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A review of Iophonidae, Myxillidae and Tedaniidae occurring in the South East Pacific (Porifera: Poecilosclerida)

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A review of Iophonidae, Myxillidae and Tedaniidae occurring in the South East Pacific (Porifera: Poecilosclerida).- Based on collections from the coasts of Chile, Peru, and the Galapagos Islands, the SE. Pacific species of *Iophon*, *Myxilla* and *Tedania* are revised. Descriptions and illustrations are provided for eleven previously known species (including thirteen new synonymy proposals). Six new species are described: *Iophon chilense*, *I. timidum*, *I. tubiforme*, *Myxilla (E.) dracula*, *M. (B.) asymmetrica*, and *Tedania (T.) galapagensis*. A key for the identification of the species is included. The results of this study provided the basis for a revised classification of related genera and a new family assignment of *Iophon*, *Myxilla* and *Tedania*. In accordance with suggestions in the recent literature *Iophon* is assigned to the revived family Iophonidae Burton, 1929 of the suborder Microcionina Hajdu *et al.*, 1994. *Myxilla* and *Tedania* are assigned to different families of the suborder Myxillina, viz. a restricted Myxillidae Topsent, 1928 and Tedaniidae Ridley & Dendy, 1886 both of the suborder Myxillina Hajdu *et al.*, 1994. It is demonstrated that the *Myxilla*-like genera *Burtonanchora* de Laubenfels, 1936, *Ectyomyxilla* Lundbeck, 1909 and *Stelodoryx* Topsent, 1904, are based on characters without phylogenetic significance. It is proposed to retain these as subgeneric units within *Myxilla*. On similar grounds, *Trachytedania* Ridley, 1881 and *Tedaniopsis* Dendy, 1924, are considered subgenera of *Tedania*. Diagnosis and generic composition of the families are discussed.

Key-words: Iophonidae - Myxillidae - Tedaniidae - SE. Pacific - Taxonomy

INTRODUCTION

Numerous species of Poecilosclerida are reported from the coasts of the South East Pacific (Ridley 1881; Ridley & Dendy 1886, 1887; Wilson 1904; Thiele 1905; De Laubenfels 1939; Desqueyroux 1972, 1976, Desqueyroux-Faúndez, 1990;

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HAJDU & DESQUEYROUX-FAÚNDEZ 1994) and adjacent areas in the South West Atlantic (BURTON 1932, 1940; SARÀ 1978). Among the poecilosclerids, particularly the genera *Iophon*, *Myxilla* and *Tedania* are well-represented. However, type specimens of newly described species from the area and specimens assigned to them subsequently have never been revised, so the fauna is not well-known. Through her contacts with many Chilean institutions, the senior author has assembled a comprehensive collection of sponges from most areas of the extensive coastline of Chile; additional samples from Chile, Peru and the Galapagos Islands were obtained from the collections of the former Smithsonian Oceanographic Sorting Centre. In addition to this, the type and other specimens of previously described species were borrowed from other institutions, and this combined comprehensive collection has been revised by us. The present study is one of an ongoing series of studies of the Poecilosclerid sponges of the South East Pacific made by the senior author (cf. HAJDU & DESQUEYROUX-FAÚNDEZ 1994).

The extensiveness of the available material enabled us to make a contribution to the improvement of the classification of the Poecilosclerida initiated recently by HAJDU *et al.* (1994). The large number of species of the genera *Iophon*, *Myxilla* and *Tedania* described in the study area and adjacent areas induced us to concentrate the present study on these genera. A further reason is that they occupy key positions in the preliminary changes in the Poecilosclerida classifications proposed by HAJDU *et al.* (1994).

Assignment of species to genera and families of the myxillid Poecilosclerida is problematic because of the lack of consensus among recent authors over their content and relationships. VAN SOEST (1984) employed a wide diagnosis of Myxillidae based on the presence of diactinal (tylote or strongylote) ectosomal spicules and a reticulate choanosomal skeleton. Thus diverging genera such as *Iophon*, *Myxilla*, *Acarnus*, *Tedania*, and *Lissodendoryx* were included in a single family Myxillidae. BERGQUIST (1978) and BERGQUIST & FROMONT (1988) assigned *Tedania* to a separate family Tedaniidae based on the absence of chelas and the possession of onychaetes; they emphasized an isotropic choanosomal skeleton as a synapomorphy for a more restricted Myxillidae. Many authors, e.g. BOURY-ESNAULT & VAN BEVEREN (1982) followed in part BERGQUIST (1978).

In their preliminary review of Poecilosclerid characters, HAJDU *et al.* (1994) proposed an extensive reorganization of the genera formerly considered to be "myxillids". They observed a striking consistency in the presence or absence of toxas and the chela morphology: species and genera with arcuate and anchorate chelas (together named "tridentate" chelas) never have toxas, (with some notable exceptions, e. g. spp. of *Dendrocia*); these are confined to sponges possessing palmate chelas. This was in line with a separation between palmate and "tridentate" coelosphaerid sponges made earlier by LÉVI & LÉVI (1983). These authors proposed to recognize two families of fistular Poecilosclerida, Coelosphaeridae with arcuate chelas and Cornulidae with palmate chelas. LÉVI & LÉVI (1983) did not mention that most of their Cornulidae had microspined tylote or strongylote apices. HAJDU *et al.* (1994) suggested to include other genera with palmate chelas into the Cornulidae, and to de-emphasize the fistular growth form. The genera concerned are *Acarnus* (cf. VAN SOEST *et al.*, 1991 for a revision), *Megaciella* and also *Iophon*, all three with microspined tylotes. The latter genus, however, is a less clear-cut case because of the lack of toxas, the possession of anisochelas and the peculiar autapomorphous bipocilla. Moreover, if Iophon is included in the Cornulidae in the widened sense, the family name has to change to Iophonidae Burton, 1929. VAN SOEST *et al.* (1994) revised the Cornulidae s.s. and concluded these are a closely related assemblage probably related to *Iophon* and *Acarnus*; however, they did not include specimens of *Iophon* in their studies. The present extensive collections contain ample material of this genus allowing a comparison with the results of Van Soest *et al.* (1994).

A further proposal of HAJDU *et al.* (1994) is a separation of myxillids possessing anchorate chelas (e.g. *Myxilla*) and those possessing arcuate chelas (e.g. *Lissodendoryx*). The substantial number of *Myxilla* s.l. species found in the study area is used to narrow down the differences between the proposed Myxillidae s.s. and an extended Coelosphaeridae. The generic contents of the Myxillidae s.s. is discussed on a preliminary basis. The Coelosphaeridae s.l. (including *Lissodendoryx*) will be treated in a forthcoming paper.

HAJDU *et al.* (1994) expressed uncertainty over the distinctness of a family Tedaniidae. The substantial number of *Tedania* species in the study area as well as a large number of borrowed type slides available to us enabled us to revise this group.

The revisions presented below are intended to give a firmer basis to discussions of poecilosclerid classification. In the absence of similar revisions of myxillids from other areas, it is not possible yet to present a definitive new system.

MATERIAL AND METHODS

Specimens from the Chilean Coast between Iquique and Seno Almirantazgo (20°-54°S) were collected during surveys realised from 1966 to 1992. Collector references, are indicated in the text as: collecting number (abbreviations are explained below), locality, geographical coordinates, date (day, month, year) and depth in m.

CHI.: Samples from the Instituto de Oceanología Universidad de Valparaiso, Chile;

Co.93: Samples from Facultad de Pesquerías y Oceanografía Universidad Austral de Chile, Puerto Montt;

Ga: Samples from SEPBOP program;

HE: Samples from Hero expedition 1969-1972 from the National Science Foundation and Departamentos de Biología Marina y Oceanografía y de Zoología de la Universidad de Concepción, Chile;.

MNHNC: Samples from the Museo nacional de Historia natural de Chile, Santiago;

MONT.: Samples from the Universidad de Chile, Valparaiso, Estación de Biología Marina de Montemar;

POR., E: Samples from Departamento de Ciencias Ecológicas, Universidad de Chile, Santiago;

VALD.: Samples from the Universidad Austral de Chile, Valdivia;
A second lot of specimens was obtained from the former Smithsonian Oceanographic Sorting Centre: several specimens from Chile, Peru and Galapagos were collected during the 1966 SE Pacific Biological Oceanography Program (SEPBOP) on board of R.V. "Anton Bruun"; other specimens were collected by individual collectors. Representative sets of specimens of this collection are deposited in the United States National Museum of Natural History at Washington, including holotypes of new species, in the Zoölogisch Museum Amsterdam, and the Muséum d'histoire naturelle de Genève.

For comparison a comprehensive set of type fragments and type slides of *Iophon*, *Myxilla* and *Tedania* species and related genera were borrowed from a number of institutions.

Abbreviations for institutions used in the text are:

BMNH: Natural History Museum, London;
CNM: Canadian National Museum;
IOUV: Instituto de Oceanología Universidad de Valparaiso;
MCSN: Museo Civico di Storia Naturale "Giacomo Doria", Genova;
MHNG: Museum d'histoire naturelle, Geneva;
MNHN: Muséum National d'Histoire Naturelle, Paris;
MNHNC: Museo nacional de historia natural de Chile, Santiago;
MZSF: Museo Zoologico de "La Specola", Firenze (Italy);
MZUC: Museo zoología Universidad Concepción, Chile;
UCH: Departamento de Ciencias Ecológicas, Universidad de Chile, Santiago.
USC/AHF University of Southern California; Allan Hancock Foundation
USNM: National Museum of Natural History, Smithsonian Institution, Washington; formerly United States National Museum;
ZMA: Zoölogisch Museum, Amsterdam;
ZMB: Museum für Naturkunde der Humboldt-Universität, Berlin;
ZMK: Zoologisk Museum København;
ZMH: Zoologisches Museum Hamburg

Skeletal slides and dissociated spicule mounts were made following Rützler (1978). The SEM study was made using a Zeiss Digital Scan Microscope dsm 940, with accelerating voltage of 20 kV and magnification up to 10,000 times.

Scales for specimens represent 0.5 cm. Scales for sem pictures are indicated with each spicule. Measurements of spicules on Tables refer to minimum-mean maximum in µm; in text they refer to minimum-maximum, in µm.

SYSTEMATIC PART

Order: Poecilosclerida; Suborder: Microcionina Hajdu, van Soest & Hooper, 1994

Family: Iophonidae Burton (1929, as section Iophoneae)

Diagnosis: Microcionina with spined tylotes as ectosomal megascleres.

Iophon Gray, 1867

Synonyms: *Alebion* Gray (1867), *Menyllus* Gray (1867), *Ingallia* Gray (1867), *Pocillon* Topsent (1891), *Iophonopsis* Dendy (1924), *Burtonella* De Laubenfels (1928) and *Iophonota* De Laubenfels (1936).

Type species: *Halichondria scandens* Bowerbank, 1866 (by original designation).

Diagnosis: Massive, branching or encrusting Iophonidae with ectosomal skeleton of intercrossing or scattered tylotes with spined heads, choanosomal skeleton consisting of an isodictyal reticulation of smooth or spined styles, arranged singly or in two's and three's, which may or may not be echinated by acanthostyles. Microscleres include bipocilla and palmate anisochelas; toxas are absent (based on VAN SOEST *et al.* 1994).

Remarks: The suborder assignment is based on the presence of palmate chelas (as opposed to the "tridentate" chelas of the suborder Myxillina). The anisochelas are shared with *Melonchela*, *Acanthorhabdus* (see below) and outside the family with the mycalid genus *Mycale* s.l. The apparent absence of toxas is unusual for the family, shared only with *Acanthorhabdus*. The genus is traditionally assigned to Myxillidae (now in suborder Myxillina), and indeed the skeletal structure of many species is reminiscent of *Myxilla*. However, Myxillidae in the restricted sense of HAJDU *et al.* (1994) possess anchorate chelas and sigmas (cf. below). The "renieroid" or isotropic skeletal structure is found in many Poecilosclerida, e.g. *Iophon*, *Acarnus*, *Myxilla*, *Lissodendoryx*, *Antho*, *Clathria*, *Ectyoplasia* and *Plocamionida*. These are not all closely related, and accordingly we assume this character to have been developed several times in the evolution of the Poecilosclerida. A further argument for including *Iophon* in the Myxillidae would be the fact that ectosomal megascleres in *Myxilla* often are tylote-like and quite often have some spines on their apices. Again, this feature is not restricted to *Myxilla* and *Iophon*, but occurs in several other genera, e.g. *Tedania* and *Ectyodoryx*. In all these cases the tylotes are not exactly similar to the uniformly shaped *Iophon* tylotes, by being either anisotornotes (*Myxilla*, *Ectyodoryx*) or very lightly spined (*Tedania* (*Tedania*)). It is assumed again that some parallel evolution in the ectosomal megascleres has taken place (see a more extensive discussion in HAJDU *et al.*, 1994).

It can be argued that the genus name *Iophon* is threatened by *Menyllus* Gray, 1867. Gray described the latter in the same publication, but one page earlier (page 533) than *Iophon* (page 534). *Menyllus* has not been used regularly (in fact there are only half a dozen records of species as *Menyllus* in the past 50 years), and the name was considered as a *nomen oblitum* under the rules of a previous edition of the

International Code of Zoological Nomenclature. However, since this rule has been abandoned, we can only refer to Article 24 which covers the actions of the "first revisor". From among the various names available for this group of sponges, RIDLEY (1881) chose *Alebion* (for his species *A. proximum*). RIDLEY (1881) may be considered as the first revisor in the sense of Article 24, and his choice supersedes any page priority considerations. Unfortunately, *Alebion* (also used by VOSMAER, 1882) was found to be preoccupied, and subsequently RIDLEY & DENDY (1886) chose *Iophon* as the name for this group. This is here explained as according to the principle of Article 24, despite the recommendation 24A which urges the first revisor to take what is described first. Gray's diagnosis of *Iophon* and *Menyllus* were sufficiently different to explain, why RIDLEY & DENDY (1886) did not consider both synonymous, as it turned out to be later. In conclusion, *Iophon* seems to be a valid name, with *Menyllus* as a junior synonym.

Iophon species fall into two groups, those with and those without a special category of fully spined echinating acanthostyles, and these have been given separate generic status by DENDY (1924), with *Iophon* reserved for species with acanthostyles (as in the type species *I. hyndmani* (Bowerbank, 1858), senior synonym of *Halichondria scandens* Bowerbank, 1866) and *Iophonopsis* for species without them (as in the type species *I. nigricans* (Bowerbank, 1858)). This distinction has not been accepted by most authors, because in other Poecilosclerid groups the same presence or absence is found (e.g. *Clathria* versus *Isociella* for example), and accordingly we consider both as synonyms. Several authors, e.g. BAKUS (1966), went even further and accepted presence or absence of acanthostyles not even as a distinction between species. As will be shown below, this is partly true: in *Iophon proximum* the recognition of smaller fully spined acanthostyles is often difficult to make. Bakus (l.c.) synonymized a long list of *Iophon* species, including *I. proximum*, under a *I. pattersoni* (Bowerbank, 1866), now recognized as a junior synonym of *I. nigricans* (Bowerbank, 1858). However, in the sympatric Eastern Atlantic *I. hyndmani* and *I. nigricans* the acanthostyle presence coincides with other morphological features, so in these it is a species character.

Iophon species are characteristic for cold water faunas (cf. VAN SOEST, 1994), as they are common in the Northern Atlantic, North Pacific and Arctic, as well as in the Southern Ocean, including New Zealand, South America and Antarctica. In tropical and subtropical waters few species have been found, and then almost exclusively in deeper waters.

Iophon proximum (Ridley, 1881) (Figs. 1-12)

Alebion proximum RIDLEY, 1881:119, pl. x, fig. 8.

? *Iophon proximum* var. *reticularis* HENTSCHEL, 1914: 89.

Iophon proximum BURTON, 1932:296, pl. 57, figs. 1-13, figs. 21-24, [in part]; 1934: 25; 1938: 15; DESQUEYROUX 1972: 22; 1976: 103; BOURY-ESNAULT 1973: 280, text fig. 34; Sarà, 1978: 49; BOURY-ESNAULT & VAN BEVEREN 1982: 89, pl. 15, fig. 59, text figs. 25a-h; GENZANO et al., 1991: 67, lam. 7, fig. B; CUARTAS, 1992: 78, text fig. 24;

Iophon pattersoni sensu RIDLEY & DENDY, 1887: 117 & sensu THIELE, 1905 (in part) [not *I. pattersoni* (Bowerbank, 1866) = *I. nigricans* (Bowerbank, 1858)]

MATERIAL STUDIED: BMNH1879:12:27:5, holotype of *Iophon proximum* (Ridley, 1881), Strait of Magellan, Sandy Point, substrate: one valva of *Pecten*, Coll. R. Coppinger "HMS" Alert, 12-15 m; ZMH S2313, holotype of *I. proximum reticularis* Hentschel, 1914, Gauss Stn., 66°02'S 89°38'W, Deutschen Südpolar-Expedition 1901-1903, 50-200 m.; ZMB 3299, *Iophon pattersoni* sensu Thiele, 1905, Calbuco, Punta Arenas.

Material studied for comparison: BMNH 1887:5:2:116, holotype of *Iophon chelifer* Ridley & Dendy, 1886, Cape of Good Hope, 35°04'S 18°37'E, Challenger Coll., 12.1873, 274 m; cnm 1900-0266, specimen of *I. chelifer* sensu LAMBE, 1893, British Columbia, Discovery Passage, 23.06.1885, 20-25 m

A. Encrusting form, on *Zygochlamys patagonica*:

MHNG 18781, 19207-19212: 18790-18792, HE 22, 23, 33, 34, 36, 58, 59, Bahia Inútil, 53°38'S 72°46'W, 10-19.09.1972, 32-59 m; MHNG 18782, 18871, 19214: HE 20d, 52, 81c, Seno de Otway, 53°00'S 71°30'W, 17.09.1972, 3-5 m; MHNG 18791: HE 62, Punta Guale, 53°04'S 73°03'W, 24.09.1972, 70 m, on *Chaetopterus* sp.; MHNG 18792: VALD. 6.1a, Quintupeu, 42°10'S 72°24'W, 15.08.1972, 15 m.

B. Irregular form:

MHNG 18793, 19215, 19216: MONT. 4, 6, 20; San Antonio, 32°42'S 71°23'W, 09.07.1990, 5-10 m; MHNG 18794, 19217: MONT. 22, 27, El Quisco, 32°24'S 71°42'W, 09.07.1990, 10-15 m; MHNG 18795: VALD. 60.II, Estero Castro, 42°30'S 73°46'W, 03.1987, 10 m; MHNG 18796, 19218: VALD. 27.1, 45, Quintupeu, 42°10'S 72°24'W, 26.04.1971, 10-15 m; MHNG 18797, 19218, 10339: PULL.1, E.85.2, Por.5, Pullinque, 39°33'S 72°11'W, 03. 1983, 5-7 m; MHNG 18798: CO.93.40, Pelluco, 41°30S 72°54'W, 20.12.1992, 15 m.

C. Massive form:

MHNG 18799: HE. 2, Isla Madre de Dios, 50°15'S 75°05'W, 07.10.1972, 5-25 m; MHNG 18800, 19221: MONT. 2, 10a, San Antonio, 32°42'S 71°22'W, 09.07.1990, 5-10 m; MHNG 18801: CO.93.6, Bahia Hueihue, 41°54'S 73°32'W, 09.10.1972, 5-7 m; MHNG 18802: Co.93.19, Pelluco, 42°30'S 72°54'W, 12.12.1992, 15 m; MHNG 18803, 19222: VALD. 4, 37a, Golfo de Quetalmahue, 41°52'S 73°52'W, 05-06.01.1972, 10-15 m; MHNG 18804, 19223: VALD. 8.1, 50.2, Islote Pelú, 41°38'S 73°43'W,18.03.1972, 15 m; MHNG 18805: VALD. 15.3, Quintupeu, 42°10'S 72°24'W, 16.07.1972, 15 m; MHNG 18806: VALD. 31, Bahia Linao, 41°57'S 73°33'W, 28.06.1971, 10-15 m; MHNG 18807: VALD. 58, Estero Quitralco, 45°43'S 73°25'W, 07.07.1972, 10 m.

DESCRIPTION

Several specimens (figs. 1-6) and fragments. We differentiate three colour/growth forms of these species: form A, encrusting on *Zygochlamys patagonica* or tubes of polychaetes, with a finely corrugated and punctate surface, colour in alcohol gray, size: 41-63 x 33-48 x 3-7 mm; form B, irregular often digitate, with finely corrugated surface, colour in alcohol blackish, size: 30-74 x 31-76 x 22-48 mm; and form C, massive, with oscules in a row, with a finely conulose surface, colour in alcohol brown, size: 60-72 x 14-47 x 22-62 mm. Some specimens are agglutinating chitinous tubes or calcareous fragments. No detachable surface membrane is visible. Small (0.5-1 mm) oscules occur on conules or are scattered on the surface.

Consistency: Crumbly and friable, very fragile or firm, elastic.

Colour: Orange to yellowish alive, light beige, brownish to blackish in alcohol. The different colours in alcohol may be attributable to artificial discolouring after collection.

Skeleton: Ectosomal skeleton: bouquets of partly perpendicular, partly tangential bundles of tylotes, and abundant microscleres.

Table 1

Spicule micrometries of *Iophon proximum* (Ridley. 1881). I. proximum (Ridley. 1881) bmnh 1879:12:27:5 holotype: *I. proximum reticularis* Hentschel, 1914 ZMHS 2313 holotype; *I. chelifer* sensu Lambe, 1893 CNM 19001266 specimen from Elk Bay; from literature and remeasured. *I. proximum* form A, specimens from Chile.

I. proximum (Ridley, 1881)	Acanthostyles 1 Acanthostyles 2	Tylotes	Anisochelas	Bipocilia
BMNH 1879:12:27:5 Sandy Point	158 x 9.5 not observed	158 x 7.9	25	10.5
Remeasured	120-138-148 x 6-7-8 78-101-117 x 5-6	140-147-160 x 4	23-24-27 16-18-20	6
I. proximum reticularis Hentschel, 1914 Holotype ZMH S2313 66°02'S 89°38'W	104-152 not observed	120-160 not observed	18-24	Absent
Remeasured	146-160 x 9-10 134 x 6	147-163-176 x 6	16-21-26	Absent
I. chelifer sensu Lambe, 1893 CNM1900-0266 British Columbia	262-327 x 13-19	220-280 x 6-8	29-36 29-36	13-18
Remeasured	259-292-316 x 8	243-261-283 x 8	32-34-38 13-17-19	14-16-18 11-12-13
I. proximum. Form A				
He 22 Bahia Inutil	106-119-125 x 6 83 x 5	109-128-138 x 4-5	11-14-18	10-12-13
He 23 Bahia Inutil	112-123-138 x 5-6-8 100 x 6	122-134-144 x 3-5-6	13-14-18	6-10-13
He 33 Bahia Inutil	141-153-163 x 6-8-10 96 x 8	170-186-208 x 6	19-22	11-12-16
He 34 Bahia Inutil x 6	141-155-176 x 3-5 91-98 x 5-6	138-163-179	10-14-19	Absent
He 36 Bahia Inutil	150-162-173 x 6-10 105 x 6	144-179-195 x 6	13-18-22	6-10-13
He 58 Bahia Inutil	154-164-176 6-9-10 96-98-102 x 5	144-164-182 x 5-6	22-23-26	13
He 59 Bahia Inutil	141-155-166 x 6-10 96 x 5	147-163-186 x 3-5-6	16-20	Absent
He 20d Seno de Otway	125-135-166 x 5-6-10 99 x 6	138-146-157 x 4	13-15-18	6-8-10

He 52 Seno de otway	134-148-160 x 5-7-10 92 x 5	131-148-166 x 3-4-5	16-18-22	10-13-16
He 81c Seno de Otway	221-241-253 x 10-10-13 102-120 x 6	218-234-253 x 6-8	26-28-32	6-7-10
He 62 Punta Guale	150-162-176 x 6-8-10 90-97-105 x 5	152-184-203 x 8	12-14-16	8
Vald. 6.1a Quintupeu	170-193-272 x 6-8-10 130 x 6	157-168-179 x 5-5-6	13-19-22	6-9-10

Choanosomal skeleton: isodictyal to subisodictyal unispicular reticulation of acanthostyles 1. Acanthostyles 2 (echinating acanthostyles) occur at the nodes; they may be very rare to moderately abundant. Bipocilla and anisochelas are also variable in abundance.

Spicules: (Table 1-3) Megascleres: Acanthostyles 1 (fig. 7) straight or slightly bent, covered by numerous small spines, more abundant at the base, diminishing regularly towards the smooth apex, 106-272 x 5-16 µm.

Acanthostyles 2 (fig. 8) echinating, straight and entirely spined, 83-157 x 5-6 µm.

Tylotes (fig. 9) straight, smooth except for the spines on the tyles, 109-252 x 3-10 µm

Microscleres: Spurred anisochelas, there are no separated categories of anisochelas, differing just by the size, 10-35 µm (fig. 10, 11) Their presence is variable: abundant, rare, and sometimes absent (?). They have the same morphology: a straight shaft, basal part shorter with spur-like structure, and alas diverging widely from shaft.

Bipocilla (fig. 12) compact, cup-shaped, with spines at the swollen extremities, 6-16 µm. Their presence is variable: abundant, rare, or extremely rare.

Ecology: Occurring on calcareous, chitinous, cultured oysters or stone substrates, 5-32 m.

Distribution: Chilean coast: 20°S-42°S, Falkland Islands, Kerguelen (?).

Remarks: This species stands out among all *Iophon* species of the studied area in possessing a second category of small echinating acanthostyles (although they are not always easy to find, and possibly not always differentiated). This character is shared with *I.chelifer* Ridley & Dendy (1886) which may account for BURTON's (1932) synonymy assignment. We distinguished three colour/growth forms in the material at hand, but there is no matching character in the skeletal structure. All three forms have essentially similar skeletons notwithstanding a wide individual variation in spicule sizes and sometimes in the differentiation of two distinct acanthostyle categories. Future in situ studies with live specimens might reveal other more subtle differences between the three. Previous authors, starting with RIDLEY & DENDY (1887 as *I. pattersoni*) tended to include a wide range of specimens and species from all

TABLE 2

Spicule micrometries of *Iophon proximum* form B, specimens from Chile.

I. proximum. Form B	Acanthostyles 1 Acanthostyles 2	Tylotes	Anisochelas	Bipocilla
Mont. 4 San Antonio	141-153-163 x 6-8-10 Absent	147-168-198 x 6	19-21-22	13-14-16
Mont. 6 San Antonio	131-148-163 x 6-8-10 Absent	163-172-182 x 6	13-14-16	10-12-13
Mont. 20 San Antonio	176-197-227 x 6-11-13 Absent	189-203-218 x 6-10	13-23-35	8-9-11
Mont. 22 El Quisco	182-207-230 x 6-11-13 Absent	198-213-227 x 6	13-23-35	6-8-10
Mont. 27 El Quisco	147-160-189 x 10 Absent	145-167-182 x 6	16-17-19	10-12-13
Vald. 60.II Estero castro	195-208-224 x 6 Absent	160-182-198 x 3	16-19-24	10-12-13
Vald. 27.1 Quintupeu	157-174-186 x 10-12 Absent	170-185-208 x 6	16-27-32	10-12-13
Vald. 45 Quintupeu	150-172-186 x 6-9-10 Absent	157-174-186 x 6	16-23-32	6-9-10
Pull. 1 Pullinque	176-186-198 x 8-10 Absent	157-172-182 x 3-5-6	13-15-16	10-12-13
E.85.2 Pullinque	141-169-192 x 5-6 Absent	147-167-186 x 3-4-5	13-15-16	10-12-13
Por. 5 Pullinque	150-163-173 x 6 Absent	147-164-176 x 3-5	13-15-16	10-12-13
Co.93.40 Pelluco	179-198-222 x 12-13 Absent	191-204-218 x 8	20-26-35	8-10-12

over the world under this species name. We were unable to examine every single assignment, but nevertheless made an attempt to evaluate this alleged cosmopolitan distribution. The correct and doubtful assignments are listed above in the synonymy. Doubts remain over the identity of specimens assigned to *I. proximum* by BURTON (1938, material not examined), DESQUEYROUX (1972, 1976, material presently unavailable for reexamination), the Brazil specimen of BOURY-ESNAULT (1973) and the Kerguelen specimens of HENTSCHEL (1914) and BOURY-ESNAULT & VAN BEVEREN

TABLE 3

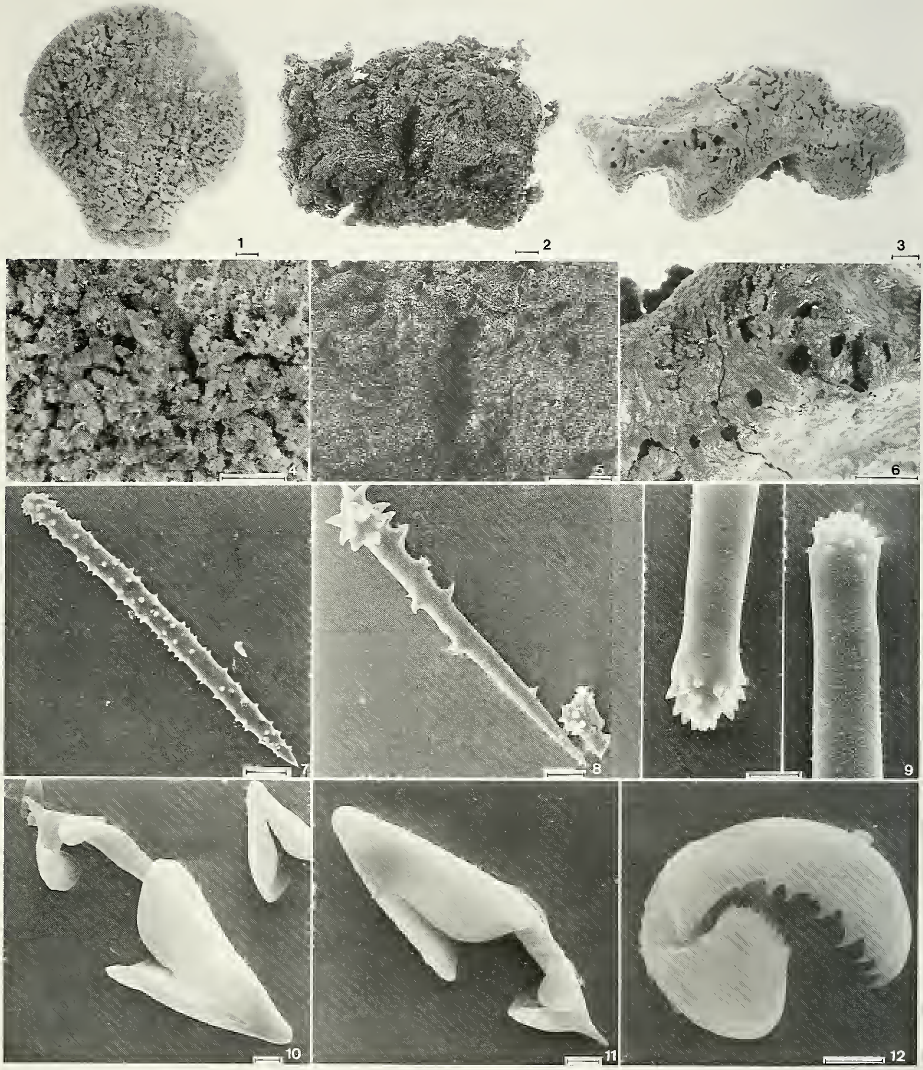
Spicule micrometries of *Iophon proximum* form C, specimens from Chile.

I. proximum. Form C	Acanthostyles 1 Acanthostyles 2	Tylotes	Anisochelas	Bipocilla
He 2 I. Madre de Dios	128-140-152 x 6-7-12 Absent	148-164-182 x 4-5-8	16-19-22	10-14-16
Mont. 2 San Antonio	144-156-166 x 6-8-10 Absent	157-170-179 x 6	13-18-22	6-9-10
Mont. 10a San Antonio	144-160-173 x 6-8-10 Absent	157-171-182 x 5-6	12-14-16	10-11-13
Co 93.6 Bahia Heihue	144-169-192 x 5-7-10 Absent	150-171-182 x 3-5-6	16-19-22	10-12-13
Co 93.19 Pelluco	166-180-192 x 5-6 110 x 10	138-175-195 x 3-5-6	16-22-26	10-12-13
Vald. 4 Golfo Quetalmahue	144-160-173 x 5-6 Absent	147-162-173 x 3-5	19-22-26	10-12-13
Vald. 8.1 Islote Pelú	186-201-218 x 10-12-16 93-106 x 5-6	179-199-227 x 6-6-10	14-16-22	10-12-13
Vald. 50.2 Islote Pelu	186-202-218 x 13-14-16 Absent	198-210-221 x 6-8-10	13-18-22	8-10-12
Vald. 15.3 Quintupeu	160-173-189 x 10-11-13 90-106 x 5-6	170-196-202 x 5-6	19-22-26	10-12-13
Vald. 31 Bahia Linao	179-177-211 x 5-8-10 Absent	173-185-202 x 5-6	16-22-26	10-10-11
Vald. 37a Golfo Quetalmahue	154-166-182 x 3-6 Absent	154-166-179 x 3-6	16-19-22	10-11-13
Vald. 58 Estero Quitralco	182-201-227 x 10-11-13 109-157 x 6	195-208-230 x 6-8	16-22-31	6-8-10

(1982). For the Kerguelen material the name *I. reticularis* is available if it would turn out to be a separate species.

In our opinion, the following specimens and species were associated incorrectly with *I. proximum*:

Iophon pattersoni (Bowerbank,1866) is originally described from the British Isles. It is undoubtedly a junior synonym of *I. nigricans* (Bowerbank, 1858). This is a



FIGS 1-12

Iophon proximum (Ridley, 1881). 1, 4, form A, encrusting specimen on *Zygochlamys patagonica*, from Bahia Inútil and enlarged view of the surface. 2, 5, form B, irregular, specimen from Pullinque and enlarged view of the surface. 3, 6, form C, massive specimen from Isla Madre de Dios and enlarged view of the surface. 7, acanthostyles 1, straight or slightly bent. 8, acanthostyles 2, or echinating styles. 9, Tylotes, straight, smooth with spined tyles. 10, spurred anisochela of big size. 11, spurred anisochela of small size. 12, compact, cup-shaped bipocilla. Scales: fig. 7 = 20µm; fig. 8 = 10µm; fig. 9 = 5µm; fig. 10-12 = 2µm.

very common species in Western Europe. It differs from *I. proximum* in having no category of smaller echinating acanthostyles, which are also considerable thinner. THIELE'S (1905) specimens labelled I. pattersoni are a mixture of *I. proximum* and *chilense* n. sp. (cf. below). *I. pattersoni sensu* Bakus (1966) probably belongs to the same, so far not further identified, species as *I.chelifer* sensu LAMBE, 1893 (cf. below).

I. chelifer Ridley & Dendy, 1886 is originally described from South Africa. It was assigned to *I. proximum* by BURTON (1932). We examined the type specimen. It is similar to *I. proximum* but differs clearly in the "cut-off" shape of the tylote heads which are also much lighter spined (only on the flattened apex) and in the clearly longer and thicker (360-420 x 16-20 µm) and more heavily spined structural acanthostyles. *I. chelifer sensu* LAMBE,1893 from British Columbia, that we examined, differs from *I. proximum* in having two clearly separated size categories of bipocilla (not mentioned by LAMBE), the tylotes are also lightly spined on the apices only and the structural acanthostyles are more heavily spined and thicker. It is likely that Lambe's material belongs to one of the Arctic *Iophon* species (cf. KOLTUN, 1959), and that Bakus' material of *I. pattersoni* belongs to that same species. *I. chelifer sensu* Thiele, 1905 belongs to the new species described below; it does not have the small acanthostyles. *I. chelifer ostiamagna* Wilson, 1904, assigned to *I. proximum* by Burton (1932) is a separate species of *Iophon*. *I. chelifer californiana* De Laubenfels, 1932 belongs to *I. lamella* Wilson, 1904 (cf. below). New Zealand specimens assigned to *I. proximum* by BERGQUIST & FROMONT (1988) are unlikely to belong to the present species; for them the name *I. semispinosus* Bergquist (1961) is available. The description of *I. proximum sensu* URIZ (1987, 1989) from South West Africa reminds strongly of *I. chelifer*, while her *I. chelifer* differs from *I. chelifer* proper in having two distinct bipocilla sizes; the latter material is likely an undescribed species.

I. lamella, *I. lamella indivisus*, and *I. indentatus*, all described by WILSON (1904) were assigned to *I. proximum* by BURTON, 1932, but are here considered a separate species. The main differences are the shape of the bipocilla and the absence of small acanthostyles.

Iophon lamella Wilson, 1904 (figs. 13-18)

Iophon lamella WILSON, 1904:146, pl. 20, figs. 3, 7-9, 12, 13, pl. 24, figs. 2-4.
Iophon indentatus WILSON, 1904: 151, pl. 19, fig. 6, pl. 20, figs. 1, 5, 6, pl. 23, fig. 4;
?*Iophon indentatus* WILSON *sensu* DICKINSON, 1945: 16, pl. 21, figs. 41, 42, pl. 22, fig. 43.
Burtonella melanokhemia DE LAUBENFELS, 1928: 361, fig. 1.
Iophon chelifer var. *californiana* DE LAUBENFELS, 1932: 82, fig. 47.

MATERIAL STUDIED: USNM 8277, holotype of *Iophon lamella* Wilson, 1904, Albatross Stn. 3405, 00°57'S 89°38'W, 95 m ; USNM 8279, syntype of *Iophon indentatus* Wilson, 1904, Albatross Stn. 3405, 00°57'S 89°38'W, 95 m; USNM 21401, holotype of *Iophon chelifer* var. *californiana* De Laubenfels, 1932, S of San Pedro, California, 27.12.1916, 48 m; USNM 21369, holotype of *Burtonella melanokhemia* De Laubenfels, 1928, California; USNM 39352, ZMA 10977, MHNG 18808 Ga.III.28, fragment, SEPBOP "Anton Bruun" Exped. Cruise 18B 791C, Galapagos Islands, Santa Cruz Island, 00°26'S 90°20'W, 21.09.1966, 95 m.

TABLE 4

Spicule micrometries of: *Iophon lamella* Wilson, 1904. *I. lamella* Wilson, 1904 USNM 8277 holotype; *I. indentatus* Wilson, 1904 USNM 8279 syntype; *I. chelifer* var. *californiana* de Laubenfels, 1932 USNM 21401 holotype; *Burtonella melanokhemia* de Laubenfels, 1928 USNM 21369 holotype; from literature and remeasured. Specimen from Galapagos of *I. lamella* Wilson, 1904.

Iophon lamella Wilson, 1904	Acanthostyles 1	Tylotes	Anisochelas 1 Anisochelas 2	Bipocilla
Holotype USNM 8277 00°57’S 89°38’W	210-220 x 12-16	220-240 x 7-8	28 14	12-16
Remeasured	210-222-234 x 12-13-15	218-223-235 x 7-8	10-14 20-26	8-13-16
Iophon indentatus Wilson, 1904				
Syntype USNM8279 00°57’S 89°38W	220 x 14-16	220 x 8	14	8
Remeasured	199-218-234 x 16	207-219-220 x 7-8	16	8
I. chelifer var. *californiana*				
de Laubenfels, 1932 Holotype USNM 21401 South San Pedro	265-290 x 12-13	240-250 x 6-8	not observed 15-33	15
Remeasured	234-248-260 x 12	200-223-241 x 7-8	27-31-35 12-15-23	12-17-20
Burtonella *melanokhemia* de Laubenfels, 1928				
Holotype USNM 21369 California	210 x 13	180 x 10	12-40	as sigmas: 50
Remeasured	270-282-304 x 16-18-20	222-238-253 x 7-8	20-21-25 12-14-16	12-15-16
Galll. 28 Sepbop 18B791C 00°26’S90°20’W.	214-229-250 x 10-16	202-226-240 x 6	22-29 13-16	10-14-16

DESCRIPTION

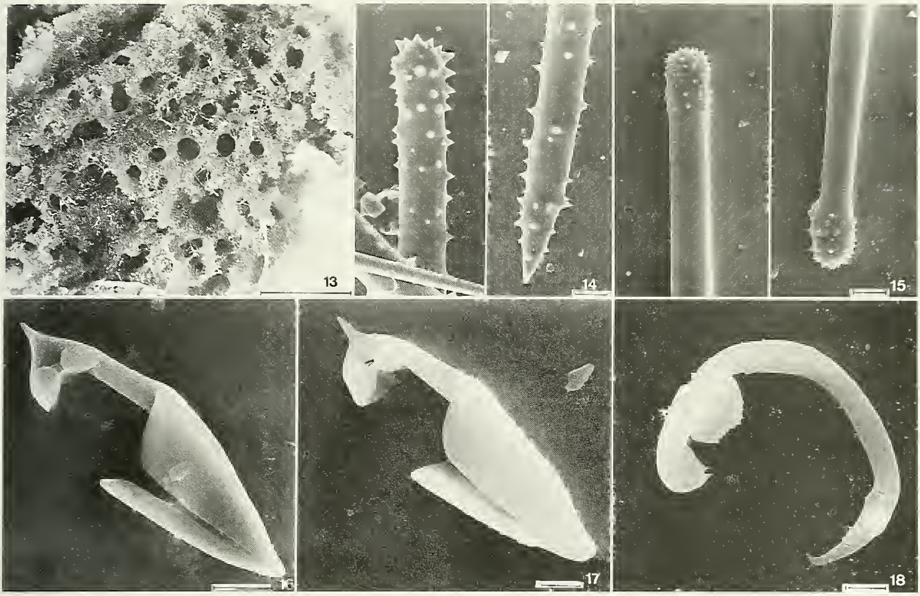
A mass of fragments of small, irregular lamellate shapes; the largest is 5 x 6 cm and 5-15 mm thick (fig.13). The surface is differentiated in a more or less undulated and punctate side and an opposite side with grooves covered by a thin, easily removed membrane.

Consistency: Firm but fragile.

Colour: Yellow or beige-brown in alcohol.

Skeleton. Ectosomal skeleton: a palisade of scattered tylotes.

Choanosomal skeleton: tight-meshed isotropical reticulation of spined styles and tylotes. Microscleres abundant.



FIGS 13-18

Iophon lamella Wilson, 1904. 13, lamellate specimen from Galapagos. 14, acanthostyle 1 heavily spined. 15, smooth tylotes, swollen apices, minutely spined. 16, 17, spurred anisochela 1 and 2, both with straight shaft. 18, strongly asymmetrical trilobate bipocilla with finger like appendages. Scales: fig. 14 = 10µm; fig. 15, 16 = 5µm; fig. 17, 18 = 2µm.

Spicules (Table 4): Megascleres: Acanthostyles 1 (fig. 14) heavily spined all over the surface 214-250 x 10-16 µm. No acanthostyles 2. Tylotes (fig. 15) with a straight and smooth shaft and swollen apices, minutely but heavily spined, 202-240 x 6 µm.

Microscleres: Spurred anisochelas 1 (fig. 16) 22-29 µm and 2 (fig. 17) 13-16 µm, both with the same morphology, straight shaft and the alas diverging from the shaft. Bipocilla (fig. 18) strongly curved, and with one of the extremities expanded and trilobate and the other with several finger like appendages, 10-14 µm. Both types of microscleres are abundant.

Ecology: Substrate, pebbles, 90-140 m.

Distribution: Galapagos Islands, West coast of Central America (DICKINSON, 1945) Pacific coast of Southern California, Baja California.

Remarks: This species differs from *I. proximum* in the lamellate shape and the yellow-brown colour, in the possession of two distinct categories of anisochelas, and in the much more openly curved trilobate bipocilla. These characters are shared with *Burtonella melanokhemia* De Laubenfels and *I. chelifer californiana* De Laubenfels and accordingly these are considered junior synonyms. Wilson's specimens of *I. lamella*, *I. lamella indivisus* and *I. indentatus* differ somewhat in shape, but their skeletons, spicule categories and bipocilla shape are essentially similar, so these are united under the present species. DICKINSON's (1945) description of *I. indentatus* from California differs substantially from that of *I. lamella* and *I. indentatus*, especially in spicule size. Perhaps it belongs to the same species as the Lambe and Bakus specimens, but study of Dickinson material is necessary for that conclusion.

Despite its lamellate habit, *I. chelifer ostiamagna* Wilson (1904) is clearly separate from *I.lamella* in having much larger and lighter spined styles, only a single category of anisochelas and two categories of bipocilla.

Iophon chilense n. sp. (figs. 19-26)

Iophon chelifer sensu THIELE, 1905: 445, figs 63a-d [non: *I. chelifer* Ridley & Dendy, 1886]
Iophon pattersoni sensu THIELE, 1905: 445 (in part) [non: *I. pattersoni* (Bowerbank, 1866)= *I. nigricans* (Bowerbank, 1864)]

MATERIAL STUDIED: HOLOTYPE: MHNG 18810, He 108, Somerset Canal, 47°58'S 74°35'W, 02.10.1972, 260 m.

Paratype: MHNG 18809, HE 81 Seno de Otway, 53° 00'S 71° 30'W, 17.09.1972, 250 m.

Material studied for comparison: ZMB 3300, Thiele's specimen of *Iophon chelifer* sensu THIELE, 1905, Calbuco; ZMB 3299, Thiele's specimen of *Iophon pattersoni* sensu THIELE, 1905, Calbuco.

DESCRIPTION

Sponge irregularly encrusting on calcareous substrates and tubes of polychaetes, or massive, irregular (figs. 19, 20). Size: 35-46 x 25-39 mm. Surface membrane thin, not easily removable, punctate.

Consistency: Crumbly, soft, very fragile.

Colour: Yellowish to orange alive, light to dark brown in alcohol.

Skeleton: Ectosomal, a palisade of bundles of tylotes and abundant microscleres.

Choanosomal: Loose subisodictyal to confused reticulation of acanthostyles 1, isolated or in occasional bundles. Abundant anisochelas

Spicules: (Table 5) Megascleres: Acanthostyles 1 (fig. 21) slightly bent, most are smooth except for spines at the base, some have the shaft abundantly microspined, 257-308 x 8-16 µm. No acanthostyles 2.

Tylotes (fig. 22, 23) straight, with swollen microspined apices, 207-259 x 5-8 µm.

Spurred anisochelas 1 (fig. 24), curved, 18-29 µm, and 2 (fig. 25) 10-16 µm.

Bipocilla (fig. 26) one of the ends trifoliate, the other with claw-like appendages, 10-16 µm.

Etymology: named after its geographic distribution.

Ecology: Occurring on calcareous, polychetes tubes, and shells, 250-260 m.

Distribution: Chilean coast, 47°S.- 53°S.

TABLE 5

Spicule micrometries of *Iophon chilense* n. sp. *I. chelifer* sensu THIELE, 1905, ZMB 3300, specimen from Plate collection; from literature and remeasured. Specimens from Chile of *I. chilense* n. sp.

I. chilense n. sp.	Acanthostyles 1	Tylotes	Anisochelas 1 Anisochelas 2	Bipocilla
I. chelifer sensu Thiele, 1905 ZMB3300 Calbuco	250 x 15	210 x 7	16-28	15
Remeasured	208-235-253 x 13-15-16	186-199-208 x 6	26-27-29 13-17-22	13-14-16
He 81 Seno De Otway	259-274-284 x 8-16	202-224-235 x 5-6	26-27-29 13-16	13-14-16
Holotype MNHG 18810 He 108	257-285-308 x 8-16	207-249-259 x 5-6-8	18-20-21 10-12-13	10-12-13

Remarks: This species differs from *I. chelifer* sensu RIDLEY & DENDY, 1886 in the absence of small acanthostyles, the almost smooth relatively short structural acanthostyles, and the much heavier spined tylote heads. From *I. proximum* and *I. lamella* it differs also in possessing almost smooth styles, furthermore its bipocilla are clearly of a different shape as those of *I. proximum* and show teeth different from those of I. lamella. There are no matching descriptions from the studied area.

Iophon timidum n.sp. (Figs 27-32)

MATERIAL STUDIED: HOLOTYPE: MHNG 18811: HE 12, Puerto Caracciolo, 50°28'S 75°11'W, 09.10.1972, 25 m.

PARATYPES: MHNG 18812: He 28; MHNG 19224: HE 56, same data as the holotype.

MATERIAL STUDIED FOR COMPARISON: MNHNDT 1976, specimen 421, slide of the syntype of *Iophon radiatus* Topsent, 1901, 71°19'S 87°37'W, 450 m.

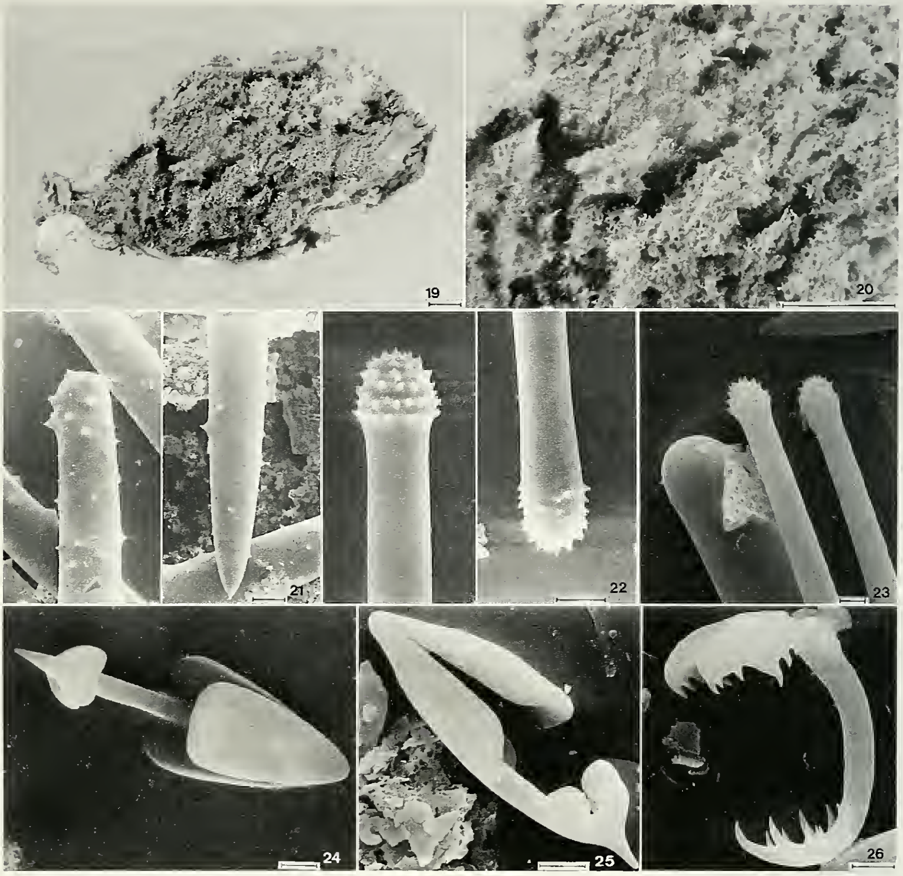
DESCRIPTION

Sponge massive (figs. 27, 28) spherical to oval, size 55-95 x 55-60 mm. Surface corrugated, irregular and covered by a thin membrane, which is easily removed. A few small oscules (1-2 mm) are irregularly distributed.

Consistency: Soft, extremely fragile, easily torn.

Colour: Beige to dark brown alive, same colour in alcohol.

Skeleton: Ectosomal skeleton: a palisade of tylotes, free or in bundles. Normal anisochelas are abundant.



FIGS 19-26

Iophon chilense n.sp. 19 [HOLOTYPE, MNHG 18810] irregular encrusting specimen from Sommerset Canal. 20. enlarged view of the surface. 21, acanthostyles 1 slightly bent, smooth, with microspined shaft. 22, 23, straight tylotes, swollen microspined apices. 24, 25, spurred anisochela 1 and 2 with curved shaft. 26, bipocilla trifoliate, with claw-like appendages. Scales: fig. 21 = 10µm; fig. 22, 23 = 5µm; fig. 24, 26 = 2µm.

Choanosomal skeleton: a loose and irregular reticulation of styles, which occasionally form longitudinal tracts connected by single styles. Anisochelas and pigment are abundant.

Spicules (Table 6): Megascleres: Smooth styles (fig. 29) with a few spines at the base and slightly bent, 186-259 x 3-6 µm. No echinating acanthostyles.

TABLE 6

Spicule micrometries of *Iophon timidum* n. sp. *I. radiatus* Topsent, 1901 LBIMDT 1976 syntypes; from literature and remeasured. Specimens from Chile of *I. timidum* n. sp.

I. timidum n. sp.	Styles	Tylotes	Anisochelas Bipocilla
I. radiatus			
Topsent, 1901			
Syntypes LB/MDT 1976			
specimen n° 306	550 x 16	300-350	17-60
71°14'S 89°14'W		x 5-6	8-12
specimen n° 421	570-580	390	17/53-70
71°19'S 87°37'W	x 20	x 8-9	8-16
Remeasured	502-552-607	340-368-413	57-61-73
specimen n° 421	x 16-19-24	x 8	8-16
			Anisochelas 1
			Anisochelas 2
HOLOTYPE MNHG 18811			
He 12	186-221-256	150-196-250	11-14
Puerto Caracciolo	x 3-6	x 3-6	5-6
He 28	202-234-259	154-184-243	10-16
Puerto Caracciolo	x 3-6	x 3-5	6-10
He 56	202-226-259	170-204-250	13-16
Puerto Caracciolo	x 3-6	x 3-5	6-10

Tylotes (fig. 30) thin, long and fusiform, apices swollen and strongly spined 150-250 x 3-6 µm.

Microscleres: Spurred anisochelas 1 (fig. 31) with a straight shaft, alas widely diverging from the shaft, 10-16 µm. Anisochelas 2 (fig. 32) with roundish concave extremities and a short axis, rare, resembling bipocilla but provided with a distinct spur, 5-10 µm.

No bipocilla were found.

Etymology: the name refers to the shape of the anisochela 1, which looks as if it is contracted with fear.

Ecology: Occuring on stones, sand, 25 m.

Distribution: Chilean coast, 50°S 75°W.

Remarks: The new species is based on the combination of (almost) smooth styles and the second category of incurved anisochelas. Since all three specimens were exactly similar in this respect, it is clear these are stable characters. The absence of bipocilla is unusual, but reported occasionally from other *Iophon* species (cf. KOLTUN, 1959) and specimens. (e. g. *I. reticularis* Hentschel, 1914 from Gauss Stn., that we examined). It is not a reliable character for species distinction.

The smooth styles and "loose" anisotropic reticulation are shared with *I. radiatus* Topsent, 1901, originally described from the Antarctic region, but subsequently reported from along the Atlantic and Pacific coasts of South America up to 37°S. Our specimens have been compared with a type slide of *I. radiatus* and the two were found to have some clear differences, the most important being the much larger styles of *I. radiatus*, the much larger anisochelas (up to 60 µm) (neither category of anisochela is malformed) and the possession of 2 sizes of normal formed bipocillas. Unfortunately, the specimens of *I. radiatus* recorded from the study area (DESQUEYROUX, 1972) are not available for re-examination, so we cannot confirm the presence of true *I. radiatus* in our area. However, the spicule sizes reported by Desqueyroux clearly exceed those of the new species, so conspecificity with the present species is unlikely.

Iophon tubiforme n. sp. (Figs. 33-38)

MATERIAL STUDIED: HOLOTYPE: MHNG 18813: He 7, Isla Newton, Rada Shinglet, 51°51'S 73°42'W, 01.10.1972, 5-10 m.

PARATYPES: MHNG 18814: HE 11, Isla Newton, Rada Shinglet, 51°51'S 73°42'W, 01.10.1972, 5-10 m.; MHNG 18815: He 20, Seno de Otway, 53°00'S 71°30'W, 17.09.1972, 35 m; MHNG 18816: HE 21, MHNG 19225: HE 26, Caleta Chica, Faro San Pedro, 47°47'S 74°54'W, 01.10.1972, 30 m, 12 m; MHNG 18817, 18992: He 32, Co.93.31, Puerto Caracciolo, 50°26'S 75°09'W, 09.10.1972, 25 m; MHNG 18818: HE 86, Islas Grupo Porvenir, Canal Zenteno, 52°49'S 73°40'W, 11.10.1972, 30 m; MHNG 18819: HE 103, Punta Guale, 53°04'S 73°03'W, 24.09.1972, 70 m; MHNG 18820: VALD. 47, Laguna Cachaña, 45°58'S 73°45'W, 28.08.10971, 10 m.

MATERIAL STUDIED FOR COMPARISON:

Iophon unicornis Topsent,1907, LBIMDT 1665 type, specimen 798, Ile Anvers, Antarctic, dragage, 06.01.1905, 25 m.

Iophon spatulatus Kirkpatrick, 1907, SYNTYPES, BMNH 1908:2:5:144, 144a,b, 145, 145a, Coulman Island, 1828 m, "Discovery" Coll.

DESCRIPTION

Several large specimens formed by up to 7 tubes, 81-87 mm high, of uniform diameter, 18-31 mm, issuing from a common base: 87-111 mm (fig. 33, 34). Tubes branch off into new tubes, 18-19 mm diameter and 32-62 mm high, all of the tubes possess a terminal oscule of 6 to 14 mm in diameter. The oscular canal is as long as the tube itself, tube wall is 3-10 mm large. Surface is irregular but smooth and covered by a membrane overlying large subectosomal cavities.

Consistency: Soft and easily torn.

Colour: Brown alive, light to dark brown in alcohol.

Skeleton: Ectosomal skeleton: dense brushes consisting of bundles of tylotes and free tylotes. Ectosomal brushes are pointed outwards, between them is a subdermal lacunae system covered by the aspicular membrane.

Choanosomal skeleton: plumose, formed by longitudinal tracts of styles (2-4 across) connected by single styles. Numerous juvenile styles are present.

TABLE 7

Spicule micrometries of *Iophon tubiforme* n. sp. *I. unicornis* Topsent, 1907 LBIMDT 1665, HOLOTYPE; from literature and remeasured. Specimens from Chile of *I. tubiforme* n. sp.

I. tubiforme n. sp.	Styles	Tylotes	Anisochelas	Bipocilla
I. unicornis Topsent, 1907 HOLOTYPE LBIMDT 1665 Ile Anvers	435-470 x 15	240-10	18-20	Not observed
Remeasured	405-443-486 x 12-15-16	194-222-243 x 8	16-19-24	32
HOLOTYPE MNHG 18813 He 7 Isla Newton	195-207-218 x 8-10-11	186-202-221 x 6-8-10	17-19	8-12-16
He 11 Isla Newton	150-173-192 x 5-6-10	141-157-170 x 3-5-6	8-10	6-10-13
He 20 Seno de Otway	170-186-195 x 6-8	141-158-166 x 5-6	12-15-16	8-10
He 21 Caleta Chica	218-237-272 x 6-7-10	173-200-218 x 3-6	11-14-16	16-17-19
He 26 Caleta Chica	170-184-202 x 5-6	134-158-173 x 3-6	13-16	10-16
He 32 Puerto Caracciolo	202-234-262 x 6-10-13	182-199-218 x 3-6	10-11-13	16-18-19
He 86 Canal Zenteno	163-179-189 x 4-6	147-157-166 x 3	13-16	6-9-10
He 103 Punta Guale	218-227-262 x 6	211-221-243 x 3-6	10-11-13	13-14-16
Vald. 47 Laguna Cachaña	192-228-262 x 10-13	173-196-211 x 5-10	13-14-16	6-8-10

Spicules: (Table 7) Megascleres: mucronate, smooth, oxeote styles (fig. 35) slightly bent, 150-272 x 5-13 µm.

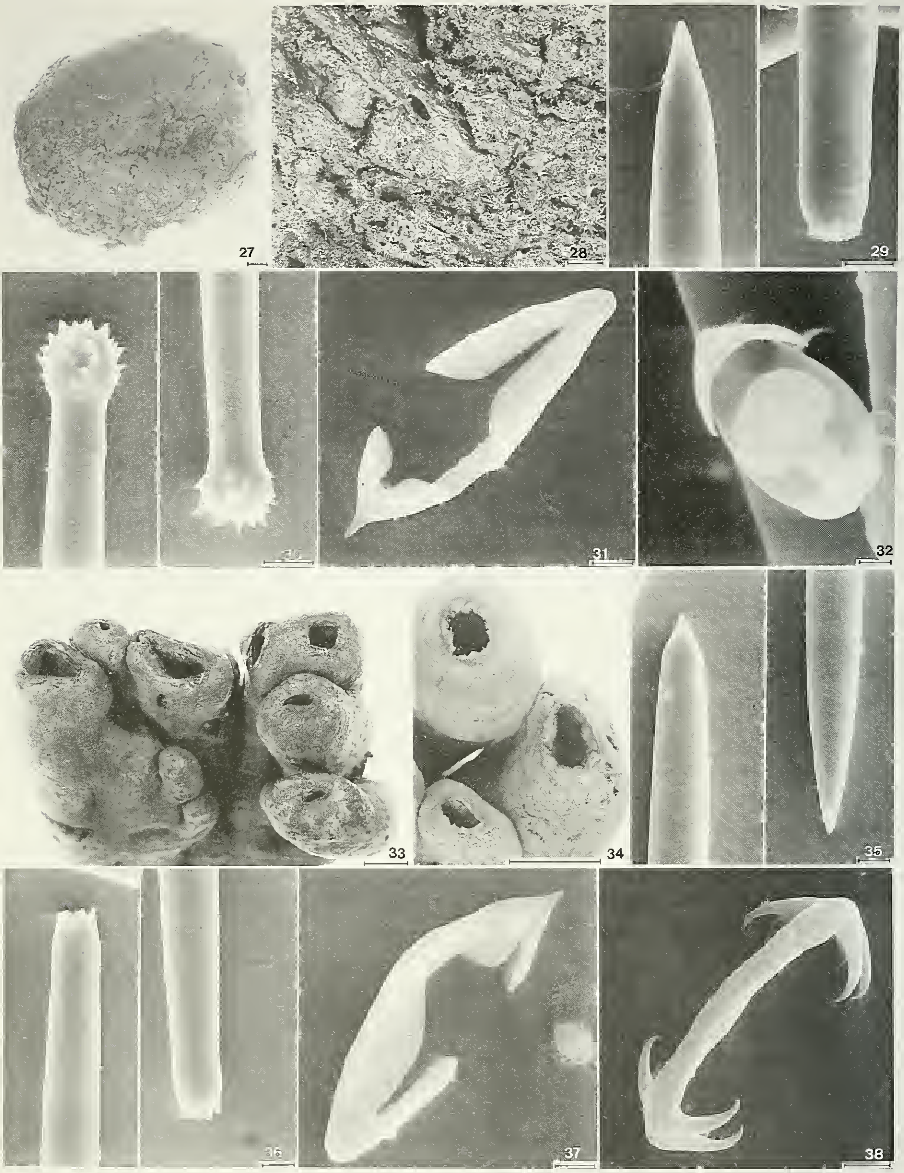
Tylotes (fig. 36) strongylote, fusiform, straight, with barely swollen, strongly microspined apices 141-243 x 3-10 µm.

Microscleres: Spurred anisochelas in a single size category (fig. 37) common, with curved shaft 8-19 µm.

Bipocilla (fig. 38) uncommon, fragile, terminal apices diverging like small fingers or teeth, 6-19 µm.

Etymology: Refers to the morphology: a mass of tubes

Ecology: Stones, fine sand, mud, 10-70 m.



FIGS 27-38. *Iophon timidum* n.sp. 27 [holotype, MNHG 18811] massive specimen from Puerto Caracciolo. 28, enlarged view of the surface. 29, smooth styles with a few spines at the base. 30, long, fusiforme tylotes with swollen apices, strongly spined. 31, spurred anisochela 1, with straight shaft. 32, malformed anisochela 2, rounded concave extremities and short axis. *Iophon tubiforme* n.sp. 33 [holotype, MNHG 18816] specimen from Caleta Chica. 34, enlaged view of the surface. 35, mucronate smooth style. 36, smooth strongylote with fusiforme swollen microspined apices. 37, spurred anisochela, with curved shaft. 38, bipocilla uncomon with finger like appendages. Scales: fig. 29, 30 = 5µm; fig. 31 = 2µm; fig. 32 = 1µm.; fig. 35, 36 = 5µm; fig. 37, 38 = 2µm.

Distribution: Chilean coast, 45°S - 53°S.

Remarks: The new species shares with *I. timidum* the smooth structural spicules and the loose skeletal reticulation; in this the two differ from all other *Iophon* of the study area. Between them they differ clearly in the form of these spicules (normal styles vs. oxeote/mucronate styles) and also in the form and spination of the tylote heads.

There is a striking match between the new species and the Antarctic *I. unicornis* Topsent (1907) in the form of the structural spicules (mucronate oxeotes). We compared the new species with the description and a slide made of the holotype of *I. unicornis*, and found several clear differences: *I. unicornis* is not tubiform, its mucronate oxeotes are about twice as long and thick as those of the new species, and its tylotes have clearly swollen apices. We also studied slides of the type of *I. spatulatus* Kirkpatrick (1907) and can confirm that this is conspecific with *I. unicornis*, as suggested by BOURY-ESNAULT & VAN BEVEREN (1982). Since TOPSENT's paper is dated July 1907 and KIRKPATRICK's September 1907, TOPSENT's name has priority.

I. spatulatus has been recorded from the study area (Isla Huemules) by DESQUEYROUX (1976) without description; since this material is not available for study, we can only speculate, that it conformed to our new species.

It is likely that Boury-Esnault's record of *I. unicornis* from Kerguelen concerns a separate new species, since its form is cup-shaped. The three mucronate-oxeote styles bearing species, one Antarctic, one Southern South America, and one Kerguelen, probably form a monophyletic group within *Iophon*.

Iophon ostiamagna Wilson, 1904

Iophon chelifer var. *ostiamagna* WILSON, 1904: 143, pl. 20, figs. 2, 4, 10, 11, pl. 24, fig. 1

MATERIAL STUDIED: HOLOTYPE: USNM 8280, Stn. 3384, 07°31'N 79°14'W, 08.03.1891, 880 m.

Not represented in our material, so only a diagnosis is given:

Lamellate growth form, 5-8 mm in thickness. Skeleton loosely reticulate. Acanthostyles long and robust, lightly spined, 450 x 20 μm. No echinating acanthostyles. Tylotes with lightly spined heads, 325 x 10 μm. Spurred anisochelas in a single category, 12-20 μm. Bipocilla in two categories, 1: 20 μm, 2: 12 μm.

Ecology: Substrate, sand, 880 m.

Distribution: 07°31'N 79°14'W.

Remarks: It is similar to the sympatric *I. lamella*, but differs in having much larger and more lightly spined acanthostyles, a single category of anisochelas and two categories of bipocilla.

Iophon radiatus *sensu* DESQUEYROUX, 1972

?*Iophon radiatus* TOPSENT, 1901: 21, pl. 3, fig. 13.
Iophon radiatus DESQUEYROUX, 1972: 23, figs. 70-75.

MATERIAL STUDIED: LBIMDT.1976, microscopic slide of Topsent's type, specimen 421.

Not represented in our material, so only a diagnosis of Desqueyroux's material, which is from the study area, is given here:

Massive, with a loosely reticulated skeleton. Long smooth styles, 460-520 x 16 µm. No echinating acanthostyles. Tylotes with distinctly spined heads, 280-350 x 9 µm. Spurred anisochelas in two widely different size categories, 1: 70µm, 2: 14 µm. Bipocilla 6-16 µm.

Ecology: Substrate, stones, 600 m.

Distribution: Chilean coast, 20°S.

Remarks: Topsent's material from Antarctica was similar in spicule sizes, and since the species has also been recorded from the Falkland Islands (Burton, 1934) and South Georgia (Burton, 1940), it may be a wide-spread species.

REVIEW OF THE FAMILY IOPHONIDAE

Shapes in this microcionine family are varied (fistular, encrusting, lobate, branching, vase-shaped). The spiculation includes those typical for the suborder: smooth or spined styles, palmate chelas and toxas (although these are absent in *Iophon* and *Acanthorhabdus*); sigmas are absent. Skeletal architecture in non-fistular forms is variously anisotropic, plumose, or isotropic.

This new concept of a revived family was first introduced by Hajdu *et al.* (1994) and elaborated by Van Soest *et al.* (1994). The following fistular genera conform to it: *Cornulum* (with junior synonym *Coelosphaerella*) *Paracornulum* (with junior synonym *Cornulacantha*) *Zyzzya* (with junior synonym *Damirina*) *Acheliderma* (with junior synonyms *Astylinifer* and *Fusifer*) *Damiria*, *Melonchela*, *Anisotylacanthaea* and *Xytopsene*. These genera were previously united in the subfamily Cornulinae Lévi & Lévi (1983). In addition, four non-fistular genera are considered to belong in this family, viz. *Iophon*, *Acarnus*, *Megaciella* and *Acanthorhabdus*.

In Van Soest *et al.* (1994) the fistular members are described and discussed. These sponges are not represented so far in the SE Pacific, so for more information on these one is referred to that paper. The remaining genera are here briefly discussed.

Acarnus Gray, 1867

Synonyms: Fonteia Gray, 1867 and *Trefortia* Deszö, 1880.

Type species: *Acarnus innominatus* Gray, 1867: 544 (by monotypy).

Diagnosis (from Van Soest *et al.*, 1994): Massive, branching or encrusting Iophonidae with ectosomal skeleton of scattered tylotes with spined heads, choanosomal skeleton consisting of an isodictyal, isotropic or anisotropic, reticulation of styles and cladotylotes, arranged singly or in tracts of several spicules, which may or may not be echinated by acanthostyles and/or cladotylotes. In thinly encrusting specimens, the choanosomal skeleton is hymedesmioid, i.e. with styles or cladotylotes erect on the substrate. The cladotylotes occur normally in two categories, but exceptionally in three or a single one. Microscleres include up to three categories of toxas, and chelas.

Remarks: Acarnus has been revised and monographed recently by VAN SOEST *et al.* (1991) (with additional data in HOOPER & LÉVI, 1993). A species of that genus occurring in the region is *Acarnus peruanus* Van Soest *et al.*, 1991; for a description one is referred to that paper. An additional specimen of that species is here recorded from the Galapagos Islands (ZMA data collections).

Genus **Megaciella** Hallmann, 1920

Type species: *Amphilectus pilosus* Ridley & Dendy, 1886 (by original designation).

Diagnosis (from VAN SOEST *et al.*, 1994): Branching or encrusting Iophonidae with ectosomal brushes of tylotes with spined heads, with a reticulate or confused choanosomal skeleton consisting of smooth styles with spined or smooth heads, arranged singly or in two's or three's. Thinly encrusting specimens have the styles erect on the substrate. Microscleres are palmate isochelas and toxas.

Remarks: The type species lacks echinating acanthostyles, but similar species with acanthostyles exist. There are no species answering to this diagnosis of *Megaciella* recorded from the SE Pacific. The Californian species *Myxichela microtoxa* De Laubenfels, 1935 is a clear *Megaciella* and "may be nearest representative" of that genus in the area.

Genus **Acanthorhabdus** Burton, 1929

Type species: *Acanthorhabdus fragilis* Burton, 1929 (by monotypy).

Diagnosis (from VAN SOEST *et al.*, 1994): Iophonidae with modified styles in the form of anisoxeas often provided with a mucron arranged in a coarse but ill-defined plumoreticulation. Ectosomal megascleres are acanthorhabds with heavy spines and microspined tylote apices. Microscleres are spurred palmate anisochelas.

Remarks: BURTON (1929) placed this rather enigmatic monotypical genus in his section Mycaleae on account of its anisochelae, but the presence of the special ectosomal megascleres makes it thoroughly untypical of this group. VAN SOEST *et al.* (1994) proposed to assign this species to Iophonidae, because the spurred anisochelae are shared with *Iophon* and the acanthorhabds have spined tylote apices found in all members of the Iophonidae. Although the occurrence of the species is technically outside the study area, we decided to examine the holotype (BMNH 1926:10:26:189), to supply more data on this intriguing species: the skeleton consists of massive plumose columns of smooth oxea-like megascleres, carrying a surface crust of acanthose spicules. The smooth oxeotes of 550 by 35 μm are decidedly asymmetrical, and often a distinct mucron (not unlike *Iophon unicornis*) is present at one end; occasionally there is a single spine at one end. The acanthorhabds of 400 by 25 μm are fusiform, heavily spined, with spines curved towards the middle of the spicules, clearly demonstrating their diactinal nature. The apices of the acanthorhabds are both provided with small spines not unlike the heads of the tylotes of *Iophon*; it is assumed - also by their position in the sponge skeleton - that these spicules are homologous to ectosomal tylotes. The spurred anisochelas of 25-30 µm length are very similar to those of various *Iophon* species. No further material of this species has become available.

KEY TO THE SPECIES OF *Iophon* OCCURING IN THE SE PACIFIC COAST

1 With two size categories of choanosomal styles. . . . . *I. proximum*
– Single size category of choanosomal styles. 2
2 Styles spined, bipocilla strongly asymmetrical. 3
– Styles smooth bipocilla almost symmatrical or absent. 4
3 Spines on styles regularly distributed. Bipocilla trilobate. Galapagos Islands . . . . *I. lamella*
– Spines on styles irregularly distributed Bipocilla trifoliate. Chilean coast. . . . . *I. chilense* n.sp.
4 Bipocilla absent. The small category of anisochelas is malformed . . . . *I. timidum* n.sp.
– Bipocilla present, almost symmetrical. . . . . *I. tubiforme* n.sp.

Suborder: Myxillina Hajdu, van Soest & Hooper, 1994

Family: Myxillidae Topsent, 1928

Diagnosis: Myxillina with smooth, mucronate or microspined tornote or tylote ectosomal megascleres arranged as bouquets, with smooth or spined monactinal or diactinal choanosomal megascleres arranged in isotropic, anisotropic or plumose reticulation. Microscleres include anchorate isochelas and/or derivates thereof (spatulate, unguiferate or birotulate chelas), and smooth sigmas.

Myxilla Schmidt, 1862

Synonyms: Burtonanchora De Laubenfels, 1936; *Crellomyxilla* Dendy, 1924; *Dendoryx* Gray, 1867; *Emplocus* Gray, 1867; *Ectyomyxilla* Lundbeck, 1909; *Hastatus* Vosmaer, 1880; *Stegxella* Bowerbank, 1874; *Stelodoryx* Topsent, 1904; *Styloptilon* Cabioch, 1968; *Tereus* Gray, 1867).

Type species: *Halichondria rosacea* Lieberkühn, 1859.

Diagnosis: Myxillidae with ectosomal spicules which are variably mucronate, strongylotylote or tornote, frequently with one or a few prominent spines on the apices. The choanosomal spicules are stylote, usually styles, with or without spination. As is usual for the family, the microscleres are anchorate chelas -spatulate and/or unguiferate- and sigmas, both types frequently in two categories.

Remarks: The suborder assignment is based on the "tridentate" nature of the chelas. The family assignment is based on the combination of tornotes, anchorate chelas and true sigmas (other myxilline genera with anchorate chelas do not have tornotes and proper sigmas, and are united in the family Crambeidae new family name).

The skeleton of the type species is a tight meshed isotropic reticulation of strongly spined styles, but other species may have more loosely constructed skeletons and smooth styles.

The possession of unguiferate chelas instead of or in addition to the spatulate anchorates occurs in several *Myxilla*-like sponges as well as in the unrelated genus *Monanchora* (*cf.* VAN SOEST, 1990), but is not considered evidence for a monophyletic group. However, for convenience sake, we propose to distinguish a subgeneric unit for *Myxilla* species with these chelas. The name *Stelodoryx* Topsent, 1904 (type *S. procera* Topsent, 1904) is available for these sponges.

The possession of smooth instead of spined styles also is not coinciding with other features and accordingly is not considered evidence for a monophyletic group. However, for convenience sake, we propose to distinguish a subgeneric unit for *Myxilla* species with smooth styles. For these, the name *Burtonanchora* De Laubenfels, 1936 (type *Myxilla crucifera* Wilson, 1925) is available.

A separate genus *Ectyomyxilla* Lundbeck, 1909 with echinating strongly spined styles is likewise not recognized as a monophyletic group, because the presence of these spicules does not coincide with other morphological features. However, it is useful as a subgeneric unit. Technically, the name *Ectyomyxilla* is a nomen nudum because LUNDBECK (1909) did not mention any species when erecting this genus. However, since the name was proposed before 1930, the subsequent use of the name by HENTSCHEL (1914) for *E. kerguelensis* HENTSCHEL 1914, satisfies Article 13 (i) of the ICZN code (1985) as subsequent type species designation.

The remaining genera listed as junior synonyms above are synonyms of Myxilla (Myxilla).

This wide diagnosis of *Myxilla* encompasses species from all areas of the world.

Subgenus **Myxilla** Schmidt, 1862

Diagnosis: Myxilla with thight meshed isotropic skeleton and exclusively spatulate anchorate chelae; without a special category of echinating acanthostyles.

Myxilla (Myxilla) mexicensis Dickinson, 1945 (Figs. 39-53)

Myxilla mexicensis DICKINSON, 1945: 18, pl. 24, figs. 47, 48, pl. 25, figs. 49, 50.

MATERIAL STUDIED: AHF 9, holotype of *Myxilla mexicensis* Dickinson, 1945, Stn. 513.36, off San Francisco Island, Gulf of California, 60 m.

USNM 37917, MHNG 18958: Ga.II.3, Stn. 17, Galapagos Islands, Kicker Rock, coll. W.D.Hope, 02.1978, 23 m; USNM 37918, MHNG 18959: Ga.II.8, Galapagos Islands, Kicker Rock; USNM 37919, MHNG 18960, ZMA 10978, USNM 39360: Ga.II.4, Stn. 8, Galapagos Islands, Punta Vicente Roca, Isla Isabela, 02.1978, 18 m; USNM 39360, MHNG 18961: Ga.IV.33, Cruise 18B 794E, Galapagos Islands, Santiago Island, 00°12'S 90°51'W, 23.09.1966, 34 m ; ZMA 10979, Cruise 18B 791C, Galapagos Islands, Santa Cruz Island, 00°26'S 90°20'W, 21.09.1966, 95 m.

Description

Five specimens (figs 39-42): 45-80-100-120 x 30-60-100-70 mm and 3 fragments: 20-50-80 x 10-20-50 mm, high and diameter. Sponge tubiform, with the basal part slightly enlarged and a central canal from 50 to 80 mm diameter in the different specimens and fragments studied. Surface strongly tuberculate and irregular (somewhat resembling *Xestospongia*) and covered by a membrane. The interior of the sponges shows large open spaces and canals. Pores irregularly scattered in surface depressions; oscules scattered over the inner wall of the tube.

Consistency: hard and fragile, crumbly.

Colour: Orange-brownish in formalin, brownish to yellow-white in alcohol.

Skeleton: Ectosomal skeleton a perpendicular compact palisade of tylotornotes and free microscleres.

Choanosomal skeleton: an tight meshed isotropic reticulation of strongly spined styles, abundant microscleres, especially sigmas.

Spicules (Table 8): Megascleres: strongly spined styles (figs 43, [44 holotype]) slightly bent and with strong spines, scarcely distributed but more abundant at the base, 163-208 x 3-10 µm.

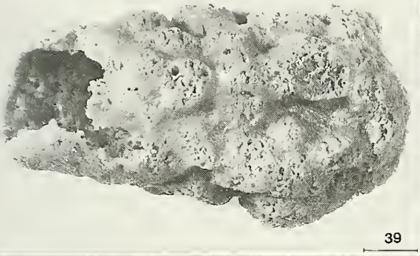
Table 8

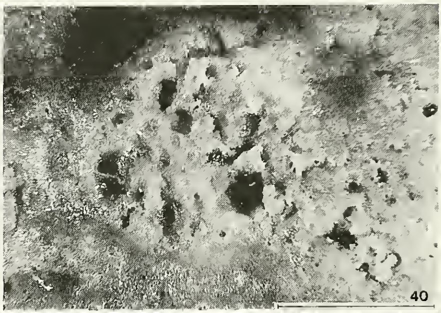
Spicule micrometries of *M. (Myxilla) mexicensis* Dickinson, 1945. *M. mexicensis* Dickinson, 1945 AHF 9 holotype; from literature and remeasured. Specimens from Galapagos of *M. (M.) mexicensis*.

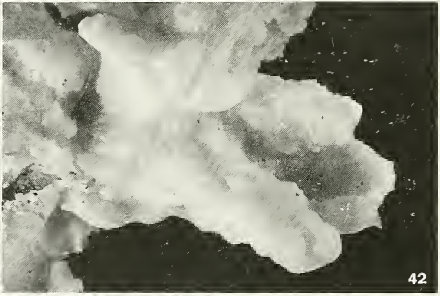
M. (Myxilla) mexicensis Dickinson, 1945	Spined styles	Tylotornotes	Isochelas 1 Isochelas 2	Sigmas 1 Sigmas 2
Holotype AHF.9 San Francisco Island	not indicated	not indicated	not observed 10-12	32 14
Remeasured	176-208-226 x 6-8-10	144-166-176 x 4	23-28-31 12-18-20	20-28-35 12-14-15
GA.II.3 Kicker Rock. Stn. 17 USNM 37917	163-178-195 x 3-6-10	144-159-173 x 3	22-27-29 10-13-16	22-28-32 11-15-19
GA.II.4 Kicker Rock USNM 37919	173-184-195 x 6-7-10	144-160-173 x 3-4-5	22-25-29 11-13-18	22-26-32 10-11-13
Ga.IV.33 18B794E Santiago Island	182-199-214 x 10-11-13	154-165-179 x 3-4-6	22-29-32 10-13-19	19-25-29 11-14-16

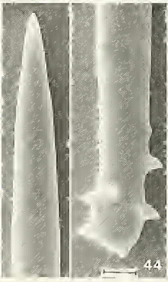
Tylotornotes (figs.45, [46 holotype]) straight, regular diameter and with barely swollen "cut-off" spined apices, about four to five spines at each end, 141-273 x 3-5 µm.

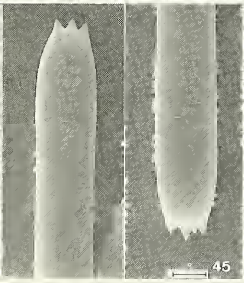
Microscleres: Anchorate spatuliferous isochelas 1 (figs.47, [49 holotype]) 22-29 µm, with a shaft only slightly curved, with three free alas of the same length, the innermost longer than the others and attached to the shaft. Anchorate spatuliferous

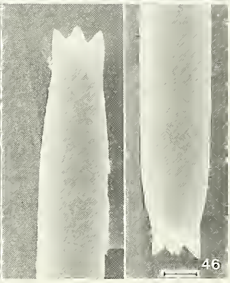








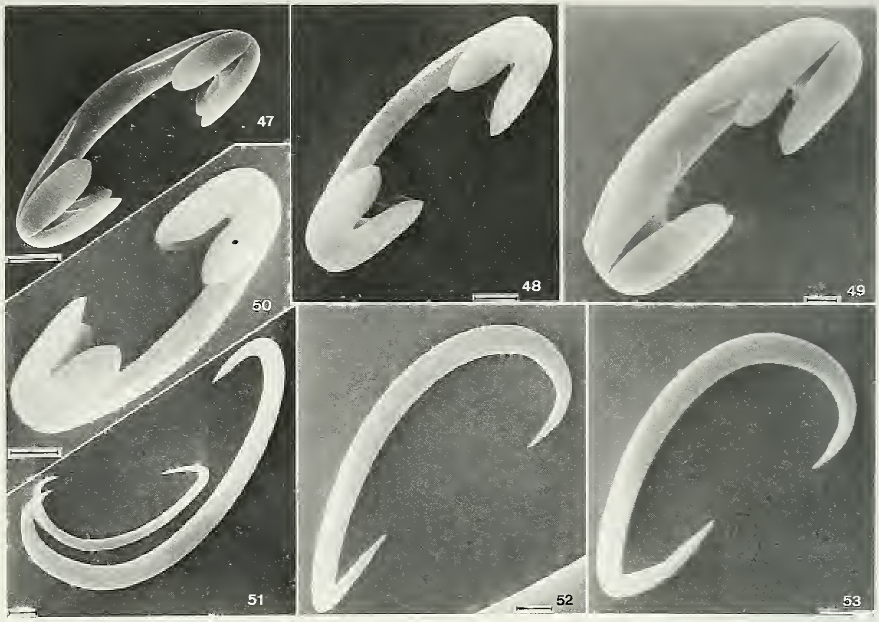




FIGS 39-46

Myxilla (Myxilla) mexicensis Dickinson, 1945. 39, specimen from Galapagos Islands. 40, enlarged view of the surface. 41 [HOLOTYPE, AHF 9] from Gulf of California. 42, enlarged view of the surface. 43, slightly bent styles, strongly spined, spines scarcely distributed. 44, style from holotype. 45, tylotornotes straight, regular diameter and with barely swollen "cut-off" spined apices about four to five spines at each end. 46, tylotornotes from holotype. Scales: figs 43, 44, 46 = 5 μm.

isochelas 2 (figs 48, [50 holotype]) 10-19 μm, shaft slightly bent, three teeth are visible in frontal view, the innermost longer than the others and attached to the shaft. Since these chelas are morphologically identical, it is not entirely certain that the size categories are genuine.



FIGS 47-53

Myxilla (Myxilla) mexicensis Dickinson, 1945. 47 [49 holotype] anchorate spatuliferous isochela 1 with a shaft only slightly curved, with three free alas of the same lenght, the innermost longer than the others and attached to the shaft. 48 [50 holotype] anchorate spatuliferous isochela 2, shaft slightly bent, three teeth visible in frontal view, the innermost longer than the others and attached to the shaft. 51, sigmas 1 and 2. 52, sigma 1. 53, sigma 2 from holotype. Scales: fig. 47 = 5 µm; figs 48-53 = 2 µm.

Sigmas (fig. 51): Sigma 1, 19-35 µm (fig. 52) and sigmas 2: 11-19 µm (fig. 53 [holotype]) with one of the apices strongly bent and the other largely open, both abruptly pointed.

Ecology: Presumably fixed to hard bottom, no visible attaching points, 18-60 m.

Distribution: Galapagos, Southern California.

Remarks: The specimens were compared with a fragment of DICKINSON's type and found to be essentially similar, as is apparent from figs 39-42. DICKINSON (1945) reported only a single category of isochelas of 10-12 µm, but we found the same size range as in our specimens (cf. figs 47-50). Although the growth form of Dickinson's specimen was not tube-shaped, it was a much smaller specimen. One of our specimens also was smaller and it showed only a widened oscule in stead forming a definite tube. We assume the growth form to be a tube only in mature specimens.

In spicule form, size and skeletal arrangement this species is closely related to the type species of *Myxilla*, viz. *M. rosacea* (Lieberkühn, 1859), and to other Northern Hemisphere species as *M. fimbriata* (Bowerbank, 1866) and *M. incrustans* (Johnston, 1842).

Myxilla (Myxilla) mollis Ridley & Dendy, 1886 (Figs. 54-65)

Myxilla mollis RIDLEY & DENDY, 1886: 471; 1887: 133, pl. xxvii, figs. 4, 4a-b; Burton, 1932: 309, pl. lv, figs1-4; 1934: 28; 1940: 107.
Myxilla spongiosa RIDLEY & DENDY, 1886: 471, 1887: 134, pl. xxvii, figs. 3, 3a-f.

MATERIAL STUDIED: BMNH 1887:5:2:112, holotype of *Myxilla mollis* Ridley & Dendy, 1886, Challenger Exped. Stn.311, off sw coast of Patagonia , 52°45'S 73°46'W, 11.01.1876 , 448 m; BMNH 1887:5:2:131, Stn. 308, 05.01.1876, 50°08'S74°41'W, 320 m; BMNH 1887:5:2:93, holotype of *Myxilla spongiosa* Ridley & Dendy, 1886, Challenger Stn. 320, off mouth of the Rio de la Plata, 37°17'S 53°52'W, 14.02.1876, 1097 m.

MHNG 18962: HE 8, HE 16, Boca Seno Baker, 47°49'S 74°38'W, 01.10.1972, 300 m; MHNG 18963: HE 48, Isla Topar, 50°06'S 74°41'W, 16.01.1972, 150 m.

DESCRIPTION

Several specimens (figs. 54, 55) and fragments with basal holdfast, 41-97 x 30-80 x 10-23 mm. Sponge massive. Surface irregularly tuberculate or minutely conulose, covered by a thin membrane; where this is damaged, an irregular system of small subdermal cavities is revealed. Several small oscules 2-4 mm diameter, scattered on the surface, in one specimen, some of them are at the end of a small tube.

Consistency: Soft and compressive, elastic.

Colour: Yellowish-orange to grey alive; light to dark brown in alcohol.

Skeleton: Ectosomal skeleton: tangentially arranged anisotylotes in a loose palisade. Abundantly distributed microscleres, producing a continuous crust.

Choanosomal skeleton: a loose reticulation of smooth styles, occasionally arranged side by side (4-5). No continuous tracts. Microscleres abundantly scattered all over the choanosome, but especially around the aquiferous canals.

Spicules (Table 9): Slightly spined styles to subtylostyles (figs. 56 [60 holotype]) smooth, swollen base with a few spines, slightly curved, 414-526 x 10-13 µm.

Anisotylotes (figs. 57 [61 holotype]) straight, apices swollen unequally, one end being more elongated than the other, with small spines on both extremities 221-280 x 7-10 µm.

Microscleres: Spatuliferous anchorate isochelas 1 (fig. 58), three to five relatively long teeth, only slightly curved, 34-49 µm. Spatuliferous anchorate isochelas 2 of similar shape (figs. 59 [62 holotype]) 16-22 µm .

Sigmas 1, 34-79 and 2 20-32 µm (figs. 63-65) common, C - or S - shape.

Ecology: Stones and calcareous substrate, 150-1097 m.

Distribution: West and east coast of South America: 47°S-52°S, 37°S; Falkland Islands; South Georgia.

Remarks: Our material was compared to the type specimen of Ridley & Dendy, and found to be quite similar, with the characteristic almost smooth styles, except at the slightly spined base and two categories of chelas and sigmas. The smooth styles are shared with *M. (Burtonanchora) asymmetrica* n.sp. (cf. below), but that species has and asymmetric chelas, and with *M. discoveryi* but that species has unguiferate chelas.

Records of this species by BURTON (1932, 1934, 1940) presumably are correct, extending the distribution to the east coast of South America, and to the Falkland Islands and South Georgia.

TABLE 9

Spicule micrometries of *M. (Myxilla) mollis* Ridley & Dendy, 1886. *M. mollis* Ridley & Dendy BMNH 1887:5:2.112 holotype; *Myxilla spongiosa* Ridley & Dendy, 1886 BMNH 1887:5:2:93 holotype; from literature and remeasured. Specimens from Chile of *M. (M.) mollis.*

M. (Myxilla) mollis R. & D., 1886	Styles	Anysotylotes	Isochelas 1 Isochelas 2	Sigmas 1 Sigmas 2
M. mollis R. & D. 1886 BMNH1887:5:2:112 sw. Patagonia	420 x 10	220 x 6	40 not observed	63
Remeasured	421-457-486 x 8	227-259-283 x 4-6-8	32-34-40 24-26-28	40-45-49 16-22-28
M. spongiosa R. & D. 1886 BMNH1887:5:2:93 Off Rio de la Plata	700 x 20	400 x 10	50 not observed	45-63 not observed
Remeasured	539-586-617 x 15-17-20	250-280-300 x 8-9-10	47-49-55 20-21-23	45-65-79 20-26-31
He 8 Boca Seno Baker	428-468-526 x 10-11-13	222-247-257 x 8-10	36-43-46 17-19-22	46-54-79 20-23-24
He 16 Boca Seno Baker	414-477-513 x 10-13	221-236-249 x 7	34-43-49 16-19-22	40-51-58 21-25-32
He 48 Isla Topar	428-471-503 x 10-12-13	250-267-280 x 7	41-48 16-18-21	34-49-58 21-24-26

By comparing microscopical slides of the types of *M. mollis* and *M. spongiosa* Ridley & Dendy, 1886 from the area off Argentina (37°S), we could ascertain that this is likely to be a junior synomym of *M. mollis* (the latter has page priority). Like *M. mollis* occasional spines occur on the styles of the type specimen. The only difference is the somewhat larger megasclere sizes of *M. spongiosa.* Hentschel's (1914) record of this species from Antarctica is probably incorrect as the styles are reported as spined. Hentschel's material has been elevated to a separate species *M. hentscheli* (in subgenus *Ectyomyxilla*) by BURTON (1929).

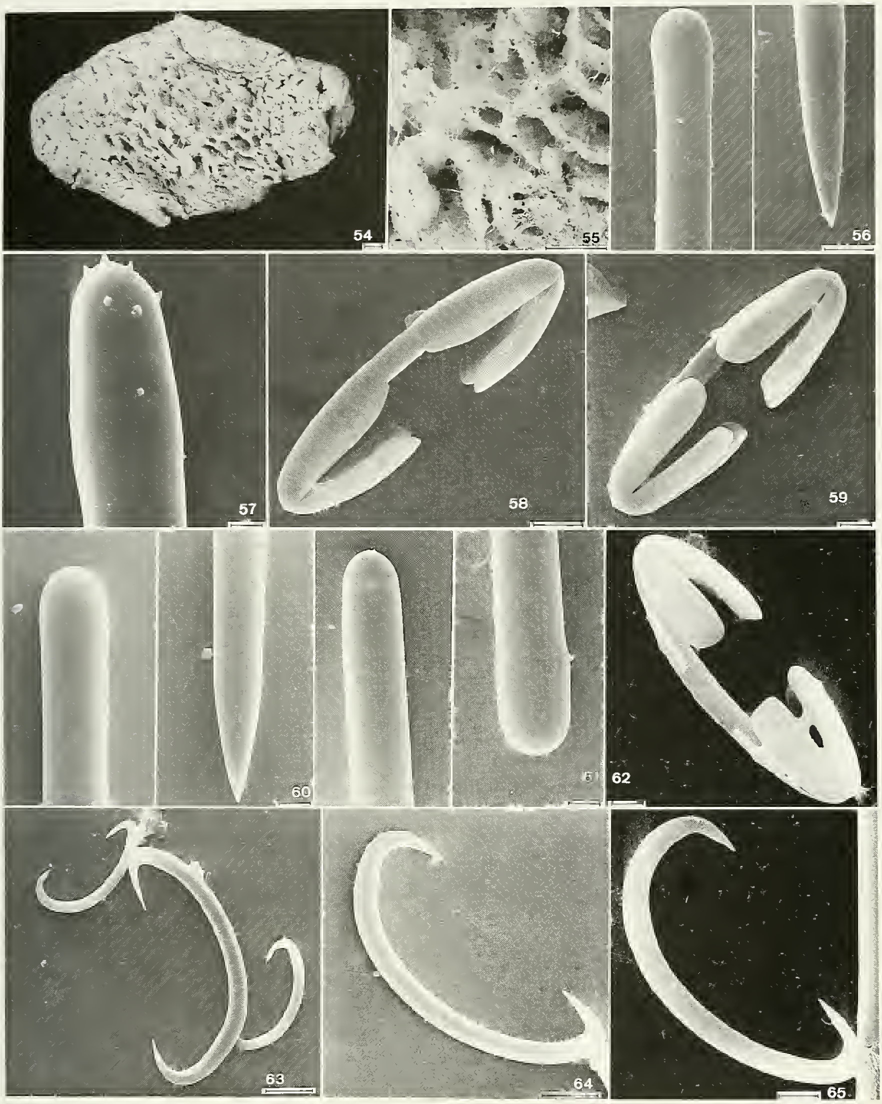
Myxilla (Myxilla) caliciformis Sarà, 1978

Myxilla caliciformis SARÀ, 1978: 46, figs. 28, 29.

MATERIAL STUDIED: EAI-76, holotype of *Myxilla caliciformis* Sarà, 1978, Puerto Roca, Isla Dos Estados, 11.01.74, 2-3 m.

Not represented in our material so only a diagnosis will be given:

Cup-shaped sponge.Anisotropic skeleton superimposed on the isotropic meshes as usuals for the genus. Acanthostyles small, strongly spined, 120 x 6 µm. Tornotes with heavily spined apices, 120 by 3 µm. Spatuliferous anchorate chelas in two size categories: 18 and 12 µm. Sigmas 30 µm.



FIGS 54-65

Myxilla (Myxilla) mollis Ridley & Dendy, 1886. 54, massive specimen from Isla Topar. 55, enlarged view of the irregular tuberculate surface. 56 [60, holotype, BMNH 1887:5:2:112] slightly spined styles to subtylostyles. 57 [61, holotype] spined swollen apex from anisotylotes. 58, spatuliferous anchorate 1. 59, spatuliferous anchorate isochela 2 [62 holotype]. 63, sigmas 1 and 2. 64 [65 holotype], sigma 2. Scales: figs. 56, 63 = 10 µm; figs. 57, 59, 62, = 2 µm; figs. 58, 60, 61, 64, 65 = 5 µm.

Distribution: Tierra del Fuego.

Remarks: Through its cup-shaped growth form this species stands out among the *Myxilla* species of the study area. Judged from the spicules and skeletal structure its closest relative is *M. (M.) mexicensis.*

Subgenus **Burtonanchora** de Laubenfels, 1936

Diagnosis: Myxilla with smooth instead of spined styles.

Myxilla (Burtonanchora) asymmetrica n. sp. (Figs. 66-73)

MATERIAL STUDIED: USNM 39335, HOLOTYPE: MHNG 18831, ZMA 10980: Ga.44 SEPBOP "Anton Bruun" Exped., Cruise 18B 754, Peru, 07°49'S 80°38'W, 06.09.1966, 605-735 m.

DESCRIPTION

Numerous specimens (figs. 66 [67 Holotype]) of 20-40 x 10-25 mm, and numerous fragments of 10-20 mm, of an encrusting to conical to massive sponge. Although the substrate is no longer preserved with the sponge, impression marks on the undersides of the specimens indicate that this species probably encrusts gastropod molluscs. Surface rugose and irregular, several small oscules, 1.5-2 mm diameter are visible.

Consistency: Soft and elastic, very fragile.

Colour: Greyish to brownish in alcohol.

Skeleton: Ectosomal skeleton: tangentially arranged compact palisade of tylotes and microscleres abundantly distributed.

Choanosomal skeleton: a loose reticulation of smooth styles, irregular aquiferous spaces rounded by isochelas.

Spicules (Table 10): Megascleres: Smooth styles (figs. 68, 69) irregularly bent and of uniform diameter, 478-571 x 16 µm.

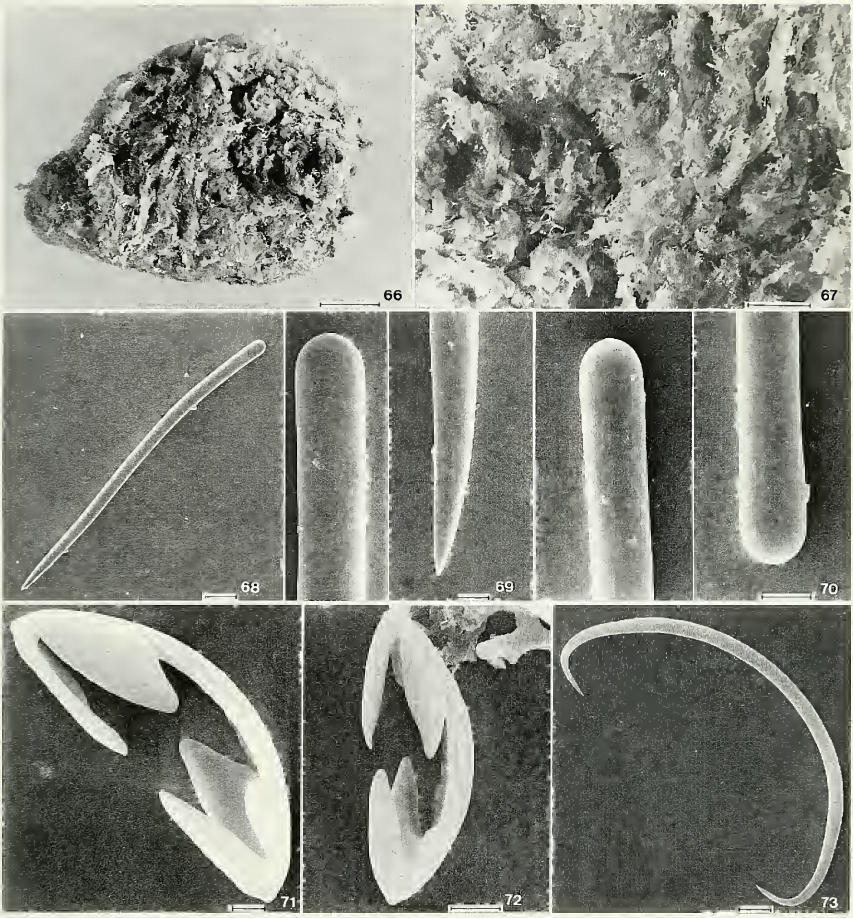
Smooth isotylotornotes (fig. 70): 219-283 x 5 µm.

Microscleres: Asymmetrical spatuliferous anchorate isochelas (figs 71, 72) that at first glance appear arcuate, but the curved shaft is sheathed in continuous fimbriae

TABLE 10

Spicule micrometries of *M.(Burtonanchora) asymmetrica* n. sp. USNM holotype from Peru.

M. (Burtonanchora) asymmetrica n. sp.	Styles	Isotylotornotes	Isochelas	Sigmas
Holotype USNM 39335 Ga.44 18B754 07°49'S 80°38'W	478-515-551 x 16	219-245-283 x 5	20-26-32	49-65



Figs 66-73

Myxilla (Burtonanchora) asymmetrica n.sp. 66 [holotype, USNM 39335] massive specimen from Galapagos. 67, enlarged view of the surface. 68, 69, smooth styles irregularly bent. 70, smooth isotylotornote. 71, 72, asymmetrical spatuliferous anchorate isochela. 73, sigma widely open. Scales: fig. 68 = 50 µm; fig. 69 = 10 µm; figs. 70, 72, 73 = 5µm; fig. 71 = 2 µm.

next to the three alae. The asymmetrical aspect is found in the length of the lateral alas of which one is always considerably shorter than the central one. This modification occurs always in opposite position. Many of the alae have frayed or denticulated rims. Size 20-32 µm.

Sigmas (fig. 73): widely curved and abruptly pointed, abundant, 49-65 µm.

Ecology: Probably encrusting gastropods, 605-735 m depth.

Distribution: Peru, 07°49'S 80°38'W.

Remarks: The asymmetrical chelas are unique for the genus. There are no matching descriptions in the literature. In other families, also species with asymmetrical chelas have been described: *Esperiopsis glomeris* Topsent, 1904 and *E. pulchella* Boury-Esnault & Van Beveren, 1982 (family Mycalidae) and *Phorbas dayi* (Lévi, 1963 as *Anchinoe*) (family Anchinoidae). These represent convergent developments.

Subgenus **Ectyomyxilla** Lundbeck, 1909

Diagnosis: Myxilla with echinating strongly spined styles.

Myxilla (Ectyomyxilla) chilense Thiele, 1905 (figs 74-81)

Myxilla chilensis THIELE, 1905: 443, figs. 22, 62 a-e; BURTON 1932: 311, pl. liv, fig. 10; 1934 [in part]: 28; 1940: 108; BOURY-ESNAULT & VAN BEVEREN 1982, as *Crellomyxilla* [in part?]: 84, pl. xiv, fig. 53, fig. 24 a-e.

MATERIAL STUDIED: ZMB 3298, holotype of *Myxilla chilensis* Thiele, 1905, Calbuco, 41°46'S 73°08'W. MHNG 18965-18967: VALD. 44.1, Quintupeu, 42°10'S 72°24'W, 23.07. 1971, 12 m; VALD. 53.7, Islote Caleta Lobato, 45°5'S 74°47'W, 17.07.1972, 15 m; Co 93-51, Pelluco, 41°30'S 72°54'W, 20.12.1990, 15 m.

DESCRIPTION

One specimen (figs. 74, 75), 50 x 40 x30 mm, and two fragments of 31-48 x 30-39 x 29-39 mm. Sponge largely massive. Surface uneven, hispid, minutely corrugated or conulose and covered by a thick, transparent surface membrane. Oscules numerous, scattered, 1.5-3 mm diameter.

Consistency: compressible.

Colour: bright yellow, yellowish-orange alive, pink to whitish in alcohol.

Skeleton: The ectosomal skeleton is a variable thick, dense palisade of tornotes and acanthostyles 2 positioned at oblique angles, forming part of the detachable surface membrane. The choanosomal skeleton is a dense and irregular to subisodictyal network of spined styles 1 and abundant microscleres. Numerous aquiferous canals are distributed all over the choanosome.

Spicules: (Table 11) Megascleres: Strongly spined acanthostyles 1 (fig. 76) almost straight, abundantly distributed spines, which are longer at the basal end, sharp apex, 176-229 x 8-13 µm. Spined acanthostyles 2 (fig. 77) slightly curved, numerous small spines, sharp apex, 83-144 x 3-6 µm.

Tornotes (fig. 78) smooth, straight, sharp, abrupt apices, 157-211 x 4-10 µm.

Microscleres: Spatuliferous anchorate isochelas 1 (fig. 79) curved shaft, common 18-45 µm. Spatuliferous anchorate isochelas 2 (fig. 80) curved shaft, common, 10-16 µm.

Sigmas, C- or S - shaped (fig. 81) common, tapering abruptly 32-64 µm.

Ecology: Pebbles, calcareous and bryozoa fragments, 12-15 m.

TABLE 11

Spicule micrometries of *M. (Ectyomyxilla) chilense* Thiele, 1905. *M. chilensis* Thiele, 1905 ZMB 3298, HOLOTYPE; from literature and remeasured. Specimens from Chile of *M. (E.) chilensis.*

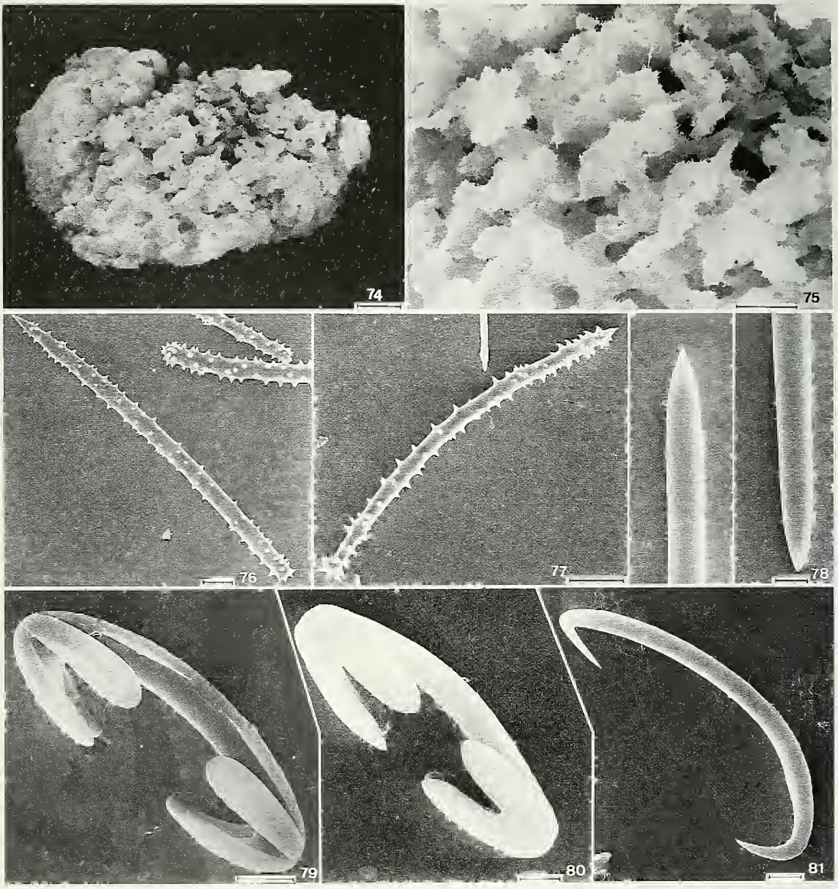
M. (Ectyomyxilla) chilense Thiele, 1905	Acanthostyles 1 Acanthostyles 2	Tornotes	Isochelas 1 Isochelas 2	Sigmas
Holotype ZMB 3298	170-200	170-190	20-35	45-47
Calbuco	x 10-12	x 6-7	12-15	
	not observed			
Remeasured	182-195-208	163-181-202	19-26-29	45-47-51
	x 6-8-10	x 6	11-14-16	
	102-122-134			
	x 6			
Vald. 44-1	205-216-229	192-201-211	18-20-29	35-54-64
Quintupeu	x 8	x 4-6	10-14-16	
	83-119-144			
	x 3-6			
Vald. 53-7	176-191-202	157-181-298	38-40-45	32-43-48
I. Caleta Lobato	x 8-10-11	x 5-6	10-14-16	
	112-125-138			
	x 3-6			
Co.93-51	176-198-218	166-184-195	19-22-29	38-40-45
Pelluco	x 10-11-13	x 4-7-10	10-14-16	
	128-132-144			
	x 6			

Distribution: Chilean coast : 41°S-45°S; Falkland Islands; Kerguelen ?

Remarks: BOURY-ESNAULT & VAN BEVEREN (1982) recorded "*Crellomyxilla*" *chilensis* and "*C.*"*kerguelensis* sympatrically from the Kerguelen Islands. Apparently, the two species may be distinguished on the different size of the sigmas, 45-58 and 12-32 µm. Other authors (e.g. BURTON 1934) considered the two as conspecific. *Crellomyxilla Dendy* (1924) with type species *C. intermedia* Dendy, 1924 from northern New Zealand, is a junior synonym of *Ectyomyxilla*. Dendy interpreted the acanthostyles 2, which are mixed in among the ectosomal tornotes, as evidence for crellid affinity. This character, however, is also found in *M. kerguelensis*, the type of *Ectyomyxilla*, so synonymy is clear. If *M. chilensis*, *M. kerguelensis*, and *M. intermedia* are distinct species, they may be separated as a monophyletic subgenus from other other *Myxilla* species possessing acanthostyles 2.

Myxilla (Ectyomyxilla) dracula n. sp. (Figs. 82-90)

HOLOTYPE: USNM 39351, MHNG 18968, ZMA 10981: Ga.III.36, SEPBOP "Anton Bruun" Cruise 16 627 A, Peru, 05°01'S 81°25'W, 06.1966, 200 m.



FIGS 74-81

Myxilla (Ectyomyxilla) chilense Thiele, 1905. 74, massive specimen from Quintupeu. 75, enlarged view of the surface. 76, acanthostyle 1, strongly spined, 77, acanthostyle 2, slightly curved. 78, smooth oxotornote. 79, 80, spatuliferous anchorate isochela 1 and 2. 81, sigma, abruptly pointed, C-shaped. Scales: figs. 76, 77 = 20µm; figs. 78, 79, 81 = 5µm; fig. 80 = 2µm.

DESCRIPTION

Small, thinly encrusting layer on a mass of hydroid chitinous stolons (figs. 82, 83). Surface irregular and covered by a spiculous membrane. No oscules are visible.

Consistency: Very fragile, but elastic.

Colour: Grayish in alcohol.

Skeleton: Ectosomal skeleton: a palisade of densely packed bundles of tylotornotes and abundant free tylotornotes. Microscleres are abundant too.

Choanosomal skeleton: A loose and confused reticulation of strongly to moderately spined acanthostyles 1 and 2 and extremely abundant microscleres. The sponge skeleton surrounds the mass of hydroid stolons.

Spicules (Table 12): Megascleres: Acanthostyles 1 (fig. 84) almost straight, with only a few strong spines, 308-397 x 8 µm. Acanthostyles 2 (fig. 85) slightly bent, spines abundant, 140-160 x 2 µm.

Table 12

Spicule micrometries of *M. (Ectyomxilla) dracula* n. sp. MNHG 18968, holotype from Galapagos.

M. (Ectyomyxilla) dracula n. sp. Holotype USNM 39351	Acanthostyles 1 Acanthostyles 2	Anisotylotornotes	Isochelas 1 Isochelas 2 2	Sigmas 1 Sigmas 2
Ga.III.36 16627A 05°01'S 81°25'W	308-355-397 x 8 140-160 x 2	170-182-194 x 4	40-45-49 12-13-16	32-42-51 18-21-24

Anisotylotornotes (fig. 86) with a few small spines at the apices, 170-194 x 4 µm.

Microscleres: Spatuliferous anchorate isochelas 1 (fig. 87) straight shaft, 40-49 µm. Peculiarly small anchorate isochelas 2 (fig. 88) strongly curved and with long narrow alas sharply bent inwards and almost meeting in the centre, 12-16 µm.

Sigmas 1 and 2 (figs. 89, 90) largely open and abruptely pointed, 32-51 and 19-24 µm.

Etymology: the name refers to the long thin teeth of the chela 2, which evoke associations of dragon's teeth.

Ecology: 200 m depth.

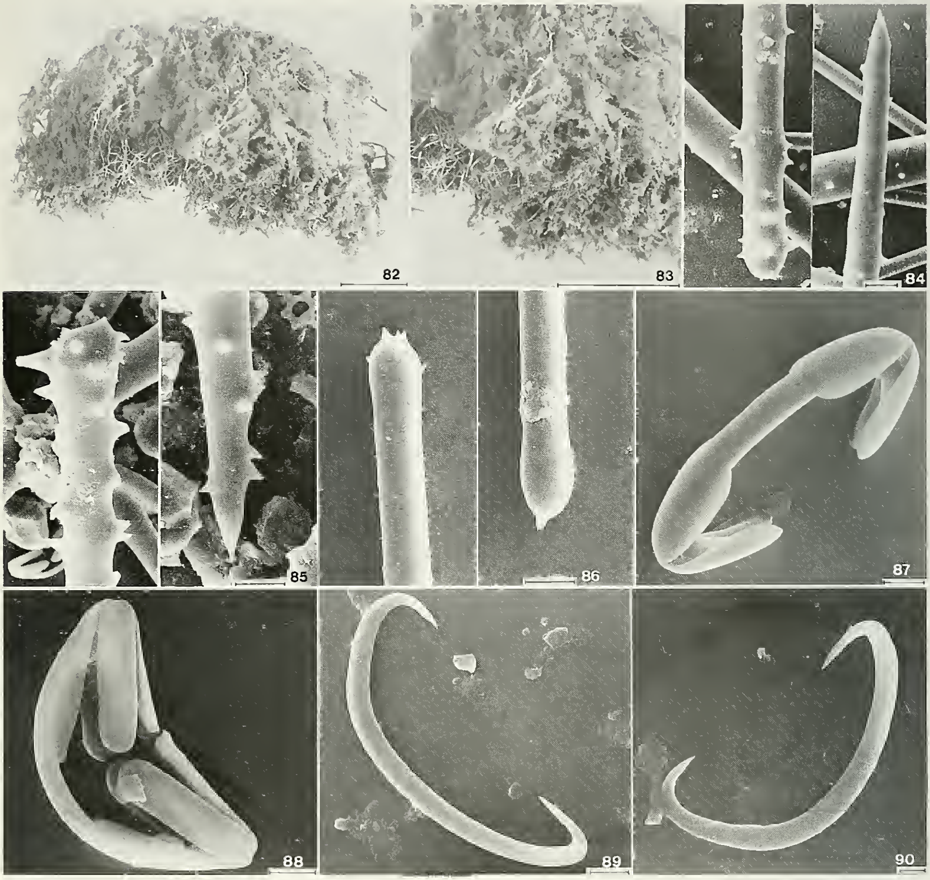
Distribution: Peru, 05°01'S 81°25'W.

Remarks: The characteristic curved chelas 2 make this new species distinct from any known species of the genus. Apart from these peculiar chelas, the new species shows similarities with *Myxilla massa* Ridley & Dendy, 1886 (cf. below), described from Chile. This species has only a single category of sigmas and the acanthostyles 1 are fully spined.

Myxilla (Ectyomyxilla) massa Ridley & Dendy, 1886

Myxilla mariana var. *massa* Ridley & Dendy, 1886: 473; 1887: 138, pl. xxvii, figs. 6, 6a-f.

Material studied: BMNH 1887:5:2:95, holotype of *M. mariana* var. *massa* Ridley & Dendy, 1886, Challenger Expedition, Station 311, off the south west coast of Patagonia, 52°45'S 73°46'W, 01.1876, 448 m; BMNH 1887:5:2:108, holotype of *M. massa* Ridley & Dendy, 1886, Challenger Expedition, Station 142, off Marion Island, 35°04'S 18°37'W, 12.1873, 274 m.



Figs 82-90

Myxilla (Ectyomyxilla) dracula n.sp. 82 [holotype USNM 39351] encrusting specimen from Galapagos. 83, enlarged view of the surface. 84, acanthostyle 1 almost straight with only few strong spines. 85, acanthostyle 2 slightly bent abundantly spined. 86, anisotylotornotes with a few small spines at the apices. 87, spatuliferous anchorate isochela 1. 88, peculiarly incurved small isochela 2. 89, 90, sigmas 1 and 2, largely open, abruptely pointed. Scales: fig. 84 = 10µm; figs 85-87 = 5µm; figs. 88, 90 = 2µm.

Not represented in our material, so only a diagnosis is given:

Massive sponge. Loosely reticulated skeleton. Acanthostyles 1 fully spined, 400-420 by 10 µm. Acanthostyles 2 fully spined, 140-150 by 6 µm. Smooth tornotes 250-280 by 4.5 µm. Spatuliferous anchorate isochelas 1 and 2, 30-37 and 18 µm. Sigmas 45-56 µm.

Distribution: Chilean Patagonia, 52°S.

Remarks: As discussed above, *M. (E.) dracula* n.sp. is similar to *M.(E.)massa* but has strongly incurved isochelas and sparingly spined styles. *M. massa* was synonymized with *M. mariana* Ridley & Dendy, 1886 from Marion Island (Indian Ocean) by KOLTUN (1964). We examined a slide made from the type specimen and found that a separate acanthostyles 2 category is not well differentiated. Also, the tornotes have rounded smooth oval heads instead of the mucronate ones of *M. massa*. We assume that these differences are evidence for specific distinctness.

?**Myxilla (Ectyomyxilla) tenuissima** (Thiele, 1905)

Hymedesmia tenuissima THIELE, 1905: 454, figs. 70a-f.
Ectyomyxilla tenuissima (Thiele, 1905); LÉVI, 1963: 36, fig. 39; DESQUEYROUX, 1976: 102.

No material examined, so only tentative remarks can be made:

Thinly encrusting sponge. Hymedesmioid skeleton or regular reticulation. Acanthostyles 1 180-290 by 10-15 µm. Acanthostyles 2 100-150 by 7-10 µm. Tornotes oxea-like, with microspined ends. Anchorate chelas 10-30 µm. Sigmas: 45-48 µm.

Distribution: Calbuco, Chilean coast, 41-42°S; South Africa, 31°14'S 16°36'E, 12-272 m.

Remarks: On paper this description comes close to *M. chilensis*, with as the only tangible difference the microspined condition of the tornotes. Type specimen is not extant at ZMB, for the time being this species must be considered as incertae sedis.

Subgenus **Stelodoryx** Topsent, 1904

Diagnosis: Myxilla with unguiferate instead of or in addition to spatulate anchorate chelae.

Myxilla (Stelodoryx) cribrigera Ridley & Dendy, 1886 (Figs. 91-98)

Myxilla cribrigera RIDLEY & DENDY, 1886: 472, 1887: 135, pl. xxvii, figs. 7, 7a,b.
Stelodoryx discoveryi BURTON, 1932: 316, fig. 28.
?*Myxilla verrucosa* BURTON, 1932: 312, text fig. 27; DESQUEYROUX, 1972: figs. 81-86; 1976: 101.

MATERIAL STUDIED: BMNH 1887:5:2:138, HOLOTYPE of *Myxilla cribrigera* Ridley & Dendy, 1886, Challenger Expedition, Stn. 306A, off the south-west coast of Patagonia, 48°27'S 74°30'W, 02.01.1876, 631 m; BMNH 1928:2:15:426, holotype of *Stelodoryx discoveryi* Burton, 1932, St. WS 88, Falkland Islands, 54°07'S 58°16'W, 06.04.1927, 96-127 m; MHNG 18969-18974: He 178, Seno de Otway, 53°00'S 71°30'W, 17.09.1972, 30 m; MNHNC 65, 50°43'S 76°08'W, 10.03.1978, 248 m; Vald. 66a, Punta Roja, 43°21'S 73°44'W, 24.05.1971, 25 m; Co 93-27, Quintupeu, 42°10'S 72°24'W, 25.03.1972, 25 m; Co 93-47, Pelluco, 41°30'S 72°54'W, 10.02.1992, 20 m; GA III 21, SEPBOP "Anton Bruun" Exped., 18B791C, Galapagos Islands, 00°37'S 90°51'W, 08.05.1966, 78 m.

DESCRIPTION

Several fragments and one specimen (figs. 91, 92) 21-27 x 17-19 and 32 x 23 mm. Sponge cylindrical, but the basal part is missing. Surface even, microhispid, covered by a thin transparent membrane, in a continuous layer firmly attached. Terminal oscule, 3-7 mm diameter, from which diverge 4-5 aquiferous canals. Numerous small oscula, 1.5-3 mm diameter, are scattered on the surface.

Consistency: Soft and fragile, elastic.

Colour: Varying form light brown to dark-brown, in alcohol.

Skeleton: Ectosomal skeleton: arranged as palisade of bundles of tylotornotes and a continuous cover of spatuliferous anchorate isochelas.

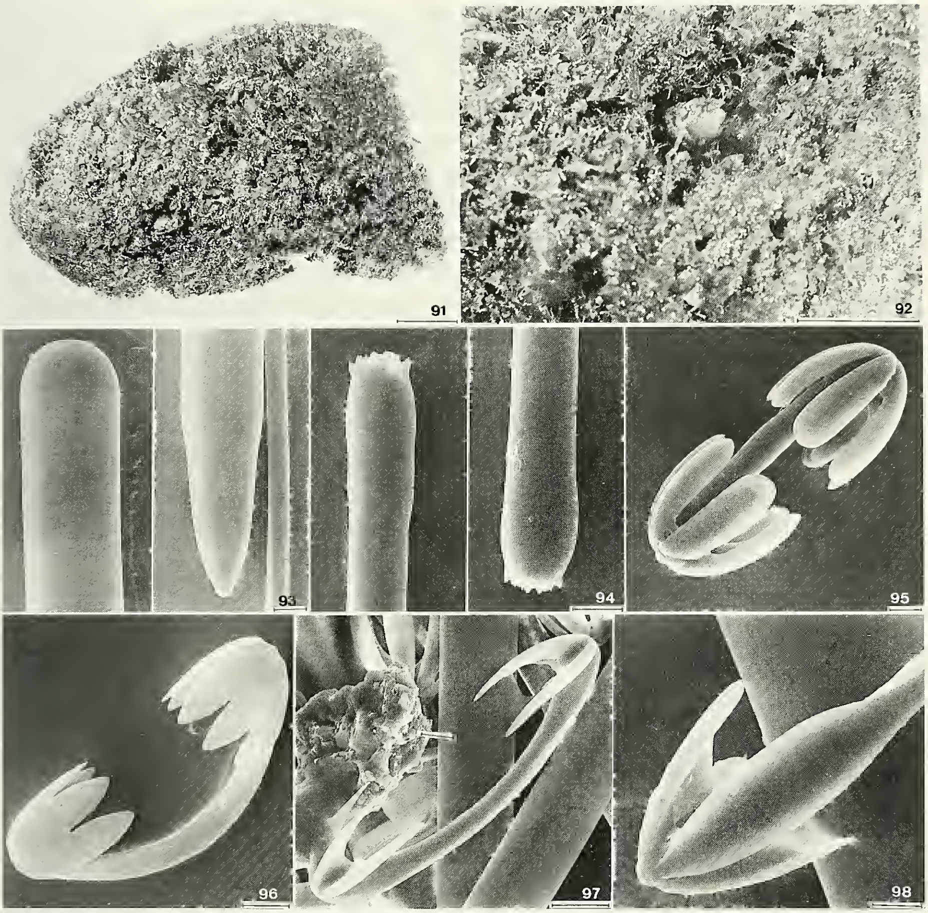
Choanosomal skeleton: isodictyal reticulation of polyspicular tracts of styles, ending by subectosomal bundles of styles passing through the surface (causing a hispid surface). Longitudinal tracts connected by transverse bundles of styles (3-4) or by single styles. Microscleres abundant.

Spicules (Table 13): Megascleres: styles (fig. 93) smooth, slightly curved 345-632 x 8-24 µm.

TABLE 13

Spicule micrometries of *M. (Stelodoryx) cribrigera* Ridley & Dendy, 1886. *Myxilla cribrigera* Ridley & Dendy, 1886, BMNH 1887:5:2:138, holotype; *Stelodoryx discoveryi* Burton, 1932 BMNH 1928:2:15:426, holotype; from literature and remeasured. Specimens from Chile of *M. (S.) cribrigera*.

Myxilla (Stelodoryx) cribrigera R. & D., 1886	Styles	Tylotornotes	Isochelas 1 Isochelas 2
M. cribrigera R. & D. 1886			
BMNH 1887:5:2:138	650 x 25	300 x 8	80
off sw coast Patagonia			
Remeasured	502-576-607	243-279-316	57-63-79
	x 16-23-24	x 8	32-39-43
Stelodoryx discoveryi			
Burton, 1932			
BMNH 1928:2:15:426	225 x 6	165 x 5	35-45
Falkland Islands			not observed
Remeasured	324-351-373	227-238-251	36-47-57
	x 8	x 8	40-46-49
He 178	389-460-494	202-235-250	48-49-58
Seno de Otway	x 12-18-20	x 6-7-8	48-53-62
MNHNC 65	446-499-527	243-265-284	61-63-67
50°43'S76°08'W	x 12-22-24	x 6-7-8	48-51-57
Vald. 66a	345-405-470	214-233-307	49-57-64
Punta Roja	x 12-15-16	x 6-8	48-60
Co 93-27	454-476-494	182-193-198	51-60-67
Quintupeu	x 6	x 6-8	35-42-48
Co 93.47	348-352-356	179-220-251	48-54-57
Pelluco	x 8-13-16	x 6-8	37-47-51
Ga.III.21	567-608-632	227-254-283	81-86-89
18B791C	x 16-22-24	x 8	74-78-86
00°37'S 90°51'W			



FIGS 91-98

Myxilla (Stelodoryx) cribrigera Ridley & Dendy, 1886. 91, fragment of a cylindrical specimen. 92, enlarged view of the surface. 93, smooth slightly curved styles. 94, tylotornotes smooth with equally swollen microspined cut-off apices. 95, 96, spatuliferous anchorate isochela 1. 97, unguiferous anchorate isochela 2. 98, terminal enlarged region of the apex. Scales: figs. 93, 97 = 10µm; figs. 94, 95, 98 = 5µm; fig. 96 = 2µm.

Tylotornotes (fig. 94) smooth, straight, with equal, slightly swollen microspined apices which have a characteristic "cut-off" shape, 179-307 x 6-8 µm.

Microscleres: Spatuliferous anchorate isochelas 1 (figs. 95, 96) with slightly curved shaft and 5 to 9 spatuliferous teeth, parallel to each other, very common, forming a continuous layer on surface, 48-89 µm. Unguiferous anchorate isochelas 2 (figs. 97, 98) less numerous, present only in the choanosome, shaft almost straight , with 5 teeth, the innermost alas visible only as slightly enlarged region of the shaft , 35-86 µm.

Ecology: no data about substrate, 20-248 m.

Distribution: Galapagos, Chilean coast, 41°S - 53° S ; Falkland Islands.

Remarks: The conspecificity of *M. cribrigera* and *M. discoveryi* was established in a comparison of the slides made from both holotypes.

The unguiferous chelas are also described for *Myxilla verrucosa* Burton, 1932, which was described simultaneously with *M. discoveryi* both from the Falkland Islands. Differences are found in the spicule sizes (*M. verrucosa*: styles 240 x 8-18 µm, tornotes 160 x 7 µm, chelas 35 µm). DESQUEYROUX (1972) reported *M. verrucosa* from Golfo Corcovado: styles 250-400 x 8-21 µm, tornotes 170-240 x 7-8 µm, isochelas 33-66. There is not indication about the morphology of anchorate chelas. DESQUEYROUX (1976) reported *M. verrucosa* from San Pedro, Chile, but gave no description of her material. It is here left undecided whether *M. verrucosa* is a separate species.

Stelodoryx was erected on the possession of unguiferous chelas in combination with a stalked growth form. This combination is not found in the present species, but we assume that a stalked habit is an adaptation to special environmental conditions. In view of the widespread occurrence in many different groups of sponges, it is likely that this character has no supraspecific significance.

REVIEW OF THE FAMILY MYXILLIDAE

Remarks: The above given diagnosis of the family Myxillidae excludes traditional Myxillid genera, such as *Lissodendoryx* and *Ectyodoryx*, which have arcuate chelas. These are united with the fistular genera *Coelosphaera* and *Forcepia*, which also have arcuate isochelas, into an emended family Coelosphaeridae. For a discussion and further arguments on this new assemblage cf. HAJDU *et al.* (1994). The major synapomorphy distinguishing the Myxillidae from the Coelosphaeridae is the anchorate condition of the chelas; other features are the more frequent spination of the ectosomal tornotes which are also predominantly oxeote or strongylote rather than tylote.

Genera possessing birotulate chelas (*Amphiasterella* Dendy, 1924, *Hymetrochota* Topsent, 1904 (with synonym *Hymenotrocha* Burton, 1930), *Iotrochota* (with synonyms *Hiattrochota*, *Iotrochostyla* and *Iotrochopsamma*, all of DE LAUBENFELS, 1950, 1954, cf. VAN SOEST, 1987), *Plocamiancora* Topsent, 1927, and *Rotuloplocamia* Lévi, 1952) have traditionally been spread over various families of the Poecilosclerida (Desmacididae, Hymedesmiidae, Coelosphaeridae, Myxillidae and Microcionidae), see for example discussion in VAN SOEST (1987) . However, the idea that birotulates have been developed only once and thus that all birotuliferous genera are monophyletic (suggested in HAJDU *et al*, 1994) has considerable merit. The polydentate condition of the birotulate chelas reminds of the polydentate-unguiferous chelas of several Myxillid genera. Also in one genus, *Iotroata*, both birotulate and anchorate chelas are found. However, birotulates in a clearly *Antho*-like sponge as *Rotuloplocamia octoradiata* Lévi, 1952, almost birotulate-like palmate chelas of

Plocamiancora denticulata Topsent, 1928, or clearly anchorate-derived condition of the *Iotroata spinosa* (Lundbeck, 1905) (see SEM photo in VAN SOEST, 1987, plate I fig. 6), are indications that convergent development of the birotulate condition may be equally likely. Since no birotuliferous genera are represented in the se Pacific, we refrain from commenting upon their family assignment (excepting *Iotroata* which is a clear myxillid); we merely list them for future treatment.

The following genera are thought to belong to the new concept of Myxillidae:

Genus **Desmacidon** Bowerbank, 1864

Type species: *Spongia fruticosa* Montagu, 1818 (topotypical specimens examined).

Diagnosis: In the ectosome smooth oxeote spicules are arranged in bouquets. Tracts of the same smooth oxeote spicules form an isodictyal reticulation in the choanosome. Microscleres are spatuliferous anchorate isochelas and sigmas very similar in shape to those of *Myxilla.*

Remarks: The megascleres are assumed to be tornotes, which have replaced the usual styles in the choanosomal tracts. It is quite possible that *D. fruticosum* is a *Myxilla* which has lost its styles, and synonymy of these genera may be warranted. In the past, the genus has been in frequent use for a wide variety of sponges, most of which are not closely related to *D. fruticosum.*

Desmapsamma Burton, 1934

Type species: *Fibulia anchorata* Carter, 1882 (topotypical specimens examined).

Diagnosis: Ectosomal coat of sand grains, partly replacing the ectosomal bouquets of oxeas. Choanosomal skeleton a paucispicular isotropic reticulation of oxeas similar to those of the ectosome. Microscleres anchorate chelas and sigmas.

Remarks: Use of *Desmapsamma* as a subgeneric unit has merit in order to manage the many arenaceous species known to live in the southern oceans (e. g. WIEDENMAYER, 1989). This sponge is similar to *D. fruticosum* in most respects, but oxeas are thinner. Chelas and sigmas smaller. Synonymy of *Desmapsamma* and *Desmacidon* seems inescapable.

Ectyonancora Lévi, 1963

Type species: *E. flabellata* Lévi, 1963. (HOLOTYPE LBIMDCL 548, 549, examined)

Diagnosis: Smooth hastate/mucronate tornotes and an isotropic reticulation of thick acanthostrongyles echinated by thick acanthostyles. Chelas are robust, spatuliferous. No sigmas.

Remarks: The generic distinctness rests on the acanthostrongyles being different from the often blunt-ending spined styles of *Myxilla*. The use of this genus name so far is limited to South African waters (including Namibia and Kerguelen).

Hymenancora Lundbeck, 1910

Type species: *Leptosia umbellifera* Topsent, 1904 (not examined).

Diagnosis: Smooth strongyles as ectosomal spicules and hymedesmioid architecture, i.e. with acanthostyles erect on the substrate. The anchorate isochelas are unguiferous with 7-9 teeth.

Remarks: The genus is customarily assigned to Hymedesmiidae because of its thinly encrusting habit and skeletal architecture. Four species have been described under this genus name, all from cold deep waters.

Iotroata De Laubenfels, 1936 (junior synonym: *Iotaota* De Laubenfels, 1936).

Type species: *Iotrochota acanthostylifer* Stephens, 1916 (not examined).

Diagnosis: Smooth ectosomal tylotes. Isotropic reticulation of smooth or acanthose styles, occasionally oxeas. Chelas include both anchorates and birotulates. No sigmas.

Remarks: The birotulates are clearly derived from anchorates, as neighbouring teeth show evidence of being the product of subdivision of a former ala. Several North Atlantic species originally described under *Iotrochota* belong to this genus (cf. VAN SOEST 1987); at least one, *I. spinosa* (Lundbeck, 1905) (examined for this study), has only birotulates, no anchorates. It is confined to cold and deep water. Possibly, the genus needs to be united with *Hymetrochota* Topsent, 1904 (cf. below).

Melonanchora Carter, 1874

Type species: *M. elliptica* Carter, 1874 (topotypical specimen examined).

Diagnosis: Fistular growth form with a paper-like thin ectosome. Ectosomal smooth tylotes, choanosomal spicules are smooth styles. Microscleres melonchelas and anchorate chelas.

Remarks: The fistular growth form and ectosomal smooth tylotes make this genus similar to many Coelosphaeridae. However, the melonchelas are clearly derived from anchorate chelas, as the youngest growth stages of these are indeed perfect anchorates. Confined to cold and deep water.

Styloptilon Cabioch, 1968

Type species: *Styloptilon ancoratum* Cabioch, 1968 (examined).

This species is similar in spiculation to *Myxilla* but has a plumose rather than an isotropic skeleton. In view of the variability of the skeletal structure a separate genus *Styloptilon* for species with plumose skeletons is not accepted as valid, but if there are more species like its type, then this can serve as a subgeneric unit.

Onychomyxilla Topsent, 1927

Type species: *Dendoryx pectinata* Topsent, 1892 (not examined).

Diagnosis: The ectosomal spicules are smooth tylotes; the choanosomal skeleton is an isotropic reticulation of acanthostyles echinated by smaller acanthostyles. The chelas are unguiferous verging towards birotulates, and there are no sigmas.

Remarks: The genus sofar is monotypical and very close to *Myxilla (Ectyomyxilla)* differing in the unguiferous condition of the chelas and the lack of sigmas. It is also close to *Myxilla* (*Stelodoryx*) differing in the possession of echinating acanthostyles. Finally, the peculiar condition of the chelas indicates that it may be close to *Iotroata* but differs from it in the possession of echinating acanthostyles.

Plocamissa Burton, 1935

Type species: *Plocamia igzo* De Laubenfels, 1930 (not examined).

Diagnosis: The ectosomal spicules are smooth tornotes; the choanosomal skeleton is "plocamiid", i.e. an isotropic basal reticulation of single acanthostrongyles echinated by long microspined styles. The chelas are spatuliferous anchorates.

Remarks: The family assignment rests on the presumed anchorate condition of the chelas, but it is otherwise similar to microcionids (genus *Antho*). The genus is monotypical, known only from the west coast of North America.

Pseudomyxilla Koltun, 1955 (with junior synonym *Stelotrochota* Bakus, 1966).

Type species: *P. vitiazi* Koltun, 1955 (not examined).

Diagnosis: Ectosomal tornotes and the choanosomal styles similar to those of the type of *Myxilla*; the chelas are unguiferous and there are no sigmas.

Remarks: The genus is very close to *Myxilla (Stelodoryx)* and should probably be considered synonymous. Species are described from Antarctic or Subantarctic waters, and from the west coast of North America.

CONCLUSIONS

Next to several well-defined genera *(Myxilla, Melonanchora, Iotroata)* there is a large number of smaller genera with dubious synapomorphies which need to be closely compared:

-Desmacidon + *Desmapsamma*: like *Myxilla* but lacking proper choanosomal megascleres different from the ectosomal ones.

-*Hymenancora* + *Onychomyxilla* + *Pseudomyxilla* : like *Myxilla (Stelodoryx)*, but with echinating acanthostyles.

- *Ectyonancora* + *Plocamissa*: like *Antho* (Microcionidae) but with spatulate anchorate chelas

The following genera with anchorate chelas are excluded from the Myxillidae, and assigned to a separate family Crambeidae:

Crambe Vosmaer, 1887: no ectosomal tornotes.
Discorhabdella Dendy, 1924: ectosomal subtylostyles
Leptosiopsis Topsent, 1927: polytylote ectosomal styles
Monanchora Carter, 1883: ectosomal subtylostyles
Psammochela Dendy, 1896: no ectosomal tornotes.

KEY TO THE SUBGENERA AND SPECIES OF *Myxilla* OCCURING ON THE SE. PACIFIC COAST

1 Single category of smooth styles. 2
– Two categories of styles: Larger spined or smooth styles. Smaller fully spined styles. . . . . Subgenus *Ectyomyxilla* 5
2 Styles slightly to strongly spined stytes, 2 sizes of spatuliferous anchorate isochelas . . . . Subgenus *Myxilla* 3
– Smooth styles. 7
3 Spines on styles concentrated at the apices. Shaft largely smooth 4
– Strongly spined styles all over . . . . *M. (Myxilla) caliciformis*
4 Sigma 1 small, from 20 to 35, sigma 2 from 10 to 20. . *M. (Myxilla) mexicensis*
– Sigmas 1 big, from 30 to 80, sigmas 2 from 20 to 30 . . . . . *M. (Myxilla) mollis*
5 With mucronate tornotes, two categories of spatuliferous anchorate isochelas and one size of sigmas . . . . *M. (Ectyomyxilla) massa* 6
– With tylotornotes, one category of normal and one of peculiarly incurved spatuliferous anchorate isochelas and two sizes of sigmas . . . . *M. (Ectyomyxilla) dracula*
6 Sigmas longer than 30 µm. *M. (Ectyomyxilla) chilensis*
– Sigmas shorter than 30 µm . . . . *M. (Ectyomyxilla) tenuissima*
7 A single category of asymmetrical spatuliferous anchorate chelas and a single category of sigmas . . . . *M. (Burtonanchora) asymmetrica*
– A single category of spatuliferous anchorate chelas, and one category of unguiferate anchorate chelas, without sigmas . . . . . *M. (Stelodoryx) cribrigera*

Tedaniidae Ridley & Dendy, 1886

Diagnosis: Myxillina without microscleres other than onychaetes. Skeletal architecture variously isotropic, anisotropic, or plumose.

Tedania Gray, 1867

Synonyms: Trachytedania Ridley, 1884, *Tedaniopsis* Dendy, 1924, *Paratedania* Burton, 1929, *Oxytedania* Sarà, 1978).

Type species *Reniera digitata* Schmidt, 1862 (junior synonym of *Halichondria anhelans* Lieberkühn, 1859).

Diagnosis: Tedaniidae possessing morphologically distinct ectosomal and choanosomal megascleres. The type species has microspined tylotes as ectosomal spicules and smooth styles as choanosomal spicules.

Remarks: Tedania anhelans (Lieberkühn, 1859), originally described from the Mediterranean-Atlantic area, is a soft irregularly lobate sponge with rather variable colour (brownish, greenish, bluish) and smooth surface. Ectosomal spicules are tylotes of 140-300 by 2-7 µm with well developed microspined heads, arranged in bouquets and scattered singly in the peripheral region. Choanosomal spicules are smooth styles 170-280 by 5-11 µm arranged in a loose reticulation with square meshes. Microscleres are thin rugose asymmetrical onychaetes in the size range between 40 and 200 µm.

Closely similar species have been reported from almost all subtropical and tropical seas of the world. It is proposed here, in continuation of proposals made the previous genera, to acknowledge the existence of a complex of probably closely related species by erecting a nominal subgenus *Tedania* for them. Species assigned to *Tedania* s.s.: *T. anhelans* (Lieberkühn, 1859) (Mediterranean-Atlantic), *T. ignis* (Duchassaing & Michelotti, 1864) (Caribbean-Brazil), *Tedania tepitootehenuaensis* Desqueyroux-Faúndez, 1990 (Isla de Pascua), and about 40 further species described from all tropical and temperate seas of the world.

The genus *Trachytedania* Ridley, 1881 (with type species *T. spinata* Ridley, 1881) was differentiated from *Tedania* proper by the alleged spination of the choanosomal styles. Re-examination of Ridley's type slides revealed that only very few styles with spines are present; few authors have accepted the occasional spines on the styles as sufficient ground for upholding a separate genus. There is, however, a further difference with species of the subgenus *Tedania*: the ectosomal spicules differ rather strongly from *T. anhelans* in being mucronate-oxeote, without spination on the apices. The skeletal structure is very loose and no distinct meshes are recognized. It is proposed here to retain *Trachytedania* as a subgenus of *Tedania*.

Species assigned to this subgenus are: *Tedania spinata* (Ridley, 1881) (with junior synonym *Tedania murdochi* Topsent, 1904) (Magellan), *Tedania patagonica* (Ridley & Dendy, 1886) (with junior synonym *Tedania inflata* Sarà, 1978) (Magellan), *Tedania gurjanovae* Koltun, 1958 (Arctic), *Tedania micr825rhaphidiophora* Burton, 1935 (North Pacific and Arctic), *Tedania mucosa* Thiele, 1905 (with junior synonyms *T. fuegiensis* Thiele, 1905, *T. pectinicola* Thiele, 1905, and *T. excavata* Thiele, 1905) (Magellan, SE Pacific), and possibly *T. toxicalis* De Laubenfels, 1930 (cf. below).

The genus *Tedaniopsis* Dendy, 1924 (with type species *T. turbinata* Dendy, 1924) was erected because of the replacement of choanosomal styles by strongylotylotes. *T. turbinata* is an elaborate stalked species from New Zealand, related to *T. massa* in spicule sizes, form and skeletal structure. The structural spicules are thick large strongylotylotes, differing from the often strongylote spicules of *T. massa*, but they are similar in size. Ectosomal spicules are thinner strongylotylotes with mucronate apices, often on one side provided with two rather than a single spine. The onychaetes 1 are long and thick, and have a clearly developed tyle. No further species with exactly similar spiculation have been described. However, the large sizes of the spicules and the irregular skeletal architecture unite the present species with several others, and accordingly it is proposed to recognize a distinct subgenus for them.

Species assigned are: *Tedania massa* Ridley & Dendy, 1886 (with junior synonyms *T. actiniformis* Ridley & Dendy, 1886 and *Tedania tantula* (Kirkpartick, 1907 as *Oceanapia*)) (Antarctic, Magellan) *Tedania charcoti* Topsent, 1917 (Antarctic, Magellan, se Pacific) *Tedania infundibuliformis* Ridley & Dendy, 1886 (se Pacific) *Tedania tenuicapitata* Ridley, 1881 (Magellan, SE Pacific) *Tedania turbinata* (Dendy, 1924) (New Zealand) *Tedania oxeata* Topsent, 1917 (Antarctic) *Tedania vanhoeffeni* Hentschel, 1914 (Antarctic) *Tedania phacellina* Topsent, 1928 (deep water North Atlantic).

The genus *Paratedania* Burton, 1929 (with type species *Oceanapia tantula* Kirkpatrick, 1907, which is probably a junior synonym of *Tedania massa* Ridley & Dendy, 1886) was erected because of a densely packed layer of tangential megascleres, as opposed to the bouquet-type arrangement of all other Tedaniidae. *Oceanapia tantula* (persistently named *tarantula* by BURTON, 1929, 1932) is a lobate to erect sponge with smooth anisostrongyles as structural megascleres and tylotornotes with an occasional mucron at one of the apices. The tangential arrangement at the surface, however, was probably entirely induced by the periostracum of mollusc shells on which the specimens were found to be attached, and thus must be considered artifactual. BURTON (1932) withdrew this genus himself, and suggested that the type was a junior synonym of *Tedania massa*. Examination of type material of both revealed some differences in the shape of tornote endings (hastate in *T. massa*), but in view of the variability of this character, conspecificity of both is certainly possible. Both are also similar to *Tedania turbinata*, and accordingly *Paratedania* is considered a junior synonym of the subgenus *Tedaniopsis*.

The genus *Oxytedania* Sarà, 1978 (with type species *O. bifaria* Sarà, 1978) was erected for a species with the spicule combination of typical *Tedania* in addition to a reticulate skeleton of oxeas. The type specimen available to us for study did not contain any of the Tedaniid spicules described by Sarà. The skeletal architecture was typically that of the Haplosclerid family Niphatidae with multispicular tracts of oxeas in a tight reticulation. It is assumed that the genus is based on a contamination of *Tedania spinata* spicules in a niphatid specimen. Indications for this conclusion is not only our failure to find any *Tedania* - like spicules, but also the fact that Sarà not only pictures the oxeas as structural megascleres, but also styles of quite dissimilar size and form as a second category of structural megascleres. Two such different structural megasclere categories together in a single sponge are unlikely to occur in a tedaniid. Accordingly this genus is pronounced unrecognizable c.q. a junior synonym of *Tedania*.

Subgenus **Tedania** Gray, 1867:

Diagnosis: Tedania possessing smooth, relatively small styles, occasionally strongylote styles, as structural megascleres and microspined tylotes as ectosomal megascleres.

Tedania (Tedania) galapagensis n.sp. (Figs. 99-104)

MATERIAL STUDIED: HOLOTYPE USNM 39355, MHNG 18975 GA III 5 SEPBOP "Anton Bruun" Cruise. 18B stat. 795D, Galapagos, 0°S 90°W, 78 m.

MATERIAL STUDIED FOR COMPARISON: USNM 21492, HOLOTYPE of *Tedania toxicalis*, de Laubenfels, 1930, Point Pinos, Pacific Grove, California, 07.1925, intertidal; USNM 21490, HOLOTYPE of *T. topsenti*, De Laubenfels, 1930, Pescadero Point, near Carmel, California, 07. 1926, intertidal.

DESCRIPTION

Several small fragments (figs. 99, 100) sizes 7-12-35 x 10-15 x 2-3 mm. Surface smooth, covered by a thin membrane which is not detachable. Several small oscules 0.5-1 mm diameter, irregularly scattered. Small aquiferous cannals are visible under the membrane.

Consistency : fragile, very soft.

Colour: whitish to pinkish in alcohol.

Skeleton: Ectosomal: palisade of bundles of tylotes partially included in the membrane, and abundant onychaetes.

Choanosomal: tight meshed reticulation of short longitudinal tracts of smooth styles connected by tylotes and abundant free onychaetes.

Spicules (Table 14): Megascleres: Thin, smooth styles (fig. 101) slightly curved, 192-246 x 6-7 µm.

TABLE 14

Spicule micrometries of *Tedania (Tedania) galapagensis* n. sp. *T. toxicalis* de Laubenfels, 1932. USNM 21492 holotype; from literature and remeasured. Specimen from Galapagos of *T. (T.) galapagensis* n. sp.

T. (Tedania) galapagensis n.sp.	Styles	Tylotes	Onychaetes 1 Onychaetes 2
T. toxicalis			
de Laubenfels, 1932			
Holotype USNM 21492	100-200	200	150
Point Pinos	x 2-7	x 8-14	not observed
Holotype USNM 39355	192-226-246	179-198-234	173-188-205
Ga.III.5-18B795D			x 2
00°S90°W	x 6	x 3	61-78-93
			x 0.5-1

Smooth tylotes (fig. 102) with oval microspined apices, regular diameter, 179-234 x 3-4 µm.

Microscleres: Onychaetes 1 (fig. 103) 173-205 x 2 µm and 2 (fig. 104) 61-93 µm x 0.5-1 µm, strongly spined.

Ecology: 78 m.

Distribution: Galapagos Islands.

Remarks: T. toxicalis De Laubenfels, 1930 from California on paper sounds close to this species, but re-examination of the type revealed some clear differences. The choanosomal skeleton is a loose plumoreticulation with single or two spicules interconnecting longitudinal tracts of 5-7 spicules thick; the styles have a swollen head and frequently have one or two spines. The ectosomal spicules are smooth tylotornotes with elongate heads. In fact, these characters make it likely that *T. toxicalis* belongs in the subgenus *Trachytedania.*

Other *Tedania (Tedania)* species in the E Pacific are *T. tepitootehenuaensis* Desqueyroux-Faúndez, 1990, which has predominantly styles as choanosomal megascleres, and *T."nigrescens" sensu* GREEN & GÓMEZ (1986) which has onychaetes not exceeding 100 µm and thinner tylotes: 153-173 x 3-4.5 µm. *T. nigrescens* (Schmidt, 1862) is a junior synonym of the Mediterranean-Atlantic *T. anhelans.*

Tedania topsenti De Laubenfels, 1930, is a second species from California. It differs quite substantially from *T. toxicalis* in having much more robust megascleres: smooth styles averaging 360 by 14 µm and smooth fusiform tylotes averaging 330 by 9 µm and. Onychaetes are rare, possibly absent. The species could indeed be a *Kirkpatrickia* as DE LAUBENFELS suggested himself.

Tedania (Tedania) tepitootehenuaensis Desqueyroux-Faúndez, 1990

Tedania tepitootehenuaensis DESQUEYROUX-FAUNDEZ, 1990: 383, figs. 43-48.

MATERIAL STUDIED: MHNG 972229, HOLOTYPE of *T. tepitootehenuaensis*, Hotu Iti, 10.1972, 0 m.

Not represented in the present material, so only a brief diagnosis is given: is a species from Easter Island with small thin styles, 240-272 x 4-9 µm, straight tylotes, oval microspined apices. Onychaetes are of two sizes: 160-285 x 2-3 µm and 48-76 x 0.6 µm. It differs from *T. mucosa* from the Chilean coast, in having smooth, thin styles and straight tornotes with oval heads instead of mucronate. It is probably an endemic species.

Subgenus **Tedaniopsis**:

Diagnosis: Tedania with relatively long thick, smooth styles, occasionally modified to anisostrongyles or anisoxeas, as structural megascleres. Ectosomal megascleres are mucronate or tylostrongylote tornotes occasionally with one or more vestigial spines.

Tedania (Tedaniopsis) charcoti Topsent, 1907 (Figs. 105-110)

Tedania charcoti Topsent, 1907: 69; 1908: 30, pl. I, fig. 3, pl. III, fig. 3, pl. V, fig. 6; Capon *et al.*, 1993: 263.

Tedania tenuicapitata sensu Ridley & Dendy, 1887: 52, pl. XI, fig. 5 [non: *T. tenuicapitata* Ridley, 1881] .

Tedania armata Sara, 1978: 51, figs. 30, 31.

Material studied: lbimdt 679, holotype of *Tedania charcoti* Topsent, 1907, Ile Wandel, Port Charcot, Stn. 346, 65°04'S 64°00'W, 30.03.1904, 40 m; mhng 18845: He 3 Seno de Otway, 53°00'S71°30'W, 16.09.1972, 260 m; mhng 18848: He 114 Caleta Hale, 47°57'S74°39'W, 01.10.1972, 40-50 m, mhng 10689: Chi.9, Zapallar, 32°33'S7143'W, 02.08 1985, 300 m; usnm 39353, mhng 18854, zma 10982: Ga.III.3, sepbop "Anton Bruun" Exped., 18A 697, Chile,35°27'S 73°01'W, 1966, 290-450 m.

Material studied for comparison: bmnh 1887:5:2:260, specimen of *Tedania tenuicapitata*, Challenger Expedition, Stn. 311, off the south west coast of Patagonia, 52°45'S 73°46'W, 11.01.1876, 448 m; Ant 3, paratype of *Tedania armata* Sarà, 1978, Spedizione Antartica Italiana, 1882, Staz. VI, Tierra del Fuego, leg. D. Vinciguerra, .

Description

Sponge irregularly massive to lamellate (figs. 105, 106) size 27-30-60 x 19-40-50 mm. Surface conulose, mammilate or minutely tuberculate. Oscules numerous, 1-5 mm diameter. Surface uneven and punctate, with a thin membrane.

Consistency: Soft, elastic, fragile.

Colour: Grayish to brownish in alcohol.

Skeleton: Ectosomal: A palisade of tornotes, free and in bundles. Abundant free onychaetes

Choanosomal: Loose, irregular and confused reticulation of longitudinal tracts of styles, and abundant free onychaetes.

Spicules (Table 15): Megascleres: Long, slightly bent, smooth styles (fig.107), 361-445 x 8-16 µm.

Smooth mucronate straight tornotes (fig. 108), regular diameter, 202-300 x 4-6 µm.

Microscleres: Onychaetes 1 (fig. 109) 112-392 x 2 µm and 2 (fig. 110) 35-97x 0.5 µm., straight, with numerous strong spines.

Ecology: Substrat, stones, 40-500 m.

Distribution: Chilean coast, 32°S - 53° S; east of the Strait of Magellan, 51°S 65°W, as *T. tenuicapitata sensu* Ridley & Dendy, 1887, Tierra del Fuego; 54°S 59°W, as *T. armata* Sarà, 1978; Wandel Island, Port Charcot, 65°S 64°W as *T. charcoti*, Topsent, 1907.

Remarks: This species is close to *T. tenuicapitata*, but differs clearly in having much shorter onychaetes 1; the tornotes are also different, having a more pronounced pointed end at one or both ends. The Challenger specimen assigned to *tenuicapitata* conforms to the type of *T. charcoti* and our specimens.

TABLE 15

Spicule micrometries of *Tedania (Tedaniopsis) charcoti* Topsent. *T. charcoti* Topsent, 1907, HOLOTYPE LBIMDT 679; *T. armata* Sarà, 1978 Ant 3, PARATYPE; from literature and remeasured. Specimens from Chile of *T (T.) charcoti*.

T. (Tedaniopsis) charcoti Topsent, 1907	Styles	Tornotes	Onychaetes 1 Onychaetes 2
T. charcoti			
Topsent, 1907			
I Wandel. Port Charcot			
HOLOTYPE LBIMDT 679	420-450	305-340	250-265
	x 13	x 10	90-120
Remeasured	410-463-549	314-325-353	235-264-365
	x 10-12	x 8-10-12	98-116-127
Sarà, 1978			
T. del Fuego			
PARATYPE ANT.3	300-350	240 x 2-3	200-280
	x 6-8		150-180
Remeasured	308-336-373	219-243-267	162-174-194
	x 8	x 4	97-126-146
He 3	361-374-401	202-233-271	112-148-176
Seno de Otway	x 9	x 6	48-59-70
He 114	298-339-355	208-237-259	160-177-204
Caleta Hale	x 8-9-10	x 6	35-44-54
CHI-9	377-403-426	262-274-291	147-271-393
Zapallar	x 9-11-13	x 5-6	38-60-96
GA III 3a USNM 39353	381-415-445	251-269-300	154-206-292
18A697	x 12-14-16	x 4	65-83-97
32°27'S 73°01'W			

Tedania (Tedaniopsis) tenuicapitata Ridley, 1881 (Figs. 111-116)

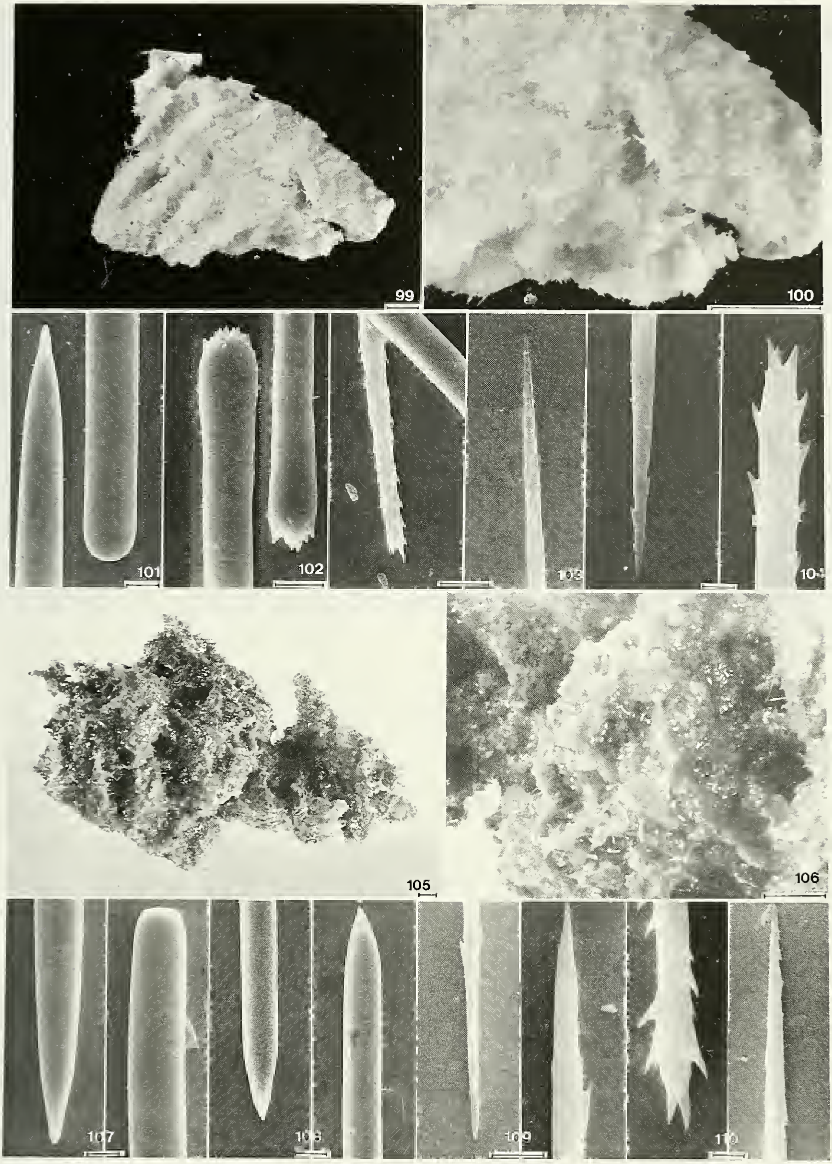
Tedania tenuicapitata RIDLEY, 1881: 124, pl. xi, fig. 1.
[non *Tedania tenuicapitata sensu* RIDLEY & DENDY, 1887: 52, pl. xi, fig. 5, = *T. charcoti* Topsent, 1907].

MATERIAL STUDIED: BMNH:1879:12:27:12, HOLOTYPE of *Tedania tenuicapitata* Ridley, 1881, Trinidad Channel, 50°00'S 75°00'W, near Madre de Dios Island, off SW Patagonia, 54.8 m. MHNG 18976, Chi. 22, 52°42'S 75°23'W, 30 m.

MATERIAL STUDIED FOR COMPARISON: LBIMDT 679, HOLOTYPE of *Tedania charcoti* Topsent, 1907, Ile Wandel, Port Charcot, Stn. 346, 65°04'S 64°00'W, 30.03.1904, 40 m; BMNH 1887:5:2:260, specimen de *Tedania tenuicapitata sensu* Ridley & Dendy, 1887, Challenger Exped. Stn. 311, off the south west coast of Patagonia, 52°45'S 73°46'W, 21.01.1876, 448 m.

Description: One specimen 27 x 14 x 10 mm (figs 111, 112) and a fragment of a massive sponge. Surface smooth, covered by a thin membrane. Small oscules (1.5-2 mm diameter) irregularly scattered.

Consistency: Very soft and fragile.



Figs 99-110. *Tedania (Tedania) galapagensis* n.sp. 99, holotype, USNM 39355, fragment of specimen. 100, enlarged view of the surface. 101, smooth styles slightly curved. 102, smooth tylotes with oval microspined apices. 103, 104, onychaetes 1 and 2 strongly spined. Scales: figs. 101-103 = 5µm; fig. 104 = 1µm. *Tedania (Tedaniopsis) charcoti* Topsent, 1907. 105, massive specimen from Caleta Hale. 106, enlarged view of the surface. 107, long smooth slightly bent styles, 108, smooth mucronate tornotes. 109, 110, onychaetes 1 and 2. Scales: figs. 107, 108 = 5µm; fig. 109 = 2µm; fig. 110 = 1µm.

Colour: Whitish to light beige in alcohol.

Skeleton: Ectosomal, dense palisade of smooth tornotes and onychaetes.

Choanosomal: Loose and irregular to slightly isotropic reticulation of styles and onychaetes.

Spicules (Table 16) Megascleres: long, smooth styles (fig.113), slightly bent, 437-543 x 8-16 µm.

TABLE 16

Spicule micrometries of: *Tedania (Tedaniopsis) tenuicapitata* Ridley, 1881, HOLOTYPE BMNH 1879:12:27:12; from literature and remeasured. Specimen from Chile of *T. (T.) tenuicapitata.*

T. (Tedaniopsis) tenuicapitata Ridley, 1881	Styles	Tomotes	Onychaetes 1 Onychaetes 2
T. tenuicapitata Ridley, 1881 BMNH 1879:12:27:12 Trinidad Channel	380 x 12.7	279 x 6	316
Remeasured	296-340-387 x 12-13	185-221-270 x 4	132-263-327 52-64-75
CHI-22 52°42'S 74°23'W	437-500-543 x 8-14-16	308-349-389 x 8	121-178-267 x 2 54-76-96 x 1

Smooth mucronate tornotes (fig. 114) with strongly pointed apices, 308-389 x 8 µm.

Microscleres: Onychaetes 1 (fig. 115) 121-267 x 2 µm, and 2 (fig. 116) 54-96 x 0.5µm, strongly spined.

Ecology: Pebbles and stones, 30 m.

Distribution: Chilean coast, 50°S - 52°S.

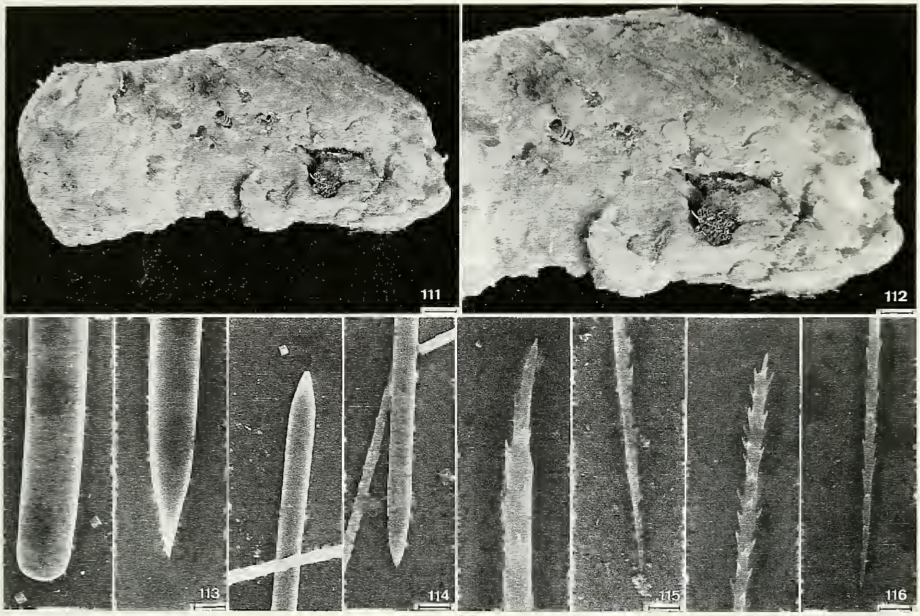
Remarks: As discussed above, the nearest relative is *T. charcoti*, which has smaller onychaetes 1, *T. tenuicapitata sensu* Ridley & Dendy, 1887 conforms to that species. A further closely related species is *T. infundibuliformis* Ridley & Dendy, 1886 which is cup-shaped, but similar in spiculation.

Tedania (Tedaniopsis) infundibuliformis Ridley & Dendy, 1886

Tedania infundibuliformis RIDLEY & DENDY, 1886: 335; 1887: 54, pl. xi, fig. 1, pl. xxix, figs. 2, 2a.

MATERIAL STUDIED: BMNH 1887:5:2:151, HOLOTYPE of *Tedania infundibuliformis* Ridley & Dendy, 1886, Challenger Expedition, Stn. 311, off the south west coast of Patagonia, 52°45'S 73°46'W, 21.01.1876, 448 m.

Not represented in our material so only a brief diagnosis can be given:



FIGS 111-116

Tedania (Tedaniopsis) tenuicapitata Ridley, 1881. 111, massive specimen from 52°S 75°W. 112, enlarged view of the surface. 113, smooth style, strongly pointed apex. 114, smooth mucronate tornote. 115, 116, onychaetes 1 and 2, strongly spined. Scales: figs. 113, 114 = 5µm; figs. 115, 116 = 2µm.

Cup-shaped. Skeleton a loose reticulation. Long smooth styles averaging 500 by 12 µm. Short, smooth tylotes with a few very faint spines on the heads, 280 by 6 µm. Onychaete 1, 360 µm, onychaetes 2, 60-70 µm.

Distribution: Chilean coast 52°S.

Subgenus **Trachytedania** Ridley, 1881

Diagnosis: Tedania of which the structural spicules are relatively small styles at least some of which show (a few) spines. The ectosomal megascleres are mucronate or oxeote tornotes.

Tedania (Trachytedania) mucosa Thiele, 1905(Figs 117-128)

Tedania mucosa THIELE, 1905: 430, figs. 50a-c.; BURTON, 1934: 27.
Tedania excavata THIELE, 1905: 431, figs. 51a-c.
Tedania pectinicola THIELE, 1905,: 432, figs. 52a-d.
Tedania fuegiensis THIELE, 1905: 433, figs. 53a-d.

MATERIAL STUDIED: ZMB 3284, HOLOTYPE of *Tedania mucosa* Thiele, 1905, Calbuco, 41°46'S 73°08'W; ZMB 3285, HOLOTYPE of *T. excavata* Thiele, 1905, Calbuco; ZMB 3286, HOLOTYPE of *T. pectinicola* Thiele, 1905, Calbuco; ZMB 3287, HOLOTYPE of *T. fuegiensis* Thiele, 1905, Cabo del Espiritu Santo, 52°58'S 68°36'W, Tierra del Fuego; MHNG 18857, 18977: He 25, 179, Seno de Otway, 53°00'S 71°30'W, 17.09.1972, 30 m; MHNG 18858, 10690: He 61, 127, Caleta Hale, 47°57'S 74°37'W, 01.10.1972, 40-50 m; MHNG 18860: He 189, Bahia Scotchwell, 55°28'S 68°07'W, 10.1972, 50-95 m; MHNG 18861: VALD. 10.1, Canal Quinchao, 42°25'S 72°35'W; MHNG 18859, 18876: VALD. 46.1, 53.2, Palena 43°45'S 73°00'W, 10.01.1972, 10-15 m; MHNG 18862: VALD.53.5a, Islote Caleta Lobato, 45°05'S74°47'W, 10-15 m; MHNG 18863, 18873, 18983, 18993: Mont. 8, 9, 10, 30, San Antonio, 32°48'S 71°23'W, 10-15 m; MHNG 18864, 18823: Co.8, VALD. 14.1, Quetalmahue, 41°32'S 73°52'W; MHNG 18999, 18865, 19228, 19229: Co.93.38, 48, 49, 53, Pelluco, 41°30'S 72°54'W; MHNG 18866, 19230, 19231: MNHNC 25, 36, 57, 43°15'S 74°32'W, 266 m; MHNG 10691: Por.2, Pullinque, 39°33'S 72°11'W, 7 m,

DESCRIPTION

Several specimens and fragments. Sponge polymorphe, massive, (figs. 117, 118) irregularly roundish and lobate to lamellate and tubiforme 77-112 x 55-84 x 28-89 mm, or repent and sending out cylindrical processes or stolon-like branches (figs. 119, 120), 40-55 x 37-59 x 9-17 mm. Surface uneven, tuberculate and conulose. Minutely and entirely punctate and with numerous aquiferous canals visible at the surface. Oscules at the summit of the conules, irregularly scattered on the surface, or arranged along the edge of branches.

Consistency: Hard, slightly compressible.

Colour: Brown to reddish alive, colouring the alcohol when fixed and producing great amounts of mucus.

Skeleton: Ectosomal skeleton: a perpendicular palisade of densely arranged mucronate tornotes. Onychaetes are numerous.

Choanosomal skeleton: Loose or dense reticulation of tracts of styles. Onychaetes abundant, free or in bundles.

Spicules (Table 17): Megascleres: Smooth styles (figs. 121, [122 holotype]) slightly bent, with sharp to roundish apex, 163-320 x 5-16 µm.

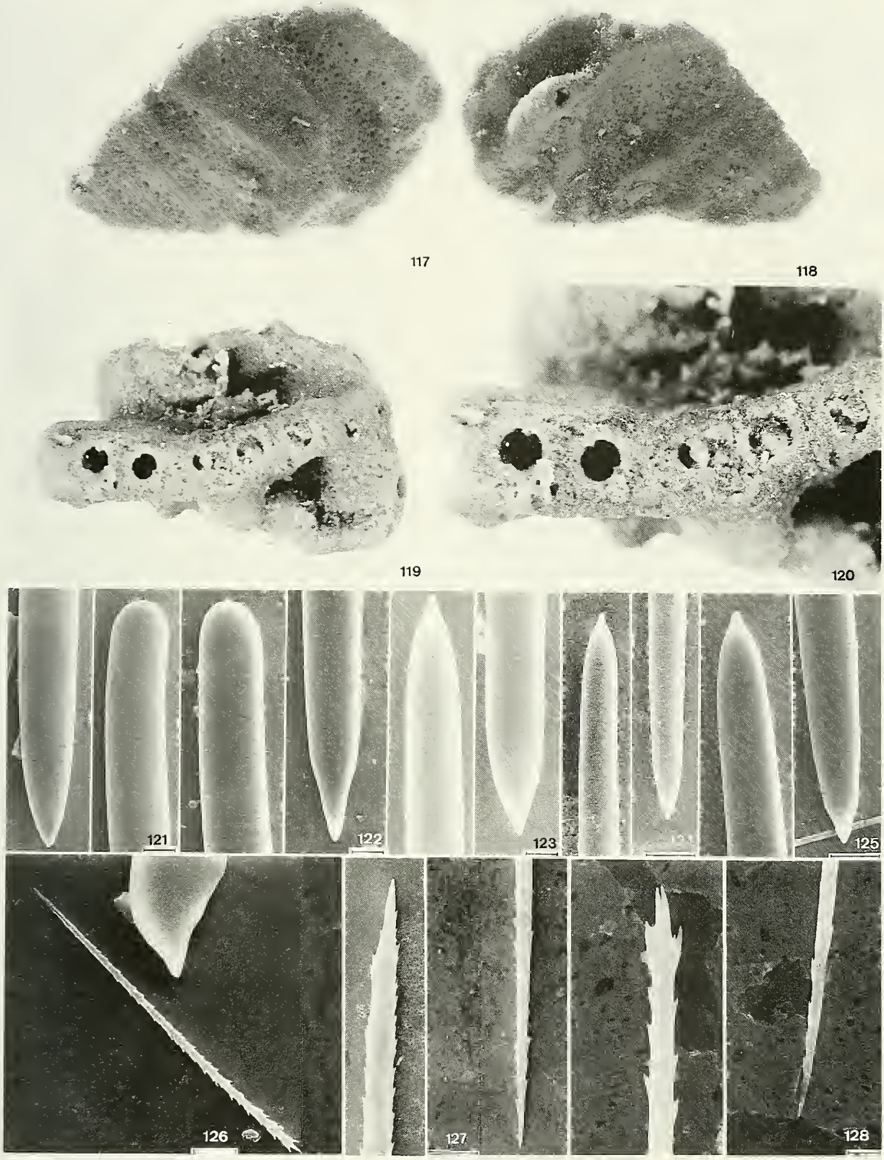
Mucronate tornotes (figs. [123 holotype] 124, 125) regular diameter, 128-267x 3-6 µm.

Microscleres: Onychaetes 1, 99-235 x 2 µm and 2, 26-99 x 1 µm, (figs. [126 holotype] 127, [128 holotype]) some of them present a tyle near the base.

Ecology: On stones, 7-266 m depth.

Distribution: Chilean coast, 32°S - 55°S; Argentinan Atlantic coast up mouth of Rio de La Plata (37°S), BURTON, 1934.

Remarks: THIELE (1905) described four species based on minor differences which were found to be partly incorrect: *T. excavata* was stated to have a digitate growth form and to possess only a single onychaete category. *T. pectinicola* would be encrusting and have a single onychaete category with distinct tyles ("tylonychaetes"). *T. fuegiensis* would have styles with occasional spines. We found a large variation in growth forms among specimens all of which in their skeletal characteristics were indistinguishable from the type of *T. mucosa*. All type specimens of the four Thiele species had two categories of onychaetes, and minor differences in spicule sizes



FIGS 117-128. *Tedania (Trachytedania) mucosa* Thiele, 1905. 117, 118, lamellate to massive specimen, from 43°S Chile, and enlarged view of the surface. 119, 120, repent specimen, and enlarged view of the surface. 121, smooth styles, slightly bent. 122, ZMB 3284, holotype of *T. mucosa* Thiele, 1905 from Calbuco, smooth styles. 123, ZMB 3286 holotype, of *T. pectinicola* Thiele, 1905 from Calbuco, mucronate smooth tornotes 124, Chilean specimen from Calbuco, mucronate smooth tornote. 125, ZMB 3284, mucronate smooth tornotes. 126, ZMB 3286, onychaete 1. 127, Chilean specimen from Calbuco, onychaete 1. 128, ZMB 3284, onychaetes 2. Scales: fig. 121 = 10µm; figs. 122-127 = 5µm; fig. 128 = 2µm.

TABLE 17

Spicule micrometries of *Tedania (Trachytedania) mucosa* Thiele, 1905. *Tedania mucosa* Thiele, 1905 ZMB 3284 holotype; *T. fuegiensis* Thiele, 1905 ZMB 3287 holotype; *T. pectinicola* Thiele, 1905 ZMB 3286 holotype; *T. excavata* Thiele, 1905 ZMB 3285 holotype; from literature and remeasured. Specimens from Chile of *T. (T.) mucosa*.

T. (Trachytedania) mucosa Thiele, 1905	Styles	Tornotes	Onychaetes 1 Onychaetes 2
T. mucosa HOLOTYPE ZMB 3284 Calbuco	280-310 x 14	190-210 x 6	190-210 not observed
Remeasured	304-364-349 x 12-13-16	208-213-220 x 5-6-7	204-219-233 40-53-64
T. fuegiensis Thiele, 1905 HOLOTYPE ZMB 3287 T. del Fuego	200-225 x 8	160-200 y 6	120 not observed
Remeasured	186-208-224 x 6-7-10	176-179-198 x 3-5-6	112-133-163 x 2 74-94-10 x 0.5-1
T. pectinicola Thiele, 1905 HOLOTYPE ZMB 3286 Calbuco	240 x 8	160 x 5	140 not observed
Remeasured	205-225-246 x 6	147-158-173 x 3	102-119-134 x 2 45-73-93 x 1
T. excavata HOLOTYPE ZMB 3285 Calbuco	240 x 13-15	150 x 6	190 not observed
Remeasured	208-253-275 x 10-12-13	157-178-192 x 6	122-155-186 x 2 58-78-99 x 1
He 25 Seno De Otway	251-370-413 x 8	194-246-267 x 4	105-156-235 x 2 49-74-97 x 1
He 179 Seno De Otway	275-299-320 x 10-12-13	166-207-234 x 3-6	157-194-230 x 2 35-54-83 x 1
He 61 Caleta Hale	202-232-246 x 6-9-13	163-178-192 x 3-5-6	106-149-189 x 2 26-65-99 x 1

He 127 Caleta Hale	234-244-272 x 6-9-13	160-174-180 x 5-6	99-143-176 x 2 35-44-51 x 1
Vald. 46.1a Palena	202-247-278 x 13-14-16	163-178-192 x 3-6	112-145-182 x 2 45-70-99 x 1
Vald. 53.2 Palena	163-237-269 x 6-13-16	150-170-186 x 3-6	106-160-205 x 2 32-59-99 x 1
He 189 BahiaScotchwell	199-218-234 x 6-10-12	152-167-180 x 4-5	109-154-183 x 2 31-42-74 x 1
Vald. 10.1 Canal Quinchao	230-252-272 x 6-9-10	186-201-224 x 3-4-6	102-144-179 x 2 29-52-86 x 1
Vald. 53.5a I. Caleta Lobato	227-252-272 x 6-7-10	176-193-208 x 3-5	121-171-192 x 2 31-39-51 x 1
Mont. 8 San Antonio	230-243-260 x 6-7-8	180-189-198 x 5-6	154-161-166 x 2 32-43-61 x 1
Mont. 9 San Antonio	228-244-262 x 9-10-12	186-206-221 x 6	144-175-198 x 2 48-51-58 x 1
Mont. 10 San Antonio	170-189-205 x 5-6	128-148-160 x 3	102-113-144 x 2 29-44-70 x 1
Co. 8 Quetalmahue	237-254-270 x 10	179-199-214 x 6	125-155-176 x 2 43-51-70 x 1
Co. 93-48 Pelluco	220-237-256 qx 6-8-10	178-209-251 x 6	138-155-176 x 2 38-64 x 1
Co. 93.49 Pelluco	237-256-282 x 6-8-10	182-215-246 x 6	160-170-176 x 2 35-44-64 x 1

Co. 93.53 Pelluco	269-306-326 x 10	202-207-211 x 6	208-218-224 x 2 38-48-64 x 1
MNHNC.25 43°15'S 74°32'W	218-237-254 x 8-13-16	163-173-208 x 5-6	134-163-192 x 2 35-42-47 x 1
MNHNC.36 43°15'S 74°32'W	224-241-256 x 10-12-13	157-171-208 x 5-6	80-115-179 x 2 35-40-45 x 1
MNHNC.57 43°15'S 74°32'W	210-240-256 x 10-12-16	166-173-182 x 6	86-122-144 x 2 35-40-45 x 1
Por. 2 Pullinque	201-229-246 x 5-6	179-192-208 x 3	99-131-166 x 2 35-44-51 x 1

reported by Thiele could not be substantiated in remeasured series of spicules in slides made from the four types. Occasional spines were found in several specimens, including the type of *T. mucosa*. It is clear to us that all four are part of the same rather variable species.

T. fuegiensis sensu Sarà, 1978 is conspecific with *T. spinata*.

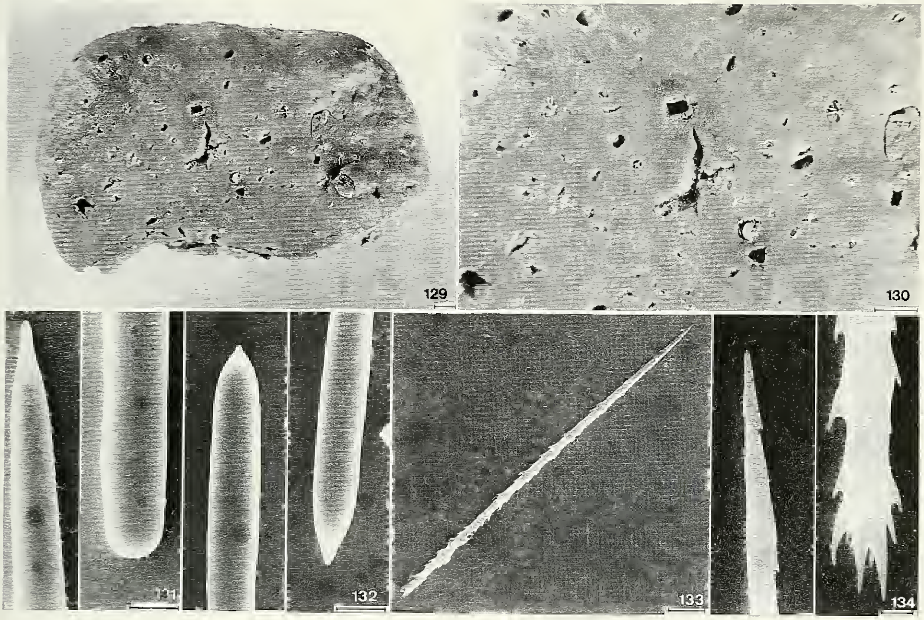
T. mucosa is similar to *T. spinata* (Ridley, 1881), but it has clearly thicker, more robust styles, and the skeleton is denser and more confused.

Tedania (Trachytedania) spinata (Ridley, 1881) (Figs. 129-134)

Trachytedania spinata Ridley, 1881:122. pl. x, fig. 10.
Tedania murdochi Topsent, 1913: 629, pl. v, fig. 5.
Tedania corticata Sara, 1978: 56, figs.34-35
Tedania fuegiensis sensu Sara, 1978 [non: *Tedania fuegiensis* Thiele, 1905: 50 = *T. mucosa*]
Tedania laminariae Sara, 1978: 54, figs. 32, 33.

MATERIAL STUDIED: BMNH:1879:12:27:9, HOLOTYPE of *Tedania (Trachytedania) spinata* Ridley, 1881, Portland Bay, 50°15'S 74°44'W, Chili (opposite the chief island of Madre de Dios Archipelago) 18.8 m; LBIMDT 1591, HOLOTYPE of *Tedania murdochi* Topsent, 1913, Stn. 118, Stanley, Falkland Islands, 01.02.1904, 20 m; SAI 7, PARATYPE of *Tedania corticata* Sara, 1978 Spedizione Antartica Italiana, 1882 (locality and date not precised), SAI 1, 8, *Tedania fuegiensis* sensu Sara, 1978, Spedizione Antartica Italiana, 1882, (locality and date not precised); C-75, PARATYPE of *Tedania laminariae* Sara, 1978, Exped. 7, AMF MARES, GRST SAI, Bahia Golondrina, Ushuaia, 54°49'S 68°16'W, 16.01.1974, on the beach, Sarà coll.; MHNG 18877, 19232-19234: HE 15, 43, 63, 69, Puerto Caracciolo , 50°26'S 75°09'W, 09.10.1972, 25 m; MHNG 18878, 19235, 19236: HE 30, 40, 50, Isla Madre de Dios, Caleta Henry, 50°00'S 75°19'W, 6-28 m; MHNG 18825: HE 39, Puerto Eden , 49°10'S 74°23'W, 05.10.1972, 20 m; MHNG 18826: VALD. 1, Punta Caucacura, 43°08'S 73°30'W, 16.01.1972, 20 m; MHNG 18827:

VALD. 5, Estero Quinchao, 42°32'S 73°26'W, 15.01.1972, 10 m; MHNG 18832: VALD. 22.1, Compu , 42°52'S 73°33'W, 14.12.1971, 15 m; MHNG18836: Vald. 32, Linao, 41°57'S 73°33'W, 27.06.1971, 15 m; MHNG 18837: VALD. 43, Quintupeu, 42°10'S 72°24'W, 23.07.1971, 10 m; MHNG 18864: VALD. 51, Corral, 39°52'S 73°25'W, 29.03.1981, 10 m; MHNG 18855: Co.9, Bahia de Ancud, 41°50'S 73°47'W, 11.1983, 10 m; MHNG 18868: Co. 93.34, Pelluco, 41°30'S 72°54'W, 09.12.1992, 15 m; MHNG 18869: MNHNC 28c, Golfo Corcovado, Off Morro Yeli, 43°31'S 73°03'W, 30.05.1966, 69 m, MHNG 10692: POR. 14, Quetalmahue, 41°50'S 73°52'W, 04.1984, 10-15 m.



FIGS 129-134

Tedania (Trachytedania) spinata (Ridley, 1881) 129, massive specimen from Puerto Eden. 130, enlarged view of the surface. 131, small smooth styles. 132, smooth mucronate tornotes. 133, 134, onychaetes 1 and 2, strongly spined. Scales: figs. 131-133 = 5µm; fig. 134 = 1µm.

DESCRIPTION

Massive sponge (figs. 129, 130): 82-115 x 30-84 mm. Surface smooth, covered by a translucent membrane, which is darker than the choanosome. Oscules, 2-3 mm diameter, irregularly scattered.

Consistency: Compact, soft, compressible.

Colour: Surface dark gray, internally brownish to grayish.

Skeleton: Surface, dense perpendicular palisade of tornotes reinforced by the terminal part of styles and abundant onychaetes.

TABLE 18

Spicule micrometries of: *Tedania (Trachytedania) spinata* (Ridley, 1881). *Trachytedania spinata* Ridley 1881 BMNH 1879:12:27:9 holotype; *T. murdochi* Topsent, 1913 LBIMDT 1591 holotype; *T. corticata* Sarà, 1978 SAI-7, paratype; *T. fuegiensis* sensu Sarà, 1978 SAI-8, specimen from Tierra del Fuego; *T. laminaria* Sarà, 1978 C-75 paratype from Ushuaia; from literature and remeasured. Specimens from Chile of *T. (T.) spinata*.

MNHNC.25 *T. (Trachytedania) spinata* (Ridley, 1881)	218-237-254 Styles	163-173-208 Tornotes	134-163-192 Onychaetes 1 Onychaetes 2
Trachytedania spinata Ridley, 1881 BMNH 1879:12:27:9 Portland bay	165 x 6	177-187 x 4	152
Remeasured	148-159-163 x 4-5	148-167-191 x 3-4	117-131-150 x 2
T. murdochi Topsent, 1913 Holotype LBIMDT 1591 Stanley	225-250 x 7-10	200-240 x 5-6	40-175
Remeasured	171-216-240 x 8-10	191-208-230 x 4	109-140-168 x 2 47-78 0.5
T. corticata Sarà, 1978 Paratype SAI-7	200-240 x 5-7	200-240 x 2-5	100-240
Remeasured	218-229-257	200-222-242	136-181-210 x 2
T. fuegiensis sensu SARÀ, 1978 SAI-8	200-240 x 6-10	160-200 x 4-6	100-200
T. laminariae Sarà, 1978 Paratype C-75 Ushuaia	150-200-260 x 2-4-6	180-200 x 1-3-4	80-200 x 0.5-1
Remeasured	190-209-240 x 5-6-7	180-193-200 x 4-6	115-122-150 x 0.5-1 38-48-60 x 0.5-1
He 15 Puerto Caracciolo	217-240-256 x 3-7-10	172-185-230 x 3-6	115-162-201 x 2 29-61-90 x 1
He 43 Puerto Caracciolo	192-214-237 x 6-8-10	122-167-214 x 3-5-6	106-148-214 x 2 48-62-73
He 63 Puerto Caracciolo	195-236-262 x 3-6	202-222-234 x 3	106-127-147 x 2 38-63-99 x 1

He 69 Puerto Caracciolo	214-239-266 x 6-7-10	154-180-221 x 3-6	106-144-186 x 2 32-62-99 x 1
He 30 Isla Madre de Dios	205-239-272 x 5-6	179-203-230 x 3-5	112-131-157 x 2 Absent
He 40 Isla Madre de Dios	208-224-246 x 3-4-5	192-206-283 x 3-4-5	128-199-154 x 2 Absent
He 50 Isla Madre de Dios	240-257-275 x 6-8-10	189-203-234 x 3	189-209-214 x 2 Absent
He 39 Puerto Edén	161-219-253 x 3-5-6	186-199-214 x 3-6	128-155-195 x 2 Absent
Vald. 1 Punta Caucacura	189-214-227 x 6-7-10	153-165-170 x 3	99-119-144 x 2 32-43-73 x 0.5
Vald. 5 Estero Quinchao	211-248-277 x 6-8-9	191-209-242 x 4	152-154-171 x 2 35-49-81 x 1
Vald. 22-1 Compu	189-206-221 x 6-7-10	150-163-179 x 3-4-5	93-115-157 x 2 38-50-89 x 1
Vald. 32 Linao	230-251-259 x 6-7-10	198-210-230 x 3-4-6	144-157-166 x 2 Absent
Vald. 43 Quintupeu	230-251-275 x 6-7-10	166-193-221 x 3	128-174-202 x 2 35-52-93 x 1
Vald. 51 Corral	240-246-278 x 6-7-10	198-215-230 x 3	147-171-189 x 2 32-57-99 x 1
Co.9 Bahia de Ancud	224-242-256 x 6-8-10	170-184-201 x 3-5-6	93-134-160 x 2 32-43-54 x 1
Co.93-34 Pelluco	230-251-307 x 6-7-10	186-201-214 x 3-4-6	112-159-192 x 2 Absent

MNHNC 28c Golfo Corcovado	214-227-234 x 6-9-10	160-167-170 x 3	96-124-144 51-55-70 x 1
Por.14 Quetalmahue	208-243-284 x 6-8-10	182-201-214 x 3-5-6	128-163-228 x 2 35-43-86 x 1

Choanosomal: Loose, irregular to isotropic reticulation of longitudinal (3-4 spicules) and transversal (2-3 spicules) tracts of smooth styles. Abundant free and in bundles onychaetes.

Spicules (Table 18): Megascleres: predominantly relatively small smooth styles (fig. 131) with occasionally one or a few at the base spines, 161-284 x 3-10 µm.

Smooth mucronate tornotes (fig. 132) abruptly pointed, 122-283 x 3-6 µm.

Microscleres: Onychaetes 1 (fig. 133) 93-228 x 2 µm, and 2 (fig. 134) 29-99 x 0.5 µm length, straight, strongly spined.

Ecology: Stones pebbles, sand, 10-69 m.

Distribution: Chilean coast, 39°S - 50°S, Atlantic coast, 50°-54°S, Falkland Islands.

Remarks: RIDLEY (1881) emphasized the presence of spines on the heads of the styles when describing *T. spinata*, but re-examination of the type specimen by BURTON (1932) and by us failed to reveal any but the faintest and rarest of spines in Ridley's material. Such occasional spines are found in many species of *Tedania* and not worthy of emphasis.

The type specimens of *T. murdochi* Topsent, 1904, *T. corticata* Sarà, 1978 and *T. laminariae* Sarà, 1978 were re-examined and could not be separated from *T. spinata*, on skeletal structure, spicule sizes and form, so their conspecificity is likely.

T. toxicalis De Laubenfels, 1930 (cf. above) from California is a close relative, also possessing styles with vestigial spines. It differs from *T. spinata* in having tylotornotes in stead of mucronate tornotes; onychaetes 2 are distinctly longer in *T. toxicalis* (100-130 µm).

Tedania (Trachytedania) patagonica Ridley & Dendy, 1886

Trachytedania patagonica RIDLEY & DENDY, 1886:336; 1887: 57, pl.xxiii, figs. 6, 6a-c.
? Tedania biraphidora BOURY-ESNAULT, 1973: 281, fig. 36.
Tedania inflata SARÀ, 1978: 59, figs. 36, 37.

MATERIAL STUDIED: SAI 5, PARATYPE of *Tedania inflata* Sarà, 1978, Spedizione Antartica Italiana, Patagonia.

Not represented in our material, so only a brief diagnosis is given here:

Massive sponge, soft and fragile. Surface uneven and hispid. Skeleton as a loose isodictyal network. Spicules: Styles fully spined all over, 350 x 13 µm. Oxeotornotes 245 x 7 µm. Onychaetes 100-200 µm.

Distribution: Chilean coast, 50°S, Patagonia, Brazil, 24°S (?).

If a separate genus for *Tedania* with spined styles would have needed to be erected, then this species would much more deserve to be in that genus than *T. spinata*. To date, this is the only known species of *Tedania* with fully spined styles.

KEY TO THE SUBGENERA AND SPECIES OF *Tedania* OF THE SE PACIFIC COAST

1 Long (from 300 to 700 µm) thick smooth styles, tornotes of diverse shapes . . . . *Subgenus Tedaniopsis* 2

– Short (from 150 to 300 µm) to relatively short styles. 3

2 Tornotes tylotornotes. . . . . *T. (Tedaniopsis) infundibulifomis*

– Tornotes mucronate or oxotornotes 4

3 Smooth styles, tylotornotes with microspined apices. *Subgenus Tedania* . . . 8

– Smooth or spined styles. With oxeote tornotes or mucronate tornotes . . . . *Subgenus Trachytedania* 6

4 With oxotornotes, long onychaetes 1 (800 µm) small onychaestes 2 (80 µm). . . . . *T. (Tedaniopsis) massa*

– With mucronate tornotes, onychaetes 1 up 400 µm, onychaetes 2 up 100 µm. 5

5 Onychaetes 2 occasionally "tylonychaetes". Chile, S.W. Atlantic and Antarctic. . . . . *Tedania (Tedaniopsis) charcoti*

– Onychaetes 2 not "tylonychaetes".Chile (50-52°S) . . . . *T. (Tedaniopsis) tenuicapitata*

6 Smooth styles with occasional spines, smooth mucronate tornotes. 7

– Styles fully spined, smooth oxeote tornotes. . . . *T. (Trachytedania) patagonica*

7 Thin styles (from 3 to 10 µm}, Chilean, S.W. Atlantic, Falkland Islands sponge. . . . . *T. (Trachytedania) spinata*

– Thicker, robust styles from 6 to 16 µm), Chilean, S.W. Atlantic sponge . . . . *T. (Trachytedania) mucosa*

8 Tylotes oval spined apices, from 190 to 250 µm, Onychaetes 1 from 160 to 285 µm, onychaetes 2 from 48 to 76 µm. Easter Island sponge . . . . T. (Tedania) tepitootehenuaensis

– Tylotes from 197 to 234 µm. Onychaetes 1 from 197 to 234 µm, onychaetes 2 from 60 to 90 µm.Galapagos sponge. . . . . *T. (Tedania) galapagensis*

REVIEW OF THE FAMILY TEDANIIDAE

Further genera assigned to the Tedaniidae, but not represented in the present material are the following:

Genus **Tedanione** Wilson, 1894

Type species *T. foetida* Wilson, 1894 (topotypical specimen examined).

Diagnosis: Tedaniidae with smooth strongyles as the only megascleres. Microscleres as usual onychaetes in single or two size classes.

Remarks: *Tedanione foetida* Wilson, 1894 (junior synonym *Hemitedania baki* Van Soest, 1984) from the Caribbean is a thinly encrusting cryptic sponge, with a loosely plumose skeleton. The major synapomorphy is the possession of a single type of megasclere, viz. smooth strongyles. In this respect, the genus is similar to *Hemitedania*, which, however, has sharply pointed oxeas as megascleres. The onychaetes of *foetida* often have distinct tyles, a feature emphasized by VAN SOEST, 1984, but now thought to be of little significance because of widespread occurrence in various unrelated Tedaniidae. Since at least a second species of *Tedanione*, *T. wilsoni* Dendy, 1922 exists, the genus is considered valid.

Genus **Hemitedania** Hallmann, 1914

Synonym: *Tedaniopsamma* Burton, 1934

Type species *Amorphina anonyma* Carter, 1886 (type specimen examined).

Diagnosis: Tedaniidae with sharp pointed oxeas as the only megascleres. Microscleres as usual onychaetes.

Remarks: Hemitedania anonyma (Carter, 1886) from South Australia is an elaborate sponge containing a large quantity of sand grains. It is one of the "sand sponges", i.e. sponges of various families of sponges which apparently replaced parts or whole of their skeleton by sand grains (WIEDENMAYER, 1989), and the possibility cannot be excluded that the choanosomal styles have become lost, while the ectosomal oxea-like tornotes have been retained. The genus is monotypical, although *Hemitedania baki* Van Soest, 1984, was reported from the Caribbean and a *Hemitedania* spec. from West Africa by VAN SOEST, 1993; both records, however, very probably concern *Tedanione foetida*. In view of its deviating characters it is proposed to keep the genus as valid and separate from *Tedanione*.

Tedaniopsamma Burton, 1934 (with type species *Hircinia flabellopalmata* Carter, 1885: 113 (holotype figured in Von Lendenfeld, 1889 as *Sigmatella*) (not examined) is a probable synonym of *Hemitedania*. *T. flabellopalmata* is also a sand sponge, and its tedaniid nature has not been established with certainty, because the spicules, including the"raphides" have never been properly described or figured. If these raphides are indeed onychaetes, then the species would fall to *Hemitedania* on account of its curved 180 µm long oxeas/strongyles (due to their thinness the exact nature has not become clear) and sand cored fibres. A second species of *Tedaniopsamma* described by VACELET & VASSEUR (1971), *T. arenosa*, appears to be a normal *Tedania (Tedania)*.

Three more genera have been associated with the family, viz. *Kirkpatrickia* Topsent, 1912, *Tedaniophorbas* De Laubenfels, 1936 and *Tedandoryx* De Laubenfels, 1954. However, the type species of these genera do not possess onychaetes, and the two latter have chelas. They belong to other families of the Poecilosclerida: *Kirkpatrickia* goes to Anchinoidae because of its surface areoles; *Tedaniophorbas* is a probable junior synonym of *Megaciella* (family Iophonidae), and *Tedandoryx* either is a Myxillidae, or possibly represents a commonplace *Tedania (Tedania)* contaminated with some arcuate isochelas.

To summarize, the family Tedaniidae comprises three valid genera, *Tedania* (with subgenera *Tedania*, *Trachytedania* and *Tedaniopsis*), *Tedanione*, and *Hemitedania*.

DISCUSSION

SYSTEMATICS

The three genera treated here were previously considered members of a loosely defined giant family Myxillidae. *Tedania* was more often than the other two genera, separated into a family of its own (Tedaniidae) because of its lack of chelas and its possession of onychaetes. For inexplicable reasons, *Iophon* did not receive the same appreciation although in its peculiar bipocilla and its palmate anisochelas it had strongly deviating characters, too. The proposal (HAJDU *et al.* 1994) to put these three genera in three different families is here supported, because it increases the internal consistency of the poecilosclerid families.

Judged on characters other than the anchorate chelas the family Crambeidae is not an obvious sistergroup of Myxillidae. Relationships within the suborder Myxillina still need to be further evaluated. It has been postulated by HAJDU *et al.* (1994) that the arcuate chela is plesiomorphous, which means that families with arcuate chelas (Coelosphaeridae, Crellidae, Anchinoidae, Hymedesmiidae) need additional defining characters, and cannot be considered closely related by the possession of the arcuate condition. The latter three families share similar surface structures, the pore sieves, which indicates they might form a monophyletic group. Those three families as well as Coelosphaeridae and Myxillidae share the possession of diactinal ectosomal megascleres (as opposed to the monactinal ones in the family Crambeidae), which is tentatively assumed to indicate that Crambeidae fall outside the five family group.

To test these ideas a preliminary character analysis of some major Poecilosclerid families was performed.

The following families were studied: Mycalidae (outgroup), Microcionidae (to seek support for the Microcionid nature of Iophonidae), Iophonidae, Myxillidae, Tedaniidae, Coelosphaeridae *sensu* HAJDU *et al.* 1994 (to investigate whether they are close to Myxillidae), Crambeidae, Hymedesmiidae, Crellidae and Anchinoidae (to see whether arcuate and anchorate chela morphology is convergent with other morphological characters).

The following characters and states were distinguished:

1. Chela morphology (with states: absent, palmate, arcuate and anchorate)
2. Ectosomal megascleres (with states: absent, monactinal and diactinal)
3. Spination of ectosomal megascleres (with states: absent and present; outgroup is scored as "?")
4. Echinating acanthostyles (with states: absent and present)
5. Choanosomal reticulation (with states: plumose, anisotropic and isodictyal)
6. Sigmas (with states: present and absent)
7. Toxas (with states: present and absent)
8. Pore sieves (with states: absent and present)

The matrix of families and character states scores was analyzed with PAUP 3.1 (SWOFFORD, 1993), using the heuristics and unweighted characters option. The result was a single tree of 18 steps length (consistency index 0.667, retention index 0.684, rescaled consistency index 0.456). This tree is depicted in Fig. 135. Only characters 6 and 8 had a consistency of 1.00, indicating a lot of conflicting character distributions and it is stressed here that this result is considered tentative.

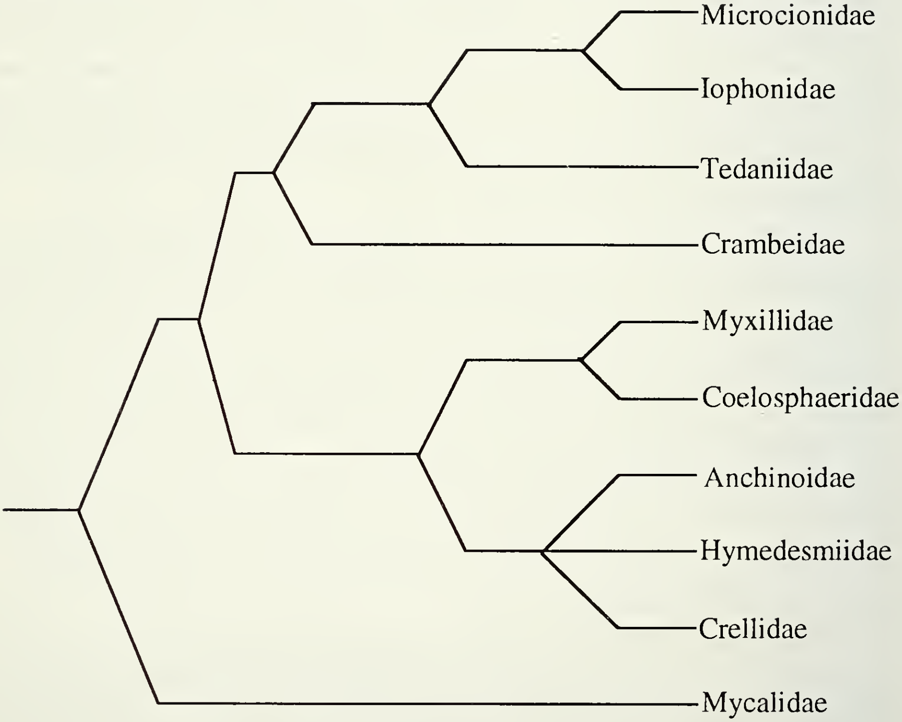


FIG. 135

Cladogram obtained by treating the matrix of families and character states in Table 19. Tree CI = 0.667, RI = 0684, RCI = 0456.

Iophonidae is indeed the sister group of Microcionidae (but Raspailiidae was not included in the analysis), Myxillidae and Coelosphaeridae are also sister groups, clearly separated from the closely related family group Hymedesmiidae-Crellidae-Anchinoidae. The position of Crambeidae and Tedaniidae on the branch of Microcionidae-Iophonidae indicates the lack of support for a clear association of these families with the "myxilline" group. There is only a single character shared with the Iophonidae-Microcionidae group (absence of sigmas), but no character is shared between Tedaniidae-Crambeidae and the "myxilline" group. Their position remains problematical.

BIOGEOGRAPHY

The biogeography of Chilean sponges was treated extensively in previous papers by one of us (DESQUEYROUX-FAUNDEZ & MOYANO, 1989, DESQUEYROUX-FAUNDEZ, 1994), as well as by older authors (e.g. EKMAN, 1953; BRIGGS, 1974). A study of Magellanic-Antarctic sponge relationships was performed by SARÀ (1992). From these studies two remaining questions are apparent:

- the existence of more than a single area along the coast of Chile
- the relationship and origin of the Chilean sponge fauna

Below, we will discuss to what extent our monographic treatments of the three genera contribute to solving these questions.

The genus *Iophon* has a predominantly coldwater distribution, with only few species recorded from the tropical or subtropical regions (VAN SOEST, 1994). In our study it is reconfirmed that *Iophon lamella* and *I. ostiamagna* are genuine endemics of the tropical-subtropical East Pacific. The other species reported here conform to the general cold water distribution by being confined to the SE Pacific and (in the case of *I.proximum*) to the area on both sides of South America. Endemism in this genus seems to indicate the existence of two areas along the coasts of Chile, viz. 20°-42°S (*Iophon proximum*) and 43°-53°S (*I.timidum* and *I.chilense*). Since so many more species of *Iophon* are found in the Southern Ocean and along the coasts of Antarctica, and relatively few in the Arctic and boreal waters, it is likely that the genus originated in the seas surrounding the southern continents.

The genus *Myxilla* is cosmopolitan but also has a predominance in cold water (VAN SOEST, 1994). Since this is is a very large genus, with almost certainly some distinct subgeneric groups, a further analysis will have to demonstrate whether all the records from tropical regions are indeed *Myxilla*. We can here record at least one species, *M. (Myxilla) mexicensis*, from the Galapagos Islands, with characters similar to that of the type species. Another species from the Galapagos is *M.(Stelodoryx) cribrigera*. Two further tropical records are *M.(Myxilla) asymmetrica* n. sp. and *Myxilla (Ectyomyxilla) dracula* n. sp. from Peru, but there were collected in deep water (200-600 m). The *Myxilla* distributions do not support a subdivision of a northern and a southern Chilean area of endemism separated at about 42°S, most species being confined to the tropics or to both sides of southern South America. One species, *M. (Stelodoryx) cribrigera* occurs over the whole study area. The subgeneric units of *Myxilla* used here are not likely to represent monophyletic groupings. Thus their distributions cannot provide us with firm clues as to their origin. However, *Myxilla* species in the study area (and also in neighbouring areas of the Southern Ocean), with the exception of *M. (M.) mexicensis* have "loose" skeletons with a tendency to form ill-defined plumoreticulate architecture. Styles often have only a few spines. These characters may indicate supraspecific endemism in the southern oceans. The *Myxilla* species of the Arctic-boreal regions are not well-studied, but an obvious close relationship with southern ocean *Myxilla* is not apparent.

The genus *Tedania* is considered to have originated in the Antarctic-Antiboreal regions (VAN SOEST, 1994), because most species have been reported from these parts of the world. As indicated above, the tropical and subtropical regions contain *Tedania* species with very similar characteristics, which by some authors are considered members of a single cosmopolitan species (*T. anhelans*), or a complex of closely related sibling species. From the Galapagos we describe here also a member of this complex, *Tedania (Tedania) galapagensis*, while in a previous study of sponges of Isla de Pascua (DESQUEYROUX-FAUNDEZ, 1990) a further species from the study area was reported. The other *Tedania* species from the area belong to clearly different subgeneric units, and their distributions are limited to both sides of southern South America. Like the *Myxilla* distributions they confirm the existence of a Magellan area on both sides of South America (EKMAN, 1953, BRIGGS, 1974), but do not present evidence for a northern Chilean area of endemism. Some of the Arctic-boreal *Tedania* belong to the subgeneric units occurring in the study area, but their number is limited.

In summary: endemism in the tropical region including the Galapagos fauna and tropical continental faunas is clearly present in all three genera. The Chile-Peru and Magellan regions are not clearly separated in the three genera, although *Iophon* shows some evidence of the existence of these two separate areas. The close relationship with faunas of Antarctica and other Southern Ocean regions is clear for all three. The Arctic-boreal regions also show close relationships with the study area, but most (sub) generic units appear poorer in species number. This perhaps indicates a southern origin.

EKMAN (1953) and BRIGGS (1974) maintain that the Chilean fauna despite is high degree of endemism is closely similar to that of the Pacific coast of North America, with many species the same in both regions. VERMEIJ (1991) postulates a Transequatorial interchange of north and south East Pacific faunas during the Pliocene, following the gradual closure of the Panama seaway. This interchange was mostly from north to south, although the subsequent Pleistocene interchange between the regions supposedly was bothways. Before the Pliocene the tropical region was too strong and currents too adverse for faunal interchange. We find little evidence to support that 1) much interchange has ocurred, and 2) that the main stream was north-south. This may have several causes, the most important probably being lack of knowledge of the northern North Pacific fauna. Since the days of Lambe at the end of last century no serious systematic work on sponges from the northern part of the area has been done. Still, the large numbers of *Tedania* and *Iophon* in the south Pacific as compared to those of the north are hardly likely to be an artifact. Also the morphological distinctness of Southern Ocean *Tedania* indicates that endemism in the south is of a high taxonomic level and likely to be at least of Tertiary age. The few Arctic-boreal *Tedania* may have invaded the north during Pleistocene times (following VERMEIJ). Pliocene northern immigrants in the study area are not apparent.

Relationships with Antarctica are distinct in all three genera. Both in *Iophon* and *Tedania* there are species described from the study area with peculiar morphological traits shared with Antarctic species (*Iophon chilense* and *I. unicornis*, *Tedania charcoti*, *T. spinata*. This indicates fairly recent interchange and subsequent speciation. During the Pleistocene, Antarctica and southern Chile were covered by a thick icecap, possibly destroying the littoral fauna to considerable depths. Subsequent reinvasion of these areas were inevitably from the north (VAN OPPEN et al., 1994), and possibly the distribution of *Tedania charcoti* in Chile and Antarctica is a product of that reinvasion.

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Taille et mélanisme chez *Vipera aspis* dans les Préalpes suisses et en Italie centrale et comparaison avec différentes populations alpines de *Vipera berus*

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Body size and melanism in *Vipera aspis* in the Swiss Prealps and Central Italy and comparison with different alpine populations of *Vipera berus*. - In a contact zone of *Vipera aspis* and *Vipera berus* in the Swiss Bernese Prealps, *V.berus* is smaller than *V.aspis*. *V.berus* seems to be a dwarf mountainous form. The rate of melanism is higher in *V.berus* (49%) than in *V.aspis* (34%), probably a consequence of the difference in habitat use between the two species. Comparisons with other Swiss and Italian populations of both *V.aspis* and *V.berus* suggest that melanism is particulary advantageous in closed, forested areas. On the other hand, for both species and in all the studied populations, the rate of melanism is higher in females than in males, suggesting a higher advantage to be black for the females. In Switzerland, as well as in Italy, melanistic *V.berus* tend to be heavier and longer than cryptic ones, whereas in *V.aspis* the opposite is the case. In both species, growth rates are higher in melanistic morphs and we suggest that the larger body size of the cryptic *V.aspis* is related to their higher survival rate and higher mean age.

Key-words: *Vipera berus* - *Vipera aspis* - Body size - Melanism - Ecology

INTRODUCTION

Le mélanisme chez *Vipera aspis*, fréquent localement et particulièrement en montagne, a souvent été rapporté (FATIO 1872; SAINT GIRONS & FONS 1977; ARNOLD & BURTON 1978, PILLET & GARD 1979; HOFER 1991; KRAMER & STEMMLER 1992) mais il n'a fait l'objet que de rares études (NAULLEAU 1973; MONNEY 1990).

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Exceptionnel, voire inexistant dans la Chaîne jurassienne, il en est de même de manière générale, au Nord de l'aire de répartition de l'espèce. Dans plusieurs régions des Alpes et des Préalpes au contraire, ce caractère est fréquent et le taux de mélanisme au sein d'une population est souvent voisin de 50%. Dans les Préalpes fribourgeoises par exemple, à l'Ouest de la Suisse, NAULLEAU (1973) signale 54% de vipères noires (n=79) et MONNEY (1990) 58% (n=21). Il en est de même dans les Apennins, au centre et à l'Est de l'Italie, où le mélanisme est localement fréquent au sein des populations montagnardes de *V.aspis* (BRUNO 1990).

La situation est bien différente pour *V.berus*. Le mélanisme chez cette espèce n'est pas rare dans le Jura et au Nord de son aire de répartion, ainsi qu'en montagne. Les hypothèses tentant d'expliquer le rôle écologique du mélanisme chez *V.berus* et sa maintenance au sein d'une population sont nombreuses, mais bien des questions restent encore ouvertes (ANDRÉN & NILSON 1981; FORSMAN & AS 1987; MADSEN & STILLE 1988; LUISELLI 1992, 1993; CAPULA & LUISELLI 1994; LUISELLI *et al.* 1994; MONNEY *et al.* 1995). Afin de mieux cerner les facteurs impliqués dans ce polymorphisme, et comme le suggère LUISELLI (1993), il nous a semblé judicieux de comparer la situation chez deux espèces proches philogénétiquement et vivant dans une même station. Occupant la même niche écologique (SAINT GIRONS 1975), ces deux serpents présentent-ils des caractéristiques morphologiques communes liées au mélanisme ? Retrouve-t-on les mêmes tendances dans d'autres populations ? Cet article est la première contribution détaillée qui tente de répondre à ces questions. D'autres publications par les mêmes auteurs aborderont le problème par le biais d'un modèle théorique.

MATÉRIEL ET MÉTHODES

Nous comparons la taille et le mélanisme des vipères aspics provenant essentiellement de trois régions différentes: deux stations préalpines situées à l'Ouest de la Suisse, l'Oberland bernois et les Préalpes fribourgeoises, et une station d'Italie centrale (Abruzzes). En ce qui concerne la vipère péliade, les données proviennent de la station de l'Oberland bernois qui abrite les deux espèces ainsi que d'autres stations alpines (MONNEY *et al.* 1995). Les données climatiques sont tirées, pour les stations suisses, de l'Atlas hydrologique de la Suisse (Kirchhofer et Sevruk, 1992) et de l'Atlas de la Suisse (Imhof, 1965).

1. STATION DE L'OBERLAND BERNOIS

L'essentiel de nos données a été récolté sur une surface d'environ 40 ha située à une altitude s'échelonnant de 1400 à 1600 m, dans l'étage subalpin inférieur. Cette surface correspond à une zone de contact relativement étroite entre *V.aspis* et *V.berus* qui fréquentent les mêmes types d'habitat mais dans des proportions différentes et sans véritable cohabitation. Il s'agit d'un versant exposé au Sud-Est, comprenant deux cônes de déjection torrentiels colonisés par une mosaïque d'associations végétales, des pâturages et des prairies humides parsemés localement de murgiers, et une forêt d'épicéas. Une troisième espèce de serpent vit dans cette station; il s'agit de *Coronella austriaca*. La température annuelle moyenne est inférieure à 5°C et la hauteur annuelle moyenne des précipitations est supérieure à 1600 mm.

De 1987 à 1993, nous avons marqué individuellement les vipères par coupe d'écailles sous-caudales (BLANCHARD & FINSTER 1933). Les serpents ont été pesés à l'aide d'un dynamomètre de type “PESOLA”. Pour mesurer leur longueur totale (LT) et leur longueur museau-cloaque (LC), une fourchette modifiée (pointe médiane coupée à sa base et remplacée par de la mousse) a été utilisée pour maintenir la tête de la vipère plaquée au sol. Toutes ces manipulations ont été faites sur le terrain, le serpent étant immédiatement relâché après ces mesures. Seule la taille des femelles reproductrices et des mâles adultes est considérée. La longueur totale minimale de ces derniers est celle des plus petits mâles observés en activité sexuelle, soit 40 cm pour *V.berus* et 45 cm pour *V.aspis*. Le poids des vipères n'est relevé que si nous n'observons aucune trace d'activité trophique récente, soit essentiellement en fin de gestation pour les femelles et au début des périodes d'accouplement pour les mâles. Si nous n'avons considéré que les femelles reproductrices, c'est que le cycle sexuel des femelles des deux espèces est pluriannuel, au plus triennal pour *V.aspis* et au plus biennal pour *V.berus* (MONNEY 1995); de ce fait, les variations pondérales annuelles chez ces vipères sont importantes et difficilement comparables. La récolte de nos données s'échelonnant sur une période de 7 années, un même individu peut être comptabilisé plusieurs fois, mais au plus une seule fois par année. L'état sexuel des femelles a été déterminé par palpation des follicules ovariens ou des embryons. Les cycles annuels d'activité de ces deux espèces, leur régime alimentaire ainsi que les données sur le mélanisme de *V.berus* ont fait l'objet d'autres publications (MONNEY 1993, 1995; MONNEY *et al.* 1995).

2. STATION DES PRÉALPES FRIBOURGEOISES

Cette station est située à une altitude moyenne de 900 m et a été prospectée intensivement en 1986 (MONNEY 1990, 1992). Elle est située dans l'étage montagnard inférieur dominé par le hêtre (*Carici-* et *Cardamino-Fagetum*) et comprend, outre la forêt, des pâturages parsemés de murgiers et de murs de pierres sèches, et de nombreuses haies buissonnantes. En plus de la vipère aspic, dont les femelles se reproduisent en moyenne tous les deux ans, on y trouve la coronelle lisse (*Coronella austriaca*) et la couleuvre à collier (*Natrix natrix*). La température annuelle moyenne est d'environ 8°C et la hauteur annuelle moyenne des précipitations est d'environ 1500 mm. Les données ont été récoltées de la même manière que dans l'Oberland bernois.

3. STATION DE L'ITALIE CENTRALE

En 1993 et 1994, une troisième série de données concernant une population mélanique de *V.aspis* a été récoltée suivant les mêmes méthodes en Italie centrale, à une altitude de 800 m (Val Sagittario, Abruzzes). Le cycle sexuel des femelles est en moyenne biennal. Pour cette station, le poids des femelles non reproductrices a également été considéré. Ces vipères vivent en sympatrie avec quatre autres espèces de serpents. Il s'agit de *Coronella austriaca*, de *Natrix natrix*, d'*Elaphe longissima* et de *Coluber viridiflavus*, cette dernière étant fréquemment mélanique. La végétation appartient à la ceinture samnitique de la région méditerranéenne (forêt de feuillus dominée par le hêtre). La température annuelle moyenne est d'environ 10°C et la hauteur annuelle moyenne des précipitations est d'environ 1150 mm. Les vipères sont abondantes en bordure de la forêt mixte, et notamment à proximité des vieux murs de pierres et des murgiers.

Les longueurs et poids moyens des vipères sont comparés à l'aide du test t de Student. Le test du X^2 est utilisé pour comparer les taux de mélanisme. Les droites de régression sont comparées selon la méthode de HALD (1967).

RÉSULTATS

1. COMPARAISON INTERSPÉCIFIQUE

Dans la station de l'Oberland bernois occupée par les deux espèces de vipères, les adultes de *V.aspis*, mâles et femelles, sont significativement plus longs (LT et LC) et plus lourds que les adultes de *V.berus* (poids des mâles: d.f.=217, t=8.283; poids des femelles: d.f.=136, t=4.054; LT mâles: d.f.=237, t=13.250; LT femelles: d.f.=136, t=6.436, $p<0.0001$ dans tous les cas). La différence est particulièrement marquée chez les mâles. Les aspics mesurent environ 10 cm de plus et pèsent en moyenne 25 g de plus (Tab. 1 et Fig. 1). La comparaison des droites de régression du logarithme de la longueur du corps par le logarithme du poids montre que les mâles péliades sont significativement plus trapus que les mâles aspics (Fig. 2). Les variances résiduelles des deux droites ne sont pas significativement différentes (p=0.130), leurs pentes valent 2.55 et 3.02 et sont significativement différente, p=0.018) (Fig. 2). Il n'y a par contre pas de différence significative entre les femelles des deux espèces.

Le pourcentage de vipères noires est significativement plus grand chez *V.berus* (49%, n=74) que chez *V.aspis* (34%, n=173) (X^2=4.632, d.f.=1, p=0.031). Dans les stations fribourgeoise et italienne au contraire, les taux de mélanisme chez *V.aspis*, resp. 58% (n=36) et 56% (n=64) ne sont pas statistiquement différents de celui observé chez *V.berus* dans l'Oberland (d.f.=1, X^2=0.910 et 0.795, p=0.340 et 0.372 resp.), alors qu'ils diffèrent significativement de celui de *V.aspis* de l'Oberland (d.f.=1, X^2=7.405 et 9.540, p=0.006 et 0.002 resp.)

2. COMPARAISON INTRASPÉCIFIQUE

a. *Vipera aspis*

Dans l'Oberland bernois, la longueur totale des mâles et des femelles n'est pas significativement différente (t=-0.332, d.f.=260, p=0.740) (Tab. 1). La longueur du corps et le poids des femelles sont significativement supérieurs à ceux des mâles (t=-

TABLEAU 1

Longueurs et poids de *Vipera aspis* et *Vipera berus* dans l'Oberland bernois. Les étoiles indiquent les couples de valeurs qui diffèrent significativement ($p<0.05$).

	Longueur totale (cm)				Longueur corps (cm)				Poids (g)			
	N	Moyenne	Ecart type	Min.-Max.	N	Moyenne	Ecart type	Min.-Max	N	Moyenne	Ecart type	Min.- Mx.
V.aspis												
Mâles	175	56.8	5.702	45.5-71.0	167	48.7*	4.881	38.9-60.4	156	75.8*	23.938	35.0-150.0
Femelles	87	57.0	4.897	45.0-70.0	82	50.6*	4.463	40.3-62.3	87	102.5*	26.385	55.0-173.0
Mâles norm.	110	56.6	5.745	45.5-71.0	104	48.3	4.932	38.9-60.4	96	75.6	21.783	35.0-135.0
Mâles mél.	65	57.2	5.653	46.0-70.0	63	49.4	4.751	40.1-59.7	60	76.2	27.226	41.5-150.0
Fem. norm.	54	57.7	5.32	45.0-70.0	49	51.2	4.925	40.3-62.3	54	107.6*	27.523	55.0-173.0
Fem. mél.	33	55.9	3.937	50.0-65.0	33	49.6	3.316	44.9-57.3	33	94.1*	22.337	63.0-159.0
V.berus												
Mâles	64	46.6*	3.795	40.0-55.0	64	39.7*	3.357	33.9-47.6	63	49.5*	12.248	31.0-81.0
Femelles	51	51.9*	3.591	44.0-58.0	49	46.6*	3.202	39.9-53.6	51	85.2*	19.649	54.0-128.0
Mâles norm.	31	45.5*	3.677	40.0-55.0	31	38.8*	3.313	33.9-47.6	31	46.2*	11.429	31.0-77.0
Mâles mél.	33	47.6*	3.687	41.0-53.5	33	40.6*	3.212	34.7-45.8	32	52.7*	12.342	31.5-81.0
Fem. norm.	26	51.1	3.744	44.0-57.5	26	46.0	3.392	39.9-53.6	26	79.5*	17.242	54.0-112.0
Fem. mél.	25	52.8	3.271	47.0-58.0	23	47.2	2.907	42.8-51.9	25	91.2*	20.538	55.8-128.0

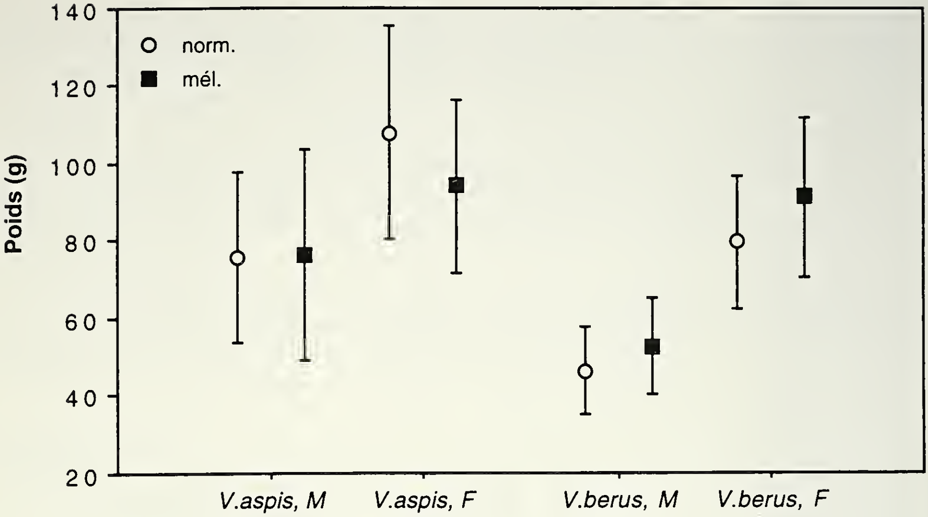


FIG. 1

Moyennes et écarts types du poids des vipères aspics et péliades dans une même station de l'Oberland bernois. Mâles (M) et femelles (F) de *V.aspis* sont significativement plus lourds que *V.berus*. On remarque d'autre part que les péliades mélaniques sont plus lourdes que les normales et que c'est l'inverse chez *V.aspis* femelle.

2.893, d.f.=247, p=0.0042; t=-8.020, d.f.=241, p<0.0001 resp.). Les femelles "normales" sont en moyenne significativement plus lourdes que les mélaniques, resp. 107.6 g et 94.1 g (t=-2.385, d.f.=85, p=0.0193). Leurs longueurs moyennes ne sont par contre pas significativement différentes (pour LT et LC, t=1.6821, d.f.=85, p=0.0961; t=1.654, d.f.=80, p=0.1020). Chez les mâles, les longueurs et poids moyens ne diffèrent pas entre les deux phénotypes. Par contre, la comparaison des droites de régression (logarithme du poids par logarithme de la longueur du corps) montre que les mâles normaux sont plus lourds, pour une longueur donnée, que les mélaniques, la distance entre les deux droites étant significativement différente de 0 (p=0.004). Elle mesure sur Y (X fixe) 0.0561 (Fig.3). Le taux de mélanisme des mâles (n=79) et des femelles (n=94), respectivement 30 et 37%, n'est pas sigificativement différent (X^2=0.897, d.f.=1, p=0.343).

La taille respective de *V.aspis* des Préalpes fribourgeoises et de l'Italie centrale ne diffère pas, pour les mâles et les femelles, de façon significative (pour LT: t=-1.491, d.f.=46, p=0.142 et t=1.499, d.f.=49, p=0.140 resp.) (Tab. 2). Ces vipères, mâles et femelles, sont par contre significativement plus grandes que celles de l'Oberland (pour LT de la station fribourgeoise: t=-3.566, d.f.=184, p=0.0005 et t=-2.643, d.f.=109, p=0.0094 resp. et pour LT de la station italienne: t=-2.184, d.f.=210, p= 0.0301 et t=-5.030, d.f.=112, p<0.0001 resp.) (Fig. 4). Dans ces deux stations, le taux de mélanisme ne diffère pas non plus de façon significative entre mâles et

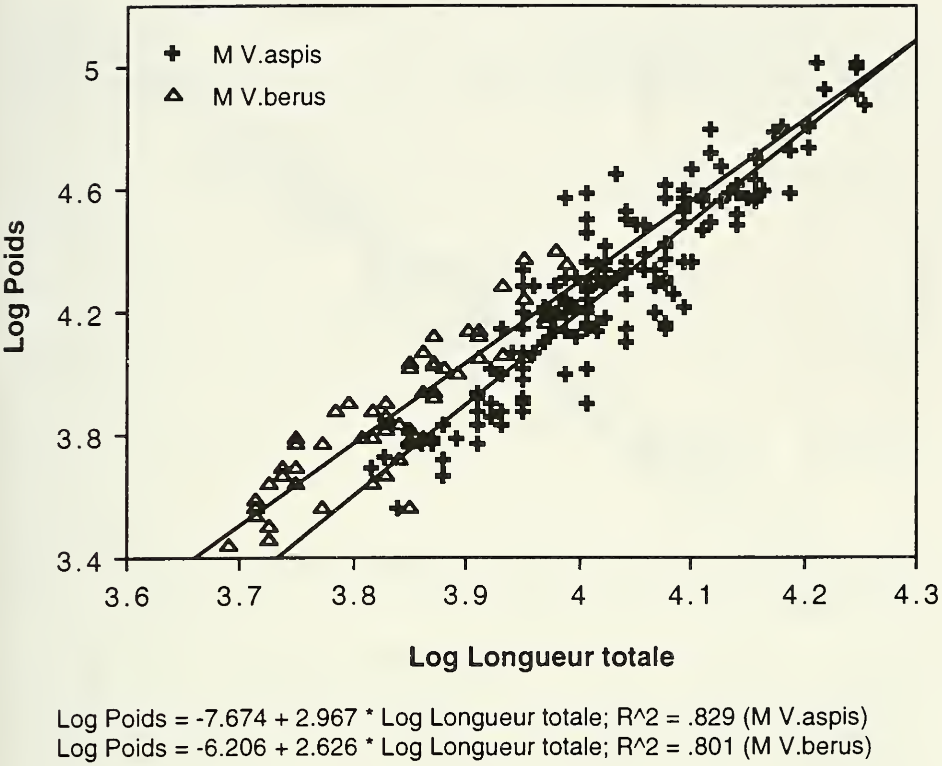
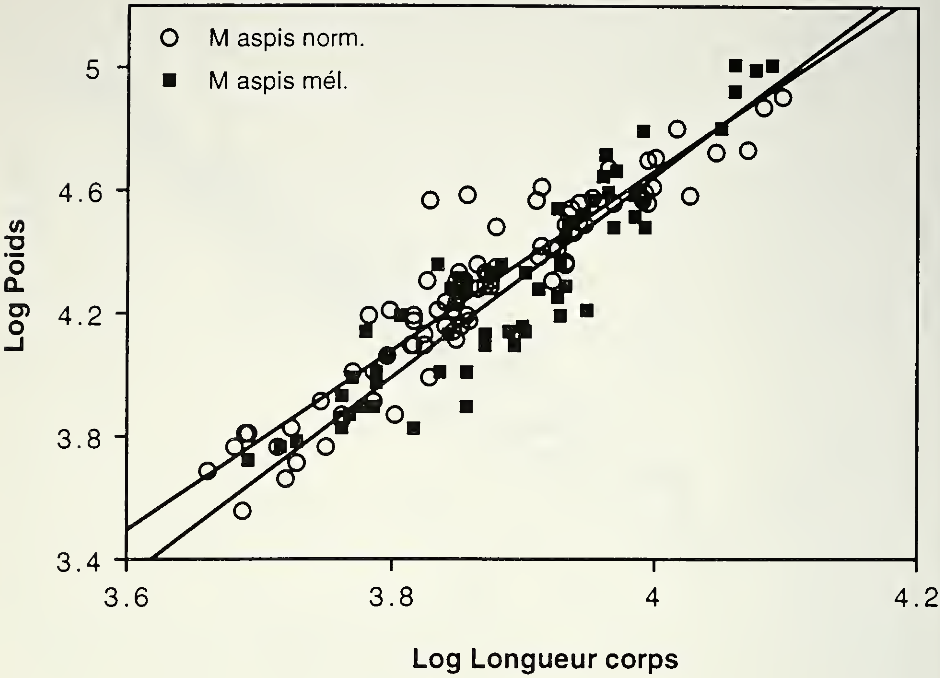


FIG. 2

Droites de régression du logarithme de la longueur en fonction du logarithme du poids de *Vipera aspis* Mâle (M) et de *V.berus* Mâle. Les pentes des deux droites sont significativement différentes (p=0.018).

femelles (X^2=0.087, d.f.=1, p=0.768 et X^2=0.855, d.f.=1, p=0.355 resp.). Il est cependant intéressant de constater que pour les trois populations, on observe la même tendance, soit un taux de mélanisme chez les femelles supérieur à celui des mâles, resp. 37 et 30% dans l'Oberland, 60 et 54% dans les préalpes fribourgeoises, et 63 et 51% dans les Abruzzes. Cette même tendance générale avait déjà été relevée chez *V.berus* dans les Alpes et dans une station de plaine (Monney et al., 1995).

Comme dans l'Oberland, la longueur totale des femelles dans les Abruzzes et les Préalpes fribourgeoises ne diffère pas significativement de celle des mâles (t=1.912, d.f.=62, p=0.0604 et t=-1.268, d.f.=33, p=0.2138, resp.). Il en est de même pour le poids, les femelles étant significativement plus lourdes que les mâles (t=3.934, d.f.=62, p=0.0002) et t=2.417, d.f.=33, p=0.0213 resp.).



Log Poids = -7.051 + 2.928 * Log Longueur corps; R^2 = .883 (M aspis norm.)
Log Poids = -8.386 + 3.258 * Log Longueur corps; R^2 = .848 (M aspis mél.)

FIG. 3

Droites de régression du logarithme de la longueur en fonction du logarithme du poids des mâles (M) mélaniques (mél.) et des mâles normaux (norm.) chez *Vipera aspis* de l'Oberland bernois. La distance entre les deux droites est significativement différente de 0 (p=0.004).

La comparaison des longueurs et des poids moyens entre les deux phénotypes mélanique et normal met en évidence la même tendance dans les Abruzzes que dans l'Oberland. Les femelles normales ont une longueur moyenne identique à celle des mélaniques, resp. 62.52 cm (n=10) et 62.68 cm, (n=17) (t=0.074, d.f.=25, p=0.941) et tendent à être plus lourdes que celles-ci (resp. 143.70g et 132.41g), la différence n'étant cependant pas significative (t=-0.853, d.f.=25, p=0.402). Les longueurs et poids moyens des mâles ne diffèrent pas significativement entre les deux phénotypes. Par contre, la comparaison des droites de régression (logarithme du poids par logarithme de la longueur du corps) montre que, comme dans l'Oberland bernois, les mâles normaux sont plus lourds, pour une longueur donnée, que les mélaniques (Fig. 5). La distance entre les droites est significativement différente de 0 (p=0.025) et mesure sur Y (X fixe) 0.0561. Les variances résiduelles des deux droites ne sont pas

TABLEAU 2

Longueurs et poids de *Vipera aspis* en Italie centrale (Abruzzes) et dans les Préalpes fribourgeoises. Les étoiles indiquent les couples de valeurs qui diffèrent significativement (p<0.05).

	Longueur totale (cm)				Poids (g)			
	N	Moyenne	Ecart type	Min.-Max.	N	Moyenne	Ecart type	Min.-Max.
***V.aspis* Abruzzes**								
Mâles	37	59.2	7.913	48.3-74.2	37	102.2*	35.643	53.0-189.0
Femelles	27	62.6	5.414	53.2-72.1	27	136.6*	33.049	92.0-197.0
Mâles norm.	18	60.4	8.364	48.3-73.3	18	113.2	43.521	53.0-189.0
Mâles mél.	19	58.2	7.524	50.2-74.2	19	91.7	24.442	54.0-142.0
Fem. norm.	10	62.5	6.031	53.2-72.1	10	143.7	33.308	96.0-197.0
Fem. mél.	17	62.7	5.212	53.9-72.1	17	132.4	32.894	92.0-189.0
***V.aspis* Préalpes frib.**								
Mâles	11	63.3	7.93	48.8-73.0	11	122.2*	36.499	65.0-168.0
Femelles	24	60.2	6.086	49.0-70.0	8	167.9*	21.184	140.0-192.0
Mâles norm.	5	61.1	9.619	48.8-73.0	5	118.7	46.154	65.0-168.0
Mâles mél.	6	65.2	6.524	53.0-72.0	6	125.1	30.616	76.0-160.0
Fem. norm.	9	60.9	5.742	51.0-68.0	2	166.0		140.0-192.0
Fem. mél.	15	59.7	6.439	49.0-70.0	6	168.6	18.864	140.0-184.0

significativement différentes (p=0.024), de même que leurs pentes qui valent 2.43 et 1.89 (p=0.107). Nous obtenons les mêmes résultats pour les femelles, relevant l'avantage pondéral, pour une longueur donnée, des femelles normales (Fig.6) (Distance entre les deux droites significativement différente de 0 (p=0.023) et mesurant sur Y (X fixe) 0.0961, pentes non différentes et valant 2.362 et 2.628 (p=0.561), variance résiduelle non significativement différente (p=0.028)).

En ce qui concerne la station fribourgeoise, le petit nombre de mâle ne permet pas de comparaison statistique entre les phénotypes et il n'y a pas de différence significative de longueur au sein des femelles.

b. *Vipera berus*

Les données concernant cette espèce sont présentées de façon plus détaillée dans une autre publication (MONNEY *et al.* 1995) et nous ne ferons que les rappeler brièvement pour la comparaison avec *V.aspis* vivant dans cette même station de l'Oberland bernois. Les femelles de *V.berus* sont significativement plus longues et plus lourdes que les mâles (t=-7.708, d.f.=113; t=-11.858; d.f.=112 resp., p<0.0001), la différence étant beaucoup plus marquée que chez *V.aspis*. Contrairement à ce que

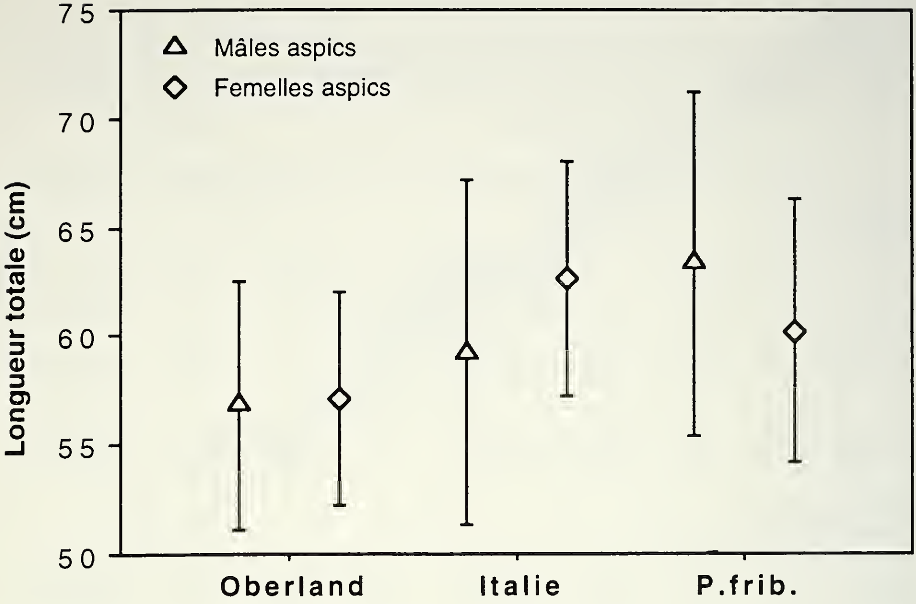
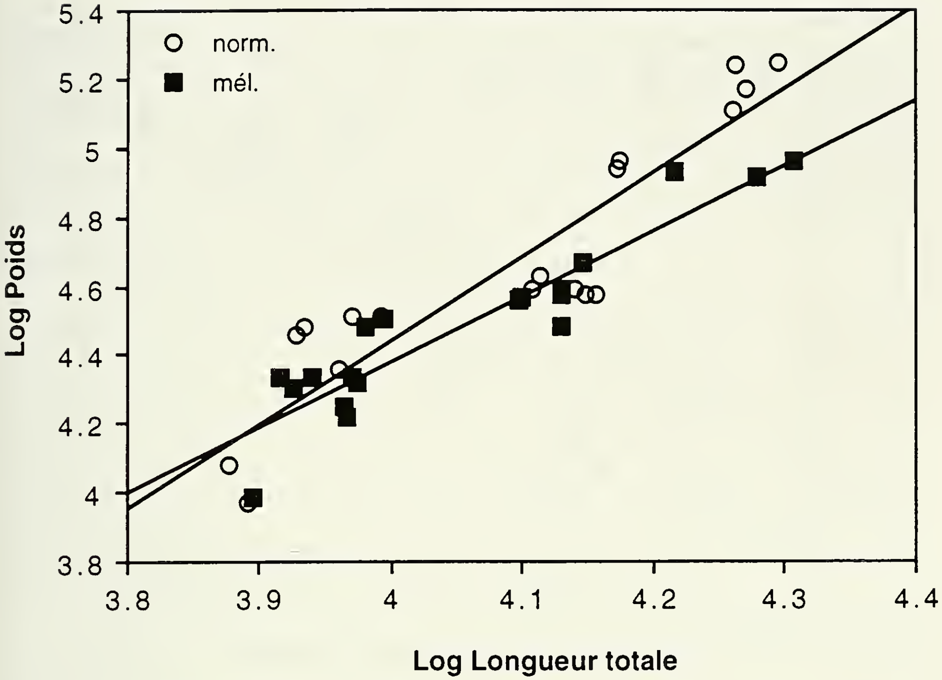


FIG. 4

Moyennes et écarts types de la longueur des vipères aspics mâles et femelles dans l'Oberland bernois, dans les Abruzzes (Italie centrale) et dans les Préalpes fribourgeoises. Les vipères aspics de l'Oberland, mâles et femelles, sont significativement plus petites que dans les deux autres stations.

l'on observe chez *V.aspis*, ce ne sont pas les femelles normales mais les mélaniques qui sont significativement plus lourdes (t=-2.209, d.f.=49, p=0.032). Comme pour les femelles de *V.aspis*, il n'y a pas de différence de longueur entre les deux phénotypes (pour LC, t=-1.353, d.f.=47, p=0.1826; pour LT, t=-1.739, d.f.=49, p=0.0884). En ce qui concerne les mâles, la situation est également différente entre les deux espèces. S'il n'y a pas de différence significative de poids moyen et de longueur moyenne chez *V.aspis*, les mâles mélaniques de *V.berus* sont quant à eux significativement plus longs et plus lourds que les normaux (pour LC: t=-2.185, d.f.=62, p=0.0327; pour LT, t=-2.216, d.f.=62, p=0.0304; pour PDS: t=-2.159, d.f.=61, p=0.0348). Les droites de régression entre les phénotypes (logarithme du poids par logarithme de la longueur du corps) ne sont par contre pas significativement différentes, que ce soit leurs pentes (p=0.608) ou la distance entre les droites (p=0.593).

Comme pour *V.aspis*, le taux de mélanisme des mâles (N=27) et des femelles (n=47), respectivement 44 et 51%, n'est pas sigificativement différent (X^2=0.301, d.f.=1, p=0.5834).



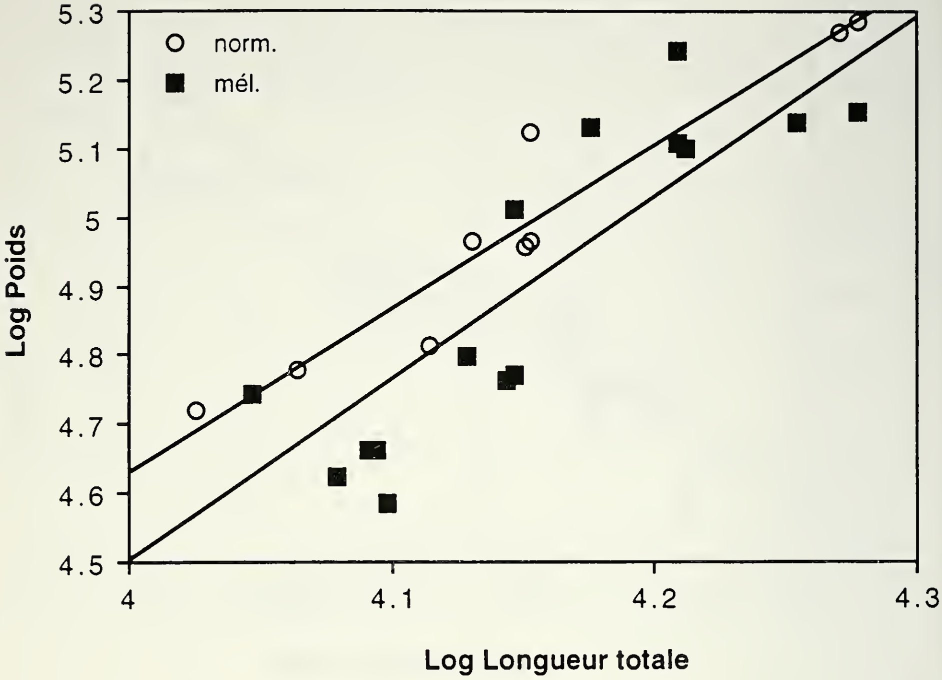
Log Poids = -3.208 + 1.897 * Log Longueur totale; R^2 = .87 (mél.)
Log Poids = -5.286 + 2.432 * Log Longueur totale; R^2 = .841 (norm.)

FIG. 5

Droites de régression du logarithme de la longueur en fonction du logarithme du poids des mâles mélaniques (mél.) et des mâles normaux (norm.) chez *Vipera aspis* des Abruzzes (Italie centrale). La distance entre les deux droites est significativement différente de 0 (p=0.025).

3. LE MÉLANISME CHEZ LES JEUNES VIPÈRES ET CHEZ LES ADULTES

A la naissance et dans toutes les stations étudiées, les vipéreaux des deux espèces sont tous normalement colorés, ce qui confirme les observations d'autres auteurs (NAULLEAU 1972, 1973, 1979; MONNEY 1990). Chez *V.berus*, il est souvent possible de différencier les nouveau-nés qui deviendront noirs à leur couleur de fond légèrement plus foncée que celle des autres, ce qui n'est pas le cas chez *V.aspis*. Chez les deux espèces, le mélanisme apparaît progressivement au cours de la croissance, par assombrissement de la couleur de fond des téguments. Durant leur première année, nous avons observé, dans l'Oberland bernois, 8 jeunes vipères aspics mélaniques qui mesuraient entre 23 et 29 cm (moyenne=25.9 cm). Toutes étaient très foncées. Le dessin dorsal était encore visible et les yeux ainsi que les écailles labiales



Log Poids = -4.818 + 2.363 * Log Longueur totale; R^2 = .942 (norm.)
Log Poids = -6.008 + 2.628 * Log Longueur totale; R^2 = .798 (mél.)

FIG. 6

Droites de régression du logarithme de la longueur en fonction du logarithme du poids des femelles mélaniques (mél.) et des femelles normales (norm.) chez *Vipera aspis* des Abruzzes (Italie centrale). La distance entre les deux droites est significativement différente de 0 (p=0.023).

étaient clairs. S'il est progressif, on peut relever cependant que l'assombrissement est très marqué immédiatement après la mue. Une femelle de 29 cm par exemple paraissait encore relativement claire le 19 juillet 1991. Suite à sa mue le 4 septembre de la même année, elle devint presque entièrement noire mis à part ses yeux et ses écailles labiales. Au cours de leur deuxième année, les vipères aspics deviennent totalement noires, y compris les écailles labiales et l'iris de l'oeil. Certains individus, essentiellement des femelles, demeurent rougeâtres, coloration pouvant persister jusqu'à l'âge adulte. Ce type de mélanisme est fréquent dans les Préalpes fribourgeoises. Six jeunes vipères aspics de l'Oberland bernois, complètement noires, dans leur deuxième année, mesuraient entre 29.5 et 35.5 cm (moyenne= 32.3 cm).

Si le mélanisme semble légèrement plus accentué et se manifeste un peu plus rapidement chez les mâles que chez les femelles de vipères aspics, la différence est encore plus nette chez la vipère péliade. Nous avons observé un mâle d'une année exactement, complètement noir à l'exception de l'iris brun de ses yeux, mesurant 21 cm. Trois jeunes femelles mélaniques dans leur deuxième année, mesurant respectivement 22, 23 et 27 cm, ainsi que deux autres dans leur troisième année, mesurant 30 et 33.5 cm, présentaient toutes une robe encore brun-foncée. Certaines femelles mélaniques passent par un stade concolor brun-rouge cuivré lorsqu'elles mesurent entre 40 et 45 cm. Cette coloration particulière a déjà été décrite par PIELOWSKI (1962) et SCHIEMENZ (1987) et correspond probablement, dans certaine région, au terme populaire de "vipère cuivrée", "Kupferotter" en allemand.

Chez les vipères adultes, les différences interspécifiques liées au mélanisme sont évidentes dans les stations suisses étudiées. La plus remarquable est la couleur de l'iris qui est, à de rares exceptions près, complètement noire chez *V.aspis*. Dans l'Oberland bernois, moins d'un pourcent des vipères aspics noires avait l'iris rougeâtre ou blanchâtre. Au contraire, l'iris de l'oeil de *V.berus* est toujours bien orangé chez les femelles et brun-foncé rougeâtre chez les mâles. Chez la plupart des femelles de cette espèce, les écailles labiales sont blanches ou jaunâtres, et le corps est parsemé de minuscules taches claires, souvent jaunâtres. Ces deux dernières caractéristiques sont tout à fait exceptionnelles chez les mâles de *V.berus* et nous ne les avons observées qu'à une seule reprise chez une femelle de *V.aspis*.

Dans les Abruzzes, les vipères aspics mélaniques, mâles et femelles, ont l'iris bien rougeâtre et souvent les écailles labiales claires, comme les femelles de *V.berus* dans l'Oberland.

DISCUSSION

La comparaison de la taille des vipères adultes entre notre station de l'Oberland bernois et une autre zone de contact, mais de plaine celle-là, en Loire-Atlantique (SAINT GIRONS & NAULLEAU 1981), est intéressante. En effet, s'il n'y a pas de différence significative de longueur et de poids pour *V.aspis*, *V.berus* est significativement plus petite dans notre station. Les dimensions que nous observons chez cette espèce correspondent à celles mentionnées par NEUMEYER (1984) dans les Grisons. Il semble s'agir d'une forme naine de montagne (MONNEY *et al.* 1995), beaucoup plus petite que les formes nordiques. Il est curieux de constater que dans les Alpes orientales italiennes, à une altitude de 1100 mètres, les vipères péliades sont également beaucoup plus grandes, les mâles excédant très rarement 63 cm et les femelles 72 cm (CAPULA *et al.* 1992; MONNEY *et al.* 1995). Il s'agit là de tailles plutôt exceptionelles, les péliades mâles des Alpes carniques mesurant pour la plupart entre 50 et 55 cm, les femelles entre 55 et 62 cm. Dans l'Oberland, les longueurs maximales que nous avons enregistrées sont respectivement 55 et 58 cm pour les mâles et les femelles. La plus petite taille des vipères aspics de l'Oberland bernois, comparée à celle de l'Italie centrale et des Préalpes fribourgeoises, est peut-être due aux conditions climatiques moins favorables de cette région, et notamment à l'enneigement qui est beaucoup plus important. La durée de la période active s'en trouve raccourcie, et par là même la croissance des vipères est ralentie. Le type de végétation reflète parfaitement les différences de climat, les forêts de hêtres de nos stations des Abruzzes et des Préalpes fribourgoises contrastant avec les forêts d'épicéas de l'Oberland bernois. Il se pourrait également que des facteurs alimentaires jouent un rôle. Dans notre station des Préalpes fribourgeoises par exemple, le lézard vivipare est absent et le lézard agile plutôt rare. Dans ces conditions, les vipères adultes n'en consomment pas ou exceptionnellement (MONNEY 1990). Ce n'est pas le cas dans l'Oberland bernois où CAVIN (1993) a dénombré localement plus de 400 lézards vivipares à l'hectare, ce qui contribue à en faire une proie habituelle des vipères aspics, jeunes et adultes (MONNEY 1993). Cette abondance de petites proies pourrait favoriser les vipères de petite taille. Il est également à relever qu'une taille réduite peut être avantageuse pour la thermorégulation en zone de montagne.

Plusieurs auteurs ont tenté d'expliquer le taux de mélanisme élevé, souvent voisin de 50%, au sein de populations de *V.berus* aussi bien alpines que de plaine. En effet, si comme cela a été démontré par BLANCHARD & BLANCHARD (1940) chez *Thamnophis s.sirtalis* le mélanisme chez les vipères est un caractère récessif ne s'exprimant que chez les homozygotes, une forte proportion d'individus noirs dans une population indique que cette coloration présente des avantages adaptatifs importants qui permettent son maintien. Le principal avantage sélectif pour une vipère d'être noire est lié à une thermorégulation plus efficace, avec toutes les conséquences métaboliques que cela peut entraîner: croissance plus rapide, prolongation de la période active, meilleure activité trophique (GIBSON & FALLS 1979; FORSMAN & ÅS 1987). Cela pourrait donc également permettre aux serpents d'exploiter des milieux plus frais et plus humides. Si Forsman et Ås ne trouvent pas de différence significative entre les deux phénotypes, plusieurs auteurs ont pu montrer que les péliades mélaniques sont plus grandes ou plus lourdes que les normales (ANDRÉN & NILSON 1981, 1983; MADSEN & STILLE 1988; LUISELLI 1992, 1993; CAPULA & LUISELLI 1994; MONNEY *et al.* 1995). Andrén et Nilson pensent que le taux de mélanisme élevé au sein d'une population résulte d'un équilibre entre les avantages que procure une grande taille dans la reproduction (femelles plus fécondes et mâles plus puissants lors des combats prénuptiaux) et la plus grande vulnérabilité des vipères mélaniques vis-à-vis des prédateurs. Luiselli et ses collègues obtiennent des résultats similaires mais pensent que le mélanisme présente des avantages sélectifs essentiellement chez les femelles. En effet, la mortalité suite à la parturition semble inférieure chez les femelles mélaniques (LUISELLI 1992) et ces femelles peuvent d'autre part se reproduire plus régulièrement que les normales (CAPULA & LUISELLI, 1994). De plus, ces auteurs constatent que le taux de mélanisme est significativement plus bas chez les mâles que chez les femelles, respectivement 13% (n=46) et 35% n=37).

Nos résultats dans l'Oberland bernois vont dans le même sens que ceux d'Andrén & Nilson et de Luiselli et collaborateurs, les péliades mélaniques étant plus lourdes et (ou) plus longues que les normales. Nous avons également mis en évidence une fécondité supérieure chez les femelles mélaniques (MONNEY *et al.* 1995), mais nous ne pouvons par contre pas évaluer de manière précise l'importance de la mortalité des femelles postparturientes. Quant au taux de mélanisme, il n'est pas significativement différent entre mâles et femelles, mais la tendance semble être la même, respectivement 44 et 51%. Nous retrouvons cette même tendance dans les trois populations de vipères aspics étudiées, ce qui semble démontrer que cette coloration est particulièrement avantageuse pour les femelles des deux espèces.

La niche écologique de *V.aspis* et *V.berus* dans les Alpes italiennes présente d'importantes différences. Les types d'habitats utilisés ne sont pas les mêmes et le régime alimentaire des jeunes est différent (LUISELLI *et al.* 1995). Cela n'est pas le cas dans la zone de contact de l'Oberland bernois où les deux espèces semblent occuper une niche écologique similaire, comme c'est également le cas en Loire-Atlantique (SAINT GIRONS 1975). Malgré cette similitude, *V.aspis* semble subir des pressions de sélection très différentes de celles de *V.berus*. En effet, non seulement le taux de mélanisme chez cette espèce est plus faible que chez *V.berus*, mais ce sont les individus normalement colorés qui présentent un avantage pondéral. Le nombre d'embryons et le poids des femelles étant positivement corrélés (NAULLEAU & SAINT GIRONS 1981; MONNEY 1994), les femelles normales contribuent à contre-sélectionner le mélanisme. On peut également soupçonner un taux de survie supérieur chez les femelles normales postparturientes, comme cela a été démontré par Luiselli pour les femelles mélaniques de *V.berus*. Si le maintien d'un taux de mélanisme élevé chez *V.berus* dans notre station peut s'expliquer par un plus grand succès dans la reproduction, il est plus difficile d'expliquer le maintien du mélanisme chez *V.aspis*. Dans l'Oberland, *V.aspis* est à la limite de ses possibilités de survie et au delà de la ligne de démarcation entre les deux espèces, elle ne pourrait vraisemblablement plus se reproduire sans entrer en hivernage avec ses embryons dans les utérus (MONNEY 1995). Pourquoi donc le pourcentage de mélanisme, caractère qui semble pouvoir augmenter les performances thermorégulatrices, est-il inférieur chez l'espèce la plus sensible aux conditions thermiques ? MADSEN & STILLE (1988) suggèrent que la disponibilité en proie du milieu peut avoir une influence sur le taux de mélanisme au sein d'une population de vipères, une pénurie en proie ayant selon eux un impact négatif plus important sur les grands individus. Cette hypothèse, qui contredit les résultats d'ANDRÉN (1982), ne nous paraît guère plausible pour notre station. Nous pensons que la pression des prédateurs, et donc indirectement les types d'habitats occupés par les vipères, et dans une moindre mesure leurs conditions d'humidité, sont des facteurs essentiels déterminant le taux de mélanisme au sein d'une population porteuse de ce gène. Dans notre station de l'Oberland bernois, la ligne de démarcation relativement étroite entre les deux espèces correspond au passage progressif d'un milieu plutôt buissonnant et ouvert, vers un milieu plus fermé, constitué d'une forêt fraîche, humide et clairièrée. La pression des prédateurs potentiels sur les vipères, essentiellement les rapaces diurnes et les corvidés, bien représentés sur notre terrain, est de toute évidence plus forte en milieu ouvert et non forestier, ce qui pourrait contre-sélectionner le mélanisme. L'avantage pondéral des femelles aspics normales ne serait pas dû à une croissance accélérée, plus rapide que chez les mélaniques, mais bien au contraire à un taux de survie et à une moyenne d'âge plus élevée. Si l'on compare la taille moyenne des plus petites femelles aspics reproductrices, soit la taille des femelles lors de leur première reproduction, on constate que les normales sont significativement plus petites que les mélaniques, leur longueur totale étant respectivement 49.37+2.66 cm (n=8) et 51.50+0.80 cm (n=8) (t=2.157, d.f.=14, p=0.049). Cette même tendance est encore plus marquée chez *V.berus*, les plus petites femelles mesurant respectivement 46.81+1.53 cm (N=8) et 49.02+1.03 cm (n=8) (t=3.379, d.f.=14, p=0.004). Si l'on admet que, pour une même espèce, l'âge de ces femelles est identique, le taux de croissance semble plus rapide chez les individus noirs des deux espèces. Si les mâles normaux de l'Oberland ne sont pas plus lourds en moyenne que les mélaniques, ils sont significativement plus trapus. Cela pourrait également refléter un âge plus avancé pour une longueur donnée, et donc un taux de croissance inférieur à celui des mâles mélaniques, ou tout simplement une meilleure condition physique que ces derniers. Il est intéressant de constater qu'en Italie centrale, dans des conditions très différentes, la tendance semble être identique, mâles et femelles de vipères aspics normalement colorés étant également plus trapus, ce qui suggère un âge moyen plus avancé chez ces individus. Une croissance plus rapide des vipères noires a déjà été décrite chez les mâles de *V.berus* (MADSEN & STILLE (1988) et chez les femelles de cette espèce (LUISELLI *et al.* in prép.), alors que les résultats de FORSMAN (1993) sembleraient contredire ces observations.

Si l'on compare les taux de mélanisme dans les trois stations étudiées avec ceux observés dans d'autres populations, il en ressort clairement que le type d'habitat, essentiellement la couverture forestière, joue un rôle primordial. En Italie centrale et dans les Préalpes fribourgeoises, les vipères aspics sont primairement liées à des hêtraies et les taux de mélanisme dépassent 50%. Il en est de même pour la station préalpine étudiée par Naulleau, à l'étage subalpin dominé par l'épicéa. Au contraire, plusieurs stations colonisées par la péliade dans les Préalpes fribourgeoises sont complètement nues, dépourvues d'arbres voire de buissons, et le taux de mélanisme est de l'ordre de 10% (9.5%, n=21 pour l'une d'entre elles, température moyenne et hauteur des précipitations moyennes annuelles resp. 0-5°C et 2000-2400 mm). A l'opposé, dans une vaste tourbière du Jura suisse (Température et hauteur des précipitations moyennes annuelles resp. 0-5°C et 1600-2000 mm), milieu essentiellement forestier, le taux de mélanisme chez la péliade est de 66% (n=18).

Dans la vallée de l'Oberland bernois que nous avons étudiée, nous connaissons deux stations extrêmes situées au-dessus de la limite supérieure de la forêt, à plus de 1900 m d'altitude. Dans la première station, qui n'est colonisée que par *V.aspis*, 15% des vipères sont mélaniques (n=13), et dans la seconde, qui n'abrite que *V.berus*, le taux de mélanisme est de 17% (n=6). Bien que notre échantillon soit petit, il semble indiquer une même tendance pour les deux espèces vivant dans un milieu ouvert.

A notre avis, et comme l'avait déjà relevé KJAERGAARD (1981) pour *V.berus*, les populations de vipères aspics et péliades à forts pourcentages d'individus noirs semblent être des populations primairement forestières qui sont liées à des forêts plutôt fraîches et humides. L'étude très détaillée de Reinert (1984) sur l'occupation spatiale de *Crotalus horridus* en Pennsylvanie semblerait à priori renforcer cette hypothèse. L'auteur démontre une utilisation de l'habitat significativement différente entre les deux phénotypes. Les crotales mélaniques "préfèrent " la forêt claire de grands arbres, avec du bois mort, les normalement colorés "préférant" la jeune forêt, avec une importante couche de feuilles mortes. Nous ne pensons pas cependant qu'au sein d'une même population de vipères, les individus noirs occupent préférentiellement les habitats les plus fermés, les individus normaux les habitats les plus ouverts (LUISELLI *et al.* 1994). La pression de sélection ne se manifeste pas sur le comportement individuel des vipères, mais sur la population entière.

S'il est indéniable que les vipères mélaniques sont avantagées pour leur thermorégulation, nous n'avons cependant pas relevé, chez les femelles reproductrices, de différences notables quant aux dates des parturitions entre les deux phénotypes. Cela est très curieux, car la durée de la gestation est probablement le critère le plus sensible d'une meilleure thermorégulation. Il est cependant possible que les différences liées à l'emplacement (donc la durée de l'insolation), ou au comportement, soient suffisamment grandes pour masquer l'influence de la coloration (SAINT GIRONS comm. pers.). En ce qui concerne la durée de la période active, les rythmes journaliers d'activité ou les cas d'exposition à l'extérieur dans des conditions climatiques extrêmes, l'influence de la coloration nous paraît négligeable. Ainsi, le mélanisme ne semble pas avantager les femelles gravides en accélérant l'embryogénèse, alors qu'il semble favoriser un taux de croissance accru avec tous les avantages qui y sont liés.

RÉSUMÉ ET CONCLUSION

La comparaison de la taille et du mélanisme chez *V.aspis* et *V.berus* provenant de différentes régions nous amène aux conclusions suivantes:

Dans une zone de contact entre *V.aspis* et *V.berus* dans l'Oberland bernois, *V.berus* est plus petite que *V.aspis*. Cela n'est pas le cas en Loire-Atlantique, à la limite nord de l'aire de répartition de *V.aspis*.

V.berus de l'Oberland bernois semble être une forme naine de montagne. Sa taille moyenne et sa taille maximale sont nettement inférieures à celles de *V.berus* vivant dans les Alpes italiennes et les pays nordiques. Au contraire, la taille moyenne relativement faible de *V.aspis* dans l'Oberland semble être uniquement due à des facteurs climatiques et alimentaires, comme en témoignent ses tailles maximales comparables à celles des autres populations étudiées.

La différence entre les taux de mélanisme chez *V.aspis* et chez *V.berus* dans l'Oberland semble être en relation avec les types d'habitats fréquentés par ces deux espèces, soit un milieu essentiellement forestier pour *V.berus*, et un milieu plus ouvert et buissonnant pour *V.aspis*. Les conditions microclimatiques et la pression des prédateurs ne sont pas les mêmes dans ces deux milieux.

Comme en témoigne la comparaison des taux de mélanisme au sein de différentes populations de vipères, un milieu forestier à caractère humide semble favoriser le mélanisme chez les deux espèces, à l'inverse d'un milieu ouvert.

Un taux de mélanisme plus élevé chez les femelles que chez les mâles est observé dans toutes les stations étudiées; cela semble indiquer que le mélanisme est particulièrement avantageux pour les femelles des deux espèces et (ou) que ces dernières sont moins vulnérables à la prédation que les mâles mélaniques.

Chez les deux espèces, le mélanisme semble accélérer le taux de croissance des vipères, mais ne semble pas avoir une influence notable sur la vitesse de l'embryogénèse.

La tendance des vipères péliades mélaniques à être plus lourdes que les normales, et celle des vipères aspics normales à être plus lourdes que les mélaniques ne semblent pas être un cas particulier et se retrouvent dans des régions très différentes.

L'avantage pondéral des vipères aspics normales pourrait être dû à leur âge moyen supérieur, conséquence d'une croissance plus lente et d'un taux de prédation inférieur, alors que l'avantage pondéral des vipères péliades mélaniques serait dû à un taux de croissance plus rapide, mais à une moyenne d'âge identique à celle des vipères normales.

Le mélanisme est un phénomène encore mal connu et ce caractère ne concerne probablement pas que la seule coloration (DUGUY & SAINT GIRONS 1988), ce caractère ne concerne probablement pas que la seule coloration, le génotype des individus semble modifié de façon notable, comme en témoigne une variation accrue de l'écaillure chez les couleuvres mélaniques.

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Diploures Campodéidés de la Pestera de la Movile (Movile Cave), Dobroudja méridionale (Roumanie).

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Diplura Campodeidae from the Pestera de la Movile (Movile Cave), Southern Dobrogea (Rumania). – The Pestera de la Movile is caracterized by its thermomineral waters containing H_2S. Most of the terrestrial species discovered are troglobitic and new for science, a probable consequence of a long isolation.Three species of Campodeidae are recorded from this cave. While *Plusiocampa isterina* Condé ressembles endogean species, two new species (*Plusiocampa euxina* n. sp. and *Campodea neuherzi* n. sp.) present clearly troglomorphic adaptations. They are related respectively to *Plusiocampa evallonychia* Silvestri and *Campodea taurica* Silvestri known from a cave in the vicinity of Mount Taurus, Peninsula of Crimea, just facing the southern Dobrogea across the Black Sea (Euxinus-Pontus).

Key-words: Campodeidae – Taxonomy – Movile Cave – Rumania.

INTRODUCTION

Movile Cave est le nom anglo-saxon de la Pestera de la Movile, grotte de Roumanie découverte en 1986, à 3 km à l'Ouest de la ville de Mangalia, sur la Mer Noire, au Sud de la Dobroudja et à proximité de la frontière bulgare. Cette cavité qui n'avait pas d'entrée naturelle s'ouvre maintenant par un puits creusé dans l'"Obanul de la Movile" (un "oban" étant une vaste dépression à fond plat) qui a coupé par hasard une galerie d'accès au niveau supérieur sec, long de 200 m; un niveau inférieur, long de 40 m, est submergé par une eau thermo-minérale, sauf au niveau d'un lac dont la surface s'ouvre sur l'étage supérieur et de cloches d'air creusées dans le plafond; la température de l'eau, variant de 20,2° à 20,8°C assure à l'air une température de 20-21°C. Il s'agit donc d'une grotte chaude comparée aux autres cavités de la même région dont la température est de 10-12°C.

A l'exception de rares épigés venus de l'extérieur par l'entrée artificielle, la faune terrestre est représentée par des espèces troglobies, nouvelles pour la plupart, ce

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qui peut s'expliquer par un isolement de la surface se situant entre la fin du Miocène et le début du Quaternaire, soit 5,5 à 3 MA (SARBU 1990).

Les Diploures figurent sans commentaire dans le tableau général de la faune (Sarbu 1990: 194) et j'ai décrit les deux premiers spécimens, récoltés en septembre 1990, sous le nom de *Plusiocampa isterina*, en soulignant la ressemblance de cette nouvelle espèce avec *Plusiocampa dobati* Condé qui peuple des grottes du Jura souabe, situées sur le cours supérieur du Danube (CONDÉ 1993a).

Depuis, trois autres spécimens m'ont été soumis, deux appartenant à *P. isterina* et le troisième représentant une espèce inédite qui, à l'inverse de la précédente, présente un allongement considérable des appendices, caractère commun aux Campodéidés dits troglomorphes. Les Campodéidés ont été récoltés à vue sur les parois des cloches d'air ou sur la plage argileuse dans la salle du lac (Sarbu, in litt. 14.11.91).

Plus récemment, Sarbu (in litt. 01.08.92) a récolté sept nouveaux Campodéidés, mais cette fois à la base du puits artificiel d'accès, au voisinage d'appâts (viande, fromage). Il s'agit d'une espèce de *Campodea* (*Dicampa*), appartenant à un complexe déjà connu d'une grotte de Bulgarie (*C. frenata* Silvestri) et d'une grotte de Crimée (*C. taurica* Silvestri), et présentant des indices d'une évolution cavernicole (antennes, cerques). En avril et août 1993, Sarbu (in litt. 07.04.93 et 09.08.93) a retrouvé deux représentants de cette dernière espèce, l'un à la base, l'autre à la partie supérieure du puits artificiel.

Les holotypes de *Plusiocampa euxina* et de *Campodea* (*D.*) *neuherzi*, montés dans le médium II de Marc André, ainsi que 2 paratypes (♂ et ♀) en alcool de *C.* (*D.*) *neuherzi* sont déposés au Muséum d'Histoire naturelle de Genève.

DESCRIPTIONS

Plusiocampa isterina Condé, 1993

Station. – Movile Cave, 28.XII.90, S. Sarbu leg.: 1 ♀ juvénile de 3,50 mm, sans cerques. – 10.I.91, S. Sarbu leg.: 1 ♀ de 3,94 mm; cerques 2,01 mm; corps/cerques : 1,96.

Tête. – Toutes les antennes ont chacune 23 articles, comme chez les types.

Thorax. – Métanotum du plus grand spécimen avec un macrochète (la_1) asymétrique, faible, sur la moitié droite (1+2), comme sur la moitié gauche de l'holotype.

Abdomen. – La papille génitale de la femelle juvénile est très peu pileuse (2+2 phanères sur le volets et 3 sur le tubercule); celle du plus grand individu, au contraire, possède le même nombre de phanères que le paratype (7+7 sur les volets et 21 sur le tubercule). Cerques formés d'une base et de 6 articles (7 ou 6 chez les types).

Plusiocampa (s.str.) **euxina** n. sp.

Station. – Movile Cave, 28.XII.90, S. Sarbu leg.: holotype, ♂ adulte (avec 1 ♀ juvénile de *Plusiocampa isterina* Condé).

Longueurs. – Corps: 4,40 mm; cerque 10,57 mm; corps/cerque = 0,41; patte métathoracique: 3 mm; corps/p.III = 1,46.

Téguments. – Cuticule sans ornementation, soies de revêtement finement barbelées, certaines sur leurs 2/3 distaux au moins, très peu denses sur les tergites.

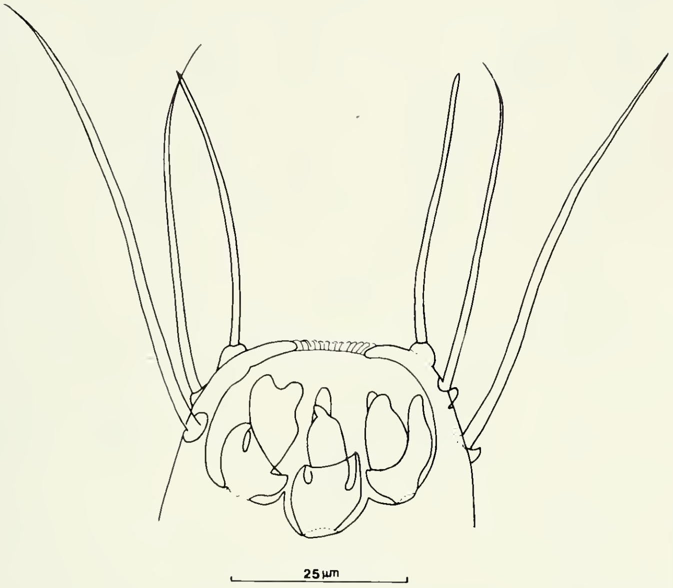

FIG. 1

Plusiocampa euxina n. sp., mâle holotype. Organe cupuliforme apical de l'antenne gauche en coupe optique.

Tête. – Antennes de 45 et 44 articles; le sensille du IIIe article subcylindrique, mince et court (19 µm), est postéro-sternal (entre *d* et *e*). Le rapport longueur/largeur de l'article apical, mesuré de l'apex à la limite proximale de la portion pileuse, est égal à 2,15 et le rapport longueur de l'article/profondeur de l'organe cupuliforme est égal à 3,43. Ce dernier renferme 8 et 10 sensilles de forme massive, à branches épaisses, de lecture difficile. Sensille du palpe maxillaire un peu plus épais et plus court que celui de l'antenne (14 µm). Sensille latéro-externe du palpe labial légèrement conique, de même longueur que le sensille antennaire, mais beaucoup plus épais; les deux poils de garde, distants l'un de l'autre, sont situés de part et d'autre du sensille, vers le plan sagittal; le palpe porte en outre une rangée antérieure de 9 phanères ordinaires et un champ de plus de 130 phanères gustatifs.

FIG. 2

Plusiocampa euxina n. sp., mâle holotype. Portion frontale de la capsule céphalique. *a, i, p* = macrochètes antérieur, intermédiaire et postérieur de la marge antennaire; *x* = macrochète de la suture en Y.

Processus frontal peu saillant, avec un long macrochète glabre antérieur, les 7 autres phanères ressemblant aux soies de revêtement. Phanères de la marge antennaire un peu barbelés sur leur région distale; longueurs relatives: *a* = 39,5, *i* = 60, *p* = 42. Phanères *x* semblables aux intermédiaires (62)

Thorax. – Répartition des macrochètes:

	ma	*la*	*lp*
Th. I	1+1	1+1	2+2
Th. II	1+1	2+2	2+2
Th. III	1+1	1+1	2+2

Tous sont très robustes et finement barbelés sur leur moitié ou leurs deux tiers distaux. En II, la_2 est beaucoup plus long et épais que la_3 et *ma* qui se ressemblent (moyennes des longueurs: *ma* = 80, la_2 = 110, la_3 = 77). Les *lp* sont les plus longs de tous les phanères, les lp_3 surpassant un peu les lp_2, sauf en III (152/117, 162/151, 143/148). Soies de revêtement clairsemées, surtout sur le tergite I (ca 6,15 et 15 par demi-tergite).

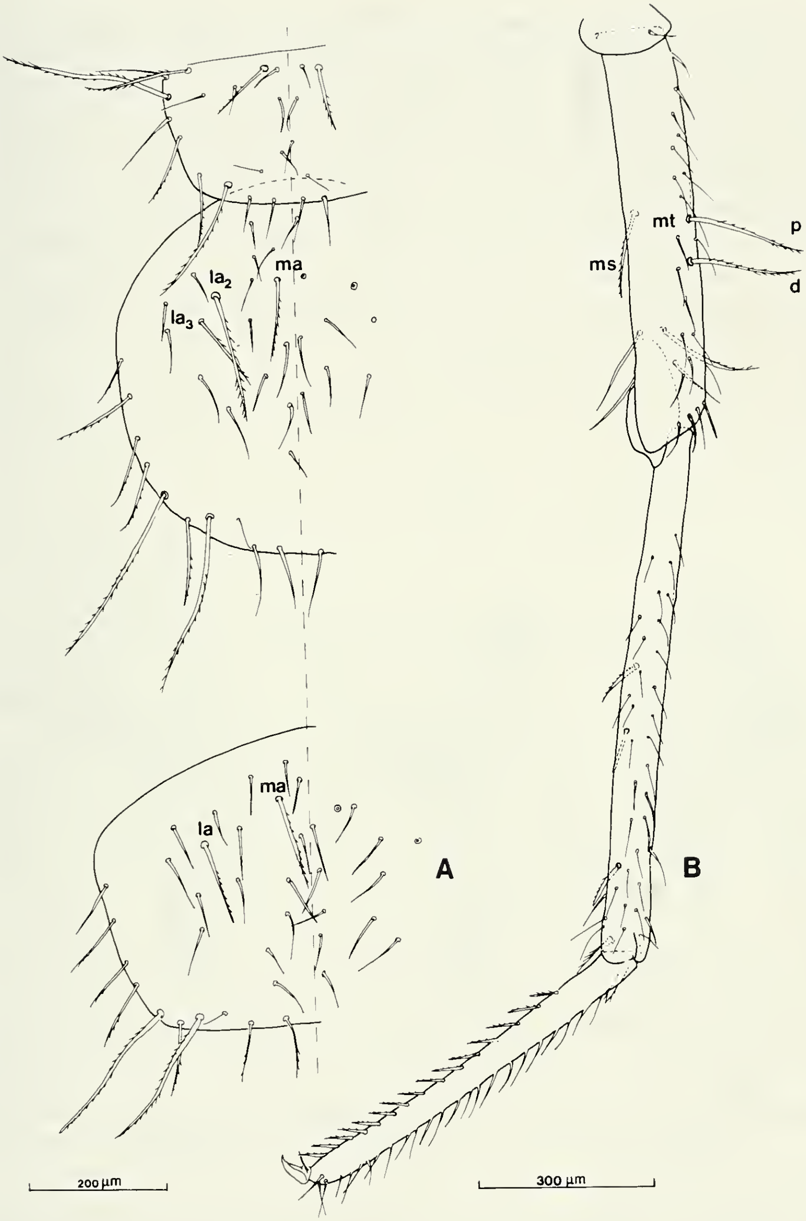

FIG. 3

Plusiocampa euxina n. sp., mâle holotype. – A. Pro-, méso- et métanotum. – B. Patte métathoracique droite à partir du trochanter, face postérieure. *la* = macrochète latéral antérieur; *ma* = macrochète médial antérieur; *ms* = macrochète sternal; *mt* = macrochètes tergaux: *p* = proximal, *d* = distal.

Les pattes métathoraciques dépassent l'extrémité de l'abdomen du tiers distal de leur tarse, les longueurs relatives des articles étant 16, 13, 54, 73, 53. On notera que le fémur est beaucoup plus court que le tibia (fe/ti = 0,74), ce dernier étant environ 12 fois plus long que large et le fémur 6 fois 3/4 seulement. Fémur avec 2 macrochètes tergaux très fortement différenciés, insérés de part et d'autre du milieu du bord de l'article, le proximal un peu plus long que le distal (61,5 et 56,5). Le macrochète sternal, beaucoup plus court (38,5), s'insère presque en face du tergal proximal. Le tibia porte 3 macrochètes sternaux, 2 insérés sur le tiers médian et un au milieu du tiers distal; ils sont équidistants à gauche, les proximaux étant au contraire plus proches l'un de l'autre à droite. Tous les phanères du tarse sont barbelés, ceux des deux rangées sternales beaucoup plus épais, avec une portion apicale glabre, de même que les 3 longues soies subapicales.

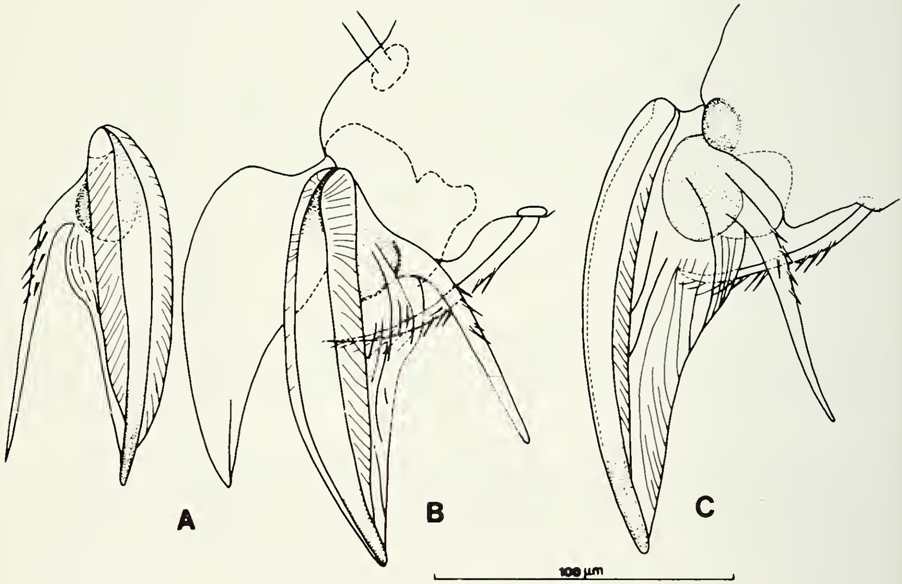

FIG. 4

Plusiocampa euxina n. sp., mâle holotype. – A. Griffe postérieure I droite. – B. Griffes II gauches, face postérieure. – C. Griffe postérieure III gauche.

Griffes peu inégales (1,2-1,3) dont la longueur augmente progressivement de I à III: antérieures = 56,5; 63,4; 68 µm; postérieures = 63,4; 71,6; 76,2 µm. Le corps et les crêtes latérales sont ornementés, mais ces dernières sont peu développées et ne forment pas de talon proéminent à la griffe postérieure. Processus télotarsaux plus courts que les griffes, rectilignes et peu atténués à l'apex; le bord sternal présente quelques barbules sur sa moitié proximale.

Abdomen. – Répartition des macrochètes tergaux:

	la	*post*
Ab. I-III	0	1+1 ($post_1$)
Ab. IV	1+1	4+4 ($post_{1,3\ à\ 5}$)
Ab. V	2+2	4+4 ($post_{1,3\ à\ 5}$)
Ab. VI-VII	2+2	4+5 ($post_2$, asymétrique)
Ab. VIII	0	6+6
Ab. IX	0	9+9 (total du segment)

A tous les tergites, 2 soies marginales postérieures seulement entre les $post_1$. Quand un $post_2$ est présent (asymétrique en VI et VII), il est plus grêle et plus court (45) que ses voisins (57, 68). Valvule supra-anale avec 2 soies sagittales subapicales.

Sternite I avec 8+7 macrochètes très barbelés. Appendices subcylindriques à large base, égale aux 2/5 environ de leur écartement, et régulièrement arrondis à l'apex qui porte un champ d'une soixantaine de phanères a_1. Pas de champ glandulaire au sternite.

Sternite II à VI avec 6+6 macrochètes très différenciés. Styles dont les 3 phanères principaux (apical, subapical, moyen sternal) sont volumineux et densément barbelés dès la base. Sternite VIII avec 2+2 macrochètes; 13 soies à la rosette du gonopore.

Le cerque droit est complet, formé d'une base et de 7 articles seulement, dont les longueurs relatives sont les suivantes: 114 (base), 53, 68, 76, 88, 97, 108, 115. Ces éléments sont extraordinairement longs: extrêmes 0,78 et 1,69 mm; X = 1,32 mm. Sauf les courtes soies du verticille apical de chaque article, tous les phanères sont semblables: longs (extrêmes 0,29 et 0,47 mm; X = 0,38 mm, n = 41), rectilignes et très finement pubescents sur la plus grande partie de leur longueur.

Affinités. – La présence de deux macrochètes tergaux au fémur, sur laquelle PACLT (1957: 46) a fondé son sous-genre *Didymocampa* (espèce type *Plusiocampa sinensis* Silvestri, endogé de Chine méridionale) ne semble pas suffisante pour justifier à elle seule le rapprochement des quatre espèces qui partagent maintenant ce caractère. CONDÉ & SENDRA (1989: 617) l'ont déjà souligné en décrivant *Plusiocampa alhamae*, du Sud de l'Espagne (Granada), qui s'apparente à des formes de la Méditerranée occidentale, tandis que *P. sinensis* est une espèce à part, méritant sans doute la coupure proposée[1].

La nouvelle espèce est la plus voisine de *Plusiocampa evallonychia* Silvestri, 1949, de la grotte I-El-Koba (U-el-Choba dans Silvestri) dans la région du Mont Taurus, en Crimée. L'une et l'autre présentent des caractères communs aux lignées troglobies, mais plus accentués chez la nouvelle espèce: antennes de 44 et 45 articles

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[1] Le premier *Didymocampa* troglobie, proche de *sinensis*, a été décrit de Chine méridionale (Hupei): *P.(D.) lipsae* Condé (CONDÉ 1993b).

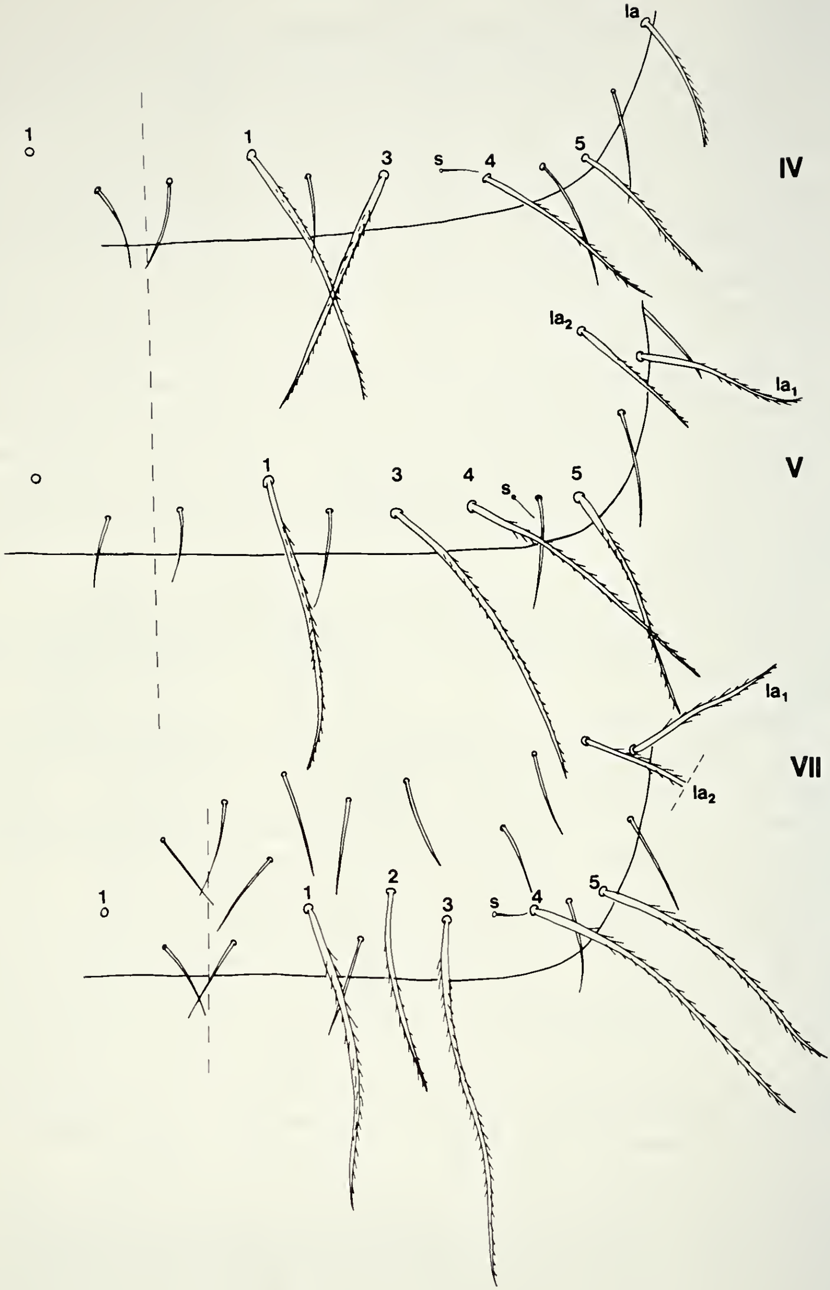

FIG. 5

Plusiocampa euxina n. sp., mâle holotype. Marge postérieure des urotergites IV, V et VII.

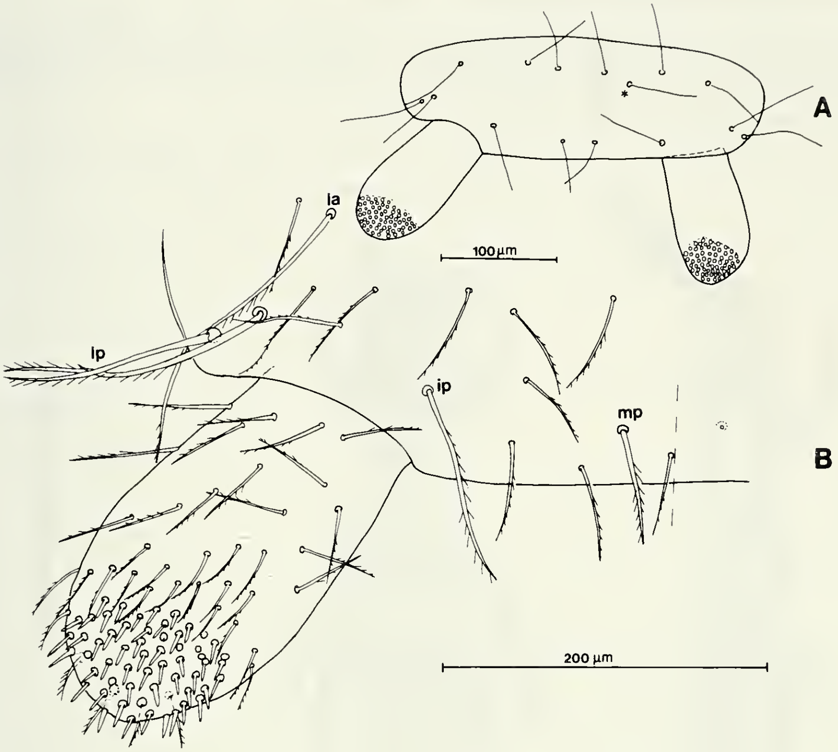

FIG. 6

Plusiocampa euxina n. sp., mâle holotype. – A. Urosternite I, diagramme, * = macrochète asymétrique. – B. Moitié postérieure droite de l'urosternite I.

(vs 33); longueur totale/longueur de la patte métathoracique: 1,46 (vs 2,33); tibia plus long que le fémur (ti/fe = 1,35 vs 1,33); tarse aussi long que le fémur (ta/fe = 1 vs 0,77). On ne peut pas comparer les caractères sexuels de l'urosternite I, ni ceux des cerques, ces derniers remarquables chez la nouvelle espèce, puisque le seul représentant de *P. evallonychia* est une femelle incomplète. Mis à part quelques détails de la chétotaxie, la forme des griffes et celle des processus télotarsaux écartent *euxina* de *evallonychia;* chez cette dernière espèce, la griffe postérieure possède de larges crêtes formant un talon qui recouvre l'extrémité du tarse, et les processus télotarsaux sont asymétriques, le postérieur dépassant l'apex de la griffe correspondante et l'antérieur étant un peu plus court que la moitié de la griffe.

Etymologie. – Du latin *euxinus*: du Pont-Euxin, ancien nom de la Mer Noire, pour rappeler la situation de la localité type de la nouvelle espèce et ses affinités étroites avec *P. evallonychia*, du Sud-Est de la presqu'île de Crimée, à quelque 400 km.

Campodea (Dicampa) neuherzi n. sp.

Station. – Movile Cave, à la base du puits artificiel d'accès, au voisinage d'appâts (viande, fromage), S. Sarbu leg.: VII.92: 2 ♂, 5 ♀; IV.93: 1 ♀. A la partie supérieure du puits artificiel, S. Sarbu leg.: VIII.93: 1 larve.

Holotype: ♀ de 6,65 mm. Paratypes: 2 ♂ et 5 ♀.

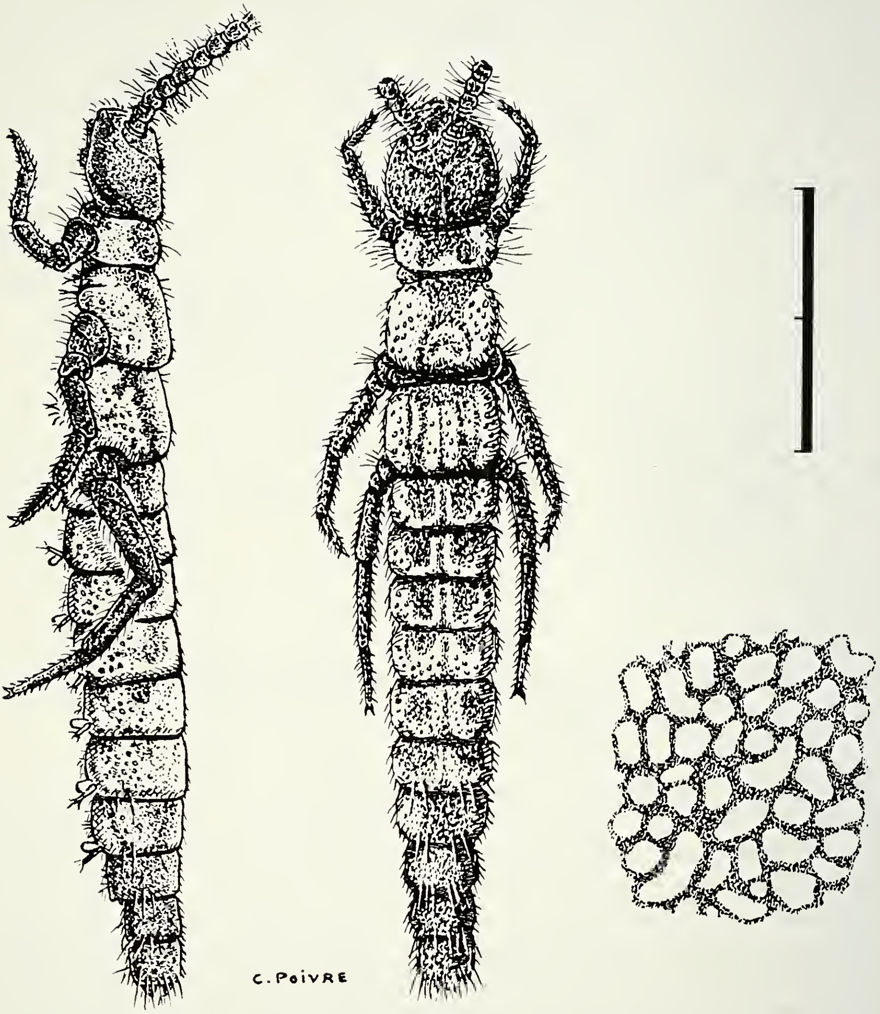

FIG. 7

Campodea (*Dicampa*) *neuherzi* n. sp., ♂ et ♀ paratypes. Habitus montrant les plages blanches, disposées symétriquement sur le corps, dues à la présence de cristaux d'urates qui réfléchissent la lumière. Echelle = 2 mm. Détail d'une plage en bas à droite.

Longueurs. – Corps. ♂: 4,78 mm; ♀: 6,55-7,60 mm (moyenne: 6,64 mm); cerques: 9,10 (holotype) et 9,60 mm (♀ n° 4); corps/cerques = 0,73 et 0,68; patte métathoracique, depuis le trochanter: 2, 2,42, 2,48 mm; corps/p.III = 2,35 (♂), 2,75-3,06 (♀).

Téguments. – Corps brun jaunâtre avec des plages blanches disposées symétriquement sur le corps, la tête, le dernier segment de l'abdomen et les appendices exceptés. Cette ornementation exceptionelle a pour origine la réflexion de la lumière, à travers la cuticule, sur des concentrations bien localisées de cristaux d'urates dont l'opacité rend, par ailleurs, l'observation par transparence difficile. Cuticule très finement granuleuse sur la face dorsale, cette structure particulièrement visible sur la capsule céphalique. Soies de revêtement courtes, simples, et sensilles sétiformes sensiblement de même longueur.

Tête. – Antennes des adultes de (34) 36-40 articles, sauf régénérats (r) souvent identifiables par les dimensions des articles distaux, l'apical en particulier (-/35r, 36/34, 36/37, 26r/38, 39/40). Antennes de la larve: 30/30.

Le sensille du IIIe article, subcylindrique, légèrement attenué aux deux extrémités, est postéro-tergal (entre *b* et *c*). Le rapport longueur sur largeur de l'article apical, mesuré de l'apex à la limite proximale de la portion pileuse, est égal à 1,86-2,23 ($\bar{X}$ = 2,03; n = 4). L'organe cupuliforme apical est très peu profond et le rapport longueur de l'article sur profondeur de l'organe cupuliforme varie de 7,68 à 12,5 ($\bar{X}$ = 9,73; n = 4), atteignant 18 à une antenne régénérée; il renferme 8 à 10 petits sensilles de forme simple. Le sensille du palpe maxillaire et celui du palpe labial sont plus courts et plus épais que celui de l'antenne; deux courts poils de garde sont insérés de part et d'autre du sensille labial, mais à quelque distance; le palpe porte en outre une rangée antérieure de 10 à 14 phanères ordinaires et de 149 (♂ de 4,78 mm) à 234 (♀ de 7,60 mm) phanères gustatifs.

Processus frontal peu saillant avec 3 macrochètes barbelés sur leur moitié ou leurs 2/3 distaux. Phanères de la marge antennaire presque glabres, sauf l'antérieur plus long et robuste que les autres (*a* = 69; *i* = 58,5; *p* = 54 chez l'holotype).

Thorax. – Formule typique du sous-genre *Dicampa* (3,2,1 par demi-tergite) dans les rapports suivants:

	ma/*la*	*lp*/*ma*	$\frac{lp}{\sum p/N}$	ε/*la*	*ma*II/*ma*III
Th. I	0,86-0,93	1,76-2	2,32-2,66		
Th. II	0,60-0,78	- -	- -	1,36-1,63	0,94-1

Les macrochètes, comme les soies marginales, sont robustes et barbelés presque dès la base. Au mésonotum, les *ma* sont environ les 2/3 des *la* et ces derniers sont égaux aux 3/4 environ de la distance entre les embases *ma-la*.

Les pattes métathoraciques atteignent le bord postérieur du VIIe urotergite, les longueurs relatives des articles étant 33,5; 15,5; 84; 102; 69. On notera que le fémur est beaucoup plus court que le tibia (fe/ti = 0,82), ce dernier étant 7,5 fois plus long que large et le fémur un peu moins de 4 fois (3,8).

Trochanters II et III (et parfois I) avec un très petit sensille grêle (13 µm), très faiblement claviforme. Tibia avec un macrochète sternal court et peu différencié, inséré vers la moitié de la longueur de l'article, les plus souvent en deçà du milieu. Tarse de longueur intermédiaire entre fémur et tibia (ta/fe = 0,82); soies de la double rangée sternale portant quelques barbules sur leur région moyenne, à l'exception de celles de la paire subapicale qui sont beaucoup plus grêles et glabres. Griffes simples, faiblement arquées et processus télotarsaux sétiformes atteignant l'extrémité des griffes.

Abdomen. – Répartition des macrochètes tergaux: une seule paire de latéraux postérieurs (*lp*) en VI et VII, 3 paires en VIII et 5+5 (total) en IX. Valvule supra-anale avec 2+1+2 (♂, ♀), 2+2+2 ou 2+3+2 (♀ dont l'holotype).

Sternite I avec 6+6 macrochètes. Chez la ♀, les appendices sont cylindriques, 3,5 fois à près de 4 fois plus longs que larges (3,50-3,85), un peu atténués à l'extrémité qui porte 26 phanères a_1 (♀ de 7,60 mm). Chez le ♂, les appendices sont subtriangulaires, l'angle le plus aigu vers le plan sagittal, et pourvus de 30-32 a_1 et de 46-52 a_2. Un champ glandulaire étroit comptant 84 phanères sur 2 à 3 rangs sur la marge postérieure.

Sternites II à VII avec 4+4 macrochètes et une paire de phanères, plus épais que les soies de revêtement voisines (submacrochètes), de part et d'autre des styles. Soie apicale des styles avec deux branches basilaires (la plus basale la plus courte) et 2-4 barbules sur la moitié distale; soie subapicale avec de faibles barbules sur la portion moyenne; soie moyenne sternale fourchue, l'une des branches formant deux fourches successives. Sternite VIII avec 1+1 macrochètes; papille génitale de la plus grande ♀ avec 14 et 13 soies aux volets et 15, dont une médiane, sur le tubercule médian (5+5, 2+2, 1); les 10 soies proximales sont beaucoup plus longues et épaisses que les autres.

Le cerque droit de l'holotype est complet, formé d'une base et de 10 articles de longueurs croissantes de la base à l'apex. Longueurs relatives: 173 (base), 70, 95, 106, 139, 152, 210, 220, 262, 271, 319 (extrêmes 0,31 et 1,43 mm). La base et les trois derniers articles sont subdivisés plus au moins nettement en 3, 3, 7 et 8 articles secondaires. Phanères de longueur modérée, les plus longs de la base atteignant 1,25 fois seulement la largeur de l'appendice; ils sont un peu barbelés sur leur portion apicale, le nombre et les dimensions des barbules régressant progressivement, et les phanères des articles terminaux sont tous glabres.

Affinités. – La nouvelle espèce est très voisine de *C.* (*D.*) *frenata* Silvestri, 1931 de la Javoreckata pestera (= caverna Jaworec de Silvestri), près de Lakatnik, dans la défilé de l'Iskâr (Bulgarie) et de *C.* (*D.*)*taurica* Silvestri, 1949[2], de la même grotte de la péninsule de Crimée que *Plusiocampa evallonychia* Silvestri, 1949.

Une comparaison des principaux caractères des trois espèces du sous-genre *Dicampa* montre bien leur haut degré de ressemblance, quoique certains éléments de

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[2] A la fin de la description originale (SILVESTRI 1949: 29), un lapsus a fait écrire "*C. bulgarica* Silv.", une espèce qui n'existe pas, pour *C. frenata*. D'autre part, le nom de *taurica* a été cité par PLIGINSKY (1927: 173), d'après une lettre de Silvestri de 1914, et la date de récolte (06.06. 1913) précisée.

comparaison fassent encore défaut. L'organe cupuliforme apical de l'antenne n'est décrit que chez *neuherzi* et atteste une évolution souterraine de cette espèce, confirmée par l'allongement des cerques, inconnus chez *taurica* , mais beaucoup plus courts chez *frenata* (0,72 et 1,25); les autres caractères n'ont pas de signification quant à l'évolution souterraine.

	C.(D.) frenata	*C.(D.) taurica*	*C.(D.) neuherzi*
Antennes	26-27	32-40	36-40
Organe cupuliforme	?	?	8-10
ma/la th.II	0,53[3]	1[3]	0,86-0,93
la VI-VII	1+1	0	0
lp VI	1+1	0	1+1
corps/cerques	1,25	?	0,68-0,73
Champ gld. st.I	3-4 rangs	4 rangs	2-3 rangs
Macro. ti. III	0	2	1

[3] Mensurations sur les figures originales agrandies.

BIOGÉOGRAPHIE

La présence de deux paires d'espèces très voisines *taurica-neuherzi* et *evallonychia-euxina* dans des grottes situées de part et d'autre de la Mer Noire est un bon exemple de vicariance et, en ce sens, la faune des Diploures de Movile Cave est exactement celle que l'on pouvait s'attendre à y rencontrer; le couple *dobati-isterina* est d'affinités danubiennes, ce qui n'est pas davantage surprenant. La densité des cristaux d'urates chez *neuherzi* est finalement la seule singularité rencontrée au cours de cette étude, mais nous ignorons si *frenata* et *taurica* présentent quelque chose d'analogue.

Etymologie. – Dédiée au Dr Heinz Neuherz, de Graz, qui a étudié les Diploures et les Palpigrades des grottes d'Autriche.

REMERCIEMENTS

Madame E. Seraoui a assuré la mise au propre de l'abondante illustration de l'une des nouvelles espèces et Monsieur Cl. Poivre a réalisé l'habitus de l'autre espèce. Nous leur exprimons notre vive gratitude pour leur aide.

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REVUE SUISSE DE ZOOLOGIE, 103 (1) : 115-118; mars 1996

A New Species and records of the genus *Pseudoagathidium* Angelini from Uganda(Coleoptera, Leiodidae, Agathidiini)

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New species and records of *Pseudoagathidium* Angelini from Uganda. - *Pseudoagathidium* ivani sp. n. is described and *P. muehlei* Angelini and *P. vignai* Angelini & DeMarzo are recorded from Uganda.

Key-words: Coleoptera - Leiodidae - *Pseudoagathidium* - taxonomy - Uganda.

INTRODUCTION

Afrotropical Agathidiini are under-represented in collections and appear rare compared to those from Holarctic and Oriental realms. Thanks to a grant of the "Académie suisse de sciences naturelles", G. Cuccodoro, accompanied by D. Erne, sampled humicolous arthropods in a number of forest remnants in Uganda. The study of the collected Agathidiini revealed the presence of three species of *Pseudoagathidium*, one of which is new and described below. The material is deposed in the Muséum d'histoire naturelle, Geneva (MHNG) and in the authors private collection (AC).

Pseudoagathidium muehlei (Angelini, 1988)

Agathidium (Neoceble) muehlei ANGELINI, 1988: 126.

Material: Uganda, Mt. Elgon, Sipi, 1750 m, 31.V.1993, leg. Cuccodoro & Erne, 2 ♂ and 1 ♀ in MHNG, 2 ♂ in AC; Mt. Elgon, Sipi, 1650 m, 29.V.1993, leg. Cuccodoro & Erne, 2 ♀ in MHNG; Kibale forest, 1250 m, 23.V.1993, leg. Cuccodoro & Erne, 1 ♂ in MHNG.

Distribution: Rwanda and new for Uganda.

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Pseudoagathidium vignai (Angelini & DeMarzo, 1984)

Agathidium (Neoceble) vignai ANGELINI & DE MARZO, 1984: 355; 1985: 76; ANGELINI & PECK, 1984: 420.

Material: Uganda, Mt.Elgon, Sipi, 1750 m, 1.VI.1993, leg. Cuccodoro & Erne, 1 ♀ in MHNG, 1 ♂ in AC; Ruwenzori, above Kilembe, 2000 m, 4.V.1993, leg. Cuccodoro & Erne, 1 ♀ in MHNG.

Distribution: Zaire and new for Uganda.

Pseudoagathidium ivani sp. n. (Figs 1-7)

Length 2.55-2.85 mm (holotype ♂ 2.6 mm). Dorsum of head and pronotum black, pronotum dark reddish-brown; venter reddish-brown, mesosternum testaceous; antennae testaceous with dark club; legs reddish-brown. Microreticulation absent, only vague traces on whole dorsum; punctures small and superficial on whole dorsum.

Head: Microreticulation absent, or only vague traces; punctures small, superficial, spaced from each other by 2-10 times their own diameter. Widest at eyes (fig. 2); eyes protuberant; clypeus sharply excavated; clypeal line absent. 3rd antennal segment 1.36 times as long as the 2nd and as long as than 4th + 5th together (fig. 1).

Pronotum: Microreticulation absent, only vague traces as on head; punctation as that of head, spaced from each other by 5-10 times their own diameter. 1.44 times as broad as head, moderately broader than long (W/L = 1.69) and moderately convex (W/H = 1.58). Anterior margin very bent (fig. 3), lateral outline strictly bent (fig. 4). Holotype: length 0.75 mm, width 1.27 mm, height 0.80 mm.

Elytra: Microreticulation absent, or only vague traces as on head; punctation as that of head, but punctures spaced from each other by 2-15 times their own diameter. Just a little broader than pronotum, moderately broader than long (W/L = 1.2) and very convex (W/H = 1.07); lateral outline with sharp humeral angle, at the middle; sutural striae weak and extending beyond the anterior 2/3 of elytra. Holotype: length 1.15 mm, width 1.38 mm, height 1.28 mm.

Metathoracic wings present. Meso- and metasternum: median carina weak anteriorly, more evident posteriorly, lateral lines absent, femoral lines short, with a tubercle between the metacoxae.

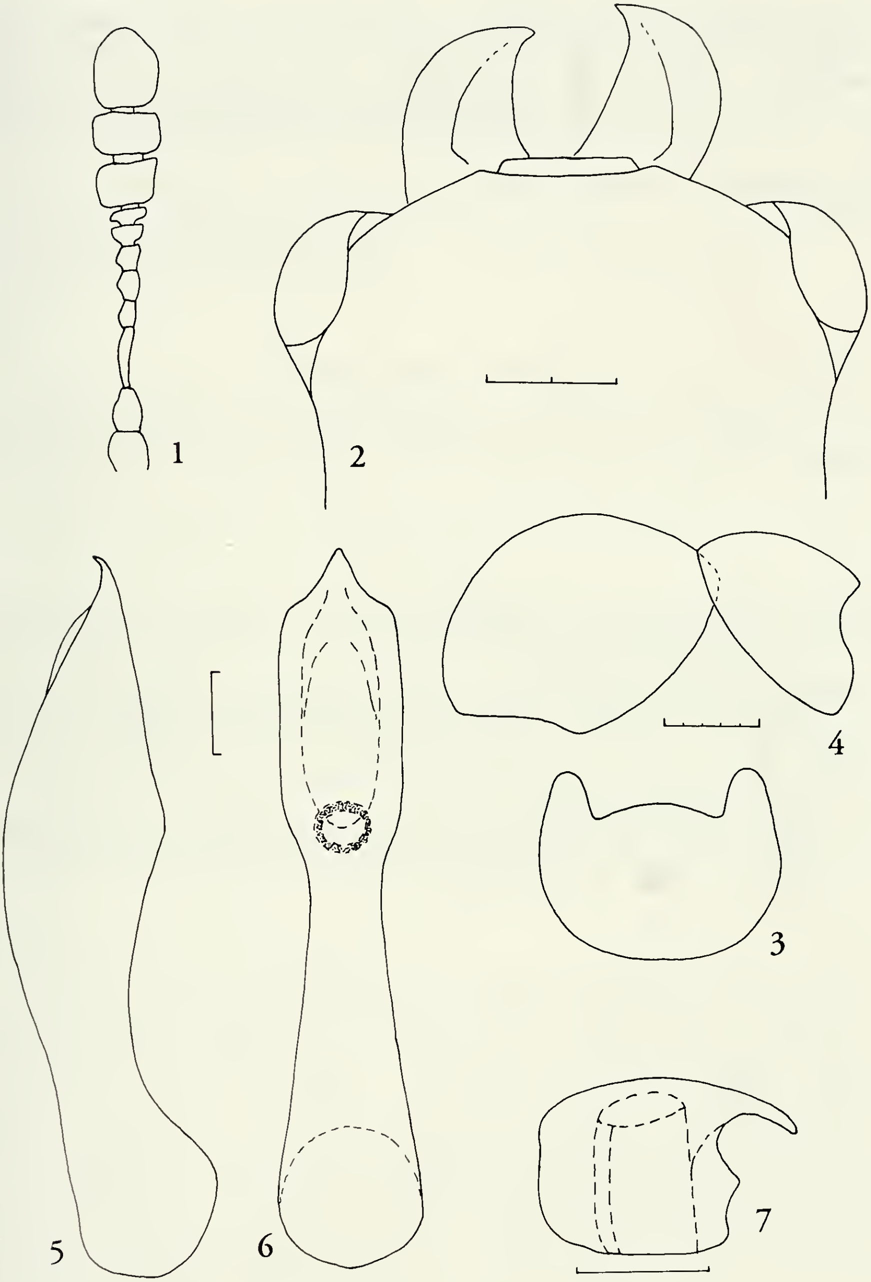
Legs: Tarsal formula ♂ and ♀ 4-4-4.

Male copulatory organ as in figs 5-6.

Spermatheca as in fig. 7.

DISCUSSION

Pseudoagathidium ivani sp. n. is similar to *P. vignai* (Angelini & De Marzo), (1984: 355, Zaire; 1985: 76) in absence of microreticulation on dorsum, punctation of dorsum, form of the posterior tibiae; it differs only by lower length ratio 3rd/2nd



FIGS 1-7
Pseudoagathidium ivani sp. n. : 1, antenna; 2, head; 3, pronotum in dorsal view; 4, pronotum and elytra in lateral view; 5-6, aedeagus in lateral and ventral view; 7, spermatheca. Scale in Fig. 1, 2= 0.2 mm, in 3, 4= 0.5 mm, in 5, 6, 7= 0.1 mm.

antennal segments and the presence of vague traces of microreticulation on dorsum; to distinguish the two species it is necessary to examine the aedeagi and spermathecae.

Derivatio nominis: Dedicated in homage to Dr Ivan Löbl, Geneva.

HOLOTYPE ♂: Uganda, Mt. Elgon, Sipi, 1750 m, 31.V.1993, leg. Cuccodoro & Erne, in MHNG.

PARATYPES: same data as holotype, 1 ♀ in MHNG, 1 ♂ and 1 ♀ in AC.

ACKNOWLEDGEMENTS

I thank Dr Ivan Löbl, Geneva, for the loan of the material and my friend Jonathan Cooter, Hereford, for help with the translation of the text into English.

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REVUE SUISSE DE ZOOLOGIE, 103 (1) : 119-150; mars 1996

A Revision of the Madeiran species of the genus *Geostiba* Thomson, 1858 (Coleoptera: Staphylinidae)

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A Revision of the Madeiran species of the genus *Geostiba* Thomson, 1858 (Coleoptera: Staphylinidae). - A revision of the types of all Madeiran taxa of *Geostiba* Thomson as well as of further material collected by the authors and from various collections yielded 15 species, all of them endemic to the Madeiran archipelago. 11 species are described for the first time: *G. arieiroensis* n. sp., *G. ruivomontis* n. sp., *G. bicacanaensis* n. sp., *G. brancomontis* n. sp., *G. graminicola* n. sp., *G. vaccinicola* n. sp., *G. lauricola* n. sp., *G. caligicola* n. sp., *G. occulta* n. sp., *G. endogea* n. sp. and *G. subterranea* n. sp. Both *G. israelsoni* (Palm) and *G. waldeni* (Palm) are considered junior synonyms of *G. filiformis* (Woll.), and *G. carli* Palm is recognized as a synonym of *G. lindrothi* Franz. *Sipalia leileri* Palm is transferred to *Atheta* Thoms. *Atheta juengeri* Benick is shown to be a junior synonym of *Sipalia leileri* Palm. The study includes detailed descriptions of each species, illustrations of diagnostic characters, faunistic and ecological data as well as a key allowing identification.

Key-words: Coleoptera - Staphylinidae - *Geostiba* - Madeira - Taxonomy.

INTRODUCTION

In his first account of Madeiran insects WOLLASTON (1854) described the genus *Xenomma* with three species. Only the first of these (*X. planifrons*) has remained in the genus, which today is placed in the Oxypodini. PALM (1981a) treated the other two species (*X. formicarum* and *X. filiformis*) as members of *Sipalia* Muls. & Rey – a name erroneously used and to be replaced with *Geostiba* Thomson (e.g. BLACKWELDER (1952)) – and described four further species from the Madeiran archipelago: *Sipalia leileri*, *S. lindrothi*, *S. israelsoni* and *S. waldeni*. In the same year FRANZ (1981) added *Geostiba lindrothi* and *G. portosantoi*, and *S. lindrothi* Palm was renamed *Geostiba carli* (PALM 1981b). Thus a total of 8 endemic species of *Geostiba* have so far been described from Madeira and Porto Santo.

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* Names in alphabetical order.

Manuscript accepted 31.03.1995.

During a joint excursion to Madeira proper and Porto Santo in spring 1993 we collected mostly large series of various species of *Geostiba*. Their identification, however, based on the original descriptions and the key in PALM (1981a) failed in most cases. A subsequent examination of all the types revealed that not only did our material contain a number of yet undescribed species, but some of the previously described taxa had also been misinterpreted.

Material from the following museum collections was studied: The Natural History Museum London (BMNH), the Muséum d'histoire naturelle, Genève (MHNG), the Museum of Zoology and Entomology Lund (MZEL) and the Swedish Museum of Natural History Stockholm (SMNH).

THE MADEIRAN SPECIES OF *GEOSTIBA* THOMSON

Our study of 812 specimens of Madeiran *Geostiba* both from our own and from loaned material yielded 15 species, 11 of them are described as new. Three names are placed in synonymy, and one species is excluded from the genus. Some characters such as colour, punctation, microsculpture, body size and even body proportions may be subject to considerable variability. The presence or absence of functioning eyes, the shape of the genitalia and the sclerites of the abdominal segment VIII generally represent more reliable diagnostic criteria. As in Italian *Geostiba* (PACE 1977) and certain *Oxypoda* (ZERCHE, pers. comm.), the form of the apex of the parameres and the parameral sensilla were found to be of high taxonomic value. For a proper evaluation of these characters, particularly in the small subterraneous species, the genitalia and the genital segments were mounted on slides.

In the descriptions, measurements of head width (HW), pronotal width (PW) and length (PL), length of elytra at suture (EL) and the length from labrum to elytral apex (SL) are indicated in µm, the total length from labrum to hind margin of tergite VIII (TL) is given in mm. Measurements of body length, of course, strongly depend on the mode of preparation. Whenever series of specimens were available, the range of the measurements, the arithmetic mean and standard deviation are also presented.

Paratypes of most of the new taxa described here as well as part of the material of the remaining species collected by us are deposited in the Muséum d'histoire naturelle, Genève (MHNG).

Geostiba formicarum (Wollaston, 1854) (Figs 1a–k)

Xenomma formicarum WOLLASTON, 1854: 545; 1857: 172; 1865: 457.
Geostiba formicarum (Wollaston), FAUVEL 1897: 338.
Sipalia formicarum (Wollaston), JANSSON 1940: 16.
nec *Sipalia formicarum* (Wollaston), PALM, 1981a: 294.

TYPES: Lectotype: ♂, here designated and labelled accordingly, in coll. Wollaston (BMNH). Paralectotypes: 1 ♂, 1 ♀, in coll. Wollaston (BMNH).

The specimen here chosen as lectotype carries a round label 'type' and a hand-written label '*Xenomma formicarum* Woll., type'. Since the former is a "curator label' (HAMMOND,

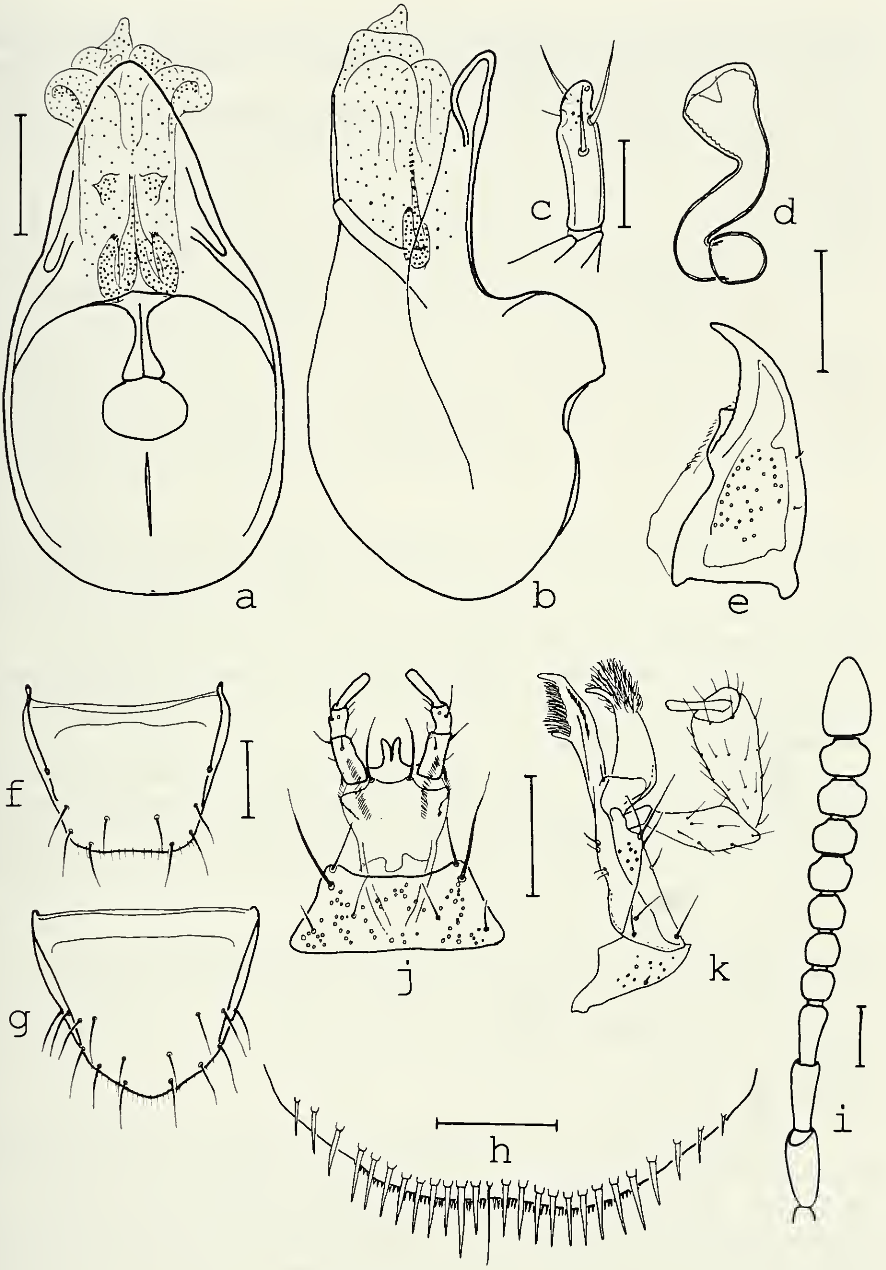

FIG. 1a–k

Geostiba formicarum (Woll.) median lobe in ventral and in lateral view (a, b); apex of paramere (c); spermatheca (d); right mandible (e); ♂ tergite (f) and sternite (g) VIII; ♀ hind margin of sternite VIII (h); antenna (i); labium (j); maxilla (k); pubescence partly omitted in f–i. Scales: a–b, d–e, h–k: 0.1 mm; c: 0.05 mm; f–g: 0.25 mm.

pers. comm.) and therefore of no taxonomic significance and as Wollaston based his original description on several specimens without fixing a type, the three specimens in the Wollaston collection must be regarded as syntypes.

Further material studied: 18 ♂♂, 15 ♀♀: Madeira, Rabacal, 1050 m, 31.III.1993, leg. & coll. Assing & Wunderle, MHNG; 1 ♂: Rabacal, 7.VIII.1975, leg. Vit (coll. Assing).

DESCRIPTION

Measurements: HW: 380–460, 408±22; PW: 450–590, 527±31; PL: 450–520, 485±20, EL: 250–320, 296±22; SL: 1100–1330, 241±72; TL: 3.0–3.6, 3.37±0.18.

Colour of body including the appendages reddish yellow to yellowish brown; tergites III–VI increasingly darkened, tergites III and IV mostly with slightly darker antero-central area, most of the surface of tergites V and especially VI, except for the hind margins, generally brown to blackish brown; tergite VII clearly lighter than tergite VI, often brownish in anterior half, tergite VIII reddish yellow; colour of the abdomen, on the whole, very variable.

Head clearly (0.76–0.80x) narrower than pronotum, with reticulate microsculpture and therefore subdued shine, punctation mostly shallow and indistinct; eyes present and functioning, their diameter equal to or slightly exceeding maximal width of first antennal segment; antennae longer than head (measured from anterior margin of labrum) and pronotum together (Fig. 1i); mouthparts as in Figs 1e, j, k.

Pronotum usually slightly wider (0.97–1.15) than long, with distinct reticulate microsculpture and often almost effaced punctation, caudadly directed pubescence short and rather inconspicuous.

Elytra much shorter (0.55–0.67x) and slightly wider than pronotum, with distinct granulose punctation, surface more shining than that of pronotum; alae reduced.

Abdomen increasing in width from segment III to V or VI, its maximal width slightly exceeding that of elytra; surface somewhat shining, but with clear reticulate microsculpture, and with rather sparse fine punctation.

♂: hind margin of tergite VIII slightly concave, that of sternite VIII convex to bluntly angled (Figs. 1f–g); median lobe and apex of paramere as in Figs. 1a–c.

♀: posterior margin of sternite VIII weakly concave with a conspicuous row of numerous bristles (Fig. 1h); spermatheca as in Fig. 1d.

DISTRIBUTION AND BIONOMICS

WOLLASTON (1854) reports *G. formicarum*, an endemic of Madeira proper, from the southern slope of Pico Arieiro and from the Lombo das Vacas in the north of the island (1 and 2 specimens, respectively). We sieved numerous specimens from soil and leaf litter in *Laurus* stands near Rabacal (1050m), where it has also been collected by Lundblad (JANSSON 1940) and Vit. It has been recorded at the end of March, in June and during the period from the end of July to the first half of August. The presumed affinity to ants (name!), which WOLLASTON (1854) concludes from the fact that he took his specimens "from beneath stones in the neighbourhood of ants' nests", appears very doubtful, particularly since *G. formicarum* does not possess any of the external characters typical of other myrmecophilous Aleocharinae. Our own observations do not confirm any such relationship either.

Comments

Palm's (1981a) description and illustrations do not refer to this species, but to the endemic *Atheta (Mocyta) sanguinolenta* (Wollaston, 1854), a light-coloured brachypterous species which Palm apparently mistook for a *Geostiba* and whose types the first author had the opportunity to study in the BMNH. Specimens of *A. sanguinolenta* in Palm's collection, which does not contain any true *G. formicarum*, are labelled '*Sipalia formicarum*'.

Geostiba filiformis (Wollaston, 1854) (Figs 2a–i)

Xenomma filiforme Wollaston, 1954: 545; 1857: 172; 1865: 457.
Geostiba filiformis (Wollaston) Fauvel, 1897: 338.
nec(?) *Sipalia filiformis* (Wollaston), Jansson 1940: 16.
Sipalia waldeni Palm, 1981: 298; syn. nov.
Sipalia israelsoni Palm, 1981: 298; syn. nov.
nec *Sipalia filiformis* (Wollaston), Palm, 1981: 297.

Types: Lectotype: ♀, '*Xenomma filiforme* Woll., type', here designated and labelled accordingly, in coll. Wollaston (BMNH).

Paralectotype: 1 ♀, in coll. Wollaston (BMNH).

There were three syntypes (see remarks below *G. formicarum*) in Wollaston's collection, one of them heavily damaged. According to the original description two of the specimens were collected on Porto Santo and one on Madeira proper.

Further material studied: 4 ♂♂, 6 ♀♀: Porto Santo, Pico do Castelo, 400 m, 1.IV.1993, leg. & coll. Assing & Wunderle; 28 ♂♂, 31 ♀♀: Porto Santo, Pico Juliana, 400 m, 1.IV.1993, leg. & coll. Assing & Wunderle, MHNG; 1 ♂, 1 ♀: Porto Santo, Pico Branco, H. Franz leg.; 1 ♀: Porto Santo, Pico Juliana, 3.II.1978, Waldén leg., Allotypus '*Sipalia israelsoni*' det. Thure Palm, coll. Palm (MZEL); 1 ♀: Madeiro, Faja da Pedro, 11.II.1978, Waldén leg., Holotypus '*Sipalia waldeni*' det. Thure Palm, coll. Palm (MZEL); 7 Ex.: Porto Santo, Pico Branco, 10.IV.1970, leg. & coll. Franz.

Description

Measurements: HW: 345–365, 355±7; PW: 435–500, 474±16; PL: 405–470, 434±19; EL: 280–350, 308±16; SL: 1100–1230, 1164±44; TL: 3.0–3.5, 3.29±0.11.

Colour of body including the appendages yellow to reddish yellow; abdomen dorsally darkened to various extents ranging from only slightly darker hue on central area of tergites III to V and on anterior half of tergites VI and VII to almost completely blackish or darkbrown colour of tergites III to VII leaving only the hind margins reddish yellow, anterior half of tergite VIII sometimes darkened, too.

Head with sides less rounded than in *G. formicarum*, clearly (0.72–0.79x) narrower than pronotum, with reticulate microsculpture (similar to *G. formicarum*), punctation usually distinct but often shallow; eyes present and functioning (ca. 6–8 ommatidia), their diameter (ca. 70 µm) exceeding maximal width of first antennal segment; antennae somewhat shorter than head and pronotum together (Fig. 2i).

Pronotum a little wider (1.07–1.14) than long, with distinct reticulate microsculpture; punctation variable, with transitions from deep and distinct to shallow and fine; pubescence even shorter and less conspicuous than in *G. formicarum*.

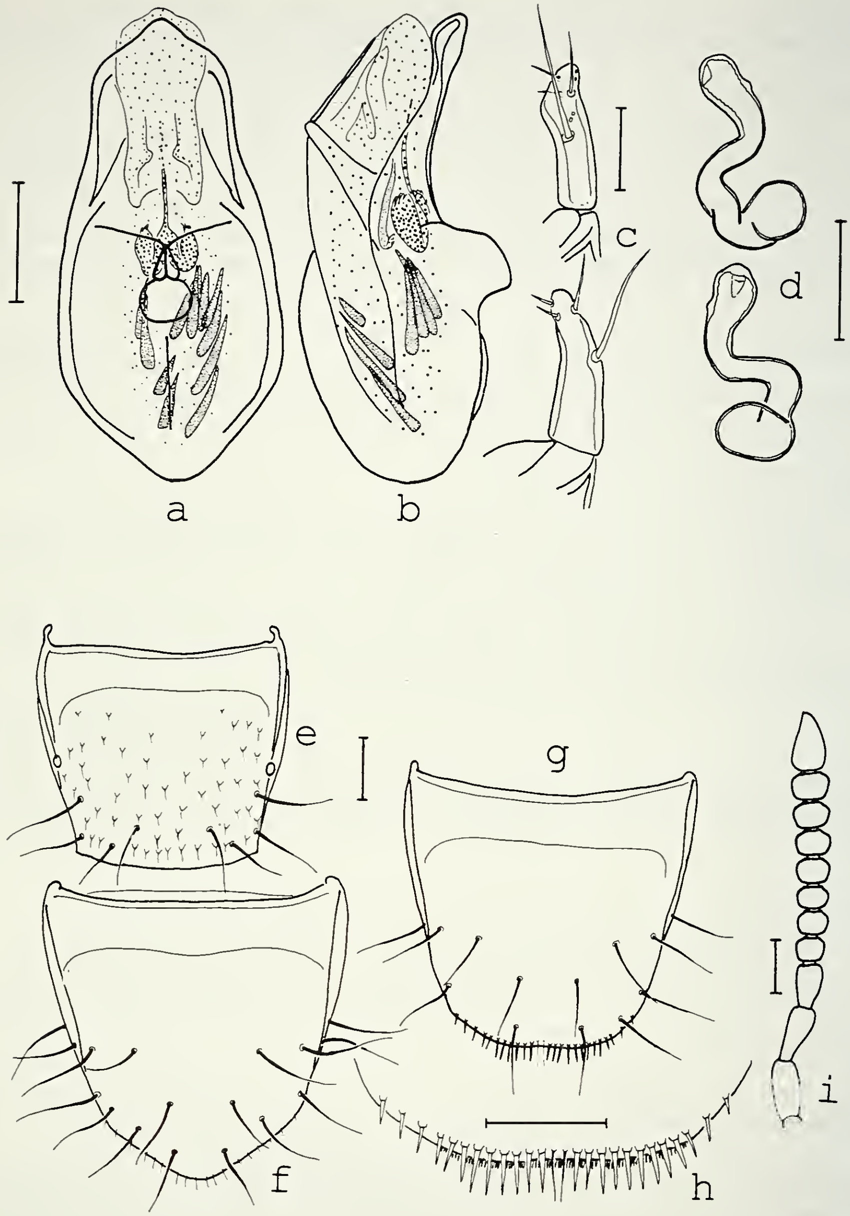

FIG. 2a–i
Geostiba filiformis (Woll.) median lobe in ventral and in lateral view (a, b); apex of paramere (c); spermatheca (d); ♂ tergite (e) and sternite (f) VIII; ♀ sternite VIII (g–h); antenna (i); pubescence partly omitted in f–i. Scales: a–b, d–i: 0.1 mm; c: 0.05 mm.

Elytra much shorter (0.68–0.75x) than pronotum, but relatively longer than in *G. formicarum*; maximal width only indistinctly exceeding that of pronotum; with usually distinct granulose punctation and with reticulate microsculpture; ♂♂ with a characteristic longitudinal elevation on anterior half of both elytra near suture; alae reduced.

Abdomen with maximal width slightly exceeding that of elytra; surface with sparse fine punctation and somewhat shining, but with clear isodiametric to transverse microreticulation.

♂: tergites VII and VIII with pronounced granulose punctures; hind margin of tergite VIII slightly convex, that of sternite VIII bluntly angled (Figs. 2e–f); aedeagus with conspicuous spines in internal sac, median lobe and apex of paramere as in Figs. 2a–c.

♀: posterior margin of sternite VIII ± convex, slightly concave or straight in the middle, with a row of numerous bristles (Figs 2g–h); spermatheca as in Fig. 2d.

DISTRIBUTION AND BIONOMICS

G. filiformis appears to be the only Madeiran *Geostiba* occurring on both Madeira proper, where it is apparently very rare, and Porto Santo. WOLLASTON (1854) collected his Madeiran specimen above Funchal and the specimens from Porto Santo "beneath stones ... on ... grassy mountain slopes" in April and "early spring". The records indicated by JANSSON (1940) obviously refer to a different species, since what he considers to be *G. filiformis* is only 1.9–2.4 mm long. We sieved our specimens, some of them still immature, together with larvae that apparently belong to the species, on April 1 from deep and moist leaf litter and under logs of dead wood on the northern slopes of Pico Juliana and Pico do Castelo (Porto Santo).

COMMENTS

In his account of Madeiran *Geostiba* PALM (1981a) clearly misiterprets *G. filiformis*, although he states that he has seen the type. His description, illustrations and records of *G. filiformis* as well as the corresponding material in his collection refer to an as yet undescribed species dealt with below. In addition, he describes *G. israelsoni* n. sp. from Porto Santo without commenting on the fact that WOLLASTON (1854) reports *G. filiformis* from the same island in his original description. Moreover, PALM (1981a) describes another new species, *G. waldeni* n. sp., on the basis of one ♀ without antennae stating that *G. waldeni* is very similar to *G. israelsoni*, but "ein wenig grösser, das [!] Hinterleib in grösserem Umfang verdunkelt und besonders durch die Form der Spermatheca distinkt abweichend" (p. 298). Our examination of the types revealed that *G. israelsoni* (Palm) is, without doubt, conspecific with *G. filiformis* (Woll.). Similarly, with regard to all the characters available the (damaged) type of *G. waldeni* is well within the range of variability of *G. filiformis,* and PALM's differential diagnosis is based on two of the most variable characters as well as on inadequate drawings of the spermathecae. Therefore, we regard both *G. israelsoni* (Palm) and *G. waldeni* (Palm) as junior synonyms of *G. filiformis* (Woll.).

Geostiba arieiroensis spec. nov. (Figs. 3a–i)

Sipalia filiformis (Woll.), PALM, 1981: 297f.

TYPES: Holotype: ♂, Madeira, Pico Arieiro, 1600 m, 26.III.1993, leg. & coll. Assing.

Paratypes: 42 ♂♂, 32 ♀♀: Madeira, Pico Arieiro, 1600 m, 26.III.1993, leg. & coll. Assing & Wunderle; 81 ♂♂, 88 ♀♀: Madeira, Pico Arieiro, 1600 m, 3.IV.1993, leg. & coll. Assing & Wunderle, MHNG; 10 Ex.: Pico Arieiro, 1600 m, 7.II.1978, leg. & coll. Palm (MZEL); 4 Ex.: Pico Arieiro, 23.IV.1978, leg. & coll. Palm (MZEL); 1 ♂: Pico Arieiro, Rib. das Calas, 4.IV.1967, leg. & coll. Franz.

DESCRIPTION

Measurements: HW: 325–370, 354±12; PW: 390–425, 411±9; PL: 345–370, 362±8; EL: 225–245, 233±7; SL: 980–1090, 1024±47; TL: 2.5–2.8, 2.66±0.08.

Colour of body including the appendages yellowish with most of tergites V and especially VI usually clearly darker, light brown to blackish, sometimes also central area of tergites III and IV and anterior half of tergite VII slightly darkened.

Head narrower than pronotum (0.82–0.90x), but relatively wider than in the two preceding species, with pronounced reticulate microsculpture and subdued shine (similar to *G. formicarum*), punctation usually distinct, but often shallow; eyes present and functioning (mostly 4 ommatidia), but small, their diameter (40–50 µm) shorter than maximal width of first antennal segment; antennae subequal in length to or slightly shorter than head and pronotum together (Fig. 3e).

Pronotum a little wider (1.12–1.17) than long, its maximal width a short distance behind the anterior angles; with reticulate microsculpture similar to that of head; punctation usually very fine and indistinct; pubescence short and inconspicuous; ♂♂ often with wide and shallow longitudinal impression on disk.

Elytra considerably shorter (0.60–0.67x) than pronotum; maximal width subequal to that of pronotum; microsculpture much weaker than on head and pronotum, therefore surface of shiny appearance; with distinct granulose punctation; alae reduced.

Abdomen with maximal width slightly exceeding that of elytra; microreticulation and punctation as in *G. filiformis*.

♂: hind margin of tergite VIII with pronounced concavity, posterior margin of corresponding sternite rounded to obtusely pointed (Figs. 3f–g); median lobe with conspicuous ventral process; median lobe and apex of paramere as in Figs. 3a–c.

♀: hind margin of tergite VIII slightly concave, straight or weakly rounded; sternite VIII posteriorly with shallow concavity and an interrupted row of long bristles (Figs 3h–i); spermatheca as in Fig. 3d.

DISTRIBUTION AND BIONOMICS

So far this new species has only been recorded from the type locality (name!) in early spring (February through April). We extracted our specimens from deep litter layers and soil in stands of *Erica* sp. (*arborea* or *scoparia*) and *Vaccinium padifolium* in both northern and southern expositions. On April 3, the ovaries of several ♀♀ contained a mature egg.

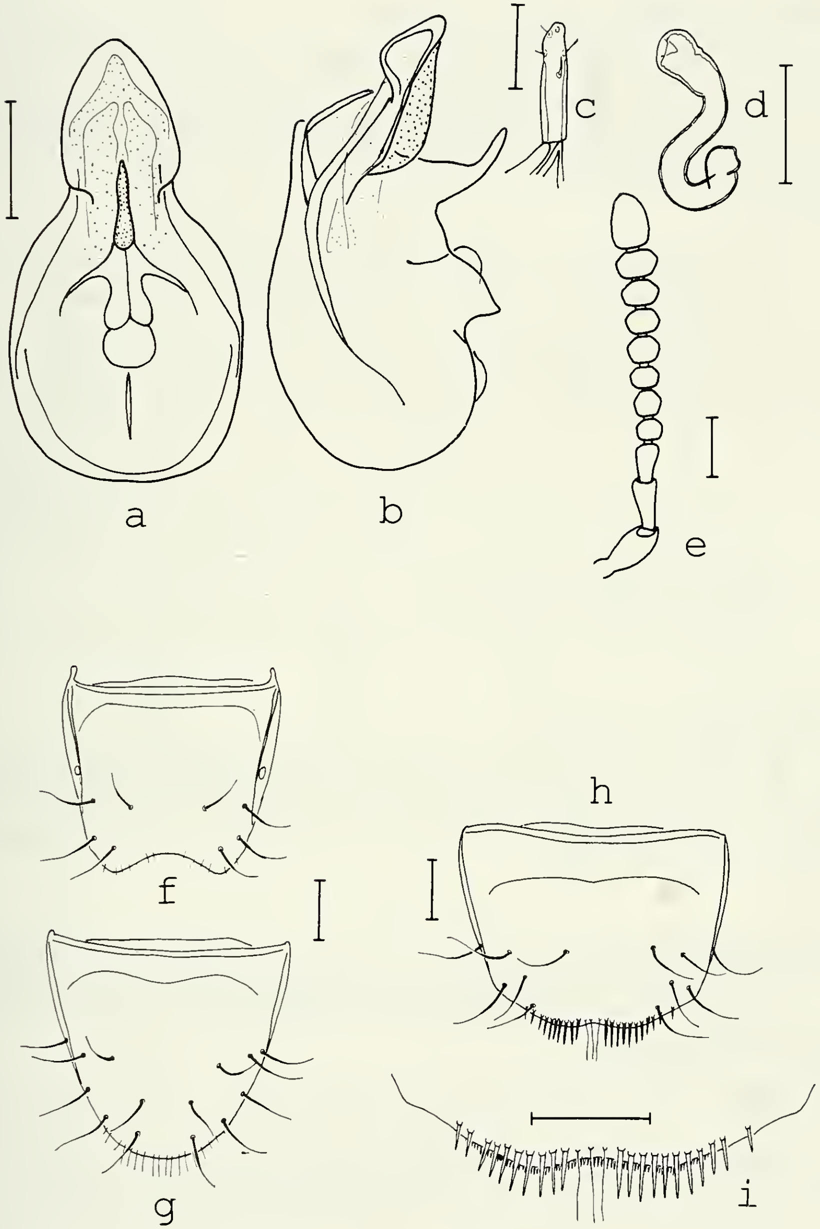

FIG. 3a–i.

Geostiba arieiroensis spec. nov.: median lobe in ventral and in lateral view (a, b); apex of paramere (c); spermatheca (d); antenna (e); ♂ tergite (f) and sternite (g) VIII; ♀ sternite VIII (h–i); pubescence partly omitted in e–i. Scales: a–b, d–i: 0.1 mm; c: 0.05 mm.

Geostiba ruivomontis spec. nov. (Figs. 4a–f)

TYPES: Holotype: ♂, Madeira, Ach. do Teixeira, 1350 m, 6.IV.1993, leg. & coll. Assing.

Paratypes: 18♂♂, 8 ♀♀: Madeira, Ach. do Teixeira, 1600 m, 6.IV.1993, leg. & coll. Assing & Wunderle; 76♂♂, 52 ♀♀: Madeira, Ach. do Teixeira, 1350 m, 6.IV.1993, leg. & coll. Assing & Wunderle; MHNG.

DESCRIPTION

Measurements: HW: 320–365, 348±10; PW: 370–420, 400±13; PL: 320–365, 349±12; EL: 210–230, 225±8; SL: 920–1050, 986±32; TL: 2.2–2.8, 2.53±0.15.

In external characters highly similar to the preceding species. It differs from *G. arieiroensis* in its on average slightly smaller body size, in that tergite VII is usually also darkened and of about the same colour as tergite V, in that the microreticulation of head and pronotum is often less distinct and in that the ♂♂ lack the longitudinal impression on the disk of the pronotum. The most reliable differences are, however, found in the shape of the sclerites of the abdominal segment VIII and the genitalia.

♂: hind margin of tergite VIII ± straight or slightly concave (Fig. 4e), that of sternite VIII strongly convex (Fig. 4f); median lobe with characteristic ventral process (Figs. 4a–b), apex of paramere as in Fig. 4c.

♀: posterior margin with shallow concavity, similar to *G. arieiroensis*; spermatheca as in Fig. 4d.

DISTRIBUTION AND BIONOMICS

At present, *G. ruivomontis* is only known from the northeastern slope of the Pico Ruivo (name!) near the Achada do Teixeira. We collected it from debris and moss in the shade of big rocks at 1600 m and from litter in a stand of old *Erica* sp. in northern exposition at 1350 m.

Geostiba bicacanaensis spec. nov. (Figs. 5a–f)

TYPES: Holotype: ♂, Madeira, Bica da Cana, 1550 m, 29.III.1993, leg. & coll. Assing.

Paratypes: 62 ♂♂, 37 ♀♀: Madeira, Bica da Cana, 1550 m, 29.III.1993, leg. & coll. Assing & Wunderle, MHNG.

DESCRIPTION

Measurements: HW: 315–350, 336±9; PW: 370–400, 385±9; PL: 320–370, 344±11; EL: 210–245, 223±10; SL: 860–1020, 954±47; TL: 2.1–2.6, 2.34±0.13.

In external characters also highly similar to the two preceding species. *G. bicacanaensis* is, on average, slightly smaller, its pronotum generally a little narrower; length of eyes ca. 45–55 µm, with 4–5 ommatidia; colour of tergites as in *G. ruivomontis*; microsculpture of head and pronotum as in *G. arieiroensis*; ♂♂ without longitudinal impression on disk of pronotum. For a safe identification of this species an examination of the genitalia, particularly of the males, is essential.

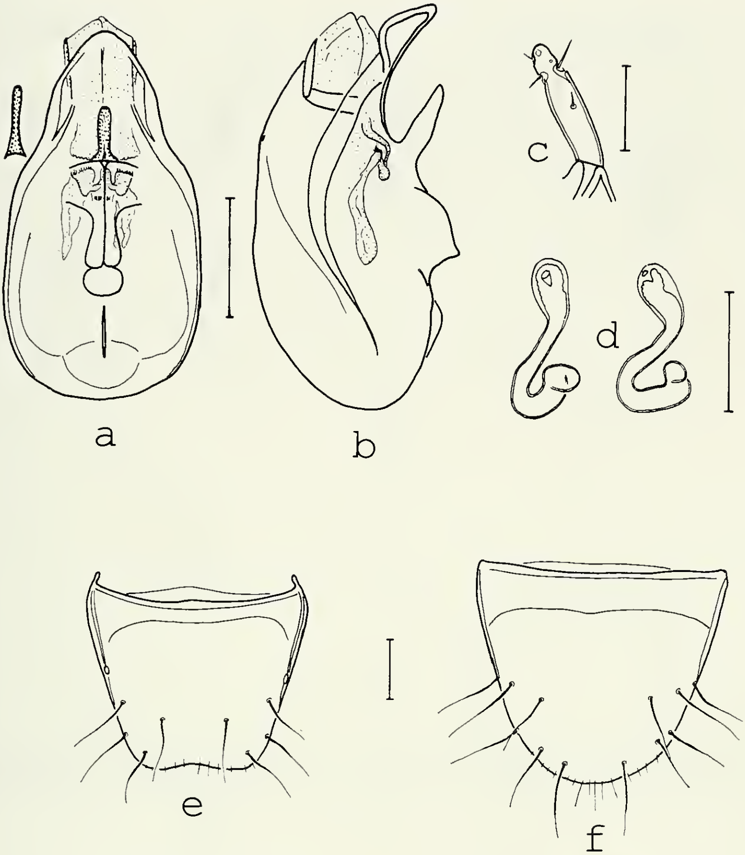

FIG. 4a–f

Geostiha ruivomontis spec. nov.: median lobe in ventral and in lateral view (a, b); apex of paramere (c); spermatheca (d); ♂ tergite (e) and sternite (f) VIII; pubescence partly omitted in e–f. Scales: a–b, d–f: 0.1 mm; c: 0.05 mm.

♂: hind margin of tergite VIII straight or very shallowly concave (Fig. 5e), the corresponding sternite rounded posteriorly (Fig. 5f); median lobe without ventral process (Figs. 5a–b), apex of paramere as in Fig. 5c.

♀: posterior margin of sternite VIII slightly concave to almost straight, similar to *arieiroensis*; spermatheca as in Fig. 5d.

DISTRIBUTION AND BIONOMICS

G. bicacanaensis has hitherto only been recorded from the type locality. It was collected on the northern slope of Bica da Cana (name!) from deep litter in stands of *Erica* sp. and *Vaccinium padifolium*. The gonads of several ♀♀ contained a mature egg.

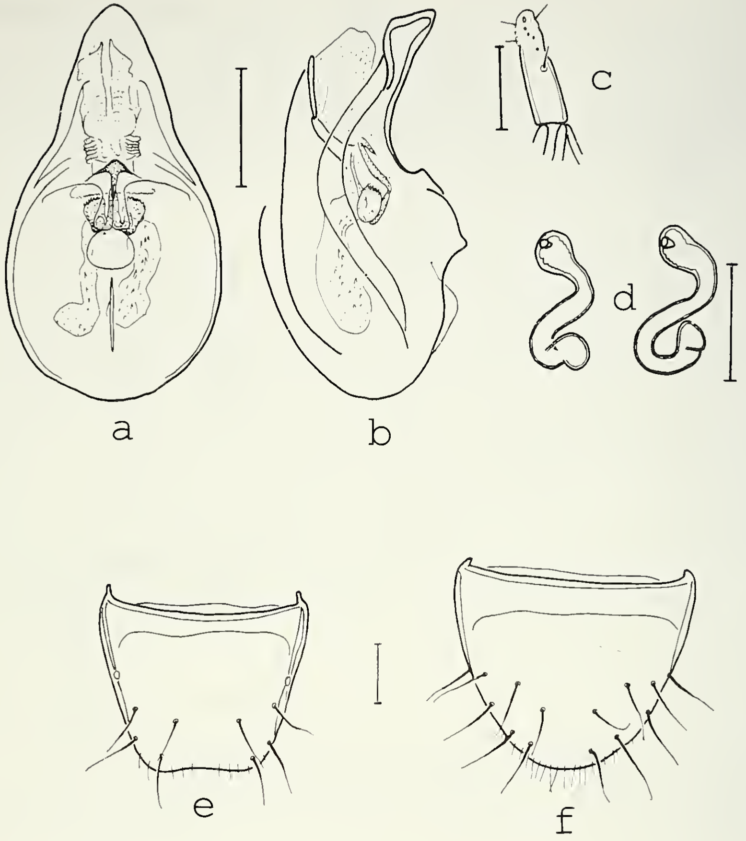

FIG. 5a–f

Geostiba bicanaensis spec. nov.: median lobe in ventral and in lateral view (a, b); apex of paramere (c); spermatheca (d); ♂ tergite (e) and sternite (f) VIII; pubescence partly omitted in e–f. Scales: a–b, d–f: 0.1 mm; c: 0.05 mm.

Geostiba portosantoi Franz, 1981 (Figs 6a–h, 8a)

Geostiba portosantoi FRANZ, 1981: 329ff.

TYPES: Holotype: ♂, Porto Santo, Pico Juliana, leg. & coll. Franz.

Paratype: 1 ♀, same data as holotype, leg. & coll. Franz.

FURTHER MATERIAL STUDIED: 22 ♂♂, 15 ♀♀: Porto Santo, Pico Juliana, 400 m, 1.IV.1993, leg. & coll. Assing & Wunderle, MHNG.

DESCRIPTION

Measurements: HW: 250–275, 262±5; PW: 310–350, 334±10; PL: 300–350, 327±10; EL: 210–245, 231±8; SL: 770–940, 863±46; TL: 2.0–2.5, 2.39±0.12.

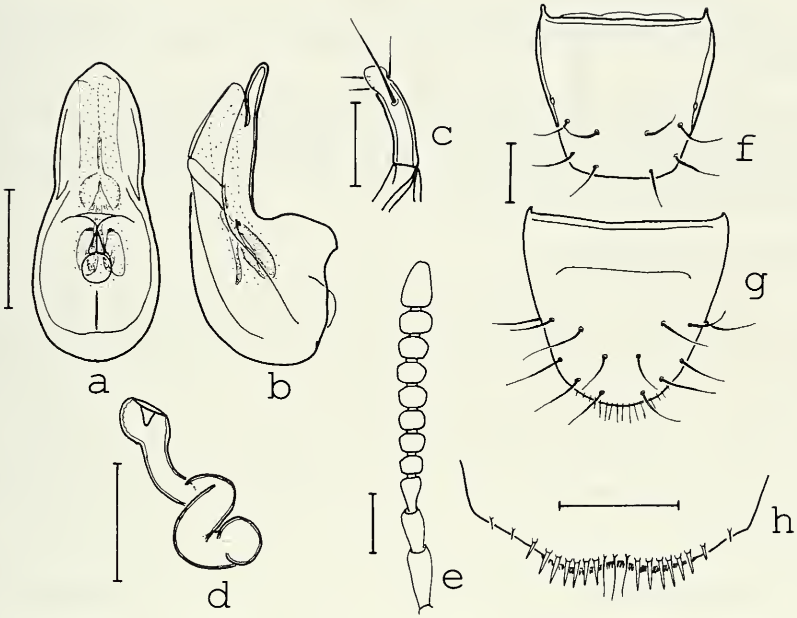

FIG. 6a–h.

Geostiba portosantoi Franz: median lobe in ventral and in lateral view (a, b); apex of paramere (c); spermatheca (d); antenna (e); ♂ tergite (f) and sternite (g) VIII; hind margin of ♀ sternite VIII (h); pubescence partly omitted in e–h. Scales: a–b, d–h: 0.1 mm; c: 0.05 mm.

Colour of body including appendages and tergites more or less uniformly yellowish to reddish yellow.

Head slender, suboval (Fig. 8a), clearly narrower than pronotum (0.74–0.81x) and than in *G. arieiroensis* and allied species; with variable, but usually weaker microreticulation and therefore more shine than in *G. arieiroensis*; punctation shallow and sparse; length of antennae slightly exceeding that of head and pronotum together (Fig. 6e); small eyes (maximal diameter ca. 40 µm) present and functioning, with usually 4 ommatidia. (Note that FRANZ (1981) states that this species is blind.)

Pronotum with lateral margins almost subparallel in the middle, about as wide as long (1.0–1.05x), smaller than in the preceding species and somewhat narrower than elytra; microsculpture and punctation similar to those of head; pubescence short, sparse and inconspicuous.

Elytra considerably shorter (0.68–0.74x) than pronotum, microsculpture similar to, sometimes even more distinct than, that of head and pronotum; with granulose punctation, which is, however, spaced more sparsely than in *G. arieiroensis*; alae reduced.

Abdomen with maximal width slightly exceeding that of elytra; dorsal surface with isodiametric microreticulation similar to that of elytra and with fine and sparse punctation.

♂: hind margin of tergite VIII ± straight, that of the corresponding sternite rounded (Figs. 6f–g); median lobe and apex of paramere as in Figs. 6a–c.

♀: hind margin of tergite VIII weakly rounded, sternite VIII weakly concave (Fig. 6h); spermatheca as in Fig. 6d.

DISTRIBUTION AND BIONOMICS

G. portosantoi is endemic to Porto Santo, where it has only been recorded from the northern slope of Pico Juliana. FRANZ (1981) sieved the type material under stones and dead trunks of *Pinus* sp. We collected our specimens from more or less isolated spots with deep and still rather moist litter and soil. Since the distribution of *G. portosantoi* is apparently restricted to a (forest) area of only a few hectares, where — according to our observations — suitable conditions are scarce, this species must be considered highly endangered. Small scale deforestation or even a fire might result in its extinction.

Geostiba brancomontis spec. nov. (Figs. 7a–c, 8b)

TYPES: Holotype: ♂, Porto Santo, Pico Branco, Gipfelbereich, 13.IV.1968, leg. and coll. H. Franz.

Paratypes: 1 ♂, 2 ♀♀: same data as holotype, coll. Assing & Wunderle.

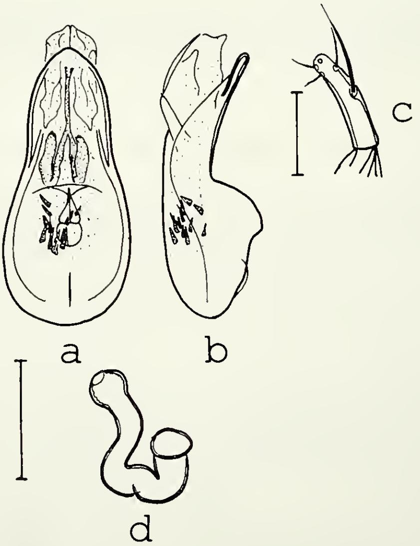

FIG. 7a–d

Geostiba brancomontis spec. nov.: median lobe in ventral and in lateral view (a, b); apex of paramere (c); spermatheca (d). Scales: a–b, d: 0.1 mm; c: 0.05 mm.

DESCRIPTION

Measurements: HW: 260–275; PW: 310–335; PL 290–305; EL: 200–215; SL: 750–770.

Body entirely yellowish; in size and general appearance highly similar to the following 4 species (see below), from which it is, however, externally distinguished by the presence of functioning eyes (maximal diameter ca. 40 µm) with 4 ommatidia. *G. brancomontis* differs from *G. portosantoi* especially in the distinctly shorter head (measured from anterior margin of clypeus to posterior margin of head), which is about as wide as long in the former and clearly longer than wide (ca. 1.15x) in the latter (Fig. 8b). Compared with *G. portosantoi* this species is also on the whole even smaller, and the pronotum is on average narrower and shorter with its maximal width a short distance behind the anterior angles and its sides more clearly converging posteriorly.

♂: hind margin of tergite VIII obtusely pointed, that of the corresponding sternite convex, similar to *portosantoi*; internal sac with sclerotized spines (Fig. 7a–b), apex of paramere as in Fig. 7c.

♀: hind margin of tergite VIII convex or very weakly obtuse, posterior margin of sternite VIII with weak concavity centrally; spermatheca smaller than in *portosantoi* and of different shape (Fig. 7d).

DISTRIBUTION AND BIONOMICS

G. brancomontis is endemic to Porto Santo and apparently exclusively inhabits the Pico Branco (name!). We have not seen the type locality during our visit to the island. It would be interesting to examine if suitable biotopes and this species still exist.

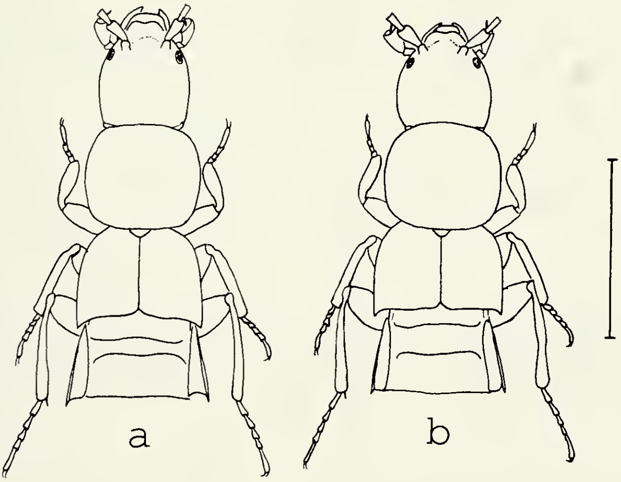

FIG. 8a–b
Habitus (forebody) of *Geostiba portosantoi* Franz (a) and *G. brancomontis* spec. nov. (b). Scale: 0.5 mm.

Geostiba lindrothi Franz, 1981 (Figs. 9a–h)

Geostiba lindrothi FRANZ, 1981: 329.
Sipalia lindrothi PALM, 1981a: 297.
Geostiba carli nom. nov. for *Sipalia lindrothi* PALM, 1981b: 447; syn. nov.

TYPES: Holotype: ♀, Madeira, Queimadas, 3.IV.1967, leg. & coll. Franz.

Paratype: 1 ♀: same data as holotype, leg. & coll. Franz.

Types of *G. carli* Palm: Holotype ♂, Madeira, Ribeira do Inferno (1150 m), 10.VIII.1935, leg. & coll. Lundblad (SMNH). Paratypes: 11 Ex., same data as holotype; 1 Ex., Caramujo (1250 m), 6. — 14.VIII.1935, leg. & coll. Lundblad (SMNH); 1 ♀: Madeira, Funchal, 500-1200 m, Terr. Luta, Febr. 1966, Palm (MZEL)

FURTHER MATERIAL STUDIED:

13 ♂♂, 6 ♀♀: Madeira, Caramujo, 1300 m, 4.IV.1993, leg. & coll. Assing & Wunderle, MHNG.

COMMENTS

An examination of the type material of *Geostiba lindrothi* Franz and of *G. carli* Palm revealed that both taxa are conspecific. (It should be noted that the types of *G. carli* deposited in the SMNH carry the handwritten label 'Sipalia lundbladi Palm', apparently an *in litteris* name; the specimens are without doubt identical with those mentioned in the original description of *G. carli* or *Sipalia lindrothi*, respectively.) Both *Geostiba lindrothi* Franz and *Sipalia lindrothi* Palm were described in 1981 in the same journal. Since PALM (1981b), as the first revising author, suggested the new

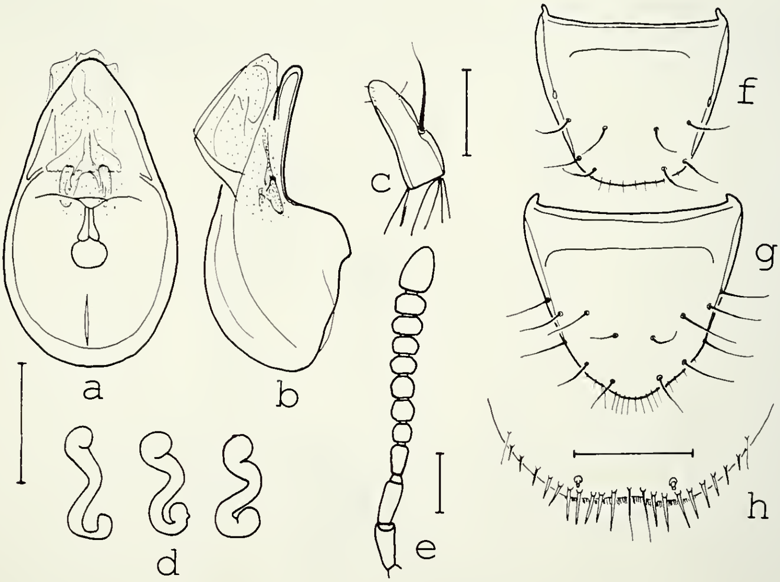

FIG. 9a–h.
Geostiba lindrothi Franz: median lobe in ventral and in lateral view (a, b); apex of paramere (c); spermathecae (d); antenna (e); ♂ tergite (f) and sternite (g) VIII; hind margin of ♀ sternite VIII (h); pubescence partly omitted in e–h. Scales a–b, d–h: 0.1 mm; c: 0.05 mm.

name *Geostiba carli* for his *Sipalia lindrothi* shortly afterwards and thus implicitly recognized the priority of *G. lindrothi* Franz, his *G. carli* must be considered a synonym of the former.

DESCRIPTION

Since this and the following four species of blind small subterraneous *Geostiba* can only be distinguished on the basis of the sclerites of abdominal segment VIII and the genitalia, only the first will be fully described. The descriptions of the remainder will focus on differential characters.

Measurements: HW: 250–275, 259±6; PW: 285–310, 301±7; PL: 275–305, 327±10; EL: 180–215, 194±7; SL: 710–830, 777±29; TL: 1.9–2.4, 2.18±0.16.

Colour of body including appendages entirely yellowish with only the antero-central area of tergites III-VI occasionally with a slightly darker hue.

Body even smaller and, on the whole, slenderer than in *G. portosantoi*.

Head narrower than pronotum (0.83–0.88x), but relatively wider than in the *G. portosantoi*. Surface somewhat shiny, but with distinct, yet variable microreticulation and mostly rather fine, sparse punctation; eyes rudimentary and without ommatidia, their maximal diameter ca. 27–30 μm; antennae about as long as head and pronotum together (Fig. 9e).

Pronotum small, as wide as or slightly wider than long (1.0–1.1x) with maximal width in anterior half; microreticulation similar to that of head, punctation very fine and sometimes indistinct; pubescence short and inconspicuous.

Elytra much shorter (0.63–0.70x) than and about as wide as pronotum; microsculpture variable, reticulate, often superficial; punctation granulose and sparse; alae reduced.

Abdomen with maximal width slightly exceeding that of elytra; dorsal surface with isodiametric microreticulation similar to that of elytra and with fine and sparse punctation.

♂: hind margin of tergite VIII straight to weakly rounded (Fig. 9f), that of sternite VIII obtusely pointed (Fig. 9g); median lobe as in Figs. 9a–b; apex of paramere with one long and three short setae (Fig. 9c).

♀: hind margin of tergite VIII weakly convex, sternite VIII posteriorly with weak concavity (Fig. 9h); spermatheca as in Fig. 9d.

DISTRIBUTION AND BIONOMICS

So far *G. lindrothi* is only known from the localities indicated above. FRANZ (1981) sieved the types from *Laurus* trunks. We extracted our specimens from soil in a stand of old *Erica* sp. in northern exposition. Two of the females had mature eggs in their abdomen.

Geostiba graminicola spec. nov. (Figs. 10a–h)

TYPES: Holotype: ♂, Madeira, Pico Arieiro, 1750 m, 26.III.1993, leg. & coll. Wunderle.
Paratypes: 24 ♂♂, 22 ♀♀: Madeira, Pico Arieiro, 1750 m, 26.III.1993, leg. & coll. Assing & Wunderle, MHNG.

DESCRIPTION

Measurements: HW: 270–290, 276±5; PW: 300–350, 320±8; PL: 285–320, 302±8; EL: 190–210, 197±6; SL: 740–910, 809±45; TL: 2.0–2.6, 2.25±0.15.

In colour and external morphology highly similar to *G. lindrothi*; the antennae are less slender with segments 4–6 clearly more transverse than in the preceding species (Fig. 10e); rudiments of eyes variable in size, often even smaller than in the preceding species (maximal diameter 20–27 μm).

♂: hind margin of tergite and sternite VIII similar to *G. lindrothi* (Figs. 10f–g); median lobe as in Figs. 10a–b; apex of paramere with two long and two short setae (Fig. 10c)

♀: hind margin of tergite VIII ± straight, that of sternite with pronounced concavity (Fig. 10h); spermatheca as in Fig. 10d.

DISTRIBUTION AND BIONOMICS

G. graminicola has only been recorded from the type locality, where it was collected in the shade of a big rock. A few specimens were found under stones, the majority, however, was sieved from soil and the roots of the grass vegetation (name!). The abdomen of one of the ♀♀ contained a mature egg.

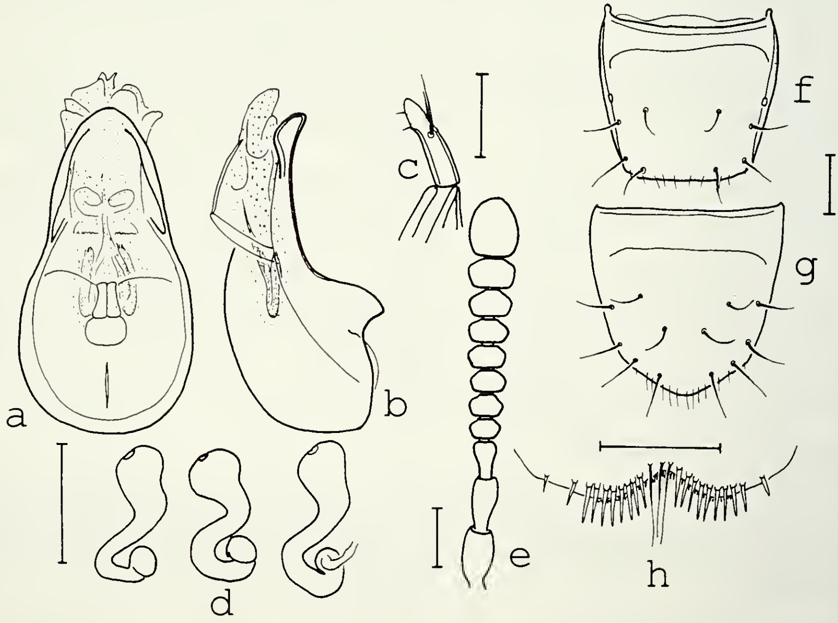

FIG. 10a–h.
Geostiba graminicola spec. nov.: median lobe in ventral and in lateral view (a, b); apex of paramere (c); spermatheca (d); antenna (e); ♂ tergite (f) and sternite (g) VIII; hind margin of ♀ sternite VIII (h); pubescence partly omitted in e–h. Scales: a–b, d–h: 0.1 mm; c: 0.05 mm.

Geostiba vaccinicola spec. nov. (Figs. 11a–h)

TYPES: Holotype: ♂, Madeira, Pico Arieiro, 1600 m, 3.IV.1993, leg. & coll. Wunderle. Paratypes: 5 ♂♂, 6 ♀♀: Madeira, Pico Arieiro, 1600 m, 3.IV.1993, leg. & coll. Assing & Wunderle, MHNG; 2 ♂♂, 1 ♀: Madeira, Pico Arieiro, 1600 m, 26.III.1993, leg. & coll. Assing & Wunderle; 2 ♂♂: Madeira, Pico Arieiro, Fonte Vermelha, 16.IV.1970, leg. & coll. Franz.

DESCRIPTION

Measurements: HW: 265–290; PW: 300–335; PL: 285–330; EL: 190–210; SL: 770–880; TL: 2.1–2.5.

Colour and external morphology as in *G. lindrothi*.

♂: hind margin of tergite and sternite VIII similar to *G. lindrothi* (Figs. 11f–g); median lobe slenderer in ventral view and larger (Figs. 11a–b); apex of paramere with one long and three short setae (Fig. 11c).

♀: hind margin of sternite VIII similar to *G. lindrothi* (Fig. 11h); spermatheca stouter and larger than in *G. lindrothi* (Fig. 11d).

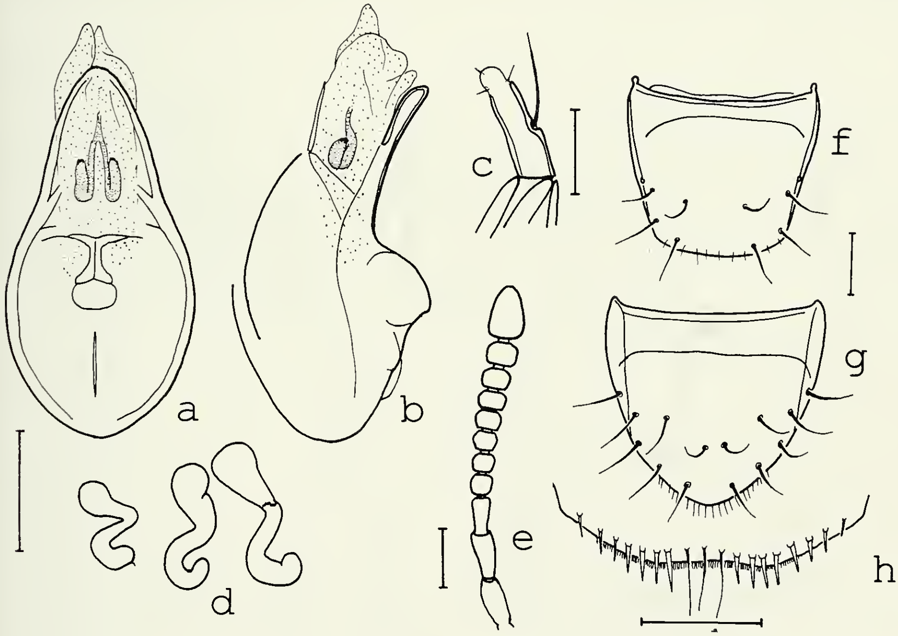

FIG. 11a–h.
Geostiba vaccinicola spec. nov.: median lobe in ventral and in lateral view (a, b); apex of paramere (c); spermathecae (d); antenna (e); ♂ tergite (f) and sternite (g) VIII; hind margin of ♀ sternite VIII (h); pubescence partly omitted in e–h. Scales a–b, d–h: 0.1 mm; c: 0.05 mm.

DISTRIBUTION AND BIONOMICS

The type specimens of this subterraneous blind species were sieved from deep litter and extracted from soil in stands of *Vaccinium padifolium* (name!) and *Erica* sp. in northern exposition below the Pico Arieiro.

Geostiba lauricola spec. nov. (Figs. 12a–d)

TYPES: Holotype: ♂, Madeira, Rib. da Janela, 800 m, 31.III.1993, leg. & coll. Wunderle.
Paratypes: 5 ♂♂, 2 ♀♀: Madeira, Rib. da Janela, 800 m, 31.III.1993, leg. & coll. Assing & Wunderle, MHNG.

DESCRIPTION

Measurements: HW: 260–280; PW: 300–325; PL: 285–310; EL: 200–215; SL: 770–850; TL: 2.0–2.3.

Colour and external morphology as in *G. lindrothi*.

♂: hind margin of tergite and sternite VIII as in *G. lindrothi*; median lobe slenderer (Figs 12a–b); apex of paramere long and slender, with three short and one long setae, the latter situated nearer to base than in *G. lindrothi* (Fig. 12c).

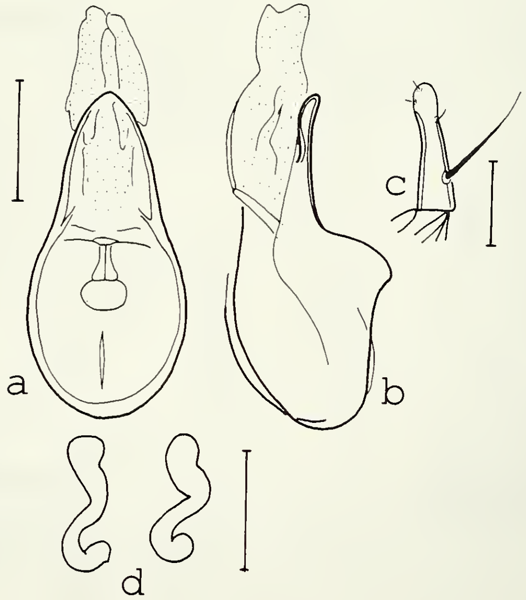

FIG. 12a–d.
Geostiba lauricola spec. nov.: median lobe in ventral and in lateral view (a, b); apex of paramere (c); spermathecae (d): Scales: a–b, d: 0.1 mm; c: 0.05 mm.

♀: hind margin of sternite VIII as in *G. lindrothi*; spermatheca slightly larger and stouter than in *G. lindrothi* (Fig. 12d).

DISTRIBUTION AND BIONOMICS

The type specimens were extracted from soil and deep litter layers in a *Laurus* stand (name!) on the ascent from Ribeira da Janela to Fanal in the northwest of Madeira.

Geostiba caligicola spec. nov. (Figs 13a–h)

TYPES: Holotype: ♂, Madeira, Ach. do Teixeira, 1600 m, 6.IV.1993, leg. & coll. Wunderle.

Paratypes: 3 ♂♂, 4 ♀♀: Madeira, Ach. do Teixeira, 1600 m, 6.IV.1993, leg. & coll. Assing & Wunderle, MHNG.

DESCRIPTION

Measurements: HW: 255–265; PW: 285–295; PL: 270–290; EL: 170–185; SL: 720–775.

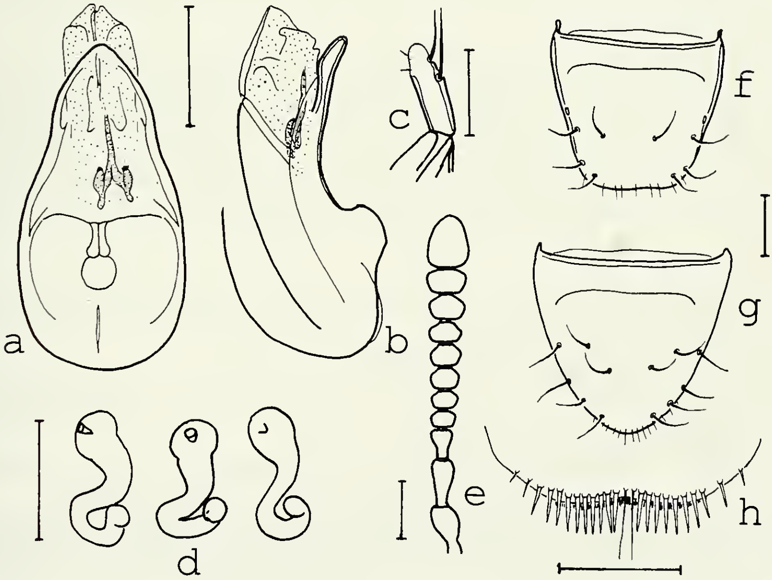

FIG. 13a–h.
Geostiba caligicola spec. nov.: median lobe in ventral and in lateral view (a, b); apex of paramere (c); spermathecae (d); antenna (e); ♂ tergite (f) and sternite (g) VIII; hind margin of ♀ sternite VIII (h); pubescence partly omitted in e–h. Scales: a–b, d–h: 0.1 mm; c: 0.05 mm.

Colour and general external morphology as in *G. lindrothi*; antennae similar to *G. graminicola*, but shorter with the first three antennomeres less elongate (Fig. 13e).

♂: hind margin of tergite and sternite VIII as in *G. lindrothi* (Figs 13f–g); median lobe in lateral view apically slightly slenderer than in *G. graminicola* (Figs 13a–b); apex of paramere with setal pattern similar to *G. graminicola*, but the apical long seta usually longer than in that species (Fig. 13c).

♀: hind margin of sternite VIII as in *G. lindrothi* (Fig. 13h); spermatheca as in Fig. 13d.

DISTRIBUTION AND BIONOMICS

The type series was sieved below the Pico Ruivo near Achada do Teixeira from moss and litter in the shadow (name!) of rocks.

Geostiba occulta spec. nov. (Figs. 14a–i)

TYPES: Holotype: ♂, Madeira, Rib. da Janela, 800 m, 31.III.1993, leg. & coll. Assing.

Paratypes: 2 ♂♂, 8 ♀♀: Madeira, Rib. da Janela, 800 m, 31.III.1993, leg. & coll. Assing & Wunderle, MHNG.

DESCRIPTION

Measurements: HW 405–430; PW 480–530; PL: 480–530; EL: 350–380; SL: 1330–1404; TL: 3.4–3.9.

G. occulta is the largest of all blind species of Madeiran *Geostiba*.

Colour of body including appendages entirely yellowish or reddish yellow with only the antero-central area of tergites III-VI sometimes with a slightly darker hue.

Head narrower than pronotum (0.81–0.84x); surface with distinct microreticulation and mostly rather fine, sparse punctation; eyes reduced to minute rudiments, without ommatidia; antennae slender, longer than head and pronotum together (Fig. 14e).

Pronotum as wide as long (0.99–1.03x) with maximal width in anterior half, microreticulation similar to that of head, punctation even finer than on head; pubescence short and inconspicuous.

Elytra much shorter (0.69–0.75x) and a little wider than pronotum; microsculpture reticulate, weaker than on head and pronotum, surface therefore more shiny; punctation granulose and fine; alae reduced.

Abdomen with maximal width clearly exceeding that of elytra; dorsal surface with distinct isodiametric microreticulation and sparse and fine punctation.

♂: hind margin of tergite VIII deeply concave; sternite VIII rounded posteriorly (Figs. 14f–g); median lobe and paramere as in Figs. 14a–c.

♀: hind margins of tergite and sternite VIII shallowly concave centrally (Figs. 14h–i); spermatheca as in Fig. 14d.

DISTRIBUTION AND BIONOMICS

The type specimens were found under the same conditions and in the same locality as *G. lauricola*.

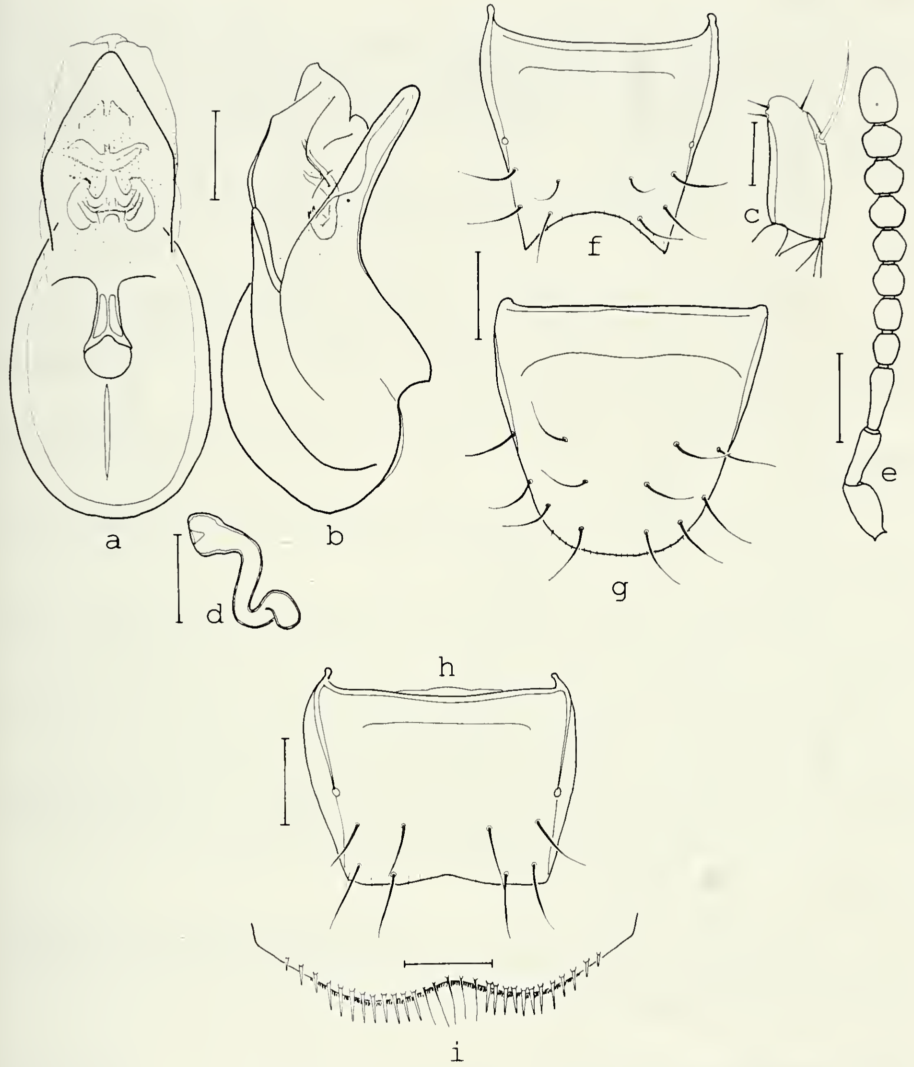

FIG. 14a–i

Geostiba occulta spec. nov.: median lobe in ventral and in lateral view (a, b); apex of paramere (c); spermatheca (d); antenna (e); ♂ tergite (f) and sternite (g) VIII; ♀ tergite and sternite VIII (h–i); pubescence partly omitted in e–i. Scales: a–b, d, i: 0.1 mm; e–h: 0.2 mm; c: 0.05 mm.

Geostiba endogea spec. nov. (Figs. 15a–i)

TYPES: Holotype: ♂, Madeira, Caramujo, 1220 m, 29.III.1993, leg. & coll. Wunderle.

Paratypes: 3 ♂♂, 4 ♀♀: Madeira, Caramujo, 1220 m, 29.III.1993, leg. & coll. Assing & Wunderle, MHNG; 1 ♀: Madeira, Rosario, 800 m, 5.IV.1993, leg. & coll. Assing & Wunderle.

DESCRIPTION

Measurements: HW: 345–365, 353±7; PW: 405–455, 429±13; PL: 375–425, 404±13; EL: 290–325, 310±10; SL: 1090–1220, 1159±44; TL: 3.0–3.3.

In general appearance *G. endogea* resembles *G. occulta*, but it is ccnsiderably smaller than the latter; on the other hand it clearly exceeds the species of the *G. lindrothi* group in body size.

Colour of body including appendages entirely yellowish or reddish yellow with only the antero-central area of tergites III-VI sometimes with a slightly darker hue.

Head narrower than pronotum (0.80–0.85x); surface somewhat shiny, with apparent, yet superficial microreticulation and very fine, sparse punctation; eyes reduced to minute rudiments; antennae less slender than in *G. occulta*, a little shorter than head and pronotum together (Fig. 15e).

Pronotum slightly wider than long (1.05–1.10x) with maximal width near the middle; microreticulation and punctation similar to that of head; pubescence short and inconspicuous.

Elytra clearly shorter (0.74–0.81x) and a little wider than pronotum; microreticulation rather superficial, with larger meshes than on head and pronotum; punctation granulose and fine; alae reduced.

Abdomen with maximal width clearly exceeding that of elytra; dorsal surface with distinct isodiametric microreticulation similar to that of elytra and sparse and fine punctation.

♂: hind margin of tergite VIII ± straight to slightly convex, that of sternite VIII convex (Figs. 15f–g); median lobe and paramere as in Figs. 15a–c.

♀: hind margin of tergite VIII slightly convex, that of sternite VIII with distinct concavity, centrally with rather many (7–9) long hairs clearly exceeding the row of bristles in length (Figs. 15h–i); spermatheca as in Fig. 15d.

DISTRIBUTION AND BIONOMICS

At the localities indicated above the type material was sieved and extracted from soil and deep litter layers, under moss and tree trunks in stands of deciduous trees with northern exposition.

Geostiba subterranea spec. nov. (Figs. 16a–f)

TYPES: Holotype: ♂, Madeira, Ribeiro Bonito, leg. & coll. H. Franz.
Paratype: 1 ♂: Madeira, Ribeiro Bonito, leg. H. Franz, coll. Wunderle.

DESCRIPTION

Measurements of the two specimens: HW: 362, 378; PW: 453, 498; PL: 438; EL: 317; SL: 1163, 1223.

In general appearance rather similar to *G. endogea*.

Colour of body including appendages entirely yellowish or reddish yellow with only the antero-central area of tergites III-VI sometimes with a slightly darker hue.

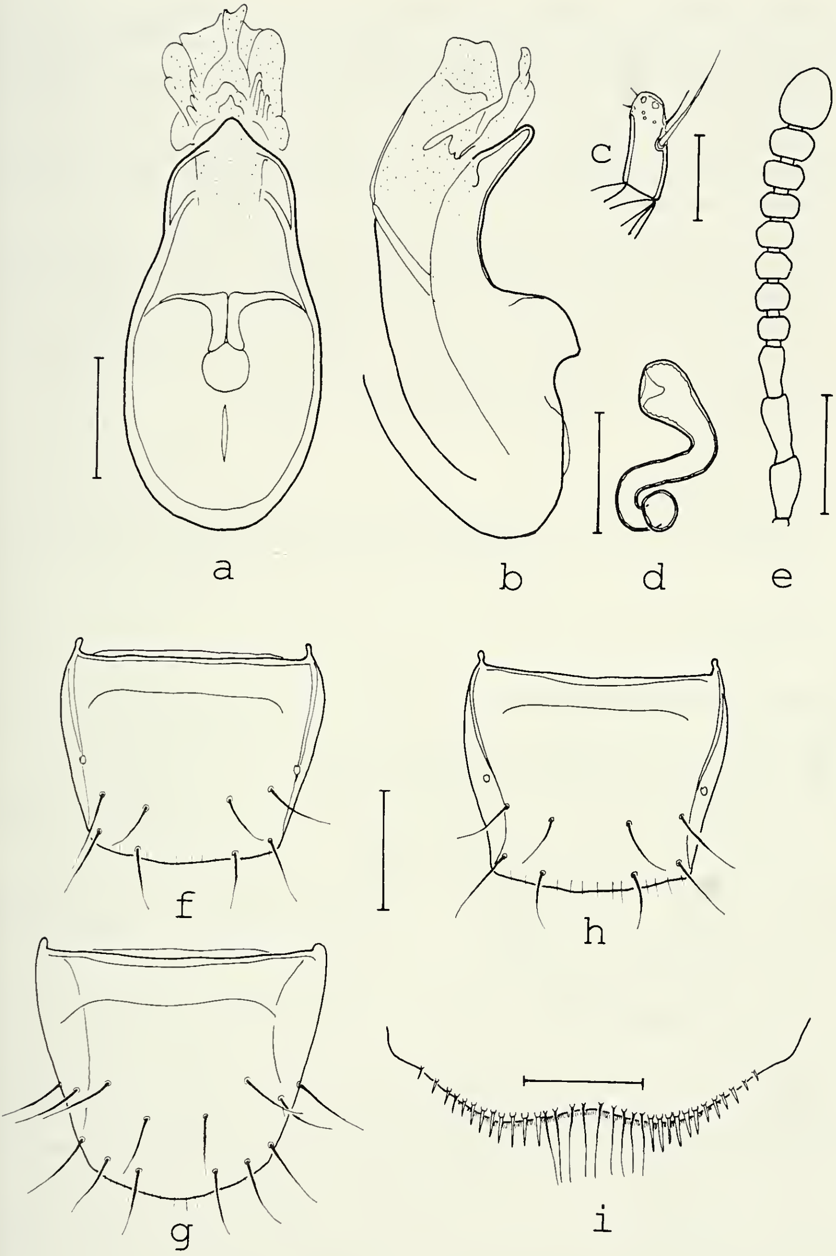

FIG. 15a–i

Geostiba endogea spec. nov.: median lobe in ventral and in lateral view (a, b); apex of paramere (c); spermatheca (d); antenna (e); ♂ tergite (f) and sternite (g) VIII; ♀ tergite and sternite VIII (h–i); pubescence partly omitted in e–i. Scales: a–b, d, i: 0.1 mm; e–h: 0.2 mm; c: 0.05 mm.

Head narrower than pronotum (0.75–0.80x), with distinct microreticulation, punctation sparse and fine; eyes reduced to minute rudiments; antennae slenderer than in *G. endogea* with segments 5–10 weakly transverse, longer than head and pronotum together (Fig. 16d).

Pronotum a little wider than long (1.05–1.15x) with maximal width in anterior half; microreticulation similar to that of head, punctation fine and sparse; pubescence short and inconspicuous.

Elytra much shorter (0.7x) and a little wider than pronotum; microsculpture less distinct than on head and pronotum; punctation granulose and fine; alae reduced.

Abdomen with maximal width clearly exceeding that of elytra; dorsal surface with distinct microreticulation and fine and sparse punctation.

♂: hind margin of tergite VIII weakly convex, sternite VIII rounded posteriorly (Figs. 16e–f); median lobe and paramere as in Figs. 16a–c.

♀: unknown.

DISTRIBUTION AND BIONOMICS

At present this species is only known from the type locality. Unfortunately, the labels lacked any information as regards the ecological circumstances.

SPECIES EXCLUDED

Atheta leileri (PALM, 1981) comb. nov.

Sipalia leileri PALM, 1981a: 294ff.
Atheta (Parameotica) juengeri BENICK 1984: 166ff. syn. nov.

TYPES: Holotype: ♂, Madeira, Pico Arieiro, 23.IV.1975, Holotypus, *Sipalia leileri* Palm, det. Thure Palm (MZEL).

Paratypes: 2 ♀♀: same data as holotype (MZEL).

FURTHER MATERIAL STUDIED: 21 ♂♂, 18 ♀♀: Madeira, Pico Arieiro, 1600 m, 26.III.1993, leg. & coll. Assing & Wunderle; 8 ♂♂, 13 ♀♀: Bica da Cana, 1550–1600 m, 29.III.1993, leg. & coll. Assing & Wunderle; 8 ♂♂, 4 ♀♀: Madeira, Pico Arieiro, 1600 m, 3.IV.1993, leg. & coll. Assing & Wunderle.

PALM (1981a) erroneously believed this species to be a *Sipalia* or *Geostiba*, respectively, apparently because of the general appearance, the small eyes and the rather short elytra. However, it does not possess any of the further typical characters of *Geostiba*. The construction of the genitalia is completely different. Furthermore, the pubescence of the pronotum is not directed caudad, but ± laterally on the sides; along midline it is directed cephalad in the anterior half and caudad in the posterior half (type III *in* BENICK & LOHSE (1974)). Having examined various characters including the mouthparts and the genitalia we conclude that *S. leileri* Palm has to be transferred to *Atheta* Thoms. For a detailed diagnosis and illustrations of the genitalia (including the internal sac of the aedeagus) see BENICK (1984), who described the same species again as *Atheta juengeri*, now a junior synonym of *S. leileri* Palm. J. Vogel, Görlitz, who studied the types of *A. juengeri* Benick, kindly confirmed that they were indeed conspecific with our material of *leileri* (pers. comm.).

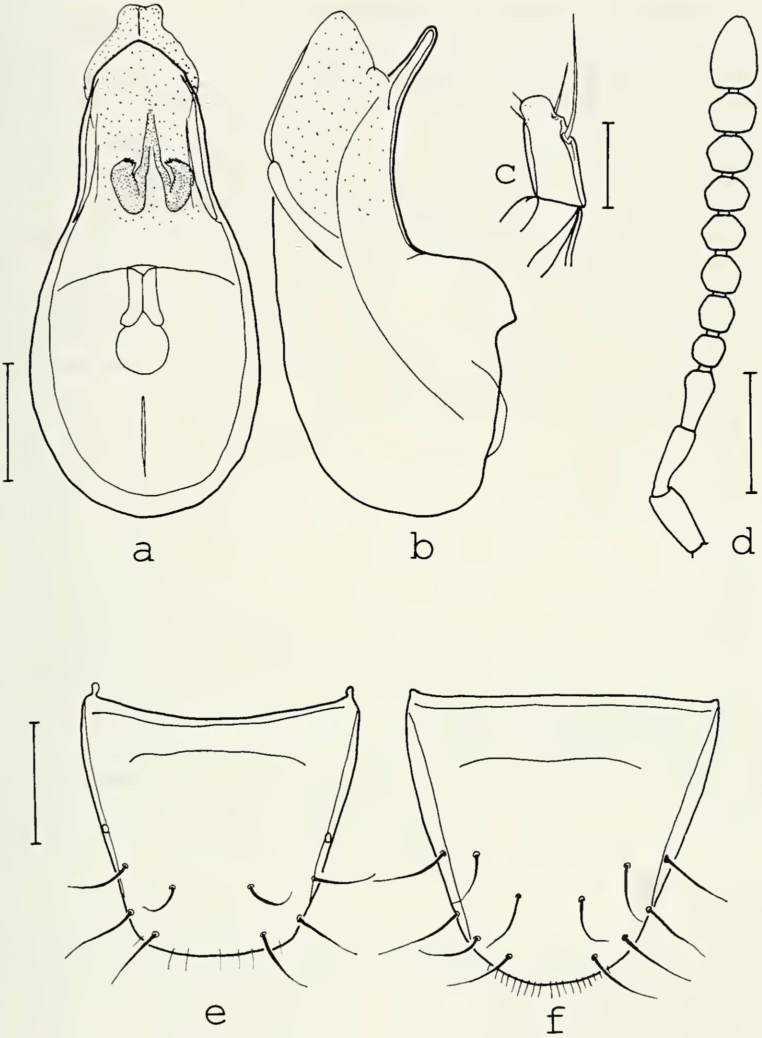

FIG. 16a–f
Geostiba subterranea spec. nov.: median lobe in ventral and in lateral view (a, b); apex of paramere (c); antenna (d); ♂ tergite (e) and sternite (f) VIII; pubescence partly omitted in d–f. Scales: a–b: 0.1 mm; c: 0.05 mm; d–f: 0.2 mm.

DISTRIBUTION AND BIONOMICS

A. leileri (Palm) has repeatedly been collected at or near the type locality (Pico Arieiro) at an altitude of ca. 1600 m (BENICK 1984; PALM 1981a; our own records, see above). We sieved numerous specimens from litter in stands of *Vaccinium* and *Erica* both in northern and southern exposition, also at Bica da Cana at 1600 m. One ♂ taken on 29.III.1993 was teneral

KEY TO THE MADEIRAN SPECIES OF *Geostiba* Thomson

1. Eyes functioning, with 4 or more ommatidia. 2

– Eyes reduced to minute rudiments, without ommatidia; inhabitants of Madeira proper. 8

2. Larger species, 3.0–3.6 mm, PW >430 µm, PL >400 µm; eyes with 6 or more ommatidia. ♂: apex of paramere with two or three long setae. 3

– Smaller species, 1.8–2.8 mm, PW >430 µm, PL >380 µm; eyes with 4–5 ommatidia. 4

3. Shape of head almost circular, HW >370 µm, abdomen distinctly widened posteriorly, pubescence of head and pronotum longer and more conspicuous, antennae slenderer with segments 6–10 only weakly transverse (Fig. 1i), elytra relatively shorter.

♂: without longitudinal elevation on elytra, pronotum without impression, punctation of tergites VII and VIII fine, median lobe and apex of paramere as in Figs. 1a–c.

♀: hind margin of sternite VIII concave (Fig. 1h), spermatheca as in Fig. 1d.

Madeira proper. . . . . *G. formicarum* (Woll.)

– Head slenderer, HW <370 µm, abdomen only slightly widened posteriorly, pubescence of head and pronotum short, less dense and inconspicous, antennae shorter with segments 5–10 distinctly transverse (Fig. 2i), elytra relatively longer.

♂: with longitudinal elevation on elytra near suture, pronotum with longitudinal impression on disk, tergites VII and VIII with pronounced granulose punctation, median lobe and apex of paramere as in Figs. 2a–c.

♀: hind margin of sternite VIII less concave (Fig. 2h), spermatheca as in Fig. 2d.

Madeira proper and Porto Santo. . . . . *G. filiformis* (Woll.)

4. Body colour ± uniformly yellowish to reddish yellow, head narrower with HW <290 µm; ♂: apex of paramere with one long and three shorter setae. Species of Porto Santo. 5

– Body ± bicoloured, yellowish with at least tergites V and VI somewhat darkened, head wider with HW >310 µm; ♂: apex of paramere with four short setae. For a safe identification of these species an examination of the aedeagus and the ♂ tergite VIII is essential. Species of Madeira proper. 6

5. Slightly smaller species; head shorter, about as long as wide (Fig. 8b), pronotum on the average shorter and narrower.

♂: median lobe smaller, with spines in internal sac (Figs. 7a–b); apex of paramere as in Fig. 7c.

♀: spermatheca smaller and of different shape (Fig 7d). Pico Branco (Porto Santo). . . . . *G. brancomontis* spec. nov.

– Somewhat larger species; head longer (ca. 1.15x) than wide (Fig. 8a), pronotum on the average longer and wider.

♂: median lobe larger, without spines in internal sac (Figs. 6a–b); apex of paramere as in Fig. 6c.

♀: spermatheca larger (Fig. 6d).

Pico Juliana (Porto Santo). . . . . *G. portosantoi* Franz

6. ♂: median lobe with pronounced ventral process 7

– ♂: median lobe without ventral process (Fig. 5b); tergite VIII weakly concave posteriorly (Fig. 5e); pronotum without impression.

♀: spermatheca as in Fig. 5d. . . . . *G. bicacanaensis* spec. nov.

7. Abdomen mostly with only tergites V and VI darkened.

♂: pronotum often with longitudinal impression on disk; tergite VIII with pronounced concavity posteriorly (Fig. 3f); ventral process of median lobe bent (Fig. 3b), apex of paramere as in Fig. 3c.

♀: spermatheca as in Fig. 3d. . . . . *G. arieiroensis* spec. nov.

– Abdomen mostly with tergite VII as dark as tergites V and VI.

♂: pronotum without longitudinal impression on disk; tergite VIII weakly concave posteriorly (Fig. 4e); ventral process of median lobe ± straight (Fig. 4b), apex of paramere as in Fig. 4c.

♀: spermatheca as in Fig. 4d. . . . . *G. ruivomontis* spec. nov.

8. Larger species, 3.0–3.9 mm. 9

– Smaller species, 1.9–2.6 mm. 11

9. Body length 3.0–3.3 mm; HW <390 µm, PL <460 µm; body appendages shorter. 10

– Larger species, 3.4–3.9 mm; HW >400 µm, PL >490 µm; legs and antennae (Fig. 14e) long and slender.

♂: hind margin of tergite VIII deeply concave (Fig. 14f), median lobe and apex of paramere as in Figs. 14a–c.

♀: spermatheca as in Fig. 14d. . . . . *G. occulta* spec. nov.

10. Antennae shorter with segments 4–10 transverse (Fig. 15e).

♂: median lobe smaller (Figs. 15a–b); apex of paramere as in Fig. 15c.

♀: spermatheca as in Fig. 15d. *G. endogea* spec. nov.

– Antennae slenderer with segments 5–10 weakly transverse (Fig. 16d).

♂: median lobe larger and of different shape (Figs. 16a–b); apex of paramere as in Figs. 16c.

♀: unknown. . . . . *G. subterranea* spec. nov.

11. ♂: apex of paramere with one long and three very short setae (see e.g. Fig. 9c). 12

– ♀: apex of paramere with two long and two very short setae (e.g. Fig. 13c). 14

12. ♂: median lobe larger, ca. 0.3 mm long (Fig. 11a–b); apex of paramere as in Fig. 11c.

♀: spermatheca as in Fig. 11d. . . . . *G. vaccinicola* spec. nov.

– ♂: median lobe smaller, ca. 0.25 mm long. 13

13. ♂: median lobe slenderer (Fig. 12a); apex of paramere more elongate, long seta situated nearer to base (Fig. 12c).
♀: spermatheca slightly larger and stouter (Fig. 12d). . *G. lauricola* spec. nov.
– ♂: median lobe wider in ventral view (Fig. 9a); apex of paramere less elongate, long seta more distant from base (Fig. 9c).
♀: spermatheca slightly smaller (Fig. 9d). . . . . *G. lindrothi* Franz
14. Antennae longer with the first three antennomeres more elongate (Fig. 10e).
♂: median lobe in lateral view as in Fig. 10b; apical long seta usually shorter (Fig. 10c).
♀: posterior margin of sternite VIII with pronounced angular concavity (Fig. 10h); spermatheca as in Fig. 10d. . . . . *G. graminicola* spec. nov.
– Antennae shorter (Fig. 13e).
♂: median lobe in lateral view of different shape (Fig. 13b); apical long seta usually longer (Fig. 13c).
♀: posterior margin of sternite VIII only shallowly concave (Fig. 13h); spermatheca as in Fig. 13d. . . . . *G. caligicola* spec. nov.

DISCUSSION

At present, 15 endemic species of *Geostiba* are known to occur on the Madeiran islands. Thus speciation through adaptive radiation appears to have developed far more endemics in this than in any other staphylinid genus on the archipelago. Of the better known taxa only *Stenus* Latr., *Othius* Steph. (both 5 endemics) and *Mycetoporus* Mannh. (3 endemics) include an appreciable number of species whose distribution is restricted to Madeira (ASSING & WUNDERLE, 1994, 1995; PALM 1980). The genus *Atheta* Thoms., particularly the subgenus *Mocyta*, can be expected to comprise a considerable number of endemics, too, but in the absence of a recent revision precise figures are impossible.

Furthermore, the number of Madeiran species of *Geostiba* considerably exceeds that of other Atlantic Islands. Several species have been described from the Canary Islands (FRANZ 1981; PALM 1975, 1976; WOLLASTON 1864), but according to our own studies only two of them are true *Geostiba*: *G. muscicola* (Woll.) and *G. lanzarotensis* (Palm). One species is reported for the Azores, *G. melanocephala* (Crotch) (BERNHAUER 1940; CROTCH 1867), whose generic identity was confirmed through an examination of two syntypes in coll. Wollaston (BMNH).

It may seem surprising that in spite of a fairly long tradition of entomofaunistic activity on the Madeiran islands, so few species of *Geostiba* were described before; many studies list no or, at the most; two species of the genus (e.g. BERNHAUER 1940; ERBER 1990; ERBER & HINTERSEHER 1988, 1990; JANSSON 1940; LIKOVSKY 1963), probably because the methods used were inadequate for these more or less subterranean insects. Considering that during a two-week excursion it was possible to collect not only the *Geostiba* species known at that time, but in addition an even greater number of new taxa, most of them from one locality only, it seems certain that a number of species remain to be discovered in the future.

Regarding their morphological and ecological properties the Madeiran *Geostiba* can be subdivided into 5 species groups. Three of them possess functioning eyes: the *G. formicarum* group (*G. formicarum*, *G. filiformis*), the *G. arieiroensis* group (*G. arieiroensis*, *G. ruivomontis*, *G. bicacanaensis*) and the *G. portosantoi* group (*G. portosantoi*, *G. brancomontis*). The remaining two groups are blind and subterraneous: the *G. lindrothi* group (containing the minute species *G. lindrothi*, *G. graminicola*, *G. vaccinicola*, *G. lauricola*, *G. caligicola*) and the *G. occulta* group (with the larger *G. occulta*, *G. endogea*, *G. subterranea*). There are, at first glance, considerable differences between these groups regarding characters such as body size, development of eyes, etc., particularly when measured against the relative uniformity of continental *Geostiba*. However, having examined numerous external characters as well as the mouthparts and the genitalia (also in comparison with the type species *G. circellaris* (Grav.)), we are convinced that the species dealt with in this study are all true members of *Geostiba*. After all, morphological (and ecological) diversity within groups of closely related species is a well-known island phenomenon, exemplified not only in Darwin's finches, but also many other animal taxa.

On the other hand the species of the *G. lindrothi* group are of remarkable similarity. Nevertheless, we recognize them as different species for several reasons. Above all, constant differences in the genitalia and other sex-related characters suggest reproductive isolation. Moreover, most species of *Geostiba* in general cannot be safely identified on the basis of external characters alone (cf. PACE 1977). A low morphological diversity should particularly be expected in the species of the *G. lindrothi* group, all of them living subterraneously and representing similar life forms; selective pressure in such habitats will eventually result in similar morphological adaptations, especially various reductions (of pigmentation, eyes, size, etc.), which unfortunately also reduce the number of available diagnostic features for the taxonomist.

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The millipede family Paradoxosomatidae on Borneo, with contributions to the faunas of some other islands of the Sunda area (Diplopoda, Polydesmida)

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The millipede family Paradoxosomatidae on Borneo, with contributions to the faunas of some other islands of the Sunda area (Diplopoda, Polydesmida). – Several fresh collections of paradoxosomatid millipedes from the Indo-Australian archipelago, mainly Borneo, comprise 14 species and two genera new to science: *Euphyodesmus reductus* sp. n., *E. perarmatus* sp. n., *E. lobatus* sp. n., *E. lateridens* sp. n., *Borneochiropus spinitergus* sp. n. (both genera allocated within the chiefly Australian tribe Antichiropodini), *Orangutana setosa* gen. n., sp. n. (Orthomorphini), *Arthrogonopus proletarius* sp. n., *Opisthodolichopus bifidus* sp. n., *Margaritosoma borneorum* sp. n., *Dajakina longipes* sp. n., *Kalimantanina crucifera* sp. n., *K. bruneica* sp. n., all from Borneo, as well as *Gigantomorpha mutilata* sp. n., from Bali, and *Margaritosoma singaporense* sp. n., from Singapore. Notes on the variation range of *Gigantomorpha immanis* Jeekel, 1963, are given. *Tectoporus filarius* (Attems, 1932), has been rediscovered on Java, *Opistodolichopus scandens* Hoffman, 1973, in Singapore, and *Tectoporus pygmaeus* (Pocock, 1894), hitherto reported solely from Java, has been recorded in Bali for the first time. Keys to the tribes and genera of Paradoxosomatidae encountered on Borneo as well as to species of the genera *Arthrogonopus* Jeekel, 1963, *Dajakina* Jeekel, 1963, *Euphyodesmus* Attems, 1931, *Gigantomorpha* Jeekel, 1963, *Margaritosoma* Jeekel, 1979, *Kalimantanina* Jeekel, 1963, and *Opisthodolichopus* Verhoeff, 1941, have been compiled. A review of the Bornean paradoxosomatid fauna is presented coupled with brief zoogeographical comments.

Key-words: Paradexosomatidae - fauna - taxonomy - keys - Borneo - Sunda Archipelago.

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INTRODUCTION

The millipede fauna of Southeast Asia, both continental and insular, is strongly dominated by species of the large family Paradoxosomatidae. Yet the fauna of Borneo, one of the biggest islands in Australasia, remains highly insufficiently known. Only very few papers have been specially or mainly devoted to Bornean paradoxosomatids, all by JEEKEL (1963, 1983a, 1983b), with the result that a total of 30 acknowledged species and nine genera have hitherto been reported from that great island. I guess that actually several times as many species await discovery on Borneo.

The present paper focuses on part of a considerable millipede collection from Borneo managed recently during several trips by Dr. Daniel Burckhardt, Dr. Bernd Hauser and Dr. Charles Lienhard, all from the Muséum d'Histoire naturelle in Geneva (MHNG). This contribution is restricted to the Paradoxosomatidae, hence providing an excellent opportunity to review and key the entire Bornean fauna of that family as well as to briefly discuss some zoogeographical issues. In addition, several sporadic samples taken by the above collectors on a few other islands of the Sunda area on their way to and back from Borneo have been incorporated in this study as well. Besides, one more Bornean specimen representing a new species and recently collected by Dr. Ottó Merkl, of the Hungarian Natural History Museum in Budapest (HNMB), has been added here too, bringing the paradoxosomatid fauna of Borneo to a total of 42 species and 12 genera.

Only a few duplicates have been retained by the author for a subsequent deposition in the collection of the Zoological Museum of the Moscow State University (ZMUM), whereas the bulk of material has been returned to MHNG or HNMB, as indicated hereinafter.

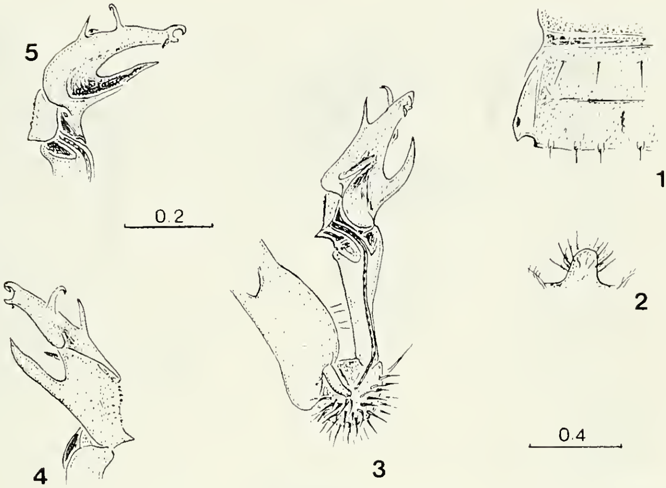
TAXONOMIC PART.

Tectoporus filarius (Attems, 1932) (Figs 1-5)

Material: 1 ♂, 2 ♀ (MHNG), 1 ♂, 1 ♀ (ZMUM), Indonesia, Java: Cibodas, *Lithocarpus-Castanopsis* forest along ravine above Botanical Gardens, 1350–1480 m, beaten from vegetation, 25.XI.1987 (Sar-87/16). – 1 ♂, 1 ♀ (MHNG), same locality, lower part of Botanical Gardens, ca. 1250–1300 m, beaten from vegetation, 27.XI.1987 (Sar-87/28), all leg. C. Lienhard.

Remarks: The above material corresponds virtually fully to the original description (ATTEMS 1932) and the only subsequent record (CHAMBERLIN 1945), as seen from Figs 1-5. The only minor discrepancy concerns the presence both of very poorly developed tubercles supporting the caudal row of tergal setae and a short axial line behind the transverse sulcus (Fig. 1). However, the above variation in metatergal sculpture can fairly well be considered as individual or populational, for the gonopod structure is identical.

This species has hitherto been known only from West Java (see review: JEEKEL 1951), and the above material actually derives from the locus typicus: Cibodas (= Tjibodas).



Figs 1–5

Tectoporus filarius (Attems, 1932), ♂: 1 – somite 10, dorsal view; 2 – sternal lamina between ♂ coxae 4, caudal view; 3 – left gonopod, mesal, lateral, and dorsal views, resp. – Scales in mm.

Tectoporus pygmaeus (Pocock, 1894) (Figs 6-14)

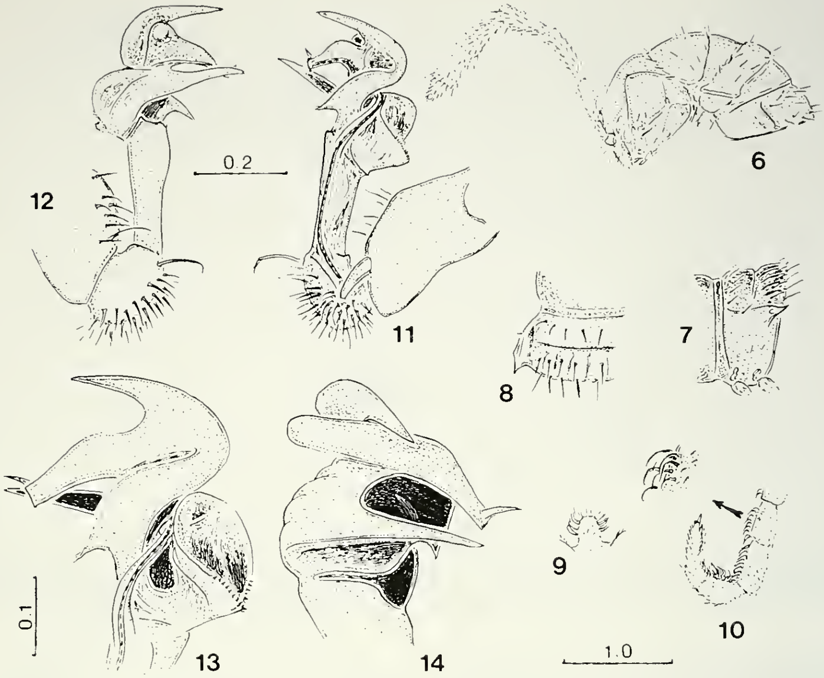
Material: 1 ♂ (NHMG), Indonesia, Bali: Bedugul, Botanical Gardens, 1230–1260 m, forest and especially in hothouses, 30.IX.1987 (Sar-87/35); leg. B. Hauser. – 2 ♂, 2 ♀ (NHMG), 2 ♂ (ZMUM), same locality, forested part, 1230–1260 m, beaten from vegetation, 30.XI.1987 (Sar-87/36); leg. C. Lienhard.

Remarks: Like the preceding species, *T. pygmaeus* has hitherto been known only from West Java (see reviews: Jeekel 1951, 1968, 1979a), being new to the fauna of Bali. Like the previous case, in spite of minor variations in some peripheral and even gonopodal characters (Pocock 1894; Attems 1903, 1937; Chamberlin 1945), the new illustrations (Figs 6-14) leave no doubt that the above new material belongs to *T. pygmaeus*. Moreover, introduction cannot be ruled out, since at least part of material could have derived from hothouses.

In addition to *T. pygmaeus*, five paradoxosomatid species have been encountered on Bali, viz. both anthropochorous *Orthomorpha coarctata* (de Saussure 1860), and *Chondromorpha xanthotricha* (Attems 1898) (Jeekel 1983b), as well as the probably endemic *Orthomorpha baliorum* Golovatch, 1994, *Margaritosoma baliorum* Golovatch, 1994 (Golovatch 1994b), and *Gigantomorpha mutilata* sp. n. (see below).

Euphyodesmus reductus sp. n. (Figs 15-18)

Material: Holotype ♂ (MHNG), East Malaysia, Borneo, Sabah, West Coast Residency, Mt Kinabalu, "Bukit Ular Trail", 1790 m, sifted leaf litter and rotten wood in *Lithocarpus-Castanopsis* forest, extracted with Winkler-Moczarski eclector, 28.IV.1982 (Sab-82/15); leg. B. Hauser.



Figs 6-14

Tectoporus pygmaeus (Pocock, 1894), ♂: 6 – anterior body portion, lateral view; 7-8 – somite 10, lateral and dorsal views, resp.; 9 – sternal lamina between ♂ coxae 4, caudal view; 10 – leg 3; 11-12 – right gonopod, mesal and lateral views, resp.; 13-14 – distal part of right gonopod, ventromesal and subfrontal views, resp. – Scales in mm.

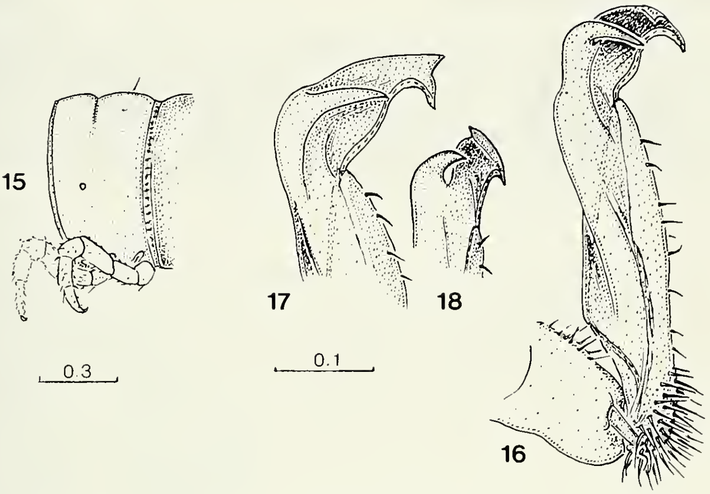
Etymology: The species epithet refers to the drastically reduced paraterga and gonopod telopodite distally of the prefemoral portion.

Diagnosis: Differs from congeners by the especially poorly developed paraterga and gonopod tibiotarsus as well as by the particularly short antennae and legs.

DESCRIPTION

Length ca. 8 mm, maximal width 0.75 mm on midbody somites and 0.8 mm on head. Coloration uniform pale brownish, anterior third of body a little brighter. Antennae only distally, but not apically, brownish. Legs, ventrum and a few basal antennomeres yellowish-whitish.

Head a bit broader than subequally wide collum and somites 5-17. Postcollar constriction evident on subequally narrowest somites 2-4. Body distinctly moniliform, rather rapidly tapering caudad on somites 18-20. Antennae short, quite clavate, in situ



Figs 15-18

Euphyodesmus reductus sp. n., ♂ holotype: 15 – somite 10, lateral view; 16 – left gonopod, mesal view; 17-18 – tip of left gonopod, subdorsal and ventromesal views, resp. – Scales in mm.

reaching to end of somite 2. Paraterga almost entirely missing, very weakly displayed as small and low ridges on somite 2, hardly traceable due to outlining sulci from above and below on somites 3–4, onward as trace sulci only from above on somites 5–6, further caudad as poor swellings (Fig. 15). Ozopores lying very low. Surface shining, smooth. Somites deeply constricted, suture dividing pro- and metazona deep, strongly striate longitudinally. Transverse metatergal sulcus starting from somite 5, rather deep, thin and lineiform, missing on somite 19. Tergal setae rather short, a few on collum, 2+2 setae on somite 2, 1+1 presulcus ones on further somites but telson (Fig. 15). Pleurosternal keels absent. Epiproct moderately long, somewhat flattened dorsoventrally, in lateral view almost straight, from above subtriangular, rather broadly truncate. Subanal scale subtrapeziform, with a pair of indistinct, setiferous, paramedian knobs at a rather wide caudal margin.

Sterna virtually bare, strongly shining, with a big, linguiform, setose, lamina directed forward between coxae 4. Legs short, rather stout, with neither adenostyles nor tarsal brushes, prefemora and femora with dense, strong, setae adpressed distad.

Gonopods (Figs 16-18) suberect. Coxite rather long, ventrally setose. Telopodite with evidence of torsion, prefemoral part unusually prominent, perhaps the most prominent not only among congeners, but also among all Paradoxosomatidae. Seminal groove running mostly laterally, shifting laterad already parabasally. Distal part of tibiotarsus with a simple, mesal, distofemoral tooth and a bifid lateral lobe with proximalmost tooth supporting seminal groove.

Euphyodesmus perarmatus sp. n. (Figs 19–24)

Material: HOLOTYPE ♂ (MHNG), East Malaysia, Borneo, Sarawak: SE of Serian, Sabal (= Forest Research Station), 190 m, beaten from vegetation, 10.XII.1987 (Sar-87/72); leg. C. Lienhard. – Paratypes: 1 ♀, 1 juv. (MHNG), same data, together with holotype. 1 ♀ (MHNG), same locality, 180 m, under bark, 10.XII.1987 (Sar-87/71); leg. B. Hauser.

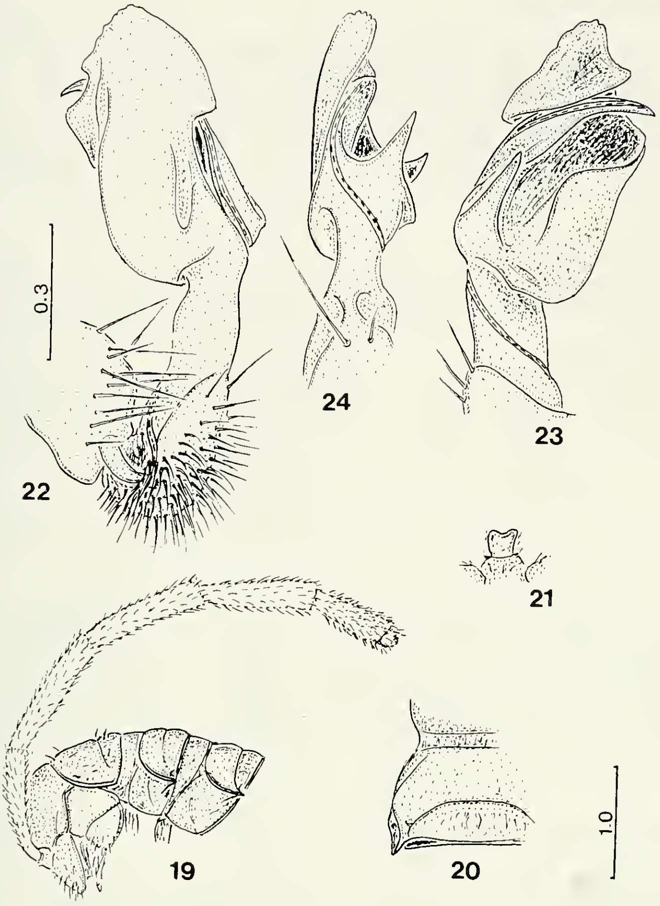
Diagnosis: Differs from congeners by the especially strongly developed gonopod tibiotarsus.

DESCRIPTION

Length ca. 21 mm, maximal width 1.1 and 1.5 (♂) and 1.1–1.2 and 1.5-1.6 mm (♀) on midbody pro- and metasomites, respectively. Coloration rather uniform dark chocolate-brown to blackish, ventrum and a few distal podomeres only a little paler, only paraterga, tips of antennae and a few proximal podomeres whitish.

Head considerably broader than narrowest collum, but a bit narrower than somite 5. Body distinctly moniliform, gradually broadening toward somite 5, parallel-sided on somites 5–17, onward rather gently but rapidly tapering. Antennae very long, slender (Fig. 19), in situ surpassing somite 5 (♂) or 4 (♂). Paraterga rather poorly developed, set at about 1/3–1/4 midbody height, directed somewhat obliquely dorso-caudad, only occasionally (on pore-bearing somites) level to dorsum, usually well below dorsum, starting already from collum, as narrow (poreless somites) or somewhat broader (pore-bearing somites) ridges, from above invariably narrowly rimmed laterally. Caudal corner of paraterga roundly subrectangular on collum, narrowly rounded on somite 2, onward invariably beak-shaped and spiniform (Fig. 20), reaching to slightly surpassing rear tergal contour, strongly surpassing the contour only on somites 17-18, almost vestigial on 19th. Lateral rim of paraterga with one or two minute incisions on pore-bearing and poreless somites, gradually coming (almost) to naught toward midbody somites. Ozopores dorsolateral, inside an oblique groove. Surface shining, generally smooth, uniform delicately shagreened, only postsulcus halves of metaterga slightly rugulose and metazona 2–5 below paraterga coarsely shagreened. Somites deeply constricted, suture dividing pro- and metazona deep, smooth. Transverse metatergal sulcus starting already from collum, rather deep, thin, arching and lineiform (Fig. 20), only traceable on somite 19. Tergal setae medium-sized, mostly missing, a few on collum, onward a pattern of 2+2 setae in presulcus row, of which only 1+1 median remain. Pleurosternal keels absent, as a vestigial oblique ridge on somite 2 and poor swellings on somites 3-4. Epiproct moderately long, somewhat flattened dorsoventrally, in lateral view almost straight, from above conical, narrowly truncate, with two minute apical papillae and preapical incisions removed very far from tip. Subanal scale subtriangular, with a pair of rather indistinct, setiferous, paramedian knobs at a rather widely rounded caudal margin.

Sterna almost bare, with distinct cross-impressions and a big, linguiform, setose, slightly emarginate lamina directed anteroventrally between coxae 4 (Fig. 21). Legs very long, slender, growing considerably longer toward caudal body end, with neither adenostyles nor tarsal brushes, relatively sparsely setose even ventrally, distinctly longer and slightly incrassate in ♂ as compared to ♀.



Figs 19-24

Euphyodesmus perarmatus sp. n., ♂ paratype: 19 – anterior body portion, lateral view; 20 – somite 10, dorsal view; 21 – sternal lamina between ♂ coxae 4, caudal view; 22-24 – left gonopod, mesal, lateral, and ventral views, resp. – Scales in mm.

Gonopods (Figs 22-24) relatively complex. Coxite rather short and stout, distally setose. Telopodite with evidence of torsion, prefemoral part not particularly prominent, femorite stout and subcylindrical. Seminal groove running mostly laterally, shifting laterad already parabasally. Tibiotarsus unusually big and complex, subcyathiform, almost sheathing solenomerite, latter with a strong parabasal distofemoral tooth.

Euphyodesmus lobatus sp. n. (Figs 25-30)

Material: Holotype ♂ (MHNG), East Malaysia, Borneo, Sarawak: Kuching-Serian road, near Kampong Kuap (18 km from Kuching), secondary forest, 30 m, beaten from vegetation, 13.XII.1987 (Sar-87/88); leg. C. Lienhard.

Diagnosis: Differs from congeners by the especially strongly reduced gonopod tibiotarsus.

Description

Length ca. 18 mm, maximal width 1.0 and 1.25 (♂) on midbody pro- and metasomites, respectively. Coloration dark brown to blackish, pattern like in *E. perarmatus*.

Head and body (Figs 25–28) like in *E. perarmatus*, except for the following characters. Paraterga set somewhat higher, at about 1/4–1/5 midbody height, with caudal spike mostly slightly elevated above or at least level to dorsum on posterior body half. Incisions on metaterga a little more distinct, especially on anterior body half, gradually coming to naught until somite 17. Metatergal sulcus poorly traceable already on somite 18, virtually missing on somite 19. Pleurosternal carinae present as a small but distinct tooth only on somite 2, vestigial on somite 3. Epiproct also narrowly truncate, but with a pair of big apical papillae divided by a very narrow notch. Subanal scale semicircular, more strongly rounded at caudal margin.

Gonopods (Figs 29–30) relatively simple. Coxite short and stout, distally setose. Prefemoral portion very big, femorite very strongly reduced, with a distodorsal lobe at base of a relatively slender and apically unciform solenomerite, tibiotarsus virtually totally missing.

Euphyodesmus lateridens sp. n. (Figs 31-36)

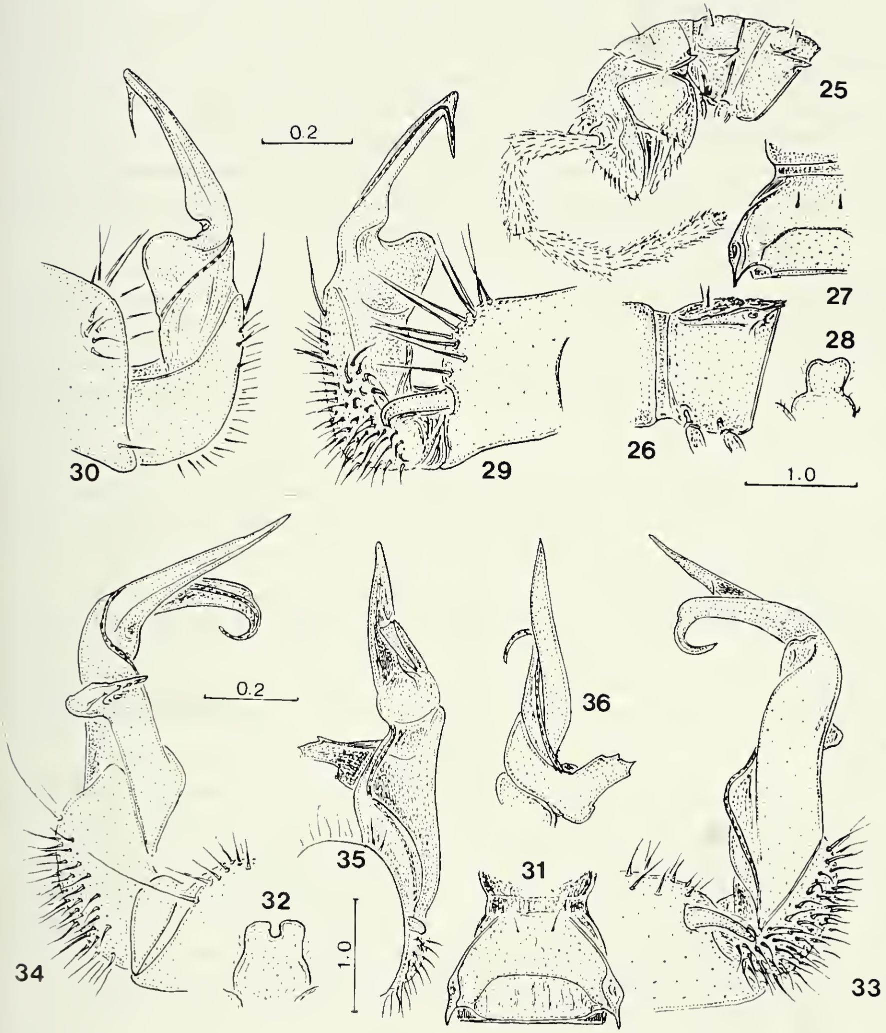
Material: Holotype ♂ (MHNG), East Malaysia, Borneo, Sarawak: Kuching-Matang road, Mt Gunung Serapi, forest along road toward TV station, 700 m, beaten from vegetation, 9.XII.1987 (Sar-87/67); leg. C. Lienhard. – Paratypes: 1 ♂, 2 juv. (19 segm.) (MHNG), 1 ♂ (ZMUM), same data, together with holotype. – 1 ♂ (MHNG), Sarawak: Bau, near cave “Gua Puang” near Kampong Pelaman Sekiang on a steep slope of Gunung Jambusan (“Pang Cave” in Wilford, 1964), 10-30 m, beaten from vegetation, 4.XII.1987 (Sar-87/51); leg. C. Lienhard.

Diagnosis: Differs from congeners both by characteristic distolateral tooth of the gonopod and sternal lamina between the ♂ coxae 4.

Description

Length ca. 20–21 mm, maximal width 1.1-1.2 and 1.6-1.7 mm on midbody pro- and metasomites respectively. Coloration dark brown to blackish, pattern like in *E. perarmatus*.

Head and body (Fig. 31) like in *E. perarmatus*, except for the following characters. Paraterga set relatively high, like in *E. lobatus*, mostly below or level to dorsum, only seldom spikes surpassing dorsum, slightly surpassing rear tergal contour already from somite 5, only from somite 4 pointed, before more or less narrowly



FIGS 25-36

Euphyodesmus lobatus sp. n., ♂ holotype (25-30), and *Euphyodesmus lateridens* sp. n., ♂ paratype (31-36): 25 – anterior body portion, lateral view; 26, 27 & 31 – somite 10, lateral, dorsal, and dorsal views, resp.; 28 & 32 – sternal lamina between ♂ coxae 4, caudal view; 29-30 – right gonopod, mesal and lateral views, resp.; 33-36 – left gonopod, mesal, lateral, dorsal, and ventral views, resp. – Scales in mm rounded, especially well-protruding on somites 16-18. Metatergal sulcus rather well-developed also on somite 18, virtually missing on somite 19. Pleurosternal carinae present only as small but distinct teeth on somites 2-3. Epiproct also rather narrowly truncate, apical papillae indistinct, preapical incisions very strongly removed from tip. Subanal scale as a very narrowly truncate trapeze or triangle. Lamina between ♂ coxae 4 particularly big and strongly notched in the middle (Fig. 32).

Gonopods (Figs 33-36) relatively complex. Coxite short and stout, distally setose. Prefemoral portion very prominent, femorite strongly reduced, with a characteristic, distolateral, scapuliform, serrate tooth at base of both a big, spiniform tibiotarsus and a strong, distally unciform solenomerite.

Remarks: The genus *Euphyodesmus* Attems, 1931, has hitherto been known to comprise only three species, all confined to Borneo: *E. gracilis* Attems, 1931 (the type-species), *E. postfemoralis* Jeekel, 1963, and *E. granulifer* Jeekel, 1963 (JEEKEL 1963). Discovery in Sabah and Sarawak of four additional congeners reported here at once seems to evidence that *Euphyodesmus* is perhaps far more species-rich, with further new members still to be found.

The gonopod traits of all four new congeners are clearly those characteristic of *Euphyodesmus*, while certain amendments in the concept of the genus, such as the degree of development and caudal projection of the paraterga, presence of tarsal brushes, length of antennae and legs, etc. (JEEKEL 1963), concern only some relatively unimportant peripheral features.

Formally, *Euphyodesmus* has hitherto been referred to the tribe Tectoporini, yet with certain reservations (JEEKEL 1963, 1968). With new evidence at hand, in particular in view of the discovery of the new monobasic genus *Borneochiropus*, that allocation appears false and actually refers to the tribe Antichiropodini (see just below).

All currently known *Euphyodesmus* species can be separated using the following key:

1(2) Metaterga with two transverse rows of knobs, presulcus one setiferous, and postsulcus one bare. Gonopod suberect, tibiotarsus as a big, simple lamina a little shorter than a bifurcate solenomerite. . . . . *E. granulifer*

2(1) Metaterga without knobs, either hairless or with a single presulcus row of setae. Gonopod either strongly enlarged or strongly reduced distally, often unciform not suberect; tibiotarsus either strongly reduced, often denti- or spiniform, or strongly folded and complex in shape.

3(4) Antennae relatively short, in situ reaching only the end of somite 2 dorsally. Paraterga strongly reduced, virtually missing on somites 7–19 (Fig. 15). Legs relatively short and stout (Fig. 15). Gonopod prefemoral part hypertrophied out of all proportions, both tibiotarsus and solenomerite simple, dentiform, strongly reduced (Figs 6–18). . . . . *E. reductus*

4(3) Antennae and legs considerably longer. Paraterga always present, mostly spiniform caudally. Gonopod prefemur never so strongly hypertrophied, both tobiotarsus and solenomerite never so strongly reduced.

5(6) Paraterga relatively underdeveloped (Figs 19-20), usually well below dorsum, set at 1/3–1/4 midbody height, only their caudal spikes sometimes scarcely reaching the level of dorsum. Transverse sulcus still traceable on metasomite 19. Gonopod tibiotarsus hypertrophied, solenophore-like (Figs 22–24). . . . . *E. perarmatus*

6(5) Paraterga better developed, set mostly at 1/4–1/5 midbody height, almost to fully level to dorsum. No transverse sulcus on metasomite 19. Gonopod tibiotarsus never solenophore-like, nor sheathing solenomerite.

7(10) Suture dividing pro- and metazona striate, although quite indistinct. Gonopod tibiotarsus strongly folded, complex in outline.

8(9) Head only a little wider than collum. Solenomerite about as long as tibiotarsus, simply acuminate at end. . . . . *E. gracilis*

9(8) Head much wider than collum. Solenomerite distinctly longer than tibiotarsus, unciform at end. . . . . *E. postfemoralis*

10(7) Suture dividing pro- and metazona virtually smooth. Gonopod tibiotarsus neither folded nor complex in outline.

11(12) Size lesser: width 1.25 mm. Sternal lamina between ♂ coxae 4 without notch (Fig. 28). Gonopod femorite without processes, tibiotarsus especially strongly reduced, retained only as a low lobe (Figs 29-30). . . . *E. lobatus*

12(11) Size bigger: width 1.6 mm. Sternal lamina between ♂ coxae 4 notched apically (Fig. 32). Gonopod femorite with a distolateral tooth, tibiotarsus long and spiniform (Figs 33-36). . . . . *E. lateridens*

Borneochiropus gen. n.

Type-species: *Borneochiropus spinitergus* sp. n.

Medium-sized Antichiropodini with very modestly developed paraterga. Adenostyles absent. Sternal lamina between ♂ coxae 4 present.

Gonopods remarkable by a medium-sized coxite, a hypertrophied prefemur, a shortened and definitely tortiled femorite, and a very long and ribbon-shaped solenomerite, without trace of a solenophore, but with an outgrowth near base of solenomerite. Seminal groove running mostly laterally before reaching solenomerite.

Remarks: The tribe Antichiropodini has hitherto been considered as restricted to Australia and Tasmania, with only a single possible member encountered in New Guinea (JEEKEL 1968, 1979b). Therefore, the discovery of a representative on Borneo is highly interesting and important zoogeographically (see below).

Within the tribe, *Borneochiropus* seems quite disjunct. Indeed, the absence of adenostyles is almost unique, this character being shared only with the monobasic genus *Mjoebergodesmus* Verhoeff, 1924, from Australia. However, the most striking deviations lie in gonopod structure. What has no parallel not only among Antichiropodini, but perhaps amongst all Paradoxosomatidae but *Euphyodesmus* is the prefemoral part of *Borneochiropus* which is hypertrophied, and the femorite is relatively strongly reduced and unusually strongly shifted dorsad in relation to the prefemur.

The relatively long solenomerite, presence of only a single medio-distofemoral process at the base of the solenomerite, the seminal groove running first along a torsate femorite and then between the distofemoral process and the base of the solenomerite rather strongly resemble those observed in *Haplochiropus* Attems, 1944. Originally, it was proposed as a subgenus of the Southwest Australian genus *Antichiropus* Attems, 1911, for a single species, *A. pustulosus* Attems, 1944, from New Guinea, but later its tribal position was questioned by JEEKEL (1968). However, in view of the existence of a number of true antichiropodines on Borneo, there seems to be no reason to further suspect that ATTEMS (1944) could have mistaken an antichiropodine for an eustrongylosomatine. In other words, *Haplochiropus* is promoted herewith to full generic status, being to some extent intermediate between Australian Antichiropodini and *Borneochiropus* not only morphologically, but also geographically.

Yet *Borneochiropus* displays the most clear-cut relationships with *Euphyodesmus*, thus corroborating with zoogeographical evidence as well. This largely concerns the shared strongly reduced and spiniform paraterga, the strongly hypertrophied gonoprefemorite and the thick solenomerite very often devoid of any support/trace of a solenophore. However, the course of the seminal groove in *Borneochiropus* is singular in passing onto the solenomerite not on the ventral, as is the case in *Euphyodesmus*, but on the dorsal side of the distalmost part of the gonofemorite. This certainly makes both stand as "good" genera. In other words, *Euphyodesmus* and *Borneochiropus* must be regarded as especially closely related genera of the tribe Antichiropodini.

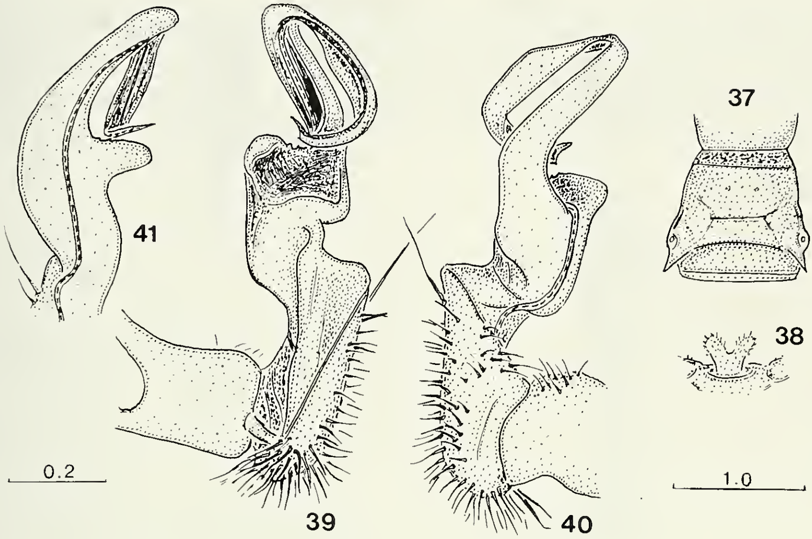
Borneochiropus spinitergus sp. n. (Figs 37-41)

Material: HOLOTYPE ♂ (MHNG), East Malaysia, Borneo, Sabah, Sandakan Residency, Sepilok, forest near pond, degraded lowland rain forest, beaten from vegetation, 26.IV.1982 (8240); leg. D. Burckhardt. – Paratypes: 1 ♂, 1 ♀ (MHNG), same locality, together with holotype. – 1 ♀ juv. (19 segm.) (MHNG), same locality, 26.IV.1982 (8239); leg. D. Burckhardt.

DESCRIPTION

Length of adults ca. 19-20 mm, width of midbody pro- and metazona 0.8 and 1.0–1.1 (♂♂), and 1.0 and 1.2 mm (♀), respectively. Coloration of adults uniform pale yellowish-brown to castaneous-brown, that of juvenile entirely pallid; in adults only paraterga, distal half of antennomere 6, proximal half of antennomere 7, tip of antenna, coxae, prefemora, and most of femora whitish.

Head considerably broader than collum and even midbody somites, postcollar constriction rather evident due to narrowest somites 3–4. Body strongly moniliform, parallel-sided on somites 5–17, onward gently and quite regularly tapering. Antennae very long, slender, in situ reaching beyond somite 5. Paraterga very modestly developed, poorly cariniform on collum and somites 2–4, onward mostly spiniform, somewhat better developed, spike-like, directed largely more dorsally than caudally, almost reaching to rear tergal contour on pore-bearing somites, gradually declining



FIGS 37-41

Borneochiropus spinitergus gen. n., sp. n., ♂ paratype: 37 – somite 10, dorsal view; 38 – sternal lamina between ♂ coxae 4, ventrocaudal view; 39-41 – left gonopod, mesal, lateral, and ventral views, resp. – Scales in mm.

almost to naught on somites 16–19. Paraterga generally set very high, on pore-bearing somites largely above dorsum and almost devoid of rim laterally (Fig. 37), on poreless ones invariably below dorsum, rather strongly rimmed laterally and well removed from rear tergal contour. Surface poorly shining, entirely smooth and very delicately shagreened. Somites strongly constricted, suture dividing pro- and metazona quite deep, somewhat more roughly shagreened but not striate. Transverse metatergal sulcus starting already from collum (♂) or somite 5 (♀), very modestly deep, thin and lineiform, almost wanting on somite 18, totally missing on somite 19. Tergal setae medium-sized, a few on collum and 1+1 on anterior half of somites 2–3, onward obliterated. Pleurosternal keels vestigial and present only on somite 2. Epiproct very short, weakly flattened dorsoventrally, narrowly truncate at tip. Subanal scale broadly and roundly subtrapeziform, usual.

Lamina between ♂ coxae 4 setose, distinctly bifid, higher than coxa, directed ventrad and slightly forward (Fig. 38). Sterna generally more shining, sparsely setose, without modifications. Legs extremely long, several times as long as body diameter, slender, in ♀ a little shorter, ♂ tarsal brushes only on pairs 1–2, onward setation thinning out together with leg elongation toward telson, without adenostyles.

Gonopods (Figs 39–41) very particular. Coxite moderately long, distoventrally modestly setose. Prefemur unusually strongly developed, setose as usual. Femorite shortened, with evidence of torsion, strongly shifted dorsad and knee-shaped near middle, with a curved digitiform outgrowth (vestigial tibiotarsus?) near border between femorite and solenomerite. No trace of tibiotarsus. Solenomerite very long, somewhat coiled, rather ribbon-shaped, apically with a spike terminating seminal groove. Latter running mostly laterally before getting onto solenomerite.

Orangutana gen. n.

Type-species: *Orangutana setosa* sp. n.

Relatively small Orthomorphini with very modestly developed paraterga. Adenostyles absent. Sternal lamina present only between ♂ coxae 4.

Gonopods remarkable by the following combination: coxite long; femorite very long and slender, lacking a sulcus demarcating a postfemoral part; tibiotarsus (= solenophore) hypertrophied due to both lamina lateralis and a distally strongly notched lamina medialis, both laminae sheathing most of a relatively short and flagelliform solenomerite; free solenomerite beginning considerably proximally of, not about level to, sulcus demarcating tibiotarsus. Seminal groove entirely mesal.

REMARKS: In the entire Sunda area, the chiefly Oriental tribe Orthomorphini has hitherto been known to be represented by the genera *Orthomorpha* Bollman, 1893 (Malay Peninsula, Java as well as Farther India, Bali and Lombok), *Gigantomorpha* Jeekel, 1963 (Borneo, Sulawesi, Bali), *Dajakina* Jeekel, 1963 (Borneo, Sumatra), *Nesorthomorpha* Jeekel, 1980 (Java), *Diglossosternum* Jeekel, 1980 (Java), and *Luzonomorpha* Hoffman, 1973 (Philippines). Of these, only *Orthomorpha* displays a gonopod tibiotarsus simple and virtually undivided at tip, so *Orangutana* appears to be more closely related in this respect to the remaining set. No gonopostfemoral sulcus is marked only in *Dajakina* and *Diglossosternum*, so *Orangutana* approaches here both of them. However, the distinctly hypertrophied gonopod solenophore and the beginning of a free solenomerite considerably more proximally of the demarcation sulcus between the femorite and tibiotarsus seem unique and make *Orangutana* easily distinguished from all other known Orthomorphini (see also review: GOLOVATCH 1994a).

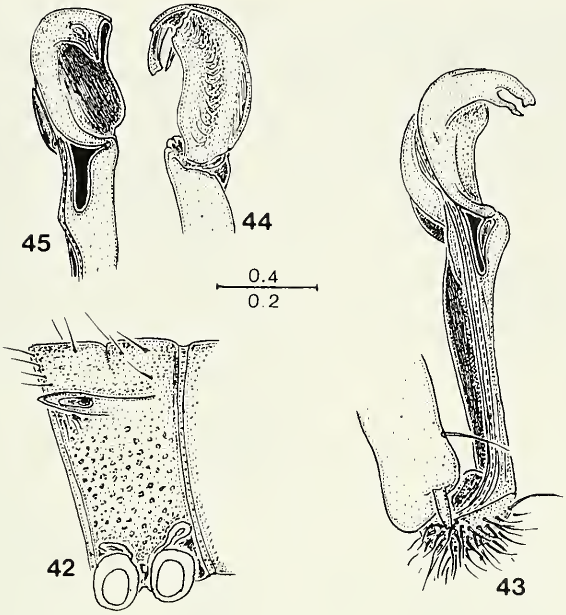
Orangutana setosa sp. n. (Figs 42–45)

Material: HOLOTYPE ♂ (MHNG), East Malaysia, Borneo, Sabah: Sandakan Residency, Sepilok, forest near pond, leaf litter in degraded lowland rain forest (extraction with Berlese-Tullgren funnel), 10.V.1982 (Sab-82/41); leg. B. Hauser. – Paratypes: 1 ♂, 1 ♀ juv. (19 segm.) (MHNG), same locality, together with holotype. – 1 ♂, 1 ♀ juv. (19 segm.) (ZMUM), same locality, sifted leaf litter and rotten wood, Winkler-Moczarski extraction, 23.IV.1982 (Sab-82/7); leg. B. Hauser.

Etymology: The generic and specific epithets refer to the cohabitation with the famous ape Orang-Utan and to the densely setose head and metaterga, respectively.

DESCRIPTION

Length of adults ca. 11–12 mm, width of midbody pro- and metazona 0.95 and 1.0 mm, respectively. Coloration of adults uniform pale yellowish-brownish to pale



Figs 42-45

Orangutana setosa gen. n., sp. n., ♂ paratype: 42 – somite 10, lateral view; 43 – left gonopod, mesal view; 44-45 – gonopod tip, sublateral and subventral views, resp. – Scales in mm.

brown, juvenile entirely pallid; in adults tip of antenna, legs and ventrum whitish-yellow.

Head broadest, a bit broader than midbody somites; collum and somites 2-4 subequal in width, narrowest, but postcollar constriction poorly developed. Body parallel-sided on somites 5-18, onward tapering mostly on telson. Head very densely setose. Antennae rather short, slightly clavate, in situ reaching only beyond somite 2. Paraterga poorly developed, as a thin lappet on collum, always spiniform on subsequent somites, somewhat thicker on pore-bearing somites, set rather low, about 1/3–1/4 midbody height (Fig. 42), always within rear contour on poreless somites, (almost) within contour even on pore-bearing somites in front of somite 12 (Fig. 42) increasingly strongly surpassing rear tergal contour and beak-shaped until somite 15, onward gradually reduced. Surface of prozona dull, very delicately shagreened; sterna shining; metaterga shining dorsally, microgranulate only below paraterga, faintly rugulose in front of metatergal sulcus, more strongly behind it. Somites relatively poorly constricted, suture dividing pro- and metazona rather shallow, poorly striate longitudinally. Transverse metatergal sulcus starting from somite 5, shallow, not very thin, lineiform, almost reaching to base of paraterga, missing on somite 19. Traces of an axial line on postsulcus parts of metaterga. Tergal setae rather long, very dense on collum, onward considerably less dense (also many broken off), but little by little growing more dense caudally, somite 19 already beset with setae almost like head; setation pattern usually as 1-2 irregular rows in front of and 2-3 rows behind sulcus, caudalmost row being especially dense and complete (Fig. 42). Pleurosternal keels entirely missing. Epiproct medium-sized, a little flattened dorsoventrally, with preapical incisions well removed from a narrowly rounded tip. Subanal scale trapeziform, with a usual paramedian pair of indistinct setiferous knobs near rear margin.

Lamina between ♂ coxae 4 setose, broad, about as high as coxa, directed ventrad and slightly forward, distinctly bimodal. Sterna sparsely setose, with vestigial rounded knobs near coxae from ♂ somite 8 onward. Legs relatively short, slightly longer and incrassate in ♂♂ as compared to juvenile, with neither adenostyles nor tarsal brushes.

Gonopods (Figs 43-45) very high, generally slender, only terminally falcate caudally. Femorite with neither traces of torsion nor postfemoral demarcation. Solenophore very strongly developed, about 1/3 femorite in length, set off from femorite by a distinct demarcation sulcus, curved caudad, sheathing a relatively moderately long solenomerite almost all along its length; both lamina medialis and lamina lateralis equally well-developed, former terminally deeply notched. Seminal groove entirely mesal, free solenomerite starting well before demarcation site between femorite and solenophore.

Dajakina longipes sp. n. (Figs 46-53)

Material: HOLOTYPE ♂ (MHNG), East Malaysia, Borneo, Sabah: Sandakan Residency, Sepilok, "Kabili-Sepilok Forest Reserve", forest near "Orang-Utan Rehabilitation Station", 30 m, lowland rain forest, 22.IV.1982 (Sab-82/2); leg. B. Hauser. – Paratypes: 1 ♂ (MHNG), 1 ♂ (ZMUM), same locality, together with holotype. – 2 ♂♂ (MHNG), same locality, beaten from vegetation, 12.III.1983 (Pal-83/7); leg. C. Lienhard.

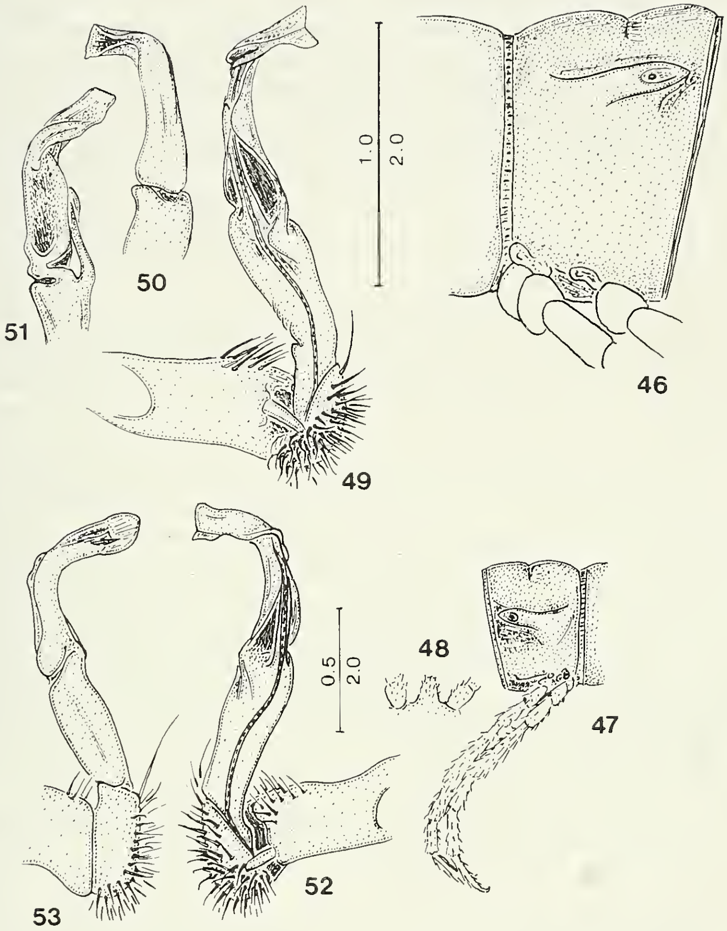
Etymology: The species epithet refers to the extremely long legs.

Diagnosis: Differs from congeners by the presence of a sternal lamina between the ♂ coxae 4 combined with the absence of gonofemoral outgrowths, as well as by the shape of the gonopod tibiotarsus.

DESCRIPTION

Length ca. 29–32 mm, width of midbody pro- and metazona 1.9-2.0 and 2 5-2.6 mm, respectively. Holotype ca. 30 mm long, 2.0 and 2.5 mm wide on midbody pro- and metazona, respectively. Coloration blackish-brown dorsally to somewhat below paraterga, rather sharply contrasting with whitish-yellow ventrum, legs, and lower halves of sides. Antennae brown to dark brown, basal half of antennomere 7 invariably, tip of antennomere 6 sometimes, very dark brown to blackish. Clypeus and labrum whitish to pale brown.

Head, collum, somites 3-4 subequal in width, each a bit broader than narrowest somite 2, but a little more narrow than somite 5. Body modestly moniliform, parallel-sided on somites 5-17, onward very gently and regularly tapering. Antennae very



Figs 46-53

Dajakina longipes sp. n., ♂♂ paratypes: 46-47 – somite 10, lateral view; 48 – sternal lamina between ♂ coxae 4, caudal view; 49-53 – gonopods, mesal, lateral, ventral, mesal, and lateral views, resp. – Scales in mm.

long, slender, very slightly clavate, in situ reaching beyond somite 4. Paraterga very modestly developed, especially thin on collum and somite 2, considerably thicker on pore-bearing somites, set rather low, 1/2-1/3 midbody height (Figs 46-47), always delimited from above and, especially on poreless somites, from below, caudally largely poorly dentiform, a little surpassing rear tergal contour only on somites 2, 18, and 19. Surface poorly shining, generally smooth, rugulose only behind metatergal sulcus. Somites rather strongly constricted, suture dividing pro- and metazona quite deep and strongly striate longitudinally. Transverse metatergal sulcus starting from somite 5, moderately deep, thin and lineiform, missing on somite 19. Tergal setae short, a few on collum and at least 1+1 on anterior half of somite 2. Pleurosternal keels present as rather strong, caudally pointed teeth surpassing rear contour on somites 2-4, smaller denticles almost within contour on somites 5-7, scarcely traceable on somite 8, onward virtually missing. Epiproct medium-sized, somewhat flattened dorsoventrally, with preapical incisions extremely close to a roundly truncate tip, in dorsal view almost parallel-sided throughout, in lateral view almost straight. Subanal scale semi-circular, with a usual paramedian pair of indistinct setiferous knobs near rear margin.

Lamina between ♂ coxae 4 setose, linguiform, about as high as coxa, directed ventrad and slightly forward (Fig. 48). Sterna generally shining, scarcely setose, without modifications. Legs very long (Fig. 47), slender, with neither adenostyles nor tarsal brushes; very moderate setation thinning out together with leg elongation toward telson

Gonopods (Figs 49-53) very slender. Femorite often with traces of dorsal wrinkles parabasally, without postfemoral demarcation. Solenophore about as long and slender as femorite, slightly curved caudad, sheathing a moderately long solenomerite almost all along its length. Tip of tibiotarsus slightly varying in shape.

Remarks: The genus *Dajakina* Jeekel, 1963, has hitherto been known to comprise four species: *D. oculata* Jeekel, 1963 (the type-species), *D. rotundata* (Attems, 1931), *D. hastata* Jeekel, 1983b, all from Borneo, and *D. inermis* (Silvestri, 1895), from Sumatra (Jeekel 1963, 1979a, 1983b). The new species is interesting in having the gonofemorite often slightly rugose in the area supporting a fringe in *D. oculata* and a strong process in *D. hastata*.

All currently known *Dajakina* species can be separated using the following key:

1(4) Paraterga of pore-bearing somites abbreviated, eye-shaped in lateral view.
2(3) Size lesser: width 2.4 mm (♂). Antennomere 6 unmodified, subcylindrical, without inflation. Pleural areas unmodified. Sternal lamina between ♂ coxae 4 present, conical. Gonopod femorite with a long, lanceolate, dorso-parabasal process. . . . . *D. hastata*
3(2) Size bigger: width 4.0 mm (♂). Antennomere 6 characteristically inflated. Pleural areas of ♂ somites 8-18 each with a caudal emargination. No sternal process on ♂ somite 5. Gonopod femorite with only a spike instead of parabasal process. . . . . *D. oculata*
4(1) Paraterga of pore-bearing somites as usual ridges, demarcated by a furrow at least from above.
5(6) Paratergal caudal corner strongly spiniform on several caudalmost somites. Transverse metatergal sulcus starting from somite 2. Sumatra. *D. inermis*
6(5) Paratergal caudal corner at most poorly dentiform. Transverse metatergal sulcus starting from somite 5. Borneo.

7(8) Paraterga rounded caudally, pore-bearing ones demarcated by a furrow only from above. No sternal lamina between ♂ coxae 4. Tarsal brushes on a few anterior legpairs of ♂ . . . . *D. rotundata*

8(7) Paraterga poorly dentiform caudally; pore-bearing ones demarcated by a furrow both from above and below (Figs 46-47). Sternal lamina between ♂ coxae 4 present (Fig. 48). Tarsal brushes wanting. . . . . *D. longipes*

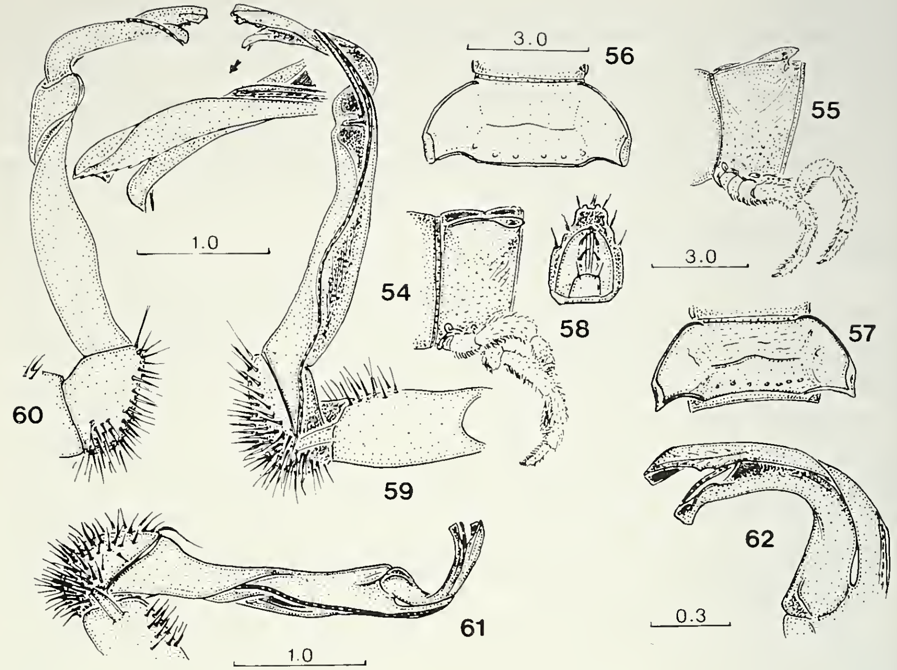
Gigantomorpha immanis Jeekel, 1963 (Figs 54-62)

Material: 2 ♂♂ (MHNG), East Malaysia, Borneo, Sabah, Sandakan Residency, Sepilok, "Kabili-Sepilok Forest Reserve", forest near "Orang-Utan Rehabilitation Station", lowland rain forest, 24.III.1983 (Pal-83/50); leg.B. Hauser. – 1 ♀ (MHNG), same locality, 3.V.1982 (Sab-82/26). – 1 ♀ (MHNG), Sepilok, forest near pond, degraded lowland rain forest, 4.V.1982 (Sab-82/28). – 2 ♂♂ (MHNG), 1 ♂ (ZMUM), Sepilok, "Kabili-Sepilok Forest Reserve", path toward mangrove, before "Ridge", lowland rain forest, 6.V.1982 (Sab-82/30). – 1 ♂ (MHNG), Interior Residency, Kimanis road, 8.5 mi from Keningau, path from "Checkpoint" to above village "Temperate Vegetation Project", 950–1150 m, 13.V.1982 (Sab-82/47). – 1 ♂ (MHNG), same locality, 8.5 mi from Keningau, Checkpoint, near barracks, under stones, 950 m, 14.V.1982 (Sab-82/52); all leg. B. Hauser. – 1 ♂ (broken into several pieces) (MHNG), Borneo, Brunei, Temburong Distr., "Peradayan Forest Reserve" (= "Bukit Patoi"), 14.5 km from Bangar (= 2.5 km from Labu), primary mixed dipterocarp forest, 10-300 m, 24.XI.1988 (Bru-88/39); leg. C. Lienhard.

Remarks: The genus *Gigantomorpha* Jeekel, 1963, has hitherto been known to comprise nine species: *G. immanis* Jeekel, 1963 (the type-species), *G. aterrima* Jeekel, 1963, *G. cornalata* Jeekel, 1963, *G. fasciata* (Attems, 1898), *G. pallida* Jeekel, 1963, *G. spinescens* Jeekel, 1963, *G. transmontana* Jeekel, 1983b, *G. trichopleura* Jeekel, 1963, all from Borneo, and *G. socialis* (Carl, 1912), from Sulawesi (JEEKEL 1963, 1983b). A tenth congener, *G. mutilata* sp. n., has just been encountered on Bali (see below). Of them, *G. immanis* seems to be quite widespread, being encountered at least in Northwest and East Borneo. The above material extends considerably the known range of this species northwesterly.

Already JEEKEL (1963) in his original description of *G. immanis* noted its pronounced variability concerning size, shape of the paraterga and epiproct, leg pubescence, etc. Based on such variations, he even referred some specimens to *G. immanis* with qualifications, writing that "a much more abundant material is needed to decide whether these characters are of really subspecific value or just represent population varieties" (op. cit., p. 247).

The above new evidence allows to significantly refine the variation range of *G. immanis*. The only Brunei ♂ is 3.95 and 6.8 mm in width on midbody pro- and metazona, respectively, while the Sabah specimens at hand are only 48–55 mm in length, width of midbody pro- and metazona 3.9-4.2 and 6.7-7.0 (♂♂), and 4.2-4.8 and 6.8-7.0 mm (♀♀), respectively, this being on the average somewhat less than reported by JEEKEL (1963). The ♂ legs are ventrally densely setose, especially due to prefemora, femora and tarsi, but the degree of gradual thinning out of setation toward the caudal body end varies, sometimes concerning not only somites 15–18, but even 13–18. Sometimes the background coloration can be quite pale brown, but the pattern



Figs 54-62

Gigantomorpha immanis Jeekel, 1963, ♂♂ from near Keningau Checkpoint (54, 56, 58-60) and Kabili-Sepilok (55, 57, 61-62): 54-55 – somite 10, lateral view; 56-57 – somite 10, dorsal view; 58 – telson, ventral view; 59-61 – gonopods, mesal, lateral, and mesal views, resp.; 62 – distal part of gonopod, mesal view. – Scales in mm.

mostly persists, discarding the poor development to virtual absence of a pale prosomital spot in the Brunei and some Sabah samples. What seems even more important is that not only the outline of some paraterga somewhat varies in dorsal view (cp. Figs 56 & 57), but the degree of elevation over the dorsal level ranges from somewhat below (Fig. 54) to a little above it (Fig. 55) even on midbody somites of Sabah specimens alone. The paraterga start surpassing the rear tergal contour on the somites 11 or 12-19, sometimes being very narrowly rounded, more often pointed throughout. The tubercles near the caudal margin of metaterga are often not very flat, as small round knobs (cp. Figs 56-57), the pattern of tuberculation usually being quite irregular, 3-4+3-4, on more caudal metaterga up to 5+5. The metatergal sulcus is always lineiform, mostly quite shallow, only more seldom relatively deep. The terminal knobs on the epiproct can be somewhat bigger or smaller (Fig. 58). Finally, even the gonopods vary in outline a bit (Figs 59-62), although the tip is very characteristic.

WANG & TANG (1965) reported *Orthomorpha hydrobiologica* Atems, 1930, from Singapore. A bit later WANG (1967b) recorded there also *Gigantomorpha tenuipes* (Atems), a Javan species long known to actually belong to the genus *Orthomorpha* (e.g., JEEKEL 1963). Why the latter species was transferred in *Gigantomorpha* by Wang, remains totally obscure, the most probable reason why JEEKEL (1968) ignored it altogether. What seems more important is that an endemic Singapore *Orthomorpha* has since emerged. This is *O. murphyi* Hoffman, 1973, which might well correspond to Wang's record(s) above.

In addition, WANG (1967a) reported *Gigantomorpha fasciata* (Attems) from Brunei and simultaneously transferred three Philippine species of Paradoxosomatidae to *Gigantomorpha*, again giving no explanation to the latter reallocations. It seems noteworthy that all those three forms from the Philippines have since been placed in the orthomorphine genus *Luzonomorpha* Hoffman, 1973. Such obvious mistakes of WANG's, some more of which will be mentioned further below, coupled with a very poor quality of his descriptions question most if not all his diplopod taxonomy (see also below). Concerning WANG's (1967a) record of a *Gigantomorpha* in Brunei, I believe he could have actually dealt with *G. immanis*.

Gigantomorpha mutilata sp. n. (Figs 63-70)

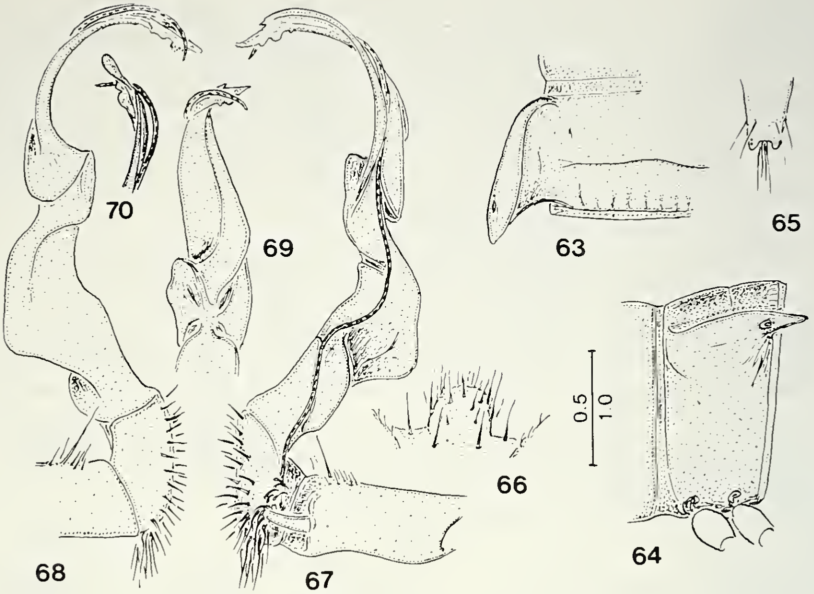
Material: HOLOTYPE ♂ (MHNG), Indonesia, Bali: Bedugul, slope above Lake Bartan, 1130–1180 m, beaten from vegetation, 29.XI.1987 (Sar-87/34); leg. C. Lienhard. – Paratypes: 1 ♀ (MHNG), same data, together with holotype. – 2 ♀♀ (MHNG), 1 ♀ (ZMUM), same locality, Botanical Gardens, forested part, 1230–1260 m, chiefly beaten from vegetation, 30.XII.1987 (Sar-87/36); leg. C. Lienhard.

Diagnosis: Differs from congeners largely by the least body size and conspicuous gonopod structure.

DESCRIPTION

Body length ca. 20–22 mm, midbody pro- and metazonites 2.0 and 3.0 (♂), 2.6 and 3.2 or 2.0 and 2.8–2.9 mm (♀♀), respectively. Coloration generally dark rusty (purplish) brown to chocolate brown; paraterga, lower parts of sides, epiproct and legs brown to pale brown; sterna yellow-brown, tip of antenna whitish.

Head subequal in width to collum and a bit narrower than somite 2, latter a bit narrower than subequally wide somites 3-4. Body parallel-sided on somites 5-16, onward gently and gradually tapering. Antennae not very long, rather slender, in situ extending only beyond somite 3 (♂) or 2 to midway of 3rd (♀) dorsally. Paraterga very strongly developed (Fig. 63), set high (at about 1/4 midbody height), yet not reaching to level of dorsum (Fig. 64), in dorsal view broadly rimmed, in lateral view almost equally narrow on pore-bearing and poreless somites, caudally mostly beak-shaped, pointed and surpassing rear tergal contour (especially well so in ♂), narrowly rounded only on collum (♂) or collum and somite 2 (♀), considerably less strongly protruding only on somite 19. Ozopores big, lateral, inside a shallow groove. Surface poorly shining, only sterna shining, prozonites delicately shagreened, metaterga



FIGS 63-70

Gigantomorpha mutilata sp. n., ♂ holotype: 63-64 – somite 10, lateral and dorsal views, resp.; 65 – epiproct, dorsal view; 66 – sternal lamina between ♂ coxae 4, caudal view; 67-68 – right gonopod, mesal and lateral views, resp.; 69-70 – distal part of right gonopod, ventral and subfrontal views, resp. – Scales in mm.

generally smooth, metazonites slightly rugulose only near base of paraterga and near caudal edge, often almost smooth, sometimes (♂) caudal edge with traces of incisions (Fig. 63); surface below paraterga slightly rugulose and delicately granulate, only collum with traces of an axial line. Both dorsal and lateral surfaces of metazonites micropiliferous, micropilosity being mostly fully or considerably obliterate. Somites only slightly constricted, suture dividing pro- and metazonites shallow, without striation. Transverse metatergal sulcus starting from somite 5, rather shallow, thin and lineiform, reaching to base of paraterga, missing on somite 19. Tergal setae medium-sized, mostly broken off, a few on collum, pattern 2+2 in a presulcus row. Pleurosternal carinae as little caudal teeth only on somites 2–4, onward wanting. Epiproct long, flattened dorsoventrally, in lateral view almost straight, from above conical, preapical incisions little, well removed from tip, apical papillae big (Fig. 65). Subanal scale high and trapeziform, with a pair of well-developed, setiferous, paramedian knobs at caudal margin.

Sterna densely setose, without modifications, between ♂ coxae 4 with a moderately big, roundly subtrapeziform, setose lamina directed mainly ventrally (Fig. 66). Legs not very long, slender, slightly longer and more strongly incrassate in ♂, without adenostyles, femora normal, tarsal brushes present until ♂ legs of somite 11, onward setation thinning out yet very dense, especially so ventrally and in ♂.

Gonopods (Figs 67-70) high and rather complex. Coxite rather short, slender, cylindrical, distoventrally setose. Prefemoral part medium-sized, densely setose as usual. Femorite rather long, folded laterally and, especially, mesally; distofemoral portion demarcated by a well-developed postfemoral sulcus laterally and ventrally; apical part with a ventral lobule with solenomerite starting at its base. Both tibiotarsus and solenomerite long and slender, slightly curved, subequal in length. Apical part of tibiotarsus (= solenophore) without distinct branching, with a few minute lobules and a little ventro-preapical spinule.

Remarks: As noted before, the bulk of *Gigantomorpha* constituents is Bornean (JEEKEL 1963, 1983b). Interestingly, the above new species extends the generic range to the Lesser Sunda. The relatively small size and a little disjunct gonopod conformation of *G. mutilata*, especially the particularly strongly folded femorite, parallel its peripheral distribution, yet failing to broaden the concept of the genus concerned.

A key to Bornean *Gigantomorpha* already exists (JEEKEL 1963) and still holds valid, except that *G. fasciata* sensu JEEKEL (1963) has since been shown to represent an independent species, *G. transmontana* (JEEKEL 1983b). Superficially, another key based on such limited materials as above might seem superfluous, yet just below I provide one, for it allows to incorporate all currently known congeners and to refine some diagnostic features:

1(2) Lesser: width 2.8–3.2 mm (♂, ♀). Paraterga especially strongly bordered (Fig. 63). Sternites usual, without cones near coxae. Gonopods as in Figs 67-70. Bali. . . . . *G. mutilata*

2(1) Bigger: width of adults at least 5 mm. Paraterga less strongly bordered. Sternites modified, usually with a cone near coxa. Gonopods different. Borneo or Sulawesi.

3(6) Lateral sides of collum rounded, caudally not angular. Paraterga 2 turned somewhat ventrad, distinctly below level of paraterga 3. Even ♂ femora straight.

4(5) Lesser: width 5.0–5.4 mm (♂, ♀). A pattern of 4(5)+4(5) very small tubercles near caudal margin of metaterga. Paraterga set relatively low (at about midheight on ♂ somite 4), below them almost all somites with an irregular row of setae along caudal margin. Pleurosternal keels extending back to somite 17. . . . . *G. trichopleura*

5(4) Bigger: width 6.3-8.0 mm (♂, ♀). Usually 3+3 bigger tubercles near caudal margin of metaterga. Paraterga set distinctly higher (at about 1/3 height on ♂ somite 4), without setae below them. Pleurosternal keels extending back only to somite 14 or 15. . . . . *G. spinescens*

6(3) Lateral sides of collum angular caudally. Paraterga 2 turned somewhat dorsad, nearly level to paraterga 3. ♂ femora distinctly arched.

5(8) Coloration in ethanol very dark brown to blackish, with paraterga and a rather narrow continuous middorsal band pale brownish. Gonopod femorite rather strongly constricted about halfway.

6(7) Pleurosternal keels traceable back to somite 14 or 15. ♂ legs more strongly incrassate, all podomeres very densely setose ventrally, forming real brushes of very dense and short setae at least on femora, the brushes gradually thinning out caudally and disappearing only in last pairs. . . . . *G. fasciata*

7(6) Pleurosternal keels traceable back to somite 10 only, onward missing. ♂ legs less strongly incrassate, ventral setation on podomeres forming virtually no true brushes. . . . . *G. transmontana*

8(5) Somites without a continuous middorsal pale band. Gonopod femorite devoid of a notable midway constriction.

9(10) Coloration in ethanol uniform blackish, only paraterga near caudal corner brown. ♂ proximal podomeres beset with short curved setae, femora less strongly arched. . . . . *G. aterrima*

10(9) Coloration of dorsum in ethanol either somewhat paler, sometimes with a pale central spot on prosomites, or dark with contrastingly yellow parts, then at least paratergal caudal corners always yellowish. ♂ legs beset with long erect setae, femora more strongly arched.

11(14) Pleurosternal keels traceable until somite 16 or 17.

12(13) Coloration of dorsum rather uniform pale brownish-gray. Paraterga more or less distinctly projecting caudally beyond rear tergal contour from somite 11 or 12 onward. East Borneo. . . . . *G. pallida*

13(12) Coloration black-brown with caudal corners of paraterga yellow. Paraterga extending caudally beyond rear tergal contour only from somite 15 onward. South Sulawesi. . . . . *G. socialis*

14(11) Pleurosternal keels traceable back at best to somite 14 or 15.

15(16) Paraterga largely strongly elevated above dorsum. Pleurosternal keels traceable back to somite 14 or 15. ♂ legs more slender, proximal podomeres without ventral brushes of setae. . . . . *G cornalata*

16(15) Paraterga more or less level to dorsum (Figs 54-55). Pleurosternal keels traceable back only to somite 9 or 10. ♂ legs more strongly incrassate, with ventral brushes on all podomeres (Figs 54-55). . . . *G. immanis*

Kalimantanina crucifera sp. n. (Figs 71–75)

Material: HOLOTYPE ♂ (MHNG), East Malaysia, Borneo, Sabah, Sandakan Residency, Sepilok, forest near pond, degraded lowland rain forest, beaten from vegetation, 8.V.1982 (82150), leg. D. Burckhardt. – Paratype: ♀ (MHNG), same locality, 26.IV.1982 (8240); leg. D. Burckhardt.

Etymology: The species epithet refers to the peculiar colour pattern on each somite resembling a cross.

Diagnosis: Differs from congeners by the cruciform colour pattern combined with the particularly strongly reduced tooth at base of the solenomerite.

DESCRIPTION

Length ca. 26 (♂) and 31 mm (♀), width 2.0 (♂) and 2.6 mm (♀). Background coloration pale whitish with a peculiar pattern on dorsum consisting of a dark brown, rather narrow, axial stripe crossed on each metatergum by a similar transverse band outlining sulcus, crossing areas and protergal line being often superimposed over a more or less big, pale brown spot; a brown, almost continuous, lateral stripe on each side level to paraterga and covering caudal half of paraterga and mostly extending onto prozona. Antennae pallid, only distally darker, especially due to very dark brown distal half of antennomere 6 and basal half of antennomere 7. Head pale brown eventually throughout. Collum margined narrowly brown.

Head a bit broader than subequal collum and somite 2, but a bit narrower than somites 5-18. Postcollar constriction evident on subequally narrowest somites 3-4. Body distinctly moniliform, rapidly tapering caudad on somites 19-20. Antennae long, slightly clavate, in situ reaching to end of somite 4 in ♂, missing (right) or too short (left) in ♀ (perhaps regenerated). Paraterga modestly developed, somewhat thicker on pore-bearing somites, set rather low, mostly at 1/2-1/3 midbody height, demarcated by a sulcus from above and below, caudally invariably gently rounded and lying mostly within rear tergal contour (Fig. 71), only on somite 19 just a bit surpassing it. Ozopores lying near caudal corner of paraterga in an indistinct groove (Fig. 71). Surface shining, generally smooth, slightly rugulose only below paraterga and behind sulcus. Somites strongly constricted, suture dividing pro- and metazona deep, strongly striate longitudinally. Transverse metatergal sulcus starting from somite 5, moderately deep, thin and lineiform, missing on somite 19. Tergal setae minute, a few on collum, pattern of 2+2 setae on somite 2, of 1+1 at least on somites 3 and 19, mostly missing. Pleurosternal keels present only until somite 7, onward totally missing, better developed in ♂, displayed as small spines either surpassing rear contour (♂) or not (♀). Epiproct long, distinctly flattened dorsoventrally, in lateral view almost straight, from above coniform, rather narrowly truncated, with preapical incisions quite distinctly removed from tip. Subanal scale roundly subtriangular, with a pair of indistinct, setiferous, paramedian knobs at a rather narrow caudal margin.

Sterna scarcely setose, strongly shining, with a big, linguiform, setose lamina between ♂ coxae 4 (Fig. 72). Legs long, similarly slender in both sexes, rather sparsely setose ventrally, without adenostyles.

Gonopods (Figs 73-75) subfalcate, typical for the genus. Base of free solenomerite with a very little, simple, mesal tooth. Tip of tibiotarsus characteristically shaped.

Kalimantanina bruneica sp. n. (Figs 76–81)

Material: HOLOTYPE ♂ (MHNG), Borneo, Brunei, Belait Distr., "Andulau Forest Reserve", 3.5 km S of Sungaim Liang (ca. 39.5 km from Labi), mixed dipterocarp forest, "K-7" beaten from vegetation, 19.XI.1988 (Bru-88/22); leg. C. Lienhard. – Paratypes: 1 ♂ (MHNG), Belait Distr., near Sungai Mau, ca. 14 km along road from Sungai Liang to Labi (1.5 mi along secondary road toward Badas), ca. 50 m, beaten from vegetation, 16.XI.1988 (Bru-88/9). – 1 ♂ (ZMUM), Belait Distr., "Badas Forest Reserve", ca. 10 km along secondary road branching 32 km of Kuala Belait toward S, 10 m, "Kerangas" forest (= tropical heath forest) mostly of *Agathis dammara* (Lambert) L.G.Rich. (Araucariaceae), under bark, 23.XI.1988 (Bru-88/36); all leg. C. Lienhard.

Other material tentatively attributed to this species: 1 ♀ (MHNG), Borneo, Brunei, Tutong Distr., little market on road coming from Muara, 77 km from Kuala Belait, ca. 40 m, beaten from vegetation, 18.XI.1988 (Bru-88/17); leg. C. Lienhard.

Etymology: The species epithet refers to the terra typica.

Diagnosis: Differs from congeners by the generally pallid coloration combined with the peculiar shape both of the tooth at base of the solenomerite and the gonopod tibiotarsus.

Description

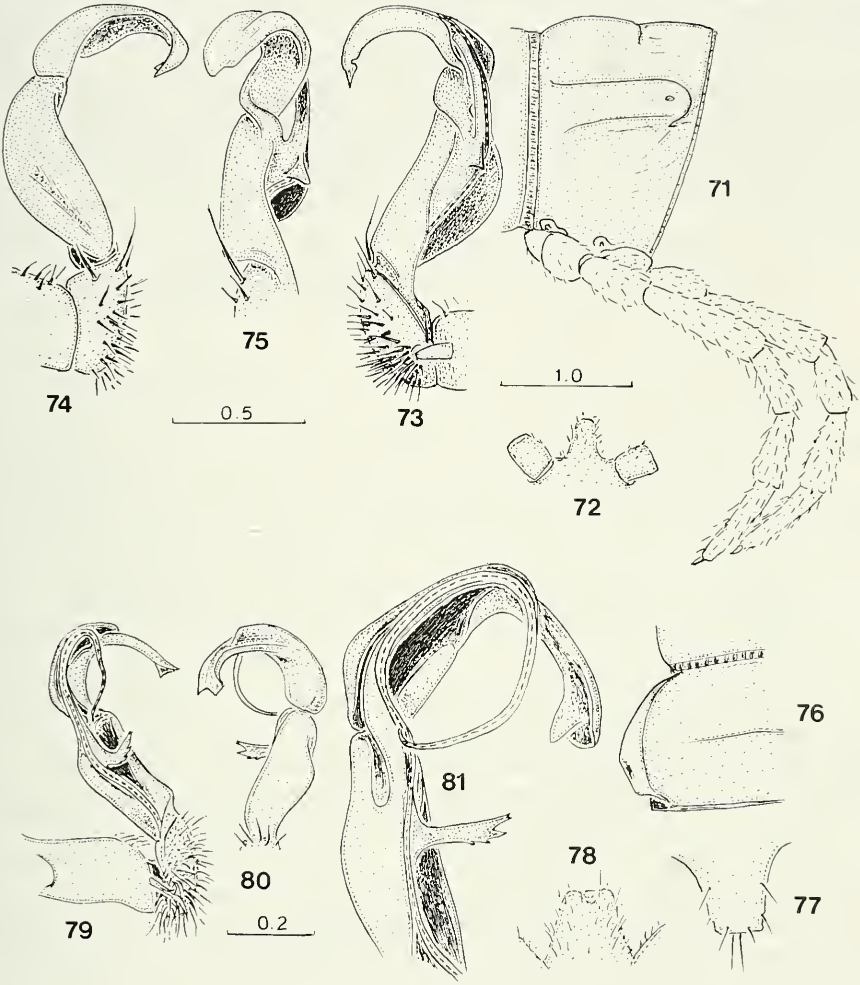
Length of ♂♂ ca. 25-26, width of midbody pro- and metazona 1.7-1.8 and 2.0-2.1 mm, respectively. Coloration entirely pallid to pale yellowish-brown, devoid of a pattern, only distal half of antennomere 6 and most of antennomere 7 sometimes dark brown to blackish.

Head a bit broader than collum, subequal to somites 2 and 4, a little broader than narrowest somite 3 but a bit narrower than somites 5-18, onward body rapidly tapering. Antennae relatively short, slightly clavate, in situ scarcely reaching to end of somite 3 in ♂. Paraterga modestly developed, much like in *K. crucifera*, somewhat thicker on pore-bearing somites, set rather low, largely at 1/2-1/3 midbody height, caudally invariably gently rounded and lying mostly within rear tergal contour (Fig. 76), only on somite 19 just a bit surpassing it and more strongly dentiform; on somite 2 anterior corner with a minute sharp denticle and caudal corner strongly rounded and somewhat surpassing rear tergal contour. Ozopores lateral, lying near caudal corner of paraterga in an indistinct groove (Fig. 76). Surface shining, generally smooth throughout, slightly microgranulate only below paraterga 2-4. Somites strongly constricted, suture dividing pro- and metazona deep, strongly ribbed longitudinally. Transverse metatergal sulcus starting from somite 5, deep, thin and lineiform, missing on somites 18-19. Tergal setae minute, mostly missing, a few on collum, pattern untraceable. Pleurosternal keels preserved only as poorly developed teeth lying within rear contour, present only on somites 2-4 and 6, virtually absent from somites 5, 7 and so on. Epiproct long, distinctly flattened dorsoventrally, in lateral view almost straight, from above coniform, rather broadly truncate, with preapical incisions very poorly developed and placed close to tip (Fig. 77). Subanal scale high, subtrapeziform, with a pair of indistinct, setiferous, paramedian knobs at a rather narrow caudal margin.

Sterna scarcely setose, strongly shining, with a big, trapeziform, setose lamina between ♂ coxae 4 (Fig. 78). Legs long, similarly slender in both sexes, rather sparsely setose ventrally, without adenostyles.

Gonopods (Figs 79-81) subfalcate, typical for the genus. Base of free solenomerite with a little, very slightly curved, serrate, mesal tooth. Tip of tibiotarsus characteristically shaped.

Remarks: The genus *Kalimantanina* Jeekel, 1963, has hitherto been known to comprise five species, all confined to Borneo: *K. ruficeps* Jekel, 1963 (the type-



FIGS 71-81

Kalimantanina crucifera sp. n., ♂ holotype (71-75), and *Kalimantanina bruneica* sp. n., ♂ holotype (76-81): 71 & 76 – somite 10, lateral and dorsal views, resp.; 72 & 78 – sternal lamina between ♂ coxae 4, caudal view; 73–75, 79-81 – gonopods, mesal, lateral, ventral, mesal, sublateral, and subdorsal views, resp.; 77 – epiproct, dorsal view; – Scales in mm: 0.35 (76-77), 0.25 (78-80), 0.12 (81).

species), *K. albonigra* Jeekel, 1963, *K. decolorata* Jeekel, 1963, *K. hirtitarsus* Jeekel, 1963, and *K. ocellata* Jeekel 1963 (JEEKEL 1963). Both *K. crucifera* and *K. bruneica* are quite typical congeners, failing to broaden the concept of the genus concerned.

All currently known *Kalimantanina* species can be separated using the following key:

1(6) Colour pattern present, distinct on body somites.

2(3) Body lesser: width 2.0 (♂) to 2.6 mm (♀). Only paraterga 19 as a small denticle projecting caudally beyond rear tergal contour. Tarsal brushes missing. Transverse metatergal sulcus wanting only on somite 19. Process at base of solenomerite particularly small, dentiform (Figs 73, 75). .... *K. crucifera*

3(2) Body bigger, width closer to 3-3.5 mm (♂). Caudal denticles on paraterga 18-19 lying within rear tergal contour. Tarsal brushes present. Transverse metatergal sulcus wanting on somites 18-19. Gonofemoral process at base of solenomerite bigger.

4(5) White area dorsally of paraterga only half as wide as paraterga. Gonofemoral process lanceolate. .... *K. ocellata*

5(4) White area dorsally of paraterga about as wide as paraterga. Gonofemoral process spiniform. .... *K. albonigra*

6(1) Coloration more or less strongly uniform, pallid to very dark, sometimes only head and anal valves of a contrasting colour.

7(8) Body lesser: width 2.0-2.1 mm (♂). Tarsal brushes missing. Pleurosternal keels only on somites 2-4 and 6. Gonofemoral process little, serrate (Figs 79–81). .... *K. bruneica*

8(7) Body bigger: width at least 2.5 mm (♂). Tarsal brushes present on most ♂ legs. Pleurosternal keels on somites 2-7, sometimes vestigial also on somite 8. Gonofemoral process bigger.

9(10) Background coloration almost entirely pallid. Sternal lamina between ♂ coxae 4 distinctly bilobed. Paraterga 18-19 caudally dentiform and slightly surpassing rear tergal contour. Gonofemoral process arising well proximally of base of solenomerite. .... *K. decolorata*

10(9) Background coloration dark to very dark, blackish, with head and anal valves contrastingly reddish-brown. Sternal lamina between ♂ coxae 4 at most scarcely emarginate. Caudal corner of paraterga 18-19 lying within rear tergal contour. Gonofemoral process arising more distally, just at base of solenomerite.

11(12) Lesser: width 2.5-2.6 (♂) and 3.2-3.4 mm (♀). Tarsal brushes absent from ♂ legs of posterior body half. Gonofemoral process arising from solenomerite. .... *K. ruficeps*

12(11) Bigger: width 3.1 mm (♂). Tarsal brushes absent only from two last ♂ legpairs. Gonofemoral process arising just proximally of base of solenomerite. .... *K. hirtitarsus*

Opisthodolichopus scandens Hoffman, 1973 (Figs 82-85)

Material: 1 ♂, 2 ♀ (MHNG), Singapore: Bukit Timah Nature Reserve, from Summit Hut to Simpang Hut along North View Path, Jungle Fall Path and Fern Valley Contour Path, 90-140 m, beaten from vegetation, 17.XII.1987 (Sar-87/97); leg. C. Lienhard.

Remarks: The above strictly topotypical material fully corresponds to the nice original description (HOFFMAN 1973), as can be seen from the new illustrations (Figs 82-85). This species has hitherto been known only from Singapore and is believed to represent a true arboricole.

In addition to a new congener described just below, the genus *Opisthodolichopus* Verhoeff, 1941, embodies four acknowledged species: *O. javanicus* (Attems, 1903), from Java, *O. nigricornis* (Pocock, 1894) and *O. thienemanni* (Attems, 1930) (the type-species), both from Sumatra, as well as *O. scandens* Hoffman, 1973, from Singapore (JEEKEL 1968; HOFFMAN 1973). Therefore, below is the first record of an *Opisthodolichopus* species in Borneo. The new illustrations of *O. scandens* are provided here for comparative purposes.

Opisthodolichopus bifidus sp. n. (Figs 86-89)

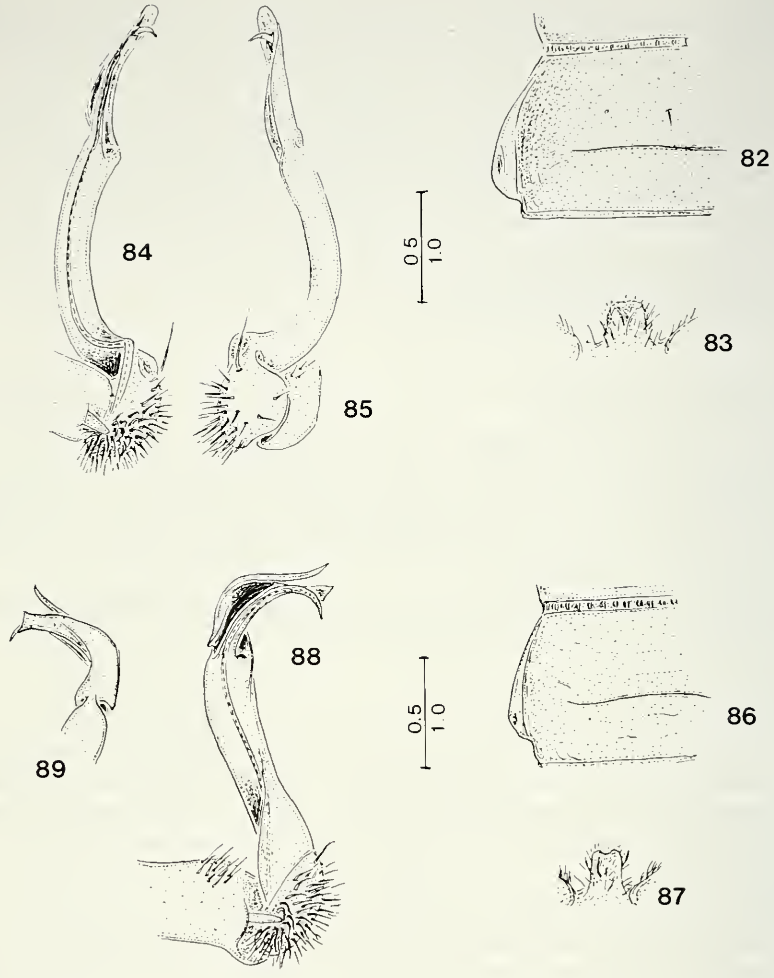
Material: HOLOTYPE ♂ (MHNG), Malaysia, Borneo, Sarawak: Bau, near Cave "Gua Puang" near Kampong Pelaman Sekiang on a steep slope of Gunung Jambusan ("Pang Cave" in Wilford, 1964), 10–30 m, beaten from vegetation, 4.XII.1987 (Sar-87/51); leg. C. Lienhard. – Paratype: ♂ (MHNG), Sarawak: Serian District, Penrissen Road 12 miles from Kuching, Semongok Wildlife Rehabilitation Centre: Nursery Centre of the Forest Department, 20–50 m, 8.XII.1987 (Sar-87/61); leg. B. Hauser.

Diagnosis: Differs from congeners by the distinctly and deeply bifid gonopod tibiotarsus as well as by the considerably shorter gonofemorite.

DESCRIPTION

Length ca. 23-26 mm, maximal width 1.9-1.95 and 2.1-2.2 mm on midbody pro- and metazonites, respectively. Coloration contrasting, being blackish dorsally down to level of paraterga and yellow-whitish below; head, almost entire antennae, epiproct and tips of tarsi pale brownish to brown; tip of antenna whitish, most of antennomere 7 blackish.

Head a bit broader than somite 5 and subequal in width to somite 7, much broader than subequally wide collum and somite 2 and, especially, narrowest somites 3-4. Body parallel-sided on pore-bearing somites (from 7th until 17th), caudally tapering. Antennae relatively long and slender, in situ extending beyond somite 4 dorsally. Paraterga very poorly developed, invariably low (at about body midheight), as a narrow ridge within rear contour only on somite 2, as very poorly developed carinae on somites 3-4, onward as bulges (pore-bearing) or thin (poreless), hardly traceable, vestigial ridges outlined only dorsally due to a sulcus, gradually reducing in size on somites 17-19, caudally always rounded and lying well within rear tergal contour (Fig. 86). Ozopores big, lateral. Surface delicately shagreened almost throughout, shining, polished only on metaterga, slightly rugulose only near fore margin of collum and more coarsely shagreened below paraterga 2–4. Only collum with some traces of an axial line. Somites not very deeply constricted, suture dividing pro- and metazona relatively shallow, strongly longitudinally striate dorsally and dorsolaterally. Transverse metatergal sulcus starting as barely traceable from somite



Figs 82-89

Opisthodolichopus scandens Hoffman, 1973, ♂ (82-85), and *Opisthodolichopus bifidus* sp. n., ♂ paratype (86-89): 82 & 86 – somite 10, dorsal view; 83 & 87 – sternal lamina between ♂ coxae 4, caudal view; 84-89 – left gonopod, mesal, lateral, mesal, and lateral views, resp. – Scales in mm.

5, onward more deep, thin. lineiform, rather short, far from reaching to bases of paraterga, missing on somites 18-19. Tergal setae short, mostly broken off, a few on collum and 1+1 on somite 2, setation pattern perhaps 1+1 or 2+2 in a presulcus row. Pleurosternal carinae as a lappet on somite 2, an oblique low ridge on somites 3-4, an incomplete ridge hardly traceable only caudally on somites 5-6, onward totally missing, never extending beyond rear contour. Epiproct long, flattened dorsoventrally, in lateral view almost straight, from above rather broadly truncate, distal half parallel-sided, preapical incisions distinct and placed close to tip, apical papillae indistinct. Subanal scale semicircular, with a pair of setiferous, paramedian knobs at a convex caudal margin.

Sterna moderately densely setose, without modifications, with a prominent, linguiform, setose, apically slightly emarginate lamina directed mainly ventrally between coxae 4 (Fig. 87). Legs long, slender, gradually growing in length toward caudal body end, perhaps a little incrassate, with neither adenostyles nor tarsal brushes, setation generally sparse to modest, mainly ventral, somewhat more dense only on coxa, prefemur and tarsus, last two especially long and more strongly enlarged.

Gonopods (Figs 88-89) simple, elongate. Coxite rather long, distoventrally setose. Prefemoral part little, densely setose as usual. Femorite relatively short, subcylindrical, folded mesally near base. Both tibiotarsus and solenomerite long and slender. subequal in length, former deeply bifid.

Remarks: The deeply bifid gonopod tibiotarsus coupled with the relatively short gonofemorite make the above new species disjunct among congeners. Such a pattern of somewhat more strongly isolated congeners confined to Borneo has already been observed in some other paradoxosomatid genera, e.g. *Gigantomorpha*, *Dajakina* (JEEKEL 1963).

Superficially, judged from a strongly bifid gonopod tibiotarsus, *O. bifidus* somewhat resembles *Antheromorpha* Jeekel, 1968, *Dajakina* as well as some other Oriental genera of the tribe Orthomorphini. However, *O. bifidus* differs by the completely mesal position of the solenomerite and entirely lateral tibiotarsus characteristic of a sundaninine.

All currently known *Opisthodolichopus* species can be separated using the following key:

1(2) Larger: width 3.3 mm. Pleurosternal keels traceable only on somites 2-4 .... *O. nigricornis*
2(1) Smaller: width at most ca. 2.5 mm. Pleurosternal keels traceable at least until somite 6
3(4) Live coloration carmine-red, in ethanol bleached white with brownish middorsal areas. Pleurosternal keels until ♂ somite 7. Gonopods as in Figs 84-85. .... *O. scandens*
4(3) Coloration in ethanol always contrasting, being dark blackish-brown dorsally and pinkish to white on sides and ventrally. Pleurosternal keels either until somite 6 or until somite 8. Gonopods different, especially tibiotarsus.
5(6) Pleurosternal keels extending back to ♂ somite 8. Gonopod tibiotarsus slender, laminate. Java. .... *O. javanicus*
6(5) Pleurosternal keels extending back only to ♂ somite 6. Gonopod tibiotarsus much more stout, either strongly bifid or broadly laminate.

7(8) Sides and ventrum in ethanol pinkish. Gonopod tibiotarsus broadly laminate. Sumatra. . . . . *O. thienemanni*
8(7) Sides and ventrum in ethanol whitish. Gonopod tibiotarsus deeply bifid. Borneo. . . . . *O. bifidus*

Arthrogonopus proletarius sp. n. (Figs 90–93)

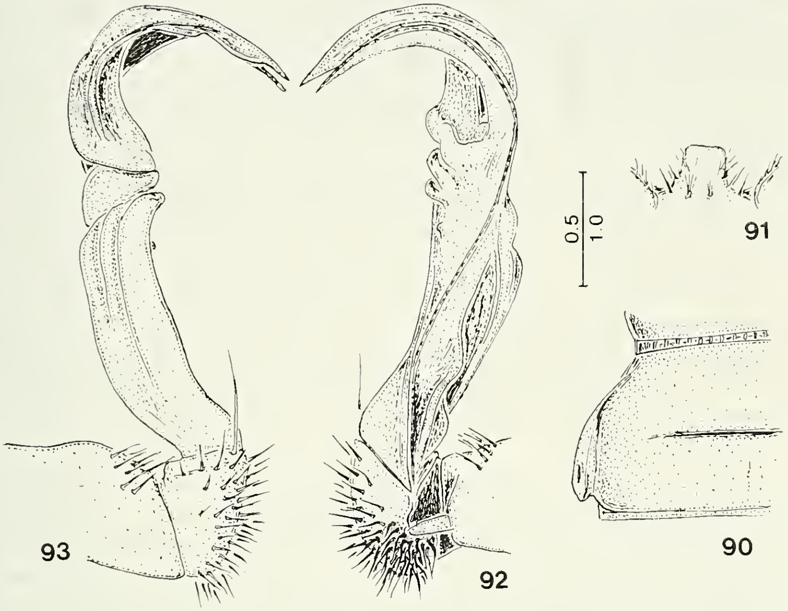
Material: HOLOTYPE ♂ (NHMB), Indonesia, Borneo, Kalimantan Barat: Gunung Palung National Park, Caban Panti Research Site (1°13'S, 110°7'E), primary lowland rainforest, under bark, 20.VII.1993; leg. O. Merkl.

Diagnosis: Differs from congeners by the caudally dentate paraterga combined with the relatively well-developed pleurosternal carinae (present as knobs even on somite 8) as well as the pointed, non-branching and long gonopod tibiotarsus.

DESCRIPTION

Length ca. 38 mm, maximal width 2.5 and 3.0 mm on midbody pro- and metazonites, respectively. Coloration generally blackish-brown; a wide, moniliform, yellowish, axial stripe on dorsum extending to epiproct (especially wide and bright on prozonites and rear half of metazonites, more brownish on frontal half of metazonites); antenna black, only tip whitish; head, paraterga, suture dividing pro- and metazonites as well as ventrum and a few distal podomeres (mostly postfemur, tibia and tarsus, more closely to telson also femur) pale brownish; proximal podomeres whitish-yellow; tibiae and tarsi of last two legpairs considerably infuscate as compared to those of preceding legs.

Head a bit narrower than subequally wide somites 5-16, but broader than collum and, especially, narrowest somites 3-4. Body gently and gradually tapering caudad on somites 18-20. Antennae very long and slender, in situ extending beyond somite 5 dorsally. Paraterga very poorly developed, invariably low, as a narrow ridge extending caudally beyond rear contour only on somite 2, onward as thick (pore-bearing) or thin (poreless) ridges outlined only dorsally due to a sulcus, gradually reduced in size on somites 17-19, caudally almost beak-shaped, very narrowly rounded from somite 5 (Fig. 90). Ozopores big, lateral. Surface delicately shagreened throughout, generally dull, poorly shining only on metaterga, rugulose only below paraterga, some metaterga with traces of an axial line. Somites deeply constricted, suture dividing pro- and metazona deep, strongly striate longitudinally. Transverse metatergal sulcus stalting from somite 5, rather deep, thin and lineiform, at bottom vaguely beaded, missing on somites 18-19. Tergal setae short, mostly broken off, a few on collum, pattern perhaps 2+2 in a presulcus row. Pleurosternal carinae as strong caudal teeth extending beyond rear contour on somites 2-6, as a moderately strong tooth lying within the contour on somite 7, as a little knob on somite 8, onward virtually wanting. Epiproct long, flattened dorsoventrally, in lateral view almost straight, from above rather broadly truncate, distal half parallel-sided, preapical incisions distinct and not greatly removed from tip. Subanal scale subtrapeziform, with a pair of setiferous, paramedian knobs at a very poorly convex caudal margin.



Figs 90-93

Arthrogonopus proletarius sp. n., ♂ holotype: 90 – somite 10, dorsal view; 91 – sternal lamina between ♂ coxae 4, caudal view; 92-93 – right gonopod, mesal and lateral views, resp. – Scales in mm.

Sterna poorly setose, without modifications, with a big, trapeziform, setose lamina directed mainly ventrally between coxae 4 (Fig. 91). Legs long, slender, with neither adenostyles nor tarsal brushes, setation sparse, mainly ventral, somewhat more dense only on coxa, prefemur and tarsus.

Gonopods (Figs 92–93) subfalcate. Coxite rather long, ventrally setose. Prefemoral part small, densely setose as usual. Femorite rather long, folded laterally and, especially, mesally; postfemoral portion set off due to well-developed lateral sulcus, with a couple of little knobs distoventrally. Both tibiotarsus and solenomerite long and slender, subequal in length, pointed.

Remarks: The genus *Arthrogonopus* Jeekel, 1963, has hitherto been considered as being endemic to Borneo, with five species involved: *A. edentulus* Jeekel, 1963 (the type-species), *A. denticulatus* Jeekel, 1963, *A. borneonus* (Attems 1931), *A. bifidus* Jeekel, 1963, and *A. vicinus* Jeekel, 1983b (Jeekel 1963, 1983b). The above new species is a typical congener, failing to alter the generic diagnosis.

The record of *A. borneonus* (as *Orthomorpha borneona* Attems, 1930, sic!) in Singapore by Wang & Tang (1965) is dubious and most probably erroneous, reason why Jeekel (1968) as usual ignored it altogether (see also above and below).

Eventually, WANG & TANG (1965) could well have dealt with *Opisthodolichopus scandens* Hoffman, 1973, the only species of the tribe Sundaninini subsequently reported from Singapore (see also above).

All currently known *Arthrogonopus* species can be separated using the following key:

1(2) Coloration of two last legpairs not differing from that of other legs. Gonopod tibiotarsus with a big, laminate, midway, distolateral process. .... *A. bifidus*
2(1) Last two legpairs contrastingly infuscate at least distally of middle of tibiae, more proximally yellowish-brown, remaining legs brown only in distal halves of tarsi. Gonopod tibiotarsus devoid of a considerable process.
3(6) Even ♂ poriferous paraterga largely fully and more or less strongly rounded caudally, at most subangular, never beak-shaped even on posteriormost somites.
4(5) Pleurosternal keels present on somites 2-8. Gonopod femorite and postfemoral part each with a distoventral knob. .... *A. borneonus*
5(4) Pleurosternal keels only on somites 2-6(7). Gonopod femorite, not postfemur, without distoventral knob. .... *A. edentulus*
6(3) At least a few posteriormost paraterga dentiform caudally (Fig. 90).
7(8) Paraterga relatively poorly developed, growing subangular only toward posterior somites, distinctly angular only on somites 17-18. Pleurosternal keels traceable only until ♂ somite 6. Gonopod tibiotarsus always devoid of a distal tooth, acuminate. .... *A. vicinus*
8(9) Paraterga subdentiform caudally at least from somite 15 onward. Pleurosternal keels present also also on ♂ somite 7. Gonopod tibiotarsus sometimes rounded apically and bearing a distal tooth.
9(10) Paraterga strongly angular, almost dentiform from somite 5 onward (Fig. 90). Pleurosternal keels traceable until ♂ somite 8. Gonopod tibiotarsus acuminate at end, devoid of a distal tooth (Figs 92–93). .... *A. proletarius*
10(9) Paraterga produced into minute denticles caudally on somites of posterior body half. Pleurosternal keels traceable only until ♂ somite 7. Gonopod tibiotarsus with a rounded apical lappet and a distal tooth. .... *A. denticulatus*

Margaritosoma borneorum sp. n. (Figs 94–101)

Material: HOLOTYPE ♂ (MHNG), East Malaysia, Borneo, Sabah, Interior Residency, Kimanis road, 16 mi from Keningau, heliport, 1400 m, mossy forest, beaten from vegetation, 14.III.1983 (Pal-83/14); leg. C. Lienhard. – Paratypes: 1 ♀ (MHNG), same locality, together with holotype. – 1 ♂ (MHNG), Sabah, Interior Residency, Kimanis road, 10 mi from Keningau, 1170 m, secondary forest, beaten from vegetation, 13.V.1982 (82187). – 1 ♀ (MHNG), Sabah, Interior Residency, Kimanis road, 16 mi from Keningau, heliport, 1380-1400 m, mossy forest, beaten from vegetation, 12.V.1982 (82178); all leg. D. Burckhardt. – 1 ♂, 1 ♀ (MHNG), 1 ♂ (ZMUM), Borneo, Brunei, Belait Distr., "Badas Forest Reserve", ca. 10 km along secondary road branching 32 km of Kuala Belait toward S, 10 m, "Kerangas" forest (=

tropical heath forest) mostly of *Agathis dammara* (Lambert) L.G. Rich. (Araucariaceae), under bark, 23.XI.1988 (Bru-88/36). – 2 ♀♀ (MHNG), Borneo, Brunei, Belait Distr., "Andulau Forest Reserve", 3.5 km S of Sungaim Liang (ca. 39.5 km from Labi), mixed dipterocarp forest, "K-7", beaten from vegetation, 19.XI.1988 (Bru-88/22). – 1 ♀ (MHNG), Borneo, Brunei, Belait Distr., "Labi Hills Forest Reserve", "Teraja", 42 km S of Sungai Liang (= 12 km S of Labi), near "Rumah Panjang" (= Longhouse of Kampong Teraja), mixed dipterocarp forest, 40 m, beaten from vegetation, 22.XI.1988 (Bru-88/33); all leg. C. Lienhard.

Etymology: The species epithet emphasizes the first congener encountered on Borneo.

Diagnosis: Differs from congeners both by the especially poorly developed paraterga and by the shape of the gonopod tibiotarsus.

DESCRIPTION

Length ca. 11-12 (♂) and 14-15 mm (♀), maximal width of midbody somites 0.85-0.95 (♂) and 1.0–1.05 mm (♀). Coloration uniform red- to chocolate-brown, body caudally somewhat more pale; only tip of antennae, suture between pro- and metazona, and legs whitish to yellowish.

Head a little broader than subequally wide collum and midbody somites, postcollar constriction slight on subequally narrowest somites 2-3. Body distinctly moniliform, parallel-sided on somites 5-16, onward very gently and gradually tapering. Antennae moderately long, slightly clavate, in situ reaching to end (♂) or midlength (♀) of somite 4. Collum with a lateral rim. Paraterga very weakly displayed as small and low ridges slightly delimited from above and below on somites 2-4 (Fig. 94), onward entirely missing. Ozopores lying very low, surmounting small swellings (Fig. 95). Surface shining, smooth. Somites strongly constricted, suture dividing pro- and metazona deep, extremely strongly striate longitudinally. Metatergal sulcus virtually missing, only sometimes poorly traceable on somites 2-3 (♀). Axial line wanting. Tergal setae rather short to medium-sized, a few on collum, onward a pattern of 2–3+2–3 and sometimes also 2–3+2–3 setae discarding a peculiar caudal seta level to ozopore on each side (Fig. 95). Setae of rear row often incomplete to virtually missing (especially so in Brunei samples). Pleurosternal carinae strong and dentiform on somites 2–3, weak on somite 4, onward obsolete. Epiproct medium-sized, somewhat flattened dorsoventrally, narrowly truncate at apex, lateral incisions strongly removed from tip. Subanal scale trapeziform, with a pair of rather distinct, setiferous, paramedian knobs at caudal corners.

Sterna usual, without modifications, sparsely to modestly setose, strongly shining, with a big, transverse, setose, deeply notched lamina directed ventrad between ♂ coxae 4 (Fig. 96). Legs rather long, somewhat incrassate and more long in ♂ as compared to ♀, with neither adenostyles nor tarsal brushes.

Gonopods (Figs 97-101) rather stout. Coxite not too long, distoventrally setose. Telopodite without evidence of torsion, prefemoral part rather prominent, femorite with a mesal groove and a more (Sabah) or less (Brunei) strongly rounded, dorsal, midway lobe. Lamina medialis of tibiotarsus unciform apically, with a small simple tooth well removed from a more or less slender tip. Lamina lateralis little, ribbon-shaped, more or less strongly bent. Distolateral process of tibiotarsus strong, simple, more or less ribbon-shaped, bent subapically. Seminal groove entirely mesal.

Margaritosoma singaporense sp. n. (Figs 102–105)

Material: Holotype ♂ (MHNG), Singapore, "Island Country Club", between Lower Peirce Reservoir and Windsor Park Estate along Upper Thomson Road, remains of primary forest surrounded by secondary forest, ca. 60 m, beaten from vegetation, 12.XI.1988 (Bru-88/2); leg. C. Lienhard.

Etymology: The species epithet refers to the terra typica.

Diagnosis: Differs from congeners both by the relatively poorly developed, distinctly incised paraterga and by the peculiar shape of the gonopod tibiotarsus.

DESCRIPTION

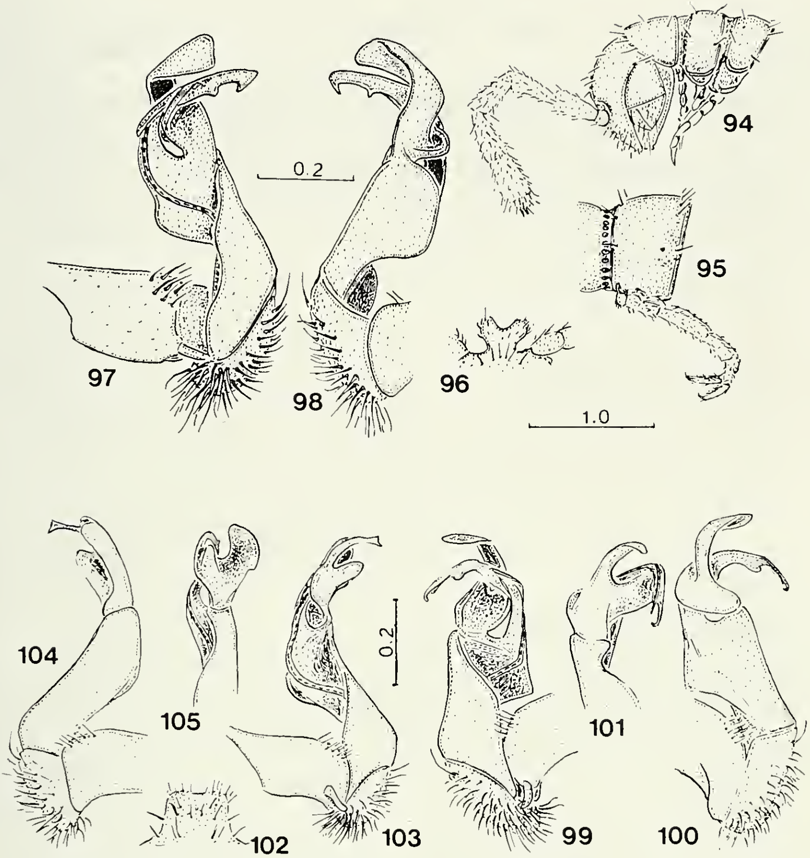
Habitus much like in *M. borneorum*, but differing as follows. Length ca. 11-12 mm, maximal width 0.8 mm on midbody somites. Coloration uniform pale brown, anterior third of body a little brighter, only legs and suture dividing pro- and metazona whitish, and antennomere 7 a little infuscate.

Head subequal in width to somites 5-15, a bit broader than subequally wide collum and somites 2-4. Body distinctly moniliform, very gradually and gently tapering caudad on somites 16–20. Paraterga almost entirely missing, very weakly displayed as small and low ridges on somite 2, hardly traceable due to outlining sulci from above and below only on somites 3-4, onward virtually missing, preserved only as poor swellings. Paraterga 2-3 with three, paraterga 4 with two distinct, lateral, setiferous incisions. Ozopores very low, surmounting the swellings. Transverse metatergal sulcus entirely missing. Tergal setae relatively long, ca. 1.5 times as long as in *M. borneorum*; pattern much like in *M. borneorum* as well, a few on collum, onward 3-4+3-4 and 4+4 setae in two rows, discarding 1-2 peculiar setae behind ozopore until somite 7. Pleurosternal keels vestigial on somites 2-4, onward absent. Epiproct rather long, from above almost parallel-sided, broadly subtruncate, with preapical incisions well-developed and rather strongly removed from tip. Subanal scale low, broadly trapeziform, with a pair of indistinct, setiferous, paramedian knobs at a wide and straight caudal margin.

A big, subtrapeziform, setose lamina directed obliquely anteventrad between ♂ coxae 4 (Fig. 102).

Gonopods (Figs 103-105) less strongly curved, midway dorsal lobe on femorite almost wanting. Lamina medialis with a prominent rounded lobe at basal 1/3, distolateral process of tibiotarsus big and scapuliform.

Remarks: Wang (1967b) once reported *Tectoporus filum* (Silvestri) from Singapore, a species originally very poorly described from Sumatra and presently known to be the generotype of *Margaritosoma* Jeekel, 1979, only since its relatively recent redescription (Jeekel 1979a). Why that species had been reallocated in *Tectoporus* by Wang & Tang (1965), remains totally obscure, the most likely reason why Jeekel (1968, 1979a) simply ignored both record and transfer altogether. What seems more important, however, is that Wang's discovery could have well belonged in fact to *M. singaporense*. Hence the entire situation strongly reminds of Wang's records of *Orthomorpha* and/or *Gigantomorpha* in Singapore (see above).



FIGS 94-105

Margaritosoma borneorum sp. n. (94-101), ♂♂ paratypes from Sabah (94-98) and Brunei (99-101), and *Margaritosoma singaporense* sp. n. (102-105), ♂ holotype: 94 – anterior body portion, lateral view; 95 – somite 10, lateral view; 96 & 102 – sternal lamina between ♂ coxae 4, caudal view (96 drawn not to scale); 97-101, 103-105 – gonopods, mesal, lateral, mesal, lateral, mesal, lateral, ventral, and ventral views, resp. – Scales in mm.

The genus *Margaritosoma* Jeekel, 1979a, has hitherto been known to comprise four species: *M. filum* (Silvestri, 1895) (the type-species), from Sumatra, *M. nanum* (Silvestri, 1895), from Enggano, *M. sequens* (Chamberlin, 1945), from Java, and *M. baliorum* Golovatch, 1994b, from Bali (JEEKEL 1979a; GOLOVATCH 1994b). Besides, JEEKEL (1979a) mentioned one more, yet undescribed congener from Padang, Sumatra, suggesting the genus be much more prolific. The above two new species from Borneo and Singapore confirm that statement to some extent, both are typical members virtually failing to broaden the concept of the genus concerned.

All currently known *Margaritosoma* species can be separated using the following key:

1(2) Transverse sulcus on metaterga present, usual. Paraterga absent, with striae in their stead. Distolateral process of gonopod tibiotarsus especially slender, a little longer than solenophore. Java. . . . . *M. sequens*

2(1) Transverse sulcus on metaterga virtually absent. Somites 5–15 without any traces of paraterga. Distolateral process of gonopod tibiotarsus shorter than solenophore.

3(4) At least most ♂ sterna with a little cone near coxa, lamina between ♂ coxae 4 fully bipartite. Gonopod tibiotarsus relatively little, only ca. 1/3 as long as femorite. Bali. . . . . *M. baliorum*

4(3) Sterna without modifications, lamina between ♂ coxae 4 always as a single piece, usually lingui- to subtrapeziform. Gonopod tibiotarsus always bigger and longer, closer to 1/2 as long as femorite.

5(6) Tergal setae especially numerous, largely 3+3 and 8+8 in two transverse rows. Suture dividing pro- and metasomites not especially strongly ribbed. Distolateral process of gonopod tibiotarsus oblong blade-like. Enggano. . . . . *M. nanum*

6(5) Tergal setae less numerous. Suture dividing pro- and metasomites very strongly ribbed (Fig. 95). Distolateral process of gonopod tibiotarsus either as a very broad lobe or ribbon-shaped.

7(8) Head considerably broader than collum. Tergal setae largely 4(5)+4(5) and 6+6 in two transverse rows. Sternal lamina between ♂ coxae 4 high, linguiform. Tarsal brushes present until two last ♂ legpairs. Sumatra. . . . . *M. filum*

8(7) Head only a little broader than collum. Tergal setae less numerous. Sternal lamina neither too high nor linguiform. Tarsal brushes virtually absent.

9(10) Paraterga 2-4 quite strongly incised. Tergal setae largely 3(4)+3(4) and 4(5)+4(5) in two transverse rows. Sternal lamina between ♂ coxae 4 subtrapeziform (Fig. 102). Distolateral process of gonopod tibiotarsus scapuliform (Figs 103-105). Singapore. . . . . *M. singaporense*

10(9) Paraterga 2-4 only with very vague incisions at lateral margin. Tergal setae usually either as 2(3)+2(3) and 3(4)+3(4) in two rows (Fig. 95) or rear row up to (almost) entirely reduced. Sternal lamina between ♂ coxae 4 strongly emarginate apically (Fig. 96). Distolateral process of gonopod tibiotarsus ribbon-shaped (Figs 97-101). Borneo. . . . . *M. borneorum*

KEY TO PARADOXOSOMATID TRIBES AND GENERA ENCOUNTERED ON BORNEO, WITH A REVIEW OF THE BORNEAN FAUNA:

1(2) Body strongly polydesmoid; paraterga very prominent, devoid of lateral calluses; ozopores located below paraterga. Males yet unknown . . . . Tribe Centrodesmini

Genus *Pleuroporodesmus* Jeekel, 1983a. Only a single species from East Borneo is known: *P. serrulatus* Jeekel, 1983a.

2(1) Body not so strongly polydesmoid; when paraterga prominent, lateral calluses always strongly developed; ozopores always on paratergal calluses. Males known.

3(6) Gonopod prefemorite hypertrophied; solenomerite not flagelliform, very thick and rigid, completely or mostly free from solenophore-like structures, if any. . . . . Tribe Antichiropodini

4(5) Seminal groove passing onto solenomerite on dorsal side of distalmost femorite (Figs 40-41). . . . . Genus *Borneochiropus* n. A single species from East Borneo.

5(4) Seminal groove passing onto solenomerite on ventral side of distalmost femorite (Figs 16, 24, 30, 34). . . . . Genus *Euphyodesmus* Attems, 1931 Seven species, all from West or East Borneo (see key above).

6(3) Gonopod prefemorite never hypertophied, largely usual; solenomerite always flagelliform, slender, mostly closely attached to or sheathed by a well-developed solenophore (= tibiotarsus).

7(8) Gonopod tibiotarsus with a big additional lateral lobe or process (Figs 97–101). Body devoid of paraterga from somite 5 on (Fig. 95) . . . . Genus *Margaritosoma* Jeekel, 1979a

A single and obviously disjunct genus of the tribe Sulciferini yet encountered on Borneo, the above being only the generic diagnosis. Only one species has been recorded in West and East Borneo, several others are widely scattered in the Sunda area (see key above).

8(7) Gonopod tibiotarsus without such outgrowths. Body always with paraterga also on somites 5-19.

9(16) Solenomerite fully mesal, attached to but not sheathed by a completely lateral solenophore. Paraterga always poorly developed. . . . Tribe Sundaninini

10(13) Gonopod femorite devoid of a marked distal process, at best only poor wrinkles in its place.

11(12) Distal part of gonofemorite with a prominent lateral sulcus marking a postfemoral portion, latter with wrinkles distoventrally (Figs 92–93) . . . . Genus *Arthrogonopus* Jeekel, 1963 Six species, all from Borneo (see key above).

12(11) Neither sulcus demarcating a gonopostfemoral portion nor traces of a distofemoral outgrowth (Figs 88–89). Genus *Opisthodolichopus* Verhoeff, 1941 A single species yet encountered on Borneo (see key above).

13(10) Gonopod femorite with a more or less prominent process at or near base of solenomerite.

14(15) Gonopod suberect, tibiotarsus shorter than femorite, curved slightly dorsad. . . . . Genus *Borneonina* Jeekel, 1963 A single species from West Borneo: *B. retrorsa* Jeekel, 1963.

15(14) Gonopod subfalcate, especially so due to a long and ventrally curved solenophore (Figs 73–75, 79–81). . . . . Genus *Kalimantanina* Jeekel, 1963

Seven species, all for East and West Borneo (see key above).

16(9) Solenomerite strongly to almost fully sheathed by solenophore, latter consisting of a lamina medialis and a lamina lateralis. Paraterga often very well-developed, subhorizontal. . . . . Tribe Orthomorphini

17(20) Paraterga very well-developed, mostly subhorizontal, close to level to dorsum.

18(19) Paraterga with moderately strong lateral calluses (Figs 56-57). Gonopod femorite with 1–2 distinct, dorsal, parabasal folds; tip of tibiotarsus with a laminate or spiniform outgrowth (Figs. 59-62) . . . . Genus *Gigantomorpha* Jeekel, 1963

Ten species, of which eight occur on Borneo (see key above).

19(18) Gonopod femorite without dorso-parabasal folds; tip of tibiotarsus as 2-3 minute lappets. . . . . Genus *Orthomorpha* Bollman, 1893

Two species have hitherto been formally reported from Borneo: *O. beaumontii* (Le Guillou, 1841), and *O. coarctata* (de Saussure, 1860). The former taxon is a big form deriving from an unidentified Bornean locality and known only from a single ♀ specimen (see redescription: JEEKEL 1963), whereas the latter congener is much smaller, representing a pantropical anthropochore.

20(17) Paraterga poorly developed, sometimes next to obsolete.

21(22) Gonopod tibiotarsus relatively slender, solenomerite beginning very near to border between femorite and tibiotarsus (Figs 49-53). Gonofemorite sometimes with a dorso-parabasal process or its traces . . . . Genus *Dajakina* Jeekel, 1963

Five species, of which four occur on Borneo (see key above).

22(21) Gonopod tibiotarsus hypertrophied, solenomerite beginning considerably proximad of border between femorite and tibiotarsus (Figs 49-53). Gonofemorite always without even traces of a dorso-parabasal process . . . . Genus *Orangutana* n.

A single species from East Borneo.

In addition, the Bornean paradoxosomatid fauna contains a couple of nomina dubia. The first of these represents a species only possibly deriving from Borneo (and/or Sulawesi?): *Strongylosoma kuekenthali* Attems, 1897. While it is clear now that the taxon has nothing to do with a true *Strongylosoma* Brandt, 1833, its identity remains totally obscure. All previous reallocations in *Orthomorpha* or *Oxidus* Cook, 1911 (ATTEMS 1937; JEEKEL 1963, 1968 — to his credit, the latter author always did so with the necessary qualifications) are bound to be useless as well, since the generic position of *S. kuekenthali* can be clarified only upon re-examination of type material.

The same can be said about yet one more Bornean paradoxosomatid, *Strongylosoma nodulosum* Attems, 1897. This species has been described from a single ♀ specimen deriving from a closer unknown locality, thus discouraging any revisionary attempt. Only a study of new abundant materials of Bornean Paradoxosomatidae may reveal samples best matching the holotype of *S. nodulosum*, thus finally offering a solution to the riddle. Yet one must be realistic that eventually this may never happen.

ZOOGEOGRAPHICAL NOTES

Having already been revised once in the scope of the entire Bornean fauna (JEEKEL 1963), the Paradoxosomatidae definitely still remains a highly insufficiently known millipede family in the entire Australasian area. Eventually, the same concerns all Diplopoda in general of almost any region of the world, especially tropical. The current estimates of the real species diversity of the class range between 50,000 to 80,000, of which only some 11-12% seem to have hitherto been described GOLOVATCH et al. 1995). In other words, with 42 acknowledged species from as many as 12 genera presently recorded in Borneo, perhaps several times as many paradoxosomatids can be expected to be ultimately found there.

Of course, the above statement concerns first of all the species level. Already now a number of genera are quite to highly species-rich on Borneo, e.g., *Gigantomorpha, Kalimantanina, Euphyodesmus, Arthrogonopus.* All of such examples but the first seem to represent true Bornean endemics, while *Gigantomorpha* can be regarded subendemic, with the bulk of its constituents being confined to Borneo. A further increase in the number of species to be yet revealed can be anticipated to be largely due to such prolific genera. On the other hand, judged from the present contribution, the number of genera to be discovered on Borneo is likely to at least double, and not only due to some more pantropical/widespread anthropochores like *Chondromorpha xanthotricha* (Attems, 1898), *Oxidus gracilis* (C. L. Koch, 1847), *Desmoxytes planata* (Pocock, 1895), *Anoplodesmus saussurei* (Humbert, 1965) or *Helicorthomorpha orthogona* (Silvestri, 1898).

Yet an outline of Bornean zoogeography as based on the Paradoxosomatidae, highly preliminary as it is, seems justified. Already JEEKEL (1963) noted that Borneo supports "a paradoxosomatid fauna which, although having general southeast Asiatic features, is characterized by a large percentage of endemic genera" (op. cit., p. 205-206). Discarding a few obvious anthropochores, virtually 100% Bornean paradoxosomatid species are endemic there. Zoogeographically, more instructive appear both generic and tribal levels.

If the quantity of indigenous Bornean species or, to a lesser degree, genera is sure to increase very considerably along with future explorations, the number of tribes is more likely to remain more stable and representative. Altogether, five tribes are currently known to occur on Borneo, with the following constituent genera: Antichiropodini (*Euphyodesmus, Borneochiropus*), Orthomorphini (*Orthomorpha, Gigantomorpha, Dajakina, Orangutana*), Sundaninini (*Arthrogonopus, Opisthodolichopus, Kalimantanina, Borneonina*), Centrodesmini (*Pleuroporodesmus*), and Sulciferini (*Margaritosoma*). As briefly outlined earlier, the Antichiropodini is a chiefly Australian tribe, with only three genera encountered west of West Australia, viz. the Papuan *Haplochiropus* and the above Bornean *Euphyodesmus* and *Borneochiropus*. The remaining tribes are certainly Asian/Oriental in origin, with the Centrodesmini and the Sundaninini clearly centering in the Sunda area. The obviously disjunct sulciferine *Margaritosoma*, the orthomorphines *Gigantomorpha* and the *weberi*-group of *Orthomorpha*, the sundaninine *Opisthodolichopus* join the examples of endemic

Sunda groups, yet not necessarily strictly Bornean. Hence, together with the truly endemic Bornean elements, first of all probably from the largely Sunda tribe Sundaninini, the paradoxosomatid fauna of that great island is indeed strongly dominated by Oriental elements.

What seems more surprising is a relatively pronounced influence of the Australian realm expressed in the obviously endemic Bornean antichiropodines. Moreover, at least one of these, *Euphyodesmus*, appears a quite species-rich genus. The gap between Borneo and New Guinea, in particular Sulawesi, still harbouring virtually no paradoxosomatids Australian/Papuan in origin, e.g., representing the tribes Antichiropodini and/or Eustrongylosomatini, seems to be an artifact, reflecting the yet highly insufficiently explored faunas of the islands/archipelagos lying in between rather than a complete absence of Australian/Papuan influence in the Sunda area east of Borneo. Only further investigations can refute or confirm that. Until then, the above remains mere speculations.

Similar observations of a mixed nature of the millipede fauna of Australasia, with strong dominance of the Oriental realm up to New Guinea in the east, have been reviewed and confirmed recently by SIMONSEN (1990, 1992). Yet there seems to be no reason whatever to explain the modern distribution patterns of the millipedes of the Sunda area in terms of continental drift and Gondwana fragmentation since the Permo-Triassic (criticism of the so-called "mobilistic biogeography" see in: ESKOV & GOLOVATCH 1986). All currently known evidence of the biogeography of Australasian Diplopoda seems to point that the gigantic archipelago in question, both Borneo and New Guinea included, definitely belongs to the Oriental Region, alghough the reciprocal influence of the Australian realm is more or less strongly traceable there as well (cp. GRESSITT 1961). As regards the Paradoxosomatidae, the abovementioned relatively pronounced share of Australian/Papuan components on Borneo suggests an even greater proportion of such forms further to the east. The little that remains to do to prove or disprove this opinion, is to adequately describe at least the Sulawesi fauna which, unfortunately, is still almost unknown.

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Aleocharinae della Sottoregione Africana Orientale al Museo di Ginevra (Coleoptera, Staphylinidae)
Parte III (conclusione)

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Aleocharinae from Eastern African Region in the Geneva Museum (Coleoptera, Staphylinidae). Part III (conclusion). – In this paper, based on the study of 70 species of the tribes Thamiaraeini, Myrmedoniini, Oxypodini, Hoplandriini and Aleocharini, 60 species are described as new. Illustrations for eight holotypes or lectotypes of species described by Bernhauer are given. Five new combinations are recorded.

Key-words: Coleoptera - Staphylinidae - Aleocharinae - Taxonomy - East Africa.

INTRODUZIONE

Con il presente lavoro si conclude l'esame e la pubblicazione delle Aleocharinae dell'Africa orientale conservate al Museo di Storia Naturale di Ginevra. Le due precedenti parti sono state pubblicate nel 1994 e nel 1995 su questa stessa "Revue suisse de Zoologie". Nel presente lavoro sono incluse specie appartenenti, oltre che alle tribù Thamiaraeini, Oxypodini, Hoplandriini e Aleocharini, anche specie appartenenti alla tribù Myrmedoniini, che include uno sterminato numero di specie africane tra loro più o meno affini. Purtroppo gli autori del passato (Fauvel, Bernhauer, Scheerpeltz, Cameron) e anche recenti (Last, Tottenham), che si sono occupati anche della tassonomia dei Myrmedoniini hanno trascurato l'esame accurato dell'edeago e della spermateca. Hanno proposto chiavi di determinazione imperfette e fuorvianti. Pertanto i lavori di questi autori sono di scarso valore e di minima utilità pratica per la determinazione. Ho pertanto esaminato l'edeago e la spermateca di numerosi tipi della tribù Myrmedoniini, come quelli di altre tribù, qui in parte illustrati. Ma l'esame di tutti i tipi esistenti, appartenenti alla tribù Myrmedoniini va oltre le possibilità di un solo individuo.

127° Contributo alla conoscenza delle Aleocharinae.

Manoscritto accettato il 23.12.1994.

Dato lo stato di incertezza attuale sullo studio sistematico di molti generi della sottofamiglia Aleocharinae dell'Africa orientale, e dati i limiti dell'attuale fase di ricerca sul campo, al termine dell'esame delle specie africane di Aleocharinae del Museo di Ginevra, non è possibile formulare varie considerazioni, nè proporre ipotesi sul popolamento di questi minuscoli Coleotteri.

Gli holotypi si conservano nel Museo di Storia Naturale di Ginevra (MG), nel Museo Zoologico "La Specola" dell'Università di Firenze e al D. E. I di Eberswalde. Paratypi si conservano nel Museo di Storia Naturale di Ginevra e in collezione dell'autore.

ELENCO SISTEMATICO DEI GENERI E DELLE SPECIE

THAMIARAEINI

Tyloplatyola microphthalma sp. n. (Figg. 1–8)

Holotypus ♂, Rwanda, Rangiro, 1800 m, 25.III.1973, (Werner leg., MG).

Paratypi: 2 ♂♂, stessa provenienza, ma 6.VIII.1973; 8 es., Rwanda, Kayove, 2100 m, 12.VIII.1973, (Werner leg.); 1 ♀, Rwanda, Gisovu, 18.IV.1973, (Werner leg.).

Descrizione. Lungh. 2,0 mm. Corpo lucido e giallo-rossiccio; antenne giallo-rossicce con i due antennomri basali gialli; zampe gialle. Sul capo la punteggiatura è distinta e la reticolazione è assente. La reticolazione della superficie del pronoto e delle elitre è distinta. Tubercoletti salienti coprono il pronoto e le elitre. Edeago figg. 6–7, spermateca fig. 8.

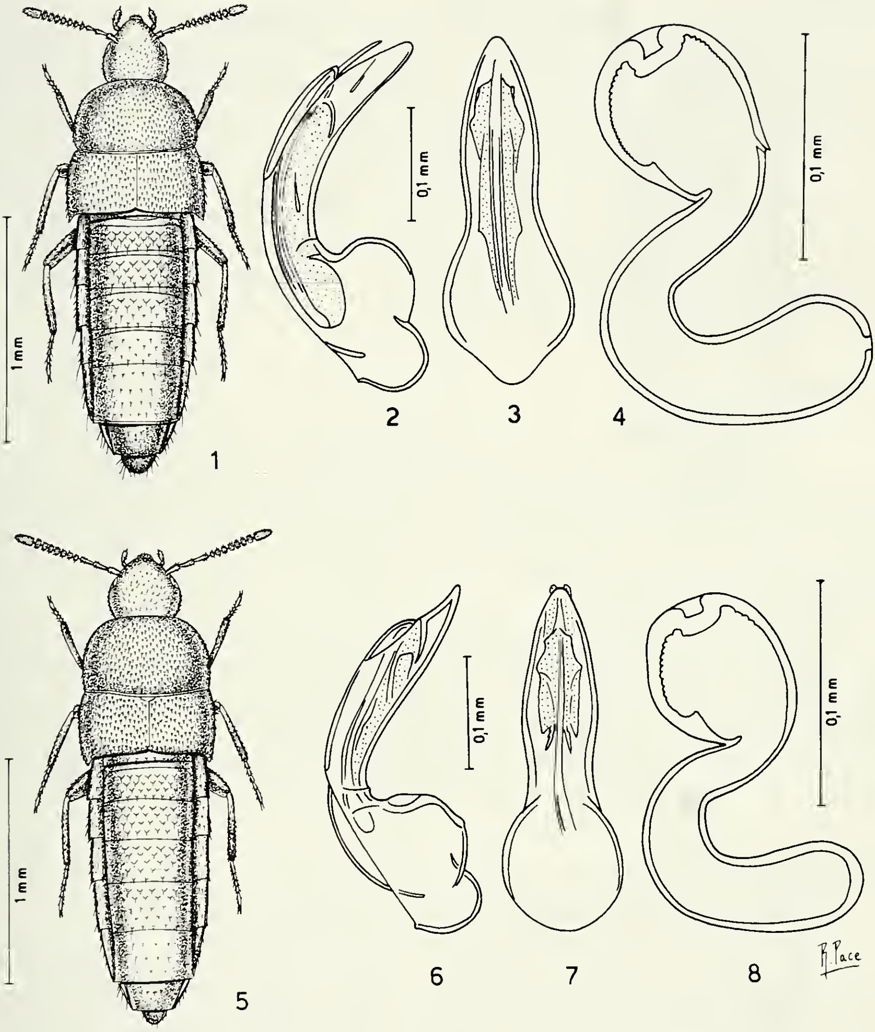
Comparazioni. Per la forma dell'edeago; la nuova specie appare sistematicamente affine a *T. orientalis* Pace, 1986, dell'Africa orientale, ma quest'ultima specie ha elitre molto più lunghe del pronoto e occhi lunghi quanto le tempie, mentre la nuova specie ha elitre più corte del pronoto e occhi molto ridotti. Inoltre l'edeago della nuova specie è più sviluppato e ha flagello del sacco interno più corto.

Tyloplatyola pseudomicrophthalma sp. n. (Figg. 9–11)

Holotypus ♂, Rwanda, Rangiro, 1800 m, 6.VIII.1973 (Werner leg., MG).

Descrizione. Lungh. 2,0 mm. Corpo lucido e giallo-rossiccio, comprese antenne e zampe. La reticolazione del capo e del pronoto è molto superficiale, quella delle elitre è svanita. La punteggiatura del capo è superficiale. I tubercoletti che coprono la superficie del pronoto sono molto superficiali, quelli sulle elitre sono molto salienti. Edeao figg. 10–11.

Comparazioni. La nuova specie è affine a *T. microphthalma* sp. n. sopra descritta. Se ne distingue per il pronoto meno trasverso e coperto di tubercoletti molto svaniti (tubercoletti salienti in *microphthalma*) e per l'edeago più sviluppato, ampiamente ricurvo e angolato al lato ventrale (strettamente ricurvo e non angolato in *microphthalma*).



FIGG. 1–8

Habitus, edeago in visione laterale e ventrale e spermateca. 1–4: *Tyloplatyola microphthalma* sp. n., paratypi di Kayove; 5–8: *Tyloplatyola microphthalma* sp. n., holotypus ♂ di Rangiro, paratypus ♀ di Gisovu.

Tyloplatyola elgonensis sp. n. (Figg. 12–15)

Holotypus ♂, Kenya, Mt. Elgon, 2700 m, Nat. Park, 15.XI.1974, Mahnert & Perret leg., MG).

Paratypi: 21 es., stessa provenienza, ma anche 2700-2800 m e 14.XI.1974.

Descrizione. Lungh. 2,1 mm. Corpo lucido e giallo-rossiccio con elitre rossicce; antenne giallo-brune con i tre antennomeri basali gialli; zampe giallo-rossicce. Il corpo è privo di reticolazione. Il capo presenta tubercoletti fini e salienti. Il pronoto e le elitre sono coperti di tubercoletti salienti. Edeago figg. 13–14, spermateca fig. 15.

Comparazioni. Specie comparabile con *T. microphthalma* sp. n. e *T. pseudomicrophthalma* sp. n. sopra descritte, per avere elitre molto più corte del pronoto e forma simile dell'edeago. Ma la nuova specie presenta habitus più tozzo, occhi meno ridotti, assenza di scultura squamosa dell'addome, edeago molto più sviluppato e parte prossimale della spermateca molto più lunga.

Tyloplatyola coeca sp. n. (Figg. 16–19)

Holotypus ♂, Rwanda, Kayove, 2100 m, 29.IV.1973, (Werner leg., MG).

Descrizione. Lungh. 1,45 mm. Corpo lucido e giallo rossiccio con i due antennomeri basali gialli; zampe gialle. La reticolazione del capo è svanita, quella del pronoto nettissima, quasi vigorosa e quella delle elitre è distinta. Il capo e il pronoto non presentano distinta punteggiatura. Le elitre sono coperte di tubercoletti molto salienti. Edeago figg. 17–18.

Comparazioni. Nell'ambito del genere *Tyloplatyola* Pace, 1984, la nuova specie si presenta isolata a motivo dell'anoftalmia ed elitre poco più corte del pronoto, con addome allargato all'indietro e non appena ristretto all'indietro, come in altre specie del genere. La ligula intera, i palpi labiali di due articoli, la formula tarsale 4–5–5 e il primo tarsomero posteriore lungo come i due seguenti tarsomeri compresi insieme, sono caratteri riscontrati nella nuova specie e tipici del genere *Tyloplatyola*.

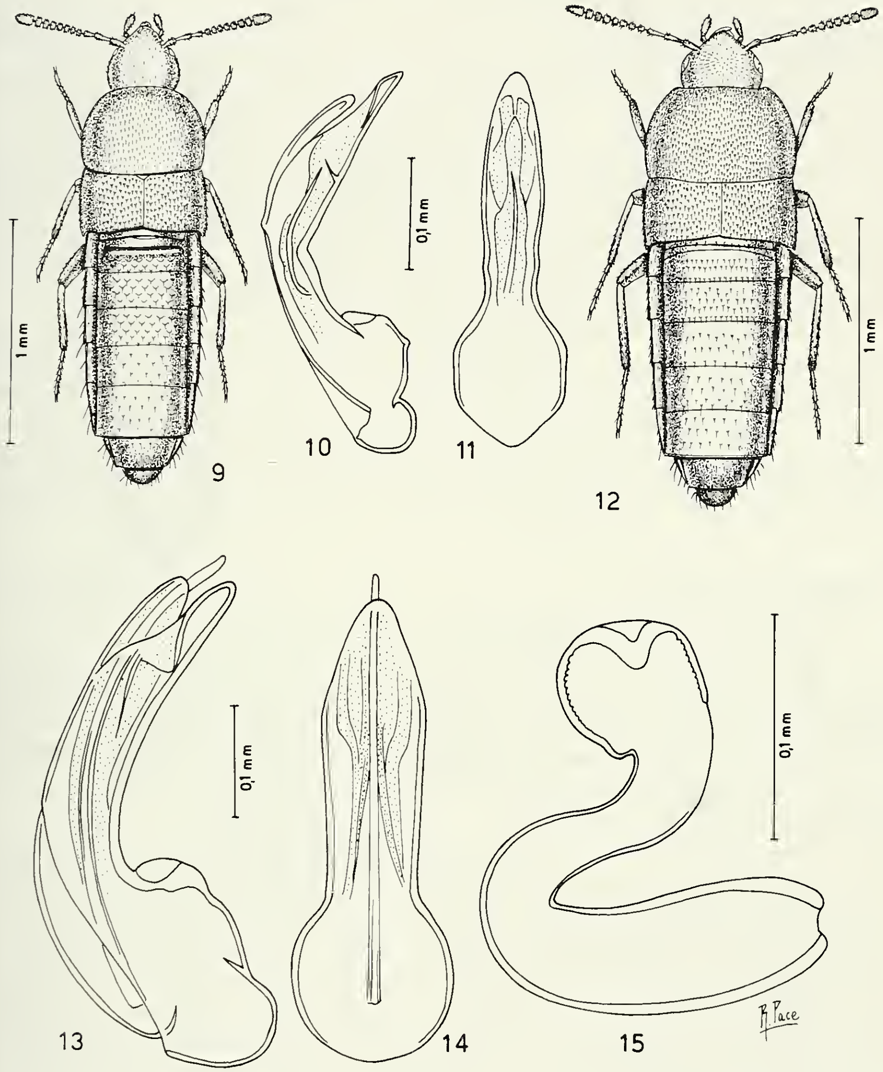
Tyloplatyola ruandensis sp. n. (Figg. 19–22)

Holotypus ♂, Rwanda, Kayowe, 2100 m, 29.IV.1973, (Wernera leg., MG).

Paratypus: 1 ♀, stessa provenienza.

Descrizione. Lungh. 2,2 mm. Corpo lucido e bruno-rossiccio con margini laterali del pronoto e addome giallo-rossicci; antenne bruno-rossicce con i due antennomeri basali gialli: zampe giallo-rossicce. La reticolazione del capo è estremamente svanita, quella del pronoto è distinta e quella delle elitre superficiale. La punteggiatura del capo è svanita. Il pronoto presenta tubercoletti distinti, le elitre hanno tubercoletti superficiali. Edeago figg. 20–21, spermateca fig. 22.

Comparazioni. La nuova specie, in base alla forma della spermateca, sembra tassonomicamente vicina a *T. simplex* Pace, 1984, del Gabon, ma la spermateca della nuova specie è di 1/3 più sviluppata e ha parte prossimale proporzionalmente più allungata. Anche l'habitus mostra caratteri differenziali: addome fortemente ristretto all'indietro nella nuova specie e quasi a lati paralleli in *simplex*; elitre molto



Figg. 9–15

Habitus, edeago in visione laterale e ventrale e spermateca. 9–11: *Tyloplatyola pseudomicrophthalma* sp. n.; 12–15: *Tyloplatyola elgonensis* sp. n.

sviluppate nella nuova specie ed elitre appena più lunghe del pronoto in *simplex*. L'edeago di *simplex* presenta un lungo flagello del sacco interno, assente nel sacco interno dell'edeago della nuova specie.

Tyloplatyola kenyensis sp. n. (Figg. 23–24)

Holotypus ♂, Kenya, Narok, Loita Hills, sous Morijo, 2050 m, 5.XI.1977, (Mahnert & Perret leg., MG).

Descrizione. Lungh. 2,2 mm. Corpo lucido e giallo-rossiccio con metà posteriore delle elitre bruna (per la presenza di ali brune sottostanti le elitre traslucide); antenne giallo-rossicce con i due antennomeri basali gialli; zampe gialle. La reticolazione del capo è assente, quella del pronoto è molto svanita e quella delle elitre superficiale. I tubercoletti che coprono a superficie del capo sono distinti, quelli del pronoto e delle elitre sono molto salienti. Edeago figg. 24–25.

Comparazioni. Per la forma dell'habitus e dell'edeago, la nuova specie è simile a *T. watrousi* Pace, 1984, del Gabon. Tuttavia la nuova specie ha occhi meno sviluppati rispetto a *watrousi* e non presenta caratteri sessuali secondari sulla zona suturale delle elitre del maschio e sul 5° urotergo libero del maschio, come in *watrousi*. Il flagello del sacco interno dell'edeago della nuova specie, all'interno del bulbo basale dell'edeago stesso, è avvolto in 6–7 spire nella nuova specie, mentre in *watrousi* è avvolto in una sola spira.

Tyloplatyola magna sp. n. (Figg. 26–27)

Holotypus ♀, Rwanda, Rangiro, 1800 m, I.1976, (Werner leg., MG).

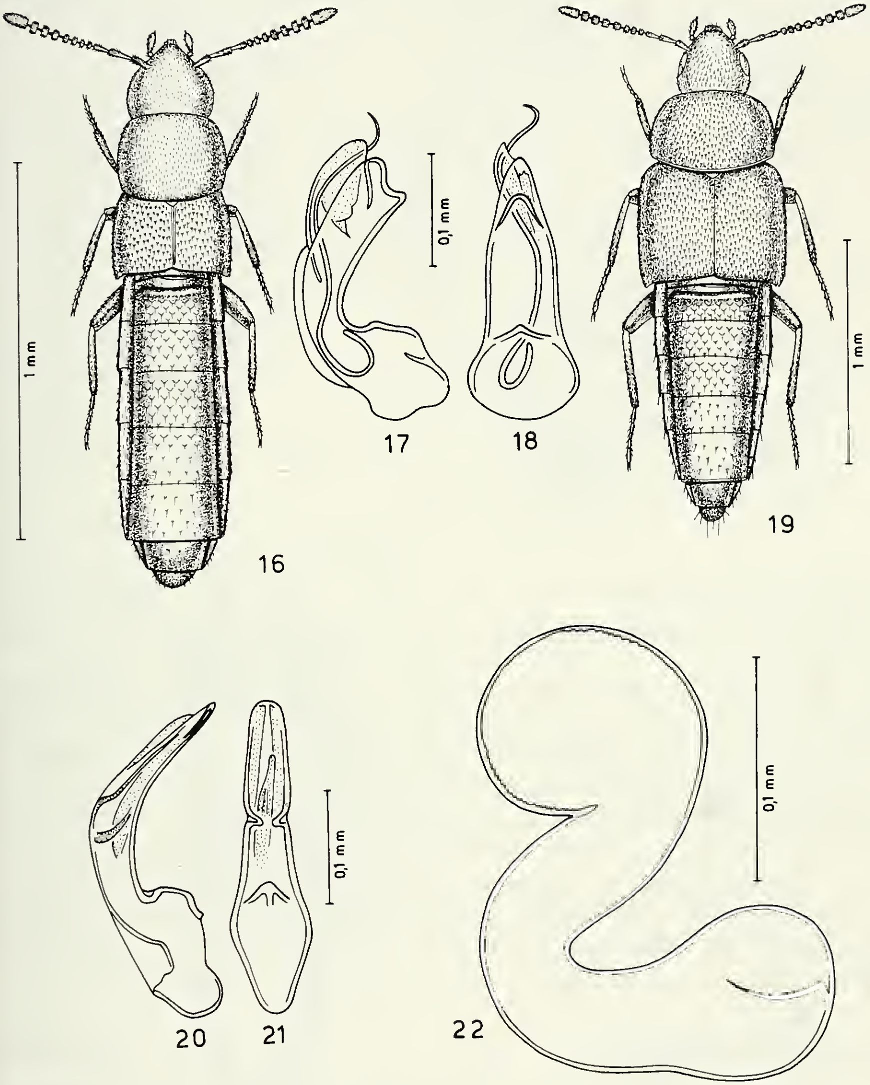
Descrizione. Lungh. 2,3 mm. Corpo lucido e giallo-rossiccio con capo e metà posteriore delle elitre bruno-rossicci; antenne bruno-rossicce con i tre antennomeri basali giallo-rossicci; zampe giallo-rossicce. La reticolazione del capo e del pronoto è svanita, quella delle elitre assente. I tubercoletti che coprono la superficie del capo sono molto superficiali, quelli del pronoto sono svaniti e quelli delle elitre sono distinti. Spermateca fig. 27.

Comparazioni. Specie affine e intermedia tra *T. simplex* Pace, 1984, del Gabon, e *T. ruandensis* sp. n., sopra descritta. Infatti è affine a queste due specie, per la forma simile della spermateca, che ha grandezza vicina a quella della spermateca di *ruandensis*, ma la parte prossimale della spermateca della nuova specie è chiaramente più corta di quella di *ruandensis*. La taglia della nuova specie è più sviluppata e l'addome è appena ristretto all'indietro nella nuova specie e fortemente ristretto in *ruandensis*. Anche *T. simplex* ha addome appena ristretto all'indietro come nella nuova specie, ma la sua taglia è nettamente minore (1,8 mm invece di 2,3 mm come nella nuova specie) e la spermateca di *simplex* è anch'essa di dimensione molto minore.

Polyteinia andreinii Bernhauer, 1933 (Figg. 28–33)

Polyteinia andreinii BERNHAUER, 1933: 59

Materiale esaminato: Lectotypus ♂, Eritrea, Cheren, 28.XII.1902, Dr A. Andreini, con *Thermes bellicosus*, *Polyteinia gridellii* (cancellato), *andreinii* BRNH, n. gen. et sp. (Museo Zoologico de "La Specola", Firenze, N° 7786).



FIGG. 16–22

Habitus, edeago in visione laterale e ventrale e spermateca. 16–18: *Tyloplatyola coeca* sp. n.; 19–22: *Tyloplatyola ruandensis* sp. n.

Nota. Questo genere e la specie non sono stati inclusi da Seevers (1957) nel suo volume "A Monograph on the Termitophilous Staphylinidae". Questa specie termitofila è qui per la prima volta illustrata. Sembra che il genere *Polyteinia* Bernhauer, 1933, non abbia sinonimi.

MYRMEDONIINI

Catarractodes methnerianus (Bernhauer, 1915) (Figg. 34–39)

Catarractes methnerianus BERNHAUER, 1915: 182
Catarractodes methnerianus: STRAND, 1928: 2

Materiale esaminato: Holotypus ♂, D. Ostafrica, Pangani Fälle, 1.VI.1910, Methner, *Catarractes methnerianus* BRNH, Typus un. (Mus. Chicago).

La specie, tipo del genere, è qui per la prima volta illustrata.

Catarractodes fulgens (Bernhauer, 1934), **comb. n.** (Figg. 40–42)

Pachorhopala fulgens BERNHAUER, 1934: 244

Materiale esaminato: Lectotypus ♂, Lubero, 23.VIII.1932, Burgeon, *Pacorrhopala* (sic!) *fulgens* BRNH (Mus. Chicago).

Specie qui illustrata per la prima volta.

Catarractodes somalus sp. n. (Figg . 43–45)

Holotypus ♂, Somalia, Sar Uanle, litorale, 25.III.1973, (S.B.S., Mus. Zool. "La Specola" Firenze).

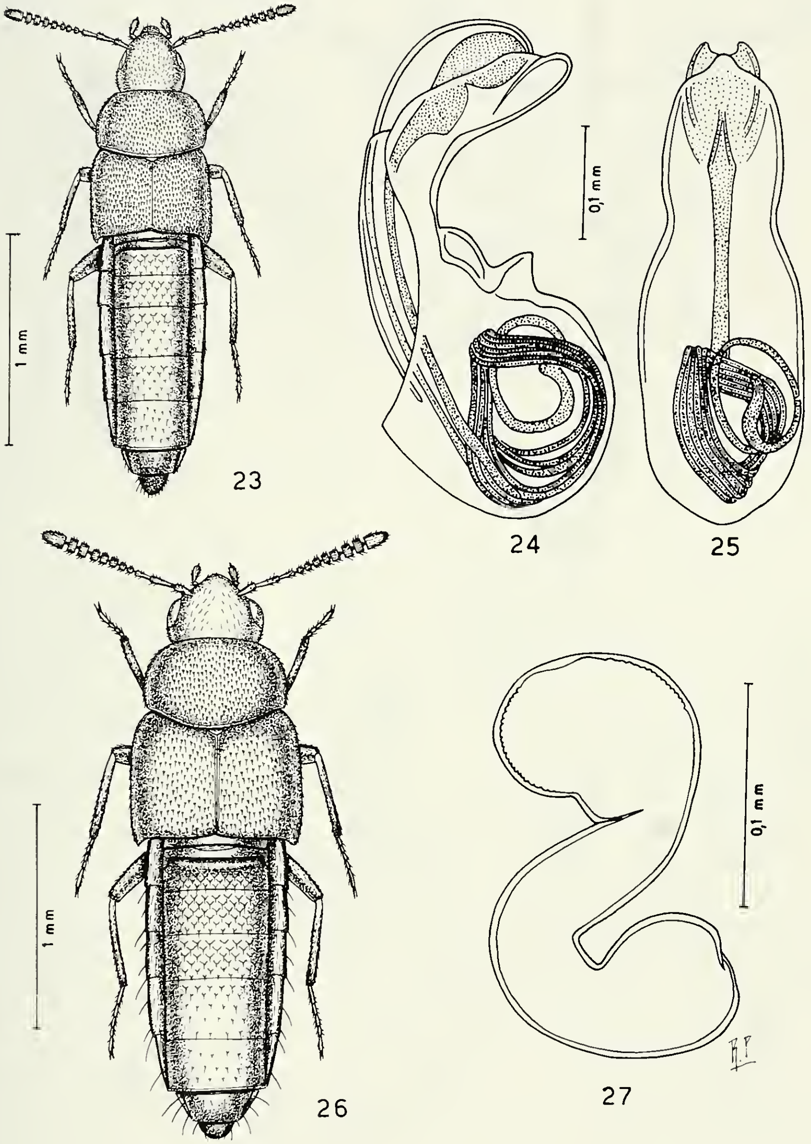
Descrizione. Lungh. 2,7 mm. L'esemplare è molto immaturo. Corpo lucido e giallo, comprese le antenne e le zampe, solo gli uriti liberi 3°, 4° e base del 5° sono rossicci. Solo sulle elitre è visibile una reticolazione svanita: sul resto del corpo la reticolazione è assente. La punteggiatura del capo e del pronoto è molto superficiale, quella delle elitre è svanita. Il 6° urotergo libero del maschio ha una carena mediana smussata: ai suoi lati stanno fossette e tubercoletti arrotondati. Edeago figg. 44–45.

Comparazioni. La nuova specie presenta habitus simile a quello di *C. brunneipennis* (Bernhauer, 1929), dell'Africa orientale, ma gli antennomeri 4° a 10° della nuova specie sono molto trasversi (più lunghi che larghi in *brunneipennis*). Non è noto il maschio di *brunneipennis.*

Catarractodes embuensis sp. n. (Figg. 46–48)

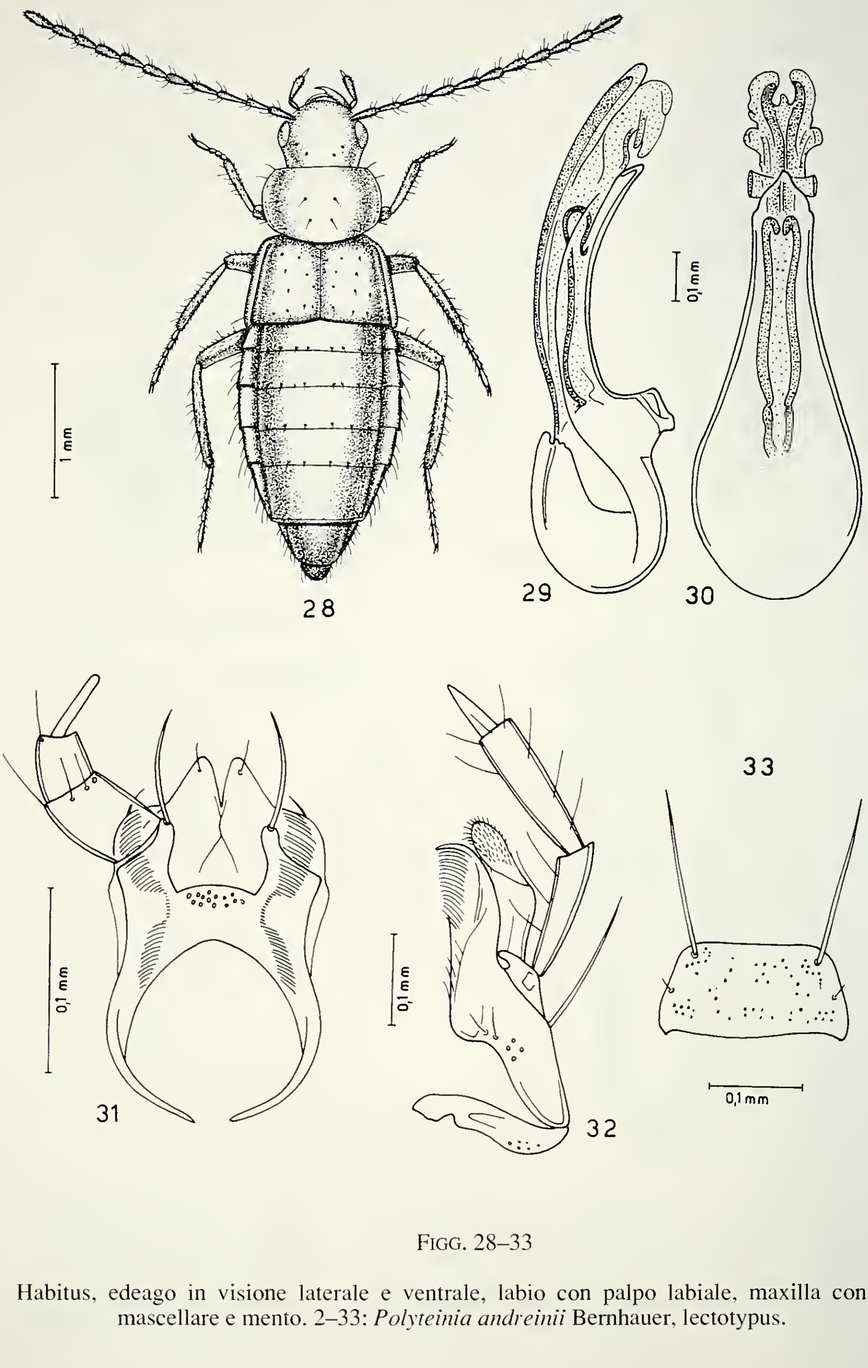
Holotypus ♂, Kenya, Embu, 10 Km 0 Ishiara MI., 900 m, 14.X.1977, (Mahnert & Perret leg., MG).

Descrizione. Lungh 2,5 mm. Corpo lucido e bruno con estremità addominale rossiccia; antenne brune con i tre antennomeri basali giallo-rossicci; zampe rossicce. Tutto il corpo non porta traccia di reticolazione. La punteggiatura del capo è molto svanita sulla metà anteriore e distinta sulla posteriore, quella del pronoto è ben visibile. Tubercoletti salienti coprono le elitre. Edeago figg. 47–48.



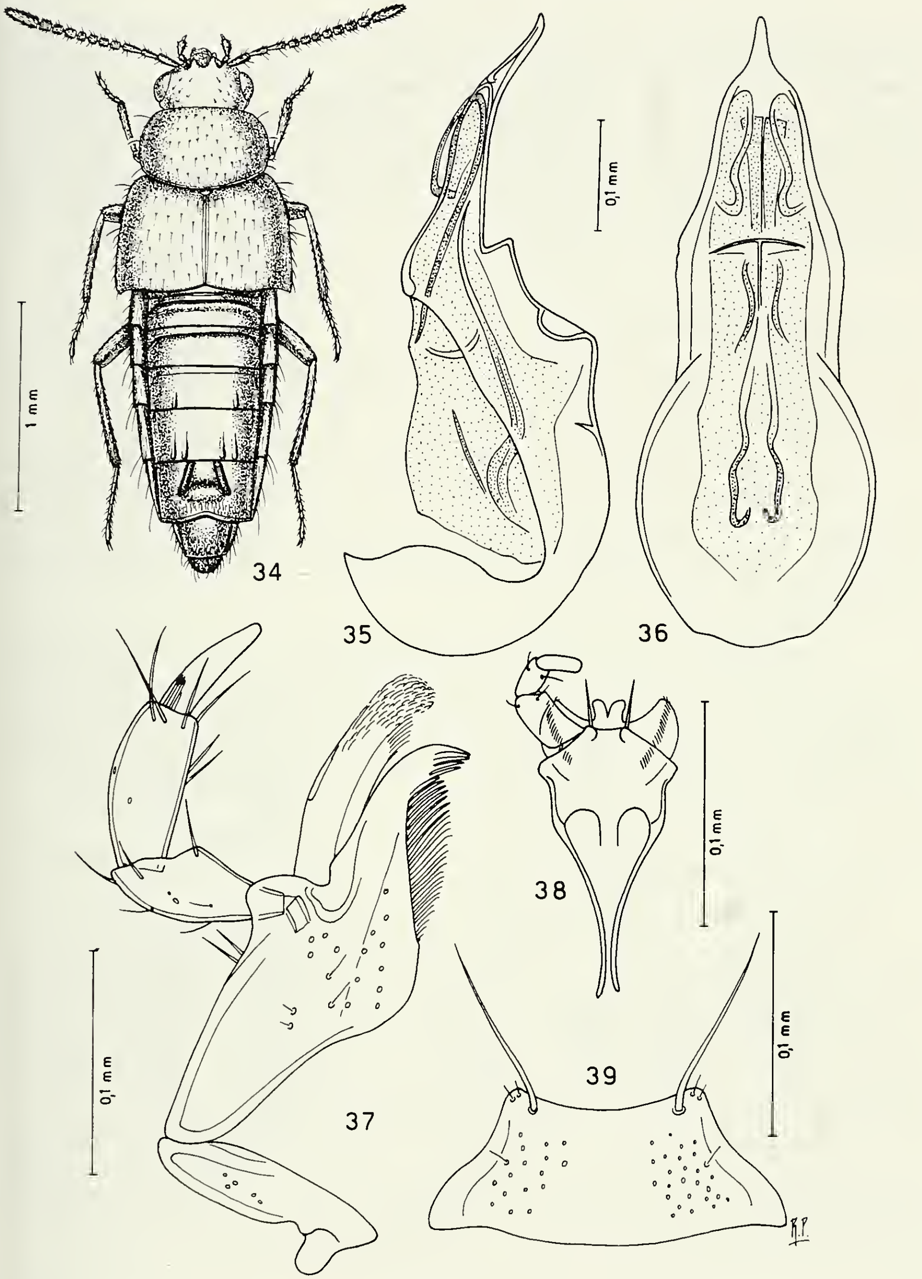
FIGG. 23–27

Habitus, edeago in visione laterale e ventrale e spermateca. 23–25: *Tyloplatyola kenyensis* sp. n.; 26–27: *Tyloplatyola magna* sp. n.



FIGG. 28–33

Habitus, edeago in visione laterale e ventrale, labio con palpo labiale, maxilla con palpo mascellare e mento. 2–33: *Polyteinia andreinii* Bernhauer, lectotypus.



FIGG. 34–39

Habitus, edeago in visione laterale e ventrale, maxilla con palpo mascellare, labio con palpo labiale e mento. 34–39: *Catarractodes methnerianus* (Bernhauer), holotypus.

Comparazioni. Dato che la nuova specie presenta antennomeri 4° a 10° fortemente trasversi, essa è comparabile con *Catarractodes serranoi* (Pace, 1988), **comb. n.**, (olim *Catarractes serranoi* Pace, 1988: 27) e *Catarractodes minimus* (Pace, 1988), **comb. n.** (olim *Catarractes minimus* Pace, 1988: 29), entrambe specie della Guinea-Bissau, che presentano pure antennomeri 4° a 10° fortemente trasversi. Ma la nuova specie ha corpo di taglia minore, con addome meno ristretto all'indietro ed edeago più robusto, rispetto a *serranoi* e corpo di taglia maggiore ed edeago più robusto rispetto a *minimus*.

Catarractodes obscurus sp. n. (Figg. 49–50)

Holotypus ♀, Kenya, Hulmes Bridge, Nanyuki, 1700 m, 22.XI.1974, (Mahnert & Perret leg., MG).

Paratypus: 1 ♀, Rwanda, Kayove, 2100 m, 29.IV.1973, (Werner leg.).

Descrizione. Lungh. 4,0 mm. Corpo lucido e bruno; antenne brune con i tre antennomeri basali giallo-rossicci; zampe giallo-rossicce con femori bruno-rossicci. La punteggiatura del capo è distinta, ma assente sul disco. La netta punteggiatura del pronoto non raggiunge il margine posteriore del pronoto stesso. Le elitre sono coperte di punteggiatura simile a quella del pronoto. Sul corpo non vi è traccia di microscultura reticolare. Spermateca fig. 50.

Comparazioni. La grande taglia del corpo, le antenne sottili, con antennomeri 4° a 10° più lunghi che larghi e gli occhi molto sviluppati, sono i più evidenti caratteri che differenziano la nuova specie dalle restanti specie note. Anche *C. methnerianus* (Bernhauer, 1915) (Figg. 34–39) e *C. fulgens* (Bernhauer, 1934) presentano antennomeri 4° a 10° più lunghi che larghi, ma non sottili come quelli della nuova specie.

Catarractodes striolatus sp. n. (Figg. 51–52)

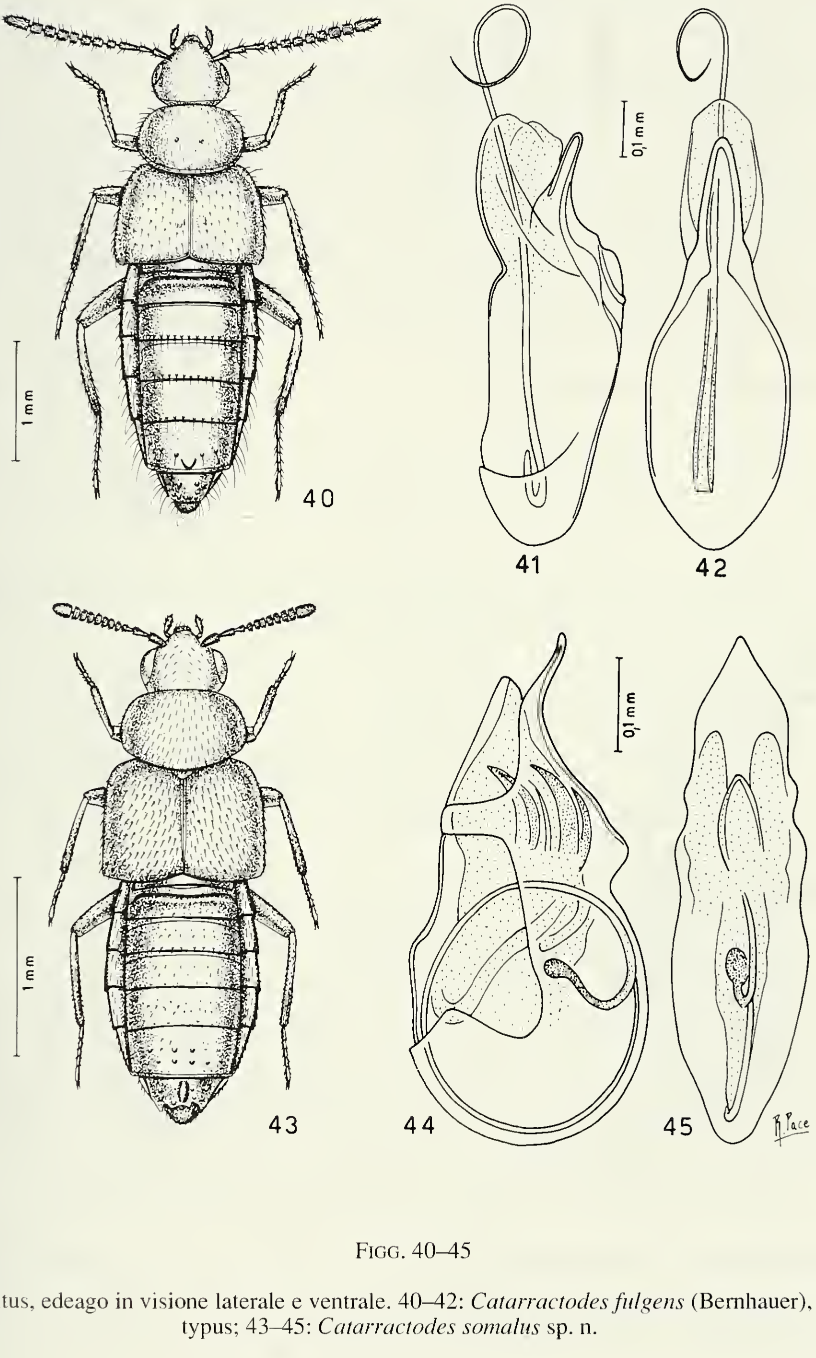
Holotypus ♀, Rhodésie, Umtali, II.1969, (R. Mussard leg., MG).

Descrizione. Lungh. 2,6 mm. Corpo lucido e giallo-rossiccio con capo e 3/4 basali degli uroteghi liberi 3°, 4°, 5° e 6° bruno-rossicci; antenne bruno-ossicce con i tre antennomeri basali e l'apice dell'11° giallo-rossicci; zampe giallo-rossicce. Il corpo è privo di microscultura reticolare. La punteggiatura del capo è distinta. Il pronoto e le elitre sono coperti di tubercoletti salienti. Gli uroterghi liberi 3°, 4° e 5° mostrano nette strie longitudinali, assenti sulla linea mediana. Spermateca fig. 51.

Comparazioni. La nuova specie, per la presenza di striole longitudinali sugli uroterghi liberi 3°, 4° e 5°, è unica nel genere. In base alla forma della spermateca, appare affine a *C. obscurus* sp. n., sopra descritta, ma la spermateca della nuova specie ha dimensione molto più ridotta, rispetto quella di *obscurus*.

Catarractodes hybridus sp. n. (Figg. 53–54)

Holotypus ♀, Kenya, env. Endebess, pr. Kitale, 14.XI.1974, (Mahnert & Perret leg., MG).



Figg. 40–45

Habitus, edeago in visione laterale e ventrale. 40–42: *Catarractodes fulgens* (Bernhauer), lectotypus; 43–45: *Catarractodes somalus* sp. n.

Descrizione. Lungh. 4,4 mm. Corpo lucido e bruno con pronoto giallo-rossiccio e con uroterghi liberi 1° e 2° rossicci; antenne brune con i tre antennomeri basali bruno-rossicci; zampe rossicce. La punteggiatura del capo è superficiale e assente sul disco e ai lati, quella del pronoto è svanita e assente sulla metà posteriore. Tubercoletti ben salienti coprono le elitre. Spermateca fig. 54.

Comparazioni. In base alla forma della spermateca, in parte avvolta a spirale, la nuova specie è comparabile con *C. brunneipennis* (Bernhauer, 1929), dell'Africa orientale. Pure essa ha la spermateca avvolta a spirale, ma il tubulo che compone la spermateca stessa di *brunneipennis*, ha calibro pressoché uguale dal bulbo distale al prossimale, mentre nella nuova specie il calibro del tubulo della spermateca è sottile presso il bulbo distale e progressivamente più ampio verso il bulbo prossimale. Inoltre gli occhi della nuova specie sono meno sviluppati che in *brunneipennis*.

Pachorhopala (s. str.) **usambarae** Bernhauer, 1929 (Figg. 55–58)

Pachorhopala usambarae BERNHAUER, 1929: 241

Lectotypus ♂, "Ost Usambara, D.O.Afr., 12–15, leg. Methner, Oxystigma *Oxystigma usambarae* BRNH., *Pachorhopala usambarae* BRNH. Tupus" (Mus. Chicago).

1 ♂ e 2 ♀♀, Kenya, Miss. Kisumu, NE Kisumu, 1650 m, 10.XI.1974 (Mahnert & Perret leg.).

La specie è qui illustrata per la prima volta. La spermateca non appartiene a materiale tipico, ma a una femmina riconosciuta perché associata a un maschio avente edeago a habitus identici a quelli del lectotypus.

Pachorhopala (s. str.) **rufonitens** Pace, 1985

Pachorhopala rufonitens PACE, 1985: 153

3 es., Kenya, Mt. Kenya, S Met St. Lodge, 3250 m, 23.XI.1974, (Mahnert & Perret leg.).

Specie finora nota solo del M. Aberdare.

Pachorhopala (s. str.) **africana** Bernhauer, 1915

Ocalea (Pachorhopala) africana BERNHAUER, 1915: 186

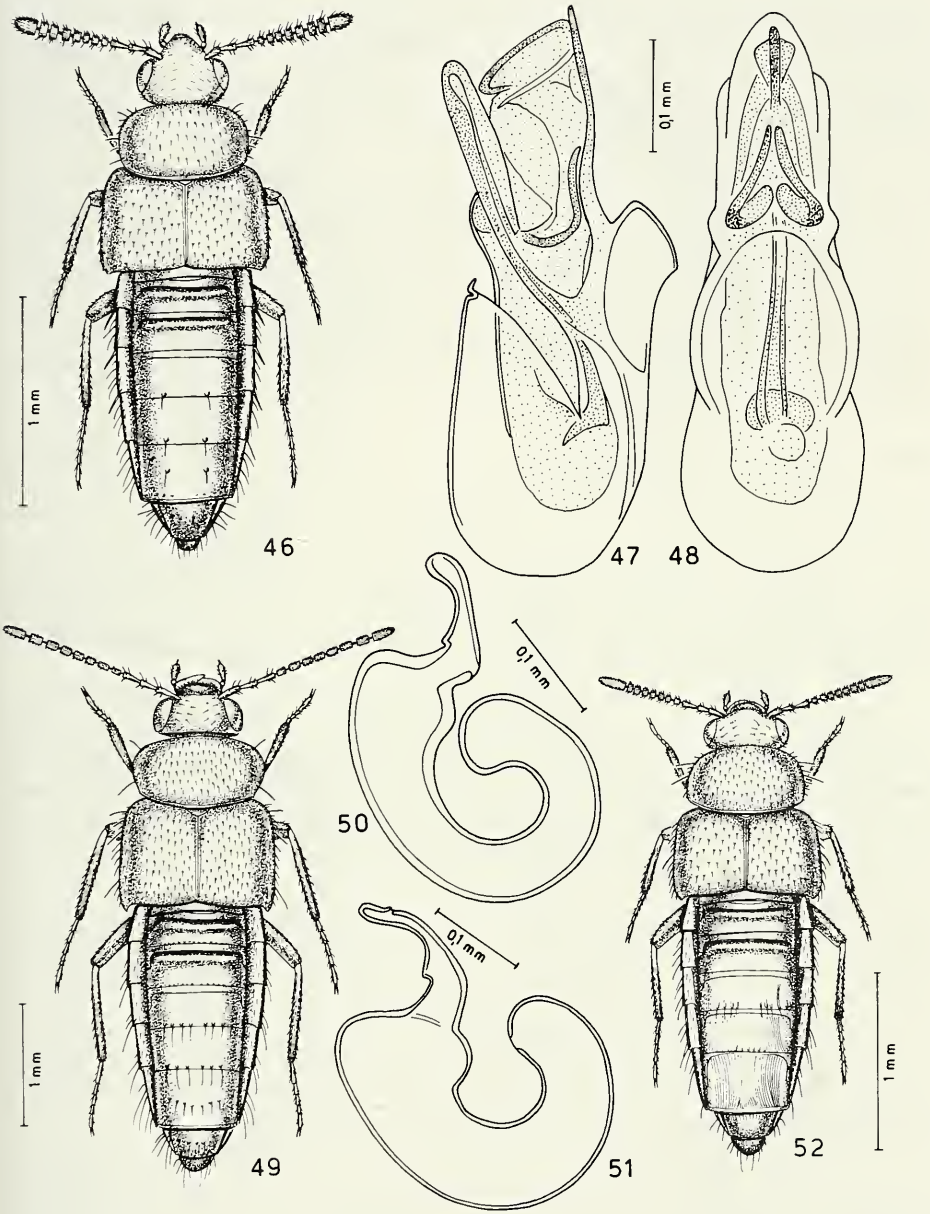
Pachorhopala africana: Scheerpeltz, 1934: 1677

4 ♀♀, Kenya, Embu, Kirimiri For., 13.X.1977, (Mahnert & Perret, leg.); 8 es., Kenya, Embu, Irangi For., 2000 m, 11.X.1977, (Mahnert & Perret, leg.); 1 ♀, Kenya, Embu, 20 Km O Ishiara, 900 m, 14.X.1977, (Mahnert & Perret, leg.); 1 ♂ e 1 ♀, Kenya, Taita Hills, env. Wundanyi, 1400 m, 2.XII.1974, (Mahnert & Perret, leg.); 6 es., Kenya, Kiambu, près de Limuru, 2300 m, 2.XI.1977, (Mahnert & Perret, leg.); 1 es., Kenya, Thomson's Falls, 2350 m, 20.XI.1974, (Mahnert & Perret, leg.); 1 es., Kenya, Mau For., Mau Saummit-Kedowa, 7.XI.1974, (Mahnert & Perret, leg.); 3 ♀♀, Rhodésie, Umtali, II.1969, (R. Mussard leg.); 3 ♂♂ e 1 ♀, Kenya, Lac Nakuru; Parc Nat., 6.XI.1974, (Mahnert & Perret, leg.).

Specie finora nota di una sola località dell'Africa orientale: Usambara.

Pachorhopala (s. str.) **kayovensis** sp. n. (Figg. 59–61)

Holotypus ♂, Rwanda, Kayove, 2100 m, 12.VIII.1973, (Werner leg., MG).
Paratypus: 1 ♂, stessa provenienza.



FIGG. 46–52

Habitus, edeago in visione laterale e ventrale e spermateca. 46–48: *Catarractodes embuensis* sp. n.; 49–50: *Catarractodes obscurus* sp. n.; 51–52: *Catarractodes striolatus* sp. n.

Descrizione. Lungh. 4,9 mm. Corpo lucidissimo e giallo-rossiccio con metà posteriore delle elitre (tranne i lati esterni) e uriti liberi 1° (tranne la metà posteriore), 2° (tranne la metà posteriore e i lati), 3° e 4° (tranne i lati) bruni; antenne e zampe giallo-rossicce. La punteggiatura del capo è molto svanita e assente sulla linea mediana, quella del pronoto e delle elitre è distinta. Sul corpo non vi è traccia di microscultura reticolare. Edeago figg. 60–61.

Comparazioni. Per l'habitus, la nuova specie sembra simile a *P. africana* Bernhauer, 1915, dell'Africa orientale, tuttavia la punteggiatura del pronoto e delle elitre della nuova specie è distinta, mentre è assai svanita in *africana*. Ma è l'edeago che presenta caratteri differenziali più marcati: edeago profondamente incavato al lato ventrale nella nuova specie, non incavato in *africana*; piastre del sacco interno dell'edeago con stiletto distale nella nuova specie e con due punte distali in *africana*; edeago, in visione ventrale, a lati debolmente convergenti verso l'apice nella nuova specie, fortemente in *africana*.

Pachorhopala (s. str.) **tambachensis** sp. n. (Figg. 62–64)

Holotypus ♂, Kenya, Tambach, E Eldoret, 2000 m, 17.XI.1974, (Mahnert & Perret leg., MG).

Descrizione. Lungh. 4,1 mm. Corpo lucido e bruno con capo bruno-rossiccio e pronoto giallo-rossiccio; antenne e zampe giallo-rossicce. La punteggiatura del capo e delle elitre è distinta, quella del pronoto è svanita. Non esiste microscultura reticolare sul corpo. Edeago figg. 63–64.

Comparazioni. In base alla forma dell'edeago, la nuova specie presenta affinità con *P. kayovensis* sp. n. sopra descritta. Tuttavia quest'organo nella nuova specie è meno sviluppato e ha l'armatura del sacco interno a stiletto largo e tronco all'apice e non sottile e aguzzo all'apice come in *kayovensis*. Inoltre il 3° antennomero della nuova specie è lungo quanto largo, mentre in *kayovensis* e nettamente trasverso e la punteggiatura del pronoto è superficiale nella nuova specie, ben distinta in *kayovensis*.

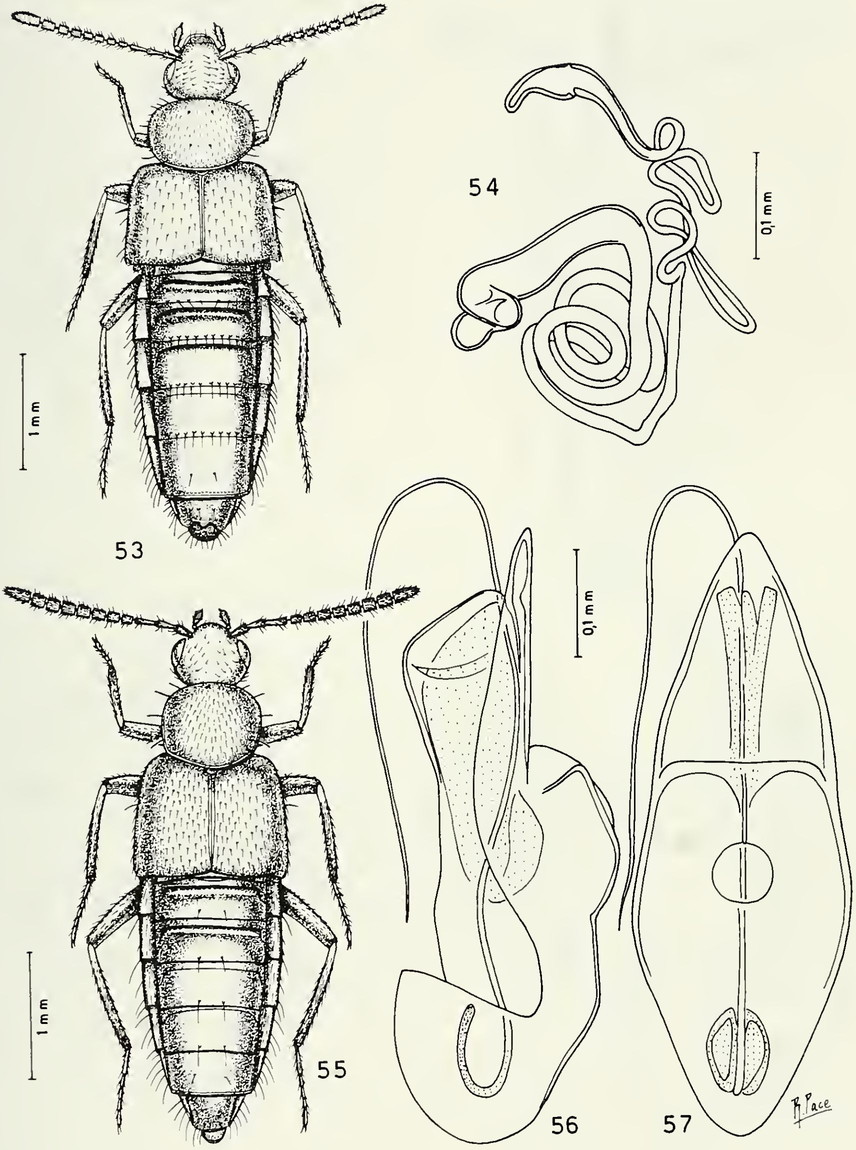
Pachorhopala (s. str.) **laevigata** sp. n. (Figg. 65–68)

Holotypus ♂, Kenya, Miss. Kaimosi, NE Kisumu, 1650 m, 10.XI.1974, (Mahnert & Perret leg., MG).

Paratypi: 1 ♂ e 2 ♀♀, stessa provenienza.

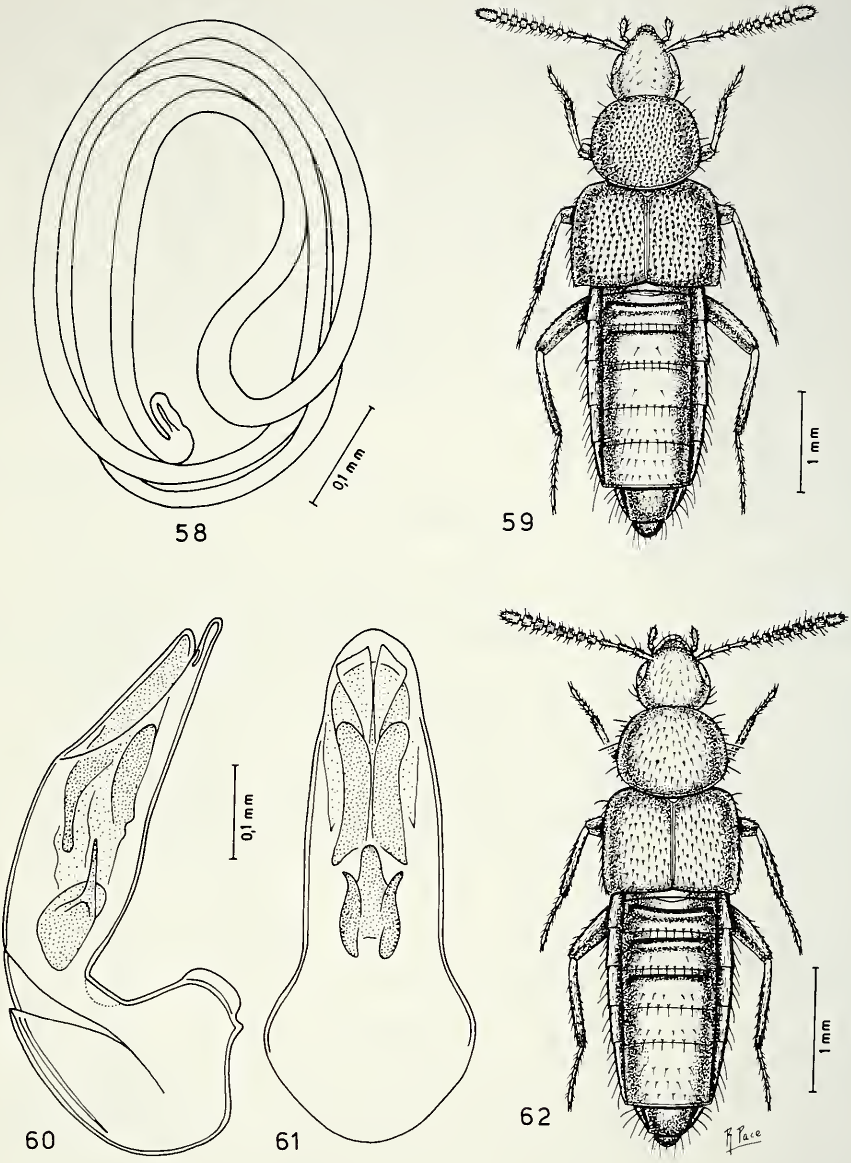
Descrizione. Lungh. 3,0 mm. Corpo lucido e bruno-rossiccio con base ed estremità addominali giallo-rossicci; antenne brune con l'antennomero basale bruno-rossiccio; zampe giallo-rossicce. Edeago figg. 66–67, spermateca fig. 68.

Comparazioni. Questa nuova specie, in base alla forma della spermateca, potrebbe essere affine a *P. usambarae* Bernhauer, 1929, (figg. 55–58), dell'Africa orientale, ma l'habitus è nettamente differente: l'addome di *usambarae* è nettamente ristretto all'indietro, mentre nella nuova specie lo è appena. La spermateca della nuova specie presenta 5–6 spire e non 3 come in *usambarae* e l' edeago della nuova specie è più ridotto e privo di flagello esteso dal bulbo basale, all'esterno dell'orifizio apicale dell'edeago stesso, come in *usambarae*.



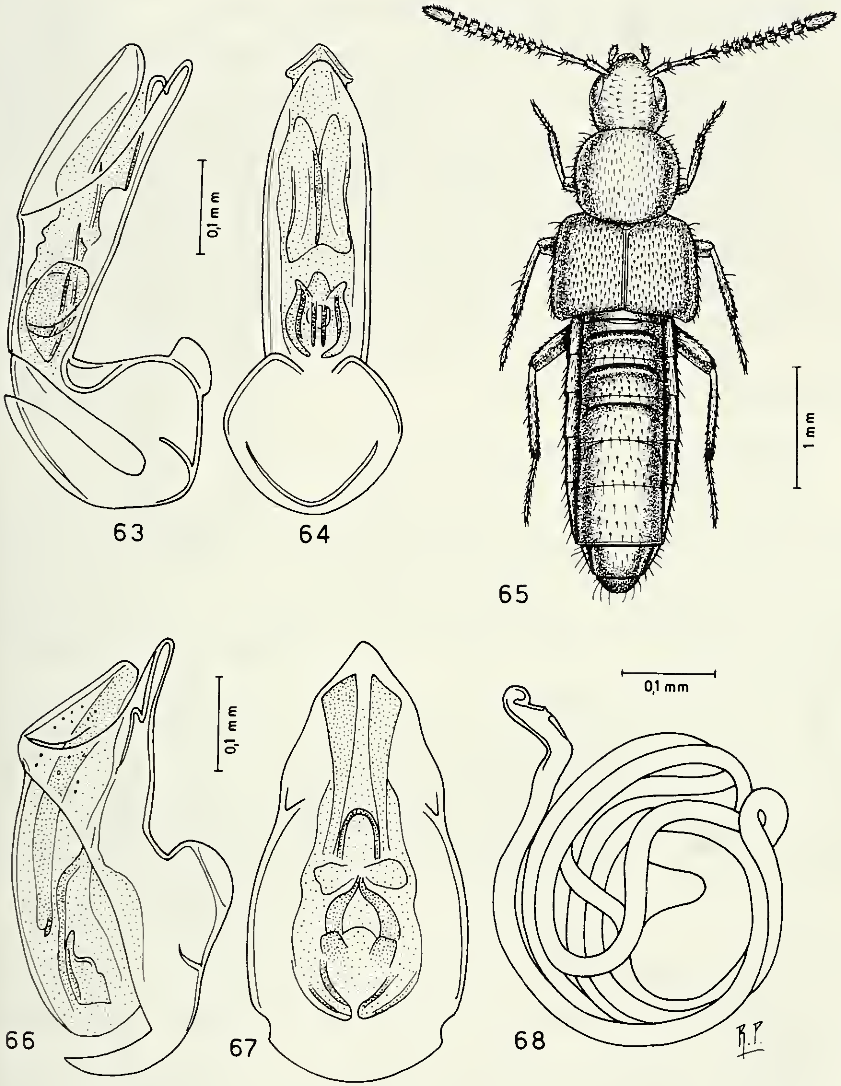
FIGG. 53–57

Habitus, spermateca ed edeago in visione laterale e ventrale. 53–54: *Catarractodes hybridus* sp. n.; 55–57: *Pachorhopala* (s. str.) *usambarae* Bernhauer, lectotypus.



Figg. 58–62

Spermateca, habitus ed edeago in visione laterale e ventrale. 58: *Pachorhopala* (s. str.) *usambarae* Bernhauer; 59–61: *Pachorhopala* (s. str.) *kayovensis* sp. n.; 62: *Pachorhopala* (s. str.) *tambachensis* sp. n.



FIGG. 63–68

Edeago in visione laterale e ventrale, habitus e spermateca. 63–64: *Pachorhopala* (s. str.) *tambachensis* sp. n.; 65–68: *Pachorhopala* (s. str.) *laevigata* sp. n.

Pachorhopala (s. str.) **confluens** sp. n. (Figg. 69–70)

Holotypus ♀, Rhodésie, Umtali, II.1969, (R. Mussard leg., MG).
Paratypus: 1 ♀, stessa provenienza.

Descrizione. Lungh. 2,9 mm. Corpo lucidissimo e bruno-rossiccio con base ed estremità addominale giallo-rossicce; antenne bruno-rossicce con antennomero basale giallo-rossiccio; zampe giallo-rossicce. La punteggiatura del capo e del pronoto è svanita, quella delle elitre e dell'addome è netta. Il capo presenta una reticolazione svanita: sul resto del corpo non è visibile reticolazione. Spermateca fig. 70.

Comparazioni. La nuova specie è strettamente affine a *P. laevigata* sp. n. sopra descritta, a motivo della forma della spermateca. Se ne differenzia per avere il pronoto più trasverso e le spire della spermateca nettamente più strette, composte di tubulo di calibro chiaramente più sottile di quello di *laevigata*.

Pachorhopala (s. str.) **ruandensis** sp. n. (Figg. 71–72)

Holotypus ♀, Rwanda, Kayove, 2100 m, 12.VIII.1973, (Werner leg., MG).
Paratypi: 2 ♀♀, stessa provenienza.

Descrizione. Lungh. 3,8 mm. Corpo lucidissimo e bruno-rossiccio con base ed estremità addominali giallo-rossicce; antenne brune con i due antennomeri basali giallo-rossicci; zampe giallo-rossicce. La punteggiatura del capo è svanita, quella del pronoto è molto superficiale e quella delle elitre e dell'addome è netta. Solo il capo presenta una reticolazione, sebbene superficiale: il resto del corpo non è reticolato. Spermateca fig. 72.

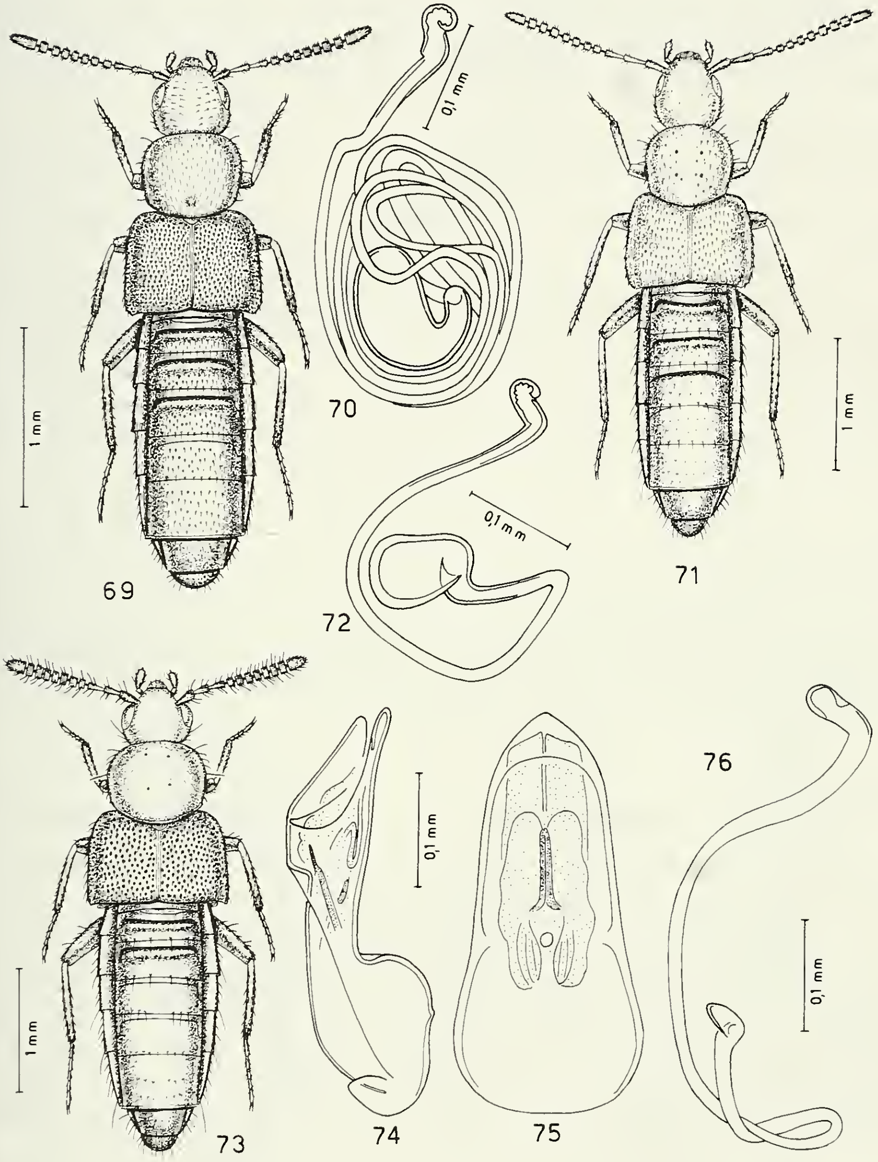
Comparazioni. La struttura della spermateca della nuova specie è simile a quella di *P. africana* Bernhauer, 1915. Tuttavia il bulbo prossimale della spermateca della nuova specie è nettamente ipertrofico, mentre è indistinto in *africana*. Inoltre l'habitus della nuova specie è nettamente snello rispetto quello tozzo di *africana*, dato che capo e pronoto della nuova specie sono molto più stretti delle elitre (poco più stretti in *africana*). Il 3° antennomero della nuova specie è lungo quanto largo, mentre è nettamente trasverso in *africana*.

Pachorhopala (s. str.) **ishiarensis** sp. n. (Figg. 73–76)

Holotypus ♂, Kenya, Embu, 10 Km O Ishiara MI., 900 m, 14.X.1977, (Mahnert & Perret leg., MG).
Paratypus: 1 ♀, stessa provenienza.

Descrizione. Lungh. 3,7 mm. Corpo lucidissimo e giallo-rossiccio con elitre con uriti liberi 3°, 4° e 5° bruno-rossicci; antenne brune con i due antennomeri basali giallo-rossicci e il 3° rossiccio; zampe giallo-rossicce. La punteggiatura del capo e del pronoto è molto svanita, quella delle elitre è netta. Non vi è traccia di reticolazione sul corpo. Edeago figg. 74–75, spermateca fig. 76.

Comparazioni. Specie affine a *P. africana* Bernhauer, 1915, sia per l'habitus, che per la forma dell'edeago e della spermateca. Tuttavia la nuova specie presenta elitre nettamente punteggiate (elitre coperte di tubercoletti poco salienti in *africana*) e



FIGG. 69–76

Habitus, spermateca ed edeago in visione laterale e ventrale. 69–70: *Pachorhopala* (s. str.) *confluens* sp. n.; 71–71: *Pachorhopala* (s. str.) *ruandensis* sp. n.; 73–76: *Pachorhopala* (s. str.) *ishiarensis* sp. n.

chiaramente molto più larghe del pronoto. L'edeago della nuova specie ha minore sviluppo e presenta un pezzo copulatore del sacco interno terminante a stiletto sottile (e non tronco con due punte come in *africana*). La spermateca della nuova specie ha minore sviluppo in lunghezza rispetto quella di *africana*.

Pachorhopala (s. str.) **maculiventris** sp. n. (Figg. 77–78)

Holotypus ♀, Kenya, Embu, Irangi Forest, 2000 m, 11.X.1977, (Mahnert & Perret leg., MG).

Descrizione. Lungh. 4,8 mm. Corpo lucidissimo e giallo-rossiccio con capo, elitre tranne la base e i lati esterni e una macchia centrale sugli uroterghi liberi 3° e 4°, bruni; antenne nere con i due antennomeri basali giallo-rossicci e l'11° bruno; zampe giallo-rossicce. La punteggiatura del capo è svanita e assente sulla linea mediana, quella del pronoto è ombelicata e netta, assente sulla linea mediana e lungo il margine posteriore e davanti agli angoli posteriori. La punteggiatura delle elitre è netta. Sul corpo non vi è traccia di reticolazione. Spermateca fig. 78.

Comparazioni. La nuova specie, per la struttura della spermateca, è avvicinabile tassonomicamente a *P. africana* Bernhauer, 1915, ma è nettamente distinta sia per l'habitus più snello dovuto al capo e al pronoto molto più stretti rispetto alla larghezza delle elitre (capo e pronoto poco più stretti delle elitre in *africana*), che per la spermateca che ha sviluppo maggiore. La macchia bruna sull'addome e la netta punteggiatura del pronoto e delle elitre della nuova specie sono ulteriori caratteri differenziali rispetto a *P. africana* che presenta capo e pronoto coperti di punteggiatura superficiale e che è priva di macchia addominale.

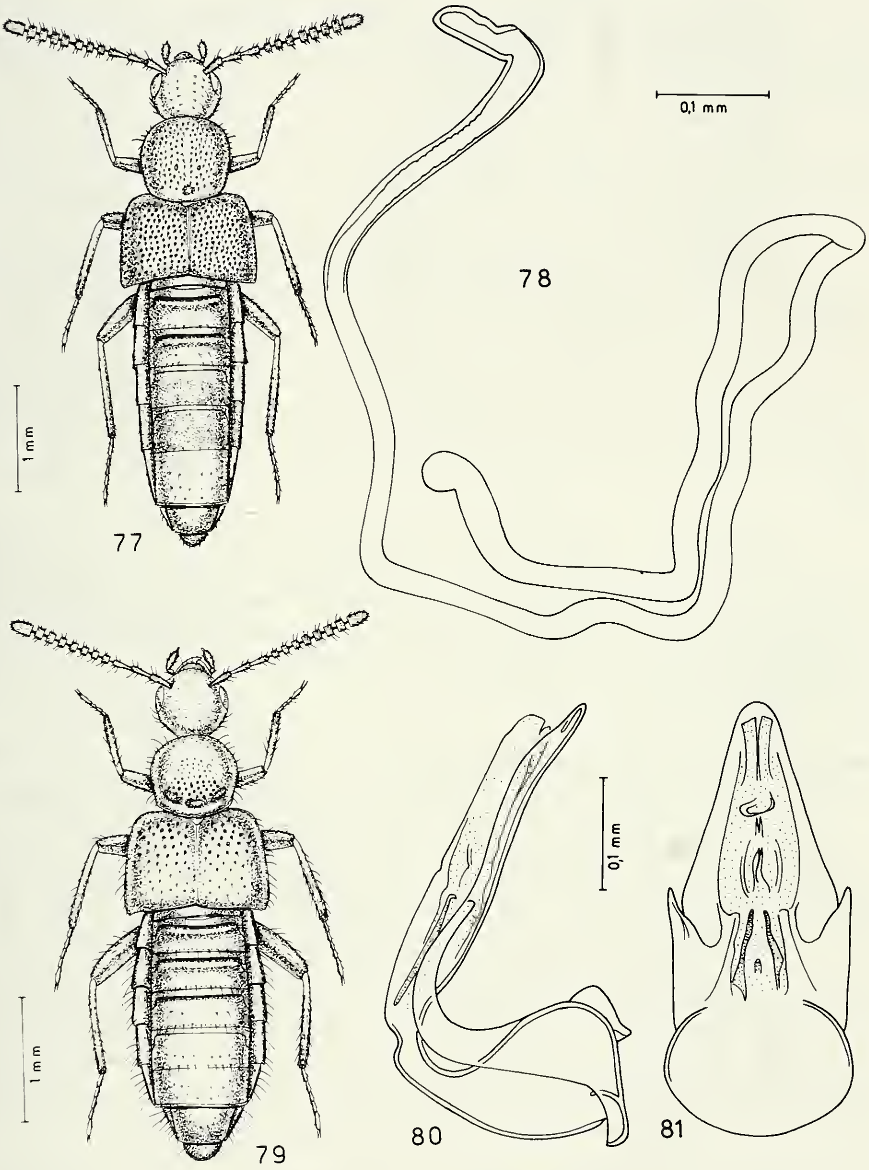
Pachorhopala (s. str.) **embuicola** sp. n. (Figg. 79–81)

Holotypus ♂, Kenya, Embu, pr. Ishiara, 900 m, 14.X.1977, (Mahnert & Perret leg., MG).

Paratypus: 1 ♂, Rhodésie, Embu, II.1969, (R. Mussard leg.).

Descrizione. Lungh. 4,0 mm. Corpo lucidissimo e rossiccio con metà posteriore delle elitre e urite libero 4° bruno-rossicci e 1° e 2° giallo-rossicci; antenne e zampe giallo-rossicce. La punteggiatura del capo è svanita e assente sulla linea mediana, quella del pronoto è netta e addensata sulla metà posteriore, ma non ai lati, nè lungo il margine posteriore. La punteggiatura delle elitre è netta sulla metà anteriore, svanita sulla posteriore. Non è presente reticolazione sul corpo. Edeago figg. 80–81.

Comparazioni. Il capo e il pronoto molto più stretti delle elitre, permettono di associare tassonomicamente la nuova specie non tanto a *P. africana* Bernhauer, 1915, quanto a *P. maculiventris* sp. n. sopra descritta. Tuttavia la nuova specie è differente da *maculiventris* poiché presenta solo la metà posteriore del pronoto profondamente punteggiata, come la metà basale delle elitre (pronoto ed elitre uniformemente punteggiate in *maculiventris*).



FIGG. 77–81

Habitus, spermateca ed edeago in visione laterale e ventrale. 77–78: *Pachorhopala* (s. str.) *maculiventris* sp. n.; 79–81: *Pachorhopala* (s. str.) *embuicola* sp. n.

Pachorhopala (Troposipalia) spectabilis (Bernhauer, 1934), **comb. n.** (Figg. 97–100)

Troposipalia spectabilis Bernhauer, 1934: 242

Materiale esaminato: Lectotypus ♂, Ruwenzori, 4200 m, VII.1932, Burgeon, *Troposipalia spectabilis* BRNH., Typus, (Mus. Chicago); paralectotypus ♀, stessa provenienza (Mus. Chicago).

Specie illustrata per la prima volta.

Pachorhopala (Troposipalia) spinifera sp. n. (Figg. 82–85)

Holotypus ♂, Rwanda, Kayove, 2100 m, 29.IV.1973, (Werner leg., MG).

Paratypi: 1 ♂ e 1 ♀, stessa provenienza; 2 ♂♂, Rwanda, Rangiro, 1800 m, 26.VIII.1975, (Werner leg.); 1 ♂, Rwanda, Kamiranzovu, 1900 m, marais, I.1976, (Werner leg.); 2 ♂♂, Rwanda, Gisovu, 18.IV.1973, (P. Werner leg.).

Descrizione. Lungh. 3,8 mm. Corpo lucido e giallo-rossiccio con uriti liberi 3° e 4° bruno-rossicci; antenne bruno rossicce con i due antennomeri basali giallo-rossicci; zampe giallo-rossicce. Sul corpo è assente la reticolazione. La punteggiatura del capo e del pronoto è superficiale e assente sulla linea mediana, quella delle elitre è netta sulla metà basale e svanita sulla posteriore. Edeago figg. 83–84, spermateca fig. 85.

Comparazioni. La nuova specie, per alcuni caratteri dell'edeago e dell'habitus, potrebbe essere affine a *P. rufonitens* Pace, 1985, del M. Aberdare e del M. Kenya, ma l'edeago della nuova specie possiede delle spine ventrali, assenti in *rufonitens* e il pronoto di *rufonitens* è più lungo che largo. La spermateca della nuova specie ha la parte prossimale semplice, mentre quella corrispondente in *rufonitens* è un groviglio serpentiforme.

Pachorhopala (Troposipalia) elgonensis sp. n. (Figg. 86–87)

Holotypus ♀, Kenya, Mt. Elgon, 2800 m, 14.XI. 1974, Manhert & Perret leg., MG).

Descrizione. Lungh. 4,2 mm. Corpo lucido e giallo-rossiccio, comprese antenne e zampe. La punteggiatura del capo è svanita e assente sulla linea mediana, quella del pronoto è distinta e pure assente sulla linea mediana, quella delle elitre è netta. Assente è la reticolazione della superficie del corpo. Spermateca fig. 87.

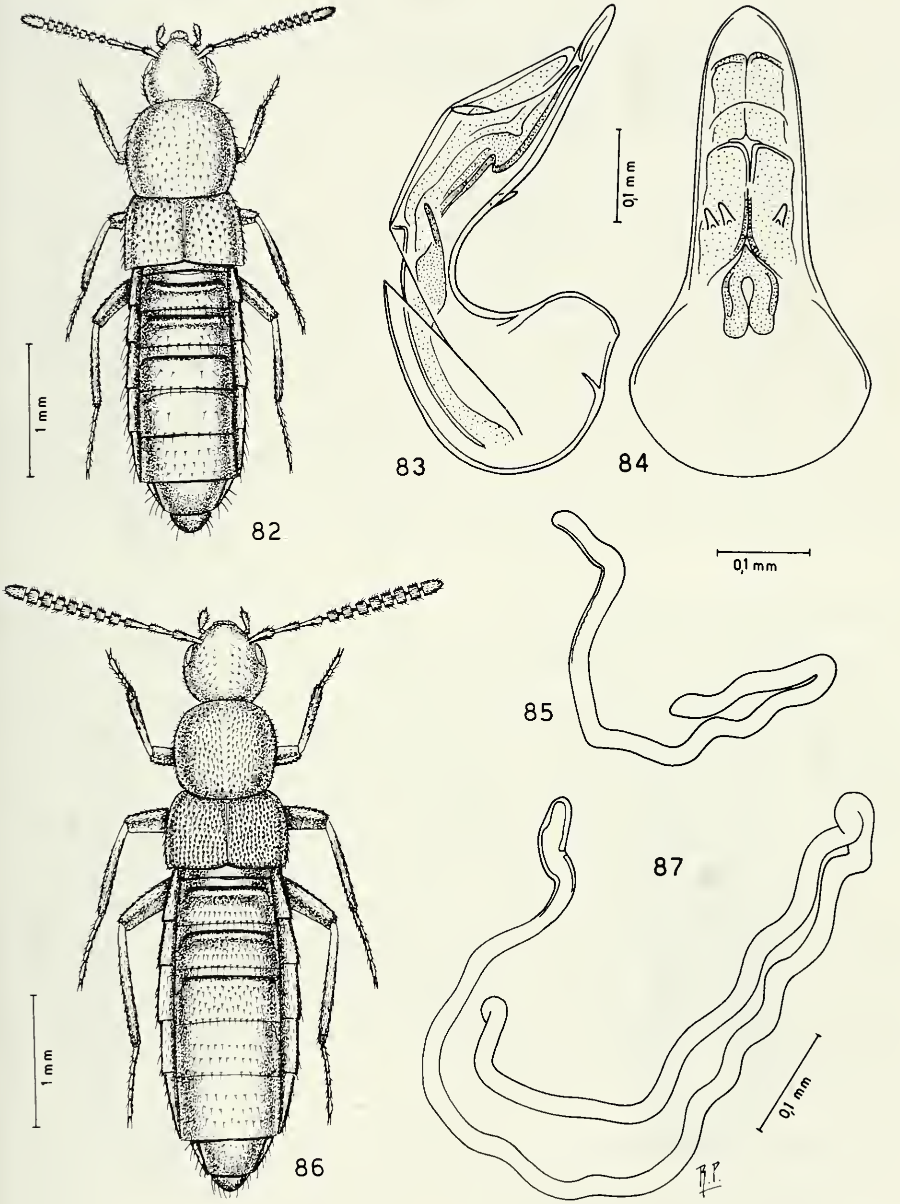
Comparazioni. A motivo della grande taglia corporea, per l'habitus simile e per la struttura della spermateca, è possibile che la nuova specie sia tassonomicamente vicina a *P. spectabilis* Bernhauer, 1934 (figg. 97–100), del Ruwenzori, tuttavia la taglia corporea della nuova specie è minore (4,2 mm, invece di 6,1 mm), le elitre sono nettamente punteggiate nella nuova specie (coperte di tubercoletti salienti in *spectabilis*) e la spermateca ha sviluppo molto minore nella nuova specie.

Pachorhopala (Troposipalia) burgeoni (Bernhauer, 1934), comb. n. (Figg. 88–90)

Troposipalia burgeoni Bernhauer, 1934: 243

Materiale esaminato: Lectotypus ♂, Ruwenzori, 4200 m, VII.1932, Burgeon, *Troposipalia burgeoni* BRNH., Typus, (Mus. Chicago).

La specie è qui per la prima volta illustrata.



FIGG. 82–87

Habitus, edeago in visione laterale e ventrale e spermateca. 82–85: *Pachorhopala (Troposipalia) spinifera* sp. n.; 86–87: *Pachorhopala (Troposipalia) elgonensis* sp. n.

Pachorhopala (Troposipalia) ruwenzorii Bernhauer, 1934, comb. n. (Figg. 91–92)

Troposipalia ruwenzorii Bernhauer, 1934: 243
Materiale esaminato: Lectotypus ♀, Ruwenzori, 4200 m, VII.1932, Burgeon L., *Troposipalia ruwenzorii* BRNH., Typus, (Mus. Chicago).

Specie illustrata per la prima volta.

Pachorhopala (Troposipalia) ruwenzorensis sp. n. (Figg. 94–97)

Holotypus ♂, Ruwenzori, Kitandara Hut, 13.200 ft., I.1984, (L. Lengeler leg., MG).
Paratypus: 1 ♀, stessa provenienza.

Descrizione. Lungh. 6,3 mm. Corpo lucidissimo e interamente giallo-rossiccio, comprese antenne e zampe. La punteggiatura del capo è distinta, quella del pronoto molto svanita. Tubercoletti salienti coprono le elitre e l'addome. Su tutto il corpo non vi è traccia di reticolazione. Edeago figg. 94–95, spermateca fig. 96.

Comparazioni. La nuova specie è distinta dalla simpatrica *P. ruwenzorii* Bernhauer, 1940, per avere la spermateca più sviluppata (figg. 92 e 96), il pronoto un po' più trasverso e il 4° antennomero lungo quanto largo (nettamente trasverso in *ruwenzorii*). Di *P. ruwenzorii* non è noto il maschio.

Diplopeurus nanyukensis sp. n. (Figg. 101–102)

Holotypus ♀, Kenya, Hulmes Bridge, Nanyuki, 1700 m, 22.XI.1974, (Mahnert & Perret leg., MG).

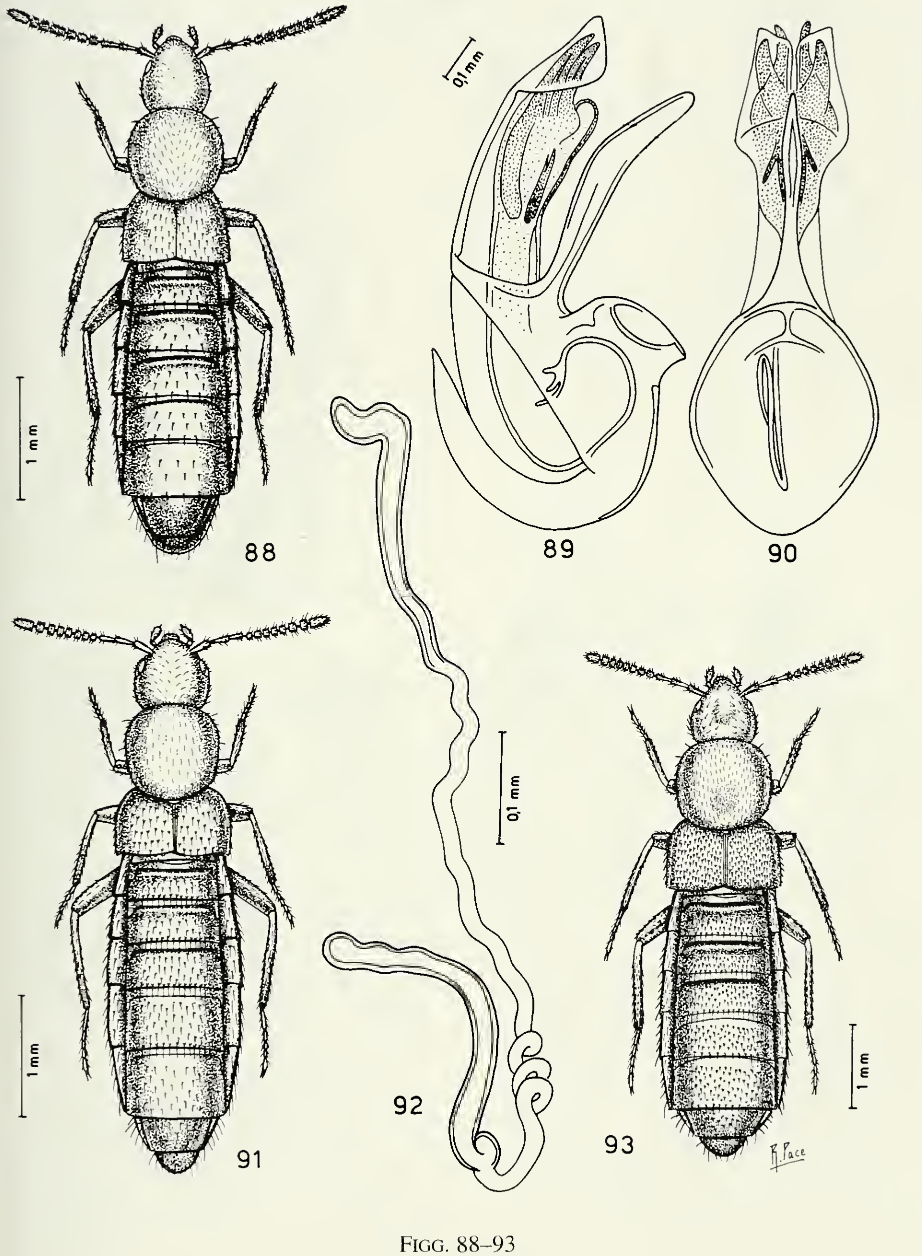
Descrizione. Lungh. 4,4 mm. Corpo lucido e bruno-rossiccio con margine posteriore degli uroterghi liberi 1°, 2° e 3° giallo-rossicci; antenne rossicce, con i due antennomeri basali giallo-rossicci; zampe giallo-rossicce. Il capo presenta una bozza tra le antenne e punteggiatura netta, profonda e diradata in avanti. Il pronoto mostra tubercoletti molto salienti e un largo solco laterale, interrotto posteriormente da una debole plica. Tubercoletti netti e salienti coprono le elitre. Spermateca fig. 102.

Comparazioni. La nuova specie è distinta da *D. excavatus* Bernhauer, 1915, dell'Africa orientale, perché i tubercoletti che coprono il pronoto sono molto più fitti nella nuova specie che in *excavatus* e perché le elitre della nuova specie sono coperte di tubercoletti molto salienti e non di punteggiatura robusta come in *excavatus*. Inoltre la base degli uroterghi liberi 3°, 4° e 5° della nuova specie è punteggiata, mentre in *excavatus* è priva di punteggiatura.

Drusilla fissata (Bernhauer, 1915) (Figg. 103–106)

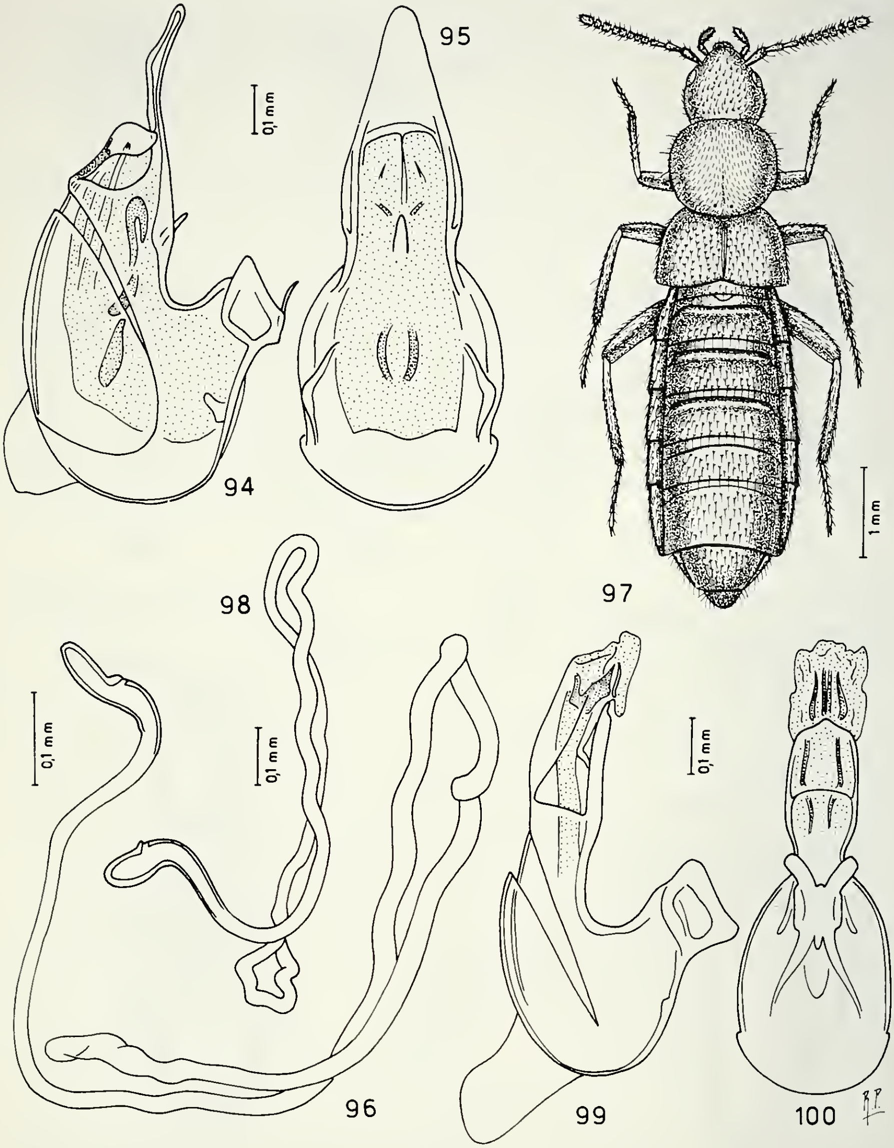
Astilbus fissatus Bernhauer, 1915: 159
Drusilla fissata: Pace, 1986: 109
Materiale esaminato: Lectotypus ♀, Africa or., Moschi, FL. Rau, Astilbus fissatus BRNH., Typus, (Mus. Budapest); paralectotypi: 1 ♂ e 1 ♀, Pangani, 1905, Katona, (Mus. Budapest).

20 es., Kenya, Tana River, Lac Shakababo, près de Ngao, 28.X.1977, (Mahnert & Perret leg.); 1 es., Kenya, Hulmes Bridge Nanyuki, 1700 m, (Mahnert & Perret leg.).



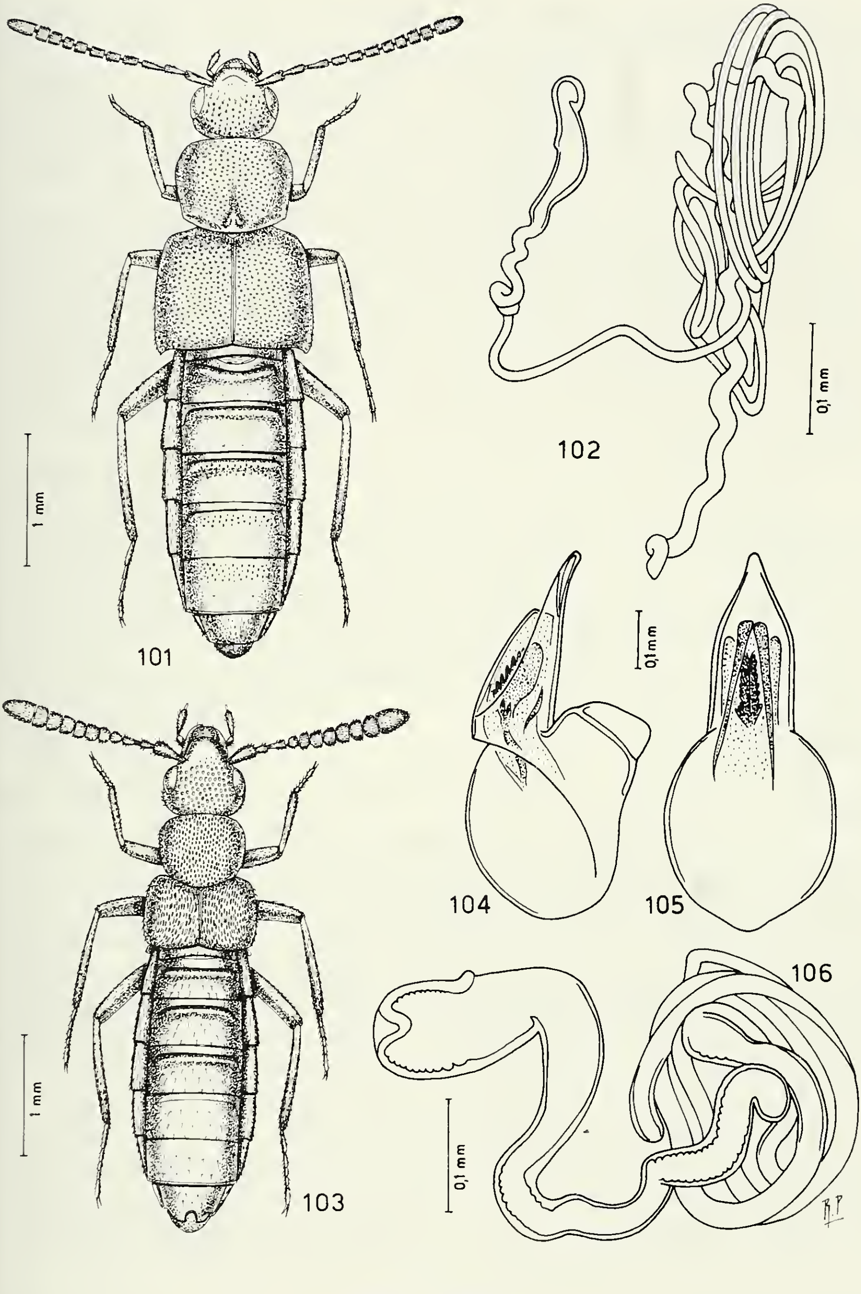
FIGG. 88–93

Habitus, edeago in visione laterale e ventrale e spermateca. 88–90: *Pachorhopala (Troposipalia) burgeoni* Bernhauer, lectotypus; 91–92: *Pachorhopala (Troposipalia) ruwenzorii* Bernhauer, lectotypus; 93: *Pachorhopala (Troposipalia) ruwenzorensis* sp. n.



FIGG. 94–100

Edeago in visione laterale e ventrale, habitus e spermateca. 94–96: *Pachorhopala (Troposipalia) ruwenzorensis* sp. n.; 97–100: *Pachorhopala (Troposipalia) spectabilis* Bernhauer, lectotypus ♂ e paralectotypus ♀.



FIGG. 101–106

Habitus, spermateca ed edeago in visione laterale e ventrale. 101–102: *Diplopleurus nanyukensis* sp. n.; 103–106: *Drusilla fissata* (Bernhauer), lectotypus ♀.

Specie finora nota di due località dell'Africa orientale: Moschi e Pangani; illustrata per la prima volta.

Drusilla kisumuensis sp. n. (Figg. 107–109)

Holotypus ♂, Kenya, Miss. Kaimosi, NE Kisumu, 1650 m, 11.XI.1974, (Mahnert & Perret leg., MG).

Descrizione. Lungh. 4,1 mm. Corpo lucidissimo e bruno-rossiccio con addome rossiccio e margini posteriori degli uroterghi giallo-rossicci; antenne giallo-rossicce; zampe gialle con estremità distale dei femori bruna. La punteggiatura del capo è quasi indistinta. Il pronoto presenta un'ampia e profonda concavità discale nel fondo della quale sta un solco mediano; è coperto di tubercoletti svaniti ed è privo di reticolazione. Le elitre presentano delle rughe nell'area periscutellare e punteggiatura netta e profonda, assente agli angoli posteriori esterni dove sta qualche fine tubercoletto. Edeago figg. 108–109.

Comparazioni. La nuova specie è chiaramente distinta da *D. fissata* (Bernhauer, 1915), (figg. 103–106), dell'Africa orientale, sia per molti caratteri esoscheletrici, che dell'edeago. Il capo e il pronoto sono privi di distinta punteggiatura nella nuova specie, mentre in fissata il capo e il pronoto sono robustamente punteggiati. L'edeago della nuova specie ha "crista apicalis" assai poco sviluppata e piastre chitinose del sacco interno non dentellate dorsalmente, mentre nell'edeago di fissata la "crista apicalis" è molto sviluppata e la piastra chitinosa corrispondente è dentellata al lato dorsale.

Drusilla mahnerti sp. n. (Figg. 110–113)

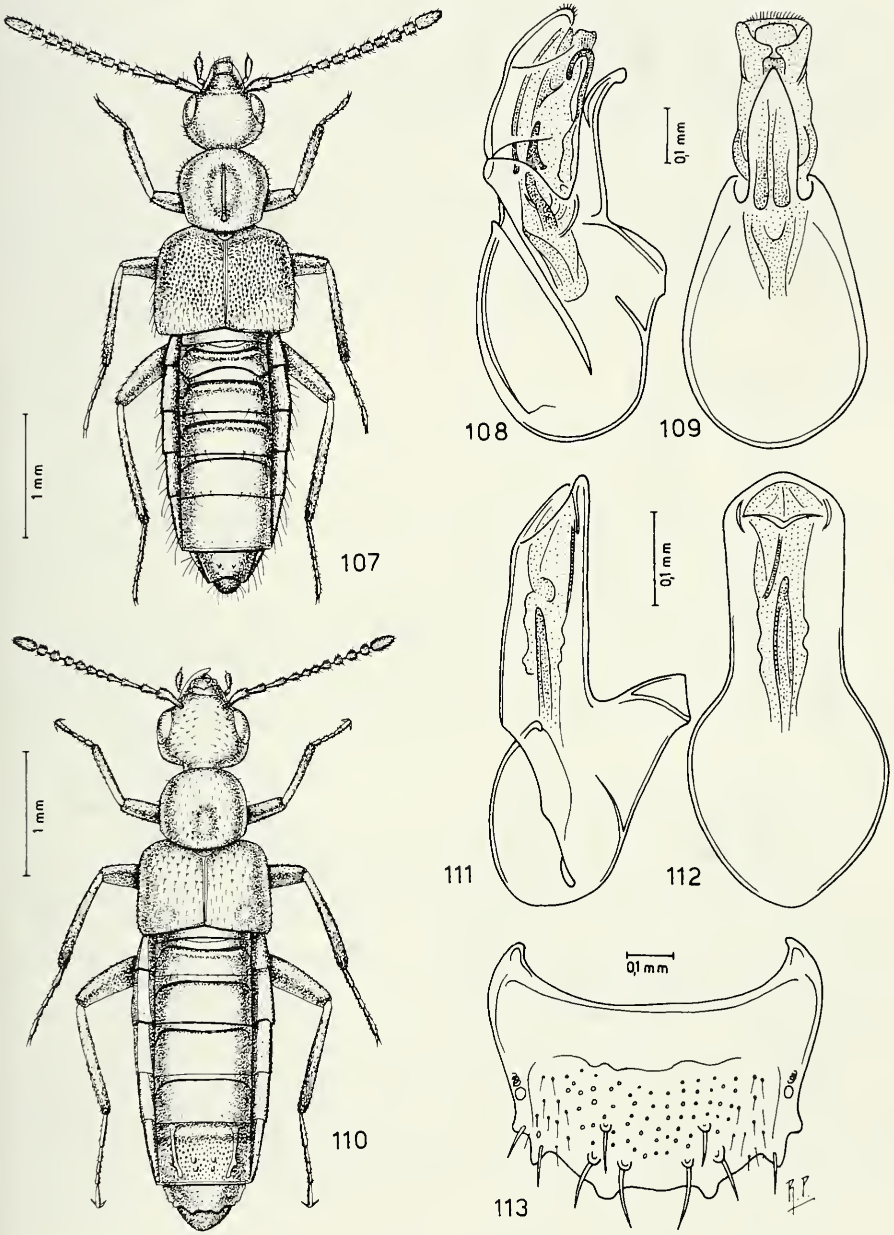
Holotypus ♂, Kenya, Shimba Hills, Makadara For., 30.XI.1974, (Mahnert & Perret leg., MG).

Descrizione. Lungh. 4,3 mm. Corpo lucidissimo e rossiccio con addome giallo-rossiccio e con lati esterni e angoli posteriori interni delle elitre bruni; antenne rossicce con i tre antennomeri basali giallo-rossicci; zampe giallo-rossicce con tarsi rossicci. La punteggiatura ombelicata del capo è distinta e assente su una larga fascia mediana. Il pronoto presenta in avanti e ai lati punteggiatura molto svanita, assente lungo la linea mediana; nell'area posteriore mediana del pronoto vi è una distinta e profonda punteggiatura situata intorno una larga fossetta posteriore. Il 5° urotergo libero del maschio mostra due carene arcuate e forte punteggiatura, tranne che nel terzo basale. Edeago figg. 111–112, 6° urotergo libero del maschio fig. 113.

Comparazioni. La nuova specie esternamente è ben distinta da *D. fissata* (Bernhauer, 1915) (figg. 103–106) dell'Africa orientale, per avere rada punteggiatura e radi tubercoletti sull'avancorpo (punteggiatura robusta e fittissima in fissata), per le due carene e la punteggiatura fitta sul 5° urotergo libero del maschio (assenti in *fissata*) e per l'edeago non appuntito, in visione ventrale (appuntito in *fissata*).

Drusilla umtaliensis sp. n. (Figg. 114–116)

Holotypus ♂, Rhodésie, Umtali, II.1969, Melsetter, 1700 m, (R. Mussard leg., MG).



FIGG. 107–113

Habitus, edeago in visione laterale e ventrale e 6° urotergo libero del maschio. 107–109: *Drusilla kisumuensis* sp. n.; 110–113: *Drusilla mahnerti* sp. n.

Descrizione. Lungh. 4,0 mm. Corpo lucido e rossiccio con gli uriti liberi 3° e 4° bruni, tranne il loro margine posteriore che è giallo-rossiccio, e il 5° interamente bruno; antenne e zampe giallo-rossicce. La punteggiatura del capo è robustissima e assente per una larga fascia mediana, quella del pronoto è profonda e robusta. Punteggiatura fitta e netta con tubercoletti salienti copre le elitre. Edeago figg. 115–116.

Comparazioni. I caratteri differenziali più evidenti della nuova specie rispetto a *D. fissata* (Bernhauer, 1915) (figg. 103–106), sono una larga fascia mediana non punteggiata sul capo (assente in *fissata*) , il 5° e 6° urotergo libero del maschio fortemente punteggiati (non punteggiati in *fissata*) ed edeago meno sviluppato e privo di "crista apicalis", (edeago più sviluppato e con "crista apicalis" grande in *fissata*).

Drusilla zimbabwensis sp. n. (Figg. 117–119)

Holotypus ♂, Rhodésie, Umtali, II.1969, (R. Mussard leg., MG).
Paratypus: 1 ♂, stessa provenienza.

Descrizione. Lungh. 8,3 mm. Corpo lucido e rossiccio con capo e uriti liberi 4° e 5° bruno-rossicci; antenne rossicce con i tre antennomeri basali giallo-rossicci; zampe giallo-rossicce. La punteggiatura del capo e del pronoto è netta e assente sulla linea mediana. Due fossette profonde solcano il pronoto. Una bozza smussata sta sulla metà posteriore del 2° urotergo libero del maschio. Edeago figg. 118–119.

Comparazioni. La nuova specie è distinta da *D. fissata* (Bernhauer, 1915) (figg. 103–106), per la presenza di due solchi sul pronoto e per l'edeago, in visione ventrale, a lati convergenti verso l'apice (lati paralleli nella porzione submediana in *fissata*).

Zyras (Androdonia) masai sp. n. (Figg. 120–122)

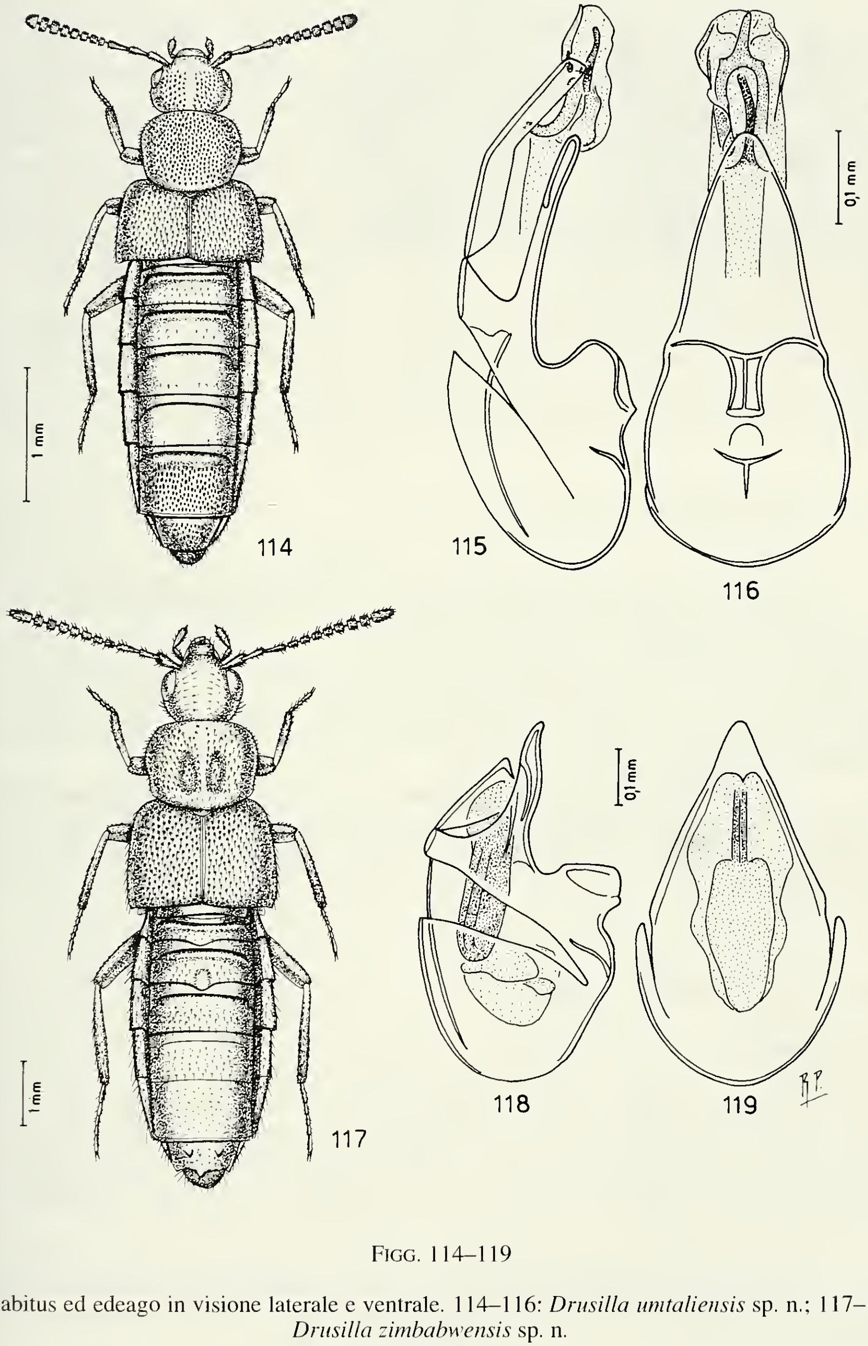
Holotypus ♂, Kenya, Nairobi, 3.XI.1974, (Mahnert & Perret leg., MG).

Descrizione. Lungh. 11,0 mm. Avancorpo debolmente opaco, addome lucido. Corpo rossiccio con capo e addome bruni; sono rossicci i lati dell'addome, la base delle spine e il 2° urotergo libero; antenne bruno-rossicce con i tre antennomeri basali e l'11° giallo-rossicci; zampe giallo-rossicce. Il capo, il pronoto e le elitre presentano reticolazione fine e netta e punteggiatura ben definita. Il 1° urotergo libero mostra una rugosità mediana coperta di distinta reticolazione. Edeago figg. 121–122.

Comparazioni. Specie tassonomicamente avvicinabile a *Z. bequaerti* Bernhauer, 1928, dello Zaire. Ne è distinta per le elitre più lunghe del pronoto (più corte del pronoto in *bequaerti*) e per le appendici del 1° urotergo libero del maschio, per nulla allargate verso l'apice, in visione laterale (fig. 122 bis) come in *bequaerti*.

Zyras (Camonia) somaliensis Bernhauer, 1927

Zyras (Camonia) somaliensis Bernhauer, 1927: 184
1 ♂ e 1 ♀, Somalia, Sar Uanle, 29.V.1973, (S.B.S. leg., Mus. "La Specola", Firenze).
Specie finora nota solo della Somalia.



FIGG. 114–119

Habitus ed edeago in visione laterale e ventrale. 114–116: *Drusilla umtaliensis* sp. n.; 117–119 *Drusilla zimbabwensis* sp. n.

Zyras (**Camonia**) **ngaoensis** sp. n. (Figg. 123–125)

Holotypus ♂, Kenya, Tana River, Lac Shakababo, près Ngao, 28.X.1977, (Mahnert & Perret leg., MG).

Descrizione. Lungh. 7,1 mm. Disco del capo opaco, resto del corpo lucido e giallo rossiccio con capo e uriti liberi 3°, 4° e 5° bruno-rossicci e angoli posteriori esterni delle elitre sfumati di bruno; antenne bruno-rossicce con i tre antennomeri basali e l'11° giallo-rossicci; zampe giallo-rossicce. Il capo presenta reticolazione netta solo sul disco e il resto della superficie senza reticolazione. La punteggiatura del capo è distinta, quella del pronoto, delle elitre e dell'addome è netta. La reticolazione sul pronoto è svanita, quella sulle elitre è molto svanita e quella dell'addome è distinta. Edeago figg. 124–125.

Comparazioni. Specie tassonomicamente avvicinabile a *Z. afer* Gestro, 1892, della Somalia. La nuova specie ne è distinta per avere il disco del capo opaco e non depresso (capo largamente depresso e fortemente reticolato in *afer*) e per i prolungamenti laterali del 1° urotergo libero del maschio più lunghi e ricurvi (corti in *afer*).

Zyras (**Camonia**) **kilifensis** sp. n. (Figg. 126–127)

Holotypus ♀, Kenya, Kilifi Jilore, 29.X.1977, (Mahnert & Perret leg., MG).

Descrizione. Lungh. 7,8 mm. Avancorpo opaco, addome lucido. Corpo giallo-rossiccio con capo, metà posteriore delle elitre e 4° urite libero bruno-rossicci; antenne rossicce con i due antennomeri basali giallo-rossicci; zampe giallo-rossicce. Il capo, il pronoto e le elitre presentano reticolazione netta a maglie regolari e punteggiatura quasi indistinta. La reticolazione dell'addome è a maglie poligonali irregolari nette. Spermateca fig. 127.

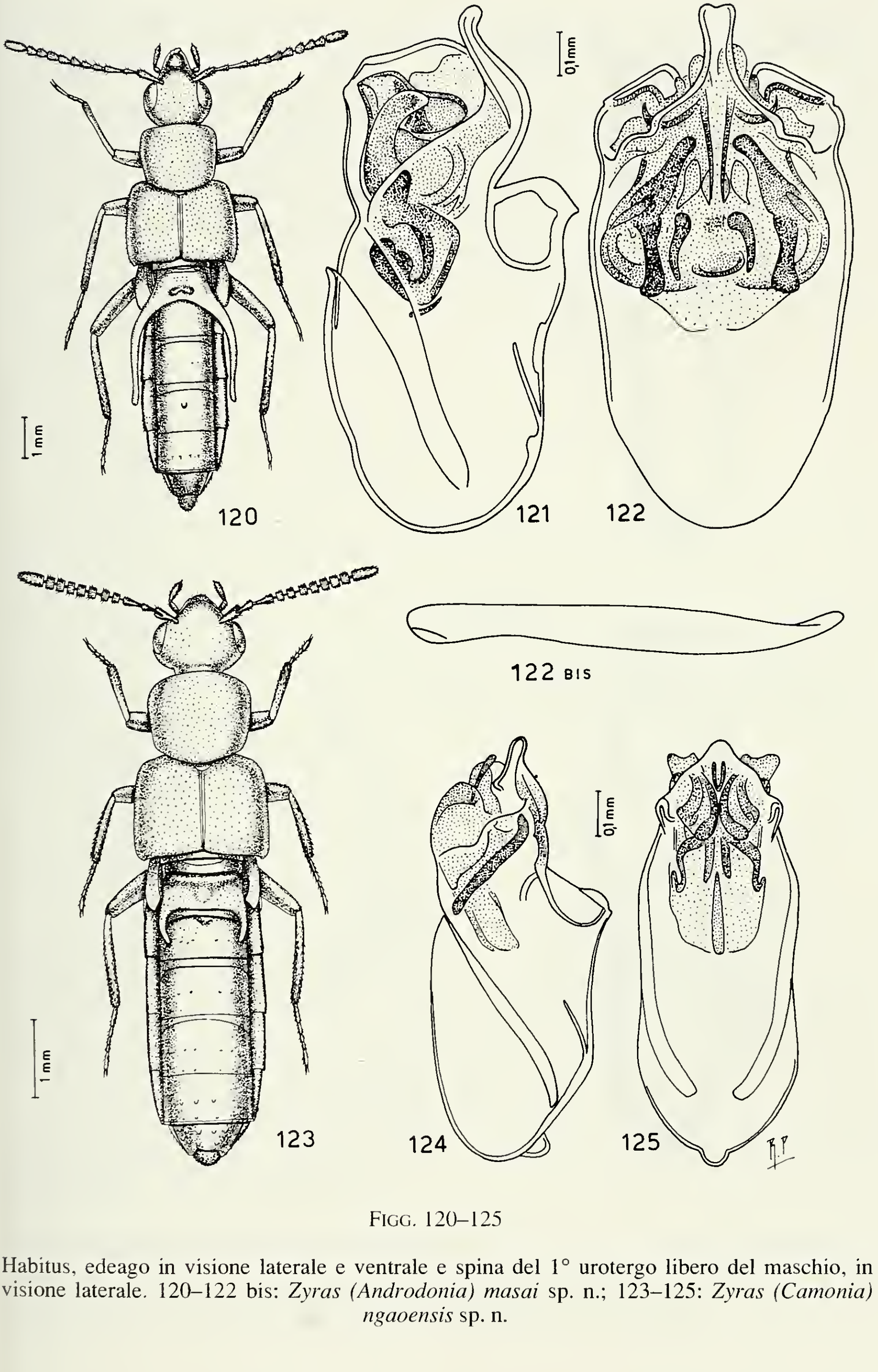
Comparazioni. Specie tassonomicamente vicina a *Z. disputandus* Last, 1963, della Rodesia, ma distinta per avere il pronoto non sinuato lateralmente e privo di fine solco mediano e per le elitre trasverse, se considerate insieme, (lunghe quanto larghe in *disputandus*).

Zyras (s. str.) **tambachensis** sp. n. (Figg. 128–130)

Holotypus ♂, Kenya, Tambach, E Eldoret, 2000 m, 17.XI.1974, (Mahnert & Perret leg., MG).

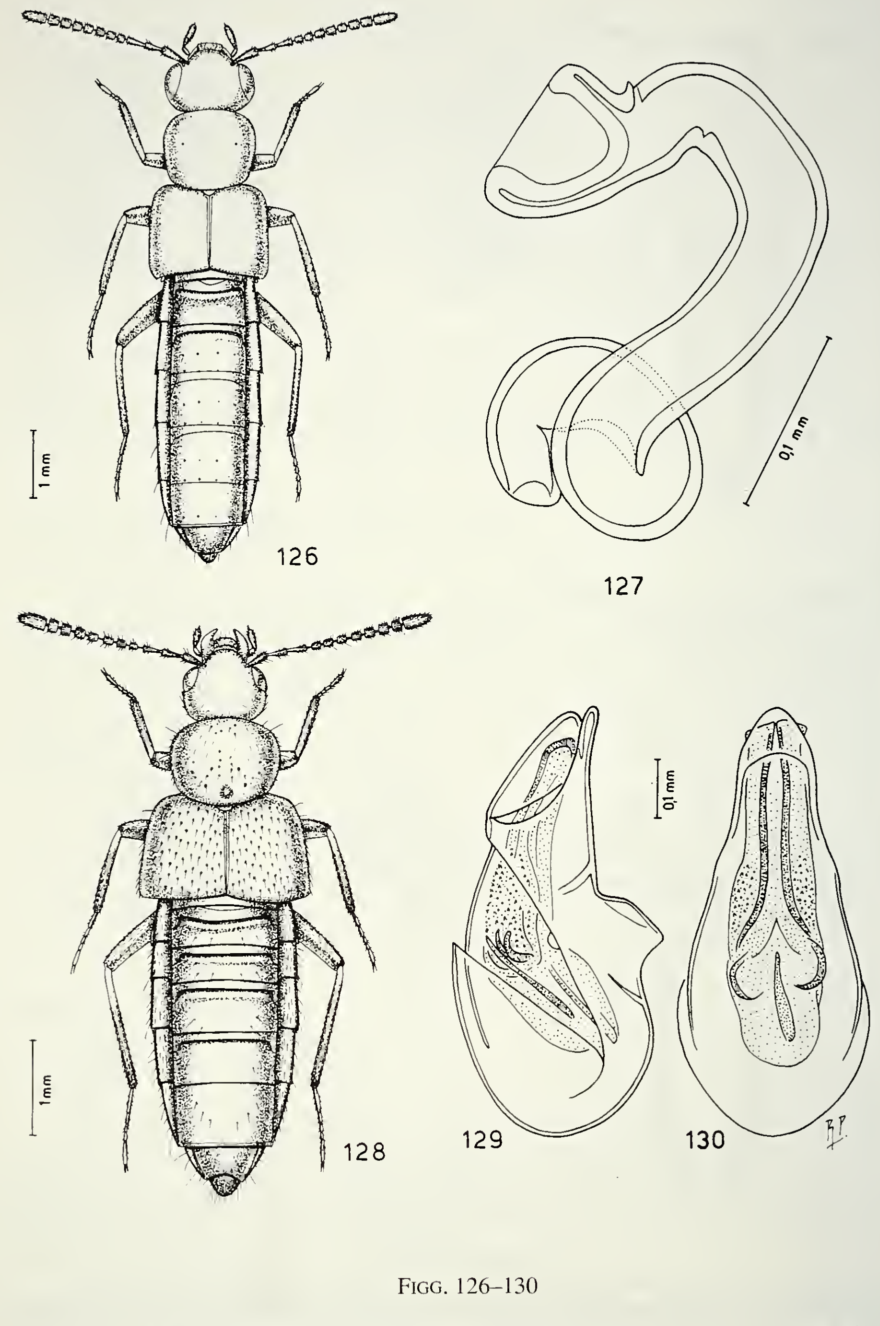
Descrizione. Lungh. 5,8 mm. Corpo lucido e giallo-rossiccio con capo bruno-rossiccio ed elitre di un giallo sporco; antenne brune con i due antennomeri basali bruno-rossicci; zampe giallo-rossicce. La punteggiatura del capo è quasi indistinta, quella del pronoto è distinta e quella delle elitre è netta. E' assente la reticolazione su tutto il corpo. Edeago figg. 129–130.

Comparazioni. Specie distinta da *Z. abessinus* (Bernhauer, 1915) dell'Abissinia, per avere la punteggiatura del capo quasi indistinta (capo chiaramente punteggiato in *abessinus*).



FIGG. 120–125

Habitus, edeago in visione laterale e ventrale e spina del 1° urotergo libero del maschio, in visione laterale. 120–122 bis: *Zyras (Androdonia) masai* sp. n.; 123–125: *Zyras (Camonia) ngaoensis* sp. n.



FIGG. 126–130

Habitus, spermateca ed edeago in visione laterale e ventrale. 126–127: *Zyras (Camonia) kilifensis* sp. n.; 128–130: *Zyras* (s. str.) *tambachensis* sp. n.

Zyras (s. str.) **nakuruensis** sp. n. (Figg. 131–132)

Holotypus ♀, Kenya, Nakuru, Lac Naivasha, près de Mundui Estate, 1950 m, 8.XI.1977, (Mahnert & Perret leg., MG).

Descrizione. Lungh. 6,0 mm. Corpo lucidissimo e giallo-rossiccio con capo, elitre tranne la base e uriti liberi 4° e 5° bruni; antenne brune con i due antennomeri basali e l'11° bruno-rossicci; zampe giallo-rossicce. La punteggiatura del capo è svanita e assente sulla linea mediana, quella del pronoto e delle elitre è netta, diradata sulla metà posteriore delle elitre. Spermateca fig. 132.

Comparazioni. Specie chiaramente distinta tassonomicamente da *Z. dudu* Eichelbaum, 1913, dell'Africa orientale, per avere la spermateca a matassa nettamente più fitta e per il capo e il pronoto sparsamente punteggiati (fittamente e profondamente punteggiati in *dudu*).

Zyras (s. str.) **mutarensis** sp. n. (Figg. 133–136)

Holotypus ♂, Rhodésie, Umtali, II.1969, (R. Mussard leg., MG).
Paratypus: 1 ♀, stessa provenienza.

Descrizione. Lungh. 3,9 mm. Corpo lucidissimo e bruno-rossiccio con pronoto, base delle elitre e base ed estremità dell'addome giallo-rossicci; antenne brune con i tre antennomeri basali giallo-rossicci; zampe gialle. La punteggiatura del capo e del pronoto è molto svanita, quella delle elitre è netta. Reticolazione del corpo assente. Edeago figg. 134–135, spermateca fig. 136.

Comparazioni. Specie ben distinta da *Z. dudu* Eichelbaum, 1913, dell'Africa orientale, per avere il pronoto molto superficialmente punteggiato, l'addome ristretto all'indietro (non ristretto in *dudu*) e per la fitta matassa della spermateca (matassa della spermateca rada in *dudu*).

Zyras (Pachydonia) seditiosus sp. n. (Figg. 137–139)

Holotypus ♂, Kenya, Mt. Aberdares, Parc National, 2300 m, 25.XI.1974, (Mahnert & Perret leg., MG).
Paratypus: 1 ♂, stessa provenienza.

Descrizione. Lungh. 5,9 mm. Corpo lucido e bruno-rossiccio con pronoto e uriti liberi 1°, 2° e 6° rossicci; antenne brune con i due antennomeri basali e la base del 3°giallo-rossicci e l'11° bruno-rossiccio; zampe giallo-rossicce. Il capo presenta una bozza frontale tra le antenne e punteggiatura distinta, assente sulla linea mediana. La punteggiatura del pronoto è distinta, fine ai lati e assente lungo il margine posteriore, quella delle elitre è netta. Edeago figg. 138–139.

Comparazioni. Specie distinta da *Z. dubius* Bernhauer, 1928, dello Zaire, per avere sul pronoto un solco posteriore mediano corto invece di una profonda fossetta, come in *dubius* e per la punteggiatura del pronoto stesso distinta (e non svanita sulla linea mediana come in *dubius*).

Zyras (Euryalonia) peranomalus sp. n. (Figg. 142–143)

Holotypus ♀, Kenya, Mt. Aberdares, près Nat. Park, 2300 m, 25.XI.1974, (Mahnert & Perret leg., MG).

Descrizione. Lungh. 5,7 mm. Corpo debolmente opaco, un po' depresso e bruno-rossiccio con base delle elitre e addome, tranne gli uroterghi liberi 4° e 5°, giallo-rossicci; antenne brune con i due antennomeri basali giallo-rossicci; zampe giallo-rossicce. L'avancorpo è coperto di reticolazione netta. La punteggiatura del capo e del pronoto è svanita e fine, quella delle elitre è netta. Gii antennomeri sono lateralmente lievemente compressi. Spermateca fig. 143.

Comparazioni. Specie ben distinta da *Z. braunsi* Bernhauer, 1928, del Sudafrica per avere il pronoto più trasverso e per il differente colore delle elitre: elitre bruno-rossicce con base giallo-rossiccia nella nuova specie, nero pece in *braunsi*.

Zyras (Tropidonia) rangirensis sp. n. (Figg. 144–145)

Holotypus ♀, Rwanda, Rangiro, 1800 m, 4.IX.1976, (Werner leg., MG).

Descrizione. Lungh. 6,4 mm. Corpo lucido e rossiccio con capo e uroterghi tranne il loro margine posteriore, bruni; antenne rossicce con i due antennomeri basali giallo-rossicci; zampe giallo-rossicce. Gli antennomeri non sono compressi lateralmente. La punteggiatura del capo è fine e distinta, ma assente sulla linea mediana, quella del pronoto è molto superficiale. Tubercoletti molto salienti stanno sulle elitre e tubercoletti molto svaniti sull'addome. Il pronoto è lateralmente profondamente depresso. Spermateca fig. 145.

Comparazioni. La nuova specie si distingue da *Z. glaberrimus* Bernhauer, 1926, dello Zaire, per avere il capo ristretto dietro gli occhi (capo un po' allargato dietro gli occhi in *glaberrimus*), per gli antennomeri 4° e 5° più lunghi che larghi (lunghi quanto larghi in *glaberrimus*) e per le elitre molto più lunghe del pronoto e debolmente allargate all'indietro (poco più lunghe del pronoto e fortemente allargate all'indietro in *glaberrimus*).

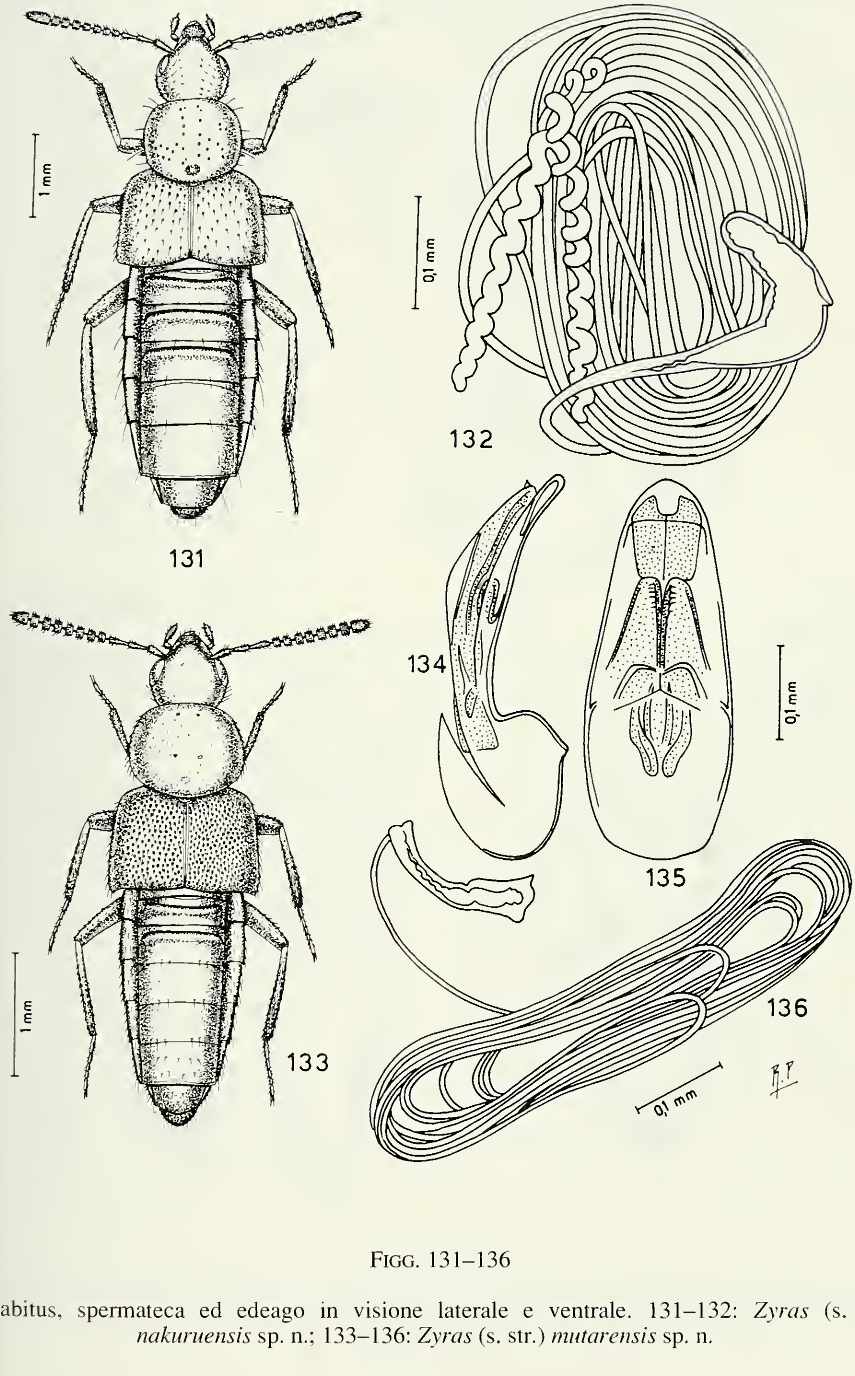
Zyras (Pycnodonia) microarmatus sp. n. (Figg. 140–141 e 146–149)

Holotypus ♂, Kenya, Nairobi, 4.XI.1974, (Mahnert & Perret leg., MG).

Paratypi: 1 ♂ e 2 ♀♀, stessa provenienza; 14 es., Namibia, East Caprivi: Katima Mulilo, lux, 17' 29"S/24' 17"E, 3.–8.III.1992, (Uhlig Leg., Mus. Berlin).

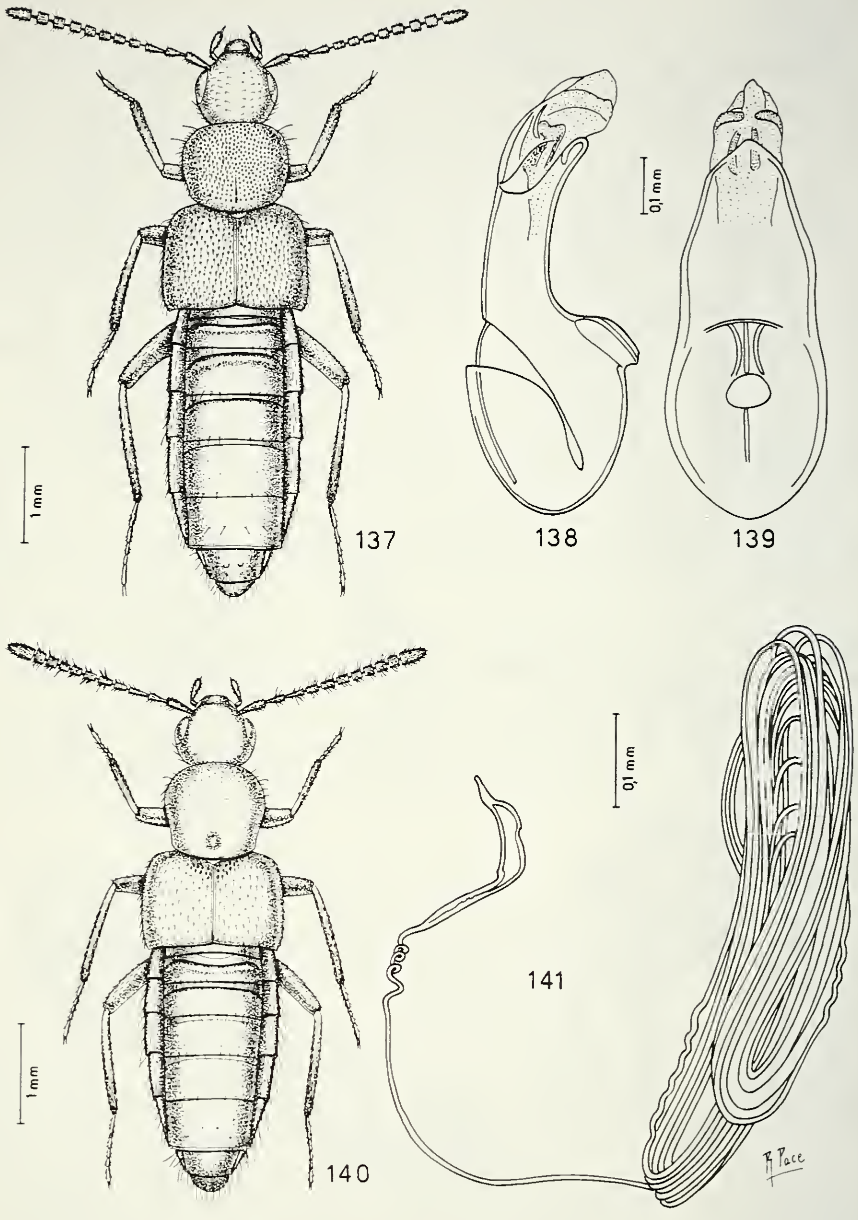
Descrizione. Lungh. 5,4 mm. Corpo lucido e bruno-rossiccio; antenne bruno-rossicce con i due antennomeri basali e l'11° giallo-rossicci; zampe giallo-rossicce. La punteggiatura del capo è estremamente svanita, quella delle elitre è profonda nella regione periscutellare: sul resto della superficie delle elitre ci sono tubercoletti salienti e radi. Il pronoto è coperto di tubercoletti fini e radi. Gli antennomeri non sono lateralmente compressi. Edeago figg. 148–149, spermateca fig. 141 e 146.

Comparazioni. Specie distinta da *Z. lioglutoides* Bernhauer, 1915, dell'Africa orientale, per avere la punteggiatura del capo e del pronoto estremamente svanita (punteggiatura robusta in *lioglutoides*), per le tempie lunghe quanto gli occhi (tempie più lunghe degli occhi in *lioglutoides*), per gli antennomeri 6° e 7° più lunghi che larghi (chiaramente trasversi in *lioglutoides*) e per le elitre robustamente punteggiate solo nella zona periscutellare (fittamente punteggiate per intero in *lioglutoides*).



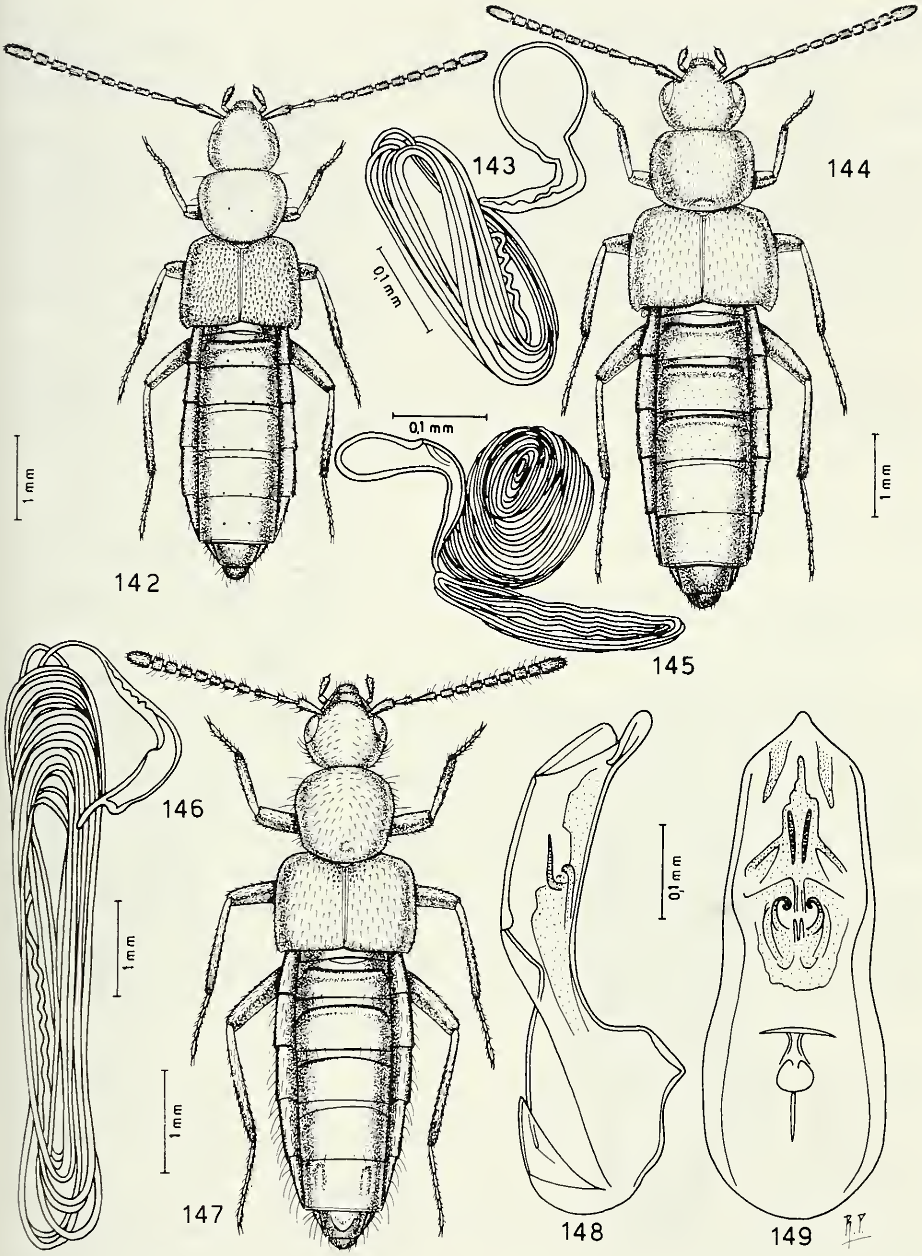
FIGG. 131–136

Habitus, spermateca ed edeago in visione laterale e ventrale. 131–132: *Zyras* (s. str.) *nakuruensis* sp. n.; 133–136: *Zyras* (s. str.) *mutarensis* sp. n.



FIGG. 137–141

Habitus, edeago in visione laterale e ventrale e spermateca. 137–139: *Zyras (Pachydonia) seditiosus* sp. n.; 140–141: *Zyras (Pycnodonia) microarmatus* sp. n.



FIGG. 142–149

Habitus, spermateca ed edeago in visione laterale e ventrale. 142–143: *Zyras (Euryalonia) peranomalus* sp. n.; 144–145: *Zyras (Tropidonia) rangirensis* sp. n.; 146–14: *Zyras (Pycnodonia) microarmatus* sp. n.

Zyras (Pycnodonia) irangicola sp. n. (Figg. 150–152)

Holotypus ♂, Kenya, Embu, Irangi For., 2100 m, 12.X.1977, (Mahnert & Perret leg., MG).

Descrizione. Lungh. 4,8 mm. Corpo lucido e rossiccio con capo bruno; antenne bruno-rossicce con i tre antennomeri basali giallo-rossicci; zampe giallo-rossicce. Il capo presenta punteggiatura distinta e assente sulla linea mediana, reticolazione distinta e una concavità discale. Il pronoto mostra punteggiatura superficiale e assente sulla linea mediana e reticolazione distinta, tranne che sulla linea mediana che perciò appare lucida. La punteggiatura e la reticolazione delle elitre sono come quelle del pronoto. Edeago figg. 151–152.

Comparazioni. La nuova specie è distinta da *Z. lioglutoides* Bernhauer, 1915, dell'Africa orientale, per la presenza di una concavità discale del capo del maschio (assente in *lioglutoides*) e per avere sul 6° urotergo libero del maschio, un tubercolo mediano e non due affilate protuberanze come in *lioglutoides*.

Zyras (Pycnodonia) mahnerti sp. n. (Figg. 153–155)

Holotypus ♂, Kenya, Mt. Aberdares, près Nat. Park, 2300 m, 25.XI.1974, (Mahnert & Perret leg., MG).

Paratypus: 1 ♂, stessa provenienza.

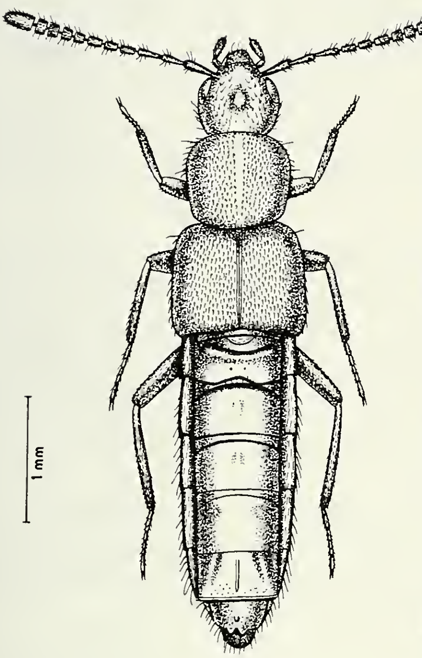
Descrizione. Lungh. 7,9 mm. Corpo lucido e rossiccio con 4° urite libero bruno-rossiccio; antenne bruno-rossicce con i due antennomeri basali giallo-rossicci; zampe giallo-rossicce. La punteggiatura è distinta sul capo e netta sul resto del corpo. Sul capo la punteggiatura è assente su una larga fascia longitudinale mediana, sul pronoto è assente sulla linea mediana, su due aree mediane anteriori e lungo il margine posteriore del pronoto stesso. Edeago figg. 153–154.

Comparazioni. Z. mahnerti sp. n. è specie distinta da *Z. lioglutoides* Bernhauer, 1915, dell'Africa orientale, per la punteggiatura del capo non robusta come quella di *lioglutoides*, per le tempie lunghe quanto gli occhi (e non più lunghe degli occhi come in *lioglutoides*) e per i caratteri sessuali secondari sul 5° urotergo libero del maschio: due tubercoli assenti nella nuova specie, presenti in *lioglutoides*.

Zyras (Pycnodonia) kisumuensis sp. n. (Figg. 156–157)

Holotypus ♀, Kenya, Miss. Kaimosi, NE Kisumu, 1650 m, 10.XI.1974, (Mahnert & Perret leg., MG).

Descrizione. Lungh. 6,8 mm. Corpo lucido e bruno-rossiccio con capo e 4° urite libero bruni; antenne rossicce con i due antennomeri basali giallo-rossicci; zampe giallo-rossicce. L'avancorpo è privo di microscultura reticolare, l'addome invece è distintamente reticolato. La punteggiatura del capo, del pronoto e delle elitre è netta: essa è assente sulla linea mediana del capo. Un fine solco mediano posteriore è presentato dal pronoto. Gli antennomeri non sono lateralmente compressi. Spermateca fig. 157.



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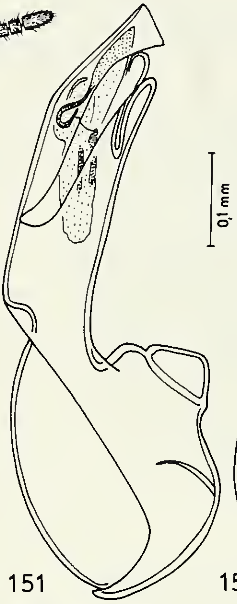

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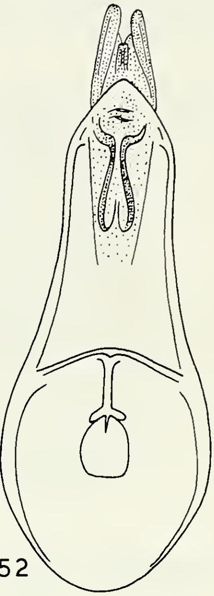

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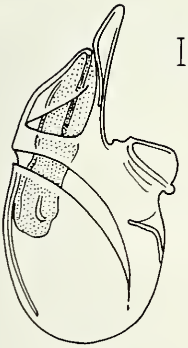

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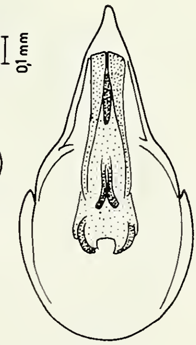

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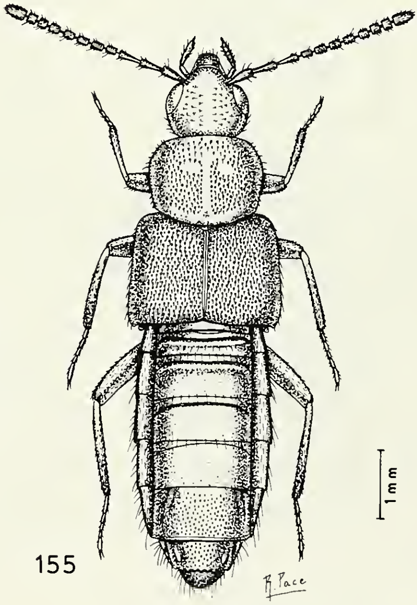

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Figg. 150–155

Habitus ed edeago in visione laterale e ventrale. 150–152: *Zyras (Pycnodonia) irangicola* sp. n.; 153–155: *Zyras (Pycnodonia) mahnerti* sp. n.

Comparazioni. Il pronoto nettamente più stretto delle elitre è tra l'altro un carattere differenziale sufficiente a distiguere la nuova specie da *Z. lioglutoides* Bernhauer, 1915 dell'Africa orientale che ha il pronoto poco più stretto delle elitre.

Zyras (Parophthalmonia) narokensis sp. n. (Figg. 158–159)

Holotypus ♀, Kenya, Narok, près de Narok, 2000 m, 3.XI.1977, (Mahnert & Perret leg., MG).

Paratypus: 1 ♀, stessa provenienza.

Descrizione. Lungh. 6,9 mm. Avancorpo lievemente opaco, addome lucido. Corpo nero-bruno con estremità addominale posteriore bruno-rossiccia; antenne bruno-rossicce con i due antennomeri basali e l'11° giallo-rossicci; zampe giallo-rossicce. La reticolazione del capo, del pronoto e dell'addome è netta, quella delle elitre è nettissima. La punteggiatura sull'avancorpo è netta, quella dell'addome è superficiale. Sul pronoto la punteggiatura è assente sulla linea mediana e al lato esterno delle due deboli fossette longitudinali mediane. Gli antennomeri sono lateralmente compressi. Spermateca fig. 158.

Comparazioni. La nuova specie è ben distinta da *Z. holtzi* Bernhauer, 1928, dell'Africa orientale, per avere il pronoto densamente punteggiato, tranne su due aree discali (sparsamente punteggiato in *holtzi*) e per le elitre lunghe quasi quanto il pronoto (e non 1/4 più lunghe del pronoto come in *holtzi*).

Zyras (Ctenodonia) luorum sp. n. (Figg. 160–162)

Holotypus ♂, Kenya, Mt. Elgon, 2400 m, For. Res., 4.XI.1974, (Mahnert & Perret leg., MG).

Descrizione. Lungh. 8,7 mm. Pronoto ed elitre debolmente opachi, resto del corpo lucido. Corpo rossiccio compresi i lati del 2° urite libero e con capo e uriti liberi 2°, 3°, 4° e 5° bruni; antenne rossicce con i tre antennomeri basali e apice dell'11° giallo-rossicci; zampe giallo-rossicce. La reticolazione del capo e dell'addome è distinta, quella del pronoto e delle elitre è vigorosa. Tutto il corpo presenta distinta punteggiatura fine. Le antenne sono compresse lateralmente e il pronoto presenta una lieve depressione laterale obliqua. Edeago figg. 161–162.

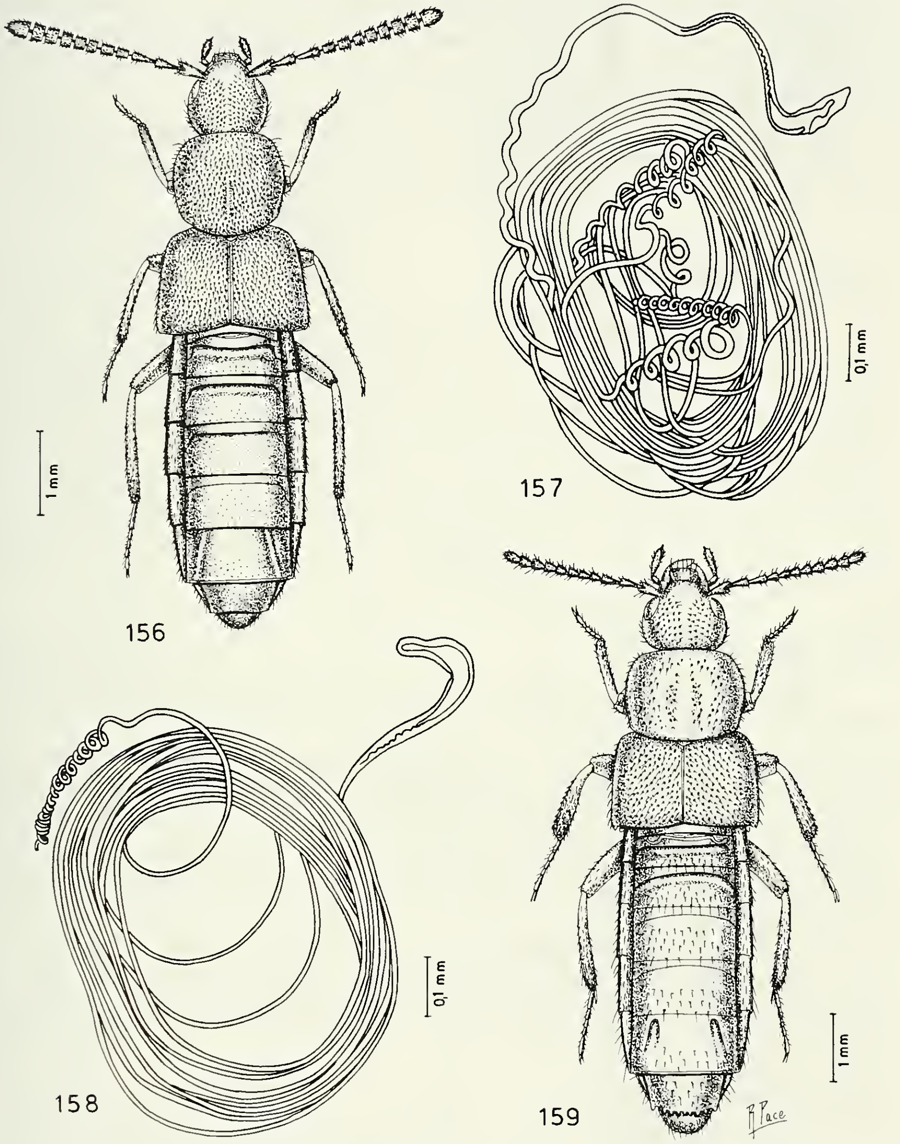
Comparazioni. Specie ben distinta da *Z. magnificus* Bernhauer, 1911, del Kilimangiaro, per avere gli antennomeri 8° a 10° più lunghi che larghi, per il pronoto lungo quanto largo (e non trasverso come in *magnificus*) e per le elitre più lunghe del pronoto (e non lunghe quanto il pronoto come in *magnificus*).

Etimologia. La nuova specie prende nome dai Luo, antico gruppo etnico del Kenya.

Zyras (Ctenodonia) perreti sp. n. (Figg. 163–164)

Holotypus ♀, Kenya, Mt. Aberdares, près Nat. Park, 2300 m, 25.XI.1974, (Mahnert & Perret leg., MG).

Paratypus: 1 ♀, stessa provenienza.



Figg. 156–159

Habitus e spermateca. 156–157: *Zyras (Pycnodonia) kisumuensis* sp. n.; 158–159: *Zyras (Parophthalmonia) narokensis* sp. n.

Descrizione. Lungh. 8,4 mm. Corpo lucido e rossiccio con capo, elitre e uriti liberi 4° e 5° bruno-rossicci; antenne bruno-rossicce con i tre antennomeri basali giallo-rossicci; zampe giallo-rossicce. La reticolazione del capo è distinta, quella sul resto del corpo è netta. La punteggiatura del capo e delle elitre è netta, quella del pronoto è superficiale. Spermateca fig. 163.

Comparazioni. La nuova specie è distinta da *Z. magnificus* Bernhauer, 1911, del Kilimangiaro, per il differente colore dell'addome (interamente nero in *magnificus* e non rossiccio con uriti liberi 4° e 5° bruno-rossicci come nella nuova specie).

Trichodonia ruandorum sp. n. (Figg. 165–166)

Holotypus ♀, Rwanda, Kayove, 2100 m, 29.VIII.1973, (Werner leg., MG).

Descrizione. Lungh. 7,1 mm. Corpo lucido e giallo-rossiccio con capo, elitre e 4° urite libero bruni; antenne brune con apice dell'11° antennomero rossiccio; zampe bruno-rossicce con tarsi rossicci. Assente è la reticolazione su tutto il corpo. La punteggiatura del capo è assente, quella dell'addome è distinta. Tubercoletti salienti coprono la superficie del pronoto e delle elitre. Il pronoto ha una larga depressione laterale. Gli antennomeri non sono compressi lateralmente. Spermateca fig. 166.

Comparazioni. Specie distinta dalle varie specie del genere, per l'assenza di lunghe setole laterali del pronoto e delle elitre.

Porus nakuruensis sp. n. (Figg. 167–169)

Holotypus ♂, Kenya, Nakuru Mau Escarp., près Enangiperi, 2700 m, 6.XI.1977, (Mahnert & Perret leg., MG).

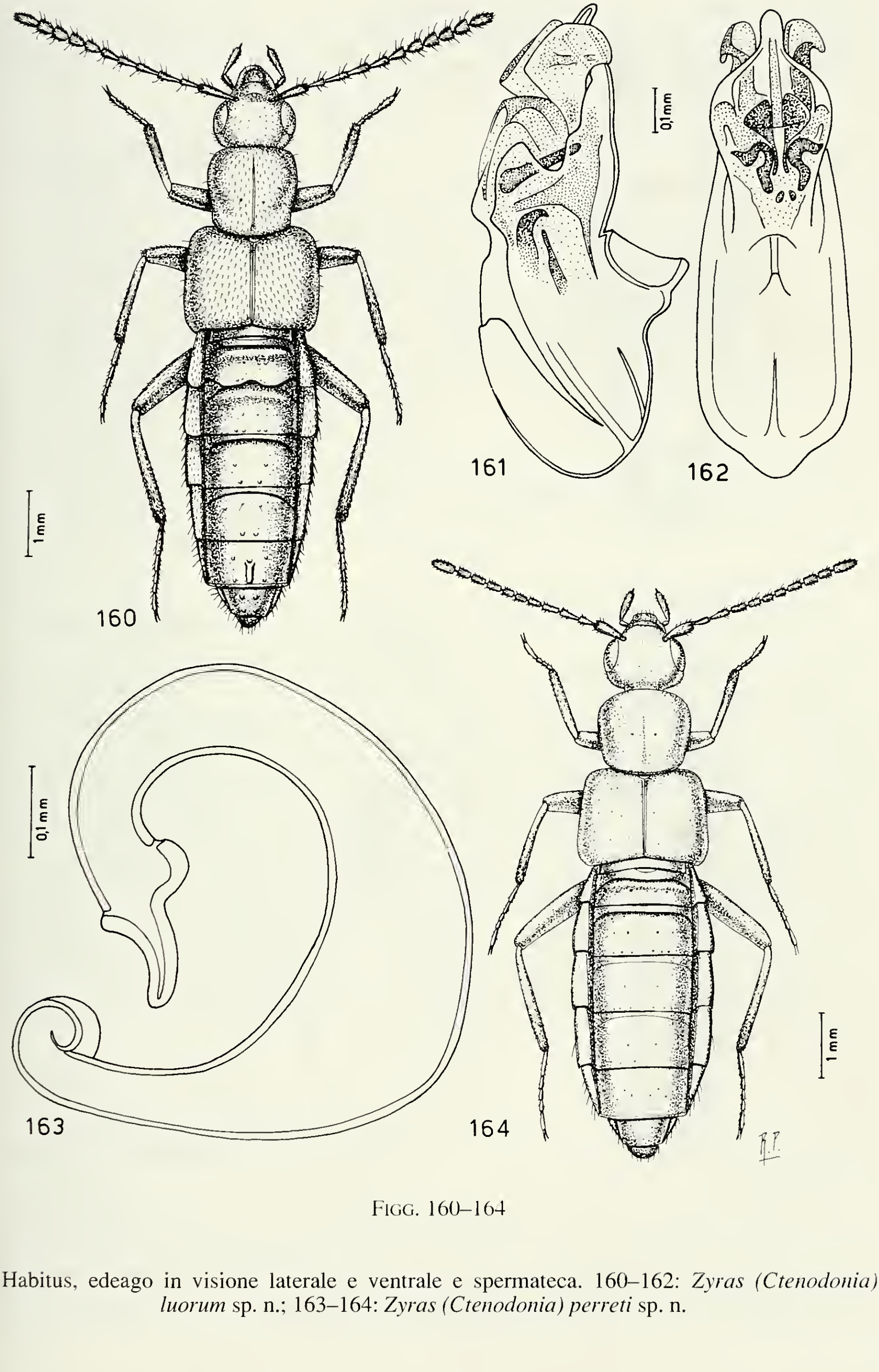
Descrizione. Lungh. 6,8 mm. Avancorpo opaco, addome lucido. Corpo nero-bruno; antenne nero-brune con 2° antennomero, base del 3° e l'11° rossicci; zampe bruno-rossicce. I tubercoletti della superficie del capo, del pronoto e delle elitre sono evidenti e allungati: sono assenti sulla linea mediana del capo e del pronoto. La reticolazione della superficie dell'avancorpo è netta, quella dell'addome è distinta. Edeago figg. 168–169.

Comparazioni. Specie distinta da *P. cupulifer* Fauvel, 1899, del Senegal, per avere la fronte priva di impressione, per l'assenza di spine sul 2° urotergo libero del maschio e per l'assenza di asperità trasversa sinuosa sul 6° urotergo libero del maschio.

Porus ruandensis sp. n. (Figg. 170–172)

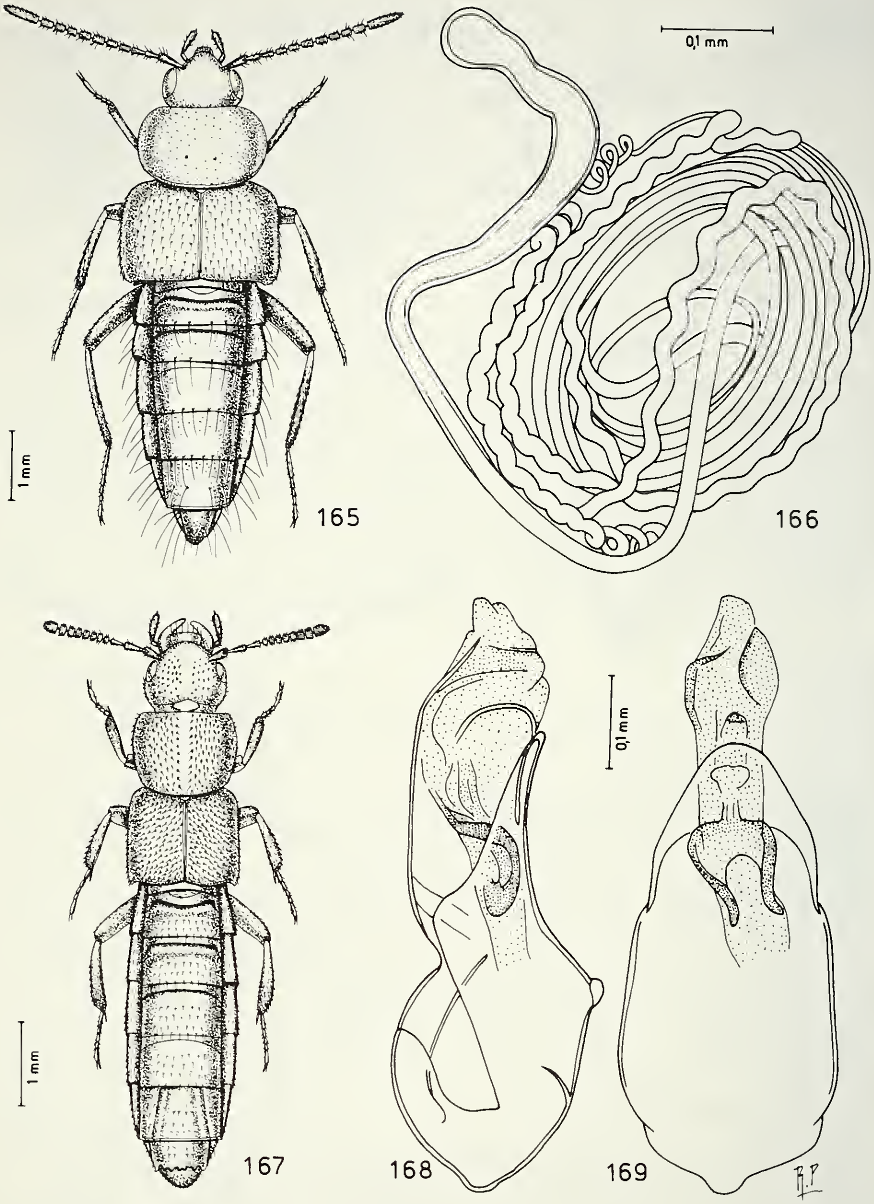
Holotypus ♂, Rwanda, Rangiro, 1800 m, 20.VIII.1976, (Werner leg., MG).

Descrizione. Lungh. 7, 6 mm. Corpo lucido e bruno con base ed estremità dell'addome bruno-rossicce; antenne brune con i due antennomeri basali rossicci; zampe giallo-rossicce. La punteggiatura del capo è ombelicata, netta e assente sulla linea mediana, quella del pronoto è evidente e presente solo su due file dorsali e due fasce laterali. La punteggiatura delle elitre è netta e assente ai lati esterni. L'addome è coperto di punteggiatura profondissima. Edeago figg. 171–172.



FIGG. 160–164

Habitus, edeago in visione laterale e ventrale e spermateca. 160–162: *Zyras (Ctenodonia) luorum* sp. n.; 163–164: *Zyras (Ctenodonia) perreti* sp. n.



Figg. 165–169

Habitus, spermateca ed edeago in visione laterale e ventrale. 165–166: *Trichodonia ruandorum* sp. n.; 167–169: *Porus nakuruensis* sp. n.

Comparazioni. Specie ben distinta da *P. natalensis* Fauvel, 1899, del Natal, per avere il capo lucido (e non opaco e reticolato come quello di *natalensis*), per l'assenza di spine sul 2° urotergo libero del maschio e di carena mediana longitudinale sul 6° urotergo libero del maschio.

Porus umtaliensis sp. n. (Figg. 173–176)

Holotypus ♂, Rhodésie, Umtali, II.1969, (R. Mussard leg., MG).
Paratypi: 3 ♀♀, stessa provenienza.

Descrizione. Lungh. 3,6 mm. Corpo lucido e bruno-rossiccio; antenne bruno-rossicce con i due antennomeri basali giallo-rossicci; zampe giallo-rossicce. La punteggiatura del capo è netta e assente sulla linea mediana e nell'area occipitale, quella del pronoto è lievemente svanita e assente lungo la linea mediana, quella delle elitre è netta e quella dell'addome svanita. Non vi è traccia di microscultura reticolare. Edeago figg. 174–175, spermateca fig. 176.

Comparazioni. A motivo della piccola taglia, la nuova specie è facilmente distinguibile sia da *P. cupulifer* Fauvel, 1899, del Senegal, sia da *P. natalensis* Fauvel, 1899, che da *P. longicollis* Fauvel, 1899, del Sudafrica, che hanno corpo lungo quasi il doppio.

Aenictonia kenyensis sp. n. (Figg. 177–179)

Holotypus ♂, Kenya, Mt. Aberdares, près Nat. Park, 2300 m, 25.XI.1974, (Mahnert & Perret leg., MG).

Descrizione. Lungh. 6,1 mm. Corpo debolmente lucido e bruno con pronoto, base degli uriti liberi 2°, 3° e 4° e lati dell'addome, rossicci; antenne rossicce con i tre antennomeri basali giallo-rossicci; zampe gialle. La reticolazione del capo, del pronoto e dell'addome è distinta, quella delle elitre è netta. I tubercoletti che coprono il capo e il pronoto sono distinti, quelli delle elitre ben salienti. Edeago figg. 178–179.

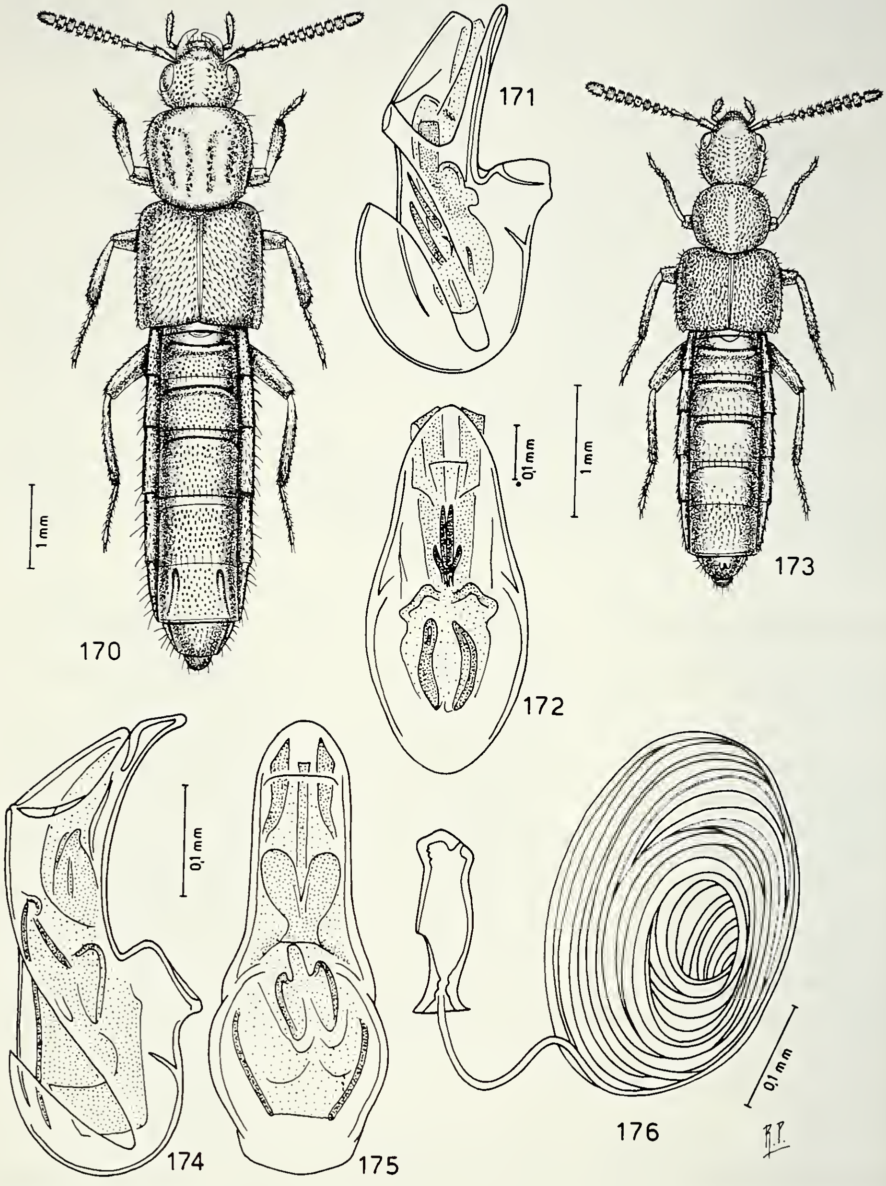
Comparazioni. Specie distinta dalle altre note, per la presenza di un'accentuata gibbosità ventrale dell'edeago, assente in tutte le specie note. La specie nuova è tassonomicamente vicina ad *A. carinata* Kistner, 1968, dello Zaire, per i caratteri esoscheletrici, ma l'edeago, oltre ad avere la citata sinuosità ventrale, in visione laterale, è privo di elevata sinuosità preapicale dell'edeago, presente invece in *carinata*.

OXYPODINI

Amarochara loitensis sp. n. (Figg. 180–183)

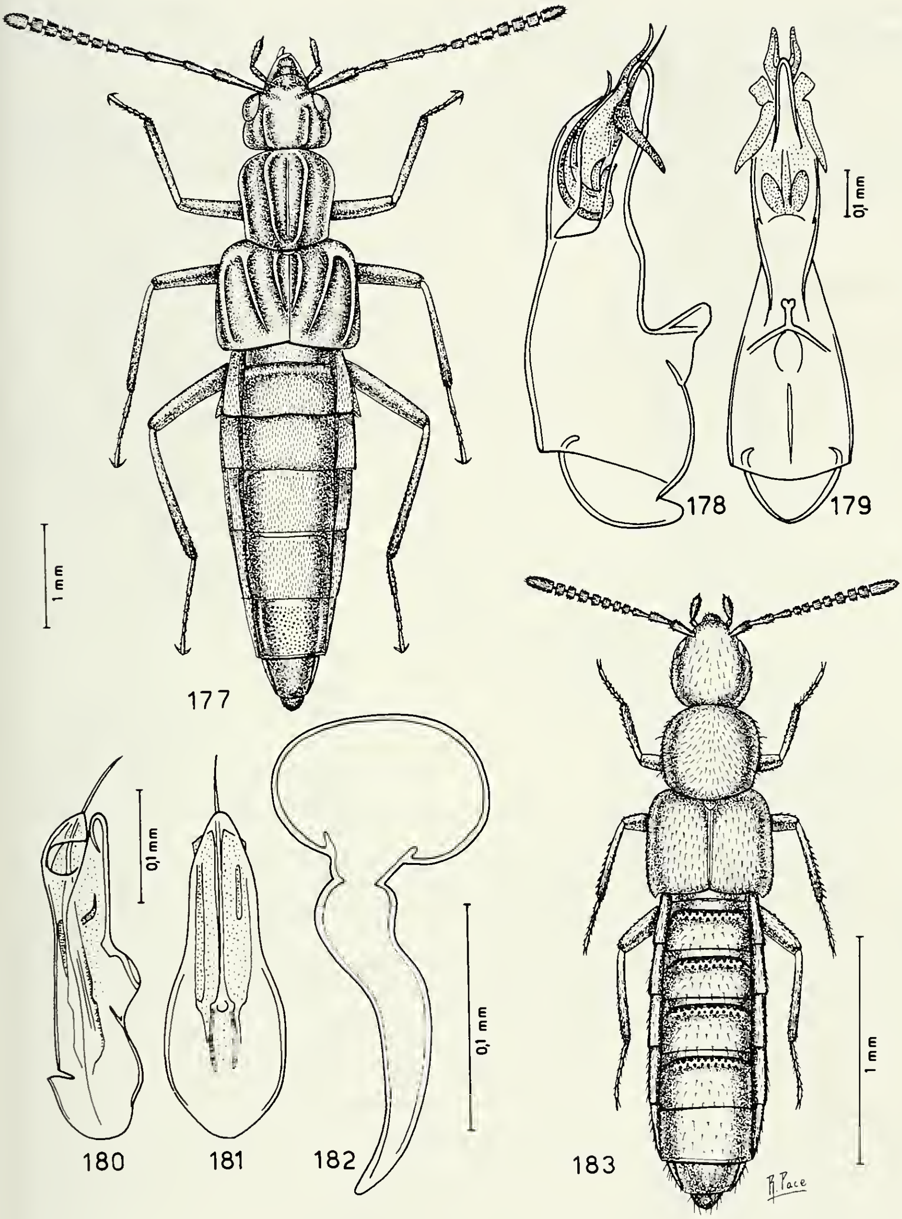
Holotypus ♂, Kenya, Narok, Loita Hills, sous Morijo, 2050 m, 5.XI.1977, (Mahnert & Perret leg., MG).
Paratypus: 1 ♀, stessa provenienza.

Descrizione. Lungh. 2,7 mm. Corpo lucido e bruno-rossiccio con elitre e base degli uroterghi brune; antenne brune; zampe giallo-rossicce. La punteggiatura del



FIGG. 170–176

Habitus, edeago in visione laterale e ventrale e spermateca. 170–172: *Porus ruandensis* sp. n.; 173–176 *Porus umtaliensis* sp. n.



FIGG. 177–183

Habitus, edeago in visione laterale e ventrale e spermateca. 177–179: *Aenictonia kenyensis* sp. n.; 180–183: *Amarochara loitensis* sp. n.

capo e del pronoto è fine e distinta. Le elitre presentano tubercoletti assai svaniti, mentre l'addome li ha distinti. La superficie dei corpo non è reticolata. Edeago figg. 180–181, spermateca fig. 182.

Comparazioni. Specie distinta da *A. sparsa* Tottenham, 1957, del Ruanda, per avere le elitre non fortemente punteggiate e per avere il bulbo distale della spermateca molto più sviluppato e la parte prossimale della spermateca stessa, a forma di corno e non sottile e a lati paralleli come in *sparsa*.

Amarochara nakuruensis sp. n. (Fig. 184–185)

Holotypus ♀, Kenya, Lac Naivasha, Nakuru, près de Mundui Estate, 1950 m, 8.XI.1977, (Mahnert & Perret leg., MG).

Descrizione. Lungh. 2,5 mm. Corpo lucido e rossiccio con uriti liberi 4° e 5° bruno-rossicci; antenne brune con i due antennomeri basali giallo-rossicci; zampe giallo-rossicce. La punteggiatura del capo e del pronoto è fine e svanita. Tubercoletti salienti coprono le elitre. Non esiste reticolazione sul corpo. Spermateca fig. 185.

Comparazioni. Specie esternamente simile ad *A. sparsa* Tottenham, 1957, del Ruanda, ma la spermateca ha forma chiaramente differente nella nuova specie: la parte prossimale è bisinuata e di calibro maggiore presso il bulbo distale e di calibro minore verso il bulbo prossimale che è indistinto, mentre la parte prossimale della spermateca di *sparsa* ha calibro uniforme ed esile e non è sinuata.

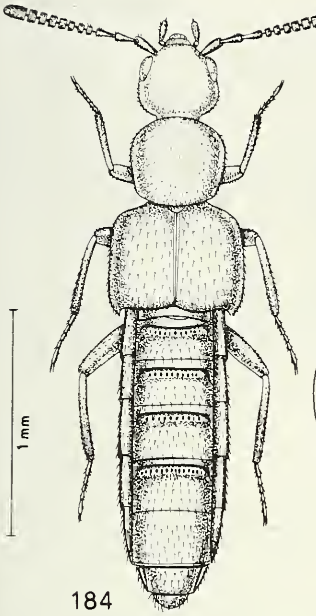
Apimela mahnerti sp n. (Figg. 213–215)

Holotypus ♂, Kenya, Narok, 5.X.1977, Loita Hills, 2050 m, (Mahnert & Perret leg., MG).

Paratypi: 1 ♀, stessa provenienza, ma 4.X.1977; 2 ♂♂ e 2 ♀♀, Kenya, Mt. Aberdares, Parc National, 2300 m, 25.XI.1974, (Mahnert & Perret leg.); 2 es. Kenya, Taita Hills, env. Wundanyi, 1350 m, 2.XII.1974, (Mahnert & Perret leg.); 3 es., Kenya, Embu, Irangi Forest st., 2000 m, 11.X.1977, (Mahnert & Perret leg.); 1 ♂, Kenya, Mt. Elgon, 2700 m, 15.XI.1974, (Mahnert & Perret leg.); 1 ♀. Kenya, Kiambu, près de Limuru, 2300 m, 2.XI.1977, (Mahnert & Perret leg.); 1 ♂, Rhodésie, Umtali, Melsetter, 1700 m, II.1969, (R. Mussard leg.); 1 ♂ e 2 ♀♀, Rhodésie, Umtali, II.1969, (R. Mussard leg.); 5 es., Rwanda, Rangiro, 1800 m, 20.IX.1976 e 8.III.1972, (Werner leg.); 550 es., Rwanda, Kayove, 15-29.V.1973, (Werner leg.).

Descrizione. Lungh. 2,3 mm. Corpo lucido e nero-bruno con pronoto e 6° urite libero bruni; antenne nero-brune con i due antennomeri basali bruni; zampe di un giallo sporco con femori posteriori giallo-bruni. La reticolazione del capo e dell'addome è svanita, quella del pronoto e delle elitre è svanita. I tubercoletti che coprono la superficie del capo sono svaniti. La punteggiatura del pronoto è finissima e poco evidente. Edeago figg. 211–212, spermateca Figg. 213.

Comparazioni. La taglia della nuova specie è maggiore di quella di *A. subparallela* (Bernhauer, 1938), dello Zaire, l'edeago della nuova specie è tozzo, mentre in subparallela è snello e la spermateca della nuova specie ha matassa molto sviluppata, mentre in *subparallela* la matassa è poco sviluppata.



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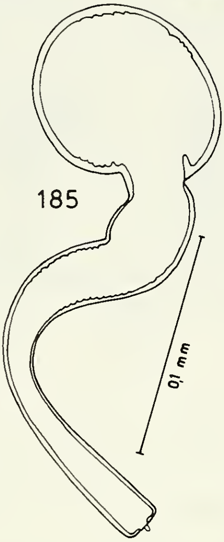

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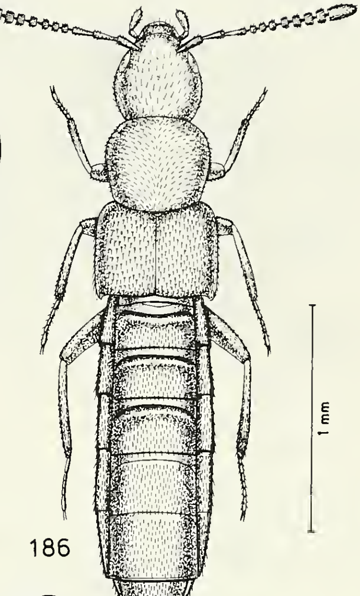

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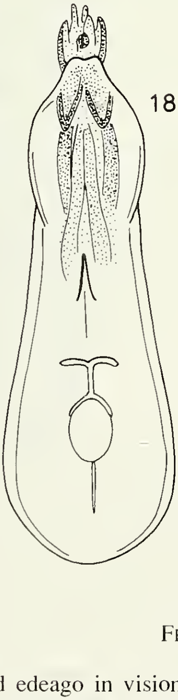

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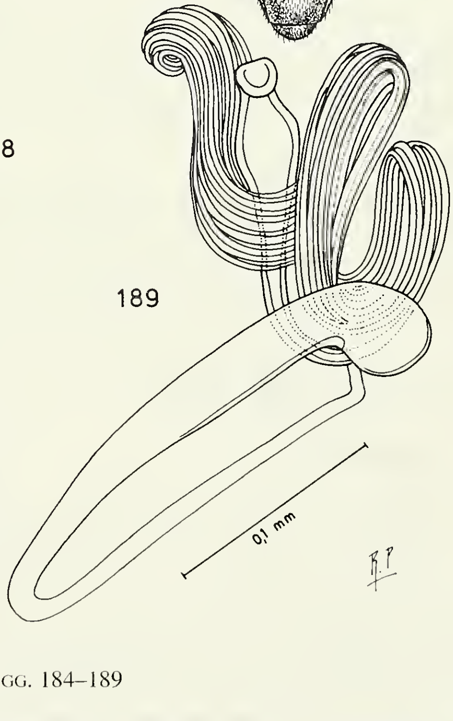

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FIGG. 184–189

Habitus, spermateca ed edeago in visione laterale e ventrale. 184–185: *Amarochara nakuruensis* sp. n.; 186–89: *Apimela luorum* sp. n.

Apimela heteroclita sp. n. (Figg. 216–219)

Holotypus /, Kenya, Nairobi, 2.XI.1974, Mahnert & Perret leg., MG).
Paratypi: 10 es., stessa provenienza, ma anche 4.XI.1974.

Descrizione. Lungh. 2,2 mm, Corpo lucido e bruno con pronoto, i tre uriti basali e l'estremità addominale bruno-rossicci; antenne brune con i due antennomeri basali bruno-rossicci; zampe gialle. La reticolazione del capo e dell'addome è svanita, quella del pronoto e delle elitre è distinta. La punteggiatura del capo è indistinta. Il pronoto presenta tubercoletti svaniti, le elitre mostrano tubercoletti poco salienti. Edeago fig. 217–218, spermateca fig. 219.

Comparazioni. La nuova specie è chiaramente distinta da *A. subparallela* (Bernhauer, 1939a, dello Zaire, per la taglia maggiore, per avere l'edeago tozzo (snello in *subparallela*) e la spermateca molto più sviluppata e molto più complessa e con un numero di spire più ampie.

Apimela luorum sp. n. (Figg. 186–189)

Holotypus ♂, Kenya, MT. Elgon, 2400 m, For. Res, 14.XI.1974, (Mahnert & Perret leg., MG).
Paratypi: 5 es., stessa provenienza; 4 es., Kenya, Embu, Irangi Forest, 2100 m, 12.X.1977, (Mahnert & Perret leg.).

Descrizione. Lungh. 2,6 mm. Corpo lucido e rossiccio sporco con margine posteriore degli uroterghi ed estremità addominale giallo-rossicci; antenne brune con l'antennomero basale giallo-rossiccio; zampe giallo-rossicce. La punteggiatura del capo e del pronoto è svanita. Tubercoletti distinti coprono la superficie delle elitre e dell'addome. Sul corpo non vi è traccia di reticolazione. Edeago figg. 187–188, spermateca fig. 189.

Comparazioni. Poiché la nuova specie presenta elitre più corte del pronoto, è nettamente distinta dalle specie finora note, che presentano elitre più lunghe del pronoto. Anche la forma molto caratteristica dell'edeago e della spermateca della nuova specie non trova riscontri in altre specie, anche in quelle attere qui di seguito descritte.

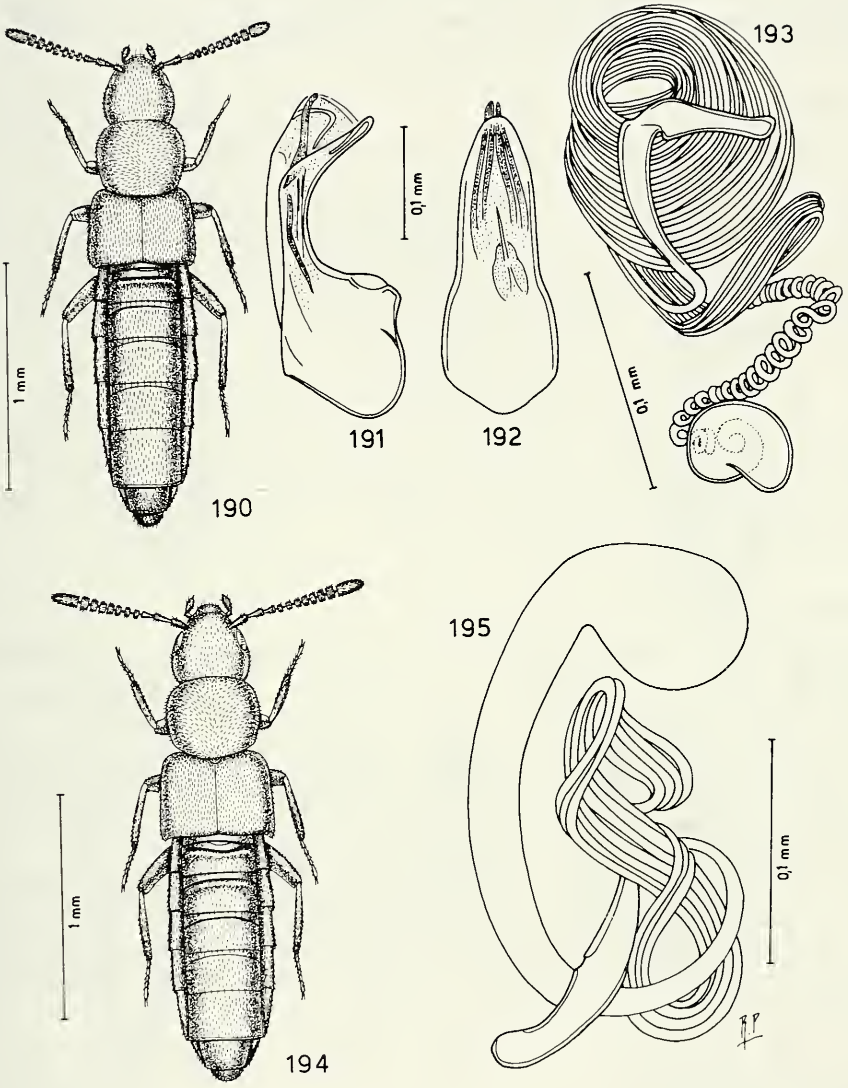
Etimologia. La nuova specie prende nome dai Luo, gruppo etnico nilotico del sud del M. Elgon, località tipica.

Apimela rangirensis sp. n. (Figg. 190–193)

Holotypus ♂, Rwanda, Rangiro, 1800 m, 6.VIII.1973, (Werner leg., MG) .
Paratypi: 73 es., stessa provenienza; ma anche 25.III.1973 e 14.IX.1976.

Descrizione. Lungh. 2,1 mm. Corpo lucido e giallo-rossiccio con capo, elitre e 4° urite libero bruno-rossicci; antenne brune con l'antennomero basale giallo-rossiccio; zampe gialle. La punteggiatura del capo è fine, fitta e distinta, quella del pronoto è svanita. Le elitre presentano tubercoletti distinti; l'addome ha tubercoletti superficiali. Edeago figg. 191–192, spermateca fig. 193.

Comparazioni. Anche questa nuova specie, come *A. luorum* sp. n. sopra descritta, mostra elitre più corte del pronoto, perciò è ben distinta da *A. subparallela*



FIGG. 190–195

Habitus, edeago in visione laterale e ventrale e spermateca. 190–193: *Apimela rangirensis* sp. n.; 194–195: *Apimela kirimirensis* sp. n.

(Bernhauer, 1938), dello Zaire, e da altre specie che presentano elitre più lunghe del pronoto. In base alla forma dell'edeago e della spermateca, la nuova specie si distingue chiaramente dalle specie con elitre più corte del pronoto qui descritte.

Apimela kirimirensis sp. n. (Figg. 194–195)

Holotypus ♀, Kenya, Embu, Kirimiri Forest, O de Runyenye, 1550 m, 13.X.1977, (Mahnert & Perret leg., MG).

Descrizione. Lungh. 2,1 mm. Corpo lucido e giallo-rossiccio con elitre bruno-rossicce; antenne brune con i due antennomeri basali giallo-rossicci; zampe gialle. Il capo e il pronoto presentano punteggiatura fitta e distinta. I tubercoletti che coprono le elitre sono svaniti, quelli dell'addome sono distinti. Solo l'addome mostra una distinta reticolazione: sul resto del corpo la reticolazione è assente. Spermateca fig. 195.

Comparazioni. Poiché la nuova specie ha elitre lunghe quanto il pronoto, è ben distinta da *A. subparallela* (Bernhauer, 1938), dello Zaire, che ha elitre più lunghe del pronoto. Inoltre la spermateca della nuova specie ha sviluppo molto maggiore e ha bulbo prossimale ipertrofico, mentre la spermateca di *subparallela* è poco sviluppata, con bulbo prossimale non ipertrofico.

Apimela perreti sp. n. (Figg. 196–197)

Holotypus ♀, Kenya, Narok, Morijo Loita Hills, 2300 m, 4.I.1977, (Mahnert & Perret leg., MG).

Paratypi: 4 ♀♀, Kenya, Embu, Irangi Forest, 2100 m, 12 X.1977, (Mahnert & Perret leg.).

Descrizione. Lungh. 2,3 mm. Corpo lucido e bruno con base ed estremità addominali bruno-rossicci; antenne brune; zampe bruno-rossicce. L'avancorpo è coperto di punteggiatura svanita, posta su un fondo non reticolato. L'addome presenta reticolazione a maglie trasverse e svanite. Spermateca fig. 197.

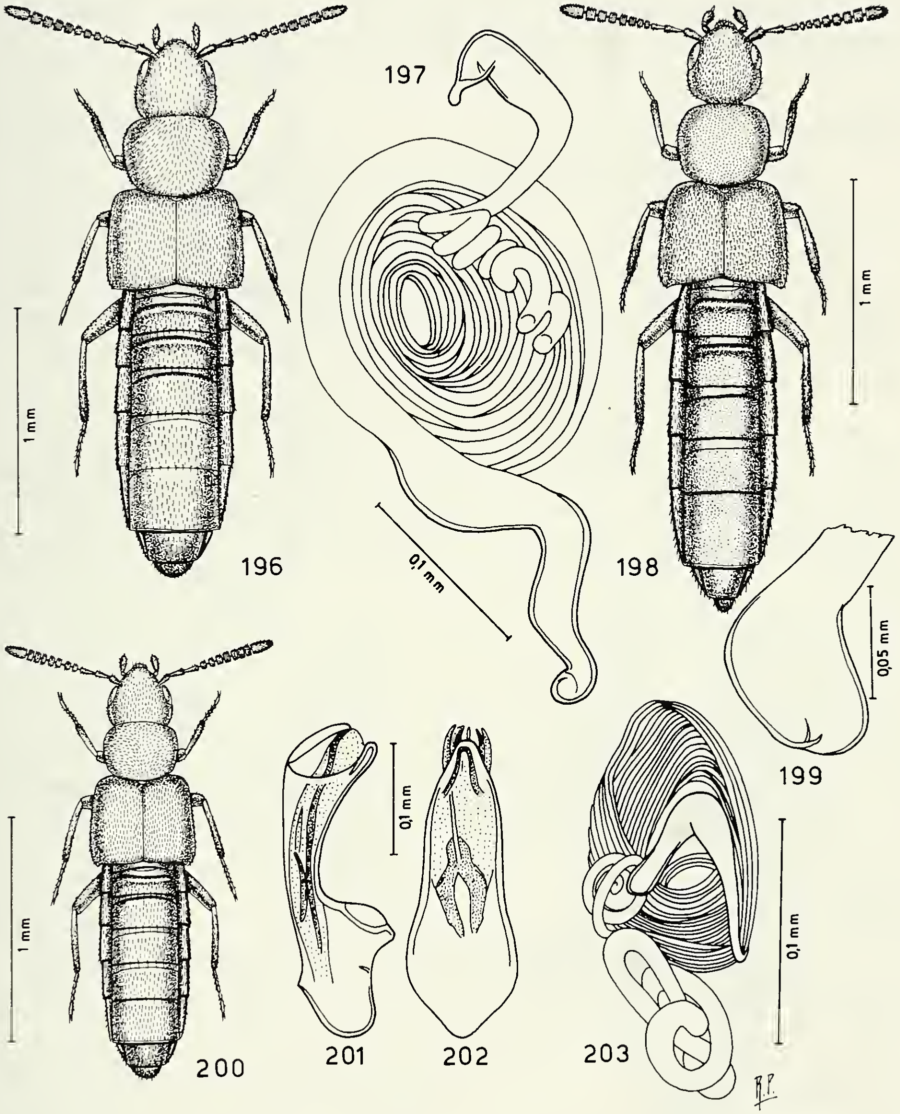
Comparazioni. La taglia corporea maggiore e le elitre molto larghe rispetto al pronoto, sono i caratteri più evidenti che permettono di distinguere a prima vista la nuova specie da *A. subparallela* (Bernhauer, 1938), dello Zaire. Inoltre la spermateca della nuova specie è molto più sviluppata di quella di *subparallela*, con matassa molto più fitta.

Apimela zerchei sp. n. (Figg. 198–199)

Holotypus ♀, Usambara (Coll. Kraatz, D.E.I.).

Descrizione. Lungh. 2, 5 mm. Corpo lucido e bruno-rossiccio; antenne bruno-rossicce con 11° antennomero giallo-bruno; zampe giallo-rossicce. Tutto il corpo è coperto di punteggiatura fine e fitta, posta su un fondo non reticolato. Spermateca fig. 199 (purtroppo amputata).

Comparazioni. La nuova specie ha elitre più lunghe del pronoto, ma non così lunghe come quelle di *A. subparallela* (Bernhauer, 1938), dello Zaire. Inoltre il bulbo



FIGG. 196–203

Habitus, spermateca ed edeago in visione laterale e ventrale. 196–197: *Apimela perreti* sp. n.; 198–199: *Apimela zerchei* sp. n.; 200–203: *Apimela kayovensis* sp. n.

prossimale della spermateca della nuova specie è molto più sviluppato di quello corrispondente della spermateca di *subparallela*.

Etimologia. La nuova specie è dedicata al Dr. Lothar Zerche, noto studioso di Staphylinidae del D.E.I. di Eberswalde, che me l'ha affidata in esame.

Apimela kayovensis sp. n. (Figg. 200–203)

Holotypus ♂, Rwanda, Kayove, 2100 m, 15.V.1973, (Werner leg., MG).

Paratypi: 10 es., stessa provenienza; 1 ♀, Rwanda, Kamiranzoyu, 1900 m, marais, I.1976, (Werner leg.).

Descrizione. Lungh. 1,8 mm. Corpo lucido e rossiccio con capo, elitre e 4° urite libero, bruni; antenne brune con i due antennomeri basali giallo-rossicci; zampe gialle. La punteggiatura del capo e del pronoto è fine e fitta. Le elitre sono coperte di tubercoletti svaniti come quelli dell'addome. Sul corpo non vi è traccia di reticolazione. Edeago figg. 201–202, spermateca fig. 203.

Comparazioni. In base alla forma della spermateca e dell'edeago, la nuova specie è sistematicamente vicina ad *A. rangirensis* sp. n., sopra descritta, tuttavia la nuova specie presenta elitre molto più lunghe del pronoto, mentre in *rangirensis* le elitre sono più corte del pronoto. La taglia della nuova specie è minore di quella di *rangirensis* e l'edeago della nuova specie è meno profondamente ricurvo al lato ventrale.

HOPLANDRIINI

Tinotus minutus Bernhauer, 1915

Tinotus minutus BERNHAUER, 1915: 158

1 ♀, Kenya, Lac Naivasha, 5 Km Fischeman's Camp, 5.XI.1974, (Mahnert & Perret leg.).

Specie nota solo dell'Africa orientale.

Tinotus natalensis Pace, 1986 (Figg. 204–205)

Tinotus natalensis PACE, 1986: 107

1 ♀, Kenya, Nairobi, 2.XI.1974, (Mahnert & Perret leg.); 3 ♀♀, Rhodésie, Umtali, II.1969, (R. Mussard leg.).

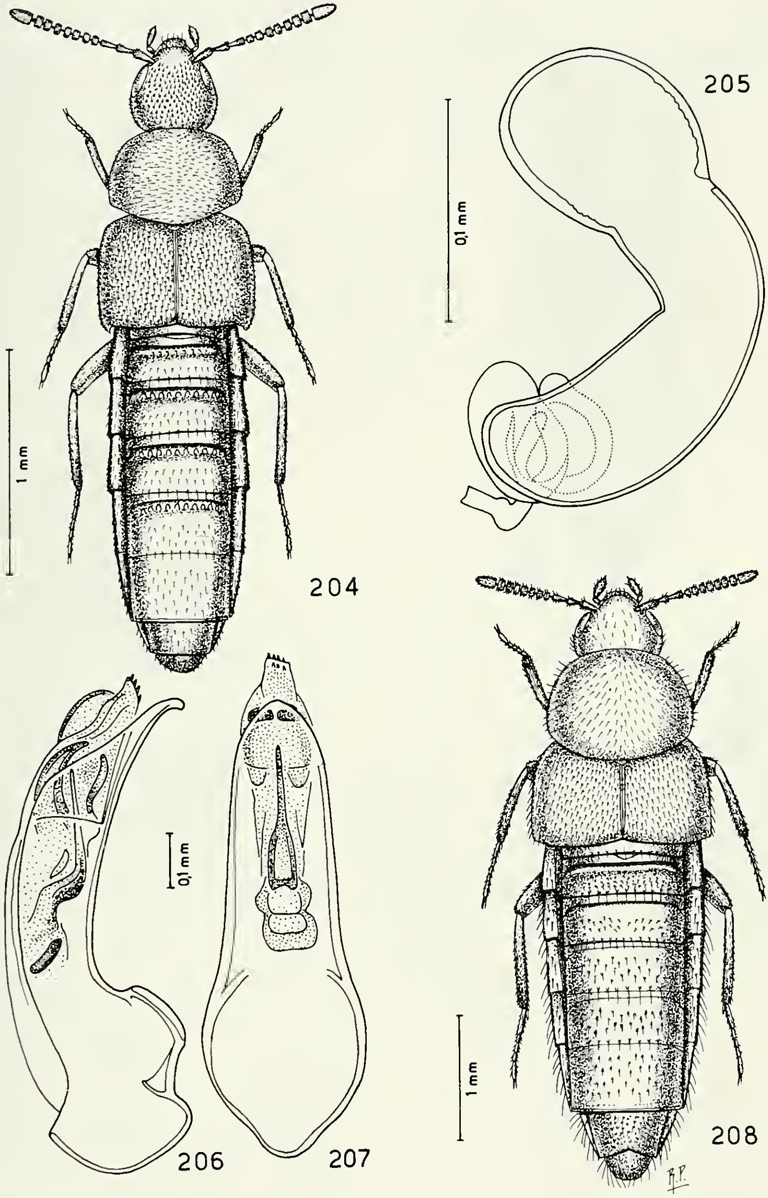
ALEOCHARINI

Aleochara (s. str.) **kiambuensis** sp. n. (Figg. 206–208)

Holotypus ♂, Kenya, Kiambu, près de Limuru, 2300 m, 2.XI.1977, (Mahnert & Perret leg., MG).

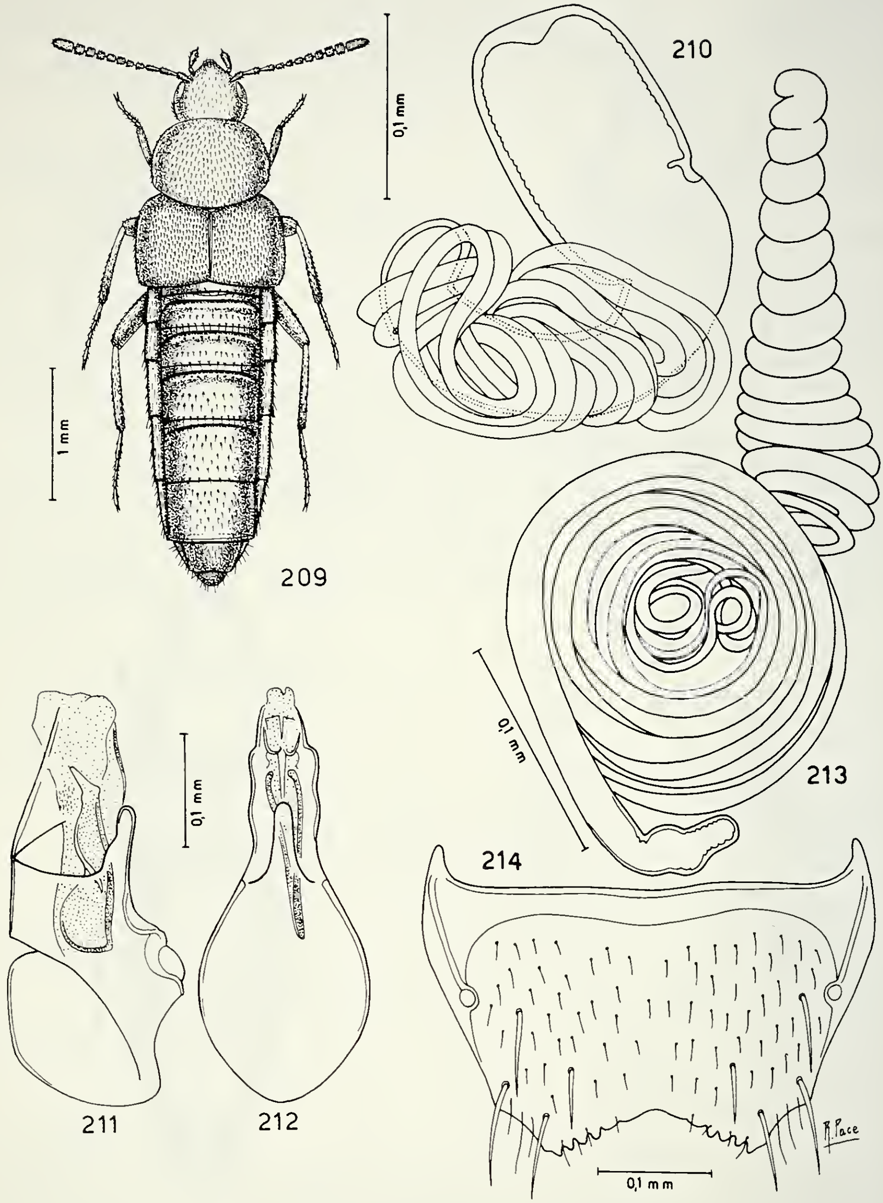
Paratypus: 1 ♂, stessa provenienza.

Descrizione. Lungh. 4,8 mm. Corpo lucido e nero, con elitre giallo-brune aventi i lati esterni bruni; antenne nere con i due antennomeri basali rossicci; zampe



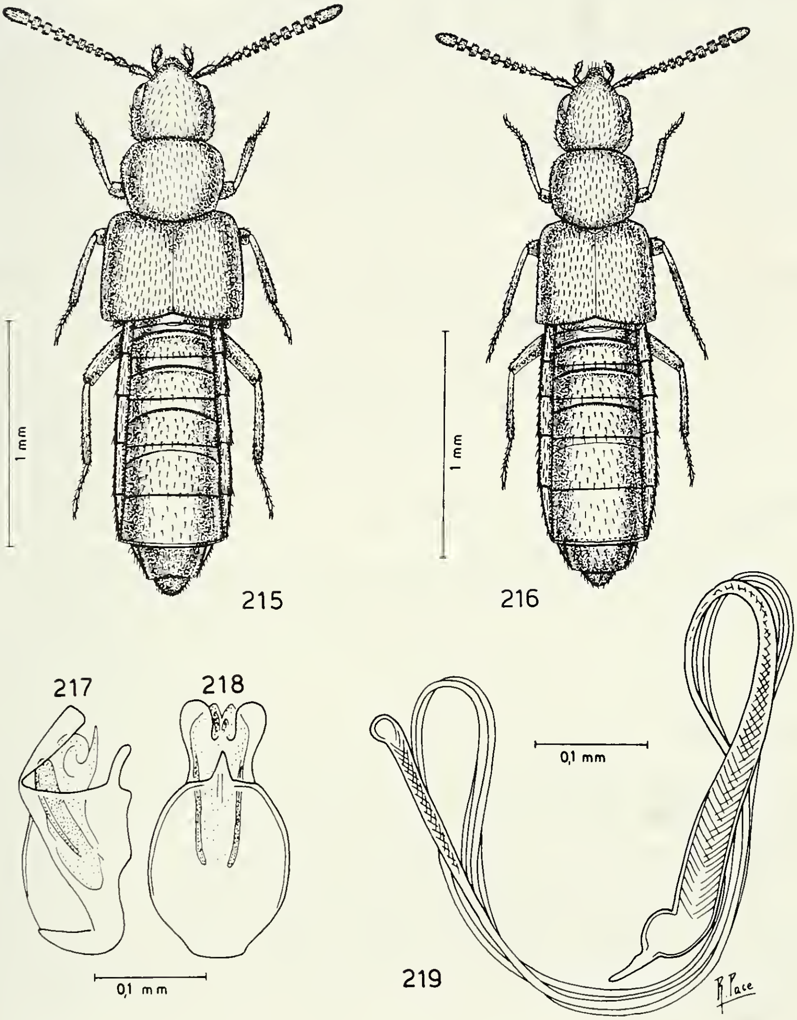
FIGG. 204–208

Habitus, spermateca ed edeago in visione laterale e ventrale. 204–205: *Tinotus natalensis* Pace; 206–208: *Aleochara* (s. str.) *kiambuensis* sp. n.



FIGG. 209–214

Habitus, spermateca e 6° urotergo libero del maschio. 209–210: *Aleochara (Xenochara) kivu* Lik.; 211–214: *Apimela mahnerti* sp.



Figg. 215–219

Habitus, edeago in visione laterale e ventrale e spermateca. 215: *Apimela mahnerti* sp. n.; 216–219: *Apimela heteroclita* sp. n.

bruno-rossicce. La punteggiatura dell'avancorpo è distinta. La punteggiatura sui due uroterghi basali è separata dal margine posteriore da una fascia senza punteggiatura. Edeago figg. 206–207.

Comparazioni. Specie con habitus più tozzo di quello di *A. arrowi* Bernhauer, 1940, dell'Uganda, con elitre più corte del pronoto (elitre lunghe quanto il pronoto in *arrowi*). In visione ventrale, l'edeao della nuova specie, all'apice termina a punta molto ogivale, mentre l'edeago di *arrowi* termina a punta molto aguzza. Inoltre il sacco interno dell'edeago della nuova specie, possiede un lungo stiletto, mentre il corrispondente pezzo in *arrowi* è corto e ricurvo

Aleochara (Xenochara) kivu Likovski, 1983 (Figg. 209–210)

Aleochara (Polychara) plagiata Cameron, 1932: 42
Aleochara kivu Likovski, 1983: 16
Aleochara (Xenochara) kivu: Klimaszewski, 1993: 74
1 ♀, Tanzania, Arusha, XI.1972, (E.C. Supper leg., MG).

Specie nota del Sudafrica, Zaire, Rwanda e Kenya. Nuova per la Tanzania.

Aleochara (Xenochara) puberula Klug, 1833

Aleochara puberula Klug, 1833: 139
1 ♀, Kenya, Embu, pr. Ishiara, 900 m, 14.X.1977, (Mahnert & Perret leg.).

Specie cosmopolita diffusa in Europa, Africa e Nordamerica.

Ringraziamenti

Un sentito ringraziameto è rivolto al Dr. I. Löbl et al Dr. C. Besuchet del Museo di Storia Naturale di Ginevra, che mi hanno concesso di studiare il materiale oggetto del presente lavoro. Per il prestito di tipi e di materiale di confronto ringrazio anche il Dr. L. Bartolozzi del Museo Zoolegico de "La Specola" dell'Università di Firenze, il Dr. L. Zerche del D.E.I. di Eberswalde, il Dr. M. Uhlig del Museo Zoologico dell'Università Humboldt di Berlino, il Dr. L. Baert dell'Institut Royal des Sciences Naturelles di Bruxelles, il Dr. A.F. Newton del "Field Museum of Natural History" di Chicago.

Résumé

Ce travail énumère 70 espèces dont 60 sont décrites comme nouvelles. Elles apartiennent aux tribus Thamiaraeini, Myrmedoniini, Oxypodini, Hoplandriini et Aleocharini. Huit holotypes ou lectotypes d'espèces décrites par Bernhauer, sont illustrés. Cinq nouvelles combinaisons sont effectuées.

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Oribatids from Sarawak I. (Acari: Oribatida).

New and interesting mites from the Geneva Museum LXXVIII

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Oribatids from Sarawak I (Acari: Oribatida). New and interesting mites from the Geneva Museum LXXVIII. – Seventeen Oribatid species are listed from Sarawak; ten of them are new to science and 2 also represent new genera: *Bakobodes* gen. n. (Carabodidae) and *Sarawakiella* gen. n. (Galumnidae).

Key-words: Acari - Oribatida - Taxonomy - New species, new genera - Sarawak.

INTRODUCTION

The present paper is the first contribution to knowledge of the Oribatid mites collected by Dr. Bernd Hauser, Head of the Arthropod Department of the Muséum d'Histoire naturelle, Geneva, during his 1987 expedition to Sarawak, organized together with Dr. Charles Lienhard, Research Officer at the same Department, as a part of the program of systematic exploration of the Microarthropoda of the rain forests of South-East Asia and surrounding areas.

The main goals and aims of this research program on Oribatids of South-East Asia were summarized in my recent paper on Brunei (MAHUNKA 1995). These first results on the Oribatids of Sarawak confirm the great importance of Borneo for a sound interpretation of the historical zoogeography of South-East Asia.

The elaboration of this rich material requires prolonged studies and the results will therefore be published in several parts. I discuss here the occurrence of 17 species, most of them belonging to the groups Ptyctima and Carabodida; 10 species are new to science, 2 of which also represent new genera: *Bakobodes* gen. n. (Carabodidae) and *Sarawakiella* gen. n. (Galumnidae).

In the descriptions I generally apply the terminology used in several publications by NORTON (e.g. 1982) and BEHAN-PELLETIER (e.g. 1984) based on Grandjean's work.

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[1] Partly sponsored by the Hungarian National Scientific Research Fund (OTKA T-016729).

Manuscrit accepted 20.04.1995.

The pilosity of the parts of the body and of the legs is expressed in formulae. The sequence of the anogenital formula is: number of genital, aggenital, anal and adanal setae. Within the setal formula of the palp and the legs, the solenidia of a given segment are marked with the symbol +. The measurements given correspond to extremes observed in the present material; length is measured from the rostral apex to the furthermost opposite point of the body, width refers to maximum body width (in the case of movable pteromorphae to maximum width without pteromorphae).

LIST OF LOCALITIES

Sar-87/60 : MALAYSIA: **Sarawak:** Serian District, Penrissen Road 12 miles de Kuching, "Semongok Wildlife Rehabilitation Centre: Nursery Centre of the Forest Department", prélèvement de sol dans les angles formés par les contreforts de grands arbres, 50 m; 8.XII.1987; leg. B. H. (B)[2]

Sar-87/64 : MALAYSIA: **Sarawak:** route Kuching–Matang, mont Gunung Serapi, prélèvement du sol dans la forêt le long de la route vers la station TV, 670 m; 9.XII.1987; leg. B. H. (B)[2]

Sar-87/66 : MALAYSIA: **Sarawak:** route Kuching–Matang, mont Gunung Serapi, prélèvement du sol dans la forêt le long de la route vers la station TV, 320 m; 9.XII.1987; leg. B. H. (B)[2]

Sar-87/76 : MALAYSIA: **Sarawak:** Bako National Park, Jalan Lintang, prélèvement de sol dans les angles formés par les contreforts de *Austrobuxus nitidus* Miq. [= *Longetia malayana* (Benth.) P. & H.] (Euphorbiaceae), 30 m; 11.XII.1987; leg. B. H. (B)[3]

LIST OF SPECIES

Hypochthoniidae Berlese, 1910

Malacoangelia remigera Berlese, 1913

Locality: Sar-87/64: 3 specimens.

Distribution: circumtropical.

Phthiracaridae Perty, 1841

Hoplophorella cucullata (Ewing, 1909)

Locality: Sar-87/64: 2 specimens.

Distribution: approximately circumtropical.

Kakophthiracarus enigmaticus sp.n.

Locality: Sar-87/60.

Hoplophthiracarus (*Plonaphacarus*) *aculeatus* Mahunka, 1995.

Localities: Sar-87/60: 1 specimen; Sar-87/64: 1 specimen; Sar-87/76: 2 specimens.

Distribution: Brunei (known from the type locality only).

Notophthiracarus lienhardi sp. n.

Locality: Sar-87/60.

Synichotritiidae Walker, 1965

Sabahtritia sarawak sp. n.

Locality: Sar-87/64.

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[2] (B) = extraction par appareil BERLESE à Kuching (Sarawak).

[3] (B) = extraction par appareil BERLESE à Genève.

Temburongiidae Mahunka, 1990
Temburongia patoi Mahunka, 1990
Locality: Sar-87/76: 2 specimens.
Distribution: Brunei (known from the type locality only).

Eremaeozetidae Balogh, 1972
Eremaeozetes maculosus Mahunka, 1995
Locality: Sar-87/64: 2 specimens.
Distribution: Brunei (known from the type locality only).

Carabodidae C. L. Koch, 1837
Bakobodes orangutan gen. n., sp. n.
Localities: Sar-87/64; Sar 87/76.
Berndobodes hauseri sp. n.
Localities: Sar-87/60; Sar-87/76.
Congocepheus orientalis Mahunka, 1987
Locality: Sar-87/76: 2 specimens.
Distribution: Sabah (known from the type locality only).
Gymnobodes semengok sp. n.
Localities: Sar-87/60; Sar-87/76.
Hardybodes penicillatus Mahunka, 1995
Locality: Sar-87/76: 2 specimens.
Distribution: Brunei (known from the type locality only).
Pasocepheus bako sp. n.
Locality: Sar-87/76.
Yoshiobodes humidus sp. n.
Locality: Sar-87/66.

Peloppiidae Balogh, 1943
Austroceratoppia serapi sp. n.
Localities: Sar-87/64; Sar-87/66.

Galumnidae Jacot, 1925
Sarawakiella longipilosa gen. n., sp. n.
Localities: Sar-87/60; Sar-87/64.

DESCRIPTIONS

Kakophthiracarus enigmaticus sp. n. (Figs 1-5)

Material examined: Holotypus: Sar-87/60, 23 paratypes from the same sample. Holotypus and 15 paratypes deposited in the MHNG[4] and 8 paratypes (1416-PO-1991) in the HNHM[5].

Measurements. – Length of aspis: 178-252 µm, length of notogaster: 312-485 µm, height of notogaster: 223-322 µm.

Integument: The whole body surface covered by a thick cerotegument layer, extremely thick in the deeper hollows of the notogaster.

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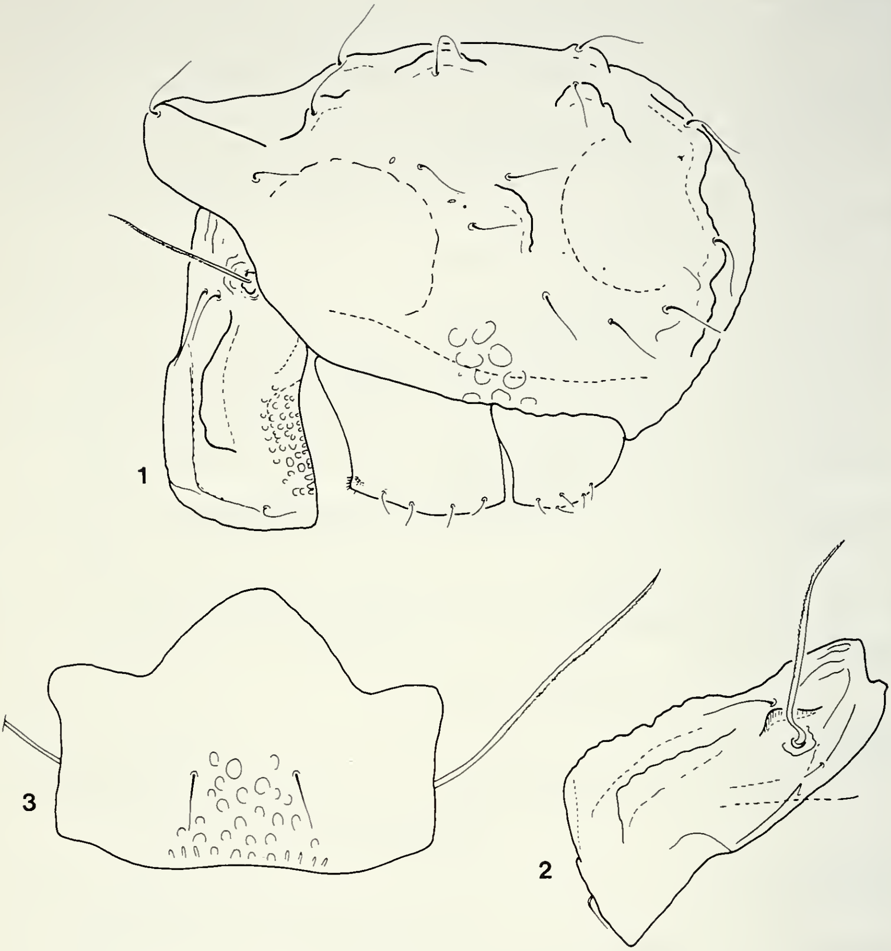
[4] MHNG = deposited in the Muséum d'Histoire naturelle, Genève.

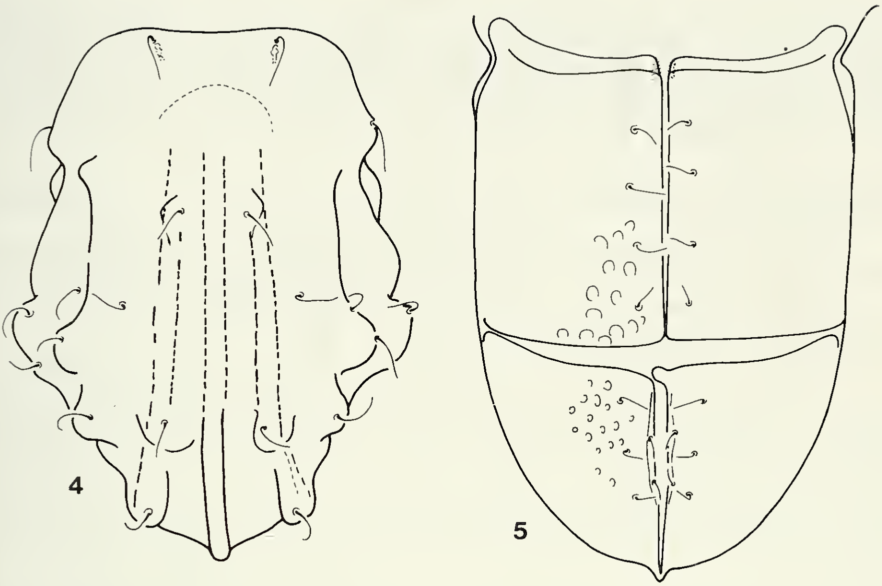
[5] HNHM = deposited in the Hungarian Natural History Museum, Budapest, with identification number of the specimens in the Collection of Arachnida.



Figs 1-3

Kakophthiracarus enigmaticus sp. n. -1: body in lateral view, 2: aspis in lateral view, 3: aspis in frontal view.

Aspis: Quadrangular in lateral view (Fig. 2), crown-shaped in frontal view (Fig.3). A very strong median crista present, parallel with it a pair of smaller and shorter cristae observable on each side. Rostral part medially excavated, rostral setae arising frontally. Lateral crista absent, sinus line observable. Bothridial squama modified, not bending over the bothridium (Fig. 2). Aspidial surface mostly alveolate, but smooth in its lateral and basal parts and also some rugae visible basally. Prodorsal setae thin, simple.



FIGS 4-5

Kakophthiracarus enigmaticus sp. n. - 4: notogaster in dorsal view, 5: anogenital region.

Sensillus very long, setiform, distinctly spinose unilaterally.

Notogaster: With large and wide anterior hood, behind it a deep hollow (Fig. 1) present. Surface with many tubercles besides two pairs of larger hollows, and three dorsal crests; all conspicuous in dorsal view (Fig. 4). Fifteen pairs of curved, thin and simple notogastral setae; the alveoli of the vestigial *f* setae, a glandular opening and two pairs of lyrifissures *ia, im* also visible.

Anogenital region: The position of the genital setae is typical for the genus, setae g_9-g_6 arising much nearer to the inner margin of the genital plates than setae g_5-g_1. (Exceptionally 10 pairs of setae were recognisable). Among the anoadanal setae two pairs arising strictly on the inner margin (Fig. 5), but the other three (ad_1- ad_3) appearing also not far from it.

Legs: Leg chaetotaxy of the "complete type", with the setal formulae:

I: 1-4-4+2-5+1-17+3-1
IV: 2-1-1-2+1-10-1

Seta *d* on femur I hooked. A small spine in front of ω_2 of tarsus I conspicuous. Setae *d* on tibia IV coupled with the solenidium.

Remarks: On the basis of the form and position of the setae in the anoadanal region and of the notogastral structure the new species can be placed into the recently established genus *Kakophthiracarus* Mahunka, 1992. The new species is readily distinguished from the related species by the three median longitudinal crests on the notogaster, absent in its congeners.

Notophthiracarus lienhardi sp. n. (Figs 6-8)

Material examined: Holotypus: Sar-87/60, 1 paratype from the same sample. Holotypus deposited in the MHNG and paratype (1417-PO-1991) in the HNHM.

Measurements. – Length of aspis: 280-297 µm, length of notogaster: 619-660 µm, height of notogaster: 355-379 µm.

Aspis: Median crista very high and wide in dorsal view (Fig. 8), rounded. Lateral carina absent, sinus line conspicuous. Surface mostly alveolate, its lateral part polygonate, and basally some rugae also visible. Bothridial squama well developed. Rostral setae setiform, simple, arising on the frontal surface and bent downwards. Lamellar and interlamellar setae straight, erect, blunt at tip and clearly spiculate or spinose. Sensillus slightly dilated distally, this part spiculate and spinose asymmetrically.

Notogaster: Anterior part of notogaster with a hood, slightly dilated laterally and continuing in a broad median band posteriorly (Fig. 6). Surface of this band smooth, all other surfaces ornamented by very deep and well framed alveoli. Seventeen pairs of straight and erect, apically blunt and fairly spiculate or spinose notogastral setae present. I was able to find only two pairs of lyrifissures *ia, im*.

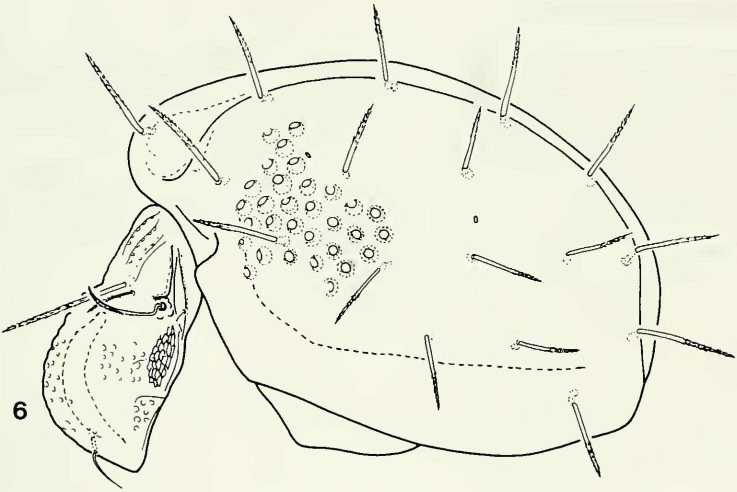
Anogenital region (Fig. 7): Nine pairs of genital setae arising in one axial row, distance between g_6 and g_5 greater than the distance between g_5 and g_4. All five pairs of anoadanal setae originating near the median margin but an_1 and an_2 clearly separated from the adanal setae. This marginal region framed laterally by a longitudinal crest.

Legs: All claws with two ventral teeth. Chaetotaxy of legs of the "complete type" with the setal formulae:

I: 1-4-2+2-5+1-16+3-1
IV: 2-1-1-2+1-10-1

Seta *d* of femur I hooked, arising far from anterior margin. Solenidium ω_2 coupled with a small seta on tarsus I, solenidium φ_1 on tibia IV also coupled with seta *d*. All solenidia of legs conspicuously long and curved distally.

Remarks: Despite the setae of the anoadanal plates originating in a typical position, this species is easily assignable to the genus *Notophthiracarus* Ramsay, 1966. It is well characterised by the smooth, longitudinal median field of the notogaster. On this basis it is related to *N. orientalis* (Mahunka, 1985) and *N. planus* (Mahunka, 1985) (see MAHUNKA 1995), but it is easily distinguished from both and from all other *Notophthiracarus* species by the characteristic ornamentation (very deep alveoli) and by the number (17 pairs) of notogastral setae.



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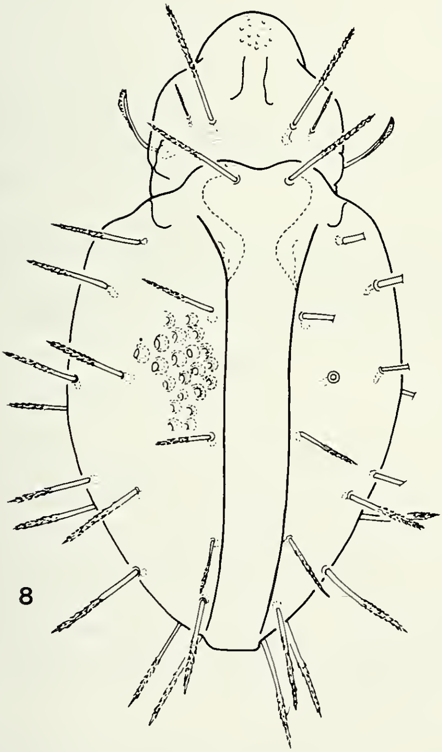

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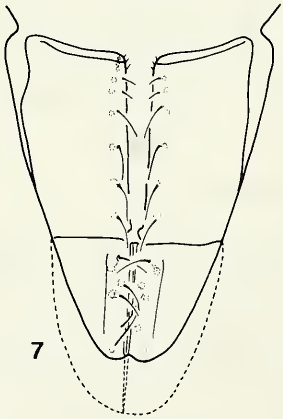

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Figs 6-8

Notophthiracarus lienhardi sp. n. - 6: body in lateral view, 7: anogenital region, 8: body in dorsal view.

Sabahtritia sarawak sp. n. (Figs 9-13)

Material examined: Holotypus: Sar-87/64, 1 paratype from the same sample. Holotypus deposited in the MHNG and paratype (1418-PO-1991): in the HNHM.

Measurements. – Length of aspis: 117-121 µm, length of notogaster: 219-226 µm, height of notogaster: 110-119 µm.

Aspis: Wide, low. Lateral carina fine, thin, fused with the lateral rim. Posterior median and laterocentral apodemes long. Surface foveolate medially, smooth anteriorly and laterally, and also some large but shallow areolae present basally (Fig. 12). Sensillus bifurcate (Fig. 10).

Notogaster (Fig. 9): Surface heavily foveolate. Fourteen pairs of simple notogastral setae present. I was able to find only two pairs of lyrifissusres (*ia, im*).

Anogenital region (Fig. 13): The whole surface fairly foveolate. Suture *kag* very strong. Seven pairs of genito-aggenital setae arising before them, all minute, except the posteromedian one. Six pairs (3+3) of setae in anoadanal position, setae an_1 distinguishable from the others, each arising on a small tubercle, directed backwards and slightly dilated basally. All other setae simple. Lyrifissures *iad* originating on posterior part of anoadanal plates.

Gnathosoma: Palp (Fig. 11) 4-segmented with the setal formula: 0-2-1-7+1.

Legs: All claws large with strong teeth on their ventral surface. Solenidia ω_1, ω_2 and φ_1 on leg I, δ_1 on legs II and III with coupled minute setae, but seta *d* on legs IV long and not coupled with the solenidium. Genu IV without seta or solenidium.

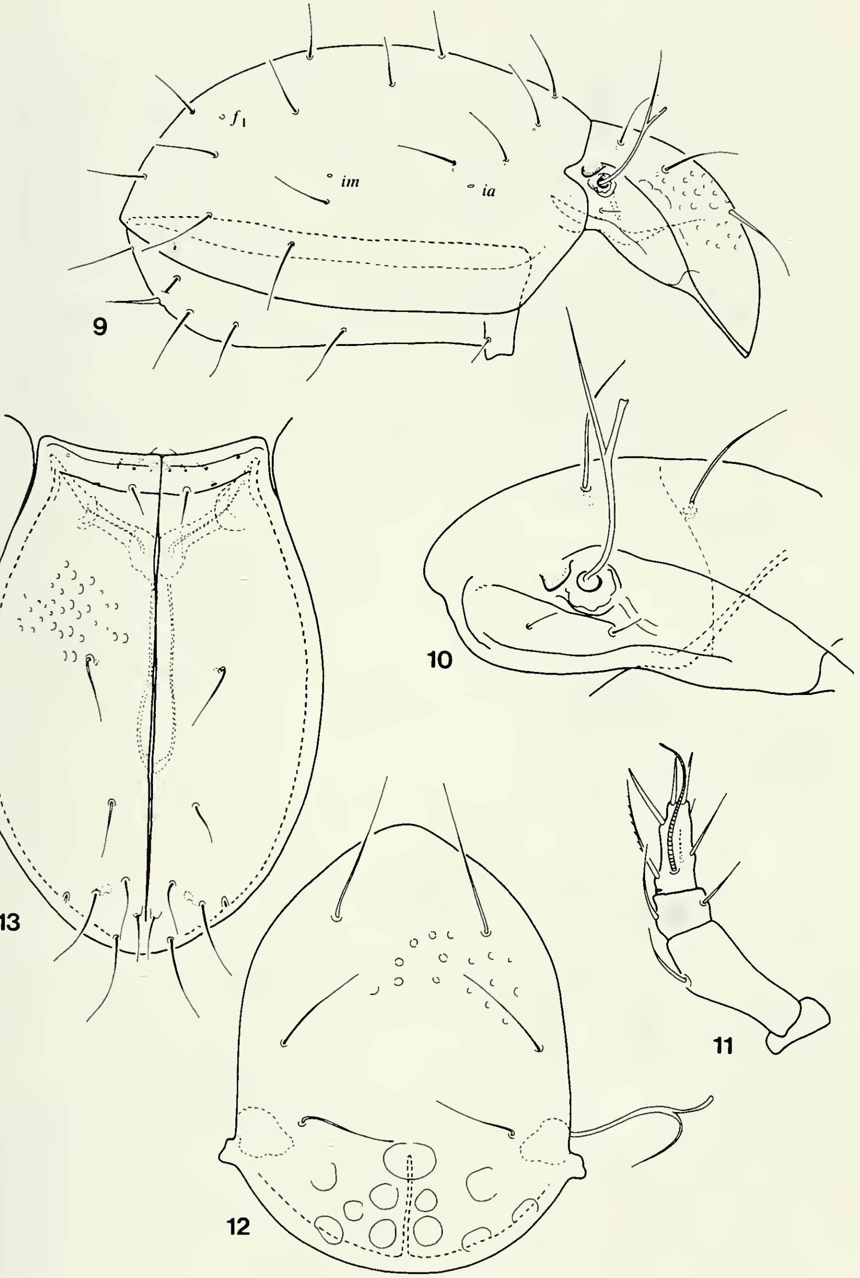
Remarks: The new species is unique in the genus *Sabahtritia* Mahunka, 1987, owing to the simple notogastral setae and the furcate sensillus. This latter feature is also unique in the whole superfamily Euphthiracaroidea Jacot, 1930.

Bakobodes gen. n.

Diagnosis: Family *Carabodidae*. Prodorsum with strong transversal elevation, notogaster gradually convex, dorsosejugal region normal, but the notogaster partly covers the prodorsum. Lamellae with well developed cuspis, lamellar setae arising between them. Interlamellar setae originating on the elevation, on the lamellar surface. Ten pairs of phylliform notogastral setae, one pair in humeral position. Mentum with anterior tectum. Coxisternal region large, with wide median field. Epimeral setal formula: 3-1-3-3. Anogenital region much smaller than coxisternal one, with strong costulae or tubercles. Anogenital setal formula: 4-1-2-3.

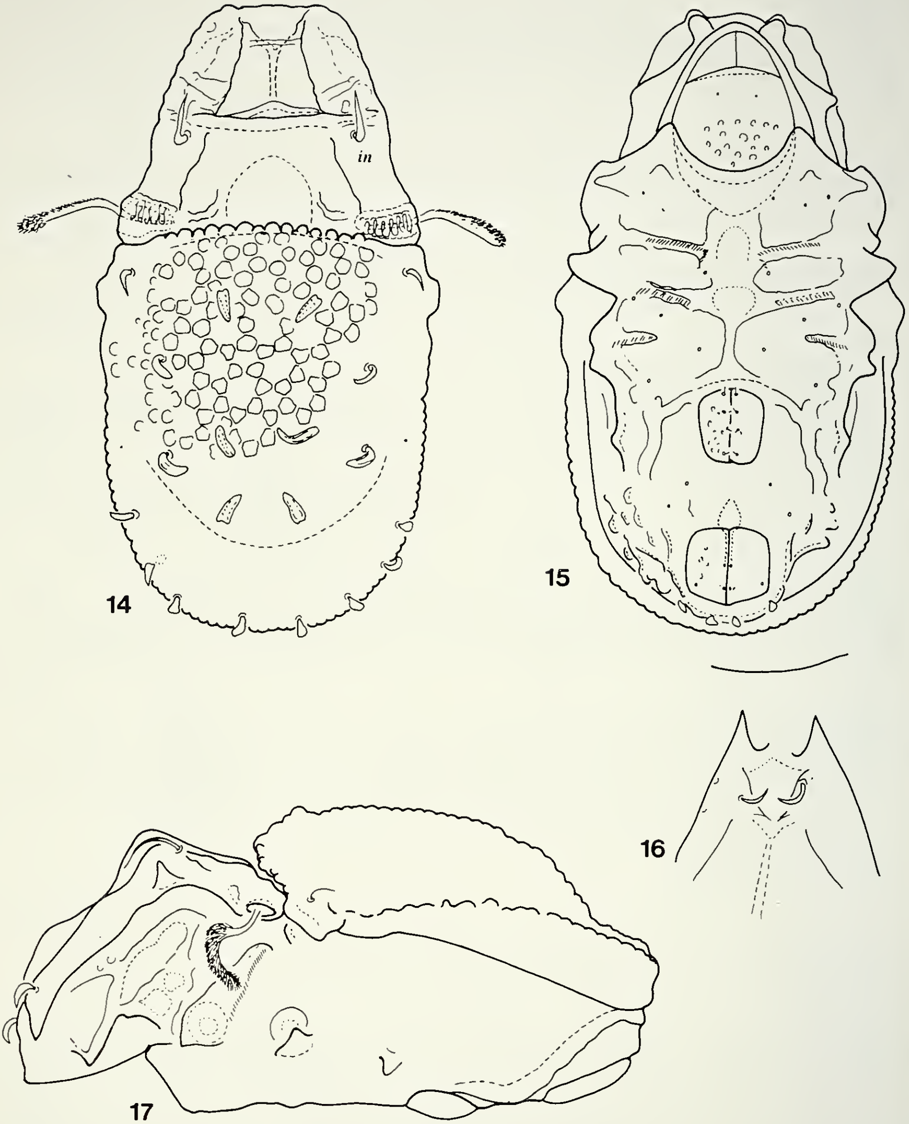
Type species: *Bakobodes orangutan* sp. n.

Remarks: Among the Carabodidae genera characterised by ten notogastral setae only *Meriocepheus* Aoki, 1973 has a highly elevated prodorsum. The new taxon is distinguished from it by the absence of the very high notogastral elevation and by the simple but characteristic dorsosejugal region.



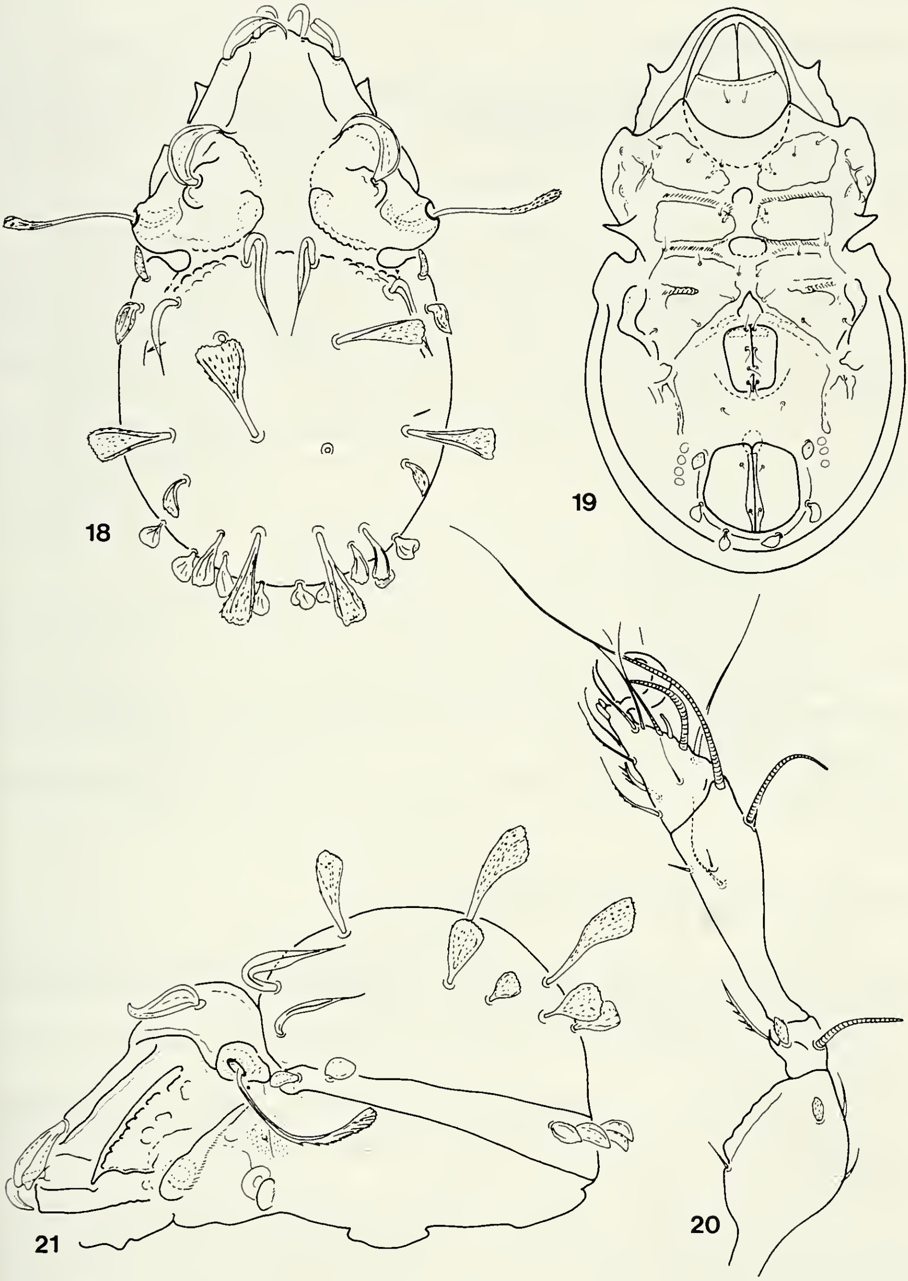
FIGS 9-13

Sabahtritia sarawak sp. n. - 9: body in lateral view, 10: basal part of aspis in lateral view, 11: palp, 12: aspis in dorsal view, 13: anogenital region.



FIGS 14-17

Bakobodes orangutan gen. n., sp. n. - 14: body in dorsal view, 15: body in ventral view, 16: rostral region in frontal view, 17: body in lateral view.



FIGS 18-21

Berndobodes hauseri sp. n. - 18: body in dorsal view, 19: body in ventral view, 20: leg I, 21: body in lateral view.

Bakobodes orangutan sp. n. (Figs 14-17)

Material examined: Holotypus: Sar-87/64, 11 paratypes from the same sample; 8 paratypes: Sar-87/76. Holotypus and 12 paratypes deposited in the MHNG and 7 paratypes (1420-PO-1991) in the HNHM.

Measurements. – Length of body: 207-243 µm, width of body: 107-134 µm.

Integument: Whole surface covered by a thick cerotegument layer.

Prodorsum: Lamellae thick, connected by a translamella anteriorly (Fig. 14). Lamellar and interlamellar setae phylliform, both groups arising on the lamellar surface (Fig. 16). Interlamellar region divided by a longitudinal crest anteriorly and a semicircular hollow basally. Sensillus directed outwards, dilated, characteristicaly bent downwards. Tutorium well developed, without cusp.

Notogaster: Ten pairs of characteristically arched, phylliform notogastral setae present. Surface ornamented by large tubercles or pustules, ordered in a polygonal formation (Fig. 14).

Lateral part of podosoma: Pedotectum 1 narrow, pedotecta 2-3 small but sharp laterally, discidium well developed (Fig. 17).

Gnathosoma: Mentum fairly foveolate, with anterior tectum.

Coxisternal region: Well framed laterally by crests. All epimeral setae minute or observable only by their alveoli.

Anogenital region: Ventral plates with rough structure. Anal opening framed by a strong crest posteriorly, some other crests and tubercles also observable (Fig. 15).

Remarks: The new species is readily characterized by the arched tectum of the mentum.

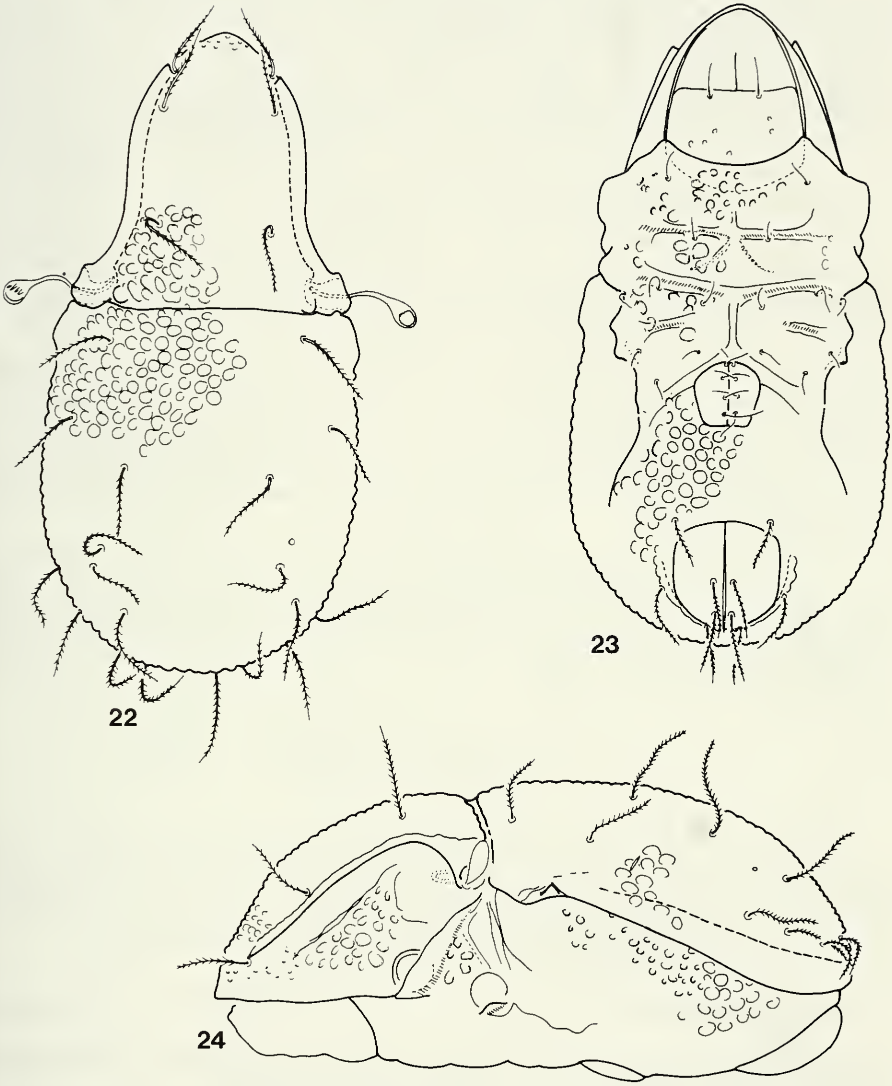
Berndobodes hauseri sp. n. (Figs 18-21)

Material examined: Holotypus: Sar- 87/76, 19 paratypes from the same sample; 6 paratypes: Sar-87/60. Holotypus and 16 paratypes deposited in the MHNG and 9 paratypes (1421-PO-1991) in the HNHM.

Measurements.– Length of body: 252-382 µm, width of body: 139-203 µm.

Integument: Body surface covered by an irregularly thick and disintegrating waxy layer comprising also "broken fragments". Cuticular surface mostly sculptured.

Prodorsum: Rostrum convex, rostral setae thick, arising on small tubercles, curved. Lamellae narrow, decurrent marginally, their surface rugose. Lamellar setae dilated, arising on dorsal surface of lamellae, far from their cusps. Interlamellar surface smooth. Basal part of prodorsum strongly concave on both sides; phylliform interlamellar setae very large, arising on additional tubercles of prodorsum (Fig. 18). Bothridium strongly protruding laterally, sensillus long, arched upwards, narrow, only dilate distally. Tutorium strong, with a sharp apex (Fig. 21).



FIGS 22-24

Gymnobodes semengok sp. n. - 22: body in dorsal view, 23: body in ventral view, 24: body in lateral view.

Notogaster: Well developed humeral projections present. Dorsosejugal suture straight, anterior margin of notogaster with large pustules, their number increasing laterally. Notogastral surface smooth. Fifteen pairs of dilated notogastral setae present (Fig. 18), two pairs in humeral and four pairs in posteromargainal positions, smaller than the others. Two pairs near the anterior margin long, narrow phylliform. without cilia or spicules, four pairs medially, much larger than the others, spatulate or cuneiform, their surface spiculate.

Lateral part of podosoma: Pedotectum 1 narrow, pedotecta 2-3 and discidium small. Sejugal region finely granulate.

Coxisternal region: Epimeral borders frame the epimeral fields, enclosing medially comparatively large hollows situated behind each other. Epimeral surface ornamented by irregular alveoli and spots. Epimeral setal formula: 3-1-3-3 (Fig. 19). Setae *3c* originating far from pedotecta 2-3.

Anogenital region: Ventral plate framed by a pair of longitudinal ribs continuing with some round tubercles along anal aperture. Around the latter a semicircular thickening observable, adanal setae arising on it. Anogenital setal formula: 4-1-2-3. Genital and aggenital setae simple, genital setae conspicuously long. Anal plates with a thickening along their inner margin, bearing setae an_1. Adanal setae spatulate.

Legs: Claws of all legs strong. Femur of legs III and IV with strong blade-like formation ventrally ending in a robust distal spur. Unguinal setae (*u*) of all legs short, spiniform. Solenidia φ_1 of tibia I very long, characteristically directed forwards and decumbent on tarsus I (Fig. 20). Setae *d* on tibiae I and II coupled, with solenidium φ_2. Setal formulae of legs:

I: 1-4-3+1-4+2-15+2-1
II: 1-4-3+1-4+1-12+2-1
III: 1-2-1+1-2+1-10-1

Remarks: Until now this genus was considered as monotypic.The type-species, *B. spathulifer*[6] Mahunka, 1986, was described from Sabah. The new species stands near to it, but differs by the shape of the notogastral setae and the sculpture of the body (e.g. the longitudinal crests and tubercles along the anal aperture).

Gymnobodes semengok sp. n. (Figs 22-24)

Material examined: Holotypus: Sar-87/76, 1 paratype: Sar 87/60. Holotypus deposited in the MHNG and paratype (1422-PO-1991) in the HNHM.

Measurements. – Length of body: 263 µm, width of body: 129 µm.

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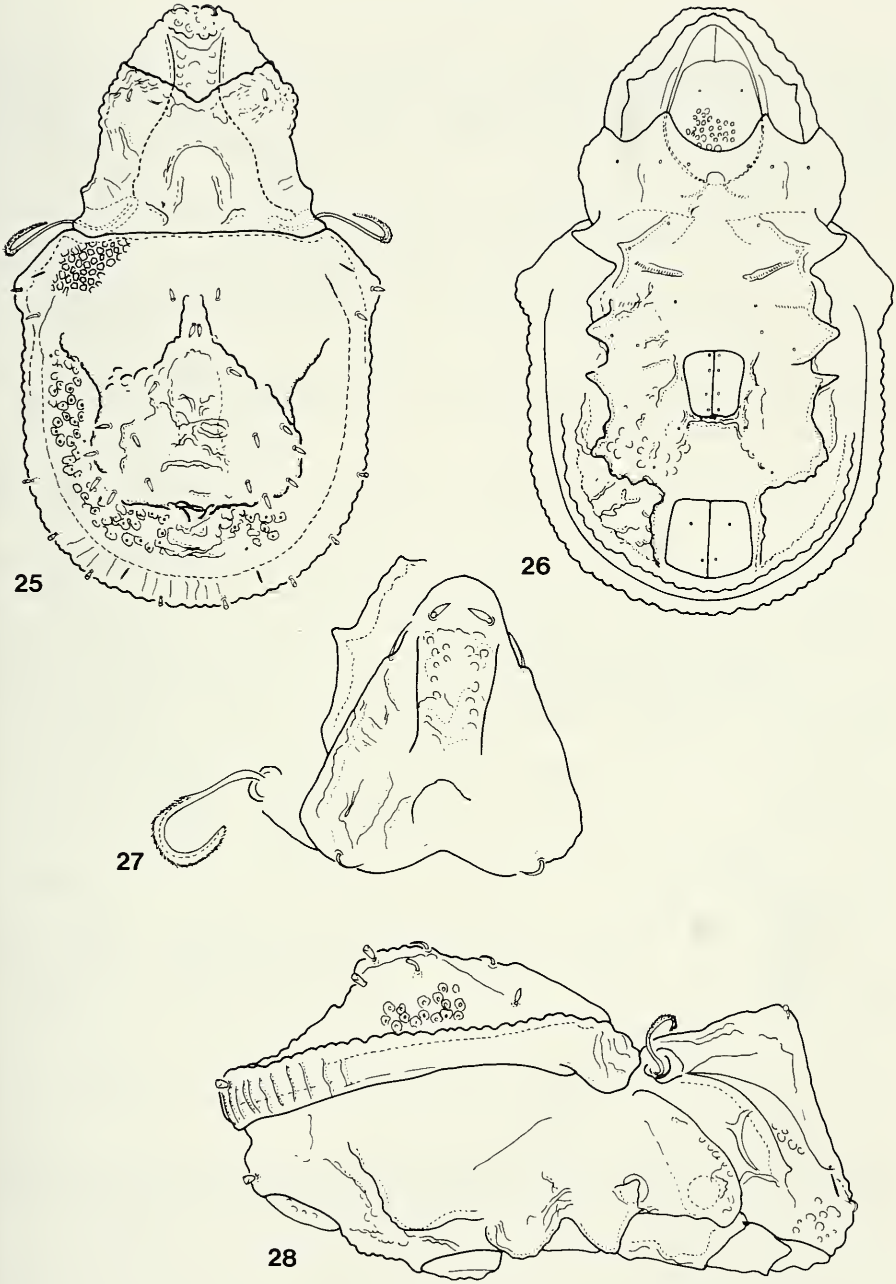
[6] On the occasion of the first diagnosis of the genus (MAHUNKA 1986) I erroneously named the type species *spathulifer* and not *spiculifer* as initially planned. Based on the same type material the species was later described in detail under the name *spiculifer* Mahunka, 1988, which has to be considered as a junior objective synonym of *spathulifer* Mahunka, 1986.



FIGS 25-28

Pasocepheus bako sp. n. - 25: body in dorsal view, 26: body in ventral view, 27: prodorsum in frontal view, 28: body in lateral view.

Prodorsum: Rostrum weakly convex in dorsal view, its surface alveolate. Lamellae thin, with clearly visible apex. Intermellar surface covered by large pustules (Fig. 22). All three dorsal pairs of prodorsal setae long, thin, flagelliform, distinctly ciliate. Sensillus short, its head funnel-shaped. Tutorium absent, only a short crest in its place.

Notogaster: Whole surface pustulate, similar to that between the lamellae. Ten pairs of long, thin, densely ciliate notogastral setae.

Lateral part of podosoma: Pedotectum 1 narrow, pedotecta 2-3 very small. The surface mostly alveolate (Fig. 24), only smaller fields appear to be smooth.

Coxisternal region: Apodemes and epimeral borders long, almost composing a close network. Surface irregularly alveolate. Epimeral setal formula: 1-1-3-3, all setae conspicuous.

Anogenital region: Major part of this surface pustulate (like the notogaster), only smaller fields alveolate behind legs IV laterally. All setae of this region long, thin, ciliate (Fig. 23). (I was not able to find the lyrifissures *iad*).

Remarks: On the basis of the free cuspis on lamellae, the weak tutorium, the epimeral setal formula and the absence of aggenital setae the new species is assignable to the genus *Gymnobodes* Balogh, 1965 (MAHUNKA 1986). Both of the heretofore known species were described from Africa and the new species is readily separated from them by the pustulate surface and the thin and well ciliate dorsal and ventral setae. This latter feature is unique in the entire family Carabodidae C. L. Koch, 1837.

The species is named after the "Semongok Wildlife Rehabilitation Centre" for orang-utangs.

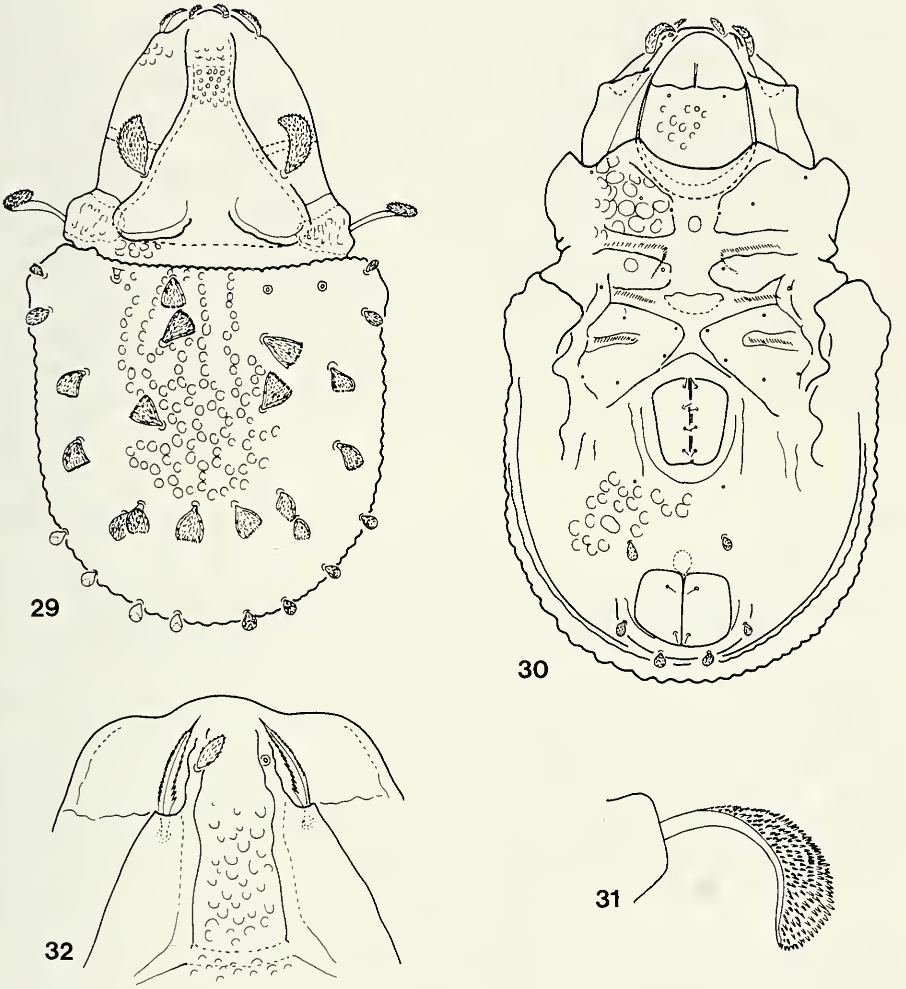
Pasocepheus bako sp. n. (Figs 25-28)

Material examined: Holotypus: Sar 87/76, 21 paratypes from the same sample. Holotypus and 14 paratypes deposited in the MHNG and 7 paratypes (1423-PO-1991) in the HNHM.

Measurements. – Length of body: 312-346 µm, width of body: 188-267 µm.

Integument: A finely granulate cerotegument layer covering the whole surface, except the tarsi and tibiae.

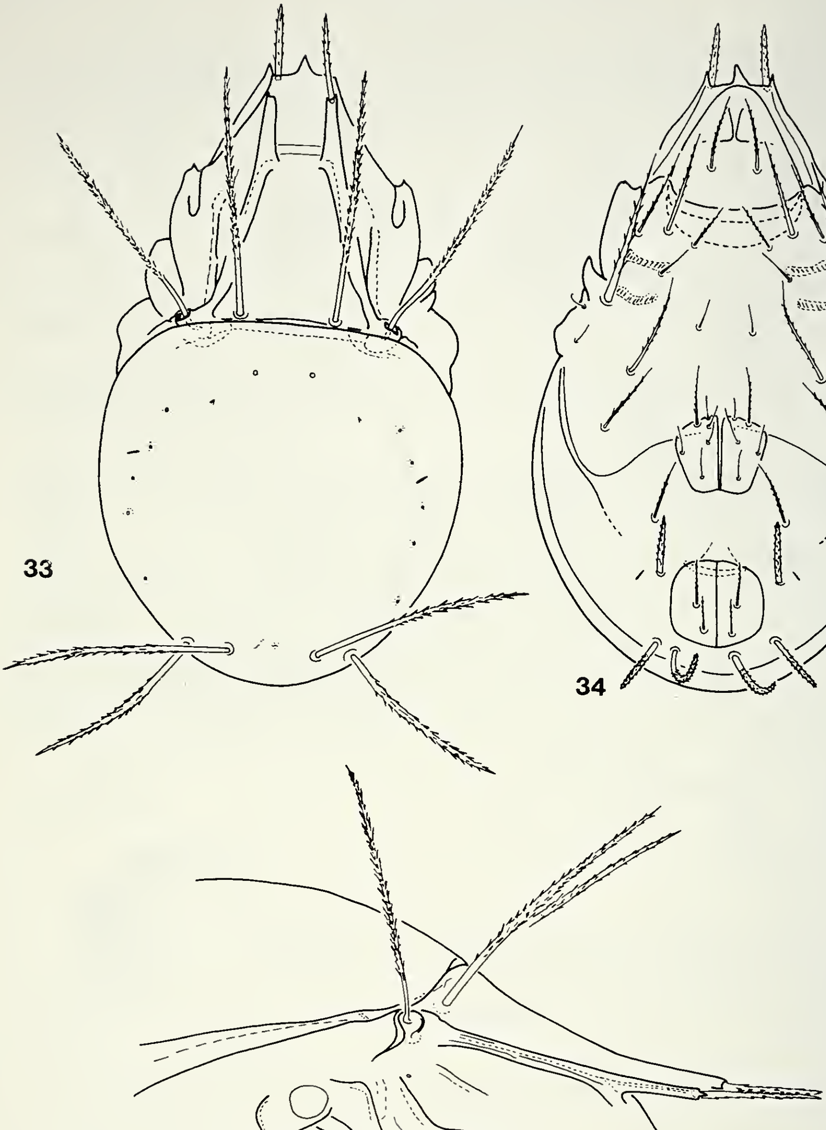
Prodorsum: Basal part of prodorsum - with the lamellae - distinctly protruding and arched abruptly to the rostrum (Fig. 28). Between them a characteristic U-shaped formation is observable, but less conspicous than in the type-species. In the rostral part of prodorsum, in the interlamellar region (Fig. 27), and also between lamellae and tutorium, some large alveoli are present; the rest of the surface wrinkled or smooth, like the basal surface medially. All prodorsal setae small, the rostral setae dilated, phylliform, lamellar setae thin, pilose. Interlamellar setae also phylliform, bent inwards. Sensillus long, strongly bent backwards (Fig. 27), nearly falciform. Tutorium well developed, but without cusp.



Figs 29-32

Yoshiobodes humidus sp. n. - 29: body in dorsal view, 30: body in ventral view, 31: sensillus, 32: rostral region in frontal view.

Notogaster: Median part of notogaster strongly protruding, but gradually declining to dorsosejugal suture. The sculpture of this region very similar to that of *Pasocepheus eremaeozetoides* Mahunka, 1995. Position and shape of setae (15 pairs) also very similar to those in that species (Fig. 25).



Figs 33-35

Austroceratoppia serapi sp. n. - 33: body in dorsal view, 34: body in ventral view, 35: podosoma in lateral view.

Lateral part of podosoma: Pedotectum 1 and discidium well developed, pedotecta 2-3 comparatively small. Anterior margin of pedotectum 1 ornamented by foveolae.

Coxisternal region: Framed laterally by a heavy crest. Median part slightly hollowed.

Anogenital region: Nearly entire surface ornamented with longer or shorter crests (Fig. 26). setae of ventral regions small, adanal setae clearly phylliform.

Legs: Femora of legs alveolate, all other joints smooth.

Remarks: In most of its features the new species exhibits a great similarity with *P. eremaeozetoides* Mahunka, 1995. But the two species are readily distinguished from each other by the form of the sensillus (straight and plumose in *P. eremaeozetoides*) and by the prodorsal protuberances (smaller and shorter in *P. eremaeozetoides*).

Yoshiobodes humidus sp. n. (Figs 29-32)

Material examined: Holotypus: Sar-87/66, 1 paratype from the same sample. Holotypus deposited in the MHNG and paratype (1424-PO-1991) in the HNHM.

Measurements. – Length: 306-342 µm, width: 183-209 µm.

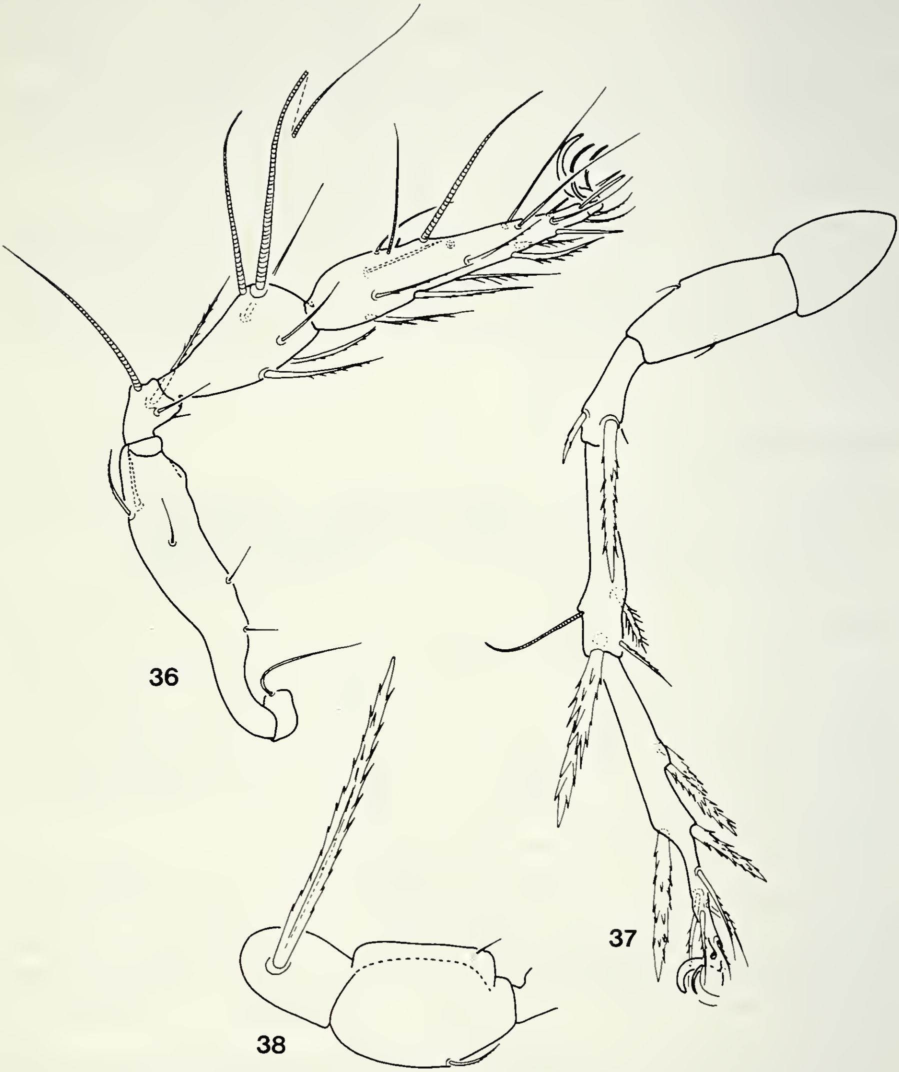
Integument: Surface covered by a cerotegument layer, consisting of granules ordered in different polygonal sculptures.

Prodorsum: Rostrum rounded. Lamellae typical for the genus, their distal end – in front of lamellar setae – strongly narrowed anteriorly, with rostral setae arising on this part (Fig. 32). Lamellar setae much longer than rostral ones, setae *in* phylliform, the largest of all. Interlamellar region distinctly, lamellar surface irregularly, foveolate. Basal part of prodorsum smooth, two lateral hollows, framed by cristae, present. Dorsosejugal region narrow, but deeply excavated, full of secretion. Sensillus (Fig. 31) dilated distally and bent backwards.

Notogaster: Cerotegumental granules composing or framing longitudinal fields anteriorly and rounded fields medially; sculpture typical for the genus. Fourteen pairs of approximately spatulate notogastral setae present, the medial ones widened distally, with straight distal margin (Fig. 29) in median region, the lateral ones smaller, narrowed distally, spoon-shaped. Two pairs of setae originating in humeral position.

Ventral regions: (Fig. 30): Mentum and coxisternal region strongly foveolate and alveolate. Sternal region wide, two rounded hollows observable medially. All epimeral setae minute, epimeral setal formula: 3-1-3-3. Anogenital region pustulate, and also some longitudinal rugae visible along genital plates and laterally; anogenital setal formula: 4-1-2-3. Aggenital setae minute, adanal setae spatulate (Fig. 30).

Remarks: The new species stands nearest to *Yoshiobodes aokii* Mahunka, 1987, but it is well distinguished from the latter by the shape of the notogastral setae (distally narrowed, phylliform in *Y. aokii*) and by the structure of the prodorsum.



FIGS 36-38

Austroceratoppia serapi sp. n. - 36: leg I, 37: leg IV, 38: trochanter and femur leg III.

Austroceratoppia serapi sp. n. (Figs 33-38)

Material examined: Holotypus: Sar-87/66, 6 paratypes from the same sample; 5 paratypes: Sar-87/64. Holotypus and 7 paratypes deposited in the MHNG and 4 paratypes (1419-PO-1991) in the HNHM.

Measurements: – Length of body: 426-481 µm, width of body: 267-292 µm.

Prodorsum: Rostrum wide, with very sharp, small apices medially and laterally (Fig. 33). Rostral setae thick, spiniform, arising on anterior margin, near lateral corner. Lamellae long, with long free cusps, but not reaching to rostral margin (Fig. 35). Their cusps with small, but well observable lateral apex. Lamellar setae thick, as the rostral setae, and arising from the cusps. A transversal band present between the lamellae resembling a translamella, but not connected with the lamellae. Interlamellar setae long, slightly thicker than setiform sensillus. Exobothridial setae reduced, represented only by their alveoli. Tutorium short, weakly developed, without cusps.

Notogaster: Notogastral setae chatacteristically reduced, only two pairs of robust, thick setae present. Five pairs of setae represented by their alveoli, each of which is a porose area, a pair of (median) alveoli without porose area (Fig. 33) observable.

Lateral part of podosoma: Very strong and long genal teeth directed forwards, reaching over rostral margin. Pedotectum 1 with a sharp dorsal spur, pedotecta 2-3 small.

Coxisternal region: Apodemes and epimeral borders weakly developed, short, not forming a transversal band. All epimeral setae characteristically directed forwards, some of them (e. g. *1b*, *3b*) robust, setae *3c* and *4c* short and thin. All fairly ciliate.

Anogenital region: A thin, strongly arched transversal line decurrent from genital aperture to acetabulum of legs IV, a secondary line partly parallel with the former one also present (Fig. 34). Circumpedal carina absent. All setae of this region directed forwards, mostly setiform, but adanal setae spiniform or bacilliform, blunt at tip and much thicker than the rest. Lyrifissures *iad* in apoanal position.

Legs: All legs tridactylous. Setae (*p*) on tarsus I thick, straight, on tarsus II-IV very thin, arising near claws, and similar to them. Trochanter of leg III with very strong seta (Fig. 38). Setal formulae of legs:

I: 1-5-3+1-4+2-20+2-3 (Fig. 36)
IV: 1-2-3-3+1-12-3 (Fig. 37)

Remarks: The new species is readily distinguished from all related species by the equal length of the adanal setae.

The new species is named after the mountain Serapi.

Sarawakiella gen. n.

Diagnosis: Family *Galumnidae*. Cuticula finely punctate, without heavy sculpture. Rostrum sharply pointed. Lamellar and sublamellar lines well developed, slightly diverging from each other. Lamellar setae arising on median surface, between lines *L*. Rostral setae arising laterally between lines *L* and *S*. Dorsosejegal suture absent. Ten pairs of long flagellate notogastral setae and four pairs of not typical areae porosae present. They are characteristic for the new genus. Epimeral setal formula: 1-0-1-2. Adanal setae reduced or minute. Lyrifissures *iad* in adanal position. Area porosa postanalis present. Chelicera of normal type. Legs tridactylous. Famulus originating far from solenidia, setae *ft*' short and almost coupled with solenidium ω_1. Solenidium ω_2 arising laterally and slightly posteriorly from ω_1.

Type species: *Sarawakiella longipilosa* sp. n.

Remarks: On the basis of the shape and position of the octotactic organs the new taxon is related to *Pilizetes* Sellnick, 1937. However, the type-species of the latter genus is characterised by a rounded rostrum, a strong notogastral sculpture, and rigid notogastral and adanal setae.

Sarawakiella longipilosa sp. n. (Figs 39-44)

Material examined: Holotypus: Sar-87/60, 7 paratypes from the same sample; 2 paratypes: Sar-87/64. Holotypus and 6 paratypes deposited in the MHNG and 3 paratypes (1425-PO-1991) in the HNHM.

Measurements. – Length: 252-302 µm, width of body: 208-238 µm.

Prodorsum: Rostrum with sharply pointed apex (Fig. 41). Lamellar and rostral setae simple, setiform, long. Rostral setae arising between the lines *L* and *S* (Fig. 42). Interlamellar setae very long, flagellate, their basal part darker than the rest. Sensillus long directed backwards, its head comparatively small, smooth, asymmetric, with a long spine on its distal end. Areae porosae dorsosejugales, small, elliptic.

Notogaster: Ten pairs of long, flagellate setae (like the interlamellar ones), 4 pairs of small, hardly recognizable areae porosae, more resembling sacculi, each with a long tubular formation in the cuticule, but the unframed pori well conspicuous on the surface (Fig. 39). All lyrifissures very narrow, inconspicuous, *ih* and *ips* standing near each other transversally, *im* located near areae porosae A_1.

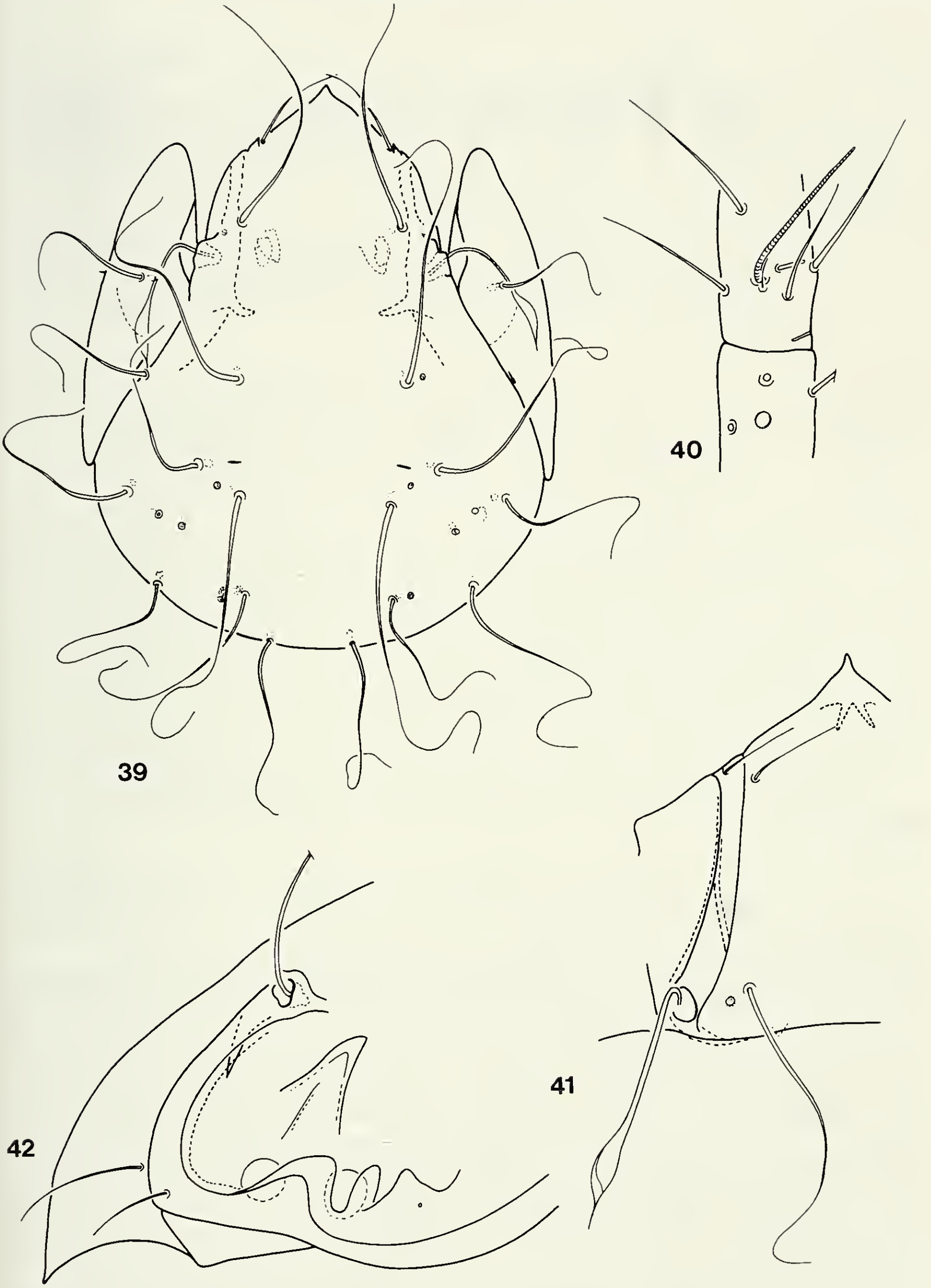
Ventral region (Fig. 43): Epimeral setal formula: 1-0-1-2, setae *4c* arising on discidium. Anoadanal region with anterior three pairs of genital setae visible, all others minute or observable only by their alveoli.

Legs: All legs tridactylous. Setal formulae of legs:

I: 0-4-3+1-4+2-20+2-3 (Fig. 44)
II: 0-4-3+1-4+1-15+2-3
III: 1-2-1+1-3+1-15-3
IV: 1-2-2-3+1-12-3

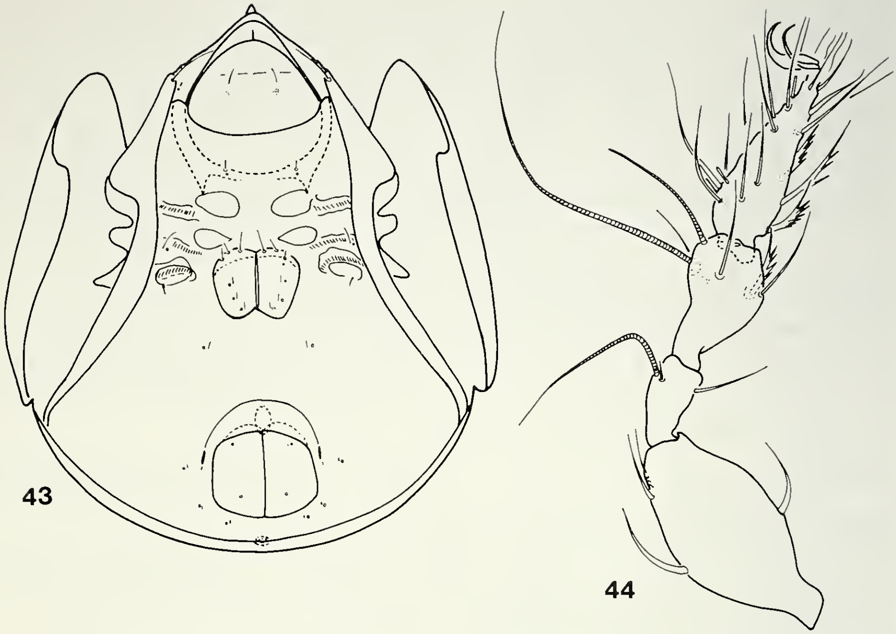
The position of the solenidial group of tarsus I shown in Fig. 40.

Remarks: On the basis of the very characteristic dorsal chaetotaxy the new species is far removed from all known species of the family Galumnidae.



FIGS 39-42

Sarawakiella longipilosa gen. n., sp. n. - 39: body in dorsal view, 40: basal part of tarsus I, 41: lateral part of prodorsum, 42: podosoma in lateral view.



FIGS 43-44

Sarawakiella longipilosa gen. n., sp. n. - 43: body in ventral view, 44: leg I.

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Contribution à la connaissance des Cholevidae du Japon et de Taiwan (Coleoptera)

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Contribution to the knowledge of the Cholevidae of Japan and Taiwan (Coleoptera). - This paper contains the description of 8 new species of Cholevidae from Japan and Taiwan: *Ptomaphagus smetanai* n. sp., *Ptomaphaginus ishizuchiensis* n. sp., *Ptomaphaginus nipponensis* n. sp., *Ptomaphaginus pingtungensis*, n. sp., *Anemadus nipponensis* n. sp., *Anemadus taiwanus* n. sp., *Anemadiola smetanai* n. sp., *Nargus taiwanensis*, n. sp. New distributional data are given for the following species: *Ptomaphagus amamianus* Nakane, *Ptomaphaginus takaosanus* Nakane, *Ptomaphaginus sauteri* (Portevin), *Micronemadus pusillimus* Kraatz, *Nemadus japanus* Coiffait et Ueno, *Anemadiola itotateoi* Hayashi, *Sciodrepoides fumatus* Spence, *Mesocatops japonicus* Jeannel, et *Catops miensis formosensis* Hayashi.

Key-words: Coleoptera - Cholevidae - Japan - Taiwan - new species.

INTRODUCTION

Les travaux consacrés à la faune des Cholevidae extrême orientale, particulièrement japonaise et taiwanaise, se sont multipliés ces derniers temps (SZYMCZAKOWSKI 1962, 1963, 1965; NAKANE 1963, 1982, HAYASHI 1969, 1985, 1986, 1987, 1988, 1990; MIYAMA 1985; NISHIKAWA 1983, 1986; Perreau 1992), et ont permis d'apprécier son intérêt biogéographique et phylogénétique. Ils ont en effet mis en évidence trois genres endémiques, dont deux pour le Japon: *Cholevodes* Portevin, et *Apterocatops* Miyama, et un commun au Japon et à Taiwan: *Anemadiola* Szymczakowski. D'autres lignées très diverses se rencontrent dans ces îles, combinant des groupes paléarctiques (*Catops* Paykull, *Ptomaphagus* Illiger) et tropicaux (*Ptomaphaginus*, *Micronemadus*).

Le présent article contribue à l'inventaire de cette faune en ajoutant 8 espèces nouvelles: *Ptomaphagus smetanai* n. sp., *Ptomaphaginus ishizuchiensis* n. sp., *Ptomaphaginus nipponensis* n. sp., *Ptomaphaginus pingtungensis* n. sp., *Anemadus taiwanus*

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n. sp., *Anemadus nipponensis* n. sp., *Anemadiola smetanai* n. sp., et *Nargus taiwanensis* n. sp., et en précisant certains détails sur la distribution géographique d'espèces encore mal connues. Certaines espèces voient donc leurs aires de répartition s'étendre. C'est ainsi le cas de *Ptomaphagus amamianus* Nakane, 1963, connu jusqu'à présent du Japon, et retrouvé maintenant à Taiwan. De même, *Ptomaphaginus takaosanus* Nakane, 1982, *Ptomaphaginus sauteri* (Portevin, 1914), *Nemadus japanus* Coiffait et Ueno, 1955, *Micronemadus pusillimus* Kraatz, 1877, *Anemadiola itotateoi* Hayashi, 1990, *Sciodrepoides fumatus* Spence, 1815, *Mesocatops japonicus* Jeannel, 1936, et *Catops miensis formosensis* Hayashi, 1988, ont été retrouvées dans différentes localités japonaises et taiwanaises.

Parmi les espèces nouvelles, certaines ne font que prolonger la liste déjà longue de groupes habituellement rencontrés en l'Asie, c'est le cas des 3 espèces de *Ptomaphaginus*. En revanche, d'autres s'avèrent particulièrement intéressantes. L'*Anemadus nipponensis* n. sp. est en effet la première espèce du genre *Anemadus* récoltée au Japon où se rencontre par contre le genre monospécifique apparenté *Cholevodes*. Ce dernier était jusqu'à présent le seul représentant des Anemadini dans ces deux îles, puisqu'*Anemadiola* Szymczakowski, considéré lors de sa description comme un Anemadini serait en fait, d'après GIACHINO & VAILATI (1993), apparenté aux Nemadini. De même, l'*Anemadus taiwanus* n. sp. est la première espèce d'Anemadini taiwanaise. Cette espèce, bien caractérisée, ne s'apparente à aucune autre lignée d'*Anemadus* (GIACHINO & VAILATI, 1993).

Dans un autre genre également, la faune taiwanaise exhibe son originalité. Ainsi, le *Nargus taiwanensis*, n. sp. est l'espèce la plus orientale connue dans le genre *Nargus*, et présente des caractères qui l'éloignent de toutes les autres espèces. Ce genre, essentiellement rencontré dans les régions méditerranéennes et en Asie mineure, ne comprenait jusqu'à présent, que deux représentants orientaux: *N. beatus* Szymczakowski, et *N. besucheti* Perreau, qui ne dépassent pas vers l'est la zone septentrionale de la péninsule indienne.

La richesse de la faune chinoise continentale, qui commence à être inventoriée en détail, et qui présente d'évidentes parentés avec celle de Taiwan et du Japon, permet de présumer pour ces îles, d'autres intéressantes découvertes à l'avenir.

Abréviations utilisées : MHNG : Muséum d'Histoire naturelle de Genève ; MNHNP : Muséum National d'Histoire Naturelle de Paris; CMP : collection Michel Perreau ; CJF : collection Jürgen Frank.

TAXONOMIE

Ptomaphagus amamianus Nakane

Taiwan: Fenchihu, 1400 m, 25-V-1977, Klapperich leg. (5 ex. CJF, 2 ex. CMP, 1 ex. MHNG)

Cette localité est la première citation de cette espèce dans l'île de Taiwan. Les exemplaires sont en tous points semblables à ceux du Japon.

Ptomaphagus smetanai n. sp. (Figs 1-5)

HOLOTYPE ♂: Taiwan, Hualien Hsien, Taroko, N. P. Duodyatunshan, 2660 m, 8/13-V-1990 A. Smetana (MHNG).

Description: longueur: 4 mm. Espèce aptère. Corps très convexe. Coloration générale brun foncé, les antennes et les tarses plus clairs. Tous le dessus du corps sauf la tête recouvert d'une fine pubescence, et d'une striolation transversale fine et peu espacée.

Tête à ponctuation fine, alignée en strioles transversales superficielles au voisinage de la carène occipitale, et évoluant vers une ponctuation grosse et désordonnée vers l'avant du front. Yeux petits relativement à la taille du corps: la largeur d'un oeil en vision dorsale représente environ un dixième de la largeur totale de la tête au niveau des yeux. Les trois premiers articles antennaires plus longs que larges, tous les suivants transverses. Longueurs des articles antennaires en microns: 220, 155, 95, 115, 95, 155, 70, 140, 130, 190 (précision: 10 microns).

Pronotum 1,7 fois plus large que long, légèrement rétréci à la base, la plus grande largeur est située à une distance de la base égale au dixième de sa longueur. Les angles postérieurs peu saillants en arrière.

Elytres 1,2 fois plus longs que larges, leur plus grande largeur au quart antérieur. Striolation de même espacement longitudinal que celle du pronotum.

Tibias intermédiaires très arqués. Les tibias postérieurs sans courbure ni épaississement particulier. Tarses antérieurs fortement dilatés.

Segment abdominal IX très sclérifié, les latérotergites en forme de coquille très convexes, et le spiculum gastrale courbé en vision latérale, dépassant de plus de la moitié de sa longueur le bord antérieur du segment (figs 3 , 4 et 5).

Edéage robuste long, et arqué, l'apex détourné vers la droite à l'apex (figs 1 et 2). Quelques soies fines sur les côtés, juste avant l'apex. Paramères libres (non fusionnés avec le lobe médian) sur les trois quart de leur longueur.

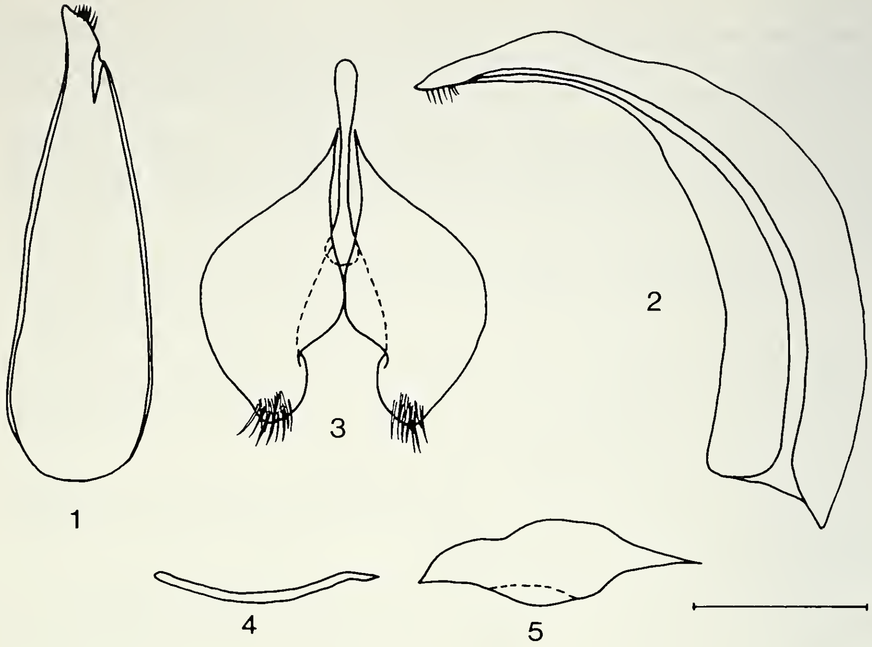
Femelle inconnue.

Cette espèce est étroitement apparentée au *P. yasutoshii* Nishikawa. Elle s'en distingue par la forme de l'édéage dont la bifurcation apicale vers la gauche est moins prononcée et la forme du corps plus trapue, moins allongée.

Ptomaphaginus takaosanus Nakane (Figs 13, 18, 19)

Japon : Nagano, J. E. Kongen N. Park, Shiga, 1500 m, I. Löbl (12 ex. MHNG, et 3 ex. CMP). Japon : Gunma, ss/Usui pass, 850 m, I. Löbl (3 ex. MHNG, et 1 ex. CMP).

Le mâle de cette espèce présente un enfoncement du ventrite VIII bordé de petits tubercules (fig. 19). De tels ornements sur les derniers ventrites visibles ont été observés récemment sur plusieurs espèces et s'avèrent de bons caractères spécifiques chez les *Ptomaphaginus*. Ils sont sans doute plus fréquents qu'il n'apparaît à la lecture de la littérature, et existent probablement chez des espèces connues où ils n'ont pas été décrits.



FIGS 1 à 5

Ptomaphagus smetanai n. sp. 1: édeage face dorsale. 2: édeage face latérale. 3: segment IX face dorsale. 4: spiculum gastrale face latérale. 5: segment IX face latérale droite. L'échelle représente 0,5 mm.

On retrouve une conformation semblable chez les mâles de *P. franki* Perreau, et *P. trautneri* Perreau. La première de ces deux espèces se rencontre à Taiwan, la seconde vient de Thaïlande. Le segment XI du mâle est représenté sur la figure 18, et la spermathèque sur la figure 13.

Ptomaphaginus ishizuchiensis n. sp. (Figs 6, 9, 12, 15)

HOLOTYPE ♂: Japon: Ehime, via Mt. Ishizuchi, 1000 m, 14-8-1980, I. Löbl (MHNG). Paratypes de même provenance: 2 ♀♀ (MHNG, et CMP).

Description: longueur: 1,9 mm. Coloration brune, l'avant du pronotum et la tête plus foncés, les antennes et les tarses antérieurs uniformément brun clair. Tout le corps recouvert d'une fine pubescence couchée dorée.

Tête couverte d'une ponctuation fine alignée transversalement, mais non confluante en strioles transversales nettes. Tout au plus quelques traits transversaux éparses et très superficiels relient certains points entre eux. Antennes courtes à massue compacte.

Pronotum à côtés rétrécis de la base à l'apex, la plus grande largeur à la base, recouvert de strioles transversales.

Elytres couvertes de strioles transversales plus espacées que celles du pronotum. Côtés presque parallèles sur la moitié basale.

Tarses antérieurs dilatés, aussi larges que l'apex des tibias.

Segment IX représenté sur la figure 15.

Edéage allongé et régulièrement arqué, arrondi à l'apex (figs 6 et 9). Trois soies du côté droit, quatre du côté gauche, toutes insérées sur la face inférieure et dirigées vers le bas.

Femelle différente extérieurement par l'absence de dilatation des tarses antérieurs. La spermathèque est représentée sur la figure 12.

Cette espèce est apparentée aux deux suivantes mais s'en distingue facilement par l'édéage dont l'apex comporte trois soies latérales et ventrales, et une expansion dorsale (figs 6 et 9).

Ptomaphaginus nipponensis n. sp. (Figs 7, 10, 16)

HOLOTYPE ♂: Japon: Ehime, via Mt. Ishizuchi, 1000 m, 14-8-1980, I. Löbl (MHNG).

Description: longueur 2 mm. Coloration brun clair uniforme (même les yeux), deux taches latérales symétriques pigmentées sur les côtés du clypéus. La coloration claire est probablement due à l'immaturité du seul exemplaire connu. Pubescence uniforme courte et couchée. Strioles des élytres et du pronotum de même espacement.

Pronotum et élytres à plus grande largeur à la base, régulièrement rétrécis de la base vers l'apex.

Tarses antérieurs dilatés, mais moins larges que l'apex des tibias.

Ventrite VIII avec une fossette médiane bordée de fortes soies. La conformation de cette fossette ressemble à celle du *Ptomaphaginus takaosanus*, mais elle est moins étendue chez *P. nipponensis* n. sp, et n'est pas exactement circulaire, légèrement plus allongée dans l'axe du corps.

Segment IX représenté sur la figure 16. Le spiculum gastrale est effilé mais ne dépasse pas vers l'avant le bord antérieur du segment.

Edéage allongé et régulièrement élargi de la base vers l'apex, et terminé en palette plate et arrondie (figs 7 et 10). Stylet interne épais.

Femelle inconnue.

Probablement apparentée au *P. takaosanus* Nakane et au *P. ishizuchiensis* n. sp., cette espèce s'en distingue facilement par l'édéage nettement plus élancé dans sa partie basale.

Ptomaphaginus pingtungensis n. sp. (Figs 8, 11, 14, 17)

Holotype ♂: Taiwan: Pingtung Hsien, Pietawushan, trail at 2000 m, 23-V-1991, A. Smetana (MHNG). Paratypes : même provenance, 6 ex.; même provenance, 1500 m, 1-V-1992, 1 ex.; Taiwan: Pingtung Hsien, Pietawushan, Kuai-Ku Hut, 2325 m, 21-V-1991, A. Smetana, 10 ex.; même provenance, 2125-2130 m, 27-30/IV/1992, 21 ex. (MHNG, MNHNP, et CMP).

Description: longueur: 2,2 mm. Ailé. Coloration générale uniformément brune, la massue antennaire un peu plus foncée. Tout le corps recouvert d'une fine pubescence couchée dorée. Les insertions des soies constituant cette pubescence s'alignent le long des strioles.

Tête à ponctuation fine, les points plus ou moins alignés en strioles très superficielles. Antennes au cinquième article plus allongé que le quatrième.

Pronotum ample, plus large que les élytres, et englobant ces derniers, les angles postérieurs légèrement saillants en arrière, 1,5 fois plus large que long. Les côtés presque parallèles sur la moitié postérieure de leur longueur, juste un peu rétrécis à la base.

Elytres courts, 1,8 fois plus longs que le pronotum. La plus grande largeur voisine de la base, régulièrement arqués. L'intervalle entre deux strioles transversales de même taille que celui du pronotum.

Tarses antérieurs largement dilatés, à peu près aussi larges que l'apex des tibias.

Segment abdominal IX représenté sur la figure 17. Spiculum gastrale long et fin, ne dépassant pas vers l'avant le bord antérieur du segment.

Edéage ovale, peu arqué, peu rétréci à l'extrémité (figs 8 et 11).

Femelle semblable à l'exception de la dilatation des tarses antérieurs. La spermathèque est représentée sur la figure 14.

Cette espèce se reconnaît facilement par sa formule antennaire particulière. Le cinquième antennomère est plus allongé que le quatrième. Chez les Ptomaphaginae, les antennomères sont généralement de longueur régulièrement décroissante de la base vers l'apex des antennes, entre le troisième article et le sixième.

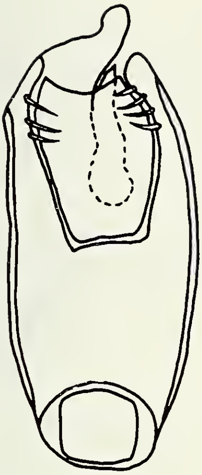
Ptomaphaginus sauteri (Portevin)

Taiwan: Taichung Hsien, Wufeng 60 m, 24-IV/2-V-9192, A. Smetana, 6 ex. (MHNG et CMP).

Le ventrite VIII du mâle présente une fossette large et peu profonde.

Hayashi (1990) a représenté l'édéage d'une espèce de *Ptomaphaginus* taiwanaise qu'il attribue au *Ptomaphaginus sauteri* et le compare au dessin de l'édéage donné par Jeannel (1936). La forme générale est manifestement différente, et il est douteux que ces exemplaires soient réellement des *P. sauteri*. D'après le dessin, l'exemplaire représenté se rapporte plus vraisemblablement au *P. pingtungensis* n. sp. On peut d'ailleurs se demander si les variations importantes, observées par cet auteur dans les longueurs relatives des antennomères entre les trois exemplaires mentionnés dans son article, ne sont pas dues à un mélange de spécimens appartenant aux deux espèces.

Figs 6 à 11: édéages faces ventrales et latérales. 6 et 9 : *Ptomaphaginus ishizuchiensis* n. sp., 7 et 10: *Ptomaphaginus nipponensis* n. sp., 8 et 11: *Ptomaphaginus pingtungensis* n. sp. Figs 12 à 14: spermathèques. 12: *Ptomaphaginus ishizuchiensis* n. sp., 13: *Ptomaphaginus takaosanus* Nakane, 14: *Ptomaphaginus pingtungensis* n. sp.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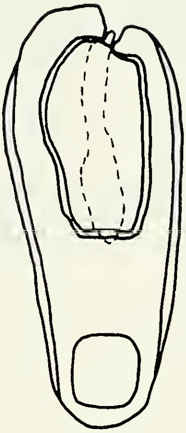
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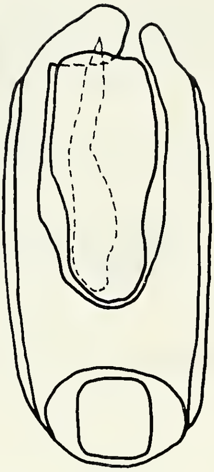
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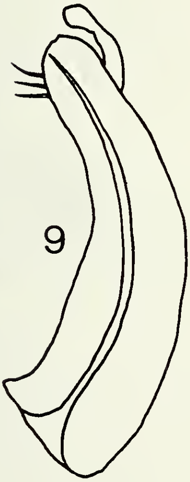
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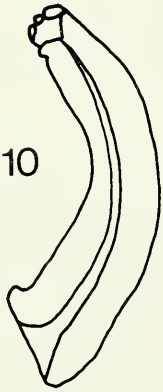
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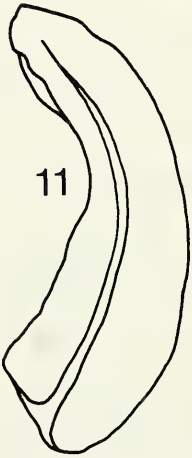
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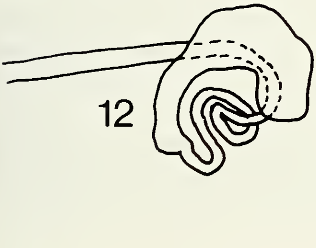
0.2 mm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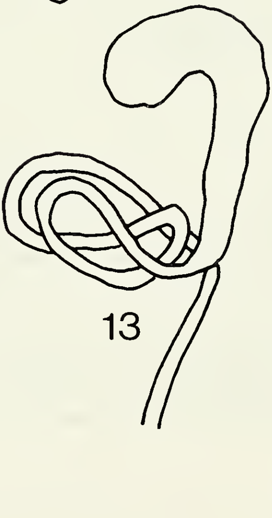
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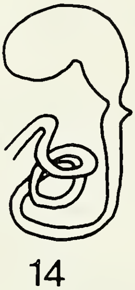
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Ptomaphaginus franki Perreau

Taiwan : Kaohsiung Hsien, Tengchih, 1610 m, 24-IV-1980, A. Smetana, 1 ♂; Pingtung Hsien, Peitawushan, Kuai-ku Hut, 2130m, 27-IV-1992, A. Smetana, 1 ♂ (MHNG).

Micronemadus pusillimus (Kraatz)

Japon: Gunma, ss/Usui pass, 250 mètres, 24-7-1980, I. Löbl, 2 ex. (MHNG).

Taiwan: Pingtung Hsien Peitawushan, Kuai-Ku Hut,, 2325 m, 21-5-1991, A. Smetana, 1 ex.; Nantou Hsien, Shanlicai, 1650 m, 19-5-1991, A. Smetana, 2 ex (MHNG).

Nemadus japanus Coiffait & Ueno

Un ♂: Japon: Ehime, via Mt. Ishizuchi, 1000 m, 14-8-1980, I. Löbl (MHNG).

Anemadiola itotateoi Hayashi (figs 20, 22)

Taiwan: Taoyuan Hsien, Takuanshan for. 17-IV-1990, 1660 m, A. Smétana, 1 ♂ et 1 ♀ (MHNG).

L'édéage est représenté sur les figures 20 et 22 par comparaison avec l'espèce suivante.

Anemadiola smetanai n. sp. (figs 21, 23, 27)

HOLOTYPE ♂: Taiwan, Nantou Hsien, Houhuanshan, 3175 m, 15-V-1990, A. Smetana (MHNG). Paratypes: 1 ♂, même origine; 1 femelle, Taiwan: Kaohschiung Hsien, Kuanshan trail, above Kaunshanchi Riv. 2550 m, 21-IV-92 A. Smetana; 4 ♀♀, Taiwan, Nantou Hsien, Houhuanshan, Kuenyang, 3050 m, 27/29-IV-90, A. Smetana (MHNG et CMP).

Description: longueur: 2,2 mm. Corps brun clair recouvert d'une pubescence assez longue et partiellement dressée.

Tête fortement ponctuée, à suture clypéo-frontale bien marquée et plus pigmentée que la surface céphalique.

Pronotum à ponctuation rugueuse, non striolé transversalement, les côtés sinués près des angles postérieurs, sans fossette latérale. Les angles postérieurs droits, et la base nettement rebordée.

Elytres striolés transversalement, la pubescence alignées sur les strioles. Stries élytrales longitudinales finement ponctuées. Ailes postérieures réduites.

Tibias antérieurs étroits à la base, brusquement élargis dans le premier tiers. Tarses antérieurs fortement dilatés, aussi larges que l'apex des tibias. Tarses intermédiaires avec les deux premiers articles dilatés (le premier nettement plus dilaté que le second).

Edéage large à la base, brusquement rétréci latéralement au milieu, effilé et recourbé vers le bas à l'apex (figs 21 et 23), moins effilé toutefois que chez l'*Anemadiola itotateoi* Hayashi.


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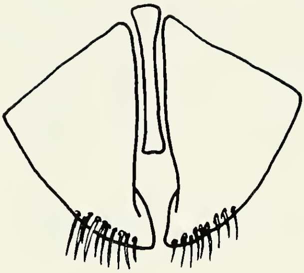
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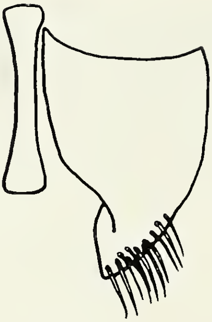
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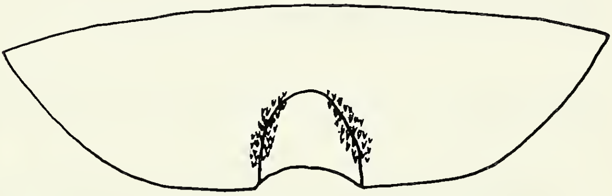
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FIGS 15 à 18: segment IX, face dorsale. 15: *Ptomaphaginus ishizuchiensis* n. sp., 16: *Ptomaphaginus nipponensis* n. sp., 17: *Ptomaphaginus pingtungensis* n. sp., 18: *Ptomaphaginus takaosanus* Nakane. FIGS 19: *Ptomaphaginus takaosanus* Nakane, ventrite VIII du mâle. L'échelle représente 0,25 mm pour les figures 15 à 18, et 0,3 mm pour la figure 19.

Femelle sans dilatation des tarses antérieurs et intermédiaires, avec un spiculum ventrale plus long que large, arrondi à l'apex (fig. 27).

L'*Anemadiola itotateoi* et l'*Anemadiola smetanai* n. sp sont étroitement apparentées, elles présentent une forme similaire d'édéage effilée et recourbée vers le bas à l'extrémité, et un spiculum ventrale plus long que large, mais arrondi à l'apex. *Anemadiola smetanai* n. sp. diffère de *Anemadiola itotateoi* par la sinuosité plus faible des angles postérieurs du pronotum, l'absence de gros points enfoncés le long des stries longitudinales élytrales, et l'absence de fovéole sur le pronotum.

La caractéristique la plus importante de ce genre est la morphologie de l'édéage, très homogène chez les trois espèces connues. La seconde moitié du lobe médian est comprimée latéralement, recourbée vers le bas, non coplanaire avec les paramères, et l'apex légèrement dilaté en palette. Le sac interne est tapissé de courtes écailles hyalines sur toute sa surface et de phanères constituées de grosses épines pigmentées. Les différences portent sur la courbure de l'apex du lobe médian, très prononcée chez *smetanai*, un peu moins chez *inordinata*, et encore moins chez *itotateoi*, et sur le rétrécissement de l'apex du lobe médian, régulier chez *smetanai*, plus brusque chez *inordinata*, et *itotateoi*.

La morphologie de l'édéage évoque certaines espèces de Nemadini, toutefois les deux espèces taiwanaises présentent tous les caractères des Anemadini : lame basale du tegmen courte, suture clypéo-frontale présente, non réduite à une ligne à pigmentation plus prononcée, spiculum ventrale arrondi et non pas en forme d'épine, et enfin, dilatation des deux premiers tarsomères intermédiaires chez les mâles.

Ce genre reste encore à découvrir en Chine continentale où il est très certainement présent.

Le tableau de détermination suivant permet d'identifier facilement les trois espèces actuellement connues d'*Anemadiola*.

TABLEAU DE DÉTERMINATION DES ESPECES DU GENRE *Anemadiola*

1. Forme large et convexe, côtés du pronotum non sinués devant les angles postérieurs. Stries élytrales avec des gros points enfoncés .... *inordinata* Szymczakowski
– Forme plus allongée, côtés du pronotum sinués devant les angles postérieurs. 2
2. Sinuosité des côtés du pronotum forte. Stries élytrales avec des gros points enfoncés. Pronotum avec deux fovéoles situées au quart de la largeur de chaque côtés. .... *itotateoi* Hayashi
– Sinuosité des côtés du pronotum plus discrète. Stries élytrales sans gros points enfoncés. Pronotum sans fovéole. .... *smetanai* n. sp.

Anemadus taiwanus n. sp. (figs 24, 28)

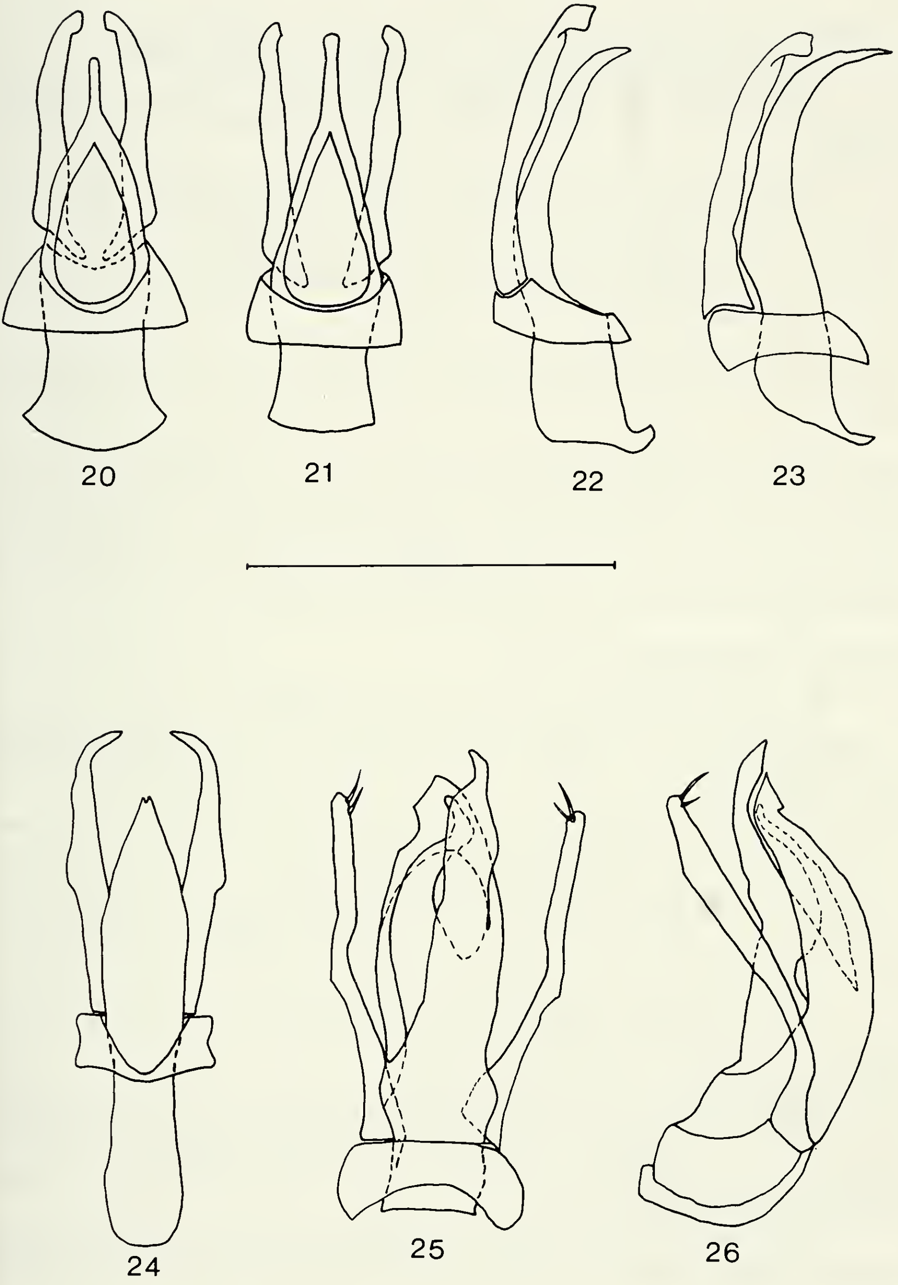
HOLOTYPE ♂: Taiwan, Chial Hsien, Alishan, sister ponds, 2180 m, le 26-IV-1990, A. Smetana (MHNG). Paratype: 1 ♀, Ilan Hsien, Chyr Duan, 1050 m, 18-IV-1990, A. Smetana (MHNG).

Description: longueur 2,8 mm. Corps large et convexe, recouvert d'une longue pubescence dorée partiellement dressée. Coloration brun-foncé, les trois premiers articles antennaires et les épaules éclaircis.

Tête à ponctuation forte et rugueuse. La suture clypéo-frontale bien marquée. Palpes maxillaires à second article très dilaté, le dernier court et conique.

Pronotum transverse et rétréci à la base, couvert d'une ponctuation rugueuse forte, non striolé transversalement. Angles postérieurs marqués, obtus.

Elytres avec des stries assez fortement ponctuées sur le tiers antérieur, la ponctuation s'atténuant régulièrement vers l'arrière. Forme convexe, la largeur



FIGS 20 à 26: édéages, faces ventrales et latérales. 20 et 22: *Anemadiola itotateoi* Hayashi, 21 et 23: *Anemadiola smetanai* n. sp., 24: *Anemadus taiwanus* n. sp., 25 et 26: *Nargus taiwanensis* n. sp. L'échelle représente 0,25 mm pour les figures 20 à 24, et 0,5 mm pour les figs 25 et 26.

s'atténuant très rapidement et régulièrement à partir du tiers antérieur où se trouve la plus grande largeur. Les angles postérieurs arrondis séparément à l'apex.

Tarses antérieurs modérément dilatés, nettement moins larges que l'apex des tibias. Dilatation des deux premiers tarsomères intermédiaires pratiquement imperceptible.

Lobe médian régulièrement arqué de la lame basale jusqu'à l'apex. L'apex avec une fine échancrure (fig. 24). Les paramères plus longs que le lobe médian, convergents à l'apex, présentant trois soies parallèles subapicales, insérées sur la face inférieure. Sac interne uniformément tapissé d'écailles fines et courtes, et équipé de deux phanères latérales courtes.

Femelle sans dilatation des tarses antérieurs, spiculum ventrale (fig. 28) large et court, arrondi, comme dans tout le genre *Anemadus*. Coloration uniformément plus claire.

L'espèce se distingue des autres *Anemadus* par sa petite taille, l'absence de dilatation des deux premiers articles mésotarsaux, l'apex de l'édéage échancré, et la structure simple du sac interne, dépourvu de toute dent sclérifiée (mais pas des habituelles phanères). Il s'agit sans doute d'une structure très primitive de sac interne chez les Anemadinae. Cette espèce ne prend pas clairement place dans un des groupes déjà définis dans le genre *Anemadus* (GIACHINO & VAILATI 1993).

Anemadus nipponensis n. sp. (fig. 31)

HOLOTYPE ♀: Japon: Nara, 27/31-7-1980, I. Löbl. (MHNG)

Cette espèce est proche de *Anemadus asperatus*, et sa description est donnée par comparaison.

Description: Longueur 3,6 mm, coloration générale brun clair. Tout le corps est recouvert d'une fine pubescence dorée couchée.

Tête avec une suture clypéo-frontale bien marquée et peu arquée, presque rectiligne (fig. 31), et une ponctuation rugueuse entremêlée d'une microréticulation.

Pronotum 1,7 fois plus large que long, et 1,3 fois plus large que les élytres, avec une ponctuation rugueuse, semblable à celle de *A. asperatus* et *A. kuluensis*.

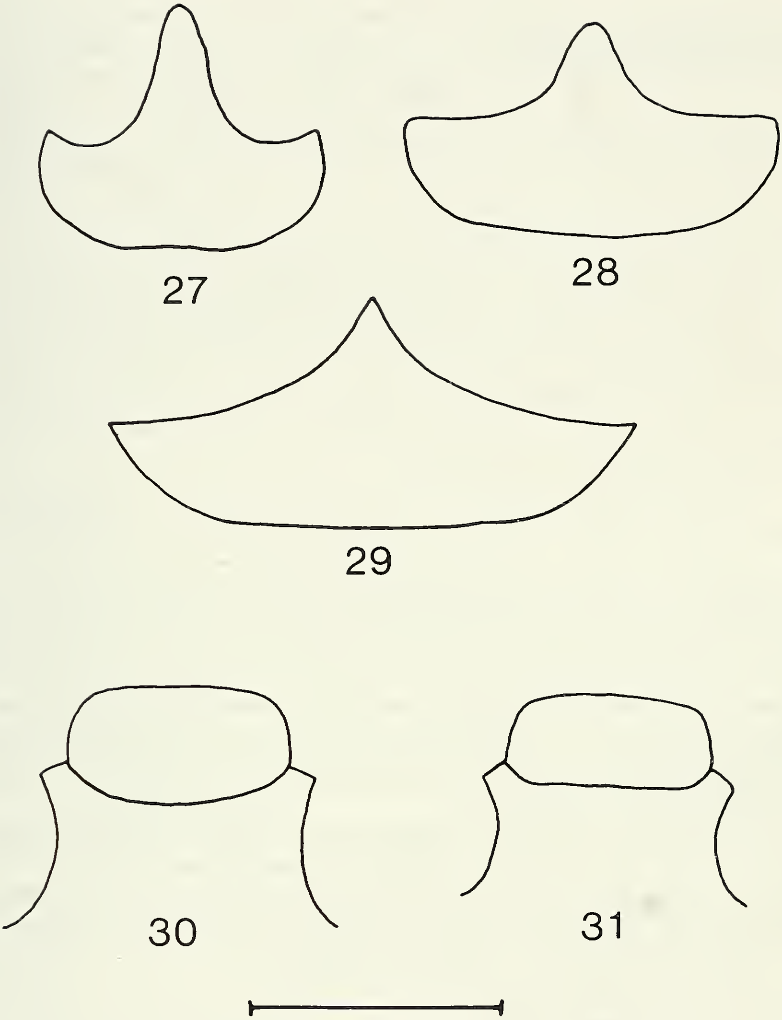
Elytres 1,5 fois plus longs que larges ensemble, la ponctuation des stries forte ainsi que la striolation transversale, et semblable à celle de *A. asperatus*. Par contre les élytres sont plus convexes que *A. asperatus*.

L'*Anemadus nipponensis* n. sp. appartient au groupe "*asperatus*" (GIACHINO & VAILATI 1993). C'est d'ailleurs l'espèce la plus proche de *A. asperatus*. Elle s'en distingue par les élytres plus convexes et par la suture clypéo-frontale presque rectiligne et non arquée (figs 30 et 31).

L'importance biogéographique de la découverte de cette espèce ainsi que de la suivante a déjà été discutée dans l'introduction.

Nargus taiwanensis n. sp.

HOLOTYPE ♂: Taiwan: Pingtung, Hsien, Peitawushan, above Kuai-Ku Hut, 2750 m, 29-IV-1992, A. Smetana (MHNG). Paratype: 1 femelle même provenance (MHNG).



Figs 27 à 29: femelles, ventrite VIII et spiculum ventrale. 27: *Anemadiola smetanai* n. sp. 28: *Anemadus taiwanus* n. sp. 29: *Nargus taiwanensis* n. sp. Figs 30 et 31 sutures clypéo-frontales. 30: *Anemadus asperatus* Champion, 31: *Anemadus nipponensis* n. sp. L'échelle représente 0,3 mm pour les figures 27 et 28, 0,5 mm pour les figures 29 à 31.

Description: Longueur: 3,6 mm. Espèce aptère, de forme générale convexe, large et courte et de coloration brun clair uniforme.

Tête fortement microréticulée, d'aspect mat, la ponctuation extrêmement fine, indiscernable au milieu de la microréticulation.

Pronotum ample dépassant la largeur des élytres, à angles postérieurs arrondis. Les téguments présentent une microréticulation profonde, aussi forte que celle de la tête, et donnant aussi un aspect mat à la surface pronotale. Ponctuation fine mais bien visible au milieu de la réticulation.

Elytres très convexes, moins profondément microréticulés que le pronotum, l'aspect général brillant, et la ponctuation nettement plus grosse. Les angles apicaux des deux élytres sont allongés en deux très fortes dents se recouvrant l'une l'autre.

Tibias antérieurs avec deux éperons externes visibles et quelques épines irrégulières. Tarses antérieurs fortement dilatés, un peu plus larges que l'apex des tibias. Soies apicales des tibias inégales.

Edéage non symétrique, les parties dorsales et ventrales du lobe médian réduites à deux longues lames bifurquées à l'apex. Ces deux lames se croisent à l'apex, la première se déplaçant vers la gauche, et la seconde vers la droite (figs 25 et 26). Paramères d'épaisseur constante, aussi longs que le lobe médian, avec deux soies apicales de longueur inégales, l'une longue, dirigée vers l'apex du lobe médian, l'autre plus interne et plus courte. Le sac interne est muni de courtes dents isolées, de phanères, et à la base, d'une très forte dent.

Femelle semblable au mâle avec les élytres également dentés, mais sans dilatation des tarses. Ventrite VIII et spiculum ventrale représentés sur la figure 29.

REMARQUE: l'absence de rangées de soies égales à l'apex des tibias, et la conformation de l'édéage suggèrent l'appartenance au sous-genre *Demochrus*, mais cette espèce présente des caractères tout à fait particuliers. Sa taille, nettement plus grande que celle des autres espèces, l'absence de la seconde paire d'aile, et la conformation complexe de l'édéage l'isolent très nettement au sein du genre. A terme, un nouveau sous-genre, voire un nouveau genre pourrait être introduit, surtout si d'autres espèces présentant une semblable évolution de l'organe copulateur venaient à être découvertes dans cette région.

Cette évolution de l'organe copulateur chez les Cholevini rappelle celle rencontrée chez les Catopini du genre endémique japonais *Apterocatops* Nakane. Une meilleure compréhension de la signification fonctionnelle de telles modifications structurales permettra peut-être de préciser l'origine de cette évolution parallèle dans les deux tribus, et se produisant dans la même région.

Sciodrepoides fumatus (Spence)

Japon: Tochigi, Nikko Nat. Park Senjogahara, 1400 m, 15-7-1980, I. Löbl, 3 ex. (MHNG).

Espèce répandue dans toute l'Europe et une grande partie de l'Asie.

Mesocatops japonicus (Jeannel)

Japon: Gunma, 4 km sw Tsumagoi, 1050 m, 18-7-1980, I. Löbl, 1 ex. (MHNG).

Catops miensis formosensis Hayashi

Taiwan: Hualien Hsien, Taroko, N. P. Nanhushi Hut, 2220 m, 8-V-1990, A. Smetana, 1 ♂; Taichung Hsien, Hsuehshan, above Shan-Liu-Gieu Hut, 3150 m, 8-V-1991, A. Smetana, 1 ♂ (MHNG).

Contrairement à la description de HAYASHI (1988), les paramères portent deux soies et non une seule, mais les deux soies sont de longueurs inégales, l'une est un peu plus courte que la moitié de la plus longue.

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ERRATUM

W.R. Lourenço 1995: *Chaerilus sabinae*, nouvelle espèce de Scorpion anophthalme des grottes de Matampa en Inde (Scorpiones, Chaerilidae). - *Revue suisse de Zoologie* 102(3): 847-850.

Suite à la publication de cette description, notre collègue Louis Deharveng (Laboratoire d'Ecologie Terrestre/Zoologie, UMR9964 du CNRS, Toulouse) nous a signalé une grave erreur dans la localité de ce scorpion anophthalme, due à une mauvaise transcription de l'étiquette originale par le prédécesseur de l'auteur.

La localité-type de cette espèce est la suivante: Indonésie, île de Sulawesi, province de Sulawesi Selatan, Grotte "Gua Atas" (en Indonésien: grotte du haut), dans le petit massif karstique de Matampa, près de Pangkajene, dans la région de Maros, coordonnées approximatives: 119° 38' E, 4° 48' 44'' S; lg. L. Deharveng, 12.VIII.1985 (no. INDO 76).

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Mertens, R. & H. Wermuth. 1960. Die Amphibien und Reptilien Europas, Kramer, Frankfurt am Main, XI + 264 pp.
Handley, C.O. Jr. 1966. Checklist of the mammals of Panama, pp. 753-795. In: Ectoparasites of Panama (R.L. Wenzel & V.J. Tipton, eds). Field Museum of Natural History, Chicago, XII + 861 pp.

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Revision westmediterraner *Scopaeus* - Arten (Coleoptera, Staphylinidae: Paederinae) und Beschreibung einer neuen Art aus Südspanien und Marokko

2. Beitrag zur Kenntnis der Gattung *Scopaeus* Erichson

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Revision of Western Mediterranean *Scopaeus*-species with description of a new species from Southern Spain and Maroc. - Revision of eight species of the genus *Scopaeus* Erichson, 1840 (Coleoptera, Staphylinidae: Paederinae). New characters for identification of females are introduced. Taxonomic results: *Scopaeus anxius* Mulsant & Rey, 1861 (*Scopaeus pourtoyi* Coiffait, 1960; *S. balazuci* Coiffait, 1968; *S. revestensis* Coiffait, 1968: syn. n.) is revalided and redescribed. *S. kerdousensis* Coiffait, 1973 syn. n. = *S. fageli* Coiffait, 1960. *S. kovaci* sp. n. (Southern Spain, Northern Maroc) is compared with *S. longicollis* Fauvel, 1874 and *S. proculus* Normand, 1934. Lectotypes are designated for *S. anxius* and *S. longicollis*.

Key-words: Coleoptera - Staphylinidae - Paederinae - *Scopaeus* - new species - new synonymies.

EINLEITUNG

Die Gattung *Scopaeus* Erichson, 1840 ist in der westlichen Paläarktis (sensu COIFFAIT 1984) gegenwärtig mit 88 validen Arten und Unterarten sowie 119 verfügbaren Namen vertreten. COIFFAIT (1984) führt 77 Arten an; FRISCH (1994) und GUSAROV (1991, 1992, 1994) erhöhten die Zahl auf jetzt 88 Spezies.

Diese Arbeit ist der erste Teil einer Revision westpaläarktischer *Scopaeus*-Arten, deren Notwendigkeit besonders durch das Studium der Coiffait'schen Typen deutlich wurde; ein Großteil der Arten Coiffait's ist in die Synonymie zu stellen. Coiffait beschrieb seine Arten ohne Typenstudium; auch bewertete er individuelle oder geringfügige geographische Variationen viel zu hoch.

Die Gliederung der Gattung in Subgenera (COIFFAIT 1960, 1968, 1981, 1984) wird nicht übernommen, da sie nach den Kriterien der phylogenetischen Systematik (HENNIG 1982) nicht haltbar ist. Eine phylogenetische Analyse der Artgruppen ist gegenwärtig nicht möglich.

Manuscript accepted 05.07.1995.

Klassifikation und Determination der ♀♀ fast aller *Scopaeus* - Arten bereiten noch immer große Schwierigkeiten. In dieser Arbeit wird versucht, die ♀♀ anhand der Terminalsklerite und der artspezifisch gestalteten, sklerotisierten Spermatheka zu charakterisieren. Die Skleritteile der Terminalsegmente 9 und 10 sind nicht immer von hohem diagnostischem Wert, aber dennoch geeignet, die Determination der ♀♀ zu erleichtern; ihre Terminologie richtet sich nach Uhlig (1989). Als Mittelfeld des Tergits 10 und der lateralen Sternalteile 9 (Valve) wird das beborstete, innerhalb der breiten Skleritränder gelegene Zentralfeld bezeichnet. Auf den Zeichnungen der weiblichen Genitalsklerite ist die gesamte Beborstung dargestellt; ausgebrochene Borsten sind an den Insertionspunkten erkennbar. Die feine Grundbeborstung der Abdominalsternite 8 der ♂♂ ist nicht dargestellt.

Die Spermatheka der *Scopaeus* - Arten scheint in vielen Artgruppen eine Klassifikation der ♀♀ zu ermöglichen. Sie ist bei allen untersuchten Arten nach einem Grundschema (vgl. Abb. 11, 12) gebaut. Die Kapsel setzt sich aus zwei distad erweiterten, astförmigen Gliedern zusammen, die scheinbar gelenkartig verbunden und in Seitenansicht zueinander gewinkelt sind; ihre Enden sind gegeneinander gebogen. Ein sklerotisierter Ductus mündet in eines der Kapselglieder; ein membranöser Ductus scheint der Gelenkstelle beider Kapselglieder zu entspringen. Die meist unter 0,1 mm messenden Spermatheken sollten im Durchlichtmikroskop bei einer Vergrößerung von mindestens 400x untersucht werden.

Maße und Abkürzungen: Die Längenangaben in den Diagnosen sind wie folgt gemessen: Vorderkörperlänge vom Vorderrand der Mandibeln bis zum Hinterrand der Elytren. Kopflänge vom Vorderrand des Clypeus bis zum Hinterrand des Kopfes. Augen- und Schläfenlänge sind von der Seite gemessen. Bei den ♀♀-Terminalskleriten beziehen sich Maße oder Indizes auf das Mittelfeld innerhalb der breiten Skleritränder. Proportionsmaße in Millimetern. NL = Nahtlänge, SL = Schulterlänge, B = Breite der Elytren, PL = Länge des Pronotums.

REVISION DER ARTEN

Scopaeus anxius Mulsant & Rey, 1861 (Abb. 1–12)

Scopaeus (Polyodontus) anxius Mulsant & Rey, 1861. – Bernhauer & Schubert 1910. – Ganglbauer 1895. – Gemminger & Harold 1868. – Mulsant & Rey 1861b, 1877.
Scopaeus (s. str.) *pourtoyi* Coiffait, 1960 syn. n. – Coiffait 1968, 1984.
Scopaeus (s. str.) *balazuci* Coiffait, 1968 syn. n. – Coiffait 1984.
Scopaeus (s. str.) *revestensis* Coiffait, 1968 syn. n. – Coiffait 1984.

Untersuchtes Typenmaterial: Zwei Syntypen aus der Sammlung Rey (MGL), die an dieser Stelle als Lectotypus (♂) und Paralectotypus (♀) designiert werden. Beide Exemplare, die auf sehr dünnen Drahtnadeln montiert waren, wurden genitalpräpariert und auf Kartonplättchen geklebt. Rey'sche Stücke tragen neben einem Genuszeichen meist noch ein verschlüsseltes Fundortetikett in Form eines kleinen farbigen Kartonplättchens. Die Syntypen tragen ein schwarzes Etikett: 'Provence' und stammen laut Diagnose aus der Umgebung von Hyères.

Scopaeus pourtoyi syn. n.: Holotypus ♂ (MHNP): Frankreich, Pyrenäen-Ostrand, env. Banyuls, 05.06.1954, leg. Pourtoy.

Scopaeus balazuci syn. n.: Holotypus ♂ (MHNP): Frankreich, Ardèche, Frigolet env. Saint-Paul-Le Jeune, 25.08.1959, leg. Balazuc.

Scopaeus revestensis syn. n.: Holotypus ♂, Paratypus ♀ (MHNP): Frankreich, Alpes de Provence, Revest des Brousses, 08.1962.

WEITERES MATERIAL: 2 ♂♂ (Coll. Frisch): Spanien, Gueja Sierra, Ufer des Genil, 1200 mNN, leg. P. Wunderle.

Länge: 3,1–3,4 mm; Vorderkörper 1,9 mm. Die folgenden Proportionsmaße beziehen sich auf den Lectotypus.

Ausgefärbt pechschwarz, doch scheinen häufig heller gefärbte (immature?) Exemplare aufzutreten. Diese sind nur auf den vier vorderen Abdominaltergiten geschwärzt. Vorderkörper einheitlich pechschwarz, Hinterrand der Elytren sehr schmal aufgehellt. Labrum braun, Antennenwurzel aufgehellt. Mandibeln, Maxillarpalpen, Antennen und Beine hellbraun. Femora stärker gebräunt, vorletztes Glied der Maxillarpalpen geschwärzt. Abdomen pechschwarz, Abdominaltergit 7 nach hinten schwach aufgehellt, Abdominaltergit 8 deutlich heller, zum Hinterrand gelbbraun.

Punktierung überall deutlich. Punktabstände am Kopf besonders auf den Schläfen kleiner als die Punktdurchmesser, auf Frons und Clypeus diesen weitgehend entsprechend. Punktierung des Pronotums obsolet und deutlich feiner als die des Kopfes, die Punktabstände entsprechen dem Durchmesser. Punktfreie Mittellinie des Pronotums schmal, im vorderen Drittel etwa von der Breite der Vorderschienenbasis. Elytren grob und doppelt so stark wie der Kopf punktiert, Punktabstände kleiner als die Durchmesser. Punktur zum Hinterrand der Elytren zunehmend obsolet, aber nicht feiner oder weitläufiger. Abdomen sehr grob, auf den Abdominaltergiten 3–6 etwas stärker und dichter als auf den Elytren punktiert, Punktur erst auf Tergit 7 feiner und etwas weitläufiger.

Mikroskulptur obsolet, Gesamteindruck glänzend. Chagrinierung des Kopfes nur auf den Schläfen deutlicher, auf Frons, Clypeus und der Mittellinie geschwunden. Pronotum und Elytren glänzend, Chagrinierung kaum erkennbar. Abdominaltergite 3–6 deutlich chagriniert, doch ebenfalls glänzend. Mikroskulptur der Abdominaltergite 7 und 8 zunehmend obsolet.

Kopf etwas länger als breit (0,51 : 0,46, Index 1,11). Größte Kopfbreite über den hinter den Augen schwach erweiterten Schläfen, diese gut doppelt so lang wie die Augen (0,14 : 0,29, Index 0,48), von ihrer Mitte unter deutlichem Winkel zu den breit verrundeten Hinterecken verengt. Hinterrand schwach konkav. Seitenzähne des Labrums halb so lang wie mittlere Zähne.

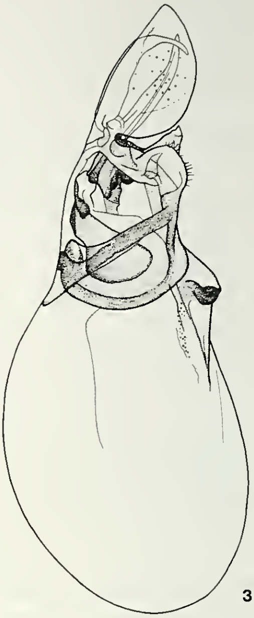
Pronotum länger als breit (0,52 : 0,41, Index 1,24), unwesentlich länger (Index 0,98) und schmaler (Index 1,12) als der Kopf. Punktfreie Mittellinie im vorderen Drittel stark, im hinteren Viertel schwächer gefurcht.

Elytren ein Viertel länger als breit (NL 0,46, SL 0,57, B 0,46, SL : B 1,24), Naht kürzer (NL : PL 1,13), Schultern etwas länger (SL : PL 0,91) als das Pronotum. Holopter. Abdominaltergit 7 mit Palisadensaum.

Antennen 0,9 mm lang. Antennomere 1–5 länger als breit, 6 und 7 so lang wie breit, 8–10 geringfügig breiter als lang. Antennomere 1–11 (L : B): 2,7; 1,4; 1,5; 1,2; 1,2; 1,0; 1,0; 0,8; 0,8; 0,8; 1,7.


1


2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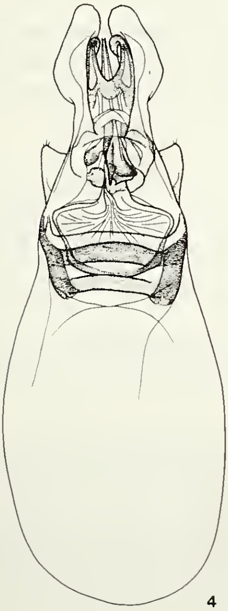
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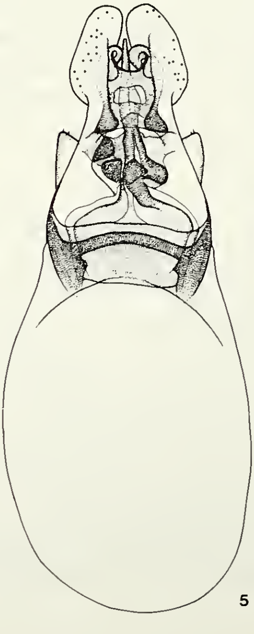
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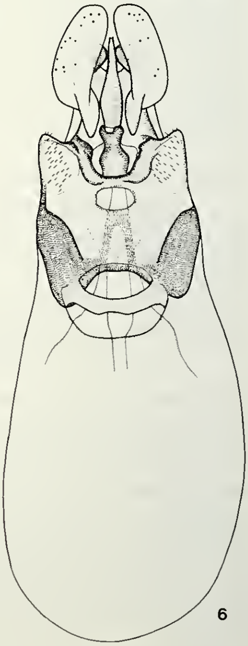

6

Beine ohne besondere Merkmale. Schienen schlank, ohne Erweiterungen. Vordertarsen beider Geschlechter stark erweitert.

MÄNNCHEN: Sternit 8 (Abb. 7) caudal auf ein Viertel der Länge dreieckig eingeschnitten, Spitzenwinkel des Ausschnittes schwach verrundet.

Aedoeagus (Abb. 1–6): 0,65–0,7 mm, Phallobasis mit ausgeprägten, ventral mit kurzen Borsten besetzten Laterallobi. Apikallobi relativ kurz und gedrungen, lateral gerundet erweitert und hier mit Sinnesgruben, die zum Teil äußerst kurze Börstchen tragen, besetzt. Ventralrand der Apikallobi bogenförmig gerundet und proximad gegen die Phallobasis vorgezogen. Länge der Apikallobi variabel. Dorsallobus apikal eingeschnitten und in zwei ventrad gebogene Dorne ausgezogen. Tiefe dieses Ausschnitts wie auch die Form der Dorne variabel, die breiter und kürzer, aber auch schlanker und länger gestaltet sein können. Ein langer, unpaarer Dorn des Endophallus, der zwischen den Dornen des Dorsallobus verläuft, erreicht fast den Apex der Apikallobi. Ein kurzer, in Ventralansicht apikal ausgerandeter Ventraldorn ragt zwischen die Laterallobi.

WEIBCHEN: Laterale Tergalteile 9 (Abb. 8) in eine lange, schwach dorsad gebogene Spitze ausgezogen, ohne dorsale Nebenspitze. Tergit 10 (Abb. 10) parallel, etwa doppelt so lang wie breit (Index 2,11). Valven (Abb. 9) schlank, über sieben mal so lang wie breit (Index 7,31), stark beborstet, die drei Hauptborsten kräftig.

Spermatheka (Abb. 11, 12): 0,1 mm, Kapselglieder distad stark beilförmig erweitert. Das Glied, in das der sklerotisierte Ductus mündet, ist besonders breit. In Seitenansicht ist das den Ducti entfernte Glied stark verlängert und gebogen.

Verbreitung: *Scopaeus anxius*, bislang nur aus Südfrankreich bekannt, ist im Rhonetal nördlich bis in die Region Ardeche belegt und liegt nun auch aus Südspanien (Andalusien) vor. Die Art ist vermutlich über ganz Spanien verbreitet.

VERWANDTSCHAFTSBEZIEHUNGEN: *Scopaeus anxius* ist mit keiner bekannten Art in direkte Beziehung zu bringen, doch scheint auf Grund der Ausbildung der Apikallobi und der Apikaldorne des Aedoeagus eine engere Verwandtschaft mit *Scopaeus gladifer* Binaghi, 1935 zu bestehen.

Scopaeus anxius scheint farbvariabel zu sein. Die Rey'schen Typen sind fast einheitlich hellbraun gefärbt; auch der Holotypus des *Scopaeus balazuci* syn. n. ist relativ hell. Ausgefärbte Stücke sind aber von tief schwarzer Farbe. Vermutlich sind die hellen Exemplare immatur wie auch der Typus des *Scopaeus revestensis* syn. n., was zu der irreführenden Zeichnung des verformten Aedoeagus mit stark gespreizten Apikallobi (COIFFAIT 1968) führte. Die Gestalt der Apikallobi, der Apikaldorne und die Tiefe des apikalen Einschnitts des Dorsallobus sind ebenfalls variabel, was aber keine spezifische Gliederung rechtfertigt.

ABB. 1–6

Scopaeus anxius: Aedoeagus, lateral: 1) *S. pourtoyi* syn. n., Holotypus, 2) Lectotypus, 3) Spanien, Gueja Sierra, dorsal: 4) Spanien, Gueja Sierra, 5) *S. pourtoyi* syn. n., Holotypus, ventral: 6) *S. pourtoyi* syn. n., Holotypus.

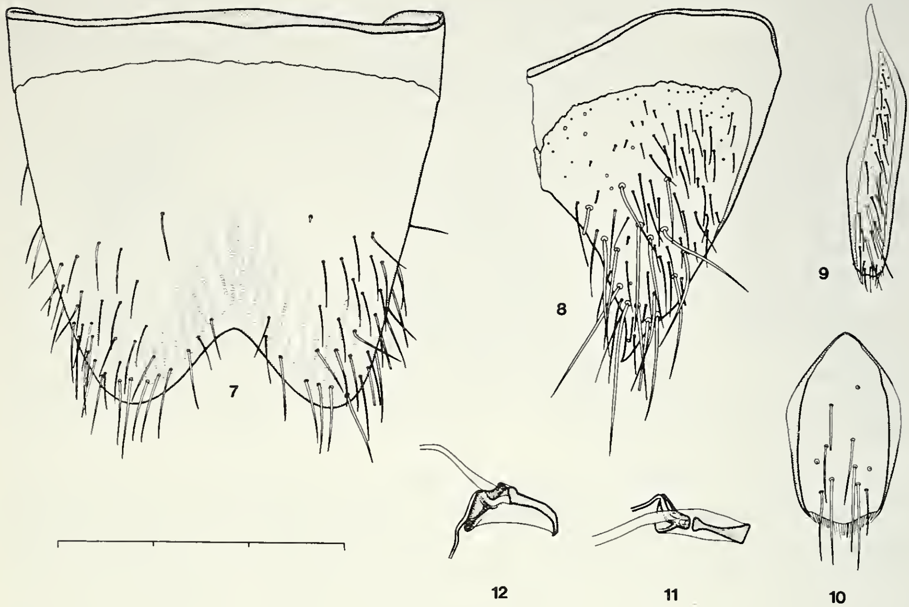


Abb. 7–12

Scopaeus anxius, ♂-Lectotypus: 7) Sternit 8. ♀-Paralectotypus: 8) laterales Tergalteil 9, 9) Valve, 10) Tergit 10, 11) Spermatheka, Aufsicht, 12) Spermatheka, Seitenansicht, Maßstabeinheit 0,1 mm.

Scopaeus kovaci sp. n. (Abb. 13–15, 20, 22, 24, 26, 29)

Typenmaterial: Holotypus ♂ (MHNG): Spanien, Caseres, Terte, 24.08.1969, leg. A. Senglet. 29 Paratypen: 1 ♂, 1 ♀ (MHNG, Coll. Frisch): Spanien, Cordoba, Villaviciosa, 29.06.1969, leg. A. Senglet. 2 ♀♀ (MHNG): Spanien, Cordoba, Palma del Rio, 26.06.1969, leg. A. Senglet. 3 ♂♂, 5 ♀♀ (MHNG, Coll. Frisch): Spanien, Huelva, Zalamea, 06.07.1969, leg. A. Senglet. 1 ♂ (MHNG): Spanien, Badajoz, Monesterio, 19.06.1969, leg. A. Senglet. 1 ♂, 1 ♀ (NMW): Spanien, Algesiras. 6 ♂♂, 8 ♀♀ (DEI, HUB): Marokko, Tanger, leg. Rolph.

Länge: 2,86–3,2 mm; Vorderkörper 1,57–1,79 mm. Die Proportionsmaße beziehen sich auf den Holotypus.

Vorderkörper matur dunkelbraun, Exemplare aus Marokko durchweg etwas heller. Kopf und Pronotum einheitlich dunkelbraun. Elytren auf den Schultern geschwärzt, zum Hinterrand heller und von der Farbe des Pronotums. Labrum braun, Antennenbasis aufgehellt. Mandibeln, Maxillarpalpen, Antennen und Beine hell gelbbraun. Abdomen schwarz, Tergit 7 aufgehellt, Tergit 8 hell braungelb.

Körper überall kräftig punktiert. Punktur des Kopfes stark und gedrängt, Punktabstände kleiner als Durchmesser, auf Frons und Clypeus weitläufiger, die Punktabstände entsprechen dort dem Durchmesser. Pronotum etwas obsolet und wesentlich feiner als der Kopf punktiert, die Punktabstände entsprechen dem Durchmesser. Pronotum ohne punktfreie Mittellinie. Elytren fast doppelt so stark, doch nicht so gedrängt wie der Kopf punktiert, Punktur zum Hinterrand etwas feiner und weitläufiger. Abdominaltergite 3–6 so grob wie die Elytren, doch stark gedrängt und etwas tiefer eingestochen punktiert. Tergite 7 und 8 zunehmend feiner, weitläufiger und nicht gedrängt punktiert.

Mikroskulptur obsolet. Glänzender Gesamteindruck, der nur durch die dichte Punktierung besonders des Kopfes geschwächt ist. Mikroskulptur des Kopfes erkennbar, doch in der dichten Punktur undeutlich, Frons und Clypeus völlig glänzend. Pronotum, Elytren und Abdomen stark glänzend, Chagrinierung obsolet, doch erkennbar.

Kopf etwas länger als breit (0,46 : 0,41, Index 1,12). Schläfen nicht erweitert, knapp 1,4 mal so lang wie die Augen (0,16 : 0,22, Index 0,73) und bereits vom ersten Drittel an schwach zu den sehr breit gerundeten Hinterecken verengt. Hinterrand gerade, Seitenzähne des Labrums halb so lang wie Mittelzähne.

Pronotum schlank, mittleres Drittel parallel. Länger als breit (0,48 : 0,38 mm, Index 1,26), etwas länger (Index 0,96) und schmaler (Index 1,08) als der Kopf. Punktfreie Mittellinie im vorderen Drittel deutlicher, im hinteren Viertel schwach gefurcht.

Elytren ein Fünftel länger als breit (NL 0,47, SL 0,61, B 0,51, SL : B 1,2) und länger als das Pronotum. Die Nahtlänge entspricht der Länge des Pronotums weitgehend (PL : NL 1,02), Schulterlänge um ein Viertel länger als das Pronotum (PL : SL 0,79). Holopter. Abdominaltergit 7 mit Palisadensaum.

Antennen 0,82 mm lang. Antennomere 1–4 länger als breit, 5–7 sehr schwach quer, 8–10 knapp ein Drittel breiter als lang. Antennomere 1–11 (L : B): 2,5; 1,5; 1,3; 1,3; 0,8; 0,8; 0,8; 0,7; 0,7; 0,7; 1,5.

Beine schlank, Mittelschienen zur Spitze erkennbar erweitert (L : B = 5,56). Vordertarsen beider Geschlechter stark verbreitert.

MÄNNCHEN: Abdominalsternit 8 (vgl. Abb. 27) im caudalen Viertel mit breitem dreieckigem Ausschnitt, dessen Spitze völlig verrundet ist. Mittellinie des Sternits durch intensivere Färbung und verdichtete, feine Grundbeborstung hervorgehoben.

Aedoeagus (Abb. 13–15): 0,6 mm, Laterallobi sehr umfangreich, die Basis der Apikallobi weit überragend, ventral mit zahlreichen, feinen Borsten besetzt. Apikallobi in Dorsalansicht parallel, ventral stark proximad verjüngt und mit vereinzelten Sinnesgruben. Dorsallobus apikal breit ausgerandet und in zwei apikad orientierte, etwas aufeinander zugebogene, dünne Dorne ausgezogen. Der Apex des Dorsallobus trägt zwei weitere, ventrad gerichtete, kurze Dornen. Ein dünner, langer Dorn des Endophallus verläuft apikad und endet zwischen diesen Dornen. Phallobasis zwischen den Laterallobi mit breitem, in Ventralansicht ausgerandetem Fortsatz.

WEIBCHEN: Laterale Tergalteile 9 (Abb. 20) apikal spitz ausgezogen, dorsale Nebenspitze gut entwickelt. Tergit 10 (Abb. 22) breit (Index 1,79), Seiten gleichmäßig schwach gerundet. Valve (Abb. 24) relativ breit gebaut (Index 5,36).

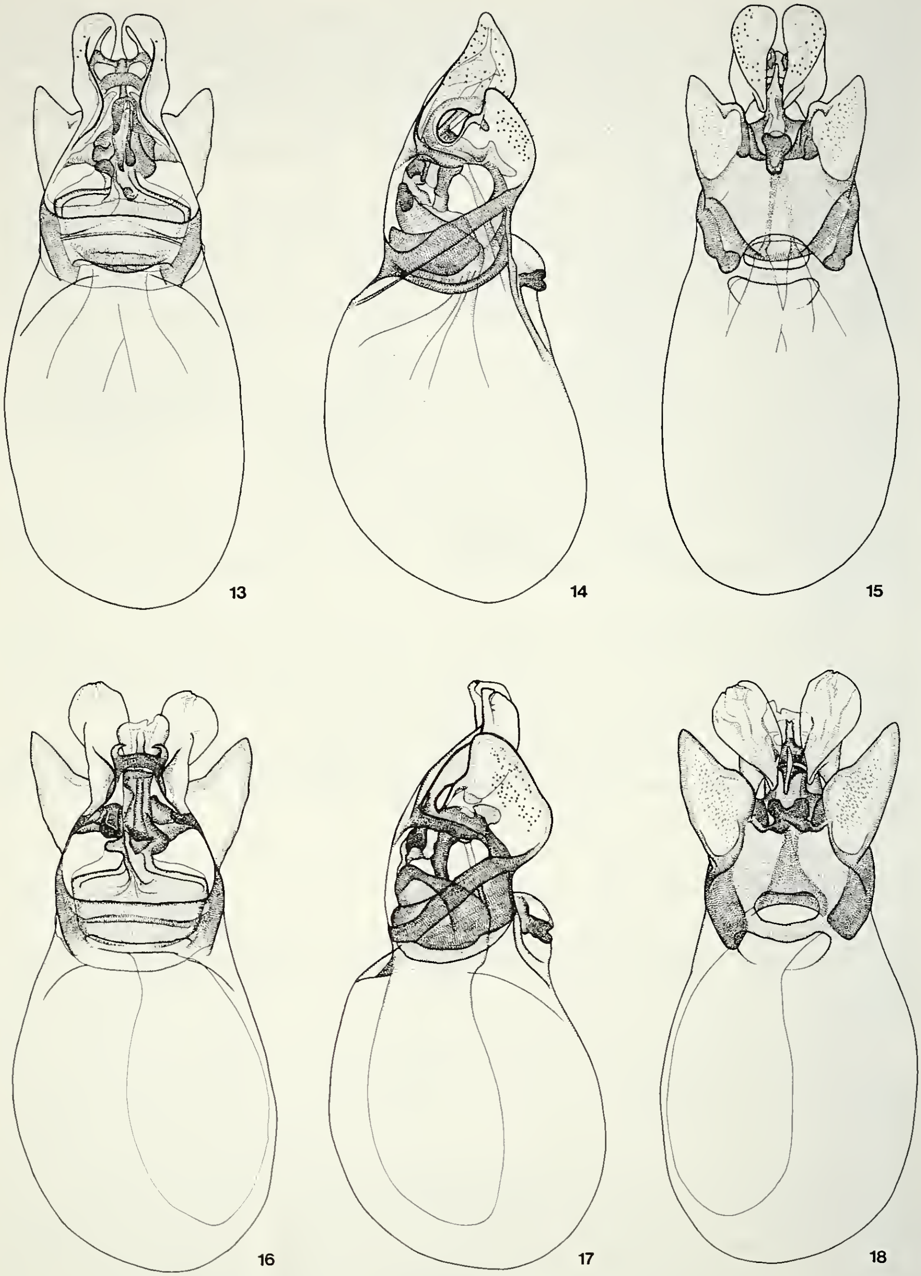


Abb. 13–18

Scopaeus kovaci sp. n., Holotypus: Aedoeagus 13) dorsal, 14) lateral, 15) ventral. *S. longicollis*, Portugal, Vila Real: Aedoeagus 16) dorsal, 17) lateral, 18) ventral.

Spermatheka (Abb. 26): 0,07 mm, mit annähernd rechtwinklig orientierten, apikal nur schwach gebogenen Kapselgliedern. Sklerotisierter Ductus robust, lang ausgezogen, am Ende verdickt und in einen membranösen Ductus verlängert.

DERIVATIO NOMINIS: Dr Damir Kovac (FSF) sei mit der Wahl des Namens für die Unterstützung dieser Arbeit herzlich gedankt.

VERBREITUNG: *Scopaeus kovaci* sp. n. ist aus dem südlichen Spanien, nördlich bis Badajoz, und von der Nordspitze Marokkos (Tanger) bekannt. *Scopaeus kovaci* sp. n. wird vermutlich nach Norden durch *Scopaeus longicollis* und in Nordafrika durch *Scopaeus proculus* ersetzt.

VERWANDTSCHAFTSBEZIEHUNGEN: *Scopaeus kovaci* sp. n. ist als vermutlich vikariierendes Adelphotaxon des *Scopaeus longicollis* aufzufassen. Folgende Synapomorphien werden angenommen:

- Laterallobi des Aedoeagus flügelförmig vergrößert und ventral mit feinen Borsten besetzt;
- Apikallobi apikad erweitert, proximad verjüngt, ventral abgeflacht;
- Dorsallobus apikad nicht verjüngt, breit abgestutzt und in zwei apikad gerichtete Dornen ausgezogen, zusätzlich mit zwei weiteren, kurzen, ventrad orientierten Dornen.

Eine engere Verwandtschaft ist auch zu dem nordafrikanischen *Scopaeus proculus* erkennbar, der sich ebenfalls durch auffallend stark entwickelte, fein beborstete Laterallobi des Aedoeagus auszeichnet, in anderen Merkmalen aber deutlich abweicht.

DIFFERENTIALDIAGNOSE: *Scopaeus kovaci* sp. n. soll mit *Scopaeus longicollis* und *Scopaeus proculus* verglichen werden.

Scopaeus longicollis Fauvel, 1874 (Abb. 16–18, 19, 21, 23, 25, 28)

BINAGHI 1935. – COIFFAIT 1952, 1984. – GANGLBAUER 1895. – PORTA 1926. – PORTEVIN 1929. – REITTER 1909.

UNTERSUCHTES TYPENMATERIAL: Zwei ♀♀-Syntypen, die der Beschreibung Fauvel's zugrundeliegen. Der Lectotypus wurde umpräpariert und genitalisiert. Lectotypus ♀ (ISNB): Frankreich, Limoges. Paralectotypus ♀ (ISNB): Frankreich, Carcassonne.

WEITERES MATERIAL: 2 ♂♂ (Coll. Frisch): Portugal, Vila Real, Cortico/Montalegre, 30.08.1969, leg. A. Senglet. 3 Expl. (MHNG): Spanien, Segovia, La Granja, 29.08.1971, leg. A. Senglet. 3 ♂♂, 4 ♀♀ (MHNG): Schweiz, Vaud, La Rippe, 31.03.1966, 04.04.1969, 04.04.1976, leg. A. Comellini. 1 ♂, 1 ♀ (MHNG): Schweiz, Vaud, Bonmont, Chéserex, 22.07.1991, 21.06.1989, leg. Cl. Besuchet. 3 ♀♀ (MHNG): Schweiz, Valais, Erde-Aven, 03.07.1988, 830 mNN, leg. Cl. Besuchet. 1 ♂ (MHNG): Frankreich, Provence, Hyères, 12.1959, leg. Ochs. 1 ♂ (MHNG): Frankreich, Provence, Foret Don, 06.08.1954, leg. Ochs. 11 ♂♂, 3 ♀♀ (MHNG): Frankreich, Alpes Maritimes, 1951–1958, leg. Ochs. 1 ♀ (Coll. Renner, Bielefeld): Deutschland, Traisen/Nahe, 1989, leg. Renner.

Scopaeus longicollis ist von *Scopaeus kovaci* sp. n. durch etwas schlankeren Körperbau, besonders den schlanken, fast parallelen Kopf und durch Unterschiede im Bau des Aedoeagus und der Spermatheka deutlich unterschieden.

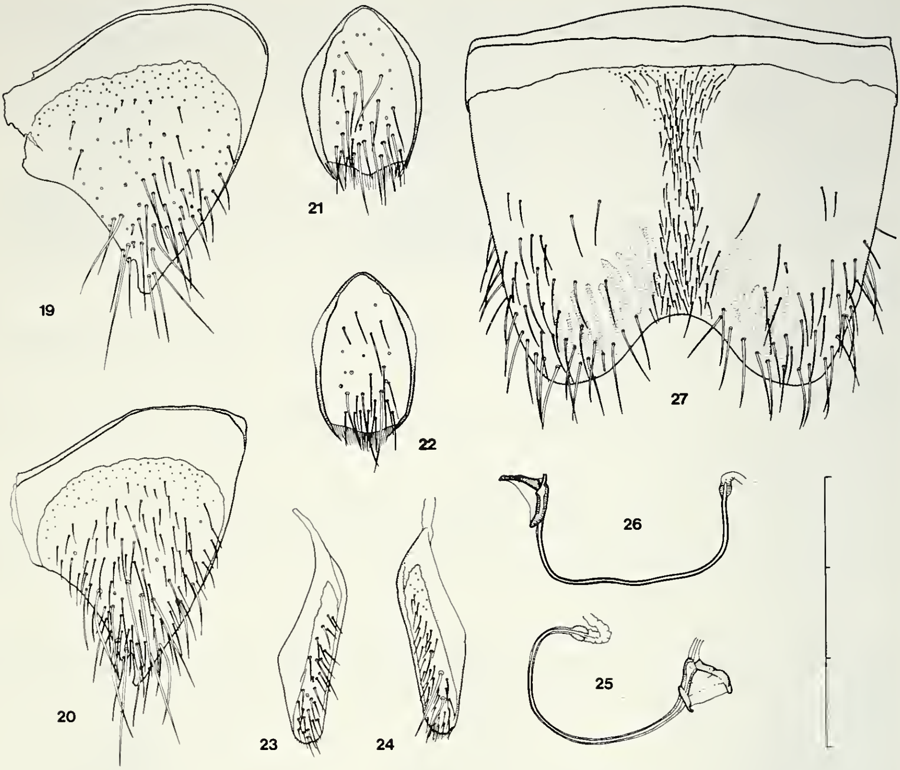


Abb. 19–27

Scopaeus kovaci sp. n., ♀-Paratypus, Spanien, Cordoba: 20) laterales Tergalteil 9, 22) Tergit 10, 24) Valve, 26) Spermatheka. *S. longicollis*, ♀-Lectotypus: 19) laterales Tergalteil 9, 21) Tergit 10, 23) Valve, 25) Spermatheka. *S. proculus*, ♂-"Cotype": 27) Sternit 8, Maßstabeinheit 0,1 mm.

Länge: 3,2 mm; Vorderkörper 1,75 mm. Den Meßwerten liegt ein ♂ aus Portugal zugrunde.

Durchschnittlich etwas dunkler gefärbt. Elytren weniger stark aufgehellt, Antennen häufig etwas gebräunt.

Punktierung und Mikroskulptur ohne Differenzialmerkmale.

Kopf etwas schlanker (0,48 : 0,41, Index 1,17). Schläfen schwach erweitert, über die Hälfte ihrer Länge gerade, erst hinter ihrer Mitte zu den schwächer gerundeten Hinterecken verengt. Kopf mit schmaler punktfreier Mittellinie.

Pronotum etwas schlanker (0,48 : 0,37, Index 1,3), hinter den Vorderecken stärker gerundet. Kopf und Pronotum von gleicher Länge.

Elytren mit den gleichen Längen und Proportionen, auch im Verhältnis zum Pronotum.

Abdomen ohne Differenzialmerkmale, Tergit 7 mit Palisadensaum.

Antennen 0,89 mm, mit schlankeren Antennomeren. Antennomere 2–4 etwas länger als breit, 4–10 quadratisch. Antennomere 1–11 (L : B): 2,5; 1,2; 1,2; 1,2; 1,0; 1,0; 1,0; 1,0; 1,0; 1,0; 1,5).

Beine schlanker, Mittelschienen schwächer erweitert (L : B = 5,58).

MÄNNCHEN: Abdominalsternit 7 (vgl. Abb. 27) wie bei *Scopaeus kovaci* sp. n. gestaltet.

Aedoeagus (Abb. 16–18): 0,6 mm, von gleicher Organisation, doch breiter gebaut. Laterallobi deutlicher flügelartig vergrößert, die Apikallobi in Seitenansicht weitgehend verdeckend. Seiten der hyalin erscheinenden, schwach sklerotisierten Apikallobi stark erweitert, nicht parallel, ihr dorsaler Innenrand stark gewinkelt. Dorsallamelle apikal mit zwei kurzen, gegeneinander gebogenen Dornen und einem Medianfortsatz, der einen apikalen, häutigen Lobus stützt und *Scopaeus kovaci* sp. n. fehlt. Der apikad gerichtete Dorn des Endophallus erscheint in Ventralansicht sehr schmal und hakenförmig gebogen. Ventraler Fortsatz zwischen den Laterallobi stark ausgerandet, breiter als lang.

WEIBCHEN: Laterale Tergalteile 9 (Abb. 19) in einen breiteren Apex ausgezogen, dorsale Nebenspitze kleiner. Tergit 10 (Abb. 21) etwas breiter (Index 1,73).

Spermatheka (Abb. 25) von gleicher Größe, durch abgesetzte, parallel stehende Endteile beider Kapselglieder unterschieden.

VERBREITUNG: Literaturangaben zufolge ist *Scopaeus longicollis* über das südliche Mitteleuropa, Südwesteuropa und Nordwestafrika verbreitet. BERNHAUER & SCHUBERT (1910) führen Südfrankreich, Spanien, Deutschland, Italien, Marokko, Algerien und Tunesien an. Die Meldung aus Südkärnten durch Scheerpeltz (in HORION 1965) ist unbelegt und abzulehnen. HORION (1965) bezweifelt die unbelegte Angabe aus Deutschland (EPPELSHEIM 1891), die auch REITTER (1909) übernahm. Ein sicherer Nachweis aus Deutschland liegt von der Nahe (Traisen, 1989) vor. BINAGHI (1935) meldet *Scopaeus longicollis* aus Algerien, Tunesien und Marokko, führt aber auch Stücke aus Tanger (leg. Rolph, Coll. Peyerimhoff) an, die sicher der gleichen Serie entstammen wie Paratypen des *Scopaeus kovaci* sp. n., die sich in den Sammlungen des NMW, DEI und der HUB befinden. Alte Angaben aus Nordafrika werden schon von COIFFAIT (1984) bezweifelt; sie sind auf *Scopaeus kovaci* sp. n. oder auf *Scopaeus proculus* zu beziehen; historische Stücke des *Scopaeus kovaci* sp. n. waren vielfach als *Scopaeus longicollis* determiniert. *Scopaeus longicollis* ist nur aus Mittel- und Südfrankreich, Deutschland westlich des Rheins, dem westlichen Norditalien, der Schweiz, Spanien ohne den Süden und dem nördlichen Portugal bekannt und wird nach Süden vermutlich durch den vikariierenden *Scopaeus kovaci* sp. n. abgelöst.

Scopaeus proculus Normand, 1934 (Abb. 27, 30, 31–37)

COIFFAIT 1968, 1984.
Scopaeus (Polyodontus) cordifer Binaghi, 1935. – COIFFAIT 1984.

UNTERSUCHTES TYPENMATERIAL: Die Art wurde nach einem ♂ beschrieben. Ein als Cotype etikettiertes, vom Locus typicus stammendes ♂ lag zur Untersuchung vor; ob es sich um den Holotypus handelt, ist nicht zu klären, da die Sammlung Normand (Tunis) gegenwärtig nicht zugänglich ist. "Cotype" ♂ (MHNG): Tunesien, Ain-Draham, leg. Normand.

Scopaeus cordifer: Nach vier Stücken beschrieben; drei Typen lagen vor. Zwei vermutlich fälschlich als Cotypen etikettierte ♀♀ befinden sich in der Sammlung Scheerpeltz (NMW). Holotypus ♂ (MCG): Algerien, Mouzaia, 09.04.1905, leg. Peyerimhoff. Paratypen 2 ♂♂ (MCG): Tunesien, Ain-Draham, leg. Normand. 2 ♀♀ (NMW): Tunesien, Ain-Draham, leg. Normand.

WEITERES MATERIAL: 1 ♂ (MHNG): Tunesien, Ain-Draham, 05.1937, leg. Normand.

Scopaeus proculus ist von *Scopaeus kovaci* sp. n. durch hellere Färbung, bedeutendere Größe, breiteren Kopf, auffallend kurze, stark punktierte Elytren und wesentlich breitere Mittelschienen zu trennen. Der schlankere Aedoeagus ist besonders durch die Gestalt des Dorsallobus verschieden.

Länge: 3,36–3,4 mm, Vorderkörper 1,86–1,89 mm. Weitere Maße beziehen sich auf die Normand'sche "Cotype".

Heller gefärbt. Vorderkörper rotbraun, Hinterhälfte des Pronotums und Elytren geschwärzt, Schultern schwarz, Hinterrand der Elytren schmal bräunlich aufgehellt. Abdomen schwarz, Tergit 7 auf der Hinterhälfte gelbbraun aufgehellt, Tergit 8 einheitlich gelbbraun. Mandibeln, Maxillarpalpen, Antennen und Beine hell gelbbraun.

Kopf deutlich, aber fein punktiert, die Punktabstände entsprechen dem Durchmesser. Punktur im Chagrin etwas aufgelöst. Frons und Clypeus weitläufiger punktiert. Pronotum etwas feiner, aber nicht weitläufiger als der Kopf punktiert. Elytren wesentlich stärker als Kopf und Pronotum punktiert, Punktur tief eingestochen und gedrängt, zum Hinterrand etwas feiner. Abdominaltergite 3–6 halb so stark wie die Elytren, doch ebenso gedrängt punktiert. Punktur der Tergite 7 und 8 feiner, im deutlichen Chagrin schwer erkennbar.

Chagrin des Kopfes deutlich, auf Frons, Clypeus und der Kopfmitte geschwunden, ruft zusammen mit der feinen Punktierung einen matten Eindruck hervor. Pronotum und Elytren obsolet chagriniert, stark glänzend. Abdomen zwischen der dichten Punktur deutlich mikroskulptiert.

Kopf etwas länger als breit (0,56 : 0,51, Index 1,1). Schläfen stark erweitert, mehr als doppelt so lang wie die kleinen, schwach gewölbten Augen (0,14 : 0,31, Index 0,45), ab der Hälfte ihrer Länge ohne Winkelbildung zu den breit verrundeten Hinterecken verengt. Seitenzähne des Labrums halb so lang wie Mittelzähne.

Pronotum mit den gleichen Proportionen, weniger parallel, Seitenränder gleichmäßiger gerundet, im Verhältnis zum Kopf etwas schmaler (Index 1,11). Mittellinie in ganzer Länge, besonders im vorderen Viertel, tief gefurcht.

Elytren im Verhältnis zum Pronotum wesentlich kürzer, kaum länger als breit (NL 0,46, SL 0,59, B 0,52, SL : B 0,13) und etwa so lang wie das Pronotum (PL : SL 0,97). Nahtlänge wesentlich kürzer als das Pronotum (Index 1,21). Holopter.

Abdomen ohne Differenzialmerkmale, Abdominaltergit 7 mit Palisadensaum.

Antennen 1,0 mm lang. Antennomere 2–5 ein Fünftel länger als breit, 6 und 7 so lang wie breit, 8–10 quer. Glieder 7–10 rundlich, perlschnurartig. Antennomere 1–11 (L : B): 2,6; 1,2; 1,2; 1,2; 1,2; 1,0; 1,0; 0,8; 0,8; 0,8; 1,8.

Beine kräftiger, besonders die Mittelschienen stärker erweitert (L : B = 4,29). Vordertarsen beider Geschlechter stark erweitert.

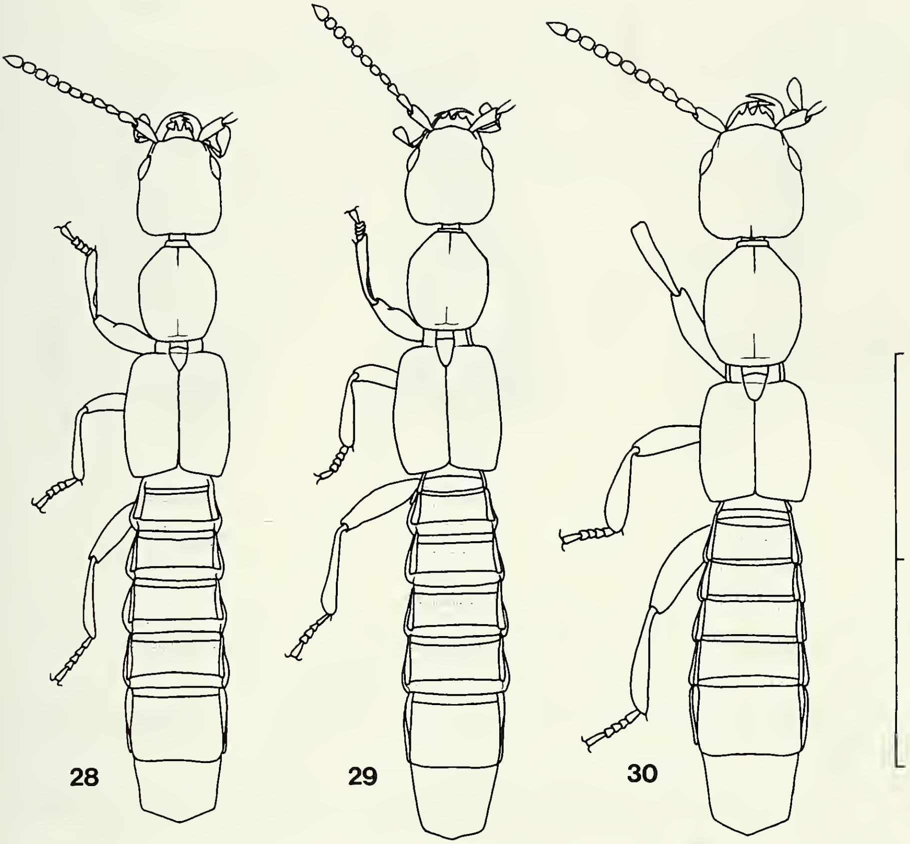


Abb. 28–30

Habitus von 28) *Scopaeus longicollis*, ♂, Portugal, Vila Real, 29) *S. kovaci* sp. n., ♂-Paratypus, 30) *S. proculus*, ♂-"Cotype", Maßstabeinheit 1 mm.

MÄNNCHEN: Abdominalsternit 8 (Abb. 27) wie bei *Scopaeus kovaci* sp. n. und *Scopaeus longicollis* gebildet.

Aedoeagus (Abb. 31–33): größer (0,7 mm) und schmaler, Apikallobi länger ausgezogen, Laterallobi aber ebenso stark entwickelt. Dorsallobus apikal verlängert und spitz zulaufend, nicht abgestutzt und keine weiteren Dorne tragend. Phallobasis ventral mit zwei kurzen Borsten.

WEIBCHEN: Laterale Tergalteile (Abb. 34) breiter zugespitzt, dorsale Nebenspitze kürzer. Tergit 10 (Abb. 36) etwas schmaler (Index 1,93).

Spermatheka (Abb. 37) etwas größer (0,08 mm), Kapselglieder distad stark erweitert, sklerotisierter Ductus länger.

VERBREITUNG: *Scopaeus proculus* ist im westlichen Nordafrika beheimatet und bislang nur aus Algerien und Tunesien bekannt.

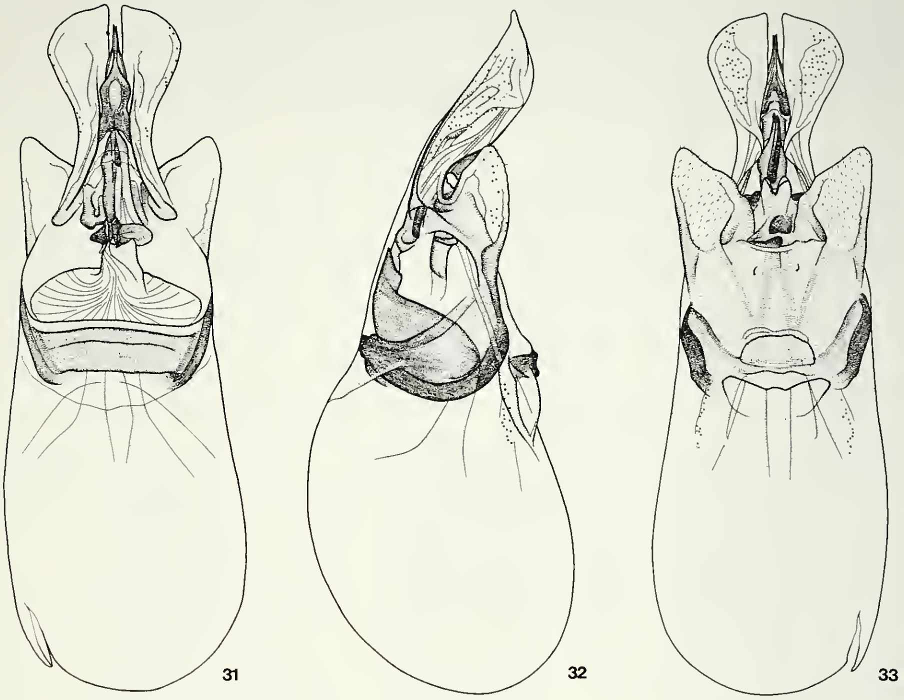


ABB. 31–33

Scopaeus proculus, "Cotype": Aedoeagus 31) dorsal, 32) lateral, 33) ventral.

Scopaeus fageli Coiffait, 1960 (Abb. 38–45)

Scopaeus (s. str.) *fageli* Coiffait, 1960. – COIFFAIT 1984.
Scopaeus (Hyposcopaeus) kerdousensis Coiffait, 1973, syn. n. – COIFFAIT 1984.

UNTERSUCHTES TYPENMATERIAL: Holotypus ♂ (ISNB), Paratypen 1 ♂, 1 ♀ (MHNP): Algerien, Gorges d'El Kantara, Djebel Metlilli, 05.1954, leg. G. Fagel.

Scopaeus kerdousensis syn. n.: Holotypus ♂ (MHNP): Marokko, Anti Atlas, Col de Kerdous, 11.1971, leg. H. Coiffait.

Länge: 2,86–3,2 mm; Vorderkörper 1,75–1,9 mm. Weitere Maße beziehen sich auf den ♂-Paratypus.

Vorderkörper rotbraun, Hinterhälfte des Pronotums schwach geschwärzt, Elytren auf den Schultern stark geschwärzt, Seitenrand und hinteres Drittel deutlich aufgehellt. Abdomen dunkelbraun, hinteres Drittel von Tergit 7 und Tergit 8 gelbbraun aufgehellt. Mandibeln, Maxillarpalpen, Antennen und Beine hell gelbbraun.

Kopf fein und gedrängt punktiert, Punktabstände kleiner als Durchmesser. Frons und Clypeus weitläufiger punktiert. Schmale, punktfreie Mittellinie von der Breite zweier Punkte nur auf dem Clypeus erkennbar. Pronotum etwas feiner und weitläufiger als der Kopf punktiert, Punktabstände so groß wie Durchmesser, mit

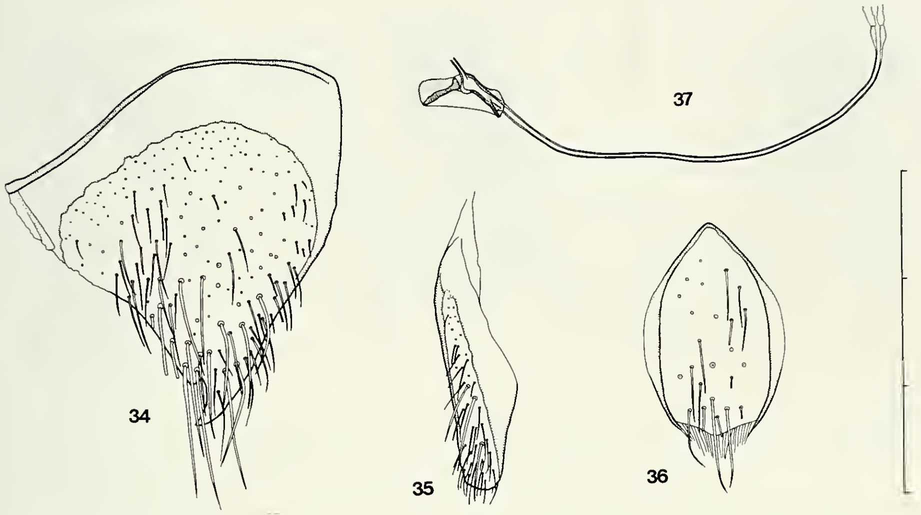


Abb. 34–37

S. proculus: (♀-"Cotype" von *S. cordifer*): 34) laterales Tergalteil 9, 35) Valve, 36) Tergit 10, 37) Spermatheka, Maßstabeinheit 0,1 mm.

schmaler, punktfreier Mittellinie. Elytren etwas stärker als der Kopf und zum Hinterrand nicht feiner oder weitläufiger punktiert, die Punktabstände entsprechen dem Durchmesser. Abdomen so stark und dicht wie die Elytren, auf den Tergiten 7 und 8 aber zunehmend feiner und weitläufiger punktiert.

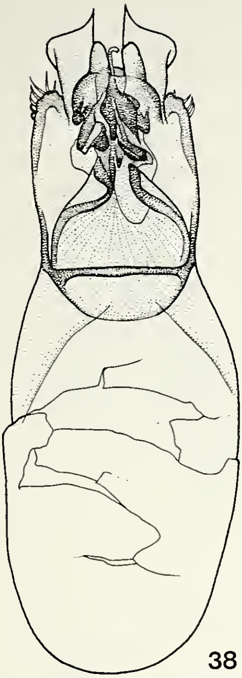
Chagrinierung obsolet, Gesamteindruck glänzend. Kopf verloschen chagriniert, Frons und Clypeus ohne Mikroskulptur. Pronotum und Elytren glänzend. Mikroskulptur des Abdomens obsolet.

Kopf etwas länger als breit (0,45 : 0,47, Index 1,09), Schläfen hinter den Augen schwach erweitert und fast doppelt so lang wie die Augen (0,14 : 0,26, Index 0,54). Schläfen ab der Hälfte ihrer Länge unter deutlicher Richtungsänderung zu den stark gerundeten Hinterecken verengt. Seitenzähne des Labrums mehr als halb so lang wie die Mittelzähne.

Pronotum schlank (0,46 : 0,39, Index 1,18), hinter den Vorderecken gleichmäßig gerundet. Etwas kürzer (Index 1,11) und ein Fünftel schmaler als der Kopf (Index 1,21). Punktfreie Mittellinie von der Breite der Vorderschienenbasis auf dem hinteren Drittel und dem vorderen Viertel schwach gefurcht.

Elytren ein Fünftel länger als breit (NL 0,54, SL 0,64, B 0,54, SL : B 1,19), gut ein Drittel länger als das Pronotum (PL : SL 0,72). Holopter. Abdominaltergit 7 mit Palisadensaum.

Antennen 0,89 mm. Antennomere 1–4 länger als breit, Glied 3 fast eineinhalb mal so lang wie breit. Antennomere 5–10 quadratisch. Antennomere 1–11 (L : B): 2,5; 1,2; 1,4; 1,2; 1,0; 1,0; 1,0; 1,0; 1,0; 1,0; 1,6.



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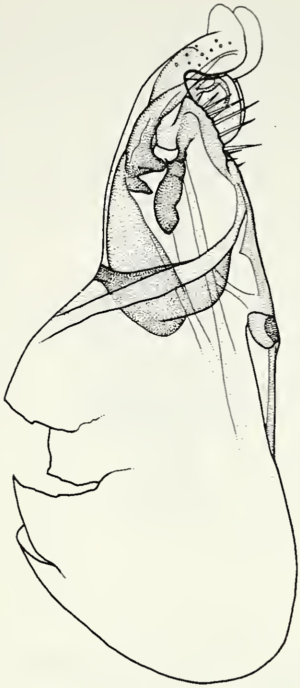

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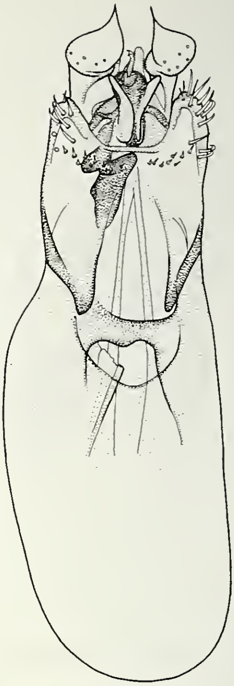

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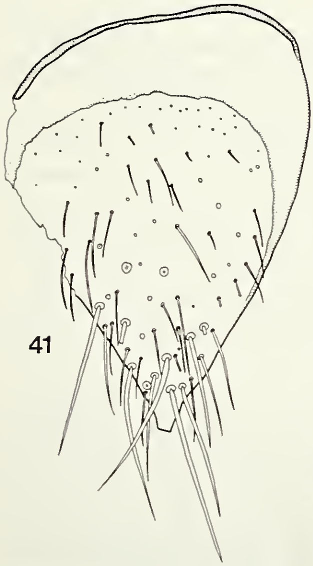

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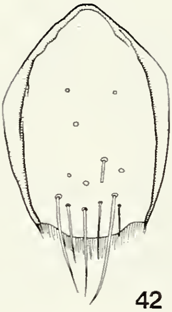

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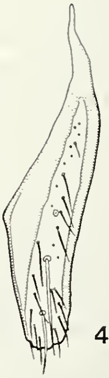

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Abb. 38–45
Scopaeus fageli: Aedoeagus von *S. kerdousensis* syn. n.: 38) dorsal, 39) lateral, 40) ventral. ♀-Paratypus: 41) laterales Tergalteil 9, 42) Tergit 10, 43) Valve, 44) Spermatheka, Seitenansicht, 45) Spermatheka, Aufsicht, Maßstabeinheit 0,1 mm.

Beine schlank, Schienen ohne Erweiterung, Vordertarsen beider Geschlechter etwas verbreitert.

MÄNNCHEN: Abdominalsternit 8 caudal mit breiter, dreieckiger, an der Spitze breit verrundeter Ausrandung.

Aedoeagus (Abb. 38–40): 0,48 mm, Laterallobi mit langen, kräftigen Borsten, die sich ventro-mediad fortsetzen. Apikallobi kurz, in Seitenansicht stark ventrad gerundet, ihre Enden apikad geknickt und in Dorsalansicht sehr spitz ausgezogen. Dorsallobus breit, abgestutzt und in zwei apikad orientierte Lappen ausgezogen, zwischen die ein langer, äußerst schlanker Dorn des Endophallus ragt. Ventralseite der Apikallobi mit zwei medianen, apikad divergierenden, ventrad stark vorgezogenen Lobi, die in Seitenansicht gut zu erkennen sind und den ventralen Winkel der Apikallobi ausfüllen.

WEIBCHEN: Terminalia spärlich beborstet. Dorsale Nebenspitze der lateralen Tergalteile 9 (Abb. 41) fehlend. Tergit 10 (Abb. 42) breit (Index 1,73), Valve (Abb. 43) schlank (Index 7,1) mit drei kräftigen Hauptborsten.

Spermatheka (Abb. 44, 45): 0,08 mm, mit sehr ungleich gestalteten Kapselgliedern. Das Glied, an dem der sklerotisierte Ductus inseriert, ist in Aufsicht beilförmig erweitert. In Seitenansicht ist das winklig abgesetzte Spitzenteil lang und gerade ausgezogen. Anderes Kapselglied nicht erweitert, in Seitenansicht lang hakenförmig gebogen.

VERBREITUNG: *Scopaeus fageli* ist bislang nur von den Typenfundorten in Algerien und Marokko bekannt.

VERWANDTSCHAFTSBEZIEHUNGEN: *Scopaeus fageli* ist mit keiner bekannten Art in Beziehung zu bringen; die Ausbildung des Aedoeagus ist gegenwärtig nicht homologisierbar.

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REVUE SUISSE DE ZOOLOGIE, 103 (2): 319-322; juin 1996

Microcharmus hauseri, nouvelle espèce de Scorpion de Madagascar (Scorpiones, Buthidae)

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Microcharmus hauseri, **new species of scorpion from Madagascar (Scorpiones, Buthidae).** - The study of some scorpions deposited in the collections of the Geneve Natural History Museum, conduct to the description of a new species of Buthidae scorpion belonging to the genus *Microcharmus*. The new species is the second known for this genus and both species are endemic to the island of Madagascar.

Key-words: Scorpion - Madagascar - New species.

INTRODUCTION

Au cours d'une étude récente sur la faune des Scorpions de l'île de Madagascar (LOURENÇO, 1995), j'ai pu découvrir et décrire trois genres nouveaux appartenant à la famille des Buthidae. Parmi ces trois genres, *Microcharmus* Lourenço, n'était connu jusqu'à présent qui par la seule espèce *Microcharmus cloudsleythompsoni* Lourenço. La description de la nouvelle espèce permet en outre de confirmer la validité des caractères génériques définissant le genre *Microcharmus*, lesquels peuvent être résumés ainsi:

"Scorpions de petite taille. Sternum sous-pentagonal. Peignes de petite taille avec un nombre de dents réduit (10 à 11); absence de fulcres. Trichobothriotaxie du type A-α, orthobothriotaxique".

Microcharmus hauseri n. sp. (Figs. 1 à 5)

Holotype: ♂, Madagascar (Prov. Antsiranana [anciennement Diego-Suarez], Sous-préf. Andoany [anciennement Hell-Ville]): Ile Nosy Be, réserve naturelle intégrale «Lokobe", forêt primaire près Ampasindava, sentier à partir de l'ancienne savonnerie, prélèvement de sol dans les angles formés par les contreforts d'un grand arbre en décomposition mais encore debout, 80 m; 30.XI.1989; leg. Bernd Hauser (extraction par appareil Berlese à Antananarivo) Mad-89/34.

Déposé au Muséum d'Histoire naturelle de Genève.

Manuscrit accepté le 25.08.1995.

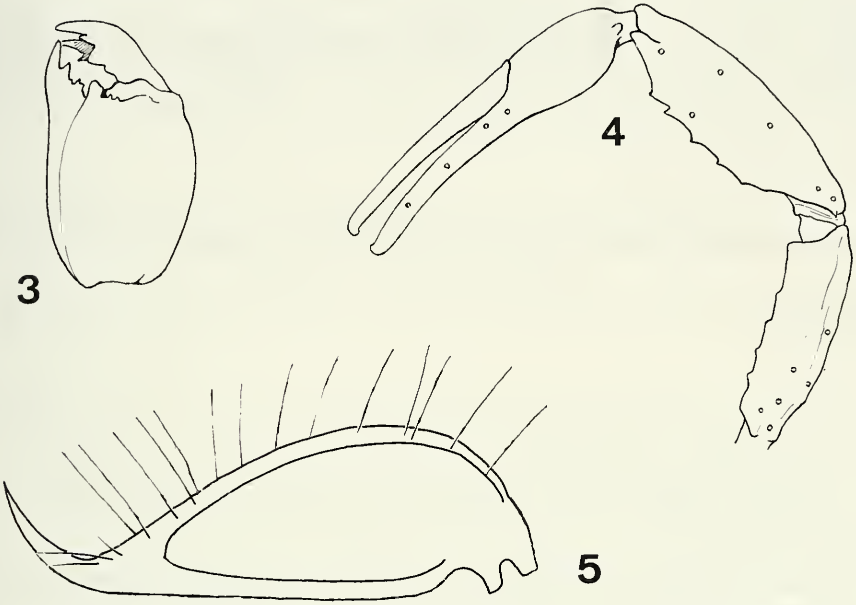
Figs 1-2

Holotype mâle, vues dorsale et ventrale.

Etymologie: Le nom spécifique est attribué en hommage au Dr. Bernd Hauser, responsable des collections d'Arthropodes au Musée de Genève.

Description. Coloration générale à fond jaunâtre, avec des très nombreuses taches brunâtres sur le corps, les pattes et les pédipalpes. Mains des pinces et telson jaunâtres sans taches. Chélicères très pigmentées. Sternum, hanches, processus maxillaires et sternites très tachetés; peignes et opercule-genital jaunâtre-pale.

Morphologie. Prosoma: plaque prosomienne avec le bord antérieur légèrement concave. Tubercule oculaire antérieur par rapport au centre de la plaque prosomienne; yeux médians séparés par moins de un diamètre oculaire. Trois paires d'yeux latéraux. Carènes du prosoma et du mesosoma moyennement marquées. Granulation de la plaque prosomienne et des tergites du mesosoma moyennement marquée. La région antérieure de la plaque prosomienne avec une granulation plus importante. Metasoma: carènes bien marquées sur les quatre premiers anneaux; les dorsales avec un petit granule distal spiniforme; les ventrales plus discrètement marquées. Vème anneau arrondi avec des carènes moins marquées que chez les autres quatre anneaux. Anneaux I et II avec 10 carènes; III et IV à 8 carènes; anneau V avec 5 carènes.



FIGS 3-5

M. hauseri, holotype mâle. 3. Chélicère, vue dorsale. 4. Pédipalpe, vue dorsale, avec la disposition des trichobothries. 5. Telson, avec soies caractéristiques.

Vésicule lisse très allongée avec des longues soies. Aiguillon court, dépourvu d'épine ventrale. Sternites à stigmates linéaires aplatis. Peignes petits avec un nombre de dents assez faible, 11-11, peu courant chez les Buthidae, mais caractéristique de diverses espèces de micro-Scorpions; absence de fulcres. Sternum sous-pentagonal, caractère retrouvé chez certains Buthidae tels les espèces des genres *Charmus* et *Microtityus*. Pédipalpes faiblement granulés avec des carènes moyennement marquées.Présence de granules spiniformes sur la face interne du tibia. Tranchant des doigts mobiles des mains des pédipalpes avec 7-7 séries de granulations légèrement obliques. Chélicères avec la dentition caractéristique des Buthidae; les deux dents basales sont néanmoins très petites, peu marquées et difficiles à distinguer (VACHON, 1963). Trichobothriotaxie du type A-α, orthobothriotaxique (Vachon, 1973, 1975). Eperon tibial présent. Pas de paratypes.

MENSURATIONS (en mm) DE L'EXEMPLAIRE DÉCRIT. Plaque prosomienne: longueur, 1,8, largeur, 1,0. Metasoma: anneau I longueur, 0,9, largeur, 1,0; anneau V longueur, 2,2, largeur, 0,9, hauteur, 0,9. Telson: largeur, 0,7, hauteur, 0,6. Pédipalpe: fémur longueur, 1,5; tibia longueur, 1,7; pince, 2,5; doigt mobile, longueur,1,7.

Microcharmus hauseri peut être facilement distinguée de *Microcharmus cloudsleythompsoni*, par la présence de nombreuse taches brunâtres sur le corps, pattes et pédipalpes, lesquelles sont absentes chez *M. cloudsleythompsoni*, espèce globalement jaunâtre, et aussi par la présence de très nombreuses soies sur la vésicule, caractère non observé chez *M. cloudsleythompsoni*.

REMERCIEMENTS

Je suis très reconnaissant aux Drs B. Hauser et V. Mahnert du Muséum d'Histoire naturelle de Genève de m'avoir facilité l'étude du matériel.

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REVUE SUISSE DE ZOOLOGIE, 103 (2): 323-338; juin 1996

New and little-known Oriental *Melittia* Hübner (Lepidoptera, Sesiidae), from the collection of Muséum d'histoire naturelle, Genève

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New and little-known Oriental *Melittia* Hübner (Lepidoptera, Sesiidae), from the collection of Muséum d'histoire naturelle, Genève. - A small collection of clearwing moth of the genus *Melittia* Hübner, 1819 from Vietnam and the Philippines, deposited in the Muséum d'histoire naturelle, Genève, Switzerland, is revised. Two new species, *M. romieuxi* sp. n. and *M. luzonica* sp. n., are described from Vietnam and the Philippines, respectively. *M. newara* Moore, 1879 and *M. eurytion* (Westwood, 1848) are recorded for Vietnam for the first time and the latter species for Palawan Id, Philippine Is. as well. A redescription of *M. gorochovi* Gorbunov, 1988 is presented. *Melittia eurytion* ab. *microfenestrata* Strand, [1916] is synonymised under *Melittia formosana* Matsumura, 1911.

Key-words: Sesiidae - *Melittia* - new species - taxonomy - Vietnam - the Philippines.

INTRODUCTION

The genus *Melittia* Hübner, [1819] is, perhaps, the largest genus of Sesiidae. It is distributed worldwide in tropical and subtropical areas and consists of more than a hundred presently known species. Unfortunately, most of them have been, in the past up to the beginning of this century, described from a single or a few specimens. Their original descriptions are very laconic. The descriptions contain, as a rule, only a few external characters. This considerably hampers the study of these beautiful clearwing moths. In addition, very important data about the types, type localities, etc., are

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scattered among numerous books and periodicals, which in many cases are rare and nearly unavailable. The majority of the species *Melittia* are highly beautiful, brightly coloured and superficially bumble-bee-like species. They are diurnal heliophile moths, but sometimes can be collected by the light trap. A number of everywhere known larvae of *Melittia* live inside the stalks of Cucurbitaceae, especially of the genus *Trichosanthes* (cucumber, pumpkin), and they may be easily reared.

Material was studied from Muséum d'histoire naturelle, Genève (MHNG). — The Natural History Museum, London, Great Britain (BMNH). — Museum für Naturkunde, Zentralinstitut der Humboldt-Universität zu Berlin, Germany (ZMHB). — collection O. Gorbunov, Moscow, Russia (CG).

The holotypes of new species described herein are deposited in MHNG, Switzerland.

Melittia gorochovi Gorbunov (Figs 1, 2, 9)

Melittia gorochovi Gorbunov, 1988: 195, figs 3–*1*, 4–*1*. Type locality: Vietnam, Shonla Prov., Shongma. Holotype male (CG).

= *Melittia indica* Butler, 1874 — Le Cerf, 1917: 182 (part.), Pl. 476, Fig. 3922 (misdetermination).

MATERIAL EXAMINED: 1 male (holotype), Vietnam, Shonla prov., Shongma vic., 3–10.V.1986, A.V. Gorokhov leg. (genital preparation No. G0064) (CG); 1 male, Vietnam, Sam Con à Vang Lom, 10.IV.1950, J. Romieux leg. (genital preparation No. GA-050) (MHNG).

REDESCRIPTION. Male (holotype) (Fig. 1). Alar expanse 29.5 mm; body length 15.5 mm; forewing 13.0; antenna 7.0 mm.

Head: antenna dorsally black with violet sheen, with a few snow-white scales dorso-internally and an elongate yellow spot dorso-externally at tip; ventrally light brown; frons grey-brown with purplish sheen, with a narrow pale yellow strip laterally; labial palpus basally pale yellow, apically black with a few yellow scales, second joint yellow with two, narrow, black stripes both ventro-internally and ventro-externally; vertex mixed with black and yellow scales; pericephalic hairs dorsally mixed with olive, black and a few white scales, laterally pale yellow to white.

Thorax: patagia dorsally mixed with yellow-olive, light brown and a few black scales; tegula, meso- and metathorax dark brown with violet sheen, with admixture of yellow-olive scales; thorax laterally mixed with grey-brown with violet sheen, pale yellow and yellow-olive scales.

Legs: fore coxa pale yellow with admixture of individual black scales basally; mid tibia internally black; externally at base and apically narrowly black; medially yellow ventrally and light brown-yellow with a small white spot dorsally; mid tarsus black with a small white spot both at base of first and second tarsomeres externally; hind tibia externally narrowly black at base; black with violet sheen, with a small white spot ventro-externally; dorso-externally light brown-yellow with a small snow-white spot medially and with a small yellow spot at base of apical spurs; dorsally yellow with a few light brown-orange scales at tip; spurs black; hind tarsus black with greenish sheen, with a small pale yellow spot medio-externally.

Abdomen: dorsally black with bluish sheen; tergites 1 and 2 densely covered with dirty olive-green scales; tergites 3–7 each with a narrow, olive-green, distal margin; ventrally entirely pale yellow; anal tuft small, black with a few yellow scales.

Forewing: basally densely covered with yellow-olive and light brownish scales; costal margin and veins within external transparent area black with violet sheen; Cu-stem, anal margin and discal spot black with violet sheen, with a few light brownish scales; apical area black with violet sheen, with a few snow-white scales with bluish hue; discal spot relatively broad with a long, narrow, cuneiform projection proximally; transparent areas well-developed; external transparent area relatively large, divided into 6 cells (cell between veins R4 and R5 minute), on level of vein M1 about 2.5 times as broad as discal spot and ca. 1.5 times as broad as apical area; cilia dark brown with bronze-violet sheen.

Hindwing: transparent; anal area black with violet sheen, densely covered with yellow-olive scales and hairs; veins, discal spot and outer margin black with violet sheen; discal spot extremely narrow and nearly undeveloped; outer margin *ca.* thrice narrower than cilia; cilia dark brown with bronze-violet sheen.

Male genitalia (genital preparation No. MHNG-2480, GA-050) (Fig. 9). Tegumen-uncus complex narrow; uncus bilobed distally with a small drop-shaped plate of strong pointed setae internally on each side; gnathos small, narrow, membranous with slight sclerotization basally (Fig. 9a); valva (Fig. 9b) elongate-oval; distal field of setae rather well separated from medial one; medial field narrow with short setae; pocket-shaped crista small; ventral lobe relatively broad and long, somewhat exceeding distal margin; saccus relatively broad, mace-shaped basally (Fig. 9c); aedeagus (Fig. 9d) narrow, broadened basally, about as long as valva; vesica with numerous minute cornuti.

Female. Unknown.

Variability. The second specimen of this species from Vietnam (Fig. 2) virtually has neither coloration nor size differences from the holotype, only the external transparent area of the left forewing divided into 5 cell, so a minute cell between veins R4–R5 is absent.

Diagnosis. M. gorochovi seems to be closest to *Melittia newara* Moore, 1879, but differs clearly from it by the shape of the external transparent area of the forewing (broader in *newara* (Fig. 3)), by the somewhat different coloration of the hind leg tuft, and by the shape of the male genitalia (gnathos somewhat less developed and sclerotized, pocket-shaped crista less developed and ventral lobe less broad, but slightly longer in *newara*). From *M. binghami* Niceville, 1900, *gorochovi* can be distinguished by the somewhat smaller size (alar expanse 35.0 mm in *binghami*), by the coloration of the hind leg tuft (more yellow in the species compared), and by the shape of the external transparent area of the forewing (broader and cell between veins R4–R5 larger in *binghami*). From *M. indica* Butler, 1874 and *M. siamica* Walker, [1865], *gorochovi* is clearly distinguishable by the shape of the external transparent area of the forewing (smaller, without hyaline cell between veins R4–R5 in these species compared) and by the brighter coloration of the hind leg tuft (with less yellow scales in *indica* and *siamica*).

Bionomics. The host plant unknown. Moths have been netted in April and May.

Habitat. Borders of tropical forest; river valleys; road sides.

Distribution. Hitherto known only from Vietnam and northeastern India (Sikkim).

Melittia newara Moore (Figs 3, 10)

Melittia newara Moore, 1879: 10. Type locality: "Darjiling" [= NE India, West Bengal, 'Darjeeling]. Holotype male (ZMHB).

MATERIAL EXAMINED: 1 male, Vietnam, Pahia, Col Bien, 16.IV.1950, J. Romieux leg. (genital preparation No. MHNG-2467, GA-052) (MHNG).

Remarks. This species will be revised by us (Gorbunov & Arita, 1995). The specimen from Vietnam (Fig. 3) slightly smaller than holotype from Darjeeling: alar expanse 32.0 mm; body length 15.8 mm; forewing 14.2 mm; antenna 7.0 mm. Also, this specimen has no small hyaline cell between veins Cu1 and Cu2, the external transparent area of the forewing of this specimen is divided into 6 cells, and the proximal projection of the discal spot of the forewing is somewhat shorter (see loc. cit., text figs 1–2). The male genitalia (Fig. 10) of this specimen has a somewhat narrower ventral lobe of the valva only. This is first record of the species for Vietnam.

Melittia romieuxi sp. n. (Figs 4, 11)

MATERIAL EXAMINED: 1 male (holotype), Vietnam, Pahia, 19.V.1950, J. Romieux leg. (genital preparation No. MHNG-2483, GA-053) (MHNG).

DESCRIPTION. Male (holotype) (Fig. 4). Alar expanse 29.0 mm; body length 13.8 mm; forewing 12.5 mm; antenna 6.7 mm.

Head: antenna dorsally black with violet sheen, ventrally light brown with a small yellow spot subapically; frons grey-brown with purplish sheen, with a narrow white stripe laterally; labial palpus white mixed with dark brown, with a narrow black stripe extro-ventrally on second joint; vertex grey-brown mixed with pale yellow; pericephalic hairs black dorsally and white laterally.

FIGS 1–8

Melittia spp. 1. *M. gorochovi* Gorbunov, 1988, holotype, male (CG). Alar expanse 29.5 mm. 2. *M. gorochovi* Gorbunov, 1988, male, Vietnam, Sam Con à Vang Lom, 10.IV.1950, J. Romieux leg. (genital preparation No. GA-050) (MHNG). Alar expanse: 30.0 mm. 3. *M. newara* Moore, 1879, male, Vietnam, Pahia, Col Bien, 16.IV.1950, J. Romieux leg. (genital preparation No. GA-052) (MHNG). Alar expanse: 32.0 mm. 4. *M. romieuxi* sp. n., holotype, male (MHNG). Alar expanse: 29.0 mm. 5. *M. nepcha* Moore, 1879, male, Vietnam, Shonla prov., Shongma, Ma River, 4–9.X.1987, N.L. Orlov leg. (CG). Alar expanse: 32.0 mm. 6. *M. luzonica* sp. n., holotype, male (MHNG). Alar expanse 28.0 mm. 7. *M. eurytion* (Westwood, 1848), male, Vietnam, Sam Con à Vang Lom, 10.IV.1950, J. Romieux leg. (MHNG). Alar expanse: 29.0 mm. 8. *M. eurytion* (Westwood, 1848), female, Philippines, Palawan, Puerto Princesa, oct. 1925 (MHNG). Alar expanse: 29.5 mm.

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Thorax: patagia brown with green-bronze sheen, with admixture of olive-green scales anteriorly and laterally; tegula, meso- and metathorax grey-brown with bronze-purple sheen, covered with olive-green scales; thorax laterally grey with purplish sheen, with a few white scales.

Legs: fore coxa black with bronzed sheen, with pale yellow to white stripe baso-internally; mid tibia externally black with green-violet sheen, with a small white with blue hue spot medially; internally grey with bronze-purple sheen, with a small pale yellow to white spot apically; spurs black; hind legs broken off.

Abdomen: dorsally green-brown; tergites 1 and 2 covered with thin olive-green scales; tergite 2 with a narrow, yellow to pale yellow, margin distally; distal margin of third tergite laterally with a few yellow scales; ventrally grey mixed with whitish scales; anal tuft small grey-brown with a few whitish scales.

Forewing: basally black with a few olive-green and grey scales; costal and anal margins, Cu-stem, discal spot, veins within external transparent area and apical area black with violet sheen; discal spot narrow with a small cuneiform broadening proximally; apical area very narrow, developed only at tip of wing; transparent areas well-developed; external transparent area extremely large, rounded apically, divided into 7 cells (cell between veins Cu1 and Cu2 narrow), about 7 times as broad as discal spot; cilia dark brown with bronze-violet sheen.

Hindwing: transparent; anal area dark brown to black with violet sheen, with a few pale yellow scales and yellow hairs; veins and outer margin black with violet sheen; discal spot extremely narrow; outer margin narrow, *ca.* twice as narrow as cilia; cilia dark brown with bronze-violet sheen.

Male genitalia (holotype, genital preparation No. MHNG-2483, GA-053) (Fig. 11). Tegumen-uncus complex narrow; uncus bilobed distally with a small drop-shaped plate of strong pointed setae internally on each side; gnathos small, narrow, membranous, nearly without sclerotization (Fig. 11a); valva (Fig. 11b) elongate-oval; distal field of setae rather well separated from medial one; medial field triangular, with short setae; pocket-shaped crista small; ventral lobe broad and short, not exceeding distal margin; saccus relatively broad, mace-shaped basally (Fig. 11c); aedeagus (Fig. 11d) narrow, broadened basally, somewhat longer than valva; vesica with a few minute cornuti.

Female. Unknown.

Variability. Unknown.

Diagnosis. Superficially, this new species appears closest to *M. newara* Moore, 1879, but can be separated from it by the coloration of the vertex (dark brown to black mixed with yellow in *newara*), abdomen dorsally (dark brown to black with purplish sheen; tergite 2 covered with thin olive-green scales basally; tergites 2 and 3 each with a narrow yellow margin distally in *newara*), and anal area of the hindwing (dark brown to black with a narrow yellow strip in the species compared), and by the form of the discal spot of the forewing (relatively narrow with a narrow and long projection proximally in *newara*). From other closely related species (*M. gorochovi* Gorbunov, 1988, *M. callosoma* Hampson, 1910, *M. indica* Butler, 1874, *M. kulluana*

Moore, 1888, and *M. proxima* Le Cerf, 1917), *romieuxi* sp. nov. is distinguishable by the larger external transparent area of the forewing (relatively narrow, divided into 5–6 cells in all these species compared (see Figs 1–2)) and by the shape of the discal spot of the forewing (with a relatively long, narrow, cuneiform projection proximally in the species compared). Besides that, *romieuxi* sp. nov. clearly differs from all these congeners by the structure of the male genitalia, especially the shape of the valva (compare with Figs 9–10).

Bionomics. The host plant unknown. Holotype specimen has been collected in May.

Habitat. Unknown.

Distribution. Known only from the type locality.

Etymology. We name this species after J. Romieux, who collected that species and many other Sesiidae in Vietnam which we have studied.

Melittia nepcha Moore (Fig. 5)

Melittia nepcha Moore, 1879: 10. Type locality: Darjiling [= northeastern India, West Bengal, Darjeeling]. Holotype male (ZMHB).

= *Melittia amboinensis vietnamica* Gorbunov

Melittia amboinensis vietnamica Gorbunov, 1988: 195, Figs. 2, 4–2. Type locality: North Vietnam, Shonla prov., Shongma. Holotype male (CG).

Gorbunov & Arita, 1995 (as a synonym of *M. nepcha* Moore, 1879).

Material examined: 1 male (holotype of *M. amboinensis vietnamica* Gorbunov, 1988), Vietnam, Shonla prov., Shongma, 3–10.V.1986, A.V. Gorokhov leg. (CG); 1 male, Vietnam, Shonla prov., Shongma, Ma River, 4–9.X.1987, N.L. Orlov leg. (CG).

Remarks. This species has been revised by the authors (Gorbunov & Arita, 1995). Specimens from Vietnam slightly vary in individual size: alar expanse 31.5–32.0 mm; body length 15.2–16.0 mm; forewing 13.5–14.0 mm; antenna 6.5–7.0 mm only and have not differences from the holotype in coloration.

Melittia luzonica sp. nov. (Figs 6, 12)

= *Melittia siamica* Walker, [1864] – Diakonoff, [1968]: 233, Figs 722–723 (misdetermination).

Material examined. 1 male (holotype), Philippines, Luzon Id., Binoessoc, (genital preparation No. MHNG-2482, GA-078) (MHNG).

Description. Male (holotype) (Fig. 6). Alar expanse 28.0 mm; body length 14.0 mm; forewing 11.6 mm; antenna 6.2 mm.

Head: antenna dorsally dark brown to black with purple-violet sheen, with individual snow-white scales at fore margin, ventrally yellow; frons grey-brown with a very narrow white stripe laterally; labial palpus dark brown to black with a few white scales ventrally; vertex dark brown mixed with black hair-like scales, with a narrow, V-shaped, white stripe between ocelli posteriorly; pericephalic hairs black dorsally and white laterally.

Thorax: patagia black with violet sheen, with a small pale yellow spot laterally; tegula and mesothorax dark brown with violet sheen; metathorax grey-brown with two tufts of hair-like scales dark grey mixed with dirty yellow; thorax laterally dark grey with violet sheen, with a few pale yellow scales anteriorly.

Legs: fore coxa dark brown with greenish sheen, with a few pale yellow scales basally; mid tibia externally dark brown to black with green-purple sheen, with admixture of individual rusty scales, with a small, diffuse, snow-white with blue hue spot at basal third, and with a small dirty yellow spot dorso-apically; mid tarsus yellow to pale yellow, externally four apical tarsomeres black with greenish sheen; hind tibia mixed with dirty yellow, light brown, dark brown and a few white scales, with a small snow-white with blue hue spot at base of mid spurs externally; spurs dark brown to black with violet sheen; hind tarsus black with green sheen, with a few white and dirty yellow scales basally and with a small snow-white spot medio-ventrally.

Abdomen: dorsally tergite 1 dark grey, remaining tergites black with violet sheen; tergites 2–4 and 6–7 each with a narrow, distinct, pale yellow stripe distally; ventrally dark brown with greenish sheen; sternite 3 with a sparse pale yellow to white stripe distally; sternites 4–6 each with a small pale yellow to white spot laterally on distal margin; anal tuft small, dark brown to black with greenish sheen, mixed with yellowish scales distally.

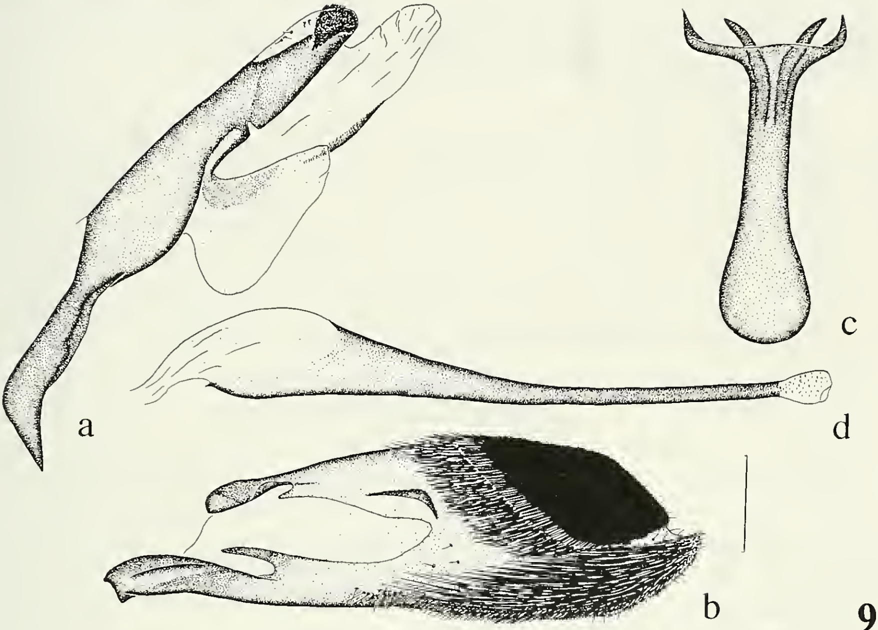
Forewing: costal margin, Cu-stem, discal spot, veins within external transparent area and apical area black with bronzed sheen; anal margin black with bronzed sheen, with admixture of individual olive-brown scales; discal spot narrow with a short pointed projection proximally; transparent areas well-developed; external transparent area rounded distally, divided into 6 cells (including minute cell between veins R4–R5), *ca.* 4.5 times broader than discal spot on level of vein M2; cilia dark grey with bronzed sheen.

Hindwing: transparent; anal area covered with dark brown and olive-brown scales; veins and outer margin narrowly black; discal spot undeveloped; outer margin about thrice narrower than cilia; cilia dark grey with bronzed sheen.

Male genitalia (holotype, preparation No. MHNG-2482, GA-078) (Fig. 12). Tegumen-uncus complex narrow; uncus bilobed distally with a small drop-shaped plate of strong pointed setae internally on each side; gnathos rather large, broad, membranous with well-sclerotized oval plate basally; pedunculus with a long seta (Fig. 12a); valva (Fig. 12b) trapeziform; distal field of setae nearly not separated from medial one; setae of medial field relatively short, slightly covering pocket-shaped crista; ventral lobe relatively narrow, barely exceeding distal margin; saccus (Fig. 12c) narrow, gradually broadened basally; aedeagus (Fig. 12d) narrow, somewhat shorter than valva; vesica with numerous minute cornuti.

FIGS 9–10

Male genitalia of *Melittia* spp. 9. *M. gorochovi* Gorbunov, 1988 (genital preparation No. GA-050). a. Tegumen-uncus complex. b. Valva. c. Saccus. d. Aedeagus. Scale bar: 0.5 mm. 10. *M. newara* Moore, 1879 (genital preparation No. GA-052). a. Tegumen-uncus complex. b. Valva. c. Saccus. d. Aedeagus. Scale bar: 0.5 mm.



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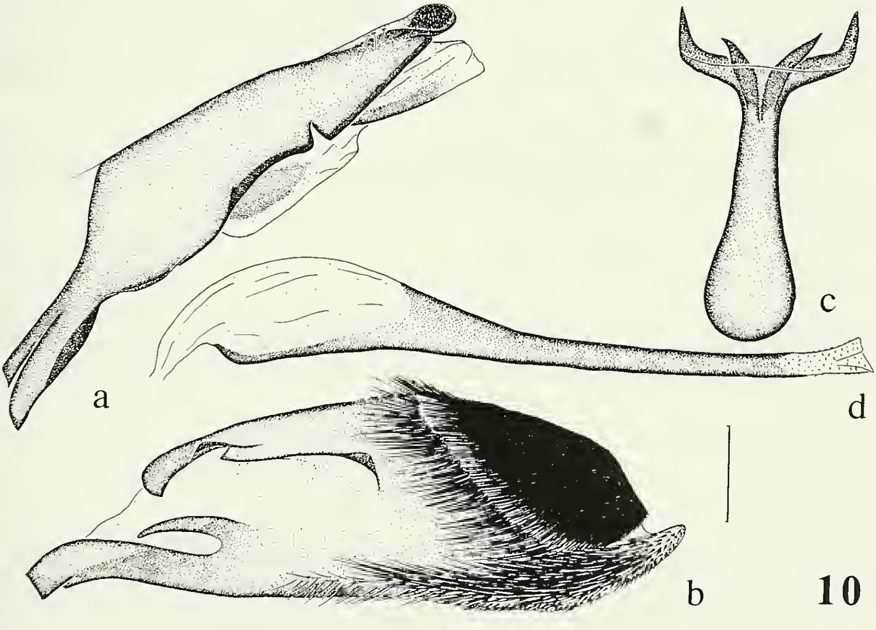

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Female. As far as we can tell from the figures published by DIAKONOFF (1968, Figs 722 and 723), the female of this new species has virtually no differences in coloration from male, but perhaps is more robust than male.

Variability. Unknown.

Diagnosis. This new species belongs to the *amboinensis* species-group. It seems to be the closest to *M. nepcha* Moore, 1879, but can be distinguished by the somewhat different coloration of the hind leg luft (dark brown both basally and apically, medially mixed with brown, light brown to yellow-brown and snow-white scales; extro-ventrally with three small white spots between bases of tibia and mid spurs, and somewhat distally both mid and apical spurs in *nepcha*) and, especially, by the coloration of the abdomen (dorsally dark brown to black mixed with olive-green scales on tergites 2, 3 and 5; all tergites with a narrow, olive-green, distal margin; ventrally entirely yellow to pale yellow in *nepcha*). However, these two species are easy separable by the male genitalia (setae of medial field of valva long, entirely covering pocket-shaped crista; saccus mace-shaped basally in *nepcha*). From *M. amboinensis* Felder, 1861, *luzonica* sp. nov. differs also by the coloration of the hind leg (with more rusty-brown scales dorsally in *amboinensis*) and abdomen (without a narrow, distinct, pale yellow stripe distally in *amboinensis*). From *M. batchiana* Le Cerf, 1917 this new species is clearly distinguishable by the more developed transparent areas of the forewing (external transparent area divided into 4 cells, on level of vein M2 about 1.6 times broader than apical area in *batchiana*). From other closely related species, such as *M. dorsatiformis* Hampson, 1891, *M. distincta* Le Cerf, 1916, *M. congruens* Swinhoe, 1890, and presently taxonomically unclear taxa described by F. Le Cerf (1916) (*meeki*, *celebica*, *javana*, *doddi*), *luzonica* sp. nov. clearly differs by the coloration of the abdomen (dorsally without a narrow, distinct, pale yellow, distal stripe; ventrally entirely pale yellow to yellow in all these taxa compared).

Bionomics and habitat. Unknown.

Etymology. This new species is named after the island Luzon, Philippine Is., where this species was collected.

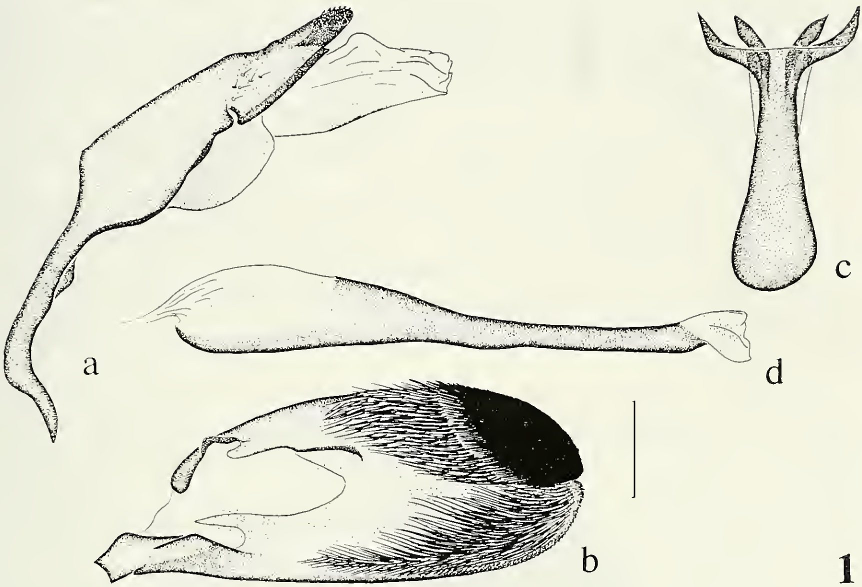
Melittia eurytion (Westwood, 1848) (Figs 7–8, 13–14)

Trochilium enrytion Westwood, 1848: 62, Pl. 30, Fig. 5. Type locality: "India Sylhet" [= NE Bangladesh, Sylhet]. Lectotype female (BMNH) (designated by Spatenka, 1992).

Melittia eurytion (Westwood, 1848) — Diakonoff, [1968]: 233, Figs 726–727.

FIGS. 11–12

Male genitalia of *Melittia* spp. 11. *M. romieuxi* sp. nov., holotype (genital preparation No. GA-053). a. Tegumen-uncus complex. b. Valva. c. Saccus. d. Aedeagus. Scale bar: 0.5 mm. 12. *M. luzonica* sp. nov., holotype (genital preparation No. GA-078). a. Tegumen-uncus complex. b. Valva. c. Saccus. d. Aedeagus. Scale bar: 0.5 mm.



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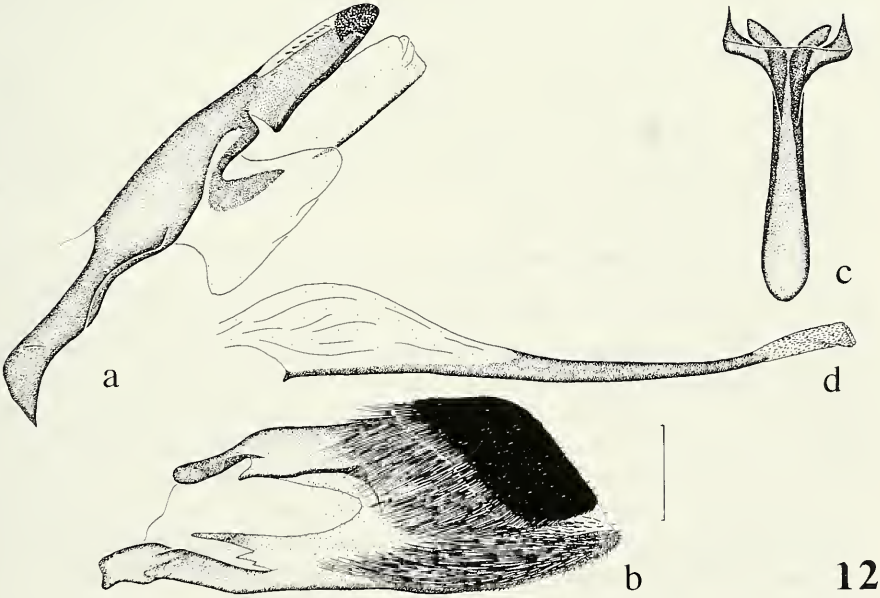

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MATERIAL EXAMINED. 1 male, Vietnam, Sam Con à Vang Lom, 10.IV.1950, J. Romieux leg. (MHNG); 1 male, Vietnam, Col Noé, Lao Sang, 19.V.1950, J. Romieux leg. (genital preparation No. GA-056) (MHNG); 1 female, Philippines, Manila, Palanoz, Apr. 28 (genital preparation No. GA-084) (MHNG); 1 female, Philippines, Palawan, Puerto Princesa, oct. 1925 (MHNG).

DESCRIPTION. Male (Fig. 7). Alar expanse 29.0 mm; body length 14.5 mm; forewing 12.5 mm; antennae broken off.

Head: antenna broken off; frons grey-brown with purple sheen, with a narrow white stripe laterally; vertex grey-brown with purple sheen mixed with black, white and yellow hair-like scales; labial palpus white basally; mid joint white with two black longitudinal stripes ventrally at margins, apical joint black with a few pale yellow scales; pericephalic hairs dorsally black mixed with yellow, laterally pale yellow to white.

Thorax: patagia dorsally dark brown with green-purple sheen, anteriorly covered with more thin olive-green scales, laterally pale yellow to white; tegula and mesothorax dark brown to black with purple-gold sheen, covered with a few olive-green scales anteriorly; metathorax somewhat paler with two tufts of white hair-like scales laterally and a few white with blue hue scales medially; thorax laterally mixed with grey and white scales.

Legs: fore coxa white to pale yellow with admixture of a few dark brown scales; mid tibia dark brown with gold sheen, with a small white with blue hue spot both medio-externally and ventrally; hind tibial tuft black with greenish sheen, mixed with white dorsally and externally, with two large white with blue hue spots both somewhat basally of mid spurs and between base of both pairs of spurs ventrally; spurs black, external spurs of both pairs with white inside; hind tarsal tuft black with greenish sheen, with a small white spot medio-externally.

Abdomen: dorsally black with green-violet sheen, with admixture of individual, narrow, white scales; scales of distal margin of each tergite with bronzed sheen; additionally, tergites 2, 4, 6 and 7 each with a few white with blue hue scales distally; ventrally sternite 1+2 black with a few white scales, other sternites entirely white; anal tuft small, black, tipped white.

Forewing: costal and anal margins, Cu-stem, discal spot, apical area and veins within external transparent area dark brown to black with bronze-purple sheen; basally at anal margin with admixture of individual olive-green and white with blue hue scales; Cu-stem basally shortly and narrowly bordered with white scales; apical area with individual snow white with blue hue scales; discal spot broad with a long cuneiform projection proximally; transparent areas well-developed; external transparent area divided into 5 cells, narrowed costally, about as broad as apical area and discal spot on level of vein M2; cilia dark brown with bronzed sheen.

Hindwing: transparent; anal area black, but densely covered with light bluish scales; veins, discal spot and outer margin narrowly black with bronze-purple sheen; cilia dark brown with bronzed sheen.

Male genitalia (genital preparation No. MHNG-2468, GA-056) (Fig. 13). Tegumen-uncus complex narrow; uncus bilobed distally with a small oval plate of

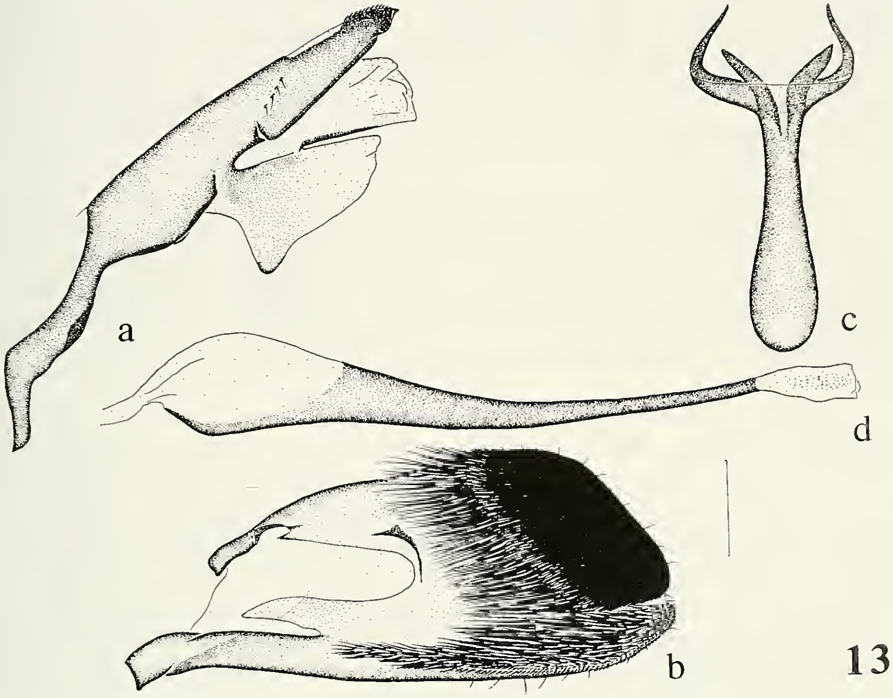


FIG.13

Male genitalia of *Melittia eurytion* (Westwood, 1848) (genital preparation No. GA-056). a. Tegumen-uncus complex. b. Valva. c. Saccus. d. Aedeagus. Scale bar: 0.5 mm.

strong pointed setae internally on each side; gnathos rather large, broad, membranous with broad but slightly sclerotized plate medially (Fig. 13a); valva (Fig. 13b) trapeziform; distal field of setae rather well separated from medial one; setae of medial field relatively long, not reaching pocket-shaped crista; ventral lobe relatively narrow, barely exceeding distal margin; saccus (Fig. 13c) narrow, mace-shaped basally; aedeagus (Fig. 13d) narrow, broadened basally, somewhat longer than valva; vesica with numerous minute cornuti.

Female (Fig. 8). Differs little from the male as to coloration and size, though slightly more robust.

Female genitalia (genital preparation No. MHNG-2481, GA-084) (Fig. 14). Papilla anales slightly sclerotized, covered with short setae; 8th tergite relatively broad with relatively short setae at distal margin and with two long setae at inner margin ventrally; both apophyses nearly equal in length; apophyses anterior with a long, narrow appendix baso-ventrally; ostium bursae opening near posterior margin of 7th sternite, slightly funnel-shaped, narrow, ring-shaped well-sclerotized; antrum narrow, membranous; ductus bursae narrow, relatively long, membranous; corpus bursae nearly pear-shaped, membranous with numerous wrinkles, with signum relatively large, narrowly pear-shaped, with numerous small, well-sclerotized thorns, with ca. 10 transverse, rather well-sclerotized, dentate stripes anteriorly, shortly bifurcate posteriorly (Fig. 14b).

Variability. This wide-spread species of the Oriental Region is extremely variable in individual size (alar expanse 26.0–33.0 mm), coloration of the labial palpus and legs (more or less white or pale yellow scales) and, especially, in the size of the external transparent area of the forewing (divided into 4–5 cells and narrower than apical area and discal spot on level of vein M2 about 1.1–2.0 times). Also, it slightly varies in the male (shape of gnathos and valva) and female (signum of corpus bursae) genitalia.

Diagnosis. It seems to be the closest to *M. formosana* Matsumura, 1911, *M. chalybescens* Miskin, 1892, *M. flaviventris* Hampson, 1919, and *M. volatilis* Swinhoe, 1890. Superficially, from *formosana*, *eurytion* can be distinguished by the relatively narrower discal spot of the forewing, but they rather clearly differ by the male genitalia (valva shortly oval; distal and medial fields of setae nearly not separated; saccus narrower in the species compared). From *chalybescens*, *eurytion* is distinguishable by the coloration of the anal area of the both wings (bright blue-green in *chalybescens*) and by the male genitalia (valva broadly oval; saccus bilobed basally in *chalybescens*). From *flaviventris*, this species can be easily separated by the shape of the anterior and external transparent areas of the forewing (anterior transparent area not divided into two longitudinal stripes by proximal projection of discal spot; external transparent area divided into 5–6 cells, about 1.8 times as broad as apical area on level of vein M2 in *flaviventris*). From *volatilis*, *eurytion* clearly differs by the more well-developed transparent areas of the forewing (anterior transparent area very short and narrow; external transparent area divided only into one small cell between veins M3–Cu1 in *volatilis*).

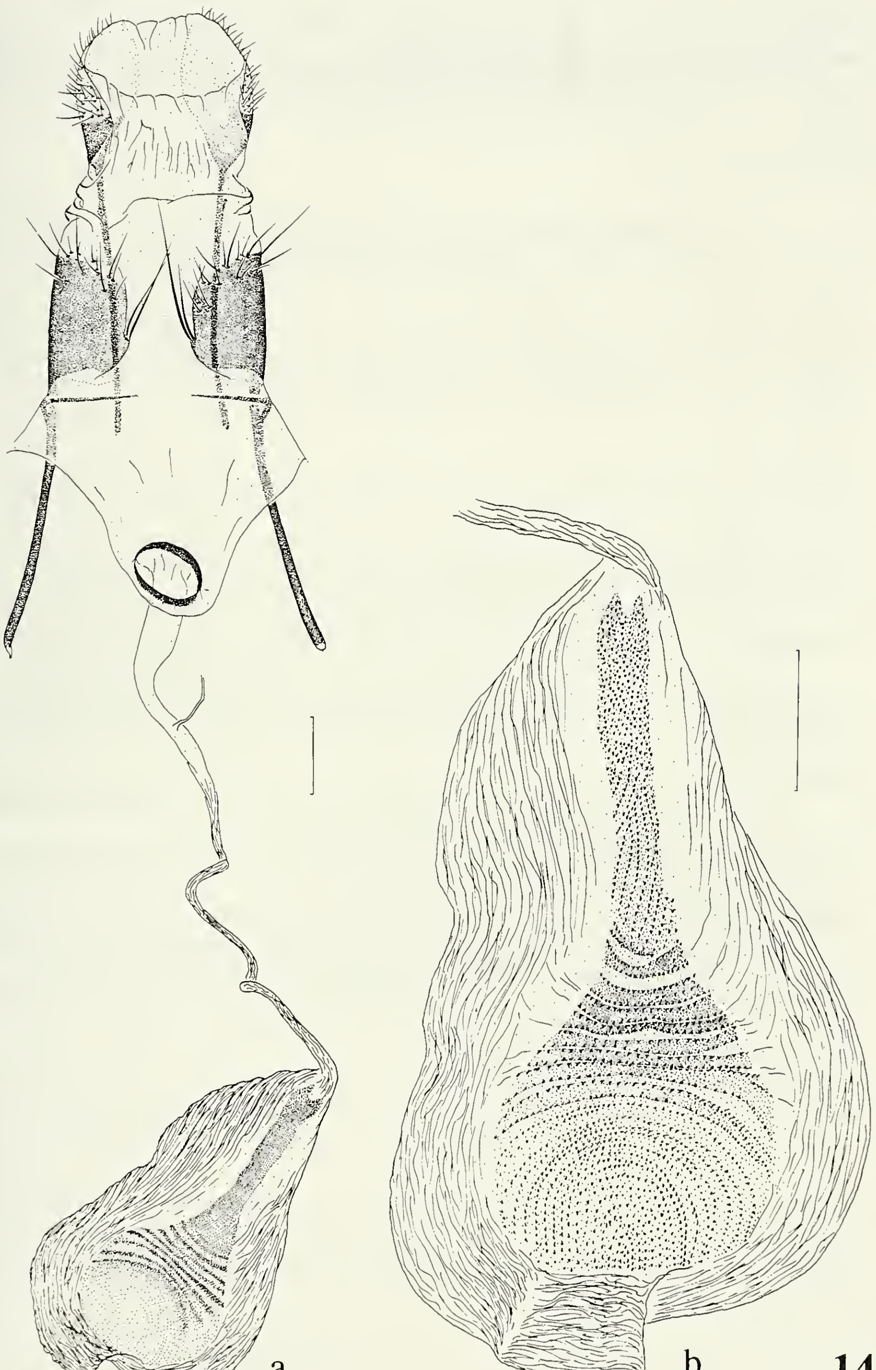
Bionomics. Specific host plant unknown, but most likely a species of the family Cucurbitaceae. Imagos collected in April-May.

Habitat. Unknown.

Distribution. This species has been reported from West China, Nepal, West (Bombey), Northeast (Sikkim) and East India (Assam), Sri Lanka, Myanmar, Philippines (Luzon, Mindanao). We record it for Vietnam and Palawan Id. (Philippines) for the first time. Additionally, E. STRAND [1916] described an aberration of *M.*

FIG. 14

Female genitalia of *Melittia eurytion* (Westwood, 1848) (genital preparation No. GA-084). a. General view. b. Corpus bursae. Scale bar: 0.5 mm.



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eurytion, *microfenestrata* Strand [1916] from Taiwan [Formosa]. At present we believe that all citations of *eurytion* for Taiwan should be regarded to *M. formosana* Matsumura, 1911 and indicate *Melittia eurytion* ab. *microfenestrata* Strand, [1916] (comb. nov. et syn. nov.) as a new synonym of *M. formosana* Matsumura, 1911 herein.

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We would like to express our cordial thanks to Dr D.B. Burckhardt, Muséum d'histoire naturelle, Genève, Switzerland, and Dr S.I. Golovatch, Institute for the Problems of Ecology and Evolution, Russian Academy of Sciences, Moscow, Russia for the opportunity to study this highly interesting collection. We also thank Dr T.D. Eichlin, California Department of Food and Agriculture, Plant Pest Diagnostics Branch, Sacramento, California, USA for linguistic help.

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Haliotids in the Red Sea, with neotype designation for *Haliotis unilateralis* Lamarck, 1822 (Gastropoda: Prosobranchia)

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Haliotids in the Red Sea, with neotype designation for *Haliotis unilateralis* **Lamarck, 1822 (Gastropoda: Prosobranchia).** – Two species of *Haliotis* are known from the Red Sea: *H. pustulata cruenta* Reeve, 1846 and *H. unilateralis* Lamarck, 1822. A neotype is here designated for *Haliotis unilateralis* because the specimen in the Lamarck collection of the Muséum d'Histoire Naturelle de Genève (MHNG) is clearly not the original specimen described by Lamarck, which is not traceable in the MHNG collections. The neotype, a complete specimen, is deposited in the MHNG. The designated type locality is Gulf of Aqaba: Sinai: Elat. The shell is redescribed and radular and epipodial characters are compared to those of similar species.

Key-words: Gastropoda - Prosobranchia - *Haliotis unilateralis* - neotype - Red Sea

INTRODUCTION

Members of the family Haliotidae occur in all tropical and temperate oceans (*e.g.* COX 1962; LINDBERG 1992), mostly in the shallow subtidal. Approximately 200 species level taxa have been described, 55 of which are considered valid species (Geiger, in prep.). Although seven taxa have been mentioned from the Red Sea, most authors record one or two species, usually identified as *H. pustulata cruenta* Reeve, 1846 and *H. unilateralis* Lamarck, 1822 (TALMADGE 1971; YARON 1983).

Comparison of animal characters as well as those of the shell has resulted in a new assessment of the Red Sea species. The specimen of *H. unilateralis* held in the Lamarck collection of the Muséum d'Histoire Naturelle de Genève proved not to be the specimen described by Lamarck, and this led me to designate a neotype for *H. unilateralis*.

Although I will use only the single genus *Haliotis*, the taxa used by other authors are often mentioned. Some authors use several genera in the family Haliotidae. I consider the use of these genera as unjustified for the following reasons.

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1) In the descriptions of the 17 supraspecific taxa (ranked either as subgenera or genera; see Pickery 1991 for list and references) only the type species had been assigned, occasionally with selected species. Of the 200 species level taxa only approximately 65 have ever been assigned to any supraspecific taxon, and 16 of those to more than one group (Geiger, unpublished) demonstrating the problematic supraspecific taxonomy of this group. The descriptions of these genus-group taxa are entirely typological and differential diagnoses between them do not exist. 2) Only a few studies have been using modern systematic methods to determine the relationship between 17 (enzyme electrophoresis) and 22 (cDNA sequencing) abalone species (Brown 1993; Lee & Vacquier, 1995). The results show that the supraspecific taxa and the limited number of associated species are not in accordance with the groups shown in the more modern approaches. However, the type species of *Haliotis sensu stricto*, *H. asinina* Linné, 1758 (by designation: Montfort 1810), had not been included in either study, making any sound taxonomic decisions impossible. 3) The only inferable consensus in the literature as well as in the abalone community (Workshop "Evolutionary Biology and Genetics of Abalone" during the Second International Symposium on Abalone Biology, Fisheries & Culture, February 1994, Hobart, Tasmania) is not to use any supraspecific taxa until these groupings are based on data.

ABBREVIATIONS

HUJ	Hebrew University Jerusalem
KBIN	Royal Belgian Institute for Natural Sciences (Brussel)
LACM	Los Angeles County Museum of Natural History
MHNG	Muséum d'Histoire Naturelle de Genève
MNHA	Museum of Natural History Amsterdam
MNHL	Museum of Natural History Leiden
NMC	Nature Museum Coburg
NHML	Natural History Museum London (formerly British Museum, Natural History)
NMW	National Museum of Wales, Cardiff
TAU	Tel Aviv University
USNM	United States National Museum of Natural History

SUPPOSED TYPE SPECIMEN

The text of the original description of Lamarck (1822) is given here:

11. Haliotide unilatérale. *Haliotis unilateralis.*
H. testâ ovali, convexo-depressâ, rudi, subverrocosâ, albido-flavescente, maculis fuscis pictâ; labio elevato, anteriùs latere producto; spirá prominulâ, obtusâ.
An Rumph. Mus. t.40. fig. G? H?

Habite les mers de Timor et de la Nouvelle-Hollande. Mon cabinet. Bord droit fort court; nacre peu brillante, Diam. longit., 16 lignes; transv., 11 et demie.

The supposed type specimen has been dealt with by MERMOD & BINDER (1963) who previously had cast doubts about its authenticity. I strongly support their suspicion, as it is clear from the description that LAMARCK (1822) described a shell with different characteristics. The specimen is olive green and white in colour whereas Lamarck described it as white-yellow. It has a rather thick shell for the genus (Figure 1), but Lamarck indicated it as being thin. The only quantitative indication in Lamarck's description is the length and width that he assigned to the shell (36 x 26 mm), which does not correspond exactly to its dimensions (35.5 x 24 mm) (see also MERMOD & BINDER 1963), but the discrepancy may also be due to the inaccurate conversion from lines to millimeters. The MHNG has the copy of Lamarck's "Histoire des animaux sans vertèbres", which had been annotated by Lamarck's daughter. The annotations consist of handwritten indications of number of specimens in Lamarck's collection. For *H. unilateralis* two specimens are noted, indicating that some changes occurred during the history of the collection. I identify the supposed type specimen as *H. varia* Linné, 1758 and it matches the potential syntypes of H. varia held in the Linnean Society in London (GEIGER, in prep.). It is now evident that the original type specimen of *H. unilateralis* has been replaced by another specimen, and as no other specimen has been traced in Lamarck's collection (MERMOD & BINDER 1963), the original type specimen is assumed to have been lost.

THE IDENTITY of *H. unilateralis*

SYNONYMS / MISIDENTIFICATIONS:

H. unilateralis Lamarck, 1822: Vol. 6, part. 2, p. 217, no 11.— YARON 1983: 489-491.

"*Sanhaliotis* cf. *pustulata* (Reeve, 1846)".— SHARABATI 1984: Pl. 2, figs. 1, 1a, 1b.

H. varia Linné, 1758. *sensu* DRIVAS & JAY 1988: 32, fig. 17, not LINNÉ, 1758.

"*H.* cf. *ovina* Gmelin, 1791".— GEIGER 1991: 95-103, figs. 1a-d, 2a-d, 3a-d, 4a-d, x (lower specimen).

"*H.* sp.".— SINGER 1993: 15.

Non H. unilateralis of KAICHER 1981 [*H. varia* Linné, 1758].

AUTHORS UNCERTAIN AS TO THE IDENTITY OF *H. unilateralis*:

WEINKAUFF (1883: 55).— SOWERBY (1887: 37).— PILSBRY (1890: 97). — MERMOD & BINDER (1963: 148-149).

CHRONOLOGICAL TREATMENT:

REEVE (1846), in his extensive monograph of the genus, did not mention *H. unilateralis*, although he discussed other Lamarckian species.

WEINKAUFF (1883) called *H. unilateralis* a missing species ("verschollene Art"). His wording subtly alludes to the possible loss of the type specimen. His

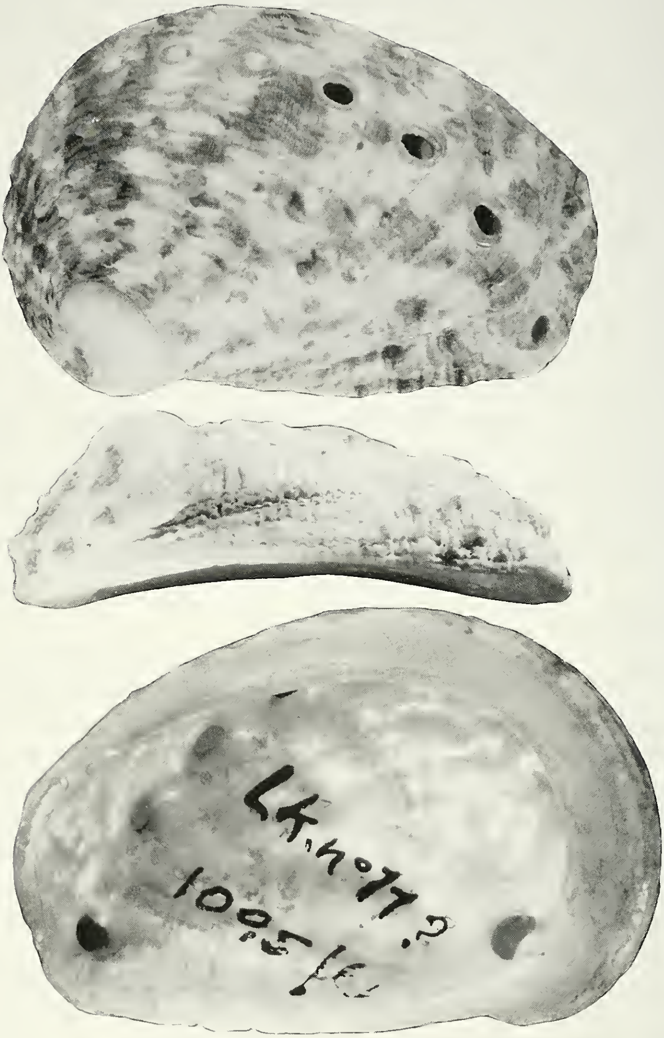

FIG. 1

Supposed type specimen of *H. unilateralis* held in the MHNG. 35.5 x 24 mm. The specimen is identified as *H. varia*. Photographs by C. Ratton, MHNG.

illustration (pl. 6: 4, 5) cannot be identified with certainty, but is closer to *H. pustulata cruenta* than *H. unilateralis* as defined here. He (p. 55-56, 66) synonymised *H. pustulata* and *H. cruenta* with *H. unilateralis*, and identified *H. concinna* as a juvenile *H. unilateralis* (p. 55, 75). WEINKAUFF (1883: 2) used informal groupings termed

"Formenkreis" or form groups, because he did not want to use the then described genera. He assigned *H. unilateralis* to the "Formenkreis" of *H. varia*, but did not synonymise *H. varia* with *H. unilateralis*. However, he mentioned that *H. varia* occurs in the Red Sea.

SOWERBY (1887: 37) called *H. unilateralis* "not identified", i.e. gave it the status of a *nomen dubium*. He compared *H. varia* with *H. concinna*, and called the differences between *H. pustulata* and *H. varia* "of questionable specific value" (p. 28).

PILSBRY (1890) corroborated the similarity between *H. concinna* and *H. varia*. He also cited Weinkauff (1883) on the synonymy between *H. concinna* and *H. unilateralis* although he had not seen any specimens of the latter. PILSBRY (1890: pl. 17: 97, 98) had based his somewhat cruder drawing on Weinkauff's figure. He also indicated *H. varia* from the Red Sea.

TALMADGE (1971) first noted the confusion regarding the identity of *H. unilateralis* that culminated in PILSBRY (1890), but did not realize that WEINKAUFF (1883) as well as SOWERBY (1887) gave *H. unilateralis* the status of a *nomen dubium*. He assigned the mistake to Weinkauff " ... who evidently failed to check on the type specimens ..."(p. 83). As an alternative the type specimens might have already been lost at this time, although only subtle supporting evidence can be found in the wording of Weinkauff (see above). TALMADGE (1971) recognized *H. unilateralis* according to the supposed type specimen in the MHNG, figured in MERMOD & BINDER (1963).

KAICHER (1981) gave the only modern illustration under the name of *H. unilateralis*, which clearly shows a specimen of *H. varia*.

Apparently only YARON (1983) has used *H. unilateralis* as defined here (see below: studied specimens), but he did not illustrate his work.

GEIGER (1991) mentioned a further species of abalone in the Red Sea, which was found, from the inspection of type material, neither to be *H. unilateralis* nor *H. pustulata cruenta*, and finally was identified as *H.* cf. *ovina* Gmelin, 1791. At that time the status of the supposed type specimen of *H. unilateralis* in the MHNG had not been clarified.

In summary, *H. unilateralis* was called a *nomen dubium* early on, was compared to *H. concinna*, which is a synonym of *H. varia*, and as the latter name was better known to the scientific community, *H. unilateralis* was taken as a synonym of *H. varia*. This error was compounded by erroneous citations of locations for *H. varia* including the Red Sea. In a further complication the supposed type specimen is a specimen of *H. varia*.

In modern collections specimens of *H. unilateralis* as defined here are very uncommon (TALMADGE 1971; this study). Equally, no old specimens of this species could be found in the European collections consulted: HUJ, KBIN, MHNG, MNHA and MNHL (R. PICKERY, pers. comm.), NHML, NMC (W. KORN, pers. comm.) and NMW, supporting the possibility that the original type specimen had been lost not long after Lamarck described the taxon. Hence, the biological species may have become unknown to the scientific community again resulting in confusion about the identity of Lamarck's taxon.

Is it possible to positively identify the species from LAMARCK'S (1822) description? First, the origin of Lamarck's material has to be discussed. Lamarck indicated Timor and Australia (his Nouvelle-Hollande) for the origin of his material. As he did not collect the specimens himself, an error in these localities might have been easily, but inadvertently, committed. In a similar case, GRAY (1826) described *H. squamosa* from Australia; only recently that species has been relocated in a restricted area of southern Madagascar (STEWART 1984; pers. comm.; D. PISOR, pers. comm.). Therefore, an error concerning the geographical provenance of the original specimens of *H. unilateralis* should not present an *a priori* hindrance to the identification of the species, and biological species from outside the Australian region should not be excluded from possibly being Lamarck's *H. unilateralis*. The taxon has primarily been reported from the Red Sea (WEINKAUFF 1883; SOWERBY 1887; PILSBRY 1890; HALL & STANDEN 1907; TALMADGE 1971; MERGER & SCHUHMACHER 1974; YARON 1983: including three additional references; SINGER 1993), but at least some of these indications may not refer to *H. unilateralis* as defined here.

LAMARCK (1822) made reference to two figures of RUMPHIUS (1766), but as he marked them with question marks, these two illustrations are of no use for the correct identification of *H. unilateralis*. Unfortunately, Lamarck did not illustrate his work, and we are left with a short description. However, he mentioned that the form of species no 12 (*H. rugosa*) is somewhat similar to the preceding one, i.e. *H. unilateralis* ("Forme un peu rapprochée de celle de la précédente": p. 217). The type material of *H. rugosa* contains two separate species (three specimens). HERBERT (1990) designated a lectotype, and identified the other specimens as *H. pustulata*. These three specimens are highly similar in the outline of the shell; therefore, the fact that Lamarck mixed two species under one name does not impose any problem in respect of the indicated similarity of form between *H. rugosa* and *H. unilateralis*.

The description of *H. unilateralis* is fairly general, potentially fitting several species. However, a set of three characters - thin, warty, white yellow - is found in only two species: the little known *H. barbouri* Foster, 1946 from Brazil, and the species known from the Red Sea area as *H. unilateralis* (YARON 1983; SINGER 1993). Of the latter, the shape of a typical shell is very similar to that of the type specimens of *H. rugosa* in the sense of Lamarck (see above for discussion of this taxon), for which Lamarck indicated to have a similar shape of the shell to *H. unilateralis*. The shell is very thin for the genus, mostly as thin as or even thinner than *H. brazieri* Angas, 1869. The shell most often is found in red and orange tones with some markings in a darker colour: brown and green. The indication of colour is slightly in contrast with "white and yellow" and "dark spots" by Lamarck. He also describes the shell as "dull" and having "little shiny nacre", and, therefore, I agree with WEINKAUFF (1883), that he described the species from a beach or slightly worn shell. It is well established that such shells lose the bright colouration and tend to fade to a certain extent, i.e. a fading from orange to yellow is easily conceivable. One of the most prominent features of the shell is the elevation and folding near the columella, a feature not clearly addressed by Lamarck.

In a statistical analysis, the length and width of the shell indicated in LAMARCK (1822) lie near the regression line of the same data for all the available specimens from the Red Sea species, which supports its identification as *H. unilateralis* (graph not shown).

I have shown above that the species from the Red Sea is quite likely the same species on which LAMARCK (1822) had based his description of *H. unilateralis*. For the sake of stability of nomenclature (ICZN Article 75(b)) I shall maintain the rather well established name. However such a decision necessitates the designation of a neotype, as the original type must be assumed to be lost and the identity of the species is highly controversial (ICZN Article 75(b)(ii)). The alternative is to designate *H. unilateralis* a *nomen dubium* and to describe the species from the Red Sea as a new species. However, for the following reasons the designation of a neotype is preferred: No new taxon is introduced; the already used association of the taxon with a biological species is retained; and, in contrast to the designation of a neotype, the declaration of *H. unilateralis* as a *nomen dubium* could eventually be overturned, causing further disruption of taxonomic stability.

The complete specimen designated here as the neotype represents the specimen that best fits the description of Lamarck, although it is not a perfect match (cf. ICZN Article 75(d)(4); MAYR & ASHLOCK 1991).

DESIGNATION OF NEOTYPE of *H. unilateralis* Lamarck, 1822

NEOTYPE: *Haliotis unilateralis* Lamarck, 1822. MHNG no. 18020. The complete specimen is stored together with Lamarck's collection. It comprises the dry shell, the animal in alcohol, and the mounted radula.

TYPE LOCALITY: Red Sea: Gulf of Aqaba: Sinai: Elat. 40 m depth, under backward slope of reef. Collected by M. Fainzilber, D. Korkos and B. Singer.

DESCRIPTION: Shell of neotype 33.8 mm long and 23.15 mm broad (Figure 2). Dorsal side bears three spiral rows of bumps, corresponding to depressions in the nacre. Tremata raised considerably. Last four tremata fully open, fifth partially closed. Dorsal surface only slightly convex and forms an angle of approximately 70° with lateral margin of shell. Most distinct character is the plicate margin which itself bears blunt lamellae. Between fold and columella three spiral ridges. Suture pronounced and spire distinctly elevated. No scar of hypertrophied adductor muscle.

Colour (based on wet shell; in dry condition colour dulled by periostracum): Overall bright reddish orange with some light green spots on dorsal side in posterior part, and at very margin (aperture) near last respiratory hole formed. Several fine, lighter spiral lines. Red margin intersected from columella up to fold by pairs of vertical, white bands. Length of intersection between pair of bands 1-2 times as wide as pair of bands themselves. Nacre uniform and shiny.

Radula: see figure 3 for terminology used. On rachidian tooth, basally, posterior end of basis bears vertical groove and not horizontal one. On lateral tooth 1, cutting edge has distinct ridge, bent to the posterior. Primary ridge forms an angle of

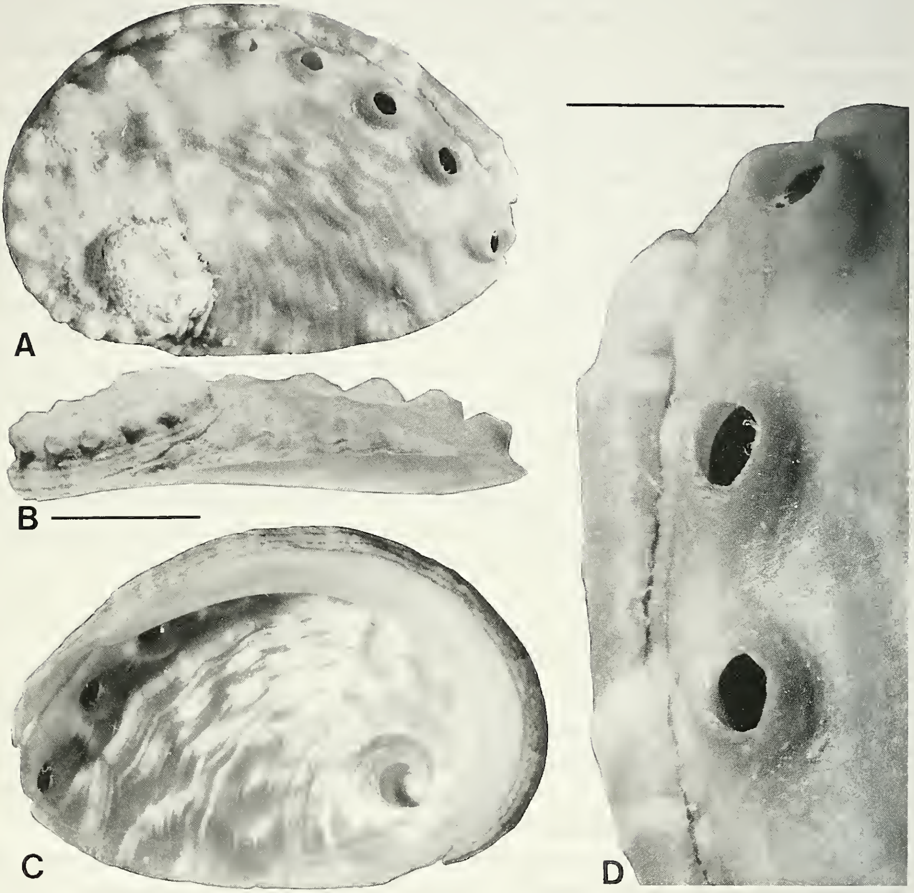

FIG. 2

Neotype of *Haliotis unilateralis*. A) Dorsal. B) Apertural. C) Ventral. D) Anterior part of row of tremata with folded margin on the left side. A-C: Bar = 10 mm, D: Bar = 5 mm.

approximately 45° to cutting edge. Primary ridge approximately as long as cutting edge. Secondary ridge separates from main part of tooth in its top third, only slightly shorter than primary ridge, and very pointed. Cusps of lateral teeth 3-5 have no denticles. Cusps of inner and middle marginal teeth slightly asymmetrically denticulated, with denticles on inner margin closer to tip than those of outer margin. Outermost marginal teeth with far less denticles on outer margin and close to tip (Figure 4).

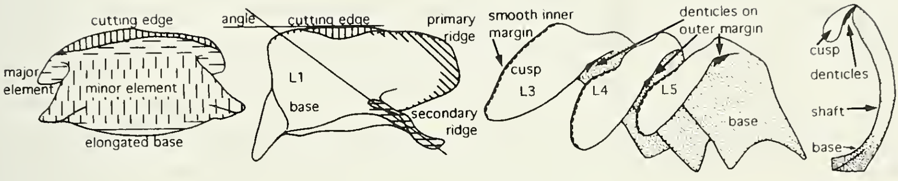

FIG. 3

Illustration of the terminology for the teeth of the radula of abalone.

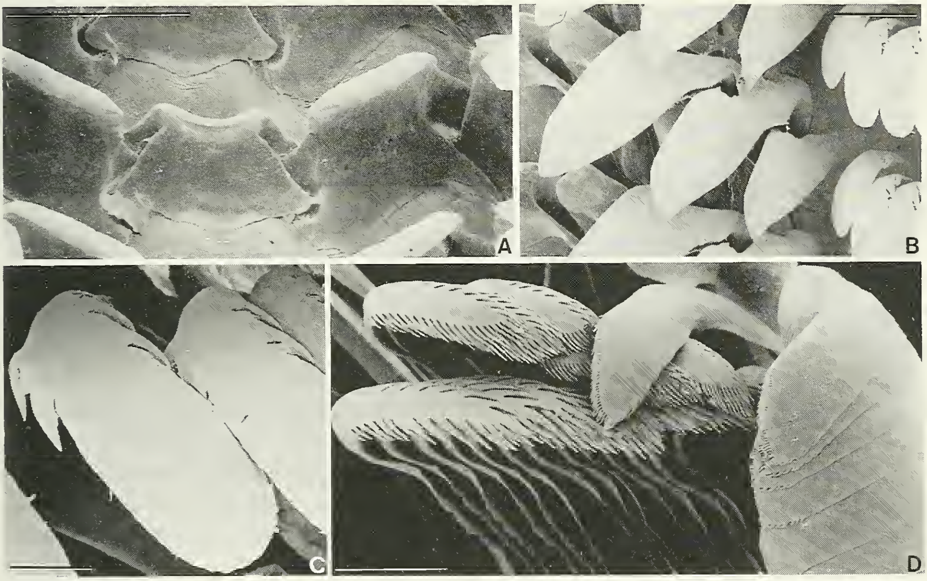

FIG. 4

SEM photographs of raduar teeth of *H. unilateralis*. A: Rachidian tooth and lateral tooth 1. Scale bar = 100 µm. B: Lateral teeth 3-5. Scale bar = 100 µm. C: Inner marginal teeth. Scale bar = 25 µm. D: Middle and outer marginal teeth. Scale bar = 25 µm.

Epipodium: Very elaborate, despite rather narrow for genus. Dorsal margin bears hand-shaped leaflets, several times fingered. On inside of epipodium, palm gives rise to smaller, less fingered, hand-shaped projections. Longer dorsal tentacles sparse. Ventral margin instead bears numerous long tentacles and palms of hands longer than those on dorsal margin, but with fewer secondary hand-shaped leaflets. In epipodial fold large tentacles at greater intervals, i.e. at intervals of 3-5 hand-shaped structure on dorsal margin. Hand-shaped structures missing on either side, when a tentacle in epipodial fold.

INTRASPECIFIC VARIABILITY

STUDIED SPECIMENS: The specimens are arranged from their northern-most localities southward with the collection in brackets and the number of specimens after the colon. Elat 40 m under backward slope of reef (Neotype MHNG no. 18020: 1); Elat, 3. 1994, at foot of reef, dead, 20 m (Singer: 1); Elat, 30.8. 1988, 10-30 m (Geiger: 1); off Elat: 2 m, on shell, 1972 (Stewart: 6); Elat (Stewart: 1); Elat 30 m (Stewart: 1); 30 km South of Elat, 8. 1993, beach, dead (Singer: 2); Lagoon of Dahab, 6. 1991, dead on sand (Singer: 1); Dahab, 8. 1993, amongst corals, 2m, dead (Singer:1); Gulf of Aqaba, approx. 1991, dead, shallow water (Singer: 2); Na'ama Bay, Sinai (Singer: 1); Gulf of Aqaba, approx. 1988 (Singer: 6); Sinai (Jones: 1); Sinai, 1 m under stone (Geiger: 1); Tiran, Jackson Reef, corals, 30-40 m (Singer: 1); Woody's Wreck, 2.9.1983 (NHML: 1); 5 mile reef, 8.1.1982 (NHML: 1); Safaga, Egypt (Pickery: 1); Djibuiti: Ille des 7 frères (Stewart: 1); Djibouti, Ouaramous Island, 6 m rock (Stewart: 1); Aldabra: Ile Picard, Passé Dubois, 07.04. 1983, Channel margin 3-10 ft (USNM 836532: 1); Mozambique Channel: Bassas Da India, 04.90 live-taken (Stewart: 1); Djibuiti: Ille des 7 frères (Stewart: 1); ---, 2.9.1982 (NHML: 1). The size of the shells varies between 12.75 and 33.8 mm for their largest dimension.

The shells mentioned by YARON (1983), housed in the HUJ and the TAU, were not available for study. However, according to the curator of the HUJ, H.K. Mienis (pers. comm.), the shells are "identical with the material you received from Solly Singer".

Shell: The dorsal surface of the shell can be planar or convex as in *H. varia*. The flat shells are so far only known from the Sinai coast of the Gulf of Aqaba. The shells from this locality are also similar to *H. brazieri*. The tremata are moderately to highly elevated, i.e. to a similar extent as in *H. parva* Linné, 1758 or more, but in none of the shells seen they are raised as much as in *H. brazieri*. The shell is thinner or occasionally as thin as *H. brazieri* or *H. parva*. Between the row of tremata and the columella the folded margin is one of the most noticeable features. It is comparable to the same structure found in *H. scalaris* Leach, 1814 [= *H. emmae* Reeve, 1846], but shows a reduced range in the extent it is formed. In the most pronounced state it consists of tightly spaced, delicate but short lamellae, approximately up to 15 between two tremata. These may become fewer and sturdier and possibly may form nodes on the folded margin.

Colour: The whole range of light rose to orange and red leading occasionally even to brown tones are found. Some green specimens are known. Most frequently fine white mottling covers the shell, with larger spots in white or a second colour being rather rarely encountered. Only two specimens show radial flammae, a pattern often seen in *H. ovina*. The nacre is rather of a light colouration for the genus.

Radula and epipodium: The radula (GEIGER, unpublished) and the epipodium (OWEN *et al.* 1971; GEIGER, pers. obs.) of abalones shows characters which vary between species. In the description, only the features different from other species investigated so far are indicated. Two radulae were investigated with a SEM, and four alcohol specimens were available. The characters indicated in the description of the neotype adequately indicate the intraspecific variability.

Habitat: From all present information the species occurs during day time under stones and coral heads and in deeper water on the underside of backward slopes of reefs. No night time observations have been made to date. The vertical range extends from at least 40 m up to the very shallow sublittoral (1 m). Therefore, in the shallow water it can be found together with the *H. pustulata cruenta.*

Geographic distribution: *H. unilateralis* has been reported primarily in the Red Sea. It has been regularly found from the Gulf of Aqaba side of the Sinai from Elat down to Sharm el Sheik (Singer, pers. comm.; this study). In the southern Red Sea, SHARABATI (1984) has found the species at the locations called "Woody's Wreck" and "5 mile reef"; I was unable to find the precise location of these places. An underwater photograph of the species was taken at Hurghada (Egypt) by U. Wüest, but the specimen had not been preserved. Additionally, several specimen from Djibouti, one specimen from Aldabra (USNM), one from Msibati, Tanzania (K. Stewart, pers. comm.), one from Mozambique, and at least two specimens from Pointe du sel, St. Leu, Reunion (M. JAY, pers. comm.: see DRIVAS & JAY 1988) are known. YARON (1983: 491) indicates without references its occurrence in East Africa. Despite the more frequent findings of the species in the Red Sea area, the abundance of *H. unilateralis* must still be termed infrequent to rare.

COMPARISONS

– *H. brazieri:* For illustrations see KAICHER (1981), ABBOTT & DANCE (1983: 20), WILSON (1993: pl. 5 fig. 1). The flat form of *H. unilateralis* from around Elat somewhat resembles *H. brazieri*. However, *H. brazieri* is found only in southeast Australia from southern Queensland to Jeffries Bay, New South Wales (WILSON 1993). The tremata of *H. brazieri* are more raised than in *H. unilateralis*, and the shell is usually heavier, the spire is much more elevated, the colour pattern usually involves red oblique flammae, and no spiral row of depressions in the nacre can be observed. The soft parts of this species are unknown to me.

– *H. ovina:* For illustrations see SPRINGSTEEN & LEOBRERA (1986: pl. 2 fig. 3), ABBOTT & DANCE (1983: 22), DHARMA (1988: pl. 1 fig. 4), WILSON (1993: pl. 3 fig. 5). Whereas *H. ovina* extends as far west as the Gulf of Siam, Andaman Sea (TALMADGE 1974) and the Maldives (BAER 1989), *H. unilateralis* has only been found as far east as Reunion (M. Jay, pers. comm.). The shell of *H. ovina* is always much heavier, and the margin between the tremata and the columella does not form a fold as in *H. unilateralis*. *H. unilateralis* can also be distinguished easily from *H. ovina* on the basis of the epipodium. The latter species has warty triangles whose broad bases form the dorsal and ventral margin, and the tips point towards the epipodial fold. The dorsal and ventral triangles are shifted by half their widths, which causes the tips of the triangles of one side to point into the gap between the two triangles on the opposite side. This arrangement forms an undulating epipodial fold. The dorsal and ventral margin bear many small projections, arranged in a single line. Dorsal to the dorsal epipodial margin large tentacles are found.

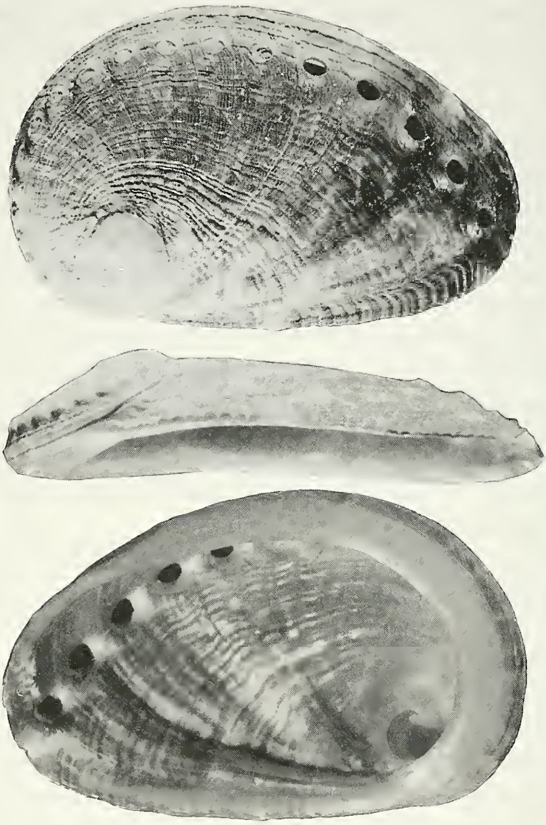

FIG. 5

Shell of *H. pustulata cruenta* in dorsal, apertural and ventral view. Sinai, Gulf of Aqaba. 34 x 21.5 mm. Collection Geiger.

– *H. p. pustulata* and *H. pustulata cruenta*: For illustrations see KAICHER (1981), BARASH & DANIN (1992: fig. 9), GIANUZZI-SAVELLI *et al.* (1994: figs. 105 a-c), this study (fig. 5). *H. pustulata* is the only species to occur sympatrically with *H. unilateralis* in the Red Sea. Its distribution in the Indopacific extends from the Persian Gulf (TALMADGE 1974) to northeastern South Africa (JACKS 1983). The two subspecies can be distinguished from *H. unilateralis* by having a thicker shell, no elevated tremata, no folded margin and they usually have a dark brown to sepia colouration with off-white mottling (Figure 5). The relation between *H. pustulata* and *H. rugosa* Lamarck, 1822 (*non* Reeve, 1846) is currently debated (cf. HERBERT 1990).

The epipodium has dorsally and ventrally closely packed fingered structures, with thick fingers. These bundles are separated by spaces bare of any such structures.

From within these dense bundles a few longer tentacles emerge. Large, isolated tentacles appear in the middle of the epipodium, which, however, are not surrounded by hand-shaped projections. No clear epipodial fold can be identified.

Occasionally *H. unilateralis* and *H. pustulata* have been confused, as in the compilation by VINE (1986). There *Sanhaliotis pustulata* was described as having raised tremata, a feature of *H. unilateralis* and not of *H. pustulata cruenta*; the second species discussed is *S. varia*, which most likely represents *H. pustulata cruenta*. Note that VINE (1986: 126) used the genus *Sanhaliotis* in the description of shells, but *Haliotis* in the list on page 172 including the species mentioned in the text.

– *H. varia:* For illustrations see KAICHER (1981), ABBOTT & DANCE (1983: 22), SPRINGSTEEN & LEOBRERA (1986: pl. 2 fig. 2), DHARMA (1988: pl. 1 fig. 6), this study (fig. 1). *H. varia* seems to have its western distributional limit around Sri Lanka (TALMADGE 1974; NHML) and Cape Comorin, India (Geiger, unpublished); occasional specimens are found on the Maldives (NHML). One specimen has allegedly been collected from Muscat, Oman in 1838 (NHML). Therefore, the western distributional limit of the species seems to be very similar to that of *H. ovina*.

The shell is much heavier, the columella much narrower, and no fold between the row of tremata and the columella is present. Numerous, narrow, spiral cords are found on the dorsal surface and show in the nacre; the cords often bear scales. In some specimens oblique lamellae can be found. The colours are only rarely bright; muddy green and brown prevails (Caution: do not confuse with *H. dohrniana* Dunker, 1863).

The epipodium is rather narrow for the genus and is composed of distinct triangular units. Each unit bears a large tentacle on the margin which is bordered on either side by finer projections, which are often fingered and form small hand shaped structures, which, however, are less elaborate than in *H. unilateralis*. In addition, the secondary palmate structures of *H. unilateralis* are not found in *H. varia*. Towards the distinct undulating epipodial fold, which is formed as in *H. ovina*, no further structures can be found; the epipodium is smooth there.

SPECIES OF *Haliotis* IN THE RED SEA

Seven taxa have been indicated from the Red Sea: *H. ancile* Reeve, 1846, *H. dringii* Reeve 1846, *H. pustulata cruenta* Reeve, 1846, *H.* cf. *ovina* Gmelin, 1791, *H. scutulum* Reeve, 1846, *H. unilateralis* Lamarck, 1822 and *H. varia* Linné, 1758 (ABBOTT & DANCE 1983; YARON 1983; SHARABATI 1984; GEIGER 1991). YARON (1983) discusses in detail the various taxa reported from the Red Sea. *H. scutulum* is a little known taxon. No specimen labeled with this name could be found in the NHML (GEIGER, pers. obs. 1993). From the description "waved, here and there larger", the colouration "olive brown ... dotted and spotted with green", and the irregular spiral ridges with occasional thickenings to be seen in the figure 63 of REEVE (1846), I tentatively identify *H. scutulum* as *H. varia*. It is mentioned a few times in the literature from the Red Sea (cf. YARON, 1983), possibly stemming from a confusion of *H.*

pustulata with *H. varia*. Some additional indications on the remaining taxa are worth mention. *H. ancile* is noted by ABBOTT & DANCE (1983) to occur in the Gulf of Suez and the north western Indian Ocean. The figured specimen looks rather like a colour form of *H. pustulata* and bears only limited resemblance to the type of *H. ancile* (GEIGER, pers. obs. in NHML), which actually is a juvenile *H. rubra* Leach, 1814 (K. STEWART, pers. comm.). In his compilation, VINE (1986) includes *H. dringii* which is reported so far only from the Australian region (WHITEHEAD 1990). Despite mention of the seven taxa listed above, only *H. pustulata cruenta* and *H. unilateralis* are known to occur in the Red Sea. The more common *H. pustulata cruenta* has most likely been involved if only one species of abalone had been identified, particularly in the non-taxonomic literature.

In conclusion, only the well known *H. pustulata cruenta* and *H. unilateralis* are known from the Red Sea area. The confusion about the latter biological species has ceased to exist due to the present designation of a neotype, which does not disrupt the usage of the taxon, hence provides taxonomic stability.

ACKNOWLEDGMENTS

Benjamin Singer, Daniel Korkos and Mike Fainzilber donated the animal (neotype), and Mark Jones, Roger Pickery, Katharine Stewart and Urs Wüest made some of the material available. Kathie Way (NHML) and Alan Kabat (USNM) sent material for study. Yves Finet and C. Vaucher (MHNG) kindly sent pictures of the supposed type specimen. R. Guggenheim and the team at the Labor für Rasterelektronenmikroskopie of the University of Basel helped with the initial observations on radulae. R. Bils and Alicia Thompson (USC) introduced me to the SEM on the USC campus. Yves Finet, James McLean (LACM), Henk K. Mienis (HUJ), Katharine Stewart and two anonymous referees read the manuscript and made valuable comments on it. I express my gratitude to all.

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Note added in proof.

The shells shown by Pickery & Steppe (1995: *Gloria Maris* 34: pl. 5, fig. 7) as *H. unilateralis* are *H. pustulata cruenta*. Four additional specimens of *H. unilateralis* were located in the California Academy of Sciences in San Francisco (CASIZ). Zanzibar: Pinna (CASIZ 1594: 1): Mauritius, leg. Boswell (CASIZ 1532: 3).

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Un Evalljapygidae (Diplura) canadien: *Evalljapyx saundersi* n. sp. – *Dicellurata Genavensia* XXI –.

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A Canadian Evalljapygidae (Diplura): *Evalljapyx saundersi* **n. sp. Dicellurata Genavensia XXI –.** *Evalljapyx saundersi* n. sp. is described, based on an adult ♂ from Vancouver (B.C.). The *E. sonoranus* Silv. (= *hubbardi* [Cook]) recorded from Vancouver Island by SAUNDERS (1946) is certainly a missidentification, *hubbardi* beeing localized in Arizona and all the other species of *Evalljapyx* are until now only known from the South-Western States of USA, the Equator and some Caribbean Islands.The author is convinced that SAUNDERS' specimen belong to the new species which is close to *E. ombris* Smith from California. Four chetotaxic patterns are proposed for the seven first abdominal segments.

Key-words: Diplura - Evalljapygidae - Canada - Taxonomy - New species.

INTRODUCTION

En 1911 SILVESTRI crée le genre *Evalljapyx* pour des Japyx caractérisés par leurs phanères pourvus de barbules et leurs mandibules d'un type particulier. Depuis cette date 33 espèces en ont été décrites; toutes sont localisées du Sud-Ouest des Etats-Unis (Californie, Nevada, Arizona, Texas), à l'Equateur et aux Caraïbes; SILVESTRI (1948b) crée la sous-famille des Evalljapyginae que j'ai élevée au rang de famille (PAGÉS 1989).

Or, en 1946 L.G. SAUNDERS rapporte la capture "at Brentwood, at the head of the Saanish Inlet on Vancouver Island" de 3 "Japygids" qui, d'après la documentation disponible à l'époque, ne pouvaient être que des *E. hubbardi* (Cook, 1899) (= *E. sonoranus* Silv., 1911), seule espèce alors connue ayant 30 articles antennaires.

En fait, *E. hubbardi* n'est signalé que de l'Arizona et sa présence au Canada est pour le moins surprenante, mais ni SILVESTRI (1947), ni SMITH (1960a) ne relèvent cette anomalie chorologique et REDDELL (1983) se contente d'écrire que "the record of this species for Canada... is almost certainly based on a misidentification".

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Cependant la présence d'un Evalljapygidé dans cette partie du Canada ne peut être totalement exclue puisque un cas identique est connu chez les Japygidés: *Occasjapyx americanus* (Mac Gillivray, 1893) a été décrit d'Olympia (Etat de Washington) et signalé du "Canada occidentalis" par SILVESTRI (1948a); deux autres espèces de ce genre sont localisées en Californie et une dans l'Arkansas.

Grâce à la capture d'un ♂ d'*Evalljapyx* indubitable à Vancouver par le Dr I. Löbl, il m'est possible de confirmer la présence d'Evalljapygidae au Canada, tout au moins dans cette région très restreinte et très particulière. Il s'agit d'une espèce nouvelle que je dédie à L.G. Saunders, car je crois que les spécimens qu'il a recoltés appartiennent à cette n. sp. qui n'a apparemment que de lointains rapports avec *E. hubbardi* si l'on ne tient compte que de la forme des cerques par exemple; le fait que ses exemplaires aient 30 articles antennaires et *E. saundersi* 29 seulement n'est pas un obstacle à ce rapprochement, les espèces gravitant autour d'*E. hubbardi* pouvant avoir de 29 à 31 articles aux antennes (SMITH 1960a).

Dans cette note outre la description de la nouvelle espèce, je propose des modèles chétotaxiques pour les 7 premiers segments abdominaux, car je crois qu'une étude précise et comparative de la chétotaxie pourrait aider à une meilleure compréhension des affinités des espèces de ce genre, comme l'écrit REDDELL (1983): "A thorough review of the genus may indicate it should be split into two or more genera".

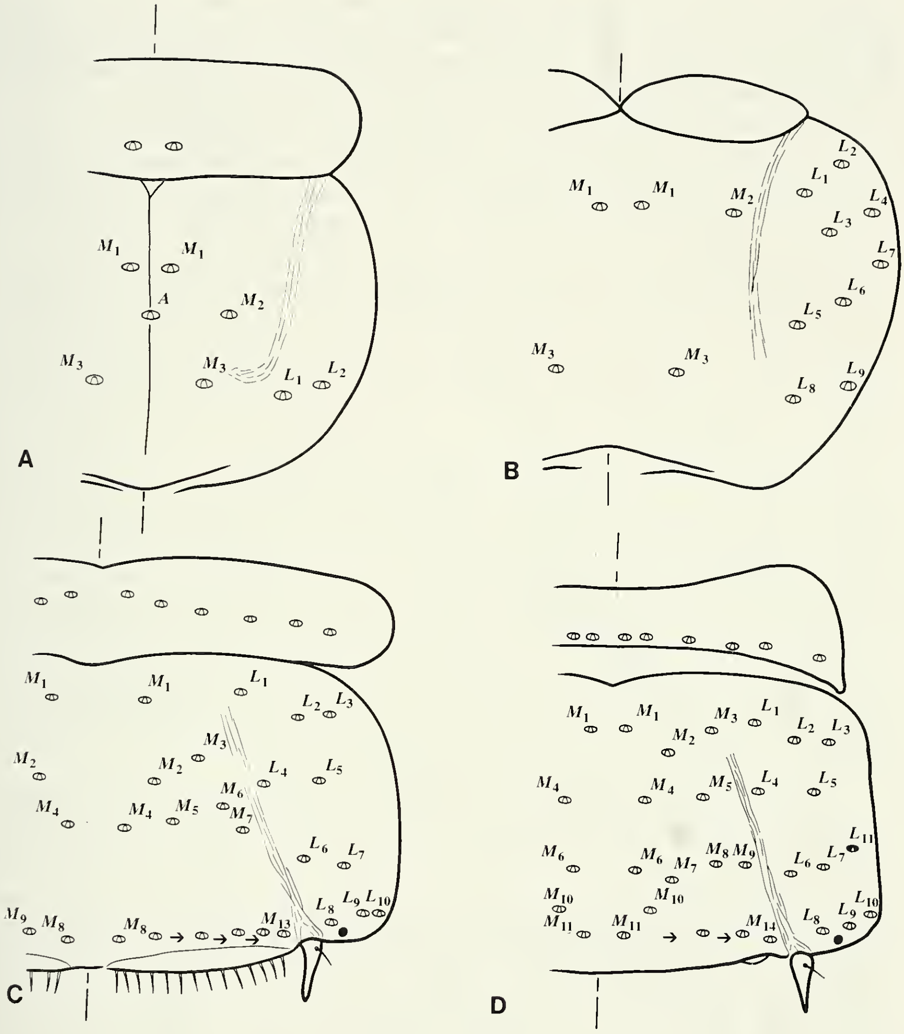
Je remercie Mme M. Krähenbühl d'avoir dactylographié ce manuscrit et Mlle F. Marteau qui a reporté sur calque mes dessins originaux.

MODELES CHÉTOTAXIQUES

A ma connaissance aucun des auteurs ayant décrit des *Evalljapyx* ne s'est préoccupé de définir de façon précise des modèles chétotaxiques que l'on pourrait considérer comme typiques des différents sclérites pris en compte dans les descriptions. Silvestri (op. cit.), quant à lui, n'indique qu'un nombre de "setis sat longis", nombre souvent précédé de "circa"; quant aux figures qu'il donne, presque uniquement des derniers tergites abdominaux (du 6ème au 10ème au mieux) et des urosternites 1 et 2, leur faible dimension et le manque presque constant de points de repère rendent leur utilisation très difficile. Smith qui est sans aucun doute le spécialiste qui a pu étudier le plus grand nombre d'*Evalljapyx* (plus de 2000!), n'a jamais publié un dessin précis d'un sclérite quelconque.

En 3 occasions, Smith donne des schémas très simplifiés et sans point de repère: en 1959b celui de l'urosternite 1 d'*E. helferi* Smith et du quart postérieur gauche de celui de la ♀ et des ♂ de 3 espèces voisines (*raneyi* Smith, *facetus* Smith, *diversipleura* Silv.); en 1960b il publie des dessins très simplifiés du mésonotum et de la moitié droite du tergite 7 de 3 nouvelles espèces (*leechi*, *decorus* et *mckenziei*); enfin en 1961, lorsqu'il compare les urosternites 1 de la ♀ et du "second instar" d'*E. facetus* Smith.

Il est certain que chez les Japygoidea la chétotaxie ne joue pas un rôle aussi fondamental que chez les Rhabdura (Campodeoidea et Projapygoidea), mais elle



Schémas des modèles chétotaxiques proposés pour les 7 premiers segments abdominaux des *Evalljapyx* Silv.. –

A. – Tergite abdominal 1; B. – Tergites abdominaux 2 à 7; C. – Sternite 1, les organes subcoxaux ont été représentés très schématiquement et très arbitrairement quant aux nombres de soies glandulaires et sensorielles, ces dernières sont barbelées chez toutes les espèces connues; D. – Sternites 2 à 7.

Sur tous les schémas les macrochètes ne sont représentés que par le contour de leurs embases; le L_{11} des sternites 2 à 7 a son embase colorée en noir pour indiquer que ce *M* est supplémentaire par rapport à ceux du sternite 1. Le rond noir entre L_8 et L_9 figure le *sm* typique des sternites 1 à 7.

permet très souvent de distinguer et de regrouper avec plus de précision les espèces de genres dits "difficiles" comme par exemple *Metajapyx* Silv., *Catajapyx* Silv., *Indjapyx* Silv. ou même *Parajapyx* Silv.; elle peut aussi apporter un complément important à la diagnose de quelques genres comme *Holjapyx* Silv., *Abjapyx* Silv., etc.

Les 33 espèces d'*Evalljapyx* actuellement décrites constituent en première analyse, un ensemble hétérogène; il est bien difficile d'après les seules descriptions, souvent trop peu précises ou incomplètes, de reconnaître les affinités des espèces entre elles. La solution adoptée par SMITH de les réunir d'après le nombre d'articles antennaires me paraît avant tout pratique, mais peu phylogénique, compte tenu de ce que l'on peut constater chez les autres Japygoidea. Par exemple SMITH (1960b) décrit 3 espèces (*leechi*, *decorus*, *mckenziei*) qui s'écarteraient des autres *Evalljapyx* par leurs antennes de 26 articles; il ne cite pas *cubanus* et *inermis*, décrits par SILVESTRI (1929) de Cuba qui ont le même nombre d'articles antennaires; or ces deux espèces présentent au lobe interne des maxilles des lames dont la première est entière, les 4 suivantes pectinées; ceci en contradiction avec la définition du genre par SILVESTRI (1911) ou SMITH (1959b, 1960a) qui indiquent 5 lames pectinées à ce lobe maxillaire. Quatre lames pectinées seulement se retrouvent dans la sous-famille des Provalljapyginae, dont c'est un des caractères principaux, proposée par SMITH (1959a, 1962). Par ailleurs SMITH (1961) écrit que le "second instar" d'*E. facetus* montre 1 lame entière et 4 autres pectinées à ce lobe; si l'on tient compte d'une part de la simplicité de l'armature des cerques de ce stade qui se rapproche, par exemple, de celle de *Nanojapyx coalingae* Smith et, d'autre part, des caractéristiques du genre *Eojapyx* Smith (1960c), on peut concevoir que la sous-famille des Provalljapyginae, apparemment hétérogène, est plus proche des *Evalljapyx* qu'il n'y paraît et qu'elle est à mon avis moins primitive que ne l'affirme SMITH (1959a).

Je crois qu'une comparaison très précise des chétotaxies aurait fourni des points de repères phylogéniques importants que les descriptions des auteurs ne permettent pas de détecter actuellement. Le manque de matériel et de documents iconographiques utilisables me fait renoncer à définir une chétotaxie typique de la tête, du thorax et des 3 derniers segments abdominaux; par contre les renseignements fournis par les dessins de Silvestri (op. cit.) et mes observations sur l'unique exemplaire en ma possession me semblent permettre de proposer des modèles chétotaxiques applicables aux 7 premières plaques tergales et sternales, indiquant la position idéale des seuls *M*, ne pouvant déterminer à coup sûr parmi les autres phanères ceux susceptibles d'être des *sm*[2] ou de simples soies. Ces modèles correspondent à un stade moyen du développement postembryonnaire et devront être affinés ou même corrigés par l'étude de nombreux spécimens de tous stades; en effet, les *Evalljapyx* montrent, d'après Smith (op. cit.), une certaine variabilité de la chétotaxie liée au sexe et au stade de développement et l'on sait que chez les Japygidés la taille et la densité des phanères peuvent, selon les lignées, se simplifier ou au contraire se compliquer au cours des mues successives.

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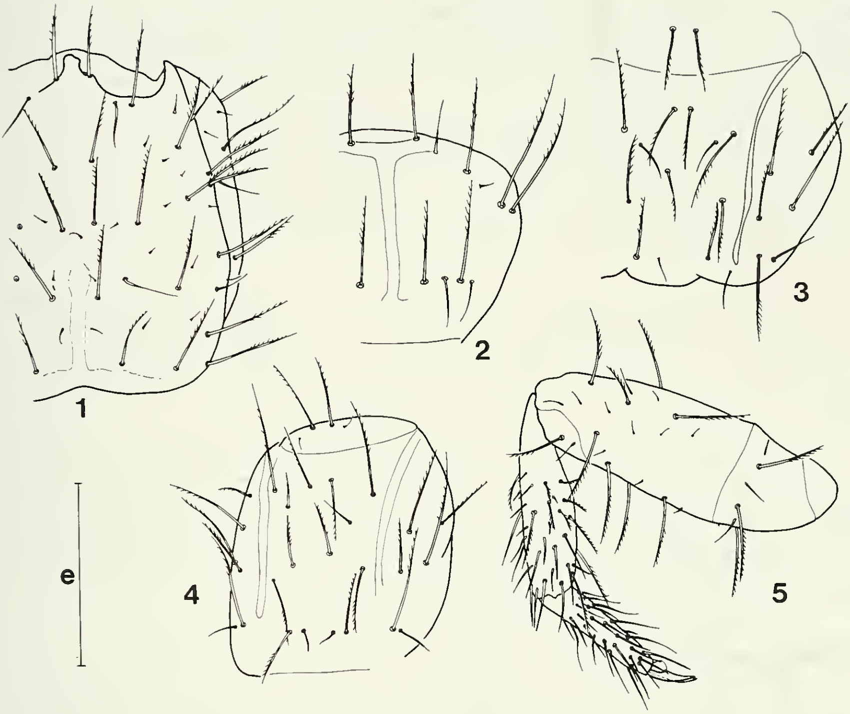
[2] On trouvera la liste des abréviations et la définition des rapports dans PAGÉS (1954) et PAGÉS & SCHOWING (1958).



FIGS 1–5

Evalljapyx saundersi n. sp., ♂ holotype. – 1. Vertex, e = 392 µm. – 2. Pronotum, e = 392 µm. – 3. Mésonotum, e = 517 µm. – 4. Métanotum, e = 517 µm. – 5. PIII droite, face antérieure, e = 417 µm.

Quelques explications sont nécessaires pour justifier le système de numérotation des *M*. Je n'ai pas considéré la répartition de ces phanères suivant des rangées transversales, comme le propose Smith (1959b, 1961), mais en tenant compte du fait que ces plaques sont constituées de 3 parties distinctes; c'est ainsi que tergalement 2 apodèmes longitudinaux, plus ou moins marqués, isolent le tergite proprement dit des 2 paratergites et que sternalement les 2 apodèmes stylaires du coxosternite séparent une aire centrale de 2 aires latérales.

L'analyse de ces modèles chétotaxiques m'amène à faire les commentaires suivants:

1. Comme chez les Japygidés, la plaque tergale du premier urite (modèle A) a une chétotaxie très simplifiée par rapport à celle des segments suivants; elle est aussi la seule à présenter un prétergite (= précosta, PAGÉS 1989) pourvu de phanères dont typiquement 1+1 *M*; le macrochète médian *A* paraît propre à *saundersi*, le seul autre *Evalljapyx* à présenter des *M* médians serait, d'après la littérature, *E. leechi* Smith, 1960b.

2. Contrairement aux Japygidés la seconde plaque tergale (modèle B) a une chétotaxie typique identique à celle des 5 plaques suivantes, mais quelques exceptions semblent exister pour autant que l'on puisse en juger d'après les descriptions (*darlingtoni* Silv., *anombris* Smith); la précosta, entière ou formée de 2 sclérites ovalaires, est toujours dépourvue de phanères.

3. Pour les plaques sternales (modèles C et D), j'ai considéré que les présternites (= apotomes auct., PAGÉS, loc. cit.) étaient ornés typiquement de 6+6 M mais ce nombre est très variable, comme chez *saundersi* par exemple, et un *M* médian semble assez fréquent; chez les Japygidés, sauf exceptions rarissimes, ces présternites sont nus.

4. L'aire centrale du coxosternite 1 est remarquable par l'absence de *M* entre la série M_4–M_7 et les *M* précédant les organes subcoxaux arbitrairement fixés à 6+6 sur le modèle C; ce territoire correspond à peu près exactement à celui occupé chez les Japygidés par les macrochètes de la série *C* et presque toujours par des soies à embase circulaire caractéristique.

5. Les aires latérales 1 à 7 présentent toutes la même chétotaxie si l'on fait abstraction du L_{11} des coxosternites 2 à 7; on notera plus particulièrement les 4 phanères insérés entre chaque style et le bord externe de l'aire, au moins 2 sont toujours des *M* (L_8 et L_{10}) alors que le L_9 peut être un *sm*, comme celui inséré entre L_8 et L_9 qui est chez toutes les espèces un *sm*.

II. **Evalljapyx saundersi** n. sp.

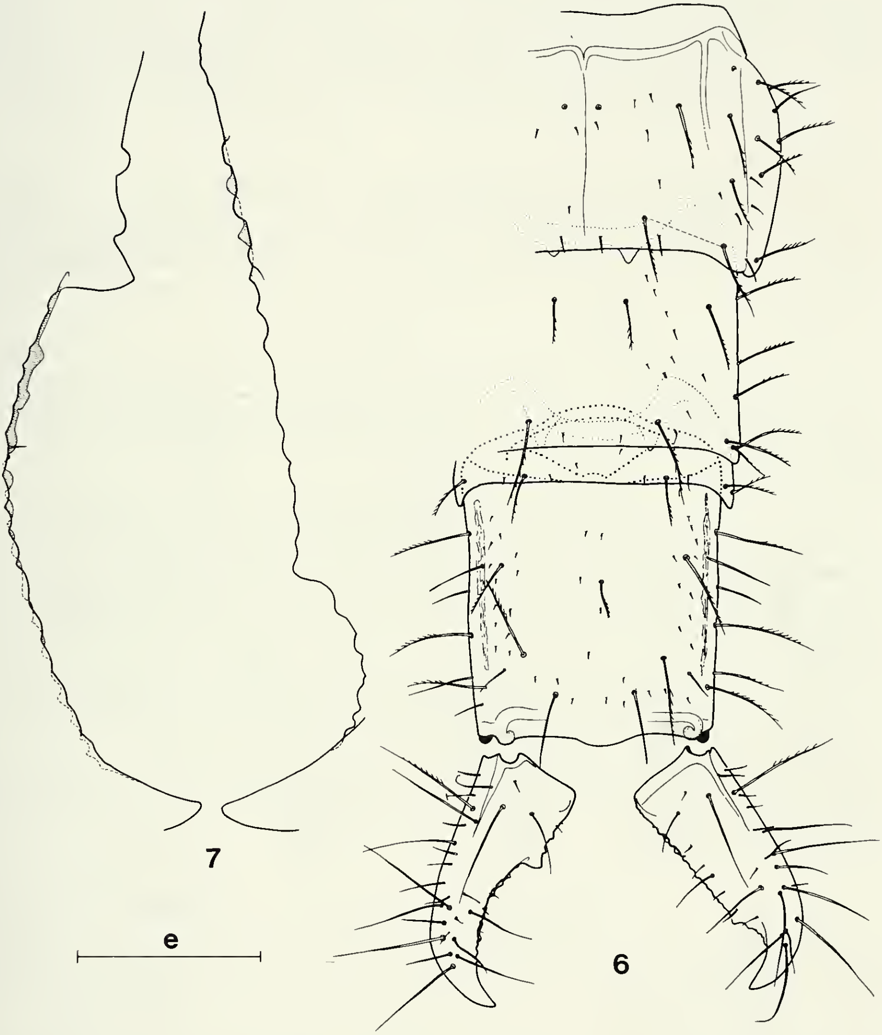
Matériel étudié: Canada. British Columbia: Vancouver, Stanley Park, niveau de la mer; 7.VII.88; forêt tempérée hygrophile. Tamisage de feuilles mortes sur sol marécageux dans la partie centrale. I. Löbl leg.: holotype, ♂ de 9,6 mm, déposé dans les collections du Muséum d'Histoire naturelle de Genève.

TÊTE

Aussi large que longue.

Vertex: sans sclérotisations particulières entre les bases des antennes; 20+20 *M* longs, pourvus de 5–7 barbules nettes; on peut les répartir sur chaque moitié du vertex de la façon suivante: 2 le long de la base de l'antenne, les 18 autres disposées sur 5 rangées longitudinales de 3, 2, 4, 5 et 4 *M* en partant de la ligne médiane; 3+3 *sm* assez longs ou assez courts, dont 1 entre les 2 *M* basiantennaires, 1 entre les *M* de la seconde rangée longitudinale et 1 entre les 2ème et 3ème *M* de la rangée la plus latérale.

Antennes: de 29 articles; des soies à barbules très fines sur les articles 1 à 3 inclus, au-delà tous les phanères sont lisses; 2 verticilles de soies droites et de sensilles recourbées jusqu'au 13ème article, puis au moins 3 à partir du 14ème, le proximal ne comportant normalement que des sensilles recourbées; on observe dans le verticille proximal des articles 4–13 et dans le verticille intermédiaire des articles 14–29, des soies droites dirigées vers la base de l'antenne; aires pileuses indistinctes; les 13 trichobothries typiques ne dépassant pas la longueur des soies droites des articles qui les portent, *a* médiane comme chez les autres *Evalljapyx*; 6 sensilles



FIGS 6–7

Evalljapyx saundersi n. sp., ♂ holotype. – 6. Tergites 7 à 10 et les cerques, e = 517 µm. – 7. Détail des marges internes des cerques, face tergale, e = 82 µm.

placoïdes disposés en 2 groupes linéaires de 3 formant un anneau pratiquement continu comme c'est la règle chez les Evalljapygidés.

Pièces buccales: typiques du genre, les 5 lames du lobe interne des maxilles pectinées, la première presque aussi longue que les 4 suivantes et pourvue d'environ 8–10 denticulations nettes; palpes labiaux 2,5 fois aussi longs que larges à la base, chacun pourvu de 9 soies dont les subapicales sont en moyenne 1,5 fois aussi longues que le palpe qui les porte, la plus externe 1,2 fois plus longue que l'interne.

THORAX

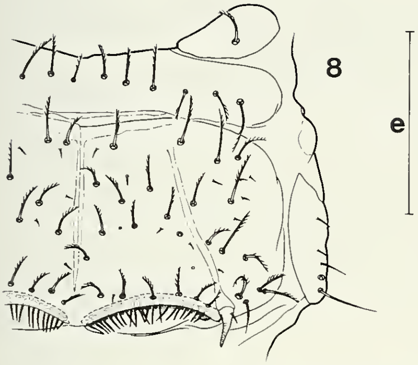
Pronotum: 6+6 *M* pourvus de 5 à 7 barbules, les 1+1 antérieurs submédians sont assez longs, leur longueur égale environ 1,25 fois l'intervalle séparant leurs embases; les sublatéraux subantérieurs sont près de 2 fois aussi longs que les *M* submédians antérieurs ou postérieurs; 3+3 *sm* assez courts, dont 1+1 subantérieurs et 2+2 subpostérieurs.

Méso- et ménatotum: Préscutum: 1+1 *M* assez longs à 5–7 barbules. 0–1+0–1 minuscules soies de part et d'autre des *M*. Scutum: 9+9 *M* à 5–7 barbules, ceux situés près de la ligne médiane et de part et d'autre des apodèmes longitudinaux assez courts; les plus longs sont les 1+1 sublatéraux subintermédiaires; 3–4+3–4 soies simples (*sm?*) assez longues à très courtes.

Pattes: peu allongées, les PIII atteignant à peine le milieu du second urosternite; la face antérieure (= externe) du tibia et du tarse est pourvue d'un grand nombre de *M*, de soies barbelées et de soies simples, souvent aussi longues que les *M* les plus développés; on notera à la base du tarse, face dorsale, un phanère coudé présent à toutes les pattes; face postérieure, à l'apex du fémur, on observe 3 phanères dont 2 barbelés et un simple comme par exemple chez *E. anombris* Smith (SMITH 1960a, fig. 8); aux PIII le tarse égale un peu moins des 2/3 de la longueur du tibia; pas de soies spiniformes sur la face sternale des tarses, mais 8–10 longues soies simples; griffes subégales, l'interne légèrement plus courte que l'externe; elles mesurent un peu plus du tiers de la longueur du tarse; unguiculus aigu, égalant un peu moins du tiers de la longueur des griffes.

FIGS 8-21

Evalljapyx saundersi n. sp., ♂ holotype. – 8. Urosternite 1, les organes subcoxaux latéraux évaginés en partie, e = 209 µm. – 9. Soie sensorielle et soies glandulaires d'un organe subcoxal latéral, e = 42 µm. – 10. Urosternite 3, e = 488 µm. – 11. Pleurites 2 gauches, e = 488 µm. – 12. Pleurites 3 droits, e = 517 µm. – 13. Style 4 droit, face antérieure, e = 110 µm. – 14. Style 1 droit, face latérale externe, e = 110 µm. – 15. Urosternite et paratergites 8, e = 517 µm. – 16. Sternopleurites 9, e = 517 µm. – 17. Urite 7, vue latérale gauche, e = 488 µm. – 18. Urite 8, vue latérale gauche de sa marge postérieure, e = 517 µm. – 19. Urite 9, vue latérale gauche de sa marge postérieure, e = 517 µm. – 20. Papille génitale ♂, vue latérale gauche, e = 251 µm. – 21. Papille génitale ♂, vue antérieure, tous les phanères ne sont pas représentés, e = 251 µm.



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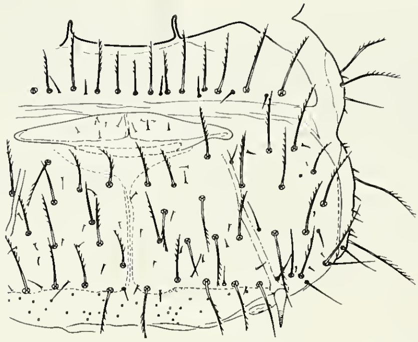

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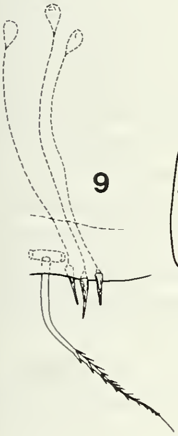

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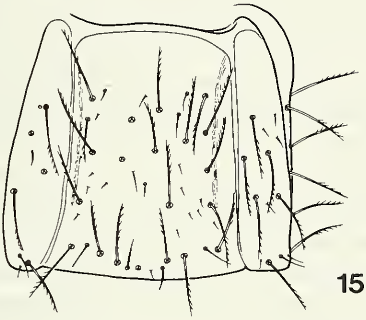

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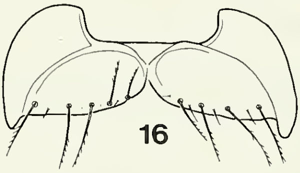

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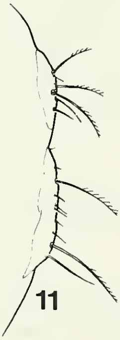

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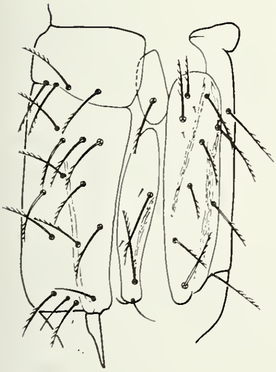

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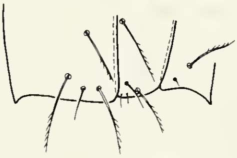

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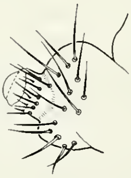

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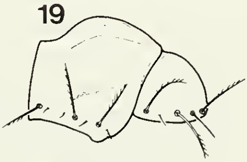

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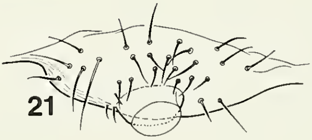

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ABDOMEN

Tergites 1 à 6 : conformes aux modèles chétotaxiques proposés; on relève les quelques irrégularités suivantes; l'absence des L_5 et des L_6 au tergite 6, 1 M supplémentaire près du L_4 droit du tergite 3, 1 M supplémentaire entre les L_1 et L_2 gauches des tergites 4 et 5 et 1 M supplémentaire entre les L_2 et L_4, à gauche au tergite 4 et à droite au 5ème.

Tergite 7 : à chétotaxie typique, on notera qu'il présente une sorte de carène fortement colorée allant en biais de l'angle antérieur, passant entre L_1 et L_2 et se terminant pratiquement sur le bord latéral substernal à hauteur de L_9.

Tergite 8 : environ 1 fois 1/5 aussi large que long; 8+8 M dont 1+1 médians antérieurs, 1+1 submédians postérieurs, 1+1 antérieurs sublatéraux, 1+1 latéraux postérieurs et 4+4 latéraux (antérieurs, intermédiaires, postérieurs); 1+1 *sm* entre les 2 M les plus postérieurs.

Tergite 9 : 2,7 fois aussi large que long; 3+3 M le long du bord postérieur dont 2+2 latéraux.

Tergite 10 : à bords latéraux rectilignes, légèrement convergents vers l'arrière; 1 fois un tiers aussi long que large au niveau des M latéraux subantérieurs; carènes bien marquées, fortement colorées, abrégées à leurs deux extrémités; 5+1+5 M avec 6–8 barbules, le médian court, les autres longs ou assez longs; 3+3 *sm* assez longs ou longs, lisses, dont 1+1 latéraux subpostérieurs, 1+1 insérés au tiers antérieur des carènes, 1+1 submédians subpostérieurs, les plus développés; 2+2 soies simples courtes dont 1+1 latérales subintermédiaires et 1+1 près de l'extrémité postérieure des carènes. Sur tous les tergites, de très nombreux microchètes, dont un tout petit nombre a été représenté.

Angles latéraux postérieurs des tergites : ne présentent rien de particulier; tout au plus, on notera la forme arrondie des angles des paratergites 7 et des tergites 8 et 9.

Acropyge : peu saillant, large, régulièrement arrondi.

Longueurs relatives des segments 7 à 10 : je ne comparerai ici que les longueurs médianes des parties découvertes de ces segments, le dixième étant, par définition, égal à 100: 91–83–25–100.

Sternite 1 : Préscutum: 6+1+6 M, les plus latéraux les plus longs, les 5+1+5 autres assez courts. Scutum: 25+26 M dont les 23+23 typiques, assez courts sur l'aire centrale, longs ou assez longs sur les aires latérales; 2+3 M supplémentaires, dont 1 près des L_6 gauches.

Organes suboxaux latéraux : ils sont très développés occupant presque toute la largeur interstylaire comme c'est la règle à quelques exceptions près, par exemple *E. crassicauda* Silv., *E aguayoi* Silv., tous deux de Cuba et peut-être *E. duricauda* Ewing & Fox du Guatemala pour autant que les descriptions nous permettent de juger; ils ne sont pas précédés d'une rangée de soies barbelées très courtes; 4 à 5 rangées très touffues de soies glandulaires, très courtes, SG/st_1 = 0,15 en moyenne; elles sont abouchées à un canal glandulaire au moins 5 fois aussi long que la soie dont il est issu et terminé par un réservoir piriforme muni d'un très court goulot; 23 soies sensorielles très densément barbelées, environ 5 fois aussi longues que les soies glandulaires SS/SG = 4,8–5,2, SS/st_1 = 0,75.

Organe glandulaire médian: inexistant.

Sternites 2 à 7: Préscutum: 7+7 *M* au sternite 2, 7+1+7 au 3ème, 6+1+6 au 4ème, 6+6 aux 5ème et 6ème, 5+5 au 7ème. Scutum: les 25+25 *M* typiques; on note chez notre exemplaire les anomalies suivantes: au sternite 2, absence du M_5 gauche et du M_2 droit, présence d'un *M* supplémentaire de chaque côté entre M_2 et M_5 ainsi qu'entre M_6 et M_{11} à gauche; au sternite 3 présence d'un *M* supplémentaire à droite de la ligne médiane entre M_6 et M_{11}; absence du M_4 droit au 5ème sternite et du L_4 au 6ème; 1 *M* supplémentaire à gauche au 4ème entre M_2 et M_4 et 1 à droite entre L_6 et L_7 au 5ème.

Sternite 3 ♂: il montre juste en arrière de la limite du préscutum une structure équivalente aux fossettes glandulaires des Japygidés. On observe un opercule constitué de 2 pièces triangulaires occupant environ la moitié de la largeur du sternite, pourvues chacune d'une demi-douzaine de minuscules soies; elles recouvrent une sorte de poche s'étendant jusque dans le segment précédent et recouverte de centaines de soies barbelées très courtes; chez *saundersi*, elle est identique au "setose sac" décrit par SMITH (1960b) chez son *E. ombris* ou à celle notée par SILVESTRI (1947) chez son *E. dispar*.

Sternite 8: 10+11 *M* disposés sur 3 rangées longitudinales de 5, 4 et 1 (postérieur) *M*, le *M* supplémentaire à droite est subantérieur entre les 2 rangées de 4 et 5 *M*; une carène peu élevée, mais très colorée court entre la rangée de 5 *M* et la limite latérale du sclérite.

Paratergites 8: 6 *M* longs à 5–7 barbules.

Sternopleurites 9: contigus sur la ligne médiane; 4–5 *M* longs.

Sternite 10: 10+10 *M* normaux.

Vésicules exsertiles: typiques aux urosternites 1 à 7, relativement petites occupant moins du 1/10ème de la largeur interstylaire, celles de l'urosternite 1 très difficiles à observer.

Styles: allongés, aigus, à cône secondaire très aigu, bien séparé du cône principal; 2 pores énigmatiques, petits; 2 soies, la plus développée 3 fois plus longue que la petite qui doit être une sensille sétiforme; s_1/st_1 = 0,36, s_1/s_7 = 0,84, st_1/st_7 = 0,71, s_1/st_7 = 0,25.

Pleurites: SMITH attache une grande importance à la chétotaxie des 2 sclérites présents dans la membrane pleurale; il nomme le sclérite antérieur "pleurite" et le postérieur "pleuron" (SMITH 1959b et 1960a), mais en 1960b, il parle de "prépleurite et de pleurite", ce dernier terme étant synonyme du pleuron; j'adopterai ici cette seconde nomenclature en rappelant que, pour moi, le "prépleurite" est présegmentaire et que le "pleurite" est homologue à un sternopleurite (PAGÉS 1989). D'après mes observations et les données que l'on peut trouver dans la littérature, il apparait que la chétotaxie du pleurite présente presque toujours 2 *M* et 1 soie simple postérieure, exception: par exemple *macswaini* Smith, *hubbardi* (O.F. Cook) (= *sonoranus* Silv.); c'est le prépleurite qui montre le plus de variations; chez *saundersi*, on observe les chétotaxies suivantes des prépleurites 1 à 7: 1 sans phanère; 2 avec 4 *M* du côté droit de l'urite et 3 *M* à gauche; 3 avec 3 *M* à droite et 2 à gauche; 4 avec 2 *M* à droite et 3 à gauche; 5 avec 2 *M* à droite et 3 à gauche; 6 avec 2 *M* à droite comme à gauche; 7 avec 1 *M* des 2 côtés; il semble donc que tout au moins chez *saundersi* la chétotaxie des sclérites pleuraux n'ait pas la valeur que lui attribue SMITH (1960a) même s'il avertit que "several ... pleura should be examined to establish the true number of these setae"; on observe entre les 2 *M* normaux du pleurite 7 une sorte de carène, peu élevée, très colorée.

Papille génitale ♂: aucune représentation n'en a été faite et je n'en ai pas fait mention dans ma note de 1989; SMITH (1959b) décrit celle de *E. helferi*, mais peu compréhensible sans figuration; chez *saundersi*, cette papille comporte une base assez large et élevée, pourvue de soies simples assez longues latéralement face antérieure et médialement quelques soies courtes; l'orifice génital est situé au sommet d'un tronc de cône, assez court, occupant environ le 1/4 de la largeur de la base, pourvu de nombreuses soies disposées sur 2 verticilles, les proximales courtes, les distales très courtes; pas d'appendices génitaux; ce type de papille ♂ me semble corroborer encore plus la séparation entre Evalljapygidés et Japygidés; aucun autre type de Diploures ne présente une papille ♂ de ce genre.

CERQUES

Nettement plus courts que la partie normalement découverte du tergite 10, $L_{cq}/L_{10\ déc} = 0{,}85$; environ 2–3 fois aussi longs que larges à la base.

Cerque droit: une dent peu saillante à sommet arrondi, nettement postmédiane, $r_d = 2{,}5$; la largeur au niveau de la dent égale environ les 3/4 de la largeur à la base; marge prédentale rectiligne avec 3 tubercules basaux supérieurs arrondis et largement espacés l'un de l'autre; la marge inférieure montre près de la base du cerque 3–4 saillies arrondies, puis 1 tubercule arrondi suivi de 3 autres équilatéraux aigus; le reste de la marge présente avant la dent 6–7 ondulations peu saillantes; la marge postdentale dessine un profond sinus pourvu de 6 denticules arrondis peu saillants.

Cerque gauche: une forte dent à sommet aigu dirigé vers la base du cerque, nettement prémédiane, $r_g = 0{,}57$; marge prédentale avec 2 tubercules arrondis largement séparés; marge postdentale régulièrement concave avec 2 rangées de denticules peu saillants; le proximal inférieur aigu, tous ceux qui lui font suite arrondis; ceux de la rangée supérieure ne sont que de simples ondulations.

Chétotaxie: tous les phanères sont lisses, sauf, sur chaque cerque, un *M* latéral subantérieur pourvu de 6–8 barbules.

AFFINITÉS

Cette espèce est bien caractérisée par ses antennes, ses sternites 1 et 3 et ses cerques; elle se rapproche beaucoup de *E. ombris* Smith, espèce propre, elle aussi, à des biotopes humides et est bien distincte de *E. hubbardi* (Cook) par ses cerques et la poche piligère du sternite 3 du ♂.

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Une évaluation de *Stygiocampa*, sous-genre troglomorphe de *Plusiocampa* (Diplura Campodeidae), avec la description d'une nouvelle espèce de Serbie orientale.

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An appraisal of *Stygiocampa*, a troglomorphic subgenus of *Plusiocampa* (Diplura Campodeidae), with description of a new species from eastern Serbia. – *Plusiocampa* (*Stygiocampa*) *christiani* n. sp. from two caves in Eastern Serbia is described. The geographical distribution of the now five known troglomorphic species of the subgenus *Stygiocampa* and the morphological adaptative characters are discussed, shared by those species are: a large size of the body (up to 9.5 mm), very long antennae by shape and number (up to 59) of the articles, enlargement of the cupuliform organ at the tip of antenna which houses up to 15 olfactive receptors, elongated legs and claws with large lateral crests, low number of macrochaetae on the greater number of tergits and the legs, multiplication of macrochaetae on abdominal sternits I-VII (up to 252 whole), propensity for the loss of glandular setae in males, very long cerci (2–3.5 times longer than the body). A map of the distribution area is provided.

Key-words: Campodeidae - Taxonomy - Caves- Balkans.

INTRODUCTION

La découverte d'un Campodéidé inédit dans deux grottes de Serbie orientale, visitées par le Dr E. Christian, en juillet 1984, nous incite à tenter une évaluation des critères morphologiques du sous-genre *Stygiocampa* Silvestri, 1934 qui rassemble des *Plusiocampa* troglomorphes de grottes de la région balkanique et dont l'espèce type *Campodea nivea* Joseph, 1882, fut la première espèce de Diploure troglobie décrite en Europe et la deuxième au monde, après *Campodea cookei* Packard, 1871, en Amérique du Nord.

Le sous-genre *Stygiocampa* Silvestri, 1934, espèce type *Campodea nivea* Joseph, 1882, par monotypie, correspond au groupe IV du genre *Plusiocampa* (CONDÉ

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1956: 127), l'unique espèce du groupe V (*Plusiocampa denisi* Condé) lui ayant été adjointe par Paclt (1957: 45).

L'aire géographique s'étend, du Nord au Sud, de la Vénétie julienne au Monténégro; vers l'Est, elle atteint la province de Zagreb près de Kamange au Nord-Est, et la rive gauche de l'Iskar, dans le district de Sofia, au Sud-Est. Les stations de la nouvelle espèce, près de Zlot, en Serbie orientale, sont à moins de 200 km au Nord-Ouest des localités bulgares.

Fig. 1

Répartition des espèces du sous-genre *Stygiocampa*.

Les matériaux de cette contribution, y compris les types, sont déposés au Muséum d'Histoire naturelle de Genève, Département des Arthropodes et d'Entomologie I, à l'exception des spécimens étudiés par Denis et Silvestri, et des *P.* (*S.*) *bureschi*, ces derniers appartenant au National Natural History Museum de Sofia.

LISTE DES ESPÈCES

P. (S.) nivea (Joseph, 1882)

Décrit de la Lukova Jama (Slovénie), a été révisé par Denis (1923), puis par Silvestri (1934), sur un spécimen de la Koschanski griza Pećina (Slovénie), donné par Joseph à Moniez, et illustré par Silvestri (1947) sur des spécimens de la Grotta del Tricolore (Postojna). Cette espèce occupe un vaste territoire dans la province de Trieste, en Slovénie et, en Croatie, dans les provinces de Lika-Krbava (entre Otočac et Gospić) et de Zagreb (une grotte près de la frontière slovène) (Condé 1959). Déjà connue d'une bonne trentaine de cavités où elle est abondante (plus de 250 spécimens nous ont été communiqués), elle est aussi présente dans la Sercetova Jama, VG 290, dans la commune de Trieste, où F. Gasparo a récolté 3 ♂ et 7 ♀ en 1982, 1985 et 1986, à ca 40 m de l'entrée, dans la zone obscure et humide, errant sur les concrétions, sous les pierres et près d'appâts de viande.

P. (S.) remyi Condé, 1947

Est cantonné en Herzégovine, Dalmatie méridionale aux environs de Dubrovnik et Monténégro. Aux stations énumérées en 1959 (168, 170), il convient d'ajouter, pour l'Herzégovine, les trois suivantes: Provalija, district de Nevesinje, près de la route reliant cette localité à Gacko, C.L. Deeleman, 25.07.62: 1 ♀; Snjetnica Pećina, Kifino Selo, P.R. & C.L. Deeleman, 23.07.63: 1 ♀; Vodena Jama (ou Pećina) à une heure au N de Gacko, P.R. & C.L. Deeleman, 07.62: 2 ♀. Il est abondant dans la Vjetrenica, l'une des deux localites des syntypes (36 spécimens reçus), les dix autres grottes ayant fourni 30 individus.

P. (S.) cf. remyi Condé

Dans la Vranjaca Pećina de Kotlenica, près de Split (Dalmatie), P.R. & C.L. Deeleman ont récolté, le 30.07.64, 3 spécimens (1 ♂, 2 ♀) d'une forme incertaine, dans laquelle les femelles n'ont pu être distinguées de celles de *P.* (*S.*) *remyi* (une seule antenne intacte de 50 articles). Le mâle, en revanche, possède un premier urosternite dont les angles latéro-postérieurs, à peine saillants, n'atteignent que le 1/5 proximal de l'appendice. Ce dernier est subcylindrique, à peine 2 fois plus long que large (140/65), sa longueur égale aux 4/5 environ de la distance le séparant de son symétrique; le champ apical comporte plus de 80 phanères sensoriels épais (a_1). Marge postérieure du sternite avec un champ de phanères glandulaires (g_1) disposés sur 5 à 7 rangs; macrochètes au nombre de 24+24. L'aspect général du sternite est plus proche de celui de la femelle de *P.* (*S.*) *remyi* que de celui du mâle de cette espèce, compte non tenu des phanères glandulaires marginaux.

Papille mâle très pileuse, avec une rosette de 16 soies autour du gonopore.

L'hypothèse d'un individu présentant une anomalie individuelle ne peut être écartée et de nouvelles récoltes dans cette cavité sont nécessaires. On remarquera cependant que la grotte est située à plus de 100 km des localités de *P.* (*S.*) *remyi*.

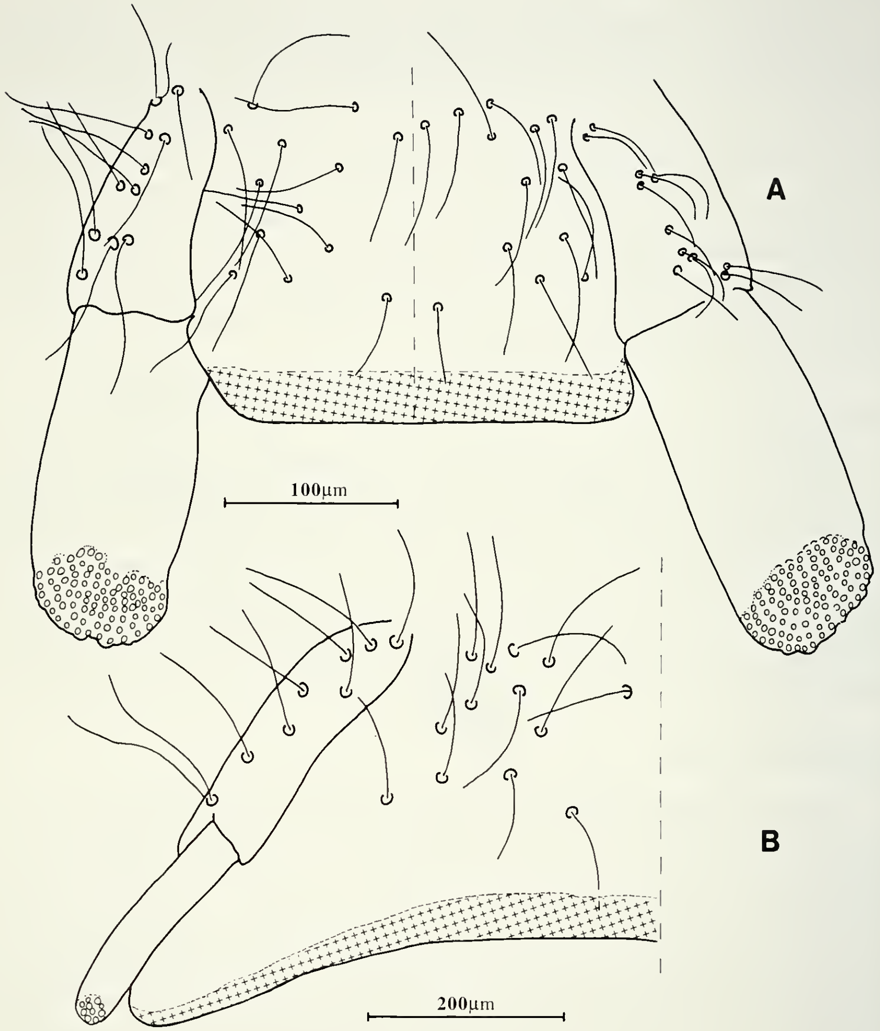

FIG. 2

Urosternite I de mâles adultes (semi-diagrammes). A. *Plusiocampa* (*Stygiocampa*) cf. *remyi* de la Vranjaca Pe3ina, Kotlenica, Dalmatie. – B. *Plusiocampa* (*Stygiocampa*) *remyi* Condé, spécimen de la série typique de la Vjetrenica Pe3ina, Herzégovine, d'après CONDÉ 1947.

P. (S.) dalmatica Condé, 1959

Décrit sur une unique femelle en très médiocre état de conservation, récoltée dans la Pe3ina Strazbenica, non loin de Sibenik, il a été retrouvé en Vénétie julienne dans la Grotta Bac, commune de Trieste, par F. Gasparo en 1979. BARETH (1988: 48) en a décrit une larve de 2,7 mm, apportant à cette occasion de nombreuses précisions sur cette espèce encore mal connue, en particulier une antenne complète de 47 articles avec un organe cupuliforme apical à nombreux sensilles très modifiés[1].

L'espèce paraît assez abondante dans cette grotte où F. Gasparo & C. Semorile ont récolté 9 nouveaux spécimens les 25.08.84 (1 ♀), 09.08.87 (1 ♀), 26.02.89 (3 ♀) et 05.03.89 (1 ♂, 3 ♀). Elle est présente également dans la Grotta Pocala, VG 91, commune de Duino-Aurisina, province de Trieste, où F. Gasparo a récolté 1 ♀ sur un morceau de bois à ca 80 m de l'entrée, le 19.06.88.

En Dalmatie, l'espèce a été reprise dans la Manita Pecina, près de Paklenica, au NE de Zadar, par P.R. & C.L. Deeleman, 02.07.64: 1 ♂, 2 ♀.

Tête. – Antenne de 41, 42, 44 (2 fois) et 46 (2 fois) articles, outre des régénérats de 32 à 42 articles.

Thorax. – Un seul métanotum à chétotaxie asymétrique (1+0 ma) chez une femelle de 5,30 mm de la Grotta Bac.

Abdomen. – Les mâles possèdent un champ glandulaire continu sur la marge postérieure du sternite I. Chez le spécimen de 3,9 mm (Grotta Bac), les phanères g_1, au nombre d'environ 90, sont disposés sur 2–3 rangs; les appendices sont subcylindriques et portent 5 phanères apicaux a_1. Chez le mâle de 5,20 mm (Manita Pe3ina), le champ glandulaire est plus large, comportant 6–8 rangs de phanères g_1.

Cerques. – Les cerques d'une femelle de 5,5 mm de la Grotta Bac sont présents, l'un et l'autre amputés d'une portion distale. Le gauche, long de 14,55 mm, comporte une très longue base (653) subdivisée en 13 articles secondaires qui, sauf le premier (46), sont de longueurs croissantes (23–82), suivie de 14 articles primaires de longueurs croissantes (87–322). Le droit, long de 13,27 mm, comprend une base un peu plus courte (534), découpée en 12 articles secondaires dans des rapports comparables à ceux de l'autre cerque (48 et 27–72) et 16 articles primaires de longueurs croissantes (84–222). Les rapports corps/cerques (0,37–0,41) sont comparables à ceux mentionnés chez *P.* (*S.*) *remyi* (0,33–0,40), compte tenu de l'absence d'un article au moins aux cerques disponibles.

Les longs macrochètes, y compris ceux des articles distaux, sont très finement barbelés sur leur moitié apicale au moins.

P. (S.) bureschi Silvestri, 1931 (syn.: *P.* (*S.*) *rauseri* Rusek, 1965)

Cette espèce est cantonnée dans les grottes de la rive gauche de l'Iskar, District

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[1] Un lapsus! (BARETH 1988: 49) a fait mentionner "le développement réduit des crêtes latérales des griffes", ce qui est en contradiction avec le texte de la diagnose originale (:166) "griffes inégales à crêtes latéro-tergales très développées" et la fig. 2,D de BARETH.

de Sofia (Bulgarie). La grotte nommée Gornata Pestera par SILVESTRI (= Raziska Dupka), l'une des trois localités citées dans la description originale, est la même que la Suchata Pestera (V.B. Guéorguiev, in litt.) d'où RUSEK (1965) a décrit son *P.* (*S.*) *rauseri*, un synonyme subjectif récent de *P.* (*S.*) *bureschi*.

Le pro- et le mésonotum portent seuls des macrochètes dont la disposition a été décrite, mais non figurée par SILVESTRI; CONDÉ (1956: 44) a cru que la description du mésonotum se rapportait au demi-tergite et non au tergite tout entier. Cette erreur d'interprétation (formule 4+4 au lieu de 2+2: *ma*, lp_3) est évidemment responsable de la description de *P.* (*S.*) *rauseri*, dans laquelle se trouve la première et seule représentation (fig. 18) des tergites thoraciques de *P.* (*S.*) *bureschi*.

Plusiocampa (Stygiocampa) christiani n. sp. (Figs 1, 3, 4)

Serbie orientale. – Lazarova Pe3ina, près de Zlot, non loin (ca 30 km) de la frontière bulgare, E. Christian, 15.07.84: 1 ♀ (holotype). Vernjikica Pe3ina non loin de la grotte précédente et dans le même massif, E. Christian, 15.07.84: 1 ♂ mature, 1 ♀ (paratypes).

Femelle holotype

Les nombres entre parenthèses se rapportent aux paratypes lorsqu'ils diffèrent de l'holotype.

Longueurs. – Corps: 6,82 mm (5,95; 5,20); cerque: 15,50 mm; corps/cerque = 0,44; patte métathoracique: 3,48 mm; corps/p. III = 1,96.

Téguments. – Epicuticule sans ornementation. Soies de revêtement finement barbelées sur leur moitié distale au moins.

Tête. – L'antenne gauche est un régénérat de 27 articles, la droite en compte 31(32, n=3). Sensille de l'article III postéro-sternal, subcylindrique et atténué à l'apex, de même forme que celui du palpe maxillaire et du palpe labial, mais environ 1,5 fois plus court qu'eux (18/27,5 µm) et beaucoup plus grêle. Les articles suivants présentent chacun un verticille apical de sensilles en gouge, assez grêles, dont le nombre dépasse la vingtaine sur les articles de la région moyenne. L'article apical est environ 2,25 fois aussi long que large et l'organe cupuliforme occupe environ 1/5 de la longueur totale; ce dernier renferme au moins 12 sensilles à l'antenne droite et environ 18 au régénérat (14 chez le mâle) de forme inhabituelle: la collerette périphérique est épaisse et le bouton central fendu jusqu'à la base ou presque; en coupe optique, le sensille apparaît digité.

Palpe labial droit avec 13 phanères banaux sur la portion antérieure et 128 phanères gustatifs sur la portion postérieure; 2 courts poils de garde de part et d'autre du sensille latéro-externe.

Processus frontal large, mais peu saillant, portant 3 phanères barbelés plus forts que leurs voisins et disposés en triangle (macrochètes), ainsi que 3+3 phanères ordinaires, aucun ne présentant d'embase tuberculée.

Thorax. – Le pronotum porte seul des macrochètes indubitables, au nombre de 4+4 (*ma*, la_2, la_3, lp_3) dont les longueurs relatives, de *ma* à lp_3, sont 68; 68,5; 81; 87. 12+11 soies marginales entre les *lp*, longues (55–76, $\Sigma p/N = 64{,}5$), grêles et finement barbelées ressemblant, à l'embase près, aux macrochètes voisins.

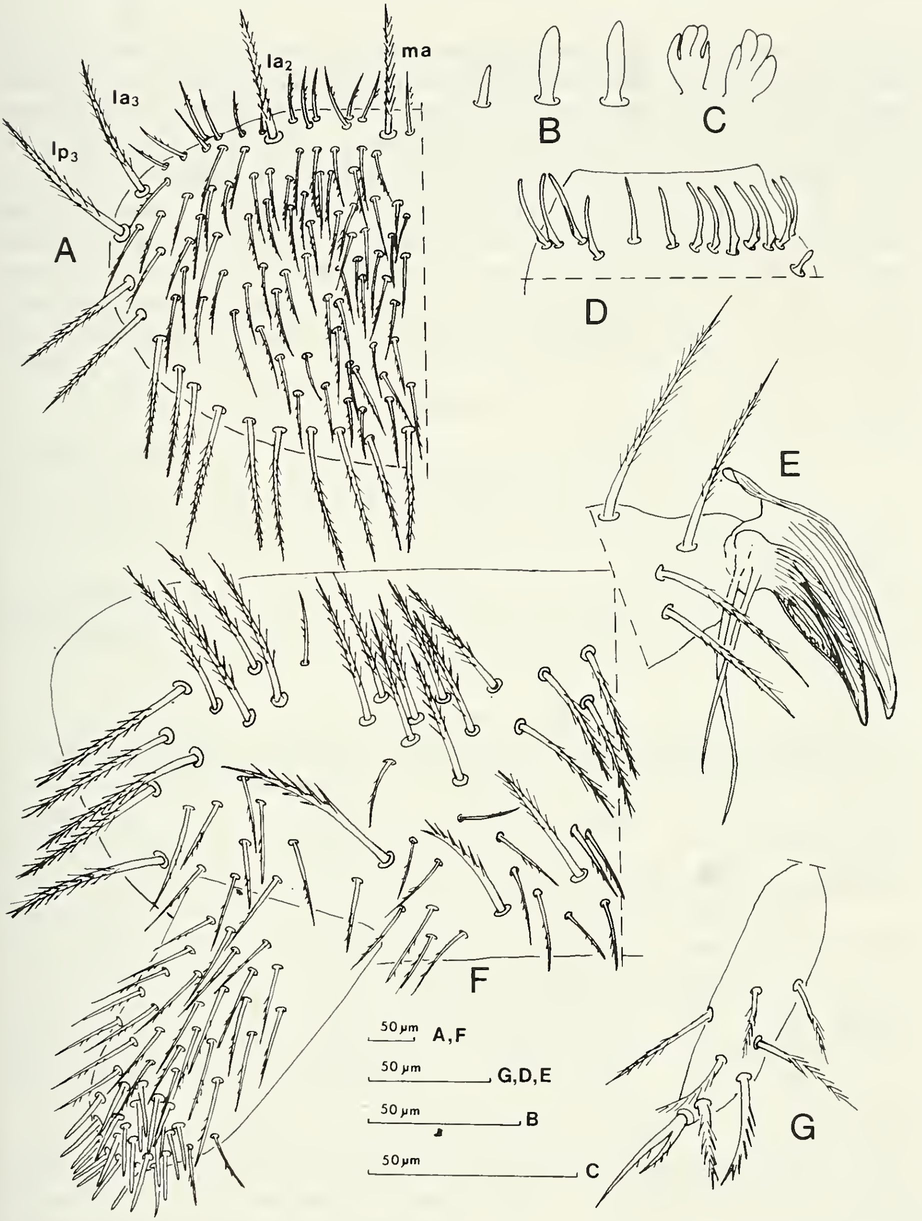

FIG. 3

Plusiocampa (*Stygiocampa*) *christiani* n. sp., femelle holotype de la Lazarova Pe3ina et mâle paratype de la Vernjikina Pe3ina. – A. Pronotum de la femelle. – B. Sensilles du mâle: IIIe article antennaire (à gauche), palpes maxillaire (au centre) et labial (à droite). – C. Sensilles de l'organe cupuliforme du mâle. – D. Portion apicale d'un article de la région moyenne de l'antenne de la femelle avec une rangée de sensilles en gouge et un court sensille subclaviforme. – E. Portion apicale du tarse III gauche et télotarse du mâle, face antérieure. – F. Urosternite I du mâle. – G. Style gauche du IVe urosternite du mâle.

Mésonotum avec une paire de phanères, un peu plus longs (50) et plus épais que leurs voisins, qui correspondent, par leur position et leur forme, à des submacrochètes latéraux antérieurs (*sla*). Ces phanères sont indiscernables chez les deux paratypes. Métanotum sans phanères différenciés en dehors des soies marginales.

Pattes grêles et allongées, l'extrémité des métathoraciques atteignant presque le bord postérieur du dernier segment de l'abdomen en extension. Les articles, à partir du trochanter, sont dans les rapports 18, 62, 76, 56. Pas de macrochète tergal ni sternal au fémur et au tibia; les macrochètes antéro-marginaux du fémur, ainsi que les calcars tibiaux, sont les seuls phanères différenciés. Pas de pseudo-articulation tarsienne; toutes le soies, y compris les 3 longues soies subapicales dorso-latérales et celles de la paire subapicale sternale, sont barbelées jusqu'à l'apex. Griffes très inégales (95/66), à crêtes ornementées, le talon de la postérieure recouvrant l'apex du tarse. Processus télotarsaux sétiformes et glabres.

Abdomen. – Une paire de macrochètes postérieurs (*post*$_5$) en VII (absents chez les paratypes). Tergites VIII avec 3+3 (*post*$_{3-5}$) et IX avec 7+7 (total), les macrochètes de la paire la plus tergale plus faibles que les autres. Valvule supra-anale avec 2 soies médianes et 2+2 latérales.

Sternites I à VII présentant une néotrichie comparable à celle de la plupart des espèces du sous-genre (*dalmatica*, *nivea*, *remyi*), le sternite I étant ici environ deux fois plus pileux que les suivants et le sexe n'intervenant pas (tableau I).

TABLEAU I

Répartition des macrochètes des urosternites chez les espèces présentant une néotrichie (ou hypertrichie)

No des sternites		I	II	III	IV	V	VI	VII	Total
P.(*S*.) *dalmatica*[2]	♀ 5,5 mm	21+19	11+11	10+10	9+9	9+9	10+11	8+10	157
	♂ 3,9mm	18+19	11+12	10+10	10+10	10+9	10+10	10+10	159
P. (*S*.) *christiani*	♀ holo.	29+25	--	12+11	12+11	12+12	12+12	13+13	196[3]
	♂ para.	21+21	12+12	13+12	12+12	13+12	12+12	14+12	190
	♀ para.	21+25	11+11	12+13	12+12	12+14	13+12	11+12	191
P. (*S*.) *nivea*[4]		15+15	14+14	14+14	14+14	14+14	14+14	14+14	198
P. (*S*.) *remyi* (syntypes)[5]	♂	22+23	19+19	16+18	16+19	17+16	18+18	14+17	252
	♀	23+23	18+18	16+16	14+14	15+14	17+16	15+15	234

Appendices du sternite I subcylindriques, légèrement atténués à l'apex, un peu moins de 2 fois aussi longs que larges (1,85), leur base presque 4,5 fois dans leur écartement (4,40) et leur longueur 2,3 fois environ (2,36). 24 et 23 phanères apicaux épais (a_1).

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[2] Grotta Bac (spécimens bien lisibles).

[3] On a admis que le sternite II, mal lisible, portait 11+11 macrochètes, soit le nombre minimum observé chez l'espèce.

[4] *cf*. SILVESTRI 1934.

[5] Vjetrenica Pe3ina.

Sternite VIII: avec 4+4 (4+5, mâle paratype). Papille génitale très pileuse: chaque volet avec respectivement 24 et 21 soies courtes, et le tubercule avec un total de 43, soit un groupe subapical de 12 soies courtes, en avant desquelles des phanères, de plus en plus longs vers la base du mamelon, forment 4 rangées de 4, 8, 7 et 12 éléments.

Cerques. – Deux cerques, l'un complet (15,5 mm), l'autre ne comportant que 6 articles distaux (10 mm) flottaient dans le tube renfermant l'holotype. Le cerque complet comprend une base (108), subdivisée en 3 articles secondaires (32, 33, 43), et 6 articles primaires dont la longueur augmente progressivement, les derniers étant extraordinairement allongés. Les 6 articles du cerque fragmentaire ne présentent pas cette particularité (il pourrait s'agir d'un appendice régénéré).

Tableau II

Longueurs relatives des articles et longueurs totales des cerques (ces dernières exprimées aussi en millimètres) de l'holotype.

	Base	I	II	III	IV	V	VI	Total
Cerque complet	108	63	93	133	171	225	258	1051 = 15,5 mm
Fragment	--	90	101	110	124	124	130	679 = 10 mm
Rapport corps/cerques	= 0,44							

Le revêtement est constitué de phanères courts, ceux de la base étant sensiblement égaux aux 2/3 de la largeur de l'article mis à plat. Tous sont pourvus de barbules assez longues et bien séparées les unes de autres sur leurs 2/3 distaux ou au moins leur moitié distale. Les phanères formant un verticille à l'extrémité des articles primaires sont densément barbelés presque depuis la base, ayant l'aspect d'arbuscules. Les macrochètes de l'article apical sont seulement fourchus avec souvent une barbule subapicale; leur longueur est égale à la largeur de l'article ou la dépasse d'environ un tiers.

Mâle paratype. – Appendices du sternite I plus courts et plus épais que ceux de la femelle, environ 1,5 fois aussi longs que larges (1,36–1,50), leur base environ 3 fois dans leur écartement et leur longueur un peu plus de 2 fois (2,19). 28 et 26 phanères apicaux épais (a_1). Papille génitale très pileuse (les soies toutes glabres), gonopore entouré d'une rosette de 19 phanères.

Affinités. – L'espèce est remarquable par le faible nombre de macrochètes tergaux: 5 ou 6 seulement pour l'ensemble des demi-tergites thoraciques et abdominaux. Elle se rapproche en cela de *P.* (*S.*) *bureschi* qui en possède 9. En revanche, elle présente une néotrichie des urosternites I à VII (190–194 macrochètes) qui n'existe pas chez *bureschi* (voir tableau III).

Faisceaux de spermatozoïdes (Fig. 4)

P. (*S.*) *nivea.* — Le filament spiralé, seul élément bien visible, ressemble à celui de *P.* (*S.*) *remyi* (BARETH 1968: 382).Il décrit 1,5 tour de spire environ pour une longueur de 200 à 250 µm. De forme elliptique, ses diamètres externe et interne sont

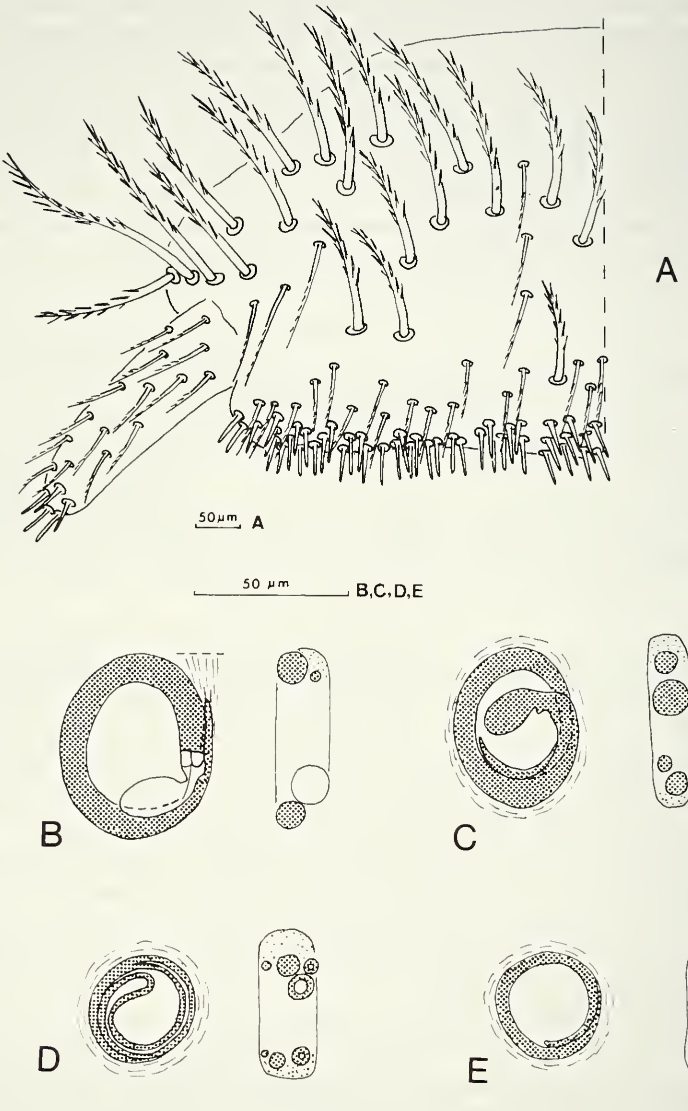

FIG. 4

Plusiocampa (*Stygiocampa*) *dalmatica* Condé. A. Urosternite I du mâle de 3,9 mm de la Grotta Bac. – B à E: faisceaux de spermatozoïdes, à plat et en coupe optique. – *B. P.* (*S.*) *nivea*. – C. *P.* (*S.*) *remyi*. – D. *P.* (*S.*) *bureschi*. – E. *P.* (*S.*) *christiani*. Les portions pleines des filaments spiralés sont représentées par un pointillé régulier; les touffes de spermatozoïdes sont figurées par un tireté irrégulier sur les vues à plat et par un fin pointillé (sections) sur les coupes optiques.

respectivement 50/40 et 35/25 µm. La tête renflée, d'un diamètre d'une douzaine de µm sur une longueur de 20 environ, est suivie d'un étranglement à la suite duquel le filament s'élargit pour atteindre jusqu'à 10 µm de diamètre, puis s'atténue ensuite progressivement jusqu'à son extrémité. Un peu après l'étranglement, une cloison transverse est visible, précédée de 2–4 petites cavités contiguës et surmontée d'une mince cloison perpendiculaire qui rejoint la paroi du filament au delà de l'étranglement .Toute cette région antérieure semble creuse, tandis que le reste du filament dont la densité optique est plus élevée apparaît plein. Les spermatozoïdes, peu nombreux, ne sont pas enroulés autour du filament comme d'habitude: fixés à l'extrémité acuminée du filament, ils s'écartent ensuite de ce dernier.

P. (*S.*) *remyi*. – Le filament spiralé décrit 1,5 tour de spire pour une longueur de 220 µm environ. La tête renflée, d'un diamètre d'environ 8 µm sur une longueur de 18–20, est suivie d'un étranglement à la suite duquel le filament s'élargit pour atteindre 8–10 µm, puis s'atténue progressivement jusqu'à son extrémité. Tout le filament semble plein et les structures décrites chez *nivea* n'ont pu être décelées. Les spermatozoïdes, quoique peu nombreux, sont enroulés autour du filament, les diamètres externe et interne de l'ensemble du faisceau, de forme elliptique, étant 60–65/45–50 et 30–33/25–27 µm.

P. (*S.*) *bureschi*. – Les faisceaux de spermatozoïdes sont circulaires, leurs diamètres externe et interne sont respectivement d'une cinquantaine et de 25 µm environ, sur une épaisseur de 20 µm. Les spermatozoïdes, enroulés autour du filament spiralé, sont bien visibles. Le filament décrit 3,5 tours de spire environ pour une longueur de 300–350 µm. Il est très légèrement renflé à une extrémité, atteignant 5–6 µm, et progressivement atténué à l'autre. La portion renflée et le premier tour de spire sont creusés d'une lumière, le reste du filament étant plein.

P. (*S.*) *christiani*. – Les faisceaux de spermatozoïdes sont circulaires, leurs diamètres externe et interne sont respectivement de 45 et 20 µm, sur une épaisseur de 10–12 µm. Le filament spiralé décrit 1,5 tour de spire environ pour une longueur de 140–150 µm seulement. Il est plein, atténué aux deux extrémités.

Le filament spiralé présente un certain intérêt taxonomique et sans doute phylogénétique (Bareth 1968: 383) et il semble exister une relation entre ses dimensions et la densité des phanères différenciés (macrochètes). C'est ainsi que le plus long connu (12–13 tours de spire pour une longueur de 1500–2000 µm) appartient à *Campodea sensillifera* Condé & Mathieu, 1958, espèce pourvue de macrochètes nombreux et très robustes. La chétotaxie tergale de *P.* (*S.*) *christiani*, la plus réduite parmi les représentants du sous-genre, s'accorde avec les faibles dimensions du filament.

DISCUSSION

Les cinq espèces les plus sûrement apparentées, *nivea*, *bureschi*, *remyi*, *dalmatica*, *christiani*, dans l'ordre chronologique, présentent des tendances évolutives communes qui peuvent se résumer ainsi:

1. Grande taille: 6,5 mm *dalmatica*, 7 mm *christiani*, 7,5 mm *nivea*, 8 mm *remyi*, 9,5 mm *bureschi*.

2. Longues antennes par la forme de leurs articles et le nombre de ceux-ci: 32 et 36 chez *christiani* et *nivea*; 47, 54 et 59 chez *dalmatica*, *bureschi* et *remyi* respectivement, ces nombres correspondant aux maximums connus pour chaque espèce.

3. Grandes dimensions de l'organe cupuliforme de l'article apical de l'antenne qui renferme de 7 à une quinzaine de sensilles (décompte souvent difficile), de forme plus ou moins complexe, opposés aux 4 sensilles simples de la plupart des formes endogées.

4. Allongement des articles des pattes et développement, sauf chez *bureschi*, des crêtes latérales de la griffe postérieure

5. Régression du nombre des macrochètes tergaux du thorax et de l'abdomen, de *dalmatica* à *christiani*, les autres espèces présentant des degrés intermédiaires, dans l'ordre *nivea*, *remyi*, *bureschi* (tableau III).

Tableau III

Répartition des macrochètes sur les tergites thoraciques et abdominaux.

	Th. I			Th. II			Th. III				Ab.V	VI	VII	
	ma	*la*	*lp*	*ma*	*la*	*lp*	*ma*	*la*	*lp*	T		*post.*		T
dalmatica	1	4	2	1(0)	2	2	1(0)	1	2	16(14)	4	4	4	12
nivea	1	4	2	-	1	2	-	-	2	12	4	4	4	12
remyi	1	4	2	-	1	2	-	-	2	12	3	3	3	9
bureschi	1	2	2	1	-	1	-	-	-	7	-	-	2	2
christiani	1	2	1	-	1(0)	-	-	-	-	5(4)	-	-	1(0)	1

6. Réduction du nombre ou absence des macrochètes des fémurs et tibias.

7. Néotrichie (hypertrichie) des sternites abdominaux I à VII, sauf *bureschi*.

8. Absence de champ glandulaire marginal au sternite I du mâle, sauf chez *remyi*, cf. *remyi* et *dalmatica*.

9. Allongement des cerques: presque 2 fois la longueur du corps (*bureschi*), un peu plus de 2 fois (*christiani*) ou 3 fois à 3 fois 1/2 (*dalmatica*, *remyi*, *nivea*).

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REVUE SUISSE DE ZOOLOGIE, 103 (2): 383-394; juin 1996

Nouvelles données sur les Trématodes d'Amphibiens d'Afrique Occidentale. Description d'*Haematoloechus aubriae* n. sp.

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New data on the Trematodes of Amphibians from Western Africa. Description of *Haematoloechus aubriae* **n. sp.** - This study reports new hosts for three Trematodes: *Xenopus tropicalis* (Gray, 1864) for *Progonimodiscus doyeri* (Ortlepp, 1926), *Ptychadena pumilio* (Boulenger, 1920) for *Mesocoelium monodi* Dollfus, 1929, and *Bufo togoensis* Ahl, 1924 for *Maederia eburnense* (Maeder, 1969). It specifies or extends the distribution of these Helminths and that of *Pleurogenoides tener* (Looss, 1898). *Phrynobatrachotrema eburnense* Goodmann, 1986 is considered a synonym of *Maederia eburnense* (Maeder, 1969). *Haematoloechus aubriae* n. sp., lung parasite of *Aubria subsigillata* (Duméril, 1856) in Porto-Novo (Bénin) is erected.

Key-words: Trematodes – Western Africa – Amphibians – *Progonimodiscus* – *Mesocoelium* – *Maederia* – *Pleurogenoides* – *Haematoloechus*.

INTRODUCTION

Cette étude est consacrée à une série de 26 Trématodes livrés par la dissection de 128 Amphibiens appartenant à 6 espèces provenant de la République du Bénin, du Niger, du Nord Togo, et collectés en 1977 et 1978.

Les parasites, fixés sur le terrain au Bouin alcoolique et ultérieurement colorés au carmin boracique de Grenacher, sont montés in toto et dessinés à la chambre claire.

Les dimensions sont données en micromètres, sauf indications contraires.

La nomenclature des hôtes Ranidae est fondée sur la révision de DUBOIS (1992).

PARAMPHISTOMIDAE

Progonimodiscus doyeri (Ortlepp, 1926) (fig. 1)

Synonymie: Diplodiscus doyeri Ortlepp, 1926; *Diplodiscus subclavatus* Goeze, *sensu* GROBBELAAR 1922; *Progonimodiscus doyeri victoriani* Vercammen-Grandjean, 1960.

Manuscrit accepté le 12.09.1995.

VERCAMMEN-GRANDJEAN (1960) observe que plusieurs caractères du *Diplodiscus doyeri* d'Ortlepp ne permettent pas de le maintenir dans le genre *Diplodiscus* Diesing, 1836 et crée pour lui un nouveau genre de Diplodiscinae: *Progonimodiscus*. Dans ce même travail Vercammen-Grandjean crée pour les *Progonimodiscus* du lac Kivu une sous-espèce nouvelle: *P. d. victoriani*. PRITCHARD (1964), aprés examen de l'holotype de *P. d. victoriani* estime que les caractères invoqués par Vercammen-Grandjean sont compris dans les limites de variation individuelle de *P. doyeri* et met la sous-espèce *P. d. victoriani* en synonymie avec *P. doyeri*, conclusion acceptée par SEY (1983). Suivant ce raisonnement, notre matériel se rapporte à l'espèce *P. doyeri* (Ortlepp, 1926).

Mentions anterieures: VERCAMMEN-GRANDJEAN (1960) précise que *Diplodiscus subclavatus*, *sensu* GROBBELAAR (1922), ainsi que *D. doyeri*, *sensu* ORTLEPP (1926), BRAVO-HOLLIS (1941), SKRJABIN (1949) et YAMAGUTI (1958), sont en fait des *Progonimodiscus*. Depuis cette date, *P. doyeri* a été retrouvé par:

PRITCHARD (1964) chez *Xenopus laevis* (Daudin, 1802) en Sud Afrique,

BEVERLEY-BURTON (1963), qui le nomme encore *Diplodiscus doyeri*, chez *X. laevis*, en Rhodésie,

GASSMANN (1975), chez *Conraua crassipes* (Buchholz & Peters, 1875) au Cameroun,

FISCHTHAL (1977), chez *Xenopus muelleri* (Peters, 1844) en Tanzanie, et chez *X. laevis victorianus* Ahl, 1924 et *X. fraseri* Boulenger, 1905 au Zaire.

Hôte, localité et occurrence: Xenopus tropicalis (Gray, 1864), Porto-Novo (République du Bénin), (10/31).

Date de la récolte: 25 mai 1977.

Habitat: Intestin.

Matériel examiné: 12 exemplaires montés in toto.

Dimensions: L. (mm) = 2,9 à 4,1 (moy. 3,6); I. (mm) = 1,5 à 2 (moy. 1,7); V.O. = 429 à 561 (moy. 474); Ac. (mm) = 1,5 à 2 (moy. 1,7); V.O./Ac. = 0,24 à 0,36 (moy. 0,28); Oes. = 429 à 627 (moy. 551); Tes. = 229 à 308 (moy. 261); Ov. = 198 à 270 (moy. 233); oeuf = 103 x 60.

Discussion: X. tropicalis est un hôte nouveau pour *P. doyeri* et la découverte de ce parasite en République du Bénin étend son aire de répartition à l'Afrique occidentale.

MESOCOELIIDAE

Mesocoelium monodi Dollfus, 1929 (fig. 2)

Synonymie: La taxonomie des *Mesocoelium* d'Afrique a fait l'objet de plusieurs analyses contradictoires: THOMAS (1965), MAEDER *et al.* (1969b), MAEDER (1973). Ces hésitations s'expliquent par la diversité des hôtes de ce parasite et son cosmopolitisme sans qu'il n'offre de nettes variations morpho-anatomiques. Actuellement, la dénomination spécifique *M. monodi* parait admise: FISCHTHAL (1977), BOURGAT (1979), PIKE (1979)...

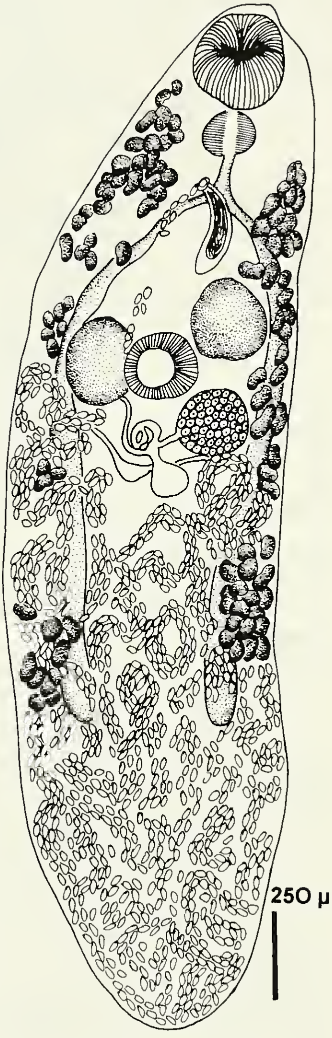


FIG. 1: *Progonimodiscus doyeri* (Ortlepp, 1926), face ventrale.

FIG. 2: *Mesocoelium monodi* Dollfus, 1929, face ventrale.

Mentions antérieures: Une liste des précédentes récoltes de *M. monodi* en Afrique, est donnée par BOURGAT (1979). Depuis cette date, *M. monodi* est encore signalé par:

PIKE (1979) chez *Bufo regularis* Reuss, 1834 au Soudan,

FASHYI (1986) qui a obtenu son dékystement expérimental au Nigeria.

Hôtes, localités et occurrence: Bufo regularis Reuss, 1834, Niamey (Sud Niger), (1/4); *Ptychadena pumilio* (Boulenger, 1920), Dapaong (Nord Togo), (1/3).

Date de la récolte: 28 février 1978 (Niamey).

Habitat: Intestin.

Matériel examiné: 6 exemplaires montés in toto.

Dimensions: L. (mm) = 2,6 à 3,15 (moy. 2,9); I. (mm) = 0,68 à 0,79 (moy. 0,73); V.O. = 188 à 255 (moy. 236) x 240 à 274 (moy. 261); Ac = 146 à 225 (moy. 186) x 174 à 225 (moy. 199); V.O./Ac. = 1,2 à 1,4 (moy. 1,32); Tes. gauche = 186 x 261, Tes. droit = 211 x 275; Ov. = 158 à 188 (moy. 176) x 191 à 248 (moy. 217); oeuf = 23 à 28 (moy. 26) x 29 à 37 (moy. 33).

Discussion: Ptychadena pumilio (Boulenger, 1920) est un hôte nouveau, et le Niger une région inédite pour *M. monodi*, dont le caractère euryxène et l'ubiquité sont ainsi confirmés.

LECITHODENDRIIDAE

Pleurogenoides tener (Looss, 1898) (fig. 3)

Synonymie: Distomum tacapense Sonsino, 1894, sensu Looss (1896); *Pleurogenes tener* Looss, 1898.

Mentions antérieures: LOOSS (1896) chez *Chamaeleo* sp. en Egypte,

ODHNER (1910) chez *Chamaeleo basilicus* en Egypte,

MACY (1964) chez *Chalcides ocellatus* en Egypte,

FISCHTHAL (1976, 1977) chez *Hoplobatrachus occipitalis* (Gunther, 1859), *Bufo regularis* et *Chamaeleo dilepis dilepis* Leach, 1820 en Afrique Equatoriale,

BOURGAT & COMBES (1977) chez *H. occipitalis* au Sud Togo,

BOURGAT (1979), idem,

PIKE (1979) chez *H. occipitalis* au Soudan,

GROSCHAFT & MORAVEC (1985) chez *Chamaeleo chamaeleon* (Linnée, 1758) en Egypte.

Hôtes, localités et occurrence: Hoplobatrachus occipitalis (Gunther, 1859), Kanté (Nord Togo). Sur 81 Grenouilles disséquées à Kanté, une seule a livré 7 *P. tener*, dont 6 ont été préparés.

Date de la récolte: 13 décembre 1977.

Habitat: Intestin.

Matériel examiné: 6 exemplaires montés in toto.

Dimensions: L. (mm) = 0,95 à 1,05 (moy. 0,99); I. (mm) = 0,76 à 0,80 (moy. 0,79); V.O. = 120 à 150 (moy. 140) x 169 à 191 (moy. 176); Ac. = 161 à 244 (moy. 185) x 157 à 268 (moy. 185); V.O./Ac. = 0.71 à 1,11 (moy. 0,975); Tes. = 109 à 200

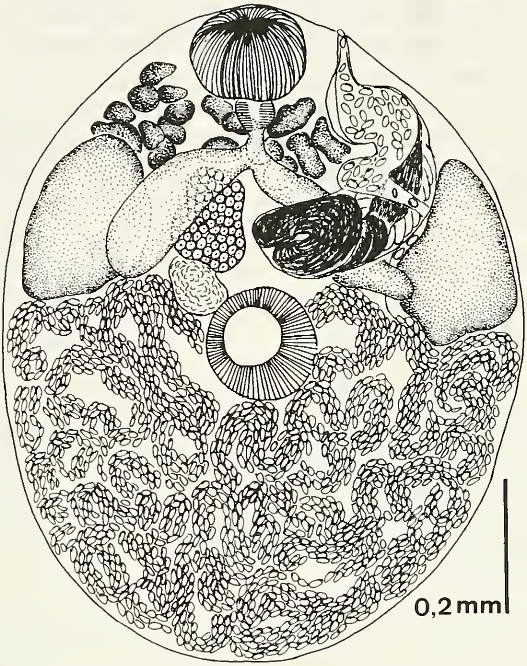


FIG. 3

Pleurogenoides tener (Looss, 1898), face ventrale.

(moy. 158) x 203 à 341 (moy. 273); Ov. = 124 à 143 (moy. 135) x 131 à 184 (moy. 164); oeuf = 19 à 30 x 12 à 16 (moy. 25 x 15).

Discussion: La découverte de *P. tener* au Nord Togo élargit sa répartition aux savanes sèches d'Afrique occidentale. On peut noter que dans cette région il est inféodé à *H. occipitalis*. Au Cameroun *P. tener* a été trouvé par FISCHTHAL (1977) chez *B. regularis*, mais au Togo aucune des 112 dissections de ce crapaud ne l'a livré. L'expérience de MACY (1964) qui a obtenu l'infestation de *P. mascareniensis*, montre que la spécificité de *P. tener* n'est pas de nature physiologique, mais vraisemblablement écologique ou liee à l'éthologie des hôtes intermédiaires.

PLAGIORCHIDAE

Maederia eburnense (Maeder, 1969) (fig. 4)

Synonymie: Haplometroides eburnense Maeder, 1969; *Plagitura eburnense* (Maeder, 1969) Gassmann, 1975; *Phrynobatrachotrema eburnense* (Maeder, 1969), Goodmann, 1986.

Aprés un nouvel examen des exemplaires étudiés par Gassmann, ainsi que du matériel collecté ultérieurement au Togo, BOURGAT & COMBES (1979) concluent à l'impossibilité de les ranger ni dans le genre *Haplometroides* ni *Plagitura*, et proposent la création du nouveau genre *Maederia.*

En 1986, GOODMANN décrit des helminthes livrés par *Rana fuscigula angolensis* (Bocage, 1866) et par *Phrynobatrachus natalensis* (Smith, 1849) en Ouganda; en particulier, il en donne une description trés fine du système excréteur. Goodmann identifie son matériel à celui découvert par MAEDER (1969) en Côte d'Ivoire et par GASSMANN (1975) au Cameroun, mais il ne reconnait pas les attributions génériques (*Haplometroides, Plagitura*) proposées successivement par ces deux auteurs et crée pour l'espèce *eburnense* le genre *Phrynobatrachotrema.* Ce raisonnement, correct, ne prend toutefois pas en compte le travail de BOURGAT & COMBES (1979) et la création du genre *Maederia* qui, par antériorité, reste prioritaire. Le genre *Phrynobatrachotrema* tombe donc en synonymie avec *Maederia.*

Mentions antérieures: MAEDER (1969) chez *Phrynobatrachus sp.* et *Ptychadena longirostris* (Peters, 1870) en Côte d'Ivoire,

MAEDER & *al.* (1969a) chez *Bufo funereus funereus* Bocage, 1866 et *B. camerunensis camerunensis* Parker, 1936 au Gabon,

MAEDER & *al.* (1970) chez *Hylarana albolabris* (Hallowell, 1856) en Centrafrique,

MAEDER (1973) chez *Phrynobatrachus alleni* Parker, 1936, *P. liberiensis* Barbour & Loveridge, 1927, *P. plicatus* (Günther, 1858) et *Ptychadena longirostris* en Côte d'Ivoire,

GASSMANN (1975) chez *Bufo latifrons* Boulenger, 1900, *Hylarana sp., H. lepus* (Andersson, 1903), *H. longipes* (Perret, 1960), *Cardioglossa gracilis* Boulenger, 1900, *Phrynobatrachus auritus* Boulenger, 1900, *P. batesii* (Boulenger, 1906), *P. steindachneri* Nieden, 1910, *Pedropedetes cameronensis* Reichnow, 1914, *Astylosternus* sp., *A. batesi* (Boulenger, 1900), *Trichobatrachus robustus* Boulenger, 1900, et *Leptodactylodon ventrimarmoratus* (Boulenger, 1904) au Cameroun,

BOURGAT & COMBES (1979) chez *Phrynobatrachus accraensis* et *P. calcaratus* (Peters, 1863) au Sud Togo,

BOURGAT (1979), idem,

GOODMANN (1986) chez *R. f. angolensis* et *Phrynobatrachus natalensis* en Ouganda.

Hôte, localité et occurrence: Bufo togoensis Ahl, 1924, Tinkoro (Togo), (1/7).

Date de la récolte: 4 juillet 1978.

Habitat: Intestin. *M. eburnense* est associé à *Mesocoelium monodi.*

Matériel examiné: 1 exemplaire monté in toto.

Dimensions: L. (mm) = 2,3; I. (mm) = 0,8; V.O. = 209 x 218; Ac. = 172 x 179; V.O./Ac. = 1,22; Oes. = 155; Tes. = 150 x 221; Ov. = 195 x 300; oeuf = 42 x 28.

Discussion: L'exemplaire étudié ici présente l'intérêt de révéler un hôte nouveau, *B. togoensis*, et une localisation inédite, le Nord Togo.

Il correspond tout à fait, par ses dimensions et ses caractères morpho-anatomiques (situation de l'ovaire et des testicules, longueur des caeca jusqu'au deux tiers du corps, distribution des vitellogènes, extension de l'utérus jusqu'à l'extrémité postérieure du corps) aux principales descriptions antérieures (MAEDER *et al.* 1969, GASSMANN 1975). Le dessin de GOODMANN (1986) montre que l'utérus n'atteint pas l'extrémite postérieure du corps mais se limite au niveau du testicule droit; le texte cependant, précise "uterus ... extending posteriorly almost to end..." ce qui permet d'associer le matériel ougandais aux *M. eburnense* du reste de l'Afrique. L'aire de repartition de cette espèce s'étend donc de la Côte d'Ivoire à l'Ouganda, c'est-à-dire sur un vaste territoire paléo-tropical.

HAEMATOLOECHIDAE

Haematoloechus aubriae n. sp. (fig. 5)

Hôte: Aubria subsigillata (Duméril, 1856). Les poumons du seul individu disséqué hébergeaient l'*Haematoloechus* étudié ici; son intestin des *Mesocoelium* et des *Diplodiscus*. Au Togo, *A. subsigillata* héberge *Opisthorchis lomeensis* Bourgat & Combes, 1975, exemple rare de Trématode biliaire d'Amphibien en Afrique.

Localité: Porto-Novo (Sud Bénin). Dans cette même station, un Trématode rare a été découvert: *Gorgoderina beninensis* Bourgat, Dossou & Gasc, 1976, parasite vésical de l'Amphibien *H. occipitalis.*

Occurrence: 1/1.

Date de la récolte: 25 mai 1978.

Habitat: Poumons.

Matériel examiné: 1 exemplaire monté in toto.

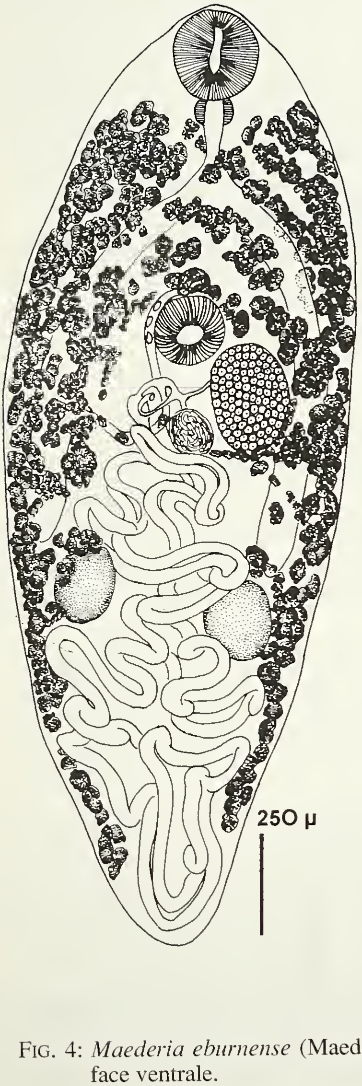
Description: Corps allongé, terminé postérieurement par un mucron; tégument lisse, relativement épais (3,5 µm); ventouse orale sub-terminale, acétabulum absent.

Appareil digestif: Cavité buccale séparée du pharynx par un court prépharynx; pharynx pyriforme; oesophage court; les caecums, aprés leur bifurcation, se dirigent transversalement, puis se contournent une fois en hélice avant de s'allonger jusqu'à proximité de l'extrémité postérieure.

Appareil reproducteur mâle: testicules globuleux, légèrement lobés, intercaecaux, situés aux 2/3 du corps, disposés en diagonale, le droit étant décalé vers l'arrière; poche du cirre conforme à la structure habituellement rencontrée chez les *Haematoloechus.* Vaisseaux efférents visibles jusqu'à leur confluent au niveau de l'ovaire.

Appareil reproducteur femelle: ovaire intercaecal, latéral droit, arrondi; réceptacle séminal grand, appliqué contre le bord interne de l'ovaire; vitellogènes rassemblés en grappes, 10 à gauche, 7 à droite, alignées latéralement en position paracaecale externe; abondantes jusqu'au niveau des testicules, on n'en compte qu'une seule dans la zone post-testiculaire; les circonvolutions de l'utérus comblent l'espace intercaecal jusqu'à la limite postérieure des caecums; il n'y a pas de boucle extracaecale.

Dimensions: L. (mm) = 9; I. (mm) = 2,45; V.O. = 454 x 484; Ac. = absent; pharynx = 225 x 206 ; Test. gauche = 605 x 681, Test. droit = 577 x 615 ; Ov. = 397; R. s. = 1300 x 700; oeuf = 34 x 22,5.



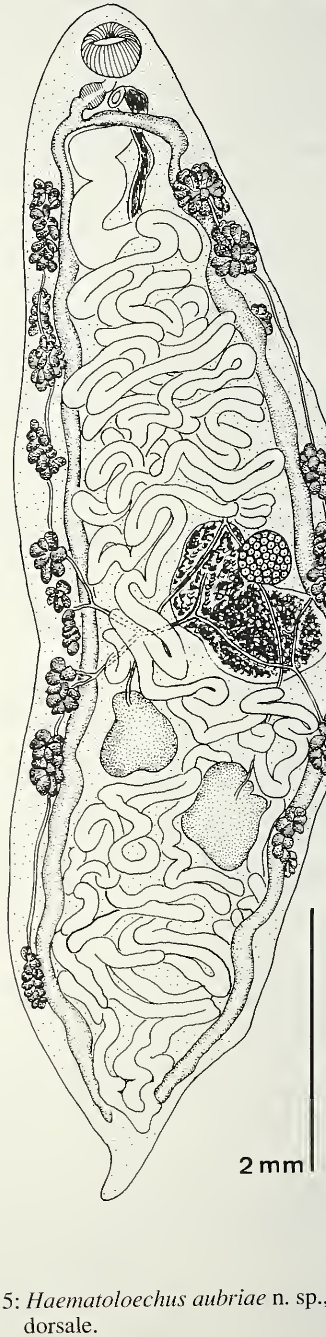


FIG. 4: *Maederia eburnense* (Maeder, 1969), face ventrale.

FIG. 5: *Haematoloechus aubriae* n. sp., face dorsale.

Dicussion: Ce Ver est un *Haematoloechus*. La présence du mucron suggère l'espèce *H. micrurus* Rees, 1964; mais, l'absence de boucle utérine extracaecale, la forme des testicules, (globuleux et non pas allongés ovales ou pyriformes), l'absence d'acétabulum, (bien que "poorly developped" selon REES, 1964, l'acétabulum existe chez *H. micrurus*), la disposition des vitellogènes, très rares dans le tiers postérieur du Ver, ne répondent pas à la diagnose de *H. micrurus*.

Depuis sa description, *H. micrurus* a été signalé chez *H. occipitalis* par:

FISCHTHAL & THOMAS (1968), au Ghana,
BAER (1972), et MAEDER (1973), en Côte d'Ivoire,
GASSMANN (1975), au Cameroun,
BOURGAT *et al.* (1976), au Bénin,
FISCHTHAL (1977), au Zaïre,
BOURGAT (1979), au Togo,
PIKE (1979), au Soudan.

Au Cameroun, ASSANJI (1990) a découvert *H. micrurus* chez *Bufo regularis*, qui n'est pas l'hôte habituel. Au Nigeria, OLADIMEJI *et al.* (1988–1990), signalent des *Haematoloechus sp.* chez *H. occipitalis*.

Malgré le nombre des collectes, leur dispersion géographique et la diversité des hôtes, aucun de ces travaux ne fait état de variations morphologiques telles que les présente notre matériel; leur déterminisme n'est donc vraisemblablement pas de nature écomorphotique. Les caractères concernant les ventouses, la taille des oeufs, les boucles utérines extracaecales, et la position des testicules ayant, selon KENNEDY (1980), la plus grande valeur taxonomique, l'*Haematoloechus* d'*Aubria subsigillata* du Bénin ne peut être identifié à l'espèce *H. micrurus*.

L'absence d'acétabulum et la présence du mucron le séparent des autres espéces d'*Haematoloechus* d'Afrique centrale et occidentale; en outre, chacune de ces espèces s'en différencie par plusieurs caractères:

H. ocellati Gassmann, 1975 – ovaire lobé, boucles utérines extracaecales présentes, vitellogènes en zone post-testiculaire, oeuf = 12 à 15,5 x 18 à 26;

H. combesi Batchvarov & Bourgat, 1974 – boucles utérines extracaecales déterminant une forme "épaulée" tout à fait particulière, vitellogènes en zone post-testiculaire, oeuf = 17 x 22;

H. darcheni Combes & Knoepffler, 1967 – acétabulum "délicat à découvrir" mais présent, ovaire trés lobé, boucles utérines extracaecales présentes, vitellogènes en zone post-testiculaire, oeuf = 14 à 17 x 18 à 22;

H. lobogonadus Meskal, 1970 – tégument spinulé, ovaire et testicules lobés, boucles utérines extracaecales présentes, vitellogènes en zone post-testiculaire, oeuf = 17 à 17,5 x 22 à 25;

H. johnsoni Bourgat, 1977 – tégument faiblement spinulé, boucles utérines extracaecales présentes, vitellogènes en zone post-testiculaire;

H. dollfusinus (Odening, 1958) – selon Dollfus (1950), ovaire lobé, circonvolutions utérines débordant les caecums, oeuf = 17 à 18,3 x 25 à 28,3;

H. variegatus leonensis Williams & Coker, 1967 – boucles utérines extracaecales présentes, vitellogènes en zone post-testiculaire.

Cet ensemble de raisons justifie la création d'une espèce nouvelle que nous proposons de nommer *Haematoloechus aubriae* pour rappeler l'identité de l'hôte. Ses principaux caractères sont: corps terminé postérieurement par un mucron, tégument lisse, acétabulum absent, prépharynx présent, testicules intercaecaux, globuleux, disposés en diagonale, ovaire arrondi, vitellogènes rares dans le tiers postérieur du corps, pas de boucle utérine extracaecale, oeufs ovales mesurant (en µm) 22,5 x 34.

L'holotype est déposé au Muséum d'Histoire naturelle de Genève sous le n° 214 77 INVE.

CONCLUSION

Cette étude a pour objet une série d'Helminthes originaires du Niger et du "corridor dahoméen", territoire étroit, étiré de l'océan au Sahel, et formé de la République du Bénin et du Togo. A ce niveau la savanne, descendue jusqu'au littoral, sépare la zone humide et forestière "éburnéo ghanéenne" occidentale, de l'orientale, ininterrompue du Nigeria à l'Afrique équatoriale. Cette situation se traduit dans la composition de la faune des Trématodes d'Amphibiens dont certaines espèces, selon BOURGAT (1979), sont ubiquistes, alors que d'autres restent inféodées à l'une ou à l'autre des trois zones.

Les résultats confortent bien le schéma général:

– l'ubiquité de *M. eburnense* et de *M. monodi* se confirme; l'aire du premier, qui parasite un hôte nouveau, se prolonge jusqu'au Nord Togo, celle du second jusqu'au Niger.

– *P. doyeri*, en parasitant un hôte nouveau pénètre dans le "corridor dahoméen" où, toutefois, il reste localisé à sa frontière orientale.

– L'aire de *P. tener* monte jusqu'aux savannes sèches où il se concentre sur un seul hôte trés inféodé aux pièces d'eau permanentes.

– Quant à *H. aubriae*, nouvelle espèce de Trématode endémique découverte dans le "corridor dahoméen" aprés *H. combesi*, *G. beninensis*, et *O. lomeensis*, il témoigne que les conditions particulières de "l'exception écologique bénino-togolaise" favorisent l'existence de formes endémiques sans interdire les espèces venues des blocs voisins.

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Aleocharinae della Colombia e dell'Ecuador: Parte I (Coleoptera, Staphylinidae)

(131° Contributo alla conoscenza delle Aleocharinae)

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Aleocharinae from Colombia and Ecuador: Part I (Coleoptera, Staphylinidae). - This paper adds further new genera, new species and data obtained in the course of many new research in Colombia and Ecuador made by the Dr H.G. Müller, Dr L. Bartolozzi and Dr Prof. H. Franz and in the past. Three new species of the tribe Myllaenini are described; four of the tribe Hygronomiini; eight of the tribe Gyrophaenini; eighteen of the tribe Diestotini; four of the tribe Homalotini and one of the tribe Bolitičharini. *Hoplandria rubicula* (Erichson) is transferred to the new genus *Cyllogerusa*; *Thamiaraea discors* (Erichson) in transferred to the new genus *Trichidryas*. The new genera *Polytelusa* and *Caralepta* are described for two new species. Four new combinations are recorded.

Key-words: Coleoptera - Staphylinidae - Aleocharinae - Taxonomy - Colombia - Ecuador.

INTRODUZIONE

E' noto che le foreste pluviali e le regioni montuose del Sudamerica ospitano un gradissimo numero di specie animali e vegetali. Allorché il Dr Hans Georg Müller dell'Università di Giessen ha effettuato ricerche sui Pantopodi in Colombia, non ha trascurato di raccogliere anche esemplari di Aleocharinae. Essi, affidatimi in esame tramite il Dr Volker Puthz della "Limnologische Flusstation" di Schlitz, sono qui pubblicati. Al termine dell'esame del materiale di Aleocharinae raccolto dal Dr. Müller, ho constatato anche per questa sottofamiglia di Stafilinidi una presenza molto consistente di specie per la Colombia, per lo più non ancora descritte. A questo materiale ho aggiunto altre specie della Colombia e del confinante Ecuador: un gruppo appartiene a un vecchio fondo delle collezioni dello "Zoologisches Museum" dell'Università Humboldt di Berlino, fondo affidatomi in studio dal Dr M. Uhlig di detto Museo. Un altro lotto di Aleocharinae fa parte delle raccolte effettuate in Ecuador dal Prof. H. Franz di Mödling, Vienna. Un ultimo lotto aggiunto è il frutto di recenti ricerche effettuate dal Dr Luca Bartolozzi del Museo Zoologico "La Specola" dell'Università di Firenze.

Manoscritto accettato il 25.08.1995.

Gli holotypi sono conservati nel "Muséum d'Histoire naturelle" di Ginevra (MG), nello "Zoologisches Museum" dell'Università Humboldt di Berlino (MB), in collezione del Prof. Franz (CFR) e nel Museo Zoologico "La Specola" dell'Università di Firenze. Alcuni paratypi sono conservati anche nel "Museo Zoologico della Pontificia Università Catòlica del Ecuador" di Quito (MQ).

ELENCO DELLE SPECIE (escluse le nuove)

OLIGOTINI

Oligota (s. str.) **parva** Kraatz, 1862

Oligota parva Kraatz, 1862: 300
1 ♀, Ecuador, Manabi, dint. Puerto Cayo, 21.II.1993 (L. Bartolozzi & G. Onore leg.).

Specie a larga diffusione, dal Nordafrica attraverso le Canarie fino al Nordamerica, Messico e Brasile. Nuova per l'Ecuador.

Oligota (s. str.) **tricolor** Biering, 1934

Oligota tricolor Biering, 1934: 116; Frank, 1972: 139
1 ♀, Kolumbien Villa Culebra bei Bonda, X.1985 (H.G. Müller leg.).

Specie finora nota solo di Cuba.

GYROPHAENINI

Gyrophaena (s. str.) **quassa** Sharp, 1876

Gyropnaena quassa Sharp, 1876: 76
6 es., Colombia, Muzo (Collez. Mus. Berlin).

Specie diffusa nella regione amazzonica.

Gyrophaena (Agaricochara) mahunkai Pace, 1991

Gyrophaena (Agaricochara) mahunkai Pace, 1991: 154
1 ♂ e 3 ♀♀, Kolumbien, Villa Culebra bei Bonda, ca. 10 Km E Sta. Marta, XI–XII.1985, Barberfallen, (Müller leg.).

Specie finora nota solo dell'Isola di Sta. Lucia.

DIESTOTINI

Plesiomalota (s. str.) **hispidula** (Fauvel, 1866)

Homalota hispidula Fauvel, 1866: 316
Atheta (s. str.) *hispidula*: Bernhauer & Scheerpeltz, 1926: 644
Plesiomalota (s. str.) *hispidula*: Pace, 1986: 425
3 es., Ecuador, Rio Hollin, 9–13.II.1993, (Bartolozzi leg.).

Specie finora nota solo del Cile.

Diestota (Apheloglossa) curticollis (Erichson, 1840), **comb. n.**

Homalota curticollis Erichson, 1840: 118

Atheta (s. str.) *curticollis:* Bernhauer & Scheerpeltz, 1926: 641

3 ♀♀, Kolumbien, Bahia de Cinto, Tayrona Park, ca. 30 Km NE Sta. Marta, Fallaub, IV.1985 (Müller leg.); 1 ♀, Kolumbien, Dept. Magdalena, Rio Frio, ca. 50 Km NE Sta. Marta, 21.VIII.1985, (Müller leg.).

Specie già nota della Colombia. La nuova combinazione è stabilita dopo esame della serie tipica di Aragua (Colombia) composta di sole femmine.

Diestota (Apheloglossa) flavipennis (Erichson, 1940), **comb. n.**

Homalota flavipennis Erichson, 1840: 118

Atheta (s. str.) *flavipennis:* Bernhauer & Scheerpeltz, 1926: 643

3 ♀♀, Kolumbien, Punta de Betin, Sta. Marta, IV.1986, (Müller leg.).

Specie finora nota solo dell'Isola di St. John (Antille). Combinazione nuova stabilita in base all'esame degli esemplari della serie tipica di St. John.

Eudera didyma (Erichson, 1840), **comb. n.**

Homalota didyma Erichson, 1840: 116

Ophioglossa didyma: Bernhauer & Scheerpeltz, 1926: 570

Diestota (Apheloglossa) didyma: Pace, 1987: 188

2 ♀♀, Kolumbien, Punta de Betin, Sta. Marta, 12.IV.1986, (Müller leg.); 1 ♂, Kolumbien, Villa Culebra bei Bonda, ca. 10 Km E Sta. Marta, 1.XII.1985, (Müller leg.).

Specie già nota della Colombia e di Guadalupa.

Questa specie va esclusa dal genere *Ophioglossa* perché non presenta il mento profondamente incavato al margine anteriore e da *Diestota* per avere il collo stretto.

Eudera bisulcata (Erichson 1840), **comb. n.**

Homalota bisulcata Erichson, 1840: 117

Ophioglossa bisulcata: Bernhauer & Scheerpeltz, 1926: 569

2 ♂♂, Kolumbien, Sierra Nevada de Sta. Marta, bei San Pedro de la Sierra, 12.IV.1986, (Müller leg.).

Specie presente in Colombia e in Brasile.

Anche questa specie va esclusa dal genere *Ophioglossa* perché il margine anteriore del mento non è profondamente incavato.

BOLITOCHARINI

Thecturota schuberti (Pace, 1983), **comb. n.**

Leptischnusa schuberti Pace, 1983: 308

1 ♀, Kolumbien, Punta de Betin, 1–26.IV.1986, (Müller leg.).

Specie diffusa in Brasile, in Bolivia e in Cile. Nuova per la Colombia.

Raccolta al lume.

FALAGRIINI

Falagria (Myrmecocephalus) stricta Erichson, 1840

Falagria stricta Erichson, 1840: 51

1 ♂, Kolumbien, Nördl. Sierra Nevada de Sta. Marta, San Lorenzo, 1700 m, 25.VIII.1985, (Müller leg.); 9 es., Kolumbien, Sierra Nevada de Sta. Marta, San Pedro de la Sierra, 12.IV.1986, (Müller leg.).

Specie già nota della Colombia e del Venezuela.

Meronera albicincta (Erichson, 1840)

Falagria albicincta Erichson, 1840: 56
Meronera albicincta: Bernhauer & Scheerpeltz, 1926: 580
1 ♀, Kolumbien, Sierra Nevada de Sta. Marta, San Pedro de la Sierra, 12.IV.1986, (Müller leg.); 1 ♀, Kolumbien, Villa Culebra bei Bonda, ca. 10 Km E Sta. Marta, XI–XII.1985, Barberfallen, (Müller leg.); 25 es., Kolumbien, Punta de Betin, Sta. Marta, IV.1986, Farbschalen, (Müller leg.); 1 ♂, Ecuador, Cotopaxi, S. Francisco de las Pampas, 1300–1500 m, II.1993, (Bartolozzi leg.).

Specie diffusa in Colombia, Venezuela, Brasile, Cuba, Messico e Guadalupa. Nuova per l'Ecuador.

ATHETINI

Atheta (Microdota) brasiliana Bernhauer, 1908

Atheta (Microdota) brasiliana Bernhauer, 1908: 358
1 ♀, Kolumbien, Bahia de Gairaca, Tayrona Park, ca. 20 Km NE Sta. Marta, 31.X.1985 (Müller leg.); 11 es., Kolumbien, Villa Culebra bei Bonda, ca. 10 Km E Sta. Marta, XI–XII.1985, (Müller leg.).

Specie finora nota solo del Brasile.

Il confronto con la spermateca e l'edeago dei tipi rende indubbia l'attribuzione specifica.

Atheta (Acrotona) parcior Bernhauer, 1927

Atheta (Acrotona) parcior Bernhauer, 1927: 257
1 ♂, Ecuador, Cotopaxi, S. Francisco de las Pampas, 1300–1500 m, II.1993, (Bartolozzi leg.).

Specie finora nota dell'Argentina, del Brasile e del Cile. Esemplari comparati con l'holotypus ♂ di Caspinchango.

Atheta (Datomicra) columbica Fauvel, 1901

Atheta columbica Fauvel, 1901: 88
22 es., Kolumbien, Villa Culebra bei Bonda, ca. 10 Km E Sta. Marta, XI–XII.1985, (Müller leg.; 175 es., Kolumbien, Punta de Betin, Sta. Marta, IV.1986, (Müller leg.); 1 ♂ e 2 ♀♀, Kolumbien, Bahia de Gairaca, Tayrona Park, ca. 20 Km NE Sta. Marta, 19.VI.1985, (Müller leg.).

Specie finora rinvenuta solo in Colombia, comparata con i tipi.

Atheta (Datomicra) conformis (Erichson, 1840)

Homalota conformis Erichson, 1840: 108
Atheta (s. str.) *conformis* Bernnauer & Scheerpeltz, 1926: 640
3 ♂♂ e 3 ♀♀, Ecuador, Cotopaxi, S. Francisco de las Pampas. 1300–1500 m, II.1994, (Bartolozzi leg.); 2 ♀♀, Kolumbien, Punta de Betin, Sta. Marta, IV.1986, (Müller leg.); 2 ♂♂, Kolumbien, Villa Culebra bei Bonda. 10 Km E Sta. Marta, XI–XII.1985, (Müller leg.).

Specie diffusa in Colombia, Venezuela, Isola di St. Thomas e Puertorico, comparata con i tipi.

Atheta (Datomicra) pseudogagatina Bernhauer, 1934

Atheta (s. str.) *pseudogagatina* Bernhauer, 1934: 504

1 ♂, Kolumbien, Punta de Betin, Sta. Marta, XI–XII.1985, (Müller leg.).

Specie diffusa in Argentina e Brasile. Nuova per la Colombia.

L'holotypus è una femmina.

Atheta (Dimetrota) bicallosa Bernhauer, 1920

Atheta bicallosa Bernhauer, 1920: 152

1 ♂, Kolumbien, Nord-Westl. Sierra Nevada de Sta. Marta, 1000 m, 12.IV.1986, (Müller leg.); 1 ♂ e 2 ♀♀, Kolumbien, Sierra Nevada de Sta. Marta nahe San Pedro, 12.IV.1986, (Müller leg.).

Specie montana diffusa solo in Colombia, comparata con i tipi.

Atheta (Pseudobessobia) columbina Bernhauer, 1920

Atheta (s. str.) *columbina* Bernhauer, 1920: 151

1 ♀, Kolumbien, Punta de Betin, Sta. Marta, 27.IV.1986, (Müller leg.).

Specie finora nota sul solo holotypus ♀ della Colombia da me esaminato. La forma della spermateca, senza difficoltà, permette di attribuire la specie al sottogenere *Pseudobessobia* Bernhauer, 1921, il cui genotipo *weiseri* Bernhauer ho esaminato.

Lamprostiba schwabei (Bernhauer, 1939)

Atheta (Philhygra) schwabei Bernhauer, 1939: 14

Lamprostiba schwabei: Pace, 1986: 444

1 ♀, Ecuador, Cotopaxi, S. Francisco de las Pampas, 1300–1500 m, II.1993, (Bartolozzi leg.).

Specie del Cile e del Perù. Nuova per l'Ecuador.

SCHISTOGENIINI

Neoplatyola hospes (Pace, 1990), **comb. n.**

Platyola hospes Pace, 1990: 70

3 ♂♂, Kolumbien, Punta de Betin, 1–10.V.1986, (Müller leg.).

Specie segnalata per il Brasile e la Bolivia. Nuova per la Colombia.

DESCRIZIONI

MYLLAENINI

Myllaena chibcha sp. n. (Figg. 1–4)

TIPI. Holotypus ♂, Kolumbien, Punta de Betin, Sta. Marta, IV.1986, (Müller leg. MG).

Paratypi: 2 ♀♀, stessa provenienza; 21 es. Punta de Betin, 1–26.IV.1986, Lichtfalle und Farbschalen, (Müller leg.).

DESCRIZIONE. Lunghezza 2,1 mm. Avancorpo opaco, addome lucido. Corpo bruno-rossiccio; addome bruno con apice rossiccio; antenne nere con antennomeri 1, 9, 10 e 11 giallo-rossicci; zampe giallo-rossicce. Una pubescenza fitta copre l'intero corpo. Edeago figg. 2–3, spermateca fig. 4.

COMPARAZIONI. Per la forma della spermateca la nuova specie può essere avvicinata tassonomicamente a *M. insipiens* Casey, 1911, del Nordamerica, ma l'edeago è meno profondamente ricurvo al lato ventrale e ha pezzi copulatori del sacco interno molto robusti (esilissimi in *insipiens*). Inoltre la spermateca della nuova specie presenta più complesse circonvoluzioni della parte prossimale rispetto quelle semplici di *insipiens*.

ETIMOLOGIA. Dai Chibha, popolazione colombiana stanziata sugli altipiani della Colombia al tempo della conquista spagnola.

Myllaena muelleri sp. n. (Figg. 5–8)

TIPI. Holotypus ♂, Kolumbien, Punta de Betin, Sta. Marta, IV.1986, Farbschalen, (Müller leg., MG).

Paratypus: 1 ♀, stessa provenienza.

DESCRIZIONE. Lunghezza 2,0 mm. Corpo debolmente lucido e bruno-rossiccio; capo bruno; margine posteriore degli uroterghi e quinto urotergo libero, tranne la base, rossicci; antenne nere con antennomeri 1 e 11 rossicci; zampe giallo-rossicce. L'intero corpo è coperto di fitta e aderente pubescenza. Edeago figg. 6–7, spermateca fig. 8.

COMPARAZIONI. Specie tassonomicamente avvicinabile a *M. currax* Notman, 1920 della Florida, in base alla forma della spermateca che ha la parte prossimale flessa su sè stessa. Tuttavia la nuova specie presenta bulbo distale della spermateca stessa molto più dilatato e il sacco interno dell'edeago presenta delle spine, assenti nel sacco interno dell'edeago di *currax*.

ETIMOLOGIA. Specie dedicata al suo raccoglitore, il Dr Hans Georg Müller di Giessen, studioso di "Pantopoda".

Myllaena puthzi sp. n. (Figg. 9–12)

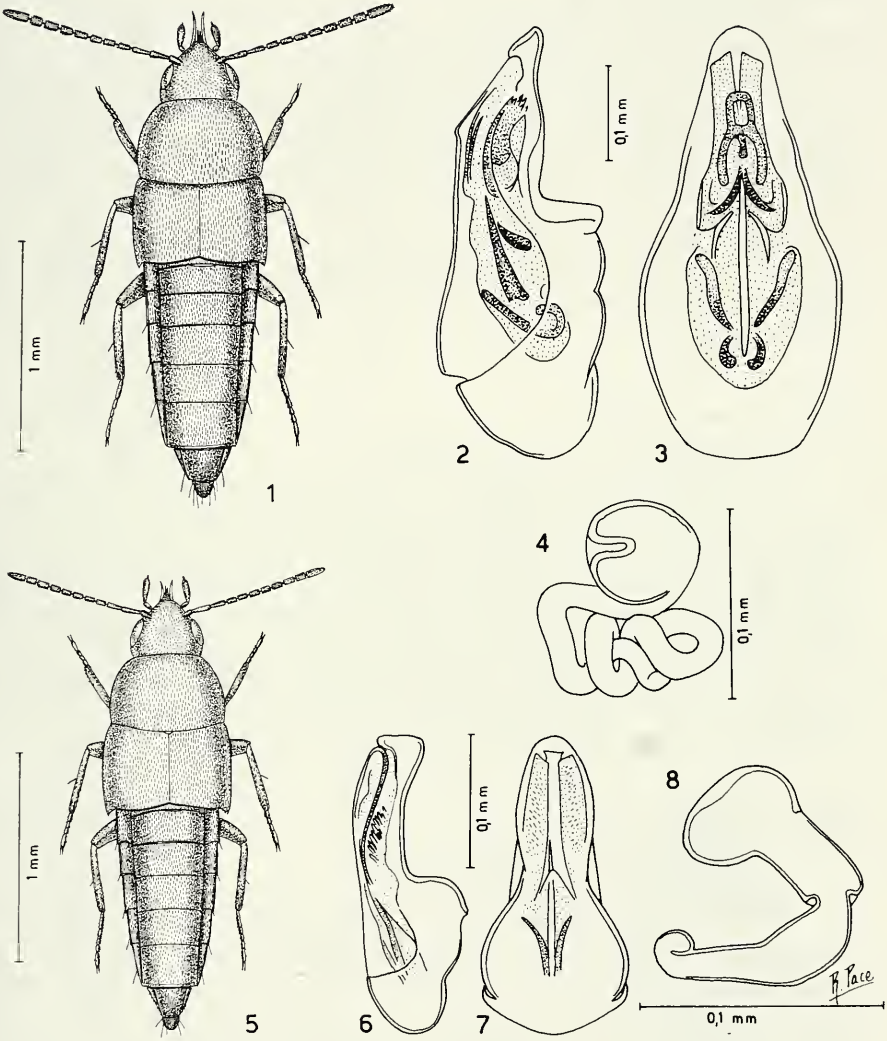
TIPI. Holotypus ♂, N Kolumbien, Nordwestl. Sierra Nevada de Sta. Marta, ca. 1000 m, nahe San Pedro de la Sierra, | 12.IV.1986, Fallaub, (Müller leg., MG).

Paratypi: 1 ♂ e 3 ♀♀, stessa provenienza; 3 ♀♀, Kolumbien, Nördl. Sierra Nevada de Sta. Marta, nähe El Campero, ca. 1000 m, aus Fall-Laub, 29.IV.1986. (Müller leg.).

DESCRIZIONE. Lunghezza 2,3 mm. Corpo debolmente opaco e bruno; estremità addominale bruno-rossiccia; antenne brune con antennomeri 1, 8, 9, 10 e 11 giallo-rossicci; zampe giallo-rossicce. L'intero corpo è coperto di pubescenza fitta e corta. Edeago figg. 10–11, spermateca fig. 12.

COMPARAZIONI. Anche questa specie, come la precedente, per la forma della spermateca è tassonomicamente avvicinabile a *M. currax* Notman, 1920, della Florida. Ma la nuova specie è microttera, non atta al volo e la parte prossimale della sua spermateca è nettamente più corta di quella di *currax* e il bulbo distale della spermateca stessa è molto più sviluppato. Anche l'edeago della nuova specie presenta caratteri differenziali: tra l'altro la parte preapicale in visione laterale, è gibbosa ventralmente, mentre in *currax* è piana.

ETIMOLOGIA. La specie è dedicata al Dr Volker Puthz di Schlitz, noto studioso di Steninae. Ciò in segno di ringraziamento per avermi affidato in studio le Aleocharinae della Colombia raccolte dal Dr Müller e qui illustrate.



FIGG. 1–8

Habitus, edeago in visione laterale e ventrale e spermateca. 1–4: *Myllaena chibcha* sp. n.; 5–8: *Myllaena muelleri* sp. n.

HYGRONOMIINI

Gyronycha filiformis sp. n. (Figg. 13–17)

TIPO. Holotypus ♀, Kolumbien, Punta de Betin, Sta. Marta, 1–26.IV.1986, Lichtfalle und Farbschalen, (Müller leg., MG).

DESCRIZIONE. Lunghezza 1,6 mm. Corpo lucido e bruno-giallioccio, comprese le antenne che però hanno i due antennomeri basali gialli; zampe gialle. L'avancorpo è coperto di punteggiatura fitta e superficiale; l'addome è coperto di tubercoletti fini. La reticolazione è assente sull'avancorpo ed è estremamente svanita sull'addome. Spermateca fig. 17.

COMPARAZIONI. La nuova specie è distinta da *G. valens* Casey, 1893, specie nordamericana, per avere contemporaneamente capo più stretto del pronoto e antenne corte. Nella specie nordamericana, che ha capo più stretto del pronoto, le antenne sono molto lunghe.

Caloderella neotropica sp. n. (Figg. 18–21)

TIPO. Holotypus ♂, Colombia, Buga (MB).

DESCRIZIONE. Lunghezza 3,7 mm. Corpo lievemente opaco e rossiccio; quarto urite libero bruno-rossiccio; antenne rossicce; zampe giallo-rossicce. Il capo e il pronoto non hanno microscultura reticolare e sono coperti di punteggiatura fine, netta e profonda. La reticolazione che copre le elitre è svanita, quella dell'addome è netta, a maglie circolari. La punteggiatura delle elitre è ben distinta. Il quinto urotergo libero ha pubescenza meno fitta di quella del primo e secondo visibili. Edeago figg. 19–21.

COMPARAZIONI. La nuova specie è distinta da *C. argentina* Bernhauer, 1912, dell'Argentina, per la taglia maggiore: 3,7 mm invece di 2,2–2,8 mm e per avere il pronoto lungo quanto largo (più lungo che largo in *argentina*).

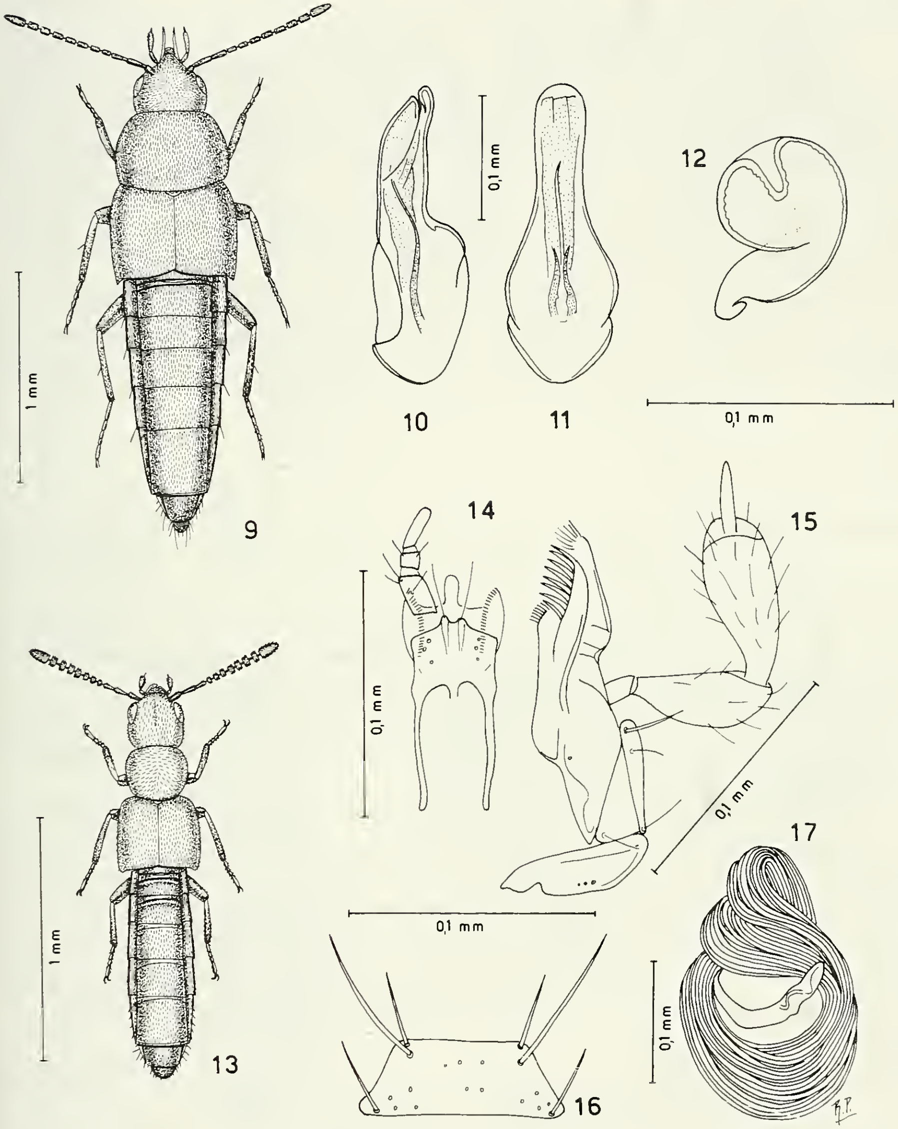
Caloderella humboldti sp. n. (Figg. 22–26)

TIPI. Holotypus ♂, Colombia, Muzo, (MB).
Paratypus: 1 ♀, stessa provenienza.

DESCRIZIONE. Lunghezza 3,7 mm. Corpo debolmente lucido e rossiccio scuro; elitre bruno-rossicce; antenne rossicce con antennomero basale giallo; zampe giallo-rossicce. Indistinta è la reticolazione dell'avancorpo, quella dell'addome, al contrario, è netta. La punteggiatura dell'avancorpo è fitta e molto superficiale. Il quinto urotergo libero del maschio presenta un gruppo di tubercoli nettamente salienti sulla metà: ai lati i tubercoli sono finissimi. Edeago figg. 23–25, spermateca fig. 26.

COMPARAZIONI. Specie simile a *C. fraterna* Bernhauer, 1912, dell'Argentina, ma differente, tra l'altro, per la taglia maggiore (3.7 mm, invece di 3,0 mm) e per il quinto urotergo libero del maschio coperto di granuli meno fittamente distribuiti.

ETIMOLOGIA. Specie dedicata ad Alexander von Humboldt, geografo e naturalista tedesco, a ricordo del suo viaggio di studio tra il 1759 e il 1804 attraverso i paesi dell'America meridionale.



FIGG. 9–17

Habitus, edeago in visione laterale e ventrale, spermateca, labio con palpo labiale, maxilla con palpo mascellare e mento. 9–12: *Myllaena puthzi* sp. n.; 13–17: *Gyronycha filiformis* sp. n.

Caloderella carinata sp. n. (Figg. 27–30)

Tipi. Holotypus ♂, Bogota (MB).
Paratypus: 1 ♀, stessa provenienza.

Descrizione. Lunghezza 3,9 mm. Corpo un po' appiattito, lucido e giallo-rossiccio; elitre giallicce; antenne e zampe giallo-rossicce. L'avancorpo è privo di reticolazione, l'addome presenta reticolazione distinta. La punteggiatura del capo, del pronoto e delle elitre è fine, fitta e netta. Il primo urotergo libero del maschio è attraversato sulla linea mediana da una carena smussata e molto saliente all'indietro. Un tubercolo basale mediano inciso longitudinalmente sta sul quinto urotergo libero del maschio. Edeago figg. 28–29, spermateca fig. 30.

Comparazioni. A motivo della presenza di caratteri sessuali secondari sul primo e sul quinto degli uroterghi liberi del maschio, costituiti da carena mediana e da tubercolo mediano basale, la nuova specie è ben distinta sia da *C. argentina* Bernhauer, 1912, che da *C. fraterna* Bernhauer, 1912, entrambe dell'Argentina.

GYROPHAENINI

Brachida columbiensis sp. n. (Figg. 31–34)

Tipo. Holotypus ♂, Colombia, (Moritz leg., N° 5272 MB, cotypus di *Myrmedonia tumidula* Erichson, 1840).

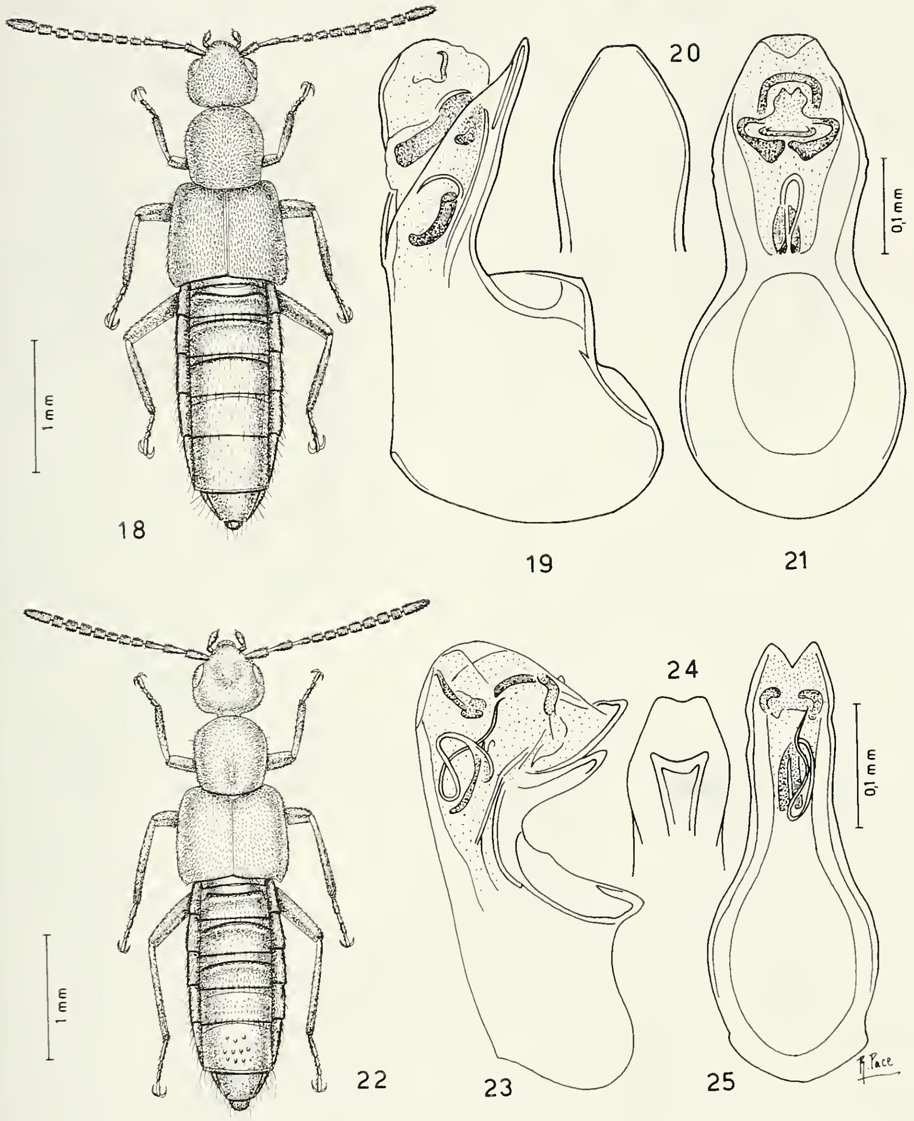
Descrizione. Lunghezza 2,2 mm. Corpo lucidissimo e giallo-rossiccio; elitre brune con base rossiccia; addome giallo-rossiccio chiaro con uriti liberi terzo e quarto di un rossiccio scuro; antenne bruno-rossicce con gli antennomeri basali 1° a 4° e 11° gialli; zampe giallo-rossicce. Sul corpo non vi è traccia di reticolazione. La punteggiatura del capo è indistinta, quella del pronoto e dell'addome è assai svanita. Edeago figg. 32–34.

Comparazioni. La nuova specie è ben distinta da *B. hirta* (Erichson, 1840), del Brasile, per la taglia minore, per gli antennomeri 4° a 7° molto più lunghi che larghi (appena più lunghi che larghi in *hirta*) e per la pubescenza del corpo corta (molto lunga in *hirta*). Non è possibile il confronto della forma dell'edeago poiché l'holotypus di *hirta* è una femmina. Non è il caso di fare comparazioni con *B. importuna* (Erichson, 1840) della Colombia poiché essa va trasferita al genere *Orphnebius* Motschulsky, 1858, come ho constatato esaminando i tipi, **comb. n.**

Brachida caldasensis sp. n. (Figg. 35–38)

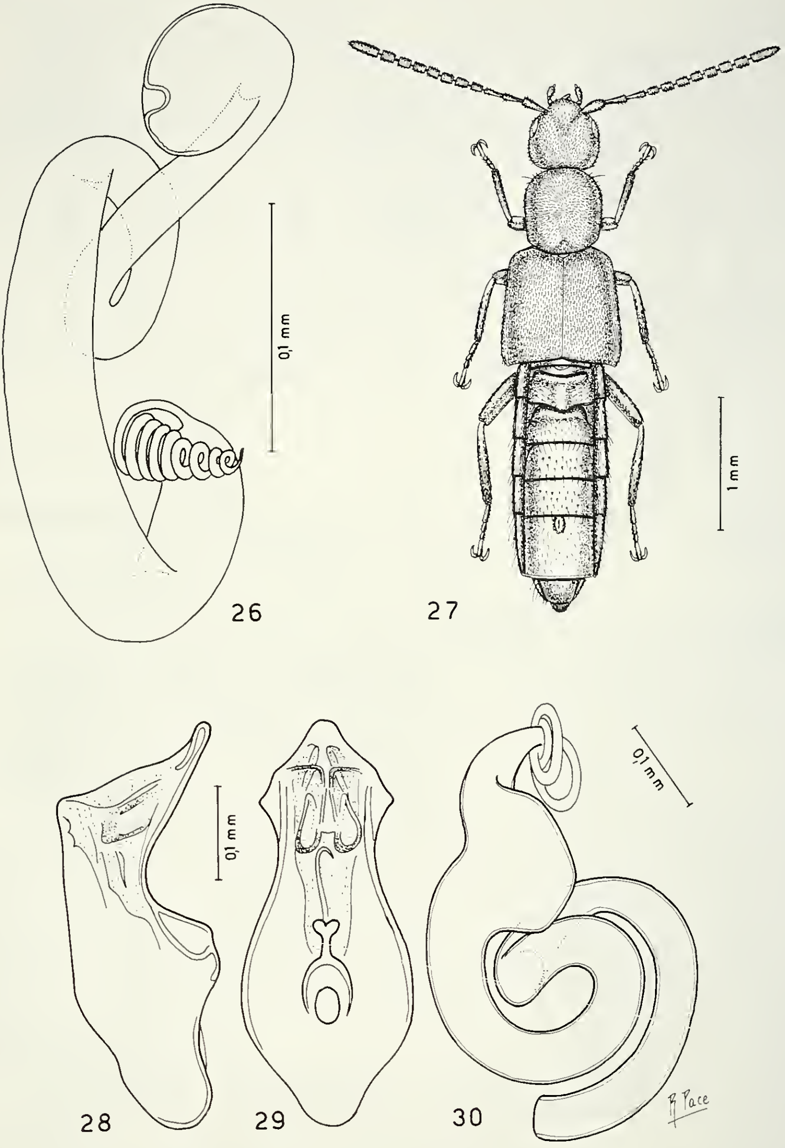
Tipi. Holotypus ♂, C. Vieja (MB).
Paratypi: 3 ♀♀, stessa provenienza; 2 ♀♀, Colombie, Cordill.re Centr., 1877, (Dr O. Thième, MB).

Descrizione. Lunghezza 3,4 mm. Corpo lucidissimo e giallo-rossiccio; parte posteriore delle elitre sfumata di bruno; antenne giallo-rossicce con gli antennomeri 1° a 4° e 11° gialli; zampe giallo-rossicce. Sul corpo non vi è traccia di reticolazione. Assente è la punteggiatura sul capo e sul pronoto, quella delle elitre è fine e svanita. Solo il quinto urotergo libero presenta una reticolazione svanita. Edeago figg. 36–37, spermateca fig. 38.



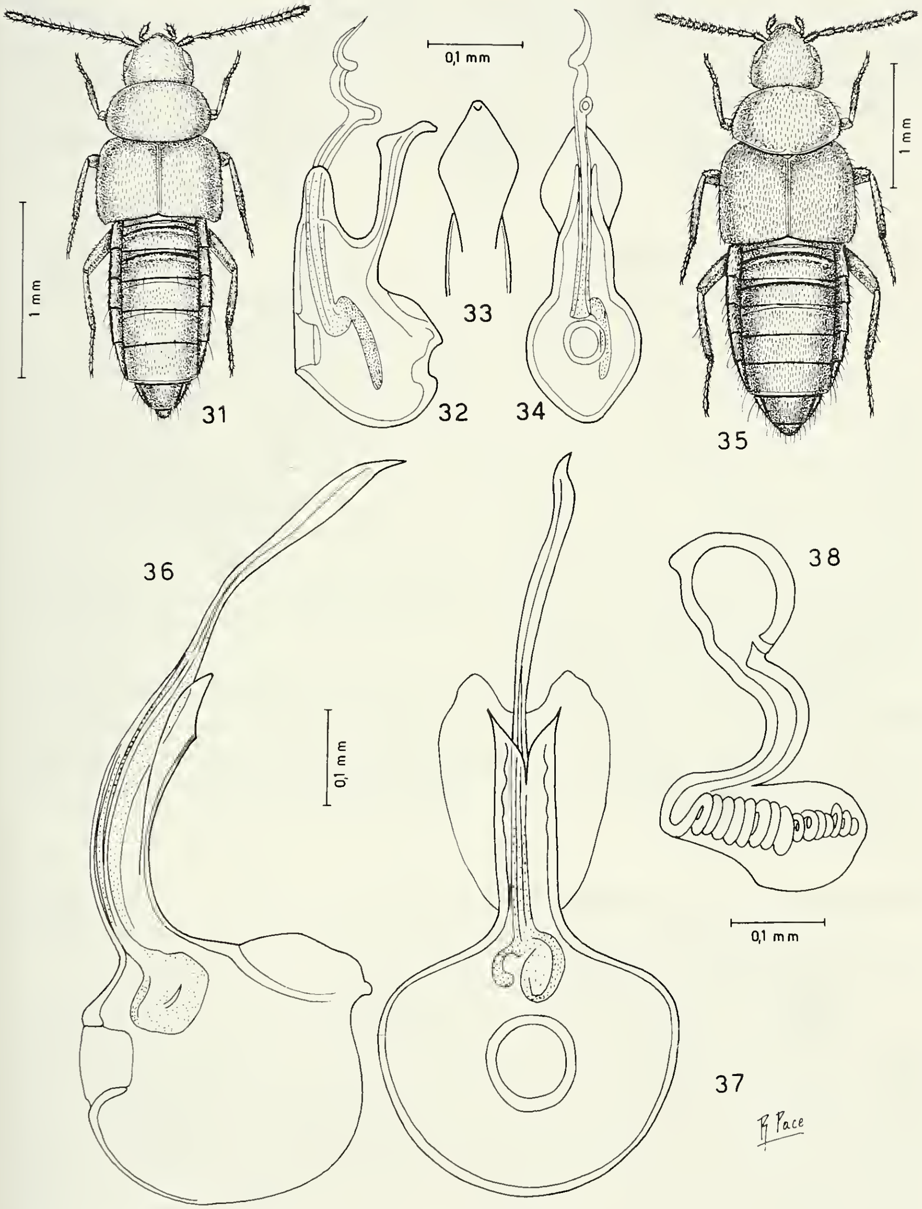
FIGG. 18–25

Habitus ed edeago in visione laterale, ventrale (solo l'apice) e dorsale. 18–21: *Caloderella neotropica* sp. n.; 22–25: *Caloderella humboldti* sp. n.



FIGG. 26–30

Spermateca, habitus ed edeago in visione laterale, ventrale. 26: *Caloderella humboldti* sp. n.; 27–30: *Caloderella carinata* sp. n.



FIGG. 31–38

Habitus, edeago in visione laterale, ventrale e dorsale e spermateca. 31–34: *Brachida columbiensis* sp. n.; 35–38: *Brachida caldasensis* sp. n.

Comparazioni. La nuova specie mostra qualche affinità con *B. tumidula* (Erichson, 1840), della Colombia, a motivo della forma dell'edeago. Ma quello della nuova specie, se visto ventralmente, è molto largo e ha l'apice incavato, mentre l'edeago di *tumidula* è stretto e termina a punta aguzza. Inoltre l'addome di *tumidula* ha pubescenza molto lunga (corta nella nuova specie).

Etimologia. La nuova specie prende nome da Caldas, regione della Cordillera Centrale della Colombia.

Gyrophaena (s. str.) **spatulata** sp. n. (Figg. 38bis–43)

Tipi. Holotypus ♂, Ecuador, Cotopaxi, S. Francisco de Las Pampas, 1300–1500 m, V.1993, (L. Bartolozzi leg., N° 9853, MF).

Paratypi: 5 es., stessa provenienza (N° 9854 MF, MQ).

Descrizione. Lunghezza 2,2 mm. Corpo lucidissimo. Sono neri il capo e le elitre, tranne gli omeri che sono bruni; pronoto bruno con margini laterali e posteriore giallo-rossicci; addome giallo-rossiccio, tranne il quarto urite libero che è bruno; antenne gialle con estremità distale sfumata di bruno; zampe gialle. La punteggiatura del capo e del pronoto è come da fig. 38. Le elitre presentano punteggiatura fine e tubercoletti salienti solo presso la sutura. La reticolazione è assente sul capo e il pronoto, quella delle elitre e dell'addome è molto svanita: il quarto urotergo libero ha reticolazione distinta, il quinto reticolazione netta e quattro carene, nel maschio. Edeago figg. 39–40, spermateca fig. 41, sesto urotergo libero del maschio fig. 42, sesto urotergo libero della femmina fig. 43.

Comparazioni. La nuova specie è tassonomicamente vicina a *G. quassa* Sharp, 1876 dell'Amazzonia, a motivo della presenza di un robusto pezzo copulatore del sacco interno dell'edeago. Tuttavia, l'edeago della nuova specie presenta un ampio lobo laterale apicale, assente in *quassa* e apice dell'edeago molto prolungato al lato ventrale (corto in *quassa*).

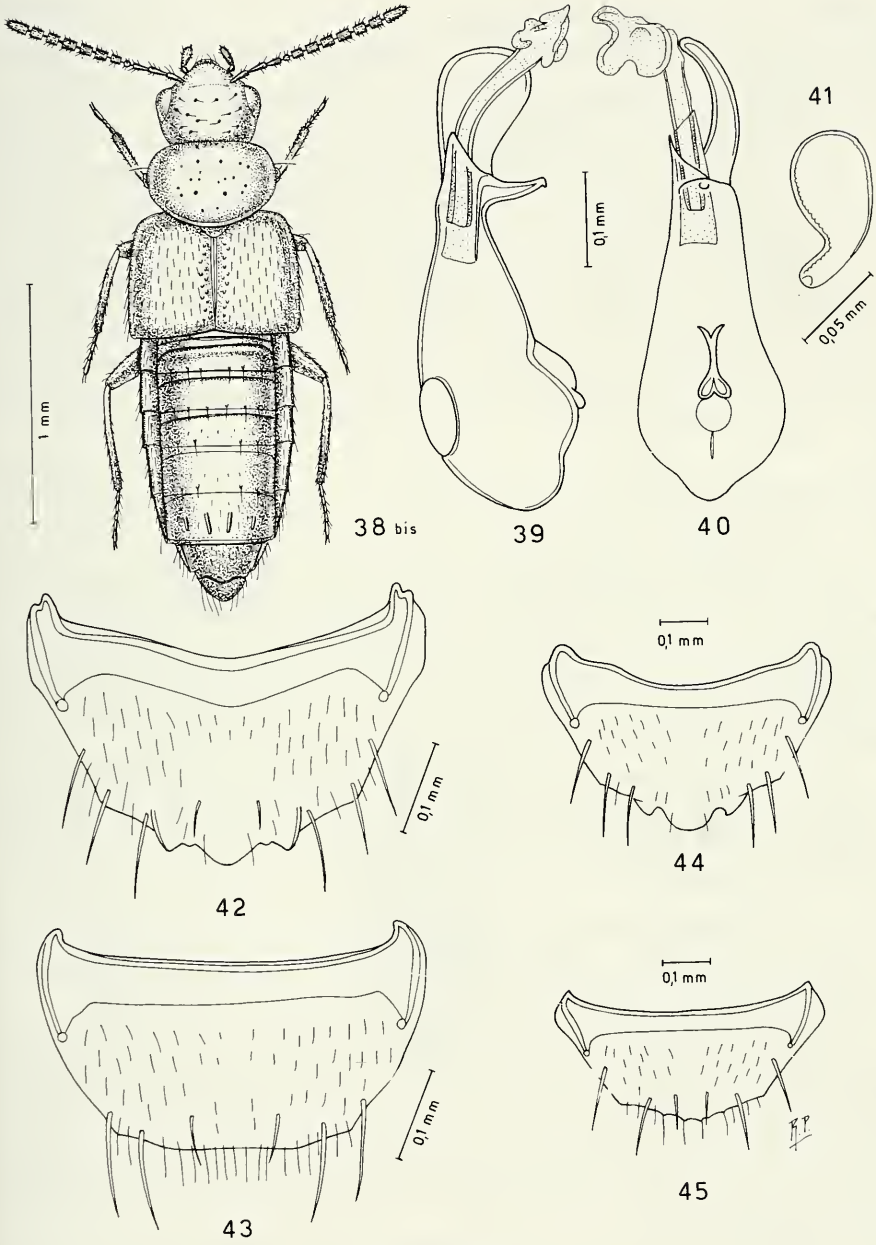
Gyrophaena (s. str.) **cotopaxiensis** sp. n. (Figg. 44–49)

Tipi. Holotypus ♂, Ecuador, Cotopaxi, S. Francisco de Las Pampas, 1300–1500 m, II.1993, (L. Bartolozzi leg., N° 9851, MF).

Paratypi: 7 es. stessa provenienza (N° 9852, MF e MQ).

Descrizione. Lunghezza 3,3 mm. Corpo lucido e nero; elitre nero-brune, antenne brune con i quattro antennomeri basali gialli e i tre seguenti giallo-bruni; zampe gialle con femori bruni. Il corpo è privo di reticolazione, tranne sul quinto urotergo libero dove è estremamente svanita. La punteggiatura del capo e del pronoto è come da fig. 46. Le elitre sono coperte di robusti tubercoli poco salienti: fra essi stanno tubercoletti fini, assenti all'angolo posteriore esterno che è compresso. Sesto urotergo libero del maschio fig. 44, sesto urotergo libero della femmina fig. 45, edeago figg. 47–48, spermateca fig. 49.

Comparazioni. Specie tassonomicamente vicina a *G. quassa* Sharp, 1876, dell'Amazzonia, ma ben distinta per l'edeago molto più sviluppato, con parte apicale fortemente asimmetrica (in visione ventrale), (simmetrica in *quassa*).



FIGG. 38 bis–45

Habitus, edeago in visione laterale e ventrale, spermateca e sesto urotergo libero del maschio e della femmina. 38 bis–43: *Gyrophaena* (s. str.) *spatulata* sp. n.; 44–45: *Gyrophaena* (s. str.) *cotopaxiensis* sp. n.

Gyrophaena (Agaricochara) martensis sp. n. (Figg. 50–53)

Tipo. Holotypus ♂, Kolumbien, Punta de Betin, Sta. Marta, IV.1986, Farbschalen, (Müller leg., MG).

Descrizione. Lunghezza 1,3 mm. Corpo lucido e bruno-gialliccio; antenne giallo-rossicce con undicesimo antennomero oscurato; zampe gialle. La reticolazione del capo e del pronoto è svanita, quella delle elitre è netta. Il capo e il pronoto sono coperti di punteggiatura superficiale. Le elitre mostrano tubercoletti poco salienti su tutta le loro superficie. Edeago figg. 51–52, sesto urotergo libero del maschio fig. 53.

Comparazioni. In base alla forma dell'edeago, la nuova specie è tassonomicamente affine a *G. anomala* Notman, 1920, della Florida. Tuttavia l'apice dell' edeago della nuova specie è piegato ad uncino verso il lato dorsale, mentre quello di *anomala* è volto al lato ventrale. Inoltre il sesto urotergo libero del maschio di *anomala* è privo di caratteri sessuali secondari al margine posteriore, mentre nella nuova specie è presente una punta mediana, larga e arrotondata.

Gyrophaena (Agaricochara) perincisa sp. n. (Figg. 54–56)

Tipo. Holotypus ♀, Ecuador, Cotopaxi, S. Francisco de Las Pampas, 1300–1500 m, II.1993, (L. Bartolozzi leg., N° 9848, MF).

Descrizione. Lunghezza 1,8 mm. Corpo lucido e nero; antenne nere con i tre antennomeri basali gialli; zampe gialle. La reticolazione del capo e del pronoto è estremamente svanita, quella delle elitre è distinta e quella dell'addome è netta. La punteggiatura del capo e del pronoto è fine. Distinti tubercoletti coprono la superficie delle elitre. Il quinto urotergo libero del maschio ha dei tubercoli laterali assai allungati. Spermateca fig. 55, sesto urotergo libero della femmina fig. 56.

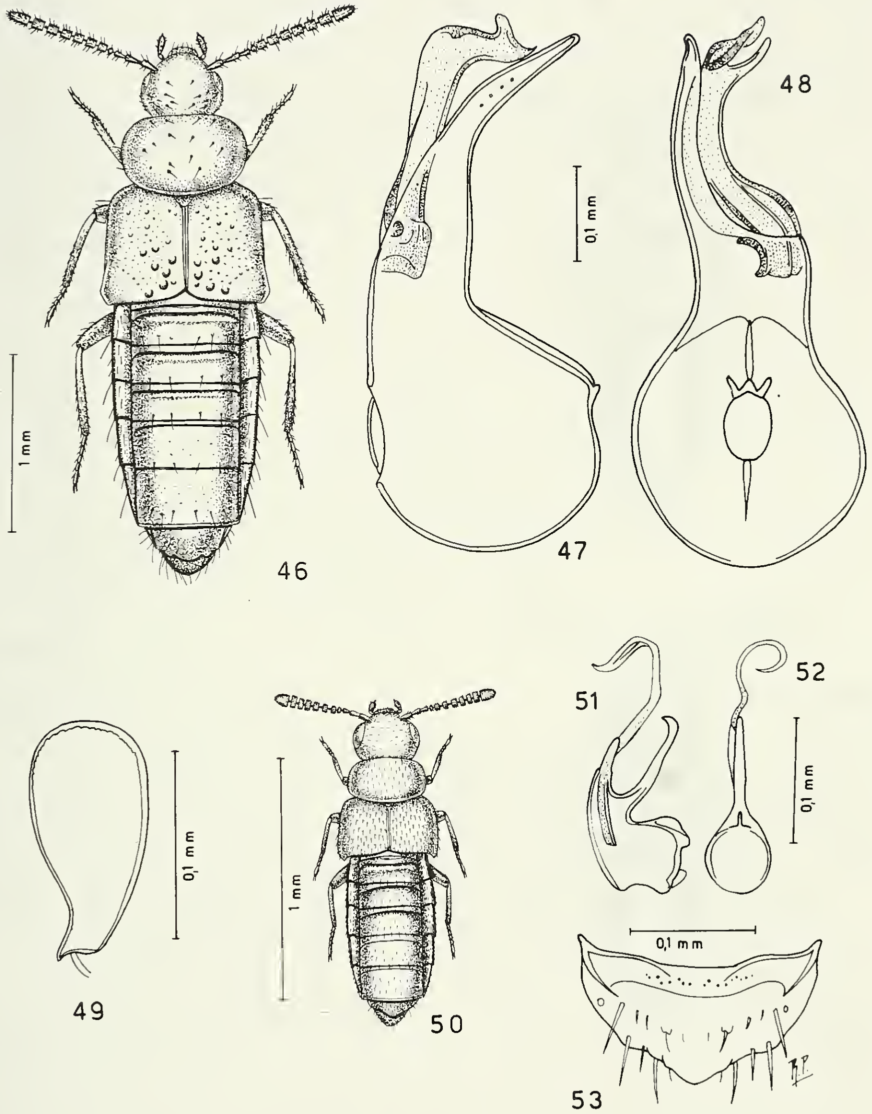
Comparazioni. Non sono note specie che presentano una profondissima incisura sul sesto urotergo libero della femmina, come si osserva nella nuova specie. Solo nel maschio di *G. hubbardi* Seevers, 1951, dell'Illinois, si riscontra una profonda incisura sul sesto urotergo libero, ma essa è assai larga.

Gyrophaena (Agaricochara) praelapsa sp. n. (Figg. 57–58)

Tipo. Holotypus ♀, Ecuador, Cotopaxi, S. Francisco de Las Pampas, 1300–1500 m, II.1993, (L. Bartolozzi leg., N° 9849. MF).

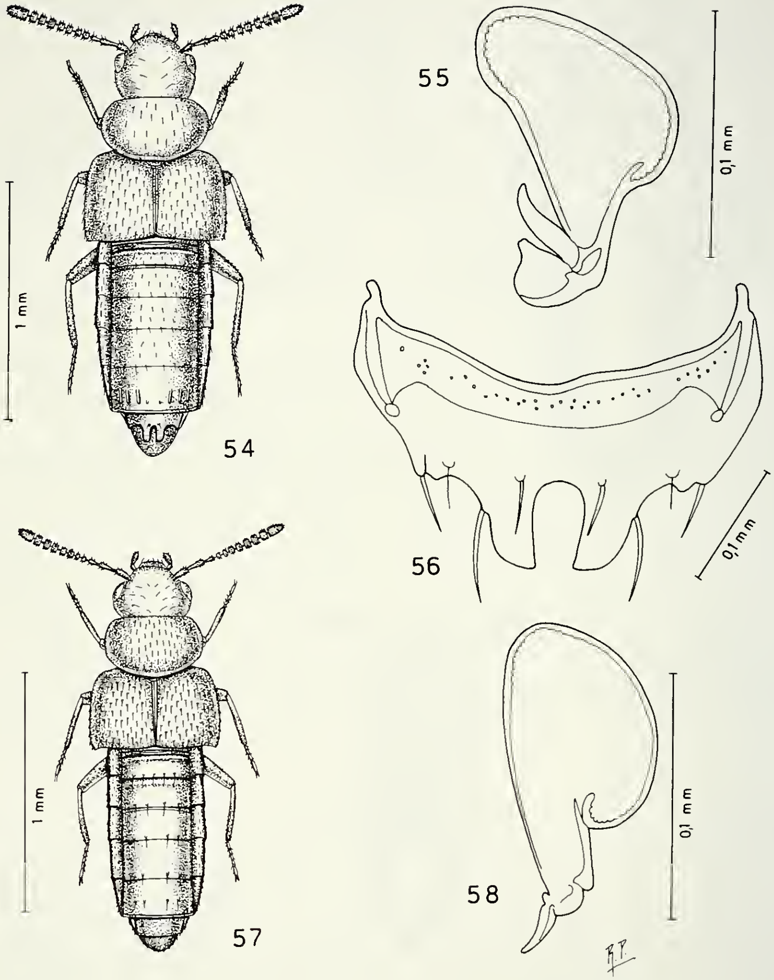
Descrizione. Lunghezza 1,6 mm. Corpo lucido. Capo e pronoto nero-bruni; margini laterali e posteriore del pronoto bruno-rossicci; elitre e uriti liberi quarto e quinto neri; uriti liberi primo, secondo e terzo ed estremità addominale bruni; antenne gialle, appena sfumate di bruno verso l'estremità distale; zampe gialle. La reticolazione del capo è molto svanita, quella del resto del corpo è distinta. La punteggiatura del capo è fine. Il resto della superficie del corpo presenta tubercoletti distinti. Spermateca fig. 58.

Comparazioni. In base ai caratteri esterni, come il corpo ben reticolato e gli angoli posteriori del pronoto indistinti, la nuova specie potrebbe essere tassonomicamente vicina a *G. sonorae* Seevers, 1951, dell'Arizona, di cui è noto il solo holotypus maschio. La nuova specie si distingue tra l'altro da *G. sonorae* per il differente colore del corpo e la maggiore taglia (1,6 mm, invece di 1,0 mm).



FIGG. 46–53

Habitus, edeago in visione laterale e ventrale, spermateca e sesto urotergo libero del maschio. 46–49: *Gyrophaena* (s. str.) *cotopaxiensis* sp. n.; 50–53: *Gyrophaena (Agaricochara) martensis* sp. n.



Figg. 54–58

Habitus, spermateca e sesto urotergo libero della femmina. 54–56: *Gyrophaena (Agaricochara) perincisa* sp. n.; 57–58: *Gyrophaena (Agaricochara) praelapsa* sp. n.

Brachychara bartolozzii sp. n. (Figg. 59–61)

Tipo. Holotypus ♂, Ecuador, Cotopaxi, S. Francisco de Las Pampas, 1300–1500 m, II.1993, (L. Bartolozzi leg., N° 9850, MF).

Descrizione. Lunghezza 2,0 mm. Corpo lucido. Capo e pronoto giallo-rossicci; elitre e addome bruno-rossicci; antenne nere fino al settimo antennomero, il resto delle antenne è andato perduto nella fase di raccolta; zampe gialle. La reticolazione del capo e del pronoto è assente, quella delle elitre è distinta e quella dell' addome è svanita. La punteggiatura del capo è netta, quella del pronoto e dell'addome è distinta. Tubercoletti ben salienti coprono la superficie delle elitre. Il quinto urotergo libero ha reticolazione distinta e uno spazio posteriore privo di punteggiatura. Edeago fig. 60, sesto urotergo libero del maschio fig. 61.

Comparazioni. Specie distinta sia da *B. crassa* Sharp, 1883, che da *B. brevicornis* Sharp, 1883, entrambe del Guatemala, per avere punteggiatura distinta sul pronoto e pubescenza non molto rada (pronoto non punteggiato in *crassa* e pubescenza molto rada in *bevicornis*) e per la forma del margine posteriore del sesto urotergo libero del maschio. In *crassa* il lobo mediano tra le due spine del margine posteriore del sesto urotergo libero del maschio, è quasi acuminato (arcuato nella nuova specie). Di *brevicornis* è noto il solo holotypus femmina.

Etimologia. Specie dedicata al Dr Luca Bartolozzi del Museo Zoologico de "La Specola" dell'Università di Firenze, che l'ha raccolta.

Diestotini

Cyllogerusa gen. n. (Figg. 62–67)

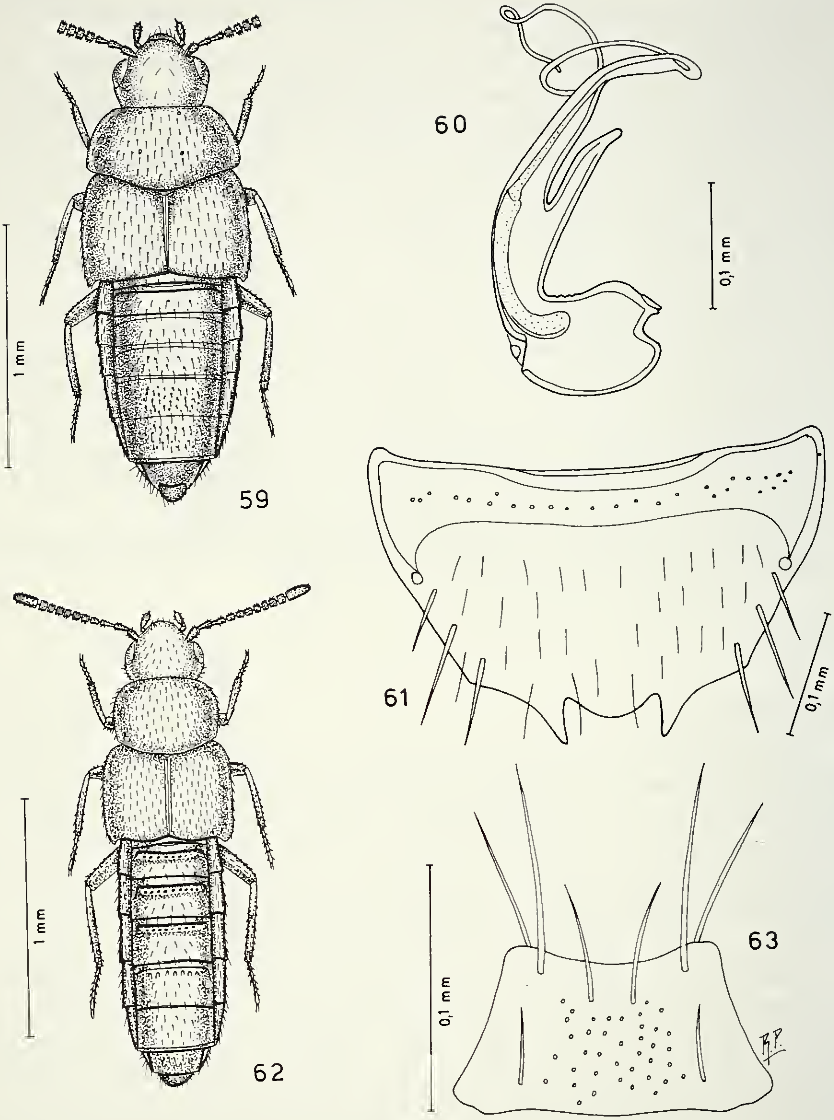
Corpo lucidissimo e convesso; addome a lati paralleli, fig. 62; tempie robustamente marginate; palpi labiali di 2 articoli; ligula molto lunga, intera e con due papille apicali; paraglosse molto prominenti in avanti, fig. 67; palpi mascellari di 4 articoli, fig. 66; mento subtrapezoidale, con margine anteriore arcuato all'indietro, fig. 63; mesocoxe lievemente separate tra loro; processo mesosternale insinuato tra esse e impresso a metà; formula tarsale 4–4–5; primo tarsomero posteriore molto lungo.

Typus generis: *Cyllogerusa rubicula* (Erichson, 1840), ("olim" *Hoplandria*).

Etimologia. Il nome del nuovo genere significa: "Colei che è curva e vecchia".

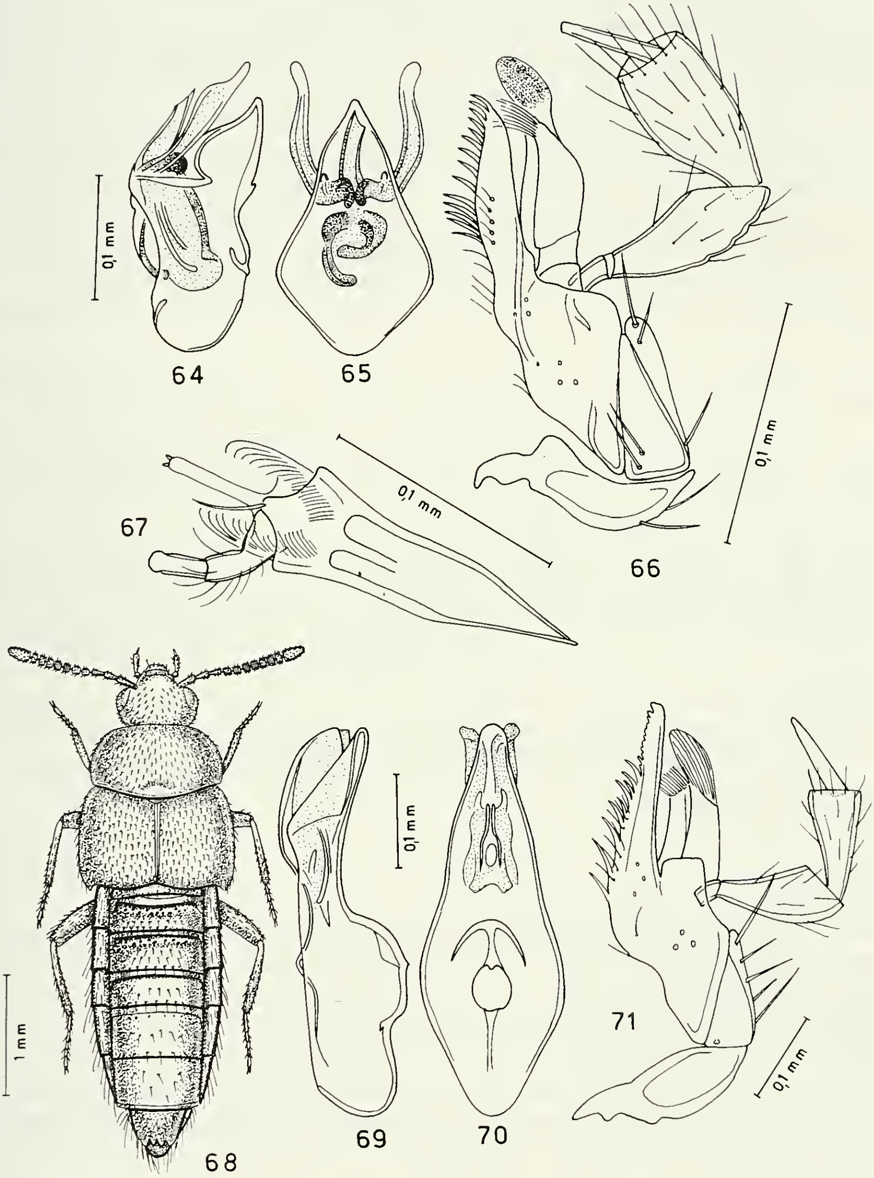
Comparazioni. Finora la specie *rubicola* Erichson, 1840, della Colombia, era attribuita al genere *Hoplandria* Kraatz, 1857. L'esame del tipo maschio, etichettato "Colombia, Moritz, *rubicula* Er., 5496, Typus" (MB), mi ha permesso di escludere l'attribuzione a *Hoplandria*. Infatti questo genere presenta formula tarsale 4–5–5, palpi labiali di 4 articoli e ligula lunga quanto quella della nuova specie, ma divisa all'apice che presenta lunghe setole. Inoltre due setole sono inserite lateralmente a metà della ligula, assenti nella ligula del nuovo genere.

Il nuovo genere probabilmente si colloca tassonomicamente presso il genere *Diestota* Mulsant & Rey, 1870, da cui differisce per la ligula intera e assai lunga. Occorrerà rinvenire la femmina del nuovo genere: la forma della sua spermateca permetterà una sicura attribuzione tribale.



FIGG. 59–63

Habitus, edeago in visione laterale, sesto urotergo libero del maschio e mento. 59–61: *Brachychara bartolozzii* sp. n.; 62–63: *Cyllogerusa rubicula* (Erichson) gen. n.



FIGG. 64–71

Edeago in visione laterale e ventrale, maxilla con palpo mascellare e labio con palpo labiale. 64–67: *Cyllogerusa rubicula* (Erichson) gen. n.; 68–71: *Trichidryas discors* (Erichson) gen. n.

Trichidryas gen. n. (Figg. 68–73)

Corpo simile al genere *Parasilusa* Bernhauer, 1908, del Brasile, cioè con pronoto molto ristretto in avanti e con una fossetta mediana posteriore trasversa, ma l'addome è più ristretto all'indietro che in *Parasilusa*. Tempie robustamente marginate; palpi labiali di 2 articoli molto lunghi; ligula divisa in due rami: all'apice di ciscuno è inserita una lunga setola, fig. 72; palpi mascellari di 4 articoli, con lobo interno assai stretto all'apice, privo di lunghi denti, fig. 71; mento largamente incavato al margine anteriore, fig. 73; mesocoxe largamente separate tra loro poiché i processi mesosternale e metasternale si insinuano tra esse con larghe appendici, tronca all' apice quella mesosternale, arrotondata la metasternale; formula tarsale 4–4–5; primo tarsomero posteriore lungo quanto i due tarsomeri seguenti compresi insieme.

Typus generis: *Trichidryas discors* (Erichson, 1840), ("olim" *Homalota* Mannerheim 1831, "postea" *Thamiaraea* Thomson, 1858).

Etimologia. Il nome del nuovo genere significa "(Ramo) di quercia con setole". Esso allude alla forma della ligula.

Comparazioni. Questo nuovo genere è creato in seguito all'accurato esame del tipo di *discors* Erichson, 1840, della Colombia, così etichettato: "Columbia, Caracas, Moritz, *discors* Er., Typus" (MB).

Il nuovo genere *Trichidryas* è tassonomicamente vicino al genere *Parasilusa* Bernhauer, 1908, diffuso in Brasile con una sola specie (*iheringi* Bernhauer, 1908), da me esaminata. Infatti i palpi labiali sono allungati in entrambi i generi e i denti del lobo interno delle maxille sono corti pure in entrambi. Ma il nuovo genere è nettamente distinto per la ligula lunga a base assai stretta e con due setole apicali, mentre *Parasilusa* presenta ligula corta, a base larga, e i due rami apicali sono privi di setole. Il mento di *Parasilusa* è molto stretto al lato anteriore, largo nel nuovo genere.

La formula tarsale 4–4–5 esclude la specie *discors* dal genere *Thamiaraea* che presenta formula tarsale 4–5–5.

Polytelusa gen. n. (Figg. 74–78)

Corpo simile a quello del genere *Trichidryas*, sopra descritto. Tempie robustamente marginate; palpi labiali di 2 articoli corti; ligula corta, divisa in due rami cortissimi che hanno, ciascuno, una setola apicale, fig. 77; palpi mascellari di 4 articoli, simili a quelli di *Trichidryas*, ma il secondo articolo è più corto del terzo; lobo interno all'apice stretto e con fini e distinte spine; mento simile a quello di *Trichidryas*, ma le setole anteriori sono meno lunghe e le posteriori più lunghe; mesocoxe largamente separate tra loro; formula tarsale 4–4–5; primo tarsomero posteriore corto.

Typus generis: *Polytelusa colombica* sp. n.

Etimologia. Il nome del nuovo genere significa "Colei che è magnifica".

Comparazioni. Il nuovo genere si pone tassonomicamente in posizione intermedia tra *Parasilusa* e *Trichidryas*. Si distingue per i caratteri dati nella seguente chiave

CHIAVE DEI GENERI *Parasilusa* Bernhauer, *Trichidryas* gen. n. e *Polytelusa* gen. n.

1 – Primo tarsomero posteriore corto; ligula corta. 2
– Primo tarsomero posteriore lungo quanto i due seguenti considerati insieme; ligula assai lunga. . . . . *Trichidryas* gen. n.
2 – Palpi labiali lunghi: il secondo articolo molto più lungo del primo e molto più stretto; mento più profondamente incavato al lato anteriore; parte basale della ligula assai larga; i due lembi apicali della ligula sono lunghi e senza setole apicali. . . . . *Parasilusa* Bernhauer
– Palpi labiali corti: il secondo articolo più corto del primo e dilatato all'apice; mento meno profondamente incavato al lato anteriore; parte basale della ligula stretta; i due lembi apicali della ligula sono cortissimi e con una setola apicale ciascuno. . . . . *Polytelusa* gen. n.

Polytelusa colombica sp. n. (Figg. 74–78)

TIPI. Holotypus ♂, Kolumbien, Nördl. Sierra Nevada de Sta. Marta, San Lorenzo, 2200 m, 28.IV.1986, aus niedriger Vegetation am Wegrand, (Müller leg., MG).

Paratypi: 1 ♂ e 1 ♀, stessa provenienza; 1 ♂, idem, ma Nordwestl. Sierra Nevada de Sta. Marta, nahe San Pedro de la Sierra, 12.IV.1986, aus Fall-Laub, (Müller leg.).

DESCRIZIONE. Lunghezza 3,0 mm. Corpo lucido e bruno; pronoto giallo-rossiccio; antenne brune con i quattro antennomeri basali giallo-rossicci; zampe giallo-rossicce. La reticolazione dell'avancorpo è assente, quella dell'addome è distinta, ma sugli uroterghi liberi quarto e quinto è vigorosa. La punteggiatura del corpo è netta e profonda. Edeago figg. 75–76, spermateca fig. 78.

Gansia colombiensis sp. n. (Figg. 79–80)

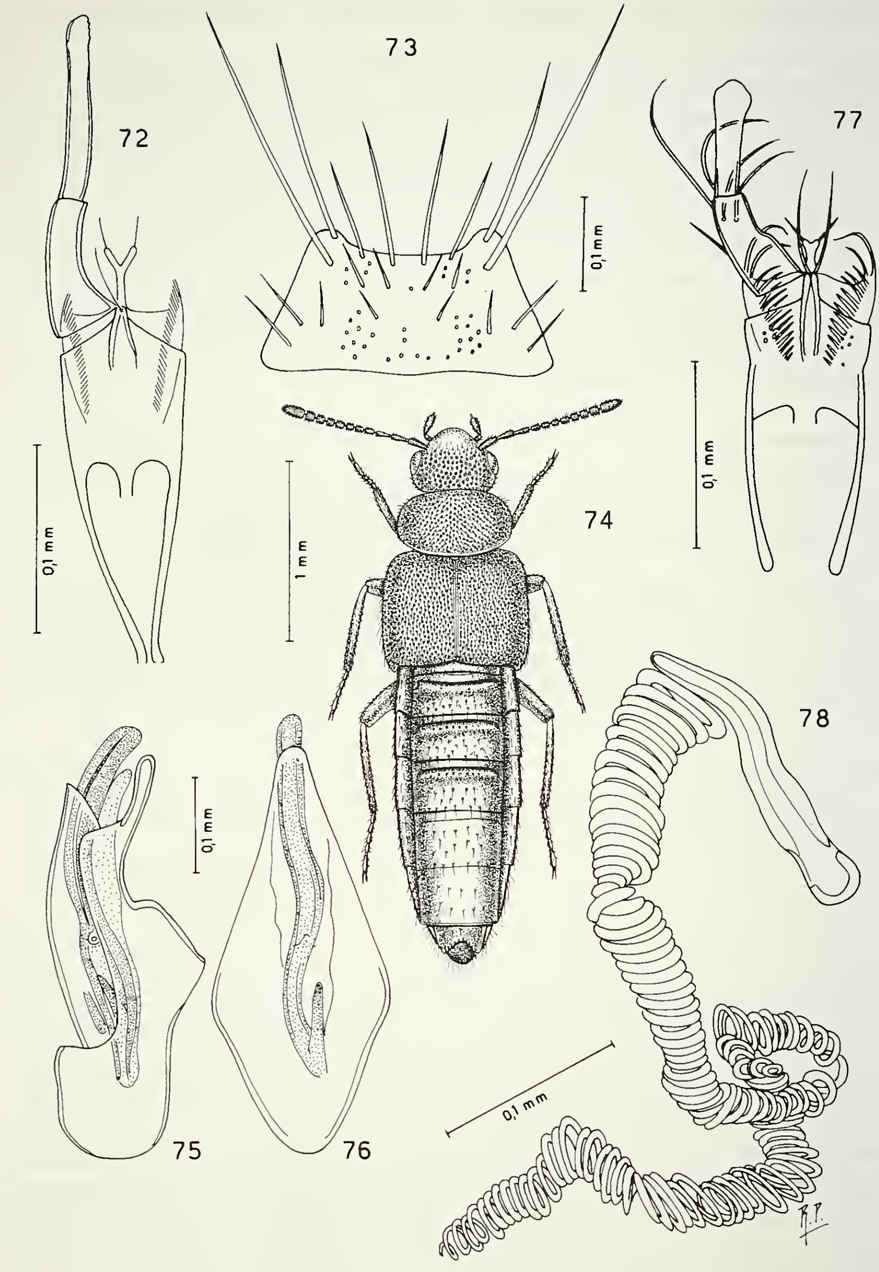
TIPO. Holotypus ♀, Kolumbien, Nördl. Sierra Nevada de Sta. Marta, nähe El Campano, ca. 1000 m, 20.IV.1986, aus Fall-Laub, (Müller leg., MG).

DESCRIZIONE. Lunghezza 2,9 mm. Corpo lucidissimo e giallo-rossiccio; capo nero; elitre bruno-rossicce; antenne nere con i quattro antennomeri basali e l'undicesimo giallo-rossicci; zampe rossicce. Su tutto il corpo non vi è traccia di reticolazione. La punteggiatura del capo è svanita, quella del pronoto è distinta. Il solco mediano del pronoto è allargato all'indietro. Tubercoletti salienti a raspa stanno sulla superficie delle elitre; sull'addome i tubercoletti sono superficiali. Spermateca fig. 80.

COMPARAZIONI. Specie distinta da *G. varicornis* (Sharp, 1876) dell'Amazzonia, per avere il capo nero e largo quanto il pronoto (capo rossiccio e più largo del pronoto in *varicornis*). La nuova specie è pure distinta da *G. bicolor* Sharp, 1883, del Guatemala e da *G. antennaria* Bernhauer, 1920, del Brasile, per avere i penultimi antennomeri nettamente trasversi, e da *G. tibialis* Sharp, 1883, pure del Guatemala, per avere un profondo solco mediano del pronoto (largamente, ma indistintamente impresso in *tibialis*).

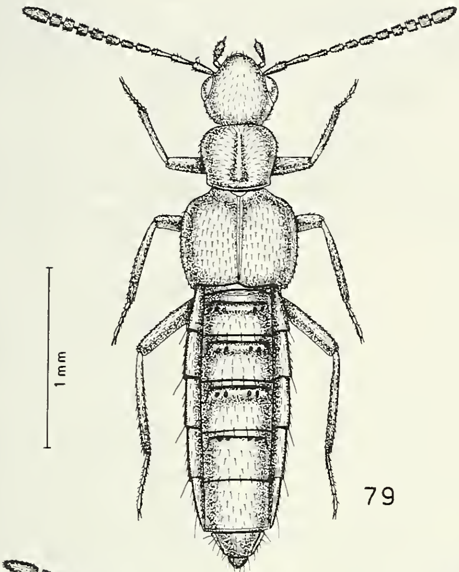
Gansia ecuadorensis sp. n. (Figg. 81–82)

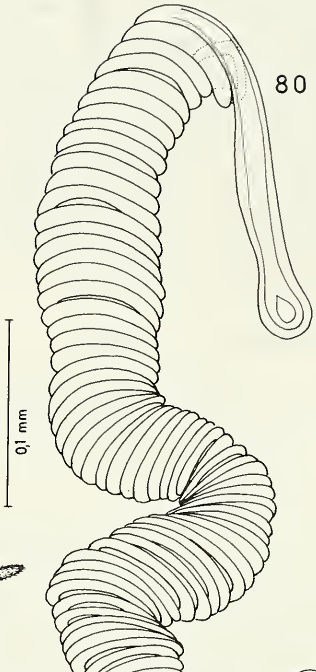
TIPI. Holotypus ♀, Ecuador, Playa Tanga b. Guayaquil, IV.1975, (H. Franz leg., CR).
Paratypus: 1 ♀, stessa provenienza.

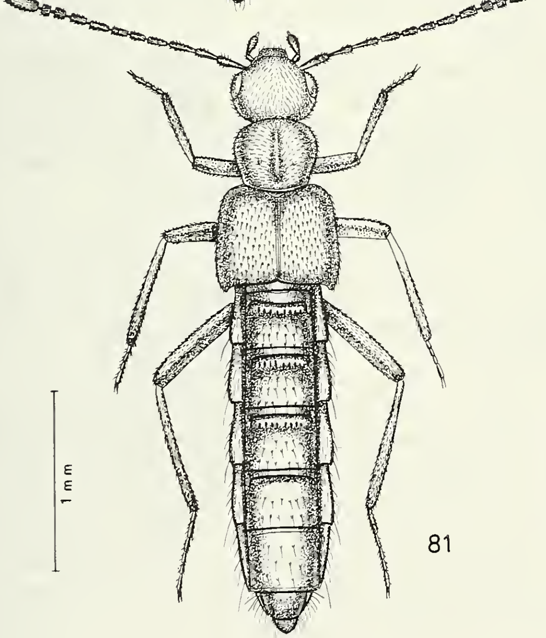


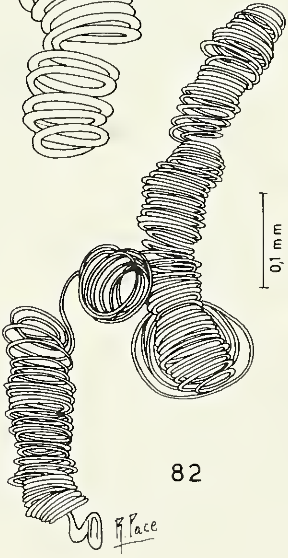
Figg. 72–78

Labio con palpo labiale, mento, habitus, edeago in visione laterale e ventrale e spermateca. 72–73: *Trichidryas discors* (Erichson) gen. n.; 74–78: *Polytelusa colombica* gen. n., sp. n.









FIGG. 79–82

Habitus e spermateca. 79–80: *Gansia colombiensis* sp. n.; 81–82: *Gansia ecuadorensis* sp. n.

DESCRIZIONE. Lunghezza 3,2 mm. Corpo lucido. Capo rossiccio; pronoto giallo-rossiccio; elitre bruno-rossicce; addome giallo con uriti liberi terzo e quarto bruno-rossicci; antenne giallo-rossicce con gli antennomeri quinto a decimo bruni e l'undicesimo giallo paglierino; zampe giallo-rossicce. L'intero corpo è senza reticolazione. La punteggiatura del capo è fine e svanita, quella del pronoto e delle elitre è distinta. Spermateca fig. 82.

COMPARAZIONI. Specie simile a *G. varicornis* (Sharp, 1876), dell'Amazzonia, ma distinta per gli angoli posteriori del pronoto non prominenti all'infuori, come in varicornis, e per le zampe interamente giallo-rossicce (zampe medie e posteriori con base delle tibie picea in *varicornis*).

Plesiomalota (s. str.) **puthzi** sp. n. (Figg 83–86)

TIPI. Holotypus ♂, Kolumbien, Nördl. Sierra Nevada de Sta. Marta, San Lorenzo, 2200 m, 20.IV.1986, aus Fall-Laub und Moos, (Müller leg., MG).

Paratypi: 7 es., stessa provenienza.

DESCRIZIONE. Lunghezza 2,4 mm. Corpo lucidissimo e nero; antenne nere con l'antennomero basale bruno e l'undicesimo giallo-rossiccio; zampe rossicce con femori bruni. La reticolazione del capo e dell'addome è svanita, quella del pronoto e delle elitre è estremamente superficiale. La punteggiatura del capo è ombelicata, netta e assente sulla fronte, quella del pronoto è indistinta e quella delle elitre è netta. Edeago figg. 88–89, spermateca fig. 90.

COMPARAZIONI. Specie che in base alla forma dell'edeago si pone tassonomicamente accanto a *P. incaica* Pace, 1986, del Perù. Se ne distingue per l'edeago più sviluppato; con l'appendice ventrale triangolare e non stretta e lunga come in *incaica*.

ETIMOLOGIA. Specie dedicata al Dr Volker Puthz di Schlitz, noto studioso di Steninae.

Plesiomalota (s. str.) **mendax** sp. n. (Figg. 87–90)

TIPI. Holotypus ♂, N. Kolumbien, nordwestl. Sierra Nevada de Sta. Marta, ca. 1000 m, nahe San Pedro de la Sierra, 12.IV.1986, aus Fall-Laub, (Müller leg., MG).

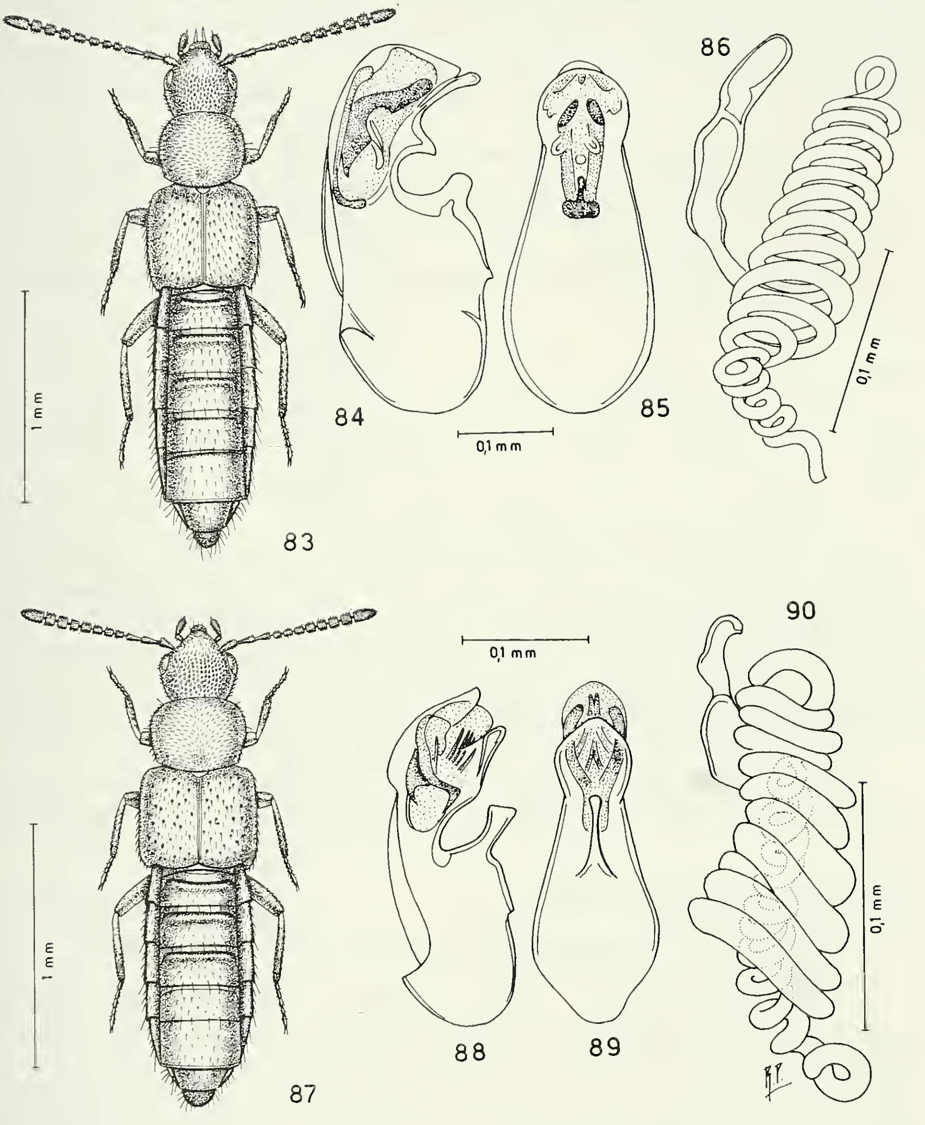
Paratypi: 10 es., idem, nähe El Campano, ca. 1000 m, 20.IV.1986, aus Fall-Laub (Müller leg.).

DESCRIZIONE. Lunghezza 1,9 mm. Corpo lucido e rossiccio scuro; capo bruno rossiccio; antenne brune con i due antennomeri basali e l'undicesimo giallo-rossicci; zampe rossicce. La reticolazione del capo e dell'addome è distinta, quella del pronoto è vigorosa e quella delle elitre è svanita. La punteggiatura del capo è ombelicata e netta, quella del pronoto è assente, quella delle elitre è netta e irregolarmente distribuita. Tubercoletti svaniti stanno sugli uroterghi. Edeago figg. 88–89, spermateca fig. 90.

COMPARAZIONI. La presenza di una lunga lamina tronca all'apice che prende origine dalla "crista apicalis" dell'edeago, rende unica la nuova specie.

Plesiomalota (s. str.) **muelleri** sp. n. (Figg. 91–93)

TIPO. Holotypus ♂, N. Kolumbien, nordwestl. Sierra Nevada de Sta. Marta, nahe San Pedro de la Sierra, 12.IV.1986, aus Fall-Laub, (Müller leg. , MG).



FIGG. 83–90

Habitus, edeago in visione laterale e ventrale e spermateca. 83–85: *Plesiomalota* (s. str.) *puthzi* sp. n.; 87–90: *Plesiomalota* (s. str.) *mendax* sp. n.

Descrizione. Lunghezza 1,9 mm. Corpo lucido e bruno-rossiccio; capo bruno; base dell'addome giallo-rossiccia; antenne brune con i due antennomeri basali e l'undicesimo giallo-rossicci; zampe gialle. La reticolazione del pronoto è vigorosa, quella delle elitre netta e quella dell'addome svanita. La punteggiatura del capo è ombelicata e distinta, quella del pronoto è assente e quella delle elitre è netta. Edeago figg. 92–93.

Comparazioni. Specie che in base alla forma dell'edeago sembra affine a *P. venezuelana* Pace, 1985. Se ne distingue per l'edeago meno sviluppato, privo di una vistosa piastra del sacco interno e non ampiamente ricurvo al lato ventrale, come in *venezuelana*.

Etimologia. Specie dedicata al suo raccoglitore, il Dr H.G. Müller di Giessen, studioso di "Pantopoda".

Plesiomalota (Heteromalota) laminata sp. n. (Figg. 94–97)

Tipi. Holotypus ♂, Nord-Kolumbien, Dept. Magdalena, nördl. Sierra Nevada de Sta. Marta, nähe San Lorenzo, ca. 1700 m, 25.VIII.1985, aus eigenrotten Blättern, (Müller leg. MG).

Paratypi: 2 ♀♀, Kolumbien, Sierra Nevada de Sta. Marta, nähe San Lorenzo, 1700 m, 25.VIII.1985, aus Moos und Streu und Wegrand, (Müller leg.).

Descrizione. Lunghezza 2,1 mm. Corpo lucido. Capo, elitre e uriti liberi terzo e quarto e base del quinto, bruni; pronoto rossiccio; base ed estremità addominale giallo-rossicce; antenne nere con antennomero basale e undicesimo giallo-rossicci; zampe gialle. La reticolazione del capo è distinta solo sulla fronte, quella del pronoto è vigorosa, quella delle elitre è ben distinta e quella dell'addome è svanita. La punteggiatura del capo è ombelicata e netta, quella del pronoto non è visibile e quella delle elitre è profonda. Edeago figg. 95–96, spermateca fig. 97.

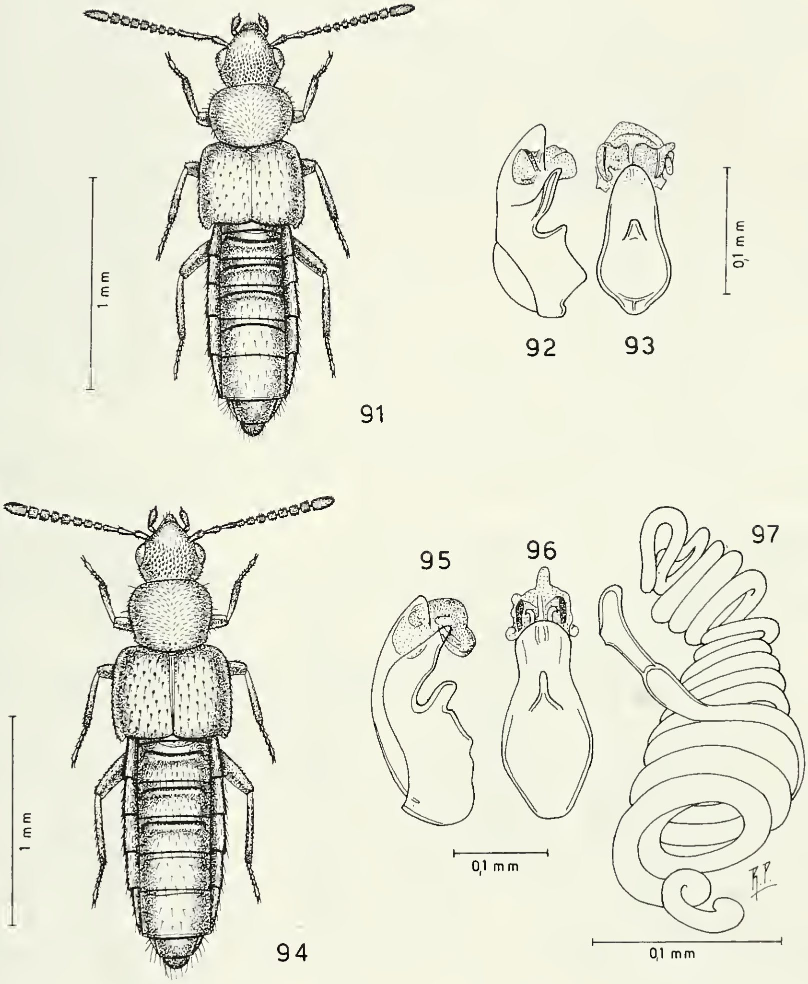
Comparazioni. La lamina ad apice arrotondato, che prende origine dalla "crista apicalis" dell'edeago, è carattere sufficiente a distinguere la nuova specie dalle note.

Plesiomalota (Microusa) cara sp. n. (Figg. 98–101)

Tipi. Holotypus ♂, Ecuador, Playa Tanga, b. Guayaquil, IV.1975; (H. Franz leg., CFR).
Paratypi: 36 es., stessa provenienza.

Descrizione. Lunghezza 1,8 mm. Avancorpo debolmente opaco, addome lucido. Corpo bruno-rossiccio; capo bruno; antenne brune con antennomero basale rossiccio scuro; zampe giallo-rossicce. La reticolazione del pronoto è vigorosa: ciascuna maglia appare come un tubercoletto, ciò dà un aspetto rugoso alla superficie. La reticolazione delle elitre è svanita, quella dell'addome è pure svanita, ma a maglie trasverse. La punteggiatura del capo è fitta e profonda. I tubercoletti che coprono le elitre sono distinti, quelli dell'addome sono poco salienti. Edeago figg. 99–100, spermateca fig. 101.

Comparazioni. Il corpo della nuova specie è simile, ma di lunghezza lievemente maggiore, rispetto quello di *P. roedingeri* (Bernhauer, 1951), del Perù. I caratteri differenziali più evidenti sono nell'edeago e nella spermateca. L'edeago della



FIGG. 91–97

Habitus, edeago in visione laterale e ventrale e spermateca. 91–93: *Plesiomalota* (s. str.) *muelleri* sp. n.; 94–97: *Plesiomalota (Heteromalota) laminata* sp. n.

nuova specie è privo di una plica ventrale, presente nell'edeago di *roedingeri* e la spermateca della nuova specie descrive un numero molto maggiore di spire (2–3 spire in *roedingeri*).

Etimologia. Dalla popolazione Cara, che verso il 980 d. C. conquistò Quito.

Plesiomalota (Chaetopiezusa) tsantsaniana sp. n. (Figg. 102–105)

Tipi. Holotypus ♂, Ecuador, Playa Tanga, b. Guayaquil, IV.1975, (H. Franz leg., CFR). Paratypus: 1 ♀, stessa provenienza.

Descrizione. Lunghezza 2,8 mm. Corpo un po' appiattito. Avancorpo opaco, addome lucido. Corpo nero pece; elitre di un giallo sporco; uriti liberi sesto e settimo bruno-rossicci; antenne brune con i due antennomeri basali e la base del terzo rossicci; zampe bruno-rossicce. La reticolazione del capo è netta, quella del pronoto è quasi vigorosa e quella delle elitre e dell'addome è distinta. La punteggiatura del capo è ombelicata e contigua. Il pronoto presenta una larga depressione mediana. Le elitre non hanno distinti tubercoletti sulla superficie. Edeago figg. 103–104, spermateca fig. 105.

Comparazioni. La nuova specie è chiaramente distinta da *P. venezuelanorum* Pace, 1985, del Venezuela. Infatti l'edeago della nuova specie è poco ricurvo al lato ventrale e la spermateca è composta da un numero minore di spire.

Etimologia. La nuova specie prende nome dal "tsantsa", la testa del nemico tagliata e ridotta nelle dimensioni dagli Jivaro.

Plesiomalota (Chaetopiezusa) bartolozzii sp. n. (Figg. 106–109)

Tipi. Holotypus ♂, Ecuador, Napo Rio Hollin, 1200 m, 9–13.II.1993, (L. Bartolozzi leg., N° 9855, MF).

Paratypus: 1 /, stessa provenienza.

Descrizioni. Lunghezza 1,8 mm. Corpo un po' depresso e lucido. Capo ed elitre bruni; pronoto ed addome giallo-brunicci; antenne bruno-rossicce con undicesimo antennomero rossiccio; zampe gialle. La reticolazione del capo è estremamente svanita, quella del pronoto e delle elitre è assente, quella dell'addome è svanita. La punteggiatura del capo è netta e fitta. Il pronoto è coperto di tubercoletti fitti e fini. Le elitre non presentano punteggiatura, nè tubercoletti. Gli uroterghi presentano tubercoletti distinti sulla loro superficie. Edeago figg. 107–108, spermateca fig. 109.

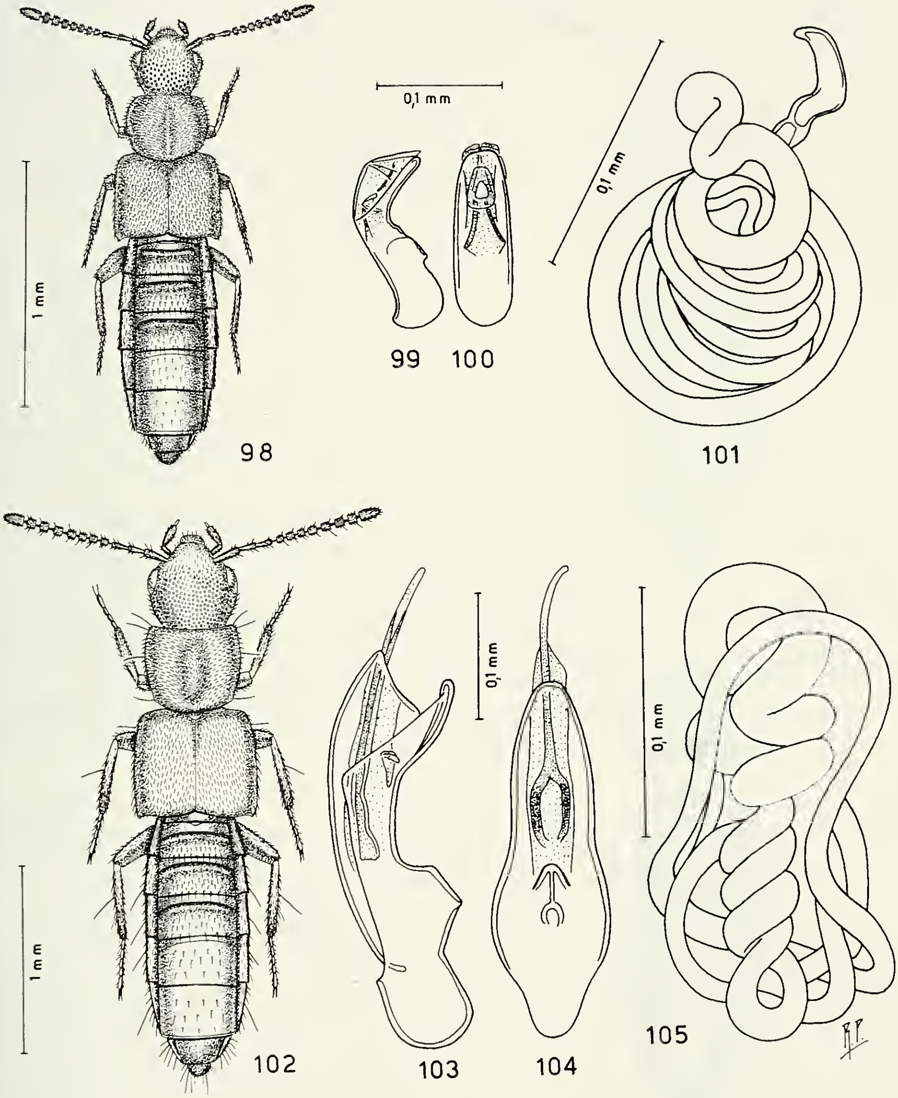
Comparazioni. L'edeago della nuova specie è poco ricurvo al lato ventrale e ha l'apice lievemente incavato, in visione ventrale, perciò la nuova specie è chiaramente distinta da *P. venezuelanorum* Pace, 1985, come dalla nuova specie sopra descritta *P. tsantsaniana*.

Etimologia. La nuova specie è dedicata al suo raccoglitore, il Dr Luca Bartolozzi del Museo Zoologico de "La Specola" di Firenze.

Plesiomalota (Chaetopiezusa) mucronata sp. n. (Figg. 110–112)

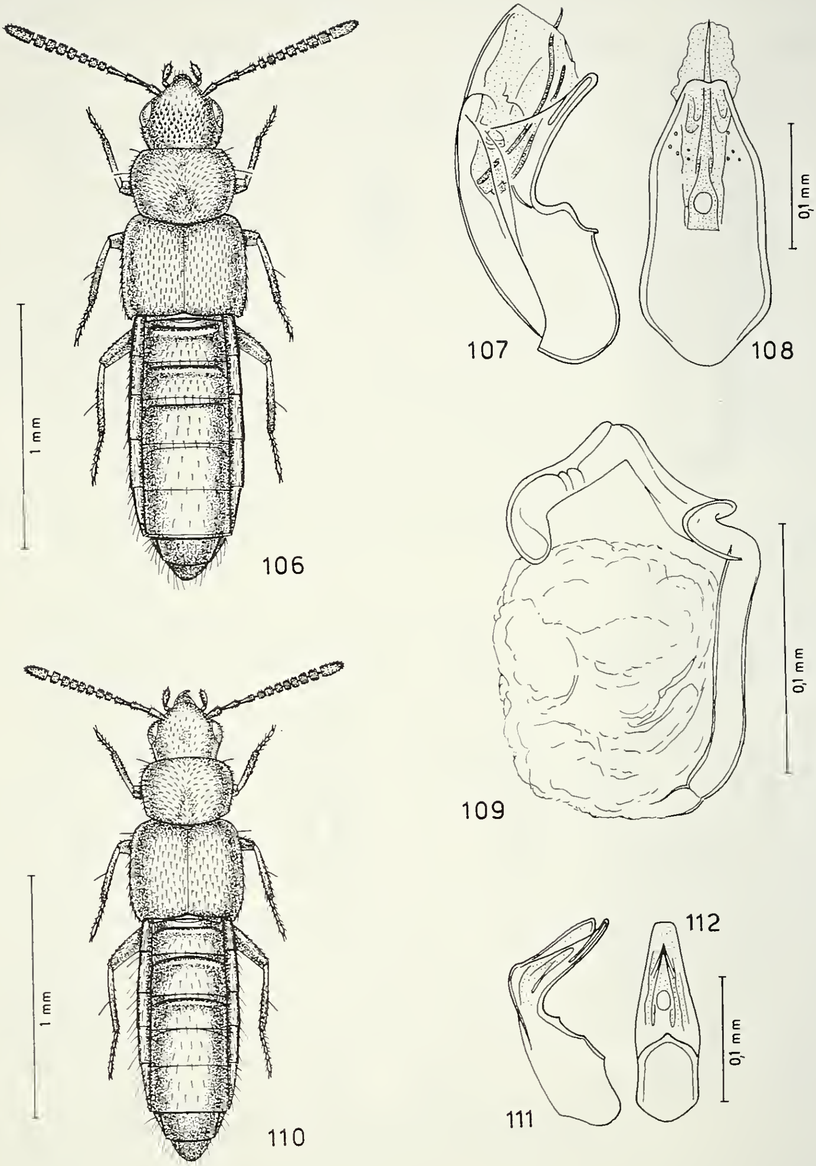
Tipo. Holotypus ♂, Ecuador, Napo Rio Hollin, 1200 m, 9–13.II.1993, (L. Bartolozzi leg., N° 9856, MF).

Descrizione. Lunghezza 1,9 mm. Capo e pronoto lievemente opachi, resto del corpo lucido. Capo, pronoto e uriti liberi terzo, quarto e quinto bruni; elitre nere;



Figg. 98–105

Habitus, edeago in visione laterale e ventrale e spermateca. 98–101: *Plesiomalota (Microusa) cara* sp. n.; 102–105: *Plesiomalota (Chaetopiezusa) tsantsaniana* sp. n.



Figg. 106–112

Habitus, edeago in visione laterale e spermateca. 106–109: *Plesiomalota (Chaetopiezusa) bartolozzii* sp. n.; 110–112: *Plesiomalota (Chaetopiezusa) mucronata* sp. n.

antenne bruno-rossicce con l'antennomero basale giallo e l'undicesimo giallo-rossiccio; zampe gialle. Il capo e il pronoto mostrano una reticolazione vigorosa e una punteggiatura poco distinta. La reticolazione delle elitre è distinta, quella dell'addome svanita. Le elitre sono coperte di tubercoletti nettamente salienti. Il quinto urosterno libero, al margine posterior ha una formazione appuntita che ha suggerito il nome della specie.

COMPARAZIONI. L'edeago di dimensioni ridotte, rispetto quello delle specie del sottogenere e la presenza di una spina mediana posteriore del quinto urosterno libero del maschio, sono caratteri che distinguono chiaramente la nuova specie dalle note.

Plesiomalota (Chaetopiezusa) bilobifera sp. n. (Figg. 113–117)

TIPI. Holotypus ♂, Ecuador, Playa Tanga, b. Guayaquil, IV.1975, (H. Franz leg., CFR). Paratypi: 6 es., stessa provenienza.

DESCRIZIONE. Lunghezza 2,5 mm. Avancorpo debolmente lucido, addome lucido; capo e quarto urite libero, bruni; pronoto, elitre e uriti liberi terzo e quinto bruno-rossicci; uriti liberi primo e secondo ed estremità addominale giallo-rossicci; antenne brune con i due antennomeri basali e l'undicesimo giallo-rossicci; zampe giallo-rossicce. La reticolazione del capo, delle elitre e dell'addome è svanita, quella del pronoto è netta. La punteggiatura del capo è ombelicata e netta, quella del pronoto è indistinta. Superficiali tubercoletti coprono la superficie delle elitre. Gli uriti liberi quarto e quinto mostrano una reticolazione a maglie molto trasverse e svanite. Edeago figg. 114–116, spermateca fig. 117.

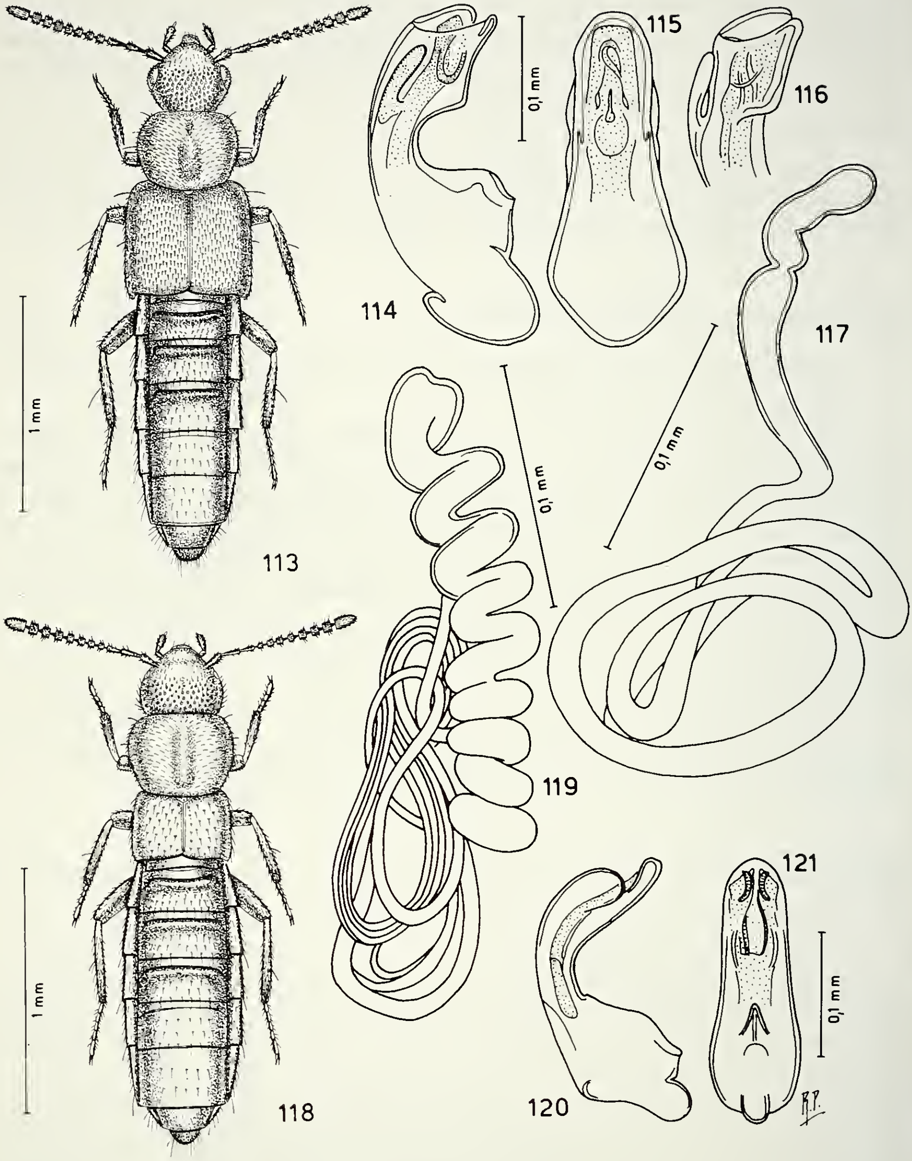
COMPARAZIONI. L'edeago più sviluppato, con un lobo a ciascun lato e la spermateca composta di poche, ma ampie spire, sono caratteri che permettono di distinguere facilmente la nuova specie da *P. venezuelanorum* Pace, 1985.

Plesiomalota (Leptosomaphya) cotopaxiensis sp. n. (Figg. 118–121)

TIPI. Holotypus ♂, Ecuador, Cotopaxi, 3900–4800 m, (H. Franz leg., CFR). Paratypi: 2 ♀♀, stessa provenienza.

DESCRIZIONE. Lunghezza 2,0 mm. Specie attera. Corpo lucido e giallo-rossiccio, comprese le zampe e le antenne: solo gli antennomeri basali 1° e 2° e l'undicesimo sono gialli. La reticolazione del capo è netta solo sul disco, quella del pronoto è nettissima, composta di maglie ampie, quella delle elitre è distinta e quella dell'addome è svanita. Il capo è coperto di punteggiatura ombelicata distinta. Il pronoto presenta una largo solco mediano, più profondo all'indietro ed è privo di punteggiatura o di tubercoletti. Tubercoletti salienti coprono la superfice delle elitre. Il quinto urotergo libero del maschio mostra una reticolazione distinta. Edeago figg. 120–121, spermateca fig. 119.

COMPARAZIONI. L'edeago della nuova specie, rispetto quello di *P. franzi* Pace, 1983 del Venezuela, è molto più sviluppato e meno profondamente ricurvo al lato ventrale. Specie attera, endemica del Cotopaxi.



FIGG. 113–121

Habitus, edeago in visione laterale e ventrale (fig. 116 apice dell'edeago in visione latero–ventrale) e spermateca. 113–117: *Plesiomalota (Chaetopiezusa) bilobifera* sp. n.; 118–121: *Plesiomalota (Leptosomaphya) cotopaxiensis* sp. n.

Plesiomalota (Microusa) filaria sp. n. (Figg. 122–123)

Tipo. Holotypus ♀, Ecuador, Playa Tanga, b. Guayaquil, IV.1975, (H. Franz leg., CFR).

DESCRIZIONE. Lungh. 1,3 mm. Avancorpo opaco, addome lucido. Capo bruno; pronoto bruno-rossiccio; elitre brune con base bruno-rossiccia; addome rossiccio con uriti liberi terzo, quarto e base del quinto bruni; antenne bruno-rossicce con i due antennomeri basali giallo-rossicci; zampe giallo-rossicce. La punteggiatura del capo e del pronoto è fittissima e netta. Le elitre sono prive di punteggiatura e di tubercoletti, però presentano una reticolazione distinta. Il capo ha un solco mediano e il pronoto un largo appiattimento mediano della superficie. Spermateca fig. 123.

COMPARAZIONI. La taglia molto ridotta e gli occhi ben sviluppati, lunghi quanto le tempie, insieme alla forma della spermateca che ha bulbo distale con un' appendice falciforme apicale, sono caratteri sufficienti a rendere unica la nuova specie rispetto alle specie del Venezuela da me descritte nel 1983.

Plesiomalota (Microusa) riobambensis sp. n. (Figg. 124–127)

TIPI. Holotypus ♂, Ecuador, Umg. Rio Bamba, IV.1975, (H. Franz leg., CFR).
Paratypi: 8 es., stessa provenienza.

DESCRIZIONE. Lunghezza 1,7 mm. Corpo lucido e rossiccio; elitre bruno-rossicce; antenne bruno-rossicce con i tre antennomeri basali e l'undicesimo giallo-rossicci; zampe gialle. Il capo e il pronoto sono coperti di tubercoletti fra loro contigui. Il pronoto mostra un appiattimento mediano posteriore. Le elitre sono coperte di tubercoletti e di reticolazione superficiali. Edeago figg. 125–126, spermateca fig. 127.

COMPARAZIONI. La nuova specie ha habitus simile a quello di *P. perpusilla* Pace, 1983, del Venezuela, ma l'edeago della nuova specie è profondamente ricurvo al lato ventrale e non bisinuato al lato ventrale come in *perpusilla*.

Diestota (Apheloglossa) chibchana sp. n. (Figg. 128–131)

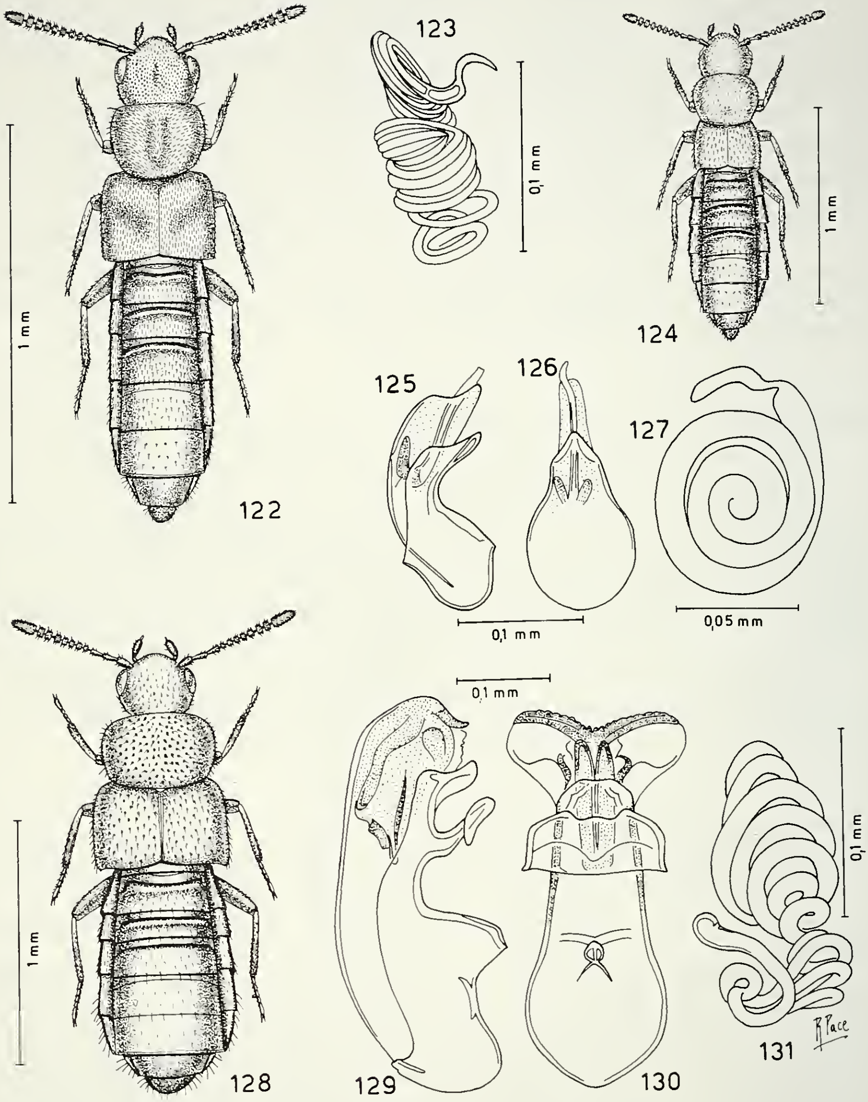
TIPI. Holotypus ♂, Kolumbien, Punta de Betin, 1–10.V.1986, Farbschalen, (Müller leg., MG).

Paratypi: 3 ♀♀, stessa provenienza, ma in data IV.1986 & 1.III.1986, Barberfallen, (Müller leg.).

DESCRIZIONE. Lunghezza 1,9 mm. Corpo lucidissimo. Capo, pronoto e base dell'addome rossicci; elitre e resto dell'addome nero-bruni; antenne brune con i tre antennomeri basali e l'undicesimo giallo-rossicci; zampe giallo-rossicce. La reticolazione del capo e dell'addome è molto svanita, quella del pronoto è superficiale e quella delle elitre è netta. La punteggiatura del capo è appena svanita, quella del pronoto è distinta e quella delle elitre è superficiale. Edeago figg. 129–130, spermateca fig. 131.

COMPARAZIONI. L'appendice spatuliforme ventrale dell'edeago permette di distinguere la nuova specie da tutte le specie del genere, poiché esse non presentano tale curiosa struttura,

ETIMOLOGIA. Dai Chibcha, antica popolazione colombiana.



FIGG. 122–131

Habitus, spermateca ed edeago in visione laterale e ventrale. 122–123: *Plesiomalota (Microusa) filaria* sp. n.; 124–127: *Plesiomalota (Microusa) riobambensis* sp. n.; 128–131: *Diestota (Apheloglossa) chibchana* sp. n.

Diestota (Apheloglossa) ecuadorensis sp. n. (Figg. 132–135)

Tipo. Holotypus ♂, Ecuador, Cotopaxi, 3900–4800 m, (H. Franz leg., CFR).

Descrizione. Lunghezza 2,0 mm. Corpo debolmente lucido e bruno-rossiccio; addome rossiccio con quarto urite libero bruno; antenne brune con i due antennomeri basali di un giallo sporco; zampe gialle. La reticolazione del capo e del pronoto è netta, quella delle elitre è distinta. La punteggiatura del capo è fitta. Fitti tubercoletti coprono la superficie del pronoto e delle elitre. Edeago figg. 133–134, sesto urotergo libero del maschio fig. 135.

Comparazioni. Specie affine a *D. guadalupensis* Pace, 1987, a motivo dei simili caratteri del sesto urotergo libero del maschio. Ne è distinta per l'edeago privo di ampia incavatura ventrale e non terminante a punta acuta, ma a punta arcuata.

Diestota (Apheloglossa) cotopaxiana sp. n. (Figg. 136–140)

Tipi. Holotypus ♂, Ecuador, Cotopaxi, S. Francisco de Las Pampas, 1300–1500 m, II.1993, (L. Bartolozzi leg., N° 9832, MF).

Paratypus: 1 ♀, stessa provenienza.

Descrizione. Lunghezza 2,2 mm. Avancorpo debolmente opaco, addome lucido. Capo, elitre e quarto urite libero neri; pronoto bruno con margini laterali rossicci; addome rossiccio, tranne il quarto urite libero nero, come indicato sopra; antenne brune con antennomero basale rossiccio e l'undicesimo giallo-rossiccio con base rossiccia; zampe giallo-rossicce. L'avancorpo è coperto di reticolazione distinta. L'addome è privo di reticolazione. La punteggiatura del capo e del pronoto è poco distinta, confusa nella reticolazione. Tubercoletti distinti stanno sulla superficie delle elitre. Sesto urotergo libero del maschio fig. 137, edeago figg. 158–159, spermateca fig. 140.

Comparazioni. Per i caratteri del sesto urotergo libero del maschio, la nuova specie è affine a *D. guadalupensis* Pace, 1987. Se ne distingue, oltre che per l'undicesimo antennomero del maschio molto lungo, per l'edeago bruscamente flesso al lato ventrale, perciò tozzo rispetto quello di *guadalupensis* e molto più largo di quello di *guadalupensis*, in visione ventrale.

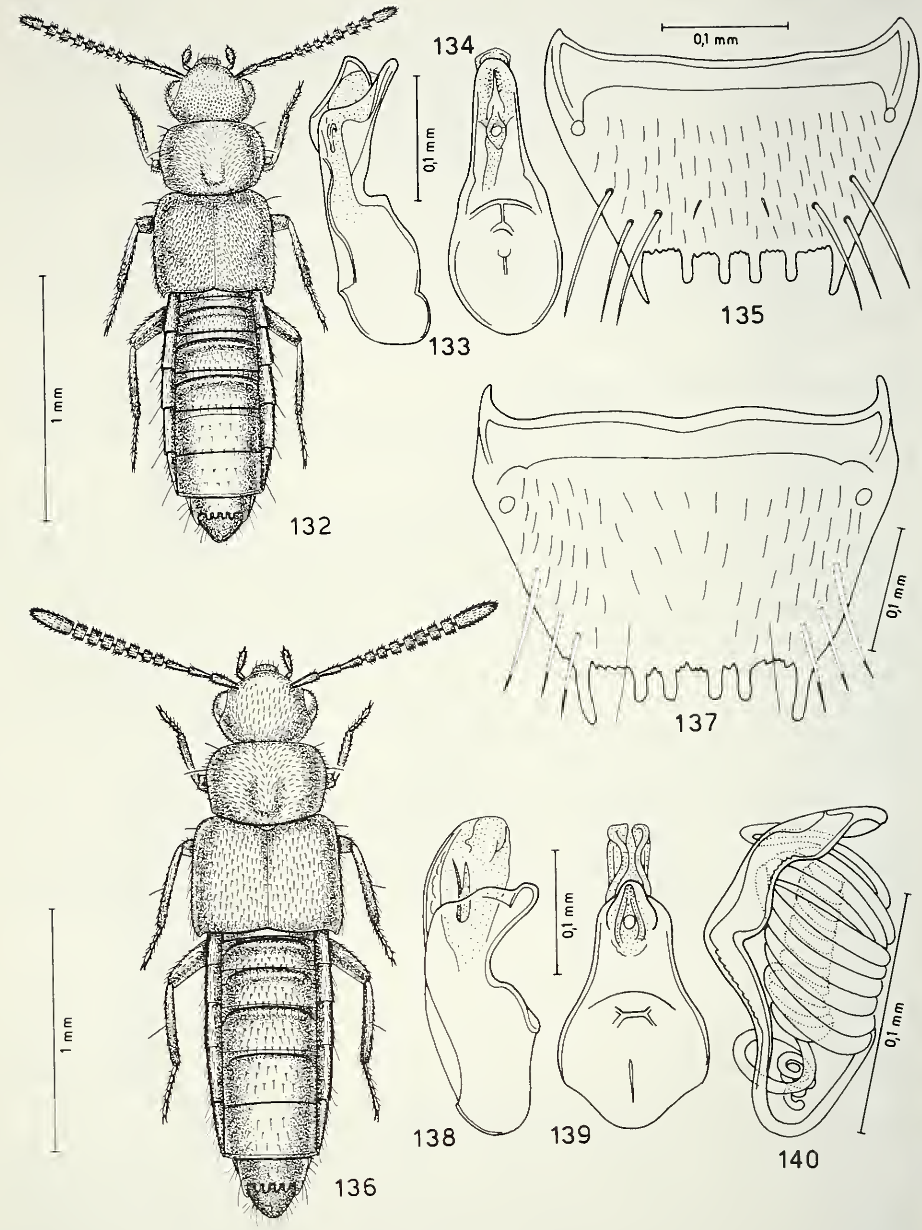
HOMALOTINI

Euvira tayronensis sp. n. (Figg. 141–142)

Tipo. Holotypus ♀, Kolumbien, Dept. Magdalena, Bahia lde Gairaca, Tayrona Park, ca. 20 Km NE Sta. Marta, VI.1985, Barberfallen, (Müller leg., MG).

Descrizione. Lunghezza 1,4 mm. Corpo lucido e giallo-bruniccio; antenne brune con i tre antennomeri basali gialli; zampe gialle. La punteggiatura del capo è composta da punti piuttosto grandi e un po' svaniti. La punteggiatura del pronoto è svanita, composta di punti fini. Le elitre presentano tubercoletti e reticolazione svaniti. Spermateca fig. 142.

Comparazioni. Specie simile a *E. fervidula* (Erichson, 1840) della Colombia, ma d'aspetto più gracile. In base al confronto della forma della spermateca della nuova



FIGG. 132–140

Habitus, edeago in visione laterale e ventrale, sesto urotergo libero del maschio e spermateca. 132–135: *Diestota (Apheloglossa) ecuadorensis* sp. n.; 136–140: *Diestota (Apheloglossa) cotopaxiana* sp. n.

specie con quella di una femmina della serie tipica di *fervidula*, è possibile rilevare consistenti differenze: presenza di introflessione apicale del bulbo distale della spermateca della nuova specie e assenza del medesimo carattere nel bulbo distale della spermateca di *fervidula*; parte mediana della spermateca della nuova specie poco sviluppata, mentre è molto sviluppata quella della spermateca di *fervidula*.

Non è il caso di fare comparazioni con *E. atratula* (Erichson, 1840), pure della Colombia, perché essa, come ho osservato sui tipi, ha taglia vistosamente maggiore (2,1 mm) e spermateca priva di introflessione apicale del bulbo distale e parte mediana della spermateca stessa cortissima.

Placusa (s. str.) **chibchana** sp. n. (Figg. 143–144)

TIPO. Holotypus ♀, Kolumbien, Punta de Betin, Sta. Marta, IV.1986, Farbschalen, (Müller leg., MG).

DESCRIZIONE. Lunghezza 2,2 mm. Corpo lucido. Capo e pronoto bruni; elitre bruno-rossicce con lati esterni e zona periscutellare bruni; addome rossiccio con quarto urite libero bruno a metà; antenne nere con antennomero basale giallo sporco; zampe giallo-rossicce. L'avancorpo è coperto di tubercoletti distinti e di reticolazione svanita. L'addome non presenta reticolazione. Spermateca fig. 144.

COMPARAZIONI. In base alla forma della spermateca e all'habitus, la nuova specie sembra affine a *P. basiventris* Pace, 1987, della Guadalupa. I caratteri distintivi sono: bulbo distale della spermateca oviforme nella nuova specie, mentre è piriforme in *basiventris*; assenza di introflessione apicale del bulbo distale della spermateca nella nuova specie, mentre in *basiventris* è presente.

ETIMOLOGIA. Dai Chibcha, antica popolazione colombiana.

Placusa (s. str.) **guambina** sp. n. (Figg. 145–146)

TIPO. Holotypus ♀, Kolumbien, Punta de Betin, Sta. Marta, IV.1986, Farbschalen, (Müller leg., MG).

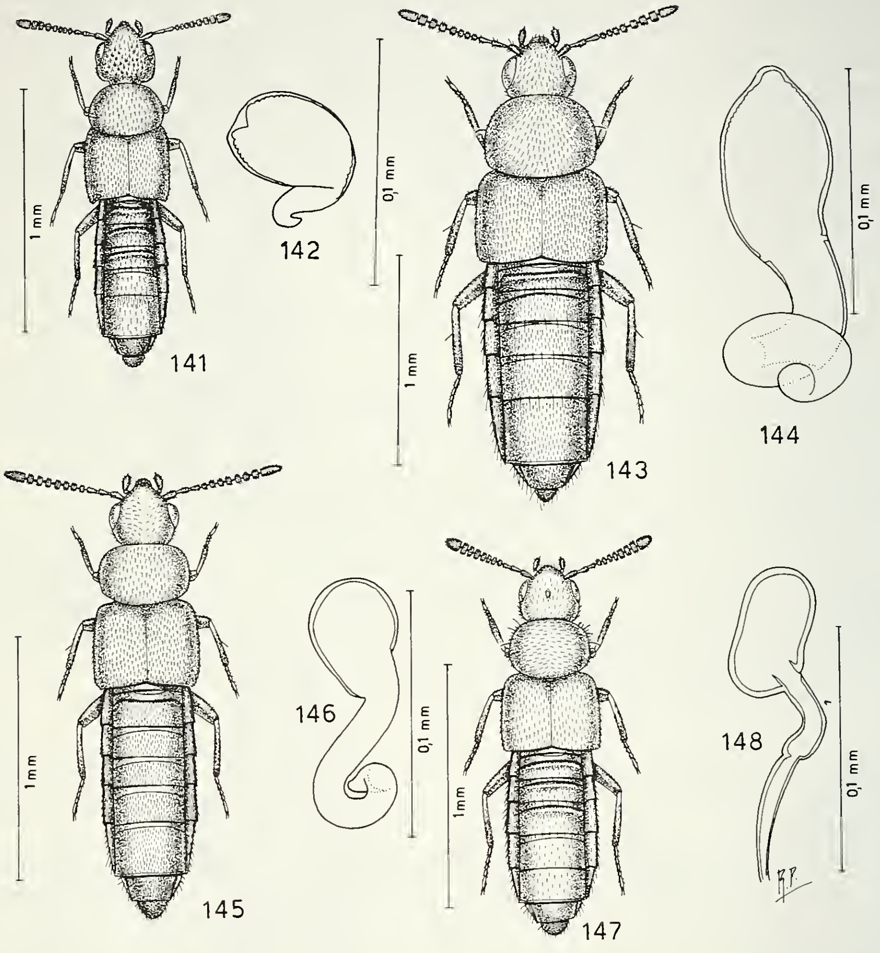
DESCRIZIONE. Lunghezza 1,8 mm. Corpo appiattito e bruno-gialliccio; antenne brune con i due antennomeri basali giallo-bruni; zampe giallo-brune. Una reticolazione distinta sta solo sul capo: sul resto del corpo la reticolazione è assente. L'avancorpo è coperto di tubercoletti salienti. Fini sono i tubercoletti che coprono la superficie dell'addome. Spermateca fig. 146.

COMPARAZIONI. La nuova specie, in base alla forma della spermateca, appare simile a *P. basiventris* Pace, 1984 della Guadalupa. La nuova specie è differente da questa specie per avere la spermateca più esile, con bulbo distale globoso e non piriforme come quello di *basiventris*.

ETIMOLOGIA. Dai Guambinos popolazione caraibica esistente prima della conquista spagnola.

Placusa (s. str.) **oligotina** sp. n. (Figg. 147–148)

TIPO. Holotypus ♀, Kolumbien, Villa Culebra bei Bonda, ca. 10 Km E Sta. Marta, 1–11.XI.1985, Trockengebiet, Farbschalen, (Müller leg., MG).



FIGG. 141–148

Habitus e spermateca. 141–142: *Euvira tayronensis* sp. n.; 143–144: *Placusa* (s. str.) *chibchana* sp. n.; 145–146: *Placusa* (s. str.) *guambina* sp. n.; 147–148: *Placusa* (s. str.) *oligotina* sp. n.

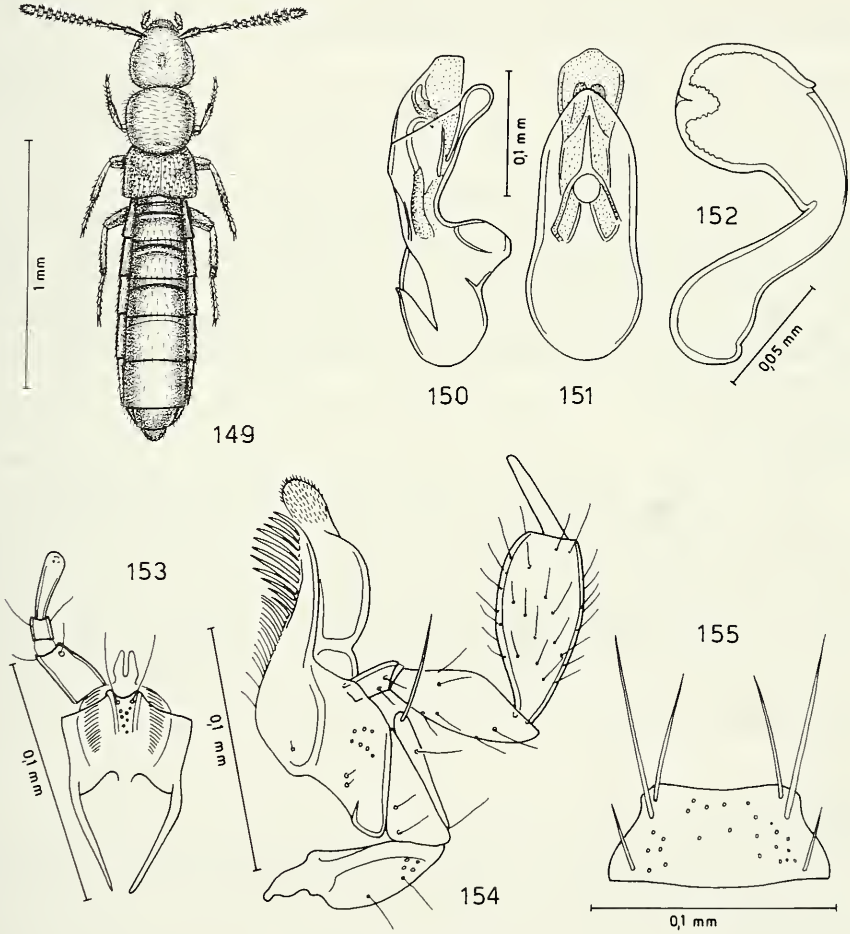
DESCRIZIONE. Lunghezza 1,5 mm. Corpo lucido e rossiccio; capo, elitre, quarto urite libero e metà basale del quinto, bruni; antenne giallo-rossicce; zampe gialle. La reticolazione del capo è netta, quella del pronoto e delle elitre è distinta e quella dell'addome è svanita. Il capo presenta una fossetta frontale, il pronoto tubercoletti estremamente svaniti e le elitre punteggiatura superficiale. Spermateca fig. 148.

Comparazioni. Specie che presenta una fossetta frontale e una spermateca con bulbo distale ipertrofico e parte mediana della stessa spermateca, esilissima. Questi caratteri non sono presenti in specie note.

Bolitocharini

Caralepta gen. n. (Figg. 149–155)

Habitus simile alle specie attere di *Leptusa* Kraatz d'alta quota altimetrica, cioè con occhi ed elitre assai ridotti. Tempie non marginate; palpi labiali di 3 articoli;



Figg. 149–155

Habitus, edeago in visione laterale e ventrale, spermateca, labio con palpo labiale, maxilla con palpo mascellare e mento. 149–155: *Caralepta cotopaxicola* gen. n., sp. n.

ligula divisa fino alla base in due lembi, fig. 153; palpi mascellari di 4 articoli; lobo interno con spine lunghissime, fig. 154; mento subtrapezoidale, a margine anteriore rettilineo, fig. 155; mesocoxe contigue; processo mesosternale ad apice acuto, privo di carene; formula tarsale 4–4–5; primo tarsomero posteriore corto.

TYPUS GENERIS: *Caralepta cotopaxicola* sp. n.

ETIMOLOGIA. Il nome del nuovo genere significa "Esile dei Caras". Caras è un regno preincaico dell'Ecuador.

COMPARAZIONI. Il nuovo genere si colloca accanto al genere *Thecturota* Casey, 1893. Si distingue essenzialmente per avere la ligula divisa fino alla base in due lembi, mentre in *Thecturota* è triangolarmente incisa all'apice. La spermateca ha struttura simile nei due generi, ma è nettamente più robusta in *Caralepta* gen. n., nonostante la taglia delle specie dei due generi sia simile.

Caralepta cotopaxicola sp. n. (Figg. 149–155)

TIPI. Holotypus ♂, Ecuador, Cotopaxi, 3500–4800 m, (H. Franz leg., CFR).
Paratypus: 1 ♀, stessa provenienza.

DESCRIZIONE. Lunghezza 1,8 mm. Specie attera. Corpo lucido e giallo-rossiccio; addome sfumato di bruno rossiccio nella parte mediana; antenne e zampe gialle. La reticolazione del capo e del pronoto è netta, quella delle elitre è distinta e quella dell'addome poligonale e svanita, netta solo sul quinto urotergo libero. La punteggiatura sul capo e sul pronoto è assente. Tubercoletti assai salienti stanno sulla superficie delle elitre. Il capo presenta una fossetta discale. Edeago figg. 150–151, spermateca fig. 152.

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Distribution of entomopathogenic nematodes in the Swiss Alps

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Distribution of entomopathogenic nematodes in the Swiss Alps. - A total of 473 soil samples taken from alpine regions in Switzerland was analysed for the presence of rhabditid entomopathogenic nematodes. These parasites were found in 27% of the samples at altitudes between 490 and 2530 m asl. The recovered nematode isolates fall into six species: *Steinernema affinis, S. feltiae, S. intermedia, S. kraussei, Steinernema* sp. (a species close to *S. intermedia*), and *Heterorhabditis* sp. (North-West European Group). The distribution of these species is discussed in relation to altitude, vegetation, orientation, soil characteristics (i.e. pH, sand content, content of organic matter), and potential host species. *Steinernema kraussei* was the most commonly encountered species, usually occurring in acidic soils rich in organic matter. *Steinernema feltiae*, the second most prevalent species, was rather confined to grassland habitats of the lower Alps and the Swiss Plateau. Similarly, the other species were usually found in grassland, but were too rare to draw conclusions about their ecological requirements.

Key-words: distribution - environmental characteristics - cold-activity - steinernematids - *Steinernema kraussei - feltiae - Heterorhabditis.*

INTRODUCTION

Nematodes of the genera *Steinernema* (Steinernematidae: Rhabditida) and *Heterorhabditis* (Heterorhabditidae: Rhabditida) are obligate parasites of soil-dwelling insects. These nematodes include in their life cycle free-living infective juveniles, able to locate and infect suitable host species. Several strains of *Steinernema* and *Heterorhabditis* are commercially sold as biological control agents of various insect pests. However, currently available strains can only be used effectively above temperatures of ca 12 °C (e.g. WOUTS 1991). Problems with the poor cold-activity of entomopathogenic nematodes are common to all countries of temperate zones. To enhance biological control of outdoor insect pests at low temperatures, cold-active nematodes are required. Such nematodes are likely to be found in the Swiss Alps, since alpine animals are adapted to long and cold winters.

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The faunistic data presented here refer to a field survey realised as part of COST Action 812 ("Selection and evaluation of cold-active lines of insect-parasitic nematodes for outdoor application"; see Ehlers 1994). Although the present survey was designed primarily to isolate cold-active nematodes, the data available allow us to investigate the distribution of entomopathogenic nematodes in the alpine regions of Switzerland. Moreover, examination of the influence of sample characteristics on nematode prevalence provides insight into the ecology of rhabditid entomopathogenic nematodes.

MATERIAL AND METHODS

A total of 472 soil samples was taken in 1991 at different altitudes in the Swiss Alps. Sampling locations were chosen in order to collect nematodes over a wide range of the Swiss Alps and of some adjacent regions. Sampling in the lower and alpine regions was performed between May and July, and between August and September, respectively. One additional sample was obtained in May 1994 from a small survey in the framework of COST 813 (Jenny 1994). Each sample consisted of 10 subsamples (to a depth of 10 - 15 cm), taken at regular intervals along a transect of ca 50 m. Subsamples were pooled, mixed and a 1 kg portion of the pooled sample was retained to check the presence of entomopathogenic nematodes. At sampling locations below the timberline two samples were generally taken (i.e. one sample within the forest, one on the outside), whereas above the timberline only one sample was taken per location. Entomopathogenic nematodes were baited in the laboratory (at 18 °C) with the wax moth (*Galleria mellonella* L.). For each sample, five late instar larvae, placed on the bottom of a 1-litre plastic pot, were carefully covered with damp soil. After 5 days, the insect larvae were recovered, and placed into plastic dishes on moist filter paper. Nematodes emerging from the *G. mellonella* larvae of each sample (i.e. an isolate) were used to establish laboratory cultures. All isolates were identified using morphological criteria (Poinar 1990; Mracek 1994), and 35 selected isolates also by restriction fragment length patterns (RFLP of steinernematids by A. Reid, GB-St Albans, Herts; RFLP of the heterorhabditid isolate by P. Smits, NL-Wageningen).

For each sampling location, the following quantitative (a) and qualitative (b) characteristics were recorded: a) altitude, pH, content of organic matter (%C), and sand content; b) region (based on main mountain ranges), orientation (two classes: S-W; NW-SE), vegetation types (woodland samples with subclasses: deciduous, mixed, coniferous with spruce, coniferous with larch; grassland samples: pasture or hay, pasture in vineyard, flowery meadows; "others": home gardens, dwarf shrubland, rosette plants). The pH and %C of soil samples was determined electrometrically in distilled water (using a glass electrode) and by a modification of the Walkley Black method, respectively. The sand content of soil samples was estimated by feel. The weather in 1991 presented generally average conditions, but May was relatively cool and the period between August and September relatively warm and dry (Schweizerische Meteorologische Anstalt 1994).

Ordination and classification of positive samples (entomopathogenic nematodes present) were performed according to similarity in vegetation (two classes: woodland as opposed to grassland and "others") and environmental characteristics (i.e. pH, altitude, sand content, %C, and orientation) using correspondence analysis and complete linkage clustering on square root transformed data (program MULVA-4; see WILDI & ORLOCI 1990), respectively. The Mann-Whitney U-test or the Kruskal-Wallis-test were used to compare rank sums of continuous variables achieved in nominal classes (samples or species). χ^2 contingency table analyses were used to test whether entomopathogenic nematodes occur more frequently in certain classes of samples (i.e. vegetation, orientation, pH, altitude, %C, sand content) than in others. For rare species, the vegetational specificity was analysed with respect to two vegetation types only (i.e. woodland as opposed to grassland and "others"). All comparisons were corrected for ties and used a 0.05 level of significance, unless otherwise indicated. For multiple analyses on the same data set, the Bonferroni correction was applied for critical probabilities (SACHS 1992).

RESULTS

The following species of entomopathogenic nematodes were identified (fig. 1): *Steinernema affinis* (Bovien, 1937), *S. feltiae* (Filipjev, 1934), *S. intermedia* (Poinar, 1985), *S. kraussei* (Steiner, 1923; sensu MRACEK 1994), *Steinernema* sp., and *Heterorhabditis* sp. (North-West European Group, sensu SMITS *et al.* 1991). The latter two species were found only once. *Steinernema kraussei* was clearly the most frequent species (52% or 67 isolates). The isolates denoted as Steinernema spp. could not be identified to species, mainly due to contamination and subsequent loss of initial cultures.

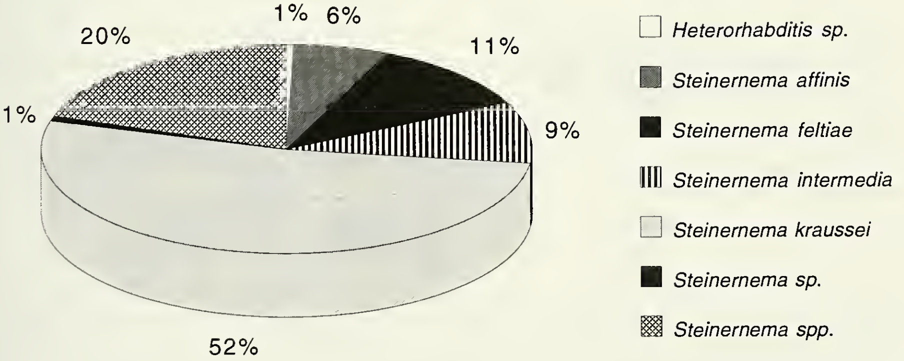

FIG. 1

Species representation of rhabditid entomopathogenic nematodes (n =128) in the Alps and lower Alps of Switzerland. *Steinernema* spp. denote unidentified isolates.

The overall percentage of soil samples yielding entomopathogenic nematodes was 27% (128 isolates in 473 samples). However, nematode frequencies differed considerably among regions, varying between 0.5 and 53% (tab. 1). The variation in prevalence most probably reflects regional differences in sample characteristics, because altitude, pH, %C, and sand content were unevenly distributed over the regions (Kruskal-Wallis-test, $n = 444$, $p < 0.001$). For example, there were no lowland samples (< 1000 m) in the regions R6, R8, and R9 (tab. 1).

TAB. 1

Recovery rates of rhabditid entomopathogenic nematodes in various geographical regions (R1 to R9) of the Swiss Alps related to altitude (asl) of the sampling locations. Regions were defined based on main mountain ranges (see fig. 2).

Regions	Altitude		No of	No of	Recovery
	Median [m]	Range [m]	isolates	samples	rate [%]
R1: Northern Jura Mountains	805	630-895	2	18	11
R2: Eastern lower Alps	1115	805-1370	4	52	8
R3: Central to eastern lower Alps	850	470-1180	3	60	0.5
R4: Central lower Alps	1130	785-1800	8	78	10
R5: Central to eastern Alps	1270	490-2050	17	52	33
R6: Eastern Alps	1810	1095-2330	39	73	53
R7: Central to southern Alps	1770	720-2320	22	56	39
R8: Central to western Alps	2215	1367-3090	19	45	42
R9: Western Alps	1830	1142-2460	14	39	36
R1 - R9: All regions	**1320**	**470-3090**	**128**	**473**	**27**

The regions R1-R4 were invariably characterised by recovery rates clearly below the overall average of 27% (tab. 1). Conversely, the high proportion of positive samples in the five alpine regions (i.e. R5-R9) suggests that entomopathogenic nematodes are very common in the mountain range. The geographical distribution of the 103 isolates identified to the species level is illustrated in fig. 2. The predominant *S. kraussei* is restricted to the alpine regions, whereas *S. affinis*, *S. feltiae*, and *S. intermedia* are more widely distributed. The two species *Steinernema* sp. and *Heterorhabditis* sp. were too rare to interpret their geographical distribution.

The majority of the isolates was recovered in soil samples taken at altitudes between 1500 and 2100 m (fig. 3A). The most elevated recovery site (i.e. with *S. kraussei*) was located at 2530 m. Visual examination of fig. 3A suggests that *S. kraussei* is the most important species in the alpine environment (mean altitude: 1800 m, 1045-2530 m; median and range). The isolates of *S. kraussei* were unevenly distributed with respect to altitude ($\chi 2 = 98$, DF = 7, $p < 0.0001$). This was largely due to their high prevalence in altitudinal classes between 1650 and 2550 m, and an absence at altitudes below 1000 m. *Steinernema kraussei* occurred at more elevated sites than both *S. feltiae* (U-test, $p < 0.001$), which predominated in the lower Alps

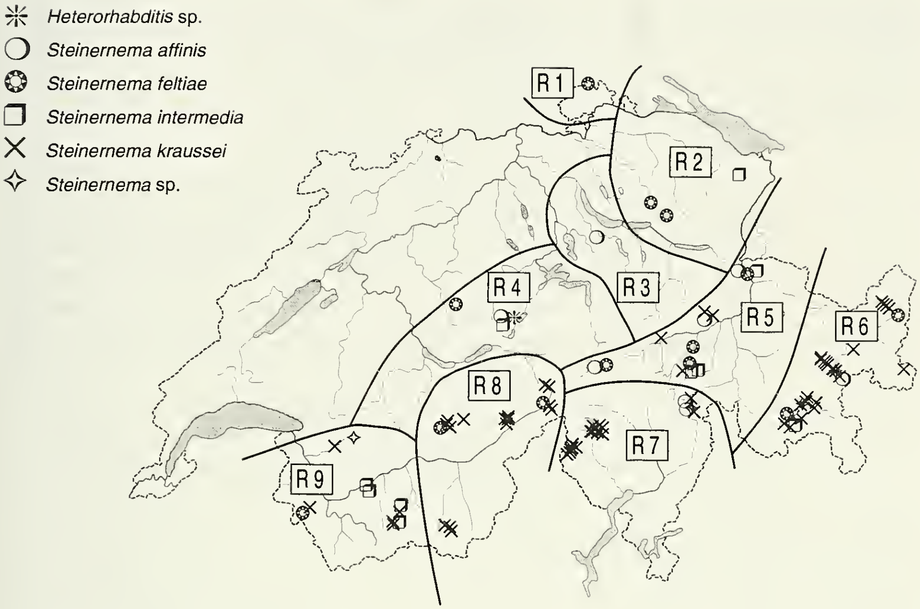

Fig. 2

Distribution of rhabditid entomopathogenic nematodes (n = 103) isolated in the Swiss Alps, in the lower Alps, and in the Jura Mountains. R1 to R9 refer to the regions explained in tab. 1. Note that isolates from nearby sampling locations are hardly distinguishable.

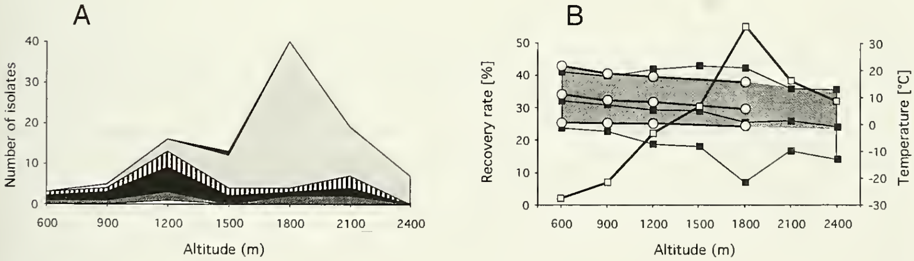

Fig. 3

A) Altitudinal distribution of alpine entomopathogenic nematodes identified at the species level (n = 103). For graphical patterns see fig. 1. B) Altitudinal variation of the recovery rate of total entomopathogenic nematodes (n = 128) and the zones of variation in air (light grey) and soil temperature (dark grey). Temperature was measured in 1991 at seven climatological stations in Switzerland (Schweizerische Meteorologische Anstalt, 1994). ■: Air temperature (top: mean of the warmest month; middle: annual mean; bottom: mean of the coldest month); ○: Soil temperature at a depth of 5 cm (top, middle, and bottom: see above), values for locations above 1800 m are extrapolated (dashed lines); □: recovery rate of entomopathogenic nematodes related to altitudinal classes.

(1255 m, 580-2170 m), and *S. intermedia* (U-test). No difference was observed in the altitudinal distribution between the other species. *Steinernema intermedia* (1440 m, 605-2205 m) and *S. affinis* (1552 m, 490-2080 m) appear to be uniformly distributed within the zone between ca 600 and 2200 m. *Heterorhabditis* sp. and *Steinernema* sp. were recovered from sites at 1130 and 1530 m, respectively.

The variation in total entomopathogenic nematodes (unidentified isolates included) and temperature changes along the altitudinal gradient are shown in fig. 3B. Values of soil temperature in the coldest months indicate that soil-dwelling animals are well protected from temperatures below the freezing point, irrespective of altitude and associated air temperatures. In the warm season, however, soil temperature decreases at a rate of 1.5 °C per altitudinal class. Therefore, soil-dwelling animals are subjected to similar winter temperatures, whereas during the other seasons less elevated habitats are characterised by considerably higher temperatures than alpine areas. Divergent altitudinal profiles of recovery rate and temperature suggest that the presence of entomopathogenic nematodes depends on factors other than temperature.

The environmental altitudinal gradient represents a complex gradient of temperature (fig. 3B) and other factors related to elevation (e.g. humidity, soil formation). In the present study, for example, altitude was significantly correlated with pH ($r_s = -0.51$, $p < 0.001$), %C ($r_s = 0.21$, $p < 0.001$), sand content ($r_s = 0.44$, $p < 0.001$), and vegetation (Kruskal-Wallis test, $p < 0.001$). Since the nematodes are expected to respond simultaneously to various of these factors, the distribution of the nematodes was analysed using multivariate methods.

Fig. 4 shows the environmental similarity of the positive samples (n = 125) based on correspondence analysis and complete linkage clustering. Characteristics of most samples change along a continuum with respect to both axes, and only a few samples are divergent. The main gradient along the first axis represents the transition from sandy soils ("s", to the left) to soils rich in organic matter ("C", to the right). The second axis, accounting mainly for the distinction between *S. kraussei* and the other species, represents a shift from low land samples with relatively high pH levels ("p", top) towards acidic alpine samples ("a", bottom). Vegetation differentiates samples along both axes. Grassland samples ("g", as opposed to woodland samples) are associated with comparatively high pH values, a high sand content, and occur usually at the less elevated sites. The orientation of the sampling locations ("N") is only slightly associated with other sample characteristics. The proximity of "N" to "a", however, indicates that at elevated sampling locations the NW-SE oriented slopes have a slightly higher nematode prevalence than south-facing slopes.

The comparison of species occurrence with sample characteristics within G1 to G5 (tab. 2) provides information about the relative position of each species in the niche defined by the six variables shown in fig. 4. Group 1 (G1) is heterogeneous with respect to entomopathogenic nematodes as it includes all species (except *Steinernema* sp.). The dominating species is *S. kraussei*, representing 67% of the identified isolates. Samples of G1 are characterised by a high organic matter content, and a low sand content. Furthermore, this group includes the majority (i.e. 56%) of all the positive samples taken in woodland soils. In G2, the predominant species is *S. feltiae*,

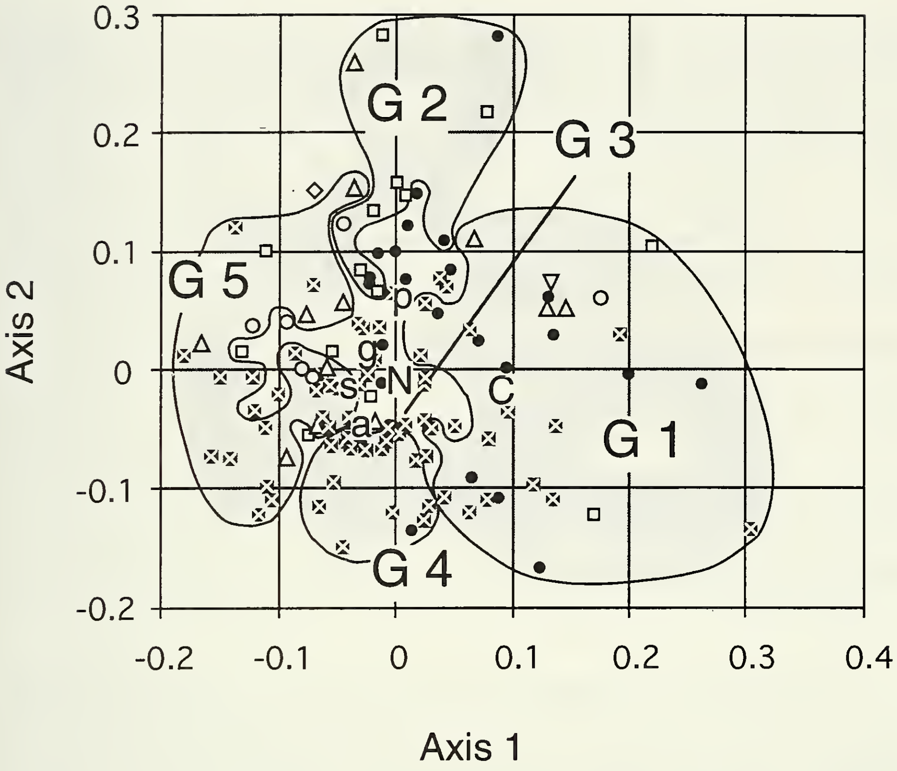

FIG. 4

Ordination and classification of positive samples (n = 128) by correspondence analysis and complete linkage clustering, respectively. Samples are characterised by vegetation ("g": grassland and "others"; as opposed to woodland) and environmental characteristics ("a": altitude; "C": organic matter content; "p": pH; "s": sand content; "N": orientation NW-SE; as opposed to S-W). The eigenvalues of the first two axes are 0.40 and 0.29, respectively. *Steinernema* spp: ●; for other species see fig. 2. G1 to G5: group identification. For clarity, the true boundary of G3 was omitted. The *S. feltiae* isolate located between "s" and "N" is a member of G4.

accompanied by one isolate of *S. intermedia* and *S. affinis*, each. All samples of G2 were taken from grassland habitats at low altitudes and were characterised by relatively high pH values. *Steinernema feltiae* has its main representation in G2 and is thus considered the most adapted species to grasslands in the lower Alps. Note that grassland samples had generally higher pH values (U-test), a higher sand content (U-test, $p < 0.001$), and a lower amount of C% (U-test, $p < 0.001$) than woodland samples.

Tab. 2

Environmental characteristics of the samples belonging to the groups G1 to G5, that were revealed by correspondence analysis and complete linkage clustering (see fig. 4).

Environmental characteristics		G1	G2	G3	G4	G5
pH	(median)	5.5	7.1	6.0	4.8	5.6
	(range)	(4.1 - 7.3)	(5.4 - 7.8)	(4.3 - 8.0)	(4.3 - 5.8)	(4.4 - 7.5)
Altitude	(median)	1565	1100	1800	1917	1765
	(range)	(970 - 1980)	(580 - 1670)	(970 - 2270)	(1610 - 2300)	(890 - 2530)
Sand content	(median)	1	1	1	2	3
	(range)	(0 - 2)	(0 - 4)	(0 - 3)	(1 - 4)	(1 - 5)
Organic content	(median)	13.7	5.8	5.8	7.4	4.5
	(range)	(5.3 - 30.9)	(2.8 - 7.9)	(2.3 - 13.0)	(4.6 - 10.4)	(1.4 - 7.7)
Vegetation (No. of samples) grassland / woodland		13 / 18	13 / 0	25 / 3	14 / 5	28 / 6
Orientation (No. of samples) S - W / NW - SE		4 / 27	3 / 10	18 / 10	1 / 18	3 / 31

The samples of G3 include all the species except *Heterorhabditis* sp., with *S. kraussei* the dominating species (71%). G3 is a transitional group with a majority of grassland samples, characterised by average values for most characteristics except orientation. About 68% of all the samples taken from south-facing slopes (S to W) are included in G3. Note that the overall recovery rate of entomopathogenic nematodes was not the same for the eight radii ($\chi^2 = 24.1$, DF = 7, $p < 0.005$), with a lower prevalence than expected on slopes with a southern orientation. G4 consists of samples yielding almost exclusively *S. kraussei* (94%), accompanied by one *S. feltiae* isolate. Samples of this group were taken at high altitudes and are characterised by low pH values, as well as by a relatively high sand content. The percentage of woodland samples in G4 corresponds to their overall rate in this survey. G5 is dominated by *S. kraussei* (67%) and *S. intermedia* (21%). The latter species has its main representation (i.e. 58%) in this group, and its ecological requirements are presumably similar to those encountered in samples of G5. *Steinernema affinis* and *S. feltiae* are represented in G5 by three and one isolates, respectively. Samples were taken mainly from grassland soils characterised by intermediate pH values, a high sand content, and a low organic matter content.

A more profound insight into the ecological requirements of relatively frequent species can be obtained by comparing positive with negative samples. For *S. kraussei*, this comparison shows that its presence in soil samples is related to orientation, soil characteristics, and vegetation. *Steinernema kraussei* was more prevalent at NW-SE facing slopes than at sampling locations exposed to S-W (χ^2= 10.4, DF = 1, $p < 0.005$). Moreover, positive samples differed from negative ones by a higher content of both organic matter (U-test) and sand (U-test, $p < 0.001$), as well as by lower pH values (U-test, $p < 0.001$). The mean pH level of samples yielding *S. kraussei* was 5.4 ± 1.1 (average ± S.D.). *Steinernema kraussei* occurred in samples characterised by significantly lower pH values than samples with *S. feltiae* (U-test), *S. intermedia* (U-test), and *S. affinis* (U-test, $p = 0.005$). Furthermore, *S. kraussei* seems to have a specificity for the some types of vegetation ($\chi^2 = 26.1$, DF = 7, $p < 0.001$). It was exceedingly frequent in alpine larch stands, but was absent in mixed forests and home gardens, and occurred less than expected in deciduous as well as in spruce forests. In pastures and dwarf shrubland, *S. kraussei* occurred according to sampling effort.

Only one isolate of *S. intermedia* and *S. feltiae*, each, were recovered from forest soils, although woodland samples were relatively frequent (n = 153). Both *S. feltiae* and *S. intermedia* seem thus to prefer grassland habitats. Similarly, *S. affinis*, *Heterorhabditis* sp., and *Steinernema* sp. were confined to grassland habitats. However, due to the low prevalence of the species other than *S. kraussei*, their association with the grassland habitat is only significant when they are treated as a group ($\chi^2 = 12.8$, DF = 1, $p = 0.001$). The pH values for *S. feltiae* (6.4 ± 1.2; average ± S.D.), *S. intermedia* (6.2 ± 0.7), *S. affinis* (6.9 ± 0.4), *Heterorhabditis* sp. (6.5), and *Steinernema* sp. (7.8) suggest that these species avoid extreme soil pH conditions.

DISCUSSION

TOTAL ENTOMOPATHOGENIC NEMATODES

Rhabditid entomopathogenic nematodes have been isolated from six continents and appear to be among the most ubiquitous insect pathogens (POINAR 1990). While most steinernematids were isolated from regions characterised by temperate or cool climates, heterorhabditids were mainly recovered from soils in warmer regions (POINAR 1990). In Europe, heterorhabditid and/or steinernematid nematodes occur in all the countries surveyed so far, however, considerable variation exists in the prevalence of entomopathogenic nematodes (BOAG *et al.* 1992). The European surveys demonstrate that these nematodes become scarce as one moves northwards. While they occur in central Europe (i.e. Germany, Switzerland, and Czechoslovakia) with a recovery rate of over 25%, corresponding values are less than 20% in Northern Europe (i.e. Norway, Republic of Ireland, Finland, Northern Ireland, and Scotland; in decreasing order). Only one survey in Sweden with 25% positive samples (BURMAN *et al.* 1986) and another one in Great Britain with 49% (HOMININCK & BRISCOE 1990a) disclaim this tendency.

The observed differences in nematode prevalence may reflect variation in the availability of suitable host species (MRACEK & WEBSTER 1993). However, since most surveys concerning entomopathogenic nematodes are primarily performed to collect new isolates for screening programs, ecological information necessary to explain the distribution of the species is often lacking. Accordingly, sampling of the present survey was designed to isolate cold-active nematodes, and no attempt was made to identify the natural hosts of the species detected. Another source for the variation in recovery rates between surveys are methodological differences. Since the presence of entomopathogenic nematodes in the soil is difficult to approve when their density is low, the sensitivity of the detection method can substantially influence the estimation of the nematode prevalence. In conclusion, only nematode-positive samples give relevant information on the distribution of the species, whereas negative samples do not provide solid evidence for the absence of the nematodes at a given sampling location. Therefore, analysis of the species' ecological niches using the information of nematode-positive samples (tab. 2, fig. 4) should yield more reliable results than the comparison of positive with negative samples, which served to analyse the environmental preferences of the species.

SPECIES LEVEL

Steinernema feltiae is recorded all over Europe (e.g. MRACEK & JENSER 1988; EHLERS *et al.* 1991; STURHAN pers. comm.). In Northern Europe, *S. feltiae* is usually the most prevalent species (e.g. BOAG *et al.* 1992; GRIFFIN e*t al.* 1991; VAINIO *et al.* 1994). In Central Europe, *S. feltiae* represents a subdominant species. For instance in Switzerland, it was the second most prevalent species (fig. 1). The observed predominance of *S. feltiae* in the lower Alps and the Jura Mountains confirms the view that it is a temperate species (HOMININCK & BRISCOE 1990). Complying with its main prevalence in soils with relatively high pH values (G2, tab. 2), *S. feltiae* was found to associate with calcareous soils in Great Britain (HOMININCK & BRISCOE 1990), and in pH neutral soils in Hungary (MRACEK & JENSER 1988). Contradictory findings exist on the vegetational specificity of S. feltiae. HOMININCK & BRISCOE (1990) recovered this species from diverse habitats, while in both Germany (STURHAN pers. comm.) and Scotland (BOAG *et al.* 1992) *S. feltiae* was most common in pastures. Results of the present study suggest that *S. feltiae* is associated with grassland habitats (G2, fig. 4). The indicated preference of *S. feltiae* for grassland soils is presumably caused by the distribution of its natural hosts, which include lepidopteran larvae (Noctuidae and Hepialidae) feeding on the roots of tussock grass (POINAR 1990). Fungus gnats and bibionid flies represent other natural hosts of *S. feltiae* (POINAR 1992), which could explain its higher efficiency in parasitising sciarid larvae as compared to the other steinernematid species (STEINER unpublished).

The overall prevalence of *S. intermedia* was similar to that of *S. feltiae* (fig.1). In Germany, *S. intermedia* is the most commonly encountered species, followed by *S. affinis* and *S. feltiae* (STURHAN pers. comm.). *Steinernema intermedia* was further discovered in Norway (HAUKELAND 1993) and in South Carolina (POINAR 1990). The analysis of its distribution (fig. 4, tab. 2) suggests that *S. intermedia* is a relatively unspecialised species, avoiding extreme pH conditions and exhibiting a slight preference for grassland habitats. In Germany, however, *S. intermedia* was significantly more often found in forests than in other habitats (STURHAN pers. comm.). Therefore, its main distribution in grassland habitats of the alpine region represents not a general vegetational specificity.

Steinernema affinis, *Steinernema* sp. and *Heterorhabditis* sp. were too rare (fig. 1) to allow a detailed interpretation of their distribution in the Swiss Alps. *Steinernema affinis* was recovered in various regions (fig. 2) at altitudes between 500 and 2100 m, and was restricted to grassland samples with pH values near neutrality. In Germany, *S. affinis* was more common than in Switzerland, and occurred most often in pastures and arable soils (STURHAN pers. comm.). This confirms the importance of the grassland habitat for the presence of *S. affinis*. Other records of this species are reported from Norway (HAUKELAND 1993), Denmark (POINAR 1990), the Republic of Ireland (GRIFFIN *et al.* 1991), and Great Britain (REID & HOMININCK 1993). The natural hosts of *S. affinis* include bibionid fly larvae, which this species therefore shares with *S. feltiae* (POINAR 1988).

Steinernema sp. is presumably a new species (close to *S. intermedia*), characterised by the same restriction fragment length patterns (RFLP) as noted for a species recently isolated in Great Britain (A. REID pers. comm.). Its geographical distribution is therefore unknown. *Heterorhabditis* sp. (i.e. North-West European Group) was detected only once in a pasture at 1130 m asl. Heterorhabditid species of the North-West European Group occur also in Denmark, Germany, and Poland (SMITS *et al.* 1991). A previously unpublished record of the same species in Switzerland at ca 400 m asl (KLINGLER pers. comm.) suggests that excessive sampling in the Swiss Plateau or in the lower Alps would reveal further isolates of *Heterorhabditis*. The poor representation of *Heterorhabditis* in the Swiss Alps, along with the high frequency of steinernematids, supports the hypothesis that heterorhabditid nematodes are endemic to warmer climates while steinernematids prevail in temperate climates (e.g. GRIFFIN *et al.* 1991; MRACEK & WEBSTER 1993).

Steinernema kraussei was the most commonly encountered species in the Swiss Alps (figs. 1 and 3). Its predominance was unexpected. In Germany, it occurred equally frequent as *S. feltiae*, but was less common than *S. intermedia* and *S. affinis*, while in Great Britain, only 20% of all samples were *S. kraussei* and around 50% *S. feltiae* (A. REID pers. comm.). Since over 25% of the *S. kraussei* isolates in Switzerland originated from sampling locations above 2000 m, this species must endure long periods of low temperatures, and is thus supposed to be a cold active species. In fact, laboratory experiments showed that *S. kraussei* was significantly more active and infective at low temperatures than *S. feltiae* or the heterorhabditid isolate (STEINER 1996).

The alpine distribution of *S. kraussei* indicates the ability of infective juveniles to survive for long periods at low temperatures (BRIAND & WELCH 1963 cited in WOUTS 1991). The permanent snow-cover in winter stabilises soil temperatures near the freezing point. The isolating effect of snow is especially important in regions with extreme minima in air temperatures. In the Engadine (R6 in fig. 2; upper part of the valley of the river Inn), for example, cold air sinking at night to the bottom of the valley leads to very low air temperatures, but soil temperatures are similar to those measured at other climatological stations (fig. 3B; 1800 m). While at 600 m the period with a permanent snow-cover lasts for only 20 days, it increases constantly as one goes upwards, reaching over 250 days above 2400 m. The upper altitudinal limit of *S. kraussei* could thus be governed by the sum of the positive temperatures in the warmer season, which also affects the duration of the vegetational period and the abundance of associated insect hosts. Evidence is drawn from laboratory observations, showing that 6-8 °C represent the lower limit for the successful propagation of most alpine isolates (STEINER unpublished). This suggests that reproduction is confined to the short summers. The precise role of temperature for the distribution of entomopathogenic nematodes is thus direct via a lower limit for reproduction, and indirect via the vegetation, the availability of associated host species, and soil formation (see below).

The higher prevalence of *S. kraussei* at NW-SE facing slopes as compared to sampling locations exposed to S-W is considered to be a further effect of temperature via soil characteristics. According to the negative relationship between temperature and soil formation, the relatively cool sampling locations oriented to NW-SE were more acidic (U-test, $p < 0.001$) and had a higher content of organic matter (U-test, $p < 0.05$) than sites oriented to S-W.

Surprisingly, though, *S. kraussei* appears to have a lower limit of its natural distribution in Switzerland. Why does *S. kraussei* not colonise areas downslope, all the more as it occurs in Germany (STURHAN pers. comm.) and southern Bohemia (MRACEK 1994) at lower altitudes? Unfortunately, the identity of this species was unclear (e.g. POINAR 1990; MRACEK 1994), and notes on the actual distribution of *S. kraussei* are scarce. Taking into account that laboratory cultures of the alpine *S. kraussei* isolates can be maintained at 25 °C (STEINER unpublished), factors other than high temperature (e.g. presence of natural hosts) must be responsible for the observed lower limit of this species. *Steinernema kraussei* was originally isolated from the web spruce sawfly (*Cephalcia abietis* [L.]) in a German forest stand (MRACEK 1994). The high prevalence of *S. kraussei* in the Swiss Alps, however, must rely on another host species, because *C. abietis* is rare in Switzerland. Occurring exactly in the same altitudinal range as *S. kraussei* in the present survey, *Zeiraphera diniana* (Gn.), a major pest of larch trees, could represent the natural host of this nematode. Since sampling in the present survey was performed only one year after the population collapse of *Z. diniana* in 1990, we can speculate that the larch bud-moth is partly responsible for the high recovery rate of *S. kraussei* in larch stands of the Engadine (R6 in fig. 2). The comparatively low frequency of *S. kraussei* in spruce forest is presumably also related to the availability of suitable host species, all the more soil characteristics of larch stands were similar to those measured in spruce forests.

The analysis of the ecological niche of *S. kraussei* showed that pH and sand content of the soil, the humus, orientation, as well as the vegetation cover influence the distribution of this species. Soil acidity, possibly associated with a high content of organic matter, is considered a key factor for the distribution of *S. kraussei*. Evidence is drawn from a general increase in soil acidity as one moves upwards, paralleled by a habitat shift of the nematode. In the plains, *S. kraussei* seems to prefer woodland soils (e.g. STURHAN pers. comm.), whereas in the Alps, its frequency was equal in grassland and forest habitats. Forest soils differed from grassland at sample sites below 1500 m by a lower pH (U-test, $p < 0.001$), whereas above 1500 m, their acidity was similar. Conversely, other differences between the two vegetation types remained constant irrespective of altitude. Likewise, woodland samples were characterised by a higher content of organic matter (U-test, $p < 0.001$), and a lower sand content (U-test, $p < 0.05$) than grassland samples.

CONCLUSIONS

The present survey showed that rhabditid entomopathogenic nematodes are represented in the Swiss Alps by six species. *Steinernema kraussei* is clearly the dominant species at high elevations and must be well adapted to alpine climate. It occurs especially frequent in alpine larch stands and occupies an ecological niche well separated from the other nematodes encountered. *Steinernema kraussei* tolerates soils with low pH and rich in organic matter, and is living in both grassland and forest ecosystems, whereas *S. feltiae*, *S. intermedia*, and *S. affinis* are most prevalent in grassland ecosystems at relatively high pH values.

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Revision of the soil-weevil genus *Guineobius* Osella from New Guinea (Coleoptera, Curculionoidea, Entiminae, Celeuthetini)*

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Revision of the soil-weevil genus *Guineobius* Osella from New Guinea (Coleoptera, Curculionoidea, Entiminae, Celeuthetini). - Four new species of the entimine soil-weevil genus *Guineobius* Osella (*G. niger* Riedel, *G. minutus* Riedel, *G. depressus* Riedel, *G. baliemensis* Riedel) are described from the highlands of Irian Jaya. This is the first record of this genus for the western part of New Guinea. The two formerly known species of this genus from Papua New Guinea are redescribed. A key is given to all species and the phylogenetic significance of characters is discussed. The relative length of abdominal sternites proved to be highly variable within the genus. The possession of modified scales in most species is suggested as an apomorphic character for *Guineobius* Osella. Notes are given on ecology and conservation.

Key-words: Coleoptera - Curculionoidea - New Guinea - Taxonomy.

INTRODUCTION

Knowledge of the soil-weevil fauna of New Guinea perfectly reflects the recent exploration of this island in other scientific and cultural fields. No endogean weevil was known from New Guinea when OSELLA (1983) described the genus *Guineobius* based upon two species, one of them known from a unique specimen, the other known from two specimens only. Since then there are no further records. However, this is not surprising, since most of the highland areas became accessible only 20–30 years ago and the few collecters who have visited this region since, resorted mainly to standard collecting techniques such as beating and sweeping. Sieving the ground litter, the usual way to obtain endogean weevils was usually neglected.

On a series of his own expeditions to New Guinea beginning in 1990 the senior author repeatedly visited one locality on the eastern slopes of the Baliem valley

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* Results of the entomological explorations of A. Riedel in New Guinea in 1990–1993.

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(Irian Jaya) which resulted in the discovery of three additional species there. One more species was found in the Nalca region. These four new species are described below and their phylogeny and ecology are discussed.

MEASUREMENTS

Since the eyes in *Guineobius* are reduced or completely absent, the length of the rostrum was not measured from the anterior margin of the eyes as is usual in most Curculionoidea, but from the transverse furrow at the base of the rostrum. The breadth of the rostrum was measured between the pterygia. The width of the elytra was measured across both elytra at their widest point.

CHARACTERS

When OSELLA (1983) described the genus he defined it mainly on the loss of eyes, the ferruginous coloration, the strong punctation of the pronotum and the morphology of the abdomen (more or less straight suture between sternites III and IV; and sternites V and VI subequal in length). Since characters associated with the soil-dwelling habit, namely loss of eyes and ferruginous coloration are prone to convergence, we were looking for better evidence to prove the monophyly of the genus *Guineobius*. This was especially important since we discovered striking differences of the relative lengths of abdominal sternites, which made at first a polyphyly appear possible.

Modified scales of asymmetrical radiate pectinate shape are interpreted as apomorphy for *Guineobius* (Figs. 1–3). They are often found in dense patches or rows, especially on the ventral surface and are usually encrusted with dirt. The function of these scales is unknown. They are similar to some scales described by PAULAY (1985) in the genus *Miocalles* of Cryptorhynchinae, but we have not found such scales in any other genus of Celeuthetini. There are two species of *Guineobius* (*G. minutus* sp. n., G. viduus Osella) which lack these scales but this can be explained by secondary loss (see Phylogeny).

The variability of the abdomen (Figs 16–21) is astonishing. The two extreme types would probably lead a taxonomist to describe two different genera if the intermediate forms were unknown. It must be noted that in *Guineobius* the length ratios between abdominal sternites are identical in both sexes. In other genera of Celeuthetini such as *Stereogastrus* and *Piezonotus* some abdominal sternites are enlarged in females only.

An interesting genital character of various genera of Celeuthetini which is also present in at least two species of *Guineobius* is a partial eversion of the median part of the endophallus (Fig. 22). This is not an incomplete re-inversion but obviously the normal state since the walls of this part of the endophallus part are partially sclerotized. In *Guineobius* this character is most conspicuous in *G. niger*, but it is present in *G. minutus* as well. We have found it also in another probably undescribed genus of Celeuthetini. Sharp (1918) mentions in a "*Trigonops*, or *Heteroglymma* sp. n.?" from New Guinea a "structure which has all the appearance of being a tube" inside the median lobe and we believe it is the same character described above. Since the species mentioned above do not seem to be closely related in other respects the character of the secondary tube seems to be an ancient one in the evolution of Celeuthetini.

The length of the flagellum seems to be highly variable within the tribe Celeuthetini. Within *Guineobius* two forms occur: one is short and simply curved, the other long, thread-like and spiral. The long form is probably a character reversal in Guineobius (see also Phylogeny). According to THOMPSON (1977) both short and long flagella also occur in the genus *Apirocalus*.

Guineobius Osella

Type-species: *Guineobius viduus* Osella, 1983, by original designation.

REDESCRIPTION:

Length. Small, pronotum plus elytron: 1.59–2.78 mm.

Rostrum with apical declivity evenly, not abruptly sloping, subglabrous, with several long setae; dorsally separated from head by more or less distinct transverse furrow which curves laterally apicad towards antennal scrobes.

Head with apical portion merging with rostrum; eyes lacking or small (not larger than last funicular article), smooth, without visible facets; if present eyes placed on anterior portion of head in front of level of median part of transverse furrow but ventral to forward curving lateral parts of transverse furrow (Figs 10, 13–15).

Antennae with scape passing anterior margin of pronotum in repose, setose, and more or less granulate; funicle with article 1 about 2X as long as broad apically, 2 shorter than 1, 3–7 subequal in length, ca. as long as broad.

Elytra smooth; strial punctures deeply impressed; humeri and scutellum lacking.

Metasternum short, shorter than diameter of mesocoxa.

Abdomen with intercoxal process broad, 1.5–1.8X wider than metacoxae.

Legs with ventral surface of tarsi with long curved suberect setae, claws stout.

Vestiture generally lacking except most punctures (especially on elytra) bearing single seta and except modified scales, often condensed in patches on head or on thoracic and abdominal venter.

KEY TO THE SPECIES OF *Guineobius*

1 Body large (pronotum plus elytron 2.4–2.8 mm), black; sternites V–VI short, equal in length (Fig. 16). . . . . *niger* sp. n.

– Body small (pronotum plus elytron 1.6–2.3 mm), ferruginous; sternites V–VI longer, subequal or unequal in length (Figs 17–21). 2

2 Sternites V and VI subequal in length with sternite VI slightly longer; suture between sternites III–IV entirely absent (Figs 17–18). 3

– Sternites V and VI slightly to strongly unequal in length with fifth sternite 2X–3X longer than sternite VI; suture between sternites III–IV distinct at least laterally (Figs 19–21). 4

3 Rostrum above with transverse basal band of scales, head smooth (Fig. 11). . . . . *deharvengei* Osella

– Rostrum lacking transverse basal band of scales, head punctate (Fig.12). . . . . *viduus* Osella

4 Fifth sternite 2.0X longer than sternite VI (Fig. 19); body size small, pronotum plus elytron 1.6 mm. . . . . *minutus* sp. n.

– Fifth sternite 2.8X–3.1X longer than sternite VI (Figs 20–21); body size larger, pronotum plus elytron 1.9–2.3 mm. 5

5 Base of rostrum ventrally with round patch of scales; body elongate, flattened (Fig. 8); head smooth (Fig. 14). . . . . *depressus* sp. n.

– Base of rostrum ventrally with glabrous pit; body not strikingly elongate or flattened (Fig. 9); head punctate (Fig. 15). . . . . *baliemensis* sp. n.

Guineobius niger Riedel, sp. n. (Figs 1–4, 10, 16, 23, 28, 33)

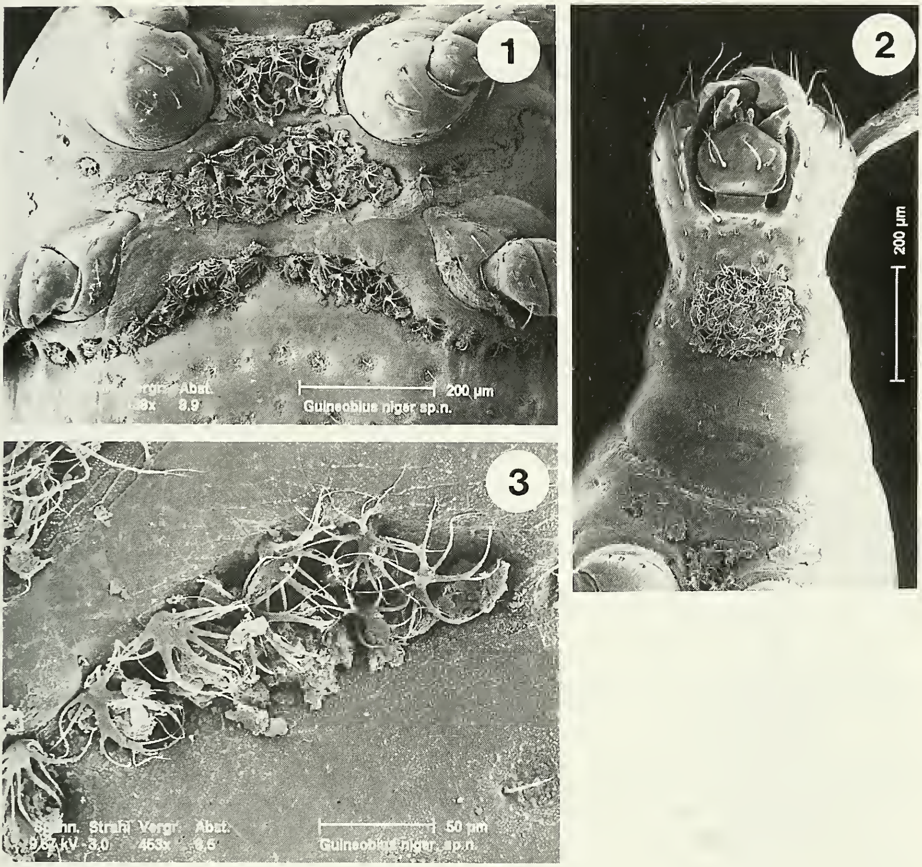
MATERIAL EXAMINED: Holotype: Irian Jaya, Jayawijaya-Province, Wamena, Jiwika; 1900–2000 m, 23.IX.1992, leg. A. Riedel. Paratypes: Irian Jaya, Jayawijaya-Province, Wamena, Jiwika, ca. 1700–2300 m, 2.IX.1991, leg. A. Riedel (4); 1700–2000 m, 11.IX.1991, leg. A. Riedel (2 and allotype); 1900–2050 m, 24.X.1993, leg. A. Riedel (15); as holotype (28, 1 coated for SEM).

Holotype and allotype deposited in the Zoologische Staatssammlung (München). Paratypes deposited in collections A. Riedel (München), G. Osella (L'Aquila), C.W. O'Brien (Tallahassee) and Muséum d'histoire naturelle (Geneva).

DIAGNOSIS: Large, black; base of rostrum ventrally with round patch of scales, center of metasternum densely squamose; sternites V–VI short, equal in length.

DESCRIPTION:

Holotype, male. Length. Pronotum plus elytron: 2.78 mm. Rostrum 1.36X longer than broad, in dorsal view lateral margins roundly diverging to antennal insertion, there rostrum much broader than at base; furrow separating dorsal part of rostrum partly merging with antennal scrobes anteriorly, laterally strongly impressed, posteriorly shallow and medially weakly impressed; declivital area in front of antennal scrobes moderately long; parts of scrobes in front of antennal insertion short, at antennal insertion curved inwards, converging obliquely in straight line, posteriorly open; dorsum between scrobes narrowing posteriad, almost flat, but slightly elevated medially in anterior portion, with long setae arranged in form of anteriorly open V; dorsum in posterior 1/2 of rostrum narrow, narrower than length of article 2 of funicle; behind with shallow, indistinct median furrow and punctate; sides of dorsum steeply concavely sloping; in lateral view straight in basal 1/2, dorsal and ventral margins parallel; at level of antennal insertion broader, curved ventrad; ventrally with large round patch of modified scales; with setiferous punctures.



FIGS 1–3

Guineobius niger sp. n., modified scales (SEM). (1) ventral aspect of mesothorax, metathorax and sternite III with squamose patches; (2) ventral aspect of head with squamose patch at base of rostrum; (3) modified scales with dirt incrustations. Scale bars: (1–2) 0.2 mm; (3) 0.05 mm.

Head with basal part globose, smooth; vestigial eyes as large as last funicular article, located dorsolaterally on ovate elevated punctate lobes reaching from rostrum onto smooth part of head. Antennae. Funicle with article 1 conical; 2 elongate, 1.7X longer than 3; club with basal half conical, apical half broadly rounded, apical 1/3 more densely setose.

Prothorax slightly (1.09X) longer than broad, side margins strongly rounded; disc strongly punctate with large punctures, distance apart greater than their diameter; sides with widely scattered, smaller punctures; basally constricted, constriction densely squamose, medially strongly rounded, apically gradually narrowing dorsally. Elytra elongate-ovate, 1.37X longer than broad, broadest at basal 1/4, then subparallel to apical 1/4; deeply punctate, setae minute, punctures separated by length of their diameter; with 10 regular striae; stria 8 shortened at base, beginning at level of metacoxa. Prosternum. Coxae separated by 0.20X coxal diameter; densely squamose behind coxae; with anterior apical constriction; with deep posterior impression between coxae. Mesosternum with intercoxal process densely squamose, coxae separated by 0.92X coxal diameter. Metasternum medially densely squamose, laterally subglabrous with row of squamiferous punctures bordering mesocoxae.

Abdomen. Sternites III and IV subequal in length, suture between fine but distinct, slightly sinuate medially; sternite III with deep, sinuate impression bordering front-margin of intercoxal process, with row of squamiferous punctures continuing to elytral margin; remainder of sternites III and IV smooth, shallowly punctate, medially concave; sternites V and VI equal, narrow, together 1/2 as long as sternite IV; sternite VII half-rotund, longer than sternites V and VI together, punctate. Legs. Tarsi with tarsomere 3 long, ventrally deeply bilobed, tarsal articulation at posterior 1/2. Coloration of cuticle black, with slightly bluish, oily shine.

Genitalia. Median lobe much shorter (0.47X) than apodemes, stout, in lateral view weakly curved from base to apex, in dorsal view apex evenly rounded. Endophallus with distinct partial median eversion, here membrane sclerotized in part; apical half curved forward to base of median lobe, with minute spines; flagellum 0.54X as long as median lobe.

Allotype, female. Same as male except: Length. Pronotum plus elytron 2.78 mm. Prothorax with side margins slightly less strongly rounded. Abdomen with sternites III and IV convex.

Genitalia. Spermatheca with distinct ramus; extended at insertion of spermathecal duct; insertion of spermathecal duct and of spermathecal gland well-separated; body apically bent inward and much thinner than at base.

Infraspecific variation: Length. Pronotum plus elytron 2.41–2.78 mm. Coloration from yellowish brown in one teneral specimen to piceous and completely black, with bluish shine in most specimens. Prothorax. Punctation varying from denser (diameter of punctures larger than interspaces between punctures) and deeper to sparser (diameter of punctures smaller than interspaces between punctures) and shallower.

Etymological Note: This epithet is based on the Latin adjective niger (black, dark) and refers to the black coloration in mature specimens.

Guineobius deharvengei Osella 1983 (Figs 5, 11, 17, 24, 33)

Guineobius deharvengei Osella, 1983: 115.

MATERIAL EXAMINED: Holotype, female, Papua New Guinea, Port Moresby, Rauna Falls, 5.XI.1978, leg. Deharveng. Deposited in Muséum d'histoire naturelle (Geneva).

DIAGNOSIS: With transverse band of scales dorsally at base of rostrum; dorsum of rostrum between antennal scrobes with sides converging posteriad in straight line; head impunctate; sternite VI longer than sternite V, suture between sternites III and IV entirely effaced.

FIGS 4–9

Habitus, dorsal: (4) *Guineobius niger* sp. n., paratype, length of pronotum plus elytron 2.65 mm; (5) *G. deharvengei* Osella, holotype, length of pronotum plus elytron 1.82 mm; (6) *G. viduus* Osella, holotype, length of pronotum plus elytron 1.80 mm; (7) *G. minutus* sp. n., holotype, length of pronotum plus elytron 1.59 mm; (8) *G. depressus* sp. n., holotype, length of pronotum plus elytron 2.34 mm; (9) *G. baliemensis* sp. n., allotype, length of pronotum plus elytron 1.94 mm.

REDESCRIPTION:

Holotype, male. Length. Pronotum plus elytron: 1.82 mm.

Rostrum as long as broad, lateral margins subparallel in dorsal view; transverse furrow separating dorsal part of rostrum medially broadly deeply impressed, laterally finer, ending below antennal scrobes, throughout partly hidden by ring of modified scales; declivital area in front of antennal scrobe moderately short; antennal scrobes S-shaped, in front of antennal insertion narrow, curved inward, posteriorly broad, converging slightly sinuate in almost straight line, posteriorly open; dorsum between scrobes narrowing with straight margins posteriad, behind separated by 1.67X length of funicular article 2, posteriad scrobes widening, but very short; dorsum smooth except median furrow in posterior 1/2 and few punctures and setae anteriorly; in lateral view straight, tapering apicad, ventral margin straight, dorsal margin sloping down roundly; base dorsally with transverse dense band of modified scales, keeping posteriad antennal scrobes, laterally tapering; in the holotype band asymmetrical, reaching further ventrad on right side; ventrally subglabrous, with few long setae; postmentum triangularly elevated.

Head globose, smooth, shining. Antennae. Funicle with article 2 short, 1.2X longer article 3; club pointed apicad, evenly setose.

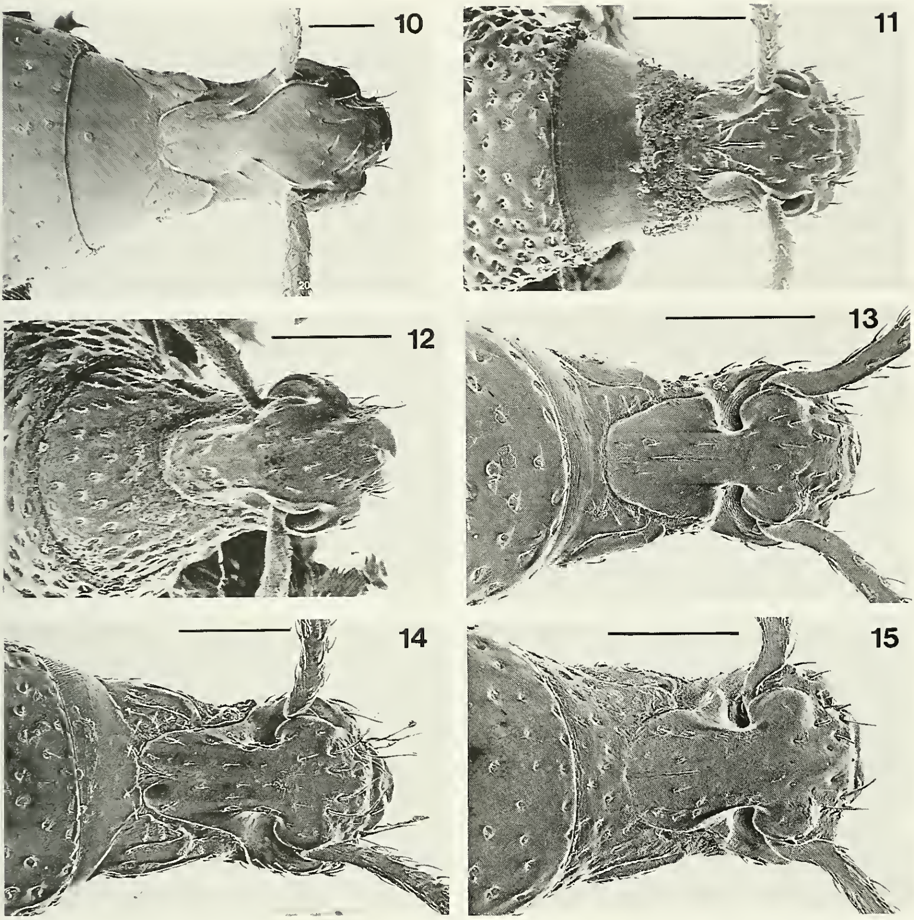
Prothorax almost (1.07X longer) as long as broad, side margins strongly rounded; disc deeply punctate, diameter of punctures larger than their distance, punctures with suberect setae; laterally with same sculpture; with squamose basal constriction. Elytra elongate, 1.59X longer than broad, broadest about middle, evenly curved from base to apex, setae moderately long; stria 8 shortened at base, beginning at level of metacoxa. Prosternum glabrous, punctate with distinct preapical constriction; coxae separated by 0.56X coxal diameter. Mesosternum with coxae separated by 1.67X coxal diameter. Metasternum especially on sides deeply punctate, subglabrous, with scattered setae.

Abdomen glabrous, sternites III-IV densely shallowly punctate, medially shallowly depressed, suture between sternite III and IV completely effaced; sternite V narrow, sternite VI broad, 1.42X longer sternite V; sternite VII 1.27X longer sternites V and VI together, apically broadly rounded. Legs. Tarsi with tarsomere 3 short, broad, deeply bilobed. Coloration of cuticle light ferruginous, head and prothorax little darker.

Genitalia: Spermatheca crescent-shaped, extended at insertion of spermathecal duct; insertion of spermathecal duct not clearly visible in allotype, but probably well separated from insertion of duct; body tapering apicad, outer margin evenly curved.

Remarks: The most distinct character of this species, a transverse dorsal band of modified scales at the base of the rostrum is not a complete ring as OSELLA described it. Ventrally there were only dirt-accrustations faking easily scale-covering, but they could easily be removed with warm water.

Etymological Note: This species was named in honour of Mr. Deharveng. If it was formed from this modern name the spelling would have to be *deharvengi*. It is spelled this way on the label of the holotype. However, in the original publication OSELLA has used the name deharvengei. This has to be taken as the genitive of the latinized name *deharvengeus*. Usually the latinization of a male personal name is formed by adding the ending -ius, but the ending -eus is valid as well. Thus the name *deharvengei* is a correct original spelling although a little unusual.



FIGS 10–15

Head, dorsal (SEM). (10) *G. niger* sp. n., paratype; (11) *G. deharvengei* Osella, holotype; (12) *G. viduus* Osella, holotype; (13) *G. minutus* sp. n., holotype; (14) *G. depressus* sp. n., holotype; (15) *G. baliemensis* sp. n., allotype. Scale bars: 0.2 mm.

Guineobius viduus Osella 1983 (Figs 6, 12, 18, 29, 33)

Guineobius viduus Osella, 1983: 114.

MATERIAL EXAMINED: Holotype, male, Papua New Guinea, Chiumbu, Chuave, 22.XI.1978, leg. Deharveng. Deposited in Muséum d'histoire naturelle (Geneva).

DIAGNOSIS: Devoid of scales; head strongly punctate; sternite VI longer than sternite V, suture between sternites III and IV entirely effaced.

REDESCRIPTION:

Length. Pronotum plus elytron: 1.80 mm. Rostrum 1.17X longer than broad, in dorsal view lateral margins slightly evenly roundly diverging apicad; furrow separating dorsal part of rostrum deeply impressed throughout, anteriorly ending below antennal scrobes; declivital area in front of antennal scrobe moderately short; antennal scrobes intermediate between S- and kidney-shaped form, posteriorly opposing each other at blunt angle, separated by 1.25X length of funicular article 2; dorsum anteriorly between antennal scrobes widening posteriad, then sinuately narrowing posteriad, posteriorly antennal scrobes parallel-sided, moderately broad, curved; dorsum in apical part medially elevated, elevation surrounded by long setae arranged in form of anteriorly open V; in lateral view straight, ventral margin straight, dorsal margin convex; laterally with setiferous punctures, sculpture confluent with head; ventrally at base with scattered non-modified suberect scales.

Head flat, above densely deeply punctate; ventrally smooth, glabrous. Antennae. Funicle with article 2 short, 1.3X longer article 3, stalked, basal 1/2 narrow and parallel-sided; club ovate, apically weakly pointed and denser setose.

Prothorax 1.15X longer than broad, side margins rounded; disc deeply punctate, laterally diameter of punctures larger than their distance, medially their distance larger and partly impunctate; on sides punctation denser; base without constriction. Elytra elongate, 1.63X longer than broad, broadest about middle, evenly curved from base to shortly before apex, then slightly sinuate; setae moderately long. Prosternum glabrous, punctate, preapical constriction indistinct; coxae separated by 0.50X coxal diameter; striae 6 and 7 shortened at base, beginning at level of metacoxa. Mesosternum with coxae separated by 1.21X coxal diameter. Metasternum subglabrous, with few setae.

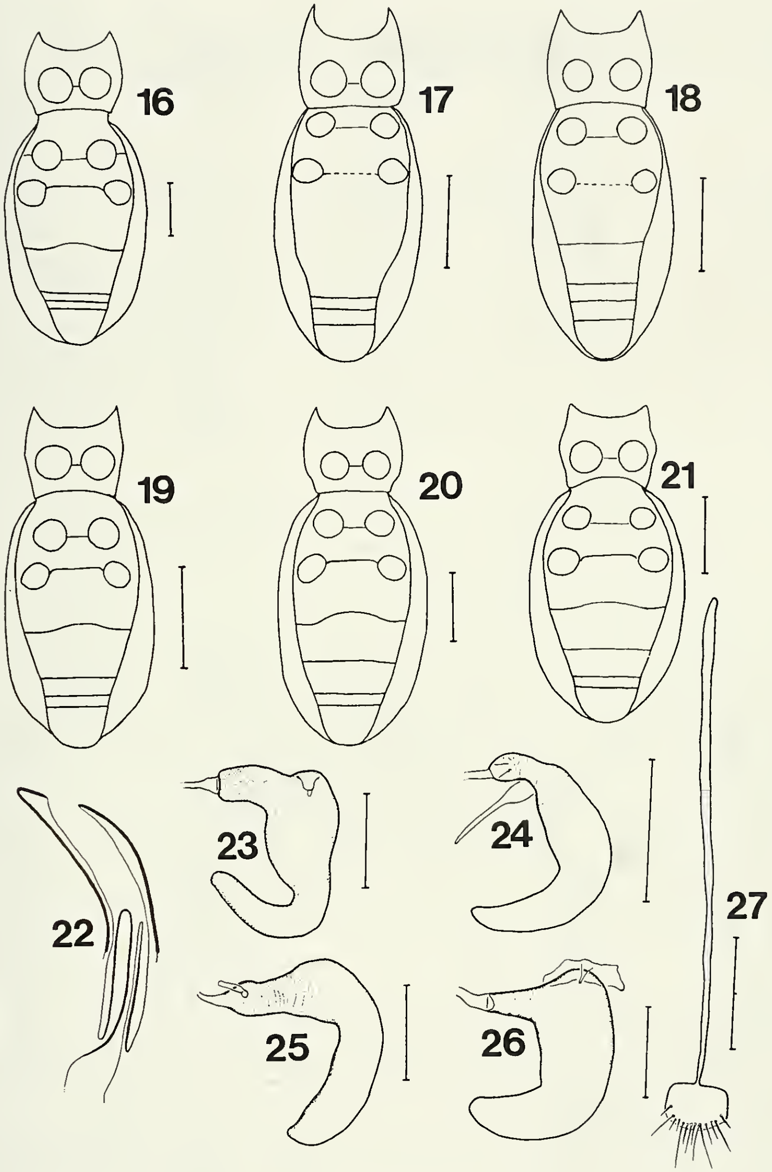
Abdomen glabrous, sternites III and IV laterally punctate, medially deeply impressed and smooth; suture between sternites III and IV medially completely effaced, laterally with trace of suture; sternites V and VI broad, subequal, sternite VI 1.1X longer sternite V; sternite VII 1.1X longer sternites V and VI together, apically rounded. Legs. Tarsi with tarsomere 3 short, broad, deeply bilobed. Coloration of cuticle light ferruginous, head and prothorax little darker.

Genitalia. Median lobe slightly shorter (0.91X) than apodemes, in lateral view strongly curved in basal 1/4, in dorsal view apex produced into pointed apical lip. Endo-phallus without visible partial median eversion, inside median lobe with minute spines, without distinct sclerites; outside median lobe first bent apicad, then bent basad resulting in Z-shaped form; flagellum 0.35X as long as median lobe.

Guineobius minutus Riedel, sp. n. (Figs 7, 13, 19, 30, 33)

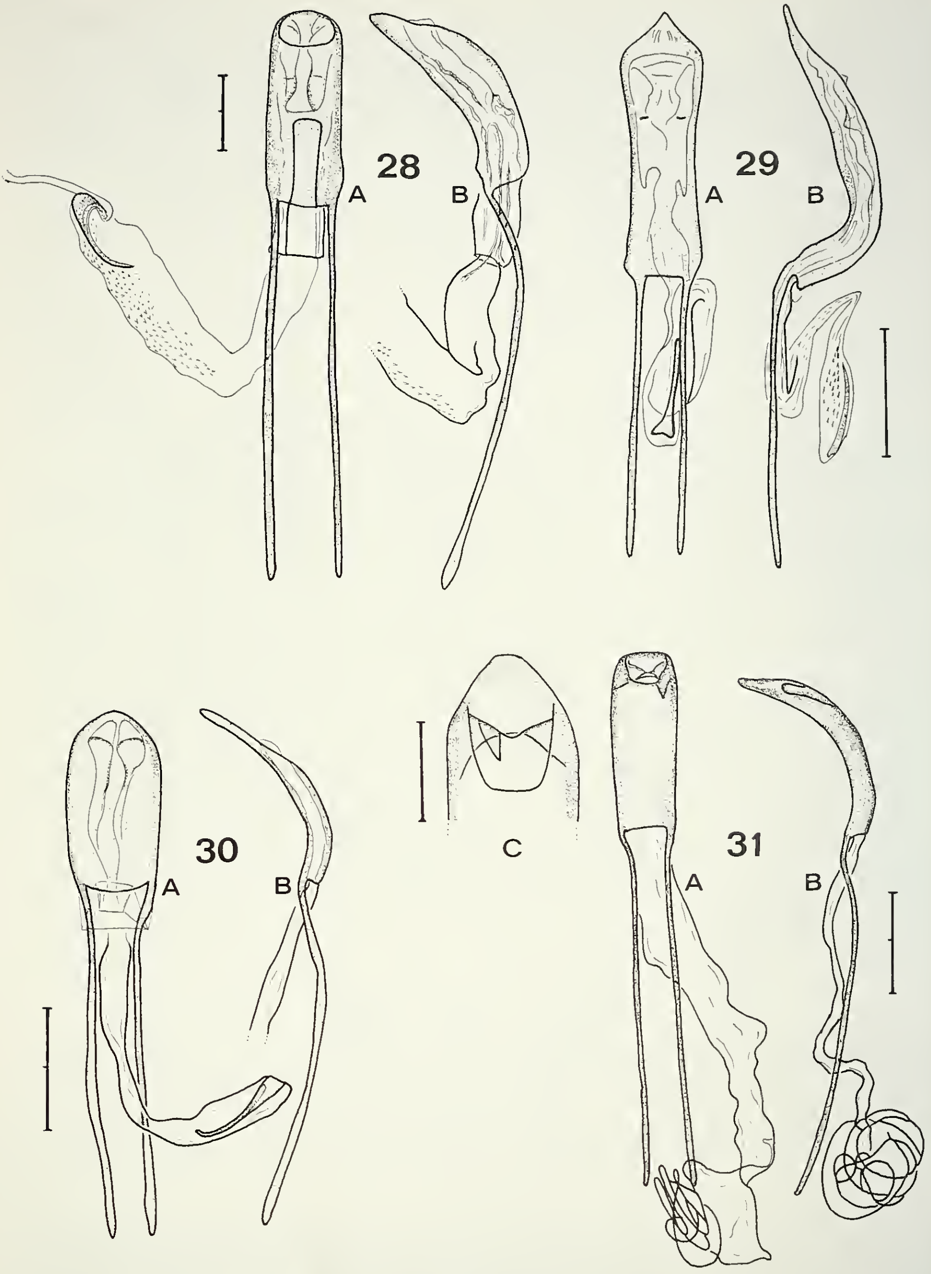
MATERIAL EXAMINED: Holotype: Irian Jaya, Jayawijaya-Province, Diuremna near Nalca, 1900–2100 m, 9–11.IX.1992, leg. A. Riedel. Left hind leg missing.

Holotype deposited in the Zoologische Staatssammlung (München).



Figs 16–27

(16–21) ventral aspect of thorax and abdomen; (16) *G. niger* sp. n.; (17) *G. deharvengei* Osella; (18) *G. viduus* Osella; (19) *G. minutus* sp. n.; (20) *G. depressus* sp. n.; (21) *G. baliemensis* sp. n.; (22) *G. niger* sp. n., aedeagus, schematic longitudinal section; (23–26) spermatheca; (23) *G. niger* sp. n., allotype; (24) *G. deharvengei* Osella; (25) *G. depressus*, holotype; (26) *G. baliemensis* n. sp., allotype; (27) *G. depressus* sp. n., holotype, sternite VIII. Scale bars: (16–21) 0.5 mm; (23–26) 0.1 mm; (27) 0.2 mm.



Figs 28–31
Male genitalia; aedeagus in dorsal (A) and lateral (B) aspect. (28) G. niger sp. n., holotype; (29) *G. viduus* Osella, holotype; (30) *G. minutus* sp. n., holotype; (31) *G. baliemensis* sp. n., holotype; (31c) apical aspect. Scale bars: (28–31B) 0.2 mm; (31C) 0.1 mm.

DIAGNOSIS: Small; without modified scales; posterior half of rostral dorsum narrow, ridge-shaped; deep punctures of elytra each with long suberect seta; sternite VI 1/2 as long as sternite V.

DESCRIPTION:

Holotype, male. Length. Pronotum plus elytron: 1.59 mm. Rostrum 1.49X longer than broad, in dorsal view lateral margins subparallel from base to apex; furrow separating dorsal part of rostrum anteriorly ending where antennal scrobes bent inwards, shallow but distinct throughout; dorsum of rostrum extending tongue-like far behind on head; declivital area in front of antennal scrobes long; antennal scrobes kidney-shaped in dorsal view, posterior 1/2 strongly bent inward, scrobes opposing each other at blunt angle, separated by dorsum equal to length of funicular article 2; dorsum between antennal scrobes subquadrate, flat, with relatively short setae, irregularly arranged in form of anteriorly open V; dorsum in posterior half of rostrum extremely narrow, ridge-shaped, but with distinct median furrow; sides of dorsum smoothly sloping, glabrous, shining; round lobes stretching backwards onto smooth head including together with posteriorly produced dorsum cuneiform process of head bearing setae directed medially and tiny vestiges of eye in the anterior corner; in lateral view parallel basally, tapering apicad; ventrally obliquely wrinkled, subglabrous, with few erect setae; medially with small pit, but without modified scales.

Head smooth and shining. Antennae. Funicle with second article 1.6X longer article 3; club ovate, apex weakly pointed, apex denser setose than base. Prothorax elongate, side margins rounded, 1.13X longer than broad; except along mid-line densely punctate with large punctures, their diameter larger than their distance, each puncture bearing long suberect seta; with narrow glabrous basal constriction. Elytra elongate, at base weakly rounded, broadest behind middle, in apical 1/5 strongly and broadly rounded to apex; strial punctures large, deep, bearing long erect seta subequal in length to diameter of puncture; stria 6 shortened at base, beginning at level of metacoxa; stria 7 complete; stria 8 shortened, beginning behind level of metacoxa; stria 10 pressed to elytral margin.

Prosternum with preapical constriction, glabrous, punctate, coxae separated by 0.29X coxal diameter. Mesosternum glabrous, punctate with deep large punctures, coxae separated 0.73X coxal diameter. Metasternum glabrous, punctate.

Abdomen glabrous, punctate; front- and hind-margin of sternite III bordered by a row of punctures; sternites III and IV subequal in length, suture between distinct throughout, medially sinuate; sternites V and VI together shorter (0.76) than sternite IV; sternite VI half as long as sternite V; sternite VII slightly longer (1.1X) than sternite V and VI together, broadly rounded apically. Legs. Tarsi with tarsomere 3 short, subquadrate, apex ventrally sinuate, cavity for articulation of tarsomere 5 occupying greatest part. Coloration of cuticle ferruginous.

Genitalia. Median lobe much shorter (0.54X) than apodemes, dorsoventrally flattened, in lateral view weakly curved from base to apex, in dorsal view apex bluntly pointed. Endophallus with short median partial eversion, without distinct sclerites, without minute spines; apex curved apicad towards base of median lobe, without distinct sclerites; flagellum 0.62X shorter median lobe.

Etymological Note: This epithet is based on the Latin adjective *minutus* (small, tiny) and refers to the small size of this species.

Guineobius depressus Riedel sp. n. (Figs 8, 14, 20, 25, 27, 33)

MATERIAL EXAMINED: Holotype: Irian Jaya, Jayawijaya-Province, Wamena, Jiwika; 1900–2000 m, 23.IX.1992, leg. A. Riedel
Holotype deposited in the Zoologische Staatssammlung (München).

DIAGNOSIS: Body flattened; rostrum ventrally with round patch of modified scales; sternite V much longer (3.07X) than sternite VI;

DESCRIPTION:

Holotype, female. Length. Pronotum plus elytron: 2.34 mm. Rostrum 1.43X longer than broad; in dorsal view lateral margins subparallel from base to apex; furrow separating dorsal part of rostrum anteriorly ending below antennal scrobes, laterally well impressed, posteriorly less distinct; declivital area in front of antennal scrobes short; antennal scrobes kidney-shaped in dorsal view, opposing each other in almost straight line, scrobes there separated by dorsum broader (1.2X) length of funicular article 2, posterolateral margin not sharply delimited; dorsum between scrobes subquadrate, flat, with long irregularly arranged setae; dorsum in posterior half of rostrum broad, broader than funicular article 2 long, with flat, broad median sulcus, sides of dorsum steeply sloping; in lateral view rostrum curved, dorsal and ventral margins parallel; laterally shining with setiferous punctures; behind vestige of eye wrinkly sculptured; ventrally with round patch of modified scales.

Head smooth. Antennae. Funicle stout, second article 1.7X longer article 3, articles 3–7 parallel-sided; club ovate, apex weakly pointed, evenly densely setose except extreme base subglabrous.

Prothorax slightly longer (1.11X) than broad, side margins moderately rounded, disc convex, strongly punctate with large punctures, their distance smaller than their diameter; sides denser punctate than disc; basal part constricted, separating cylindrical, ventrally and laterally densely squamose basal part narrowing dorsally, there medially glabrous; Elytra elongate, 1.46X longer than broad, at shoulders evenly rounded, then subparallel till rounded at apex; dorsoventrally depressed; strial punctures small, laterally punctures bearing short erect seta, medially glabrous; striae 7–8 shortened at base, beginning at level of metacoxa. Prosternum. Coxae separated 0.63X coxal diameter; with preapical constriction; behind constriction to hind margin densely covered with modified scales. Mesosternum. Coxae separated by 1.1X coxal diameter; margin of intercoxal process with modified scales. Metasternum. Center glabrous, shining, punctate; sides and margin of mesocoxae punctate, punctures with sparse modified scales.

Abdomen. Sternites III and IV subequal in length, suture between distinct throughout and strongly sinuate; sternite III with a row of deep, squamiferous punctures bordering front margin of intercoxal process; rest of abdomen glabrous, shining, sparsely shallowly punctate; sternite V and VI together almost (0.88X) as long as sternite IV; fifth sternite 3.07X longer than sternite VI; sternite VII shorter (0.83) than sternites V and VI together, broadly rounded apically. Legs. Tarsi with tarsomere 3 moderately long, narrow, apex deeply bilobed. Coloration of cuticle ferruginous.

Genitalia. Spermatheca robust, with weak ramus; extended at insertion of spermathecal duct; insertion of spermathecal duct and spermathecal gland well-separated; body weakly tapering apicad, apical 1/2 in right angle bent inward.

Etymological Note: This epithet is based on the participle of the Latin verb deprimere (flatten) and refers to the dorsoventrally flattened body-shape.

Remarks: Unfortunately this species is known only from a unique female. However it can be clearly separated from the other known species and the male genitalia are not of such crucial importance in this genus as in some other groups of Curculionoidea. Therefore we consider it beneficial to provide a name for this species here as well.

Guineobius baliemensis Riedel, sp. n. (Figs 9, 15, 21, 26, 31, 33)

MATERIAL EXAMINED: Holotype: Irian Jaya, Jayawijaya-Province, Wamena, Jiwika; 1900–2050 m, Winkler-ecclector, 24.X.1993, leg. A. Riedel. Paratypes: as holotype (2); Irian Jaya, Jayawijaya-Province, Wamena, Jiwika, 1900–2050 m, 24.X.1993, leg. A. Riedel (allotype).

Holotype and allotype in collection A. Riedel (München), deposited on indeterminate loan in the Zoologische Staatssammlung (München). Paratypes deposited in collection A. Riedel (München).

DIAGNOSIS: Rostrum ventrally at base with glabrous pit; head punctate; prosternum with coxae widely (0.6X their diameter) separate, deeply impressed, with modified scales; sternite V much longer (2.8X) than sternite VI.

DESCRIPTION:

Holotype, male. Length. Pronotum plus elytron: 1.60 mm. Rostrum 1.30X longer than broad, in dorsal view lateral margins subparallel from base to apex; furrow separating dorsal part of rostrum anteriorly ending below antennal scrobes, its anterior 1/2 broadly and well impressed, behind shallow and almost effaced; declivital area in front of antennal scrobes long; scrobes evenly kidney-shaped in dorsal view, well delimited, posteriorly separated by dorsum broader (1.4X) length of funicular article 2; dorsum between antennal scrobes subquadrate, subglabrous with few setae; dorsum in posterior half of rostrum broad, broader than funicular article 2 long; sides of dorsum smoothly convexly sloping; in lateral view weakly tapering apicad, ventral margin straight, dorsal margin weakly curved; laterally mat, sparsely shallowly punctate, setose; with vestige of eye; lateral lobes weakly developed; ventrally behind with deep median elongate glabrous pit, laterally with sparse modified scales.

Head punctate. Antennae. Funicle with article 2 elongate, subequal in length to article 1, 1.8X longer article 3; articles 3–7 subequal, about as long as broad; club ovate, apical 1/2 denser setose than base.

Prothorax slightly longer (1.13X) than broad, side margins weakly rounded, densely punctate but medially distance between punctures longer than diameter; basal constriction narrow, glabrous. Elytra ovate, 1.40X longer than broad; strial punctures large, deep, on declivity shallow; with 10 regular striae; striae 7 and 8 shortened, beginning at level of metacoxa; laterally punctures each with short erect seta, medially glabrous. Prosternum. Coxae widely separated by 0.6X coxal diameter; area between coxae cavernous, with scattered modified scales; without preapical constriction. Mesosternum with intercoxal process sparsely squamose, coxae separated by 1.15X diameter, suture with metasternum distinct. Metasternum glabrous, punctate. Abdomen glabrous, center sparsely, shallowly punctate; anterior margin of sternite III with row of deeper punctures; sternites III and IV medially with broad impression; sternites III–IV subequal in length, suture between medially obsolete, laterally weak; sternites V–VI together equal in length to sternite IV; sternite V little shorter (0.75) sternite IV, 2.8X longer than sternite VI; sternite VII shorter (0.85X) than sternite V and VI together, broadly rounded apically. Legs. Tarsi with tarsomere 3 moderately long, apex deeply bilobed. Coloration of cuticle ferruginous.

Genitalia. Median lobe much shorter (0.53X) than apodemes, in lateral view strongly curved, moderately flattened dorsoventrally, in dorsal view apex with straight sides angulately pointed, behind orifical area internally with sclerites. Endophallus hyaline, without visible partial eversion, without minute spines, straight; flagellum long, thread-like, spiralized.

Allotype, female: same as holotype except: Length. Pronotum plus elytron: 1.94 mm. Rostrum 1.36X longer than broad; dorsum between antennal scrobes with few short, maybe broken setae, medially with flat broad ridge; dorsum in posterior half with median furrow. Prothorax densely punctate throughout, sometimes distance between punctures smaller than diameter. Elytra with stria 8 shortened. Mesosternum with coxae separated by 1.6X diameter.

Abdomen. Sternites III–V convex. Spermatheca without ramus, insertion of spermathecal gland approximate to insertion of spermathecal duct; body hardly tapering apicad, thinner at base than at apex; outer margin evenly curved except slightly concave near base.

Infraspecific variation. Prothorax. Area between procoxae more or less deeply impressed to cavernous.

Etymological Note: This epithet is based on the name of the Baliem-river-valley where the type locality is located.

Systematic Position of *Guineobius*

The only classification of Celeuthetini available is the revision by Marshall (1956). Although being of great value for taxonomic purposes it does not provide an appropriate basis for phylogenetic considerations. Marshall did not give a proper diagnosis of the tribe except differentiating it against Elytrurini. From his comments and from our observations the Celeuthetini *sensu* Marshall are likely a monophyletic group; the character of the transverse sulcus dorsally separating head from rostrum would be the only autapomorphy available at present. However, it must be noted that some African Peritelini have a similar structure, so additional studies are required to confirm the significance of this character. Most genera of Celeuthetini have their rostrum abruptly declivous at the apex, but some genera including *Guineobius* have it evenly sloping apicad. We consider the first character state synapomorphic, the second one symplesiomorphic. Within the paraphyletic assemblage of genera having evenly sloping rostrum, the genera *Apirocalus*, *Hellerrhinus* and *Kokodanus* possess conspicuous spines on their elytral declivity and are thus considered to constitute another monophyletic group. Looking for a sister group of *Guineobius* we would have to consider following other groups in the analysis: All species with abrupt rostral declivity, the group of *Apirocalus – Hellerrhinus – Kokodanus* and each of the remaining (monotypic) genera with evenly sloping rostrum, namely *Acoptorrhynchus*, *Oedirrhynchus*, *Idorrhynchus* and *Pachyrrhynchidius*. Unfortunately the four latter genera are known to us from the description only. No characters were found to hint on the position of Guineobius among the above mentioned groups.

Another possible sister group of *Guineobius* was found in leaf litter in New Guinea. Two species were collected that should be placed in a new genus close to *Guineobius*, but for a formal description the material at hand is not sufficient.

The species have an apicad evenly sloping rostrum. Furthermore they possess in relation to *Guineobius*, plesiomorphic character states such as the small prominent eyes with few facettes and the squamose vestiture. The males have a long spiral flagellum. However, it must be admitted that no synapomorphy with *Guineobius* could be found except the mode of life in the leaf litter and the somewhat smaller eyes in relation to other Celeuthetini.

PHYLOGENY

Unfortunately four of the six species of *Guineobius* are known from only one sex which renders inclusion of genitalic characters into a cladistic analysis difficult. However, the genitalia possess characters that could be useful for such a purpose when additional material becomes available. By using the available characters a preliminary classification was obtained.

The polarity for all characters was determined by outgroup comparison. Generally the remainder of Celeuthetini was used as an outgroup. To decide the polarity of characters 3 and 5 where both states occur in in the remainder of Celeuthetini it was necessary to use two yet undescribed species. These are also dwelling in the leaf-litter in New Guinea and probably represent a new genus of Celeuthetini which is presumably closely related to *Guineobius* (See "systematic position").

In the following character list numbers in brackets indicate the state of polarity; (0) is plesiomorphic, (1) is apomorphic and (2) more apomorphic.

1. Scales
– subovate and appressed or elongate and erect, but always with entire margins (0)
– asymmetrical radiate pectinate (1)
– entirely missing (2)

2. Body length
– large, pronotum plus elytron: 2.4–2.8 mm (0)
– small, pronotum plus elytron: 1.6–2.3 mm (1)

3. Antennal scrobes
– in dorsal view margins curved inwards, converging obliquely in straight line (0)
– in dorsal view margins kidney-shaped in dorsal view, opposing each other in an almost straight line (1)

4. Presence of eyes
– vestigial, but distinct (0)
– absent or vestiges extremely small (1)

5. Shape of elytra
– broad at base and apex, medially weakly rounded (0)
– relatively narrow, elongate, evenly rounded from base to apex (1)

6. Abdomen
– sternites V–VI equal or subequal with sternite VI slightly longer (0)
– sternite V at least 2X longer than sternite VI (1)
– sternite V ca. 3X longer than sternite VI (2)

7. Suture between sternites III–IV
– distinct (0)
– completely effaced, or at best only with lateral traces (1)

8. Cuticular coloration
– black (0)
– red-brown (1)

For discussion of characters 1 and 6 see under "Characters".

G. niger possesses most of the primitive traits, but whether it is really the sister-group to all remaining *Guineobius* appears somewhat doubtful. Characters 2, 4 and 8 connecting the two following clades are extremely prone to convergence as shown by numerous groups of subterranean Coleoptera having lost eyes and melanization. However, unless convergence can be demonstrated in this case, characters 2, 4 and 8 must be interpreted as synapomorphies.

Character 6 was treated as an ordered transformation series with a gradual elongation of sternite V. The state in *G. minutus* (intermediate length) is apomorphic to the state with a short sternite V, and the state in *G. depressus* and *G. baliemensis* with a long sternite V would be most apomorphic.

G. deharvengei and *G. depressus* are known from female specimens only. For that reason male genital characters could not be included in the analysis. Still, it may be noted that a long thread-like spiral flagellum occurs both in the outgroup-representatives and in *G. baliemensis*. A short simply curved flagellum is found in the remainder of *Guineobius*. According to our present hypothesis of *Guineobius*-relationships this character is a reversal of the derived state (short flagellum) to the formerly primitive one (spiral flagellum).

TABLE 1

Character state matrix for the species of *Guineobius*.

Character	1	2	3	4	5	6	7	8
G. niger	1	0	0	0	0	0	0	0
G. deharvengi	1	1	0	1	1	0	1	1
G. viduus	2	1	0	1	1	0	1	1
G. minutus	2	1	1	1	0	1	0	1
G. depressus	1	1	1	1	0	2	0	1
G. baliemensis	1	1	1	1	0	2	1	1

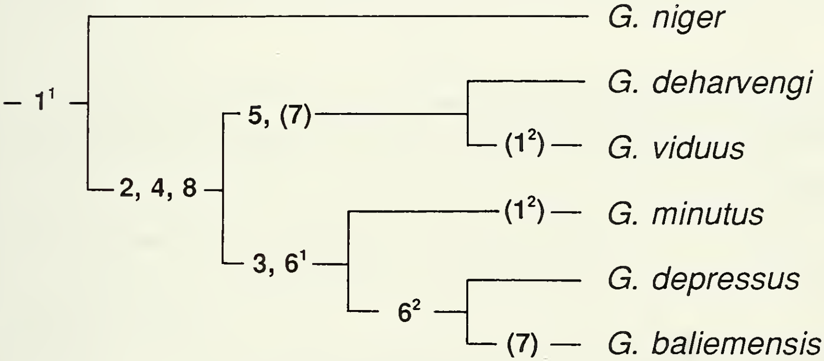


FIG. 32

Hypothesized relative relationships of *Guineobius*-species according to manual reconstruction. Numbers refer to table 1 and to character list in the text. Convergence in parenthesis.

ECOLOGY AND CONSERVATION

G. niger, *G. depressus* and *G. baliemensis* were collected by sieving ground-litter in a montane forest disturbed by human activity, but especially influenced by pigs from the nearby villages digging the ground in search for food. The forest was situated on sandy ground and unusually dry, but moist pockets were found for sieving. The area is located at an altitude of 1900–2050 m, samples taken at 2300 m did not contain *Guineobius*. It was found that *Guineobius*-species stay motionless for a long time, even in bright sunshine, and may easily be overlooked during hand-sampling. Sifted material that was searched in bright sunshine and that was completely dried out provided a surprising number of *Guineobius* when put into a Winkler-ecclector overnight. *G. minutus* was collected in a slightly disturbed forest that was moister than the

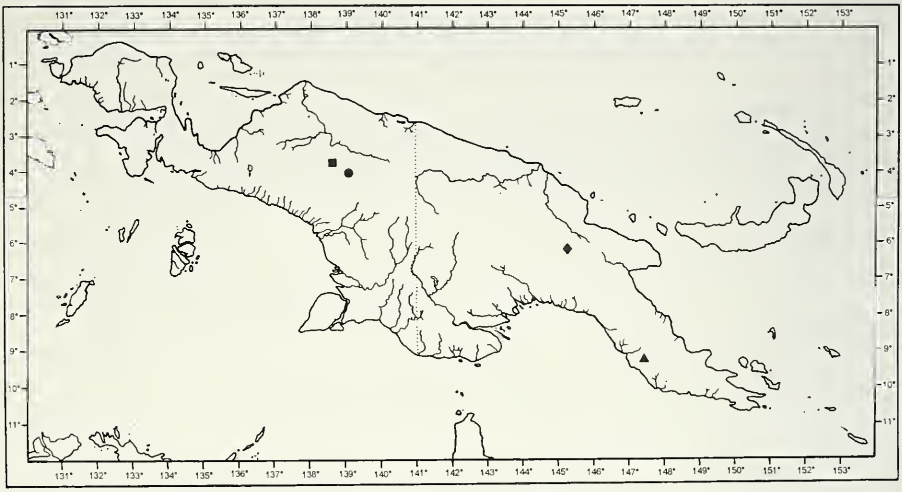


FIG. 33

Distribution of *Guineobius* in New Guinea. (■) *G. niger* sp. n., *G. depressus* sp. n. and *G. baliemensis* sp. n.; (●) *G. minutus* sp. n.; (◆) *G. viduus* Osella; (▲) *G. deharvengei* Osella.

previous locality, but not as wet as usual montane forests in New Guinea. In those other extremely mossy and wet forests good results were never obtained for soil-weevils. It may be that these failures are due to technical problems, since the wet particles stick together and may not get into the sieve or it takes the beetles even longer than in drier material before they start moving and can be seen and collected. But it is possible that the extremely wet mossy forests most common in New Guinea do not meet the ecological requirements of soil-weevils.

Except for the type locality nothing more is known of the distribution of the species. However, we expect that their range is very limited (See also below). Based on this point of view *G. niger*, *G. depressus* and *G. baliemensis* are highly endangered species. The greatest part of the presumably unique weevil fauna of the valley floor probably already has become extinct: In the western part of the highlands of New Guinea the Baliem valley was unique in possessing extensive swamps and gallery forests at an elevation of about 1700m. They have been cleared before arrival of the first explorers (ARCHBOLD *et al.*, 1942); probably these extensive clearings date back as long as 7000 to 5200 years BP (HABERLE *et al.* 1991). Now increasing pressure for fire-wood and land is being exerted on relict forests on the slopes of the valley through the dense and growing population of the fertile valley. Influenced by the favourable climate of the grand valley these relict forests are usually much drier than forests of comparable altitude in other parts of the highlands. For this reason an unique fauna and flora might have developed. To prove this assumption an effective protection and exploration of these forests is necessary, otherwise they are likely to disappear before we can get sufficient information on their biodiversity.

The record of three sympatric species occurring on one small locality is of some significance. It shows that there must be considerable ecological differentiation in this genus, allowing their coexistance. One difference between *G. niger* and *G. depressus* is rather obvious from their morphology. The flat and ferruginous *G. depressus* seems to be better adapted to a life in deeper litter layers where it would fit between small gaps in the material, wheras *G. niger* with its larger, more convex and black body would be expected to dwell on or a little below the surface of the litter. As a consequence a much greater number of species than is known today can be expected from New Guinea. Within a group of slow-moving, apterous insects a lot of "trivial species" e.g. allopatric species, not very different biologically, with trivial local adaptions (HOLLOWAY, 1990) can be expected in a country as mountainous as New Guinea. Probably the same set of ecological niches could be found in each suitable locality, resulting in a vast number of species.

ACKNOWLEDGEMENT

We would like to thank Dr I. Löbl (Geneva) for the loan of the holotype of *G. deharvengei* and *G. viduus*. We also owe many thanks to Prof. Dr C.W. O'Brien (Tallahassee), M. Balke (Berlin), Prof. Dr H. Bohn (Munich) and Dr J. Muona (Oulu) for reviewing and improving the manuscript and to Prof. Dr O. Kraus (Hamburg) for his help in interpreting the International Code of Zoological Nomenclature. Mrs. R. Kühbandner (Munich) kindly redrew some of the illustrations.

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

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Revision of the Japanese rove-beetles of the genus *Megarthrus* (Coleoptera, Staphylinidae, Proteininae). - The Japanese species of *Megarthrus* are revised to include 16 species, five of which are described as new: *M. aino*, *M. constrictus*, *M. conspirator*, *M. incubifer* and *M. sawadai*. *Megarthrus denticollis* (Beck) and *M. impressicollis* Eppelsheim are recorded for the first time from Japan, and *M. japonicus* Sharp and *M. montanus* Sawada from the Asian continent. Three names are relegated into synonymy: *M. heteropus* Sawada = *M. hemipterus* (Illiger); *M. montanus subangulatus* Sawada = *M. montanus* Sawada; *M. subparallelus* Sawada = *M. parallelus* Sharp). Lectotypes are designated for *M. convexus* Sharp, *M. corticalis* Sharp, *M. japonicus* Sharp, *M. parallelus* Sharp and *M. scriptus* Sharp. Descriptions are given and diagnostic characters are figured for all species, except for the widely distributed *M. denticollis* (Beck) and *M. hemipterus* (Illiger). A key to the Japanese species is provided, and biogeographical relationships are discussed.

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

INTRODUCTION

In traditional biogeography a lot of emphasis was put on the delimition of realms, regions, areas etc. In general the boundaries of zoogeographical realms defined by WALLACE (1876) are still used today. Two major interfaces, however, are problematics as the natural boundaries greatly depend on the group studied: the Nearctic / Neotropical and Palaearctic / Oriental boundaries, respectively. This is particularly relevant for the fauna of Japan, which is usually considered Palaearctic.

Among other staphylinoid groups, the Batrisinae and Scaphisomatini of Japan appear Oriental (LÖBL, 1981 & 1984; NOMURA, 1991), whereas *Bryaxis* Kugelann and *Micropeplus* Latreille have more Palaearctic affinities (CAMPBELL, 1968; JEANNEL,

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1950). Steel (1966) considered the Proteinini a Holarctic taxon represented in Japan by two genera and 16 species (Hayashi, 1988; Sawada, 1962) but detailed phylogenetic and biogeographical relationships remain unknown.

Within the Proteinini, *Megarthrus* is of particular interest as it is very diverse in the Himalaya range (MHNG data) and penetrates into the Southern hemisphere as far South as New Caledonia, New Guinea (Cuccodoro, 1995), South Africa (Cuccodoro & Löbl, 1995) and northern Argentina. Ten species and one subspecies of *Megarthrus* have been recorded so far from Japan. The present revision recognises 16 species and briefly discusses their biogeographical relationships.

MATERIAL AND METHODS

The present study is based exclusively on adults (380 specimens). The material was mostly collected with Berlese and Winkler-Moczarsky eclectors, or with carrion, dung and Malaise traps. For detailed examination, specimens were dissected, cleared in 0.1 N potassium hydroxide and mounted in Eukit or Canada balsam on acetate slides. Drawings were made using a drawing tube. Detailed locality data are reproduced according to labels. The name of major administrative units are standardised according to Kano et al. (1967), and those of G. Lewis' collecting localities are taken from Park (1948). Unless specified otherwise, material mentioned in the text has been examined. Diagnosis of *M. denticollis* and *M. hemipterus* are not given here, as these widely distributed species will be redescribed elsewhere. Generally only the distribution of species in Japan is recorded here in detail, but for three East Asian species - *M. conspirator*, *M. impressicollis*, *M. japonicus* and *M. montanus* - also some non Japanese records are included.

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

Material was examined from the following collections: ASPC = A. Smetana private collection, Ottawa; BMNH = The Natural History Museum, London; BPBM = Bishop Museum, Honolulu; CNCI = Canadian National Collection of Insects, Ottawa; DEI = Deutsches Entomologisches Institut, Eberswalde; FMNH = Field Museum of Natural History, Chicago; KSPC = K. Sawada private collection, Nishinomiya; MHNG = Muséum d'histoire naturelle, Geneva; NHMW = Naturhistorisches Museum, Vienna; ZMHB = Museum für Naturkunde der Humboldt-Universität, Berlin.

NATURAL HISTORY AND ECOLOGY

Except for few a specimens of *M. montanus*, the Japanese members of *Megarthrus* possess fully developed wings. According to label data they have been found in forests, plantations and swamps, on and under the bark of logs, in leaf litter, moss, fungi and decaying vegetable matter.

TAXONOMY

Pending a phylogenetic analysis defining natural species groups, the species are listed alphabetically.

KEY TO SPECIES

1 Elytra yellow-brown with black spots. 2
– Elytra unicolorous. 3
2 Male metatibia bearing peg-like setae; female valvifers with lateral margins distant (Fig. 13a). . . . . *M. corticalis* Sharp
– Male metatibia lacking peg-like setae; female valvifers with lateral margins contiguous (Fig. 25a). . . . . *M. scriptus* Sharp
3 Temples, in dorsal view, flattened or weakly convex (Fig. 1h). 4
– Temples, in dorsal view, strongly convex, subangulate or angulate (Fig. 1i-n). 7
4 Highest point of the eyes, in frontal view, reaching level of vertex . . . . *M. hemipterus* (Illiger)
– Highest point of the eyes, in frontal view, not reaching level of vertex. 5
5 Eighth abdominal sternite 3.5-5.0x as wide as its basal projection . . . . *M. denticollis* (Beck)
– Eighth abdominal sternite 2.0-3.0x as wide as its basal projection. 6
6 Male metatrochanter lacking peg-like setae; female abdominal tergite 10 bearing two semicircular sclerites (Fig. 27b). . . . .*M. shibatai* Sawada
– Male metatrochanter bearing peg-like setae; female abdominal tergite 10 without sclerites (Fig. 18b). . . . . *M. japonicus* Sharp

7 Lateral edges of pronotum rounded. 8
– Lateral edges of pronotum angular or denticulate. 13
8 Anterior portion of prothoracic hypomeron with an oblique ridge. 9
– Anterior portion of prothoracic hypomeron without ridge. 10
9 Elytra, in lateral view, with sutural area strongly arcuate. . . . . . . *M. aino* sp. n.
– Elytra, in lateral view, with sutural area almost straight
. . . . *M. impressicollis* Eppelsheim
10 Male with tip of aedeagus incised (Fig. 4g); female abdominal tergite 10 with center of apical cupula hyaline (Fig. 5g). 11
– Male with tip of aedeagus pointed (Fig. 6a); female abdominal tergite 10 with center of apical cupula sclerotised (Fig. 7f). 12
11 Male with internal sac of aedeagus bearing laterobasal sclerites (Fig. 10b); female with lateral contours of apical portion of valvifers parallel-sided (Fig. 11). . . . . *M. convexus* Sharp
– Male with internal sac of aedeagus without laterobasal sclerites (Fig. 4a); female with lateral contours of apical portion of valvifers tapering (Fig. 5a). . . . . *M. conformis* Sawada
12 Male with internal sac of aedeagus bearing laterobasal sclerites (Fig. 8a); female abdominal tergite 10 with cupula bearing a pit (Fig. 9b)
. . . . *M. constrictus* sp. n.
– Male with internal sac of aedeagus lacking laterobasal sclerites (Fig. 6a); female abdominal tergite 10 with cupula lacking a pit (Fig. 9b)
. . . . *M. conspirator* sp. n.
13 Anterior portion of prothoracic hypomeron with an oblique groove. 14
– Anterior portion of prothoracic hypomeron without groove. 15
14 Frons forming a ridge above clypeus. . . . . *M. incubifer* sp. n.
– Frons not forming a ridge above clypeus. . . . . *M. montanus* Sawada
15 Male metatrochanter bearing peg-like setae; female genital segment as in Fig. 22a, b. . . . . *M. parallelus* Sharp
– Male metatrochanter lacking peg-like setae (female unknown)
. . . . *M. sawadai* sp. n.

Megarthrus aino sp. n. (Figs 1g, 2a-g, 3a-f)

TYPE MATERIAL. Holotype ♂: Japan, Honshu, Iwate pref., Kawai, Yoshibezawa, 600-700 m, 16.viii.1991 (A. Smetana) #J57, MHNG. Paratypes (8): same data as holotype, 2♂ in ASPC and 1♂ in MHNG; Japan, Honshu, Iwate pref., Sugo, Takizawa, Iwate Un. Exp. For., 220 m, 11.viii.1991 (A. Smetana) #J44, 1♂ in ASPC; Kyoto pref., Seryô-Tôge, 13 Km N Kyoto, 500-600 m, 6.viii.1980 (C. Besuchet) ex leaf litter, moss and old log in plantation of *Cryptomeria japonica*, 1♀ in ASPC; same data, but (I. Löbl) ex leaf litter at foot of rocky cliff, 1♀ in ASPC and 2♀ in MHNG.

DISTRIBUTION. Japan: Honshu (Kinki and Tohuku distr.).

Description. Length 1.1-1.2 mm; width 0.7-0.8 mm. Body and appendages yellow-brown. Dorsal pubescence fairly uniform, sparser on elytron. Anteriomedian portion of frons with setae orientated backward. Elytral setae curved and recumbent. Metasternal setae longer than prosternal setae, becoming denser posteriomedianly. Abdominal pubescence parallel, becoming longer near apical margins of sternites 4-7. Punctation on anterior portion of hypomeron coarse, posteriomedial portion of metasternum impunctate. Frons on level with or raised above level of vertex, forming a ridge above clypeus; frontal ridge sharp, fine. Anterior frontal edge weakly convex in middle, oblique laterally. Frontal impression shallow. Eye moderately convex, with highest point above level of vertex; supra-ocular margin sinuate in dorsal view. Temple and occipital ridge similar to that in Fig. 1i, occipital ridge indistinct in middle and sinuate laterally. Submentum weakly convex. Antenna (Fig. 2c) without patches of sensilla; scape not flattened; antennomeres 3-4 symmetrical; short and dense pubescence present on antennomeres 8-11. Pronotum (Fig. 3f) strongly convex in frontal view; mesal portion slightly arcuate in lateral view. Pronotal disc with deep depression along apical portion of lateral edge; median groove very shallow, parallel-sided. Hypomeral ridge present anteriorly, oblique. Median prosternal ridge fine and straight, interrupted in middle; anterior prosternal margin bordered by a regular row of conspicuous longitudinal ridges. Protrochanter lacking transverse ridge. Lateral portion of prepectal ridge angulate, then bifid. Scutellum as in Fig. 1g. Elytron not or weakly narrowed basally; base abruptly inclined, then overhanging. Humeral callus low. Elytral disc without swellings, flat along lateral edge; lateral edge finely carinate, weakly convex in dorsal view; sutural area slightly arcuate basally and strongly arcuate apically in lateral view; apical margin convex near suture; inner apical angle obtuse. Metasternum with femoral line arcuate in middle; median ridge absent. Abdominal tergite 3 with anterior portion flat, then strongly transversely vaulted. Sternites 2 and 3 with median processes as in Fig. 2g, process of sternite 3 straight. Sternite 4 flat.

Ratios: AL 1.9; EL 1.7-1.8; ET 1.9; EW 1.2; EY 2.3-2.4; GT 2.1-2.2; GW 1.8-1.9; HW 1.4-1.5; ML 1.4-1.5; MP 2.0-2.2; PT 2.0-2.1; SP 3.5-4.5; TPF abs.

♂. Frontoclypeal area unmodified. Protarsomere 1 lacking tenent setae. Mesofemur longer than metafemur. Mesotibia about as long as metatibia. Metatarsomere 1 shorter than combined length of metatarsomeres 2-4. Legs unmodified. Apex of abdominal tergite 8 as in Fig. 2d, e. Sternite 8 as in Fig. 2f. Sternite 10 without subbasal protuberance. Aedeagus as in Fig. 2a, b.

♀. Abdominal tergite 8 (Fig. 3c, d) without medioapical projection. Sternite 8 as in Fig. 3b. Genital segment as in Fig. 3a, e.

Comments. *Megarthrus aino*, *M. conformis*, *M. conspirator*, *M. constrictus*, *M. convexus*, *M. corticalis* and *M. scriptus* are the only Japanese species to possess angulate temples. Among these, *M. aino* is characterised by the unicolorous elytra and an oblique hypomeral ridge. It resembles *M. minor* Coiffait (1976) from Nepal, from which it may be distinguished by the sexually unmodified mesotibia. See also comments under *M. impressicollis*.

Megarthrus conformis Sawada (Figs 1a, i, 4a-g, 5a-i)

Megarthrus conformis SAWADA, 1962: 11.

TYPE MATERIAL. Holotype ♀: Japan, Honshu, Kyoto pref., Kyoto city, Kitashirakawa, 27.xii.1952 (S. Huêno), KSPC, not examined (probably lost, Sawada, pers. comm.).

Additional material (17). Japan, Honshu, Gunma pref., E Usui Pass, 850 m, 24.vii.1980 (I. Löbl) ex rotted wood and leaf litter on slope of ravine with stream in forest, 1♀ in MHNG; Nagano pref., Jô-shin-etsu Kogen N.P., Shiga, 1500 m, 23.vii.1980 (I. Löbl) ex leaf litter and mould on steep rocky slope of ravine with stream in forest, 1♂ and 4♀ in MHNG; Shikoku, Ehime pref., Mt. Ishizuchi N. P., Mt. Ishizuchi, 13-14.viii.1980 (C. Besuchet) ex leaf litter and grass in dwarf bamboos above forest, 2♂ and 4♀ in MHNG; Ehime pref., Mt. Ishizuchi N. P., Mt. Ishizuchi, 1350 m, 13.viii.1980 (I. Löbl) ex leaf litter at foot of old *Fagus* with bamboos, 3♀ in MHNG; Ehime pref., Saragamine, 30.xii.1954 (K. Morikawa) 1♂ in BMNH; Tokushima pref., Gyô-ba, 4.viii.1967 (Y. T. Yoshida) 1♀ in KSPC.

DISTRIBUTION. Japan: Honshu (Chubu and Kanto distr.) and Shikoku.

DESCRIPTION. Length 1.3-1.5 mm; width 0.9-1.0 mm. Body and appendages predominantly yellow-brown with vertex, pronotum and scutellum usually darkened. Dorsal pubescence fairly uniform, sparser on elytron and near lateral edge of pronotum. Anteriomedian portion of frons with setae orientated backward. Elytral setae curved and recumbent. Metasternal setae longer than prosternal setae, fairly uniform. Abdominal pubescence converging on tergites 4-6, uniform on sternites 4-7, but with a pair of long subapical setae on each sternite. Punctation fine on anterior portion of hypomeron and posteriomedial portion of metasternum. Frons raised above level of vertex, forming a ridge above clypeus; frontal ridge sharp, fine in middle, conspicuous laterally. Anterior frontal edge subangulate in middle, oblique laterally. Frontal impression shallow in middle, deep laterally. Eye moderately convex, raised above level of vertex; supra-ocular margin sinuate in dorsal view. Temple and occipital ridge as in Fig. 1i, occipital ridge indistinct in middle and sinuate laterally. Submentum weakly convex. Antenna (Fig. 5d) without patches of sensilla; scape flattened; antennomeres 3-4 symmetrical; short and dense pubescence present on antennomeres 7-11. Pronotum (Fig. 5b) weakly convex in frontal view; mesal portion almost straight in lateral view. Pronotal disc with shallow depression along apical portion of lateral edge; median groove almost indistinct, parallel-sided. Hypomeral ridge absent. Median prosternal ridge present anteriorly, fine and straight; anterior prosternal margin not bordered by longitudinal ridges. Protrochanter lacking transverse ridge. Lateral portion of prepectal ridge angulate, then bifid. Scutellum as in Fig. 1a. Elytron weakly narrowed basally; base abruptly inclined, then overhanging. Humeral callus low. Elytral disc without swellings, shallowly depressed, or flat along lateral edge; lateral edge conspicuously carinate, weakly convex in dorsal view; sutural area slightly arcuate basally and strongly arcuate apically in lateral view; apical margin convex near suture; inner apical angle obtuse. Metasternum with femoral line arcuate in middle; median ridge absent. Abdominal tergite 3 slightly transversely vaulted. Sternites 2 and 3 with median processes as in Fig. 5i, process of sternite 3 straight. Sternite 4 flat.

Ratios: AL 1.8-1.9; EL 2.0; ET 2.0; EW 1.0-1.1; EY 2.5-2.8; GT 2.1-2.2; GW 1.8-1.9; HW 1.6-1.8; ML 1.4-1.5; MP 1.9-2.0; PT 2.0-2.1; SP 5.5-7.0; TPF 5.0.

♂. Frontoclypeal area raised, horn-like. Protarsomere 1 lacking tenent setae. Mesofemur (Fig. 4d) longer than metafemur (Fig. 4c). Mesotibia (Fig. 4f) longer than metatibia (Fig. 4e). Metatarsomere 1 about as long as combined length of metatarsomeres 2-4. Peg-like setae absent from protibia and metatrochanter (Fig. 4c); arranged in a single row on mesotrochanter (Fig. 4d), mesotibia and metatibia. Apex of abdominal tergite 8 as in Fig. 5h. Sternite 8 as in Fig. 4b. Sternite 10 without subbasal protuberance. Aedeagus as in Fig. 4a, g.

♀. Abdominal tergite 8 (Fig. 5c, f) with medioapical projection. Sternite 8 as in Fig. 5e. Genital segment as in Fig. 5a, g.

COMMENTS. The definition of this species is based on a female from Gyô-ba identified as *M. conformis* by K. Sawada. Its characters agree with the data given in the original description.

Megarthrus conformis, *M. conspirator*, *M. constrictus* and *M. convexus* differ from other species with distinctly angulate temples (see comments under *M. aino*) by the absence of a hypomeral ridge. Within these species, *M. conformis* may be distinguished by the incised aedeagal tip and internal sac lacking laterobasal sclerites. The former character is shared only with *M. convexus*, in which the aedeagal internal sac bears laterobasal sclerites. See also comments under *M. impressicollis*.

Megarthrus conspirator sp. n. (Figs 6a-g, 7a-i)

TYPE MATERIAL. Holotype ♂: Japan, Honshu, Gunma pref., Nikko N. P., below Konsei Pass, 1500-1600 m, 15.vii.1980 (I. Löbl) ex very wet leaf litter in a ravine, MHNG. Paratypes (15): same data as holotype, 1♂ in MHNG; Japan, Honshu, Gunma pref., 4 Km SW Tsumagoi, 1050 m, 18.vii.1980 (I. Löbl) ex trunk with fungi near river, 1♂ in MHNG; Gunma pref., Konsei Pass, 1800-1900 m, 13.viii.1980 (P. M. Hammond) 2♀ in BMNH and 1♀ in MHNG; Iwate pref., Kawai, Yoshibezawa, 600-700 m, 16.viii.1991 (A. Smetana) #J57, 1♂ in ASPC; Shizuoka pref., Mt. Amagi, 4.v.1957 (K. Ishida) 1♂ in BMNH; Tochigi pref., Nikko N. P., Senjogahara, 1400 m, 15.vii.1980 (I. Löbl) ex leaf litter near stream, 1♂ in MHNG; Tochigi pref., Nikko N. P., Konsei Pass, 1800 m, 15.vii.1980 (I. Löbl) ex leaf litter under *Rhododendron* in very degraded forest on very steep slope, 1♀ in MHNG; Shikoku, Ehime pref., Mt. Ishizuchi N. P., Mt. Ishizuchi, 1550 m, 13.viii.1980 (I. Löbl) ex moss rotted wood and leaf litter under old *Abies* and *Fagus*, 1♂ in MHNG; Ehime pref., Mt. Ishizuchi N. P., Mt. Kamegamori, 1650 m, 15.viii.1980 (S. & J. Peck) ex *Abies* & moss litter, 1♂ and 2♀ in CNCI; Russia, Sakhalin, Aniva distr., Zunayiskiy Khrebet, Mt. Ishekovsk, 600-1000 m, 13.vii.1993 (A. Pütz & Wrase) 2♀ in DEI.

DISTRIBUTION. Japan: Honshu (Chubu, Kanto, and Tohuku distr.) and Shikoku; Russia: Sakhalin.

DESCRIPTION. Similar to *M. conformis* from which it differs as follows: Antenna as in Fig. 6c. Pronotum as in Fig. 7g. Abdominal sternites 2 and 3 with median processes as in Fig. 7i. Ratios: AL 1.8-2.0; EL 2.0-2.2; ET 2.2; TPF abs.

♂. Frontoclypeal area raised, horn-like. Protarsomere 1 lacking tenent setae. Mesofemur (Fig. 6f) longer than metafemur (Fig. 6g). Mesotibia (Fig. 6e) longer than metatibia (Fig. 6d). Metatarsomere 1 about as long as combined length of metatarsomeres 2-4. Peg-like setae absent from protibia and metatrochanter (Fig. 6f), arranged in a single row on mesotrochanter (Fig. 6g), mesotibia and metatibia. Apex of abdominal tergite 8 as in Fig. 7d. Sternite 8 as in Fig. 7b. Sternite 10 without subbasal protuberance. Aedeagus as in Fig. 6a, b.

♀. Abdominal tergite 8 (Fig. 7c, e) without medioapical projection. Sternite 8 as in Fig. 7h. Genital segment as in Fig. 7a, f.

COMMENTS. *Megarthrus conspirator* is one of the four species with distinctly angulate temples and lacking hypomeral ridge (see comments under *M. conformis*). It may be distinguished by the pointed aedeagal tip and the internal sac without laterobasal sclerites. The former character is shared with *M. constrictus*, in which the internal sac bears laterobasal sclerites.

Megarthrus constrictus sp. n. (Figs 8a-h, 9a-h)

TYPE MATERIAL. Holotype ♂: Japan, Honshu, Nagano pref., Minami Alps, Kitazawa Toge, 2000 m, 3.ix.1985 (S. T. Martin) BMNH. Paratypes (7): same data as holotype, 2♂, 3♀ in BMNH and 1♂, 1♀ in MHNG.

DISTRIBUTION. Japan: Honshu (Chubu distr.).

DESCRIPTION. Similar to *M. conformis* from which it differs as follows: Antenna as in Fig. 9c. Pronotum as in Fig. 9g. Elytral disc shallowly depressed along lateral edge; lateral edge weakly convex, except for median portion straight in dorsal view. Abdominal sternites 2 and 3 with median processes as in Fig. 9h. Ratios: EL 1.8; ET 2.1-2.2; TPF abs.

♂. Frontoclypeal area raised, horn-like. Protarsomere 1 lacking tenent setae. Mesofemur (Fig. 8g) longer than metafemur (Fig. 8h). Mesotibia (Fig. 8e) longer than metatibia (Fig. 8f). Metatarsomere 1 about as long as combined length of metatarsomeres 2-4. Peg-like setae absent from protibia and metatrochanter (Fig. 8h), arranged in a single row on mesotrochanter (Fig. 8g), mesotibia and metatibia. Apex of abdominal tergite 8 as in Fig. 8b. Sternite 8 as in Fig. 8d. Sternite 10 without subbasal protuberance. Aedeagus as in Fig. 8a, c.

♀. Abdominal tergite 8 (Fig. 9e, f) without medioapical projection. Sternite 8 as in Fig. 9d. Genital segment as in Fig. 9a, b.

COMMENTS. See comments under *M. aino*, *M. conformis* and *M. conspirator*.

Megarthrus convexus Sharp (Figs 10a-h, 11a-h)

Megarthrus convexus SHARP, 1874: 100.

M. convex Sharp; SAWADA, 1962: 11 (incorrect spelling).

TYPE MATERIAL. Lectotype ♂: "Japan, Simabara, 10.iii.1870, G. Lewis" (Kyushu), BMNH. Paralectotypes (3): same data as lectotype, 2♀ in BMNH; "Japan, Lewis / 210" 1♂ in FMNH, by present designation.

Additional material (13). Japan, Honshu, Gunma pref., Nikko, 1430-1500 m, 11-12.viii.1980 (L. Maranuma) 2♂ and 1♀ in BMNH; Iwate pref., Kawai, Zaimokuzawa, 720 m, 15.viii.1991 (A. Smetana) #J54, 1♂ in ASPC; Kyoto pref., Kyoto city, Arashiyama, 18-20.viii.1980 (C. Besuchet) ex leaf litter and rotted wood in small ravine, 2♂ and 1♀ in MHNG; Kyoto pref., Mt. Hiei, Yaseyuen, 4.viii.1980 (C. Besuchet) ex leaf litter in ravine, 1♂ in MHNG; Osaka pref., Sakai, Hachi ga ne, Hodo-ji, 1.xii.1985 (K. Harusawa) Berlese, 1♂ in

DEI; Shizuoka pref., Ko-Myosan, 26.ii.1937 (Y. Saito) 1♀ in BPBM; Kyushu, Nagasaki, 21.iv.1881 (G. Lewis) 2♀ in BMNH; Shikoku, Ehime pref., Matsuyama, 15.iii.1953 (S. Hisamatsu) 1♀ in BMNH.

Distribution. Japan: Honshu (Chubu, Kanto, Kinki and Tohuku distr.), Kyushu and Shikoku.

Description. Similar to *M. conformis* from which it differs as follows: Antenna as in Fig. 11e. Pronotum as in Fig. 11g. Abdominal sternites 2 and 3 with median processes as in Fig. 10e. Ratios: AL 1.9-2.1; EL 2.1-2.3; ET 2.1-2.4; ML 1.5-1.6; TPF 5.0.

♂. Frontoclypeal area raised, horn-like. Protarsomere 1 lacking tenent setae. Mesofemur (Fig. 10g) longer than metafemur (Fig. 10h). Mesotibia (Fig. 10c) longer than metatibia (Fig. 10f). Metatarsomere 1 about as long as combined length of metatarsomeres 2-4. Peg-like setae absent from protibia and metatrochanter (Fig. 10h), arranged in a single row on mesotrochanter (Fig. 10g), mesotibia and metatibia. Apex of abdominal tergite 8 as in Fig. 10d. Sternite 8 as in Fig. 11a. Sternite 10 without subbasal protuberance. Aedeagus as in Fig. 10a-b.

♀. Abdominal tergite 8 (Fig. 11b, f) with medioapical projection. Sternite 8 as in Fig. 11c. Genital segment as in Fig. 11d, h.

Comments. See comments under *M. aino* and *M. conformis*.

Megarthrus corticalis Sharp (Figs 12a-i, 13a-i)

Megarthrus corticalis Sharp, 1889: 468.

Type material. Lectotype ♂: "Japan, Oyayama, 12.iii.1881, G. Lewis" (Honshu) BMNH. Paralectotype (♂): same data as lectotype, BMNH, by present designation.

Additional material (8). Japan (G. Lewis) ex bark, 1♂ in BMNH; Kuma (Honshu, Kumagaya?) 14.iii.1881 (G. Lewis) 1♀ in BMNH; same data, but 17.iii.1881 (written underneath the card bearing the specimen) and with a locality label "Nagasaki, 13.xi.1880-21.iv.1881", 1♂ in FMNH; Honshu, Kyoto distr., Kibune, 9.iii.1951 (A. Nobuchi) 1♂ in BMNH, Shizuoka pref., Mt. Amagi, 3.v.1957 (Y. Watanabe) 1♂ in MHNG; Shikoku, Omogo kei. 15.vi.1956 (M. Miyatake) 1♀ in BMNH; Mt. Takanawa,, 19.v.1956 (M. Miyatake) 1♀ in BMNH; Sakase, Omogo Iyo, 19.vi.1951 (M. Miyatake) 1♀ in MHNG.

Distribution. Japan: Honshu (Chubu and Kinki distr.) and Shikoku.

Description. Length 1.5-1.6 mm; width 1.0-1.1 mm. Body and appendages predominantly yellow-brown with vertex, pronotum, scutellum and apical margins of abdominal tergites darkened; elytron with colour pattern as in Fig. 13d. Dorsal pubescence fairly uniform, sparser on elytron. Anteriomedian portion of frons with setae orientated backward. Elytral setae curved and recumbent. Metasternal setae longer than prosternal setae, fairly uniform. Abdominal pubescence converging on tergites 4-6, uniform on sternites 4-7, but with a pair of long subapical setae on each sternite. Punctation coarse on anterior portion of hypomeron and posteriomedial portion of metasternum. Frons raised above level of vertex, forming a ridge above clypeus; frontal ridge fine, blunt in middle, sharp laterally. Anterior frontal edge weakly convex in middle, oblique laterally. Frontal impression shallow in middle, deep laterally. Eye strongly convex, raised above level of vertex; supra-ocular margin sinuate in dorsal view. Temple and occipital ridge similar to that in Fig. 1i, occipital ridge indistinct in middle, sinuate laterally. Submentum weakly convex. Antenna (Fig. 13c) without patches of sensilla; scape flattened; antennomeres 3-4 symmetrical; short and dense pubescence present on antennomeres 6-11. Pronotum (Fig. 13i) strongly convex in frontal view; mesal portion almost straight in lateral view. Pronotal disc with shallow depressions along apical portion of lateral edge and beside median groove; median groove shallow, widened apically. Hypomeral ridge present anteriorly, oblique. Median prosternal ridge conspicuous, straight; anterior prosternal margin bordered by a regular row of conspicuous longitudinal ridges. Protrochanter lacking transverse ridge. Lateral portion of prepectal ridge angulate, then bifid. Scutellum as in Fig. 1a. Elytron weakly narrowed basally; base abruptly inclined, then overhanging. Humeral callus low. Elytral disc with low swellings, shallowly depressed along lateral edge; lateral edge conspicuously carinate, weakly convex in dorsal view; sutural area straight basally and strongly arcuate apically in lateral view; apical margin convex near suture; inner apical angle obtuse. Metasternum with femoral line arcuate in middle; median ridge absent. Abdominal tergite 3 slightly transversely vaulted. Sternites 2 and 3 with median processes as in Fig. 13g, process of sternite 3 straight. Sternite 4 flat at base, then strongly transversely vaulted.

Ratios: AL 2.0; EL 2.0-2.1; ET 2.0; EW 1.0-1.1; EY 2.5-2.8; GT 2.2-2.3; GW 1.8; HW 1.6-1.8; ML 1.4-1.5; MP 1.9-2.0; PT 2.0-2.1; SP 3.1-3.3; TPF abs.

♂. Frontoclypeal area unmodified. Protarsomere 1 lacking tenent setae. Mesofemur (Fig. 12f) longer than metafemur (Fig. 12g). Mesotibia (Fig. 12d) about as long as metatibia (Fig. 12e). Metatarsomere 1 about as long as combined length of metatarsomeres 2-4. Peg-like setae absent from protibia, arranged in a single row on mesotrochanter (Fig. 12f), mesotibia, metatrochanter (Fig. 12g) and metatibia. Apex of abdominal tergite 8 as in Fig. 12c, i. Sternite 8 as in Fig. 12h. Sternite 10 without subbasal protuberance. Aedeagus as in Fig. 12a, b.

♀. Abdominal tergite 8 (Fig. 13e, f) without medioapical projection. Sternite 8 as in Fig. 13h. Genital segment as in Fig. 13a, b.

COMMENTS. *Megarthrus corticalis* differs from its Japanese congeners, *M. scriptus* excepted, by the bicolorous elytra. It may be distinguished easily from *M. scriptus* by the symmetrical aedeagus and, in the female, by the lateral margins of the valvifers widely separated. See also comments under *M. aino*.

Megarthrus denticollis (Beck)

Omalium denticolle Beck, 1817: 26.
Megarthrus denticollis; ERICHSON, 1840: 906.

TYPE MATERIAL. Unknown. According to the original description from Bavaria, Germany. *Additional material* (1 ♀). Japan, Honshu, Shiga Pref. (Tshusuki) MHNG.

DISTRIBUTION. Europe; Japan: Honshu (Kinki distr.). New to Japan.

COMMENTS. This species has been over a century currently identified as *M. denticollis* (e.g. Erichson, 1840; Ganglbauer, 1895; Lohse, 1964). It is the only member of the genus occuring in central Europe which has the metatibiae flat and wide, and very stout metafemora in male. In *Megarthrus denticollis*, *M. japonicus* and *M. shibatai*, the highest point of the eyes is below the level of the vertex. *Megarthrus denticollis* differs from the other two species by the 8th abdominal sternite which is 3.6-5.0x as wide as its basal projection.

Megarthrus hemipterus (Illiger)

Silpha hemiptera Illiger, 1794: 597.
Megarthrus hemipterus; Erichson, 1839: 645.
Megarthrus heteropus Sawada, 1962: 12 (syn. n.).

Type material. *Megarthrus hemipterus:* not existing.

Megarthrus heteropus. Holotype, ♂: Japan, Honshu, Aomori Pref., Spa Tsuta, 19.viii.1959 (T. Shibata) KSPC.

Additional material (105). Japan, Simarima, 25-26.vii.1946 (T. Nakane) 1♀ in BMNH; Hokkaido, Sapporo, Usubetsu, Muine Bridge, 600 m, 7.viii.1991 (A. Smetana) #J37, 4♂ and 3♀ in ASPC; Honshu, Bibi or Nikko (G. Lewis) 1♂ and 1♀ in BMNH; Aomori pref., Fukaura, Mt. Shirakami, Oku-akaishikawa-rindo, 270-400 m, 14.viii.1991 (A. Smetana) #J53, 8♂ and 1♀ in ASPC; Iwate pref., Kawai, Yoshibezawa, 1050 m, 12.viii.1991 (A. Smetana) #J49, 1♀ in ASPC; Nagano pref., Minami Alps, Kitazawa Toge, 2000 m, 3.ix.1985 (S. T. Martin) 1♂ and 1♀ in BMNH; Tochigi pref., Nikko N. P., Senjogahara, 1400 m, 15.vii.1980 (I. Löbl) ex leaf litter near stream, 1♂ in MHNG; Wakayama pref, Arida, Shimizu T., Kamiyukawa, Nikko-jinja, 28.viii-23.ix.1989 (K. Harusawa) ex rotten chicken trap, 2♂ in DEI; Yamagata pref., Tachiyazawa-Village, 2.vii.1960 (Y. Watanabe) 1♀ in BMNH; Shikoku, Ehime pref., Mt. Ishizuchi N. P., Tsuchigoya, 1400 m, 11-18.viii.1980 (S. & J. Peck) ex carrion traps in *Fagus-Abies* forest, 4♂ and 4♀ in FMNH; same data, but ex dung cup traps in *Fagus-Abies* forest, 1♂ and 2♀ in FMNH; same data, but ex malaise trap trough in *Fagus-Abies* forest, 1♂ and 1♀ in FMNH; same data, but ex berlese, litter in *Fagus-Abies* forest, logs, stumps, moss and fungi, 1♀ in FMNH; Ehime pref., Mt. Ishizuchi N. P., Omogo Valley, 700 m, 18-25.viii.1980 (S. Peck) 12♂ and 18♀ in CNCI; same data, but ex rotted watermelon, 3♂ and 2♀ in CNCI; same data, but (S. & J. Peck) ex carrion traps in mixed warm temperate forest, 13♂ and 9♀, FMNH; same data, but ex malaise trap trough in mixed warm temperate forest, 1♀ in FMNH; same data, but ex berlese, litter under rotting water melon in warm temperate forest, 1♂ in FMNH; Ehime pref., Omogo-kei, 23.viii.1953 (M. Miyatake) 1♂ in BMNH; Ehime pref., Mt. Ishizuchi N. P., Tsuchigoya, 1400 m, 11-18.viii.1980 (S. & J. Peck) ex carrion traps in *Fagus-Abies* forest, 3♂ and 2♀ in CNCI.

Distribution. Europe; Russia to Far East, China; Japan: Hokkaido, Honshu (Tohuku and Chubu distr.) and Shikoku.

Comments. *Megarthrus hemipterus* is a common Palaearctic species, unique in Europe by its colour pattern, mentionned in the original description. Thus, it may be reliably indentified though the type material does not exist. It is distinguished from its Japanese congeners by the eye which does not reach the level of the vertex, in combination with the temples similar to that in Fig. 1h.

Megarthrus impressicollis Eppelsheim (Figs 1e, m, 14a-i)

Megarthrus impressicollis Eppelsheim, 1893: 67.

Type material. Holotype ♀: "Ost-sibirien, Quellgebiet des Irkut. Leder 1891" NHMW.

Additional material (1♀). Japan, Honshu, Nagano pref., Jô-shin-etsu Kogen N. P., Shiga, 1500 m, 23.vii.1980 (I. Löbl) ex leaf litter and mould on steep rocky slope of ravine with stream in forest, MHNG.

DISTRIBUTION. Russia: Transbaikal; Japan: Honshu (Chubu distr.). New to Japan.

DESCRIPTION. Length 1.4-1.5 mm; width 0.8-0.9 mm. Body and appendages yellow-brown with vertex somewhat darkened. Dorsal pubescence fairly uniform, sparser on frons, denser along median pronotal groove. Anteriomedian portion of frons with setae orientated backward. Elytral setae straight and recumbent. Metasternal setae longer than prosternal setae, becoming sparser posteriomedianly. Abdominal pubescence somewhat converging on tergites 4-6, uniform on sternites 4-7, but with a pair of long subapical setae on each sternite. Punctation fine on anterior portion of hypomeron and posteriomedial portion of metasternum. Frons raised above level of vertex; forming a blunt ridge above clypeus. Anterior frontal edge weakly convex in middle, oblique laterally. Frontal impression indistinct in middle, deep laterally. Eye almost hemispherical, reaching level of vertex; supra-ocular margin sinuate in dorsal view. Temple as in Fig. 1m. Occipital ridge indistinct. Submentum weakly convex. Antenna (Fig. 14a) without patches of sensilla; scape not flattened; antennomere 3 somewhat asymmetrical, antennomere 4 symmetrical; short and dense pubescence present on antennomeres 7-11. Pronotum (Fig. 14i) strongly convex in frontal view; mesal portion straight in lateral view. Pronotal disc with shallow depression along apical portion of lateral edge, and deep depression along median groove; median groove shallow, parallel-sided. Hypomeral ridge present anteriorly, oblique. Median prosternal ridge fine, straight; anterior prosternal margin bordered by a regular row of fine longitudinal ridges. Protrochanter lacking transverse ridge. Lateral portion of prepectal ridge sinuate, then bifid. Scutellum as in Fig. 1e. Elytron not narrowed basally; base gradually inclined, then overhanging. Humeral callus low. Elytral disc with low swellings, flat along lateral edge; lateral edge finely carinate, almost straight in dorsal view; sutural area almost straight in lateral view; apical margin straight near suture; inner apical angle right-angled. Metasternum with femoral line arcuate in middle; median ridge absent. Abdominal tergite 3 slightly transversely vaulted. Sternites 2 and 3 with median processes as in Fig. 14h, process of sternite 3 straight. Sternite 4 flat.

Ratios: AL 2.0; EL 2.0; ET 2.2; EW 1.3; EY 2.6; GT 2.2; GW 1.8; HW 1.7; ML 1.9; MP 1.4; PT 1.8; SP 2.9; TPF abs.

♀. Abdominal tergite 8 (Fig. 14e, f) without medioapical projection. Sternite 8 as in Fig. 14k. Genital segment as in Fig. 14b-d, g.

♂. Unknown.

COMMENTS. Six Japanese species of *Megarthrus*, *M. aino*, *M. conformis*, *M. conspirator*, *M. constrictus*, *M. convexus* and *M. impressicollis*, possess uniformly yellow-brown elytra and convex lateral edges of pronotum. *Megarthrus impressicollis* may be distinguished by the sutural area almost straight in lateral view. The shape of the apical abdominal tergites in female is particularly notable.

Megarthrus incubifer sp. n. (Figs 1f, k, 15a-i, 16a-g)

TYPE MATERIAL. Holotype ♂: Japan (G. Lewis), BMNH. Paratypes (2♀): Japan, Hokkaido, Mt. Daisetsu, 3.vii.1958 (M. Miyatake) MHNG; Shikoku, Ehime pref., Mt. Ishizuchi N.P., Tsuchigoya, 1400 m, 11-18.viii.1980 (S. & J. Peck) ex malaise trap trough in *Fagus-Abies* forest, FMNH.

Distribution. Japan: Hokkaido and Shikoku.

Description. Length 1.4-1.5 mm; width 1.0-1.1 mm. Body uniformly dark brown with appendages paler. Dorsal pubescence fairly uniform, sparser on elytron, denser near medioapical margin of abdominal tergite 7. Anteriomedian portion of frons with setae orientated forward. Elytral setae curved and recumbent. Metasternal setae as long as prosternal setae, fairly uniform. Abdominal pubescence converging on tergites 4-5, uniform on sternites 4-7, but with a pair of long subapical setae on each sternite. Punctation coarse on anterior portion of hypomeron and posteriomedial portion of metasternum. Frons raised above level of vertex; forming a ridge above clypeus; frontal ridge sharp, fine. Anterior frontal edge evenly convex. Frontal impression deep. Eye almost hemispherical, with highest point above level of vertex; supra-ocular margin sinuate in dorsal view. Temple as in Fig. 1k. Occipital ridge indistinct. Submentum weakly convex. Antenna (Fig. 16a) without patches of sensilla; scape not flattened; antennomeres 3-4 symmetrical; short and dense pubescence present on antennomeres 5-11. Pronotum (Fig. 16e) strongly convex in frontal view; mesal portion almost straight in lateral view. Pronotal disc with deep depressions along apical portion of lateral edge, and beside median groove; median groove deep, parallel-sided. Hypomeral ridge present anteriorly, oblique. Median prosternal ridge conspicuous, Y-shaped; anterior prosternal margin bordered by a regular row of conspicuous longitudinal ridges. Protrochanter lacking transverse ridge. Lateral portion of prepectal ridge sinuate, then bifid. Scutellum as in Fig. 1f. Elytron not narrowed basally; base abruptly inclined, then overhanging. Humeral callus low. Elytral disc with low swellings, flat along lateral edge; lateral edge finely carinate, weakly convex in dorsal view; sutural area slightly and evenly arcuate in lateral view; apical margin straight near suture; inner apical angle obtuse. Metasternum with femoral line arcuate in middle; median ridge absent. Abdominal tergite 3 slightly transversely vaulted. Sternites 2 and 3 with median processes as in Fig. 15e, process of sternite 3 straight. Sternite 4 flat at base, then stongly transversely vaulted.

Ratios: AL 2.1-2.2; EL 1.6-1.7; ET 1.6-1.7; EW 1.1-1.2; EY 2.4-2.5; GT 2.0-2.3; GW 1.9-2.0; HW 1.8-1.9; ML 1.5-1.6; MP 1.8-2.0; PT 2.0-2.1; SP 2.9-3.0; TPF abs.

♂. Frontoclypeal area unmodified. Protarsomere 1 lacking tenent setae. Mesofemur (Fig. 15g) longer than metafemur. Mesotibia (Fig. 15c) shorter than metatibia (Fig. 15d). Metatarsomere 1 about as long as combined length of metatarsomeres 2-4. Peg-like setae arranged in a single row on mesotrochanter (Fig. 15g), mesotibia and metatibia, absent from protibia and metatrochanter. Apex of abdominal tergite 8 as in Fig. 15f, i. Sternite 8 as in Fig. 15h. Sternite 10 without subbasal protuberance. Aedeagus as in Fig. 15a, b.

♀. Abdominal tergite 8 (Fig. 16c, d) without medioapical projection. Sternite 8 as in Fig. 16b. Genital segment as in Fig. 16f, g.

Comments. *Megarthrus incubifer* and *M. montanus* differ from other Japanese members of the genus by their uniformly dark brown elytra and oblique hypomeral ridge. The former species may be distinguished by the Y-shaped prosternal ridge.

Megarthrus japonicus Sharp (Figs 1c, h, 17a-k, 18a-h)

Megarthrus japonicus SHARP, 1874: 99.

TYPE MATERIAL. Lectotype ♂: Japan (G. Lewis) BMNH. Paralectotypes (14): same data as lectotype, 7♂, 6♀, BMNH and 1♂, FMNH, by present designation.

Additional material (50). China, Fukien prov., Chungan, Bohea Hills, 16.xi.1940 (T. C. Maa) 1♂ in BPBM; Japan (V. Quedenfeldt) # 59 037, 1♂ in MHNG and 2♂ in ZMHB; (Hiller) 2♀ in ZMHB; (Shönfeldt) 1♀ in DEI; Yokkaichi, Meer (Sauter) 1♂ in FMNH; Honshu, Gose pref., Mt. Kongo (= Watamaya pref., Mt. Kongodoji) 1100 m, 30.vii.1980 (C. Besuchet) ex leaf litter in forest, 1♀ in MHNG; Hyogo pref., Kobe, 25.i.1933, 2♂ in BMNH; Hyogo pref., Kobe, ii-v.1930, 1♀, BMNH; Hyogo pref., Mayasan, 15.x.1928 (J. Ea? unreadable, Lewis) 1♀ in BMNH; Kanagawa pref. (Sauter) 2♀ in FMNH; Kyoto distr., Kyoto, Midorogaike Pond, 7-8.viii.1980 (C. Besuchet) 1♀ in MHNG; Tokyo pref., Tokyo, 1925, 1♂, 3♀ in BMNH and 1♀ in MHNG; Tokyo, iv.1913 (F. Muir) 2♀ in BPBM; Tokyo, 1925 (Koch) 1♂ in FMNH; Tokyo pref., Inaginaganuma, 1.iv.1959 (Y. Watanabe) 1♂ in BMNH; Kanagawa pref., Yokohama (G. Lewis) 2♂, 5♀ in BMNH and 1♂, 1♀ in MHNG; Kyushu, Nagasaki pref., 7.iii.1881 (G. Lewis) 1♂ in BMNH; same data but 9.iii.1881, 1♀ in BMNH; same data but 3.iv.1881, 3♂ in BMNH; same data but 13.xi.1880-21.iv.1881, 2♂ and 3♀ in BMNH; Shikoku, Ehime pref., Matsuyama, 12.v.1951 (S. Hisamatsu) 1♂ in BMNH; same data, but 9.ii.1947 (M. Miyatake) 1♂ and 1♀ in BMNH; Kochi pref., Kuroson, 28.iv.1956 (S. Hisamatsu) 2♂ in BMNH and 1♂ in MHNG; Russia, Primorskij Kraj, Vladivostok, 11.vii.1993 (A. Pütz) 1♂ in DEI; Sakhalin, Aniva distr., Nuovo Alexandrovsk, 10 Km N Yusshno-Sakhalinsk, Zuzuya river, 12.vii.1993 (A. Pütz & Wrase) 1♀ in DEI.

DISTRIBUTION. Far East Russia; China: Fukien prov.; Japan: Honshu (Kanto and Kinki distr.), Kyushu and Shikoku. New to China and Russia.

DESCRIPTION. Length 1.3-1.4 mm; width 0.8-0.9 mm. Body predominantly dark brown or blackish with pronotum, elytron and appendages paler, sutural margin of elytron darkened; antennomeres 1-4 somewhat paler than antennomeres 5-11. Dorsal pubescence fairly uniform, somewhat denser along median pronotal groove, near humeral area of elytron and apical margin of abdominal tergite 7. Anteriomedian portion of frons with setae orientated backward. Elytral setae curved and recumbent. Metasternal setae shorter than prosternal setae, becoming sparser posteriomedianly. Abdominal pubescence parallel, uniform on sternites 4-7, but with a pair of long subapical setae on each sternite. Punctation fine on anterior portion of hypomeron, posteriomedial portion of metasternum impunctate. Frons raised above level of vertex, forming a blunt ridge above clypeus. Anterior frontal edge evenly convex. Frontal impression shallow or indistinct. Eye strongly convex, with highest point below level of vertex; supra-ocular margin sinuate in dorsal view. Temple similar to that in Fig. 1h. Occipital ridge indistinct. Submentum almost flat. Antenna (Fig. 18c) with patches of sensilla on antennomeres 6-10; scape not flattened; antennomere 3 somewhat asymmetrical, antennomere 4 strongly asymmetrical; short and dense pubescence present on antennomeres 5-11. Pronotum (Fig. 18h) weakly convex in frontal view; mesal portion almost straight in lateral view. Pronotal disc not depressed; median groove shallow, parallel-sided. Hypomeral ridge absent. Median prosternal ridge absent; anterior prosternal margin bordered by an irregular row of fine longitudinal ridges. Protrochanter lacking transverse ridge. Lateral portion of prepectal ridge straight, then bifid. Scutellum similar to that in Fig. 1c. Elytron not narrowed basally; base gradually inclined, then vertical. Humeral callus low. Elytral disc with low swellings, shallowly depressed along apical portion of lateral edge; lateral edge finely carinate, straight in dorsal view; sutural area almost straight in lateral view; apical margin somewhat sinuate near suture; inner apical angle right-angled. Metasternum with femoral line arcuate in middle; median ridge present posteriorly, fine and low. Abdominal tergite 3 slightly transversely vaulted. Sternites 2 and 3 with median processes as in Fig. 17h, process of sternite 3 straight. Sternite 4 flat at base, then slightly transversely vaulted.

Ratios: AL 1.8-2.0; EL 1.8-2.0; ET 1.8-2.0; EW 1.2; EY 2.3-2.5; GT 2.1-2.2; GW 1.7-1.8; HW 1.6-1.7; ML 1.6-1.7; MP 1.5-1.7; PT 2.2; SP 2.0-3.0; TPF 7.0-8.0.

♂. Frontoclypeal area unmodified. Frontal pubescence parallel. Protarsomere 1 with tenent setae. Metafemur (Fig. 17k) longer than mesofemur (Fig. 17g). Metatibia (Fig. 17d) longer than mesotibia (Fig. 17c). Metatarsomere 1 about as long as combined length of metatarsomeres 2-4. Peg-like setae absent from protibia, arranged in a single row on mesotrochanter (Fig. 17g), grouped to from a field on mesotibia and metatrochanter (Fig. 17k), arranged in a single row on metatibia, but near metatibial apex grouped to form a field. Apex of abdominal tergite 8 as in Fig. 17e, f. Sternite 8 as in Fig. 18g. Sternite 10 with small subbasal protuberance (Fig. 17i). Aedeagus as in Fig. 17a, b.

♀. Frontal pubescence converging. Abdominal tergite 8 (Fig. 18c, e) with medioapical projection. Sternite 8 as in Fig. 18f. Genital segment as in Fig. 18a, b.

COMMENTS. *Megarthrus japonicus* differs from other Japanese congeners, *M. shibatai* excepted, by the eyes which do not reach the level of the vertex, in combination with the 8th abdominal sternite which is 2.0-3.0x as wide as its basal projection. It differs from *M. shibatai* by the male metatrochanter bearing peg-like setae and, in female, by the hyaline 10th abdominal tergite. See also comments under *M. denticollis*.

Megarthrus montanus Sawada (Figs 1d, n, 19a-i, 20a-h)

Megarthrus montanus SAWADA, 1962: 14.

Megarthrus montanus subangulatus SAWADA, 1962: 14 (syn.n.).

TYPE MATERIAL. *Megarthrus montanus*. Holotype, ♂: Japan, Honshu, Nagano pref., Inago-Yu, 27.vii.1959 (T. Shibata) KSPC. Paratype, ♀: same data as holotype, KSPC.

Megarthrus montanus subangulatus. Holotype, ♀: Japan, Honshu, Kanagawa pref., Osaka, Katsuoji, 24.xii.1954 (K. Sawada) KSPC. Paratype, ♀: Japan, Honshu, Kii, Mt. Kôjin, 1.vii.1956 (M. Hayashi) KSPC.

Additional material (10). China, Heilungkiang prov., Harbin, 16.vi.1966 (P. M. Hammond) #1364, 1♀ in BMNH; Japan, Honshu, Gunma pref., below Usui Pass, 750 m, 20.vii.1980 (I. Löbl) ex leaf litter in ravine, 1♀ in MHNG; Gunma pref., Nikko, Kozawa, 1000 m, 15.viii.1980 (P. M. Hammond) 1♀ in BMNH; Iwate pref., Kawai, Yoshibezawa, 1050 m, 12.viii.1991, #J49 (A. Smetana), 1♂ in ASPC; Russia, slopes of Parwaja Rjetschka, Valley N Wladiwostok, 1918-1920 (H. Frieb) 2♀ in NHMW; Primorskiy Kray, Ussuriysky Zapovednik, 33 Km SE Ussuriysk <43°37' N; 132°18' E> 500 m, 13.vi.1993 (L. Zerche) 1♂, 1♀ in DEI and 1♂, 1♀ in MHNG.

DISTRIBUTION. Northeastern China; Japan: Honshu (Chubu, Kanto and Tohuku distr.); Far East Russia. New to Russia and China.

Description. Length 1.5-1.6 mm; width 0.9-1.1 mm. Body uniformly dark brown with sutural margin of elytron darkened, appendages paler; antennomeres 1-4 paler than antennomeres 5-11. Dorsal pubescence fairly uniform, sparser on elytron, denser near humeral area. Anteriomedian portion of frons with setae orientated backward. Elytral setae curved and recumbent. Metasternal setae as long as prosternal setae, becoming denser posteriomedianly. Abdominal pubescence converging on tergites 4-6, uniform on sternites 4-7. Punctation coarse on anterior portion of hypomeron, fine on posteriomedial portion of metasternum. Frons raised above level of vertex, evenly deflected toward clypeus. Anterior frontal edge weakly convex in middle, oblique or sinuate laterally. Frontal impression shallow in middle, deep laterally. Eye almost hemispherical, reaching level of vertex; supra-ocular margin sinuate in dorsal view. Temple and occipital ridge as in Fig. 1n, occipital ridge straight in middle and sinuate laterally. Submentum almost flat. Antenna (Fig. 20c) without patches of sensilla; scape not flattened; antennomere 3 slightly asymmetrical, 4 symmetrical; short and dense pubescence present on antennomeres 5-11. Pronotum (Fig. 20g) strongly convex in frontal view; mesal portion slightly arcuate in lateral view. Pronotal disc with deep depression along apical portion of lateral edge, and shallow depression beside median groove; median groove shallow, parallel-sided. Hypomeral ridge present anteriorly, oblique. Median prosternal ridge fine, straight, interrupted in middle; anterior prosternal margin bordered by a regular row of conspicuous longitudinal ridges. Protrochanter lacking transverse ridge. Lateral portion of prepectal ridge sinuate, then bifid. Scutellum as in Fig. 1d. Elytron weakly narrowed basally; base abruptly inclined, then overhanging. Humeral callus low. Elytral disc with low swellings, flat along lateral edge; lateral edge finely carinate, weakly convex, or straight, in dorsal view; sutural area straight basally and slightly arcuate apically in lateral view; apical margin weakly convex near suture; inner apical angle obtuse. Metasternum with femoral line arcuate in middle; median ridge absent. Abdominal tergite 3 slightly transversely vaulted. Sternites 2 and 3 with median processes as in Fig. 20h, process of sternite 3 trifid. Sternite 4 flat.

Ratios: AL 1.7-1.8; EL 1.7-1.9; ET 1.8-2.0; EW 1.1-1.2; EY 2.4-2.8; GT 2.5-2.6; GW 1.7-1.8; HW 1.8-2.0; ML 1.3-1.9; MP 1.4-1.5; PT 2.0; SP 1.8-2-3; TPF abs.

♂. Frontoclypeal area unmodified. Protarsomere 1 lacking tenent setae. Mesofemur (Fig. 19b) longer than metafemur. Mesotibia (Fig. 19d) shorter than metatibia. Metatarsomere 1 about as long as combined length of metatarsomeres 2-4. Peg-like setae absent from mesotrochanter (Fig. 19b), metatrochanter (Fig. 19c) and metatibia, grouped to form a field on mesotibia. Apex of abdominal tergite 8 as in Fig. 19h, i. Sternite 8 as in Fig. 19e. Sternite 10 (Fig. 19g) with large subbasal protuberance. Aedeagus as in Fig. 19a, f.

♀. Abdominal tergite 8 (Fig. 20e, f) without medioapical projection. Sternite 8 as in Fig. 20d. Genital segment as in Fig. 20a, b.

Comments. *Megarthrus montanus* is characterised by the male mesotibia deeply notched and, in female, the V-shaped posterior margin of the 8th abdominal sternite. See also comments under *M. incubifer*.

The two females collected respectively by I. Löbl and P. M. Hammond possess smaller eyes, shortened wings and metasternum.

Megarthrus parallelus Sharp (Figs 1b, 21a-i, 22a-h)

Megarthrus parallelus SHARP, 1874: 99.

Megarthrus subparallelus SAWADA, 1962: 12 (syn.n.).

TYPE MATERIAL. *Megarthrus parallelus*. Lectotype, ♀: "Japan, G. Lewis", BMNH. Paralectotype, ♀: same data as lectotype, BMNH, by present designation.

Megarthrus subparallelus. Holotype, ♂: Japan, Honshu, Osaka pref., Minoo, Katsuoji, 24.xii.1954 (K. Sawada) KSPC. Paratype, ♀: Japan, Honshu, Nara pref., Mt Kasuga, 15.i.1953 (G. Imadate) KSPC.

Additional material (8). Japan (G. Lewis) 2♀ in BMNH, same data, but #228 [labelled as "*Megarthrus parallelus* var?"] 1♀ in FMNH; Kiga (G. Lewis) 1♀in BMNH; Fukuoji, Aki, 12.iv.1955 (M. Miyatake) 1♂ in BMNH; Honshu, Hyogo pref., Kobe, Mayasam, 13.vi.30, 350 m, 1♀ in BMNH; Kyushu, Nagasaki pref., 23.iii.1881 (G. Lewis) 1♀ in BMNH; Shikoku, Shirainot Aki, 13.xi.1949 (M. Miyatake) 1♀ in BMNH.

DISTRIBUTION. Japan: Honshu (Kinki distr.), Kyushu and Shikoku.

DESCRIPTION. Length 1.2-1.4 mm; width 0.8-0.9 mm. Body uniformly dark brown with sutural margin of elytron darkened, appendages somewhat paler. Dorsal pubescence fairly uniform, sparser on elytron. Anteriomedian portion of frons with setae orientated forward. Elytral setae curved and recumbent. Metasternal setae as long as prosternal setae, becoming denser anteriorly. Abdominal pubescence converging on tergite 4, uniform on sternites 4-7, but with a pair of long subapical setae on each sternite. Punctation fine on anterior portion of hypomeron, coarse on posteriomedial portion of metasternum. Frons raised above level of vertex, forming a ridge above clypeus; frontal ridge sharp, conspicuous. Anterior frontal edge evenly convex. Frontal impression deep. Eye almost hemispherical, highest point somewhat above level of vertex; supra-ocular margin sinuate in dorsal view. Temple as in Fig. 1m. Occipital ridge indistinct. Submentum weakly convex. Antenna (Fig. 22c) without patches of sensilla; scape not flattened; antennomeres 3-4 symmetrical; short and dense pubescence present on antennomeres 7-11. Pronotum (Fig. 22d) strongly convex in frontal view; mesal portion almost straight in lateral view. Pronotal disc with shallow depression along apical portion of lateral edge; median groove shallow, parallel-sided. Hypomeral ridge present anteriorly, oblique. Median prosternal ridge conspicuous and straight anteriorly, indistinct posteriorly; anterior prosternal margin bordered by a regular row of conspicuous longitudinal ridges. Protrochanter lacking transverse ridge. Lateral portion of prepectal ridge sinuate, then bifid. Scutellum as in Fig. 1b. Elytron not narrowed basally; base abruptly inclined, then overhanging. Humeral callus low. Elytral disc with low swellings, flat along lateral edge; lateral edge finely carinate, almost straight in dorsal view; sutural area slightly and evenly arcuate in lateral view; apical margin straight near suture; inner apical angle obtuse. Metasternum with femoral line arcuate in middle; median ridge present anteriorly, fine and low. Abdominal tergite 3 slightly transversely vaulted. Sternites 2 and 3 with median processes as in Fig. 21e, process of sternite 3 straight. Sternite 4 flat at base, then slightly transversely vaulted.

Ratios: AL 2.1-2.2; EL 1.9-2.0; ET 1.7-1.8; EW 1.0-1.1; EY 2.6-2.7; GT 2.2-2.3; GW 1.9-2.0; HW 1.6-1.7; ML 1.7-2.2; MP 1.9-2.1; PT 2.0-2.1; SP 3.4-3.7; TPF abs.

♂. Frontoclypeal area unmodified. Protarsomere 1 lacking tenent setae. Mesofemur (Fig. 21h) longer than metafemur (Fig. 21k). Mesotibia (Fig. 21d) longer than metatibia (Fig. 21c). Metatarsomere 1 about 1.5x as long as combined length of metatarsomeres 2-4. Peg-like setae absent from protibia, arranged in a single row on mesotrochanter (Fig. 21h), grouped to form a field on mesotibia, metatrochanter (Fig. 21k) and metatibia. Apex of abdominal tergite 8 as in Fig. 21f, i. Sternite 8 as in Fig. 22g. Sternite 10 (Fig. 21g) with small subbasal protuberance. Aedeagus as in Fig. 21a, b.

♀. Abdominal tergite 8 (Fig. 22f, h) without medioapical projection. Sternite 8 as in Fig. 22e. Genital segment as in Fig. 22a, b.

COMMENTS. Among the Japanese species of the genus, *M. parallelus* and *M. sawadai* are characterised by the uniformly dark brown elytra and the lateral edges of the pronotum forming six distinct denticles. *Megarthrus parallelus* differs from *M. sawadai* by the aedeagal characters and the shape of the legs in male.

Megarthrus sawadai sp. n. (Fig. 23a-n)

TYPE MATERIAL. Holotype ♂: Japan, Honshu, Gunma pref., below Usui Pass, 750 m, 20.vii.1980 (I. Löbl) ex leaf litter in ravine, MHNG. Paratype,♂: Japan, Honshu, Kanagawa pref., Monomitouge, 18.iv.1959 (Y. Watanabe) BMNH.

DISTRIBUTION. Japan: Honshu (Kanto distr.).

DESCRIPTION. Similar to *M. parallelus* from which it may be distinguished as follows: Length 1.2 mm; width 0.8 mm. Anterior frontal edge weakly convex in middle and oblique laterally. Antenna as in Fig. 23i. Pronotum as in Fig. 23g. Abdominal sternites 2 and 3 with median processes as in Fig. 23n. Ratios: EL 1.9-2.0; GW 1.7-1.8; ML 1.5-1.6; SP 3.1-3.5.

♂. Frontoclypeal area unmodified. Protarsomeres 1 lacking tenent setae. Mesofemur (Fig. 23k) longer than metafemur. Mesotibia (Fig. 23b) longer than metatibia (Fig. 23c). Metatarsomeres 1 about as long as combined length of metatarsomeres 2-4. Peg-like setae absent from protibia and mesotrochanter, arranged in a single row on mesotrochanter (Fig. 23k) and metatibia, arranged in a double row on mesotibia, but near mesotibial apex arranged in a single row. Apex of abdominal tergite 8 as in Fig. 23h, m. Sternite 8 as in Fig. 23e. Sternite 10 (Fig. 23i) with small subbasal protuberance. Aedeagus as in Fig. 23a, d.

♀. Unknown.

COMMENTS. See discusion under *M. parallelus*.

ETYMOLOGY. The species is named in honor of Mr Kohei Sawada, Nishinomyia.

Megarthrus scriptus Sharp (Figs 24a-g, 24a-i)

Megarthrus scriptus SHARP, 1889: 469.

TYPE MATERIAL. Lectotype ♂: Japan, Honshu, Gunma pref., Chuzenji, 19.viii.1881 (G. Lewis) BMNH, by present designation.

Additional material (89). Japan, Honshu, Aomori pref., Fukaura, Mt. Shirakami, Oku-akaishikawa-rindo, 270-400 m, 14.viii.1991 (A. Smetana) #J53, 2♂ in ASPC; Gifu pref., 8 Km SE Osaka, 750 m, 1.viii.1980 (I. Löbl) on and under bark of rotted trunk in *Cryptomeria* plantation, 4♂ and 4♀ in MHNG; Gunma pref., below Usui Pass, 700 m, 20.vii.1980 (I. Löbl) ex grass in abandoned field, 3♂ and 6♀ in MHNG; Gunma pref., E Usui Pass, 850 m, 24.vii.1980 (I. Löbl) ex rotted wood and leaf litter, forest on slope, 4♂ and 3♀ in MHNG; Gunma pref., Jô-shin-etsu Kogen N. P., Shirane, 1500 m, 22.vii.1980 (I. Löbl) ex swamp, 1♂ and 2♀ in MHNG; Gunma pref., Chuzenji, Nataisan, 18.viii.1965 (D. H., A. C. & A. H. Kistner) field # 1002, 2♂ and 3♀ in BPBM; Iwate pref., Iwaizumi, Hitsutori, 790 m, 11.viii.1991 (A. Smetana) #J45, 1♀ in ASPC; Iwate pref., Kawai, Yoshibezawa, 1050 m, 12.viii.1991 (A. Smetana) #J49, 7♀ in ASPC; Kanagawa pref., Sagami, Ohtakitoge, Nishi-tanzawa, 12.vi.1939 (H. Araki) 1♂ in BMNH; Nagano pref., Jô-shin-etsu Kogen N. P., Shiga, 1500 m, 23.vii.1980 (I. Löbl) under bark of dead *Abies*, 1♀ in MHNG; Nikko pref., 3-21.vi.1880 (G. Lewis) 1♂ in BMNH; Shizuoka pref., Mt.Amagi, 18.v.1957 (K. Ishida) 1♂ in BMNH; Tottori pref., Dai-sen-oki, 8.viii.1933 (H. Araki) 2♂ in BMNH; Shikoku, Ehime pref., Mt. Ishizuchi N. P., Tsuchigoya, 1400 m, 11-18.viii.1980 (S. & J. Peck) berlese, litter, logs, stumps, moss & fungi in *Fagus-Abies* forest, 1♂ in FMNH; same data, but ex malaise trap trough in *Fagus-Abies* forest, 1♀ in FMNH; Ehime pref., Mt. Ishizuchi N. P., Mt. Kamegamori, Siraza Pass, 1500 m, 15.viii.1980 (S. Peck) ex *Fagus* logs, 1♂ and 3♀ in CNCI; Ehime pref., Mt. Ishizuchi N. P., Omogo Valley, 700 m, 18-25.viii.1980 (S. Peck) 2♀ in CNCI; same data, but ex fungi on log & moss in mixed warm temperate forest, 2♂ and 1♀ in CNCI; same data, but (S. & J. Peck), litter under rotting watermelon, berlese, fungi on mossy logs, and malaise trap, 6♂ and 9♀ in FMNH; Ehime pref., Mt. Ishizuchi N. P., Mt. Ishizuchi, 1350 m, 13.viii.1980 (I. Löbl) ex leaf litter at foot of old *Fagus* with bamboos, 1♀ in MHNG; Ehime pref., Omogo-kei, 13.vi.1954 (S. Hisamatsu) 1♀ in BMNH; Ehime pref., Omogo, Sakase, 19.vi.1955 (M. Miyatake) 1♀ in BMNH; Ehime pref., Omogo-kei, 21, 22, 23.viii.1953 (M. Miyatake) 2♂, 1♀ in BMNH; same data, but 1 and 2.viii.1954, 3♀, 21.viii.1955, 1♀, 27.viii.1955, 3♂, and 15.vi.1956, 1♀ in BMNH; Ehime pref., Saragamine, 12.xii.1953 (T. Mohri) 1♀ in BMNH.

DISTRIBUTION. Japan: Honshu (Chubu, Kanto and Tohuku distr.) and Shikoku.

DESCRIPTION. Length 1.3-1.5 mm; width 0.8-1.0 mm. Body and appendages predominantly yellow-brown with vertex and pronotum occasionnally darkened; elytra with colour pattern as in Fig. 25c. Dorsal pubescence fairly uniform, sparser on elytron. Anteriomedian portion of frons with setae orientated backward. Elytral setae curved and recumbent. Metasternal setae as long as prosternal setae, becoming denser posteriomedianly. Abdominal pubescence converging on tergites 4-6, uniform on sternites 4-7, but with a pair of long subapical setae on each sternite. Punctation fine on anterior portion of hypomeron, posteriomedial portion of metasternum impunctate. Frons raised above level of vertex, forming a ridge above clypeus; frontal ridge sharp, fine. Anterior frontal edge strongly convex in middle, oblique laterally. Frontal impression shallow in middle, deep laterally. Eye strongly convex, reaching level of vertex; supra-ocular margin sinuate in dorsal view. Temple and occipital ridge as in Fig. 1i, occipital ridge indistinct in middle and sinuate laterally. Submentum weakly convex. Antenna (Fig. 25d) without patches of sensilla; scape not flattened; antennomeres 3-4 symmetrical; short and dense pubescence present on antennomeres 6-11. Pronotum (Fig. 25g) weakly convex in frontal view; mesal portion almost straight in lateral view. Pronotal disc with shallow depressions along apical portion of lateral edge and beside median groove; median groove shallow, widened apically. Hypomeral ridge present anteriorly, oblique. Median prosternal ridge conspicuous, straight; anterior prosternal margin bordered by a regular row of conspicuous longitudinal ridges. Protrochanter lacking transverse ridge. Lateral portion of prepectal ridge angulate, then bifid. Scutellum as in Fig. 1a. Elytron not narrowed basally; base abruptly inclined, then overhanging. Humeral callus low. Elytral disc with low swellings, flat along lateral edge; lateral edge conspicuously carinate, moderately convex in dorsal view; sutural area slightly and evenly arcuate in lateral view; apical margin convex near suture; inner apical angle obtuse. Metasternum with femoral line arcuate in middle; median ridge absent. Abdominal tergite 3 slightly transversely vaulted. Sternites 2 and 3 with median processes as in Fig. 25h, process of sternite 3 straight. Sternite 4 flat.

Ratios: AL 1.8-2.0; EL 2.0-2.1; ET 2.1-2.2; EW 1.1-1.2; EY 2.2-2.5; GT 1.9-2.1; GW 1.8; HW 1.6-1.8; ML 1.1-1.3; MP 1.6-1.8; PT 2.0; SP 2.5-3.0; TPF abs.

♂. Frontoclypeal area unmodified. Protarsomere 1 lacking tenent setae. Mesofemur (Fig. 24d) longer than metafemur. Mesotibia (Fig. 24c) about as long as metatibia. Metatarsomere 1 about as long as combined length of metatarsomeres 2-4. Peg-like setae absent from protibia, mesotibia and metatrochanter, arranged in a single row on metatibia and mesotrochanter (Fig. 24d). Apex of abdominal tergite 8 as in Fig. 24e, g. Sternite 8 as in Fig. 24f. Sternite 10 without basal protuberance. Aedeagus as in Fig. 24a, b.

♀. Abdominal tergite 8 (Fig. 25f, i) without medioapical projection. Sternite 8 as in Fig. 25e. Genital segment as in Fig. 24a, b.

COMMENTS. See discussion under *M. aino* and *M. corticalis.*

Megarthrus shibatai Sawada (Figs 26a-m, 26a-h)

Megarthrus shibatai SAWADA, 1962: 13.

TYPE MATERIAL. Holotype ♂: Japan, Honshu, Nagano pref., Inago-yu, 1500-2000 m, 16.vii.1959 (T. Shibata) KSPC. Paratype (1♀): same data as holotype, but 24.vii.1959, KSPC.

Additional material (1♂). Japan, Honshu, Iwate pref., Kawai, Yoshibezawa, 1050 m, 12.viii.1991 (A. Smetana) #J49, MHNG.

DISTRIBUTION. Japan: Honshu (Chubu, and Tohuku distr.).

DESCRIPTION. Similar to *M. japonicus* from which it differs as follows: Dorsal pubescence fairly uniform. Submentum strongly convex. Antenna as in Fig. 27c, d. Pronotum as in Fig. 27e. Apical margin of elytron weakly convex near suture; inner apical angle obtuse. Abdominal sternites 2 and 3 with median processes as in Fig. 26m. Ratios: AL 1.6-1.7; EL 1.5-1.6; ET 1.6-1.7; ML 1.5; PT 1.8; TPF 6.0-7.0.

♂. Frontoclypeal area unmodified. Frontal pubescence parallel. Protarsomere 1 with tenent setae. Metafemur (Fig. 26f) somewhat longer than mesofemur (Fig. 26h). Metatibia (Fig. 26b) longer than mesotibia (Fig. 26a). Metatarsomere 1 about as long as combined length of metatarsomeres 2-4. Peg-like setae absent from protibia and metatrochanter (Fig. 26f), arranged in a single row on mesotrochanter (Fig. 26h), grouped to from a field on mesotibia, arranged in a single row on metatibia, but near metatibial apex grouped to form a field. Apex of abdominal tergite 8 as in Fig. 26g, i. Sternite 8 as in Fig. 26k. Sternite 10 (Fig. 26d) with small subbasal protuberance. Aedeagus as in Fig. 26c, d.

♀. Frontal pubescence converging. Abdominal tergite 8 (Fig. 27f, g) with medioapical projection. Sternite 8 as in Fig. 27g. Genital segment as in Fig. 27a, b.

COMMENTS. See discussion under *M. japonicus.*

DISCUSSION

All available Japanese material of *Megarthrus* is from the main islands, totalling 16 species (Fig. 28, table 1). Most of the Japanese *Megarthrus* are from Honshu, Chubu district (10 species). Altitudinal records indicate a preference of *Megarthrus* for montane biotopes ranging from 700-1600 m a. s. l. Only 5 species were found between 200-700 m, and 3 above 1600 m. The surprisingly high number of species from Shikoku compared to that from Kyushu may be explained by gaps in the detailed knowledge of the distribution. The related Omaliinae are represented in both islands by an equal number of species (WATANABE 1990). In unrelated groups, such as Calliphoridae and Sarcophagidae (KANO *et al.*, 1967; KANO & SHINONAGA 1968) these figures are essentially the same. The relatively high proportion of species that also occur outside Japan (37.5%) is notable. In the Omaliini which usually inhabit similar habitats (Löbl, pers. comm.) only one of 17 Japanese species is also found in other countries (WATANABE 1990). All of the non-endemic Japanese species of *Megarthrus* occur, outside Japan, in Russia, temperate China and Europe. This suggests that *Megarthrus* represents a Palaearctic rather than an Oriental element in Japan.

ACKNOWLEDGMENTS

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TABLE 1. Geographical distribution of the Japanese *Megarthrus*.

Localities	Hokkaido	Honshu					Shikoku	Kyushu	Europe	Russia	China
Species		Tohuku	Kanto	Chubu	Kinki	Chugoku					
M. aino		X			X						
M. conformis			X	X			X				
M. conspirator		X	X	X			X			X	
M. constrictus				X							
M. convexus		X	X	X	X		X	X			
M. corticalis				X	X		X				
M. denticollis					X				X		
M. hemipterus	X	X		X			X		X	X	X
M. impressicollis				X						X	
M. incubifer	X						X				
M. japonicus			X		X		X	X		X	X
M. montanus		X	X	X						X	X
M. parallelus					X		X	X			
M. sawadai			X								
M. scriptus		X	X	X		X	X				
M. shibatai		X		X							
		7	7	10	6	1			2	5	3
16	**2**	**15**					**9**	**3**	**6**		

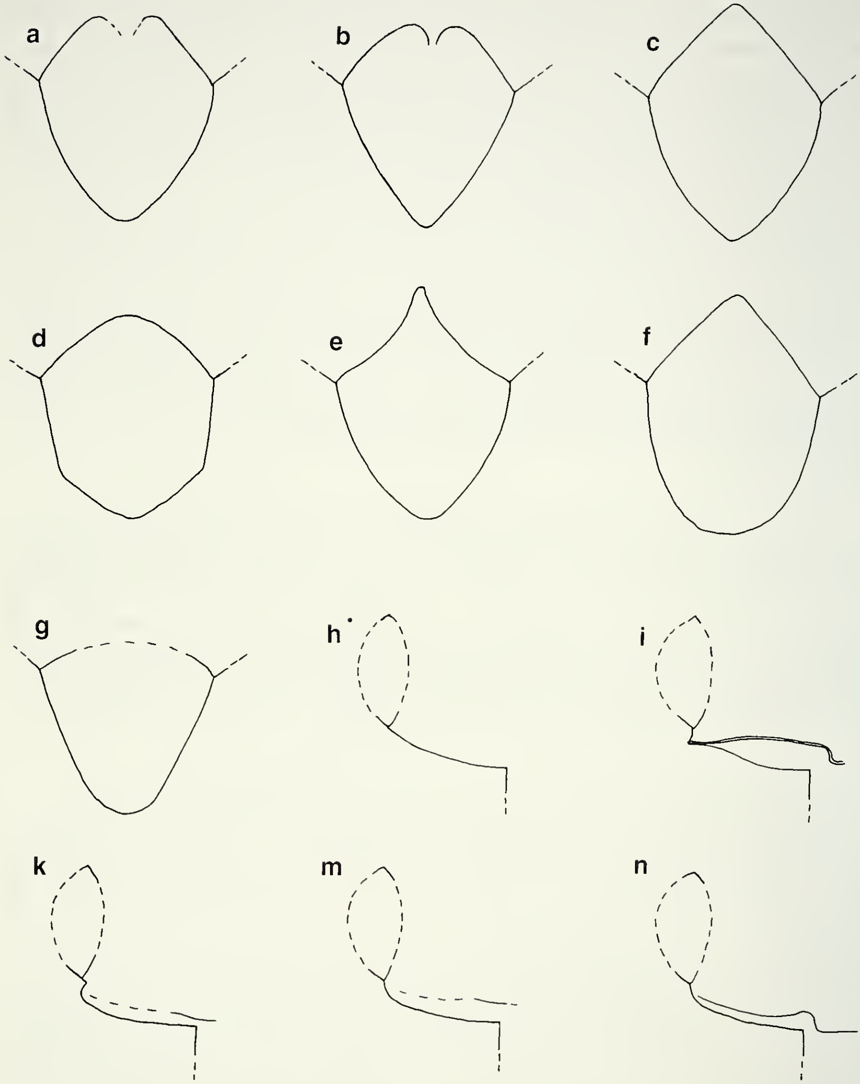


Fig. 1

Scutellum: a-g; Temple and occipital ridge: h-n; schematic. *Megarthrus* aino: g; *M. conformis*: a, i; *M. impressicollis*: e, m; *M. incubifer*: f, k; *M. japonicus*: c, h; *M. montanus*: d, n; *M. parallelus*: b.

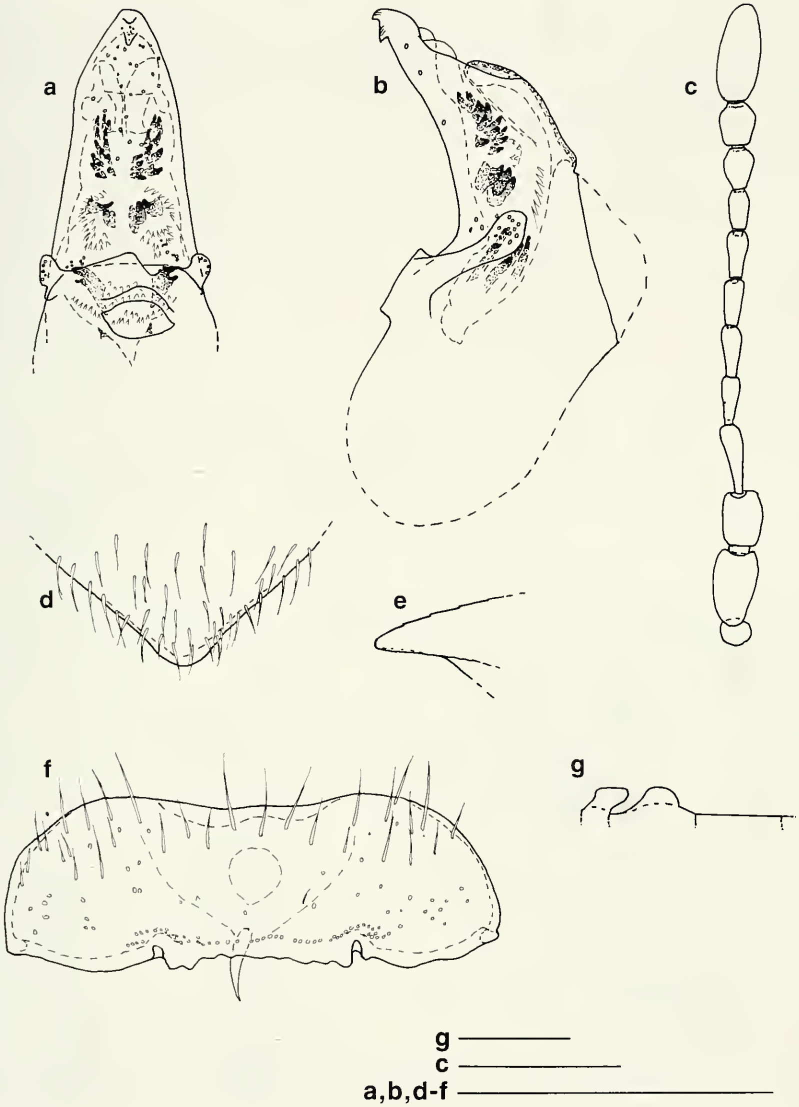


FIG. 2

Megarthrus aino; a, b: aedeagus, ventral (apical portion) and lateral; c: antenna; d, e: male, apex of abdominal tergite 8, lateral and dorsal; f: male, abdominal sternite 8; g: median processes of abdominal sternites 2-4 (left to right), schematic. Scale bars = 0.2 mm.

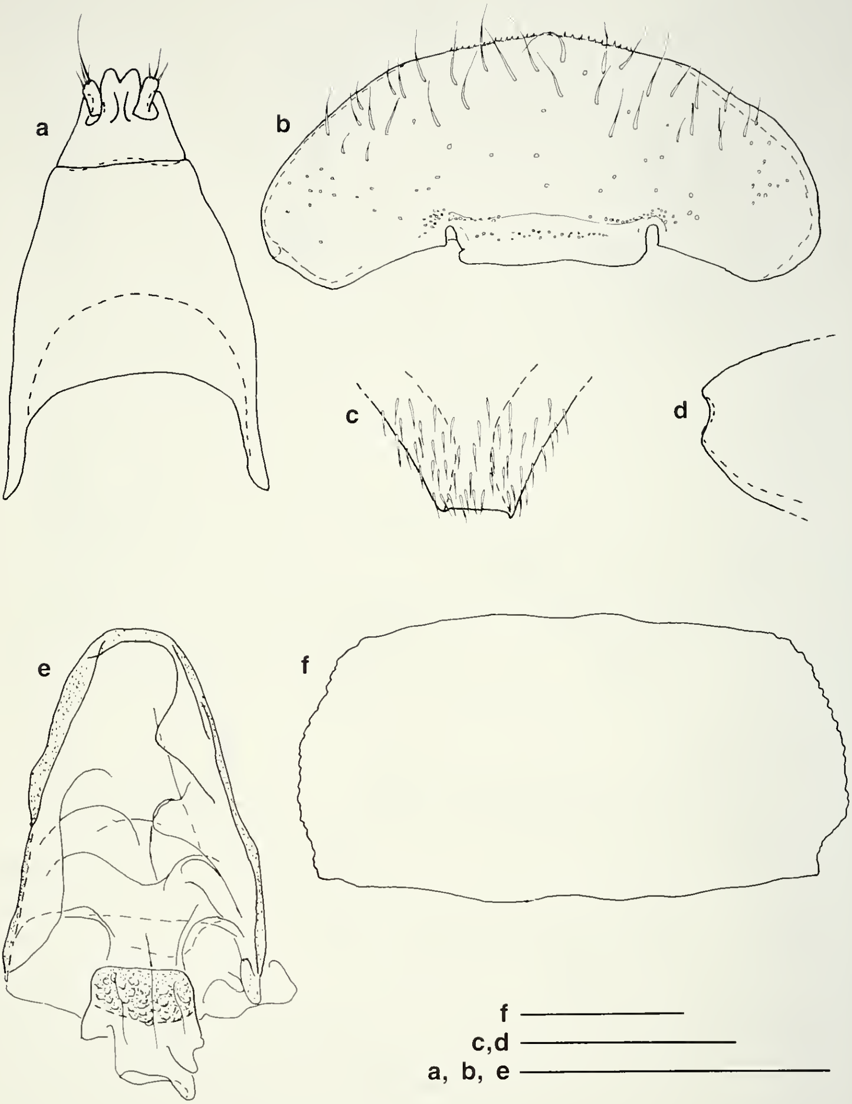


FIG. 3

Megarthrus aino; a, e: female, genital segment, sternites (a) dorsal and tergites (e) ventral; b: female, abdominal sternite 8; c, d: female, apex of abdominal tergite 8, dorsal and lateral; f: pronotum. Scale bars = 0.2 mm.

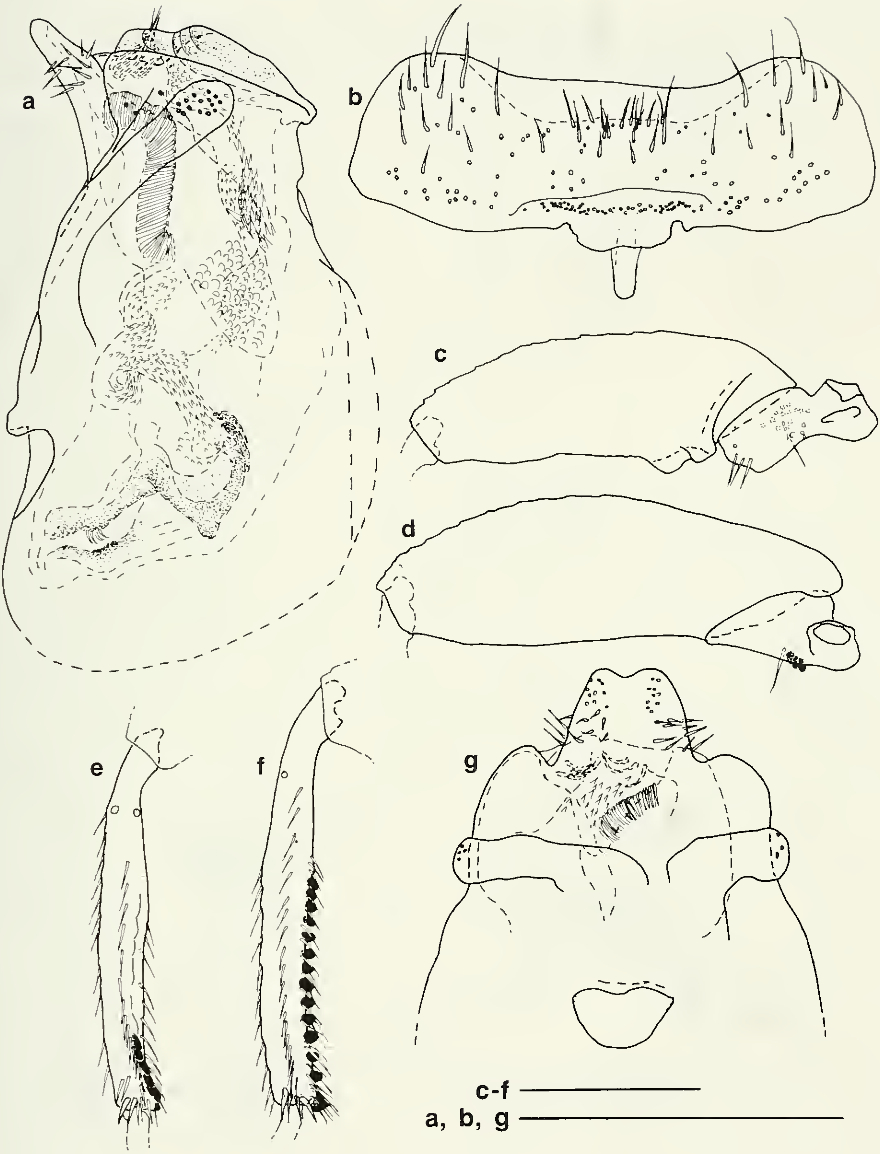


FIG. 4

Megarthrus conformis, male; a, g: aedeagus, lateral and ventral (apical portion); b: abdominal sternite 8; c: metafemur and metatrochanter; d: mesofemur and mesotrochanter; e: metatibia; f: mesotibia. Scale bars = 0.2 mm.

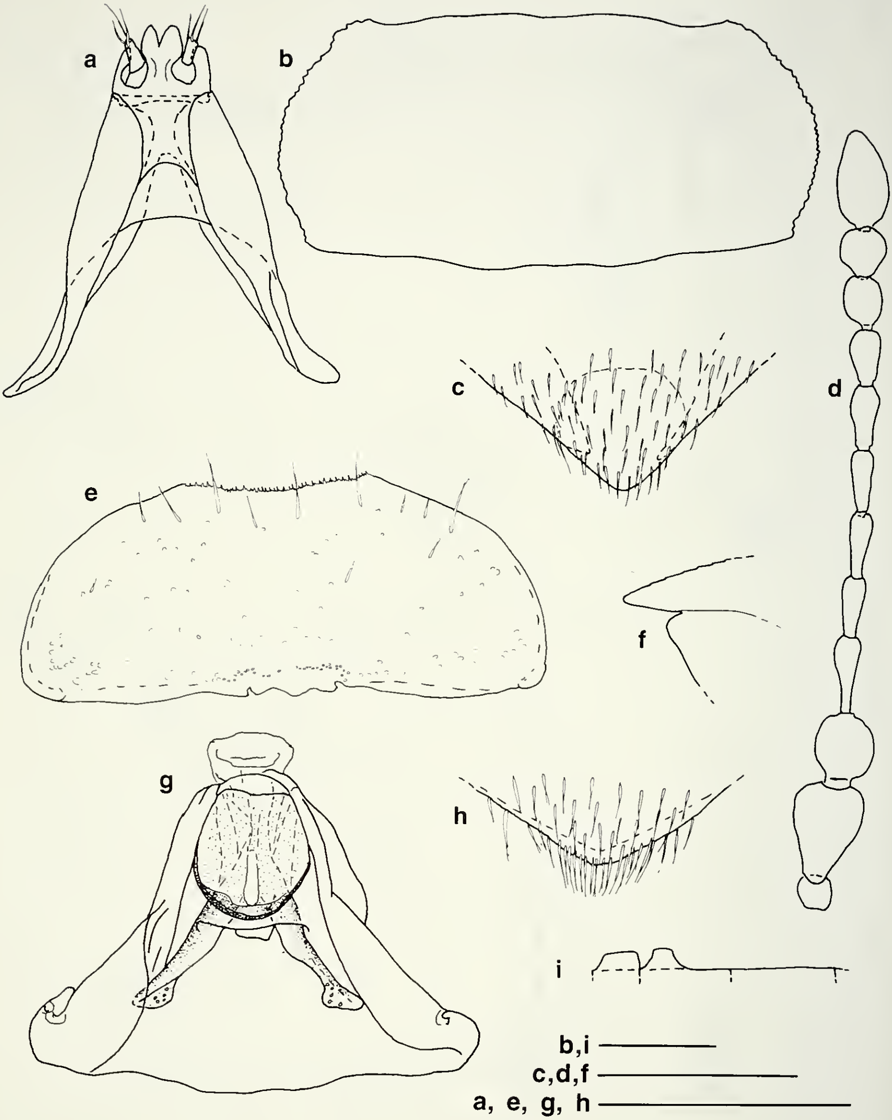


FIG. 5

Megarthrus conformis; a, g: female, genital segment, sternites (a) dorsal and tergites (g) ventral; b: pronotum; c, f: female, apex of abdominal tergite 8, dorsal and lateral; d: antenna; e: female, abdominal sternite 8; h: male, apex of abdominal tergite 8, dorsal; i: median processes of abdominal sternites 2-4 (left to right), schematic. Scale bars = 0.2 mm.

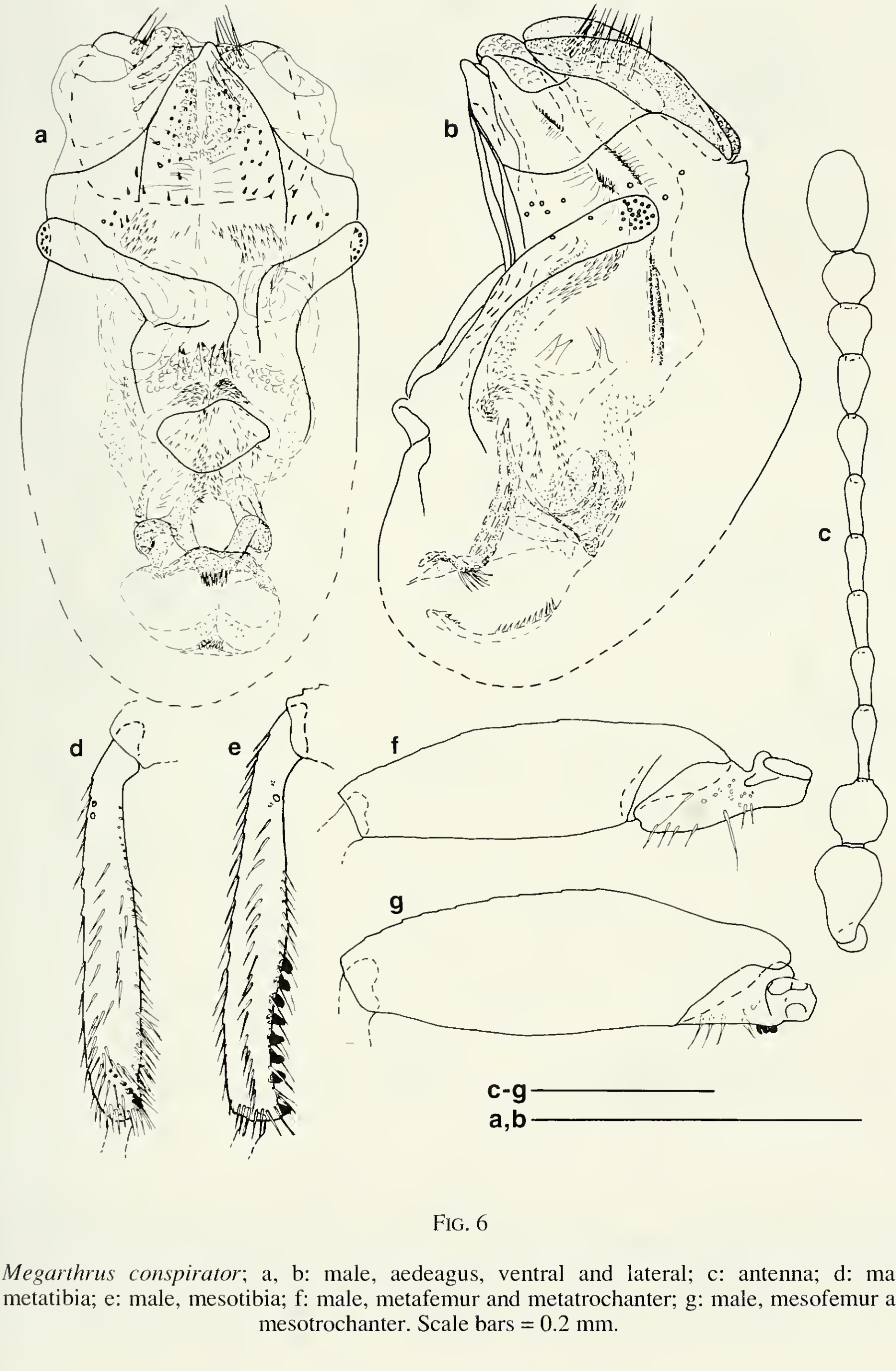


FIG. 6

Megarthrus conspirator; a, b: male, aedeagus, ventral and lateral; c: antenna; d: male, metatibia; e: male, mesotibia; f: male, metafemur and metatrochanter; g: male, mesofemur and mesotrochanter. Scale bars = 0.2 mm.

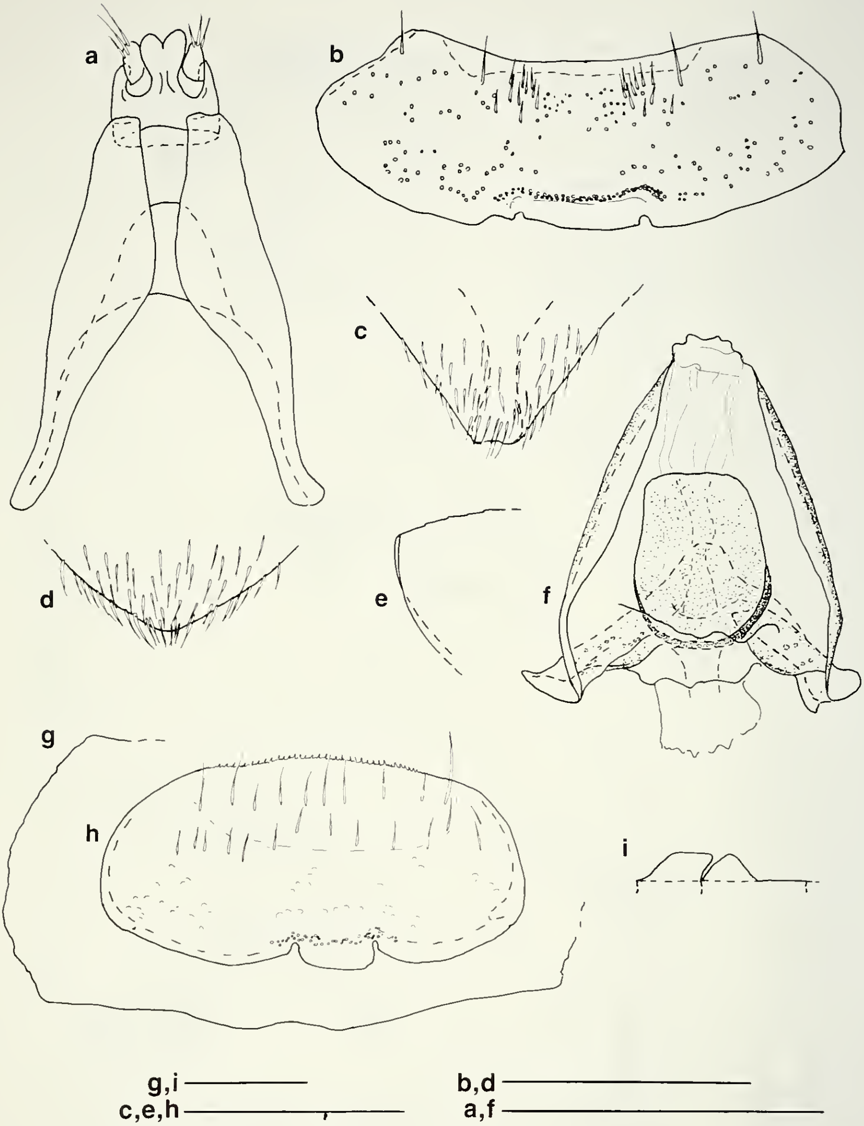


FIG. 7

Megarthrus conspirator; a, f: female, genital segment, sternites (a) dorsal and tergites (f) ventral; b, h: abdominal sternite 8 (b) male and (h) female; c, e: female, apex of abdominal tergite 8, dorsal and lateral; d: male, apex of abdominal tergite 8, dorsal; g: pronotum, contour, basal and lateral; i: median processes of abdominal sternites 2-3 (left to right), schematic. Scale bars = 0.2 mm.

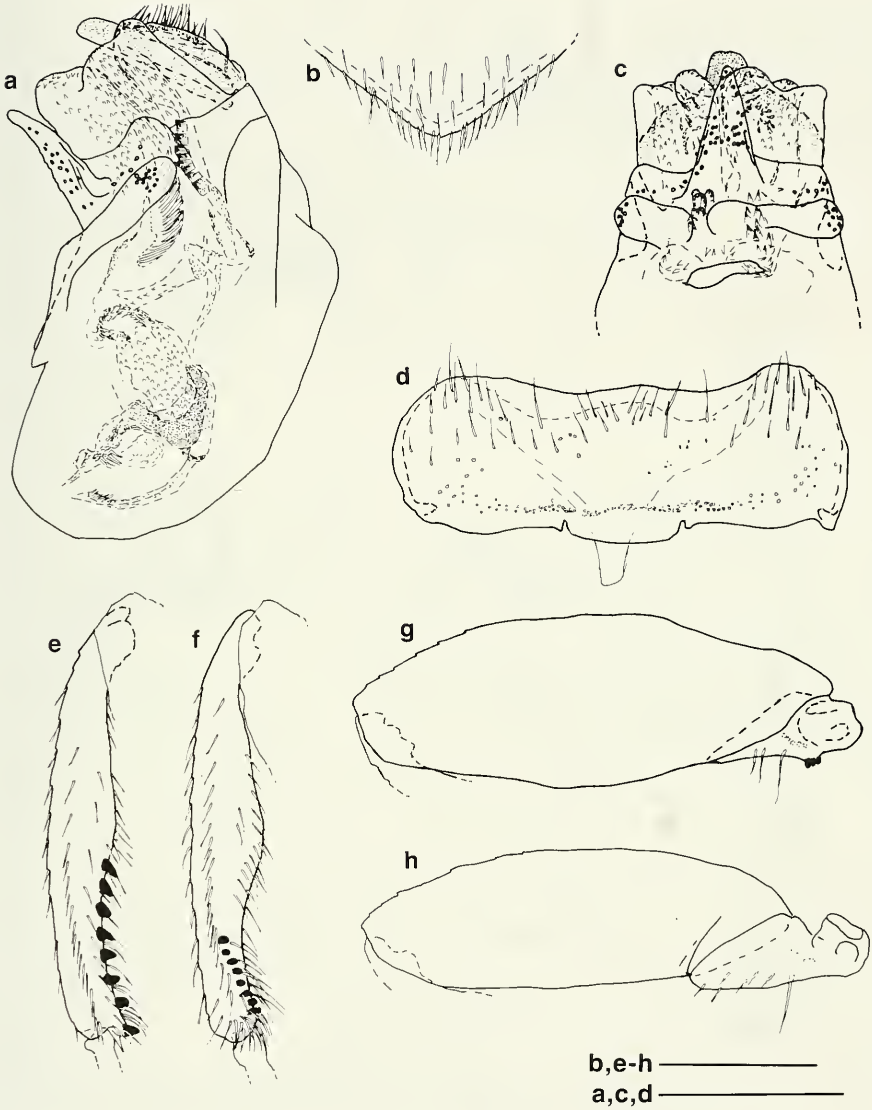


FIG. 8

Megarthrus constrictus, male; a, c: aedeagus, lateral and ventral (apical portion); b: apex of abdominal tergite 8, dorsal; d: abdominal sternite 8; e: mesotibia; f: metatibia; g: mesofemur and mesotrochanter; h: metafemur and metatrochanter. Scale bars = 0.2 mm.

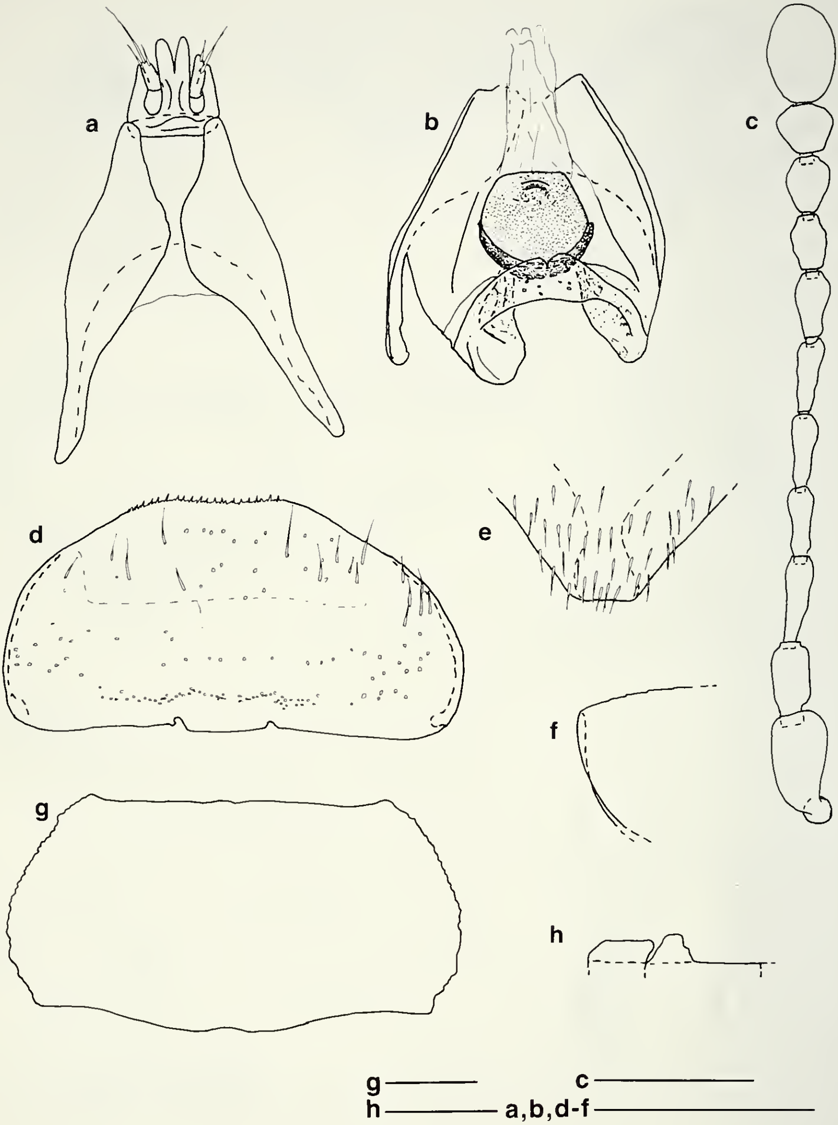


FIG. 9

Megarthrus constrictus; a, b: female, genital segment, sternites (a) dorsal and tergites (b) ventral; c: antenna; d: female, abdominal sternite 8; e, f: female, apex of abdominal tergite 8, dorsal and lateral; g: pronotum; h: median processes of abdominal sternites 2-3 (left to right), schematic. Scale bars = 0.2 mm.

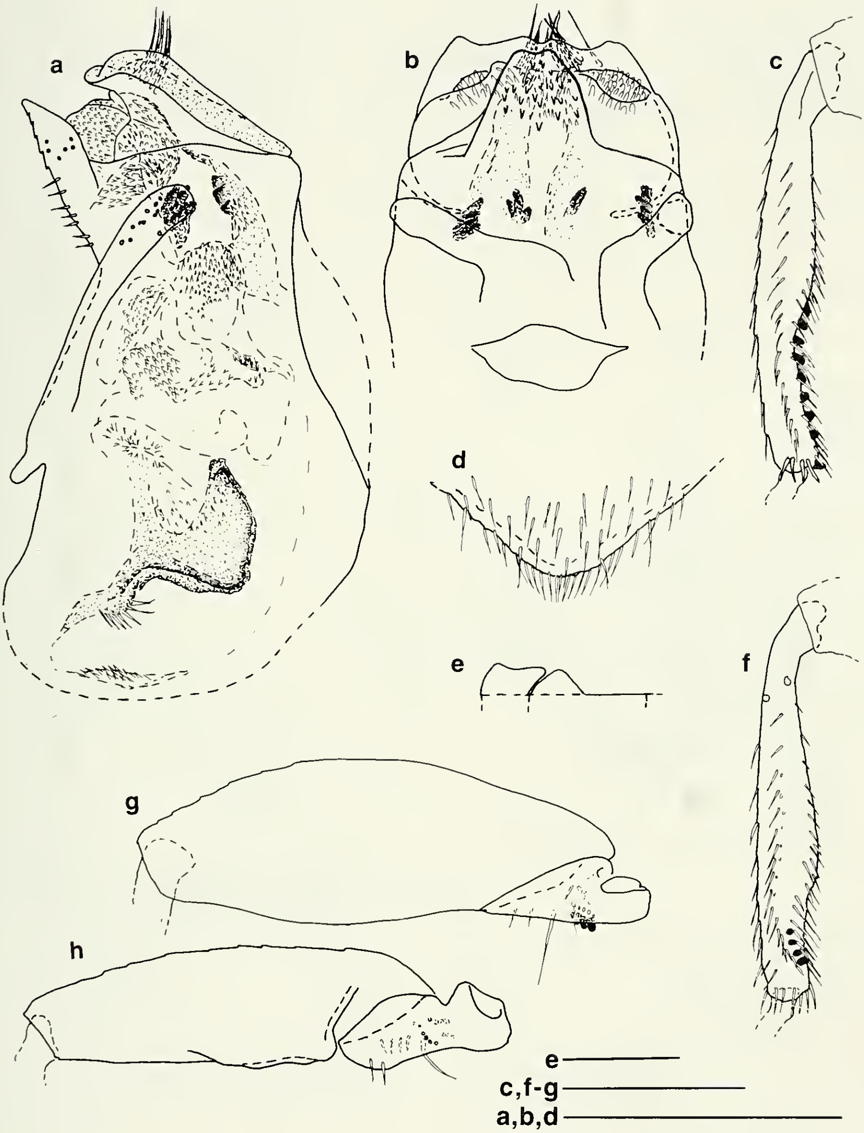


FIG. 10

Megarthrus convexus; a, b: male, aedeagus, lateral and ventral (apical portion); c: male, mesotibia; d: male, apex of abdominal tergite 8, dorsal; e: median processes of abdominal sternites 2-3 (left to right), schematic; f: male, metatibia; g: male, mesofemur and mesotrochanter; h: male, metafemur and metatrochanter. Scale bars = 0.2 mm.

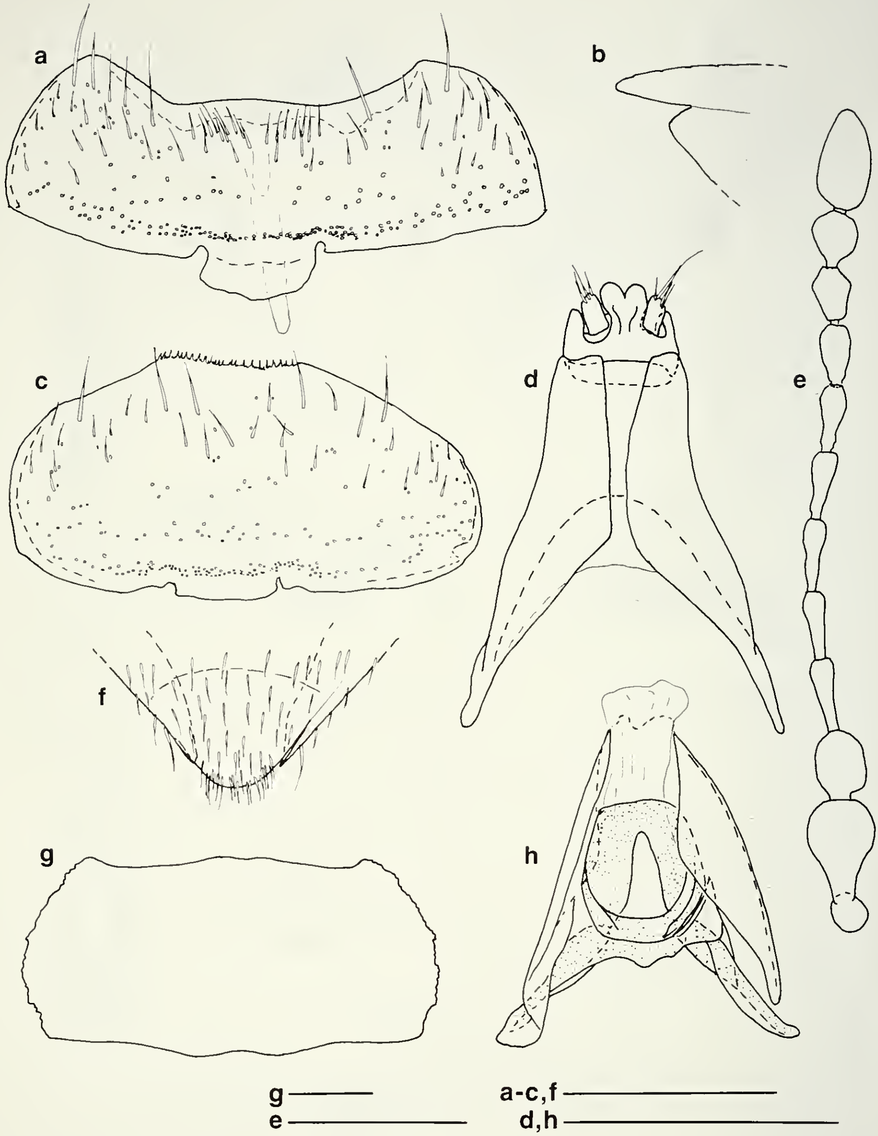


FIG. 11

Megarthrus convexus; a, c: abdominal sternite 8 (a) male and (c) female; b, f: female, apex of abdominal tergite 8, lateral and dorsal; d, h: female, genital segment, sternites (d) dorsal and tergites (h) ventral; g: pronotum. Scale bars = 0.2 mm.

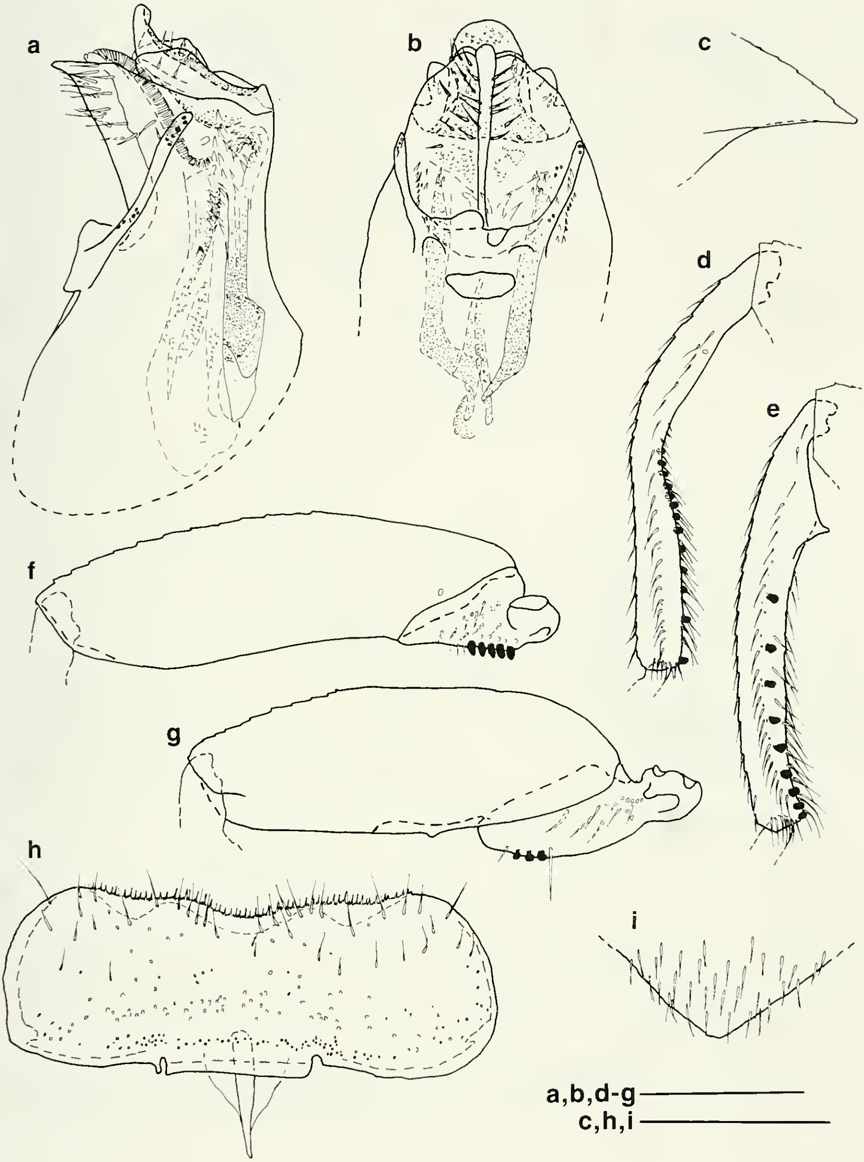


FIG. 12

Megarthrus corticalis, male; a, b: aedeagus, lateral and ventral (apical portion); c, i: apex of abdominal tergite 8, lateral and dorsal; d: mesotibia; e: metatibia; f: mesofemur and mesotrochanter; g: metafemur and metatrochanter; h: abdominal sternite 8. Scale bars = 0.2 mm.

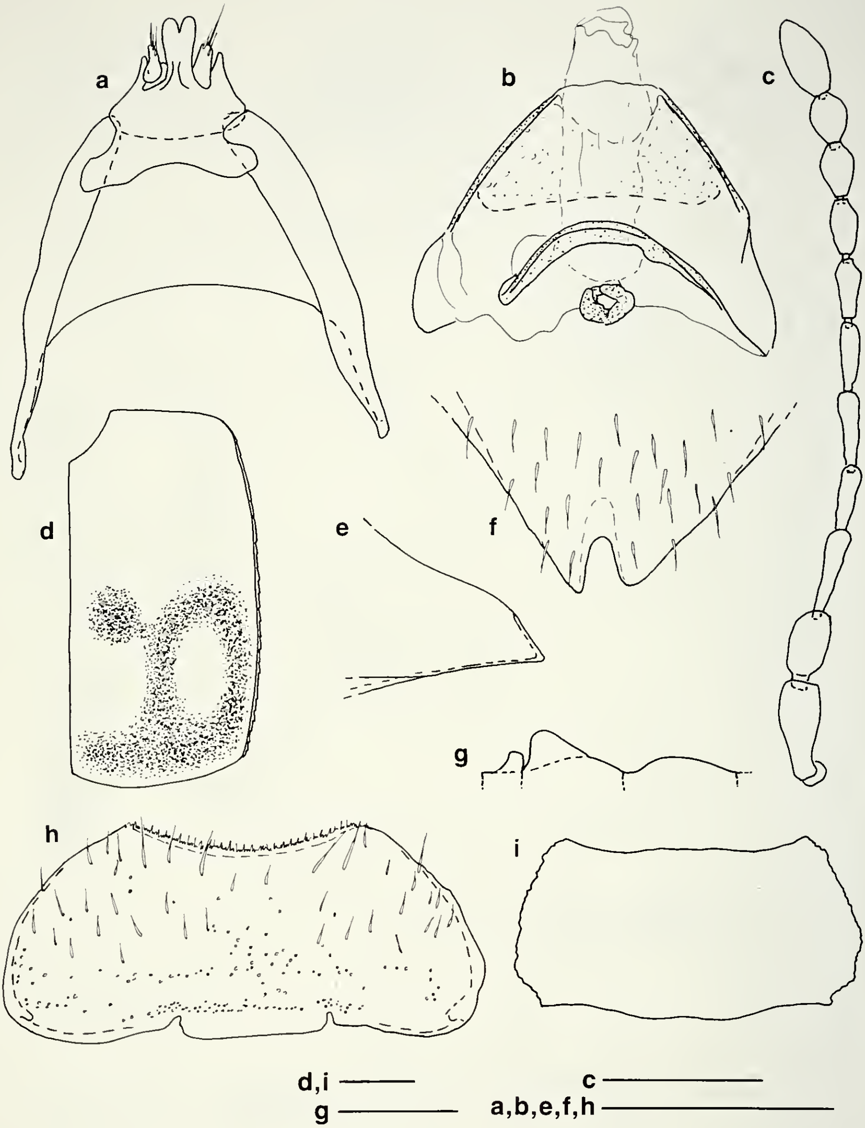


FIG. 13

Megarthrus corticalis; a, b: female, genital segment, sternites (a) dorsal and tergites (b) ventral; c: antenna; d: right elytron; e, f; female, apex of abdominal tergite 8, lateral and dorsal; g: median processes of abdominal sternites 2-4 (left to right), schematic; h: female, abdominal sternite 8; i: pronotum. Scale bars = 0.2 mm.

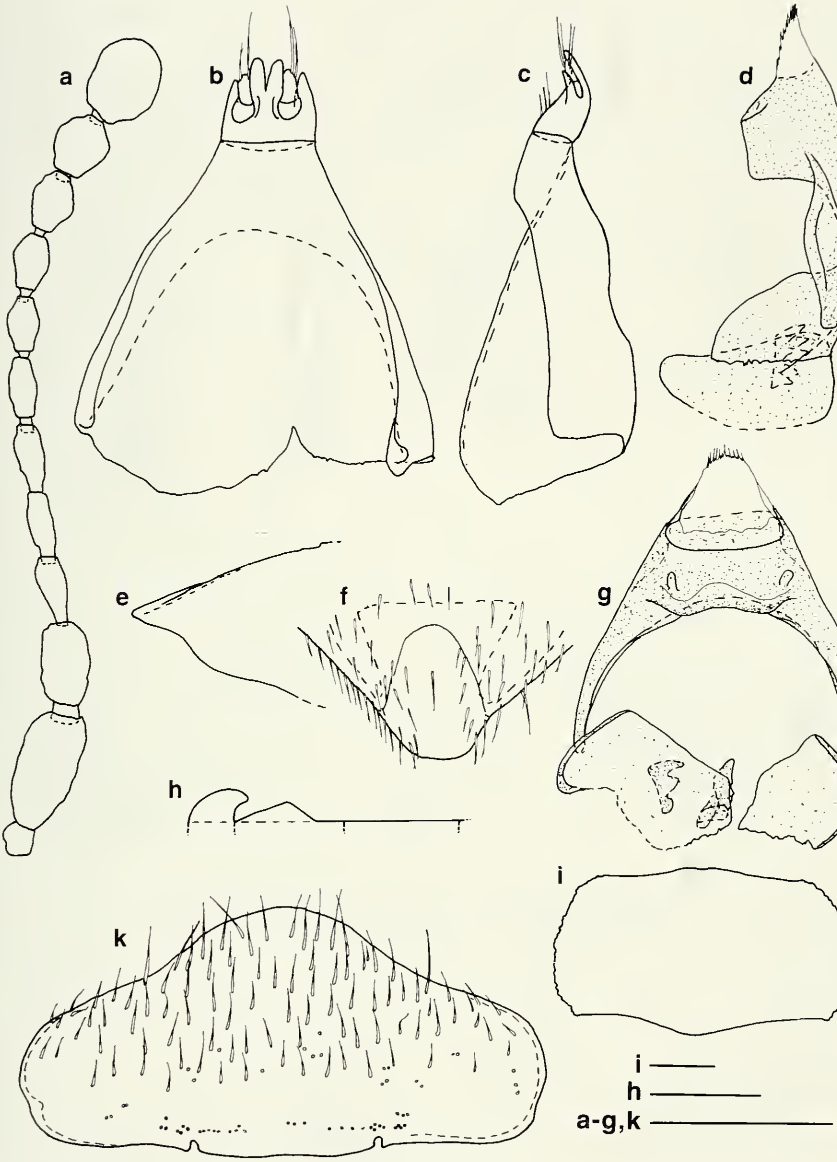


FIG. 14

Megarthrus impressicollis; a; antenna; b-d, g: female, genital segment, sternites (b, c) dorsal and lateral, and tergites (d, g) lateral and ventral; e, f: female, apex of abdominal tergite 8, lateral and dorsal; h: median processes of abdominal sternites 2-4 (left to right), schematic; i: pronotum; k: female, abdominal sternite 8. Scale bars = 0.2 mm.

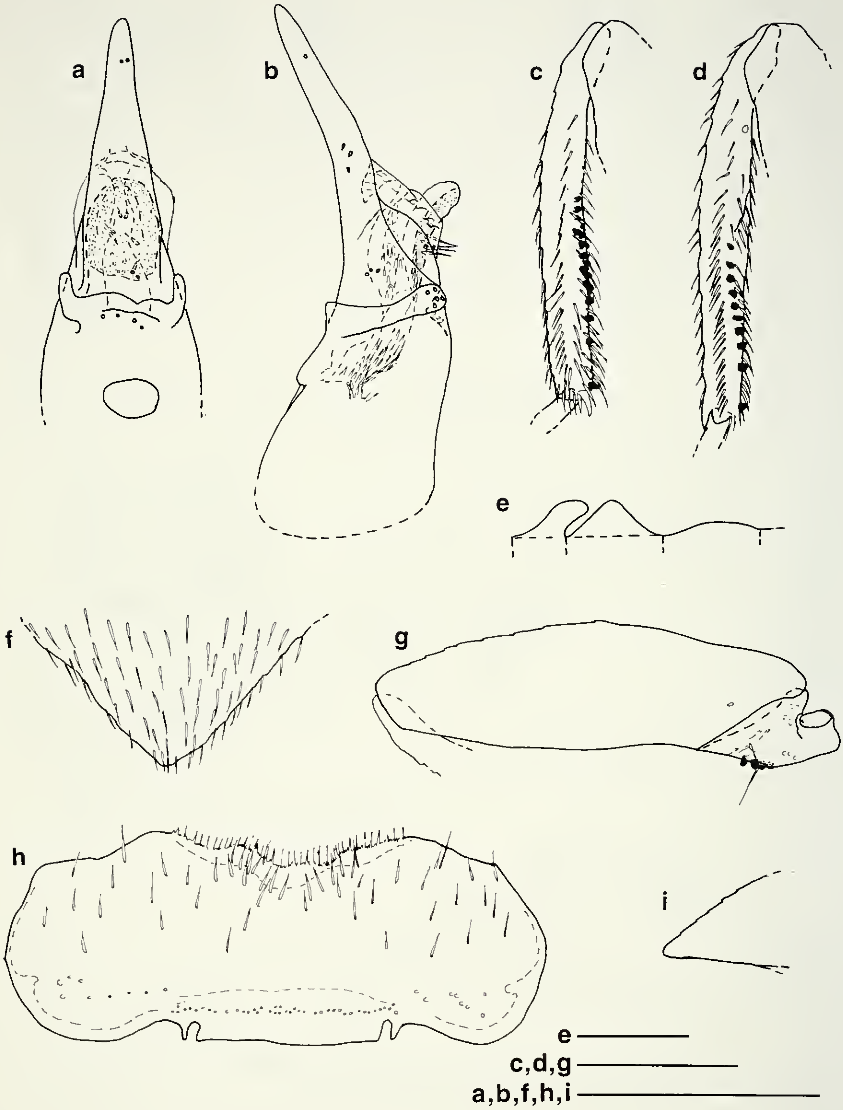


FIG. 15

Megarthrus incubifer; a, b: male, aedeagus, ventral (apical portion) and lateral; c: male, mesotibia; d: male, metatibia; e: median processes of abdominal sternites 2-4 (left to right), schematic; f, i: male, apex of abdominal tergite 8, dorsal and lateral; g: male, mesofemur and mesotrochanter; h: male, abdominal sternite 8. Scale bars = 0.2 mm.

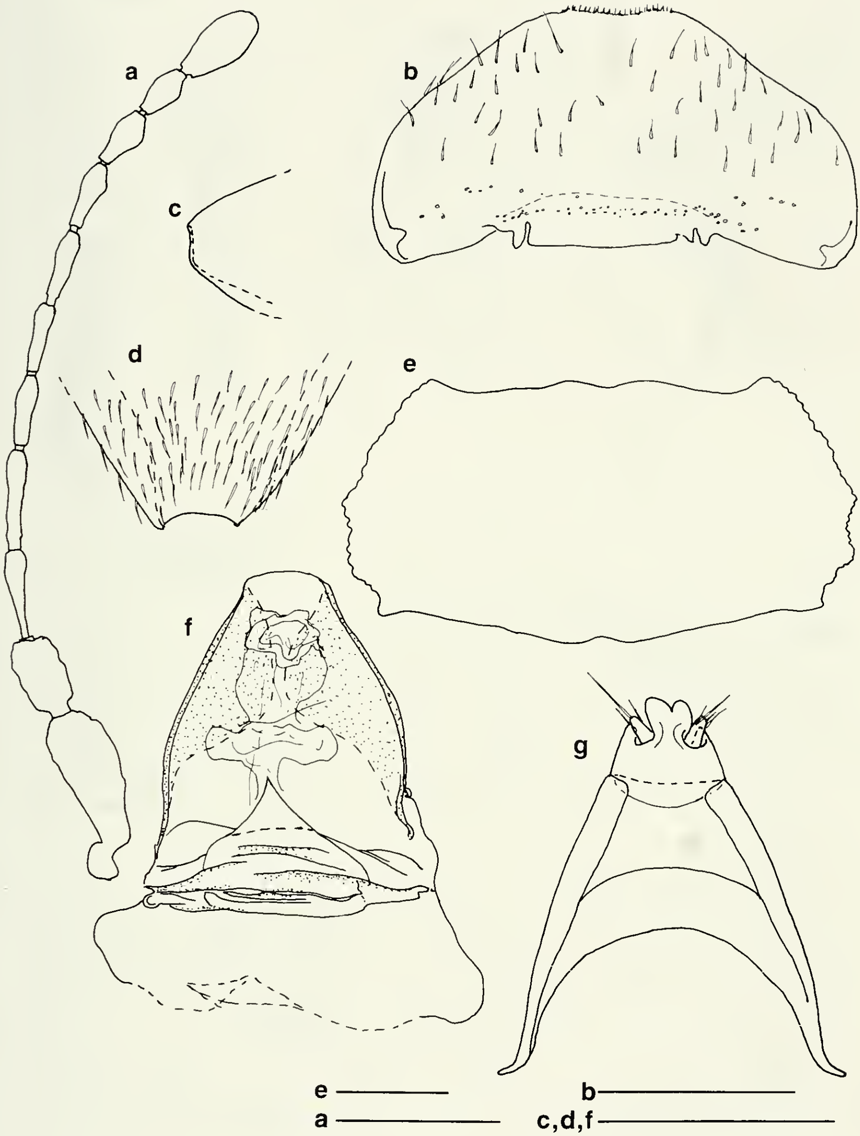


Fig. 16

Megarthrus incubifer; a: antenna; b: female, abdominal sternite 8; c, d: female, apex of abdominal tergite 8, lateral and dorsal; e: pronotum; f, g: female, genital segment, tergites (f) ventral and sternites (g) dorsal. Scale bars = 0.2 mm.

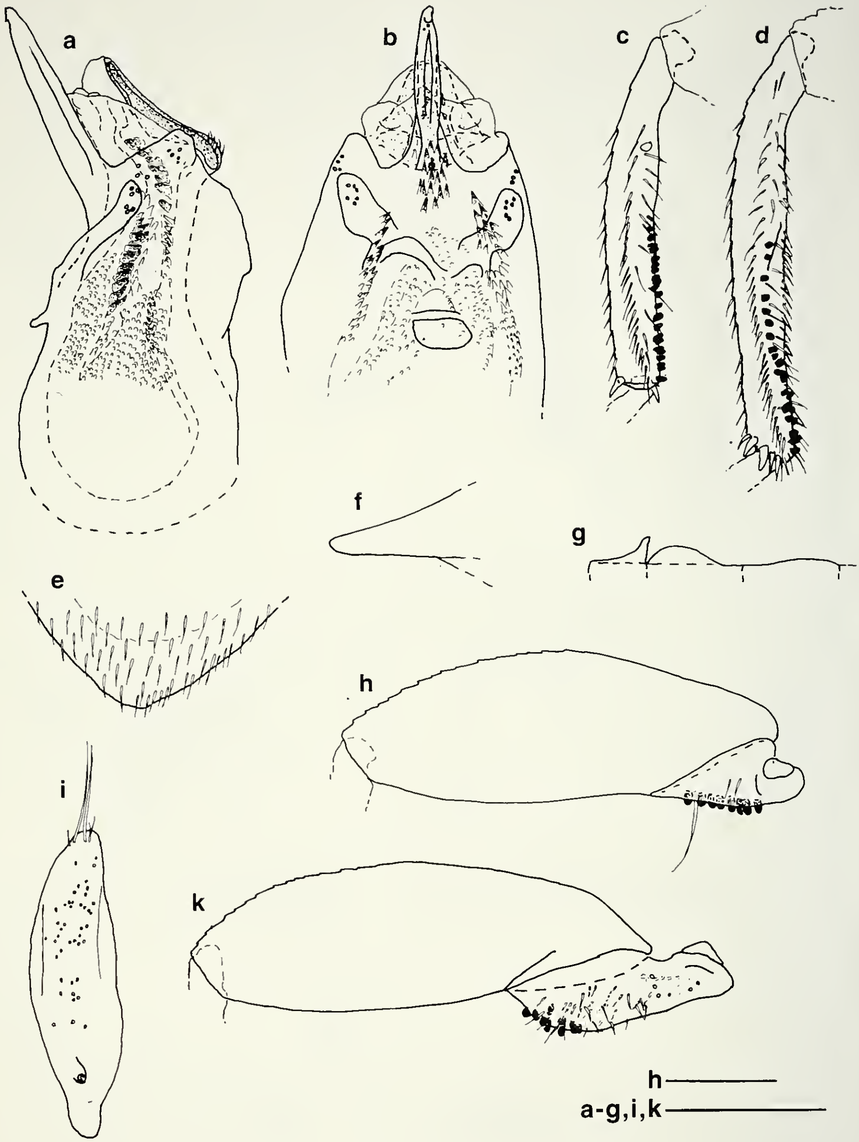


FIG. 17

Megarthrus japonicus; a, b: male, aedeagus, lateral and ventral (apical portion); c: male, mesotibia; d: male, metatibia; e, f: male, apex of abdominal tergite 8, dorsal and lateral; g: median processes of abdominal sternites 2-4 (left to right), schematic; h: male, mesofemur and mesotrochanter; i: male, abdominal sternite 10; k: male, metafemur and metatrochanter. Scale bars = 0.2 mm.

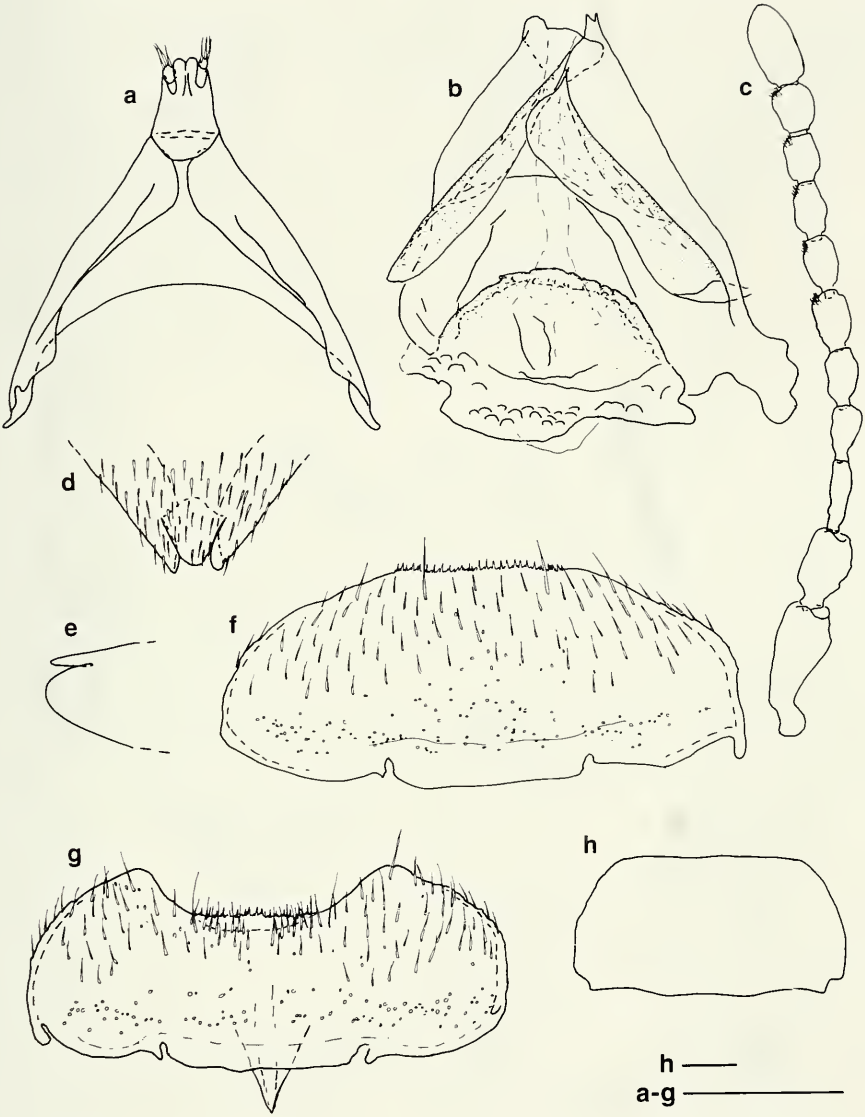


FIG. 18

Megarthrus japonicus; a, b: female, genital segment, sternites (a) dorsal and tergites (b) ventral; c: antenna; d, e: female, apex of abdominal tergite 8, lateral and dorsal; f, g: abdominal sternite 8 (f) female and (g) male; h: pronotum. Scale bars = 0.2 mm.

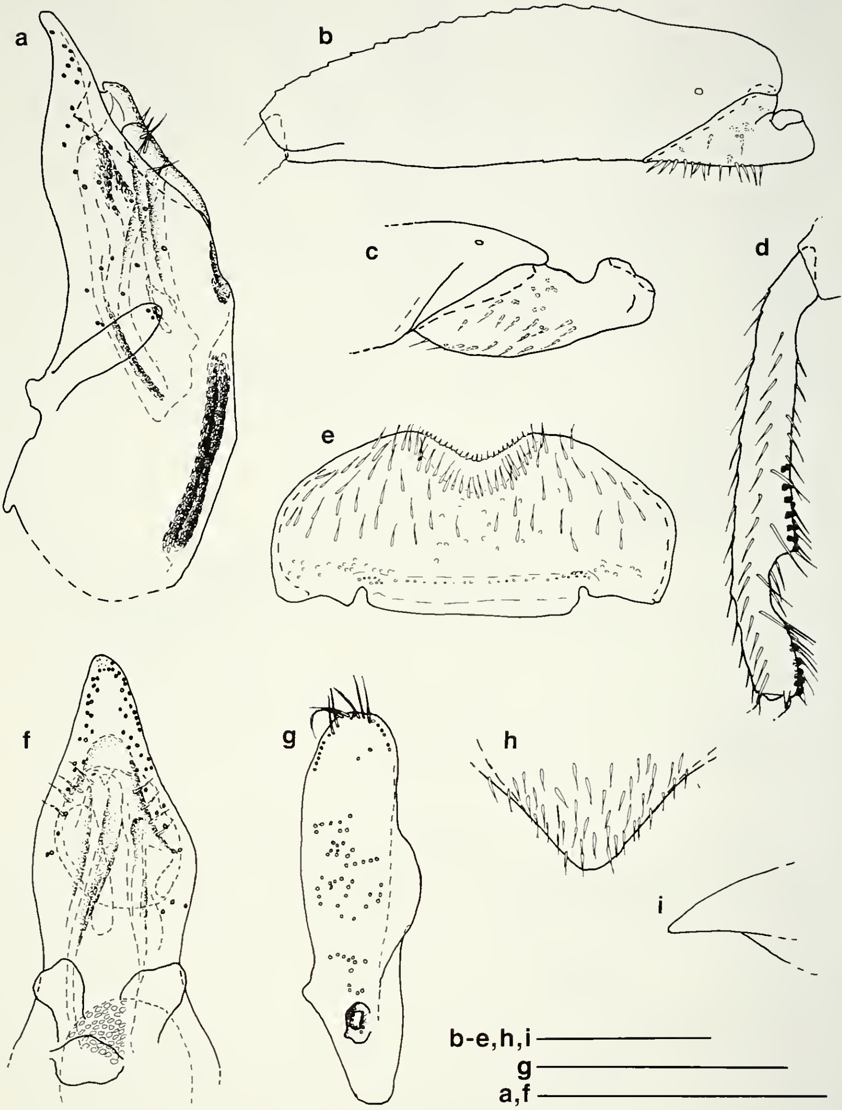


FIG. 19

Megarthrus montanus, male; a, f: aedeagus, lateral and ventral (apical portion); b: mesofemur and mesotrochanter; c: metatrochanter; d: mesotibia; e: abdominal sternite 8; g: abdominal sternite 10; h, i: apex of abdominal tergite 8, dorsal and lateral. Scale bars = 0.2 mm.

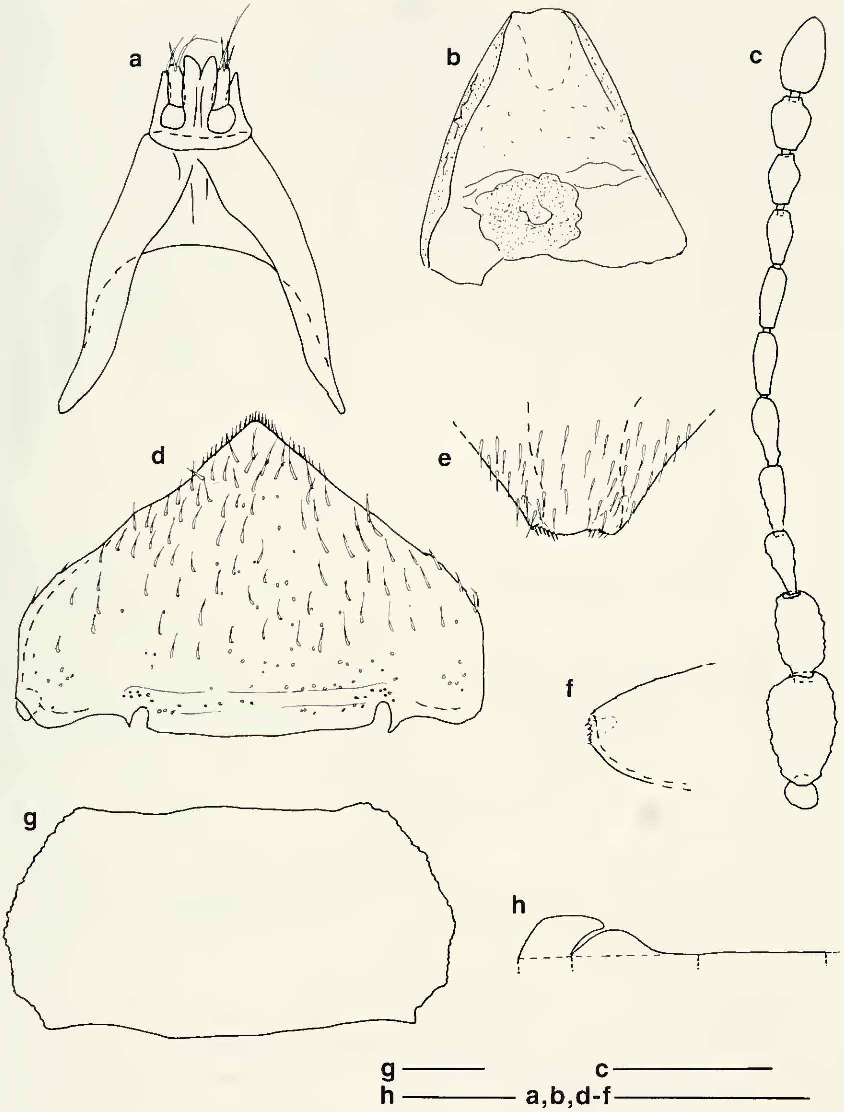


FIG. 20

Megarthrus montanus; a, b: female, genital segment, sternites (a) dorsal and tergites (b) ventral; c: antenna; d: female, abdominal sternite 8; e, f: female, apex of abdominal tergite 8, lateral and dorsal; g: pronotum; h: median processes of abdominal sternites 2-4 (left to right), schematic. Scale bars = 0.2 mm.

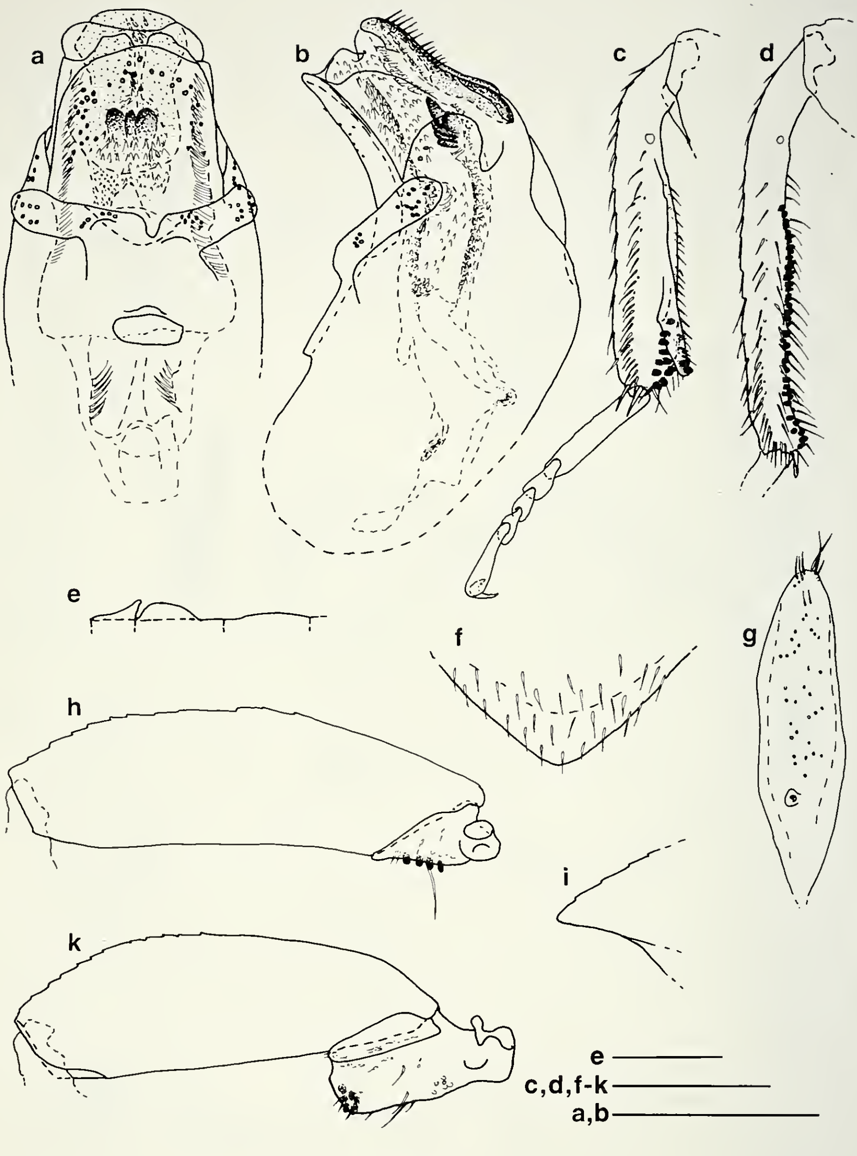


FIG. 21

Megarthrus parallelus; a, b: male, aedeagus, ventral (apical portion) and lateral; c: male, metatibia and metatarsomeres; d: male, mesotibia; e: median processes of abdominal sternites 2-4 (left to right), schematic; f, i: male, apex of abdominal tergite 8, dorsal and lateral; g: male, abdominal sternite 10; h: mesofemur and mesotrochanter; k: metafemur and metatrochanter. Scale bars = 0.2 mm.

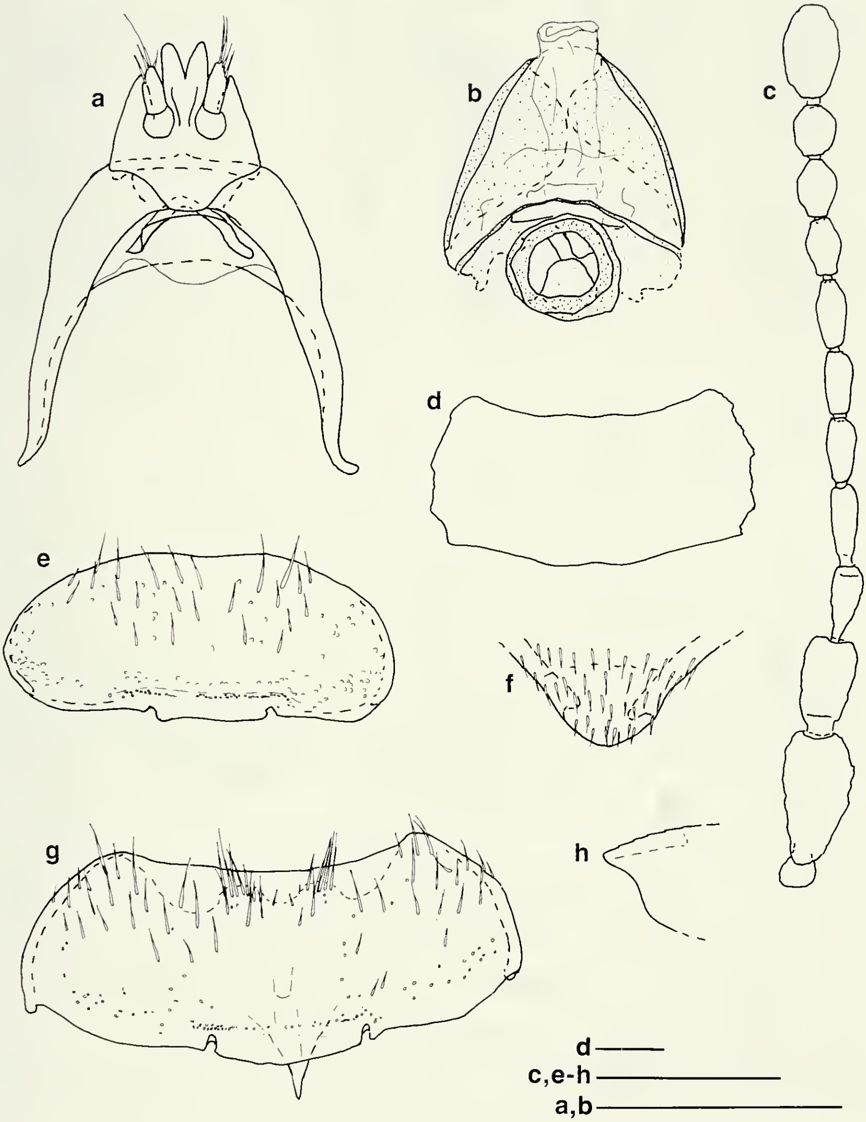
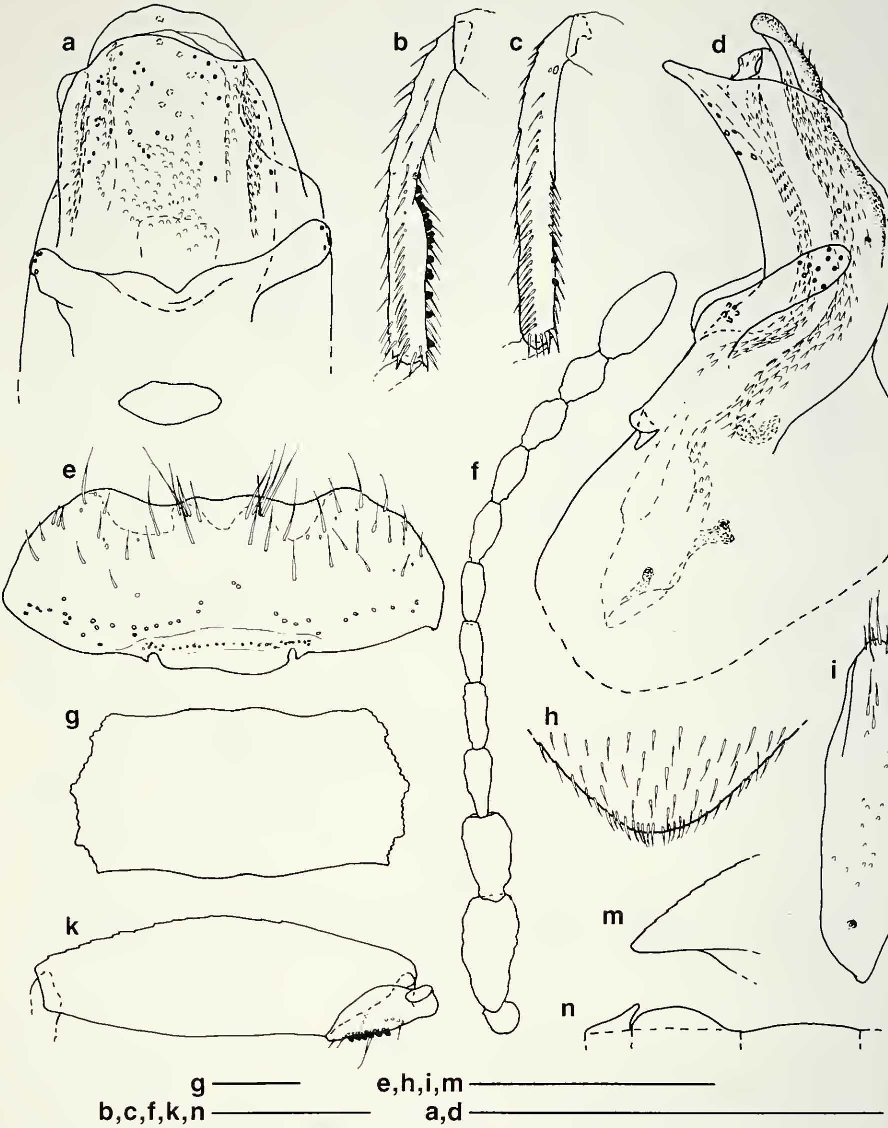


FIG. 22

Megarthrus parallelus; a, b: female, genital segment, sternites (a) dorsal and tergites (b) ventral; c: antenna; d: pronotum; e, g: abdominal sternite 8 (e) female and (g) male; f, h: female, apex of abdominal tergite 8, dorsal and lateral. Scale bars = 0.2 mm.



.Fig. 23

Megarthrus sawadai; a, d: male, aedeagus, ventral (apical portion) and lateral; b: male, mesotibia; c: male, metatibia; e: male, abdominal sternite 8; f: antenna; g: pronotum; h, m: male, apex of abdominal tergite 8, dorsal and lateral; i: male, abdominal sternite 10; k: mesofemur and mesotrochanter; n: median processes of abdominal sternites 2-4 (left to right), schematic. Scale bars = 0.2 mm.

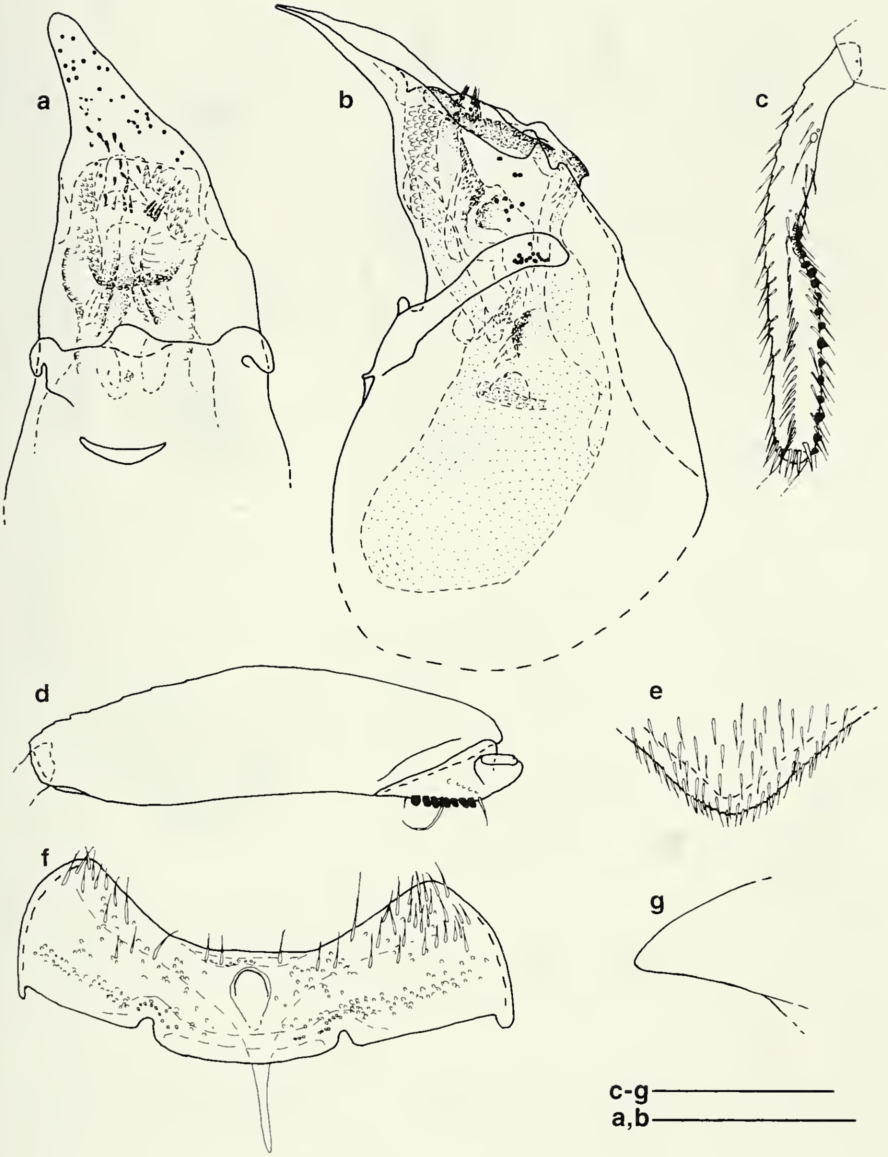


FIG. 24

Megarthrus scriptus, male; a, b: aedeagus, ventral (apical portion) and lateral; c: mesotibia; d: mesofemur and mesotrochanter; e, g: apex of abdominal tergite 8, dorsal and lateral; f: abdominal sternite 8. Scale bars = 0.2 mm.

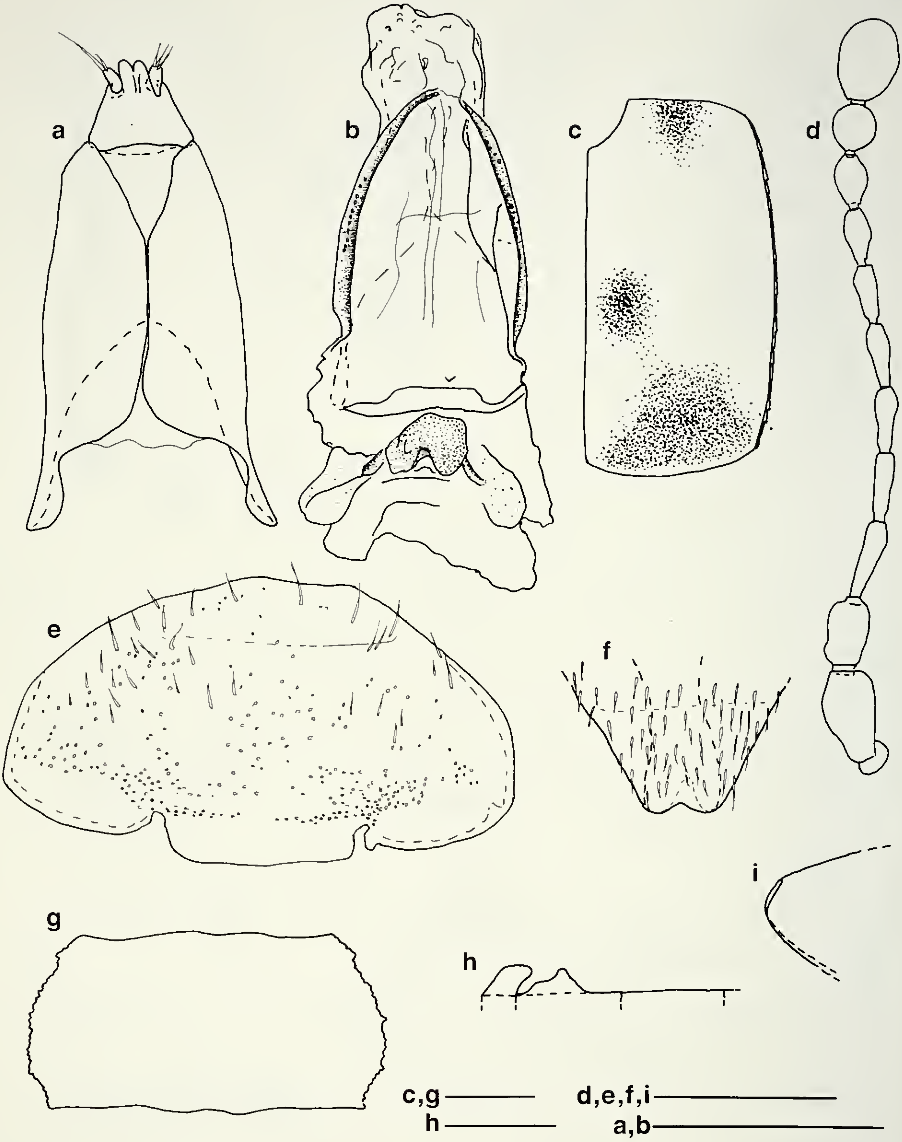


FIG. 25

Megarthrus scriptus; a, b: female, genital segment, sternites (a) dorsal and tergites (b) ventral; c: right elytron; d: antenna; e: female, abdominal sternite 8; f, i: female, apex of abdominal tergite 8, dorsal and lateral; g: pronotum; h: median processes of abdominal sternites 2-4 (left to right), schematic. Scale bars = 0.2 mm.

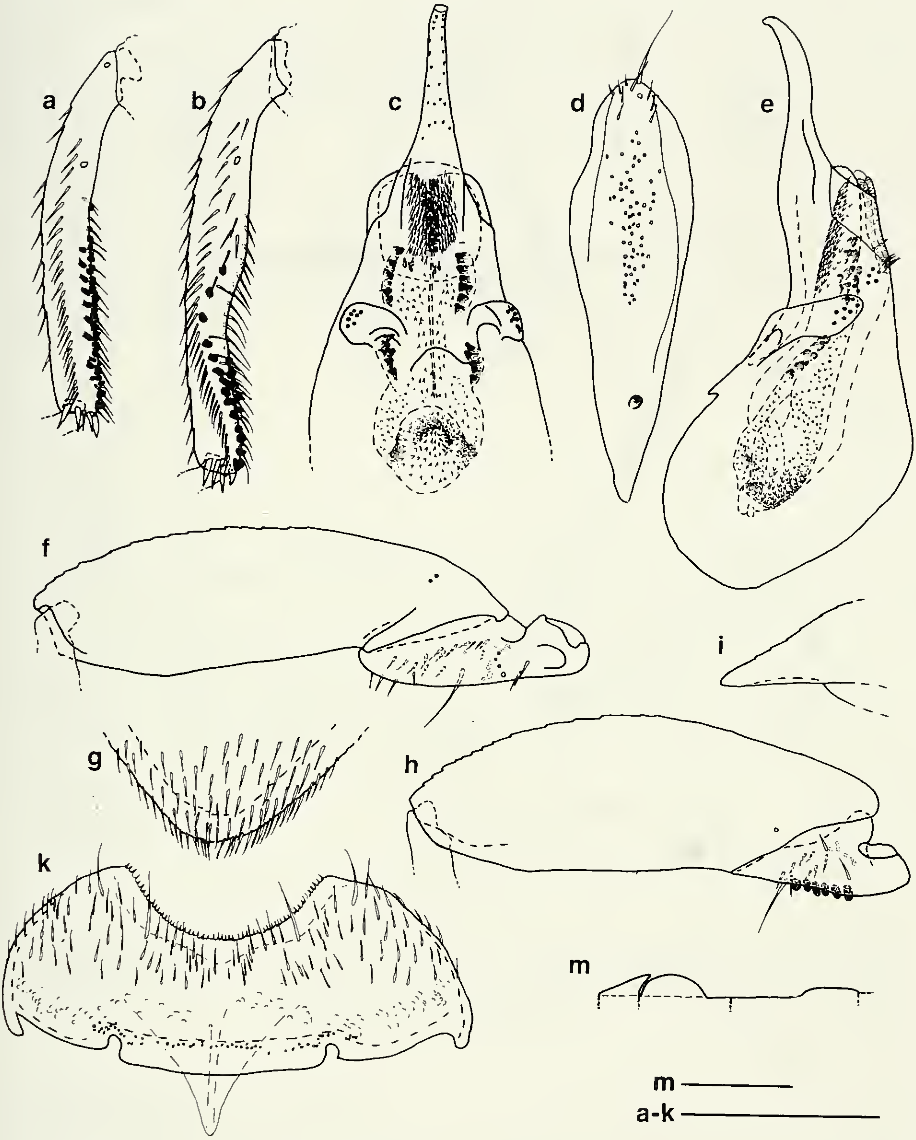


FIG. 26

Megarthrus shibatai; a: male, mesotibia; b: male, metatibia; c, e: male, aedeagus, ventral (apical portion) and lateral; d: male, abdominal sternite 10; f: male, metafemur and metatrochanter; g, i: male, apex of abdominal tergite 8, dorsal and lateral; h: male, mesofemur and mesotrochanter; k: male, abdominal sternite 8; m: median processes of abdominal sternites 2-4 (left to right), schematic. Scale bars = 0.2 mm.

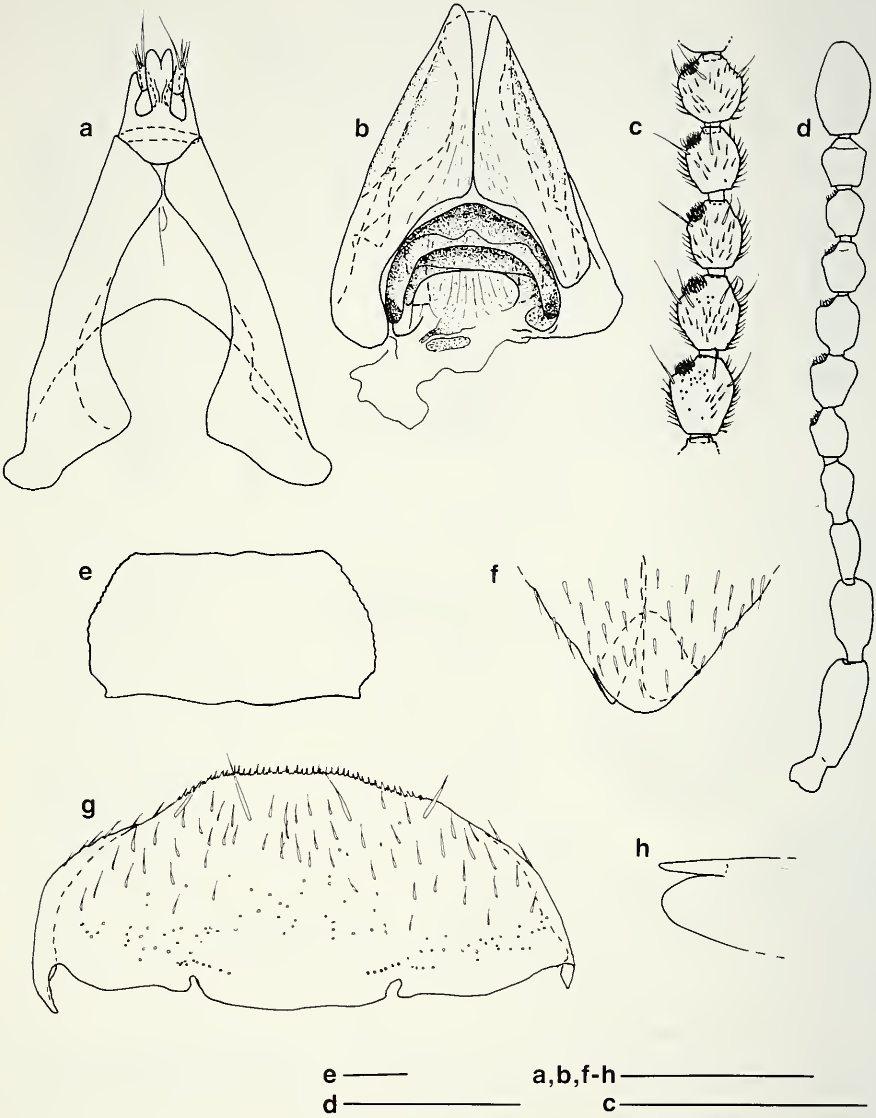


FIG. 27

Megarthrus shibatai; a, b: female, genital segment, sternites (a) dorsal and tergites (b) ventral; c: antennomeres 5-9; d: antenna; e: pronotum; f, h: female, apex of abdominal tergite 8, dorsal and lateral; g: female, abdominal sternite 8. Scale bars = 0.2 mm.

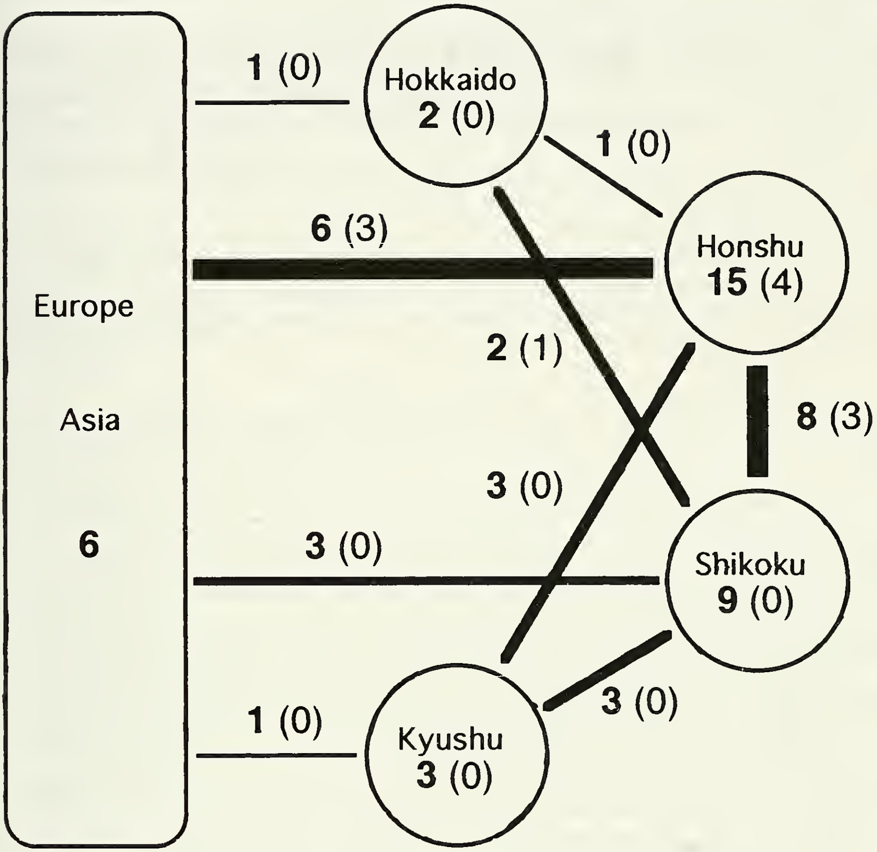


FIG. 28

Numerical relationships of 16 species of *Megarthrus* between the main Japanese islands and the continent (bold numbers = total number of species in main islands and total number of species shared between them and the continent; number in parenthesis = number of species unique to a single island or uniquely shared).

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Contribution to the knowledge of European Bourletiellidae (Collembola, Symphypleona). III.
Description of some species of *Heterosminthurus* and *Deuterosminthurus*.

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Contribution to the knowledge of European Bourletiellidae (Collembola, Symphypleona). III. Description of some species of *Heterosminthurus* **and** *Deuterosminthurus*. - According to our standard of the appendicular chaetotaxy, the following species are redescribed: *Heterosminthurus bilineatus* (Bourlet, 1842), *H. claviger* (Gisin, 1958), *H. insignis* (Reuter, 1876), *Deuterosminthurus bicinctus* (Koch, 1840), *D. flavus* (Gisin, 1946), *D. pallipes* (Bourlet, 1843), and *D. sulphureus* (Koch, 1840). Two new species are described: *Deuterosminthurus maculatus* sp. n. and *Deuterosminthurus pleuracanthus* sp. n. A discussion is given on the morphology of the claw, which is used to distinguish genera in the family Bourletiellidae. Appendicular chaetotaxic characters are relevant for defining genera, but more difficulty applicable for species distinctions. On the basis of such characters, apomorphies of *Heterosminthurus* and *Deuterosminthurus* are emphasized. Setae of body and color pattern are also used for species diagnoses, and a key to European species of *Deuterosminthurus* is provided.

Key-words: Collembola - Symphypleona - Bourletiellidae - *Heterosminthurus* - *Deuterosminthurus* - taxonomy - Europe.

INTRODUCTION

Ontogeny of the appendicular chaetotaxy in species of the genera *Heterosminthurus* and *Deuterosminthurus* is described according to a standard I proposed (Nayrolles 1993*a*, 1993*b*) and since then have used to study the family Bourletiellidae (Nayrolles 1994, 1995). Chaetotaxy of the body is less known, excepted for the trichobothrial pattern (Richards 1968; Betsch 1980; Betsch & Waller 1989) and the small abdomen. I recently discussed the setal nomenclature of the small

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abdomen (NAYROLLES 1995). I deemed that the paper of BETSCH & WALLER (1994) is fundamental for any study to come. My view relied on two arguments: these authors observed all ontogenetic levels, and used a wide taxonomic range. Nevertheless, they did not propose a coherent nomenclature, probably because they considered further observations to be necessary. For a practical reason, I have adopted BRETFELD' s (1990) nomenclature of the small abdomen, which is sufficient for the adult chaetotaxy. In the present paper, only the adult female circumanal setae are described. The female of *Heterosminthurus* and *Deuterosminthurus* has seven circumanal setae on the upper anal flap (the impaired a0 and the paired a1, a2, and a3), and five setae on the lower anal flap (from dorsal to ventral side: av1', av1, av2, av3, av4, and av5 = anal appendage). Two species redescribed here, *Heterosminthurus insignis* and *Deuterosminthurus bicinctus*, have already been studied by BRETFELD (1990). I criticized this work (NAYROLLES 1993*b*), and explained the reasons for dismissing BRETFELD' s nomenclature of appendicular setae.

I give a definition of each genus with emphasis on the most obvious apomorphies. Other characters will be discussed in a future paper. Nevertheless, an account of the empodial morphology is here needed.

According to BETSCH (1980), the empodial appendage of Bourletiellidae displays an array of regressive evolutions, so that the definition of genera is mainly based on its morphology. Using a scanning electron microscope, BETSCH & MASSOUD (1970) provided an accurate survey of this organ in *Jeannenotia stachi* Stach, 1956 (Sminthurididae). In the most typical form, the empodial appendage consists of a central rib, three lamellae, a subapical filament, and an apical needle. In comparison with the leg orientation, a lamella is external (thus opposite the claw), another is internal and slightly posterior, the last is anterior with a very slightly internal position. The central rib and a large area of lamellae are covered with granular cuticle. The ridge of lamellae is smooth, excepted for the basal part of the outer lamella. Smooth cuticle is also present on the tip of the empodial appendage, at the apex of the filament and needle. RICHARDS (1968) described the subapical filament as a projection of the central rib. BETSCH (1980) refuted Richards' view, showing that the subapical filament fitted with the outer lamella extension. More precisely, I consider that the ridge of the outer lamella extends beyond the central rib in the subapical filament, and the ridges of the other two lamellae join together into the apical needle.

European genera of Bourletiellidae can be readily defined by the shape of the empodial appendage. *Fasciosminthurus* Gisin, 1960 *sensu* Bretfeld, 1992 and the related genus *Cyprania* Bretfeld, 1992 — which perhaps should not have been isolated (NAYROLLES 1993*b*) — show an empodial appendage made up of a granular central rib ending in the filament and needle and devoid of lamellae. Filament and needle are thus the only traces of lamellae in these genera. In *Bourletiella* and *Cassagnaudiella*, the lamellae, filament, and apical needle are reduced but distinct. Lamellae in *Deuterosminthurus* and *Heterosminthurus* are present, and they extend in a single apical spike. I was not able to state whether this apical point corresponds to the filament, the apical needle, or both welded together. BETSCH' s (1974) description of the pretarsus of *Bourletiellitas imerinensis* Betsch, 1974 and *Vatomadiella pauliani*

Betsch, 1974 shows that the apical spike likely amounts to the filament and apical needle welded together. It may be the same in *Deuterosminthurus* and *Heterosminthurus*. The use of scanning electron microscope would possibly permit us to resolve this problem.

All the species were collected in southwestern France and northeastern Spain. Abbreviations and setal symbol follow NAYROLLES (1993*a*, 1993*b*).

The material is deposited in the following institutions: Laboratoire d'Ecologie des Invertébrés Terrestres, Université Paul Sabatier, Toulouse, France (LEITT) — Muséum d'histoire naturelle de Genève, Switzerland (MHNG) — Muséum National d'Histoire Naturelle, Paris, France (MNHN) — Institute of Systematics and Population Biology (Zoologisch Museum) Universiteit van Amsterdam, the Netherlands (ZMA).

GENUS **Heterosminthurus** Stach, 1955

BRETFELD (1990) has noted the absence of Jp on all tibiotarsi of *H. insignis*. However, IIi is always more basal than Ja and Jp, and, in comparison with Ja, the apical remaining seta on the inner side of *H. insignis* is approximately at the same level regarding the longitudinal axis of legs. Therefore, I consider that IIi is absent and the remaining seta is Jp.

Heterosminthurus shows a characteristic pretarsus. The claw is devoid of tunica, pseudonychia and distinct teeth on the inner crest. The empodial lamellae of forelegs are reduced as well as the central rib which extends in a long apical point as a bent outward blade. On the mid and hindlegs, the central rib and lamellae are very distinct, and the apical point is shorter than on forelegs and bent toward inner side. The posterior pretarsal seta is absent as in all Bourletiellidae.

Heterosminthurus is characterized by the following apomorphies: empodium of forelegs different from the empodium of mid and hindlegs, (TI.)IIi absent, and setae (AT)a+2 and (AT)ai+2 present in adults.

Three species are studied: *H. insignis*, *H. bilineatus*, and *H. claviger*.

Heterosminthurus insignis (Reuter, 1876) (Figs 1-8; Table I)

MATERIAL EXAMINED - FRANCE, dép. Lozère, district Nasbinals, Souvérols Lake, alt. 1230 m; peat bog, edge of lake on the floating vegetation, with *Menyanthes trifolia*, *Sphagnum* sp., *Drosera rotundifolia*, *Comarum palustre*, *Ligularia sibirica*, etc.; collected with a net on *Sphagnum* sp. and *D. rotundifolia* (LZ1d). 21-VI-1986: many specimens; 5 juv. mounted. 11-IX-1988: many specimens; 7 juv. and 7 ad. mounted (LEITT). — Dép. Gironde, district Carcans, between Carcans and Maubuisson, Hourtin-Carcans Lake, alt. 0 m; near the lake, with *Phragmites communis* and *Hydrocotyle vulgaris*; collected with a net on *Phragmites communis* (GI4). 23-X-1987: 3 juv., 2 mounted (LEITT). — Dép. Pyrénées-Atlantiques, district Lecumberry, between Estérençuby and Larrau, near Astakieta wood, alt. 1150 m; small peat bog with *Sphagnum* sp., *Eriophorum* sp., *Vaccinium myrtillus* and *Erica vagans*; collected with a net on unselected plants (PA8a). 10-V-1987: 21 specimens; 1 juv. and 4 ad. mounted (LEITT).

Table I. Appendicular chaetotaxy of *Heterosminthurus insignis*

AP	Δ		—
AD	Π		—
	Δ		D: i0 T: i+1, a+1, e+1 Q: i-1, pe+1 Ai is a trichobothrium.
AT	Π		—
	Δ		Other setae: Q: ae+2, a+2, ai+2, pe+2, pe+3
AQ	Str		B completely zoned. Section M euwhorled with 5 whorls. Right euwhorlation. Subsegmentation formula: 1 + 6 + 1 = (A) + (M1, 5 + BA) + (BM+BB). Right subsegmentation.
	A	Π	—
		H	AIIIeae, AIIIppe
		Δ	Apical bulb: joined to the apex Subapical organ: small D: AIai AIIpe is a blunt microchaeta AIIe is shifted toward apex
	M & B	H	Occurrences of H setae on M & B: for Heae 1-1-1-1-1/0.7, for Hipi 1-1-0-0-0/0, and for Hppe 1-1-1-1-1/0.6. m(*h**) =5.6.
		G	Setae of BB: P: BBe, BBae, BBa, BBp, BBpe / all G setae on M are present. In female: BA complete whorl; n80%(*BM*) = 15-23; n80%(*B*) = 28-36; n80%(*G*) = 93-101. In male: BA complete whorl; n80%(*BM*) = 23-30; n80%(*B*) = 36-43; n80%(*G*) = 101-108. BBae and BBa are cucumiform setae on large base.

AT Δ:

	Ge	Gae	Ga	Gai	Gi	Gpi	Gp	Gpe
Setae -1	Q	T	Q	T	T	T	T	T
Setae 0	Q	D	D	D	D	D	T	D
Setae +1		T	T	Q	Q		Q	T

SB	PS	—	—	—
	Δ	P: 1 seta	P: 1 seta	P: 1 seta
SA	Δ	—	P: 1 seta	P: 1 seta
CX	Δ	P: i1	P: ae, i1, ms T: Oi1 Q: a	P: ae, i1, ms T: a, ai2, Oi1
TR	Π	—	—	—
	Δ	T: Oi1, Oi2	T: a2, Oi1, Oi2 Q: ae	T: a2, Oi1, Oi2 Q: ae
FE	Π	—	—	pe1
	Δ	delayed primordial seta: Q: ae3 T: pe2, Op Q: ai2, pe4	T: ai2, pe2, Op (T)Q: a5 (oc = 0.4) Q: pe4	T: a5, ai2, pe2 Q: ai3, ai4, pe4, Oi
TI	V	IIi	IIi, IVp, Vp	IIi, IIIp, IVp, Vp
	K	—	—	—
	FP	+	+	+
	Δ	T: 4ai1, Vai, Vpi, FSa, O2pe Q: 3a, 3p, 4a1, 4pi1, 4p1, 4ai2, FSai, FSpi Ipi, Ip and Ipe are spatulate setae. Ja is a winged seta.	T: 4ai1, Vai, Vpi, FSa, O2pe Q: 3a, 3p, 4a1, 4pi1, 4p1, 4ai2, FSai, FSpi Ipi, Ip and Ipe are spatulate setae.	T: 3ai, 3i, 4ai1, 4i1, Vai, Vpi, FSa, O2pe Q: 2a, 3a, 3pi, 4a1, 4pi1, 4ai2, FSai, FSpi Ip and Ipe are spatulate setae.

MA	Π	—
	Δ	T: pe2, pe3
DE	Δ	Other setae: P: 2pe setae on Gpi from Ipi to Vpi are macrochaetae
MU	Δ	Chaetotaxy: — Morphology: anterior lamella simple, outer and inner lamellae smooth, mucro ending in a small point.

DE Δ:

		Ge	Gae	Ga	Gai	Gi	Gpi	Gp	Gpe
Whorls I to VI	I	P	P	P	P	P	P	P	P
	II		P	P	P		P	P	P
	III			P			P	P	P
	IV			P			P	P	P
	V						T	T	T
	VI						Q		T
Whorl B		T		P			P	P	P

DESCRIPTION

Development. — Number of juv. st. = 3.

Size ad. — ♂: 0.7 - 0.85 mm; ♀: 0.75 - 1.5 mm (female specimens collected in mountain do not reach beyond 1.2 mm).

Color. — Background yellow, often with ochre shades. Dark pigment sometimes present, particularly in the posterior area of great abd., the color being brown or wine-red in some specimens. A very dark male was collected, it was wholly black except between eyes, with pigment on legs and furcula. Antennae brown, eyepatches black. The different color-forms are similar to those described by BRETFELD (1988).

Great abd. — Back strongly concave. Trichobothria: A, B, and C in linear pattern. Dorsal setae: mesochaetae.

Antennae (figs 6 & 7). — Seta AIIe of ant. IV shifted toward apex. Antennal ratios: in ♀, ant. I : II : III : IV = 1 : 2.3 : 3.5 : 6.4 and ant. : ceph. diag. = 1.9; in ♂, ant. I : II : III : IV = 1 : 2.8 : 4.0 : 7.6 and ant. : ceph. diag. = 2.5. Chaetotaxic variables, in both sexes: m(*ISh**) = 0.94 ; in ♀ : for *G*: m = 97.6 / min = 91 / max = 102 ; m(*RSh*) = 0.55 ; in ♂: for *G*: m = 104.6 / min = 100 / max = 108 ; m(*RSh*) = 0.51.

Head. — Eyes: 8+8; eyepatch with two setae. 2+2 ov. org. in the back-ventral area (see BRETFELD, 1990). Labral formula: 6/5-5-4. Cephalic setae: only mesochaetae in ♀; ♂ with 2+2 macrochaetae in inner edge of eyepatches. Several frontal setae small, but not broadened at the basis as in *H. bilineatus* and *H. claviger*.

Legs (figs 1-5). — Femur: cup present. Pretarsus characteristic of the genus.

Ventral tube. — Sacs warty from 2st st. on. Chaetotaxy: apical flaps with one pair of primary setae, corpus without seta.

Retinaculum. — At 1st st. rami tridentate, bidentate from 2nd. Chaetotaxy: on anterior lobe two setae appear at 3rd st. and one in ad.

Furcula (fig. 8). — Dental setae of Gpi, from Ipi to Vpi, are macrochaetae.

Small abd. — Made up of abd. V + abd. VI. Trichobothria: D and E. Male genital papilla with 16 setae. Size comparison of female circumanal setae: av1' = av1 < av3 < av2 = av4. An. app. spine-like, slightly bent. Ratio an. app. : mucro = 0.59.

Heterosminthurus bilineatus (Bourlet, 1842) (Figs 9-15; Table II)

MATERIAL EXAMINED – FRANCE, dép. Aveyron, district Bessuéjouls, Le Plateau de la Justice, alt. 450 m; meadow belonging to the phytosociological association of Orchido-Brometum with some small trees (*Quercus pubescens*, *Pinus sylvestris*, *Juniperus communis*) and *Bromus erectus*, *Hippocrepis comosa*, *Globularia vulgaris*, *Eryngium campestre*, etc.; collected with a net on unselected plants (AV1a). Several collections from March until December 1987. In all 62 specimens; 4 juv., 3 ♀, and 4 ♂ mounted (LEITT). — Dép. Aveyron. district La-Bastide-Solages, D33 road between Plaisance and Brasc, alt. 350 m; grass alongside a chestnut grove; collected with a net (AV15b). 22-VIII-1987: 77 specimens; 2 juv. and 2 ♂ mounted (LEITT). — Dép. Lozère, district Nasbinals, Souvérols Lake, alt. 1230 m; peaty soil near the lake, with *Eriophorum polystachyon*, *Equisetum limosum*, *Orchis incarnata*; collected with a net on unselected plants (LZ1c). 21-VI-1986: 114 specimens; 2 ♂ and 2 ♀ mounted. 19-VII-1986: 8 specimens. 11-IX-1988: 194 specimens; 5 juv. and 1 ♀ mounted (LEITT). — Dép.

Table II. Appendicular chaetotaxy of *Heterosminthurus bilineatus*

AP	Δ		—
AD	Π		—
			D: i0 T: i+1, a+1, e+1 Q: i-1, pe+1 Ai is a trichobothrium. In adult male: Ae, Aae, Aa, and e+1 are acanthoids; Be, Bae, Ba, Bai, and a+1 are small and slender.
AT	Π		—
	Δ		Qther setae: Q: ae+2, a+2, ai+2, pe+2, pe+3 Qnly in adult male: Bae is an acanthoid; Ae, Aa, Ai, Ap, Be, Ba, Bai, Bi, and Bp are small and slender; p-1 is shifted toward inner side.
AQ	Str		B completely zoned. Section M euwhorled with 5 whorls. Right euwhorlation. Subsegmentation formula: 1 + 6 + 1 = (A) + (M1, 5 + BA) + (BM+BB). Right subsegmentation.
	A	Π	—
		H	AIIIeae, AIIIppe
		Δ	Apical bulb: joined to the apex Subapical organ: small D: AIai AIIpe is a blunt microchaeta AIIe is shifted toward apex
	M & B	H	Occurrences of H setae on M & B: for Heae 1-1-1-1-0.9/0.8, for Hipi 1-1-0-0-0/0, and for Hppe 1-1-1-1-1/0.3. m(*h**) =5.4.
		G	Setae of BB: P: BBe, BBae, BBa, BBp, BBpe / all G setae on M are present. In female: BA complete whorl; n80%(*BM*) = 16-22; n80%(*B*) = 29-35; n80%(*G*) = 94-100. In male: BA complete whorl; n80%(*BM*) = 29-36; n80%(*B*) = 42-49; n80%(*G*) = 107-114. BBae and BBa are cucumiform setae on large base.

	Ge	Gae	Ga	Gai	Gi	Gpi	Gp	Gpe
Setae -1	Q	T	Q	T	T	T	T	T
Setae 0	Q	D	D	D	D	D	T	D
Setae +1		T	T	Q	Q		Q	T

SB	PS	—	—	—
	Δ	P: 1 seta	P: 1 seta	P: 1 seta
SA	Δ	—	P: 1 seta	P: 1 seta
CX	Δ	P: i1	P: ae, i1, ms T: Qi1 Q: a	P: ae, i1, ms T: a, ai2, Oi1
TR	Π	—	—	—
	Δ	T: Qi1, Oi2	T: a2, Qi1, Qi2 Q: ae	T: a2, Qi1, Qi2 Q: ae
FE	Π	—	—	pe1
	Δ	delayed primordial seta: Q: ae3 T: pe2, Qp Q: ai2, pe4	T: ai2, pe2, Qp (T)Q: a5 (oc = 0.6) Q: pe4	T: a5, ai2, pe2 Q: ai3, ai4, pe4, Oi
TI	V	IIi	IIi, IVp, Vp	IIi, IIIp, IVp, Vp
	K	—	—	—
	FP	+	+	+
	Δ	T: 4ai1, Vai, Vpi, FSa, O2pe Q: 3a, 3p, 4a1, 4pi1, 4p1, 4ai2, FSai, FSpi Ipi, Ip and Ipe are spatulate setae. Ja is a winged seta. Jp is a very slender microchaeta.	T: 4ai1, Vai, Vpi, FSa, Q2pe Q: 3a, 3p, 4a1, 4pi1, 4ai2, FSai, FSpi (Q): 4p1 (oc = 0.7) Ipi, Ip and Ipe are spatulate setae. Jp is a very slender microchaeta.	T: 3ai, 3i, 4ai1, 4i1, Vai, Vpi, FSa, Q2pe Q: 2a, 3a, 3pi, 4a1, 4pi1, 4ai2, FSai, FSpi Ip and Ipe are spatulate setae.

MA	Π	—
	Δ	T: pe2, pe3
DE	Δ	Qther setae: P: 2pe
MU	Δ	Chaetotaxy: — Morphology: anterior lamella simple, outer and inner lamellae smooth, mucro ending in a small point.

		Ge	Gae	Ga	Gai	Gi	Gpi	Gp	Gpe
Whorls I to VI	I	P	P	P	P	P	P	P	P
	II		P	P	P		P	P	P
	III			P			P	P	P
	IV			P			P	P	P
	V						T	T	T
	VI						Q		T
Whorl B		T		P			P	P	P

Tarn, district Murat-sur-Vèbre, D162 road, Laouzas Lake, alt. 800 m; lakeside with *Baldingera arundinacea*, *Juncus silvaticus*, *Molinia cærulea*; collected with a net on unselected plants (TN3). 22-VIII-1987: 62 specimens; 3 ♂ mounted (LEITT). — Dép. Tarn, district Murat-sur-Vèbre, D162 road between Laouzas Lake and Murat-sur-Vèbre, about 3.5 km from Murat-sur-Vèbre, alt. 820 m; near a small stream in a damp meadow, with *Juncus* sp., *Glyceria* sp., and *Molinia cærulea*; collected with a net on unselected plants (TN4a). 22-VIII-1987: 77 specimens; 2 juv. mounted (LEITT).

DESCRIPTION

Development. — Number of juv. st. = 3.

Size ad. — ♂: 0.5 - 0.55 mm; ♀: 0.6 - 0.9 mm.

Color. — Background light yellow. Back of great abd. with a pair of longitudinal brown or orange stripes, generally quite diffuse, and joined behind. Several small patches on the posterior flanks of great abd. forming a pair of short stripes which do not reach halfway the body. A pair of posterior and lateral small elongated flecks is sometimes present. Trichobothrial sockets brown. Back of small abd. marbled with variable brown pigment. Head light with two small flecks behind eyes in the same line of great abd. streaks. Eyepatches black, antennae brown, legs very light yellow, and furcula white.

Great abd. — Back weakly concave. Trichobothria: A, B, and C in linear pattern. Dorsal setae: mesochaetae.

Antennae (figs 10-15). — Seta AIIe of ant. IV shifted toward apex. ♂ with several special-shaped setae on ant. II and III, and (AT)p-1 shifted toward inner side, so that it might almost be thought of as included in the generatrix Gpi. Antennal ratios: in ♀, ant. I : II : III : IV = 1 : 2.3 : 4.1 : 7.2 and ant. : ceph. diag. = 2.0 ; in ♂, ant. I : II : III : IV = 1 : 2.6 : 4.5 : 7.5 and ant. : ceph. diag. = 2.6. Chaetotaxic variables, in both sexes: m(*ISh**) = 0.92 ; in ♀ : for *G*: m = 97.3 / min = 90 / max = 101 ; m(*RSh*) = 0.53 ; in ♂ : for *G*: m = 110.3 / min = 103 / max = 117 ; m(*RSh*) = 0.47.

Head. — Eyes: 8+8; eyepatch with two setae. 1+1 ov. org. in the back-ventral area (it remains the ventral — anterior in arthropleon orientation — pair). Labral formula: 6/5-5-4. Cephalic setae: only mesochaetae in ♀ ; ♂ with several transformed setae. In dorsal part of the frons, near the sagittal plane, 2+2 acanthoids, the more posterior pair being the longer. Inner edge of eyes with 1+1 macrochaetae; frons with several small onion-shaped setae.

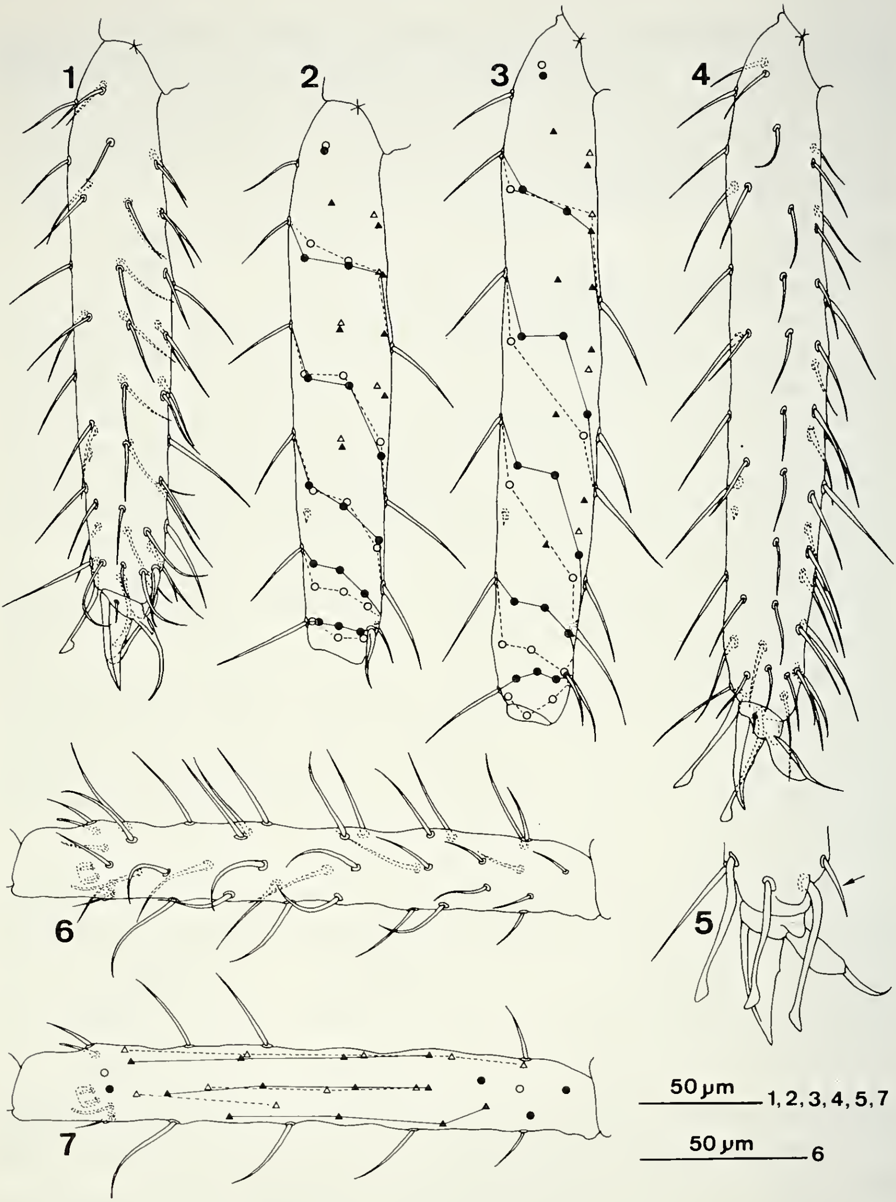
Legs (fig. 9). — Femur: cup present. (TI1,2)Jp is a very slender microchaeta. Pretarsus characteristic of the genus.

Ventral tube. — Sacs warty from 2st st. on. Chaetotaxy: apical flaps with one pair of primary setae, corpus without seta.

Retinaculum. — At 1st st. rami tridentate, bidentate from 2nd. Chaetotaxy: on anterior lobe two setae appear at 3rd st. and one in ad.

Furcula. — See chaetotaxic table.

Small abd. — Made up of abd. V + abd. VI. Trichobothria: D and E. Male genital papilla with 12 setae. Female circumanal seta av1' far shorter than the others, with the following size comparison: av1' < av1 = av4 < av2 = av3. An. app. spine-like, slightly bent. Ratio an. app. : mucro = 0.76.



FIGS 1-7

Heterosminthurus insignis ad.; 1: foretibiotarsus, anterior view; 2: schematic representation of fig.1, setae of Ge and Gi, and ov. org. are drawn, other setae are schematized as follows: a full symbol for a seta on reader's side (thus on anterior side), an empty symbol for a seta on opposite of reader's side, a circle for a primary seta, a triangle for a secondary seta; setae belonging to a same whorl are linked together by a line which is continuous on the anterior side and discontinuous on the posterior side; 3: schematic representation of fig. 4 (hindtibiotarsus),

Heterosminthurus claviger (Gisin, 1958) (Fig. 16)

MATERIAL EXAMINED – FRANCE, dép. Lot-et-Garonne, district Durance, track of Le Brocq farm, alt. 120 m; alongside a wood of *Pinus pinaster*, with *Calluna vulgaris* and *Ulex europæus*; collected with a net on unselected plants (LG2). 10-X-1989: many specimens; 8 juv. and 9 ad. mounted (LEITT). – Dép. Landes, district Brocas, Marais de la Coumme, alt. 80 m; near a wood, with *Molinia cærulea*, *Calluna vulgaris* and *Agrostis* sp.; collected with a net on unselected plants (LA6b). 22-X-1987: 38 specimens; 2 ♂ mounted. 10-X-1989: 43 specimens (LEITT).

DESCRIPTION

The 1st st. has not been observed, and the primary appendicular chaetotaxy is an interpretation based on comparisons with other instars of this species as well as the primary chaetotaxy of the other two studied species of *Heterosminthurus*.

Concerning the appendicular chaetotaxic table, refer to *H. bilineatus* (Table II), with the following differences:

Antennae. Sexual dimorphism: (AD)Be is an acanthoid in ♂, shape of other setae similar as in *bilineatus*, the acanthoids being slightly thicker — Occurrences of H setae on M & B: for Heae 1-1-1-1-1/0.8, and for Hppe 1-1-1-1-0.8/0.3. m(h*) = 5.5 — Chaetotaxic variables in ♀ : n80%(BM) = 18-25 ; n80%(B) = 31-38 ; n80%(G) = 96-103. In ♂ : n80%(BM) = 30-41 ; n80%(B) = 43-54 ; n80%(G) = 108-119.

Legs. (FE2)a5 : ontogeny type T — (TI2)4p1 : ontogeny type Q.

Development. — Number of juv. st. = 3.

Size ad. — ♂: 0.55 - 0.6 mm; ♀: 0.65 - 0.9 mm.

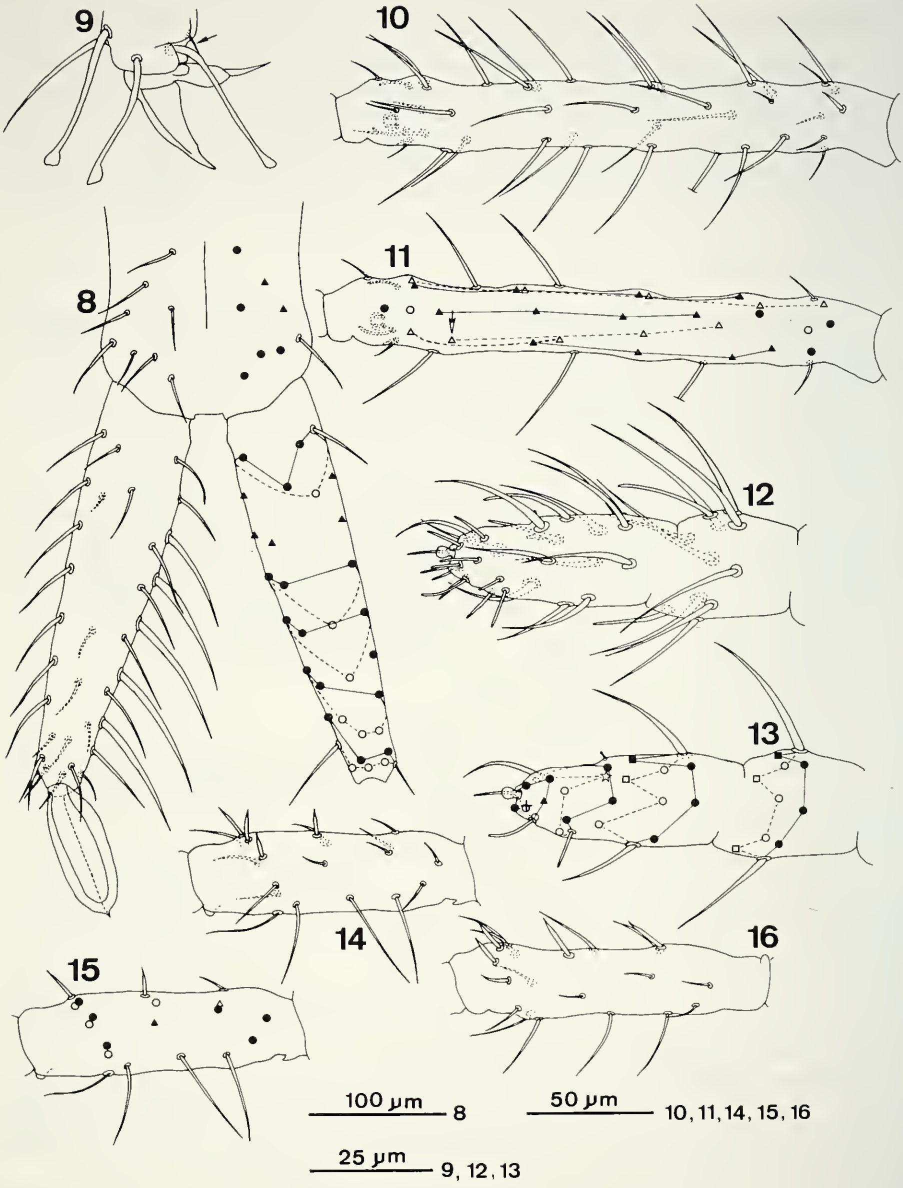
Color. — Same pattern as in *H. bilineatus* with a darker pigment (dark brown).

Great abd. — Back weakly concave in posterior area. Trichobothria: A, B, and C in linear pattern. Dorsal setae: mesochaetae.

Antennae (fig. 16). — Seta AIIe of ant. IV shifted toward apex. ♂ with several special-shaped setae on ant. II and III, and (AT)p-1 shifted toward inner side, so that it might almost be thought of as included in generatrix Gpi. Antennal ratios: in ♀, ant. I : II : III : IV = 1 : 2.2 : 3.7 : 6.6 and ant. : ceph. diag. = 2.0 ; in ♂, ant. I : II : III : IV = 1 : 2.3 : 4.2 : 6.7 and ant. : ceph. diag. = 2.7. Chaetotaxic variables, in both sexes: m(ISh*) = 0.91 ; in ♀ : for G: m = 98.2 / min = 94 / max = 103 ; m(RSh) = 0.53 ; in ♂ : for G: m = 113.6 / min = 105 / max = 120 ; m(RSh) = 0.45.

Head. — Eyes: 8+8; eyepatch with two setae. 1+1 ov. org. in the back-ventral area (it remains the ventral pair). Labral formula: 6/5-5-4. Cephalic setae: only mesochaetae in ♀ ; ♂ with several transformed setae. In dorsal part of the frons, near

same legend as in fig. 2; 4: hindtibiotarsus, anterior view; 5: apex of midleg, detail in posterior view, the arrow points the seta Jp, Ipi has its socket topped by an integumentary bulge; 6: ant. III, anterior view; 7: schematic representation of fig. 6, setae of Ge and Gi are drawn as those of antennal III organ (Xe, Xi) and its guard setae (Aai, Api, Ape), other setae are schematized as follows: a full symbol for a seta on reader's side (thus on anterior side), an empty symbol for a seta on opposite of reader's side, a circle for a primary seta, a triangle for a secondary seta; secondary setae belonging to a same generatrix are linked together by a line which is continuous on the anterior side and discontinuous on the posterior side.



Figs 8-16

Fig. 8: *Heterosminthurus insignis* ad., furcula, posterior view; on the right, schematic representation as follows: setae of Ge and Gi drawn, a full symbol for a seta on reader's side (thus on posterior side), an empty symbol for a seta on opposite of reader's side, a circle for a primary seta, a triangle for a secondary seta; for the dental whorls I to IV and B, setae belonging to a same whorl are linked together by a line which is continuous on the posterior side and discontinuous on the anterior side. Figs 9-15: *Heterosminthurus bilineatus* ♂; 9: apex

the sagittal plane, 2+2 acanthoids, the more posterior pair being thick, very long, and widened at apex as fan-shaped. Inner edge of eyes with several fairly long setae; frons with several small onion-shaped setae.

Legs. — Femur: cup present. (TI1,2)Jp is a very slender microchaeta. Pretarsus characteristic of the genus.

Ventral tube. — Sacs warty from 2st st. on. Chaetotaxy: apical flaps with one pair of primary setae, corpus without seta.

Retinaculum. — Rami bidentate from 2nd st. on. Chaetotaxy: on anterior lobe two setae appear at 3rd st. and one in ad.

Furcula. — Same chaetotaxy as in *bilineatus*.

Small abd. — Made up of abd. V + abd. VI. Trichobothria: D and E. Male genital papilla with 12 setae. Size comparison of female circumanal setae: av1' < av1 < av2 = av3 = av4. An. app. spine-like, slightly bent. Ratio an. app. : mucro = 0.71.

DISCUSSION

On the criterion of presence vs absence of setae, the appendicular chaetotaxy is virtually the same among the three species. Indeed, few setae variable in a species and constant in others are the only differences. Such characters, perhaps variable between populations, cannot be used to distinguish species. Setal shape provides some relevant characters, e.g., the dental macrochaetae in *insignis*, and (TI1,2)Jp as a minute microchaeta in *bilineatus* and *claviger*. Morphology of cephalic setae makes the distinction between males of *claviger* and *bilineatus* easy. Juveniles and females can be identified by the lateral chaetotaxic pattern of great abd. described by BRETFELD (1986).

Genus Deuterosminthurus (Börner, 1901) *sensu* Gisin, 1960

Deuterosminthurus, as other genera of Bourletiellidae, displays a particular pretarsal morphology. The claw is without tunica and pseudonychia, and its inner crest bears a small and sometimes hardly distinguishable tooth. The empodium is ending in a single apical spike. The reduction of empodial lamellae in all legs is an apomorphy of *Deuterosminthurus*. The absence of the femoral setae (FE3)ai3 and (FE3)ai4 in all the species of *Deuterosminthurus* I have observed also fits with a

of midleg, detail in posterior view, the arrow points the microchaeta Jp, the sockets of Jp and Ipi are hidden by an integumentary fold; 10: ant. III, anterior view; 11: schematic representation of fig. 10, same legend as in fig. 7, the arrow shows the displacement of the seta p-1; 12: apex of ant. IV (with the section A and the whorl M1), anterior view; 13: schematic representation of fig. 12, setae of Ge and Gi drawn, other setae are schematized as follows: a full symbol for a seta on reader's side (thus on anterior side), an empty symbol for a seta on opposite reader's side, a square for a H seta, a triangle for the secondary seta (AIai), and a circle for a primary G seta except a cross for AA and a star for AIIpe; setae belonging to a same whorl are linked together by a line which is continuous on the anterior side and discontinuous on the posterior side; 14: ant. II, anterior view; 15: schematic representation of fig. 14, setae of Ge and Gi are drawn, other setae are schematized as follows: a full symbol for a seta on reader's side (thus on anterior side), an empty symbol for a seta on opposite of reader's side, a circle for a primary seta, a triangle for a secondary seta. Fig. 16: *Heterosminthurus claviger* ♂, ant. II, anterior view.

putative evolved character. The same assumption can be made for the absence of (DE)IIae and (DE)IVa.

From observations on an extensive material, I state that the character "strong vs weak tooth on the inner lamella of claw", which has been frequently mentioned in literature, is worthless. This point and chaetotaxy involve to consider that the species, subspecies, or forms described as *pallipes*, *repandus*, *mixtus*, *feneysi*, and *beckeri* (see Ellis 1974) merely amount to only one species: *D. pallipes*. All these forms chiefly corresponded to differences in color patterns, but color is a variable character and a large range of tinges can be observed. Ellis (1974) clustered these forms in two species, *repandus* and *pallipes*, and in 1978 he questioned the separation of both. The name *pallipes* (Bourlet, 1843), coined for a dark form, is prior to *repandus* (Ågren, 1903). The valid name is thus *pallipes*; even though the form *pallipes*, in its original description, relates to a rare color-form (males and females dark blue-purple excepted for mouth, furcula, and legs) observed for some specimens collected in Atlantic meadows, and the name *repandus* is more frequently cited in literature than *pallipes*.

The different color-forms of *pallipes* do not present a defined pattern. On the other hand, *D. maculatus* sp. n., a close species to *pallipes*, has a constant color pattern which consists of sharply outlined maculae always laid down in the same arrangement. In some places, both species occurred together, and never it was found a specimen with an intermediate color; such a fact involved to give each form a specific status. Hence, I tried in vain to find a chaetotaxic trait which would have permitted to distinguish these species. I observed that all specimens of *pallipes* collected from Département Aveyron bear six long setae on the most posterior cross row of great abd. whilst all other species have four, and, for a while, I believed that this setal number was a worthwhile character. Nevertheless, I collected specimens of *pallipes* from Atlantic populations with four setae, and in intermediate locations with four to six. Another character lies in the thickness of male antennal acanthoids, but the difference is not very strong, and this character does not provide a sharp distinction between both species.

Distinction between *D. bicinctus* and *D. flavus* raised another problem. Typical two black spotted specimens and others uniformly light yellow occurred together in several populations of *bicinctus*. This last form absolutely looked like *flavus*, so that one could question the specific status of *flavus*. Nevertheless, I uncovered a chaetotaxic difference on the fourth antennal segment which permits to maintain the distinction between *bicinctus* and *flavus*. The number of setae of the intergeneratrices Heae and Hppe, and limited to the section M, is seven in *flavus* and nine in *bicinctus*. For these setae, I observed a compensation phenomenon* in *flavus*, so that a sharp distinction

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* Variable setae may present relationships for their presence vs absence, i. e., statistically speaking, they are correlated (Nayrolles 1991*a*). For a set of correlated setae, histogram of the variable "observed number of setae" is compared with the theoretical histogram related to the assumption of independence between setae. In the phenomenon of compensation (Nayrolles 1993*c*), the observed histogram is much narrower than the calculated one. Consequently, characters, i. e. features near constant within and variable between species, should refer not to individual setae but to sets of correlated setae. In this case, variables are setal numbers.

between the species cannot be performed by considering the setae one by one but by calculating a setal number. Another difference lies in the instar of appearance of the seta (FE2)a5, in third instar in *flavus* and in adult in *bicinctus*, and (AD)a+1, in adult in *flavus* and in third instar in *bicinctus*.

ELLIS (1974) described *Deuterosminthurus sulphureus mediterraneus*, and justified this subspecies arguing that the male did not bear the two posterior acanthoids on the upper anal flap, so conspicuous in the typical form. I deem this character is sufficient for raising the subspecies to specific rank: *Deuterosminthurus mediterraneus* Ellis, 1974, stat. nov. Furthermore, the ecological analysis of epigeic Symphypleona (NAYROLLES 1991*b*) showed that *D. sulphureus* scarcely occurred in Mediterranean areas; it was only collected in submediterranean zone, and in stations where the drought was temperate by local conditions as waterside or undergrowth. On the other hand, *D. mediterraneus* is likely a true Mediterranean species since ELLIS (1974) collected it in Rhodos Island (Greece).

Deuterosminthurus pleuracanthus sp. n. (Figs 17-20; Table III)

MATERIAL EXAMINED - SPAIN, prov. Huesca, Puerto de Monrepós, alt. 1260 m; pasture and rest area of cattle, with many graminae, *Poa* sp., *Phleum* sp., *Alopecurus pratensis*, *Dactylis glomerata*, and also *Achillea millefolium*, *Daucus carota*; collected with a net on these plants (HU24a). 21-VI-1990. Syntypes: 59 specimens; 13 juv., 3 ♂, and 5 ♀ mounted (8 specimens in alcohol in MHNG, 8 in MNHN, 8 in ZMA, other specimens in LEITT).

Other material.— Same station. 1-VIII-1987: 5 ♀ and 1 ♂; 1 ♀ and 1 ♂ mounted. 30-V-1990: 1 ♀ mounted (LEITT).

DESCRIPTION

Development. — Number of juv. st. = 3.

Size ad. — ♂: 0.45 - 0.55 mm; ♀: 0.6 - 0.85 mm.

Color. — Light yellow, slightly pigmented with orange in posterior area of great abd. Head light with a small orange fleck on the frontal ocellus. Antennae light brown-yellow; eyepatches black. Legs very light yellow; furcula white.

Great abd (figs 17 & 18). — Back concave in posterior area. Trichobothria: A, B, and C in linear pattern. Dorsal setae different between sexes: female with normal mesochaetae, and male with several swollen and spine-like setae (acanthoids).

Antennae. — Antennal ratios: in ♀, ant. I : II : III : IV = 1 : 2.0 : 3.1 : 5.5 and ant. : ceph. diag. = 1.7 ; in ♂, ant. I : II : III : IV = 1 : 2.0 : 3.3 : 6.3 and ant. : ceph. diag. = 2.1. Chaetotaxic variables, in both sexes: m(*ISh**) = 0.66 ; in ♀ : for *G*: m = 90.8 / min = 87 / max = 95 ; m(*RSh*) = 0.44; in ♂ : for *G*: m = 102.3 / min = 98 / max = 106 ; m(*RSh*) = 0.39.

Head. — Eyes: 8+8; eyepatch with two setae. Cephalic setae: mesochaetae. No ov. org. Labral formula: 6/5-5-4.

Legs. — Femur: cup present. Tibiotarsal generatrix Gp without secondary seta. Pretarsus characteristic of the genus.

Ventral tube. — Sacs warty from 2st st. on. Chaetotaxy: apical flaps with one pair of primary setae, corpus without seta.

Table III. Appendicular chaetotaxy of *Deuterosminthurus pleuracanthus* sp. n.

AP	Δ		—
AD	Π		—
	Δ		D: i0 T: i+1, e+1 (T)Q: a+1 (oc = 0.3) Q: i-1, pe+1 Ai is a trichobothrium.
AT	Π		—
	Δ		Other setae: Q: ae+2, pe+2, pe+3

	Ge	Gae	Ga	Gai	Gi	Gpi	Gp	Gpe
Setae -1	Q	T	Q	T	T	T	T	T
Setae 0	Q	D	D	D	D	D	T	D
Setae +1		T	T	Q	Q		Q	T

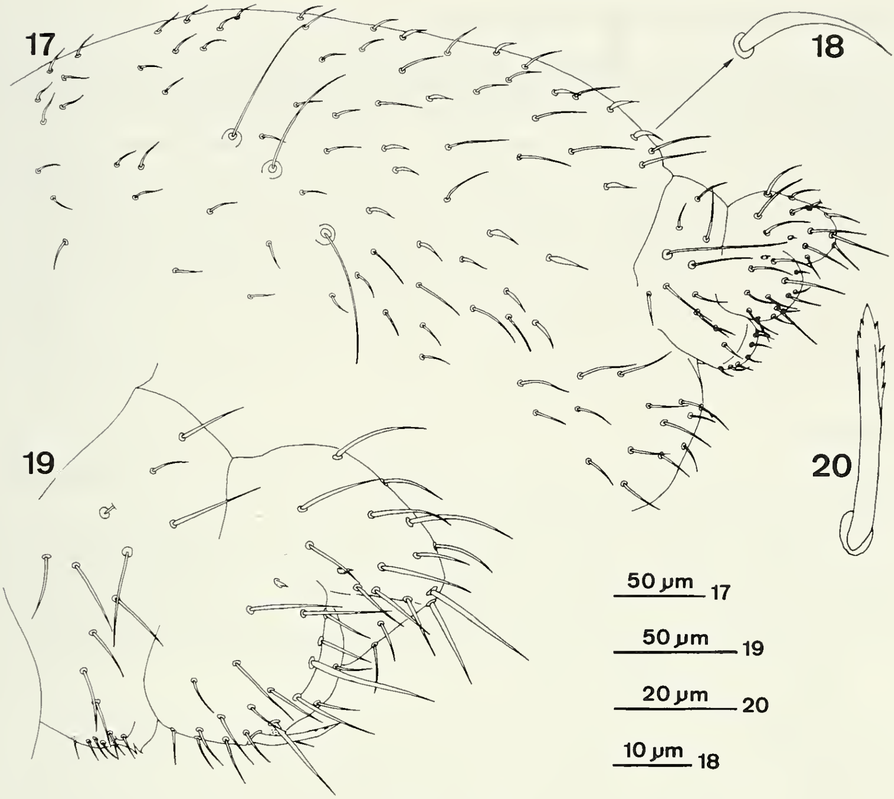
AQ	Str		B completely zoned. Section M euwhorled with 5 whorls. Right euwhorlation. Subsegmentation formula: 1 + 6 + 1 = (A) + (M1, 5 + BA) + (BM + BB). Right subsegmentation.
	A	Π	—
		H	AIIleae, AIIlppe
		Δ	Apical bulb: joined to the apex Subapical organ: very small D: AIai AIIpe is a blunt microchaeta
	M & B	H	Occurrences of H setae on M & B: for Heae 1-1-1-1-0/0, for Hipi 1-1-1-0-0/0, and for Hppe 1-1-1-0.8-0.1/0. m(*h**) = 3.9.
		G	Setae of BB: P: BBe, BBae, BBa, BBp, BBpe / all G setae on M are present. In female: BA with BAi variable (oc = 0.8); n80%(*BM*) = 10-16; n80%(*B*) = 23-28; .n80%(*G*) = 88-93. In male: BA complete whorl; n80%(*BM*) = 21-27; n80%(*B*) = 34-40; n80%(*G*) = 99-105. BBae and BBa are cucumiform setae on large base.

SB	PS	—	—	—
	Δ	P: 1 seta	P: 1 seta	P: 1 seta
SA	Δ	—	P: 1 seta	P: 1 seta
CX	Δ	P: i1	P: ae, i1, ms T: Oi1 Q: a	P: ae, i1, ms T: a, ai2, Oi1
TR	Π	—	—	—
	Δ	T: Oi1, Oi2	T: a2, Oi1, Oi2 Q: ae	T: a2, Oi1, Oi2 Q: ae
FE	Π	—	—	pe1
	Δ	delayed primordial seta: Q: ae3 T: pe2, Op Q: ai2, pe4	T: a5, ai2, pe2, Op Q: pe4	T: a5, ai2, pe2 Q: pe4, Oi
TI	V	—	IVp, Vp	IIIp, IVp, Vp
	K	—	—	—
	FP	+	+	+
	Δ	T: 4ai1, Vai, Vpi, FSa, O2pe Q: 3a, 4a1, 4pi1, 4ai2, FSai, FSpi Ja is a winged seta. Ipi, Ip and Ipe are spatulate setae.	T: 4ai1, Vai, Vpi, FSa, O2pe Q: 3a, 4a1, 4pi1, 4ai2, FSai, FSpi Ipi, Ip and Ipe are spatulate setae.	T: 3ai, 3i, 4ai1, 4i1, Vai, Vpi, FSa, O2pe Q: 2a, 3a, 3pi, 4a1, 4pi1, 4ai2, FSai, FSpi Ip and Ipe are spatulate setae.

MA	Π	—
	Δ	T: pe2, pe3
DE	Δ	Other setae: P: 2pe

		Ge	Gae	Ga	Gai	Gi	Gpi	Gp	Gpe
Whorls I to VI	I	P	P	P	P	P	P	P	P
	II			P			P	P	P
	III			P			P	P	P
	IV						P	P	P
	V						T	T	T
	VI						Q		T
Whorl B		T		P			P	P	P

MU	Δ	Chaetotaxy: — Morphology: anterior lamella simple, outer and inner lamellae smooth.



Figs 17-20

Deuterosminthurus pleuracanthus sp. n.; 17: ♂, small abd. and lateral and dorsal area of great abd., lateral view; 18: detail of a swollen seta of great abd.; 19: ♀, small abd. in lateral view; 20: right an. app. in ventral view.

Retinaculum. — At 1st st. rami tridentate, bidentate from 2nd. Chaetotaxy: on anterior lobe two setae appear at 3rd st. and one in ad.

Furcula. — See chaetotaxic table.

Small abd. (figs 19-20). — Made up of abd. V + abd. VI. Trichobothria: D and E. Male genital papilla with 12 setae. Female circumanal setae av1' and av1 shorter than the others. An. app. fairly long, flat, and with few serration at apex. Ratio an. app. : mucro = 0.64.

Discussion

The acanthoids of male great abd. permit to distinguish *D. pleuracanthus* from all other species of *Deuterosminthurus*.

Etymology: The name *pleuracanthus*, from Greek *pleuron* = flank and *acantha* = spine, refers to the acanthoids on the male great abd.

Deuterosminthurus bicinctus (Koch, 1840)

MATERIAL EXAMINED - FRANCE, dép. Gers, district Cravencères, between Cravencères and Manciet, alt. 150 m; undergrowth of *Quercus robur*; collected with a net (GS1). 5-V-1990: 189 specimens; 6 juv., 2 ♀, and 1 ♂ mounted (20 specimens in alcohol in MHNG, 20 in MNHN, 20 in ZMA, other specimens in LEITT). — Dép. Tarn, district Rouairoux, between Lacabarède and Rouairoux, about 1-2 km from Lacabarède, alt. 440 m; grove with chestnut, *Quercus pubescens*, and *Acer pseudo-platanus*, in undergrowth: *Lonicera periclymenum*, *Teucrium scorodonia*, *Pteridium aquilinum*, *Euphorbia silvatica*, *Lamium hybridum*, *Rubus* sp., etc.; collected with a net on unselected plants (TN1). 22-VIII-1987: 66 specimens; 4 ♂ and 4 ♀ mounted (LEITT). — SPAIN, prov. Guipúzcoa, between Bergara and Zumarraga, near Puerto de Descarga, alt. 550 m; damp grove with *Alnus glutinosa*, *Fraxinus excelsior*, *Sorbus torminalis*, *Corylus avellana*, in undergrowth: *Athyrium filix-femina*, *Geranium robertianum*, etc. (phytosociological association of Alno Ulmion); collected with a net on unselected plants (PB1): 36 specimens; 5 juv. mounted (LEITT).

DESCRIPTION

Concerning the appendicular chaetotaxic table, refer to *D. pleuracanthus* (Table III), with the following differences:

Antennae. (AD)a+1 ontogeny type T — Occurrences of H setae on M & B: for Heae 1-1-1-1-0/0, and for Hppe 1-1-1-1-1/0.2. m(h^*) = 4.6 — Chaetotaxic variables in ♀: n80%(BM) = 13-16 ; n80%(B) = 26-29 ; n80%(G) = 91-94. In ♂ : n80%(BM) = 18-25 ; n80%(B) = 31-38 ; n80%(G) = 96-103. BA complete whorl in both sexes.

Legs. (FE2)a5 ontogeny type Q.

Furcula. (MA)pe2 ontogeny type T(Q), oc = 0.8.

Development. — Number of juv. st. = 3.

Size ad. — ♂: 0.5 - 0.55 mm; ♀: 0.5 - 0.75 mm.

Color. — Background yellow with, in the normal form, two, one before, one behind, black flecks on great abd. The anterior spot is the larger. Head dotted with two small spots behind eyes. In some cases, I found other colored specimens living with this typical form in a same population. Some had many minute black spots in place of the black flecks, these minute spots were orange-pink in others, the lightest form was pigmented with orange, particularly in the rear of great abd., and without a trace of the typical flecks. In all cases, antennae orange-brown, eyepatches black, legs and furcula light.

Great abd. — Back concave in posterior area. Trichobothria: A, B, and C in linear pattern. Dorsal setae: mesochaetae.

Antennae. — Antennal ratios: in ♀, ant. I : II : III : IV = 1 : 1.8 : 3.0 : 5.6 and ant. : ceph. diag. = 1.6 ; in ♂, ant. I : II : III : IV = 1 : 1.9 : 3.2 : 5.6 and ant. : ceph. diag. = 2.1. Chaetotaxic variables, in both sexes: m(ISh^*) = 0.77 ; in ♀: for G: m = 92.6 / min = 90 / max = 95; m(RSh) = 0.48; in ♂ : for G: m = 99.3 / min = 95 / max = 106 ; m(RSh) = 0.45.

Head. — Eyes: 8+8; eyepatch with two setae. Cephalic setae: mesochaetae. No ov. org. Labral formula: 6/5-5-4.

Legs. — Femur: cup present. Tibiotarsal generatrix Gp without secondary seta. Pretarsus characteristic of the genus.

Ventral tube. — Sacs warty from 2st st. on. Chaetotaxy: apical flaps with one pair of primary setae. corpus without seta.

Retinaculum. — At 1st st. rami tridentate, bidentate from 2nd. Chaetotaxy: on anterior lobe two setae appear at 3rd st. and one in ad.

Furcula. — Same chaetotaxy as in *pleuracanthus* (excepted for a manubrial variable seta).

Small abd. — Made up of abd. V + abd. VI. Trichobothria: D and E. Male genital papilla with 12 setae. Female circumanal setae with about the same length. An. app. fairly long, flat, and serrated. Ratio an. app. : mucro = 0.61.

Deuterosminthurus flavus (Gisin, 1946)

Material examined – SPAIN, prov. Vizcaya, between Elgoibar and Markina-Xemein, alt. 350 m; undergrowth of *Pinus pinaster*, with *Athyrium filix-femina*, *Holcus lanatus*, etc.; collected with a net on unselected plants (PB2). 9-VII-1987: 106 specimens; 7 juv. and 9 ad. mounted (12 specimens in alcohol in MHNG, 12 in MNHN, 12 in ZMA, other specimens in LEITT). — Prov. Vizcaya, between Ondanoa and Lekeitio, alt. 100 m; moor with *Pteridium aquilinum*, *Brachypodium pinnatum*, *Agrostis setacea*, *Lithospermum prostratum*, *Androsæmum officinale*, *Molinia cærulea*, etc.; collected with a net on unselected plants (PB3). 9-VII-1987: 34 specimens; 2 ♂ mounted (LEITT). — Prov. Vizcaya, between Bermeo and Bakio, near Cabo Machichaco, alt. 70 m; undergrowth of *Pinus pinaster* with *Pteridium aquilinum*, *Hedera helix*, *Viburnum tinus*, *Smilax aspera*; collected with a net (PB19). 16-IX-1987: 7 specimens; 1 ♂ and 1 ♀ mounted (LEITT).

Description

Concerning the appendicular chaetotaxic table, refer to *D. pleuracanthus* (Table III), with the following differences:

Antennae. (AD)a+1 ontogeny type Q — Occurrences of H setae on M & B: for Heae 1-1-0.9-0.2-0/0, and for Hppe 1-1-1-0.8-0.2/0. $m(h^*) = 3.6$ — Chaetotaxic variables in ♀: $n80\%(BM) = 11\text{-}15$; $n80\%(B) = 24\text{-}27$; $n80\%(G) = 89\text{-}92$. In ♂: $n80\%(BM) = 17\text{-}21$; $n80\%(B) = 30\text{-}34$; $n80\%(G) = 95\text{-}99$. BA complete whorl in ♂, with variable setae in ♀.

Legs. (TI1)3p ontogeny type (Q), oc = 0.3 — (TI1)4p1 ontogeny type (Q), oc = 0.7.

Development. — Number of juv. st. = 3.

Size ad. — ♂: 0.45 - 0.5 mm; ♀: 0.55 - 0.85 mm.

Color. — Background yellow with orange on the back of great abd. Head more or less pigmented, with a small orange fleck on the frontal ocellus. Antennae light brown-yellow; eyepatches black, legs very light, and furcula white.

Great abd. — Back concave in posterior area. Trichobothria: A, B, and C in linear pattern. Dorsal setae: mesochaetae.

Antennae. — Antennal ratios: in ♀, ant. I : II : III : IV = 1 : 1.9 : 2.9 : 5.5 and ant. : ceph. diag. = 1.6 ; in ♂, ant. I : II : III : IV = 1 : 1.9 : 3.3 : 6.5 and ant. : ceph. diag. = 2.1. Chaetotaxic variables, in both sexes: $m(ISh^*) = 0.59$; in ♀ : for G: m = 90.2 / min = 87 / max = 93 ; $m(RSh) = 0.40$; in ♂ : for G: m = 97.0 / min = 94 / max = 100 ; $m(RSh) = 0.38$.

Head. — Eyes: 8+8; eyepatch with two setae. Cephalic setae: mesochaetae. No ov. org. Labral formula: 6/5-5-4.

Legs. — Femur: cup present. The generatrix Gp of forelegs often bears a seta which is either 3p or 4p1. No seta on Gp of mid and hindlegs. Pretarsus characteristic of the genus.

Ventral tube. — Sacs warty from 2st st. on. Chaetotaxy: apical flaps with one pair of primary setae, corpus without seta.

Retinaculum. — At 1st st. rami tridentate, bidentate from 2nd. Chaetotaxy: on anterior lobe two setae appear at 3rd st. and one in ad.

Furcula. — Same chaetotaxy as in *pleuracanthus*.

Small abd. — Made up of abd. V + abd. VI. Trichobothria: D and E. Male genital papilla with 12 setae. Female circumanal setae with about the same length. An. app. fairly long, flat, pointed and serrated. Ratio an. app. : mucro = 0.52.

Deuterosminthurus sulphureus (Koch, 1840)

MATERIAL EXAMINED – FRANCE, dép. Aveyron, district Bessuéjouls, Le Plateau de la Justice, alt. 450 m; meadow of the phytosociological association of Orchido-Brometum with some small trees (*Quercus pubescens*, *Pinus sylvestris*, *Juniperus communis*) and *Bromus erectus*, *Hippocrepis comosa*, *Globularia vulgaris*, *Eryngium campestre*, etc.; collected with a net on unselected plants (AV1a). Several collections from 17-IV-1987 until 13-VI-1987. In all 55 specimens; 13 juv. mounted (LEITT). — Dép. Aveyron, district Montrozier, Causse Comtal, road to Gages, alt. 620 m; grass on limestone with *Bromus erectus*, *Kœleria valesiaca*, *Festuca* gr. *ovina*, *Coronilla minima*, *Hippocrepis comosa*, *Lotus corniculatus*, *Anthyllis vulneraria*, *Carduncellus mitissimus*, *Eryngium campestre*, *Teucrium chamædrys*, etc.; collected with a net on unselected plants (AV2a). Several collections from 17-IV-1987 to 30-VII-1987. Many specimens; 6 ad. and many juv. mounted (LEITT). — Dép. Haute-Garonne, distric Toulouse, campus of Université P. Sabatier, alt. 160 m; long grass under fruit trees; collected with a net. 21-V-1988: many specimens collected and mounted (LEITT). — Dép. Ariège, district Ornolac-Ussat-les-Bains, Ariège river bank, alt. 500 m; long grass with many graminae and *Rhinanthus major*, *Anthyllis vulneraria*, *Orchis militaris*, etc.; collected with a net on unselected plants (AR2a). 22-V-1987: many specimens; 1 juv. and 4 ad. mounted (LEITT).

DESCRIPTION

Concerning the appendicular chaetotaxic table, refer to *D. pleuracanthus* (Table III), with the following differences:

Antennae. I have noted differences between two studied populations, particularly for the number of setae in males. (AD)a+1 ontogeny type T — (AD)pe+1 ontogeny type (T)Q or Q depending on populations — Occurrences of H setae on M & B: for Heae 1-1-1-1-0/0, and slightly variable for Hppe, 1-1-0.8-0.3-0/0 or 1-1-1-0-0/0, depending on populations. In all cases, m(h^*) = 3.5 — Chaetotaxic variables in ♀: n80%(BM) = 10-15 ; n80%(B) = 23-28 ; n80%(G) = 88-93. ♂ with differences between populations: n80%(BM) = 20-25 / 24-30 ; n80%(B) = 33-38 / 37-43 ; n80%(G) = 98-103 / 102-108. BA complete whorl in both sexes.

Legs. (TI1)3p ontogeny type Q — (TI1)4p1 ontogeny type Q — (TI2)3p ontogeny type (Q), oc = 0.7 — (TI2)4p1 ontogeny type (Q), oc = 0.2 — Setae of the outer side of tibiotarsi, (TI.)IIIe, (TI.)IIIae, (TI.)IIIpe, (TI.)IVe, (TI.)IVae, (TI.)IVpe, (TI1,2)Ve, (TI1,2)Vae, (TI1,2)Vpe, (TI3)IIe, are macrochaetae, their length grows during development.

Furcula. The primary seta (DE)IVpi is generally present, but may be variable in some populations.

Development. — Number of juv. st. = 3.

Size ad. — ♂: 0.55 - 0.6 mm; ♀: 0.7 - 1.0 mm.

Color. — Golden yellow with more orange in males. A small orange fleck on the frontal ocellus. Eyepatches black, antennae light yellow, legs very pale yellow, furcula white.

Great abd. — Back concave in posterior area. Trichobothria: A, B, and C in linear pattern. Dorsal setae: mesochaetae.

Antennae. — Antennal ratios: in ♀, ant. I : II : III : IV = 1 : 1.8 : 2.9 : 5.4 and ant. : ceph. diag. = 1.6 ; in ♂, ant. I : II : III : IV = 1 : 1.9 : 3.3 : 6.4 and ant. : ceph. diag. = 2.1. Chaetotaxic variables of ♂ have not the same values between populations; absolute minimum and maximum as well as range of average are given. In both sexes, m(*ISh**) = 0.58. In ♀ : for *G*: m = 90 / min = 86 / max = 94 ; m(*RSh*) = 0.40. In ♂: for *G*: m = 100.5 - 104.9 / min = 95 / max = 112 ; m(*RSh*) = 0.34 - 0.36.

Head. — Eyes: 8+8; eyepatch with two setae. Cephalic setae: mesochaetae. No ov. org. Labral formula: 6/5-5-4.

Legs. — Femur: cup present. Tibiotarsal generatrix Gp with two setae on forelegs, and often one on midlegs. Several long macrochaetae on tibiotarsal outer side. Pretarsus characteristic of the genus.

Ventral tube. — Sacs warty from 2st st. on. Chaetotaxy: apical flaps with one pair of primary setae, corpus without seta.

Retinaculum. — At 1st st. rami tridentate, bidentate from 2nd. Chaetotaxy: on anterior lobe two setae appear at 3rd st. and one in ad.

Furcula — (DE)IVpi variable in some populations.

Small abd. — Made up of abd. V + abd. VI. Trichobothria: D and E. Male genital papilla with 12 setae. Female circumanal setae av1' and av1 shorter than the others. An. app. fairly long, flat, pointed and slightly serrated. Ratio an. app. : mucro = 0.68.

Deuterosminthurus maculatus sp. n. (Figs 21-24; Table IV)

MATERIAL EXAMINED – FRANCE, dép. Aveyron, district Montrozier, Causse Comtal, road to Gages, alt. 620 m; collected with a net on *Juniperus communis* (AV2d). 23-V-1987. Syntypes: 7 juv. and 20 ad.; 5 juv., 3 ♀, and 2 ♂ mounted (LEITT).

Other material.— Same station. 17-IV-1987: 2 juv. and 1 ♀. 30-VII-1987: 1 juv (LEITT). — Same location; grass and small shrub at the edge of a grove of *Quercus pubescens*, with *Teucrium chamædris*, *Hippocrepis comosa*, *Spiræa hypericifolia*, *Helianthemum canum*, *Ornithogalum umbellatum*, *Euphorbia dulcis*, and *Fumana procumbens*; collected with a net on unselected plants (AV2e). Several collections from 17-IV-1987 to 1-X-1987. In all 24 specimens; 4 juv., 2 ♀, and 1 ♂ mounted (LEITT). — Dép Aveyron, district Bessuéjouls, Le Plateau de la Justice, alt. 450 m; meadow belonging to the phytosociological association of

Orchido-Brometum with some small trees (*Quercus pubescens*, *Pinus sylvestris*, *Juniperus communis*), and *Bromus erectus*, *Hippocrepis comosa*, *Globularia vulgaris*, *Eryngium campestre*, etc.; collected with a net on unselected plants (AV1a). 17-IV-1987: 1 ♀ mounted. 23-V-1987: 1 juv. (LEITT). — Dép. Aude, district Valmigère, road D54 between Valmigère and Arques, near Valmigère, alt. 680 m; moor with *Pteridium aquilinum*; collected with a net on this plant (AU11e). 8-VIII-1987: 33 specimens; 4 juv., 1 ♀, and 3 ♂ mounted (LEITT). — Dép. Haute-Garonne, district Roquefort-sur-Garonne, field between the roads D62 and N117, alt. 270 m; hedge with *Salix caprœa*, *Cornus sanguinea*, *Rubus* sp., *Rosa* sp., *Cytisus scoparius*, *Quercus pubescens*, *Clematis vitalba*, etc.; collected with a net on the hedge (HG5b). 16-VI-1987: 116 specimens (12 specimens in alcohol in MHNG, 12 in MNHN, 12 in ZMA, other specimens in LEITT).

DESCRIPTION

Development. — Number of juv. st. = 3.

Size ad. — ♂: 0.5 - 0.6 mm; ♀: 0.65 - 0.9 mm.

Color (fig. 21). — Background white or very light yellow in female, yellow in male. Several brown patches arranged in a characteristic pattern. Spots of female forming a pair of laterodorsal stripes along the great abd. A mediodorsal band more or less pigmented with orange. The laterodorsal stripes are completely or partially connected by two cross flecks, one is near the halfway back, the other situated in the rear quarter. End of great abd. spotted with a transversally stretched out fleck which does not reach the laterodorsal stripes. Two oblong patches in a very lateral position. Expanse of brown pigment on small abd. varying between specimens. Expanse of dark pigment is lesser in males, lateral brown stripes being narrower and vanished forward about halfway the back. At this level, the cross fleck, present in females, is absent or very faded in males. Head colored with yellow excepted for a light area around the eyepatches. Eyepatches black. Color of antennae varying from yellow to brown, lighter on the three first segments than on the fourth. Legs light yellow; furcula white.

Great abd (fig. 24). — Back concave in posterior area. Trichobothria: A, B, and C in linear pattern. Dorsal setae: mesochaetae. Posterior cross row with always 4 setae.

Antennae. — Several setae transformed in acanthoids on ant. I and II in adult male. Antennal ratios: in ♀, ant. I : II : III : IV = 1 : 1.8 : 2.6 : 5.1 and ant. : ceph. diag. = 1.6 ; in ♂, ant. I : II : III : IV = 1 : 1.8 : 2.8 : 5.5 and ant. : ceph. diag. = 2.0. Chaetotaxic variables, in both sexes: m(*ISh**) = 0.67 ; in ♀: for *G*: m = 97.0 / min = 94 / max = 101 ; m(*RSh*) = 0.41 : in ♂ : for *G*: m = 104.2 / min = 102 / max = 111 ; m(*RSh*) = 0.38.

Head. — Eyes: 8+8; eyepatch with two setae. Cephalic setae: mesochaetae, some facial setae being longer in male than in female. 1+1 ov. org. in the back-ventral area (it remains the ventral pair). Labral formula: 6/5-5-4.

Legs. — Femur: cup present, as well as the seta (FE3)pe1. Tibiotarsal generatrix Gp with two setae on forelegs, and two on midlegs. Pretarsus characteristic of the genus.

Ventral tube. — Sacs warty from 2st st. on. Chaetotaxy: apical flaps with one pair of primary setae, corpus without seta.

Table IV. Appendicular chaetotaxy of *Deuterosminthurus maculatus* sp. n.

AP	Δ		e and pe are acanthoids in male
AD	Π		—
	Δ		D: i0 T: i+1, a+1, e+1 (T)Q: pe+1 (oc = 0.7) Q: i-1 Ai is a trichobothrium. Ae, Be, Ape, Bpe, e+1, and pe+1 are acanthoids in male; Ap is also an acanthoid, but less stout than the others.
AT	Π		—
	Δ		Other setae: Q: ae+2, pe+2, pe+3
AQ	Str		B completely zoned. Section M euwhorled with 5 whorls. Right euwhorlation. Subsegmentation formula: 1 + 6 + 1 = (A) + (M1, 5 + BA) + (BM + BB). Right subsegmentation.
	A	Π	—
		H	AIIIeae, AIIIppe
		Δ	Apical bulb: joined to the apex Subapical organ: very small D: AIai AIIpe is a blunt microchaeta
	M & B	H	Occurrences of H setae on M & B: for Heae 1-1-1-1-0/0, for Hipi 1-1-1-0-0/0, and for Hppe 1-1-1-1-0/0. $m(h^*) = 4$.
		G	Setae of BB: P: BBe, BBae, BBa, BBp, BBpe / all G setae on M are present. In female: BA: complete whorl; n80%(*BM*) = 17-22; n80%(*B*) = 30-35; n80%(*G*) = 95-100. In male: BA: complete whorl; n80%(*BM*) = 27-31; n80%(*B*) = 40-44; n80%(*G*) = 105-109. BBae and BBa are cucumiform setae on large base.

AT Δ:

	Ge	Gae	Ga	Gai	Gi	Gpi	Gp	Gpe
Setae -1	Q	T	Q	T	T	T	T	T
Setae 0	Q	D	D	D	D	D	T	D
Setae +1		T	T	Q	Q		Q	T

SB	PS	—	—	—
	Δ	P: 1 seta	P: 1 seta	P: 1 seta
SA	Δ	—	P: 1 seta	P: 1 seta
CX	Δ	P: i1	P: ae, i1, ms T: Oi1 Q: a	P: ae, i1, ms T: a, ai2, Oi1
TR	Π	—	—	—
	Δ	T: Oi1, Oi2	T: a2, Oi1, Oi2 Q: ae	T: a2, Oi1, Oi2 Q: ae
FE	Π	—	—	—
	Δ	delayed primordial seta: Q: ae3 T: pe2, Op Q: ai2, pe4	T: a5, ai2, pe2, Op Q: pe4	T: a5, ai2, pe2 Q: pe4, Oi
TI	V	—	IVp, Vp	IIIp, IVp, Vp
	K	—	—	—
	FP	+	+	+
	Δ	T: 4ai1, Vai, Vpi, FSa, O2pe Q: 3a, 3p, 4a1, 4pi1, 4p1, 4ai2, FSai, FSpi Ja is a winged seta. Ipi, Ip and Ipe are spatulate setae.	T: 4ai1, Vai, Vpi, FSa, O2pe Q: 3a, 3p, 4a1, 4pi1, 4p1, 4ai2, FSai, FSpi Ipi, Ip and Ipe are spatulate setae.	T: 3ai, 3i, 4ai1, 4i1, Vai, Vpi, FSa, O2pe Q: 2a, 3a, 3pi, 4a1, 4pi1, 4ai2, FSai, FSpi Ip and Ipe are spatulate setae.

MA	Π	—
	Δ	T: pe2, pe3
DE	Δ	Other setae: P: 2pe oc(IVpi) = 0.3
MU	Δ	Chaetotaxy: — Morphology: anterior lamella simple, outer and inner lamellae smooth.

DE Δ:

		Ge	Gae	Ga	Gai	Gi	Gpi	Gp	Gpe
Whorls I to VI	I	P	P	P	P	P	P	P	P
	II			P			P	P	P
	III			P			P	P	P
	IV						(P)	P	P
	V						T	T	T
	VI						Q		T
Whorl B		T		P			P	P	P

Retinaculum. — At 1st st. rami tridentate, bidentate from 2nd. Chaetotaxy: on anterior lobe two setae appear at 3rd st. and one in ad.

Furcula. — (DE)IVpi often absent.

Small abd. (figs 22-24). — Made up of abd. V + abd. VI. Trichobothria: D and E. Male genital papilla with 12-13 setae. Female circumanal setae with about the same length. An. app. flat, pointed and serrated. Ratio an. app. : mucro = 0.49.

Discussion

D. pallipes and *D. maculatus* sp. n. can be distinguished from the other species of *Deuterosminthurus* by the seta (FE3)pe1 present from the 1st st. on, the male acanthoids on ant. I and II (see Ellis, 1974, fig. 7b p. 135), and 1+1 ov. org. behind the head. The color pattern is very characteristic and invariable in *maculatus*, whereas *pallipes* displays a wide range of colors without specific pattern. Two other characters can be used: *pallipes* has 4 to 6 long setae on the last cross row of great abd., and *maculatus*, as the other species of *Deuterosminthurus* I have observed, always bears 4 setae, and the antennal acanthoids of *maculatus* are thicker than in *pallipes*.

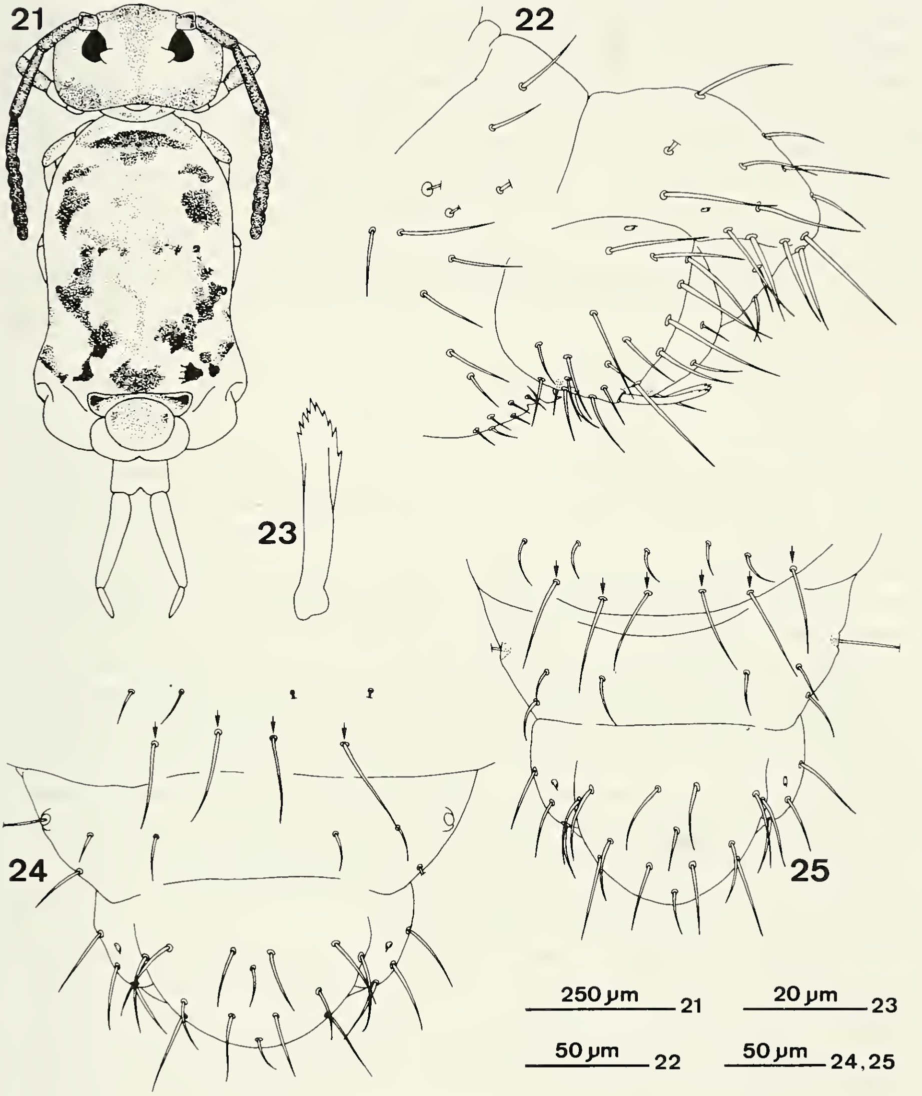
Etymology: The name *maculatus* from Latin *macula* = mark, spot.

Deuterosminthurus pallipes (Bourlet, 1843) (Fig. 25)

Material examined – FRANCE, dép. Aveyron, district Montrozier, Causse Comtal, road to Gages, alt. 620 m; grass on limestone with *Bromus erectus*, *Kœleria valesiaca*, *Festuca* gr. *ovina*, *Coronilla minima*, *Hippocrepis comosa*, *Lotus corniculatus*, *Anthyllis vulneraria*, *Carduncellus mitissimus*, *Eryngium campestre*, *Teucrium chamædrys*, etc.; collected with a net on unselected plants (AV2a). Several collections from 17-IV-1987 to 11-IX-1987. In all 17 juv. and 11 ad.; 6 ad. and all juv. mounted (LEITT). — Same location; doline with *Molinia cærulea*, *Avena pratensis*, *Eryngium campestre*, *Carduncellus mitissimus*, *Lathyrus pratensis*, *Vicia peregrina*, and some specimens of *Prunus spinosa*; collected with a net on unselected plants (station AV2b). Several collections from 17-IV-1987 to 1-X-1987. In all 123 specimens; 32 juv. and 9 ad. mounted (LEITT). — Dép. Aveyron, district Sébazac-Concourès, Causse Comptal, road D581 between Lioujas and Concourès, alt. 600 m; collected with a net on *Spiræa hypericifolia* (AV7d). 21-VI-1986: many specimens; 4 juv. mounted (LEITT). — Dép. Pyrénées-Orientales, district Lesquerde, road D619 between Saint-Paul-de-Fenouillet and Ansignan, about 3 km from Saint-Paul-de-Fenouillet, alt. 350 m; scrub with *Quercus ilex*, *Bupleurum fruticosum*, *Quercus coccifera*, etc.; collected with a net on unselected plants (PO15a). 24-VI-1987: 142 specimens; 8 juv. and 7 ad. mounted (LEITT).

Description

Concerning the appendicular chaetotaxic table, refer to *D. maculatus* (Table IV), with the following differences:



Figs 21-25

Figs 21-24: *Deuterosminthurus maculatus* sp. n. ♀; 21: habitus; 22: small abd. in lateral view; 23: right an. app. in ventral view; 24: small abd. and posterior area of great abd. in dorsal view. arrows point setae of the most posterior row of great abd. Fig. 25: *Deuterosminthurus pallipes* ♀, small abd. and posterior area of great abd. in dorsal view, arrows point setae of the most posterior row of great abd.

Antennae. Acanthoids of male are a little less stout than in *maculatus*, and (AD)Ap cannot be termed an acanthoid. I have noted some differences between populations. (AD)pe+1, depending on populations, appears or not at 3rd st. (oc varying from 0 to 1) — Occurrences of H setae on M & B: for Heae 1-1-1-1-0/0, and fluctuate for Hppe from 1-1-1-1-0/0 to 1-1-1-1-0.8/0. Consequently, m(h^*) varies from 4.0 to 4.4. — Chaetotaxic variables in ♀: n80%(BM) = 12-15 / 14-17 ; n80%(B) = 25-28 / 27-30 ; n80%(G) = 90-93 / 92-95. In ♂: n80%(BM) = 19-24 / 22-30 ; n80%(B) = 32-37 / 35-43 ; n80%(G) = 97-102 / 100-108. BA complete whorl in both sexes.

Furcula. The primary seta (DE)IVpi is seldom present, its occurrence varying from 0 to 0.2.

Development. — Number of juv. st. = 3.

Size ad. — ♂: 0.45 - 0.55 mm; ♀: 0.6 - 0.75 mm.

Color. — Very variable between populations, from light yellow to very dark purple. Males are generally more colored than females. Color depends on climatic zones in which populations live. Males of the Mediterranean area vary from orange flecked to entirely dark red. Females are generally yellow, with sometimes orange or ochre spots. In Atlantic area, two different patterns are mixed, most of specimens are yellow, some others, males and females, are dark purple (this form corresponds to the typical color of pallipes). In mountains, specimens living on *Rhododendron ferrugineum* are wine-red (only one yellow female was observed in a collection of more 100 specimens). In other areas, specimens are yellow (this form was described as *repandus*). In Mediterranean populations, females are colored with orange or ochre shades as in *D. maculatus*, but the pigment is far more diffuse than in *maculatus*. In addition, color widely varies between specimens, and in these populations, entirely red males are present, so that one cannot confuse the species. Head more or less colored, depending on the expanse of pigment on the body; surround of eyepatches often remains light as in *maculatus*. Eyepatches black, antennae with pigment varying from yellow to brown, legs light yellow, furcula white.

Great abd. (fig. 25). — Back concave in posterior area. Trichobothria: A, B, and C in linear pattern. Dorsal setae: mesochaetae. Posterior cross row with 4 to 6 setae.

Antennae. — Several setae transformed in acanthoids on ant. I and II in adult male. Antennal ratios: in ♀, ant. I : II : III : IV = 1 : 1.8 : 2.7 : 5.2 and ant. : ceph. diag. = 1.6 ; in ♂, ant. I : II : III : IV = 1 : 1.7 : 2.7 : 5.4 and ant. : ceph. diag. = 1.9. Chaetotaxic variables with some differences between populations. Absolute minimum, maximum, and range of average are given. In both sexes: m(ISh^*) = 0.67 - 0.73. In ♀: for G: m = 91.8 - 93.1 / min = 90 / max = 96 ; m(RSh) = 0.44 - 0.46 ; in ♂ : for G: m = 99.9 - 104.3 / min = 97 / max = 109 ; m(RSh) = 0.40 - 0.41.

Head. — Eyes: 8+8; eyepatch with two setae. Cephalic setae: mesochaetae, some facial setae being longer in male than in female. 1+1 ov. org. in the back-ventral area (it remains the ventral pair). Labral formula: 6/5-5-4.

Legs. — Femur: cup present, as well as the seta (FE3)pe1. Tibiotarsal generatrix Gp with two setae on forelegs, and two on midlegs. Pretarsus characteristic of the genus.

Ventral tube. — Sacs warty from 2st st. on. Chaetotaxy: apical flaps with one pair of primary setae, corpus without seta.

Retinaculum. — At 1st st. rami tridentate, bidentate from 2nd. Chaetotaxy: on anterior lobe two setae appear at 3rd st. and one in ad.

Furcula. — In most cases, (DE)IVpi absent.

Small abd. (fig. 25). — Made up of abd. V + abd. VI. Trichobothria: D and E. Male genital papilla with 12-13 setae. Female circumanal setae with about the same length. An. app. flat, pointed and serrated. Ratio an. app. : mucro = 0.52.

DISTINCTION OF THE EUROPEAN SPECIES OF *Deuterosminthurus*

A key to the European species of *Deuterosminthurus* is provided, that includes the studied species as well as *D. pandayi* Ellis, 1974 and *D. mediterraneus* Ellis, 1974, stat. nov. I recall that *D. cruciata* Haybach, 1972 should be taken out from *Deuterosminthurus* and placed in *Cassagnaudiella* (ELLIS 1975; NAYROLLES 1995). *D. quadranculata* (Loksa & Bogojevi3, 1970) was described from only one female. The description was insufficient, and this species is not included in the key.

In their description of *D. quadranculata*, LOKSA & BOGOJEVI3 (1970) noted: "Die neue Art steht der Art *repanda* (Ågren, 1903) am nächsten. Unterscheidet sich von dieser durch das Muster, durch die Zahl der zirkumanalen Borsten und durch die Anordnung dieser." However, the figure of small abd. given by LOKSA & BOGOJEVI3 (*ibid*., fig. 63, p. 141) does not show any difference from *pallipes*. The claw of *quadranculata* was described as untoothed; on the contrary, a tooth is generally present on the inner side of the claw of *pallipes*. Nevertheless, this character, difficult to observe and sometimes variable, has long been given an excessive importance, and I consider it to be irrelevant for distinguishing species. The color does not make up a good character any more. It is variable, without a defined pattern in *pallipes*; on the other hand, *quadranculata* is not really different from certain colored specimens of *pallipes*. Consequently, the distinction between *quadranculata* and *pallipes* may be questioned. However, LOKSA & BOGOJEVI3 described a retinaculum with two setae, and all *Deuterosminthurus* species I have observed have three setae in adult. Do the two *quadranculata*' s setae come from a mistake in observation, an aberrant specimen, or an actual species character? Only new collections in the location in which *quadranculata* was found (Deliblat, Yugoslavia) and new observations may give an answer.

KEY TO EUROPEAN SPECIES OF *Deuterosminthurus*

1 - three thick setae (IIa, IIIa, and IIai) on anterior dental side .... *pandayi*
- no thick setae on the dens 2

2 - macrochaetae on outer side of tibiotarsi 3
- tibiotarsi without macrochaetae 4

3 - posterior margin of the male upper anal flap with 1+1 acanthoids .. *sulphureus*
- male upper anal flap without acanthoid .... *mediterraneus*

4 - (FE3)p1 present, 1+1 ov. org. behind head, several acanthoids on male ant. I and II 5
- (FE3)p1 absent, no ov. org. behind head, no acanthoid on male ant. I and II 6

5 - brown spots forming a characteristic pattern, 4 long setae on the most posterior row of great abd. .... *maculatus* sp. n.
- variable color without a defined pattern, 4 to 6 long setae on the most posterior row of great abd. .... *pallipes*

6 - male great abd. with acanthoids .... *pleuracanthus* sp. n.
- no acanthoid on male great abd. 7

7 - back of great abd. with often two black patches, ant. IV with 9 setae in the set Heae + Hppe of M section. .... *bicinctus*
- back of great abd. unstained, ant. IV with 7 setae in the set Heae + Hppe of M section .... *flavus*

For the studied species, we can distinguish, on the one hand, those (*maculatus* and *pallipes*) displaying the seta (FE3)pe1 from the 1st instar on, acanthoids on ant. I and II in males, and 1+1 ov. org. on the back-ventral area of head, and on the other hand, those (*sulphureus*, *pleuracanthus*, *bicinctus*, and *flavus*) without the seta (FE3)pe1, nor male special shaped setae, nor cephalic ov. org. Concerning *pandayi* and *mediterraneus*, we know from Ellis (1974) that they have no male antennal acanthoid, it will be then of interest to determine whether the seta (FE3)pe1 and ov. org. behind the head are present or absent.

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REVUE SUISSE DE ZOOLOGIE, 103 (2): 553-564; juin 1996

Influence de l'exploitation forestière sur trois familles de coléoptères liés au bois dans les Gorges de l'Areuse[1]

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Influence of forest management on three wood-eating Beetles families in the Areuse Gorges (Canton of Neuchâtel, Switzerland). - The species richness and abundance of selected wood-eating Beetles (Buprestidae, Lucanidae and Cerambycidae) between managed and unmanaged forests since 1945 have been compared. The following traps were used: window traps, small Malaise traps, beer traps and yellow plates. Among the 46 collected species, 34 belonged to the Cerambycidae, 9 to the Buprestidae and 3 to the Lucanidae. This beetle fauna is not richer in the unmanaged forests and is favourably influenced by the presence of clearings. Species characteristic of old forests are missing in the studied area.

Key-words: Cerambycidae - Buprestidae - Lucanidae - Forest ecology - Swiss Jura.

INTRODUCTION

Depuis le début du siècle, on a pu constater une forte raréfaction d'espèces de Coléoptères du bois autrefois fréquentes. La liste rouge allemande des espèces menacées (GEISER 1984) signale à ce sujet 60% d'espèces en danger parmi ces Coléoptères. On ne dispose de données, principalement muséographiques, que depuis la fin du XIXe siècle, mais il n'est pas exclu que le déclin de certaines espèces ait commencé bien avant. Certaines de ces espèces, qui avaient un impact économique non négligeable, comme les Cérambycides *Saperda carcharias* (L.) et *Tetropium castaneum* (L.) ou le Bupreste *Agrilus viridis* (L.) (SCHAEFFER 1949; BRAUNS 1964; CHARRARAS 1972), ne causent pratiquement plus de dégâts aujourd'hui, du moins dans la zone étudiée (P. JUNOD, com. pers). Les espèces potentiellement nuisibles à la sylviculture ne représentent, de plus, qu'une faible minorité des Coléoptères du bois, les autres, comme par exemple les Lucanides *Lucanus cervus* (L.) et *Dorcus parallelipipedeus* (L.), jouent un rôle essentiel dans le recyclage du bois mort. La régression de cette

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[1] Cet article fait partie de la thèse de l'auteur.

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faune est généralement attribuée à la raréfaction des arbres vieux ou morts (Geiser, 1984), ainsi qu'aux enrésinements (SPEIGHT 1989). Afin de conserver une richesse faunistique maximale dans nos forêts, divers auteurs préconisent une sylviculture plus extensive avec, par exemple, l'abandon des plantations d'arbres étrangers à la station, la conservation des vieux arbres ou le maintien de forêts claires. (GEISER 1980; PAULUS 1980; LSPN, 1993).

Cependant, à notre connaissance, très peu de travaux ont été consacrés à l'étude de l'entomofaune du bois en relation avec l'exploitation ou la structure de la forêt. Citons toutefois le travail de SPRECHER-UEBERSAX (1989) qui s'est intéresssé à l'influence de la quantité de bois mort sur les Coléoptères du bois.

Pour cette première année de recherche, nous nous sommes fixé deux buts:

- le premier consiste à estimer l'influence de l'exploitation forestière sur trois familles de Coléoptères liés au bois. Pour ce faire, nous avons tenté, pour quelques types de forêts, de trouver une parcelle exploitée à comparer avec une parcelle inexploitée;

- le second est l'étude de l'influence de deux éléments structurels supposés favorables à ces insectes: les clairières et le bois mort.

Les Coléoptères du bois formant un groupe très vaste, seules trois familles ont été retenues. Il s'agit d'une part des Cérambycides et des Buprestides, familles essentiellement xylophages dont les larves se nourrissent de bois mort relativement frais, et d'autre part des Lucanides, famille saproxylophage dont les larves se nourrissent plutôt de bois en décomposition. Etant donné notre problématique, il nous a paru pertinent de choisir des familles au sujet desquelles il existe une bonne documentation, aussi bien bibliographique que muséographique. Elle permet une interprétation appropriée des résultats en nous renseignant sur la biologie des espèces et l'évolution de leur statut en Suisse. De plus, vu la raréfaction de nombreux représentants de ces familles, il paraissait important de mieux connaître les milieux qu'ils fréquentent afin de proposer des mesures de protection les plus adéquates possibles.

DESCRIPTION DES MILIEUX

Les Gorges de l'Areuse, à l'entrée du Val de Travers (NE), présentent toute une gradation de forêts allant de la thermophile chênaie buissonnante à la montagnarde hêtraie à *Asplenium*. Le terme de "station" désignera ci-après l'intérieur du périmètre où les pièges ont été posés, c'est-à-dire environ 2500 m^2. La figure 1 indique l'emplacement des stations dans la zone d'étude.

Dans le canton de Neuchâtel, le type d'exploitation forestière le plus répandu est celui de la forêt jardinée. Il vise à maintenir dans la forêt des arbres de tous âges. Lors de coupes, seuls les arbres d'âge mûr sont abattus, ce qui maintient un couvert arborescent relativement constant. Toutefois, afin de favoriser des essences de lumière comme le chêne *(Quercus sp.)* ou le pin sylvestre (*Pinus sylvestris*), les forestiers pratiquent en certains endroits des ouvertures appelées coupes d'abri. Dans notre zone, elles se rencontrent dans une aire assez restreinte où la composition du peuplement est hétérogène et la forêt claire car le sol y est souvent mince. Ce sont les

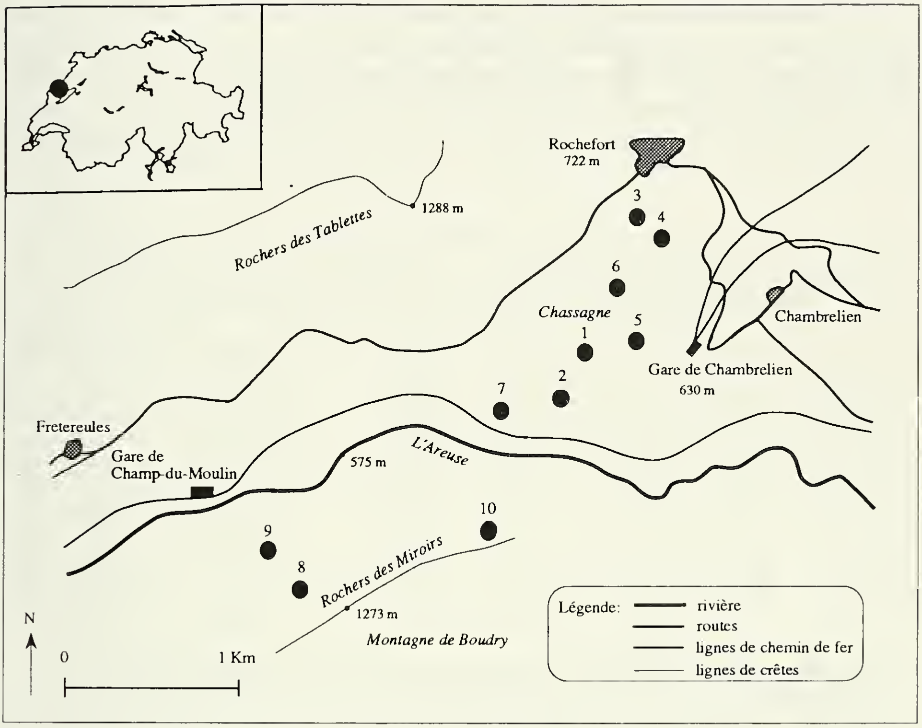

FIG. 1

Situation des stations étudiées

uniques clairières rencontrées dans la zone étudiée. Elles mesurent le plus souvent entre 600 m^2 et un hectare. Aucune forêt vierge ne subsiste dans le canton. Toutefois, l'exploitation de forêts situées sur des pentes très raides a été abandonnée à la fin de la deuxième Guerre mondiale.

Le bois mort est présent sous forme de branches de diamètre variable entassées après une coupe, de petits arbres abattus ou de petits arbres secs sur pied. Contrairement aux apparences, il n'est pas si simple de trouver une parcelle de forêt sans bois mort. En ces périodes de conjoncture morose, seul le “bois rentable” est évacué. Les petits arbres secs ne gênant pas la croissance des autres ainsi que les tas de branches sont laissés sur place. L'inventaire de ces derniers a permis d'évaluer la quantité de bois mort.

A l'intérieur d'une forêt exploitée, en l'occurence une hêtraie thermophile, on souhaitait évaluer l'importance de deux éléments structurels supposés favorables aux insectes xylophages: les clairières et le bois mort. A l'intérieur de ce type de forêt, il fallait donc trouver quatre stations aux caractéristiques suivantes:

- présence d'une clairière et de bois mort;
- présence d'une clairière et absence de bois mort;
- absence de clairière et présence de bois mort;
- absence de clairière et de bois mort;

Le tableau 1 résume les principales caractéristiques des 10 stations choisies.

Tableau 1: description des stations.

alt. = altitude, exp. = exposition; recouvr. = recouvrement de la strate arborescente, bm = station avec bois mort, cl. = station avec clairière, coupe = date de la dernière coupe.

station	commune	coordonnées	alt.	exp.	pente	forêt	exploitation	recouvr.	coupe
1	Rochefort	5517 2018	720 m	SE	30%	chênaie	exploitée	40%	1990
2	Rochefort	5514 2017	720 m	SE	60%	chênaie	inexploitée	40%	1949
3	Rochefort	5519 2027	790 m	SE	20%	hêtraie	exploitée	90%	1977
4	Rochefort	5518 2025	760 m	SE	40%	hêtraie	exploitée, bm	75%	1991
5	Rochefort	5520 2019	725 m	SE	20%	hêtraie mixte	exploitée, cl., bm	40%	1985
6	Rochefort	5519 2025	770 m	SE	15%	hêtraie mixte	exploitée, cl.	60%	1987
7	Rochefort	5513 2018	670 m	SE	90%	hêtraie	inexploitée	90%	1944
8	Boudry	5500 2006	890 m	NW	50%	hêtraie à sapins	exploitée	75%	1991
9	Boudry	5498 2008	810 m	NW	30%	hêtraie à sapins	"inexploitée"*	80%	1974
10	Boudry	5512 2011	825 m	NE	100%	hêtraie à sapins	inexploitée	60%	1938

* La station 9 sert de parcelle-témoin pour l'observation du dépérissement des forêts; aucune intervention forestière n'y a été réalisée depuis 1985, pas même le débardage des chablis.

MATERIEL ET METHODES

Ce travail a pour but de comparer l'abondance en Coléoptères du bois et leur richesse spécifique dans les différentes stations. Nous avons donc opté pour des pièges pouvant être disposés équitablement partout et représenter un effort d'échantillonnage identique pour toutes les stations.

Les pièges suivants ont été employés (Barbalat, 1995): le piège-fenêtre (80 x 50 cm; 1 par station) (Hartmann & Sprecher 1990), la mini-Malaise (40 x 40 x 25 cm; 3 par station) et l'assiette colorée (diamètre: 20 cm / hauteur: 10 cm; 1 par station) (Basset 1985), ainsi que le piège à bière (diamètre: 8 cm / hauteur: 23 cm; 3 par station) (Allemand & Aberlenc 1991); en parallèle, une tournée hebdomadaire (quand la météo était favorable) de chasse à vue a été effectuée. Cette dernière méthode nous a fourni des informations essentiellement faunistiques, puisque les insectes capturés de cette façon se trouvaient le plus souvent en dehors des stations. La saison de piégeage a duré de début mai à mi-septembre 1993. Les pièges ont été relevés tous les 10 jours. Il n'a pas été possible de poser de piège-fenêtre dans la station 10 trop escarpée.

Les résultats obtenus ont été traités par une analyse canonique des correspondances (ci-après: ACC) (ter Braak 1986, 1988*a*) à l'aide du programme CANOCO (ter Braak 1988*b*), cela afin d'identifer les variables les plus pertinentes qui influencent la distribution des espèces dans les stations étudiées. Cette technique permet d'extraire d'une matrice de données la variance expliquée par une ou des variables explicatives introduites a priori. De même qu'en régression multiple, ces variables peuvent être sélectionnées selon une procédure pas à pas. Les trois variables explicatives suivantes ont été introduites dans l'analyse pour y faire l'objet d'une sélection pas-à-pas: présence ou absence de clairière, présence ou absence d'exploitation et présence ou absence de bois mort.

RESULTATS

Le tableau 2 présente les 46 espèces récoltées dans la zone d'étude. La répartition spécifique par taxon est la suivante: Cerambycidae: 34 espèces; Buprestidae: 9 espèces; Lucanidae: 3 espèces. Les résultat obtenus par les différents pièges sont discutés dans une publication séparée (BARBALAT, 1995).

Comme une sélection pas à pas l'a montré, seule la variable "présence ou absence de clairière" explique une proportion significative de la variance des données (19,3% de la variance; p=0,01). Le tableau 3 a été diagonalisé en fonction de la position des stations et des espèces sur le premier axe canonique, qui représente cette partie de la variance.

DISCUSSION

INFLUENCE DES CLAIRIERES

Le petit Cérambycide floricole *Strangalia melanura* représente à lui seul respectivement 84% et 56% des captures dans les stations 5 et 6, les seules situées en clairière. Si l'on fait abstraction de cette espèce, sujette à d'importantes fluctuations d'effectifs, ces deux stations conservent en moyenne un nombre d'individus plus de dix fois supérieur à celui des autres stations, ainsi qu'un nombre d'espèces plus de trois fois supérieur.

L'arrivée de soleil au sol dans les clairières y permet une activité de l'entomofaune beaucoup plus importante que dans une forêt fermée. De plus, les fleurs de la clairière représentent une source de nourriture pour beaucoup d'espèces butineuses et favorisent les rencontres de partenaires sexuels. Il est donc logique que nos pièges, qui mesurent essentiellement l'activité des insectes, se soient révélés plus efficaces en clairière. La quantité d'individus dans les pièges peut donc simplement refléter une activité accrue en clairière qui n'est pas forcément liée à l'abondance des insectes dans le milieu. Cela dit, il paraît raisonnable de considérer que, pour les raisons évoquées plus haut, une clairière représente un milieu fortement attractif, notamment pour les espèces floricoles. De plus, les Cérambycides, qui constituent l'essentiel de nos captures, sont généralement thermophiles, aussi bien à l'état larvaire qu'imaginal. Ils auront tendance à pondre dans des troncs ou des branches exposés au soleil, donc de préférence en clairière ou en lisière (KLAUSNITZER & SANDERS 1981). A notre avis, la forte activité constatée dans les clairières est donc également liée à une plus grande abondance d'individus.

Il est intéressant de constater l'importance des milieux semi-ouverts pour ces insectes, pour la plupart réputés forestiers. Dans notre cas, seul le Cérambycide

Leiopus nebulosus ne semble pas avoir besoin de quitter la forêt pour boucler son cycle. Cependant, d'après S. Bily (com. pers.), cette espèce serait indifférente à l'état de fermeture de son milieu et non pas strictement forestière comme le laisseraient supposer nos résultats.

Influence de l'exploitation forestiere

En ce qui concerne l'abondance et la richesse spécifique des Coléoptères étudiés dans les parcelles non exploitées (les stations 2, 7, 9 et 10), on constatera qu'elles sont au mieux équivalentes (stations 2 et 9) à celle des parcelles exploitées, ou nettement plus faibles (stations 7 et 10).

On supposait a priori qu'une forêt inexploitée, comportant plus d'arbres vieux ou morts et davantage d'arbres tombés créant des trouées qu'une forêt exploitée, serait plus favorable aux insectes du bois. Les parcelles considérées ont été exploitées jusqu'en 1945. Depuis lors, la structure du peuplement n'a pas sensiblement changé. Tout au plus y voit-on de nombreux petits arbres secs, ainsi qu'une canopée très dense, étant donné qu'aucune éclaircie n'y a été effectuée depuis 50 ans et que les arbres n'ont pas encore atteint le stade sénescent auquel leur feuillage s'éclaircit. Puisque l'ensoleillement constitue un facteur essentiel à la présence d'une faune de Coléoptères du bois variée et abondante, on considérera comme logique la faiblesse des effectifs capturés dans les stations inexploitées.

Influence du bois mort

Dans le cas présent, la quantité de bois mort seule ne semble pas constituer un facteur déterminant l'abondance de la faune étudiée. La comparaison des stations 3 et 4 en témoigne. Cette dernière, pourtant nettement mieux dotée en bois mort, présente une faune qui n'est guère plus diversifiée que celle de la station 3. En revanche, lorsque l'offre en bois mort est couplée avec un bon ensoleillement, elle semblerait constituer un attrait non négligeable, dont il est cependant difficile ici d'estimer précisément l'importance.

Cela dit, le bois mort des forêts étudiées consiste principalement en branches mortes au sol et en petits arbres secs sur pied. Il s'agit donc de bois mort récent et généralement de faible diamètre. Ce bois n'a sans doute pas la même valeur pour les insectes saprophages et xylophages que de vieux arbres pourvus de nombreuses branches mortes. Ces derniers représentent en effet pour la faune concernée un milieu stable et diversifié à long terme.

Faunistique et écologie

D'un point de vue faunistique, cette étude a permis d'ajouter une espèce à la faune du canton de Neuchâtel, le Bupreste *Agrilus olivicolor*. Il se rencontre surtout en plaine mais remonte les vallées alpines jusque vers 1500 mètres. Seule une localité (Delémont) a été signalée dans le Jura jusqu'à présent.

On peut également se réjouir de la présence sur le terrain d'étude de trois espèces de Cérambycides rares figurant sur la liste rouge des espèces menacées

Tableau 2: espèces capturées et aperçu écologique
(nomenclature selon Freude, Harde & Lohse 1992, 1994) *

Distribution: M-O = Moyen-Orient, holomédit. = holoméditerranéenne; **Etage:** col = collinéen, mon = montagnard, sub = subalpin; **Milieu:** ffeu = forêt de feuillus, fcon = forêt de conifères, mix = forêt mixte, tran = clairières et lisières, mou = milieu ouvert, prm = forêt primitive, riv = milieu riverain; **Plante-hôte:** feuil. = diverses essences de feuillus, conif. = diverses essences de conifères; **Station:** sans autre indication que le numéro de la station, espèce capturée au piège, (chv) = espèce capturée dans la station par chasse à vue, hs = espèce attrapée par chasse à vue en dehors des stations.

Espèce	Auteur	Distribution	Etage	Milieu	Plante-hôte	Station
BUPRESTIDAE						
Agrilus angustulus	(Ill.,1803)	eurosibérienne	col	ffeu/tran	Quercus	5
Agrilus biguttatus	(F.,1777)	européenne, M-O	col	ffeu/tran	Quercus	5
Agrilus laticornis	(Ill.,1803)	européenne, M-O	col	ffeu/tran	Quercus	6
Agrilus olivicolor	Kiesw.,1857	eurosibérienne	col	ffeu/tran	Corylus,Carpinus	4
Agrilus sulcicollis	Lacord.,1835	eurosibérienne	col	ffeu/tran	Quercus	2,5,6
Agrilus viridis	(L.,1758)	eurosibérienne	col-mon	ffeu/tran	feuil.	5
Anthaxia helvetica	Stierl.,1868	oréale	col-sub	fcon/tran	conif.	4,5,6,hs
Anthaxia quadripunctata	(L.,1758)	oréale	mon-sub	fcon/tran	conif.	5,6,hs
Chrysobothris affinis	(F.,1794)	eurosiberienne	col-mon	ffeu/tran	feuil.	5,hs
LUCANIDAE						
Platycerus caprea	(Geer,1774)	Europe centrale	mon-sub	ffeu	feuil.	8
Platycerus caraboides	(L.,1758)	Europe centrale	col-mon	ffeu	feuil.	7,hs
Sinodendron cylindricum	(L.,1758)	eurosibérienne	col-mon	ffeu/prm	feuil.	9
CERAMBYCIDAE						
Alosterna tabacicolor	(Geer,1775)	paléarctique	col-mon	ffeu/tran	feuil.	1,2,3,4,5,6,7,hs
Anaglyptus mysticus	(L.,1758)	holomédit.	col-mon	ffeu/tran	feuil.	3,6,8,hs
Callidium aeneum	(Geer,1775)	boréo-alpine	mon-sub	fcon	conif.	8
Clytus arietis	(L.,1758)	européenne, M-O	col-mon	ffeu	feuil.	1,2,3,4,5,6,7,hs
Gaurotes virginea	(L.,1758)	boréo-alpine	mon	fcon/tran	conif.	6,hs
Grammoptera ruficornis	(F.,1781)	européenne	col	ffeu/mou	feuil.	2,3,hs
Grammoptera ustulata	(Schall.,1783)	européenne	col	ffeu/tran	feuil.	6
Grammoptera abdominalis	(Steph.,1831)	holomédit.	col	ffeu/tran	Quercus,Castanea	6,hs
Judolia cerambyciformis	(Schrk.,1781)	holomédit.	col-mon	ffeu/mou	feuil./conif.	1,4,5,6,hs
Leiopus nebulosus	(L.,1758)	européenne	col-mon	ffeu/mix	feuil.	3,7,8,9
Leptura dubia	Scop.,1763	européenne	mon-sub	fcon/tran	conif.	5,6
Leptura livida	F.,1776	eurosibérienne	col	mou/tran	terricole	hs
Leptura maculicornis	Geer,1775	boréo-alpine	mon-sub	mou/tran	conif/feuil.	hs
Leptura rubra	L.,1758	paléarctique	col-mon	fcon/mou	conif/feuil.	1,4,5,6,hs
Leptura sanguinolenta	L.,1761	boréo-alpine	mon-sub	tran	conif.	5,6,hs
Leptura sexguttata	F.,1775	européenne	col-mon	ffeu/tran	Quercus	2,3,5
Molorchus minor	(L.,1758)	holarctique	col-sub	fcon/mix	conif.	6,10,hs
Obrium brunneum	(F.,1792)	européenne, M-O	mon-sub	fcon/mix	conif.	1,5,6,9,hs
Oxymirus cursor	(L.,1758)	boréo-alpine	mon-sub	fcon/mix	conif/feuil.	6,9
Parmena balteus	(L.,1767)	méditerranéenne	col	ffeu/tran	feuil.	10,hs
Phymatodes testaceus	(L.,1758)	européenne, M-O	col-mon	ffeu	feuil.	3,hs
Plagionotus arcuatus	(L.,1758)	européenne, M-O	col	ffeu/mix	Quercus	5
Pogonocherus hispidulus	(Pill.Mitt.,1783)	européenne	col-mon	ffeu/mix	feuil.	2,5,9
Pogonocherus hispidus	(L.,1758)	européenne	col-mon	ffeu/mix	feuil.	9 (chv)
Pogonocherus ovatus	(Goeze,1777)	européenne	mon-sub	fcon/mix	conif.	5,6
Pyrrhidium sanguineum	(L.,1758)	holomédit.	col	ffeu	Quercus	3 (chv),5
Rhagium bifasciatum	F.,1775	européenne	col-mon	fcon/mix	conif./feuil.	hs
Rhagium inquisitor	(L.,1758)	eurosibérienne	col-mon	fcon/mix	conif./feuil.	hs
Rhagium mordax	(Geer, 1775)	eurosibérienne	col-mon	ffeu/mix	feuil./conif.	9,hs
Stenocorus meridianus	(L.,1758)	eurosibérienne	col	ffeu	feuil.	1,2,5
Strangalia maculata	(Poda,1761)	européenne, M-O	col-mon	ffeu/tran	feuil.	5,6,hs
Strangalia melanura	(L.,1758)	eurosibérienne	col-mon	ffeu	feuil./conif.	1,2,4,5,6,8,hs
Tetropium castaneum	(L.,1758)	paléarctique	col-sub	fcon	conif.	8
Tetropium fuscum	(F.,1787)	eurosibériennne	col-sub	fcon	conif.	8

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* Cf. note à la fin de la bibliographie.

TABLEAU 3

Stations et espèces ordonnées selon leur position sur le premier axe canonique représentant la variance expliquée par la variable "présence ou absence de clairière".

Espèces / Stations	st.10	st.5	st.6	st.1	st.4	st.2	st.9	st.8	st.7	st.3	
Parmena balteus	1										
Agrilus angustulus		10									
Agrilus bigutatus		6									
Agrilus laticornis			1								
Agrilus viridis		3									Espèces
Anthaxia quadripunctata		9	5								
Chrysobothris affinis		9									
Gaurotes virginea			1								
Grammoptera abdominalis		1									
Grammoptera ustulata			3								de
Leptura dubia		5	2								
Leptura sanguinolenta		7	6								
Molorchus minor	1		1								
Plagionotus arcuatus		1									clairières
Pogonocherus ovatus		1	1								
Potosia cuprea		1									
Pyrrhidium sanguineum		1									
Strangalia maculata		24	14								
Trichius fasciatus		12	2								
Anthaxia helvetica		11	7		1						
Leptura rubra		31	18	1	1						
Agrilus sulcicollis		2	3			1					
Judolia cerambyciformis		6	8	1	1						
Serica brunnea		1	1		1						
Strangalia melanura		973	156	9	2	4		3			
Clytus arietis		16	4	1	1	2			1	1	Espèces
*Oxymirus cursor**			1				1				ubiquistes
Obrium brunneum	1	3	1	2			2				plutôt
Anaglyptus mysticus			2					1		1	thermophiles
Alosterna tabacicolor		19	42	8	6	2		18	1	6	
Pogonocherus hispidulus		2				1	2				
Leptura sexguttata		1				1				1	
Stenocorus meridianus		1		1		2					
Agrilus olivicolor					2						
Grammoptera ruficornis						2				1	
Callidium aeneum								1			
Leiopus nebulosus							2	1	1	7	Espèces de
*Phymatodes testaceus**										2	forêts
Platycerus caprea								1			fraîches et
Platycerus caraboides									1		plutôt
Rhagium mordax							1	1			sombres
Sinodendron cylindricum							1				
Tetropium castaneum								4			
Tetropium fuscum								1			
nombre total d'individus	3	1155	280	23	15	15	9	31	4	19	1554
nombre total d'espèces	3	25	22	7	8	8	6	9	4	7	44

Remarques: Etant donné le très faible nombre d'espèces capturées dans la station 10, sa position sur l'axe 1 n'est pas interprétable. Les espèces munies d'une astérisque ont été trouvées dans des milieux ne correspondant pas à ceux cités dans la littérature.

d'Allemagne (GEISER 1984) (une telle liste n'existe pas encore pour la Suisse). Il s'agit de *Leptura sexgutatta*, (statut 2: très menacé) *Pogonocherus ovatus*, et *Tetropium fuscum* (statut 3: menacé). En Suisse, ces espèces sont peu communes. La consultation de la base de données du Centre Suisse de Cartographie de la Faune à Neuchâtel permet d'estimer le statut de ces espèces en Suisse. Si les effectifs de *Leptura sexguttata* sont stables, ceux de *Pogonocherus ovatus* et *Tetropium fuscum* sont en diminution.

Pour ces espèces et d'une manière générale, il est difficile de savoir si le peu de données jurassiennes correspond à une distribution réelle de l'insecte ou à un effort de prospection faible comparé à d'autres régions du pays.

D'autres espèces méritent aussi quelque intérêt. Le Lucanide *Sinodendron cylindricum* présente selon KOCH (1992) une affinité marquée pour les vieilles forêts de hêtres (*Fagus sylvatica*). L'espèce a été capturée dans la station 9 qui comporte effectivement quelques vieux hêtres. Le Cérambycide *Plagionotus arcuatus*, sans être une espèce relique des vieilles forêts, indique selon RIECKEN & BLAB (1989) des peuplements de chênes d'âge respectable. Il en va de même pour le Bupreste *Agrilus biguttatus* (S. BILY, com. pers.). *Parmena balteus* est un petit Cérambycide. Il est assez commun dans le bassin lémanique. Cette espèce méditerranéenne est rare en Suisse en dehors de cette région. On la signale cependant dans plusieurs localités du pied du Jura entre Yverdon et Bienne.

CONCLUSION

Cette recherche a permis de mettre en évidence certaines préférences écologiques des familles étudiées. Elle représente également un certain apport faunistique à la connaissance d'une région peu prospectée. Elle infirme aussi, pour les insectes concernés du moins, une idée souvent répandue: toute exploitation forestière serait nuisible à l'entomofaune. On a pu le constater, c'est précisément dans les endroits exploités et particulièrement dans les clairières ouvertes par les forestiers que la richesse faunistique et l'abondance sont les plus importantes. Cette variété est due à la clairière elle-même, ainsi qu'à la qualité du peuplement dans lequel elle se situe.

En visitant une forêt primitive (Bialowieza, Pologne), nous avons pu nous rendre compte qu'elle présentait une canopée relativement clairsemée et comportait de nombreuses clairières dues à de vieux arbres tombés. Il semble donc qu'à l'origine, les forêts étaient beaucoup moins sombres qu'actuellement. Cela expliquerait la prédilection pour les clairières que nous avons constatée chez des insectes réputés forestiers.

La richesse faunistique de la région étudiée est assez bonne si on la compare à d'autres inventaires de l'entomofaune forestière (HARTMANN & SPRECHER, 1990; SCHERLER *& al.* 1989). Il faut cependant relever qu'on n'y a trouvé qu'un seul individu d'une espèce (le Lucanide *Sinodendron cylindricum*) caractéristique des forêts primitives. Ces dernières n'ont pratiquement jamais subi d'exploitation et présentent de nombreux vieux arbres. Il est certes réjouissant qu'une forêt fortement marquée par l'influence humaine conserve une faune entomologique variée, mais il faut toutefois garder en mémoire qu'il s'agit d'espèces, pour la plupart fréquentes, ayant pu s'adapter aux conditions dictées par la sylviculture. D'après les ouvrages consultés (PALM 1959; RIECKEN & BLAB 1989 et HOLZSCHUH 1984), il existe une série d'espèces de Coléoptères du bois que l'on peut considérer comme des reliques de la forêt primitive. Citons parmi elles les Cérambycides *Cerambyx cerdo*, *Plagionotus detritus*, *Mesosa curculionoides* et *Trichoferus pallidus*, les Lucanides *Aesalus scarabaeoides* et *Ceruchus chrysomelinus* ou le Bupreste *Eurythrea quercus*. Ces espèces sont pour la plupart rarissimes en Suisse. Cette rareté, qui ne semble d'ailleurs pas récente, est vraisemblablement imputable à la disparition déjà ancienne des forêts primitives en Suisse. Il est également probable que certaines espèces à répartition plutôt méridionale telles *Cerambyx cerdo* ou *Eurythrea quercus* se montrent plus sensibles à des modifications de leur milieu lorsqu'elles se trouvent dans les régions marginales de leur aire de répartition. Etant donné la quasi absence de vieux arbres dépérissants dans nos forêts, il semble assez peu probable que de telles espèces aient quelque chance de les recoloniser. On a toutefois pu constater que, dans les forêts prospectées, un certain nombre d'arbres ayant visiblement dépassé l'âge où ils sont d'habitude abattus, sont laissés sur pied. Nous ne pouvons qu'encourager cette tendance favorisant le maintien à long terme d'une entomofaune diversifiée dans nos forêts.

RÉSUMÉ

Une comparaison de la richesse faunistique et de l'abondance des Coléoptères liés au bois (Buprestidae, Lucanidae et Cerambycidae) entre des forêts exploitées actuellement et des forêts inexploitées depuis 1945 a été réalisée. Les pièges suivants ont été utilisés: le piège-fenêtre, la mini tente Malaise, l'assiette jaune et le piège à bière. Des 46 espèces récoltées, 34 appartiennent aux Cérambycides, 9 aux Buprestides et 3 aux Lucanides. Les forêts inexploitées ne présentent pas une faune plus riche que les forêts exploitées. La faune considérée est très favorablement influencée par les clairières. Il manque cependant dans les peuplements étudiés des Coléoptères caractéristiques de vieilles forêts.

ZUSAMMENFASSUNG

Der faunistiche Reichtum wurde mit der Häufigkeit zwischen heutzutage bewirtschafteten Wäldern und seit 1945 nicht mehr bewirtschafteten Wäldern verglichen. Dabei wurden die folgenden Fangmethoden benützt: Fensterfalle, kleine Malaisefalle, Gelbschale und Bierfalle. Unter den 46 gefangenen Arten gehören 34 zu den Cerambyciden, 9 zu den Buprestiden und 3 zu den Lucaniden. Die Wälder, die nicht mehr bewirtschaftet werden, weisen keine reichere Totholzkäferfauna (Buprestidae, Lucanidae und Cerambycidae) als bewirtschaftete Wälder auf. Diese Fauna findet man bevorzugt auf Lichtungen. Arten, die als Urwaldrelikte gelten fehlen in den untersuchten Wäldern.

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NOTE

Nous n'avons pas pu tenir compte dans les tableaux 2 et 3 du travail de BENSE (1995), "Longhorn Beetles: Illustrated key to the Cerambycidae and Vesperidae of Europe", *Margraf, Weikerscheim*, 512 pp., qui nous est parvenu en cours d'impression.

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

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

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

Sex symbols should be used rather than "male" and "female".

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

References. The Harvard System must be used for the citation of references in the text, e.g. White & Green (1995) or (White & Green 1995). For references with three and more authors the form Brown *et al.* should be used. Authors' names should not be written in capitals. The list of references must include all publications in the text but only these. References must be listed in alphabetical order of authors, and both the title and name of the journal must be given in full in the following style:

Penard, E. 1888. Recherches sur le Ceratium macroceros. These, Genève, 43 pp.
Penard, E. 1889. Etudes sur quelques Héliozoaires d'eau douce. Archives de Biologie, 9:1-61.
Mertens, R. & H. Wermuth. 1960. Die Amphibien und Reptilien Europas, Kramer, Frankfurt am Main, XI + 264 pp.
Handley, C.O. Jr. 1966. Checklist of the mammals of Panama, pp. 753-795. In: Ectoparasites of Panama (R.L. Wenzel & V.J. Tipton, eds). Field Museum of Natural History, Chicago, XII + 861 pp.

References should not be interspaced and, in the case of several papers by the same author, the name has to be repeated for each reference.

The text should be in roman (standard) type face throughout, including headings, with genus and species names underlined with pencil; bold, small capitals, large capitals italics and other type faces should not be used. Footnotes and cross-references by page should be avoided.

Also, we encourage authors to submit the text on floppy disk (3,5'' or 5 1/4'', Macintosh or IBM compatible, with "Microsoft Word" or similar programmes). The authors should refrain from using special codes for text formating.

Tables. These should be self-explanatory, with the title at the top organised to fit 122 x 180 mm. Each table should be typed, double spaced, on a separate page and numbered consecutively and its position indicated in the text.

Figures. These may be line drawings or half tones and all should be numbered consecutively, and their position indicated in the text. Figures should be arranged in plates which can be reduced to 122 x 160 mm. Drawings and lettering should be prepared to withstand reduction. Magnification should be indicated with scale lines. Authors should refrain from mixing the drawings and half tones. Original drawings will not be returned automatically. The *Revue suisse de Zoologie* declines responsability for lost or damaged slides or other documents.

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