LES

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

tome 104
fascicule 3
1997

REVUE SUISSE DE ZOOLOGIE

GENÈVE SEPTEMBRE 1997 ISSN 0035 - 418 X

REVUE SUISSE DE ZOOLOGIE

TOME 104 — FASCICULE 3

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

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ANNALES

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SOCIÉTÉ SUISSE DE ZOOLOGIE
et du
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de la Ville de Genève

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REVUE SUISSE DE ZOOLOGIE 104 (3): 473; septembre 1997

Invalid name of a *Deuterosminthurus* species

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I recently described *Deuterosminthurus maculatus* Nayrolles, 1996 which appears to be a primary homonym of *Deuterosminthurus obscurus* var. *maculatus* Womersley, 1939.

Dr. Bellinger kindly informed me of the homonymy. Thus, I propose the new name dedicated to my American colleague: *Deuterosminthurus bellingeri* **nom. n.** in replacement of *Deuterosminthurus maculatus* Nayrolles, 1996.

Concerning the status of *Deuterosminthurus obscurus* var. *maculatus* Womersley, 1939, this variety is not a *Deuterosminthurus* but a species of the genus *Aneuempodialis*, a very distinct genus from *Deuterosminthurus* (*Aneuempodialis* is Australian, *Deuterosminthurus* holartic). According to GREENSLADE (1977), *Deuterosminthurus obscurus* Womersley, 1932 which was included in *Aneuempodialis* by STACH (1955), is a species of the genus *Rastriopes*.

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Manuscript accepted 10.04.1997

REVUE SUISSE DE ZOOLOGIE 104 (3): 475-483; septembre 1997

Abundance and phenology of Pseudoscorpiones (Arachnida) from a mixedwater inundation forest in Central Amazonia, Brazil

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13.418 Piracicaba/SP, Brazil.

Abundance and phenology of Pseudoscorpiones (Arachnida) from a mixedwater inundation forest in Central Amazonia, Brazil. - A total of 675 Pseudoscorpiones, representing nine species, were captured during 12 months in an inundation forest near Manaus, which is covered by several meters of mixedwater for 5-7 months each year. In the terrestrial phase, the average abundance of pseudoscorpions in the soil (0-14 depth) was three times higher during the rainy season (140 ind./m^2/month) when compared to the season with less rainfall (48 ind./m^2/month). A survival strategy in response to flooding was observed in the terricolous and univoltine *Tyrannochthonius amazonicus* (Chthoniidae): immature tritonymphs, representing a migrating stage, moved from the soil to the trunk/canopy region where they passed the aquatic phase. *Pseudochthonius homodentatus* (Chthoniidae) changed from a terricolous mode of life in Central Amazonian upland forests to an arboricolous living in the inundation forest. Six other species, obtained in low numbers predominantly in the trunk/canopy region, are considered arboricolous as well. Our data reconfirm that seasonally inundated forests of the mixedwater type near Manaus represent an ecotone: *Pachychernes baileyi* (Chernetidae), *Tyrannochthonius amazonicus* (Chthoniidae), *Geogarypus amazonicus* (Geogarypidae), *Pachyolpium irmgardae* (Olpiidae) and *Dolichowithius minutus* (Withiidae) inhabit blackwater inundation forests in the valley of the Negro River. *Parachernes adisi* (Chernetidae) was collected from whitewater inundation forests along the lower Solimões River. *Paratemnoides minor* (Atemnidae) occurs in black- and whitewater inundation forests. *Pseudochthonius homodentatus* (Chthoniidae) lives in primary and secondary (non-flooded) upland forests of Central Amazonia. The occasionally phoretic *Lechytia chthoniiformis* (Chthoniidae) is found throughout South America.

Manuscript accepted 01.02.1997.

Key-words: abundance - phenology - adaptation - vertical distribution - Pseudoscorpiones - Amazon - Neotropics.

INTRODUCTION

Forests in the Central Amazon region are divided into non-flooded upland forests and inundation forests (Braga 1979). The period of flooding (= aquatic phase) in seasonal inundation forests (Prance 1979) varies from 5 to 7 months a year and is caused by a monomodal flood pulse (Junk *et al.* 1989). Terrestrial invertebrates that inhabit these forests stay in the area and make use of various survival strategies or, when possible, migrate to adjacent upland (= terra firme) forests before the beginning aquatic phase (Adis 1997). In this study we present the reaction of Pseudoscorpiones to flooding as well as the abundance and phenology of the species found in a seasonal mixedwater inundation forest near the city of Manaus in the northern region of Brazil.

STUDY AREA, MATERIAL AND METHODS

The experimental area was at Lago Janauarí (03°20'S, 60°17'W), located on a strip of land between the Negro and Solimões Rivers, about 10 km distant from Manaus. The region was influenced by blackwater of the Negro River during low water-level and by whitewater of the Solimões River during the high water period. Terrestrial arthropods were collected from July 1987 to June 1988. The study area was inundated until the end of July 1987 and from June 1988 onwards (terrestrial phase: August 1987 - May 1988). The Pseudoscorpiones were monitored in the soil and at the soil surface (terrestrial phase) as well as on the lower part of tree trunks (terrestrial and aquatic phases):

During the terrestrial phase, six soil samples were taken monthly, along a transect. Their combined area represented $0.21 m^2$. Each sample, 14 cm in depth, was subdivided into four subsamples of 3.5 cm each. Pseudoscorpiones were extracted from subsamples following a modified method of Kempson (Adis 1987). Four ground photo-eclectors (= emergence traps) and seven pitfall traps (= Barber traps) were placed on the forest floor to collect pseudoscorpions from the soil surface. The vertical migration of Pseudoscorpiones on tree trunks was detected by weekly samples with arboreal photo-eclectors (= trunk traps) directed upwards and downwards on one tree trunk each. Further information on sampling techniques and the study site are given in Adis (1981), Adis *et al.* (1996) and Funke (1977).

In addition, the presence of Pseudoscorpiones was checked in soil samples which were taken under water at the end of the aquatic phase (late August 1988) as described above and subsequently extracted by means of a flotation method via sugar water (for methodology see Adis *et al.* 1989). The presence of Pseudoscorpiones in tree crowns was tested by fogging canopies with natural pyrethrum during the aquatic phase (early August 1979; cf. Erwin 1983).

Collection data were statistically evaluated by means of linear correlation (Cavalli-Sforza 1972) with local abiotic factors (temperature, pH and humidity of the soil, as well as temperature and relative humidity of the air and precipitation).

Seasonal inundation forests in Central Amazonia are subject to a rainy season (December-May: average precipitation 1550 mm), and a "dry" season (June-November: average precipitation 550 mm, but each month has some rain events; cf. RIBEIRO & ADIS 1984).

The taxonomic work for this paper was done by V. Mahnert (cf. MAHNERT 1979; MAHNERT & ADIS 1985), the collection and evaluation of field data by J. Adis, J.W. de Morais and E. Berti-Filho. Pseudoscorpiones sampled were classified as protonymphs, deutonymphs, tritonymphs, adult males and females.

RESULTS AND DISCUSSION

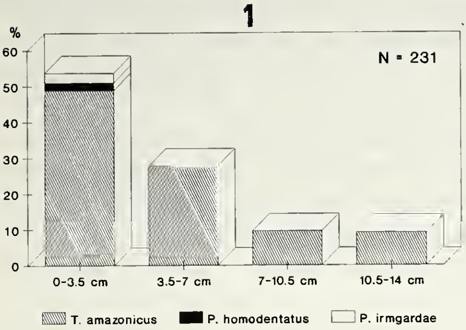
A total of 675 Pseudoscorpiones, representing nine species, were sampled from the experimental area. Out of these, 34.2% were obtained in the soil, 28.5% from the soil surface (26.4% in emergence traps, 2.1% in pitfall traps) and 37.3% from trees (14.4% in upwards directed, 21.3% in downwards directed trunk traps and 1.6% in the canopy).

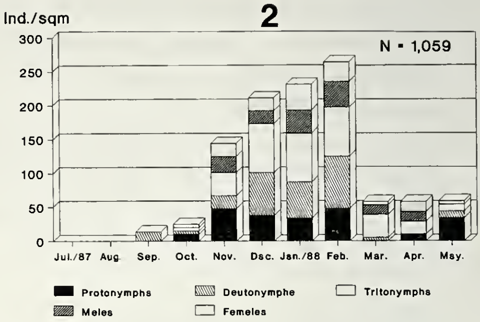
Only 1.4% of the total Arthropoda extracted from the soil (Acari and Collembola omitted; cf. MORAIS 1995) were Pseudoscorpiones (n=231). Of these, 95.2% were represented by *Tyrannochthonius amazonicus* (Chtoniidae), 2.6% by *Pachyolpium irmgardae* (Olpiidae) and 2.2% by *Pseudochthonius homodentatus* (Chthoniidae). These species were most frequent within the first 3.5 cm of soil depth (Fig. 1). Their greatest abundance occurred in February 1988 (rainy season), with 24.2% of the total catch being extracted from the soil (270 ind./m^2; Fig. 2). Averages of 48 ± 68 ind./m^2/month were collected in the dry season and 140 ± 113 ind./ m^2/month in the rainy season. Of the total Pseudoscorpiones extracted from the soil, 20% (22 ± 20 ind./m^2/month on average) were represented by protonymphs, 22% (25 ± 28 ind./m^2/ month on average) by deutonymphs, 30% (33 ± 30 ind./m^2/month on average) by tritonymphs, 15% (16 ± 15 ind./m^2/month on average) by males and 13% (14 ± 13 ind./m^2/month on average) by females. No Pseudoscorpiones were found in soil materials taken underwater during the aquatic phase. Five specimens were obtained by fogging the canopy during the aquatic phase.

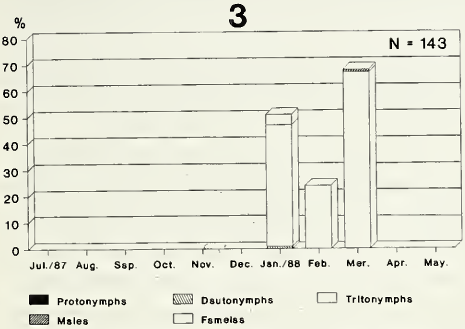
The highest abundance of pseudoscorpions recorded in the soil of the mixed-water forest (265 ind./m^2 in February 1988) was lower than that found in a forest flooded by blackwater in the valley of the Negro River (655 ind./m^2 in January 1981; ADIS & MAHNERT 1985).

Tyrannochthonius amazonicus (Chthoniidae)

This was the most abundant species in the experimental area (cf. Fig. 1). Its highest "activity density" (SCHAEFER 1992) was observed during the rainy season of the terrestrial phase. Reproduction started at the end of the dry season and lasted throughout the rainy season (Fig. 2). The first protonymphs were collected in October 1987 by soil extration. During the following months, deutonymphs and tritonymphs







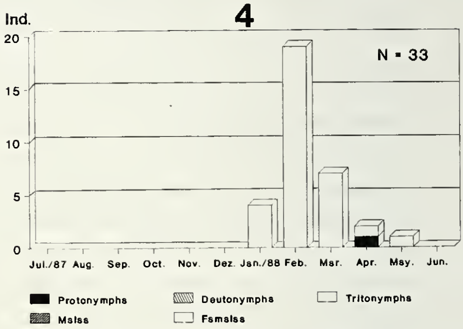


FIG. 1. Vertical distribution of pseudoscorpion species in the soil. Monthly samples taken every 3.5 cm to a depth of 14 cm between August, 1987 and May, 1988 (terrestrial phase) in a seasonal mixedwater inundation forest of Central Amazonia. Total catch (N) = 100%.

FIG. 2. *Tyrannochthonius amazonicus* (Chthoniidae): Temporal occurrence and abundance of developmental stages (ind./m^2) in the soil. Monthly samples (0-14 cm soil depth) taken between August, 1987 and May, 1988 (terrestrial phase) in a seasonal mixedwater inundation forest of Central Amazonia.

FIG. 3. *Tyrannochthonius amazonicus* (Chthoniidae): Temporal occurrence of developmental stages captured in ground photo-eclectors between August, 1987 and May, 1988 (terrestrial phase) in a seasonal mixedwater inundation forest of Central Amazonia. Total catch (N) = 100%.

FIG. 4. *Tyrannochthonius amazonicus* (Chthoniidae): Temporal occurrence of developmental stages captured in one arboreal photo-eclector for trunk ascents between July, 1987 and June, 1988 in a seasonal mixedwater inundation forest of Central Amazonia.

increased in number (Fig. 2). Males and females were occasionally captured on the forest floor with pitfall traps. Our extraction data also suggested that the lifetime of the adults was restricted to the terrestrial phase (Fig. 2). Tritonymphs came to the soil surface (Fig. 3), moved to the trunk/canopy region (Fig. 4) where they passed flooding, and returned to the forest floor at the end of the aquatic phase (Fig. 5). Upward migration occurred mainly in February/March 1987 (Fig. 4), during the rainy season. The number of tritonymphs captured during trunk ascents was higher than that obtained during trunk descents (Figs 4, 5). ADIS (1981) suggested, that many tritonymphs suffer predation during their forced stay in the trunk/canopy region. In addition, some tritonymphs have moulted during their downward migrations because the first adults were captured on tree trunks at the end of the aquatic phase (Fig. 5). They were smaller in size when compared to adults from the forest floor. The low number of proto- and deutonymphs on the forest floor and in the trunk/canopy region confirm data by ADIS & MAHNERT (1985) which indicated that these instars live mostly in the soil.

With respect to the vertical distribution in the soil, tritonymphs were most abundant in the upper soil layer (Fig. 6), whereas protonymphs were more abundant in the mineral subsoil below the organic layer (3.5-7 cm soil depth). One possible explanation to this fact is, that they are less active and thus more susceptible to predation, which is more intense near the soil surface (cf. MORAIS 1995; ADIS 1997). Results from the correlations between the vertical distribution of *T. amazonicus* and the local abiotic parameters showed that the population density decreased from the upper to the lower soil layers with increasing soil humidity ($p<0.01$, $r=-0.9905$; $n=4$ in March and $p<0,001$, $r=-0.9999$; $n=4$ in April 1988), with decreasing soil temperature ($p<0.01$, $r=+0.9980$, $n=4$ in February and $p<0.05$, $r=+0.9802$, $n=4$ in March 1988), and with decreasing pH of the soil ($p<0.01$; $r=+0.9901$ $n=4$ in March and $p<0.05$, $r=+0.9897$, $n=4$ in April 1988). Changes in abiotic parameters on the experimental area occurred with the beginning rainy season (cf. data in MORAIS 1995).

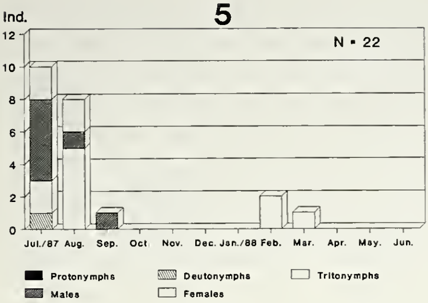
The results of *T. amazonicus* from the mixedwater inundation forest coincide with those obtained by ADIS & MAHNERT (1985) from a blackwater inundation forest in the valley of the Negro River. The nocturnal tritonymphs represent migratory stages which pass inundation of 5-7 months duration mostly under loose bark in the trunk/canopy region and return to the forest floor at the end of the aquatic phase. However, upward migration of trionymphs in the blackwater inundation forest was recorded mostly 2-3 weeks before the beginning aquatic phase (in March) whereas in the mixedwater inundation forest tritonymphs ascended tree trunks 14 weeks before the forest floor was flooded (in February; Fig. 4).

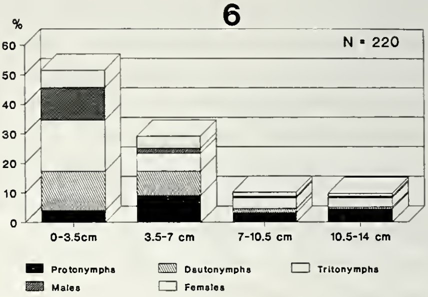
According to the ecological classification of terrestrial invertebrates from Central Amazonian inundation forests (cf. ADIS 1997), *T. amazonicus* represents a terricolous migrating species. It is considered endemic to black- and mixedwater inundation forests as it is neither found in non-flooded upland forests of Central Amazonia nor in whitewater inundation forests along the lower Solimões River (cf. ADIS 1981, MAHNERT & ADIS 1985).

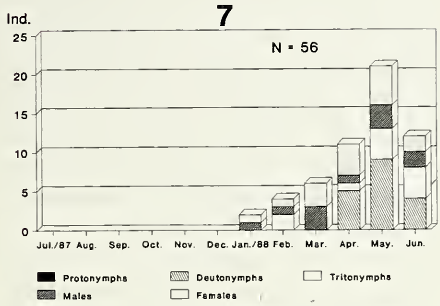
Pseudochthonius homodentatus (Chthoniidae)

In the soil, this species represented only 2.2% (0.5 ± 1.1 ind.m^2/month on average) of the total pseudoscorpions. Animals were exclusively obtained from the organic layer (0-3.5 cm), 80% represented adults and 20% tritonymphs.

On the soil surface, *P. homodentatus* was only captured during the rainy season of the terrestrial phase (12/87-3/88). Abundance in emergence traps was 11 ± 21 ind./m^2/month on average, 68% of all specimens were adults and 32% deuto- and tritonymphs.







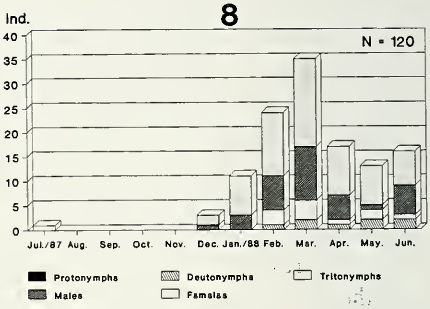


FIG. 5. *Tyrannochthonius amazonicus* (Chthoniidae): Temporal occurrence of developmental stages captured in one arboreal photo-eclector for trunk descents between July, 1987 and June, 1988 in a seasonal mixedwater inundation forest of Central Amazonia.

FIG. 6. *Tyrannochthonius amazonicus* (Chthoniidae): Vertical distribution of developmental stages in the soil. Monthly samples taken every 3.5 cm to a depth of 14 cm between August, 1987 and May, 1988 (terrestrial phase) in a seasonal mixedwater inundation forest of Central Amazonia. Total catch (N) = 100%.

FIG. 7. *Pseudochthonius homodentatus* (Chthoniidae): Temporal occurrence of developmental stages captured in one arboreal photo-eclector for trunk ascents between July, 1987 and June, 1988 in a seasonal mixedwater inundation forest of Central Amazonia.

FIG. 8. *Pseudochthonius homodentatus* (Chthoniidae): Temporal occurrence of developmental stages captured in one arboreal photo-eclector for trunk descents between July, 1987 and June, 1988 in a seasonal mixedwater inundation forest of Central Amazonia.

On tree trunks, *P. homodentatus* was captured during the rainy season and the beginning dry season (n=176; Figs 7, 8). Most animals were obtained in arboreal photo-eclectors for trunk descents (68%) when compared with the catches in traps for trunk ascents (32%). About 15% of all specimens represented deutonymphs, 13% tritonymphs and 72% adults (47% females, 25% males).

According to the classification of ADIS (1997), *P. homodentatus* represents an arboricolous migrating species which has its main reproduction in the trunk/canopy region and a secondary reproduction on the forst floor during the terrestrial phase.

However, in primary and secondary (non-flooded) upland forests *P. homodentatus* was only found on the forest floor (Mahnert & Adis 1985; Adis & Mahnert 1990, 1993). This suggests an adaptation towards an arboreal life in mixed- and blackwater inundation forests, similar to that reported for *Brazilatemnus browni* (Miratemnidae; Adis *et al.* 1988).

Other Pseudoscorpion species

The following seven species were collected in low numbers:

All developmental stages of *Pachyolpium irmgardae* (Olpiidae) were obtained during the rainy season (12/87-5/88) from the organic soil layer (n=6), on the soil surface (emergence traps; n=13) and on tree trunks (n=5). Our data reinforce the view that this pseudoscorpion represents an arboricolous migrating species (cf. Adis & Mahnert 1985; Mahnert & Adis 1985) which is endemic to black- and mixedwater inundation forests.

Geogarypus amazonicus (Geogarypidae; 1♂, 1♀, 1 protonymph) was captured in trunk traps. *Paratemnoides minor* (Atemnidae; 5♀♀), *Parachernes adisi* (Chernetidae; 4♂♂), *Pachychernes baileyi* (Chernetidae; 1♂) and *Dolichowithius minutus* (Withiidae; 1♂) were obtained by fogging the canopy. All these pseudoscorpions are regarded as arboricolous non-migrating species (Adis 1981; Adis & Mahnert 1985).

Lechytia chthoniiformis (Chthoniidae; 1♂) was captured on the forest floor with emergence traps. This pseudoscorpion species is found throughout South America (cf. Harvey 1991). In Amazonia, it was reported to be phoretic on the cerambycid beetle *Stenodontes spinibarbis* (Aguiar & Buernheim 1991, 1992).

CONCLUSIONS

T. amazonicus is a terricolous, univoltine species and most abundant in the organic soil layer. The migration of tritonymphs from the soil to the trunk/canopy region is regarded as a survival strategy in response to the flood pulse.

P. homodentatus changed from a terricolous mode of life in Central Amazonian upland forests to an arboricolous living in mixed- and blackwater inundation forests.

Our results are in line with the hypothesis that seasonally inundated forests of the mixedwater type near Manaus represent an ecotone (Adis 1992); *Pachychernes baileyi* (Chernetidae), *Tyrannochthonius amazonicus* (Chthoniidae), *Geogarypus amazonicus* (Geogarypidae) and *Pachyolpium irmgardae* (Olpiidae) and *Dolichowithius minutus* (Withiidae) inhabit blackwater inundation forests in the valley of the Negro River. *Parachernes adisi* (Chernetidae) was collected from whitewater inundation forests along the lower Solimões River. *Paratemnoides minor* (Atemnidae) occurs in black- and whitewater inundation forests. *Pseudochthonius homodentatus* (Chthoniidae) lives in primary and secondary (non-flooded) upland forests of Central Amazonia.

ACKNOWLEDGEMENTS

This study was supported by a grant from the German Academic Exchange Service (DAAD) for the first author. We wish to acknowledge the valuable support received by PD Dr. Wolfgang J. Junk, Head of the Tropical Ecology Working Group at the Max-Planck-Institute for Limnology in Ploen, FR Germany. Dr. Helen Read (Burnham Beeches, Slough/United Kingdom) and Dr. Raul de Queiroz (INPA, Manaus/Brazil) are thanked for valuable suggestions regarding manuscript format.

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REVUE SUISSE DE ZOOLOGIE 104 (3): 485-489; septembre 1997

Cryphoecina deelemanae gen. n., sp. n., a remarkable spider from the mountains of Montenegro (Yugoslavia) (Arachnida, Araneae, Hahniidae)

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Cryphoecina deelemanae **gen. n., sp. n., a remarkable spider from the mountains of Montenegro (Yougoslavia) (Arachnida, Araneae, Hahniidae).** - The new genus and species are described and illustrated (male/female) from Pastrovacka Gora mountain of Montenegro (Yougoslavia). They represent an interesting discovery, with somatic characters close to *Cryphoeca* and genital organs, different from all known Hahniidae species.

Key-words: Araneae - Hahniidae - *Cryphoecina* - Montenegro.

INTRODUCTION

Four genera (*Antistea*, *Cryphoeca*, *Hahnia*, *Tuberta*) of the family Hahniidae are known from Europe (PLATNICK 1993). The new genus *Cryphoecina* is described from material presented to me by Dr. C.L. Deeleman.

DESCRIPTIONS

Cryphoecina gen. n.

Typus generis: *Cryphoecina deelemanae* sp. n.

Diagnosis: *Cryphoecina* is close to genus *Gryphoeca* but can be distinguished by the form and distribution of eyes, the different number of the teeth on the inner margin of the chelicerae and different spinulation of the legs. The genetic characters differ from all species of Hahniidae: very characteristic are the spheric tibia of the male palp, the very long embolus and the typical structures of the vulva (figs 2–7).

Derivatio nominis: A modification of *Cryphoeca*.

Description: Cephalothorax: Oval, attenuated in front. Clypeus not wider than diameter of a lateral anterior eyes. Eyes (fig. 1): Anterior row strongly

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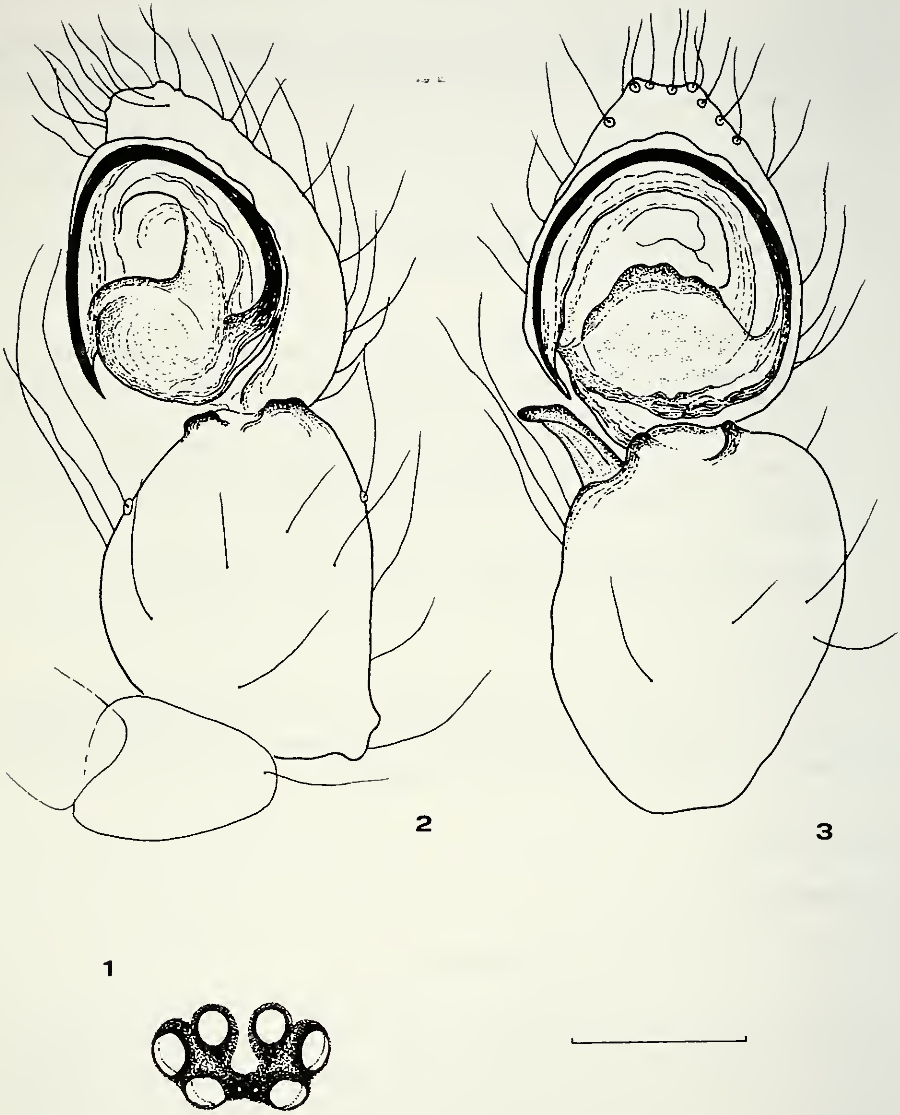
Manuscript accepted 15.10.1996



Figs 1–3

Cryphoecina deelemanae n. sp. Eyes, frontal view (1). Male palp, retroventral (2) and ventral view (3). Scale line 0.3 mm.

procurved (as seen from in front); medians very small, almost invisible: the laterals are equal to all the remaining eyes. Posterior row procurved, with eyes of equal size and nearly equidistant. Chelicerae: Nearly vertical, distinctly but moderately swollen at the base. Inner margin with four teeth. Sternum: Almost circular, pointed behind. Abdomen: With pattern composed of broad black transverse bars on a grey background, interspersed with white spots (similar to *Cryphoeca*). Spinners: Anteriors separated by more than their. Legs: Short and robust. Tibiae I, II each with 4–5 pairs of strong ventral spines. Metatarsi I, II each with 3–4 pairs of strong ventral spines.

Male palpal femora and patella cilindri-form. Tibia stout, spheric, provided with short and long weak spines and characteristic apophysis. Cymbium globose covered with weak spines. Embolus narrow and long and together with conductor encircled the whole bulb (figs 2–5). Female vulva with typically structured (figs 6–7).

Discussion: The somatic characters of the new genus *Cryphoecina* are close to those of *Cryphoeca* but the genital organs are strongly different from all known Hahniidae species. Very characteristic and not typical for the family is this stout and spheric tibia with simple apophysis. The bulb is close to *Cryphoeca* but provided with much longer embolus. The vulva slightly resembles this of *Cryphoeca montana* Emerton (North America).

Looking on these arguments in phylogenetic respect it can be considered that the probable position of the new genus is near to *Cryphoeca*. The origin and formation of *Cryphoecina* gen. n. can be regarded as a result of the relative isolation of the mountains compared with the zonal areas, in the context of paleo-environmental changes since Pliocene.

Cryphoecina deelemanae sp. n. Figs 1-7

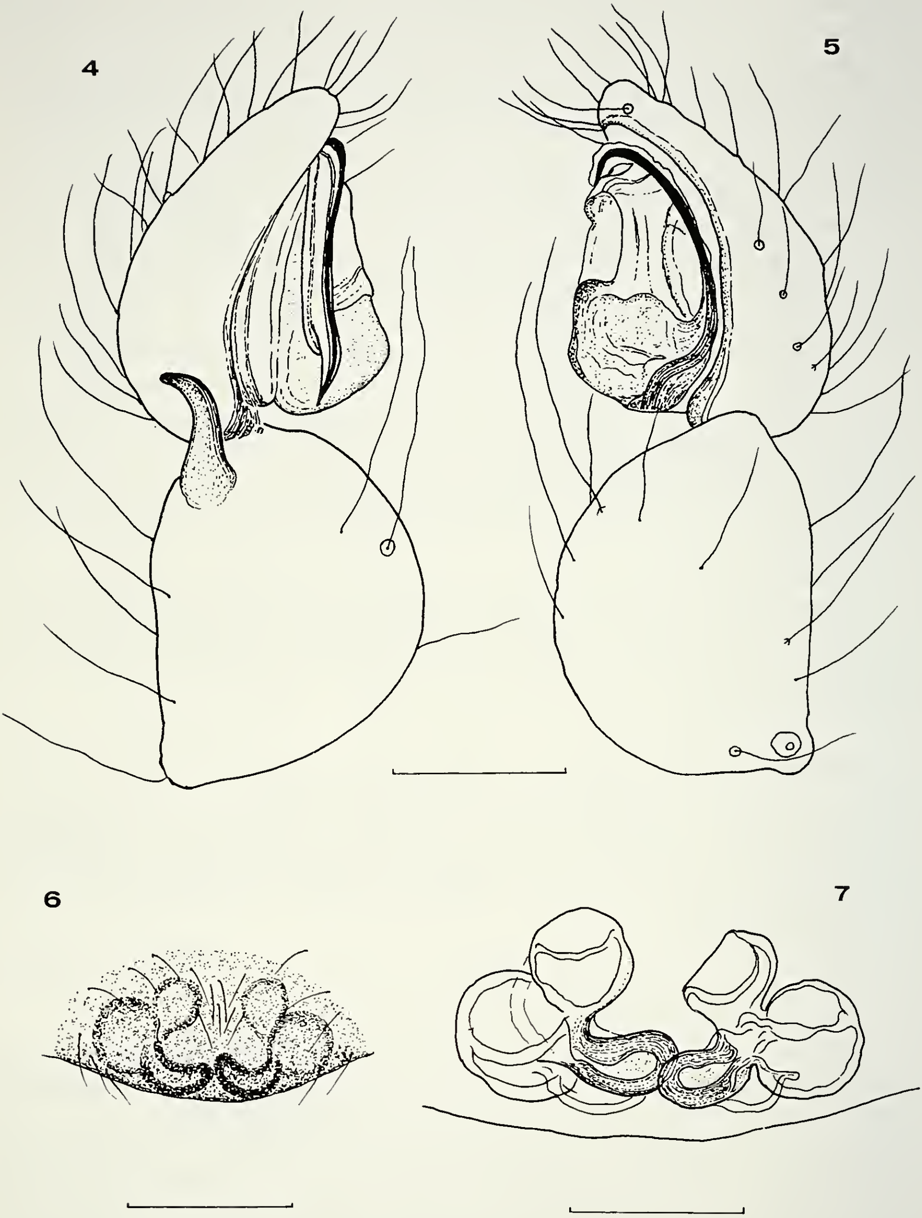
Material: Montenegro, Petrovac-Virpazar, Petrovacka Gora (600 m) in detritus in oak-woodland (*Quercus*), 1 ♂ holotype, 5 ♂ and 6 ♀ paratypes, 05.10.1980 (leg. P.R. Deeleman). Depository: Institute of Zoology, Sofia. 1 ♂ and 1 ♀ paratypes will be deposited in Muséum d'histoire naturelle, Genève; 1 ♂ and 1 ♀ paratypes in Naturhistorisches Museum, Wien; 10 ♂ and 10 ♀ paratypes in the collection of C.L. Deeleman; 1 ♂ and 1 ♀ paratypes in the collection of K. Thaler (Innsbruck).

Diagnosis: With the characters of the genus, male palps as in figures 2–5, and female genitalia as in figures 6–7.

Derivatio nominis: named in honour of Dr. C.L. Deeleman.

Male/female (measurements in mm): Total length 2.32/2.62. Cephalothorax, length 0.97/.90, width 0.95/.67; sternum length 0.67/0.60, width 0.52/0.52; abdomen, length 1.20/1.35. Cephalothorax similar in both sexes, yellow to yellow grey. Abdomen grey to dark grey with distinct patterns (described in the description of genus). Anterior row of eyes strongly procurved (as seen from in front); medians very small, almost unvisible: the laterals are equal to all the remaining eyes (fig. 1). Posterior row procurved, with eyes equal and nearly equidistant (fig. 1). Chelicerae brown, inner margin with 4 teeth.

Legs (male/female): short and robust, yellow to yellow grey. Tibiae I, II each with 4–5 pairs of strong ventral spines. Metatarsi I, II each 3–4 pairs of strong ventral spines.



Figs 4–7

Cryphoecina deelemanae n. sp. Male palp, retrolateral (4) and prolateral view (5). Epigyne, ventral view (6). Vulva, ventral view (7). Scale lines 0.2 mm (6), 0.3 mm (4, 5, 7).

Male palp, epigyne and vulva described in the description of genus, and presented on figures 2–5, and 6–7.

Discussion: In spite of the fact, that by somatic characters, *Cryphoecina deelemanae* sp. n. stay near to *Cryphoeca*, it is difficult to find strong resemblance in genital respect to most of *Cryphoeca* species.

ACKNOWLEDGEMENTS

I am especially indebted to Dr. C.L. Deeleman (Ossendrecht, The Netherlands) for the opportunity which she gave me to describe the new taxa, and to Dr. K. Thaler (Innsbruck, Austria) for the discussion and comments.

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Revue suisse de Zoologie 104 (3): 491-501; septembre 1997

Micrargus alpinus sp. n., eine weitere Art der *M. herbigradus*-Gruppe aus Österreich (Arachnida: Araneae: Linyphiidae)

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Micrargus alpinus **sp. n., an additional species of the** *M. herbigradus*-**group from Austria (Arachnida: Araneae: Linyphiidae).** - *Micrargus alpinus* sp. n. was discovered in the Austrian Alps. Differential diagnoses, drawings and ecological data are presented. *Micrargus herbigradus majus* (Simon, 1926), described from the Western Alps (France, Switzerland) is a junior synonym of *M. apertus* (O.P.-Cambridge, 1870).

Key-words: Araneae - Linyphiidae - Taxonomy - Alps - *Micrargus*.

EINLEITUNG

Die Bestimmung der drei von Millidge (1976) unterschiedenen europäischen Arten *Micrargus herbigradus* (Blackwall, 1854), *M. apertus* (O.P.-Cambridge, 1870) und *M. georgescuae* Millidge, 1976 erweist sich der subtilen morphologischen Differenzierung wegen als schwierig. Insbesondere bei syntopen Vorkommen sowie bei Verwendung der Bestimmungsschlüssel von Heimer & Nentwig (1991) sind Verwechslungen nicht immer auszuschließen (Weiss 1997).

Im Alpenraum wurde seit der Aufspaltung der Sammelart nur das Vorkommen von *M. herbigradus* wiederholt belegt. Das Areal von *M. georgescuae* ist zur Zeit in den Alpen durch die Erstbeschreibung aus Nordtirol und vereinzelte Wiederfunde nur unzureichend bekannt (Thaler 1978, 1982, Maurer & Walter 1980), während das Vorkommen und der taxonomische Status von *M. apertus* für die Schweiz erneut in Frage gestellt wurde (Maurer & Hänggi 1990).

Ökologische Untersuchungen zur Spinnenfauna der östlichen Hohen Tauern (Gasteinertal, Land Salzburg, Österreich) in den Jahren 1993–1994 (Relys 1996) ergänzen das Verbreitungsbild von *M. georgescuae* und bestätigen das Vorkommen von *M. apertus* im alpinen Raum. Gleichzeitig erbrachten sie den überraschenden

Manuscript accepted 26.02.1997

Nachweis einer vierten, subalpin verbreiteten Art, die im Vergleich mit den anderen drei mitteleuropäischen Vertretern der *M. herbigradus*-Gruppe beschrieben wird.

TAXONOMISCHER TEIL

Micrargus apertus (O.P.-Cambridge 1870) (Abb. 2, 12, 16, 20)

Blaniargus herbigrada majus Simon, 1926: 439, 517 (♂, ♀) **syn. n.**

Simon (1926) hat die Unterart *M. herbigradus majus* aus Nadelwäldern der West-Alpen (Frankreich, Schweiz) als neue "Lokalrasse" beschrieben. Sie ist seither nur noch von Vogelsanger (1947) gemeldet worden. Wenngleich *M. h. majus* nie abgebildet wurde, weist die Differenzial-Diagnose dennoch eindeutig auf *M. apertus* hin (hellere Körperfärbung, verlängerte Beine, kürzere Tibial-Apophyse). Der Hinweis "chélicères plus finement granuleuses" ist möglicherweise auf die typisch gestalteten Stridulations-Rillen zu beziehen (siehe Abb. 20).

Ost-Alpen, Hohe Tauern, Gasteinertal, Kötschachtal: 1 ♂, 17.05.–12.06.93, leg. Relys, syntop mit *M. herbigradus*; Nordtirol, Innsbruck, Gleirschkar (Nordkette), ca. 2150 m NN, Rohschutt am Fuß einer Schutthalde 1 ♂, 26.10.76–30.06.77 (Coll. Thaler: E 1792 — in Thaler 1982 unter "*M. georgescuae*").

Micrargus georgescuae Millidge, 1976 (Abb. 3, 13, 17, 21)

Ost-Alpen, Hohe Tauern, Gasteinertal, Kötschachtal: 1 ♂, 26.04.–20.05.94; 2 ♂, 19.05–12.06.93; 1 ♂, 17.05–09.06.93 leg. Relys; Nordtirol, Stubaier Alpen, Maria Waldrast 1470–1750 m: 4 ♂, 2 ♀, 22.04.–15.05.76; 13 ♂, 15.05.–06.06.76; 7 ♂, 2 ♀, 06.06.–26.06.76 (Coll. Thaler: E 1670, 1686 und 1695 siehe Thaler 1982; syntop mit *M. alpinus* sp. n.).

Micrargus herbigradus (Blackwall, 1854) (Abb. 4, 14, 18, 22)

Ost-Alpen, Hohe Tauern, Gasteinertal, Kötschachtal: 1 ♂, 17.05.–12.06.93, leg. Relys, syntop mit *M. apertus*; Nordtirol, Umgebung Innsbruck, Wörgltal-Klamm: 4 ♂, 3 ♀, 19.05.–19.07.63, syntop mit Typusmaterial von *M. georgescuae* (Coll. Thaler: E 1189).

Micrargus alpinus sp. n. (Abb. 1, 5–6, 7–10, 11, 15, 19)

Material (Bodenfallen, 1993–1994, leg. Relys): Österreich, Ost-Alpen, Hohe Tauern, Gasteiner Tal, Naßfeld-Alm, 1620–1665 m NN, Zwergstrauchbestände. Holotypus: 1 ♂. Paratypen: 2 ♂, 1 ♀ (Muséum d'histoire naturelle Genève; ursprünglich als Typenmaterial vorgesehene 5 ♂, 5 ♀ sind beim Postversand verlorengegangen); 6 ♂, 5 ♀ (Biologiezentrum des OÖ Landesmuseums Linz-Dornach); 2 ♂, 1 ♀ (Naturhistorisches Museum Wien).

Nordtirol, Stubaier Alpen, Maria Waldrast 1470–1750 m NN, Bodenfallen: 1 ♂, 06.06.–26.06.76 syntop mit *M. georgescuae* (Coll. Thaler: E 1695 — siehe Thaler 1982 unter "*M. georgescuae*").

Männchen:

Gesamtlänge: 2,30 mm; Prosoma 1,00 mm lang und 0,85 mm breit. Im Vergleich zu den anderen Arten der Gruppe auffallend groß und robust gebaut.

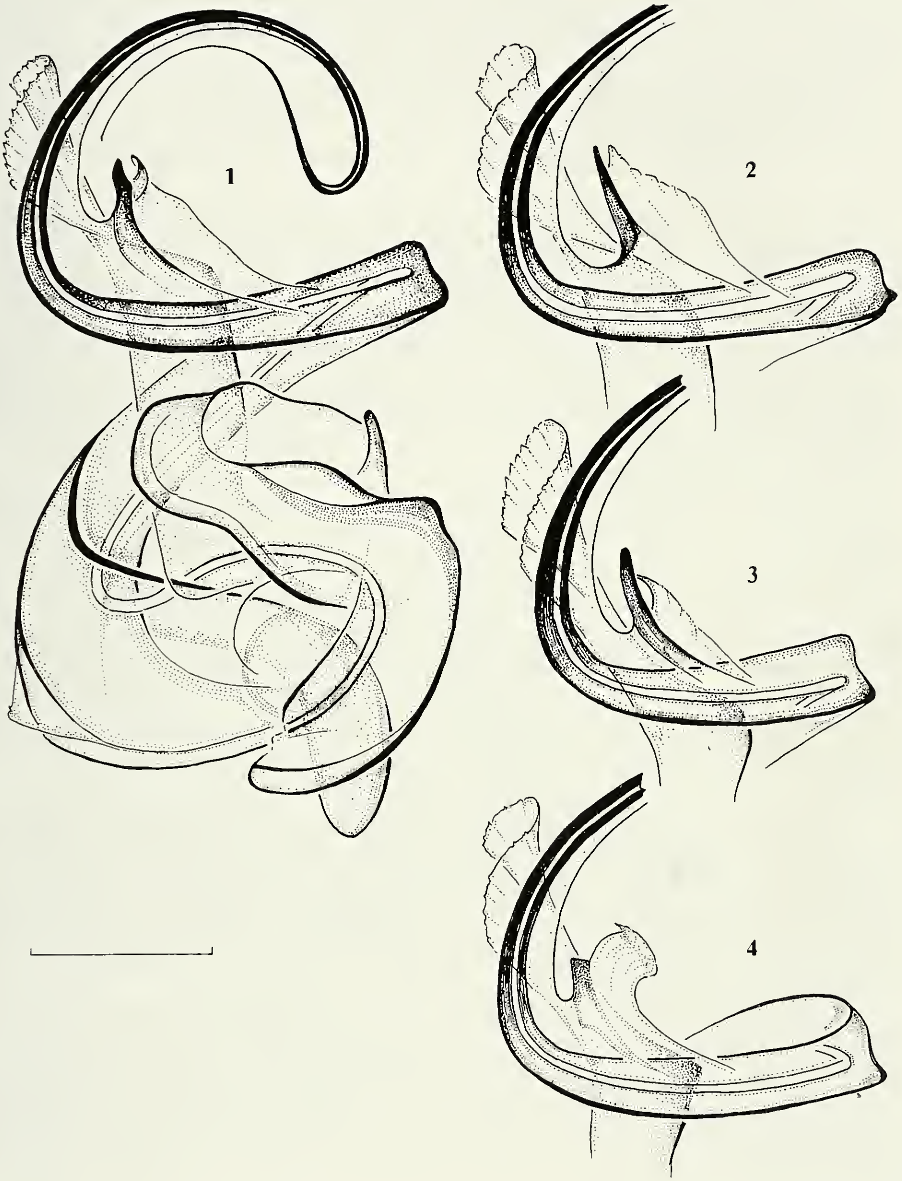

ABB. 1–4

Endapparat des linken Tasters von retrolateral und Ausbildung des Embolus-Zahnes bei: *Micrargus alpinus* sp. n. (1), *M. apertus* (2), *M. georgescuae* (3) und *M. herbigradus* (4). (Maßstab: 0,1 mm).

Prosoma dunkel kastanienbraun, Beine und Taster etwas heller braun, insbesondere die ersten beiden Beinpaare stärker verdunkelt. Abdomen grau bis schwarz. Zum Unterschied der anderen mitteleuropäischen Arten insgesamt dunkler gefärbt.

Kopfpartie schwach erhöht, hinter den Seitenaugen mit Depressionen, Augenstellung wie bei den anderen Arten der Gruppe. Prosoma netzartig genarbt.

Beinmerkmale: Tibialborsten 2.2.1.1; Becherhaar auf Metatars I–III in Position 0.35.

Bei ♂ der Gattung *Micrargus* weisen die Cheliceren sekundäre Geschlechtsmerkmale auf. Die drei Zähne am Vorderrand der Klauenfurche stehen bei *M. alpinus* für gewöhnlich in gleichem Abstand (Abb. 10). Dieses Merkmal ist allerdings variabel. Bei etwa 20% der untersuchten ♂ nähert sich die Anordnung der Zähne den Verhältnissen bei *M. herbigradus* (d.h. der Abstand zwischen dem ersten und zweiten proximalen Zahn ist 3–4 mal größer als der Abstand zwischen den beiden distalen Zähnen). Seitlich weisen die Cheliceren eine schuppenförmig-netzartige Struktur auf, ohne deutlich ausgebildete Stridulations-Rillen (Abb. 9, 19) (wichtiges Unterscheidungsmerkmal zu *M. apertus*).

Taster: im Vergleich mit den anderen Arten auffallend größer. Femur proximal-prolateral mit schwach ausgebildetem Schrillzahn. Tibialapophyse und Paracymbium ohne spezifische Merkmale (Abb. 8).

Bulbus-Ventralansicht: im Übergangsbereich Embolus-Stützlamelle breit, mit einem schwach ausgebildeten, kurzen Kiel (Abb. 8, 11). *M. alpinus* kann dieses breiten Basalabschnittes der Stützlamelle wegen, leicht mit *M. georgescuae* verwechselt werden (siehe auch BAUCHHENSS 1987, WEISS 1997), doch fehlt bei *M. georgescuae* ein Kiel. Mittlere Apophyse (im Sinne von MERRETT 1963) deutlich breiter als bei *M. apertus*, bei beiden Arten mit einer kleinen, fingerförmigen bzw. spitzen Apophyse am distalen Rand (Abb. 1, 11).

Embolus: Längenverhältnisse wie bei *M. apertus*, am transparenten, inneren Saum (Velum) mit einem charakteristisch gestalteten Zahn (Abb. 1, 15). Nach dieser stärker sklerotisierten Apophyse, die einen fahnenförmigen Anhang aufweist, lassen sich die ♂ der vier Arten am sichersten unterscheiden. WIEHLE (1960, Fig. 481) bezeichnet diese Apophyse des Velums berechtigter Weise, von der Funktion her als "Conductor".

Die zwischen Embolus und mittlerer Apophyse gelegene "Membran" (siehe MERRETT 1963) ist wie bei *M. apertus* transparent. Bei *M. herbigradus* und *M. georgescuae* ist sie hingegen im mittleren, abgewinkelten Abschnitt stärker sklerotisiert (bei PALMGREN 1977, Fig. 33b/7 wird diese Struktur als "Knopf" bezeichnet und abgebildet).

Weibchen:

Gesamtlänge: 2,45 mm; Prosoma 0,95 mm lang und 0,75 mm breit. Färbung und Beinmerkmale wie beim ♂.

Cheliceren: vordere Klauenfurche mit 6 (selten 5) Zähnen, hinten mit 4–5 kleineren Zähnchen.

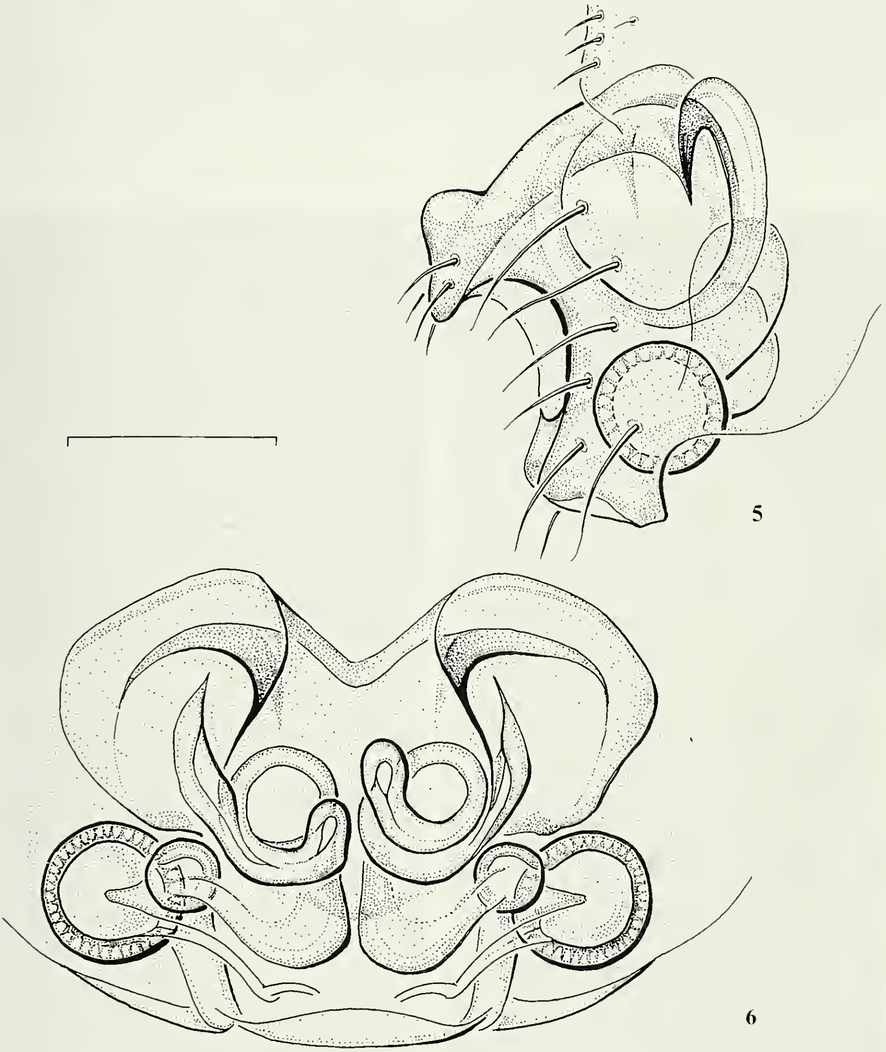

Abb. 5–6

Micrargus alpinus sp. n. Weibchen. Epigyne lateral (5), Vulva dorsal (6). (Maßstab: 0,1 mm).

Epigyne/Vulva: allgemeine Struktur wie bei den anderen europäischen Arten dieser Gruppe, jedoch deutlich größer. Kontur der Epigynengrube wenig charakteristisch, ihre vordere Begrenzung jedoch in Seitenansicht mit einem deutlichen Höcker (Abb. 5). Einführungsgänge zum Teil asymmetrisch; ihr Verlauf erinnert weitgehend an die Verhältnisse bei *M. apertus*. Sie erreichen zunächst die Symmetrie-

Achse, biegen hier von ventral nach dorsal ab, um sodann nach einer weiteren Wende von etwa 90° in eine große, kreisförmige Schlinge überzugehen. Die Länge dieser Einführungswege und die sich daraus ergebende Schleifenbildung steht bei den europäischen Arten der *M. herbigradus*-Gruppe in eindeutiger Korrelation zur Länge des Embolus.

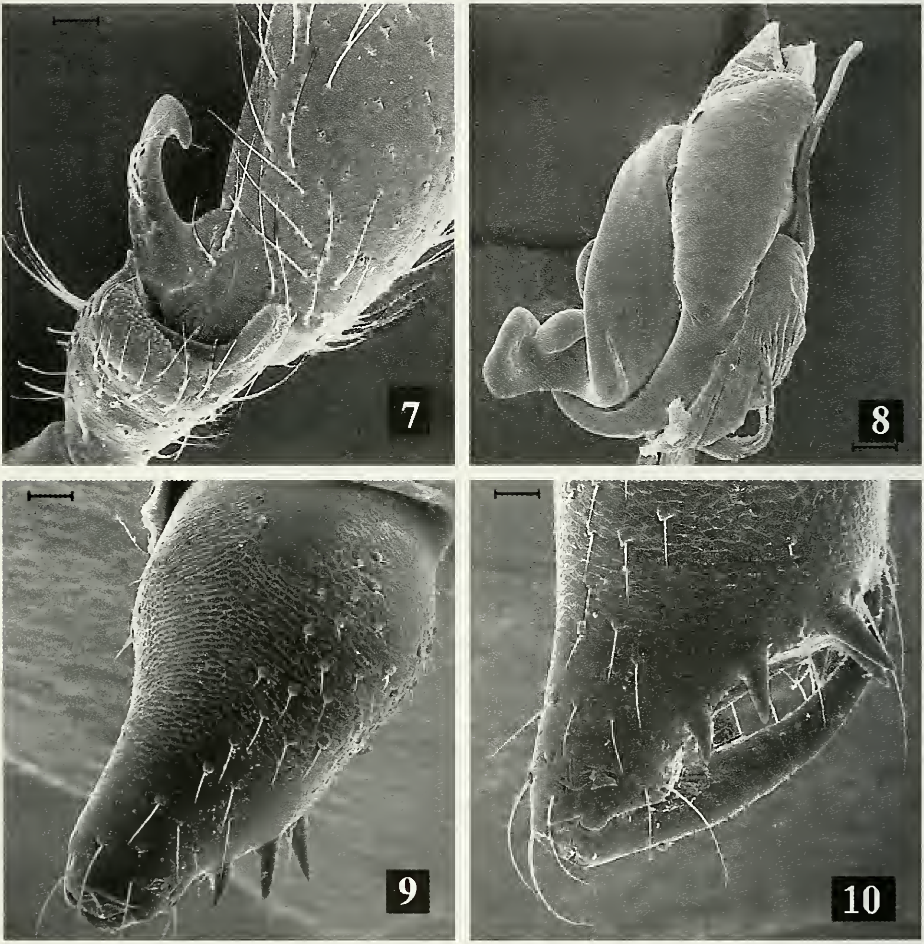

Abb. 7–10

Micrargus alpinus sp. n. Männchen. Linke Tibial-Apophyse von dorsal (7), Bulbus des linken Tasters von ventral (8), rechte Chelicere von lateral (9), und von frontal (10). (Maßstab: 7: 0,041 mm, 8: 0,042 mm, 9: 0,049 mm, 10: 0,039 mm).

BEZIEHUNGEN

Die neue Art steht genitalmorphologisch, durch die Ausbildung des Endapparates, die Länge des Embolus und die Struktur der Vulva *M. apertus* nahe. Während *M. apertus* durch eine Reihe spezifischer Merkmale (hellere Färbung, verlängerte Beine) Anpassungen an eine endogäische Lebensweise aufweist, scheint *M. alpinus* dem Habitus nach, sonnige Offenland-Biotope epigäisch zu besiedeln.

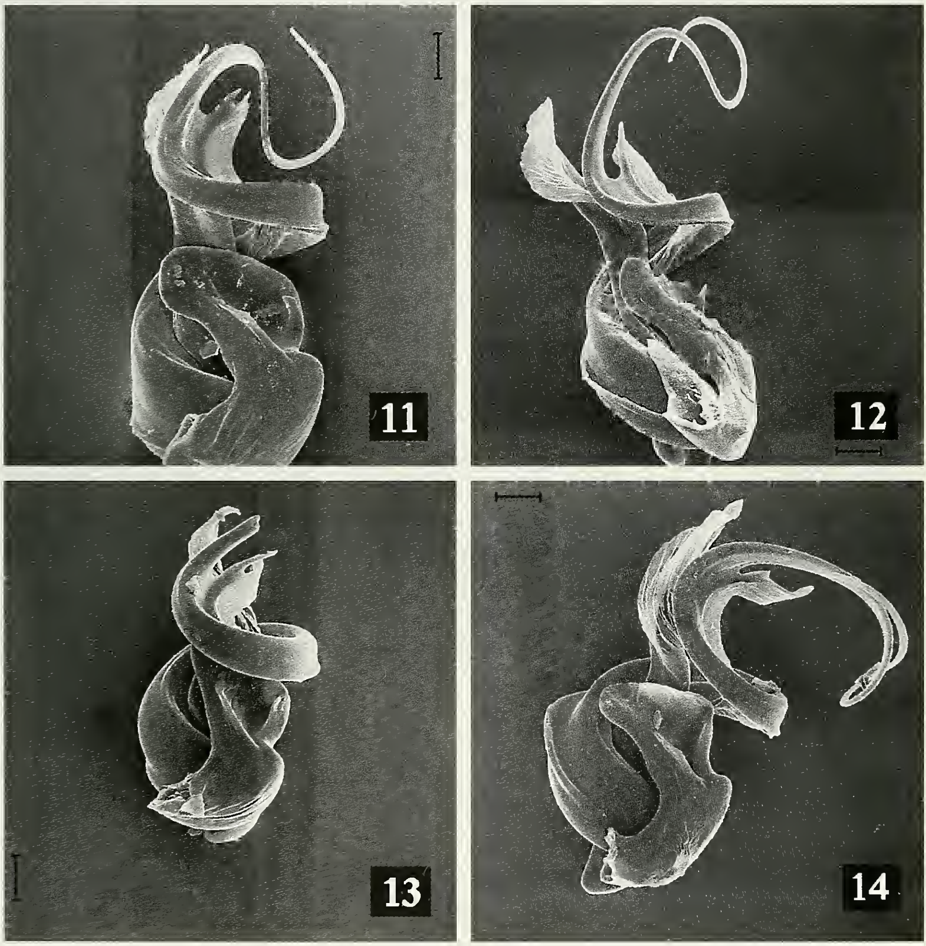

Abb. 11–14

Endapparat des linken Tasters von retrolateral bei: *Micrargus alpinus* sp. n. (11), *M. apertus* (12), *M. georgescuae* (13) und *M. herbigradus* (14). (Maßstab: 11: 0,044 mm, 12: 0,045 mm, 13: 0,043 mm, 14: 0,043 mm).

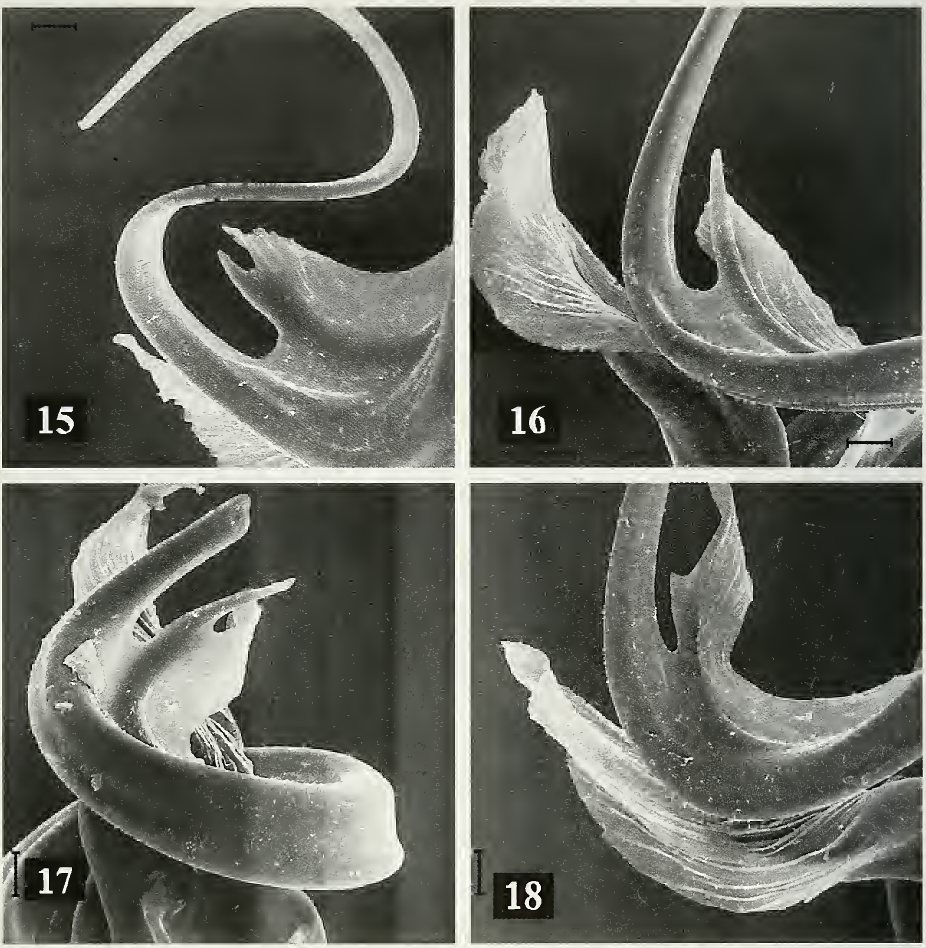

ABB. 15–18

Ausbildung des Embolus-Zahnes bei: *Micrargus alpinus* sp. n. (15), *M. apertus* (16), *M. georgescuae* (17) und *M. herbigradus* (18). (Maßstab: 15: 0,017 mm, 16: 0,018 mm, 17: 0,018 mm, 18: 0,017 mm).

Die phylogenetischen Beziehungen von *M. alpinus* zu weiteren paläarktischen Arten der *M. herbigradus*-Gruppe sind unbekannt. WUNDERLICH (1995) hat kürzlich zwei neue nominelle Arten aus Japan in diese Gruppe gestellt, wobei die Weibchen z.T. nicht eindeutig zugeordnet werden konnten. Über innerartliche Variabilität und Rassenbildung ist noch wenig bekannt, doch dürfte mit Lokalformen insbesondere bei troglophilen Arten zu rechnen sein (siehe GEORGESCU 1971). Das sympatrische und vielfach syntope Vorkommens der vier Formen im Alpenraum, weist auf eigenständige Arten hin, auch wenn die morphologische Differenzierung wenig ausgeprägt ist.

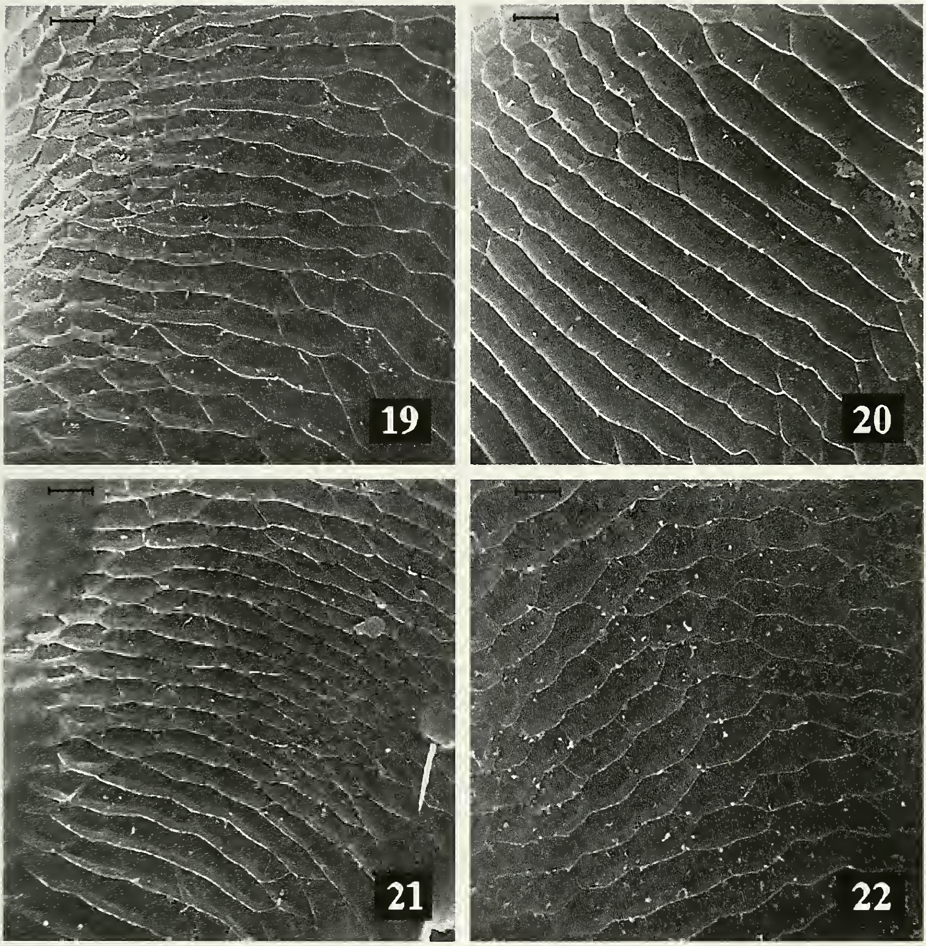

ABB. 19–22

Oberflächen-Struktur der rechten Chelicere (Seitenansicht) bei Männchen von: *Micrargus alpinus* sp. n. (19), *M. apertus* (20), *M. georgescuae* (21) und *M. herbigradus* (22). (Maßstab: 19–22: 0,01 mm).

ÖKOLOGIE

Die Nachweise von *M. alpinus* im Gasteiner Tal (Hohe Tauern) stammen aus der subalpinen Stufe. Die höchste Siedlungsdichte und Repräsentanz wird in inselartig ausgebildeten Zwergstrauchheiden der Talsohle erreicht (mit *Rhododendron ferrugineum*, *Juniperus nana*, *Vaccinium myrtillus* und mit gut ausgebildeter Moosschicht auf lockerem Rohhumus).

Begleitarten und Dominanzgefüge (%) der Spinnenzönose: *Pardosa oreophila* (22.2), *Alopecosa pulverulenta* (14.1), *Centromerus pabulator* (9.0), ***Micrargus alpinus*** (9.0 = 30 Exemplare), *Centromerus subalpinus* (9.0), *Robertus truncorum* (6.9), *Bolyphantes luteolus* (3.6), *Collinsia nemenziana* (2.7), *Pardosa palustris* (2.7), *Ceratinella brevipes* (2.4), *Lepthyphantes mengei* (2.1), *Hilaira tatrica* (1.8), *Haplodrassus signifer* (1.8), *Erigone atra* (1.2), *Lepthyphantes alacris* (1.5), *Pardosa riparia* (0.9), *Walckenaeria vigilax* (0.9), *Xysticus cristatus* (0.9), *Maso sundevalli* (0.9), *Walckenaeria antica* (sowie 20 subrezedente Arten).

Im Gasteiner Tal konnte *M. alpinus* außerdem in stark vergrasten und zeitweilig beweideten Zwergstrauchbeständen auf Nordhängen (8 Ex.) und an einem relativ vegetationsfreien Ruderalstandort (Loipensanierungen auf Uferterassen der Naßfelder Ache, 12 Ex.) nachgewiesen werden.

In vergleichsweise untersuchten Fichtenwäldern und in Latschenbeständen wurde *M. alpinus* nicht verzeichnet. An diesen Standorten wird die Art durch *M. georgescuae*, *M. herbigradus* und *M. apertus* ersetzt. Es liegen somit unterschiedliche Lebensraumbindungen bzw. Optimalbiotope der sympatrisch auftretenden Arten vor. Phänologisch ist *M. alpinus* durch eine ausgedehnte Reifezeit gekennzeichnet. Ein deutliches Aktivitätsmaximum konnte in den Herbstmonaten festgestellt werden. Zahlreiche Belege liegen aus dem Winterhalbjahr (17.10.93–30.5.94) vor.

DANK

Herrn Prof. Dr. H. Adam (Salzburg) danken wir für die wissenschaflliche Betreuung der Untersuchungen im Gasteinertal. Desgleichen gilt ein besonderer Dank der Geschäftsführung und dem Kuratorium des Forschungsinstituts Gastein-Tauernregion, speziell Herrn J. Flatscher, für die finanzielle Unterstützung des Projekts. Bei der Anfertigung der REM-Aufnahmen war Herr Doz. Dr. P. Simonsberger (Salzburg) behilflich. Für Belege aus Nordtirol und wertvolle Anregungen danken wir Herrn Dr. Doz. K. Thaler (Innsbruck). Herr T. Blick (Hummeltal) war mit Literaturhinweisen behilflich.

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Revue suisse de Zoologie 104 (3): 503-516; septembre 1997

Towards a revision of the Italian *Mitostoma*.
1: Subdivision in groups and description of new species (Arachnida, Opiliones, Nemastomatidae)

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Towards a revision of the Italian *Mitostoma*. 1: subdivision in groups and description of new species (Arachnida, Opiliones, Nemastomatidae). - The Italian species of the genus *Mitostoma* (Opiliones Nemastomatidae) are here subdivided in groups and three new species are described. *M. fabianae* sp. n. lives on Isola d'Elba and seems to be related to *M. valdemonense* Marcellino; *M. daccordii* sp. n. lives in the Venetian Prealps and shows affinity with *M. orobicum* di Caporiacco, from the Lombardic Prealps. *M. sabbadinii* sp. n. lives in Northern Sardinia and shows no close relationship with any of the other known species.

Key-words: *Mitostoma* - Italy - new species - taxonomy - revision.

INTRODUCTION

The genus *Mitostoma* is a typical European element, distributed, according to Martens (1978), from the Iberian peninsula to Caucasus. The species are not very numerous, but the systematic subdivision of the genus is still unclear. After examining abundant material from different italian regions, we have made two main observations:

1) the species easily identifiable in Italy are many more than described up to day;

2) these species can be grouped by means of easily observable external characters.

The characters of the penis, very useful at the genus level in the family Nemastomatidae (Silhavy 1966), are in our opinion of very little help for a specific differentiation. This occurs because the pieces of the glans are composed of very complicate structures, whose appearance varies considerably even with extremely small rotations. For this reason, and since the external characters are much easier to observe, we have decided not to use them in this work. In spite of this, having

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Manuscript accepted 21.01.1997

examined the penes of all the Italian species, we can say here that they all are very similar to those figured by SILHAVY (1966), MARTENS (1978) and CHEMINI (1985) for different species of *Mitostoma*.

With this work our aim is to present our proposal of dividing the genus into groups and to revise some of these groups describing three new species. Only the *chrysomelas*-group will be left outside, since the evaluation of some populations requires further studies.

DESCRIPTION

Mitostoma Roewer, 1951

Type-species: *Phalangium chrysomelas* Hermann, 1804 (by original designation).

M. anophthalmum-group: characterized by eyes reduced or absent, absence of longer hairs on all legs, almost glabrous body, chelicera of large size with small apophysis on segment 1 and no supplementary apophysis on segment 2, size large. Legs quite long (ratio femur 1/body = 1.2-1.4). Species included: *M. anophthalmum* (Fage, 1946), *M. patrizii* Roewer, 1953.

M. sabbadinii-group: characterized by normally developed eyes, long, perpendicular hairs interspersed with normal, short ones on all legs, body covered with dense hairs, chelicera of normal size with small apophysis on segment 1 and no supplementary apophysis on segment 2, size small. Legs very short (ratio femur 1 /body = 0.8). Species included: *M. sabbadinii* sp. n.

M. orobicum-group: characterized by normally developed eyes, long, perpendicular hairs interspersed with normal, short ones on all legs, glabrous body, chelicera of normal size with very large apophysis on segment 1 and no supplementary apophysis on segment 2, size medium. Legs of medium length (ratio femur 1/body = 1.1-1.2). Species included: *M. orobicum* (di Caporiacco, 1949), *M. daccordii* sp. n.

M. valdemonense-group: characterized by normally developed eyes, absence of longer hairs on all legs, glabrous body, chelicera of normal size with small apophysis on segment 1 and a supplementary tooth on segment 2, size medium or small. Legs quite long (ratio femur 1/body = 1.2-1.6). Species included: *M. valdemonense* Marcellino, 1974, *M. fabianae* sp. n.

M. chrysomelas-group: characterized by normally developed eyes, absence of longer hairs on all legs, glabrous body, chelicera of normal size with small apophysis on segment 1 and no supplementary hairs interspersed with normal, short ones on all on segment 2, size medium. Legs very long (ratio femur 1/body = 1.9-2.7). Species included: *M. chrysomelas* (Hermann, 1804), *M. alpinum* Hadzi, 1931.

Some of the features characteristic of these groups are probably only due to convergence (i.e. the reduction of eyes and of hairs in the two cavernicolous species of the *anophthalmum*-group), but others (like the occurrence of two types of hairs on legs, the great size of the apophysis of article 1 of chelicera or the occurrence of an additional apophysis of article 2 of chelicera) have, in our opinion, a stronger phylogenetical value. In any case, these characters have the obvious advantage that are simple to observe and allow an easy distinction of all species.

The *chrysomelas*-group seems mainly characterized by the absence of the apomorphies typical of the other groups, but at least one character typical of this group is at the apomorphic state, i.e. the extremely long legs, longer than in almost all the other groups. This group is by far the most difficult and many species have been described and later synonymized. Our opinion is that many species still exist to be described, while the real distribution of *M. chrysomelas* remains to be cleared.

Mitostoma patrizii Roewer, 1953 (Figs 1, 8, 15)

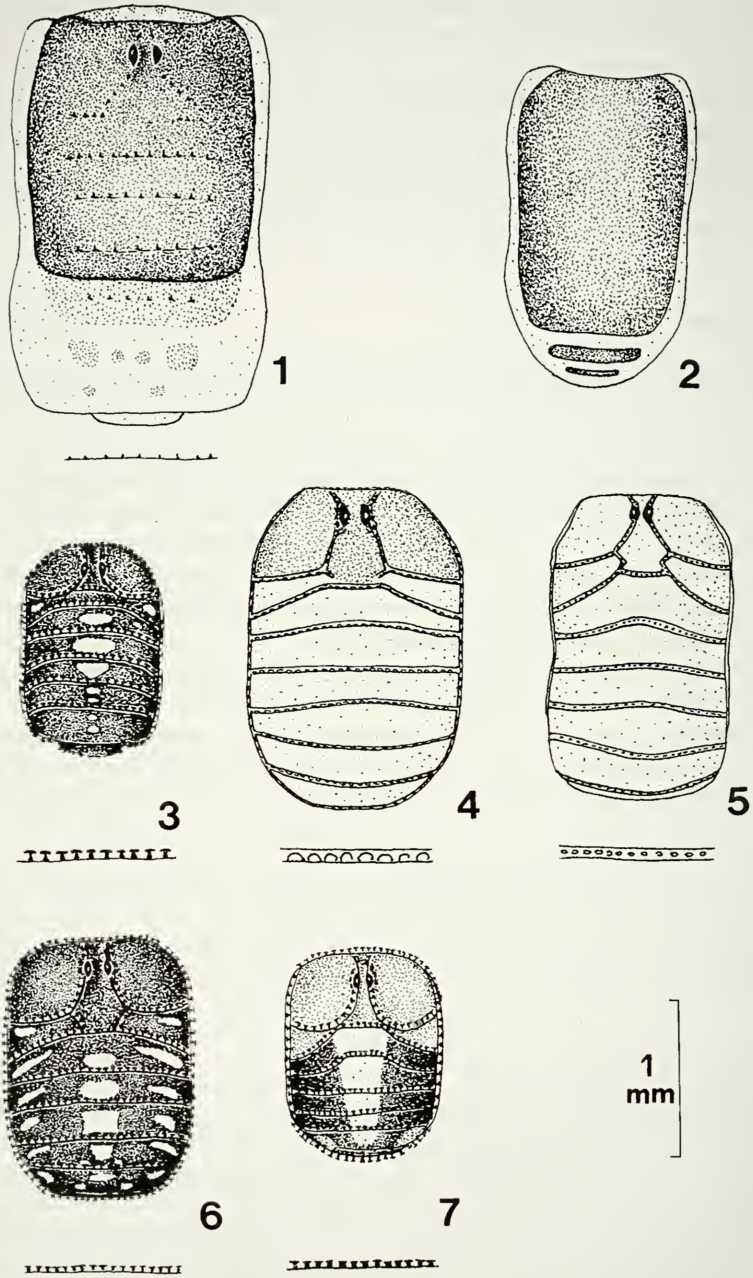
Examined material: 1 ♂ from Sardinia, Nuoro, Urzulei, Grotta Mammenone I, leg. Casale (coll. Tedeschi).

Description. General pattern of the genus. Body length 2.4 mm (♂). Colour yellow with brown scutum and a few rounded spots in the hind part. Body glabrous. Rows of modified tubercles ("processuli ancoriformes" sensu Roewer 1951; "Brückenzähne" sensu Martens 1978) very reduced, partially separating anterior areas of body only. Modified tubercles dark brown, simple, pointed at tip, each completely separated from adjacent ones, gradually decreasing in size at the sides (fig. 1). Eyes reduced, but ocular tubercle present.

Chelicera with a small, rounded apophysis at the distal extremity of segment 1 and a small tooth at the base of segment 2 (fig. 8).

Pedipalps yellowish, very elongate and slender. Legs very elongate, dark brown except trochanters, coxae and base of femora yellowish. Leg 1 of 18 articles; leg 2 measuring 28 mm. All legs with short hairs only, not interspersed with longer, sparse hairs.

Distribution. Known only from eastern Sardinia, where it lives apparently as a real troglobite. Described from the cave Grotta di San Giovanni Domusnovas (Roewer 1953), it was later reported from two other caves, Grotta Sa Oche and Grotta Toddeitto (Roewer 1956). In his catalogue of the cave arthropods from Sardinia, Cerruti (1968) quotes this species from: "Grotte di San Giovanni Ispinigòli, sa Oche e dell'Arciprete", not mentioning new specimens. The name "Grotta dell'Arciprete" indicates the same cave called "Grotta Toddeitto", but the other quotation rises a problem. In fact, the Grotta di San Giovanni Domusnovas is in the province of Cagliari, at the southern end of Sardinia, while the Grotta di San Giovanni Ispinigòli is in the province of Nuoro, at the east of the region. The most probable explanation is that Roewer has written a wrong name on the original description of the species, while Cerruti knew very well Patrizi's speleological explorations and findings. In the beginning of his work Cerruti lists the first speleological expeditions carried on in Sardinia and writes that in 1952 Patrizi explored for biospeleological purposes the caves of the province of Nuoro. So, we assume that the type-locality of this species is not the cave mentioned by Roewer, but the cave "Grotta di San



FIGS 1-7

Habitus and details of rows of modified tubercles of *M. patrizii* (1), *M. anophthalmum* (2), *M. sabbadinii* (3), *M. orobicum* (4), *M. daccordii* (5), *M. valdemonense* (6), *M. fabianae* (7).

Giovanni Ispinigòli" (= Grotta di San Giovanni su Anzu), in the province of Nuoro. Also the cave from which the specimen seen by us (Gr. Mammenone I) is in the province of Nuoro, relatively close to the three caves already known for the species.

Affinities. This species is similar in several characters to *M. anophthalmum* (Fage 1946), the only other Italian species with modifications related to troglobitic habits. The main differences, listed also in the key, are the persistence of eyes and of rows of modified tubercles. Moreover this is the largest Italian species of the genus.

Mitostoma anophthalmum (Fage, 1946) (Figs 2, 9, 15)

Examined material: 2 ♂♂ 1 ♀ from Lombardy, Bergamo, S. Omobono Imagna, Gr. dei Morti 1042 Lo/Bg, leg. Piva (coll. Muséum d'histoire naturelle, Génève, coll. Tedeschi). 1 ♂ juv. from Lombardy, Bergamo, Rota Imagna, Gr. Tomba del Polacco 1003 Lo/Bg, leg. Monzini (coll. Tedeschi). 1 ♂ 1 ♀ from Lombardy, Bergamo, Bedulita, Nala di S-Ciupì, 1245 Lo/Bg, leg. Regalin (coll. Tedeschi).

Description. Quite atypical within the genus in the total absence of rows of modified tubercles and of eyes. Body length 2.0-2.3 (♂) 2.5 (♀) mm. Body testaceous with brown scutum. Hairs absent from body and legs. Eyes completely atrophied, ocular tubercle indistinguishable (fig. 2).

Chelicera with a small, pointed apophysis at the distal extremity of segment 1 and a small tooth at the base of segment 2 (fig. 9).

Pedipalps very elongate, brown. Legs very elongate, brown. All legs with short hairs only, not interspersed with longer, sparse hairs.

Distribution. Known only from Lombardy, where it has been found in several caves in the province of Bergamo. The localities of which we directly know it are: Grotta grande della Cava di Burligo (loc. typ.), Gr. Tomba del Polacco, Gr. di Val d'Adda (MARTENS 1978), Gr. dei Morti, Nala di S-Ciupì. Other caves from which the species is known are: Fonteno, Taberna de la Bressana, 1110 Lo/Bg; Grone, Pozzo Minimale, 3740 Lo/Bg; Grone, Pozzo del Bosco Faet, 1127 Lo/Bg; Adrara San Rocco, Grotta Lacca, 1124 Lo/Bg; Vigolo, Lacca del Pirù, 3627 Lo/Bg; all Chemini det. (Regalin, in prep.). These data prove that its distribution, until now believed to be limited to the area immediately at the east of Como Lake, extends in all the Orobic Prealps as far as the Iseo Lake.

Affinities. This species is similar to *M. patrizii* Roewer, 1953, but easily distinguished by the total absence of eyes and of rows of modified tubercles. It is quite likely that this group is paraphyletic, since the characters separating the two species composing it are regressive. Anyway, missing any information on their derivation we consider the group as valid. In case that new characters or new species should be discovered allowing to better understand its affinities, we believe that they will be with the *chrysomelas*-group.

Mitostoma sabbadinii sp. n. (Figs 3, 10, 15)

Type material: Holotypus ♂ from Sardinia, Sassari, North slopes of M. Limbara, 11.XII.1992, leg. Sciaky and Sabbadini, in coll. Muséum d'histoire naturelle, Génève. Paratypes: 8 ♂♂ and 4 ♀♀ with the same data as Holotypus, in coll. Tedeschi.

Diagnosis. Only known species of *Mitostoma* of the *sabbadinii*-group, with small, dark, hairy body with withish spots and legs with long hairs interspersed with short, stiff hairs.

Description. General pattern of the genus. Body length 1.2-1.3 (♂) - 2.3-2.9 (♀) mm. Body dark brown with some whitish spots: 1 medial and two lateral on segment 1, only one medial on all other segments. Black rows of modified tubercles on posterior margin of all thoracical tergites and abdominal areae of body. Space between the anterior margin of prosoma and first row of tubercles quite large, representing nearly 1/4 of total length of body. Modified tubercles T-shaped, each well separated from adjacent ones (fig. 3).

Chelicera with a very small apophysis at the distal extremity of segment 1 and a small tooth at the base of segment 2 (fig. 10).

Pedipalps blackish, not very elongate. Legs rather short, entirely dark brown. All legs with long, sparse hairs interspersed with short, dense ones. Morphometric characters of legs as in tab. 1; number of tarsal articles and of pseudoarticulations as in tab. 4; ratios legs/body and femurs/body as in tab. 5.

Distribution. Known only from the type locality, a mountain in north Sardinia whose interesting fauna often shows Corsican affinities.

Derivatio nominis. The species is cordially dedicated to our colleague and friend Andrea Sabbadini from Milan, who collected the first specimens of the new species during a collecting trip with one of us immediately noting its interest.

Affinities. This species is very isolated within the genus. Its most peculiar character is the occurrence on all legs of long hairs interspersed with short dense ones. While in the orobicum-group the long hairs are interspersed with short, normal hairs very similar to those of all the other species, here these are transformed into spine-like hairs, short and very dense. Another peculiar character is the occurrence of a dense pubescence on all body segments, mainly ventrally, but also dorsally.

Mitostoma orobicum (di Caporiacco, 1949)

Examined material: 2 ♂♂ 1 ♀ from Lombardy, Bergamo, M. Arera, leg. Tedeschi (coll. Muséum d'histoire naturelle, Génève, coll. Tedeschi); 1 ♂ 1 ♀ from Lombardy, Bergamo, Monte Madonnino m 2300, leg. Valle, Quirci (coll. Museo Civico di Storia Naturale, Bergamo, coll. Tedeschi).

Description. General pattern of the genus. Body length 2.0 (♂) - 2.9 (♀) mm. Colour yellow-brownish, slightly darker on anterior part; ocular tubercle dark brown. Body glabrous. Rows of modified tubercles well developed, on posterior margin of all

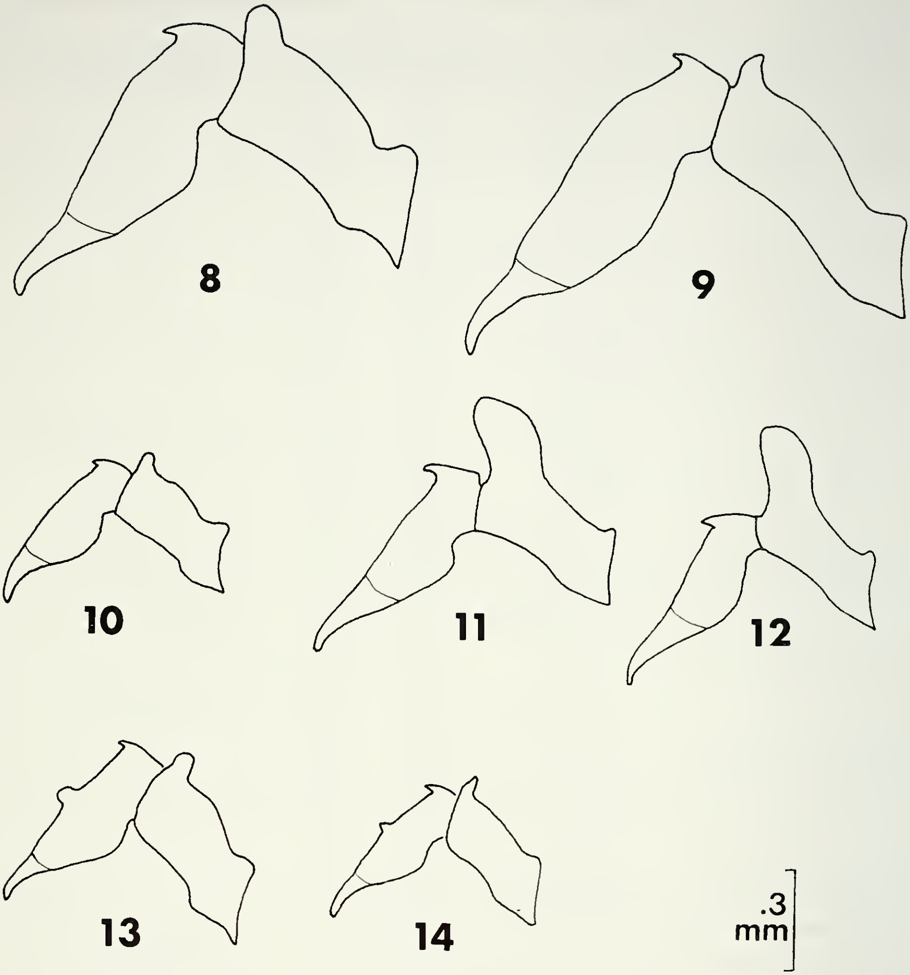
TAB. 1 - Morphometrical data of *M. sabbadinii* (in mm).

	M. sabbadinii Male	Female
Pedipalpus	2.2	3.3
Femur	0.6	1.0
Patella	0.7	1.1
Tibia	0.6	0.8
Tarsus	0.3	0.4
Leg 1 (tot.)	4.4	5.2
Trochantere	0.2	0.2
Femur	1.0	1.2
Patella	0.4	0.4
Tibia	0.9	1.0
Metatarsus	1.0	1.5
Tarsus	0.9	0.9
Leg 2 (tot.)	8.4	8.5
Trochantere	0.2	0.2
Femur	2.2	2.0
Patella	0.5	0.4
Tibia	1.8	1.6
Metatarsus	2.6	2.8
Tarsus	1.2	1.5
Leg 3 (tot.)	4.8	5.3
Trochantere	0.2	0.2
Femur	1.2	1.4
Patella	0.3	0.3
Tibia	0.9	1.0
Metatarsus	1.4	1.5
Tarsus	0.8	0.9
Leg 4 (tot.)	6.7	6.8
Trochantere	0.2	0.2
Femur	1.8	2.0
Patella	0.3	0.3
Tibia	1.2	1.3
Metatarsus	2.2	2.1
Tarsus	1.0	0.9

thoracical tergites and abdominal areae of body. Space between the anterior margin of prosoma and first row of tubercles of medium size, representing about 1/4 of total length of body. Ocular tubercle with two rows of modified tubercles. Modified tubercles dark brown, all fused, although less than in *M. daccordii*, and forming a sort of long "bridge" (fig. 4). Eyes normally developed, ocular tubercle present.

Chelicera with a very large apophysis at the distal extremity of segment 1 and a large tooth at the base of segment 2 both even larger and slightly different than in the preceding species (fig. 11).

Pedipalps brownish, elongate and slender. Legs very elongate, entirely dark brown. All legs with short hairs and longer, sparse, yellowish hairs intermingled. Morphometric characters of legs as in tab. 2; number of tarsal articles and of pseudoarticulations as in tab. 4; ratios legs/body and femurs/body as in tab. 5.



FIGS 8-14

Left chelicera in lateral view of *M. patrizii* (8), *M. anophthalmum* (9), *M. sabbadinii* (10), *M. orobicum* (11), *M. daccordii* (12), *M. valdemonense* (13), *M. fabianae* (14) (schematic, only to show position and shape of apophyses; hairs omitted).

Distribution. Known only from the type locality and a second one here mentioned for the first time, Monte Madonnino. In two nearby mountains, M. Alben and M. Presolana, there lives a species of the *chrysomelas*-group still in study.

Affinities. This species was regarded as a synonym of *M. chrysomelas* by MARTENS (1978) but was later revalidated and redescribed by CHEMINI (1985). In this work we consider these two species as forming a distinct group characterized by the occurrence of a very large apophysis on segment 1 of chelicera and of two kinds of hairs on all legs.

TAB. 2 - Morphometrical data of *M. orobicum* and *M. daccordii* (in mm).

	Male		Female	
	M. orobicum	*M. daccordii*	*M. orobicum*	*M. daccordii*
Pedipalpus	4.1	3.8	5.1	-
Femur	1.2	1.1	1.6	-
Patella	1.3	1.2	1.6	-
Tibia	1.0	1	1.3	-
Tarsus	0.6	0.5	0.6	-
Leg 1 (tot.)	8.5	7.0	8.4	-
Trochantere	0.2	0.2	0.2	-
Femur	2.3	2	2.4	-
Patella	0.4	0.4	0.5	-
Tibia	1.7	1.3	1.6	-
Metatarsus	2.4	2.0	2.4	-
Tarsus	1.5	1.1	1.3	-
Leg 2 (tot.)	14.1	9.9	13.2	-
Trochantere	0.2	0.2	0.2	-
Femur	3.5	3.0	3.5	-
Patella	0.5	0.5	0.5	-
Tibia	3.2	2.0	3.0	-
Metatarsus	4.4	3.0	4.0	-
Tarsus	2.3	1.2	2.0	-
Leg 3 (tot.)	9.2	7.0	8.4	-
Trochantere	0.2	0.2	0.2	-
Femur	2.5	2.0	2.5	-
Patella	0.4	0.3	0.5	-
Tibia	1.8	1.4	1.5	-
Metatarsus	2.8	2.0	2.5	-
Tarsus	1.5	1.1	1.2	-
Leg 4 (tot.)	11.9	7.2	10.9	-
Trochantere	0.2	0.2	0.2	-
Femur	3.5	2.0	3.5	-
Patella	0.5	0.4	0.5	-
Tibia	2.4	1.4	2.1	-
Metatarsus	3.6	2.0	3.2	-
Tarsus	1.7	1.2	1.4	-

Mitostoma daccordii sp. n. (Figs 5, 12, 15)

Type material: Holotypus ♂ from Veneto, Monti Lessini, Cima Posta, 14.VII.1971, leg. Daccordi, in coll. Tedeschi.

Diagnosis. A *Mitostoma* of the *orobicum*-group, with a very large apophysis on distal end of segment 1 of chelicere and large tooth on proximal end of segment 2; body completely yellow-brownish.

Description. General pattern of the genus. Body length 1.9 (♂) mm. Colour yellow-brownish. Body glabrous. Ocular tubercle smooth. Rows of modified tubercles well developed, on posterior margin of all thoracical tergites and abdominal areae of body. Space between the anterior margin of prosoma and first row of tubercles quite narrow, representing nearly 1/5 of total length of body. Modified tubercles dark brown, all fused and forming a sort of long "bridge" (fig. 5). Eyes normally developed, ocular tubercle present.

Chelicera with a very large apophysis at the distal extremity of segment 1 and a large tooth at the base of segment 2 (fig. 12).

Pedipalps brownish, elongate and slender. Legs very elongate, entirely brown. All legs with short hairs and longer, sparse hairs intermingled. Morphometric characters of legs as in tab. 2 (in boldface we have pointed out those that we regard as more significant differences between this species and *M. orobicum*, the only other known species of this group); number of tarsal articles and of pseudoarticulations as in tab. 4; ratios legs/body and femurs/body as in tab. 5.

Distribution. Known only from the type locality, where is sympatric with *Mitostoma* sp. (prope *chrysomelas*).

Derivatio nominis. Dedicated to our colleague and friend Dr. Mauro Daccordi, of the Museo Regionale di Scienze Naturali, Torino, who collected this interesting specimen and with his usual kindness gave it to us for study.

Affinities. This species is closely related to *M. orobicum* Caporiacco, 1949, regarded as a synonym of *M. chrysomelas* by MARTENS (1978) but revalidated and redescribed by CHEMINI (1985). In this work we consider these two species as forming a distinct group characterized by the occurrence of a very large apophysis on segment 1 of chelicera and of two kinds of hairs on all legs: long, sparse and short, dense.

Mitostoma valdemonense Marcellino, 1974 (Figs 6, 13, 15)

Examined material: 1 ♂ from Sicily, M.ti Nebrodi, Monte Soro, leg. Osella (coll. Tedeschi). 1 ♀ from Basilicata, M. Sirino, leg. Sciaky (coll. Tedeschi).

Description. General pattern of the genus. Body length 1.6 (♂) - 2.1 (♀) mm. Body blackish with silvery spots; black rows of modified tubercles on posterior margin of all thoracical tergites and abdominal areae of body. Space between the anterior margin of prosoma and first row of tubercles quite narrow, representing nearly 3/10 of total length of body. Modified tubercles T-shaped, each well separated from adjacent ones (fig. 6).

Chelicera with a small apophysis at the distal extremity of segment 1; on segment 2, beyond the basal tooth, there is a supplementary apophysis almost at middle of length (fig. 13).

Pedipalps yellow-brownish. Legs yellow-brownish. All legs only with short hairs, not interspersed with longer, sparse hairs. Morphometric characters of legs as in tab. 3; number of tarsal articles and of pseudoarticulations as in tab. 4; ratios legs/body and femurs/body as in tab. 5.

Distribution. Known until now only from a few localities in northern Sicily, on the Nebrodi mountains, and from southern Italy (Calabria) (CHEMINI 1986).

Affinities. This species is related to *M. fabianae*, with which it shares the character of the occurrence of a second apophysis near the middle of segment 2 of chelicera. Besides this, the differences are many and important both in the shape of the body and the structure of chelicere (see figs. 6-7 and 13-14).

TAB. 3 - Morphometrical data of *M. valdemonense* and *M. fabianae* (in mm).

	Male		Female	
	M. valdemonense	*M. fabianae*	*M. valdemonense*	*M. fabianae*
Pedipalpus	3.7	2.1	3.9	3
Femur	1.2	0.7	1.3	1.0
Patella	1.2	0.7	1.3	1.0
Tibia	0.9	0.5	0.9	0.7
Tarsus	0.4	0.2	0.4	0.3
Leg 1 (tot.)	8.2	6.0	6.8	6.2
Trochantere	0.3	0.3	0.3	0.3
Femur	2.6	1.6	1.8	1.7
Patella	0.4	0.3	0.4	0.4
Tibia	1.3	1.2	1.1	1.0
Metatarsus	2.3	2.0	2.0	1.9
Tarsus	1.3	0.6	1.2	0.9
Leg 2 (tot.)	13.7	6.5	11.3	11.1
Trochantere	0.3	0.3	0.3	0.3
Femur	3.4	1.9	2.8	2.7
Patella	0.4	0.3	0.4	0.4
Tibia	2.7	1.1	2.2	2.4
Metatarsus	4.7	1.9	3.6	3.6
Tarsus	2.2	1.0	2.0	1.7
Leg 3 (tot.)	8.2	6.4	6.6	6.7
Trochantere	0.3	0.3	0.3	0.3
Femur	2.4	1.7	1.6	1.2
Patella	0.4	0.3	0.3	0.4
Tibia	1.4	1.2	1.2	1.1
Metatarsus	2.5	2.0	2.1	2.5
Tarsus	1.2	0.9	1.1	1.2
Leg 4 (tot.)	11.1	9.0	8.9	8.2
Trochantere	0.3	0.3	0.3	0.3
Femur	3.2	2.9	2.3	2.2
Patella	0.4	0.4	0.4	0.4
Tibia	2.0	1.7	1.6	1.6
Metatarsus	3.5	2.5	2.8	2.5
Tarsus	1.7	1.2	1.5	1.2

Mitostoma fabianae sp. n. (Figs 7, 14, 15)

Type material: Holotypus ♂ from Tuscany, Isola d'Elba, North slopes of M. Tambora, 3.I.1992, leg. Sciaky and Polese, in coll. Muséum d'histoire naturelle, Génève. Paratypes: 3 ♂♂ and 4 ♀♀ with the same data as Holotypus, in coll. Tedeschi.

Diagnosis. A *Mitostoma* of the *valdemonense*-group, with an additional apophysis on segment 2 of chelicere, body anteriorly and medially pale reddish and laterally dark brown.

Description. General pattern of the genus. Body length 1.1-1.5 (♂) - 1.9-2.4 (♀) mm. Body anteriorly and medially pale reddish and laterally dark brown, with black rows of modified tubercles on posterior margin of all thoracical tergites and abdominal areae of body. Space between the anterior margin of prosoma and first row of tubercles very large, representing nearly 3/8 of total length of body. Modified tubercles T-shaped, each well separated from adjacent ones (fig. 7).

Chelicera with a small apophysis at the distal extremity of segment 1; on segment 2, beyond the basal tooth, there is a supplementary apophysis almost at middle of length (fig. 14).

TAB. 4 - Number of tarsal articles and of pseudoarticulations in five of the species here treated.

		Tarsal articles				Pseudoarticulations	
		leg 1	leg 2	leg 3	leg 4	Femur	Tibia
M. fabianae	♂	10	17	7	8	5; 11; 4; 7	2; 10; 0; 2
	♀	6	15	5	8	4; 10; 4; 7	0; 10; 0; 0
M. valdemonense	♂	13	22	16	14	6; 14; 6; 9	0; 9; 0; 0
	♀	11	21	15	14	4; 11; 5; 7	0; 7; 0; 0
M. daccordii	♂	11	9	14	8	2; 2; 2; 2	1; 0; 0; 0
M. orobicum	♂	10	14	13	11	2; 7; 2; 4	0; 0; 0; 0
	♀	8	11	11	9	3; 3; 3; 3	0; 0; 0; 0
M. sabbadinii	♂	9	18	8	7	3; 8; 2; 5	0; 8; 0; 0
	♀	8	12	7	7	4; 10; 3; 5	0; 6; 0; 0

Pedipalps brown. Legs brown except the distal portion of femora, that is paler. All legs only with short hairs, not interspersed with longer, sparse hairs. Morphometric characters of legs as in tab. 3; number of tarsal articles and of pseudoarticulations as in tab. 4 (in boldface we have pointed out those that we regard as more significant differences between this species and *M. valdemonense*, the only other known species of this group); ratios legs/body and femurs/body as in tab. 5.

Distribution. Known until now only from the type locality, a mountain on Isola d'Elba. No other species of this genus are known from the same island; the only Nemastomatidae reported from Isola d'Elba is *Nemastoma perfugium* Roewer, 1951. MARCELLINO (1976) regards this species as very doubtful, since it has never been found again. In any case, from the original description and drawings it is easy to see that it does not belong to the genus *Mitostoma*, but most probably to *Paranemastoma*.

Derivatio nominis: This species is dedicated to Fabiana Polese, who collected with one of us the type series of the new species.

Affinities. This species is related to *M. valdemonense* Marcellino, 1974, with which it shares the characters of the group.

FIG. 15

Distribution map of the species of *Mitostoma* dealt with in this work.

TAB. 5

Body length (in mm), ratio legs/body and ratio femurs/body in five of the species here treated.

		Body lengh	Ratio legs/body	Ratio femurs/body
M. fabianae	♂	1.3	4.6; 5.0; 4.9; 6.9	1.2; 1.5; 1.3; 2.2
	♀	2.2	2.8; 5.5; 3.0; 3.7	0.8; 1.2; 0.5; 1.0
M. valdemonense	♂	1.6	5.1; 8.6; 5.1; 6.9	1.6; 2.1; 1.5; 2.0
	♀	2.1	3.2; 5.4; 3.1; 4.2	0.8; 1.3; 0.8; 1.1
M. daccordii	♂	1.9	3.7; 5.2; 3.7; 3.8	1.1; 1.6; 1.1; 1.1
M. orobicum	♂	2.0	4.2; 7.0; 4.6; 6.0	1.2; 1.8; 1.3; 1.8
	♀	2.9	2.9; 4.6; 0.9; 3.8	0.8; 1.2; 0.9; 1.2
M. sabbadinii	♂	1.2	3.7; 7.0; 4.0; 5.6	0.8; 1.8; 1.0; 1.5
	♀	2.6	2.0; 3.3; 2.0; 2.6	0.5; 0.8; 0.5; 0.8

KEY TO THE SPECIES

1 Segment 2 of chelicera of male with one supplementary apophysis in apical half, beyond the normal basal tooth (*valdemonense*-group). 2

- Segment 2 of chelicera of male without apophysis in apical half, only with the normal basal tooth. 3

2 Body blackish with silvery spots, Sicily. *valdemonense*

- Body anteriorly and medially pale reddish and laterally dark brown, Isola d'Elba. . . . . *fabianae*

3 All legs with long hairs interspersed with normal, shorter hairs, perpendicular to the axis of the leg itself. 4

- All legs only with normal, short, decumbent hairs. 6

4 Chelicera with very large apophysis on segment 1. Body not densely pubescent. Legs long. Alps (*orobicum*-group). 5

- Chelicera with small apophysis on segment 1. Body densely pubescent. Legs short. Sardinia (*sabbadinii*-group). . . . . *sabbadinii*

5 Ocular tubercle with two rows of modified tubercles. Leg 2 longer (14 mm); tarsus 1 of 14 articles. Orobic Prealps. *orobicum*

- Ocular tubercle smooth. Leg 2 shorter (10 mm); tarsus 1 of 21 articles. Venetian Prealps. . . . . *daccordii*

6 Eyes of normal size. Chelicera shorter. Rows of modified tubercles developed and complete. . . . . *chrysomelas*-group

- Eyes reduced or absent. Chelicera very long. Rows of modified tubercles reduced or absent (*anophthalmum*-group). 7

7 Eyes reduced but still distinct. Sardinia. . . . . *patrizii*

- Eyes completely absent. Lombardy. . . . . *anophthalmum*

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REVUE SUISSE DE ZOOLOGIE 104 (3): 517-522; septembre 1997

Pauropus furcifer Silvestri (Pauropodidae, Pauropoda): towards an adaptation for life in caves

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Pauropus furcifer **Silvestri (Pauropodidae, Pauropoda): towards an adaptation for life in caves.** - A cave-dwelling population of *Pauropus furcifer* Silvestri (Pauropodidae, Pauropoda) has been found in the Zlotska Pećina Cave, near Bor, East Serbia, Yugoslavia. Some morphological traits of the specimens studied may demonstrate adaptations of this population for life underground. Additionally, some taxonomical and biogeographical features of this pauropod species have been discussed in view of the evolution of the underground karst relief in the Balkan Peninsula.

Key-words: taxonomy - biogeography - evolution - cave fauna - Pauropoda.

INTRODUCTION

Despite the enormous growth of ecological investigations in recent decades, pauropods have seldom received attention. This is remarkable because they inhabit strata from litter to subsoil and are more or less associated with many groups of soil-living organisms. The reasons may be their small body size, scattered literature, and anticipated low population density. Another reason, probably responsible for the low number of records in the biospeleological literature, is that pauropods still are unfamiliar to many, even well-trained soil zoologists. Thus, so far only 13 species (out of about 650) have been found in natural caves and mines.

CAVE-INHABITING PAUROPODA IN EX-YUGOSLAVIA

It is well-known that some species of cave-inhabiting animals occur in exceedingly low population densities while others may occur in remarkably high numbers. The Pauropoda probably belong to the former group and seem to be rare in caves, but there is no doubt that a number of subterranean species still remain to be discovered.

Manuscript accepted 23.08.1996.

Only two reports from Yugoslav caves have previously been published and those by REMY (1938: 160) and by REMY & HUSSON (1938: 3) are probably the first ones. They reported one adult female of *Pauropus furcifer* Silvestri, collected in Hercegovina (now Bosnia - Hercegovina) in 1936, 10 m from the entrance of the Šipovica Cave (Blagaj, near Mostar). Well over 20 years later ATTEMS (1959: 284, 285, 298, 319 and 397), in his report on cave animals from the Balkan Peninsula collected by Prof. Karel Absolon, published a second find: a single specimen of *Trachypauropus latzeli* (Cook) from the Bosnian cave Ivan-Pass on Mt. Ozren, near Sarajevo (REMY 1962: 75). The species reported below, *P. furcifer*, has been collected in a natural cave once earlier, in La Preste, the cave Sainte-Marie, in Pyrénées Orientales in southern France (REMY 1961) and is known also from the catacombs in Paris (REMY 1961: 86).

REMY (1962: 75) reported a single female from the Ivan-Pass Cave. Because he did not note any adaptation for life in caves, his specimen probably was epigean and had moved into the cave recently or had been introduced there. However, the specimens reported in this study, the first ones from a Serbian cave, were collected in the deeper part of a natural cave and exhibit some morphological traits which indicate adaptations for life underground.

SYSTEMATIC PART

Order Hexamerocerata

Family Pauropodidae

Pauropus furcifer Silvestri, 1902 (Figs 1 and 2)

Material examined: One male, one female, and two subadult females, from the Zlotska Pećina Cave or Gaura Lazari Cave), village of Zlot, near Bor, East Serbia, Yugoslavia; 21-22 October 1995, collected by R.N. Dimitrijević, L.R. Lučić and S.E. Makarov. The adults are deposited in the collections of the Institute of Zoology, Faculty of Biology, University of Belgrade, Belgrade, Yugoslavia; the subadults in the collections of the Muséum d'histoire naturelle, Geneva, Switzerland.

Taxonomical remarks: Although no other comparison except on the basis of literature data and our own analyses of numerous specimens from adjacent countries (mainly Greece and Italy) have been made, it is apparent that the specimens from the Zlotska Pećina Cave show clear dissimilarities if compared to their apparently conspecific and epigean forms; these differences indicate adaptations to the life in caves. Comparisons have been made only with the adult specimens.

Antennae. The ratio of the length of the flagellum F_1 of the tergal antennal branch to the length of the branch itself is higher than in epigean specimens (2.3 - 2.5 vs. 1.9 - 2.0).

Pygidium. Though the set of setae is not fully complete, the following observations are of importance. The a_2 and a_3 of the tergum are proportionally thin and the a_3 are 2.8 times as long as the a_1 vs. 1.9 - 2.5 in epigean specimens. The *st* are proportionally long and thin, more pointed and also glabrous; the ratio *st-st* / *st* is 1.2 vs. 1.4 - 1.7 in epigean material. The pubescence of the setae is conspicuously faint (Fig. 1).

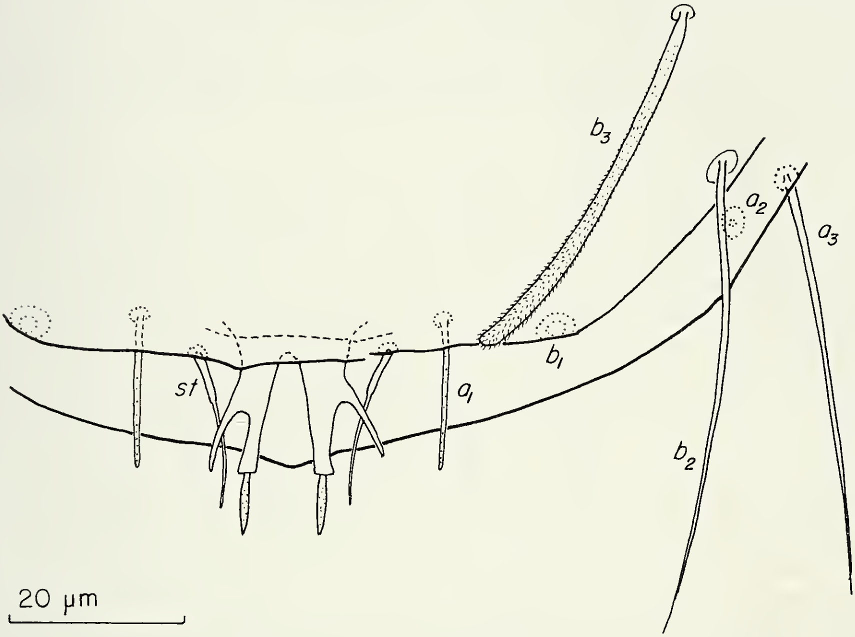

FIG. 1

Pauropus furcifer Silvestri. Adult male, from the Zlotska Pećina Cave, East Serbia, Yugoslavia. Pygidium, posterior and left part, sternal view.

The sternum too has deviating characters. The b_3 are distinctly thickened and have not the typical end-swelling of epigean specimens. A slight thickening has been stated earlier but then only in combination with an end-swelling. The anal plate is quite glabrous disregarding the distal appendages which are faintly granular.

In comparison with epigean specimens the pygidium and its setae have remarkably delicate pubescence or are quite glabrous.

General distribution: The species is West Palaearctic and is known from Great Britain, Belgium, Germany, France, Switzerland, Austria, Czech Republic, Bulgaria, Roumania, Andorra, Portugal, ex-Yugoslavia (Bosnia - Hercegovina), Spain, Italy, Greece and Algeria. Records from outside West Palaearctic (Natal, REMY 1959; New Zealand, REMY 1952) are most dubious. From the former country, Remy reported a single very defective *Pauropus* specimen, the anal plate of which is resembling the *furcifer* plate, and from the latter a juvenile specimen in very bad condition lacking the antennal branches, trichobothria, and the main part of the tergal setae.

DISCUSSION AND CONCLUSIONS

The karst terrains of East Serbia are characterized by an extremely complex and variable surface relief. The landscape is dominated by the typical karst phenomena as well as by the presence of polymorphic karstic elements (ĆURČIĆ 1990; GAVRILOVIĆ 1989). The karstic process took place in Mesozoic limestone and dolostone rocks. While the Cretaceous limestones are more abundant, the Triassic ones are less frequent. Cenozoic formations, however, are also widely distributed (ĆURČIĆ 1990; GAVRILOVIĆ 1965). These are represented mainly by the Oligocene and Neogene lacustrine sediments.

The Zlotska Pećina Cave is located on the slopes of Mt. Kučaj on the left bank of the Lazareva Dolina which is the deepest and narrowest canyon in East Serbia. This cave was formed in the limestones of the Lower Cretaceous age; actually, it is a complex underground system, a net of complicated channels and corridors. The total length of all passages is over 1,600 m (PETROVIĆ & GAVRILOVIĆ 1965; PETROVIĆ 1958), and these constitute several levels. The morphological evolution of the main channel had been largely affected by the hydrological evolution of an underground stream; due to subsequent karstification, the upper channels became dry and fossilized while the underground water is now circulating in the lowest cave horizon, which is inaccessible for visitors (PETROVIĆ 1958; GAVRILOVIĆ 1975). The cave was formed during the late diluvial phase, or at the end of the Pleistocene, when the climate changed from humid and cold into arid and warm (PETROVIĆ 1958).

The specimens of *P. furcifer* were found about 200-220 m from the entrance in deep, humid and dark channels of the cave, either on small parts of rotten wood or under stones. The occurrence of subadults indicates that the life cycle is gone through in the cave. This is strongly supported by some clear adaptations to the life underground, e.g.: the elongation of the pygidial setae *(st)*, the thickening of b_3, the reduction of pubescence (compared with the epigean forms from the Balkans), as well as the elongations in the antennae (Figs 1 and 2). Therefore, it is evident that *P. furcifer* is presently in a phase of actively colonizing a cave.

It is evident that the pauropods studied lived or originated in areas or geological epochs with a humid climate. With increasing aridity and the formation of different niches underground, this species evolved as a cave inhabitant too. Therefore, adaptation to the life in deep soil and in caves is not characteristic of a particular taxonomic group of animals but rather represents an adaptive response of the epigean and humicolous species, including pauropods, in order to survive in the conditions of a typical or modified Mediterranean climate.

Another item is worth mentioning here. The Zlotska Pećina Cave is inhabited by more than 20 different endemic and relict invertebrates including representatives of copepods, ostracods, isopods, diplopods, pseudoscorpions, collembolans, diplurans, thysanurans, and coleopterans; to these we may add the pauropods. It is already known that the better an area was sheltered from unfavourable changes, the richer it is in relict forms. This is precisely the case with the Zlot cave system. However, the question of the direct provenance of its fauna still remains open. We have every

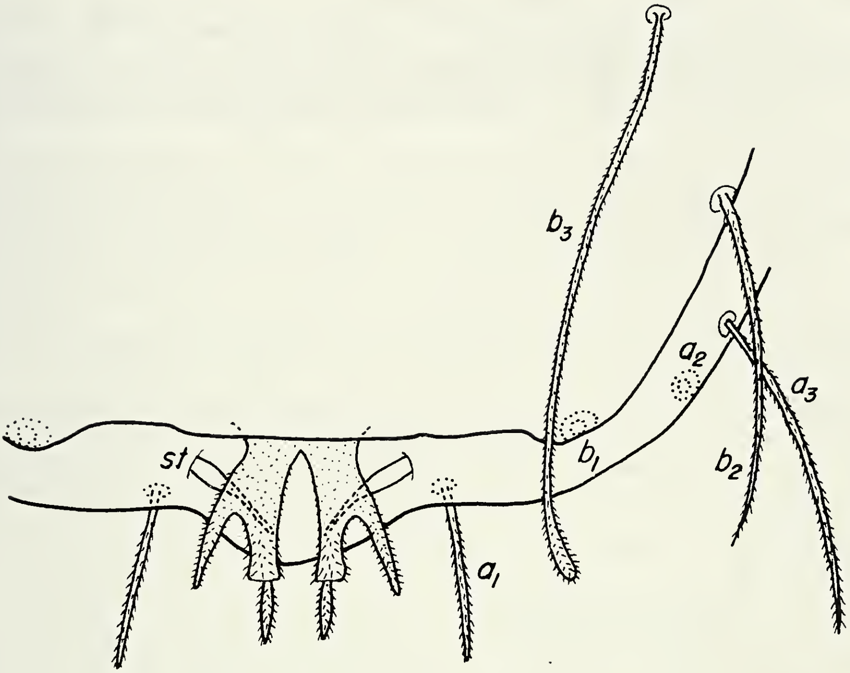

FIG. 2

Pauropus furcifer Silvestri. Adult epigean female, from Greece (Corfu, Pantokrator Massif, between Perithia and Lautse). Pygidium, posterior and left part, sternal view. Scale as in Fig. 1.

reason to assume that this living world evolved from the ancient circum-Mediterranean fauna, its origin to be sought in the proto-Balkanic region (ĆURČIĆ 1986, 1988).

ACKNOWLEDGEMENTS

This study was supported by the Serbian Ministry of Science and Technology Grant 03E03, and by the Serbian Academy of Sciences and Arts, Belgrade, Yugoslavia. We are also indebted to Dr. Rajko N. Dimitrijević and Luka R. Lučić, for collecting help of the pauropods considered herein.

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REVUE SUISSE DE ZOOLOGIE 104 (3): 523-557; septembre 1997

A revision of some West Palaearctic species of *Scopaeus* Erichson (Coleoptera, Staphylinidae, Paederinae)

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A revision of some West Palaearctic species of *Scopaeus* **Erichson (Coleoptera, Staphylinidae, Paederinae). -** Four new species are described: *S. illyricus* sp. n. from Albania, *S. loebli* sp. n. from Turkey, *S. haemusensis* sp. n. from Bulgaria and *S. cyprius* sp. n. from Cyprus. Additional 11 species are redefined, and 11 species names synonymized: *Scopaeus lemnicus* Coiffait, *S. turcicus* Coiffait, *S. ectypus* Coiffait syn. n. = *S. camenoni* Coiffait. *S. maderae* Coiffait syn. n. = *S. subopacus* Wollaston. *S. portai temperei* Coiffait, *S. portai lusitanicus* Coiffait, *S. portai marocanus* Coiffait syn. n. = *S. portai* Luze. *S. bulgaricus* Coiffait syn. n. = *S. gladifer* Binaghi. *S. bicolor kochi* Binaghi, *S. remsensis* Coiffait syn. n. = *S. signifer* Fauvel. *S. gredensis* Coiffait syn. n. = *S. hispanicus* Binaghi. *Scopaeus chalcodactylus* (Kolenati), considered a synonym of *S. minutus* Erichson, is revalidated. Lectotypes are designated for *S. cognatus* Mulsant & Rey, *S. chalcodactylus* (Kolenati), *S. minutus* Erichson, *S. minutus* var. *debilis* Mulsant & Rey, *S. minutus* var. *intermedius* Mulsant & Rey, *S. portai* Luze, *S. pusillus* Kiesenwetter, *S. signifer* Fauvel and *S. sulcicollis* Stephens.

Key-words: Staphylinidae - Paederinae - *Scopaeus* - West Palaearctic Region - taxonomy.

INTRODUCTION

Scopaeus Erichson constitutes likely the most speciose genus of the Paederines. The group is distributed throughout the tropics, subtropics and the temperate zones with about 400 described species, of which almost 80 are from the West Palaearctic Region. Judging from material examined, numerous additional species remain undescribed. Within the subtribe Scopaeina the *Scopaeus* is distinguished by a four-toothed labrum (e.g. COIFFAIT 1982, 1984) but its phylogenetic relationships are unknown. Members of *Scopaeus* are encountered mainly on damp, denuded grounds like banks and shorelands. Although they are often common the knowledge of the specific ecological requirements is as poor as the level of taxonomic treatment. Many descriptions lack

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Manuscript accepted 04.03.1997

diagnostic characters, or are incorrect. Presently, it is impossible to identify many species without a previous study of the respective type material, and a large amount of distributional data are consequently ill-based.

In order to give a more solid basis of the taxonomy and to precise the distribution pattern of the West Palaearctic species of *Scopaeus*, the author revised the relevant type material and other significant collections. Thus, the present paper is a further contribution on a revisional study of the West Palaearctic *Scopaeus* (FRISCH 1994, 1996). It gives definitions of 15 species, four of which are new, and establishes 11 new synonymies. Thus, the number of valid species occurring in the West Palaearctic (sensu COIFFAIT 1984) is reduced to 77.

METHODS

The subgenera in *Scopaeus* do not represent monophyletic groups (FRISCH 1996) and are not accepted in the present paper. The puncturation and reticulation of the body are often variable within species and of little taxonomic use. Unlike the older works, these characters are not or little used.

The terminology of the aedeagus and the genital sclerites follows FRISCH (1994, 1996) and UHLIG (1989). The fine primary setae are omitted in the drawings of sternites 8 in male. The spermatheca is composed of two different parts (FRISCH 1996). The 'chamber' refers to the hollow one from which the sclerotized ductus arises; the 'process' is used for the solid one. The abdominal sternites and tergites are counted from the first morphological segment.

Measurements and ratios are defined as follows: length = interval from the apical margin of the mandibules to the end of the abdomen; forebody length = interval from the apical margin of the mandibules to the sutural margin of the elytra; length of head = interval from the apical margin of the clypeus to the posterior margin; HLW = head length : head width; PLW = pronotal length : pronotal width; HPW = width of head : pronotal width; HPL = length of head : pronotal length; PSL = pronotal length : elytral sutural length (excluding scutellum); PLL = pronotal length : elytral lateral length; ELW = elytral lateral length : elytral width; ET = eyes length : temporal length (both measured laterally); MT = mesotibial length : mesotibial width; A = length (measured without the basal and distal tapering) : width of the antennal segments 1–11; T = length : width of the central area (between sclerite margins) of the tergite 10; V = length : width of the central area of the female valve. When possible, the ratios are based on ten specimens at least, representing both sexes and exhibiting maximum variation range in size and form.

MATERIAL EXAMINED

All material mentioned was examined, unless otherwise specified. Details are given only for type material. Records are listed alphabetically, followed by acronyms of the collections in which the respective material is housed.

ASC = coll. A. Schmidt, Wetzlar
BKCB = coll. C. Brandstetter & coll. A. Kapp, Bürs
BMNH = The Natural History Museum, London
CMCB = coll. C. Morkel, Butzbach
DEIC = Deutsches Entomologisches Institut, Eberswalde
SMFD = Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt am Main
HTCO = coll. H. Terlutter, Osnabrück
ISNB = Institut Royal des Sciences Naturelles de Belgique, Brussel
JFCG = coll. J. Frisch, Gießen
JHUG = Steiermärkisches Landesmuseum Joanneum, Graz
MCSN = Museo Civico di Storia Naturale "Giacomo Doria", Genova
MHNL = Musée Guimet d'histoire naturelle, Lyon
MHNG = Muséum d'histoire naturelle, Genève
MNHN = Muséum National d'Histoire Naturelle, Paris
MMBC = Musée de Brou, Bourg-en-Bresse
MSCB = coll. M. Schülke, Berlin
NMPC = Národni Muzeum, Prague
NHMB = Naturhistorisches Museum, Basel
NHMW = Naturhistorisches Museum, Wien
SMTD = Staatliches Museum für Tierkunde, Dresden
SNMC = Slovenské narodní múzeum, Bratislava
HNHM = Hungarian Natural History Museum, Budapest
VACH = coll. V. Assing, Hannover
VGCB = coll. V. Gollkowski, Berlin
ZMAL = Zoological Museum, Academy of Sciences, St. Petersburg
ZMHB = Museum für Naturkunde, Berlin
MZLU = Zoological Museum, Lund
ZSMC = Zoologische Staatssammlung, München

TAXONOMY

Scopaeus cameroni Coiffait (Figs 1–3, 46, 61–66)

Scopaeus (Hyposcopaeus) cameroni Coiffait, 1968: 422. Holotype ♂, Turkey: Beikos, Cameron (BMNH); examined.
Scopaeus (Hyposcopaeus) lemnicus Coiffait, 1968: 421. Holotype ♂, Greece: Lemnos, Cameron (BMNH); examined. **Syn. n.**
Scopaeus (Hyposcopaeus) turcicus Coiffait, 1968: 423. Holotype ♂, Turkey: Ankara, 08.08.1960, Coiffait (MNHN); examined. **Syn. n.**
Scopaeus (Hyposcopaeus) ectypus Coiffait, 1971: 285. Holotype ♂, Bulgaria: Madara, 15.10.1970, Coiffait (MNHN); examined. **Syn. n.**

Material examined (94 specimens). Bulgaria: holotype ♂ of *S. ectypus*, Madara (MNHN): Sliven (DEIC, JFCG, NHMW). Greece: holotype ♂ and 17 paratypes of *S. lemnicus*, Lemnos (BMNH); Chalcidici (VACH); Chios (JFCG); Ikaria (ZMHB). Romania: Mehedinti (NMPC). Turkey: holotype ♂ and paratype ♀ of *S. cameroni*, Beikos (BMNH); holotype ♂ of *S. turcicus*, Ankara (MNHN); Ankara; Cankiri (JFCG, NMPC); Izmir (MHNG, ZMHB).

Description. Length 2.9–3.2 mm; forebody 1.5–1.8 mm. Body uniformly brown, abdomen blackish. Appendages light brown. Tempora slightly widened, posterior margin of head weakly concave. Eyes length slightly longer than half of temporal length. Elytra about 1.25 as long as pronotum, along suture about 1.1 times as long as pronotum. Metathoracic wings fully developed. Protarsomeres 1–4 in both sexes more than twice as wide as long. Mesotibia slender. Laterotergite 9 (fig. 61) with a very obtuse dorsal tooth. Sternite 8 in male (fig. 46) with a V-shaped emargination in distal third. Shape of aedeagus (figs 1-3) as in *S. armeniacus* subgroup (FRISCH 1994). Apical lobes each ventrally extended to form a slender, reversely hook-shaped spiny process, their ventral edges straight. Ventral endophallic spine curved to right in ventral view. Spermatheca (figs 64-66) large, mostly narrow, chamber triangular.

Ratios. HLW 1.08–1.11; PLW 1.13–1.19; HPW 1.09–1.16; HPL 1.0–1.08; PSL 0.88–0.97; PLL 0.7–0.78; ELW 1.2–1.28; ET 0.54–0.61; MT 5.75; A 2.2, 1.4, 1.1, 1.0, 0.9, 0.9, 0.9, 0.9, 0.9, 0.8, 1.6; T 1.7; V (♀) 5.1.

Distribution. The distribution ranges from the South Carpathians over the East Balkans and North-East Greece to West Anatolia (eastwards to Ankara) and the neighbouring Aegean islands. *Scopaeus cameroni* is known from a line east of Orsova (west of Romania) – Lemnos – Chios – Ikaria (Southern Sporades). Judging from material of the closely related species, *S. cameroni* seems to be replaced by *S. creticus* Frisch on the Aegean Cyclades and on Crete, by *S. schusteri* Scheerpeltz on Rhodes, by *S. puthzi* Frisch in South Greece and by *S. fagelianus* Coiffait in South Anatolia.

Comments. The aedeagus of the holotype of *S. cameroni* is lost. According to COIFFAIT (1968), the description of *S. lemnicus* is based on four ♂ and twelve ♀ deposited in the Cameron collection (BMNH). In fact, two additional ♀ labelled as paratypes are in the Coiffait collection (MNHN). *Scopaeus cameroni* appears to be closely related to *S. illyricus* from Albania, described below, and to *S. armeniacus* from the Caucasus region, which share a similar shape of the apical lobes of the aedeagus.

Scopaeus illyricus sp. n. (Figs 4–6)

Material examined. Holotype ♂, Albania: Elbasan, Mader (NHMW). Paratypes. Greece: 1 ♂, 1 ♀, Corfu, Paganetti (SMTD).

Description. Length 3.3 mm; forebody 1.6 mm. *Scopaeus illyricus* does not differ from *S. cameroni* by external characters, but is distinguished by shape of the aedeagus (figs 4–6). Apical lobes each extended to form a slender, hook-shaped spine, which is less curved backwards than in *S. cameroni*. Ventral margin of apical lobes not straight but concave distally.

Ratios. HLW 1.1; PLW 1.18; HPW 1.11; HPL 1.03; PSL 0.94; PLL 0.76; ELW 1.21; ET 0.54; MT 5.4; A 2.3, 1.4, 1.2, 1.1, 1.0, 1.0, 1.0, 0.9, 0.9, 0.8, 1.6.

Comments. The aedeagal characters (Figs 4–6) are similar to those in *S. cameroni* (Figs 1–3) and fit those of the *S. armeniacus* subgroup as defined in FRISCH (1994).

Scopaeus cyprius sp. n. (Figs 7–9, 47, 67–70)

Material examined. Holotype ♂, Cyprus: Troodos Mts., Agios Mamas, 450 m, 18.03.1996, collected on a very narrow, sandy bank of a small stream, Frisch (MHNG). Paratypes. 3 ♂, 8 ♀, same data as holotype, Frisch, Morkel (JFCG, CMCB).

Description. Length 3.0–3.1 mm; forebody 1.6 mm. Body uniformly light reddish brown, head in front of eyes slightly darker, abdomen blackish. Tempora weakly widened, head with a straight posterior margin. Eyes length almost half of temporal length. Elytra only 1.1 times as long as pronotum, along suture slightly shorter than pronotum. Metathoracic wings fully developed. Protarsomeres 1–4 in both sexes more than twice as wide as long. Mesotibia slender. Antennae relatively slender, segments 1–8 longer than wide, segment 10 slightly transverse. Laterotergite 9 (fig. 67) with a wave-like dorsal dilatation. Distal quarter of sternite 8 in male (fig. 47) with a V-shaped emargination. Aedeagus (figs 7–9) as in *S. elegans* group (Frisch 1994). Apical lobes narrow and parallel in lateral view, apically enlarged and rounded in dorsal view. Dorsal lobe slender, extended into a long acute spine projecting from ventral margins of apical lobes. Ventral endophallic spine hardly projecting and orientated in longitudinal direction. Phallobase with two lateral groups of minute setae. Spermatheca (fig. 70) variable in shape, with capsule and process narrow.

Ratios. HLW 1.14–1.16; PLW 1.21–1.27; HPW 1.1–1.12; HPL 1.0–1.03; PSL 1.05–1.08; PLL 0.87–0.9; ELW 1.17–1.25; ET 0.52–0.56; MT 5.6; A 2.2, 1.4, 1.5, 1.5, 1.4, 1.3, 1.1, 1.1, 1.0, 0.9, 1.4; T 2.2; V (♀) 4.6.

Comments. *Scopaeus cyprius* is a member of the *S. elegans* group (Frisch 1994), but is unique in having the apically undivided and ventrally unspined dorsal lobe of the aedeagus.

Scopaeus haemusensis sp. n. (Figs 10–12, 48, 71, 74, 75, 80)

Material examined. Holotype ♂, Bulgaria: Maglige, 07.–08.1912, Hilf (NHMW). Paratypes. 41 ♂, 58 ♀, same data as holotype (JFCG, MHNG, NHMW); 5 ♂, Kröstilea (SMTD).

Description. Length 3.0–3.3 mm; forebody 1.7–1.9 mm. Body uniformly dark brown, abdomen blackish. Elytra in apical half and along suture lightened. Appendages brown. Head widest above slightly enlarged tempora, with posterior margin straight or weakly concave. Eyes length slightly more than half of temporal length. Elytra about 1.25 times as long as pronotum, along suture slightly shorter than pronotum. Metathoracic wings fully developed. Protarsomeres 1–4 in both sexes more than twice as wide as long. Mesotibia slender. Dorsal margin of laterotergite 9 (fig. 71) enlarged and sinuate. Sternite 8 in male (fig. 48) with a V-shaped emargination for apical third. Aedeagus (figs 10–12) with characters as in *S. heinzi* subgroup (Frisch 1994). Ventral margins of lateral lobes regularly rounded with rows of short setae. Dorsal lobe broad and parallel in dorsal view, ventrally extended to form a hook-shaped, acute spine both in middle and at apex. Ventral endophallic spine orientated longitudinally and curved dorsally to apical lobes. Phallobase on both sides with a small group of minute setae. Chamber of spermatheca (fig. 80) triangular, process slender and gradually enlarged.

Ratios. HLW 1.04–1.11; PLW 1.12–1.21; HPW 1.09–1.14; HPL 1.0–1.08; PSL 0.87–0.96; PLL 0.71–0.79; ELW 1.18–1.29; ET 0.57–0.64; MT 5.78–6.38; A 2.4, 1.4, 1.3, 1.1, 1.1, 1.1, 1.0, 0.9, 0.9, 0.9, 1.8; T 1.7; V (♀) 5.0.

Comments. I am unable to locate the Bulgarian type-locality "Kröstilea". *Scopaeus haemusensis* may be placed in the *S. heinzi* subgroup of the *S. elegans* group (Frisch 1994). It shares the narrow, two-spined dorsal lobe of the aedeagus with *S. heinzi* Korge from South-East Anatolia. *Scopaeus haemusensis* appears to be also very close to *S. graecus* Frisch occurring in Greece and ex-Yugoslavia up to Dalmatia. *Scopaeus graecus* is very similar in external characters but may be easily distinguished by the three-spined dorsal lobe of the aedeagus.

Scopaeus pusillus Kiesenwetter (Figs 16–18, 50, 73, 78, 79, 82)

Scopaeus pusillus Kiesenwetter, 1834: 309. Lectotype ♂, Germany: Saxony (DEIC); here designated (examined).
Scopaeus (Polyodontus) pusillus; Binaghi 1935: 104.
Scopaeus (Euscopaeus) pusillus; Coiffait 1960: 285.
Scopaeus (Alloscopaeus) pusillus; Coiffait 1968: 405.
Scopaeus sulcicollis var. *pusillus*; Fauvel 1872: 29.
Scopaeus (Polyodontus) sulcicollis var. *pusillus*; Ganglbauer 1895: 530.
Scopaeus minutus var. *pusillus*; Everts 1898: 311.
Scopaeus abbreviatus Mulsant & Rey, 1854: 177; 1855: 65; synonymised with *S. pusillus* by Kraatz 1857: 708.

Material examined (892 specimens). Albania (NHMW, ZMHB). Austria: Carinthia (MHNG, NHMW, ZSMC); Burgenland (NHMW, VACH); Lower Austria (MHNG, NHMW); Styria (JHUG); Tyrol (BKCB, NHMW, VGCB); Upper Austria (NHMW); Vienna (MZLU, NHMW); Vorarlberg (BKCB, NHMW, VGCB, ZMHB). Bosnia-Hercegovina (DEIC, HNHM, MHNG, NHMW, SMTD, ZMHB). Bulgaria: Burgas; Rumelia (NMPC); Samokov (DEIC); Sofia (NMPC). Croatia (DEIC, NHMW, ZMHB). Czech Republic: Jihocesky Kraj (NMPC); Prague (NHMW). France: Haut-Rhin (MHNG); Haute Savoie (MHNG); Pyrénées (NHMW); Savoie (BMNH). Germany: lectotype ♂ of *S. pusillus*, Saxony (DEIC); Baden-Württemberg (NHMW, ZSMC); Bavaria (ZMHB, ZSMC); Brandenburg (ZMHB, ZSMC); Hesse (DEIC); Lower Saxony (MHNG, VACH); Saxony (SMTD); Thuringia (SMTD, ZMHB). Greece: Attica; Chalcidici (NHMW, VACH); Corfu (DEIC, NHMW, SMTD, ZMHB); Epirus (NHMW); Giona (JFCG); Levkas; Naxos (NHMW); Parnassus (JFCG, NHMW); Peloponnese (JFCG, NMPC); Taygetos (JFCG, NHMW); Thessalia (MHNG, NHMW). Hungary: Budapest (HNHM, ZMHB); Csongrad; Heves; Pest; Somogy (HNHM). Italy: Friuli-Venezia Giulia (MHNG); Liguria (MHNG, NHMW, SMTD, ZMHB); Lombardia (MHNG, NHMW, ZMHB); Piemonte (MHNG, NHMW, SMTD, ZMHB); Toscana (DEIC, MHNG, NHMW, ZMHB); Trentino-Alto Adige (ZMHB); Veneto (MHNG, NHMW, SMTD, ZMHB). Liechtenstein (BKCB, VACH). Macedonia (ZMHB). Poland: Silesia (ZMHB). Romania: Mehedinti (HNHM); Sibiu (NMPC); Timis (MHNG). Russia: Altai Mts.; Lake Baikal (ZMHB). Slovenia (NHMW, NMPC). Switzerland: Graubünden; Ticino (NHMB). Sweden: Kalmar Län (MZLU). Turkey: Camlidere (NMPC); Izmir; Kastamonu; Sinop (NHMW). Yugoslavia: Serbia (NHMW, ZMHB).

Description. Length 2.8–3.4 mm; forebody 1.5–1.8 mm. Body brown to dark brown, elytra slightly darker, abdomen blackish. Appendages light yellowish-brown. Puncturation on elytra dense and relatively coarse. Tempora distinctly enlarged, posterior margin of head slightly concave. Eyes half or almost half length of tempora. Elytra usually about 1.1 times as long as pronotum, along suture up to 0.2 times shorter than pronotum. Specimens with elytra 1.25 times as long as pronotum are known from Greece (NHMW). Metathoracic wings fully developed. Protarsomeres

1–4 in both sexes twice as wide as long. Mesotibia notably thickened, about five times longer than wide. Dorsal margin of laterotergite 9 smooth (fig. 73). Tergite 10 (fig. 78) parallel-sided. Sternite 8 in male (fig. 50) with a triangular emargination in distal fifth. Apical lobes of aedeagus (figs 16–18) each extended to form a slender, right-angled, dorsal spiny process, ventral margins of apical lobes each with a very deep, narrow, oblique incision. Dorsal lobe short, divided apically and extended terminally into two ventral processes. Ventral endophallic process discoid in lateral view. Lateral lobes well developed, each bearing an apical group of long setae and some very short ventral setae. Spermatheca (fig. 82) with narrow, slightly curved capsule and process.

Ratios. HLW 1.06–1.16; PLW 1.19–1.27; HPW 1.08–1.2; HPL 0.98–1.05; PSL 0.97–1.25; PLL 0.77–0.98; ELW 1.12–1.21; ET 0.44–0.51; MT 4.6–5.63; A 2.2, 1.4, 1.2, 1.0, 1.0, 1.0, 1.0, 0.9, 0.9, 0.8, 1.6; T 2.1; V (♀) 5.8.

Distribution. *Scopaeus pusillus* is a widespread species. It is known from most parts of the West Palaearctic area and from Altai and Baikal, but is absent from North Africa, the Iberian Peninsula, the Caucasus and the Middle East. *Scopaeus pusillus* has been recorded from southern Fennoscandia (Lindroth 1960; Palm 1963; Horion 1965), and specimens from South Sweden (Östergötland) have been examined by the author. The record for the British Isles (Coiffait 1984) is doubtful, as British authors have not recorded that species. Brakman (1966) recorded the species from the Netherlands. *Scopaeus pusillus* is common on the Balkans reaching the Peloponnese and the Aegean islands. In Italy it is known southwards to the Perugia region in the Central Apennine Mountains (Binaghi 1935). On the Iberian Peninsula *S. pusillus* is replaced by *S. pusilloides* (Frisch 1997), which has been misidentified and recorded as *S. pusillus* from Madrid by Outerelo (1981). The available data from Anatolia indicate a distribution throughout the northwest up to Kastamonu. Records from the Caucasus (Binaghi 1935; Coiffait 1968, 1984; Horion 1965) refer to *S. chalcodactylus*. Thus, Bohác (1985*a*, *b*) characterizes incorrectly *S. pusillus* as an Euro-Caucasian species.

Bionomics. *Scopaeus pusillus* is a thermo-hygrophilous inhabitant of banks obviously distinguished from most *Scopaeus* species in that it also inhabits dry areas. Bohác (1985*a*, *b*), Horion (1965) and Koch (1989) consider *S. pusillus* a xerothermophilous species inhabiting mainly dry hillsides, meadows or man-made sites such as gravel pits and brickworks. Bohác (1985*a*) consideres the species typical for extremely dry forest-steppe habitats. The author collected *S. pusillus* repeatedly below stones and in gravel on damp, stony shorelands and banks of rivers and small streams. Obviously it avoids very wet areas close to the water. The presumed myrmecophily of *S. pusillus* (Horion 1965; Koch 1989) has not been confirmed since Kiesenwetter (1843), who recorded this species from nests of *Formica rufa* Linné.

Comments. The original description is based on five specimens from Ober-Lausitz, Saxony. This material is absent from the Kiesenwetter collection (ZSMC). A specimen in the Kraatz collection (DEIC) bearing a label 'Saxon' handwritten by Kiesenwetter is obviously one of the syntypes and is designated here as lectotype.

KRAATZ (1858) mentiones to have seen two female types of *S. pusillus* which are not traceable presently. Some authors (e.g. SCHEERPELTZ 1933) placed *S. pusillus* as an infraspecific form of *S. minutus* Erichson. FAUVEL (1872, 1873), GANGLBAUER (1895) and PORTEVIN (1929) had the same opinion, but have used the name *S. sulcicollis* (Stephens) for *S. minutus*. BINAGHI (1935) revalidated *S. pusillus* and described its aedeagus. The synonymy of *S. pusillus* and *S. abbreviatus* Mulsant & Rey was first recognized by KRAATZ (1857) and was accepted by most authors. EDMONDS (1932) misinterpreted *S. abbreviatus* and used that name for dark British specimens of *S. sulcicollis*. The type material of *S. abbreviatus*, which was described after specimens from the Guillebeau collection (MMBC), is not traceable in the Guillebeau collection and in the Rey collection (MHNL).

Scopaeus chalcodactylus (Kolenati) (Figs 13–15, 49, 72, 76, 77, 81)

Lathrobium chalcodactylus Kolenati, 1846: 23. Lectotype ♂, Azerbaijan: Berg-Karabach, Kolenati (ZMHB); here designated (examined).

Scopaeus chalcodactylus; KRAATZ 1857: 708; synonymised with *Scopaeus minutus*.

Material examined (21 specimens). Azerbaijan: lectotype ♂, Berg-Karabach (ZMHB). Armenia: paralectotype ♀ (ZMAL); (NHMW). Caucasus (DEIC, JFCG, NHMW, ZMHB); Araks Valley (NMPC). Russia: Crimea, Laila Mts. (NHMW).

Description. Similar to *S. pusillus* from which it differs as follows: Length 2.8-3.2 mm; forebody 1.6–1.7 mm. Body and appendages slightly lighter. Forebody usually uniformly brown or light brown, elytra rarely darker. Mesotibia slightly stouter. Dorsal margin of laterotergite 9 (fig. 72) slightly angled. Emargination of sternite 8 in male (fig. 49) somewhat wider. Apical lobes of aedeagus (figs 13–15) more parallel in dorsal view, each with notably broader dorsal spiny process (lateral view), their ventral incision broader and transversely orientated. Dorsal lobe more deeply divided at apex, ventral endophallic process shorter. Spermatheca (fig. 81) with capsule and process broader and stronger curved.

Ratios. HLW 1.05–1.14; PLW 1.16–1.23; HPW 1.09–1.13; HPL 1.0–1.03; PSL 1.08–1.18; PLL 0.86–0.94; ELW 1.08–1.17; ET 0.46–0.5; MT 4.36–5.0; A 2.4, 1.4, 1.5, 1.3, 1.0, 1.0, 0.9, 0.9, 0.9, 0.8, 1.4; T 2.0; V (♀) 5.7.

Distribution. Caucasus and Crimea where *S. chalcodactylus* appears to replace *S. pusillus*.

Comments. KRAATZ (1857) transferred the species from *Lathrobium* to *Scopaeus* and synonymised it with *S. minutus* Erichson. *Scopaeus pusillus* and *S. chalcodactylus* form a distinct group, presently named *S. pusillus* group. It is characterized mainly by the apical lobes of the aedeagus, each bearing a deep, narrow, ventral incision and an apicodorsal spiny process.

Scopaeus minutus Erichson (Figs 22–24, 52, 83, 86, 87, 92–94)

Scopaeus minutus Erichson, 1840: 606. Lectotype ♂, Germany: Saxony, Sächsische Schweiz, Maerkel (ZMHB); here designated (examined).

Scopaeus (Polyodontus) minutus; FAUVEL 1890: 40.
Scopaeus (Euscopaeus) minutus; COIFFAIT 1960: 285.
Scopaeus (Alloscopaeus) minutus; COIFFAIT 1968: 418.
Scopaeus sulcicollis; GEMMINGER & HAROLD 1868: 619.
Scopaeus (Polyodontus) sulcicollis; Heyden 1891: 109.
Scopaeus minutus var. *debilis* Mulsant & Rey, 1854: 183; 1855: 71. Lectotype ♂, Switzerland (MHNL); here designated (examined); synonymised with *S. minutus* by BAYFORD 1932: 258.
Scopaeus debilis; DOHRN 1858: 26.
Scopaeus sulcicollis var. *debilis*; GEMMINGER & HAROLD 1868: 619.
Scopaeus (Polyodontus) sulcicollis var. *debilis*; GANGLBAUER 1895: 530.
Scopaeus minutus var. *intermedius* Mulsant & Rey, 1854: 183; 1855: 71. Lectotype ♂, Switzerland (MHNL); here designated (examined); synonymised with *S. minutus* by BAYFORD 1932: 258.
Scopaeus intermedius; DOHRN 1858: 26.
Scopaeus sulcicollis var. *intermedius*; GEMMINGER & HAROLD 1868: 619.
Scopaeus (Polyodontus) sulcicollis var. *intermedius*; GANGLBAUER 1895: 530.
Lathrobium pumilum Heer, 1838: 236; synonymised with *S. minutus* by KRAATZ 1857: 708.
Scopaeus pumilus: REDTENBACHER 1849: 718.
Scopaeus gracilipes Edmonds, 1933: 8. Holotype ♂, England: Charmouth, 10.06.1914 (BMNH); examined; synonymised with *S. minutus* by ALLEN 1968: 204.

Material examined (564 specimens). Austria: paralectotype 1 ♀ of *S. minutus* (ZMHB); Burgenland (MHNG, NHMW, SMTD); Carinthia (HNHM, MHNG, NHMW, VACH); Lower Austria (NHMW); Styria (NHMW, ZMHB); Tyrol (NHMW); Upper Austria (NHMW); Vienna (MHNG, NHMW, SMTD); Vorarlberg (NHMV). Bosnia-Hercegovina: (DEIC, HNHM, NHMW, NMPC, SMTD). Bulgaria: Jambol (HNHM, SMTD); Sliven; Sofia (NMPC); Stara Zagora (ZMHB). Croatia: Dalmatia (NHMW, SMTD); Istria (NHMW); Slavonia (HNHM, NMPC). Czech Republic: Jihomoravsky Kraj (HNHM, NHMW, SMTD); Prague (NHMW, SMTD); Stredocesky Kraj (MHNG, NHMW). England: holotype ♂ and paratypes 3 ♀ of *S. gracilipes*, Dorset, Charmouth (BMNH). France: paralectotypes 2 ♀ of *S. minutus* var. *debilis*, Lyon; paralectotypes 2 ♂, 1 ♀ of *S. minutus* var. *intermedius*, Lyon (MHNL); paralectotype 1 ♀ of S. minutus, Paris, Aubé (ZMHB); Ain (MHNG); Allier (NHMW, ZMHB); Alpes Maritimes; Ardèche (MHNG); Beaujolais (DEIC, NHMW); Corsica (MHNG); Haute Marne (MHNG); Hautes-Pyrénées (NMPC); Isère; Provence (MHNG); Rhône (NHMW, ZMHB); Savoir (BMNH). Germany: Lectotype ♂ and paratypes 2 ♂ of *S. minutus*, Saxony (ZMHB); Baden-Württemberg (MHNG, ZMHB, ZSMC); Bavaria (SMTD, ZMHB, ZSMC); Berlin (ZMHB); Brandenburg (ZMHB, ZSMC); Lower Saxony (VACH, ZMHB); Mecklenburg-West Pomerania (ZMHB); Saxony (MHNG, SMTD, ZMHB); Saxony-Anhalt (MHNG, SMTD, ZMHB); Schleswig-Holstein (MHNG, NHMW, SMTD); Thuringia (ZMHB). Hungaria: Bács-Kiskun (VACH); Budapest (NHMW, TMP); Pest; Somogy (HNHM). Italy: Emilia-Romagna (MHNG, ZMHB); Friuli-Venezia Giulia (SMFD, ZMHB); Liguria (ZMHB); Lombardia (NHMW); Piemonte (DEIC, MCSN, MHNG); Trentino-Alto Adige (NHMW); Veneto (SMTD). Jugoslavia: Montenegro (SMTD). Poland: Cracow; Silesia (NHMW). Portugal: Coimbra (SMTD). Romania: Caras-Severin; Harghita (HNHM); South Carpathians (NHMW); Timis (MHNG); Transylvania (NHMW). Serbia: Belgrade (NMPC). Slovakia: Zapadoslovensky Kraj (MHNG). Slovenia (NHMW). Spain: Andalucia (NHMW). Switzerland: lectotype ♂ of *S. minutus* var. *intermedius*; lectotype ♂ and paralectotype 1 ♀ of *S. minutus* var. *debilis* (MHNL); Genève (MHNG); Graubünden (NHMB).

Description. Length 2.8–3.2 mm; forebody 1.5–1.8 mm. Uniformly light brown to dark brown, abdomen blackish. Elytra rarely a little darker, in dark specimens frequently lightened for more than half distal length. Appendages light yellowish-brown, in dark specimens slightly darker. Shape of head variable, tempora more or less enlarged, posterior margin of head slightly concave. Eyes about half length of tempora. Elytra variably long, about 1.1–1.25 times as long as pronotum. Brachypterous specimens frequently with reduced metathoracic wings and with elytra often narrowed at base, strongly rounded shoulders and distally widened lateral margins. Protarsomeres 1–4 in both sexes twice as wide as long. Mesotibia usually slender, but often clearly thickened. Laterotergite 9 (fig. 83) with an obtuse dorsal tooth. Sternite 8 in male (fig. 52) in distal 1/4 with a V-shaped emargination. Apical lobes of aedeagus (figs 22–24) with dorsal margins straight proximally, strongly enlarged apically, with terminally truncate apices; ventral margins each extended proximally to form a slender, apicadly curved process. Dorsal lobe very short, triangular, deeply divided apically and extended into two hook-shaped ventral spines, truncate apically in lateral view. Ventral endophallic process rounded. Lateral lobes each with an apical group of long setae. Spermatheca (figs 92–94) very slender in lateral view, variable in shape.

Ratios. HLW 1.06–1.17; PLW 1.16–1.24; HPW 1.07–1.13; HPL 0.99–1.09; PSL 0.93–1.16; PLL 0.77–0.93; ELW 1.13–1.3; ET 0.46–0.53; MT 4.78–6.25; A 2.2, 1.4, 1.1, 1.0, 1.0, 1.0, 1.0, 0.9, 0.9, 0.9, 1.6; T 1.7; V (♀) 5.9.

Distribution. *Scopaeus minutus* is distributed throughout Western and Central Europe and over large parts of Southern Europe. In the north, *S. minutus* is distributed in Denmark (HANSEN 1951), southern Finland (LINDROTH 1960) and southern Sweden (Skane, Smaland; PALM 1963). In the British Isles it is only known from the south (Western Dorset; ALLEN 1968). The known distribution in East Europe has many gaps. Records are from South Poland, Romania, Bulgaria and, according to BINAGHI (*in* HORION 1965), from the Ukraine. Southward it reaches southern Spain (Malaga), Corsica, Central Italy (Teramo; BINAGHI 1935) and Bulgaria, Serbia and Hercegovina. BOHAC (1985*b*) reports *S. minutus* for North Africa without giving more detail.

Bionomics. *Scopaeus minutus* is a thermo-hygrophilous species inhabiting damp, denuded banks of rivers and small streams (BOHÁC 1985*a*). It inhabits also secondary biotopes such as wet barrens in gravel pits or brickworks (HORION 1965). KOCH (1989) erroneously characterizes *S. minutus* as xero-thermophilous.

Comments. Prior to 1930, some authors (e.g. GEMMINGER & HAROLD 1868; FAUVEL 1872, 1873; GANGLBAUER 1895; REITTER 1906) used the name *S. sulcicollis* (Stephens) for *S. minutus*, although MULSANT & REY (1877) had already pointed out that error. EDMONDS (1931, 1932) used the name *S. minutus* for *S. ryei* Wollaston and described British specimens of *S. minutus* as *S. gracilipes*. BINAGHI (1935) used aedeagal characters in *Scopaeus* and redefined *S. minutus*. The description of *S. pumilus* (HEER 1839) lacks diagnostic characters. It is based on specimens from Bern (Switzerland), which are not traceable in ETHZ and BMNH collections. Most authors, beginning with KRAATZ (1857), treated *S. pumilus* as a junior synonym of *S. minutus*, although *S. pumilus* is a senior synonym. In absence of type material *S. pumilus* is a nomen dubium. The record of *S. armeniacus* Coiffait from Slovakia (BOHÁC 1985*b*) is based on a specimen (Roubal collection, SNMC), which proved to be a female of *S. minutus*.

Scopaeus loebli sp. n. (Figs 19–21, 51)

Material examined. Holotype ♂, Turkey: Kars, env. Karakurt, Aras river, 1400 m, 17.06.1986, Besuchet, Burckhardt, Löbl (MHNG). Paratypes. Turkey: 1 ♂, South-East Anatolia, 05.1967, Wittmer (MHNG); 1 ♂, Taurus Mts., Suluhan, 11.08.1947, Anatolia expedition of NMPC (NMPC); 1 ♂, Ankara, Cankaya, 02.07.1947, Anatolia expedition of NMPC (JFCG); Syria: 1 ♂, 6 ♀, Helfer (NHMW).

Description. Similar to *S. minutus* from which it differs as follows: Length 2.8–3.1 mm; forebody 1.5–1.7 mm. Body light brown to brown, pronotum frequently lighter, yellowish-brown. Elytra rarely darker, abdomen blackish. Appendages light yellowish-brown. Elytra shorter, about as long as pronotum, along suture up to 1/4 shorter than pronotum. Specimens with elytra distinctly longer than pronotum are not known. Metathoracic wings more or less reduced. Mesotibia often thickened. Aedeagus (figs 19–21) with dorsal margins of apical lobes strongly curved, hardly widened apically, not truncate; ventral margins each extended proximally to form a broader, more strongly curved process. Sternite 8 in male (fig. 51), lateral tergite 9, tergite 10, valve and spermatheca as in *S. minutus* (figs 52, 83, 86, 87, 92–94).

Ratios. HLW 1.06–1.14; PLW 1.18–1.25; HPW 1.09–1.21; HPL 0.99–1.03; PSL 1.08–1.25; PLL 0.9–1.02; ELW 1.1–1.18; ET 0.44–0.54; MT 4.78–5.75; A 2.5, 1.3, 1.2, 1.2, 1.2, 1.0, 0.9, 0.9, 0.9, 0.9, 1.6.

Distribution. *Scopaeus loebli* appears to replace *S. minutus* in Anatolia. It is known from the surroundings of Ankara, the Taurus Mountains and Kars. Specimens labelled "Syria" are ancient and possibly from Turkey.

Comments. The similar shape of the aedeagi of *S. minutus* and *S. loebli* indicates close relationship. *Scopaeus loebli* is dedicated to one of the collectors, Dr. Ivan Löbl.

Scopaeus subopacus Wollaston (Figs 25–27, 53)

Scopaeus subopacus Wollaston, 1860: 103. Holotype ♂, Madeira: S. Antonio da Serra, 1859, Bewicke (BMNH); examined.

Scopaeus (Euscopaeus) maderae Coiffait, 1960: 288. Holotype ♂, Madeira: Pico Ruivo, Coiffait (MNHN); examined. **Syn. n.**

Scopaeus (Alloscopaeus) maderae; COIFFAIT 1984: 187.

Material examined (2 specimens). Madeira: holotypes ♂ of *S. subopacus* (BMNH) and *S. maderae* (MNHN).

Description. Length 2.9–3.0 mm; forebody 1.6–1.7 mm. Body brown, elytra darker, except for suture and posterior margin, abdomen blackish. Appendages light brown, third segment of maxillary palpi somewhat darker. Surface notably dull, head and pronotum with dense isodiametric reticulation. Puncturation on elytra coarse, intervals variable, usually smaller than diameters. Elytral reticulation obsolete, elytra slightly more shining than head, pronotum and abdomen. Shape of head variable, tempora parallel or clearly widened, hind angles strongly rounded, posterior margin straight. Eyes about half as long as tempora. Head as long as pronotum or longer, elytra 1.2 times as long as pronotum. Metathoracic wings fully developed. Protarsomeres 1–4 twice as wide as long, mesotibia slender. Lateral tergite 9 and tergite 10 as in *S. minutus* (figs 83, 86, 87). Emargination of sternite 8 in male (fig. 53) more narrow than in *S. minutus*. Aedeagus (figs 25–27) similar as in *S. minutus*, distinguished as follows: apical lobes knife-shaped, curved ventrally, not truncate terminally, their ventral margins each extended to form a conspicuously slender, curved proximal process. Dorsal lobe with a wider incision. Ventral endophallic process strongly elongate. Female unknown.

Ratios. HLW 1.09–1.15; PLW 1.18; HPW 1.09–1.24; HPL 1.06–1.17; PSL 0.97–1.03; PLL 0.77–0.8; ELW 1.19–1.25; ET 0.45–0.5; MT 6.25; A 2.4, 1.4, 1.5, 1.4, 1.1, 1.0, 0.9, 0.9, 0.9, 0.9, 1.6.

Distribution. *Scopaeus subopacus* is known only from Madeira.

Comments. Coiffait (1984) overlooked the description of *S. subopacus*. *Scopaeus subopacus*, *S. loebli* and *S. minutus* are characterized by the aedeagi with long, slender apical lobes each bearing a slender, proximal process. These species form a distinct group named presently *S. minutus* group.

Scopaeus portai Luze (Figs 28–30, 54, 84, 88, 89, 95)

Scopaeus portai Luze, 1910: 393. Lectotype ♂, Italy: Umbria, Porta (NHMW); here designated (examined).
Scopaeus (Polyodontus) portai; Coiffait 1952: 8.
Scopaeus (Hyposcopaeus) portai; Coiffait 1960: 285.
Polyodontus portai; Ochs 1953: 5.
Scopaeus portae; Laszlo 1983: 25 (misspelling).
Scopaeus (Polyodontus) portae; Binaghi 1935: 101 (misspelling).
Scopaeus (Polyodontus) lareyniei Coiffait 1952. Holotype ♂, France: Alpes Maritimes, Vaugrenier, 22.02.1946, Laneyrie (MNHN); not examined; synonymised with *S. portai* by Ochs 1953: 6.
Scopaeus (Polyodontus) laneyriei; Coiffait 1953: 268 (misspelling).
Scopaeus (Polyodontus) portai temperei Coiffait, 1952: 5. Holotype ♂, France: Gironde, Gazinet, 24.06.1945, Tempère (MNHN); examined. **Syn. n.**
Scopaeus (Hyposcopaeus) portai temperei; Coiffait 1968: 420.
Scopaeus (Hyposcopaeus) portai lusitanicus Coiffait, 1968: 420. Holotype ♂, Portugal: Beja, Castro Verde, 07.1961, Coiffait (MNHN); examined. **Syn. n.**
Scopaeus (Hyposcopaeus) portai marocanus Coiffait, 1970: 109. Holotype ♂, Marocco: Lac Aaouat, 20.03.1968, Coiffait (MNHN); examined. **Syn. n.**

Material examined (146 specimens). France: paratype 1 ♂ of *S. lareyniei*, Gironde (MHNG); holotype ♂ (MNHN) and paratype 1 ♂ (MHNP) of *S. portai temperei*, Gironde (MNHN); Alpes Maritimes (NMPC); Pyrénées-Orientales; Var (MNHN). Italy: lectotype ♂ and paralectotypes 1 ♂, 3 ♀ of *S. portai*, Umbria (NHMW); Giglio Isl. (MCSN); Lazio (DEIC, MCSN, ZMHB); Lombardia (NHMW); Toscana (DEIC); Veneto (NHMW). Marocco: holotype ♂ of *S. portai marocanus*, Lac Aaouat (MNHN); Atlas Mts.; Chaouen; Tanger (MHNG). Portugal: holotype ♂ of *S. portai lusitanicus*, Beja (MNHN); Castelo Branco; Faro; Leiria; Lisbon; Setubal (BMNH, MHNG); Viana do Castelo (MHNG); Vila Real (BMNH, MHNG). Spain: Andalucia (DEIC, MHNG, NHMW, ZMHB); Catalonia (MHNG); Castilla-La Mancha (MHNG); Extremadura (VGCB); Valencia (MHNG). Tunisia: El Kef (MHNG).

Description. Length 2.6–3.0 mm, forebody 1.4–1.6 mm. Body dark brown, pronotum marginally lighter, abdomen blackish. Elytra blackish, with posterior margin and broad strip along suture somewhat lighter. Appendages uniformly brown. Reticulation obsolete on elytra, clearly visible on head and pronotum, rendering puncturation indistinct. Pronotum with impunctate midline area as wide as protibial base. Tempora hardly widened, posterior margin of head straight. Eyes slightly shorter than tempora. Elytra about 1.2 times as long as pronotum. Metathoracic wings fully developed. Protarsomeres 1–4 in male distinctly more than twice as wide as long, in female about twice as wide as long. Dorsal margin of laterotergite 9 (fig. 84) with a strong tooth. Sternite 8 in male (fig. 54) with a shallow, obtuse, triangular apical emargination with sinuate lateral margins. Aedeagus (figs 28–30) with apical lobes conspicuously elongate and divided into a strongly sclerotized, longitudinally undivided proximal part and a more transparent apical part; apical part narrowed basally, deeply divided dorsally and on both sides extended to form a slender ventral spine. A ventral flagellar spine projecting from the apical lobes. Ventral endophallic process hook-shaped. Lateral lobes each with an apical group of long ventral setae. Process of spermatheca (fig. 95) hardly curved, chamber conspicuously discoid.

Ratios. HLW 1.09–1.15; PLW 1.17–1.22; HPW 1.02–1.12; HPL 0.97–1.04; PSL 0.98–1.02; PLL 0.79–0.83; ELW 1.18–1.25; ET 0.52–0.58; MT 5.33–5.71; A 2.3, 1.3, 1.4, 1.1, 1.0, 1.0, 1.0, 0.9, 0.9, 1.0, 1.6; T 1.8; V (♀) 4.1.

Distribution. *Scopaeus portai* is widespread in the western Mediterranean area and is known from Italy, southern France, Iberian Peninsula and from North Africa. BINAGHI (1935) recorded the species from Algeria. In the north *S. portai* reaches Verona and Bordeaux. In Italy it is distributed southwards to Sicily (CICERONI *et al.* 1995) and reaches Istria (BINAGHI 1935).

Comments. According to the description, additional syntypes of *S. portai* are in the collection of the University of Camerino. The aedeagi of the types of the different subspecies (COIFFAIT 1952, 1968, 1970) cannot be distinguished. The description of *S. portai lusitanicus* (COIFFAIT 1968) is based on a teneral specimen. *Scopaeus portai* differs drastically from other species in aedeagal characters and appears to represent a distinct group.

Scopaeus sulcicollis (Stephens) (Figs 34–36, 56, 97)

Astenus sulcicollis Stephens, 1832: 277. Lectotype ♂, England (BMNH); examined; here designated.
Scopaeus sulcicollis; GEMMINGER & HAROLD 1868: 619.
Scopaeus (Polyodontus) sulcicollis; FAUVEL 1890: 40.
Scopaeus (s. str.) *sulcicollis*; COIFFAIT 1984: 181.
Scopaeus cognatus Mulsant & Rey, 1854: 180; 1855: 68. Lectotype ♂, France: Lyon (MHNL); here designated (examined); synonymised with *S. sulcicollis* by FAUVEL 1890: 40.
Scopaeus (Polyodontus) cognatus; HEYDEN 1891: 109.
Scopaeus (s. str.) *cognatus*; COIFFAIT 1952: 8.

Material examined (436 specimens). Austria: Carinthia (MHNG); Lower Austria (NHMW); Styria (JHUG, NHMW); Tyrol (BKCB, HTCO, MSCB, NHMW); Upper Austria (NHMW); Vienna (JHUG); Vorarlberg (BKCB, MHNG, NHMW). Belgium: Namur (SMTD). Bosnia-Hercegovina (MHNG, NHMW, SMTD). Bulgaria: Blagoevgrad (DEIC). Croatia: Dalmatia (ZMHB); Istria (MHNG). Czech Republic: Jihocesky Kraj (NMPC); Krusné Hory (NHMW);

Prague (MHNG); Stredocesky Kraj (MHNG, NHMW). England: lectotype ♂ of *S. sulcicollis*; Devon; Dorset; East Sussex; Essex (BMNH); London (BMNH, DEIC); Oxfordshire (BMNH); Surrey (BMNH); Tyne and Wear (MZLU). France: lectotype ♂ and paralectotypes 2 ♂, 1 ♀ of *S. cognatus*, Lyon (MHNL); Ain; Alpes Maritimes (MHNG); Alsace; Aisne (ZMHB); Basses-Pyrénées; Calvados (MHNG); Finistère (ZSMC); Gironde; Haute-Garonne; Hautes-Pyrénées; Isère; Paris; Rhône; Var (MHNG). Germany: Baden-Württemberg (MHNG, ZMHB, ZSMC); Bavaria (NHMW, ZMHB, ZSMC); Hamburg (MHNG); Hesse (ASCW, CMCB, DEIC, JFCG); Lower Saxony (DEIC, MHNG, ZMHB); Mecklenburg-West Pomerania (ZMHB); North Rhine-Westphalia (MZLU); Rhineland-Palatinate (ZMHB); Saxony-Anhalt (DEIC, SMTD, ZMHB); Saxony (DEIC, SMTD); Schleswig-Holstein (MHNG); Thuringia (DEIC). Greece: Olympus Mts. (JFCG). Hungary: Budapest (HNHM); Györ Moson-Sopron (MHNG); Pécs (NHMW). Italy: Calabria (DEIC); Emilia-Romagna (NHMB, ZMHB); Friuli-Venezia Giulia (SMFD, ZMHB); Liguria (MCSN, NHMW, NMPC); Lombardia (NHMW); Piemonte (DEIC, MCSN, NHMW, ZMHB); Puglia; Toscana (NHMW, SMTD); Trentino-Alto Adige (MCSN, MHNG, NHMW, ZMHB); Veneto (MHNG, NHMW). Liechtenstein (BKCB). Poland: Cracow (ZSMC); Silesia (NHMW, ZMHB). Romania: Alba (NHMW); Timis (DEIC); Transsylvania (NHMW). Slovakia: Stredoslovensky Kraj; Vychodoslovensky Kraj (ZMHB). Slovenia (NMPC, NHMW). Spain (ZMHB). Sweden: Göteborgs Län; Östergötlands Län (MZLU). Switzerland: Graubünden (NHMB, NHMW); Ticino (NHMB); Vaud (NHMW).

Description. Length 2.8–3.6 mm; forebody 1.6–1.8 mm. Body uniformly more or less dark brown. Posterior margins and suture of elytra often somewhat lighter brown, abdomen blackish. Appendages light yellowish-brown, third segment of maxillary palpi darker. Elytral puncturation coarse and dense. Tempora distinctly widened, posterior margin of head remarkably concave. Eyes about half length of tempora. Elytra short, less than 1.2 times as long as wide and about 1.1 times as long as pronotum, along suture up to 1.2 times shorter than pronotum. Metathoracic wings reduced. Protarsomeres 1–4 in both sexes widened, twice as wide as long. Mesotibia strongly widened, less than five times as long as wide. Lateral tergite 9, tergite 10 and valve as in *S. argonauta* Gusarov (figs 85, 90, 91). Laterotergite 9 (fig. 85) with small, obtuse dorsal dilatation. Sternite 8 in male (fig. 56) with a semicircular emargination in distal fifth and with two extensive, elongate depressions in distal half, which are divided by a longitudinal elevation with a posterior group of long, dark setae. Depressions without setae. Apical lobes of aedeagus (figs 34–36) with almost straight ventral margins, each extended into a short apical dent. Dorsal lobe curved ventrally, not projecting from ventral margins of apical lobes. Lateral lobes reduced, bearing short setae. Chamber of spermatheca (fig. 97) widened triangularly, process slender with parallel margins.

Ratios. HLW 1.06–1.14; PLW 1.13–1.2; HPW 1.08–1.14; HPL 1.0–1.08; PSL 1.06–1.19; PLL 0.86–0.93; ELW 1.13–1.18; ET 0.49–0.53; MT 4.25–4.73; A 2.1, 1.2, 1.4, 1.2, 1.0, 0.9, 0.9, 0.9, 0.8, 0.8, 1.7; T 1.8; V (♀) 5.5.

Distribution. *Scopaeus sulcicollis* is common in Central Europe and in temperate areas of Western Europe. It is known northwards to Newcastle near the Scottish border, Oslo (Lindroth 1960) and Dalama (Palm 1963). The eastermost data are from Estonia (Silfverberg 1992), Poland (Cracow), Hungary, Romania and Bulgaria. *Scopaeus sulcicollis* reaches in Southern Europe Calabria and Northern Greece (Olympus Mountains), but is unknown from the Iberian Peninsula and from

Mediterranean islands, except for the doubtful records from Corsica and Sardinia (PORTA 1926).

Bionomics. Unlike most *Scopaeus* species, *S. sulcicollis* is less hygrophilous and not restricted to banks or shorelands. It also occurs in dry areas like barrens, grassland and forest-steppes (BOHÁC 1985*a*; HORION 1965; KOCH 1989). In Hesse (Germany) it occurs in rather dry grassland (*Brometalia erecti*, *Arrhenatheretum elatioris*) (pers. observation).

Comments. While British authors except FOWLER (1888) interpreted *S. sulcicollis* correctly (ALLEN 1968), continental authors followed FAUVEL (1872) in applying this name to *S. minutus* and used the junior synonym *S. cognatus* for the true *S. sulcicollis*. Some authors (e.g. Binaghi 1935) ignored the latter name. Fauvel (1890) revalidated *S. minutus* early and synonymized *S. cognatus*, but some continental authors (e.g. BOHÁC 1985*b*; BOHÁC 1993; LOHSE 1964) still use the latter for *S. sulcicollis*. EDMONDS (1931, 1932, 1933) pointed out this error too. But he recorded dark specimens of *S. sulcicollis* from Britain as *S. abbreviatus*, as the author confirmed through the examination of Edmonds material.

Scopaeus argonauta Gusarov (Figs 31–33, 55, 85, 90, 91, 96)

Scopaeus (s. str.) *argonauta* Gusarov, 1992: 781.

Material studied (3 specimens). Caucasus (JFCG, NHMW).

Description. Similar to *S. sulcicollis* from which it differs as follows: Length 3.2–3.6 mm, forebody 1.8–1.9 mm. Body shape as in *S. sulcicollis*, but somewhat larger, tempora less widened. Elytra longer, about 1.2 times as long as pronotum. Metathoracic wings fully developed. Mesotibia more slender, about five times as long as wide. Sternite 8 in male (fig. 55) as in *S. sulcicollis*, but triangular emargination less rounded and entire median elevation bearing dark setae. Apical lobes of aedeagus (figs 31–33) widened distadly and truncate apically, each with a ventral emargination; dorsal lobe curved ventrally and projecting from ventral margins of apical lobes. Spermatheca (fig. 96) as in *S. sulcicollis*.

Ratios. HLW 1.1–1.12; PLW 1.16–1.17; HPW 1.08–1.1; HPL 1.03–1.06; PSL 1.0–1.04; PLL 0.8–0.81; ELW 1.19–1.21; ET 0.5–0.51; MT 4.58–5.09; A 2.1, 1.3, 1.3, 1.3, 0.9, 0.9, 0.9, 0.8, 0.8, 0.8, 1.7; T 1.8; V (♀) 5.5.

Distribution. *Scopaeus argonauta* is known from the Caucasus region only. GUSAROV (1992) described the species from Georgia (Agara), Abchasia and South Russia (Krasnodar Kraj).

Comments. *Scopaeus argonauta* appears to replace *S. sulcicollis* in the Caucasus region. Both species apparently form a distinct group, presently named *S. sulcicollis* group, which is distinguished by aedeagal characters (shape of apical lobes, apically undivided, ventrally curved dorsal lobe) and by the characterictic shape of sternite 8 of males.

Scopaeus gladifer Binaghi (Figs 37–39, 57, 98, 101, 102, 107)

Scopaeus (Polyodontus) gladifer Binaghi, 1935: 105. Holotype ♂, Romania: Tulcea, Macin, Montandon (MCSN); examined.
Scopaeus (Alloscopaeus) gladifer; COIFFAIT 1984: 185.
Scopaeus (Hyposcopaeus) bulgaricus Coiffait, 1971: 285. Holotype ♂, Bulgaria: Burgas, Jasna Poljana, 11.10.1970, Coiffait (MNHN); examined. **Syn. n.**

Material examined (9 specimens). Bulgaria: holotype ♂ of *S. bulgaricus*, Burgas (MNHN); Burgas (ZMHB). Romania: holotype ♂ and paratype 1 ♀ of *S. gladifer*, Tulcea (MCSN). Russia: Orenburg Oblast' (JFCG, NMPC). Ukraine: Laila Mts. (MHNG).

Description. Length 3.1–3.4 mm; forebody 1.6–1.9 mm. Body uniformly brown, often slightly darker, abdomen blackish. Appendages light brown, third segment of maxillary palpi darker. Tempora widened, posterior margin of head notably concave. Eyes about half as long as tempora. Pronotum with impunctate midline area as wide as half of width of protibial base. Elytra relatively long, laterally about 1.2 times as long as pronotum, along suture as long as pronotum. Metathoracic wings either fully developed or somewhat reduced. Protarsomeres 1–4 in both sexes twice as wide as long. Mesotibia widened, usually more than five times as long as wide. Laterotergite 9 (fig. 98) with an obtuse, sinuate dorsal dilatation. Sternite 8 in male (fig. 57) with a triangular distal emargination for less than 1/5 of its length. Apical lobes of aedeagus (figs 37–39) parallel and shortly rounded apically in dorsal view, narrowed gradually with hook-shaped proximal margins in lateral view. Dorsal lobe long and very slender, its distal half deeply notched longitudinally. Ventral endophallic process shortly rounded. Lateral lobes slightly extended, each bearing a row of long setae. Spermatheca (fig. 107) with chamber and process triangularly widened in dorsal view and curved in lateral view; chamber widened basally.

Ratios. HLW 1.06–1.09; PLW 1.12–1.18; HPW 1.08–1.1; HPL 0.99–1.06; PSL 0.97–1.12; PLL 0.78–0.88; ELW 1.14–1.22; ET 0.45–0.51; MT 4.9–5.56; A 2.2, 1.3, 1.1, 1.1, 1.0, 0.9, 0.9, 0.9, 0.8, 0.8, 1.7; T 1.9; V (♀) 6.0.

Distribution. *Scopaeus gladifer* is widespread in southern parts of East Europe. It is known from the Black Sea regions of Romania, Bulgaria and the Ukraine and from the Russian Samara region west of the Ural Mountains.

Comments. According to the description, an additional paratype of *S. gladifer* from Tulcea is in the Dodero collection. Also, two locotypical paratypes of *S. bulgaricus* (MNHN) have not been examined. *Scopaeus gladifer* appears to be close to *S. minutoides* Coiffait from southern Anatolia by the aedeagal characters.

Scopaeus signifer Fauvel (Figs 40–42, 59, 60, 100, 105, 106, 109)

Scopaeus signifer Fauvel, 1899: 72. Lectotype ♂, Tunisia: Gabés (ISNB); here designated (examined).
Scopaeus (s. str.) *signifer*; COIFFAIT 1968: 414.
Scopaeus bicolor kochi Binaghi (*in* KOCH 1937): 255. Holotype ♂, Libya: Fezzan, Traghen, 25.04.1936, Koch (MCSN); examined. **Syn. n.**
Scopaeus (Hyposcopaeus) remsensis Coiffait, 1973: 285. Holotype ♂, Marocco, Tarfaya, Tuisgui Rems, 25.10.1971, Coiffait (MNHN); examined. **Syn. n.**

Material examined (21 specimens). Iran: Lorestan (MHNG). Iraq: Mesopotamia (BMNH); Misan (HNHM). Israel: Galilee (JFCG, MHNG). Libya: holotype ♂ and paratypes 1 ♂, 1 ♀ of *S. bicolor kochi*, Fezzan, Traghen, 25.04.1936, Koch (MCSN). Marocco: holotype ♂ of *S. remsensis*, La' Youn (MNHN). Tunisia: lectotype ♂ and paralectotypes 1 ♂, 1 ♀ of *S. signifer*, Gabés (ISNB); paralectotype 1 ♀ of *S. signifer*, same data as lectotype (NMPC). Turkey: Adana (NMPC); Antalya (VACH).

Description. Length 3.0–3.4 mm; forebody 1.6–1.8 mm. Colour variable. Specimens from Anatolia, Iran and Irak are uniformly light yellowish-brown and likely teneral. Specimens from Tunisia are slightly darker, light brown with lighter, yellowish elytra and appendages. Specimens from Israel are brown with elytra and abdomen notably darker, appendages light brown. Puncturation on forebody relatively dense and fine. Head conspicuously slender, about 1.25 times as long as wide, hind angles strongly rounded, posterior margin straight or slightly convex. Tempora not widened, frequently somewhat narrowed behind eyes, about 1.5 times as long as eyes. Eyes large. Elytra conspicuously long, laterally 1.25 times as long as pronotum, along suture not more than 1.1 times as long as pronotum. Metathoracic wings fully developed. Protarsomeres 1–4 in both sexes twice as wide as long. Mesotibia conspicuously slender. Laterotergite 9 (fig. 100) with a strong dorsal tooth, ventral margin obtusely narrowed apically. Sternite 8 in male (fig. 60) with a wide, obtuse distal emargination. Sternite 7 (fig. 59) in male with a roughly rectangular, medioapical emargination, surrounded by long setae. Aedeagus (figs 40–42) with apical lobes and dorsal lobe short and weakly sclerotized. Apical lobes curved towards each other apically and bearing minute lateral setae, ventral margins regularly rounded. Endophallic spine long, reaching apex of apical lobes. Lateral lobes well developed, bearing each a row of long setae. Spermatheca (fig. 109) slender with chamber and process strongly curved towards each other in lateral view. Process regularly narrowed, distal half of chamber curved and widened, sclerotized ductus strong.

Ratios. HLW 1.2–1.26; PLW 1.23–1.35; HPW 1.04–1.12; HPL 1.0–1.07; PSL 0.89–0.97; PLL 0.75–0.8; ELW 1.17–1.29; ET 0.61–0.7; MT 6.13–7.14; A 2.3, 1.4, 1.5, 1.1, 1.1, 1.0, 0.9, 0.9, 0.9, 0.8, 1.8; T 2.2; V (♀) 7.3.

Distribution. *Scopaeus signifer* is widespread from southern Marocco to Libya and in Middle East.

Comments. FAUVEL (1899) mentions additional syntypes of *S. signifer* in the Alluaud collection (not examined), housed primarily in MNHN (HORN *et al.* 1960). According to KOCH (1937), the description of *S. bicolor kochi* is based on 25 specimens deposited in the Museum Pietro Rossi, Duino (not examined). Paratypes (1 ♂, 3 ♀) of *S. remsensis* (MNHN and coll. I.S.C., Rabat) have neither been examined. The shape of male sternites 7 and 8 and the aedeagal characters are similar in *S. signifer*, *S. bicolor* Binaghi, distributed in north of Italy and on the Balkans, and *S. galinae* Gusarov from Turkmenistan and Uzbekistan. These species appear to form a distinct species group, here named *S. signifer* group.

Scopaeus hispanicus Binaghi (Figs 43–45, 58, 99, 103, 104, 108)

Scopaeus (Polyodontus) hispanicus Binaghi, 1935: 98. Holotype ♂, Spain: Castilla-León, Béjar, Champion (MCSN); examined.
Scopaeus (Alloscopaeus) hispanicus; Coiffait 1968: 415.
Scopaeus (Alloscopaeus) gredensis Coiffait, 1968: 415. Holotype ♂, Spain: Castilla-León, Sistema Central, Sierra de Gredos, Franz (MNHN); examined. **Syn. n.**
Scopaeus (Hyposcopaeus) gredensis; Coiffait 1984: 196.

Material examined (67 specimens). Portugal: Beja (MHNG); Braga (MHNG); Vila Real (MHNG). Spain: holotype ♂ of *S. hispanicus*, Castilla-León (MCSN); holotype ♂ of *S. gredensis*, Sistema Central (MHNH); Castilla-León (JFCG, MHNG, MSCB).

Description. Length 2.7–3.2 mm; forebody 1.5–1.6 mm. Body dark brown, anterior third of pronotum frequently slightly lighter. Appendages light brown, third segment of maxillary palpi a little darker. Pronotum with narrow, impunctate midline area as wide as half of protibial base. Tempora slightly widened, posterior margin of head weakly concave. Eyes about as long as 0.5–0.6 of tempora. Elytra conspicuously long, laterally about as long as 1.25 times of pronotum, along suture as long as 1.1 times of pronotum. Metathoracic wings fully developed. Protarsomeres 1–4 in male more than twice as wide as long, in female about twice as wide as long. Mesotibia slender. Laterotergite 9 (fig. 99) with a strong dorsal tooth. Sternite 8 in male (fig. 58) with a triangular emargination in apical fifth, bearing two elongated, markedly light depressions separated by a darker midline. Apical lobes of aedeagus (figs 43–45) separated in a wide proximal part and a more slender, slightly sclerotized distal part. Proximal part with strongly rounded ventral margins and weakly concave dorsal margins, lateral margins slightly concave in dorsal view. Dorsal lobe long and slender, very deeply divided medially in two outwardly curved parts. Ventral spine strongly hook-shaped, forming two short apical teeth. Lateral lobes strongly elongate, without setae, slightly sclerotized and translucent at apex. Spermatheca (fig. 108) slender with shortly widened ends in dorsal view; process strongly curved, chamber approximately straight, markedly curved apically; sclerotized ductus arising from end of chamber, strong and elongate.

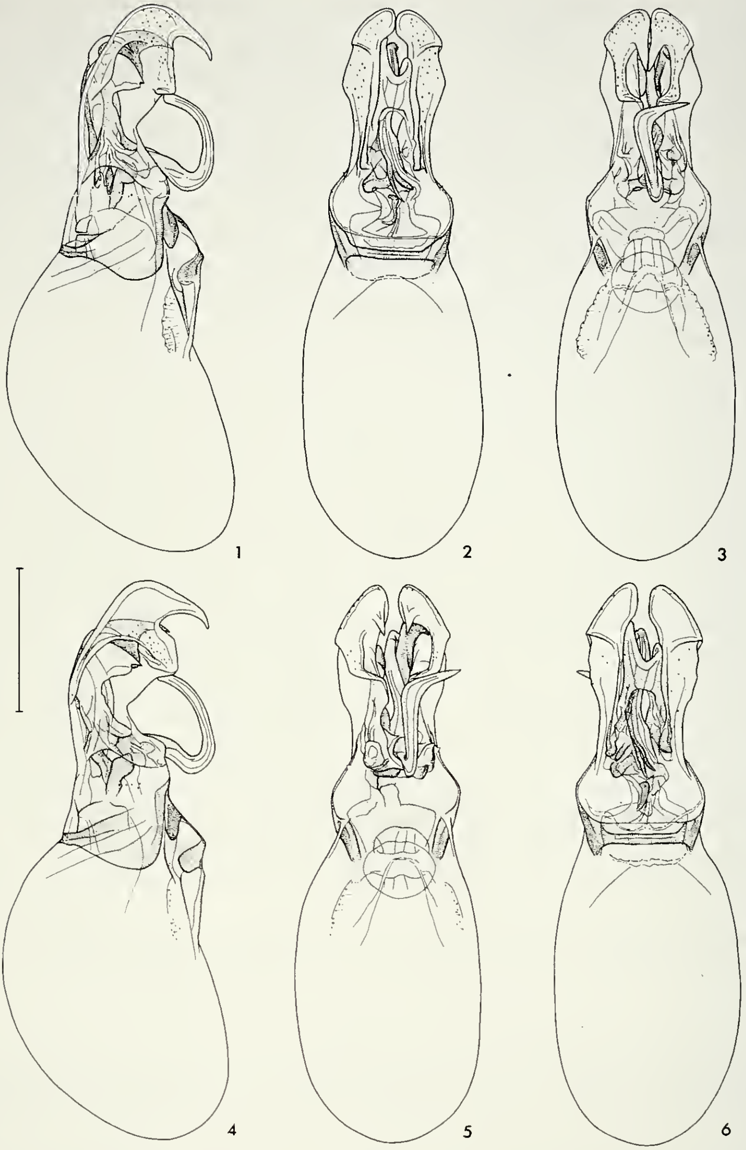
Ratios. HLW 1.11–1.16; PLW 1.13–1.22; HPW 1.04–1.12; HPL 1.02–1.07; PSL 0.88–0.97; PLL 0.71–0.78; ELW 1.2–1.25; ET 0.51–0.59; MT 5.22–6.43; A 2.1, 1.3, 1.2, 1.1, 0.9, 0.9, 0.9, 0.8, 0.8, 0.9, 1.8; T 1.8; V (♀) 7.5.

Distribution. *Scopaeus hispanicus* is known from Portugal and Central Spain (Castilla-León). It appears to be absent from north-west Spain where the related *S. franzi* Coiffait occurs.

Comments. A paratype ♂ of *S. gredensis* (MHNH) from the type locality has not been examined.

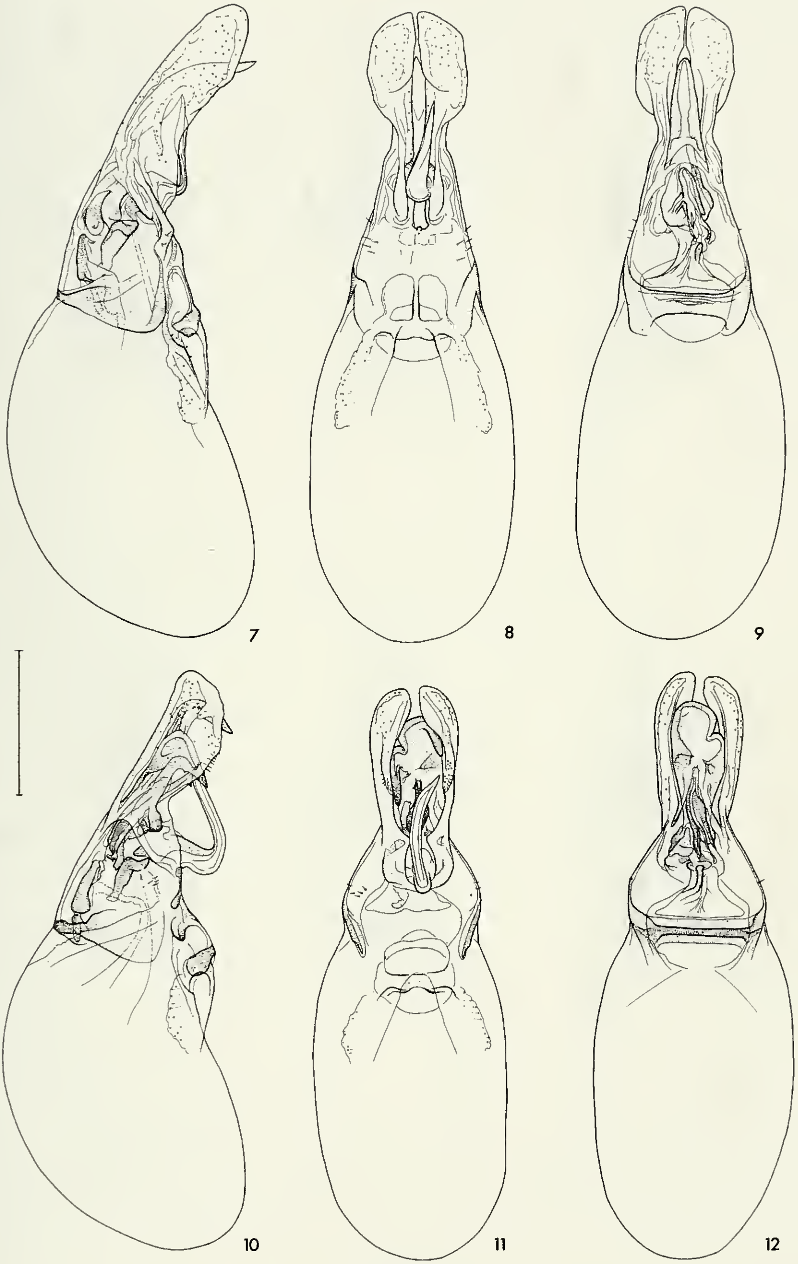
ACKNOWLEDGEMENTS

I would like to express my thanks to the following colleagues who have provided specimens for the present study: K. Adlbauer, JHUG; M. Baehr, ZSMC; N. Berti, MNHN; J. Bohác, Ceske Budejovice; M. Brancucci, NHMB; J.D. Brendell, BMNH; E. De Boise, BMNH; J. Clary, MHNL; K. Desender, JSNB; V. Gusurov, ZMAL; D. Haghebaert, ISNB; P.M. Hammond, BMNH; J. Jelinek, NMPC; I. Löbl, MHNG; B. Merz, ETH Zurich; I. Okali, SNMC; R. Poggi, MCSN; M.F. Poiret, MMBC; H. Schillhammer, NHMW; G. Szél, HNHM; M. Uhlig, ZMHB; S. Wesmanis (SMFD) and L. Zerche (DEIC). I am also indebted to C. Besuchet (MHNG), D. Burckhardt (MHNG), D. Kovac (SFM), I. Löbl (MHNG) and V. Wolters, University of Gießen, for supporting my work. Moreover, I am grateful to V. Assing, Hannover, D. Burckhardt, Geneva, S. Hille, Gießen, A. Korell, Kassel, and I. Löbl, Geneva, for comments on the manuscript. This paper is part of a project towards the degree of Ph. D. at the University of Gießen, granted by the Studienstiftung des Deutschen Volkes, Bonn-Bad Godesberg.



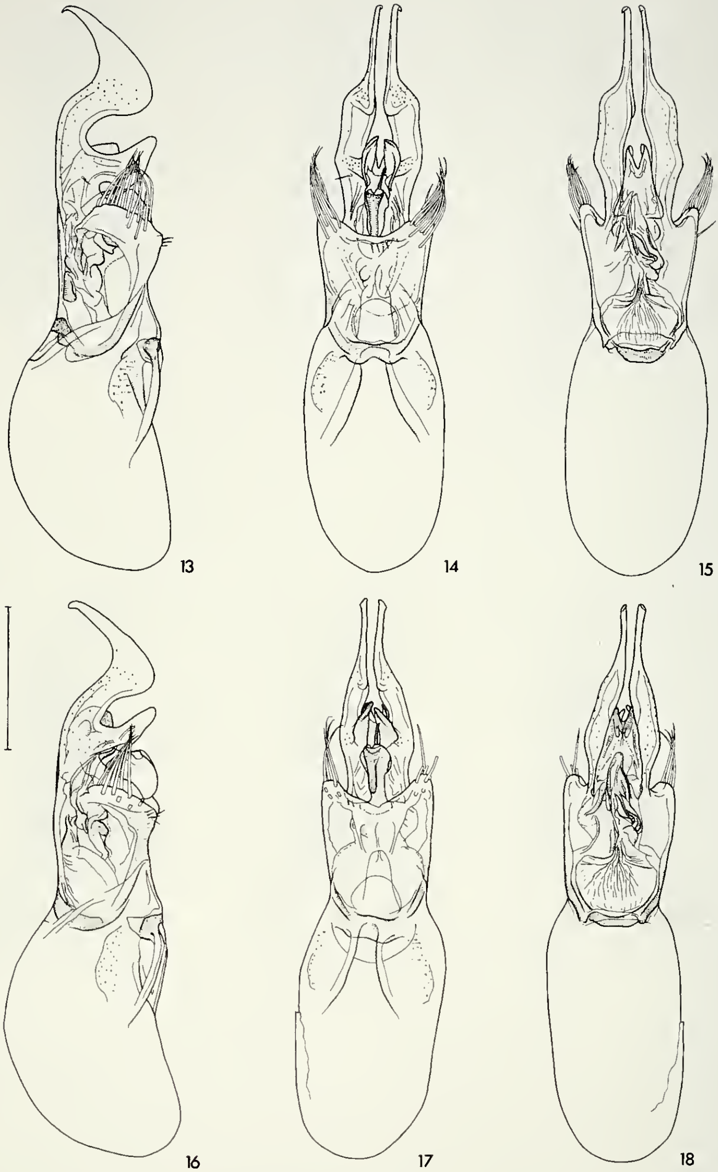
Figs 1–6

Scopaeus cameroni, ♂ paratype: aedeagus in 1) lateral, 2) dorsal, 3) ventral view. *Scopaeus illyricus* sp. n., ♂ holotype: aedeagus in 4) lateral, 5) ventral, 6) dorsal view. Scale bar = 0.1 mm.



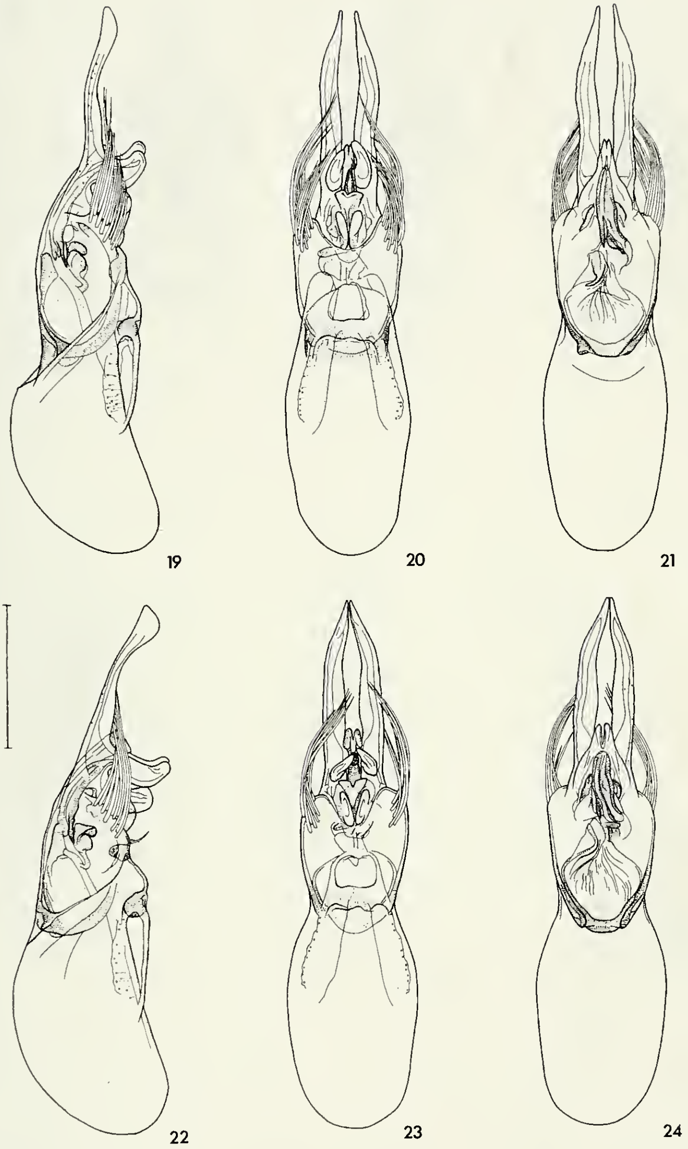
FIGS 7–12

Scopaeus cyprius sp. n., ♂ holotype: aedeagus in 7) lateral, 8) ventral, 9) dorsal view. *Scopaeus haemusensis* sp. n., ♂ holotype: aedeagus in 10) lateral, 11) ventral, 12) dorsal view. Scale bar = 0.1 mm.



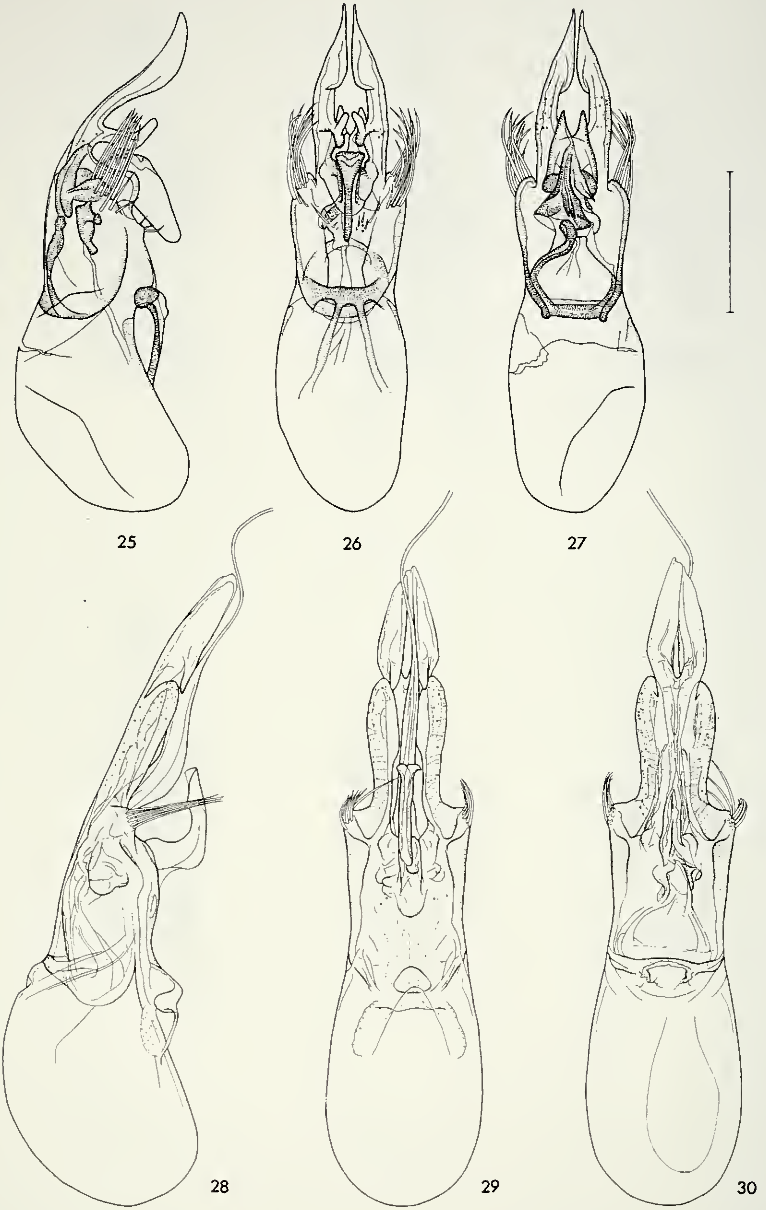
Figs 13–18

Scopaeus chalcodactylus, ♂ lectotype: aedeagus in 13) lateral, 14) ventral, 15) dorsal view. *Scopaeus pusillus*, ♂ lectotype: aedeagus in 16) lateral, 17) ventral, 18) dorsal view. Scale bar = 0.1 mm.



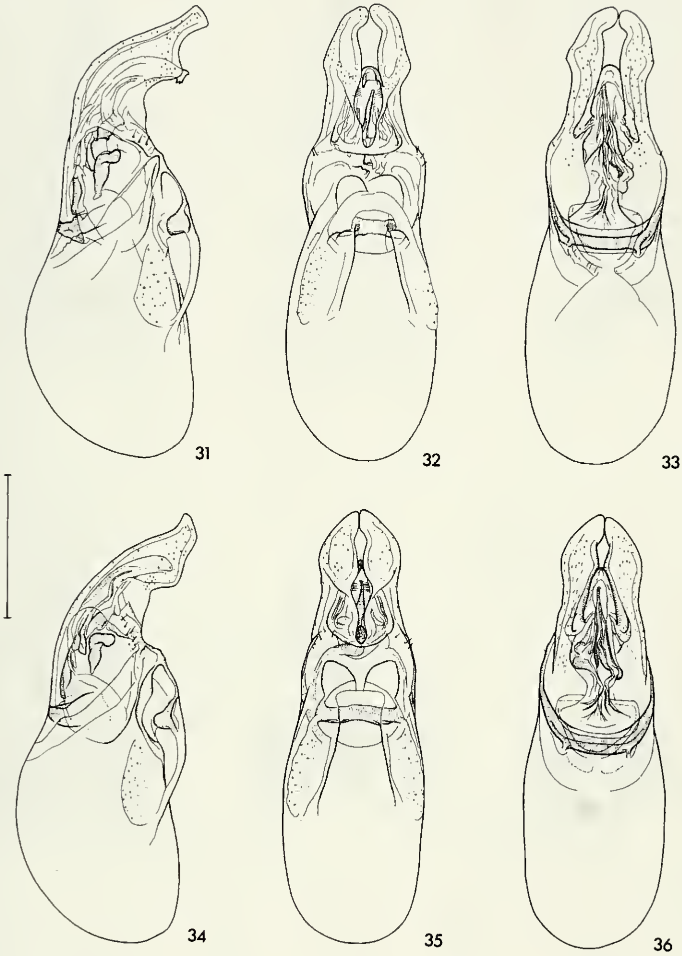
Figs 19–24

Scopaeus loebli sp. n., ♂ holotype: aedeagus in 19) lateral, 20) ventral, 21) dorsal view. *Scopaeus minutus*, ♂ lectotype: aedeagus in 22) lateral, 23) ventral, 24) dorsal view. Scale bar = 0.1 mm.



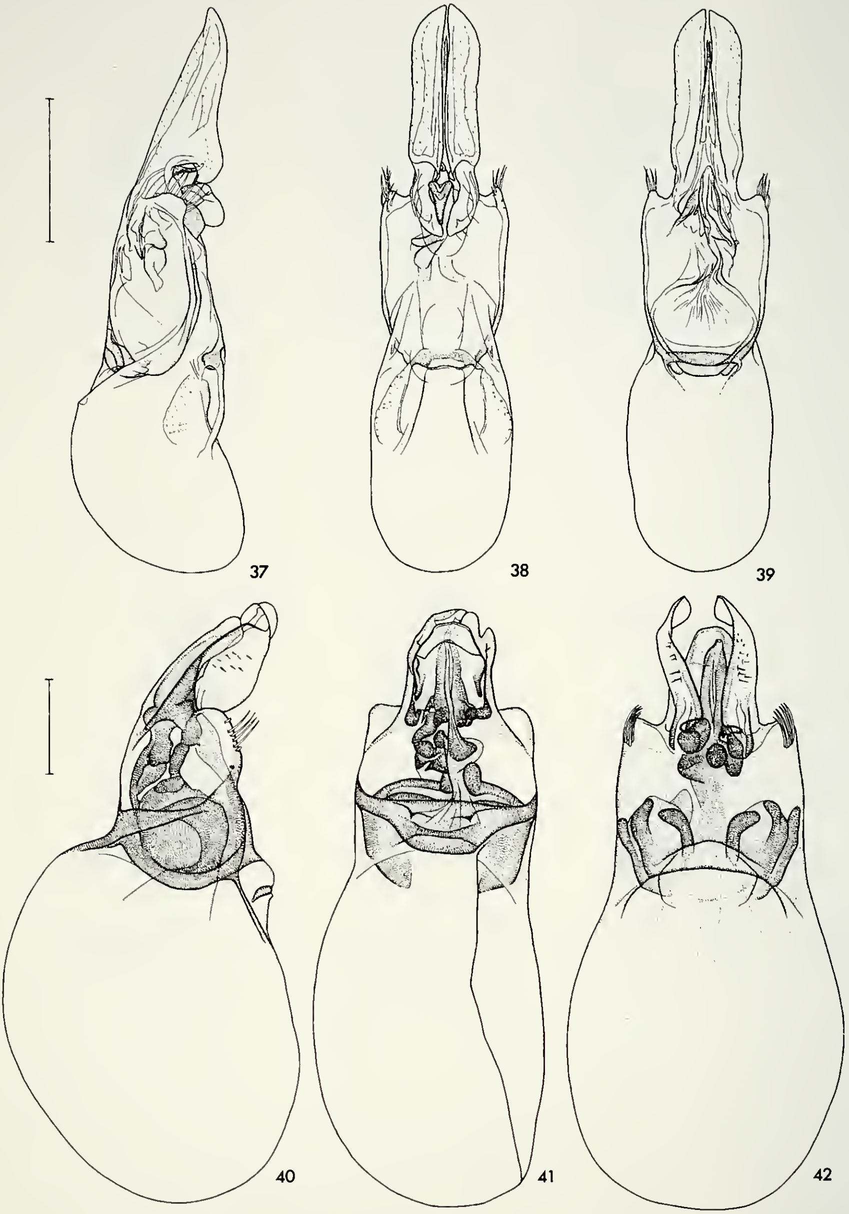
FIGS 25–30

Scopaeus subopacus, ♂ holotype of *S. maderae* syn. n.: aedeagus in 25) lateral, 26) ventral, 27) dorsal view. *Scopaeus portai*, ♂ lectotype: aedeagus in 28 lateral, 29) ventral, 30) dorsal view. Scale bar = 0.1 mm.



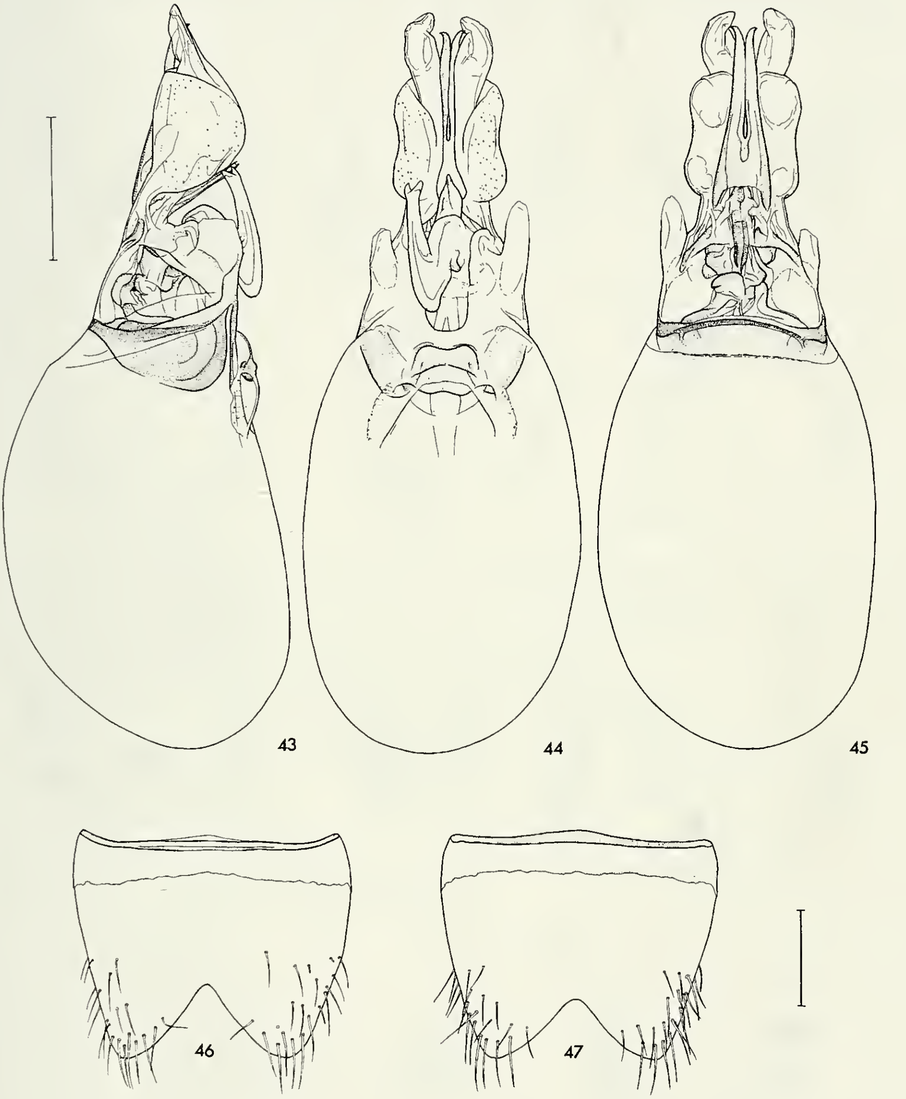
FIGS 31–36

Scopaeus argonauta, ♂, Caucasus: aedeagus in 31) lateral, 32) ventral, 33) dorsal view. *Scopaeus sulcicollis*, ♂ lectotype: aedeagus in 34) lateral, 35) ventral, 36) dorsal view. Scale bar = 0.1 mm.



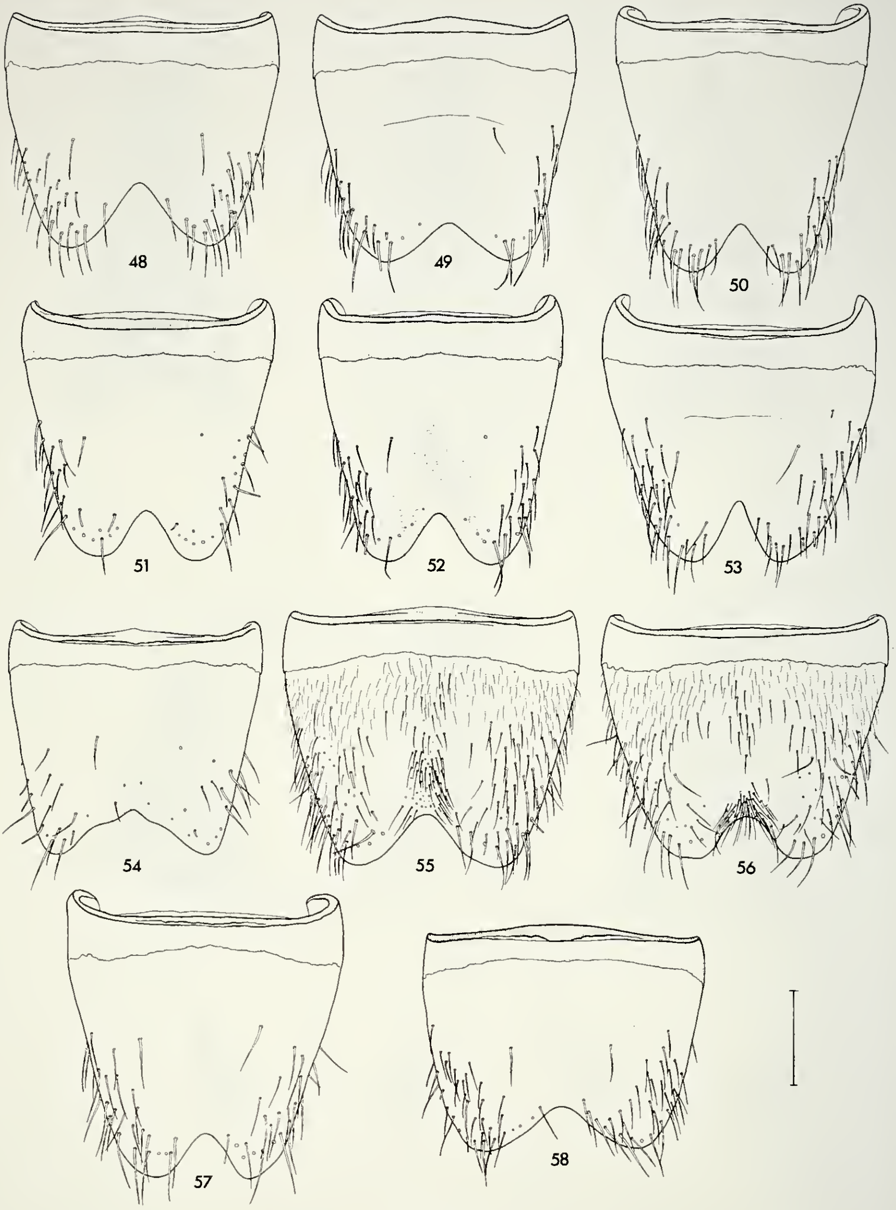
Figs 37–42

Scopaeus gladifer, ♂ holotype: aedeagus in 37) lateral, 38 ventral, 39) dorsal view. *Scopaeus signifer*, ♂ lectotype: aedeagus in 40) lateral, 41) dorsal view, ♂ paralectotype: aedeagus in 42) ventral view. Scale bar = 0.1 mm.



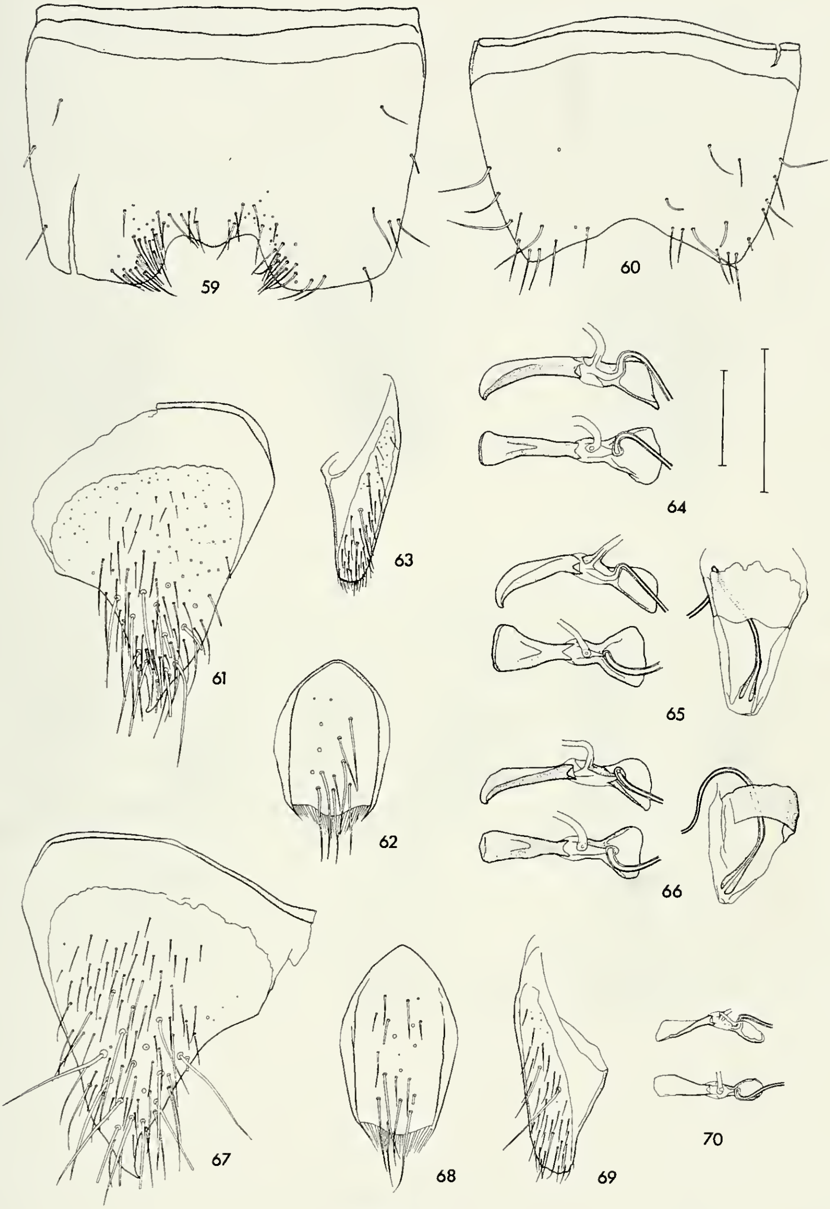
FIGS 43–47

Scopaeus hispanicus, ♂, Spain, Burgos, Sierra de Neila: aedeagus in 43) lateral, 44) ventral, 45) dorsal view. ♂ sternite 8: 46) *S. cameroni*, Turkey, Izmir. 47) *S. cyprius* sp. n., holotype. Scale bars = 0.1 mm.



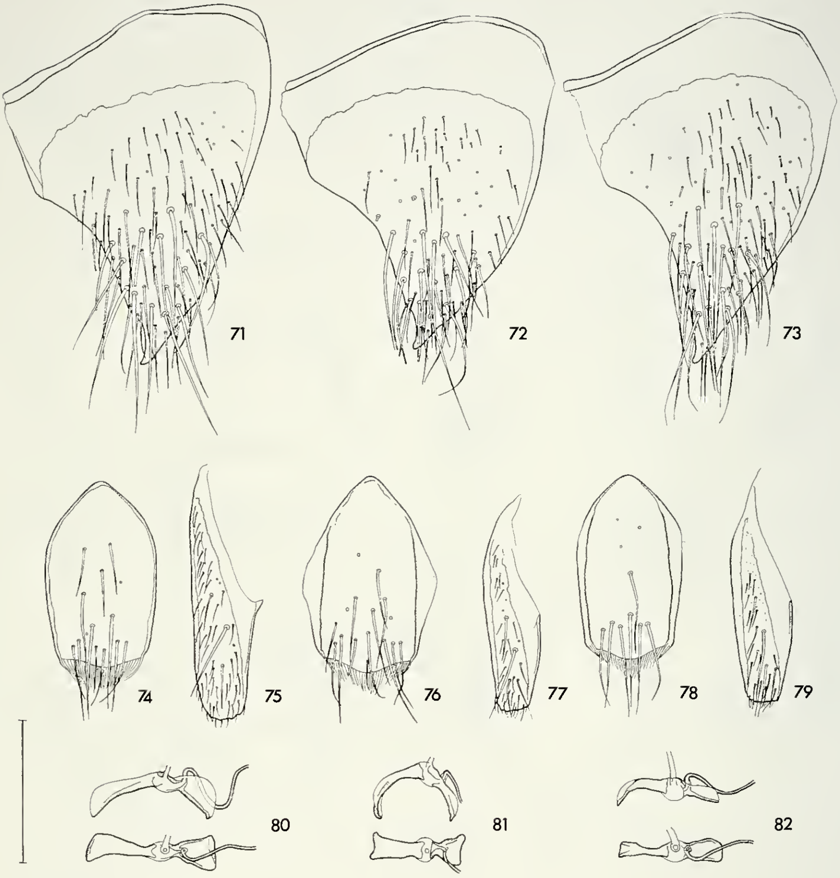
Figs 48–58

♂ sternite 8: 48) *Scopaeus haemusensis* sp. n., paratype. 49) *S. chalcodactylus*, lectotype. 50) *S. pusillus*, Greece, Peloponnese. 51) *S. loebli* sp. n., holotype. 52) *S. minutus*, lectotype. 53) *S. subopacus*, holotype of *S. maderae* syn. n. 54) *S. portai*, lectotype. 55) *S. argonauta*, Caucasus. 56) *S. sulcicollis*, Bosnia. 57) *S. gladifer*, holotype, 58) *S. hispanicus*, Spain, Burgos. Scale bar = 0.1 mm. Pubescence completly illustrated in figs 55) and 56).



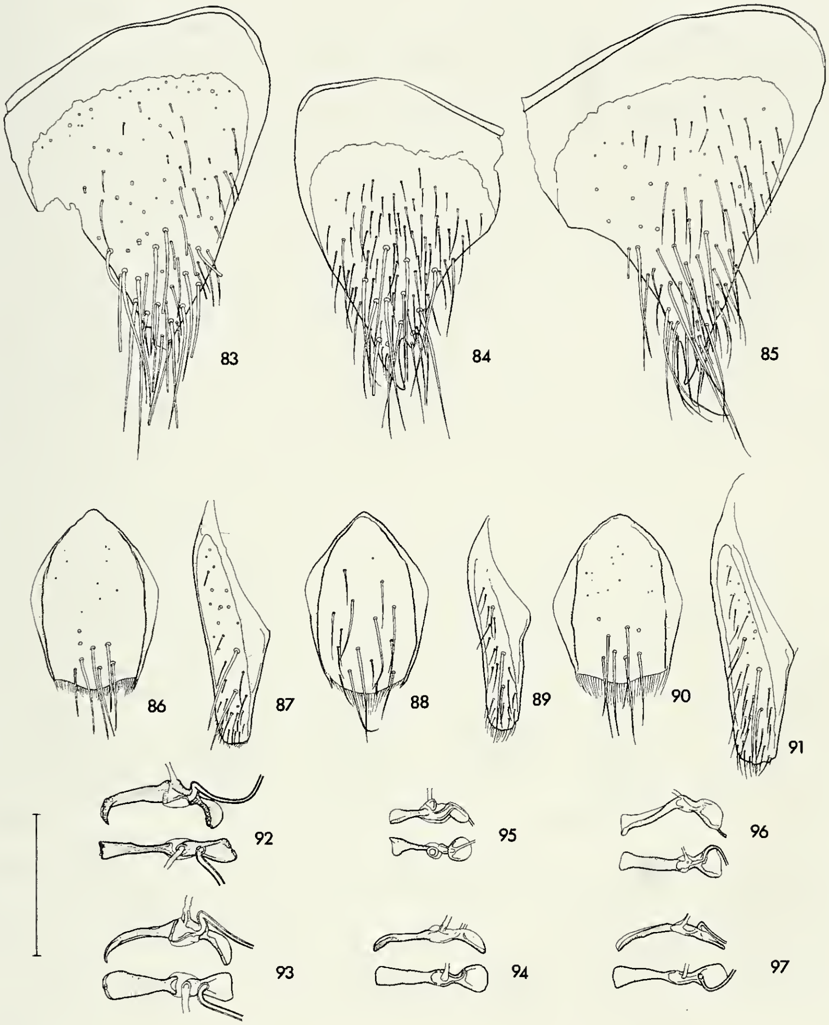
FIGS 59–70

Scopaeus signifer, paralectotype: 59) ♂ sternite 7, 60) ♂ sternite 8. *Scopaeus cameroni*, ♀ paratypes of *S. lemnicus* syn. n.: 61) laterotergite 9, 62) tergite 10, 63) valve, 64), 66) spermatheca. *Scopaeus cameroni*, ♀, Turkey, Izmir: 65) spermatheca. *Scopaeus cyprius* sp. n., ♀ paratype: 67) laterotergite 9, 68) tergite 10, 69) valve, 70) spermatheca. Figs 59–63: scale bar a), figs 64–70: scale bar b), scale bars = 0.1 mm.



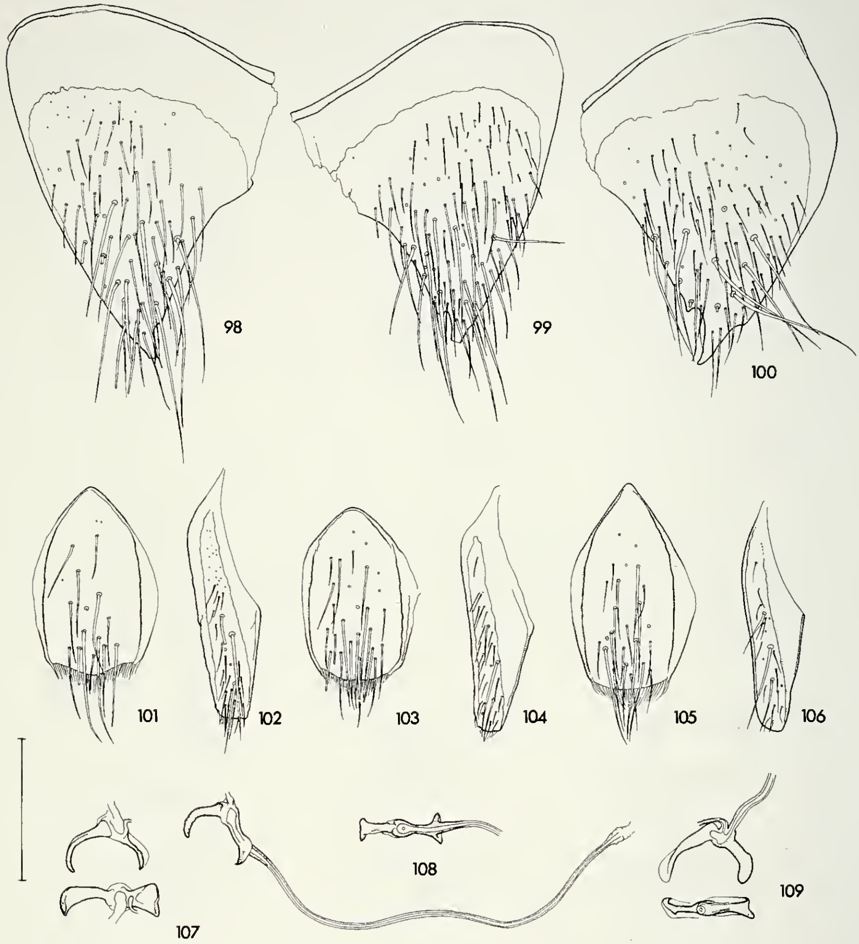
FIGS 71–82

Scopaeus haemusensis sp. n., ♀ paratype: 71) laterotergite 9, 74) tergite 10, 75) valve, 80) spermatheca. *Scopaeus chalcodactylus*, ♀, Caucasus: 72) laterotergite 9, 76) tergite 10, 77) valve, 81) spermatheca. *Scopaeus pusillus*, ♀, Austria: 73) laterotergite 9, 78) tergite 10, 79) valve; ♀, Greece, Peloponnese: 82) spermatheca. Scale bar = 0.1 mm.



FIGS 83–97

Scopaeus minutus, ♀ paralectotypes. Austria: 83) laterotergite 9, 86) tergite 10, 87) valve, 93), 94) spermatheca. *Scopaeus minutus* var. *intermedius*, ♀ paralectotype: 92) spermatheca. *Scopaeus portai*, ♀ paralectotype: 84) laterotergite 9, 88) tergite 10, 89) valve; ♀, France, Vaugmenier: 95) spermatheca. *Scopaeus argonauta*, ♀, Caucasus: 85) laterotergite 9, 90) tergite 10, 91) valve, 96) spermatheca. *Scopaeus sulcicollis*, ♀, Bosnia, Bjelasnica planina: 97) spermatheca. Scale bar = 0.1 mm.



FIGS 98–109

Scopaeus gladifer, ♀ paratype, Bulgaria: 98) laterotergite 9, 101) tergite 10, 102) valve, 107) spermatheca. *Scopaeus hispanicus*, ♀, Spain, Burgos: 99) laterotergite 9, 103) tergite 10, 104) valve, 108) spermatheca. *Scopaeus signifer*, ♀ paralectotype: 100) laterotergite 9, 105) tergite 10, 106) valve, 109) spermatheca. Scale bar = 0.1 mm.

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REVUE SUISSE DE ZOOLOGIE 104 (3): 559-585; septembre 1997

New species and records of pseudoscorpions (Arachnida, Pseudoscorpiones) from the Canary Islands

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New species and records of pseudoscorpions (Arachnida, Pseudoscorpiones) from the Canary Islands. – The following six new species are described: *Chthonius (Ephippiochthonius) gracilimanus, Lagynochthonius curvidigitatus, Tyrannochthonius setiger* (Chthoniidae), *Halominniza oromii* (Olpiidae), *Pseudorhacochelifer canariensis* (Cheliferidae), and *Allochernes longepilosus* (Chernetidae). The species *Chthonius (C.) jonicus* Beier, *Microcreagrella caeca* (Simon), *Rhacochelifer hoggarensis* Vachon, *Pachychelifer* (?) sp. and *Lamprochernes savignyi* (Simon) are recorded for the first time from this archipelago. *Microcreagrina gomerae* Mahnert is sunk into synonymy of *Microcreagrina hispanica* (Ellingsen). The new combination *Pseudorhacochelifer spiniger* (Mahnert) n. comb. is proposed.

Key-words: Canary Islands - biospeleology - new species - Pseudoscorpiones - Canary Islands.

INTRODUCTION

BEIER (1975) summarized our knowledge of pseudoscorpions of the Macaronesian Islands, citing 18 species and subspecies from the Canary Islands. In subsequent publications (ESTANY 1979; MAHNERT 1980, 1986, 1989, 1993) this number increased up to (a surprising) 33. In this paper, 13 additional species are described or recorded for the first time from this archipelago, but the current number of 46 species (one species had to be relegated into synonymy) is certainly not the final one. The importance of different sampling methods in faunistic work is once again emphasized through the restricted species diversity present in the collections obtained by different methods (hand-sampling, sifting, pitfall-traps, window and bottle traps, Berlese and Winkler extraction). An intensive study of the fauna of volcanic lava tubes, carried out by Prof. Pedro Oromí and his team at the University of Laguna (Tenerife), yielded two more species of highly-adapted chthoniid species whose systematic affinities are unclear.

Manuscript accepted 12.01.1997

Acronyms:

DZUL Departamento de Zoologia de la Universidad de La Laguna, Tenerife, Spain
MHNG Muséum d'histoire naturelle, City of Geneva, Switzerland
MNHN Muséum national d'histoire naturelle, Paris, France

NEW SPECIES AND RECORDS

Chthonius (C.) jonicus Beier

Material studied: Hierro, Valverde, ravine below the village, 500 m a.s.l., sieved under opuntias, Ig. Cl. Besuchet, 7.III.1983: 2 ♀.

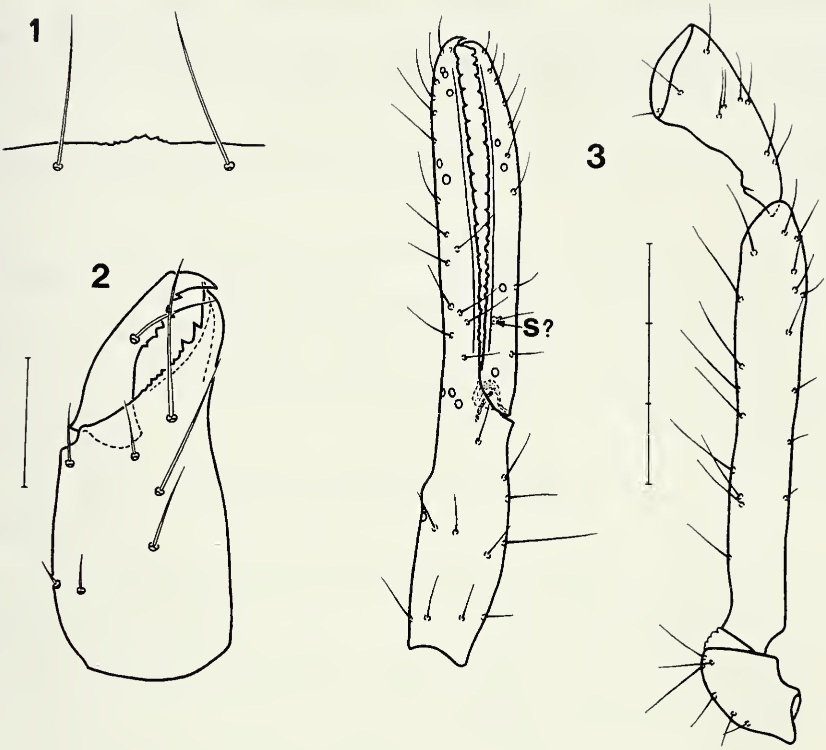
New to the Canary Islands; the species seems to be widespread throughout the Mediterranean basin (HARVEY 1991) and is easily recognized by the presence of 4 setae on the posterior border of carapace and the stout pedipalps.

Chthonius (Ephippiochthonius) gracilimanus n. sp. Figs 1–3

Material studied: La Palma, municipality of Mazo, Barranco el Cabrito (Tigalate): Salto de Tigalate, Ig. Rafael García Becerra, pitfall-trap with beer and cheese, 300 m a.s.l., 7.I.1994: 1 ? (holotype) (DZUL), 3 ♂ 4 ♀ (paratypes; MHNG 2 ♂ 2 ♀).

Description: General colour whitish-yellow. Carapace 1.1–1.2 longer than broad, posteriorly slightly restricted; no epistome, anterior border medially rounded and dentate; two indistinct anterior eye-spots, posterior ones practically absent; 18 macrosetae (4:6:4:2:2) and one (rarely 2) preocular microseta on each side (length of central anterior macroseta 0.09–0.11 mm). Tergal setae: 4:4:4:4:6:6:6:6:6:6:4:6 (2 submedian tactile setae). Manducatory process with 2 setae, coxal setae: pedipalpal coxa 3 (4 on one coxa), I 3 + 3 marginal microsetae, II 4 + 6–9 serrated coxal spines, III 6 + 3–6 coxal spines, IV 6; intercoxal tubercle bisetose. Genital opening broadly V-shaped, bordered by 5–9 setae; genital operculum with (8–)10 setae, sternal setae: 7–8 (female) or 8–9 (male) (+ 3 microchaetae on each stigma): 6–7 (+ 2 x 1–3): 6–7:6:6:6:6:4:0. Cheliceral palm (Fig. 2) with 6 + 1 setae, fixed finger with 7–10 (two distal ones larger), movable finger with 4–7 teeth and one isolated subdistal tooth; spinneret of both sexes small and tubercle-like; serrula exterior with about 16 blades; flagellum typical, with 11 setae.

Pedipalps (Fig. 3): fixed chelal finger with 15–19 triangular teeth and some tiny rudiments basally, movable finger with 11–14 triangular (halfway between *sb*/*st*) + 6–10 rounded teeth (at level of *sb*) + some tiny rudimentary ones; a rounded hump distad of *ib*/*isb*, trichobothria see fig. 3, *ist* level with *esb*, *sb* nearer *b* than *st*. Femur 6.8–7.1 (male) (6.6–6.9: female) times longer than broad and 2.29–2.38 times longer than patella, patella 2.0–2.4 (2.5–2.6) times, hand of chela 2.6–2.9 (2.5–2.6) times, chela 7.0–7.2 (6.4–6.8) times longer than broad, finger 1.5–1.6 times longer than hand. Leg I: femur 6.6–7.1 times longer than deep and 2.0–2.2 times longer than patella, patella 3.2–3.4 times, tibia 4.4–5.1 times, tarsus 11.3–13.4 times longer than deep and 2.1–2.2 times longer than tibia. Leg IV: femur + patella 3.1–3.6 times, tibia



FIGS 1–3

Chthonius (E.) gracilimanus n. sp., holotype; 1: dentate epistome. of carapace; 2: chelicera; 3: pedipalps; 5 ? = sensillum ?; scale unit 0.1 mm.

5.8–6.3 times, basitarsus 3.8–4.2 times, telotarsus 12.2–13.9 times longer than deep and 1.9–2.2 times longer than basitarsus.

Measurements (4 ♂ 4 ♀) (in mm): Carapace 0.38–0.40/0.33–0.37 (female: 0.40–0.45/0.38–0.40). Pedipalps: femur 0.57–0.58/0.08 (0.61–0.65/0.09), patella 0.25/0.10–0.12 (0.26–0.27/0.10–0.11), hand 0.31–0.32/0.11–0.12 (0.32–0.35/0.13–0.14), finger length 0.47–0.50 (0.51–0.53), chelal length 0.77–0.81 (0.82–0.85). Leg I: femur 0.36–0.37/0.05–0.06 (0.38–0.41/0.06), patella 0.17–0.18/0.05 (0.18–0.19/0.05–0.06), tibia 0.19–0.20/0.04 (0.20–0.22/0.04–0.05), tarsus 0.40–0.43/0.03–0.04 (0.44–0.46/0.04). Leg IV: femur + patella 0.54–0.55/0.15–0.18 (0.57–0.60/0.16–0.18), tibia 0.38–0.41/0.06–0.07 (0.41–0.44/0.07), basitarsus 0.19–0.21/0.05 (0.21–0.24/0.05–0.06), telotarsus 0.39–0.43/0.03 (0.43–0.44/0.03).

The new species belongs to the *machadoi*-group, characterized by the dentition of the movable palpal finger, the presence of a distinct dorsal hump distad of *ib*/*isb* and by the presence of an isolated subdistal tooth on the movable cheliceral finger. It is distinguished from *rimicola* Mahnert and *dubius* Mahnert by the position of trichobothrium *ist* (distad of *esb*) and from *machadoi canariensis* Beier by the strongly reduced eyes. It differs from *setosus* Mahnert by the smaller number of microsetae on carapace, more slender palpal chela, and its smaller size.

Identification key to the species of *Chthonius (Ephippiochthonius)* recorded from the Canary Islands

1 Movable cheliceral finger without isolated subdistal tooth .... *tetrachelatus* (Preyssler)
1* Movable cheliceral finger with isolated subdistal tooth 2
2 Trichobothria *eb–esb–ist* placed in a straight line, *ist* clearly distad of *esb* . . . 3
2* Trichobothria *eb–esb–ist* not in straight line, *ist* level with *esb* 4
3 Posterior margin of carapace with 4 setae, epistome reduced, length of setae normal .... *rimicola* Mahnert
3* Posterior margin of carapace with 2 setae; epistome prominent, rounded and dentate; setae of carapace (particularly those of ocular and subbasal row) shortened .... *dubius* Mahnert
4 Anterior eyes well developed, with rounded lense; pedipalps stout, hand 2.0 times and chela 5.3 times as long as deep; 9–10 pointed teeth on movable finger up to level of *st* .... *machadoi canariensis* Beier
4* Anterior eyes reduced, pedipalps slender, hand at least 2.3 times and chela 6.0 times as long as deep; at least 12 pointed teeth reaching well beyond *st* (nearly halfway between *st* and *sb*) 5
5 Carapace with 1–2 preocular microsetae, chela slender (female ratio 6.4–6.8); anterior eye-spots present; smaller (length of chela about 0.8 mm); setae of carapace short (0.10 mm) .... *gracilimanus* n. sp.
5* Carapace with about 15 microsetae (preocular ones and ocular row), chela less slender, chela ratio (female) 6.0 times; larger (length of chela 1.0 mm); setae of carapace longer (0.15 mm) .... *setosus* Mahnert

Lagynochthonius curvidigitatus n. sp. Figs 4–9

Material studied: Tenerife, Icod de los Vinos, Cueva Felipe Reventón (F7.V), lg. L. Sala, 9.V.1994: 1 ♂ (holotype) (DZUL).

Description: General colour whitish-yellow. Carapace (Fig. 4) 1.2 longer than broad, not constricted posteriorly; epistome broad triangular and very short; eyeless; 16 macrosetae (4:4:4:2:2) and one preocular microseta on each side (length of central anterior macroseta 0.10 mm). Tergal setae: 3:4:4:7:6:7:7:7:7:7:4:6 (2 submedian tactile setae). Manducatory process with 2 setae, coxal setae: pedipalpal coxa 3, I 3, II 3 + 8 serrated coxal spines (in one row), III 6, IV 5; intercoxal tubercle absent. Genital opening broadly V-shaped, bordered by 10 setae; genital operculum 10 setae, sternal setae: 8 (+ 2 microchaetae on each stigma): 7 (+ 2 x 3): 10:9:9:9:9:8 (2 tactile setae): 0. Cheliceral palm (Fig. 5) with 5 setae; fixed finger with 7, movable finger with 8–9 teeth; spinneret absent; serrula interior with 14, s. exterior with 18 blades; flagellum typical.

Pedipalps (Figs 6–8): hand without lengthened spine-like seta, both fingers strongly curved, fixed finger with 30, movable finger with 33 curved and basally slightly shorter teeth of nearly equal length; basal apodeme of movable finger reinforced; no transparent tubercle (sensorium) on tip of fixed finger; trichobothria see fig. 8, *ist* clearly distad of *esb*, *sb* halfway between *b* and *st*. Femur 5.5 times longer than broad and 2.23 times longer than patella, patella 2.7 times, 2.4 times, chela 6.7 times longer than broad, finger 1.9 times longer than hand.

Leg I: femur 6.6 times longer than broad and 1.8 times longer than patella, patella 3.8 times, tibia 4.7 times, tarsus 10.7 times longer than deep and 2.1 times longer than tibia. Leg IV (Fig. 9): femur + patella 3.3 times, tibia 6.5 times, basitarsus 3.5 times, telotarsus 11.4 times longer than deep and 2.4 times longer than basitarsus.

Measurements (in mm): Carapace 0.43/0.36. Pedipalps: femur 0.65/0.12, patella 0.29/0.11, hand 0.33/0.12, finger length 0.63, chelal length 0.95. Leg I: femur 0.39/0.06, patella 0.21/0.06, tibia 0.20/0.04, tarsus 0.42/0.04. Leg IV: femur + patella 0.53/0.16, tibia 0.41/0.06, basitarsus 0.17/0.05, telotarsus 0.41/0.04.

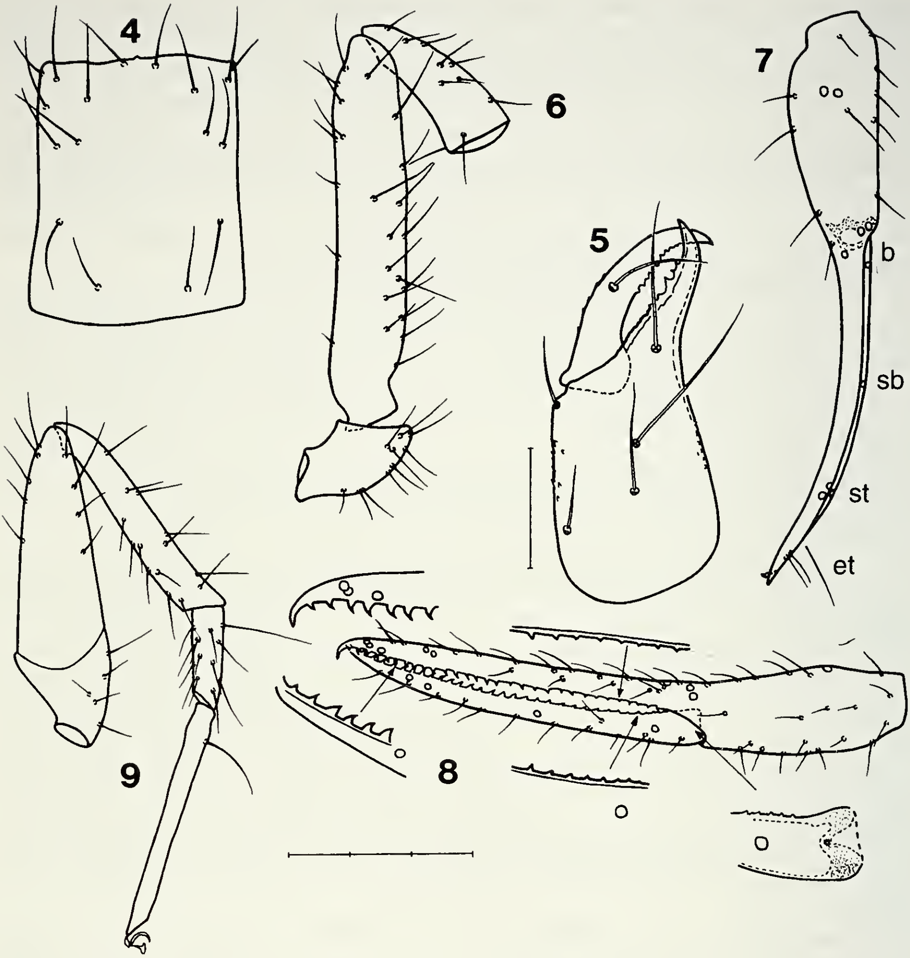
This surprising species is placed in the *Lagynochthonius* Chamberlin because of the sclerotized basal apodeme of the movable palpal finger, despite the untypical palpal hand (not evidently "flask-like"), absence of a rounded, hyaline projection on the tip of fixed palpal finger and some other characters emphasized by MUCHMORE (1991). Species of this genus are recorded mainly from tropical Asia and Australia; some are known from northern South America, Jamaica and Africa. Only three species have been collected in caves: *guasirih* (Mahnert) from Sireh Cave (Sarawak), *mordor* Harvey from Tier Cave (Australia) and *cavicolus* (= *cavicola*) Muchmore from Cousins Cove Cave no. 2 (Jamaica). The new species clearly differs from all known species of this genus (as well as those of the genus *Tyrannochthonius*) by the shape of palpal hand, the strongly curved palpal fingers and its morphometric characters.

Lagynochthonius curvidigitatus n. sp. has been collected in Cueva Felipe Reventón, which is also the type locality for two other highly adapted cave-dwelling chthoniid species, *Paraliochthonius tenebrarum* Mahnert and *Tyrannochthonius superstes* Mahnert. MUCHMORE (1991) recorded co-existence of *Lagynochthonius cavicola* and *Tyrannochthonius hoffi* Muchmore in Cousins Cove Cave (Jamaica).

Tyrannochthonius setiger n. sp. Figs 10–13

Material studied: Tenerife, Icod de los Vinos, Cueva del Sobrado (S–15–C), lg. L. Sala, IV.1994: 1 ♀ (holotype, DZUL), 2 ♀ (paratypes, MHNG); lg. P. Oromí, 16.IV.1992: 1 ♀ (paratype, DZUL).

Description: General colour yellowish. Carapace (Fig. 10) 1.1 longer than broad, slightly constricted posteriorly; epistome triangular and prominent; eyeless; 16 macrosetae (4:4:4:2:2) plus one preocular microseta on each side (length of central anterior macroseta 0.16 mm); laterally reticulate. Tergal setae: (3–)4:4:4:5–



FIGS 4–9

Lagynochthonius curvidigitatus n. sp., holotype; 4: carapace; 5: chelicera; 6–8: pedipalps; 9: leg IV; scale unit 0.1 mm.

6:6–7:7–8:7–8:8:7–8:4:4–6 (2 submedian tactile setae). Manducatory process with 2 setae, coxal setae: pedipalpal coxa 3, I 3, II 3 + 8–10 serrated coxal spines (in one row) (Fig. 12), III 4–5, IV 5; intercoxal tubercle absent. Genital operculum 10–11 setae, sternal setae: 8 (+ 3 microchaetae on each stigma): 9–10 (+ 2 x 3) : 11–13 + 2 medial discal setae: 11:11:11–12:11:9 (2 tactile setae): 0. Cheliceral palm (Fig. 11) with 6 setae (in one case 7 on the left chelicera), fixed finger with 5 (distalmost enlarged) and movable finger with about 11 small teeth; spinneret absent; serrula interior with 18, s. exterior with 28 blades; flagellum typical (8 setae).

Pedipalps (Fig. 13): hand without elongate spine-like setae; fixed finger with 44–49, movable finger with unmodified base and 45–47 teeth of nearly equal length; sensillum between *sb* and *st*; trichobothria see Fig.13, *ist* slightly distad of *esb*, *sb* slightly nearer *st* than *b*, which is displaced distally; femur 6.2–7.0 times longer than broad and 2.26–2.36 times longer than patella, patella 2.4–2.5 times, hand 2.0–2.2 times, chela 7.0–7.7 times longer than broad, finger 2.3–2.6 times longer than hand.

Leg I: femur 6.7–7.6 times longer than deep and 1.6–1.7 times longer than patella, patella 5.1–5.5 times, tibia 5.8–6.7 times, tarsus 12.9–14.4 times longer than deep and 1.8–1.9 times longer than tibia. Leg IV: femur + patella 3.8–4.1 times, tibia 7.7–8.5 times, basitarsus 3.6–4.1 times, telotarsus 14.4–15.0 times longer than deep and 2.3–2.6 times longer than basitarsus, both with a basal tactile seta.

Measurements (in mm): Carapace 0.72/0.63–0.68. Pedipalps: femur 1.24–1.31/0.19–0.20, patella 0.53–0.58/0.22–0.24, hand 0.57–0.63/0.26–0.29, finger length 1.41–1.49, chelal length 1.98–2.08. Leg I: femur 0.72–0.75/0.10–0.11, patella 0.43–0.46/0.08–0.09, tibia 0.42–0.46/0.07, tarsus 0.80–0.84/0.06. Leg IV: femur + patella 1.05–1.10/0.27–0.28, tibia 0.82–0.90/0.10–0.11, basitarsus 0.30–0.36/0.08–0.10, telotarsus 0.79–0.85/0.05–0.06.

This species, the second of the genus *Tyrannochthonius* recorded in caves of Tenerife, is clearly related to *superstes* Mahnert (Cueva Felipe Reventón) (similar trichobothrial pattern, dentition of chelal fingers, chaetotaxy of carapace), but differs from it by its slightly smaller size, less elongate pedipalps (particularly chelal hand: 2.0–2.2 times versus 2.8 times and chela: 7.0–7.7 times versus 10.3–10.6 times), 6–7 setae on cheliceral hand (instead of 5), and by the presence of an enlarged distal tooth on the fixed cheliceral finger. The coexistence of these species in the Cueva del Sobrado is quite surprising.

An (unnamed) *Tyrannochthonius* species is mentioned by HEURTAULT (1994) in the "Grotte de los Ninos" (Mers-el-Kébir, Algeria, lg. R. Jeannel, 2.VI.1912, Biospeologica no. 522, MNHN). Affinities with *Tyrannochthonius psoglavi* Curcic from a Serbian cave (CURCIC 1990) are unclear.

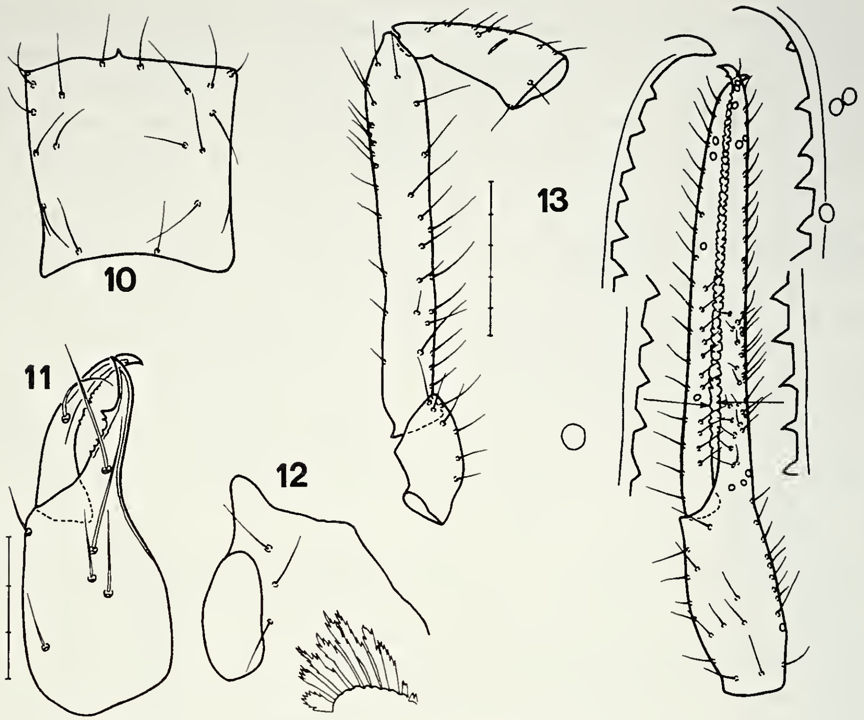
Tyrannochthonius superstes Mahnert

Material studied: Tenerife, Icod de los Vinos, Cueva del Sobrado, lg. P. Oromí, 16.XII.1994: 1 ♂ (MHNG).

This male agrees in all morphological and morphometric details with specimens from the Cueva Felipe Reventón, except for the exceptional presence of six setae on the left cheliceral palm.

Paraliochthonius tenebrarum Mahnert

This species was described from Cuevas Negras (Las Cañadas) and has since been collected in two other caves in Tenerife: Cueva de los Roques, Las Cañadas, lg. N. Zurita (22FM/Ps 192) and Cueva Felipe Reventón, Icod de los Vinos, lg. L. Sala (Lab. 4–c), V.1994.



Figs 10–13

Tyrannochthonius setiger n. sp. holotype; 10: carapace; 11: coxa II; 13: pedipalps; scale unit 0.1 mm.

Microcreagrina hispanica (Ellingsen)

Microcreagrina gomerae Mahnert, 1993: 980, **nov. syn.**

Material studied: Gomera, Llanos de Crispin, lg. P. Oromí, 29.IV.1995: 2 ♂; Gomera, Juel, in humus, lg. P. Oromí, 1.V.1995: 2 ♂ 1 ♀; Gomera, Parque Nacional Garajonay, 1.5 km south of Mirador de Vallehermoso, 990 m, soil sample in laurel forest, lg. B. Hauser, 2.V.1993: 1 ♂; Tenerife, Las Mercedes, laurel forest, 700 m, lg. E. Heiss, 29.III.1983: 1 ♂.

The morphological and morphometric characters of these additional specimens, mainly from La Gomera, clearly close the gap between the diagnostic characters of *hispanica* and *gomerae* emphasized in the original description of *gomerae* (Mahnert 1993): palpal femur 3.07–3.54 times longer than broad (length 0.39–0.49 mm), patella 2.05–2.20 times, hand with pedicel 1.29–1.44 times, hand 0.96–1.15 times longer than finger, chela with pedicel 2.44–2.87 times; number of teeth on fixed finger 36–44, on movable finger 37–46. Leg I: femur 2.21–2.37 times, patella 1.66–2.26 times, tibia 2.96–4.26 times, basitarsus 1.86–2.03 times, telotarsus

3.56–4.41 times longer than deep. Leg IV: femur 2.52–2.75 times, tibia 3.76–4.81 times, basitarsus 1.60–1.91 times, telotarsus 3.73–4,25 times longer than deep.

No single specimen was fully concordant with the holotype of *gomerae*, intermediates in most of the characters were evident. Without hesitation, *Microcreagris gomerae* is therefore considered to be a junior subjective synonym of *M. hispanica* (Ellingsen), its holotype, from the MSS (superficial subterranean milieu) apparently presents extreme values of variable characters.

Microcreagrina subterranea Mahnert

Material studied: Tenerife, Las Cañadas, Cueva de los Roques, lg. P. Oromí, 8.XII. 1996: 1 ♀ (22C/12643).

Microcreagrina caeca caeca (Simon)

Material studied: Tenerife, Barranco Las Canteras, under bark in laurel forest, lg. M. Báez, IV.1994: 1 ♀; Hierro, Valverde, ravine below the village, 500 m, sieving under opuntias, lg. Cl. Besuchet, 7.III.1983: 1 tritonymph.

New to the Canary Islands. Further studies might be necessary to confirm the validity of the subspecies *madeirensis* Beier, described from Madeira, since one female from the island of São Miguel (Azores, type locality) (Ponta Delgada, Furna do Carvao (= lava tube), don. J. Lips, 27.VII.1994) possesses slightly shorter fingers (equal to hand length with pedicel, but still longer than hand without pedicel).

Olpium pallipes (H. Lucas)

Beier (1975) mentioned this widespread species from Tenerife; I have studied supplementary specimens from Alegranza (Llano de la Atalaya, lg. P. Oromí, 27.IV.1994; Caldera, lg. P. Oromí, 4.V.1990), Fuerteventura (Valle del Ciervo, lg. P. Oromí, 17.II.1995; La Oliva, lg. P. Oromí, 25.II.1990), La Gomera (Fortaleza de Chipude, lg. P. Oromí, 14.III.1989), Gran Canaria (San Bartolomé, lg. E. Heiss, IV.1986), Lanzarote, Playa Blanca (lg. E. Heiss, 29.IX.1990) and Tenerife (Puertito de Güimar; El Abrigo, Bco. Ciguena: lg. J. Murphy, III.1996).

One male from La Gomera (Puntallana, lg. M. Arechavaleta, 2.V.1995) possesses more slender pedipalps (femur 4.0 times longer than broad); its identity with *pallipes* is questionable.

Olpium canariense Beier

The species is newly recorded from the following islands: Alegranza (Caldera; Llano de la Atalaya; La Desgraciada), Graciosa (Mte Mojón), Lanzarote (Mirador del Rio) et Roque del Este: all specimens collected by P. Oromí.

Calocheirus canariensis (Beier)

This species is recorded for the first time from Graciosa (Mte Mojón; lg. P. Oromí, 24.II.1995).

Halominniza oromii n. sp. Figs 14–15

Material studied: Island of Alegranza (N. Lanzarote), El Callaíto, lg. P. Oromí, 7.V.1990: 1 ♀ (holotype; DZUL).

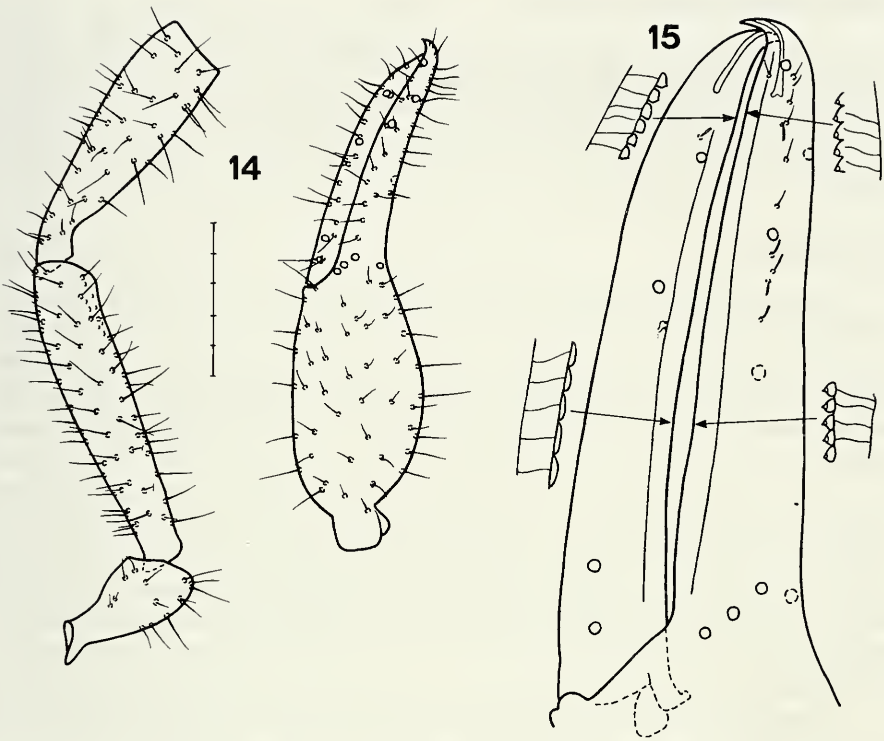
Description: Pedipalps and legs brownish-yellow, palpal chela slightly darker, greenish-olive; carapace and most tergites brown; carapace (sclerotized part) 1.5 times longer than broad, desclerotized at posterior border, smooth, median transverse furrow visible only laterally, subbasal transverse furrow reticulate; 4 eyes, anterior pair strongly rounded, one diameter from anterior border, posterior eyes somewhat flattened; 33 setae (6:8:8:6:5 (left lateral seta doubled, lateral setae short)). Tergites undivided, tergal setae: I 2, II 4, III–IX 6, X 7 (4 tactile setae), XI 9 (4 tactile setae), setae smooth, anal cone 2 + 2 setae; manducatory lobe with 3 marginal and 2 discal setae, pedipalpal coxa smooth, 13–14 setae, I 7–8, II 8–10, III 10–11, IV 16–17; genital operculum 7 setae; tracheal tubes normal, not enlarged. Cheliceral palm 5 setae, fixed finger with 5 teeth, movable finger with subapical tooth-like lobe, galeal seta *gs* short and curved; galea probably with 3 apical rami, serrula exterior 22 blades, flagellum 3 setae.

Pedipalps (Fig. 14) slender, trochanter 2.1 times longer than broad, with indistinct dorsal hump, femur without dorsal tactile seta, in distal part indistinctly granulate, 5.1 times, patella smooth, 3.5 times (club 2.7 times) as long as broad, hand smooth, with pedicel 2.1 times longer than broad and as long as finger, chela with pedicel 3.9 times, without pedicel 3.6 times longer than broad; fixed finger with 59, movable finger with 46 teeth (basal ones flattened and rounded). Trichobothria see Fig. 15, distal trichobothrial setae shortened, *st* nearer *t* than *sb*, *ist* clearly proximal to *st*; venom ducts short; a series of sensory setae in distal part of fixed finger, double-pored sensillum near *st*.

Leg I: femur 3.6 times longer than deep and 1.7 times longer than patella, which is 2.1 times longer than deep, tibia 5.6 times, basitarsus 3.5 times longer than deep and 1.14 times longer than telotarsus, which is 3.6 times longer than deep. Leg IV: femur + patella with 8 dorsal setae, 3.7 times, tibia 6.2 times (setae TS + 4:3:3 pairs), basitarsus with basal tactile seta, 3.7 times longer than deep and 1.12 times longer than telotarsus, which is 4.0 times longer than deep. Arolia undivided, clearly longer than smooth claws.

Measurements (mm): Carapace 0.91/0.61. Palps: femur 1.05/0.21, patella 0.91/0.26, hand with pedicel 0.86/0.42, pedicel 0.11, finger length 0.85, chela length with pedicel 1.63. Leg I: femur 0.44/0.12, patella 0.25/0.12, tibia 0.44/0.08, basitarsus 0.22/0.06, telotarsus 0.19/0.05. Leg IV: femur + patella 0.90/0.24, tibia 0.71/0.11, basitarsus 0.31/0.08, telotarsus 0.28/0.07.

Two species were known in this genus, from coastal regions of Israel, Jordan (*aegyptiacum litorale* Beier), Egypt (*aegyptiacum*) and Moucha Island/F.T.A.I. (*parentorum* Mahnert). The new species differs from *aegyptiacum*, morphologically the most similar species, in trichobothrial pattern (in *oromii st* is clearly nearer *t* than *sb*; *ist* clearly proximal to *st*, group *est–it–et* nearer to finger tip) and the (indistinctly) granulate palpal femur. The new species is placed in *Halominniza* due to its long



FIGS 14–15

Halominniza oromii n. sp., holotype; 14: pedipalps; 15: chelal fingers, lateral view; scale unit 0.1 mm.

femur of leg I and the presence of two transverse furrows on the carapace, but possible affinities between *Halominniza* and some species placed actually in *Olpium* (*tenue* Chamberlin, *canariense* Beier) should be reassessed; *oromii* is clearly distinguished from *canariense* by its larger size and more slender pedipalps.

Geogarypus canariensis Beier

First record for Roque del Este (lg. P. Oromí, 7.V.1993: 1 ♀).

Geogarypus minor (L. Koch)

This widespread Mediterranean species had not previously been recorded from the archipelago. Pedro Oromí collected 2 ♂ 1 ♀ on Gran Canaria (Bco. Oscuro, 8.I.1988).

Apocheiridium ferum (Simon)

One tritonymph of this genus collected on Hierro, above Frontera (road to Valverde), in a soil sample in laurel forest ("Laurisilva", 1130 m (lg. B. Hauser, 5.V.1994) is tentatively attributed to *ferum*. This genus has not previously been recorded from the archipelago. The specific identity needs to be confirmed with adult specimens.

Pachychelifer (?) sp. Figs 16–17

Material studied: El Hierro, "El Pinar" above Las Casas, 1180 m, *Pinus canariensis* forest, lg. Ch. Lienhard, 5.V.1993: 1 ♀.

Unidentifiable as a female, but it cannot be placed in any cheliferid genus hitherto recorded from the archipelago: tergites with 5 setae on posterior margin and one lateral discal seta on IV–X, XI with 2 tactile setae; cheliceral palm with 4 smooth setae, galea with 6 apical rami; flagellum 3 setae; median cribrate plate band-shaped (Fig. 17); pedipalps stout, finely granulate, without coarser granules; femur not abruptly enlarged, 2.8 times (0.74 mm/0.26 mm), patella 2.1 times (0.69/0.32), hand with pedicel 1.9 times (0.79/0.43) longer than broad and 1.5 times longer than finger, finger length 0.53; chela with pedicel 3.0, without pedicel 2.8 times, length with pedicel 1.25; fixed finger with 23, movable finger with 24 broad, pointed teeth, trichobothria see Fig. 16; tarsus of leg IV without tactile seta, subterminal seta smooth, claws simple and smooth.

It is tentatively placed in this monotypic genus (known from the Black Sea border only). Males are necessary to determine its generic and specific identity.

Rhacochelifer hoggarensis Vachon, **nov. stat.** Figs 18–22

Rhacochelifer maculatus hoggarensis Vachon, 1940: 157–159, figs 1–3 (Hoggar, massif de l'Atakor, In Ameri, 2320 m); Heurtault 1970: 698; Harvey 1991: 528.

Material studied : Hierro, Riso de los Hermanos, lg. P. Oromí, 25.III.1987 (8208 M/C): 2 ♂ 1 ♀; El Pinar, above Las Casas, 1100 m, sieving a rotten stump of *Pinus*, lg. Cl. Besuchet, 5.III.1983: 1 ♂.

Complementary description: Carapace granulate, without coarser granules; hind corners with tiny knob-like enlargements, with a seta at their base; tergites divided, scaly, lateral hind corners of tergite I with tiny knob-like enlargements; 5–6 setae at posterior border of half tergites, one lateral and medial discal seta (IV–X), on VIII–X a supplementary discal seta may be present; XI 7–8 (2 tactile setae, 2 median discal setae). Half-sternites normally with 4–5 setae at posterior border, XI 6 (2 tactile setae); coxa IV of male with atrium and short coxal sac (about half of coxal length); genital operculum with about 36–48 long setae (the central ones dentate) in male and 16 (8–8) setae in female, male genital apodeme similar to that figured by Vachon (1940, fig. 1) and that of *tibestiensis* (Heurtault 1971, fig. 17), two pairs of smooth interior setae of male genital opening; median unpaired cribrate plate of female mushroom-shaped (Fig. 22); cheliceral palm (Fig. 18) with 5 mostly smooth setae, galea of male short, with 3–4 apical teeth, that of female with 6 apical rami; serrula exterior 18–20 blades, flagellum 3 blades.

Pedipalps (Figs 20–21) granulate, femur and patella with coarser granules on inner surface, trochanter with prominent rounded dorsal hump, finger slightly gaping, fixed finger with 36–38 (female 41), movable finger with 36–41 (female 44) teeth of normal shape; femur 3.7–4.0 times, patella 2.8–3.1 times, club 2.08–2.31 times as long as broad, hand with pedicel 2.2–2.5 times longer than broad and 1.5 times longer than finger, finger about 1.4 times longer than hand width, chela with pedicel 3.5–3.8 times, without pedicel 3.2–3.6 times longer than broad.

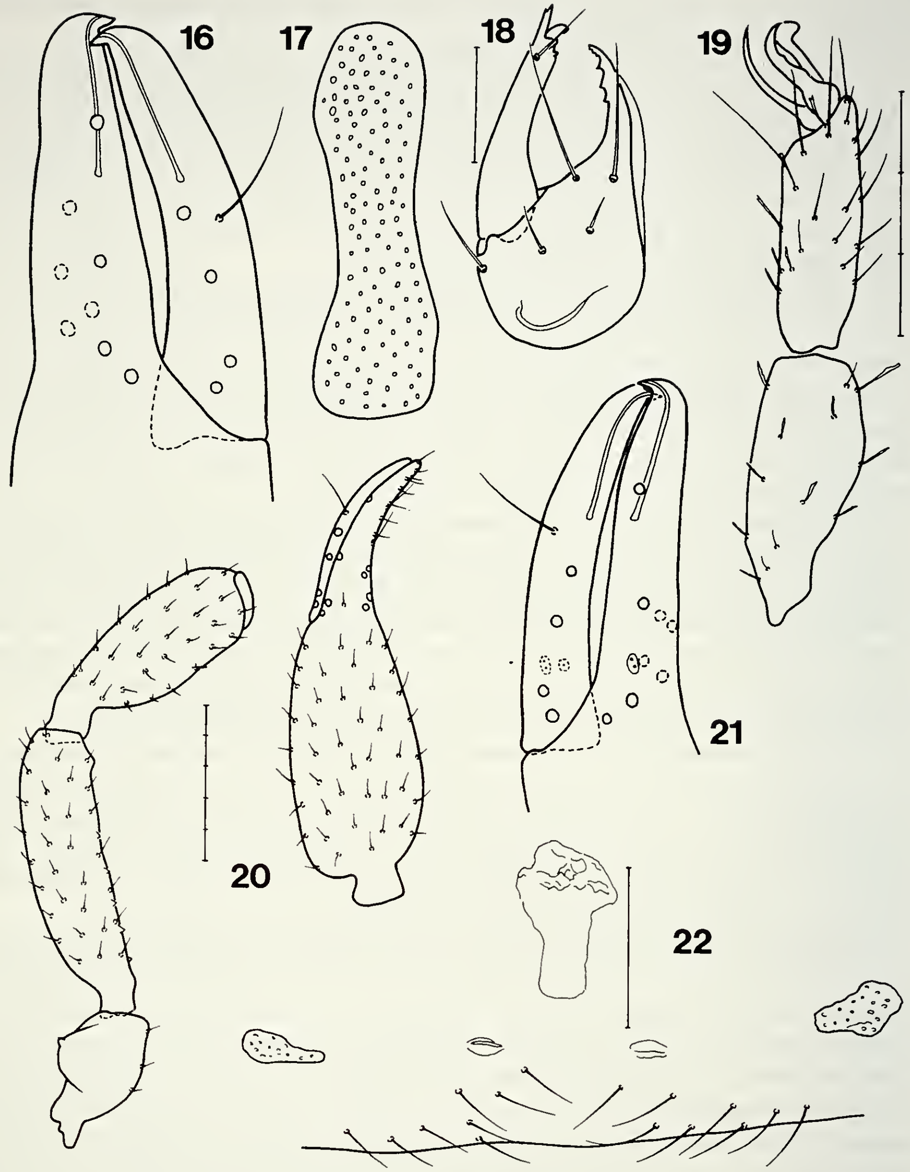
Leg I (Fig. 19): tarsus of male with outer apical corner slightly rounded, anterior border slightly concave, claws asymmetric, exterior one slender, upper border partly folded, interior one stouter, with one rounded tooth on lower border; femur 1.8–1.9 times, patella 2.6–3.1 times, tibia 2.7–2.8 (male) and 3.8 (female) times, tarsus 3.0–3.4 (female 4.6) times longer than deep; leg IV: femur + patella 3.0–3.1 (female: 3.5) times, tibia 4.1–4.4 (4.6) times, tarsus 3.9–4.7 times longer than deep, no tactile seta, subterminal setae dentate.

Measurements (3 ♂ 1 ♀) (in mm): Carapace 0.80–0.88/0.77–0.98. Pedipalps: femur 0.78–0.94/0.20–0.24 (female: 0.95/0.24), patella 0.70–0.79/0.23–0.28 (0.81/0.29), hand with pedicel 0.78–0.92/0.32–0.42 (0.98/0.40), finger length 0.51–0.59 (0.65), chela length with pedicel 1.23–1.44 (1.55). Leg I: femur 0.27–0.28/0.14–0.15, patella 0.32–0.40/0.12–0.13 (0.40/0.14), tibia 0.29–0.35/0.11–0.13 (0.36/0.10), tarsus 0.27–0.32/0.08–0.09 (0.34/0.07). Leg IV: femur 0.63–0.75/0.21–0.24 (0.79/0.22), tibia 0.49–0.56/0.11–0.13 (0.60/0.13), tarsus 0.34–0.39/0.08–0.09 (0.41/0.09).

Only the male holotype of this species was known, described by VACHON (1940) as a subspecies of *R. maculatus* (L. Koch). Distinctions at the subspecific level are questionable in pseudoscorpions, and the differences between *maculatus* and *hoggarensis* are sufficient to consider the latter as separate species. Attribution of these specimens to *hoggarensis* might be surprising, but I could not find sufficient differences to justify the description of a new species.

Only a few *Rhacochelifer* species of the *maculatus*-group (male tarsus I with rounded, not prominent anterior corner, coarser granules on palpal femur and patella) with such slender pedipalps (femur ratio at least 3.6 in male, patella ratio at least 2.8) are described in the central and western Mediterranean region and northern Africa: *andreinii* Beier (Libya), *chopardi* Vachon (Aïr, Niger), *hoggarensis* Vachon (Hoggar, Algeria), *tenuimanus* Heurtault (Tibesti), and *tibestiensis* Heurtault (Tibesti). These species had been differenciated by HEURTAULT (1971). *R. andreinii* was not included in her key, but this species (only male holotype known) is said to lack discal setae on tergites and also to lack tactile setae on tergite XI.

Rhacochelifer spiniger Mahnert (from Portugal) must be, at the actual level of knowledge, transferred to *Pseudorhacochelifer* (**nov. comb.**), since it possesses distinct spine-like lateral enlargements on carapace and anterior tergites.



Figs 16–22

Pachychelifer (?) sp., chelal fingers, lateral view (16) and median cribrate plate (17); *Rhacochelifer hoggarensis* Vachon; 18: chelicera; 19: male fore tibia and tarsus; 20: pedipalps; 21: chelal fingers, lateral view; 22: female genital operculum with spermatheca and lateral cribrate plates; scale unit 0.1 mm.

Rhacochelifer gracilimanus Mahnert

Material studied: Gran Canaria, Inagua, lg. P. Oromí, 6.X.1996: 5 ♂ 5 ♀ (DZUL, MHNG).

Described from Tenerife, this species is now recorded from Gran Canaria. The length of the male palpal femur may vary from 1.02 mm to 1.20 mm, females are slightly larger (femur length up to 1.30 mm).

Rhacochelifer pinicola (Nonidez)

I have no hesitations in attributing to this species one female from Hierro (above Tabaique, 1000 m, under bark of *Pinus canariensis*, lg. E. Heiss, 19.IV.1991) and one tritonymph from La Gomera (Parque Nacional Garajonay, road from Laguna Grande to Las Rosas, 1.5 km south of the "Mirador de Vallehermoso", 990 m, in laurel forest ("Laurisilva"), lg. Ch. Lienhard, 2.V.1993).

Pseudorhacochelifer schurmanni Beier

Two females from La Palma, Pico de la Cruz, 2300 m, (lg. P. Oromí, 12.VII.1992) belong to this species, which was described from Tenerife.

Pseudorhacochelifer canariensis n. sp. Figs 23–26

Rhacochelifer cf. *spiniger*: MAHNERT 1980: 264 (Gran Canaria, Tejeda).

Material studied: Tenerife, Las Cañadas, Cañada Blanca, in the surroundings of Parador Nacional, rather dry habitat with *Spartocytisus supranubius* and *Descourainia bourgeauana*, hand collecting (6C/Ps 352), Ig. N.Z.P., 7.VI.1995: 1 ♂ (holotype; DZUL), 1 ♂ (paratype; MHNG); Las Cañadas, La Fortaleza, pitfall trap, lg. N. Zurita, 6.X.1995 (26V2/Ps 4883): 2 ♀, hand collecting, lg. P. Oromí, 11.VI.1995 (26C/Ps 658): 1 ♀; pitfall trap, lg. N. Zurita, 11.VI.1995 (26V3/Ps 1917): 1 ♀, hand collecting, lg. A. Camacho, 7.VI.1995 (26FM/Ps 41):1 ♀, in litter of *Cistus osbaeckifolius*, lg. A. Camacho, 7.VI.1995 (26E/Ps 2711) 1 ♀ 1 protonymph; Las Cañadas, Risco Verde, hand collecting, lg. M.A.H., 3.VI.1995 (24C/Ps 257) : 1 ♀, window trap, lg. N. Zurita, 3.VI.1995 (24W/Ps 2410):1 ♀; window traps, lg. N.Z.P., 31.V.1995 (24W/Ps 10): 2 ♀; Las Cañadas, west slope of Pico Viejo, 2100 m a.s.l., vegetation dominated by *Spartocytisus supranubius* and *Pterocephalus viscosus*, bottle trap, Ig. A. Camacho, 29.VI.1995 (7B4/Ps 2032): 1 /; in litter, lg. P. Oromí, 28.V.1996: 1 / 1 P (7E/6598); south slope of Pico Viejo, 2000 m a.s.l., substrate alluvial, sparse vegetation dominated by *Spartocytisus supranubius* and *Adenocarpus viscosus*, lg. A. Camacho, 28.V.1996: 1 ♂ (4C/6392); in litter, lg. P. Oromí, 28.V.1996: 1 ♀ 1 D (4E/6584) (all paratypes, DZUL and MHNG); Tenerife, Las Bodegas, 200–500, lg. E. Heiss, 31.III.1983: 3 ♂ 1 ♀ tritonymph (paratypes, MHNG). Gran Canaria, Tejeda, 1000 m, lg. S. Vit, 30.XII.1977: 1 ♀ 1 protonymph (MAHNERT 1980) (paratypes; MHNG).

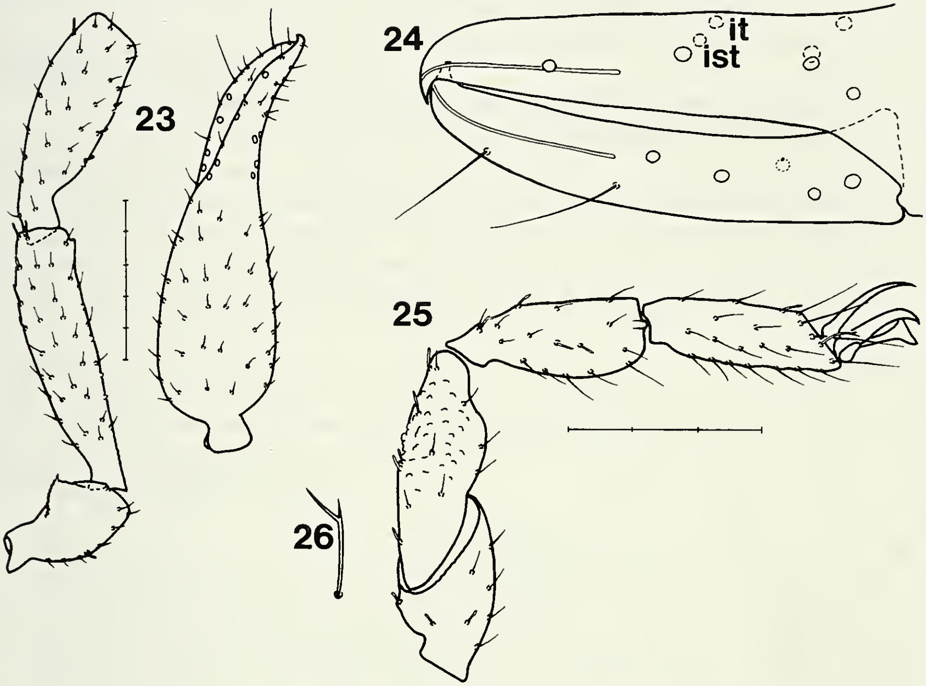
Description: Carapace granulate, with coarser granules; two well-developed eyes; two distinct, granulate, transverse furrows, subbasal one slightly nearer to posterior border than to median furrow; hind corners with short spine-like process; setae relatively short, clavate and dentate, 4 setae (and one preocular small seta on each side) on anterior border and normally 9–10 (8–14) setae on posterior border; tergites divided (XI scaly, undivided or incompletely divided), granulate, lateral hind corners of tergites I–VII (on last ones short) (one male I–IV, one I–VIII) with spine-like keels; tergal setae clavate, of equal length on all tergites, setae of XI only dentate; 4–6 setae at posterior border of half-tergites, one lateral, one medial and one discal seta on IV–X; XI 8–10 (2 tactile setae, 2 median discal setae). Manducatory process 3 marginal and one discal setae, palpal coxa scaly, about 10 setae (one tactile one), coxa I 6, II 6, III 10, IV about 29; coxa IV of male with atrium and short coxal sac (about half of coxal length); genital operculum with about 40 long setae (the central ones dentate: Fig. 26) in male and 12–23 setae in female, male genital apodeme normal, 7 (3/4) interior dentate setae behind male genital opening (holotype); median unpaired cribrate plate of female mushroom-shaped; sternal setae slender and smooth, only last ones finely dentate, half-sternites normally with 4 setae on posterior border, one suprastigmatal seta on IV, VIII–X with an additional lateral seta, XI with 7–8 setae (total number) (2 tactile setae). Cheliceral palm with 5 setae (*db* and *ib* short; smooth or finely dentate), galea of male short, with 3–4 apical teeth, that of female with 6 apical rami; serrula exterior 18 blades, flagellum 3 blades.

Pedipalps (Figs 23–24) slender, distinctly granulate, setae short and indistinctly clavate, femur and patella with coarser granules on inner surface, trochanter with prominent rounded dorsal hump, fingers slightly gaping, fixed finger with 38–44 (female 34–43), movable finger with 39–46 (female 40–44) teeth of normal shape; trichobothrial pattern see Fig. 24. Femur 3.9–4.4 (female 3.7–4.1) times, patella 3.0–3.3 (2.7–3.3) times, hand with pedicel 2.3–2.5 (2.1–2.3) times longer than broad and 1.4–1.6 times longer than finger, chela with pedicel 3.7–4.0 (3.3–3.6) times, without pedicel 3.4–3.7 (3.1–3.4) times longer than broad.

Leg I (Fig. 25): tarsus of male nearly parallel-sided, with outer apical corner slightly rounded, anterior border straight, claws assymetric, exterior one slender; femur 1.7–2.0 times, patella 2.7–3.1 times, tibia 2.4–2.7 (female 3.4–3.9) times, tarsus 3.0–3.4 (female 4.6–5.0) times longer than deep; leg IV: femur + patella 3.0–3.3 times, tibia 4.4–4.3 (4.3–4.7) times, tarsus 4.4–4.6 (4.1–5.1) times longer than deep, no tactile seta, subterminal setae dentate.

Measurements (5 ♂ 4 ♀) (in mm): Carapace 0.82–0.85/0.88–0.94 (0.91–1.04/ 0.94–1.06). Pedipalps: femur 0.86–0.99/0.20–0.23 (female 0.90–1.04/0.23–0.28), patella 0.76–0.84/0.24–0.27 (0.83–0.88/0.27–0.33), hand with pedicel 0.85–0.91/ 0.35–0.37 (0.95–1.02/0.43–0.45), finger length 0.55–0.64 (0.61–0.68), chela length with pedicel 1.35–1.45 (1.50–1.67). Leg I: femur 0.26–0.30/0.14–0.17, patella 0.33–0.38/0.12–0.13 (0.38–0.44/0.13–0.15), tibia 0.30–0.33/0.12–0.13 (0.37–0.38/ 0.10–0.11), tarsus 0.30–0.31/0.09–0.10 (0.35–0.36/0.07–0.08). Leg IV: femur + patella 0.67–0.76/0.22–0.25 (0.78–0.85/0.24–0.28), tibia 0.50–0.55/0.12–0.13 (0.58–0.62/0.12–0.14), tarsus 0.39–0.42/0.09 (0.41–0.44/0.08–0.10).

This new species is closely related to *spiniger* (Mahnert), known from Portugal, but it differs from the latter by its larger size, slightly more slender pedipalps and slightly more slender leg I (tibia and tarsus). The male foretarsus is similar in shape, but has a straight anterior face (in *spiniger* there is a smooth concavity situated proximad of the middle of the anterior face). It is easily distinguished from *Pseudorhacochelifer* *schurmanni* Beier in having coarser granules on palpal femur and patella and by its larger size.



FIGS 23–26

Pseudorhacochelifer canariensis n. sp., holotype; 23: pedipalps; 24: chelal finger, lateral view; 25: leg I; 26: seta of genital operculum; scale unit 0.1 mm.

Artificial key to the species (adults only) of the genera *Rhacochelifer* and *Pseudorhacochelifer* recorded from the Canary Islands

1 Pedipalpal femur and patella without coarser granules besides normal granulation 2
1* Pedipalpal femur and patella with coarser granules 4
2 Larger species (femur length at least 0.70 mm) with slender pedipalps (femur at least 3.6 times longer than broad), with or without discal setae on tergites 3
2* Small species (femur length about 0.60 mm) with stout pedipalps (femur about 3 times longer than broad), no discal setae on tergites . . . . *Rhacochelifer pinicola*
3 Large species (femur length more than 1.0 mm), chelal hand slender (2.6 times longer than broad); male without spine-like lateral prolon-

gations on carapace and anterior tergites, medial discal setae present on half-tergites . . . . *Rhacochelifer gracilimanus*

3* Smaller species (femur length 0.7–0.8 mm), hand less slender, 2.3–2.4 times longer than broad; male with spine-like lateral prolongations on carapace and anterior tergites, medial discal setae absent on half-tergites . . . . *Pseudorhacochelifer schurmanni*

4 Pedipalps stout, femur at most 3.5 times, patella 2.5 times longer than broad, femur abruptly enlarged at base, femur length 0.69–0.89 mm . . . . *Rhacochelifer maculatus*

4* Pedipalps slender, femur at least 3.7 times, patella at least 2.8 times longer than broad, femur gently enlarged at base, femur length 0.87 mm 5

5 Discal setae on tergites IV–X normally absent; male without spine-like lateral projections on hind corners of carapace and tergites, internal seta of male genital opening smooth, male femur 3.7–4.0 times longer than broad . . . . *Rhacochelifer hoggarensis*

5* Discal setae on tergites IV–X present, male with spine-like lateral projections on hind corners of cephalothorax and tergites I–V present, internal setae of male genital opening dentate, male femur 4.1–4.3 times longer than broad . . . . *Pseudorhacochelifer canariensis*

BRIEF REMARK ON *Chelifer mayeti* Simon

This species was described from "Gafsa, Tunisia" and compared with *Chelifer* (= *Rhacochelifer*) *peculiaris* and *maculatus*, but also with *Chelifer* (= *Withius*) *piger* and its synonym *subruber* (SIMON 1885). After examination of the type specimen, BEIER (1932) transferred it to *Lophochernes*, since he ascertained the presence of a tactile seta on tarsus IV and of smooth subterminal setae on the hind tarsi. This species is only known from the type specimen which could not be located in neither the Muséum national d'histoire naturelle Paris (J. Heurtault and M. Judson, in litt.) or in the Naturhistorisches Museum Vienna (J. Gruber, in litt.). It has not been recorded since the original description, and since the unique known specimen is a female, its generic (or even familial?) status cannot now be established with certainty.

Canarichelifer teneriffae Beier

This species is now also recorded from Roque del Este (Lanzarote) (lg. P. Oromí, 7.V.1993).

Withius piger (Simon)

This cosmopolitan species is now also recorded from La Palma (Juan Adalid, lg. P. Oromí, 15.I.1994).

Lamprochernes savignyi (Simon)

Material studied: Hierro, Las Playas, ravine south of the Parador, sieving of compost heaps in a garden, lg. Cl. Besuchet, 3.III.1983: 5 ♂ 11 ♀ 6 tritonymphs.

New to the Canary Islands. This cosmopolitan synanthropic species is frequently found in compost heaps. HARVEY (1991) summarized the known records; SCHAWALLER (1991, 1995) added localities from Nepal and China.

Dendrochernes cyrneus (L. Koch)

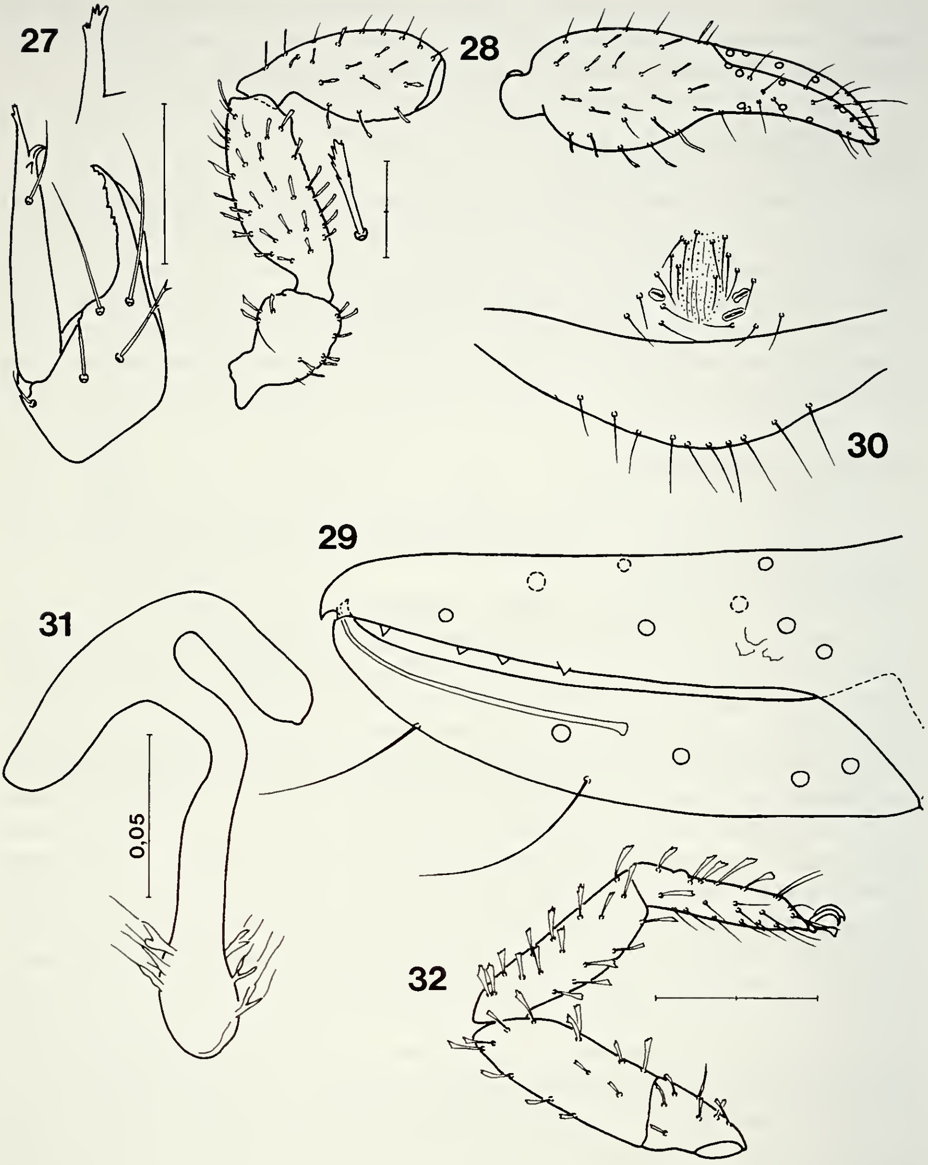
Recorded from Hierro and La Gomera (BEIER 1975). Three specimens of this species (1 ♂ 1 ♀ 1 tritonymph) have been collected by M. Báez in April 1994 on Tenerife, La Esperanza, under bark of *Pinus canariensis*. I have also seen some more specimens from Hierro (Sabinosa; El Pinar, above Las Casas, 110 m; Amoco near Jarales, 900 m; above Tabaique, 1000 m, under bark of *Pinus canariensis*; lg. Cl. Besuchet, E. Heiss and P. Oromí) and La Gomera (Juan Tomé, Llanos de Crispin, El Cedro; lg. P. Oromí).

Allochernes longepilosus n. sp. Figs 27–32

Material studied: Tenerife, Roque de Caramujo, 2200 m, near Las Cañadas, in old trunks of *Adenocarpus* (?), lg. Cl. Besuchet, 13.III.1983: 1 ♀ (holotype), 1 ♂ 2 ♀ 4 tritonymphs (paratypes; MHNG).

Description: Carapace coarsely granulate, with microsculpture between the round granules; eyes or eyespots lacking; two distinct, granulate, transverse furrows, subbasal one smoother than medial one; setae clavate and dentate, 6 setae on anterior border and normally 9–10 (plus 5–6 discal ones in metazone) setae on posterior border; tergites divided, granulate; tergal setae clavate, slightly longer on posterior tergites; 4–6 setae at posterior border of half-tergites, one lateral and one medial on (II) III–X; XI 8–9 (2 median discal setae). Manducatory process 3 marginal and one or two discal setae, palpal coxa granulate, about 17–19 clavate setae (one tactile one), coxa I 9–12 (some smooth), II 11–15, III 14–17 (some smooth), IV 24–35 (some smooth); genital operculum of male with 17 setae (central ones longer) and 17–20 setae in female (Fig. 30), 4 (2/2) interior smooth setae at border of male genital opening; spermatheca of typical shape (Fig. 31); sternal setae smooth on anterior sternites, apically dentate/clavate and longer on posterior sternites, chaetotaxy of half-sternites: III 5–6 and 3 suprastigmatal setae, IV 3–4 and 3 suprastigmatal setae; following ones with 6–8 posterior, one lateral and one medial anterior setae, XI 8–10 setae (total number) (2 medial discal tactile setae, lateral ones longer, finely dentate). Cheliceral palm (Fig. 27) with 5 setae (*db* and *ib* short, finely dentate), subapical lobe on movable finger tooth-like; galea slender, with 4 apical teeth; serrula exterior 17–18 blades, flagellum 3 blades.

Pedipalps (Figs 28–29) stout, distinctly granulate, setae long, apically dentate, setae of hand long, internal ones apically slightly clavate, external ones shorter and dentate, trochanter with prominent rounded dorsal hump, fixed finger with 29 (male) to 31–33 (female), movable finger with 32 (female 33–39) teeth of normal shape; accessory teeth on fixed finger: 3–5 external and 2 internal ones, on movable finger 3–4 external and one internal ones; venom duct in movable finger long, nodus



FIGS 27–32

Allochernes longepilosus n. sp., holotype; 27: chelicera, with female galea enlarged; 28: pedipalps; 29: chelal fingers, lateral view; 30: female genital operculum; 31: spermatheca; 32: leg IV; scale unit 0.1 mm.

ramosus between *t* and *st*; trichobothrial pattern see Fig. 29. Femur abruptly enlarged, 2.6–2.7 times, patella 2.4–2.5 (club 1.6–1.7) times, hand with pedicel 1.7–1.9 times longer than broad and 1.1 (male) to 1.2 (female) times longer than finger, chela with pedicel 3.4 (male) (female 3.0–3.2) times, without pedicel 3.1 (2.8–3.0) times.

Leg I: femur 1.4–1.5 times, patella 2.4–2.8 times longer than deep and 1.47–1.55 times longer than femur, tibia 3.1 (female: 3.3–3.8) times, tarsus 4.5–4.9 times longer than deep. Leg IV (Fig. 32): dorsal (lateral) setae apically dentate/ clavate, ventral (internal) ones apically dentate (femur, tibia) or smooth (tarsus), femur + patella 3.8–4.0 times, tibia 3.9–4.2 times, tarsus 4.3–4.8 times longer than broad, no tactile seta, subterminal seta smooth, claws simple, smooth, as long as arolia.

Measurements (1 ♂ 3 ♀) (in mm): Carapace 0.49/0.44 (0.55–0.58/0.47–0.50). Pedipalps: femur 0.41/0.15 (female 0.41–0.45/0.16–0.17), patella 0.40/0.17 (0.42–0.47/0.17–0.19), hand with pedicel 0.39/0.21 (0.42–0.46/0.23–0.27), finger length 0.36 (0.36–0.38), chela length with pedicel 0.72 (0.74–0.80). Leg I: femur 0.13/0.09 (0.14/0.09–0.10), patella 0.20/0.08 (0.20–0.22/0.08–0.09), tibia 0.19/0.06 (0.19–0.21/0.05–0.06), tarsus 0.21/0.04 (0.21–0.22/0.04–0.05). Leg IV: femur + patella 0.37/0.09 (0.39–0.41/0.10), tibia 0.27/0.07 (0.29–0.31/0.07), tarsus 0.23/0.05 (0.23–0.25/0.05).

The affinities of this species are uncertain. It is amongst the smallest species of this genus along with *pityusensis* Beier, *siciliensis* (Beier), *rhodius* Beier and *microti* Beier (from Turkey and Georgia), but it differs from all these species by the long, apically slightly clavate pedipalpal setae; it can also be distinguished from *pityuensis* by the higher number of tergal setae and longer palpal fingers, and from *microti* by the shape of palpal femur (smoothly enlarged). The species *rhodius* is characterized by much shorter pedipalpal setae, relatively longer palpal fingers, the reduced number of accessory teeth on palpal fingers and the distal position of *it* (close to *et*). *Allochernes siciliensis* possesses stouter palpal segments (particularly patella ratio 2.0–2.1), longer galeal branches and is smaller.

Curiously, this genus had not been recorded from this archipelago before, though the presence of some widespread species, such as *powelli* (Kew), *masi* (Navas) or even *wideri* (C.L. Koch), would not be surprising.

List of pseudoscorpion species recorded from the Canary Islands

Chthonius (C.) ischnocheles (Hermann): Tenerife
Chthonius (C.) jonicus Beier: Hierro
Chthonius (E.) dubius Mahnert: Tenerife (Cueva de San Marcos)
Chthonius (E.) gracilimanus Mahnert: La Palma
Chthonius (E.) machadoi Vachon
    m. machadoi: Gomera, Hierro, Gran Canaria (should be verified)
    machadoi canariensis Beier: Hierro, Lanzarote, Tenerife
Chthonius (E.) rimicola Mahnert: Hierro, La Palma, Tenerife (MSS and caves)
Chthonius (E.) setosus Mahnert: Tenerife (MSS)

Chthonius (E.) tetrachelatus (Preyssler): Gomera, Gran Canaria, La Palma, Tenerife
Lagynochthonius curvidigitatus Mahnert: Tenerife (Cueva Felipe Reventón)
Paraliochthonius canariensis Vachon: Lanzarote
Paraliochthonius martini Mahnert: Hierro (Cueva de Don Justo)
Paraliochthonius tenebrarum Mahnert: Tenerife (Cuevas Negras, Cueva Felipe Reventón, Cueva de los Roques)
Tyrannochthonius setiger Mahnert: Tenerife (Cueva del Sobrado)
Tyrannochthonius superstes Mahnert: Tenerife (Cueva Felipe Reventón; Cueva de la Candelaria; Cueva del Sobrado)
Microcreagrella c. caeca (Simon): Hierro, Tenerife
Microcreagrina cavicola Mahnert: La Palma (Cueva Tacande, Cueva El Raton)
Microcreagrina hispanica (Ellingsen): Fuerteventura, Gomera, Gran Canaria, Tenerife
Microcreagrina subterranea Mahnert: Gomera, Tenerife (Cueva Felipe Reventón, Cueva de los Roques, MSS)
Calocheirus canariensis (Beier): Fuerteventura, Gomera, Graciosa, Hierro, Tenerife
Calocheirus gigas (Mahnert): Gran Canaria
Calocheirus mirus Mahnert: Gomera
Halominniza oromii Mahnert: Alegranza
Olpium canariense Beier: Alegranza, Fuerteventura, Graciosa, Gran Canaria, Lanzarote, Roque del Este, Tenerife
Olpium pallipes (Lucas): Alegranza, Fuerteventura, Gomera, Graciosa, Gran Canaria, Lanzarote, Tenerife
Garypus beauvoisi (Audouin): Fuerteventura, Lanzarote, Lobos, Tenerife
Geogarypus canariensis (Tullgren): Gomera, Gran Canaria, Hierro, Lanzarote, La Palma, Roque del Este, Tenerife
Geogarypus minor (L. Koch): Gran Canaria
Atemnus politus (Simon): Fuerteventura
Diplotemnus ophthalmicus (Redikorzev): Gran Canaria, Tenerife
Apocheiridium (*ferum*?) (Simon): Hierro
Canarichelifer teneriffae Beier: Fuerteventura, Gran Canaria, Roque del Este, Tenerife
Chelifer cancroides Linné: Tenerife
Mesochelifer thunebergi Kaisila: Gran Canaria, Tenerife
Pachychelifer (?) sp.: Hierro
Pseudorhacochelifer canariensis Mahnert: Gran Canaria, Tenerife
Pseudorhacochelifer schurmanni Beier: Gran Canaria, La Palma, Tenerife
Rhacochelifer gracilimanus Mahnert: Gran Canaria, Tenerife
Rhacochelifer hoggarensis Vachon: Hierro
Rhacochelifer maculatus (L. Koch): Tenerife
Rhacochelifer pinicola (Nonidez): Gomera, Hierro, Tenerife
Allochernes longepilosus Mahnert: Tenerife
Dendrochernes cyrneus (L. Koch): Gomera, Hierro, Tenerife

Lamprochernes savignyi (Simon): Hierro
Pselaphochernes lacertosus (L. Koch): Gomera
Withius piger (Simon): Gran Canaria, Hierro, La Palma, Tenerife

FAUNAL LISTS OF THE DIFFERENT ISLANDS

Eastern Islands (12 spp., 7 endemic Canary species = 58%, 2 "eastern" species)

FUERTEVENTURA (7/0 endemic species): *Microcreagrina hispanica, Olpium pallipes, O. canariense, Calocheirus canariensis, Garypus beauvoisi, Atemnus politus, Canarichelifer teneriffae*

LANZAROTE (6/1): *Chthonius (E.) machadoi canariensis, Paraliochthonius canariensis, Olpium pallipes, O. canariense, Garypus beauvoisi, Geogarypus canariensis*

ALEGRANZA (3/1): *Olpium pallipes, O. canariense, Halominniza oromii*

GRACIOSA (3/0): *Olpium pallipes, O. canariense, Calocheirus canariensis*

LOBOS (1/0): *Garypus beauvoisi*

ROQUE DEL ESTE (3/0): *Olpium canariense, Geogarypus canariensis, Canarichelifer teneriffae*

Central Islands (34 spp., 20 endemic species = 59%,12 "central" species)

GRAN CANARIA (15/1 endemic sp.): *Chthonius (E.) m. machadoi* (?), *C. (E.) tetrachelatus, Microcreagrina hispanica, Olpium pallipes, O. canariense, Calocheirus gigas, Geogarypus canariensis, Geogarypus minor, Diplotemnus ophthalmicus, Withius piger, Mesochelifer thunebergi, Rhacochelifer gracilimanus, Pseudorhacochelifer canariensis, P. schurmanni, Canarichelifer teneriffae*

TENERIFE (29/7): *Chthonius (C.) ischnocheles, Chthonius (E.) dubius, C. (E.) machadoi canariensis, Chthonius (E.) rimicola, C. (E.) setosus, C. (E.) tetrachelatus, Paraliochthonius tenebrarum, Lagynochthonius curvidigitatus, Tyrannochthonius superstes, T. setiger, Microcreagrella c. caeca, Microcreagrina hispanica, M. subterranea, Olpium canariense, Calocheirus canariensis, Garypus beauvoisi, Geogarypus canariensis, Diplotemnus ophthalmicus, Allochernes longepilosus, Dendrochernes cyrneus, Withius piger, Chelifer cancroides, Mesochelifer thunebergi, Rhacochelifer gracilimanus, R. maculatus, R. pinicola, Pseudorhacochelifer canariensis, P. schurmanni, Canarichelifer teneriffae*

LA GOMERA (11/1): *Chthonius (E.) m. machadoi* (?), *C. (E.) tetrachelatus, Microcreagrina hispanica, M. subterranea, Olpium pallipes, Calocheirus canariensis, C. mirus, Geogarypus canariensis, Pselaphochernes lacertosus, Dendrochernes cyrneus, Rhacochelifer pinicola*

Western Islands (18 spp., 9 endemic species = 50%,4 western species)

LA PALMA (7/2 endemic species): *Chthonius (E.) gracilimanus, C. (E.) rimicola, C. (E.) tetrachelatus, Microcreagrina cavicola, Geogarypus canariensis, Withius piger, Pseudorhacochelifer schurmanni*

HIERRO (14/2): *Chthonius (C.) jonicus*, *Chthonius (E.) machadoi* ssp. *(machadoi, canariensis)*, *C. (E.) rimicola*, *Paraliochthonius martini*, *Microcreagrella caeca*, *Calocheirus canariensis*, *Geogarypus canariensis*, *Apocheiridium (ferum)*, *Lamprochernes savignyi*, *Dendrochernes cyrneus*, *Withius piger*, *Pachychelifer* (?) sp., *Rhacochelifer hoggarensis*, *R. pinicola*

PRELIMINARY BIOGEOGRAPHIC CONSIDERATIONS:

Up to 1965 only two pseudoscorpion species were recorded from the Canary Islands (TULLGREN 1900: *Geogarypus canariensis*; BEIER 1940: *Chelifer cancroides*); only ten years later, BEIER (1975) mentioned the presence of 18 species (and subspecies) from these islands. The current total of 46 pseudoscorpion species and subspecies enables a short biogeographic analysis, even if additional species will certainly be found and the list of species inhabiting the different islands more or less reflects the collecting efforts and faunistic studies carried out during the last 20 years.

Generally speaking the known species can be attributed to two major groups: cosmopolitan/widespread species and species endemic to the archipelago (or to one island only).

A) COSMOPOLITAN AND WIDESPREAD SPECIES (20)

At least five species have probably been introduced by human activity to the islands, all of them having been transported to several continents (HARVEY 1991): *Chthonius (C.) ischnocheles*, *Chthonius (E.) tetrachelatus*, *Chelifer cancroides*, *Lamprochernes savignyi* and *Withius piger*. Two of them have apparently colonized several islands (*C. tetrachelatus* and *Withius piger*), while the others have been recorded from one island only. Since accidental introduction might have occurred in isolated cases only, and since man-made habitats (gardens, parks, houses) have certainly not been intensively studied, these rare records are not surprising.

Amongst the remaining 12 species, probably ten (specific identity of *Apocheiridium* is uncertain) represent species which are widely spread throughout the Mediterranean basin: *Microcreagrina hispanica*, *Olpium pallipes*, *Garypus beauvoisi*, *Geogarypus minor*, *Diplotemnus ophthalmicus*, *Atemnus politus*, *Rhacochelifer maculatus*, *Pselaphochernes lacertosus* and *Dendrochernes cyrneus*. Most are recorded from the central islands (with the most intensive human activity), but also, surprisingly, from Hierro.

Chthonius (C.) jonicus (eastern Mediterranean basin) and *Rhacochelifer hoggarensis*, known only from Hoggar Mts., might have been accidentally introduced. *Rhacochelifer pinicola* and *Microcreagrella caeca* represent elements of the fauna of the Iberian peninsula. The distribution of *Geogarypus canariensis* is concentrated on the Canary Islands, but it is also recorded from the Madeira Islands and from Morocco.

B) ENDEMIC SPECIES

a) **Cave dwelling species** (7)

Intensive studies of lava tubes of the Canary Islands (e.g. HERNANDEZ *et al.* 1986, MARTIN *et al.* 1986, MARTIN *et al.* 1988; MARTIN & OROMI 1986) yielded a surprising number of highly adapted species known from one cave (or cave system) only, all but two are known from Tenerife and belong to the families Chthoniidae (6) and Syarinidae (1): *Chthonius dubius*, *Paraliochthonius martini*, *P. tenebrarum*, *Lagynochthonius curvidigitatus*, *Tyrannochthonius superstes*, *T. setiger* and *Microcreagrina cavicola*. Four of them (*C. dubius*, *P. martini*, *P. tenebrarum*, *M. cavicola*) probably derived from widespread Iberian or Mediterranean species. The ancestors of *L. curvidigitatus*, *T. setiger* and *T. superstes* might have been members of the Afrotropical fauna.

b) **Superficial subterranean milieu** (MSS) (3)

High specificity can also be observed in this specialized environment, the involved species occur also in caves, but seem less restricted in their distribution: *C. rimicola*, *C. setosus* (Chthoniidae), *Microcreagrina subterranea* (Syarinidae). They belong to the same families as the cave dwelling species.

c) **Epigean species**

At present one might also distinguish two groups (species restricted to one or at most two islands, and species recorded from several or most of the islands), but this division is probably artificial (at least for some or perhaps all cheliferid bark inhabiting species), since some specific habitats are still inadequately explored. The following five species seem to be widely distributed in the archipelago: *Olpium canariense* (7 islands), *Calocheirus canariensis* (5) (Olpiidae), *Canarichelifer teneriffae* (4) and *Pseudorhacochelifer schurmanni* (3) (Cheliferidae). Both subspecies of *Chthonius (E.) machadoi* (*machadoi* and *canariensis*) are recorded from the archipelago (5 islands), but this is awaiting taxonomic revision and detailed comparison with specimens from the Iberian peninsula.

Nine species may be considered (at least for the moment) as endemic species of the one or more of the islands: *Chthonius (E.) gracilimanus* (La Palma), *Paraliochthonius canariensis* (Lanzarote) (Chthoniidae), *Calocheirus gigas* (Gran Canaria), *Calocheirus mirus* (Gomera), *Halominniza oromii* (Alegranza) (Olpiidae), *Allochernes longepilosus* (Tenerife) (Chernetidae), *Mesochelifer thunebergi* (Gran Canaria, Tenerife), *Pseudorhacochelifer canariensis* (Gran Canaria, Tenerife) and *Pachychelifer* (?) sp. (Hierro) (Cheliferidae).

Considering the presently known genera of pseudoscorpions from the Canary Islands, two major faunal influences might be emphasized: central European faunal elements are represented by the genus *Chthonius* (Chthoniidae), but most of the other genera can be considered as representatives of a Mediterranean and North African

(Saharan) fauna. Predominance and surprising radiation can be particularly observed in the families of Syarinidae and Olpiidae. Only two (cave-dwelling) genera might have originated from Aethopian ancestors: *Tyrannochthonius* and *Lagynochthonius*.

ACKNOWLEDGEMENTS

I wish to express my thanks to the following colleagues for their patience and confidance: Prof. Pedro Oromí and his colleagues (University of La Laguna, Tenerife), Dr Claude Besuchet, Dr Bernd Hauser and Dr Charles Lienhard (Natural History Museum of Geneva), Dr Ernst Heiss (Innsbruck), Mr. John Murphy (Hampton) and Dr Konrad Thaler (University of Innsbruck). Prof. J. Heurtault (Paris Natural History Museum) and Dr Jürgen Gruber (Vienna Natural History Museum) tried to trace the type specimen of *Chelifer mayeti* Simon. I am deeply indebted to Dr Mark Judson (Paris Natural History Museum) for his comments and linguistic help.

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REVUE SUISSE DE ZOOLOGIE 104 (3): 587-604; septembre 1997

Additions à la faune de scorpions néotropicaux (Arachnida)

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Addition to the scorpion fauna of the neotropics (Arachnida). - In this paper are presented the results of the study of an interesting collection of neotropical scorpions deposited in the Geneva Museum. The collection is composed of 6 families, 14 genera and 42 species. Two new species, *Tityus dinizi* n. sp. (Buthidae) and *Broteochactas kelleri* n. sp. (Chactidae) are described. Some comments on the species which are able to climb the vegetation and on those living in high mountain habitats are also included.

Key-words: Scorpion - Neotropics - New species - *Tityus* - *Broteochactas*.

INTRODUCTION

La faune des Scorpions de la région néotropicale peut être considérée comme une des plus étudiées au monde, avec de nombreuses contributions depuis le début du 19ème siècle, jusqu'à la synthèse globale de MELLO-LEITÃO (1945).

Dans une perspective plus moderne, plusieurs travaux d'ensemble concernant la systématique et la biogéographie ont été réalisés dans la dernière quinzaine d'années. A titre d'exemple, nous pouvons citer parmi les plus importants, MAURY (1979), LOURENÇO (1982*a*, *b*, 1983, 1988*a*, 1991, 1994*a*, 1995, 1997), FRANCKE & STOCKWELL (1987). Cependant, la région néotropicale est celle qui présente, vraisemblablement, la plus grande diversité parmi les faunes scorpioniques mondiales (LOURENÇO 1994*b*), ainsi la découverte de nouveau taxa, mais aussi la confirmation de nouvelles stations pour des espèces déjà connues est chose courante.

Le présent travail est le résultat de l'étude d'une collection hétérogène de Scorpions néotropicaux déposés désormais au Muséum d'histoire naturelle de Genève. En plus de la description de deux espèces nouvelles, quelques considérations sont faites sur des espèces rares et sur celles habitant des milieux insolites. Sont aussi apportées quelques remarques sur les espèces qui grimpent la végétation et sur celles ayant des caractéristiques saxicoles (habitant des hautes montagnes). Pour le restant des espèces, seule une liste est proposée.

Manuscrit accepté le 25.03.1996.

La présentation du matériel étudié est faite dans l'ordre alphabétique des familles. Les pays concernés sont: Grandes Antilles: Cuba, Haïti, Jamaïque; Petites Antilles: Barbuda, Curaçao, Martinique, St. Barthélémy; Bolivie, Brésil, Equateur, Guyane française, Mexique, Pérou, Trinidad, Venezuela.

La totalité du matériel cité dans le présent travail est déposé dans le Muséum d'histoire naturelle de Genève.

TAXA CONSIDÉRÉS DANS LE TRAVAIL:

Famille des Bothriuridae Simon, 1880

Genre **Bothriurus** Peters, 1861

Bothriurus chilensis (Molina, 1782)

Matériel: Chili, La Dehesa/Santiago, III/1994 (leg. Schenone), 1 ♀. VII Region, Province Talca, Parque Gil de Vilches, Monumento Natural, 1100 m, 12/I/1996 (leg. D. Burckhardt), 1 ♀.

Bothriurus coriaceus Pocock, 1893

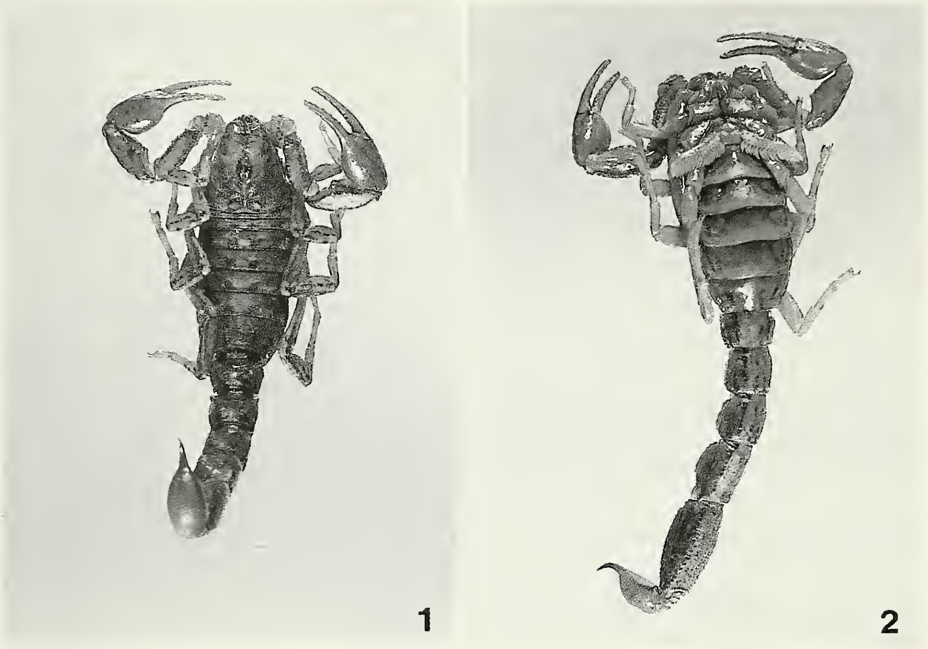
Matériel: Chili, La Serena, III/1994 (leg. Schenone), 1 ♂. VIII Region, Province BioBio, Parque Nacional Laguna del Laja, sector Lagunillas, 1100 m, open *Austrocedrus* forest and sclerophyll scrub, 21/I/1996 (leg. D. Burckhardt), 1 ♂.

Genre **Orobothriurus** Maury, 1975

Orobothriurus crassimanus Maury, 1975 Figs 1, 2

Les Scorpions du genre *Orobothriurus* sont caractéristiques des milieux de haute montagne dans la région andine. L'holotype mâle décrit par Maury d'une localité à 20 km de Cajamarca au Pérou a été collecté à 2850 m. Au cours d'une mission réalisée en 1981, plusieurs nouveaux exemplaires ont été collectés dans la région du «Nevado de Huascaran» sommet culminant à 6768 m (Fig. 23). Lors de la publication de son livre Polis (1990) a pu situer le record d'altitude pour cette espèce de Scorpion à 5500 m, tout en signalant qu'il s'agissait de données personnelles de Lourenço (non publiées). Goyffon (1993) dans une compilation plus récente crédite ce record d'altitude à Polis de manière inexacte. Dans une nouvelle étude du matériel collecté en 1981, j'ai pu trouver un exemplaire mâle collecté à 5560 m. Cette nouvelle donnée correspondant ainsi au record d'altitude connu pour une espèce de Scorpion.

Matériel: Pérou, Llanganuco, Nevado de Huascaran, II/1981 (leg. W. Lourenço), 1 ♀ (4000 m), 3 ♀ (4300 m), 2 ♀ (4400–5500 m), 1 ♂ (5560 m). Quebrada de Queroccocha-Catac (3900 m), VI/1981 (leg. W. Lourenço), 1 ♂, 2 ♀. Districto Recuay, Huama (4200 m), 22/VIII/1972 (leg. P. Brignoli), 2 ♂, 4 ♀, 14 juvéniles.



FIGS 1 et 2

Orobothriurus crassimanus, mâle trouvé à 5560 m alt. dans les Andes péruviennes. Record absolu d'altitude pour une station de collecte d'un Scorpion. 1. Vue dorsale. 2. Vue ventrale.

Famille des Buthidae Simon, 1880

Genre **Ananteris** Thorell, 1891

Ananteris balzani Thorell, 1891

Matériel: Brésil, Brasilia, III/1979 (W. Lourenço), 1 ♂.

Genre **Centruroides** Marx, 1889

Centruroides barbudensis (Pocock, 1898)

Matériel: Antilles, St. Barthélémy, IX/1989 (M. Ballet), 1 ♂, 1 ♀.

Centruroides elegans insularis Pocock, 1902

Matériel: Mexique, Nayarit, Tres Marias (Camp V), 28/III/1984 (A. Garcia Aldrete & T. Navarro), 1 ♂, 1 ♀.

Centruroides hasethi Pocock, 1902

Matériel: Curaçao, Natuurpark Christoffel, 15/II/1985 (P. Strinati & V. Aellen), 1 ♂.

Centruroides margaritatus (Gervais, 1841)

Matériel: Mexique, Agua Blanca, Tabasco, XII/1995 (J. Garzoni), 1 ♀.

Centruroides suffusus Pocock, 1902.

Matériel: Mexique, Durango, 10/VIII/1973 (A. Garcia), 1 ♂.

Cette espèce est parmi les plus toxiques pour l'homme, et responsable de très nombreux cas d'accidents mortels.

Centruroides thorelli (Kraepelin, 1891)

Matériel: Mexique, Yucatan, Cancun, I/1986 (P. Gachet), 1 ♀.

Genre **Isometrus** Hemprich & Ehrenberg, 1828

Isometrus maculatus (DeGeer, 1778)

Matériel: Brésil, Atol das Rocas, III/1982 (leg. W. Lourenço), 1 ♂, 4 ♀. Fernando de Noronha, Sora do Sueste-Rasa Tamar, 1/VI/1990 (V. Daniel), 1 ♂.

Nouvelle station pour l'espèce.

Genre **Rhopalurus** Thorell, 1876

Rhopalurus junceus (Herbst, 1800)

Matériel: Cuba, Isla de la Juventud, Nueva Gerona, 20/VI/1988 (leg. W. Lourenço), 1 ♂.

Rhopalurus pintoi Mello-Leitão, 1932

Matériel: Brésil, Roraima, Alto Cavéné, vers l'île de Maraca, 12/X/1978 (V. Daniel), 1 ♀. Route 101, 12 Km après Boa Vista, 14/X/1978 (V. Daniel), 1 ♂, 1 ♀, 7 juvéniles (portée).

Rhopalurus princeps (Karsch, 1879)

Matériel: Antilles, Haïti, environs de Port au Prince, 15/III/1988 (D. Rigolage), 2 ♂, 3 ♀, 1 juvénile.

Genre **Tityus** Koch, 1836

Tiyus acutidens Mello-Leitão, 1933

Matériel: Brésil, Goias/Tocantins, Mutunopolis, 21/VI/1976 (W. Lourenço), 1 ♀.

Le type de cette espèce est perdu; cet exemplaire a valeur d'un topotype (cf. LOURENÇO 1981).

Tityus asthenes Pocock, 1893

Matériel: Equateur, Loja, Loja Ville, 15/VI/1987 (J.M. Touzet), 1 ♂. Lumbaqui, 4/X/1977 (leg. W. Lourenço), 1 ♀ juvénile.

Tityus bahiensis (Perty, 1834)

Matériel: Brésil, São Paulo Ville, 12/VIII/1987 (W. Lourenço), 1 ♀.

Tityus cambridgei Pocock, 1897 Figs 8, 9

Matériel: Guyane française, Cacao, X/1983 (leg. Chippaux), 4 ♂, 1 juvénile; II/1989 (leg. W. Lourenço), 1 ♂; I/1992 (leg. P. Soler), 1 ♂. Cayenne (région), IX/1987 (leg. Freitag), 1 ♂. Kourou, 16/II/1995 (leg. R. Garrouste) (Obs: spécimen responsable d'accident grave). 9/X/1987 (leg. Freitag), 1 ♂. Petit-Saut, (collecté dans la canopée par le radeau de cimes), 4/XI/1989 (H.P. Aberlenc), 1 ♀ juvénile.

Tityus charreyroni Vellard, 1932

Matériel: Brésil, Mato Grosso, Chavantina, 23/IV/1976 (E. Bastos) 1 ♂ juvénile.

Tityus clathratus Koch, 1845

Matériel: Brésil, Roraima, Ile de Maracá, 4/VII/1987 (J.A. Rafael), 2 ♀; Rio Uraricoera, Ile de Maracá, 2–13/V/1987 (J.A. Rafael), 1 ♂.

Tityus costatus (Karsch, 1879)

Matériel: Brésil, Côte nord de l'Etat de São Paulo, 17/II/1976 (E. Forges), 1 ♀ juvénile (forme trisfasciata, cf. LOURENÇO & EICKSTEDT 1988).

Tityus crassimanus (Thorell, 1877)

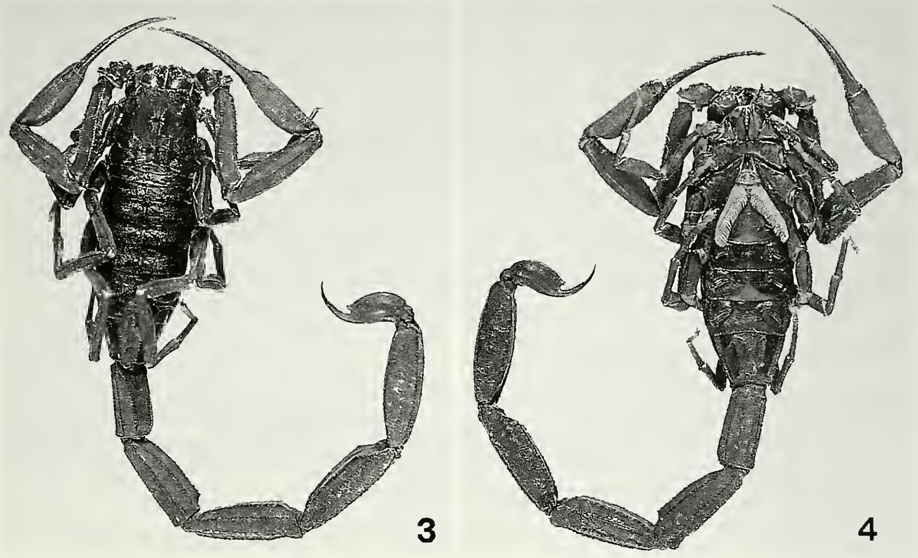
Matériel: Antilles, Jamaique, 1970 (leg. W. Lourenço), 1 ♂, 1 ♀.

Espèce très rare dans son milieu naturel; peut-être en voie de disparition.

Tityus dinizi sp. n. Figs 3–7

Holotype: Brésil, Amazonas, Paraná do Porto, Arquipelago das Anavilhanas (Rio Negro), 26/X/1981 (M. Parmaundo), ♂.

Diagnose: Espèce de grande taille (cf. Tableau I), de couleur sombre appartenant au groupe de *Tityus asthenes*. La nouvelle espèce peut être distinguée de *Tityus tucurui* Lourenço et de *Tityus cambridgei* Pocock, par la forme de la main de la pince bien plus arrondie, une épine sous-aiguillonaire courte et rhomboïdale, et par la forme pointue de la lame basilaire intermédiaire des peignes. Chez les mâles des deux espèces voisines elle est arrondie.

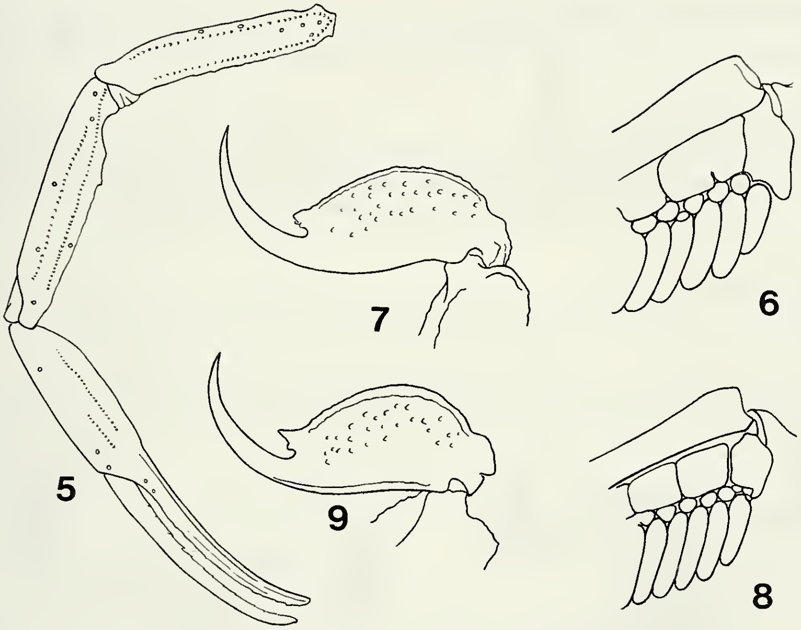


Figs 3–4
Tityus dinizi, holotype-mâle, vues dorsale et ventrale.

Description:

Coloration générale brun-rougeâtre. Prosoma: Plaque prosomienne brunâtre avec des taches jaunâtres diffuses; tubercule oculaire et yeux latéraux noirâtres. Mesosoma: Tergites I à VII avec la même coloration que celle de la plaque prosomienne, mais légèrement plus foncés. Sternites brunâtres avec des taches claires dans la région postérieure du IIIème et du Vème. Metasoma: Anneaux caudaux I à V brun-rougeâtres avec des taches noirâtres très diffuses. Telson rougeâtre; aiguillon à base jaune-rougeâtre et à extrémité noirâtre. Peignes jaune-clair; opercule génital, sternum, hanches et processus maxillaires d'un jaune tacheté. Pattes et pédipalpes brun-rougeâtre, avec présence de quelques taches jaunâtres sur les pattes. Chélicères jaunâtre foncé avec une trame de taches noires sur son ensemble.

Morphologie. Prosoma: Front de la plaque prosomienne avec une échancrure frontale moyennement marquée. Tubercule oculaire antérieur par rapport au centre de la plaque prosomienne; yeux médians séparés par plus d'un diamètre oculaire; trois paires d'yeux latéraux. Plaque prosomienne faiblement granulée; carènes médianes oculaires allant du bord antérieur jusqu'en arrière du tubercule oculaire; carènes médianes postérieures moyennement marquées; sillon interoculaire bien marqué. Mesosoma: Tergites moyennement granulés; carène axiale présente sur tous les tergites; tergite VII avec cinq carènes, l'axiale limitée au tiers antérieur; les deux médianes et les deux latérales fusionnées dans la région proximale. Sternites



Figs 5–9

Figs 5 à 7. *Tityus dinizi*, holotype-mâle. 5. Fémur, tibia et pince, vue dorsale. 6. Détail de la lame basilaire intermédiaire du peigne. 7. Telson, vue latérale. Figs 8 et 9. *Tityus cambridgei*, mâle. 8. Détail de la lame basilaire intermédiaire du peigne. 9. Telson, vue latérale.

moyennement granulés; stigmates linéaires. Peignes avec 20–20 dents; lame basilaire intermédiaire avec une petite dilatation pointue. Metasoma: Anneaux I avec 10 carènes; anneaux II à IV avec 8 carènes; anneau V avec 5 carènes; espaces intercarénaux faiblement granulés; vésicule peu granulée; épine sous-aiguillonaire courte et rhomboïdale avec deux granules ventraux. Pédipalpes: Fémur à 5 carènes, tibia à 7 carènes, la carène interne-dorsale à granules spiniformes. Pince avec 9 carènes très estompées. Tranchant des doigts mobiles avec 16–16 séries de granules. Chélicères avec la dentition caractéristique des Buthidae (VACHON 1963). Trichobothriotaxie du type A–α, orthobothriotaxique (VACHON 1973, 1975).

Etymologie: Le nom spécifique est attribué en hommage au Prof. Carlos Diniz, Directeur de Recherches à l'Institut Ezequiel Dias, Belo Horizonte, Brésil.

Tityus discrepans (Karsch, 1879)

Matériel: Trinidad, Esperanza Estate, Vega de Oropouche (in Banana Plantation), 19/V/1959 (T.H.G. Aitken), 1 ♀.

Tityus ecuadorensis Kraepelin, 1896

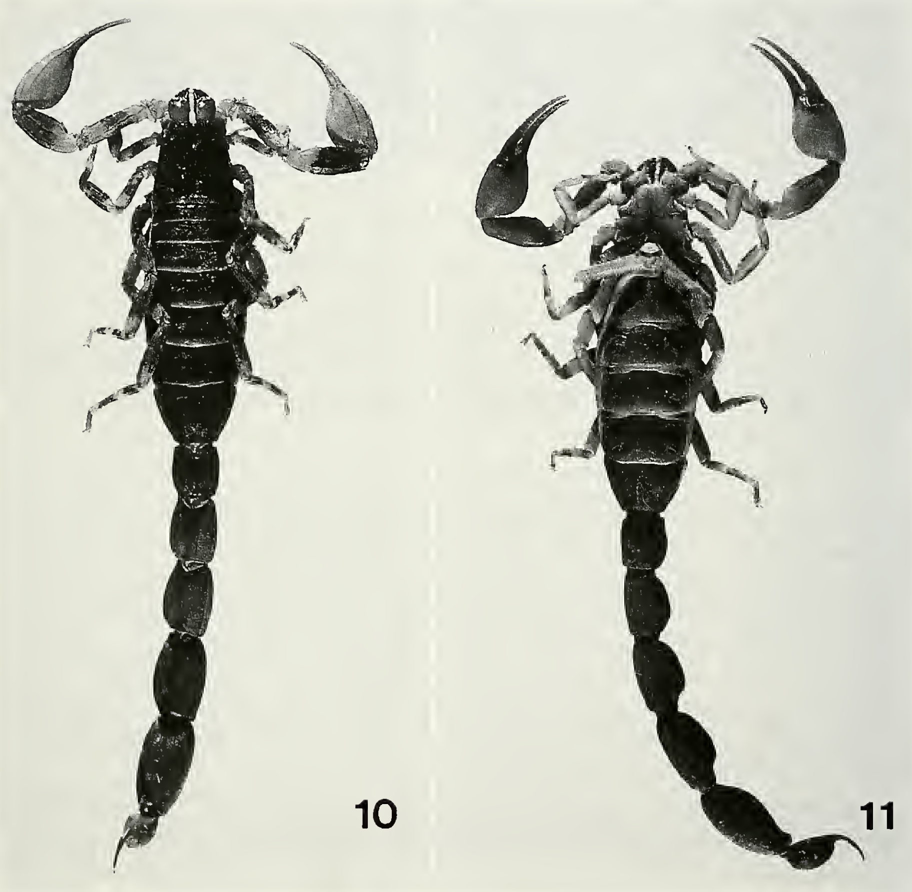
Matériel: Pérou, Prov. Cajamarca, Catachi 3 Km de Cuterva, 30/VIII/1977 (C. Ribera), 1 ♀.

Tityus fasciolatus Pessôa, 1935 Figs 10 et 11

Matériel: Brésil, D.F., Brasilia, X–XII/1975 (W. Lourenço), 11 ♂, 11 ♀, 19 immatures; IV–V/1976 (W. Lourenço), 2 ♂, 8 ♀, 16 immatures. Goiás, Vianópolis, 12/VI/1976 (W. Lourenço), 1 ♂. (spécimen avec valeur de topotype: LOURENÇO 1980).

Tityus funestus Hirst, 1911

Matériel: Venezuela, Edo. Tachina, San Cristobal, 4/X/1975 (M.A. Gonzales-Sponga), 1 ♂, 1 ♀.



FIGS 10–11

Tityus fasciolatus, topotype-mâle, vues dorsale et ventrale.

Tityus magnimanus Pocock, 1897

Matériel: Venezuela, Edo. Falcon, 17/V/1975 (leg. W. Lourenço), 1 ♂.

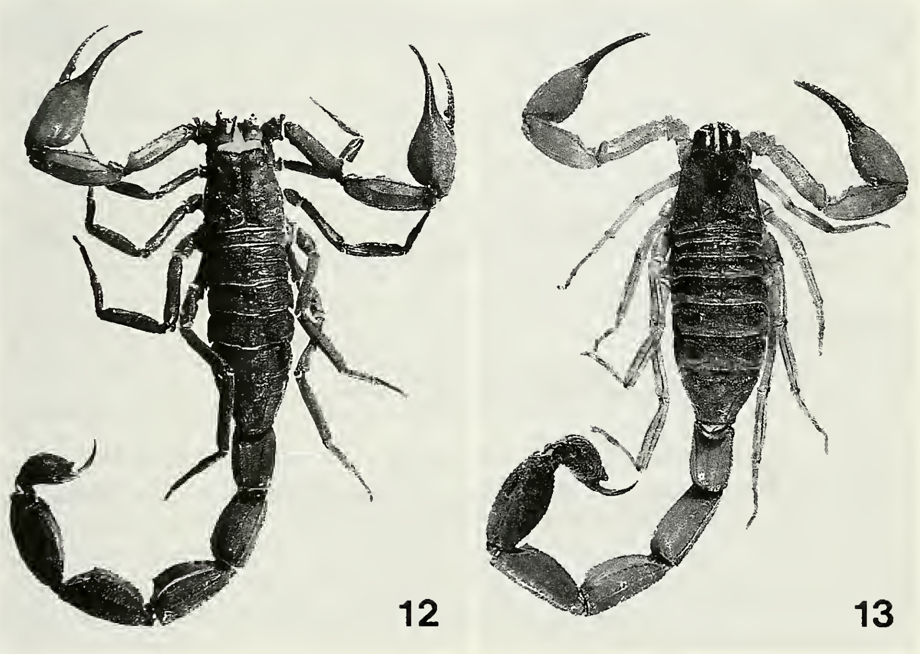
Tityus mattogrossensis Borelli, 1901

Matériel: Brésil, Bahia, Barreiras, 29/IX/1975 (W. Lourenço), 1 ♀; Goiás, Aruanã, 5–6/IX/1976 (W. Lourenço), 4 ♂, 2 ♀; Parque Nac. Araguaia, VI/1979 (W. Lourenço), 12 ♂, 9 ♀; Mato Grosso do Sul, Corumbá (Fazenda Nhumirim), VI/1985 (E. Bastos), 2 ♀.

Tityus metuendus Pocock, 1897 Fig. 12

Matériel: Brésil, Amazonas, Manaus, 3/XII/1982 (J. Adis), 1 ♂, 1 ♀. Reserva Ducke, 1/I/1983 (W.E. Magnusson), 1 ♂; 21/V/1983 (W.E. Magnusson), 1 ♂. Rondonia, Porto Velho, 5/X/1991 (M. Bernardi), 1 ♀ (nouvelle station). Roraima, Ile de Maracá, 2–13/V/1987 (J.A. Rafael), 1 ♀ (nouvelle station). Pérou, Loreto, Jenaro Herrera, 20/X/1989 (G. Couturier), 1 ♀; 15/VI/1990 (G. Couturier), 1 ♂ juvénile. Région d'Equitos, V/1990 (Sanchez), 3 ♀.

L'étude du présent matériel permet d'élargir la répartition connue de l'espèce (Fig. 23). Un cas d'accident mortel a été recensé au Pérou.



Figs. 12–13

12. *Tityus metuendus*, mâle. 13. *Tityus strandi*, mâle, vue dorsale.

Tityus ocelote Francke & Stockwell, 1987

Matériel: Costa Rica, Prov. Heredia, O.T.S., Finca la Selva, 4–11/I/1978 (O.F. Francke), 1 ♂, 1 ♀ (paratypes).

Tityus pococki Hirst, 1907

Matériel: Venezuela, Mérida (1700 m), 23/IX/1987 (G. Lamas), 2 ♀; 18/III/1975 (leg. W. Lourenço), 1 ♀.

Tityus pusillus Pocock, 1893

Matériel: Brésil, Pernambuco, Tapacura (réserve écologique), 14/III/1979 (W. Lourenço), 1 ♀, 10 juvéniles (portée).

Tityus serrulatus Lutz & Mello, 1922

Matériel: Brésil, São Paulo, 18/III/1985 (W. Lourenço), 2 ♀, 4 ♀ juvéniles.

Tityus silvestris Pocock, 1897 Figs 14 et 15

Matériel: Brésil, Amazonas, Balbina, 20/X/ 1983 (leg. W. Lourenço), 1 ♂; Manaus, XII/1982 (U. Barbosa), 1 ♂; 28/VIII/1987 (A.C. Trancredo), 1 ♂; Tarumã-Mirim (Igapo), 16/IX/1976 (J. Adis), 1 ♀; 29–31/ X/1980 (J. Adis), 1 ♂; 14/III/1983 (J. Adis), 1 ♂. Pará, Alter do Chão, Santarém, 25/IX/1981 (Albertino), 1 ♂; 9/II/1984 (leg. W. Lourenço), 1 ♂. Belém, 23/II/1988 (leg. W. Lourenço), 1 ♀. Guyane française, Cacao, X/1983 (Chippaux), 1 ♂. Pérou, Madre de Dios, Puerto Maldonado, 3/IV/1992 (G. Couturier), 1 ♂.

Espèce à caractère polymorphe du type «Ochlospecies» (cf. Lourenço 1988*b*).

Tityus soratensis Kraepelin, 1911

Matériel: Bolivie, Km 215 S. Totora (3000 m), 8/II/1976 (leg. W. Lourenço), 1 ♀; Zudanez, Chuquisata (2500 m), 13/II/1976 (leg. W. Lourenço), 1 ♂; 3/III/1976 (leg. W. Lourenço), 2 ♀. Pérou, Dept. Loreto, V/1991 (J.-L. Sanchez), 2 ♀.

Tityus strandi Werner, 1939 Fig. 13

Matériel: Brésil, Amazonas, Lago Amanã, 29/X/1979 (R. Barthem), 1 ♂. Pará, Tucurui, 20/II/1987 (leg. W. Lourenço), 1 ♂, 4 ♀, 16 juvéniles.

Tityus trivittatus Kraepelin, 1898

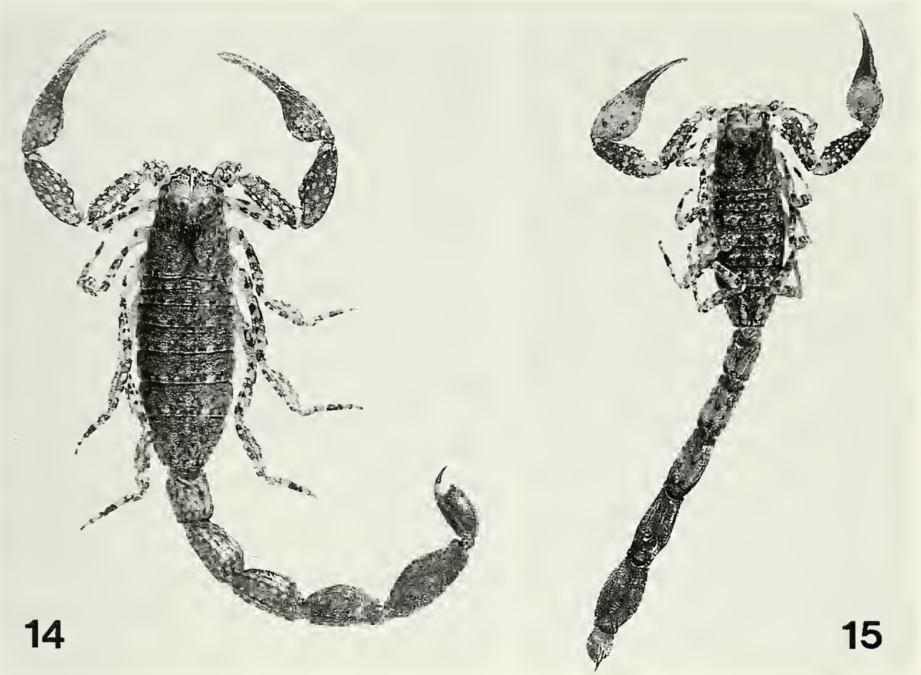
Matériel: Brésil, Mato Grosso do Sul, Corumbá, 14/XII/1984 (R.R. Tullio), 1 ♀; 26/III/1985 (E. Gairtner), 1 ♀; 10/V/1986 (E. Bastos), 1 ♂ juvénile.

Famille des Chactidae Laurie, 1896

Genre **Broteochactas** Pocock, 1893

Broteochactas delicatus (Karsch, 1879)

Matériel: Guyane française, Cacao, II/1989 (leg. W. Lourenço), 1 ♂, 1 ♀; Maripasoula, X/1987 (Marty), 1 ♀; St. Georges de l'O., 20/VIII/1982 (leg. W. Lourenço), 1 ♀.



FIGS 14 et 15

Tityus silvestris, mâles, de Santarém et de Belém, Pará, Brésil. Observer le polymorphisme du type ochlospecies.

Broteochactas fravalae (Lourenço, 1983)

Matériel: Guyane française, Saül (sous bois mort), VIII/1987 (P.K. Moritz), 1 ♀.

Nouvelle localité pour l'espèce.

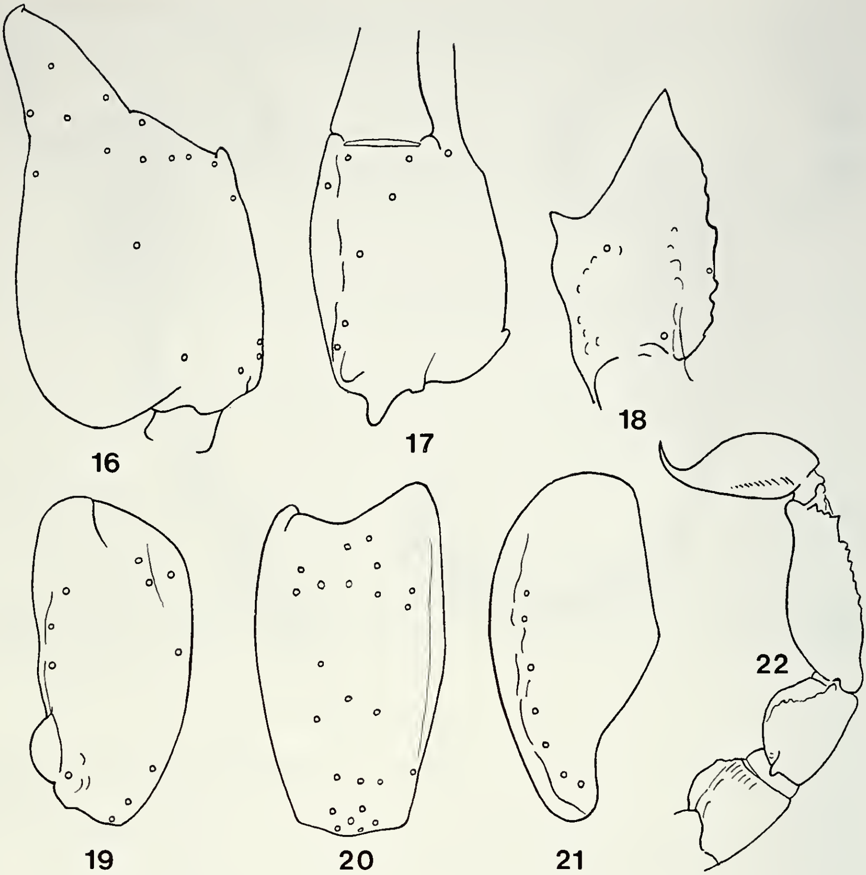
Broteochactas kelleri sp. n. Figs 16–22

Holotype: Guyane française, Cacao, II/1989 (leg. W. Lourenço), ♀.

Diagnose: La nouvelle espèce de *Broteochactas* appartient au groupe d'espèces «Auyantepuia», ainsi qu'il a été défini par LOURENÇO (1986). L'espèce est de petite taille comme toutes les espèces de son groupe. Elle est voisine de *Broteochactas gaillardi* (LOURENÇO 1983), mais peut être distinguée par une coloration générale beaucoup plus sombre et par des rapports de valeurs morphométriques assez différents (cf. Table I).

Description:

Coloration générale brunâtre. Prosoma: Plaque prosomienne brunâtre avec des taches plus sombres situées en avant; les zones des sillons et la zone postérieure plus



FIGS 16-22

Broteochactas kelleri n. sp., holotype-femelle. 16 et 17. Pince, vues externe, ventrale. 18. Fémur, vue dorsale. 19 à 21. Tibia, vues dorsale, externe et ventrale. 22. Anneaux III à V du metasoma et telson, vue latérale.

claires; tubercule oculaire clair. Mesosoma: Tergites brunâtres avec des plages confluentes plus claires, jaunâtres. Metasoma: Tous les anneaux d'une coloration rougeâtre foncée. Vésicule rougeâtre; aiguillon à base rougeâtre et à extrémité rouge noirâtre. Sternites brun-jaunâtre. Peignes, opercule génital, sternum, hanches et processus maxillaires de la même couleur que les sternites. Pattes jaune brunâtre avec des taches grisâtres, un peu diffuses. Pédipalpes rougeâtre foncé; pinces rougeâtres. Chélicères rouge jaunâtre avec des taches grisâtres; doigts jaunâtres avec des dents rougeâtres.

Morphologie. Prosoma: Plaque prosomienne très légèrement concave frontalement. Tubercule oculaire antérieur par rapport au centre de la plaque prosomienne. Yeux médians séparés d'environ un diamètre oculaire. Deux paires d'yeux latéraux; présence d'une troisième paire d'yeux vestigiaux, situés derrière la deuxième paire. Plaque prosomienne sans granules, pratiquement lisse. Mesosoma: Tergites avec quelques granules très fins et très épars. Metasoma: Carènes dorsales à peine esquissées sur les anneaux I à IV; les latéro-dorsales à peine esquissées sur les anneaux I à IV; les autres carènes sont absentes. Face ventrale de l'anneau V avec une granulation spiniforme. Vésicule aplatie avec quelques granules épars sur la face ventrale; aiguillon d'une longueur moyenne. Sternites à stigmates arrondis; tégument lisse. Peignes avec 6-6 dents, sans fulcres. Pédipalpes: Fémur à 3 carènes bien nettes, presque complètes; tibia et pince avec des esquisses de carènes; fémur granulé sur la face interne; face dorsale de la pince faiblement granulée, l'interne avec quelques granules très épars. Tranchant des doigts mobiles avec une série linéaire de granules divisée en cinq séries par des granules plus gros. Pattes: Télotarses avec des nombreuses soies irrégulièrement distribuées. Chélicères avec la dentition caractéristique des Chactidae (VACHON 1963); présence d'une serrula sur la face ventrale du doigt mobile. Trichobothriotaxie du type C; néobothriotaxie majorante (VACHON 1973).

Etymologie: Le nom spécifique est attribué en hommage à M. Albert Keller du Muséum d'histoire naturelle de Genève.

Genre **Brotheas** Koch, 1843

Brotheas gervaisi Pocock, 1893

Matériel: Guyane française, Cacao (F–T–574), XII/1988, (T. Freitag), 1 ♂; II/1989 (leg. W. Lourenço), 1 ♂, 1 ♀; X/1983 (Chippaux), 1 ♀; DZ3, future route Régina-St. Georges, I/1991 (Marty), 1 ♂; Saül, 23/VII/1987 (leg. W. Lourenço), 1 ♀; 16/VII/1986 (leg. W. Lourenço), 1 ♂ juvénile.

Brotheas granulatus Simon, 1877

Matériel: Guyane française, Cacao, II/1989 (leg. W. Lourenço), 1 ♀, 1 juvénile; X/1983 (Chippaux), 1 ♀; XII/1988 (T. Freitag), 1 ♂.

Genre **Chactas** Gervais, 1844

Chactas mahnerti Lourenço, 1995

Matériel: Equateur, Lumbaqui, 4/X/1977 (leg. W. Lourenço), 1 ♀.

Cette espèce a été décrite d'après un exemplaire mâle. Le nouvel exemplaire est la première femelle connue.

Genre **Chactopsis** Kraepelin, 1912

Chactopsis insignis Kraepelin, 1912

Matériel: Pérou, Loreto, V/1990 (Sanchez), 1 ♀.

TABLEAU I

Mensurations (en mm) des espèces décrites

	T. dinizi	*B. kelleri*	(*B. gaillardi* Lourenço, 1983)*
	M	F	F-allotype
Prosoma			
– Longueur	8,5	4,0	4,1
– Largeur antérieure	6,4	2,6	2,7
– Largeur postérieure	9,7	3,8	4,1
Anneau caudal I			
– Longueur	8,0	1,2	1,8
– Largeur	4,4	2,5	2,6
Anneau caudal V			
– Longueur	14,1	3,2	3,4
– Largeur	4,8	1,8	1,9
– Hauteur	2,3	1,4	1,6
Vésicule			
– Largeur		0,8	1,6
– Hauteur	1,8	0,9	1,2
Pédipalpe			
– Fémur longueur	12,6	2,3	2,5
– Fémur largeur	2,4	0,9	1,2
– Tibia longueur	13,3	2,4	3,0
– Tibia largeur	3,1	1,3	1,6
– Pince longueur	20,5	5,1	5,8
– Pince largeur	3,1	2,8	2,2
– Pince hauteur	3,1	2,0	3,1
Doigt mobile			
– Longueur	12,2	2,7	3,0

* Valeurs données à titre comparatif.

Genre **Teuthraustes** Simon, 1878

Teuthraustes atramentarius Simon, 1878

Matériel: Equateur, Prov. Pichincha, Yaruqui (NE Quito), V/1996 (F. Nobile), 1 ♀.

Famille des Diplocentridae Peters, 1861

Genre **Didymocentrus** Kraepelin, 1905

Didymocentrus hasethi (Kraepelin, 1896)

Matériel: Curaçao, San Pedro, 13/II/1985 (P. Strinati & V. Aellen), 1 ♀.

Didymocentrus lesueurii (Gervais, 1844)

Matériel: Antilles, Martinique, Plateau Concorde (forêt primaire, 600 m), 17/II/1981 (leg. W. Lourenço), 1 ♀; Le Precheur, Anse Couleuvre (forêt mésophile, 50 m), 19/II/1981 (leg. W. Lourenço), 1 ♂, 1 ♀.

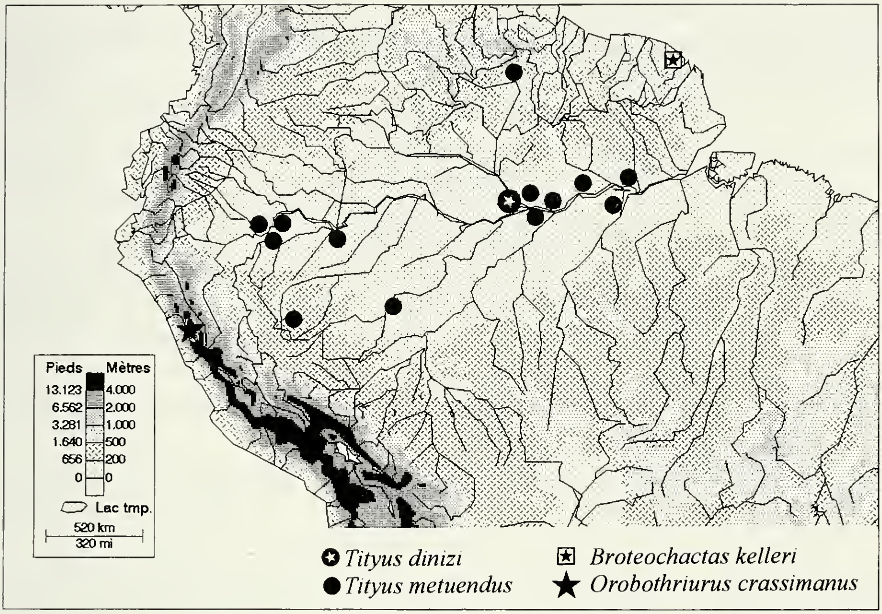


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FIG. 23

Localités typiques de *Tityus dinizi* n. sp. et de *Broteochactas kelleri* n. sp. Répartition connue de *Tityus metuendus*. Localisation du «Nevado de Huascarán», station de collecte d'*Orobothriurus crassimanus* à 5560 m alt.

Genre **Oieclus** Simon, 1880

Oieclus purvesii (Becker, 1880)

Matériel: Antilles, Barbuda, X/1994 (leg. W. Lourenço), 1 ♀.

Famille des Ischnuridae Pocock, 1893

Genre **Opisthacanthus** Peters, 1861

Opisthacanthus cayaporum Vellard, 1932

Matériel: Brésil, Pará, Campos dos Caiapos, VI/1979 (W. Lourenço), 2 ♂, 1 ♀, 4 immatures.

Famille des Iuridae

Genre **Hadruroides** Pocock, 1893

Hadruroides lunatus (Koch, 1867)

Matériel: Pérou, Canon del Pato, VII/1981 (M. Curti), 1 ♀.

Hadruroides maculatus (Thorell, 1876)

Matériel: Equateur, Provincia del Guayas, Manglaralto (15 Km de la côte), VI/1981 (F. Mongeolle), 1 juvénile.

ESPECES QUI GRIMPENT DANS LA VÉGÉTATION ET ESPECES SAXICOLES PRÉSENTES DANS LA COLLECTION ÉTUDIÉE

A. Cas des espèces qui grimpent dans la végétation

1. *Tityus cambridgei* (femelle) collectée dans la canopée par le Radeau des cimes à Petit Saut en Guyane française. Région de forêt primaire; la canopée étant formée par des arbres atteignant 30 à 40 mètres. Cette altitude de collecte d'un Scorpion grimpé dans la végétation semble représenter um record absolu.
2. *Rhopalurus pintoi* (mâle, femelles) collectées sous l'écorce d'un arbre à environ 2 m du sol, à Roraima, Brésil.
3. *Tityus silvestris* (mâle) collecté en Amazonie péruvienne, au sommet d'un palmier *Astrocaryum gratum*. Un autre cas (mâle), collecté en Amazonie brésilienne dans *Aechmea setigera* à 19 m de hauteur.
4. *Tityus metuendus* (femelle) collecté en Amazonie péruvienne, dans *Euterpe oleraceae*, à 12 m alt. Un autre cas (mâle), collecté dans *Astrocaryum javarense* au sommet.
5. *Tityus mattogrossensis* (femelle) collectée à Bahia, Brésil, dans *Mauritia flexuosa* à environ 22 m de hauteur.

On remarquera que seules les espèces appartenant à la famille des Buthidae manifestent le comportement grimpeur. Cette règle semble être générale non seulement chez les espèces américaines mais dans d'autres régions du monde.

B. Espèces saxicoles

Quelques exemples méritent d'être signalés:

1. *Tityus costatus*, espèce pouvant être retrouvée jusqu'à 1500 m alt. dans le sud-est du Brésil.
2. *Tityus pococki* (femelles) collectées dans la région de Mérida jusqu'à 1700 m alt.
3. *Tityus soratensis* (mâle, femelles) collectées dans la cordillère des Andes en Bolivie de 2500 à 3000 m alt.
4. *Orobothriurus crassimanus* (mâles, femelles) collectés dans la cordillère des Andes au Pérou depuis 3900 jusqu'à 5560 m alt.

Le record d'altitude pour une station scorpiologique revient à cette dernière espèce de la famille des Bothriuridae. Ceci n'a rien d'étonnant car les représentants de ce groupe de Scorpions semblent être bien adaptés aux conditions extrêmes de froid et d'aridité. Certaines espèces sont retrouvées tout au sud de la Patagonie (MAURY 1968) où la température au cours de l'hiver peut descendre à –30/40°C. Les espèces habitant ces régions extrêmes présentent un comportement fousseur et s'enterrent pendant plusieurs mois de l'année dans des galeries qu'ils creusent (MAURY 1969), condition qui leur permet ainsi d'échapper à de très basses températures extérieures.

REMERCIEMENTS

Je tiens à remercier les Drs. V. Mahnert et B. Hauser du Muséum d'histoire naturelle de Genève de m'avoir facilité la réalisation de la présente étude. M. J. Rebière pour la réalisation de plusieurs dessins et le Dr. S. Jourdan pour la révision du texte.

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REVUE SUISSE DE ZOOLOGIE 104 (3): 605-609; septembre 1997

Leleuporella sexangulata sp. n. from Sri Lanka, a *Leleuporella* species outside the Ethiopean realm (Coleoptera, Carabidae)

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Leleuporella sexangulata **sp. n. from Sri Lanka, a** *Leleuporella* **species outside the Ethiopean realm (Coleoptera, Carabidae).** - *Leleuporella sexangulata* sp. n. from Sri Lanka is described and illustrated. It is the first species of the genus described outside the Ethiopean region. A key is given to the known *Leleuporella* species.

Key-words: Coleoptera - Carabidae - Scaritinae - *Leleuporella* - taxonomy - Sri Lanka.

INTRODUCTION

The genus *Leleuporella* Basilewsky belongs to the tribe Clivinini (Scaritinae) and consists of small species of 2-3 mm length. The first species described was named as *Trilophus mandibularis* Burgeon (1935). Basilewsky errected a separate genus, *Leleuporella*, when he described *L. cacea* Basilewsky (1956). JEANNEL (1957) recognized that the two species belong to the same genus and this was confirmed and summarized by BASILEWSKY (1959). Both species occur in the western part of Africa at the equator in the same area, but are ecologically separated: *L. mandibularis* possesses hemisphaerically protruding eyes and was often collected in the forest in light traps whereas in *L. cacea* has completely reduced eyes and the species was washed out of sand and gravel at the border of a river near the Tumba See.

Among material collected by staff of the Muséum d'histoire naturelle Geneva in Sri Lanka, there were two specimens which do not belong to any of the genera known from the Oriental realm. Comparison with the type and other material of *Leleuporella mandibularis* and *L. cacea* exhibit two results: the two specimens belong to the genus *Leleuporella*, and are different in many characters from the known African species. Thus, *Leleuporella* occurs outside the Ethiopean realm.

Terms and descriptions of characters are based on BALKENOHL (1996).

Material is deposited in following collections:

MHNG: Muséum d'histoire naturelle (Genève, Switzerland)
MRACT: Musée Royal de l'Afrique Centrale, Tervuren, Belgique;
CBA: Collection of author (Denzlingen near Freiburg, Germany)

Manuscript accepted 18.02.1997

KEY TO THE SPECIES OF THE GENUS *Leleuporella*

1	Without eyes; genae conspicuously tumid; frons smooth, with indistinct puncture-like median impression. Outline of pronotum rounded laterally. Sides of elytra subserrate. Length 2.7 - 3.0 mm	*L. cacea* Basil
–	With distinct eyes; genae inconspicuous; frons with furrows or carinae. Outline of pronotum straight laterally. Sides of elytra smooth	2
2	Eyes big, hemisphaerically protruding; genae hardly visible. Frons with longitudinal furrow at middle and indistinct foveae at each side at neck constriction. Anterior margin of pronotum slightly convex; reflexed lateral border ending behind anterior setigerous puncture, extended to basal constriction as a submarginal furrow without marginal channel. Base of elytra truncated convex. Length 2.1 - 2.4 mm	*L. mandibularis* Burg
–	Eyes smaller, reduced; genae distinct, rounding eyes in posterior quarter. Frons with about 6 irregular carinae. Anterior margin of pronotum concave, reflexed lateral border and marginal channel reaching nearly up to basal constriction. Base of elytra truncated rectangularly. Length 2.5 - 2.7 mm	*L. sexangulata* sp. n.

Leleuporella sexangulata sp. n. (Figs 1-3)

Type material: Holotype ♂, Ceylan, Southern, Yala Nat. Park, 24.1.1970, leg. I. Löbl, C. Besuchet, R. Mussard (MHNG).

Paratype: 1 ♂, same data as holotype (CBA).

Measurements: Length 2.54/2.63 mm, width 0.72 mm; ratio length/width of pronotum 1.1; ratio length/width of elytra 1.95.

Colour: Head, pronotum, ventral surface, and elytra brown. Mouthparts, antennae, legs yellowish-brown.

Head: A quarter smaller than pronotum. Surface dull. Clypeus, supraantennal plates finely but distinctly margined. Clypeus elongated, slightly bisinuate anteriorly, bisetose, separated from wings by broad indistinct notches, wings slightly projecting, devided from supraantennal plates by distinct notches: supraantennal plates convex, with keel-like longitudinal elongation posteriorly; clypeus with conspicuous hexagonal carina, hexagon opened anteriorly, posteriorly separated from frons by a flat transverse furrow. Clypeus and frons devided from supraantennal plates and eyes by deep longitudinal furrows. Furrows diverging posteriorly, with 2 supraorbital setae each. Sharp carina between furrow and frons at each side starting at mid-eye level, ending at neck constriction. Frons convex, with rounded carinae somewhat irregularly situated. Neck with distinct transverse carina and constriction. Eyes reduced, small but distinctly convex and protruding. Genae visible from above, rounding eyes in posterior quarter. Labrum convex, 7-setose. Mandibles elongate, slender, sharp, right one with tooth basally. Apical maxillary palpomere conspicuously securiforme, hollowed out dorsally, 2nd segment conspicuously tumid. Apical labial palpomere bottle-like, 2nd segment bisetose (Fig. 3). Antennae reaching up to basal constriction

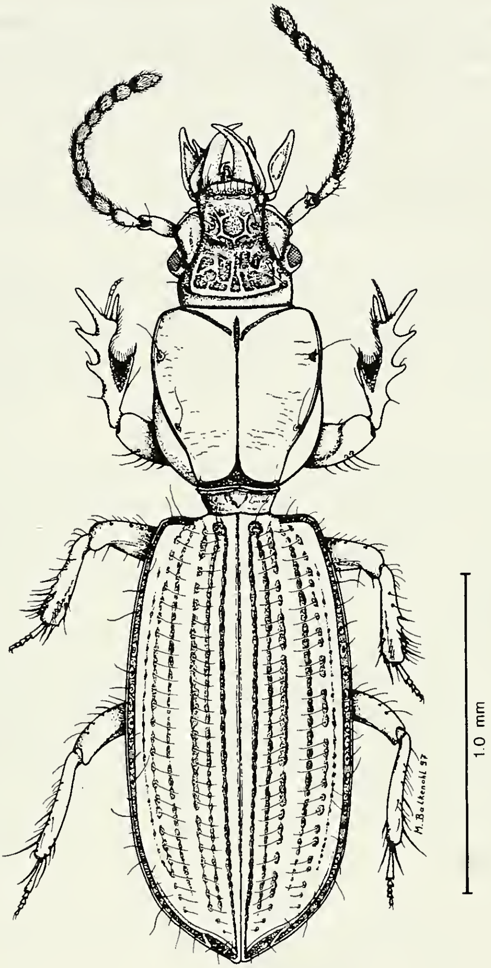


FIG. 1

Leleuporella sexangulata sp. n., holotype, habitus ♂.

of pronotum; pedicellus attached excentrically to scapus, scapus constricted apically, with one seta dorsoapically; segment 5 to 10 elongate (L/W 1.25).

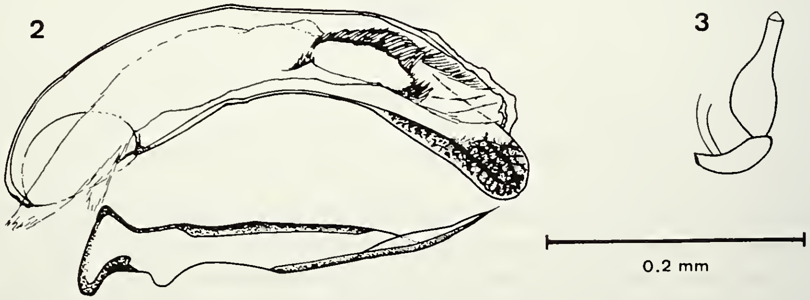
Pronotum: Lateral view: anterior half explanate, moderately convex in posterior part, more convex to basal constriction; frontal view; moderately and regularly convex. Longer than wide, parallel at middle. Anterior margin slightly concave. Reflexed lateral border complete, extending over posterior setigerous puncture, extended to basal constriction as submarginal furrow and obtuse vault, bisinuate posteriorly. Two lateral setigerous punctures somewhat removed from marginal channel. Proepisternum tumid laterally, distinctly visible from above and forming outline of pronotum. Anterior angles acute, steeply bend ventrally and not visible from above, posterior ones missing. Anterior transverse line deep. Entire median line conspicuously sharp, not reaching anterior margin, surpassing anterior transverse line without joining, deeper anteriorly and posteriorly, adjoining basal constriction. Surface indistinctly and irregularly reticulated but shiny. No basal fovea. Basal constriction broad, deep. Ring-like flange elongated, concavely truncate at pedunculus, acute in lateral view.

Elytron: Explanate on disc. Elongate, side nearly straight at middle. Base truncate rectangularly. Marginal channel moderately broad, with uninterrupted series of setigerous punctures arising from small tubercles; reflexed margin smooth, distinct from humerus to apex, fine at base, fold-like carina at apex, crossing marginal channel. Humerus obtuse angeled, no humeral tooth. Basal tubercle with setigerous puncture situated at declivity of 2nd interval. Stria 1 - 3 free at base. Stria 1 conspicuously deep, 2 to 4 moderately deep, all punctate-striate, 5 and 6 developed as rows of partly connected punctures, 6 shortened basally. Intervals moderately convex, 4th broader as others, 7th forming carina apically. Interval 3 and 5 with series of 25 to 30 setigerous punctures, situated regularly at outer stria; setae long, shiny, all bent ctenidiiforme mesially.

Wings: Reduced, length two fifth of elytron, width one third of elytron.

Lower surface: Proepisternum with distinct transverse wrinkles, submarginal furrow distinct at anterior angles, prosternum compressed between coxal cavities. Sternites with pair of paramedian ambulatory setae; terminal sternite shiny, without reticulation, 2 apical setae on each site widely separated. Ventral strigae distinct.

Legs: Anterior tibia with three lateral preapical denticles of increasing length towards apex, apical spine long, curved ventrally and slightly laterally. Mesotibia with fine tubercles. First tarsal segment conspicuously long at all legs.



FIGS 2, 3

Leleuporella sexangulata sp. n. 2. aedeagus and paramere, dorsal view; 3. labial palp.

Adeagus (Fig. 2): Median lobe regularly arcuate at middle, apex spatulate. Endophallus with group of few fine teeth basally, apical cup covered with long bristles. Dorsal paramere slender, fine at apex, ventral one rudimentary, both asetose.

Habitat: The specimens were sifted from vegetational debris.

DISCUSSION

The key in BALKENOHL 1996 leads to *Trilophus* Andrewes/*Trilophidius* Jeannel. In contrast to these genera, *Leleuporella* posesses the following characters: The 3rd and 5th intervals of the elytra exhibit series of over 20 conspicuously regular setigerous punctures all adjoining the outer striae. The setae are long, shiny, and are all bent distinctly towards the suture so that this gives the structure a comb-like appearance. In addition, the apical segments of the maxillary and labial palps exhibit the form of a bottle, and the apical part of the aedeagus is spatulate like the apex of *Dyschirius* species.

Among some groups of small-sized Clivinini, the proepisterna are conspicuously swollen posterio-laterally. Because of this tumidity the line representing the reflexed marginal border in other Clivinini is located on the surface of the pronotum without forming hind angles or teeth and the proepisterna are clearly visible from above. In addition, the submarginal furrows bordering the proepisterna on the lower surface of the pronotum are visible only in the anterior part. In the genus *Syleter* Andrewes this character is present only in *S. andrewesi* Basilewsky from Africa and is developed inconspicuously in some species of *Oxydrepanus* Putzeys from America, and *Afroreicheia* Jeannel (Ethiopis) also show transitions. The character is well developed in *Psilidius* Jeannel (Ethiopis), *Trilophus* Andrewes (Orientalis) and *Trilophidius* Jeannel (Ethiopis and Orientalis). It is most conspicuously developed in *Leleuporella*.

ACKNOWLEDGEMENTS

I would like to thank Dr. I. Löbl (MHNG) for the opportunity of examining the material. Cordial thanks are due to Dr. E. de Coninck (MRACT) for making available type and other material of *Leleuporella cacea* and *L. mandibularis*.

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REVUE SUISSE DE ZOOLOGIE 104 (3): 611-659; septembre 1997

Leleupidiini from the Oriental Region. 1. New species of the genus *Colasidia* Basilewsky (Insecta, Coleoptera, Carabidae, Zuphiinae)

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Leleupidiini from the Oriental Region. 1. New species of the genus *Colasidia* Basilewsky (Insecta, Coleoptera, Carabidae, Zuphiinae). - 13 new species of the genus *Colasidia* Basilewsky from West Malaysia, Sumatra, and northern Borneo (Sarawak, Sabah) are described and illustrated: *Colasidia atra*, *C. attenuata*, *C. borneensis*, *C. burckhardti*, *C. denticollis*, *C. depressa*, *C. helvetorum*, *C. laticeps*, *C. loebli*, *C. mateui*, *C. oviceps*, *C. similis*, and *C. triangularis*. The male of *Colasidia lagadiga* (Morvan) from Malaysia is described for the first time. *Leleupidia lagadiga* Morvan and *L. rougemonti* Morvan are transferred to genus *Colasidia*. A revised key to the species of the Indoaustralian genus *Colasidia* is provided.

Key-words: Coleoptera - Carabidae - Zuphiinae - Leleupidiini - *Colasidia* - Taxonomy - Oriental Region.

INTRODUCTION

By courtesy of Dr. I. Löbl (Muséum d'histoire naturelle, Genève) I received samples of Leleupidiini for identification which had been collected during the last 25 years by staff of the museum in various countries of southern Asia. A part of this sample was sent several years ago to Dr. J. Mateu (Almeria) for identification, but had not been studied until now, when Dr. Löbl turned it over to me.

Although still rare in collections, Oriental Leleupidiini became increasingly numerous in the last few years, which is certainly due to more intense collecting and specialized sampling methods. However, Leleupidiini are yet unrecorded from large parts of the Oriental region. Apparently, Oriental Leleupidiini either concentrate in few regions, or have been only sampled in these areas, because other regions have not been adequately worked until now.

The first leleupidiine beetle from the Oriental region was yet described in 1954, but till now altogether 19 species are known from Asia (BASILEWSKY 1954, LANDIN 1955, DARLINGTON 1968, MATEU 1981, PERRAULT 1982, CASALE 1985, BAEHR

Manuscript accepted 14.12.1996.

1988, 1990, 1991, 1993, MORVAN 1994), further three species from New Guinea (DARLINGTON 1971, BAEHR 1991), and a single species from northern Australia (BAEHR 1987, 1991). The two species described by Morvan, however, were described almost without argumentation in the genus *Leleupidia* Basilewsky which has been used for African species only. Moreover, one species was until now somewhat doubtful, because it was described from a single female, and the author did not compare his species with any described ones. In the meantime, I was able to compare the holotypes by courtesy of the author, and I found in the material of the Geneva museum the unknown male of one of Morvan's species.

Most Oriental species have been included in the genus *Colasidia* Basilewsky, but thus far three species each belong to the genera *Paraleleupidia* Basilewsky, subgenus *Megaleleupidia* Mateu, and *Gunvorita* Landin. Although the classification of Leleupidiini is not really satisfactory, I maintain this generic concept for the present and include all species in the genus *Colasidia* that possess a distinctly and more or less coarsely punctate surface without distinct microreticulation, and that lack the more or less distinct circular impressions medially of the eyes that are present in *Gunvorita*. There is some reason to believe that male genitalic characters can be used for better recognition of the genera, but at present male genitalia were known of little more than half of the species of *Colasidia*, and of no species at all of the genus *Paraleleupidia*. Moreover, the known aedeagi of *Colasidia* are very diverse and thus far do not give a clear picture. Hence, for the present, male genitalia have been only used for distinction of species.

The recorded distribution of the three Oriental genera is rather different: *Colasidia* ranges over vast areas of southeast Asia from the Malayan peninsula through Indonesia to New Guinea and northern Australia (Queensland); *Gunvorita* is distributed in the eastern half of Nepal, Sikkim, and adjacent northeastern India; *Paraleleupidia* occurs only in the mountains of South India. This distribution scheme is evidence that *Gunvorita* and *Paraleleupidia* are perhaps well delimited genera, but due to its considerable morphological differences *Colasidia* might be subdivided later in subgenera or even genera.

Despite the many recent records, the known distribution of the Oriental Leleupidiini is still rather fragmentary, because vast areas thus far lack any record of Leleupidiini, e.g. central India, Ceylon, Burma, Thailand, Indochina, southern China, large islands such as Java, the whole Indonesian part of Borneo, the Lesser Sunda Islands, the Philippines, the Moluccas, and West Irian. It is uncertain, whether this fragmentary knowledge is purely caused by unsatisfactory collecting, whether it reflects real distribution gaps. Hence, Leleupidiini are probably present in some of the mentioned areas and will be detected in future due to more intense sampling. In other areas, however, probably they do not occur. The reasons for this failure shall be discussed in a second paper that will cover the genus *Gunvorita* Landin and some general considerations about the biogeography of the Oriental Leleupidiini.

MATERIAL AND METHODS

The holotypes of the new species are deposited at the Muséum d'histoire naturelle, Genève (MHNG), some paratypes are deposited in the working collection of the author at the Zoologische Staatssammlung, München (CBM), and in Naturhistorisches Museum, Wien (NHMW).

Measurements have been made under a stereo microscope using an ocular micrometer. Length has been measured from tip of labrum to apex of elytra, therefore, measurements may slightly differ from those of other authors. Length of head is measured from anterior border of clypeus to anterior border of "neck". The ratio length of orbit/length of eye is likewise measured to anterior border of "neck".

For better recognition the label data of all types are exactly reproduced with respect to spelling, abbreviations etc.

SPECIES ACCOUNT

Colasidia Basilewsky

Colasidia Basilewsky, 1954: 215, fig. 1; DARLINGTON 1971: 322, figs 82, 83; MATEU 1981: 722, fig. 6; PERRAULT 1982: 77, figs 1, 2; BAEHR 1987: 137, figs 1, 2; BAEHR 1988: 117, figs 1-12; BAEHR 1990: 11, figs 2-4, 6-8, 10-12; BAEHR 1991: 194, figs 1-8; BAEHR 1993: 39, figs 1, 2.

Leleupidia Basilewsky, MORVAN 1994: 330, figs 44-52.

Type species: *Colasidia malayica* Basilewsky, 1954, by monotypy.

In this genus all those species of the Oriental and Australian regions are combined that do not fit the diagnoses of *Gunvorita* and *Paraleleupidia*. Therefore, at present the genus is remarkably heterogenous and includes as well elongate, depressed species with dense, diffuse puncturation of surface, as short, convex species with very coarse puncturation that is regularly arranged on the elytra. The male and female genitalia are likewise rather diverse: the male aedeagus is very differently shaped, without or with variously shaped sclerites in the internal sac; the female stylomere 2 is elongate or short, with more or less elongate apex, 1 or 2 short or fairly elongate ventral ensiform setae, a dorsal ensiform seta of different size, and with or without a nematiform seta; stylomere 1 apparently lacks nematiform setae at the median rim.

In future it may be appropriate to divide the genus *Colasidia* in certain subgenera or even different genera, but at the present state of knowledge such procedure seems premature. In spite of the high morphological diversity, the genus includes groups of externally very similar species. Hence, for species distinction examination of the male genitalia is almost always indispensible, because the aedeagi are highly characteristic.

Comments. Best characters for differentiation of species are found in the structure of the aedeagus that, however, is not yet known in all species. Useful characters are also the shapes of head, pronotum, and elytra (expressed in a number of measurements and ratios), sizes of eyes and head appendages, the degree and shape of puncturation of upper surface, and pilosity.

Because of the great number of new species described in this paper, the most recent keys to *Colasidia* (Baehr 1991, 1993) are outdated and are replaced by the following new key. In some doubtful cases, species key out under both couplets. Because the figures of the yet described species are not included in this paper though are of great value for identification, the numbers of the respective figures have been added under the following chiffres: **Ba64**: Basilewsky 1964; **D71**: Darlington 1971; **P82**: Perrault 1982; **B87**, **B88**, **B90**, **B91**, **B93**: Baehr 1987, 1988, 1990, 1991, 1993; **M94**: Morvan 1994. I have seen the types of all described species.

KEY TO THE SPECIES OF THE GENUS *Colasidia* BASILEWSKY

1 Head parallel, or wider across eyes than across orbits; base of head usually considerably rounded 2

– Head decidedly wider at posterior angles or across orbits than across eyes; base of head less rounded, more square 13

2 Head laterally evenly rounded, markedly egg-shaped (**B91** fig. 8) **and** dorsal surface of head, pronotum, and elytra convex **and** puncturation of head and pronotum sparse and fine, diffuse; aedeagus short, compact, with short, projecting apex (**B91** fig. 4). Sumatra . . . . . . *globiceps* Baehr

– Head laterally less rounded and less egg-shaped or dorsal surface of head, pronotum, and elytra markedly depressed or puncturation of head and pronotum either very dense or markedly coarse; aedeagus different or unknown. Distribution different (Malaysia, Borneo, Papua New Guinea) . 3

3 Elytra depressed, markedly triangular, widest behind apical third, apex distinctly oblique (Figs 21-23). Malaysia 4

– Elytra convex, not markedly triangular, widest at or slightly behind middle, apex almost transverse or more or less convex. Distribution different (Borneo, Papua New Guinea) 7

4 Eyes very small, orbits to neck appr. 5 x as long as eyes; head narrow, parallel, basal angles shortly rounded (Fig. 39); pronotum narrow and elongate, much longer than wide (Fig. 55); puncturation of head and pronotum less dense, on pronotum not diffuse; aedeagus very short and stout, with elongate, straight, very wide, spatulate apex (Fig. 3) . . . . *attenuata* sp. n.

– Eyes larger, orbits to neck <3 x as long as eyes; head wide, laterally evenly rounded, basal angles widely rounded (Figs 36-38); pronotum rather wide, little longer than wide (Figs 52-54); puncturation of head and pronotum dense, on pronotum rather diffuse; aedeagus less short and stout, with differently shaped apex (**M94** fig. 46; figs 1, 2) 5

5 Larger species, length appr. 5.8 mm; eyes larger, orbits to neck c. 2 x as long as eyes; basal angles of head more widely rounded (Fig. 36); aedeagus moderately short, lower surface distinctly bisinuate, apex thick (Fig. 1) . . . . *oviceps* sp. n.

– Smaller species, length <5.5 mm; eyes smaller, orbits to neck >2.5 x as long as eyes; basal angles of head less widely rounded (Figs 37, 38); aedeagus slightly longer, lower surface almost straight, apex rather thin or unknown (**M94** fig. 46; fig. 2) 6

6 Head slightly wider, perceptibly widened behind eyes, eyes larger, orbits to neck little more than 2.5 x as long as eyes (Fig. 37); pronotum wider, considerably wider than head (Fig. 53); for aedeagus see fig. 2 . . . . *depressa* sp. n.

- Head slightly narrower, not at all widened behind eyes, eyes smaller, orbits to neck appr. 3 x as long as eyes (Fig. 38); pronotum narower, little wider than head (Fig. 54); for aedeagus see **M94** fig. 46 . . . . *rougemonti* (Morvan)

7 Head short, eyes very large, orbits to neck <1.5 x as long as eyes; basal angles of head very widely rounded off (**B91** fig. 6); puncturation of elytra irregular, rather confused, odd intervals raised in anterior half; aedeagus unknown. Papua New Guinea . . . . *kokodae* Baehr

– Head longer, eyes smaller, orbits to neck >1.5 x as long as eyes; basal angles of head less widely rounded off; puncturation of elytra in regular rows, all intervals slightly raised along their whole length; aedeagus as in **B88** fig. 10; **B90** fig. 2; figs 13, 14, or unknown 8

8 Pronotum narrower, <0.85 x as wide as long, prebasal sinuosity longer, basal angles less prominent (**B88** fig. 1; fig. 66); aedeagus with apex slightly upturned (**B88** fig. 10; fig. 13) 9

– Pronotum wider, >0.9 x as wide as long, prebasal sinuosity shorter, basal angles more prominent (**D71** fig. 82; **B90** figs 2, 3; fig. 67) ; aedeagus different (**B90** fig. 2; fig. 14), or unknown 10

9 Head longer and more parallel, not at all widened towards base; eyes slightly smaller, orbits to neck >2 x as long as eyes; pronotum narrower, appr. 0.8 x as wide as long, anteriorly less widened (**B88** fig. 1); aedeagus elongate, internal sac without any sclerites, apex slightly upturned (**B88** fig. 10). Sarawak (Borneo) . . . . *angusticollis* Baehr

- Head shorter and less parallel, faintly widened towards base; eyes slightly larger, orbits to neck appr. 2 x as long as eyes (Fig. 50); pronotum wider, appr. 0.85 x as wide as long, anteriorly more widened (Fig. 66); aedeagus elongate, apex thin, slightly asymmetric, markedly upturned, internal sac with a small sclerotized plate (Fig. 13). Sabah (Borneo) . . . . *burckhardti* sp. n.

10 Eyes larger, orbits to neck <2.25 x as long as eyes (**B90** figs 2, 3; fig. 51). Borneo 11

– Eyes smaller, orbits to neck appr. 3 x as long as eyes (D71 fig. 82); aedeagus unknown. Papua New Guinea .... *papua* Darlington

11 Colour deep black, legs black; head slightly widened behind eyes, orbits to neck >2 x as long as eyes (Fig. 51); aedeagus with knob-like, faintly upturned apex (Fig. 14). Sabah .... *atra* sp. n.

– Colour piceous, legs reddish; head not at all widened behind eyes, orbits to neck distinctly <2 x as long as eyes (**B90** figs 2, 3); aedeagus with apex slightly turned down (**B90** fig. 10) or unknown. Sarawak 12

12 Head slightly shorter, more rounded behind eyes; eyes slightly larger, orbits to neck <1.75 x as long as eyes; elytra decidedly widened behind middle (**B90** fig. 3); aedeagus unknown .... *macrops* Baehr

– Head slightly longer, more parallel behind eyes; eyes slightly smaller, orbits to neck >1.8 x as long as eyes; elytra widest about in middle (**B90** fig. 2); aedeagus with several sclerites within internal sac and with apex slightly turned down (**B90** fig. 10) .... *riedeli* Baehr

13 Eyes very small, orbits to neck >5 x as long as eyes; head very elongate, usually markedly triangular (**Ba64** fig. 1; **B87** fig. 1; figs 41, 42) . 14

– Eyes larger, orbits to neck <4 x as long as eyes; head shorter, usually less markedly triangular 17

14 Puncturation on head and pronotum very dense, on elytra dense and irregular, rather diffuse, intervals not visible, pilosity on elytra dense, not seriate (Figs 24, 25); for aedeagus see figs 4, 5 15

– Puncturation on head and pronotum rather sparse, on elytra far less dense and in regular rows, intervals slightly raised; pilosity on elytra sparser, seriate (**Ba64** fig. 1; **B87** fig. 1); aedeagus with very elongate, straight apex (**B91** fig. 1), or unknown 16

15 Head shorter and wider, more triagonal (Fig. 40); pronotum shorter and wider, appr. 0.95 x as wide as long (Fig. 56); elytra distinctly widened towards apex (Fig. 24); aedeagus short and stout, with straight, acute apex, with several narrow, coiled sclerites inside internal sac (Fig. 4). Malaysia .... *triangularis* sp. n.

– Head longer and narrower, less triagonal (Fig. 41); pronotum longer and narrower, appr. 0.8 x as wide as long (Fig. 57); elytra barely widened towards apex (Fig. 25); aedeagus rather elongate, with bisinuate lower surface, stout, slightly upturned apex, and with several elongate, markedly toothed sclerites inside internal sac (Fig. 5). Malaysia .... *lagadiga* (Morvan)

16 Head shorter and wider, wider than pronotum; pronotum shorter, basal angles barely projecting; elytra shorter, more triangular and depressed, puncturation less coarse (**Ba64** fig. 1); aedeagus unknown. Singapore .... *malayica* Basilewsky

– Head longer and narrower, distinctly narrower than pronotum; pronotum longer, basal angles markedly projecting; elytra longer, less triangular and rather convex, puncturation coarser (B87 fig. 1); aedeagus with straight, very elongate apex (**B91** fig. 1). Queensland (Australia) .... *monteithi* Baehr

17 Eyes shorter, orbits to neck appr. 4 x as long as eyes (Fig. 42); puncturation of elytra less regular and less coarse, not markedly seriate; aedeagus rather short, with obtuse apex, and with several narrow sclerotized rods inside internal sac (Fig. 6). Sumatra . . . . *denticollis* sp. n.

– Eyes longer, orbits to neck at most 3 x as long as eyes; puncturation of elytra regular and coarse, markedly seriate; aedeagus different, or unknown 18

18 Larger species, lenght >4.8 mm 19

- Smaller species, length <4.6 mm 23

19 Eyes larger, orbits to neck <2.25 x as long as eyes (**B88** fig. 2; fig. 51); aedeagus more or less hooked at apex (**B88** fig. 11; fig. 14). Sarawak (Borneo) 20

– Eyes smaller, orbits to neck >2.5 x as long as eyes (B91 fig. 7; figs 44, 45); aedeagus slightly turned down at apex (Figs 8, 9) or unknown. Sumatra 21

20 Colour dark piceous, legs reddish; eyes slightly larger, orbits to neck appr. 2 x as long as eyes (B88 fig. 2); aedeagus distinctly bisinuate on lower surface, apex markedly hooked (B88 fig. 11) . . . . *taylori* Baehr

– Colour deep black, legs black; eyes slightly smaller, orbits to neck >2 x as long as eyes (Fig. 51); aedeagus evenly concave on lower surface, apex barely hooked (Fig. 14) . . . . *atra* sp. n.

21 Head very sparsely punctate; pronotum narrower, <0.9 x as wide as long, apex almost straight, basal sinuation deep, basal angles laterally conspicuously projecting (B91 fig. 7); aedeagus unknown. . . . . *lustrans* Baehr

– Head less sparsely punctate; pronotum wider, >0.95 x as wide as long, apex distinctly concave, basal sinuation less deep, basal angles laterally barely projecting (Figs 60, 61); aedeagus slightly turned down at apex (Figs 8, 9) 22

22 Slightly larger species, length >5.1 mm; head larger and wider (Fig. 44); pronotum anteriorly narrower, only slightly wider than head (Fig. 60); apex of elytra absolutely straight (Fig. 28); aedeagus with wider, barely knob-shaped apex, both parameres longer (Fig. 8) . . . *helvetorum* sp. n.

– Slightly smaller species, length <4.9 mm; head smaller and narrower (Fig. 45); pronotum anteriorly wider, considerably wider than head (Fig. 61); apex of elytra perceptibly convex (Fig. 29); aedeagus with very narrow, slightly knob-shaped apex, both parameres shorter (Fig. 9) . . . . *similis* sp. n.

23 Lateral margin of pronotum anteriorly suddenly curved inwards, hence apex laterally oblique (Fig. 59); aedeagus rather short and stout, with short, slightly downcurved apex (Fig. 7). Malaysia . . . . *loebli* sp. n.

– Lateral margin of pronotum anteriorly regularly curved inwards, apex laterally regularly convex; aedeagus different (**P82** fig. 2; **B88** fig. 12; **B90** fig. 12; **B93** fig. 2; figs 10-12), or unknown. Distribution different (Sumatra, Borneo, Papua New Guinea) 24

24 Puncturation of head and pronotum less coarse and dense, diameter between punctures considerably larger than diameter of punctures; puncturation of elytra less coarse, diameter between punctures about as large as diameter of punctures; pronotum not impressed along mid-line; aedeagus with slightly thickened apex and with two conspicuous multidentate sclerites (**B93** fig. 2). Sumatra . . . . *convexior* Baehr

– Puncturation of head and pronotum coarse and dense, diameter between punctures usually smaller than diameter of punctures; puncturation of elytra coarse, diameter between punctures considerably smaller than diameter of punctures; pronotum deeply impressed along mid-line; aedeagus different (**P82** fig. 2; **B88** fig. 12; **B90** fig. 12; figs 11-13), or unknown. Borneo, Papua New Guinea 25

25 Head barely widened behind eyes (Fig. 50) and apex of elytra almost straight (Fig. 34) and apex of aedeagus markedly upturned (Fig. 13); head and pronotum usually distinctly lighter than elytra. Sabah (Borneo) . . . . *burckhardti* sp. n.

– Head distinctly widened behind eyes; apex of elytra more or less distinctly convex, rarely almost straight; apex of aedeagus when known at most slightly upturned (**B88** fig. 12; figs 11, 12); surface usually unicolourous 26

26 Larger species, length >4.1 mm; aedeagus with short, stout, not upturned apex (**P82** fig. 2), or unknown. Borneo, Papua New Guinea 27

– Smaller species, length <4.1 mm; aedeagus either with narrower, slightly upturned apex (**B88** fig. 12; figs 11, 12), or very short, with extremely short apex (**B90** fig. 12), or unknown. Borneo 29

27 Basal angles of pronotum acute, laterally rather projecting (**D71** fig. 83); aedeagus unknown. Papua New Guinea . . . . *madang* Darlington

– Basal angles of pronotum rectangular, laterally barely projecting (Figs 62, 63); aedeagus short, with short, stout, straight apex (**P82** fig. 2), or unknown. Sabah (Borneo) 28

28 Slightly larger species, length >4.4 mm; head larger, posteriorly much wider (Fig. 47); pronotum anteriorly remarkably wider, lateral margins deeply sinuate (Fig. 63); aedeagus short, with short, stout, straight apex (**P82** fig. 2) . . . . *gerardi* Perrault

– Slightly smaller species, length <4.3 mm; head narrower, posteriorly less widened (Fig. 46); pronotum anteriorly rather narrow, lateral margins far less deeply sinuate (Fig. 62); aedeagus unknown . *borneensis* sp. n.

29 Small species, length appr. 3.7 mm; pronotum distinctly wider than long, basal angles laterally markedly projecting (**B90** fig. 4); aedeagus short, with very short apex (B90 fig. 12). Sarawak (Borneo) . . . . *pumila* Baehr

– Larger species, length >3.9 mm; pronotum not wider than long, basal angles laterally less projecting (**B88** fig. 3; figs 62, 64, 65); aedeagus with longer, slightly upturned apex (**B88** fig. 12; figs 11, 12) or unknown . . 30

30 Apex of elytra almost straight (B88 fig. 3); aedeagus with longer, more upturned apex, internal sac at base with tridentate sclerite (**B88** fig. 12). Sarawak (Borneo) . . . . *brevicornis* Baehr

– Apex of elytra remarkably convex (Figs 30, 32, 33); aedeagus with shorter, less upturned apex (Figs 11, 12), or unknown. Sabah (Borneo) 31

31 Head heavy and wide, markedly triagonal (Figs 48, 49); pronotum rather wide, almost as wide as long (Figs 64, 65); aedeagus with slightly upturned apex (Figs 11, 12) 32

- Head rather small and narrow, feebly triagonal (Fig. 46); pronotum rather narrow, distinctly longer than wide (Fig. 62); aedeagus unknown . . . . *borneensis* sp. n.

32 Head remarkably heavy and wide, distinctly wider than pronotum (Fig. 49); aedeagus slightly longer, with longer apex (Fig. 12) . . . . . . *laticeps* sp. n.

- Head slightly less heavy and wide, not distinctly wider than pronotum (Fig. 48); aedeagus slightly shorter, with shorter apex (Fig. 11) . . *mateui* sp. n.

Colasidia oviceps sp. n. (Figs 1, 15, 21, 36, 52)

Type material: Holotype: ♂, W. Malaysia: Pahang, Taman Negara, 90-120m, Tembeling trail, Löbl & Calame, 10.& 13.3.93, primary forest, stat. 1a (MHNG).
Paratype: 1 ♀, same data (CBM).

Diagnosis: Large, depressed species, characterized by elongate, rather ovalish elytra with oblique apical margin, fine and dense puncturation, and dense, short, markedly depressed pilosity; distinguished from related species by the large, markedly ovalish head, large eyes, wide, heart-shaped pronotum, comparatively elongate antennae with median antennomeres distinctly longer than wide, and rather short, at lower surface bisinuate aedeagus with wide, slightly knobbed apex.

Description:

Measurements: Length: 5.70-5.75 mm; width: 2.0-2.05 mm. Ratios. Lenght/width of head: 1.40-1.42; lenght orbit/eye: 2.20-2.25; length/width of pronotum: 1.09-1.11; width widest part/base of pronotum: 1.43-1.49; width pronotum/head: 1.23; length/width of elytra: 1.47-1.53; width elytra/pronotum: 1.77-1.82.

Colour: Dark piceous, pronotum and anterior part of elytra faintly lighter, also suture and margins of elytra indistinctly lighter. Labrum, palpi, legs, and antennae yellowish, 1st-3rd antennomeres slightly darker.

Head: Large and wide, markedly oval-shaped, widest at or slightly behind eyes, posteriorly evenly narrowing, orbit posteriorly widely rounded off. Upper surface rather depressed. Frons not grooved. Eyes large, though depressed, length slightly <1/2 of orbit length. Clypeus anteriorly almost straight, lateral angles (above base of antenna) barely projecting. Clypeal suture laterally with shallow grooves. Labrum anteriorly rather excised, 6-setose, though inner 4 setae short, lateral margin densely pilose. Mandibles short. Mentum with wide, at apex slightly excised tooth. Labium truncate. Maxillary palpus very elongate, apex obtusely rounded. Terminal segment of labial palpus large and very elongate. Antenna comparatively elongate, attaining the basal third of pronotum. Median antennomeres distinctly longer than wide, 3rd antennomere almost as long as 1st, almost twice as long as 2nd antennomere. Surface with traces of microreticulation only on clypeus and anterior margin of frons, rather glossy. Puncturation rather fine and dense, distance between punctures on frons about equal to diameter of punctures, on vertex less wide, there punctures confluent to irregular transverse furrows. Pilosity dense, though short, markedly depressed, inclined anteriorly. Anterior supraorbital seta elongate, well distinguished from pilosity, posterior supraorbital setae in both specimens broken, position not perceptible.

Pronotum: Rather cordiform, slightly longer than wide, distinctly wider than head, widest in anterior third. Upper surface rather depressed, centre convex though depressed again along median line. Lateral margin strongly convex in anterior half, deeply sinuate in front of posterior angles, though straight and slightly oblique in basal third. Apex rather wide, well excised, anterior angles convex, rather projecting. Base wide, laterally excised, posterior angles projecting as small, acute denticles. Lateral margin slightly raised, with distinct border line, with rather wide marginal channel. Median line distinct, sulcate. Prebasal grooves moderately deep. Anterior marginal seta elongate, situated at anterior fourth of pronotum, posterior setae in both specimens broken, situated presumably right on basal angles. Surface without microreticulation, fairly glossy, with dense, fine puncturation. Diameter of punctures as wide or wider than distance between them. In lateral channel punctures confluent to irregular transverse furrows. Pilosity dense, short, inclined anteriorly, rather depressed.

Elytra: Moderately wide, laterally evenly curved, widest in posterior third, upper surface rather depressed, odd intervals near humerus slightly raised. Humeri wide, rounded off. Apex rather wide, straight, oblique, markedly redressed to suture. Striae barely marked, puncturation dense, rather fine, irregular, punctures rather confluent to transverse or oblique furrows, surface somewhat coriaceous. Third interval with three very short fixed setae, these hardly recognizable within the dense puncturation. Series of marginal pores difficult to detect when setae broken, apparently consisting of 8 basal, 3 postmedian, 6 apical pores, and 1 pore at apex of 3rd stria. Setae very elongate. Surface without microreticulation, rather glossy. Pilosity dense, short, irregular, inclined posteriorly, depressed.

Male genitalia: Genital ring rather wide, ovalish, apex wide, asymmetric. Aedeagus rather short, with short, rather thick, faintly knob-like apex. Lower surface markedly bisinuate. Internal sac at bottom with a large, strongly sclerotized, oblique sclerite deeply split into elongate teeth on both ends, and basally at top with a similarly dentate, somewhat coiled sclerite. For parameres see fig. 1, left paramere rather elongate.

Female genitalia: Stylomere 2 rather elongate with acute apex, with 2 elongate ventral ensiform seta the lower one being considerably shorter, one elongate dorsal ensiform seta, and a nematiform seta arising from a large groove in apical third of median surface. Apex of stylomere 1 asetose.

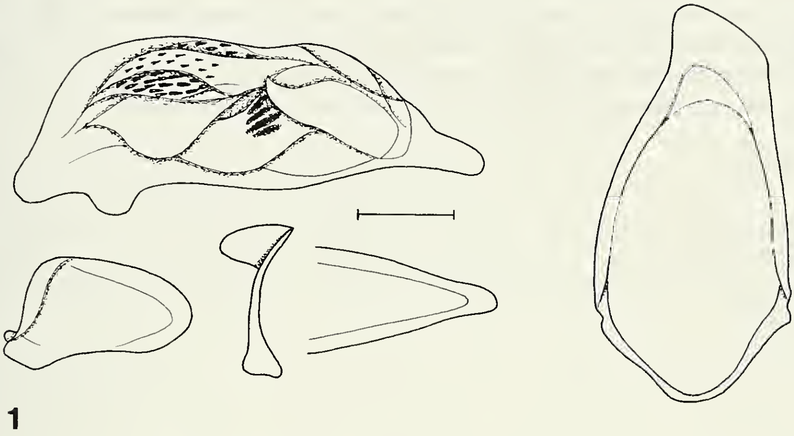


FIG. 1

Colasidia oviceps sp. n. ♂ genitalia: aedeagus (left side), shape of apex (from below), left and right parameres, genital ring. Scale: 0.25 mm.

Variation: In ♀ paratype head behind eyes slightly widened, pronotum slightly narrower, and elytra slightly less widened posteriorly, otherwise little variation noted.

Etymology: The name refers to the very characteristic shape of head.

Collecting circumstances: Collected by sieving ground litter in primary forest of low altitude.

Remarks: This species belongs to the presumably most plesiotypic group that is characterized by rather ovalish head, depressed body, fine and dense, irregular puncturation, and short, depressed pilosity. Within this group, it is most closely related to *C. depressa* sp. n. and *C. rougemonti* (Morvan).

Colasidia depressa sp. n. (Figs 2, 16, 22, 37, 53)

Type material: Holotype: ♂, W. Malaysia: Pahang, Genting Highlands, Awana, 1150m, 3.IV.93, Löbl & Calame, stat. 27c (MHNG).

Paratypes: 1 ♀, W. Malaysia: Selangor, 1km below Fraser's Hill, 1280m, sec.for. stat. 5, Löbl & Calame, 15.3.93 (MHNG); 1 ♀, W. Malaysia: Pahang, Cameron Highlands, trail 9, 1400m, 27.3.93, Löbl & Calame, stat. 21 (CBM); 1 ♀, Pahang stat. 16a, Cameron Highlands, 1600m, Bukit Mentiga, trail 14, Löbl & Calame, 23.3.93 (MHNG); 1 ♀, Malaysia: Pahang, Cameron Highlands, Umg. Tanah Rata, 1500m, 27.-31.7.1993, lg. Schuh; *Leleupidia rougemonti* Morv. det. Kirschenhofer (NHMW).

Diagnosis: Rather large, depressed species, characterized by elongate, rather ovalish elytra with oblique apical margin, fine and dense puncturation, and dense, short, markedly depressed pilosity; distinguished from related species by the large, ovalish head, fairly large eyes, rather wide, heart-shaped pronotum, comparatively elongate antennae, and rather short, at lower surface straight aedeagus. Distinguished from most similar *C. rougemonti* (Morvan) by wider and shorter, behind eyes faintly but distinctly widened head, wider and shorter prothorax, more distinctly raised intervals in basal part of elytra, and distinctly convex apex of elytra.

Description:

Measurements: Length: 5.05-5.25 mm; width: 1.8-2.0 mm. Ratios. Lenght/width of head:1.42-1.52; lenght orbit/eye: 2.62-2.73; length/width of pronotum: 1.11-1.15; width widest part/base of pronotum: 1.38-1.46; width pronotum/head: 1.19-1.30; length/width of elytra: 1.43-1.46; width elytra/pronotum: 1.87-1.89.

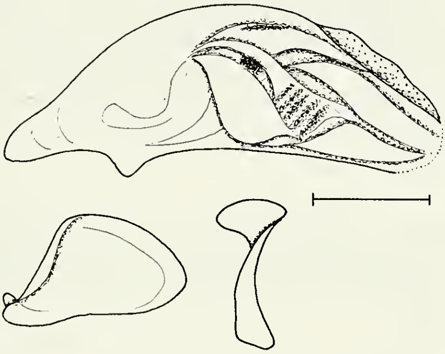
Colour: Dark piceous. Labrum, palpi, and antennae yellowish, 1st-3rd antennomeres slightly darker. Femora and tibiae partly infuscate, tarsi yellowish.

Head: Large and rather wide, oval-shaped, slightly widened behind eyes, orbit posteriorly evenly rounded off. Upper surface rather depressed. Frons not grooved. Eyes fairly large, though depressed, length slightly <2/5 of orbit length. Clypeus anteriorly almost straight, lateral angles (above base of antenna) barely projecting. Clypeal suture laterally with shallow grooves. Labrum anteriorly rather excised, 6-setose, though inner 4 setae short, lateral margin densely pilose. Mandibles short. Mentum with wide, at apex slightly excised tooth. Labium truncate. Maxillary palpus very elongate, apex obtusely rounded. Terminal segment of labial palpus large and very elongate. Antenna rather short, barely attaining middle of pronotum. Median antennomeres distinctly wider than long, 3rd antennomere almost as long as 1st, almost twice as long as 2nd antennomere. Surface with traces of microreticulation only on clypeus and anteriorlateral part of frons, glossy. Puncturation moderately fine and dense, distance between punctures on frons about equal to diameter of punctures. Pilosity dense, though short, markedly depressed, inclined anteriorly. Both supraorbital setae elongate, well distinguished from pilosity, posterior supraorbital setae situated far behind eye.

Pronotum: Rather cordiform, distinctly longer than wide, distinctly wider than head, widest in anterior third. Upper surface rather depressed, centre convex though depressed again along median line. Lateral margin strongly convex in anterior half, sinuate in front of posterior angles, though almost straight and fairly oblique in basal third. Apex rather wide, well excised, anterior angles convex, rather projecting. Base wide, laterally excised, posterior angles slightly projecting but not denticulate. Lateral margin slightly raised, with distinct border line, with rather wide marginal channel. Median line distinct, sulcate. Prebasal grooves moderately deep. Anterior marginal seta elongate, situated at anterior fourth of pronotum, posterior seta short, inconspicuous, situated right on basal angle. Surface without microreticulation, fairly glossy, with dense, fine puncturation. Diameter of punctures wider than distance between them. In lateral channel punctures confluent to irregular transverse furrows. Pilosity dense, short, inclined anteriorly, rather depressed.

Elytra: Rather wide, laterally evenly curved, widest in posterior third, upper surface rather depressed, odd intervals near humerus slightly raised. Humeri wide, rounded off. Apex rather wide, slightly convex, oblique, markedly redressed to suture. Striae barely marked, puncturation dense, rather fine, irregular, punctures rather confluent to transverse or oblique furrows, surface somewhat coriaceous. Third interval with three very short fixed setae, these hardly recognizable within the dense puncturation. Series of marginal pores difficult to detect when setae broken, apparently consisting of 8 basal, 3 postmedian, 6 apical pores, and 1 pore at apex of 3rd stria. Setae very elongate. Surface without microreticulation, rather glossy. Pilosity dense, short, irregular, inclined posteriorly, depressed.

Male genitalia: Genital ring unknown. Aedeagus fairly short, apex unknown. Lower surface almost straight. Internal sac at bottom with a large, strongly sclerotized, oblique sclerite deeply split into elongate teeth on both ends, basally at top with a similarly dentate, somewhat coiled sclerite. For parameres see fig. 2, left paramere rather short.



2

FIG. 2

Colasidia depressa sp. n. ♂ genitalia. For legend see fig. 1.

Female genitalia: Stylomere 2 elongate with acute apex, with 1 or 2 elongate ventral ensiform seta situated basally, the upper one being much larger than the lower one, one elongate dorsal ensiform seta situated below middle, and a nematiform seta arising from a large groove in apical third of median surface. Apex of stylomere 1 asetose.

Variation: Little variation noted in shape of head, size of eyes, relative width of pronotum.

Etymology: The name refers to the depressed surface.

Distribution: West Malaysia.

Collecting circumstances: Collected by sieving ground litter at median altitude.

Remarks: This species belongs to the presumably most plesiotypic group that is characterized by rather ovalish head, depressed body, fine and dense, irregular puncturation, and short, depressed pilosity. Within this group, it is most closely related to *C. rougemonti* (Morvan) and *C. oviceps* sp. n.

Colasidia rougemonti (Morvan) **comb. nov.** (Figs 38, 54)

Leleupidia rougemonti Morvan, 1994: 331, figs 44-49.

This species was described in the genus *Leleupidia*. It is herewith transferred to *Colasidia*. I have seen the ♂ holotype (labelled "*derougemonti*"!) that is distinguished from the most similar *C. depressa* sp. n. mainly by longer, narrower head that is not at all widened behind eyes, longer and narrower prothorax, less distinctly raised intervals in basal part of elytra, straight, though oblique apical margin of elytra, and shape of aedeagus.

Colasidia attenuata sp. n. (Figs 3, 23, 39, 55)

Type material: Holotype: ♂, W. Malaysia: Pahang, stat. 18b, Cameron Highlands, 1550m, Gunung Jasar, trail 11, Löbl & Calame, 24.3.93 (MHNG).

Diagnosis: Medium-sized, depressed species, characterized by elongate, rather triangular elytra with oblique apical margin, fine and dense puncturation, and dense, short, markedly depressed pilosity; distinguished from related species by the parallel-sided head, very small eyes, and very short, compact aedeagus with straight, elongate, wide though depressed apex.

Description:

Measurements: Length: 4.5 mm; width: 1.6 mm. Ratios. Lenght/width of head: 1.55; lenght orbit/eye: 4.5; length/width of pronotum: 1.22; width widest part/base of pronotum: 1.48; width pronotum/head: 1.14; length/width of elytra: 1.44; width elytra/pronotum: 1.98.

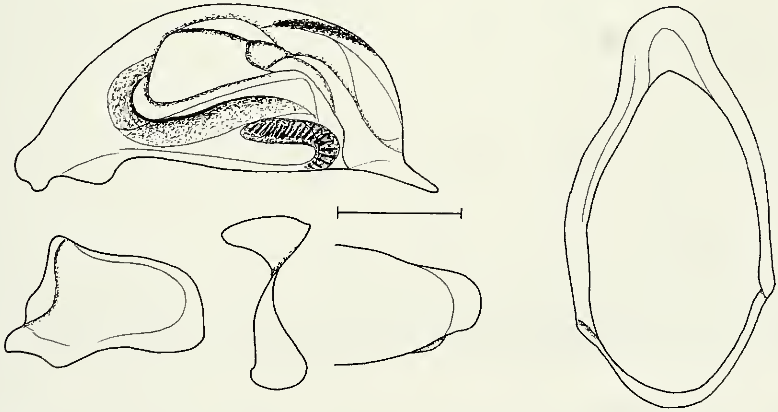
Colour: Reddish-brown, head faintly darker (specimenperhaps not fully coloured). Labrum, palpi, legs, and antennae yellowish.

Head: Large, rather elongate, remarkably parallel-sided, not widened behind eyes, orbit posteriorly rounded off. Upper surface fairly convex. Frons not grooved. Eyes very small, laterally not projecting, length slightly >1/5 of orbit length. Clypeus anteriorly almost straight, lateral angles (above base of antenna) barely projecting. Clypeal suture laterally with shallow grooves. Labrum anteriorly rather excised, 6-setose, though inner 4 setae short, lateral margin densely pilose. Mandibles short. Mentum with wide, at apex slightly excised tooth. Labium truncate. Maxillary palpus elongate, apex obtusely rounded. Terminal segment of labial palpus large and elongate. Antenna rather short, slightly surpassing middle of pronotum. Median antennomeres about as wide as long, 3rd antennomere slightly shorter than 1st, c. 1.5 x as long as 2nd antennomere. Surface even without traces of microreticulation, highly glossy. Puncturation fairly coarse, moderately dense, Diameter of punctures distinctly wider than distance between punctures. Pilosity moderately dense, fairly elongate, somewhat hirsute, moderately depressed, inclined anteriorly. Both supraorbital setae elongate, fairly well distinguished from pilosity, posterior supraorbital setae situated far behind eye.

Pronotum: Rather narrow and elongate, fairly cordiform, slightly wider than head, widest in anterior third. Upper surface rather convex. Lateral margin strongly convex in anterior half, sinuate in front of posterior angles, though basal quarter almost straight. Apex rather wide, slightly excised, anterior angles convex, slightly projecting. Base rather narrow, laterally deeply excised and markedly oblique, basal angles slightly projecting but not denticulate. Lateral margin slightly raised, with distinct border line, with narrow marginal channel. Median line distinct, though not sulcate. Prebasal grooves rather shallow. Anterior marginal seta elongate, situated at anterior fourth of pronotum, posterior seta rather short, situated right on basal angle. Surface without microreticulation, glossy, with fairly dense, moderately coarse puncturation. Diameter of punctures wider than distance between them. Pilosity fairly dense, moderately elongate, somewhat hirsute, inclined anteriorly, oblique.

Elytra: Rather wide, markedly triangular, laterally regularly curved, widest in posterior third. Upper surface moderately depressed, odd intervals near humerus slightly raised. Humeri rather narrow, rounded off. Apex wide, slightly convex, faintly oblique, slightly redressed to suture. Striae barely marked, puncturation dense, moderately fine, irregular, punctures rather confluent to transverse or oblique furrows, surface somewhat coriaceous. Third interval with three very short fixed setae, these hardly recognizable within the dense puncturation. Series of marginal pores difficult to detect when setae broken, apparently consisting of 8 basal, 3 postmedian, 6 apical pores, and 1 pore at apex of 3rd stria. Setae very elongate. Surface without microreticulation, rather glossy. Pilosity dense, rather short, irregular, inclined posteriorly, fairly depressed.

Male genitalia: Genital ring rather wide, ovalish, apex wide, fairly asymmetric. Aedeagus very short and stout, with straight, fairly elongate, depressed though wide apex. Lower surface fainly convex. Internal sac basally with a large,



3

FIG. 3

Colasidia attenuata sp. n. ♂ genitalia. For legend see fig. 1.

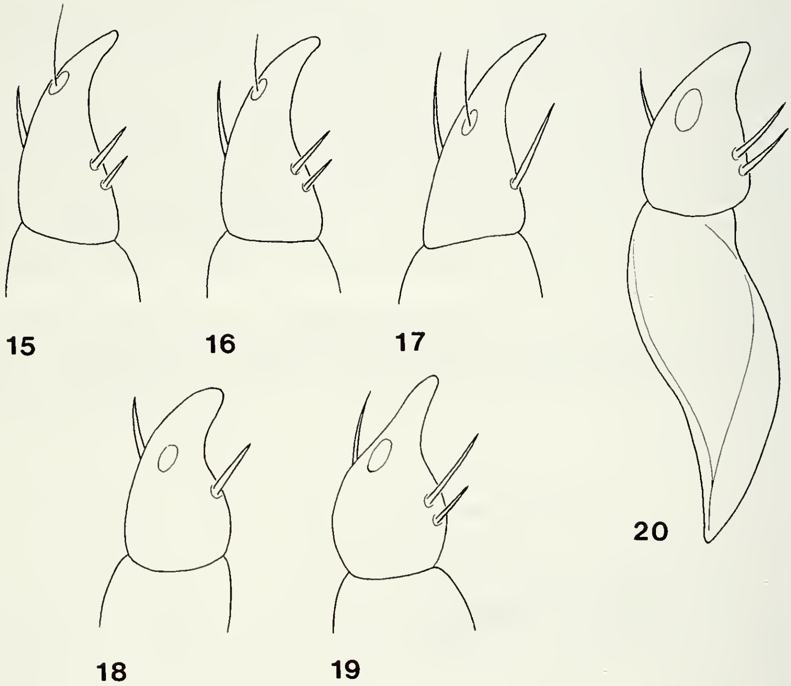
strongly coiled, moderately sclerotized sclerite, on top with another, narrow sclerite, and apically on bottom with a curved, dentate sclerite. For parameres see fig. 3, both parameres short, right with markedly triangular, left with wide, oblique apex.

Etymology: The name refers to the narrow head and prothorax.

Distribution: West Malaysia, Cameron Highlands. Known only from type locality.

Collecting circumstances: Collected by sieving ground litter at median altitude.

Remarks: This species is intermediary between those Malaysian species possessing ovalish head with large eyes and depressed pronotum and elytra, and those having a triangular head with small eyes and more convex pronotum and elytra.



FIGS 15-20

♀ stylomere 2 and base of stylomere 1. 15. *Colasidia oviceps* sp. n. 16. *C. depressa* sp. n. 17. *C. denticollis* sp. n. 18. *C. helvetorum* sp. n. 19. *C. borneensis* sp. n. 20. *C. laticeps* sp. n.

Colasidia triangularis sp. n. (Figs 4, 24, 40, 56)

Type material: Holotype: ♂, W. Malaysia: Pahang, Ringlet, 1250m, ravine, stat. 20, Löbl & Calame 26.3.93 (MHNG).

Diagnosis: Small, depressed species, characterized by posteriorly widened, rather triangular head with very small eyes, triangular elytra with fairly oblique apical margin, fine and dense puncturation, and dense, short, markedly depressed pilosity; further distinguished from related species by rather short aedeagus with straight, moderately elongate, stout though narrow apex.

Description:

Measurements: Length: 3.9 mm; width: 1.5 mm. Ratios. Lenght/width of head: 1.28; lenght orbit/eye: 4.45; length/width of pronotum: 1.03; width widest part/base of pronotum: 1.47; width pronotum/head: 1.14; length/width of elytra: 1.41; width elytra/pronotum: 1.85.

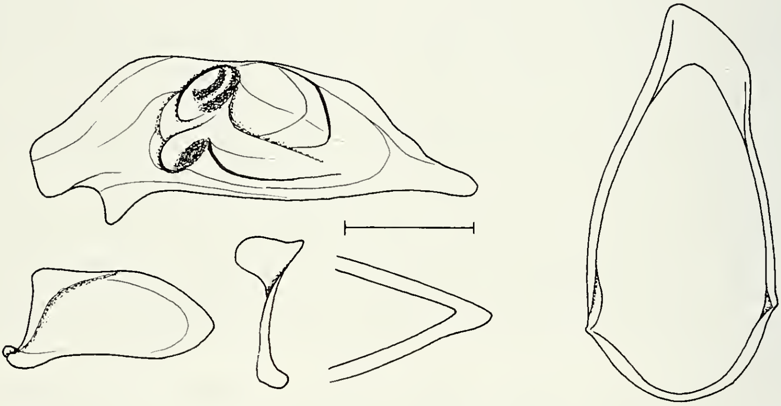
Colour: Dark piceous. Labrum, palpi, legs, and antennae yellowish.

Head: Large, rather wide, moderately triangular, distinctly widened behind eyes, orbits posteriorly shortly rounded. Upper surface fairly convex. Frons not grooved. Eyes very small, laterally not projecting, length slightly >1/5 of orbit length. Clypeus anteriorly almost straight, lateral angles (above base of antenna) slightly projecting. Clypeal suture laterally with shallow grooves. Labrum anteriorly slightly excised, 6-setose, inner 4 setae little shorter, lateral margin densely pilose. Mandibles short. Mentum with unidentate, triangular tooth. Labium truncate. Maxillary palpus elongate, apex obtusely rounded. Terminal segment of labial palpus large and elongate. Antenna short, not attaining middle of pronotum. Median antennomeres distinctly wider than long, 3rd antennomere much shorter than 1st, unsignicantly longer than 2nd antennomere. Surface with fine traces of microreticulation, fairly glossy. Puncturation fairly coarse, moderately dense, diameter of punctures slightly wider than distance between punctures. Pilosity moderately dense, fairly elongate, somewhat hirsute, moderately depressed, inclined anteriorly. Both supraorbital setae elongate, fairly well distinguished from pilosity, posterior supraorbital setae situated far behind eye.

Pronotum: Rather wide and short, fairly cordiform, slightly wider than head, widest in anterior third. Upper surface rather convex, in middle slightly impressed. Lateral margin strongly convex in anterior half, moderately sinuate in front of posterior angles, though basal quarter almost straight. Apex rather wide, slightly excised, anterior angles convex, barely projecting. Base rather wide, laterally excised and somewhat oblique, basal angles barely projecting, not denticulate. Lateral margin slightly raised, with distinct border line, with narrow marginal channel. Median line distinct, though hardly sulcate. Prebasal grooves rather shallow. Anterior marginal seta elongate, situated at anterior fourth of pronotum, posterior seta rather short, situated right on basal angle. Surface with fine traces of microreticulation, fairly glossy, with fairly dense, moderately coarse puncturation. Diameter of punctures wider than distance between them. Pilosity fairly dense, moderately elongate, somewhat hirsute, inclined anteriorly, oblique.

Elytra: Rather wide, markedly triangular, laterally regularly curved, widest in posterior third. Upper surface moderately depressed. Humeri rather narrow, somewhat projecting, rounded off. Apex wide, slightly convex, faintly oblique, slightly redressed to suture. Striae not marked, puncturation dense, moderately fine, irregular, punctures rather confluent to transverse or oblique furrows, surface somewhat coriaceous. Third interval with three very short fixed setae, these hardly recognizable within the dense puncturation. Series of marginal pores difficult to detect when setae broken, apparently consisting of 8 basal, 3 postmedian, 6 apical pores, and 1 pore at apex of 3rd stria. Setae very elongate. Surface with traces of microreticulation, rather glossy. Pilosity dense, rather short, irregular, inclined posteriorly, fairly depressed.

Male genitalia: Genital ring fairly wide, ovalish, apical plate large, fairly asymmetric. Aedeagus rather short, with straight, fairly elongate, rather thick though very narow, acutely ending apex. Lower surface very faintly bisinuate. Internal sac basally with a large, strongly coiled, moderately sclerotized sclerite that is dentate at the end, on botom with another coiled sclerite, and with two narrow sclerotized rods aalong bottom and near apex. For parameres see fig. 4, right paramere short, left rather elongate.



4

FIG. 4

Colasidia triangularis sp. n. ♂ genitalia. For legend see fig. 1.

Etymology: The name refers to the triangular shape of the head.

Collecting circumstances: Collected by sieving ground litter at median altitude.

Remarks: This species belongs to a group of species that have a triangular head with small eyes but rather depressed pronotum and elytra, dense, irregular puncturation on elytra, and dense and short pilosity.

Colasidia lagadiga (Morvan) **comb. nov.** (Figs 5, 25, 41, 57)

Leleupidia lagadiga Morvan, 1994: 332, figs 50-52.

This species was described in the genus *Leleupidia*. It is herewith transferred to *Colasidia*. I have seen the ♀ holotype (labelled "*lagadigus*"!) and found it identical with a small series in the sample from the Museum of Genève. As males are now available, the description is extended and improved to give the opportunity for comparison with other species.

New records: 1 ♂, W. Malaysia: Pahang, stat. 18b, Cameron Highlands, 1550m, Gunung Jasar, trail 11, Löbl & Calame, 24.3.93 (MHNG); 1 ♂, W. Malaysia: Pahang, Cameron Highlands, trail 5, 1600m, 28.3.93, Löbl & Calame, stat. 22 (CBM); 1 ♂, W. Malaysia: Pahang, stat. 17, Cameron Highlands, 1520m, Bukit Mentiga, trail 14, Löbl & Calame, 23.3.93 (MHNG).

Diagnosis: Large, rather depressed species, characterized by posteriorly widened, rather triangular head with very small eyes, ovalish elytra with transverse apical margin, fine and dense puncturation, and dense, short, depressed pilosity; further distinguished from related species by elongate aedeagus with markedly bisinuate lower surface and moderately elongate, slightly upturned apex.

Description:

Measurements: Length: 5.0-5.15 mm; width: 1.68-1.80 mm. Ratios. Lenght/width of head: 1.56-1.62; lenght orbit/eye: 4.62-4.85; length/width of pronotum: 1.23-1.27; width widest part/base of pronotum: 1.41-1.42; width pronotum/head: 1.28-1.33; length/width of elytra: 1.49-1.53; width elytra/pronotum: 1.83-1.88.

Colour: Dark piceous, base of elytra and suture indistinctly reddish. Labrum, palpi, legs, and antennae yellowish.

Head: Narrow and elongate, slightly triangular, widened towards base, widest near base, orbits posteriorly shortly rounded. Upper surface moderately convex. Frons not grooved. Eyes very small, though projecting, length almost 1/5 of orbit length. Clypeus anteriorly almost straight, lateral angles (above base of antenna) barely projecting. Clypeal suture laterally with shallow grooves. Labrum anteriorly rather excised, 6-setose, though inner 4 setae short, lateral margin densely pilose. Mentum with wide, at apex slightly excised tooth. Labium truncate. Maxillary palpus rather elongate, apex obtusely rounded. Terminal segment of labial palpus large and elongate. Antenna short, barely attaining middle of pronotum. Median antennomeres distinctly wider than long, 3rd antennomere c. 2/3 of length of 1st, c. 1.5 x as long as 2nd antennomere. Surface with traces of microreticulation only on clypeus and anteriorlateral part of frons, glossy. Puncturation rather coarse, fairly dense, distance between punctures less than diameter of punctures. Pilosity moderately dense, rather elongate, fairly hirsute, inclined anteriorly. Both supraorbital setae elongate, fairly well distinguished from pilosity, posterior supraorbital setae situated far behind eye.

Pronotum: Rather narrow and elongate, moderately cordiform, distinctly wider than head, widest in anterior third. Upper surface evenly convex. Lateral margin strongly convex in anterior half, deeply sinuate in front of posterior angles. Apex rather wide, almost straight, anterior angles convex, barely projecting. Base fairly wide, laterally markedly excised and oblique, posterior angles distinctly projecting but not denticulate. Lateral margin slightly raised, with distinct border line, with narrow marginal channel. Median line distinct, but not sulcate. Prebasal grooves rather shallow. Anterior marginal seta elongate, situated at anterior fourth of pronotum, posterior seta short, inconspicuous, situated right on basal angle. Surface without microreticulation, fairly glossy, with rather fine and dense puncturation. Diameter of punctures wider than distance between them. Pilosity rather dense, fairly short, inclined anteriorly, rather depressed.

Elytra: Moderately wide, laterally evenly curved, widest in posterior third, upper surface moderately depressed, intervals not raised. Humeri wide, rounded off. Apex rather wide, almost straight, transversal, not redressed to suture. Striae barely marked, puncturation dense, rather fine, irregular, distance between punctures wider than diameter of punctures. Third interval with three very short fixed setae, these hardly recognizable within the dense puncturation. Series of marginal pores difficult to detect when setae broken, apparently consisting of 8 basal, 3 postmedian, 6 apical pores, and 1 pore at apex of 3rd stria. Setae very elongate. Surface without microreticulation, glossy. Pilosity dense, rather short, irregular, inclined posteriorly, depressed.

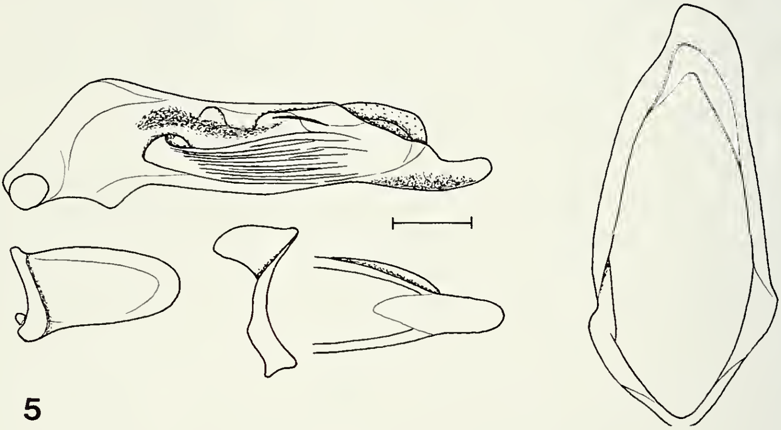


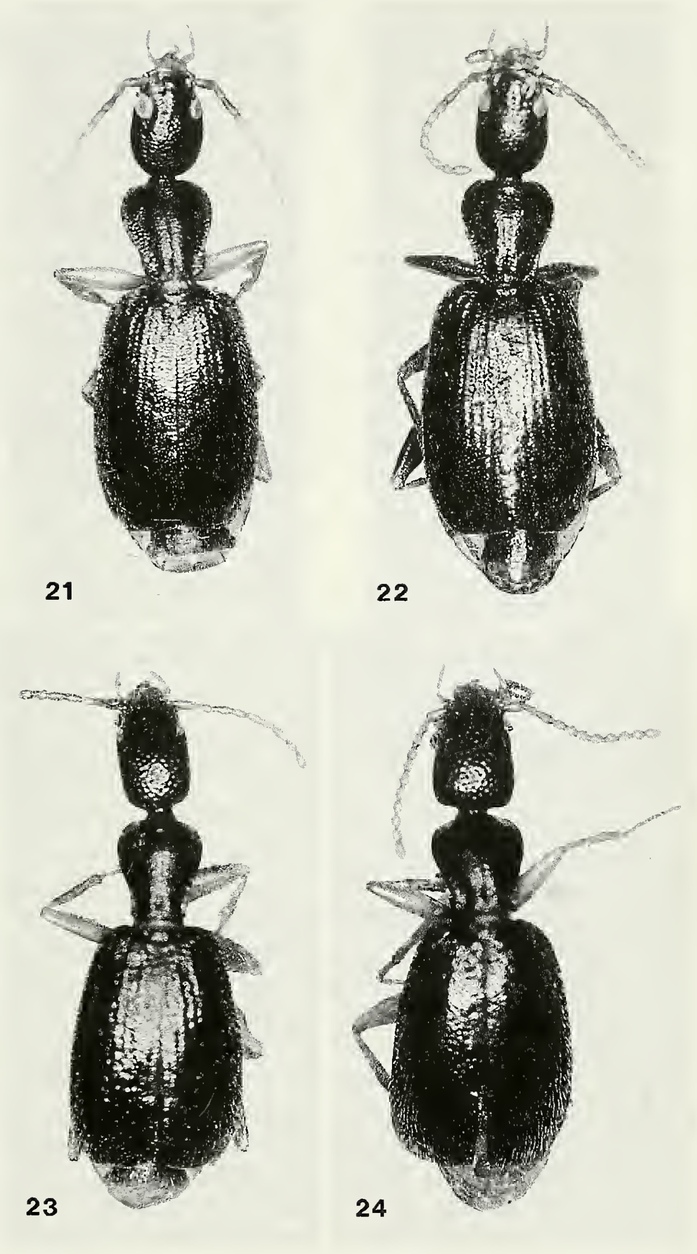
FIG. 5

Colasidia lagadiga (Morvan). ♂ genitalia. For legend see fig. 1.

Male genitalia: Genital ring rather narrow, ovalish, basal part markedly triangular, apical plate large, fairly asymmetric. Aedeagus elongate, with fairly elongate, stout, slightly upturned apex. Lower surface markedly bisinuate. Internal sac with a very elongate, coiled sclerite that is split into very elongate teeth, and with a narrow sclerotized rod along top near apex. For parameres see fig. 5, left paramere rather elongate with evenly rounded apex.

Female genitalia: As described and figured by MORVAN (1994: fig. 52).

Variation: Slight variation noted in relative width of pronotum and elytra and size of eyes.



FIGS 21-24

Entire view. 21. *Colasidia oviceps* sp. n. 22. *C. depressa* sp. n. 23. *C. attenuata* sp. n. 24. *C. triangularis* sp. n. Lengths: 5.75 mm; 5.05 mm; 4.5 mm; 3.9 mm.

Distribution: West Malaysia, Cameron Highlands.

Collecting circumstances: Collected by sieving ground litter at median altitude.

Remarks: This species belongs to a group that is characterized by rather triangular head with small eyes, moderately depressed body, fine and dense, irregular puncturation, and short, depressed pilosity.

Colasidia denticollis sp. n. (Figs 6, 17, 26, 42, 58)

Type material: Holotype: ♂, Sumatra: Aceh, stat. 27, Mt. Leuser National Park, Ketambe, 1000m, 23-30.XI.1989, Löbl, Agosti, Burckhardt (MHNG).

Paratype: 1 ♀, Sumatra: Aceh, stat. 25a, Mt. Leuser National Park, 300-500m, Ketambe, 23-30.XI.1989, Löbl, Agosti, Burckhardt (CBM).

Diagnosis: Medium-sized, fairly convex species, characterized by large and wide, rather triangular head with small eyes, short and wide elytra with transverse apical margin, fine and dense puncturation, and rather dense and short pilosity; further distinguished from related species by rather short aedeagus with straight lower surface and short, obtuse apex.

Description:

Measurements: Length: 4.05-4.1 mm; width: 1.6 mm. Ratios. Lenght/width of head: 1.27-1.31; lenght orbit/eye: 3.28-3.31; length/width of pronotum: 1.02-1.06; width widest part/base of pronotum: 1.33-1.34; width pronotum/head: 1.10-1.15; length/width of elytra: 1.33-1.35; width elytra/pronotum: 1.79-1.93.

Colour: Reddish brown, apex of elytra slightly darker. Labrum, palpi, legs, and antennae yellowish.

Head: Large and wide, rather triangular, widened towards base, widest near base, orbits posteriorly shortly rounded. Upper surface moderately convex. Frons not grooved. Eyes small, little projecting, length slightly <1/3 of orbit length. Clypeus anteriorly almost straight, lateral angles (above base of antenna) slightly projecting. Clypeal suture laterally with shallow grooves. Labrum anteriorly rather excised, 6-setose, inner 4 setae barely shorter than outer ones, lateral margin densely pilose. Mandibles short. Mentum with trinagular, at apex faintly excised tooth. Labium truncate. Maxillary palpus elongate, apex obtusely rounded. Terminal segment of labial palpus large and elongate. Antenna short, not attaining middle of pronotum. Median antennomeres distinctly wider than long, 3rd antennomere slightly shorter than 1st, distinctly longer than 2nd antennomere. Surface even without traces of microreticulation, highly glossy. Puncturation fairly coarse, moderately dense, diameter of punctures wider than distance between them. Pilosity moderately dense, fairly elongate, rather erect and hirsute, inclined anteriorly. Both supraorbital setae elongate, fairly well distinguished from pilosity, posterior supraorbital setae situated far behind eye.

Pronotum: Wide and short, markedly cordiform, barely longer than wide, distinctly wider than head, widest in anterior third. Upper surface rather convex, slightly depressed along median line. Lateral margin strongly convex in anterior half, deply sinuate in front of posterior angles. Apex wide, rather excised, anterior angles convex, slightly projecting. Base very wide, laterally excised, posterior angles acute, far projecting but not denticulate. Lateral margin slightly raised, with distinct border line, almost without marginal channel. Median line distinct, faintly impressed. Prebasal grooves moderately deep. Anterior marginal seta elongate, situated at anterior fourth of pronotum, posterior seta rather short, situated right on basal angle. Surface without microreticulation, glossy, with dense, rather coarse puncturation. Diameter of punctures wider than distance between them. Laterally punctures confluent to irregular transverse furrows. Pilosity rather dense, fairly short, inclined anteriorly, rather erect.

Elytra: Short and wide, laterally evenly curved, widest about in middle, upper surface moderately convex, odd intervals near humerus slightly raised. Humeri wide, markedly projecting, rounded off. Apex wide, almost straight, transverse, not redressed to suture. Striae irregularly marked, puncturation dense, rather coarse, irregularly arranged to longitudinal rows, punctures laterally rather confluent to transverse or oblique furrows, surface somewhat coriaceous. Fixed setae in third interval extremely difficult to recognize within the dense puncturation. Series of marginal pores difficult to detect when setae broken, apparently consisting of 8 basal, 3 postmedian, 6 apical pores, and 1 pore at apex of 3rd stria. Setae very elongate. Surface without microreticulation, glossy. Pilosity dense, short, rather irregular, inclined posteriorly, depressed.

Male genitalia: Genital ring unknown. Aedeagus rather short, with short, obtuse apex. Lower surface almost straight. Internal sac without a large, dentate sclerite, but with several small, rod-like sclerites. For parameres see fig. 6, both parameres rather short with rounded apex.

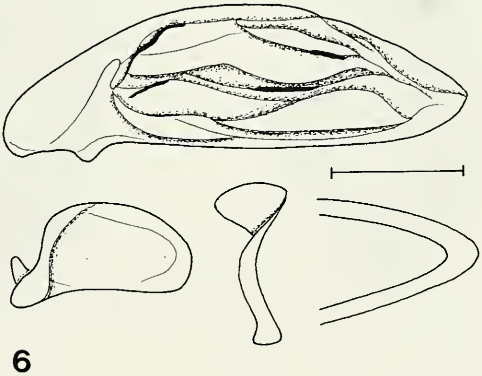


FIG. 6

Colasidia denticollis sp. n. ♂ genitalia. For legend see fig. 1.

Female genitalia: Stylomere 2 elongate with acute apex, with 1 elongate ventral ensiform seta situated basally, one elongate dorsal ensiform seta situated below middle, and a nematiform seta arising from a large groove in middle of median surface. Apex of stylomere 1 asetose.

Variation: Some variation noted in colouration and relative width of pronotum.

Etymology: The name refers to the acute basal angles of pronotum.

Distribution: Northernmost Sumatra. Known only from the Mt. Leuser area.

Collecting circumstances: Collected by sieving ground litter at median altitude.

Remarks: This species is intermediary between the group of species having rather fine and dense, irregular puncturation, and short, depressed pilosity of elytra and that group of species with coarse, regular elytral puncturation and sparse, elongate, regular pilosity.

Colasidia loebli sp. n. (Figs 7, 27, 43, 59)

Type material: Holotype: ♂, W. Malaysia: Pahang, Taman Negara, 90-130m, Tahan trail, Löbl & Calame, 11.3.93, primary forest, stat. 2a (MHNG).

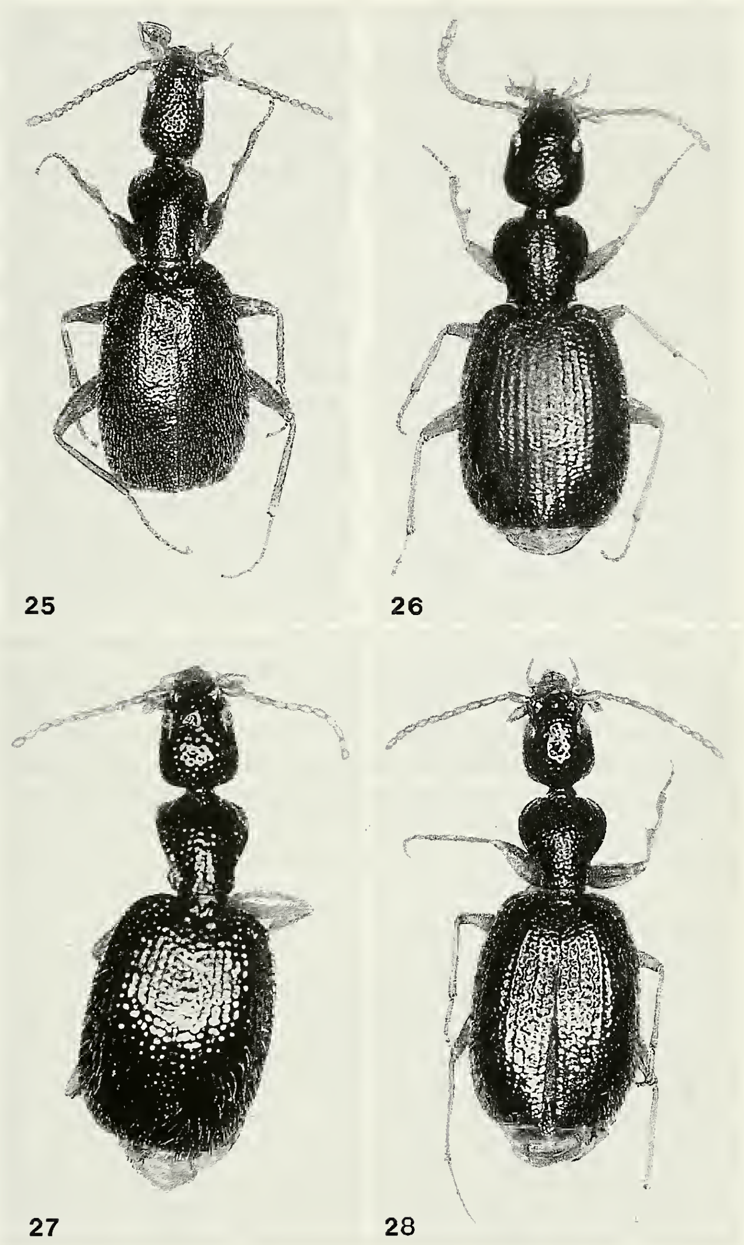
Diagnosis: Small, fairly convex species, characterized by large and wide, rather triangular head with small eyes, short and wide elytra with transverse apical margin, and coarse and sparse, regularly arranged puncturation and pilosity; further distinguished from related species by rather short aedeagus with straight lower surface and rather short, slightly downcurnved apex.

Description:

Measurements: Length: 3.85 mm; width: 1.5 mm. Ratios. Lenght/width of head: 1.25; lenght orbit/eye: 2.96; length/width of pronotum: 1.08; width widest part/base of pronotum: 1.52; width pronotum/head: 1.12; length/width of elytra: 1.35; width elytra/pronotum: 1.95.

Colour: Dark piceous. Labrum, palpi, legs, and antennae yellowish.

Head: Large and wide, rather triangular, widened towards base, widest near base, orbits posteriorly shortly rounded. Upper surface moderately convex. Frons not grooved. Eyes small, slightly projecting, length slightly >1/3 of orbit length. Clypeus anteriorly almost straight, lateral angles (above base of antenna) slightly projecting. Clypeal suture laterally with shallow grooves. Labrum anteriorly rather excised, 6-setose, inner 4 setae barely shorter than outer ones, lateral margin densely pilose. Mandibles short. Mentum with triangular, at apex faintly excised tooth. Labium truncate. Maxillary palpus elongate, apex obtusely rounded. Terminal segment of labial palpus large and elongate. Antenna short, barely attaining middle of pronotum. Median antennomeres distinctly wider than long, 3rd antennomere a third shorter than 1st, a quarter longer than 2nd antennomere. Surface even without traces of microreticulation, highly glossy. Puncturation coarse, sparse, on vertex diameter of punctures slightly wider than distance between them, on frons punctures very sparse. Pilosity sparse, elongate, rather erect and hirsute, inclined anteriorly. Both supraorbital setae elongate, fairly well distinguished from pilosity, posterior supraorbital setae situated far behind eye.



FIGS 25-28

Entire view. *Colasidia lagadiga* (Morvan). 26. *C. denticollis* sp. n. 27. *C. loebli* sp. n. 28. *C. helvetorum* sp. n. Lengths: 5.0 mm; 4.05 mm; 3.85 mm; 5.1 mm.

Pronotum: Rather narrow, moderately cordiform, distinctly longer than wide, distinctly wider than head, widest in anterior third. Upper surface rather convex, slightly depressed along median line. Lateral margin at apex oblique, feebly rounded, than strongly convex, in front of posterior angles moderately sinuate. Apex wide, rather excised, anterior angles slightly projecting. Base rather narrow, laterally deeply excised, markedly oblique, basal angles slightly projecting but not denticulate. Lateral margin slightly raised, with distinct border line, almost without marginal channel. Median line distinct, faintly impressed. Prebasal grooves moderately deep. Anterior marginal seta elongate, situated at anterior fourth of pronotum, posterior seta rather short, situated right on basal angle. Surface without microreticulation, highly glossy, with sparse, coarse puncturation. Diameter of punctures about as wide as distance between them. Pilosity sparse, elongate, inclined posteriorly, rather erect.

Elytra: Short and wide, laterally evenly curved, widest about in middle, upper surface moderately convex. Humeri wide, rather projecting, rounded off. Apex wide, faintly convex, transverse, not redressed to suture. Striae regularly marked by rows of punctures, puncturation sparse, coarse, regularly arranged to longitudinal rows. Fixed setae in third interval not recognized within the coarse puncturation. Series of marginal pores very difficult to detect when setae broken, apparently consisting of 8 basal, 3 postmedian, 6 apical pores, and 1 pore at apex of 3rd stria. Setae very elongate. Surface without microreticulation, highly glossy. Pilosity sparse, elongate, hirsute, rather regular, inclined posteriorly, rather erect.

Male genitalia: Genital ring moderately wide, ovalish, apical plate large, fairly asymmetric. Aedeagus rather short, with fairly short, slightly downcurved apex. Lower surface straight. Internal sac with a very large, complexly coiled, dentate sclerite. For parameres see fig. 7, both parameres rather narrow and elongate.

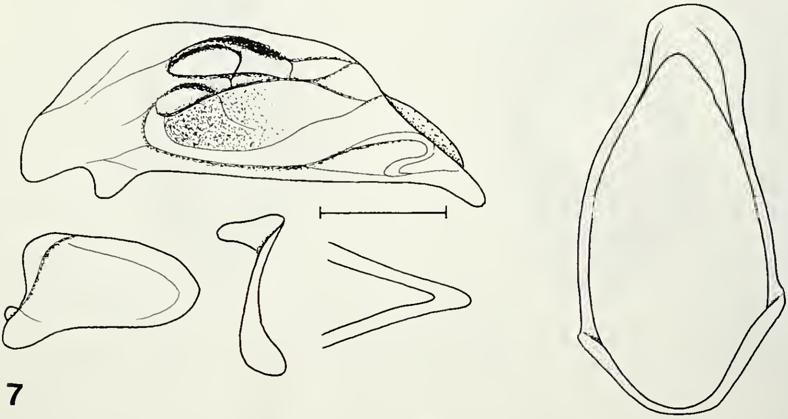


Fig. 7

Colasidia loebli sp. n. ♂ genitalia. For legend see fig. 1.

Etymology: The name is a patronym of Dr. I. Löbl, collector of this and of many other species.

Collecting circumstances: Collected by sieving ground litter in primary forest at low altitude.

Remarks: This and all the following species belong to the main group of species that are characterized by very coarse, regular elytral puncturation and sparse, elongate pilosity.

Colasidia helvetorum sp. n. (Figs 8, 18, 28, 44, 60)

Type material: Holotype: ♂, Sumatra: Jambi, km 15 Sungaipenuh to Tapan, 1450m, 9.XI.1989, Agosti, Löbl, Burckhardt, stat. 10 (MHNG).

Paratype: 1 ♀, same data (CBM).

Diagnosis: Large, rather convex species, characterized by large and wide, rather triangular head with moderately small eyes, fairly short and wide elytra with transverse apical margin, and coarse and sparse, regularly arranged puncturation and pilosity; further distinguished from related species by moderately elongate aedeagus with almost straight lower surface and fairly elongate apex that bears an extremely feeble tooth at lower edge. Further distinguished from its nearest relative, *C. similis* sp. n., by wider, more triangular head, larger eyes, shorter elytra with straight apical margin, lighter colour, longer and narrower aedeagus with slightly longer apex that is even less toothed, and longer parameres.

Description:

Measurements: Length: 5.1-5.2 mm; width: 1.95 mm. Ratios. Lenght/width of head: 1.20-1.24; lenght orbit/eye: 2.12-2.23; length/width of pronotum: 1.05-1.06; width widest part/base of pronotum: 1.76-1.79; width pronotum/head: 1.11-1.15; length/width of elytra: 1.39-1.42; width elytra/pronotum: 1.89-1.92.

Colour: Piceous, elytra faintly lighter. Labrum, palpi, legs, and antennae yellowish.

Head: Large and wide, rather triangular, widened towards base, widest near base, orbits posteriorly shortly rounded. Upper surface moderately convex. Frons not grooved. Eyes moderately large, barely projecting, length slightly >1/2 of orbit length. Clypeus anteriorly almost straight, lateral angles (above base of antenna) slightly projecting. Clypeal suture laterally with shallow grooves. Labrum anteriorly rather excised, 6-setose, inner 4 setae barely shorter than outer ones, lateral margin densely pilose. Mandibles short. Mentum with triangular, at apex faintly excised tooth. Labium truncate. Maxillary palpus elongate, apex obtusely rounded. Terminal segment of labial palpus large and elongate. Antenna short, barely attaining middle of pronotum. Median antennomeres about as wide as long, 3rd antennomere a third shorter than 1st, 1.5 x as long as 2nd antennomere. Surface on clypeusand antero-laterally on frons with traces of microreticulation, highly glossy. Puncturation fairly coarse, very sparse, distance between punctures much wider than diameter of punctures. Pilosity sparse, elongate, rather erect and hirsute, inclined anteriorly. Both supraorbital setae elongate, fairly well distinguished from pilosity, posterior supraorbital setae situated far behind eye.

Pronotum: Rather wide, fairly cordiform, anteriorly very wide, slightly longer than wide, distinctly wider than head, widest in anterior third. Upper surface rather convex, slightly depressed along median line. Lateral margin in anterior two thirds strongly convex, in front of posterior angles moderately sinuate. Apex wide, rather excised, anterior angles convex, fairly projecting. Base rather narrow, laterally excised, fairly oblique, basal angles slightly projecting but not denticulate. Lateral margin slightly raised, with distinct border line, almost without marginal channel. Median line distinct, faintly impressed. Prebasal grooves moderately deep. Anterior marginal seta very elongate, situated at anterior fourth of pronotum, posterior seta fairly elongate, situated right on basal angle. Surface without microreticulation, highly glossy, with moderately dense, rather coarse puncturation. Diameter of punctures about as wide as distance between them. Pilosity fairly dense, elongate, inclined anteriorly, rather erect.

Elytra: Moderately short and wide, laterally evenly curved, widest about in middle, upper surface moderately convex. Intervals irregularly raised in anterior half. Humeri wide, rather projecting, rounded off. Apex wide, almost straight, transverse, not redressed to suture. Striae fairly regularly marked by rows of punctures, puncturation moderately sparse, fairly coarse, moderately regularly arranged to longitudinal rows. Fixed setae in third interval not recognized within the coarse puncturation. Series of marginal pores very difficult to detect when setae broken, apparently consisting of 8 basal, 3 postmedian, 6 apical pores, and 1 pore at apex of 3rd stria. Setae very elongate. Surface without microreticulation, highly glossy. Pilosity rather sparse, elongate, hirsute, rather regular, inclined posteriorly, rather erect.

Male genitalia: Genital ring wide, ovalish, widened towards apex, apical plate wide, markedly rounded, almost symmetric. Aedeagus fairly elongate, with rather elongate, straight apex that bears an extremely feeble tooth at the lower edge. Lower surface straight. Internal sac with a very large, complexly coiled, dentate sclerite at top, with another, narrow, coiled sclerite behind this, and a third sclerite on the right side near apex. Bottom of internal sac in apical part with a weakly sclerotized and dentate area. For parameres see fig. 8, both parameres rather elongate, left paramere at apex obliquely cut.

Female genitalia: Stylomere 2 rather short with fairly obtuse apex, apparently with only one elongate ventral ensiform seta situated basally, one elongate dorsal ensiform seta situated at middle, and a large groove in middle of median surface but apparently without a nematiform seta. Apex of stylomere 1 asetose.

Variation: Little variation noted, in paratype elytral intervals slightly more distinct.

Etymology: The name is a patronym of the very successful Swiss collectors.

Distribution: Central western Sumatra. Known only from type locality.

Collecting circumstances: Collected by sieving ground litter at median altitude.

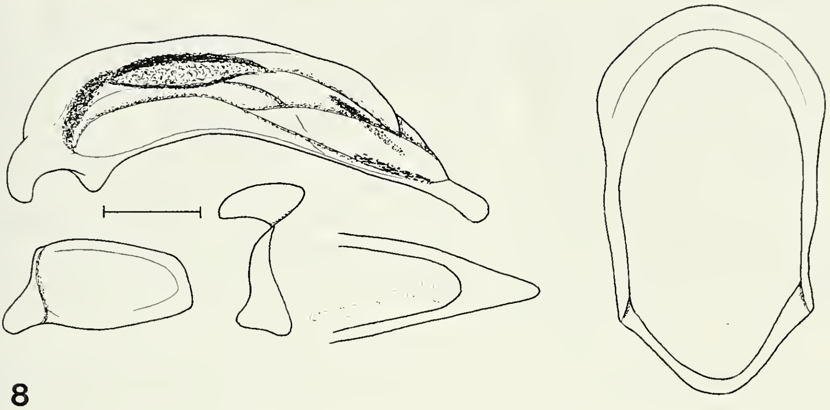


FIG. 8

Colasidia helvetorum sp. n. ♂ genitalia. For legend see fig. 1.

Colasidia similis sp. n. (Figs 9, 29, 45, 61)

Type material: Holotype: ♂, Sumatra: Jambi, km 12 Sungaipenuh to Tapan, 1350m, 9.XI.1989, Agosti, Löbl, Burckhardt, stat. 9 (MHNG).

Diagnosis: Fairly large, rather convex species, characterized by large and wide, rather triangular head with moderately small eyes, fairly short and wide elytra with convex apical margin, and coarse and sparse, regularly arranged puncturation and pilosity; distinguished from related species by moderately elongate aedeagus with almost straight lower surface and fairly elongate apex that bears a feeble tooth at lower edge. Further distinguished from its nearest relative, *C. helvetorum* sp. n., by narrower, less triangular head, smaller eyes, longer elytra with convex and somewhat oblique apical margin, darker colour, shorter aedeagus with shorter apex that is more distinctly toothed at lower edge, and shorter parameres.

Description:

Measurements: Length: 4.9 mm; width: 1.8 mm. Ratios. Lenght/width of head: 1.31; lenght orbit/eye: 2.35; length/width of pronotum: 1.04; width widest part/base of pronotum: 1.81; width pronotum/head: 1.20; length/width of elytra: 1.47; width elytra/pronotum: 1.79.

Colour: Dark piceous. Labrum, palpi, legs, and antennae yellowish.

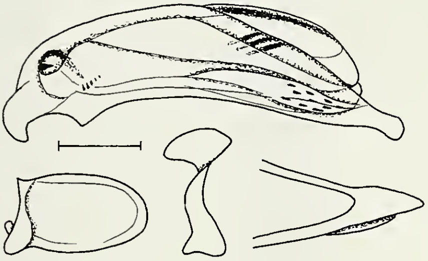
Head: Rather large and wide, rather triangular, widened towards base, widest near base, orbits posteriorly fairly shortly rounded. Upper surface moderately convex. Frons not grooved. Eyes moderately large, barely projecting, length slightly >2/5 of orbit length. Clypeus anteriorly almost straight, lateral angles (above base of antenna) slightly projecting. Clypeal suture laterally with shallow grooves. Labrum anteriorly barely excised, 6-setose, inner 4 setae slightly shorter than outer ones, lateral margin densely pilose. Mandibles short. Mentum with triangular, at apex faintly excised tooth. Labium truncate. Maxillary palpus elongate, apex obtusely rounded. Terminal segment of labial palpus large and very elongate. Antenna rather short, slightly surpassing middle of pronotum. Median antennomeres about as wide as long, 3rd antennomere a third shorter than 1st, a third longer than 2nd antennomere. Surface without traces of microreticulation, highly glossy. Puncturation fairly coarse, sparse, on frons very sparse, distance between punctures much wider than diameter of punctures. Pilosity sparse, elongate, rather erect and hirsute, inclined anteriorly. Both supraorbital setae elongate, fairly well distinguished from pilosity, posterior supraorbital setae situated far behind eye.

Pronotum: Rather wide, fairly cordiform, anteriorly very wide, slightly longer than wide, distinctly wider than head, widest in anterior third. Upper surface convex, slightly depressed along median line. Lateral margin in anterior two thirds strongly convex, in front of posterior angles moderately sinuate. Apex wide, slightly excised, anterior angles convex, fairly projecting. Base rather narrow, laterally excised, fairly oblique, basal angles slightly projecting but not denticulate. Lateral margin slightly raised, with distinct border line, almost without marginal channel. Median line distinct, faintly impressed. Prebasal grooves moderately deep. Anterior marginal seta very elongate, situated at anterior fourth of pronotum, posterior seta fairly elongate, situated right on basal angle. Surface without microreticulation, highly glossy, with moderately dense, coarse puncturation. Diameter of punctures about as wide as or slightly wider than distance between them. Pilosity moderately dense, elongate, inclined anteriorly, rather erect.

Elytra: Moderately short and wide, laterally evenly curved, widest about in middle, upper surface moderately convex. Intervals irregularly raised in anterior half. Humeri wide, rather projecting, rounded off. Apex wide, evenly convex, slightly redressed to suture. Striae fairly regularly marked by rows of punctures, puncturation moderately sparse, fairly coarse, moderately regularly arranged to longitudinal rows. Fixed setae in third interval very difficult to recognize within the coarse puncturation. Series of marginal pores very difficult to detect when setae broken, apparently consisting of 8 basal, 3 postmedian, 6 apical pores, and 1 pore at apex of 3rd stria. Setae very elongate. Surface without microreticulation, highly glossy. Pilosity rather sparse, elongate, hirsute, rather regular, inclined posteriorly, rather erect.

Male genitalia: Genital ring wide, ovalish, widened towards apex, apical plate wide, markedly rounded, almost symmetric. Aedeagus fairly elongate, with moderately elongate, almost straight apex that bears a feeble tooth at the lower edge. Lower surface very gently bisinuate. Internal sac with a large, coiled, dentate sclerite at top, with another, narrow, coiled sclerite behind this, and a third sclerite on the right side near apex. Bottom of internal sac in apical part with a weakly sclerotized and dentate area. For parameres see fig. 9, both parameres rather short, left paramere at apex evenly rounded.

Etymology: the name refers to the high external similarity of this and the foregoing species.



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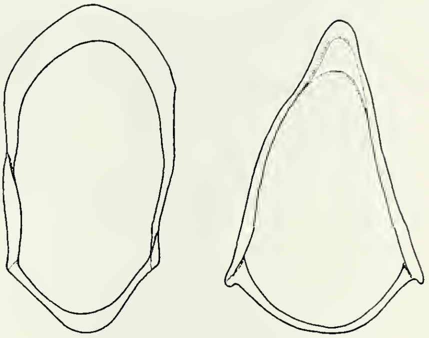


10

FIGS 9, 10

♂ genitalia. 9. *Colasidia similis* sp. n. 10. *Colasidia borneensis* sp. n. Genital ring. For legend see fig. 1.

Distribution: Central western Sumatra. Known only from type locality.

Collecting circumstances: Collected by sieving ground litter at median altitude.

Colasidia borneensis sp. n. (Figs 10, 19, 30, 46, 62)

Type material: Holotype: ♂, Sabah: Crocker Ra. 1550-1650m, 16.V.1987, Burckhardt-Löbl (MHNG).

Paratype: 1 ♀, same data (CBM).

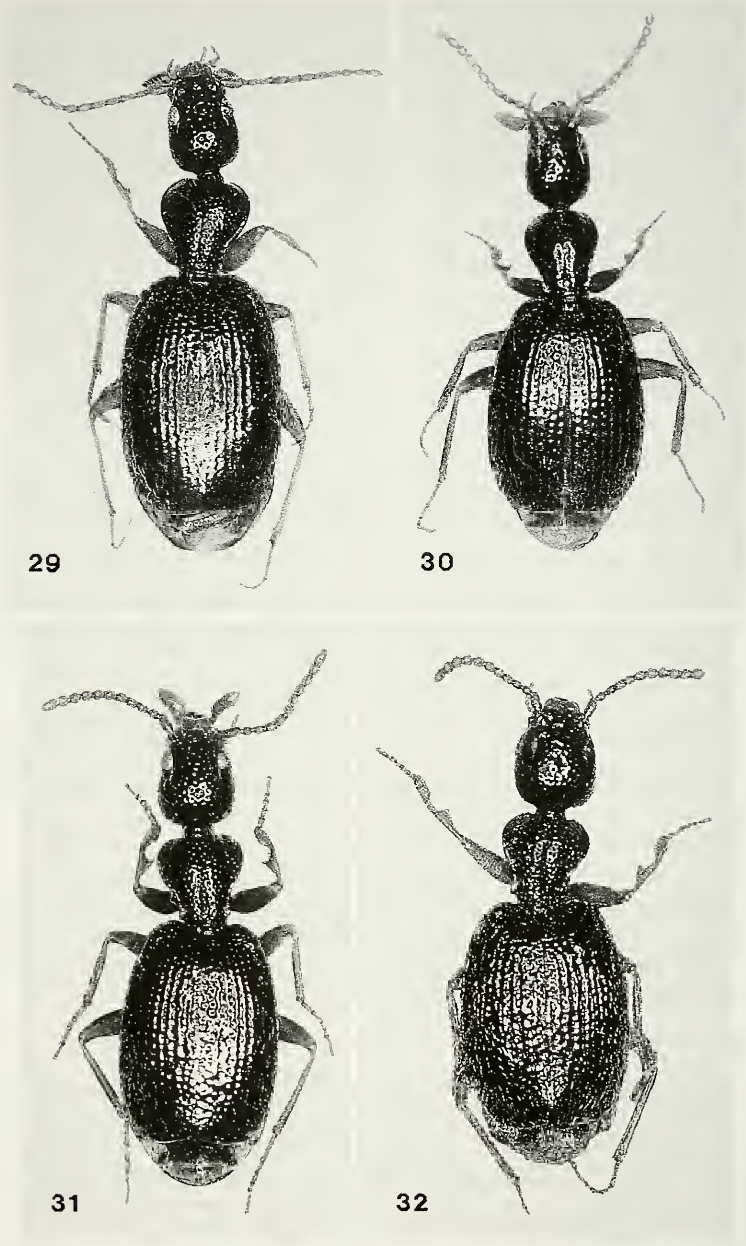
Diagnosis: Small to medium-sized, rather convex species, characterized by slightly widened though not triangular head with fairly large eyes, fairly short and wide elytra with convex apical margin, and coarse and sparse, regularly arranged puncturation and pilosity; further distinguished from related species by the lighter colouration of head and pronotum compared with elytra.

Description:

Measurements: Length: 3.95-4.3 mm; width: 1.45-1.65 mm. Ratios. Lenght/width of head: 1.30-1.31; lenght orbit/eye: 2.32-2.45; length/width of pronotum: 1.10-1.15; width widest part/base of pronotum: 1.51-1.53; width pronotum/head: 1.06-1.11; length/width of elytra: 1.38-1.41; width elytra/pronotum: 2.04-2.10.

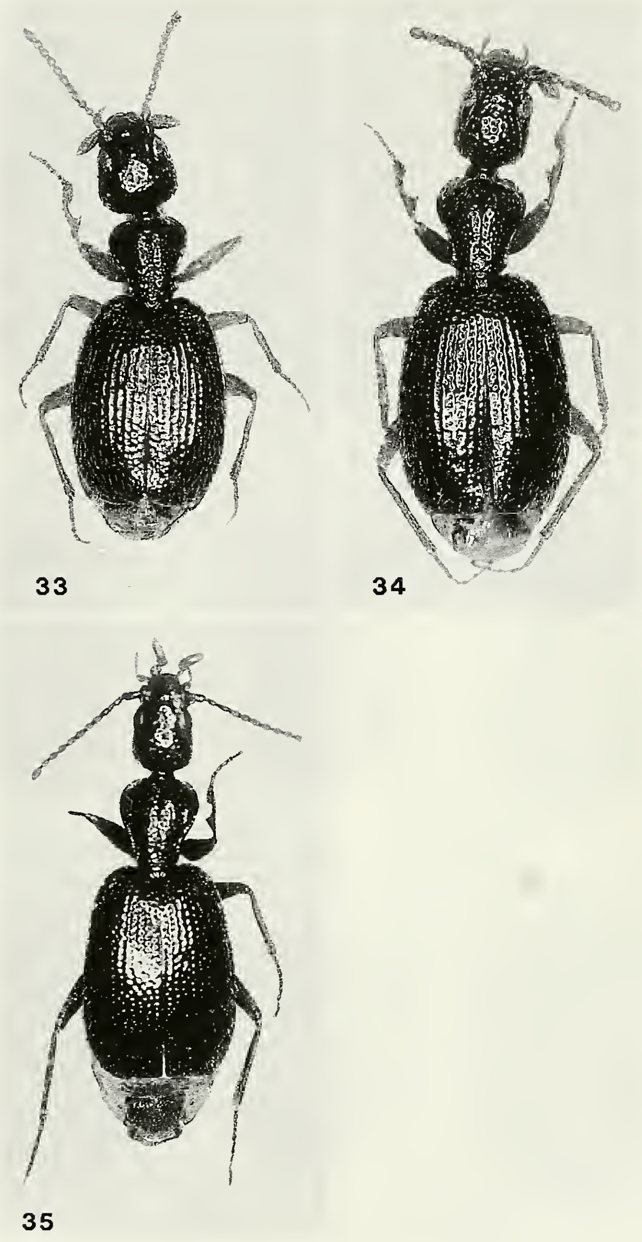
Colour: Piceous, head and pronotum very faintly lighter than elytra. Labrum, palpi, legs, and antennae yellowish.

Head: Fairly large and wide, widened behind eyes, though not triangular, widest in basal third, orbits posteriorly widely rounded off. Upper surface moderately convex. Frons not grooved. Eyes moderately large, not projecting, length slightly



Figs 29-32

Entire view. 29. *Colasidia similis* sp. n. 30. *C. borneensis* sp. n. 31. *C. gerardi* Perrault. 32. *C. mateui* sp. n. Lengths: 4.9 mm; 3.95 mm; 4.3 mm; 4.1 mm.



FIGS 33-35

Entire view. 33. *Colasidia laticeps* sp. n. 34. *C. burckhardti* sp. n. 35. *C. atra* sp. n. Lengths: 4.05 mm; 4.25 mm; 4.8 mm.

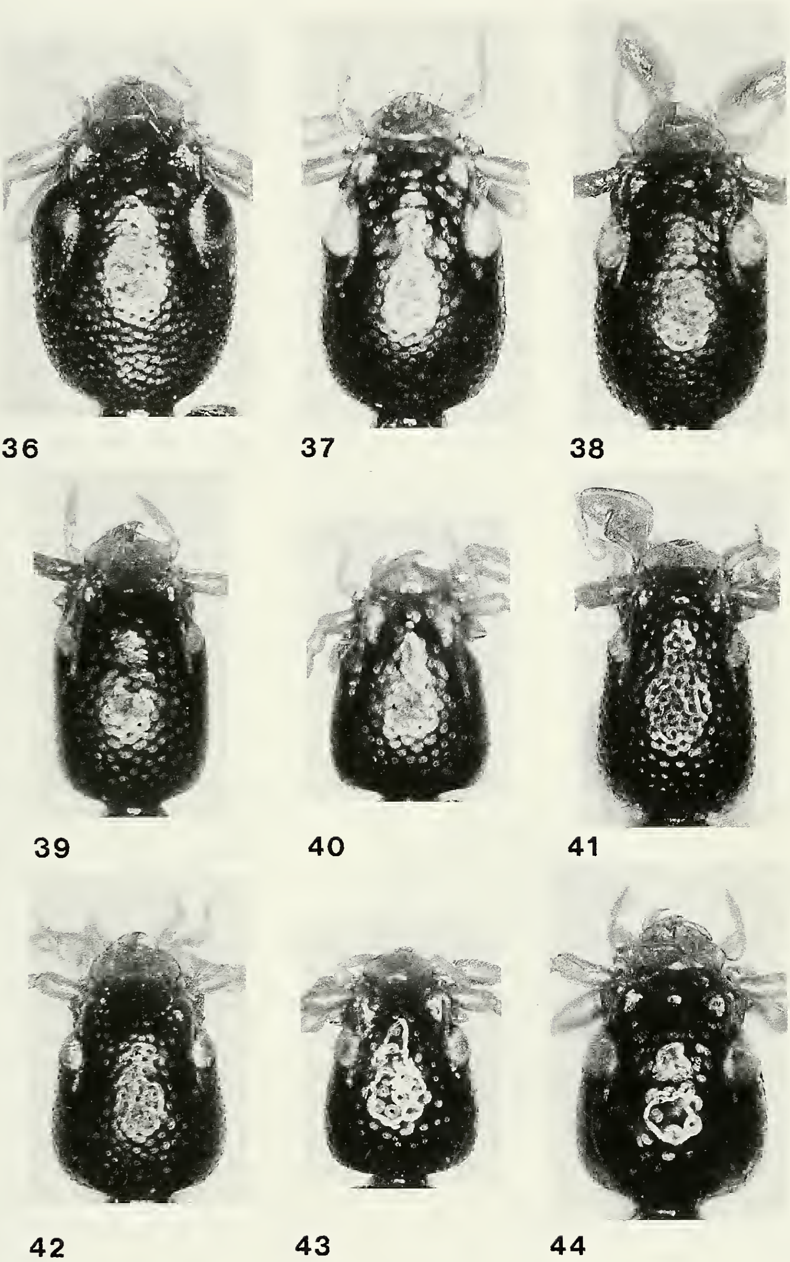
>2/5 of orbit length. Clypeus anteriorly faintly concave, lateral angles (above base of antenna) shortly though acutely projecting. Clypeal suture laterally with shallow grooves. Labrum anteriorly rather excised, 6-setose, inner 4 setae markedly shorter than outer ones, lateral margin densely pilose. Mandibles short. Mentum with triangular, at apex faintly excised tooth. Labium truncate. Maxillary palpus comparatively short, apex obtusely rounded. Terminal segment of labial palpus large and elongate. Antenna very short, barely attaining anterior third of pronotum. Median antennomeres almost twice as wide as long, 3rd antennomere a third shorter than 1st, only slightly longer than 2nd antennomere. Surface without microreticulation, highly glossy. Puncturation fairly coarse, very sparse, distance between punctures much wider than diameter of punctures. Pilosity sparse, remarkably elongate, rather erect and hirsute, inclined anteriorly. Both supraorbital setae elongate, not well distinguished from pilosity, posterior supraorbital setae situated far behind eye.

Pronotum: Rather narrow, fairly cordiform, slightly longer than wide, distinctly wider than head, widest in anterior third. Upper surface rather convex, slightly depressed along median line. Lateral margin in anterior two thirds regularly convex, in front of posterior angles moderately sinuate. Apex moderately wide, faintly excised, anterior angles convex, faintly projecting. Base rather narrow, laterally excised, fairly oblique, basal angles slightly projecting and faintly denticulate. Lateral margin slightly raised, with distinct border line, almost without marginal channel. Median line distinct, faintly impressed. Prebasal grooves rather shallow. Anterior marginal seta very elongate, situated at anterior fourth of pronotum, posterior seta fairly elongate, situated right on basal angle. Surface without microreticulation, highly glossy, with sparse, rather coarse puncturation. Distance between punctures distinctly wider than diameter of punctures. Pilosity sparse, elongate, markedly hirsute, inclined anteriorly, rather erect.

Elytra: Rather short and wide, laterally curved, widened towards apex, widest slightly behind middle, upper surface moderately convex. Humeri rather narrow, moderately projecting, rounded off. Apex wide, markedly convex, redressed to suture. Striae rather regularly marked by rows of punctures, puncturation moderately sparse, fairly coarse, regularly arranged to longitudinal rows. Fixed setae in third interval not recognized within the coarse puncturation. Series of marginal pores very difficult to detect when setae broken, apparently consisting of 8 basal, 3 postmedian, 6 apical pores, and 1 pore at apex of 3rd stria. Setae very elongate. Surface without microreticulation, glossy. Pilosity rather sparse, elongate, hirsute, rather regular, inclined posteriorly, rather erect.

Male genitalia: Largely unknown, the male genitalia had been dissected by J. Mateu, but the aedeagus has been unfortunately lost, only the genital ring left. The latter is markedly triangular, but slightly asymmetric.

Female genitalia: Stylomere 2 rather short and basally wide with fairly narrow apex, with two elongate ventral ensiform setae situated basally, the lower one being much smaller, one elongate dorsal ensiform seta situated at middle, and a large groove in middle of median surface but apparently without a nematiform seta. Apex of stylomere 1 asetose.



FIGS 36-44

Head. 36. *Colasidia oviceps* sp. n. 37. *C. depressa* sp. n. 38. *C. rougemonti* (Morvan). 39. *C. attenuata* sp. n. 40. *C. triangularis* sp. n. 41. *C. lagadiga* (Morvan). 42. *C. denticollis* sp. n. 43. *C. loebli* sp. n. 44. *C. helvetorum* sp. n. All figures to scale.

Variation: Prothorax in ♀ paratype wider and laterally more convex, otherwise both specimens similar.

Etymology: The name refers to the range of the species.

Collecting circumstances: Collected by sieving ground litter at median altitude.

Colasidia mateui sp. n. (Figs 11, 32, 48, 64)

Type material: Holotype: ♂, Sabah, Mt. Kinabalu, 1750m, 27.IV.1987, Burckhardt-Löbl (MHNG).

Paratype: 1 ♂, Sabah: Crocker Ra. 1600m, km 51 rte Kota Kinabalu-Tambunan, 18.V.87, Burckhardt-Löbl (CBM)

Diagnosis: Medium-sized, rather convex species, characterized by widened, rather triangular head with fairly large eyes, fairly short and wide elytra with convex apical margin, and coarse and sparse, regularly arranged puncturation and pilosity; further distinguished from related species by moderately elongate aedeagus with gently concave lower surface, rather short, slightly upturned apex, and lack of larger dentate sclerites in the internal sac.

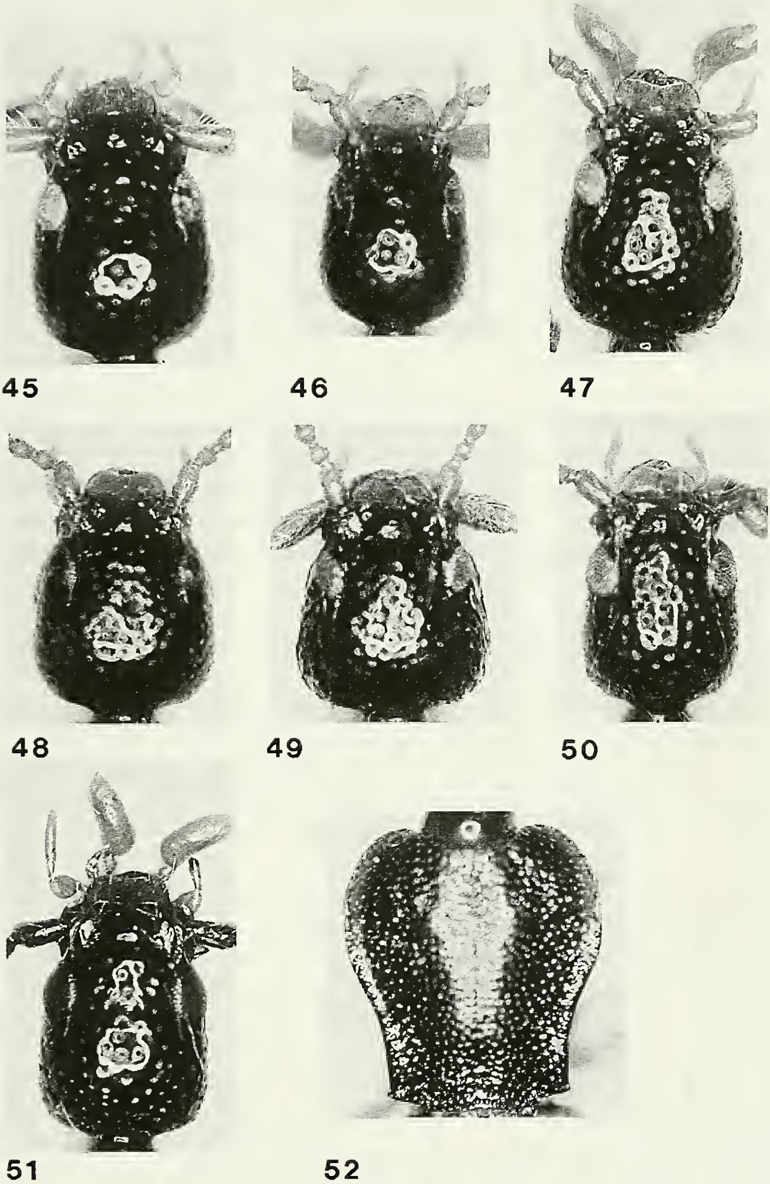
Description:

Measurements: Length: 4.1-4.5 mm; width: 1.55-1.75 mm. Ratios. Lenght/width of head: 1.18-1.20; lenght orbit/eye: 2.12-2.14; length/width of pronotum: 1.0-1.01; width widest part/base of pronotum: 1.62-1.65; width pronotum/head: 1.04-1.10; length/width of elytra: 1.33-1.34; width elytra/pronotum: 1.89-1.94.

Colour: More or less dark piceous, head and pronotum faintly lighter, suture of elytra very narrowly reddish. Labrum, palpi, legs, and antennae yellowish.

Head: Large and wide, rather triangular, widened towards base, widest near base, though orbits posteriorly rather widely rounded. Upper surface moderately convex. Surface of clypeus and frons rather uneven, frons in middle slightly raised, but laterally not deeply grooved. Eyes fairly large, barely projecting, length slightly <1/2 of orbit length. Clypeus anteriorly almost straight, lateral angles (above base of antenna) barely projecting. Clypeal suture laterally with shallow grooves. Labrum anteriorly rather excised, 6-setose, inner 4 setae considerably shorter than outer ones, lateral margin densely pilose. Mandibles short. Mentum with triangular, at apex faintly excised tooth. Labium truncate. Maxillary palpus elongate, apex obtusely rounded. Terminal segment of labial palpus large and very elongate. Antenna very short, barely attaining anterior third of pronotum. Median antennomeres almost twice as wide as long, 3rd antennomere more than a third shorter than 1st, <1.5 x as long as 2nd antennomere. Surface without microreticulation, highly glossy. Puncturation very coarse, moderately dense, diameter of punctures wider than distance between punctures. Pilosity fairly dense, rather elongate, moderately erect, inclined anteriorly. Both supraorbital setae elongate, fairly well distinguished from pilosity, posterior supraorbital setae situated far behind eye.

Pronotum: Wide, cordiform, anteriorly very wide, c. as long as wide, distinctly wider than head, widest in anterior third. Upper surface rather convex,



FIGS 45-52

Head. 45. *Colasidia similis* sp. n. 46. *C. borneensis* sp. n. 47. *C. gerardi* Perrault. 48. *C. mateui* sp. n. 49. *C. laticeps* sp. n. 50. *C. burckhardti* sp. n. 51. *C. atra* sp. n. All figures to scale. Fig. 52. Prothorax. *Colasidia oviceps* sp. n. To scale.

sulcate along median line. Lateral margin in anterior two thirds strongly convex, in front of posterior angles moderately sinuate, basal third almost straight. Apex wide, slightly excised, anterior angles convex, moderately projecting. Base rather narrow, laterally angulately excised, basal angles barely projecting but very faintly denticulate. Lateral margin slightly raised, with distinct border line, at least in basal half with distinct marginal channel. Median line distinct, deeply impressed, sulcate. Prebasal grooves deep. Anterior marginal seta very elongate, situated at anterior fourth of pronotum, posterior seta short, situated right on basal angle. Surface without microreticulation, highly glossy, with moderately dense, very coarse puncturation. Diameter of punctures considerably wider than distance between them. Pilosity fairly dense, elongate, hirsute, irregularly inclined, rather erect.

Elytra: Rather short and wide, laterally evenly curved, widest slightly behind middle, upper surface moderately convex. Intervals irregularly raised throughout. Humeri wide, rather projecting, rounded off. Apex wide, markedly convex, redressed to suture. Striae somewhat irregularly marked by rows of punctures, puncturation moderately sparse, very coarse, rather irregularly arranged to longitudinal rows. Fixed setae in third interval very difficult to recognize within the coarse puncturation. Series of marginal pores extremely difficult to detect when setae broken, apparently consisting of 8 basal, 3 postmedian, 6 apical pores, and 1 pore at apex of 3rd stria. Setae very elongate. Surface without microreticulation, highly glossy. Pilosity rather sparse, elongate, hirsute, fairly irregular, inclined posteriorly, rather depressed.

Male genitalia: Genital ring fairly narrow, triangular, apical plate small, feebly asymmetric. Aedeagus fairly elongate, with rather short, slightly upturned apex. Lower surface gently concave. Internal sac without a large, dentate

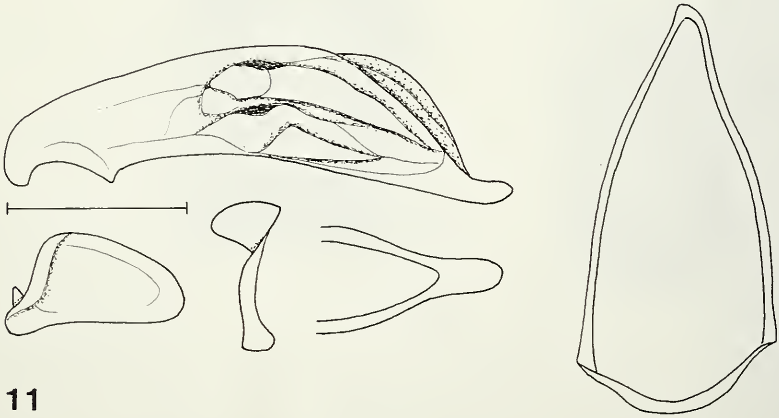


FIG. 11

Colasidia mateui sp. n. ♂ genitalia. For legend see fig. 1.

sclerite, but with two small rod-like sclerites in middle. For parameres see fig. 11, both parameres rather short, at apex rounded triangular.

Variation: In ♀ paratype pronotum and elytra are slightly more convex, and the pronotum is slightly narrower, otherweise very similar.

Etymology: The name is a patronym of Dr. J. Mateu, who examined part of the present sample.

Distribution: Sabah, northern Borneo.

Collecting circumstances: Collected by sieving ground litter at median altitude.

Colasidia laticeps sp. n. (Figs 12, 20, 33, 49, 65)

Type material: Holotype: ♂, Sabah: Crocker Ra. 1550-1650m, 16.V.1987, Burckhardt-Löbl (MHNG).

Paratypes: 2 ♀♀, same data (CBM, MHNG).

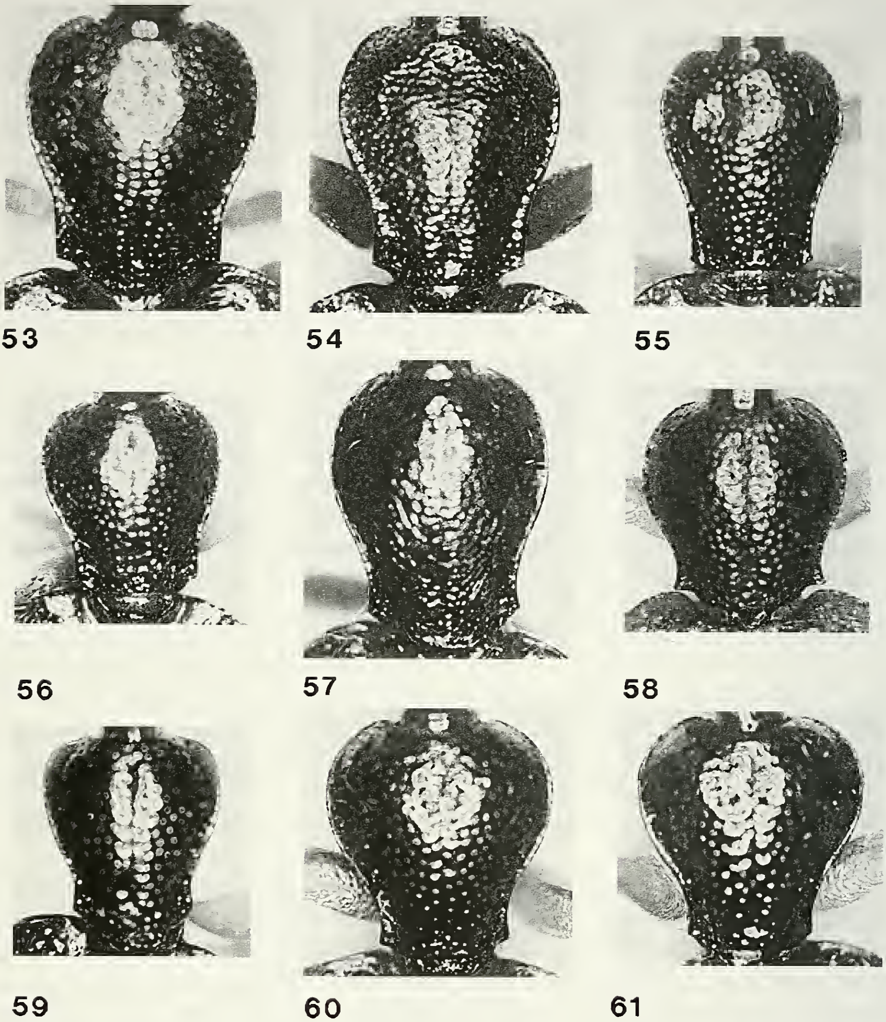
Diagnosis: Rather small, wide, convex species, characterized by very wide, triangular head with fairly large eyes, short and wide elytra with convex apical margin, and coarse and sparse, regularly arranged puncturation and pilosity; further distinguished from related species by elongate aedeagus with gently concave lower surface, fairly elongate, slightly upturned apex, and presence of a large dentate sclerite in the internal sac.

Description:

Measurements: Length: 4.05-4.2 mm; width: 1.55-1.65 mm. Ratios. Lenght/width of head: 1.06-1.08; lenght orbit/eye: 2.38-2.46; length/width of pronotum: 1.0-1.03; width widest part/base of pronotum: 1.53-1.62; width pronotum/head: 0.93-0.95; length/width of elytra: 1.32-1.35; width elytra/pronotum: 1.96-2.02.

Colour: More or less dark piceous, sometimes head and pronotum faintly lighter, suture of elytra very narrowly reddish. Labrum, palpi, legs, and antennae yellowish.

Head: Very large, short and wide, triangular, widened towards base, widest near base, orbits posteriorly rather shortly rounded. Clypeus and frons in middle slightly raised, frons not grooved. Eyes fairly large, barely projecting, length slightly >2/5 of orbit length. Clypeus anteriorly almost straight, lateral angles (above base of antenna) barely projecting. Clypeal suture laterally with shallow grooves. Labrum anteriorly rather excised, 6-setose, inner 4 setae slightly shorter than outer ones, lateral margin densely pilose. Mandibles short. Mentum with triangular, at apex faintly excised tooth. Labium truncate. Maxillary palpus moderately elongate, apex obtusely rounded. Terminal segment of labial palpus large and very elongate. Antenna very short, barely attaining anterior third of pronotum. Median antennomeres c. 1.75 x as wide as long, 3rd antennomere little more than half as long as 1st, only slightly longer than 2nd antennomere. Surface without microreticulation, highly glossy. Puncturation very coarse, moderately dense, diameter of punctures wider than distance between punctures. Pilosity moderately dense, rather elongate, moderately erect, inclined anteriorly. Both supraorbital setae elongate, fairly well distinguished from pilosity, posterior supraorbital setae situated far behind eye.



FIGS 53-61

Prothorax. 53. *Colasidia depressa* sp. n. 54. *C. rougemonti* (Morvan). 55. *C. attenuata* sp. n. 56. *C. triangularis* sp. n. 57. *C. lagadiga* (Morvan). 58. *C. denticollis* sp. n. 59. *C. loebli* sp. n. 60. *C. helvetorum* sp. n. 61. *C. similis* sp. n. All figures to scale.

Pronotum: Rather wide, cordiform, anteriorly wide, c. as long as wide, distinctly narrower than head, widest in anterior third. Upper surface rather convex, sulcate along median line. Lateral margin in anterior two thirds strongly convex, in front of posterior angles moderately sinuate, basal third almost straight. Apex wide, slightly excised, anterior angles convex, moderately projecting. Base rather narrow, laterally angulately excised, basal angles barely projecting, not denticulate. Lateral margin slightly raised, with distinct border line, at least in basal half with distinct marginal channel. Median line distinct, rather impressed, slightly sulcate. Prebasal grooves deep. Anterior marginal seta very elongate, situated at anterior fourth of pronotum, posterior seta short, situated right on basal angle. Surface without microreticulation, highly glossy, with moderately dense, very coarse puncturation. Diameter of punctures wider than distance between them. Pilosity fairly dense, elongate, hirsute, irregularly inclined, rather erect.

Elytra: Rather short and wide, laterally evenly curved, widest slightly behind middle, upper surface moderately convex. Intervals irregularly raised throughout. Humeri wide, rather projecting, rounded off. Apex wide, markedly convex, redressed to suture. Striae rather regularly marked by rows of punctures, puncturation moderately sparse, very coarse, rather regularly arranged to longitudinal rows. Fixed setae in third interval very difficult to recognize within the coarse puncturation. Series of marginal pores extremely difficult to detect when setae broken, apparently consisting of 8 basal, 3 postmedian, 6 apical pores, and 1 pore at apex of 3rd stria. Setae very elongate. Surface without microreticulation, highly glossy. Pilosity rather sparse, elongate, hirsute, rather regular, inclined posteriorly, rather depressed.

Male genitalia: Genital ring fairly narrow, regularly triangular, basal part short, apical plate very small, almost symmetric. Aedeagus elongate, with moderately elongate, slightly upturned apex. Lower surface gently concave. Internal sac in middle with a large, dentate sclerite. For parameres see fig. 12, both parameres fairly elongate, rather parallel, with widely rounded apex.

Female genitalia: Stylomere 2 short and wide with rather short, obtuse apex, with two elongate ventral ensiform setae of about similar size situated basally, one elongate dorsal ensiform seta situated below middle, and a large groove

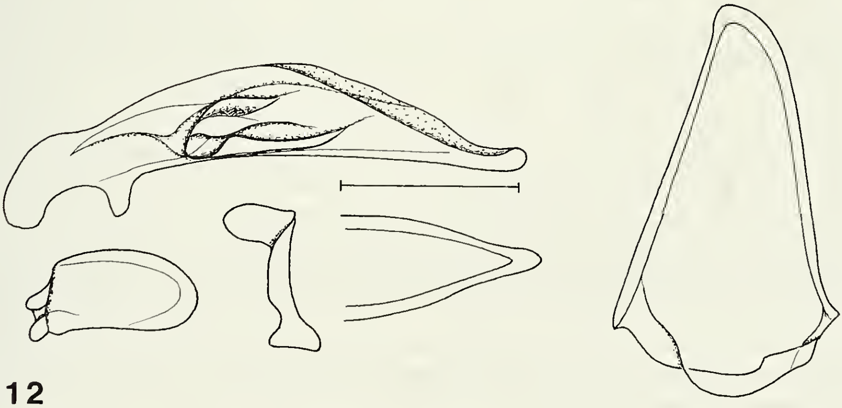


FIG. 12

Colasidia laticeps sp. n. ♂ genitalia. For legend see fig. 1.

above middle of median surface but apparently without a nematiform seta. Apex of stylomere 1 asetose.

Variation: Little variation noted.

Etymology: The name refers to the very large head.

Collecting circumstances: Collected by sieving ground litter at median altitude.

Colasidia burckhardti sp. n. (Figs 13, 34, 50, 66)

Type material: Holotype: ♂, Sabah, Mt. Kinabalu, 1550-1650m, 24.IV.1987, Burckhardt-Löbl (MHNG).

Paratypes: 2 ♂♂, Sabah, Mt. Kinabalu, 1550m, 29.IV.1987, Burckhardt-Löbl (CBM, MHNG); 1 ♂, Sabah, Mt. Kinabalu, 1550m, 28.IV.1987, Burckhardt-Löbl (MHNG).

Diagnosis: Medium-sized, rather convex species, characterized by gently triangular head with fairly large eyes, rather elongate elytra with transverse apical margin, and coarse and sparse, regularly arranged puncturation and pilosity; further distinguished from related species by rather elongate aedeagus with elongate, depressed, slightly asymmetric, markedly upturned apex, and presence of only a small, non-dentate sclerite in middle of the sac.

Description:

Measurements: Length: 4.2-4.45 mm; width: 1.5-1.6 mm. Ratios. Lenght/width of head: 1.30-1.36; lenght orbit/eye: 2.05-2.08; length/width of pronotum: 1.10-1.14; width widest part/base of pronotum: 1.55-1.59; width pronotum/head: 1.14-1.16; length/width of elytra: 1.42-1.45; width elytra/pronotum: 1.87-1.91.

Colour: Reddish piceous, base of elytra faintly lighter, head and pronotum reddish. Labrum, palpi, legs, and antennae yellowish.

Head: Fairly large, moderately elongate, gently triangular, widest in basal third, orbits posteriorly rather widely rounded. Dorsal surface gently convex, frons not grooved. Eyes fairly large, barely projecting, length c. 1/2 of orbit length. Clypeus anteriorly almost straight, lateral angles (above base of antenna) barely projecting. Clypeal suture laterally with shallow grooves. Labrum anteriorly rather excised, 6-setose, inner 4 setae slightly shorter than outer ones, lateral margin densely pilose. Mandibles short. Mentum with triangular, at apex faintly excised tooth. Labium truncate. Maxillary palpus moderately elongate, apex obtusely rounded. Terminal segment of labial palpus large and elongate. Antenna very short, barely attaining anterior third of pronotum. Median antennomeres almost twice as wide as long, 1st antennomere very short, 3rd antennomere c. 2/3 as long as 1st, a third longer than 2nd antennomere. Surface without microreticulation, highly glossy. Puncturation very coarse, rather sparse, diameter of punctures about as wide as distance between punctures. Pilosity rather sparse, elongate, erect, hirsute, inclined anteriorly. Both supraorbital setae elongate, not well distinguished from pilosity, posterior supraorbital setae situated far behind eye.

Pronotum: Rather elongate, fairly cordiform, anteriorly moderately wide, distinctly longer than wide, distinctly wider than head, widest in anterior third. Upper surface rather convex, faintly impressed along median line. Lateral margin in anterior two thirds moderately convex, in posterior third evenly sinuate to basal angles. Apex rathernarrow, slightly excised, anterior angles convex, moderately projecting. Base rather narrow, laterally markedly but not angulately excised, very oblique, basal angles fairly projecting, faintly denticulate. Lateral margin slightly raised, with distinct border line, at least in basal half with distinct marginal channel. Median line distinct, faintly impressed. Prebasal grooves deep. Anterior marginal seta very elongate, situated at anterior third of pronotum, posterior seta short, situated right on basal angle. Surface without microreticulation, highly glossy, with rather sparse, somewhat irregularly spaced, coarse puncturation. Diameter of punctures about as wide as distance between them. Pilosity fairly sparse, elongate, hirsute, irregularly inclined, rather erect.

Elytra: Moderately elongate, laterally evenly curved, widest slightly behind middle, upper surface moderately convex. Intervals slightly raised throughout. Humeri wide, rather projecting, rounded off. Apex wide, straight, transverse, not redressed to suture. Striae regularly marked by rows of punctures, puncturation moderately sparse, very coarse, regularly arranged to longitudinal rows. Fixed setae in third interval difficult to recognize within the coarse puncturation. Series of marginal pores extremely difficult to detect when setae broken, apparently consisting of 8 basal, 3 postmedian, 6 apical pores, and 1 pore at apex of 3rd stria. Setae very elongate. Surface without microreticulation, highly glossy. Pilosity rather sparse, elongate, hirsute, rather regular, inclined posteriorly, rather depressed.

Male genitalia: Genital ring very narrow, rather parallel-sided, apical plate large, quadrate, fairly asymmetric. Aedeagus elongate, with elongate, depressed, slightly asymmetric, markedly upturned apex. Lower surface basally straight, then convex. Internal sac in middle with a small, non-dentate sclerite. For parameres see fig. 13, both parameres rather short, with widely rounded apex.

Variation: Little variation noted.

Etymology: The name is a patronym of Dr. H. Burckhardt, collector of this and several additional species.

Collecting circumstances: Collected by sieving ground litter at median altitude.

Colasidia atra sp. n. (Figs 14, 35, 51, 67)

Type material: Holotype: ♂, Sarawak, Kampung Segu, 20 mi SW Kuching, R. Taylor, 4.6.68 (MHNG).

Diagnosis: Fairly large, rather convex species, immediately recognized by the deep black colour of surface, legs, and antennae, and by the fairly short and stout aedeagus with concave lower surface and short, wide, thick, slightly upturned apex.

Description:

Measurements: Length: 4.8 mm; width: 1.75 mm. Ratios. Lenght/width of head: 1.37; lenght orbit/eye: 2.10; length/width of pronotum: 1.09; width widest part/base of pronotum: 1.66; width pronotum/head: 1.25; length/width of elytra: 1.49; width elytra/pronotum: 1.86.

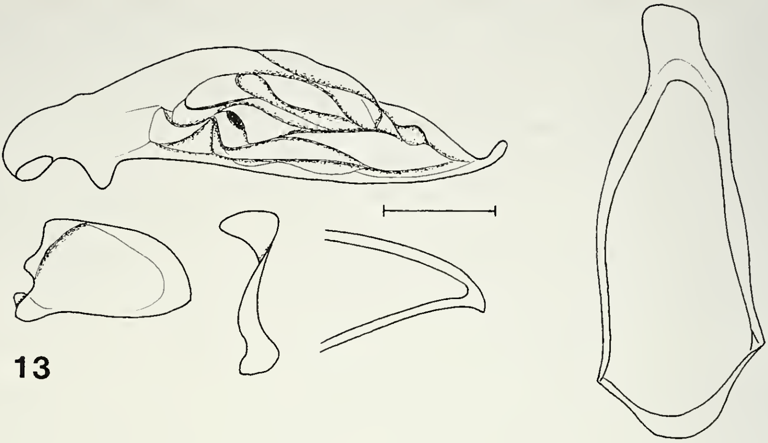


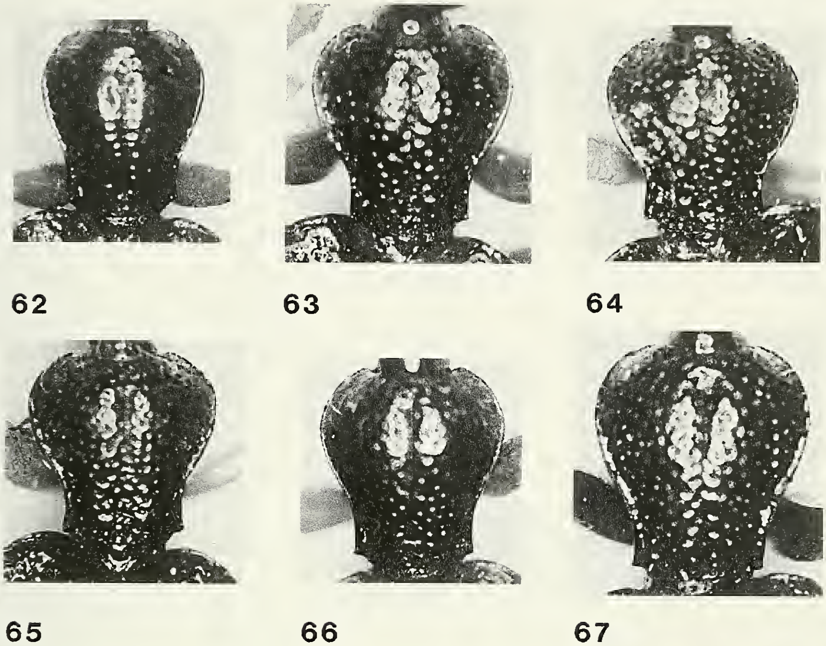
FIG. 13

Colasidia burckhardti sp. n. ♂ genitalia. For legend see fig. 1.

Colour: Deep glossy black. Antenna and legs black, labrum and palpi dirty brownish.

Head: Fairly large, moderately elongate, gently triangular, widest in basal third, orbits posteriorly rather narrowly rounded. Dorsal surface gently convex, frons not grooved. Eyes fairly large, barely projecting, length slightly <1/2 of orbit length. Clypeus anteriorly almost straight, lateral angles (above base of antenna) barely projecting. Clypeal suture laterally with shallow grooves. Labrum anteriorly rather excised, 6-setose, inner 4 setae considerably shorter than outer ones, lateral margin densely pilose. Mandibles short. Mentum with triangular, at apex faintly excised tooth. Labium truncate. Maxillary palpus moderately elongate, apex obtusely rounded. Terminal segment of labial palpus large and very elongate. Antenna fairly short, barely attaining anterior middle of pronotum. Median antennomeres c. 1.5 x as wide as long, 3rd antennomere c. 2/3 as long as 1st, c. 1.5 x as long as 2nd antennomere. Surface without microreticulation, highly glossy. Puncturation coarse, rather sparse, distance between punctures about as wide as diameter of punctures, in certain areas slightly wider. Pilosity rather sparse, elongate, erect, hirsute, inclined anteriorly. Both supra-orbital setae elongate, not well distinguished from pilosity, posterior supraorbital setae situated far behind eye.

Pronotum: Fairly wide, rather cordiform, anteriorly moderately wide, distinctly longer than wide, distinctly wider than head, widest in anterior third. Upper surface rather convex, faintly impressed along median line. Lateral margin in anterior two thirds convex, in posterior third evenly sinuate to basal angles. Apex rather wide, slightly excised, anterior angles convex, moderately projecting. Base rather narrow,



Figs 62-67

Prothorax. 62. *Colasidia borneensis* sp. n. 63. *C. gerardi* Perrault. 64. *C. mateui* sp. n. 65. *C. laticeps* sp. n. 66. *C. burckhardti* sp. n. 67. *C. atra* sp. n. All figures to scale.

laterally angulately excised, basal angles slightly projecting, faintly denticulate. Lateral margin slightly raised, with distinct border line, at least in basal half with distinct marginal channel. Median line distinct, fairly impressed. Prebasal grooves ratherdeep. Anterior marginal seta situated at anterior fourth of pronotum, posterior seta presumably situated right on basal angle, all setae broken. Surface without microreticulation, highly glossy, with rather sparse, somewhat irregularly spaced, coarse puncturation. Distance between punctures about as wide as diameter of punctures or slightly wider. Pilosity fairly sparse, elongate, hirsute, irregularly inclined, rather erect.

Elytra: Moderately elongate, laterally faintly curved, widest slightly behind middle, upper surface moderately convex. Intervals not raised. Humeri very wide, rather projecting, rounded off. Apex wide, straight, slightly oblique, slightly redressed to suture. Striae regularly marked by rows of punctures, puncturation moderately sparse, coarse, regularly arranged to longitudinal rows. Fixed setae in third interval not recognized within the coarse puncturation, because setae broken. Series of marginal pores extremely difficult to detect when setae broken, apparently consisting of 8 basal, 3 postmedian, 6 apical pores, and 1 pore at apex of 3rd stria. Setae very elongate. Surface without microreticulation, highly glossy. Pilosity rather sparse, elongate, hirsute, rather regular, inclined posteriorly, rather depressed.

Male genitalia: Genital ring rather wide, irregularly ovalish, basal part shallow, apical plate very small, fairly asymmetric. Aedeagus fairly short and stout, with short, wide, thick, slightly upturned apex. Lower surface regularly concave. Internal sac basally in middle with a horseshoe-shaped, strongly sclerotized bar, a large, coiled, markedly dentate sclerite in front of that, and further small sclerites behind, below, and in front of the large sclerites. For parameres see fig. 14, both parameres rather short, with roundly triangular apex.

Etymology: The name refers to the conspicuously black colour.

FIG. 14

Colasidia atra sp. n. ♂ genitalia. For legend see fig. 1.

APPENDIX

Because measurements and ratios are rather useful in species differentiation, the used ratios for the newly described *Colasidia* species are compiled in the following table. For the benefit of the user the table includes also the measurements of those species that were yet available for comparison (with exception of the following species: *Colasidia madang*, *C. malayica*, and *C. papua*).

TAB. 1

Measurements and ratios of species of genus *Colasidia*. L. Length (in mm). 1. Length/width of head. 2. Length orbit/eye. 3. Length/width of pronotum. 4. Widest diameter/width of base of pronotum. 5. Width pronotum/head. 6. Length/width of elytra. 7. Width elytra/pronotum.

Species	L	1	2	3
angusticollis	4.1	1.61	2.61	1.24
atra	4.8	1.37	2.10	1.09
attenuata	4.5	1.55	4.50	1.22
borneensis	3.95-4.3	1.30-1.31	2.32-2.45	1.10-1.15
brevicornis	3.95	1.51	2.73	1.14
burckhardti	4.2-4.45	1.30-1.36	2.05-2.08	1.10-1.14
convexior	4.2-4.3	1.34-1.36	3.84-3.93	1.03-1.06
denticollis	4.05-4.1	1.27-1.31	3.28-3.31	1.02-1.06
depressa	5.05-5.25	1.42-1.52	2.62-2.73	1.11-1.15
gerardi	4.4	1.23	2.67	1.04
globiceps	3.9-4.2	1.50-1.55	4.87-5.10	1.10-1.11
helvetorum	5.1-5.2	1.20-1.24	2.12-2.23	1.05-1.06
kokodae	4.5	1.42	2.24	1.12
lagadiga	5.0-5.15	1.56-1.62	4.62-4.85	1.23-1.27
laticeps	4.05-4.2	1.06-1.08	2.38-2.46	1.00-1.03
loebli	3.85	1.25	2.96	1.08
lustrans	4.9	1.42	3.92	1.14
macrops	4.4	1.33	1.53	1.02
mateui	4.1-4.5	1.18-1.20	2.12-2.14	1.00-1.01
monteithi	4.45	2.52	5.04	1.27
oviceps	5.7-5.75	1.40-1.42	2.20-2.25	1.09-1.11
pumila	3.7	1.17	2.85	0.94
riedeli	4.6	1.45	1.94	1.02
rougemonti	5.2	1.71	2.78	1.18
similis	4.9	1.31	2.35	1.04
taylori	4.8	1.42	2.48	1.01
triangularis	3.9	1.28	4.45	1.03

	4	5	6	7
angusticollis	1.61	1.19	1.52	1.82
atra	1.66	1.25	1.49	1.86
attenuata	1.48	1.14	1.44	1.98
borneensis	1.51-1.53	1.06-1.11	1.38-1.41	2.04-2.10
brevicornis	1.48	1.18	1.52	1.88
burckhardti	1.55-1.59	1.14-1.16	1.42-1.45	1.87-1.91
convexior	1.92-1.94	1.14-1.16	1.35-1.36	1.90-1.93
denticollis	1.33-1.34	1.10-1.15	1.33-1.35	1.79-1.93
depressa	1.38-1.46	1.19-1.30	1.43-1.46	1.87-1.89
gerardi	1.73	1.08	1.39	1.85
globiceps	1.55-1.59	1.08-1.11	1.41-1.46	2.03-2.10
helvetorum	1.76-1.79	1.11-1.15	1.39-1.42	1.89-1.92
kokodae	1.75	1.16	1.44	1.82
lagadiga	1.41-1.42	1.28-1.33	1.49-1.53	1.83-1.88
laticeps	1.53-1.62	0.93-0.95	1.32-1.35	1.96-2.02
loebli	1.52	1.12	1.35	1.95
lustrans	1.62	1.06	1.46	2.00

macrops	1.51	1.23	1.33	1.87
mateui	1.62-1.65	1.04-1.10	1.33-1.34	1.89-1.94
monteithi	1.31	1.21	1.63	1.76
oviceps	1.43-1.49	1.23	1.47-1.53	1.77-1.82
pumila	1.71	1.10	1.30	1.80
riedeli	1.48	1.38	1.42	1.75
rougemonti	1.44	1.26	1.42	1.94
similis	1.81	1.20	1.47	1.79
taylori	1.58	1.31	1.49	2.55
triangularis	1.47	1.14	1.41	1.85

ALPHABETIC CHECKLIST OF THE SPECIES OF THE GENUS *Colasidia*

Colasidia angusticollis Baehr, 1988	Sarawak (Borneo)
Colasidia atra sp. n.	Sarawak (Borneo)
Colasidia attenuata sp. n.	Malaysia
Colasidia borneensis sp. n.	Sabah (Borneo)
Colasidia brevicornis Baehr, 1988	Sarawak (Borneo)
Colasidia burckhardti sp. n.	Sabah (Borneo)
Colasidia convexior Baehr, 1993	Sumatra
Colasidia denticollis sp. n.	Sumatra
Colasidia depressa sp. n.	Malaysia
Colasidia gerardi Perrault, 1982	Sabah (Borneo)
Colasidia globiceps Baehr, 1991	Sumatra
Colasidia helvetorum sp. n.	Sumatra
Colasidia kokodae Baehr, 1991	Papua New Guinea
Colasidia lagadiga (Morvan, 1994)	Malaysia
Colasidia laticeps sp. n.	Sabah (Borneo)
Colasidia loebli sp. n.	Malaysia
Colasidia lustrans Baehr, 1991	Sumatra
Colasidia macrops Baehr, 1990	Sarawak (Borneo)
Colasidia madang Darlington, 1971	Papua New Guinea
Colasidia malayica Basilewsky, 1954	Malaysia
Colasidia mateui sp. n.	Sabah (Borneo)
Colasidia monteithi Baehr, 1987	Queensland (Australia)
Colasidia oviceps sp. n.	Malaysia
Colasidia papua Darlington, 1971	Papua New Guinea
Colasidia pumila Baehr, 1990	Sarawak (Borneo)
Colasidia riedeli Baehr, 1990	Sarawak (Borneo)
Colasidia rougemonti (Morvan, 1994)	Malaysia
Colasidia similis sp. n.	Sumatra
Colasidia taylori Baehr, 1988	Sarawak (Borneo)
Colasidia triangularis sp. n.	Malaysia

ACKNOWLEDGEMENTS

My heartily thanks are due to Dr. I. Löbl, Genève, for kindly submitting the bulk of the mentioned material, and to Dr. T. Deuve, Paris, Mr. E. Kirschenhofer, Vienna, and Mr. P. Morvan, Karentoir, for the kind loan of some types and specimens.

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REVUE SUISSE DE ZOOLOGIE 104 (3): 661-700; septembre 1997

Oribatids from Brunei II (Acari: Oribatida). (*Acarologica Genavensia* LXXXII)[1]

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Oribatids from Brunei II. (Acari: Oribatida). *(Acarologica Genavensia LXXXII).* - Twenty-four species are listed, fourteen are new to science. Three new genera are established, one in the family Hermanniellidae (*Bruneiella* gen. n.) and two in the family Haplozetidae (*Bolkiah* gen. n. and *Borneozetes* gen. n.). The following new combination is proposed: *Teraja tuberculata* (Mahunka) comb. n. = *Microzetes tuberculatus* Mahunka, 1987.

Key-words: Acari - Oribatida - Taxonomy - New species, new genera - Brunei.

INTRODUCTION

In the first part of this series dealing with the oribatids gathered in the Sultanate of Brunei, I described the collecting circumstances, and made reference to the final aim and motives of this work (MAHUNKA 1995). I also listed the basic literature and presented the fundamental principles of terminology used.

The material proved to be very rich and included several new taxa. Presently[2] I propose to discuss 24 species of which 14 are new. Three species also represent new genera belonging to two families: *Bruneiella* gen. n. (Hermanniellidae), *Bolkiah* gen. n. and *Borneozetes* gen. n. (Haplozetidae). The occurrence in Brunei of the following two species is also of particular interest: *Gehypochthonius xarifae* Strenzke, 1963 and *Epilohmannoides esulcatus* Ohkubo, 1979.

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[1] New title for the series "Neue und interessante Milben aus dem Genfer Museum I. - LX." and "New and interesting mites from the Geneva Museum LXI. - LXXX.".

[2] This research programme was partly sponsored by the Hungarian Scientific Research Fund (OTKA No. 16729).

Manuscript accepted 26.09.1996.

LIST OF LOCALITIES

Bru–88/21: Brunei (Belait District): "Andulau Forest Reserve", à 3,5 km au sud de Sungai Liang (= à 39,5 km de Labi), forêt primaire ("Mixed dipterocarp forest"), K–7 ("Kompartment 7"), prélèvement de sol dans les angles formés par les contreforts de grands arbres, 50 m; 19.XI.1988; leg. B. Hauser (B)[3]

Bru–88/29: Brunei (Belait District): Sungai Liang, "Arboretum Forest Reserve", forêt primaire ("Mixed dipterocarp forest"), prélèvement de sol dans les angles formés par les contreforts de deux arbres appelés "Nyatho", 90 m; 21.XI.1988; leg. B. Hauser (B)[3]

Bru–88/41: Brunei (Belait District): Sungai Liang, "Arboretum Forest Reserve", forêt primaire ("Mixed dipterocarp forest"), prélèvement de sol dans les angles formés par les contreforts d'arbres appelés "Kempas" (= *Koompassia malaccensis* Maing. & Benth. [Fabaceae]), 20 m; 25.XI.1988; leg. B. Hauser (B)[4]

Bru–88/46: Brunei (Belait District): "Andulau Forest Reserve", à 3,5 km au sud de Sungai Liang (= à 39,5 km de Labi), forêt primaire ("Mixed dipterocarp forest"), K–8 ("Kompartment 8"), prélèvement de sol dans les angles formés par les contreforts d'un grand arbre, 70 m; 26.XI.1988; leg. B. Hauser (B)[4]

ABBREVIATIONS USED

MHNG = Muséum d'histoire naturelle, Genève.

HNHM = Hungarian Natural History Museum, Budapest, with identification number of the specimens in the Collection of Arachnida.

LIST OF IDENTIFIED SPECIES

Eniochthoniidae Grandjean, 1947

Eniochthonius sumatranus (Mahunka, 1989)

Locality: Bru–88/41: 10 specimens.

Distribution: Sumatra (known from the type locality only) and the Comoro Islands (unpublished: Mwali (Moheli) Island: near Mriringoni village, 230–400 m; 30.VIII.1992; leg. T. Pócs); new record for Brunei.

Gehypochthoniidae Strenzke, 1963

Gehypochthonius xarifae Strenzke, 1963

Locality: Bru–88/41: 80 specimens.

Distribution: Known from the type locality only (Hitadu Island, Maldives Islands); new record for Brunei.

Parhypochthoniidae Grandjean, 1932

Parhypochthonius asiaticus sp. n.

Locality: Bru–88/41.

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[3] (B) = extraction par appareil Berlese à Bandar Seri Begawan (Brunei).

[4] (B)) extraction par appareil Berlese à Hong Kong.

Phthiracaridae Perty, 1841
Hoplophthiracarus (Plonaphacarus) aculeatus Mahunka, 1995
Locality: Bru–88/46: 1 specimen.
Distribution: Brunei, Sarawak.

Temburongiidae Mahunka, 1990
Temburongia patoi Mahunka, 1990
Localities: Bru–88/41: 16 specimens, Bru–88/46: 18 specimens.
Distribution: Brunei.

Epilohmanniidae Oudemans, 1923
Epilohmannia nortoni sp. n.
Localities: Bru–88/29; Bru–88/41; Bru–88/46.
Epilohmannoides esulcatus Ohkubo, 1979
Localities: Bru–88/29: 4 specimens; Bru–88/41: 10 specimens;
Bru–88/46: 1 specimen.
Distribution: Japan, Sarawak; new record for Brunei.

Lohmanniidae Berlese, 1916
Papillacarus lienhardi sp. n.
Locality: Bru–88/29.

Hermanniellidae Grandjean, 1934
Bruneiella sultan gen. n., sp. n.
Localities. Bru–88/41; Bru–88/46.

Microtegeidae Balogh, 1961
Microtegeus sabahnus Mahunka, 1987
Localities: Bru–88/21: 3 specimens; Bru–88/41: 2 specimens.
Distribution: Well distributed in Borneo; new record for Brunei.
Suctotegeus tumescitus Mahunka, 1987
Locality: Bru–88/41: 1 specimen.
Distribution: Known from some localities in Sabah;
new record for Brunei.

Microzetidae Grandjean, 1936
Anakingia borneensis sp. n.
Locality: Bru–88/41.
Teraja sungai sp. n.
Localities: Bru–88/41; Bru–88/46.
Teraja wongi Mahunka, 1994
Locality: Bru–88/29: 1 specimen.
Distribution: Second record for Brunei
(known from the type locality only).

Carabodidae C.L. Koch, 1837

Congocepheus orientalis Mahunka, 1987

Locality: Bru–88/41: 16 specimens.

Distribution: Sumatra (known from the type locality only); new record for Brunei.

Hardybodes flabellatus Mahunka, 1994

Locality: Bru–88/41: 17 specimens.

Distribution: Brunei (known from the type locality only).

Otocepheidae Balogh, 1961

Dolicheremaeus andulauensis sp. n.

Localities: Bru–88/41; Bru–88/46.

Dolicheremaeus furcillatus sp. n.

Localities: Bru–88/21; Bru–88/46.

Dolicheremaeus wallacei sp. n.

Localities: Bru–88/29; Bru–88/46.

Otocepheus durian sp. n.

Locality: Bru–88/46.

Dampfiellidae Balogh, 1961

Dampfiella zellwegeri sp. n.

Localities: Bru–88/21; Bru–88/46.

Rhynchoribatidae Balogh, 1961

Suctoribates foliatus sp. n.

Localities: Bru–88/29; Bru–88/41.

Haplozetidae Grandjean, 1936

Bolkiah hauseri gen. n., sp. n.

Localities: Bru–88/41; Bru–88/46.

Borneozetes lanceolatus gen. n., sp. n.

Locality: Bru–88/29.

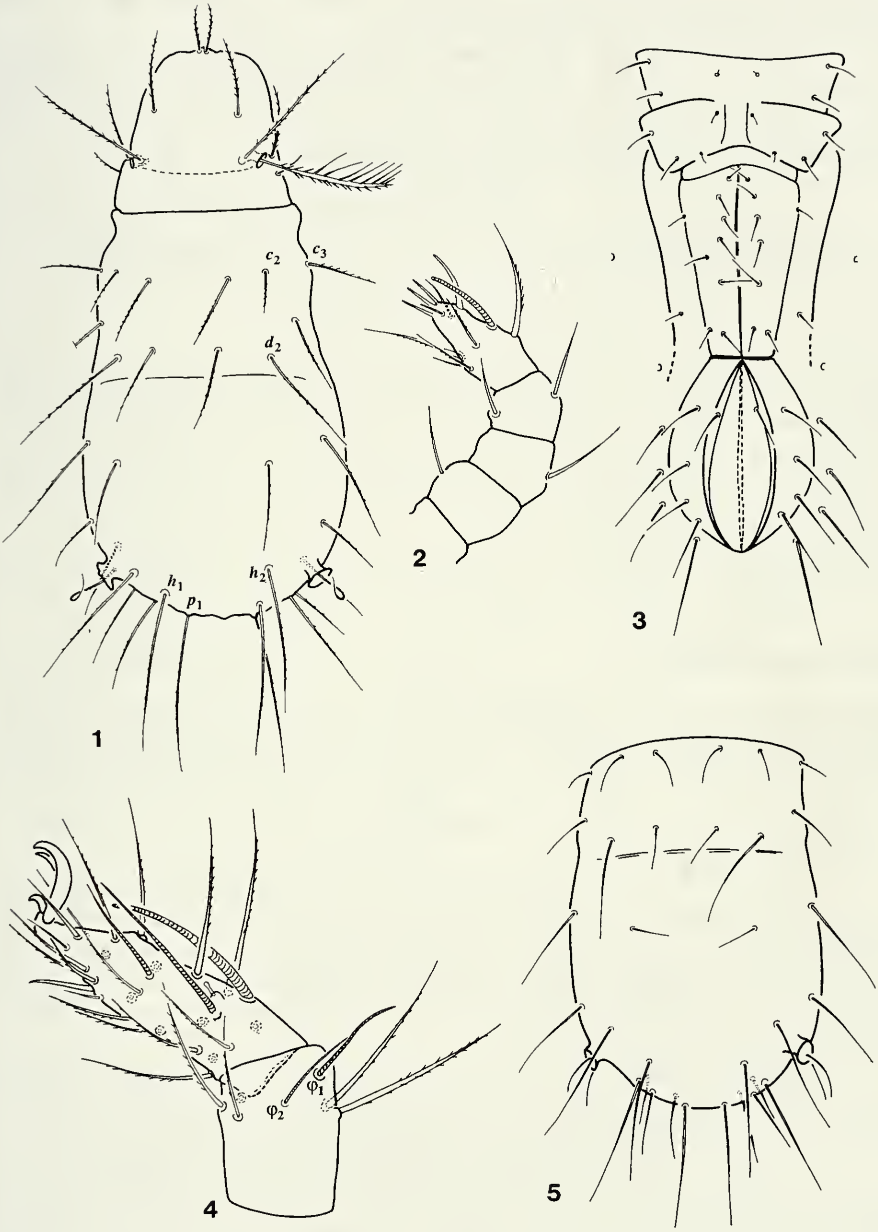
DESCRIPTIONS AND DISCUSSIONS

Parhypochthonius asiaticus sp. n. (Figs 1–4)

Material examined: Holotype: Bru–88/41, 10 paratypes from the same sample. Holotype and 6 paratypes: MHNG, 3 paratypes (1449–PO–1993): HNHM, 1 paratype: in Dr. R.A. Norton's private collection (Syracuse University, NY, USA).

Measurements. - Length of body: 305–369 µm, width of body: 147–178 µm.

Prodorsum: Rostral apex hardly protruding from the anterior margin of prodorsum, rounded. Rostral setae arising on it, very near to each other. These and the



Figs 1–5

Parhypochthonius asiaticus sp. n. — 1: body from dorsal aspect, 2: palp, 3: anogenital region, 4: tibia and tarsus of leg I. *Parhypochthonius aphidinus* Berlese, 1904 — 5: notogaster.

other four pairs of prodorsal setae conspicuously pilose. Sensillus with 8–9 long branches and numerous short spicules or barbs.

Notogaster: Its form similar to that of the other species of this genus. All notogastral setae (Fig. 1) unambiguously pilose, seta c_3 long, much longer than seta c_2. All setae in the median and posterior part of notogaster long, seta d_2 only slightly shorter than h_2. Setae p_1 and h_1 the longest of all.

Gnathosoma (Fig. 2): Palpal setal formula: 1 – 1 – 2 – 11+1.

Ventral regions: Epimeral setal formula: 3 – 1 – 3 – 4. All setae fine and short. Anogenital setal formula: 9 – 1 – 1 – 4 – 5. All setae simple, setiform.

Legs: All legs "tridactylous", empodium much smaller than lateral claws. The chaetotaxy of tibia and tarsus of leg I as shown in Fig. 4.

Remarks: I had the opportunity to compare three species of the genus *Parhypochthonius* Berlese, 1904 (*P. aphidinus* Berlese, 1904, *P. pilosus* Mahunka, 1991 and the above described new species), and I consider that they differ clearly from each other by the length and ratio of setae (e.g. c_3) and the pilosity of setae (smooth in *P. aphidinus*, see Fig. 5, pilose in the new species and in *P. pilosus*). See also my remarks on *P. pilosus* (MAHUNKA 1991).

Derivatio nominis: This genus was hitherto known only from the palaearctic and nearctic Regions.

Epilohmannia nortoni sp. n. (Figs 6–11, 13)

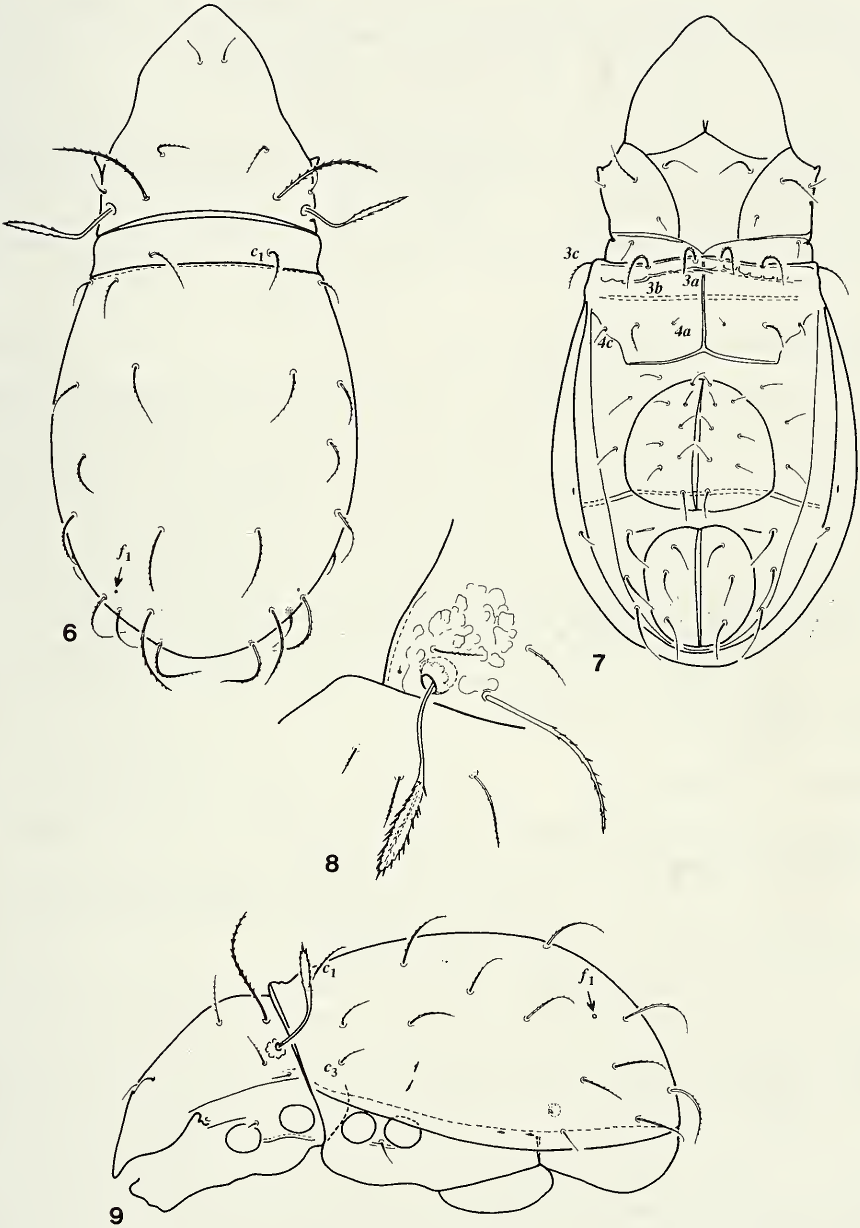
Material examined: Holotype: Bru–88/41, 8 Paratypes: from the same sample; 9 paratypes: Bru–88/46; 4 paratypes: Bru–88/29. Holotype and 12 paratypes: MHNG, 8 paratypes (1450–PO–1993): HNHM, 1 paratype in Dr. R.A. Norton's private collection (Syracuse University, NY, USA).

Measurements. – Length of body: 329–354 µm, width of body: 147–167 µm.

Prodorsum: Rostrum gradually narrowing anteriorly, beak-shaped in lateral aspect. Prodorsal surface with a fine sculptural pattern in front of the trichobothrium (Fig. 8) having two acute teeth and a ridge laterally. Among the prodorsal setae only the interlamellar ones strong and long, all the others, especially the posterior exobothridial setae, much shorter and thinner than the preceding ones. Sensillus normal, with cylindrical head.

Notogaster: Fourteen pairs of notogastral setae present. Setae x_2 smooth, all others pilose. Setae h_1 and p_1 much longer than setae c_1. A pair of alveoli (setae f_1), four pairs of lyrifissures and the glandular opening observable (Fig. 9).

Ventral regions (Fig. 7): Mentum not separated. Epimeres I widely separated from each other. All other epimeres normally developed. On the surface of epimeres *3a* characteristic, strongly sclerotized transversal ridge observable. Epimeral setal formula: 3 – 1 – 3 – 3, among the length and thickness of the setae great differences exist: setae *1a*, *2a*, *4a*, *4c* much thinner and shorter than setae *3a*, *2b*. Genital plates wide, each plate bears 8 setae, 5 of them medially, 3 laterally. Three pairs of anal and three pairs of adanal setae present.



Figs 6–9

Epilohmannia nortoni sp. n. — 6: body from dorsal aspect, 7: body from ventral aspect, 8: sensillus and the bothridial region, 9: body from lateral aspect.

Legs: Tarsus IV bears only one strongly thickened seta (a''). Setae v'' of tibia spathulate, characteristically pilose. Legs setal formulae:

I: 1 – 5 – 4+2 – 5+2 – 17+3 – 1 (Figs 10, 13)
IV: 2 – 3 – 4+1 – 4+1– 9 – 1 (Fig. 11)

Remarks: The new species is well characterised by the dilated setae on tibia IV and the unique dilated, spiniform seta on tarsus IV. This combination of features was hitherto unknown in this genus.

Derivatio nominis: I dedicate the new species to my friend Dr. Roy A. Norton (Syracuse, USA) for his help in my work.

Epilohmannoides esulcatus Ohkubo, 1979 (Fig. 12)

The genus was not recorded for a long time after JACOT's original description (1936) of *Epilohmannoides terrae*. Almost at the same time an excellent redescription of the type species (NORTON *et al.* 1978) was published, along with the descriptions of new and very closely related species (OHKUBO 1979, HAMMER 1981). The latter two authors were only partly aware of the others' publications, therefore, some confusion arose. It appears that JACOT's species is different from each of the others by the longer and thinner spiniform setae of tarsus IV, but the two other species (*Epilohmannoides esulcatus* Ohkubo, 1979 and *E. wallworki* Hammer, 1981) might be separated only on the basis of a very insignificant difference (the form of a'' setae of tarsus IV).

The specimens from Brunei correspond exactly to OHKUBO's description, the shape of tarsus IV is given in Fig. 12.

Papillacarus lienhardi sp. n. (Figs 14–17)

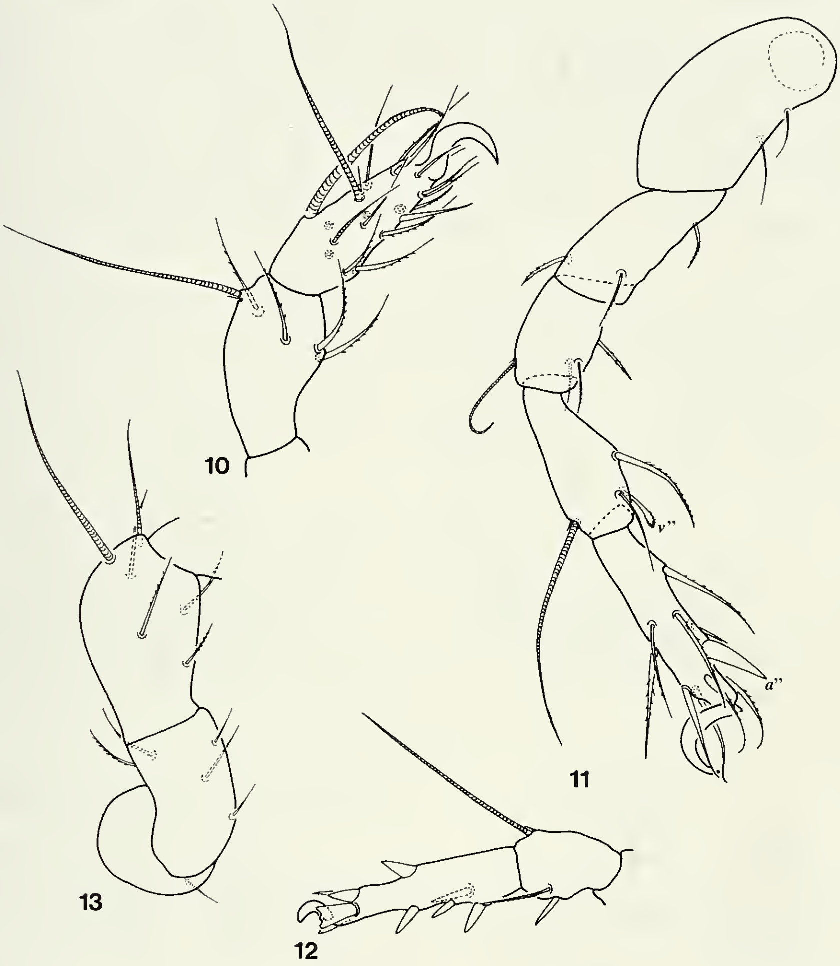
Material examined: Holotype: Bru–88/29, 32 paratypes: from the same sample. Holotype and 20 paratypes: MHNG, 12 paratypes (1451–PO–1992): HNHM.

Measurements. – Length of body: 404 µm, width of body: 202 µm.

Integument: Cuticle generally punctate, with large porose areas (?) everywhere (on the body and also on the legs' surface).

Prodorsum: Rostrum rounded with waved margin. Transverse band *(Sib)* distinct, gradually arched anteriorly. Prodorsal setae long, with conspicuously ciliate margins, setae *exa* and *ro* shorter than the others, setae *in* and *exp* the longest of all (Fig. 14). Sensillus slightly dilated medially, with 8–10 pectinate branches and some small spicules.

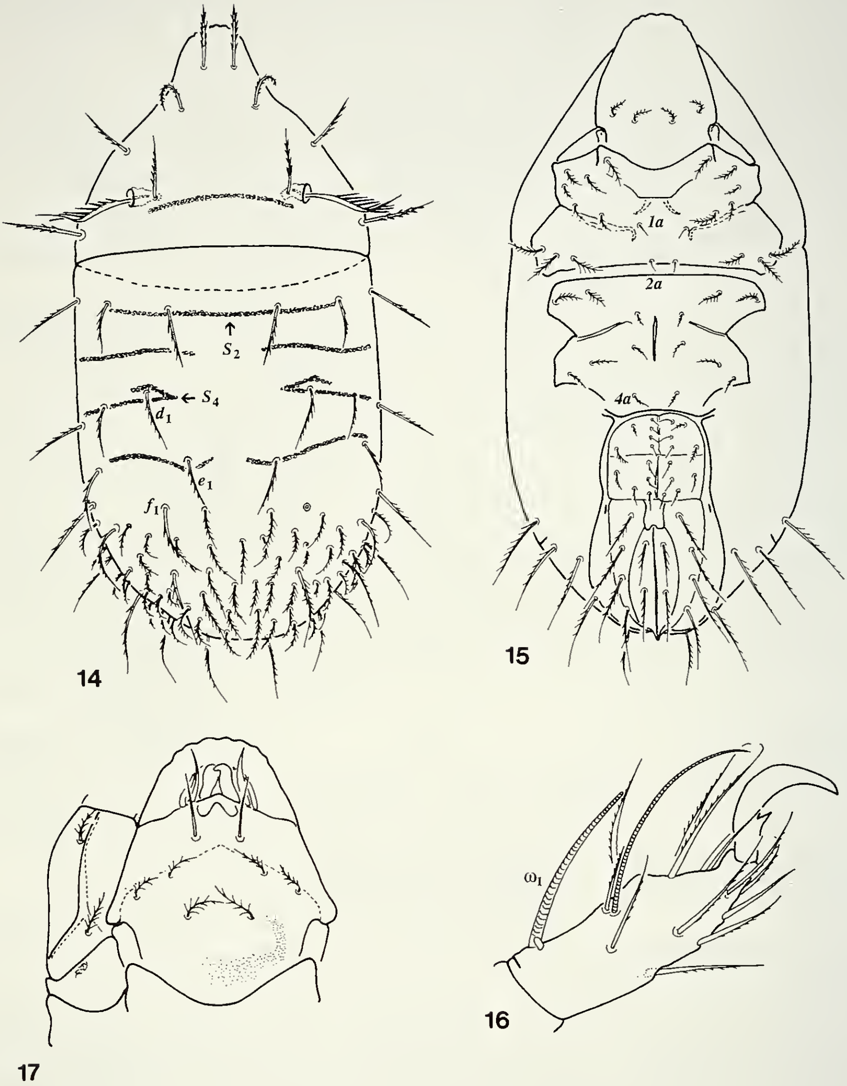
Notogaster: Four pairs of transversal bands observable, but only one of them (Si_2) complete. Band Si_4 embraces the insertion of seta d_1. On the posterior half of the notogaster (behind setae f_1 and f_2) strong neotrichy present, but the normal setae (*h* and *p*) are well distinguishable. Among setae *c* and *d* no essential difference present, setae c_1 longer than c_2, all equally ciliated. Setae d_1 and e_1 also ciliate (Fig. 14). Approximately 50 neotrichial setae present on the posterior part of the notogaster, all shorter than the normal setae, but their cilia generally longer than those of normal setae.



Figs 10–13

Epilohmannia nortoni sp. n. – 10: tibia and tarsus of leg I, 11: leg IV, 13: trochanter, femur and genu of leg I. *Epilohmannoides esulcatus* Ohkubo, 1979 – 12: tibia and tarsus of leg IV.

Ventral regions: Setae of mentum, excepting seta *a*, short and well ciliate (Fig. 17). Epimeral setal formula: 6(7) – 4 – 3 – 4, all setae short, mostly with long cilia. Setae *1a*, *2a, 3a* and *4a* with shorter cilia than the others. Genital plates divided, their setation slightly variable (5 + 6). All setae ciliate, but differences exist in cilia lengths. Preanal plate narrow, like that of the other species of this genus. Anal and adanal setae setiform, with long and strong cilia (Fig. 15).



FIGS 14–17

Papillacarus lienhardi sp. n. – 14: body from dorsal aspect, 15: body from ventral aspect, 16: tarsus of leg I, 17: mentum.

Legs: All femora have well developed ventral crests. Solenidium ω_1 of tarsus I (Fig. 16) without basal thickening.

Remarks: *Papillacarus lienhardi* sp. n. has the strongest neotrichy among the so far described species of this genus. It is also distinguished from all its related species by the comparatively long and conspicuously ciliate seta c_1, which is longer than seta c_2.

Derivatio nominis: I dedicate the new species to Dr. C. Lienhard (Geneva Museum) for his continuing help in my studies at Geneva.

Bruneiella gen. n.

Diagnosis: Family Hermanniellidae. Whole body surface covered by polygonate (body) or simple (legs) cerotegument layer. Sensillus long, interlamellar seta dilated, fusiform, arising on small tubercles at the end of a longitudinal lath. Tritonymphal scalp bearing 10 pairs of large, fusiform, split and finely ciliate, and 4 pairs of small but also fusiform setae, the latter ones in posteromarginal position (Fig. 21). Epimeral setal formula: 3 – 1 – 2 – 3. Anogenital setal formula: 7 – 1 – 2 – 3. Aggenital setae located between the genital and anal opening. Legs monodactylous, with normal (leg I) or reduced (leg III and IV) chaetom.

Type species: *Bruneiella sultan* sp. n.

Remarks: On the basis of the number and size of the notogastral setae and of the presence of a pair of interlamellar crests or sclerotized plates the new genus stands nearest to *Dicastribates* Balogh & Balogh, 1988.[5] However, it differs from the latter by the modified (phylliform) interlamellar setae (simple, bacilliform in *Dicastribates*) and by the form of the interlamellar structure.

Derivatio nominis: After the Sultanate of Brunei. The name Borneo for the entire island derivates from the name Brunei.

Bruneiella sultan sp. n. (Figs 18–24)

Material examined: Holotype: Bru–88/46, 24 paratypes: from the same sample; 25 paratypes: Bru–88/41. Holotype and 29 paratypes: MHNG, 20 paratypes (1452–PO–1992): HNHM.

Measurements. – Length of body: 314–360 µm, width of body 176–219 µm.

Integument: Thick cerotegument layer covering the whole surface. Under it a polygonate (prodorsum, notogaster, coxisternal region and the ventral plate) or foveolate (mentum, genital and anal plates) sculpture observable. The surface of the legs smooth.

Prodorsum: Rostrum rounded, without incision. Bothridial cups well protruding, located near to each other. Between them a pair of longitudinal crests visible, interlamellar setae arising on their end (Fig. 18). Rostral and lamellar setae arising on small tubercles and ensiform. Interlamellar setae fusiform, split, exobothridial setae (*ex*) very small, but dilated (Fig. 20).

Notogaster: Its setae dilated (see generic diagnosis; Fig. 22).

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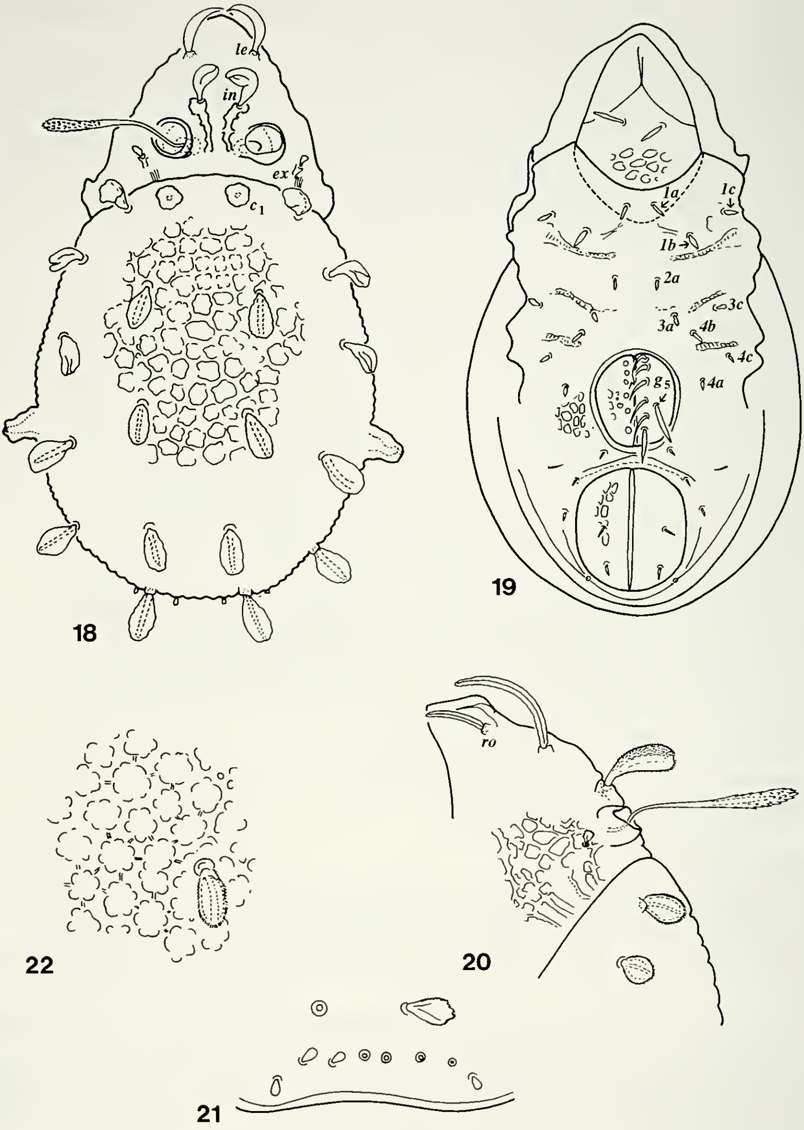
[5] I wish to express my sincere thanks to Dr. M. Luxton also here, for this suggestion and for giving me access to his unpublished key which allows to separate these two taxa.



Figs 18–22

Bruneiella sultan gen. n., sp. n. – 18: body from dorsal aspect, 19: body from ventral aspect, 20: prodorsum from lateral aspect, 21: position of the posteromarginal setae, 22: sculpture of the notogaster.

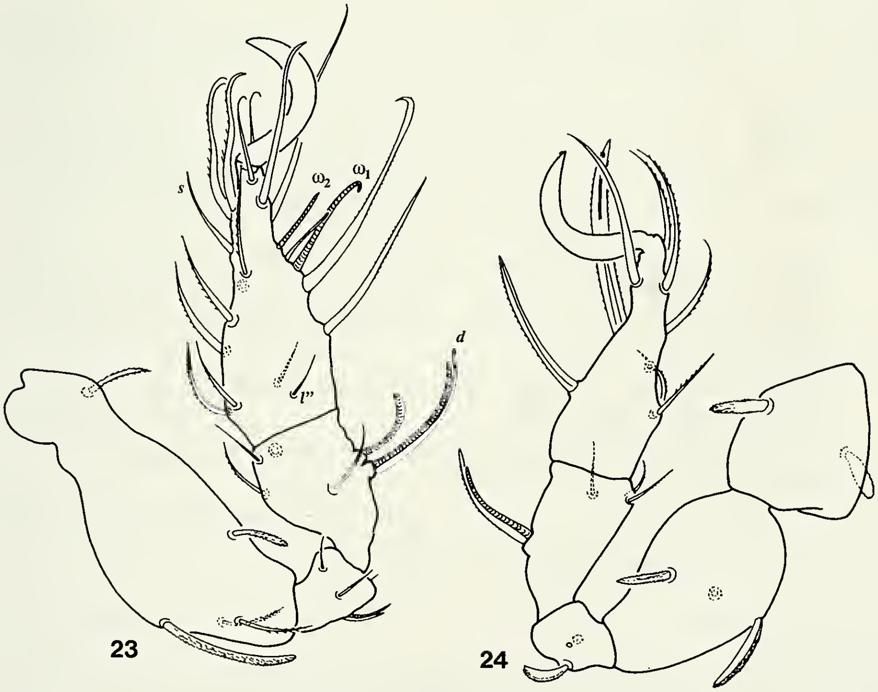
Coxisternal region: The apodemes (Fig. 19) hardly observable under the cerotegument layer. They seem similar to those of *Sacculobates* (as illustrated by GRANDJEAN 1962, Fig. 2). All epimeral setae simple, spiniform, their position normal.

Anogenital region: Genital and anal opening well framed, between them an arched transversal lath, setae ad_3 arising on its two lateral ends. Genital setae arranged in longitudinal rows, only g_5 located farther from the inner margin of the genital plates than the others. Aggenital setae arising clearly behind the genital opening.

Legs: Solenidium ω_1 of tarsus I bent characteristically inwards, ε very long, not shorter than ω_2. Only seta *s* is eupathidial. Both setae *l* conspicuously short. Seta *d* on tibia I and both solenidia arising on a flat tubercle, the seta longer than the solenidium.

I: 0 – 5 – 4+1 – 5+2 – 18+2 – 1 (Fig. 23)
III: 2 – 2 – 3+1 – 4+1 – 9 – 1
IV: 1 – 2 – 1 – 3 – 4+1– 9 – 1 (Fig. 24)

Derivatio nominis: After the more than 600 years old Islamic monarchy (first ruler Sultan Muhammad Shah, reign: 1361–1402) of Brunei.



FIGS 23–24

Bruneiella sultan gen. n., sp. n. – 23: leg I, 24: leg IV.

Anakingia borneensis sp. n. (Figs 25–27)

Material examined: Holotype: Bru–88/41, 1 paratype from the same sample. Holotype: MHNG, paratype (1453–PO–1993): HNHM.

Measurements. – Length of body: 176–187 µm, width of body: 113–121 µm.

Prodorsum: Rostrum obtuse, with one pair of small teeth laterally, not covered by the strongly converging lamellae (Fig. 25). Lamellar cusps gradually narrowed, without sharply pointed distal end. Rostral and lamellar setae minute, interlamellar setae arising in interlamellar position, also very short. Sensillus slightly dilate, directed obliquely forwards, with short cilia on its outer margin.

Notogaster: Pteromorpha very small, observable only from lateral aspect (Fig. 27). Notogastral surface ornamented by polygonal sculpture, with a large unpaired lenticulus medially and a pair of hollows laterally. All notogastral setae minute but well visible. No difference between them.

Lateral part of podosoma: Tutorium short, with short, wide cusps.

Ventral regions (Fig. 26): Mentum longitudinally striated. Coxisternal region large, twice as long as the anogenital region. Transversal apodemes wide and strong, sternal apodeme absent between *ap. 2* and *ap. sej.* A weak polygonal reticulation also observable in this region. Epimeral setae minute. Ventral plate mostly with longitudinal wrinkles. Genital and anal plates normal, with minute setae. Anogenital setal formula: 6 – 1 – 2 – 2. Lyrifissures *iad* in adanal position.

Remarks: Both heretofore known species of this genus were described from South America. There is no doubt that the new species belongs to this taxon, but is well distinguished from the South American species by the following key:

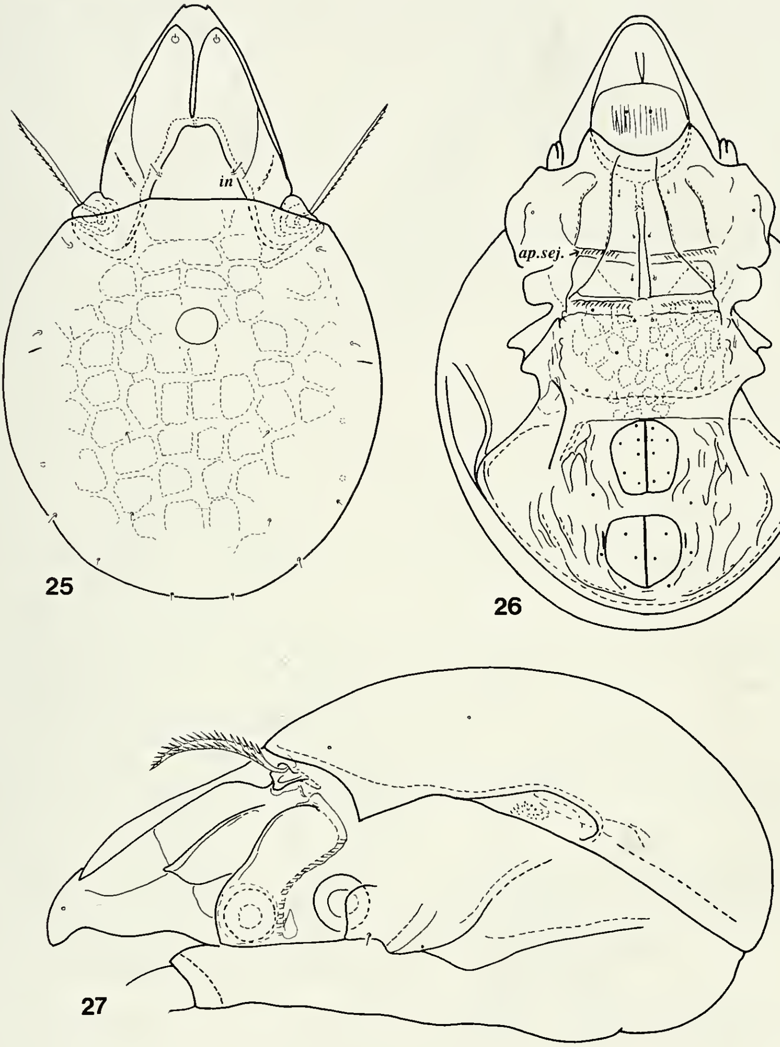
1 The notogastral sculpture consists of very small cells, they are much smaller than the diameter of the bothrydium . . . . *A. williamsae* Hammer, 1961
– The notogastral sculpture consists of large cells, they are greater than the bothrydium.
2 Whole notogastral surface ornamented by polygonal sculpture, consisting of nearly identical cells . . . . *A. borneensis* sp. n.
– Posterior part of notogaster ornamented by elongated areas, anterior part by short ones, which are nearly as wide as long . . . . *A. reticulata* Balogh & Mahunka, 1969

Derivatio nominis: After the island of Borneo.

Teraja sungai sp. n. (Figs 28–32)

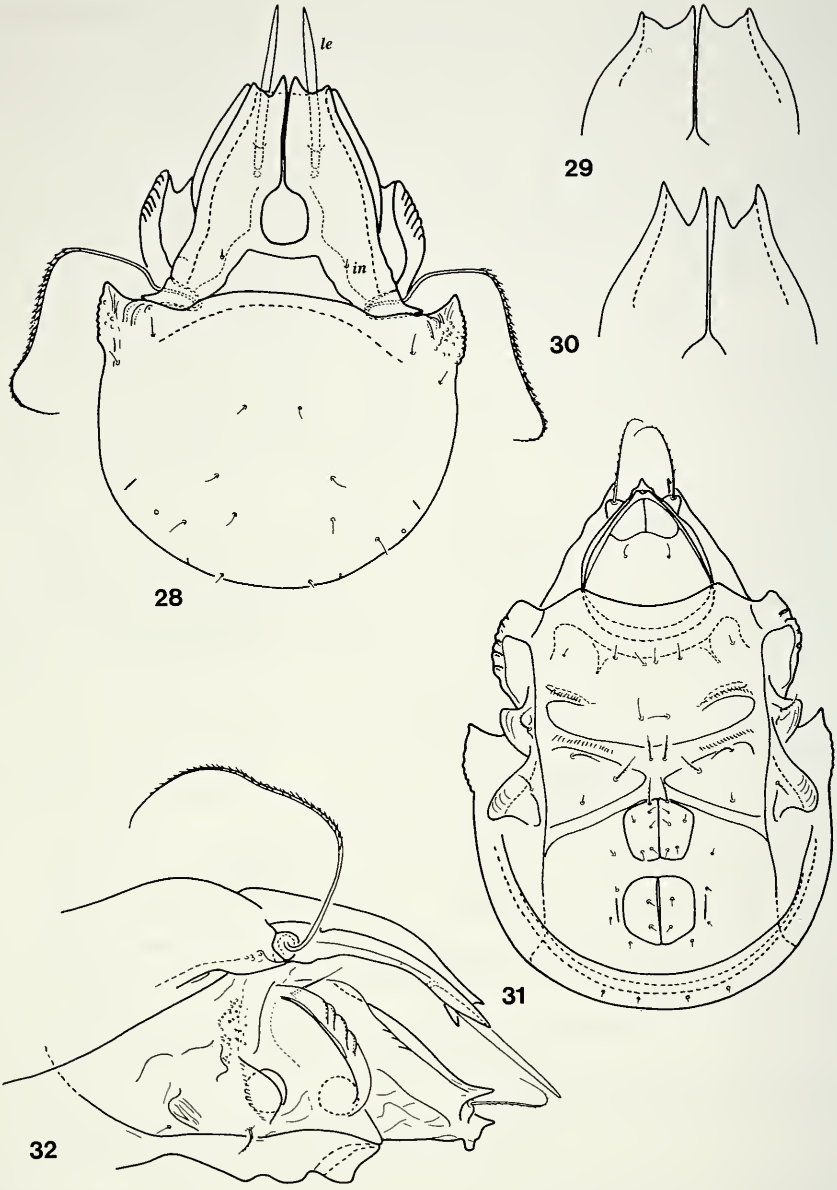
Material examined: Holotype: Bru–88/46, 4 paratypes: from the same sample; 4 paratypes: Bru–88/41; 1 paratype: Bru–88/29. Holotype and 6 paratypes: MHNG, 3 paratypes (1454–PO–1993): HNHM.

Measurements. – Length of body: 189–203 µm, width of body: 131–145 µm.



Figs 25–27

Anakingia borneensis sp. n. – 25: body from dorsal aspect, 26: body from ventral aspect, 27: body from lateral aspect.



FIGS 28–32

Tereja sungai sp. n. – 28: body from dorsal aspect, 29–30: varieties of lamellar cusps, 31: body from ventral aspect, 32: podosoma from lateral aspect.

Integument: Some weak cerotegument granules visible in the shoulder region and in posterolateral position, some stronger ones in the lateral part of podosoma, behind the sejugal apodeme. Cuticle mostly smooth, but some conspicuous granules visible on the pteromorphae, also some wrinkles present on pedotecta 1.

Prodorsum: Rostrum elongated, its apex sharply pointed, characteristically convex in dorsal aspect behind the apex. Lamellae wide, touching medially, excavated basally and connected with each other by a transversal band. Both lamellar cusps present, no essential difference between them, the anterior lamellar border between the two cusps varying (Figs 29–30). Rostral setae long, curved distally, finely ciliate. Lamellar setae (*le*) spiniform, arising from the basal surface. Interlamellar setae (*in*) minute, located on the dorsal surface of the lamellae. Sensillus very long, reclinate, with strong spines on its outer margin arranged in two longitudinal rows.

Lateral region of podosoma: Pedotecta 1 large, with well separated anterior margins. Tutorium with sharply pointed apex, rostral seta arising near to the apex on a large tubercle (Fig. 32). Circumpedal carina well developed, connected with the discidial carina and reaching to pedotecta 1.

Notogaster: The form of pteromorphae characteristic for the genus, nearly triangular, with some large tubercles and wrinkles (Fig. 28). The outline of the body is characteristically impressed in posterolateral position. Nine pairs of fine and short notogastral setae present.

Ventral regions: Coxisternal region with a very strong transversal "X-shaped" band (Fig. 31), the other apodemes and borders very weakly developed. Setae of this region short, finely ciliate, no essential difference between them. Anogenital region normal, anogenital setal formula: 6 – 1 – 2 – 3.

Remarks: The genus *Teraja* was established and discussed by the present author (MAHUNKA 1995). There is no doubt that the new species belongs to this genus, in spite of the fact that its tutorial apex is simple.

On the basis of the main features (habitus, form of the rostrum, lamellae, pteromorphae and especially the sensillus) *Microzetes tuberculatus* Mahunka, 1987 is closely related to it and consequently has to be transferred to the genus *Teraja*: *Teraja tuberculata* (Mahunka, 1987) **comb. n.**

The four species can be identified by the following key:

1 Outer lamellar apices much longer than the inner ones and bent inwards. Distal apex of the tutorium divided.

– Outer lamellar apices very long, touching each other medially. Distal apex of the tutorium mostly serrate . . . . *T. wongi* Mahunka, 1995

2 Outer lamellar apices shorter, ending far from each other. Distal apex of the tutorium with long appendages . . . . *T. fimbriata* (Mahunka, 1988)

– Lamellar apices nearly equal in length, their form triangular.

3 Lamellar setae very thick, resembling a bean-pod, bent inwards; not longer than the diameter of the lamella . . . . . . *T. tuberculata* (Mahunka, 1987)

– Lamellar setae spiniform, straight; much longer than the diameter of the lamella . . . . *T. sungai* sp. n.

Derivatio nominis: After Sungai Liang, the locality of the "Arboretum" of Brunei.

Dolicheremaeus andulauensis sp. n. (Figs 33–38)

Material examined: Holotype: Bru–88/46. 16 paratypes: from the same sample; 8 paratypes: Bru–88/41. Holotype and 15 paratypes: MHNG, 9 paratypes (1455–PO–1993): HNHM.

Measurements. – Length of body: 330–446 µm, width of body: 165–248 µm.

Integument: Cerotegument very thin, being present in very small granules. Integument finely punctate, in the sejugal region pustulate.

Prodorsum: Rostrum rounded. Lamellae narrow, convergent anteriorly, reaching over the insertion of the lamellar setae. Their basal part characteristically bifurcate (Fig. 34) and the two branches delimiting an elliptical field. Lateral lamelliform expansion short, arched, not reaching to the insertion of rostral setae (Fig. 38). Median and lateral prodorsal condyles well developed, separate. Rostral and lamellar setae setiform, more acute than the interlamellar ones. Sensillus long, slightly dilated distally, finely roughened.

Notogaster: Median notogastral condyles semicircular, lateral ones larger. On the lateral margin of notogaster, following the lateral condyles some large protuberances observable (Fig. 33). Ten pairs of acute notogastral setae present, setae c_2 much shorter than the others. Among the four setae in posteromarginal position seta h_3 much shorter than the others. Lyrifissures *ih* and *ips* located before seta h_3.

Coxisternal region: Seta *1c* arising on a small tubercle. Setae *4b* and *4c* originating near to each other, behind them is a short curved crest (Fig. 35).

Anogenital region: All setae simple, setiform. Lyrifissures *iad* located far from the anal opening in inverse apoanal position (Fig. 35).

Legs: Solenidium φ_2 on tibia I stands conspicuously far from φ_1 (Fig. 37). All femora and genua have conspicuously large basal blades (Fig. 36), these ventrodistal scales also very large on genu IV.

Remarks: The new species is well characterised by the basally branched lamellae and the very large ventrodorsal scales on femur and genu of leg III and IV. On this basis the new species is well distinguishable from all heretofore known taxa.

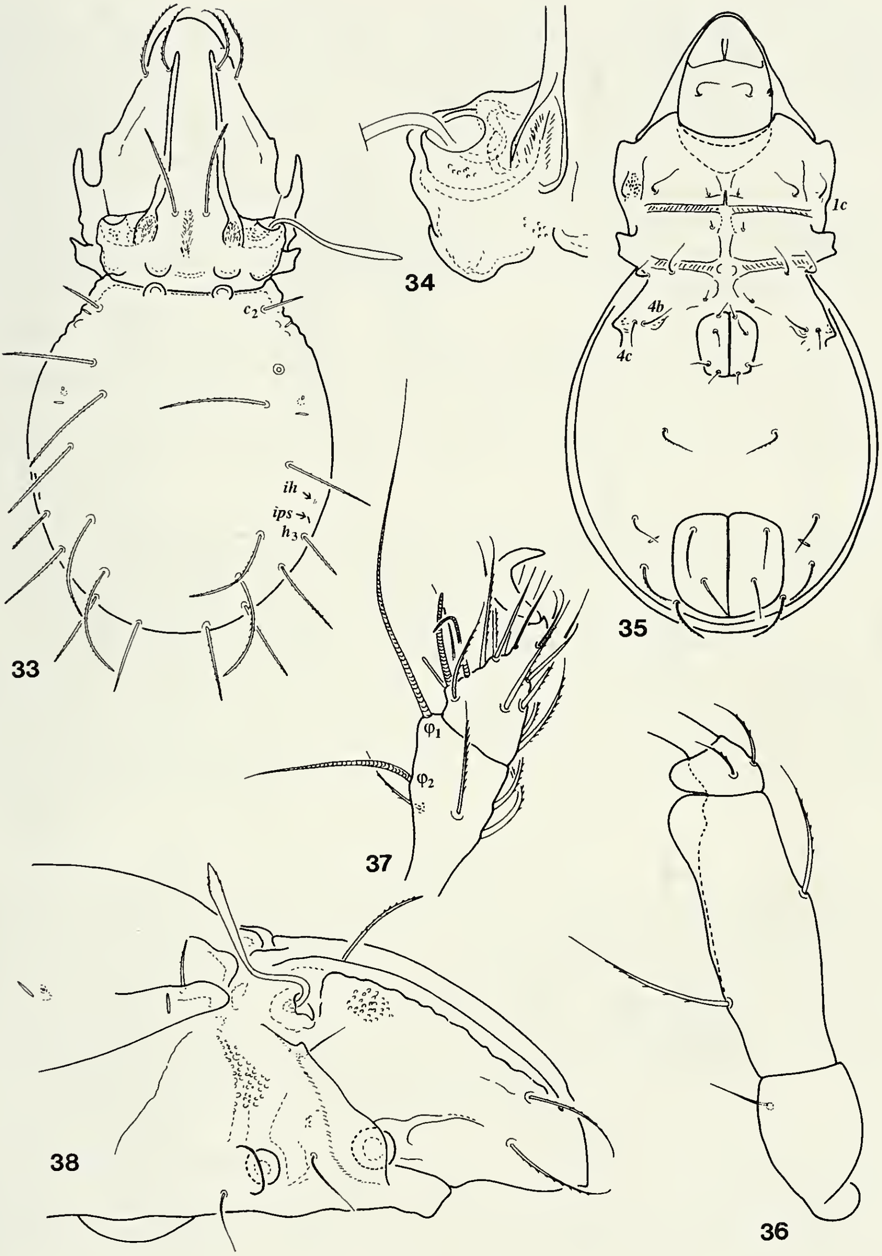
Derivatio nominis: After the "Andulau Forest Reserve".

Dolicheremaeus furcillatus sp. n. (Figs 39–43)

Material examined: Holotype: Bru–88/46; 1 paratype: from the same sample; 1 paratype: Bru–88/21. Holotype and 1 paratype: MHNG, 1 paratype (1456–PO–1993): HNHM.

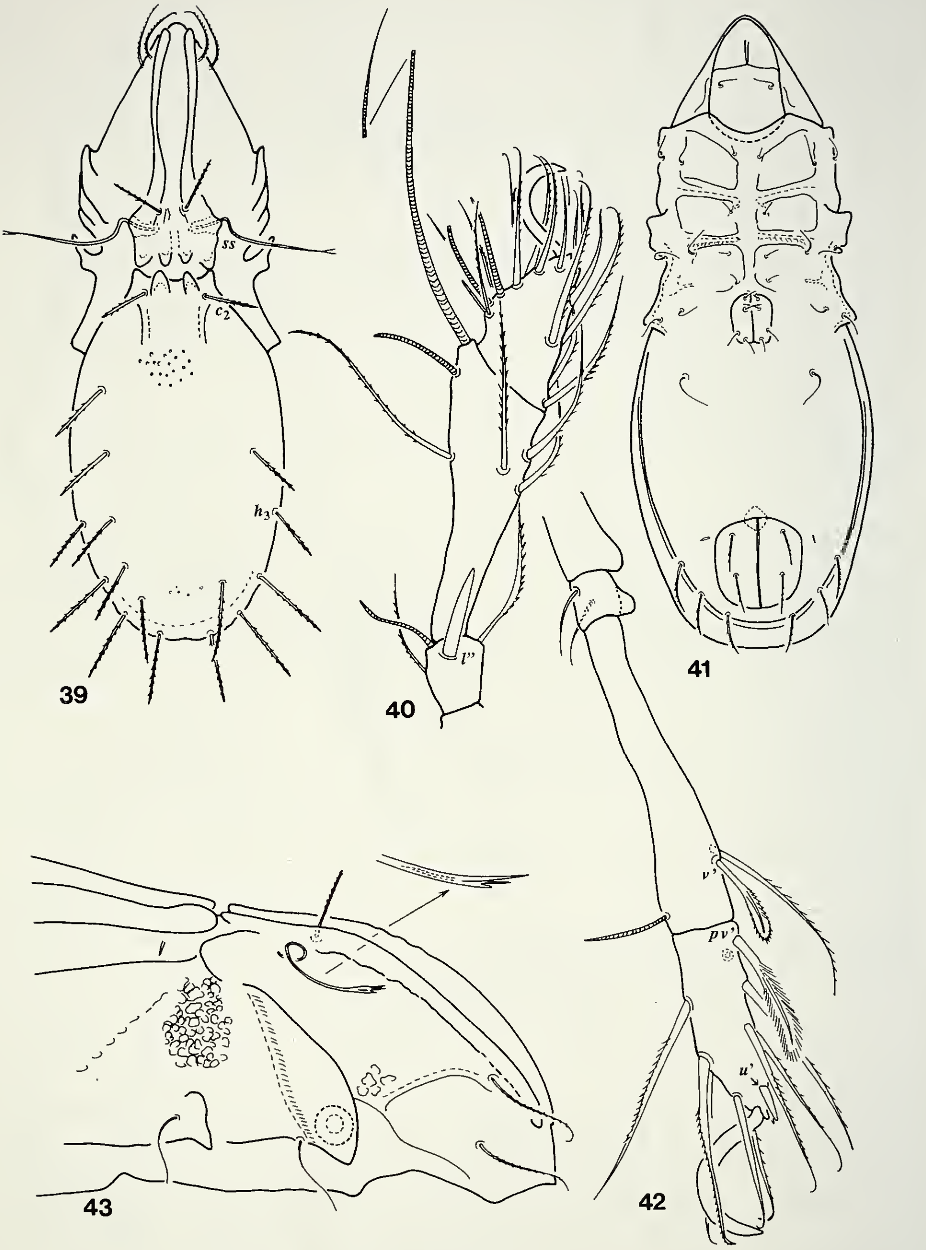
Measurements. – Length of body: 792–1172 µm, width of body: 289–388 µm. A striking difference exists between male and female.

Integument: Cerotegument not observable. Cuticle glittering, colour very dark brown. Surface of prodorsum smooth, but notogastral surface well foveolate. Sejugal region with characteristic polygonal sculpture, the small polygonate fields protruding like pustules.



Figs 33–38

Dolicheremaeus andulauensis sp. n. – 33: body from dorsal aspect, 34: bothridium and the basal end of the lamella, 35: body from ventral aspect, 36: trochanter, genus and tibia of leg IV, 37: tibia and tarsus of leg I, 38: podosoma from lateral aspect.



FIGS 39–43

Dolicheremaeus furcillatus sp. n. – 39: body from dorsal aspect, 40: genu, tibia and tarsus of leg I, 41: body from ventral aspect, 42: leg I, 43: podosoma from lateral aspect.

Prodorsum: Lamellae very long, reaching nearly to the rounded apex of rostrum (Fig. 39). Lamellae arched medially, running comparatively near to each other. Very large and well developed prodorsal condyles present. Rostral and lamellar setae setiform, distinctly barbed, interlamellar ones clearly blunter at tip and rarely pilose. Sensillus (*ss*) very long, nearly setiform, with two or three small and short branches at its distal end (Fig. 43). Exobothridial setae minute.

Notogaster: Narrow, median part slightly convex, a well framed marginal part observable, separated from the median part by a channel around the notogaster. Its posterior outline slightly undulate in dorsal aspect. Ten pairs of rigid, acute notogastral setae present, all finely ciliate. Setae c_2 and h_3 shorter than the others.

Lateral part of podosoma: Lateral lamelliform expansion arched anteriorly, directed toward lamellar setae. Pedotecta I conspicuously large.

Coxisternal region: Both the apodeme and the border conspicuous. Apodeme 2 and the sejugal apodeme straight, the epimeral fields well framed (Fig. 41), quadrangular.

Anogenital region: Genital and anal aperture located very far from each other. The distance between the aggenital setae also great. Anal and adanal setae equal in length. All three pairs of adanal setae inserted along the posterior half of anal aperture. Lyrifissures *iad* in apoanal position.

Legs: Femora of legs I and II with sharply pointed blade-like formation anteriorly. These crests on femora III and IV rounded. All solenidia — excepting the tarsal ones — characteristically acute, never ending in a filiform part. Seta *l*" of genu thick, short, spiniform, setae *v*' of tibia and *pv*" of tarsus IV, phylliform, their margin distinctly ciliate (Fig. 42). Type of the ultimate setae (*u*): L–S–S–S. Legs setal formulae are:

I: 1 – 4 – 3+1– 4+2 –16+2 –1
IV: 1 – 2 – 2 – 2+1 – 12 – 1

Remarks: On the basis of the habitus, the form of lamellae and apodemes the new species belongs to one of the genera of the subfamily Otocepheinae. However, on the basis of main characters (shape of pedotecta 2–3) it must be placed in the genus *Dolicheremaeus*, Jacot, 1928 of the subfamily Tetracondylinae Aoki, 1967. Some features (the position of lyrifissures *iad*, the distance of aggenital setae, the thickened *l*" seta on genua I and II) distinguish the new species from all congeners.

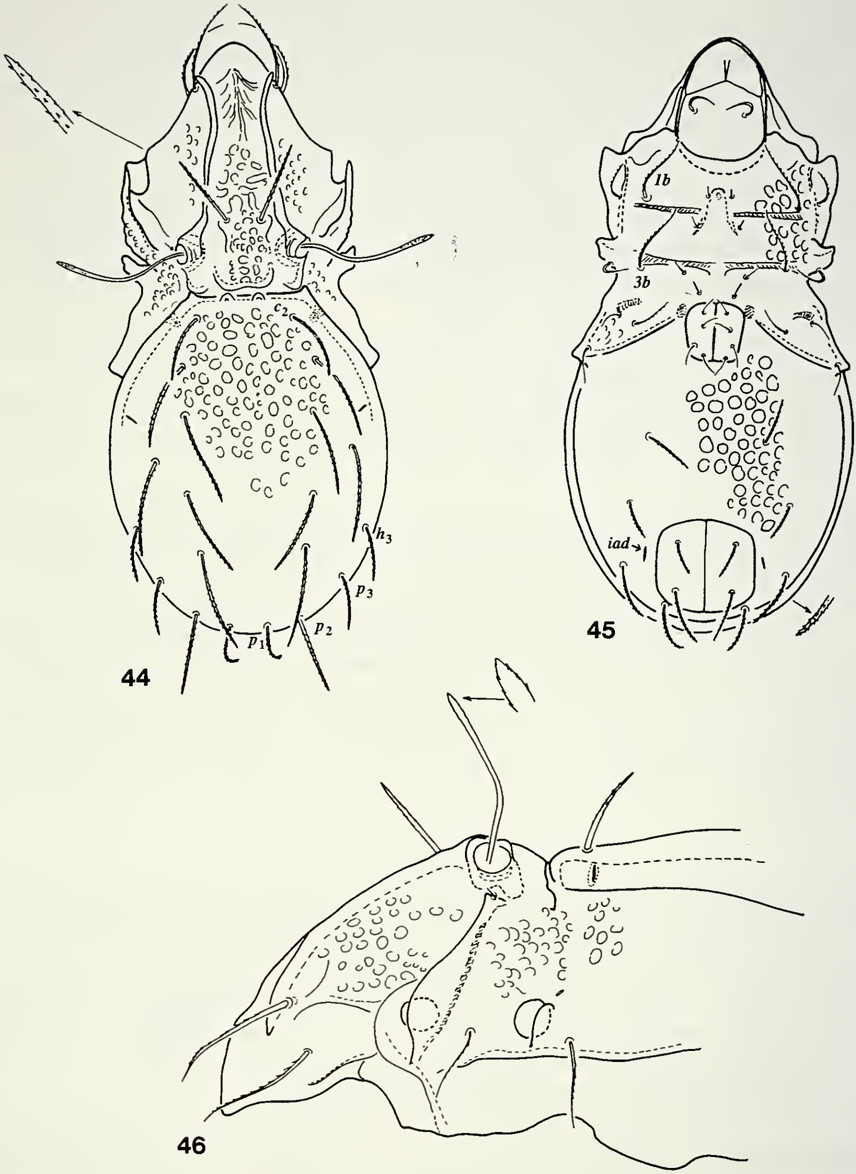
Derivatio nominis: After the form of the sensillus.

Dolicheremaeus wallacei sp. n. (Figs 44–48)

Material examined: Holotype: Bru–88/29, 5 paratypes: from the same sample; 12 paratypes: Bru–88/46. Holotype and 11 paratypes: MHNG, 6 paratypes (1457–PO–1993): HNHM.

Measurements. – Length of body: 420–462 (male), 512–594 (female) μm, width of body: 214–306 μm.

Integument: Very thin cerotegument layer observable, covered with small granules. The cuticle – excepting some smaller areas (exobothridial region,

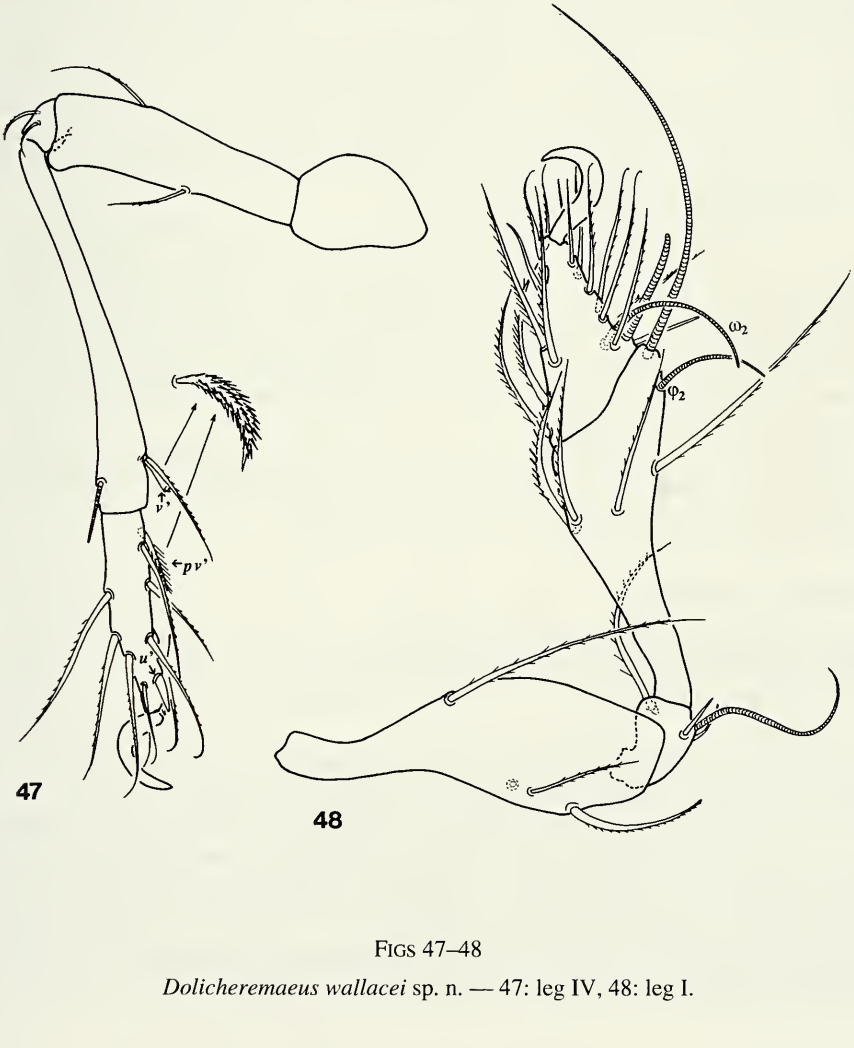


FIGS 44–46

Dolicheremaeus wallacei sp. n. – 44: body from dorsal aspect, 45: body from ventral aspect, 46: podosoma from lateral aspect.

genital plate, legs) – is areolate. Exobothridial region pustulate, genital plates smooth as is the surface of the legs.

Prodorsum: Rostrum widely rounded. Lamellae comparatively narrow, undulate medially and divergent distally, between them a strong crest is formed anteriorly (Fig. 44). Lamellar cuspis observable. Interlamellar region mostly alveolate, but around the insertion of the interlamellar setae a longitudinal crest observable. Tutorium absent, but the "lateral lamelliform expansion" present. This latter arched anteriorly and not reaching to the rostral seta (Fig. 46). Median prodorsal condyles fused, lateral ones normal. Rostral and lamellar setae setiform, interlamellar setae blunt at tip. Peduncle of the sensillus very long, with small, scarcely dilated, cylindrical head. Its surface finely roughened.



FIGS 47–48

Dolicheremaeus wallacei sp. n. — 47: leg IV, 48: leg I.

Notogaster: Median and lateral condyles conspicuous, median ones sometimes partially fused. Inner pair rounded, the lateral ones triangular. Ten pairs of notogastral setae present, all blunt at tip and finely roughened. Seta c_2 shorter than *da*, the others — excepting the posteromarginal ones — nearly equal in length. Setae p_1, p_3 and h_3 much shorter than p_2.

Lateral region of podosoma: Pedotecta 1 long, their dorsal margin sharply pointed, the minute exobothridial setae arising at the basis of pedotecta. Pedotecta 2–3 triangular, shape typical for the genus.

Coxisternal region: Apodeme 2 and *ap. sej.* straight, well developed, ap_3 represented only by its short basal part. Between ap_2 an elongated hollow present. Coxisternal region bordered posteriorly by a sharp tectum or minitectum ending medially near the genital aperture, at the tubercular aggenital thickening (apodeme). Epimeral setal formula: 3 – 1 – 3 – 3. Among them setae *1b*, *3b* very long, directed forwards, seta *4b* also longer than the other epimeral setae.

Anogenital region: Anogenital setal formula: 4 – 1 – 2 – 3. The anterior genital seta located far from the margin of the genital plate. Genital setae simple, aggenital, anal and adanal setae thicker, longer and ciliate, adanal setae blunt at tip, similar to those of notogaster. Lyrifissures *iad* in adanal position, slightly far from the margin of the anal aperture (Fig. 45).

Legs: Type of the ultimate (*u*) setae: L–S–S–S. Solenidia ω_2 and φ_2 conspicuously long, directed and arched backwards (Fig. 48). Seta *v′* on trochanter IV absent. Seta *v″* on tibia IV and seta *pv″* on tarsus IV dilated, distinctly pilose (Fig. 47).

Remarks: The new species is well characterised by the following: sharp protruding crest between the lamellae, very long sensillus, minute spindle-shaped head, peculiar sculpture of the body, very great difference among the posteromarginal setae and the absence of seta *v′* on trochanter IV.

Derivatio nominis: I dedicate this new species to the great naturalist Alfred Russel Wallace (28.I.1823 – 6.XI.1913), author of "The Malay Archipelago" (1869) and pioneer of the zoological exploration of South-East Asia.

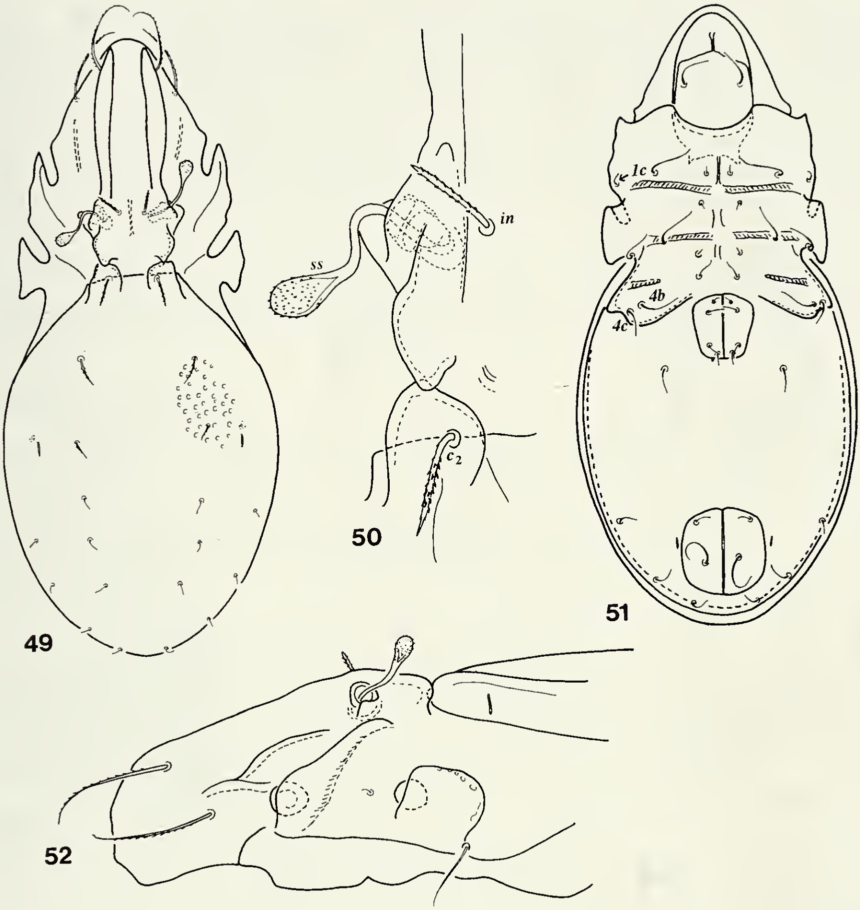
Otocepheus durian sp. n. (Figs 49–55)

Material examined: Holotype: Bru–88/46, 5 paratypes: from the same sample. Holotype and 3 paratypes: MHNG, 2 paratypes (1458–PO–1993): HNHM.

Measurements. – Length of body: 602–676 μm, width of body: 222–281 μm.

Integument: Finely granulated cerotegument layer observable everywhere, excepting the surface of the legs. Cuticle sparsely foveolate.

Prodorsum: Rostrum widely rounded. Lamellae broad, running to rostrum, approximately parallel (Fig. 49). One pair of large, lateral prodorsal condyles present, angulate. Tutorium weakly developed, but observable; lateral lamelliform expansion not extending to the insertion of rostral seta (Fig. 52). Rostral and lamellar setae normal, setiform, interlamellar one bacilliform, spatulate. Sensillus short, with a comparatively large, round head, its surface finely spiculate (Fig. 50).



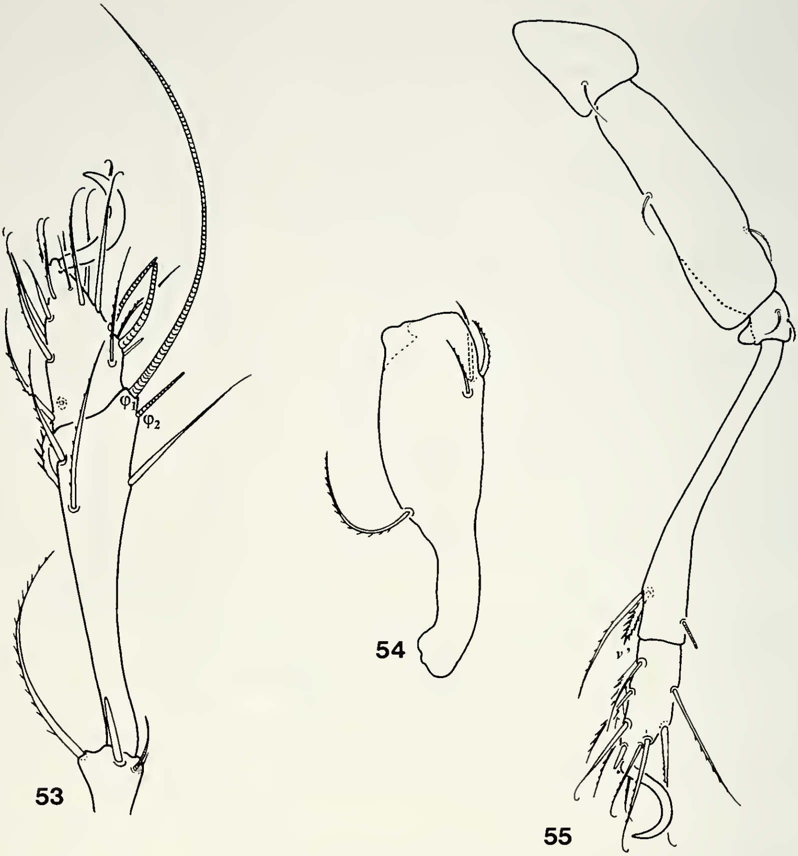
FIGS 49–52

Otocepheus durian sp. n. – 49: body from dorsal aspect, 50: trichobothrium and the lateral prodorsal and notogastral condyles, 51: body from ventral aspect, 52: podosoma from ventral aspect.

Notogaster: One pair of large lateral condyles present opposite to the prodorsal ones. The position of notogastral setae characteristic, they — excepting the posteromarginal ones — arising in two parallel longitudinal rows (Fig. 49). Their length and ciliation decreasing posteriorly, setae p and h_3 equal in length.

Lateral part of podosoma: Pedotecta 1 large, pedotecta 2–3 typical fish-tail-shaped, also large (Fig. 52). Discidium normal.

Coxisternal region: Apodeme and the epimeral borders normal, a short sternal apodeme also observable in the front of *ap. 2*. A well developed pos-



Figs 53–55

Otocepheus durian sp. n. — 53: tibia and tarsus of leg I, 54: femur of leg I, 55: leg IV.

terior border (minitectum) running from the discidium to the anterior margin of the genital opening (Fig. 51). Among the epimeral setae great differences exist in their length, setae *1a*, *1c* (!), *2a*, and *3a* short and simple, the others long and directed inwards. Setae *4b* and *4c* located laterally, near the discidium.

Anogenital region: Genital and anal plates without sculpture. Aggenital setae arising conspicuously far from each other, genital and aggenital setae simple. All setae short – excepting an_1 –, adanal setae not longer than notogastral ones. Lyrifissures *iad* located in adanal position.

Legs: All femora have weakly developed blades ventrally, observable also on genu IV (Figs 54–55). Solenidium φ_2 located near to φ_1 (Fig. 53). Seta *l'* on genu I fine and short, seta *l"* large, spiniform. Seta *v"* of tibia IV, and *pv"* on tarsus, dilated, well ciliate. Type of the ultimate setae: L–S–S–S. Setal formula of legs normal.

Remarks: There is no doubt that this new species belongs to the genus *Otocepheus* Berlese, 1905. It is readily distinguished from all other related species by the characteristic form of its notogastral setae and the great difference existing between setae an_1 and an_2.

Derivatio nominis: After the Durian (*Durio zibethinus* Murray), a delicious tree fruit (Bombacaceae) of an exquisite and unsurpassed flavour, considered by A.R. Russel as the "king of the fruits".

Dampfiella zellwegeri sp. n. (Figs 56–61)

Material examined: Holotype: Bru–88/46; 1 paratype: Bru–88/21; 1 paratype: Bru–88/29. Holotype and 1 paratype: MHNG, 1 paratype (1459–PO–1993): HNHM.

Measurements. – Length of body: 400–512 µm, width of body: 115–142 µm. Great difference observable between male and female.

Integument: Cuticle, excepting the surface of all femora, smooth, the latter well foveolate.

Prodorsum: Dorsal surface concave medially in lateral aspect (Fig. 61). Rostrum rounded. Some irregular spots are present on the usual sites. Rostral and lamellar setae normal, ciliate, interlamellar one very short, but also ciliate. Exobothridial seta (*ex*) minute. Sensillus conspicuously long, directed backwards and outwards, with a large, asymmetrical, spiculate head.

Lateral region of podosoma: Pedotecta 1 large, dorsal margin undulate. Bothridium slightly elongated posteriorly.

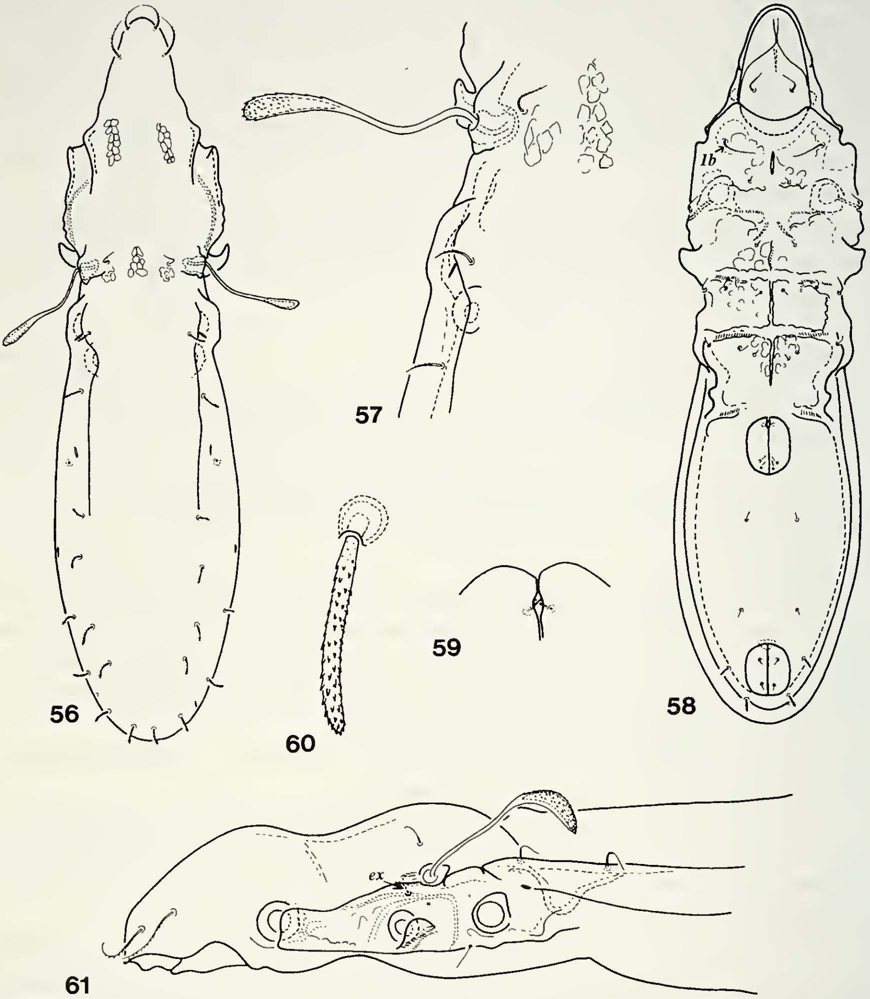
Notogaster: Shoulder normal, from here a fine crest runs posteriorly and reaches to the insertion of seta *lm*. This crest is not connected with the border of the notogastral cavity which is relatively small (Fig. 56). Ten pairs of short, bacilliform notogastral setae (Fig. 60) present, no essential difference between them.

Ventral regions (Fig. 58): Very similar to that of other *Dampfiella* species from the Oriental Region. All coxisternal setae simple, seta *1b* the longest of all. Setae *1c* and *4c* sometimes reduced. Their position is given in Fig. 58. Anogenital setal formula: 3 – 1 – 2 – 3. The anterior genital setae arising on the inner margin of the genital plates (Fig. 59). Aggenital, anal and ad_3 setae minute, the other adanal ones bacilliform, like the notogastral setae.

Legs: Solenidia ω_1 and ω_2 normal, nearly equal in length. δ of genu characteristically curved anteriorly. Legs setal formulae are:

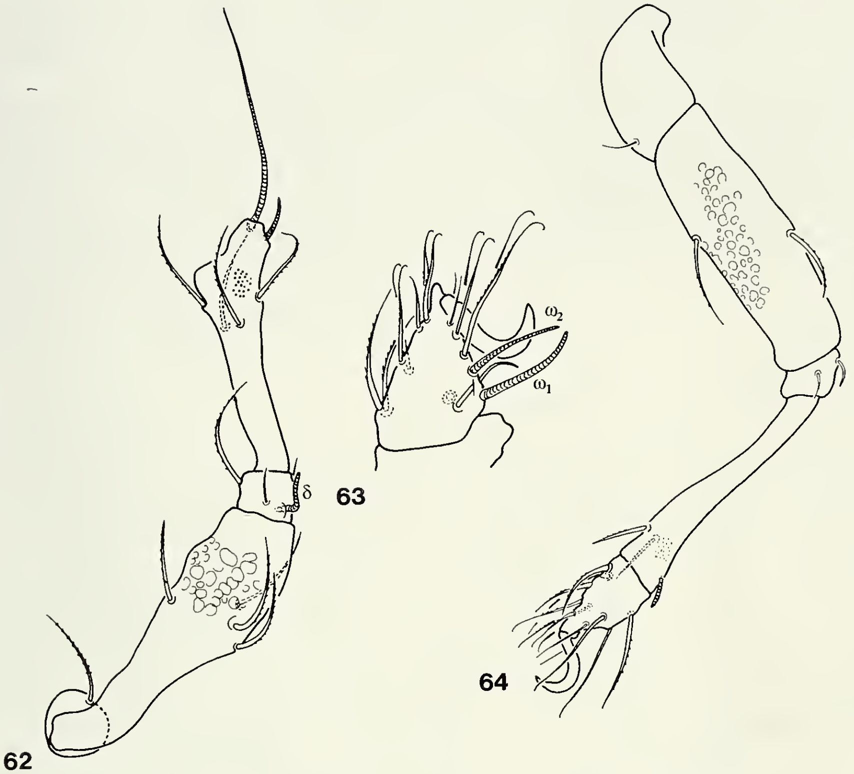
I: 1 – 4 – 3+1 – 4+2 – 16+2 – 1 (Fig. 62–63)
IV: 1 – 2 – 2 – 2+1 – 12 – 1 (Fig. 64)

Remarks: The new species is well characterised by the bacilliform and finely spiculate notogastral setae and the form of the sensillar capitulum. The heretofore known



Figs 56–61

Dampfiella zellwegeri sp. n. – 56: body from dorsal aspect, 57: trichobothrium and the anterolateral part of notogaster, 58: body from ventral aspect, 59: anterior part of genital plates, 60: seta p2, 61: podosoma from lateral aspect.



Figs 62–64

Dampfiella zellwegeri sp. n. — 62, 63: leg I, 64: leg IV.

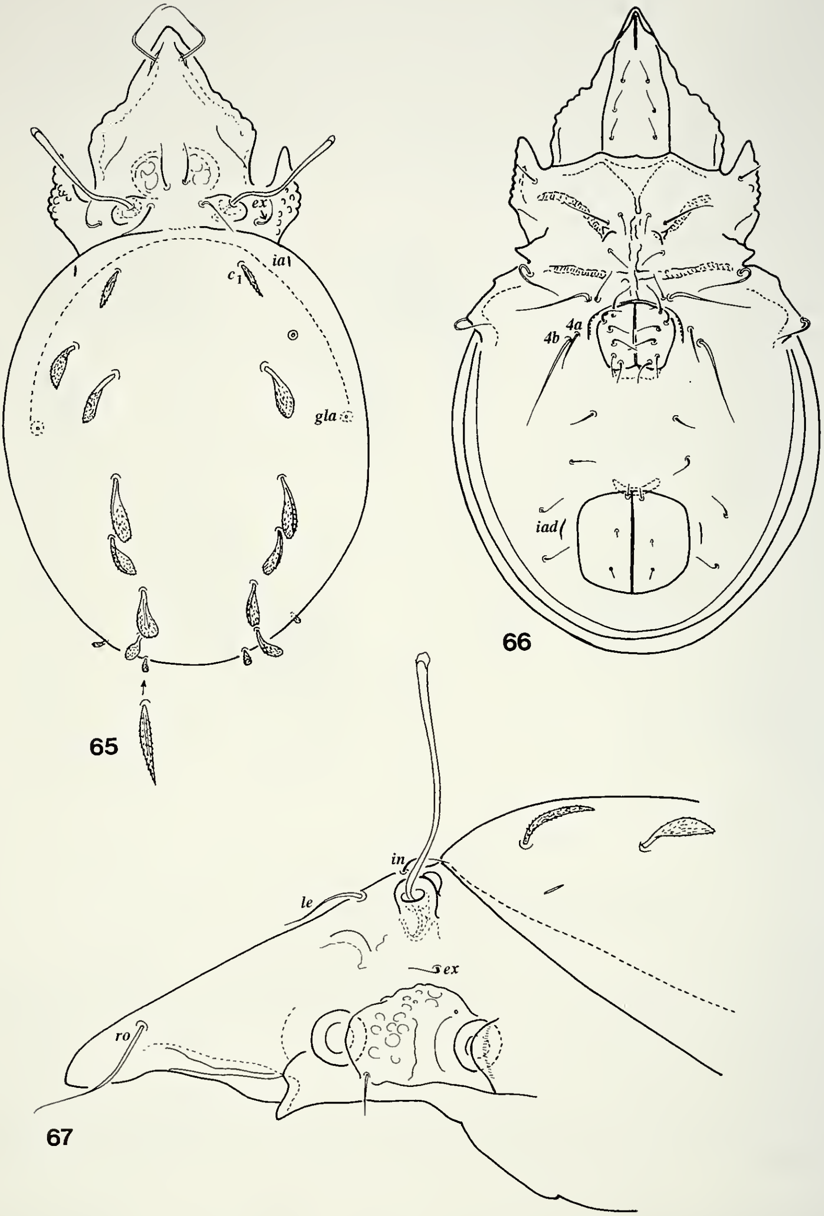
Dampfiella species from this region (*D. angusta* Hammer, 1980, *D. dubia* Hammer, 1971, *D. euaensis* Hammer, 1973, *D. foliata* Balogh & Mahunka, 1974, *D. prostrata* Aoki, 1965 and *D. similis* Hammer, 1971) have only smooth and spini- or setiform (in one case phylliform) notogastral setae.

Derivatio nominis: I dedicate this new species to my friend P. Zellweger, responsible for microscopy, Bio-Med department of the Zeiss branch establishment in Lausanne, for his technical help.

Suctoribates foliatus sp. n. (Figs 65–70)

Material examined: Holotype: Bru–88/41, 24 paratypes: from the same sample; 2 paratypes: Bru–88/29. Holotype and 16 paratypes: MHNG, 10 paratypes (1460–PO–1993): HNHM.

Measurements. – Length of body: 346–462 µm, width of body: 198–281 µm.

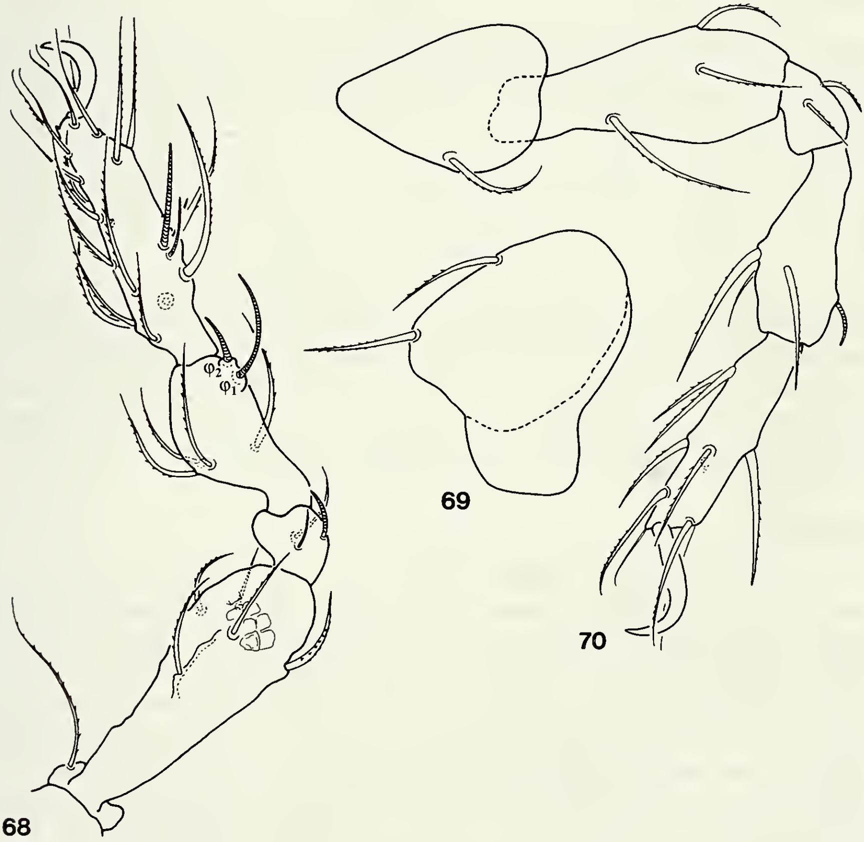


Figs 65–67

Suctoribates foliatus sp. n. – 65: body from dorsal aspect, 66: body from ventral aspect, 67: podosoma from lateral aspect.

Integument: The whole body surface, including the legs, covered by cerotegument layer. Cuticle generally smooth, but all femora ornamented by crests forming a polygonal reticulation.

Prodorsum: Rostrum elongated, Prodorsal surface with one pair of low depressions, bordered by a weak lath laterally. Bothridium well protruding like a cup. Rostral setae strong, bent characteristically inward, arising on the dorsal surface of prodorsum. Lamellar setae simple, inserted near to each other, between the depressions, in the basal part of the prodorsum. Interlamellar setae short and fine, directed backwards. Exobothridial setae (*ex*) only slightly shorter than the preceding ones. Sensillus long, directed outwards, bacilliform, with a small, separate distal apex (Fig. 65).



FIGS 68–70

Suctoribates foliatus sp. n. — 68: leg I, 69: femur of leg III, 70: leg IV.

Lateral region of podosoma: Pedotecta I large, ornamented by very large tubercles (Fig. 67).

Notogaster: Nine pairs of dilated, phylliform notogastral setae present (seta p_3 absent). Their form and size much varying. Seta c_2, p_1, and p_2 narrow, willow-leaf-shaped, the other setae wider and spoon-shaped (Fig. 65). Only two pairs of lyrifissures (*ia* dorsally, and *im*? marginally) and the glandular opening observable.

Coxisternal region: Mental tectum well protruding medially, this apex visible also in lateral aspect (Fig. 67). Apodemes and borders weakly developed, only the sejugal ones are complete and fused medially with the part of the sternal apodeme. In front of the genital opening a strong, well arched crest observable. Epimeral setal formula: 3 – 1 – 3 – 3, setae *1a* and *1b*, *3a* and *3b*, *4a* and *4b* located very near to each other (Fig. 66). Most of epimeral setae long, but scarcely ciliate or roughened.

Anogenital region: Anogenital setal formula: 6 – 1 – 2 – 3. Genital setae long, aggenital setae slightly thicker than the preceding ones, anal setae minute and located in the anterior part of the anal plates. Adanal setae simple and arising laterally, none of them inserted in postanal position. Lyrifissures *iad* located far from the anal aperture.

Legs: Trochanters III and IV with a horizontal plate (Fig. 69). Setal formulae of legs are:

I: 1 – 4 – 2+1 – 4+2 – 20+2 – 1 (Fig. 68)
IV: 1 – 3 – 2 – 3+1– 10 – 1 (Fig. 70)

Remarks: The genus *Suctoribates* Balogh, 1963 shows a circumtropical distribution, although only three species have previously been described: one from Africa, one from South America and one from Java. The new species is well characterised by the widely foliate notogastral setae.

Derivatio nominis: After the form of the notogastral setae.

Bolkiah gen. n.

Diagnosis: Family Haplozetidae. Female and male very different in size. Body surface uniformly ornamented by foveolae. Rostrum rounded. Lamellae reduced, partly absent, their short basal and distal end observable, but not visible in dorsal aspect. Lamellar setae inserted on their blunt cusp (Fig. 75). Tutorium weak, triangular, without cusp, not extending to the rostral seta. Exobothridial seta minute, all other prodorsal setae thick, thickly ciliate. Sensillus setiform, directed outwards and backwards. Dorsosejugal porose area absent. Eleven (!) pairs of notogastral setae, two (!) pairs of minute sacculi, five pairs of lyrifissures present. Pteromorphae movable. Epimeral setal formula: 3 – 1 – 3 – 3. Anogenital setal formula: 5 – 1 – 2 – 3. Lyrifissures *iad* in adanal position, located at the anterior corner of the anal opening. Circumpedal carina present, discidium well developed, custodium absent. Anal plates with high, sharp median blades (Fig. 74). Another longitudinal crest runs on the plates laterally. All legs monodactylous.

Type species: *Bolkiah hauseri* sp. n.

Remarks: On the basis of the above characters the new genus has to be placed in the family Haplozetidae Grandjean, 1936. It is distinguished from the heretofore known genera by the reduced lamellae, the eleven pairs of notogastral setae and the two pairs of minute sacculi.

Derivatio nominis: After the family name of the reigning Sultan of Brunei The gender of the genus name is masculine.

Bolkiah hauseri sp. n. (Figs 71–81)

Material examined: Holotype: Bru–88/41, 15 paratypes: from the same sample; 50 paratypes: Bru–88/46. Holotype and 40 paratypes: MHNG, 25 paratypes (1461–PO–1993): HNHM.

Measurements. – Length of body: 511–594 µm (females), 420–462 µm (males), width of body: 379–420 µm (females), 288–330 µm (males).

Integument: Cerotegument layer covering irregularly the different parts of the body, mostly the notogaster. Cuticle regularly foveolate on the prodorsum, notogaster and the anal plates. The form of foveolae varying on the mentum and the sternal surface, on the latter smaller foveolae medially and larger ones laterally. Genital plates ornamented by minute, anal plates by normal, foveolae, as on the notogastral surface. The foveolate sculpture observable also on some joints of the legs, i.e. on trochanters III and IV and on the femora.

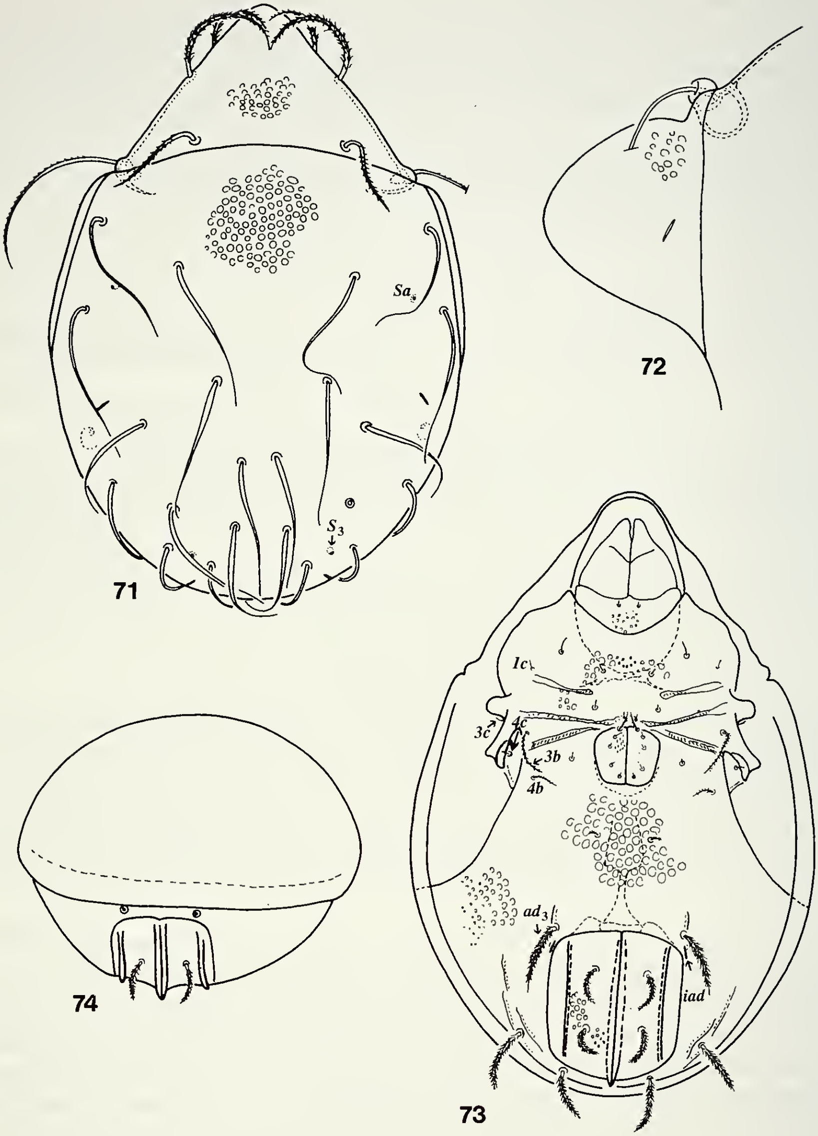
Prodorsum: Rostrum conical in dorsal aspect, prodorsal surface concave behind the rostrum in lateral aspect (Fig. 75). Lamellae poorly developed, not observable in dorsal aspect (Fig. 71). Lamellar cusp is also reduced. Tutorium much stronger than the lamella (Fig. 77), two other crests visible in this region. Porose area *Al* conspicuously large. Rostral and lamellar setae arising laterally, both distinctly and thickly ciliate. Interlamellar setae slightly blunter at tip, with fewer and straighter cilia. Sensillus reclinate, setiform, with spicules on its distal half, arranged mostly in two rows.

Notogaster: Dorsosejugal suture moderately undulate, without depression. Pteromorphae (Fig. 72) rounded. Dorsophragmatic apophyses (*hy*) small and hardly observable. Eleven pairs of long, smooth and slightly thickened notogastral setae present. Only two pairs (Sa, S_3) of minute sacculi were observable. Among the lyrifissures *ia* located on the pteromorpha while *ih* and *ips* in posterolateral position, very near to each other. The opening of the gland is small and circular.

Lateral region of podosoma: Pedotecta 1 very small, flattened. Discidium well developed, with a strong median edge. Circumpedal carina confluent with the discidial carina.

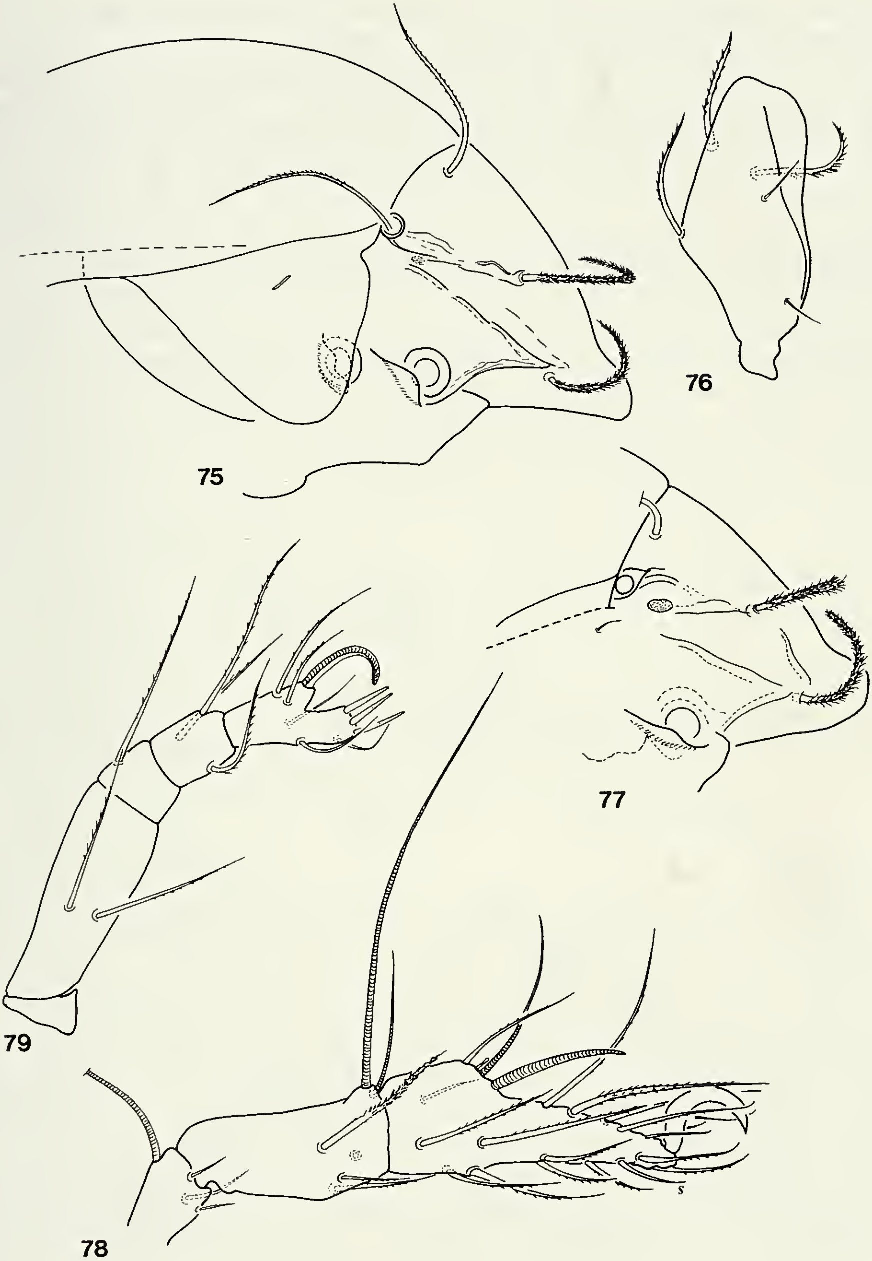
Gnathosoma: Chelicerae normal, palp also with its normal setation, as shown in Fig. 79.

Coxisternal region: Sejugal apodeme complete, with small thickening medially in front of the genital opening (Fig. 73). Apodemes 2 and 3 short.



Figs 71–74

Bolkiah hauseri gen. n., sp. n. – 71: body from dorsal aspect, 72: pteromorpha, 73: body from ventral aspect, 74: blades of anal plates from posterior aspect.



Figs 75–79

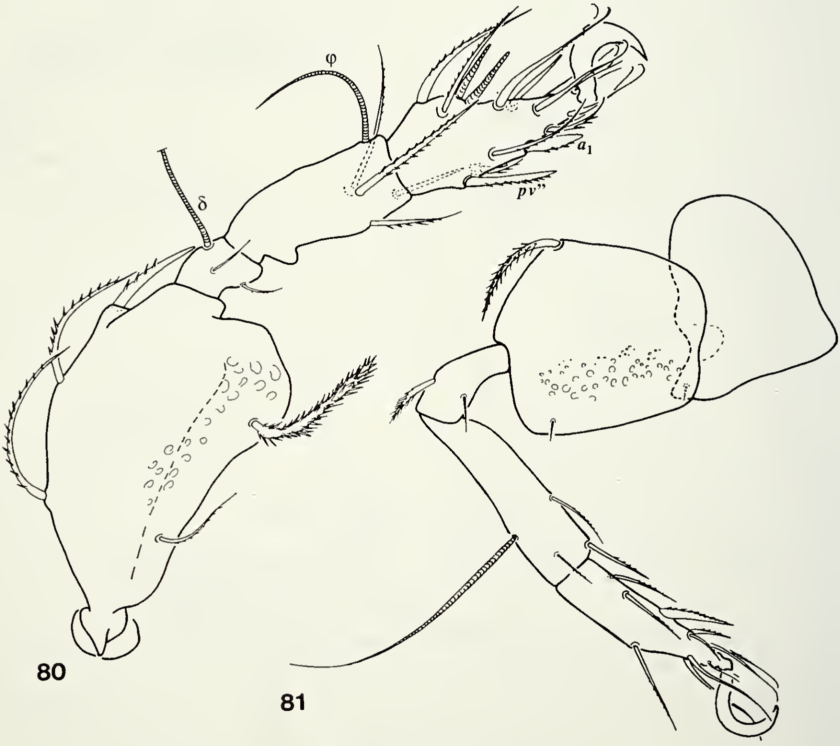
Bolkiah hauseri gen. n., sp. n. – 75, 77: prodorsum and podosoma from lateral aspect, 76: femur of leg I, 78: genu, tibia and tarsus of leg I, 79: palp.

The epimeral setation is normal, but well distinguished in their form: setae *3b* and *4b* long and distinctly ciliate, all the others minute and simple.

Anogenital region: Ventral plate with two depressions laterally. Median margin of the anal plates modified like a blade, composing a high median edge. A well protruding extra longitudinal crest also present on the anal plates (Fig. 74). Among the genital setae a great difference observable, seta g_1 long, ciliate, all the others minute. Aggenital setae also very short, but clearly ciliate. Anal and adanal setae similar to rostral or lamellar setae, distinctly and thickly ciliate. Lyrifissures *iad* located very near to the anterior corner of the anal opening, behind setae ad_3. Setae ad_3 originating on short crests.

Legs: All femora have blades, they are in ventrolateral position on femora I and II, ventral on trochanter and femora III and IV. The setal formulae are:

I: 1 – 5 – 3+1 – 4+2 – 20+2 – 1 (Figs 76, 78)
II: 1 – 5 – 3+1 – 4+1 – 15+2 – 1 (Fig. 80)
IV: 1 – 2 – 3+1 – 12 – 1 (Fig. 81)



Figs 80–81

Bolkiah hauseri gen. n., sp. n. – 80: leg II, 81: leg IV.

Some setae characteristically modified, i.e. *pv*" and a_1 on tarsus II, seta *p* on tarsi III and IV.

Remarks: Refer to the remarks after the generic diagnosis.

Derivatio nominis: I dedicate the new species to my friend Dr. B. Hauser who collected this very rich and interesting material.

Borneozetes gen. n.

Diagnosis: Family Haplozetidae. Rostrum rounded. Lamellae well developed, running in marginal position, cusps small and short, but lamellar setae arising on them. Translamella present. Tutorium (Fig. 84) very strong, at the insertion of the rostral setae directed inwards and forwards. Sensillus setiform, reclinate. Dorsosejugal suture complete, strongly arched anteriorly. Pteromorphae movable. Notogaster with two conspicuous, posterior tubercles. Fourteen pairs of phylliform notogastral setae, 4 pairs of very small sacculi[6], the glandular openings also visible. Discidium with a long, sharp spiniform appendage, directed inwards. Custodium absent. Circumpedal carina present, well developed, but not connected with the discidial carina. Ventral plate with a pair of strong longitudinal crests. Anogenital setal formula: 5 – 1 – 2 – 3. Gnathosoma normal. All legs monodactylous, with normal chaetom. Femora of legs II, III and IV with broad blade-like lamina ventrally.

Type species: *Borneozetes lanceolatus* sp. n.

Remarks: On the basis of the posteromarginal tubercles the new genus resembles *Baloghia* Mahunka, 1993. The latter one differs by the lamellar region, by the number of sacculi (2 pairs in *Baloghia*) and by the form and position of the notogastral setae.

Derivatio nominis: After the island of Borneo.

Borneozetes lanceolatus sp. n. (Figs 82–87)

Material examined: Holotype: Bru–88/29, 22 paratypes: from the same sample. Holotype and 14 paratypes: MHNG, 8 paratypes (1462–PO–1993): HNHM.

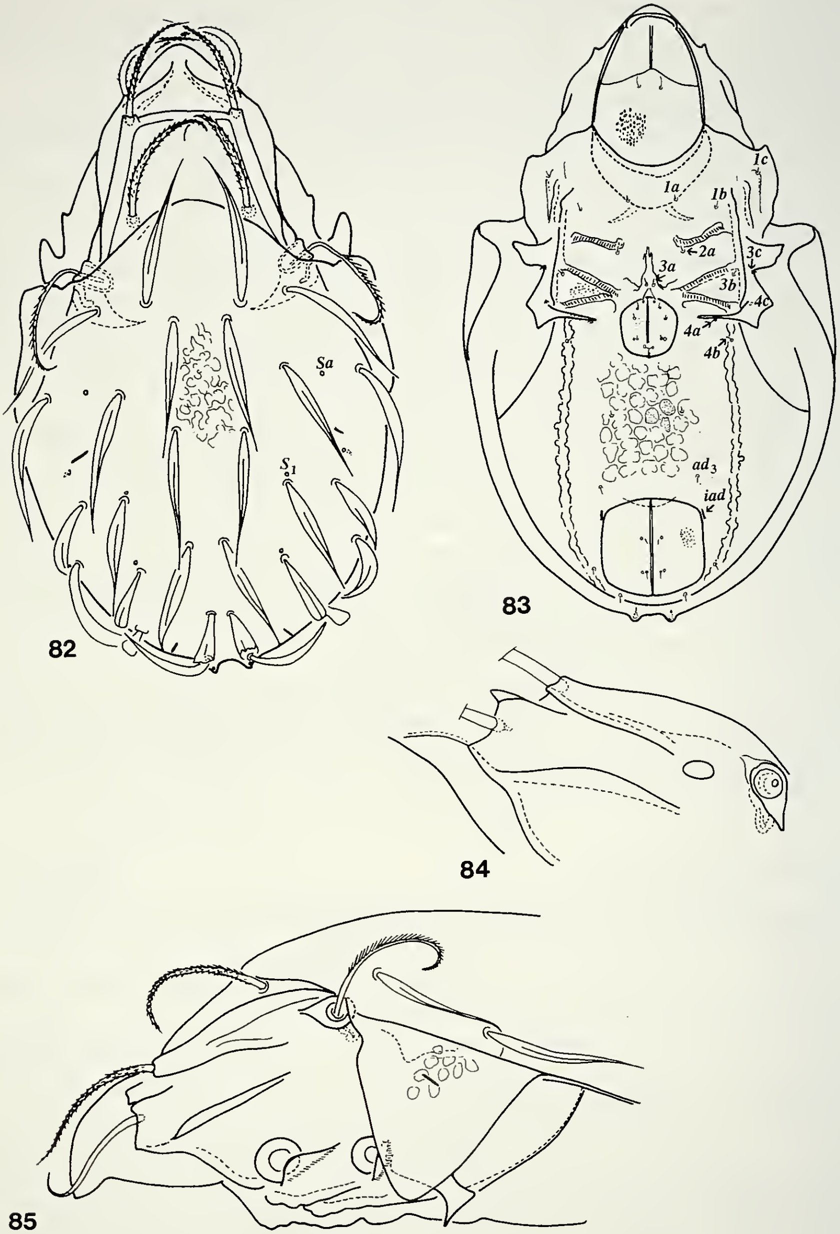
Measurements. – Length of body 297–396 μm, width of body: 181–264 μm. Male and female significantly different in size.

Integument: Nearly the whole surface covered by a cerotegument layer, which forms an irregular polygonal reticulation on the notogaster and the ventral plates. Surface — excepting mentum, genital and anal plates — strongly granulate.

Prodorsum: Surface of the lamellar and interlamellar setae distinctly pilose (Fig. 82), rostral setae are the same in thickness and in length, but their surface only finely roughened. Sensillus directed backwards, outer margin bearing thin spines arranged in two longitudinal rows. The length of spines decreases toward the distal end.

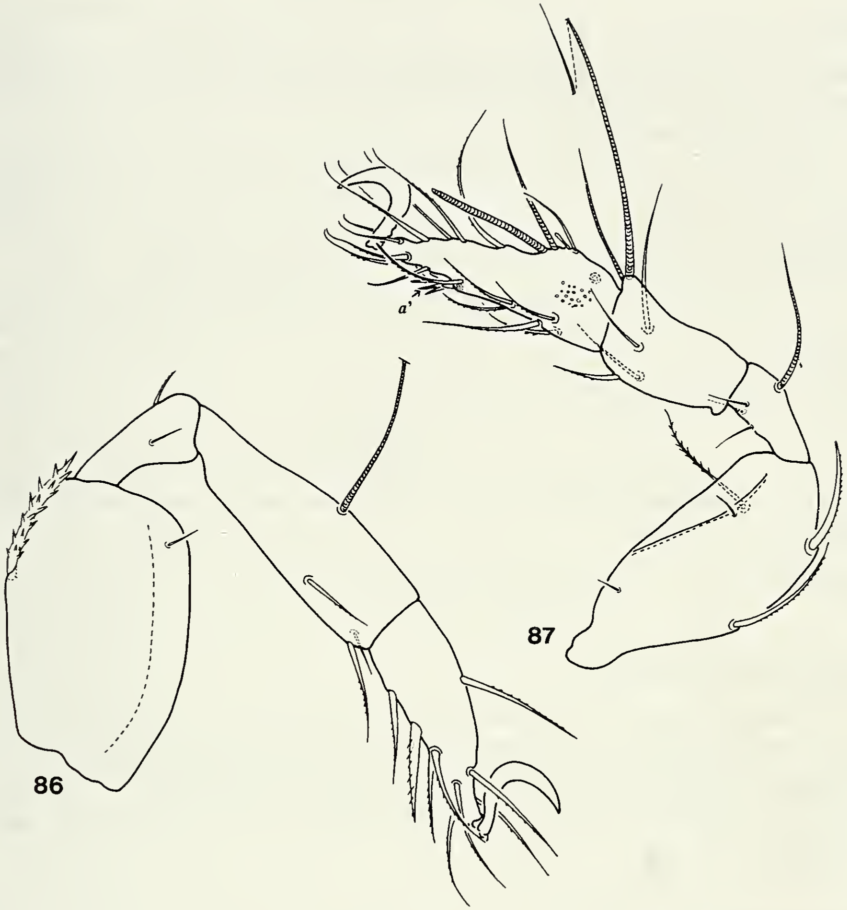
---

[6] The fourth pair of sacculi seems to be on the posterior tubercle of the notogaster. The other sacculi – excepting *Sa* – are hardly observable, located at the insertion of the notogastral setae. The "sacculi" on the tubercle could be glandular openings, if so only three pairs of sacculi are present on the notogaster.



Figs 82–85

Borneozetes lanceolatus gen. n., sp. n. – 82: body from dorsal aspect, 83: body from ventral aspect, 84: cusps of tutorium and lamella from lateral aspect, 85: podosoma from lateral aspect.



Figs 86–87
Borneozetes lanceolatus gen. n., sp. n. — 86: leg IV, 87: leg I.

Lateral region of podosoma: Pedotecta 1 low in lateral aspect (Fig. 85). Discidium with a double undulation posteriorly. Circumpedal carina long, reaching to the lateral margin of ventral plate. It is not connected with the discidial carina and runs to epimere 1.

Notogaster: Dorsosejugal suture strongly convex, reaching anteriorly between the interlamellar setae. Pteromorpha large (Fig. 85), bent down to the coxisternal region. Fourteen pairs of willow-leaf-shaped notogastral setae present. Some of them, in posteromarginal position, smaller than the others.

Gnathosoma: Chelicerae and the palp are normal, the solenidium and the eupathidium *acm* are very long and strongly curved.

Coxisternal region: Apodeme well developed, *ap. sej.* and *ap. 3* join with each other. *ap. 4* short, but present. In the sternal region a short ridge observable, running from the genital aperture anteriorly (Fig. 83). Setae *3a* arising on them, near to each other. Epimeral setal formula: 3 – 1 – 3 – 3. All setae minute, seta *3c* and *4c* hardly observable.

Anogenital region: Ventral plate with a pair of long longitudinal crests reaching anteriorly to epimere 4, posteriorly framing the anal aperture. Anogenital setal formula: 5 – 1 – 2 – 3, all the setae minute and spiniform. Seta ad_3 located anterior of the anal aperture, lyrifissures *iad* in normal position.

Legs: The basal part of the tarsus and tibia I with strong longitudinal or partly askew crests. The outer side (in dorsal aspect) of these joints is well porose. The outer side of all leg-joints also porose. The femora of legs II–IV with a broad ventral blade-like formation. Setal formulae of legs are:

I: 1 – 5 – 3+1 – 4+2 – 20+2 – 1 (Fig. 87)
IV: 1 – 2 – 2 – 3+1 – 10 (Fig. 86)

Both tarsi I and II bearing modified seta *a'*, their cilia very large, so the seta pectinate (Fig. 87). Seta *a* on tarsus IV conspicuously thick, spiniform (Fig. 86).

Derivatio nominis: After the form of the notogastral setae.

ACKNOWLEDGEMENTS

I wish to thank Dr. R.A. Norton (Syracuse University, NY, USA) for checking some of my determinations and giving his comments on the genera *Parhypochthonius* and *Epilohmannoides*. I am very grateful to Dr. Malcolm Luxton (National Museum of Wales, Cardiff) for his many suggestions and his very careful review of this manuscript.

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Walter, Thomas (ETH Zürich)
Aua: Faunistische Datenbank als Instrument für den Naturschutz in der Schweiz unter besonderer Berücksichtigung des Auenschutzes

Wedekind, Claus & D. Strahm (Bern)
Strategic egg production in a hermaphroditic cestode

Zbinden, Niklaus (Vogelwarte Sempach)
Die Überwachung der Avifauna in der Schweiz. Methoden – Stand – Bedeutung

Zettel, Jürg, U. Zettel & A. Ryser (Bern)
Surface activity in *Ceratophysella sigillata* (Collembola: Hypogastruridae) and the influence of climatic parameters

Zoller, Stefan & Ch. Scheidegger (WSL Birmensdorf)
Transplantation of isidia and thallus fragments from the endangered lichens *Parmelinopsis minarum* and *Parmotrema crinitum* as a conservation measure

Zschokke, Samuel & P. Studer (Basel)
Preservation of genetic diversity in the captive population of the Great Indian Rhinoceros

Zwölfer, Helmut (Bayreuth)
Evolution of the diversity of plant-insect communities: the example of the fauna of Cardueae host plants

Satellite Symposium

Giorgina Bernasconi[1] **& Michael Krieger**[2] ([1]Universität Bern, Zoologisches Institut, CH-3032 Hinterkappelen, Schweiz; [2]Université de Lausanne, IZEA, Bâtiment de Biologie, CH-1015 Lausanne, Suisse): Hierarchy of investment roles during cooperative colony founding as revealed by microsatellite DNA analysis in fire ants, *Solenopsis invicta.*

Cooperation among ant queens during colony founding considerably increases colony growth and survival. However, after fatal fights following worker eclosion only one queen monopolises the colony. Kin selection predicts that workers should bias the outcome of fights in favour of their mother or the most productive queen, while queens should restrain weight loss if this maintains their fighting ability. These two hypotheses make opposite predictions if brood production relates to weight loss. Using highly polymorphic microsatellite DNA loci we determined the genetic relationships of colony members at the time of queen execution in fire ants, *Solenopsis invicta.* The queen losing less weight in a pair and thus being most likely to survive did not have fewer progeny as expected. On the contrary, the higher the difference in weight loss, the more likely it was that the queen losing less weight had a higher share of the worker and larval brood. Differential weight loss is thus the expression of a stable hierarchy of roles between queens, with unequal partitioning of brood care tasks and differential cannibalism as potential mechanisms. These results thus reconcile the expectation that workers should favour the queen most likely to be their mother with the finding that differential weight loss is a predictor of queen survival.

Elmar F. Benelli & Paul Schmid-Hempel (Experimentelle Ökologie, ETH Zentrum NW, CH-8092 Zürich, Schweiz): Sources of variation in the immunocompetence of *Bombus lucorum.*

An immune system offers fitness advantages to individuals upon an attack of a parasite. But development and maintenance of immunity could itself have costs (energy, space, metabolites) and may therefore vary according to environmental conditions and coevolutionary history. We therefore predicted that alpine populations when compared to those from the lowlands are utilising a marginal habitat and generally face fewer parasites and thus would invest less into immunity. Furthermore, we expected that low temperatures would impose higher costs for the development and maintenance of immunity. We tested these predictions by exposing colonies of *B. lucorum* originating from two regions of Switzerland (lowland and Alps) to different temperature regimes (18°C and 28°C) and later implanting individuals of these colonies with an artificial parasitoid under standard conditions (20°C) to measure their encapsulation ability. Results only partially agreed with the predictions, notably alpine colonies were better defended. Possible effects of local adaptation and trade-offs with other functions will be discussed.

Max Reuter (Zoologisches Museum der Universität Zürich, Winterthurerstr. 190, CH-8057 Zürich, Schweiz): The pattern of female arrival at the mating site in the yellow dung fly *Scathophaga stercoraria* represents a mixed ESS.

Whereas male *S. stercoraria* colonise mating sites, freshly deposited dung pats, very rapidly females arrive at a low, decreasing rate over an interval of about five hours. In this study, it is hypothesised that the distribution of female arrival times represents a mixed ESS formed by different trade-offs between costs and benefits of early and late arrival. Early arrival is favoured as the substrate decreases in quality and is rapidly depleted; late arrival is favoured by diminishing negative effects of male-male competition on females. Computer simulations with arrival patterns deviating from the natural one were performed to "measure" the costs for females arriving at different times. These costs were compared with benefits calculated from assumed functions, thus giving fitness estimates. This procedure revealed that in a population of females arriving shortly after deposition delayed females would be favoured. In a population arriving according to a uniform distribution early females would have a fitness advantage. Thus evolution would lead to an intermediate distribution of arrival times, as occurs in nature. Therefore it is suggested that the pattern of female arrival represents a mixed ESS and is adaptive. The simulation also revealed that the intensity of sexual selection by male-male competition is highest with the natural pattern of female arrival. Thus natural selection generating this pattern as a by-product amplifies the intensity of male-male interaction.

Heinz Richner, Anne Oppliger & Philippe Christe (Zoology Departments, Universities of Bern and Lausanne): Parasitism and the trade-off between current and future reproduction.

Evolutionary theory predicts a trade-off between current reproductive effort and future survival or fecundity. At the physiological level, this trade-off predicts that parents which invest heavily in their current offspring will have fewer resources to allocate to parasite defence, thereby impairing their own future reproduction. Evidence for this trade-off from two experiments on great tits will be presented *(PNAS, 1995, Vol. 92, pp. 1192-1194; Nature, 1996, Vol. 381, p. 565)* where reproductive effort was manipulated and the resulting susceptibility to malaria parasites assessed.

Claus Wedekind & Dora Strahm (Abteilung Verhaltensökologie, Zoologisches Institut, Universität Bern, CH-3032 Hinterkappelen, Schweiz): Strategic egg production in a hermaphroditic cestode.

The pseudophyllidean cestode *Schistocephalus solidus* is a simultaneous hermaphrodite that reproduces in the gut of birds. Reproduction can take place by self- or cross-fertilisation. These two modi of reproduction are expected to result in offspring of different viability. Moreover, reproduction by cross-fertilisation is expected to put hermaphrodites in a social dilemma situation (the "hermaphrodites' dilemma"). If this cestode species has the potential of a strategic egg production, we expect egg production to differ between *S. solidus* that reproduce alone or in pairs. In an *in vitro* system which we use to replace the bird, we observed that the egg production of the cestodes actually seemed to depend on their social situation. When kept alone, there was a strong correlation between worm size and egg size: larger cestodes produced larger eggs. There was no such correlation in cestodes kept in pairs, the difference between these two reproductive modi being highly significant in this respect. To control for some potentially confounding variables we did a series of experiments which verified these findings. The experiments furthermore revealed that these hermaphrodites produced more eggs and overall more egg mass when kept alone than when kept in pairs. This suggests that *S. solidus* is capable of adjusting its investment into its overall female reproductive output according to the situation it finds itself in the final host, i.e. whether it is alone or together with a potential mate. *S. solidus* also seems to be capable of adjusting its investment into each egg depending on its expected viability, i.e. whether the offspring is the result of self- or cross-fertilisation.

Betty Benrey (Center for Ecology, Universidad Nacional Autónoma de México, México and Institut de Zoologie, Université de Neuchâtel, CH-2007 Neuchâtel, Suisse): Host plant effects on the interaction between an insect herbivore and its larval parasitoid.

The species of host plant fed upon by a herbivore may affect its natural enemies directly or indirectly. I examined the influence of four host plant species *(Brassica oleracea, Tropaeolum majus, Lunaria annua and Cleome spinosa)* of the cabbage butterfly, *Pieris rapae*, on its interaction with the parasitoid *Cotesia glomerata*.

The indirect effects of plant species on *C. glomerata* were assessed by determining the relationship between development time of *P. rapae* and susceptibility to parasitoid attack across the four plant species. Parasitism (%) was higher on larvae feeding on *B. oleracea* than on larvae on the other three host plants, and there was no clear relationship between development time of the host larvae and parasitism rates. The lack of association between larval growth rate and mortality across host plant species resulted from the direct effects of the host plant on the ability of *C. glomerata* to locate and attack their *Pieris* host.

Host plant species also indirectly influenced parasitoid performance by differentially altering the quality of *Pieris* larvae as a food resource for *C. glomerata*. Parasitoids developed more rapidly, produced larger clutches, survived better and emerged as larger adults when its host was feeding on *B. oleracea* and *T. majus*. Additionally, the sex ratio of *C. glomerata* emerging from larvae of *P. rapae* also differed across the four plant species.

The results from this study provide evidence that host plants mediate herbivore-enemy interactions by affecting the herbivore's vulnerability to parasitoid attack and the searching behaviour and performance of parasitoids.

Frédéric Tripet & Heinz Richner (Zoologisches Institut, Universität Bern, CH-3032 Hinterkappelen, Schweiz): Host responses to ectoparasites: food compensation by parent blue tits.

Parental food compensation has been proposed to account for the absence or small effects of parasites on offspring in various bird-parasite systems. An increase in the quantity of energy and nutrients provided by the adults would therefore compensate for the offspring's loss of blood to ectoparasites. We studied parental food compensation *(OIKOS, in press)* in a blue tit *Parus caeruleus* population with experimentally controlled infestations by the bird flea *Ceratophyllus gallinae*. Parental feeding effort, offspring quality, and parasite reproduction were measured in randomly assigned parasite-free and infested broods. Although the ectoparasites reproduced at a high rate in infested nests, the nestlings did not suffer higher mortality or reduced body size and body condition than nestlings in parasite-free nests. Parent blue tits of infested nests increased rate of food provisioning by 29%. The results support the parental food compensation hypothesis. No short-term costs (i.e. lowered body condition) of parasites on the parents could be detected. It suggests that parents alone bear the cost of parasitism. Life history models predict a trade-off between present and future reproduction, and evidence will be presented that the cost of food compensation is expressed by reduced survival of parents.

Kerstin Huck, Horst H. Schwarz & Paul Schmid-Hempel (ETH Zürich, Experimental Ecology, ETH Zentrum NW, CH-8092 Zürich, Schweiz): Phoretic mites discriminate between different castes of their bumble-bee hosts.

Mite species that utilise scattered microhabitats need specific dispersal strategies. All stages of the mite *Parasitellus fucorum* (Mesostigmata: Parasitidae) live in bumble-bee nests. For dispersal the deutonymphs (the last pre-adult stage) attach phoretically to adult bumblebees (*Bombus:* Hymenoptera: Apidae). Mites which are able to discriminate between bumblebee castes should have an advantage because only the queens overwinter. Deutonymphs of *P. fucorum* were found phoretic on both bumble-bee queens and workers in the field. However, they were detected significantly more frequently on the queens. In choice experiments carried out using a Y-tube, bumble-bee queens were more attractive to deutonymphs of *P. fucorum* than workers. In a further experiment, deutonymphs switched from males to queens but never from a queen to a male. Thus our behavioural results correspond with the caste-specificity found in the field.

Heinz-Ulrich Reyer, K. Bollmann, A. R. Schläpfer, A. Schymainda & G. Klecack (Zoologisches Institut, Universität Zürich, Schweiz): Ecological determinants of extra-pair fertilisations and egg dumping in Alpine water pipits, *Anthus spinoletta*.

Behavioural ecology has successfully explained the diversity in social mating systems ("who lives with whom?") through differences in environmental conditions, but diversity in genetic mating systems ("who mates with whom?") is poorly understood. The difference is important, where parents care for extra-pair young (EPY) originating from extra-pair paternity (EPP), extra-pair maternity (EPM) and intra-specific brood parasitism (IBP). In birds, IBP and EPM are rare, but EPP is widespread and highly variable among species and populations. Explanations for this variability are controversial, mainly because detailed ecological information is usually lacking in paternity studies. Here we present results of the first study to identify the ecological determinants of extra-pair activities for both sexes of the same species, the water pipit *(Anthus spinoletta)*. DNA fingerprints of 1052 young from 258 nests revealed EPP in 5.2% of the young from 12.4% of the nests. EPM and IBP – both involving egg (EDP) – each occurred in 0.5% of the young from 1.9% of the nests. Nests with and without EPY could not be distinguished by traits of the breeders and by reproductive success, but they differed with respect to ecology: nests with EPP-young were characterised by asynchronous clutch initiation, nests with EPM- and IBP-young by higher overlap with neighbouring territories and closer proximity to communal feeding sites. We suggest that chance events, resulting from the temporal and spatial distribution of broods, offer a better explanation for the occurrence of extra-pair activities than female search for genetic or phenotypic benefits. This possibility of "accidental" extra-pair reproduction as an "ecological epiphenomenon" with low potential for selection should also be considered for species other than the water pipit.

Philipp Heeb, Isabelle Werner, Mathias Kölliker & Heinz Richner (Zoologisches Institut, Universität Bern, CH-3032 Hinterkappelen, Schweiz): Benefits of great tit responses against hen fleas.

Cavity-nesting birds often face ectoparasites inhabiting their nest and can show behavioural, physiological or immunological responses to them. Host responses have evolved as a way to reduce the impact that parasites have on their fitness. In our study, we investigated the responses of breeding great tits *(Parus major)* when infested by a common ectoparasite, the hen flea *(Ceratophyllus gallinae)*. We also determined the fitness benefits arising from these responses. When infested by fleas, male but not female great tits increased their feeding rates. Such increase in feeding rates is thought to compensate for the negative effect of the fleas by increasing the amount of food delivered to the young. Females with infested nests increased the mass of the nests and tended to increase their nest sanitation behaviour. Male responses appeared to be based on flea assessments made early in the nesting cycle. Our results show that if flea infestations take place at the start of incubation, males did not increase their feeding rates and the birds produced young of lower body weights and sizes. In contrast, if flea infestations took place during egg laying, the responses of the great tits compensated for the effect of the fleas and no detectable flea virulence was observed. Thus, great tit responses reducing the effect of hen flea infestations can only be mounted if birds detect flea loads early in their nesting cycle.

Christian Som[1], Bradley R. Anholt[2] & Heinz-Ulrich Reyer[1] ([1]Zoologisches Institut, Universität Zürich, Schweiz; [2]Dept. of Biology, University of Victoria, Canada): The importance of female choice for the population structure of the *Rana esculenta - Rana lessonae* hybrid system.

Recent models of the structure and dynamics in mixed water frog populations indicate that exchange between ponds is essential for the coexistence of the hybrid *Rana esculenta* (E) and its sexual host *R. lessonae* (L). Our model predicts that female choice alone can lead to stable genotype frequencies in the L/E-system, even in isolated populations without migration between neighbouring ponds. Different mating frequencies of *R. esculenta* and *R. lessonae* females with *R. lessonae* males allow coexistence over a wide range of relative clutch size relations. If female choice is affected by the L/E-ratio of mating males, the genotype composition in the mixed populations develops faster to an equilibrium than if female choice is independent of the male ratio. Simulated disturbances of mixed populations with stable genotype frequencies showed that the model lacks global stability. Disturbance leads to L/E-equilibria different from those before the impact. Repeated disturbance can increase these differences which may explain why L/E ratios differ in nature. Populations with less than 10% of *R. lessonae* are very vulnerable and disturbance may cause a collapse of the mixed population.

Christina Chang Wai Ying[1], **Michael J. B. Krieger**[1], **Kenneth G. Ross**[2] **& Laurent Keller**[1] ([1]Université de Lausanne, IZEA, BB, 1015 Lausanne, Suisse; [2]University of Georgia, Dept. of Entomology, Athens 30602 GA, U.S.A.): Polygyny associated with high level of triploidy in the fire ant *Solenopsis invicta*.

Ploidy level of fire ant females was studied using microsatellites. More than 10% of the workers and queens were triploid in polygyne (multiple-queen colonies) populations. By contrast, not a single triploid individual was detected in monogyne (single-queen colonies) populations. This difference in ploidy level between the two social forms might stem from the presence of diploid males in the polygyne form. Males are generally haploid in Hymenoptera but a recent bottleneck resulted in a dramatic increase in the proportion of diploid males in the polygyne form only, with 83% of the males being diploid. These males were thought never to produce sperm. However dissection of diploid males showed that 2.4% of these males indeed produce sperm. These diploid fertile males may thus be at the origin of the high level of triploid females in the polygye form.

Theo C. M. Bakker & Dominique Mazzi (Zoologisches Institut, Universität Bern, Schweiz); How necessary is paternal care for the development of stickleback embryos?

In species with exclusive male parental care, females may directly benefit by mating with males that occupy territories that are advantageous for embryo development and survival. One may thus expect male-male competition for territory quality and female mate choice for territory quality or male traits that indicate territory quality. We tested in the field (Roche near Montreux, Switzerland) whether variation in embryo survival was associated with physical variables at the nest, and whether successful males occupied better territories for embryo survival. We did this by depriving stickleback nests of paternal care during a variable period while preventing egg predation. The current velocity near the nest sites is relatively high in this population. In addition to the length of the deprivation period and the number of eggs, current velocity significantly correlated negatively with proportional embryo mortality. Males with intense blue eye had a high relative reproductive success and were occupying the best territories for embryo survival.

Else J. Fjerdingstad[1] **& J. J. Boomsma** (Dept. Ecology & Genetics, Aarhus University, Ny Munkegade 540, DK-8000 Aarhus C, Denmark. [1] After Feb. 1st, 1997 at: Institut de Zoologie et d'écologie animale IZEA, Bâtiment de Biologie, Université de Lausanne, CH-1015 Lausanne): Polyandry and multiple paternity in the Leafcutter ant *Atta colombica* - Do queens mate multiply for more sperm?

Polyandry (multiple mating) by ant queens is considered an evolutionary puzzle: it is likely to be costly for queens and clear benefits have not yet been demonstrated. Hamilton (1964) and Cole (1983) suggested that queens of large colony species may have to be polyandrous in order to obtain large sperm stores. In this study we tested an individual-level version of this hypothesis in the Panamanian leafcutter ant *Atta colombica*, a highly polyandrous large colony species. We found that the number of sperm stored by queens correlated positively with their mating frequency as estimated through microsatellite DNA mother-offspring analysis. Also, we show that storing more sperm is likely to enhance the potential fitness of a queen. This is the first evidence genuinely in favour of the "mating-multiply-for-more-sperm" hypothesis. It is also the first evidence that polyandry in ants may be selectively favoured for causes not related to genetic diversity or relatedness effects of multiple paternity.

Mathias Kölliker, Heinz Richner, Isabelle Werner & Philipp Heeb (Ethologische Station Hasli, Zoologisches Institut der Universität Bern, Schweiz): Begging signals and biparental care: nestling great tits discriminate between parents.

In birds, biparental care is the norm and evidence that male and female parents differ concerning their simultaneous investment pattern in individual offspring is growing. How and why do such interparental differences arise, given that both parents depend on nestling signals for appropriate food allocation? In this study, we report an experiment carried out on great tits *(Parus major)* where nestling hunger level was manipulated by food deprivation and hand-feeding. Subsequent filming revealed that parents made themselves recognisable by feeding from different and stable locations within the nest. Nestlings approached the female but not the male if previously "food-deprived", retreated (or were displaced by siblings) from positions near the female but not the male it artificially "fed". Females allocated a 58% higher proportion of feedings to hungry nestings than males. Recognisability may allow parents to favour different nestling phenotypes (e.g. need, sex, size) in close positions and hence for feeding. Individual parents may likewise be able to adjust nestling begging signals to their own optimal (short-term) investment pattern.

Steven N. Fry & R. Wehner (Zoologisches Institut, Universität Zürich, Schweiz): How honey bees use a single landmark to locate a food source.

Honey bee foragers repeatedly visit a rewarding food source. Amongst other navigational strategies, landmarks along the route and near the feeding site are used for visual guidance. What landmark information do the bees store, and how are memora and present visual input used to guide the bee to a certain location?

Bees were trained to enter a uniform flight arena (diameter 2.4 m) and fly to a small hole devoid of olfactory cues at 1.9 metres distance. The bees then passed through the hole to receive a food reward, after which they left the reward box directly. A single black cylindrical landmark was placed 50 cm to the side of the hole. Successive flights of experienced bees were video-recorded and digitised for analysis.

The bees never flew in a straight line to the hole, but chose an initial heading towards the cylinder, which they then passed, swerving directly towards the hole.

Analysis of the azimuth of the landmark, as it appeared to the bees, show that they approached the landmark keeping it in a near frontal position, within about 60° of the visual field. Similarly, bees trained to a frontal landmark fixated it within about 60° of the frontal retina.

A bee flying a straight course perceives objects in motion, unless the object is located directly in front of it. We have shown that bees avoid inducing image motion, by first aiming for the landmark. Paradoxically, the bee avoids the bee-line to the goal.

Main Symposium

Invited lectures

Robert D. Holt (The University of Kansas, Natural History Museum, Lawrence, KS 66045-2454 U.S.A.): The conservation implications of niche conservatism and evolution: a theoretical perspective.

Many species world-wide are at risk of extinction because of a wide range of human activities, including habitat destruction, direct mortality pressure, the introduction of exotics, and management practices (e.g., pesticide application). Given that most natural populations harbour genetic variation for many characters, evolutionary processes can in principle modulate extinction risk. Yet a general theme of the history of life is that species exposed to novel environments often fail to adapt. In my lecture, I first sketch some examples of such "niche conservatism". I then present a conceptual framework which emphasises how population dynamics can constrain evolutionary responses. Although the overall message is rather sobering, the framework does highlight features of landscape structure which facilitate rapid evolution to novel environments, potentially rescuing populations from extinction. Finally, these insights are applied to an important applied ecological problem – the long-term evolutionary stability of biological, versus chemical, control of pest organisms.

Paul M. Brakefield (Institute of Evolutionary and Ecol. Sciences (EEW), Leiden University, The Netherlands): Genetics and habitat fragmentation: some empirical data from studies of butterflies.

The general features of potential genetic problems in small natural populations are illustrated with particular attention to butterflies. I will then show how laboratory experiments using a tropical butterfly are detecting the potential roles of genetic drift, inbreeding and gene flow.

Robert D. Martin & Franziska von Segesser (Anthropologisches Institut, Universität Zürich, Schweiz): The Barbary macaque as a model for conservation biology of primates.

Endangered species face a set of common problems, notably drastic reduction in total habitat area combined with habitat fragmentation. Because of overall reduction in population size and isolation of subpopulations, loss of genetic variation is assumed to be a major factor threatening the survival of isolated relict populations, but empirical data are still relatively scarce. Among primates – long-lived mammals with complex social patterns – the Barbary macaque *(Macaca sylvanus)* is an instructive model for studying genetic effects of population decline. Surviving wild populations in Algeria and Morocco are severely fragmented and genetic isolation is also of central concern for the management of existing captive populations. Fundamental questions that need attention include assessment of the genetic effects of isolation, definition of minimum viable population size and determination of the requisite level of gene flow between subpopulations.

The Barbary macaque is a particularly suitable test case because it has been possible to sample the entire wild and captive world population through an international collaborative network. The overall population is subdivided into subpopulations of different sizes and degrees of isolation. An ongoing project is applying DNA-typing methods to assess genetic variability in wild and captive Barbary macaques. Pilot studies using protein electrophoresis and multilocus DNA fingerprinting showed that Barbary macaques have low genetic variability in comparison to other macaque species, so work on microsatellites was initiated. Over 300 blood samples have been collected from four wild populations in Algeria, two semifree-ranging subpopulations in Europe of Moroccan origin, one mixed zoo colony and an extremely isolated colony of uncertain origin on Gibraltar.

For our studies using PCR-based microsatellite analysis, emphasis was placed on developing non-invasive sampling techniques (e.g. using DNA extracted from hair-root cells) and on the use of non-radioactive labelling techniques. We present results for six hypervariable microsatellite loci (primers supplied by M. Inoue and M. Bruford). The microsatellite markers used are highly variable (average heterozygosity about 55% within each subpopulation) and permit identification of pronounced differences in both distribution and degree of variation between subpopulations. There is, for instance, a clear distinction between Algerian from Moroccan macaques. Results from the small isolated colony in Gibraltar are particularly interesting with respect to potential effects of long-term inbreeding.

Helmut Zwölfer (Universität Bayreuth, D-95440 Bayreuth, Germany): Evolution of the diversity of plant-insect communities: the example of the fauna of Cardueae host plants.

Plant-insect communities, i.e. groups of organisms co-occurring in the same area, connected by trophic links and interacting through antagonistic and synergistic relationships form an essential element of the biodiversity of terrestrial ecosystems. Thus, a study of the evolution of plant-insect foodwebs offers a chance to gain insight into processes involved in the evolution of biodiversity. This will be shown for the insect fauna of the Cardueae (= thistles in the broad sense). In this host group a comparative analysis of food webs and guilds is possible over much of its Holarctic distribution range. Together with data on phylogenies, fossil records, biogeography, host race formation and functional morphology it allows to reconstruct steps and to identify driving forces in the evolution of the faunal diversity associated with a major plant taxon. The study shows that the four stages postulated by K. O. Wilson (1969) for the development of communities are well represented in the Cardueae fauna, the evolution of which can be traced back to the late Oligocene and Miocene. Starting from random assemblies of the "non-interactive phase", levels of guild organisation and complexity of life-histories increase over an "interactive phase" and an "assortative phase" and reach a maximum in the final "evolutionary stage".

Peter K. Endress (Institut für Systematische Botanik, Universität Zürich, Schweiz): Unknown diversity.

Like complexity, diversity of life has many dimensions. Two prominent aspects are (1) the diversity of clades, which are in the focus systematics / phylogenetics, and (2) the diversity of landscapes, which are in the focus of ecology. The first aspect deals with all constituents of a phylogenetically defined (monophyletic) group and their relationships at a worldwide scale, the second with all organismal constituents of a geographically restricted region and their interrelations. I will focus on the first aspect and on plants. The last five years have seen an unprecedented progress in systematic botany due to new techniques, especially molecular systematics. At the same time gaps in our knowledge of the diversity of even spectacular and "familiar" plants become more obvious. This will be illustrated. In addition, the basal diversity of angiosperms, the most diverse plant group, will be highlighted, which is of special importance also for large scale conservation issues.

David M. Newbery (Vegetation Ecology Group, Geobotanisches Institut, Universität Bern, CH-3013 Bern, Schweiz): Bernoulli and the botanist: sampling problems in the tropics.

Very species-rich rain forest vegetation presents major problems for sampling and understanding the processes which determine its structure, composition and dynamics. How probable is it, for example, that a tree of one species will be a neighbour to that of another? Either we submit to the "laws of chance" or we have to adopt a new approach.

Actions for perception and maintenance of biodiversity

Andreas Gigon[1]; **Regula Langenauer**[1], **Claude Meier**[2] & **Bernhard Nievergelt**[2] ([1]Geobotanisches Institut, ETH Zürich; [2]Zoologisches Institut, Universität, Zürich, Schweiz): Blue Lists – a new encouraging instrument in nature conservation.

The Red Lists become longer and longer indicating that biodiversity is decreasing. This often leads to a negative and discouraging picture of nature conservation. But is this whole story? As a new instrument for monitoring the success of nature conservation the Blue Lists were developed: registers of those Red List species that show a stabilisation or increase of abundance in the area investigated. These changes can be due to the application of nature conservation, but also to factors like climatic change or eutrophication.

The instrument of the Blue Lists comprises six categories concerning the change of abundance of the individual species in the area investigated. As an addition to the Blue Lists, six other categories assessing the effect of the application of nature conservation techniques on the individual species are defined. Nature conservation techniques are conservation measures that have a direct effect upon species.

Weaknesses, strengths and possibilities for the application of the Blue Lists in nature conservation are discussed.

Andreas Gigon[1], **Regula Langenauer**[1] **& Claude Meier**[2] ([1]Geobotanisches Institut, ETH Zürich; [2]Zoologisches Institut, Universität, Zürich, Schweiz): Blue Lists of animal and plant species of the Red Lists in northern Switzerland.

The Blue Lists (registers of those Red List species that show a stabilisation or increase of abundance in the area investigated) are presented for the vertebrates, butterflies, grasshoppers and dragonflies of the cantons of Aargau, Schaffhausen and Zürich.

Of the over 200 animal and 700 plant species assessed – all in the Red List categories "vulnerable" or "threatened" – approximately 30% experienced a stabilisation or increase of abundance in the investigation area in the last 10-15 years. About 20% of the species show a decrease in abundance; for the remaining 50% the development of the abundance during the last 10-15 years is not known but it is probably mostly declining.

For about 80% of the investigated Red List species nature conservation techniques, which can lead to a stabilisation or increase of abundance, have been successfully applied or are at least known. A wider application of these techniques could lead to a stabilisation or even increase of the abundance of a large number of Red List species.

Thus, nature conservation also shows successes, which could even be enlarged considerably. The positive picture given by the Blue Lists can hopefully help to increase the motivation for the conservation of Nature.

Martina Gebhardt (Sozialökonomisches Seminar der Universität Zürich, Schweiz): Ökonomische Aspekte der Erhaltung der Biodiversität.

Die Erhaltung des Regenwaldes, als Ort der grössten biologischen Vielfalt, ist trotz international anerkannter Bedeutung nicht sichergestellt. Die konkurrenzierende Nutzung des Regenwaldes (Tropenholzexport, Transformation in Weideland, etc.) führt zu einer Zerstörung des Regenwaldes und somit der Biodiversität. Die Biodiversität muss eine finanzielle Wertsteigerung erfahren, um konkurrenzfähig gegenüber den anderen Gütern zu werden. Eine Möglichkeit der monetären Bewertung der Biodiversität kann über die Erfassung des Nutzens für die Pharmaindustrie dargestellt werden. Die Biodiversität gilt als potentielle Basis für neue Medikamente. Das Interesse der Pharmaindustrie an der Biodiversität manifestiert sich zum Beispiel im Vertrag zwischen Merck, USA und INBio, Costa Rica, Dabei stellt Costa Rica "ihre" Biodiversität dem Pharmaunternehmen zu Forschungszwecken zur Verfügung. Als Gegenleistung ist Costa Rica an den daraus resultierenden Medikamenten umsatzbeteiligt (Royalties). Dieser Vertrag ist der erste, der den "Besitzern" der Biodiversität, als Anbieter ihrer Ressource, eine Abgeltung gewährleistet. Die Royalties können dabei als Preis für das Nutzungsrecht des Pharmaunternehmens gesehen werden. Dadurch erhält die Biodiversität eine finanzielle Wertsteigerung. Ein wesentliches Problem bei der Ausgestaltung eines solchen Vertrages ist die Bewertung der Biodiversität. Das Pharmaunternehmen kennt den Wert der konkurrenzierenden Güter, der Marktwert der Biodiversität ist hingegen nicht bekannt. Im Vertrag wird daher ein Wert vereinbart, der nur leicht über dem Wert der konkurrenzierenden Gütern liegt und den effektiven Wert der Biodiversität nur ungenügend widerspiegelt. Eine alternative Methode zur Berechnung des monetären Nutzen der Biodiversität ist die Ertragswertanalyse. Die zukünftigen Erträge der Nutzung durch die Pharmaindustrie werden auf heute abdiskontiert und mit dem gegenwärtigen Ertrag der konkurrenzierenden Nutzung verglichen.

Susette Biber-Klemm (Institut für Rechtswissenschaften, Universität Basel, Schweiz): Erhaltung der Lebensräume – Instrumente und Strategien des Rechts.

Ausgehend von der Konferenz der Vereinten Nationen über die Umwelt von 1972 (Stodkholmer Konferenz) hat sich der Grundsatz des "sustainable use" – in Rio erweitert zur "nachhaltigen Entwicklung" – auch in der Rechtsordnung zum Schutz und zur Erhaltung der natürlichen Lebensräume niedergeschlagen.

Die vom Recht zur Verfügung gestellten Instrumente und deren Umsetzung entwickelten sich von lokalen und punktuellen Schutzmassnahmen zur grossflächigen Prävention und Integration. Dieser Prozess wurde durch internationale Entwicklungen insbesondere im Bereich der Landwirtschaft unterstützt. Der Schutz von Ökosystemen und Lebensräumen von Arten ist allerdings seit jeher schwierig – zu viele verschiedene Interessen konzentrieren sich auf das knappe Gut Boden.

Von verwaltungs (rechtlicher) Seite her ist der Vollzug des Umweltrechts im allgemeinen und somit auch des Naturschutzrechts aktuell geprägt durch Entwicklungen, die Deregulierung, Übernahme von Eigenverantwortung, Freiwilligkeit der Umsetzung durch Setzung von wirtschaftlichen Anreizen postulieren.

In diesem Umfeld findet die Umsetzung der rechtlichen Vorgaben zum Schutz und zur Erhaltung der natürlichen Lebensräume von Tieren und Pflanzen statt.

Ihr Erfolg ist nicht nur geprägt von den gesetzlichen Vorgaben. Positionen und Funktionen der beteiligten Akteure, Wahl und Einsatz der Instrumente, organisatorische, finanzielle und personelle Faktoren beeinflussen die Wirksamkeit. Nicht zuletzt spielt auch Information und die Art und Weise des wissenschaftlichen Inputs eine Rolle. Gefragt wären praxisnahe Fragestellungen und Kommunikation zwischen Theorie und Praxis.

Patterns of and causes for the decline of biodiversity in Europe

Anna-Katherina Holenweg & Heinz-Ulrich Reyer (Zoologisches Institut, Universität Zürich, Schweiz): Migration and population dynamics in a water frog metapopulation.

The structure and dynamics of mixed water frog populations, consisting of individually marked *Rana lessonae*, *R. ridibunda* and their hybridogenetic associate *R. esculenta*, were studied at nine neighbouring breeding sites in Switzerland. We found all three genotypes in all ponds, but their relative numbers were significantly related to pond size and shape. Pond-specific composition persisted even when relative genotype frequencies in the whole population changed between successive years. Although most of the frogs remained at the same pond during summer and returned to the same pond after hibernation, there was considerable exchange of reproductive water frogs between eight of the nine neighbouring sites. 3% of all marked frogs (n=2735) and 10% of those recaptured (n=932) changed ponds within seasons (1995 and 1996), 2% and 12%, respectively, did so between seasons. Thus, with the exception of one pond isolated by a highway, neighbouring ponds must be considered as parts of a metapopulation rather than as separate populations. These findings are consistent with recent models indicating that composition and stability of communities strongly depends on the movements of organisms between neighbouring resource patches, in our case breeding sites.

Sylvie Barbalat (Institut de Zoologie, Emile Argand 11, 2007 Neuchâtel): Forest structures and wood beetle diversity: the example of the Buprestidae, Cerambycidae, phytophagous Scarabaeidae and Lucanidae in the Areuse Gorges (NE).

The species diversity of selected wood beetles (Buprestidae, Cerambycidae, phytophagous Scarabaeidae and Lucanidae) between various forest stands showing different ecotone structures has been compared. Window traps and coloured plates have been used. Among the 65 captured species, 13 belonged to the Buprestidae, 41 to the Cerambycidae, 8 to the phytophagous Scarabaeidae and 3 to the Lucanidae. Forest stand and clearing type have been found to have a significant influence on these beetle communities. In oak stands we find several typical oak species, while in beech stands only one characteristic species has been found. Phytophagous Scarabaeidae, which live in half-open habitats are typical edge species. Natural edges are characterized more precisely by Cerambycidae and Buprestidae living in herbaceous plants and shrubs. In artificial clearings, Cerambycidae and Buprestidae living in stumps or in branches left after a cutting have been found to be characteristic. Diversity indices have been calculated. Although no significant difference between diversity indices in artificial clearings or in edges has been found, the species are not the same in these two types of biotopes. Therefore, both are to be conserved in order to maintain a maximal biodiversity in forest.

Christoph Jäggi & Bruno Baur (Institut für Natur-, Landschafts- und Umweltschutz (NLU), Universität Basel, St. Johanns-Vorstadt 10, CH-4056 Basel, Schweiz): Overgrowing forests threaten local populations of the "Juraviper" *(Vipera aspis).*

Habitat alterations can lead to species extinction. In the northwestern Swiss Jura mountains, the Asp viper *Vipera aspis* was common until the 1940ies. During the past 50 years many populations went extinct and today the species is threatened. We examined habitat characteristics at localities with extant viper populations and at localities where the species went extinct in the past 50 years. Localities with extant populations did not differ in altitude, inclination, soil structure and cover of ground vegetation. Localities where the species persisted are situated more frequently at the forest edge, in dry meadows and at roadsides, whereas localities in which *V. aspis* went extinct are situated more frequently in forests. Furthermore, the density of woody plants is lower at localities where the viper still occurs. The results show that the former habitats of *V. aspis* became overgrown by bushes and trees, which in turn may have led to a colder and more humid microclimate. These alterations of the habitats may cause the local extinction of this viviparous snake. We conclude that logging is an essential tool to maintain the habitat suitability for this thermophilous reptile.

Samuel Zschokke[1] & Peter Studer[2] ([1]Institut für Natur-, Landschafts- und Umweltschutz (NLU), Universität Basel; [2]Zoologischer Garten, Basel, Schweiz): Preservation of genetic diversity in the captive population of the Great Indian Rhinoceros.

Great Indian Rhinoceros *(Rhinoceros unicornis)* – one of the most endangered large mammals – have been kept in captivity for more than 50 years now and are distributed in zoological gardens world-wide. Breeding in captivity was first successful at Basel Zoo in 1956. Nowadays, 82 of the 130 Indian Rhinoceros kept in zoos are zoo-born. Until recently, however, little attention was paid to the genetic health of the zoo-population.

In the present study we analysed, based on the studbook, the breeding hirtory and its genetic consequence on the zoo population of the Indian Rhinoceros. Inbreeding coefficients of zoo-kept Indian Rhinoceros vary between 0% and 37.5%. At present, nearly 50% of the genes of all zoo-born Indian Rhinoceros stem from three founder individuals, whereas the other 29 founders contributed the other half of the genes. The founder equivalent, a measure to describe the genetic health of a zoo population, is 10.16. For a viable zoo population, a founder equivalent of at least 20 is considered to be necessary.

We analysed the outcome of seven more or less hypothetical breeding programmes for Basel Zoo and their impact onto the genetic health of the world-wide zoo population.

Irene Bisang (Dept. of Botany, Stockholm University, S-106 91 Stockholm, Sweden. Formerly: Institut für Systematische Botanik, Zollikerstr. 107, CH-8008 Zürich, Schweiz): Endangered bryophytes –Swiss and European perspective.

The "Red Data List for Swiss Bryophytes" indicates that 39% of the 1030 bryophyte species known to occur in Switzerland have vanished (5) or are rare and/or threatened

(214/182). Drainage of wetlands, intensified agriculture and forest management, and atmospheric pollution are found as the main causes of threat to species and populations. A **bryophyte species conservation plan** was elaborated on behalf of the Swiss National Office for Environment, Forest and Landscape (BUWAL). It is based on the examination of 525 individual records of taxa in acute need of protection. Only 31% of about 200 formerly known populations could be refound in a field survey, the proportion of confirmed populations being smallest in the Plateau (Mittelland). The report is addressed to the nature conservancy authorities of the 26 Swiss cantons and describes broad outlines for species conservation programmes. A separate **documentation** provides data sheets for the confirmed and recently discovered populations of the selected taxa with recommendations for practical conservation measures. Data on the population biology of *Anthoceros agrestis* and *Phaeoceros carolinianus* (hornworts; Anthocerotatae) and the implication for conservation actions are presented as an example. – National Red Data Lista for bryophytes have been compiled in 18 European countries, but bryophytes were rarely included in practical conservation efforts so far. Moreover, there is a strong need for rational assessments of conservation priorities on a larger scale to use the limited available resources in an optimal way. The recently published "Red Data Book of European Bryophytes", judging one fourth of the bryoflora as threatened or rare on the European level, is an important step in this direction.

Felix Gugerli[1], **Martin Bauert**[2], **Ingrid von Flüe**[1], **Rolf Holderegger**[1], **Eva Lutz**[1] **& Jakob Schneller**[1] ([1]Institut für Systematische Botanik, Universität Zürich, Zollikerstr. 107, 8008 Zürich; [2]Geobotanisches Institut, ETH Zürich, Zürichbergstr. 38, CH-8044 Zürich, Schweiz): Patterns of genetic variation in populations of five different *Saxifraga* species with respect to distribution, habitat and reproduction.

Species of *Saxifraga* are important elements of the circumarctic and alpine flora. There is large variation in the genus with regard to ecological and evolutionary parameters, such as geographic distribution, habitat characteristics, population history, life-form, breeding system, and potential for asexual reproduction. We studied five species (*S. aizoides*, *S. biflora*, *S. cernua*, *S. mutata*, *S. oppositifolia*), which represent a wide array of the above mentioned variation within the genus. To investigate the genetic variation within and among populations, we used isozyme electrophoresis or RAPDs. The investigations covered different geographical scales and biogeographical situations, e.g., isolated relic populations of the arctic-alpine *S. cernua* or high alpine populations of *S. oppositifolia* from its continuous main distribution area in Central Europe. The reproductive strategies partially explained the detected patterns of genetic variation of the respective species. But only when several additional parameters are taken into account, i.e., biogeography, habitat dynamics, population size, or flowering phenology, can we relate our results to expectations which are based on theoretical concepts.

Ruth Streitwolf-Engel, Marcel G. A. van der Heijden, Ian R. Sanders, Thomas Boller & Andres Wiemken (Botanisches Institut, Universität Basel, Hebelstr. 1, CH-4056 Basel, Schweiz): Sexual and asexual reproductive traits of two *Prunella* species are influenced by co-occurring arbuscular mycorrhizal fungi.

P. vulgaris and *P. grandiflora*, like most perennials of species-rich grasslands, have the possibility to reproduce both sexually and asexually. The population structure of these two species will be affected by the proportion and frequency of sexual propagation versus clonal propagation. In both species, clonal reproduction is dependent on stolon branching intensity and stolon length. Differences in these traits are normally explained either as genotypic effects or as effects of environmental heterogeneity. We investigated the influence of colonisation by different arbuscular mycorrhizal fungi (AMF), which were isolated from a species-rich calcareous grassland, on reproductive traits of *Prunella*. The different AMF isolates had significantly different effects on clonal growth in each of the two plant species. AMF differentially influenced the stolon branching intensity and stolon length in *P. vulgaris* and flowering in *P.*

grandiflora. Although our experiment included mixed genotypes of *Prunella*, the AMF isolate effect was very strong, suggesting that it plays an important role. To test this, several genotypes of *P. vulgaris* were collected from the field site, propagated by meristem culture and grown with several AMF isolates from the same field site. First results show that there is a significant effect of plant genotype on clonal growth as well as an AMF isolate effect. Our results suggest that AMF have the potential to affect the number and distribution of ramets in *Prunella* populations as well as their genetic diversity. The genotypic variation is shown to be important in affecting clonal growth, but the AMF occupying the roots is just as important as a potential regulator of plant populations.

Nicolas Maire[1], **Daniel Borcard**[2], **Willy Matthey**[2] & **Endre Laczkó**[3] ([1]C/Reloj 1, E-13300 Valdepeñas (C. Real), Spain; [2]Institut de Zoologie, Université de Neuchâtel, Emile-Argand 11, CH-2007 Neuchâtel, Suisse; [3]SOLVIT, Langsägestrasse 15, CH-6010 Kriens, Schweiz): Organic matter recycling in grassland soils of the Swiss Jura mountains: biodiversity and strategies of the living communities.

Several characteristics of the soils of three nutrient-poor grasslands, pertaining to the biological activity in the soils, have been measured three times during the vegetative cycle of 1994 in the Swiss Jura: abundances of the faunal groups Collembola (Insecta), Oribatida, Gamasida and Actinedida (Acarina), PLFA spectrum (Indicating microbial diversity), ATP content (an index of soil biomass) and soil respiration (CO_2), as well as the enzymes alkaline phosphatase, urease, chitinase, xylanase and laminarinase, as biochemical tracers of biotic activity.

Most of these variables show significant differences from site to site. In particular, the biochemical descriptors ATP, phosphatase and urease vary in accordance to the importance of the argilo-humic complex.

Seasonal variations are also important, and conditioned by organic matter recycling. The studied soils show **two strategies of litter degradation:** (a) an **enzymatic strategy**, prevailing at the end of winter, when the edaphic climate is unfavourable; (b) a **biotic strategy**, based upon the work of the whole living community (fauna and microflora), at its maximum at the end of summer and in autumn.

Diversity of the microbial communities (as estimated by the PLFA diversity) is highest in spring, when the carbon sources are complex (young litter), and decreases along the season, in inverse relationship with the specific activity of the biomass (CO_2/ATP ratio). This behaviour is attributed to an increase of the amount of simple organic compounds. This increase is probably due both to the enzymatic activity and to the activity of microphytophagous microarthropods.

Monitoring: methods, scales and priorities

Urs Hintermann (Hintermann & Weber AG, CH-4153 Reinach): Monitoring of biodiversity in Switzerland.

The changes of biodiversity (genetic diversity, species diversity and diversity of habitats) in Switzerland are to be surveyed in a long-term project, the Biodiversity Monitoring of Switzerland (BDM-CH).

At the present time BDM-CH includes 30 indicators. Indicators concerning the state of species diversity are inevitably central. Most of the indicators can be calculated from already existing data. A few central indicators require additional data-gathering programmes: the frequency of common species and the species richness in cultivated and other areas are to be surveyed by systematic sampling.

Annual reports based on series of data stretching over a period of five to ten years are planned. Statements concerning the whole of Switzerland are most important. At the same time statements can be made referring to areas covering at least 10% of the country's surface.

Reports on biodiversity are aimed at many different groups (i.e. administration, politics, general public, NGO) with very varying requirements. The information must therefore be individually prepared for each of these groups.

Philippe Jeanneret (Eidg. Forschungsanstalt für Agrarökologie und Landbau (FAL), Reckenholzstr. 191, 8046 Zürich, Schweiz: Biodiversity (species diversity) analysis: on the need of defining the purpose and using a multimethod approach.

While studying the biodiversity, the analysis of data based on species lists is a crucial point. Usually, people use some synthetic value like the well known Shannon and Simpson index to describe the species diversity. Another method is to relate the individual distribution within the species to models like the logarithmic series model. These methods are proved to be relevant in appreciating the structure of a given community and can also be used to compare sites or ecosystems and relate the biodiversity to environmental factors through the simple and multiple regression analysis. The advantage of using an index is that a lot of information is summarised in only one value. The disadvantage is that we lose information about the species themselves. Indeed, when sites are compared with an index, it is realistic to have values very close to each other if not equal, but the community can be composed with a completely different set of species with a very different ecological meaning. It is then particularly difficult to interpret the relationship between the investigated community and the environmental variables that could explain the difference between sites. It is therefore necessary to use a multidimensional approach, using multivariate analysis and associated statistics (Principal Component, Canonical. Corresp. Analysis, etc.). These methods are particularly adapted to the comparison of sites and to the investigation of the relationship between the studied community and the environment. It has the advantage to keep the information about the species, because the methods compare the sites not only on the basis of the individual distribution within the species, but also taking into account the species list for each site. Furthermore, to relate the community to the environmental variables, it is possible to use the variance partitioning like in the regression analysis.

Christoph Scheidegger, Stefan Zoller & B. Frey (Institut für Wald, Schnee und Landschaft (WSL), CH-8903 Birmensdorf, Schweiz): Strategies for the conservation of epiphytic lichen populations.

Intensified agricultural or forestry management, acidic air pollution and/or ozone are major causes for the decline or local extinction of numerous epiphytic lichen species. Populations of rare epiphytic lichens are often restricted to a very low number of trees and the main threat for the lichen is the death or cut-off of its substrate. Although habitat conservation such as the protection of phorophytes or the specific management measures of the forest stand is essential for the maintenance of small populations, specific conservation measures at the population level are needed in order to reduce the influence of environmental stochasticity. Long-term maintenance of the population could probably most successfully be realised by increasing the population size in terms of number of trees colonised by the lichen species.

Transplantation of vegetative diaspores of various threatened lichens such as *Sticta sylvatica, Lobaria pulmonaria, Bunodophoron melanocarpus* and *Parmotrema crinitum* enabled the establishment of additional populations. Because harvesting vegetative diaspores did not negatively influence the natural population, this method was found to be a suitable approach for lichen conservation activities aimed at increasing small and therefore endangered populations.

Niklaus Zbinden (Schweizerische Vogelwarte Sempach): Die Überwachung der Avifauna in der Schweiz. Methoden – Stand – Bedeutung.

Die Überwachung von Fauna und Flora ist insbesondere für die Festlegung von Prioritäten im Naturschutz und den Vollzug verschiedener gesetzlicher Bestimmungen wichtig. Dank einer grossen Zahl von Amateurspezialisten ist die Voraussetzung für Datenerhebung bei den Vögeln besonders günstig. Da Artenzusammensetzung und Bestandsgrösse sich ständig wandeln, ist eine kontinuierlich Überwachung nötig. Die Schweizerische Vogelwarte Sempach sammelt seit den 1950er Jahren Beobachtungsmeldungen, und das Meldewesen wurde anfangs der 80er Jahre stärker standardisiert. Neben den Zufallsmeldungen wird von Amateuren auf alljährlich bearbeiteten Flächen die Bestandsentwicklung der eher häufigen Arten erhoben. Da die ehrenamtlichen Mitarbeiter und Mitarbeiterinnen in erster Linie im Mittelland aktiv sind, erhalten wir für diesen wichtigen, vom Menschen stark geprägten Raum aussagekräftige Daten, während aus den Alpen und aus dem Jura wesentlich weniger Beobachtungen gemeldet werden. Um ein repräsentatives Bild der Situation der Avifauna der Schweiz zu erhalten, wird gegenwärtig ein Überwachungsprogramm entwickelt, bei dem vorgegebene Flächen zu bearbeiten waren. Für deren Auswahl ist neben einer ausgewogenen geographischen Verteilung die praktische Durchführbarkeit zu berücksichtigen, insbesondere im schlecht zugänglichen Alpenraum. Neben der Bestandsentwicklung ist die Erfassung der Verbreitung und deren Veränderung ein wichtiges Kriterium für die Beurteilung der Situation einer Vogelart. Dazu werden Atlasprojekte durchgeführt. Eine erste Aufnahme erfolgte 1972-76, die zweite 1993-96. Die Überwachung ist von besonderer Bedeutung, wenn gezielt Landschaftsaufwertungen vorgenommen werden und eine Erfolgskontrolle durchgeführt werden soll.

Biodiversity in grasslands

Bernhard Schmid, Jasmin Joshi & Matthias Diemer (Institut für Umweltwissenschaften, Universität Zürich, Winterthurerstr. 190, CH-8057 Zürich, Schweiz): Biodiversity and the restoration of permanent grassland.

With large areas of land taken out of the agricultural system in Europe it becomes an important question how the abandoned land should best be restored. With respect to ecosystem and landscape integrity the best option may often be to establish permanent grassland that is managed by low-intensity mowing or grazing. In a European-wide programme experimental plots with 1, 2, 4, 8, and >10 plant species were set up at eight locations, including one in the Jura mountains near Basel (village of Lupsingen). The first two years of observations and measurements show that both ecosystem properties as well as population dynamics of selected species are strongly influenced by plant diversity. Often, these response variables are linearly related to the logarithm of plant species number, suggesting that the omission of a fixed proportion of species in a sown grassland (or the loss of species in a natural grassland) is more problematic in low- than in high-diversity systems. The preliminary conclusion of our research is that permanent grassland can faster be restored if high- rather than low-diversity mixtures are sown (faster build-up of vegetation cover and standing biomass, greater invasion resistance, etc.). The further monitoring of the experiment will show if these effects also translate into long-term differences among the mixtures.

Paul W. Leadley, Pascal Niklaus, Reto Stocker & Christian Körner (Botanisches Institut, Schönbeinstrasse 6, Universität Basel, CH-4056 Basel, Schweiz): Effects of experimental manipulations of plant diversity on ecosystem function in a calcareous grassland.

In order to determine the effects of a decline in species richness on ecosystem function in calcareous grasslands, we manipulated plant species number and CO_2 concentrations at a low altitude field site in the Jura Mountains of Switzerland. Experimental plots were planted with 5, 12 or 31 species of plants commonly found in the calcareous grasslands of the region and then these plots were exposed to ambient or elevated CO_2. Three years after planting we find that decreasing species number led to a reduction in aboveground plant biomass, particularly in the fall, and reductions in plant biomass were accompanied by lower rates of canopy photosynthesis. We also observed that soil solution concentrations of nitrate increased with declining diversity, but we saw no change in soil water content. The primary effect of elevated CO_2 at all diversity levels was to increase canopy photosynthesis and soil water content. No effect of elevated CO_2 on plant biomass was observed in any of the diversity treatments except in the first year following planting. We suggest that changes in species richness of these calcareous grassland communities will have a strong influence on ecosystem functions even at levels of species richness greater than five.

Marcel G. A. van der Heijden, Ruth Streitwolf-Engel, Ian R. Sanders, Thomas Boller & Andres Wiemken (Botanisches Institut, Universität Basel, Hebelstr. 1, CH-4056, Schweiz): Diversity of arbuscular mycorrhizal fungi as a potential determinant of plant community diversity.

Arbuscular mycorrhizal fungi (AMF) form mutualistic symbioses with the roots of approx. 80% of plant species. In species-rich grasslands, highly diverse communities consisting of many different AMF species occur. The function and importance of these diverse AMF communities for plant communities is, at present, unknown. If the growth of plant species is differentially affected by different AMF species then the diversity and species composition of AMF communities could be important in determining plant community diversity. To test if plant species respond differently to different AMF species, three plant species were inoculated with four different AMF species, all of which originated from the same species-rich grassland. The plant species responded differently to each of the AMF species. Furthermore, by using multivariate statistical techniques we show that the degree to which the plants responded to each of the AMF isolates varied among the plant species. Some plant species responded differently to almost every AMF species tested while other plant species respond indifferently to several AMF species even though they benefit from the symbiosis. The results suggest firstly that the fitness of some plant species may be much more dependent on which AMF species colonises their roots than in other plant species and secondly that plant species coexistence may depend on which AMF species colonises plant roots. AMF diversity may, therefore, strongly influence plant community structure by differentially affecting plant species.

Stephan Ledergerber, Claudine Dolt & Bruno Baur (Institut für Natur-Landschafts- und Umweltschutz (NLU), Universität Basel, St. Johanns-Vorstadt 10, CH-4056 Basel, Schweiz): Assessment of grazing pressure in a fragmented grassland.

Habitat fragmentation is expected to change the abundance of species, species composition and interactions between species (e.g. plant-herbivore interactions) in the remnants. We examined grazing damage in the three plants *Betonica officinalis, Cirsium vulgaris* and *Salvia pratensis* in experimentally fragmented grasslands in the Swiss Jura mountains. The extent of grazing damage increased in all three plants from July to September 1996. The grazing damage varied among species and reached a maximum of 18% of leaf area consumed in *S. pratensis*. Grazing pressure was assessed in fragments and corresponding control plots by exposing seedlings of *Trifolium repens*, grown in little dishes, to herbivores (grasshoppers and gastropods) in the field. Herbivore pressure was lower in experimentally fragmented plots than in the control plots. Furthermore, herbivore pressure decreased with fragment size. These effects were significant in June but not in September 1996. This could be explained by differences in plant growth and changes in herbivore density between fragmented and non-fragmented areas, as well as by seasonal changes in the composition and activity of herbivores.

Hans-Peter Rusterholz & Andreas Erhardt (Botanisches Institut der Universität Basel, Schönbeinstrasse 6, CH-4056 Basel, Schweiz): Do butterflies select for specific nectar constituents? From field observations to experiments.

For most butterflies, nectar is the most important food resource in their adult stage. Since butterfly-pollinated flowers have high sucrose: hexose ratios and high levels of amino acids in their nectar, the question arises if butterflies select for these specific nectar properties. Field observations in the Swiss Jura mountains showed that males and females of *Lysandra bellargus* differ in their flower preferences. These differences are correlated with differences in nectar characteristics of the preferred flowers: males preferred flowers with high amounts of sucrose in their nectar whereas females tended to prefer flowers with nectar rich in amino acids. Nectar preference experiments with *Inachis io* butterflies showed that (1) males and females preferred both sucrose and fructose over glucose and also sucrose over fructose. (2) In tests with mixed sugar solutions, the butterflies clearly preferred both sucrose-dominant and balanced sugar solutions over hexose-dominant sugar solutions. (3) Females clearly preferred a mimic of *Lantana camara* nectar containing amino acids over a corresponding plain sugar solution, whereas males did not discriminate between these test solutions. These results confirm the hypothesis that butterflies select for high levels of sucrose and amino acids in floral nectar, and suggest that adult feeding may also play an important, if so far not adequately recognised role for longevity and reproduction in butterflies.

Posters

Adrian Aebischer (Zoologisches Institut, Universität Freiburg, Pérolles, CH-1700 Freiburg, Schweiz): Determinants of bird abundance changes in a periodically disturbed environment.

Monique Derron (Sekretärin der SKEW, Domaine de Changins, case postale 254, CH-1260 Nyon 1): Schweizerische Kommission für die Erhaltung von Wildpflanzen - SKEW / Commission suisse pour la conservation des plantes sauvages - CPS / Commissione svizzera per la conservazione delle piante selvatiche - CPS.

Das Ziel der SKEW ist die Forderung des Schutzes der genetischen Vielfalt der wildwachsenden Pflanzen. Die SKEW unterhält ein Sekretariat, das als Informations- und Vermittlungsstelle funktioniert und in kooperativer Verbindung mit dem BUWAL, dem SBN, den Kantonalen Naturschutzfachstellen sowie den Botanischen Gärten und Universitätsinstituten steht. Es unterstützt und initiiert auch selber Projekte. Im Bereich der Arterhaltung wurde die Priorität auf die europaweit gefährdeten und seltenen Arten in der Schweiz gelegt. Aufgrund der vom Sekretariat auf Umfragen basierenden aufgebauten Datenbank, Literatur- und Herbarrecherchen sowie umfassender Feldarbeit wurden 1995 und 1996 von Ch. Käsermann die Bestandesentwicklung sowie die Gefährdung von 36 Arten untersucht und aufgrund der Resultate aktuelle Verbreitungskarten sowie Vorschläge für geeignete Schutzmassnahmen aufgestellt. Die Ergebnisse werden für jede bearbeitete Art in einem Merkblatt zusammengefasst und an die zuständigen Stellen zur Information verschickt. Im Bereich der Erhaltung der genetischen Vielfalt innerhalb der Arten hat die SKEW "Empfehlungen zur Gewinnung und Verwendung von standortgerechtem Saat- und Pflanzgut" mit allgemeinen Richtlinien und Artenlisten erarbeitet.

Monique Derron[1] (Sekretärin - SKEW), **Raoul Palese**[2] (Koordinator - CRSF), **Beat Bäumler**[2] (Mitarbeiter - CRSF) **& Daniel Moser**[2] (Mitarbeiter - CRSF) ([1]Sekretariat SKEW, Domaine de Changins, case postale 254, CH-1260 Nyon 1; [2]CRSF, case postale 60, CH-1292 Chambésy (Genève) / ZDSF, Altenbergrain 21, CH-3013 Bern, Schweiz): Erhaltung der gefährdeten Arten in der Schweiz, 1. Teilprojekt. Zusammenarbeit ZDSF - SKEW (Zentrum des Datenverbundnetzes der Schweizer Flora, Schweizerische Kommission für die Erhaltung von Wildpflanzen).

Die 1995/96 erstellte Datenbank zu 36 europaweit gefährdeten und seltenen Arten der SKEW und die weiteren beim SKEW-Sekretariat eingegangenen und eingehenden Fundmeldungen werden an das ZDSF übergeben. 1997 wird ein erstes gemeinsames Projekt "Erhaltung der gefährdeten Arten in der Schweiz, 1. Teilprojekt" durchgeführt. Die so erhaltenen Daten werden vom ZDSF aufgearbeitet, das unter anderem aktuelle Verbreitungskarten aufstellt. Die SKEW gibt Merkblätter zu den neu bearbeiteten Arten heraus und leitet weitere Projekte zu den am stärksten gefährdeten Arten ein. In Zukunft werden die Informationen laufend zwischen beiden Institutionen ausgetauscht das Ziel ist folgendes: das ZDSF verarbeitet die Grundlageninformationen und liefert Karten mit dem ehemaligen und dem aktuellen Verbreitungsgebiet; die SKEW kann aufgrund dieser Angaben zusammen mit ihren eigenen Informationen die Gefährdungssituation einer Art beurteilen und gezielte Artenschutzprojekte initiieren.

Claudine Dolt, Stephan Ledergerber & Bruno Baur (Institut für Natur-, Landschafts- und Umweltschutz (NLU), Universität Basel, St. Johanns-Vorstadt 10, CH-4056 Basel, Schweiz): A quantitative analysis of standing crop in artificially fragmented grasslands.

Habitat fragmentation may affect plant growth at the edges of fragments. We examined this hypothesis by measuring the aboveground plant biomass production in artificially fragmented, unfertilised calcareous grasslands in the Swiss Jura mountains. The aboveground plant biomass was collected in 48 fragments (12 fragments measuring 4.5 x 4.5 m, 12 fragments 1.5 x 1.5 m and 24 fragments 0.5 x 0.5 m and 48 control plots of corresponding size) in October 1996. In small and medium-sized fragments the plant biomass (expressed as g DW/m^2) was significantly larger than in control plots of the same size. In fragments plant biomass per area decreased with fragment size, whereas in control plots no size effect was found. The increase of plant biomass per area in the fragments may mainly be due to edge effects. The increased plant biomass may change interactions among plants as well as interactions between plants and herbivores.

Peter M. Frischknecht[1], Regula Steiner[2] & Olaf Weber[2] ([1]Departement für Umweltnaturwissenschaften, ETH Zürich; [2]Umweltnatur- und Umweltsozialwissenschaften, ETH Zürich, Schweiz): Bewertung von Biodiversität durch Interessensgruppen als Grundlage für Raumnutzungsverhandlungen.

Ein zentrales Problem für die Erhaltung von Biodiversität ist die Verfügbarkeit des notwendigen Raums. In der Regel bestehen für jede Fläche verschiedenartige Nutzungsinteressen, die miteinander in Einklang gebracht werden müssen.

Im Rahmen einer Fallstudie zum Zentrum Zürich Nord wurde für die Grünraumplanung ein empirisches Verfahren angewendet, das auf einer Bewertung des Grünraums durch Vertreter und Vertreterinnen von Interessensgruppen basiert. Es wurde ein sogenannter Explorationsparcours aufgebaut, der aus einer Folge von Interviews und Situationsbegegnungen bestand und eine Beschreibung der Interessen von Akteurgruppen ermöglichte. Im Zentrum dieses Explorationsparcours stand eine computergestützte Bewertung zentraler Kriterien der Grünraumgestaltung. Diese Kriterien umfassten die ökologische, umwelthygienische, soziale und ökonomische Perspektiven.

Es zeigt sich, dass auf einer emotionalen Ebene die ökologische Perspektive sehr hoch bewertet wird, bei einer multikriteriellen Bewertung, basierend aud entscheidungstheoretischen Grundlagen, jedoch andere Perspektiven stärker gewichtet werden. Zudem können auch unterschiedliche Interessen der einbezogenen Gruppen nachgewiesen werden.

Auf der Basis dieser offengelegten Interessenlage könnten in einem nachfolgenden moderierten Verhandlungsprozess Nutzungskonflikte entschärft und gleichlaufende Interessen für eine multifunktionelle Nutzung des Raumes ausgenützt werden.

Nadine Gerber & Andreas Stampfli (Geobotanisches Institut, Universität Bern, Schweiz): Vegetations-Monitoring in artenreichen Wiesen.

Globale Umweltveränderungen und ein rascher tiefgreifender Wandel in der Landwirtschaft erschweren die Aufgabe, die biologische Vielfalt von Lebensgemeinschaften durch geeignete Nutzung langfristig zu erhalten. Rechtliche Grundlagen zur Erhaltung artenreicher Wiesen sind in der Schweiz vorhanden, es besteht jedoch ein grosser Handlungsbedarf zugunsten der Artenvielfalt. Am Beispiel der Tessiner Magerwiesen werden Schwachpunkte stattlicher Naturschutzbemühungen aufgezeigt. Die gegenwärtigen Massnahmen und Instrumente sind ungenügend, weil sie dem starken Rückgang von Wiesenarten in einzelnen Regionen nicht zielgerichtet entgegenwirken. Wir schlagen als Ergänzung vor, dass in den heute weitgehend bekannten "regionalen Zentren des Artenreichtums" bestimmte Flächen kontrolliert genutzt werden und einer langfristigen Überwachung der Artenvielfalt erste Priorität eingeräumt wird. Beispiele des Vegetations-Monitorings in solchen "Schwerpunktgebieten" werden vorgestellt.

Rob Hendriks & Joop Ouborg (Department of Ecology, University of Nijmegen, The Netherlands): Genetic erosion and loss of biodiversity. The current use of population genetic theory in nature conservation in the Netherlands.

In this one year pilot project, funded by the Dutch Prins Bernhard Fund, the (potential) role of population genetic theory in nature conservation is the subject of study. A provisional literature survey provided the theoretical aspects that are most relevant to the conservation of populations and species in an increasingly fragmented Dutch landscape. Based on these insights an inventory is being made of the practice of nature conservation and the policy towards genetic erosion, reintroduction of species, the use of corridors, etc. among the main nature conservation organisations in the Netherlands. Furthermore current and planned Dutch research activities in the area of conservation genetics are being listed in order to determine to what extent policy, practice and research are in line with each other and with the main questions resulting from the literature survey.

Fridli Marti[1] **& André Stapfer**[2] ([1]quadra – Beratungsgemeinschaft für Naturschutz und Landwirtschaft, Zürich; [2]Baudepartement des Kantons Aargau, Abt. Landschaft und Gewässer, Aarau): Controlling and reporting in nature conservation: assessing the success of conservation measures and monitoring ecological change in the canton of Aargau.

In the canton of Aargau there is currently an extensive programme underway for assessing the success of conservation measures and for monitoring ecological change ("Kontrollprogramm"). This programme has been developed for the years 1993 to 2001 by the cantonal agency for nature conservation as part of the programme "Nature 2001". It is based on some ten years of experience with monitoring in the canton of Aargau. During development and application several aspects have been recognised as vital for a successful realisation:

- Proper definition of goals and targets for conservation measures.
- Clear distinction between assessing implementation, effectiveness and target definition.
- Extensive coordination between projects for conservation measures and projects for assessing their success.
- Presentation of the results of monitoring and assessing the success by means of environmental reporting and performance review (feedback for environmental policy and public opinion).

Some of the projects that have been developed according to these guidelines are: assessing the success of management measures in nature reserves and of financial subsidies in agriculture as well as monitoring of biodiversity in managed landscapes and in biodiversity hotspots. After only the first few years the usefulness of the programme became evident: Some of the projects have already revealed first trends which in some cases allowed an optimisation of different conservation measures and processes.

Raoul Palese (Koordinator), **Beat Bäumler** (Mitarbeiter) **& Daniel Moser** (Mitarbeiter) (CRSF, case postale 60, CH-1292 Chambésy (Genève) / ZDSF, Altenbergrain 21, CH-3013 Bern, Schweiz): Zentrum des Datenverbundnetzes der Schweizer Flora - ZDSF / Centre du Réseau Suisse de Floristique - CRSF / Centro della Rete Svizzera di Floristica - CRSF.

Die grundsätzlichen Aufgaben des Zentrums sind der Aufbau, der Unterhalt und dieWeiterentwicklung einer gesamtschweizerischen floristischen Datenbank, welche vielfältige Angaben zur Flora der Schweiz sammelt. Es trägt mit diesen Daten zu einer kontinuierlichen Überwachung der pflanzlichen Biodiversität der Schweiz und zum Schutz von Biotopen und Arten bei, indem es für Naturwissenschaftler und Verantwortliche in Natur- und Landschaftsschutz für Auskünfte zur Verfügung steht. Die Datenbank erlaubt nicht nur die Verwaltung, sondern auch die Auswertung der Daten auf vielfältige Weise, wie z. B. das Erstellen aktueller Verbreitungskarten, die Aktualisierung Roter Listen oder die Herausgabe der Fortschritte in der Schweizer Floristik. Mit dem in der Datenbank enthaltenen Synonymie-Index der Schweizer Flora und der angrenzenden Gebiete hat das ZDSF zudem eine wichtige Grundlage für die Vereinheitlichung der Nomenklatur der Schweizer Flora geschaffen.

Die Stiftung des ZDSF vergügt über zwei Geschäftsstellen in Genf (Conservatoire et jardin botaniques) und in Bern (Geobotanisches Institut) deren Arbeit von zahlreichen ehrenamtlichen Mitarbeitern unterstütz wird.

Finanziell getragen wird das ZDSF zurzeit durch die Gründungsmitglieder (SANW, SBN, SBG, Stadt Genf) sowie durch Beiträge des BUWAL, der Universität Bern sowie etlicher Kantone.

Andreas Stampfli & Michaela Zeiter (Geobotanisches Institut, Universität Bern, Schweiz): Can plant species decline due to abandonment of meadows be reversed by mowing?

Two experiments were carried out in an abandoned meadow situated in close vicinity to a mown meadow on the slope of Monte Generoso (southern Switzerland). During 20 years of abandonment species richness was strongly reduced due to competitive exclusion by the dominant grass *Brachypodium pinnatum*. In the first experiment annual mowing in July and October during eight years did not affect the proportions among abundant species. The majority of new species were most probably recruited from the persistent seed bank or from vegetative parts in the soil. The second experiment showed that species from an adjacent meadow were able to establish after having been sown in mown and burnt plots in the abandoned meadow. But there was no obvious case of spontaneous long-distance immigration. It is concluded that the former species composition of abandoned meadows cannot easily be restored by mowing because many plant species of meadows do not have persistent seed banks, and successful long-distance immigration is very unlikely.

Regula Tester (Urs Graf-Str. 11, 4052 Basel, Schweiz): A new indirect method for dormouse (Gliridae) recording.

The recent distribution and habitat preferences of dormice, especially in European alpine regions coincide neither with climatic factors nor with habitat availability. It is assumed that the distribution is a consequence of Pleistocene immigration and/or interspecific competition. Using a new method, called "hairtubes", which was described for the Hazel dormouse *(P. Bright & P. Morris, Mammal Society no. 11 (1989))*, it was possible to demonstrate the occurrence of all four central European dormice species in an area about 200 km^2 in a single field season by one person. There were four localities in which two or three different species occurred in sympatry. The method is very useful to easily get basic information about distribution, habitat preferences and coexistence. The method neither harms the animals nor does it reduce their fitness. The method is as successful as life traps, but more efficient, easier to use and less expensive than life traps.

Thomas Walter (Professur für Natur- und Landschaftsschutz, Departement Wald- und Holzforschung, ETH Zürich, Schweiz). Weitere mitwirkende Institutionen und Personen: **BUWAL** (Bern), **CSCF** (Centre suisse de carto-graphie de la faune) **KARCH** (Koordinationsstelle für Amphibien- und Reptilienschutz der Schweiz, 3005 Bern), **Schweizerische Vogelwarte** (Sempach), **Bürogemeinschaft für angewandte Ökologie** /Zürich), **Insecta** (Neuenburg), **Dr. Rainer Neumeyer** (Zürich), **Dr. Achim Otto Erlenbach** (Informatikdienst, ETH Zürich): Aua: Faunistische Datenbank als Instrument für den Naturschutz in der Schweiz unter besonderer Berücksichtigung des Auenschutzes.

Ziel des Projektes ist die Erstellung eines Instrumentariums, um faunistische Aspekte beim Vollzug des Auenschutzes besser berücksichtigen zu können. Dazu wurde als Grundlage eine Datenbank eingerichtet, welche es ermöglicht, folgende Informationen über Tierarten in ihren verschiedenen Entwicklungsstadien miteinander zu verbinden: Biotoptypen, Strukturen, Phänologie, Verbreitung, allgemeine Arteigenschaften, Nahrung, Gefährdung, Systematik, Literatur und Beobachtungen. Die Beobachtungen wurden aus den Datenbanken des CSCF, der KARCH und der Schweizerischen Vogelwarte übernommen. Die weiteren Informationen entstammen der Literatur.

Die Datenbank ist bezüglich der Struktur und den Relationsmöglichkeiten in der vorliegenden Form ein Novum. Von spezieller Bedeutung ist die gesonderte Behandlung verschiedener Entwicklungsstadien der Tierarten bezüglich der ökologischen Eigenschaften. Damit können potentielle Auswirkungen von Bewirtschaftungen und Eingriffen (auch ausserhalb von Auen) auf einzelne Arten oder Artgruppen beschrieben werden. Potentiell in einem Gebiet vorkommende Arten können nach horizontaler und vertikaler Verbreitung und nach Biotoptypen abgerufen und mit den bis anhin in diesen Gebieten registrierten Arten verglichen werden. Ebenso sind z. B. die Gefährdungen und Schutzstatus der Arten in verschiedenen Biotoptypen abrufbar. Sie können als Grundlage für die Festlegung von Schutzprioritäten verwendet werden. Über Eigenschaften einer einzelnen Art kann zudem rasch ein Überblick gewonnen werden. Ergänzungen und neue Erkenntnisse können laufend in die Datenbank integriert werden.

Jürg Zettel, Ursula Zettel & Andreas Ryser (Zoologisches Institut, Universität Bern, Schweiz): Surface activity in *Ceratophysella sigillata* (Collembola: Hypogastruridae) and the influence of climatic parameters.

C. sigillata is a monovoltine species living in lowland forests and displaying a unique biology. Main growing season is winter, reproduction takes place in early spring; summer and autumn are spent in a dormancy. Each individual runs through two polymorphisms with a total of four different morphs: a reproductional polymorphism, and a seasonal polymorphism coupled with dormancy. The species is not evenly distributed in its habitat, but occurs in individual-rich colonies comprising up to more than a million individuals. These colonies show a spectacular and synchronised pattern of surface activity during four time windows: two in winter and two in spring and early summer. Only two morphs are involved in this behaviour. Active colonies may move over the forest floor and may climb on trees to feed on algae colonising the bark.

Surface activity is restricted by low humidity and by temperature. In late spring and early summer high temperatures (above 10°C for adults, above 20°C for juveniles) reduce surface activity, a low threshold is never attained. In winter activity can be observed down to –2°C, at lower temperatures the animals retreat into the litter layer. Feeding may occur at subzero temperatures, too. Values between +5 and 0°C are optimal, at lower values the bimodal diel activity pattern is shifted towards a single peak at dusk. With the presence of snow the surface activity can be observed mainly during late afternoon.

Stephan Zoller & Christoph Scheidegger (Institut für Wald, Schnee und Landschaft (WSL), Birmensdorf, Schweiz): Transplantation of isidia and thallus fragments from the endangered lichens *Parmelinopsis minarum* and *Parmotrema crinitum* as a conservation measure.

The two foliose lichen species *Parmelinopsis minarum* and *Parmotrema crinitum* are considered as critically endangered in Switzerland. *Parmelinopsis minarum* is only known from a few small populations. These populations are especially threatened by forestry measures and stochastic perturbations (e.g. wind throw). The risk of extinction would be reduced by increasing the number of subpopulations on different trees or boulders. To achieve this aim we dispersed vegetative diaspores (isidia) artificially, transplanted small thallus fragments and studied survival, growth rate and development.

The transplantations were carried out in the valley of Bergell. Cotton gauze discs (1 cm diameter) were fixed on selected substrata (boulders and *Abies alba*). Isidia were collected with a small brush from intact thalli and transferred onto the discs. Thallus fragments of both species were fixed with glue next to the discs. Discs and fragments were regularly photographed, samples taken to the lab and studied with a scanning electron microscope. In *P. crinitum* cilia tips established fan shaped contact zones with the cotton fibres within two months. Diaspores of *P. minarum* needed four to six months to form anchoring hyphae. Rain and water run-off can wash the isidia down easily before establishing the attachment and therefore loss of diaspores is considerably high (40-90%). Isidia of *P. crinitum* (with cilia) survived better than *P. minarum* (without cilia). Additional pseudo-meristematic growth zones were formed within six months *(P. crinitum)* and ten months *(P. minarum)*. In *P. crinitum* these growth zones developed after 16 months into obovate lobes with up to 0.6 mm diameter. Transplanted thallus fragments survived at all sites but up to 50% of the fragments in *P. minarum* became necrotic or were destroyed by herbivores.

The results prove that transplantation of diaspores and small fragments is a useful method for the conservation of endangered lichens. The risk of extinction of the species through stochastic perturbations will be reduced due to a bigger population size. Further observations will show if the diaspores and fragments can grow and develop successfully to reproducing adult thalli.

Revue suisse de Zoologie 104 (4): 727-749; décembre 1997

Les espèces épigées du genre *Oritoniscus* (Crustacea, Isopoda, Oniscidea).
II. Le complexe *Oritoniscus bonadonai-pyrenaeus-remyi.*

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Studies on epigean species of the genus *Oritoniscus* (Crustacea, Isopoda, Oniscidea). II. The *Oritoniscus bonadonai-pyrenaeus-remyi* complex. - Epigean species of the genus *Oritoniscus* which lack obvious male sexual characters on peraeopods II and III are described or redescribed using morphological features and molecular markers. These approaches give convergent results. These species may be separated in three groups: the first consisting of *O. bonadonai* Vandel,1948, the second including *O. simplex* Vandel, 1957 and *O. pyrenaeus* (Racovitza,1907), and the third including *O. remyi* Dalens 1964, *O. aurensis* sp.n. and *O. baroussensis* sp.n.

Key-words: Isopoda - Oniscidea - *Oritoniscus* - Morphology - RAPD-PCR.

INTRODUCTION

Le groupe des espèces épigées de l'isopode terrestre du genre *Oritoniscus* a été retenu comme l'un des modèles d'une étude portant sur la distribution et l'origine des zones de haut endémisme en Europe de l'Ouest. Dans une première note (Dalens *et al.* 1996) nous avons montré que parmi les 4 espèces alors connues (*O. bonadonai*, *O. flavus*, *O. pyrenaeus* et *O. remyi*) l'une d'elles, *O. flavus*, s'individualisait par une différenciation très poussée des caractères sexuels secondaires mâles au niveau des péréiopodes II et III et qu'elle était en fait un complexe de 3 taxons dont nous avons, au moyen de critères morphologiques et moléculaires, établi la valeur spécifique.

Le présent travail est consacré à la description ou à la redescription de six espèces ne montrant aucune différenciation au niveau des péréiopodes mâles II et III. Il s'agit des 3 espèces *O. bonadonai*, *O. pyrenaeus* et *O. remyi* déjà citées auxquelles s'ajoutent *O. simplex* et 2 espèces nouvelles: *O. aurensis* et *O. baroussensis*. Leurs relations phénétiques sont précisées par l'étude du polymorphisme de leur ADN génomique au moyen de la méthode RAPD-PCR.

Manuscrit accepté le 16.04.1997.

Abbréviations utilisées dans le texte :

Cne Commune;
MNHN Muséum National d'Histoire Naturelle, Paris;
RAPD-PCR random amplified polymorphic DNA - polymerase chain reaction.

MATERIEL ET METHODES

Morphologie - Le matériel étudié provient essentiellement de récoltes effectuées par les deux premiers auteurs dans la chaîne pyrénéenne et dans le département du Var. S'y ajoutent des échantillons de la collection Vandel et occasionnellement du matériel légué par d'autres collecteurs. Par ailleurs, exception faite d'*O. bonadonai* et d'*O. pyrenaeus* dont les habitus sont caractéristiques et permettent une discrimination sûre des espèces dans les deux sexes, il n'est pas possible, dans le cas de mélanges d'espèces en une même station, de parvenir à une détermination fiable des femelles, aussi ne donnerons-nous à la fois le nombre de mâles et de femelles que dans le cas de récolte monospécifique.

Dans l'étude précédente, nous avions utilisés trois méthodes: morphologie, polymorphismes enzymatique et moléculaire. Au vu des résultats obtenus précédemment avec le groupe *O. flavus* et, compte tenu du fait qu'il ne s'agit plus dans le cas présent d'espèces sympatriques, conjointement à l'approche morphologique, nous avons préféré privilégier l'étude du polymorphisme de l'ADN génomique au moyen de la méthode de marqueurs moléculaires générés par RAPD-PCR.

Pour chacune des six espèces, l'analyse porte sur des individus mâles originaires d'une même localité. Les spécimens sont maintenus vivants en élevage ou conservés en azote liquide (-196°C) de préférence à l'alcool 95° qui s'est révélé inadéquat au delà de quelques jours. Extraction et amplification de l'ADN sont conduites comme indiqué dans notre précédent travail, avec toutefois une quantité d'enzyme Taq Polymérase fortement augmentée (1,3 unités dans 25 ml de volume de réaction). La reproductibilité est contrôlée par double expérimentation. Sur vingt amorces décamériques testées, quatre ont montré des bandes bien réparties et bien amplifiées
(A03 : 5'AGTCAGCCAC; A04 : 5'AATCGGGCTG3'; A11 : 5'CAATCGCCGT3'; A19 : 5'CAAACGTCGG3') et ont été retenues pour les analyses.

Analyse des données - Les différents fragments d'ADN séparés sur les gels peuvent être utilisés comme marqueurs pour détecter de façon globale les variations génétiques.Deux types de calculs ont été sélectionnés :

- Index de dissimilarité (**APD**) - Nous avons suivi le mode de calcul de la moyenne des différences entre individus (exprimé en pourcentage) indiqué par Gilbert *et al.*, (1990) et par Yuhki & O'Brien (1990) : **PD** (percent difference) = $(V_{AB} / F_A+F_B) \times 100$, où V_{AB} est le nombre total de fragments différents entre deux individus, F_A est le nombre de fragments résolus dans l'individu A et F_B le nombre de fragments dans B ; **APD** (Average percent difference) = $1/C \; \Sigma$ PD, où C est le nombre de comparaisons des individus pris deux à deux dans la population étudiée.

- Index de similarité - celui défini par Nei & Li (1985) sera utilisé. La mesure de la similitude entre individus s'effectue en déterminant le pourcentage de présence (ou absence) simultanée d'une bande chez deux individus selon la formule : **S** = 2 N_{AB} / $N_A + N_B$ où N_{AB} est le nombre de bandes partagées, N_A et Nb étant les nombres de chacun des individus.

La mesure des distances génétiques est effectuée par la méthode UPGMA (unweighted pair-group method of arithmetic averages) en utilisant les mêmes programmes informatiques que dans notre étude précédente. Ces programmes permettent en outre une évaluation graphique des relations phénétiques entre les différentes unités taxonomiques étudiées.

RESULTATS

ETUDE MORPHOLOGIQUE

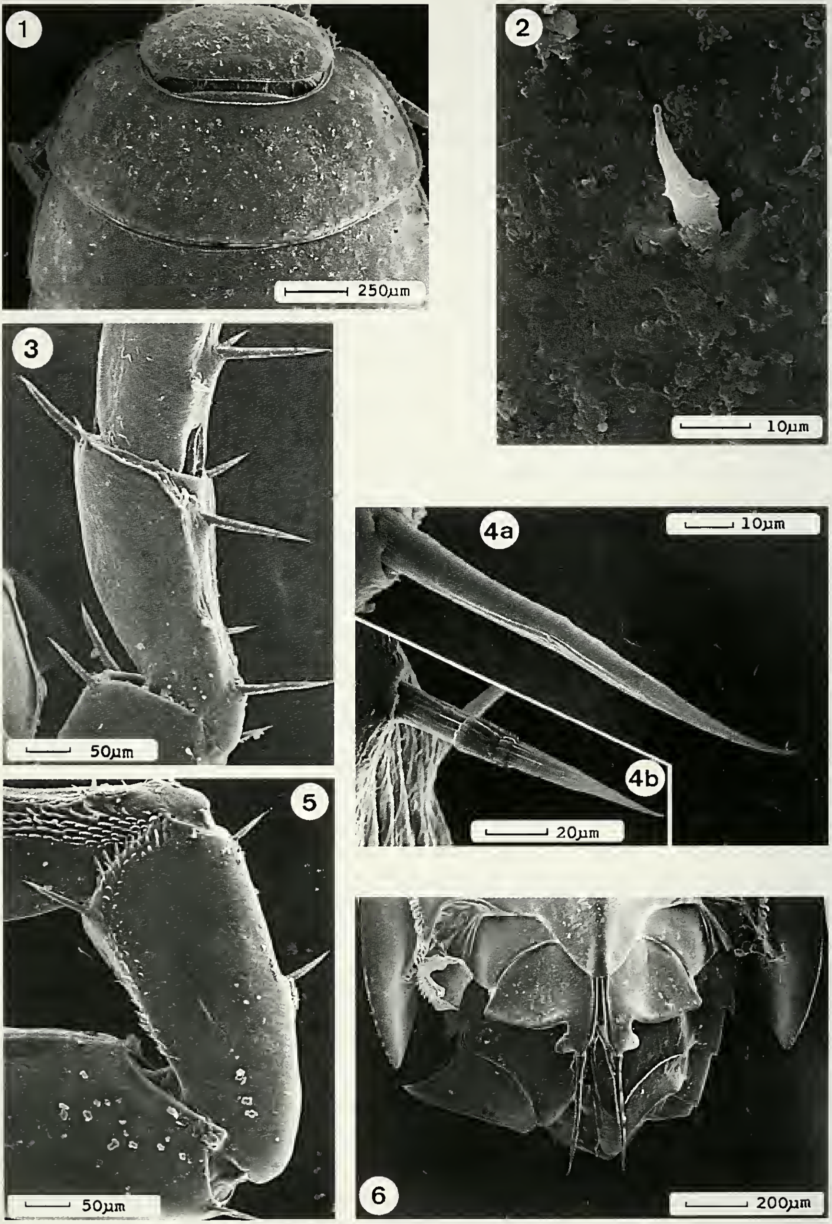
Oritoniscus bonadonai Vandel, 1948 Figs 1-6

Oritoniscus bonadonai Vandel, 1948: 8, figs. 1-4
Oritoniscus bonadonai; VANDEL 1960: 185, fig. 82

Matériel examiné: syntypes de la Collection Vandel du MNHN: Cne de Chateaudouble (Var); Baume Pouteri, 09/02/1946: 28♂♂, 25 ♀♀; 26/03/1949: 28♂♂, 55♀♀ -- Hameau de Rebouillon sur les bords d'un petit affluent de la Nartuby, 01/05/1946: 3♂♂, 6♀♀ -- aven du Mouret, 23/06/1946: 1♀;

Coll. Dalens: Cne de Chateaudouble (Var); Baume Pouteri (= grotte des Chauves-souris), alt. 449m, 30-31/04/1996: 86♂♂, 172♀♀ -- aven du Mouret à Rebouillon, 05.1996 A. Franco leg: 1♂, 1♀.

Description : les tailles maximales observées ont été de 5 mm pour un mâle et de 6,6 mm pour une femelle; dans la très grande majorité des cas cependant les mâles ne dépassaient pas 4,2 mm et les femelles 5,8 mm. C'est certainement la plus petite des espèces épigées du genre *Oritoniscus*. La coloration rose carminé est assez typique de l'espèce. Elle est uniformément répartie sur tout le corps y compris les pleurépimères et seules les insertions musculaires apparaissent un peu plus pâles. L'oeil est formé d'un ocelle unique de couleur foncée et bien apparent sur l'animal vivant. Sur l'animal fixé en alcool ou examiné au microscope électronique à balayage seul le bombement de la carapace à son niveau permet de le repérer, le revêtement cuticulaire du vertex recouvrant sa surface comme cela avait déjà été observé sur les trois espèces du groupe *O. flavus* et comme cela sera également le cas pour les cinq autres espèces qui suivent. L'antennule peut porter 10 aesthétascs apicaux flanqués d'une courte épine. Flagelle antennaire de 8 articles subégaux à l'exception du second sensiblement deux fois plus long que les autres et portant 11 à 12 aesthétascs. Les téguments sont lisses et garnis de soies simples et courtes (figs 1-2). En ce qui concerne les caractères sexuels mâles, ils concernent peu les péréiopodes qui restent assez indifférenciés. Seule l'épine sternale de la base du méros V amorce un début de différenciation marqué par un très léger sillon transversal et médian (figs 3-4a) qui, chez un individu de 5mm, s'est révélé plus accusé (fig 4b). La soie sterno-distale de l'ischion VI s'insère aussi bien chez le mâle que chez la femelle directement sur le corps de l'appendice (fig. 5). Au niveau des pléopodes de la première paire (fig. 6) l'exopodite présente un bord externe à concavité



FIGS 1- 6 - *Oritoniscus bonadonai.* 1: tergite I; 2: détail du revêtement cuticulaire du tergite I; 3: méros V ♂; 4: détail de la soie sterno-basale du méros, 4a: morphotype général, 4b: morphotype d'un ♂ de 5mm; 5: ischion VI ♂; 6: pléopodes 1 ♂; (clichés H. Dalens sur Hitachi S-450).

distale à peine esquissée, et un lobe interne prolongé par une forte tige se terminant par une pointe fine et courte.

Répartition : Cette espèce paraît uniquement présente dans le sud-est de la France, dans le département du Var. Elle semble restreinte au petit massif calcaire environnant Chateaudouble. Une population relativement dense existe dans la grotte des Chauves-souris; la capture de quelques individus dans l'aven du Mouret indique ou bien que la population y est peu dense, ou bien que le lieu de capture est marginal, le noyau de la population se trouvant dans une partie non explorée ou inaccessible. Malgré une prospection étendue aux massifs calcaires voisins (Draguignan - Chateaudouble - Tourtour - Salernes), l'espèce n'a pas été retrouvée dans les cavités visitées. L'espèce semble donc très localisée, ce qui semble confirmer l'opinion de VANDEL (1960) selon laquelle pour cette espèce "Il s'agit de toute évidence d'une relicte".

Oritoniscus simplex Vandel, 1957 Figs 7-12

Oritoniscus flavus simplex Vandel, 1957: 92, fig. 1A
Oritoniscus flavus simplex; VANDEL 1960: 189, fig. 84D

Lorsqu'il décrit ce taxon, VANDEL en fait une sous-espèce d'*O. flavus* dont selon lui elle ne diffère du type «..que par l'absence de différenciation sexuelle propre aux péréiopodes». Il ne désigne par contre, ni holotype, ni localité type. L'examen des échantillons présents dans sa collection sous la dénomination *flavus simplex*, montre qu'il s'agit dans la quasi totalité des cas, d'échantillons appartenant en fait à l'espèce *Oritoniscus remyi* Dalens, 1964. Le seul échantillon exploitable correspondant sensiblement à sa description est référencé 954 avec la date du 23.VIII.1919 sans aucune autre indication de provenance. Comme il ne semble manifestement pas s'agir en ce cas d'une référence Biospeologica, nous avons été amenés à choisir un topotype dans une population récoltée par nous même et provenant d'une localité située dans une région citée par Vandel comme hébergeant *flavus simplex*. Nous avons retenu la station d'Arrec d'Er sur la commune de Laruns en vallée d'Ossau dont les échantillons récoltés par nous mêmes correspondent à quelques détails près à la description donnée par VANDEL (1948, 1960) de la sous-espèce *O. flavus simplex*. En fait, si l'on s'en tenait strictement à la description donnée par VANDEL pour cette sous-espèce, aucune des espèces retrouvées dans les Pyrénées n'y correspond parfaitement. Celle à qui nous attribuons le nom spécifique de *simplex*, est toutefois celle qui s'en rapproche le plus.

Matériel examiné: Topotype (MNHN-IS 5066): 1 ♂ provenant d'Arrec d'Er sur la D.934, Cne de Laruns (Hte-Pyrénées), alt. 960m, UTM 709300/4754150, 14/11/1995 Dalens & Rousset réc.;

PYRÉNÉES-ATLANTIQUES*:* Cne d'Arudy, source de Sépé, alt.420m, 03/10/1995: 1♂, 6♀♀; Cne de Barcus, abreuvoir Barcus, alt.360m, 25/09/1995: 9♂♂, 3♀♀; Cne de Béost, cirque du Litor, alt.1360m, 14/11/1995: 5♂♂, 11♀♀ -- Pont de Lagnères, alt.1565m, 14/11/1995: 3♂♂, 2♀♀; Cne de Bielle, Le Bourdalat, alt.540m, 04/06/1996: 48♂♂, 44♀♀ -- pont de Bilhères, alt.760m, 04/06/1996: 17♂♂ -- route Ariou-Mage, alt.720m, 04/06/1996: 3♂♂, 1♀ -- ruisseau de Hourdenette, alt.940m, 14/11/1995: 2♂♂; Cne de Bilhères, sources sur la D294, alt.889m, 03/10/1995: 3♂♂, 4♀♀; 14/11/1995: 20♂♂; 04/06/1996: 2♂♂; Cne des Eaux-Bonnes, Gourette parking, alt.1350m, 14/11/1995: 1♂ -- Hôtel "Crêtes Blanches", alt.1525m, 14/11/1995:

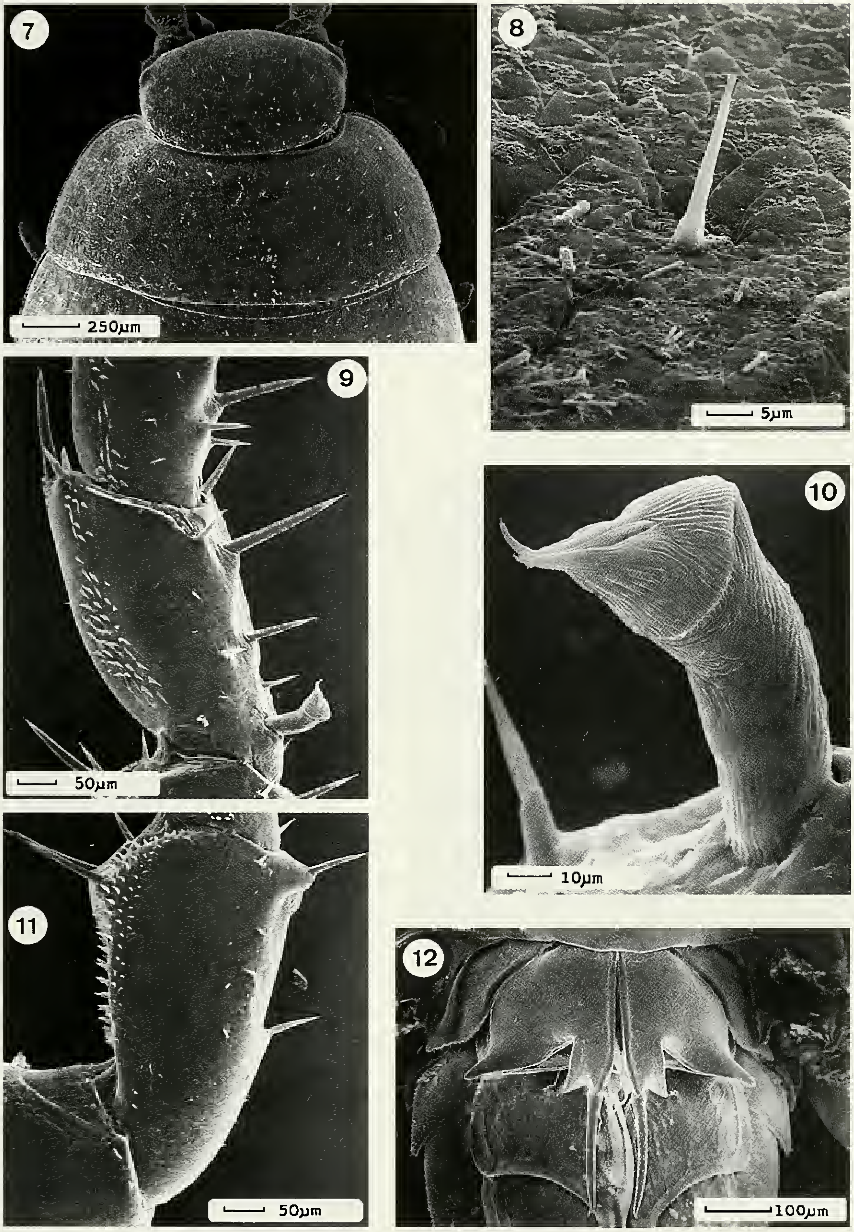
11♂♂, 7♀♀-- prise d'eau d'Iscoo, alt.820m, 14/11/1995: 6♂♂ -- route sortie Gourette, alt.1440m, 14/11/1995: 3♂♂, 4♀♀; Cne de Laruns, Arrec d'Err, alt.960m, 03/10/1995: 21♂♂; 14/11/1995: 144♂♂ -- barrage de Fabrèges, alt.1225m, 03/10/1995: 4♂♂. 10♀♀; Cne de Lescun, Borde d'Orrum, alt.850m, 03/10/1995: 2♂♂ -- Borde de Casaux, alt.820m, 03/10/1995: 1♂♂, 5♀♀; Hautes-Pyrénées: Cne d'Aucun, Bois de la Plape, alt.1260m, 14/11/1995: 24♂♂, 29♀♀; Cne de Bagnères de Bigorre, Lesponne ruisseau du Hour, alt.1135m, 08/10/1996: 1♂ -- Lesponne source B2, alt.960m, 08/10/1996: 29♂♂; Cne de Cauterets, Le Limaçon, alt.760m, 06/07/1995: 4♂♂; 18/08/1996: 7♂♂; Cne de Ferrières, carrière Rachou, alt.1090m, 14/11/1995: 21♂♂, 19♀♀ -- ruisseau de Sarradet, alt.1100m, 14/11/1995: 7♂♂; Cne de Gez, ruisseau de Inglès, alt.770m, 14/11/1995: 8♂♂.

Description: Les tailles les plus grandes observées ont été de 6,1 mm pour les mâles et 6,6 mm pour les femelles. La coloration est rouge brun, d'autant plus foncé en règle générale que l'animal est de plus grande taille. Cette coloration est un peu plus claire au niveau de la limite des tergites et des pleurépimères. Appareil oculaire formé d'un ocelle pigmenté bien apparent sur le vivant. Antennule avec 9 à 10 aesthétascs apicaux. Flagelle antennaire de 6 articles pas toujours très distincts les uns des autres à l'observation en microscopie optique; le second article qui porte 7 aesthétascs est nettement plus long que les autres qui paraissent sub-égaux . Les téguments sont lisses et garnis de soies simples (figs 7-8). En ce qui concerne les caractères sexuels mâles des péréiopodes, ils sont chez cette espèce plus marqués. L'épine sternale de la base du méros V est nettement différenciée (figs 9-10) tandis que la soie sterno-distale de l'ischion VI est portée par un tubercule basal bien développé (fig. 11) qui n'existe pas chez la femelle. L'exopodite des pléopodes de la première paire du mâle (fig. 12) est à bord externe plutôt convexe mais ce dernier présente sur sa région distale une courbure concave plus marquée que chez *O. bonadonai* et qui individualise un lobe postéro-externe. Le lobe interne est, tout comme chez *O. bonadonai*, prolongé par une forte tige qui se termine par une pointe fine et courte.

Répartition: Vandel (1960) avait attribué à ce qu'il considérait alors comme une sous-espèce d'*O. flavus* une répartition assez vaste notamment dans la partie occidentale de la chaîne pyrénéenne. Nombre de ces stations se sont révélées correspondre en fait à l'espèce *O. remyi*. Il est donc nécessaire de revoir l'ensemble de la zone de répartition de cette espèce, et les citations qui s'y réfèrent, notamment en ce qui concerne l'Espagne. Pour notre part les observations que nous avons conduites jusqu'ici nous permettent d'affirmer que dans les Pyrénées françaises, l'espèce est bien présente dans les bassins versants des vallées d'Aspe, d'Ossau, de l'Ouzom et du Gave de Pau. Sa répartition doit probablement s'étendre encore plus à l'ouest, comme semble en témoigner la station de Barcus.

Oritoniscus pyrenaeus (Racovitza,1907) Figs 13-17

Trichoniscoides pyrenaeus Racovitza,1907:160, figs 41-77
Trichoniscus (Oritoniscus) pyrenaeus; Racovitza 1908: 330
Oritoniscus pyrenaeus; Vandel 1933: 46
Trichoniscus (Oritoniscus) pyrenaeus; Arcangeli 1935: 185, fig. 3
Oritoniscus pyrenaeus; Vandel 1946: 12
Oritoniscus pyrenaeus; Vandel 1960: 193, fig. 86
Oritoniscus pyrenaeus; Schmölzer 1971: 13, 80, 141
Oritoniscus pyrenaeus; Lebreton & Besson 1984
Oritoniscus pyrenaeus; Cruz 1992

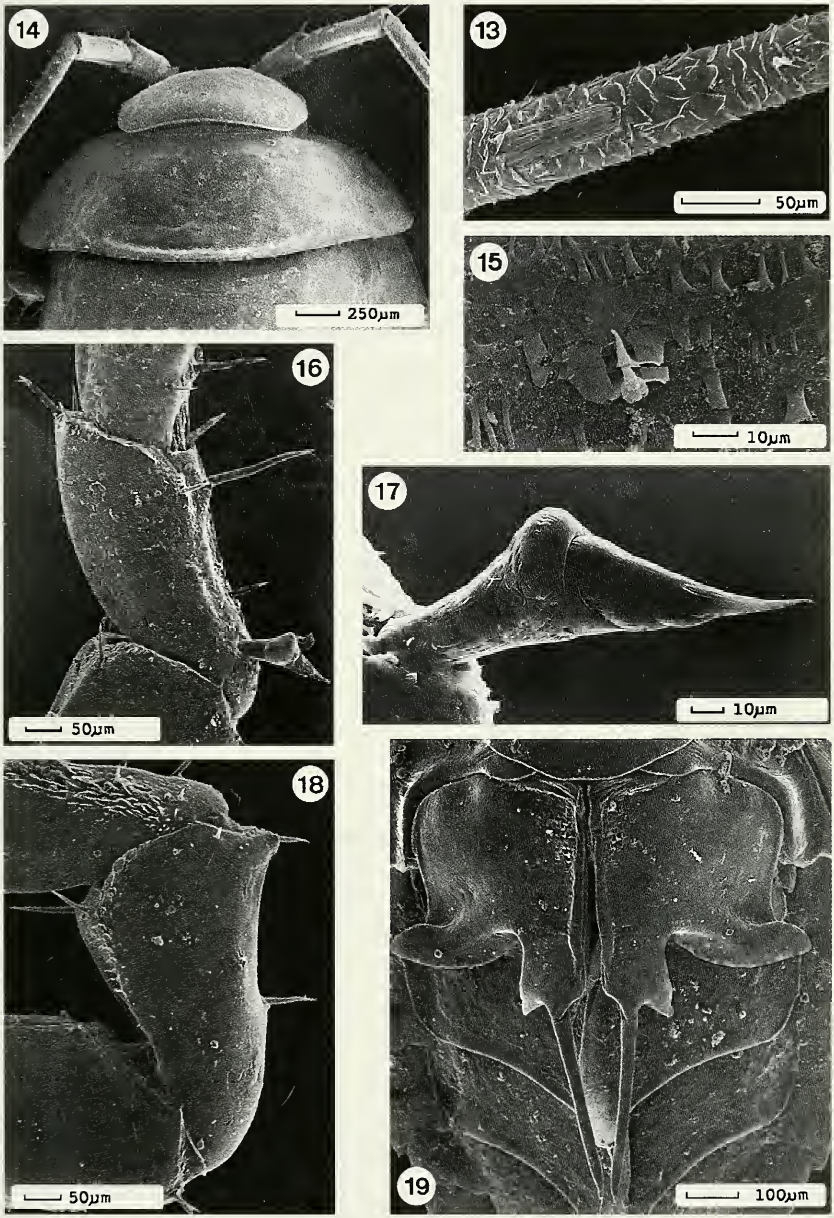


FIGS 7-12 - *Oritoniscus simplex*. 7: tergite I; 8: détail du revêtement cuticulaire du tergite I; 9: méros V ♂; 10: détail de la soie sterno-basale du méros V; 11: ischion VI♂; 12: pléopodes 1 ♂; (clichés H. Dalens).

Matériel examiné: Collection Vandel: Pyrénées-Atlantiques, Cne de St-Engrâce, grotte de Kakouetta (Biosp. 235) 12/8/1908: 13♂♂, 20♀♀ - Kakouetta, 7/1952: 1♂ - grotte au lac dans les gorges de Kakouetta, 9/9/1964: 3♀♀; Cne de Lanne, grotte des Voleurs à Barlanes, 16/8/1946: 1♂; 14/2/1947: 5♀♀; 20/4/1949: 2♂♂, 2♀♀ -- Clothe de Haout , 21/10/1947: 1♂, 3♀♀; Cne de Larrau, grotte d'Ayssagues, 9/1952: 1♂, 2♀♀; 27/11/1952: 3♂♂, 4♀♀; Cne de Rébénacq, Oueil de Neez, 21/10/1941: 1♀; Cne d'Arette, grotte d'Ambielle, 21/10/1946: 1♂, 5♀♀; Cne de Lescun, 8/1950: 50♂♂, 99♀♀; Espagne, Villanuà, partido de Jaca, prov. de Huesca, Cueva de las Guixas, 23.VII.1914 (Biospéol. 784): 16♂♂, 2♀♀.

Collection Dalens: Pyrénées-atlantiques: Cne d'Accous, grotte de la Cuerde (= grotte de l'Aygue), 1/9/1993 Besson leg: 2♂♂, 2♀♀; Cne d'Arudy, source d'Anglars, alt.490m, 03/10/1995: 1♂, 1♀ -- source de Sépé, alt.420m, 03/10/1995: 1♂, 3♀♀; Cne de Bielle, Le Bourdalat, alt.540m, 04/06/1996: 54♂♂, 52♀♀ -- ravin d'Artigasse, alt.940m, 03/10/1995: 1♀ -- pont de Bilhères, alt.760m, 04/06/1996: 2♂♂, 8♀♀ -- ruisseau de Hourdenette, alt.940m, 03/10/1995: 7♂♂, 10♀♀; 14/11/1995: 1♀ -- Sources du Turon de Técouère, alt.950m, 03/10/1995: 3♂♂ -- grotte du col d'Aran, alt.1650m, 18/8/1993, Besson leg: 1♂, 1♀; Cne de Bilhères, Arroust sur la route D294 muret, alt.690m, 03/10/1995: 1♀ -- col de Marie Blanque, alt.1000m, 03/10/1995: 3♂♂, 2♀♀; 14/11/1995: 27♂♂, 45♀♀; 04/06/1996: 61♂♂, 133♀♀ -- sources au bord de la D294, alt.889m, 03/10/1995: 3♂♂, 1♀; 14/11/1995: 4♂♂, 3♀♀; 04/06/1996: 1♂; Cne des Eaux-Bonnes, prise d'eau d'Iscoo, alt.820m, 14/11/1995: 3♀♀; Cne d'Izeste, carrière de marbre, alt.470m, 03/10/1995: 1♂, 1♀ -- grotte de Sespiau, puits, alt.470m, 03/10/1995: 2♂♂, 3♀♀; 14/12/1991, Besson leg: 1♂; Cne de Lescun, ruisseau de Serrelongue, alt.675m, 03/10/1995: 2♂♂ -- vallée de Lhers (bois), alt.845m, 03/10/1995: 4♀♀; Cne de St-Engrâce, grotte des Lacs dans les gorges de Kakouetta, 21/4/1984, Deharveng leg: 1♂, 1♀; Hautes-Pyrénées: Cne d'Arbéost, source Malacau, alt.720m, 15/11/1995: 1♂, 1♀; Landes: Cne de Seignanx, grotte Audin n°8, 26/09/1983, Lebreton leg: 1♂.

Description: Les tailles maximales observées ont été de 6,1 mm pour les mâles et de 7 mm pour les femelles. La coloration gris-brun tirant parfois un peu sur le violet ainsi que le pattern de coloration sont typiques et permettent au premier coup d'oeil de reconnaître cette espèce qui par ailleurs est celle dont le corps est le moins convexe. Sur le péréion, la région médiane est largement décolorée, mais à des degrés variables suivants les individus et les populations. Cette zone médiane est latéralement encadrée par deux bandes foncées. Les pleurépimères sont très décolorés mais sont par contre fortement pigmentés sur leur bord externe. Le pléon est nettement pigmenté avec parfois une intensité moindre sur la ligne médiane. Antennes, péréiopodes et pléopodes sont également pigmentés. L'appareil oculaire est formé d'un ocelle pigmenté bien apparent sur l'animal vivant. L'antennule porte 8 aesthétascs apicaux flanqués d'une courte épine. Le flagelle antennaire possède 7 articles très peu distincts les uns des autres et recouverts de soies écailles très apparentes (fig. 13); le second nettement plus long que les autres porte une dizaine d'aesthétascs. Téguments lisses, garnis de soies simples (figs 14-15). Les cinq premiers péréionites présentent légèrement en avant du bord postérieur du tergite une ride en relief qui s'arrête au niveau des pleurépimères. Cette différenciation se réalise par ailleurs suivant un gradiant antéro-postérieur décroissant, et la ride est d'autant plus apparente que l'animal est de plus grande taille. Au niveau des péréiopodes un dimorphisme sexuel net existe au niveau de la soie basale et sternale du méros V (fig.16-17) laquelle est chez le mâle très nettement hypertrophiée et coudée vers la partie basale de l'appendice. On relève par ailleurs la différenciation d'un tubercule qui porte la soie sternale et distale de l'ischion VI (fig. 18). Au niveau des pléopodes on note, sur l'exopodite de la première paire du mâle (fig.



FIGS 13-19 - *Oritoniscus pyrenaeus*. 13: second article du flagelle antennaire; 14: tergite I; 15: détail du revêtement cuticulaire du tergite I; 16: méros V♂; 17: détail de la soie sterno-basale du méros V; 18: ischion VI♂; 19: pléopodes 1♂; (clichés H. Dalens).

19) la présence d'un lobule nettement séparé du reste de l'appendice. Ce lobule qui, chez tous les autres *Oritoniscus*, n'est jamais détaché permet également une discrimination rapide et fiable sans dissection de l'échantillon.

Répartition : A ce jour, nos propres récoltes confirment l'aire de répartition définie par Vandel (1960) pour cette espèce. On peut semble-t-il parler d'un endémique ou d'une espèce relicte dont l'aire de répartition dans les Pyrénées françaises semble se limiter à un territoire délimité à l'ouest par la vallée du Saison et à l'est par celle de L'Ouzum. Vers le sud et en Espagne sa présence n'est connue que des régions de Villanuà, Hécho et Anso, (Racovitza 1907; Arcangeli 1935; Cruz 1992) dans la haute vallée de l'Aragon. Au nord, les deux stations françaises du département des Landes (Lebreton & Besson 1984) où l'espèce a été retrouvée dans des grottes demandent une prospection renouvellée de cette région afin de vérifier s'il s'agit de stations relictes ou au contraire si l'espèce y est plus largement présente.

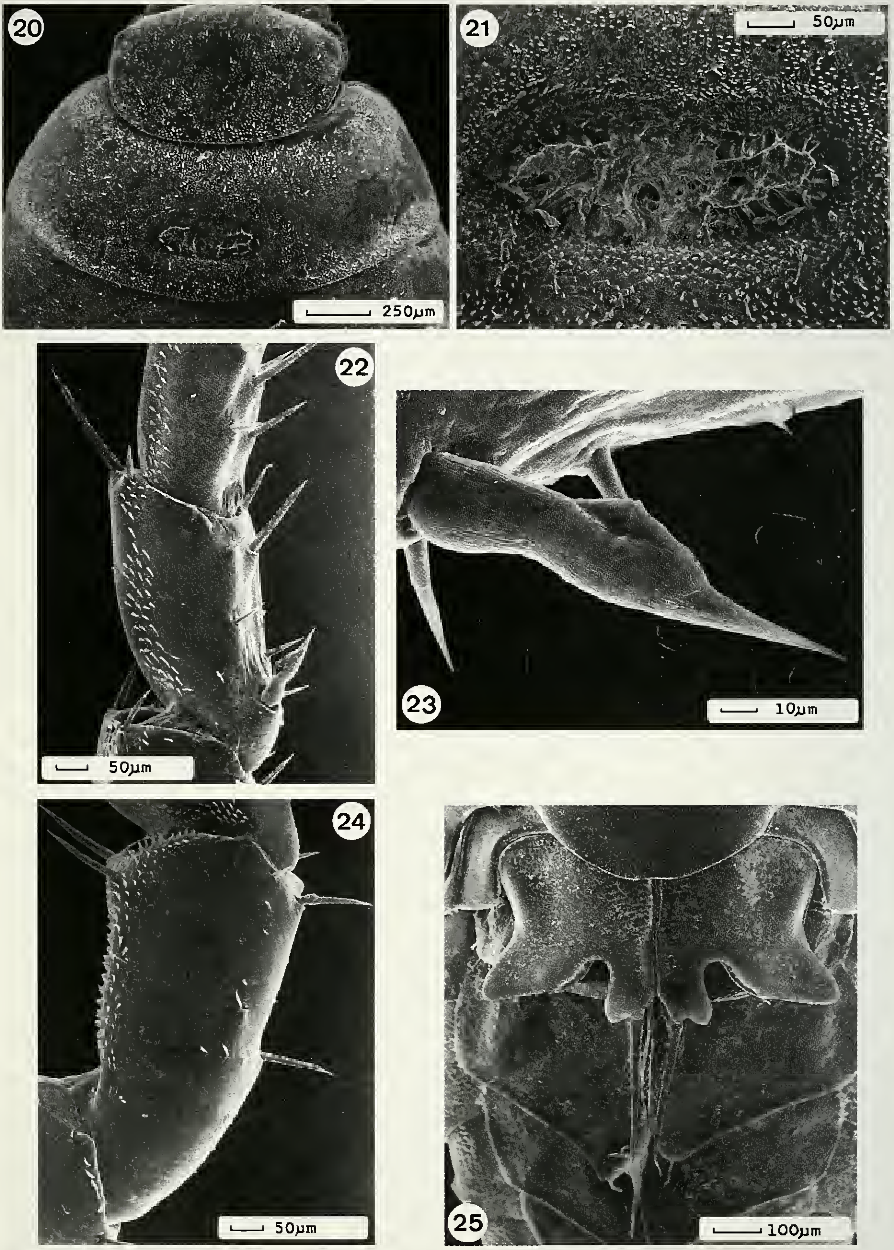
Oritoniscus remyi Dalens,1964 Figs 20-25

Oritoniscus remyi, Dalens, 1964: 286, figs 1-6
Oritoniscus remyi; Dalens 1973: 142, fig. 1
Oritoniscus remyi; Cruz 1992: 97

Matériel examiné: Coll. Vandel: 24 tubes d'échantillons appartenant à cette espèce y figurent, 7 sous la dénomination *O. flavus* et 17 sous celle d'*O. flavus simplex*. Ils proviennent de l'ensemble de la chaine pyrénéenne française et en Espagne des provinces de Guipuzcoa, Navarre et Santander.

Coll. Dalens: Pyrénées-Orientales: Cne de Fenouillet, thalweg du Roc de Boucheville, alt.1065m, 24/10/1995: 88♂♂, 107♀♀ -- 23/09/1996: 35♂♂, 58♀♀; Cne de Prats-de-Mollo-La-Preste, La Barragagne (forêt), alt.1230m, 25/05/1994: 1♂ -- La Barragagne (vallon), alt.1200m, 25/05/1994: 24♂♂ -- La Preste D115, alt.1040m, 25/05/1994: 28♂♂ -- 07/09/1996: 8♂♂ -- ravin du col de Viel, alt.1190m, 25/05/1994: 2♂♂, 3♀♀; Cne de Vira: thalweg sur la route de Gincla, alt.758m, 24/08/1995: 7♂♂ -- Forêt de Boucheville, fontaine de Coulom, alt.1070m, 24/10/1995: 7♂♂ -- Forêt de Boucheville, Pont des Verriers, alt.780m, 24/08/1995: 2♂♂, 10♀♀ -- Forêt de Boucheville, Rond Point, alt.1020m, 24/08/1995: 4♂♂; -- 24/10/1995: 32♂♂; Aude: Cne de Gincla: ruisseau Le Renard, alt.730m, 24/10/1995: 7♂♂; Cne de La Fajolle, col de Pradel, alt.1545m, 11/07/1996: 3♂♂ -- forêt de la Fontaine d'Argens, alt.1335m, 11/07/1996: 36♂♂; Cne de Roquefeuil: Fontaine de la Jasse, alt.880m, 17/10/1995: 16♂♂; Ariege: Cne d'Auzat, barrage de Soulcem (cascade), alt.1490m,13/06/1996: 2♂♂, 1♀; Cne de Bélesta, Fontaine de l'Ours - bois du Pinet, alt.895m, 17/10/1995: 6♂♂; Cne de Couflens, Les Neuf Fontaines, alt.990m, 02/06/1994: 1♂; Cne de L'Herm, Fontaine Sainte, alt.550m, 23/09/1996: 1♂; Cne de Montferrier, La Peyregarde (ruisseau), alt.920m, 17/10/1995: 1♂ -- La Peyregarde La Senaurié, alt.905m, 17/10/1995: 4♂♂, 8♀♀; Cne de Nescus, La Freyche, alt.450m, 28/06/1994: 5♂♂; Cne d'Orgeix, source de bas de vallée, alt.820m, 11/07/1996: 26♂♂; Cne de Sentenac-de-Sérou, ruisseau de Ruyère, alt.895m, 28/06/1994: 16♂♂; Cne de Taurignan-le-Vieux, résurgence de Touasse, alt.386m, 08/12/1994: 4♂♂; Haute Garonne: Cne d'Oô, sentier du Lac d'Oô, alt.1230m, 19/06/1996: 4♂♂, 3♀♀; Hautes-Pyrénées: Cne d'Arrens-Marsous: entrée des mines d'Arrens, alt.1030m, 05/06/1996: 2♂♂, 7♀♀ -- Maison du Parc , alt.1470m, 05/06/1996: 14♂♂, 15♀♀; Cne de Bagnères-de-Bigorre, bois de Bayssou à Lesponne, alt.1300m, 08/10/1996: 1♂ -- ruisseau du Hour, alt.1135m, 08/10/1996: 9♂♂; Cne de Campan, ruisseau du Garet, alt.1350m, 08/10/1996: 5♂♂, 2♀♀; Cne de Cauterets, Le Limaçon, alt.760m, 06/07/1995: 2♂♂ -- Pont d'Espagne, alt.1410m, 06/07/1995: 6♂♂, 22♀♀ -- Thermes de Pauze, alt.1020m, 06/07/1995: 2♂♂ -- Val de Jéret, alt.1275m, 06/07/1995: 1♂♂, 7♀♀; Cne d'Esparros: ruisseau d'Artigaou, alt.520m, 21/09/1995: 3♂♂ -- Col de Couradabat, alt.980m, 21/09/1995: 1♂ -- écoulements sur schistes, alt.925m, 21/09/1995: 17♂♂, 31♀♀-- fontaine Caraillère, alt.930m, 21/09/1995: 4♂♂; Cne d'Estaing, source de l'Escale, alt.1235m, 05/06/1996: 12♂♂, 18♀♀; Cne de Ferrières: ruisseau de Sarradet, alt.1100m, 14/11/1995: 2♂♂; Cne de Gèdre, ruisseau de Biroulet, alt.1100m, 06/07/1995: 1♂; Cne de Hèches, Coureillou, alt.1044m, 11/01/1996: 2♂♂ -- Coureillou (talus sec), alt.1040m, 11/01/1996: 10♂♂, 12♀♀; Cne de Labastide, D26 captage, alt.700m, 21/09/1995: 2♂♂; Cne de Nistos, col de Mènes (ruisseau), alt.1170m, 21/09/1995: 10♂♂, 20♀♀; Cne de Sost, bois de Coste Dorade (source), alt.920m, 07/06/1995: 1♂; Pyrénées-Atlantiques: Cne d'Accous, vallée de Lhers, alt.1035m, 03/10/1995: 2♂♂, 3♀♀; Cne d'Arudy, source d'Anglars, alt.490m, 03/10/1995: 10♂♂, 12♀♀; Cne de Bielle, Le Bourdalat, alt.540m, 04/06/1996: 4♂♂, 5♀♀ -- ravin de la Hourdenette (talus), alt.980m, 03/10/1995: 6♂♂, 8♀♀, -- pont de Bilhères, alt.760m, 04/06/1996: 9♂♂ -- ruisseau de Hourdenette, alt.940m, 03/10/1995: 22♂♂, 11♀♀; 14/11/1995, 8♂♂ -- Sources du Turon de Técouère, alt.950m, 03/10/1995: 2♂♂, 3♀♀; Cne de Bilhères, Arroust muret sur la D294, alt.690m, 03/10/1995: 43♂♂, 67♀♀; 14/11/1995: 31♂♂, 59♀♀ -- Arroust, fontaine sur la D294, alt.700m, 14/11/1995: 21♂♂, 24♀♀; 04/06/1996: 18♂♂, 7♀♀ -- col de Marie Blanque, alt.1000m, 14/11/1995: 1♂; 04/06/1996: 3♂♂, 4♀♀ -- sources sur la D294, alt.889m, 03/10/1995: 1♂; 14/11/1995: 12♂♂; 04/06/1996: 5♂♂; Cne des Eaux-Bonnes, prise d'eau d'Iscoo, alt.820m, 14/11/1995: 2♂♂; Cne d'Izeste, carrière de marbre, alt.470m, 03/10/1995: 16♂♂, 12♀♀ -- grotte de Sespiau (extérieur), alt.470m, 03/10/1995: 9♂♂, 9♀♀; Cne de Laruns, Ayguebères, alt.960m, 03/10/1995: 1♂; 14/11/1995: 11♂♂; Cne de Lescun, Borde d'Orrum, alt.850m, 03/10/1995: 5♂♂, 20♀♀ -- Borde de Savoye, alt.830m, 03/10/1995: 3♂♂, 12♀♀ -- ruisseau de Labrenère, alt.798m, 03/10/1995: 20♂♂, 15♀♀ -- ruisseau de Serrelongue, alt.675m, 03/10/1995: 2♂♂ -- vallée de Lhers (bosquet), alt.845m, 03/10/1995: 3♂♂, 3♀♀; Espagne: Prov. de Cantabria, 16-18/05/1996 -- Municipal d'Arredondo, entrée de la Cueva del Molino, alt.210m, 1♂ -- entrée de la cueva de la Cubera, alt.168m, 2♂♂ 2♀♀ -- Municipal de Ramales de la Victoria, entrée de la Cueva de la Cullalvera, alt.100m, 1♂ 1♀ -- Col de los Tornos, alt.940m, 2♂♂ -- Municipal de Riba, entrée de la Cueva de la Codisera, alt.140m, Deharveng/Bedos réc., 1♂, 1♀; Prov. de Burgos, 16-18/05/1996 -- Municipal de Soncillo, Puerto de Carralès, alt.960m, 17♂♂ 11♀♀.

Description: Les tailles maximales observées ont été celles de 6,8 mm pour un mâle et de 7,1 mm pour les femelles. Coloration violet intense, uniformement répartie, mais laissant deviner les insertions musculaires qui apparaissent légèrement plus pâles et la limite tergite -pleurépimère qui est un peu moins intensement colorée. Péréiopodes légèrement pigmentés. Appareil oculaire formé d'une ommatidie fortement pigmentée et bien apparente sur l'animal vivant. Téguments lisses parsemés de soies simples et courtes. Antennule avec 12 aesthétascs apicaux. Flagelle antennaire pouvant avoir jusqu'à 7 articles peu distincts, le second nettement plus long que les autres portant 6 aesthétascs. Chez le mâle le péréion porte sur le tergite I une fossette médio-centrale allongée dans le sens transversal (figs 20-21). Le bord postérieur de ce même tergite est par ailleurs très légèrement sinué sur ses parties latérales. Chez le mâle immature la plage pilifère centrale est plus ou moins visible, mais la dépression est dès le début de sa différenciation, allongée dans le sens transversal. Au niveau des péréiopodes le dimorphisme sexuel se traduit sur le méros V qui présente une soie sterno-basale hypertrophiée mais non coudée (figs 22-23). Par contre la soie sterno-distale s'insère directement sur l'ischion VI (fig.24) sans l'intermédiaire de tubercule. Les pléopodes 1 (fig.25) ont un exopodite à bord externe concave différenciant une pointe postero-externe bien individualisée; le lobe interne se prolonge comme chez les espèces précédentes par une tige qui se termine en une pointe longue et fine.



FIGS 20-25 - *Oritoniscus remyi*. 20: tergite I du ♂; 21: détail de la fossette; 22: méros V♂; 23: détail de la soie sterno-basale du méros V; 24: ischion VI♂; 25: pléopodes 1♂; (clichés H. Dalens).

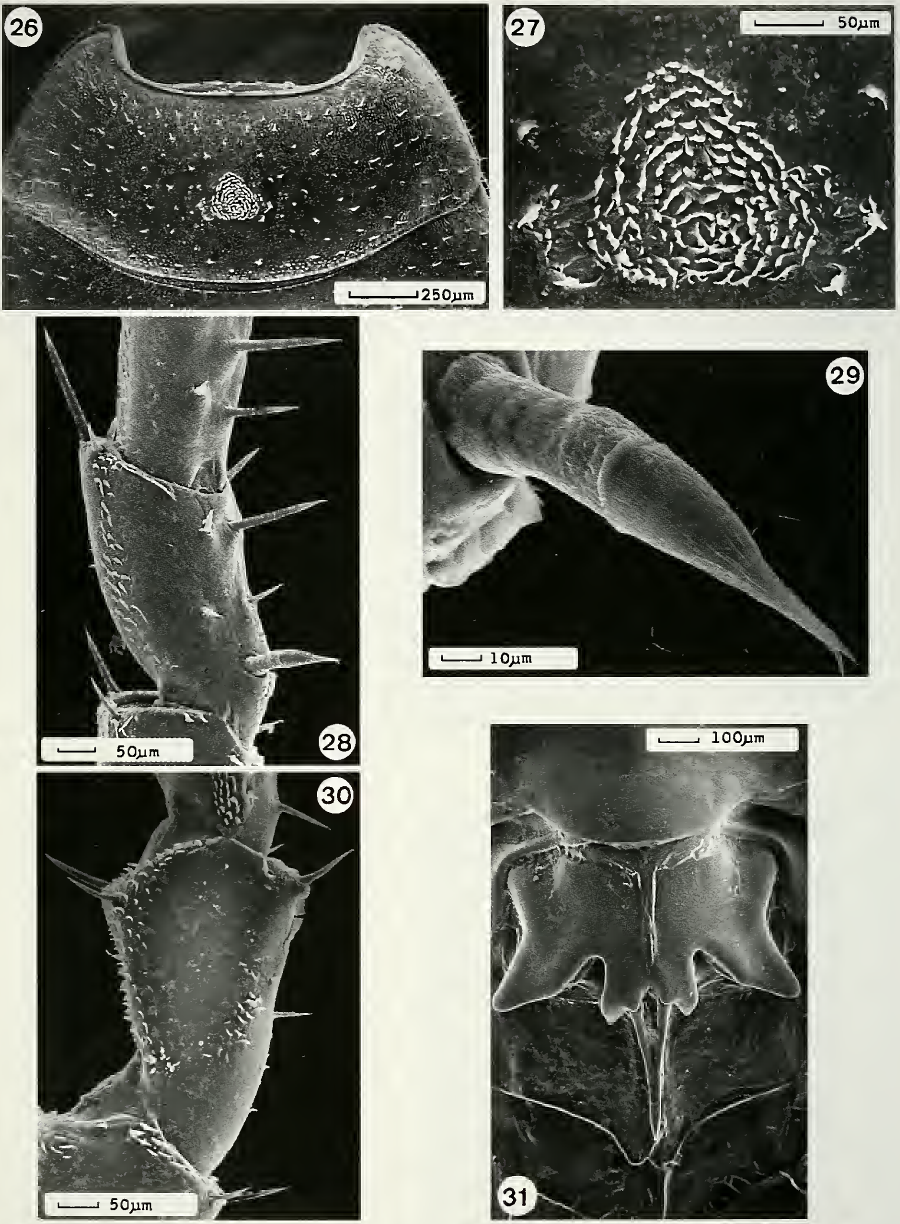
Répartition : Cette espèce est celle qui, dans la chaîne pyrénéenne, a la plus vaste répartition, puisqu'on la trouve depuis les Pyrénées-Orientales à l'est jusqu'aux Pyrénées Atlantiques à l'ouest; en Espagne on la retrouve même encore plus à l'ouest dans la chaîne des Monts Cantabriques (DALENS 1973).

Oritoniscus aurensis sp. n. Figs 26-31

Matériel examiné: Holotype (MNHN-IS 5067): 1 mâle de Rioumajou, Ravin du Mont (source), Cne Saint-Lary-Soulan (Htes-Pyrénées), alt.1100m, 07/09/1995, Dalens & Rousset réc.

Collection Dalens: HAUTES-PYRÉNÉES : Cne d' Aragnouet, D929 pont de Couplan, alt. 1410 m, 07/09/1995: 58♂♂, 48♀♀ -- Orédon ruisseau l' Estaragne, alt.2100m, 7/09/1995: 1♂, 9♀♀ -- Pont de Badet, alt.1250m, 07/09/1995: 1♂ -- Pont de Moudang (cascade), alt. 1075m, 07/09/1995: 1♂; Cne d'Aspin-Aure, Serre du Mont d'Arreau, alt.790m, 23/06/1995: 19♂♂, 17♀♀; Cne d'Aulon, Le Castet pont sur le Lavédan, alt.1260m, 07/09/1995: 18♂♂, 18♀♀; Cne de Bordères-Louron, Artigue-Merly (ruisseau), alt.1015m, 23/06/1995: 1♂, 2♀♀ -- fontaine Bordères-Louron, alt. 885m, 23/06/1995: 64♂♂, 75♀♀; 11/01/1996: 103♂♂, 122♀♀ -- Ilhan (fontaine abreuvoir), alt.1085m, 23/06/1995: 7♂♂, 12♀♀ -- Médas, alt. 910m, 23/06/1995: 11♂♂, 21♀♀; Cne de Campan, route du col d'Aspin, alt.1195m ,08/10/1996: 2 ♂♂; Cne de Cazaux-Débat, bord de route D618, alt.760m, 23/06/1995: 25♂♂; Cne de Gouaux, fontaine de La Peyre, alt.990m, 23/06/1995: 3♂♂, 15♀♀ -- Ravin de Hougues (ruisseau), alt.1200m, 23/06/1995: 23♂♂, 23♀♀ -- source point coté 1409, alt.1409m, 23/06/1995: 5♂♂, 10♀♀; Cne de Guchen, vallée d'Aulon (source du Bosquet), alt.1075m, 07/09/1995: 85♂♂, 73♀♀; 11/01/1996: 51♂♂, 59♀♀; Cne de Loudervielle, près de la source Balestas, alt.1600m, 19/06/1996: 1♂, 9♀♀ -- source Hangasses, alt.1395m, 19/06/1996: 17♂♂, 22♀♀; Cne de Saint-Lary-Soulan, Rioumajou Escalette, alt.1360m, 07/09/1995: 5♂♂, 16♀♀ -- Rioumajou Ravin du Mont (source), alt.1100m, 07/09/1995: 46♂♂, 47♀♀; 11/01/1996, 135♂♂.

Description : Holotype 5,2 mm; la taille la plus grande observée chez les femelles a été de 7,2 mm. La coloration est rouge brun paraissant, à l'oeil nu, uniformement repartie sur l'ensemble du corps. En fait il existe une zone légèrement plus claire à la limite tergite-pleurépimère où la pigmentation est moins dense. Antennes, péréiopodes et pléopodes sont également colorés. Appareil oculaire formé d'une ommatidie pigmentée bien apparente sur l'animal vivant. L'antennule porte dix aesthétascs plus une courte épine. Le flagelle antennaire comprend 5 articles dont le second nettement plus long que les autres porte 6 aesthétascs. Les téguments sont lisses et parsemés de soies simples nettement apparentes. Chez le mâle, le tergite du péréionite I (fig. 26) porte dans sa région medio-centrale une légère fossette non visible à l'oeil nu, mais par contre assez apparente à l'examen à la loupe binoculaire, du moins chez les plus gros individus. Chez les autres il faut un examen attentif et en lumière incidente rasante pour déceler une légère dépression qui apparaît avec une réfringence différente du reste du tergite. Examiné au M.E.B. cette dépression de forme arrondie ou parfois même trilobée est tapissée de soies-écailles plus massives et plus courtes que celles qui revètent le reste du tégument (fig. 27). Par ailleurs le bord postérieur de ce même tergite I présente sur ses parties latérales une sinuation nette. Les caractères sexuels mâles des péréiopodes se traduisent par une légère hypertrophie de la soie sterno- basale du meros V (figs. 28-29) et par le développement d'un petit tubercule à la base de la soie sterno-distale de l'ischion VI (fig. 30). Au niveau des pléopodes de la première paire (fig. 31), l'exopodite présente un bord externe fortement concave diffé-



FIGS 26-31 - *Oritoniscus aurensis.* 26: tergite I du ♂; 27: détail de la fossette; 28: méros V ♂; 29: détail de la soie sterno-basale du méros V; 30: ischion VI♂; 31: pléopodes 1♂; (clichés H. Dalens).

renciant très nettement une pointe postéro-externe et un lobe interne prolongé par une forte tige se terminant brusquement par une pointe fine.

Répartition : La répartition de cette espèce semble restreinte aux Hautes-Pyrénées et de façon plus précise au bassin versant de la vallée d'Aure depuis 760m jusqu'à 2100m d'altitude.

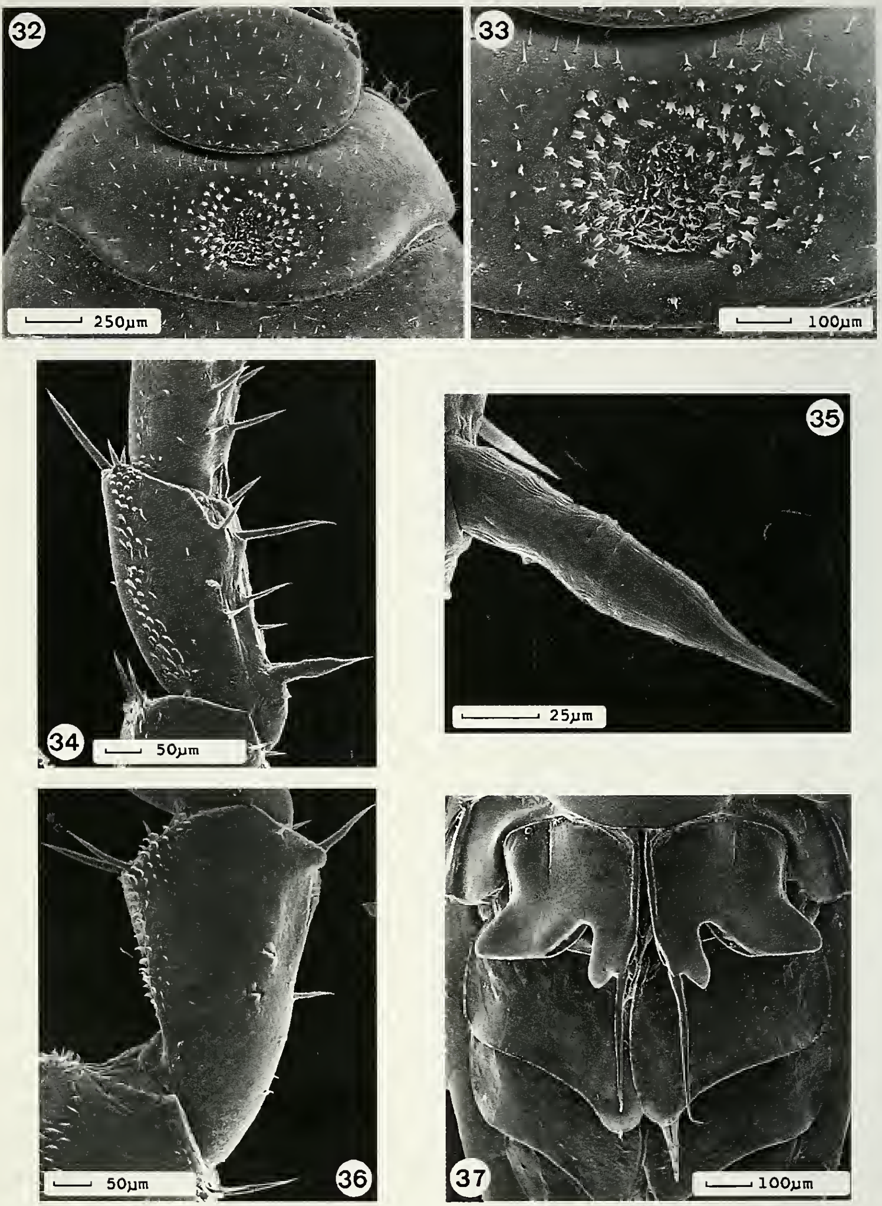
Oritoniscus baroussensis n.sp. Figs 32-37

Matériel examiné: Holotype: 1♂ (MNHN-IS 5068) ruisseau de Coureillou, Cne de Hèches (Htes-Pyrénées), alt. 1044m, 21/09/1995, Dalens & Rousset réc. dans des mousses, saxifrages et cresson pyrénéen ruisselants, sur paroi de schistes.

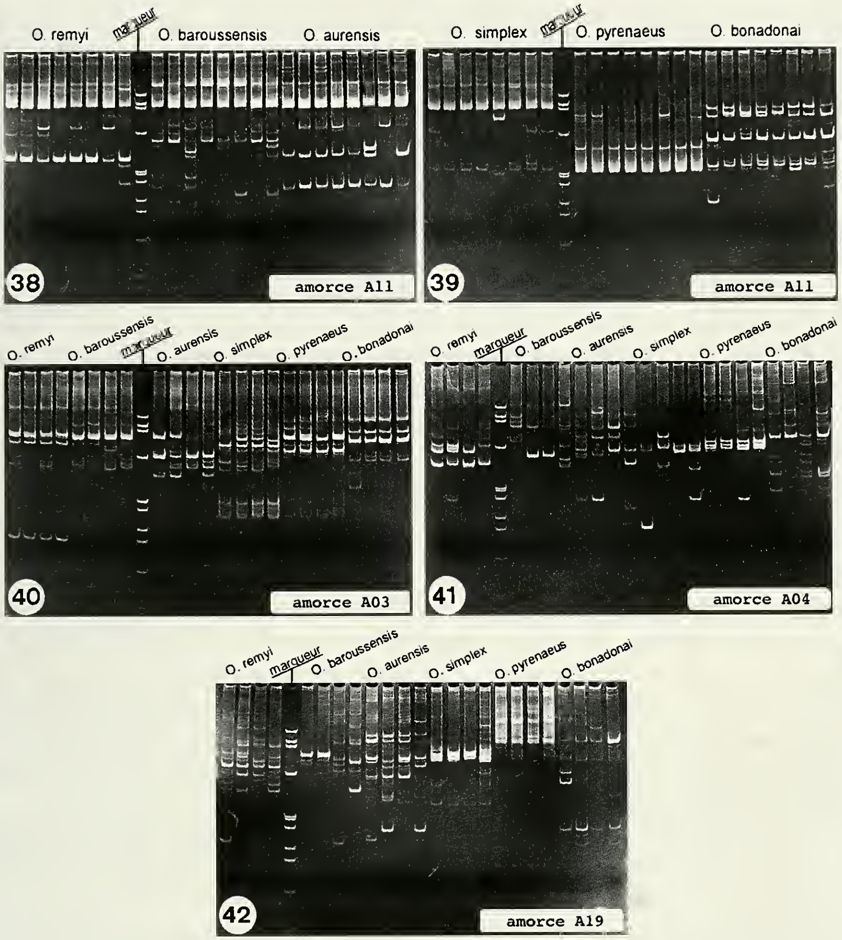
coll. Dalens: HAUTES-PYRÉNÉES: Cne de Bareilles, vallon d'Ardengost, alt.1030m, 21/09/1995: 7♂♂; Cne de Campan, route du col d'Aspin, alt.1195m, 08/10/1996: 1♂; Cne de Hèches, ruisseau de Coureillou, alt. 1044m, 21/09/1995: 38♂♂, 111♀♀; 11/01/1996: 159♂♂; Cne de Mauléon-Barousse, Pradettes, alt. 615m, 07/06/1995: 4♂♂; Cne de Nistos, Hameau de Gerlé, 11/1964: 1♂, J.P. Mauries réc.; Cne de Sost, bois de Coste Dorade (source), alt. 920m, 18/10/1994: 63♂♂; 07/06/1995: 161♂♂.

Description : Holotype de 5 mm; les tailles les plus grandes observées ont été 5,9 mm pour les mâles et 6 mm pour les femelles. Coloration lie de vin sombre et uniforme sur le vivant examiné à sec; dans l'eau l'animal apparaît plus clair mais il n'y a pas de taches blanches à la limite tergite - pleurépimère. Péréiopodes et sternites sont pigmentés, mais pas les pléopodes. Téguments lisses parsemés de soies simples nettement apparentes. L'antennule porte 9 aesthétascs apicaux plus une courte épine. Le flagelle antennaire comprend 7 articles dont le second un peu plus long que les autres possède 8 aesthétascs. Chez le mâle le tergite du péréionite I (fig. 32) montre une fossette pilifère medio-centrale et subcirculaire, très nettement visible à l'oeil nu. Examiné à fort grossissement ou au M.E.B. (fig. 33), cette fossette présente des flancs antérieur et latéraux garnis de soies écailles à trois pointes et une plage centrale plus ou moins lisse suivant les échantillons; des formations concentriques excrétoires ou tégumentaires apparaissant chez certains individus. Par ailleurs le bord postérieur de ce même tergite I surplombe en abrupt le tergite II et présente latéralement et chez le mâle uniquement deux sinuosités concaves avec dépression des téguments lesquelles pourraient correspondre à des zones sécrétoires. Les caractères sexuels mâles des péréiopodes se traduisent par une hypertrophie modérée de la soie basale et sternale du meros V (figs 34-35) et par la différenciation d'un tubercule à la base de la soie sterno-distale de l'ischion VI (fig. 36). Au niveau des pléopodes 1 du mâle (fig. 37), le bord externe de l'exopodite présente une forte concavité qui différencie un lobe postéro-externe très accusé. Le lobe interne de ce même exopodite se prolonge comme chez les espèces précédentes par une longue tige terminée par une pointe très effilée.

Répartition : Cette espèce semble essentiellement se limiter aux massifs de la Barousse et du Nistos compris entre la vallée de la Garonne à l'est et celle de la Neste d'Aure à l'ouest. Certaines populations paraissent très denses et toutes concentrées dans des milieux qui sont constamment très humides, voire même aquatiques, quoi qu'il en soit toujours avec de l'eau libre.



FIGS 32-37 - *Oritoniscus baroussensis*. 32: tergite I du ♂; 33: détail de la fossette; 34: méros V♂; 35: détail de la soie sterno-basale du méros V; 36: ischion VI♂; 37: pléopodes 1♂; (clichés H. Dalens).



FIGS 38-42 Gels de polyacrylamide (7%) contenant les fragments d'ADN amplifiés par RAPD-PCR, relatifs aux espèces *O. remyi*, *O. baroussensis*, *O. aurensis*, *O. simplex*, *O. pyrenaeus* et *O. bonadonai*. En 38-39 , 8 individus de chaque espèce traités avec l'amorce A11. En 40, 41 et 42 chaque gel montre 4 individus de chaque espèce avec des amorces différentes (A03, AO4 et A19). Marqueur : $\phi\chi$174 digéré par HaeIII, pb : 1353, 1078, 872, 603, 310, 281, 234, 194, 118, 72; (clichés A. Rousset).

ETUDE MOLÉCULAIRE

Polymorphisme de l'ADN génomique

- Polymorphisme intraspécifique. Dans le but de définir les relations entre des espèces d'*Oritoniscus* , dont certaines à large répartition géographique, l'amplification PCR a d'abord été utilisée pour analyser le polymorphisme de l'ADN d'individus provenant de plusieurs isolats appartenant à un même ensemble populationnel. Pour chaque espèce (sauf *O. bonadonai* dont on ne connaît qu'une seule population) douze individus mâles ont été prélevés dans deux stations éloignées de 10 à 15 km. Cet intervalle correspond sensiblement à l'aire d'extension des deux espèces *O. baroussensis* et *O. aurensis* dans les Pyrénées Centrales.

Après amplification RAPD - PCR, les données des patterns électrophorétiques sont traitées selon deux approches méthodologiques complémentaires afin de comparer les degrés de polymorphisme présents entre ces isolats d'une population et celui existant entre les espèces.

Dans la première approche, la similitude entre les individus des différents isolats a été évaluée par la méthode UPGMA : chez *O. remyi* la distance maximale calculée entre les individus des deux isolats est de 0,037 alors que la distance interspécifique est de 0,105; chez les autres espèces ces valeurs sont respectivement : 0,068 et 0,091 chez *O. baroussensis*; 0,055 et 0,091 chez *O. aurensis*; 0,054 et 0,114 chez *O. simplex*; 0,048 et 0,114 chez *O. pyrenaeus*. Ceci se traduit sur un phénogramme (non montré) d'une part, par un mélange des individus des deux isolats dans chacune des espèces et d'autre part, par une séparation stricte de ces mêmes espèces. Le tableau 1 donne les résultats statistiques de la seconde approche qui utilise l'indice de dissimilarité APD : dans une espèce donnée, cet indice et l'erreur standard sur la moyenne (ES) sont calculés pour chaque isolat et pour l'ensemble des individus de l'espèce; l'utilisation du test non-paramétrique de Mann et Whitney met en évidence le fait qu'il n'y a aucune différence statistique dans les taux de polymorphisme entre les isolats d'une même espèce. Ainsi les résultats obtenus par ces deux méthodes concourent à montrer que les échantillons provenant de différentes populations d'une même espèce ne sont pas différenciables par les marqueurs moléculaires utilisés. Le polymorphisme ainsi détecté est bien représentatif de l'espèce.

- *Polymorphisme interspécifique.* - Pour chacune des 6 espèces, le polymorphisme génétique a été étudié chez 8 individus mâles prélevés dans une même station à forte densité de population: *O. remyi*: forêt Boucheville (66), *O. baroussensis*: ruisseau de Coureillou (65), *O. aurensis*: Bordères-Louron (65), *O. simplex*: Bielle (64), *O. pyrenaeus*: Col de Marie-Blanque (64), *O. bonadonai*: grotte des chauves-souris , Draguignan (83).

Les figures 38 à 42 montrent les profils électrophorétiques obtenus avec les 4 amorces selectionnées. L'amorce A11 (fig 38-39) permet de distinguer facilement les espèces les unes des autres et certaines bandes semblent caractéristiques de l'espèce, le polymorphisme intraspécifique est faible; il est bien plus élevé dans les profils générés par les amorces A03 (fig 40) A04 (fig 41) et surtout A19 (fig 42). L'intensité de ce polymorphisme est également variable selon les espèces, pour une même amorce : les individus des espèces *O. baroussensis* et *O. aurensis* montrent une bien plus grande variabilité (déjà indiquée sur le tableau 1: APD > 20%) , alors que, dans l'ensemble , les individus d' *O. pyrenaeus* sont bien plus semblables entre eux.

Pour évaluer le polymorphisme génétique, chez les 48 individus des 6 espèces, 114 bandes d'ADN bien amplifiées par les .4 amorces précitées ont été utilisées. Le phénotype (1 - 0 = présence - absence) de chaque individu à chaque locus est renseigné

Isolats	A. P. D. (%)	E. S.	M. W.
O. remyi Fenouillet (66)	6,8	1,4	**ΔNS**
O. remyi Vira (66)	9,4	1,8	
O. remyi (F + V)	7,7	0,8	
O. baroussensis Hèches (65)	21,5	2,9	**ΔNS**
O. baroussensis Sost (65)	24,8	3,6	
O. baroussensis (H + S)	21,5	1,6	
O. aurensis Bordères-Louron (65)	19,2	2,7	**ΔNS**
O. aurensis Saint-Lary (65)	14,5	2,6	
O. aurensis (BL + SL)	18,8	1,3	
O. simplex Bielle (64)	16,7	2,4	**ΔNS**
O. simplex Aucun (65)	19,2	2,7	
O. simplex (B + A)	17,6	1,3	
O. pyrenaeus Bielle (64)	10,7	1,8	**ΔNS**
O. pyrenaeus Bilhères (64)	15,1	2,9	
O. pyrenaeus (Bielle + Bilhères)	12,1	1,1	

TABLEAU 1 - Résumé statistique de la dissimilarité intra- et interpopulation chez *O. remyi*, *O. baroussensis*, *O. aurensis*, *O. simplex* et *O. pyrenaeus* (pour une localisation précise des populations, se reporter aux paragraphes «Matériel examiné» des espèces citées). **A.P.D.** = indice de dissimilarité (en pourcentage), **E.S.** = erreur standard, **M.W.** = Test de Mann et Whitney, **Δ NS** = différence non significative, au seuil de 5%, entre les isolats de chacune des espèces.

dans une matrice de données qui est ensuite analysée par les programmes informatiques précédemment mentionnés (RAPDPLOT et ensemble PHYLIPS 3.5c). Il en résulte la construction d'un phénogramme (fig. 43) qui montre qu'il y a regroupement des individus de chaque espèce et que toutes les espèces sont clairement séparées. L'espèce *O. bonadonai* se singularise très rapidement des 5 autres; puis *O. simplex* et *O. pyrenaeus* se séparent d'un autre groupe comprenant *O. remyi*, *O. baroussensis* et *O. aurensis*; ces deux dernières espèces restent très proches l'une de l'autre bien que parfaitement distinctes.

DISCUSSION

Un travail portant sur l'écologie, la répartition et l'évolution des espèces épigées du genre *Oritoniscus* fera l'objet d'une prochaine publication. Il ressort déjà des travaux de VANDEL (1960) que l'évolution de l'ensemble des espèces du genre *Oritoniscus* se fait au travers d'une complexification progressive des pléopodes 1 et 2 du mâle, elle-même corrélative d'une différenciation de plus en plus poussée des péréiopodes mâles. Dans le cadre de ce schéma, la simple analyse morphologique de ces six espèces met en évidence trois groupes. Le premier correspond à un degré d'évolution et de différenciation des caractères sexuels secondaires mâles quasiment nul. Hormis la présence des pléopodes de la première paire du mâle, il est très difficile, voire impossible de séparer les individus de sexe mâle de ceux de sexe femelle. Ce groupe ne comprend à ce jour que la seule espèce *O. bonadonai* qui est sans conteste l'espèce épigée la plus primitive. Même l'exopodite 1 du mâle est celui qui des six espèces étudiées est le moins différencié, avec un bord externe assez régulier ne montrant pratiquement pas de pointe postéro-externe. Il se trouve que de surcroît cette espèce est aussi géographiquement très isolée de toutes les autres. Le deuxième groupe correspond à des espèces dont les pléopodes 1 du mâle sont nettement plus différenciés au niveau des exopodites qui présentent une pointe postéro-externe. Par ailleurs, les caractères sexuels secondaires mâles sont très affirmés au niveau de la soie sternale et basale du méros V. Par contre les tergites I sont absolument semblables dans les deux sexes. Se rattachent à ce groupe *O. simplex* et *O. pyrenaeus*. Cette dernière espèce est toutefois nettement plus évoluée que la première en ce qui concerne l'exopodite 1 mâle qui présente un lobule postéro-externe séparé du reste du corps de l'appendice et un tubercule à l'angle sterno-distal de l'ischion VI mâle, alors qu'*O. simplex* montre un exopodite 1 entier et une absence de tubercule à l'ischion VI. Le troisième groupe, rassemble des espèces qui présentent une évolution apparemment moins poussée au niveau de la soie sterno-basale du méros V, mais dont le tergite I du mâle montre par contre une fossette glandulo-pilifère plus ou moins différenciée. A cet égard, *O. baroussensis* semble être la forme la plus évoluée tant par le degré de différenciation de sa fossette, que par la sinuosité marquée des extrémités latérales du bord postérieur du tergite I. *O. aurensis* semble être une espèce très proche, y compris géographiquement, et très affine d'*O. baroussensis*: sinuosité déjà marquée du bord postérieur du tergite I et même degré d'évolution du tubercule sterno-distal de l'ischion VI. Même si chez l'adulte les fossettes glandulo-pilifères sont très dissemblables, leur architecture de base reste assez semblable et chez le jeune immature il est sur ce caractère très difficile de séparer les deux espèces. Bien qu'ayant chez l'adulte une fossette glandulo-pilifère très nettement différenciée, *O. remyi* paraît un peu plus éloigné des deux espèces précédentes. Le jeune immature a déjà une fossette qui permet de le reconnaitre et par ailleurs la sinuosité du bord postérieur du tergite I du mâle est très peu marquée, contrairement à *O. aurensis* ou *O. baroussensis*. Par ailleurs, le tubercule basal de la soie sterno-distale de l'ischion VI est absent chez *O. remyi* alors qu'il est bien présent chez les deux autres espèces.

Pour ce qui est de l'analyse moléculaire, les marqueurs RAPD sont apparus comme des outils utiles dans les études de population et de taxonomie chez les Crustacés. GARCIA *et al.* (1994) détectent par cette méthode un haut degré de polymorphisme chez *Penaeus*. Chez *Macrobrachium borellii* la mesure de la distance génétique (d'AMATO & CORACH 1996) permet l'estimation de la diversité génétique des populations. C'est au moyen de l'analyse par RAPD-PCR du génome que BADARACCO *et al.* (1995) ont pu discriminer dans le genre *Artemia*, non seulement des populations,

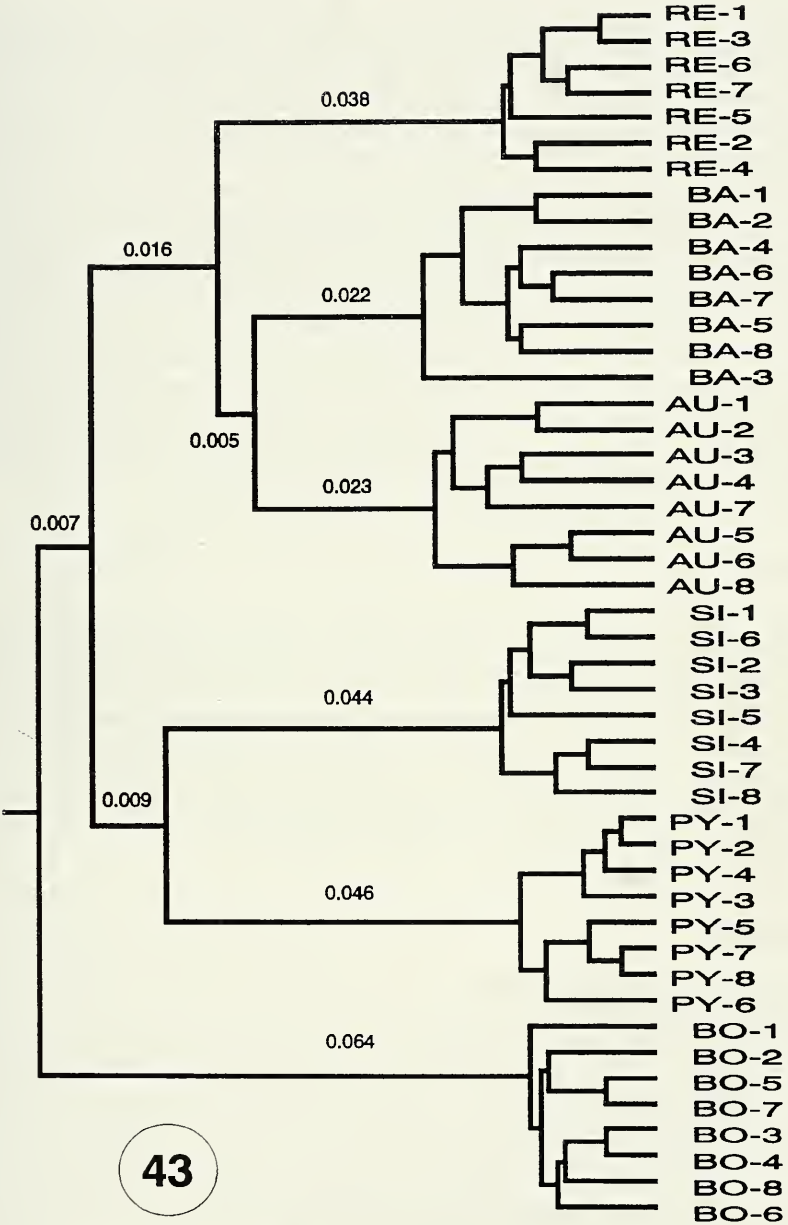


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FIG 43 - Phénogramme relatif aux relations décelées entre les individus des espèces *O. remyi* (RE1 à RE8), *O. baroussensis* (BA1 à BA8), *O. aurensis* (AU1àAU8), *O. simplex* (SI1 à SI8), *O. pyrenaeus* (PY1 à PY8) et *O. bonadonai* (BO1 à BO8) établi d'après un polymorphisme généré par RAPD-PCR et traité par la méthode UPGMA. Les distances entre noeuds sont indiquées.

mais également des espèces très proches les unes des autres. Dans notre précédent travail nous avions mis en évidence la congruence des approches morphologiques et moléculaires chez trois espèces d'*Oritoniscus* et, du fait d'une analyse sur des populations sympatriques, démontré leur indépendance en tant qu'espèces. Chez les 6 autres espèces du groupe des *Oritoniscus* épigés étudiés dans cette note, l'analyse du polymorphisme génomique nous permet de montrer d'une part que le taux de polymorphisme intraspécifique est bien moindre que le polymorphisme entre les espèces; et d'autre part que les distances génétiques peuvent être appréciées et donner lieu à la construction d'un phénogramme interspécifique où on retrouve les trois groupes définis par les critères morphologiques. Ce phénogramme montre la disjonction immédiate de l'espèce *O. bonadonai* qui correspond au premier groupe selon les critères morphologiques (caractères les moins évolués). Il y a également concordance quant au groupe *O. simplex* - *O. pyrenaeus*. Dans le troisième groupe les données moléculaires confirment les distinctions établies d'après les critères morphologiques: d'une part, en séparant *O.remyi* des deux autres espèces *O. baroussensis* et *O. aurensis* et d'autre part, en démontrant l'étroite parenté génétique de ces deux dernières espèces.

REMERCIEMENTS

Les auteurs tiennent à remercier les autorités du Parc National des Pyrénées et tout particulièrement Monsieur J.P. Besson pour les autorisations de prélèvements qui leur ont été délivrées. Nos remerciements vont également à Messieurs A. Franco et Th. Javelle du Spéléo Club du Var pour l'aide qu'ils nous ont apporté dans la recherche et la prospection de grottes et de cavités du Var. Les auteurs tiennent par ailleurs à indiquer que ces travaux se sont pour une large part inscrits et financés dans le cadre du projet européen CEE n° EV5V-CT94-0435 "High Endemism areas, Endemic biota and the Conservation of Biodiversity in Western Europe"

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REVUE SUISSE DE ZOOLOGIE 104 (4): 751-760; décembre 1997

Specie del genere *Leptusa* in Cina. Monografia del genere *Leptusa* Kraatz: Supplemento VII (Coleoptera, Staphylinidae)

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Species of the genus *Leptusa* from China. Monograph on the genus *Leptusa* Kraatz: Supplementum VII (Coleoptera, Staphylinidae). - The first species of the genus *Leptusa* Kr. from continental China are described and illustrated. Three new species (*L. chinensis* from Sichuan, *L. xiahensis* and *L. gansuensis* from Gansu) are assigned to the new subgenus *Aleteleptusa* and a new species *L. gonggamontis* from Sichuan, to the new subgenus *Mimumenepisalia*. Further three new species (*L. sichuanensis* from Sichuan, *L. rougemonti* from Shanxi and *L. microvolans* from Hong Kong) are assigned to the subgenus *Drepanoleptusa* Pace. A key to the subgenera of *Leptusa* from China is presented.

Key-words: Coleoptera - Staphylinidae - Aleocharinae - taxonomy - Leptusa - new subgenus - new species China.

INTRODUZIONE

Nella mia "Monografia del genere *Leptusa* Kraatz" a livello mondiale (PACE 1989), sulla cartina di distribuzione mondiale delle specie di questo genere, tra l'area nippo-siberiana e l'Himalaya, le sottoregioni palearcheartica e indocinese (in cui è compreso il territorio delle Cina) erano sgombre della presenza di specie. Ciò faceva supporre più un'assenza di ricerche specializzate, che un'effettiva assenza del genere in quest'area geografica, poiché in Cina sono presenti territori favorevoli all'insediamento di specie di questo genere, costituiti da zone umide e da catene montuose.

Allorché, ad iniziare dal 1990, il Dr Ales Smetana del Biosystematics Research Centre di Ottawa ha condotto ricerche specializzate alle alte cime montuose dell'isola di Taiwan, con la scoperta di ben 13 nuove specie da me descritte (PACE 1991, 1995, 1996*a*, *b*) è stato confermato che l'assenza di dati conoscitivi su questo genere a Taiwan era da attribuite all corrispondente assenza di ricerche specializzate. Ciò portava a prevedere che anche nella Cina continentale si potesse riscontrare una presenza di specie del genere *Leptusa* allorché ricerche specializzate fossero state condotte.

(137° Contributo alla conoscenza delle Aleocharinae)

Manoscritto accettato il 26.05.1997.

Finalmente questo tipo di ricerche sono state effettuate in Cina per la prima volta nel 1994 ancora dal Dr Ales Smetana che per primo ha scoperto le prime specie cinesi del genere *Leptusa* (cinque), qui di seguito descritte. Parallelamente alle ricerche del Dr Smetana, il collega Guillaume de Rougemont di Londra, ha pure esso condotto ricerche specializzate sulle Aleocharinae della Cina. Ciò gli ha permesso di rinvenire pur esso specie di *Leptusa* (due), anch’esse qui di seguito descritte.

Gli holotypi delle nuove specie sono conservati nel “Muséum d’histoire naturelle” di Ginevra (MHNG).

CHIAVE DEI SOTTOGENERI DI *LEPTUSA* KR. DELLA CINA

Vengono qui inquadrati tassonomicamente i sottogeneri presenti nel territorio cinese, comprese le isole. E’ una sistemazione a carattere provvisorio poiché di alcune specie non è noto il maschio o la femmina e altre nuove specie possono in futuro essere scoperte sì da rendere possibili future modifiche.

1 Pronoto molto trasverso 2
\- Pronoto poco trasverso 8
2 Pronoto fortemente ristretto all’indietro 3
\- Pronoto poco ristretto all’indietro 5
3 Corpo di taglia maggiore: 3,0-3,3 mm; lati del pronoto sinuati davanti agli angoli posteriori; elitre più lunghe o lunghe quanto il pronoto; espansioni preapicali laterali dell’edeago molto sviluppate. Taiwan . . . . *Aphaireleptusa* Pace, 1996 (tipo: *L. anmashanensis* Pace)
\- Corpo di taglia minore: 1,8-2,3 mm; lati del pronoto non sinuati davanti agli angoli posteriori; elitre più corte del pronoto; esansioni preapicali laterali dell’edeago non sviluppate 4
4 Taglia minore: 1,8 mm; elitre molto più corte del pronoto; non sono punteggiati i solchi trasversi basali degli uroterghi; bulbo distale della spermateca asimmetrico e allungato. Taiwan . . . . *Nesopisalia* Pace, 1991 (tipo: *L. centralis* Pace)
\- Taglia maggiore: 2,3 mm; elitre poco più corte del pronoto; sono punteggiati i solchi trasversi basali degli uroterghi; bulbo distale della spermateca subsferico. Cina. *Mimumenepisalia* subg. n. (tipo: *L. gonggamontis* sp. n.)
5 Lati del pronoto chiaramente sinuati davanti gli angoli posteriori (carattere valido solo per le specie della Cina); tubulo mediano interno dell’edeago lunghissimo. California, Giappone e Taiwan. *Heteroleptusa* Pace, 1989 (tipo: *L. frontalis* (Casey))
\- Lati del pronoto non sinuati davanti agli angoli posteriori; tubulo mediano interno dell’edeago da lungo a brevissimo 6

6 Tubulo mediano interno dell'edeago lungo e arcuato, lungamente sporgente dall'orifizio apicale e presentante striature della parete interna largamente estese sulla porzione mediana. Taiwan. . . *Anosiopisalia* Pace, 1995
(tipo: *L. nemoricultrix* Pace)

\- Tubulo mediano interno dell'edeago corto, rettilineo e appena sporgente dall'orifizio apicale. 7

7 Edeago poco ricurvo al lato ventrale; tubulo mediano del sacco interno dell'edeago meno corto; piastre basali del sacco interno volte verso il lato dorsale. Taiwan. . . . . *Akratopisalia* Pace, 1996
(tipo: *L. cribrata* Pace)

\- Edeago molto profondamente ricurvo al lato ventrale; tubulo mediano del sacco interno cortissimo; piastre basali interne non rovesciate al lato dorsale. Taiwan. . . . . *Kochliodepisalia* Pace, 1996
(tipo: *L. spirarum* Pace)

8 Edeago privo di plica centrale e, in visione ventrale, senza espansioni preapicali laterali; piastre distali del sacco interno dell'edeago prive di pliche al margine preapicale interno. Himalaya, Cina, Giappone.
. . . . *Drepanoleptusa* Pace, 1982
(tipo: *L. annapurnensis* Pace)

\- Edeago con plica ventrale e con espansioni preapicali laterali; piastre distali del sacco interno dell'edeago presentanti pliche al margine preapicale interno. Cina. . . . . *Aleteleptusa* subg. n.
(tipo: *L. chinensis* sp. n.)

Il nome del nuovo sottogenere *Aleteleptusa* significa "Leptusa vagabonda". Il nome del nuovo sottogenere *Mimumenepisalia* significa "Pisalia imitatrice".

DESCRIZIONI

Leptusa (Aleteleptusa) chinensis sp. n. Figg. 1-4

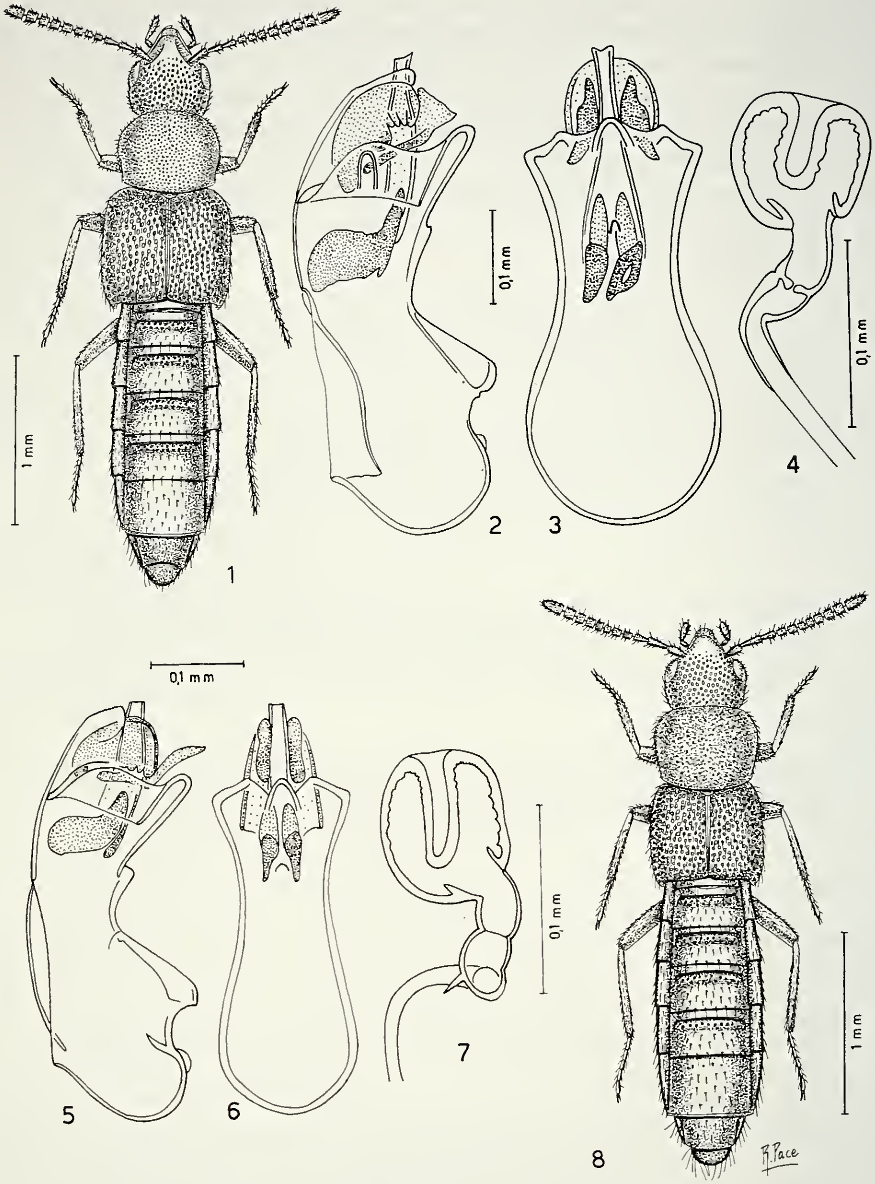
Holotypus ♂, China, Sichuan, Gongga Shan, above Camp 3, 3050 m, 22.VII.1994, (A. Smetana leg., MHNG).

Paratypi: 1 ♂, stessa provenienza; 2 ♂♂ e 2 ♂♂, ibidem, ma 3300-3390 m, 23.VII.1994 (A. Smetana leg.).

Descrizione. Lunghezza 3,3 mm. Corpo lucido e nero, con margine posteriore degli uroterghi bruno-rossiccio; antenne brune con i tre antennomeri basali giallo-rossicci; zampe bruno-rossicce. La punteggiatura del capo è fittissima, ombelicata e netta, quella delle elitre è profonda. Il pronoto è coperto di tubercoletti salienti e netti, più fittamente distribuiti sulla metà posteriore.

Gli uroterghi sono privi di reticolazione, tranne il quinto che l'ha svanita e il sesto che l'ha nettissima. Edeago figg. 2-3, spermateca fig. 4.

Comparazioni. Si veda oltre la chiave delle specie del sottogenere *Aleteleptusa* data per *L. gansuensis* sp. n.



Figg. 1-8

Habitus, edeago in visione laterale e ventrale e spermateca. 1-4: *Leptusa* (*Aleteleptusa* subgen. n.) *chinensis* sp. n.; 5-8: *Leptusa* (*Aleteleptusa* subgen. n.) *xiahensis* sp. n.

Leptusa (Aleteleptusa) xiahensis sp. n. Figg. 5-8

Holotypus ♂, China, Gansu Mts., 25 Km E Xiahe, 2805-2925 m, 3.VIII.1994, (A. Smetana leg., MHNG).

Paratypus: 1 ♀, stessa provenienza.

Descrizione. Lunghezza 3,1 mm. Corpo lucido e nero, con addome nero-bruno tranne il quarto urite che è nero; antenne bruno-rossicce con i tre antennomeri basali giallo-rossicci; zampe rossicce. La punteggiatura del capo è ombelicata e contigua, quella delle elitre è netta e profonda su un fondo lucido. Il pronoto mostra una superficie rugosa tra cui stanno tubercoletti poco distinti. Gli uroterghi sono privi di reticolazione, tranne il sesto che ha reticolazione svanita. Edeago figg. 5-6, spermateca fig. 7.

Comparazioni. Si veda oltre la chiave delle specie del sottogenere *Aleteleptusa* data per *L. gansuensis* sp. n.

Leptusa (Aleteleptusa) gansuensis sp. n. Figg. 9-12

Holotypus ♂, China, Gansu Mts., 25 Km E Xiahe, 3000 m, 5.VIII.1994, (A. Smetana leg. MHNG).

Paratypi. 8 es., stessa provenienza.

Descrizione. Lunghezza 2,9 mm. Corpo lucido e nero-bruno, con margine posteriore degli uroterghi ed estremità addominale bruno-rossicci; antenne brune con i due antennomeri basali e la base del terzo giallo-rossicci; zampe rossicce. La punteggiatura del capo e delle elitre è netta. Il capo presenta nessuna traccia di reticolazione, il pronoto ha reticolazione svanita, le elitre l'hanno distinta e gli uroterghi mostrano reticolazione distinta, tranne nel fondo dei solchi trasversi basali dove la reticolazione è netta. Edeago figg. 10-11, spermateca fig. 12.

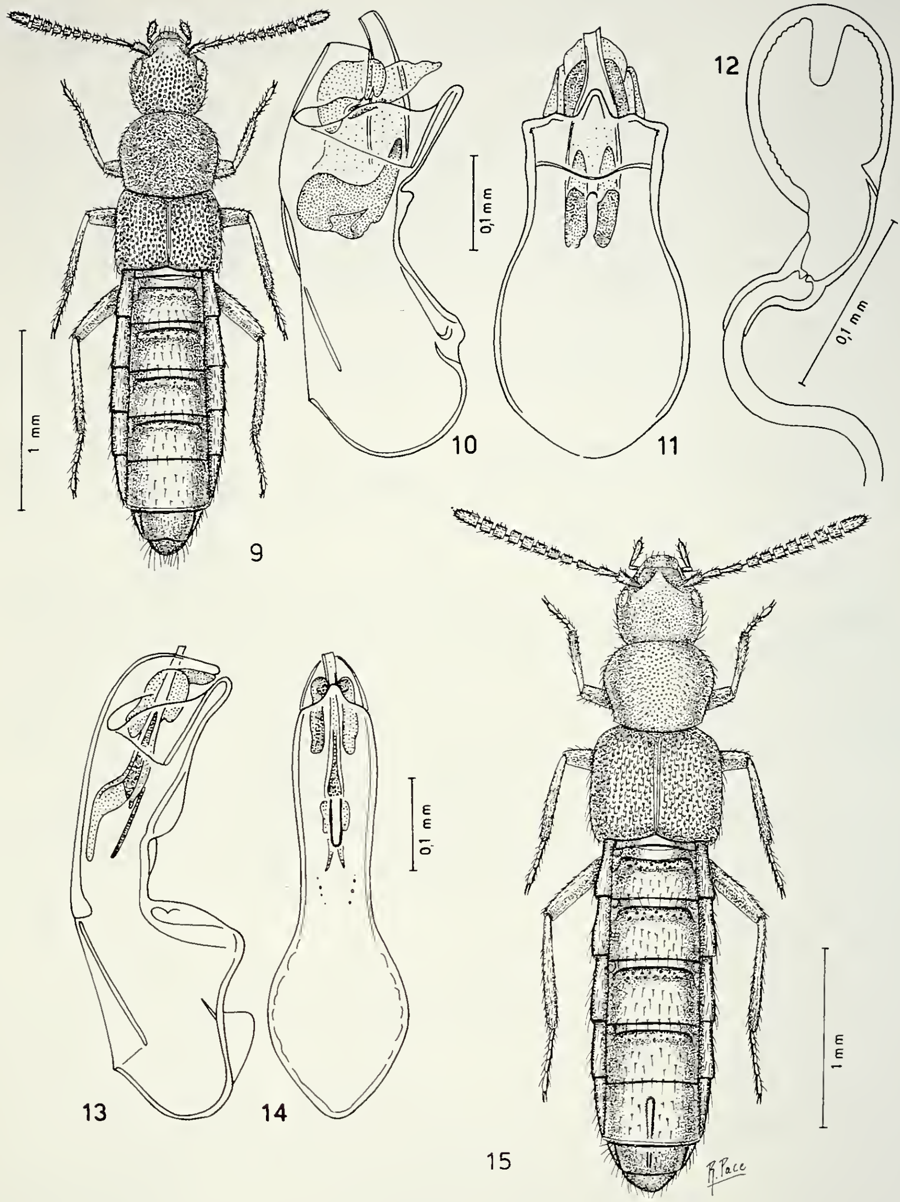
Comparazioni. Per le comparazioni di *L. gansuensis* sp. n., *L. xiahensis* sp. n. e *L. chinensis* sp. n. con le restanti specie cinesi del genere, si veda la chiave dei sottogeneri data prima della descrizione delle presenti nuove specie.

Le tre specie del nuovo sottogenere *Aleteleptusa* si possono separare mediante la seguente chiave:

1 Specie alate, atte al volo, con elitre più lunghe del pronoto; occhi meno ridotti; edeago più profondamente ricurvo al lato ventrale; introflessione apicale del bulbo distale della spermateca raggiungente il centro dello stesso bulbo distale. 2

- Specie alata, ma non atta al volo, con elitre più corte del pronoto; occhi più ridotti; edeago meno profondamente ricurvo al lato ventrale; introflessione apicale del bulbo distale della spermateca non superante il centro dello stesso bulbo distale. China: Gansu. . . . . *gansuensis* sp. n.

2 Lati del pronoto sinuati davanti agli angoli posteriori; pronoto coperto di tubercoletti netti, più fitti sulla metà posteriore; elitre più sviluppate, sia in larghezza che in lunghezza; edeago più robusto, con plica ventrale della lama sternale dell'edeago situata circa a metà tra la "crista apicalis" e l'apice dell'edeago stesso; introflessione apicale del bulbo distale della spermateca robusta e corta. China: Sichuan. . . . . . *chinensis* sp. n.



FIGG. 9-15

Habitus, edeago in visione laterale e ventrale e spermateca. 9-12: *Leptusa* (*Aleteleptusa* subgen. n.) *gansuensis* sp. n.; 13-15: *Leptusa (Drepanoleptusa) sichuanensis* sp. n.

\- Lati del pronoto non sinuati davanti agli angoli posteriori; pronoto coperto di tubercoletti poco distinti tra la rugosità della superficie; elitre meno sviluppate, sia in lunghezza che in larghezza; edeago meno robusto, con plica ventrale della lama sternale dell'edeago situata più vicino alla "crista apicalis" che all'apice dell'edeago stesso; introflessione apicale del bulbo distale della spermateca stretta e lunga. China: Gansu. . . . . *xiahensis* sp. n.

Leptusa (Drepanoleptusa) sichuanensis sp. n. Figg. 13-15

Holotypus ♂, China, Sichuan, Gongga Shan, above Camp 3, 3050 m, 22.VI.1994, (A. Smetana leg., MHNG)

Descrizione. Lunghezza 3,7 mm. Corpo lucido e rossiccio, comprese le antenne e le zampe. La reticolazione del capo è vigorosa, quella del resto del corpo è distinta. La punteggiatura del capo è superficiale e confusa nella reticolazione. I tubercoletti che coprono il pronoto sono distinti, più fitti sulla linea mediana, quelli delle elitre sono robusti. Edeago figg. 13-14.

Comparazioni. Specie che per l'habitus si avvicina tassonomicamente a *L. annapurnensis* Pace, 1982 del Nepal. Se ne distingue in base ai caratteri dati nella seguente chiave:

1 Taglia minore: 2,8-3,0 mm; occhi lunghi quanto le tempie; edeago privo di carena ventrale. Nepal. . . . . *annapurnensis* Pace

\- Taglia maggiore: 3,7 mm; occhi nettamente più corti delle tempie; edeago con carena ventrale. China: Sichuan. . . . . *sichuanensis* sp. n.

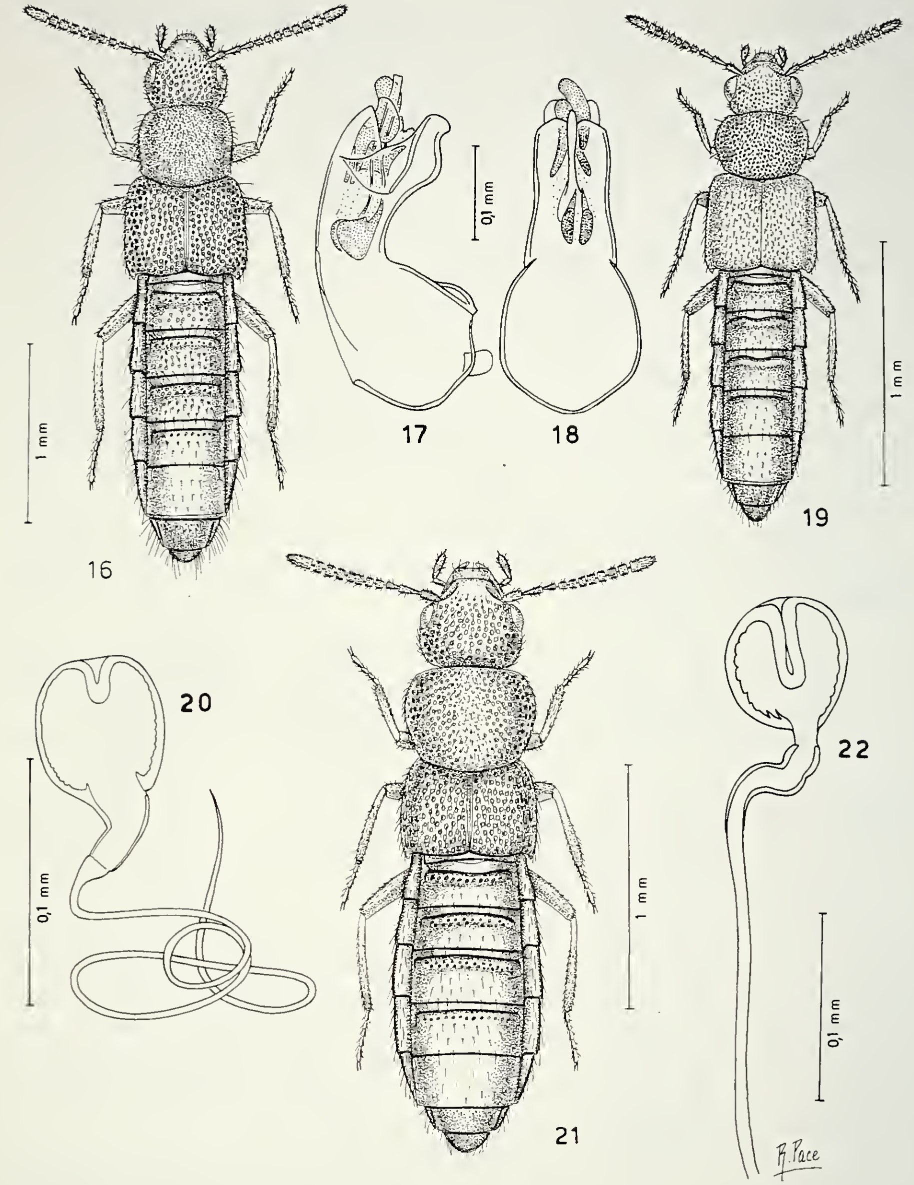
Leptusa (Drepanoleptusa) rougemonti sp. n. Figg. 16-18

Holotypus ♂, China, Shanxi, Nonwutai, 17.IX.1995, (G. de Rougemont leg., MHNG).
Paratypi: 2 ♂♂, stessa provenienza.

Descrizione. Lunghezza 3,0 mm. Corpo lucido e rossiccio con uriti liberi quarto e quinto bruni; antenne giallo-rossicce; zampe rossicce. Solo le elitre presentano una reticolazione che è estremamente svanita: sul resto del corpo è assente, ma gli uroterghi liberi quarto e quinto sono coperti di reticolazione distinta. La punteggiatura del capo e delle elitre è fitta, netta e contigua. Il pronoto è coperto di tubercoletti contigui salienti che danno un aspetto rugoso alla superficie. Solo i tre uroterghi basali hanno punteggiatura netta. Edeago figg. 17-18.

Comparazioni. L'habitus e l'edeago della nuova specie sono simili a quelli di *L. himalayiana* Pace, 1989 del Nepal. Tuttavia in *himalayiana* la taglia è minore (2,2 mm), gli occhi più ridotti e l'edeago poco profondamente ricurvo al lato ventrale e con sinuosità preapicale ventrale non così accentuata come quella dell'edeago della nuova specie.

Etimologia. Specie dedicata al suo raccoglitore, il noto studioso di Staphylinidae Guillaume de Rougemont di Londra.



FIGG. 16-22

Habitus, edeago in visione laterale e ventrale e spermateca. 16-18: *Leptusa (Drepanoleptusa) rougemonti* sp. n.; 19-20: *Leptusa (Drepanoleptusa) microvolans* sp. n.; 21-22: *Leptusa (Minumenepisalia)* subgen. n.) *gonggamontis* sp. n.

Leptusa (Drepanoleptusa) microvolans sp. n. Figg. 19-20

Holotypus ♀, Hong Kong, Kadoorie Agricultural Research Centre: Kadoorie Farm, flight interception trap, 19-31.V.1996, (G. de Rougemont leg., MHNG).
Paratypus: 1 ♀, Hong Kong, Tai PO, VII.1996, (G. de Rougemont leg.).

Descrizione. Lunghezza 1,9 mm. Corpo lucido e giallo-rossiccio con disco del capo, elitre tranne la base e quarto urite libero, bruno-rossicci; antenne rossicce con i due antennomeri basali e l'apice dell'undicesimo giallo-rossicci; zampe giallo-rossicce. La reticolazione sul capo e sui tre uroterghi basali è svanita, quella del pronoto e delle elitre è distinta e quella degli uroterghi quarto, quinto e sesto è vigorosa. La punteggiatura del capo e del pronoto è netta. Tubercoletti distinti coprono la superficie delle elitre. Spermateca fig. 20.

Comparazioni. La spermateca della nuova specie è molto simile nel suo aspetto generale a quella di *L. himalayiana* Pace, 1989, del Nepal; tuttavia l'habitus delle due specie è chiaramente differente: gli occhi sono molto sviluppati nella nuova specie, mentre sono molto ridotti in *himalayiana*; il pronoto è nettamente più trasverso nella nuova specie e i solchi trasversi basali degli uroterghi non sono punteggiati (robustamente punteggiati in *himalayiana*).

Leptusa (Mimumenepisalia) gonggamontis sp. n. Figg. 21-22

Holotypus ♀, China, Sichuan, Gongga Shan, above Camp 3, 3050 m, 22.VII.1994, (A. Smetana leg., MHNG).

Descrizione. Lunghezza 2,4 mm. Specie attera. Corpo lucido e bruno-rossiccio con quarto urite libero bruno; antenne brune con i quattro antennomeri basali giallo-rossicci; zampe rossicce con tarsi giallo-rossicci: Spermateca fig. 22.

Comparazioni. I caratteri differenziali dati sopra nella chiave dei sottogeneri presenti in Cina, sono più che sufficienti a permettere di distinguare la nuova specie dalle attere geograficamente vicine.

RINGRAZIAMENTI

Rivolgo i miei più vivi ringraziamenti al Dr A. Smetana e a G. de Rougemont per avermi affidato in studio il materiale da essi raccolto in Cina e oggetto del presente lavoro.

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REVUE SUISSE DE ZOOLOGIE 104 (4): 761-783; décembre 1997

Revision der *Bembidion*-Untergattung *Phyla* Motschulsky 1844 (Coleoptera, Carabidae, Bembidiinae)

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Revision of the *Bembidion* subgenus *Phyla* Motschulsky 1844 (Coleoptera, Carabidae, Bembidiinae). – The subgenus *Phyla* Motschulsky 1844 (*Bembidion (Phyla) obtusum, B. incommodum, B. tethys, B. abdelkrimi, B. liliputanum, B. rectangulum*) has been revised. Two new species are described (*Bembidion minoum* nov. sp. and *B. phoeniceum* nov. sp.), two taxa are synonymized. Determination keys are given as well as the distribution areas of the mostly mediterranean *Phyla* species.

Key-words: Carabidae - *Bembidion* - *Phyla* - revision - taxonomy - new species - key - palaearctic.

EINLEITUNG

Die Untergattung *Phyla* Motschulsky 1844 der Gattung *Bembidion* umfasst nur wenige südwest-paläarktische Arten. Diese sind erkennbar an ihrer kurzen, winkelig eingefügten Schulterfalte und an der fehlenden oder höchstens schwach metallischen Färbung, wodurch sie sich von den intensiv metallisch gefärbten Arten der Untergattung *Metallina* unterscheiden. Lange Zeit waren nur zwei Arten aus dem mediterranen Raum bekannt (*B. obtusum* Audinet-Serville, 1821 und *B. rectangulum* Jacquelin duVal, 1852). 1907 etablierte SAHLBERG *liliputanum* und erst 1926 beschrieb NETOLITZKY drei weitere Taxa (*tethys*, *abdelkrimi*, *incommodum*), die er als Unterarten von *B. obtusum* einstufte. Einen ersten (und guten) Überblick über die *Phyla*-Arten schuf GRIDELLI (1929, 1931), indem er verschiedene endophallische Sklerite zur Artdiagnose beizog. Seit Netolitzkys grossem Werk von 1942/43 über die Gattung *Bembidion* befasste sich jedoch kaum mehr jemand mit der Untergattung *Phyla*. SCHULER (1963, *Phyla gallicum*) und MORVAN (1977, *Phyla obtusum* ssp. *iranicum*) beschrieben zwei neue Taxa, ohne aber deren Stellung innerhalb der Untergattung zu überprüfen. Eine Revision der *Phyla*-Gruppe drängte sich auf.

Der Status von *Phyla* als Gattung oder Untergattung ist nicht Gegenstand dieser Untersuchung. JEANNEL (1941) teilte die *Bembidion* der französischen Fauna in 18 Genera auf, PERRAULT (1981) weltweit in zehn. Obwohl letzterer aufgrund einer

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Manuskript angenommen am 03.03.1997

Analyse der weiblichen Spermathek *Phyla* als Genus behandelte, bezeichnete er selbst den Gattungsstatus als noch ungesichert. Trotz einiger phylogenetischer Untersuchungen ist die cladistische Struktur des Subtribus Bembidiina weiterhin unklar (MADDISON 1993): Wir behandeln deshalb *Phyla* im herkömmlichen Sinn NETOLITZKYS (1942/43) als Untergattung von *Bembidion*.

MATERIAL UND METHODEN

Insgesamt standen 2632 Tiere der Untergattung *Phyla* aus Museumsbeständen und Privatsammlungen zur Verfügung. Sofern nötig, wurden bei den Männchen der Aedoeagus und das IX. Abdominalsegment (Urit) präpariert. Die freigelegten Aedoeagi wurden in 10% KOH aufgehellt, für 2 bis 3 Stunden in 96% Alkohol, anschliessend für 8 bis 12 Stunden in Xylol gehalten. Die Einbettung auf Transparentplättchen erfolgte mit dem Einschlussmittel DPX oder mit Kanadabalsam.

Die für die Diagnose von *Phyla*-Arten charakteristischsten Merkmale finden sich im männlichen Genital, die weiblichen Armaturen erwiesen sich als ungeeignet. GRIDELLI (1929, 1931) und SCHATZMAYR (1936) verwendeten als erste und zutreffend bei *B. obtusum* und *B. incommodum* eine sklerotisierte doppelhörnige Innenstruktur des Aedoeagus als Bestimmungsmerkmal ("pièce copulatrice"). JEANNEL (1941) verallgemeinerte diesen Begriff und übertrug ihn sinnverändernd und im Plural ("pièces copulatrices") auf weitere Endosklerite; gleichzeitig schrieb er fälschlicherweise *B.*

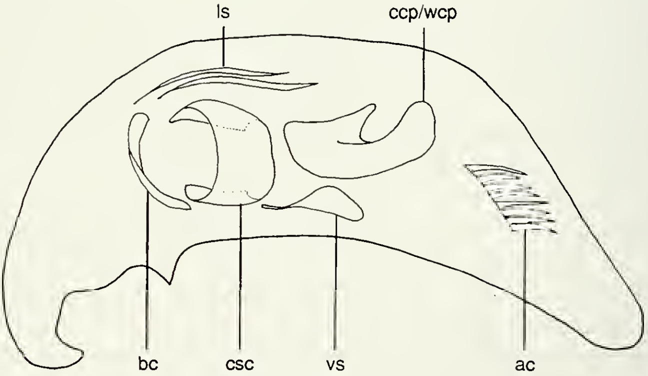


ABB. 1

Diagnostisch wichtige Endosklerite des Aedoeagus bei Arten der Untergattung *Phyla* (linksseitige Ansicht, schematisch. Terminologie nach MADDISON (1993), ergänzt).
ac apikaler Dornenkamm (apical spine comb), vs Ventralsklerit (ventral sclerite), ccp drehrundes Doppelhorn (corned copulation piece) = "pièce copulatrice" sensu GRIDELLI (1929), wcp abgeflachtes Doppelhorn (winglike copulation piece), csc zentraler Skleritkomplex (central sclerite complex; hier nur der linke Lobus als Halbschale dargestellt), ls dorsale Längsstütze (dorsal plate), bc Basalspange (basic clasp).

tethys den doppelhörnigen Sklerit als arteigen zu. Jeannels Begriffsänderung und Fehler waren verwirrend und vor allem bei französischen Autoren nicht ohne Wirkung: Antoine (1955), Schuler (1963) und Bonadona (1971) haderten in der Folge mit dem Taxon *B. tethys*. Da für eine sichere Artdetermination ausser dem doppelhörnigen "pièce copulatrice" noch weitere Endosklerite von Bedeutung sind, seien diese in Abb. 1 definiert. Lindroth (1940) erkannte die diagnostische Bedeutung der genitalen Endosklerite, die er mit Bezeichnungen versah; allerdings wandte er zum Teil dieselben Termini bei eindeutig nicht homologen Strukturen an, weshalb wir von seiner Endosklerit-Nomenklatur absehen und uns an diejenige von Maddison (1993) halten.

Die in der vorliegenden Revision ermittelten Verbreitungsareale der Arten beruhen auf Funddaten persönlich überprüfter Tiere aus zahlreichen Sammlungen. Da die Systematik der *Phyla*-Arten bislang nur unzureichend geklärt war, ist bei der Übernahme von Daten für faunistische Fragestellungen – vor allem aus älterer Literatur – Vorsicht angebracht: Zu oft wurden die Arten *B. obtusum*, *B. rectangulum* und *B. tethys* verwechselt beziehungsweise nicht unterschieden. Nur in wenigen Fällen erfolgten Berichtigungen wie etwa von Netolitzky (1926) über die falsche Meldung von *B. obtusum* durch Holdhaus (1923) von der Insel Elba (= *B. tethys*). So bleiben hier zahlreiche alte Fundmeldungen (Fuente y Morales 1918, Normand 1933, Schatzmayr 1935) unberücksichtigt, da die Tiere zumeist nicht mehr überprüfbar sind.

Zu morphometrischen Vergleichen wurden die grösste Halsschildbreite, die mediane Halsschildlänge sowie die Proportion Halsschildbreite/-länge beigezogen (t-Test, SYSTAT).

Museen, die Material für die vorliegende Revision zur Verfügung stellten, werden wie folgt abgekürzt:

- BMNH	The Natural History Museum London,
- MHNG	Muséum d'histoire naturelle Genève,
- MHNP	Muséum National d'Histoire Naturelle Paris,
- MNB	Museum für Naturkunde Berlin,
- MZSt	Musée Zoologique Strasbourg,
- NHMS	Naturhistorisches Museum Stuttgart,
- NHMW	Naturhistorisches Museum Wien,
- NMBE	Naturhistorisches Museum Bern,
- ZMHE	Zoological Museum of the University Helsinki,
- ZMTU	Zoological Museum of the University Turku.

BESTIMMUNGSSCHLÜSSEL

Bestimmung der Artengruppen und Arten nach der Genitalmorphologie

1 Aedoeagus enthält ausser dem zentralen Skleritkomplex keine auffälligen sklerotisierten Innenstukturen (Abb. 2g, h) . . (*rectangulum*-Gruppe) 2

– Aedoeagus mit auffälligen Endoskleriten wie Doppelhorn (Abb. 2a, b, c), Apikalkamm (Abb. 2d, e) oder Ventralsklerit (Abb. 2f) 3

2 Spitze des IX. Abdominalsegments (Urit) lang und schmal oder wenig erweitert (Abb. 3d). Tiere ungeflügelt, Schultern verrundet. Westmediterran . . . . *B. rectangulum*

– Spitze des IX. Abdominalsegments sehr kurz und schmal (Abb. 3c). Tiere geflügelt, Schultern ausgeprägt entwickelt. Ostmediterran . . . . *B. phoeniceum* sp. n.

3 Aedoeagus mit doppelhörnigem Endosklerit . . . . (*obtusum*-Gruppe) 4

– Aedoeagus mit anderen Innenstrukturen (Ventralsklerit, Apikalkamm), aber ohne doppelhörnigen Endosklerit 6

4 Beide Äste des doppelhörnigen Endosklerits stielrund (Abb. 2a). Europa . . . . *B. obtusum*

– Äste des doppelhörnigen Endosklerits abgeflacht (Abb. 2b, c) 5

5 IX. Abdominalsegment mit schaufelförmig verbreiterter Spitze (Abb. 3b). Kaukasus und Nordiran . . . . *B. incommodum*

– IX. Abdominalsegment mit langer, schmaler Spitze (Abb. 3a). Kreta . . . . *B. minoum* sp. n.

6 Aedoeagus ohne endophallischen Apikalkamm, dafür mit grossem Ventralsklerit (Abb. 2f). Ostmediterran . . (*liliputanum*-Gruppe) *B. liliputanum*

– Aedoeagus im Bereich der Spitze mit endophallischem Apikalkamm (Abb. 2d, e) . . . . (*tethys*-Gruppe) 7

7 Endophallischer Apikalkamm mit 6–10 Dornen (Abb. 2d), Halsschildhinterwinkel gerundet. 6. und 7. Punktreihe der Flügeldecken undeutlich. Holomediterran . . . . *B. tethys*

– Endophallischer Apikalkamm mit meist mehr als 10 schwächeren Dornen (Abb. 2e), Halsschildhinterwinkel schwach ausgeschweift und deshalb rechtwinklig. 6. und 7. Punktreihe der Flügeldecken bis zur Spitze durchgehend deutlich. Atlantisch . . . . *B. abdelkrimi*

Bestimmung der Arten nach vorwiegend exoskeletalen Merkmalen

1 6. und 7. Punktreihe der Flügeldecken bis zu den Spitzen durchgehend deutlich. Atlantisch . . . . *B. abdelkrimi*

– 6. und 7. Punktreihe der Flügeldecken undeutlich, hinter der Mitte schwächer werdend oder fehlend 2

2 Halsschildhinterwinkel gerundet, ohne Hinterecke (Abb. 4d). Holomediterran . . . . *B. tethys*

– Halsschildhinterwinkel stumpfwinklig (130°) oder ausgeschweift und rechtwinklig 3

3 Halsschildseitenrand zu den stumpfwinkligen (130°) Hinterecken geradlinig verengt (Abb. 4a). Europa . . . . *B. obtusum*

– Halsschildseitenrand zu den rechtwinkligen Hinterecken konkav verengt, vor den Hinterecken ausgeschweift 4

4 Schultern ausgeprägt, Tiere geflügelt, Flügeldecken seitlich nahezu parallel (Abb 5h). Ostmediterran . . . . *B. phoeniceum* sp. n.

– Schultern verrundet, Tiere apter oder brachypter, Flügeldecken seitlich gerundet 5

5 Aedoeagus mit doppelhörnigem Endosklerit (Abb. 2b, 2c) 6

– Aedoeagus ohne doppelhörnigen Endosklerit 7

6 IX. Abdominalsegment (Urit) mit schmaler Spitze (Abb 3a). Endemit Kretas . . . . *B. minoum* sp. n.

– IX. Abdominalsegment mit schaufelförmig erweiterter Spitze (Abb 3b). Kaukasus und Nordiran. . . . . *B. incommodum*

7 Basolaterale Längsfalte (Carina) im Hinterwinkel des Halsschildes ausgeprägt und nach vorn-aussen gekrümmt (Abb. 4f). Antennenglieder gedrungen. Aedoeagus mit grossem Ventralsklerit (Abb 2f). Ostmediterran . . . . *B. liliputanum*

– Carina im Hinterwinkel des Halsschildes kurz und gerade. Antennenglieder gestreckt. Aedoeagus ohne Ventralsklerit (Abb. 2g). Westmediterran . . . . *B. rectangulum*

TAXONOMIE

Phyla Motschulsky, 1844

Phyla Motschulsky, 1844: 238.
Typusart: *Bembidion obtusum* Audinet-Serville, 1821.
Phayla Motschulsky, 1844 (nom. emend.)
Phaula Bedel, 1879 (nom. emend.)
Phila auct. (incorr. emend.)
Microcys J. Sahlberg, 1907: 11.
Typusart: *Microcys liliputanus* J. Sahlberg, 1907.

obtusum-Gruppe

Merkmal der *obtusum*-Gruppe: Aedoeagus mit doppelhörnigem Endosklerit (Abb. 1, ccp bzw. wcp). Drei Arten.

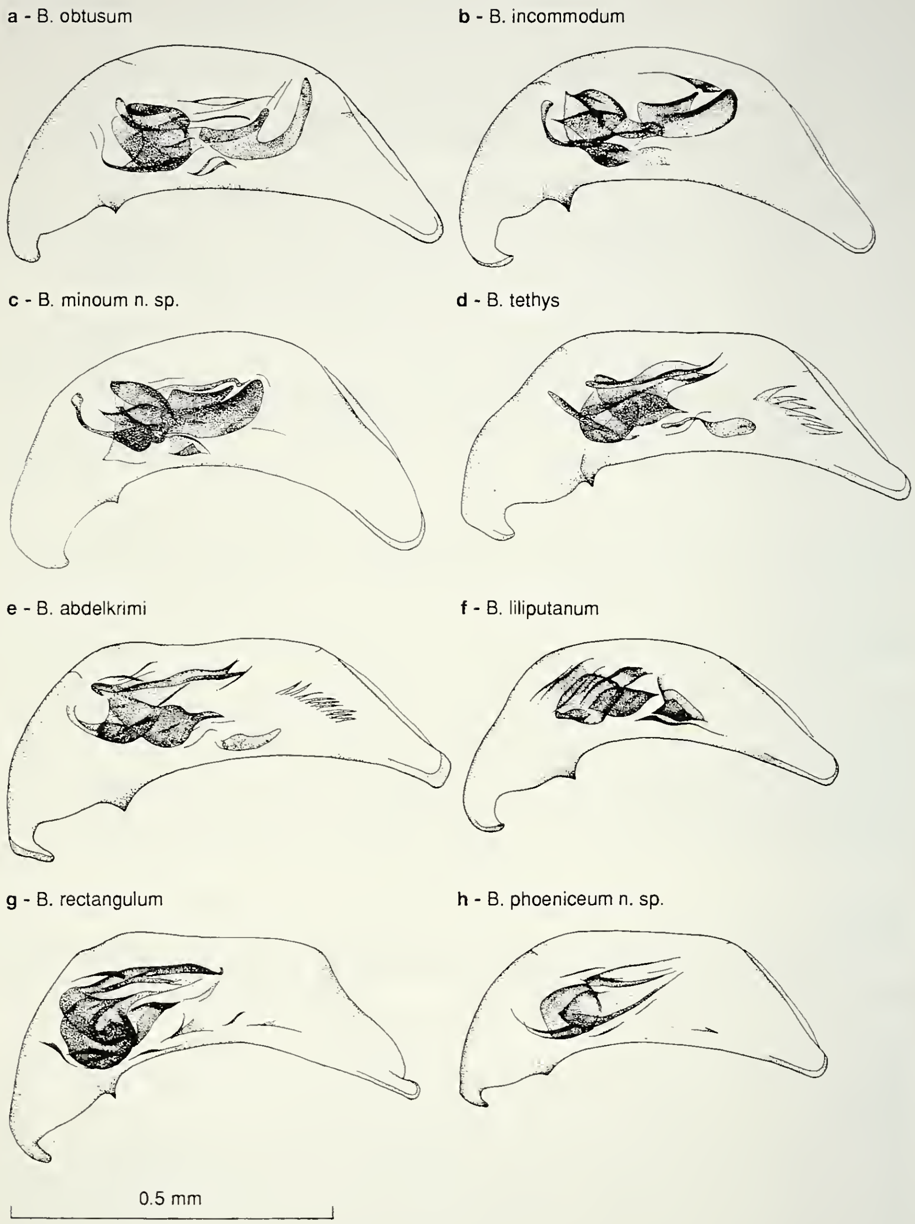
Bembidion (Phyla) obtusum Audinet-Serville, 1821

Bembidion obtusum Audinet-Serville, 1821: 83. Locus typicus: Paris.

Tachys gracilis Stephens, 1829: 6. Locus typicus: bei Swansea. Typus ♀ aus Coll. Stephens (BMNH) überprüft (trägt Determinationsetikette "*B. obtusum* det. Netolitzky").

Tachys immunis Stephens, 1829: 6. Standort des Typus nicht bekannt. Stephens beschrieb die Art nach Angaben aus Kirbys Notizbuch (MSS; HAMMOND 1972), der Typus befindet sich aber nicht in der Coll. Kirby. 3 Exemplare (mit Determinationsetikette "*B. obtusum* det. Netolitzky") aus Coll. Stephens (BMNH) überprüft.

Tachys pusillus Stephens, 1829: 6. Standort des Typus nicht bekannt (Coll. Dejean?). Stephens bezog sich auf eine Determination durch Hope von Tieren der Coll. Dejean. 2 Exemplare (mit Determinationsetikette "*B. obtusum* det. Netolitzky") aus Coll. Stephens (BMNH) überprüft.



a - B. obtusum

b - B. incommodum

c - B. minoum n. sp.

d - B. tethys

e - B. abdelkrimi

f - B. liliputanum

g - B. rectangulum

h - B. phoeniceum n. sp.

Abb. 2

Aedoeagi der Arten der *Bembidion*-Untergattung *Phyla*.

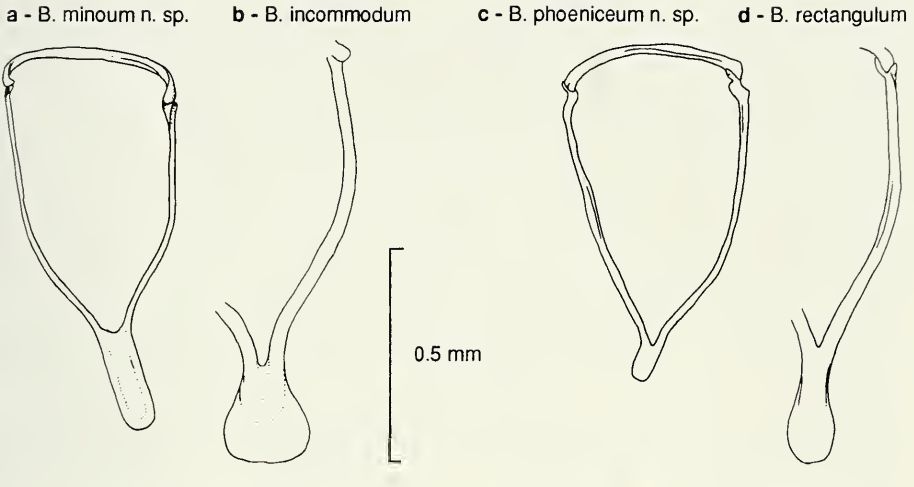


ABB. 3

IX. Abdominalsegment von Arten der *Bembidion*-Untergattung *Phyla*.

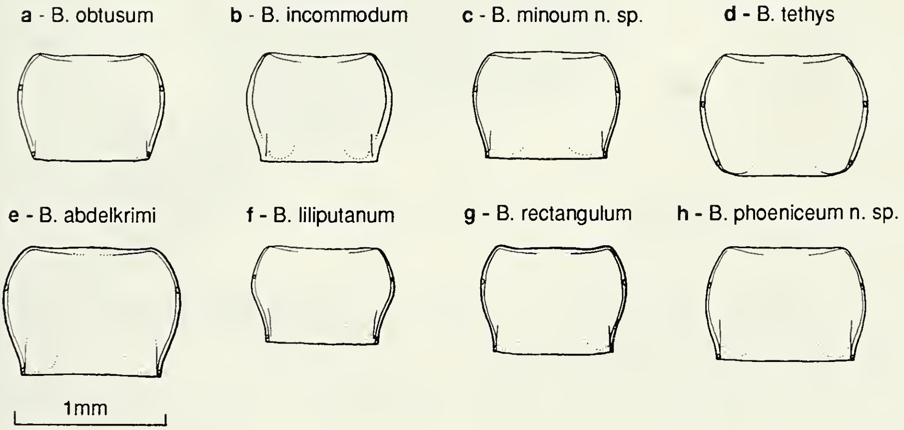


ABB. 4

Pronota der Arten der *Bembidion*-Untergattung *Phyla*.

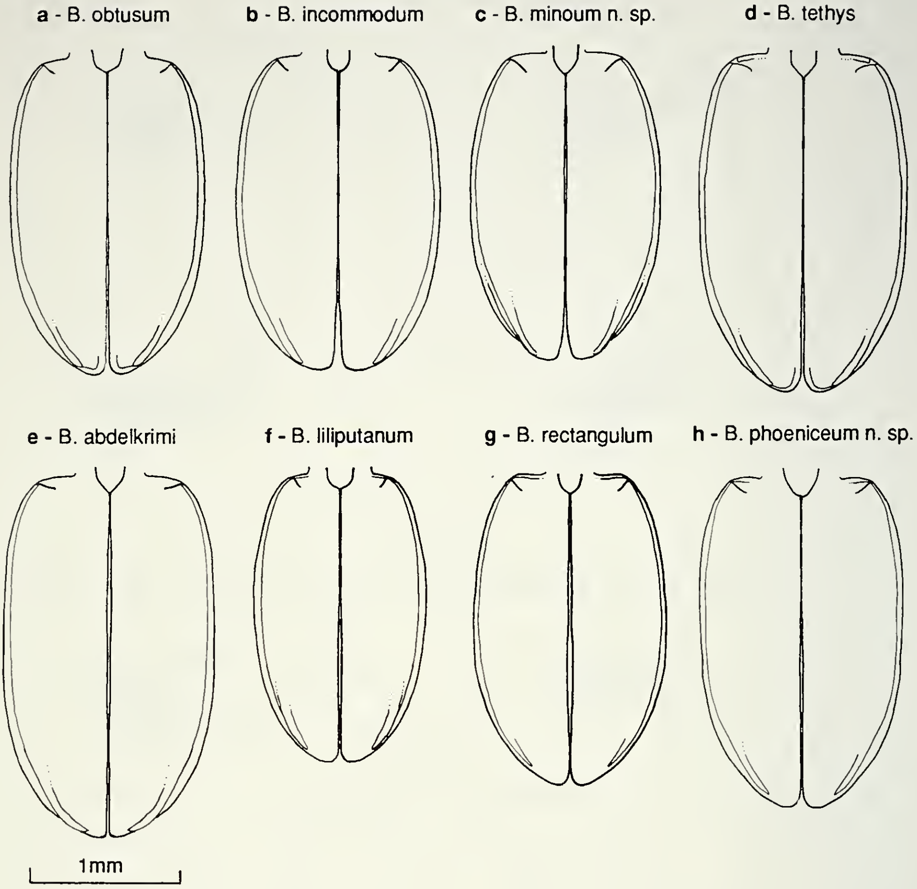


Abb. 5

Flügeldecken der Arten der *Bembidion*-Untergattung *Phyla*.

Der Halsschild ist für die Art charakteristisch: Die gerade Verengung zur Basis und die fehlende Ausschweifung vor den Hinterwinkeln führen zur *obtusum*-typischen stumpfwinkligen Hinterecke von ca. 130° (Abb. 4a).

Im Aedoeagus sind die beiden ungleichlangen Äste des doppelhörnigen Endosklerits (Abb. 2a) arttypisch drehrund gegenüber den abgeflachten Ästen bei *B. incommodum* und *B. minoum* n. sp.
Netolitzky (1926) und Lindroth (1945) erwähnten bei der sonst brachypteren Art *B. obtusum* einen Flügeldimorphismus. Im umfangreich zur Verfügung stehenden Material fanden sich lediglich acht makroptere Tiere. Offensichtlich ist hier die genetische Potenz zur Entwicklung der Hinterflügel noch vorhanden, die phaenotypische Aus-

prägung ist jedoch als seltene Ausnahme zu werten. Mit der Reduktion der Hinterflügel zur Brachypterie ging auch eine Rückbildung der Schulter einher; die Flügeldecken erscheinen deshalb bei verrundeten Schultern länglich-oval (Abb. 5a).

Verbreitungsareal (Abb. 6): Europäische Art, inklusive England und Irland (JOY 1932). Von Skandinavien ist die Südspitze Schwedens besiedelt (HANSEN *et al.* 1939) wie auch Gotland (GRIDELLI 1931). Der Arealverlauf in Osteuropa ist unsicher: Belege liegen vor aus Polen, Tschechien, der Slowakei und aus Ungarn. Nach KRYZHANOVSKIJ *et al.* (1995) erstreckt sich das Verbreitungsareal von *B. obtusum* bis nach Nordwestrussland ("Northern Russain Plain and central part of Russian Plain", p. 78). Von Oberitalien ist nur ein einziger Beleg (Bozen, MNB) bekannt. Der alte Fund zweier Tiere aus Sardinien (Coll. Netolitzky, NHMW) sowie die Literaturangaben von ZABALLOS & JEANNE (1994) über ein Vorkommen von *B. obtusum* auf den Balearen bedürfen einer Bestätigung. GRIDELLI (1931) bestritt alte Meldungen Apfelbecks von *B. obtusum* vom Balkan und deutete sie richtig als *B. tethys*. Die wenigen Belege aus Algerien (Alger, Coll. Desbrochers/Schuler MZSt; Miliana, Coll. Hauser NHMW) und Tunesien (Bizerti, Coll. Sicard/Jeannel MHNP) sind ebenfalls

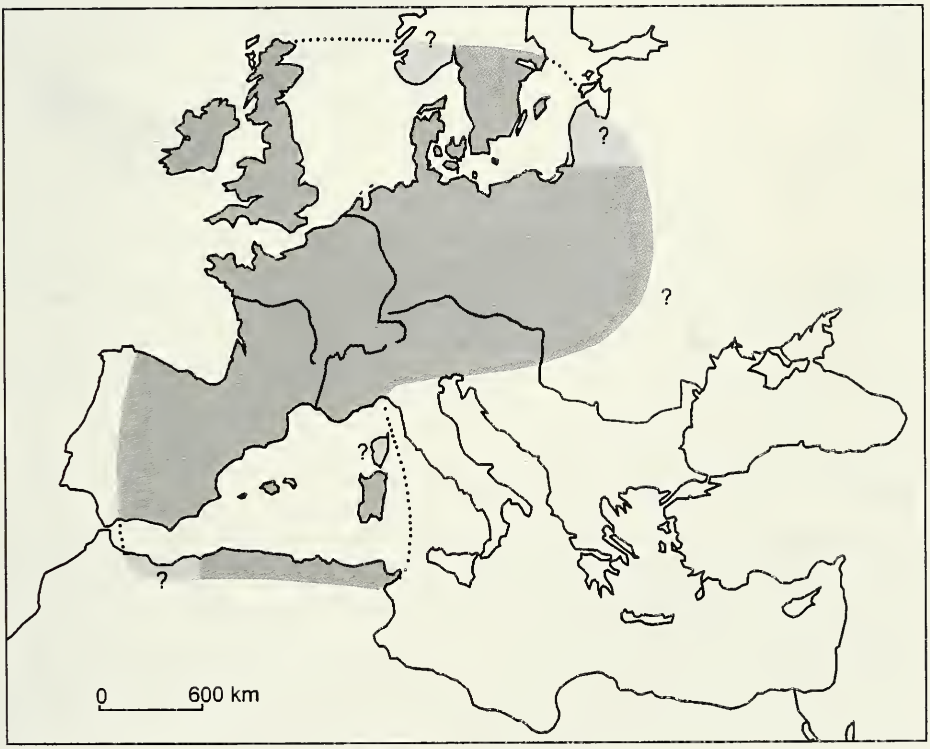


ABB. 6

Verbreitung von *Bembidion (Phyla) obtusum* Audinet-Serville. ? = unsicherer Arealverlauf.

alte und unbestätigte Funde. In Portugal fehlt die Art trotz zahlreicher *Phyla*-Nachweise (allesamt *B. tethys*). Die Art ist im Süden des Areals (Mittelmeerraum) nicht häufig (vgl. auch THÉROND 1975).

Die von STEPHENS (1829) der Gattung *Tachys* zugeschriebenen Taxa wurden bereits von SCHAUM (1848) richtig als die *Phyla*-Art *B. obtusum* erkannt, was Netolitzky später auch bestätigte.

Anzahl untersuchter Tiere: 1328.

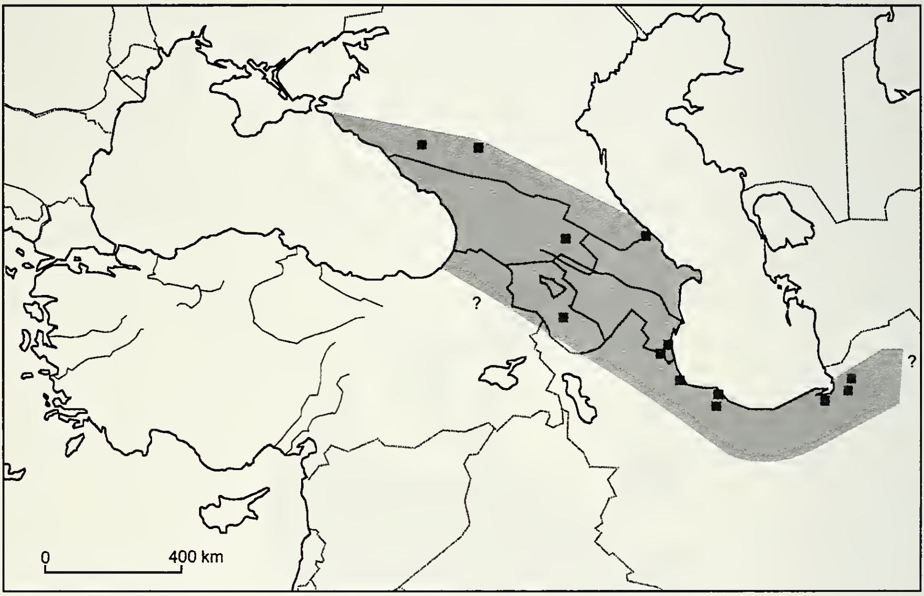


ABB. 7

Verbreitung von *Bembidion (Phyla) incommodum* Netolitzky. Quadrate = Fundorte überprüfter Tiere. ? = unsicherer Arealverlauf.

Bembidion (Phyla) incommodum Netolitzky, 1926

Bembidion (Phila) obtusum ssp. *incommodum* Netolitzky, 1926: 164. Typen (1 ♂, 2 ♀, Lenkoran/Aserbaidschan 1897, leg. Korb) und Cotypen (4 ♂, 3 ♀, gleiche Angaben sowie 2 ♂, Talysch/Iran-Aserbaidschan 1897, leg. Korb) im NHMW. 1 Cotypus (♀, Lenkoran/Aserbaidschan 1897, leg. Korb,) im ZMHE. Alle überprüft.
? Phyla obtusa sensu MOTSCHULSKY 1844.
Phyla obtusum ssp. *iranicum* Morvan, 1977: 21-59. Locus typicus: Javaherdeh/Iran. **Nov. syn.**

Halsschild gleichmässig gerundet, vor den rechtwinkligen Hinterecken kurz ausgeschweift. Hinterwinkel mit gerader basolateraler Längsfalte.

Die Art ist mittels der Endosklerite des Aedoeagus nicht vom kretischen *B. minoum* n. sp. zu trennen. Hingegen zeigt das IX. Abdominalsegment (Urit) mit der schaufelförmig verbreiterten Spitze ein charakteristisches Artmerkmal (Abb. 3b).

Morvan beschrieb 1977 bei seiner Unterart *B. obtusum* ssp. *iranicum* Genital-Innenstrukturen, deren entscheidendes Merkmal – abgeflachtes Doppelhorn – für eine Zuordnung zu *B. incommodum* spricht, keinesfalls aber zu *B. obtusum*. Der vorliegenden Untersuchung standen zudem 44 andere Exemplare von Morvans locus typicus (Javaherdeh/Iran, 7. 8. 1974, leg. Senglet, MHNG) zur Verfügung, die sich allesamt als *B. incommodum* und artgleich mit kaukasischen Tieren erwiesen. Es erstaunt, dass Morvan die Existenz der längst bekannten Art *B. incommodum* entgangen ist, war doch *B. incommodum* vor 1977 mehrfach zitiert worden (Netolitzky 1926, 1942/43, Gridelli 1931, Jeannel 1941, Iablokoff-Khnzorian 1976). Das Taxon *Phyla obtusum iranicum* Morvan wird hiermit zu *B. incommodum* Netolitzky synonym gestellt.

Verbreitungsareal (Abb. 7): Art südrussischer Republiken des Kaukasus, ferner in Georgien, Armenien, Aserbaidschan sowie in den nordiranischen Gebirgszügen (Talysch- und Elburz-Gebirge) südlich des Kaspischen Meeres.

Schatzmayr (1935) erwähnt Exemplare von *B. incommodum* von den ägäischen Inseln Rhodos und Castelrosso, beide nahe der südtürkischen Küste gelegen; dabei dürfte es sich um eine andere Art handeln. Aufgrund der heutigen Kenntnisse der Verbreitungsareale kommen nur *B. phoeniceum* n. sp. oder *B. liliputanum* in Betracht, jedoch ist eine eindeutige Zuordnung der unüberprüfbaren Tiere nicht möglich.

Anzahl untersuchter Tiere: 180.

Bembidion (Phyla) minoum sp. n.

Holotyp ♂: Lassithi, Kaminakion/Kreta, 13. 7. 1970, leg. Senglet, MHNG.
Paratypen: 4 ♂, 5 ♀: gleiche Daten wie Holotyp, MHNG. 1 ♂, 1 ♀: gleiche Daten wie Holotyp, NMBE. 1 ♂, 1 ♀: gleiche Daten wie Holotyp, Coll. Marggi. 1 ♀: Choumeki/Kreta, 31. 6. 1970, leg. Senglet, MHNG. 1 ♀: Stavromenos/Kreta, 29. 6. 1970, leg. Senglet, MHNG. 1 ♀: Agios Nikolaos/Kreta, 14.4.-3.5.1975, leg. R. Köstlin, NHMS. 1 ♂: Plakias/Kreta, 1. 4. 1988, leg. Winkelmann, Coll. Wrase/Berlin.

Körpergrösse (Kopf-Rumpflänge): ♂: 2,8–3,2 mm; ♀: 3,0–3,4 mm.

Farbe: Kopf, Halsschild und Flügeldecken hell- bis dunkelrötlichbraun, Beine heller. Die ersten drei Antennenglieder hell, die übrigen deutlich angedunkelt; gelegentlich sind auch das 2. und 3. Glied schwach angedunkelt.

Halsschild gleichmässig gerundet, grösste Breite vor der Mitte. Seitenrand zu den Hinterwinkeln mehr oder weniger gerade verengt, kurz vor den Hinterwinkeln leicht ausgeschweift, so dass diese nahezu rechtwinklig sind (Abb. 4c). Halsschild mit einer Borste im Hinterwinkel und einer Seitenrandborste an der breitesten Stelle vor der Mitte. Halsschildbasis grob punktiert. Basalgruben gegen aussen mit einer deutlichen Längsfalte und zur Basis scharf begrenzt. Längsfalte rechtwinklig zur Basis und gerade nach vorn verlaufend.

Schultern gerundet, nicht vorstehend. Die Tiere sind brachypter, die Stummelflügel nicht länger als die Mitteltibia. Flügeldecken länglich-oval, Seiten gerundet (Abb. 5c). Kurze Punktreihe neben dem Schildchen vorhanden. Vier dorsale Punktreihen deutlich vorhanden, schwach vertieft; 1. Punktreihe bis zur Spitze durchgehend, die übrigen vor der Spitze schwächer werdend. 5. Reihe schwach punktiert vorhanden, 6. und 7. Reihe nur sehr schwach punktiert angedeutet oder fehlend. Flügeldecken bei starker Vergrösserung quermaschig chagriniert.

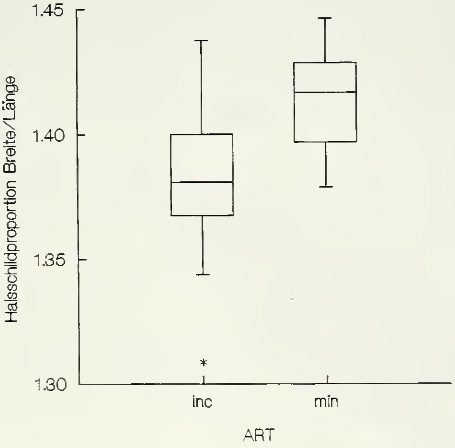


Abb. 8

Halsschildproportionen Breite/Länge von *Bembidion (Phyla) incommodum* und *B. (Phyla) minoum* n. sp. Der Unterschied ist signifikant (p < 0,01).

Aedoeagus mit abgeflachtem, doppelhörnigem Endosklerit (Abb. 2c). IX. Abdominalsegment lang und schmal schnabelförmig zugespitzt (Abb. 3a).

Differenzialdiagnose: *Bembidion* (*Phyla*) *minoum* n. sp. gehört aufgrund seiner genitalen Innensackstruktur zur *obtusum*-Gruppe. Die Art steht wegen des abgeflachten Doppelhornes (bei *B. obtusum* stielrund) *B. incommodum* nahe, unterscheidet sich von letzterer durch die lange schmale Spitze des IX. Abdominalsegments, die bei *B. incommodum* schaufelförmig verbreitert ist. In der Proportion Halsschildbreite/-länge ist *B. minoum* von *B. incommodum* signifikant verschieden (p < 0,01; Abb. 8), der Halsschild ist bei *B. minoum* stärker querförmig.

Verbreitungsareal: Endemische Art Kretas.

Anzahl untersuchter Tiere: 18.

Etymologie: Die neue Art ist nach der antiken minoischen Kultur Kretas benannt.

tethys-Gruppe

Merkmale der *tethys*-Gruppe: Aedoeagus mit einem endophallischen apikalen Kamm sklerotisierter Dornen (Abb. 1, ac) (Gridelli 1931). Zwei Arten.

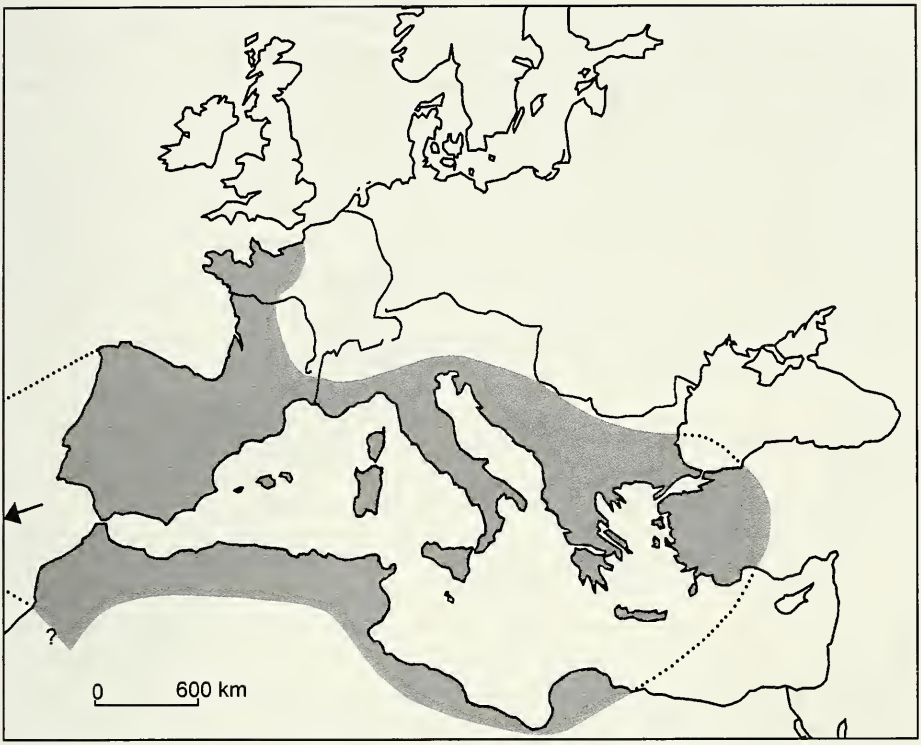


Abb. 9

Verbreitung von *Bembidion (Phyla) tethys* Netolitzky. Pfeil = Vorkommen auf Madeira.

Bembidion (Phyla) tethys Netolitzky, 1926

Bembidion (Phila) obtusum ssp. *Tethys* Netolitzky, 1926: 163. Typen (1 ♂, 2 ♀, Barcelona-Gualba, undatiert, leg. Mas de Xaxars, Coll. Netolitzky) im NMHW; überprüft.
Bembidion (Phila) Tethys; Netolitzky 1942/43.
Phyla gallicum Schuler, 1963: 84-87. Locus typicus: Garde (Var) F. Standort des Typus unbekannt (befindet sich nicht in der Coll. Schuler im MZSt). **Nov. syn.**

Antennenglieder im Vergleich zur nahestehenden Art *B. abdelkrimi* kürzer und gedrungener. Halsschildseite gleichmässig gerundet, Hinterwinkel stark verrundet, nie eine Ecke bildend (Abb. 4d). Keine Längsfalte in den Hinterwinkeln, höchstens eine solche schwach angedeutet. Grösste Breite vor der Mitte. Makroptere Art. Schultern deutlich, Flügeldeckenseiten in der Mitte deshalb nahezu parallel. 6. und 7. Punktreihe vorhanden, aber nicht vertieft, zur Spitze schwächer werdend.

Aedoeagus apikal mit 6-10 sklerotisierten, zu einem Kamm verbundenen Dornen (Abb. 2d); diese kräftiger entwickelt als bei *B. abdelkrimi*. Bei nicht ausgefärbten Tieren kann der Apikalkamm nur schwach sklerotisiert und somit schwer zu sehen sein.

Die Überprüfung der Tiere, die SCHULER (1963) seiner *Phyla gallicum* zuschrieb, hat in allen Fällen eine eindeutige Zuordnung zu *B. tethys* ergeben; das Taxon *Phyla gallicum* Schuler wird somit eingezogen. Bereits THÉROND (1975) hatte in seinem Katalog südfranzösischer Käfer Schulers Taxon richtigerweise negiert.

Verbreitungsareal (Abb. 9): Holomediterrane Art. Atlantische Küste von Marokko über die Iberische Halbinsel bis zur Bretagne, jedoch nicht nachgewiesen auf den Britischen Inseln. Gesamter Mittelmeerraum bis zur Türkei und der Cyrenaica (Libyen; GRIDELLI 1929, 1930) mit Ausnahme der östlichsten Region (Osttürkei, Levante, Ägypten). Von Madeira ist *B. tethys* mehrfach belegt. Von den Kanarischen Inseln hingegen wurde die Art nur ein einziges Mal erwähnt (COLAS & MATEU 1958), wird aber in der neuesten kanarischen Faunenliste (MACHADO 1992) nicht angeführt.

Anzahl untersuchter Tiere: 840.

Bembidion (Phyla) abdelkrimi Netolitzky, 1926

Bembidion (Phila) obtusum ssp. *Abd-el-Krimi* Netolitzky, 1926: 163. Typen (1 ♂, 2 ♀; Marokko, undatiert, leg. Quedenfeld) im NHMW; überprüft.

Phyla Abd el Krimi ab. *Colombati* Antoine, 1955: 167. Locus typicus: Col de Zehaza/Maroc. (Name ungültig, da von infrasubspezifischem Rang [International Code of Zoological Nomenclature, third edition, Artikel 45f]).

Grosse Art: 3,6–4,0 mm. Farbe rotbraun, Beine heller. Antennenglieder langgestreckt, 3–4 Mal so lang wie breit. Drei Basalglieder hell, erst ab dem 4. Glied angedunkelt. Halsschild zur Basis gerade verengt, kurz vor der rechtwinkligen Hinterecke ausgeschweift (Abb. 4e). Grösste Breite vor der Mitte. Aedoeagus apikal mit einem endophallischen sklerotisierten Kamm mit meistens mehr als 10 Dornen (Abb. 2e), diese gegenüber *B. tethys* schwächer ausgebildet.

Art mit Flügeldimorphismus mit brachy- und makropteren Exemplaren. Bei brachypteren Tieren nehmen die reduzierten Flügel ca. die Hälfte der Decken ein. Die Schultern sind deutlich, die Flügeldecken deshalb langgestreckt, in der Mitte nahezu parallelseitig (Abb. 5e). 1.–5. Punktreihe der Flügeldecken schwach vertieft, bis zur Spitze durchgehend, gelegentlich ist auch die 6. Reihe schwach vertieft. 6. und 7. Reihe deutlich bis zum Spitzenwulst punktiert, davor vereinigt.

Verbreitungsareal (Abb. 10): Atlantische Art der Nordwestküste Afrikas (Marokko, Mauretanien) und des südlichen Andalusiens (Spanien) um Gibraltar.

Anzahl untersuchter Tiere: 71.

liliputanum-Gruppe

Merkmal der *liliputanum*-Gruppe: Aedoeagus mit einem ausgeprägten endophallischen Ventralsklerit (Abb. 1; vs). Eine Art.

Bembidion (Phyla) liliputanum (J. Sahlberg, 1907)

Microcys liliputanus J. Sahlberg, 1907: 11. Loci typici: Deir Aban/Judäa und Dêr el Musallabe/Judäa. 1 Cotypus (♂, Jerusalem, undatiert, Coll. J. Sahlberg) im ZMTU und 1 Cotypus (♂, Mont. Jud. occ., undatiert, Coll. J. Sahlberg) im ZMHE; beide überprüft.

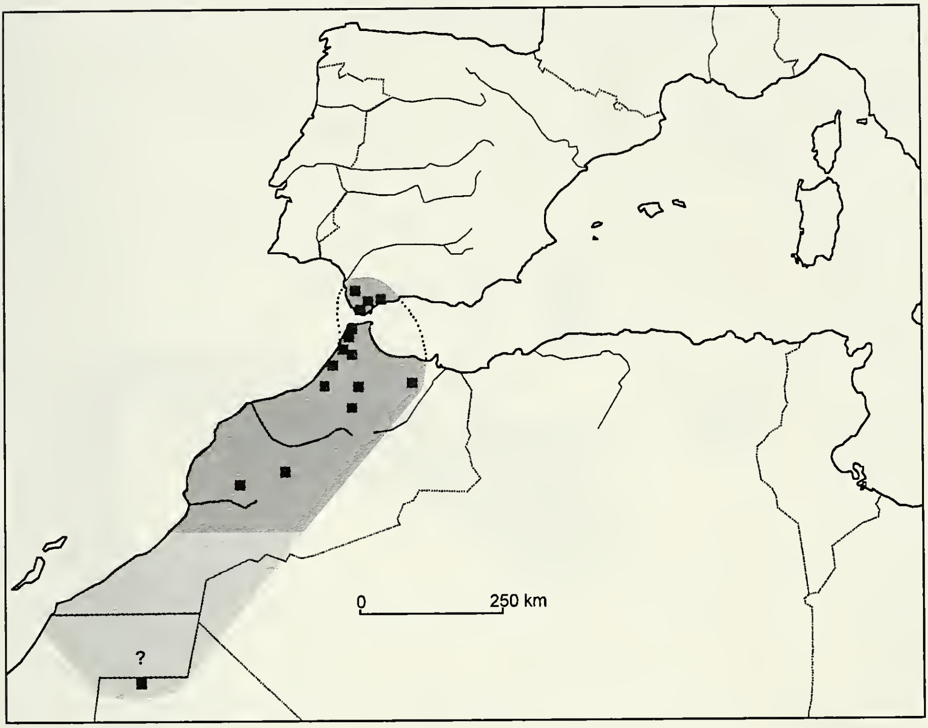


ABB. 10

Verbreitung von *Bembidion (Phyla) abdelkrimi* Netolitzky. Quadrate = Fundorte überprüfter Tiere. ? = unsicherer Arealverlauf.

Antennenglieder gedrungen, höchstens zweimal so lang wie breit. Die ersten drei Antennenglieder hell, erst ab dem 4. Glied angedunkelt. Halsschild gleichmässig gerundet, kurz vor den Hinterwinkeln markant ausgeschweift, mit rechtwinkligen Hinterecken. Hinterwinkel mit scharfer, nach vorn-aussen gekrümmter Längsfalte (Abb. 4f). Grösste Breite deutlich vor der Mitte.

Flügeldeckenpunktierung schwach, nur 1. Punktreihe etwas vertieft. 2.–5. Punktreihe vor der Spitze schwächer werdend. 6. und 7. Reihe nur weitläufig und schwach punktiert, hinter der Mitte erlöschend. Brachyptere Art; Flügel reduziert, nur ca. die Hälfte der Flügeldecken einnehmend.

Verbreitungsareal (Abb. 11): Ostmediterrane Art. Südost-Türkei, Libanon, Israel.

Anzahl untersuchter Tiere: 41.

rectangulum-Gruppe

Merkmale der *rectangulum*-Gruppe: Aedoeagus nur mit zentralem Skleritkomplex, jedoch ohne auffällige Sklerite wie Apikalkamm, Doppelhorn oder Ventralsklerit.

ABB. 11

Verbreitung von *Bembidion (Phyla) liliputanum* (Sahlberg). Quadrate = Fundorte überprüfter Tiere.

Bembidion (Phyla) rectangulum Jacquelin duVal, 1852

Bembidion rectangulum Jacquelin duVal, 1852: 184. Locus typicus: Algerien. Der Standort des Typus ist nicht bekannt (nicht in der Coll. Jacquelin duVal am MHNP).
Bembidion (Philochthus) obtusum var. *rectangulum* sensu MARSEUL 1882
Phila obtusum ssp. *rectangulum* sensu J. MÜLLER 1918
Bembidion obtusum var. *rectangulum* (auct.)
Bembidion (Phila) obtusum syn. *rectangulum* (auct.)

Körpergrösse (Kopf-Rumpflänge): ♂: 3,0–3,5 mm; ♀: 3,2–3,6 mm. Halsschildbreite: 0,85–1,05 mm.

Die ersten drei Antennenglieder heller, erst ab dem 4. Glied angedunkelt, gelegentlich 2. und 3. Glied apikal angedunkelt. Halsschild schlank (Abb. 4g), das Verhältnis Halsschildbreite/-länge immer < 1,4 (1,36 +/- 0,02; N = 35). Halsschild zu den Hinterwinkeln gerade verengt, vor den rechtwinkligen Hinterecken ausgeschweift. Längsfalte in den Hinterwinkeln deutlich und gerade. Ungeflügelte Art mit verrundeten Schultern, Flügeldecken seitlich lang-oval gerundet (Abb. 5g), deshalb schlank wirkend.

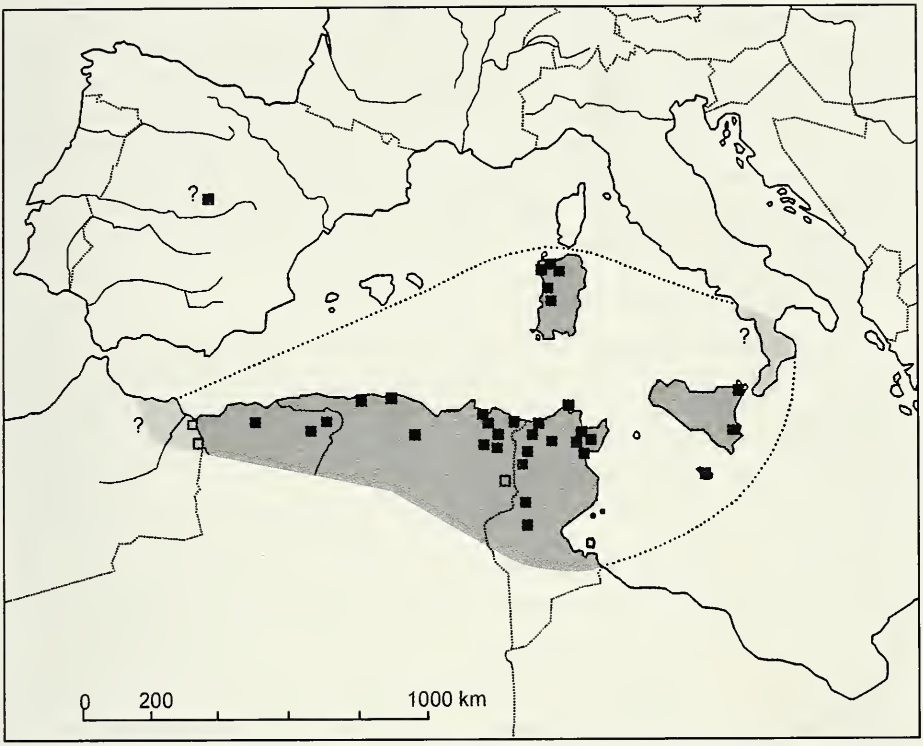


ABB. 12

Verbreitung von *Bembidion (Phyla) rectangulum* Jacquelin duVal. Quadrate = Fundorte überprüfter Tiere. Leere Quadrate = Fundorte nach Literaturangaben (ANTOINE 1955, KOCHER 1963, SAMA 1985, CHAVANON 1994). ? = unsicherer Arealverlauf.

Der Aedoeagus enthält ausser dem zentralen Skleritkomplex keine auffälligen Endosklerite wie Doppelhorn, Apikalkamm oder Ventralsklerit (Abb. 2g). Das IX. Abdominalsegment mit einer lang ausgezogenen schmalen, allenfalls wenig erweiterten Spitze.

Verbreitungsareal (Abb. 12): Algerien, Tunesien, Malta, Sardinien, Sizilien, Süditalien(?), Spanien(?). Nach GRIDELLI (1931: Roma) und VIGNA TAGLIANTI (1993) kommt die Art in Süditalien vor, doch konnten keine Tiere dieser Herkunft untersucht werden. Ein Vorkommen der Art in Marokko ist durchaus denkbar, gibt es doch einige glaubwürdige Literaturhinweise wie diejenigen von ANTOINE (1955) und KOCHER (1963: beide Oued Isly/Oujda, Ost-Marokko) sowie von CHAVANON (1994: Pont Cap de l'Eau/Ain Beda Moulouya, Ost-Marokko).

Neu zu bestätigen bleibt das Vorkommen auf der Iberischen Halbinsel; bislang ist lediglich ein einziges ♂ von Pozuelo de Alarcon/Madrid bekannt (undatiert, leg. de la Fuente, Coll. Netolitzky, NHMW; nach Genitaldiagnose eindeutig *B. rectangulum*). Das Tier wurde von NETOLITZKY (1926) ohne Genitalanalyse und unter Negierung der

Gültigkeit von *B. rectangulum* noch als ssp. *tethys* verkannt und als "Übergang zur Nominatform" *B. obtusum* bezeichnet. Obwohl eine Ausbreitungsbrücke des nordafrikanischen Vorkommens über die Meerenge bei Gibraltar denkbar ist – und im Falle von *B. abdelkrimi* auch existiert –, liegen seit jenem Einzelfund keine weiteren iberischen Tiere von *B. rectangulum* vor. Auch das angebliche Vorkommen auf den Balearen (ZABALLOS & JEANNE 1994) ist nicht gesichert. Das zahlreich vorliegende spanische Material des Festlandes liess sich nur *B. tethys* oder *B. obtusum* zuordnen, was auch neuere, lokalfaunistische Arbeiten bestätigen (NOVOA DOCET 1975, ZABALLOS 1989).

Anzahl untersuchter Tiere: 89

Eine sichere Artdiagnose der meisten *Phyla*-Arten ist nur anhand des männlichen Genitals möglich. So sind denn rückblickend die systematisch-taxonomischen Schwierigkeiten von Autoren früherer Zeiten verständlich, als die Genitalmorphologie und deren Analyse noch nicht zur entomologischen Routine zählten. Die Probleme entstanden 1926 mit NETOLITZKYS Beschreibung dreier neuer Taxa. Als erster hielt GRIDELLI (1929, 1931) mit seiner Beschreibung äedoeager Endosklerite den Schlüssel zur Lösung des *Phyla*-Problems in der Hand. Unglücklicherweise irrte sich JEANNEL (1941) in seiner "Faune der France" bei der (Unter-)Gattung *Phyla* gleich mehrfach, als er die nordafrikanische und für ihn somit faunenfremde Art *B. rectangulum* trotz leicht erkennbarer genitalmorphologischer Unterschiede zu *B. obtusum* synonym stellte sowie *B. tethys* falsche Endosklerite zuschrieb. Die Irrtümer waren umso gravierender, als nachfolgende Autoren sich immer wieder auf Jeannels Arbeit beriefen. Gridellis Vorgaben waren Jeannel offensichtlich nicht bekannt, was bereits ANTOINE (1955) vermutete, wusste dieser doch bereits um die genitalen Differenzen ("son organ copulateur [*B. rectangulum*] est très different de celui d'*obtusum*", p. 167). Zudem ist anzunehmen, dass Jeannel *B. rectangulum* gar nie genitaliter untersucht hat. Wenig verständlich ist deshalb die erneute Synonymisierung von *B. rectangulum* zu *B. obtusum* durch KRYZHANOVSKIJ *et al.* (1995) in der Checklist der russischen Laufkäferfauna. Auch hier wurde voreilig über die systematische Stellung einer themen- und faunenfremden Art befunden; eine einzige Genitalüberprüfung hätte die Wiederholung des Jeannelschen Irrtums verhindert.

Bembidion (Phyla) phoeniceum sp. n.

Holotyp ♂: Mamonia, Zypern, 14. 7. 1977, leg. C. Besuchet, MHNG.
Paratypen: 18 ♂, 17 ♀: gleiche Daten wie Holotyp, MHNG. 2 ♂, 2 ♀: gleiche Daten wie Holotyp, NMBE. 2 ♂, 2 ♀: gleiche Daten wie Holotyp, Coll. Marggi. 1 ♂, 1 ♀: Bath of Aphrodite, Zypern, 20. 7. 1977, leg Besuchet, MHNG. 1 ♂, 1 ♀: Stroumbi, Zypern, 22. 7. 1977, leg Besuchet, MHNG.

Weiteres untersuchtes Material: Galataria/Paphos CYP (4, Coll. Jeanne); Kantara CYP (2, Coll. Jeanne); Zypern (2, MZSt); Choumeki/Kreta GR (4; MHNG); Atakent/Mersin TR (1, Coll. Teunissen); Avsallar/Alanya TR (1, Coll. Wrase); Djebel-Akra TR (1, NHMW); Libanon (1, NHMW), Beirut LIB (2, NHMW); Damaskus SYR (1, MHNP); Djebel-el-Schech (Grand Hermon) SYR (6, MHNP); Gafad/Galiläa IL (3, MHNG); Monfort, Keziv River/Hagalil IL (1, MHNG); Nahariyya Kabri/Hagalil IL (1, MHNG).

Körpergrösse (Kopf-Rumpflänge): ♂: 3,0–3,5 mm; ♀: 3,2–3,6 mm. Halsschildbreite: 0,95–1,10 mm.

Farbe: Kopf, Halsschild und Flügeldecken dunkelrötlichbraun bis schwarzbraun, Körperanhänge heller. Die ersten drei Antennenglieder hell, vom 4. bis 11. Glied etwas angedunkelt.

Halsschild quer, Verhältnis Halsschildbreite/-länge in der Regel > 1,4 (1.41 +/- 0,02; N = 41). Seitenrand gleichmässig gerundet, grösste Breite wenig vor der Mitte, vor der Hinterecke schwach ausgeschweift, so dass der Hinterwinkel stumpf- bis rechtwinklig ist (Abb. 4h). Hinterwinkel mit 1 langen Borste, 1 Seitenrandborste im vorderen Drittel vor der grössten Breite. Halsschildbasis grob punktiert. Basalgruben gegen aussen mit einer deutlichen Längsfalte und zur Basis scharf begrenzt.

Geflügelte Art, Schultern ausgeprägt, Flügeldecken langgestreckt, an den Seiten in der Mitte parallelseitig (Abb. 5h), bei starker Vergrösserung quermaschig chagriniert. Kurze Punktreihe beim Schildchen vorhanden. Flügeldecken mit 4 vertieften Punktreihen, die 1. neben der Naht bis zur Spitze durchgehend, die anderen vor der Spitze schwächer werdend. 5. Punktreihe deutlich, aber nicht vertieft. 6. und 7. Punktreihe sehr schwach oder fehlend.

Aedoeagus ausser dem zentralen Skleritkomplex ohne zusätzlichen auffälligen Endosklerite (Abb. 2h), dadurch *B. rectangulum* nahestehend. IX. Abdominalsegment nur mit kurzer, schmaler Spitze (Abb. 3c).

Differenzialdiagnose: Die Art steht aufgrund der genitalen Ähnlichkeit *B. rectangulum* nahe. Sie ist von dieser durch die kurze, schmale Spitze des IX. Abdominalsegments verschieden, die bei *B. rectangulum* lang und schmal ist. Die Hinterwinkel des Halsschildes sind weniger ausgeprägt als bei *B. rectangulum*. Die Art ist

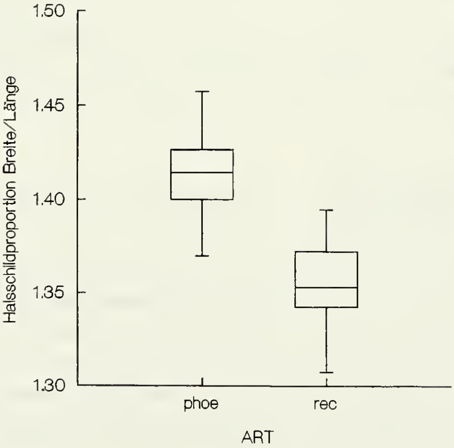


ABB. 13

Halsschildproportionen Breite/Länge von *Bembidion (Phyla) rectangulum* und *B. (Phyla) phoeniceum* n. sp. Der Unterschied ist signifikant (p < 0,01).

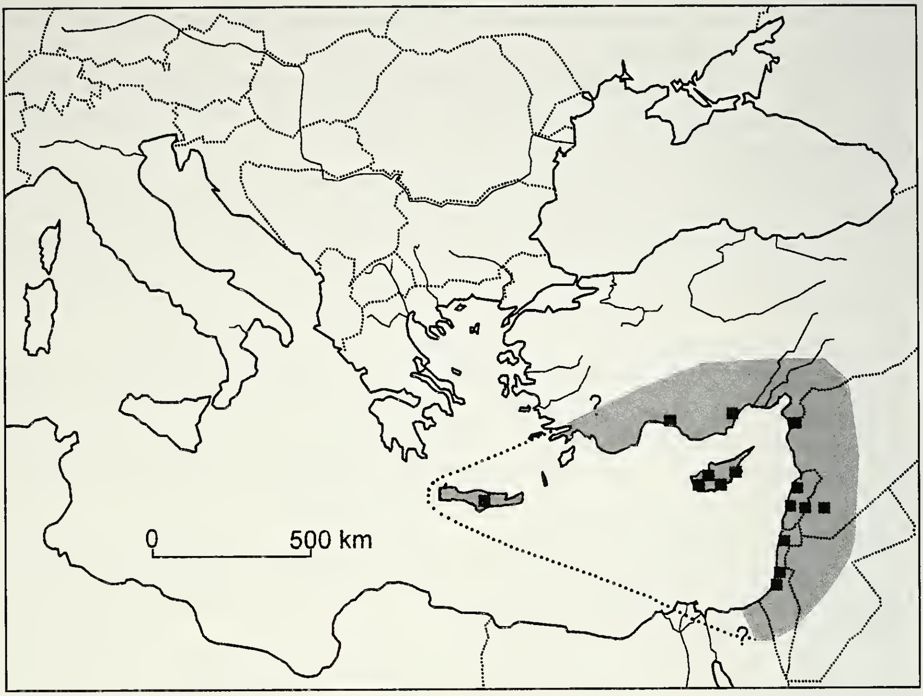


Abb. 14

Verbreitung von *Bembidion (Phyla) phoeniceum* n. sp. Quadrate = Fundorte überprüfter Tiere. ? = unsicherer Arealverlauf.

gegenüber *B. rectangulum* in der absoluten Halsschildbreite sowie in der Proportion Halsschildbreite/-länge signifikant verschieden (p jeweils < 0,01. Abb. 13); der Halsschild ist ausgeprägter querförmig (Abb. 4h). Zudem unterscheidet sich *B. phoeniceum* n. sp. als geflügelte Art durch die ausgeprägten Schultern von der ungeflügelten und schlanken Art *B. rectangulum*.

Verbreitungsareal (Abb. 14): Ostmediterrane Art. Zypern, Kreta, Südost-Türkei, Libanon, Westsyrien, Israel.

Ostmediterrane *Phyla*, die weder *B. liliputanum* noch *B. incommodum* waren, erfuhren bislang eine taxonomische Irrfahrt. Sie wurden aufgrund der rechtwinkligen Halsschildhinterecken zu *B. rectangulum* gestellt (Gridelli 1929 [das angebliche Vorkommen von *B. rectangulum* in Syrien wird allerdings vom Autor bezweifelt], Gridelli 1931, Antoine 1955) und letztere gelegentlich als Subspezies oder Varietät *B. obtusum* zugeordnet (Piochard de la Brûlerie 1876, Normand 1933) oder gar mit *B. obtusum* synonymisiert (Netolitzky 1926, Kryzhanovskij et al. 1995). Jeannel (1941) betrachtete syrische *Phyla* unüberprüft als *B. incommodum*, wie auch Netolitzky (1926) zwei Tiere von Beirut dieser kaukasisch-iranischen Art zuschrieb. Sofern verfügbar, erwiesen sich diese Tiere alle als *B. phoeniceum* n. sp.

Anzahl untersuchter Tiere: 75.

Etymologie: Die neue Art ist nach dem antiken phönizischen Reich des Ostmediterrans benannt.

DANK

Wir sind den Kuratoren wissenschaftlicher Museumssammlungen wie auch Privatpersonen, die uns ihr Material zur Verfügung gestellt haben, sehr zu Dank verpflichtet: M. Baehr, Zoologische Staatssammlung, München/D, P. Bonavita, Centro di Ecologia Alpina, Viote del Monte Bondone/I, G. Chavanon, Université de Oujda, Oujda/MAR, T. Deuve (MHNP), M. Hartmann, Naturkundemuseum, Erfurt/D, W. Heinz, Schwanfeld/D, F. Hieke (MNB), C. Jeanne, Langon/F, J. Kless, Konstanz/D, S. Koponen (ZMTU), E. Lang (MZSt), I. Löbl (MHNG), C. Martin, Museo Nacional de Ciencias Naturales, Madrid/E, M. Persohn, Herxheimweyher/D, M. Sartori, Musée Zoologique, Lausanne, W. Schawaller (NHMS), H. Schönmann (NHMW), A. Sermet, Yverdon, H. Silfverberg (ZMHE), S. Shute (BMNH), P. Sowig, Zoologisches Institut, Freiburg/D, A. Teunissen, Vlijmen/NL, D. Wrase, Berlin/D. S. Shute (BMNH) verdanken wir zudem die Hinweise zu Stephens' Typen. H. Luka, Rheinfelden, danken wir für Übersetzungen aus dem Russischen und M. Gosteli Huber (NMBE) für die kritische Durchsicht des Manuskripts.

ZUSAMMENFASSUNG

Die Untergattung *Phyla* Motschulsky 1844 der Gattung *Bembidion* wird revidiert. Zu den bislang bekannten Arten (*Bembidion (Phyla) obtusum, B. incommodum, B. tethys, B. abdelkrimi, B. liliputanum, B. rectangulum*) werden zwei neue Arten beschrieben: *Bembidion (Phyla) minoum* n. sp. und *B. (Phyla) phoeniceum* n. sp. Eine Art (*Phyla gallicum* Schuler) und eine Unterart (*B. obtusum iranicum* Morvan) werden eingezogen. Bestimmungsschlüssel und Verbreitungsbilder werden vorgelegt.

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REVUE SUISSE DE ZOOLOGIE, 104 (4): 785-793; décembre 1997

A new species of the genus *Reductoniscus* Kesselyák, 1930 from Sabah, North Borneo, Malaysia (Isopoda: Oniscidea: Armadillidae)

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A new species of the genus *Reductoniscus* Kesselyák, 1930 from Sabah, North Borneo, Malaysia (Isopoda Oniscidea: Armadillidae). - During a field trip to North Borneo, some terrestrial isopods had been collected, among them were the three specimens of a new species of *Reductoniscus* Kesselyák, 1930. A description of *Reductoniscus tuberculatus* sp. n. is given and the phylogenetic relationships of the members of *Reductoniscus* Kesselyák, 1930 are discussed.

Key-words: Isopoda - Oniscidea - Armadillidae - Reductoniscus tuberculatus n. sp. - taxonomy - phylogeny.

INTRODUCTION

The genus *Reductoniscus* Kesselyák, 1930 (family Armadillidae) includes three recognised species which are known from Southeast Asia and Papua New Guinea. *Reductoniscus costulatus* Kesselyák, 1930, the type species, has also been found in the Hawaiian Islands and in greenhouses in western Europe, presumably introduced through human activity. Some species attributed to *Reductoniscus* Kesselyák have been described from the Neotropics (LEMOS DE CASTRO 1972) and Saint Helena Island (VANDEL 1977) but have since been transferred to different genera (FERRARA & TAITI 1990). *Reductoniscus* Kesselyák shows some distinctive autapomorphic characters (cf. FERRARA & TAITI 1990): tergites of pleonite 1-2 are reduced and the exopod of pleopod 1 is lacking. The species can conglobate, the schisma of pereonite 1 is connected with a groove which accompanies the entire length of the coxal plate with the inner lobe longer than the outer; pereonite 2 bears a lobe which is directed backwards; scutum of the profrons has a schismatic duplication of the border. The pereonites bear well developed ornamentation; species of the genus can be identified by details of the pereonal ornamentation. For differential characters from the genus *Pseudodiploexochus* Arcangeli, 1934 see FERRARA & TAITI (1983).

Acronymes used: MHNG = Muséum d'histoire naturelle, Geneva
ZMHB = Zoologisches Museum der Humboldt-Universität Berlin.

Manuscript accepted 07.03.1997

DESCRIPTION

Reductoniscus tuberculatus sp. n.

Studied material: Holotype female 5 mm long, without marsupium, War Memorial Park, Sandakan, Sabah, Borneo, Malaysia; 21.12.1995 leg. Mr. S. Sugathan, ZMHB collection no. 27182.

Paratypes: 2 females 2-3 mm long, same data as holotype, MHNG and author's collection.

Description:

Colour: Buff to rosy-cream coloration, without mottling. Profrons, ventrum and pereopods lack pigment.

Cephalothorax: Set back in pereonite 1. Supra-antennal line absent, frontal line producing a groove between vertex and profrons. Border of frontal scutum grooved, continuing the groove of pereonite 1. Vertex covered with 3 transverse rows of tubercles, frons with 2 bent grooves, receiving antennae during volvation. Eyes globose, composed of 6 large ommatidia (plate 1, Ctd/Ctf).

Pereon: Convex, heavily ornamented with costae and tubercles, protruding posteriorly on dorsum, most developed on pereonite 7, covering pleon in dorsal view. Junction between pereonites and coxal plates marked by carina-like costa (2 on the pereonite 1). Coxal plate 1 with groove along entire length. Inner lobe of schisma protruding the outer caudally. Coxal plate 2 with caudally directed tooth with rounded apex. (plate 1, Cxp). Shape of coxal plates 2-3 triangular, 4-5 rounded, 6-7 rectangular.

Pleon: Pleonites 1 and 2 reduced. Pleonites 3-5 well developed, slightly protruding backwards, without ornamentation, with dense cover of tricorn-like setae (plate 1, PLc,/Hal).

Pleotelson: Twice as wide as long, distal margin slightly convex, medially with 2 inconspicuous tubercles, covered with tricorn-like setae (plate 1, Ste).

Appendages:

Antennula: Composed of 3 articles, articles 1 and 3 subequal in length, almost 3 times as long as second. Article 2 with small tooth medially, article 3 acute, bearing 6 aesthetascs distally (plate 3, An1).

Antenna: Article 1 stout, articles 2, 4 and 5 subequal in length with article 3 intermediate. All scaled, covered with tricorn-like setae and sensory spines, longest spines latero-distally on article 5. Flagellum biarticulate, article 2 twice as long as article 1, with dense setation, 2 aesthetascs medially on distal article. Terminal bristle shorter than distal article (plate 5, An2).

Mouthparts:

Mandible: Molar penicil simple, appearing slightly furrowed. On left mandible pars intermedia with 2 stout penicils and some small, coniform setae, additional penicil half way between molar penicil and pars intermedia. Right mandible with only molar penicil and 2 penicils on pars intermedia (plate 2, Mdl/Mdr).

Maxillula: Lateral endite of maxillula with 4+4 teeth distally, all with rounded apices, lateral margin with short setae distally. Medial endite with 2 stout, close set penicils. (plate 2, Mxl/Mxm).

Maxilla: Both lobes rounded, lateral lobe dominant, covered with faint hairlike setae, medial lobe with stronger, but short setae on medio-distal margin (plate 2, Mx2).

Maxilliped: Basis scaled on latero-proximal edge, covered with tricorn-like setae. Palp composed of 2 articles, proximal with 2 unequal setae, distal terminated by setal tuft, second setal tuft more medio-proximally with 1 strong seta, 2 setae on medial margin half way the second article. Endite with strong seta distally on caudal surface. Rostral surface with hairlike setae on medial margin, distal border dentate. Epipod slender, slightly shorter than base (plate 2, Mxp).

Pereopods: Stout, carpus to basis scaled, all articles covered with tricorns and tricorn-like setae, medial border of propus to merus with sensory spines. Dactylus slender, secondary unguis weak, dactylar seta flagelliform (figs 3-4).

Pleopods: First female pleopod reduced, second lacking the endopod. Exopods reniform, with pleopodal lungs, medial margin with pectinate scales on rostral surface. Pleopod 5 exopod with pectinate scales on caudal surface along lateral margin, too (plate 5, PL2-5).

Uropod: Protopodite subrectangular, laterally concave, distally obtuse, with fringe of tricornlike setae. Exopod reduced to a tuft of setae, endopod with some tricorn-like setae.

Remarks:

FERRARA & TAITI (1990) recently revised the genus *Reductoniscus* Kesselyák and transferred all species but the type *Reductoniscus costulatus* Kesselyák and 2 newly described species from New Ireland to other genera. *Reductoniscus tuberculatus* sp. n. can be separated from its congeners by the characteristic ornamentation the carinated costae on the coxal plates and the great protrusion of pereonite 7, justifying the description of a new species of Oniscidea in the absence of males. The largest specimen of *Reductoniscus tuberculatus* sp. n. has more ommatidia than the other known species, i. e. 6 instead of 5 in specimens of equal size (*Reductoniscus novaeiberniae* Ferrara & Taiti, 1990). The pleotelson tuberculation resembles that of *R. novaehiberniae* Ferrara & Taiti, 1990, which has 2 slight tubercles, certainly a plesiomorphy within this genus, since all species but *R. pulcher* Ferrara & Taiuti, 1990 show this character. The ornamentation of *R. costulatus* Kesselyák might be close to the groundpattern of the genus, while in the other species the tubercles of pereonite 7 are fused to form a hump. This hump is most conspicuous in *R. tuberculatus* sp. n. as are the dorsal tubercles and it might be the sister species of the two representatives from New Ireland, which have in common a very prominent carina c2 (according to terminology used by HOLTHUIS 1947) on their pereonites and less tuberculation medially of the carinae, representing apomorphic characters.

The record of *Reductoniscus tuberculatus* sp. n. on Borneo leads to the assumption, that this genus might be well represented in the indo-pacific region. Since the animals are of small size, with a maximum length of 5 mm, they might have been overlooked by former field studies on malaysian Oniscidea (cf. HEROLD 1932; SCHULTZ 1982; GREEN *et al.* 1990). It might be another example for genera occuring both in the oriental and the austral region.

ACKNOWLEDGEMENTS

The author wishes to thank Mrs Evi Wollscheid, University of Bielefeld, for the provision with the material from Borneo.

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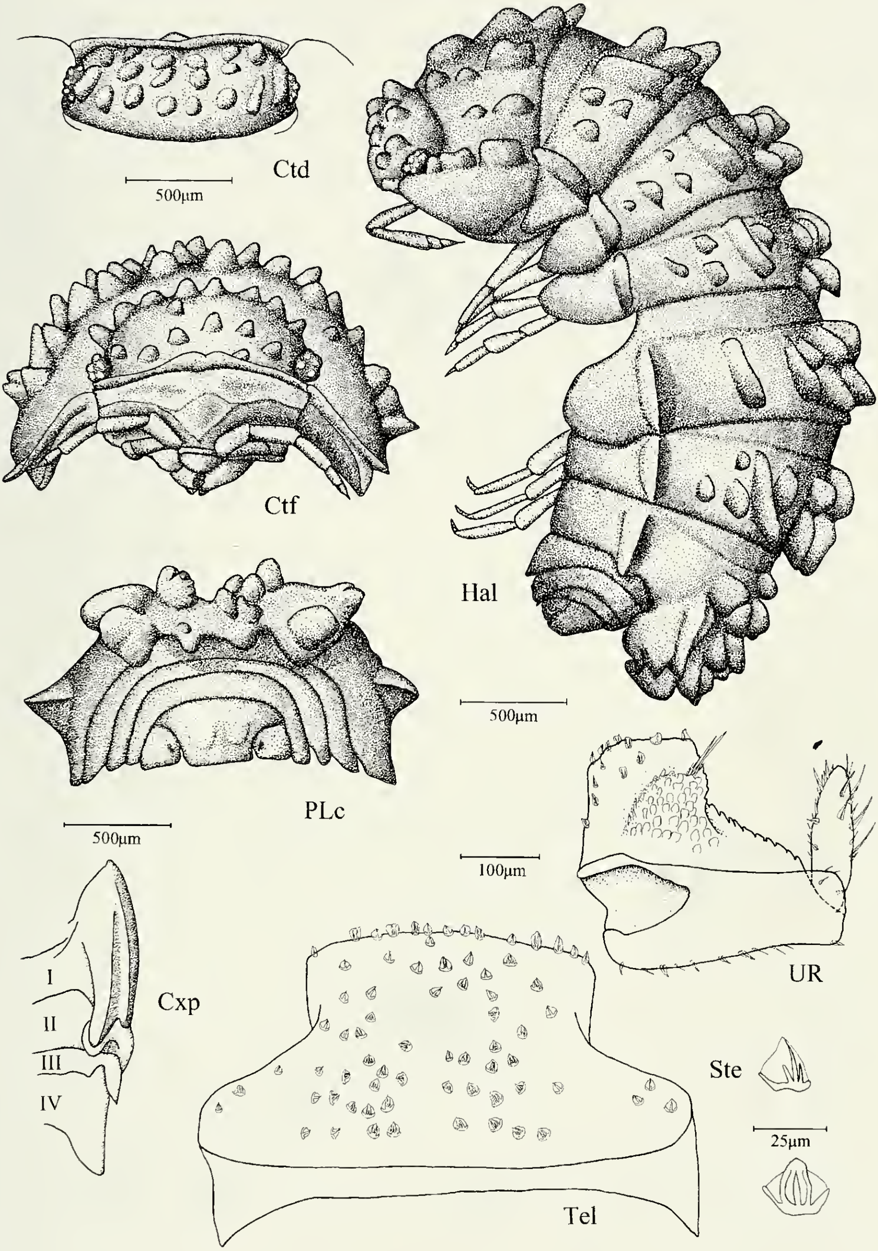

PLATE 1: Ctd cephalothorax, dorsal view; Ctf cephalothorax, frontal view; Cxp coxal plates 1-4, ventral view; Hal habitus, lateral view; Plc pleon and seventh pereonite, caudal view; Ste tricorn-like setae of pleotelson; UR uropod; female holotype.

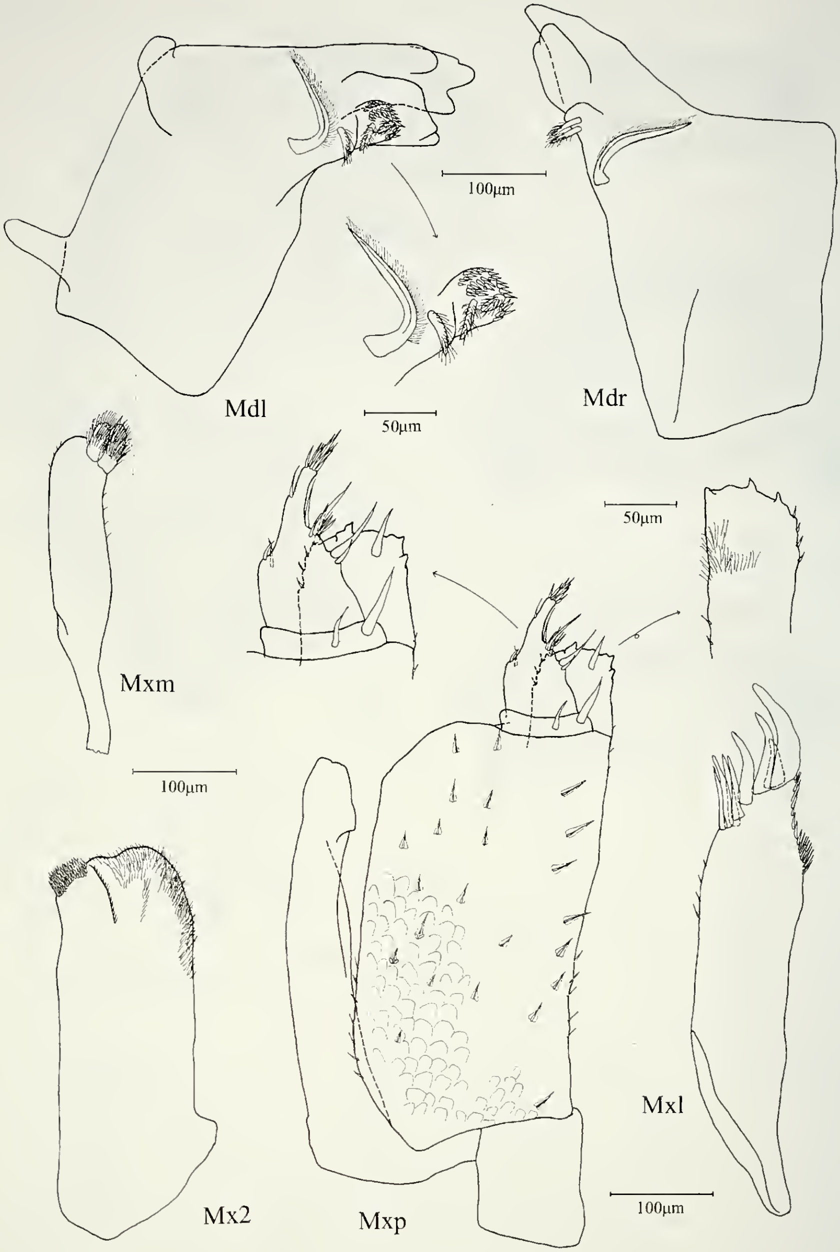

PLATE 2: Mdl left mandible with detail of pars intermedia; Mdr right mandible; Mx2 maxilla; Mxl lateral endite of maxillula; Mxm medial endite of maxillula; Mxp maxilliped with detail of palp and rostral surface of endite; female holotype.

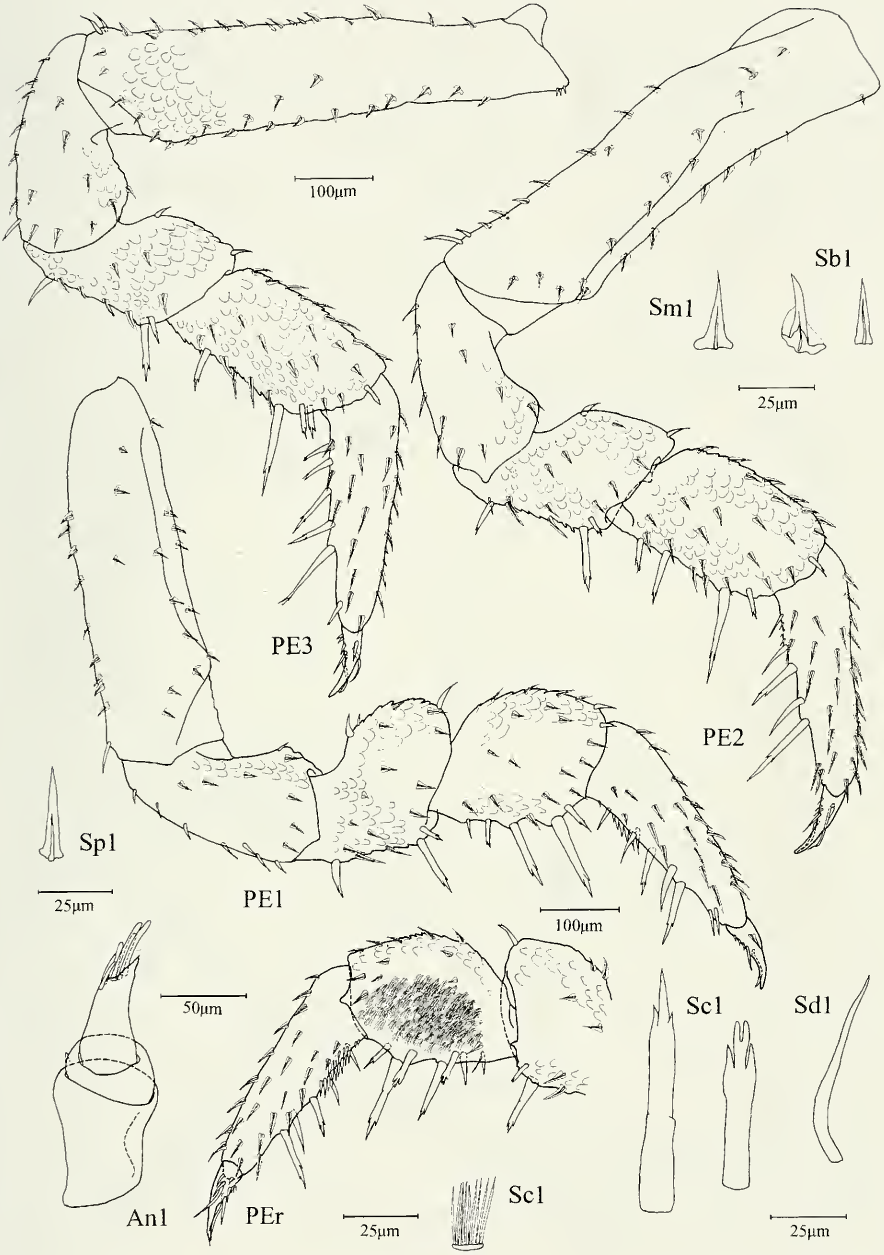

PLATE 3: An1 antennula; PE1-3 pereopod 1-3; PEr rostral view of distal articles of pereopod 1; Sb1 tricorn-like setae of basis 1; Sc1 pectinate scales and sensory spines of carpus 1; Sd1 dactylar seta of pereopod 1; Sm1 tricorn-like seta of merus 1; Sp1 tricorn-like seta of propus 1, female holotype .

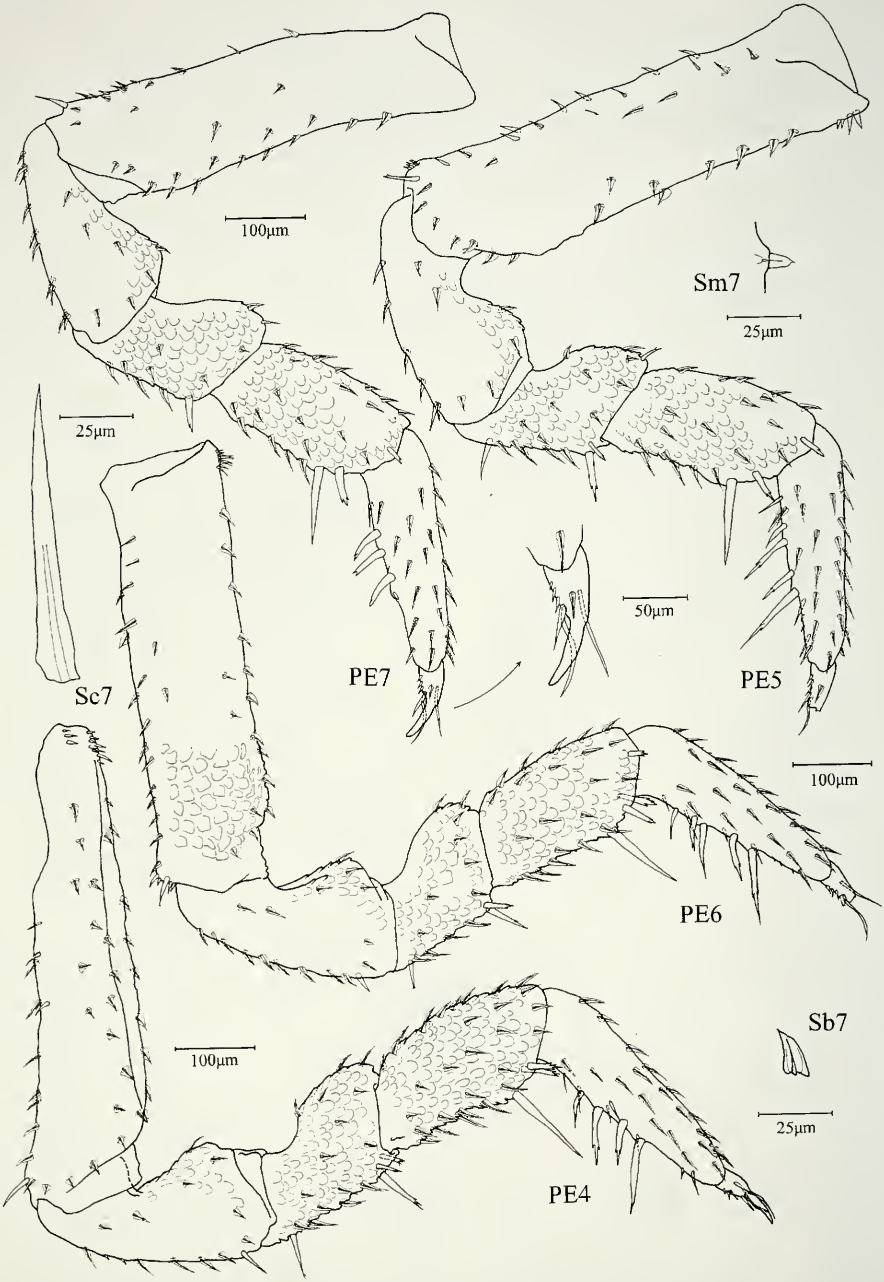

PLATE 4: PE4-7 pereopods 4-7; Sb7 tricorn-lie seta of basis 7; Sc7 sensory spine of carpus 7; Sm7 tricorn-like seta of merus 7; female holotype.

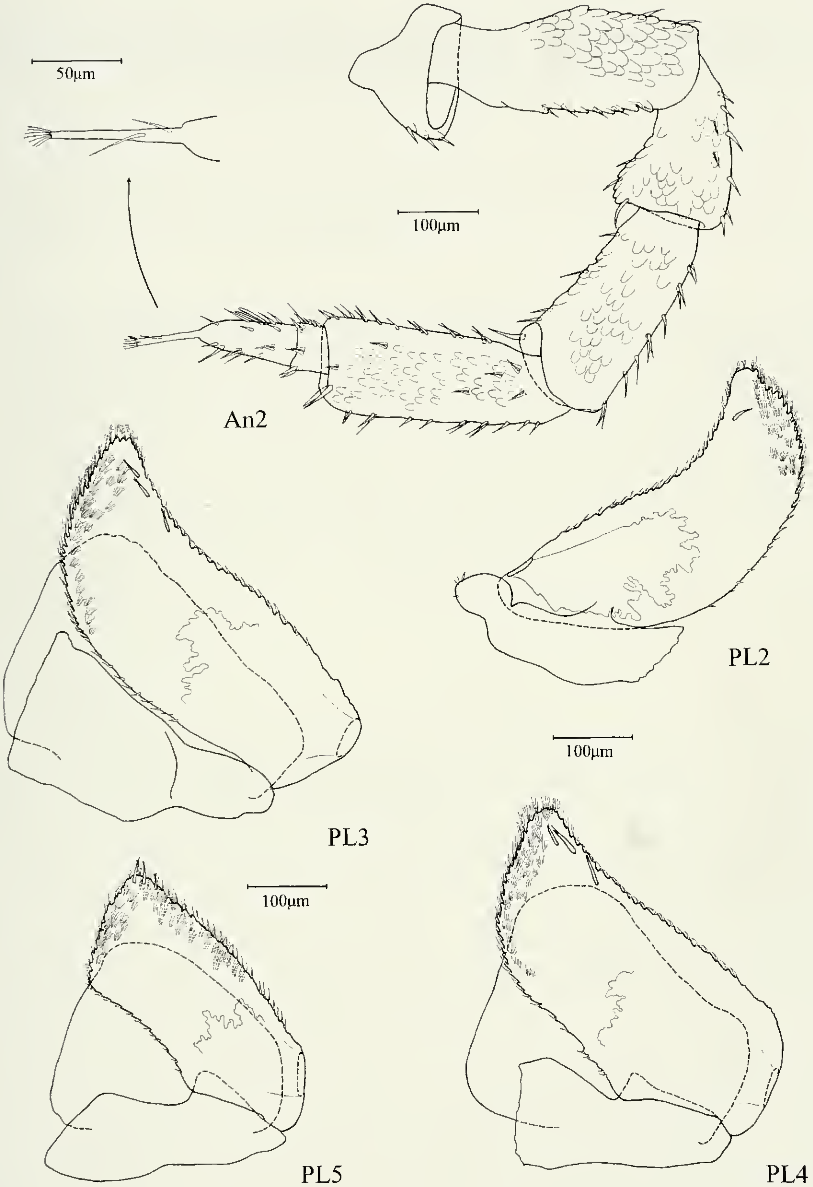

PLATE 5: An2 antenna with detail of terminal bristle; PL2-5 pleopods 2-5 with visible borders of lungs, in pleopod 3-5 obscured by pigmentation; female holotype.

Revue suisse de Zoologie 104 (4): 795-806; décembre 1997

Some Zygentoma (Nicoletiidae, Ateluridae) from the Neotropics, with description of one new *Metrinura* species

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Some Zygentoma (Nicoletiidae, Ateluridae) from the Neotropics, with description of one new *Metrinura* species. - Specimens of *Anelpistina* sp. and of *Grassiella* sp. were collected in the Calichal Cave in Honduras and concern the first record of thysanurans s.l. in this country. *Metrinura chibcha* sp.n. is described from Colombia and represents the first Nicoletiidae known to this country and the first one in the genus registered to the Neotropics. New and better preserved specimens of the Dominican amber *Archeatelura sturmi* were also studied.

Key-words: Zygentoma - Neotropics - New species - New records - Caves.

INTRODUCTION

The Nicoletiidae and Ateluridae from Neotropics and southern Nearctics remain, with a few exceptions, quite poorly known. None thysanuran s.l. was known to occur in Honduras and (among the Zygentoma) only Lepismatidae have been reported to Colombia. From the Dominican Republic, none extant species has ever been studied, though the only known fossil representatives of both these families were described from its amber deposits (Mendes 1997 and Sturm & Mendes 1997). Furthermore, the taxonomic position of some neotropical species as *"Nicoletia" neotropicalis* and *"Nicoletia" armata*, is quite dubious as the types remain untraced and their original and unique descriptions (Silvestri 1902) are extremely short and detailless which prevents their definitive recognition.

In the present paper two samples of extant thysanurans are studied, one collected in a cave in Honduras (two genera represented), the other obtained as sublithic in a mountain forest in Colombia; new specimens of the only described amber preserved Ateluridae - *Archeatelura sturmi* Mendes - are noticed from the Dominican Republic, being a few complementary notes added to its original description (Mendes

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Manuscript accepted 14.05.1997

1997). The species from Colombia is described as new and compared with the remaining taxa considered under *Metrinura* Mendes, 1992.

The specimens are deposited in the American Museum of Natural History, New York, USA (AMNH), in the Centro de Zoologia of the IICT, Lisboa, Portugal (CZ), in the Muséum d'histoire naturelle de Genève, Switzerland (MHNG) and in the Oregon State University, Corvallis, Oregon, USA (OST).

Fam. NICOLETIIDAE

Subfam. CUBACUBANINAE

Anelpistina sp.

Material examined: Honduras - Cueva Calichal, 22.IV.1995, 1 young male, 1 female (CZ) 2 young males, 1 female, 2 young females and 1 juvenile, (MHNG), leg. P. Strinati, with *Grassiella* sp.

As previously registered, none thysanuran s.l. species has been hitherto registered from Honduras, though regarding its known geographical distribution, the presence of *Anelpistina* in the country is not surprising: *A ruckeri* and *A. weeleri* (both SILVESTRI 1904) are known from the southern USA/Texas; *A anophthalma* (BILIMEK 1867 and WYGODZINSKY 1946), *A. bolivari*, *A. boneti* and *A. carrizalensis* (all WYGODZINSKY 1946) and *A. miranda* (SILVESTRI 1912) seem endemic from Mexico; and *A. weyrauchi* (WYGODZINSKY 1959) is known from near Lima, Peru only. Like the species from Honduras, *A. anophthalma* and *A. boneti* are exclusively known as troglobionts.

A ruckeri is known from males only and, so, its comparison with the material from the Calichal Cave remains impossible; the young honduran males have not yet developed neither the cercal spines (impossible to trace) nor the IVth urosternal apophysis (already visible but quite reduced). *A anophthalma* and *A. carrizalensis* share a quite short ovipositor with less than 10 articles, that scarcely surpasses the level of the IXth stylets, - the ovipositor in the material from Honduras is much longer (about 3 times the stylet length) and composed by 23-25 articles. *A. weyrauchi* presents, otherwise, a longer ovipositor with about 30 articles, as well as one subterminal denticle on the ventral surface of the lateral claws, a feature that seems unique in the genus; *A. miranda* is isolated from the remaining species by the shortened tarsus of P III and by the little anterior abdominal stylets - both, with the usual development in the observed material; *A. boneti* shows a much thicker setation along urotergites and urosternites, being the specimens from Honduras typical relatively to this characteristic. *A. weeleri* presents a distinct Xth urotergite shape. At last *A bolivari*, probably the most similar species, is longer (9 mm, versus 7.6 mm of the bigger adult female) and presents a shorter ovipositor with a lower number of articles (about 20). However, only the description of the adult male will allow to specify the taxonomic status of the Honduran species and enable, almost certainly, the description of a new species.

Subfam. SUBNICOLETIINAE

Metrinura chibcha sp.n. Figs 1-32

Material examined: Colombia - Ca. 10 Km N of Bogotá: Tibabitá, 2 600 - 2 700 m, mountain forest, under stones, 30.XI-13.XII.1967, 1 male holotype, 1 female allotype, 1 young male and 1 female paratypes (CZ), leg. H. Sturm; holotype strongly affected by moulds.

Description:

Body length: 5.0 - 8.0 mm (males) 5.8 - 7.0 mm (females); thorax length: 1.7 - 2.5 mm (males) - 1.9 - 2.0 mm (females); thorax width: 1.2 - 1.5 mm (males) 1.5 - 1.7 mm (females); antennae length (damaged): maximum of 4.7 mm in the paratype female; cerci length (never completely preserved): maximum of 2.5 mm in the allotype. Terminal filament always apically damaged.

Body not specially thin, elongeted, parallel-sided, whitish, devoid of pigment and without scales.

Head clearly wider than long, thickly setose, some of the macrochaetae of the supraantennal and posterolateral areas robust and long (Fig. 1); clypeum with a few strong setae, the labrum with a transverse row of similar setae. Antennae of the female and of the immature male with subcylindrical, not transformed pedicellus, the holotype (Fig. 2), with a short, rounded outer apophysis and - not clearly visible due to fungus hyphae - with a glandular area; distal flagellar chains composed by 4 subarticles, much longer than wide and with thin and long setulae, the most distal unities with several thin cylindrical sensilla. Mandibles robust, with well sclerotized incisive area, the molar area present but less clear. Maxilla without special features, the lacinia attaining the same level than the galea, this one with two apical sensorial conules (Fig. 3). Maxillary palp typical (Fig. 4), the apical article almost twice longer than the preceeding, in a quite elongated oval, about 4 times longer than wide; setae without special characteristics, some - apical area of the second and third articles - stift and longer than the remaining; in the distal article, besides the typical 6 specialized sensilla (subcylindrical, elongate and with a "brush-like" apex) one oblong (coeloconic ?) sensillum quite similar to that reported by WYGODZINSKY (1980: Fig. 1B) to the genus *Nicoletia*. Labium without special features, the labial palp as in Fig. 5, its distal article rounded and as long as wide.

Thorax longer than 1/4 of the body length; nota almost straight along their posterior border, covered by numerous short setae and with strong macrochaetae along the lateral and posterior margins (pronotum - Fig. 6 - also with anterior row of macrochaetae). Legs strong and elongated (Figs 7-13), the tarsus 4-articled, the praetarsus simple and complete (Fig. 13); tibia I, 3-4 times longer than wide, identical to tibia II and shorter than tibia III in the female (Figs 7-9), longer than tibia II and much longer than tibia III in the male (Figs 10 and 11); subdistal dorsal area of male femur III expanded, with 3 thin and stift setae and one very strong and long incurvated macrochaeta (Figs 11 and 12), with a somewhat spatulated preapical area, and which apex is suddenly pointed.

Urotergites I-IX as in Fig. 14, with numerous short setae and with one posterior row of strong macrochaetae, being the longer ones not much shorter than the tergite itself. Xth urotergite as in Figs 15 and 16, with 2 pairs of strong, spiniform, posterolateral macrochaetae, the outer pair shorter, area between the inner macrochaetae almost straight, narrower in the younger male, always shorter than the length of these seta; ventral surface of the Xth male abdominal tergite devoid of pegs; holotype Xth tergite not well preserved due to the fungus hyphae, though similar.

Urosternite I-VII entire, their posterior border almost straight. Urosternite I (Fig. 17) with a few setae along the middle area only; IInd urosternite entirely setose, with a pair of vesicles (Fig. 18), the III (Fig. 19)-VII with stylets and vesicles - the VIIth (Fig. 20) with pseudovesicles. Coxites VIII (Fig. 21) and IX (Fig. 22) of male also posteriorly straight, the IXth fused; paramera apically subdivided, more transformed in the adult (Figs 23 and 24) than in the immature male (Fig. 22); penis typical. VIIth female urosternite as in Fig. 20, the subgenital plate parabolic, wider than long and setose. Ovipositor (Fig. 25) strong, exceeding the level of the IXth stylets by about their own length, the gonapophysis typical and with 7-8 articles.

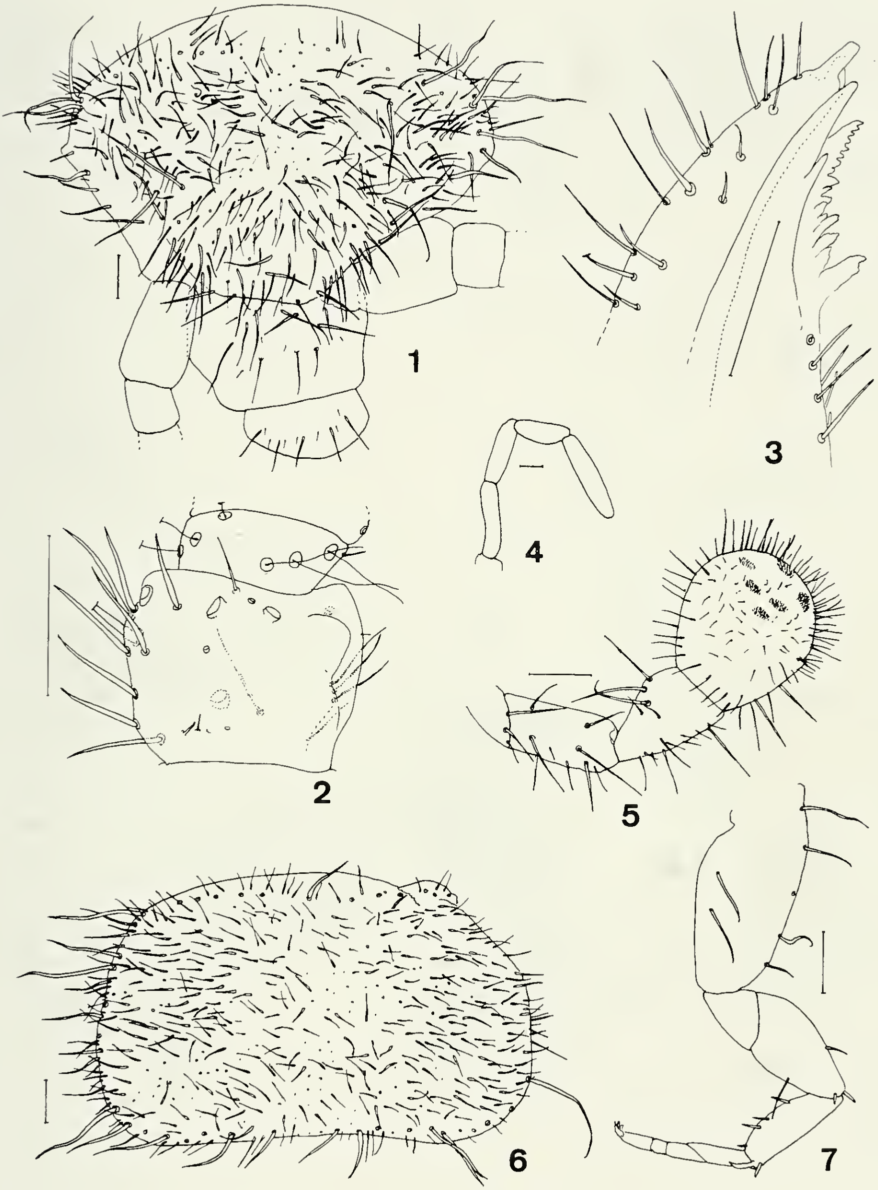
Terminal filaments of the female with some strong and elongated macrochaetae. In the male (Figs 26 and 27), inner margin of cerci and lateral areas of paracercum with abundant, strong and short, sclerotized pegs, at least along the 10 basal articles.

Spermatolophids not detected.

Etymology: The new species is dedicated to the Chibcha people, who inhabited the actual Colombia in pre-Colombian times.

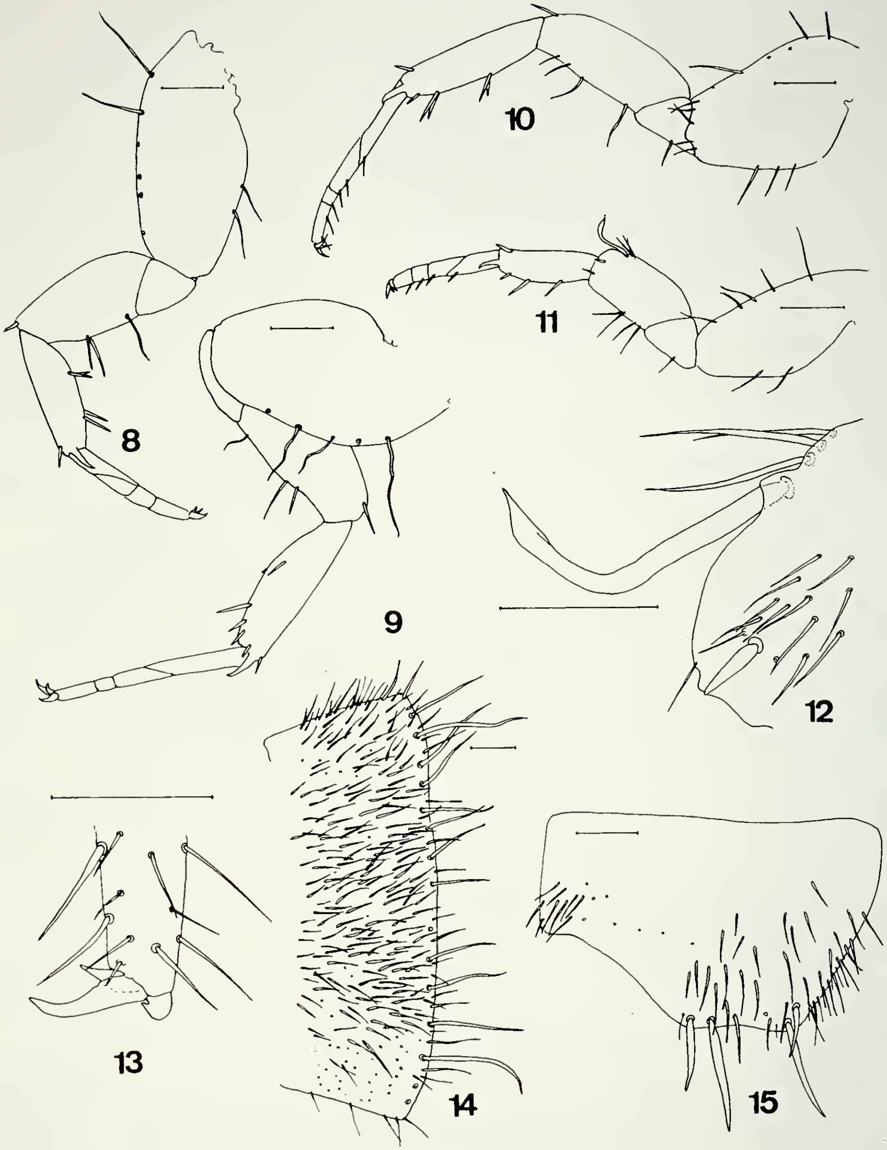
Discussion: *Metrinura chibcha* sp.n. is the only species of the genus known to occur in the Neotropics. *Metrinura* was known by 7 species from the Australian Region only: *Metrinura novaecaledoniae* (Silvestri) from New Caledonia (SILVESTRI 1915), New Hebrides (WOMERSLEY 1937*a*), Solomon and Marshall islands (PACLT 1982); *M. excelsa* (Silvestri) from South Australia (SILVESTRI 1920, and WOMERSLEY 1936 and 1937*b*); *M. gracilis* (Carpenter) from Samoa (CARPENTER 1928) and New Britain (PACLT 1982); *M. pacifica* (Carpenter) from Samoa, New Hebrides and Bismark (CARPENTER 1928), collected again in the Bismark islands (PACLT 1971), in New Britain (PACLT 1974) and in New Ireland (PACLT 1982); *M. russendenensis* (Smith & Shipp) from Queensland, Australia (SMITH & SHIPP 1977); *M. anemonae* (Smith) from New South Wales, Australia (SMITH 1988); and *M. norfolkensis* (Smith) from the Norfolk island, off Australia (SMITH op. cit.) - Smith's review of the Australasian Nicoletiids is under press.

M. gracilis and *M. pacifica*, known in female sex only - PACLT (1982) notices the occurrence of males of both species but does not describe this sex - present, opposite to all the remaining species in the genus, 8 pairs of abdominal stylets (segments II-IX), among other differences. *M. excelsa*, *M. anemonae* and *M. norfolkensis* have 5 pairs only of abdominal vesicular structures (III-VI with vesicles, VII with pseudovesicles); in addition, the first one have a very unique male pedicellar apophysis and the two last species share flower-shaped structures (more complex in *M. anemonae*) along the male cerci insteadt of spines or pegs, as well as distinct pedicellar apophysis; *M. anemonae*, like the poorly described *M. russendenensis*, exhibits very short paramera scarcely surpassing the level of the IXth stylets insertion. *M. novaecaledoniae* is probably the closest species relatively to *M. chibcha* sp.n. on



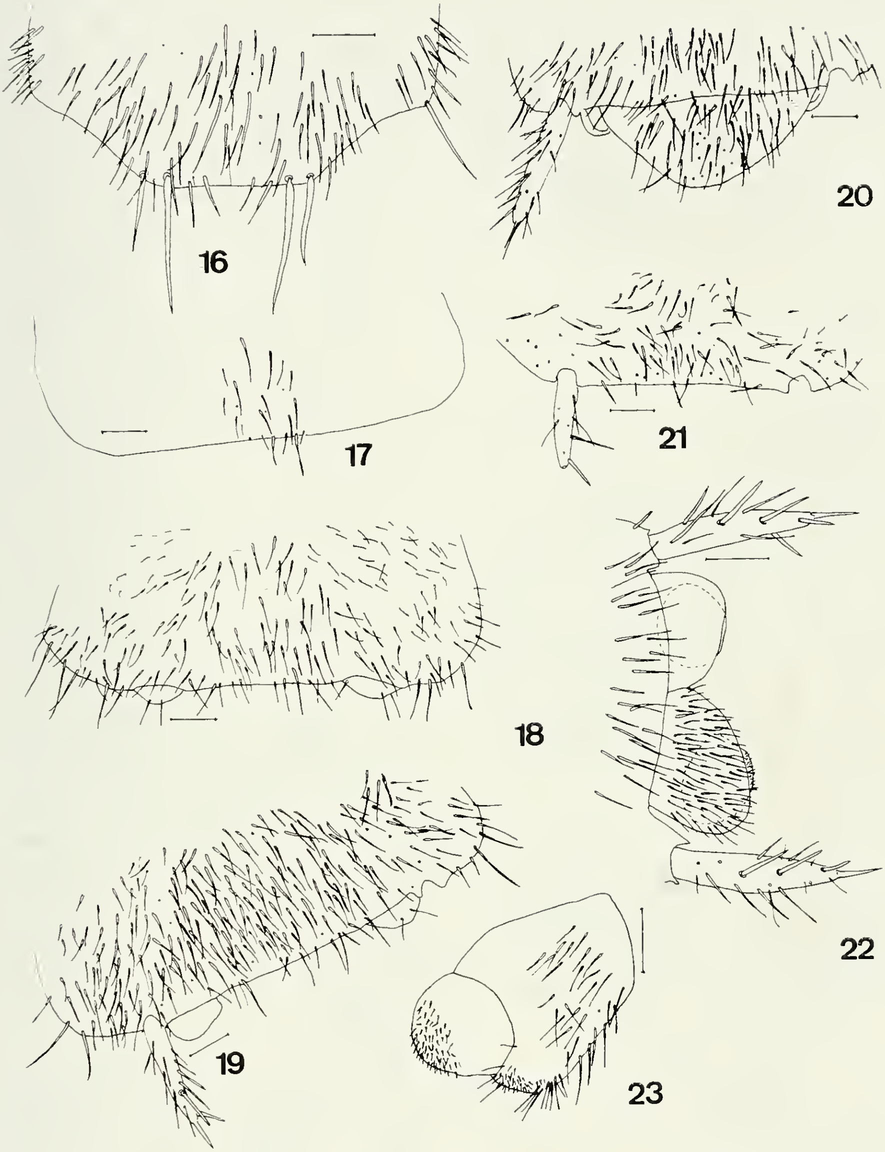
FIGS 1-7

Metrinura chibcha sp.n. Fig. 1 - Head; Fig. 2 - Pedicellus of adult male antenna; Fig. 3 - Apex of maxilla, Fig. 4 - Maxillary palp; Fig. 5 - Labial palp; Fig. 6 - Pronotum (right side bended); Fig. 7 - P I of female. Scales: 0.1 mm.



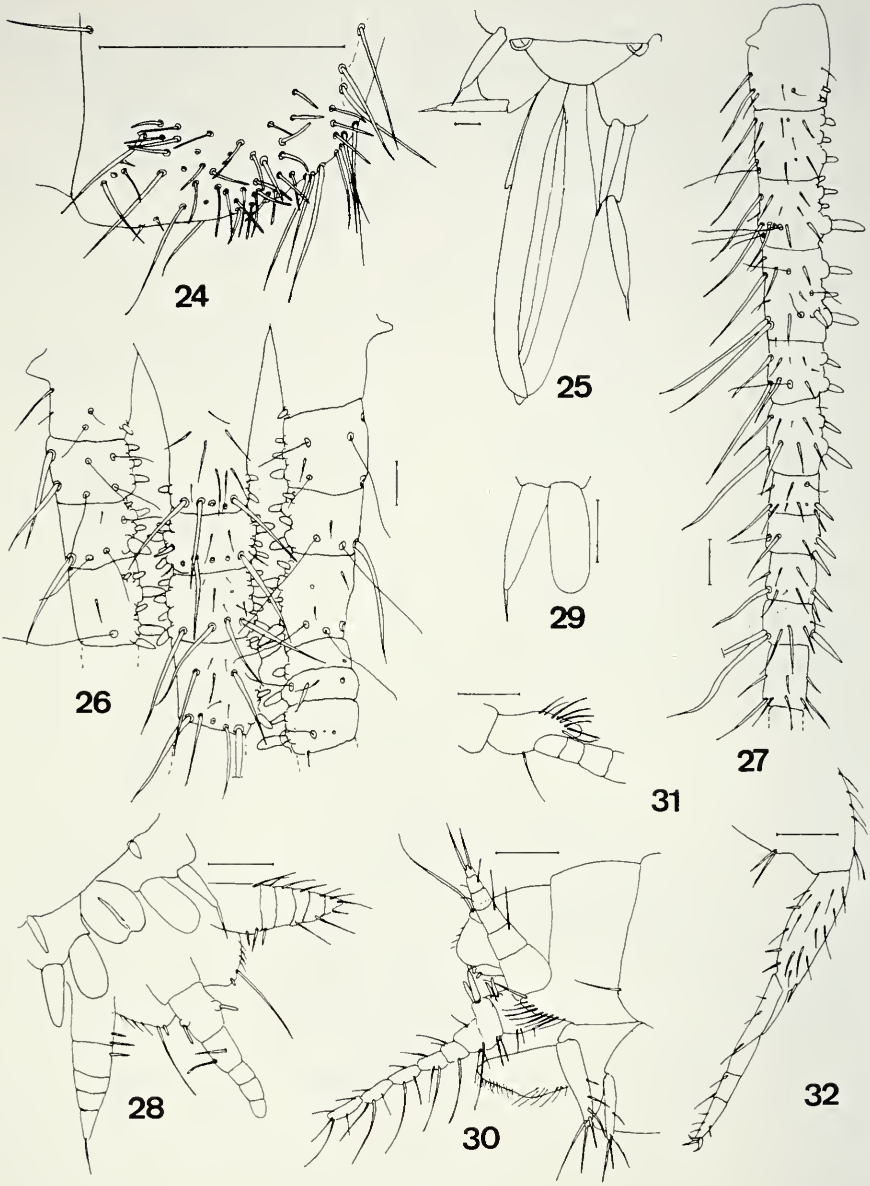
FIGS 8-15

Metrinura chibcha sp.n. Fig. 8 - P II of female; Fig. 9 - P III of female; Fig. 10 - P I of male; Fig. 11 - P III of male; Fig. 12 - Ibid., detail of the dorsoapical chaetotaxy of the femur; Fig. 13 - Ibid., detail of the praetarsus; Fig. 14 - IInd urotergite; Fig. 15 - Xth urotergite of the younger male. Scales: 0.1 mm.



FIGS 16-23

Metrinura chibcha sp.n. Fig. 16 - Xth urotergite of the female; Fig. 17 - Ist urosternite; Fig. 18 - IInd urosternite; Fig. 19 - IIIrd urosternite; Fig. 20 - VIIth female urosternite and subgenital plate; Fig. 21 - VIIIth male coxite; Fig. 22 - IXth coxite and paramera of the younger male; Fig. 23 - Adult male paramerum. Scales: 0.1 mm.



Figs 24-32

Metrinura chibcha sp.n. Fig. 24 - Adult male paramerum, detail of the outer distal region of the proximal area; Fig. 25 - Posterior ventral view of the female abdomen; Fig. 26 - Preserved part of the cerci and paracercum of the holotype; Fig. 27 - Right cercus, ventral view, of the younger male. *Archeatelura sturmi* Mendes. Fig. 28 - Ventral view of the posterior abdomen (n. DR-14-275); Fig. 29 - Outline of the right IXth stylet and paramerum (n. T-1-5); Fig. 30 - Lateral view of the abdomen (n. DR-14-1121); Fig. 31 - Ventral view of left antennal pedicellus (n. DR-14-1121); Fig. 32 - P I (n. DR-14-1121). Scales: 0.1 mm.

account of the number of abdominal vesicles and stylets besides several other characteristics; it presents, however 1) a much bigger subgenital plate, 2) a conspicuous (though not deep) Xth urotergite median depression and, in the male sex, 3) a distinct Xth tergum, 4) much longer paramera which distal portion is proportionally shorter and 5) a quite different chaetotaxy along the terminal filaments. Relatively to this last species, it must be registered also that the ovipositor, reported by SILVESTRI (1915, p. 11) as "... crassiusculus, ... apicem stilorum IX spatio brevi (mm 0,70) superans..." seems to be longer in this melanesian taxon though the IXth coxites and stylets were not represented (SILVESTRI op. cit., Fig. VIII.4) despite their citation in the correspondent legend ("... 4. Feminae urosterna 7-9 cum ovipositore..."); as a matter of fact the represented sternites are the VI-VIII, what unables a definitive comparison relatively to this characteristic.

Under the zoogeographical point of view, the presence of *Metrinura* in Colombia sounds quite peculiar, since the previously described species of the genus are restricted to Australia and Melanesia. However, it must be emphasized that the Subnicoletiinae (MENDES 1988 and 1992) are already known from the New World by one recent endemic genus (*Trichatelura*) and by oligocenic (amber preserved) species of the actually Austro-malaysian genus *Trinemurodes* (STURM & MENDES 1997) - the presence of a non-introduced *Hematelura* species in Central and South America remains dubious. Otherwise, the previously reported *"Nicoletia" neotropicalis* and *"N." armata* shall belong also to this subfamily and not to the Nicoletiinae, that is, one of these species or both may, as a matter of fact, belong to *Metrinura*, to *Trinemura*, to *Trinemurodes* or to any undescribed genus of this same group. A transantarctic passage could, so, be suggested for some representatives of the Subnicoletiinae, a subfamily represented also in Western tropical Africa (genera *Hematelura*, *Trichotriura*, *Trichotriuroides* and *Subnicoletia*). In spite of the huge area - partially corresponding to accidentally introduced populations as repeetedly registered by several authors - from where *Nicoletia phytophila* (the only unquestionable representative of the Nicoletiinae) is signalized, some of the recorded data may correspond also to misidentifications of representatives of the Subnicoletiinae - v.g. Indonesia: Flores and Sumatra islands (OUDEMANS 1890) and/or Marquesan and Society islands (SILVESTRI 1935) - namely of species belonging to genera like *Trinemura* or *Metrinura*.

Fam. ATELURIDAE

Grassiella sp.

Material examined: Honduras - Cueva Calichal, 22.IV.1995, 2 adult females (MHNG), leg. P. Strinati, with *Anelpistina* sp.

One female has 4.7 mm body length (the other one is in poor conditions); the lack of adult males unables a specific determination.

This amphi-atlantic genus, with 10 species distributed along southern USA (Texas and Louisiana) Mexico, Central and South America, has not been reported from Honduras. However, *G. praestans* Silvestri (see SILVESTRI 1912 and

WYGODZINSKY 1958) is distributed from Mexico and Costa Rica to Peru and Argentina and several other species are known to occur in the area.

Archeatelura sturmi Mendes, 1997

Material examined: Dominican Republic - in amber: 1 male n° 10; 1 young male n° DR-14-275; 2 males n° DR-14-1121 with ants; 1 female, n° DR-10-1562; 1 female n° DR-10-1585; 1 young female n° DR-14-1130 with ants; all (AMNH), leg. D. Grimaldi; 1 male n° T-1-5 (OSU), leg. Poinar Jr.

These specimens of *A. sturmi* agree fairly with the original description (MENDES 1997) in what the major characteristics are concerned. The minute setae present along the posterior border of the nota and the even thiner setulae of the hind margin of the urotergites, are quite difficult to see in the majority of the specimens, due to their extremely reduced dimensions as well as to the abundance of scales, sometimes overlaping the setae. The paramera, not well observable on the type-specimens due to the position of the insects inside the amber, are elongated (Figs 28-30), subcylindrical, with a somewhat depressed extremity and (visible only in some cases) with very thin elongated outer setae and numerous minute apical setulae; they are as long as the IXth stylets (without the apical spine) and 2 (in the younger males) to 3 times (adult specimens) longer than wide. The posterior margin of the VIIIth coxite is straight. The Xth male urotergite presents very few apical ventral conules (1-3 only) and, as it was originally reported, these ones are inserted on 1+1 ventral distal globous expansions. The development of the paracercal pegs is also variable with the age of the specimen, being the humped areas where the second pair (the bigger one) is inserted, clearly more conspicuous in the adult males (Figs 28 and 30). Fig. 31 represents the distal dorsal apophysis of the adult male pedicellus, a character not distinctly visible in the original material. Opposite to what was previously described there are thin and short spines in the tibias - 1 distal dorsal and 3 ventral (Fig. 32).

The presence of ants in the same amber samples (n° DR-14-1121 and DR-14-1130) suggests that in oligocenic times some kind of close interrelationship occurred already between these two groups; cases of almost certain myrmeco - and termitophyly have been noticed, indeed, to this period, though relatively to other groups of insects (POINAR 1993).

ACKNOWLEDGEMENTS

We want to thank Prof. H. Sturm, from the Hildesheim University, Germany, by the offered sample from Colombia and by the opportunity to see part of the Grimaldi's amber specimens that are deposited in New York; Dr. D. Grimaldi (AMNH), by the loan of further specimens of Dominican amber of this same museum; Dr. P. Strinati, who collected, and Prof. V. Aellen who loaned the sample from Honduras and who offered the duplicates, both from Geneva; and Dr. D. Poinar Jr (OSU), who loaned one further amber preserved Dominican atelurid. We are also indebted to Dr. J.M. Thibaud (Museum National d'Histoire Naturelle, Paris, France) by the facilities concerning bibliography.

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REVUE SUISSE DE ZOOLOGIE 104 (4): 807-820; décembre 1997

Beitrag zur Regenwurmfauna Ostafrikas (Oligochaeta, Eudrilidae), mit Beschreibung einer neuen *Polytoreutus*-Art.

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Contribution to the knowledge to the earthworm fauna of East Afrika (Oligochaeta: Eudrilidae), with description of a new species of *Polytoreutus*. - Fourteen species in four genera of terrestrial Oligochaeta from East Africa (Kenya, Tanzania) were studied. One new species, *Polytoreutus mixtus*, is described from Kenya (Mts Aberdares). The status of *Stuhlmannia minuta* (Michaelsen, 1891) comb. n., *Bettoniella rochei* (Cognetti, 1907) comb. n. and *B. nakitawae* (Cognetti, 1907) comb. n. are discussed. *Polytoreutus sjoestedti* Michaelsen, 1907 is revalidated.

Key-words: Earthworms - Eudrilidae - Pareudrilinae - Eudrilinae - Taxonomy - Tanzania - Kenya.

EINLEITUNG

In vorausgehenden Arbeiten über die Fauna Ostafrikas (ZICSI 1996, 1997) wurden die Arten der Gattungen *Polytoreutus* Michaelsen, 1890 und *Eudriloides* Michaelsen, 1890 der Familie Eudrilidae aus Tansania eingehend besprochen. In diesem Teil werden Arten der Gattungen *Bettoniella*, *Eminoscolex*, *Polytoreutus* und besonders *Stuhlmannia* behandelt. Obwohl in Tansania, wo ein Teil des zur Bestimmung vorliegenden Materials zwischen dem 29.1. - 27. 2. 1987 und 12. 3. - 1.4. 1989 gesammelt wurde, zahlreiche *Stuhlmannia*-Arten angetroffen werden konnten (JAMIESON 1967), war die Ausbeute dieser Gattung hier bescheidener als die der Gattungen *Polytoreutus* und *Eudriloides*. Ob dies auf die nicht ausgesprochen günstigen Feuchtigkeitsverhältnisse der Sammelzeitpunkte zurückzuführen ist, bleibt fraglich, allenfalls wurden die Arten meistens in der Nähe von besonders feuchten Stellen (Fluss- und Bachufern, in der Umgebung von Wasserquellen, am Rande von Tümpeln etc.) angetroffen.

Ausser diesen, im Rahmen des Forschungsprogramms ungarischer bodenzoologischer Expeditionen in Tansania durchgeführten Aufsammlungen, lagen zur Bearbeitung noch kleine Ausbeuten von Herrn Prof. Dr. H. Franz, dem damaligen

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Manuskript angenommen am 25.06.1997.

Vorstand des Instituts für Bodenforschung der Hochschule für Bodenkultur, Wien, von der Ungarischen Teleki-Expedition aus dem Jahre 1988, von Dr. O. Merkl, Naturhistorisches Museum, Budapest, und aus dem British Museum, London, aus Tansania und Kenia vor.

Die Arten werden in der Sammlung des Tiersystematischen und Ökologischen Lehrstuhls der Universität Budapest (AF), Belegexemplare auch im Naturhistorischen Museum Genf (MHNG.INVE) aufbewahrt.

BESPRECHUNG DER ARTEN

PAREUDRILINAE Beddard, 1894

Stuhlmannia minuta (Michaelsen, 1891) **comb. n.**

Reithrodrilus minutus Michaelsen, 1891: 21
Eudriloides minutus; MICHAELSEN 1913: 35
Eudriloides minutus; SIMS 1987: 379

Fundort: Tansania. Reg. Morogoro AF/3127 1 + 1 juv. Ex., Turiani, Ufer des Chazi- Flusses, 25. 3. 1987, leg. Zicsi & Mahunka.

Von dieser Art liegen nur 2 Exemplare vor, von denen nur ein Tier vollkommen geschlechtsreif ist. Morphologisch stimmen sie mit der als *Reithrodrilus minutus* beschriebenen Art überein. Die auf dem 15. und 16. Segment angeführten Pubertätsgrübchen sind so kennzeichnend, dass eine Verwechslung nicht möglich wäre, wenn nicht bei den anderen Kennzeichen Unterschiede bestünden, die vorerst besprochen werden müssen.

Eine weitere Art mit Drüsenpölstern auf dem 15. und 16. Segment wurde von MICHAELSEN (1905) als *Platydrilus armatissimus* beschrieben, soll sich aber in der Form der Geschlechtsborsten und Penialborsten von *R. minutus* unterscheiden. Eine Nachuntersuchung des Typenmaterials von *armatissimus*, das in sehr erweichtem Zustand vorliegt (Inv. Nr. 6663: Amani, Ost Usambara, leg Borgert), bestätigt, dass es sich hier um rundliche Drüsenpölster handelt und nicht um Grübchen, die von einem Wall umgeben sind (Abb. 1-2).

Platydrilus voessleri Michaelsen, 1905, die vom gleichen Fundort wie *P. armatissimus* stammt, verfügt über ein Paar Geschlechtsborsten auf dem 16. Segment. Die Typenexemplare (Inv. Nr. 6721 D.-O. Afrika Amani, leg. Vössler) besitzen ebenfalls runde Drüsenpölster (Abb. 3). An Grösse sind sich die beiden Arten sehr ähnlich, nur die Geschlechtsborsten sind verschieden (Abb. 4-5).

R. minutus wurde vorwiegend wegen der eigenartigen Asymmetrie des männlichen Geschlechtsapparates in einer gesonderten Gattung beschrieben. Schon 1912 ist MICHAELSEN bei der Beschreibung von *P. voessleri* der Meinung, dass die asymmetrische Ausbildung des hinteren männlichen Geschlechtsapparates kaum zur Absonderung einer Gattung verwendet werden kann. Eine spätere Ueberprüfung dieses einzigen Tieres ergänzte die Aussage der Originalbeschreibung "Hoden, Samentrichter und Samensäcke scheinen nicht ausgebildet zu sein" mit der Aussage "Ich habe zwar bei der Nachuntersuchung weder Hoden, Samentrichter noch Samensäcke erkennen können, wohl aber die Samenleiter, und diese Samenleiter sind, wenigstens schon im 13. Segment, in einem einzigen Paar vorhanden. So ist also *R. minutus* mit grosser Wahrscheinlichkeit meroandrisch und wie alle anderen meroandrischen Eudrilaceen metandrisch." Deswegen stellte MICHAELSEN (1913: 35) *R. minutus* in die Gattung *Eudriloides*.

Der Typus dieser Art war in der Sammlung von Hamburg unter *Platydrilus minutus* (Inv. Nr. V.225) eingereiht.

Nachstehend erfolgt eine Beschreibung meines geschlechtsreifen Tieres, da wegen Unreife des Tieres MICHAELSEN in der Originalbeschreibung Ungenauigkeiten unterlaufen sind.

Kopf prolobisch. Gürtel durch Verfärbung angedeutet auf dem 1/2 13.-17. Segment.

Samentaschenporus auf dem 13. Segment. Männlicher Porus auf Intersegmentalfurche 17/18. Weibliche Poren auf dem 14. Segment, ventral gelegen. Borsten sehr zart, eng gepaart.

Innere Organisation. Dissepimente 5/6 -10/11 stark verdickt. Muskelmagen im 5. Segment mit einem kragenförmigen Fortsatz. Herzen im 10. und 11. Segment. Fettkörperchen im 6. -12. Segment. Hoden und Samentrichter im 10. und 11. Segment frei. Samensäcke im 11.und 12. Segment. Samenleiter verlaufen stark gewunden bis zu den zwei kleinen, wurstförmigen Prostata, die gemeinsam ausmünden. Zwei Geschlechtsborsten im 15. und 16. Segment in Borstensäcken. Penialborsten ebenfalls in Borstensäcken im 17./18. Segment. Geschlechtsborsten und Penialborsten von verschiedener Form und Länge (Abb. 6a, b). Geschlechtsborsten 0,5 mm lang und 0,04 mm breit. Penialborsten 0,8 mm lang und 0,06 mm breit. Penialborste unterscheidet sich etwas von der Originalbeschreibung. Nephridien vom 14. Segment beginnend mit Nephridialblasen.

Samentasche eine flache blasenförmige Ampulle mit langem, bis zur Prostata reichendem Schlauch. An der Basis der Ampulle stehen zahlreiche, unregelmässig verdickte Büschel, die in die Leibeshöhle hineinragen. Die Form der Samentasche erinnert an die von *S. armatissima*. Ovarienschlauch bildet einen Ring im 13. Segment, seitlich gehen aus ihm der Eileiter mit Eitrichter und diesen gegenüber ein Eiersack hervor. Eileiter mündet ventral im 14. Segment aus.

Beide mir vorliegenden Tiere besitzen zwei Paar Hoden und Samentrichter und auch 2 Paar Samensäcke im 11. und 12. Segment, sind im übrigen aber mit *minutus* identisch und werden daher in die Gattung *Stuhlmannia* gestellt.

Stuhlmannia variabilis Michaelsen, 1890

Stuhlmannia variabilis Michaelsen, 1890: 44-45
Stuhlmannia variabilis; MICHAELSEN 1891: 23-28
Stuhlmannia variabilis; BEDDARD 1893: 243-244
Stuhlmannia variabilis; JAMIESON 1967: 115

Fundorte: Tansania. Reg. Tanga. AF/1284-85 13+ 2 juv. Ex., MHNG.INVE 23171: 2 Ex., Kwedilomba, Galeriewald am Ufer eines kleinen Baches im Schlamm, 6. und 23. 2. 1987, leg. Zicsi, Mahunka & Pocs. -AF/1295 3 + 23 juv. Ex., zwischen Mkomazi und Mombo, feuchter Graben am Wegrand, 21. 2. 1987, leg. Zicsi. - Reg. Morogoro. AF/1337 8 Ex., Dorf Jiji und Umgebung, 1. 2. 1987, leg. Zicsi. - AF/3148 1 Ex., 150 km von Morogoro in Richtung Mikumi - Nationalpark, Flussufer, 29. 3. 1989, leg. Zicsi & Mahunka. - AF/3154 4 Ex., Morogoro, Sokoine Universität, Wald, 30. 3. 1989, leg. Zicsi & Mahunka.

Die Art ist im tropischen Afrika weit verbreitet.

Stuhlmannia zimmermanni (Michaelsen, 1905)

Platydrilus zimmermanni Michaelsen, 1905: 315-318
Stuhlmannia zimmermanni; JAMIESON 1967: 124

Fundorte: Tansania. Reg. Tanga. AF/1306 1 Ex., Ost-Usambara-Gebirge, Amani Botanischer Garten am Bachrand, 800 m, 8. 2. 1987, leg. Zicsi & Mahunka. - AF/1340 4 Ex., MHNG.INVE 23172: 1 Ex., Ost-Usambara-Gebirge Kwamkoro, Waldreservat Kwamsambi, 1050 m, 19. 2. 1987, leg. Zicsi & Mahunka. - AF/1343 18 Ex., AF/1387 1 Ex., Ost-Usambara Gebirge, Derema, Tal des Hunga-Baches, 6. 2. 1987, leg. Zicsi & Mahunka.

Durch die kennzeichnende Form der Penialborsten kann diese Art von allen anderen leicht unterschieden werden.

Stuhlmannia borgerti (Michaelsen, 1905)

Platydrilus borgerti Michaelsen, 1905: 320-322
Stuhlmannia borgerti; JAMIESON 1967: 103

Fundort: Tansania. Reg. Tanga. AF/1320 10 praead. und juv. Ex., MHNG.INVE 23173: 1 Ex., Ost-Usambara-Gebirge, Kwamkoro, im sumpfigen Boden 7. 2. 1987, leg. Zicsi & Mahunka.

Obwohl nur praeadulte und juvenile Tiere von dieser Art vorliegen, lassen sie sich auf Grund der Penialborsten mit Sicherheit zu *S. borgerti* stellen (Abb. 7). Das Divertikel der Samentasche ist nicht so deutlich ausgeprägt, wie dies in der Originalbeschreibung angeführt wird. Es ist der erste Wiederfund dieser Art.

EUDRILINAE Claus, 1880

Bettoniella Gates, 1941

Bettonia Beddard, 1903: 211
Bettoniella Gates, 1941, nom. nov. pro *Bettonia* Beddard, 1903 (non Butler, 1898): 497
Bettoniella; SIMS 1987: 381

Da die bisher beschriebenen Arten dieser Gattung (*B. lagariensis* Beddard, 1903, *B. adolphifriderici* Michaelsen, 1912, *B. budduensis* Michaelsen, 1912, *B. monticola* Michaelsen, 1937 und *B. elgonensis* Cernosvitov, 1938) sich in allen Kennzeichen sehr nahe stehen, stösst das Einreihen von neuem Material dieser Arten auf grösste Schwierigkeiten. Im Museum Hamburg ist ein Exemplar des Typenmateriales von *B. adolphifriderici* (Inv. Nr. V. 3580: Ruwenzori, leg. Schubolz) ausgetrocknet, 2

Exemplare von *B. monticola* aus Uganda, vom Mount Elgon und Mount Debasien (Inv. Nr. V. 12281 u. V.12285) sind ebenfalls ausgetrocknet und nicht nachbestimmbar. Das einzige Exemplar von *B. budduensis* im Zoologischen Museum von Berlin (Inv. Nr. ZMB 4772) ist verschollen. Die Typusart *B. lagariensis* ist an Hand eines Exemplares, *B. elgonensis* an Hand von 3 Tieren beschrieben worden; die Typen dieser Arten lagen mir nicht vor.

Nach der Originalbeschreibungen unterscheiden sich die Arten voneinander nur in unwesentlichen Kennzeichen. Diese sind die Grössenunterschiede, Unterschiede in der Form der Prostata und Kopulationstaschen sowie in der Lage der Samentaschenporen in der Borstelinie *ab*, *b*, und *c*. Das sind meines Erachtens nicht so wesentliche Unterschiede, dass man auf Grund dieser neue Arten begrenzen könnte. Überdies kommen im vorliegenden Material auch praeadulte Tiere vor, bei denen deutlich eine Paarigkeit der männlichen Poren zu erkennen ist (Abb. 8a), und nur mit fortschreitender Geschlechtsreife sackt der ventrale Körperteil zwischen den männlichen Poren ein. Dadurch bildet sich ein unpaariges Loch, in das seitlich, beiderseits durch Kopulationstaschen, die männlichen Poren ausmünden.

Trotz dieser Beobachtung sehe ich derzeit von einer Synonymisierung der Arten mit *lagariensis* ab.

Bettoniella lagariensis (Beddard, 1903)

Bettonia lagariensis Beddard, 1903: 212
Bettoniella lagariensis; Sims 1987: 381

Fundorte: Kenia. Mt. Kenya, Nationalpark, AF/3245 2 Ex., 3248 2 Ex., AF/3250 1 Ex., Meteorologische Station und Umgebung, 3050 m, 27.-28. 3. 1988 leg. Teleki Expedition. - AF/3259 6 Ex., Fundort wie zuvor, 2. 2. 1992 leg. Merkl. - AF/3261 11 + 2 Ex., MHNG.INVE 20411:2 Ex., Aberdare-Gebirge, 3000 m, 2. 6. 1962 leg. Franz.

Länge 60-110 mm, Dicke 4,5-5,2 mm, Segmentzahl 80-115. Farbe dorsal rötlichgrau, ventral hellgrau. Kopf epilobisch 1/2 zu. Borsten weitläufig gepaart, Borstendistanz hinter dem Gürtel *aa*: *ab*: *bc*: *cd*: *dd* wie 2: 1,3: 1,6: 1: 4,6. Nephridialporen zwischen der Borstenlinie *cd*.

Gürtel ringförmig, stark drüsig vom 14.-17. Segment, bei einigen Tieren auf der Dorsalseite auch auf das 13. bzw. 18. Segment übergehend. Weibliche Poren von aussen nicht erkannt, von innen im 14. Segment, in Höhe der Borstenlinie *a*. Männlicher Porus ein grosses, unpaariges Loch auf Intersegmentalfurche 17/18, ventralmedian mit deutlich gefurchten Rändern. Die männlichen Poren münden beiderseits in dieses Loch ein. Die Mittelpartie des 17. Segmentes ist tief in dieses Loch eingesunken und teilt die Kopulationstasche in 2 gesonderte Organe. (Abb. 8).

Samentaschenporus paarig auf Intersegmentalfurche 12/13 in der Borstenlinie *b*, umgeben von kleinen Drüsenhöfen, aus denen bei einigen Exemplaren kolbenartige Gebilde hervorstehen. Struktur des 13. Segmentes stark drüsig, so wie dies auch bei *B. elgonensis* erwähnt wird (Cernosvitov 1938).

Innere Organisation. Dissepimente 6/7-11/12 etwas verdickt. Schlunddrüsen überdecken den Muskelmagen im 5.- 6. Segment. Grosse und kräftige, kolbenförmige

Chylustaschen im 9., 10. und 11. Segment. Letzte Paar Herzen im 10. und 11. Segment. Samensäcke im 11. und 12. Segment. Kalkdrüsen im 13. Segment, grosse gekerbte Gebilde.

Prostata besitzen einen dicken, mässig langen Drüsenteil, der zu einer einfachen, nach hinten gerichteten Schleife eng zusammengelegt ist. Der proximale Schleifenteil ist etwas kürzer als der distale, doch bedeutend dicker. Die Samenrinnen münden am Ende des proximalen Teiles ein. Der aus dem distalen Teil hervorgehende Ausführungsgang geht beiderseits in je eine grosse Kopulationstasche über, die deutlich voneinander getrennt sind. Die Kopulationstaschen sind dicht nebeneinander.

Weiblicher Geschlechtsapparat. Im 13. Segment von einer Cölomhaut eng umhüllt, die die Samentaschen und Ovarien vollkommen einschliesst. Nur am hinteren Teil ragen die Eileiter, der Eitrichter und die grossen Eiersäcke beiderseits hervor.

Die Samentaschenporen führen in je eine muskulöse, dickwandige, eiförmige Samentasche. Die Samentaschen sind von einem dünnwandigen Schlauch umgeben, der auch vom Cölom umhüllt ist. Je ein grosses Ovarium liegt medial neben der Samentasche und ist von einer Ovarialblase umgeben. Der geschlossene Eitrichter trägt an der Oberseite einen runden Eiersack, der in einen gestreckten Eileiter übergeht. Eileiter mündet in der ventralen Medianlinie des 14. Segmentes aus.

Bemerkung. Die Gattung *Bettoniella* Gates unterscheidet sich von *Eminoscolex* Michaelsen, 1896 nur durch das Auftreten von unpaaren männlichen Poren; das von Sims (1987, p.281) erwähnte Merkmal (Samentaschenporen auf Intersegmentalfurche 13/14) beruht auf einem Irrtum. Zwei Arten, *Eminoscoelx rochei* Cognetti, 1907 und *E. rochei* f. *nakitawae* Cognetii, 1907 (= E. *nakitawae*: Cognetti 1909) besitzen eine unpaare Öffnung der männlichen Poren; nach Überprüfung der jeweiligen Holotypen aus dem Museum Torino (*rochei*: Inv.Nr.OL 355; *nakitawae*: OL 354A) stelle ich diese Arten in die Gattung *Bettoniella*. Fraglich bleibt, ob die Verschmelzung der paarigen männlichen Poren zu einem unpaaren Ausführgang als ausreichendes Gattungsmerkmal betrachtet werden kann.

Eminoscolex crassus Cernosvitov, 1938

Eminoscolex crassus Cernosvitov, 1938: 311
Eminoscolex crassus; Sims 1987: 381

Fundorte: Kenia. AF/3270 1+ 1 juv. Ex., Mt. Elgon, Fluss Kimothon, 3200 m, 11. 1. 1992, leg. Merkl. - AF/3272 5 juv. Ex., Fundort wie zuvor, 18. 1. 1992, leg. Merkl.

Nur ein Tier ist vollkommen adult, die übrigen lassen sich jedoch trotz sehr erweichten Zustandes auch bestimmen.

Meine Tiere stimmen vollkommen mit der Beschreibung von Cernosvitov überein. Es sei bemerkt, dass ich den Ringschlauch, der die beiden Samentaschen verbindet, eindeutig erkennen konnte. Dieser wird bei Cernosvitov nicht erwähnt.

Polytoreutus kenyaensis-Artengruppe

In meiner vorausgehenden Arbeit (Zicsi 1996) befasste ich mich mit Ausnahme von *P. mahunkai* Zicsi, 1996 nur mit *Polytoreutus*-Arten aus Tansania. Hier sollen weitere Arten dieser Gattung aus Kenia gemeldet werden. Die drei Arten, die von SIMS (1982) in der *P. kenyaensis*-Gruppe belassen wurden: *P. montiskenyae* Beddard,1902, *P. kenyaensis* Beddard, 1902 und *P. annulatus* Michaelsen,1912 (*P. sjoestedti* Michaelsen, 1907 und *P. gracilis* Michaelsen,1907 wurden mit *P. kenyaensis* Beddard; *P. montiskenyae jeanneli* Michaelsen, 1914 und *P. alluaudi* Michaelsen, 1914 mit *P. montiskenyae* Beddard synonymisiert), zeigen untereinander so grosse Ähnlichkeiten, dass sie nur schwer voneinander getrennt werden können. Für diese Synonymisierung hatte SIMS (1982, p.267-268) sicherlich dem Fehlen oder Vorhandensein von Prostata-Höckern Bedeutung zugemessen, ein Merkmal, das in den Originalbeschreibungen von *P. gracilis* und *sjoestedti* nicht erwähnt wird. Im mir vorliegenden Material werden jedoch diese Höcker verschieden weit vom Ausführungsgang der Prostata in unterschiedlicher Deutlichkeit gebildet, wodurch die von SIMS hervorgehobenen Unterschiede zwischen *P. montiskenyae* und *annulata* verwischt werden. Da auch gewisse Ähnlichkeiten in der Form der Samentaschen bestehen (SIMS 1982, p.265), müssen den Unterschieden in der Ausbildung des Geschlechtsfeldes und deren inneren Organisation grössere Bedeutung zugemessen werden.

Nach den von SIMS (loc.cit.) erarbeiteten Artmerkmalen müsste mein reiches Material zu *P. annulatus* gestellt werden, da die Prostata je einen deutlichen Höcker besitzen, in den die Samenleiter einmünden. Anhand zusätzlicher Merkmale muss jedoch dieser Artenkomplex neu diskutiert werden, was zu einer Rehabitilation von *P. sjoestedti* und zur Beschreibung einer neuen Art führt.

Polytoreutus kenyaensis Beddard,1902

Polytoreutus kenyaensis Beddard, 1902: 191
Polytoreutus gracilis Michaelsen, 1907: 4
Polytoreutus kenyaensis; SIMS 1982: 385

Fundort: Kenia. AF/3468 1 Ex., Aberdare-Gebirge, 3000 m, 2. 7. 1962, leg. H. Franz.

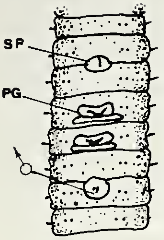
Der Gürtel erstreckt sich vom 13.-17. Segment, geht auch etwas auf das 18. Segment über, ist ringförmig und stark drüsig. Männlicher Porus auf dem 17. Segment, der Hof von diesem geht auch auf das 18. Segment über. Samentaschenporus auf Intersegmentalfurche 18/19. Ventrale Partie des 20.-25. Segmentes polsterförmig verdickt, auf einem kleinen Wall verläuft eine dünne Rinne, die auf dem 25. Segment endet.

Innere Organisation. Samenleiter münden direkt seitlich in die Prostata ein. Samentasche endet kolbenförmig verdickt im 23. Segment, wohin auch die stark verdickten Prostata reichen. Ebenfalls von da erweitern sich die bislang dünnen Samensäcke zu breiten Gebilden, die den Dissepimenten entsprechend eingeschnürt bis ins 36.-37. Segment verlaufen. Prostata münden durch eine Bursa propulsoria aus. Im Inneren keine drüsigen Gebilde, die sich der Ausmündung anschliessen.

Polytoreutus sjoestedti Michaelsen, 1907

Polytoreutus sjoestedti Michaelsen, 1907: 5.
Polytoreutus kenyaensis; SIMS 1982: 385.

Fundorte: Kenia. AF/3274 2 Ex., MHNG.INVE 23175:1 Ex., Aberdare-Gebirge, 10 000 Fuss, leg. Hinde. - 1 Ex., British Museum Nr. 1910. 8.42, Fundort wie zuvor.



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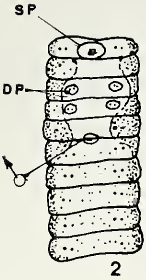

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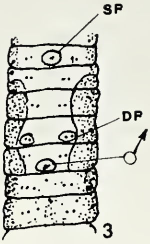

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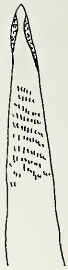

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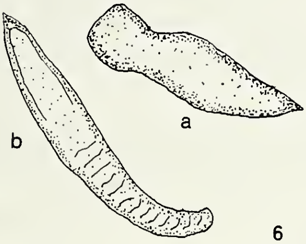

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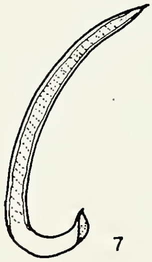

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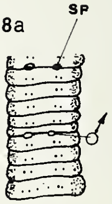

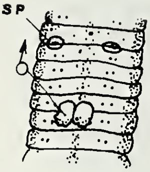

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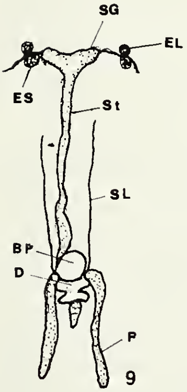

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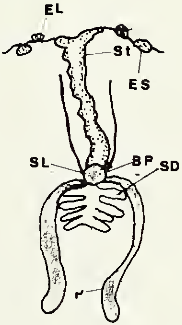

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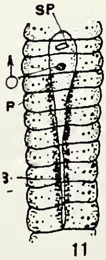

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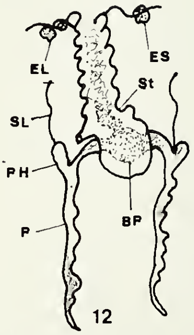

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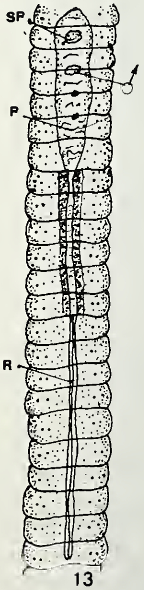

13

Obwohl diese Art von SIMS (1982) zu *P. kenyaensis* eingezogen wurde, zeigen die von mir untersuchten Tiere so bedeutende Unterschiede zu *kenyaensis* in der inneren Organisation auf, dass ich *sjoestedti* als gute Art betrachte.

Vor allem ist bei dieser Art hinter der Ausmündung der Samentasche ein schmetterlingsförmiges Gebilde (Abb. 9) zu erkennen. Dieses kann auch als Divertikel der Samentasche betrachtet werden, da es innen hohl und mit Samenmassen gefüllt ist. Diesem Divertikel folgt eine 3-4 Segmente einnehmende, nach hinten zugespitzte Erhebung, die bei *P. gracilis* von Michaelsen als Kopulationstasche betrachtet wird. Aber auch bei *P. sjoestedti* wird dieses vollständig gesonderte, breite, ziemlich niedrige Gebilde als Kopulationstasche beschrieben. Auf der Abbildung der Originalbeschreibung wird es als ein rundes Gebilde veranschaulicht. Ich nehme an, dass das bei *P. gracilis* als Kopulationstasche bezeichnete Organ mit dem runden, breiten Gebilde von *P. sjoestedti* nicht identisch sein kann. Ein ähnliches Gebilde, wie das bei *P. gracilis* erwähnt wurde, ist auch bei der mit Prostatahöckern versehenen Art *P. alluaudi* erwähnt worden und wird zweifellos mit dem äusseren Pubertätsfeld in Verbindung gebracht (MICHAELSEN 1914). Obwohl in der Originalbeschreibung von *P. sjoestedti* ausdrücklich betont wird, dass die Samentasche ohne Divertikel ausmündet, bin ich mir nicht sicher, ob diese runde Kopulationstasche nicht doch als Divertikel betrachtet werden kann. Deswegen reihe ich meine Exemplare, die in allen Kennzeichen mit *P. sjoestedti* übereinstimmen, dieser Art ein.

Polytoreutus mixtus sp. n.

Fundorte: Kenia. Holotypus (erweicht): Aberdare-Gebirge, 10 000 Fuss, leg. Hinde. British Museum N. 1910. 8. 41. - Paratypus (erweicht): AF/3273 1 Ex., Fundort wie beim Holotypus.

Holotypus: Länge 54 mm, Dicke 5 mm, Segmentzahl 72. Paratypus: Länge 85 mm, Dicke 5 mm, Segmentzahl 87.

Farbe unpigmentiert, weiss. Kopf epilobisch zu. Borsten weitläufig gepaart, Borstenverhältnis hinter dem Gürtel *aa*: *ab*: *bc*: *cd*: *dd* wie 2,2: 1,5: 2: 1: 6. Nephridialporen in der Borstenlinie *cd*.

ABB. 1-13

1: *Stuhlmannia minuta* (Michaelsen), Ventralansicht der Gürtelregion. - 2: *Stuhlmannia armatissima* (Michaelsen), Ventralansicht der Gürtelregion. - 3: *Stuhlmannia voessleri* Michaelsen, Ventralansicht der Gürtelregion. - 4: *Stuhlmannia minuta* (Michaelsen), Penialborste nach MICHAELSEN 1891. - 5: *Stuhlmannia voessleri* Michaelsen, Penialborste nach MICHAELSEN 1905. - 6: *Stuhlmannia minuta* (Michaelsen), a: Geschlechtsborste des 16. Segments, b: Penialborste des 17/18. Segments. - 7: *Stuhlmannia borgerti* (Michaelsen), Penialborste. - 8: *Bettoniella lagariensis* (Beddard), a: Ventralansicht der Gürtelregion des juvenilen Tieres, b: Ventralansicht der Gürtelregion des adulten Tieres. - 9: *Polytoreutus sjoestedti* Michaelsen, weiblicher und männlicher Geschlechtsapparat (St = Samentaschenschlauch). - 10: *Polytoreutus mixtus* sp. n., weiblicher und männlicher Geschlechtsapparat. - 11-12: *Polytoreutus annulatus* Michaelsen, 11: Ventralansicht der Gürtelregion mit Pubertätsfeld, 12: weiblicher und männlicher Geschlechtapparat (P = Pubertätsfeld, St = Samentasche,) . - 13: *Polytoreutus montiskenyae* Beddard, Ventralansicht der Gürtelregion.
BP = Bursa propulsoria, D = Divertikel, EL = Eileiter, ES = Eiersack, P = Prostata, PG = Pubertätsgrübchen, PH = Prostatahöcker, SD = Samentaschendivertikel, SG = Gabelung der Samentasche, SL = Samenleiter, SP = Samentaschenporus, R = Pubertätsrinne.

Gürtel ringförmig auf dem 13.-17. Segment. Männlicher Porus auf dem Rand des 17. Segmentes, bei einem Exemplar etwas nach links verschoben, von einem ovalen Hof umgeben, aus dem der Penis hervorsteht. Samentaschenporus auf Intersegmentalfurche 18/19, unter dem männlichen Porus.

Geschlechtsfeld. Ventrale Partie der Segmente 17-22 etwas polsterförmig verdickt. Vom 23.-27. Segment sind diese Drüsenpölster kräftiger und besitzen in der Mitte eine deutliche rinnenförmige Vertiefung. Schwach angedeutet, aber keine Rinne bildend, setzt sich dieses Gebilde strichförmig bis zum 19. Segment fort. Längswälle, wie bei den übrigen Arten dieser Gattung, konnten nicht erkannt werden.

Innere Organisation. Dissepimente 5/6 sehr schwach, 6/7-12/13 etwas stärker verdickt. Muskelmagen im 5. Segment, gross, metallisch glänzend. Je eine plattgedrückte, feigenförmige Chylustasche im 9., 10., 11. Segment. Kalkdrüsen im 13. Segment, den Darm umgebend und in zwei Hälften geteilt. Herzen im 10. und 11. Segment. Samenmagazine im 11. Segment in oesophageale Testikelblasen eingeschlossen. Aus ihnen gehen dünne Samensäcke hervor, die hinter den Prostata wieder sackförmig dick anschwellen und bis ins 37. Segment reichen.

Prostata bis ins 35. Segment reichend, hier geknickt und stark angeschwollen, können auch nach vorne gerichtet sein. Prostata münden durch eine Bursa propulsoria aus. Samenleiter treten direkt unter der Einmündung der Prostata an die Bursa propulsoria heran. Keine Prostata-Höcker vorhanden.

Weibliche Geschlechtsorgane. Die Hauptachse der Samentasche gabelt sich in 2 kleine Fortsetzungen, aus denen die dünnen, geschlängelten Verbindungsschläuche sich in den geschlossenen Eitrichter fortsetzen. An der Hinterseite tragen die Eitrichter einen hervorstehenden Eiersack. Lateral verengt sich der geschlossene Eitrichter und geht in den Eileiter über, der seitlich im 14. Segment ausmündet. Die Samentasche ist vor der Ausmündung unpaarig, sie besitzt die Gestalt eines sich dem Ende zu erweiternden Sackes, der durch die Dissepimente eingeschnürt ist. Sie mündet durch einen schlauchförmigen, dünnwandigen, nicht muskulösen Ausführungsgang aus. Von den übrigen Arten dieser Gattung abweichend setzt sich die Samentasche durch Divertikel verzweigt fort (bis zu fünf) und erinnert so an die Samentaschenform von *P. violaceus* Beddard, 1890 (Abb. 10) aus der *P. coeruleus*-Gruppe.

Die neue Art unterscheidet sich von den übrigen Arten dieser Gattung vor allem durch die Form des Geschlechtsfeldes und durch die Form der Samentasche mit dem Divertikel.

Polytoreutus annulatus Michaelsen 1912

Polytoreutus annulatus Michaelsen, 1912: 3
Polytoreutus annulatus; MICHAELSEN 1913: 5
Polytoreutus annulatus; MICHAELSEN 1914: 122
Polytoreutus annulatus; MICHAELSEN 1915: 38

Fundorte: Kenia. AF/3262 4 Ex., AF/3264 1 Ex., Mt. Kenya, 3000 m, 2. u. 25. 7. 1962, leg. Franz. - AF/3265 1 Ex., Mt. Kenya, W-Hang, 3800 m, oberhalb der Waldgrenze, 26. 7. 1962, leg. Franz. -Tansania. AF/3266 1 Ex., Kilimanjaro, SO-Hang, 3000 m, 13. 7. 1962, leg. Franz.

Obwohl die Original- und Ergänzungsbeschreibungen von MICHAELSEN (1912, 1913) ausführlich sind, gebe ich eine Beschreibung an Hand meines Materials.

Länge 60-110 mm, Dicke 4-6 mm, Segmentzahl 160-196.

Kopf epilobisch 2/3 zu. Kopflappen manchmal durch eine Querfurche getrennt. Farbe dorsal rotviolett bis kastanienbraun. Borstenverhältnis hinter dem Gürtel *aa*: *ab*: *bc*: *cd*: *dd* wie 2,5: 1,8: 2: 1: 15. Nephridialporen in der Borstenlinie *cd*.

Gürtel vom 13., 1/2 13., 14.-17., 1/2 18. Segment. Männlicher Porus auf dem hinteren Rand des 17. Segmentes oder auf Intersegmentalfurche 17/18 auf einer ovalen oder kreisrunden Papille, aus der bei einigen Tieren der Penis hervorsteht. Samentaschenporus auf Intersegmentalfurche 18/19, ein länglicher Schlitz.

Geschlechtsfeld. Ventrale Partie um den männlichen Porus bis zum 20. Segment verdickt. Vom männlichen Porus verlaufen 2 Längswälle bis ins 26.-30. Segment. Der Zwischenraum zwischen dem 1/2 19.-1/2 23. Segment breiter, von da bis ins 26. bzw. 30. Segment schmal, fast rinnenförmig, am Ende gebogen (Abb. 11).

Innere Organisation. Dissepimente 5/6-12/13 verdickt, 5/6 und 12/13 weniger stark. Muskelmagen im 5. Segment, kräftig, von den Schlunddrüsen vollkommen überdeckt. Fingerförmige, plattgedückte Chylustaschen im 9., 10., 11. Segment. Kalkdrüsen im 13. Segment, umranden den Darm beiderseits und sind in der Mitte eingeschnitten. Herzen im 10. und 11. Segment. Hoden und Samentrichter im 11. Segment in oesophageale Testikelblasen eingeschlossen. Aus ihnen gehen beiderseits die Samensäcke hervor, die zuerst dünn, dann vom Porus der Samentasche verdickt bis ins 26. Segment gehen. Prostata sind den Dissepimenten entsprechend eingeschnürte Gebilde, die bis ins 33. Segment reichen können. Sie münden durch eine kleine Bursa propulsoria aus. Die Samenleiter münden beiderseits in einen Höcker der Prostata ein (Abb. 12).

Samentasche unpaarig, nach hinten zu dicker werdend und kolbenförmig hinter der Bursa propulsoria bis ins 22. Segment gehend. Sie mündet durch einen kurzen muskulösen Ausführungsgang auf Intersegmentalfurche 18/19 aus. Vorne gabelt sich die Samentasche kurz, die Verbindungsschläuche münden nach einem knieförmigen Knick in die Hinterseite des geschlossenen Eitrichters ein. Diesen gegenüber grosse Eiersäcke, die sich in den Eileitern fortsetzen und im 14. Segment seitlich ausmünden.

Hinter der Ausmündung der Samentasche ist noch eine kurze zugespitzte Ausbuchtung zu erkennen, die bis ins 22., 23. oder 24. Segment verläuft. Sie ist auch mit einer Oeffnung auf Intersegmentalfurche 21/22 oder 22/23 versehen. Die Funktion dieser drüsigen Ausbuchtung ist unbekannt.

Meine Beschreibung weicht in einigen Kennzeichen von der Originalbeschreibung ab, in der die Ausbuchtung hinter der Ausmündung der Samentasche mit ihren Öffnungen im 21./22. und 22./23. Segment nicht erwähnt sind. Der in der Originalbeschreibung im 22. Segment erwähnte Querwall ist bei meinen Tieren nicht beobachtbar.

Polytoreutus montiskenyae Beddard, 1902

Polytoreutus montiskenyae Beddard, 1902: 194
Polytoreutus montiskenyae jeanneli Michaelsen, 1914:120

Polytoreutus alluaudi Michaelsen, 1914: 122
Polytoreutus montiskenyae; Sims 1982: 268

Fundorte: Kenia. AF/3243 11 + 15 juv. Ex., MHNG.INVE 23176:2 Ex., Mt. Kenya, Nationalpark, 3050 m, Meteorologische Station, 27. 3. 1988, leg. Teleki Exp. - AF/3246 19 Ex., AF/3249 22 + 14 juv. Ex., Fundort wie zuvor, 3300 m, 28. 3. 1988, leg. Teleki Exp. - AF/3257 13. Ex., Fundort wie zuvor, 3040 m, 2. 2. 1992, leg. Merkl.

Zahlreiche Exemplare aus der Umgebung der Meteorologischen Station weisen eine variable Länge der von den männlichen Poren ausgehenden Längswälle auf (Tiere aus 3300m: bis zum 30. Segment; 3040+3050m: bis ins 38 Segment) (Abb. 13). Diese Variabilität wurde auch bei *P. usambariensis* Michaelsen, 1905 (Usambara-Gebirge: Amani und Umgebung) beobachtet, weshalb die Wallänge als Artmerkmal nicht verwendet werden kann.

Die mir vorliegenden Exemplare stimmen morphologisch mit der Beschreibung Beddard's (1902) überein; sie besitzen überdies Prostata-Höckerm die nicht genau seitlich hervorgehen, sondern mehr oder weniger weit von der Ausmündung der Prostata entspringen und innen deutliche drüsige Anschwellungen hinter den Samentaschenausmündungen, wie dies von *montiskenyae* und ihrem Synonym *alluaudi* beschrieben wurde (Michaelsen 1914).

Polytoreutus meranus-Gruppe

Polytoreutus minutus Michaelsen 1912

Polytoreutus minutus Michaelsen, 1912: 2
Polytoreutus minutus; Michaelsen 1913: 53
Polytoreutus minutus; Michaelsen 1937: 473
Polytoreutus minutus; Sims 1982: 273
Polytoreutus minutus; Zicsi 1996: 32

Fundorte: Kenia. AF/3244 11 + 15 juv. Ex., MHNG.INVE 23174 :2 Ex. Mt. Kenya, Nationalpark, 3050 m, Meteorologische Station, 27. 3. 1988, leg. Teleki Exp. - AF/3247, AF/3251, AF/3253 33 Ex., Fundort wie zuvor, 3300 m, 28. 3. 1988, leg. Teleki Exp. - AF/3260 13 Ex., Mt. Kenya. Nationalpark, Meteorologische Station, 3040 m. 2. 2. 1992, leg. Merkl.

Zahlreiche Exemplare ermöglichen es, die Beschreibungen Michaelsen's (1912, 1913) zu überprüfen und zu ergänzen. Obwohl die Beschreibungen an Hand eines Exemplares erfolgten, ist die aus dem Jahr 1913 sehr ausführlich, sodass eine Wiedererkennung der Art keine Schwierigkeiten bereitete.

Unsere Tiere sind etwas grösser als in der Originalbeschreibung angegeben, sie sind 60-70 mm lang, rotviolett pigmentiert. Kopf epilobisch 1/2 offen.

Innere Organisation. Dissepimente 6/7-10/11 etwas verdickt. Muskelmagen im 5. Segment, von den Schlunddrüsen überdeckt. Chylustaschen im 9., 10., 11. Segment, es sind runde, feigenförmige Gebilde. Herzen im 10. und 11. Segment. Der unpaarige Stamm der Samentasche setzt sich nach meinen Beobachtungen in einem unpaarigen Divertikel fort, der weit nach hinten bis ins 30. Segment reichen kann. Die Struktur des Divertikels weicht von der muskulösen Struktur des Hauptstammes ab.

DANKSAGUNG

Für die Überlassung von Typenmaterial spreche ich Herrn Prof. Dr. M. Dzwillo, Zoologisches Institut und Museum, Hamburg und Herrn Dr. A. Rolando, Museo ed Istituto die Zoologia Sistematica della Università, Torino, meinen besten Dank aus. Für einen Arbeitsplatz im Naturhistorischen Museum von Genf, wo die Bearbeitung des Materials z. T. erfolgte, wird der Direktion sowie Herrn Dr. Cl. Vaucher auch an dieser Stelle gedankt.

Für die Fahrtmöglichkeiten im Gelände und Unterstützung unserer Sammeltätigkeit in Tansania gebührt Frau und Herrn Prof. Dr. T. Pocs unser aufrichtigster Dank.

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REVUE SUISSE DE ZOOLOGIE 104 (4): 821-830; décembre 1997

Données nouvelles sur l'évolution et la biogéographie des Morulininae (Collembola : Neanuridae)

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New data on evolution and biogeography of Morulininae (Collembola: Neanuridae). - *Morulina himalayana* n.sp. akin to japanese species, is described from the Himalayan range (Nepal). The new genus *Promorulina* is proposed for *Morulina nuda* Cassagnau, 1956 from Oregon (USA), based on morphological characters which had not been retained at the time of its description. A key to the various species is provided as well as a biogeographical analysis showing the spreading of this subfamily towards the Carpathian mountains, Himalaya, Japan, and the Eastern parts of the USA from a sibero-canadian amphiberingian center of différenciation. *Morulina pallidissima* nom. nov. is proposed for *Morulina orientis* f. *pallida* Tanaka, 1984.

Key-words: Biogeography - holartic region - Collembola - new taxa - Morulininae.

INTRODUCTION

Au sein des Poduromorphes à pièces buccales modifiées (Neanuridae) la sous-famille monogénérique des Morulininae est une des plus faciles à caractériser par la coexistence d'une tuberculisation du corps de type Neanurien et d'un organe postantennaire de grande taille formé par la coalescence de très nombreux lobules élémentaires regroupés sur une aire circulaire. Le quatrième article antennaire est d'autre part dépourvu des 8 soies épaisses (S1 à S8) caractérisant les Neanurinae.

Paradoxalement les différentes espèces décrites sporadiquement de points souvent très éloignés les uns des autres sont pour la plupart mal connues du fait de l'ambiguïté des diagnoses anciennes et de l'absence de vue d'ensemble des caractères utilisables (voir à ce sujet les diverses interprétations des tubercules récapitulées dans TANAKA (1984).

Ont successivement été décrites dans le genre *Morulina* Boerner, 1906 les espèces suivantes :

Manuscrit accepté le 20.05.1997.

- *gigantea* (Tullberg, 1876) = *Anura gigantea*
- *verrucosa* (Boerner, 1903) = *Neanura verrucosa*
- *gilvipunctata* (Uchida, 1938) = *Neanura gilvipunctata*
- *multatuberculata* (Coleman, 1941) = *Neanura multatuberculata*
- *callowayia* Wray, 1953
- *mackenziana* Hammer, 1953
- *thulensis* Hammer, 1953
- *gigantea* f. *alata* Yosii, 1954
- *nuda* Cassagnau, 1956
- *gilvipunctata* f. *irrorata* Yosii, 1958
- *kotzebuensis* Bödvarsson, 1960
- *ghilarovi* Solnzeva, 1964
- *solnzevae* Dunger, 1974
- *triverrucosa* Tanaka, 1978
- *alia* Christiansen et Bellinger, 1980
- *crassa* Christiansen et Bellinger, 1980
- *australis* Tanaka, 1984
- *orientis* Tanaka, 1984
- *orientis* f. *pallida* Tanaka, 1984
- *pawlowskii* Deharveng et Weiner, 1984

Nous écarterons tout d'abord *callowayia*, *alia*, *crassa*, *multatuberculata*, dont les diagnoses sont trop imprécises ou erronées pour que l'on puisse les prendre en compte.

Nous érigerons au rang d'espèces les "formes" *alata* Yosii (1954) et *pallida* Tanaka (1984), cette dernière sous le nom de *pallidissima* nom. n. (suivant IGZN art. 45g). Nous ne retiendrons pas la synonymie *gigantea* = *verrucosa* de HANDSCHIN (1929) et SALMON (1964) les travaux de STACH (1951) et FJELLBERG (1985) ayant apporté une meilleure connaissance de ces espèces, soulignant les caractères discriminatoires justifiant leur séparation. Par contre nous admettrons les synonymies suivantes: *ghilarovi* = *kotzebuensis* = *gigantea* (in MARTYNOVA 1975 et FJELLBERG 1985) et *solnzevae* = *alata* qui nous paraissent tout à fait justifiées.

Morulina nuda Cassagnau sera redécrite dans le genre *Promorulina* n.g; la diagnose succincte que nous avions donnée en 1956 ne tenait pas compte de la chétotaxie exhaustive en particulier d'un caractère hautement original dans le contexte systématique actuel: la persistance des quatre groupes de soies Di, De, Dl et l sur le premier segment thoracique.

Il justifie à lui seul l'isolement de cette espèce qui s'écarte aussi des *Morulina* par l'absence de tuberculisation des aires Di et parfois De sur les tergites post-céphaliques. Nous décrivons aussi une nouvelle espèce en provenance de l'Himalaya, *Morulina himalayana*, qui étend de façon spectaculaire l'aire de répartition de la lignée vers le Sud-Ouest. Une clé d'orientation permettra de mettre en évidence quelques caractères fondamentaux utilisables dans les systématique de ce genre.

Promorulina gen. n.

Morulininae à tuberculisation incomplète et à chétotaxie dorsale courte. Les groupes de soies Di ne sont pas surélevés en tubercules de l'arrière de la tête à Abd. IV, les aires plus externes marquées par des tubercules peu convexes.

Chétotaxie de Th I en quatre groupes de soies: Di, De, Dl, l.

Espèce type: *Morulina nuda* Cass., 1956 (fig. 1).

Promorulina nuda (Cassagnau, 1956) nov. comb.

Matériel examiné: USA. Oregon: Corvallis, 15-10-1949 (4 exemplaires, matériel Mills).

Longueur: 4 à 5 mm. Habitus de *Neanura*, peu convexe, à bords plus ou moins parallèles. Couleur: bleu-noir, très foncé. Tubercules segmentaires parfois peu nets, mieux marqués sur les zones latérales des segments abdominaux I à IV et sur les deux lobes du segment V (fig. 1G). Segment Abd. VI en position entièrement ventrale, comme chez les autres espèces de Morulininae. Aires céphaliques et postérieures soulignées par des réticulations bien visibles sur les gros individus. Grain tégumentaire arrondi, plus fort sur les tubercules postérieures et latéraux de l'abdomen, mais sans former de grains tertiaires.

Soies lisses; macrochètes épais et raides; soies courtes légèrement renflées à l'apex. Plurichaetose accentuée sur les régions latérales et postérieures.

Segments antennaires A1 et A2 portant 6 macrochètes dorsaux et une vingtaine de soies ventrales plus fines. A3 et A4 coalescents, l'organe sensoriel de A3 constitué par 3 soies épaisses très inégales (fig. 1B), les deux organites internes étant absents. Les soies sensorielles spécialisées de A4 sont peu différenciées des soies banales. Il y a une rape sensorielle ventrale de soies très courtes et une massue terminale trilobée.

5 + 5 cornéules fortement pigmentées. Organe postantennaire circulaire à très nombreuses papilles secondaires, subégal ou légèrement plus large qu'une cornéule (fig. 1C). Tubercules oculaires réticulés en profondeur.

Cône buccal bien développé, mais relativement court. Chétotaxie labrale à 4 longues soies antérieures de chaque côté et 3 + 3 soies plus courtes sur la marge postérieure. Soies labiales de type classique, 4 antérieures longues, 3 postérieures longues et 3 postérieures courtes de chaque côté.

Pièces buccales de type primitif non étiré. Mandibule puissante à 6 denticulations de tailles inégales (fig. 1E), la basale très forte, surmontée d'un crochet réduit. Capitulum maxillaire court, à griffe puissante à deux dents nettes; deux lamelles pectinées et une troisième étirée, terminée par un pinceau très fin, (fig. 1D). Tibiotarses de formule, 19, 19, 18 (soies m présente). Griffe puissante pourvue d'une forte dent sur la crête interne.

Chétotaxie céphalique dorsale (fig. 1A) :

14-15 clypéales (plage impaire)
7 antennaires, 3 oculaires
3 frontales (plage impaire)
di + de = 6, dl = 3, L + So = 3 macrochètes + 15 soies courtes.

Chétotaxie postcéphalique dorsale (fig. 1A, 1G) :

	Di	De	Dl	l
Th. I	4	3	5-6	9-10
II	3	7 + S	8 + S	10-12
III	3	7 + S	8 + S	10-14
Abd. I	3	4-5 + S	7	10-12
II	3	5 + S	7	14
III	3	5 + S	7	14-16
IV	1+3	5-6 + S	10-12	20-24
V		20-22 + S		

Chétotaxie ventrale:

Abd. I	TV: 10 à 12
II	15
III	TF : (15) + 18 V. pas de vestige des dentes
IV	25 V + 18 à 20 Vl
V	18 à 20 ag. + 16 V
VI	10-12 + Va = 22

Morulina himalayana sp. n.

Matériel examiné: Népal. (Muséum d'histoire naturelle de Genève et Laboratoire de Zoologie de Toulouse). Holotype mâle (MHNG) et 6 paratypes (LZT): Forêt de Goropani, entre la Kali Gandaki et Pokhara. Tamisage au pied d'un énorme sapin, au bord d'un petit marécage. 3100 m. 7-X-1983 (Löbl et Smetana leg.)

Autres stations: - Forêt de Goropani (MHNG) (Löbl et Smetana leg.), tamisage de feuilles mortes, bois pourri, mousses et champignons sur tronc de rhododendron. 2700 m. 4 ex. 6-X-1983; Punhill; tamisage de mousses et feuilles mortes. 3050 à 3100 m, en lisière de forêt de rhododendron et sapins. 4 ex. 8-X-1983; Sud du col de Goropani; tamisage de feuilles mortes dans un ravin boisé (érables, rhododendron). 1 ex. 9-X-1983. - Vallée de la Kali Gandaki; forêt au-dessus de Lete. Tamisage de feuilles mortes, mousses et bois pourri, en forêt de chênes. De 2550 à 2700 m, du 14 au 17-X-1983. 5 ex. (MHNG) (Löbl et Smetana leg.). - Mahabarat. Bois mort et litière sous Quercus; 2350 m au Nord d'Hetauda; 3 ex. 20-X-1977 (L.Deharveng leg.) (LZT).

Description: longueur: 3 à 4 mm. Bleu-noir intense sur tout le corps, coloration parfois plus claire entre les tubercules; habitus typique du genre. La plupart des caractères correspondent à ceux donnés par TANAKA (1984) pour *orientis*, en particulier ceux des pièces buccales. Les différences essentielles portent sur :

* la structure des macrochètes, beaucoup plus barbelés chez *himalayana* et à apex triangulaire et non dilaté, plus proches de ceux de *triverrucosa*;

* la chétotaxie générale beaucoup moins dense, suivant le modèle ci-dessous (entre parenthèses, quelques chiffres de comparaison donnés chez *orientis* (d'après TANAKA 1984).

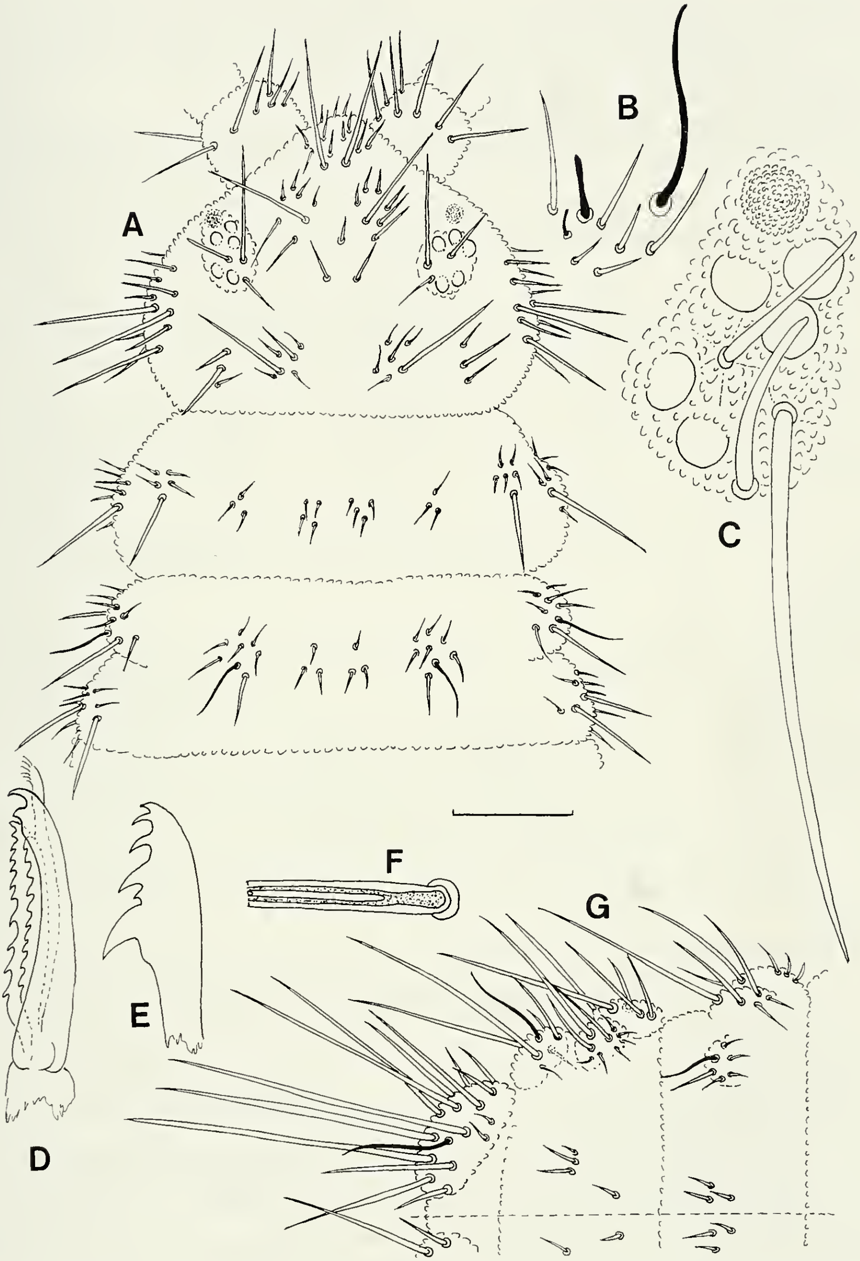

FIG. 1. *Promorulina nuda:* A, chétotaxie dorsale de la tête et des deux premiers segments thoraciques; B, détail de l'organe sensoriel d'Ant. III; C, plage oculaire et organe postantennaire; D, capitulum maxillaire; E, mandibule; F, détail de la base d'un macrochète; G, chétotaxie des segments abdominaux III, IV, V. (Echelle: 200 μm pour A et G; 50 μm pour C et F; 40 μm pour B; 20 μm pour D et E).

Chétotaxie céphalique dorsale :

5 soies clypéales en une plage impaire
4 antennaires (5), 3 oculaires
2 frontales en une plage impaire (5 à 6)
di + de = 3-4 (8 à 10) ; dl 3 (8 à 10) ; L + So = 5 macrochètes + 7 soies courtes.

Chétotaxie postcéphalique dorsale :

	Di	De	Dl	l
Th. I	2 (4 à 7)	5 (10-11)	5-7	
II	4-5 (8 à 10)	4-5 + S (9-11)	4-5 + S	5-7
III	4-5	4-5 + S	4-5 + S	5-7
Abd. I	5-6	4+S	4-5	6-7
II	5-6	4+S	4-5	10
III	5-6	4+S	4-5	9-10
IV	5-6	4+S	2	10
V		7-8 + S		

Chétotaxie ventrale :

Abd I	TV: 5 à 5
II	1+1+3
III	TF: 2+2; +- 10 dont 1 macrochète
IV	20 à 30 ventrolatérales
V	TG ♂: 30-35 AG 13 ventrolatérales
VI	14 à 15, Va: 13 à 15

Clé de détermination du genre *Morulina*:

1 Tubercules De et Dl séparés sur le 4° segment abdominal, le De décalé vers le bord postérieur du segment 3
2 Tubercules De et Dl soudés en une seule masse sur le 4° abdominal 19
3 Plage interoculaire occupée par 3 tubercules: 2 antennaires latéraux, 1 axial frontal 5
4 Plage interoculaire occupée par 2 tubercules résultant de la soudure de chaque antennaire latéral et de la moitié du frontal axial 17
5 Coloration du corps bleu-noir homogène 9
6 Pigment bleu-noir non homogène, ou absent sur le corps 7
7 Des plages jaunes sur les segments thoraciques I et II, et abdominaux I, II, III et IV. Mandibule à 3 dents . . . . *gilvipunctata* (Uchida)
Japon

8 Couleur de fond dorsale blanchâtre, avec des traces de pigment sur les tubercules dorsaux. Mandibule à 5 dents . . . . *pallidissima* nom. n.
(= *pallida* Tanaka)
Japon

9 Mandibule pectiniforme à 12-15 dents; maxille étirée . . *mackenziana* Hammer
Alaska

10 Mandibule à 5-6 dents, les deux apicales plus ou moins courbes 11

11 Maxille à capitulum court, à griffe épaisse à 3 dents; tubercules oculaires à 5-6 soies 15

12 Maxille à capitulum étiré, styliforme; tubercules oculaires à 3 soies 13

13 Hyperchaetose accentuée; tubercule frontal à 5 soies. Macrochètes globuleux ou cylindriques à l'apex. Di de Th I avec 4 à 7 soies . . . . *orientis* Tanaka
Japon

14 Hyperchaetose faible; tubercule frontal à 2 soies; macrochètes à apex triangulaire ou effilé; Di de Th I à 2 soies . . . . *himalayana* n.sp.
Népal

15 Hyperchaetose accentuée; Di de Th I avec 9 à 12 soies. Tubercules antennaires portant 9 à 12 soies. Mandibule pourvue de 5 dents . . . *alata* Yosii
Japon
(= *solnzevae* Dunger; Sakhaline?)

16 Hyperchaetose faible; Di de Th I avec 3 à 7 soies. Tubercules antennaires portant 5 à 7 soies. Mandibule portant 6 dents dont l'apicale tournée vers l'extérieur . . . . *thulensis* Hammer
Nord Canada

17 8 à 10 soies sur les tubercules Di + De de la tête . . . . *triverrucosa* Tanaka
Japon; Corée

18 6 à 7 soies sur les tubercules Di + De de la tête : plurichaetose généralement moins intense que dans l'espèce précédente dont elle est peut-être synonyme . . . . *pawlowskii* Deharveng et Weiner
Corée

19 Pièces buccales peu étirées; maxille à griffe épaisse et courte, tridentée à l'apex. Mandibule à 6 dents. Tubercule oculaire portant 5 à 6 soies
. . . . *gigantea* Tullberg
(=*kotzebuensis* Bödvarsson; *ghilarovi* Solnzeva)
Sibérie, Alaska, Sakhaline

20 Pièces buccales étirées, maxille styliforme; tubercules oculaires à 3 soies . . 21

21 Mandibule à 7-8 dents . . . . *verrucosa* (Boerner)
Carpathes

22 Mandibule à 5 dents courbes . . . . *australis* Tanaka
Japon, Iles Ryukyu

CONCLUSIONS

La comparaison des diverses espèces de *Morulina* fait ressortir, malgré une architecture très homogène marquée essentiellement par une cryptopygie accentuée et la bilobation du 5° segment abdominal, quelques caractères importants pouvant servir à la discrimination des espèces et au regroupement de certaines d'entre elles en noyaux évolutifs. Ce sont :

- la configuration des tubercules sur la tête et le quatrième segment abdominal;
- l'état d'étirement des pièces buccales, en particulier la structure du capitulum maxillaire;
- le degré de plurichaetose contrôlable essentiellement sur les tubercules céphaliques;
- la structure de l'apex des macrochètes dorsaux.

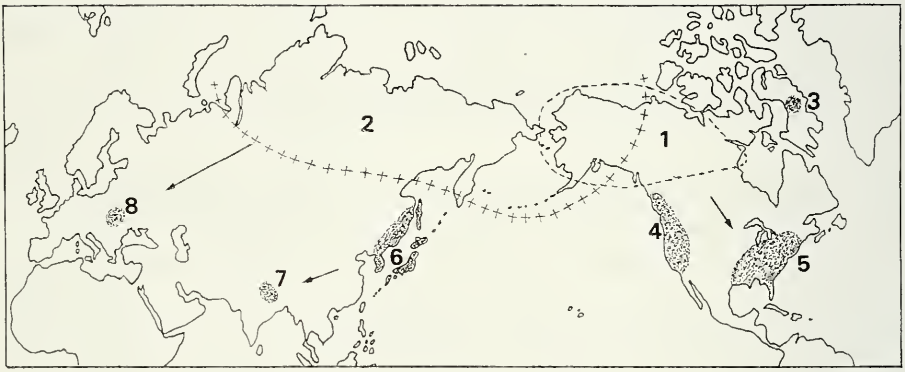

FIG. 2 : Biogéographie des Morulininae: 1, aire alasko-canadienne (*thulensis*, *mackenziana*); 2, aire alasko-siberienne de *gigantea* (populations confirmées); 3, Terre de Baffin, station douteuse de *gigantea*; 4, aire californienne (*Promorulina nuda*, *Morulina gigantea* (?) sensu Bacon, *multatuberculata* sp. inquirenda); 5, aire est-américaine (*gigantea* (?), *alia*, *crassa*, *callowayia*, s. inquirendae); 6, aire coreo-japonaise (*australis*, *alata*, *triverrucosa*, *pawlowskii*, *gilvipunctata*, *pallidissima*, *orientis*); 7, *himalayana* du Népal; 8, *verrucosa* des Carpathes.

Si de façon générale, les *Morulina* faisaient encore récemment partie intégrante des Neanurinae dans la plupart des classifications, il ne fait pas de doute aujourd'hui que l'on doit considérer Morulininae et Neanurinae comme deux groupes frères enracinés au sein des Pseudachorutinae par l'intermédiaire des *Anurida* primitifs particulièrement diversifiés sur les terres amphiberingiennes du Pacifique Nord (FJELLBERG 1985, CASSAGNAU 1989). A cet égard, le groupe d'*Anurida hammerae* défini par FJELLBERG semble annoncer l'évolution ultérieure conduisant aux Morulininae: persistance de 5 + 5 cornéules, d'un organe postantennaire, d'un capitulum maxillaire à trois lamelles dentées, tendance à la réticulation tégumentaire au niveau des groupes de soies et conservation d'une chétotaxie abondante sur le 1er segment thoracique (2 + 2 + 3 + 2 soies par demi-segment chez *A. hammerae*).

Promorulina nuda localisée aujourd'hui au Nord-Est des USA apparaît alors comme une forme primitive rélictuelle faisant transition vers les *Morulina* s. str.

On peut discerner dans ce dernier genre deux types de répartition :

- Si les déterminations douteuses de *Morulina gigantea* se confirmaient, celle-ci apparaîtrait comme une espèce expansive capable de peupler un vaste territoire, de l'embouchure du Ienissei au Territoire de Baffin à l'Est et à la Caroline au Sud-Est (aires 2, 3, 4 et 5 de la fig. 2)

- Les autres espèces semblent plus localisées, en particulier en Asie du Sud-Est et aux USA (aires 1, 4, 5, 6 de la fig. 2).

Une vague de migration a pu être favorisée vers l'Ouest par les épisodes glaciaires du Pleistocène, conduisant à l'isolement de *verrucosa* dans les Carpathes à partir de *gigantea*, favorisant la réduction des pièces buccales adaptées à un régime suceur. (aire 8). D'autre part la colonisation de l'Himalaya a pu se faire (aire 7) à partir des espèces issues de l'aire coréo-japonaise (*triverrucosa*, *orientis*...). Une telle liaison entre Japon et Corée d'une part, chaîne himalayenne d'autre part se retrouve d'ailleurs chez les Neanurinae Paranurini ou Lobellini (cf. par exemple *Paranura ieti* de Corée, du Japon et du Népal).

L'étude de la faune chinoise encore fort peu connue pourrait peut-être nous apporter des précisions sur les étapes intermédiaires.

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REVUE SUISSE DE ZOOLOGIE 104 (4): 831-836; décembre 1997

A new species of *Lychas* Koch, 1845 (Chelicerata, Scorpiones, Buthidae) from Sri Lanka

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A new species of *Lychas* Koch, 1845 (Chelicerata, Scorpiones, Buthidae) from Sri Lanka. - A new species of scorpion, *Lychas srilankensis* sp. n., is described based on two specimens; one male specimen collected in Man District, Occapu Kallu, Wilpattu and one protonymphe collected in Hambantota District, Palatupana near the entrance of the Yala National Park. This is the second record of a *Lychas* species in Sri Lanka. The first record is the citation by VACHON (1982) of a immature specimen described merely as a species of *Lychas*.

Key-words: Scorpion - *Lychas* - Sri Lanka

INTRODUCTION

The genus *Lychas* with approximately 30 described species (KOVARIK 1995) has a wide range of distribution extending from Australia and the Indo-Malayan region, to southern China, the Himalayan region and parts of Africa. Although it is well represented in India no species has yet been described from Sri Lanka. In a very comprehensive paper on the scorpions of Sri Lanka, VACHON (1982), recorded a single first instar specimen collected at Palatupana at the entrance of the Yala National Park which, according to him, showed affinities to *Lychas shoplandi* (Oates, 1888) and *Lychas feae* (Thorell, 1889), both from Burma. VACHON (1982) recorded several morphological characters of this specimen. He did not reach a final conclusion, but insisted that, as far as he knew, this was the first *Lychas* ever collected in Sri Lanka.

While examining a small collection of scorpions from Sri Lanka I found another specimen of *Lychas*, this time a sub-adult male which, after precise examination was found to correspond quite well with the specimen previously studied by VACHON (1982) and restudied by me, but could not be attributed to any known species.

Lychas srilankensis n. sp. Figs 1-9

Holotype male (pre-adult): Sri Lanka, Northern Province: Mannar District, Occapu Kallu, Wilpattu, 50 m, in abondoned termite nest, 18-III-1970, leg. Davis & Rowe.

Manuscript accepted 23.05.1997.

Paratype (protonymphe): Sri Lanka, Southern Province: Hambantota District, Palatupana near the entrance of the Yala National Park, sifting in humide zone of savannah, 24.-I-1970, leg. C. Besuchet & I. Löbl (VACHON 1982: 84-86).

Deposited in the Muséum d'histoire naturelle, Genève.

Etymology: the specific name refers to the country.

Diagnosis: As already suggested by VACHON (1982), the new species shows affinities with *Lychas shoplandi* (Oates, 1888) and *Lychas feae* (Thorell, 1889), both described from Burma. When describing *L. feae* Thorell (1889) also suggested that it had affinities with *L. shoplandi*, whereas KRAEPELIN (1899) considered *L. feae* to be an intermediate form between *L. shoplandi* and *Lychas scaber* Pocock, 1892. Moreover, he did not include *L. feae* in his key for the determination of the species.

The new species *Lychas srilankensis* can be distinguished from *L. shoplandi* by the presence of lighter pigmentation generally and from *L. feae* by the number of pectinal teeth. Moreover, the insular geographical distribution of the new species confirms its position as representing an isolated population, since scorpion populations in general present very predictable geographical ranges of distribution (LOURENÇO 1996*a*, *b*).

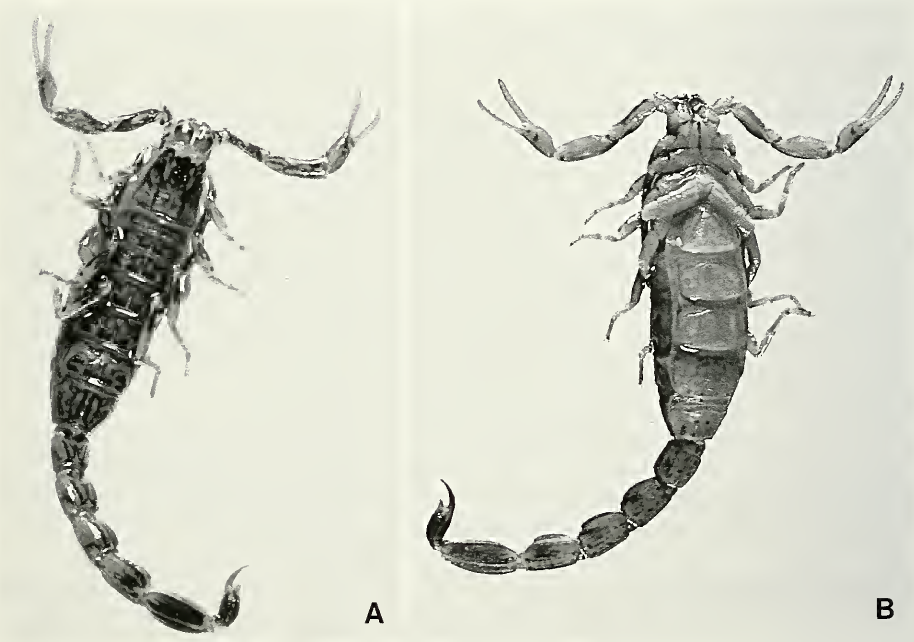
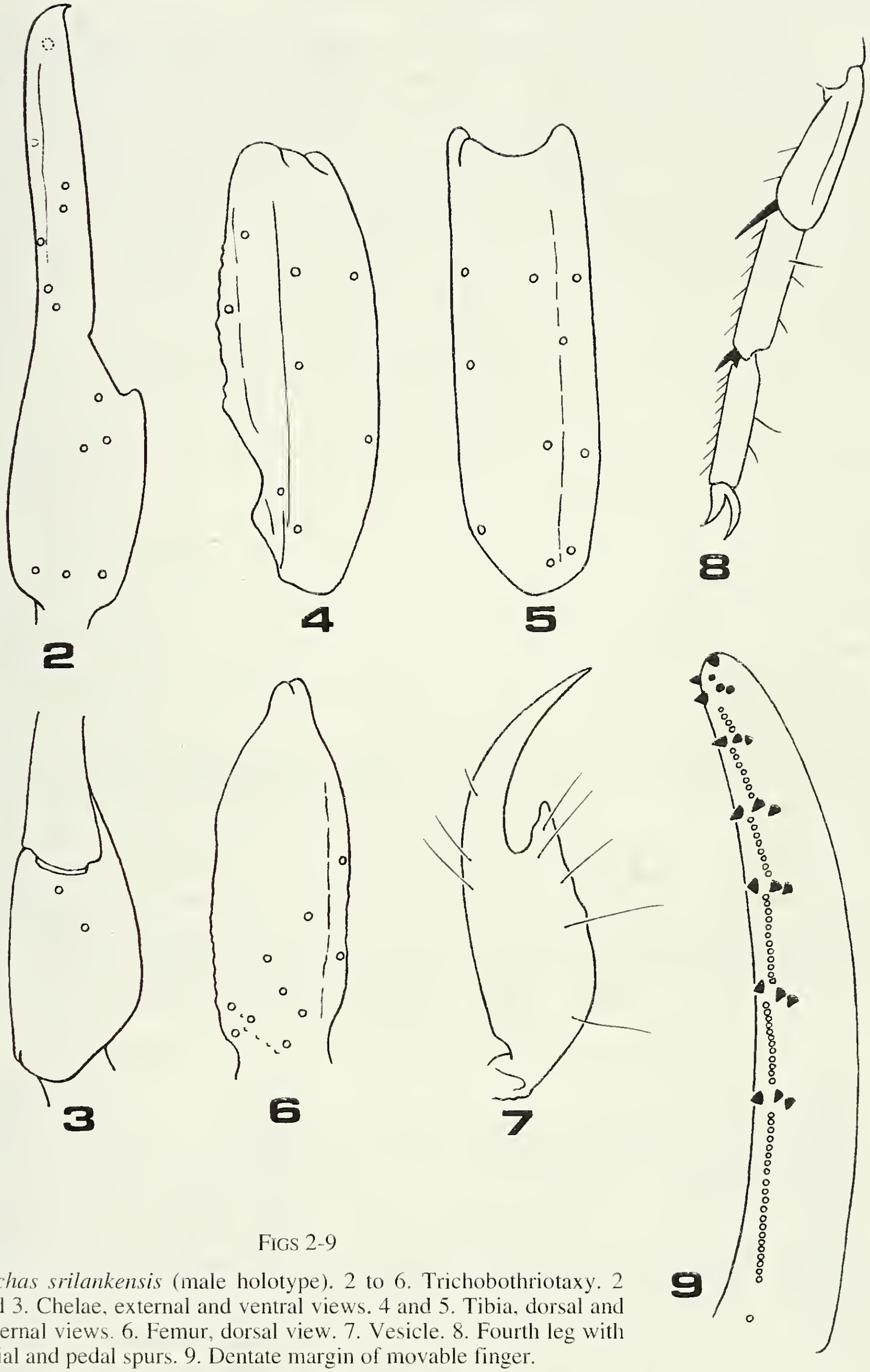


FIG. 1

Lychas srilankensis (male holotype). A. Dorsal view. B. Ventral view.



Figs 2-9

Lychas srilankensis (male holotype). 2 to 6. Trichobothriotaxy. 2 and 3. Chelae, external and ventral views. 4 and 5. Tibia, dorsal and external views. 6. Femur, dorsal view. 7. Vesicle. 8. Fourth leg with tibial and pedal spurs. 9. Dentate margin of movable finger.

Description based on holotype (measurements in Table I).

Coloration. Basically yellowish, symmetricaly marbled with dark reddish brown producing an overall spotted appearence. Prosoma: carapace yellowish and heavily spotted, excepted on the anterior margin; eyes surrounded with black pigment. Mesosoma: yellowish with variegated brown spots over all tergites; more densely marked on the last five. Metasoma: segments I to IV yellowish, with small round brown spots ventrally; diffuse spots laterally; triangular spots dorsally. Segment V very dark brown to black; extremities yellowish. Vesicle dark brown with the base of the aculeous yellowish and the extremity reddish. Venter light yellow with a few darker spots on posterior end of sternite V. Chelicerae yellowish with variegated brown spots; base of fingers black; fingers yellowish-red. Pedipalps: yellowish with several spots on the femur and tibia; chelae less densely spotted; fingers yellowish. Legs yellowish with dark brown longitudinal spots on the first four segments.

Morphology. Carapace feebly granular; anterior margin with a very feeble median concavity. Anterior median superciliary and posterior median keels feeble. All furrows very feeble. Carapace very flat overall. Median ocular tubercle distinctly anterior to the centre; median eyes separated by more than one ocular diameter. Three pairs of lateral eyes. Sternum subtriangular. Mesosoma: tergites feebly granular. Median keel present in all tergites; tergites III to VI tricarinate. Tergite VII pentacarinate. Venter: genital operculum divided longitudinally. Pectines: pectinal tooth count 23-22; basal middle lamellae of the pectines not dilated. Sternites smooth with elongated stigmata; VII without keels. Metasoma: segments I to III with 10 keels, crenulate; lateral inframedian keels on segment III vestigial; absent from IV which has 8 keels. Segment V with 5 keels. Intercarinal spaces moderately granular. Telson with 5 vestigial keels ventrally and with a long and moderately curved aculeous; subaculeous tooth very strong and spinoid. Cheliceral dentition characteristic of the family Buthidae (VACHON 1963). Pedipalps: femur pentacarinate; tibia and chelae with some keels but moderately crenulate; internal face of tibia smooth; all faces moderate to feebly granular. Movable fingers with 6/7 oblique rows of granules; small internal and external accessory granules present. Trichobothriotaxy; orthobothriotaxy A-β (VACHON 1973, 1975). Legs: tarsus with very numerous median fine setae ventrally. Legs III and IV with one strong tibial spur and moderate pedal spurs.

TABLE I. Morphometric values (in mm) of the male holotype of *Lychas srilankensis*

Carapace:		Vesicle:	
- length	2,8	- width	0,9
- anterior width	1,9	- depth	0,8
- posterior width	2,7	Pedipalp:	
Metasomal segment I:		- Femur length	2,1
- length	1,8	- Femur width	0,6
- width	1,5	- Tibia length	2,6
Metasomal segment V:		- Tibia width	0,8
- length	3.0	- Chelae length	3,7
- width	1.5	- Chelae width	0,8
- depth	1,4	- Chelae depth	0,8
		Movible finger:	
		- length	2,3

10

FIG. 10

Map of Sri Lanka indicating the type locality of *Lychas srilankensis* and the locality indicated by VACHON (1982) of the earlier specimen of *Lychas*.

ACKNOWLEDGEMENTS

I am most grateful to Prof. John L. Cloudsley-Thompson of University College London, for reviewing the manuscript and to Mr. Jacques Rebière, Laboratoire de Zoologie Arthropodes, for preparing several drawings.

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REVUE SUISSE DE ZOOLOGIE 104 (4): 837-844; décembre 1997

Leporinus falcipinnis n.sp., a new species from the lower rio Tapajos basin, Para, Brazil (Pisces, Characiformes, Anostomidae)

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Leporinus falcipinnis **n.sp., a new species from the lower rio Tapajos basin, Para, Brazil (Teleostei, Characiformes, Anostomidae). -** The new species is described and figured. It belongs to the *fasciatus*-group and is characterized by the high number of rather narrow transverse bands, its filiform dorsal and its deeply forked caudal fin with elongated, pointed lobes.

Key-words: Systematics - Teleostei - Anostomidae - new species - South America.

INTRODUCTION

During a fish photographing trip to the rio Arapiuns, organized by Rainer Stawikowski, local fishermen near a fazenda on this river displayed their daily catch including two remarkable specimens of a *Leporinus* species strangely ressembling to some members of Hemiodidae. On this occasion one specimen was photographed and purchased, and despite a further visit to the Arapiuns, no additional specimens were found. The new species described here is therefore based on the unique preserved specimen. We are conscious that such a description is fragmentary, as no osteological details could be studied, the juvenile colour pattern and, mainly, the sexual dimorphism in this species remain unknown. But it may encourage further investigations in the rio Arapiuns.

METHODS

Measurements and terminology follow GÉRY *et al.* (1987). For the colour pattern description, the transverse bands on body are numbered as follows (the first bar, clearly just behind the occiput, counted as the first one on body): Nuchal (1), humeral (2), predorsal (3), dorsal (4, between dorsal and ventral fins, sometimes prolonged onto the fin), postdorsal (5), preanal (6), anal (7), between adipose fin and end of anal fin (8, sometimes prolonged onto the fins), peduncular (9) and precaudal (10) (cf. BLOCH 1794, plate Nr.379).

Manuscript accepted 27.07.1996

DESCRIPTION

Leporinus falcipinnis n.sp. Figs 1 - 6

Locality: Holotype MZUSP 51827 (Mus.Zool.,Univ.Sao Paulo), male, 220 mm standard length (S.L.), rio Arapiuns, 1 hour by boat downstream mouth of rio Arua, small fazenda at right shore, lower Tapajos basin, Para, Brazil (2°4'S, 55°38'W), 4.X.1992, leg. R. Stawikowski et al.

Diagnosis: The species belongs to the *fasciatus*-group as defined by GÉRY (1978) and discussed below, characterized by the presence of at least 8 transverse bands. It differs from all described species by the combination of the following characteristics: number of vertical transverse bands (13 total), scales counts (7/38-39+3/6), and, at least in males, morphology of caudal (deeply forked, falciform) and dorsal fins (third ray filiform).

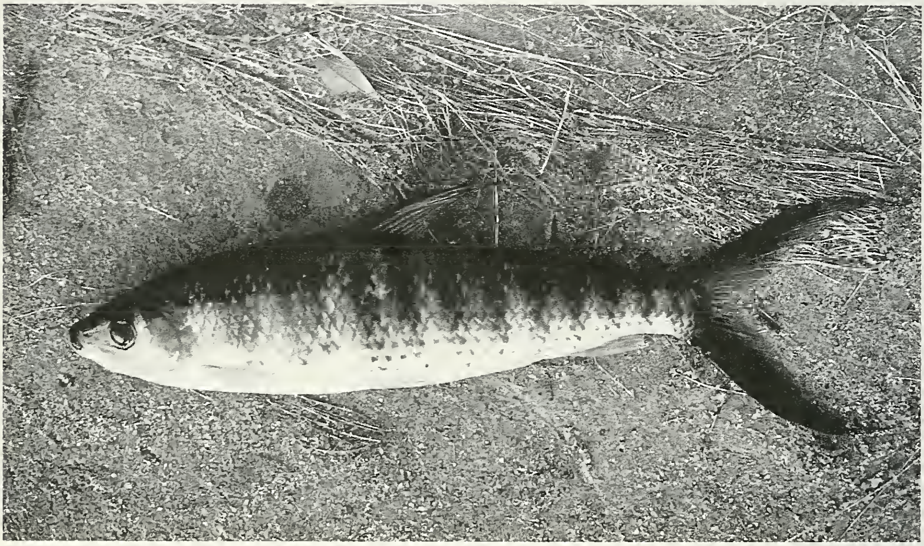


FIG. 1

Leporinus falcipinnis n.sp., coloration of the freshly-dead specimen (photo S. Muller)

Description: Body medium sized, 220 mm S.L.; body depth 3.9 times in S.L.; head 4.5 times in S.L.; eyes small, orbital diameter 4.5 times in head length and 1.9 times in interorbital distance, which is 2.3 times in head length; snout short and blunt, 2.5 times in head length. Dorsal profile convex from tip of snout to dorsal fin, straight between dorsal fin and adipose fin, slightly concave between adipose and caudal fin. Ventral profile gently convex between snout tip and caudal fin. Gill opening wide, about 10 gill rakers on lower half of first branchial arch.

Mouth terminal, both lips vertically papillose (forming vertical ribs), teeth 4/4 on each side (fig. 5).

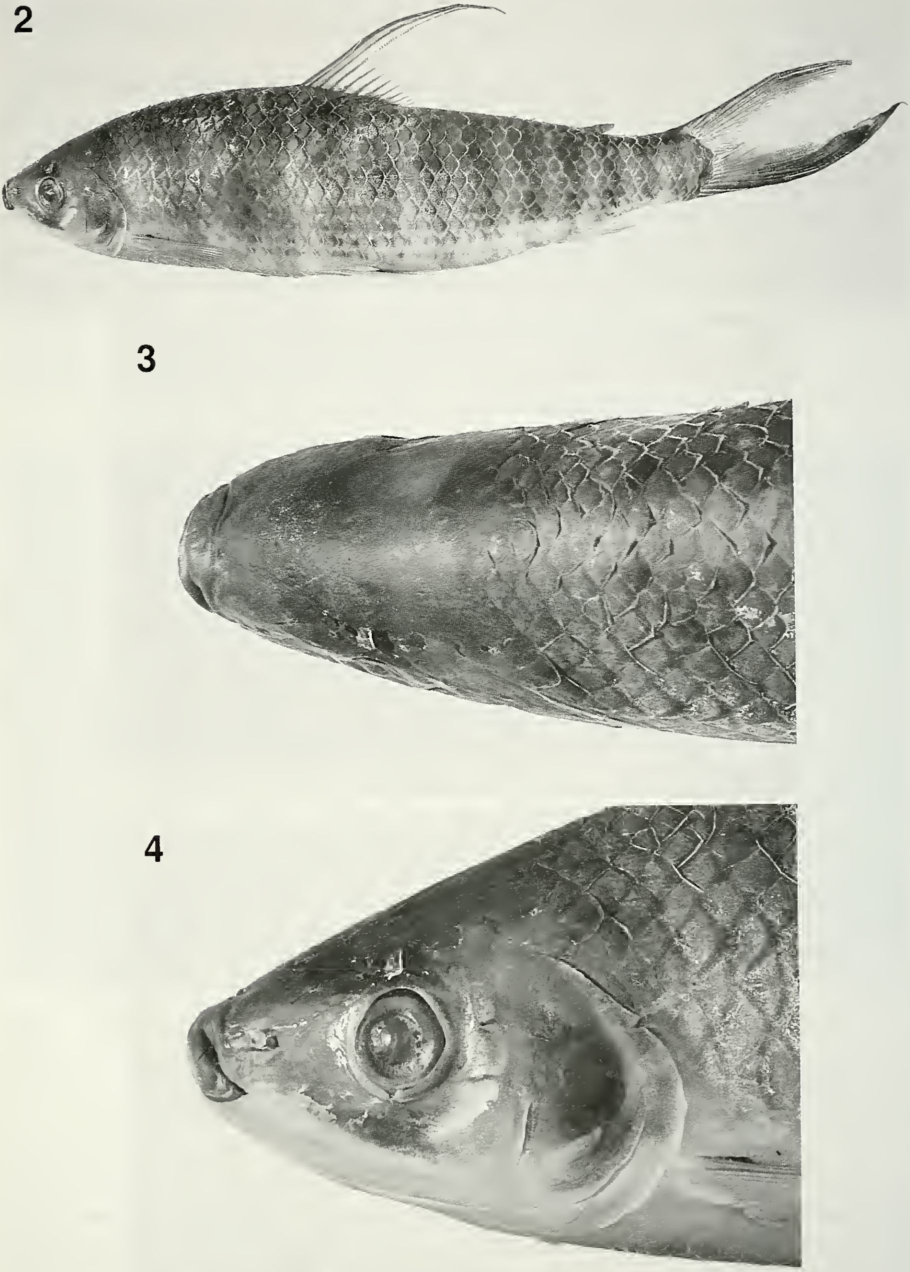
Lateral line with 38 (right side) or 39 (left side) +3 perforated scales, 7 scales between lateral line and dorsal fin, 6 scales between lateral line and pelvics, 17 predorsal scales in an irregular row, 11 scales between last dorsal fin ray and adipose, 11 scales between ventral fin and anus, 20 preventral scales; axillary scale long, half as long as the unbranched ray of the pelvic fin; anal fin base without any series of scales. Caudal peduncle with 16 circumferencial scales; some scales at the base of the median caudal fin rays. Dorsal fin ii 10, last unbranched ray filiform, its length 3 times in standard length ; pectoral fin i 14, longest reaching to 9th scale, origine of pectoral fin below 1st and 2nd branched dorsal ray; pelvic fin obliquely truncate, i 9; anal fin obliquely truncate, short, clearly not reaching base of caudal fin, ii 8; outer rays of caudal fin strongly elongate, deeply notched, both lobes of equal length. Number of vertebrae 35 (21 caudal ones), plus urostyle.

Colour of specimens (fixed in formaldehyde, transfered into alcohol) (fig. 2): Ground colour of dorsal parts brownish. Two transverse bands on head (snout and eyes), one on occiput (numbered 1, see discussion below), 11 transverse or very slightly oblique ones on dorsum, and a vertical, crescent shaped band on the last precaudal scales, totalling 13 bands, as compared with a total of 10 bands in adults *Leporinus fasciatus* (Bloch). Second band divided on dorsum, third one deeply divided, but confluent below lateral line; two preanal bands joining on venter, two bands reaching base of anal fin; on the ventral part, below the bands two (anteriorly) to eight (in front of anal fin), some lines of brown spots. Dorsal fin (except dark unbranched rays), pectoral, pelvic and anal fins hyaline; a dark axillary spot at base of pectoral fins; outer rays of caudal fin dark, other parts greyish; adipose fin brown.

Colour of the freshly-dead specimen (fig.1): Ground colour bluish black, with some golden reflections on flancs, transversal bands nearly black; head ventrally yellowish, venter yellowish white; dorsal, adipose and caudal fins dark (greyish to nearly black), pectoral and pelvic fins yellow, anal fin hyaline, with yellow base.

Measurements (in mm): standard length 220; greatest body depth 57.0; head length 48.4; head depth 38.6; vertical orbital diameter 11.3; interorbital distance 21.3; snout length 19.0; interopercular distance 29.6; predorsal distance 103.5; caudal peduncle, length 28.1, depth 21.9; distance end of dorsal fin to adipose fin 59.4; dorsal-fin base, length 31.4; of third unbranched dorsal ray 73.0; pectoral fin, length 36.4; ventral fin, length 38.0; anal fin, length 31.6; mouth width at tip of dentaries 12.6.

Habitat and distribution: The water level of the rio Arapiuns was very low in October 1992, at the moment of the capture of this new Leporinus. The black water river was slowly running, clear and quiet. Besides some Serrasalmidae, different big cichlid species were displayed by the local fishermen (field notes and slides). Some small species of Characoidea (belonging to the genera *Hoplias*, *Nannostomus*, *Pyrrhulina*, *Hemiodopsis*, *Hemigrammus*, *Bryconops*, *Iguanodectes* et *Tyttobrycon*) and of Cichlidae (*Aequidens mauesanus* was recently described by KULLANDER 1997) were caught near the riverbanks. The conditions were drastically different three



FIGS 2-4
Leporinus falcipinnis n.sp.; total view of preserved specimen (slightly curved) (2), dorsal (3) and lateral (4) view of head (Photos C. Ratton).

years later: the water level was very high, the fazenda deserted as was the village near the falls upstream, no fish could be observed (R. Stawikowski, pers. comm.).

Exact distribution of *L. falcipinnis* n.sp. is unknown, however the species might be common in the Tapajos basin, as suggested by an underwater photograph representing probably this species (ROGGO 1996, p.55 fig.2).

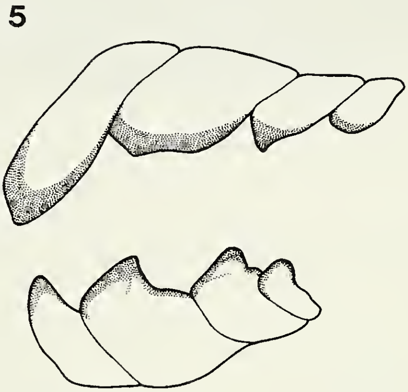


FIG. 5

Leporinus falcipinnis n.sp.: upper and lower tooth range.

DISCUSSION

The *fasciatus*-group (GÉRY 1978) includes the type species of the genus, *Leporinus novemfasciatus* Spix in Spix & Agassiz from Brazil (which is considered by most authors as a synonym of *Salmo fasciatus* Bloch from "Surinam"), and at least *affinis* Günther, *latofasciatus* Steindachner, *octofasciatus* Steindachner and *tigrinus* Borodin (GÉRY *et al.* 1987).

The colour pattern, consisting in transverse bands on body, seems to be a basic one in the genus *Leporinus*. Most of the species are striped when young, and several ones retain that pattern in adult.

Usually, there are 2 black bands on the snout and between the eyes, plus sometimes a black mark on the upper lip and (or) on the maxillary. They are followed by several bands, the first one constant, but the number of the others may vary, depending on age, by the division of some bands in the older fishes.

The species of the *fasciatus*-group are differenciated by the following characters:

1) transverse scale numbers low, 4/3.5:

L. latofasciatus Steindachner, 1910 (only one juvenile known from "Orinoco"); dorsal fin in the middle of the body; bands 1-4 very broad, 3 times in the space between them, bands 5-7 slightly narrower, about 2 times in the space between them; tooth number unknown.

2) transverse scale numbers 5-7/4-6, number of maxillary teeth 3:

L. tigrinus Borodin, 1929; scales 6-7/39-41/5-6 (SANTOS & JÉGU 1989; 6/39-40/5 in the original description, see BRITSKI & GARAVELLO 1978; 6/36/6: one type specimen, according to Roberts, in BRITSKI & GARAVELLO 1978); number of dentary teeth 4; the 3 or 4 middle transverse bands in Y, according to the description; loc. typ. "Goyaz, Brazil"; Tocantins-Araguaia basin (GARAVELLO 1979, cited after SANTOS & JÉGU 1989) (possibly the fish of the lower fig. p. 160 in GÉRY 1978, under the name "*fasciatus*-group").

L. octofasciatus Steindachner, 1915; scales 5/35-39/4-5; number of dentary teeth 4 (rarely 3 or 5); 8 transverse bands: bands strictly vertical, not very broad, equalling the space between them (BRITSKI & GARAVELLO 1978); loc. typ. "near Joinville, Santa Catarina"; upper fig. p. 160 in GÉRY 1978, under the name "*fasciatus*".

3) transverse scale number 6-9/5-8; number of maxillary teeth 4

L. affinis Günther, 1864; scales 8-9/42-44/6-8; number of dentary teeth 4; 8 transverse bands; dorsal and caudal fins not elongate, anal fin rounded and quite long (GÜNTHER 1864; SANTOS & JÉGU 1989) (loc. typ. "rio Capim, Para"; restricted by SANTOS & JÉGU 1989 to the Tocantins- Araguaia basin; this restriction without any commentary on the type locality is subject to discussions, since it does not satisfy the recommandation 72H of the ICZN).

L. fasciatus (Bloch, 1794); scales 6-7.5/40-45/5-6 (BRITSKI & GARAVELLO 1978; SANTOS & JÉGU 1996); number of dentary teeth 4; 8 (juveniles) to 10 (adults) broad and slightly inclined transverse bands; dorsal and caudal fins not elongate (loc.typ. "Surinam"; Guianas and Amazon basin: SANTOS & JÉGU 1996)

Leporinus falcipinnis n.sp. seems most closely related to *L. fasciatus* as defined by BRITSKI & GARAVELLO (1978) and SANTOS & JÉGU (1996), from the Guianas rivers, and the basins of the Madeira, Solimoes, Negro, Trombetas and Uatuma, but not from the Tocantins where it is said to be replaced by *L. affinis* (SANTOS & JÉGU 1989), and possibly not from the upper Tapajos.

The new species shares with *L. fasciatus* the scale counts and the teeth number and possesses an even higher number of transverse bands. It differs by its somewhat more elongate body and more rounded snout, a slightly shorter anal fin, and a different colour pattern (arrangement and number of transverse bands on body, 13 in total vs. 10 in total), but particularly by the shape of caudal and dorsal fins. This last characteristic also distinguishes *L. falcipinnis* n.sp. from all other members of the *fasciatus*-group.

Some other multi-banded species had been described in the genus *Leporinus*, but they are of uncertain identity:

The description of *Leporinus multifasciatus* Cope, 1878 mentions 14 vertical bands on the body and a rounded caudal spot. The three type specimens of this species are juveniles of 57mm max.S.L. "in very poor condition", with broken fins, fide FOWLER (1906). They have the typical colour pattern of most young *Leporinus*. This species differs clearly from falcipinnis n.sp. by its low scale counts (4/36/5). The photo taken by Harald Schultz and labelled *Leporinus multifasciatus* in AXELROD *et al.* (1985, fig.6 p.121), showing 11 bands in total, may represent a large specimen of *L. fasciatus* with the fifth band split, somewhat like that in the original figure of BLOCH.

FIG. 6

Leporinus falcipinnis n.sp.; X-ray-photograph (photo S. Muller).

Leporinus fasciatus altipinnis Borodin, 1929 from Jatuarana, Solimoes, is said to have 6/5 transverse scale counts and 8 transverse body bands. *Leporinus holostictus* Cope, 1878, known from two juvenile fishes (the largest ca 90 mm SL) in poor conditions from upper Amazon (collected by James Orton in 1877, possibly near Pebas "below the mouth of the Rio Napo"), seems to have the same tooth number and a similar scale count as *L. falcipinnis* n.sp. (6/41/5), but possesses only 8 transverse body bands.

ACKNOWLEDGEMENTS

We are grateful to Dr. Heraldo A. Britski (Museo de Zoologia, Sao Paulo) and Dr. Julio C. Garavello (Universidade Federal de Sao Carlos) for their comments on the manuscript. We express our thanks to Rainer Stawikowski (Gelsenkirchen, Germany) for his complementary informations on the Rio Arapunis.

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REVUE SUISSE DE ZOOLOGIE 104 (4): 845-851; décembre 1997

Neue Negastriinae (Coleoptera: Elateridae) aus Südostasien

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New Negastriinae (Coleoptera, Elateridae) from Southeast Asia.- Three new genera and four new species are described and illustrated: *Loebliquasis burckhardti* gen.n., sp.n., *Paraquasimus smetanai* gen.n., sp.n., *P. baliensis* sp.n. and *Pseudoquasimus arcanus* gen.n., sp.n. *Loebliquasis* differs from the known Negastriinae genera by the absence of a carina on the posterior angles of the pronotum and by the unusual form of the aedoeagus. The genus *Paraquasimus* is characterized by the flattened antennal segments 5-11 and by the presence of a short carina on the posterior angles of the pronotum. *Pseudoquasimus* may be distinguished by the weak keels on the posterior angles of the pronotum and by complete absence of a metasternal keel.

Key-words: Coleoptera - Elateridae - Negastriinae - taxonomy - Southeast Asia.

EINLEITUNG

Dank der angewendeten Sammelmethoden, namentlich Gesiebe von Waldstreu und Auslese des Materials in "Winkler-Moczarski" Apparaten (LÖBL 1992), hat sich im Naturhistorischen Museum Genf ein reichhaltiges Material der kleinen Elateriden angesammelt. Unter diesem Material, das mir liebenswürdigerweise von Dr. I. Löbl zur Verfügung gestellt wurde, habe ich nicht nur neue Arten, sondern sogar drei unbekannte Negastriinae-Gattungen festgestelltt. Die Gattungen werden im Rahmen einer vorbereitenen Revision der Negastriinae besprochen, ihre Beschreibungen sollen doch schon jetzt erscheinen. Die neue Taxa erlaube ich mir den Entdeckern, Dr. I. Löbl, Dr. D. Burckhardt und Dr. A. Smetana, zu widmen.

Akronymen:		
	MHNG	Muséum d'histoire naturelle, Genf
	SIZ	Schmalhausen Institut für Zoologie, Kiew

BESCHREIBUNGEN

Loebliquasis gen. n.

Typus-Art: *Loebliquasis burckhardti* sp.n.

Körper klein, gestrecktoval. Fühler vom 4. Glied an schwach sägeförmig erweitert, 2. und 3. Glied zylindrisch. Pronotum mit langen, stark abgeflachten unge-

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Manuskript angenommen am 15.04.1997

kielten Hinterwinkeln und dreizähnigem Raum gegenüber der Basis des Scutellums. Das Scutellum mit deutlichem, gerandetem flachem Eindruck. Flügeldecken sehr fein punktiert, ohne Spur von Längsstreifen. Das 4. Tarsenglied merklich verbreitert. Der Aedoeagus von aussergewöhnlichem Bau: die verbreiterten lappenförmigen Parameren und der Penis bilden ein gestrecktes Röhrchen (Abb. 4). Metasternum nur mit einem schräg nach aussen gerichteten Kiel versehen (Abb. 3).

Verbreitung: Borneo.

Von den bisher bekannten Negastriinae-Gattungen (STIBICK 1971) durch das Fehlen der Kiele auf den stark abgeflachten Hinterwinkeln des Pronotums und durch den Bau des Aedoeagus leicht zu trennen. Nach dem Aedoeagus ist diese neue Gattung in der Nähe von *Eudicronychus* zu stellen.

Loebliquasis burkhardti sp. n. Abb. 1-5

Holotypus: ♂ (MHNG) und 9 Paratypen (♂,6 -MHNG, 3-SIZ): East Malaysia, Sabah (Borneo), Mt. Kinabalu 2600 m, 1.05.1987 (Burckhardt, Löbl), weitere Paratypen (1 ♂, 3 ♀: 2 - MHNG, 1 - SIZ): ibid., Kinabalu National Park, below Layang Layang, 2600 m,2.-8.05.1987, Intercept Trap, A. Smetana.

♂: Tiefschwarz, mattglänzend, dicht kurz anliegend bronze behaart, mit einem Querband von weissen Härchen hinter der Mitte der Flügeldecken und zwei weissen Flecken an den Flügeldeckenspitzen. Länge: 2,4 mm, Breite: 1,0 mm (Abb. 1).

Kopf flach gewölbt mit deutlicher Längsvertiefung, dicht und sehr fein punktiert. Vorderrand der Stirn fein gerandet und breit gerundet. Fühler ziemlich lang, um 1 1/2 - 2 Glieder die Spitzen der Hinterwinkel des Pronotums überragend; 2. Glied merklich (1,1 mal) länger und breiter als das 3., beide 2 mal so lang wie breit; 4. Glied am längsten, 1,75 mal so lang als an der Spitze breit, folgende Glieder 1,2 mal kürzer als das 4. und 1,4 - 1,5 mal länger als an der Spitze breit .

Pronotum trapezförmig, gewölbt, mit schwach gerundeten Seiten, fein und dicht punktiert, Entfernung zwischen den Punkten 2 mal grösser als die Punkte selbst. Hinterwinkel stark gestreckt, nadelförmig zugespitzt, divergierend. Scutellum 1,5 mal länger als breit, dicht und lang behaart, mit konkaver Basis und deutlichem, gerandetem rhomboidalen Eindruck (Abb. 2). Flügeldecken gestreckt oval, deutlich breiter und 3,3 mal länger als der Halsschild und 1,7 mal so lang wie in der Mitte breit, ohne Spur von Längsstreifen. Hintertarsen 1,5 mal kürzer als die Hinterschienen. Aedoeagus und genitale Tergite wie Abb. 4 und 5.

Das Weibchen unterscheidet sich durch die breiteren und kürzeren Glieder der Fühler, die die Spitzen der Hinterwinkel des Pronotums nur um 1/2 Glied überragen. Länge: 2,6 mm, Breite: 1,1 mm.

Paraquasimus gen. n.

Typus-Art: *Paraquasimus smetanai* sp. n.

Körper klein, gestreckt, fast parallelseitig. Fühler beim Männchen vom 5. Glied an breit bandförmig (Abb.6). Hinterwinkel des Pronotum breit abgeflacht, eine Ecke von 45 Grad bildend, gekielt, die Kiele dünn, bis zum vorderen Drittel des

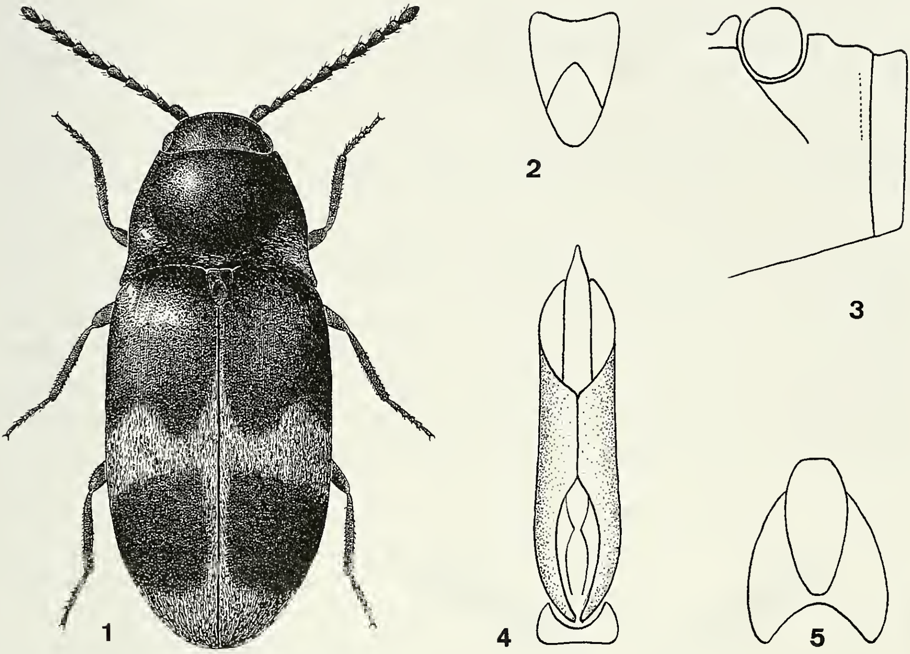

ABB. 1-5

Loebliquasis burckhardti sp. n., Holotypus: 1 - Gesamtansicht; 2 - Scutellum; 3 - Metasternum ; 4 - Aedoeagus; 5 - genitale Tergiten.

Segments reichend. Die Basis des Halsschild gegenüber dem Scutellum mit 3 Zähnchen versehen. Scutellum zungenförmig, länger als breit, mit glattem gerandetem Eindruck versehen. Flügeldecken kaum breiter als der Halsschild, parallel, sehr dicht und fein punktiert, ohne Spur von Längsstreifen, 4. Tarsenglied merklich verbreitert. Metasternum nur mit einem schräg nach hinten gerichteten Kiel. Aedoeagus mit für die Gattung *Quasimus* typischem Bau.

Die Fühler beim Weibchen von normalem Bau: vom 4. Glied an stumpf sägeförmig.

Artenbestand: zwei Arten - *P. smetanai* sp. n., *P. baliensis* sp. n.

Verbreitung: East Malaysia: Sabah, Indonesia: Bali.

Diese neue Gattung ist nach den meisten Mermalen mit *Quasimus* Gozis verwandt. Sie unterscheidet sich eindeutig durch den Bau der Fühler und den verkürzten Kiel der Hinterwinkel des Pronotums.

Paraquasimus smetanai sp. n. Abb. 6 - 10

Holotypus (♂, MHNG) und 2 Paratypen (♀, MHNG, SIZ): East Malasia, Sabah (Borneo), Mt. Kinabalu National Park, below Layang Layang, 2600 m, 9. - 20.05.1987. Intercept Trap, A. Smetana.

♂: Tief schwarz, mattglänzend, dicht kurz anliegend bronze behaart, mit Ausnahme des Scutellums, der Seiten und eines Querband in der Mitte der Flügeldecken, diese weiss behaart. Länge 2,6 mm, Breite 1,0 mm (Abb. 6).

Kopf flach gewölbt, sehr fein und dicht punktiert, Vorderrand der Stirn scharf gerandet und sehr breit gerundet. Fühler matt, mässig lang, um 2 Glieder die Spitze der Hinterwinkel des Pronotums überragend, 2. und 3. Glied kurz zylindrisch, fast gleich lang, 1,3 mal länger als breit; 4. Glied dreieckig, fast so lang wie 2 vorhergehenden zusammen, 1,5 so lang wie an der Spitze breit; 5. bis 10. Glied stark verbreitert und abgeplattet, fast parallelseitig, merklich (1,1 - 1,2 mal) breiter als lang, die Basen der Fühlerglieder nicht schmäler oder kaum schmäler (beim 5. Glied) als an der Spitze breit; vom 9. bis zur Fühlerspitze allmählich verschmälert (Abb. 7).

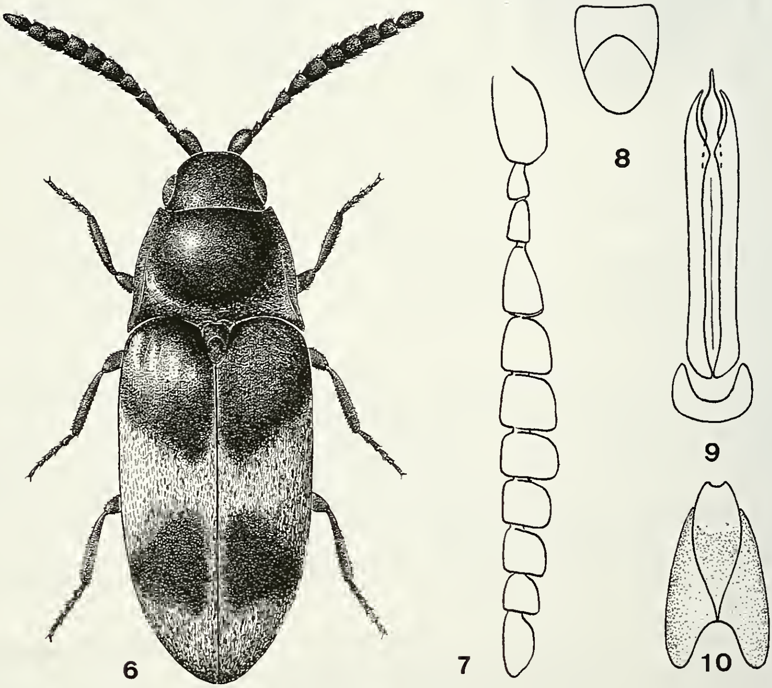

Abb. 6-10

Paraquasimus smetanai sp.n., Holotypus: 6 - Gesamtansicht; 7 - Fühler; 8 - Scutellum; 9 - Aedoeagus; 10 - genital Tergite.

Pronotum trapezförmig, an den Hinterwinkelspitzen 1,57 mal breiter als lang, fein und dicht wie der Kopf punktiert, Entfernung zwischen den Punkten 1 - 2 Durchmesser der Punkte entsprechend. Hinterwinkel fein gekielt, Kiele um 1/3 der Länge des Segments den Vorderrand nicht erreichend.

Scutellum 1,4 mal länger als breit, in der hinteren Hälfte dicht lang behaart, mit gerade abgestutzter Basis und länglich ovalem Eindruck (Abb. 8). Flügeldecken nur ein wenig breiter und 3,4 mal länger als das Pronotum und 1,85 mal so lang wie breit.

Aedoeagus und genitale Tergiten siehe Abb. 9, 10.

Das Weibchen unterscheidet sich gut durch die kürzere, normal stumpf sägeförmige Fühler und durch ein breiteres Scutellum, das nur 1,25 mal länger als breit ist. Länge 2,6 mm, Breite 1,1 mm.

Paraquasimus baliensis sp. n. Abb. 11 -13

Holotypus (♀, MHNG) und 2 Paratypen (♀, MHNG, SIZ) : Indonesia, Bali : Penulisan, 22.11.1978, J.T.

♀: Tiefschwarz, mattglänzend. Ober- und Unterseite dicht kurz anliegend bronze behaart, die Seiten des Pronotums und die Naht der Flügeldecken weiss behaart. Länge: 2,5 mm, Breite: 1,05 mm.

Kopf flach gewölbt, fein und dicht ungleichmässig punktiert, Entfernung zwischen den Punkten 1 - 2 mal dem Durchmesser der Punkte entsprechend. Vorderrand der Stirn fein gerandet und sehr breit gerundet. Fühler kurz, um die Länge der 2 vorletzten Glieder die Spitzen der Hinterwinkel des Pronotums nicht erreichend; 2. und 3. Glied zylindrisch, beide gleich lang und gleich breit, 1,7 mal so lang wie breit, das 3. zur Spitze leicht konisch verbreitert; 4. bis 10. Glied in der Länge den vorhergehenden gleich, gerundet dreieckig, fast perlschnurartig, 1,25 - 1,40 mal länger als an der Spitze breit (Abb. 11).

Pronotum trapezförmig, in der Basis der Hinterwinkel am breitesten, 1,75 mal so breit wie in der Mittellinie lang, sehr fein weitläufig punktiert, Entfernung zwischen den Punkten dreimal grösser als die Punkte selbst. Seitenränder vor der Basis der Hinterwinkel leicht ausgeschweift, die zugespitzten Winkel eine Ecke von zirka 35° bildend (Abb. 12).

Scutellum fast pentagonal, 1,1 mal länger als breit, mit dem scharf begrenzten glänzenden Eindruck (Abb. 13). Flügeldecken vom hinteren Drittel an allmählich gerundet, 3,35 mal länger als der Halsschild und 1,7 mal so lang wie breit.

Von *P. smetanai* sp. n. durch die kürzeren, fast perlschnurartigen Fühler der Weibchen und das Fehlen des weissen Querbands auf den Flügeldecken leicht zu trennen.

Pseudoquasimus gen. n.

Typus-Art : *Pseudoquasimus arcanus* sp.n.

Körper klein, oval. Fühler kurz, perlschnurartig. Pronotum polsterförmig, mit dreieckigen, gewölbten kurz und schwach gekielten Hinterwinkeln und dreieckigem

Raum gegenüber der Basis des Scutellums. Das Scutellum halboval, ohne Spur eines Eindrucks. Flügeldecken oval, ohne Spur von Längsstreifen. Metasternum glatt, ohne Kiele. Das 4. Tarsenglied deutlich verbreitert. Aedoeagus von für die Gattung *Quasimus* typischem Bau.

Verbreitung: Borneo

Von allen bisher bekannten Negastriinae- Gattungen unterscheidet sich *Pseudoquasimus* gut durch den schwach ausgeprägten kurzen Kiel auf den Hinterwinkeln des Pronotums und das Fehlen der Kiele auf dem Metasternum. Der Habitus von *Pseudoquasimus* erinnert jenen von *Quasimus*, die Merkmale der Ventralseite des Körpers wie bei *Zorochrus* Thomson.

Pseudoquasimus arcanus sp. n. Abb. 14-18

Holotypus (♂, MHNG) und 2 Paratypen (♂, MHNG, SIZ): East Malaysia, Sabah (Borneo), Mt. Kinabalu National Park, below Sayat - Sayat, 3700 m, 7.08.1988, A. Smetana (B 86); 1 Paratypus (♀, MHNG): ibid. Kinabalu above Gunting Lagadan, 3400 m, 6.08.1988, A Smetana (B85); 11 Paratypen (4 ♂, 3 ♀, MHNG; 2 ♂,2 ♀ - SIZ): ibid. Kinabalu National Park, east base St.John's, 8.08.1988, A. Smetana (B 88).

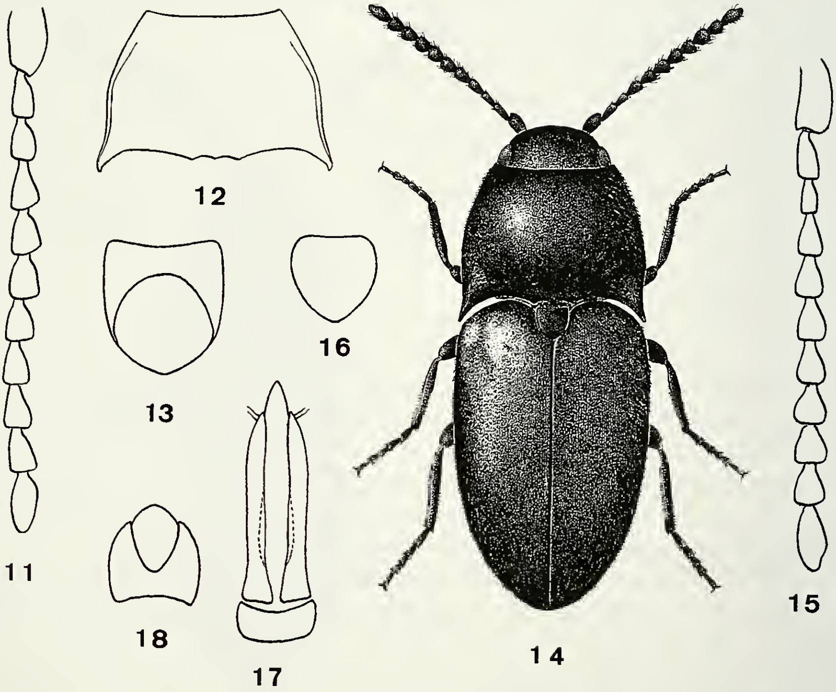

Abb. 11-18

11 - 13. *Paraquasimus baliensis* sp.n. Holotypus: 11 - Fühler; 12 - Umriss des Pronotums; 13 - Scutellum. 14 - 18. *Pseudoquasimus arcanus* sp. n., Holotypus: 14 - Gesamtansicht; 15 - Fühler; 16 - Scutellum; 17 - Aedoeagus; 18 - genitale Tergite.

♂: Tiefschwarz, glänzend, Fühler und Beine braunschwarz. Ober- und Unterseite dicht weissgrau behaart. Länge: 2,2 mm, Breite: 0,8 mm (Abb. 14).

Kopf mässig gewölbt, sehr fein und dicht punktiert, Entfernung zwischen den Punkten 1,5 bis 3 mal grösser als der Durchmesser der Punkte selbst. Vorderrand der Stirn in der Mitte schwach gerundet vorragend, nicht gerandet. Fühler kurz, die Spitzen der Hinterwinkel des Pronotums knapp erreichend; 2. und 3. Glied fast zylindrisch, das 2. Glied 1,3 mal länger als das 3. und 2 mal so lang wie breit; 3. Glied 1,6 mal länger als breit; vom 4. Glied an sind die Fühler perlschnurartig, Glieder gerundet dreieckig, 4. - 7. sind einander in Länge und Breite gleich, 8. - 10. merklich länger (1,2 mal) als an der Spitze breit (Abb. 15).

Pronotum 1,4 mal breiter als lang, an der Basis der Hinterwinkel am breitesten, nach vorne allmählich gerundet verengt, mässig dicht, gröber als der Kopf punktiert, Entfernung zwischen den Punkten 2 mal so gross wie die Punkte selbst. Hinterwinkel kurz, fast gerade nach hinten gerichtet, eine Ecke von ca. 45° bildend (Abb. 14). Hinterwinkelkiel undeutlich, bis zur Hälfte der Länge des Segments erreichend. Scutellum halboval, nicht länger als breit, glatt, ohne Eindruck (Abb.16). Flügeldecken 2,5 mal länger als der Halsschild und 1,55 mal so lang wie breit. Die Hintertarsen kaum oder nicht kürzer als die Hinterschienen.

Aedoeagus und genitale Tergiten siehe Abb. 17, 18.

Weibchen vom Männchen äusserlich nicht zu unterscheiden.

LITERATUR

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Field observations on ophthalmotropic Lepidoptera in southwestern Brazil (Paraná)

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Field observations on ophthalmotropic Lepidoptera in southwestern Brazil (Paraná). - Field investigations in Brazil in November 1994 yielded 36 ophthalmotropic specimens belonging to the Geometridae, Noctuidae and Pyralidae, and to 18 different species, the majority being members of the genus *Pero* of the subfamily Ennominae (Geometridae). Together with the previously recorded specimens, a total of 28 nocturnal species and one diurnal nymphalid species (*Dryas iulia* F.) is now known. Cattle and horses have been found as hosts of the nocturnal moths, the sampling sites being at mixed farms with relic formations of tropical/subtropical evergreen rainforest. The Brazilian eye-frequenting moths inhabit an extreme moist biotope. Regarding the diurnal eye-frequenting Lepidoptera, no additional records have been obtained, but *Dryas iulia* is illustrated with in a black/white shot transferred from an original film, and this is the first picture of a diurnal eye-frequenter to be published.

Key-words: Nocturnal and diurnal ophthalmotropic Lepidoptera - South America - taxonomy.

INTRODUCTION

The first record of nocturnal eye-frequenting moths in South America was given by Dr. Carlos Bruch from Paraguay in 1904 who explained that according to a letter which he had received that the horses of a friend of his were being troubled by "mariposas" (butterflies) which produced great irritation to their eyes. His record was reported by SHANNON (1928) who, on a second occasion, observed 11 moths species belonging to the Pyralidae, Notodontidae, Geometridae and Sphingidae on the Argentinian side of the Rio Iguaçu Waterfalls. Reference is made in that paper to the species spectrum, the hosts and the possible transmission of diseases. It has also been surmised that these insects use the lachrymation as a source of food, salt and moisture.

Another interesting observation was made in the Mato Grosso, Brazil by COLLENETTE & TALBOT (1928), where certain butterflies alight on people and probe about on the skin with their proboscis for the uptake of salt. These authors also mentioned that this region, in common with other large areas of Brazil, has a lack of salt in the soil. Observations on the soil – and mud puddle – visiting habits of other moth species, and references to butterflies are given, for example, by ADLER (1982).

Manuscript accepted 16.05.1997

Exceptionally interesting new observations on the strange feeding habits of a butterfly have recently been reported almost simultaneously from Peru and Brazil, where specimens of the diurnal *Dryas iulia* Fabricius, 1775 (Heliconiinae, Nymphalidae) were found approaching the eyes of half-submerged yellow-throated caymans (*Caiman latirostris* spp.) known locally as jacaré and freshwater turtles (*Podocnemis* spp.) (TURNER *et al.* 1986). According to these new observations, however, the specimens were obviously drinking lachrymal fluid by inserting their proboscis into the corners of the eyes. It was also observed that some of the caymans were immediately irritated by this and would disturb the butterflies by blinking or would even attempt to shake them off by starting to submerge. In a short note LAMAS (1986) mentions that it is well known to lepidopterists that a number of butterflies feed on the lachrymal secretions of caymans and turtles, particularly in less disturbed areas of South America (Table 2).

The first record of eye-frequenting moths dates back to 1852 when specimens were found on cows at "Port Natal" (now Durban, South Africa). Old and new records from Africa and Asia have been summarized by BÜTTIKER (1993) and BÜTTIKER & NICOLET (1975). Very important contributions to this subject and reference to the existance of skin-piercing blood-sucking moths were published by BÄNZIGER (e.g. 1972, 1983, 1995) and BÄNZIGER & BÜTTIKER (1969).

Relatively little progress has been made in the past in assessing the economic importance of the eye-frequenters as vectors of diseases, despite the assumptions made in this respect by many authors (e.g. MARSHALL *et al.* 1915, SHANNON 1928, REID 1954, BÜTTIKER 1962). The first systematic attempt to prove the transmission of pathogenic agents was made in the Ivory Coast by NICOLET & BÜTTIKER (1975). A very recent microbiological study carried out at Pretoria University produced additional evidence that the moths are carriers of numerous important disease agents in domestic livestock (GOUWS *et al.* 1996).

In view of the academic and practical importance of the ophthalmotropic Lepidoptera, it has been thought desirable to investigate in more detail the actual situation of these moths in South West Brazil.

As to the sampling of the moths collecting was done by hand and butterfly nets, but the latter could only be used on rare occasions due to the fierce and unmanageable behaviour of the prairie host animals. It was also particularly time-consuming to bring the horses into a kraal as they were kept in large paddocks for considerable lengths of time. All moth specimens caught are in the collection of the Natural History Museum, Basle.

Fieldwork was carried out at two sites in the Paraná State, Southwestern Brazil. Seven cows and one horse were available for inspection at the Facenda Frederico Keller, and four horses and one cow at Facenda Lindolandia. The survey normally started one hour after sunset and lasted until midnight. The flight of the eye-frequenting moths and of the sweat- and mud-puddle-feeders started approximately 1 1/2 hours after sunset but had become very sparse by the end of the collecting period.

FIG. 1

Map showing the old and new records of eye-frequenting nocturnal and diurnal eye-frequenting Lepidoptera in South America. Legend see Tables 1 and 2.

RESULTS

The itinerary of the expedition to Brazil in 1994 and the old and new records for the nocturnal moths and diurnal Heterocera are summarized in Tables 1 and 2 and mapped in Fig. 1. The expedition produced 36 specimens of eye-frequenting moths belonging to the Pyralidae (two species), Geometridae (thirteen) and Noctuidae (three species).

Unfortunately, we were unable to collect specimens from wild mammals, and no skin-piercing blood-sucking moths were observed during our work in the Iguaçu district. Contrary to experience in Africa and Asia, we did not observe any moth-hunting bats during the field-work at Iguaçu.

A. NOCTURNAL OPHTHALMOTROPIC LEPIDOPTERA

The species listed by SHANNON (1928) are the following (even if their specific identy could not be confirmed).

Pyralidae
    Pyrausta sp.
Notodontidae
    Crinodes besckei Hb., 1824
Sphingidae
    Xylophanes tersa L., 1758
Geometridae
    Pergama polygonaria H.S., 1855 (*Pero polygonaria* (H.S., 1855))
    P. speciosata Gn., 1857 (*Pero speciosata* (Gn., 1857))
    P. pumaria Feld. & Rogenh., 1873 (*Pero pumaria* (Feld & Rogenh., 1873))
    Meticulodes xylinaria Gn. (*Pero xylinaria* (Gn., 1857))
    Pero stolidata (Gn., 1857)
    P. maculicosta (Warr., 1897)
    Dichromatopodia deflexa Warr., 1900 (*Samaepus deflexa* (Warr., 1900))
    Pterocypha tabascana Schaus, 1901 (*Obila tabascana* (Schaus, 1901))

The original vegetation of the Iguaçu district where the nocturnal eye-frequenters occur is the "evergreen subtropical rainforest" (HUECK 1966), or the "tropischer makrothermer immergrüner Regenwald" of MANN (1968). These plant communities are certainly different from the presentday arid vegetation types in Africa where lachryphagous Lepidoptera mainly occur (BÜTTIKER 1973*a, b*). The community most similar to that of Iguaçu/Paraná is the deciduous rainforest in Thailand, as illustrated in BÜTTIKER (1964, plate 6).

Pyralidae, Epipaschiinae

As in the Asian collection, there are only males in my South American pyralid collections, with one exception, i.e. *Peso maculicosta*.

Accincta pubes chinopheralis (Hampson, 1906)

Material: 1 ♂ Frederico Keller Farm, 4.xi.94, host: cattle; 1 ♂ Frederico Keller Farm, 1.xi.94, host: cattle.

Distribution: South America.

Samea ecclesialis Guenée, 1854

Material: 2 ♂ Lindolandia Farm, 5.xi.94, host: cattle; 1 ♂ Isaia Scalco Farm 10.xi.94, host: cattle, and briefly on a mud-puddle.

Distribution: Brazil.

Table 1

Records of Nocturnal Eye-frequenting Lepidoptera in South America (Situation end November 1994)

No	Location/Coordinates S W	Country	Altitude	Groups/Species	Date of observation	Reference	Hosts	Collector(s) or observer(s)
1	"Paraguay", eastern part	Paraguay	–	unspecified	1904	Shannon 1928	Horse	C. Bruch
2	Misiones	Argentina	–	Pyralidae, Notodontidae, Geometridae, Sphingidae	1927	Shannon 1928	Horses	R.C. Shannon and others
3	Eldorado, Misiones 26° 25' 54°' 35'	Argentina	110	eye-frequenting moths; unidentified	26.VIII.75	Ruther (pers. comm.)	Cattle	C. Ruther
4-6	Foz do Iguaçu, Paraná (Facenda Frederico Keller and Isaia Scalco) 25° 33' 54° 36' (35')	Brazil	140-150	new records	1.XI.94 2.XI.94	This report	Cattle / horses	W. Büttiker & party
7	San Miguel, (Facenda Schorr) 25° 30' 54° 36'	Brazil	120	new records	3.XI.94	"	"	"
8-11	Foz do Iguaçu, (Facenda F. and A. Keller and I. Isaio Scalco) 25° 33' 54° 36' (35')	Brazil	140-150	new records	4.XI.94 5.XI.94 9.XI.94 10.XI.94	"	"	"

TABLE 2

Records of Diurnal Eye-frequenting Lepidoptera in South America (Situation end November 1994)

No	Location/Coordinates S W	Country	Altitude	Groups/Species	Date of observation	Reference	Hosts	Collector(s) or observer(s)
12	Rio Manú, Madre de Dios, Cocha Cashú 12° 13' 70° 45'	Peru	300	*Dryas iulia*	1983	TURNER *et al.*, 1986	*Podocnemis* spp.	Film, "The Flight of the Condor", part 3, Film team J.R.G. Turner, U. Andrews, A. Mc Gregor
13	Caceres-Poconé (Facenda Santa Inez) 16° 07' 57° 10'	Brazil (Pantanal)	120	*Dryas iulia*	1983	"	*Caiman latirostris*	"
14	Lowland forests	"Tropical South America"	–	Pieridae: *Phebis*, *Aphrissa*, *Glutophrissa*	misc.	LAMAS 1986	Caimans and turtles	Misc. collectors
15	Miranda, Mato Grosso do Sul (Facenda Miranda) 20° 21' 56° 20'	Brazil	125	no records	11.XI.94	This report	"	S. & P. Krauer of Büttiker & party
16	Pantanal, Mato Grosso do Sul (Facenda Arara Azul) 19° 20' 57° 03'	Brazil	130	no records	12./13.XI.94	"	"	"
14	Caceres, Mato Grosso 16° 04' 57° 42'	Brazil	118	no records	14.XI.94	"	"	"
15	Cuiaba, Mato Grosso (Zoo, University) 15° 38' 56° 06'	Brazil	186	no records	15.XI.94	"	"	"

Geometridae, Ennominae

It is noteworthy that the Ennominae include strict eye-frequenters also in S.E. Asia, such as several species of *Hypochrosis* and *Chiasmia* (=syn. *Semiothisa*), and, in addition, *C. inaequilinea* (Warren, 1911) in South Africa (BÜTTIKER & NICOLET 1975).

Aeschropteryx sectata Guenée, 1858 Fig. 2

Material: 2 x Lindolandia Farm, 9.xi.94, host: horse.

This species is a conspicuous eye-frequenting feeder due to its remarkable size (wingspan 46 mm) and rapid flight.

Oxydia chalybeata Warren, 1897

Material: 1 x Frederico Keller Farm, 2.xi.94, host: cattle.

This species has a wide range from Mexico to South America.

Oxydia sp. or **mexicata** Guenée, 1850 Fig. 3

Material: 1 x Lindolandia Farm, 9.i.94, host: horse.

Both *Oxydia* species are also very conspicuous eye-frequenting moths, with a swift flight pattern. Like all other ophthalmotropic Lepidoptera, both *Oxydia* species showed similar characteristics but they arrived rather late at the kraal.

Pero albivena (Warren, 1897)

Material: Brazil, 1 ♂ Frederico Keller Farm, 4.xi.94, host: horse.

Known from Belize and almost all countries of South America.

Pero amanda (Druce, 1898) Fig. 4

Material: Brazil: 1 ♂ Frederico Keller Farm, 4.xi.94, host: horse; 3 ♂ Lindolandia Farm, 9.xi.94, host: horse.

Known from Cuba, Belize, Mexico, Panama, Venezuela, Fr. Guiana, Brazil, Paraguay, Uruguay, Argentina, Bolivia, Peru and Colombia a.o.

Pero fusaria (Walker, 1860) Fig. 5

Material: Brazil: 1 ♂ Frederico Keller Farm, 4.xi.94, host: horse; 2 ♂ Lindolandia farm, 9.xi.94, host: horse.

This species has been recorded from Mexico, Guatemala, Belize, Costa Rica, Panama and almost all countries of South America.

Pero hoedularia (Guenée, 1857)

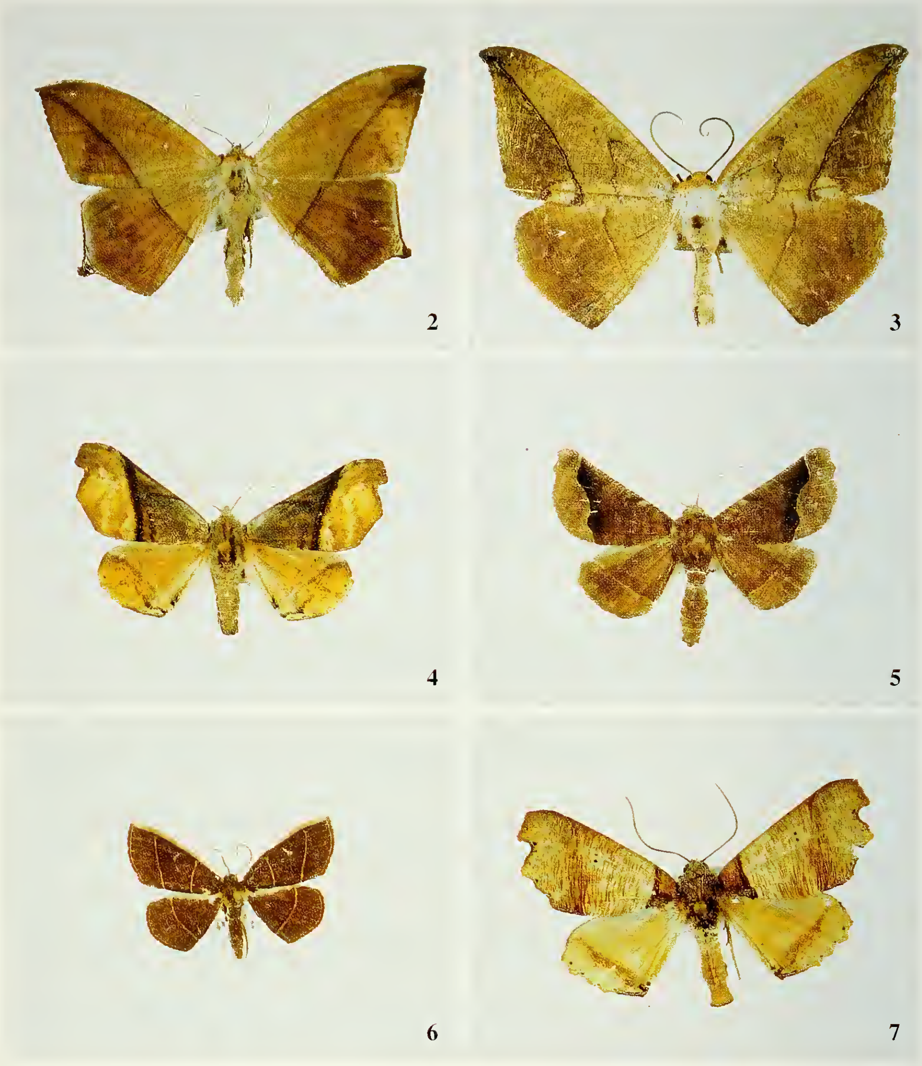
Material: Brazil: 1 ♂ Lindolandia Farm, 5.xi.94: host: horse.

This species is known from Brazil, Paraguay and Argentina.

Pero maculicosta (Warren, 1897)

Material: Brazil: 1 ♀ Frederico Keller Farm, 4.xi.94, host: horse; 1 ♂ Lindolandia Farm, 4./9.xi.94, host: horse.

Known from Brazil, Paraguay, Argentina, Bolivia, Peru, Ecuador and Colombia.



Figs 2-7

2: *Aeschropteryx sectata*, eye-frequenting on horse. Lindolandia Farm, Foz-do-Iguaçu, 9.xi.95. Wingspan 46 mm. – 3: *Oxydia* nr/or *mexicata*, eye-frequenting on horse at Lindolandia Farm, Foz-do-Iguaçu, 9.xi.95. Wingspan 51 mm. – 4: *Pero amanda* (♂), one of the geometrid eye-frequenting moths of South America. Foz-do-Iguaçu, Alfredo Keller Farm, 9.xi.94. Wingspan 37 mm. – 5: *Pero fusaria* (♂), eye-frequenting on horse, Lindolandia farm, Foz-do-Iguaçu, 9.xi.94. Wingspan 33 mm. – 6: *Pero nyctopa* (♂). Host: cattle. Facenda Frederico Keller, Foz-do-Iguaçu, 2.xi.94. Wingspan 23 mm. – 7: *Pero polygonaria* (♂), eye-frequenting on cattle, Frederico Keller Farm, Foz-do-Iguaçu, 2.xi.94. Wingspan 41 mm.

Pero nyctopa Prout, 1934 Fig. 6

Material: 6 ♂ Frederico Keller Farm, 1./2.xi.94, host: cattle (5) and horse (1); 1 ♂ Lindolandia Farm, 9.xi.94, host: horse.

This species was a relatively regular eye-frequenter, but was difficult to collect. Several specimens escaped hand and net collecting, out of a total of about 20 specimens present between 20.00 to 23.00 hours each night. There was never more than one specimen at the eyes, and the flight to the host's eye was also direct and straight. It is difficult to state whether watery eyes were more commonly fequented than normal eyes, due to the low number of specimens. However, one cow was clearly a more preferred host although it had no inflamed eye.

This species is known from Belize, Colombia and Brazil. It is an exceptionally small and dark species.

Pero polygonaria (Herrich-Schaeffer, 1855) Fig. 7

Material: 2 ♂ Frederico Keller Farm, 1. and 2.xi.94, host: cattle.

This species has also been reported by Shannon (1928) from the neighbourhood of Iguaçu Falls, Misiones, Argentina. The distribution covers almost all countries from Mexico to the southern part of South America.

Pero refellaria (Guenée 1857)

Material: 1 ♂ Lindolandia Farm, 9.xi.94, host: horse.

This species also fed a few times on the wound exudate of cattle caused by *Dermatobia* sp. (Probably *hominis* L.) (Diptera, Cuterebridae).

Distribution: Brazil, Paraguay, Argentina, Bolivia, Peru, Ecuador and Colombia.

Pero teleclyta Prout, 1928

Material: 1 ♂ Frederico Keller Farm, 4.xi.94, host: cattle.

Distribution: Venezuela, Guyana, Brazil, Paraguay and Peru.

It is very interesting that so many *Pero* species were found during such a short observation period. It is probable that further species of this genus will be collected during future collecting activities. In this connection, Poole (1987) writes:

"*Pero* is a large genus of geometrid moths of the subfamily Ennominae taxonomically distinct from all other genera in the Geometridae. It is an entirely New World genus and is most highly evolved in the Andes, the mountains of southeastern Brazil and northern Venezuela. However, species of the genus are found in almost every conceivable habitat, including high montane, lowland, and northern coniferous forests, deserts, mangrove swamps, and paramo areas. Within the genus *Pero* are species exhibiting one or more of the following characteristics: Sexual dimorphism, polymorphism, extreme geographic variation, a high degree of individual variation, and even an apparent case of circular overlap of races."

Phyllodonta sp. near or **angulosa quadruncata** Warren, 1862

Material: Brazil: 1 x Frederico Keller Farm, 4.xi.94, host: cattle.

The recent revision of the geometrid genus *Semiothisa* and the separation of *Chiasmia* (=syn. *Macaria*) from it, as well as its close relationship with *Tephrina*, makes the subfamily of the Ennominae in Eurasia, Africa and South America a very interesting subject for evolutionary research. In addition, there are several other genera in this family with different degrees of lachryphagous behaviour (BÜTTIKER 1967) which should be included in such a genetic study.

Noctuidae

Catocalinae

Achaea ablunaria Guenée, 1852

Material: 1 x Lindolandia Farm, 9.xi.94, host: horse. One additional damaged specimen; same location and host on 4.xi.94.

Achaea species are well known fruit-piercing moths in the Palaearctic and Afrotropical Regions (BÜTTIKER 1962), and is the first time that a member of this fruit-sucking genus is now incriminated as an ophthalmotropic species. However, it is not clear whether these specimens would have remained on or below the edge of the host's eye for a longer stay, as they were immediately collected as soon as they settled.

During future field work it would be desirable to collect more specimens of *Achaea*, which should then be investigated by microtome studies (e.g. Büttiker, in press) and precipitin tests in order to confirm their eye-frequenting behaviour.

Ophiderinae

Acolasis bibitrix Hübner, 1823

Material: 1 x Lindolandia Farm, 4.xi.94, host: horse.

Distribution: probably over much of South America.

Acronictinae

Condica concisa Walker, 1856 complex (Now in *Platysenta* according to BMNH index)

Material: 1 x Lindolandia Farm, 9.xi.94, host: cattle.

Distribution: much of South America.

B. DIURNAL OPHTHALMOTROPIC LEPIDOPTERA

Nymphalidae, Heliconiinae

Dryas iulia Fabricius, 1775

The exciting news about the strange eye-frequenting behaviour of a heliconiine is of rather recent date and has been reported by TURNER *et al.* (1986) from Rio Manú, Peru, and between Caceres and Poconé, Brazil. Additional information has been given by Lamas (1986) on several eye-frequenting Pieridae of the genera *Phoebis*, *Aphrissa* and *Glutophrissa* that were observed feeding on turtles (*Podocnemis* spp.) and cayman (*Caiman latirostris*).

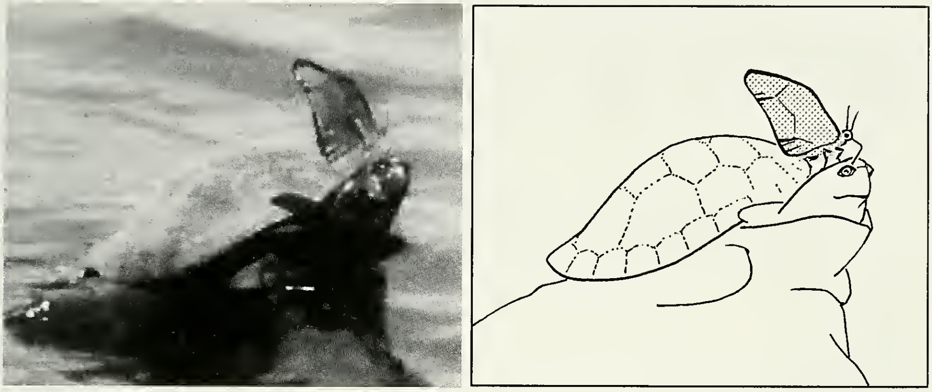


FIG. 8

A. *Dryas iulia*, a diurnal eye-frequenting butterfly, feeding on a turtle's eye (*Podocnemis* sp.) perched on a log. Location: Rio Manu, eastern Peru. Still print from the film "Flight of the Condor", part 3, footage ~2349; reproduction by kind permission of BBC South, Bristol.
B. Linedrawing based on Fig. 8A with enhanced position of antenna and proboscis.

Four field trips were made in areas where diurnal eye-frequenting butterflies on caymans and freshwater turtles were previously observed. Mainly on account of rainy weather the search proved to be unsuccessful (Table 2).

By courtesy of BBC South, Bristol, figure 8 has been produced and shows *Dryas iulia* on a specimen of *Podocnemis* sp. (see TURNER *et al.* 1986). This is the first published photographic record of a herpetophilic and diurnal ophthalmotropic Lepidoptera.

CONCLUSIONS

The present study should be regarded as no more than a preliminary contribution to the knowledge of nocturnal eye-frequenting moths in South America and to the complex situation occurring on three continents.

So far as taxonomic aspects of nocturnal ophthalmotropic moths in South America are concerned there is a relatively high number of species present, and many *Pero* species in particular. In view of this situation it would be highly desirable to intensify the study on the species and host spectrum, and to extend the field research into other geographical areas of South America. Parallel to these investigations other natural biomes, such as the savannahs of Brazil, Argentina and Paraguay, should be investigated as it can be expected that additional species, and perhaps even members of other ophthalmotropic lepidopteran genera, will eventually be found.

One of the most important taxa of eye-frequenters in Africa and Asia is the genus *Acryophora* (Noctuidae, Westermanniinae) with eight species of eulachryphagous moths known so far and another 6 species that have not yet been recorded as indulging in this strange behaviour. This genus, and the closely related Asiatic monobasic *Lobocraspis*, is absent from South America, which suggests that *Arcyophora* is of African or Asian origin.

On the other hand, most of the other eye-frequenting families (Pyralidae, Geometridae, Notodontidae and the still somewhat questionable Sphingidae) are represented by a variable number of species in all the three continents. The ophthalmotropic Thyatiridae which occur in Asia only, apparently occupy a special place.

TABLE 3

Approximate rating of abundance of nocturnal ophthalmotropic Lepidoptera in S. America, Africa and Asia (as of 1996)

Family	South America	Africa	Asia
Noctuidae	+*	+++++	++++
Notodontidae	+	-	+
Geometridae	+++++	+	+++
Pyralidae	++	+	+++
Thyatiridae	-	-	+
Sphingidae	+	+(?)	+(?)

* The situation regarding *Achaea ablunaria* is not clear as this genus includes the very well-known and distinctive fruit-piercing moths.

In South American eye-frequenting moths, many of the biological and behaviouristic features are identical with those of the African and Asian species, in particular the onset of flight, host-finding, duration of feeding, light shyness and avoidance of flight during heavy rain and strong wind. Monsoon-like weather conditions prevailed during our stay in the Iguaçu District when the temperature did not drop below 20°C.

The ingestion of pus from inflamed eyes by various *Pero* species has been observed on several occasions, when *P. amanda* has settled on the host's head below the eye and has made its way up whilst probing with the proboscis on the wet area. On other occasions some of the specimens reached the edge of the eye and imbibed lachrymal fluid there. Feeding lasted for more than 10 minutes whenever the moths were allowed to continue and were not captured after settling at the eyes.

Reference to these parameters of African and Asian species has been made in several publications (e.g. BÜTTIKER 1993; BÄNZIGER & BÜTTIKER 1969). However, fundamental taxonomic and biological information on S. American ophthalmotropic Lepidoptera is still lacking, especially concerning the spectrum of host species for each moth species, degree of host preference of the species, genera and families involved, and the abundance of species occurring in other South American areas.

An analysis of the conditions in South America shows that the ophthalmotropic Lepidoptera observed so far occur in the monsoon rainforest. In Africa, however, their occurence is confined predominantly to the wooded savannah, and the desert steppe (BÜTTIKER 1973*a*, p. 339, after Cloudsley-Thompson loc. cit.). In the Arabian Peninsula, which geographically belongs to S.W. Asia, the records stem from stony and sandy deserts interspersed with relatively good plant growth. In S. and S.E. Asia the range of plant communities extends from dry deciduous to arid associations (Table 4).

TABLE 4

Schematic Comparison of Plant Associations, Bioclimates, and Relative Abundance of Nocturnal Geometrid, Noctuid and Pyralid Eye-frequenters on three Continents.

South America			Africa			Asia		
Plant association	Bioclimate	Abundance of eye-frequenters	Plant association	Bioclimate	Abundance of eye-frequenters	Plant association	Bioclimate	Abundance of eye-frequenter
super arid	–	–	super arid	very dry tropical	–	super arid*	very dry tropical	+
arid	–	–	arid (Sahel)	very tropical	+	arid**	dry subtropical/ tropical	++
sub-desert	dry tropical	?	sub-desert steppe	dry subtropical/ tropical	++	–	–	–
wooded steppe	tropical (sub-moderate	?	wooded steppe	subtropical/tropical moderate	+++	very dry deciduous	tropical moderate	++++
wooded savanna	subtropical/tropical moderate		wooded savanna	subtropical/tropical moderate	++++	dry deciduous	tropical moderate	+++++
lowland forest wet-evergreen	moist subtropical/ tropical	+++	lowland forest (wet-evergreen)	moist tropical	–	wet evergreen	moist tropical	–
montane	tropical moderate	?	montane	tropical moderate	–	evergreen montane	subtropical	–

FIG. 9

Type of South American subtropical climax rain-forest at Foz do Iguaçu, Brazil (Nov. 1994).

ACKNOWLEDGEMENTS

My best thanks are due to the members of this study trip to Brazil, to my dear wife Sonja, and to our daughter Sybille and her husband Mr. Peter Krauer-Büttiker who extended the visit to the Pantanal area (Mato Grosso and Mato Grosso do Sul). We are all very grateful to our enthusiastic friends and colleagues at the Parque de Aves, Iguaçu: Mrs. Carmel Glissmann, Mr. John Leggatt, Mr. Salmir Cubas; to Mr. J. Keller; Mrs. Rose Gasparini and Mr. Ronaldo Morato, Parque Nacional de Iguaçu; to Messrs. Frederico and Werner Keller, Facenda São Jao Batista (Camping Ecologico). Foz-do-Iguaçu; to Mr. Sergio, Facenda Lindolandia (Propriator Mr. Alfredo Keller) and Mr. Isaia Scalco, also of Foz-do-Iguaçu, for assistance in the field. Special thanks are extended to Dr. N. Gmür, Director, Ciba Chimica S.A., São Paulo for logistic help. I also wish to thank Dr. J. Holloway, Dr. M.J. Scoble, Mr. M.R. Honey, Mr. D.J. Carter and Mr. D.T. Goodger of the Natural History Museum, London, for their assistance with the identification of the moths; the late Mr. E. de Bros, Basle for providing literature; and the staff of BBC South, Bristol, for their assistance in providing the picture of *Dryas iulia*.

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Revue suisse de Zoologie 104 (4): 869-896; décembre 1997

Notes sur des Diploures Rhabdoures (Insectes, Aptérygotes) n° 1 – *Diplura Genavensia* XXII –.

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New data on some Diplura Rhabdura (Insecta, Apterygota) n° 1 – *Diplura Genavensia* XXII –. - The main characteristics of Rhabdura Cook, 1896 (sensu Pagés 1958) are briefly exposed. The paper deals with several species of Procampodeidae and Anajapygidae. *Procampodea brevicauda* Silv. (from Algeria) is compared with *P. macswaini* Condé & Pagés; new data are given on the chaetotaxy of vertex, thorax and abdomen, the trichobothria of the antennae and the labial palpi. The description of *Anajapyx vesiculosus* Silv., 1905 is completed based on the study of 44 specimens from Morocco. *Anajapyx carli* n. sp. is described from South India (Anaimalais Hills). In both species bundles of spermatozoans have been observed in the spermiducts of males. Silvestri's var. *guineensis* is considered a good species: *Anajapyx guineensis* Silv., stat. n.. *Anajapyx menkei* Smith and *A. amabilis* Smith are believed to be mere post-embryonic instars of the same species which may be *A. mexicanus* Silv., but a revision of the types is necessary to confirm this synonymy. *Paranajapyx* n. gen. is proposed for *A. hermosus* Smith whose antennae, mandibles and lacinia differ clearly from those of *Anajapyx* Silv.: *Paranajapyx hermosus* (Smith), n. comb.. Lectotypes are designated for *Japyx insuetus* Pgs, *Metajapyx phitosi* Pgs, *Parindjapyx aelleni* Pgs and *Parajapyx* (*P.*) *genavensium* Pgs. The original description of *Unjapyx mussardi* Pgs is corrected.

Key-words: Taxonomy - Procampodeidae - Anajapygidae - New taxa - *Japyx* - *Unjapyx* - *Metajapyx* - *Parindjapyx* - *Parajapyx*.

INTRODUCTION

De très nombreux chercheurs s'occupent actuellement d'établir les relations exactes existant entre les multiples types et groupes d'Arthropodes. En ce qui concerne les Diplura qui font partie des "anciens" Apterygota, une des tendances serait de les répartir entre deux classes d'un subphylum des Hexapoda : Japygina et Campodeina. Ces derniers ne comprendraient que les Campodeoidea; les Japygina

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Manuscrit accepté le 23.05.1997.

réuniraient les Japygoidea et peut-être les Projapygoidea, reprenant en quelque sorte les idées de Cook (1899) ou celles d'Ewing (1942) (Štys & Biliński 1990, Štys & Zrzavy 1994).

En attendant qu'un consensus soit trouvé après analyse des résultats déjà obtenus par les méthodes phénétiques, évolutives et cladistiques ou en cours d'élaboration, je continuerai à utiliser la classification, basée presque exclusivement sur la morphologie externe et les pièces buccales (Pagés 1958), dans laquelle je proposais la division des Diplura en 2 ordres: les Rhabdura Cook et les Dicellurata[2] Pagés considérés selon les auteurs comme des catégories systématiques allant de la famille au sous-phylum!

Les Rhabdura possèdent au moins 4 caractères uniques:

1) les mandibules ont une prosthéca bien distincte des dents de la *pars apicalis*;

2) le labium présente des processus palpiformes pourvus de phanères spéciaux;

3) les styles des sternites abdominaux sont membraneux, porteurs de plusieurs soies dont une est apicale;

4) les cerques sont composés de plusieurs articles membraneux, dont certains peuvent fusionner et former une base indivise, mais toujours membraneuse.

Par contre chez les Dicellurata (qui ne renferment que la seule super-famille des Japygoidea) les mandibules sont dépourvues de prosthéca, le labium ne montre aucune trace de processus palpiforme, tous ont des styles indurés d'un seul article et dépourvus de soie apicale, les cerques ne présentent aucune indication d'une segmentation, même chez les larves néonates connues.

Les Rhabdura comprennent 5 familles réparties entre les Projapygoidea (Anajapygidae Silv., Octostigmatidae Rusek, Projapygidae Silv.) et les Campodeoidea (Procampodeidae Silv. et Campodeidae Lubbock).

ETUDE COMPARATIVE DE **Procampodea brevicauda** Silv. ET **Procampodea macswaini** Condé & Pagés (PROCAMPODEIDAE).

Matériel étudié.

1. Procampodea brevicauda Silv. (Figs 1-6)

Algérie: oasis d'Iherir sur la piste Illizi-Fort Gardel, au bord de la guelta, alt. 1017 m, Winkler-Moczarski et récolte à la main, 16.12.79, leg. A. de Chambrier: 1 ex. asexué de 1,64 mm sans les cerques.

La capture a eu lieu tout près de l'eau, à peu de profondeur ou en surface, sous les touffes de Graminées qui bordent la guelta sur une assez faible surface (voir photo). Il est vraisemblable de penser que le Procampodé a été récolté à la main, plutôt que par la méthode de Winkler-Moczarski beaucoup trop brutale.

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[2] Je n'ai utilisé le terme Dicellurata dans le titre de mes notes qu'à partir de 1976 pour désigner la série d'études consacrées aux collections de Diploures du Muséum d'histoire naturelle de Genève et publiées dans la *Revue suisse de Zoologie* (Pagés 1976).

2. *Procampodea macswaini* Condé & Pagés (Fig. 4)

Etats-Unis: Californie, Pinnacles national Monument, San Benito County, 24.03.55, P. Remy col.; lectotype ♂ et paralectotype ♀ des collections du Muséum de Genève.

Cette famille a été créée par SILVESTRI (1948) pour son *Procampodea brevicauda* qu'il avait décrit en 1905 d'après un seul exemplaire récolté à Molfetta (Province de Bari) en Italie continentale. Grâce à de plus nombreux exemplaires italiens il redécrit en 1948 cette espèce avec plus de précision et mieux illustrée, mais sans rectifier les inexactitudes et les quelques obscurités qui pouvaient s'être glissées dans son premier travail.

L'opportunité qui m'était donnée d'étudier un représentant de ce que je considère être un *Procampodea brevicauda* incontestable, m'a incité à le comparer aux lectotype et paralectotype de *P. macswaini* conservés dans les collections du Muséum de Genève. J'ai essayé de corriger ou compléter les travaux de SILVESTRI qui, soulignons-le, étaient les seuls documents ayant servi de base aux descriptions de *P. macswaini* par CONDÉ & PAGÉS (1956) et de BARETH *et al.* (1989).

Dans le carnet de notes tenu par P. Remy lors de son voyage aux Etats-Unis, le passage relatif à la station où ont été récoltés les Procampodés permet d'apporter quelques précisions sur le biotope de capture; le libellé exact est: "107 Pinnacles près du Headquarters et des "Cabines" (cases de passage) alt. 1270 feet[3]. 1 Koen. grosse, sans queue (entre les cabines 7 et 14, sous pierre enfoncée très profondément dans terre riche en humus et fraîche) – 15 Pauropodes (en 2 tubes) – Symphyles, Campodés 4 h. (11 1/2 – 15 1/2) – 24 mars 55". Il ne parle pas des Procampodés, les comptabilisant avec les Campodés, mais je suis persuadé qu'ils étaient en compagnie de la *Koenenia*. En effet, à propos de la capture de ces Diploures, P. Remy m'avait dit avoir eu beaucoup de mal pour retourner la pierre sous laquelle ils se trouvaient malgré l'aide du Professeur J. W. Mac Swain qui l'accompagnait.

La redescription détaillée de cette espèce (BARETH *et al.* 1989) a été presque exclusivement basée sur le ♂, la préparation de la ♀ étant peu utilisable.

Depuis le Dr B. Hauser a réussi à démonter la préparation, à débarrasser le spécimen des corps étrangers qui le recouvraient; le Dr. C. Lienhard a remonté l'exemplaire dans le milieu de Berlese suivant la technique des 2 lamelles couvre-objet qu'il a mise au point (LIENHARD 1994: p. 126-127).

J'ai pu ainsi comparer facilement les 3 exemplaires des collections du Muséum de Genève, ce qui m'a amené à faire les quelques remarques suivantes:

1) la question du sexe des exemplaires décrits et figurés par SILVESTRI (1905, 1948) ne me semble plus se poser maintenant. Je crois pouvoir affirmer que ces individus sont des ♀. Ses figures XII-28 de 1905 et III-17 de 1948 sont très comparables et il précise pour la seconde qu'à l'arriète du sternite 8 existe: "un breve lobo, sul quale corrisponde l'appertura genitale ed è fornito di una serie di 4 setolucce anteriori e 6 posteriori". Cette description correspond presque parfaitement avec celle

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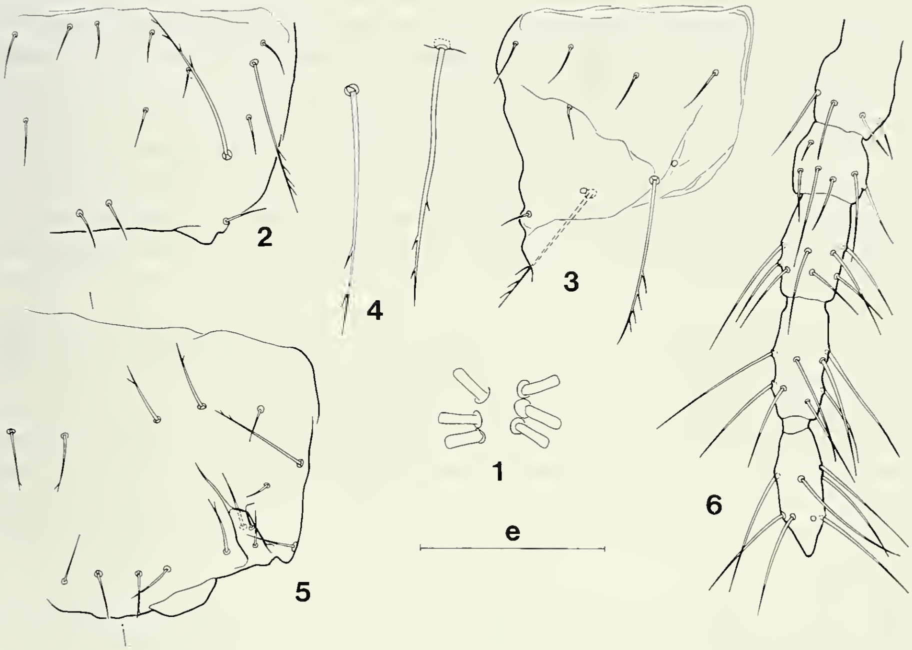
[3] 1260 feet (= 384 m) au "Bear Gulch Visitor Center" d'après l'édition de 1994 du dépliant consacré aux Pinnacles National Monument.

Procampodea brevicauda Silv. - Vue d'ensemble de la guelta de l'oasis d'Iherir, montrant le contraste entre la zone humide et celle désertique, nue, rocheuse ou sablonneuse. (Phot. A. de Chambrier).

que j'ai donnée en 1961 de la ♀ de *P. macswaini*, la seule différence notable étant la présence chez cette dernière espèce de 9 soies postérieures au lieu de 6. De plus, je suis persuadé que Silvestri savait reconnaître sans problème les ♂ de Campodéidés, sinon en 1905, certainement en 1948, et s'il avait eu sous les yeux un individu présentant une papille similaire à celle du ♂ de *P. macswaini* figurée par Bareth *et al.* (1989), il n'aurait eu aucune peine à la considérer comme ♂ et à la décrire. On peut même se demander si Silvestri avait réussi à capturer un ♂ de *P. brevicauda*!

2) Le vertex des 2 espèces ne présente bien que 2+2 M comme le représente Silvestri (1948) et non 3+3 comme pouvait le laisser supposer le texte et la fig. XII-18 de son travail de 1905.

3) La répartition et les longueurs relatives des trichobothries sont identiques sur les 2 antennes des 2 espèces. On peut cependant faire la remarque suivante à propos des 2 trichobothries du 6e article: Bareth *et al.* écrivent que cet article a "2 trichobothries tergales à flagelle long, celui de l'antérieure l'étant un peu moins". Or, tant sur l'immature d'Algérie que sur la ♀ d'Amérique, cet article présente 1 trichobothrie postéro-tergale longue, l'antérieure étant nettement du type court, comme l'a représenté Silvestri (1905) sur sa fig. XII-24; on pourrait en conclure qu'il existerait chez *Procampodea* un caractère sexuel secondaire portant sur les tailles relatives des



Figs 1-6

Procampodea brevicauda Silv. - 1. Exemplaire asexué d'Algérie, processus palpiformes, e = 18 µm. - 2. id., mésonotum, e = 63 µm. - 3. id., métanotum, e = 63 µm. - 4. A gauche macrochète latéral antérieur du métanotum de la ♀ de *P. macswaini* Condé & Pagés, à droite même phanère du *P. brevicauda* Silv. algérien, e = 36 µm. - 5. Exemplaire algérien, urosternite 6, e = 63 µm. - 6. id., extrémité du cerque gauche, face tergale, e = 85 µm.

2 trichobothries tergales de l'article VI: subégales et longues chez le ♂, une longue et une beaucoup plus courte chez la ♀ et les immatures.

4) Les palpes labiaux sont morphologiquement parfaitement comparables; on note cependant que le nombre de phanères courts et trapus qui les constituent sont au nombre de 8-9 chez l'exemplaire algérien de 1,64 mm et de 9-12 chez les spécimens de Silvestri dont la taille varie de 1,6 à 1,7 mm, alors que chez le ♂ de *P. macswaini* de 2,30 mm il y en a seulement 7-8 et 5-6 chez la ♀ de 1,76 mm; de plus chez *P. brevicauda* les embases de ces phanères sont jointives alors qu'elles sont nettement écartées l'une de l'autre chez *P. macswaini*.

5) La description de la chétotaxie du thorax est un exemple des "obscurités" rencontrées dans les notes de Silvestri: d'après le texte de 1905, on peut en conclure que méso- et métanotum ont, l'un et l'autre, 2+2 *M*, mais seul le mésosotum est figuré (fig. XII-31) alors que dans son travail de 1948, si le texte n'en dit rien, les fig. I et II montrent que le mésonotum a bien 2+2 *M* et que le métanotum n'en a que 1+1, les *lp* d'ailleurs en position assez antérieure; c'est cette répartition qui est exacte d'après les 3 spécimens étudiés ici.

6) D'après mes observations, si la chétotaxie des tergites ne diffère entre les 2 espèces que par l'absence au tergite 1 de *P. macswaini* des 1+1 *M* présents chez *P. brevicauda*, celle des sternites est plus délicate à interpréter. Il est indubitable que l'espèce californienne ne présente aucun *M* reconnaissable sur le sternite 1, alors qu'il y en a 4+4 chez les *P. brevicauda* d'Italie et d'Algérie. Quant aux sternites suivants, le texte de SILVESTRI de 1905 et sa fig. XII-27 pourraient faire penser à la présence de 6+6 *M* alors que dans le travail de 1948, il ne parle pas de la chétotaxie des urosternites et que sa fig. II est trop imprécise pour que l'on puisse se faire une opinion valable. Si, comme j'en suis persuadé, l'exemplaire algérien est bien un *P. brevicauda*, son étude montre que les sternites abdominaux 2 à 7 ont 4+4 *M* distribués comme ceux de *P. macswaini* (BARETH *et al.* 1989: fig. 11).

En conclusion, on peut retenir entre *P. brevicauda* et *P. macswaini* les différences suivantes: palpes labiaux à phanères sensoriels plus nombreux et plus serrés chez *P. brevicauda* que chez *P. macswaini* à tailles égales; le plus grand développement chez *P. macswaini* des angles latéraux de l'urosternite 1 chez le ♂ comme chez la ♀, alors qu'ils sont très peu saillants chez *P. brevicauda*; absence de *M* sur le tergite 1 de *P. macswaini*, absence de tout *M* sur l'urosternite 1 de *P. macswaini*, mais présence de 4+4 *M* chez *P. brevicauda*: les urosternites 2 à 7 des 2 espèces présentent 4+4 *M*.

DONNÉES NOUVELLES SUR **Anajapyx vesiculosus** Silv. ET DESCRIPTION D'**Anajapyx carli** sp. n. DES INDES (ANAJAPYGIDAE).

Si les Anajapygidae sont très souvent cités dans les traités de Zoologie ou les travaux de morphologie comparée, la bibliographie qui concerne leur systématique pure est très peu fournie: 9 références dont 7 pour des travaux de SILVESTRI allant de 1903 à 1936, 1 pour SMITH (1960) et 1 pour PAGÉS (1959).

Cette famille ne comprend jusqu'à présent que le genre *Anajapyx* Silv. dont l'espèce-type est *A. vesiculosus* Silv. décrite en 1903 et un peu plus complètement en 1905; par la suite SILVESTRI définit très sommairement *A. mexicanus* en 1909 et 1912 et, en 1936, *A. vesiculosus* var.[4] *guineensis*. SMITH (1960) donne la description de 3 espèces nouvelles: *A. hermosus* de Californie, *A. menkei* et *A. amabilis* du Mexique; cet auteur se base sur les premiers travaux de Silvestri qui sont, comme je le démontre plus loin, peu fiables car souvent peu compréhensibles et renfermant un certain nombre d'erreurs manifestes qu'il n'a pas toujours corrigées dans ses travaux ultérieurs. Rappelons que j'ai signalé la présence du genre à Madagascar (PAGÉS 1955), ce que de nouvelles observations ont confirmé.

J'ai pu étudier en détail une partie des *Anajapyx* récoltés en Afrique du Nord par le regretté Professeur P. Remy lors de ses expéditions de 1950 et 1953. En comparant les données de Silvestri dans ses divers travaux avec mes observations sur les exemplaires maghrébins je crois pouvoir affirmer que les spécimens récoltés par Remy sont des *Anajapyx vesiculosus* indubitables; j'ai pu examiner un des syntypes

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[4] Pour Silvestri le terme "var." désigne le plus souvent une sous-espèce (cf. PAGÉS 1978).

de Portici, donné par Silvestri au Professeur J. R. Denis, mais cet exemplaire monté dans le baume du Canada était pratiquement devenu inétudiable car trop transparent et trop déformé; malheureusement la préparation, à la suite de plusieurs déménagements et réorganisations de Services, s'est égarée avant qu'il m'ait été possible d'utiliser les techniques du contraste de phase; j'avais pu néanmoins en obtenir quelques points de comparaison très utiles.

Suite à la création par J. Rusek (1982) de la famille de Octostigmatidae, présentant de nombreux caractères communs avec les Anajapygidae, il m'a paru utile de donner une description la plus complète et la plus critique possible d'*Anajapyx vesiculosus* Silv..

Anajapyx vesiculosus Silvestri, 1903 Figs 7-18, 19-28, 53-54

Outre le syntype de Portici, tous les spécimens qui ont servi de base à cette étude proviennent des récoltes de P. Remy Au Maroc. Les étiquettes des tubes en ma possession ne comportent le plus souvent que le numéro et la date correspondant à une station. B. Condé a eu l'amabilité de consulter les notes manuscrites de P. Remy rédigées au jour le jour lors de ses missions et indiquant les biotopes exacts.

Matériel étudié:

27. Khenifra: parc de l'administration des Eaux-et-Forêts, sous des pierres au bord de la grande seguia, 05.08.50. (1 ♀ juv. de 1,25 mm, 1 ♀ de 1,71 mm).
44. Ijoukak: jardins de la Maison Forestière; 14-15.08.50. (2 asexués de 0,92 et 0,95 mm, 3 ♀ de 1,63, 1,92 et 2,38 mm).
46. Dar el Oued: cette station, qui n'a pas été retrouvée dans les notes de chasse conservées à Nancy, est proche d'Ijoukak comme la localité précédente (45) et la suivante (47). (1 sexe?).
47. Ijoukak: champs entre le hameau de Imin ou Gourzi et la rive droite de l'oued N'fis; 15.08.50. (1 asexué de 0,86 mm, un autre asexué détruit, ♀ juv. de 1,08 mm, 1 ♀ de 1,95 mm).
49. Taroudant: verger de la Maison Forestière; 16.08.50. (1 ♀? de 1,82 mm).
50. Taroudant: pépinière du Bureau des Affaires Indigènes; 17.08.50. (1 asexué de 0,96 mm, 1 sexe? de 0,95 mm).
52. Tiznit: jardin du Bureau des Affaires Indigènes; 18-19.08.50. (1 ♂ de 1,01 mm, 1 ♀ de 1,61 mm).
54. Tiznit: palmeraie près de Bab Targua et champs voisins; 19.05.50. (1 ♀ de 1,41 mm).
56. Goulimine: jardin en contre-bas de la mosquée: 20.08.50. (1 ♂ de 1,90 mm).
58. Bou Izakarn: palmeraie; 21.08.50. (1 ♂ détruit, 2 ♀ de 1,37 et 1,60 mm, 1 préparation de la moitié abdominale postérieure d'une ♀ ad.).
61. Safi: jardins potagers du vallon de la Châba; 23.08.50. (3 asexués de 1,10, 1,11 et 1,21 mm, 4 sexe? de 1.11, 1,20, 1,84 et un spécimen détruit, 1 ♂ de 1,57 mm, 1 ♀ de 2,02 mm).
105. Figuig: palmeraie près d'El Oudaghir, au bord de seguias; 22.05.50. (1 ♂ de 1,43 mm).
160. Erfoud: seguias, jardin du Colonel; 25.08.53. (1 ♀ de 1,77 mm).
203. Zagora: palmeraie, rive gauche du Draa; 06.09.53. (1 sexe? de 1,25 mm, 1 ♂ de 1,54 mm, 2 ♀ de 1,48 et 1,91 mm).
216. Goulimine: Jardins; 15.09.53. (1 asexué de 1,17 mm, 2 ♀ de 1,05 et 1,67 mm).
218. Bou Izakarn: jardin du Bureau des Affaires Indigènes; 15.09.53. (1 ♀? de 1,60 mm, 1 ♀ de 1,85 mm).

"223. Akka": 20.09.53. Il s'agirait en fait de la station 223 bis: Akka, palmeraie, 1 "*Projapyx*"[5] (B. Condé in litteris). (1 ♀ de 1,07 mm).

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[5] Par "*Projapyx*" P. Remy désignait tout Rhabdoure non campodéoide.

Les 2 tubes suivants n'ont pas été retrouvés dans le matériel "Maroc":

223. Foum el Hassane, partie aval de la palmeraie, "quelques *Projapyx*"; 19.09.53.
226. Tata: jardin près de la grande seguia, entre le poste et 300 m en aval, "1 *Projapyx*"; 21.09.53.

Soit au total 44 individus: 9 asexués, 6 ♂, 2 ♀ juv., 18 ♀, 2 ♀?, 7 sexe ?.

Il faut ajouter 3 individus qui ont servi à faire des coupes sériées de la région céphalique et dont le sexe n'a pas été déterminé avant fixation; un quatrième spécimen, ♂, a fourni des coupes longitudinales. Le numéro de la (ou des) station(s) n'a pas été noté.

TÊTE

Vertex: Tous les phanètes sont simples. 3 + 3 grandes soies dont 1 + 1 situées un peu en arrière de l'angle postérieur externe de la base de chaque antenne, et 1 + 1 dans les angles postérieurs de la capsule céphalique; ces quatre grandes soies ont été décrites par SILVESTRI dès 1903a; on en observe 1 + 1 autres latérales antérieures, mais leur position très latérale pourrait faire penser qu'elles appartiennent aux plis oraux, l'absence de point de repère précis ne permet pas de trancher. Le long du bord postérieur de la base de chaque antenne 4 soies dont 2 assez longues au niveau des angles de la base et, entre elles, 2 soies courtes; de nombreuses paires de soies assez courtes ou courtes, dont le nombre augmente avec le stade de l'animal, recouvrent le sclérite.

Front: 2 courtes soies.

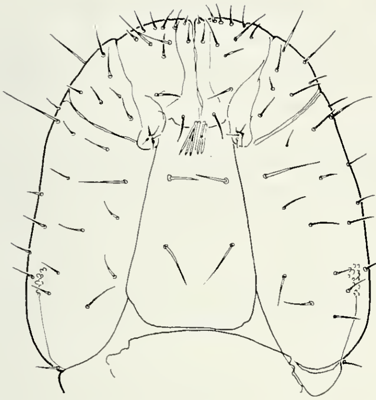
Clypéus: 1 soie médiane assez longue et 2 + 2 microsoies latérales.

Labre: 4 soies courtes près de la suture clypéo-labrale et, dans le tiers distal, une quinzaine de soies courtes formant des rangées transversales plus ou moins nettes; bord antérieur émarginé, porteur de 2 + 2 minuscules sensilles tergales.

Antennes: elles comptent de 20 à 23 articles suivant les stations et souvent chez les individus de la même station. La chétotaxie générale a été parfaitement figurée par SILVESTRI (1932) et je n'y reviendrai pas. L'équipement sensoriel est constitué de trichobothries, d'une sensille piriforme fortement colorée en brun-rouge, pourvu d'une minuscule pointe apicale sur le seul article 7, enfin, sur l'article apical, d'un organe sensoriel particulier. Le contour des embases des trichobothries et de la sensille piriforme ont la forme d'un triangle curviligne isocèle à sommet dirigé vers l'apex de l'antenne; ce type d'embase ne se rencontre ailleurs chez les Rhabdura que chez les Octostigmatidae; elles sont circulaires chez les autres familles.

FIGS 7-18

Anajapyx vesiculosus Silv., exemplaires des stations maghrébines. - 7. Ijoukak, ♀ de 1,95 mm, vertex, e = 105 µm. - 8. Safi, ♂ de 1,57 mm, face sternale de la capsule céphalique, e = 116 µm. - 9. Dar el Oued, sexe? moitié gauche de l'épipharynx, e = 45 µm. - 10. Safi, ♀ de 2.02 mm, article apical de l'antenne droite, e = 37 µm. - 11. Safi, sexe?, lobe externe de la maxille droite, e = 45 µm. - 12. Pour comparaison, lobe externe de la maxille gauche d'une *Campodea* sp. de Dijon (France), e = 45 µm. - 13. Tiznit, ♂, palpe labial droit, e = 28 µm. - 14. Dar el Oued, sexe?, mésonotum, e = 108 µm. - 15. id., métanotum, e = 108 µm. - 16. Safi, ♂ de 1,57 mm, PI gauche, face postérieure, e = 105 µm. - 17. Tiznit, ♂ de 1,01 mm, calcars de la PIII droite, e = 28 µm. - 18. Dar el Oued, sexe?, prétarse de la PII droite, e = 38 µm.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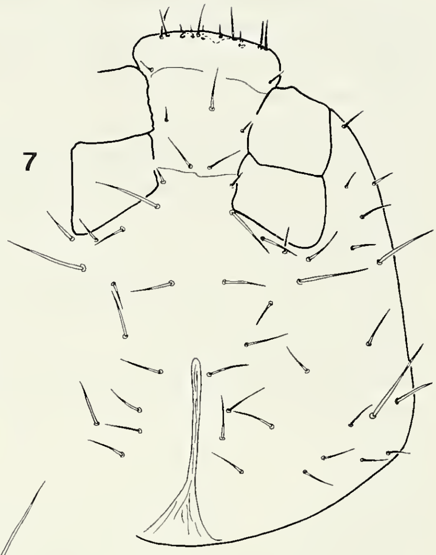
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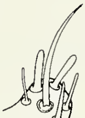
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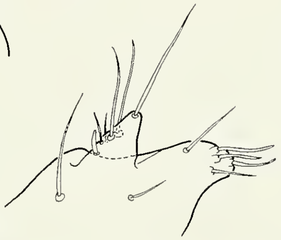
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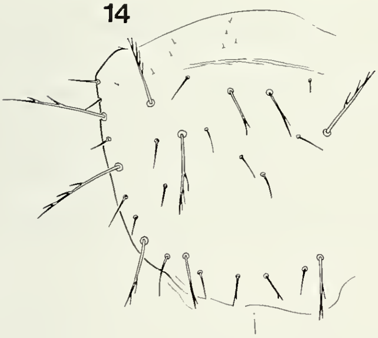
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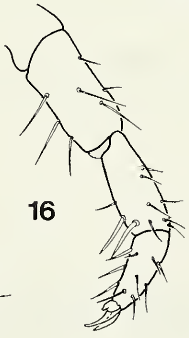
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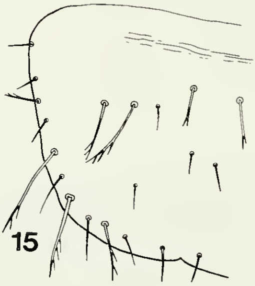
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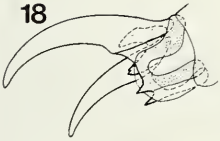
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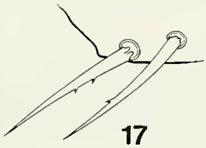
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Le nombre de trichobothries est variable; la répartition typique moyenne me semble être la suivante:

article n°	1 à 4	5	6	7	8	9	10	11	12	13 à l'apical
nombre de trichob.	0	3	3	2	3	1	2	0	1	0

On peut rencontrer jusqu'à 5 trichobothries sur l'article 6 ou seulement 2 sur l'article 8, de même l'article 11 en est normalement dépourvu, mais il est assez fréquent qu'il en ait une sur une antenne et pas sur l'autre, alors que l'article 12 peut en être dépourvu!

L'article 7 porte normalement une seule sensille piriforme, mais on peut en rencontrer une supplémentaire sur les articles 6 ou 8 et SILVESTRI (1932) en a même observé 2 sur l'article 7.

J'ai rassemblé dans le tableau suivant quelques répartitions anormales des trichobothries.

N° articles		1-4	5	6	7	8	9	10	11	12	13 20	21	22	23	24	25
Safi, sexe ?		0	3	3	3*	3	1	2	0	1	0 0					
Bou Izakarn, ♀		0	3	5*	4*	3	1	2	1	1	0	....	0			
Ijoukak, asexué	D	0	3	4	3*	3*	1	2	1	0	0	0				
-"- -"-	G	0	3	4	3*	3*	1	2	0	1	0	0				
Ijoukak, ♀		0	3	4*	3*	3	1	2	0	1	0	....	....	0		
Bou Izakarn, ♂		0	3	4	3*	3	1	2	0	1	0	....	0			
Taroudant, ♀(?)	D	0	3	4*	3*[6]											
-"- -"-	G	0	3	4	3*	3	1	2	$1^{?}$	0	0	....	....	0		

*: indique la présence d'une sensille piriforme; D: antenne droite; G: antenne gauche.

Je ne crois pas que le nombre et la répartition de ces sensilles puissent être considérées comme des caractères spécifiques sûrs.

J'avais écrit (PAGÉS 1959) qu'une grande sensille placoïde recouvrait l'apex de l'article apical, suivant en cela ce que SILVESTRI (1932) avait représenté sur sa fig. XVI; en fait il s'agit d'une observation faite sous un mauvais angle: en réalité l'organe sensoriel apical d'*Anajapyx* est identique à celui décrit par RUSEK (1982) chez *Octostigma herbivora*, c'est-à-dire fait de 2 lobes membraneux, un dorsal et un sternal.

Pièces buccales.

Mandibules: conformes à la description de Silvestri (1905) c'est-à-dire avec 4 dents apicales dont la première est toujours bien distincte des 3 autres; toutes sont obtuses; dans certains cas il peut sembler qu'une 5e dent existe, mais il ne s'agit en fait que d'une différenciation plus marquée du corps de la mandibule avant la 4e dent apicale. Prosthéca conforme à la représentation de SILVESTRI (1905), mais avec une base d'insertion plus étroite et avec 6 à 8 indentations sur le bord libre.

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[6] cassée

Maxilles: le lobe externe présente 4 sensilles sétiformes apicales à sommet mousse, précédées d'une soie assez longue; le corps du lobe est pourvu d'une sensille courte et d'une soie longue; le palpe, uniarticulé, bien différencié, montre une longue soie apicale et, sur son bord externe, 5 sensilles dont une proximale légèrement claviforme suivi de 2 autres sétiformes de même taille qui précèdent une paire de soies assez longues; cela correspond parfaitement à ce que RUSEK (1982) décrit et figure chez son *Octostigma herbivora*; je donne le dessin du lobe externe de la maxille d'un *Campodea* sp. chez lequel le palpe se présente, comme chez *Procampodea*, sous la forme d'un renflement tergal mal individualisé du corps de la galea, sans articulation nette, mais avec la sensille claviforme et les 2 autres sétiformes observé chez *Anajapyx*. Le lobe interne (= lacinia) a un crochet bifide et 2 lames pectinées; la plus externe est constituée d'environ 13 digitations dont la première paire ainsi que la dernière ont une base commune et forment 2 fourches; à la limite et dans le cas d'une observation difficile, il serait possible de croire que la fourche proximale est indépendante et qu'elle formerait une troisième lame pectinée extrêmement réduite.

Labium: le lobe interne est très étroit, il porte 2 soies, l'antérieure plus courte que la postérieure. Lobe externe non individualisé du reste du mentum; son bord antérieur est pourvu de 5 soies courtes précédant 2 longues soies; ce que BITSCH (1952) considère comme l'ensemble coxa 1 et 2 ou mentum montre une courte soie antérieure et au moins 1 soie plus ou moins longue postérieure; il peut y avoir sur ce territoire jusqu'à 3 soies assez longues. Chaque palpe est réduit à un mamelon peu saillant porteur de 6 phanères: 1 longue sensille médiane postérieure, 5 sensilles très courtes dont 2 antérieures cylindriques à sommet arrondi, 2 autres latérales externes en cône allongé et 1 autre latérale interne sétiforme. Les aires porteuses des processus palpiformes sont relativement saillantes, chacune avec au moins 1 soie assez longue et jusqu'à 4 chez certains spécimens, le nombre semble augmenter avec le stade post-embryonnaire; chacun des processus palpiformes proprement dit porte 3 phanères spatuliformes à extrémité distale très amincie. Submentum trapézoïdal à petite base antérieure avec 2 + 2 longues soies.

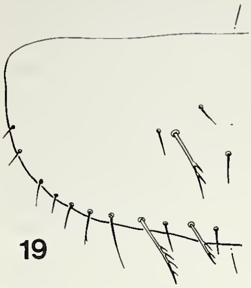
Admentum: avec 1 longue soie dans le sommet contigu au palpe labial et 2 rangées divergentes vers l'extérieur de 3-4 soies, les plus externes les plus longues.

Pli oral: subrectangulaire présentant 2 longues soies, 1 antérieure externe et une subantérieure interne; une douzaine de soies courtes réparties sur tout le sclérite forment des rangées transversales plus ou moins régulières.

THORAX

Pronotum: 4 + 4 *M*, les médians antérieurs et les latéraux intermédiaires courts avec 2-3 barbules, les sublatéraux intermédiaires et submédians postérieurs assez longs avec 1 seule longue barbule.

Mésonotum: 7 + 7 *M* bien nets dont 4 + 4 sur les bords latéraux, homologues aux B_2 à B_5 des tergites abdominaux des Projapygidés (cf. PAGÉS 1953); leurs tailles décroissent des plus antérieurs B_5, aux plus postérieurs B_2; ces derniers ne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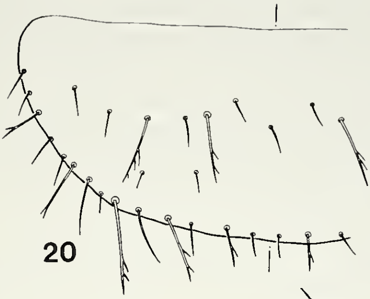
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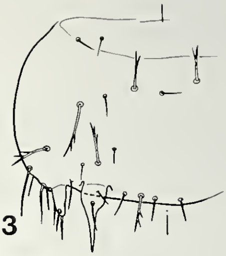
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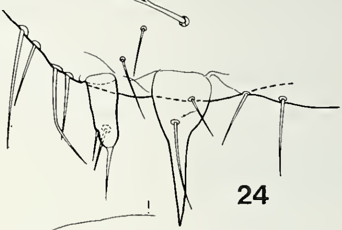
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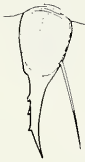
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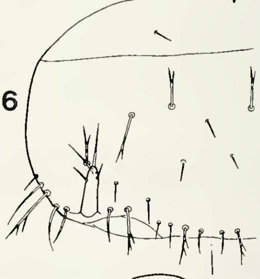
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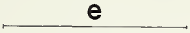

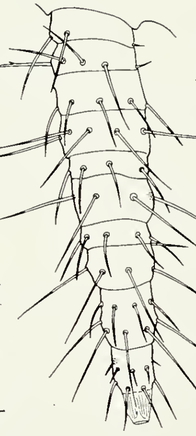
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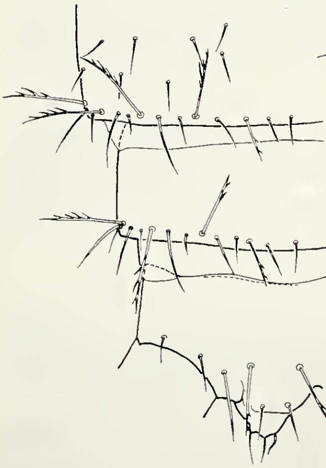
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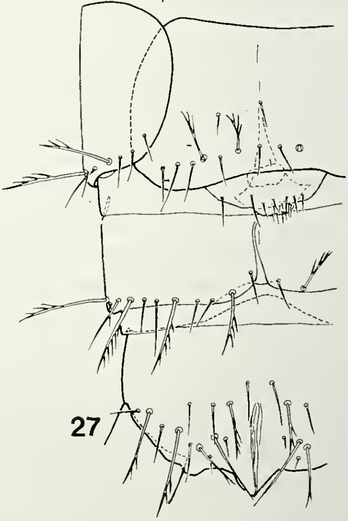
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présentent qu'une courte barbule subapicale, les 3 + 3 autres en montrant 2 ou 3; les 1 + 1 *M* médians antérieurs sont comme les B_2, courts et pourvus d'une seule barbule subapicale. On pourrait aussi considérer qu'il y a 8 + 8 *M* dont 5 + 5 le long du bord externe du sclérite si l'on admet que les 1 + 1 phanères médians postérieurs, courts, pourvus d'une minuscule barbule sont des *M* ou plus exactement des submacrochètes homologues des B_1; ce nombre de 8 + 8 *M* correspond à ce qu'indique et figure SILVESTRI (1905) pour la f. typ., alors que 7 + 7*M* est celui que l'on peut compter sur le dessin de la var. *guineensis* Silv. 1936, mais qui n'en posséderait que 6 + 6 d'après la diagnose donnée dans le même travail.

Métanotum: 6 + 6 *M* dont 3 + 3 correspondant aux B_2, B_3 et B_4 des urotergites. Comme pour le mésonotum, on pourrait admettre la présence de 7 + 7 *M* si l'on considère que les phanères homologues aux B_5 courts, avec 2 barbules, sont des *M* et non des submacrochètes, les embases ne permettant pas cette distinction. SILVESTRI (1905) indique 8 + 8 *M* comme au mésonotum, mais n'en représente que 7 + 7 sur sa fig. 9B; quant à la var. *guineensis*, elle n'en posséderait que 6 + 6 d'après le texte, la fig. XXI-2 en montre 6 + 6 nets et 1 + 1 courts, homologues aux B_5, comme ci-dessus (SILVESTRI 1936).

En résumé, je considère que les nombres typiques de *M* présents sur chacun des notums thoraciques sont, pour les spécimens du Maroc, les suivants:

Th. I: 4 + 4 *M*; Th. II: 7 + 7 *M*; Th. III: 6 + 6 *M*.

Mes observations ne me permettent pas de savoir si ce que je considère être des *sm* peuvent, chez les spécimens les plus âgés, devenir des *M*, ce qui pourrait expliquer une partie des divergences entre mes chiffres et ceux de Silvestri.

Pattes: assez courtes et trapues. Le fémur présente une longue soie apicale tergale et 2 autres apicales sternales, longues, de forme normale, à barbules pratiquement nulles; ces 3 phanères sont peu différenciés et difficilement reconnaissables sur les PI. SILVESTRI (1903a et b, 1905) écrit que le tibia est muni de 3 robustes soies dans sa partie inférieure distale. On n'observe en fait que les 2 calcars typiques des Rhabdura, accompagnés ou non suivant les espèces d'une ou plusieurs soies, au moins de même taille. C'est ce que représente SILVESTRI (1932) chez les *A. vesiculosus* de l'île de Rhodes. Chez les spécimens que j'ai pu examiner, ces 2 calcars sont relativement épais à la base et aigus à l'apex; ceux des PI sont lisses, aux PII et PIII au moins un d'entre eux présente 1 à 3 minuscules épines sur un côté. Griffes inégales peu arquées, la postérieure la plus développée; unguiculus nul aux PI, bien différencié aux PII et PIII; sur des exemplaires marocains fraîchement capturés j'ai pu

FIGS 19-28

Anajapyx vesiculosus Silv., exemplaires des stations maghrébines. - 19. Dar el Oued, sexe?, urotergite 1, e = 108 µm. - 20. id., urotergite 2, e = 108 µm. - 21. id., urotergite 3, e = 108 µm. - 22. Goulimine, ♂ de 1,90 mm, urotergites 8 à 10, e = 108 µm. 23. id., urosternite 1, e = 108 µm. - 24. id., détail de l'angle postérieur droit de l'urosternite 1, e = 45 µm. 25. Dar el Oued, sexe?, appendice subcoxal gauche, vue latérale interne, e = 45 µm. - 26. Goulimine, ♂, urosternite 2, e = 108 µm. - 27. id., urosternites 8 à 10, e = 108 µm. - 28. Dar el Oued, sexe?, cerque gauche, face tergale, e = 108 µm.

observer que la pelote prétarsale présente deux épaississements latéraux (=? “auxilia”, sensu SNODGRASS 1935) en forme de n minuscule, porteur chacun d’une pointe distale aiguë à leur angle sternal.

ABDOMEN

Tergite 1: 3 + 3 *M* correspondant aux A_1, B_1 et B_2 des Projapygidés; 1 + 1 *sm*, très courts, pourraient être assimilés aux B_3. Chez *A. vesiculosus*, SILVESTRI (1905) parle de 6 + 6 *M* pour les tergites 1 à 7, mais n’en figure que 5 + 5 sur le tergite 1 de sa fig. 9B; il n’indique pas la chétotaxie de ce tergite pour sa var. *guineensis*.

Tergite 2 : 7 + 7 *M* correspondant aux A_1, A_2, et B_1 - B_5; les B_1 et B_5 sont courts avec une seule barbule subapicale.

Tergites 3 à 7 : 8 + 8 *M* (A_1-A_3, B_1-B_5); ici seuls les B_1 sont courts. Pour les tergites 2 à 7 de sa var. *guineensis* SILVESTRI (1936) indique et figure 7 + 7 *M*, les B_1 étant présents, mais indifférenciés. Quant au plus grand individu de l’île de Rhodes, SILVESTRI (1932) représente 8 + 8 *M* nets sur le tergite 4 (fig. XV-5) et écrit que “i suoi caractteri concordano con quelli degli esemplari italiani” reconnaissant ainsi implicitement que la description de 1905 n’est pas totalement correcte, ce qui est exact sur bien des points.

Tergite 8 : 5 + 5 *M* postérieurs, les 1 + 1 médians courts avec 2 barbules, les autres environ 2 fois plus longs avec 3-4 barbules.

Urite 9 : comme je l’ai indiqué dans ma note de 1990, il n’y a pas toujours de limite entre le tergite et les sternopleurites, on n’observe le plus souvent qu’un seul anneau qui porte 7 + 7 *M* postérieurs dont 4 + 4 visibles tergalement et 3 + 3 autres sternaux; les 1 + 1 tergaux médians courts avec 2 barbules, les autres 1 fois 1/2 à 2 fois plus longs avec 3-4 fortes barbules.

Tergite 10 : 1 + 1 *M* médians et 3 + 3 soies le long de l’insertion de la base des cerques.

Valvules supra-anales : avec 1 + 1 + 1 soies courtes.

La chétotaxie des sternites 1 à 7 des spécimens marocains peut être décrite ainsi qu’il suit en la comparant à *A. vesiculosus* f. typ. et var. *guineensis*.

Sternite 1 : Présternite: 1 + 1 soies très courtes, sublatérales. Scutum: 5 + 5 *M* pourvus de 2 barbules, sauf les 1 + 1 médians antérieurs qui n’en possèdent qu’une subapicale: on notera 2 + 2 phanères latéraux postérieurs et subpostérieurs, externes par rapport aux styles, aussi longs que les *M* et qui sont en fait des *sm*. Sur la fig. 9A de son travail de 1905, SILVESTRI figure 7 + 7 *M* sur ce sternite, disposés bien différemment de ce qu’il représente sur les spécimens de la mer Egée; chez ces derniers les 2 + 2 *sm* décrits ci-dessus sont différenciés en *M*; chez *guineensis*, il en décrit et figure 5 + 5.

Sternites 2 - 7 : Préscutum: 1 + 1 minuscules soies submédianes. Scutum: 6 + 6 *M* par suite de la différenciation en *M* des *sm* latéraux subpostérieurs; on notera que le *M* situé en avant de l’appendice subcoxal du sternite 1 est inséré ici en avant de la vésicule exsertile, ce qui est un indice de plus en faveur de l’homologie que je proposais entre ces appendices et les vésicules exsertiles (Pagés 1989). La fig. 8 de 1905 ne montre apparemment que 2 + 2 *M* bien développés, mais on peut en admettre en fait 5 + 5, la paire manquante par rapport à mes observations serait celle correspondant aux styles; le texte ne parle pas de ces sternites. On en compte 7 + 7 sur la figure XV-10 de la mer Egée, la paire supplémentaire étant insérée entre les styles et les vésicules exsertiles. Quant à *guineensis*, il en posséderait 5 + 5 par suite de la non différenciation des 1 + 1 *M* médians postérieurs.

En résumé, je considère comme typique pour les 7 premiers sternites des spécimens marocains la chétotaxie suivante: Sternite 1: 5 + 5 *M*. Sternites 2-7: 6 + 6 *M*.

Sternite 8: 2 + 2 *M* postérieurs assez longs.

Sternite 10: 4 + 4 *M* dont 1 + 1 médians subantérieurs assez longs avec 2-3 barbules, 1 + 1 postérieurs submédians un peu plus courts avec 1 barbule subapicale, et 2 + 2 longs, pourvus de 2 fortes barbules, le long de l'insertion de la base des cerques.

Appendices subcoxaux: avec chez les adultes 2 soies, la plus proximale la plus courte; chez les jeunes individus n'est présente que la soie la plus distale. Dans ses notes de 1903 et de 1905 Silvestri écrit que le "processo del primo urosternite .... è fornito di tre o quattro setole brevi sulla parte globosa et di una piccola setola all'apice". Ce texte est en contradiction totale avec les figures qu'il donne en 1905, 1932 et 1936 sur lesquelles il ne représente que 2 soies sur la partie globuleuse et aucune à l'apex de l'appendice. Je ne sais comment expliquer cette contradiction qui doit être un *lapsus calami*.

Styles: présents sur les sternites 1 à 7; au sternite 1 ils sont toujours pourvus de 3 soies, 1 apicale longue et 2 subapicales nettement plus courtes, la sternale 2 fois plus longue que la latérale externe; aux sternites suivants la taille des styles augmente et leur chétotaxie se complique par l'apparition de 2 soies courtes sur leur côte interne.

Vésicules exsertiles: typiques sur les sternites 2 à 7.

Papilles génitales: typiques (Pagés 1961, 1989; Smith 1960). En ce qui concerne la papille ♂, deux compléments soivent être apportés à ma description de 1989: 1) la papille ♂ comprend, comme chez la ♀, 2 parties, 1 base portant le mamelon au sommet duquel s'ouvre le gonopore; 2) le bord du gonopore présente 4 minuscules lobes arrondis, deux antérieurs, 2 postérieurs, correspondant aux 4 valves triangulaires des Campodeidae.

CERQUES

Leur segmentation me paraît plus complexe et moins stable que ce qui a été proposé par Silvestri (1903-1936) et Smith (1960).

Un cerque typique de *A. vesiculosus* peut se décrire ainsi qu'il suit: une base assez courte, plus ou moins recouverte par le dixième tergite, avec 3 soies assez longues du côté externe et 1-2 minuscules sensilles sétiformes face interne; une ligne d'autonomie la sépare du reste du cerque. Viennent ensuite 5 longues soies formant un demi-verticille sur la moitié externe du cerque; en général 2 de ces soies, la seconde (tergale) et la quatrième (substernale) portent 1 à 3 barbules plus ou moins développées; une minuscule sensille sétiforme insérée face interne complète ce demi-verticille (=D). Au-delà se succèdent régulièrement des verticilles de soies courtes (=C) et d'autres de soies plus longues (=L); en règle très générale un article porte un C proximal et un L distal. Cependant dès sa première description Silvestri note que chaque article peut présenter "un anello dopo la serie prossimale", mais que cet "anello" n'est qu'un léger repli de la cuticule et qu'il n'indique pas une limite entre 2 articles. Si cela s'avère exact la plupart du temps, on constate de nombreuses anomalies dont la suivante me paraît la plus intéressante: il n'y a pas toujours de ligne de séparation entre D et le premier C (=C1), alors qu'il en existe souvent une très marquée, allant jusqu'à la séparation complète entre ce C1 et le L suivant (=L1), lui-même toujours nettement séparé du C suivant (=C2); en définitive on peut rencontrer des individus ayant D, C1 et L1 séparés comme sur la fig. 15 ou formant un complexe par fusion totale ou encore avoir D et C1 réunis et séparés de L1 ou, enfin, D indépendant d'un complexe C1-L1.

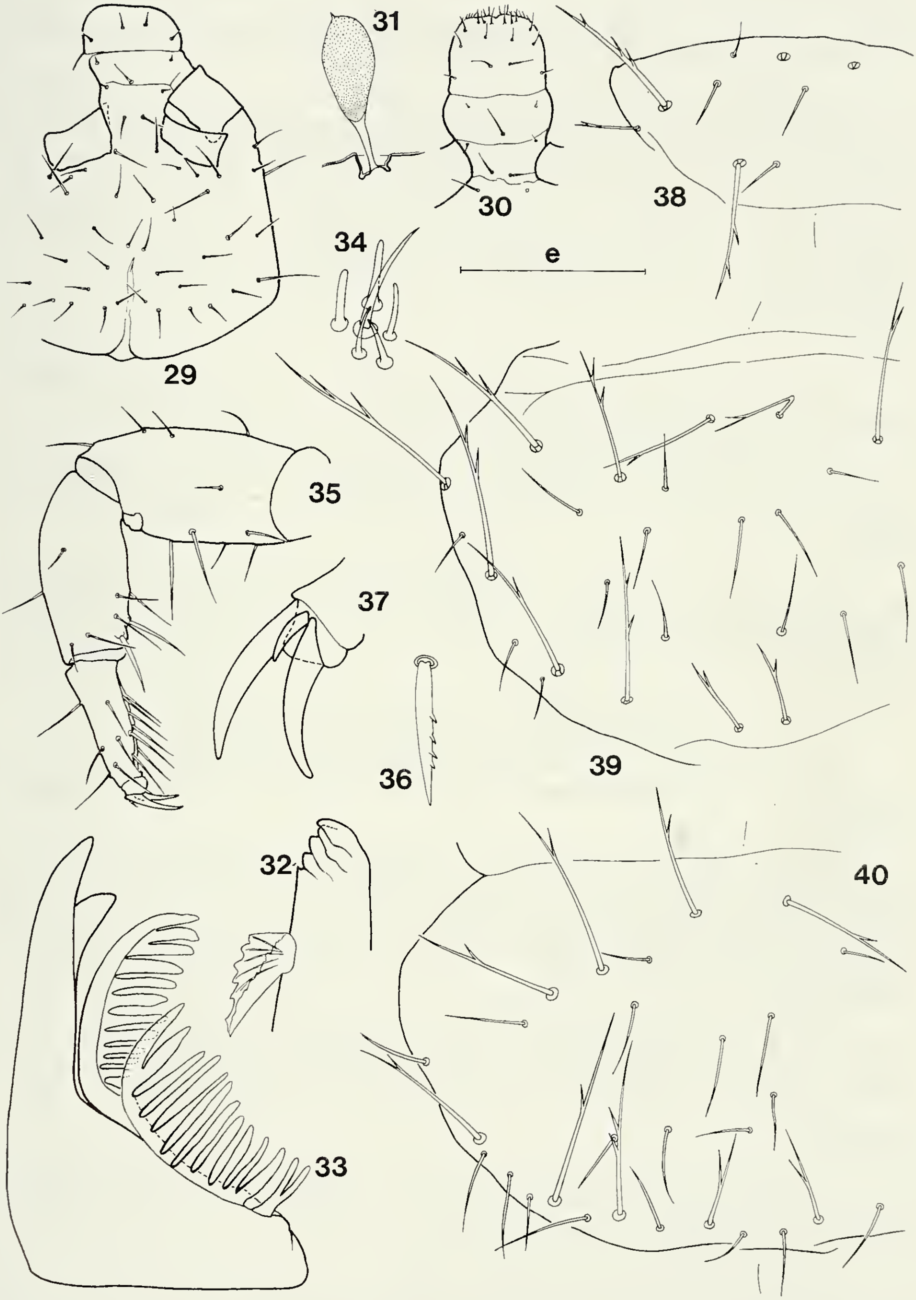
Cette grande instabilité dans la segmentation de la partie basale des cerques serait très intéressante à étudier plus complètement, surtout si l'on remarque que le complexe D-C1-L1 correspond en partie, d'une part aux articles fusionnés de la base des cerques d'*Octostigma*, d'autre part à ceux qui, chez *Symphylurinus* Silv., *Pentacladiscus* San Martin et *Biclavula* San Martin (ces trois genres appartenant aux Projapygidae), présentent des caractères sexuels secondaires généralement chez les ♂, mais aussi chez les ♀.

En admettant qu'un article typique soit pourvu d'un C et d'un L, les cerques des *A. vesiculosus* sexués présenteraient donc 10 verticilles répartis entre 5 articles théoriques, plus l'anneau portant le demi-verticille D, plus la base, soit 7 "articles" au total; la fig. 10 de Silvestri (1905) représente exactement ce cas si l'on ajoute à son dessin le verticille de soies très courtes qu'il a omis sur le dernier article. Faisant suite à ce dernier s'observe l'exutoire membraneux des glandes cercales qui, comme chez tous les Projapygoidea, est finement plissé longitudinalement: contrairement à ce que j'ai écrit dans mes notes antérieures sur les Projapygoidea je ne considère plus cet exutoire, dénommé alors "fusule", comme un article vrai (cf. Pagés 1951 et sequ.).

On remarquera que chez les Anajapygidae le dernier article d'un cerque (celui précédant l'exutoire) présente toujours un verticille proximal de soies très courtes et un distal de soies beaucoup plus longues, ce qui s'observe aussi chez *Octostigma herbivora* Rusek. Chez les Projapygidae c'est l'inverse, le verticille proximal est constitué de soies longues et le distal de soies toujours nettement plus courtes; c'est aussi le cas des articles à 2 verticilles des Procampodeidae.

Figs 29-40

Anajapyx carli n.sp. - 29. ♂ holotype, vertex, e = 158 µm. - 30. id., détail du clypéus et du labre, e = 63 µm. - 31. id., sensille piriforme du septième article de l'antenne gauche, vue latérale, e = 15 µm. - 32. ♀ paratype, extrémité distale de la mandibule gauche, face sternale, e = 63 µm. - 33. id., lacinia droite, e = 35 µm. - 34. ♂ holotype, palpe labial droit, e = 18 µm. - 35. ♀ paratype, PIII gauche, face postérieure, e = 105 µm. - 36. ♂ holotype, calcar distal du tibia de la PII droite, e = 36 µm. - 37. ♀ paratype, prétarse de la PIII droite, e = 36 µm. - 38. id., pronotum, e = 85 µm. - 39. id., mésonotum, e = 70 µm. - 40. id., métanotum, e = 70 µm.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Anajapyx carli n.sp. Figs 29-40, 41-46, 47-52

Matériel étudié. Inde: Ind-72/4 Tamil Nadu: Anaimalais Hills, 700-1000 m; holotype: ♂ de 1,58 mm: paratype: ♀ de 1,66 mm; 17.01.73, leg. R. Mussard.

Ces spécimens mal fixés lors de leur récolte étaient très contractés et difficilement étudiables. Grâce au Dr. B. Hauser le traitement qu'il a appliqué à ces spécimens a permis de les regonfler en grande partie, mais certains segments sont restés déformés ou télescopés les uns dans les autres; le montage en suivant la technique des deux lamelles porte-objet (LIENHARD 1994) m'a permis de faire pratiquement toutes les observations utiles pour la définition et la description de la nouvelle espèce.

TÊTE

Vertex et front: chétotaxie typique, les 3 grands phanères simples à peine plus longs que les 2 soies insérées près des angles de la base des antennes.

Clypéus et labre: identiques à ceux de *A. vesiculosus*.

Antennes: de 22 articles: la répartition des trichobothries s.l. est la suivante: articles 1-4 = 0; 5 = 3; 6 = 4; 7 = 2 + 1 piriforme; 8 = 3; 9 = 1; 10 = 2; 11 à 22 = 0.

Pièces buccales: semblables à celles de *A. vesiculosus*, en particulier les palpes labiaux et les processus palpiformes ne présentent aucune différence significative entre les 2 espèces.

THORAX

Pronotum: 3 + 3 *M* longs, à 2-3 barbules bien détachées.

Mésonotum: 8 + 8 *M* avec 1 à 3 barbules, les 1 + 1 médians postérieurs égalant à peine la moitié de la longueur des autres *M* et pourvus d'une seule barbule subapicale.

Métanotum: 7 + 7 *M*, les 1 + 1 *M* latéraux antérieurs indifférenciés; 1 à 2 barbules; les plus courts sont les médians postérieurs.

On notera que les *M* de cette espèce sont beaucoup plus fins que ceux de *A. vesiculosus* et cela au thorax comme à l'abdomen: de même les barbules sont nettes et bien détachées.

Pattes: semblables à celles de *A. vesiculosus*; elles présentent toutes 2 calcars, longs, épais, pourvus le long de leur bord interne de 3-5 barbules espacées, très courtes et aiguës. L'inguiculus est ici aussi nul aux PI, bien développé aux PII et PIII.

ABDOMEN

Tergite 1: 4 + 4 *M* (A_1, $B_{1\text{-}3}$).

Tergite 2: 6 + 6 *M* (A_1, A_2, $B_{1\text{-}4}$); le *M* représenté en position B_5 sur la fig. 42 est en fait inséré sur le pleurite.

Tergites 3 à 7: 7 + 7 *M* ($A_{1\text{-}3}$, $B_{1\text{-}4}$).

Les *M* de ces 7 premiers tergites ont jusqu'à 3 barbules bien développées sauf les *M* médians antérieurs (A_1) et médians postérieurs (B_1) qui ont toujours 1 seule barbule médiane ou subapicale.

Tergite 8: 4 + 4 *M* postérieurs, les 1 + 1 médians assez courts avec 1 barbule submédiane ou subapicale, les autres avec 2 barbules.

Urite 9: 6 + 6 *M* dont 4 + 4 tergaux et 2 + 2 sternaux, pourvus de 1 à 4 barbules.

Tergite 10: 1 + 1 *M* submédians subantérieurs avec 1 à 3 barbules, 3-4 + 3-4 soies assez longues le long du bord postérieur.

Valvule supra-anale: avec les 1 + 1 + 1 soies très courtes habituelles.

Sternite 1: 5 + 5 *M* avec 1 ou 2 barbules.

Appendices subcoxaux: typiques. L'holotype ♂ apporte la preuve du peu de valeur à attribuer au nombre de soies présentes sur la partie globuleuse de l'appendice: il a les 2 soies typiques sur l'appendice gauche et seulement la distale sur le droit.

Sternites 2-7: 7 + 7 *M* dont 3 + 3 disposés sur une rangée transversale subantérieure, 1 + 1 au-dessus des styles et 3 + 3 sur le bord postérieur. Au sternite 2 pratiquement tous les *M* n'ont qu'une seule barbule subapicale, mais ce nombre augmente d'un sternite à l'autre pour atteindre 4 barbules sur certains *M* du sternite 7.

Sternite 8: 2 + 2 *M* relativement courts, les médians avec 1 barbule subapicale, les autres avec 2 barbules.

Sternite 10: 4 + 4 *M* dont 1 + 1 subantérieurs submédians avec 1 barbule submédiane et 3 + 3 autres le long de la base des cerques, les plus internes avec 1 faible barbule, les autres avec 2-3 fortes barbules; 1 + 1 longues soies simples postérieures insérées du côté interne des *M* postérieurs submédians.

Styles 1 à 7: avec les 3 soies typiques des Rhabdura.

Vésicules exsertiles: typiques aux sternites 2 à 7.

Papilles génitales ♂ et ♀: typiques du genre.

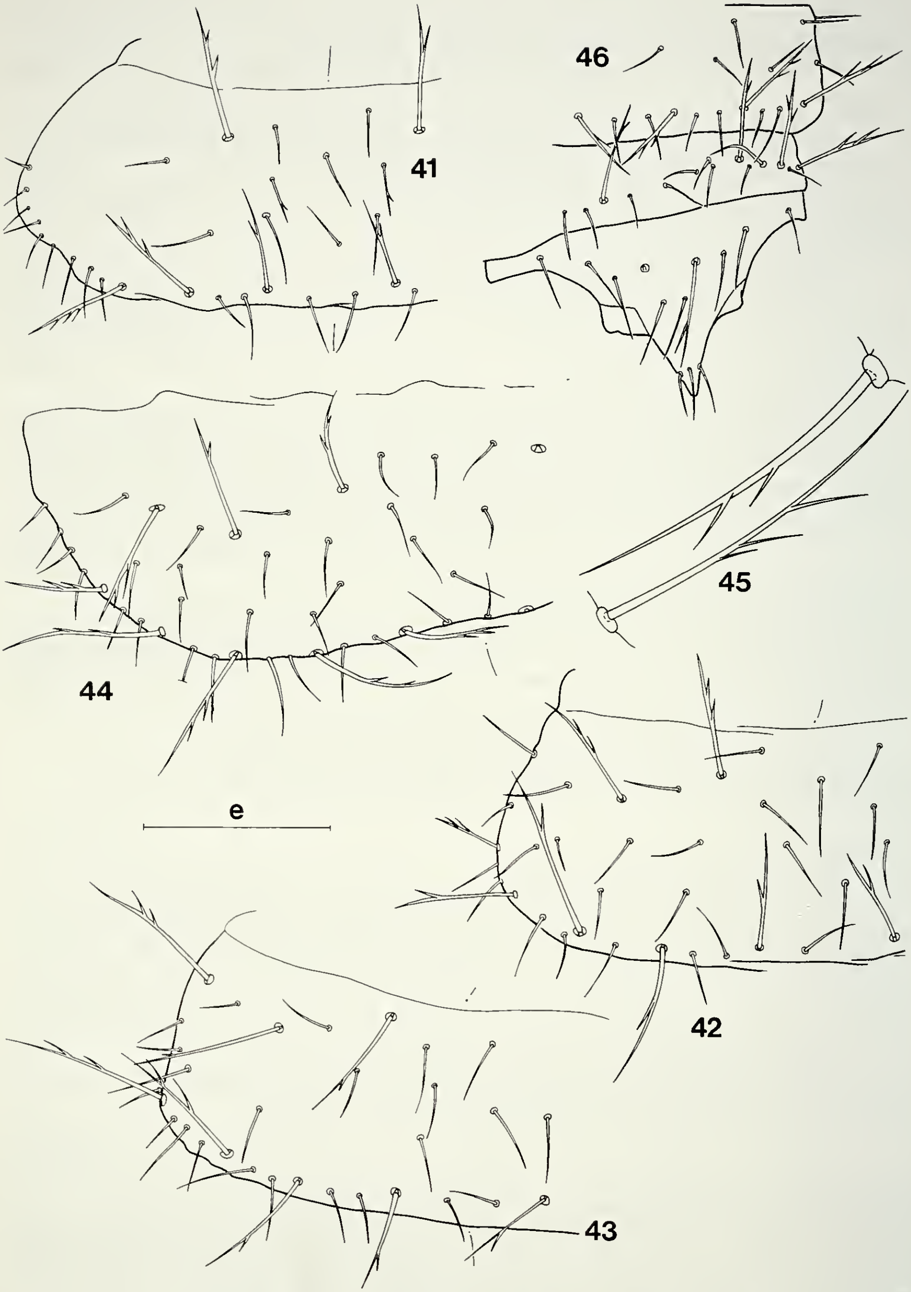
CERQUES

Ils sont parfaitement comparables à ceux de *A. vesiculosus* quant à la répartition des soies; on doit néanmoins faire les remarques suivantes: 1) Ils possèdent 12 verticilles complets ce qui donne 6 articles théoriques au lieu de 5 chez *A. vesiculosus;* 2) Chez le ♂ tous les verticilles, à l'exception des L1 et C2, sont séparés les uns des autres; 3) Chez la ♀ on observe la réunion des verticilles D-C1 et L1-C2.

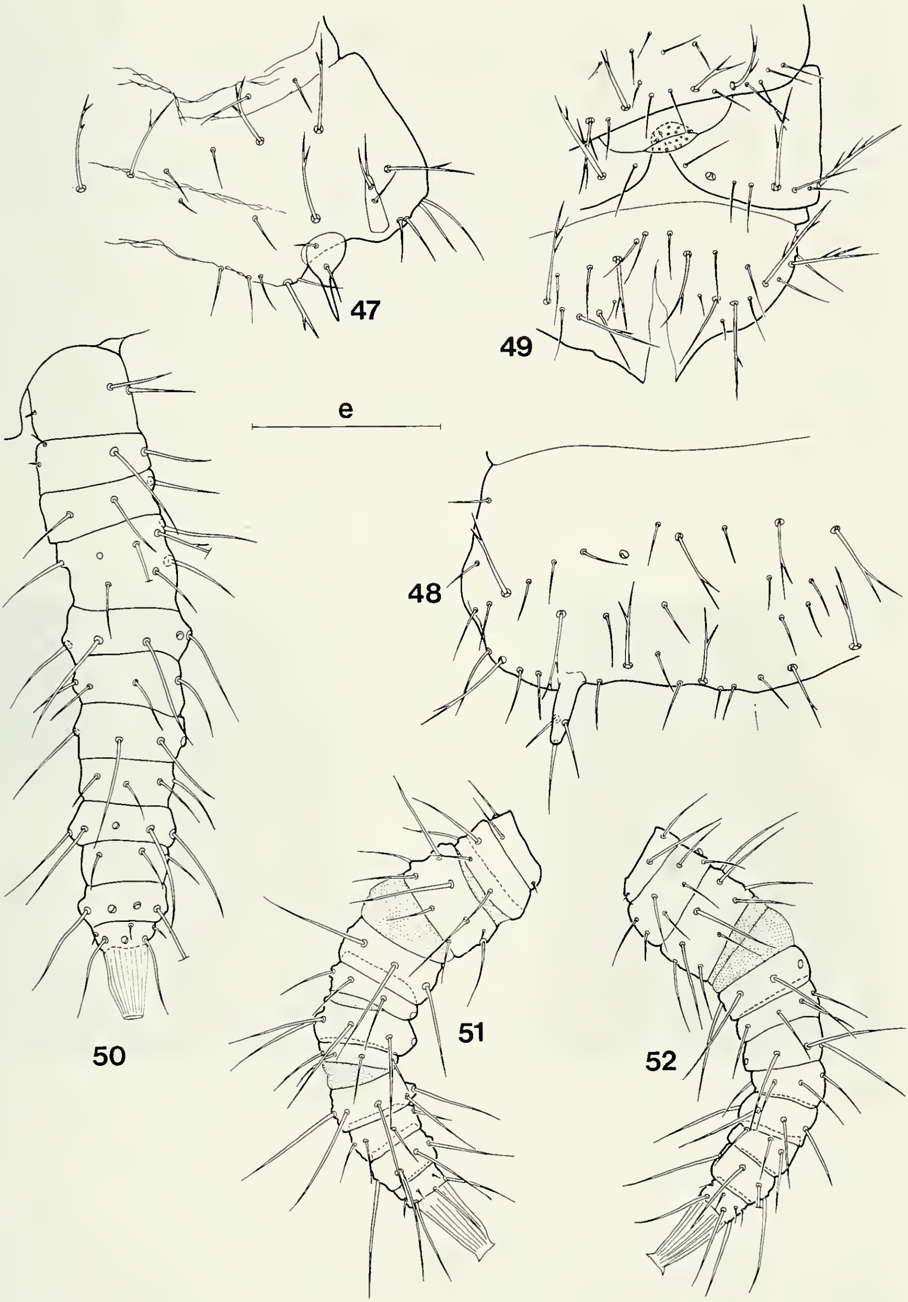
Les 2 cerques ont donc au total 8 "articles", plus l'exutoire.

Affinités: cette espèce se distinguera facilement de *A. vesiculosus* par la chétotaxie des sclérites thoraciques et abdominaux et par ses cerques.

Dérivatio nominis: Jean Carl (1877-1944), fut Conservateur du Département d'Entomologie, Sous-Directeur du Muséum d'histoire naturelle et Privat-Docent à l'Université de Genève. Il effectua plusieurs missions d'exploration dont une, durant l'hiver 1926-1927, se déroula dans la partie méridionale de l'Inde où il explora autant en zoologiste qu'en géographe 3 massifs montagneux des Ghates occidentales dont celui des Anaimalais Hills, les deux autres étant les Nilgiri Hills et le plateau des Palnis (CARL 1930). Je lui dédie cette espèce en hommage à son rôle de pionnier en zoogéographie et en biogéographie de terrain pour cette région du globe (cf. P. REVILLIOD 1944).



Figs 41-46. *Anajapyx carli* n.sp. - 41. ♀ paratype, urotergite 1, e = 85 µm. - 42. id., urotergite 2, e = 85 µm. - 43. id., urotergite 3, e = 85 µm. - 44. id., urotergite 7, e = 85 µm. - 45. id., B_3 gauche de l'urotergite 4 et B_3 gauche de l'urotergite 6, e = 39 µm. - 46. ♂ holotype, urotergites 8 à 10, e = 105 µm.

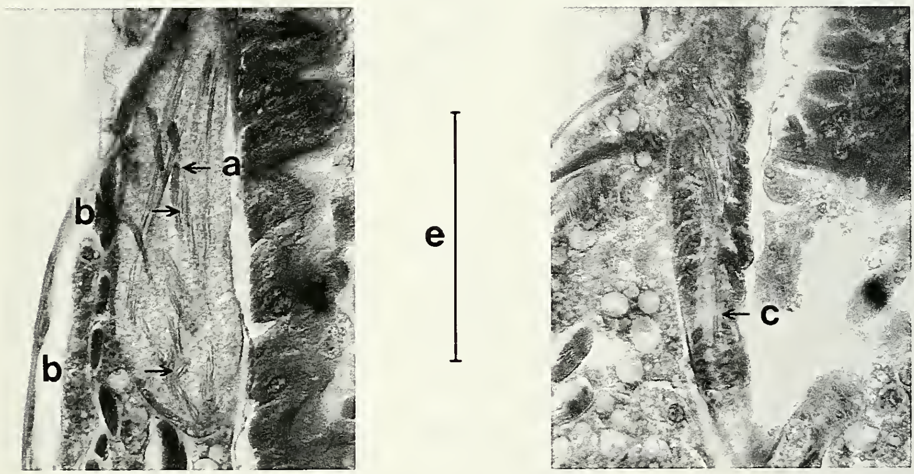


FIGS 47-52. *Anajapyx carli* n.sp. - 47. ♀ paratype, urosternite 1, e = 85 µm. - 48. id., urosternite 2, e = 85 µm. - 49. ♂ holotype, urosternites 8 à 10, la chétotaxie de la papille génitale n'est pas représentée, e = 105 µm. - 50. id., cerque droit, face tergale, e = 85 µm. - 51. ♀ paratype, cerque gauche, face tergale, e = 112 µm. - 52. id., face sternale du même cerque, e = 112 µm.

NOTES SUR LES GAMETES ♂ DES **Anajapygidae** Figs 53-54

Silvestri (1905) décrit et figure les appareils génitaux ♂ et ♀ d'*A. vesiculosus*. Le ♂ présenterait de chaque côté de l'abdomen 2 testicules dont le plus développé s'étend de la région antérieure du quatrième segment au sixième, le second est localisé dans le sixième segment. Chez la ♀ il y a aussi 2 ovarioles de chaque côté, 1 dans l'urite 4, l'autre dans le sixième; au point de rencontre des 2 oviductes dans le huitième urite, s'observe une petite spermathèque. Il ne dit rien des gamètes.

Parmi les *Anajapyx* étudiés ici j'ai rencontré 4 ♂ dont les canaux déférents sont remplis de produits génitaux groupés en paquets plus ou moins compacts de longs cordons de spermatides ou spermatozoïdes de structure complexe: 3 ♂ d'*A. vesiculosus* dont 2 montés dans le milieu de Berlese mesurant respectivement 1,54 mm (station 203: Zagora), et 1,90 mm (station 56: Goulimine); le troisième de 1,68 mm (station marocaine inconnue) fixé au Bouin-Hollande, a fourni une série de coupes horizontales colorées à l'hémalun-éosine; le ♂ d'*A. carli* de 1,58 mm est le quatrième spécimen.



53 54

Figs 53-54

Anajapyx vesiculosus Silv., exemplaire marocain ♂ de 1,68 mm fixé au Bouin-Hollande, coupe horizontale de 7,5 µm, coloration à l'Eosine-Hémalun de Masson. - 53. Coupe horizontale du canal déférent gauche montrant la coiffe (a) et l'axe central des spermatides (b), e = 72 µm. - 54. Coupe au niveau du carrefour des 2 spermiductes. A noter l'unique spermatozoïde présent dans la partie tout à fait terminale du spermiducte gauche (c), e = 72 µm. (Zeiss Axioskop, contraste interférentiel différentiel [CID], Polaroid 57 Professional - phot. Hauser & Lienhard).

La longueur occupée par les paquets de cordons de gamètes semble dépendre de la taille et de l'espèce à laquelle appartient l'individu; chez le ♂ fixé ils atteignent à peine la limite entre les urites 5 et 6; chez le ♂ de Zagora ils sont localisés dans les segments 5 et 6; chez celui de Goulimine ils sont visibles du second urite au début du huitième; quant au ♂ de l'Inde, très contracté, ils s'étendent pratiquement de la limite métathorax-urite 1 à la papille génitale.

En moyenne un cordon a, chez les ♂ marocains, une longueur d'environ 95 µm et une largeur moyenne de 3 µm; chez *A. carli* ces dimensions sont approximativement de 150-200 µm et 2,1 µm; ces chiffres sont vraisemblablement sous-estimés, surtout pour la longueur, les cordons ondulant aussi bien verticalement qu'horizontalement dans la lumière des canaux déférents.

La découverte fortuite de ces produits sexuels n'a pas permis de mettre en œuvre des méthodes d'examens spécifiques pour leur étude fine; cependant l'utilisation du contraste de phase sur les individus montés dans le milieu Berlese a permis de faire un certain nombre d'observations que les coupes sériées ont confirmées.

Les cordons apparaissent aux plus forts grossissements, aussi bien chez *A. vesiculosus* que chez *A. carli*, comme de longs rubans pourvus d'un axe central réfringent, sombre, flanqué de 2 bandes très pâles; chez les ♂ marocains la partie la plus antérieure d'un cordon est recouverte d'une sorte de coiffe réfringente hémisphérique de 1,6 µm de long sur 3,7 µm de large; cette coiffe est surmontée d'une minuscule pointe de 1 µm environ: chez *A. carli* rien de tel n'a pu être observé.

La structure fine d'un de ces cordons se révèle lorsque l'un d'eux fait une ondulation très serrée vers l'objectif; on peut alors observer 7 points foncés, parfaitement délimités, disposés 2-3-2, espacés les uns des autres de 1,52 µm; ils représentent à mon avis les axes des spermatides constituant chaque cordon.

Cette structure a été confirmée grâce à la ♀ de 2,02 mm de la station 61 (Safi) dont la spermathèque, très importante, renferme 4 de ces cordons, très raccourcis: 70 µm de long en moyenne; ici les spermatozoïdes de chaque cordon sont réunis à une extrémité, sans coiffe discernable et s'écartent largement les uns des autres, en éventail, à l'autre extrémité; il est alors possible de compter 7 filaments d'une largeur de 0,5-0,7 µm; il semble que ces 4 cordons soient disposés tête-bêche 2 par 2.

Ces cordons paraissent être comparables à ce que Bareth (1968) a décrit chez les Campodeidae, mais avec 3 importantes différences: apparemment pas de "filament axial", touffes de spermatides formées d'un très petit nombre d'éléments et surtout par d'enroulement sur eux-mêmes de ces cordons avant émission.

Le mode de transmission des gamètes reste inconnue, mais il est très vraisemblable de supposer que le ♂ émet des spermatophores renfermant un très petit nombre de cordons de spermatozoïdes comme chez les Campodeidae.

PROPOSITION POUR UNE CLASSIFICATION DES **Anajapygidae**.

Cette famille ne comporte jusqu'à présent que le genre *Anajapyx* Silv., 1903; il comprendrait 6 espèces et une "variété" au sens de Silvestri: *A. vesiculosus* Silv. du bassin méditerranéen. *A. vesiculosus* var. *guineensis* Silv. de la République de Guinée, *A. hermosus* Smith de Californie, 3 autres du Mexique, *A. mexicanus* Silv., *A. amabilis* Smith, *A. menkei* Smith et enfin *A. carli* n. sp. de l'Inde.

Il est très difficile de comparer ces différents taxons pour 3 raisons principales. Tout d'abord les erreurs présentes dans les premières notes de SILVESTRI (1903a, b, 1905) qui, par exemple, faussent complètement la clef dichotomique donnée par Smith (1960) et la rendent inutilisable. La seconde raison est la disparité des descriptions, chaque auteur prenant en compte des caractères négligés par les autres. Enfin, c'est vraisemblablement le plus important, nous ignorons tout du développement postembryonnaire de ces Diploures; par exemple et par comparaison avec ce qui est connu chez d'autres Rhabdura, les figures des papilles génitales ♀ dont SMITH (1960: figs 22 et 25) fait un caractère distinctif entre ses *A. amabilis* et *A. menkei* ne représentent à mon avis que des stades du développement postembryonnaire, celle d'*amabilis* étant la plus "jeune".

Après analyse des descriptions de SILVESTRI, de SMITH et en fonction de mes observations, je suggère la systématique suivante pour ces 7 taxons.

Anajapyx Silvestri, 1903.

1) *A. vesiculosus guineensis* Silv. doit être considéré comme une bonne espèce par sa chétotaxie générale et ses cerques, la longueur relative de l'unguiculus par rapport aux griffes des tarses me parait une caractéristique très secondaire: *Anajapyx guineensis* Silv. **stat. n.**.

A) *A. mexicanus* Silv., *A. menkei* Smith et *A. amabilis* Smith ne sont vraisemblablement que des stades du développement postembryonnaire d'une même espèce; seule une étude comparative approfondie de tous les individus appartenant à ces 3 taxons doit précéder toute mise en synonymie.

3) *A. vesiculosus* Silv. et *A. carli* n. sp. seraient, pour l'instant, les espèces les mieux définies du genre *Anajapyx*.

Paranajapyx gen. n.

Diagnose: Appartient (sous réserve) à la famille des Anajapygidae; Habitus et coloration typiques des Projapygoidea. Ce genre est caractérisé par des antennes de plus de 24 articles, la présence de trichobothries antennaires au-delà du 14ème article, des mandibules à 5 dents et 2 denticules dorsaux, la lacinia avec 3 lames pectinées; les 3 premiers caractères le rapprocheraient d'*Octostigma* Rusek (Projapygoidea, Octostigmatidae Rusek), mais la structure de la lacinia l'en écarterait, même si un nouvel examen du type d'*hermosus* mettait en évidence la présence de 4 paires de stigmates thoraciques: il conviendrait alors de transférer *Paranajapyx* de la famille des Anajapygidae à celle des Octostigmatidae Rusek.

Espèce-type: *Anajapyx hermosus* Smith 1960

Derivatio nominis. Préfixe grec παρα (= près de, à côté de) et *Anajapyx*.

A PROPOS DES TYPES DE MES ESPECES GENEVOISES DE **Japygidae**.

Dans les collections du Muséum d'histoire naturelle de Genève (Département des Arthropodes et d'Entomologie I) sont conservés tous les exemplaires des espèces nouvelles que j'ai décrites depuis 1975 dans la série *Dicellurata Genavensia* I à XXI.

J'ai pris grand soin à la fin de chaque étude de répartir les individus examinés dans des tubes dont j'ai rédigé à la main, pour chaque taxon, les étiquettes indiquant s'il s'agit de l'holotype ou du (des) paratype(s) correspondant(s).

Or je me suis aperçu que, si dans mes descriptions, j'indiquais toujours en détail pour chaque espèce le sexe et la taille de tous les individus étudiés qui pour moi appartenaient à la série-type de l'espèce, j'ai négligé, pour quelques espèces, d'en désigner l'holo- et le(s) paratypes(s) comme spécifié sur les étiquettes correspondantes.

Pour remédier à cet état de chose j'indique ci-après pour les espèces concernées, précédée du numéro respectif de la série genevoise, les exemplaires que j'ai étiquetés être les holotypes et les paratypes.

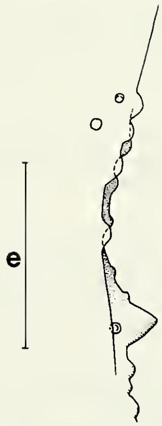
III – 1977: *Parindjapyx aelleni* Pgs: je désigne comme lectotype la ♀ de 4,00 mm et comme paralectotypes les 2 autres ♀.

IV – 1977: *Parajapyx* (*P.*) *genavensium* Pgs: je désigne comme lectotype le ♂$_3$ de 2,4 mm et comme paralectotypes les 2 autres ♂.

XII – 1983: *Japyx insuetus* Pgs: je désigne comme lectotype le ♂ de 4 mm et comme paralectotypes l'autre ♂ et la ♀; *Metajapyx phitosi* Pgs: je désigne comme lectotype le ♂ de 4,5 mm et comme paralectotype la ♀$_1$.

A PROPOS D'*Unjapyx mussardi* Pagés, 1993

Une erreur s'est glissée dans la description et l'illustration concernant cette espèce marocaine. La Fig. 13 (p. 350) donnant une vue tergale de l'armature des cerques, montre au cerque gauche, le premier tubercule de la marge prédentale, le plus proximal, recouvert de pointillés ce qui veut dire qu'il appartiendrait à la rangée



55

FIG. 55

Unjapyx mussardi Pagés, ♀ holotype - 55. Marge interne du cerque gauche après correction, face tergale, e = 125 µm.

inférieure. Le texte (p. 354) donne pour ce cerque la formule: 2 + 1/3 + 2 tubercules, incompatible avec celle représentée Fig. 13: 2 + 1 / 4 + 2, alors que d'après la Fig. 14 la rangée inférieure ne compterait que 3 + 2 tubercules.

En réalité le premier tubercule proximal du cerque gauche appartient à la rangée supérieure; par conséquent la formule exacte est: 3 + 1 / 3 + 2 tubercules au cerque gauche.

La Fig. 55 du présent travail représente la marge interne du cerque après correction.

REMERCIEMENTS

Je suis très reconnaissant au Professeur B. Condé d'avoir bien voulu rechercher dans les carnets de chasse du regretté P. Remy, les annotations précises sur les localités et biotopes de capture du *Procampodea macswaini* et des *Anajapyx* étudiés dans cette note.

Sans le remarquable travail de démontage-remontage de la préparation de la ♀ de *P. macswaini* effectué par le Dr. B. Hauser, Conservateur du Département des Arthropodes et d'Entomologie I et le Dr. C. Lienhard, Chargé de recherche dans le même département, les comparaisons entre les deux espèces de *Procampodea* connues n'auraient pu être faites; je les remercie très vivement pour la peine qu'ils se sont donnée pour me permettre ces observations inédites.

Je tiens à remercier Mme B. Rossire qui a mis au net mon manuscrit ainsi que Mlle F. Marteau et M. G. Roth qui ont reporté sur calque mes dessins originaux.

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