cubitiglabra dayaoshanana Li Fasheng, 2002a: 197 (as *Cubitiglabrus dayaoshananus*, incorrect subsequent spelling of genus name).

Valvepipsocus Li Fasheng, 2002a: 222. Gender: M. Type species: *Valvepipsocus diodematus* Li Fasheng. Alternative original spelling: *Valviepipsocus* (on p. 194, in key); *Valvepipsocus* is here selected as the correct original spelling.

DOLABELLOPSOCIDAE

Auroropsocus conoidalis Li Fasheng, 2002a: 192. Alternative original spelling: *conoidalis* (on p. 1780); *conoidalis* is here selected as the correct original spelling.

Dimidistriata longicapita Li Fasheng & Mockford. Li Fasheng, 2001: 123 (as *Dimidistriatus longicapitus*, incorrect subsequent spelling of genus name).

CAECILIUSIDAE

Anoculaticaecca chuanshanica Li Fasheng. Li Fasheng, 2002a: 301 (as *Anoculaticaeccilius chuanshanicus*, incorrect subsequent spelling of genus name).

Bivalvicaecilia Li Fasheng, 2002a: 302. Gender: F. Type species: *Bivalvicaecilia longiansa* Li Fasheng. Alternative original spelling: *Bivalvicaecilius* (on p. 227, in key); *Bivalvicaecilia* is here selected as the correct original spelling.

Caecilius bicurris Li Fasheng, 2002a: 348. Alternative original spelling: *bicuris* (on p. 307, in key); *bicurris* is here selected as the correct original spelling.

Caecilius ceratostictus Li Fasheng, 2002a: 413. Alternative original spelling: *ceratostictous* (on p. 312, in key); *ceratostictus* is here selected as the correct original spelling.

- Caecilius cuboideus* Li Fasheng. Li Fasheng, 2002a: 418 (as *C. cuboides*, incorrect subsequent spelling).
- Caecilius dicornis* Li Fasheng. Li Fasheng, 2002a: 444 (as *C. bicornis*, incorrect subsequent spelling).
- Caecilius diploideus* Li Fasheng. Li Fasheng, 2002a: 339 (as *C. diploides*, incorrect subsequent spelling).
- Caecilius erythrostigmus* Li Fasheng. Li Fasheng, 2002a: 410. NOTE: By using the spelling *erythrostigmus*, Li Fasheng (2002a) automatically selects one of the alternative original spellings [Li Fasheng, 1993a: *erythrostigma* (pp. 334, 414) and *erythrostigmus* (p. 335)] as the correct original spelling (ICZN, 1999: art. 24.2.4.). Mockford (2000) and Lienhard & Smithers (2002) only mention the spelling *erythrostigma*, but their choice cannot be considered as a selection of the correct original spelling because they don't explicitly mention the alternative original spelling (ICZN, 1999: art. 24.2.3.). The name *erythrostigmus* is a compound noun in apposition based on the masculine Greek noun "stimos" (*erythrostigma* is based on the neuter Greek noun "stigma").
- Caecilius jilinensis* Li Fasheng, 2002a: 523. Alternative original spelling: *jilinsnsis* (on p. 1812); *jilinensis* is here selected as the correct original spelling.
- Caecilius laterimacularis* Li Fasheng, 2002a: 483. NOTE: The spelling *laterimacularis*, used by Li Fasheng (2002b: 124), is a nomen nudum or an incorrect subsequent spelling (see Introduction).
- Caecilius longiansatus* Li Fasheng, 2002a: 481. Alternative original spelling: *longiansalus* (on p. 317, in key); *longiansatus* is here selected as the correct original spelling.
- Caecilius medivittatus* Li Fasheng, 1992c: 306. Li Fasheng, 2002a: 355.
Caecilius platytaenus Li Fasheng, 1992f: 214. Synonymy: Li Fasheng, 2002a: 355.
Caecilius platytaenius Li Fasheng. Li Fasheng, 1992c: 308 (incorrect subsequent spelling for *platytaenus*).
NOTE: *Valenzuela platytaenius* (Li Fasheng, 1995) sensu Mockford (2000: 382) is erroneously also declared as a synonym of *C. medivittatus* by Li Fasheng (2002a: 355). This 1995-species listed by Mockford is *Caecilius platytaenius* Li Fasheng, 1995d: 158, and is evidently not identical with the above mentioned *Caecilius platytaenus* Li Fasheng, 1992. Li Fasheng (2002a: 473) mentions the 1995-species as *Caecilius immensifascus*, a replacement name for *platytaenius* Li Fasheng, 1995. This replacement name is justified because the one-letter difference between *platytaenus* and *platytaenius* is not sufficient to prevent homonymy (ICZN, 1999: art. 58.15.).
- Caecilius paurosphaerus* Li Fasheng, 2002a: 522. Alternative original spelling: *paurophaerus* (on p. 1812); *paurosphaerus* is here selected as the correct original spelling.
- Caecilius phaeozanalis* Li Fasheng. Li Fasheng, 2002a: 486 (as *C. phaeozonalis*, incorrect subsequent spelling).
- Caecilius punctulosus* Li Fasheng, 2002a: 320. Alternative original spelling: *punctalosalus* (on p. 306, in key); *punctulosus* is here selected as the correct original spelling.

- Caecilius qiongshanensis*** Li Fasheng, 2002a: 440. Alternative original spelling: *qiongshaniensis* (on p. 314, in key); *qiongshanensis* is here selected as the correct original spelling. NOTE: The spelling *qiongshanicus*, used by Li Fasheng (2002b: 123), is a nomen nudum or an incorrect subsequent spelling (see Introduction).
- Caecilius quaterimaculus*** Li Fasheng, 2002a: 380. Alternative original spelling: *quaterimaclus* (on p. 310, in key); *quaterimaculus* is here selected as the correct original spelling.
- Caecilius quinarius*** Li Fasheng, Li Fasheng, 2002a: 333 (as *C. qunarius*, incorrect original spelling, cf. Lienhard & Smithers, 2002: 180).
- Caecilius zhuangshani*** Li Fasheng, 2002a: 517. Alternative original spelling: *zhongshani* (used several times); *zhuangshani* is here selected as the correct original spelling.
- Disialacaecilia*** Li Fasheng, 2002a: 290. Gender: F. Type species: *Disialacaecilia ningxiaensis* Li Fasheng. Alternative original spellings: *Disiacaecilia* (on p. 1790) and *Disialacaecilius* (on plate VI); *Disialacaecilia* is here selected as the correct original spelling.
- Dypsocus abaxialis*** Li Fasheng, 2002a: 230 (incorrect subsequent spelling of genus name on on p. 230, in legend to fig. 188: *Dypscus*).
- Dypsocus cornutus*** Li Fasheng, 2002a: 246. Alternative original spelling: *cormutus* (on p. 247, in legend to fig. 204); *cornutus* is here selected as the correct original spelling.
- Dypsocus longidigitalis*** Li Fasheng, 2002a: 232. Alternative original spelling: *longidigitulis* (on p. 233, in legend to fig. 190); *longidigitalis* is here selected as the correct original spelling.
- Enderleinella magnioculus*** (Li Fasheng). Li Fasheng, 2002a: 541 (from *Valenzuela*, as *E. magniocola*, incorrect subsequent spelling). NOTE: For the etymology of the species name see *Enderleinella minutoculus*.
- Enderleinella minutoculus*** (Li Fasheng). Li Fasheng, 2002a: 536 (as *E. minutiocola*, incorrect subsequent spelling). NOTE: The correct original spelling (*Caecilius minutoculus*) has been selected by Lienhard & Smithers (2002: 173). The spelling *minutiocola* contains two spelling errors: an additional “i” in the middle of the word and the ending “-a”. The name *minutoculus* is a compound noun in apposition based on the masculine Latin noun “oculus”.
- Enderleinella monospaera*** Li Fasheng. Li Fasheng, 2002a: 544 (as *E. monospaera*, incorrect subsequent spelling).
- Licaecilius*** nom. nov.
- Licaecilius* Lienhard, **nom. nov.** (replacement name). Gender: M. Type species: *Neocaecilius triradiatus* Li Fasheng.
- Neocaecilius* Li Fasheng, 2002a: 292. Gender: M. Type species: *Neocaecilius triradiatus* Li Fasheng.
- [Not *Neocaecilius* Li Fasheng, 2000 (Pseudocaeciliidae); see Lienhard & Smithers, 2002].
- Licaecilius mangshiensis*** (Li Fasheng), **comb. nov.**
- Neocaecilius mangshiensis* Li Fasheng, 2002a: 294.

Licaecilius triradiatus (Li Fasheng), **comb. nov.**

Neocaecilius triradiatus Li Fasheng, 2002a: 293.

Paracaecilius lativalvis (Li Fasheng). Li Fasheng, 2002a: 583 (as *P. lativalvus*, incorrect subsequent spelling).

Paracaecilius meniscoides Li Fasheng, 2002a: 577. Alternative original spelling: *miniscoides* (used several times); *meniscoides* (in key on p. 567, and in legend to fig. 518 on p. 577) is here selected as the correct original spelling.

Parvialacaecilia hebeiensis Li Fasheng, 2002a: 291. Alternative original spelling: *hedeiensis* (on p. 1791); *hebeiensis* is here selected as the correct original spelling.

Phymocaecilius Li Fasheng, 2002a: 295. Gender: M. Type species: *Phymocaecilius subulosus* Li Fasheng. Alternative original spellings: *Phymocaeilius* (on p. 227, in key), *Phymocaecilus* (on p. 1791: *Phymocaecilus puniceifascus*) and *Phtmo-caecilius* (on p. 1792: *Phtmo-caecilius fortis*); *Phymocaecilius* is here selected as the correct original spelling.

STENOPSOCIDAE

Cubipilis leucoresbius Li Fasheng, 2002a: 721. Alternative original spelling: *leucors-bicus* (on p. 707, in key); *leucoresbius* is here selected as the correct original spelling.

Graphopsocus luojiashanensis Li Fasheng, 2002a: 593. Alternative original spelling: *luojiashnensis* (on pp. xviii and 593); *luojiashanensis* is here selected as the correct original spelling.

Graphopsocus putuoshanensis Li Fasheng, 2002a: 586. Alternative original spelling: *prtuoshanensis* (on p. 586, in legend to fig. 527); *putuoshanensis* is here selected as the correct original spelling.

Stenopsocus anthracinus Li Fasheng. Li Fasheng, 2002a: 644 (as *St. anthraeinus*, incorrect subsequent spelling).

Stenopsocus brachychelus Li Fasheng & Yang Chikun. Li Fasheng, 2002a: 618 (as *St. brachychilus*, incorrect subsequent spelling). NOTE: The alternative original spelling *brachychelur* (cf. Li Fasheng & Yang Chikun, 1988: 153) is here declared as an incorrect original spelling because this has not explicitly been done by Lienhard & Smithers (2002) who use the spelling *brachychelus* without comment.

Stenopsocus dichospilus Li Fasheng, 2002a: 657. Alternative original spelling: *dechospilus* (on p. 607, in key); *dichospilus* is here selected as the correct original spelling.

Stenopsocus emeishanicus Li Fasheng, 2002a: 679. Alternative original spelling: *emishanicus* (on p. 680, in legend to fig. 615); *emeishanicus* is here selected as the correct original spelling.

Stenopsocus kunmingiensis Li Fasheng, 2002a: 681. Alternative original spelling: *kuanmingiensis* (on p. 609, twice in key); *kunmingiensis* is here selected as the correct original spelling.

Stenopsocus laterimaculatus Li Fasheng, 2002a: 651. Alternative original spelling: *latermaculatus* (used several times); *laterimaculatus* (on p. 607, in key) is here selected as the correct original spelling.

- Stenopsocus liupanshanensis*** Li Fasheng, 2002a: 653. Alternative original spelling: *liupanshanicus* (on p. 607, in key); *liupanshanensis* is here selected as the correct original spelling.
- Stenopsocus metastictus*** Li Fasheng, 2002a: 629. Alternative original spelling: *metostictus* (used several times); *metastictus* (on p. 606, in key) is here selected as the correct original spelling.
- Stenopsocus paxillivalvaris*** Li Fasheng, 2002a: 687. Alternative original spelling: *pasillivalvaris* (on p. 688, in legend to fig. 623); *paxillivalvaris* is here selected as the correct original spelling.
- Stenopsocus revolatus*** Li Fasheng. Li Fasheng, 2002a: 625 (as *St. revolatus*, incorrect subsequent spelling).
- Stenopsocus xilingxianicus*** Li Fasheng. Li Fasheng, 2002a: 645 (as *St. xilingxianus*, incorrect subsequent spelling).

AMPHIPSOCIDAE

- Amphipsocus mucronatus*** Li Fasheng. Li Fasheng, 2002a: 829 (as *A. macronatus* incorrect subsequent spelling).
- Amphipsocus parilis*** Li Fasheng, 2002a: 801. Alternative original spelling: *parillis* (on p. 799, in key); *parilis* is here selected as the correct original spelling.
- Amphipsocus perbrevis*** Li Fasheng, 2002a: 818. Alternative original spelling: *perbervis* (used several times); *perbrevis* (on p. 798, in key) is here selected as the correct original spelling.
- Amphipsocus phoenicophlebius*** Li Fasheng. Li Fasheng, 2002a: 807 (as *A. phoenio-phlebius*, incorrect subsequent spelling).
- Complaniamphus*** Li Fasheng, 2002a: 846. Gender: M. Type species: *Complaniamphus atrimaculatus* Li Fasheng. Alternative original spellings: *Complaniamphius* (on p. 1840) and *Complaniapmhus* (on p. 851); *Complaniamphus* is here selected as the correct original spelling.
- Dasydemella estrita*** Li Fasheng. Li Fasheng, 2002a: 867 (as *D. estriata*, incorrect subsequent spelling).
- Kodamaius conostigmus*** Li Fasheng, 2002a: 280. Alternative original spelling: *constigmus* (on p. 1789); *conostigmus* is here selected as the correct original spelling.
- Kodamaius jiangxiensis*** Li Fasheng, 2002a: 274. Alternative original spelling: *jianxiensis* (on p. 1788); *jiangxiensis* is here selected as the correct original spelling.
- Kodamaius macrostigmus*** Li Fasheng. Li Fasheng, 2002a: 276. NOTE: By using the spelling *macrostigmus*, Li Fasheng (2002a) automatically selects one of the alternative original spellings [Li Fasheng, 1993a: *macrostigma* (p. 358) and *macrostigmus* (p. 419)] as the correct original spelling (ICZN, 1999: art. 24.2.4.). Mockford (2000) and Lienhard & Smithers (2002) mention the species as *K. macrostigma*, but their choice cannot be considered as a selection of the correct original spelling because they don't explicitly mention the alternative original spelling (ICZN, 1999: art. 24.2.3.). The name *macrostigmus* is a compound noun in apposition based on the masculine Greek noun "stigma" (*macrostigma* is based on the neuter Greek noun "stigma").

- Kodamaius mingshuii*** Li Fasheng, 2002a: 279. Alternative original spelling: *minrshuii* (on p. 1788); *mingshuii* is here selected as the correct original spelling.
- Kodamaius yunnanicus*** Li Fasheng, 2002a: 284. Alternative original spelling: *yuan-nanicus* (on p. 257, in key); *yunnanicus* is here selected as the correct original spelling.
- Matsumuraiella perducta*** Li Fasheng, 2002a: 875. NOTE: According to Li Fasheng (*in litt.*) the same species is mentioned as *M. producta* by Li Fasheng (2001: 126), this species name being a nomen nudum (cf. Introduction).
- Pseudokolbea*** Li Fasheng, 2002a: 772. Gender: F. Type species: *Pseudokolbea nigrisetosa* Li Fasheng. Alternative original spellings: *Pseudoklobea* (on p. xxii and twice on p. 772) and *Pseudokolba* (on p. 772); *Pseudokolbea* is here selected as the correct original spelling.
- Pseudokolbea nigrisetosa*** Li Fasheng, 2002a: 775 (erroneously mentioned as *K. [sic!] nigrisetosa* on p. 772, in key). Alternative original spelling: *nigrietosa* (on p. 772); *nigrisetosa* is here selected as the correct original spelling.
- Pseudokolbea phaea*** Li Fasheng, 2002a: 774 (erroneously mentioned as *K. [sic!] phaea* on p. 772, in key).
- Pseudokolbea xanthoptera*** Li Fasheng, 2002a: 773 (erroneously mentioned as *K. [sic!] xanthoptera* on p. 772, in key).
- Pseudokolbea xuthosticta*** Li Fasheng, 2002a: 776 (erroneously mentioned as *K. [sic!] xuthosticta* on p. 772, in key).
- Siniamphipsocus acutus*** Li Fasheng, 2002a: 791 (as *Siniamphipsocus acutus* on p. 791, incorrect subsequent spelling of genus name).
- Siniamphipsocus deltoides*** Li Fasheng, 2002a: 783 (as *Sineamphipsocus deltoides* on p. 783, in legend to fig. 713, incorrect subsequent spelling of genus name).
- Siniamphipsocus huashanensis*** Li Fasheng, 2002a: 779. Alternative original spelling: *huashaniensis* (used several times); the spelling *huashanensis* (on p. 1834) is here selected as the correct original spelling.
- Siniamphipsocus yangzijiangiensis*** Li Fasheng. Li Fasheng, 2002a: 788. NOTE: By using the spelling *yangzijiangiensis*, Li Fasheng (2002a) automatically selects one of the alternative original spellings [Li Fasheng, 1997: *yangzijiangensis* (pp. 445, 519) and *yangzijiangiensis* (p. 445, in legend to fig. 62)] as the correct original spelling (ICZN, 1999: art. 24.2.4.). Lienhard & Smithers (2002) use the name *yangzijiangensis*, but their choice cannot be considered as a selection of the correct original spelling because they don't explicitly mention the alternative original spelling (ICZN, 1999: art. 24.2.3.).
- Taeniostigma longicrurium*** Li Fasheng, 2002a: 754 (as *T. longicruria*). Alternative original spelling: *longicruris* (= genitive singular of the Latin noun "crus") (on p. 749, in key); the adjectival form *longicruri(-us, -a, -um)* is here selected as the correct original spelling, with mandatory change of the ending because of neuter gender of genus name.

LACHESILLIDAE

- Ceratolachesillus quinquecornus*** Li Fasheng, 2002a: 1738. Alternative original spelling: *quinquecornusus* (in description of genus, on p. 1738); *quinquecornus* is here selected as the correct original spelling.

Lachesilla Westwood

Lachesilla Westwood, 1840a: 47. Gender: F. Type species: *Termes fatidicum* Linnaeus.

Dicrolachesillus Li Fasheng, 2002a: 1708. **Syn. nov.** Gender: M. Type species: *Dicrolachesillus qianshanensis* Li Fasheng.

NOTE: See comments on *Lachesilla quercus*.

Lachesilla crutifurca Li Fasheng, 2002a: 1720 (as *L. crutifurcus*).

Lachesilla dichodolichna (Li Fasheng), **comb. nov.**

Dicrolachesillus dichodolichnus Li Fasheng, 2002a: 1712.

Lachesilla intrans Li Fasheng. Combination re-established.

Dicrolachesillus intrans (Li Fasheng). Li Fasheng, 2002a: 1713.

Lachesilla novemimaculata Li Fasheng. Combination re-established.

Dicrolachesillus novemimaculatus (Li Fasheng). Li Fasheng, 2002a: 1709.

Lachesilla qianshanensis (Li Fasheng), **comb. nov.**

Dicrolachesillus qianshanensis Li Fasheng, 2002a: 1711.

Lachesilla quercus (Kolbe). Combination re-established.

Dicrolachesillus quercus (Kolbe). Li Fasheng, 2002a: 1710.

NOTE: According to the figures given by Li Fasheng (2002a: figs 1517 and 1518) it is evident that the species *quercus* Kolbe, 1880 and *qianshanensis* Li Fasheng, 2002 are closely related and belong to the same genus. But in my opinion there is at present no reason to take *quercus* out of the genus *Lachesilla*. Consequently, *qianshanensis* (type species of *Dicrolachesillus*) should also be assigned to *Lachesilla*. In this case *Dicrolachesillus* becomes a junior subjective synonym of *Lachesilla*.

Lachesilla sabiniae Li Fasheng. Combination re-established.

Dicrolachesillus sabiniae (Li Fasheng). Li Fasheng, 2002a: 1715.

Lachesilla wutaishanensis (Li Fasheng), **comb. nov.**

Dicrolachesillus wutaishanensis Li Fasheng, 2002a: 1714.

Zonolachesillus aterilineus Li Fasheng, 2002a: 1729. Alternative original spelling: *aterilienus* (on p. xlv); *aterilineus* is here selected as the correct original spelling.

Zonolachesillus microplatyclatae (Li Fasheng). Li Fasheng, 2002a: 1733 (as *Z. microplatycladae*, incorrect subsequent spelling).

ECTOPSOCIDAE

Ectopsocopsis flavipedia Li Fasheng, 2002a: 950 (as *E. flavipedius*). Alternative original spelling: *flavipedius* (on p. 1850); *flavipedius* is here selected as the correct original spelling, with mandatory change of ending because of feminine gender of genus name.

Ectopsocopsis septentrionalis Li Fasheng, 2002a: 937. Alternative original spelling: *septentrionalus* (on pp. 937 and 938); *septentrionalis* (on p. 1848) is here selected as the correct original spelling.

Ectopsocus McLachlan

Ectopsocus McLachlan, 1899d: 277. Gender: M. Type species: *Ectopsocus briggsi* McLachlan.

Chaetopsocus Pearman, 1929d: 105. Gender: M. Type species: *Chaetopsocus richardsi* Pearman.

Ectotrichus Li Fasheng, 2002a: 902. **Syn. nov.** Gender: M. Type species: *Ectopsocus setulosus* Li Fasheng.

NOTE: Li Fasheng (2002a: 903) places the species *richardsi* Pearman in his new genus *Ectotrichus*. This species is the type species of *Chaetopsocus* Pearman, which is at present considered as a synonym of *Ectopsocus* McLachlan (cf. Lienhard & Smithers, 2002: 248). If this synonymy and the generic concept of *Ectotrichus* proposed by Li Fasheng are accepted, the latter genus name becomes a junior subjective synonym of *Ectopsocus*.

Ectopsocus decenipunctatus Li Fasheng. Li Fasheng, 2002a: 907 (as *E. decemipunctatus*). NOTE: Li Fasheng (1993b) uses two different original spellings for the species name: *decenipnctatus* and *decenipunctatus*. Lienhard & Smithers (2002: 253) use only the name *decenipunctatus*, but this choice cannot be accepted as a selection of the correct original spelling because they don't explicitly mention the alternative original spelling (ICZN, 1999: art. 24.2.3.). Li Fasheng (2002a) only uses a third spelling throughout his book: *decemipunctatus*. Because there is some doubt whether this different subsequent spelling is an emendation or an incorrect subsequent spelling it is to be treated as an incorrect subsequent spelling (ICZN, 1999: art. 33.5.). The spelling *decenipunctatus* is here selected as the correct original spelling.

Ectopsocus equidentus Li Fasheng. Li Fasheng, 2002a: 914 (as *E. equicornutus* Li Fasheng, 1999). NOTE: There are two alternative original spellings used by Li Fasheng, 1999: *equidentus* and *equicornutus*; the former has been selected as the correct original spelling by Lienhard & Smithers (2002: 253).

Ectopsocus hirsutus Thornton. Combination re-established.

Ectotrichus hirsutus (Thornton). Li Fasheng, 2002a: 903.

Ectopsocus ornatus Thornton. Combination re-established.

Ectotrichus ornatus (Thornton). Li Fasheng, 2002a: 903.

Ectopsocus quadratiapicius Li Fasheng, 2002a: 908. Alternative original spelling: *quadratiapicis* (on p. 908, in legend to fig. 824); *quadratiapicius* is here selected as the correct original spelling.

Ectopsocus richardsi (Pearman). Combination re-established.

Ectotrichus richardsi (Pearman). Li Fasheng, 2002a: 903.

Ectopsocus setulosus Li Fasheng. Combination re-established.

Ectotrichus setulosus (Li Fasheng). Li Fasheng, 2002a: 903.

Estipulaceus Li Fasheng, 2002a: 920. Gender: M. Type species: *Ectopsocopsis baidichengensis* Li Fasheng. Alternative original spelling: *Estippulaceae* (on p. 924, *E. daliensis*); *Estipulaceus* is here selected as the correct original spelling.

Estipulaceus daliensis Li Fasheng, 2002a: 924 (as *Estippulaceae daliensis*, incorrect original spelling of genus name, see above).

PERIPSOCIDAE

Campanulatus Li Fasheng, 2002a: 1224. Gender: M. Type species: *Campanulatus jaculatorius* Li Fasheng. Alternative original spelling: *Canpanulatus* (twice on p. 1224); *Campanulatus* is here selected as the correct original spelling.

Campanulatus jaculatorius Li Fasheng, 2002a: 1224. Alternative original spellings: *jaculotorius* (on p. 1224), *jaculotoria* (on p. 1876); *jaculatorius* is here selected as the correct original spelling.

Coniperipsocus jindingensis Li Fasheng, 2002a: 1278. Incorrect subsequent spelling of genus name on p. 1279: *Comiperipsocus jindingensis*.

Coniperipsocus quadrangulus (Li Fasheng, 1992). Li Fasheng, 2002a: 1281 (from *Diplopsocus*).

Diplopsocus quadrangulus Li Fasheng, 1992c: 317. NOTE: The indication “nom. nud.” on p. 1281 in Li Fasheng (2002a) applies only to the genus name, not to the species name, because the name *Diplopsocus* was a nomen nudum in 1992 (this fact does not affect the availability of the species name *quadrangulus*, cf. ICZN, 1999: art. 11.9.3.1.). The genus *Diplopsocus* was described by Li Fasheng & Mockford (1993).

Diplopsocus quadrangulus Li Fasheng & Mockford, 1993: 69. Synonymy: Lienhard & Smithers (2002: 267) and Li Fasheng (2002a: 1281).

Coniperipsocus quadrangulus (Li Fasheng). Li Fasheng, 2002a: 1281.

Coniperipsocus quadrangulus (Li Fasheng & Mockford). Li Fasheng, 2002a: 1281.

NOTE: At present the name *quadrangulus* Li & Mockford, 1993, has to be considered as a junior primary homonym and a junior objective synonym of *quadrangulus* Li Fasheng, 1992 (both names are based on the same name-bearing type). Lienhard & Smithers (2002: 267) did not try to resolve the problem of the relative precedence of one of these names, because they were not sure if Li's paper had really been published earlier than his joint paper with Mockford. As Li Fasheng (2002a) explicitly considers “Li, 1992” as the original reference for the species description (cf. pp. xxxiv and 1281), the precedence of *quadrangulus* Li over *quadrangulus* Li & Mockford has to be admitted. The fact that he considers *Diplopsocus* Li Fasheng, 1992 as a nomen nudum supports also this solution of the precedence problem (even if he erroneously cites Li & Mockford as the authors of *Coniperipsocus quadrangulus* in the legend to fig. 1161).

Cycloperipsocus pangi Li Fasheng. Li Fasheng, 2002a: 1234 (as *Cycloperopsocus pangi*, incorrect subsequent spelling of genus name).

Diplopsocus cupressicolus Li Fasheng & Mockford. Li Fasheng, 2002a: 1263 (as *D. cupressicola*, incorrect subsequent spelling).

Diplopsocus liupanshanensis Li Fasheng, 2002a: 1259. Alternative original spelling: *liupenshanensis* (on p. 1246, in key); *liupanshanensis* is here selected as the correct original spelling.

Diplopsocus magniocellatus Li Fasheng. Li Fasheng, 2002a: 1257. NOTE: The species was described by Li Fasheng (1993a: 375) and not by Li Fasheng & Mockford (1993) as indicated erroneously by Li Fasheng (2002a: 1257).

Diplopsocus phaeophlebius Li Fasheng, 2002a: 1254. Alternative original spelling: *phaeophlebius* [on pp. 1245 (in key) and 1254 (in legend to fig. 1134)]; *phaeophlebius* is here selected as the correct original spelling.

Orbiperipsocus Li Fasheng, 2002a: 1222. Gender: M. Type species: *Orbiperipsocus fractiflexus* Li Fasheng. Alternative original spelling: *Orbiperipaocus* (on p. 1876); *Orbiperipsocus* is here selected as the correct original spelling.

- Peripsocus disdentus*** Li Fasheng. Li Fasheng, 2002a: 1203 (as *P. distentus*, incorrect subsequent spelling).
- Peripsocus equispineus*** Li Fasheng, 2002a: 1119. Alternative original spelling: *eguispineus* (on p. 1100, in key); *equispineus* is here selected as the correct original spelling.
- Peripsocus lifashengi*** nom. nov.
Peripsocus lifashengi Lienhard, **nom. nov.** (replacement name).
Peripsocus orientalis Li Fasheng, 2002a: 1125.
[Not *Peripsocus orientalis* Garcia Aldrete, 1999b: 243].
- Peripsocus medifasciarius*** Li Fasheng, 2002a: 1181. Alternative original spelling: *medifasciarius* (on p. 1873); *medifasciarius* is here selected as the correct original spelling.
- Peripsocus microcheilus*** Li Fasheng. Li Fasheng, 2002a: 1127. NOTE: By using the spelling *microcheilus*, Li Fasheng (2002a) automatically selects one of the alternative original spellings [Li Fasheng, 1993a: *microcheilius* (pp. 373, 374) and *microcheilus* (pp. 421, 423)] as the correct original spelling (ICZN, 1999: art. 24.2.4.). Lienhard & Smithers (2002) mention the species as *P. microcheilius*, but their choice cannot be considered as a selection of the correct original spelling because they don't explicitly mention the alternative original spelling (ICZN, 1999: art. 24.2.3.).
- Peripsocus odontopetalus*** Li Fasheng, 2002a: 1191. Alternative original spelling: *codntopetalus* (on p. 1191, in legend to fig. 1076); *odontopetalus* is here selected as the correct original spelling.
- Peripsocus plstylpus*** Li Fasheng. Li Fasheng, 2002a: 1130 [as *P. platypus* (on pp. xxxi and 1130) and *P. platylpus* (on p. 1131, in legend to fig. 1019), incorrect subsequent spellings]. NOTE: In my opinion, the name *platypus*, though more euphonious than *plstylpus* (which is the unique original spelling), has to be considered as an incorrect subsequent spelling rather than a justified emendation.
- Peripsocus rhombocanthus*** Li Fasheng, 2002a: 1123. Alternative original spelling: *rhombocanthus* (on p. 1867); *rhombocanthus* is here selected as the correct original spelling.
- Peripsocus sedcimidentalis*** Li Fasheng. Li Fasheng, 2002a: 1151. NOTE: By using the spelling *sedcimidentalis*, Li Fasheng (2002a) automatically selects one of the alternative original spellings [Li Fasheng, 1997: *sedecimidentalis* (pp. 466, 523) and *sedcimidentalis* (p. 466, in legend to fig. 81)] as the correct original spelling (ICZN, 1999: art. 24.2.4.). Lienhard & Smithers (2002) mention the species as *P. sedecimidentalis*, but their choice cannot be considered as a selection of the correct original spelling because they don't explicitly mention the alternative original spelling (ICZN, 1999: art. 24.2.3.).
- Peripsocus varidentatus*** Li Fasheng, 2002a: 1145. NOTE: This species is mentioned by Li Fasheng (2001: 132) under the nomen nudum *P. septemidentus* (cf. Li Fasheng, *in litt.*). The spelling *varidentatus*, used by Li Fasheng (2002b: 125), is also a nomen nudum or an incorrect subsequent spelling (see Introduction).
- Peripsocus zhangliani*** Li Fasheng, 2002a: 1165. Alternative original spellings: *zhengliangi* (on p. 1103, in key), *zhangliangi* (on p. 1165); *zhangliani* (on

p. 1871) is here selected as the correct original spelling (the species is named after the locality Zhanglianmiao).

Periterminalis lata Li Fasheng, 2002a: 1284 (as *P. latus*). Incorrect subsequent spelling of genus name on p. 1879: *Periteriminalis latus*. NOTE: The genus name is of feminine gender (cf. Lienhard & Smithers, 2002: 283).

Properipsocus quadartus Li Fasheng, 2002a: 1238. Alternative original spelling: *gradartus* (on p. 1238, in legend to fig. 1122); *quadartus* is here selected as the correct original spelling.

Turriperipsocus cunninghamiae Li Fasheng. Li Fasheng, 2002a: 1227 (as *T. cunninghamius*, incorrect subsequent spelling).

PSEUDOCAECILIIDAE

Meplerinae is defined as a new subfamily by Li Fasheng (2002a: p. 1853), containing only the genus *Mepleres*; erroneously it is called Pseudoscotiinae on pp. xxvii and 979.

Fashengocaecilius nom. nov.

Fashengocaecilius Lienhard, **nom. nov.** (replacement name). Gender: M. Type species: *Allocaecilius biaduncus* Li Fasheng.

Calocaecilius Li Fasheng, 2002a: 1057. Gender: M. Type species: *Allocaecilius biaduncus* Li Fasheng.

[Not *Calocaecilius* Mockford, 1974d: 155 (Amphipsocidae)].

Fashengocaecilius biaduncus (Li Fasheng), **comb. nov.**

Allocaecilius biaduncus Li Fasheng, 1992f: 226.

Calocaecilius biaduncus (Li Fasheng). Li Fasheng, 2002a: 1057.

Heterocaecilius Lee & Thornton

Heterocaecilius Lee & Thornton, 1967: 13. Gender: M. Type species: *Heterocaecilius minotus* Lee & Thornton (cf. Lienhard & Smithers, 2002: 301).

Orbocaecilius Li Fasheng, 1999: 36. Gender: M. Type species: *Orbocaecilius paulicellus* Li Fasheng. Genus name several times misspelled *Obrocaecilius* by Li Fasheng (2002a) (incorrect subsequent spelling).

NOTE: By placing *Heterocaecilius minotus* Lee & Thornton (type species of *Heterocaecilius*) in his genus *Orbocaecilius*, Li Fasheng (2000) proposes a concept of the latter genus which automatically put into synonymy the genus names *Orbocaecilius* and *Heterocaecilius*. This synonymy has formally been established and discussed by Lienhard & Smithers (2002: 302). Li Fasheng (2002a) does not propose any revision of the generic concept of *Orbocaecilius*, that's why there is no reason to rediscuss the synonymy. In the following, all species mentioned by Li Fasheng (2002a) in *Orbocaecilius* are transferred to *Heterocaecilius* (new or re-established combinations, cf. Lienhard & Smithers, 2002).

Heterocaecilius argutus (Li Fasheng), **comb. nov.**

Orbocaecilius argutus Li Fasheng, 2002a: 1028 (as *Obrocaecilius argutus*, incorrect subsequent spelling of genus name).

Heterocaecilius bicruris (Li Fasheng), **comb. nov.**

Orbocaecilius bicruris Li Fasheng, 2002a: 1036 (as *Obrocaecilius bicruris*, incorrect subsequent spelling of genus name).

- Heterocaecilius bidigitatus*** Li Fasheng. Combination re-established.
Orbocaecilius bidigitatus (Li Fasheng). Li Fasheng, 2002a: 1027.
- Heterocaecilius bifarius*** (Li Fasheng), **comb. nov.**
Orbocaecilius bifarius Li Fasheng, 2002a: 1032 (as *Obrocaecilius bifarius*, incorrect subsequent spelling of genus name).
- Heterocaecilius brachystigmus*** (Li Fasheng), **comb. nov.**
Orbocaecilius brachystigmus Li Fasheng, 2002a: 1038 (as *Obrocaecilius brachystigmus*, incorrect subsequent spelling of genus name).
- Heterocaecilius circulicellus*** Li Fasheng. Combination re-established.
Orbocaecilius circulicellus (Li Fasheng). Li Fasheng, 2002a: 1038.
- Heterocaecilius dasoceratus*** (Li Fasheng), **comb. nov.**
Orbocaecilius dasoceratus Li Fasheng, 2002a: 1029 (as *Obrocaecilius dasoceratus*, incorrect subsequent spelling of genus name).
- Heterocaecilius duodecidentus*** (Li Fasheng), **comb. nov.**
Orbocaecilius duodecidentus Li Fasheng, 2002a: 1035 (as *Obrocaecilius duodecidentus*, incorrect subsequent spelling of genus name).
- Heterocaecilius imparilis*** (Li Fasheng), **comb. nov.**
Orbocaecilius imparilis Li Fasheng, 2002a: 1031 (as *Obrocaecilius imparilis*, incorrect subsequent spelling of genus name).
- Heterocaecilius longicornis*** (Li Fasheng), **comb. nov.**
Orbocaecilius longicornis Li Fasheng, 2002a: 1032 (as *Obrocaecilius longicornis*, incorrect subsequent spelling of genus name).
- Heterocaecilius paulicellus*** (Li Fasheng). Combination re-established.
Orbocaecilius paulicellus Li Fasheng. Li Fasheng, 2002a: 1040.
- Heterocaecilius pseudoanomalus*** Li Fasheng. Combination re-established.
Orbocaecilius pseudoanomalus (Li Fasheng). Li Fasheng, 2002a: 1033 (as *Obrocaecilius pseudoanomalus*, incorrect subsequent spelling of genus name).
- Heterocaecilius sedecimidentus*** (Li Fasheng), **comb. nov.**
Orbocaecilius sedecimidentus Li Fasheng, 2002a: 1037 (as *Obrocaecilius sedecimidentus*, incorrect subsequent spelling of genus name).
- Heterocaecilius vulturius*** (Li Fasheng), **comb. nov.**
Orbocaecilius vulturius Li Fasheng, 2002a: 1041 (as *Obrocaecilius vulturius*, incorrect subsequent spelling of genus name).
- Heterocaecilius xihuicus*** (Li Fasheng), **comb. nov.**
Orbocaecilius xihuicus Li Fasheng, 2002a: 1039 (as *Obrocaecilius xihuicus*, incorrect subsequent spelling of genus name).
- Mepleres longitudinalis*** Li Fasheng, 2002a: 991. Alternative original spelling: *longitudianlis* (on p. 1855); *longitudinalis* is here selected as the correct original spelling.
- Pseudocaecilius bibulbus*** Li Fasheng. Li Fasheng, 2002a: 1069 (as *P. bibalbus*, incorrect subsequent spelling).
- Pseudocaecilius euryocercus*** Li Fasheng, 2002a: 1065. Alternative original spelling: *eurocerus* (on p. 1062, in key); *euryocercus* is here selected as the correct original spelling.

Pseudocaecilius galactozonalis Li Fasheng, 2002a: 1072. Alternative original spelling: *galactozonacis* (on p. 1062, in key); *galactozonalis* is here selected as the correct original spelling.

Pseudocaecilius monotaeniatus Li Fasheng, 2002a: 1073. Alternative original spellings: *monotaenitus* (on p. 1863), *monotaenius* (on p. 1074, in legend to fig. 973); *monotaeniatus* is here selected as the correct original spelling.

Trichocaecilius Badonnel

Trichoelipsocus Li Fasheng. Synonymy: Li Fasheng, 2002a: 992 (incorrect subsequent spelling: *Trichelipsocus*).

Trichocaecilius sanxianicus (Li Fasheng). Li Fasheng, 2002a: 996 (as *T. sanxiaicus*, incorrect subsequent spelling).

Trichocaecilius tianmushanicus Li Fasheng, 2002a: 993. Alternative original spelling: *tianmushaicus* (on p. 992, in key); *tianmushanicus* is here selected as the correct original spelling.

PHILOTARSIDAE

Haplophallus trachopetalus Li Fasheng. Li Fasheng, 2002a: 971 (as *H. trachopterus*, incorrect subsequent spelling).

MESOPSOCIDAE

Mesopsocus corniculatus Li Fasheng, 2002a: 1299. Erroneously with feminine ending (*corniculata*) on p. 1299 (in legend to fig. 1174).

Mesopsocus curvimarginatus Li Fasheng, 2002a: 1305. Alternative original spelling: *curvimangiratus* (on p. 1299, in key); *curvimarginatus* is here selected as the correct original spelling.

HEMIPSOCIDAE

Metahemipsocus cunestus Li Fasheng. Li Fasheng, 2002a: 888 (as *M. cuneatus*, incorrect subsequent spelling).

Metahemipsocus longifurcus Li Fasheng, 2001: 129 (as *Metabemipsocus longifurcus*, incorrect subsequent spelling of genus name).

PSOCIDAE

Amphigerontiinae

Amphigerontia anchorae Li Fasheng. Li Fasheng, 2002a: 1346. NOTE: Li Fasheng (1989) uses two different original spellings of the species name: *anchora* (on pp. 44, 45) and *ancorne* (on p. 58). By using the spelling *anchora* throughout his book, Li Fasheng (2002a) automatically selects this spelling as the correct original spelling (ICZN, 1999: art. 24.2.4.). Lienhard & Smithers (2002: 374) mention the species as *A. anchonae*, an incorrect subsequent spelling.

Amphigerontia lhasaensis Li Fasheng & Yang Chikun. Li Fasheng, 2002a: 1344. NOTE: Li Fasheng & Yang Chikun (1987a) use three different original spellings of the species name: *lhasana* (on p. 8), *lhasasna* (on p. 9) and *lhasaensis* (on p. 28). By using the spelling *lhasaensis* throughout his book, Li Fasheng (2002a) automatically selects this spelling as the correct original spelling.

(ICZN, 1999: art. 24.2.4.). Lienhard & Smithers (2002: 377) only use the spelling *lhasana*, without mentioning the alternative original spellings; according to art. 24.2.3. of the Code this cannot be considered as a valid selection of the correct original spelling.

Chilopsocus Li Fasheng, 2002a: 1353. Gender: M. Type species: *Chilopsocus macrochilus* Li Fasheng. Alternative original spelling: *Chilosopsocus* [on pp. 1341 (in key), 1353, 1354]; *Chilopsocus* is here selected as the correct original spelling.

Chilopsocus macrochilus Li Fasheng, 2002a: 1353 (as *Chilosopsocus macrochilus*, incorrect original spelling of genus name, see above).

Epiblaste huananiensis Li Fasheng, 2002a: 1352. Alternative original spelling: *huananinsis* (on plate VIII); *huananiensis* is here selected as the correct original spelling.

Pentablaste flavida (Li Fasheng). Li Fasheng, 2002a: 1376 (as *P. flavidae* and *P. flavidae*, incorrect subsequent spellings).

Pentablaste pentasticha Li Fasheng, 2002a: 1372. Alternative original spelling: *pentaticha* (on p. 1890); *pentasticha* is here selected as the correct original spelling.

Pentablaste tetraedrica Li Fasheng, 2002a: 1371. Alternative original spelling: *tetraedirca* (on p. 1368, in key); *tetraedrica* is here selected as the correct original spelling.

Psocinae

Ceratostigma Li Fasheng, 2002a: 1595. Gender: N. Type species: *Ceratostigma gracile* Li Fasheng. Alternative original spellings: *Ceratostigmas* (on p. 1596), *Ceratostigmus* (on p. 1911); *Ceratostigma* is here selected as the correct original spelling.

Ceratostigma macrostigmatum (Li Fasheng & Yang Chikun). Li Fasheng, 2002a: 1596 [as *Ceratostigmas macrostigmus*, incorrect original spelling of genus name (see above) and incorrect subsequent spelling of species name].

Clematoscenea yunnanica Li Fasheng, 2002a: 1598 (on p. 1911 as *Clematocenea yunnanica*, incorrect subsequent spelling of genus name).

Clematostigma excavatum Li Fasheng, 2002a: 1428. Alternative original spelling: *excavata* (on p. 1429, in legend to fig. 1280); *excavata* is here selected as the correct original spelling, with mandatory change of ending because of neuter gender of genus name.

Conothoracalis corollata Li Fasheng, 2002a: 1524 (as *C. corollatus* and, on p. 1906, as *Conothoracailis corollatus*, incorrect subsequent spelling of genus name and incorrect ending of species name).

Conothoracalis guangxiica Li Fasheng, 2002a: 1527 (as *C. guangxiicus*). Alternative original spelling: *gnangxiicus* (on p. 1518, in key); *guangxiicus* is here selected as the correct original spelling, with mandatory change of ending because of feminine gender of genus name.

Conothoracalis unciformis Li Fasheng, 2002a: 1526 (on p. 1906 as *Conothporacalis unciformis*, incorrect subsequent spelling of genus name).

***Fashenglianus* nom. nov.**

Fashenglianus Lienhard, **nom. nov.** (replacement name). Gender: M. Type species: *Psocidus albimaculatus* Li Fasheng.

Latalvalva Li Fasheng, 2002a: 1403. Gender: F. Type species: *Psocidus albimaculatus* Li Fasheng. Alternative original spelling: *Latalvalvae* (used several times); *Latalvalva* (on p. 1397, in key) is here selected as the correct original spelling. NOTE: *Latalvalva* is a noun in nominative singular as required by the Code (ICZN, 1999: art. 11.8.).

[Not *Latalvalva* Amsel, 1956 (Lepidoptera); see Edwards & Vevers, 1975].

***Fashenglianus albimaculatus* (Li Fasheng), comb. nov.**

Latalvalva albimaculata (Li Fasheng). Li Fasheng, 2002a: 1403 (from *Psocidus*, as *Latalvalvae albimaculata*, incorrect original spelling of genus name, see above).

***Lipsocus* nom. nov.**

Lipsocus Lienhard, **nom. nov.** (replacement name). Gender: M. Type species: *Cyclotus bannaicus* Li Fasheng.

Cyclotus Li Fasheng, 2002a: 1589. Gender: M. Type species: *Cyclotus bannaicus* Li Fasheng.

[Not *Cyclotus* Edwards, 1852 (Mollusca); see Neave, 1939].

***Lipsocus bannaicus* (Li Fasheng), comb. nov.**

Cyclotus bannaicus Li Fasheng, 2002a: 1589.

***Lipsocus guizhouensis* (Li Fasheng & Yang Chikun), comb. nov.**

Cyclotus guizhouensis (Li Fasheng & Yang Chikun). Li Fasheng, 2002a: 1592 (from *Psococerastis*).

***Lipsocus microcorneus* (Li Fasheng), comb. nov.**

Cyclotus microcorneus Li Fasheng, 2002a: 1591.

Loensia guangdongica (Li Fasheng). Li Fasheng, 2002a: 1540 (from *Trichadenotecnum*). NOTE: The spelling *guandongicum* used by Lienhard & Smithers (2002: 465) is an incorrect subsequent spelling.

Loensia stigmatoidea (Li Fasheng). Li Fasheng, 2002a: 1545 (as *L. stigmatoides*, incorrect subsequent spelling).

Lubricus dayaoshanensis Li Fasheng, 2002a: 1688. Alternative original spelling: *dayaoshanicus* (on pp. 1688 and 1918); *dayaoshanensis* is here selected as the correct original spelling.

Mecampsis multimacularis Li Fasheng, 2002a: 1417. NOTE: This species is mentioned as *Mampsis multimacularis* by Li Fasheng (2001: 142), incorrect subsequent spelling of genus name (the species name is a nomen nudum in 2001, cf. Introduction).

Mecampsis ophiocephais Li Fasheng. Li Fasheng, 2002a: 1421 (as *M. ophiocephalus*, incorrect subsequent spelling).

Mecampsis septangulata Li Fasheng, 2002a: 1420 (as *M. septangulatus*). Alternative original spelling: *septangulartus* (on p. 1420, in legend to fig. 1272); *septangulatus* is here selected as the correct original spelling, with mandatory change of ending because of feminine gender of genus name.

Propsococerastis Li Fasheng & Yang Chikun. Li Fasheng, 2002a: Genus name several times misspelled *Porpsococerastis* (incorrect subsequent spelling).

- Pseudoclematus xanthoznatus* Li Fasheng. Li Fasheng, 2002a: 1579 (as *P. xanthozonatus*, incorrect subsequent spelling). NOTE: This species is listed by Lienhard & Smithers (2002) as *P. xanthoznatus*, but these authors don't mention the alternative original spelling *xanthozanatus* (Li Fasheng, 1992f: p. 243, second line from above). The spelling *xanthoznatus* is here selected as the correct original spelling, while *xanthozonatus* has to be considered as an incorrect subsequent spelling.
- Psocidus bifurcatus* Li Fasheng, 2002a: 1441. Alternative original spelling: *bicruris* (on p. 1898 and on plate IX); *bifurcatus* is here selected as the correct original spelling. NOTE: This species is not identical with *Psocidus bicruris* Li Fasheng, 1990a: 10.
- Psocidus longifolius* Li Fasheng, 2001: 142 (as *Psocodus longifolius*, incorrect subsequent spelling of genus name).
- Psococerastis hunaniensis* Li Fasheng. Li Fasheng, 2001: 157, 2002a: 1671. NOTE: By using the spelling *hunaniensis*, Li Fasheng (2001) automatically selects one of the alternative original spellings [Li Fasheng, 1992f: *hunanensis* (on pp. 230, 231) and *hunaniensis* (on p. 242)] as the correct original spelling (ICZN, 1999: art. 24.2.4.). Lienhard & Smithers (2002) mention the species as *P. hunanensis*.
- Psococerastis scissilis* Li Fasheng. Li Fasheng, 2001: 159 (as *P. sissilis*, incorrect subsequent spelling).
- Psococerastis venimaculis* Li Fasheng & Yang Chikun. Li Fasheng, 2002a: 1622 [as *P. venimacula* (on pp. 1622 and 23) and *P. venimaculatus* (on p. 1601, in key), incorrect subsequent spellings]. NOTE: Lienhard & Smithers (2002) mention the species as *P. venimaculis* without explicitly selecting this spelling as the correct original spelling. The alternative original spelling *venimaculi* (Li Fasheng & Yang Chikun, 1987a: p. 29) is here declared as an incorrect original spelling and the spelling *venimaculis* selected as the correct original spelling.
- Psocomesites bimaculatus* Li Fasheng. Li Fasheng, 2002a: 1457 (as *Psocomesites bimaculatum*, incorrect subsequent spelling of genus name and incorrect ending of species name).
- Psocomesites guangzhouensis* Li Fasheng, 2002a: 1458 (as *P. guangzhouense*). Alternative original spelling: *guangzhouicum* (on p. 1899); *guangzhouense* is here selected as the correct original spelling, with mandatory change of ending because of masculine gender of genus name.
- Ptycta flavipalpi* Li Fasheng & Yang Chikun. Li Fasheng, 2002a: 1431 (as *P. flavipalpa*, incorrect subsequent spelling).
- Sciadionopsocus* Li Fasheng, 2002a: 1406. Gender: M. Type species: *Sciadionopsocus fenzelianae* Li Fasheng. Alternative original spelling: *Scidionopsocus* (on p. 1397, in key); *Sciadionopsocus* is here selected as the correct original spelling.
- Sigmatoneura (Sigmatoneura) antenniflava* Li Fasheng, 2002a: 1692. Alternative original spelling: *antenniflava* (on p. 1692, in key); *antenniflava* is here selected as the correct original spelling.
- Sigmatoneura (Sigmatoneura) baiyunica* Li Fasheng, 2002a: 1698 (as *Sigmatoneuros baiyunica* on plate X, incorrect subsequent spelling of genus name).

Sigmatoneura (Sigmatoneura) coronata Li Fasheng, 2002a: 1695. Species name erroneously with masculine ending on p. 1692 (in key): *coronatus*.

Symbiopsocus Li Fasheng. Erroneously mentioned as new genus ("gen. nov.") by Li Fasheng (2002a: p. 1397, in key). The genus was described by Li Fasheng (1997: 491).

Symbiopsocus subrhombeus Li Fasheng, 2002a: 1415 (as *Synbiopsocus subrhombeus*, incorrect subsequent spelling of genus name).

***Trichadenotecnum* Enderlein**

NOTE: *Trichadenopsocus* Roesler is considered as a junior synonym of *Trichadenotecnum* Enderlein by Lienhard & Smithers (2002), and the species described in *Trichadenopsocus* by Li Fasheng up to the year 2000 have been transferred to *Trichadenotecnum* by these authors. This synonymy, initially proposed by Mockford (1993a), has also been accepted by Yoshizawa (2001a), in his revision of the genus *Trichadenotecnum* (Li Fasheng doesn't take account of this revision for his monograph on Chinese Psocoptera). All species assigned to *Trichadenopsocus* by Li Fasheng (2001, 2002a, 2002b) are here (re)transferred to *Trichadenotecnum*. The species *T. medium*, considered as belonging to *Trichadenotecnum* by Yoshizawa (2001a), but placed in *Loensia* Enderlein by Li Fasheng (2002a), is here also retransferred to *Trichadenotecnum*. Five other species of *Trichadenotecnum* (*bidens*, *dolabratum*, *guangdongicum*, *rectangulum*, *scrobiculare*, cf. Lienhard & Smithers, 2002), transferred to *Loensia* by Li Fasheng (2002a) and not explicitly mentioned by Yoshizawa (2001a) as belonging to *Trichadenotecnum*, are not retransferred to the latter genus.

***Trichadenotecnum aduncatum* (Li Fasheng), comb. nov.**

Trichadenopsocus aduncatus Li Fasheng, 2002a: 1498.

***Trichadenotecnum alexandrae* Sommerman. Combination re-established.**

Trichadenopsocus alexandrae (Sommerman). Li Fasheng, 2002a: 1499.

***Trichadenotecnum alternatum* (Li Fasheng), comb. nov.**

Trichadenopsocus alternatus Li Fasheng, 2002a: 1491.

***Trichadenotecnum ampullaceum* (Li Fasheng), comb. nov.**

Trichadenopsocus ampullaceus Li Fasheng, 2002a: 1503.

***Trichadenotecnum apertum* Thornton. Combination re-established.**

Trichadenopsocus apertus (Thornton). Li Fasheng, 2001: 151, 2002a: 1495.

***Trichadenotecnum bicolor* (Li Fasheng), comb. nov.**

Trichadenopsocus bicolor Li Fasheng, 2001: 152.

***Trichadenotecnum bidentatum* Thornton. Combination re-established.**

Trichadenopsocus bidentatus (Thornton). Li Fasheng, 2002a: 1510.

***Trichadenotecnum bitenatum* (Li Fasheng). Combination re-established.**

Trichadenopsocus bitenatus Li Fasheng, 2002a: 1492 (as *T. biter-natus*, incorrect subsequent spelling).

***Trichadenotecnum bucciniforme* Li Fasheng. Combination re-established.**

Trichadenopsocus bucciniformis (Li Fasheng). Li Fasheng, 2002a: 1513.

***Trichadenotecnum dactylinum* (Li Fasheng), comb. nov.**

Trichadenopsocus dactylinus Li Fasheng, 2002a: 1504.

***Trichadenotecnum digitatum* (Li Fasheng), comb. nov.**

Trichadenopsocus digitatus Li Fasheng, 2002a: 1495.

- Trichadenotecnum emeishanense*** Li Fasheng, 2002a: 1487. Alternative original spellings: *emeishananse* (on pp. xl and 1487), *emeishanaense* (on p. 1487, in legend to fig. 1327), *emeishanse* (on p. 1902); *emeishanense* (on p. 1462, in key) is here selected as the correct original spelling.
- Trichadenotecnum felix*** Thornton. Combination re-established.
Trichadenopsocus felix (Thornton). Li Fasheng, 2002a: 1504.
- Trichadenotecnum himalayense*** Li Fasheng & Yang Chikun. Combination re-established.
Trichadenopsocus himalayensis (Li Fasheng & Yang Chikun). Li Fasheng, 2002a: 1514 (as *T. himalayaensis*, incorrect subsequent spelling).
- Trichadenotecnum jaculatorum*** (Li Fasheng), **comb. nov.**
Trichadenopsocus jaculatorus Li Fasheng, 2002a: 1494.
- Trichadenotecnum jinxiuense*** (Li Fasheng), **comb. nov.**
Trichadenopsocus jinxiuensis Li Fasheng, 2002a: 1497.
- Trichadenotecnum majus*** (Kolbe). Li Fasheng, 2002a: 1472 [as *T. majum* (on pp. 1472 and 1473) and *T. maijum* (on p. 1462, in key), incorrect subsequent spellings]. NOTE: The neuter form of *major* is *majus*.
- Trichadenotecnum malayense*** New. Combination re-established.
Trichadenopsocus malayensis (New). Li Fasheng, 2002a: 1905 (as *Trichadenopsocus malayaense*, incorrect subsequent spelling and incorrect ending).
- Trichadenotecnum mclachlani*** New. Combination re-established.
Trichadenopsocus mclachlani (New). Li Fasheng, 2002a: 1501.
- Trichadenotecnum medium*** Thornton. Combination re-established.
Loensia media (Thornton). Li Fasheng, 2002a: 1538 (from *Trichadenotecnum*, as *Lenisia media*, incorrect subsequent spelling of genus name).
- Trichadenotecnum minisexmaculatum*** Li Fasheng & Yang Chikun. Li Fasheng, 2002a: 1480 [as *T. minsexmaculatus* (on p. 1462, in key) and *minsexmaculatum* (on p. 1480), incorrect subsequent spellings].
- Trichadenotecnum multangulare*** (Li Fasheng), **comb. nov.**
Trichadenopsocus multangularis Li Fasheng, 2002a: 1499. NOTE: Li Fasheng (2001: 153) gives a description of the female of this species, without explicitly describing the species as new. The species is only explicitly described as new in 2002; in 2001 the species name *multangularis* is a nomen nudum, in spite of the description given (ICZN, 1999: art. 16.1.).
- Trichadenotecnum multicuspidatum*** (Li Fasheng), **comb. nov.**
Trichadenopsocus multicuspidatus Li Fasheng, 2002a: 1496.
- Trichadenotecnum opiparipardale*** (Li Fasheng). Combination re-established.
Trichadenopsocus opiparipardalis Li Fasheng. Li Fasheng, 2002a: 1516.
- Trichadenotecnum pardus*** Badonnel, 1955. Combination re-established.
Trichadenopsocus pardus (Badonnel). Li Fasheng, 2002a: 1511.
Trichadenotecnum pardidum Thornton, 1961. Combination re-established.
Trichadenopsocus pardidus (Thornton). Li Fasheng, 2002a: 1516.
NOTE: Based on Badonnel (1967a), *pardidum* is considered as a junior subjective synonym of *pardus* by Lienhard & Smithers (2002).

- Trichadenotecnum paululum* (Li Fasheng), **comb. nov.**
Trichadenopsocus paululus Li Fasheng, 2002a: 1509.
- Trichadenotecnum periphericum* (Li Fasheng), **comb. nov.**
Trichadenopsocus periphericus Li Fasheng, 2001: 149.
- Trichadenotecnum quadruplex* (Li Fasheng), **comb. nov.**
Trichadenopsocus quadruplex Li Fasheng, 2002a: 1510.
- Trichadenotecnum resupinum* (Li Fasheng). Combination re-established.
Trichadenopsocus resupinus Li Fasheng, Li Fasheng, 2002a: 1506.
- Trichadenotecnum scoparium* (Li Fasheng). Combination re-established.
Trichadenopsocus scoparius Li Fasheng, Li Fasheng, 2002a: 1508.
- Trichadenotecnum spiniserrulum* Datta. Combination re-established.
Trichadenopsocus spiniserrulus (Datta). Li Fasheng, 2002a: 1505.
- Trichadenotecnum stipulatum* (Li Fasheng), **comb. nov.**
Trichadenopsocus stipulatus Li Fasheng, 2002a: 1501.
- Trichadenotecnum subrotundum* (Li Fasheng), **comb. nov.**
Trichadenopsocus subrotundus Li Fasheng, 2002a: 1515.
- Trichadenotecnum subscalare* (Li Fasheng), **comb. nov.**
Trichadenopsocus subscalaris Li Fasheng, 2002a: 1512.
- Trichadenotecnum sufflatum* Li Fasheng. Combination re-established.
Trichadenopsocus sufflatus (Li Fasheng). Li Fasheng, 2002a: 1511.
- Trichadenotecnum trichotomum* (Li Fasheng), **comb. nov.**
Trichadenopsocus trichotomus Li Fasheng, 2002a: 1502.
- Trichadenotecnum uncorne* (Li Fasheng). Combination re-established.
Trichadenopsocus uncornis Li Fasheng, Li Fasheng, 2002a: 1517.
- Trichadenotecnum uniforme* (Li Fasheng), **comb. nov.**
Trichadenopsocus uniformis Li Fasheng, 2002a: 1507.

MYOPSOCIDAE

- Lichenomima cylindra* Li Fasheng, 2002a: 1326 (incorrect subsequent spelling of genus name on p. 1885: *Lachenomima*).
- Lichenomima excavata* Li Fasheng, 2002a: 1331 (incorrect subsequent spelling of genus name on p. 1886: *Lichenomima*).
- Lichenomima orbiculata* Li Fasheng, 2002a: 1328 (incorrect subsequent spelling of genus name on p. 1885: *Lachenomima*).
- Lophopterygella* Enderlein

NOTE: A redefinition of the genus *Lophopterygella* Enderlein, based on the study of the lectotype of the type species will soon be published, together with the description of a new genus of Myopsocidae from SE-Asia (Lienhard, in prep.). In this context some additional nomenclatural acts concerning Chinese Myopsocidae will also be proposed.

Smithersia Thornton

- Smithersia* Thornton, 1992, in: Thornton & Browning, 1992: 358. Gender: F.
 Type species: *Psocus hermosus* Banks.
- Polygonomyus* Li Fasheng, 2002a: 1314. **Syn. nov.** Gender: M. Type species:
Polygonomyus sinicus Li Fasheng.

NOTE: Li Fasheng (2002a) doesn't take account of the important paper on Indonesian Myopsocidae published by Thornton & Browning (1992), where the very characteristic genus *Smithersia* is described. Based on the description and the figures given by Li Fasheng (2002a), there is no doubt that the species assigned by this author to his new genus *Polygonomyus*, in particular the type species *P. sinicus*, belong in reality to the genus *Smithersia* Thornton.

Smithersia scapiformis (Li Fasheng), **comb. nov.**

Polygonomyus scapiformis Li Fasheng, 2002a: 1317.

Smithersia sexangula (Li Fasheng), **comb. nov.**

Polygonomyus sexangulus Li Fasheng, 2002a: 1315.

Polygonomyus [sic!] *sexangulus* Li Fasheng. Li Fasheng, 2002b: 126 (genus name nomen nudum or incorrect subsequent spelling, see Introduction).

Smithersia sinica (Li Fasheng), **comb. nov.**

Polygonomyus sinicus Li Fasheng, 2002a: 1316.

ACKNOWLEDGEMENTS

I am very grateful to my wife H. Lienhard-Meng for her help in analysing Li's monumental monograph. Prof. Li Fasheng (Beijing) kindly sent me copies of his most recent papers, with comments on their dates of publication and on some particular nomenclatural problems. I would also like to thank Dr K. Yoshizawa (Sapporo) for managing the PsocoNet Homepage, for publishing the "Additions and Corrections to the World Catalogue" in "Psocid News", edited by him, and for critical reading of a first draft of the present paper.

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New species of coelotine spiders (Araneae, Amaurobiidae) from northern Thailand I

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New species of coelotine spiders (Araneae, Amaurobiidae) from northern Thailand I. - Six new coelotine spider species are described from Chiang Mai and Chiang Rai Provinces, northern Thailand: *Draconarius abbreviatus* sp. n., *D. anthonyi* sp. n., *D. inthanonensis* sp. n., *D. siamensis* sp. n., *D. subulatus* sp. n. and *Coelotes thailandensis* sp. n. The specific name *Coelotes wangi* Hu, 2001, from Tibet, China, is a junior homonym of *Coelotes wangi* Chen & Zhao, 1997 and is here replaced by *Coelotes hui* nom. n.

Key-words: Araneae - Amaurobiidae - Coelotinae - *Draconarius* - *Coelotes* - new species - taxonomy - zoogeography- Thailand.

INTRODUCTION

The northern part of Thailand is essentially a series of mountainous ridges folded between two offshoots of the Himalayan Range: the Dawna-Tenasserim and the Annamitic Chain. This region makes up approximately 20 percent of the country's land area and is dotted with many mountains higher than 1500 m, where coelotine spiders are abundant.

The spider family Amaurobiidae is represented by 67 genera and 590 described species (Platnick, 2003) from around the world. Most species occurring in Asia were described from China, and only few species were recorded from tropical regions south of it. There is no record of any amaurobiids from Thailand, though coelotine spiders are fairly common in evergreen hill forests in the north of the country.

Several coelotine spiders examined in this study were collected by Dr Peter J. Schwendinger (MHNG) during the 1980s and 1990s. Additional specimens examined were obtained in the cause of an ecological project conducted in the Doi Inthanon National Park by the first author. New coelotine species described in this paper were collected only from the mountains of the Dawna-Tenasserim Range (Doi Inthanon, Doi Suthep-Pui, Doi Lanka). Additional species from other parts of the country will be described in subsequent papers.

MATERIAL AND METHODS

All illustrations were made with an Olympus SZX-9 stereomicroscope equipped with a drawing tube. Body measurements are in millimetres. Measurements of leg segments were taken from the dorsal side. Epigyna were drawn in natural and cleared state (immersing in lactic acid for 10-20 minutes). Male palps were drawn in lateral and ventral view. The material examined is deposited in the collections of the Muséum d'histoire naturelle, Genève (MHNG) and of the Department of Entomology at the California Academy of Sciences (CAS), except for the specimens marked with PDC (Pakawin Dankittipakul Collection, Auckland, New Zealand), which will later also be deposited in the MHNG.

Abbreviations used in the text and in the figures: ALE, anterior lateral eyes; AME, anterior median eyes; C, conductor; CD, copulatory duct; CL, conductor lamella; DC, dorsal apophysis of conductor (= conductor dorsal apophysis according to Wang, 2002); E, embolus; LE, lateral eyes; MA, median apophysis; ME, median eyes; MOQ, median ocular quadrangle; PA, patellar apophysis; PLE, posterior lateral eyes; PME, posterior median eyes; RDTA, retrolateral dorsal tibial apophysis (= lateral tibial apophysis according to Wang, 2002); RTA, retrolateral tibial apophysis; SH, spermathecal head; SS, spermathecal stalk.

TAXONOMY

Draconarius Ovtchinnikov, 1999

Diagnosis: The genus *Draconarius* resembles *Asiacoelotes* Wang, 2002 in possessing an elongated lateral cymbial furrow, a long, slender embolus and a long, strongly convoluted spermathecae. Males can be distinguished by the presence of a dorsal apophysis on the conductor (Fig. 2). Females can be distinguished by posteriorly originating copulatory ducts and widely separated spermathecae (Fig. 4).

Draconarius abbreviatus sp. n.

Figs 1-4

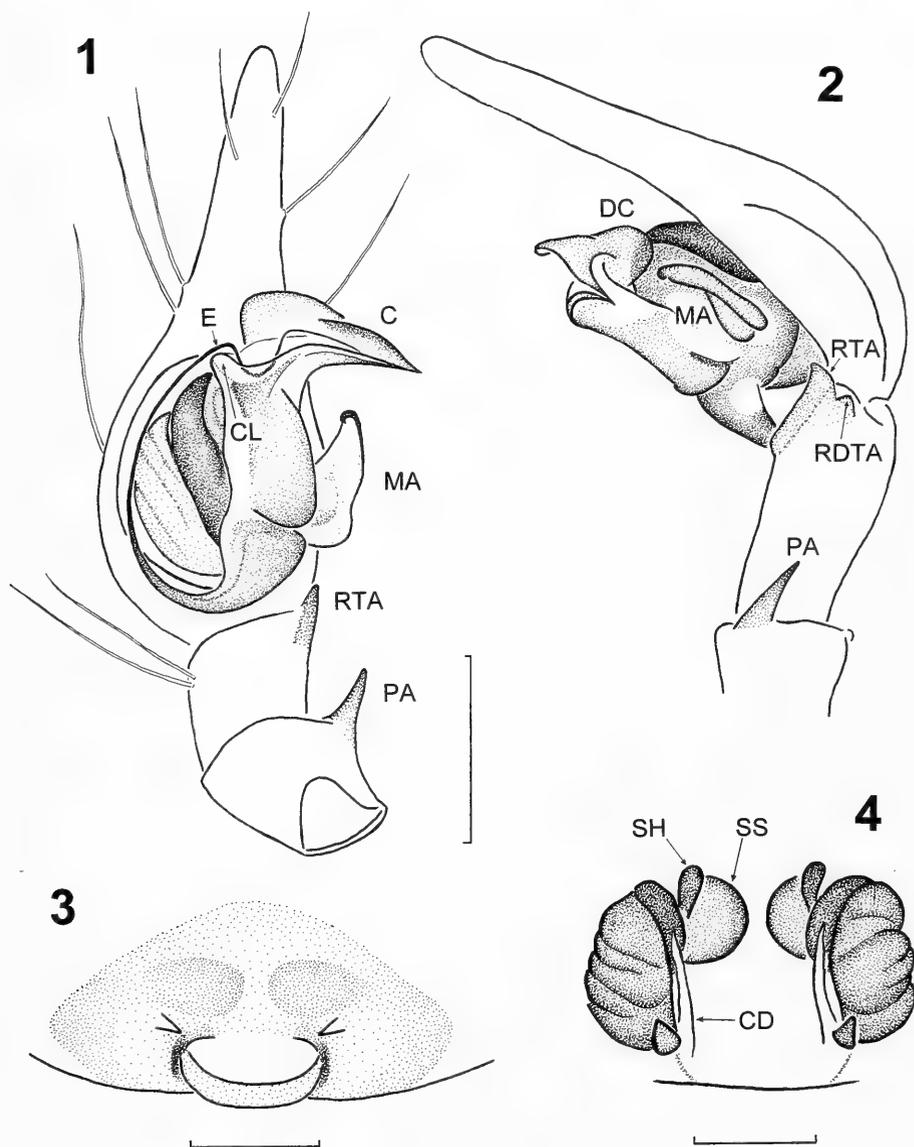
Type locality: THAILAND, Chiang Mai Province, Chomthong District, Doi Inthanon National Park, Doi Inthanon.

Type material: Holotype: ♂, from the type locality, pine forest, 1000 m, pitfall trap, 25.xii.1999-29.i.2000, leg. P. Dankittipakul (MHNG). Paratypes (all from the type locality): 1♀, pine forest, 1000 m, litter sample, 15.iv.2000 (MHNG); 2♂, 1000 m, pitfall trap, 25.xii.1999-29.i.2000, leg. P. Dankittipakul (MHNG); 2♂, pine forest, 1000 m, pitfall trap, 29.i-26.ii.2000, leg. P. Dankittipakul (CAS); 1♂, evergreen hill forest, 1750 m, litter sample, 15.i.2000, leg. P. Dankittipakul (PDC AM00154).

Etymology: The specific name refers to the short retrolateral tibial apophysis of the male palp.

Diagnosis: Males are similar to those of *D. everesti* (Hu, 2001) but can be distinguished by the elongated median apophysis of the palpal organ and by differences in their conductors. Females are similar to those of *D. lutulentus* (Wang *et al.*, 1990) but can be distinguished by the small copulatory ducts of the epigynum.

Description: ♂ (holotype). Total length 8.49. Carapace 4.85 long, 3.33 wide. Abdomen 3.64 long. Promargin of chelicerae with 3 teeth, retromargin with 5. Labium longer than wide (0.54/0.50).



FIGS 1-4

Draconarius abbreviatus sp. n., ♂ holotype (1, 2), ♀ paratype (3, 4). Left palp, ventral (1) and retrolateral (2) view. Epigynum, ventral view (3). Vulva, dorsal view (4). Scale lines 0.5 mm (1-2), 0.25 mm (3-4). Abbreviations: C, conductor; CD, copulatory duct; CL, conductor lamella; DC, dorsal apophysis of conductor; E, embolus; MA, median apophysis; PA, patella apophysis; RDTA, retrolateral dorsal tibial apophysis; RTA, retrolateral tibial apophysis; SH, spermathecal head; SS, spermathecal stalk.

Eye sizes and interdistances: AME 0.15, ALE 0.18, PME 0.16, PLE 0.18; AME-AME 0.13, AME-ALE 0.07, PME-PME 0.15, PME-PLE 0.20, ALE-PLE 0.07; MOQ 0.48 long, anterior width 0.41, posterior width 0.48. Clypeus height 0.23. Leg formula: 1-4-2-3.

Leg measurements:

	I	II	III	IV
Femur	4.04	3.54	3.23	3.94
Patella + Tibia	5.15	4.34	3.74	5.05
Metatarsus	3.94	3.33	3.13	4.14
Tarsus	2.02	1.82	1.52	1.92
Total	15.15	13.03	11.62	15.05

Palp (Figs 1-2): Patellar apophysis long, with sharply pointed apex; retrolateral tibial apophysis short, less than half of tibial length; retrolateral dorsal tibial apophysis small, close to retrolateral tibial apophysis; cymbial furrow short; conductor short; conductor lamella medium-sized; dorsal apophysis of conductor large; median apophysis spoon-shaped, elongated; embolus originating proximally.

♀ (paratype). Total length 9.10. Carapace 4.55 long, 3.13 wide. Abdomen 3.54 long. Promargin of chelicerae with 3 teeth, retromargin with 5.

Eye sizes and interdistances: AME 0.10, ALE 0.15, PME 0.15, PLE 0.16; AME-AME 0.13, AME-ALE 0.07, PME-PME 0.15, PME-PLE 0.18, ALE-PLE 0.07; MOQ 0.46 long, anterior width 0.35, posterior width 0.46. Clypeus height 0.22. Leg formula: 4-1-2-3.

Leg measurements:

	I	II	III	IV
Femur	3.33	3.03	2.73	3.54
Patella + Tibia	4.24	3.54	3.03	4.04
Metatarsus	3.03	2.63	2.22	3.33
Tarsus	1.51	1.31	1.11	1.62
Total	12.11	10.71	9.09	12.53

Epigynum and vulva (Figs 3-4): Epigynal teeth short, close to atrial margin; atrium small; copulatory ducts small, extended mesad of spermathecae; spermathecal heads situated anteriorly; spermathecal bases broad, widely separated; spermathecal stalks broad, anteriorly converging.

Distribution and habitat: Known only from the type locality. Most specimens were collected from pine forest at 1000 m elevation; one male was collected from leaf litter of evergreen hill forest (at 1750 m).

Draconarius anthonyi sp. n.

Figs 5-8

Type locality: THAILAND, Chiang Mai Province and District, Doi Suthep-Pui National Park, Doi Pui.

Type material: Holotype: ♂, at 1500 m, 15.viii.1987, leg. P. J. Schwendinger (MHNG). Paratypes: 2♂, 1♀, data as holotype (MHNG); ♂, 1680 m, 27.i.2001, leg. P. Dankittapakul (MHNG); 1♂, 1610 m, 19.ix.1993, leg. P. J. Schwendinger (PDC AM0080); 4♂, 3♀, 1500-

1600 m, 27.ix.1990, leg. P. J. Schwendinger (CAS); 3♂, 2♀, 1500-1600 m, 27.ix.1990, leg. P. J. Schwendinger (MHNG).

Etymology: The specific name is a patronym dedicated to Anthony Osa, Auckland, New Zealand.

Diagnosis: Males of *D. anthonyi* sp. n. are similar to those of *D. argenteus* (Wang *et al.*, 1990) but can be distinguished by their broader conductor and by differences of their embolus and embolic base. Females of this species are similar to those of *D. lutulentus* but can be distinguished by the broader spermathecae.

Description: ♂ (holotype). Total length 10.61. Carapace 4.95 long, 3.23 wide. Abdomen 5.15 long. Promargin of chelicerae with 3 teeth, retromargin with 5.

Eye sizes and interdistances: AME 0.18, ALE 0.20, PME 0.16, PLE 0.20; AME-AME 0.13, AME-ALE 0.10, PME-PME 0.19, PME-PLE 0.25, ALE-PLE 0.07; MOQ 0.58 long, anterior width 0.51, posterior width 0.53. Clypeus height 0.23. Leg formula: 1-4-2-3.

Leg measurements:

	I	II	III	IV
Femur	4.44	4.04	3.64	4.34
Patella + Tibia	5.76	5.05	2.73	5.56
Metatarsus	4.55	4.04	3.84	5.05
Tarsus	4.24	2.12	1.72	2.02
Total	17.17	15.25	11.93	16.97

Palp (Figs 5, 6): Palp without patellar apophysis; retrolateral tibial apophysis short, approximately half of tibial length; retrolateral dorsal tibial apophysis small, close to retrolateral tibial apophysis; cymbial furrow about half of cymbial length; conductor short; conductor lamella medium-sized; dorsal apophysis of conductor large; median apophysis spoon-shaped, elongated; embolus originating proximally.

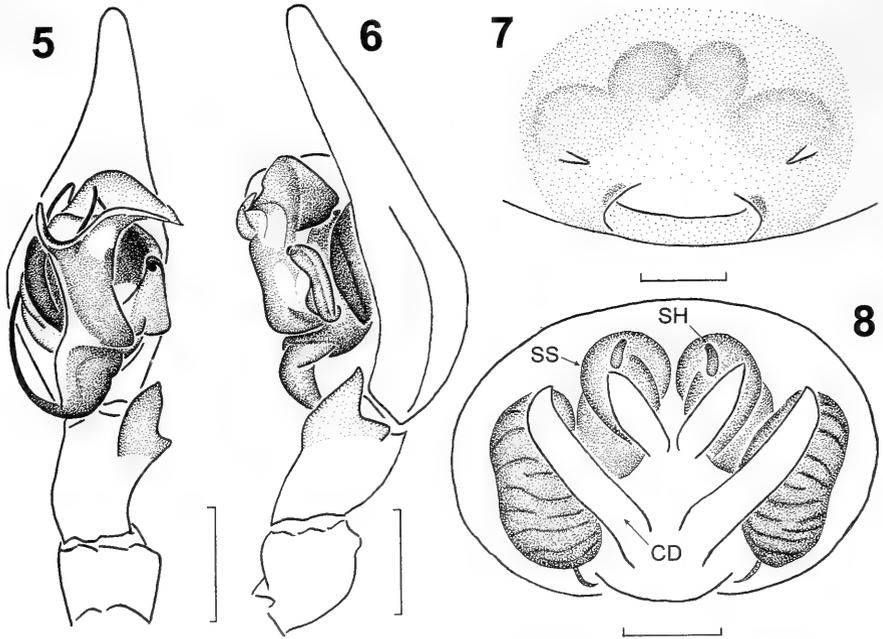
♀ (paratype). Total length 10.10. Carapace 4.75 long, 3.23 wide. Abdomen 5.15 long. Promargin of chelicerae with 3 teeth, retromargin with 5, occasionally 6. Labium slightly longer than wide (0.87/0.76).

Eye sizes and interdistances: AME 0.18, ALE 0.23, PME 0.19, PLE 0.20; AME-AME 0.11, AME-ALE 0.76, PME-PME 0.20, PME-PLE 0.25, ALE-PLE 0.10; MOQ 0.56 long, anterior width 0.51, posterior width 0.56. Clypeus height 0.23. Leg formula: 4-1-2-3.

Leg measurements:

	I	II	III	IV
Femur	3.54	3.33	3.03	4.04
Patella + Tibia	4.54	4.04	3.54	4.75
Metatarsus	3.43	2.93	2.73	3.64
Tarsus	1.71	1.52	1.41	1.52
Total	13.22	11.82	10.71	13.95

Epigynum and vulva (Figs 7-8): Epigynal teeth widely separated, situated anterior to atrium; atrium small, situated posteriorly near epigastric furrow; copulatory ducts originating posteriorly, looped around spermathecae; spermathecal heads small,



FIGS 5-8

Draconarius anthonyi sp. n., ♂ holotype (5, 6), ♀ paratype (7, 8). Left palp, ventral (5) and retrolateral (6) view. Epigynum, ventral view (7). Vulva, dorsal view (8). Scale lines 0.5 mm (5-6), 0.25 mm (7-8). Abbreviations: CD, copulatory duct; SH, spermathecal head; SS, spermathecal stalk.

situated anteriorly; spermathecal bases broad, widely separated; spermathecal stalks long, convoluted, converging anteriorly.

Distribution and habitat: Known only from the type locality. *D. anthonyi* sp. n. can be found along road banks in evergreen hill forest. The spiders usually build tubular retreats occupying a hole in a road bank. Only few specimens were collected from funnels in crevices of trees. All specimens examined were collected in between 1500 m and 1680 m altitude.

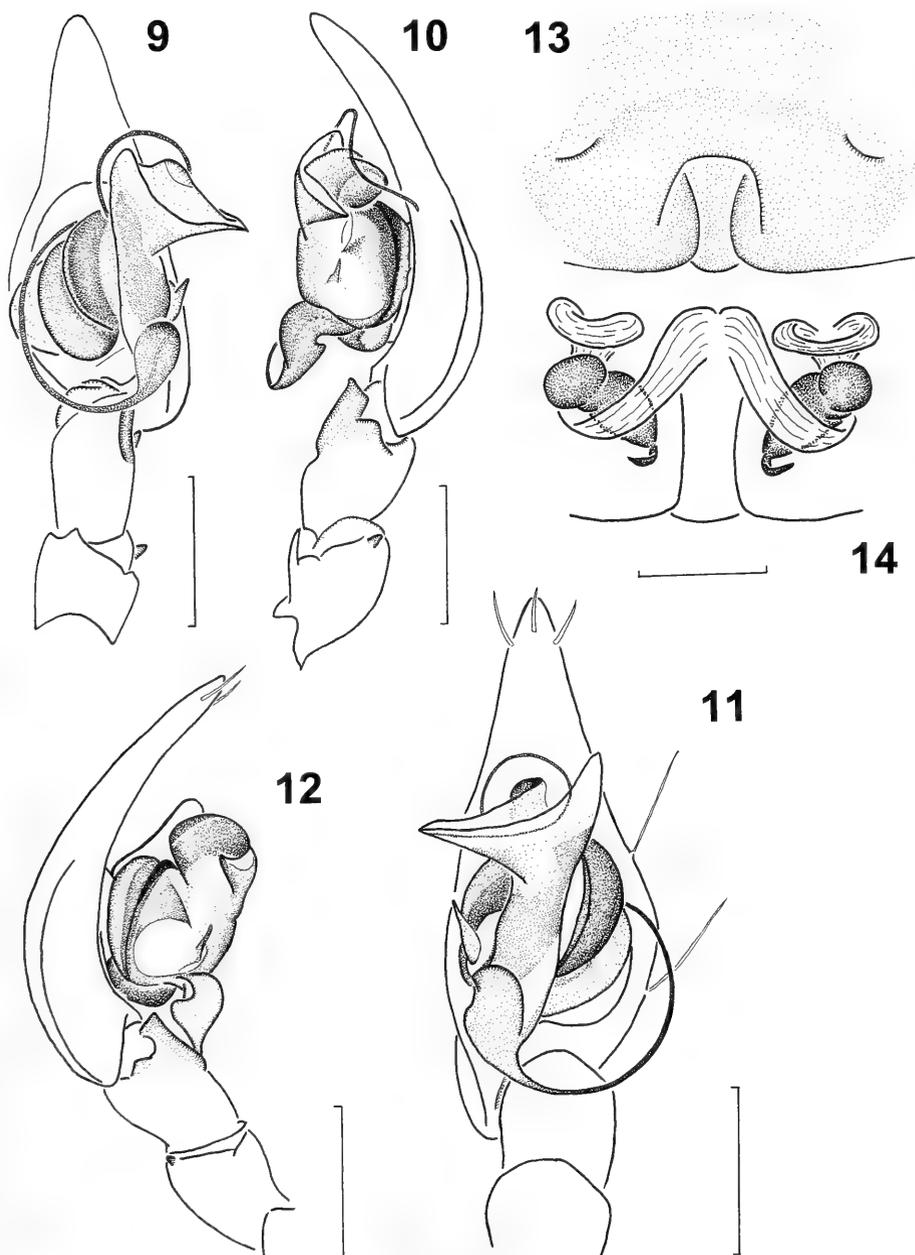
Draconarius inthanonensis sp. n.

Figs 9-14

Type locality: THAILAND, Chiang Mai Province, Chomthong District, Doi Inthanon National Park, Doi Inthanon.

Type material: Holotype: ♂, from the type locality, Kew Mae Pan 2100 m, pitfall trap, 27.vi.-26.vii.2000, leg. P. Dankittipakul (MHNG). Paratypes: 2♀, 1800 m, leaf litter sample, 26.xi.2002, leg. P. Dankittipakul (MHNG); 2♂, Kew Mae Pan, 2100 m, pitfall trap, 27.vi.-26.vii.2000, leg. P. Dankittipakul (MHNG); 1♂, 2530 m, pitfall trap, 29.iii.-27.iv.2000, leg. P. Dankittipakul (CAS); 1♂, 1750 m, leaf litter sample, 15.vi.2000, leg. P. Dankittipakul (MHNG); 4♂, 2300 m, pitfall trap, 27.xi.1986-14.i.1987, leg. P. J. Schwendinger (MHNG), PDC AM0041-0042).

Etymology: The specific name refers to the type locality, Doi Inthanon (2565 m), the highest mountain in Thailand.



FIGS 9-14

Draconarius inthanonensis sp. n., ♂ holotype (9, 10), ♂ paratype (11, 12), ♀ paratype (13, 14). Left palp, ventral (9) and retrolateral (10) view. Right palp, ventral (11) and retrolateral (12) view. Epigynum, ventral view (13). Vulva, dorsal view (14). Scale lines 0.5 mm (9-12), 0.25 mm (13-14).

Diagnosis: This new species is similar to *D. siamensis* sp. n. but can be distinguished by the presence of a simple, not spoon-shaped median apophysis on the male palp and by differences in the atrium and spermathecal tubes of female genitalia.

Description: ♂ (holotype). Total length 7.37. Carapace 4.04 long, 2.42 wide. Abdomen 3.54 long. Promargin of chelicerae with 2 teeth, retromargin with 2. Labium longer than wide (0.56/0.51).

Eye sizes and interdistances: AME 0.08, ALE 0.18, PME 0.15, PLE 0.15; AME-AME 0.10, AME-ALE 0.10, PME-PME 0.08, PME-PLE 0.18, ALE-PLE 0.10; MOQ 0.43 long, anterior width 0.30, posterior width 0.43. Clypeus height 0.10. Leg formula: 1-4-2-3.

Leg measurements:

	I	II	III	IV
Femur	3.23	2.93	2.53	3.13
Patella + Tibia	4.24	3.54	2.82	3.94
Metatarsus	3.33	2.73	2.63	3.33
Tarsus	2.32	1.92	1.52	1.72
Total	13.12	11.12	9.50	12.12

Palp (Figs 9-12): Patellar apophysis very small; retrolateral tibial apophysis about half of tibial length; retrolateral dorsal tibial apophysis small; cymbial furrow approximately half of cymbial length; conductor short; dorsal apophysis of conductor small; conductor lamella medium-sized; median apophysis simple, weakly sclerotized, not spoon-shaped; embolus originating proximally.

♀ (paratype). Total length 10.91. Carapace 4.65 long, 3.13 wide. Abdomen 6.01 long. Cheliceral promargin with 2 teeth, retromargin with 2.

Eye sizes and interdistances: AME 0.15, ALE 0.25, PME 0.25, PLE 0.20; AME-AME 0.13, AME-ALE 0.13, PME-PME 0.10, PME-PLE 0.25, ALE-PLE 0.13; MOQ 0.56 long, anterior width 0.46, posterior width 0.58. Clypeus height 0.13. Leg formula: 4-1-2-3.

Leg measurements:

	I	II	III	IV
Femur	3.64	3.33	2.83	3.84
Patella + Tibia	4.55	4.04	3.03	4.55
Metatarsus	3.33	2.63	2.52	3.74
Tarsus	2.02	1.62	1.41	1.61
Total	13.54	11.62	9.79	13.74

Epigynum and vulva (Figs 13-14): Epigynal teeth absent; epigynal hoods distinct; atrium small; copulatory ducts long, originating anteriorly, laterally extended and looped around spermathecae; spermathecal heads large, situated anteriorly; spermathecal bases small, widely separated; spermathecal stalks short, anteriorly converging.

Distribution and habitat: Known only from the type locality. *D. inthanonensis* sp. n. inhabits evergreen hill forest from about 1600 m elevation up to the summit (2560 m) of the mountain.

Draconarius siamensis sp. n.

Figs 15-20

Type locality: THAILAND, Chiang Mai Province, Chomthong District, Doi Inthanon National Park, Doi Inthanon.

Type material: Holotype: ♂, 2300 m, pitfall trap, 14.vii.-20.viii.1987, leg. P. J. Schwendinger (MHNG). Paratypes: 2530 m, 1 ♀, pitfall trap, 16.ii.-18.iv.1987, leg. P. J. Schwendinger (MHNG); 2530 m, 3 ♂, pitfall trap, 11.vi.-14.vii.1987, leg. P. J. Schwendinger (MHNG); 2530 m, 1 ♀, 23.ii.1997, leg. P. J. Schwendinger (MHNG); 2530 m, 2 ♀, pitfall trap, 18.iv.-23.v.1987, leg. P. J. Schwendinger (MHNG); 2530 m, 1 ♀, pitfall trap, 23.x.-17.xii.1986, leg. P. J. Schwendinger (MHNG); 2530 m, 6 ♂, pitfall trap, 14.vii.-20.viii.1987, leg. P. J. Schwendinger (MHNG); 2530 m, 1 ♂, pitfall trap, 23.v.-11.vi.1987, leg. P. J. Schwendinger (PDC AM00120); 2530 m, 4 ♂, pitfall trap, 20.viii.-8.x.1987, leg. P. J. Schwendinger (MHNG); 2530 m, 1 ♀, pitfall trap, 17.xii.1986-16.ii.1987, leg. P. J. Schwendinger (MHNG); 2530 m, 1 ♂, litter sample, 8.vii.2002, leg. P. Dankittipakul (PDC AM0089); 2530 m, 1 ♂, pitfall trap, 24.v.-27.vi.2000, leg. P. Dankittipakul (PDC AM0090); 2530 m, 1 ♂, pitfall trap, 28.viii.-26.ix.1999, leg. P. Dankittipakul (PDC AM0091); 2500 m, 1 ♀, 28.x.2000, leg. P. J. Schwendinger (MHNG TH-00/03); 2500 m, 4 ♀, pitfall trap, 20.viii.-8.x.1987, leg. P. J. Schwendinger (PDC AM00121-00124); 2300 m, 12 ♂, pitfall trap, 14.vii.-20.viii.1987, leg. P. J. Schwendinger; 2300 m, 6 ♂, 3 ♀, pitfall trap, 11.vi.-14.vii.1987, leg. P. J. Schwendinger (CAS); 2300 m, 8 ♂, 1 ♀, pitfall trap, 20.viii.-8.x.1987, leg. P. J. Schwendinger (MHNG); 2300 m, 2 ♀, pitfall trap, 27.xi.1986-14.i.1987, leg. P. J. Schwendinger (CAS); 2100 m, 1 ♂, pitfall trap, 27.vi.-26.vii.2000, leg. P. Dankittipakul (PDC AM0092); Doi Inthanon, 2100 m, 2 ♀, pitfall trap, 27.viii.-26.ix.2000, leg. P. Dankittipakul (PDC AM0093-0094).

Other material examined: Doi Inthanon, Kew Mae Pan, 2100 m, 2 ♂, 28.viii.-26.ix.2000, leg. P. Dankittipakul: Specimens destroyed in preservative diluted by rainfall (only male palps and carapaces remaining).

Etymology: Latin: *siamensis*, adjective of Siam, the former name of Thailand.

Diagnosis: This new species can be easily identified by: patellar apophysis small, retrolateral tibial apophysis short (less than half of tibial length), retrolateral tibial apophysis and retrolateral dorsal tibial apophysis situated close to each other in males; spermathecal bases large, widely separated and the spermathecal stalks short in females.

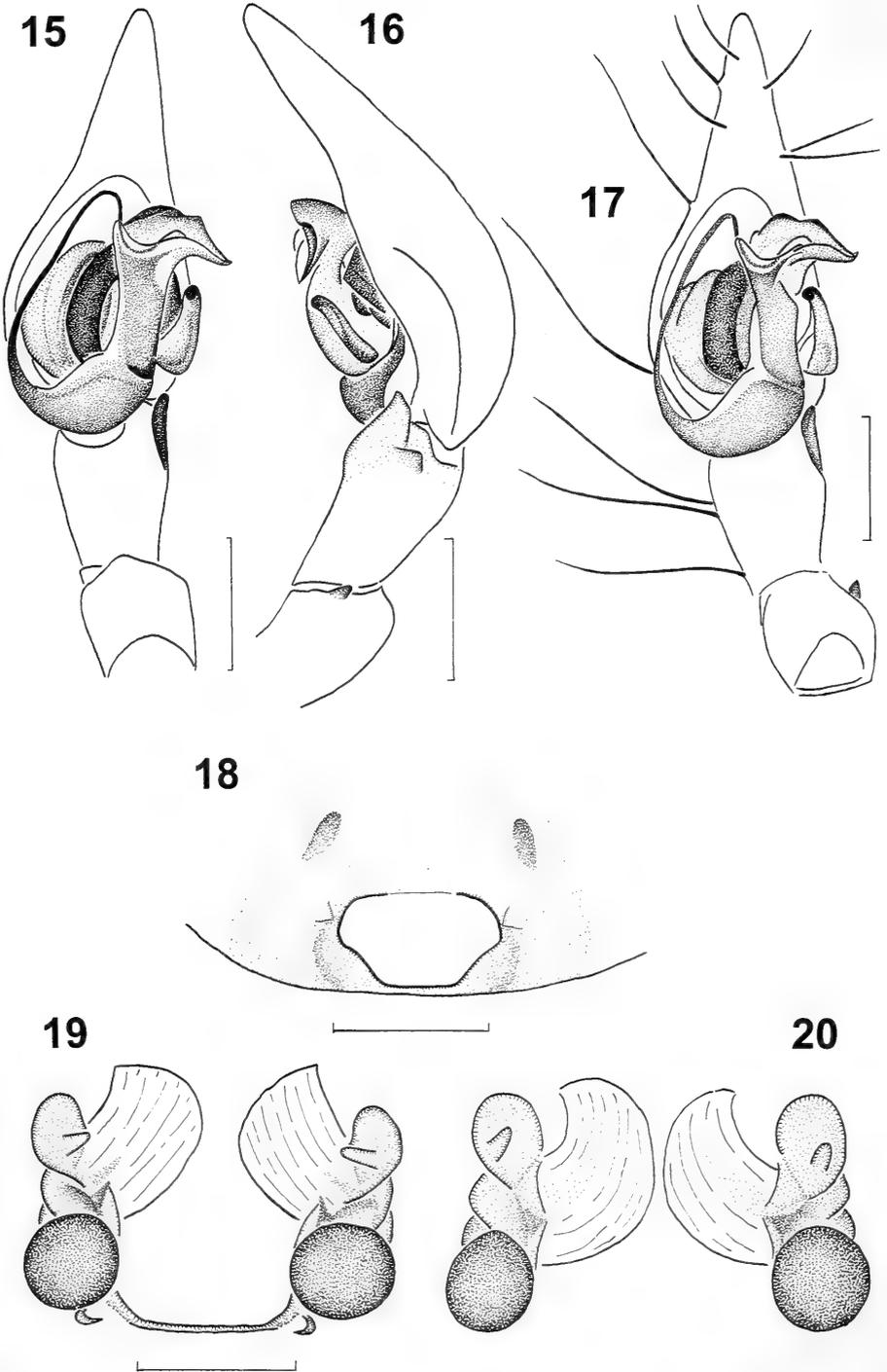
Description: ♂ (holotype). Total length 9.30. Carapace 4.54 long, 3.43 wide. Abdomen 4.44 long. Promargin of chelicerae with 3 teeth (two large and one small), retromargin with 4 small teeth. Labium longer than wide (1.01/0.79).

AME smallest. Eye sizes and interdistances: AME 0.10, ALE 0.19, PME 0.15, PLE 0.20; AME-AME 0.13, AME-ALE 0.10, PME-PME 0.15, PME-PLE 0.24, ALE-PLE 0.10; MOQ 0.51 long, anterior width 0.35, posterior width 0.46. Clypeus height 0.20.

Leg measurements:

	I	II	III	IV
Femur	3.93	3.64	3.23	4.04
Patella + Tibia	5.05	4.14	3.54	4.85
Metatarsus	3.13	3.00	2.83	4.14
Tarsus	2.00	1.82	1.41	1.92
Total	14.11	12.6	11.01	14.95

Palp (Figs 15-17): Patellar apophysis small; retrolateral tibial apophysis short, less than half of tibial length; retrolateral dorsal tibial apophysis small, situated close to retrolateral tibial apophysis; cymbial furrow short; conductor beak-like, short;



conductor lamella medium-sized; dorsal apophysis of conductor large; median apophysis spoon-shaped, elongated; embolus originating prolateral-proximally.

♀ (paratype). Total length 13.43. Carapace 5.45 long, 3.93 wide. Abdomen 7.38 long. Promargin of chelicerae with 3 teeth, retromargin with 5. Labium longer than wide (1.15/0.89).

Eye sizes and interdistances: AME 0.13, ALE 0.20, PME 0.17, PLE 0.17; AME-AME 0.15, AME-ALE 0.15, PME-PME 0.20, PME-PLE 0.33, ALE-PLE 0.10; MOQ 0.54 long, anterior width 0.41, posterior width 0.56. Clypeus height 0.33. Leg formula: 4-1-2-3.

Leg measurements:

	I	II	III	IV
Femur	3.74	3.23	3.13	3.94
Patella + Tibia	5.05	4.04	3.53	4.65
Metatarsus	3.33	2.83	2.73	4.10
Tarsus	1.92	1.72	1.41	1.82
Total	14.04	11.82	10.8	14.51

Epigynum and vulva (Figs 18-20): Epigynal teeth short, situated lateral to atrium; atrium situated posteriorly, close to epigastric furrow; copulatory ducts situated mesal to spermathecae, anteriorly expanded; spermathecal heads situated anteriorly; spermathecal bases rounded, widely separated; spermathecal stalks short, widely separated.

Distribution and habitat: Known only from the type locality. The spiders inhabit moist evergreen hill forests above 2000 m elevation.

***Draconarius subulatus* sp. n.**

Figs 21-23

Type locality: THAILAND, Chiang Mai Province, Chomthong District, Doi Inthanon National Park, Doi Inthanon.

Type material: Holotype: ♂, 2510 m, pitfall trap, 25.v.-27.vi.2000, leg. P. Dankittipakul & S. Sonthichai (MHNG).

Etymology: The specific name refers to the pointed patellar apophysis of the male.

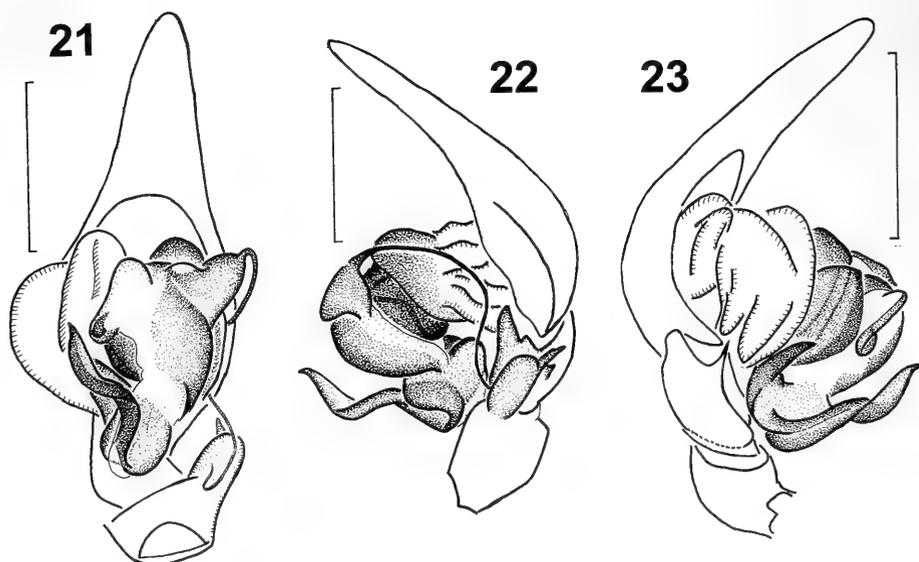
Diagnosis: This new species can be easily recognized by the finger-like, pointed patellar apophysis and the long, spiral, posteriad-directed conductor in the male.

Description: ♂ (holotype). Total length 10.51. Carapace 5.44 long, 3.88 wide. Abdomen 5.11 long. Promargin and retromargin of chelicerae each with 3 teeth. Labium almost as long as wide (0.82/0.76).

Eye sizes and interdistances: AME 0.17, ALE 0.23, PME 0.20, PLE 0.23; AME-AME 0.16, AME-ALE 0.17, PME-PME 0.10, PME-PLE 0.23, ALE-PLE 0.10; MOQ 0.63 long, anterior width 0.51, posterior width 0.56. Clypeus height 0.23. Leg formula: 4-1-2-3.

FIGS 15-20

Draconarius siamensis sp. n., ♂ holotype (15, 16), ♂, paratype (17), ♀ paratypes (18-20). Left palp, ventral (15, 17) and retrolateral (16) view. Epigynum, ventral view (18). Vulva, dorsal view (19, 20). Scale lines 0.5 mm.



Figs 21-23

Draconarius subulatus sp. n., ♂ holotype. Left palp, ventral (21), retrolateral (22) and prolateral (23) view. Scale lines 1.0 mm.

Leg measurements:

	I	II	III	IV
Femur	5.36	4.94	4.57	5.78
Patella + Tibia	6.84	5.78	5.10	6.05
Metatarsus	5.63	5.00	4.78	6.31
Tarsus	3.15	2.89	2.36	2.89
Total	20.98	18.61	16.81	21.03

Palp (Figs 21-23; expanded): Patellar apophysis large, finger-like, with sharp, pointed apex; RTA as long as tibia; retrolateral dorsal tibial apophysis small; cymbial furrow short; conductor long and spiral, proximad-directed; dorsal apophysis of conductor large; median apophysis spoon-shaped; embolus slender, originating proximally.

♀. Unknown.

Distribution and habitat: Known only from the type locality. The type specimen was collected from moist evergreen hill forest near the summit of Doi Inthanon, where also *D. inthanonensis* sp. n. and *D. siamensis* sp. n. occur.

Coelotes Blackwall, 1841

Diagnosis: Males of *Coelotes* resemble those of *Eurocoelotes* Wang, 2002 in possessing a dorsal apophysis on the conductor and a rounded median apophysis, but can be distinguished by the presence of a broad patellar apophysis. Females of this

genus also resemble *Eurocoelotes*, but differ in having laterally situated epigynal teeth, a reduced genital atrium and shorter copulatory ducts.

Coelotes hui nom. n.

Remark: *Coelotes hui* nom. n. is a replacement name for *C. wangi* Hu, 2001: 133, figs 44.1-3 (♀ holotype and 2 ♀ paratypes from Linzhi, Tibet, China, deposited in Shandong University, Jilian, China, not examined), which is a junior homonym of *C. wangi* Chen & Zhao, 1997.

Coelotes thailandensis sp. n.

Figs 24-25

Type locality: THAILAND, Chiang Rai Province, Wiang Papao District, Khun Jae National Park, Doi Lanka, Mae Toh waterfall, 1200 m.

Type material: Holotype: ♂, 15.x.2002, leg. P. Dankittipakul & S. Sonthichai (MHNG).

Etymology: The specific name refers to the type locality.

Diagnosis: This new species is similar to *C. pseudoterrestris* Schenkel, 1963 but can be distinguished by the short conductor and the reduced retrolateral dorsal tibial apophysis of the male.

Description: ♂ (holotype). Total length 11.67. Carapace 6.22 long, 4.33 wide. Abdomen 5.56 long. Promargin of chelicerae with 2 teeth, retromargin with 4. Labium slightly longer than wide (0.79/0.71).

Eye sizes and interdistances: AME 0.15, ALE 0.23, PME 0.17, PLE 0.20; AME-AME 0.12, AME-ALE 0.12, PME-PME 0.14, PME-PLE 0.25, ALE-PLE 0.05; MOQ 0.56 long, anterior width 0.46, posterior width 0.48. Clypeus height 0.25. Leg formula: 4-1-2-3.

Leg measurements:

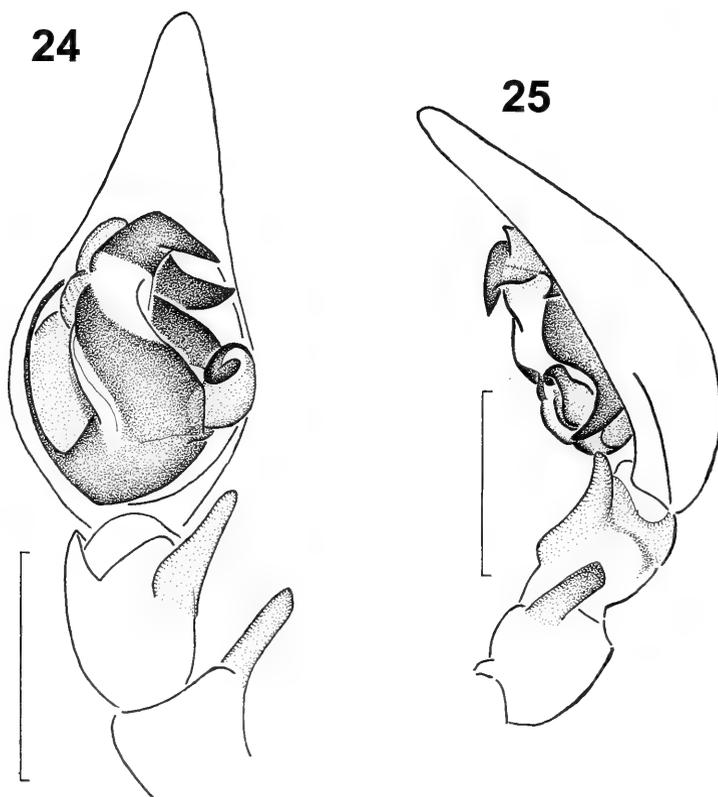
	I	II	III	IV
Femur	5.89	5.26	5.00	6.31
Patella + Tibia	7.36	6.15	5.68	7.47
Metatarsus	6.10	5.26	5.26	7.10
Tarsus	3.42	2.89	2.47	3.15
Total	22.77	19.56	18.41	24.03

Palp (Figs 24-25): Patellar apophysis large; retrolateral tibial apophysis relatively long, with strong distal end; retrolateral dorsal tibial apophysis absent; cymbial furrow short; conductor short; dorsal apophysis of conductor larger than conductor; median apophysis short, rounded; embolus slender, originating prolateral-proximally.

Distribution and habitat: Known only from the type locality. The specimen was collected from a rotten log in an evergreen hill forest.

ZOOGEOGRAPHY

Although various authors have brought together considerable information on the spider fauna of Thailand, the occurrence of the family Amaurobiidae there has never been mentioned before. This is the first record of amaurobiid spiders from that country.



FIGS 24-25

Coelotes thailandensis sp. n., ♂ holotype. Left palp, ventral (24) and retrolateral view (25). Scale lines 1.0 mm.

Draconarius has previously been recorded from Central and East Asia (Ovtchinnikov, 1999; Wang, 2002). The present study expands the known distribution of *Draconarius* towards the southeast and provides a better understanding of the actual geographical range of this genus.

The genus *Coelotes* is widely distributed in the temperate zone of Europe, Central and East Asia. The new species described from Thailand is possibly restricted to high altitudes of mountainous areas. Distribution of this genus in Thailand is not clear since only a single species is reported here in this study. Additional observations are required.

The syntopic occurrence of three congeneric species (*Draconarius inthanonensis* sp. n., *D. siamensis* sp. n. and *D. subulatus* sp. n.) near the summit of Doi Inthanon is remarkable and underlines the high biodiversity of this mountain, where tropical and subtropical/temperate faunal and floral elements meet.

ACKNOWLEDGEMENTS

We are grateful to Dr Peter J. Schwendinger for providing material from his personal collection and for the loan of specimens from the MHNG. We thank Dr Charles Griswold (CAS) for allowing the depository of some types in the collection of the Department of Entomology at the California Academy of Sciences. The Thailand Research Fund TRF/BIOTEC Special Program for Biodiversity Research and Training Grant (project number BRT_T 542094) supported the first author at the beginning of this project. The Royal Forest Department gave permission to collect spiders in protected areas.

Work on this paper was carried out while the first author was based at Chiang Mai University (CMU). He is grateful to people who provided assistance, in particular to Prof. Saowapa Sonthichai (CMU), Dr Wipada Vungsilabutr (Department of Entomology and Zoology, Ministry of Agriculture) and Dr Angoon Lewvanich (Institute of Science, The Royal Academy of Thailand).

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Four new species of pseudoscorpions (Arachnida, Pseudoscorpiones: Neobisiidae, Chernetidae) from caves in Yunnan Province, China

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Four new species of pseudoscorpions (Arachnida, Pseudoscorpiones: Neobisiidae, Chernetidae) from caves in Yunnan Province, China. - The new species *Parobisium martii* sp. n., *Parobisium scaurum* sp. n., *Parobisium titanium* sp. n., and *Nudochernes lipsae* sp. n. are described from caves near the city of Zhen Xiong (Yunnan), and their taxonomic positions are discussed. *Parobisium titanium* sp. n., with a body length of about 4.5 mm, is the pseudoscorpion species with by far the largest known pedipalpal length of about 17 mm.

Key-words: China - Yunnan - biospeleology - Pseudoscorpiones - new species.

INTRODUCTION

The state of knowledge of the pseudoscorpion fauna of China has been reviewed by Schawaller (1995b) who cited 47 species, but this number certainly presents only a fraction of the diversity which might be expected in this country. Three species are recorded from Chinese caves: *Stenohya chinacavernicola* Schawaller, 1995 (Neobisiidae) (Sichuan Prov., two caves); *Megachernes* cf. *himalayensis* (Ellingsen, 1914) (Chernetidae) (Guangxi Prov., one cave) and *Megachernes* cf. *vietnamensis* Beier, 1967 (Hubei and Sichuan Prov., 3 caves). Harvey (1999) redescribed the type specimens of *Microcreagris lampra* Chamberlin, 1930, *M. orientalis* Chamberlin, 1930, and *M. silvestrii* Chamberlin, 1930 and transferred them to the genus *Biseto-creagris*. He emended the type locality of *B. orientalis* to Vietnam, and synonymized *Microcreagris chinensis* Beier, 1943 (= *Chinacreagris chinensis*) with *B. silvestrii*. Five speleological surveys of China have been carried out since 1992 by the French Federation of Speleology (Aventures Karstiques Lointaines), and the pseudoscorpions collected were sent to me by Mrs Josiane Lips (Lyon) (collections of 1992-1999) and Dr Philippe Marti (Geneva) (collection of 2001). The descriptions of the caves have been published by Degouve *et al.* (1999) who indicate also the French names and the GPS data.

The results of the first survey (1992) were published by Schawaller (1995b). Due to the fragmentary knowledge of the cave fauna of China it is not surprising that

the four specimens collected represent four new species. At least two of them are highly specialized troglobionts and one of them is the pseudoscorpion species with by far the largest recorded pedipalpal length of about 17 mm. Types of the new species are deposited in the Muséum d'histoire naturelle, Geneva.

DESCRIPTIONS

Parobisium martii sp. n.

Figs 1-4

Material: Holotype ♀, China, Yunnan Province, Zhen Xiong, Guo Quan Dong cave (Grotte du Cirque) (N 104°44,678 / E 27°29,712 GPS), leg. Ph. Marti, 30.III.2001 (no. 20) (collected near the end of the first hall, around a huge block near the separation of the two galleries).

Diagnosis: The new species is characterized by the morphometry and length of palpal segments (e.g. femur 4.25 x longer than broad, length 1.58 mm), by the presence of 6 setae on posterior border of the carapace, by the number of setae on cheliceral hand (6) and of sternal setae (14-16).

Etymology: Named in honour of the collector Dr Philippe Marti.

Description: Pedipalps and carapace reddish brown, tergites and sternites yellowish. Carapace slightly longer than broad, smooth, with a very weak sub-basal transverse impression, four small distinct eyes; 24 setae in total, of which 4 are at anterior and 6 at posterior margin, 2 ocular microsetae on each side; tergites undivided, chaetotaxy: I-IX mostly with 11 marginal setae, X 9 (2 tactile setae), XI 9 (2 tactile setae). Manducatory process with 4/5 bristles; coxae of pedipalps smooth, with 9 bristles (including one tactile seta), coxae I 8, II 6, III 4/5, IV 10 bristles; genital operculum with 13 setae (Fig. 4); sternites undivided, chaetotaxy: 14 + 5 microsetae on each stigma (the three central marginal setae shorter)/10+5/14/15/16/14/15/11 (2 tactile setae)/6 (2 tactile setae). Pleural membrane granulate. Chelicera: 6 setae on hand, fixed finger with 21, movable finger with 13 small pointed and partly rounded teeth, flattened and broad transparent spinneret present, serrula exterior with approximately 42 lamellae, serrula interior with approx. 31 lamellae, flagellum composed of 8 anteriorly-dentate blades, the first one with slightly enlarged base, the two proximal ones shorter.

Pedipalp (Figs 1-3): Trochanter with small dorsal hump, femur indistinctly granulate medially, 4.25 times longer than broad, patella smooth, 2.7 times, club 1.7 times longer than broad, hand finely granulate mediodistally, with pedicel 1.9 times longer than broad and 1.1 times longer than finger, chela with pedicel 3.45 times longer than broad; fixed finger with 83, movable finger with 81 small, pointed teeth; fixed finger with a short venom duct, nodus ramosus at base of claw. Trichobothrial pattern see Fig. 3; *est* in distal half, closer to *et* than to *ist*, five trichobothria grouped at base of finger.

Leg I: Femur 3.6 times longer than deep and 1.5 times longer than patella, patella 2.8 times longer than deep, tibia 5.9 times, basitarsus 3.3 times, telotarsus 5.1 times longer than deep and 1.5 times longer than basitarsus. Leg IV: femur+patella 3.8 times longer than deep, suture between them vertical, tibia 6.7 times longer than deep, tactile seta near middle (TS=0.46), basitarsus 2.9 times longer than deep, with one basal tactile seta (TS=0.17), telotarsus 5.1 times longer than deep and 1.5 times longer

than basitarsus, tactile seta at middle (TS=0.50); arolia undivided, clearly shorter than the smooth and slender claws, subterminal seta forked and dentate.

Measurements (length/width in mm): Carapace 1.23/1.18. Pedipalp: Femur 1.58/0.37, patella 1.35/0.50, hand with pedicel 1.44/0.77, length of finger 1.34, length of chela with pedicel 2.64. Leg I: Femur 0.84/0.23, patella 0.58/0.20, tibia 0.81/0.14, basitarsus 0.38/0.12, telotarsus 0.56/0.11; leg IV: Femur+patella 1.50/0.40, tibia 1.38/0.21, basitarsus 0.49/0.17, telotarsus 0.73/0.14.

Discussion: *Parobisium martii* sp. n. shows affinities with *Parobisium magnum chejuense* Morikawa, 1970 (from Seong-gul Cave, South Korea) and *Parobisium longipalpus* Hong, 1996 (Mt Chiri, South Korea). It shares with these species the chaetotaxy of carapace (6 setae on posterior border) and tergites (10-12 setae) and the number of teeth of chelal fingers. It differs from the female of *P. m. chejuense* by the smaller size (palpal femur 1.58 mm vs 1.82 mm), by a slightly more slender palpal femur (4.25 times vs 3.9 times) and chela (3.4 times vs 2.9 times), less numerous sternal setae (14-16 vs. 20-22) and the smaller number of setae on the cheliceral hand (6 vs 7). *Parobisium longipalpus* is clearly smaller (palpal femur length 1.05-1.16 mm vs 1.58 mm) and has 7 setae on the cheliceral hand; the trichobthrium *st* on movable finger is placed clearly distally compared to *est*, whereas in *martii* sp.n. *st* is level with *est*.

Parobisium titanium sp. n.

Figs 5-9

Material: Holotype ♂, China, Yunnan Province, Zhen Xiong, Guo Quan Dong cave (Grotte du Cirque) (N104°44,678/ E 27°29,712 GPS), leg. Ph. Marti, 8.IV.2001 (no. 94) (collected at the bottom of the cave, on sand-bank near the terminal siphon).

Diagnosis: The species is characterized by its pedipalpal morphology and size, chaetotaxy of tergites (mostly 6 setae), by the presence of 5 setae on cheliceral hand and by the high number (13) of flagellum setae.

Etymology: From the latin adjectif *titanius* = titanic, gigantic.

Description: Pedipalps and carapace dark reddish-brown, tergites and sternites yellowish. Carapace 1.1 times longer than broad, smooth, with a very weak subbasal transverse impression, eyes or eyespots absent; with 20 setae in total, 6 of which are at anterior and 6 at posterior margin; tergites undivided, chaetotaxy: I 8, II-X 6, XI 8 (2 tactile setae). Manducatory process with 5 bristles; coxae of pedipalps smooth, with numerous setae, coxae I 6, II 6, III 5, IV 10 bristles; anterior genital operculum with about 55 central setae, posterior genital operculum (sternit III) with a small median groove and tiny lateral rod-like sclerotizations (Fig. 9); sternites with uniseriate chaetotaxy: approx. 26 marginal setae + 12 central discal setae + 2 suprastigmatal microsetae/16 + 5/20/18/16/14/12/ 8(?). Pleural membrane granulate. Chelicera (Fig. 5): 5 setae on hand, fixed finger with 11, movable finger with 10 pointed teeth, a small flattened transparent spinneret present, serrula exterior with about 44 lamellae, flagellum composed of 13 anteriorly-dentate blades, the anterior one with slightly enlarged base, the five proximal ones shorter.

Pedipalp (Figs 6-8): Trochanter without hump, femur smooth, 8.9 times longer than broad, patella 8.0 times, hand with pedicel 4.6 times longer than broad and 1.3 times longer than finger, chela with pedicel 7.8 times longer than broad; fixed finger with 103 small pointed teeth, movable finger with 110 pointed teeth (flattened in basal

half). Trichobothrial pattern see Fig. 8: five basal trichobothria, *est* in middle of finger, halfway between *ist* and *et*; *st* halfway between *sb* and *t*.

Leg I: Femur 7.3 times longer than deep and 1.5 times longer than patella, patella 5.5 times longer than deep, tibia 10.7 times, basitarsus 6.6 times, telotarsus 7.1 times longer than deep and 1.1 longer than basitarsus. Leg IV: Femur+patella 11.7 times longer than deep, suture vertical, tibia 15.6 times longer than deep, with a longer seta proximal of middle, basitarsus 6.8 times longer than deep, with a basal tactile seta, telotarsus 7.3 times longer than deep and 1.1 longer than basitarsus, a tactile seta distal of the middle; arolia undivided, clearly shorter than the smooth and slender claws; subterminal seta forked and dentate.

Measurements (in mm): Carapace 1.62/1.52. Pedipalps: Femur 4.43/0.50, patella 4.58/0.57, hand with pedicel 3.60/0.78, length of finger 2.80, length of chela with pedicel 6.08. Leg I: Femur 2.32/0.32, patella 1.55/0.28, tibia 2.25/0.21, basitarsus 1.12/0.17, telotarsus 1.20/0.17; leg IV: Femur+patella 4.08/0.35, tibia 3.90/0.25, basitarsus 1.30/0.19, telotarsus 1.38/0.19.

Discussion: The relationships of this new species are uncertain: no other *Parobisium* species shows a similar pedipalpal morphology. The flagellum has a morphology comparable to that of other species of this genus, but its number is much higher and perhaps size-dependent (13 serrate setae; versus 9 in *scaurum* sp. n., 8 in *martii* sp. n and *longipalpus* Hong). The extreme adaptation of the species to the hypogean environment and, mainly, the meagre knowledge of the cave fauna of this region makes it impossible to determine its relationships. Affinities might exist with *Parobisium scaurum* sp. n., but both species are insufficiently known. *Parobisium titanium* sp. n. stands out from all described pseudoscorpion species by possessing by far the longest pedipalps: 17 mm in length, with a body length of about 4.5 mm.

From the "Grotte du Cirque Guo Quan Dong" two new species of *Parobisium* are described. Whilst *P. martii* sp. n. is probably an epigeal troglophilous species without evident morphological adaptations to the subterranean habitat, *P. titanium* sp. n. is a highly adapted troglobiont without any apparent affinities to *P. martii*.

Parobisium scaurum sp. n.

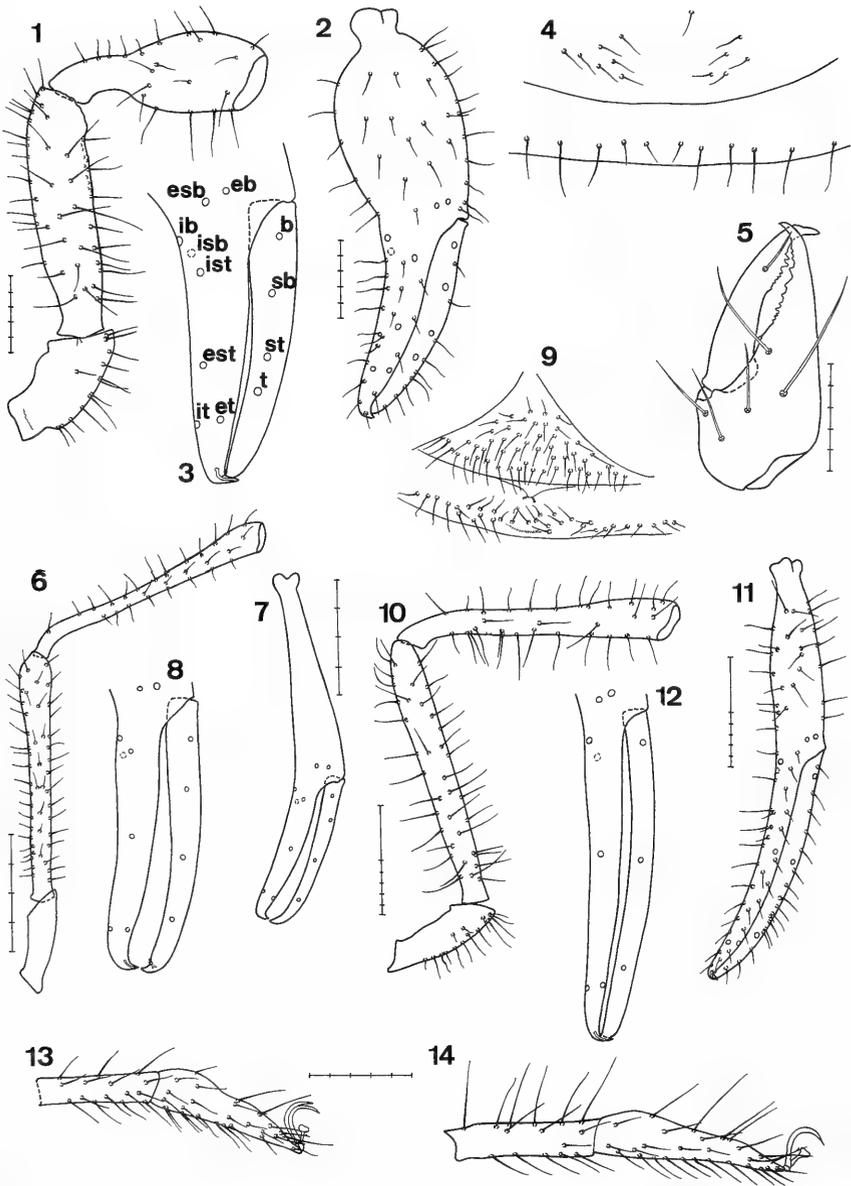
Figs 10-14

Material: Holotype tritonymph, China, Yunnan Province, Zhen Xiong, Da Hei Dhong cave (Grande Grotte Noire) (N 104°48,702/ E 27°22,804 GPS), leg. Josiane Lips, 20.VIII.1999 (no. 547).

Diagnosis: The morphometric data and the shape of its pedipalps are characterizing this species (e.g. femur 7.5 times longer than broad, length 2.48 mm); adults are unknown.

Etymology: The specific name refers to the inflated telotarsi of the walking legs (lat. *scaurus* = club-footed).

Description: Pedipalps brown, carapace, tergites and sternites yellowish. Carapace 1.1 times longer than broad, smooth, eyes or eye-spots absent; 20 setae in total, 4 of them are at anterior and 6 at posterior margin, one ocular microseta on each side present; tergites undivided, all with 6 setae, XI 6 (2 tactile setae). Manducatory process with 4 marginal bristles; coxae of pedipalps smooth, with 6/7 bristles, coxae I 8-9, II 7, III 4, IV 8 bristles; sternites undivided, chaetotaxy: 12 + 5 microchaetae on each



FIGS 1-14

1-4: *Parobisium martii* sp. n.; 1-2, pedipalp; 3, trichobothrial pattern on chelal fingers; 4, chaetotaxy of genital operculum and sternite III; scale units 0.1 mm. 5-9: *Parobisium titanium* sp. n.; 5, chelicera; 6-7, pedipalp; 8, trichobothrial pattern on chelal fingers; 9, chaetotaxy of genital operculum and sternite III; scale units 0.1 mm (Fig. 5), 0.5 mm (Figs 6, 7). 10-14: *Parobisium scaurum* sp. n.; 10-11, pedipalp; 12, trichobothrial pattern on chelal fingers; 13, basi- and telotarsus of leg I; 14, basi- and telotarsus of leg IV; scale units 0.1 mm.

stigma/12 + 6/21/18/17/15/12/10/4 (2 tactile setae). Pleural membrane granulate. Chelicera: 6 setae on palm, fixed finger with 15, movable finger with 13 small, pointed teeth, a small rounded transparent spinneret present, serrula exterior with 40 lamellae, flagellum composed of 9 serrate blades, first one slightly dilated at base, two posterior ones distinctly shorter.

Pedipalp (Figs 10-12): Trochanter without hump, femur smooth, 7.5 longer than broad, patella 7.0 times, club 4.7 times, hand with pedicel 3.8 times longer than broad, chela with pedicel 8.6 times longer than broad, finger 1.3 times longer than hand; fixed finger with 105 small pointed teeth, movable finger with 105 pointed teeth (flattened in basal half). Trichobothrial pattern see Fig. 12: apparently comparable to that of *P. titanium* sp. n.

Leg I: Femur 5.4 times longer than deep and 1.4 times longer than patella, patella 4.7 times longer than deep, tibia 8.1 times, basitarsus 4.1 times longer than deep, telotarsus distinctly inflated at base, 3.8 times longer than deep and 1.3 times longer than basitarsus (Fig. 13). Leg IV: Femur+patella 8.5 times longer than deep, suture vertical, tibia 11.1 times longer than deep, with two longer setae near middle and near distal end, basitarsus 4.6 times longer than deep, with a basal tactile seta, telotarsus 4.3 times longer than deep and 1.2 times longer than basitarsus, distinctly inflated at base, tactile seta absent, with a slightly longer seta near middle (Fig. 14); arolia undivided, clearly shorter than the smooth and slender claws, subterminal seta forked and dentate.

Measurements (length/width in mm): Carapace 1.21/1.11. Pedipalp: Femur 2.48/0.33, patella 2.50/0.36, hand with pedicel 1.77/0.46, length of finger 2.26, length of chela with pedicel 3.98. Leg I: Femur 1.26/0.22, patella 0.87/0.19, tibia 1.14/0.14, basitarsus 0.58/0.14, telotarsus 0.77/0.20; leg IV: Femur+patella 2.29/0.27, tibia 2.02/0.18, basitarsus 0.77/0.17, telotarsus 0.93/0.22.

Discussion: This species is unfortunately known only from a tritonymph, but there is no doubt that it represents a new species, being characterized by its morphometric data and the shape of pedipalps. Affinities might exist with *P. titanium* sp. n., but from this species *scaurum* sp.n. differs clearly by the shape of chelal hand and the length of chelal finger which is 1.3 times longer than hand in *scaurum*, but 1.3 shorter than hand in *titanium*. The unusual morphology of its telotarsi, with an enlarged base, might represent a diagnostic character of this species, but it also might be a nymphal character (?). Such inflated tarsi have been recorded from tritonymphs of syarinid species (e.g., *Pseudoblothrus strinatii* Vachon, *Hadoblothrus gigas* di Caporiacco) (Vachon, 1954; Mahnert, 1980).

DISCUSSION OF THE GENUS *PAROBISIUM*

First described as subgenus of *Neobisium* Chamberlin, the genus *Parobisium* is characterized within the family Neobisiidae by the absence of a galea on the movable cheliceral finger and by its trichobothrial pattern with a basal/subbasal cluster of five trichobothria and only three trichobothria in the distal half of fixed chelal finger (*est – et – it*) (Chamberlin, 1962). Only 16 species and subspecies are currently recognized in this genus which is known from North America (six taxa), Japan (seven taxa) and Korea (four taxa) (Harvey, 1991; Hong, 1996). Cave dwelling species or subspecies are recorded from Japan, South Korea and the USA (Harvey, 1991). Beier's (1937) sug-

gestion that *Neobisium rathkii* sensu Menge might belong to *Parobisium* is not corroborated by Judson (2003). The Asian species seem to differ from the North American ones in the position of trichobothrium *est*, which is placed near *et/it* forming a dense cluster of three trichobothria in American species, but is clearly separated from the distal pair *et/it* and situated near the finger middle in Asian species.

The systematic situation of neobisiid genera needs clarification, particularly in this Asian region, a first attempt was published by Curcic (1983). The trichobothrial pattern typical for *Parobisium* is also present in the genus *Bisetocreagris* Curcic, which possesses an identical flagellar morphology (all setae serrate) as well. However, the latter genus is characterized by the presence of tactile setae on tarsi of at least leg IV (lacking in at least some species of *Parobisium*?), by the presence of a bisetous median groove on sternite III of the male and of a galea, although the latter character seems to be of limited value at the generic level (Judson, 1992).

Nudochernes lipsae sp. n.

Figs 15-21

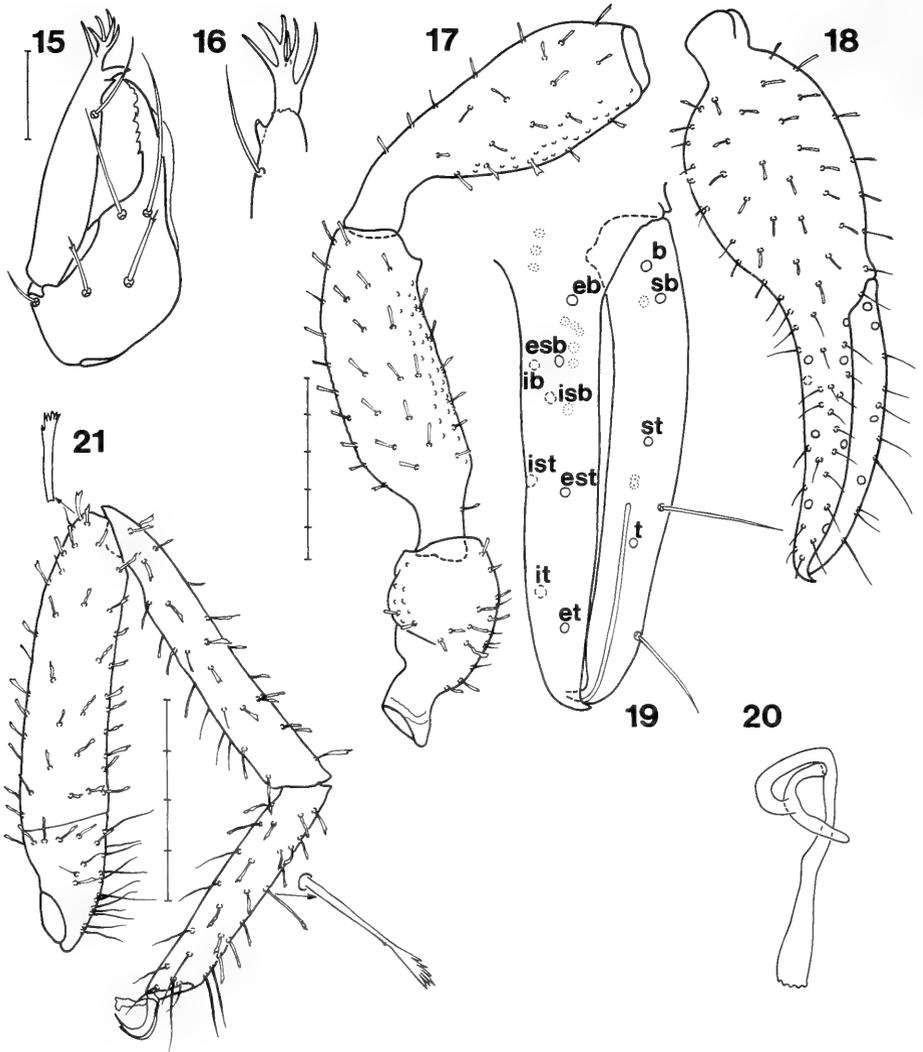
Material: Holotype ♀, China, Yunnan Province, Zhen Xiong, Da Hei Dong cave (Grande Grotte Noire) (N 104°48,702/ E 27°22,804 GPS), leg. Josiane Lips, 20.VIII.1999 (no. 547).

Diagnosis: The stout pedipalps and their length characterize the new species (pedipalpal femur 3.2 times longer than broad, length 0.91 mm); femur pedicillate, not broadened at its base.

Etymology: Named in honour of Mrs Josiane Lips (Lyon) for her sustained interest in pseudoscorpions.

Description: Pedipalps and carapace reddish brown, tergites and sternites yellowish. Carapace as long as broad, densely granulate, with two granulate transverse furrows, eyes or eyespots absent; 8 setae at anterior and 12 (+ 4 submarginal ones) at posterior margin; setae of carapace and tergites indistinctly clavate and apically dentate; tergites divided, chaetotaxy of half-tergites: 9 - 9 - 9+ 1 lateral seta - 10+ 1 lateral + 1 medial seta - 9/1/1 - 8/1/1 - 8/1/1 - 6/1/1 - 5/1/1 - 6/0/1, XI totally 12 (4 longer setae), lateral, submedial and medial setae longer on hind tergites. Manducatory process with 3 marginal and 1 discal setae; coxae of pedipalps granulate, with 35 setae (1 tactile seta, distal ones slightly clavate), coxae I 23, II 27, III approx. 36 setae; IV numerous setae; genital operculum with 28 setae (in semi-circular arrangement), spermatheca (Fig. 20) with a long unpaired stem and two short apical tubules; sternites divided, setae finely dentate and long, chaetotaxy: 4+4 suprastigmal microchaetae - 4+4 - 10 - 8/1 med. seta/1 lat. seta - 7/1/1 - 8/1/1 - 5/1/1 - 4/1/1 - 5/0/1, XI totally 9 (4 setae longer). Chelicera (Fig. 15): 5 setae on palm, *db* and *ib* dentate, fixed finger with 5 proximad-directed teeth, movable finger with broad tooth-like subapical lobe, galea (Fig. 16) with 6 long branchlets in distal part, serrula exterior with 20 lamellae, flagellum with three apically dentate blades.

Pedipalp (Figs 17-19): Trochanter with distinct rounded dorsal hump, femur finely granulate, 3.2 longer than broad, patella finely granulate medio-distally, 3.0 times, club 2.1 times longer than broad, hand indistinctly granulate medio-distally, with pedicel 2.0 times longer than broad and 1.05 times longer than finger, chela with pedicel 3.7 times longer than broad; fixed finger granulate in basal half, with 47 pointed



FIGS 15-21

Nudochernes lipsae sp. n.; 15, chelicera; 16, galea, in detail; 17-18, pedipalp; 19, trichobothrial pattern on chelal fingers; 20, spermatheca; 21, leg IV; scale units 0.1 mm.

teeth, 6 external and 2 internal accessory teeth, movable finger with 54 pointed teeth, 5 external and 2 internal accessory teeth; nodus ramosus closer to *t* than to *st*. Trichobothrial pattern see Fig. 19: *est* halfway between *et* and *esb*, *ist* nearly at same level.

Leg I: Femur 1.7 times longer than deep, patella 3.5 times longer than deep and 1.6 times longer than femur, tibia 5.0 times, tarsus 5.7 times longer than deep. Leg IV (Fig. 21): Femur+patella 5.3 times, tibia 6.4 times, tarsus 5.8 times longer than deep,

with a slightly longer and dentate seta in the middle; arolia undivided, slightly shorter than the smooth and large claws, subterminal seta smooth and curved.

Measurements (in mm): Carapace 0.92/0.95. Pedipalp: Femur 0.91/0.28, patella 0.93/0.31, hand with pedicel 0.82/0.41, length of finger 0.78, length of chela with pedicel 1.53. Leg I: Femur 0.29/0.18, patella 0.47/0.13, tibia 0.48/0.10, tarsus 0.45/0.08; leg IV: Femur+patella 0.88/0.17, tibia 0.71/0.11, tarsus 0.55/0.09.

Discussion: The new species is placed in the genus *Nudochernes* Beier, known from the Afrotropical region (East and Central Africa), and with one species recorded from Israel, because of the following combination of characters: T-shaped spermatheca with short lateral arms; vestitural setae dentate (indistinctly clavate); presence of an elongate dentate seta on tergite XI; presence of an elongate dentate seta on tarsus IV.

Several species currently placed in *Allochernes* may also belong to *Nudochernes*, e.g. *Allochernes tropicus* (Beier) from Thailand (Beier, 1967) and China, Sichuan Province (Schawaller, 1995b) and *Allochernes liwa* Harvey, 1988 from Sumatra. Both have (pseudo-)tactile tarsal setae. *Nudochernes lipsae* sp. n. differs from *A. tropicus* in having stouter pedipalps (e.g., palpal femur 3.2 times vs 4.2 times) and much smaller size (e.g., length of palpal femur 0.91 mm vs 1.45 mm). *Allochernes himalayensis* Beier, 1974 from Nepal has a more slender palpal femur and chela, and is smaller than *lipsae* sp. n. (femur length 0.75 mm vs. 0.91 mm). The new species differs from species of this genus from Japan or Mongolia by the shape of palpal femur and by morphometric data. The wide-spread species *Allochernes asiaticus* (Redikorzev) (Schawaller, 1995a) has been transferred to *Wyochernes* Hoff which is characterized by the quite different shape of spermatheca and a different trichobothrial pattern. Affinities of *Allochernes asiaticus nepalensis* Morikawa, 1968 are doubtful, but it possesses a trichobothrial pattern similar to that of *Wyochernes* (Muchmore, 1996).

ACKNOWLEDGEMENTS

I express my sincere thanks to Mrs Josiane Lips (Lyon) for her sustained interest in pseudoscorpions and for her patience. I also thank Dr Philip Marti (Geneva) who entrusted me with interesting specimens for study and who provided me with literature on some expeditions. My cordial thanks to Dr Mark Judson (Paris) for his comments and the permanent exchange of ideas.

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Spiders of the genus *Plexippus* from China (Araneae: Salticidae)

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Spiders of the genus *Plexippus* from China (Araneae: Salticidae). - Five *Plexippus* species, including one new species, *Plexippus yinae* Peng & Li, are reported from China. A description of the new species and diagnoses of the known species are given. Distributional data, a key to these species, and illustrations of body and genital organs are provided.

Key-words: Araneae - Salticidae - *Plexippus* - review - China.

INTRODUCTION

The spider genus *Plexippus* was established by C. L. Koch (1846) to accommodate *Plexippus ligo* C. L. Koch, now in synonymy with *Plexippus paykulli* (Audouin, 1826). According to the catalogue of Prószyński (2002), this salticid genus is now represented by 53 species worldwide, including 4 known species occurring in China. During our study of *Plexippus* material from China, one new species has been identified. A description of this new species and diagnoses of the other species known from China are given in the present paper.

MATERIAL AND METHODS

Specimens, preserved in 80% ethanol, were examined under SZ40-Olympus stereomicroscope and illustrated. The epigyna were drawn before they were dissected from the spider abdomina, while the vulvae were drawn after they were macerated in lactic acid. The leg measurements are given in the following sequence: Total (femur, patella + tibia, metatarsus, tarsus). All measurements are given in millimeters.

The material examined is deposited in the Institute of Zoology, Chinese Academy of Sciences in Beijing (IZCAS), in the Hunan Normal University in Changsha, China (HNU), and in the Muséum d'histoire naturelle in Genève, Switzerland (MHNG).

For each species only the following synonyms and references are given in the text: References to relevant papers by Chinese colleagues, and synonyms not listed in Platnick's spider catalogue (Platnick, 2003) or in Prószyński's Salticidae catalogue (Prószyński, 2002).

Abbreviations used: AER-anterior eye row, AL-abdomen length, ALE-anterior lateral eye, AME-anterior median eye, AW-abdomen width, CL-carapace length, CLYH-clypeus height, CW-carapace width, EFL-eye field length, PER-posterior eye row, PLE-posterior lateral eye, TL-total length.

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TAXONOMY

***Plexippus* C. L. Koch, 1846**

Plexippus C. L. Koch, 1846, Die Arachniden 13:107.

Type species: Plexippus paykulli (Audouin, 1826)

The genus *Plexippus* was used in the 19th century to accommodate a variety of non-related species. Many of them are not related to the type species of the genus (Bohdanowicz & Prószyński, 1987). The known species of the genus are distributed in almost all zoogeographical regions (Zabka, 1985).

Diagnosis: Medium to large spiders with elevated cephalothorax. Ocular area occupying less than half of carapace length, length about two thirds of width, PME located at the midpoint between ALE and PLE; both carapace and abdomen with distinct longitudinal bands. Palpal organ: bulb usually longer than wide, its prolateral side strongly sclerotized and spatuliform, posterior end of bulb usually with small lobe (Figs 2B, 3B, 4B, 5B). Epigynum usually with central anterior hood (Figs 1B, 3E), copulatory opening narrow and usually slit-shaped, spermathecae spherical and connected to short stout ducts (Figs 2F, 3F, 4F).

KEY TO *PLEXIPPUS* SPECIES OCCURRING IN CHINA

- | | | |
|---|--|------------------------|
| 1 | Male | 2 |
| - | Female | 5 |
| 2 | Bulb with serrated prolateral side (Figs 4B, 5B) | 3 |
| - | Bulb with smooth prolateral side (Figs 2B, 3B) | 4 |
| 3 | Embolus long and thin, with pointed tip (Fig. 4B) | <i>P. setipes</i> |
| - | Embolus short and stout, with truncated tip (Fig. 5B) | <i>P. yinae</i> sp. n. |
| 4 | Tibial apophysis close to cymbium, tip of apophysis reaching beyond the base of embolus in ventral view (Fig. 3B) | <i>P. petersi</i> |
| - | Tibial apophysis not close to cymbium, tip of apophysis not reaching the base of embolus in ventral view (Fig. 2B) | <i>P. paykulli</i> |
| 5 | Epigynal hood close to anterior margin of epigynum (Figs 1C, 3E) | 6 |
| - | Epigynal hood in a central position on the epigynum (Figs 2E, 4E) | 7 |
| 6 | Copulatory opening wide, V-shaped (Fig. 1B) | <i>P. bhutani</i> |
| - | Copulatory opening slit-shaped (Fig. 3E) | <i>P. petersi</i> |
| 7 | Epigynum with deep mid-lateral incisions (Figs 2E-F) | <i>P. paykulli</i> |
| - | Epigynum without lateral incisions (Figs 4E-F) | <i>P. setipes</i> |

***Plexippus bhutani* Zabka, 1990**

Figs 1A-C

Plexippus bhutani: Xie & Peng, 1993: 21, figs 9-11 (♀); Peng *et al.*, 1993: 180, figs 629-631 (♀); Song *et al.*, 1999: 540, figs 311a, 312a (♀).

Material examined: 1 ♀ (MHNG), Wuying Town, Weishan District, Yunnan Province, China, 8.VI.1999, leg. Z. X. Li; 1 ♀ (IZCAS), Mt. Cangshan, Dali Prefecture, Yunnan Province, 9.III.2002, leg. Z. X. Li.

Diagnosis. This species is similar to *P. petersi* (Karsch, 1878), but can be separated from the latter by: 1. epigynum with much wider posterior margin versus as wide as anterior margin in *P. petersi* (Figs 1B-C, versus Figs 3E-F); 2. epigynal hood close to top of epigynum, that of *P. petersi* close to median area; 3. copulatory opening wide,

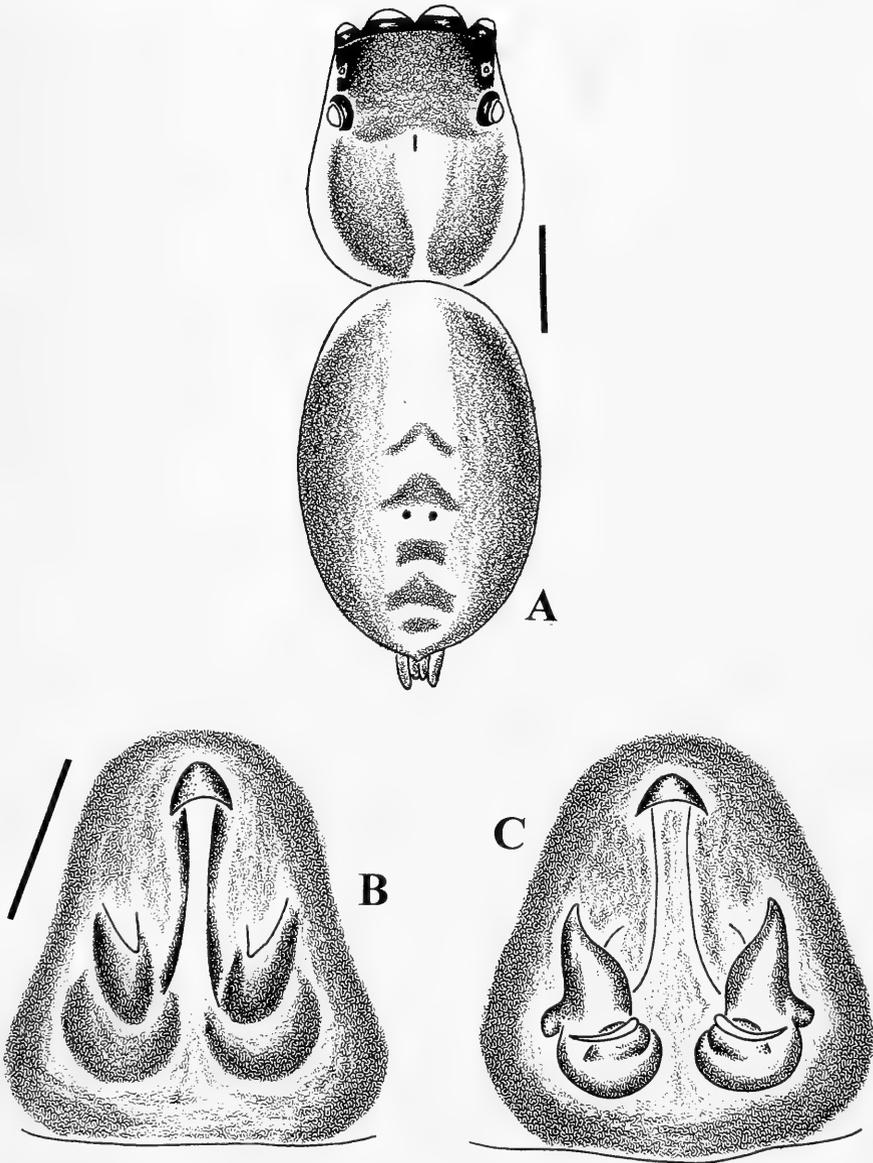


FIG. 1

Plexippus bhutani Zabka, 1990: A. Body of female; B. Epigynum; C. Vulva. Scales = 1.0 mm (A), 0.2 mm (B-C).

V-shaped, close to median area, that of *P. petersi* narrow, slit-shaped and located in the anterior half of epigynum (Fig. 1B, versus Fig. 3E); 4. copulatory ducts much shorter (Fig. 1C, versus Fig. 3F).

Distribution. Bhutan, China. (Yunnan).

Plexippus paykulli (Audouin, 1826)

Figs 2A-F

Plexippus paykulli: Lee, 1966: 74, figs 27i-k (♂ ♀); Yin & Wang, 1979: 37, figs 21A-E (♂ ♀); Yin *et al.*, 1983: 34, fig. 4C (♂); Hu, 1984: 386, figs 402.1-6 (♂ ♀); Guo, 1985: 182, figs 2-105.1-3 (♂ ♀); Song, 1987: 300, fig. 256 (♂ ♀); Zhang, 1987: 250, figs 222.1-3 (♂ ♀); Feng, 1990: 213, figs 188.1-6 (♂ ♀); Chen & Gao, 1990: 194, figs 247a-c (♂ ♀); Chen & Zhang, 1991: 296, figs 312.1-5 (♂ ♀); Song *et al.*, 1993: 886, figs 62A-D (♂ ♀); Peng *et al.*, 1993: 181, figs 632-638 (♂ ♀); Zhao, 1993: 417, figs 217a-c (♂ ♀); Chen, 1996: 137; Song *et al.*, 1999: 540, figs 14K, 310P, 311B, 328L (♂ ♀); Song *et al.*, 2001: 451, figs 301A-D (♂ ♀).

Plexippus incognitus Lee, 1966: 74, figs 28a-c (♂ ♀, misidentified); Hu, 1984: 384, fig. 401 (♂ ♀ misidentified); Song *et al.*, 1999: 540 (misidentified).

Material examined: 1 ♀ (MHNG), Jinxiu District, Guangxi Zhuang Autonomous Region, China, 13.V.1999, leg. G. Q. Zhang; 1 ♀ (IZCAS), Pingxiang City, Guangxi Zhuang Autonomous Region, 22.III.1998, leg. M. Wu; 1 ♂ (MHNG), Fulong Town, Fangcheng District, Guangxi Zhuang Autonomous Region, 23.V.1999, leg. G. Q. Zhang; 2 ♀ (HNU), Fugong District, Yunnan Province, 25.VII.2000, leg. D. Kavanaugh & H. M. Yan; 1 ♂ (IZCAS), Wuying Town, Weishan District, Yunnan Province, 5.VIII.1999, leg. X. L. Fan; Jiancao Town, Yunlong District, Yunnan Province, leg. E. B. Yang (IZCAS); 1 ♀ (IZCAS), Midu District, Yunnan Province, 10.VIII.1999, leg. Y. Q. Chen.

Diagnosis. The male of this species is similar to that of *P. petersi* (Karsch, 1878), but differs in: 1. tibial apophysis (Figs 2B-D) shorter, further away from the cymbium, tip of apophysis not reaching level of the base of embolus in ventral view; tibial apophysis of *P. petersi* (Figs 3B-D) closer to cymbium, with distal end beyond the level of the embolus base in ventral view; 2. embolus (Fig. 2B) shorter, originating from the position of 11:00 o'clock; that of *P. petersi* (Fig. 3B) from the position of 9:00 o'clock; 3. prolateral side of bulb with a shorter and wider apophysis (Fig. 2B) versus with a conical apophysis in *P. petersi* (Fig. 3B). The female of this species resembles that of *P. setipes* Karsch, 1879, but can be distinguished from the latter by: epigynum with deep mid-lateral incisions (Figs 2E-F) which are absent in *P. setipes* (Figs 4E-F).

Distribution. Cosmopolitan. In China recorded from the provinces: Anhui, Fujian, Shandong, Jiangsu, Zhejiang, Hubei, Hunan, Guangdong, Guangxi, Sichuan, Guizhou and Yunnan.

Plexippus petersi (Karsch, 1878)

Figs 3A-F

Plexippus petersi: Song & Chai, 1991: 21, figs 12A-D (♂ ♀); Xie, 1993: 359, figs 11-15 (♂ ♀); Peng *et al.*, 1993: 183, figs 639-645 (♂ ♀); Song *et al.*, 1999: 531, figs 310Q, 312C, 328M (♂ ♀).

Material examined: 1 ♂ 1 ♀ (MHNG), Mt. Jianfengling, Ledong District, Hainan Province, China, 1990; 1 ♂ (HNU), Mengla District, Yunnan Province, China, 5.V.1981, leg. J. F. Wang; 1 ♂ (IZCAS), Jinghong District, Yunnan Province, China, 2.XI.1988; 3 ♂ (IZCAS), Mt. Jianfengling, Ledong District, Hainan Province, China, III.1990; 1 ♂ (IZCAS), Funing District, Yunnan Province, China, 17.IV.1988.

Diagnosis. This species is very similar to *P. bhutani* and *P. paykulli*. For differences between these three species see "Diagnosis" under "*Plexippus bhutani* Zabka, 1990" and "*Plexippus paykulli* (Audouin, 1826)".

Distribution. Africa, India, Sri Lanka, Singapore, Japan, Vietnam and China (Guangdong, Guangxi, Hunan, Yunnan).

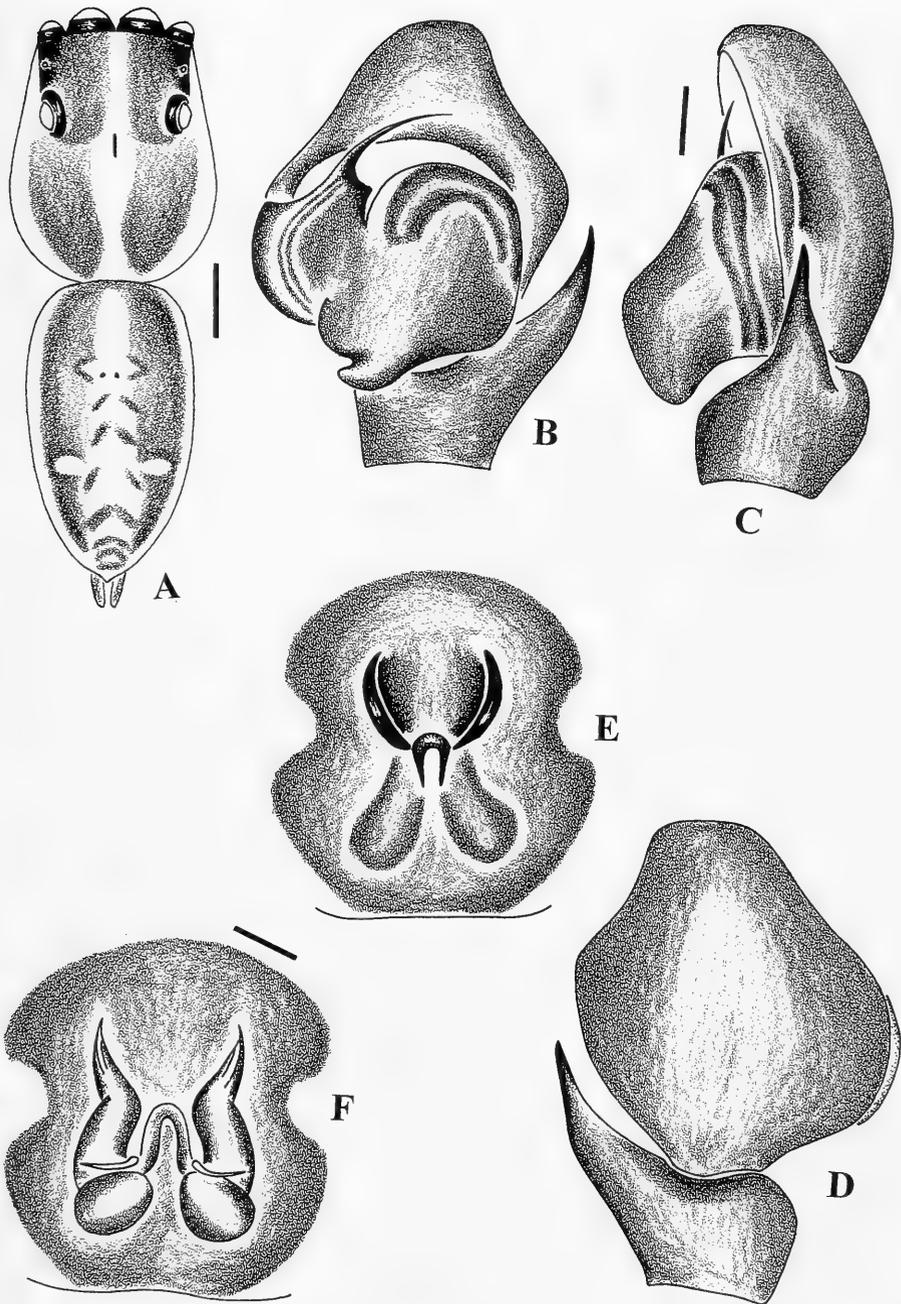


FIG. 2

Plexippus paykulli (Audouin, 1826): A. Body of male; B. Left palpal organ, ventral view; C. Left palpal organ, retrolateral view; D. Left palpal organ, dorsal view; E. Epigynum; F. Vulva. Scales = 1.0 mm (A), 0.2 mm (B-F).

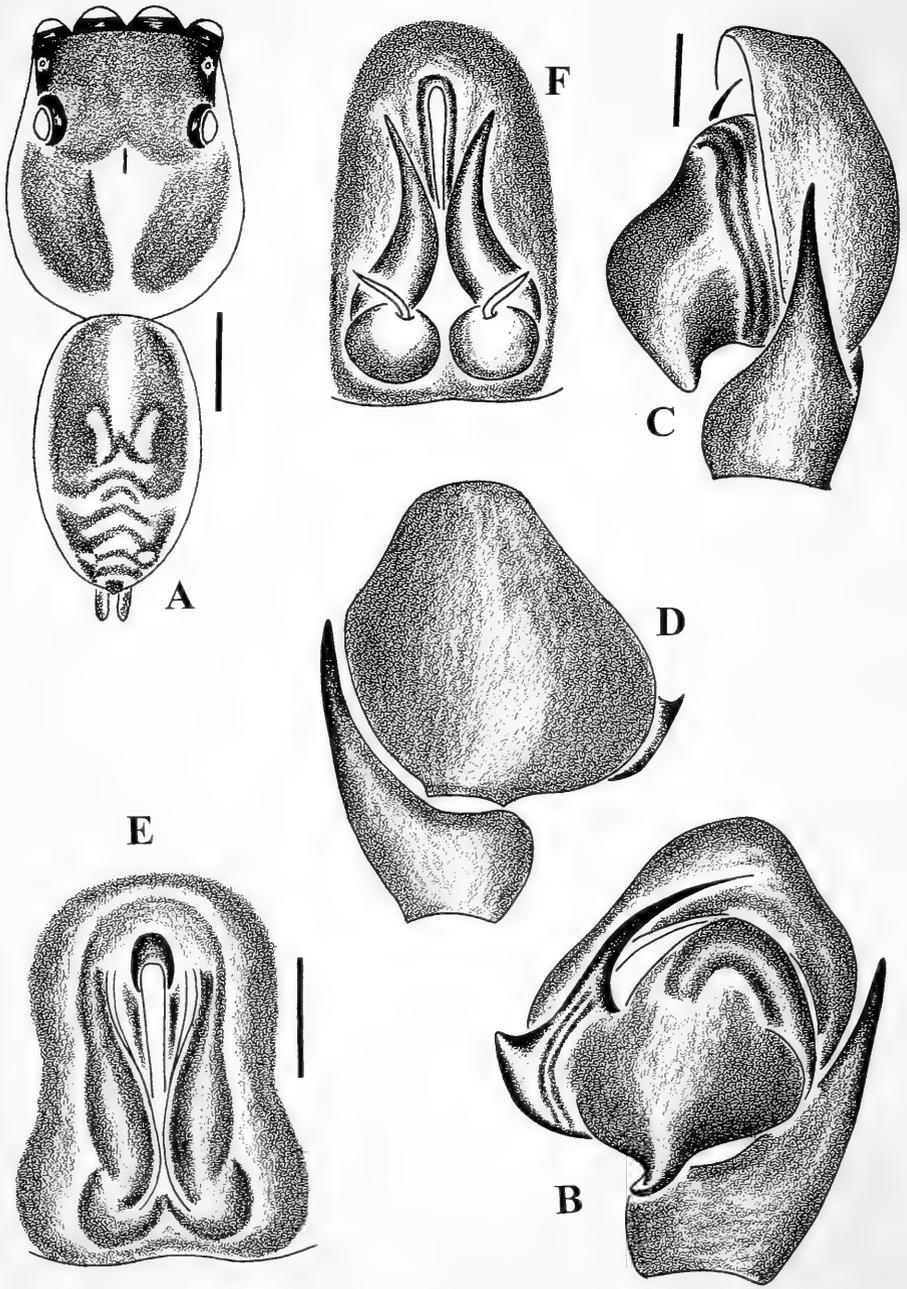


FIG. 3
Plexippus petersi (Karsch, 1878): A. Body of male; B. Left palpal organ, ventral view; C. Left palpal organ, retrolateral view; D. Left palpal organ, dorsal view; E. Epigynum; F. Vulva. Scales

***Plexippus setipes* Karsch, 1879**

Figs 4A-F

Plexippus setipes: Yin & Wang, 1979: 37, figs 22A-E (♂ ♀); Hu, 1984: 387, figs 403.1-2 (♂ ♀); Guo, 1985: 183, figs 2-106.1-3 (♂ ♀); Zhu & Shi, 1983: 213, figs 195a-c (♀); Song, 1987: 301, fig. 257 (♂ ♀); Zhang, 1987: 251, figs 223.1-3 (♀); Feng, 1990: 214, figs 189.1-5 (♂ ♀); Chen & Gao, 1990: 194, figs 248a-c (♂ ♀); Chen & Zhang, 1991: 297, figs 313.1-4 (♂ ♀); Song *et al.*, 1993: 886, figs 63A-D (♂ ♀); Peng *et al.*, 1993: 185, figs 646-652 (♂ ♀); Zhao, 1993: 419, figs 218a-c (♂ ♀); Song *et al.*, 1999: 541, figs 311I, 312D, 328N (♂ ♀).

Material examined: 1 ♀ (MHNG), Xuanen District, Hubei Province, China, 24.V.1989; 1 ♂ (MHNG), Yingjiang Town, Dehong District, Yunnan Province, China, 10.VII; 1 ♂ (MHNG), Mt. Longqi, Jiangle County, Fujian Province, China, 11.IX.1990, leg. S. Li; 2 ♂ 1 ♀ (HNU), Liuku suburb, Yunnan Province, 25.VI.2000, leg. D. Kavanaugh & H. M. Yan; 2 ♂ 1 ♀ (HNU), Liuku along Nujiang, Yunnan Province, 26.VI.2000, leg. D. Kavanaugh, C. Griswold & H.M. Yan; 1 ♂ (HNU), Gongshan suburb, Yunnan Province, 26.VI.2000, leg. H. M. Yan; 1 ♂ (HNU), Liuku along Yongping, Yunnan Province, 26.VII.2000, leg. D. Kavanaugh & H.M. Yan; 1 ♀ (MHNG), Fulong Town, Fangchenggang City, Guangxi Zhuang Autonomous Region, China, alt. 200m, 23.IV.1999, leg. G. Q. Zhang; 1 ♀ (IZCAS), Nanjing, Zhejiang Province, China, 28.IV.1925, leg. G. Ping.

Diagnosis. This species is closely related to *P. petersi* (Karsch, 1878), but differs in: 1. prolateral side of bulb serrated (Fig. 4B) versus smooth in *P. petersi* (Fig. 3B); 2. tibial apophysis shorter (Figs 4B-D versus Figs 3B-D); 3. cymbium with a series of bent hairs near tibial apophysis versus no such hairs in *P. petersi*; 4. differences in the structure of the epigynum (see “Diagnosis” under “*Plexippus paykulli* (Audouin, 1826)”).

Distribution. China (Anhui, Fujian, Gansu, Guangdong, Guangxi, Hebei, Hubei, Hunan, Jiangsu, Jiangxi, Shanghai, Shaanxi, Shangdong, Shanxi, Sichuan, Yunnan, Zhejiang), Japan, Turkmenistan, Vietnam.

***Plexippus yinae* sp. n.**

Figs 5A-E

Material examined: Holotype ♂ (IZCAS), paratype 1 ♂ (MHNG), northern entrance of Dali Teacher's College of Yunnan, Dali City (25.60°N, 100.1°E), 18.I.2001, leg. Z. X. Li.

Diagnosis. The new species is allied to *Plexippus setipes* Karsch, 1879, but differs in: 1. embolus shorter and stouter, with truncated tip (Figs 5B-C) versus pointed end in *P. setipes* (Figs 4B-C); 2. posterior lobe of bulb much bigger (Fig. 5B, versus Fig. 4B); 3. tibial apophysis much longer (Figs 5B-D, versus Figs 4B-D).

Etymology. The new species is named after Professor Chang-Min Yin, who has had her 80th birthday in October 2003. Professor Yin is one of the leading spider taxonomists in China.

Description. Male (holotype): Measurements: TL 5.60. CL 2.80, CW 2.00, AL 2.70, AW 1.60, AER 1.60, PER 1.60, EFL 1.00, AME 0.50, ALE 0.25, PLE 0.25, CLYH 0.20. Leg I 5.90 (1.80, 2.50, 1.10, 0.50); II 5.00 (1.60, 2.00, 0.90, 0.50); III 5.20 (1.60, 1.80, 1.10, 0.70); IV 5.80 (1.80, 2.10, 1.20, 0.70); leg formula 1, 4, 3, 2. Carapace (Fig. 5A) light brown with black margin, densely clothed in white and black hairs; ocular area black, carapace surrounded by white marginal band formed by white hairs, each PME followed by a longitudinal black band; fovea reddish brown, longitudinal; median area of thoracic region with light brown band extending forward to center of ocular area; each side of carapace with a wide, light brown submarginal band;

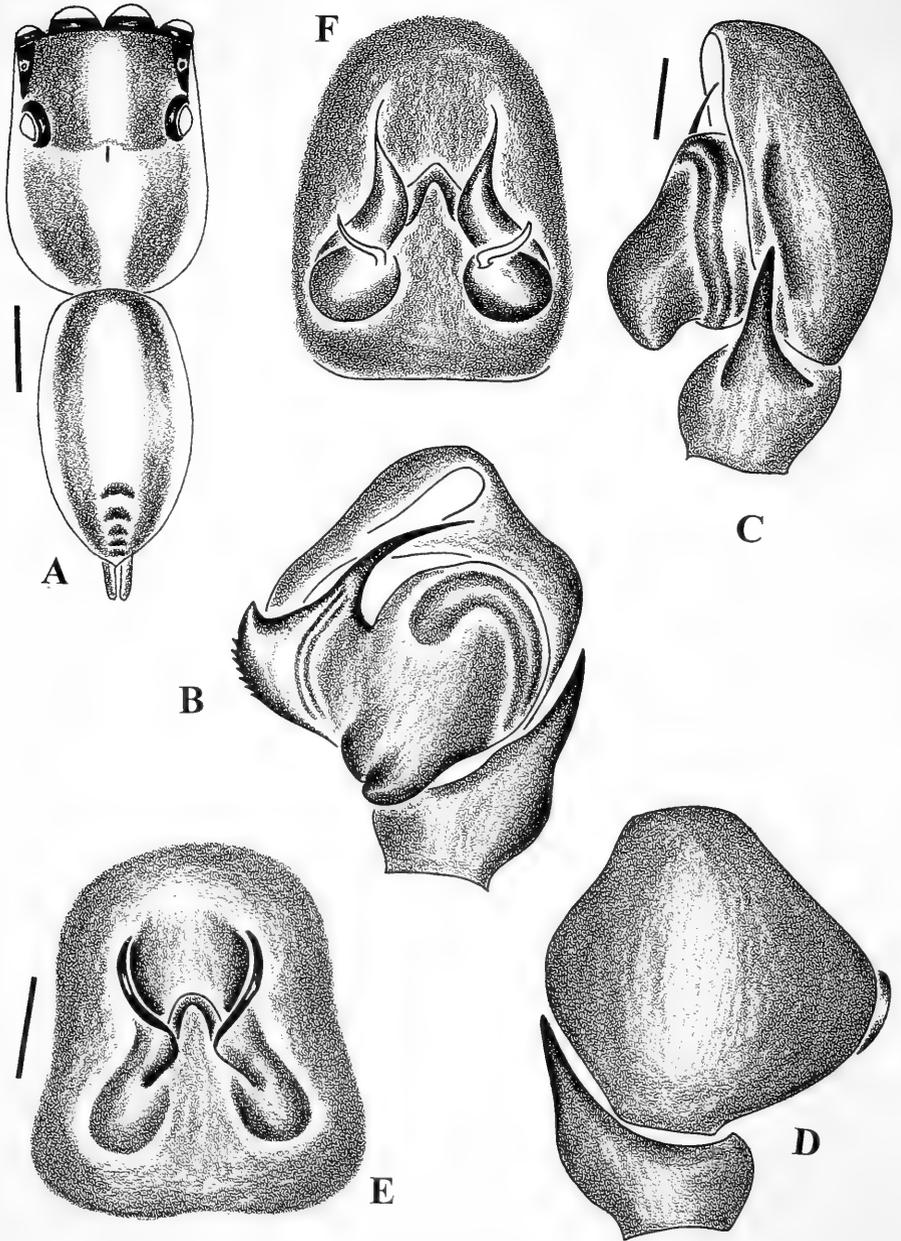


FIG. 4

Plexippus setipes Karsch, 1879: A. Body of male; B. Left palpal organ, ventral view; C. Left palpal organ, retrolateral view; D. Left palpal organ, dorsal view; E. Epigynum; F. Vulva. Scales = 1.0 mm (A), 0.2 mm (B-F).

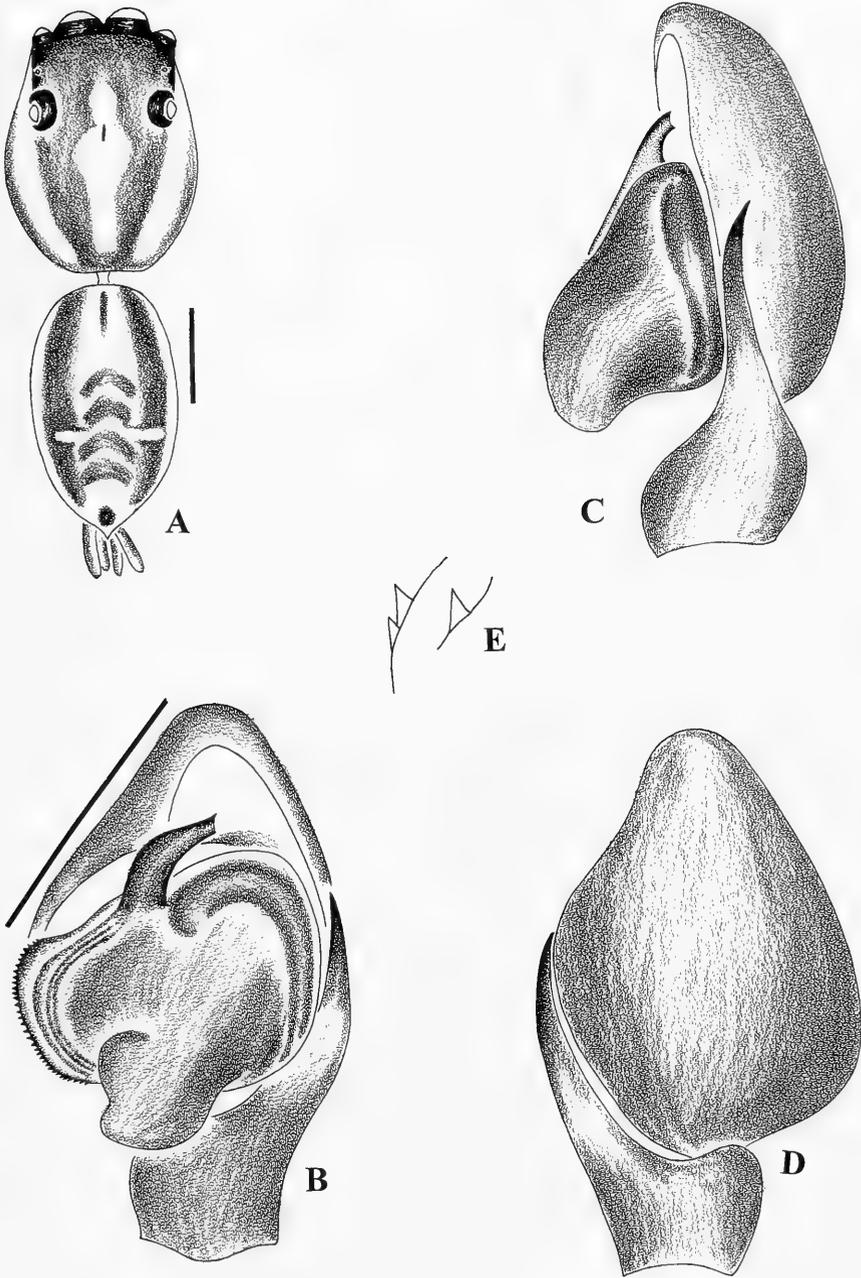


FIG. 5

Plexippus yinae sp. n.: A. Body of male; B. Left palpal organ, ventral view; C. Left palpal organ, retrolateral view; D. Left palpal organ, dorsal view; E. Teeth on cheliceral groove. Scales = 1.0 mm (A), 0.5 mm (B-D).

cervical and radial grooves indistinct. Sternum elongated oval, with smooth margin, anterior margin truncated; light yellowish brown background with black margin and grayish black median area; clothed in short black hairs and long black setae. Clypeus brown with black front margin and sides; median area densely clothed in short feather-shaped white hairs. Chelicerae brown, anterior side dark brown with few feather-shaped white hairs in basal portion; two promarginal teeth and one retromarginal tooth on cheliceral groove (Fig. 5E). Endites and labium dark brown, with dense black hairs on distal areas. Legs greyish black with lightly colored irregular patches, covered with long gray hairs and short black hairs; spines sparse and stout, 3 pairs on ventral side of tibiae I and II, 2 pairs on ventral side of metatarsi I and II. Abdomen (Fig. 5A) cylindrical, slightly wider anteriorly. Dorsum grayish black with two longitudinal black bands, each band with a transverse white band in posterior portion; cardiac band black, short and bar-shaped; 4 chevrons in posterior median area, posterior end with a distinct black mark; two pairs of light brown muscular depressions. Ventral side of abdomen dark gray with three longitudinal black bands separated by two longitudinal light yellow bands. Palpal organ: bulb with serrated prolateral margin and a big posterior lobe in ventral view (Fig. 5B); tibial apophysis longest among the known species; tibial apophysis (Figs 5B-C) shortest among the known species, its terminal end truncated.

Discussion. The embolus of male palpal organ sometimes is broken off during copulation. Its tip then remains in the female vulva. This case usually occurs in some spiders of the family Araneidae (such as the spiders of the genus *Argiope*). But no report about this can be found in the Salticidae spiders up to now. After examining the four palpal organs of the holotype and the paratype in this study, we found that all four palpal organs have the same type of embolus. Does the truncated end of the embolus of the new species result from the break of embolus during copulation? It can be exactly answered only after more materials, especially the embolus tip kept in the female vulva, will be found in future research.

Female: Unknown.

Distribution. China (Yunnan).

ACKNOWLEDGEMENTS

We are very grateful to Dr Peter Schwendinger (Geneva) and Dr Peter Jäger (Frankfurt am Main) for their continued support during our study on Chinese jumping spiders.

The present study was supported by the National Natural Sciences Foundation of China (NSFC-30270183, 39970102), by the National Science Fund for Fostering Talents in Basic Research (NSFC-J0030092), and was also partly supported by the Knowledge Innovation Program of the Chinese Academy of Science (CAS) (KSCX2-1-06A, KSCX3-IOZ-01) and by the Life Science Special Fund of the CAS (STZ-00-19) supported by the Ministry of Finance.

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Gyrophaenini dei generi *Sternotropa*, *Pseudoligota* e *Adelarthra* del Monte Kinabalu (Borneo, Sabah) (Coleoptera, Staphylinidae)*

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The Gyrophaenini of the genera *Sternotropa*, *Pseudoligota* and *Adelarthra* from Mount Kinabalu (Borneo, Sabah) (Coleoptera, Staphylinidae). - The three genera *Sternotropa* Cameron, 1920, *Pseudoligota* Cameron, 1920 and *Adelarthra* Cameron, 1920, have not been reported so far from Borneo. Seven new species of each of the genera *Sternotropa*, *Pseudoligota* and *Adelarthra* are described. Each new species is illustrated and compared to related species from India, Singapore and the Philippines. Identification keys are provided for all new species. *Brachida borneorum* Pace, 1986 is transferred to *Sternotropa* based on the structure of male terminalia.

Key-words: Coleoptera - Staphylinidae - Aleocharinae - taxonomy - Borneo.

INTRODUZIONE

I tre generi della tribù Gyrophaenini del Borneo trattati nel presente lavoro, *Sternotropa* Cameron, 1920, *Pseudoligota* Cameron, 1920 and *Adelarthra* Cameron, 1920, finora erano sconosciuti per questa grande isola. Il primo è diffuso con poche specie in India (Cameron, 1939), Nepal (Pace, 1989), Thailandia (Pace, 2000a), Singapore (Cameron, 1920), Filippine (Pace, 1990), Papua-Nuova Guinea (Pace, 2000b), Nuova Zelanda (Cameron, 1948) e Nuova Caledonia (Pace, 1991), il secondo è noto dell'India (Cameron, 1939), Singapore (Cameron, 1920), Sri Lanka (Pace, 1987) e Nuova Caledonia (Pace, 1991) e il terzo è diffuso con due specie, una di Singapore (Cameron, 1920), l'altra delle Filippine (Pace, 1990). Da questa distribuzione geografica risulta che ciascuno di questi generi è strettamente intertropicale. Le specie a cui appartengono sono per lo più di piccola o piccolissima taglia corporea, raccolti sempre in numero esiguo di esemplari. Sono specie fungicole, fitodetriticole, succicole e per *Adelarthra* occasionalmente termitofile e mirmecofile. Nonostante l'accentuata uniformità dei caratteri esterni delle specie di ciascun genere, l'edeago presenta per lo più struttura ultraevoluta complessa che permette un'agevole separazione delle specie, che risultano avere un areale per ora ristretto. Finora nessuna specie è stata riconosciuta avere un areale ampio.

Il carattere unico dei Gyrophaenini è la presenza sull'apice della lacinia, il lobo interno delle maxille, di un largo pettine di corte spine accompagnato da molte spine addizionali, pure corte. Grazie a questa struttura, nel presente lavoro i tre generi sono

* 180° Contributo alla conoscenza delle Aleocharinae.

Manoscritto accettato il 04.12.2002

inclusi nella tribù Gyrophaenini Kraatz, 1856 e non nella sottotribù Gyrophaenina come per Ashe (1984), inclusa nel sottogenere Homalotini Heer, 1831, le cui specie non hanno le suddette spine della lacinia.

Il materiale descritto e illustrato nel presente lavoro proviene dalle ricerche sul Monte Kinabalu del noto studioso di Staphylinidae D. Aleš Smetana di Ottawa e di Ivan Löbl e Daniel Burckhardt, già studiosi e ricercatori del Museo di Storia Naturale di Ginevra.

Gli olotipi delle nuove specie sono conservati nel Museo di Storia Naturale di Ginevra (MHNG). Paratipi si conservano in collezione A. Smetana di Ottawa e nel Museo regionale di Scienze Naturali di Torino (MRSN).

DESCRIZIONI

Sternotropa vexillifera sp. n.

Figg. 1-4

Holotypus ♂, Borneo, Sabah, M. Kinabalu N.P., below Layang Layang, 2590 m, 1.V.1987, leg. A. Smetana (MHNG).

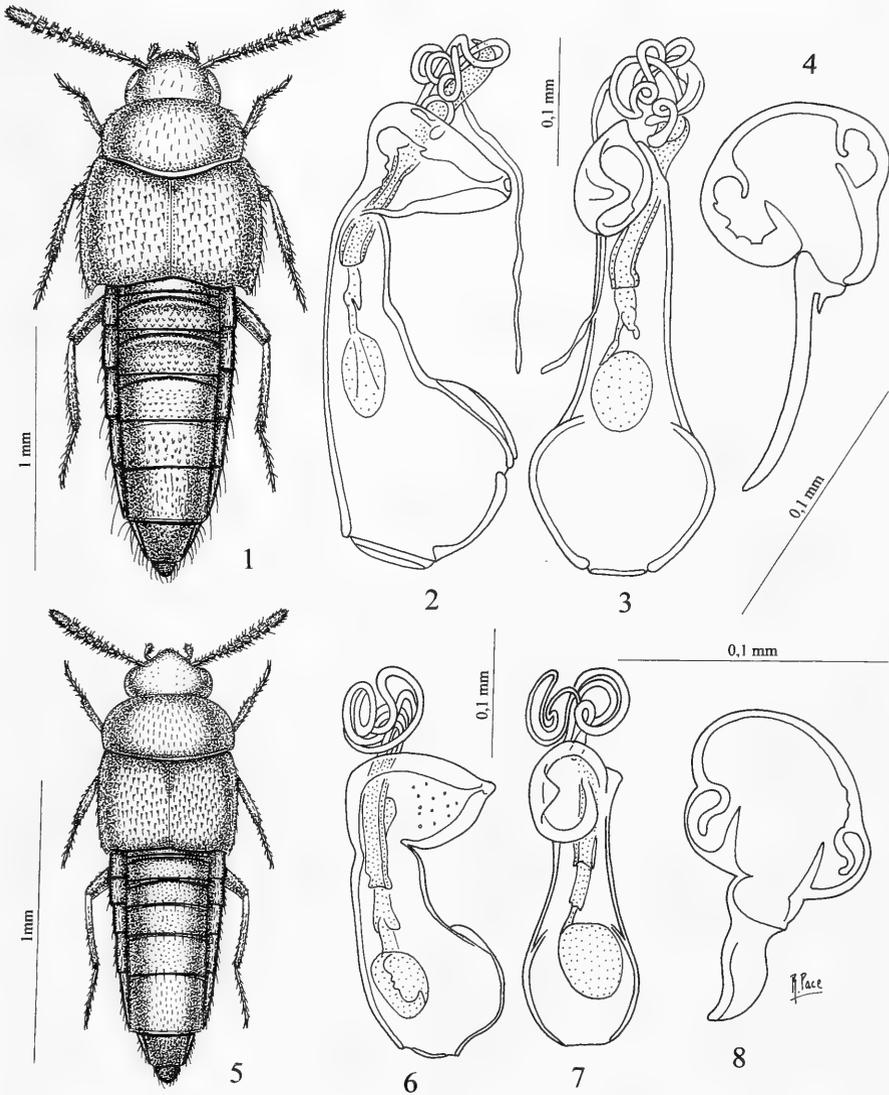
Paratypi: 2 ♀♀. stessa provenienza.

DESCRIZIONE. Lungh. 2,1 mm. Corpo lucido e bruno; antenne giallo-rossicce con undicesimo antennomero bruno; zampe rossicce. La punteggiatura del capo è fine e rada: La granulosità del pronoto e delle elitre è ben distinta. I tre uroterghi basali sono coperti di microscultura squamiforme regolare, i restanti uroterghi presentano granuli allungati su tutta la loro superficie. La reticolazione del capo è assente, quella del pronoto è assai superficiale e quella delle elitre è distinta. Edeago figg. 2-3, spermateca fig. 4.

ETIMOLOGIA. Il nome della nuova specie significa «portatrice di vessillo» a motivo dell'apice dell'edeago che ha forma di vessillo triangolare, in visione laterale.

COMPARAZIONI. La nuova specie, per la forma dell'edeago, è probabilmente tassonomicamente vicina a *S. coiffaiti* Pace, 1984 e a *S. smetanai* Pace, 1989, entrambe del Nepal. Se ne distingue per i caratteri dati nella seguente chiave.

- | | | |
|---|--|------------------------------|
| 1 | Corpo bicolore bruno e giallo-rossiccio; apice dell'edeago, in visione laterale, dilatato a forma di triangolo ridotto; presenza di due spine ventrali dello stesso organo | 2 |
| - | Corpo unicolore bruno; apice dell'edeago, in visione laterale, dilatato a forma di grande triangolo; assenza di spine ventrali dello stesso organo. Lungh. 2,1 mm. Sabah | <i>S. vexillifera</i> sp. n. |
| 2 | Elitre bicolori, brune con base giallo-rossiccia; quarto antennomero lungo quanto largo; in visione laterale, presenza di angolo preapicale dorsale dell'edeago, in visione ventrale parte apicale dello stesso organo fortemente asimmetrica; presenza di introflessione apicale della spermateca. Lungh. 2,1 mm. Nepal: Phulkoki | <i>S. coiffaiti</i> Pace |
| - | Elitre unicolori brune; quarto antennomero trasverso; in visione laterale, assenza di angolo preapicale dorsale dell'edeago, sostituito da una spina dorsale, in visione ventrale parte apicale dello stesso organo lievemente asimmetrica; assenza di introflessione apicale della spermateca. Lungh. 2,1 mm. Nepal: Kuwapani | <i>S. smetanai</i> Pace |



FIGG. 1-8

Habitus, edeago in visione laterale e ventrale e spermateca. 1-4: *Sternotropa vexillifera* sp. n.; 4-8: *Sternotropa microvexillifera* sp. n.

Sternotropa microvexillifera sp. n.

Figg. 5-8

Holotypus ♂, Borneo, Sabah, Mt. Kinabalu Nat. Pk., HQ at Liwagu Rv., 1500 m, 30.IV.1987, leg. A. Smetana (MHNG).

Paratypi: 4 es., stessa provenienza; 1 ♂, Borneo, Sabah, M. Kinabalu Nat.Pk., HQ Silau-Silau Tr., 1550 m, 2.IX.1988, leg. A. Smetana.

DESCRIZIONE. Lungh. 1,5 mm. Corpo lucido e bruno; antenne gialle con undicesimo antennumero giallo-bruno; zampe giallo-brune. La punteggiatura del capo è fine e assente sulla fascia longitudinale mediana. La granulosità del pronoto è saliente, quella delle elitre è distinta e quella degli uroterghi è superficiale. La reticolazione del capo è assente, quella del pronoto è estremamente superficiale e quella delle elitre è svanita. Edeago figg. 6-7, spermateca fig. 8.

ETIMOLOGIA. Il nome della nuova specie significa «piccola vessillifera» per non dimenticare la sua affinità con *S. vexillifera* sp. n. sopra descritta e la sua taglia corporea minore.

COMPARAZIONI. La nuova specie è, per la forma dell'edeago, tassonomicamente vicina a *S. vexillifera* n. sp. sopra descritta. Se ne distingue per i caratteri dati nella seguente chiave.

- 1 Pronoto meno trasverso, con rapporto larghezza/lunghezza pari a 1,76; i tre uroterghi basali coperti di scultura squamiforme; parte dilatata apicale dell'edeago a forma di triangolo meno sviluppato in rapporto alla parte restante dello stesso edeago. Lungh. 2,1 mm. Sabah . . *S. vexillifera* sp. n.
- Pronoto più trasverso, con rapporto larghezza/lunghezza pari a 2,00; i tre uroterghi basali coperti di granulosità superficiale; parte dilatata apicale dell'edeago a forma di triangolo più sviluppato in rapporto alla parte restante dello stesso edeago. Lungh. 1,5 mm. Sabah . . *S. microvexillifera* sp. n.

***Sternotropa asymmetricitatis* sp. n.**

Figg. 9-11

Holotypus ♂, Sabah, E Mt. Kinabalu, 1150 m, rte. Ranau-Kota Kinabalu, 24.V.1987, leg. Burckhardt & Löbl (MHNG).

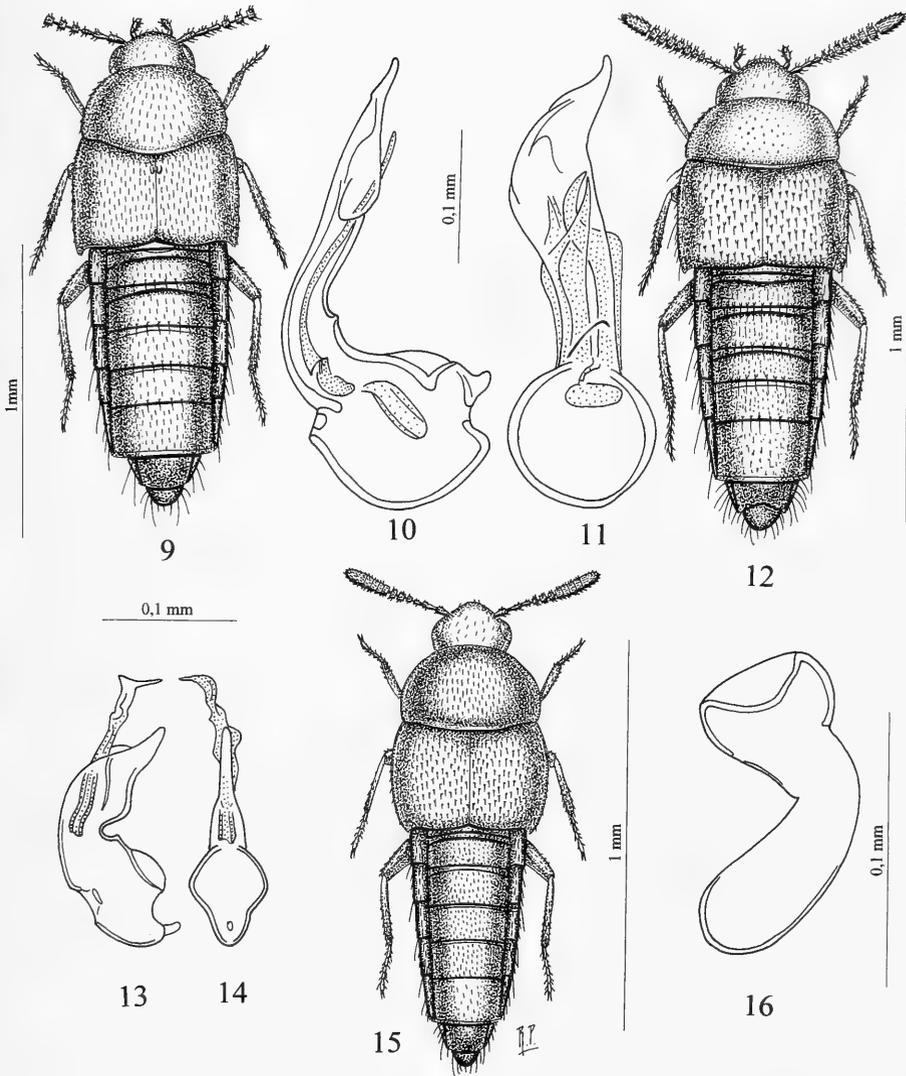
Paratypi: 1 ♂, Sabah, Poring Hot Springs, 500 m, 8.V.1987, leg. Burckhardt & Löbl; 2 ♂♂, Sabah, Poring Hot Springs, 550-600 m, 9.V.1987, leg. Burckhardt & Löbl.

DESCRIZIONE. Lungh. 1,7 mm. Corpo lucido e di un giallo sporco, con capo ed elitre bruni; antenne e zampe gialle. Punteggiatura e granulosità assenti sul capo. La granulosità del pronoto è distinta, quella delle elitre è superficiale e quella dell'addome è fine. Sul corpo non vi è traccia di reticolazione. Edeago figg. 10-11.

ETIMOLOGIA. Il nome della nuova specie significa «dell'asimmetricità» in quanto l'edeago è fortemente asimmetrico, in visione ventrale.

COMPARAZIONI. L'unica specie nota che presenta edeago simile a quello della nuova specie è *S. nigra* Cameron, 1920, di Singapore (tipi esaminati). Queste due specie si distinguono come segue.

- 1 Corpo unicolore nero-bruno; quarto antennumero lungo quanto largo; occhi più sviluppati e sporgenti; assenza di tubercoli periscutellari del ♂; edeago con lunga appendice sternale (nella figura dell'edeago data da Ashe (1984) tale appendice non compare, quasi sicuramente amputata nel corso della sua dissezione, essendo fragilissima); in visione ventrale edeago simmetrico. Lungh. 1,8 mm. Singapore *S. nigra* Cameron
- 2 Corpo bicolore giallo sporco e bruno; quarto antennumero trasverso; occhi meno sviluppati e non sporgenti; presenza di due tubercoli periscutellari del ♂; edeago senza lunga appendice sternale e in visione ventrale fortemente asimmetrico. Lungh. 1,7 mm. Sabah . *S. asymmetricitatis* sp. n.



FIGG. 9-16

Habitus, edeago in visione laterale e ventrale e spermateca. 9-11: *Sternotropa asymmetricitatis* sp. n.; 12-14: *Sternotropa misera* sp. n.; 15-16: *Sternotropa ranauensis* sp. n.

Sternotropa misera sp. n.

Figg. 12-14

Holotypus ♂, Sabah, E Mt. Kinabalu, 1150 m, rte. Ranau-Kota Kinabalu, 24.V.1987, leg. Burckhardt & Löbl (MHNG).

DESCRIZIONE. Lungh. 1,2 mm. Corpo lucido e bruno; antenne bruno-rossicce con i tre antenomeri basali gialli; zampe gialle. La punteggiatura del pronoto è dis-

tinta solo sul disco: ai lati è assente. La granulosità del capo è superficiale, quella delle elitre è saliente e quella dell'addome è composta di granuli allungati. Assente è la reticolazione del corpo. Edeago figg. 13-14.

ETIMOLOGIA. La nuova specie è chiamata «misera» a motivo della taglia corporea estremamente ridotta.

COMPARAZIONI. La struttura dell'edeago della nuova specie è unica nel genere *Sternotropa* e non esistono specie tassonomicamente vicine comparabili.

***Sternotropa ranauensis* sp. n.**

Figg. 15-16

Holotypus ♀, Sabah, E Mt. Kinabalu, 1150 m, rte. Ranau-Kota Kinabalu, 24.V.1987, leg. Burckhardt & Löbl (MHNG).

DESCRIZIONE. Lungh. 1,1 mm. Corpo debolmente lucido e rossiccio, con addome giallo-rossiccio; antenne rossicce con i tre antennomeri basali gialli. La punteggiatura del capo è fine e distinta, quella del pronoto evidente. La granulosità delle elitre è saliente, quella dell'addome superficiale. Assente è la reticolazione sul corpo. Spermateca fig. 16.

ETIMOLOGIA. La nuova specie prende nome dalla sua località tipica Ranau.

COMPARAZIONI. Specie del genere *Sternotropa* da comparare con la nuova specie, con il pronoto bruscamente ristretto all'indietro, con addome giallo-rossiccio e con spermateca allungata, non sono ancora note.

***Sternotropa fungithecæ* sp. n.**

Figg. 17-18

Holotypus ♀, Borneo, Sabah, Mt. Kinabalu Nat. Pk., HQ Silau-Silau Tr., 1550 m, 2.IX.1988, leg. A. Smetana (MHNG).

DESCRIZIONE. Lungh. 1,7 mm. Corpo lucido e rossiccio scuro, con metà posteriore delle elitre bruna; antenne e zampe gialle. La granulosità del capo è molto superficiale e rada, quella del pronoto e delle elitre è distinta. La scultura squamiforme si trova solo alla base del primo e del secondo degli uroterghi liberi, i restanti sono coperti di granulosità distinta. Assente è la reticolazione del corpo. Spermateca fig. 18.

ETIMOLOGIA. Il nome della nuova specie significa «spermateca a forma di fungo».

COMPARAZIONI. Specie da comparare con la nuova specie che presenta una spermateca di forma così singolare, non sono ancora note.

***Sternotropa prensilis* sp. n.**

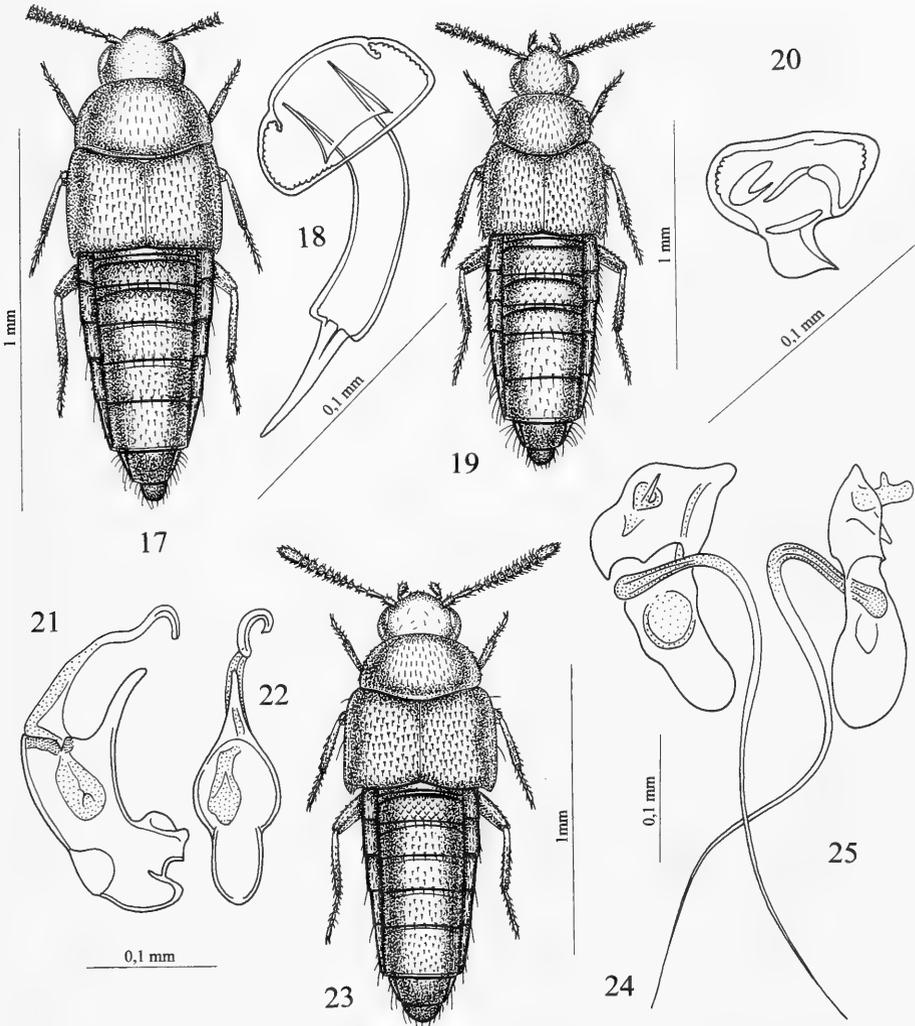
Figg. 19-22

Holotypus ♂, Sabah, Mt. Kinabalu, 1500 m, 25.IV.1987, leg. Burckhardt & Löbl (MHNG).

Paratypi: 2 ♀ ♀, Sabah, Mt. Kinabalu, 1500 m, 21.V.1987, leg. Burckhardt & Löbl.

DESCRIZIONE. Lungh. 1,6 mm. Corpo lucido giallo sporco con pigidio giallo. La punteggiatura del capo e delle elitre è superficiale. La granulosità del pronoto è fine e poco distinta. Una debole scultura squamiforme copre i due uroterghi basali. La reticolazione è presente solo sulle elitre dove è estremamente svanita. Spermateca fig. 20, edeago figg. 21-22.

ETIMOLOGIA. Il nome «prensile» della nuova specie è in riferimento alla forma dell'edeago, in visione laterale, con forma simile a una mano nell'atto di prendere con il pollice e l'indice.



FIGG. 17-25

Habitus, spermatheca ed eedeago in visione laterale e ventrale. 17-18: *Sternotropa fungitheca* sp. n.; 19-22: *Sternotropa prensilis* sp. n.; 23-25: *Pseudoligota fustigans* sp. n.

COMPARAZIONI. È nota una sola specie che presenta un eedeago simile a quello della nuova specie. È *S. igorotorum* Pace, 1990, delle Filippine. Le due specie di distinguono per i caratteri dati nella seguente chiave.

- 1 Terzo antennomero giallo paglierino; reticolazione del capo netta; pronoto più trasverso, con rapporto larghezza/lunghezza pari a 1,64; granulosità delle elitre forte; eedeago fortemente ristretto a metà, sia in visione laterale, sia ventrale. Lunghezza 1,6 mm. Filippine . . . *S. igorotorum* Pace

- Terzo antennumero giallo; reticolazione del capo assente; pronoto meno trasverso, con rapporto larghezza/lunghezza pari a 1,50; elitre coperte di punteggiatura superficiale; edeago fortemente largo a metà, sia in visione laterale, sia ventrale. Lungh. 1,6 mm. Sabah *S. prenilis* sp. n.

COMBINAZIONE NUOVA

Al genere *Sternotropa*, per la forma dell'edeago, va attribuita la seguente specie.

***Sternotropa borneorum* (Pace, 1986), comb. n.**

Brachida borneorum Pace, 1986: 172

Gyropaena borneorum, Pace, 2001: 736

CHIAVE DELLE SPECIE DEL GENERE *STERNOTROPA* DEL BORNEO

- 1 Pronoto bruscamente ristretto all'indietro; addome giallo-rossiccio. Taglia corporea ridottissima. Lungh. 1,1 mm. Sabah *S. ranauensis* sp. n.
- Pronoto non ristretto all'indietro; addome giallo sporco a nero-bruno. Taglia corporea da 1,2 a 2,1 mm 2
- 2 Elitre bicolori, brune con metà basale rossiccia. Lungh. 1,7 mm. Sabah. *S. fungitheca* sp. n.
- Elitre unicolori, brune o giallo-brune 3
- 3 Corpo unicolore bruno 4
- Corpo bicolore, bruno e rossiccio, giallo-bruno e giallo, bruno e giallo-bruno 6
- 4 Undicesimo antennumero più lungo dei tre precedenti riuniti; punteggiatura del pronoto assente ai lati; uroterghi coperti di granuli allungati. Lungh. 1,2 mm. Sabah *S. misera* sp. n.
- Undicesimo antennumero più corto dei tre precedenti riuniti; pronoto coperto di granulosità anche ai lati; uroterghi coperti di scultura squamiforme o di granuli non allungati 5
- 5 Pronoto meno trasverso, con rapporto larghezza/lunghezza pari a 1,76; i tre uroterghi basali coperti di scultura squamiforme; parte dilatata apicale dell'edeago a forma di triangolo meno sviluppato in rapporto alla parte restante dello stesso edeago. Lungh. 2,1 mm. Sabah *S. vexillifera* sp. n.
- Pronoto più trasverso, con rapporto larghezza/lunghezza pari a 2,00; i tre uroterghi basali coperti di granulosità superficiale; parte dilatata apicale dell'edeago a forma di triangolo più sviluppato in rapporto alla parte restante dello stesso edeago. Lungh. 1,5 mm. Sabah *S. microvexillifera* sp. n.
- 6 Avancorpo bicolore; capo ed elitre bruni, pronoto giallo-bruno; tubercoli periscutellari del ♂ presenti; edeago fortemente asimmetrico, in visione ventrale. Lungh. 1,7 mm. Sabah *G. asymmetricitatis* sp. n.
- Avancorpo unicolore bruno o giallo-bruno; elitre del ♂ senza tubercoli periscutellari; edeago simmetrico, in visione ventrale 7
- 7 Avancorpo bruno, addome rossiccio; antenne rossicce con decimo antennumero bruno; pronoto fortemente trasverso, con rapporto larghezza/lunghezza pari a 1,62; edeago con spatola ventrale. Lungh. 1,2 mm. Sabah *S. borneorum* (Pace)

- Avancorpo e addome giallo-bruni; antenne di un giallo sporco con decimo antennumero del medesimo colore; pronoto meno trasverso, con rapporto larghezza/lunghezza pari a 1,50; edeago senza spatola ventrale. Lungh. 1,6 mm. Sabah *S. prensilis* sp. n.

***Pseudoligota fustigans* sp. n.**

Figg. 23-25

Holotypus ♂, Borneo, Sabah, Mt. Kinabalu Nat. Pk., HQ Liwagu Rv. Tr., 1520 m, 11.VIII.1988, leg. A. Smetana (MHNG).

DESCRIZIONE. Lungh. 1,4 mm. Corpo lucido e giallo sporco, con margine posteriore delle elitre giallo-bruno; antenne gialle con undicesimo antennumero giallo sporco; zampe gialle. La granulosità del capo è molto svanita, quella del pronoto e delle elitre è distinta. Solo il primo urotergo libero presenta scultura squamiforme, i restanti uroterghi sono coperti di granulosità superficiale. Sul corpo non vi è traccia di reticolazione. Edeago figg. 24-25.

ETIMOLOGIA. Il nome della nuova specie prende nome di «fustigante» a motivo della lunghezza del flagello dell'edeago.

COMPARAZIONI. L'edeago delle specie note (Ashe, 1984) *P. affinis* Cameron, 1920 e *P. varians* Cameron, 1920, entrambe di Singapore, presenta la parte apicale stretta, in visione laterale e non fortemente dilatata come nella nuova specie.

***Pseudoligota perpusilla* sp. n.**

Figg. 26-29

Holotypus ♂, Sabah, Mt. Kinabalu, 1500 m, 25.IV.1987, leg. Burckhardt & Löbl (MHNG).

Paratypus: 1 ♂, stessa provenienza; 1 ♂, Sabah, Poring Hot Springs, 500 m, 7.V.1987, leg. Burckhardt & Löbl.

DESCRIZIONE. Lungh. 1,1 mm. Corpo lucido e nero-bruno; antenne di un giallo sporco con i tre antennumeri basali gialli; zampe gialle. Il capo non presenta punteggiatura, né granulosità. La granulosità del pronoto è distinta, quella delle elitre è superficiale. Microscultura squamiforme solo sui due uroterghi basali. Sul corpo non esiste reticolazione. Edeago figg. 27-28, spermateca fig. 29.

ETIMOLOGIA. Il nome della nuova specie significa «piccolissima» a motivo della taglia corporea ridotta.

COMPARAZIONI. L'edeago della nuova specie presenta una plica ventrale, assente nell'edeago delle specie dell'India e di Singapore, di cui è noto l'edeago.

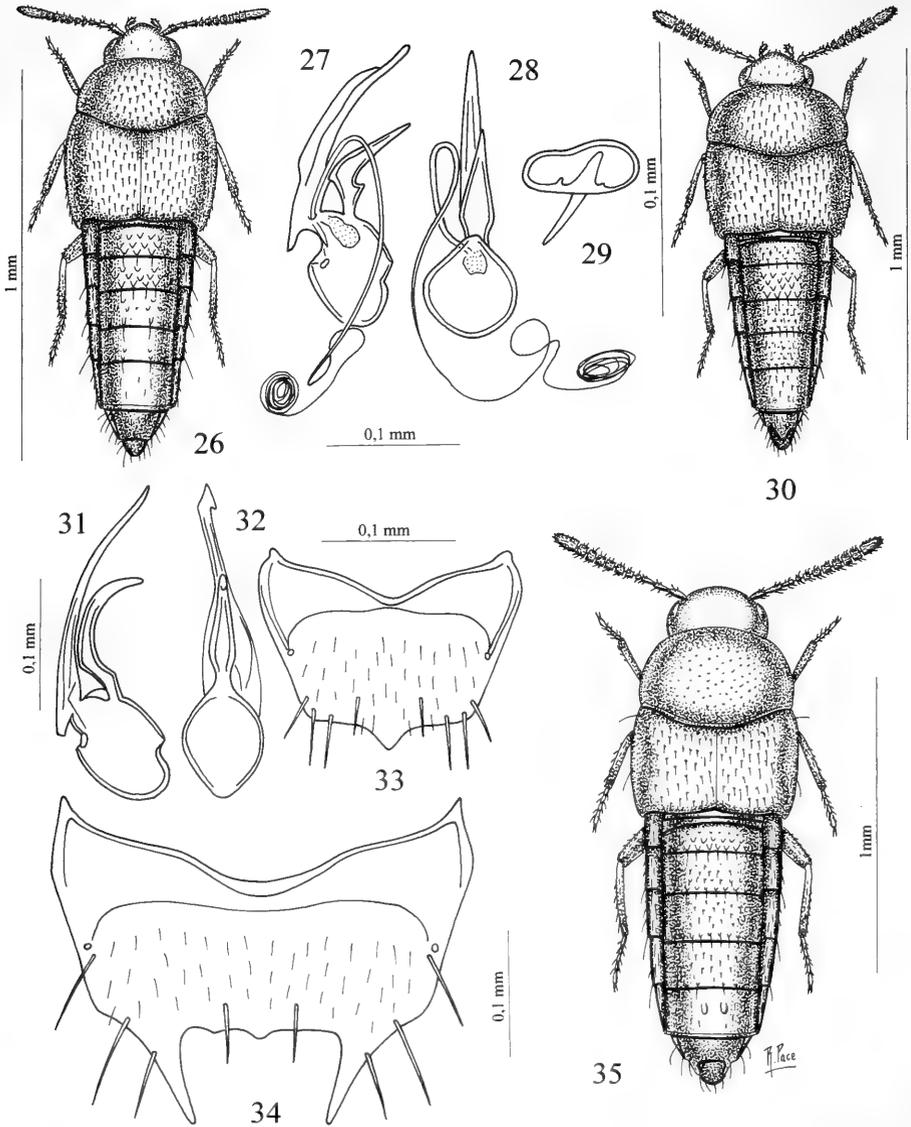
***Pseudoligota unilobata* sp. n.**

Figg. 30-33

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

DESCRIZIONE. Lungh. 1,0 mm. Corpo lucido e bruno; antenne gialle con antennumeri ottavo a decimo di un giallo sporco; zampe gialle. La punteggiatura del capo è assente. La granulosità del pronoto e dell'addome è distinta, quella delle elitre è saliente. Solo il secondo urotergo libero mostra scultura squamiforme. Sul corpo non si osserva reticolazione. Edeago figg. 31-32, sesto urotergo libero del ♂ fig. 33.

ETIMOLOGIA. Il nome della nuova specie significa «con un solo lobo». È quello del margine posteriore del sesto urotergo libero del ♂.



FIGG. 26-35

Habitus, edeago in visione laterale e ventrale, spermateca e sesto urotergo libero del ♂. 26-29: *Pseudoligota perpusilla* sp. n.; 30-33: *Pseudoligota unilobata* sp. n.; 34-35: *Pseudoligota burckhardtii* sp. n.

COMPARAZIONI. L'edeago della nuova specie è simile a quello di *P. affinis* Cameron, 1939, dell'India. Ma questo, tra l'altro, ha un lobo preapicale dorsale, assente nell'edeago della nuova specie.

***Pseudoligota burckhardti* sp. n.**

Figg. 34-39

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

Paratypus: 1 ♀, Sabah, Poring Hot Springs, 500 m, 8.V.1987, leg. Burckhardt & Löbl.

DESCRIZIONE. Lungh. 1,7 mm. Corpo lucido e giallo-rossiccio con elitre brune, tranne gli omeri giallo-rossicci; antenne rossicce con i tre antenomeri basali e l'undicesimo gialli; zampe gialle. La punteggiatura del capo è indistinta. La granulosità del pronoto è saliente e quella delle elitre distinta. La scultura squamiforme del primo e secondo degli uroterghi liberi è poco distinta. Due mediani tubercoli allungati stanno sul quinto urotergo libero del ♂. Sesto urotergo libero del ♂ fig. 34, edeago figg. 36-37, sesto urotergo libero della ♀ fig. 38, spermateca fig. 39.

ETIMOLOGIA. La nuova specie è dedicata a uno dei suoi raccoglitori, il dr. Daniel Burckhardt, già del Museo di Storia Naturale di Ginevra.

COMPARAZIONI. Per la forma dell'edeago, la nuova specie si mostra affine a *P. affinis* Cameron, 1939, dell'India, ma il ridotto lobo preapicale dell'edeago di *P. indica*, nella nuova specie diventa enormemente sviluppato fino ad assumere la funzione di lama sternale dello stesso edeago.

***Pseudoligota picea* sp. n.**

Figg. 40-44

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

Paratipi: 6 es., Sabah, Mt. Kinabalu, 1500 m, 21.IV.1987, leg. Burckhardt & Löbl.

DESCRIZIONE. Lungh. 1,8 mm. Corpo lucido e nero-bruno, con elitre e quarto urite libero neri; antenne nero-brune; zampe di un giallo sporco. Il capo è privo di punteggiatura. La granulosità del pronoto è fine, quella delle elitre è saliente e quella dell'addome è distinta. Assente è la reticolazione sul corpo. La sutura delle elitre del ♂ è carenata, coperta di granuli. Il quinto urotergo libero del ♂ ha un tubercolo mediano allungato. Edeago figg. 41-42, spermateca fig. 43, sesto urotergo libero del ♂ 44.

ETIMOLOGIA. La nuova specie prende nome di «colore di pece» per la tonalità scura del suo corpo.

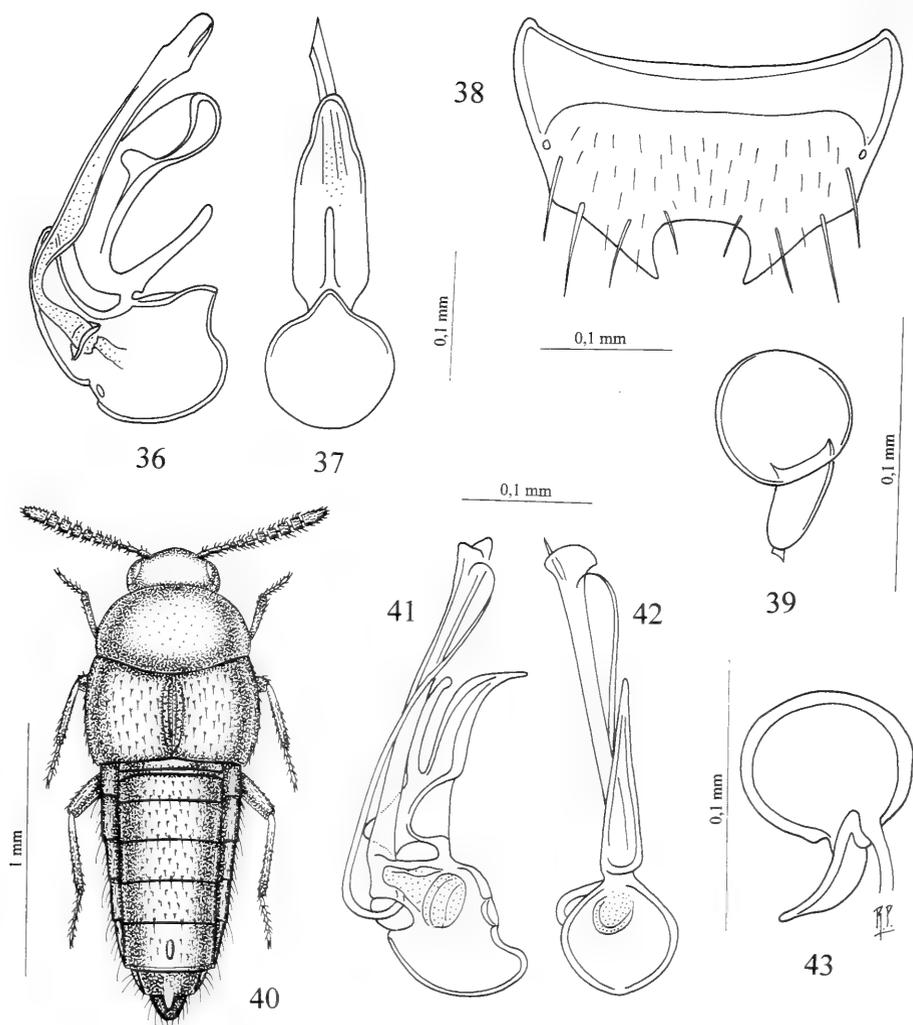
COMPARAZIONI. L'edeago della nuova specie ha struttura simile a quella dell'edeago di *P. varians* Cameron, 1920, di Singapore. Ma mentre l'apice dell'edeago della nuova specie è ricurvo e acutissimo, in visione laterale, quello di *variens* è gibboso e arrotondato. Inoltre il flagello dell'edeago della nuova specie è corto rispetto quello di *variens*.

***Pseudoligota piceoides* sp. n.**

Figg. 45-48

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

DESCRIZIONE. Lungh. 1,5 mm. Corpo lucido e nero-bruno; antenne nero-brune, con i tre antenomeri basali gialli; zampe gialle. Il capo è privo di punteggiatura. La granulosità del pronoto è superficiale, quella delle elitre è distinta. Ciascuna elitra del ♂ presenta tre tubercoli suturali situati tra scutello e angolo posteriore interno. Una



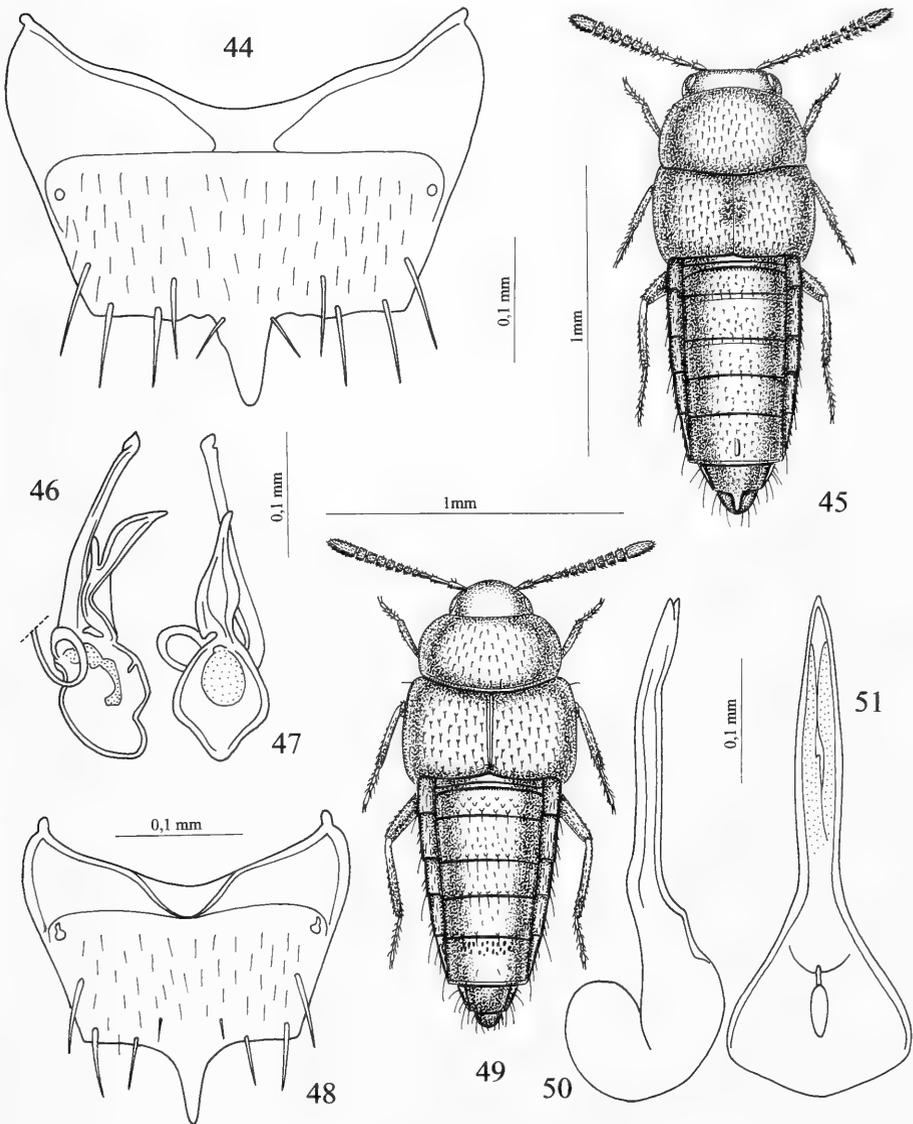
FIGG. 36-43

Edeago in visione laterale e ventrale, sesto urotergo libero della ♀, habitus e spermateca. 36-39: *Pseudoligota burckhardti* sp. n.; 40-43: *Pseudoligota picea* sp. n.

vaga scultura squamiforme s'intravede sugli uroterghi. Il quinto urotergo libero del ♂ ha un tubercolo mediano allungato saliente. Sul corpo non vi è reticolazione. Edeago figg. 46-47 (flagello amputato), sesto urotergo libero del ♂ fig. 48.

ETIMOLOGIA. La nuova specie prende nome di «aspetto di picea» a motivo della sua affinità con *P. picea* sp. n. sopra descritta.

COMPARAZIONI. La nuova specie è simile a *P. picea* n. sp. sopra descritta. Se ne distingue essenzialmente per la brevità dell'appendice preapicale dorsale dell'edeago, che è lunghissima in *picea*.



FIGG. 44-51

Sesto urotergo libero del ♂, habitus ed edeago in visione laterale e ventrale. 44: *Pseudoligota picea* sp. n.; 45-48: *Pseudoligota piceoides* sp. n.; 49-51: *Pseudoligota simplicitalis* sp. n.

***Pseudoligota simplicitalis* sp. n.**

Figg. 49-51

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

DESCRIZIONE. Lungh. 1,6 mm. Corpo lucido e giallo-rossiccio: antenne brune con i tre antenomeri basali e l'apice dell'undicesimo gialli; zampe gialle. La pun-

teggiatura del capo è assente. La granulosità del pronoto è superficiale, quella delle elitre è distinta. Una vaga scultura a squame sta sul primo urotergo libero. La reticolazione del capo e delle elitre è distinta, quella del pronoto e dell'addome è assente. Edeago figg. 50-51.

COMPARAZIONI. Il colore giallo-rossiccio del corpo e la struttura semplice dell'edeago sono i principali caratteri che distinguono la nuova specie da quelle note.

ETIMOLOGIA. «Della semplicità» è il nome della nuova specie a motivo della struttura non complessa dell'edeago.

CHIAVE DELLE SPECIE DEL GENERE *PSEUDOLIGOTA* DEL BORNEO

- | | | |
|---|--|--------------------------------|
| 1 | Corpo unicolore | 2 |
| - | Corpo bicolore | 5 |
| 2 | Corpo giallo-rossiccio; apice dell'undicesimo antennumero giallo.
Lungh. 1,6 mm. Sabah | <i>P. simplicitatis</i> sp. n. |
| - | Corpo bruno o nero-bruno | 3 |
| 3 | Pronoto debolmente trasverso, con rapporto larghezza/lunghezza pari a 1,64; uroterghi privi di scultura squamiforme; quinto urotergo libero del ♂ con tubercolo allungato posteriore saliente; taglia corporea maggiore.
Lungh. 1,5 mm. Sabah | <i>P. piceoides</i> sp. n. |
| - | Pronoto fortemente trasverso, con rapporto larghezza/lunghezza pari a 1,83-1,90; uroterghi con scultura squamiforme; quinto urotergo libero del ♂ senza tubercolo; taglia corporea minore: 1,0-1,1 mm | 4 |
| 4 | Pronoto più trasverso, con rapporto larghezza/lunghezza pari a 1,90; solo il secondo urotergo libero con scultura squamiforme. Lungh. 1,0 mm. Sabah | <i>P. unilobata</i> sp. n. |
| - | Pronoto meno trasverso, con rapporto larghezza/lunghezza pari a 1,83; uroterghi liberi primo e secondo con scultura squamiforme. Lungh. 1,1 mm. Sabah | <i>P. perpusilla</i> sp. n. |
| 5 | Undicesimo antennumero nero-bruno come i precedenti; elitre nere, quelle del ♂ con carena suturale. Lungh. 1,8 mm. Sabah | <i>P. picea</i> sp. n. |
| - | Undicesimo antennumero giallo rossiccio o giallo sporco in contrasto con gli antennumeri precedenti rossicci o giallo-bruni; elitre brune con omeri giallo rossicci o giallo-brune, quelle del ♂ senza carena suturale | 6 |
| 6 | Capo, pronoto, addome e omeri giallo-rossicci; due tubercoli allungati sul quinto urotergo libero del ♂. Lungh. 1,7 mm. Sabah | <i>P. burckhardti</i> sp. n. |
| - | Corpo gialliccio con margine posteriore delle elitre giallo-bruno; quinto urotergo libero del ♂ semplice. Lungh. 1,4 mm. Sabah | <i>P. fustigans</i> sp. n. |

Adelarthra borneensis sp. n.

Figg. 52-56

Holotypus ♂, Sabah, Crocker Range, 1550-1650 m, 16.V.1987, leg. Burckhardt & Löbl (MHNG).

Paratipi: 6 es., stessa provenienza; 1 ♂, Sabah, Crocker Range, 1600 m, 18.V.1987, leg. Burckhardt & Löbl; 2 es., Sabah, Mt. Kinabalu, 1550 m, 28.IV.1987, leg. Burckhardt & Löbl; 1 es., Sabah, Mt. Kinabalu, 1500 m, 25.IV.1987, leg. Burckhardt & Löbl.

DESCRIZIONE. Lungh. 1,6 mm. Corpo lucido, convesso e rossiccio; antenne nere con i tre antennumeri basali gialli; zampe giallo-rossicce; setole lunghe nere con

estremità apicale gialla. La punteggiatura del capo è assente, quella del pronoto è rappresentata da quattro distinti punti. La granulosità delle elitre è rada e saliente. Il capo e il pronoto sono privi di reticolazione. Le elitre presentano una reticolazione trasversa superficiale. Le strie longitudinali degli uroterghi sono profonde. Edeago figg. 53-54, spermateca fig. 55, labio con palpo labiale fig. 56.

ETIMOLOGIA. La nuova specie, ovviamente, prende nome dal Borneo.

COMPARAZIONI. L'edeago della nuova specie è simile a quello di *A. barbara* Cameron, 1920, di Singapore [«nec» *A. barbari* (sic!): Ashe, 1984], ma distinta per avere il lobo ventrale più spostato verso l'apice (spostato verso il bulbo basale in *barbara*). Lo spazio vuoto, tra il bulbo basale e la lama sternale, è subtriangolare nella nuova specie e polilobato in *barbara*.

Adelarthra differens sp. n.

Figg. 57-59

Holotypus ♂, Sabah, E Mt. Kinabalu, 1150 m, rte. Ranau-Kota Kinabalu, 24.V.1987, leg. Burckhardt & Löbl (MHNG).

Paratypi: 1 ♀, Sabah, Crocker Range, 1600 m, Km 51 rte. Kota Kinabalu-Tambunan, 18.V.1987, leg. Burckhardt & Löbl; 1 ♂ e 1 ♀, Sabah, Poring Hot Springs, 500 m, 6.V.1987, leg. Burckhardt & Löbl.

DESCRIZIONE. Lungh. 1,5 mm. Corpo lucido e rossiccio; antenne nere con i tre antennomeri basali gialli; zampe giallo-rossicce. La punteggiatura del capo è assente, quella del pronoto è rappresentata da quattro distinti punti. La granulosità delle elitre è distinta. Il capo e il pronoto sono privi di reticolazione. Le elitre presentano una reticolazione molto superficiale. Le strie longitudinali degli uroterghi sono profonde. Edeago figg. 58-59, spermateca fig. 60.

ETIMOLOGIA. La nuova specie è chiamata «differente» perché simile ad *A. borneensis* sp. n., ma distinta per alcune parti dell'edeago.

COMPARAZIONI. La nuova specie è simile ad *A. borneensis* sp. n. sopra descritta. Se ne distingue essenzialmente per l'armatura interna dell'edeago robusta in *borneensis* e filiforme nella nuova specie.

Adelarthra implicationis sp. n.

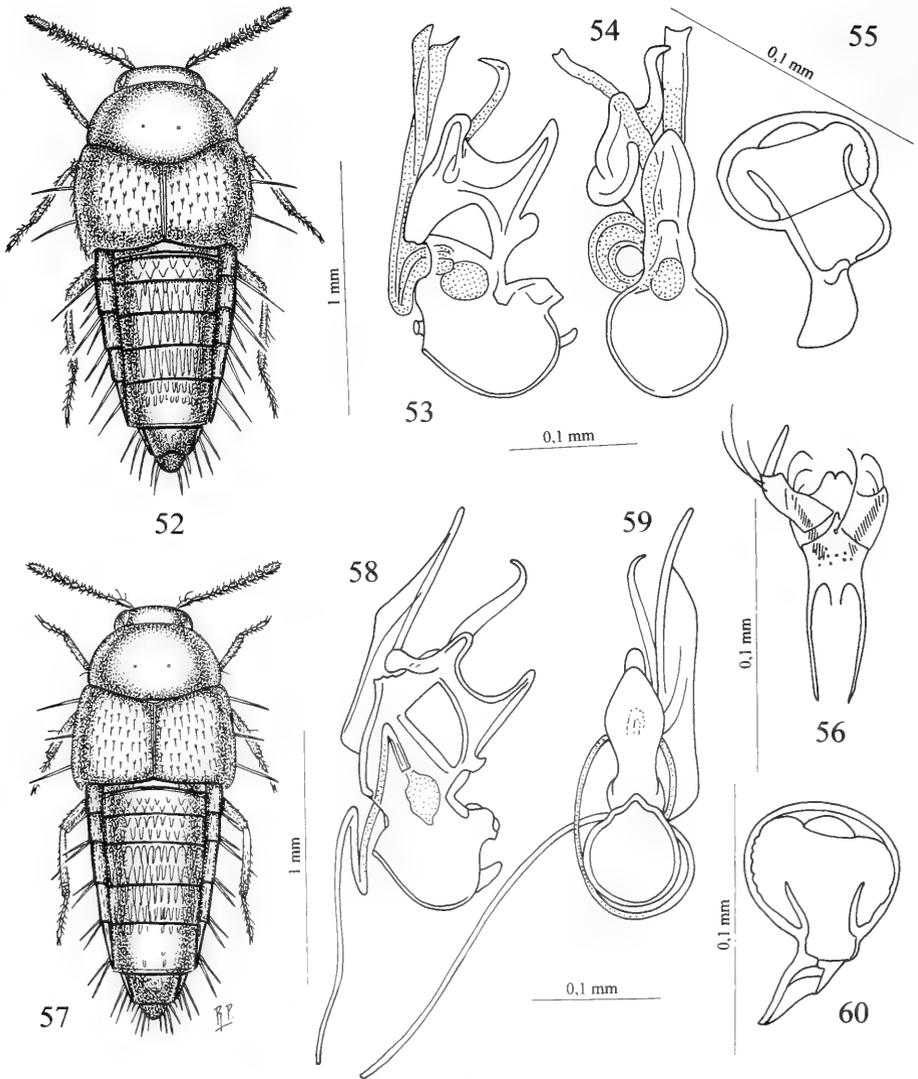
Figg. 61-63

Holotypus ♂, Sabah, Mt. Kinabalu, 1430 m, 22.V.1987, leg. Burckhardt & Löbl (MHNG).

DESCRIZIONE. Lungh. 1,8 mm. Corpo lucido e rossiccio con metà posteriore delle elitre bruna; antenne nero-brune con i tre antennomeri basali gialli; zampe giallo-rossicce con meso-metatibie brune a metà; setole lunghe nere con estremità apicale gialla. La punteggiatura del capo è superficiale, composta di punti ampi. La punteggiatura del pronoto è composta di sei punti isolati. La granulosità delle elitre è trasversa. I due uroterghi basali sono coperti di scultura squamiforme e i due successivi hanno scultura a squame strette e nette. Il capo e il pronoto sono privi di reticolazione. La reticolazione delle elitre è trasversa e superficiale. Su ciascuna elitra del ♂ si trova una bozza periscutellare obliqua e allungata. Edeago figg. 62-63.

ETIMOLOGIA. La forma complessa dell'edeago dà nome alla nuova specie che significa «della complessità».

COMPARAZIONI. L'edeago della nuova specie è nettamente differente da quello di *A. barbara* Cameron, 1920, di Singapore, [«nec» *A. barbari* (sic!): Ashe, 1984], per



FIGG. 52-60

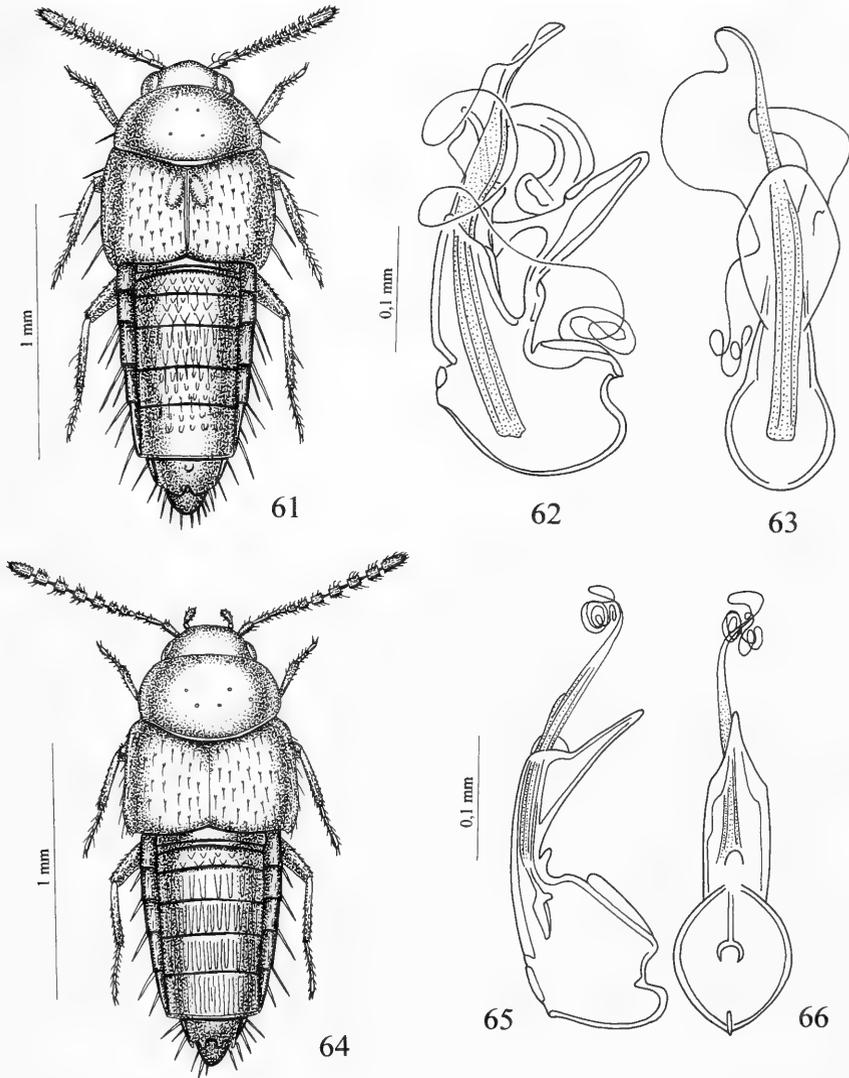
Habitus, edeago in visione laterale e ventrale, spermateca e labio con palpo labiale. 52-56: *Adelarthra borneensis* sp. n.; 57-60: *Adelarthra differens* sp. n.

l'assenza di saliente plica ventrale e per la presenza, nell'edeago della nuova specie, di un lungo flagello filiforme.

***Adelarthra concursiois* sp. n.**

Figg. 64-67

Holotypus ♂, Sabah, Mt. Kinabalu Nat. Pk., HQ 1500 m, 30.IV-8.V.1987, int. trap, leg. A. Smetana (MHNG).



FIGG. 61-66

Habitus ed edeago in visione laterale e ventrale. 61-63: *Adelarthra implicationis* sp. n.; 64-66: *Adelarthra concursiois* sp. n.

DESCRIZIONE. Lungh. 1,6 mm. Corpo lucido e nero-bruno; antenne rossicce con i due antennomeri basali gialli; zampe gialle. La punteggiatura del capo è superficiale, quella del pronoto è composta di dieci punti distinti. La granulosità delle elitre è distinta e rada. La reticolazione del capo è distinta, quella del pronoto è assente e quella delle elitre è trasversa ed estremamente superficiale. Edeago figg. 65-66, sesto urotergo libero del ♂ fig. 67.

ETIMOLOGIA. Il nome della nuova specie significa «della convergenza» in quanto l'edeago presenta un'armatura interna simile a quella di alcune specie del genere *Brachida* e il pronoto ha punteggiatura simile a quello di molte specie del genere *Gyrophaena*, ciò probabilmente per convergenza evolutiva.

COMPARAZIONI. L'edeago della nuova specie, nella sua semplice forma, indica una sua affinità con *A. caligata* Pace, 1990, delle Filippine, piuttosto che ad *A. barbara* Cameron, 1920, di Singapore, («nec» *A. barbari* (sic!): Ashe, 1984), che presenta edeago a struttura complessa. Le due specie si distinguono con la seguente chiave.

- 1 Corpo pluricolorato, con un triangolo giallo-rossiccio sulle elitre nere; meso-metatibie nere; edeago privo di plica ventrale e con parte preapicale strettissima, sia in visione laterale, sia ventrale. Lungh. 1,9 mm. Filippine *A. caligata* Pace
 - Corpo monocoloro nero-bruno; zampe gialle; edeago con plica ventrale e parte preapicale larga, sia in visione laterale, sia ventrale. Lungh. 1,9 mm. Sabah *A. concursionis* sp. n.

***Adelarthra fulva* sp. n.**

Figg. 68-69

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

Paratypus: 1 ♀, stessa provenienza.

DESCRIZIONE. Lungh. 1,3 mm. Corpo lucido e giallo-rossiccio, con capo e uriti liberi secondo, terzo e quarto rossicci; base delle antenne (parzialmente perdute) gialla; zampe gialle. La punteggiatura del capo è assente, quella del pronoto è composta di sei punti evidenti. La granulosità delle elitre è saliente. Nell'olotipo si trova una piccola bozza solo sull'elitra sinistra. Assente è la reticolazione. Spermateca fig. 69.

ETIMOLOGIA. Il nome della nuova specie si riferisce al colore giallo-rossiccio del corpo.

COMPARAZIONI. Il colore prevalente giallo-rossiccio del corpo della nuova specie, la distingue da *A. barbara* Cameron, 1920, di Singapore, [«nec» *A. barbari* (sic!): Ashe, 1984], che ha solo la base dell'addome giallo-rossiccia, da *A. caligata* Pace, 1990, delle Filippine, che ha elitre nere con triangolo giallo-rossiccio e dalle altre specie qui descritte che non presentano il corpo di simile colore, tranne *A. pallida* n. sp., sotto descritta, che presenta forma del pronoto e della spermateca differenti.

***Adelarthra pallida* sp. n.**

Figg. 70-71

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

DESCRIZIONE. Lungh. 1,3 mm. Corpo lucido e giallo-rossiccio, con disco delle elitre bruniccio; antenne brune con i tre antennomeri basali gialli; zampe gialle. La punteggiatura del capo è assente, quella del pronoto è composta di sei punti evidenti. La granulosità delle elitre è saliente. La reticolazione è presente solo sulle elitre dove è distinta. Spermateca fig. 71.

ETIMOLOGIA. Il nome della nuova specie deriva dal colore del suo corpo.

COMPARAZIONI. Il colore prevalente giallo-rossiccio del corpo della nuova specie, la distingue da *A. barbara* Cameron, 1920, di Singapore, [«nec» *A. barbari*

(sic!): Ashe, 1984], che ha solo la base dell'addome giallo-rossiccio, da *A. caligata* Pace, 1990, delle Filippine, che ha elitre nere con triangolo giallo-rossiccio e dalle altre specie qui descritte che non presentano il corpo di simile colore, tranne *A. fulva* n. sp., sopra descritta, che presenta forma del pronoto e della spermateca differenti.

***Adelarthra burckhardtii* sp. n.**

Figg. 72-74

Holotypus ♀, Sabah, Mt. Kinabalu, 1500 m, 30.V.1987, leg. Burckhardt & Löbl (MHNG).

Paratypus: 1 ♀, Sabah, Mt. Kinabalu Nat. Pk., HQ at Liwagu Rv., 1505 m, 9.VIII.1988, leg. A. Smetana; 1 ♀, Sabah, Mt. Kinabalu Nat. Pk., HQ at Liwagu Rv., 1500 m, 16.V.1987, leg. A. Smetana.

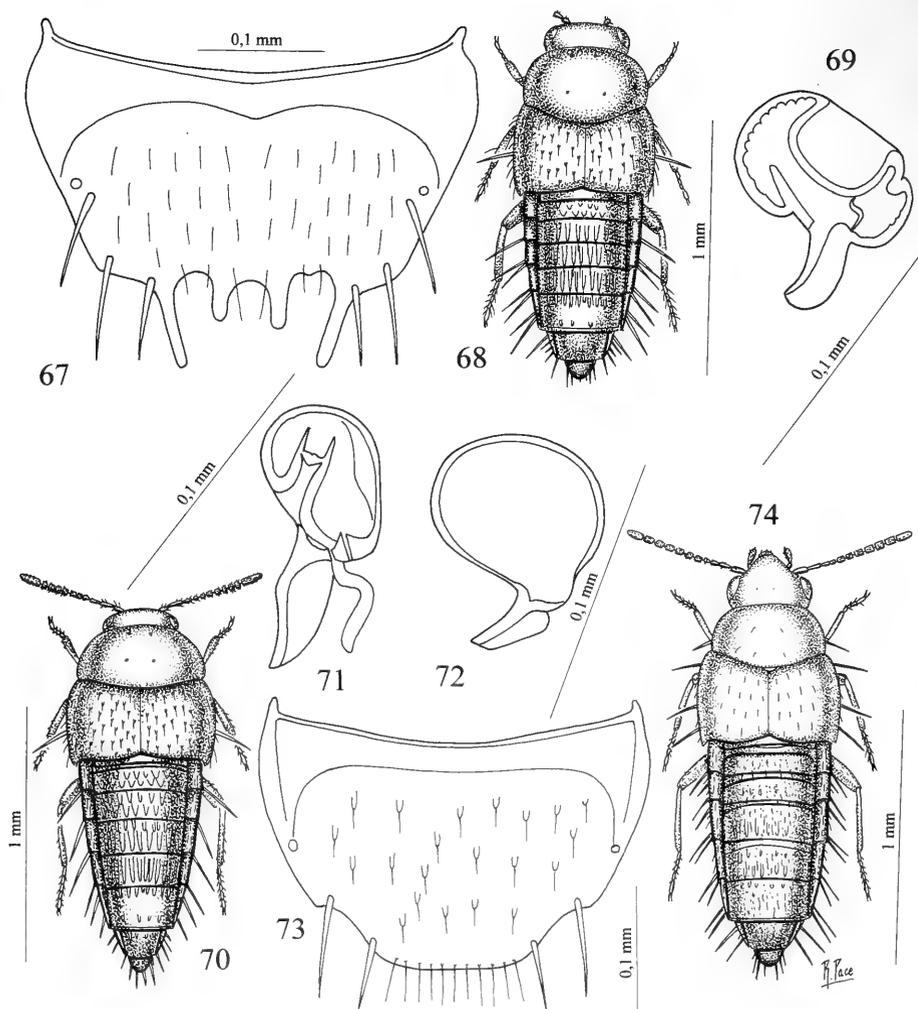
DESCRIZIONE. Lungh. 1,6 mm. Corpo lucido e bruno-rossiccio, con elitre brune; antenne bruno-rossicce con i tre antennomeri basali gialli e undicesimo bruno; zampe giallo-rossicce. La punteggiatura del capo e del pronoto è molto superficiale, quella delle elitre è svanita e irregolarmente distribuita. Gli uroterghi presentano una rugosità longitudinale assai distinta dal terzo urotergo libero all'indietro. La reticolazione del capo e del pronoto è estremamente superficiale, quella delle elitre è composta di maglie trasverse distinte. Spermateca fig. 72, sesto urotergo libero della ♀ fig. 73.

ETIMOLOGIA. La nuova specie è dedicata a uno dei suoi raccoglitori, il dr. Daniel Burckhardt, già del Museo di Storia Naturale di Ginevra.

COMPARAZIONI. Per il colore scuro del corpo la nuova specie è comparabile con *A. concursionis*, nuova specie sopra descritta. Il pronoto della nuova specie è chiaramente ridotto rispetto quello di *A. concursionis* e le strie longitudinali degli uroterghi sono poco impresse nella nuova specie e fortemente in *A. concursionis*.

CHIAVE DELLE SPECIE DEL GENERE *ADELARTHRA* DEL BORNEO

- 1 Corpo giallo-rossiccio, con capo e fascia addominale rossicci. Lungh. 1,3 mm. Sabah *A. fulva* sp. n.
- Corpo diversamente colorato 2
- 2 Decimo antennomero lungo quanto largo 3
- Decimo antennomero trasverso 5
- 3 Corpo bicolore bruno-rossiccio con elitre brune; addome con rugosità longitudinale. Lungh. 1,6 mm. Sabah *A. burckhardtii* sp. n.
- Corpo unicolore rossiccio o nero-bruno; addome con strie longitudinali 4
- 4 Antenne rossicce con base gialla, corpo nero-bruno; pronoto con dieci punti; edeago con struttura semplice. Lungh. 1,6 mm. Sabah *A. concursionis* sp. n.
- Antenne nere con base gialla, corpo rossiccio; pronoto con quattro punti; edeago con struttura complessa. Lungh. 1,5 mm. Sabah . . *A. differens* sp. n.
- 5 Corpo unicolore giallo-rossiccio con macchia discale delle elitre brunniccia. Lungh. 1,3 mm. Sabah *A. pallida* sp. n.
- Corpo diversamente colorato, unicolore rossiccio o rossiccio con metà posteriore delle elitre bruna 6
- 6 Corpo unicolore rossiccio; zampe gialle. Lungh. 1,6 mm. Sabah *A. borneensis* sp. n.
- Corpo bicolore, rossiccio con metà posteriore delle elitre bruna; meso-metatibie nero-brune. Lungh. 1,8 mm. Sabah *A. implicationis* sp. n.



FIGG. 67-74

Sesto urotergo libero del ♂ (67), habitus, spermateca e sesto urotergo libero della ♀ (73). 67: *Adelarthra concursio* sp. n.; 68-69: *Adelarthra fulva* sp. n.; 70-71: *Adelarthra pallida* sp. n.; 72-74: *Adelarthra burckhardtii* sp. n.

RINGRAZIAMENTI

Rivolgo i miei più cordiali ringraziamenti a coloro che mi hanno affidato in studio il raro materiale oggetto del presente lavoro: il Dr Aleš Smetana di Ottawa, e il Dr Ivan Löbl, già del Museo di Storia Naturale di Ginevra. Per il prestito di tipi ringrazio il Dr P. M. Hammond del Museo di Storia Naturale di Londra.

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***Okalia globosa*, a new genus and species of Macronychini from Malaysia (Insecta: Coleoptera: Elmidae)**

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***Okalia globosa*, a new genus and species of Macronychini from Malaysia (Insecta: Coleoptera: Elmidae).** - *Okalia*, a new genus with a new species, *O. globosa* from Pahang (Peninsular Malaysia), is described and illustrated. It inhabits small rivers, preferring limestone gravel covered by a conspicuous film of algae.

Key-words: *Okalia globosa* - new genus - new species - Macronychini - Elmidae - Coleoptera - Malaysia.

INTRODUCTION

The tribe Macronychini currently contains 21 genera described mainly from South-east Asia and eastern Palearctic (Jäch & Boukal, 1995, 1996, 1997a; Jäch & Kodada, 1996a, b, 1997). Only two genera (*Zaitzevia* Champion and *Macronychus* Ph. Müller) occur in Nearctic region (Brown, 1981). No members of this tribe have so far been discovered in Afrotropical, Neotropical and Australian regions.

The elmid fauna of Peninsular Malaysia is not well known, only eight genera with 13 species have been recorded (Jäch, 1993; Jäch & Boukal, 1996, 1997b; Kodada & Čiampor, 2000). The Malaysian Macronychini are represented by three genera: *Macronevia* Jäch & Boukal, *Haraldaria* Jäch & Boukal and *Aulacosolus* Jäch & Boukal.

A short collecting trip of the authors to Peninsular Malaysia revealed several hundred elmids belonging to the following genera: *Ancyronyx* Erichson, *Aesobia* Jäch, *Aulacosolus*, *Dryopomorphus* Hinton, *Graphelmis* Delève, *Graphosolus* Jäch & Kodada, *Grouvellinus* Champion, *Haraldaria*, *Hedyselmis* Hinton, *Leptelmis* Sharp, *Macronevia*, *Ordobrevia* Sanderson, *Podelmis* Hinton, *Potamophilinus* Grouvelle, *Stenemis* Dufour, *Vietelmis* Delève, as well as a few specimens of at least two undescribed genera. One of these genera, belonging to Macronychini, is described below.

MATERIAL AND METHODS

Specimens prepared for morphological study were cleared in hot lactic acid and washed in distilled water. They were then disarticulated and studied under an Amplival microscope as temporary glycerine slides at magnifications up to 600x. Dry prepar-

ations of other specimens were studied under a Wild M3Z stereomicroscope with diffuse lighting at magnifications up to 100x. All drawings were made using a drawing tube. For scanning electron microscopy, specimens were dehydrated in graded ethanol series and air-dried from absolute ethanol, mounted on stubs with Tempfix, sputter coated with gold and then viewed in Jeol 840 A at 10 kv.

Metric characters were measured using a Wild M3Z with ocular grid. The following measurements are presented in the text: AW – anterior pronotal width; EL – elytral length along suture; EW – elytral width, maximum width combined; PL – pronotal length along midline; PW – posterior pronotal width; TL – distance measured from anterior margin of pronotum to elytral apices.

The material examined has been deposited in the following collections: CKB – Ján Kodada collection, Bratislava, Slovakia; NMW – Naturhistorisches Museum, Vienna, Austria; MHNG – Muséum d'histoire naturelle, Genève, Switzerland.

SYSTEMATICS

Okalia gen. n.

TYPE SPECIES: *Okalia globosa* sp. n.

DIAGNOSIS. Small, widely to moderately obovate, strongly convex dorsally; surface scarcely punctate, smooth; dorsal plastron on head, anterolateral portion of pronotum and on elytra between lateral margin and fifth interval; antenna eight-segmented; labial palpi three-segmented; pronotal median groove absent; sublateral carinae of pronotum short and indistinct; femora moderately expanded; fifth elytral interval granulate nearly entirely, sixth granulate posteriorly, seventh granulate entirely; elytral striae obsolete; elytral apices obliquely truncate; lateral sides of pronotum and elytra serrate; parameres absent; penis abruptly constricted apically, with apex arrowhead-like.

DESCRIPTION. Habitus (Fig. 1). Body form in wingless specimens widely obovate, widest at elytral midlength, lacking shoulders; in winged specimens elytra subparallel-sided with shoulders prominent (Fig. 17). Plastron structures on: clypeus, frons, area posteriad of eyes, anterolateral portion of pronotum, hypomera, lateral portions of prosternum, mesepisterna, metepisterna, lateral portion of metaventrite, epipleura, lateral portion of ventrites, elytra between margin and fifth interval, anterior face of metacoxae, femora and tibiae.

Head (Figs 2-4) partly retractable, retracted portion reticulated, without plastron structures. Labrum with anterior margin fringed by row of shorter hair-like ventral setae; anterolateral portion with row of longer, erect setae; lateral tormal processes short (Fig. 21). Clypeus about as long as labrum, wider than long; frontoclypeal suture distinct, arcuate; surface finely punctate, punctures setigerous, setae adpressed. Frons with scattered small granules and setigerous punctures; eyes small, feebly protuberant from dorsal view, ellipsoidal from lateral view, longer than wide, with slightly more than 60 facets. Subantennal groove very shallow, present near anteroventral portion of eye. Antenna (Fig. 26) short, reaching posterior margin of eye, eight-segmented, capitate, with terminal segment forming abrupt club; scape short; pedicel longer, enlarged distally, with a few hair-like setae; segment 3 shorter than pedicel; segments 4-7 short,

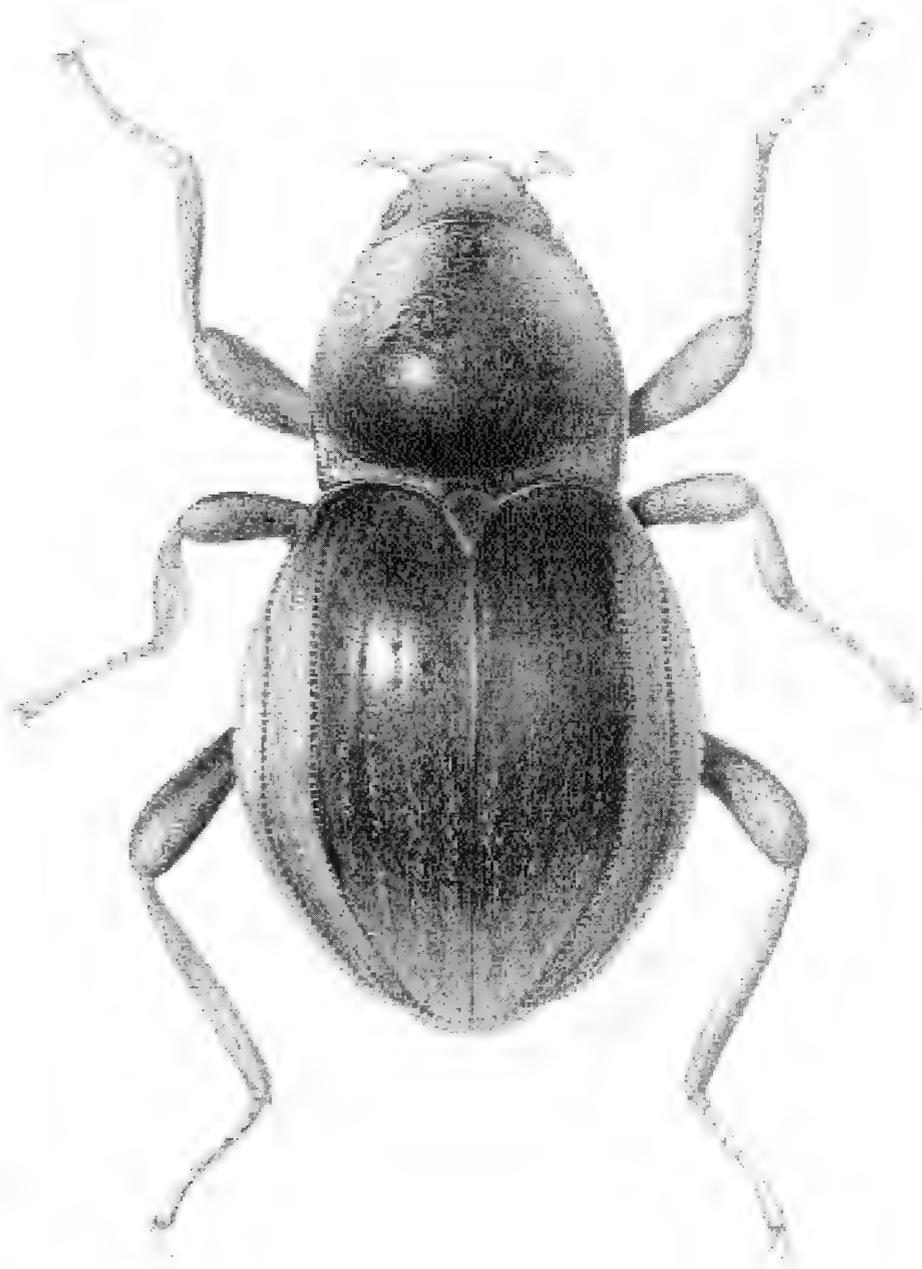
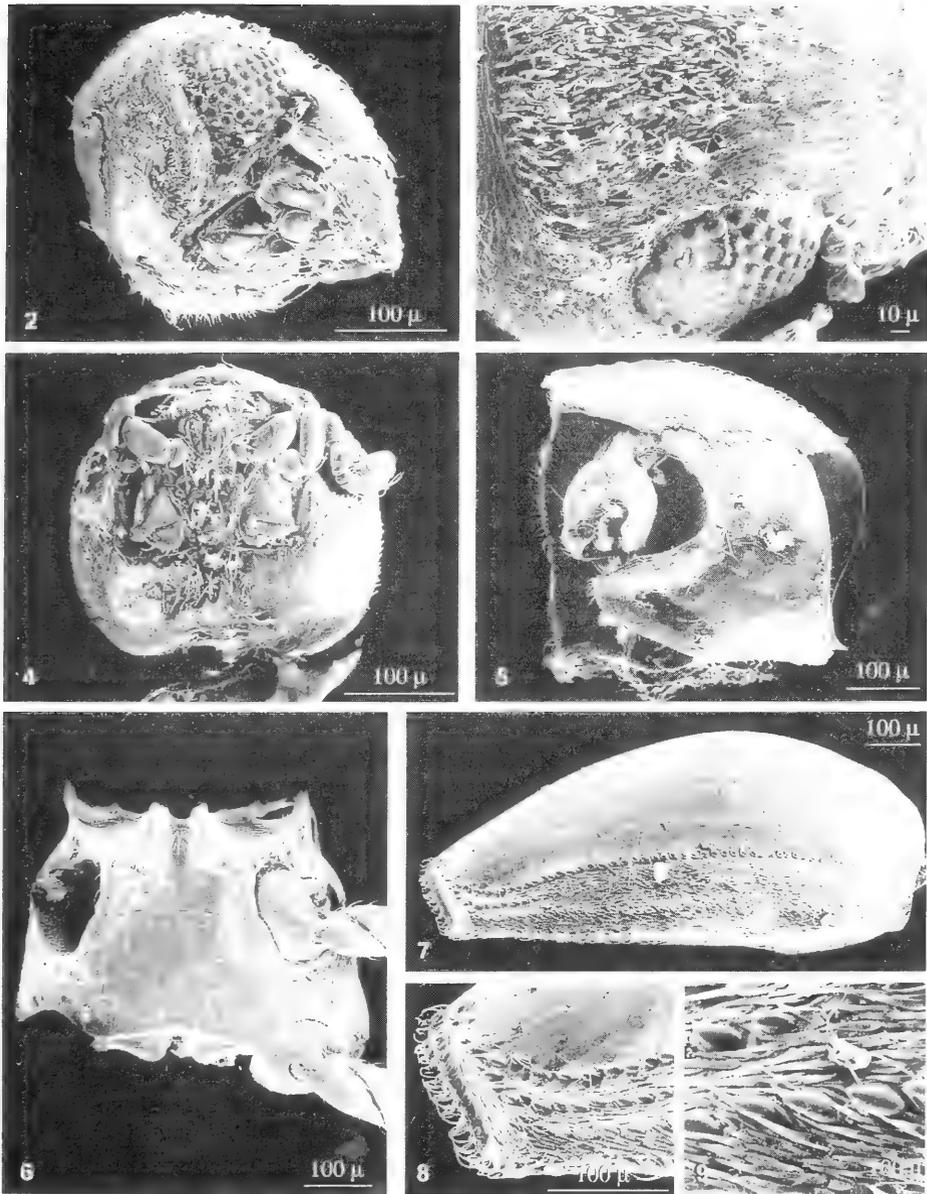


FIG. 1
Habitus of *Okalia globosa* sp. n.

wider than long; segment 8 nearly as long as combined length of five preceding segments, enlarged, with numerous setae. Mandibles (Figs 22, 23) short and wide, moderately asymmetrical each other; lateral lobe present, setose; outer outline strongly excised at apical third; apices tridentate; prosthema hyaline, with row of stronger setae mesally and with scattered thin setae apically. Maxilla (Fig. 25): exposed portion of cardo short and wide, with a few hair-like setae; stipes shorter than cardo, trapezoidal, with few setae laterally; palpifer long and narrow, with longer setae near insertion of palpus; lacinia about twice as long as wide, feebly setose ventrally, with transverse rows of dense, apically curved setae on apical portion and with moderately long setae on dorsolateral portion; galea two-segmented, proximal segment long and narrow, distal segment wider apically, flattened, with row of setae; maxillary palpus four-segmented, terminal segment longest with sensory field apically and with a few setae laterally. Labium (Fig. 24): mentum about twice as wide as long, setose, dorsal apodemes long and fused distally; palpifers fused mesally; palpus short, three-segmented, basal segment extremely short, terminal segment about as long as ligula, with sensory field apically; ligula wide, more strongly sclerotized posteriorly, anterior margin arcuate, anterolateral angles narrow and projecting posteriad. Submental region short; obvious gular sutures absent, genae meet at midline.

Thorax. Pronotum slightly wider than long, or as wide as long, widest near posterior fourth; disc convex, punctate, punctures with moderately long semi-erect setae; sublateral carinae very thin, indistinct; median groove absent; prebasal pits shallow, weakly impressed; anterior margin translucent, moderately arcuate; anterior angles acute, strongly protruding; lateral margin serrate, more strongly along anterior than along posterior half. Hypomerion (Fig. 5) widest near middle, separated by a gap from prosternum anteriorly, postcoxal projection absent. Prosternum in front of coxae about half as long as length of protibia, feebly deflected anteriorly; prosternal process subtriangular, narrowed posteriorly, apex nearly truncate, sides weakly and widely raised. Procoxae globular, separated by width subequal to maximum width of profemur; mesocoxae subglobular, more transverse than procoxae, intercoxal distance twice as those between procoxae; metacoxae about twice as wide as long, reaching elytra, separated each other similarly as mesocoxae; pro- and mesocoxal cavities deep; paired mesoventral procoxal rest deep, strongly oblique. Mesothorax (Fig. 6) short, strongly sclerotized ventrally and dorsally; scutellum small and subtriangular; mesoventrite short, with medial groove deep and narrow; mesepisterna fused with metaventrite; mesepimeron short, strongly sclerotized; mesoventral process with lateral sides raised. Metaventrite moderately longer than mesoventrite, flat on disc; meso-metaventral junction mesally formed by distinct suture; discrimen very fine; transverse suture absent; posterior portion with transverse row of larger punctures; exposed portion of metepisternum long and very narrow; metaventral process wide, with lateral sides raised. Metanotum well sclerotized and divided. Elytra (Figs 7-9) strongly convex dorsally, highest near anterior third (lateral view), obovate in wingless specimens, subparallel-sided in winged specimens (dorsal view); apices more or less obliquely truncate; lateral sides and apices serrate; striae obsolete, their punctures distinctly larger than punctures of intervals; surface with semi-erect moderately long hair-like setae on striae and intervals, and with a few scattered longer and thinner setae on plastron area;

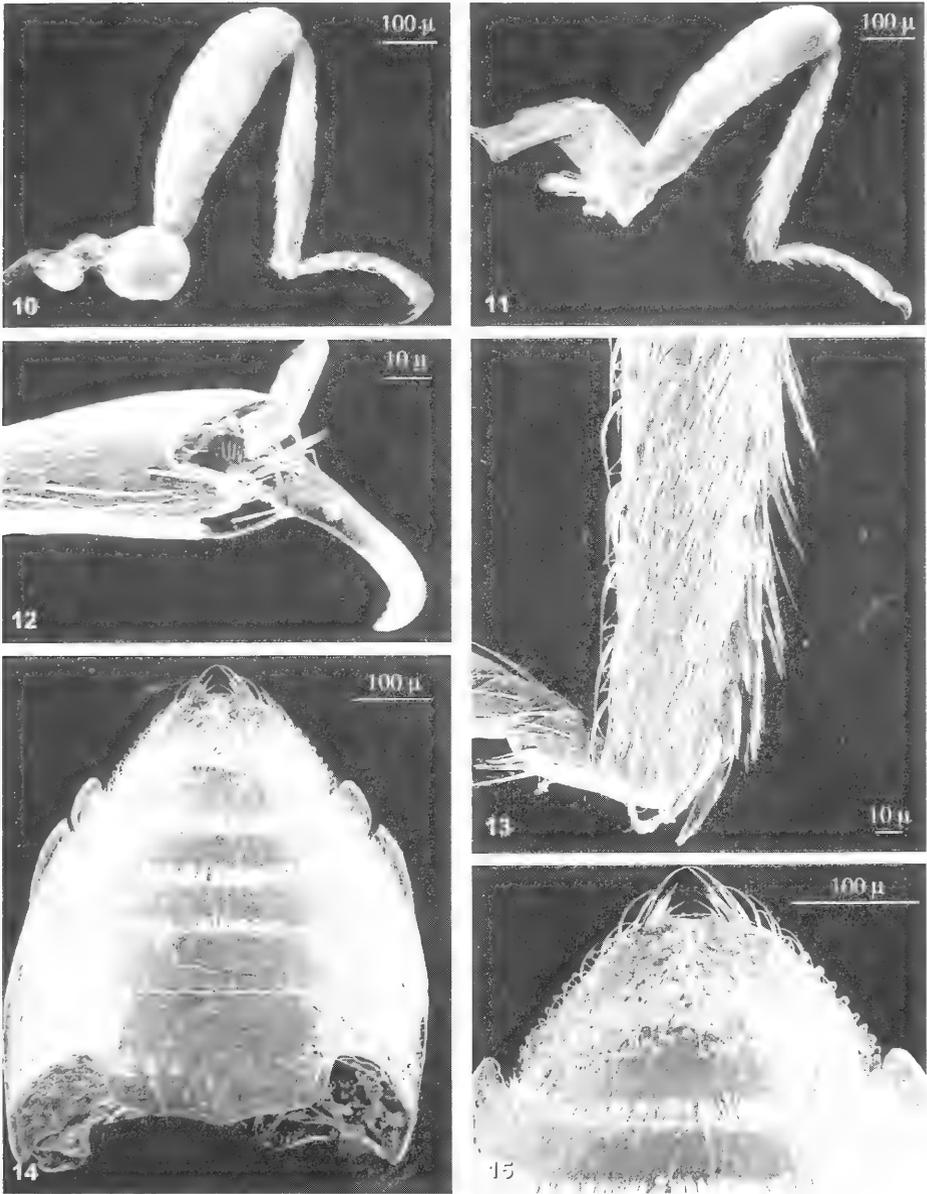


FIGS 2-9

Okalia globosa sp. n., SEM: 2) head, lateral view; 3) head, dorsal view; 4) head, ventral view; 5) prothorax, legs removed, ventrolateral view; 6) meso- and metathorax, legs partly removed, ventral view; 7) elytron, lateral view; 8) elytral apex, dorsolateral view; 9) plastron setae of elytron intermixed with pointed granules, dorsolateral view.

interval 5 with densely spaced granules lengthwise from anterior tenth/third to elytral apex; sixth interval with scattered granules anteriorly and entirely granulate posteriorly; seventh granulate along whole length; shoulders absent in wingless specimens, prominent in winged specimens. Epipleura widest anteriorly, inflected and slightly narrowed at level of metacoxa, concealed by lateral projection of ventrites 3 and 4, effaced at truncated apical portion. Hind wing about 1.3 times as long as TL, weakly pigmented, with strongly reduced venation in medial and anal fields. Legs (Figs 10-11) shorter than elytra and pronotum combined, surface granulate and setose. Femora nearly as long as pronotum, moderately expanded and feebly grooved distally; mesofemur shorter than pro- and metafemur; pro- and mesofemur with dense adpressed, long setae at proximal half on inner face; each femoral attachment of trochanter strongly oblique, base of each femur separated from coxa. Tibiae subequal in length with femora, straight and simple. Protibia (Fig. 18) with dense, long, apically bifid setae lengthwise of distal two thirds on anterior face, and with a few similar setae on posterior face, setae parallel to tibia; row of widely spaced peg-like setae situated ventrolaterally of bifid setae; few peg-like, conspicuous setae near tibial spur; tibial spurs curved, stout; area between spurs with two stout curved peg-like setae. Meso- and metatibia (Fig. 13) with area of bifid setae slightly shorter than on protibia, mesotibial bifid setae on anterior and posterior face, metatibial bifid setae on posterior face only; setae bordered by row of widely spaced, stout peg-like setae ventrolaterally, peg-like setae nearly perpendicular to tibia. Tarsi five segmented (Figs 19-20), moderately shorter than tibia; surface reticulated; terminal tarsomere as long as combined length of preceding segments; segments 1-4 with a few peg-like, stout setae ventrally and with a few hair-like setae laterally and dorsally; terminal segment with hair-like setae only. Claws shorter than half of terminal segments, moderately curved, similar each other in form and angle of inclination; empodium with two short setae (Fig. 12).

Abdomen (Fig. 14) with five ventrites; ventrites strongly sclerotized, moderately convex, separated by sutures; ventrites 1-3 connate; laterosternites of ventrite 1 highest, those of ventrites 2-4 slightly lower, laterosternites of ventrite 5 moderately high on anterior half and gradually effaced posteriad; lateral margins of ventrites 1, 2 simple, of ventrites 3 and 4 projecting, those of ventrite 5 with numerous small projections; abdominal intercoxal process wide and short, with margins flat; admedian carinae of ventrite 1 very fine and short, not reaching posterior margin; ventrite 5 (Fig. 15) with numerous irregularly spaced granules, posterior margin widely rounded to nearly truncate, with two clusters of stronger setae laterally. Spiracles of segments 1-7 in pleural membranes, sixth and seventh very close to laterosternite with terminal portion of trachea strongly expanded. Sternite 8 (Figs 28, 30) in both sexes with median strut long, reaching posterior margin of ventrite 1; tergite 8 (Figs 27, 29) less sclerotized, simple. Segment 9 in male (Fig. 35) forms genital capsule surrounding aedeagus; posterior portion well sclerotized, surrounding phallobasis and basal portion of aedeagus (in extruded position), posterior margin rounded; anterior extension forming strongly asymmetrical median strut; paraprocts narrow, rod-like, asymmetrical. Segment 9 in female forms part of ovipositor, proctiger membranous with two rod-like lateral sclerotizations. Aedeagus (Figs 33-34) strongly sclerotized, nearly as long as abdomen, tubular, without parameres, abruptly constricted apically, apex



FIGS 10-15

Okalia globosa sp. n., SEM: 10) fore leg, anterior face; 11) middle leg, posterior face; 12) terminal tarsomere of middle leg, ventral view; 13) metatibia, anterior face; 14) abdomen, ventral view; 15) abdominal apex, ventral view.

arrowhead-like; ventral sac present at distal portion of aedeagus, lacking corona, with two longitudinal lateral sclerotizations; endophallus with numerous small spinules; phallobasis short, strongly asymmetrical basally. Ovipositor tubular (Fig. 31), subequal in length with combined length of ventrites 3-5; vulva between base of coxites; valvifer strengthened by longitudinal bar-like sclerotization mesally; coxite divided by transverse line ventrally, ventral portion with transverse sclerotizations, apical portion (Fig. 32) strongly produced laterad; stylus short, curved, with apical sensilla. Female internal genital tract*: vagina elongate, simple; bursa copulatrix enlarged, saccular, with sclerotized armature; spermatheca with two branches (Fig. 36).

ETYMOLOGY. Named in honour of our friend, Dr Ilja Okáli from the Slovak National Museum, Bratislava, one of Slovakia's most renowned entomologist, who passed away on October 11, 2002 at the age of 68. The name is of feminine gender.

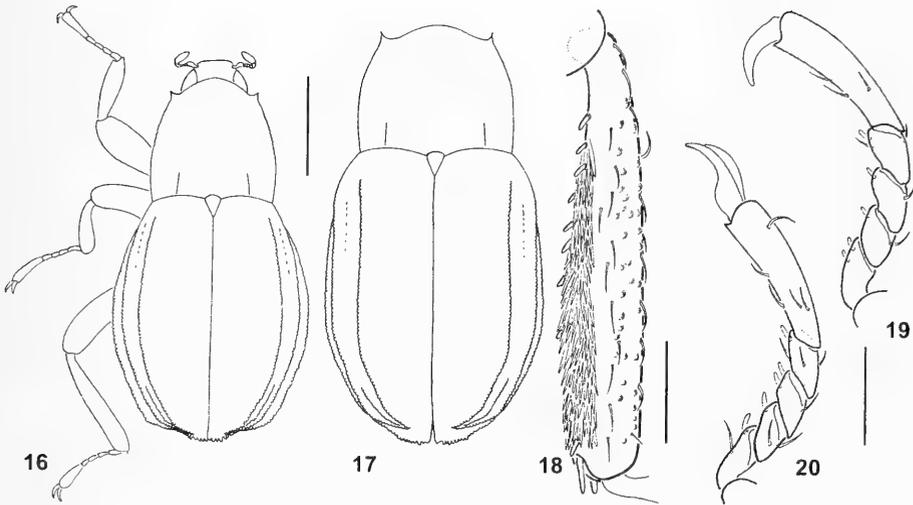
DISTRIBUTION. So far known only from Peninsular Malaysia and Sabah.

COMPARATIVE NOTES. All Macronychini share a reduced number of antennomeres from ten to six, as well as parameres reduced to the different extent. Classification of Macronychini (the tribe contains 21 genera) is not simple and except of number of antennal segment based also on position and extent of plastron, carination or granulation of elytral intervals, segmentation of labial palpi, presence or absence of pronotal grooves and carinae, number of elytral striae, modification of femora, as well as form of genitalia. Hind wings are not used in systematics of Macronychini because of greatly reduced venation and existence of numerous wingless species. Generally, intraspecific wing polymorphism, correlated with subsequent changes of elytral form, is well known in Elminae.

Within Macronychini, 14 genera share eight-segmented antennae. Five of these genera (*Aulacosolus*, *Graphosolus*, *Indosolus* Bollow, *Loxostirus* Jäch & Kodada and *Nesonychus* Jäch & Boukal) possess two-segmented labial palpi. Remaining nine genera (*Cuspidevia* Jäch & Boukal, *Jilanzhunychus* Jäch & Boukal, *Macronevia*, *Okalia*, *Paramacronychus* Nomura, *Rhopalonychus* Jäch & Kodada, *Urumaelmis* Satô, *Zaitzevia* Champion and *Zaitzeviaria* Nomura) bear three-segmented palpi. Within the genera with three-segmented palpi *Okalia*, *Macronevia* and some *Zaitzeviaria* spp. have pronotum without medial pronotal groove (medial groove is more or less deeply impressed in remaining genera). *Okalia* differs from *Macronevia* and *Zaitzeviaria* (among others subtle characters) in elytra being carinate on intervals 5, 6 and 7 and in elytral plastron located between lateral margin and interval 5 (in *Macronevia* elytra carinate on intervals 5 and 6, in *Zaitzeviaria* on intervals 7 and 8, and elytral plastron is between lateral margin and interval 7 in both genera).

From the genera with medial pronotal groove (*Cuspidevia*, *Jilanzhunychus*, *Paramacronychus*, *Rhopalonychus*, *Urumaelmis*, *Zaitzevia* and some *Zaitzeviaria* spp.), *Okalia* is most similar to *Rhopalonychus* in the morphology of aedeagus, obsolete elytral striae and scarcely punctate surface. However, *Okalia* differs from *Rhopa-*

*The description of internal genital tract is based only on dry, cleared females. The preparations for study of spermathecal duct, common oviduct and other possible glandular structures, were not optimal and it is possible that some additional structures are missing in the illustration and description.



Figs 16-20

Okalia globosa sp. n.: 16) outline of wingless specimen, dorsal view; 17) outline of winged specimen, legs and head not illustrated, dorsal view; 18) mesotibia, posterior face; 19) protarsus, lateral view; 20) mesotarsus, lateral view. Scales: 0.5 mm (Figs 16, 17), 0.1 mm (Figs 18-20).

lonychus in: (1) elytral interval 5 granulate nearly entirely, interval 6 granulate posteriorly and interval 7 granulate entirely; (2) elytral plastron between lateral margin and interval 5; (3) pronotum with plastron anterolaterally; (4) pronotum without medial groove; (5) elytral apices obliquely truncate; (6) femora not strongly clavate.

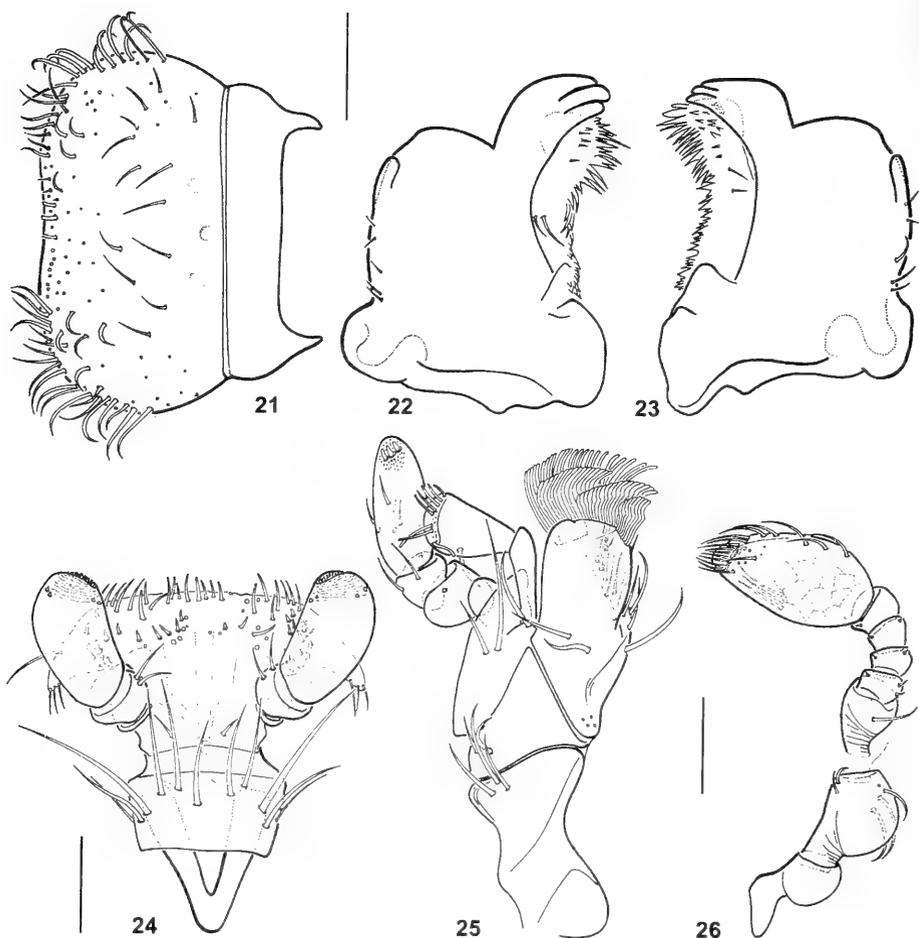
***Okalia globosa* sp. n.**

TYPE LOCALITY: Malaysia, Pahang, Kuala Lipis environment, Kenong Rimba Park, Kesong river. At the collecting site, the river is 7-10 m wide and 0.3-0.9 m deep, slowly flowing through primary forest, with substrate containing sand, gravel, submerged wood and dense macrophytes.

TYPE MATERIAL: Holotype ♂ (NMW): "Malaysia, Pahang, Kuala Lipis env., Kenong Rimba Park, Kesong river, 5. VI. 2001 J. Kodada & F. Ciampor lgt.". Paratypes 4 ♂♂, 4 ♀♀, 2 specimens sex not examined (CKB, NMW, NHMG): with same data as holotype.

DESCRIPTION (of wingless specimens). Habitus (Figs 1, 16). Body form widely obovate, about 1.9 times as long as wide (TL/MW). Length (TL) in ♂♂: 1.30-1.38 mm, in ♀♀: 1.44-1.48 mm; maximum width (EW) ♂♂: 0.72-0.75 mm, in ♀♀: 0.74-0.76 mm. Colour black except for reddish-brown femora and tibiae, tarsi and antennae yellowish.

Head. Labrum about 2.4 times as wide as long; surface scarcely, weakly punctate on anterior half and finely reticulate on posterior half. Frons finely punctate and granulate; granules pointed, widely and irregularly spaced; interocular distance longer than longitudinal diameter of eye; HW in ♂♂ 0.27-0.30 mm, in ♀♀ 0.30-0.31 mm.



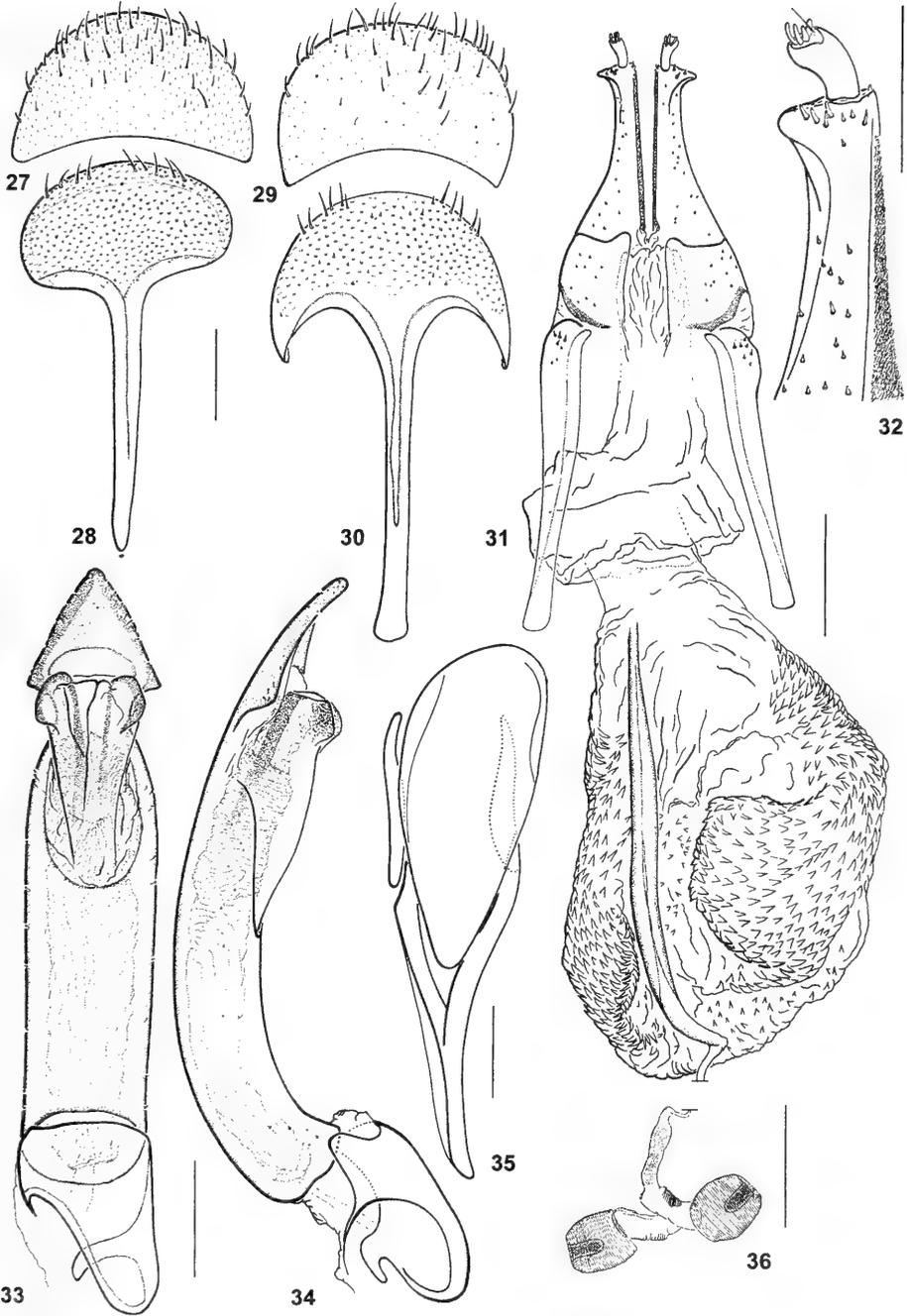
FIGS 21-26

Okalia globosa sp. n.: 21) labrum, dorsal view; 22) left mandible, dorsal view; 23) right mandible, dorsal view; 24) labium, ventral view; 25) right maxilla, ventral view; 26) antenna, ventral view. Scales: 0.05 mm.

Thorax. Pronotum: AW in ♂♂: 0.32-0.33 mm, in ♀♀: 0.33-0.35 mm; PW ♂♂: 0.45-0.48 mm, in ♀♀: 0.46-0.49 mm; PL ♂♂: 0.45-0.46 mm, in ♀♀: 0.45-0.48 mm; disc convex, sparsely and finely punctate, punctures distinctly smaller than facets, interstices glabrous; sublateral carinae very thin, confined to posterior fifth of pronotum;

FIGS 27-36

Okalia globosa sp. n.: 27) male tergite 8, dorsal view; 28) male sternite 8, ventral view; 29) female tergite 8, dorsal view; 30) female sternite 8, ventral view; 31) ovipositor with bursa copulatrix, ventral view; 32) same, apical portion, ventral view; 33) aedeagus, ventral view; 34) same, lateral view; 35) male genital segments, ventral view; 36) spermatheca. Scales: 0.1 mm (Figs 27-31, 33-36), 0.05 mm (Fig. 32).



posterior angles finely rugosely punctate; plastron area nearly triangular, situated on each side of midline, widest anteriorly, not reaching midlength. Elytra obovate, without shoulders, widest near middle, highest near anterior third (Fig. 7); stria punctures fine, but distinctly larger than punctures of intervals, widely spaced; interval 5 lengthwise with densely arranged granules from anterior tenth to apex; EL in ♂: 0.87-0.93 mm, in ♀: 0.97-0.98 mm.

Abdomen. Abdominal intercoxal process (Fig. 14) about 3 times as wide as long; anterior portion with irregular fine longitudinal furrows; posterior portion with a few fine and very sparse punctures. Ventricle 5 with densely arranged granules mainly near middle (Fig. 15). Sternite 8 (Figs 28, 30) with long median strut; tergite 8 simple (Figs 27, 29). Male segment 9 with short asymmetrical median strut, paraprocts narrow, rod-like, asymmetrical (Fig. 35). Aedeagus (Figs 33, 34) about 0.65 mm long, bent more strongly basally than apically (lateral view), abruptly constricted near apex; ventral sac confined to apical half of aedeagus, longitudinal lateral sclerotizations short, not reaching middle; phallobasis about 0.3 times as long as aedeagus. Ovipositor (Figs 31, 32) with valvifer subequal in length to combined length of coxite and stylus. Female internal genital tract (Fig. 36): vagina elongate, without sclerotized structures; bursa copulatrix enlarged, saccular as long as ovipositor, with mesal longitudinal sclerite and numerous short spinules; spermatheca with two branches.

WINGED SPECIMEN. The single winged female is 1.42 mm long (TL) and 0.70 mm wide (EW); it differs from wingless specimens in elytra nearly parallel-sided with shoulders prominent (Fig. 17).

ETYMOLOGY: from Latin *globosus* (globular, spherical); named in reference to globular body shape of wingless specimens.

DISTRIBUTION. So far known only from Peninsular Malaysia.

Okalia sp.

MATERIAL EXAMINED: 1 ♀ (CKB): "Malaysia, Sabah, ca. 25 km Sapulut, Sabalangang river, 21. V. 2001, J.F. Kočiam lgt."

DISCUSSION. The single available specimen from Sabah is a winged female which differs from winged female of *Okalia globosa* in: (1) larger size (TL: 1.58 mm, EW: 0.82 mm); (2) less distinct stria punctures and in (3) interval 5 being granulate from anterior third. As long as males are unknown we refrain from a description.

ACKNOWLEDGEMENTS

Our thanks are also due to Jozef Stankovič (Bratislava) for taking the micrographs, to Manfred A. Jäch (Vienna) and David Boukal (České Budějovice) for comments on the manuscript. This study was partly supported by the Slovak Scientific Grant Agency as a Project No. 1/7196/20 and No. 1/0114/03.

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Comments on *Leptogamasus* Trägardh sensu Juvara-Bals, 1981 with the description of *Leptogamasus* (*Holoperigamasus*) *tabacarui* sp. n. (Acari: Gamasida: Parasitidae)

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Comments on *Leptogamasus* Trägardh sensu Juvara-Bals, 1981 with the description of *Leptogamasus* (*Holoperigamasus*) *tabacarui* sp. n. (Acari: Gamasida: Parasitidae). - A key to the genera *Tomeogamasus* Athias-Henriot, 1971, *Ernogamasus* Athias-Henriot, 1971, *Leptogamasus* Trägardh, 1936 and its subgenera are given. Notation of idiosoma chaetotaxy and adenotaxy after Athias-Henriot (1967) and Lindquist and Evans (1965) are illustrated. *Leptogamasus* (*Holoperigamasus*) *tabacarui* sp. n. from Romania is described and illustrated.

Key-words: Acari - Gamasida - Parasitidae - *Leptogamasus* - key to genera and subgenera - new species.

INTRODUCTION

The genus *Leptogamasus* Trägardh, 1936 includes predatory mites living in leaf litter, upper soil horizons and widely distributed in the Holarctic region. Athias-Henriot (1972) mentioned the importance of some species of the genus *Leptogamasus* as typical inhabitants of forest soil. She presumed that this group also has high value for biogeographically studies and that many new species will be found from eastern and southern Europe.

Unfortunately there are two difficulties in studying Holarctic *Leptogamasus*: the lack of data from many European countries and the confusing generic concept of *Leptogamasus*.

Three subdivisions (=“types d’organisations”) of the genus *Leptogamasus* Trägardh, 1936 based primarily on the presence or absence of some opisthosomal setae, were recognized by Athias-Henriot (1967). In 1971 Athias-Henriot attributed her “types d’organisation” to the following subgenera: “types d’organisation *parvulus* = *Leptogamasus* sensu stricto; ”type d’organisation” *leruthi* = *Ernogamasus* Athias-Henriot, 1971; ”type d’organisation” *falculiger* = *Tomeogamasus* Athias-Henriot, 1971.

In my generic concept (Juvara-Bals, 1981) I followed the subdivisions of Athias-Henriot (1967, 1971) but I considered her former subgenera as genera and divided the genus *Leptogamasus* Trägardh into three subgenera corresponding to the species groups = “sections” already established and characterized by Athias-Henriot (1967) and Juvara-Bals (1981). Diagnoses of these genera and subgenera were given.

Karg (1993) also divided the genus *Leptogamasus* into two subgenera, but his *Valigamasus* Karg, 1993 is a synonym of *Ernogamasus* Athias-Henriot, 1971 as established by Juvara-Bals (2002). In 1981 I mentioned the existence of a new species belonging to the subgenus *Leptogamasus* (*Holoperigamasus*) Juvara-Bals, 1981 but no description was given; this new species *Leptogamasus* (*Holoperigamasus*) *tabacarui* sp. n. is finally described in this paper. A key to the genera and subgenera formerly included in *Leptogamasus* Trägårdh, 1936 is given.

MATERIAL AND METHODS

Mites were sampled from leaf litter and humus layer of beech forest in Romania (Southern Carpathian Mountains). The holotype and paratypes are deposited in the collection of the Muséum d'histoire naturelle, Geneva (MHNG).

Morphological terminology is based on Evans and Till (1979). Concerning the setal notation of the idiosoma, the two systems currently in use are one proposed by Hirschmann (1957), and the other by Lindquist & Evans (1965). The descriptions of *Leptogamasus* by Athias-Henriot (1967, 1972) and by Juvara-Bals (1981) followed the terminology of the idiosoma chaetotaxy as in Athias-Henriot (1967). Karg (1993) followed Hirschmann's system. More recently revisions of Parasitidae by Hyatt (1980), Juvara-Bals (2002), Al-Atawi *et al.* (2002) adopted the notation system of Lindquist & Evans (1965). Presently the latter one is applied to a greater extend in many descriptive studies of gamasid mites. Notational equivalents of both systems are available in Lindquist & Evans (1965) and in Lindquist & Moraza (1998). Notations of gland pore (adenotaxy) and poroids (poroidotaxy) follow those of Johnston & Moraza (1991) and chaetotaxy follows those of Lindquist & Evans (1965) as modified by Lindquist (1994). Both kinds of notation of idionotal systems (chaetotaxy, adenotaxy) are illustrated in figure 1A. Setal notation in parentheses is that used by Athias-Henriot (1967).

RESULTS

KEY TO GENERA

This key to the genera *Tomeogamasus* Athias-Henriot, 1971, *Ernogamasus* Athias-Henriot, 1971 and *Leptogamasus* Trägårdh, 1936 is based on the published diagnoses of genera and subgenera (Athias-Henriot 1967, 1971; Juvara-Bals, 1981) that were previously included in *Leptogamasus* Trägårdh 1936 *sensu* Athias-Henriot, 1971.

- 1 Podonotum with 4 setae lacking i.e. s1(=r2), r2(=r4), z3(=s3), s3(=s4); ventrianal shield with 9 pairs of ventral setae; trochanter of pedipalp with setae v1,v2 inserted at same level; movable digit of chelicera in female multidentate genus *Tomeogamasus* Athias-Henriot, 1971
type species: *Pergamasus falculiger* Berlese, 1906
- Podonotum with 1 or 2 setae lacking, ventrianal shield with 9-10 pairs of ventral setae; trochanter of pedipalp with setae v1, v2 not inserted at the same level; movable digit of chelicera in female with 4 teeth 2

- 2 Podonotum without setae $s_2 (=r_3)$ and $s_3 (=s_4)$; peritremes extending anteriorly to level of setae j_2 ; female with presternal sclerites triangular, contiguous and epigynium with 0-32 pairs of denticles; male with armature of leg II of different types: with simple, triangular spurs or differently shaped apophyses genus *Ernogamasus* Athias-Henriot, 1971
type species: *Pergamasus leruthi* Cooreman, 1951
- Podonotum with setae $s_2 (=r_3)$ but without seta $s_3 (=s_4)$; peritremes with different length: vestigial or reaching setae j_2 or setae r_2 ; female with presternal sclerites usually not contiguous, triangular, sometimes small sclerotized fragments between them (*L. lionsi*, *L. lossainti* excepted) and with epigynium with 0-2 pairs of denticles; male with armature of leg II simple: one apophysis and axillary process on femur and one spur on genu and another on tibia genus *Leptogamasus* Trägårdh, 1936
type species: *Leptogamasus suecicus* Trägårdh, 1936
- a Peritremes vestigial (Fig.1D), their length not exceeding stigmatal diameter; podonotal adenotaxy without gland pores gdz_5 and gdj_2 ; female endogynium with spherules fused; male with simple spurs on leg II or some species with big apophysis on femur and big spurs on genu and tibia subgenus *Breviperigamasus* Juvara-Bals, 1981
type species: *Leptogamasus semisicatus* (Athias-Henriot, 1967)
- b Peritremes exceeding stigmatal diameter (Fig.1C) or reaching setae r_2 or gland pore gdj_2 (Fig.1B); adenotaxy with gland pores gdz_5 and gdj_2 ; female endogynium with separate spherules or with different shapes of stipula and spherules; male with armature of leg II simple: spurs on genu, tibia and triangular apophysis and axillary process on femur c
- c Peritremes long, apex extending anteriorly to gland pore gdj_2 or poroid idj_1 (Fig. 3C); setae on opisthosoma long, their tips reaching the following setal row; female endogynium with two big spherules subgenus *Holoperigamasus* Juvara-Bals, 1981
type species: *Leptogamasus tintinellus* (Athias-Henriot, 1967)
- d Peritremes short, apex reaching seta $r_5 (=r_7)$ or $s_2 (=r_3)$; setae on opisthosoma short, their tips not reaching the following setal row; female endogynium with spherules and different shaped stipula subgenus *Leptogamasus* sensu stricto
type species: *Leptogamasus suecicus* Trägårdh, 1936

DESCRIPTION OF THE NEW SPECIES

Leptogamasus (Holoperigamasus) tabacaru sp. n.

Type material. ROMANIA: 1 ♀ holotype, 4 ♀, 1 ♂ paratypes, Pausa Valley, tributary to Olt river (district of Râmnicu-Vâlcea), sifting of leaf litter in a beech forest, substratum gneiss, 10.09.1969, leg. I. Tabacaru.

Other material. ROMANIA: 2 ♂, 1 ♀ Cheile Bistritei (district of Râmnicu-Vâlcea), sifting of leaf litter, beech forest, 4.09.1972, leg. I. Juvara-Bals.

Diagnosis

Endogynium of female with two big, oval spherules and with two lateral denticles on inner surface of epigynium; digitus fixus of male with an indentation on mid-dorsal surface.

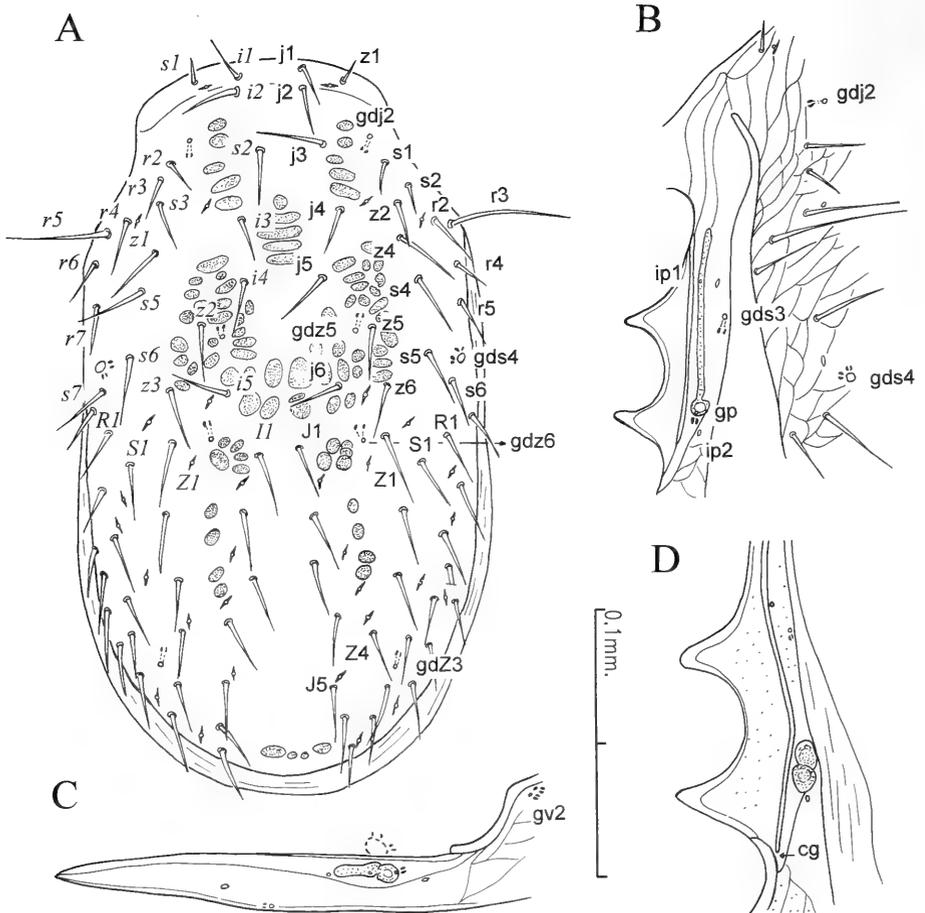


FIG. 1

A - Idiosomal dorsum of female of *Leptogamasus (Leptogamasus) variabilis* Juvara-Bals, 1981 (redrawn and modified from Juvara-Bals, 1981). Setae on the right side are labeled according to Lindquist & Evans (1965) and those of the left side according to Athias-Henriot (1967). Peritremal shield of females: B - *L. (L.) variabilis*; C - *L. (L.) Sp.* (Autriche, no. A104-MHNG); D - *L. (Breviperigamasus) seorosus* Athias-Henriot, 1972.

Description

Female

Idiosoma length 548-574 μm , color yellow-brownish. Podonotum with 20 pairs of setae, their length 53-63 μm , except for $r3 = 87-88 \mu\text{m}$, $s1 = 30 \mu\text{m}$, $s2 = 36 \mu\text{m}$, $z1 = 24 \mu\text{m}$. Opisthonotum with 27 pairs of setae, their length 60-70 μm . Adenotaxy with 5 pairs of gland pores: on podonotum $gdj2 (=gd2)$, $gds4 (=gd4)$, $gdz5 (=gd5)$ and on opisthonotum $gdz6 (=gd6)$, $gdZ3 (=gd8)$. Peritremes extending to seta $s1 (=r2)$, gland pore $gdj2$.

Idiosomal venter. Presternal sclerites triangular, with fine sclerotized lines between them and little sclerotized fragment lateral to them. Sternal shield with poly-

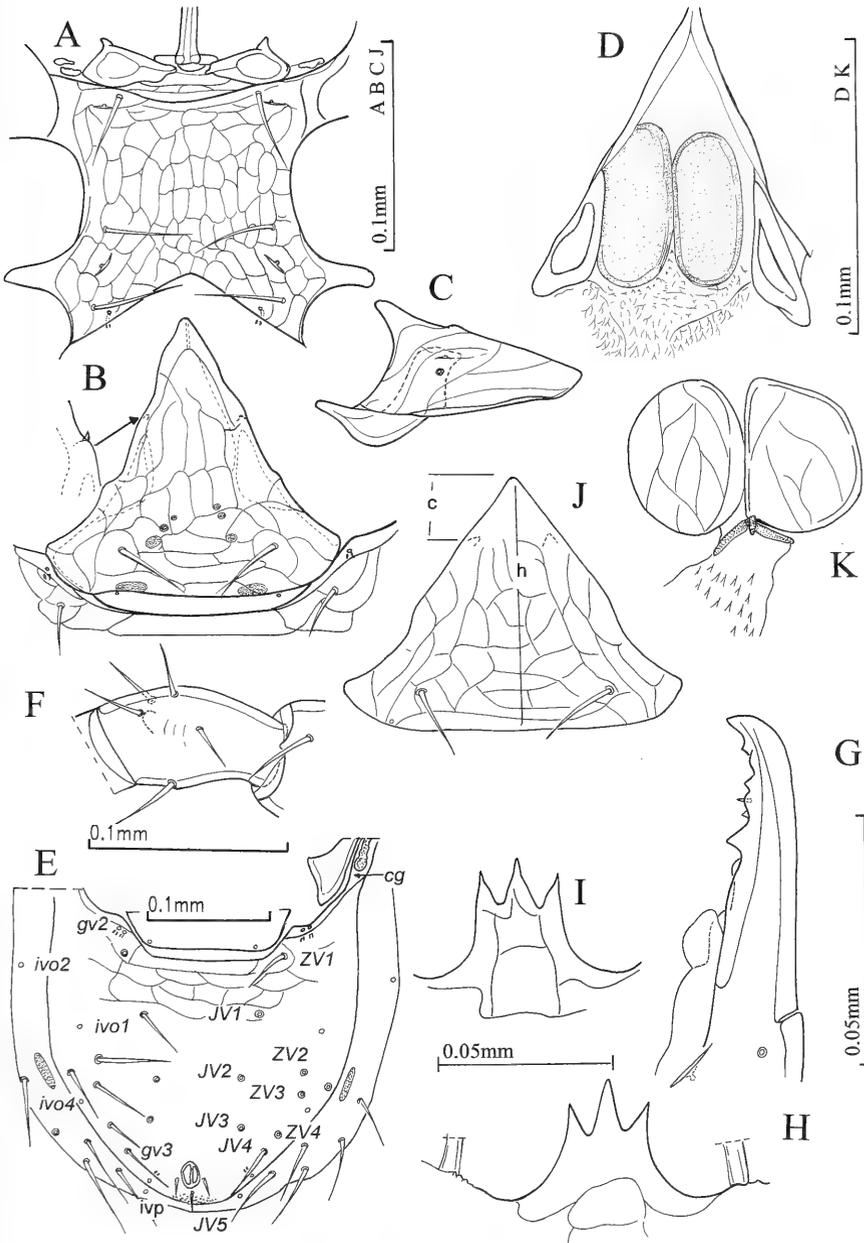


FIG. 2

Leptogamasus (Holoperigamasus) tabacarui sp. n. Female: A - sternal shield; B - epigynum; C - paragynial shield; D - endogynium; E - opisthogastric region, cg = cingulum; F - trochanter IV, ventral view; G - digitus fixus of chelicera, antiaxial view; H - tectum. Male: I - tectum. *Leptogamasus stipulodimissus* Athias-Henriot, 1979: J - epigynum; K - endogynium. Abbreviations: c - distance between top of epigynum and lateral denticles; h - length of epigynum.

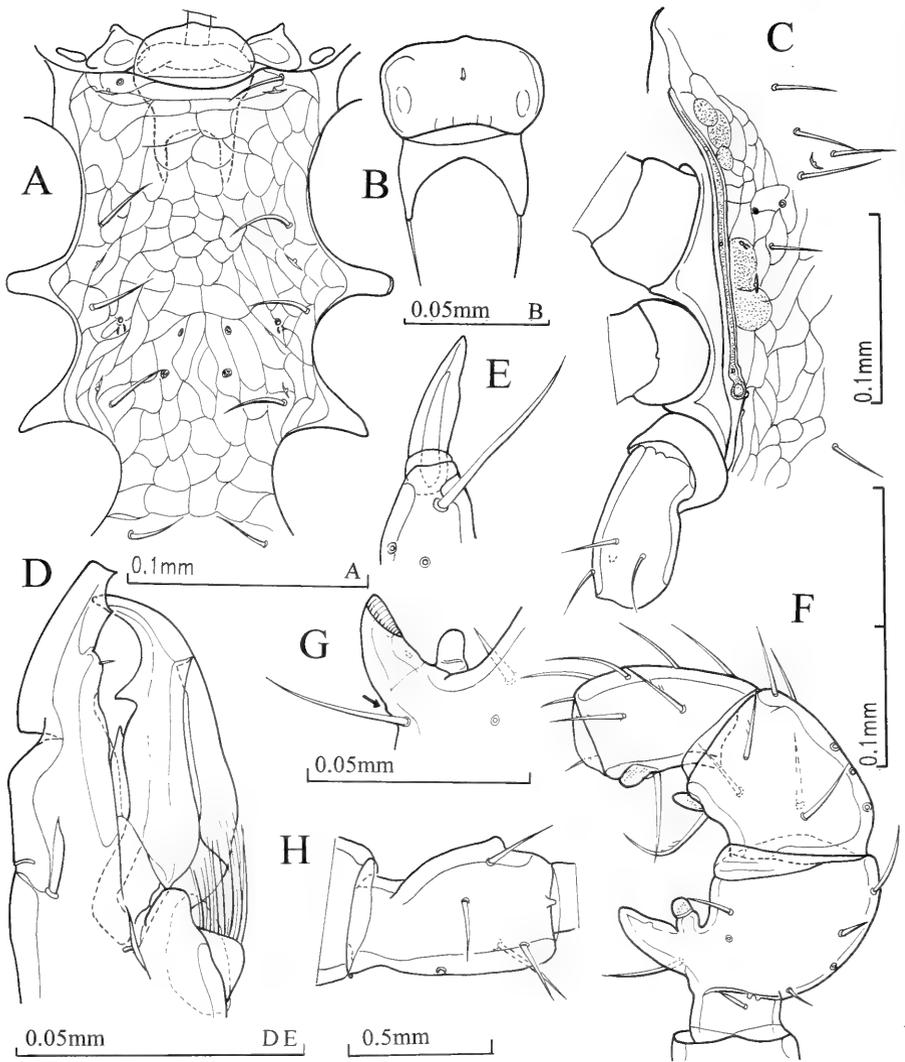


FIG. 3

Leptogamasus (Holoperigamasus) tabacarii sp. n. Male: A - sternogenital shield; B - genital lamina; C - peritrematal region; D - chelicera, antiaxial view; E - corniculus; F - leg II, femur, genu, tibia, posterior view; G - femoral apophysis and basal protuberance (arrow), anterior view; H - trochanter IV, antero-dorsal view.

gonal reticulation, gland pore $gv1$ located behind seta $st3$ (Fig. 2A); length of sternal shield = 82-85 μm ; distance between sternal setae: $st1-st1' = 70 \mu\text{m}$; $st2-st2' = 78-81 \mu\text{m}$; $st3-st3' = 86-90 \mu\text{m}$. Paragnyal shield slightly reticulated, metagnyal sclerite trapezoidal (Fig. 2C). Endogynium (Fig. 2D) sack-like, with two big, oval spherules covered by a membranous flap with denticles. Epigynium (Fig. 2B) triangular, bear-

ing two small lateral denticles on inner surface of its anterior part; distance between top of epigynium and location of lateral denticles (c) = 48-53 μm ; length of epigynium (h) = 134-139 μm , st5-st5' = 72-79 μm . Opisthogastric region (Fig. 2E). Ventrianal shield with 9 (in some specimens with 9/10) pairs of ventral setae, their length from 36 to 60 μm ; ventral setae JV5 and ZV5 inserted on soft cuticule. Setae of marginal series R5-R6 about 66-72 μm . Adenotaxy: gv2 double, gv3 simple. Poroidotaxy: ivo1, ivo2, ivo4, ivp.

Peritrematal shield connected to ventrianal shield by "cingulum" (Fig. 2E-cg); gland pore gds3 and lyrifissure ids3 present. Peritremes groove with two lyrifissures ip1, ip2 and gland pore gp.

Gnathosoma. Tectum triramous, central prong slightly longer than lateral ones (Fig. 2H). Hypognathal groove with 11 denticulate rows, hypostomatic setae simple, palpcoxal seta slightly pilose. Chelicera: digitus mobilis with 4 teeth, digitus fixus with 2 denticles distal to pilus dentilis and with 2 other denticles proximal to it (Fig. 2G).

Legs. Trochanter IV with antero-dorsal tubercle near distal margin (Fig. 2F).

Measurements. Tarsus I = 127-132mm; tarsus IV = 156-168mm; seta pd2 (leg IV) = 87-88mm.

Male

Idiosoma length 505-522 mm. Other characteristics of podonotum and opisthonotum as in female.

Idiosomal venter. Sternogenital shield reticulated (Fig. 3A). Genital lamina rectangular with lateral margin rounded, anterior margin with small protuberance (Fig. 3B). Base of tritosternum fixed to a rectangular, transversally elongate sclerite; pre-sternal sclerites triangular, flanked by small sclerotized fragment. Gland pore gv1 near seta st3. Ventrianal shield with 9 pairs of ventral setae.

Gnathosoma: Tectum with three triangular prongs (Fig. 2I). Corniculus elongated, conical (Fig. 3E). Hypognathal groove with 9 denticulate rows; setae on hypognathum as in female. Palptrochanter with v1 simple and v2 pilose. Chelicera (Fig. 3D): digitus fixus with an indentation in middle of its dorsal surface, with a truncate apex, and its ventral surface with a tooth distal to pilus dentilis; digitus mobilis with one tooth in its distal quarter and with a long spermatotreme reaching mid-distance between tooth and apex.

Legs. Armature of leg II as shown in figure 3F-G. Near base of femoral apophysis small protuberance (Fig. 3G-arrow); apophyses on genu and tibia triangular. Tarsus IV with small protuberance located on antero-dorsal face (Fig. 3H).

Measurements. Tarsus I = 119mm; tarsus IV = 140-144mm.

Etymology

Leptogamasus tabacarui sp.n. is named in honour of my friend and colleague Dr I. Tabacaru (Institute of Speology "E. Racovitza", Bucharest) who has continuously provided material for study.

Discussion

The following species are included in the subgenus *Holoperigamasus*: *L. septimellus* (Athias-Henriot, 1967), *L. tintinellus* (Athias-Henriot, 1967), *L. bicorniger* Witalinski, 1977, *L. stipulodimissus* Athias-Henriot, 1979 and *L. tabacarui* sp. n.

Males of the four known species are separated by the shape of the chelicerae. The male of *L. tabacarui* sp. n. is easily recognized by having the mid-dorsal surface of its digitus fixus indentate (Fig.3D). The females can be distinguished by the presence or absence of denticles on the epigynium and by the shape of the endogynium. *L. tabacarui* sp. n. has two lateral denticles on the inner side of the epigynium and an endogynium formed by two big spherules.

The female of *L. tabacarui* sp. n. resembles the females of *L. stipulodimissus* Athias-Henriot described from Ukraine. The specimen of *L. stipulodimissus* Athias-Henriot found in the Athias collection (paratype-SU62/AH530) differs from *L. tabacarui* sp. n. by a thickening at the base of spherules (Fig. 2K), by the shape of the epigynium, a much sharper protuberance on trochanter IV and the following measurements: epigynium (Fig. 2J): distance $c = 30 \mu\text{m}$, $h = 125 \mu\text{m}$, $st5-st5' = 96 \mu\text{m}$; sternal shield: length = $84 \mu\text{m}$, $st1-st1' = 74 \mu\text{m}$, $st2-st2' = 90 \mu\text{m}$, $st3-st3' = 96 \mu\text{m}$; tarsus I = $144 \mu\text{m}$, tarsus IV = $168-180 \mu\text{m}$.

ACKNOWLEDGEMENTS

I would like to thank E. E. Lindquist (Ottawa, Canada), I. Löbl and P. Schwendinger (Geneva, Switzerland) for their critical comments and helpful suggestions.

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***Astyanax pynandi* sp. n. (Characiformes, Characidae) from the Esteros del Iberá wetland, Argentina**

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***Astyanax pynandi* sp. n. (Characiformes, Characidae) from the Esteros del Iberá wetland, Argentina.**

Astyanax pynandi is described from the Esteros del Iberá, one of the major wetlands in South America. *Astyanax pynandi* bears hooks on all fin rays of males, such as in *A. troya* and *A. ojiara*. *Astyanax pynandi* is distinguished from the remaining species of the genus by the following combination of characters: one maxillary tooth with 5 or 7 cusps; teeth of inner premaxillary row expanded distally; low dentary, bearing 8 teeth decreasing in size anteroposteriorly; 34-37 perforated scales in lateral series; 6-7 upper transverse scales; iii-v, 21-26 anal-fin rays; orbital diameter (36.7-43.5% of HL); postorbital length (37.0-44.7% of HL); and peduncle length (32.3-37.7% of HL). One humeral spot vertically elongated, bounded by a light area, and a second lateral spot faint or well developed.

Key-words: Characiformes - Characidae - *Astyanax* - Esteros del Iberá wetlands.

INTRODUCTION

The Esteros del Iberá is a wetland complex situated between the Paraná and Uruguay rivers in the north-east of Argentina. The Esteros del Iberá spreads about 12,000 km² and are fed exclusively by rainwater. This environment is one of the most important sources of pure water in South America (Neiff, 1997). Since 1983, it is a Provincial Reserve and in January 2002 part of this area was included in the Ramsar List of Wetlands of International Importance (Ramsar, 2003).

The Esteros del Iberá are included in the zoogeographic Brazilian subregion, the richest in South America with about 3,000 fish species (Arratia, 1997). In Argentina, the Brazilian subregion includes about 330 species, many of them restricted to the north and the east of the country (Almirón *et al.*, 1997), i.e., the area where the Esteros del Iberá are situated. Most of characiform fishes inhabiting these wetlands are members of the family Characidae (Casciotta *et al.*, 2003). Within this family, the

genus *Astyanax* is represented only by *Astyanax asuncionensis* Géry, 1972, *A. cf. fasciatus* (Cuvier, 1819), and *A. pynandi* sp. n. described below.

MATERIAL AND METHODS

The specimens examined in this study were cleared and counterstained (C&S) following Taylor & Van Dyke (1985). Measurements are straight distances taken with calliper to the nearest 0.1 mm. Peduncle length is the distance between last branched anal-fin ray and hypural joint. Vertebral counts include Weberian apparatus and CU1+PU1 as one element.

Material is deposited in the Academy of Natural Science of Philadelphia, USA (ANSP); Asociación Ictiológica, La Plata, Argentina (AI); Facultad de Ciencias Naturales y Museo, Universidad Nacional de La Plata, Argentina (MLP); Museo Argentino de Ciencias Naturales Bernardino Rivadavia, Argentina (MACN-Ict); Muséum d'histoire naturelle, Genève, Switzerland (MHNG).

COMPARATIVE MATERIAL (SL in mm)

Astyanax abramis (Jenyns, 1842): MLP 9427, 2 ex., 102.0-113.0 mm, Argentina, Misiones, río Paraná. *Astyanax alburnus* (Hensel, 1870): MLP uncat., 5 ex., 40.5-47.2 mm, Uruguay río Yaguarón. *Astyanax alleni* (Eigenmann & McAttee, 1907): MLP 6774, 5 ex., 50.0-64.2 mm, Argentina, Santa Fe, Laguna Setúbal. *Astyanax asuncionensis* Géry, 1972: MLP 8660, 5 ex., 43.6-61.4 mm, Argentina, Santiago del Estero, Bañado de Añatuya. MLP 8844, 7 ex., 25.0-44.9 mm, Argentina, Formosa, río Bermejo basin, arroyo Mbiguá. *Astyanax eigenmanniorum* (Cope, 1894): ANSP 21627, paratypes, 2 ex., 42.5-49.4 mm, Brasil, Rio Grande do Sul; MLP 9160, 6 ex., 37.3-70.6 mm, Argentina, Buenos Aires, Río de la Plata basin, laguna de Los Talas. MLP 2494, 13 ex., 30.0-53.1 mm, Argentina, Córdoba, río Quinto, Barreto. MLP 5202, 5 ex., 56.5-68.5 mm, Argentina, Córdoba, río Primero frente a Capilla de los Remedios. *Astyanax cf. fasciatus* (Cuvier, 1819): MLP 7115, 1 ex., 47.8 mm, Argentina, Santa Fe, río Paraná basin, San José del Rincón. MLP 8647, 5 ex., 34.0-45.8 mm, Argentina, Santiago del Estero, río Salado. *Astyanax leonidas* Azpelicueta *et al.*, 2002: MLP 9580, holotype, 45.6 mm, Argentina, Misiones, río Paraná basin, headwaters of arroyo Urugua-í. *Astyanax ojiara* Azpelicueta & García, 2000: MLP 9470, holotype, 50.5 mm, Argentina, Misiones, arroyo Benítez. *Astyanax troya* Azpelicueta *et al.*, 2002, MACN-Ict 8310, holotype, 73.8 mm, Argentina, Misiones, arroyo Cuñapirú Chico.

Cleared and stained material (Personal collection of JRC): *Astyanax abramis*: 2 ex., 74.5-92.0 mm, Argentina, Buenos Aires, Río de la Plata in Punta Lara; 2 ex., 80.6-98.8 mm, Argentina, Misiones, río Piray-Mini, 2 ex., 62.4-72.9 mm, Argentina, Corrientes, río Riachuelo. *Astyanax asuncionensis* Géry, 1972: 2 ex., 28.0-37.6 mm, Argentina, Santa Fe, Isla Los Sapos; 2 ex., 80.4-92.7 mm, Argentina, Misiones, río Uruguay in San Isidro. *Astyanax eigenmanniorum*: 2 ex., 17.7-33.0 mm, Argentina, Buenos Aires, desembocadura del río Colorado; 2 ex., 28.0-30.5 mm, Argentina, Buenos Aires, Laguna de Gómez; 1 ex., 60.3 mm, Argentina, Buenos Aires, Río de la Plata; 1 ex., 45.0 mm, Brasil, Rio Grande do Sul, Viamão, açude Charolês. *Astyanax cf. fasciatus*: 2 ex., 91.0-106.5 mm, Argentina, Misiones, río Uruguay in San Isidro. *Astyanax leonidas*: 6 ex., 33.0-45.6 mm, Argentina, Misiones, río Paraná basin, headwaters of arroyo Urugua-í. *Astyanax ojiara*: 10 ex., 37.8-58.0 mm, Argentina, Misiones, arroyo Benítez. *Astyanax troya*: 3 ex., 76.0-81.5 mm, Argentina, Misiones, río Paraná basin, arroyo Cuñapirú chico. *Astyanax paris*: 4 ex., 66.2-68.5 mm, Argentina, Misiones, río Uruguay basin, head-water of arroyo Yabotí Guazú, Arroyo Fortaleza.

RESULTS

Astyanax pynandi sp. n.

Figs 1-7, Tables 1-2

Holotype. MACN-Ict 8543, 52.0 mm SL, Argentina, Corrientes, Esteros del Iberá, Laguna Iberá, Lobo-Cuá (28°32'S-57°12'W), coll. J. Casciotta, J. Bechara, and P. Roux, July 2000.

Paratypes. MHNG 2640.34, 4 ex., 41.1-49.7 mm SL, collected with the holotype. AI 104, 4 ex., 48.9-54.3 mm SL, Argentina, Esteros del Iberá, Laguna Iberá, small canal close to house of park rangers (28°32'S-57°11'W), coll. J. Casciotta and A. Almirón, September 2002. AI 105, 1 ex., 36.2 mm SL, Argentina, Corrientes, Esteros del Iberá, Laguna Paraná-Canal Carambolas (28°15'S-57°26'W) coll. J. Casciotta and A. Almirón, September 2002. AI 106, 3 ex., 35.0-44.6 mm SL, Argentina, Corrientes, Esteros del Iberá, natural channel close to Laguna Sucia or Yacaré (Canal Pirayú, 28°44'S-58°02'W) coll. J. Casciotta, A. Almirón, and J. Bechara, July 2001. AI 115 1 ex., 35.1 mm Argentina, Corrientes, Esteros del Iberá, Laguna Paraná, collected below "embalsado" (28°20'S-57°30'W) coll. J. Casciotta, A. Almirón, and P. Roux, September 2002.

Diagnosis. The species is distinguished by the following combination of characters: one maxillary tooth with 5 or 7 cusps; teeth of inner premaxillary row expanded distally, low dentary bearing 8 teeth decreasing in size anteroposteriorly; males with hooks in all fins: 34-37 perforated scales in lateral series; 6-7 upper transverse scales; iii-v, 21-26 anal-fin rays; orbital diameter 36.7-43.5 (in % of HL); post-orbital length 37.0-44.7 (in % of HL); peduncle length 32.3-37.7 (in % of HL). One humeral spot vertically elongated, bounded by a light area; a second lateral spot may be faint or well developed.

Description. Morphometrics of holotype and paratypes are presented in table 1. Maximum body depth at dorsal-fin origin (Fig. 1). Dorsal profile of body slightly convex on snout, concave over eye and supraoccipital region, gently curved from supraoccipital area to origin of dorsal fin, slanted ventrally from dorsal-fin origin to caudal peduncle, almost curved in some large specimens. Dorsal profile of caudal peduncle scarcely concave; ventral profile concave. Ventral profile of body curved from tip of lower jaw to pelvic-fin origin, straight between pelvic fin and anal-fin origin, and slightly slanted dorsally to caudal peduncle. Body rounded between pectoral and pelvic fins; body laterally compressed between pelvic and anal fins.

Dorsal-fin origin almost equidistant from tip of snout and base of caudal fin. Pelvic-fin origin anterior to vertical through dorsal-fin origin. Adipose fin small, anterior to base of last branched anal-fin rays. Tip of pectoral fin reaching or very close to pelvic-fin origin; tip of pelvic fin not reaching anal-fin origin.

Dorsal fin with ii,8-9 rays (holotype = ii,9); posterior margin of dorsal fin straight, last unbranched and first branched dorsal-fin ray longest. In males, tip of dorsal-fin rays, with very small and slender hooks on first six unbranched rays, one pair on each segment, until 5 pairs on each ray.

Anal fin with iii-v, 21-26 rays (holotype = iii,24). Males with posterior margin almost straight; females with last unbranched and five or six branched rays produced forming a small lobe. Anal fin of males bearing small hooks on last unbranched and sixteen branched rays, directed outward and curved dorsally; one pair of hooks on each segment, until 11 pairs on each ray.

One unbranched and 9 branched principal caudal-fin rays in upper lobe; 8 branched and 1 unbranched principal rays in lower lobe; lower lobe slightly longer. Males, with few very slender hooks occurring on distal tips on middle caudal-fin rays.

Pectoral fin with i,11-13 rays (holotype = i,12). Posterior margin of pectoral fin rounded. Few very small and slender hooks on tips of three or four first branched rays in males.

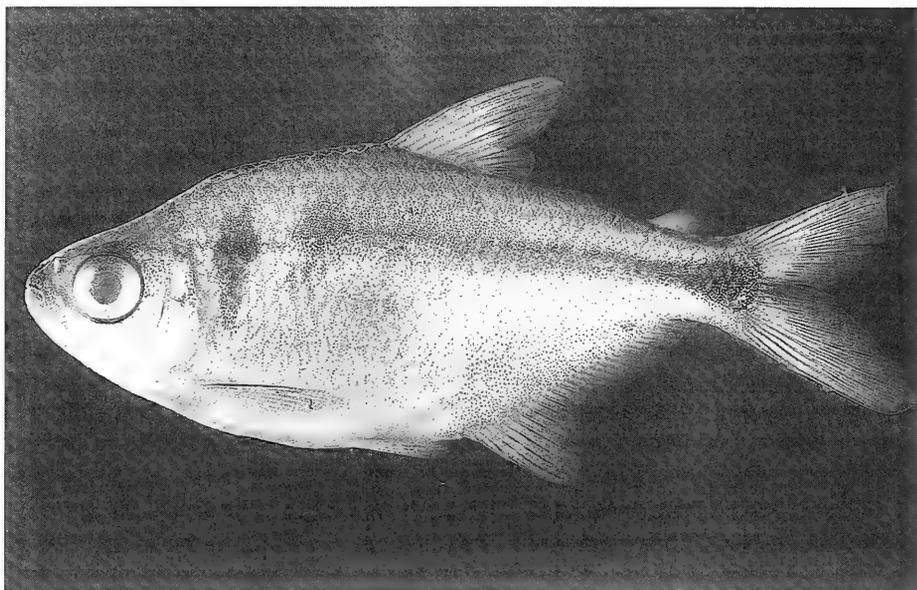


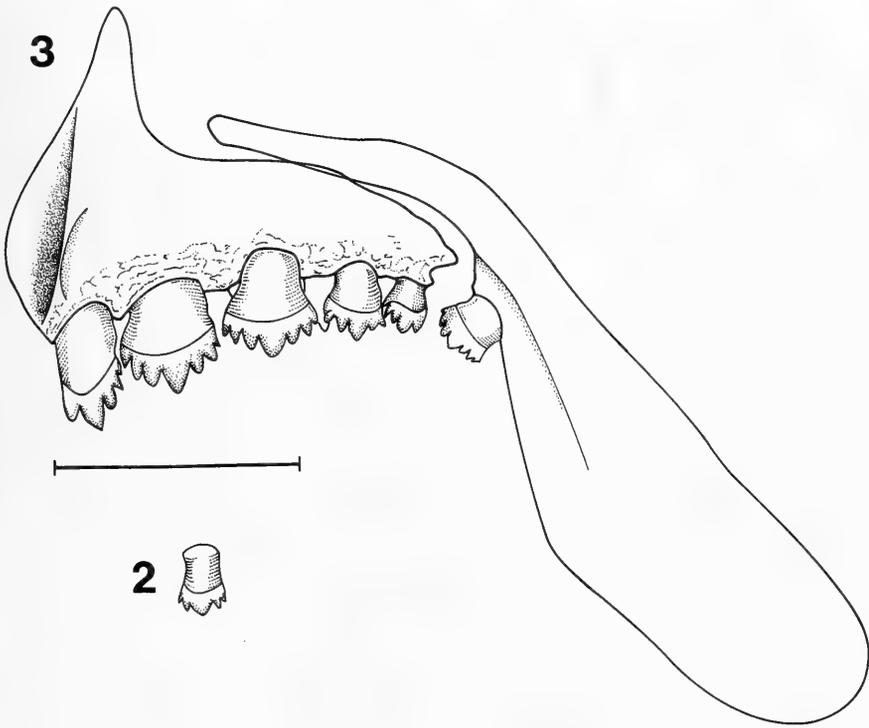
FIG. 1

Astyanax pynandi sp. n., holotype: MACN-Ict 8543, 52.0 mm SL, Argentina, Corrientes, Esteros del Iberá, Laguna Iberá, Lobo-Cuá.

Pelvic fin with i,7 rays, posterior margin of fin slightly rounded. Males with hooks on branched rays. One pair of hooks on each segment, few pairs on each ray, curved dorsally.

Head length less than $1/3$ of SL, mouth terminal, horizontal; snout short. Lower and upper jaws equal in length. Premaxilla with 2 series of teeth, each tooth with a central cusp larger. Outer row with 3 to 4 teeth with 4 to 7 cusps, usually 5 (Fig. 2). Inner series of premaxilla with 5 teeth very expanded distally; symphyseal tooth slender, with 5 cusps; remaining teeth with 5 to 8 cusps (Fig. 3), central cusp scarcely longer than the others. Maxilla with long anterodorsal and laminar processes, the last one surpassing vertical through anterior orbital margin. One maxillary tooth with 5 to 7, usually 7 cusps (10 ex. and holotype); similar in shape to those of inner series of premaxilla (Fig. 3). Dentary low, with 8 teeth decreasing in size anteroposteriorly. Symphyseal tooth and the remaining 4 with 5 or 7 cusps, sixth and seventh teeth with 3 cusps, and eighth tooth unicuspidate (Fig. 4).

Eye large, interorbital area convex. Third infraorbital not reaching sensory tube of preopercle. Lateral series with 34-37 perforated scale (1 ex. = 34, 1 ex. = 35, 10 ex. = 36, 1 ex., holotype = 37); lateral line running on lower half of caudal peduncle. Six or 7 scales between dorsal-fin origin and lateral line; 5 or 6 scales between lateral line and ventral-fin origin. Ten to fourteen scales between supraoccipital process and dorsal-fin origin. Six to thirteen rectangular scales placed on anal-fin base, covering all unbranched and eleven branched anal-fin rays. Scales covering basal fifth of caudal lobes. Pelvic axillary scale without hooks on its posterior area in males.



FIGS 2-3

Astyanax pynandi sp. n.: 2, detail of last tooth of outer premaxillary series in labial view; 3, right upper jaw in lingual view. Scale = 1 mm.

Osteological characters: In one cleared and stained specimen, first arch bearing 17 gill-rakers: 3 on hypobranchial, 1 on cartilage, 9 on ceratobranchial, and 4 on epi-branchial. Vertebral counts: 35 vertebrae (16 precaudal + 19 caudal).

Coloration upon capture: Upper half of body darker, wide lateral band gray ending in a caudal spot, lower half silvery. Basal half of caudal lobes red, middle caudal rays faint gray, caudal fin margin hyaline or black. Base of anal fin red of faint red, and most specimens with anal-fin margin black. Pelvic fin redish near its origin.

Color of alcohol preserved specimens: Background pale brown, dorsal region of flanks and head darker, one dark midline along body on dorsum. Dark humeral spot vertically elongated, bounded by a clear area. Second lateral spot well developed or faint. Deep dark lateral band ending in a caudal spot.

Dorsal fin with black chromatophores on the unbranched rays, dark chromatophores on anterior and posterior margins of branched rays. Dorsal-fin membrane with chromatophores on its distal half. Large black chromatophores on distal margin of anal fin, forming a faint band in some specimens. Middle caudal-fin rays black; remaining caudal-fin rays with dark chromatophores on their margins. Pectoral and pelvic fins hyaline, few chromatophores along ray surfaces.

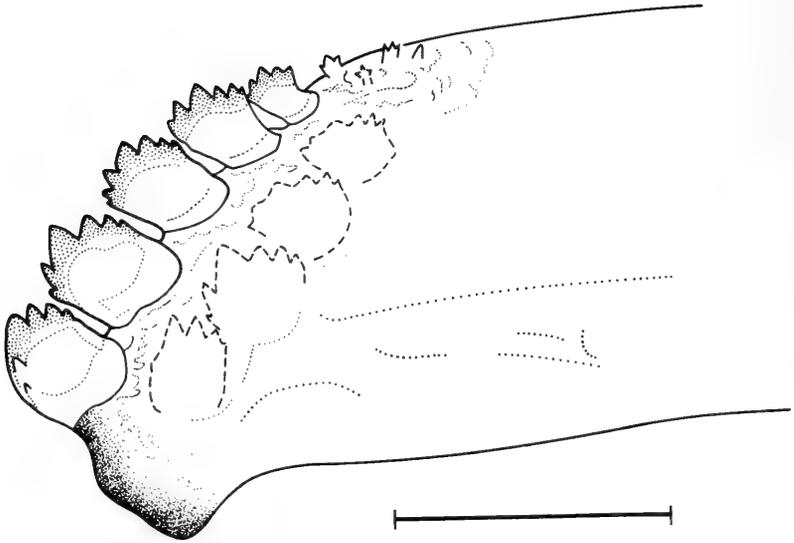


FIG. 4

Astyanax pynandi sp. n., right lower jaw in lingual view. Scale = 1 mm.

Chromatophores completely covering scales surface on upper half of flank, although leaving a marginal light area, forming a reticulate pattern; limit of scales bounded by black minute chromatophores. Scales on lower half of flanks with scattered chromatophores on their surface.

Dorsum of head black, also, premaxilla, dorsal half of maxilla, and middle lower jaw with numerous black chromatophores.

Sexual dimorphism. Males of *Astyanax pynandi* sp. n. have a body depth lower, pelvic fins and the anal-fin base longer, and the distance between pelvic and anal-fin origins shorter than those of females (table 1). Also they bear bony hooks on all fin rays, and have higher number of branched anal-fin rays (23-26 vs. 21-24 in females).

Etymology. The specific epithet *pynandi* is a guaraní word that refers to people without shoes, and was given in honor of the "descalzos" that every day struggle to recover their dignity in an unjust world.

Distribution. *Astyanax pynandi* sp. n. is known from the Laguna Iberá, Laguna Paraná, Canal Carambolas, and Canal Pirayú between Laguna Sucia or Yacaré and río Corriente (Fig. 5).

Habitat. *Astyanax pynandi* sp. n. was collected in littoral areas of both lentic and lotic waterbodies of Esteros del Iberá. Habitats were close to or surrounded by "embalsados", a local name given to thick (1-3 m) peat accumulations originated by incompletely decomposed aquatic plants such as *Typha* sp. and *Cyperus* sp. Masses of this tropical organic soils extend for thousands of kilometers, surrounding large shallow lakes connected by natural channels. "Embalsados" were deposited through thousands of years over sands, which were in turn transported by abandoned branches of the río Paraná.

TABLE 1. Morphometric data of the holotype and 13 other specimens of *Astyanax pynandi* sp. n.; minimum, maximum, and media between parentheses. Standard length expressed in mm.

	holotype	males	females
SL	52.0	35.1-49.7	36.2-54.3
Percents of SL			
Predorsal distance	53.5	51.5 - 55.8 (52.8)	50.8 - 55.2 (53.2)
Preventral distance	48.1	45.7 - 49.9 (47.6)	47.2 - 51.2 (49.3)
Preanal distance	65.4	61.6 - 67.5 (63.5)	65.3 - 69.7 (67.1)
Body depth	42.9	35.4 - 37.8 (36.4)	38.7 - 42.9 (40.3)
Dorsal-fin base	17.1	13.7 - 14.9 (14.5)	13.7 - 17.1 (14.8)
Anal-fin base	32.9	32.1 - 36.0 (33.7)	30.0 - 32.9 (31.6)
Pectoral-fin length	21.3	21.3 - 24.3 (22.5)	20.1 - 22.9 (21.6)
Pelvic-fin length	16.9	17.5 - 18.6 (18.1)	14.9 - 17.3 (15.9)
Distance between pectoral and pelvic-fin origins	22.5	20.0 - 22.8 (21.9)	20.7 - 23.8 (22.4)
Distance between pelvic and anal-fin origins	18.3	16.6 - 18.5 (17.6)	18.3 - 20.6 (19.7)
Head length	28.1	27.8 - 30.8 (28.7)	27.5 - 30.4 (28.8)
Peduncle depth	11.5	10.5 - 12.3 (10.8)	10.6 - 11.5 (11.0)
Percents of HL			
Peduncle length	36.3	32.7 - 34.8 (33.5)	32.3 - 37.7 (35.8)
Snout length	24.7	22.7 - 26.9 (25.2)	23.8 - 26.4 (25.2)
Eye diameter	38.4	39.1 - 43.5 (41.9)	36.7 - 41.7 (38.5)
Interorbital length	32.2	27.7 - 32.6 (30.4)	29.8 - 34.0 (31.5)
Postorbital length	42.5	37.0 - 42.2 (39.5)	39.9 - 44.7 (42.6)
Maxillary length	26.0	23.5 - 27.5 (25.6)	22.8 - 26.0 (24.8)

The main characteristics of the habitats are presented in table 2. In most cases, this species was found in transparent, brown coloured and slightly acidic waters. In addition, conductivity was more frequently below $20 \mu\text{S cm}^{-1}$, alkalinity between 5 and 10 mg l^{-1} , and oxygen saturation between 68 and 95%. Due to the dislodgment of peats, bottoms are muddy and organic, layered over the sand basement that can emerge in some areas.

The only exception to several of these features was the southernmost sampling site (Canal Pirayú, table 2, Fig. 5), close to río Corriente, which is the only superficial outlet of the wetlands. This site is in contact with soils containing higher salt contents, and receiving during summer poorly oxygenated waters from upstream wetlands.

REMARKS

Only two species of *Astyanax* were described having hooks on all fins of males, *A. ojiara* and *A. troya* (Azpelicueta & García, 2000; Azpelicueta *et al.*, 2002). *Astyanax pynandi* is similar to *A. troya* in many morphometric characters. However, *A. pynandi* is differentiated from *A. troya* in having longer anal-fin base (30.0-36.0 vs. 22.9-28.8 % of SL) and a higher number of anal-fin rays (iii-v, 21-26 rays vs. iv-v, 18-21). In addition, *Astyanax pynandi* has one, penta to heptacuspoid, usually heptacuspoid, maxillary tooth vs. one pentacuspoid in *A. troya*.

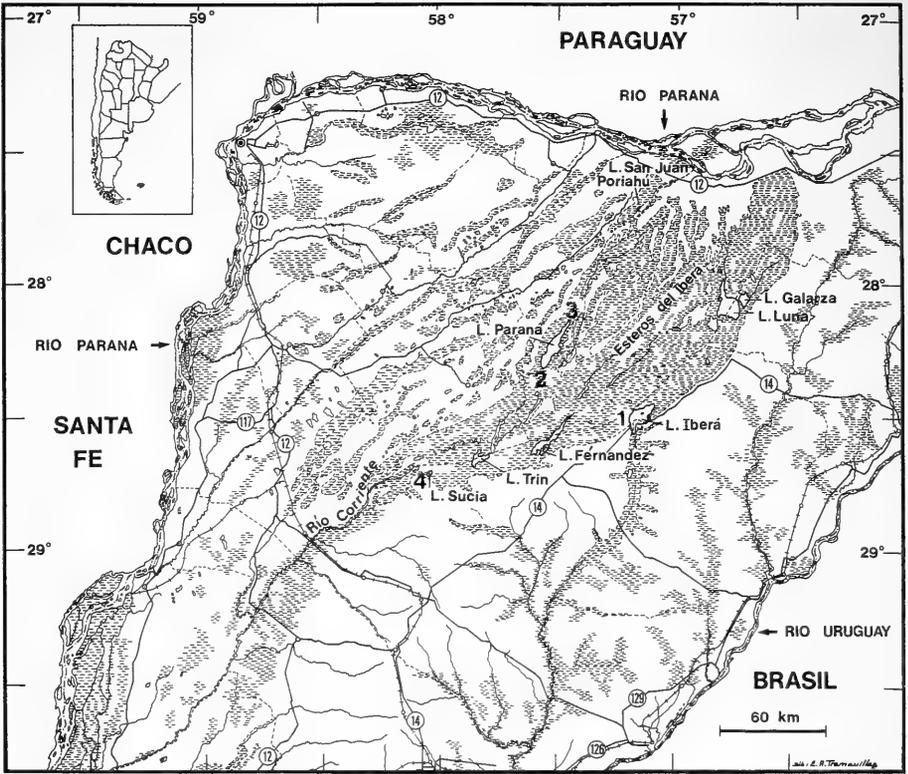


FIG. 5

Geographical distribution of *Astyanax pynandi* sp. n.: 1, Laguna Iberá (Lobo-Cuá and small canal close to the house of park rangers); 2, Laguna Paraná below of “embalsado”; 3, Laguna Paraná-canal Carambolas; 4, Laguna Sucia or Yacaré- canal Pirayu, río Corriente.

Astyanax pynandi is similar to *A. ojiara* in having one heptacuspoid maxillary tooth; also, they share the shape and number of premaxillary and dentary teeth, number of anal-fin rays and many morphometric characters. However *A. pynandi* is distinguished from *A. ojiara* in having lower dentary, less than 50% of lower jaw length (Figs 6-7); absence of hooks on the pelvic axillary scale, eye larger (36.7-43.5 vs. 29.1-37.2% of HL), postorbital shorter (37.0-44.7 vs. 50.0-57.2 % of HL); caudal peduncle length shorter (32.3-37.7 vs. 38.8-56.8% of HL); and greater number of upper transverse scale series (6-7 vs. 5).

Astyanax ojiara was described from the río Uruguay basin whereas *A. troya* comes from the río Paraná basin. *Astyanax pynandi* described herein is the third species with hooks on all fin rays of males and was found in the Esteros del Iberá which are part of the río Paraná basin. The water of the Esteros del Iberá comes exclusively from rainwater and it is only connected with the río Paraná basin through the río Corriente. The fish fauna inhabiting this wetland reaches 126 species and represents more than one third of freshwater fishes known from the Brazilian subregion in Argentina

TAB. 2. Description of some environmental variables of the habitat at the five sampling sites inhabited by *Astyanax pynandi* sp. n.

Sampling sites	Depth (m)	Bottom type	Water Temperature (°C)	pH	Conductivity ($\mu\text{S cm}^{-1}$)	Dissolved Oxygen (mg l^{-1})	D.O. (% saturation)	Secchi disk transparency (m)	Alkalinity (mg l^{-1})
Lentic habitats									
Laguna Iberá. Park rangers area.	0.6-0.9	muddy	24.3	5.8	16.1	6.49	79.0	0.6	7
Laguna Iberá. Lobo-Cuá area.	1.7	muddy	28.8	6.7	15.1	7.8	94.9	0.7	5
Laguna Paraná.	2.0	sandy and muddy	20.4	6.6	17.7	7.49	84.3	>2.0	6
Lotic habitats									
Canal Carambolas	3.5	sandy	21.5	6.4	19.9	6.03	68.2	>3.5	10
Canal Pirayú.	2.1	muddy	31.4	6.3	82.2	1.9	26.6	1.5	30

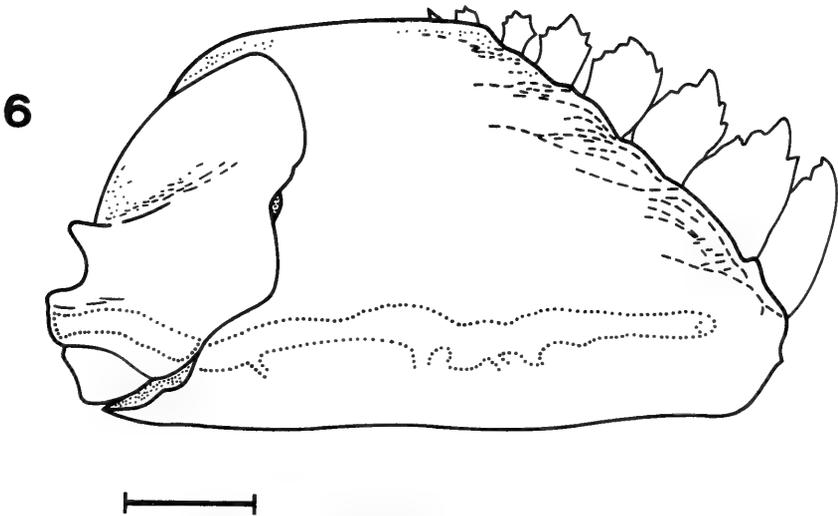


FIG. 6

Lower jaw, right external view, scale = 1 mm: *Astyanax ojiara*.

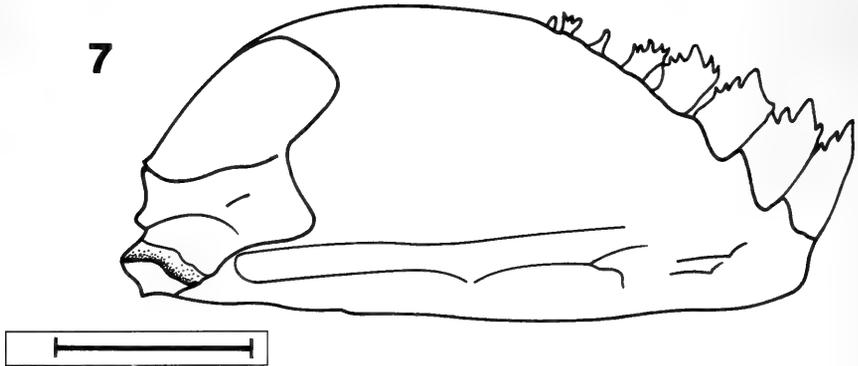


FIG. 7

Lower jaw, right external view, scale = 1 mm: *Astyanax pynandi* sp. n.

(Casciotta *et al.*, 2003). Although all of them are present in other river basins, *Astyanax pynandi* is at the moment the only endemic species in the Esteros del Iberá wetlands. Remarkably, it seems to prefer a distinctive and widespread habitat of these marshlands: the ecotone between “embalsados” and open waters.

ACKNOWLEDGEMENTS

We would like to express our gratitude to the partners of the INICNE (UNNE) and students of Facultad de Ciencias Naturales y Museo (UNLP) by their support in several activities during the field trips and to C. Tremouilles (UNLP) for help with figures. This project was financed by the National Geographic Society (Grant 7314-01) and Universidad Nacional del Nordeste (Grant).

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Predation by larvae of *Sepedon ruficeps* (Diptera: Sciomyzidae) and population dynamics of the adult flies and their freshwater prey

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Predation by larvae of *Sepedon ruficeps* (Diptera: Sciomyzidae) and population dynamics of the adult flies and their freshwater prey.

The biology, phenology, and population dynamics of the adults of *Sepedon ruficeps*, the most widely distributed species of Sciomyzidae in Africa, were studied in Benin in permanent and temporary freshwater habitats. The feeding behavior of the larvae, expressed as the number of snails consumed, varies as a function of the species of prey utilized (*Bulinus forskalii* or *Biomphalaria pfeifferi*), as a function of the sizes of the predator/prey, and as a function of the stages of development of the larvae. In relation to the snail-prey, the second- and third instar- larvae show a food choice varying according to the specific ethology of the prey attacked. In all cases, the third- instar larvae always consume the largest number of snails and indifferently attack all of the species of snails utilized in laboratory rearings. The larvae consume, equally well, *B. forskalii* that are healthy or parasitized by the larvae of trematodes. Curiously, in laboratory rearings, in the absence of snails, the larvae of *S. ruficeps* are equally capable of attacking and developing at the expense of *Aulophorus furcatus*, a small, freshwater, oligochaete annelid (Naididae).

Key-words: Diptera - Sciomyzidae - *Sepedon ruficeps* - predation - phenology - biology - freshwater snails - Oligochaeta.

INTRODUCTION

Since the publication by Berg (1953), Sciomyzid flies have been well known for the obligate malacophagous feeding of their larva. Throughout the world, 517 species have been described, of which 64 are from the Afrotropical Region. In this Region, 49

species are in *Sepedon* Latreille and related genera, for which the keys to the genera, sub-genera, and species given by Verbeke (1950, 1961, 1963) are still useful. Knutson (1980) provided a catalog of the Afrotropical Sciomyzidae, and Miller (1995) presented a revised key to the genera. In regard to 2 monotypic Afrotropical genera known from only 1 or 2 females, Knutson & Vala (1999) described the male of *Tetanoptera leucodactyla* Verbeke and Vala *et al.* (2000b) described the male of *Verbekaria punctipennis* Knutson. The relationships of these genera were discussed in those publications.

With regard to the Sciomyzidae of the Republic of Benin, we have previously recorded the collection and distribution of 8 species, with the description of *Sepedon* (*Mesosepedon*) *knutsoni* (Vala *et al.*, 1994). We also have described the stages of development of *Sepedon* (*Parasepedon*) *trichrooscelis* Speiser, a parasitoid/predator of semi-terrestrial snails of the family Succineidae (Vala *et al.*, 1995). Furthermore, we have provided evidence of the obligate feeding by larvae of *Sepedonella nana* Verbeke on small, freshwater oligochaetes (Vala *et al.*, 2000a). The same observations were obtained with larvae of *Sepedon* (*Mesosepedon*) *knutsoni* (Vala *et al.*, 2002). At present, these two species are the only true sciomyzids known to have strictly non-malacophagous feeding behavior. In the laboratory, the larvae of *Salticella fasciata* Meigen (w. Palearctic Region) have been shown to have a tendency to feed on certain other kinds of invertebrates (Knutson *et al.*, 1970), as well as on their natural host, terrestrial snails (Knutson *et al.*, 1970, Vala, 1989, Coupland & Baker, 1995). In the course of our recent work, (Gbedjissi) has found that occasionally the larvae of *Sepedon* (*Parasepedon*) *ruficeps* Becker are also capable of feeding on the same freshwater oligochaetes as *S. nana* in laboratory rearings.

The biology of Afrotropical Sciomyzidae is very poorly known, with information on only 8 species of *Sepedon*, *Sepedonella nana*, and *Hydromya dorsalis* (Fabricius). In addition to the studies in Benin noted above, there are limited biological data on *S. ruficeps* from Ethiopia (Knutson *et al.*, 1967) and complete life cycles of *S. (P.) trichrooscelis* from Ghana (Knutson, 1999) and of *S. (P.) neavei* Steyskal, *S. (P.) testacea* Loew (Barraclough, 1983) and *S. (P.) scapularis* [Maharaj *et al.*, 1992; Appleton *et al.*, 1993 (including *S. neavei*)] from South Africa. The complete life cycle of *S. (P.) hispanica hispanica* Loew was presented by Knutson *et al.* (1967) from rearings in its limited distribution in Europe (se. Spain), and some data were presented for *S. h. ruhengeriensis* Verbeke from Nigeria by Knutson (1999). *Sepedon knutsoni* Vala *et al.*, and *S. umbrosa* Verbeke have recently been reared through the complete life cycle (Gbedjissi *et al.*, in prep.). The complete life cycle of the Palearctic *Hydromya dorsalis*, which extends into Ethiopia, was reported by Knutson & Berg (1963).

The present study is focussed on various aspects of the biology of *S. ruficeps*, the most widely distributed species of Sciomyzidae in the Afrotropical Region. It is known from Namibia and Botswana to Egypt, and from East Africa (Cape Verde Island, Senegal) through West Africa to the Arabian Peninsula (s. Yemen, Aden). Its altitudinal distribution is very broad, from a few meters above sea level (Cotonou, Benin; present data) to 4,000 m (Virunga, Democratic Republic of the Congo, Verbeke 1963).

In the perspective of attempts to control populations of the snail intermediate hosts of the larvae of trematodes in Benin we have, a) followed the seasonal changes of populations of *S. ruficeps* adults in 2 types of freshwater habitats, b) studied the food choice of the larvae vis-a-vis the autochthonous snails of different species and sizes, and, c) studied the feeding behavior of larvae on healthy snails and on those parasitized by larvae of trematodes. The results are discussed in relation to the meteorological conditions and the variations in populations of the snail prey during the study period.

Our data on *S. ruficeps* corroborate several key aspects of the extensive field and experimental laboratory data on typical, aquatic, predaceous sciomyzid larvae from the Nearctic, Palearctic, and Oriental Regions, and the limited data on other Afrotropical Sciomyzidae. Whereas there is a relative wealth of data on behavior and phenology from outside the Afrotropics, our information on the seasonal abundance of the adult flies and their larval prey, especially in comparing permanently wet and seasonally dry habitats in relation to meteorological conditions, helps to fill a major gap in the knowledge of phenological aspects of tropical Sciomyzidae.

COLLECTING SITES

We investigated 6 freshwater localities in southern Benin during January to December 1996 which we have grouped into 2 types according to the permanent (P) or temporary (T) presence of water (Fig. 1). Three of these stations fit the definition of the permanent freshwater type: P1) Calavi, 15 km north of Cotonou, where captures were made along Nokoué Lake not far from a boat embarkation place. The vegetation, identical to that of the Cotonou locality (P2), is closely limited to cultures of *Thalia geniculata* L. (= *T. welwitchii* Ridl.) (Araceae) (which leaves are used to envelop the local corn food "akassa"); P2) Cotonou, which is a permanent, artificial pond near the Atlantic Ocean, regularly fed by polluted waste-water from the city. The coastal flora is degraded and includes *Ipomoea aquatica* Forsk. (Convolvulaceae), *Paspalum vaginatum* Sw. (Poaceae), *Typha australis* Shum. & Thonn. (Typhaceae), etc.; P3) Porto-Novo, a small, shallow, partly brackish water pond situated at the edge of the brackish lagoon. The site is strongly disturbed, with major production of vegetables requiring permanent, manual irrigation. The vegetation, always luxuriant, is typical of marshy areas having permanent water. Three stations of the temporary freshwater type have been followed: T1) Agnavo, 12 km NNW of Lokossa, an artificial impoundment made by the public works service of Mono Dept. During the rainy season, beside filamentous algae, we found *Ceratophyllum* sp., *Leersia hexandra* Sw. (Lauraceae), *Ludwigia abyssinica* A. Rich. (Loganiaceae), *Nymphaea* sp., etc.; T2) a well-delimited marsh in Cocotomey city, 15 km west of Cotonou. The main vegetation found here is *Ceratophyllum* sp. (Ceratophyllaceae), *Cyperus articulatus* L. (Cyperaceae), *Leersia hexandra* Sw. (Poaceae), *Lemna paucicostata* Hegel (Lemnaceae), *Ludwigia* sp. (= *Jussiaea* sp.) (Onagraceae), *Nymphaea* sp. (Nymphaeaceae), *Pentodon pentandrus* (Shum. & Thonn.) Vatke (Rubiaceae), *Pistia stratiotes* L. (Araceae), *Typha australis*, etc.; T3) Djeffa, 14 km east of Cotonou and 600 m from the Cotonou-Porto-Novo road; the habitat is a temporary pond whose water depth may reach 2 m during flood periods. The flora here consists essentially of *Diplasium sammatii* (Kühn) (Athyriaceae), *Fuirena umbellata* Rottb. (Cyperaceae), *Ipomoea aquatica*, *Ludwigia abyssinica* A.

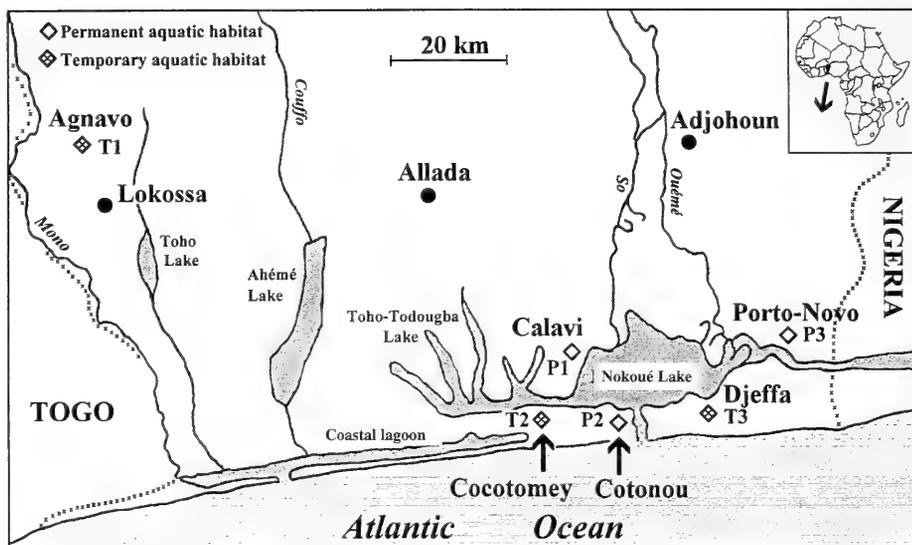


FIG. 1
Geographical distribution of the six studied stations in southern Benin.

Rich (Onagraceae), *Panicum laxum* Sw. (Poaceae), *Paspalum vaginatum*, *Thalia geniculata*, etc.

MATERIAL AND METHODS

Adults were collected from vegetation for 30 minutes every 15 days with a sweep net. In the laboratory adults were reared in plastic boxes (diameter 9 cm, height 11 cm) with a fine mesh aeration window. Inside each box were put wet cotton, a small container for water, and a small cup with honey and manioc flour as food. Experimental conditions were those of the laboratory with natural photoperiod (approximately LD: 12:12), temperature from 25 to 32 C, and relative humidity of 70-85 %.

The rearing containers were examined daily. Eggs laid on the sides of the containers were recovered with the aid of a fine wet brush and placed for incubation on wet filter paper in Petri dishes. On hatching, the young larvae were placed in new Petri dishes with selected snail species. Each day, all of the dead or consumed snails were replaced by others of the same size.

The snails needed for the experiments were collected with a metallic net of 20 cm diameter, having a mesh of 1 mm. The 8-10 collections were made randomly during 30 minutes in a 20 x 2 m area or around the habitats when they were flooded, to accommodate the heterogeneity and variation in density of the snails. In the laboratory, the snails were reared and fed with plant material in order to have available the range of sizes of prey needed. For the predation experiments, the snails were divided into 3 size classes (diameter for planorbids, length for bulinids) : Pc (smallest sizes, < 3 mm), Mc (average sizes, 3-7 mm), and Gc (largest sizes, > 7 mm). Parasitized snails were

identified by isolating each individual in a crystal container, 5 cm high, partly filled with fresh water. The daily observation of containers permitted determination of the eventual emergence of swimming cercariae from the snail host. The emission of cercariae was accelerated by illuminating the containers with a 100 W lamp for 30-60 minutes.

Three aspects of predation by the larvae of *S. ruficeps* were followed: a) the predatory behavior in the presence of only 1 species of snail prey, *Bulinus forskalii* (Ehrenberg) or *Biomphalaria pfeifferi* (Krauss), by placing together 1 larva (first, second, or third instar) and 3 snails of the same size class; b) the food preference vis-a-vis 1 or the other of 2 snail prey by placing together 1 larva of *S. ruficeps*, 3 *B. forskalii*, and 3 *B. pfeifferi* of the same size class; c) the behavior of the larvae as a function of the healthy or parasitized state of *B. forskalii* collected in Cocotomey.

Each experiment, with a minimum of 10 repetitions, was made in small Petri dishes with a water level of 3-5 mm, the water taken from the habitats of the snails. Two observations were made each day, at 9 AM and 3 PM. The statistical analysis of the results was made with the Wilcoxon test with a margin of error of 5 %.

RESULTS

Four species of Sciomyzidae were collected (Table 1). *Sepedon ruficeps* (larvae predatory primarily on freshwater snails) and *Sepedonella nana* (larvae predatory on small, freshwater oligochaetes) were collected at all of the stations. *Sepedon trichroscelis* (larvae parasitoid/predatory on semi-terrestrial, hygrophilous *Succinea* sp.) was absent in the temporary habitats at Djéffa and Cocotomey, but very abundant in the perennial freshwater habitats except at Agnavo. *Sepedon knutsoni*, always collected in small numbers and originally described from Agnavo, is here reported from Cocotomey. Our recent laboratory studies and field observations of *S. knutsoni* show that the feeding behavior and the biology of larvae are similar to the behavior of *Sepedonella nana* larvae.

Concerning the freshwater pulmonate Gastropoda collected, some of which are intermediate hosts of trematodes having veterinary or medical consequences, the predominant are (Table 1): *Bulinus forskalii* (implicated in the transmission of *Schistosoma intercalatum* Fischer, *B. globosus* (Morelet), and *B. truncatus* (Audouin) (intermediate hosts of *S. haematobium* (Bilharz), *Biomphalaria pfeifferi* (intermediate host of *S. mansoni* Sambon), *Lymnaea natalensis* Krauss (intermediate host of cattle liverfluke, *Fasciola gigantica* (Cobbold) in Benin (Schillhorn Van Veen 1980; Assogba & Youssao 2001)) and the Physidae *Aplexa waterloti* (Germain). Among Planorbidae a small species (diameter more than 3 mm) is relatively abundant in some stations. The semi-terrestrial hygrophilous *Succinea* sp., living on emergent freshwater vegetation, frequents specific habitats. Prosobranch (operculate snails) were represented only by *Lanistes* spp. According to the station considered, all of these snails are not sympatric. All snails were identified with Brown & Kristensen's key freshwater snails of West Africa (1993).

TABLE 1. Sciomyzidae and snails found in each freshwater station (data from 1996). +++, very abundant; ++, abundant; +, few; ±, present only from May to September in low numbers.

Taxon	Permanent water			Temporary water		
	Calavi P1	Cotonou P2	Porto Novo P3	Agnavo T1	Cocotomey T2	Djeffa T3
Sciomyzidae						
<i>Sepedon knutsoni</i>				±	±	
<i>Sepedon ruficeps</i>	++	++	++	++	++	++
<i>Sepedon trichrooscelis</i>	+++	+++	++	+		
<i>Sepedonella nana</i>	+	-	+	+++	++	-
Snails						
<i>Biomphalaria pfeifferi</i>		+++				
<i>Bulinus forskalii</i>	++	+	+	++	+++	
<i>Bulinus globosus</i>			+			++
<i>Bulinus truncatus</i>			+			++
<i>Lanistes</i> spp.		+		+	+	
<i>Lanistes varicus</i>	+		+			+
<i>Lymnaea natalensis</i>		+++		+		++
<i>Aplexa waterloti</i>	++	+		++		++
<i>Planorbis</i> sp.	++	++		++	++	
<i>Succinea</i> sp.	-	+	-	-		

A. Meteorological Information

In s. Benin, data collected at the meteorological station at the airport of Cotonou during 1996 (Fig. 2) showed 2 rainfall periods, characteristic of this zone of Africa. The major rainfall period extends usually from April to the beginning of August (> 50 mm) with the maximum precipitation occurring during 3 months (May, 259.6 mm; June, 512.3 mm; and July, 143.8 mm) and the minor rainfall period from September through November with a maximum of 112.8 mm occurring in October. The dry period extends from the end of November to the beginning of March with a near-total absence of rain during December and January. The annual temperature varies very little and presents 2 phases opposite to that of the rainfall. During the course of the heavy rains, the temperature decreases from 29.9 C (March) to 26.1 C (August) but increases from 26.2 C (September) to 29.9 C (March).

B. Development of populations of *Sepedon ruficeps* and of snails

B. 1. POPULATIONS OF *SEPEDON RUFICEPS* IN A TEMPORARY FRESHWATER HABITAT: COCOTOMEY STATION (T2).

At this station, selected as typical of a temporary freshwater habitat, the collections of *S. ruficeps* totaled 131 adults (67 males, 64 females). The changes in captures over time (Fig. 3) shows that the number of adults were zero through January to July. The population then increased to a very strong peak in October. We determined that the maximum captures were about 4 months after the heaviest rainfall, at the time when the habitat began to dry out. Here, *Bulinus forskalii* is the principal prey of the larvae of *S. ruficeps*. The presence of this snail was limited during the course of the year

(Table 2). From low numbers in June, its population increased progressively, somewhat in accord with the increase in water level, to reach a maximum in November as drying began. This maximum is explained by the decrease in water level which results in the concentration of snails that reproduce in the wet places thus remaining. From mid December, the quantity of snails diminished very rapidly and they were not collected by our method at the end of December. The habitat then was completely dry. Obviously, aestivating snails were hidden in the substrate cover and/or in cracks in the soil. Also, a certain number of snails were lost by predation (especially by birds). The mortality of the snails was also accentuated by the increased temperature of the water as it evaporated. During the completely dry period we collected several *B. forskalii* inside domestic wells and others partially buried in cracks in the soil. In this type of temporary freshwater habitat, due to the absence of water and the dispersal or disappearance of the snail population indispensable for the development of its larvae, *S. ruficeps* entirely disappeared from the habitat (Fig. 3).

TABLE 2. Numbers of *Bulinus forskalii* collected monthly during 1996 (per m²) at the Cocotomey station (T2). (*, snails present in domestic well-water).

	Months											
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
N snails/m ²	*0	*0	0	0	0	2	40	82	82	210	298	87
Status of habitat	Dry					Inundated			Low water level			

B. 2. POPULATIONS OF *SEPEDON RUFICEPS* IN A PERMANENT FRESHWATER HABITAT: COTONOU STATION (P2).

At Cotonou, of a total of 239 *S. ruficeps*, we found 121 males and 118 females. In contrast to the preceding habitat, adults were present throughout the year (Fig. 4). The curve of monthly captures is bell-shaped, with a peak number during the months of August (34 adults), September (38), and October (35). During the course of this chorology, the sex ratio remained essentially 1:1. As in the preceding case, the maximum numbers of adults is observed about 3 months after the strongest rains. There is thus a strong similarity between the development of the populations in the 2 types of stations. At Cotonou, the continual presence of *S. ruficeps* is explained by the permanent nature of the water.

As to the population level of snails, there is a large difference in the chorology in comparison to the preceding example. We particularly followed the development of the populations of the 2 most abundant species, *Biomphalaria pfeifferi* and *Lymnaea natalensis* (Fig. 5). For *B. pfeifferi*, we observed a unimodal bell-shaped curve with an important peak culminating at about 75-100 individuals per m² at the time of the minor period of rain during September through October. The curve of *L. natalensis* is different and bimodal. The first peak was in April (45 snails) with the appearance of the rains. The second was much more important (72 snails) and was found in August-September.

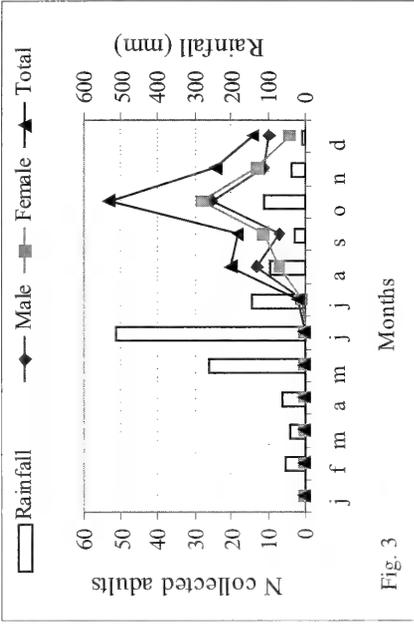


Fig. 3

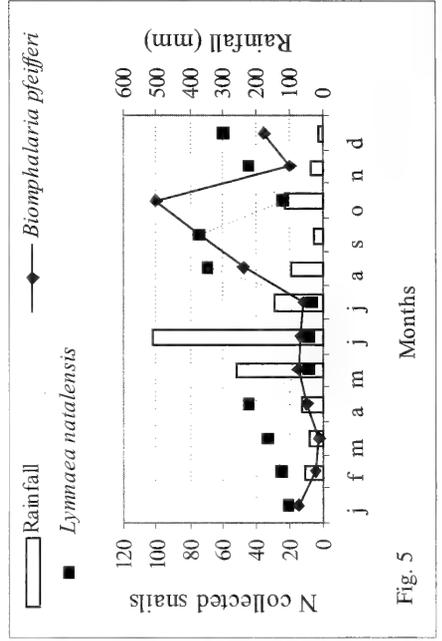


Fig. 5

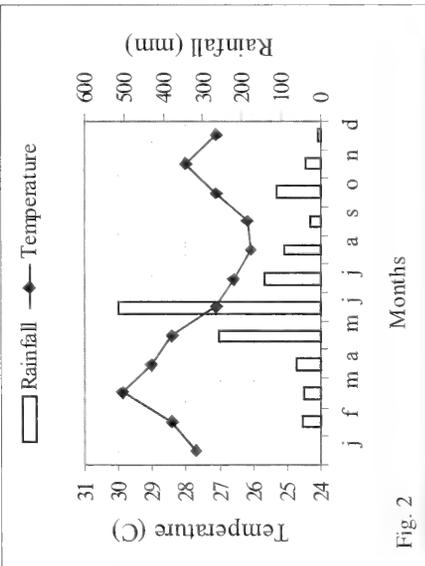


Fig. 2

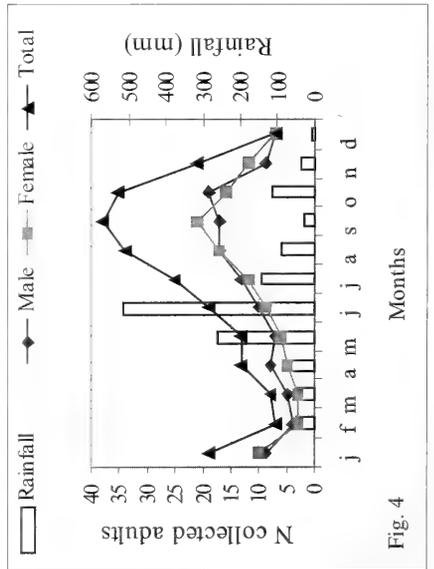


Fig. 4

At the Cotonou station, the maximum of captures of the 2 species of snails thus decreased. This situation, probably due to their respective periods of reproduction, is favorable for predation by larvae of *S. ruficeps*. In effect, the larvae have at their disposal, successively and for a long period, a variety of sizes of prey. In this habitat of permanent water the population peaks of the snails is when the level of water is low, resulting in an aggregation of individuals that are thus more easily collected. In contrast, at the time of the strong rains of May to July, the snails are dispersed, their drift is important, and the collection of snails is weaker.

C. Biology and feeding behavior in terms of the number and species of snails killed and eaten during the larval instars

In the laboratory, *S. ruficeps* adults lived about 3 months, with a larval development of 16-19 days. *S. ruficeps* appears to be a multivoltine species with several successive and overlapping generations in the course of the year.

The larvae of *S. ruficeps* avoid attacking the foot of the snail. Instead, the point of attack is preferentially the soft tissues of the head. The shells of snails of small sizes are rapidly and completely emptied; those of large sizes are killed quickly and completely emptied after several hours or are killed after 1 or 2 days. The larvae do not have necrophagous or detritivorous behavior and they never consume snails that have died naturally. The larvae of *S. ruficeps* fed on all of the freshwater snails under consideration, except the operculate *Lanistes* spp. We have limited the study of predation to *Bulinus forskalii* and *Biomphalaria pfeifferi*, which serve as intermediate hosts of human bilharziasis in Benin.

The average number of *B. forskalii* (Fig. 6) killed by larvae of *S. ruficeps* varied from 8.75 ± 1.9 (first stadium) to 42.18 ± 4.05 (third stadium). First-instar larvae readily attacked the size-classes Pc ($\bar{x} = 5.31 \pm 1.33$) and Mc ($\bar{x} = 2.78 \pm 0.78$), but attacked with difficulty the size-class Gc ($\bar{x} = 0.18$). The several Gc snails killed and eaten by the first-instar larvae were all parasitized by bilharzian furcocercaria. That is to say, for most of the old snails the larval development of schistosomes had enough time to complete their entire cycle (from miracidia to furcocercaria) from bilharzian infested human populations (mainly by *Schistosoma haematobium*) living near water bodies.

The second- and third- instar larvae indifferently fed upon all sizes of *B. forskalii*. In comparison, omitting the size-class Pc, third instar larvae consumed 5 times more than the first instar and 3 times more prey than the second instar.

With *B. pfeifferi* as prey (Fig. 7), first instar larvae killed and ate all of the snails of class Pc ($\bar{x} = 4.96 \pm 0.19$), with difficulty those of class Mc ($\bar{x} = 0.12$), and never

FIGS 2-5

2. Rainfall (histograms) and temperature (solid line) data during 1996 in Cotonou from meteorological station of Cotonou. 3. Change in the *Sepeidon ruficeps* population in the temporary habitat of Cocotomey. Rainfall is indicated during the same time (1996). 4. Change in the *Sepeidon ruficeps* population in the permanent habitat of Cocotomey. Rainfall is indicated during the same time (1996). 5. Evolution of snail populations of *Lymnaea natalensis* and *Biomphalaria pfeifferi* during the year (1996) in function of rainfall in Cotonou.

those of class Gc. Second-instar larvae killed and ate individuals of classes Pc ($\bar{x} = 6.7 \pm 1.57$) and Mc ($\bar{x} = 3.1 \pm 0.78$) and none of Gc. Third-instar larvae attacked with success snails of all size-classes. For snails of class Pc, the third-instar larvae consumed 5 times that of the first instar and 4 times that of the second instar.

Independent of the prey species utilized, the small sizes were always much more extensively killed and eaten. During the development of the larvae, the number of snails killed increased distinctly. Certain larvae, having fed sufficiently, continued to attack and to kill snails without eating them. This strictly killing behavior or "wasteful feeding" has been reported for certain species of *Sepedon*, particularly by Neff & Berg (1966), and for other genera of aquatic, predacious Sciomyzidae by other authors. The size of the prey, especially for the first instar larvae, appeared also to be an important factor in predation, especially in the case of *B. pfeifferi*. Mature larvae of *S. ruficeps* were very efficient in killing snails, and this probably had a direct effect on the level of the snail population by destruction of the parents. On occasion, the efficacy of predation was limited by the secretion of mucous by the snails, which trapped and asphyxiated the larvae, notably small first-instar larvae.

In the presence of both *Bulinus forskalii* and *Biomphalaria pfeifferi* (Fig. 8), first-instar larvae did not show any food preference and killed and fed upon about 50 % of each species (Wilcoxon test). In contrast, in the other 2 instars, there was a strong tendency for preferential attack on *B. forskalii*, with 76.1 % (second-instar larvae) and 67.3 % (third-instar larvae) against, respectively, 23.9 % and 32.7 % of *B. pfeifferi*.

D. Parasitism and predation of *Bulinus forskalii*

Bulinus globosus and *B. truncatus* are known to be intermediate hosts of *Schistosoma haematobium*, and *B. forskalii* in the transmission of *S. intercalatum*. The dry habitat at Cocotomey permits a good understanding of the development of the prevalence of parasitization (Table 3). The rate of parasitism regularly increased in July to reach a peak in November. The rate then declined at the beginning of December. The increase seen was partly due to the frequenting of the habitat by numerous vertebrates (probably those infested with trematodes). The snails can be infested precociously because the individuals less than 3 mm have released cercaria. Three types of cercariae have been found among the snails collected at Cocotomey: cercarium type (no tail) in *B. forskalii*, xyphidiocercaria type (simple tail) in *L. natalensis* and *B. forskalii*, and furcocercaria type (bifid tail characterizing *Schistosoma* sp.) in *B. globosus*. Sometimes multiple parasitism (with definitive hosts being cattle, birds, etc.) by trematodes existed in the same snail.

The results (Fig. 9) show, no matter which stage is considered, that the larvae of *S. ruficeps* indifferently consumed parasitized or healthy *B. forskalii*. Here there also appeared higher consumption of parasitized snails of size-class Pc by first instar larvae (Wilcoxon test). When the larva attacks a parasitized snail, the cercariae are liberated into the water (because the immature stadia of the parasite, sporocysts or rediae, are destroyed). In choice experiments, Fontana (1972) showed that the aquatic predator *Dichetophora biroi* (Kertész) in Australia did not show any preference for *Lymnaea tomentosa* (Pfeiffer) infected or not with the cattle fluke, *Fasciola hepatica* L., and

TABLE 3. Annual rate of snail parasitism by schistosomiasis cercaria in Cocotomey station (T2) during 1996.

	Months											
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
N tested	0	0	0	0	30	30	30	30	30	30	0	0
N parasitized	0	0	0	0	1	3	7	12	16	8	0	0
% parasitism	0	0	0	0	3.3	10.0	23.3	40.0	53.3	26.6	0	0
Status of habitat	Dry					Inundated				Low water level		

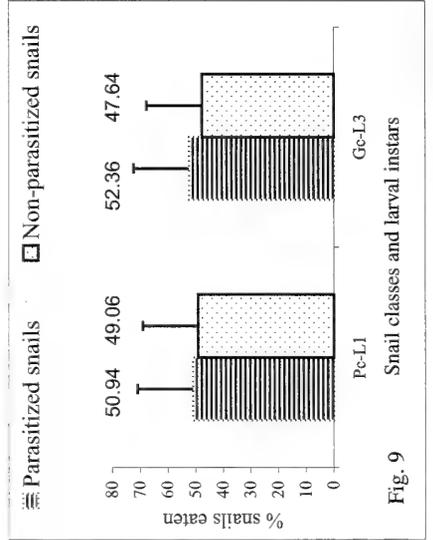
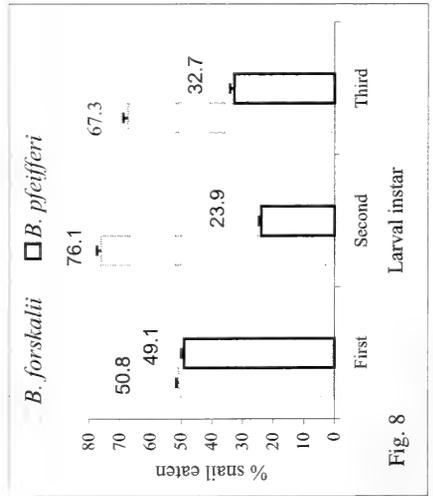
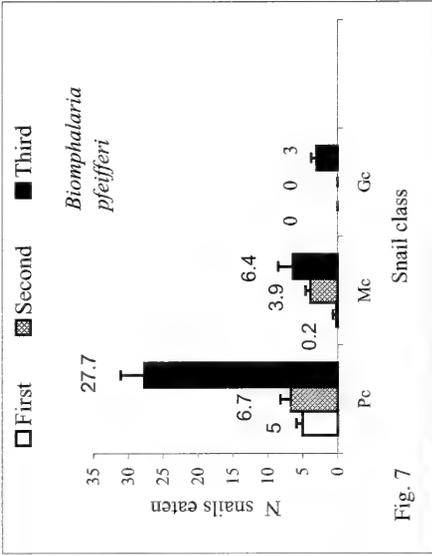
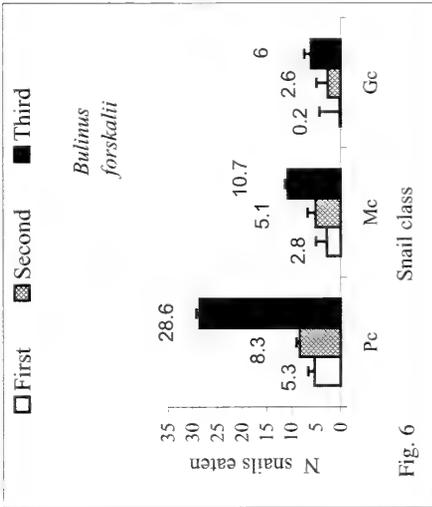
Lindsay (1982) showed the same for *Ilione albiseta* (Scopoli) in Ireland when offered infected or healthy *L. truncatula* Müller.

DISCUSSION

A. Phenology

In permanent freshwater habitats, *S. ruficeps* adults were present throughout the year. In habitats that dried out annually they disappeared with the evaporation of the water and the increasing rarity of the snail prey. It is possible that the species could pass the dry period in a dormant stage (most likely in the puparium or as an adult) but such aestivation has not been proved for any tropical species of Sciomyzidae. Considering the proximity of temporary and permanent freshwater habitats in many areas, it is unlikely that a species could be adapted to have small, dispersed portions of its population sensitive enough to extremely local conditions of dryness to effect a scenario of continuous breeding in wet areas and dormancy in dry areas. Rather, it is much more likely that there is extensive migration from drying areas to wet areas. Capture-mark-release-recapture studies and search for aestivating puparia (perhaps by experimental flooding) in temporary freshwater habitats in the tropics are needed areas of research.

The seasonal variation in populations of adults in relation to rainfall that we have noted conforms, in general, with observations in the Parc National de la Garamba (ne. Democratic Republic of the Congo, ex-Zaire) by Verbeke (1963). The meteorological conditions, especially rainfall, at Garamba (about 5° N. lat.) and s. Benin (about 6° N. lat.) which are about 2,800 km distant, are rather comparable (Walter & Breckle, 1986). Verbeke (1963) provided a summary of collection dates of 787 specimens of 11 species of *Sepedon* and related genera captured between Dec. 1950 and Sept. 1952 in 16 types of habitats (a much broader range of habitats than those studied in the present paper). He compared the collection dates with average monthly rainfall, and concluded that these species fly throughout the year. Maximum abundance is in the dry season (Nov. to Feb.), and the curve of abundance of Sciomyzidae is inverse to that of precipitation. However, half of the specimens referred to by Verbeke (1963) were *Sepedon trichrooscelis* (subsequently shown by Vala *et al.* (1995) and Knutson (1999) to be atypical for *Sepedon* in being a parasitoid/predator of semi-terrestrial hygrophilous Succineidae) and the closely related, biologically unknown *S. lippensi* Verbeke. Furthermore, only 14 of the 399 specimens of *S. trichrooscelis* and *S. lippensi* were collected



during the 5 months of April through Aug., indicating that at least these species do not breed continuously. However, Vala *et al.* (1995) concluded that *S. trichrooscelis* is multivoltine, based on lab rearings in which the entire life cycle required only 30 days and on limited field collections of immatures.

There are also data from the Neotropical Region that indicate that populations of adult Sciomyzidae are inversely correlated with rainfall. Knutson & Carvalho (1989) found that 172 specimens of 2 species of *Thecomyia* (probably aquatic predators) collected at 1 site near Belém, Brazil on 49 dates during 1977 and 1978 were taken just before and after the rainy season. Mello & Brecht (1978) made monthly collections of 5 species of *Sepedonea* Steyskal and 1 species of *Sepedomerus* Steyskal (aquatic predators) during 1975 and 1976 near Brasilia, Brazil and found that populations peaks occurred as the period of heaviest rainfall declined, with adults of some species found during every month of 1 of the years. Further research in tropical zones on voltinism (numbers of generations produced per year) and how species survive inclement conditions is needed, particularly in view of the use of aquatic predators for control of disease-carrying snails.

B. Predation

Predation by both aquatic and terrestrial sciomyzid larvae has been very extensively studied in primarily qualitative life history researches, rather extensively studied in lab experiments, and studied to a limited extent in field experiments. The majority of studies are on Northern Hemisphere species, in many genera, with the freshwater predators *Sepedon f. fuscipennis* Loew (Nearctic) and *Tetanocera ferruginea* Fallén (Holarctic) being especially well known. In tropical regions, there have been far fewer natural history and experimental studies. Three Oriental species of *Sepedon* have been studied experimentally to some extent: *S. plumbella* Weidemann (Bhuangprakone & Areekul, 1973), *S. senex* Weidemann (Beaver, 1989), and *S. spangleri* Beaver (Sucharit *et al.*, 1976). Our data on *S. ruficeps* complement the 3 papers on freshwater, predaceous *Sepedon* spp. in the Afrotropical Region (Barraclough 1983; Maharaj *et al.*, 1992; Appleton *et al.*, 1993).

The larvae of *S. ruficeps* have a broad valence of predation on freshwater pulmonate snails. In nature, it seems that the larvae adapt their prey-choice to the simultaneous or successive presence of the snail prey, especially Bulinidae and Planorbidae, whose periods of reproduction and population peaks decrease during the year. This polyphagy explains, in part, the broad geographical distribution of many species

FIGS 6-9

6. Number of *Biomphalaria forskalii* eaten by each larval stadium in presence of this species only. Pc, Mc, Gc, respectively small, medium and large sizes of snails. 7. Number of *Bulinus pfeifferi* eaten by each larval stadium in presence of this species only. Pc, Mc, Gc, respectively small, medium and great sizes of snails. 8. Relative (%) number of *Biomphalaria forskalii* and *Bulinus pfeifferi* eaten by each larval stadium when both snail species are present together. 9. Percentage of snails eaten by *Sepedon ruficeps* larvae according the presence or absence of trematode larvae and size of the snails. Pc, Gc, small and large sizes of snails eaten; L1, L3, larval stage.

of Sciomyzidae in the Afrotropical Region. Furthermore the freshwater oligochaete *Aulophorus furcatus* (Müller) constitutes without doubt an alternate prey for some Sciomyzidae in the absence of snail prey, as we have determined in the laboratory (unpublished data).

Its broad malacophagy also indicates that *S. ruficeps* represents a good possibility for control of the snail intermediate hosts of bilharziasis because the larvae feed upon healthy or infested snails, without choice, and on all sizes of snails. It is possible to envisage introductions of larvae into freshwater habitats, principally when the snails aggregate at the time preceding the drying of the habitat. As determined by Barraclough (1983) for the immature stages of *Sepedon* (*Parasepedon*) *testacea* and *S. neavei*, consumption by the larvae of *S. ruficeps* increases as a function of the age of the larvae and the type of snail prey.

ACKNOWLEDGEMENTS

We are very grateful to the ASECNA (National Meteorological Agency of Cotonou airport) for rainfall and temperature informations; Eric Boudouresque (Orleans University) for information on the distribution of African vegetation. From our material, five pairs of *Sepedon ruficeps* have been deposited in the collection of the Muséum d'histoire naturelle, Geneva (Switzerland) as voucher specimens.

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***Myloplus planquettei* sp. n. (Teleostei, Characidae), une nouvelle espèce de grand Serrasalminae phytophage du bouclier guyanais**

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***Myloplus planquettei* sp. n. (Teleostei, Characidae), a new species of large phytophagous Serrasalminae from Guiana Shield.** - *Myloplus planquettei* sp. n. is a new species which can reach 58 cm of standard length. *M. planquettei* is described from Mana, Maroni and Essequibo Basins on the Guiana Shield. Wayana people look upon *M. planquettei* as a patrimonial species. In Maroni Basin, *M. planquettei* differs from *M. rubripinnis* and a specimen identified as *Myloplus* sp. by the presence of a black distal margin well defined on the caudal fin and a larger number of postdorsal vertebrae. The number of rays on the anal and dorsal fins is lower in *M. planquettei* than in *M. rubripinnis*. *M. planquettei* is also different from the *Myloplus* sp. specimen of Maroni by more prepelvic and total serrae. In the Maroni and Mana Basins, *M. planquettei* is sympatric with *Tometes lebaili*, another large phytophagous Serrasalminae.

Key-words: *Myloplus* - *Myloplus planquettei* sp. n.- Serrasalminae - Guiana Shield - Patrimonial species.

INTRODUCTION

Müller & Troschel (1844), Valenciennes, in Cuvier & Valenciennes (1850), Günther (1864) puis Steindachner (1881) décrivent plusieurs espèces de *Myleus* des Guyanes placées par Géry (1972, 1976) dans le sous-genre *Myleus* (*Myloplus*) récemment réhabilité au niveau de genre *Myloplus* Gill, 1896 par Jégu *et al.* (sous presse). Eigenmann (1912: 391-392, pl. 57) signale deux espèces décrites du Guiana, *Myloplus asterias* (Müller & Troschel, 1844) et *Myloplus rubripinnis* (Müller & Troschel, 1844), du bassin de l'Essequibo. Géry (1972) place *Myloplus asterias*, *M. luna* (Valenciennes, 1850), décrit de Cayenne et de Colombie, et *M. ellipticus* (Günther, 1864), décrit du Guiana, en synonymie avec *M. rubripinnis*. Géry (1972: 169) signale un spécimen du Maroni, identifié par erreur *Myleus knerii* (Steindachner, 1881) suivant Jégu & Santos (2002), puis rapporté à *Myloplus* sp. par Jégu *et al.* (sous presse).

Planquette *et al.* (1996) ne reconnaissent que *Myloplus rubripinnis* dans les bassins du Maroni et de la Mana. Jégu *et al.* (sous presse) qui réhabilite *Myloplus asterias* tout en plaçant *M. ellipticus* et *M. luna* en synonymie avec *M. rubripinnis*, signalent la présence de *M. rubripinnis* et *Myloplus* sp. dans le Maroni.

Pagezy & Jégu (2002) font état de deux grandes espèces de Serrasalminae phytophages dans le haut cours du Maroni appelées watau par les amérindiens Wayana. Le watau yaïke appartient au genre *Tometes* (Jégu *et al.*, 2002b). L'autre espèce, appelée watau ihle, est rapportée au genre *Myloplus* par Pagezy & Jégu (2002) sans avoir été formellement identifiée. D'après les auteurs, cette espèce est caractérisée par une marge distale noire à la caudale et peut atteindre 58 cm de LS.

Plusieurs spécimens de grands Serrasalminae ont déjà été cités du bouclier guyanais. Jardine & Schomburgk (1841) décrivent *Myletes pacu* de l'Essequibo, une espèce qui atteint 16 à 24 pouces, soit 400 à 600 mm de longueur totale. La description originale très succincte et l'absence de matériel de référence ne permettent pas de préciser le statut de cette espèce, mais Jégu *et al.* (sous presse) la place par défaut dans *Myloplus*. Eigenmann (1912) signale quatre grands spécimens de l'Essequibo (490-563 mm LS) qu'il rapporte à *Myletes pacu*. Pour Jégu & Santos (2002) qui ont examiné 2 de ces spécimens, ils diffèrent de la description originale de *Myletes pacu* par un nombre bien plus faible de rayons à l'anale. Jégu *et al.* (sous presse) place ces spécimens dans *Myloplus*.

Deux espèces de *Myloplus* de taille plus réduite sont également caractérisées par une marge distale noire bien définie à la caudale. Il s'agit de *Myloplus torquatus* (Kner, 1858) décrit du Rio Negro et de *Myloplus arnoldi* Ahl, 1936 décrit de l'Amazonie.

L'objectif du présent travail est de montrer que le grand Serrasalminae phytophage de la Mana et du Maroni appelé watau ihle par les Wayana est une nouvelle espèce du genre *Myloplus* et que les spécimens de l'Essequibo rapportés à *M. pacu* par Eigenmann appartiennent à la même espèce.

MATÉRIEL ET MÉTHODES

Les récoltes ont d'abord été réalisées au cours des inventaires faunistiques de Guyane fr. menés par l'INRA en 1986 puis au cours des campagnes menées par le MNHN et l'INRA sur la Convention INRA/DIREN-GFC (n° 41011) en 1997. Les collectes dans le haut Maroni ont été réalisées dans le cadre des programmes SOFT 1996 (Convention IRD/ECOFOR 2350, en 1998-99, Convention MNHN/ECOFOR 048 et MNHN/DIREN 049 en 2001), Ecosystèmes Tropicaux du MATE (Conventions IRD/ECOFOR 4403.00 et IRD / CSP 2548 en 2000). Les radiographies aux rayons X ont été exécutées au MNHN, Paris, à l'aide d'un appareil Faxitron 43855A et sur des négatifs radio AGFA DW Structurix dans le laboratoire d'Ichtyologie. Pour les spécimens de plus de 250 mm LS, les radiographies ont été réalisées à l'aide d'un appareil Philips à usage vétérinaire et sur des négatifs Kodak Industrex type M, dans le laboratoire d'Anatomie Comparée.

Les mesures et les comptages ont été établis sur des spécimens de 67 à 478 mm de longueur standard (LS) issus des bassins du Maroni, de la Mana et de l'Essequibo

(Fig. 1). Les mesures ont été prises sur les radiographies ou directement sur les spécimens. Les points remarquables, entre lesquels les distances ont été mesurées au pied à coulisse, sont figurés dans Merckx *et al.* (2000: fig. 3a et b).

Les caractères méristiques relevés sur les radiographies ainsi que ceux qui sont pris directement sur les spécimens sont décrits dans Jégu *et al.* (sous presse).

La description du squelette a été réalisée d'après l'examen d'un squelette sec de mâchoire (MNHN 2002-267, env. 300 mm LS), du squelette d'une tête (MNHN 1998-134, env. 450 mm LS) et l'examen des radiographies de 5 spécimens de 67 à 465 mm de LS. L'étude de la musculature faciale a été réalisée d'après la tête du spécimen MNHN 1998-134, tandis que les examens de la vessie natatoire, de la musculature latérale et du tractus digestif ont été réalisés sur des paratypes de différente taille. La nomenclature française des os est celle de Courtemanche et Legendre (1985).

La liste des acronymes utilisés dans le texte est la suivante. - FMNH, Field Museum of Natural History, Chicago, U.S.A. - INPA, Instituto Nacional de Pesquisas da Amazônia, Manaus, Brésil. - MHNG, Muséum d'histoire naturelle de Genève, Genève, Suisse. - MNHN, Muséum National d'Histoire Naturelle, Paris, France. - RMNH, Rijksmuseum van Natuurlijke Historie, Leiden, Hollande. - ZMA, Universiteit van Amsterdam, Zoologisch Museum, Amsterdam, Hollande.

DESCRIPTION

Myloplus planquettei sp. n.

Myleus pacu non Schomburgk: Eigenmann, *Memoirs of Carnagie Museum* 5(1) : 393-395 (in part.), pl. 59 figs 3 et 6, 1912, Essequibo (Guiana).

Myloplus sp., Pagezy & Jégu, *Bulletin Français de Pêche et de Pisciculture* 364 : 49, fig. 2c, 2002, Maroni (Guyane française).

DIAGNOSE

Myloplus planquettei présente une large marge distale noire bien définie sur le bord libre de la nageoire caudale. *M. planquettei* présente 20-23 rayons branchus à la dorsale et 32-34 à l'anale, 23-29 serrae prépelviennes, 5-6 supraneuraux en avant de la dorsale et 39-41 + CP1 vertèbres dont 15-16 + CP1 en arrière du dernier ptérygiophore de la dorsale. Le corps est allongé (55-70% de LS) et le diamètre de l'œil réduit (6,3-12,9% de LS). La base de la dorsale est courte (28,8-33% de LS). L'adipeuse est rectangulaire et sa base est longue (4,3-6,2 % de LS).

ETYMOLOGIE

Myloplus planquettei est dédiée à Paul Planquette (†), chercheur de l'INRA à Kourou, en hommage au travail d'inventaire de la faune des poissons de Guyane française qu'il a réalisé à partir de 1978 jusqu'à ce qu'il nous quitte en 1996.

NOMS VERNACULAIRES

watau ihle, watau takpilem (Wayana, fl. Maroni); kumaru, kumalu (Créole, Guyane française).

DISTRIBUTION

Myloplus planquettei sp. n. est connu des bassins de la Mana en Guyane française, du Maroni en Guyane française et au Suriname et de l'Essequibo au Guyana.

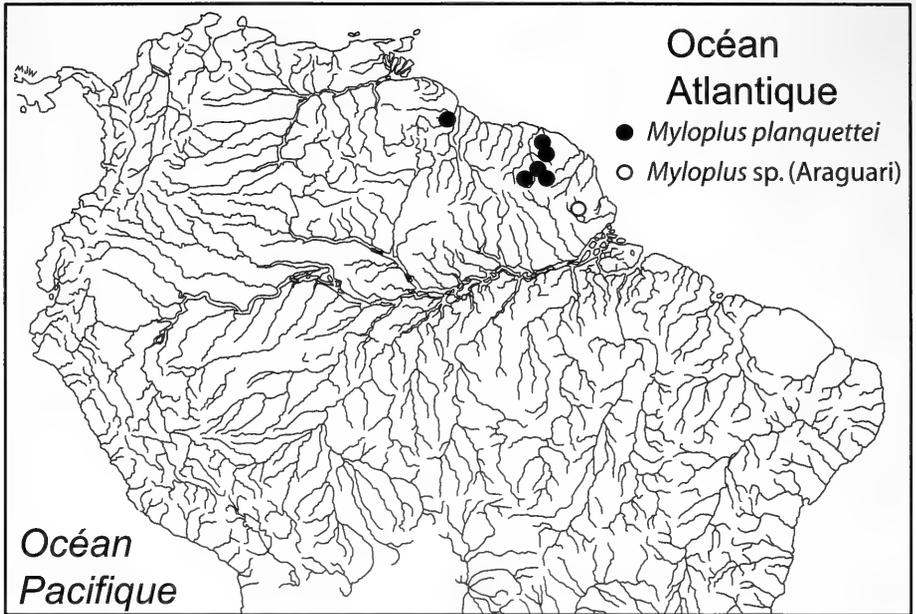


FIG. 1

Localisation géographique du matériel examiné. – Geographical distribution of examined material.

MATÉRIEL

La liste des spécimens examinés pour comparaison figure dans le chapitre "Discussion".

Liste du matériel examiné

Holotype: - MNHN 1997-730, 112 mm LS, fleuve Maroni, Twenke, Guyane française, coll. de Mérona, 1997.

Paratypes: *Fleuve Mana, Guyane française*: - MNHN 1997-729, 1 ex. (juvénile), 67 mm LS, Saut Valentin, coll. Renno & Keith, 1988. - MNHN 1997-731, 2 ex. (mâle et femelle), 465 mm LS, saut Sabbat, coll. Planquette, 1988. *Paratypes*: *Fleuve Maroni, Guyane française*: - MNHN 2001-1224, 1 ex., 139 mm LS, Kawatop, rivière Litany, coll. Fermon & al., fév. 2001. - MNHN 2001-2345, 1 ex. (mâle), 505 mm LS, saut Alimina-emem, riv. Litany, coll. Fermon et al., 2001. - MNHN 2001-1225, 1 ex. (femelle), 472 mm LS, saut Loue, riv. Litany, coll. Fermon et al., fév. 2001. - MNHN 2001-1226, 1 ex., 358 mm LS, saut Loue, riv. Litany, coll. Fermon et al., fév. 2001. - MNHN 2001-1227 (femelle), 1 ex., 478 mm LS, saut Loue, riv. Litany, coll. Fermon et al., fév. 2001. - MHNG 2640-26, 1 ex. (mâle), 501 mm LS, saut Alimina-emem, riv. Litany, coll. Fermon et al., 2001.

Matériel complémentaire

Fleuve Mana, Guyane française: - MNHN 1998-134, 1 tête, env. 450 mm LS, coll. Renno 1988.

Fleuve Maroni, Guyane française: - MNHN 2002-267, env. 300 mm LS, squelette sec des mâchoires, Antecume Pata, riv. Litany, coll. Le Bail et Planquette, 1983. - MNHN 2001-2248, 1 ex. (juvénile), 25,8 mm LS, Antecume Pata, riv. Litany, coll. Fermon et al., fév. 2001. - MNHN 2002-819, 1 ex. (femelle), 535 mm LS, amont Antecume Pata, riv. Litany, coll. Fermon et Ksas, mars 2002. - MNHN 2002-820, 1 ex. (femelle), 475 mm LS, amont Antecume Pata, riv. Litany, coll. Fermon et Ksas, mars 2002. - MNHN 2002-821, 1 ex. (mâle), 548 mm LS, amont

Antecume Pata, riv. Litany, coll. Fermon et Ksas, mars 2002. - MNHN 2002-822, 1 ex. (femelle), 497 mm LS, amont Antecume Pata, riv. Litany, coll. Fermon et Ksas, mars 2002. - MNHN 2002-825, 1 ex. (femelle), 346 mm LS, amont Antecume Pata, riv. Litany, coll. Fermon et Ksas, mars 2002. - MNHN 2002-935, 1 ex. (mâle), 497 mm LS, amont Antecume Pata, riv. Litany, coll. Fermon et Ksas, mars 2002. - MHNG 2640-25, 1 ex. (femelle), 478 mm LS, amont Antecume Pata, riv. Litany, coll. Fermon et Ksas, mars 2002. - INPA 20.452, 1 ex. (femelle), 458 mm LS, amont Antecume Pata, riv. Litany, coll. Fermon et Ksas, mars 2002.

Fleuve Maroni, Suriname: - NZCS (non reg.), 1 ex. (femelle), 560 mm LS, proche de l'aéroport d'Oelemary, riv. Oelemari, bassin du Maroni, Suriname, coll.. Outboter, 20 avr. 1998.

Fleuve Essequibo, Guiana: - FMNH 59292, 1 ex. (mâle), 465 mm LS - FMNH 59298, 1 ex. (femelle), 465 mm LS, Falls at the Mazaruni.

Matériel observé in situ

1 ex., 465 mm LS, Saut Valentin et 1 ex., 360 mm LS, Saut Belle Etoile, obs. P. Keith & J.-F. Renno, La Mana, Guyane française, 1988. - 5 ex., 1,7 à 4,7 kg, rivière Oelemari (N 03° 08' 791, W 54° 26' 797), bassin du Maroni, Suriname, obs. M. Jégu & H. Pagezy, oct. 1998. - 2 ex., 1,0 à 1,4 kg, village Pidima, rivière Litany, bassin du Maroni, Guyane française, obs. M. Jégu & H. Pagezy, oct. 1998. - 28 ex., 1,4 à 5,8 kg, saut Pierkuru, Tampok, Guyane française, obs. M. Jégu, P. Keith et H. Pagezy, oct. 2000.

MORPHOLOGIE

Les principaux caractères morphométriques (exprimés en pourcentage de la LS) et les principaux caractères méristiques sont présentés aux Tableaux I et II, respectivement.

Le corps est allongé et peu profond (Fig 2). Le profil prédorsal, rectiligne chez le plus jeune spécimen, est légèrement arrondi chez les plus gros individus. La base de la nageoire dorsale et la zone post-dorsale sont aussi très peu inclinées par rapport à l'axe du corps. Le profil ventral est très peu arrondi au niveau des pectorales et subrectiligne au niveau des ventrales, jusqu'à la nageoire anale. L'origine de l'anale est située en arrière de la verticale à l'extrémité postérieure de la dorsale. La base de l'anale est courte mais très oblique par rapport à l'axe du corps.

La tête est peu profonde et allongée. Le museau est rectiligne chez les jeunes et nettement obtus chez les grands individus. La bouche, terminale, est située au niveau du bord inférieur de l'oeil. La bouche est courte et la commissure est située bien en avant de la verticale au bord antérieur de l'oeil. Le bord libre de la membrane à la commissure est lisse. L'oeil est situé à plus d'un demi-diamètre de la pointe du museau. Le diamètre de l'oeil atteint 38-42% de la longueur de la tête chez les spécimens de moins de 150 mm LS et 24-28% chez les spécimens de plus de 300 mm LS. En dessous de l'oeil et *in situ*, l'infraorbitaire 2 est haut et arrondi. L'infraorbitaire 3 est court. La zone nue à la joue est aussi large que l'infraorbitaire 3 chez les jeunes individus et nettement plus étroite chez les grands spécimens. L'operculaire est haut et étroit mais la distance post-orbitaire reste toujours plus longue que le museau. La distance interorbitaire est plus étroite chez les spécimens de moins de 150 mm LS (37-46 % de la longueur de la tête vs. 56-64% chez les spécimens de plus de 330 mm LS).

La bouche est étroite et peu profonde. En arrière des dents du prémaxillaire, on observe deux crêtes charnues longitudinales au palais. En revanche il n'apparaît pas de lobe charnu en arrière des dents du dentaire. Au prémaxillaire, on compte 5 dents à la série externe et deux dents à la série interne. Les deux séries de dents sont suffisamment proches l'une de l'autre pour que la base des dents de la série labiale soit au

TABLEAU I. Principaux caractères morphométriques, exprimés en % de LS, de *Mylopius planquettei* sp. n. (holotype, un paratype de 67,3 mm LS et 8 paratypes de 139 mm LS ou plus et 2 ex. d'Essequibo) comparés à ceux de *M. rubripinnis* du Maroni (Guyane fr.), de *Mylopius* sp. (Maroni) et de *Mylopius* sp. (rio Araguari, Brésil) (Nb= nombre de spécimens ; Moy= moyenne; ET=Écart-type). — TABLE I. Main morphometric characters expressed in percent of SL, of *Mylopius planquettei* sp. n. (holotype, one paratype of 67,3 mm SL and 8 paratypes of 139 mm SL or more and 2 specimens from Essequibo) compared to *M. rubripinnis* from Maroni basin (French Guiana), *Mylopius* sp. (Maroni) and *Mylopius* sp. (rio Araguari, Brazil) (NB=specimen number; Moy= average; ET= standard deviation).

	holotype paratype			Mylopius planquettei sp. n. paratypes (Mana et Maroni)			Mylopius sp. Mylopius sp.				Mylopius rubripinnis			
	Maroni	Mana	Nb	Variation	Moy.	E.T.	2 ex.		1 ex.		Nb	Variation	Moy.	E.T.
							Essequibo	Araguari	Maroni	Maroni				
Longueur standard (mm)	112,0	67,3	8	139,0-470,0	404,9	117,3	470,0-475,0	415	155,5	20	82,0-136,0	136,0	66,5	
Hauteur du corps	63,1	55,7	8	60,6-69,7	63,2	3,2	58,5-61,9	57,8	64,7	20	64,5-77,0	70,9	3,2	
Longueur de la tête	29,1	30,5	8	24,2-28,8	26,9	1,6	25,6-29,7	26,2	28,7	20	27,4-30,2	28,8	0,8	
Distance intraorbitaire	12,0	11,3	8	13,2-17,8	15,9	1,6	14,4-16,0	14,6	14,8	20	12,9-15,7	14,1	0,7	
Diamètre de l'œil	11,1	12,9	8	6,3-10,7	7,4	1,4	6,6-7,1	6,8	11,9	20	12,2-14,4	13,0	0,5	
Longueur du museau	6,3	7,9	8	5,4-8,7	7,6	1,0	9,5-9,6	8,1	5,7	20	5,5-7,4	6,3	0,6	
Largeur de l'infraorbitaire 3	3,0	2,7	8	2,7-4,5	3,6	0,5	2,5-3,4	2,9	3,4	20	2,5-3,7	3,0	0,3	
Lacune à la joue	3,7	3,6	8	1,4-4,0	2,5	0,7	1,9-3,3	2,7	3,0	20	2,0-3,6	2,8	0,4	
Largeur de l'infraorbitaire 4	3,9	3,9	8	3,9-4,9	4,3	0,3	3,1-4,7	3,6	3,5	20	3,0-3,9	3,3	0,3	
Distance postorbitaire	10,1	8,8	8	9,2-11,1	10,2	0,7	10,2-11,7	9,8	9,3	20	7,5-10,0	8,4	0,7	
Distance postoccipitale	35,0	33,9	6	31,2-33,9	32,6	1,0	30,9-35,4	33,7	33,8	20	32,8-38,0	34,9	1,4	
Distance pré dorsale	57,9	55,1	8	55,3-61,4	58,5	2,0	54,7-54,9	60,7	56,7	20	55,5-61,5	57,8	1,7	
Base de la dorsale	28,8	28,4	8	29,6-32,2	31,0	0,9	31,4-33,0	27,5	38,2	20	33,6-38,2	35,6	1,2	
Distance interdorsale	12,9	10,1	8	10,2-14,2	12,3	1,4	11,2-11,7	10,2	9,4	20	8,4-11,3	9,7	0,7	
Base de l'adipose	5,9	5,6	8	4,3-6,2	5,2	0,7	4,7-5,0	6,6	3,9	20	3,0-3,8	3,4	0,2	
Hauteur du pédoncule	10,4	10,7	8	10,0-11,3	10,6	0,5	10,7-11,2	10,8	9,7	20	8,9-10,4	9,8	0,4	
Base de l'anale	33,4	32,2	8	33,0-37,7	35,3	1,2	35,1-36,8	32,0	35,8	19	35,7-43,7	39,3	2,2	
Distance préanale	77,9	73,6	8	74,5-86,0	79,2	4,2	80,0-81,3	80,0	77,7	19	75,6-81,0	78,6	1,6	
Distance prépelvienne	60,3	56,3	7	55,5-63,4	59,3	3,1	56,8-57,4	59,8	57,8	19	57,7-63,2	60,9	1,5	
Distance prépectorale	28,4	29,9	8	24,3-30,1	26,9	2,2	23,4-25,1	25,1	28,6	19	26,3-30,6	29,0	1,0	
Distance origine dorsale-anale	63,2	59,0	8	64,5-74,8	69,1	4,2	62,3-67,4	60,2	67,7	19	65,8-75,4	70,3	2,8	
Distance fin dorsale-anale	29,9	24,7	8	23,6-27,5	25,4	1,1	24,2-24,9	24,5	23,7	20	21,1-24,2	22,5	1,0	
Distance fin dorsale-origine anale	48,0	43,2	8	45,1-54,8	50,7	3,6	47,4-50,4	44,6	48,2	19	48,0-56,6	52,1	2,5	
Largeur de la tête	15,4	14,3	3	16,0-20,0	17,6	2,1	*	*	18,3	17,2	20	15,5-18,7	17,1	0,8
Largeur de la mâchoire inférieure	*	*	3	9,4-10,8	10,2	0,7	*	*	9,1	8,2	*	*	*	
Longueur du lobe anal 1	24,1	25,9	8	18,2-28,1	22,8	4,2	17,3-20,9	18,8	15,8	16	15,1-25,8	20,6	3,8	
Longueur du lobe anal 2	*	*	4	13,4-17,7	16,4	2,0	16,6	16,0	12,8	8	10,7-13,8	12,2	1,1	

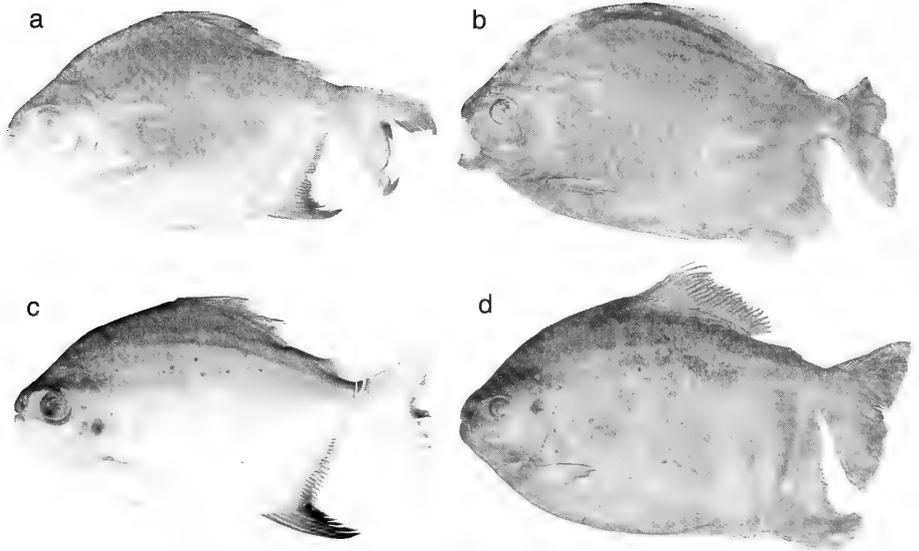


FIG. 2

Myloplus planquettei sp. n. : (a) MNHN 1997-730, holotype, 112 mm LS, fl. Maroni, (b) MNHN 2001-2345, paratype, 470 mm LS, mâle, fl. Maroni, (c) MNHN 1997-729, paratype, 67 mm LS, fl. Mana et (d) NZSC non cat., 560 mm LS, femelle, fl. Maroni. – *Myloplus planquettei* sp. n.: (a) MNHN 1997-730, holotype, 112 mm SL, Maroni basin, (b) MNHN 2001-2345, paratype, 470 mm SL, male, Maroni basin, (c) MNHN 1997-729, paratype, 67 mm SL, Mana basin and (d) NZSC non cat., 560 mm SL, female, Maroni basin.

contact de celle des dents de la série linguale (Fig. 3), sans que les deux séries soient plaquées l'une contre l'autre comme chez *Myleus setiger* (Jégu & Santos, 2002: fig. 5c). Les dents médianes de la série labiale sont aussi séparées l'une de l'autre (Fig. 3). Les quatre dents postérieures de la série labiale sont latéralement en contact les unes avec les autres, sans toutefois être engrenées. La couronne des dents de la série linguale est située au même niveau que celle des trois premières dents de la série labiale. Les trois premières dents de la série labiale sont triangulaires, hautes et leur face concave est orientée vers l'intérieur de la bouche. Les deux dernières dents sont courtes, larges et leur face concave est orientée vers l'extérieur de la bouche. La couronne de ces deux dernières dents est très basse.

Au dentaire, on compte 5 dents à la série labiale plus une dent symphysaire conique en arrière de la série principale. Les dents sont basses et la couronne des trois premières est triangulaire et pointue. La couronne des dents suivantes est arrondie mais présente un lobe latéral. Le bord postérieur des dents est au contact du bord antérieur de la dent suivante sans toutefois que les dents soient engrenées.

L'origine de la nageoire dorsale est située légèrement en arrière du milieu du corps. La base de la dorsale, de même taille ou légèrement plus longue que la tête, reste courte. La distance interdorsale (35-45% de la base de la dorsale) est 2 à 3 fois plus longue que la base de la nageoire adipeuse. Le bord distal de la nageoire dorsale est

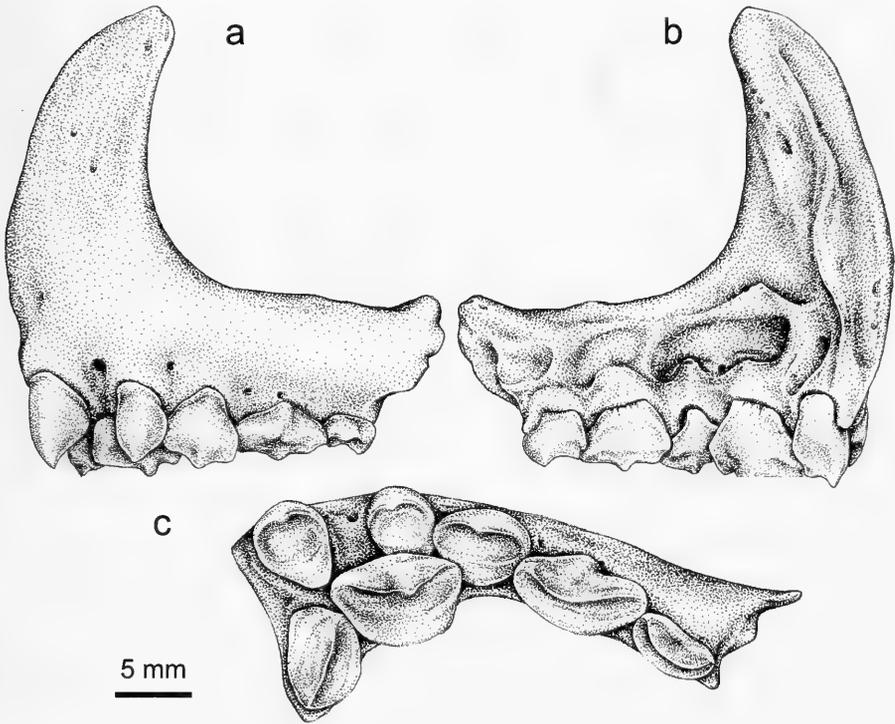


FIG. 3

Myloplus planquettei sp. n., MNHN 2002-267, environ 300 mm LS, fl. Maroni, prémaxillaire gauche: (a) vue labiale, (b) vue linguale et (c) vue ventrale. – *Myloplus planquettei* sp. n., MNHN 2002-267, about 300 mm SL, Maroni basin, left premaxillary: (a) labial view, (b) lingual view and (c) ventral view.

rectiligne. Chez les grands individus mâles, les rayons sont prolongés par des filaments courts et fins. L'adipeuse est rectangulaire.

L'origine de la nageoire anale est située en arrière ou au niveau des derniers rayons de la dorsale. Le bord distal de l'anale est falciforme chez les jeunes, mais les premiers rayons forment un gros lobe arrondi chez les femelles. Les mâles présentent un second lobe dont l'apex est situé au niveau des rayons branchus 15 à 17. La longueur des rayons du second lobe est voisine de celle des rayons premier lobe. Seuls, deux mâles de 470 mm LS présentent des crochets doubles à l'extrémité des rayons du second lobe. On compte 6 à 8 séries d'écailles sur la base des rayons de l'anale.

Les nageoires pectorales et pelviennes sont courtes. Le bord des rayons des pectorales atteint toutefois la verticale à l'origine de la dorsale. En revanche, la pointe des pelviennes n'atteint jamais l'origine de la nageoire anale. On compte 32-34 rayons branchus à l'anale, 20-23 à la dorsale, 11 à 13 aux pectorales et 7 aux pelviennes.

La série des serraes prépelviennes prend son origine entre le bord postérieur du coracoïde et la pointe distale des côtes pleurales 5. Ces serraes, toujours beaucoup plus courtes et plus fines que les serraes post-pelviennes (environ 2/3 de la hauteur des serraes

post-pelviennes), sont formées d'une épine pointue dessinant une carène abdominale et sont soutenues par deux ailes latérales insérées sous la peau. Chez les plus grands spécimens, les serrae sont émoussées et la carène n'est plus toujours sensible au toucher. Les serrae post-pelviennes sont toujours hautes et pointues. On compte 23-29 serrae prépelviennes, 6-8 serrae post-pelviennes simples et 6-8 épines doubles de part et d'autre du cloaque.

La seconde chambre de la vessie natatoire est conique, terminée par un appendice plus fin. La chambre est parcourue par une bande de muscle intrinsèque unique qui se divise vers l'avant. Le bord antérieur de la seconde chambre est lisse et uniformément arrondi. En vue frontale, les deux bandes musculaires joignent leur homologue pour former une bande sagittale verticale. La longueur de la seconde chambre (sans l'appendice) atteint 25-30% de LS (30-35% avec l'appendice). La hauteur de la chambre est de 35-40% de sa longueur et la largeur de la bande musculaire est de l'ordre de 10-12% de la hauteur de la chambre. La première chambre est ovaloïde et plus courte que la seconde. La longueur de la première chambre est d'environ 15% de la LS et sa hauteur est d'environ 2/3 de sa longueur. Les deux chambres sont reliées par un canal non spiralé.

Le hiatus de la musculature latérale est obstrué par des corps graisseux jusqu'au niveau de la vessie natatoire. Cette lacune au niveau de l'*obliquus superioris* et de l'*obliquus inferioris* s'étend depuis l'avant de la 5ème côte jusqu'à la 6ème.

La musculature faciale suit le schéma observé chez *Tometes lebailli* (Jégu et al., 2002b: fig. 8). La branche A1 de l'*adductor mandibularis* vient recouvrir la branche A2 de ce muscle sur les deux tiers inférieurs de la joue (Fig. 5a). La branche A2 latérale est réduite à un triangle restreint à la partie postéro-médiane de la face. L'extrémité dorsale de la branche A2 médiane s'insère sous le *dilatator operculi*. La branche A3 est plus large que chez *Myloplus asterias* et que sur le spécimen rapporté à *Myleus* par Alexander (1964: fig.5). Elle vient s'insérer entre le *levator* et l'*adductor arcus palatini* pour se fixer sur la face externe du processus laminaire antérieur de la tête de l'hyomandibulaire.

Sur le dentaire, la branche A3 est réduite et quelques fibres musculaires de la partie ventrale rejoignent la branche A2 pour former le tendon d'insertion sur le dentaire (Fig. 5b). Au-dessus de ce tendon, l'Aw est comparable à celui que l'on observe chez *M. asterias*. La branche dorsale du A1 forme un fourreau qui couvre le bord dorsal du dentaire et de l'anguloarticulaire, et se termine en un tendon qui vient s'insérer juste sous le A2, sur le bord dorsal de la face linguale du dentaire (Fig. 5c). La branche ventrale s'insère sur le dentaire au-dessus de l'ossification du cartilage de Meckel.

On compte 15-17/14-16 branchiospines au premier arc branchial. Les branchiospines sont en forme de lamelles triangulaires, soutenues par un éperon ossifié le long duquel court une lame charnue dont le bord libre est sinusoïdal. La partie ossifiée de chaque branchiospine est recouverte d'un tapis de petites épines.

SQUELETTE

Les mâchoires

Le prémaxillaire présente une forme de "L" (Fig. 3). Le processus latéral est un axe subrectangulaire dont le bord postérieur est situé légèrement en arrière de la

dernière dent. En vue ventrale, le prémaxillaire est plutôt rectiligne, et les dents sont implantées sur toute l'extension du bord ventral de l'os. La face médiane du prémaxillaire est plane en arrière d'une crête verticale antérieure, prolongement de la face frontale de l'os. En vue frontale, le processus ascendant du prémaxillaire est large, oblique par rapport à l'axe antéro-postérieur de l'os, et fortement incurvé. Le bord dorsale du processus ascendant est large et arrondi. La face occlusale du processus ascendant présente une crête postérieur lamellaire sur la partie inférieure. Cette lame osseuse définit un plan médian sub-triangulaire. La face labiale du processus latéral présente une fosse de remplacement des dents divisée en trois éléments, dont une fosse médiane arrondie et largement ouverte. Nous n'avons pas observé d'appendice transversal sur la face labiale comme celui que Jégu & Santos (2002) signalent pour *Myleus setiger*. Le maxillaire ne porte pas de dents.

Le dentaire est massif, court et haut (Fig. 4). La zone d'implantation des dents suit la courbure latérale de l'os et est restreinte à la zone antérieure du dentaire. Les dents sont implantées sur le bord de l'os. La fosse de remplacement des dents de la série labiale est divisée en trois larges orifices subcirculaires séparés les uns des autres par des ponts osseux. La fosse de remplacement de la dent symphysaire est grande et située juste en-dessous de la base de cette dent. En vue linguale, on observe 4 à 5 indentations de la suture mandibulaire suivant une organisation radiale. En vue frontale, la suture mandibulaire est rectiligne et haute, définissant une plage triangulaire plane sous la ligne des dents. On peut ainsi définir un menton au niveau de la pointe inféro-antérieure de la suture. Le processus postérieur du dentaire est court. Le bord supérieur du processus dorso-postérieur est rectiligne et se termine par une pointe projetée au-dessus et légèrement en arrière du processus ascendant de l'angulo-articulaire. Sur la face linguale de la mâchoire, le lobe dorsal du processus antérieur de l'angulo-articulaire est très réduit et la suture dentaire-angulo-articulaire est sub-rectiligne. Le processus ascendant du bord supérieur de l'angulo-articulaire qui recouvre le dentaire est très réduit. L'ossification du cartilage de Meckel forme un tube allongé. Le processus postéro-ventral du dentaire se termine en une pointe. La fosse du muscle *intermandibularis* est large.

La série infraorbitaire

L'infraorbitaire 2, avec une forte convexité ventrale, est plus haut que long. En avant de cet os, l'infraorbitaire 1 est triangulaire et vient s'enchasser sur le bord antérieur de l'IO2. L'IO3 est sub-rectangulaire et présente de nombreux rameaux radiaux du canal sensoriel infraorbitaire. L'IO4, plus petit, est sub-carré et présente un long rameau oblique du canal sensoriel qui court du bord antéro-dorsal au bord postéro-ventral de l'os. L'IO6 est presque aussi développé que l'IO5. L'antéorbitaire est en forme de massue et le supraorbitaire, subovale, forme une saillie importante au-dessus de l'orbite.

Le suspensorium

L'operculaire est haut et étroit. La lame osseuse présente sur le bord antérieur du processus ascendant de l'hyomandibulaire est courte, triangulaire et pointue. Le bord ventral présente une encoche ventro-postérieure. Le bord dorsal du mésoptéry-

goïde est convexe et celui du métaptérygoïde est très oblique. L'ectoptérygoïde est réduit à un fin arc osseux dépourvu de dent.

Le neurocrâne

Le neurocâne est haut, large et massif, mais plus proche de celui de *Myloplus rubripinnis* que de celui de *M. asterias* (Jégu *et al.*, sous presse: figs. 13, 17). En particulier, la fontanelle est allongée, étroite, formée de deux ouvertures, de part et d'autre de la barre épiphyséale, parfaitement visibles en vue dorsale et sensiblement égales. L'aire située entre la fosse dilatatoire et le canal supratemporal est plus large que le conduit du canal supraorbitaire. L'aire postéro-dorsale du neurocrâne, située en arrière du canal supratemporal, s'étend sur un peu moins d'un tiers de la face dorsale du neurocrâne.

En vue latérale, le bord dorsal du neurocrâne est subrectiligne sans concavité au niveau de la barre épiphyséale. Le bord du supraoccipital est aligné avec celui du neurocrâne. Le supraoccipital est court. Sur le squelette examiné, une ébauche de pont non jointif est située immédiatement en avant de la suture frontal-pariétal.

Région ethmoïdienne: En vue dorsale le mésethmoïde forme un triangle étroit et court. Les gorges supraethmoïdales sont larges, profondes et étendues sur presque toute la longueur du mésethmoïde. Les ailes supraethmoïdales sont aussi très développées. En vue latérale, le mésethmoïde, formant le toit de la fenêtre olfactive, est épais et haut. Le bord antérieur du mésethmoïde n'est pas projeté en une pointe vers l'avant comme chez *Myleus* (Jégu & Santos, 2002: fig. 8a), *Tometes* (Jégu *et al.*, 2002b: fig. 10a) ou *Mylesinus*, mais reste sub-vertical comme chez *M. rubripinnis* ou *M. asterias* (Jégu *et al.*, sous presse: figs. 13a et 17b). Le toit de la fenêtre olfactive est épais. L'ouverture de la fenêtre olfactive est basse mais plus allongée que chez *Myloplus asterias* ou *M. rubripinnis*. Le bord ventral de la fenêtre est formé par une projection postérieure du mésethmoïde et une projection antérieure de l'ethmoïde latéral. Le vomer, situé juste sous la suture ethmoïde latéral-mésethmoïde, est exclu du bord de la fosse olfactive. Les capsules olfactives sont isolées vers l'avant par le septum nasal, formé d'une lame osseuse issue du vomer et d'une autre issue du mésethmoïde. Le processus antéro-médian de l'ethmoïde latéral sépare les capsules olfactives du myodome antérieur et vient presque au contact du septum internasal vers l'avant. Le foramen du nerf olfactif situé dans la capsule olfactive apparaît difficilement en vue frontale. En vue ventrale, le vomer est formé d'un large écusson antérieur et d'un processus postérieur oblongue. L'écusson du vomer est trop court pour couvrir tout le plancher des capsules olfactives. Entre l'écusson du vomer et l'ethmoïde latéral, une lame osseuse épaisse forme ce plancher.

Région orbitaire: La fosse orbitaire est très largement ouverte. Mesurée entre la pointe du mésethmoïde latéral et celle du sphénotique, la largeur de la fosse orbitaire varie entre 41% et 44% de la longueur du neurocrâne, mesurée entre le bord antérieur du mésethmoïde et la branche postérieure de l'épiotique pour les spécimens de plus de 300 mm LS (48% pour un spécimen de 140 mm LS). Vers l'avant, le myodome antérieur est limité antéro-ventralement par l'expansion médio-antérieur de l'ethmoïde latéral et limité dorsalement par une expansion de l'orbitosphénoïde projetée vers l'avant de la suture frontal - orbitosphénoïde. En vue latérale, l'orbitosphénoïde

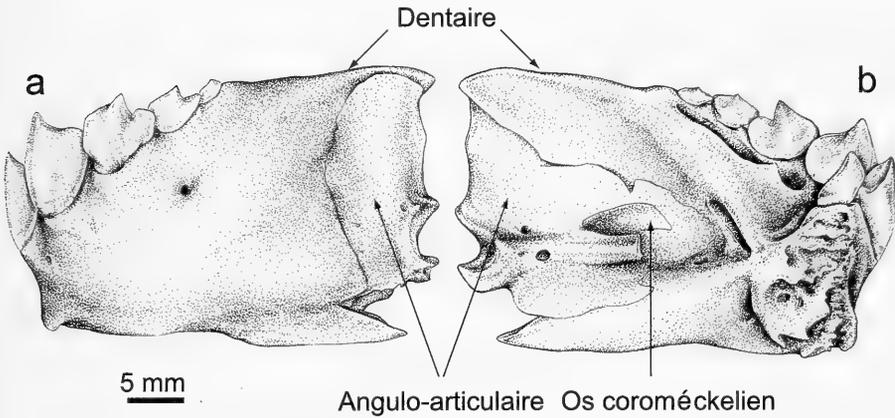


FIG. 4

Myloplus planquettei sp. n., MNHN 2002-267, environ 300 mm LS, fl. Maroni, dentaire gauche: (a) vue labiale and (b) vue linguale. – *Myloplus planquettei* sp. n., MNHN 2002-267, environ 300 mm SL, Maroni basin, left dentary: (a) labial view and (b) lingual view.

présente une forme de “L”. Le processus antéro-ventral de l’orbitosphénoïde entre en contact avec les processus médian de l’ethmoïde latéral, limitant le myodome vers le bas.

En vue ventrale, le toit de la fosse orbitaire est très profond et très irrégulier. Le ptérosphénoïde est de forme subpentagonale et présente des sutures rectilignes avec le prootique, le sphénotique et l’orbitosphénoïde. Le foramen du nerf trochléaire est entièrement placé sur le ptérosphénoïde, mais situé sur la portion distale de cet os. La suture avec le frontal est fortement indentée. Le ptérosphénoïde délimite, avec l’orbitosphénoïde vers l’avant et le prootique vers l’arrière, un large foramen optique. La suture frontal-sphénotique est rectiligne. En vue frontale, le sphénotique présente une forme d’aile. Le bord inférieur de l’os est concave, mais irrégulier. Plusieurs foramens sont ouverts dans le sphénotique. Le plus large d’entre eux est directement ouvert sur la fosse dilatatoire. La face frontale du prootique est presque entièrement occupée par le foramen du nerf trigémino-facial, situé au fond d’une dépression. Le pont prootique qui limite le bord postérieur du foramen optique et le bord dorsal du myodome postérieur, est situé sur le même plan transversal que le bord antérieur du processus ventral du prootique. Le myodome postérieur est très largement ouvert jusqu’au bord postérieur du parasphénoïde.

Fosse dilatatoire et région otique: La fosse dilatatoire est étroite. Le bord postéro-dorsal de la fosse est nettement marqué par une crête du frontal. Ensuite, le ptérotique forme une lame osseuse qui délimite le bord postérieur de la fosse. L’épine sphénotique est courte et trapue. La fosse dilatatoire présente de nombreux foramens. Deux foramens situés de part et d’autre d’un pilier postérieur de l’épine sphénotique sont directement ouverts dans la fosse orbitaire, sur la face antérieure du sphénotique. La zone d’insertion de l’hyomandibulaire est large et profonde. La face latérale du prootique présente des sutures rectilignes avec le parasphénoïde et le basioccipital. La fosse temporale est profonde et bordée postéro-ventralement par un bourrelet osseux formé par l’articulaire.

La région située entre la fosse dilatatoire et le canal supratemporal, de même largeur que la fosse dilatatoire, est plus proche de celle de *M. rubripinnis* que de *M. asterias*. Le frontal forme une bande étroite et le pariétal présente un lobe ventral. Le face latérale du ptérotique est aussi réduite. L'épine ptérotique est de forme laminaire et courte.

Région occipitale

L'aire postéro-dorsale du neurocrâne est limitée vers l'avant par un simple bourrelet du pariétal sans zone de recouvrement au niveau de la naissance du supraoccipital comme on peut l'observer chez *Piaractus* (Machado-Allison, 1982: fig. 28). La fosse post-temporale dorsale est large. En vue postérieure, la branche postérieure de l'épiotique est forte. Les sutures épiotique-exoccipital-basioccipital-supraoccipital sont rectilignes. La pointe ventrale du supraoccipital est située plus bas que le niveau des branches postérieures des épiotiques. Le bord ventral du neurocrâne est limité par l'intercalaire et la suture intercalaire-exoccipital est rectiligne.

En vue latérale, le profil ventral du supraoccipital est d'abord horizontal, puis oblique jusqu'à l'extrémité dorsale de l'os.

Squelette axial et squelette appendiculaire

L'examen du squelette axial à partir des radiographies nous a permis de compter 39 à 40 vertèbres dont 9-10 en avant du premier ptérygiophore de la dorsale et 15-16 en arrière du dernier ptérygiophore de cette nageoire. Le nombre de supraneuraux est de 5-6.

L'épine prédorsale est allongée et le bord antérieur du premier ptérygiophore est régulièrement convexe. Le squelette de la nageoire caudale suit le schéma général observé chez *Tometes*, *Myleus* ou *Myloplus*. En particulier, l'hypural 2, réduit à une mince lame osseuse, est soudé au centrum préural et séparé des hypuraux 1 et 3, qui sont eux-mêmes libres du centrum préural.

A la ceinture scapulaire, le post-cleithrum 1 est séparé des post-cleithrum 2 et 3. Le post-cleithrum 3 développe une lame osseuse postérieure juste en-dessous du post-cleithrum 2. Le bord distal du cleithrum est lisse, sans épine rétrorse. Le bord médian du cleithrum est régulièrement concave, même au niveau de l'attache dorsale du mésocoracoïde qui ne déborde pas au-delà de la limite du cleithrum. La fenêtre coracoïdale est ovale et le bord ventral du coracoïde est convexe. Un processus postérieur pointu prolonge le bord postéro-dorsal du coracoïde. En vue interne, l'attache dorsale du mésocoracoïde sur le cleithrum est discoïde tandis que celle de la scapula est oblongue, orientée antéro-postérieurement.

COLORATION

Sur le matériel préservé en alcool, la marge distale noire à la caudale est bien définie et contrastée. Le bord distal de la dorsale et celui de l'anale sont noirs. Les nageoires ventrales et pectorales ainsi que la tête sont foncées chez les deux grands individus. On note une bande verticale noire à l'oeil. Chez les deux plus petits individus (25 et 67 mm LS) une tache humérale ronde et noire est située entre la 8^{ème} et la 11^{ème} écaille perforée de la ligne latérale. Alors que l'individu de 67 mm LS présente quelques taches sombres ovales et verticales sur les flancs, l'holotype (112 mm LS) ne

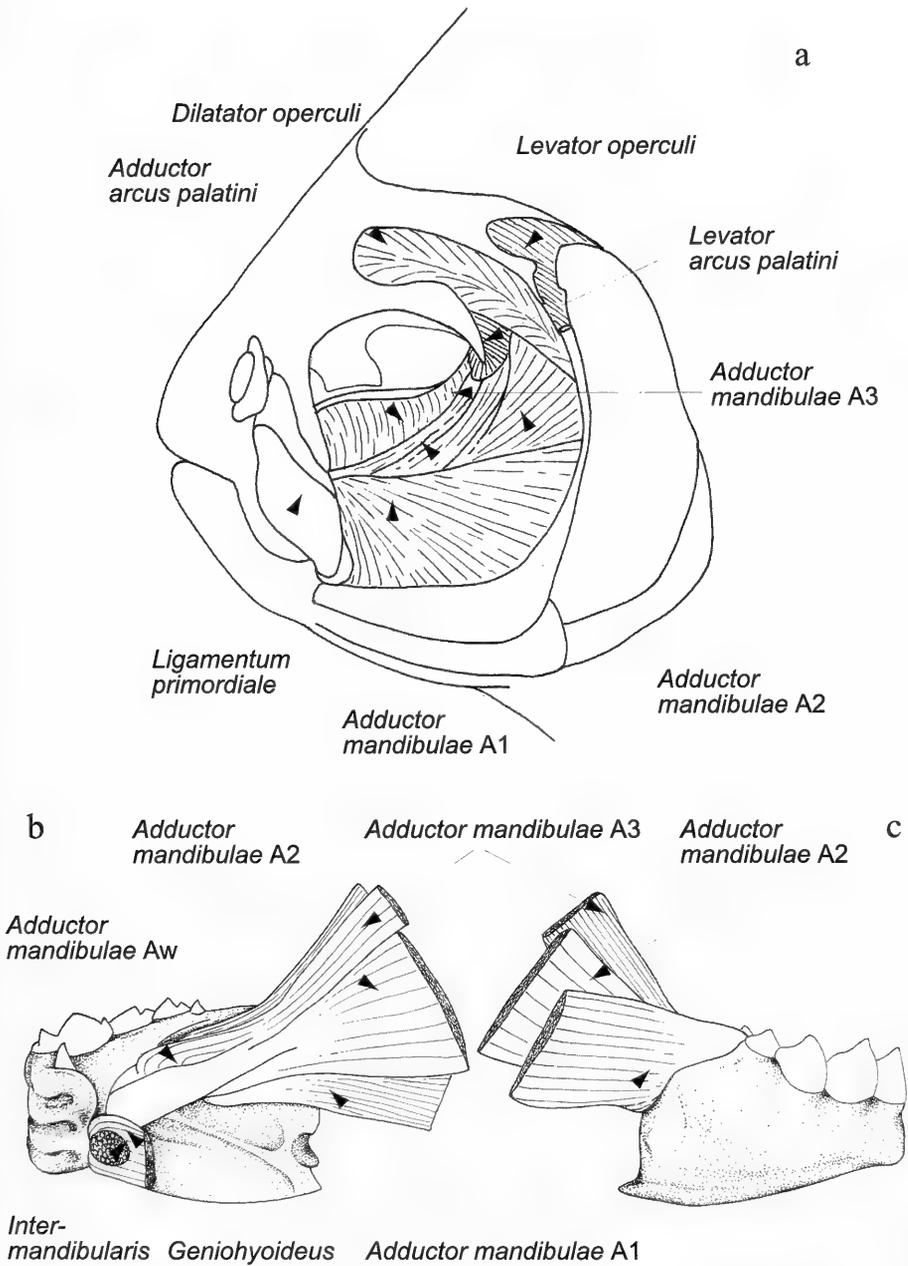


FIG. 5

Myloplus planquettei sp. n., MNHN 1998-134, env. 450 mm LS: (a) vue générale de la musculature faciale; (b) vue interne et (c) vue externe de la musculature de la mâchoire inférieure. – *Myloplus planquettei* sp. n., MNHN 1998-134, about 450 mm SL: (a) general view of facial musculature; (b) internal view and (c) external view of dentary musculature.

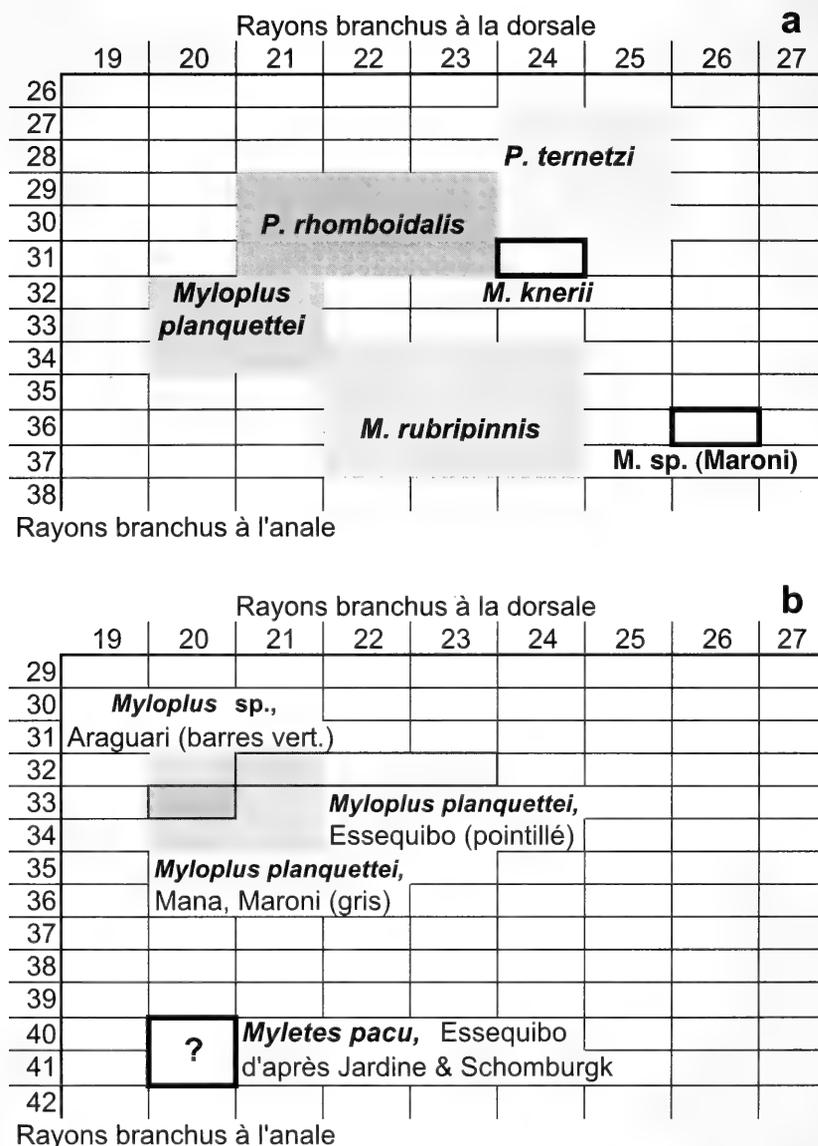


FIG. 6

Distribution croisée du nombre de rayons branchus aux nageoires anale et dorsale : (a) chez *Myloplus planquettei* (n= 12), *Myloplus sp.* (n=1), *M. rubripinnis* (n=20), *Myleus knerii* (n=1), *Prosimyleus rhomboidalis* (n=7) du bassin du Maroni et *Paramyloplus ternetzi* (n=15) du bassin du Suriname; (b) chez *Myloplus planquettei* (n=14), *Myloplus sp.* de l' Araguari (n=1) et *Myletes pacu* Jardine and Schomburgk (d'après la description originale). – Branched rays number of anal and dorsal fins : (a) in *Myloplus planquettei* (n= 12), *Myloplus sp.* (n=1), *M. rubripinnis* (n=20), *Myleus knerii* (n=1), *Prosimyleus rhomboidalis* (n=7) from Maroni Basin and *Paramyloplus ternetzi* (n=15) from Suriname Basin; (b) in *Myloplus planquettei* (n=14), *Myloplus sp.* from Araguari Basin (n=1) and *Myletes pacu* Jardine and Schomburgk (from original description).

présentent aucune marque colorée sur les flancs. L'œil des deux plus petits individus présente une bande noire verticale.

In situ les adultes ont le corps gris-rosé. Les nageoires présentent souvent une teinte rouge sur les zones les plus claires. L'œil des adultes *in situ* présente aussi une barre noire verticale. La marge distale noire à la caudale est parfois moins nette chez les plus grands spécimens frais.

DISCUSSION

POSITION TAXONOMIQUE CHEZ LES SERRASALMINAE

Myloplus planquettei sp. n. partage les caractères suivants avec *Myloplus asterias* et *M. rubripinnis*: - second lobe à l'anale des mâles au niveau des rayons branchus 15-18; - épines à la pointe de ces rayons chez les plus grands mâles; - fosse orbitaire largement ouverte; - fosse dilatatoire étroite et allongée; - gorges supraethmoïdales larges, longues et profondes; - mésethmoïde épais; - prémaxillaire composé de deux axes en forme de L; - processus latéral du prémaxillaire projeté en arrière de la dernière dent et sans processus transversal; - dents au dentaire accolées latéralement et non engrenées; - séries linguale et labiale des dents du prémaxillaire non accolées.

En revanche, *M. planquettei* se différencie de *M. asterias* par les caractères suivants: - les deux ouvertures de la fontanelle sont allongées, étroites et de taille voisine; - le frontal est plus long que la plage dorso-postérieure du neurocrâne; - l'aire située en arrière de la fosse dilatatoire est de même largeur que la fosse dilatatoire. Ces caractères sont aussi observés chez *M. rubripinnis* (Jégu *et al.*, sous presse).

La présence des crochets doubles à la pointe des rayons du second lobe de l'anale chez certains grands mâles a déjà été signalée chez *Myleus* (Jégu & Santos, 2002), *Tometes* (Jégu *et al.*, 2002a et b) et *Mylesinus* (Jégu *et al.*, 1989), mais Jégu *et al.* (sous presse) remarquent l'absence de tel crochet chez *M. asterias* et *M. rubripinnis*. Par ailleurs, l'allongement de la fenêtre olfactive chez *M. planquettei* est plus proche de ce que nous avons pu observer chez *Myleus setiger*. En revanche *M. planquettei* ne partage aucun des caractères liés à l'allongement du neurocrâne, en particulier dans la zone ethmoïdienne, et à la transformation des mâchoires relevés dans le groupe *Myleus-Tometes-Mylesinus-Ossubtus*.

L'étude morpho-anatomique *M. planquettei* présentée ici montre clairement que cette espèce doit être placée dans *Myloplus* Gill, 1896.

COMPARAISON AVEC LES ESPÈCES DE MYLOPLUS

Nous avons pu examiner deux des quatre grands spécimens de l'Essequibo (FMNH 59292 et 59298) rapportés à *Myletes pacu* Jardine & Schomburgk, 1841 par Eigenmann (1912: 393-395, pl. 54). Ils se différencient de la description originale de *Myletes pacu* par un nombre de rayons bien plus faible à la nageoire anale (Fig. 6a). En revanche, ces spécimens présentent des caractères proches ou confondus avec la série type de *M. planquettei* du Maroni et de la Mana (Tableaux I et II). Ils en diffèrent à peine par le nombre de rayons à la dorsale légèrement plus grand chez l'un d'eux (Fig. 6a). Nous plaçons donc ces spécimens dans *Myloplus planquettei*, une espèce qui, d'après la description de Jardine & Schomburgk (1841 : 236) se différencie de *Myletes*

pacu par le nombre de rayons aux nageoires et la présence d'une marge noire verticale à la caudale.

Un autre grand spécimen de l'Araguari (INPA 18452, 430 mm LS, mâle) présente des caractères voisins de ceux de *M. planquettei*. Toutefois, il s'en différencie par le nombre réduit des serraes (31 vs. 37-44 pour *M. planquettei*) et la position très en retrait des premières serraes prépelviennes, situées en arrière de l'extrémité des côtes pleurales 8. En l'absence d'autre matériel de comparaison, nous proposons de maintenir ce spécimen comme *Myloplus* sp., différent de *M. planquettei*.

Deux espèces de *Myloplus* ont été décrites avec une marge distale noire large et bien définie à la caudale. Il s'agit de *Myloplus torquatus* (Kner, 1858) décrit du bassin du Rio Negro au Brésil et *Myloplus arnoldi* Ahl, 1936, décrit du bassin de l'Amazonie. Dans le cadre d'un travail de révision en cours, nous avons pu revoir les types de ces espèces, ainsi que des spécimens du rio Xingu (Pará, Brésil) que nous rapportons à *M. arnoldi* (Tableau II). Ces deux espèces se différencient de *Myloplus planquettei* par un nombre plus faible de vertèbres totales (34-36 vs. 39-41 pour *M. planquettei*) et un nombre plus faible de vertèbres post-dorsales (9-11 vs. 15-16 pour *M. planquettei*). La variation intraspécifique du nombre total de vertèbres est très réduite chez les Serrasalminae, même sur une ample aire de distribution (Jégu & Santos, 2002; Jégu *et al.*, sous presse). Un tel écart montre que *M. planquettei* est une espèce différente de *M. torquatus* et *M. arnoldi*.

Les espèces de *Myloplus* ne présentant pas de marge distale bien nette comme chez *M. planquettei*, peuvent aussi se différencier de cette espèce par d'autres critères.

Nous avons vu plus haut que *M. planquettei* se différencie de *M. asterias* par plusieurs caractères ostéologiques au niveau du neurocrâne, mais il s'en distingue aussi par un nombre plus faible de rayons à la nageoire dorsale (ii+20-23 vs. ii+24-29 pour *M. asterias*) et de vertèbres post-dorsales (15-16 vs. 10-12 pour *M. asterias*). D'autre part, les mâles de *M. asterias* présentent un patron particulier de taches sur les flancs (Jégu *et al.*, sous presse: fig. 6) que nous n'avons pas observé chez *M. planquettei*.

M. rubripinnis se distingue de *M. planquettei* par la présence d'une large bande noire verticale sur l'œil et par un nombre de vertèbres post-dorsales plus faible (11-13 de l'Essequibo au Maroni vs. 15-16 pour *M. planquettei*). Dans le Maroni *M. rubripinnis* se distingue aussi de *M. planquettei* par une combinaison de rayons branchus à la dorsale et l'anale plus forte (Fig. 6) et par quelques caractères morphométriques (Tab. I). La base de la dorsale est plus grande chez *M. planquettei* (28,4-33% de LS vs. 33,6-38,2% pour *M. rubripinnis*) tout comme la base de l'adipeuse (4,3-6,2% de LS vs. 3,0-3,8% chez *M. rubripinnis*)

Dans le Haut Maroni Jégu *et al.* (sous presse) signalent la présence d'un spécimen de *Myloplus* (MHNG 2191-83, 1, 155,5 mm LS) préalablement rapporté par erreur à *Myleus knerii* (Steindachner, 1881) par Géry (1972). D'une morphologie générale assez voisine de *M. asterias*, ce spécimen se distingue de *M. planquettei* par un nombre plus grand de rayons aux nageoires (36 rayons branchus à l'anale vs. 32-34 pour *M. planquettei*; 26 rayons branchus à la dorsale vs. 20-21 pour *M. planquettei*) et par un nombre de vertèbres post-dorsales plus faible (13 vs. 15-16 pour *M. planquettei*). Ce spécimen est aussi différent du *Myloplus* sp. rapporté de l'Araguari.

Myloplus planquettei est bien une espèce nouvelle pour le plateau des Guyanes, dans les bassins de la Mana, du Maroni et de l'Essequibo. Dans l'Atlas des poissons

d'eau douce de Guyane française, Planquette *et al.* (1996) font état de 5 espèces de Serrasalminae phytophages dans le Maroni et la Mana. Des travaux récents de révision des Serrasalminae du plateau des Guyanes (Jégu & Santos, 2002; Jégu *et al.*, 2002a et b; Jégu *et al.*, sous presse) auxquels s'ajoute la description de *Myloplus planquettei* ont permis de mieux connaître la faune de ces deux bassins. Nous proposons ci-après une clé d'identification des Serrasalminae phytophages du Maroni et de la Mana faisant la synthèse des observations récentes.

- 1a Bouche réduite, terminale, horizontale 2
- 1b Bouche largement fendue, oblique et tournée vers la haut. Dents incisiformes bi- ou tricuspides et engrenées *Tometes lebaili* Jégu *et al.*, 2002
- 2a Présence de serrae prépelviennes. Zone préventrale avec une carène médiane, ou arrondie chez les très grands spécimens 3
- 2b Absence de serrae prépelviennes. Zone prépelvienne plane avec deux carènes latérales *Acnodon oligacanthus* (Müller & Troschel, 1844)
- 3a Présence d'une paire de dents symphysaires en arrière de la série principale du dentaire 4
- 3b Absence de dents symphysaires en arrière de la série principale du dentaire. Quatre à sept rangées d'écailles sur la base des rayons de l'anale. 27-30 rayons branchus à l'anale, 24-25 à la dorsale *Paramyloplus ternetzi* Norman, 1929
- 4a Dents des deux paires frontales de la série labiale du prémaxillaire séparées les unes des autres, et séparées des dents de la série linguale. Dents non engrenées 5
- 4b Dents des deux paires frontales de la série labiale du prémaxillaire accolées latéralement les unes aux autres, et étroitement accolées aux dents de la série linguale. Dents du dentaire engrenées. 31 rayons branchus à l'anale, 24 à la dorsale (Maroni) . . . *Myleus knerii* (Steindachner, 1881)
- 5a Les deux séries de dents du prémaxillaire forment deux arcs parallèles proches. La couronne des dents est triangulaire 6
- 5b Les deux séries de dents du prémaxillaire sont éloignées l'une de l'autre et forment un triangle ayant l'aspect d'un "A". Couronne des dents du dentaire rectiligne, horizontale et située au niveau médian de la dent. Lèvre de la machoire inférieure charnue. Bord antéro-distal de la dorsale noir. 29-31 rayons branchus à l'anale, 21-23 à la dorsale *Prosomyleus rhomboidalis* (Cuvier, 1818)
- 6a 36 rayons branchus à l'anale, 26 à la dorsale (Maroni) *Myloplus* sp.
- 6b 34-37 rayons branchus à l'anale, 22-24 à la dorsale, œil barré d'une bande verticale noire *Myloplus rubripinnis* (Müller et Troschel, 1844)
- 6c 32-34 rayons branchus à l'anale, 20-21 à la dorsale. Bande noire large et bien définie sur le bord distal de l'anale *Myloplus planquettei* sp. n.

CONCLUSION

La faune des poissons de Guyane est l'une des mieux connues d'Amérique du Sud (Planquette *et al.*, 1996; Keith *et al.*, 2000; Le Bail *et al.*, 2000). La description

aujourd'hui d'espèces nouvelles de grande taille, pourtant très communes pour les populations riveraines (Pagezy & Jégu, 2002), fournit une indication du travail de prospection et d'inventaire encore nécessaire dans cette région.

Pagezy & Jégu (2002) montrent l'importance que tiennent les watau (*Tometes lebaili* Jégu et al., 2002b et *Myloplus planquettei* sp. n.) dans la culture, les pratiques traditionnelles, l'alimentation et les ressources économiques des Wayana du Haut Maroni. Ces deux espèces phytophages sont parmi les onze plus grandes espèces du haut Maroni (*Hoplias aimara*^(*), *Pseudoplatystoma fasciatum*^(*), *P. tigrinum*^(*), *Hemisorubim platyrhynchos*^(*), *Potamotrygon hystrix*^(*), *Prosomyleus rhomboidalis*, *Serrasalmus rhombeus*^(*), *Cichla ocellaris*^(*), *Plagioscion* sp.^(*)) dont huit sont des espèces carnivores (*). Les Serrasalminae phytophages, et les watau en particulier, sont d'autant plus importants aujourd'hui comme ressource alimentaire, que la contamination par le méthyl-mercure touche déjà les grands carnivores (Fréry et al., 2001). La pression anthropique (barrages, exploitations minières, surpêche, tourisme, etc.) sur ces milieux des hauts cours du plateau guyanais dont on connaît la pauvreté et la fragilité (Goulding et al., 1988) met en péril le maintien de ces ressources. A coté des travaux d'inventaires, un travail de fond sur la conservation de ces milieux et des espèces associées est nécessaire et urgent afin d'appliquer une véritable politique de gestion durable dans ces régions.

REMERCIEMENTS

Nos remerciements aux Amérindiens Wayana du Haut Maroni, et particulièrement à ceux des villages d'Antecume Pata, de Palimino et de Pidima, qui ont eut la gentillesse de nous accueillir et nous aider au cours de nos expéditions. Nos remerciements à Yves Fermon et à Bernard de Mérona pour le matériel récemment collecté dans le Haut Maroni. Nos remerciements à F. Meunier, M.-L. Bauchot et M. Beaunier (MNHN, Paris) pour la relecture du manuscrit et leurs suggestions. Nos remerciements à E. Belmont-Jégu qui a exécuté les dessins.

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Separation of two species standing as *Sitticus zimmermanni* (Simon, 1877) (Araneae, Salticidae), a pair of altitudinally segregated species

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Separation of two species standing as *Sitticus zimmermanni* (Simon, 1877) (Araneae, Salticidae), a pair of altitudinally segregated species. - *Sitticus zimmermanni* auctt. is found to encompass two distinct species, here recognized as *S. atricapillus* (Simon) (with *Attus alpicola* Kulczyński, *Sitticus semivittatus* Simon, and *S. appolinis* Bristowe as junior synonyms) and *S. zimmermanni* (Simon). Both species, belonging to the *floricola* species group, are redescribed. A lectotype (♀) is designated for *Attus atricapillus* Simon, 1882. *S. atricapillus* seems to be confined to mountainous habitats above 900 m asl in central and southern Europe where the spider occurs among rock debris. *S. zimmermanni* has a wide distribution from Europe to Transbaikalia (Russia). In Europe, this species has been found at altitudes up to ca 400 m asl, mostly in exposed sandy habitats. Some old European records attributed to *Attus* (or *Sitticus*) *zimmermanni* have been found to refer to *S. inexpectus* Logunov & Kronstedt.

Key-words: Araneae - Salticidae - *Sitticus* - taxonomy - revalidated species - Palearctic.

INTRODUCTION

Sitticus Simon, 1901 is one of the most speciose genera of jumping spiders in Europe. Despite a long tradition of arachnological research on salticid species in central Europe, there are still some taxa in need of a revision, partly due to unclear identity from existing descriptions, or to confusing synonymy (e.g. Braun, 1963; Harm, 1973; Prószyński, 1980). Recently, Logunov & Kronstedt (1997) separated two species up to then standing as *Sitticus rupicola* (C. L. Koch, 1837), and here we treat another species pair in the *floricola* group.

Kropf (1996) announced the presence of what he identified as *S. zimmermanni* in the Jura Mts. in western Switzerland. He noted, however, some differences between the Jura specimens and *S. zimmermanni* as described in Harm (1973), notably in the

abdominal pattern of the male and in habitat preference. Earlier Prószyński (1980) remarked that “the species [*i.e.* *S. zimmermanni*] seems to occur in two different environments: on rocks in mountains and on sand ground in lowlands” but did not pay further attention to this ‘diplostenoccity’ (*sensu* Duffey, 1968), which is still given as information (*e.g.* in Bellmann, 1997) when referring to *S. zimmermanni*.

At the request of Dr Christian Kropf, we have studied the material from the Jura together with conspecific material from other areas at higher elevations in central and southern Europe. It proved that the high mountain specimens differ from the material of *S. zimmermanni* examined from lowland localities in Europe. The central and southern European high mountain form unequivocally belongs to a separate species already named but placed in synonymy with *S. zimmermanni* (cf. Prószyński & Staręga, 1971; Prószyński, 1980). We conclude that the name *Sitticus atricapillus* (Simon) should be revalidated for this high mountain species.

Among the junior synonyms of *S. zimmermanni* given in Prószyński & Staręga (1971) are *Attus alpicola* Kulczyński, 1887 and *A. hungaricus* Kulczyński, 1891. Prószyński (1980) gave further details after examining specimens identified as either of them in the Budapest Museum. Kulczyński described *A. hungaricus* after having described *A. alpicola* and apparently he clearly distinguished the two species (see Chyzer & Kulczyński, 1891: 20–21): *A. alpicola* ♂: “oculorum area antice plus minusve albo marginata...” [applies to “*A. Zimmermannii*?”, *A. floricola* (C. L. Koch) and *A. rupicola* (C. L. Koch) as well] and “abdominis dorsum antice vitta brevi alba cum limbo dorsuali coniuncta ornatum”; *A. hungaricus* ♂: “oculorum area antice non albo marginata”. This is in accordance with our view that two species are currently standing as *S. zimmermanni*.

Furthermore, we found that the species given as “*A. Zimmermannii* Simon?” in Chyzer & Kulczyński (1891) is conspecific with *Sitticus inexpectus* Logunov & Kronstedt, 1997. In the key to males of *Attus* (p. 21) Chyzer & Kulczyński (1891) stated: “cephalothoracis limbus albus marginalis, e pube efformatus supra coxas III. in dentem triangularem magnum dilatatus...”. This is a diagnostic character for the male of *S. inexpectus* (see Logunov & Kronstedt, 1997; Kronstedt, 1998) [2♂ “Coll. Chyzer” (HNHM), re-examined]. Also a later description by Simon (1937: 1192, “Ligne blanche marginale du céphalothorax émettant en arrière au niveau de la déclivité, une ligne verticale abrégée effilée au sommet mais souvent épaissie à la base”) indicates that the species, which he then referred to under the name “*Sitticus zimmermanni* E. S.”, is actually conspecific with *S. inexpectus*. Harm (1973) commented on *S. zimmermanni sensu* Simon (1937) without being able to place it. Simon’s material from France consisted, however, of only a single ♂ stored together with *S. rupicola* in a sample collected at a high altitude in Haute-Alpes (a misplaced specimen?), which is not consistent with the present knowledge about *S. inexpectus* being a lowland species. Simon (1937) also referred to its occurrence in Britain, where *S. inexpectus* is indeed known from coastal habitats. In view of the fact that *Attus zimmermanni* had been included in two fairly recent revisions (Harm, 1973; Prószyński, 1980), we did not consider that species when describing *S. inexpectus*. In any case, the holotype of *Attus zimmermanni* is unambiguously not conspecific with *S. inexpectus* but with what we redescribe as *Sitticus zimmermanni* below.

The recognition of *S. atricapillus* being a high mountain species in central and southern Europe, with *S. zimmermanni* as the morphologically close counterpart at low to medium altitudes and with a wide Palearctic distribution, parallels the situation with the species pair *S. rupicola* and *S. inexpectus* (cf. Logunov & Kronstedt, 1997).

From the experience gained while studying the pairs *S. atricapillus* - *S. zimmermanni* and *S. rupicola* - *S. inexpectus* we want to stress the importance of routinely presenting scale bars along with drawings (e.g., the bulbi of *S. zimmermanni* and *S. inexpectus* are considerably smaller than those of *atricapillus* and *rupicola*, respectively) as well as giving information about place of origin for the material depicted.

Females of *S. atricapillus* and of *S. zimmermanni* are difficult to distinguish (see Table I), therefore records based on single females are to be considered provisional if no additional information (habitat, altitude, etc.) is at hand; males are required to confirm or reject such records.

DEPOSITORIES

- BMNH The Natural History Museum, London, UK (J. Beccaloni)
 CCK Collection of C. Komposch, Graz, Austria
 CCM Collection of C. Muster, Dresden, Germany
 CJB Collection of J. Buchar, Prague, Czech Republic
 CJS Collection of J. Svatoň, Martin, Slovakia
 CMZ Collection of M. Zabka, Siedlce, Poland
 COvH Collection of O. von Helversen, Erlangen, Germany
 CRB Collection of R. Bosmans, Ghent, Belgium
 CRP Collection of Roger Pettersson, Umeå, Sweden
 CTB Collection of T. Blick, Hummeltal, Germany
 CTh Collection of K. Thaler, Innsbruck, Austria
 CVR Collection of V. Ružička, České Budějovice, Czech Republic
 DBAC Dipartimento di Biologia Animale dell'Università di Catania, Catania, Italy (T. Cantarella)
 HNHM Hungarian Natural History Museum, Budapest, Hungary (T. Szûts)
 MBCG Museo Civico di Scienze Naturali "Enrico Gaffi", Bergamo, Italy (P. Pantini)
 MMUM Manchester Museum, University of Manchester, Manchester, UK (D. V. Logunov)
 MNHN Muséum National d'Histoire Naturelle, Paris, France (C. Rollard)
 NHMB Naturhistorisches Museum, Basel, Switzerland (A. Hänggi)
 NHRS Swedish Museum of Natural History, Stockholm, Sweden (T. Kronstedt)
 NMBE Naturhistorisches Museum, Bern, Switzerland (C. Kropf)
 ZISB Institute of Zoology, Bulgarian Academy of Sciences, Sofia, Bulgaria (C. Deltshv)
 ZMHB Museum für Naturkunde der Humboldt-Universität, Berlin, Germany (J. Dunlop)
 ZMPA Museum and Institute of Zoology, Polish Academy of Sciences, Warsaw, Poland (T. Huflejt)
 ZMUM Zoological Museum of the Moscow State University, Moscow, Russia (K. G. Mikhailov)
 ZMUU Museum of Evolution, Uppsala University, Uppsala, Sweden (M. Eriksson)

ABBREVIATIONS IN THE TEXT AND TABLE

ALE	anterior lateral eye(s)	PLE	posterior lateral eye(s)
AME	anterior median eye(s)	pr	prolateral
ap	apical	Pt	patella
d	dorsal	rt	retrolateral
Fm	femur	SRR	secondary receptacle
I, II, etc.	referring to first leg, second leg, etc.	Tb	tibia
L	length	Tr	tarsus
Mt	metatarsus	v	ventral

For leg spination the system adopted is that used by Ono (1988). Measurements are given in millimetres.

REDESCRIPTIONS

Sitticus atricapillus (Simon, 1882)

Figs 1, 3-5, 9-11, 15-17

Attus atricapillus Simon, 1882: 31-32 (♂ ♀). ♀ from Italy: Basilicata/Calabria, Massiccio del Pollino, Cima del Dolcedorme, in MNHN, here designated as lectotype in order to preserve stability of nomenclature (see remarks below).

Attus alpicola Kulczyński, 1887: 251, 285-289, pl. 5, figs 1-3 (♂ ♀). Syntypes from Italy: Trentino-Alto Adige, Mt. Schlern and Trafoi Valley, not examined. **Syn. n.**

Sitticus alpicola; Roewer, 1954: 1243; Bonnet, 1958: 4069.

Sitticus appolinis Bristowe, 1935: 784-786, figs 17-20 (♂ ♀). Syntypes from Greece: Mt. Parnassos in Bristowe's private collection, destroyed. Roewer, 1954: 1243; Bonnet, 1958: 4069. **Syn. n.**

Sitticus atricapillus; Roewer, 1954: 1243.

Sitticus cingulatus (Simon)? (misidentification); Braun, 1963: 125-128, figs 22-25 (♂ ♀).

Sitticus semivittatus Simon, 1937: 1192, fig. 1882 (♂). Syntypes from France: Hautes-Alpes, Lautaret, in MNHN, examined. Roewer, 1954: 1248; Bonnet, 1958: 4083. **Syn. n.**

Sitticus zimmermanni (Simon) (misidentification); Prószyński, 1980: 24-27 (in part), figs 72-74, 77, 78 (♂ ♀), 2003 (in part); Kropf, 1996: 108, fig. 2 (♂-habitus); Metzner, 1999: 84-85, pl. 49 (♂ ♀); Platnick, 2003 (in part).

MATERIAL EXAMINED

GREECE. Central Greece: Mt. Timfristos, summit area, 1-2 Aug. 1978, 1♂ (O. v. Helversen, COvH). Epirus: Tomaros, 18-19 Aug. 1983, 1♂ 2♀ (O. v. Helversen, COvH). – **BULGARIA.** Plovdiv: Stara Planina Mts, Kozya Stena Hut, 1600 m asl, 19 July 1995, 1♀; Stara Planina Mts, Bratanets Peak, 2030 m asl, 16 June 1995, 1♀ (C. Deltshv, ZISB). Blagoevgrad: Pirin Mts, Vihren Hut, 2000 m asl, 23 July 1985, 1♂; Pirin Mts, Vasilashko Ezero Lake, 2000 m asl, 25 July 1986, 1♀; Pirin Mts, Muratovo Ezero Lake, 2400 m asl, 12 July 1989, 1♂ (C. Deltshv, ZISB). – **MACEDONIA.** Šar Planina Mts, Tri vode Hut, 1800 m asl, 22 July 1996, 2♀; Šar Planina Mts, Loboten Peak, 2000 m asl, 20 July 1996, 3♂ 2♀, 11 July 1997, 1♀ (G. Blagoev, ZISB). – **CROATIA.** Rijeka: Crni lug, 1♂ (Coll. Chyzer, HNHM); Risnjak, 1♀ (without epigyne) (Coll. Chyzer, HNHM). – **ITALY.** Basilicata/Calabria: Cima del Dolcedorme [visited 27 July 1880 (Cavanna, 1882)], 1♀ (Coll. Simon, MNHN; lectotype of *Attus atricapillus*). Friuli Venezia: Osternig, 1770 m asl, 16 August 1997, 1♂ (B. & C. Komposch, CCK). Lombardia: Bergamo, Colzate, Baite Sedernello, 1200 m asl, 2 August 2001, 1♀ (Ferrario, Pantini, Pellizzoli & Valle, MBCG). Sicily: Mt. Frumento (part of Mt. Etna), 2150 m asl, 11 July 1984, 2♂ 1♀ (P. Alicata & T. Cantarella, DBAC). Trentino-Alto Adige: Mt. Tremalzo near Bezzecca [W of Lake Garda], 14 June 1964, 4♂ 11♀ (K. Thaler, CTh). – **AUSTRIA.** Carinthia (Kärnten): Gailtaler Alpen, NW Kötschach-Mauthen, NSG Mussen, 2030 m asl, pitfall trap 1

July-26 August 2000, 2♂ (B. & C. Komposch, CCK); Oisternig, 2040 m asl, 16 August 1997, 1♀ (B. & C. Komposch, CCK). – **CZECH REPUBLIC.** Severočeský: Liberec, Mt Ještěd, 920 m asl, scree slope, 22 August 1987, 1♂ 2♀ (V. Ružička, CVR). – **GERMANY.** Bavaria (Bayern): Spiegelau (Bayerischer Wald), exposed slope with rocks, 1370 m asl, 26 June 1999, 1♀ (G. Langer, CTB); Karwendel, Soiernspitze, dwarf pine forest with open scree, 1780 m asl, 10 August 1998, 1♂ 1♀, 30 May 1999, 1♂ 2♀ (C. Muster, CCM). – **SWITZERLAND.** Neuchâtel: Gorgier, Creux-du-Van, ca 1220 m asl, scree slope, 31 July 1996, 2♂ (C. Kropf, NMBE), 2 June 1997, 1♂ 1♀ (C. Kropf, NMBE), 7 June 1997, 1♂ (A. Rohner, NMBE). – **FRANCE.** Hautes-Alpes: Lautaret, 2♂ (Coll. Simon, MNHN; syntypes of *S. semivittatus*). Hautes-Pyrénées: Aragnouet, 2100 m asl, 28 July 1984, 3♀ (R. Bosmans, CRB).

REMARKS

Prószyński (1980) examined what he considered to be the type of *Attus atricapillus* (deposited in MNHN). We have re-examined the same ♀ specimen [labelled *nigrocapillatus*/Baulicuta (Cav.) (*i.e.* a misspelling of Basilicata, see Prószyński, 1980)]. The abbreviation "(Cav.," most probably refers to G. Cavanna, who was one of the excursion participants collecting material from Basilicata which was later studied by Simon (1882). The following foot-note in Cavanna (1882: 28), regarding *A. atricapillus*, may explain the error in labelling: "Per errore *nigricornis* nei Resoconti". We are therefore convinced that this specimen belongs to the type material.

Attus atricapillus was originally described from both sexes. Regrettably no male from the type series seems to exist any longer. However, in the original description, Simon (1882: 32) stated: "Cephalothorax ...parte cephalica utrinque linea longitudinali pilis flavis albisque composita ornata; pilis oculorum ac clypei nigris pilis albis paucis et brevibus intermixtis." Thus, he gave no indication of a transverse white band above the first eye row as typical for males of *S. atricapillus*.

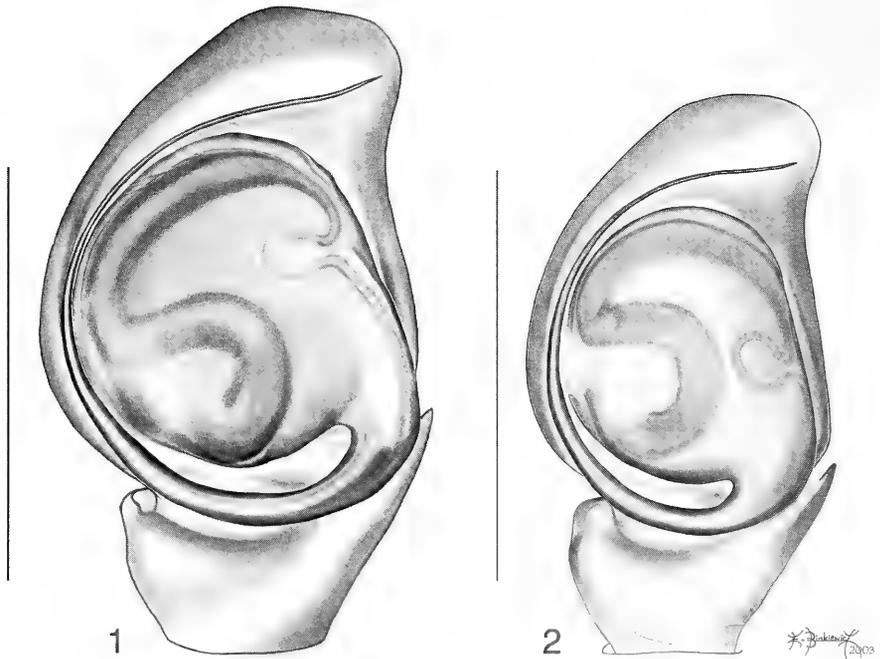
The two males from Sicily studied by us also lack this transverse white band (except for a few white hairs) above the first eye row, which is so characteristic for other males referred to this species (*cf.* description below). In most characters, however, the males from Sicily seem to concur with males from other parts of the distribution area (*cf.* also Fig. 21). Until more is known about South Italian populations of *S. atricapillus* we consider all the material here referred to this species as being conspecific and consequently use the oldest available name.

DIAGNOSIS. See Table I.

DESCRIPTION

MALE (from Italy, Trentino). *Measurements.* Carapace 2.15 long, 1.65 wide, 0.83 high at PLE. Ocular area 0.98 long, 1.30 wide anteriorly and 1.29 posteriorly. Diameter of AME 0.39. Abdomen 1.98 long, 1.50 wide. Cheliceral length 0.85. Clypeal height 0.09. Length of leg segments:

	Fm	Pt	Tb	Mt	Tr	Total
I	1.30	0.81	0.93	0.85	0.53	4.42
II	1.10	0.66	0.65	0.63	0.41	3.45
III	1.03	0.50	0.55	0.64	0.45	3.17
IV	1.61	0.68	1.08	0.90	0.55	4.82



FIGS 1, 2

Left male palp, ventral view. – 1. *Sitticus atricapillus* (Croatia). – 2. *S. zimmermanni* (Sweden: Dalarna). Scale line: 0.5 mm.

Leg spination. Leg I: Fm d 0-1-1-2; Pt pr 0-1-0; Tb pr 1-1, v 2-2-2ap; Mt v 2-2ap. Leg II: Fm d 0-1-1-2; Pt pr 0-1-0; Tb pr 1-1, v 1-1-2ap; Mt pr 1ap, v 2-2ap. Leg III: Fm d 1-1-3; Pt pr and rt 0-1-0; Tb pr and rt 1-1-1, v 1-0-2ap; Mt pr and rt 2-2ap, v 2ap. Leg IV: Fm d 1-0-1-3; Pt pr and rt 0-1-0; Tb d 1-0, pr and rt 1-1-1, v 1-0-2ap; Mt pr and rt 1-1-2ap, v 1ap.

Coloration. Carapace: brown, shining, covered with a dark appressed pubescence. A longitudinal streak of white hairs on each side, running from ALE below PLE to posterior slope of carapace (Figs 5, 15). A transverse band of white hairs present between ALE and above AME. A median streak of white hairs from fovea forwards to level of PME. Eye brows (outside upper part of AME) with longer white scale-like hairs. AME and ALE surrounded by scattered short white scale-like hairs. Clypeus brown with light (greyish) hairs. Sternum greyish brown. Abdomen: dorsally blackish brown. Dorsum bordered with white hairs forming a white band around anterior part. A distinct median white lanceolate spot in anterior part (often confluent with white band at anterior margin) and a pair of large distinct white spots just behind the middle of dorsum. A few small median chevron-like marks of white hairs present towards the rear end of the abdomen. Sides and venter light greyish brown with whitish pubescence. Spinnerets light greyish brown. Legs: brown to yellowish brown, with very slightly darker markings. Fm+Tb+Mt I sometimes uniformly dark brown. Palp: brown;

Pt more or less yellowish throughout; Fm (dorso-distally), Pt and Tb furnished with white hairs, longest laterally on Tb, cymbium dorso-basally with a spot of a few white hairs, otherwise with dark hairs.

Palp. Structure as in Figs 1, 3, 4.

FEMALE (from Italy, Trentino). *Measurements.* Carapace 2.33 long, 1.78 wide, 0.88 high at PLE. Ocular area 1.03 long, 1.39 wide anteriorly and 1.43 posteriorly. Diameter of AME 0.40. Abdomen 2.28 long, 1.80 wide. Cheliceral length 0.70. Clypeal height 0.14. Length of leg segments:

	Fm	Pt	Tb	Mt	Tr	Total
I	1.13	0.66	0.73	0.60	0.48	3.60
II	1.05	0.58	0.63	0.55	0.43	3.24
III	1.08	0.51	0.58	0.63	0.45	3.25
IV	1.93	0.78	1.21	1.00	0.54	5.46

Leg spination. Leg I: Fm d 0-1-1-2; Tb v 2-2-2ap; Mt v 2-2ap. Leg II: Fm d 1-1-2; Tb pr 0-1, v 1-1-2ap; Mt v 2-2ap. Leg III: Fm d 1-1-3; Pt pr and rt 0-1-0; Tb pr and rt 1-1-1, v 1-2ap; Mt pr and rt 2-2ap, v 2ap. Leg IV: Fm d 1-1-1; Pt pr and rt 0-1-0; Tb pr and rt 1-1-1, v 1-0-2ap; Mt pr 1-2-2ap, rt 2-2ap, v 2ap.

Coloration. Carapace dusky brown, with appressed light hairs. Clypeus light brown, with dense pubescence of long white hairs. Abdomen dorsally greyish, with two pairs of dark irregular blotches (with dark hairs), one pair just anterior to the middle and the other in the posterior part; anterior pair often immediately followed by a pair of lighter spots. A few lighter chevron-like marks at the midline posteriorly (Figs 16, 17). Legs light brownish with slightly darker annulation. Palp mostly yellowish brown, tip of tarsus blackened, and densely equipped with long white hairs, especially laterally.

Epigyne and spermathecae as in Figs 9-11.

HABITAT

Sitticus atricapillus appears to be a high mountain species (up to 2600 m asl in the Alps: Thaler, 1997) found among accumulations of rocks (Kropf, 1996: sub *S. zimmermanni*), gravel with dwarf pines and *Erica*, as well as in grassy heaths with stones (Thaler, 1997: sub *S. zimmermanni*).

DISTRIBUTION

The species seems to have a central and southern European range and is virtually restricted to mountainous regions (Fig. 22). It has been recorded from Greece (Bristowe, 1935: sub *S. appolinis*; Metzner, 1999: sub *S. zimmermanni*), Bulgaria (Deltshev & Blagoev, 1997 and Deltshev, 1998: sub *S. zimmermanni*), Croatia (Chyzer & Kulczyński, 1891: sub *Attus alpicola*), Italy (Basilicata/Calabria: Simon, 1882; Trentino-Alto Adige: Kulczyński, 1887: sub *Attus alpicola* and Komposch, 2000: sub *S. zimmermanni*; Sicily: Alicata & Cantarella, 2000: sub *S. zimmermanni*), Austria (Thaler, 1997 and Komposch, 2000: sub *S. zimmermanni*), Czech Republic (Buchar & Ružička, 2002: sub *S. zimmermanni* in part: material listed above), Germany (Muster,

2001: sub *S. zimmermanni*), Switzerland (Kropf, 1996: sub *S. zimmermanni*), France (Hautes-Alpes: Simon, 1937 and Hautes-Pyrénées: Denis, 1953 (♂): sub *S. semivittatus*; Bosmans *et al.*, 1986: sub *S. zimmermanni*).

Sitticus zimmermanni (Simon, 1877)

Figs 2, 6-8, 12-14, 18-20

Attus Zimmermanni Simon, 1877: 74-75 (♂). Holotype from Germany or Poland: River Neisse, in ZMHB, examined.

A. Zimmermannii; Bösenberg, 1903: 433, pl. 41 fig. 637 (♂).

A. hungaricus Kulczyński in Chyzer & Kulczyński, 1891: 23-26, pl. 1 fig. 37a, b (♂♀). Syntypes from Hungary: Péczel (Pécel) and Kecskemét, and Romania: Érmihályfalva (Valea lui Mihai), not examined.

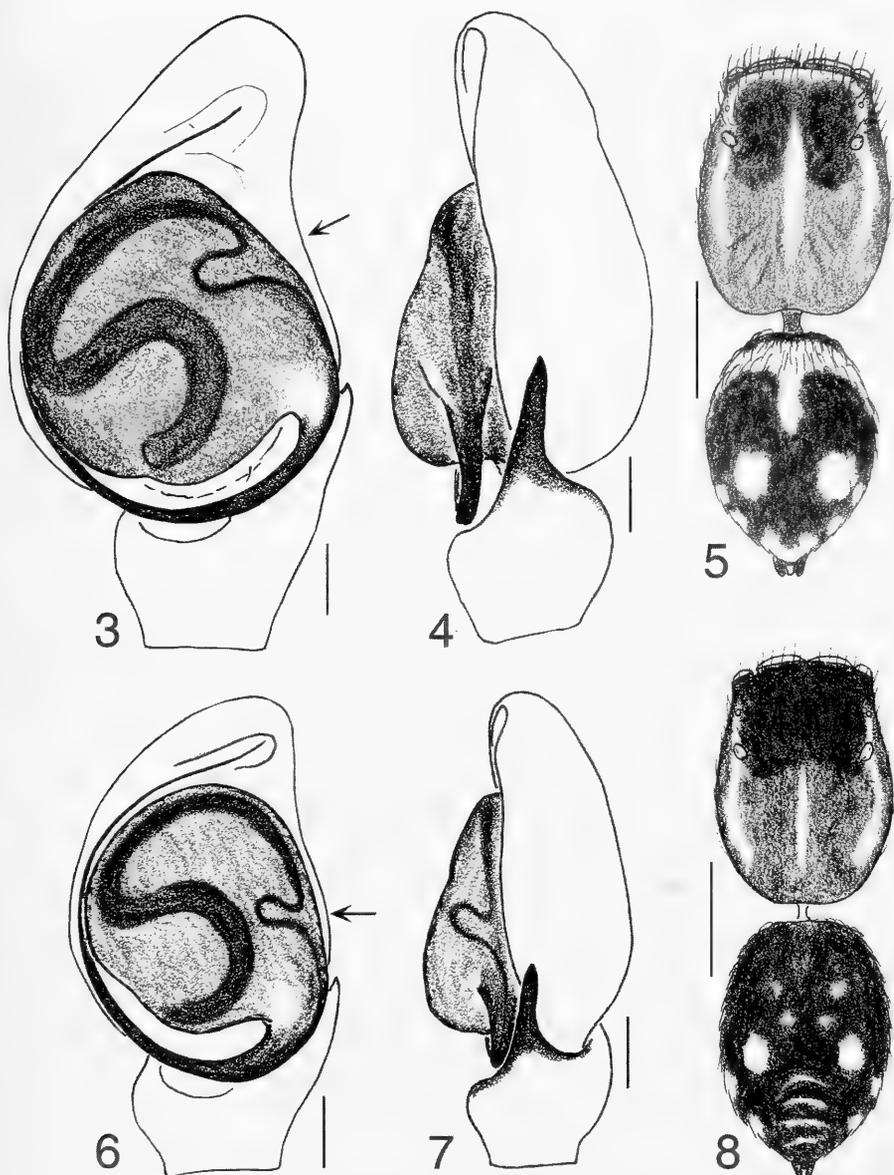
Sitticus hungaricus; Roewer, 1954: 1245; Bonnet, 1958: 4076.

Sitticus tullgreni Holm, 1944: 3-4, figs 4-7 (♀) [printed 4 July 1944, not in 1945 as given in Platnick, 2003]. Holotype from Sweden: Uppland, Hagede, Vargholmen, in ZMUU, examined. Tullgren, 1944: 29-30, fig. 21B, pl. 2 fig. 32 (♀); Roewer, 1954: 1248; Kleemola, 1969: 47, figs 2-3 (♂♀).

Sitticus zimmermanni; Roewer, 1954: 1249 (in part); Bonnet, 1958: 4085 (in part); Prószyński & Staręga, 1971: 289 (in part); Harm, 1973: 386-388 (in part, description and figures apparently based on *S. zimmermanni*), figs 5, 10, 31, 32, 39, 40, 46-50 (♂♀); Prószyński, 1980: 24-27 (in part), figs 69-71, 75, 76, 79-81 (♂♀), 1991: 518-521 (in part), figs 1384.1, 1384.3-4 (♂♀), 2003 (in part); Wesołowska, 1996: 42, fig. 34 a-c (♂♀); Zabka 1997: 97-98, figs 376-381 (♂♀); Logunov & Marusik, 2000: 225-226; Platnick, 2003 (in part). A complete set of references for Siberian records is given in Logunov & Marusik (2000).

MATERIAL EXAMINED

SWEDEN. Dalarna: Ore, Lake Skattungen, 20 June 1982, 1♀, 25 June 1982, 1♂, 17 July 1982, 2♂ 1♀, 3 Sept. 1982, 2♂, 22 July 1983, 2♂, 3 June 2001, 1♀, 15 August 2002, 1♂; Ore, Lake Oresjön, 22 July 1983, 2♂, 30 July 1999, 2♂, 30 July 2000, 2♂, 10 August 2000, 1♂, 27 August 2000, 1♂, 6 July 2001, 3♂, 20 July, 2♂ 1♀ (T. Kronstedt, NHRS). Norrbotten: Haparanda Sandskär, 21-23 June 1996, 1♂ 2♀ (R. Pettersson, CRP). Östergötland: Gryt, Långskär, 25 July 1980, 1♂ 1♀ (T. Kronstedt, NHRS). Uppland: Hagede, Vargholmen, 28 July 1941, 1♀ (H. O. Backlund, ZMUU; holotype of *S. tullgreni*). – **GERMANY.** Bavaria (Bayern): ca 10 km S of Augsburg, near Königsbrunn, at River Lech, 15-31 August 2001, 1♂ (K. Gees, CTB). Sachsen: Lausitz, Neisse, 1870, 1♂ (H. Zimmermann, ZMHB 5972; holotype: frons, palps and legs mounted on a microscopic slide); Niesky, 1♂ (Coll. Koch, BMNH); Halbendorf, sandy grassland, 5 June 1995, 1♀ (Gerlach, NMBE). Sachsen-Anhalt: E of Bitterfeld, Goitzsche, restored former brown coal opencast mine, 18 July -1 August 1997, 2♂ (I. Al Hussein, CTB); E of Halle (on the Saale), Lochau, restored former brown coal opencast mine, 28 June - 12 July 1996, 1♀ (I. Al Hussein, CTB). – **POLAND.** Swietokrzyskie: Puszcza Sandomierska, leśn. Krawce, *Leucobryo-Pinetum* (pitfall traps), 13 July 1998, 2♂ (T. Huflejt, ZMPA); same locality, nadl. Kotowa (clearing, pitfall trap), 14 May 1998, 1♂ (T. Huflejt, ZMPA). Mazowieckie: near Siedlce (Białki), 29 May 2000, 2♀ (J. Janowska, CMZ). – **CZECH REPUBLIC.** Středočeský: Tišice-Kozly, sandy locality, 25 May 1961, 2♂ (J. Buchar, CJB). – **SLOVAKIA.** Nitra: Chotínske piesky, 19 October 1973, 1♂ (J. Svatoň, CJS); Čenkov near Šturovo, sandy locality, 12 May 1964, 1♂ (J. Buchar, CJB). – **SWITZERLAND.** Vaud: Buchillon (at the border of Lake Geneva), 1♂ 1♀ (R. de Lessert, NHMB; identified as *S. hungaricus* by W. Kulczyński). – **AUSTRIA.** Carinthia (Kärnten): Völkermarkter Stausee, Neudenstein-Insel (Komposch, 1996), 391 m asl, 10 July-10 August 1993, 1♀ (W. Graf, CCK), 14 September 1993, 1♀ (C. Komposch, CCK). – **HUNGARY.** Pest: Vasad, 1♂ (HNHM). – **RUSSIA.** Orenburg Area: Kuvandyk District, near Aituar, birch-poplar stand (in litter), 14 May 1997, 1♀ (S. L. Esyunin, MMUM). Volgograd Area: near Frolovo, June 1993, 1♂ 1♀ (Y. M. Marusik, MMUM). – **UKRAINE.** Crimea: Saki District, Pribrezhnaya railway station, dry meadow on yellow porous limestone



FIGS 3-8

Left male palp, ventral (3, 6) and retrolateral view (4, 7); male habitus, dorsal view (5, 8). - 3-5. *Sitticus atricapillus* (Italy: Trentino). - 6-8. *S. zimmermanni* [Sweden: Östergötland (6, 7), Dalarna (8)]. Scale lines: 0.1 mm (3, 4, 6, 7), 1 mm (5, 8).

(pitfall traps), 3-19 July 2000, 1 ♀ (N. M. Kovblyuk, MMUM). - **AZERBAIJAN**. Leninavan, S of Mir Bashir, 4 June 1987, 1 ♂ (S. I. Golovatch & K. Y. Eskov, ZMUM). - For additional material previously examined by one of us (DVL), see Wesołowska (1996), Logunov & Marusik (2000), and Logunov & Guseinov (2002).

REMARK

The holotype was redescribed and illustrated by Bösenberg (1903) and examined by Harm (1973) and Prószyński (1980).

DIAGNOSIS. See Table I.

DESCRIPTION

MALE (from Sweden, Östergötland). *Measurements*. Carapace 1.76 long, 1.33 wide, 0.76 high at PLE. Ocular area 0.79 long, 1.05 wide anteriorly and 1.08 posteriorly. Diameter of AME 0.30. Abdomen 1.68 long, 1.33 wide. Cheliceral length 0.68. Clypeal height 0.10. Length of leg segments:

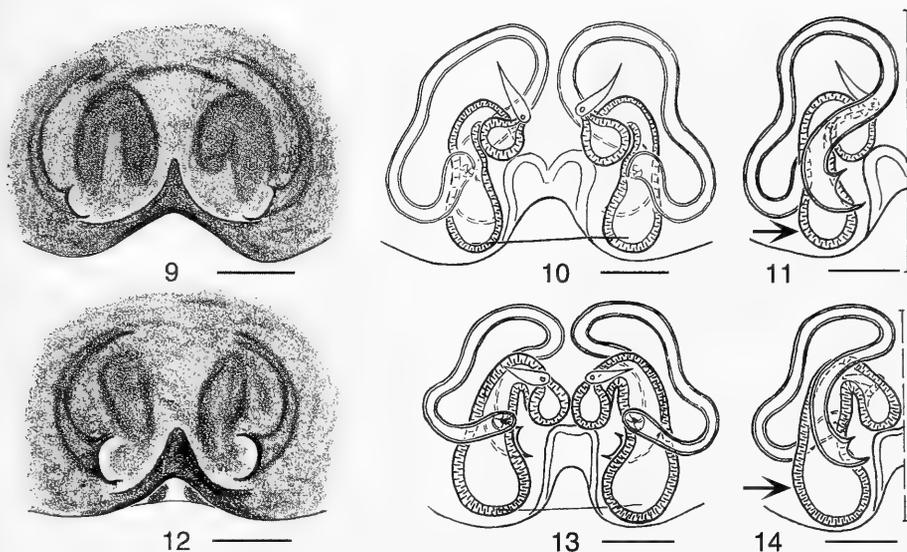
	Fm	Pt	Tb	Mt	Tr	Total
I	1.07	0.61	0.74	0.65	0.39	3.46
II	0.81	0.49	0.48	0.46	0.31	2.55
III	0.76	0.43	0.41	0.49	0.32	2.41
IV	1.21	0.54	0.74	0.67	0.37	3.53

Leg spination. Leg I: Fm d 0-1-1-2; Pt pr 0-1-0; Tb pr 1-1, v 2-2-2ap; Mt v 2-2ap. Leg II: Fm d 0-1-1-3; Pt pr 0-1-0; Tb pr 1-1, v 1-1-2ap; Mt v 2-2ap. Leg III: Fm d 0-1-1-3; Pt pr and rt 0-1-0; Tb pr and rt 1-1-1, v 1-0-2ap; Mt pr and rt 2-2ap, v 2ap. Leg IV: Fm d 1-1-3; Pt pr and rt 0-1-0; Tb d 0-1-0, pr and rt 1-1-1, v 1-0-2ap; Mt pr 2-1-2ap, rt 1-1-2ap, v 1ap.

Coloration. Carapace: brownish, eye field blackish, covered with dark appressed hairs. Sides of thoracic part with white appressed hairs. Narrow median band of white hairs from level of PLE to beginning of rear slope of carapace. Each side with a lateral band of white hairs from ALE, passing PME and PLE, to rear slope of carapace (not reaching margin). A transversal row of stout black hairs pointing forwards above AME; "eyebrows" composed of shorter black hairs mixed with short whitish hairs surrounding AME. Sides of carapace with mixed black and white appressed hairs. Clypeus brownish, with thin light hairs. Chelicerae yellowish to light brown. Sternum greyish brown. Abdomen: dorsally blackish brown, at about its middle with a pair of white spots (smaller than in *S. atricapillus*). Dorsum bordered with band of white hairs, in anterior part interrupted medially; white lanceolate spot in anterior part lacking (cf. *S. atricapillus*). White lateral bands broken into a few white spots (mainly posteriorly). (Dorsal pattern on abdomen may vary, cf. illustration in Kleemola, 1969, fig. 4a.) Legs: yellowish brown with dark blotches/annulation; Fm I dorsally and laterally and entire Tb I in some specimens dark brown. Palp: femur and patella yellowish brown and more or less sooty, tibia and cymbium dark brown. Femur dorsally and patella covered with white hairs of moderate length, tibia dorso-retrolaterally with longer white hairs and dorso-prolaterally with longer black hairs. Cymbium with black hairs (a few whitish hairs may be present basally).

Palp. Structure as in Figs 2, 6, 7.

FEMALE (from Sweden, Dalarna). *Measurements*. Carapace 2.18 long, 1.61 wide, 1.01 high at PLE. Ocular area 0.84 long, 1.26 wide anteriorly and 1.33 posteri-



FIGS 9-14

Epigyne, ventral view (9, 12) and spermathecae, dorsal view (10, 13) and ventral view of right side (11, 14). — 9-11. *Sitticus atricapillus* (Italy: Trentino). — 12-14. *S. zimmermanni* (Sweden: Dalarna). Scale lines: 0.1 mm.

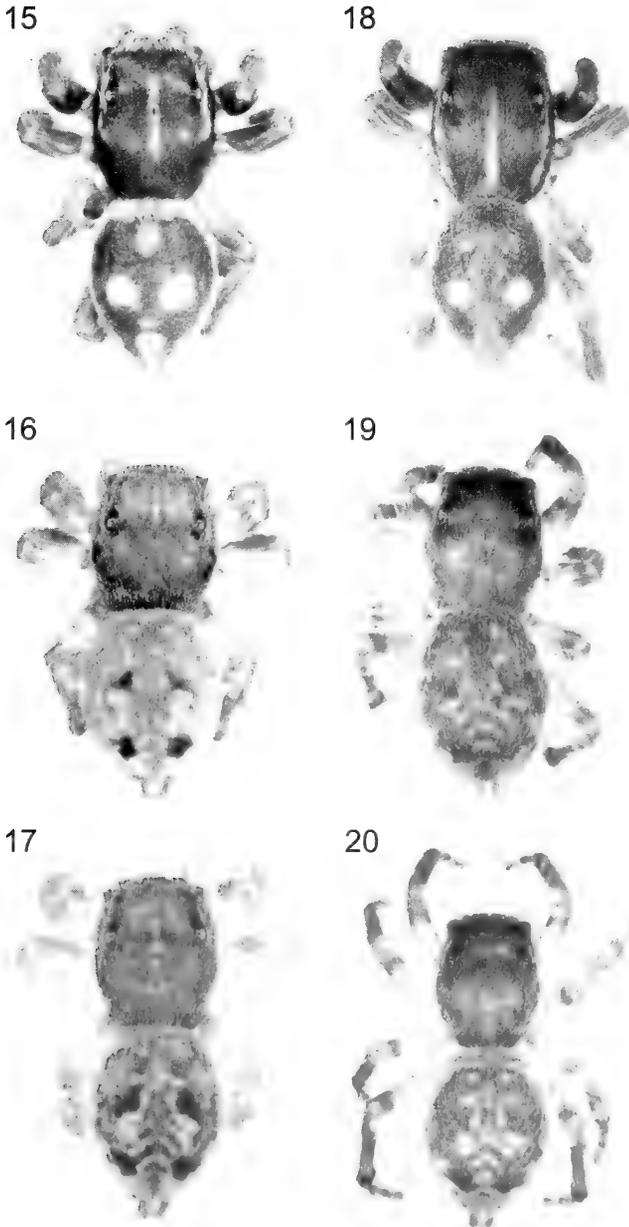
orly. Diameter of AME 0.40. Abdomen 2.35 long, 1.80 wide. Cheliceral length 0.68. Clypeal height 0.10. Length of leg segments:

	Fm	Pt	Tb	Mt	Tr	Total
I	1.00	0.61	0.64	0.52	0.37	3.14
II	0.91	0.54	0.52	0.50	0.36	2.83
III	0.93	0.50	0.50	0.57	0.36	2.86
IV	1.56	0.69	1.06	0.83	0.51	4.65

Leg spination. Leg I: Fm d 0-1-1-2; Pt pr 0-1-0; Tb v 2-2-2ap; Mt v 2-2ap. Leg II: Fm d 0-1-1-3; Tb pr 0-1, v 1-1-2ap; Mt v 2-2ap. Leg III: Fm d 0-1-1-3; Pt pr and rt 0-1-0; Tb pr 1-1-1, rt 1-1, v 1-2ap; Mt pr and rt 2-2ap, v 2ap. Leg IV: Fm d 1-0-1-2; Pt pr and rt 0-1-0; Tb d 0-1-0, pr and rt 1-1-1, v 1-0-2ap; Mt pr 1-1-2ap, rt 1-2-2ap, v 2ap.

Coloration. Carapace dusky brown, with appressed light hairs. Clypeus brown, with appressed light hairs. Abdomen dorsally greyish, with a pair of larger white spots behind the middle and a few lighter chevron-like markings along midline posteriorly; a pair of diffuse dark spots close to rear end. Live females may be uniformly greyish in appearance. Palp yellowish, with more or less dark greyish markings, most of Tr dark. Palp with light and (fewer) dark hairs. Legs yellowish, with distinct greyish annulation.

Epigyne and spermathecae as in Figs 12-14.



FIGS 15-20

Habitus, dorsal view. – 15-17. *Sitticus atricapillus* (15 male from Greece: Timfristos, 16 female from Greece: Tomaros, 17 female from Czech Republic). – 18-20. *S. zimmermanni* (18 male, 19 female, both from Sweden: Dalarna; 20 female from Austria).

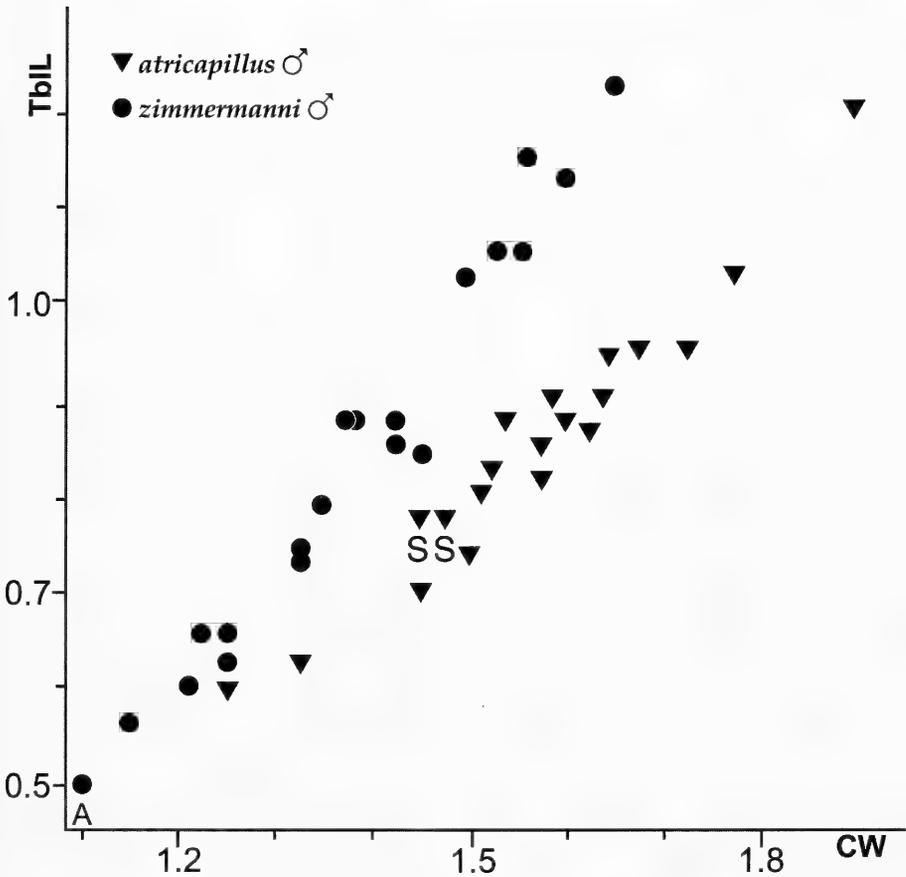


FIG. 21

Tibia I length (TbIL)/carapace width (CW) ratios in males of *Sitticus atricapillus* (▼) and of *S. zimmermanni* (●). A = male from Azerbaijan, S = non-characteristic males from Sicily: Etna.

COMMENTS

Due to its presumed rarity, *S. zimmermanni* is included in the Red Lists of Threatened Species in Germany (Platen *et al.*, 1998), in Slovakia (Gajdoš *et al.*, 1999) and in Austria: Carinthia (Komposch & Steinberger, 1999). In the light of two species being encompassed under the name *Sitticus zimmermanni*, a re-evaluation of these species is necessary.

The specimens listed above from Russia, Ukraine and Azerbaijan differ somewhat from the rest of the material examined. The females from Russia and Ukraine were caught without males and have a more yellowish appearance and a more pronounced abdominal pattern than females from western Europe. The male from Azerbaijan is unusually small (cf. Fig. 21: A). Until further comparison between north-western and central European material on the one hand and Ukrainian, Russian, and Asiatic material on the other has been undertaken, we regard it all as conspecific.

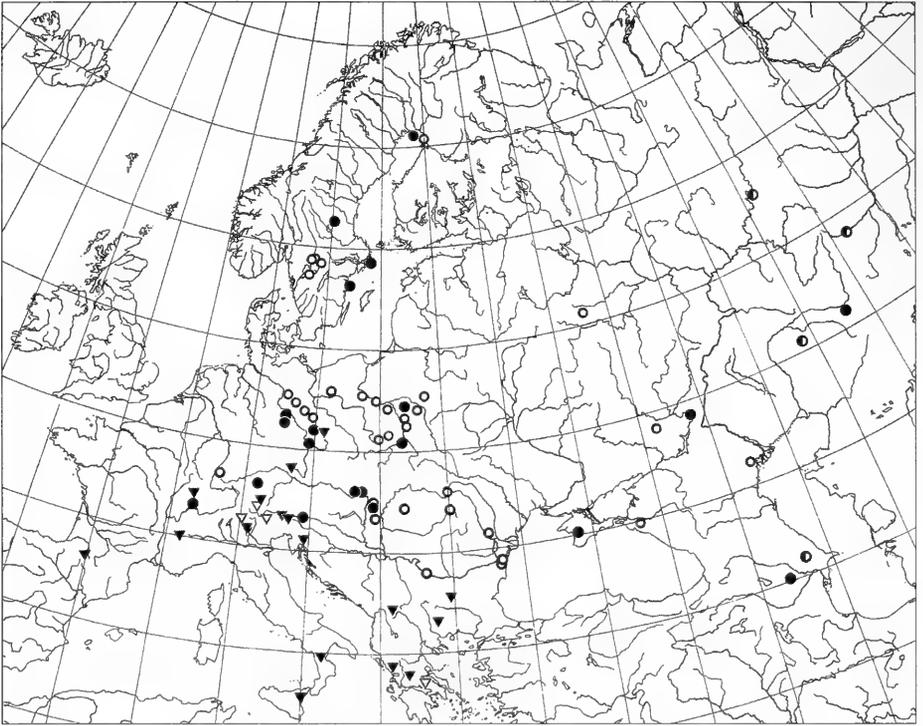


FIG. 22

Localities of *Sitticus atricapillus* (triangles) and of *S. zimmermanni* (circles). For additional records of *S. zimmermanni* in northern Asia see Logunov & Marusik (2000: map 50). Filled symbols refer to material seen by the authors, open symbols refer to records in the literature; half-filled circles refer to records in the literature based on material previously examined by DVL. One symbol may represent more than one close locality.

HABITAT AND NOTE ON BIOLOGY

Sitticus zimmermanni appears to be a species confined to lower altitudes; the highest localities where it has so far been found are situated at about 400 m asl. This species has been characterized as a xerobiont (Harm, 1973), though it would be more appropriate to regard it as an inhabitant of certain xerothermic habitats (cf. Bauchhens, 1990). In Sweden, it has been found on shores with sand and sparse vegetation and also on rocky shores at the Baltic Sea, northwards as far as the innermost part of the Bothnian Gulf, as well as at similar localities at some inland lakes in the south and central parts of the country (Kronestedt *et al.*, 1997); the sandy shores of the lakes in Dalarna with adjacent dry pine forests on sandy ground. In Germany, the species has been found in various xerothermic inland habitats, also on river banks. In Poland, it has mainly been met with on sandy ground (Próchniewicz, 1991). The finds from newly restored habitats in Germany and from an artificial island in Austria (Komposch, 1996) suggest a potential in this species to colonize suitable habitats in early succession stages. In Russia (the southern Urals, western and central Siberia), *S. zimmermanni* has

TABLE I. Morphological differences between *Sitticus atricapillus* and *S. zimmermanni*

	<i>S. atricapillus</i>	<i>S. zimmermanni</i>
Males		
Carapace pattern	Transverse dorsal band of white hairs above first eye row distinct*, backwards continuing into a longitudinal band of white hairs on each side (Figs 5, 15).	Without transverse band in front; each side with a longitudinal band of white hairs (Figs 8, 18)
Chelicerae	Stouter than in <i>S. zimmermanni</i>	Less stout than in <i>S. atricapillus</i>
Abdomen	Dorsum anteriorly with a white transverse band, often confluent with white lanceolate median spot (Figs 5, 15)	Dorsum lacking white transverse anterior band and white lanceolate median spot (Figs 8, 18)
Leg I length	Tb shorter in relation to carapace width compared with <i>S. zimmermanni</i> (Fig. 21)	Tb longer in relation to carapace width compared with <i>S. atricapillus</i> (Fig. 21)
Palpal pubescence	Entire Tb with numerous white hairs	Tb with white hairs mostly situated retrolaterally
Tegulum (in ventral view)	More rounded (Figs 1 & 3) compared with <i>S. zimmermanni</i>	More elongated (Figs 2 & 6) compared with <i>S. atricapillus</i>
Position of small loop of seminal duct (bulbus in resting position)**	At 1-2 o'clock (Figs 1 & 3, arrow)	At 2-3 o'clock (Figs 2 & 6, arrow)
Females		
Palp	Yellow, except for darkened tip of Tr	Yellow, with brown annulations on all segments
Epigyne**	Copulatory openings relatively wider apart from each other (Fig. 9)	Copulatory openings relatively closer to each other (Fig. 12)
Spermathecae**	SRR relatively small, not swollen (Fig. 11, arrow)	SRR relatively large, swollen (Fig. 14, arrow)

* For South Italian males see comments above

** The differences in this character are not always distinct.

been recorded from sandy stands, birch and pine forests and forest plantations in the steppe zone (see Logunov & Marusik, 2000),

A pregnant female captured in Sweden (Dalarna) produced 15 eggs in a thin sac attached to the wall inside a silk chamber.

DISTRIBUTION

Sitticus zimmermanni has a Euro-Siberian subboreal range; it has been recorded from Sweden (Kronestedt *et al.*, 1997), Finland (Palmgren, 1977: sub *S. tullgreni*), Poland (map with localities given in Próchniewicz, 1991), Germany (map with references given in Staudt, 2003), Austria (Komposch, 1996), Switzerland (Prószyński, 1980 in part: sub *S. hungaricus* from Lac Buchillon), Czech Republic (Buchar & Ružička, 2002 in part: material listed above), Slovakia (at least some of the finds reported in Gajdoš *et al.*, 1999), Hungary (Samu & Szinetár, 1999), Romania (Fuhn & Gherasim, 1995), Russia (from Moscow: Grese, 1911: sub *Attus Zimmermannii*; eastwards to Transbaikalia: Logunov & Marusik, 2000), Azerbaijan (Logunov & Guseinov, 2002), Turkmenistan (Fet, 1983; Wesołowska, 1996), and China (Xinjiang: Hu & Wu, 1989) (Fig. 22; for additional eastern records not shown on this map, see Logunov & Marusik, 2000: map 50).

Some records attributed to *S. zimmermanni* from Slovakia (Gajdos *et al.* 1999) need confirmation. One male from Vel'ká Fatra (Selenec, Vel'ká Skalná, 7 August 1974, leg. P. Hroznár, det. F. Miller) turned out to be a misidentified *S. rupicola*. Also Roșca's records from northern Romania (see Fuhn & Gherasim, 1995) and Ukraine (Bucovina) (Roșca, 1930, 1936), as well as other records from Ukraine (Polesye and Chernomorski Reserve: Polchaninova, 1988, 1990, 1997; Evtushenko, 1991) and from the southern part of European Russia (Rostov Areas and Kalmykiya: Minoranskiy, 1995; Minoranskiy & Ponomarev, 1984; Mikhailov, 1997; Ponomarev, 2002), need to be confirmed.

ACKNOWLEDGEMENTS

We are especially indebted to Dr Christian Kropf (NMBE) for initiating this study. We are also much obliged to the following colleagues for loan of spider material: Mrs Janet Beccaloni (BMNH), Mr Theo Blick (Hummeltal, Germany), Dr Robert Bosmans (Ghent, Belgium), Prof. Jan Buchar (Department of Zoology, Charles University, Prague, Czech Republic), Prof. Teresa Cantarella (DBAC), Dr Christo Deltshv (ZISB), Dr Jason Dunlop (ZMHB), Dr Mats Eriksson (ZMUU), Dr Ambros Hänggi (NHMB), Prof. Otto von Helversen and Dr Detlev Cordes (Institut für Zoologie II der Universität, Erlangen, Germany), Dr Tomasz Huflejt (ZMPA), Dr Christian Komposch (ÖKOTEAM - Institut für Faunistik und Tierökologie, Graz, Austria), Dr Kirill G. Mikhailov (ZMMU), Dr Christoph Muster (Museum für Naturkunde, Dresden), Dr Paolo Pantini (MBCG), Dr Roger Pettersson (Swedish University of Agricultural Sciences, Umeå), Dr Christine Rollard (MNHN), Dr Vlastimil Ružička (Institute of Entomology, Czech Academy of Sciences, České Budějovice, Czech Republic), Mr Jaroslav Svatoň (Martin, Slovakia), Dr Tamás Szűts (HNHM), Prof. Konrad Thaler (Institut für Zoologie und Limnologie der Universität Innsbruck, Austria) and Prof. Marek Zabka (Department of Zoology, University of Podlasie, Siedlce, Poland). Dr

Mikhailov kindly helped us gathering Ukrainian and some Russian records for *S. zimmermanni*. We are also obliged to Ms Elizabeth Binkiewicz for making some of the drawings. We thank Mr Blick for providing us with some information on literature; he, Prof. Thaler and Dr Peter Schwendinger (Muséum d'histoire naturelle, Geneva, Switzerland) kindly commented on the manuscript of this paper.

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Compléments à la faune de scorpions (Arachnida) de l'Afrique du Nord, avec des considérations sur le genre *Buthus* Leach, 1815¹

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Additions to the scorpion fauna (Arachnida) of North Africa with special reference to the genus *Buthus* Leach, 1815. - Results of the study of an interesting collection of North African scorpions, now deposited in the Geneva Museum are presented. The collection contains specimens of two families, seven genera and 20 species. Five new species belonging to the genus *Buthus* (Buthidae) are described, i.e. *Buthus mariefranceae* sp. n., *Buthus rochati* sp. n., *Buthus lienhardi* sp. n., *Buthus albengai* sp. n. and *Buthus brignolii* sp. n. Comments are given on the distributional patterns found in this genus.

Key-words: Scorpions - *Buthus* - new species - North Africa.

INTRODUCTION

Malgré l'importante contribution de Vachon (1952) à la connaissance des scorpions de l'Afrique du Nord, une grande biodiversité relative à cette faune continue d'être dévoilée. Ainsi, de nouvelles espèces ainsi que des genres nouveaux ont pu être décrits récemment pour l'Ethiopie, le Niger, le Maroc et l'Egypte (Lourenço, 1998, 1999a,b,c, 2002a,b).

Le présent travail est le résultat de l'étude d'une collection de scorpions réunie en grande partie par notre collègue et ami P. M. Brignoli dans diverses régions d'Afrique du Nord, Algérie, Libye, Maroc, Soudan et Tunisie, et déposés désormais au Muséum d'histoire naturelle de Genève. Plusieurs espèces nouvelles appartenant au genre *Buthus* sont décrites. Des considérations sur la situation taxonomique et les modèles de répartition géographique de ce genre sont également proposées. Par ailleurs, une liste des espèces présentes dans le matériel étudié est établie.

MATÉRIEL ET MÉTHODES

Le matériel collecté par P. M. Brignoli, et très certainement des collaborateurs, m'a été confié peu de temps avant sa disparition. Selon sa volonté, la collection devrait être déposée au Muséum d'histoire naturelle de Genève après étude. Pour différentes raisons cette étude n'a pu être réalisée que récemment, presque 20 après avoir reçu

¹ Etude subventionnée par le Département municipal des affaires culturelles de la Ville de Genève.

Manuscrit accepté le 21.03.2003

cette collection. Dans la mesure où le présent travail concerne dans sa grande majorité des espèces déjà traitées par Vachon (1952), j'ai décidé de réutiliser l'iconographie employée dans sa monographie, avec quelques modifications. Lors de la description de sous-espèces et variétés, Vachon n'a pas formellement indiqué de types. Pour cette raison, des types sont désignés pour chacune des trois nouvelles espèces décrites ici, bien que celles-ci correspondent à trois variétés décrites par Vachon (voir Vachon, 1952).

PARTIE SYSTÉMATIQUE

SCORPIONIDAE Latreille, 1802

Scorpio Linnaeus, 1758

Scorpio maurus Linnaeus, 1758

Figs 1-2

Matériel: Maroc, 50 km Guercif, X/1980 (P.M. Brignoli leg.), 1 ♂, 1 ♀. Soudan, Toukoto, Riv. Bakey, X/1979 (P.M. Brignoli leg.), 4 ♂. Tunisie, Gafsa, 29/V/1980 (P.M. Brignoli leg.), 1 ♂; Matuali, 28/V/1980 (P.M. Brignoli leg.), 1 juvénile; Tabarka, 2/VI/1980 (P.M. Brignoli leg.), 1 ♂; Utique, 14/VI/1980 (P.M. Brignoli leg.), 1 ♂, 1 ♀.

Note: D'après Fet (2000), dans le catalogue des scorpions du monde, 19 sous-espèces sont reconnues au sein de l'espèce *S. maurus*. Je m'abstiens ici de considérer les catégories sous-spécifiques. La réalisation d'une étude approfondie de l'ensemble des formes, y compris à l'aide des techniques moléculaires, permettrait de clarifier la position systématique des sous-espèces. Il est assez probable que certaines d'entre elles correspondent en fait à des espèces valides.

BUTHIDAE C.L. Koch, 1837

Orthochirus Karsch, 1891

Orthochirus innesi Simon, 1910

Figs 3-5

Matériel: Algérie, El Hawraia (Biskra – El Oued), 26/X/1977 (P.M. Brignoli leg.), 1 ♀; Hassi-Zguilma, 118 km N.O. Beni-Abbés (Sahara), 13/IV/1977 (P.M. Brignoli leg.), 1 ♀; Sahara, N.O., Sebka el Melah, 8/IV/1977 (P.M. Brignoli leg.), 1 ♂, 1 ♀. Maroc, Marrakech, Skour des Rehamna (à mi-chemin de Casablanca – station douteuse), 12/IV/1964 (Cl. Girard leg.), 1 ♂.

Note: Cette espèce a été décrite d'une localité, Djebel Mokattam, aux environs du Caire en Egypte. La distribution de cette espèce est sans doute limitée à l'Afrique du Nord et sa présence au Moyen Orient demande à être confirmée (Fet & Lowe, 2000). Les populations algériennes correspondent bien à l'espèce de Simon.

Hottentotta Birula, 1908

Hottentotta franzwernerii franzwernerii (Birula, 1914)

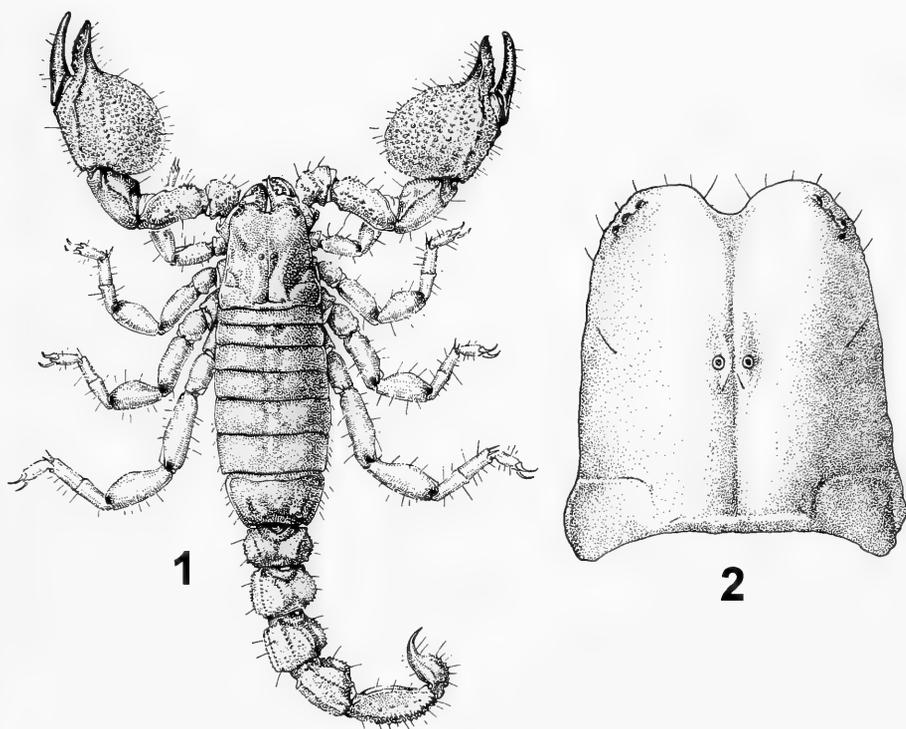
Fig. 6

Matériel: Algérie, Saoura (Dépt.), Sahara N.O., Kheneg El Aateve, Djs. d'Ougartas, 1/IV/1979 (P.M. Brignoli leg.), 1F; 5/IV/1979 (P.M. Brignoli), 2 juvéniles. Maroc, Taghit, 24/V/1963 (D. Foley leg.), 2 ♂ juvéniles, 1 ♀.

Hottentotta franzwernerii gentili (Pallary, 1924)

Figs 7-9

Matériel: Maroc, Aouinet Torkoz, 25/III/1981 (P.M. Brignoli leg.), 1 ♂, 1 ♀, 2 ♂, 1 ♀ juvéniles; Camp de Mséd, 16/II/1981 (P.M. Brignoli leg.) 1 ♀; Mechre Sfi, 14/IV/1981 (P.M. Brignoli leg.), 2 ♀ juvéniles; Ouarzate, 18/V/1981 (P.M. Brignoli leg.), 1 ♂, 1 ♂ juvénile, 2 juvéniles; 16/V/1981 (P.M. Brignoli leg.), 1 ♀ juvénile; 13/V/1981 (P.M. Brignoli leg.), 2 ♂.



FIGS 1-2

Scorpio maurus, femelle. 1. Habitus (d'après Vachon, 1953). 2. Idem, plaque prosomienne.

Note : *Hottentotta franzwernerii* est la seule espèce du genre représentée en Afrique du Nord occidentale. Deux sous-espèces sont acceptées par Vachon (1952). Leur distinction est possible grâce à certaines différences mineures telles la taille globale ou la coloration des pattes. Seule une étude approfondie des deux formes, y compris à l'aide des techniques moléculaires pourra clarifier leurs positions taxonomique de manière précise.

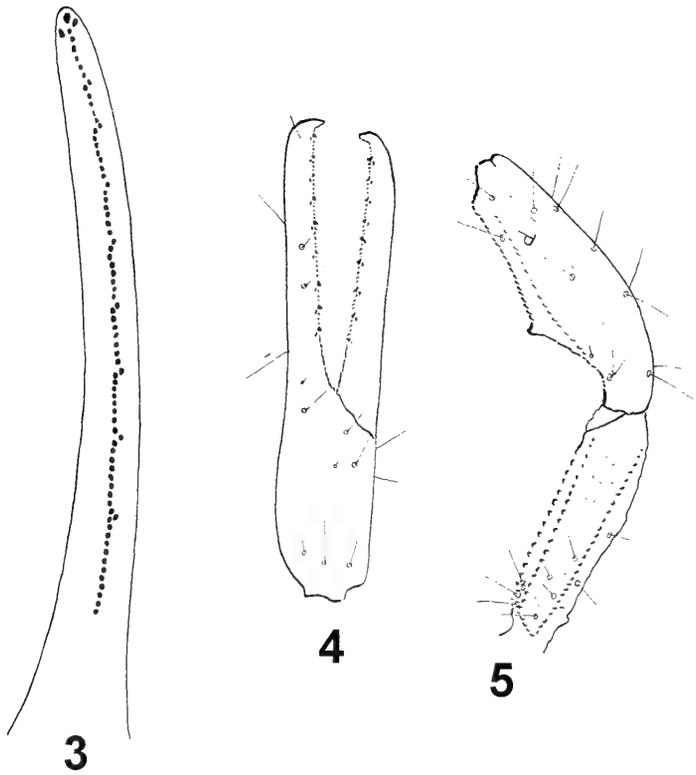
Buthacus Birula, 1908

Buthacus leptochelys (Ehrenberg, 1829)

Fig. 10

Matériel: Algérie, Dept. Saoura, Beni-Abbés-Erg, IX/1983 (P.M. Brignoli leg.), 1 ♀; X/1983 (P.M. Brignoli leg.), 3 ♂, 7 ♀, 5 juvéniles. Maroc, 50 km Guercif, X/1980 (P.M. Brignoli leg.), 1 juvénile.

Note: La position taxonomique de diverses espèces du genre *Buthacus*, distribuées en Afrique du Nord occidentale, a été récemment clarifié (Lourenço, 2001). Le matériel collecté en Algérie est pour le moment attaché à l'espèce *B. leptochelys* (sensu Vachon, 1952). Des nouvelles études fondées sur un matériel plus abondant devront déterminer avec plus de précision le statut de cette population.



FIGS 3-5

Orthochirus innesi, mâle. 3. Tranchant du doigt mobile. 4. Pince, vue externe-dorsale. 5. Fémur et tibia du pédipalpe, vue dorsale.

***Buthiscus* Birula, 1905**

***Buthiscus bicalcaratus* Birula, 1905**

Figs 11-13

Matériel: Algérie, Dept. Saoura, Beni-Abbés, X/1983 (P.M. Brignoli leg.), 1 ♂, 1 ♀.

Note: Le genre *Buthiscus* est monotypique et son identification facile à l'aide de deux caractères: une petite protubérance sur le bord frontal de la carapace et la présence de trois trichobothries sur la face externe du fémur. Une redescription détaillée a été récemment proposée par Lourenço (2002c).

***Androctonus* Ehrenberg, 1828**

***Androctonus amoreuxi amoreuxi* (Audouin, 1826)**

Figs 14-17

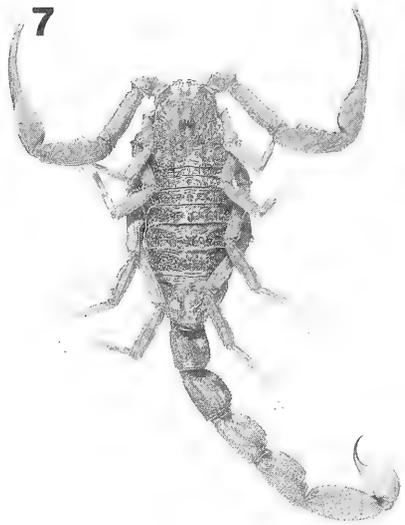
Matériel: Algérie, Dept. Saoura, Beni-Abbés (Palmeraie), III/1982 (P.M. Brignoli leg.), 1 ♂, 1 ♀; Beni-Abbés-Erg, X/1983 (P.M. Brignoli, leg.), 2 juvéniles. Maroc, Aouinet Torkoz, 25/III/1981 (P.M. Brignoli leg.), 4 ♀, 1 juvénile; 16/V/1981 (P.M. Brignoli leg.), 1 ♀.

Note: Fet & Lowe (2000) indiquent trois sous-espèces pour *A. amoreuxi*. L'espèce nominale est présente en Afrique. La classification des espèces du genre

6

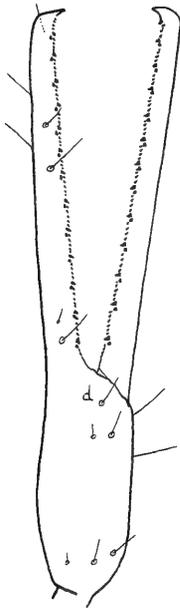


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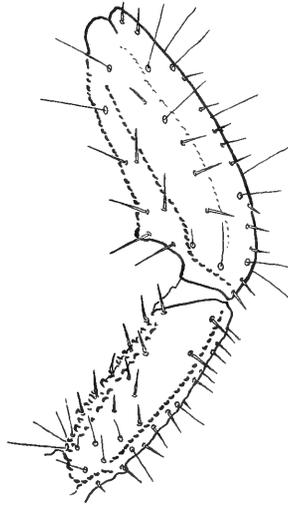


FIGS 6-7

Hottentotta franzwernerii franzwernerii et *Hottentotta franzwernerii gentili*, femelles, vue dorsale.



8



9

FIGS 8-9

Hottentotta franzwernerii gentili, mâle. 8. Pince, vue externe-dorsale. 9. Fémur et tibia du pédi-palpe, vue dorsale.

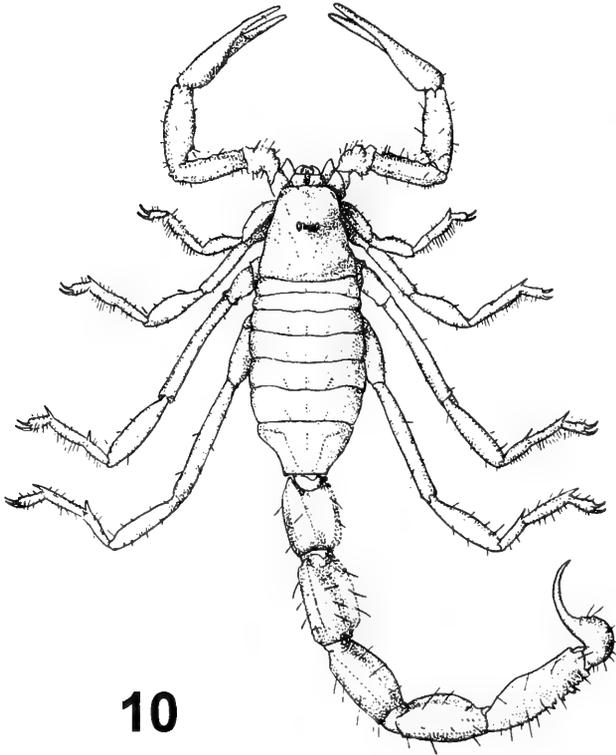


FIG. 10

Buthus leptochelys, femelle. Habitus (d'après Vachon, 1952).

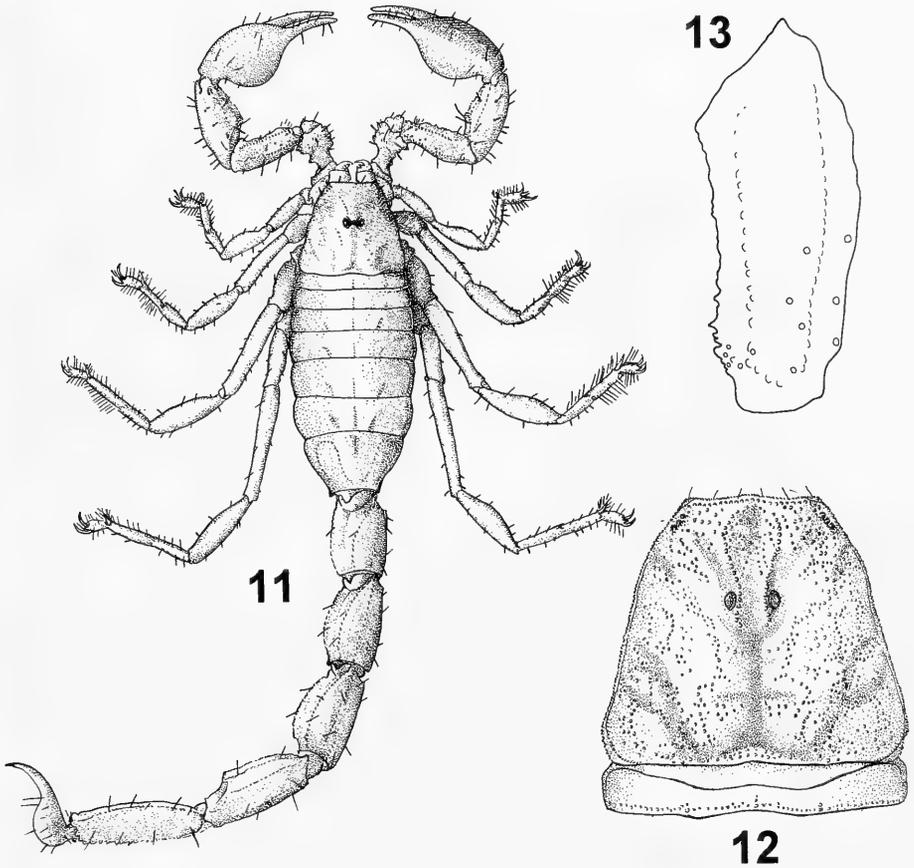
Androctonus se trouve dans une situation de confusion semblable à celle des espèces du genre *Buthus*, avec de nombreuses sous-espèces. Une révision partielle du genre *Androctonus* est en préparation.

Buthus Leach, 1815

CONSIDÉRATIONS HISTORIQUES

Le genre *Buthus* a été décrit par Leach, 1815 avec comme espèce type (par désignation originale), *Scorpio occitanus* Amoreux, 1789, décrit de Sauvignargues dans le Sud de la France. Lorsque Vachon entama sa révision des scorpions d'Afrique du Nord (1952), le genre *Buthus* est composé de près d'une centaine d'espèces, parfois morphologiquement très différentes. Vachon décide alors de revoir la composition spécifique du genre, afin de le rendre davantage homogène. Il lui donne une valeur systématique plus restreinte en ne conservant que les espèces proches du type générique, *Buthus occitanus*, le scorpion jaune du Languedoc décrit par Amoreux.

Les espèces morphologiquement plus divergentes sont retirées du genre *Buthus* et placées dans plusieurs autres genres dont trois existaient déjà en tant que sous-

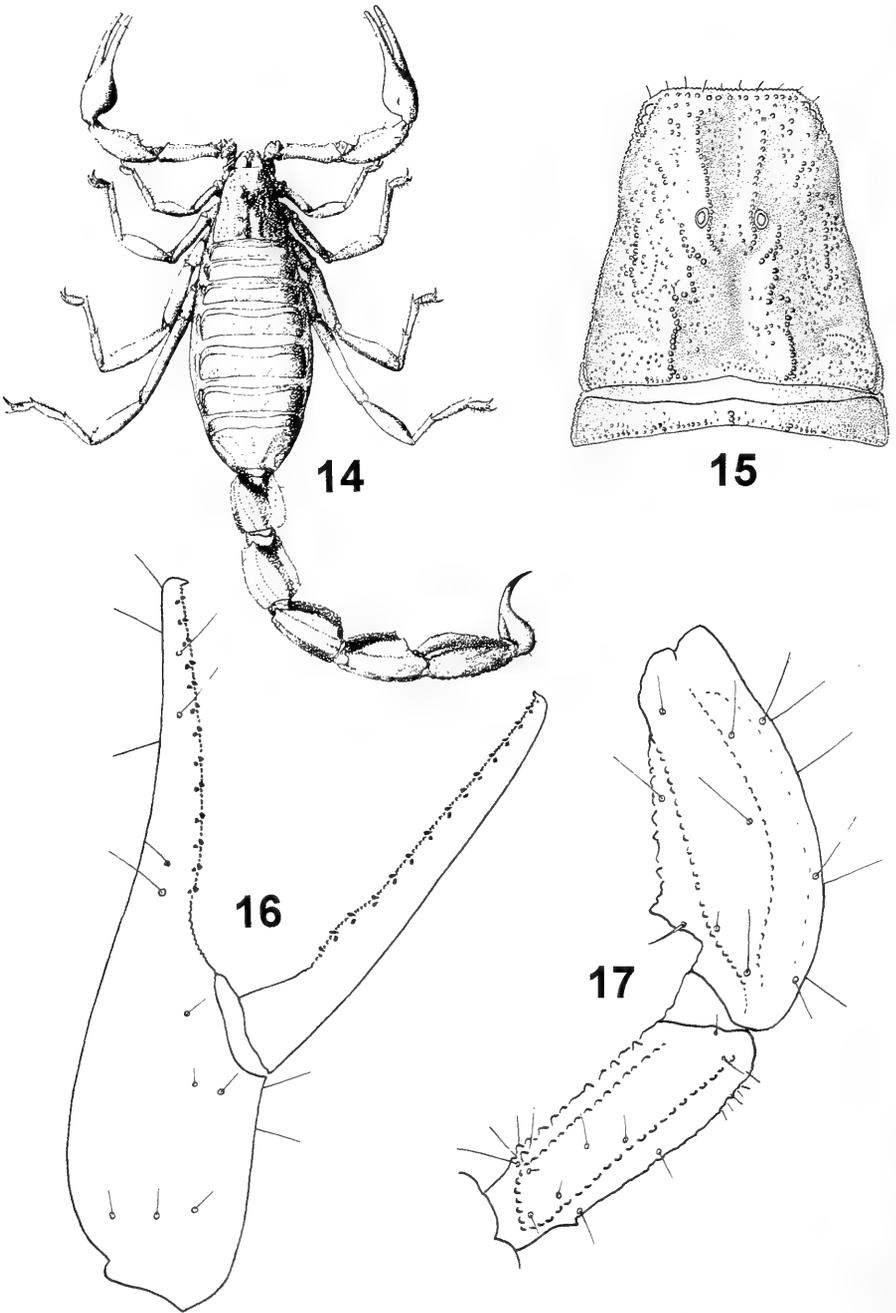


FIGS 11-13

Buthiscus bicalcaratus, mâle. 11. Habitus (d'après Vachon, 1952). 12. Plaque prosomienne. 13. Fémur du pédipalpe, vue dorsale.

genres: *Androctonus* Ehrenberg, 1828, *Buthacus* Birula, 1908 et *Leiurus* Ehrenberg, 1828. Deux autres genres contenant des espèces d'Afrique du Nord sont décrits par Vachon (1949a,b) : *Compsobuthus* et *Buthotus* (= *Hottentotta* Birula, 1908). Le genre *Buthus* fut ainsi redéfini par Vachon d'une manière plus précise avec une diagnose assez complète.

La distribution du genre *Buthus* demeure néanmoins très étendue, on le rencontre en Afrique, en Asie et également en Europe. Selon Fet & Lowe, (2000), catalogue mondial des scorpions, la répartition du genre serait la suivante: Afrique: Algérie, Burkina-Faso, Djibouti, Egypte, Ethiopie, Gambie, Ghana, Guinée-Bissau, Libye, Mauritanie, Maroc, Nigeria, Sénégal, Somalie, Soudan, Tunisie. Asie: Chypre, Irak, Israël, Jordanie, Liban, Arabie Saoudite, Turquie. Europe: France, Grèce, Italie, Malte, Portugal, Espagne.



FIGS 14-17

Androctonus amoreuxi amoreuxi, femelle. 14. Habitus (d'après Vachon, 1952). 15. Plaque prosomienne. 16. Pince, vue externe-dorsale. 17. Fémur et tibia du pédipalpe, vue dorsale.

Depuis la publication de Vachon (1952) sur les scorpions de l'Afrique du Nord, aucune espèce nouvelle n'avait été ajoutée au genre *Buthus*. Ceci allait de pair avec l'absence de toute nouvelle tentative de révision de ce genre. Tout récemment, j'ai pu décrire une nouvelle espèce de *Buthus* pour la région du Tassili des Ajjer en Algérie (Lourenço, 2002a). Quelques années avant sa disparition, M. Vachon m'avait fait part de son opinion à propos de la population de *Buthus* du Tassili des Ajjer qui pourrait correspondre à une espèce distincte de *Buthus occitanus tunetanus*. Cependant, comme pour bien d'autres dossiers, il n'a réalisé aucune description pour cette population des montagnes du Sud de l'Algérie.

Les efforts de Vachon (1952) pour clarifier la composition du genre *Buthus* ont été considérables, mais très souvent ses décisions n'ont fait que rendre la taxonomie du genre plus confuse. Il n'a pas été possible de définir les modèles précis de distribution et de différenciation des espèces. Ce problème touche tout particulièrement l'espèce *Buthus occitanus* avec sa pléiade de sous-espèces et de variétés. Cependant il paraissait évident qu'au sein de ce «complexe de formes», certaines populations devraient être considérées comme des véritables espèces.

Dans le catalogue mondial des scorpions, Fet & Lowe (2000) reprennent la position de Vachon (1949b, 1952), selon laquelle uniquement trois espèces seraient «valables»: *Buthus atlantis* Pocock, 1889, *Buthus maroccanus* Birula 1903 et *Buthus occitanus* (Amoreux, 1789). Le catalogue reconnaît aussi deux sous-espèces pour *Buthus atlantis*, et mentionne également deux espèces douteuses, *Buthus barbouri* Werner, 1932 et *Buthus insolitus* Borelli, 1925. Dix sous-espèces sont reconnues pour *Buthus occitanus*. Les variétés infra sous-spécifiques établies par Vachon ne sont pas considérées valables (selon le Code de nomenclature zoologique. Article 45.5), et n'ont pas été prises en compte dans le catalogue.

Tout au long de son travail de révision des scorpions d'Afrique du Nord, Vachon (1952) s'est vu confronté au problème de la «variabilité» présenté par *Buthus occitanus*. Il remplaça certaines espèces telles *Buthus tunetanus* (Herbst) (= *Scorpio tunetanus* Herbst), *Buthus occitanus paris* (C.L. Koch) (= *Androctonus paris* C.L. Koch, 1839) ou encore *Buthus occitanus mardochei* Simon (= *Buthus mardochei* Simon) au rang de sous-espèce, décrit d'autres sous-espèces telles que *Buthus occitanus malhommei*, et décrit un certain nombre de variétés non citées dans le catalogue mondial des scorpions (Fet & Lowe, 2000), Cependant le véritable statut des sous-espèces demeure confus et douteux.

Certaines populations géographiquement bien définies semblent suggérer déjà à l'époque des études de Vachon, l'existence de véritables entités spécifiques. Elles sont à présente décrites en tant qu'espèces nouvelles.

ESPÈCES DE *BUTHUS* CONSIDÉRÉES DANS LA PRÉSENTE NOTE

Buthus atlantis atlantis Pocock, 1889

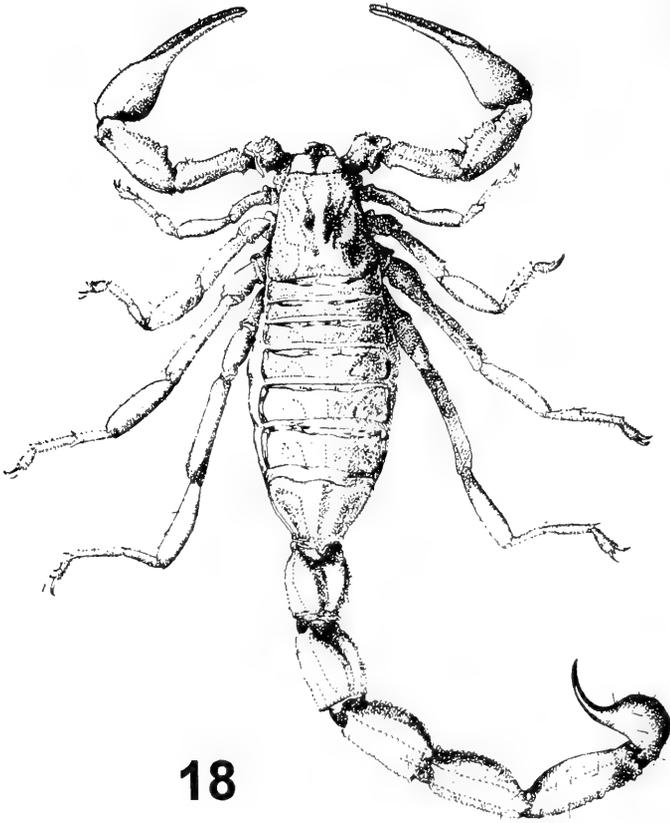
Figs 18-22

Matériel: Maroc, Sud Mogador, 23/IV/1979 (P.M. Brignoli leg.), 3 ♂, 2 ♀, 4 juvéniles.

Buthus atlantis parroti Vachon, 1949

Figs 23-26

Matériel: Maroc, SW Agadir (région Ademine) 18/VI/1979 (P.M. Brignoli leg.), 1 ♂, 3 ♀; 20/VI/1979 (P.M. Brignoli leg.), 2M, 2F, 2 juvéniles.



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FIG 18

Buthus atlantis atlantis, femelle. Habitus (d'après Vachon, 1952).

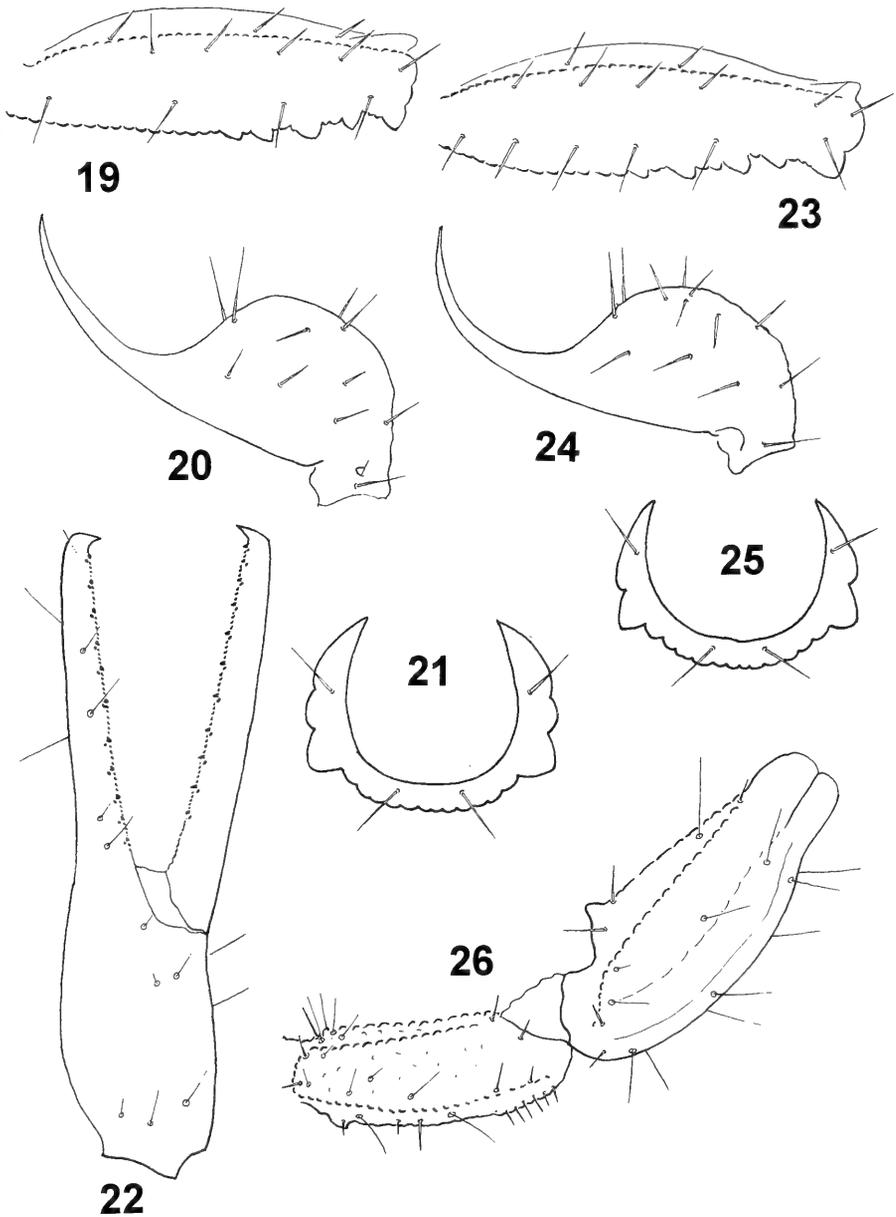
Note: Deux sous-espèces sont acceptées par Vachon (1952). Leur distinction est possible grâce à certaines différences mineures telles la morphologie du Vème anneau du metasoma et du cadre anal et la longueur relative de l'aiguillon. Seule une étude approfondie des deux formes, y compris à l'aide des techniques moléculaires pourra clarifier leur position taxonomique de manière précise.

Buthus occitanus (Amoreux, 1789)

Figs 27-32

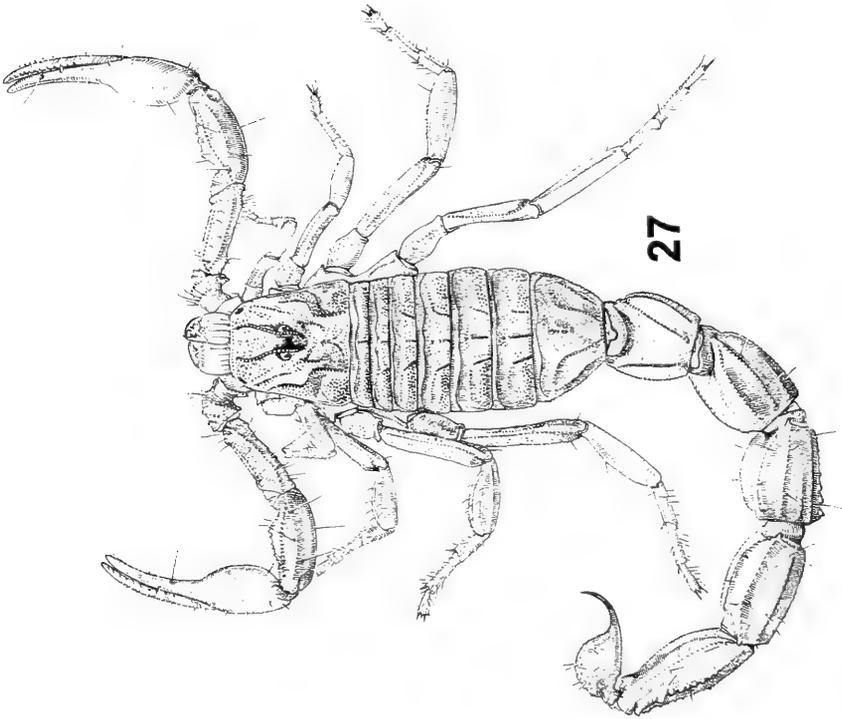
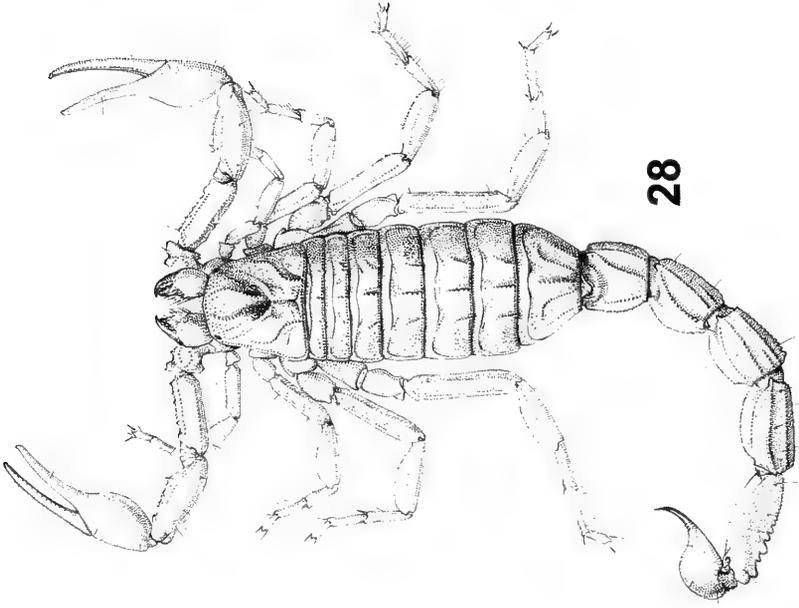
Matériel: Espagne, Province d'Aragon, Nuevalos (800 m, garrigue), 14/VIII/2002 (L. J. Breton leg.), 3♂. Maroc, Rabat, 22/IV/1979 (P.M. Brignoli leg.), 1♂.

Diagnose: Espèce de taille moyenne avec environ 45-65 mm de longueur totale. Coloration générale jaunâtre, avec les tergites légèrement plus sombres mais sans bandes colorées. Plaque prosomienne avec les carènes et les granules fortement marqués. Tergites avec les carènes et les granules bien marqués. Anneaux métasomiaux I à V avec les carènes bien marquées et complètes; Vème anneau avec le cadre anal à deux

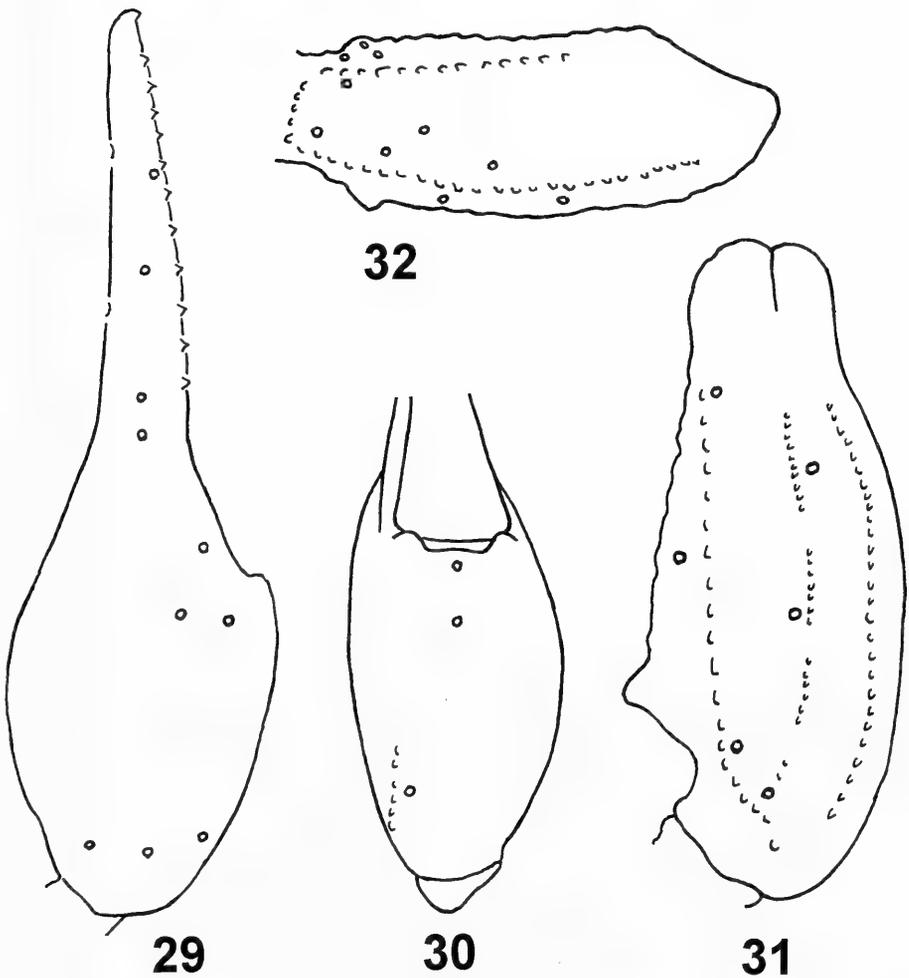


FIGS 19-26

19-22. *Buthus atlantis atlantis*, femelle. 19. Vème anneau du metasoma, vue latérale. 20. Telson, vue latérale. 21. Cadre anal. 22. Pince, vue externe-dorsale. Figs 23-26. *Buthus atlantis parroti*, femelle. 23. Vème anneau du metasoma. 24. Telson, vue latérale. 25. Cadre anal. 26. Fémur et tibia du pédipalpe, vue dorsale.



Figs 27-28
Buthus occitanus. Habitus mâle (27) et femelle (28).



FIGS 29-32

Buthus occitanus, femelle, pédipalpe. 29-30. Pince, vues externe-dorsale et ventrale. 31. Tibia, vue dorsale. 32. Fémur, vue dorsale.

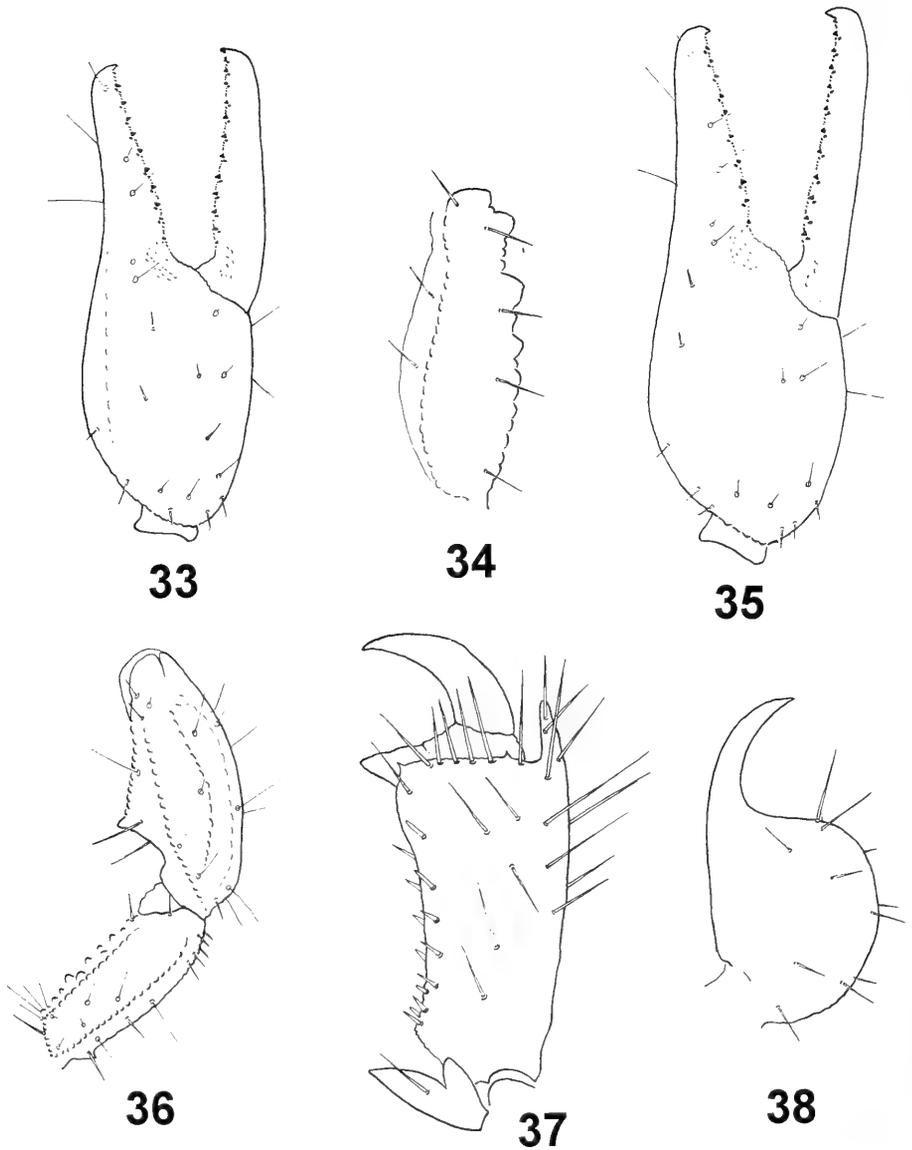
lobes; vésicule presque lisse avec quelques granules sur la face ventrale; aiguillon peu courbé et plus long que la vésicule. Pédipalpes: tranchants des doigts fixe et mobile avec 12-13 séries semi-obliques de granules de couleur plus foncé que les doigts. Pattes avec la face interne des segments dépourvue de granules spiniformes. Peignes avec 29-35 dents chez le mâle et 24-30 chez la femelle.

Buthus malhommei Vachon, 1949 stat. nov.

Figs 33-38

Buthus occitanus malhommei Vachon, 1949

Matériel: Maroc, région de Mechra ben Abbou (Marrakech), V/1979 (P.M. Brignoli leg.), 2 ♀, 2 ♀ juvéniles.



FIGS 33-38

Buthus malhommei. 33-34. Mâle. 35-38. Femelle. 33. Pince, vue externe-dorsale. 34. Vème anneau du metasoma, vue latérale. 35. Pince, vue externe-dorsale. 36. Fémur et tibia du pédipalpe, vue dorsale. 37. Tarse de la patte IV, vue latérale. 38. Telson, vue latérale.

Diagnose: Espèce de petite taille avec environ 45-55 mm de longueur totale. Coloration générale jaunâtre, avec la région postérieure de la carapace et les tergites plus sombres; présence de trois bandes colorées sur les tergites. Plaque prosomienne avec les carènes et les granules moyennement marqués. Tergites avec les carènes et les

granules peu marqués. Anneaux métasomaux I à V avec les carènes bien marquées et complètes; les carènes ventrales des anneaux II-III-V avec des granules bien développés, lobés; Vème anneau avec le cadre anal à deux lobes; vésicule très globuleuse, presque lisse avec quelques granules sur la région proximale de la face ventrale; aiguillon fortement courbé et plus court que la vésicule. Pédipalpes: trapus avec les doigts courts; tranchants des doigts fixe et mobile avec 10-10 séries semi-obliques de granules de couleur plus foncée que les doigts. Pattes avec la face interne des segments dépourvue de granules spiniformes. Peignes avec 26-30 dents chez le mâle et 21-25 chez la femelle.

***Buthus mardochei* Simon, 1878**

Fig. 39

Buthus mardochei Simon, 1878 = *Buthus occitanus mardochei*: voir Vachon, 1952.

Matériel: Maroc, Agadir SE, 16/VI/1979 (P.M. Brignoli leg.), 1 ♀; 18/VI/1979 (P.M. Brignoli leg.), 4 ♂, 7 ♀.

Diagnose: Espèce de taille moyenne avec environ 50-65 mm de longueur totale. Coloration générale jaunâtre, avec les tergites légèrement plus sombres mais sans bandes colorées. Plaque prosomienne avec les carènes et les granules peu marqués. Tergites avec les carènes et les granules faiblement marqués. Anneaux métasomaux I à V avec les carènes bien marquées et complètes; Vème anneau avec le cadre anal à deux lobes aigus et écartés; présence d'un ou deux lobes aigus sur la carène latéro-ventrale; vésicule presque lisse avec quelques granules sur la région proximale de la face ventrale; aiguillon moyennement courbé et un peu plus court que la vésicule. Pédipalpes: tranchants des doigts fixe et mobile avec 10-11 séries semi-obliques de granules de couleur plus foncée que les doigts. Pattes avec la face interne des segments pourvue de quelques granules spiniformes. Peignes avec 29-35 dents chez le mâle et 25-29 chez la femelle.

***Buthus mariefranceae* sp. n.**

Figs 40-46

Buthus occitanus mardochei var. *mimeuri*: voir Vachon, 1952.

Matériel: Maroc, 100 km sud de Goulimine, Tan-Tan, 13/II/1979 (P.M. Brignoli leg.) 1 ♀ (holotype); Goulimine, 12/II/1979 (P.M. Brignoli leg.), 1 ♂ (paratype); 13/II/1979 (P.M. Brignoli leg.), 1 ♂, 2 ♀ juvéniles (paratypes); 18/V/1979 (P.M. Brignoli leg.), 3M, 4F (paratypes).

Diagnose: Espèce de petite taille avec environ 45-50 mm de longueur totale. Coloration générale jaune brunâtre, avec les tergites plus sombres; présence de trois bandes longitudinales brunâtres; des taches foncées sont présentes sur la carapace le metasoma et les pédipalpes. Plaque prosomienne avec les carènes et les granules bien marqués. Tergites avec les carènes et les granules moyennement marqués. Anneaux métasomaux I à V avec les carènes bien marquées et complètes; Vème anneau avec le cadre anal à deux lobes, bien écartés mais pas aigus; présence de trois lobés sur les carènes latéro-ventrales; vésicule globuleuse, presque lisse avec quelques granules sur la région proximale de la face ventrale; aiguillon moyennement courbé et plus court que la vésicule. Pédipalpes: tranchants des doigts fixe et mobile avec 8-9 séries semi-obliques de granules de couleur plus foncée que les doigts. Pattes avec la face interne des segments dépourvue de granules spiniformes. Peignes avec 24-31 dents chez le mâle et 20-27 chez la femelle.

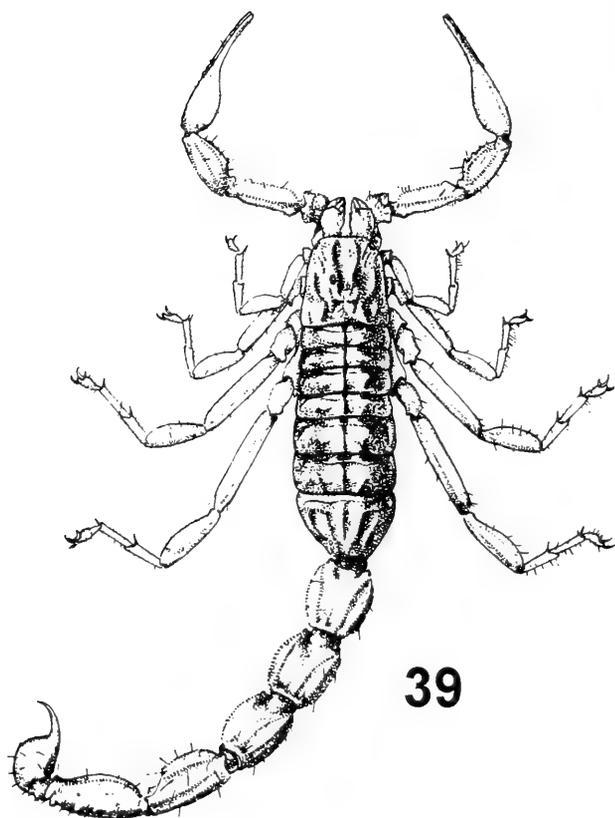


FIG 39

Buthus mardochei, mâle. Habitus (d'après Vachon, 1952).

Etymologie: Le nom spécifique est donné en hommage au Dr Marie-France Martin-Eauclaire, CNRS-Université d'Aix-Marseille, pour sa contribution à l'étude des toxines de scorpion.

Description (basée sur la femelle holotype et un mâle paratype): Coloration générale jaune brunâtre, un peu plus foncé chez la femelle. Plaque prosomienne jaune brunâtre; la région antérieure et un carré postérieur sont dépourvus de pigments. Mesosoma jaunâtre avec trois bandes longitudinales brunâtres; bandes latérales plus larges que la médiane. Anneaux metasomaux I à IV jaunâtres; anneau V très foncé, noirâtre; telson jaunâtre; aiguillon jaunâtre à la base et noirâtre à l'extrémité. Peignes, opercule génital, sternum, hanches et processus maxillaire jaune clair. Pattes jaune très clair, dépourvues de taches même estompées. Pédipalpes: fémur, tibia et pinces jaunâtres, avec quelques taches sur les carènes du tibia. Chélicères jaunâtres dépourvues de toute trame, seule une petite tache estompée est présente latéralement; doigts rougeâtres.

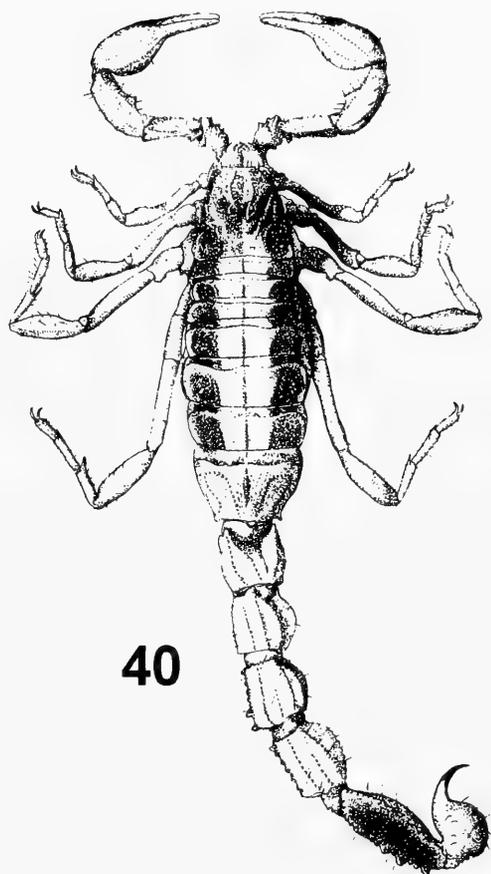
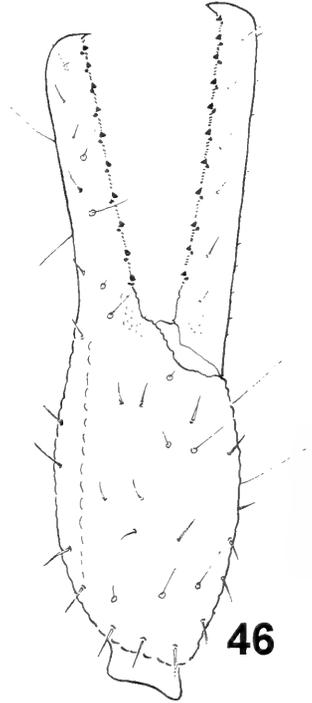
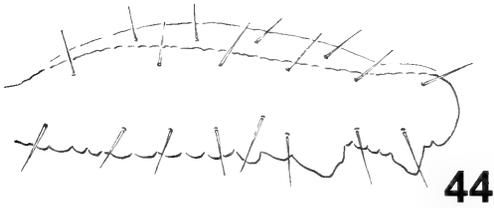
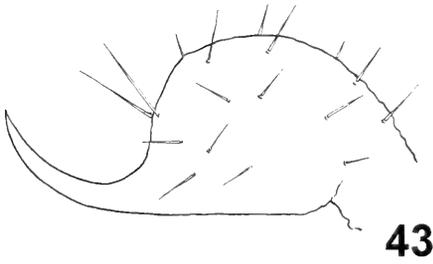
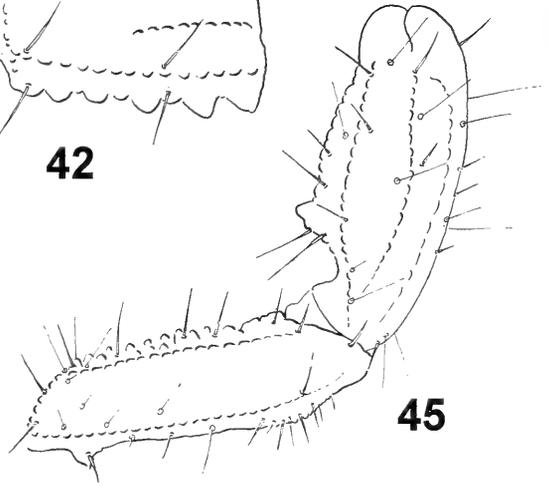
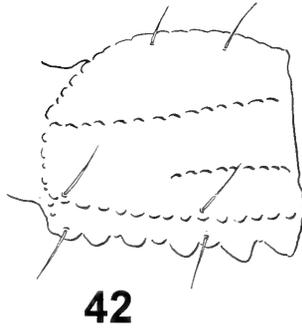


FIG 40

Buthus mariefranceae sp. n., femelle. Habitus (d'après Vachon, 1952).

Morphologie. Prosoma: front de la plaque prosomienne sans aucune concavité, presque droit; tubercule oculaire situé à peu près au centre de la plaque prosomienne; yeux médians de grande taille, séparés par trois diamètres oculaires environ; quatre paires d'yeux latéraux; trois de taille normale et un réduit situés en arrière de trois premiers; toutes les carènes bien marquées, avec formation de la configuration en forme de lyre; tégument avec une granulation peu épaisse moyennement marquée. Mesosoma: tergites avec une granulation bien marquée latéralement; trois carènes moyennement marquées, bien moins développées que chez *B. occitanus*. Metasoma: anneaux plutôt carrés avec le tégument presque lisse et la présence de 10-10-10-8-5 carènes; toutes les carènes bien marquées, en particulier les ventrales et latéro-ventrales des anneaux II-III-V. Telson: Vésicule presque lisse, avec des rares granules sur la face ventrale; aiguillon plus court que la vésicule, moyennement incurvé et dépourvu d'épine sous-aiguillonnaire. Sternites à stigmates de taille moyenne, linéaires. Peignes avec 22-22 dents chez la femelle et 24-24 dents chez le mâle. Pédipalpes: fémur et tibia



avec des carènes bien marquées; présence de quelques granules spiniformes sur sa face interne du tibia; pince avec des carènes ébauchées; tranchant des doigts fixe et mobile avec 8-9 séries semi-obliques de granules. Chélicères avec la dentition caractéristique des Buthidae (Vachon, 1963); doigt mobile à deux dents basales réduites. Trichobothriotaxie du type A- β , orthobothriotaxique (Vachon, 1974, 1975). Eperons tarsaux présents sur toutes les pattes; éperons tibiaux présents sur les pattes III-IV, bien développés.

Mensurations (en mm) de la femelle holotype et d'un mâle paratype: Longueur totale 47,1/45,4; prosoma: longueur 6,2/6,3, largeur antérieure 4,6/4,4, largeur postérieure 7,2/6,8; anneau caudal I: longueur 3,7/4,0, largeur 4,3/4,8; anneau caudal V: longueur 6,8/7,1, largeur 3,5/3,6, hauteur 2,9/3,0; vésicule: largeur 3,3/3,2, hauteur 2,8/2,9; pédipalpe: fémur longueur 4,2/4,8, largeur 1,8/1,9; tibia longueur 5,1/5,3, largeur 2,4/2,3; pince longueur 9,1/9,3, largeur 2,8/2,3, hauteur 3,1/2,6; doigt mobile longueur 5,4/5,5.

***Buthus rochati* sp. n.**

Figs 47-51

Buthus occitanus mardochei var. *panousei*: voir Vachon, 1952.

Matériel: Maroc, région de Tafnidit, 17/III/1979 (P.M. Brignoli leg.), 1 ♂ (holotype), 1 ♂, 1 ♀ (paratypes); 15/III/1979 (P.M. Brignoli leg.), 2 ♂ (paratypes); région ouest de Tafnidit (vallée du Dra), 15/III/1979 (P.M. Brignoli leg.), 6 ♀ (paratypes); 17/III/1979 (P.M. Brignoli leg.), 1 ♂, 1 ♀ (paratypes).

Diagnose: Espèce de petite taille avec environ 40-45 mm de longueur totale. Coloration générale jaunâtre, avec les carènes des tergites légèrement plus sombres et avec la présence de bandes colorées chez les juvéniles. Plaque prosomienne avec les carènes et les granules moyennement marqués. Tergites avec les carènes et les granules peu marqués. Anneaux métasomaux I à V avec les carènes bien marquées et complètes; Vème anneau avec le cadre anal à deux lobes aigus et bien écartés; présence d'un ou deux lobes sur la carène latéro-ventrale; vésicule presque lisse avec quelques granules sur la région proximale de face ventrale; aiguillon peu courbé et plus court que la vésicule. Pédipalpes: tranchants des doigts fixe et mobile avec 10-11 séries semi-obliques de granules de couleur plus foncé que les doigts. Pattes avec la face interne des segments dépourvue de granules spiniformes. Peignes avec 29-35 dents chez le mâle et 26-29 chez la femelle.

Etymologie: Le nom spécifique est donné en hommage au Dr Hervé Rochat, CNRS-Université d'Aix-Marseille, pour sa contribution à l'étude des toxines de scorpion.

Description (basée sur le mâle holotype et une femelle paratype): Coloration générale jaunâtre. Plaque prosomienne jaune clair avec quelques zones assombries autour des carènes. Mesosoma: tergites jaune clair comme la plaque prosomienne; trois bandes sombres estompées parfois présentes chez la femelle. Anneaux métasomaux I

FIGS 41-46

Buthus mariefranceae sp. n. 41-42. femelle. 43-46. Mâle. 41. Pince, vue externe-dorsale. 42. IIIème anneau du metasoma, vue latérale. 43. Telson, vue latérale. 44. Vème anneau du metasoma, vue latérale. 45. Fémur et tibia du pédipalpe, vue dorsale. 46. Pince, vue externe-dorsale.

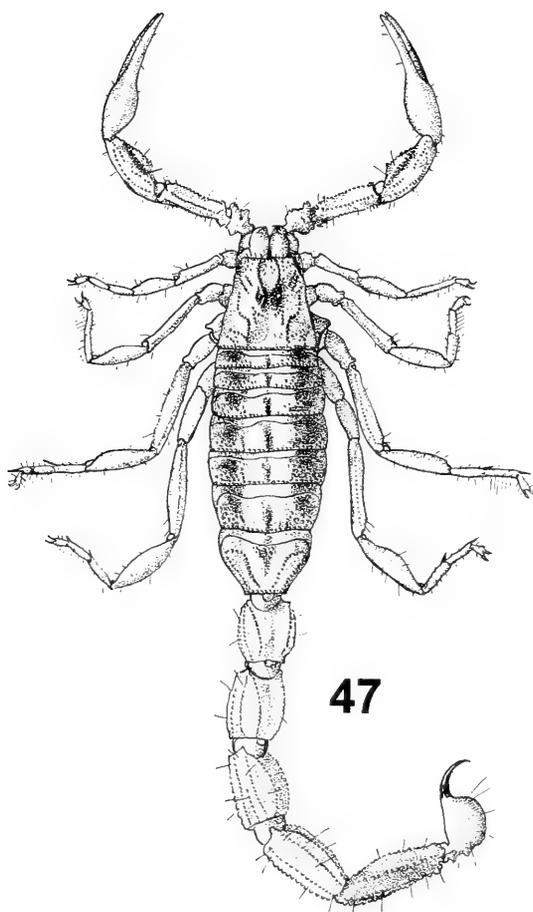
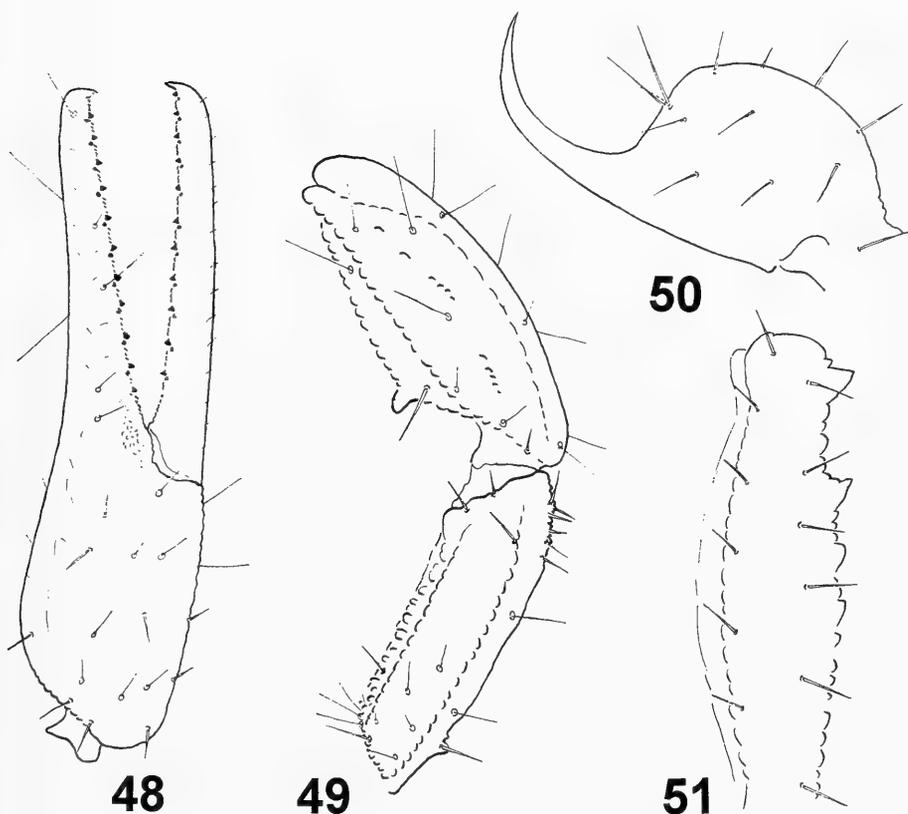


FIG 47

Buthus rochati. sp. n., mâle. Habitus (d'après Vachon, 1952).

à IV jaune clair; anneau V et telson de couleur sombre chez la femelle; aiguillon jaunâtre à la base et rougeâtre foncé à l'extrémité. Peignes, opercule génital, sternum, hanches et processus maxillaire jaune clair. Pattes jaune très clair; aucune esquisse de taches même pas estompées. Pédipalpes: fémur, tibia et pinces jaunâtres. Chélicères jaunâtres dépourvues de toute tâche ou trame; doigts rougeâtres.

Morphologie. Prosoma: front de la plaque prosomienne avec une très faible concavité, presque droit; tubercule oculaire situé à peu près au centre de la plaque prosomienne; yeux médians de grande taille, séparés par trois diamètres oculaires environ; trois paires d'yeux latéraux; toutes les carènes moyennement marquées, avec la formation de la configuration en forme de lyre; tégument avec une granulation moyennement marquée. Mesosoma: tergites avec une granulation moyennement marquée latéralement; trois carènes peu marquées, bien moins développées que chez *B. occi-*

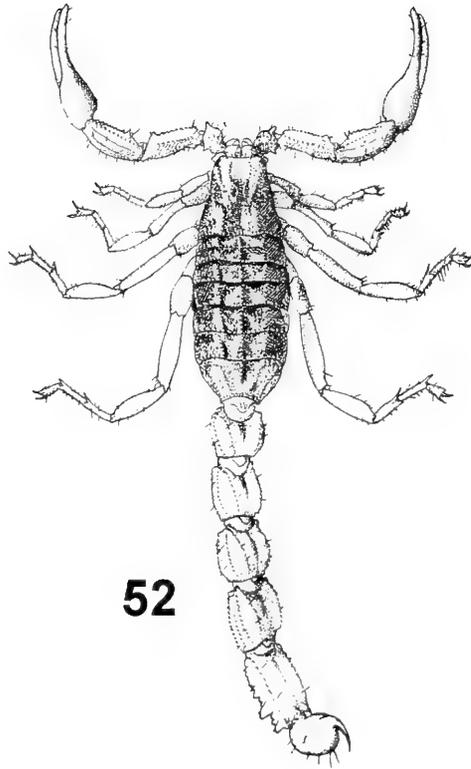


FIGS 48-51

Buthus rochati. sp. n., mâle. 48. Pince, vue externe-dorsale. 49. Fémur et tibia du pédipalpe, vue dorsale. 50. Telson, vue latérale. 51. Vème anneau du metasoma, vue latérale.

tanus. Metasoma: anneaux plutôt carrés avec le tégument presque lisse et la présence de 10-10-10-8-5 carènes; toutes les carènes bien marquées, en particulier les ventrales et latéro-ventrales des anneaux III et V. Telson: Vésicule peu granulée sur la face ventrale; aiguillon plus court que la vésicule, peu incurvé et dépourvu d'épine sous-aiguillonnaire. Sternites à stigmates linéaires. Peignes avec 29-29 dents chez le mâle et 27-27 dents chez la femelle. Pédipalpes: fémur et tibia avec des carènes bien marquées; présence de quelques granules spiniformes sur sa face interne du tibia: pince avec des carènes ébauchées; tranchant des doigts fixe et mobile avec 10-11 séries semi-obliques de granules. Chélicères avec la dentition caractéristique des Buthidae (Vachon, 1963); doigt mobile à deux dents basales très réduites. Trichobothriotaxie du type A- β , orthobothriotaxique (Vachon, 1974, 1975). Eperons tarsaux présents sur toutes les pattes; éperons tibiaux présents sur les pattes III-IV, bien développés.

Mensurations (en mm) du mâle holotype et d'une femelle paratype: Longueur totale 44,1/42,8; prosoma: longueur 5,5/5,4, largeur antérieure 3,9/4,0, largeur pos-



52

FIG 52
Buthus paris, femelle. Habitus (d'après Vachon, 1952).

térieure 5,9/6,4; anneau caudal I: longueur 3,7/3,2, largeur 3,8/3,3; anneau caudal V: longueur 6,4/6,0, largeur 2,9/2,6, hauteur 2,4/2,1; vésicule: largeur 2,5/2,5, hauteur 2,3/2,3; pédipalpe: fémur longueur 4,2/4,1, largeur 1,4/1,6; tibia longueur 4,8/4,7, largeur 2,1/2,2; pince longueur 8,4/8,5, largeur 2,2/2,3, hauteur 2,2/2,4; doigt mobile longueur 5,1/5,2.

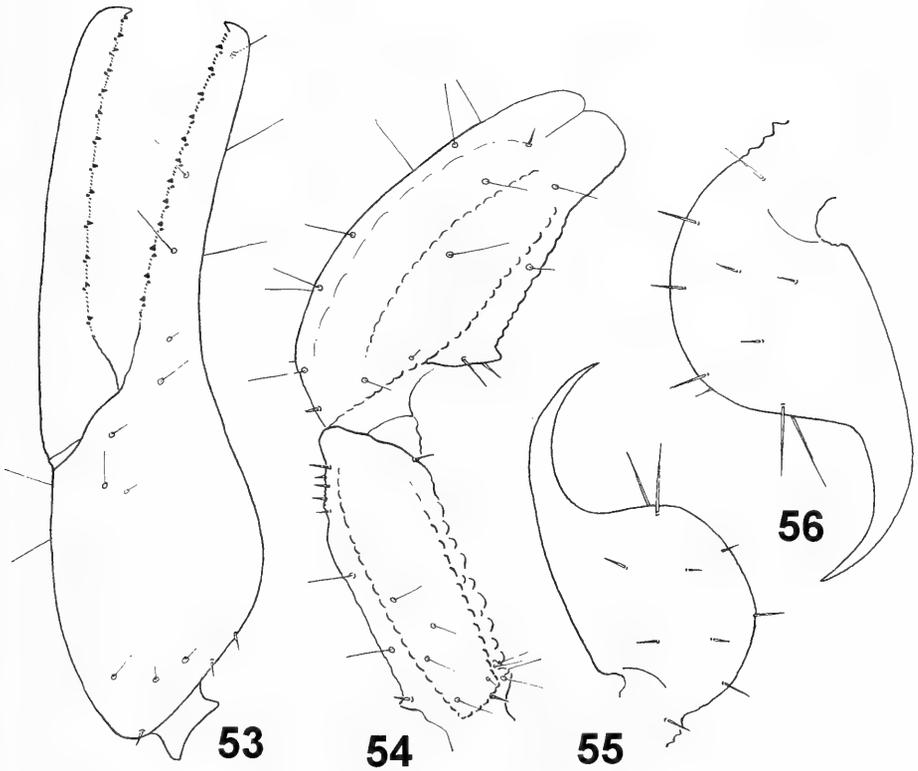
Buthus paris (C.L. Koch, 1839)

Figs 52-56

Androctonus paris C.L. Koch, 1839 = *Buthus occitanus paris* (C.L. Koch): voir Vachon, 1952.

Matériel: Algérie, Alger (région), X/1974 (Bianco leg.), 1 ♂, 1 ♀; Chrea, 20/X/1977 (P.M. Brignoli & Bianco leg.), 1 ♀; Tala Guilet (Djurdjura), 21/X/1977 (P.M. Brignoli leg.), 2 ♀. Maroc, Argana (zone à Thuya), 19/V/1979 (P.M. Brignoli leg.), 1 ♂, 1 ♀ juvénile; Argana (zone d'Arganier), 12/V/1979 (P.M. Brignoli & Simoni leg.), 1 juvénile; Ifrane (région-Bois de Cèdres), 13/IV/1979 (P.M. Brignoli & Simoni leg.), 2 ♂.

Diagnose: Espèce de taille moyenne avec environ 55-75 mm de longueur totale. Coloration générale jaunâtre, avec les tergites légèrement plus sombres mais sans bandes colorées. Plaque prosomienne avec les carènes et les granules de moyennement à fortement marqués. Tergites avec les carènes et les granules bien marqués. Anneaux



FIGS 53-56

Buthus paris. 53-55. Femelle. 53. Pince, vue externe-dorsale. 54. Fémur et tibia du pédipalpe, vue dorsale. 55. Telson, vue latérale. 56. Idem, mâle.

métasomaux I à V avec les carènes bien marquées et complètes; Vème anneau avec le cadre anal à deux lobes; présence d'un ou deux lobes aigus sur la carène latéro-ventrale; vésicule presque lisse avec quelques granules sur la région proximale de la face ventrale; aiguillon moyennement courbé et un peu plus court que la vésicule. Pédipalpes: tranchants des doigts fixe et mobile avec 12-14 séries semi-obliques de granules de couleur plus foncé que les doigts. Pattes avec la face interne des segments dépourvue de granules spiniformes. Peignes avec 29-34 dents chez le mâle et 23-28 chez la femelle.

Buthus tunetanus (Herbst, 1800)

Figs 57-61

Scorpio tunetanus Herbst, 1800 = *Buthus occitanus tunetanus* (Herbst): voir Vachon, 1952.

Matériel: Tunisie, Iles Kerkennat, 16/X/1979 (P.M. Brignoli leg.), 1 ♂; 10/XI/1979 (P.M. Brignoli leg.), 2 ♂; Dept. Djebel Birino, Thala, 10/XI/1979 (P.M. Brignoli leg.), 1 ♂, 1 ♀; Djebel Diza, 11/XI/1979 (P.M. Brignoli leg.), 1 ♂ juvénile; Matuali, 28/V/1980 (P.M. Brignoli leg.), 1 ♂ juvénile; Tunis (région), VI/1996 (T. Ziegler leg.), 2 ♂.

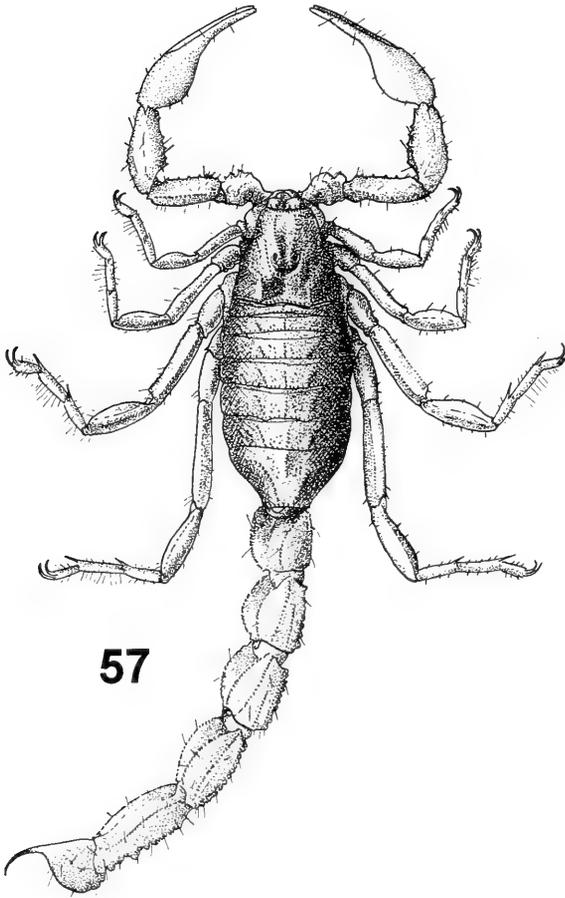
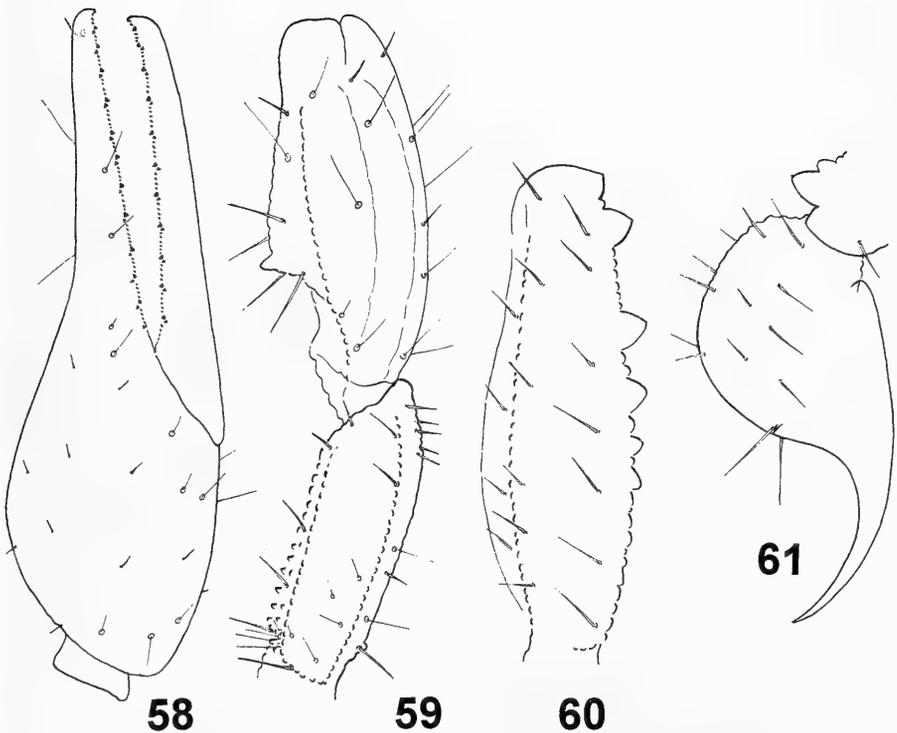


FIG 57

Buthus tunetanus, mâle. Habitus (d'après Vachon, 1952).

Diagnose: Espèce de taille moyenne ou grande avec environ 55-75 mm de longueur totale. Coloration générale jaunâtre, avec les tergites légèrement plus sombres et parfois avec des bandes colorées chez les formes juvéniles. Plaque prosomienne avec les carènes et les granules fortement marqués. Tergites avec les carènes et les granules bien marqués. Anneaux métasomiaux I à V avec les carènes bien marquées et complètes; Vème anneau avec le cadre anal à deux lobes; présence d'un ou deux lobes aigus sur la carène latéro-ventrale; vésicule presque lisse avec quelques granules sur la région proximale de la face ventrale; aiguillon moyennement courbé et aussi long que la vésicule. Pédipalpes: tranchants des doigts fixe et mobile avec 10-11 séries semi-obliques de granules de couleur plus foncé que les doigts. Pattes avec la face interne des segments dépourvue de granules spiniformes. Peignes avec 29-35 dents chez le mâle et 24-29 chez la femelle.



FIGS 58-61

Buthus tunetanus. 58. Pince, vue externe-dorsale. 59. Fémur et tibia du pédipalpe, vue dorsale. 60. Vème anneau du metasoma, vue latérale. 61. Telson, vue latérale.

***Buthus lienhardi* sp. n.**

Figs 62-69

Buthus occitanus tunetanus var. *lepineyi*: voir Vachon, 1952.

Matériel: Maroc, Oukaimeden (Marrakech), 18/V/1979 (P.M. Brignoli leg.), 1 ♂ (holotype), 1 ♀, 2 juvéniles (paratypes; 10/V/1979 (P.M. Brignoli leg.), 3 juvéniles.

Diagnose: Espèce de taille moyenne avec environ 60-70 mm de longueur totale. Coloration générale jaunâtre foncé, avec les tergites plus sombres et la présence des bandes colorées confluentes. Plaque prosomienne avec les carènes et les granules fortement marqués. Tergites avec les carènes et les granules bien marqués. Anneaux métasomaux I à V avec les carènes bien marquées et complètes; Vème anneau avec le cadre anal à deux lobes moyennement aigus; vésicule avec quelques granules sur la face ventrale; aiguillon peu courbé et aussi long que la vésicule. Pédipalpes: tranchants des doigts fixe et mobile avec 12 séries semi-obliques de granules de couleur plus foncé que les doigts. Pattes avec la face interne des segments armée de quelques granules spiniformes. Peignes avec 27-29 dents chez le mâle et 22-23 chez la femelle.

Etymologie: Le nom spécifique est donné en hommage au Dr Charles Lienhard, du Muséum d'histoire naturelle, Genève pour sa constante collaboration à la publication de mes articles sur les scorpions.

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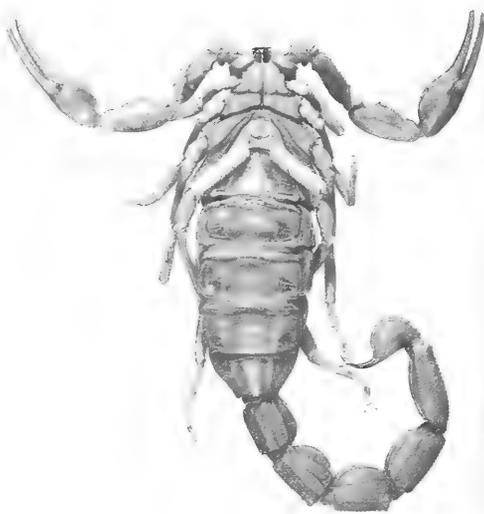
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64



65



FIGS 62-65

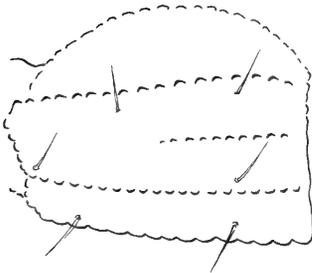
Buthus lienhardi sp. n. 62-63. Mâle holotype. 64-65. Femelle paratype. Vues dorsale et ventrale.



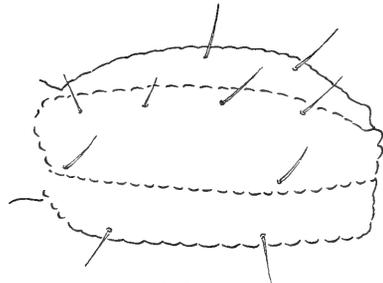
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68



69

FIGS 66-69

Buthus lienhardi sp. n. 66. Pince, vue externe-dorsale (mâle). 67-69. Femelle. 67. Telson, vue latérale. 68-69. Anneaux II (68) et IV (69) du metasoma, vue latérale.

Description (basée sur le mâle holotype et une femelle paratype): Coloration générale jaunâtre foncé. Plaque prosomienne assombrie avec une zone plus claire entre les carènes médianes oculaires. Mesosoma avec les tergites assombris par des bandes brunâtres confluentes; carènes et granules foncés. Anneaux metasomaux I à V jaunâtres avec les carènes ventrales rougeâtres; telson jaune clair; aiguillon jaunâtre à la base et rougeâtre à l'extrémité. Peignes, opercule génital, sternum, hanches et processus maxillaire jaune clair. Pattes jaune clair; aucune esquisse de taches. Pédipalpes: fémur, tibia et pinces jaunâtres. Chélicères jaunâtres dépourvues de toute tâche ou trame; doigts rougeâtres.

Morphologie. Prosoma : front de la plaque prosomienne sans aucune concavité, presque droit; tubercule oculaire situé à peu près au centre de la plaque prosomienne; yeux médians, séparés par trois diamètres oculaires environ; trois paires d'yeux latéraux; toutes les carènes fortement marquées, avec la formation de la configuration en forme de lyre; tégument avec une granulation épaisse et bien marquée. Mesosoma: tergites avec une granulation moyennement épaisse mais bien marquée latéralement; trois carènes bien marquées, mais moins développées que chez *B. occitanus*. Meta-soma: anneaux plutôt carrés avec le tégument presque lisse et la présence de 10-10-10-8-5 carènes; toutes les carènes bien marquées, en particulier les ventrales et latéro-ventrales de l'anneau V. Telson: Vésicule avec quelques granules sur la face ventrale; aiguillon aussi long que la vésicule, moyennement incurvé et dépourvu d'épine sous-aiguillonnaire. Sternites à stigmates linéaires. Peignes avec 27-27 dents chez le mâle et 22-22 dents chez la femelle. Pédipalpes: fémur et tibia avec des carènes bien marquées; présence de quelques granules spiniformes sur sa face interne du tibia; pince avec des carènes ébauchées; tranchant des doigts fixe et mobile avec 12 séries semi-obliques de granules. Chélicères avec la dentition caractéristique des Buthidae (Vachon, 1963); doigt mobile à deux dents basales réduites. Trichobothriotaxie du type A- β , orthobothriotaxique (Vachon, 1974, 1975). Eperons tarsaux présents sur toutes les pattes; éperons tibiaux présents sur les pattes III-IV, bien développés.

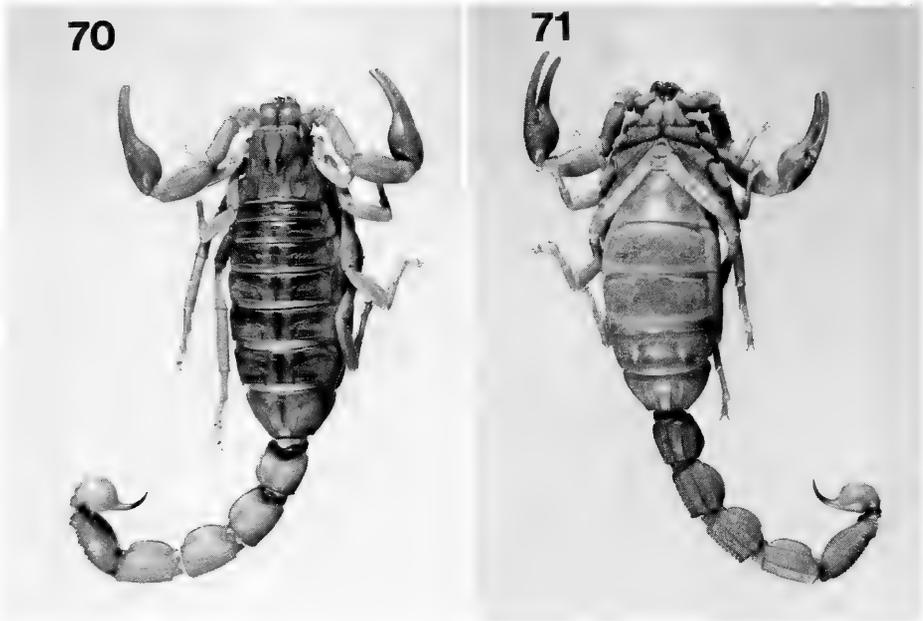
Mensurations (en mm) du mâle holotype et d'une femelle paratype: Longueur totale 62,7/67,1; prosoma: longueur 6,6/7,6, largeur antérieure 4,5/5,5, largeur postérieure 7,8/9,7; anneau caudal I: longueur 4,8/5,2, largeur 4,9/5,2; anneau caudal V: longueur 8,1/9,1, largeur 3,8/4,2, hauteur 3,5/3,8; vésicule: largeur 3,0/3,7, hauteur 2,9/3,3; pédipalpe: fémur longueur 5,9/6,8, largeur 1,9/2,3; tibia longueur 6,8/8,1, largeur 2,6/3,3; pince longueur 11,2/13,7, largeur 2,5/3,6, hauteur 2,8/3,8; doigt mobile longueur 7,2/8,4.

***Buthus albengai* sp. n.**

Figs 70-74

Matériel: Maroc, Plateau d'Ito, 9/IV/1979 (P.M. Brignoli leg.), 1 ♀ (holotype), 3 ♀ (paratypes); Ifrane (bois de Cèdres), 13/IV/1979 (P.M. Brignoli – Simoni leg.), 2 juvéniles (paratypes); Région nord de Kenifra, 19/IV/1979 (P.M. Brignoli leg.), 1 ♂, 1 ♀ juvéniles (paratypes).

Diagnose: Espèce de taille moyenne ou grande avec environ 65-85 mm de longueur totale. Coloration générale jaunâtre, avec les tergites plus sombres et la présence de trois bandes longitudinales brunâtres ; bande médiane moins large que les latérales. Plaque prosomienne avec les carènes et les granules bien marqués. Tergites avec les carènes et les granules moyennement marqués. Anneaux métasomaux I à V avec les carènes bien marquées et complètes; Vème anneau avec le cadre anal à deux lobes pas aigus; vésicule globuleuse, presque lisse avec quelques rares granules sur la région proximale de la face ventrale; aiguillon peu courbé et un peu plus court que la vésicule. Pédipalpes: tranchants des doigts fixe et mobile avec 11-12 séries semi-obliques de granules de couleur plus foncée que les doigts. Pattes avec la face interne des segments dépourvue de granules spiniformes. Peignes avec 29-33 dents chez le mâle et 26-30 chez la femelle.



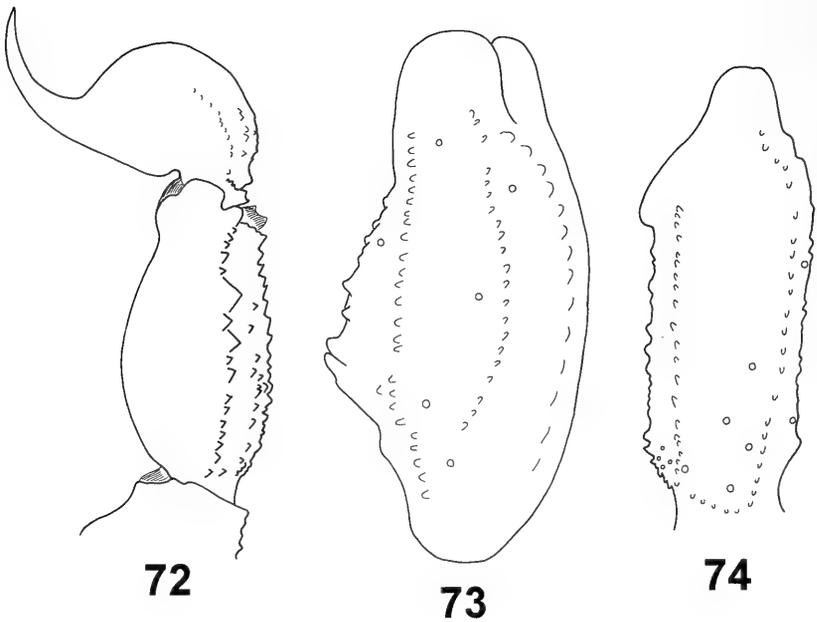
FIGS 70-71

Buthus albengai sp. n. Femelle holotype, vues dorsale et ventrale.

Etymologie: Le nom spécifique est donné en hommage à Laurent Albenga, Dépt. de Systématique et Evolution, section Arthropodes, Muséum national d'histoire naturelle, Paris, pour son aide technique à la recherche sur les scorpions.

Description (basée sur la femelle holotype): Coloration générale jaunâtre avec des régions assombries, en général plus marquées chez les juvéniles. Plaque prosomienne jaunâtre avec quelques zones brunâtres autour des carènes. Mesosoma jaunâtre un peu plus foncé que la plaque prosomienne, avec la présence de trois bandes brunâtres longitudinale; la bande médiane plus étroite que les latérales; carènes et granules assombries, plus foncés que ceux de la plaque prosomienne. Anneaux metasomiaux I à V et telson jaune clair, avec les carènes rougeâtres; aiguillon jaunâtre à la base et rougeâtre à l'extrémité. Peignes, opercule génital, sternum, hanches et processus maxillaire jaune clair. Pattes jaune très clair dépourvues de taches. Pédipalpes: fémur, tibia et pinces jaunâtres. Chélicères jaunâtres avec une trame brunâtre dans la région antérieure; doigts rougeâtres.

Morphologie. Prosoma: front de la plaque prosomienne sans aucune concavité, presque droit; tubercule oculaire situé à peu près au centre de la plaque prosomienne; yeux médians, séparés par trois diamètres oculaires environ; trois paires d'yeux latéraux; toutes les carènes bien marquées, avec la formation de la configuration en forme de lyre; tégument avec une granulation épaisse et bien marquée. Mesosoma: tergites avec une granulation moyennement épaisse mais bien marquée latéralement; trois carènes moyennement marquées, bien moins développées que chez *B. occitanus*.



FIGS 72-74

Buthus albengai sp. n. Femelle holotype. 72. Vème anneau du metasoma et telson, vue latérale. 73-74. Tibia (73) et fémur (74) du pédipalpe, vue dorsale.

Metasoma: anneaux plutôt carrés avec le tégument presque lisse et la présence de 10-10-10-8-5 carènes; toutes les carènes bien marquées, en particulier les ventrales et latéro-ventrales des anneaux II-III-V. Telson: Vésicule globuleuse, presque lisse avec quelques rares granules sur la face ventrale; aiguillon un peu plus court que la vésicule, moyennement incurvé et dépourvu d'épine sous-aiguillonnaire. Sternites à stigmates linéaires. Peignes avec 33-33 dents chez le mâle et 28-30 dents chez la femelle. Pédipalpes: fémur et tibia avec des carènes bien marquées; présence de quelques granules spiniformes sur sa face interne du tibia; pince avec des carènes à peine ébauchées, presque lisse; tranchant des doigts fixe et mobile avec 11-12 séries semi-obliques de granules. Chélicères avec la dentition caractéristique des Buthidae (Vachon, 1963); doigt mobile à deux dents basales très réduites. Trichobothriotaxie du type A- β , orthobothriotaxique (Vachon, 1974, 1975). Eperons tarsaux présents sur toutes les pattes; éperons tibiaux présents sur les pattes III-IV, bien développés.

Mensurations (en mm) de la femelle holotype: Longueur totale 85,2; prosoma: longueur 9,4, largeur antérieure 6,8, largeur postérieure 11,5; anneau caudal I: longueur 6,6, largeur 6,9; anneau caudal V: longueur 10,6, largeur 5,7, hauteur 4,7; vésicule: largeur 5,2, hauteur 4,5; pédipalpe: fémur longueur 7,5, largeur 2,7; tibia longueur 8,9, largeur 4,4; pince longueur 15,9, largeur 4,7, hauteur 5,0; doigt mobile longueur 10,2.

Buthus brignolii sp. n.

Figs 75-79

Matériel: Holotype femelle, Soudan, Darfur, Djebel Meidob, 14/1/1973 (P.M. Brignoli leg).²

Diagnose: Espèce de petite taille avec 41 mm de longueur totale. Coloration générale jaunâtre, avec les tergites légèrement plus sombres et la présence de trois bandes longitudinales brun-rougeâtre; bande médiane plus étroite et plus foncée. Plaque prosomienne avec les carènes et les granules bien marqués. Tergites avec les carènes et les granules peu marqués. Anneaux métasomaux I à V avec les carènes moyennement marquées; sur les anneaux II-III les carènes intermédiaires sont représentées uniquement par quelques granules, tandis que les ventrales présentent 4 et 6 gros granules spiniformes (caractère rappelant le genre *Odontobuthus* Vachon); Vème anneau avec le cadre anal à deux lobes bien écartés; présence de quatre lobes sur la carène ventrale; vésicule presque lisse avec quelques granules sur la région proximale de la face ventrale; aiguillon bien courbé et un peu plus court que la vésicule. Pédipalpes: tranchants des doigts fixe et mobile avec 10-9 séries semi-obliques de granules de couleur plus foncé que les doigts. Pattes avec la face interne des segments armées de quelques granules spiniformes peu marqués. Peignes avec 28-29 chez la femelle.

Étymologie: Le nom spécifique est donné en hommage à P.M. Brignoli, pour sa très importante contribution à l'arachnologie.

Description: Coloration générale jaunâtre avec les tergites plus sombres. Plaque prosomienne jaune clair avec quelques zones brunâtres autour des carènes et du tubercule oculaire. Mesosoma jaune clair comme la plaque prosomienne; carènes et granules brunâtres, moins foncés que ceux de la plaque prosomienne; présence de trois bandes longitudinales, la médiane étant plus étroite et foncée. Anneaux métasomaux I à IV jaune clair avec des carènes rougeâtres; anneau V et telson avec des zones sombres latéralement; aiguillon jaunâtre à la base et rougeâtre à l'extrémité. Peignes, opercule génital, sternum, hanches et processus maxillaire jaune clair. Pattes jaune très clair avec des esquisses de taches brunâtres estompées sur les carènes. Pédipalpes: fémur, tibia et pinces jaunâtres; présence de taches brunâtres sur les carènes du tibia et de la pince. Chélicères jaunâtres dépourvues de toute tâche ou trame; doigts rougeâtres.

Morphologie. Prosoma: front de la plaque prosomienne sans aucune concavité, presque droit; tubercule oculaire situé à peu près au centre de la plaque prosomienne; yeux médians de grande taille, séparés par deux diamètres oculaires environ; quatre paires d'yeux latéraux; trois de taille normale et un réduit situé en arrière de trois premiers; toutes les carènes bien marquées, avec la formation de la configuration en forme de lyre; tégument avec une granulation moyennement épaisse et peu marquée. Mesosoma: tergites avec une granulation plutôt fine et peu marquée; trois carènes faiblement marquées et bien moins développées que chez *B. occitanus*; carènes latérales absentes des tergites I-II et estompées sur le III. Metasoma: anneaux plutôt carrés avec le tégument lisse et la présence de 10-10-10-8-5 carènes; toutes les carènes moyennement marquées; sur les anneaux II-III les carènes intermédiaires sont représentées unique-

² Dans une courte note sur les scorpions du Soudan Oriental, Vachon (1955), signale une forme, d'après lui, très voisine de *Buthus* pour Djebel Meidob. Le dit exemplaire n'a pas pu être examiné.

75



76



FIGS 75-76

Buthus brignolii sp. n. Femelle holotype, vues dorsale et ventrale.

ment par quelques granules, tandis que les carènes ventrales présentent 4 et 6 gros granules spiniformes distaux. Telson: Vésicule presque lisse avec quelques rares granules sur la face ventrale; aiguillon un peu plus court que la vésicule, bien incurvé et dépourvu d'épine sous-aiguillonnaire. Sternites à stigmates linéaires. Peignes avec 28-29 dents chez la femelle. Pédipalpes: fémur et tibia avec des carènes bien marquées; présence de quelques granules spiniformes sur sa face interne du tibia; pince avec des carènes ébauchées; tranchant des doigts fixe et mobile avec 10-9 séries semi-obliques de granules. Chélicères avec la dentition caractéristique des Buthidae (Vachon, 1963); doigt mobile à deux dents basales très réduites. Trichobothriotaxie du type A- β , orthobothriotaxique (Vachon, 1974, 1975). Eperons tarsaux présents sur toutes les pattes; éperons tibiaux présents sur les pattes III-IV, bien développés.

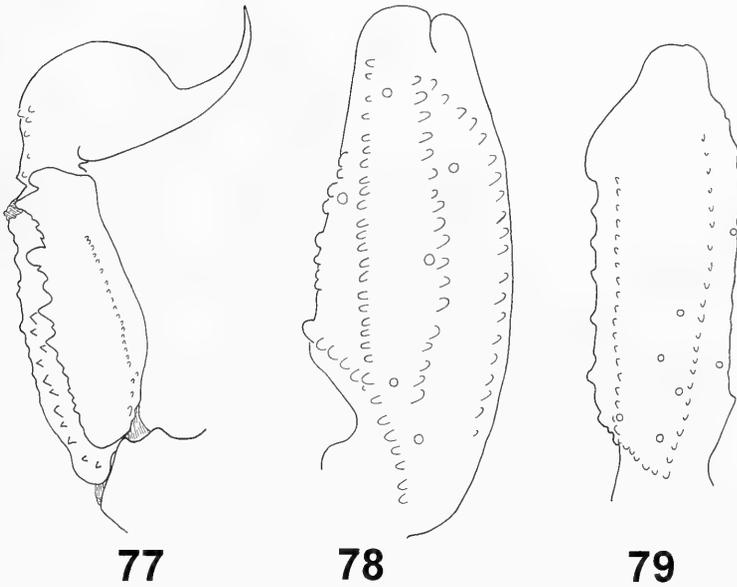
Mensurations (en mm) de la femelle holotype: Longueur totale 41,0; prosoma : longueur 4,4, largeur antérieure 3,3, largeur postérieure 4,8; anneau caudal I: longueur 2,8, largeur 2,8; anneau caudal V: longueur 4,9, largeur 2,3, hauteur 2,0; vésicule: largeur 2,2, hauteur 2,1; pédipalpe: fémur longueur 3,7, largeur 1,2; tibia longueur 4,2, largeur 1,8; pince longueur 7,1, largeur 1,4, hauteur 1,7; doigt mobile longueur 4,2.

Buthus tassili Lourenço, 2002a

Figs 80-86

Buthus tassili: Lourenço, 2002 : 113.

Matériel: Algérie, Issakharassen (Hoggar), 6/X/1974 (Simoni leg.), 1 ♀; Tassili, Djabaren (1650 m) 9/II/1967 (J. Garzoni leg.), 1 ♀; Tassili, Tin Absteika (1800 m, sable, pierre), 8/II/1967 (J. Garzoni leg.), 1 ♂.



FIGS 77-79

Buthus brignolii sp. n. Femelle holotype. 77. Vème anneau du metasoma et telson, vue latérale. 78-79. Tibia (78) et fémur (79) du pédipalpe, vue dorsale.

Diagnose: Espèce de taille moyenne avec environ 50-55 mm de longueur totale. Coloration générale jaunâtre, plus pâle que chez *B. occitanus tunetanus*, mais avec des taches foncées bien marquées sur le Vème anneau du metasoma et le telson. Plaque prosomienne avec les carènes et les granules rougeâtres. Tergites avec les carènes et les granules rougeâtres, mais plus clairs que ceux de la plaque prosomienne. Sternites jaune pâle. Anneaux métasomaux I à IV jaunâtres, avec les carènes ventrales rougeâtre clair; Vème anneau et vésicule de coloration sombre; aiguillon jaunâtre à la base et rougeâtre à l'extrémité. Pédipalpes jaune pâle; tranchants des doigts fixe et mobile avec 11-10 séries semi-obliques de granules de couleur rougeâtre. Pattes jaune pâle avec la face interne des segments armée de granules spiniformes. Peignes avec 30-32 dents chez le mâle et 23-27 chez la femelle.

CLÉ D'IDENTIFICATION POUR LES ESPÈCES DE *BUTHUS* TRAITÉES DANS LE PRÉSENT TRAVAIL

- 1 Carènes ventrales des anneaux II-III du metasoma avec 4 et 6 granules fortement marqués ; répartition Soudan *B. brignolii*
- (1) Carènes ventrales des anneaux II-III du metasoma avec des granules moyennement ou peu marqués 2
- 2 Plaque prosomienne avec les carènes fortement marquées 3
- (2) Plaque prosomienne avec les carènes moyennement ou peu marquées 9
- 3 Tergites avec les carènes fortement marquées 4
- (3) Tergites avec les carènes moyennement ou peu marqués 8

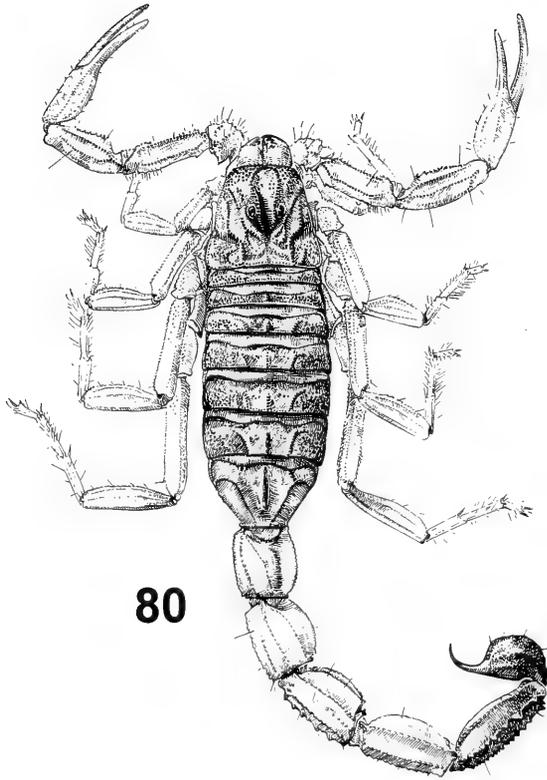
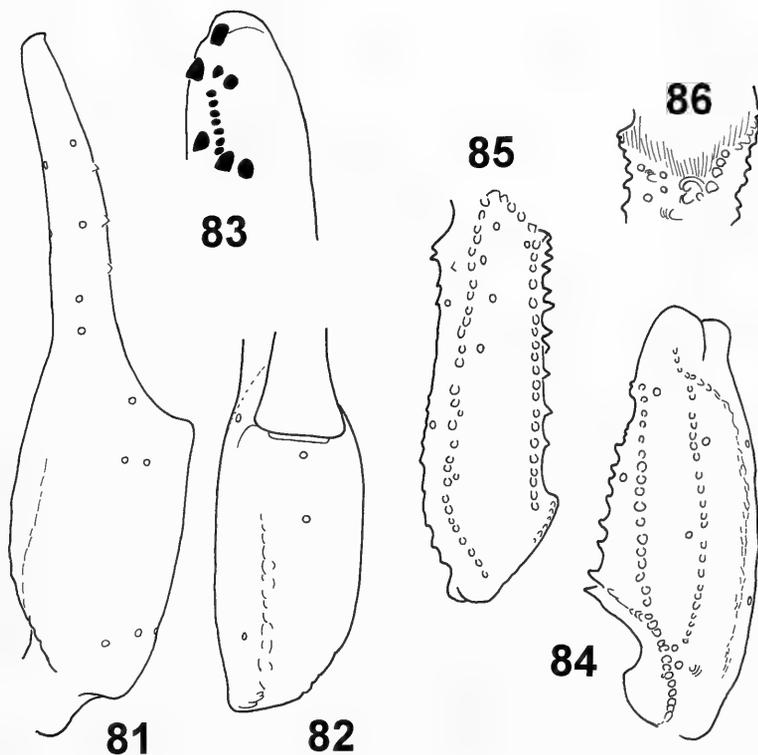


FIG 80
Buthus tassili. Habitus mâle holotype.

- 4 Tranchants des doigts des pédipalpes avec 12 ou plus de 12 séries de granules 5
- (4) Tranchants des doigts des pédipalpes avec moins de 12 séries de granules . . . 7
- 5 Aiguillon plus long que la vésicule; répartition Nord du Maroc et Europe *B. occitanus*
- (5) Aiguillon plus court ou de même longueur que la vésicule 6
- 6 Peignes avec 29-34 dents chez le mâle et 23-28 chez la femelle; répartition Algérie et Nord du Maroc *B. paris*
- (6) Peignes avec 27-29 dents chez le mâle et 22-23 chez la femelle; répartition Maroc *B. lienhardi*
- 7 Anneau V du metasoma et vésicule de coloration claire; répartition Tunisie et Algérie? *B. tunetanus*
- (7) Anneau V du metasoma et vésicule de coloration sombre, noirâtre; répartition Sud de l'Algérie, Tassili et Hoggar *B. tassili*
- 8 Longueur totale d'environ 45-50 mm; doigts des pédipalpes avec 8-9 séries de granules; répartition Sud du Maroc *B. mariefranceae*



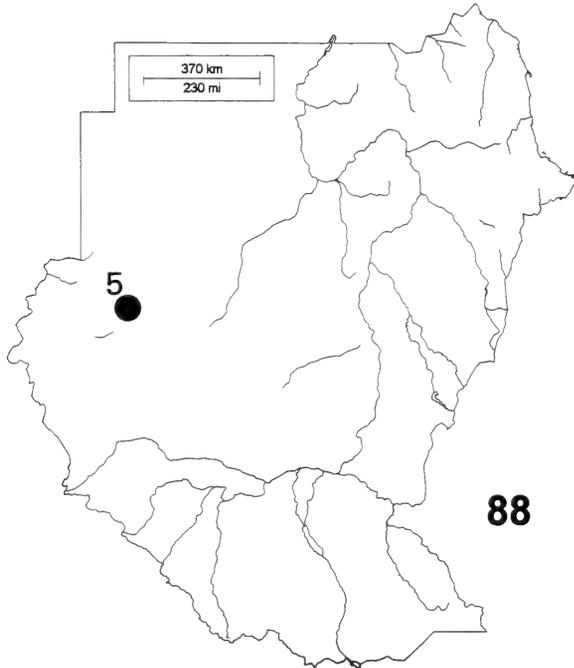
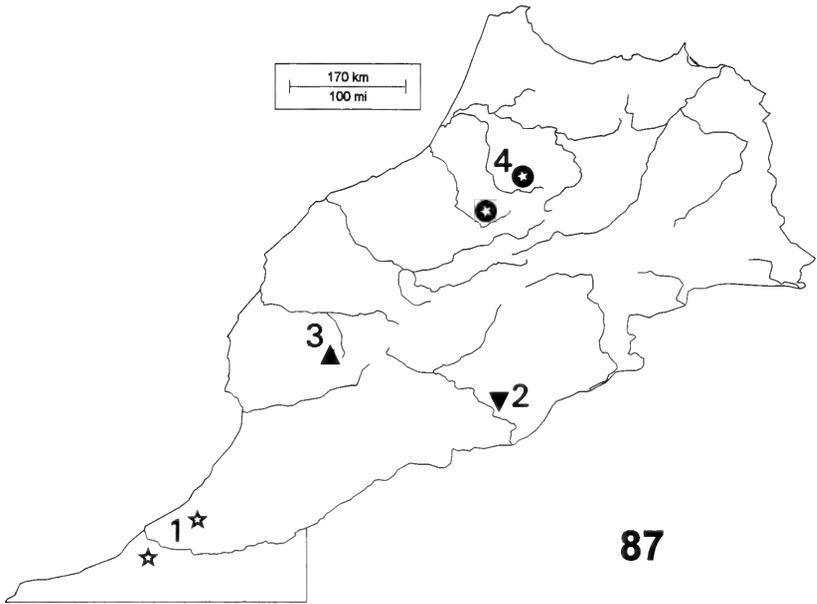
FIGS 81-86

Buthus tassili, mâle holotype. 81-82. Pince, vues externo-dorsale et ventrale. 83. Extrémité du doigt mobile. 84-86. Tibia (84) et fémur (85-86) du pédipalpe, vues dorsale et interne.

- (8) Longueur totale d'environ 65-85 mm; doigts des pédipalpes avec 11-12 séries de granules; répartition Nord du Maroc *B. albengai*
- 9 Tergites assombrés mais sans bandes colorées; répartition région côtière du Maroc *B. mardochei*
- (9) Tergites avec trois bandes colorées au moins chez les juvéniles 10
- 10 Peignes avec 26-30 dents chez le mâle et 21-25 chez la femelle; anneaux II-III-V avec des granules lobés sur la carène latéro-ventrale; répartition Sud du Maroc *B. malhommei*
- (10) Peignes avec 29-35 dents chez le mâle et 26-29 chez la femelle; anneau V avec un ou deux granules lobés sur la carène latéro-ventrale; répartition Est du Maroc *B. rochati*

CONSIDÉRATIONS BIOGÉOGRAPHIQUES

Ainsi que le précise déjà Vachon (1951, 1952), la répartition actuelle des scorpions de l'Afrique septentrionale peut être expliquée par la paléogéographie et la paléoclimatologie. Les modifications climatiques subies par l'Afrique du Nord dans



FIGS 87-88

Cartes du Maroc (87) et du Soudan (88) avec les stations connues des espèces nouvelles de *Buthus* décrites dans le travail. 1. *Buthus mariefranceae*. 2. *Buthus rochati*. 3. *Buthus lienhardi*. 4. *Buthus albengai*. 5. *Buthus brignolii*.

des périodes géologiques récentes (Quaternaire), et en particulier l'expansion de la zone désertique du Sahara (Furon, 1951) ont agi sur les populations scorpioniques alors présentes comme des facteurs de spéciation. Les réactions des populations aux pressions abiotiques ont dû dépendre de leurs caractéristiques biodémographiques: i.e. stratégies adaptatives et reproductrices (Lourenço 1991). Les conséquences ont certainement été variables: i.e. régressions voire disparitions de populations, et ruptures de distributions jadis continues. Les transformations du milieu conduisent souvent à la réduction de la répartition de certaines espèces. En effet, certains organismes inféodés à des biotopes particuliers, du fait de la réduction de ces zones géographiques écologiquement viables, voient leurs aires de répartition diminuées très fortement. Des populations sont ainsi isolées et évoluent indépendamment. Les pressions climatiques peuvent donc être à l'origine de spéciations allopatriques. Cette dernière hypothèse semble convenir à certaines espèces telles que *Buthus tassili* présente au Tassili des Ajjer en Algérie, ainsi qu'aux différentes espèces nouvelles de *Buthus* décrites dans la présente note et qui habitent les régions centrale et Sud du Maroc. Toutes ces régions principalement montagneuses auraient joué le rôle de refuges permettant la survie de certaines populations, qui, isolées sur ces « îles écologiques » auraient divergé morphologiquement et formé de nouvelles espèces.

Les modèles de distribution et différenciation des espèces du genre *Buthus* (Lourenço, 2002a) suggèrent que la colonisation de l'Europe par *Buthus occitanus* a dû se faire depuis l'Afrique, probablement depuis certaines régions côtières du Maroc où cette espèce est encore présente. L'implantation du genre *Buthus* en Europe a dû avoir lieu relativement récemment au cours des changements climatiques du Quaternaire (Lourenço, 2002a). Cette hypothèse se place en désaccord avec l'opinion de Vachon (1941, 1951, 1952), selon laquelle *Buthus* serait un genre d'origine européenne importé par la suite en Afrique.

REMERCIEMENTS

Je suis très reconnaissant au Dr S. Jourdan, Paris et aux Drs Charles Lienhard et Peter Schwendinger, Muséum d'histoire naturelle, Genève pour la révision des versions préliminaires du texte. Les dessins sont de Maurice Gaillard, Paris et les photos de Claude Ratton, Muséum d'histoire naturelle, Genève.

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The Baltic amber ant genus *Bradoponera* (Hymenoptera: Formicidae), with description of two new species and a reassessment of the Proceratiini genera

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The Baltic amber ant genus *Bradoponera* (Hymenoptera: Formicidae), with description of two new species and a reassessment of the Proceratiini genera. - Two new species of *Bradoponera* are described from Baltic amber. *B. wunderlichi* sp. n. is described on a single dealate gyne and *B. electrina* sp. n. on a single worker. *B. wunderlichi* resembles in general body shape and sculpture the sole previously known species of the genus, *B. meieri* Mayr. *B. wunderlichi* differs from *meieri* mainly by the antennae, 9-jointed instead of 12-jointed and by its smaller size. *B. electrina* is the most distinctive *Bradoponera* species by possessing at least two autapomorphies, the body with suberect hairs and the petiole narrow and rectangular in profile. *B. electrina* shares with *meieri* the 12-jointed antennae but the two species differ considerably in body shape and size. Description of these new species and re-discovery of the genus *Bradoponera* allow a set of improvements to the classification of the Ponerinae which were needed but impossible before. Among the main taxonomic conclusions made possible by the examination of *Bradoponera* material are, the first definition of a monophyletic ponerine clade corresponding to the “classic” tribe Proceratiini and characterization of its three component genera *Proceratium*, *Discothyrea*, and *Bradoponera* by at least one autapomorphy each.

Key-words: Hymenoptera - Formicidae - ants - *Bradoponera* - new species - Proceratiini - Baltic amber - fossils.

INTRODUCTION

The genus *Bradoponera* Mayr is known from one species only, *B. meieri* Mayr, described from 5 workers from Baltic amber (Mayr, 1868). Wheeler (1915) examined 10 additional workers and redescribed the species giving additional details of the sculpture and described for the first time an ergatoid female.

Mayr (1868) considered *Bradoponera* to be close to *Proceratium* and Wheeler (1915) much more closely related to *Discothyrea*. *Proceratium* and *Discothyrea* are the sole two Recent genera constituting the tribe Proceratiini as it is currently understood (see later).

Brown (1958) synonymized the Proceratiini with the Ectatommini, placing *Proceratium* and *Discothyrea* close to *Heteroponera*. In his conception *Bradoponera* was an intermediate step along this line.

Kugler (1991) by means of a cladistic analysis of six Ectatommini genera (*Paraponera*, *Acanthoponera*, *Gnamptogenys*, *Ectatoma*, *Proceratium* and *Discothyrea*) based on the morphology of the sting apparatus, suggests that *Proceratium* and *Discothyrea* are sister genera. Kugler (l.c.) listed eight synapomorphies linking these two genera together.

Lattke's (1994) phylogenetic study of the ectatommines based on 36 morphological characters, resurrects the tribe Proceratiini including in it *Proceratium* and *Discothyrea* only. On the basis of Mayr's (1868) description and Wheeler's (1915) notes, Lattke (1994) suggests the possibility that *Bradoponera* may represent the ancestral form of *Discothyrea*.

A re-analysis of Lattke's phylogeny by Keller (2000) takes strength from the consideration of 12 additional characters. All these characters, however, are invariant or uninformative within the subset of taxa considered in the present paper.

The crux of the problem, on the other hand, lies on the most probable phylogenetic position of *Bradoponera* and, as a consequence of this, on the possibility to identify two extant and one fossil Proceratiini genera, characterized by at least one clear autapomorphy each.

A concrete difficulty to reach this target is represented by the fact that internal morphological characters (like all those considered by Kugler, 1991) cannot be observed in the fossil *Bradoponera*.

The opportunity to examine five *Bradoponera* specimens, two of which representing two undescribed species, motivated us to attempt the present study.

MATERIAL AND METHODS

The morphological nomenclature, the measurements and their relative acronyms are those already defined by Baroni Urbani & de Andrade (2003) for the closely related genus *Proceratium*.

The following fossil specimens of *Bradoponera* were in 5 samples (4 of which already cut and polished) of Baltic amber. All samples originally belonged to the collection of Jörg Wunderlich, Straubenhardt (Baden-Württemberg, Germany) (JWCS). The holotypes of the two new species described in this paper were subsequently purchased from Dr Wunderlich by the Museo Regionale di Scienze Naturali of Turin (MRSN) in order to allow type deposition in a public collection.

BB-1 (fig. 1). A small, 1.3x0.8x0.3 cm, yellow sample containing a dealate *Bradoponera* gyne and a mite. The preservation condition of the ant is good and is only slightly hindered by a longitudinal fissure filled by whitish impurities.

BB-6 (fig. 2). A opaque-yellow small sample, 0.4x0.7x0.4 cm, containing only a *Bradoponera* worker. The preservation condition of the ant is good and many filaments run it on the left lower side and ventrally. A longitudinal fissure filled with whitish material is also present.

BB-4 (fig. 3). A yellow, slightly opaque sample, 1.2x0.9x0.4 cm, containing a *Bradoponera* worker and many small impurities. The preservation condition of the ant is good and only a few fissures reduce observation.

BB-7 (fig. 4). A transparent yellow sample, 0.8x0.7x0.3 cm, containing a worker of *Bradoponera*, a dipteran and many small impurities. The preservation condition of the ant is good and only a longitudinal fissure filled with whitish material close to the head affects slightly its view.

BB-8 (fig. 5). A large yellow sample, 3.0x1.8x0.7 cm, containing a *Bradoponera* worker, a ponerine male?, a dipteran, many air bubbles and fissures. The preservation condition of the ant worker is good and only a longitudinal fissure runs along its right side, rendering impossible this view.

To assess the distribution of some characters of presumed importance in reconstructing the phylogenetic relationship of *Bradoponera* with its most closely related genera, we examined also Recent material of the other two Proceratiini genera, *Proceratium* and *Discothyrea*, and of the following genera used for the outgroup comparison: *Paraponera*, *Ectatomma*, and *Gnamptogenys*.

Our character coding for the analysis is drawn from examination of the following species:

Bradoponera: three species, i. e. all known ones.

Proceratium: 4 fossil and 73 recent species, i. e. all known species except *longigaster* Karavaiev.

Discothyrea: *Discothyrea* sp. (Darjeeling, India, Naturhistorisches Museum, Basel), *oculata* Emery, *sauteri* Forel, *sculptior* Santschi, *sexarticulata* Borgmeier, *stumperi* Baroni Urbani, †*gigas* de Andrade, i. e. ca. 25% of the known species.

Paraponera: *clavata* (Fabricius) and †*dieteri* Baroni Urbani, i. e. all known species.

Ectatomma: *brunneum* Smith, *edentatum* Roger, *lugens* Emery, *muticum* Mayr, *opaciventre* (Roger), *permagnum* Forel, *ruidum* (Roger), *tuberculatum* (Olivier), i. e. ca. 60% of the known species.

Gnamptogenys: *Gnamptogenys* sp. (two different species, both from Queensland, Australia, both in Naturhistorisches Museum, Basel), *aculeaticoxae* Santschi, *annulata* (Mayr), *arcuata* (Santschi), *bispinosa* (Emery), *bruchi* (Santschi), *continua* (Mayr), *curtula* (Emery), *gracilis* (Santschi), *haenschei* (Emery), *horni* (Santschi), *magnifica* (Santschi), *menozzii* (Borgmeier), *moelleri* (Forel), *mordax* (Smith), *pleurodon* (Emery), *porcata* (Emery), *rustica* (Santschi), *striatula* Mayr, *strigata* (Norton), *teffensis* (Santschi), *tornata* (Roger), *tortuolosa* (Smith), *triangularis* (Mayr), *wasmanni* (Santschi), *wheeleri* (Santschi), i. e. ca. 25% of the known species.

After we submitted our manuscript for publication, an anonymous referee suggested that we should include in our analysis the genus *Heteroponera* according to Brown's (1958) intuitive statement that this is the genus closest to *Proceratium* and *Discothyrea*.

We added it and, of our own initiative, we added also the genus *Acanthoponera*: this genus results regularly as sister genus of *Heteroponera* in both cladistic analyses by Latke (1994) and by Keller (2000). Of these two genera we examined the following material:

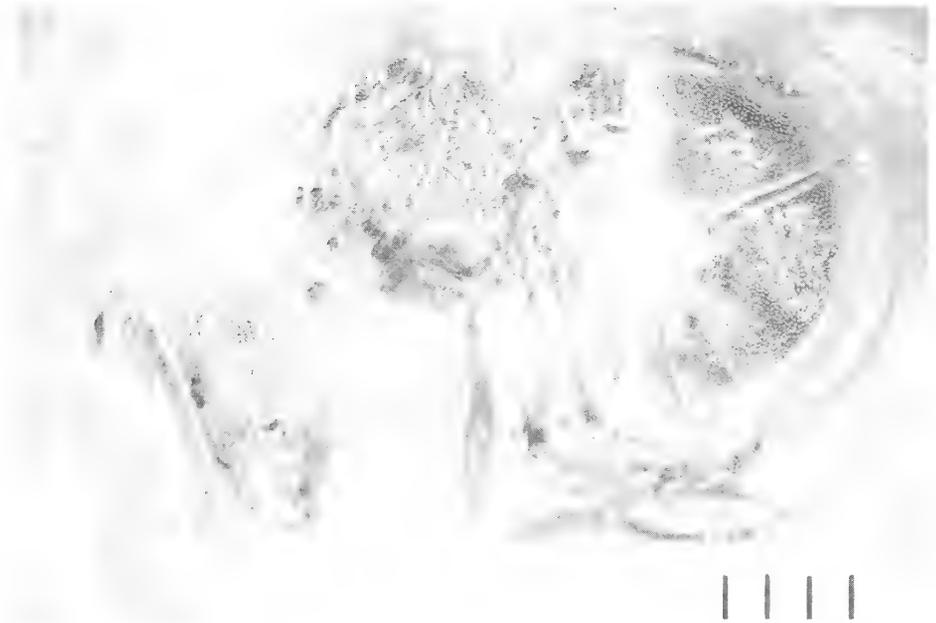


FIG. 1

Baltic amber specimen BB-1, *Bradoponera* sp., dealate gyne, lateral view. Distance between two scale bars 0.1 mm.

Heteroponera: *brounii* (Forel), *carinifrons* Mayr, *dentinodis* (Mayr), *dolo* (Roger), *inermis* (Emery), i. e. ca. 30% of the described species.

Acanthoponera: *Acanthoponera* sp. (S. Paulo, Brazil, Museo Regionale di Scienze Naturali, Turin), *mucronata* (Roger), i. e. ca. 50% of the known species.

Inclusion of these two genera changed our previous conclusions only for the appearance of the two genera in the cladogram among the outgroups (see later, the results of the cladistic analysis).

The following characters were retained as of potential phylogenetic significance (Table 1):

1. Worker and gyne. Anterior clypeal lamella absent (0), or present (1). This is character No. 5 of Lattke (1994). Our coding differs nonetheless from the one of Lattke since we considered the lamella to be polymorphic instead of present in *Ectatomma* (admitted to be polymorphic also in Lattke's text, page 110), *Gnamptogenys* (presence of this structure is equally referred to "most species" by Lattke, page 110, and the lamella is definitely missing in one of our Queensland species), *Heteroponera* (lamella missing at least in *brounii*).

2. Worker and gyne. Antennal insertion separate from clypeus (0), or fused with the clypeus (1).

3. Worker and gyne. Frontal carinae "normally" thin, lamelliform in profile (0), or remarkably thick in profile (1).

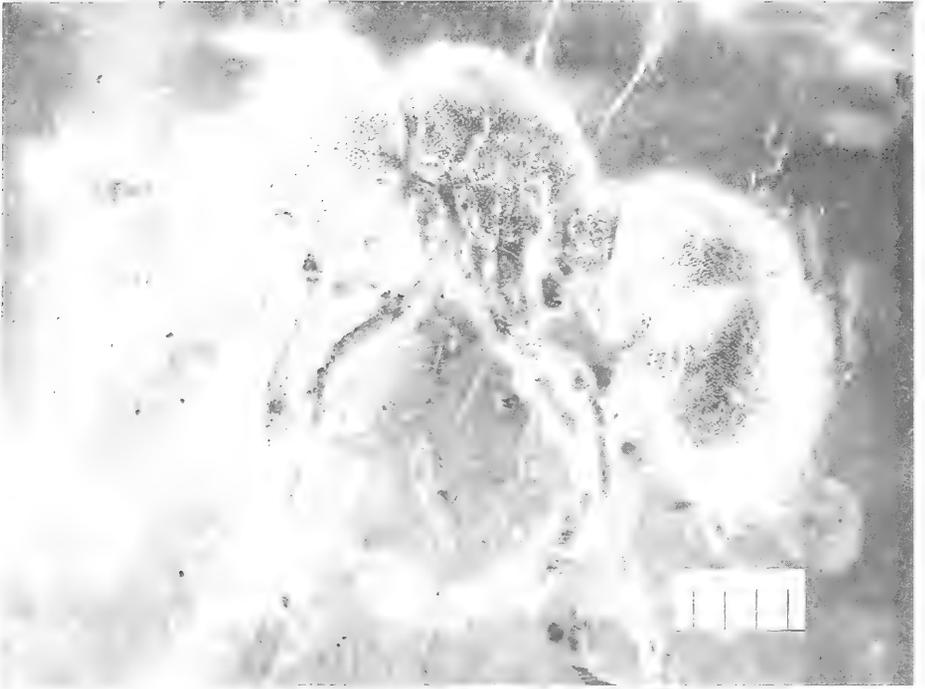


FIG. 2

Baltic amber BB-6, *Bradoponera* sp., worker, head in dorsal view (top) and dorsal view of the whole specimen (bottom). Distance between two scale bars 0.1 mm.

4. Worker and gyne. Funiculus simple (0), or clubbed (1). We find it difficult to make a clear cut between thick and clubbed funiculi. For this reason this is the binary transformation of Lattke's (1994) character No. 7.

5. Worker and gyne. Mandibles toothed (0), or edentate (1).



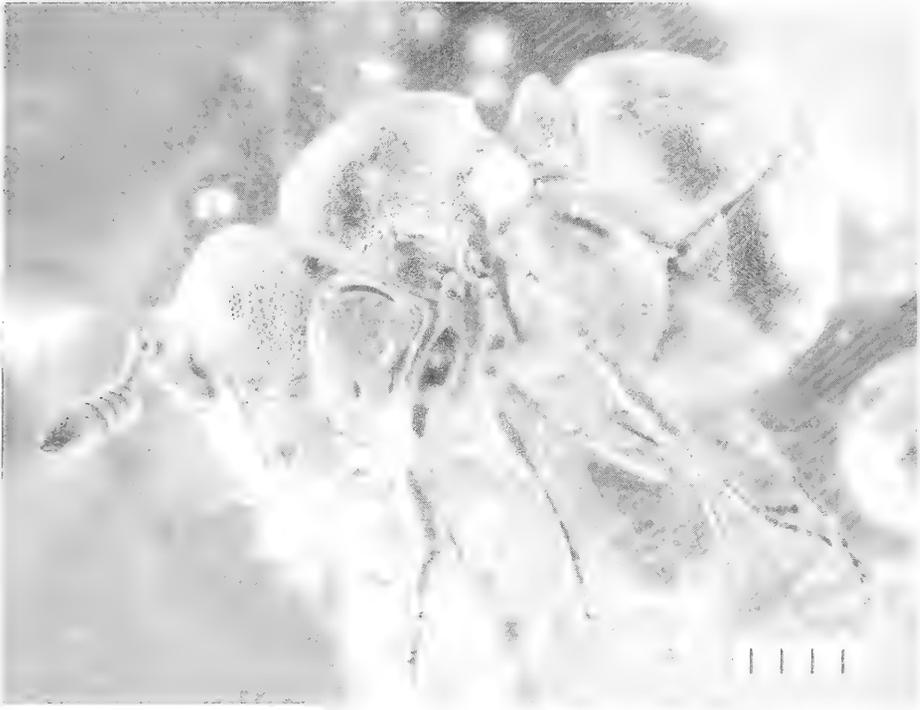


FIG. 5

Baltic amber BB-8, *Bradoponera meieri*, worker, lateral view. Distance between two scale bars 0.1 mm.

6. Worker and gyne. Maxillary palps without remarkable expansions (0), or with the second joint hammer-shaped (1).

7. Worker and gyne. Prosternal process triangular (0), or posteriorly bifurcate (1). This is character No. 9 of Lattke (1994) and it is coded entirely after this work but reduced to binary state for clarity, as already suggested by Keller (2000).

8. Worker. Promesonotal suture movable (0), or fused (1). This is character No. 8 of Lattke (1994)

9. Worker and gyne. Metacoxal cavities open (0), or closed (1). This is character No. 16 of Lattke (1994).

10. Worker and gyne. Number of stout, movable setae on the foretibial apex: one (0), or none (1). This is character No. 10 of Lattke (1994). Our coding differs nonetheless from the one of Lattke since we considered this character to be polymorphic in *Gnamptogenys* (a movable seta is well visible in both Queensland species).

FIGS 3-4

3. Baltic amber BB-4, *Bradoponera meieri*, worker, lateral view. Distance between two scale bars 0.1 mm. – 4. Baltic amber BB-7, *Bradoponera meieri*, worker, lateral view. Distance between two scale bars 0.1 mm.

11. Worker and gyne. Row of foretarsal setae present (0), or absent or at most reduced to a single seta (1). This is character No. 11 of Lattke (1994). Our coding differs nonetheless from the one of Lattke. We considered this character to be polymorphic in *Gnamptogenys* since a row of foretarsal setae is present in both Queensland species and in *haenschei*.

12. Worker and gyne. Prominent seta on the foretarsal base absent (0), or present (1). This is character No. 12 of Lattke (1994).

13. Worker and gyne. Number of mesotibial apical spurs, two (0), one (1), or none (2). This is character No. 13 of Lattke (1994). Our coding differs from the one of Lattke since we have abundant evidence for polymorphism of this character in both *Proceratium* and *Discothyrea*.

14. Worker and gyne. Empodia absent (0), or present (1). We find it difficult to make a clear cut between variable and present empodia. For this reason this is the binary transformation of Lattke's (1994) character No. 15, as already suggested by Keller (2000).

15. Worker and gyne. Claws unidentate (0), or bidentate (1).

16. Worker and gyne. Opening of the metapleural gland directed laterally (0), obliquely or posteriorly (1). This character No. 20 of Lattke (1994).

17. Worker and gyne. Petiole with (0) or without (1) lateral tergite. This is character No. 18 of Lattke (1994).

18. Worker and gyne. Dorsoventral fusion of petiole incomplete (0), or complete (1). This is character 19 of Lattke (1994).

19. Worker and gyne. Edge of posterior petiolar foramen where sternite meets tergite invaginated (0), or straight (1). This is character No. 29 of Lattke (1994).

20. Worker and gyne. Posterior border of petiolar sternite with (0), or without lateral lobes (1). This is character No. 23 of Lattke (1994).

21. Worker and gyne. Dorsal stridulitrum on abdominal segment IV absent (0), or present (1). This is character No. 30 of Lattke (1994).

22. Worker and gyne. Anterior face of third abdominal segment smooth (0), or with a carina or ridge (1). This is character No. 22 of Lattke (1994).

23. Worker (and gyne?). Spiracular plate posterior edge not reduced (0), or abruptly reduced in dorsal half (1). This is character No. 1 of Kugler (1991) and it is coded entirely after this work.

24. Worker (and gyne?). Oblong plate fulcral arm not extending along entire postincision (0), or extending along entire postincision to dorsal ridge of oblong plate (1). This is character No. 2 of Kugler (1991) and it is coded entirely after this work.

25. Worker (and gyne?). Gonostyli two segmented (0), or single segmented (1). This is character No. 3 of Kugler (1991) and it is coded entirely after this work.

26. Worker (and gyne?). Gonostylus pilosity abundant (0), or sparse (1) on distal segment. This is character No. 4 of Kugler (1991) and it is coded entirely after this work.

27. Worker (and gyne?). Furcula dorsal arm large, with lateral flanges (0), a distinct simple shaft without flanges (1), reduced to a small tubercle or absent (2), fused to sting base or entirely lost (3). This is character No. 6 of Kugler (1991) and it is coded entirely after this work.

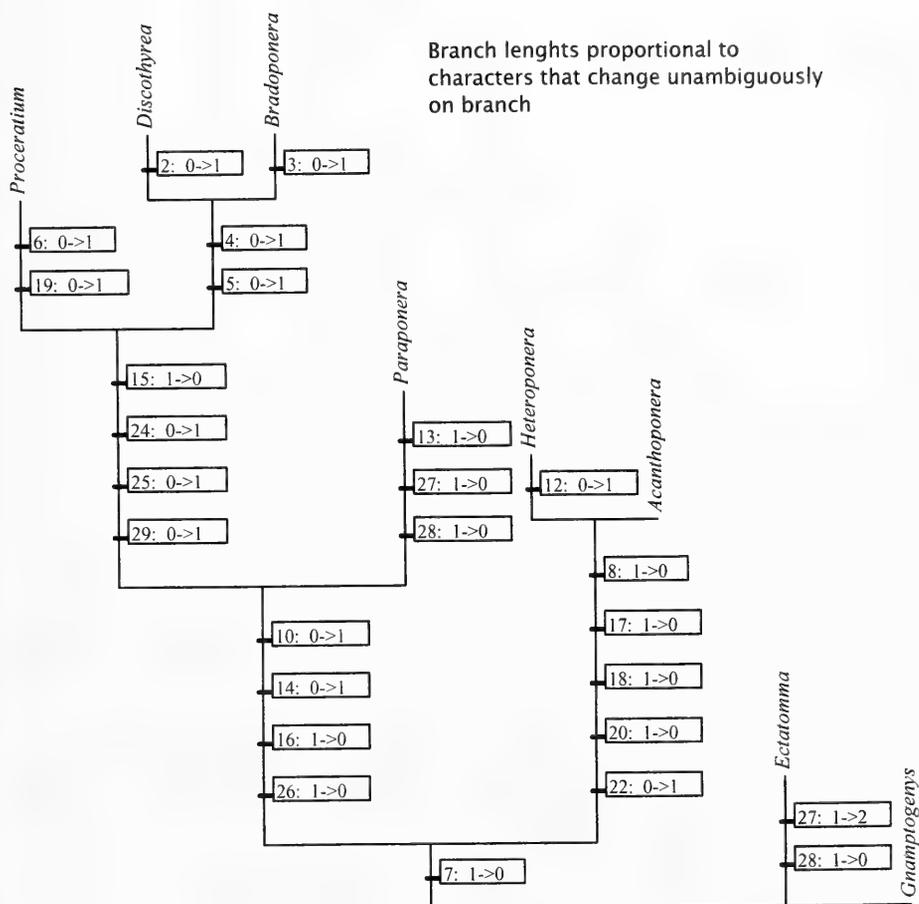


FIG. 6

Phylogram of the three Proceratiini genera and five outgroups. The labels on the branches list the apomorphic characters. See text for further explanations.

28. Gyne (and male?). Jugal lobe of hind wings present (0), or absent (1). This is character No. 34 of Latke (1994).

29. Larvae. Haired (0), or completely hairless (1). This character is coded according Wheeler & Wheeler (1976, 1985).

Characters employed in other phylogenies and not considered in the present analysis are listed below with their respective justification.

We did not include in our analysis the following characters of Latke (1994):

For being of difficult appreciation and/or variable in a number of genera (our interpretation would differ from the original one in a number of cases): 1, 24, 33, 35.

For being polymorphic among one or more of the three ingroup taxa considered in the present paper: 3, 4, 6.

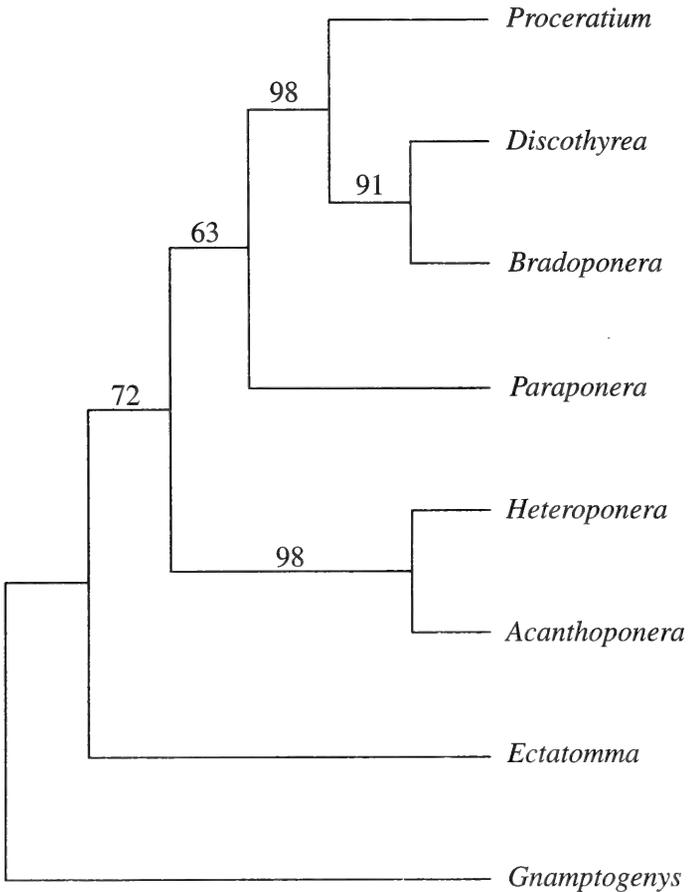


FIG. 7

Same tree as in Fig. 6 obtained as a result of 1,000 bootstrap replicates. The clade including the three Proceratiini genera appears with highly significant frequency.

For being autapomorphic (i. e. uninformative) for an outgroup taxon among those considered in the present paper: 2, 14, 17, 21, 25, 32, 36.

For being invariant among the taxa considered in the present paper: 26, 27, 28, 31.

Character 5 of Kugler (1991) was excluded for being variable according to Kugler's own description and character 7 for being autapomorphic (i. e. uninformative) for an outgroup taxon among those considered in the present paper.

Search for the optimal phylogenetic relationships between the genera considered before was performed by PAUP 4.0b10 (Swofford, 2002). Given the small number of taxa involved, an exhaustive search for the optimal tree(s) was performed.

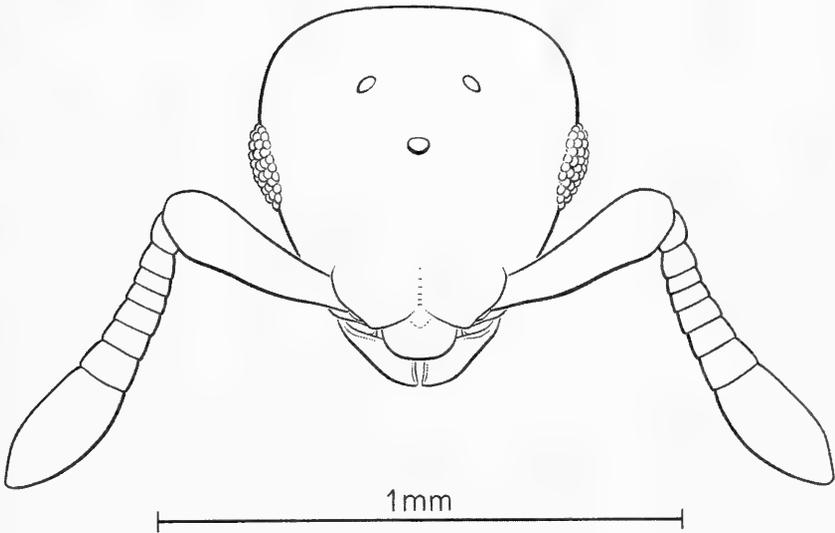


FIG. 8

Bradoponera wunderlichi Baroni Urbani & de Andrade sp. n. dealate gyne, head in dorsal view.

All characters were considered as unordered.

The phylogram with plotted apomorphies over the branches of fig. 6 was obtained by MacClade 3.01 (Maddison & Maddison, 1992).

RESULTS

Searching for the shortest tree(s) for the genera considered on the base of the characters described above results in only one optimal tree of length 51, Consistency index (CI) = 0.9020, Homoplasy index (HI) = 0.3725, CI excluding uninformative characters = 0.8611, HI excluding uninformative characters = 0.1389, Retention index (RI) = 0.8276, and Rescaled consistency index (RC) = 0.7465. This result remains unchanged using as outgroup either all the non-Proceratiini genera or *Gnamptogenys* only. This tree is drawn in form of phylogram at fig. 6.

1,000 bootstrap replicates of the same analysis result in a topologically identical tree where the clade composing the tribe Proceratiini (i. e. ((*Proceratium*, (*Discothyrea*, *Bradoponera*))) has a frequency of 98% (fig. 7).

Rooting the tree by means of all non-Proceratiini genera might imply our forcing the Proceratiini to appear as a monophyletic group. This risk was avoided in our second analysis where the tree was rooted by using *Gnamptogenys* only as outgroup. The use of *Gnamptogenys* as single outgroup appears as the most plausible outgroup choice within our data matrix. In fact, *Gnamptogenys* (and not *Paraponera* as one might have expected) appears as the most distantly related genus to the Proceratiini even in a comprehensive analysis without outgroup definition. This will

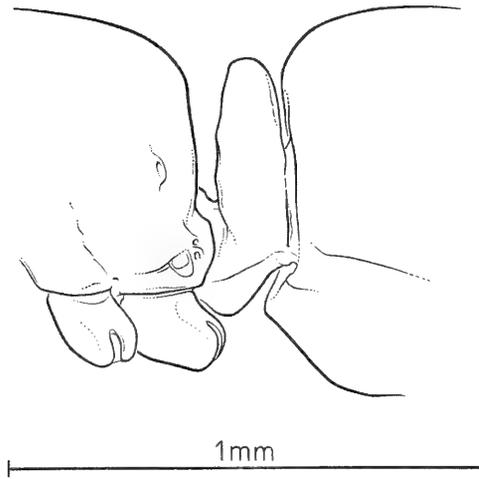


FIG. 9

Bradoponera electrina Baroni Urbani sp. n. worker, petiole in side view.

appear clearly by examination of Table 2 where the patristic distances between the genera considered in such a non-polarized tree are given.

This result could be changed only by changing the data.

One might object, however, that this result was obtained by using a number of characters either unknown in *Bradoponera*, or verified in a small number of species, or both.

But this is not the case.

Performing another exhaustive search after excluding characters 7, 9, and 19, 21, 23-29 results in three trees differing only in the position of *Ectatomma* among the outgroups and with one tree perfectly identical to the one of figs 6 and 7. These trees have a length of 33, Consistency index (CI) = 0.9394, Homoplasy index (HI) = 0.4242, CI excluding uninformative characters = 0.9091, HI excluding uninformative characters = 0.0909, Retention index (RI) = 0.8889, Rescaled consistency index (RC) = 0.8350.

A bootstrap analysis of these data results in a tree with a minority clade (29%) where *Ectatomma* appears as sister group of the clade containing (*Paraponera*, (*Proceratium*, (*Discothyrea*, *Bradoponera*))), but -understandably- the clade comprising the Proceratiini and the one comprising *Discothyrea* and *Bradoponera* appear at lower frequencies (71% and 87% respectively).

We consider as Proceratiini all ponerine ants corresponding to the description following the tribal synonymy.

PROCERATIINI Emery

Proceratii Emery, 1895: 765. Type genus: *Proceratium* (by root homonymy). Valid genera included: *Proceratium*, *Discothyrea*.

- Proceratiini Emery, Ashmead, 1905: 382. Valid genera included: *Proceratium*, *Discothyrea*.
- Proceratiini, Emery, 1911: 49. Valid genera included: *Proceratium*, *Discothyrea*, *Probolomyrmex*.
- Proceratiini Emery, Wheeler, 1922: 644. Valid genera included: *Proceratium*, *Discothyrea*, *Probolomyrmex*.
- Ectatommini Emery (partim), Brown, 1958. Senior synonym of Proceratiini.
- Proceratiini Emery, Wheeler & Wheeler, 1985: 256. Tribal status justified. Valid genera included: *Proceratium*, *Discothyrea*.
- Discothyrinae Clark, 1951: 15. Type genus *Discothyrea* (by root homonymy). Implicit synonym of Proceratiini, Wheeler & Wheeler, 1985: 256. Synonym of Ectatommini, Bolton, 1994: 264.
- Proceratiini Emery, Lattke, 1994: 112. Valid genera included: *Proceratium*, *Discothyrea*.
- Proceratiini Emery, Bolton, 1995: 15. Valid genera included: *Proceratium*, *Discothyrea*, *Bradoponera*.

There seems to be broad but not unequivocal consensus on the genera to be included in the tribe. Former attributions of *Probolomyrmex* to the Proceratiini were shown to be improbable by means of non-phylogenetic, but morphologically plausible arguments by Brown (1952). A recent paper by Perrault (2000) suggests that *Probolomyrmex* should represent a separate, monotypic subfamily within the Formicidae. If, on one hand, we are rather sceptic on this conclusion and on the rationale from which it was drawn, we take advantage of it at least as a further argument for the exclusion of *Probolomyrmex* from the Proceratiini.

PRO CERATIINI: DIAGNOSIS AND DESCRIPTION

Worker. Monomorphic but variable in size. Head subglobose, generally longer than broad, rarely as long as broad or broader than long, variable in shape, i. e. with sides convex, subparallel, diverging posteriorly or converging anteriorly. Clypeus well developed, rectangular or subround, rarely triangular, largely or partially overhanging the mandibles, or medially armed with an anterior projection of variable size, convex, rectangular or triangular, or unarmed (truncate). Frontal carinae apart from each other with thin, rarely thick lateral expansions, diverging backwards, gently convex or straight, or attached to form a vertical plate of variable shape and size. Lateral expansions of the frontal carinae never or only partially covering the antennal insertions. Genal carina absent or present; in this case variably marked and generally delimiting a sulcus of changeable depth. Gular area impressed or not. Eyes absent or present; when present represented by small pigmented dots, or by a clear convex facet, or by an agglomeration of salient ommatidia generally with interommatidial pilosity and placed approximately below or over the mid line of the head. Ocelli absent, rarely only the anterior ocellus vestigial or as developed as in the gyne. Antennal insertions entirely or partially surpassing, or on the same line as, or behind the anterior margin of the head. Antennae 6-12-jointed. Scapes surpassing, reaching or much shorter than the vertexal margin, gently or strongly incrassate apically. First funicular joint about as long as broad, broader than long or longer than broad. Funicular joints 2-10 generally broader than long, or about as broad as long, or slightly longer than broad. Last funicular joint slightly inflated or strongly globular, about as long as the sum of joints 2-7, 3-10, 6-10, 7-10, or 8-10, or as long as or longer than the remaining joints. Mandibles subtriangular. Basal margin of the mandibles straight or convex distally.

Mandibles always with a pointed apical tooth. Masticatory margin of the mandibles edentate or with 2-13 denticles of variable size. Palp formula (basal condyle included, when present) 1,3, 2,2, 3,2, 3,3, 4,3, 4,4, 5,3, or 5,4. Second maxillary palp joint hammer-shaped or not.

Mesosoma short to elongate. Dorsum of the mesosoma sloping posteriorly or variably convex dorsally. Promesonotal and propodeal sutures generally absent, rarely superficially impressed. Promesopleural and meso-metapleural sutures more impressed ventrally. Propodeum unarmed, simply angulate or denticulate or toothed, rarely with a pair of spines. Area between basal and declivous faces of the propodeum variably concave medially and with or without carina. Each side of the declivous face of the propodeum with a variably marked margin, carina or lamella. Propodeal lobes simply convex or truncate, with or without a pointed or rounded dorsal tooth. Propodeal spiracle round or tubuliform and at mid propodeal height in lateral view. Petiole variable in size, width and height. Petiolar node loaf-shaped, or scale-like, variable in width and thickness, rarely dorsally compressed or pointed. Ventral petiolar process small or large, truncate, triangular, subround or spiniform. Postpetiole (abdominal segment III) anteriorly as broad as or broader than petiole. Postpetiole in dorsal view antero-laterally with sides diverging, convex or angulate. Postpetiolar sternite antero-medially with a variably marked subtriangular margin bearing or not a longitudinal carina prolonged posteriorly. Constriction between postpetiole and gastral segment I present, more or less impressed. Gastral tergum I (abdominal tergum IV) of variable length, convex, continuously curved ventrally or at least with a posterior half clearly separated by a curve from the dorsal one. Sides of the gastral sternite I diversely projecting anteriorly. Remaining gastral tergites and sternites curved ventrally. Sting developed, curved downwards. Legs short or variably elongate. Tibiae of fore and hind legs with a large, pectinate spur. Mid tibiae with or without a pectinate spur variably developed. Spurs of fore legs with or without a basal spine. Mid basitarsi generally shorter or at most as long as the fore ones. Second tarsomere of all legs about as long as, slightly or much longer than the third and fourth tarsomeres. Pretarsal claws simple. Arolia reduced or well developed. Head, mesosoma, petiole, postpetiole and gastral tergum I variably reticulate and/or punctate-granulate; this sculpture superimposed or not by irregular rugosities or by foveae. Remaining gastral tergites variably smooth, reticulate-punctate, punctate, or punctate-foveolate. Legs variably smooth, with superficial or deep punctuation-granulation. Body covered by at least two types of hairs: (1) short and often dense, erect, suberect or subdecumbent on the whole body, rarely sparse and appressed, (2) very short, decumbent or appressed on the funicular joints only. A third hair type may be present or absent: (3) long erect or suberect on the whole body, sometimes subdecumbent, dense or sparse; in some cases this pilosity is restricted to the apex of the gaster only. Colour yellowish light brown, reddish-brown, dark brown or black. Legs concolorous with or lighter than the body.

Gyne. Similar to the worker but slightly differing from it in the usual caste-dependent characters. The most salient of these characters are the following: size generally larger; compound eyes larger and with apparently widespread ocular pilosity; ocelli always present; mesosoma robust; promesonotal and propodeal sutures impressed; metanotum sometimes spiniform. Basal face of the propodeum very short or slightly prolonged backwards.

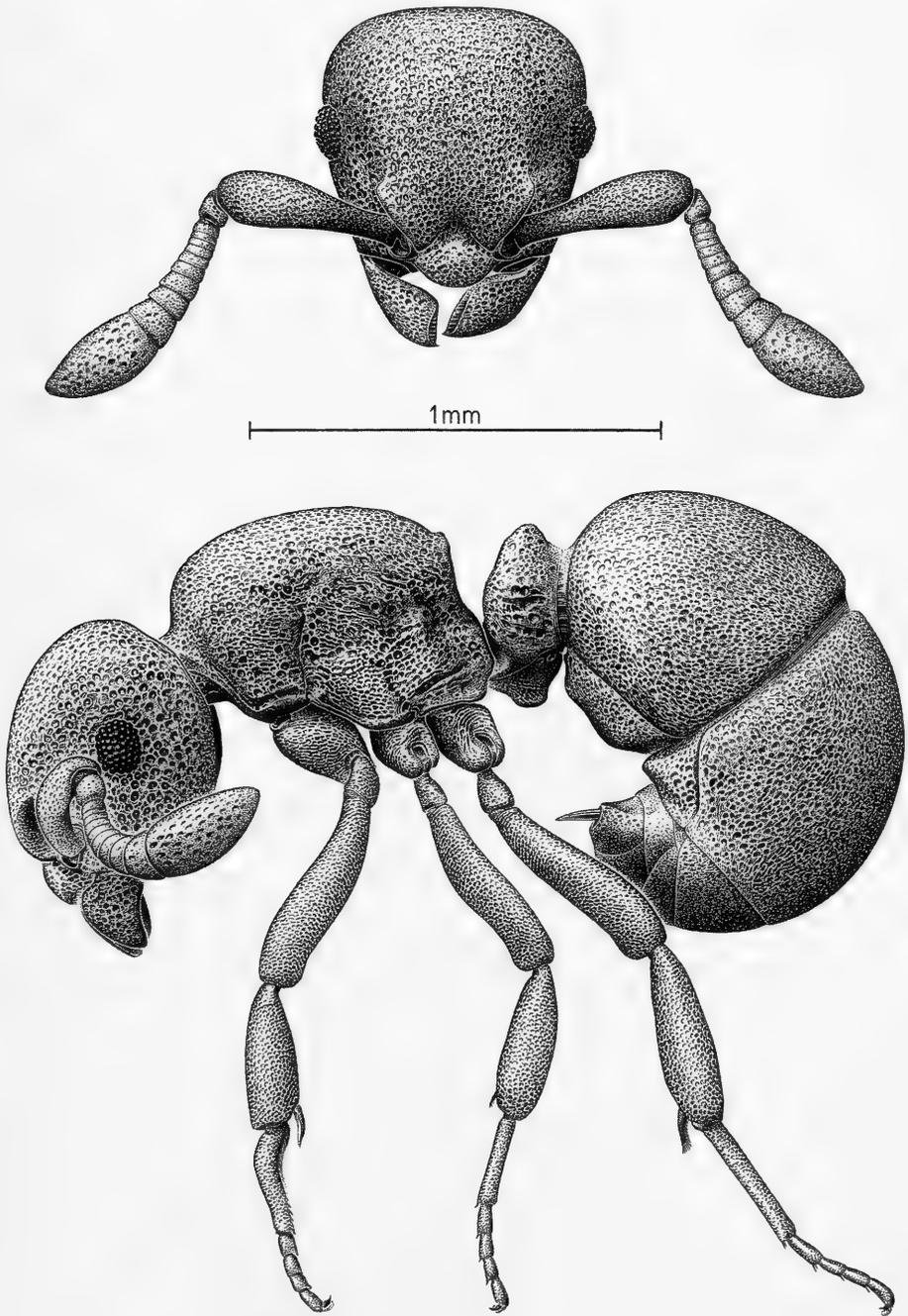


FIG. 10

Bradoponera meieri Mayr, worker, head in dorsal view (top) and entire profile (bottom).

Wings. Fore wings variably pigmented, in some species infusate, brown or whitish-yellow to hyaline. The wing venation appears to follow six distinct patterns as follows (*Bradoponera* wings are unknown):

1. *m-cu* marked and *Rsf3* not reaching *Rsf1*. *2r*, *Rsf4*, *Rsf5*, *r-m*, *Mf4* marked. *Rsf5* reaching the Costa.

2. *m-cu* marked, *Rsf3* and *Rsf4* missing. *2r*, *Rsf5*, *r-m* marked. *Rsf5* not reaching the Costa.

3. *m-cu* marked, *Rsf3*, *Rsf4*, *r-m* and *Mf4* missing. *2r*, *Rsf5* marked. *Rsf5* not reaching the Costa.

4. *m-cu*, *Rsf3* and *Rsf4* missing. *2r* very long, *Rsf5*, *r-m*, and *Mf4* of variable length. *Rsf5* not reaching the Costa.

5. *m-cu*, *Rsf3*, *Rsf4*, *r-m* and *Mf4* missing. *2r* very long, *Rsf5* of variable length. *Rsf5* not reaching the Costa.

6. *m-cu*, *Rsf3*, *Rsf4*, and *Mf4* missing. *2r* short, *Rsf5* and *r-m* absent to long. *Rsf5* approaching or reaching the Costa. According to the material available to us this type seems to be the characteristic *Discothyrea* wing.

Hind wings pigmented as the fore wings and showing three venation patterns (we were unable to examine *Discothyrea* hind wings):

1. *r-m* distinct and *R* reaching the anterior margin. *M* and *CuA* variably marked.

2. *r-m* distinct and *R* not reaching the anterior margin. *M* and *CuA* variably marked.

3. *r-m* missing. *M* and *CuA* variably marked.

Male. Size variable, generally smaller than or nearly as large as the gyne. Head about as broad as long, broader than long or longer than broad. Vertex variably convex. Clypeus antero-medially variably projecting; simply straight, slightly convex, subrectangular or subtriangular. Frontal carinae reduced, never hiding the antennal socket and generally separate, rarely close to each other. Sides of the frontal carinae subparallel, or slightly diverging posteriorly. Antennae 13-segmented. Ocelli large. Compound eyes very large and mostly on the anterior half of the head sides. Scapes variable in size, not reaching or surpassing the unpaired ocellus or slightly surpassing the vertexal margin. First funicular joint shorter than or as long as the second; distal joint as long as the sum of joints 10-11 or 9-11. Mandibles slender, edentate or minutely and irregularly denticulate, and with a visible apical, pointed tooth. Palp formula (basal condyle included) 3,2 4,3, 5,2 or 5,3. Second maxillary palp joint with or without hammer-shape. Mesosoma robust. Mesonotum and scutellum convex. Propodeum with or without differentiated basal and declivous faces. Sides between basal and declivous faces of the propodeum separate by similar projections as in the worker and gyne but sometimes more reduced. Metanotum spiniform or not. Propodeal lobes similar to those of the worker and gyne. Petiole variably convex, rarely scale-like, lower and narrower than in the female castes. Subpetiolar process and postpetiolar sternite with structures resembling those of the female but usually much more reduced. Postpetiole broader than the petiole. Gastral segments generally less curved than in the worker and gyne. Legs long and slender. Sculpture similar to the one of the worker and gyne but generally more superficial; few species with the sculpture on the first gastric tergite more impressed than in the worker and gyne. Pilosity resembling the one of the worker and gyne but slightly less dense.

Wings. Gynes and males have similar fore and hind wings. Male wings are usually smaller than those of the gynes but their venation follows the same patterns.

Colour generally darker than the worker and the gyne. Some species black with lighter legs.

Members of the tribe Proceratiini are often easy to distinguish from their general appearance. At least the combination of a short cephalic capsule coupled with exposed antennal insertions and the curved gaster should allow an easy separation of these ants from the remaining ponerines in most instances.

According to Wheeler & Wheeler (1976, 1985) the Proceratiini larvae are highly characteristic by being entirely hairless. This conclusion is based on examination of three *Proceratium* and two *Discothyrea* species.

In our cladistic framework, the following characters result synapomorphic for the tribe:

Claws unidentate.

Oblong plate extending along entire postincision of plate.

Unisegmented gonostyli.

Hairless larvae.

There are at least three additional characters shared by the Proceratiini genera and not by what results as their sister genus in our study, i. e. closed metacoxal cavities, loss of foretarsal setae and loss of the dorsal stridulitrum. These characters can not be interpreted as Proceratiini synapomorphies in our analytical framework since they are present also in *Acanthoponera* and *Heteroponera*.

We are aware that the previous synapomorphy list is likely to undergo modifications if the analysis would be extended to a broader array of ponerine genera.

The following genera are included in the tribe: *Proceratium*, *Discothyrea* and †*Bradoponera*.

***Proceratium* Roger**

Proceratium Roger, 1863: 171. Type species *Proceratium silaceum* Roger, 1863, by monotypy.

Proceratium Roger, Baroni Urbani & de Andrade, 2003: 40 ff. World revision.

Undoubted autapomorphy of the genus: worker, gyne and male with hammer-shaped maxillary palps.

***Discothyrea* Roger**

Discothyrea Roger, 1863: 171. Type species *Discothyrea testacea* Roger, 1863, by monotypy.

Undoubted autapomorphy of the genus: worker and gyne antennal insertion fused with the clypeus. This character is actually present in one *Proceratium* species as well: *P. microsculptum* de Andrade. Our phylogenetic analysis (Baroni Urbani & de Andrade, 2003) shows that its appearance in this species is homoplastic. *P. microsculptum*, however, has the characteristic hammer-shaped maxillary palps missing in *Discothyrea*.

†*Bradoponera* Mayr

Bradoponera Mayr, 1868: 73. Type species: *Bradoponera meieri* Mayr, 1868, by monotypy.

Undoubted autapomorphy of the genus: worker and gyne frontal carinae thick (not lamelliform) in profile.

Table 3 summarizes the main characters distinguishing *Proceratium*, *Discothyrea* and *Bradoponera*.

For the genus *Bradoponera* we propose the following detailed diagnosis and description:

†**BRADOPONERA** Mayr

Worker. Monomorphic and little variable in size. Head subglobose, slightly longer than broad, with sides convex or diverging posteriorly. Clypeus medially armed with a slightly developed anterior projection, convex in shape. Frontal carinae separate from each other with narrow, thick lateral expansions diverging backwards. Lateral expansions of the frontal carinae only partially covering the antennal insertions. Genal carina absent or superficially marked posteriorly only and delimiting a shallow sulcus. Gular area not impressed. Eyes small, flat and represented by few inconspicuous ommatidia with ocular pilosity, or large, convex and composed by an agglomeration of salient ommatidia, generally with ocular pilosity and approximately over the mid line of the head. Antennal insertions at the same level of the anterior margin of the head. Antennae 9 or 12-jointed. Scapes shorter than the vertexal margin, gently incrassate apically. First funicular joint about as long as broad or slightly longer than broad. Second funicular joint broader than long or about as long as broad. Joints 3-7 or 3-10 broader than longer. Last funicular joint about as long as the sum of joints 3-10 or slightly shorter than the sum of joints 2-7.

Mandibles subtriangular. Basal margin of the mandibles gently convex distally, with a pointed apical tooth. Masticatory margin edentate. Palp formula 5,4. Second maxillary palp joint apparently not hammer-shaped.

Mesosoma short and robust, its dorsum gently convex. Promesonotal suture superficially impressed (see e. g. fig. 3). Propodeal suture superficially impressed or not. Promesopleural and meso-metapleural sutures more impressed ventrally. Propodeum unarmed, or with a pair of small subround teeth. Area between the basal and declivous faces of the propodeum weakly concave medially. Sides of the declivous face of the propodeum with a variably marked margin. Propodeal lobes gently convex. Propodeal spiracle round and placed at mid height in profile. Petiole in side view with cuneiform apex, or scale-like. Ventral petiolar process subround. Postpetiole (abdominal segment III) anteriorly broader than the petiole. Postpetiole in dorsal view antero-laterally with variably convex sides. Postpetiolar sternite antero-medially with a marked subtriangular margin. Constriction between postpetiole and gastral segment I impressed. Gastral tergum I convex, continuously curved dorsoventrally. Sides of the gastral sternite I projecting or not anteriorly. Remaining gastral tergites and sternites curved ventrally. Sting developed. Legs little elongate with slightly incrassate tibiae. Tibiae of fore and hind legs with a large, pectinate spur. Mid tibiae with a small pectinate spur. Spurs of fore legs without basal spine. Mid basitarsi shorter than the fore ones. Second tarsomere of the three pairs of legs about as long as or slightly longer than each third and fourth tarsomeres. Pretarsal claws simple. Arolia strongly developed.

Head, mesosoma, petiole and postpetiole punctate-granulate or variably punctate-foveolate. Gastral tergum I superficially punctate and with traces of small foveae or superficially granulate. Legs punctate.

Body covered by short, appressed hairs with or without additional, short, sparse, suberect and subdecumbent hairs.

Colour apparently dark brown.

Gyne. Similar to the worker and differing from it only by the presence of ocelli and by the stouter mesosoma with wing sclerites.

Wings unknown.

Male unknown.

SPECIES DESCRIPTIONS

Bradoponera wunderlich Baroni Urbani & de Andrade sp. n.

Figs 1, 8

Type material: holotype, unique, dealate gyne in Baltic amber, labelled: BB-1, in the MRSN.

Derivatio nominis: this species is named after Dr J. Wunderlich who sent us several important Baltic amber samples to study.

Diagnosis. A *Bradoponera* species, known from the gyne only, similar to *meieri* but differing from it, by the antennae 9 segmented instead of 12 segmented, by the integumental sculpture more superficial and by its smaller size (TL = 2.53 mm instead of TL = 3.25 mm).

Gyne. Head slightly longer than broad with the sides diverging posteriorly. Vertex convex. Frontal carinae stout, partially covering the antennal insertions. Lateral expansions of the frontal carinae narrow, very thick, diverging anteriorly and gently convex posteriorly. Frontal carinae dorso-medially with a superficial sulcus starting from a small, subround anterior denticle and reaching the median ocellus posteriorly. Clypeus strongly convex, protruding anteriorly, slightly narrower than the frontal carinae anteriorly and clearly separated from them by a superficial suture. Antennal sockets about as long as the antero-lateral clypeal margin. Scapes stout, surpassing the posterior border of the eyes. First and second funicular joints subequal in size, about as long as broad. Joints 3-7 broader than long. Last funicular joint slightly shorter than the sum of joints 2-7. Eyes slightly longer than 1/5 of the head length (mandibles excluded). Interocellar pilosity, if present, indistinguishable in the sole specimen available. Mandibles triangular, edentate and dorsally convex.

Mesosoma robust, about as long as the head (mandibles included). Mesonotum and scutellum gently convex. Propodeum with distinct basal and declivous faces. Basal face short, weakly depressed medially. Sides between the basal and declivous faces with a stout angle. Declivous face flat. Propodeal lobes subround.

Petiole twice broader than long, with the apex of the node angled in profile. Anterior face truncate to gently declivous anteriorly in side view. Petiolar sides subparallel. Ventral process of the petiole subround and developed. Postpetiole about as long as the first gastric tergite. Anterior face of the postpetiole gently concave and about as high as the apex of the petiolar node. First gastral tergite gently curved ventrally. First gastral sternite triangular in lateral view and very narrow medially. Remaining gastral tergites and sternites curved ventrally.

TABLE 1: Distribution of characters of presumed phylogenetic value among a sample of ponerine genera. Further explanations in the text.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
<i>Proceratium</i>	0	01	0	0	0	1	0	1	1	1	1	0	12	01	0	0	1	1	1	1	0	0	1	1	1	1	0	1	1
<i>Discothyrea</i>	0	1	0	1	1	0	0	1	1	1	1	0	12	1	0	0	1	1	0	1	0	0	1	1	1	0	3	1	1
<i>Bradoponera</i>	0	0	1	1	1	0	?	1	?	1	1	0	1	1	0	0	1	1	?	1	?	0	?	?	?	?	?	?	?
<i>Gnamptogenys</i>	01	0	0	0	01	0	1	1	0	01	01	1	1	0	01	1	1	1	0	1	01	0	0	0	0	0	1	1	0
<i>Ectatomma</i>	01	0	0	0	01	0	1	1	0	0	0	1	0	1	1	1	1	1	0	1	1	0	0	0	0	0	1	2	0
<i>Paraponera</i>	0	0	0	0	0	0	0	1	0	1	0	0	1	1	0	1	1	1	0	1	1	0	1	0	0	0	0	0	0
<i>Heteroponera</i>	01	0	0	0	0	0	01	0	1	0	1	1	1	0	01	1	0	0	0	0	0	1	?	?	?	?	?	?	1
<i>Acanthoponera</i>	1	0	0	0	0	0	0	0	1	0	1	0	1	0	1	1	0	0	0	0	0	1	?	0	0	1	?	?	1

TABLE 2: Patristic distances among the genera considered in the present paper in the unique most parsimonious unrooted tree.

Below diagonal: adjusted character distances. Above diagonal: patristic distances.	<i>Proceratium</i>	<i>Discothyrea</i>	<i>Bradoponera</i>	<i>Gnamptogenys</i>	<i>Ectatomma</i>	<i>Paraponera</i>	<i>Heteroponera</i>	<i>Acanthoponera</i>
<i>Proceratium</i>		5	5	17	17	10	24	23
<i>Discothyrea</i>	4		2	18	18	11	25	24
<i>Bradoponera</i>	4	2		18	18	11	25	24
<i>Gnamptogenys</i>	11	12	5		2	9	11	10
<i>Ectatomma</i>	15	16	7	2		9	11	10
<i>Paraponera</i>	10	11	5	7	6		16	15
<i>Heteroponera</i>	11	13	12	6	10	13		1
<i>Acanthoponera</i>	15	17	13	8	10	14	1	

TABLE 3: Synopsis of some significant characters distinguishing the three Proceratiini genera: *Proceratium*, *Discothyrea* and *Bradoponera*.

	<i>Proceratium</i>	<i>Discothyrea</i>	<i>Bradoponera</i>
Clypeus anteriorly	protruding or not	protruding	protruding
Antennal insertions on a clypeal prominence	on or out	on	out
Number of antennal joints	12	6 to 12	9 or 12
Last funicular joint	at most as long as joint 6 up to penultimate	at least as long as joint 2 up to penultimate	about as long as joint 2 up to penultimate
Mandibles	dentate	edentate	edentate
Palp formula	2,2; 3,2; 3,3; 4,3	1,3; 4,3; 4,4; 5,3	5,4
Second maxillary palp	Hammer-shaped	at most slightly curved	apparently curved only
Petiolar peduncle	present or absent	absent	absent
Fore tibiae basal seta	present or absent	absent	absent
Empodia	developed or not	developed	developed

Femora slightly elongate. Tibiae inflated. Each tibia with a pectinate spur; spurs of mid legs small. Hind tibiae about 1/6 shorter than the hind femora. Hind basitarsi slightly shorter than the hind tibiae. Arolia strongly developed.

Sculpture. Head, mesosoma and petiole densely and minutely punctate-foveolate, the foveae slightly deeper and larger on the head sides, variably clumped on the mesosoma and missing on the declivous face of the propodeum. Postpetiole super-

ficially punctate-foveolate, the foveae very small and denser antero-laterally. First gastral tergite minutely and superficially punctate and with traces of foveae on the sides only. Legs punctate.

Pilosity. Body covered by minute, appressed hairs.

Colour. Dark brown-black.

Measurements in mm and Indices: TL 2.53; HL 0.67; HW 0.61; EL 0.14; SL 0.41; WL 0.73; PeL 0.16; PeW 0.32; HFeL 0.39; HTiL 0.33; HBaL 0.31; LS4 0.16; LT4 0.47; CI 91.0; SI 61.2; IGR 0.34.

Bradoponera electrina Baroni Urbani sp. n.

Figs 2, 9

Type material: holotype, unique, worker in Baltic amber, labelled: BB-6, in the MRSN.

Derivatio nominis: From the Latin *electrinus* (= made of amber).

Diagnosis. A *Bradoponera* species the worker of which differs from the worker of *meieri* and from the gyne of *wunderlichii* by its larger size (TL = 3.49 mm instead of TL \leq 2.85 mm), by the petiole almost four times broader than long instead of only twice broader than long and by the body with suberect hairs (missing in *meieri* and *wunderlichii*).

Worker. Head stout, slightly longer than broad, with convex sides. Vertex weakly convex. Frontal carinae narrower and less raised than in *meieri* and *wunderlichii*, leaving completely exposed the antennal insertions. Sides of the frontal carinae diverging posteriorly. Frontal carinae dorso-medially with a longitudinal ruga prolonging posteriorly. Clypeus less developed than in *meieri* and *wunderlichii*, convex, protruding anteriorly, about as broad as the frontal carinae anteriorly and clearly separated from them by an impressed suture. Antennal sockets about as long as the antero-lateral clypeal margin. Scapes less stout than in *meieri* and *wunderlichii*, surpassing the posterior border of the eyes. First funicular joint about 1/4 longer than broad. Joints 2-10 broader than long. Last funicular joint slightly shorter than the sum of joints 2-10. Eyes small, composed by a flat agglomeration of inconspicuous ommatidia with inter-ocellar pilosity. Mandibles triangular, edentate and dorsally convex.

Mesosoma stout, 1/5 shorter than head length (mandibles included). Mesosoma in profile weakly convex. Pronotal suture superficially impressed. Propodeum with separate basal and declivous faces. Basal face not distinctly differentiated from the mesonotum and slightly sloping posteriorly, close to the declivous face. Basal and declivous propodeal faces separated dorsally and laterally by a superficial margin only. Declivous face of the propodeum flat. Propodeal lobes reduced and subround.

Petiole almost four times broader than long. Petiole in profile scale-like, weakly narrowing apically and with gently convex apex. Anterior and posterior faces of the petiole in side view truncate. Ventral process of the petiole subround and developed. Postpetiole slightly longer than the first gastric tergite. Anterior face of the postpetiole straight and about as high as the apex of the petiolar node. First gastral tergite gently curved ventrally, less triangular than in *meieri* and *wunderlichii* in profile, and narrow medially. Remaining gastral tergites and sternites curved ventrally.

Femora slightly elongate. Mid and hind tibiae less inflated than in *meieri* and *wunderlichii*. Fore tibiae moderately inflated. Each tibiae with a pectinate spur; spurs of fore legs small. Hind tibiae about 1/10 shorter than the hind femora. Hind basitarsi about 1/3 shorter than the hind tibiae. Arolia well developed.

Sculpture. Head, mesosoma and petiole densely punctate-granulate. Postpetiole and gaster superficially granulate and with minute piligerous punctures. Legs punctate.

Pilosity. Body covered by dense, short, appressed hairs and by sparser suberect and subdecumbent hairs longer than the appressed ones, slightly shorter and sparser on the funicular joints.

Colour. Dark brown-black.

Measurements in mm and Indices: TL 3.49; HL 0.91; HW 0.86; EL 0.07; SL 0.51; WL 0.86; PeL 0.15; PeW 0.55; HFel 0.49; HTiL 0.45; HBaL 0.31; LS4 0.26; LT4 0.68; CI 94.5; SI 56.0; IGR 0.38.

***Bradoponera meieri* Mayr**

Figs 3-5, 10

Material examined: BALTIC AMBER: 3 workers, BB-4, BB-7, BB-8 [all JWCS].

Diagnosis. A *Bradoponera* species the gyne of which is similar to the one of *wunderlichii*, but differs from it by the antennae 12 instead of 9 segmented, by the sculpture more impressed, and by the larger size (TL = 3.25 mm instead of 2.53 mm).

Worker. Vertex gently convex. Frontal carinae stout, reaching the internal border of the antennal insertions. Lateral expansions of the frontal carinae narrow, very thick, anteriorly diverging and posteriorly gently convex. Frontal carinae dorso-medially with a superficial sulcus originating from a small, subtriangular anterior denticle and prolonging posteriorly.

Clypeus strongly convex, protruding anteriorly, about as broad as the frontal carinae anteriorly and clearly separated from them by an impressed suture. Antennal sockets about as long as the antero-lateral clypeal margin. Scapes stout, surpassing the posterior border of the eyes. First funicular joint about as long as broad. Joints 2-10 broader than long. Last funicular joint as long as the sum of joints 3-10. Eyes about 1/5 of the head length (mandibles excluded) with minute interocellar pilosity. Mandibles triangular, edentate and dorsally convex.

Mesosoma robust, about as long as the head (mandibles included), dorsally convex in profile. Pronotal and propodeal sutures superficially impressed. Propodeum with distinct basal and declivous faces. Basal face very short and gently sloping posteriorly. Basal and declivous faces separated by a superficial margin dorsally and by a marked angle resembling a small, subround tooth laterally. Declivous face of the propodeum flat. Propodeal lobes subround.

Petiole twice broader than long. Petiole in side view with the apex of the node angle-shaped. Anterior face of the petiole in profile truncate to gently declivous. Petiolar sides subparallel. Ventral process of the petiole subround and developed. Postpetiole subequal in length to the first gastric tergite. Anterior face of the postpetiole about as high as the apex of the petiole. First gastral tergite gently curved ventrally. First gastral sternite triangular in lateral view and very narrow medially. Remaining gastral tergites and sternites curved ventrally.

Femora moderately elongate. Tibiae inflated. Each tibia with a pectinate spur; spurs of mid legs small. Hind tibiae slightly shorter than or about as long as the hind femora. Hind basitarsi about 1/5 shorter than the hind tibiae. Arolia well developed.

Sculpture. Head, mesosoma and petiole densely and minutely punctate-foveolate and minutely rugulose, the foveae slightly deeper and larger on the head sides,

sparser on the pleurae and on the petiole, missing on the declivous face of the propodeum, and the rugosities rare on the petiole. Postpetiole punctate-foveolate, the foveae smaller and denser antero-laterally. First gastral tergite superficially punctate and with very sparse foveae, more superficial than those on the postpetiole. Legs punctate.

Pilosity. Body covered by minute, appressed hairs.

Colour. Dark brown-black.

Measurements in mm and Indices: TL 2.70-2.85; HL 0.68-0.70; HW 0.60-0.63; EL 0.14; SL 0.45; WL 0.76-0.78; PeL 0.17-0.19; PeW 0.34-0.38; HFeL 0.44-0.45; HTiL 0.42-0.44; HBaL 0.33-0.35; LS4 0.19-0.20; LT4 0.52-0.56; CI 88.2-90.0; SI 64.3; IGR 0.34-0.38.

CONCLUDING REMARKS

Since the original description of Mayr (1868) the genus *Bradoponera* was never fully justified to belong to the Proceratiini. The main reason for such ambiguity is the fact that *Bradoponera* was known from a single fossil species from Baltic amber and the sole specimens representing it were deposited in the Koenigsberg amber collection, a collection partly lost or destroyed during Second World War. Placement within the Proceratiini, however, appears likely and is fully confirmed by the rediscovery of the genus reported in this paper. The Proceratiini, hence, result as a rather homogeneous tribe of Ponerinae containing three genera, *Proceratium*, *Discothyrea* and *Bradoponera*, all represented in the fossil record (de Andrade, 1998, Baroni Urbani & de Andrade, 2003, and present contribution). The first two genera have a broad tropical and subtropical distribution with deep penetrations into the temperate zones today, while the third one appears to be extinct, although the three species described from Baltic amber in this paper demonstrate a previously unsuspected species diversity in Europe during Palaeogene.

We show for the first time that each Proceratiini genus is characterized by a clear, significant autapomorphy. The sole known exception (the fusion of the clypeus with the antennal insertions characteristic of *Discothyrea* and appearing occasionally also in *Proceratium microsculptum*) is interpreted as due to homoplasy. This interpretation is confirmed by the internal phylogeny of the genus *Proceratium* proposed by Baroni Urbani & de Andrade (2003) where *P. microsculptum* occupies a rather terminal position.

The Proceratiini as a whole appear as a fairly homogeneous tribe whose members are easy to recognize by a combination of characters ranging from their bauplan to the clypeal and antennal morphology.

We suggest a set of four synapomorphies for the tribe after a cladistic analysis of their genera comprising five plausible, potential outgroups. We are aware, however, that a broader analysis considering the whole subfamily Ponerinae or the discovery of new characters might modify at least partially our results.

ACKNOWLEDGEMENTS

Our gratitude goes to Dr Jörg Wunderlich for sending us to study several interesting amber samples without exercising any pressure to have them returned quickly. Dr Pier Mauro Giachino accepted to acquire for the Museo Regionale di Scienze Naturali of Turin the types of the new species described in this paper in order to allow

their deposition in a public institution. Armin Coray executed the drawings with his customary competence. An anonymous referee provided a very careful, circumstantial analysis of a first draft of this paper. Its present shape benefits considerably from these criticisms.

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