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ANNALES

DE LA

SOCIÉTÉ SUISSE DE ZOOLOGIE

ET DU

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Taxonomical revision of the species of *Hypostomus* Lacépède, 1803 (Siluriformes, Loricariidae) from the Lower rio Paraiba do Sul, State of Rio de Janeiro, Brazil

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Taxonomical revision of the species of *Hypostomus* Lacépède, 1803 (Siluriformes, Loricariidae) from the Lower rio Paraiba do Sul, State of Rio de Janeiro, Brazil. – A taxonomical revision of the nominal species of the loricariid catfish genus *Hypostomus* from the lower rio Paraiba do Sul (State of Rio de Janeiro, Brazil) is presented. Analysis of a large sample (over 2'000 specimens), collected monthly from March 1989 to February 1990, revealed that only two species were found in the area. *Hypostomus affinis* (Steindachner, 1876) and *Hypostomus luetkeni* (Steindachner, 1877) are the names applicable to these species. Lectotypes are designed, and the synonymies, redescriptions and illustrations are presented. The current taxonomical status of each nominal species is discussed.

Key-words: Pisces - Siluriformes - Loricariidae - Taxonomy - Brazil.

INTRODUCTION

The species of the Neotropical loricariid catfish genus *Hypostomus* Lacépède, 1803 are usually hard to identify. Old descriptions, with incomplete or poor characterization of species, are often useless for correct recognition. This has resulted in a proliferation of misidentifications, and currently several nominal species are available for every fluvial system analysed.

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The rio Paraiba do Sul, belonging to the Brazilian Eastern Basin, extends from the slopes of the Mantiqueira Mountain Range, in the State of São Paulo, to its mouth on the north of the State of Rio de Janeiro, after running for about 1'000 km.

This paper presents a taxonomical revision of the nominal species of the genus *Hypostomus* from the lower rio Paraíba do Sul. The study area (Fig. 1) comprises the rio Paraíba do Sul and its main tributaries, in the Municipalities of Três Rios, Além Paraíba, Cataguases, Itaocara, Nova Friburgo, Itaperuna and Campos, between 21°00' and 22°15' S, and 41°10' and 43°05' W, in the States of Rio de Janeiro and Minas Gerais, Southeastern Brazil.

MATERIAL AND METHODS

Type-specimens examined are housed in the fish collections of the Natural History Museum, London (BMNH), the Muséum national d'Histoire naturelle, Paris (MNHN) and the Naturhistorisches Museum, Wien (NMW). Voucher-specimens are in

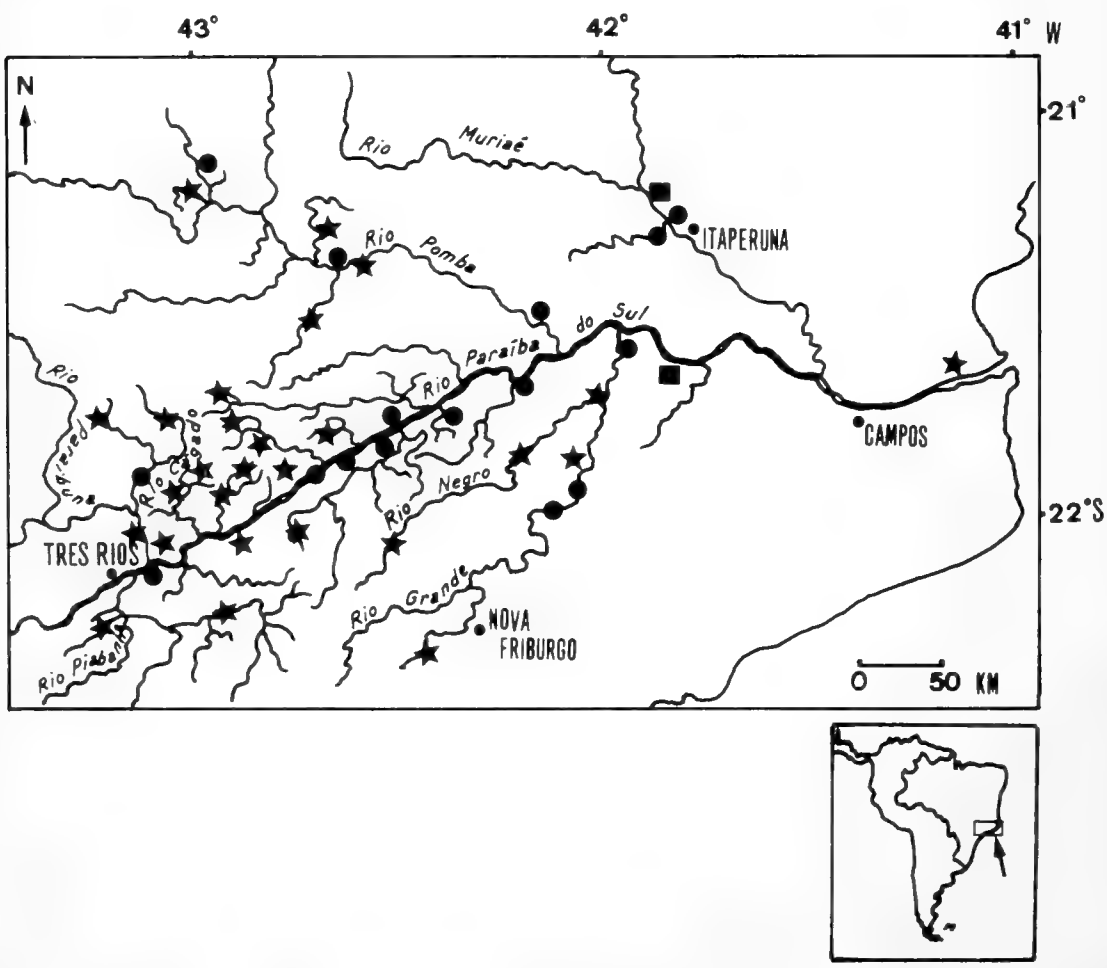

FIG. 1

Lower rio Paraíba do Sul, showing the localities reported for *Hypostomus affinis* (stars). *H. luetkeni* (squares), and the places where they are syntopic (dots); some marks represent more than one locality.

the Museu Nacional, Rio de Janeiro (MNRJ), and Museu de Zoologia, Universidade de São Paulo (MZUSP). In addition, over 2'000 specimens collected monthly from March 1989 to February 1990, during an analysis of the distributional and reproductive traits of the fish fauna of the study area, are deposited in the Departamento de Ecologia, Universidade Federal do Rio de Janeiro, Brazil (UFRJ), and were refered by CARAMASCHI (1991).

Measurements and terminology in Tables 2 and 3 follow WEBER (1985). Morphometric and meristic data were treated by routine statistical methods and processed with the the microcomputer program DATAX (REIS *et al.*,1990; REIS & FONTOURA, 1991). Abreviations are: L1 and L2, lower and upper confidence limits (CL); SD, standard deviation; SL, standard length.

RESULTS

Seven nominal species have been objectively recorded for the lower rio Paraíba do Sul system, a number that can be increased to twelve if more general regional citations were considered. The study of specimens, however, demonstrated that only two valid species are present. The analysis of the available names revealed that *Hypostomus affinis* (Steindachner, 1876) and *Hypostomus luetkeni* (1877) are the applicable ones to these species, as quoted below.

Hypostomus affinis (Steindachner) (Figs. 1 and 2; Tab. 1 and 2)

Plecostomus affinis Steindachner, 1876.

SPECIMENS EXAMINED:

Lectotype (by present designation): NMW 44041:1 (7190) (287.0 mm SL; alcohol preserved), collected at Campos (21°50' S, 41°20' W), rio Paraíba do Sul, State of Rio de Janeiro, Brazil, 1865 (registred in January 1874), by F. Hartt and E. Copeland (Thayer Expedition[1]).

Paralectotypes: NMW 44041: 2, 3, 4, 5, 6, 7 (225.0, 133.0, 109.8, 87.0, 110.3, 96.5 mm SL), same data as lectotype; NMW 55014: 1,2 (142.3, 186.0 mm SL) collected in rio Muriaé, States of Rio de Janeiro, Brazil by F. Hartt and E. Copeland (Thayer Expedition);NMW 44044:1, 2, 3 (199.3, 193.7, 176.2 mm SL), collected at Santa Clara, rio Mucuri, State of Bahia, Brazil, no date(registred in January 1874), by A. Wertheimer ; NMW 44326: 1, 2, 3 (180.9, 149.5, 108.5 mm SL), collected at the same locality, 1865 (registred in January 1874), by F. Hartt and E. Copeland (Thayer Expedition); NMW 44040 (287.0 mm SL), collected at Santo Antônio dos Ferros, State of Minas Gerais, Brazil, 1865, by F. Hartt and E. Copeland (Thayer Expedition).

Description: SL of examined specimens 78.0 to 397.0 mm; other meristic and morphometric data are presented in Table 2.

Head completely covered with small, juxtaposed dermal ossifications, except for a little naked area on tip of snout. Dorsal margin of orbit slightly elevated, continuing in

[1] Additional datas of Thayer Expedition from Dick (1977). Labels of NMW of Thayer's and Wertheimer's specimens bear January 1874, date of registration.

Fig. 2

Hypostomus affinis Steindachner, 1876. Lectotype, NMW 44041:1 (287.0 mm SL). (Photo: C. Weber)

a low ridge on post-temporal region. Interorbital space slightly convex. A low ridge on supraoccipital region, diverging in two separate ridges on predorsal plates. Posterior margin of supraoccipital bone bordered by one scute, sometimes subdivided in two or three portions. Body deep; dorsal profile raising abruptly from the tip of snout to the origin of dorsal fin, and gently descending from this point to the end of caudal peduncle.

Body covered by four rows of keeled scutes, forming four lateral ridges along flanks, progressively less conspicuous from anterior to posterior part of body, and disappearing on caudal peduncle region. Caudal peduncle ovate in cross-section; slightly flattened ventrally. Dorsal scutes between the end of dorsal fin base and adipose fin spine flattened in their dorsal portions.

Outer face of upper lip covered with small scutelets. Maxillary barbels normal. Teeth with short crown and small lateral cuspid, moderately numerous. Inner surface of lower lip covered with few, large papillae.

Pectoral fin with strong spine covered dorsally with odontodes anteriorly curved, specially in larger specimens. Abdomen and lower surface of head covered with minute scutelets, except in small specimens. Adipose fin with a strong spine, slightly curved. Margin of caudal fin concave; outer rays strong, medium-sized.

C o l o u r : In alcohol, colour pattern is given by many dark spots of variable diameter on a light-brown background; head covered by many small spots which increase in size as they grow away from the tip of the snout; all fins heavily spotted with two, sometimes one, row of black spots in inter-radial membranes. In life, specimens are commonly just like alcohol preserved ones, but also with a pattern of dark and clear transversal bands.

Hypostomus affinis belongs to the *plecostomus* group, as defined in MULLER & WEBER (1992) (see Table 2, mandibular ramus in head length, shape and count of teeth).

D i s t r i b u t i o n : Rio Paraíba do Sul basin (CARAMASCHI, 1991). For more detailed localities, see Appendix 1.

E c o l o g y : *Hypostomus affinis* was found in large and small waters, in lentic or rapids sections of the river, on rocky or sandy-rocky bottoms. Young specimens (to 50 mm SL) inhabit the riparian vegetation along those habitats.

C o m m e n t s : *Hypostomus affinis* was described by Steindachner (1876) based on a heterogeneous series of syntypes obtained from rio Mucuri, in the Municipality of Santa Clara, and from rio Mucuri without specific site, both localities in the State of Bahia, Brazil; from rio Santo Antônio at Santo Antônio dos Ferros, rio Doce basin in the State of Minas Gerais, Brazil; from rio Paraíba do Sul, in the Municipality of Campos, and from rio Muriaé, both localities in the State of Rio de Janeiro, Brazil.

By the present designation of the lectotype for this species, the type-locality is consequently restricted to Campos, in the rio Paraíba do Sul basin. The paralectotypes, coming from localities belonging to three distinct river basins, comprise a heterogeneous series.

Hypostomus luetkeni (Steindachner) Figs. 1 and 3. Tab. 1 and 3)

Plecostomus lima Steindachner, 1876 (non *Plecostomus lima* Reinhardt in Lükten, 1874).
Plecostomus lütkeni Steindachner,1877.
Plecostomus vermicularis Eigenmann & Eigenmann, 1888 (part).

SPECIMENS EXAMINED:

Lectotype (by present designation): NMW 44196:1 (906) (156.0 mm SL; alcohol preserved), collected in rio Paraíba do Sul and tributaries, State of Rio de Janeiro, Brazil,1865, by F. Hartt and E. Copeland (Thayer Expedition).

Paralectotypes: NMW 44196: 2, 3, 4, 5, 6, 7 (146.0, 144.0, 120.0, 111.0, 105.0, 83.0 mm SL), same data as lectotype; NMW 45014, same locality, no date, no collector; BMNH 89.11.14.50, MNHN 89-288 (259.5, 224 mm SL), collected at Santa Clara, rio Mucuri, State of Bahia, Brazil, 1865, by F. Hartt and E. Copeland (Thayer Expedition), from Mus. Comp. Zool. (registred in 1889[1]); NMW 44190 (295.7 mm SL), same locality, Brazil, no date, no collector; NMW 44199:1, 2, 3, 4, (257.0, 227.0, 185.0, 184.0 mm SL), same locality, no date, by A. Wertheimer.

Description: SL of examined specimens 82.0 to 286.0 mm; other meristic and morphometric data presented in Table 3.

Head completely covered with small, juxtaposed dermal ossifications, excluding a small naked area on tip of snout. Dorsal margin of orbit only slightly elevated, continuing in a low ridge on post-temporal region. Interorbital space flat. Supraoccipital and predorsal regions slightly convex, without ridges. Supraoccipital bone bordered by one scute subdivided in three portions. Body deep; dorsal profile raising from tip of snout to the origin of dorsal fin, and descending from this point to the end of caudal peduncle. Body covered with four rows of not keeled scutes. Caudal peduncle round in cross-section. Dorsal scutes between end of dorsal fin base and adipose fin spine flattened in their dorsal portions.

Outer face of upper lips covered with small scutelets. Maxillary barbels normal. Teeth with elongated crown and small lateral cuspid, numerous. Inner surface of lower lip covered with many little papillae.

Pectoral fin with strong spines covered dorsally with odontodes anteriorly curved, specially in larger specimens. Abdomen and lower surface of head covered with minutes scutelets, except in small specimens. Adipose fin with a strong spine, slightly curved. Margin of caudal fin concave; outer rays strong, medium-sized.

Colour: In alcohol, colour given by a plain brownish pattern; sometimes with one large light brown spot on each dorsal scute; head covered by many small brown spots which coalesce into vermiculations. All fins usually plain brownish, sometimes with some light brown spots. In life, the specimens are just like alcohol preserved ones, varying only in the intensity of colour pattern described above.

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[1] In 1870, Steindachner was invited by Agassiz in Cambridge (U.S.A.) to examine all fresh-water fishes of Thayer Expedition (Kähsbauer, 1959). Both specimens of BMNH and MNHN are to be regarded as typical specimens. Steindachner noted in the original description: "Museum zu Cambridge erhielt viele Exemplare durch die Herren Hartt und Copeland".

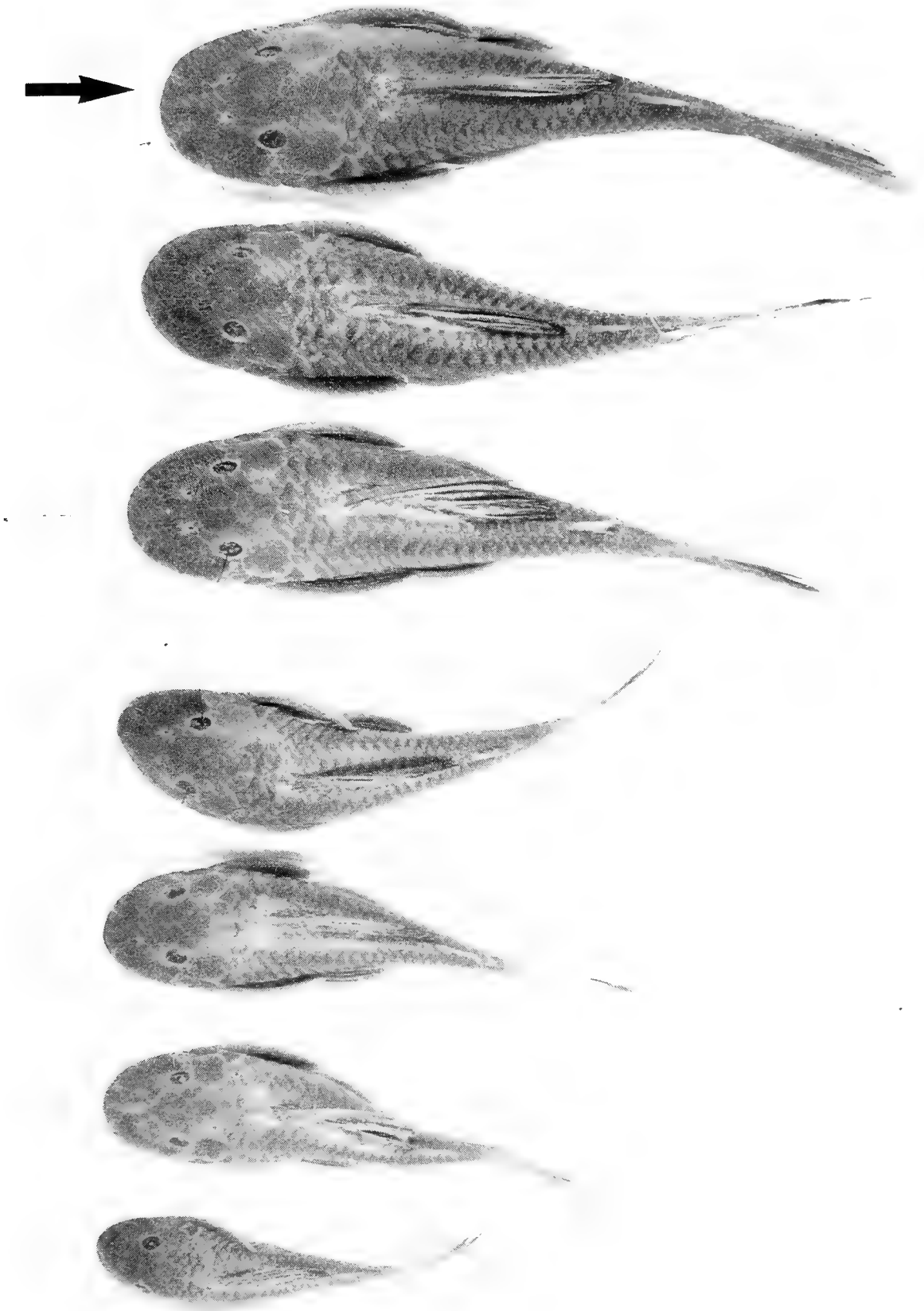

FIG 3

Hypostomus luetkeni Steindachner, 1877. Lectotype (arrow), NMW 44196: 1 (906) (156.0 mm SL). Paralectotypes, NMW 44196: 2 (146.0 mm SL), 3 (144.0 mm SL), 4 (120.0 mm SL), 5 (111.0 mm SL), 6 (105.0 mm SL), and 7 (83.0 mm SL). Photo: C. Weber.

Hypostomus luetkeni belongs to the *regani* group, as defined in MULLER & WEBER (1992) (see Table 3, mandibular ramus in head length, shape and count of teeth).

D i s t r i b u t i o n : Rio Paraíba do Sul basin (CARAMASCHI, 1991). For more detailed localities, see Appendix 1.

E c o l o g y : *Hypostomus luetkeni* is found mainly in big and rapid waters with rocky bottoms. Young specimens (to 50 mm SL) were not found during the study period.

C o m m e n t s : STEINDACHNER (1876) gave a complementary description of *Plecostomus lima* (Reinhardt *in* Lütken, 1874). This description was based on two syntypes of the species (NMW 44194-5) from *"rivulis flumini Rio das Velhas affluentibus"* [= Lagoa Santa (Ribeirão do Mato) on the label], rio São Francisco basin, and on other specimens from rio Santo Antônio, rio Mucuri and rio Pedra (= Pardo) (State of Bahia, Brazil), and rio Paraíba do Sul (State of Rio de Janeiro, Brazil). The "Rio Quenda", also cited by STEINDACHNER (1876) was not localized (cf. DICK, 1977; HIGUCHI, unpubl. ms.). One year later, he described *Plecostomus luetkeni*, for these specimens with the exception of those from the São Francisco basin.

By the present designation of the lectotype for the species, the type-locality is accordingly restricted to the rio Paraíba do Sul (State of Rio de Janeiro, Brazil). The paralectotypes comprise a heterogeneous series, and probably the specimens from other localities outside the rio Paraíba do Sul basin, do not belong to the species.

Plecostomus vermicularis Eigenmann & Eigenmann, 1888 was described based on 37 specimens proceeding from "Rio Parahyba; Rio de Janeiro; Mendez; Macacos; Goyaz" (EIGENMANN & EIGENMANN, 1888, 1890; ISBRÜCKER, 1980). All localities, except "Goyaz" (referring to upper course of the rio Vermelho at Goyaz, rio Araguaia drainage, State of Goias; see Isbrücker, 1973), are in the State of Rio de Janeiro, and two of them are definitively in the rio Paraíba do Sul basin ("Rio Parahyba", and "Mendez", currently Municipality of Mendes, State of Rio de Janeiro, Brazil). The locality "Rio de Janeiro" could represent the homonyms State or Municipality of Rio de Janeiro, and "Macacos" showed to be very inaccurate and currently not recognizable. The original diagnosis (EIGENMANN & EIGENMANN, 1888), subsequent description (EIGENMANN & EIGENMANN 1890), and the syntype of *Plecostomus vermicularis* from rio Parahyba, housed in the BMNH (1904.1.28.5), perfectly agree with *Hypostomus luetkeni*. Consequently, we conclude that at least part of the type-specimens of *Plecostomus vermicularis* belong to *Hypostomus luetkeni*. The formal designation of a lectotype for *Plecostomus vermicularis* will definitively solve the problem.

DISCUSSION

The large number of nominal species of *Hypostomus* (or under its synonym *Plecostomus*) cited for the rio Paraíba do Sul in literature deserves some comments. Only two species were objectively identified in the large sample examined. *H. affinis*

and *H luetkeni*, although five other names were explicitly given for the rio Paraíba do Sul, a list which could be amplified to nine species names if more generalized regional accounts were considered. These citations were generated by synonymies and by misidentifications repeated in subsequent works.

Of the extant five nominal species of the rio Paraíba do Sûl, *Plecostomus lima* Steindachner, 1876 (*non* Lütken) was in part (see above) substituted by *Plecostomus lütkeni* Steindachner, 1877 (= *Hypostomus luetkeni*), and *Plecostomus vermicularis* Eigenmann & Eigenmann, 1888 is a very plausible junior synonym of the same species. LOPEZ & MIQUELARENA (1991) reported the occurrence of *H. luetkeni* for Salto Grande, rio Uruguay, Argentina; according to a geographical rationale, this register, based on a single specimen, probably is erroneous, and caused by a misidentification.

Plecostomus auroguttatus Natterer & Haeckel *in* KNER, 1854 has no original type-locality, but STEINDACHNER (1881) stated that the type-specimen is definitively from the rio Paraíba do Sul. This citation was followed by EIGENMANN & EIGENMANN (1890) and REGAN (1904). However, GOSLINE (1947) reported that, in spite of his efforts, nothing similar to *P. auroguttatus* was found among the hundreds of specimens obtained from several points in the upper rio Paraíba do Sul. The analysis of a large sample proceeding from the lower rio Paraíba do Sul, reported in this paper, did not indicated any specimens related to the above mentioned species (which has a colour pattern of white or cream-white spots on a dark background). One of us (WEBER 1986 a, unpubl.ms.) reported the occurence of *H. auroguttatus* for the rio Paraná system in the Departamento Alto-Paraná, Paraguay.

Hypostomus commersonii Valenciennes *in* CUVIER & VALENCIENNES, 1840, was cited for the rio Paraíba do Sul by several authors (STEINDACHNER, 1876; EIGENMANN & EIGENMANN, 1888, 1890; REGAN, 1904; MIRANDA-RIBEIRO, 1911, 1918). Its type-locality was restricted by one of us (WEBER, 1986 b) to Rio de La Plata, Montevideo, Uruguay. The species does not occur in the rio Paraíba do Sul, and the citations above mentioned probably were based on misidentifications. Although they inhabit two distinct systems, similarities between *Hypostomus commersonii* and *Hypostomus affinis* deserve a special attention (as the similarities existing between *Hypostomus plecostomus* of Guyana and *Hypostomus boulengeri* of Paraguay basin). There are only few morphological differences (slightly smaller abdomen length for *Hypostomus commersonii* - 4.7-5.7 mean 5.2 (REIS *et al.*, 1990) against 3.8 - 5.1, mean 4.5). Neither meristic characters nor the colour pattern (important individual variations) are discriminating. Supplementary material and application of new technics may clear up the affinities of *Hypostomus affinis* with *Hypostomus commersonii*.

VALENCIENNES (*in* CUVIER & VALENCIENNES, 1840) described *Hypostomus punctatus* based on a specimen collected at Rio de Janeiro by M. Gaudichaud. REGAN (1904), STIGCHEL (1947) and FOWLER (1954), synonymized *Hypostomus affinis* Steindachner with *Hypostomus punctatus* Valenciennes, with the consequence that this last species was cited for the rio Paraíba do Sul. According to PAPAVERO (1971), Gaudichaud collected only in the vicinity of the city of Rio de Janeiro, and so that it is

very unprobable that the specimen referred by Valenciennes comes from the rio Paraíba do Sul . Consequently, *Hypostomus punctatus* Valenciennes is an available name which refers to one species occuring in the coastal rivers of the State of Rio de Janeiro. Unfortunately the type was not found in MNHN at Paris and the original description is so poor that it is of no use. *Hypostomus rachovii* (Regan, 1913) was also described from near Rio de Janeiro, and may prove to be a junior synonym of *H. punctatus*.

Hypostomus subcarinatus Castelnau, 1855 was described from "des rivières de la province des Mines" (currently, rivers of the State of Minas Gerais), a type-locality very inaccurate considering the extension of the area explored by Castelnau, which involves sections of several river basins, including part of the rio Paraíba do Sul system. The species, however, have not been cited for this basin, and was treated as synonym of *H. commersonii* by EIGENMANN & EIGENMANN (1888, 1890), and of *H. punctatus* by REGAN (1904), FOWLER (1943), and GOSLINE (1945).

Three other nominal species, *Plecostomus wuchereri* Günther, 1864, *Plecostomus johnii* Steindachner, 1876, and *Plecostomus vaillanti* Steindachner, 1877, have been referred to Rio de Janeiro. The first one, described from "Bahia, Brazil", was erroneously considerer a senior synonym of *Plecostomus vermicularis* Eigenmann & Eigenmann by REGAN (1904) and FOWLER (1954), and of *Plecostomus luetkeni* by MIRANDA-RIBEIRO (1918). However, *Hypostomus wuchereri*, of the *regani* group, is a name applicable to a species occurring in Northeastern Brazil, and was not currently recorded to the State of Rio de Janeiro.

Plecostomus johnii was described on the basis of specimens collected at the rio Poti (= rio Puty) and rio Preto by the Thayer Expedition. The rio Poti is a tributary of the rio Parnaíba, in the State of Piauí, and the rio Preto belongs to the rio São Francisco system. The citation of *P. johnii* for Rio de Janeiro, in Southeastern Brazil was caused by the erroneous synonymyzation of the species with *Plecostomus auroguttatus*, proposed by EIGENMANN (1910) and followed by FOWLER (1954).

Finally, *Plecostomus vaillanti* (type-locality, rio Preto, in the rio Parnaíba drainage) was recorded from Rio de Janeiro by FOWLER (1954); this citation was probably due to the reference of EIGENMANN & EIGENMANN (1889, 1890) to the occurrence of the species in "Rio Puty; Rio Preto; San Gonçallo". The rio Poti and rio Preto, as seen above, respectively belong to the rio Parnaíba and rio São Francisco systems, and São Gonçalo is situated next to the rio Poti. Fowler probably confused that last reference, with another locality also named São Gonçalo, that one in the State of Rio de Janeiro. *Plecostomus vaillanti* is a name applicable to a species occuring in the rio Parnaíba drainage, and possibly also in the rio São Francisco system, but not to the rivers in the State of Rio de Janeiro.

IDENTIFICATION

The two recognized species from the rio Paraiba do Sul Bassin are distinguished easily one from the other by the datas given in table 1. Nevertheless, it can be asserted

that these characters define more the respective group (*plecostomus* and *regani* group, in study by the third author) than the species and it seems somewhat prematured to open the discussion on characters and relationships between the species of each group, far from to be clearly established.

OTHER SPECIMENS EXAMINED:

Plecostomus group:

Holotype of *P. rachovii* Regan, 1913, BMNH 1913.10.30.15 (100.5 mm SL, alcohol preserved), collected near Rio de Janeiro by A. Rachow.

Regani group:

Syntypes of *P. johni* Steindachner, 1876, NMW 44191:1,2, NMW 44193:1,2 (118.9, 105.6,102.1, 95.0 mm SL, alcohol preserved), collected in rio Preto, 1865 (registred Jan. 1874), by F.Hartt & E. Copeland (Thayer Exped.); 44192:1,2 (103.6, 88.4 mm SL, alcohol preserved), collected in rio Puty, no date (registred Jan. 1874), by O. St John (Thayer Exped.).

Syntype of *P. lima* Reinhardt, 1874, NMW 44195 (93.8 mm SL, alcohol preserved), collected near Lagoa Santa in Riberão do Mato (under stones), no date (registred Jan. 1874), collected by J. Reinhardt.

Syntypes of *P. vermicularis* Eigenmann & Eigenmann, 1888, NMW 44279 (190.0 mm SL, alcohol preserved) collected at "Goyaz", no date, by Honorio. (Thayer Exped., received from Museum of Cambridge in 1889); BMNH 1904.1.28.5 (84.1 mm SL, alcohol preserved), collected in rio Parahyba, 1865, by F. Hartt & E. Copeland (Thayer Exped.)

Syntype of *P. wuchereri* Günther, 1864, BMNH 186.3.27.15. (198.9 mm SL, alcohol preserved), collected at "Bahia", by O. Wucherer.

Syntypes of *P. vaillanti* Steindachner, 1877, NMW 44273, 43276:1,2,3. (134.0, 112.2, 97.0, 71.8 mm SL, alcohol preserved), collected in rio Preto, no date (registred Jan. 1874), no collector.

TABLE I

Main comparating datas for *H. affinis* and *H. luetkeni*, with means in brackets.

Characters	H. affinis	H. luetkeni
Number of scales in lengh	28-31	26-29
Number of post-supraoccipital plates (main)	1	2-3
Four lateral ridges on flanks	yes	no
Number of teeth (right premaxilla)	smaller (30.5)	larger (54.2)
Mandibular ramus (in head lenght)	smaller (7.6)	larger (5.1)
Eye (in head lenght)	smaller (7.0)	larger (6.2)
Caudal peduncle (depth in SL)	lower (11.4)	deeper (9.6)

TABLE II

Morphometric and meristic data of *Hypostomus affinis* of the Lower Paraíba do Sul River.

Character	lectotype	n	Range low	Range high	Range mean	95% CL$ L1	95% CL$ L2	SD
Standard Length (mm)	285.0	37	87.0	285.0	179.2			42.992
			Ratios of Std. length					
Predorsal distance	2.9	37	2.4	2.9	2.7	2.672	2.774	
Head length	3.8	37	3.1	3.8	3.4	3.390	3.495	
Cleithral width	4.4	37	3.1	4.4	3.9	3.788	3.942	
Length of dorsal fin spine	3.6	36	2.9	3.7	3.1	3.066	3.222	
Length of dorsal fin base	4.2	37	3.4	4.4	3.8	3.763	3.924	
Dorsal base to adipose spine	4.6	37	4.3	5.6	5.0	4.871	5.079	
Trunk length	4.3	37	3.5	4.9	4.1	3.999	4.174	
Pectoral fin spine length	4.0	37	3.0	4.0	3.6	3.515	3.667	
Abdominal length	4.6	37	3.8	5.1	4.5	4.437	4.645	
Pelvic fin spine length	4.5	37	3.6	4.6	4.1	4.062	4.228	
Caudal peduncle length	4.0	37	2.8	4.0	3.0	2.961	3.093	
Caudal peduncle depth	12.8	37	10.1	12.8	11.4	11.234	11.655	
Adipose fin spine length	14.9	37	11.9	17.6	13.8	13.369	14.215	
Upper caudal ray length	3.0	31	2.8	3.8	3.2	3.079	3.260	
Lower caudal ray length	2.8	30	2.6	3.6	3.1	2.972	3.154	
			Radios of head length					
Head depth	1.7	37	1.5	1.9	1.7	1.679	1.757	
Snout length	1.8	37	1.5	1.8	1.7	1.655	1.692	
Horizontal eye diameter	8.1	37	5.3	8.1	7.0	6.831	7.229	
Least interorbital width	2.7	37	2.3	2.9	2.5	2.501	2.580	
Right mandibular ramus	7.9	36	5.3	10.2	7.6	7.272	7.962	
			Counts					
Series of lateral scutes	31	37	28	31	28.8			0.750
Predorsal scutes	3	35	3	4	3.5			0.169
Scutes at dorsal fin base	7	34	7	10	8.4			0.743
Teeth on left premaxilla	43	37	21	43	31.2			5.773
Teeth on right premaxilla	43	37	21	43	30.5			5.268
Teeth on left dentary	39	37	23	44	32.5			5.419
Teeth on right dentary	41	37	23	44	33.4			5.683
Plates bordering supraoccipital	1	37	1	1	1.0			0

TABLE III

Morphometric and meristic data of *Hypostomus luetkeni* of the Lower Paraíba do Sul River.

Character	lectotype	n	Range low	Range high	Range mean	95% CL$ L1	95% CL$ L2	SD
Standard Length (mm)	156.0	24	83.0	229.0	172.0			39.387
			Ratios of Std. length					
Predorsal distance	2.6	24	2.5	3.0	2.7	2.691	2.797	
Head length	3.2	24	2.9	3.6	3.4	3.319	3.497	
Cleithral width	3.6	24	3.3	4.0	3.6	3.562	3.706	
Length of dorsal fin spine	3.2	24	2.9	3.7	3.2	3.092	3.283	
Length of dorsal fin base	4.2	24	3.5	4.3	3.8	3.727	3.908	
Dorsal base to adipose spine	6.2	24	5.1	6.5	5.8	5.667	5.989	
Trunk length	4.7	24	3.8	5.3	4.5	4.302	4.607	
Pectoral fin spine lenth	3.5	24	3.1	3.8	3.4	3.333	3.497	
Abdominal length	3.9	24	3.9	4.6	4.2	4.126	4.266	
Pelvic fin spine length	4.0	24	3.7	4.5	4.0	3.908	4.108	
Caudal peduncle length	3.1	24	2.8	3.1	2.9	2.894	2.969	
Caudal peduncle depth	10.1	24	5.6	10.6	9.6	9.247	10.034	
Adipose fin spine length	11.0	24	7.6	12.6	11.0	10.595	11.463	
Upper caudal ray length	3.5	19	3.2	3.8	3.5	3.378	3.538	
Lower caudal ray length	2.9	19	2.9	3.5	3.2	3.035	3.269	
			Radios of head length					
Head depth	2.0	24	1.6	2.2	1.9	1.798	1.919	
Snout length	1.6	24	1.5	1.9	1.6	1.569	1.664	
Horizontal eye diameter	5.6	24	5.0	7.3	6.2	5.948	6.490	
Least interorbital width	2.8	24	2.6	3.1	2.8	2.752	2.874	
Right mandibular ramus	4.3	24	3.2	6.5	5.1	4.643	5.464	
			Counts					
Series of lateral scutes	26	24	26	29	27.3			0.868
Predorsal scutes	3	24	3	3	3.0			0.000
Scutes at dorsal fin base	8	24	8	10	8.5			0.588
Teeth on left premaxilla	56	24	30	69	52.8			11.305
Teeth on right premaxilla	58	24	38	69	54.2			9.632
Teeth on left dentary	49	24	42	68	55.5			9.031
Teeth on right dentary	51	24	38	68	54.5			9.996
Plates bordering supraoccipital	3	24	2	3	2.6			0.504

APPENDIX 1

Rivers, localities and coordinates reported for *Hypostomus affinis* and *Hypostomus luetkeni* from Lower Paraíba do Sul River, (adapted from CARAMASCHI, 1991).

RIVER	LOCALITY	COORDINATES	*H. AFFINIS*	*H. LUETKENI*
Preto	Faz. Sta. Genoveva	22°07'S; 43°29'W	X	
Cágado	Chiador	22°01'S; 43°09'W	X	X
	Ericeira	22°00'S; 43°09'W	X	
	Caguinho	21°59'S; 43°10'W	X	
	Mar de Espanha	21°51'S; 43°02'W	X	
Paraibuna	Três Rios	22°06'S; 43°11'W	X	X
Paraíba do Sul	Pontal	22°07'S; 43°09'W	X	X
Piabanha	Paraiba do Sul	22°13'S; 43°10'W	X	
Calçado	Três Rios	22°06'S; 43°04'W	X	
	Bemposta	22°07'S; 43°10'W	X	
Macuco	Chiador	22°02'S; 43°01'W	X	
	Chiador	22°01'S; 43°01'W	X	
	Mar de Espanha	21°58'S; 43°01'W	X	
Paraíba do Sul	Areia	22°00'S; 43°55'W	X	
	Areia	22°01'S; 43°00'W	X	
	Areia	21°56'S; 42°57'W	X	
	Cachoeirinha	21°55'S; 42°56'W	X	
	Areia	21°55'S; 42°58'W	X	
	Lagoa Marginal	21°57'S; 42°53'W	X	
	Sapucaia	21°56'S; 42°52'W	X	X
	Ribeirão do Peixe	21°54'S; 42°58'W	X	
	Além Paraíba	21°54'S; 42°43'W	X	X
Paquequer	Carmo	21°53'S; 42°38'W	X	X
	Glória	21°55'S; 42°35'W	X	
	Glória	21°54'S; 42°33'W	X	
	Sumidouro	22°05'S; 42°45'W	X	
São Francisco	Sapucaia	22°02'S; 42°47'W	X	
Aventureiro	Marinópolis	21°46'S; 42°45'W	X	
	Cachoeira	21°46'S; 42°46'W	X	
São Geraldo	Boa Vista	21°48'S; 42°38'W	X	
Paraíba do Sul	Monte Alegre	21°52'S; 42°34'W	X	
	Volta Grande	21°51'S; 42°36'W	X	X
	Porto Velho do Cunha	21°50'S; 42°34'W		X
Angú	Senador Cortes	21°44'S; 42°54'W	X	
Paraíba do Sul	Coronel Teixeira	21°42'S; 42°07'W	X	X
Pomba	Baltazar	21°31'S; 42°08'W	X	X
	Cataguases	21°25'S; 42°39'W	X	
	Cataguases	21°31'S; 42°44'W	X	X
	Meia Pataca	21°21'S; 42°40'W	X	
Pardo	Cataguases	21°29'S; 42°46'W	X	
Novo	Calaguases	21°24'S; 42°46'W	X	X
Pomba	Astolfo Dutra	21°18'S; 42°50'W	X	
Paraopeba	Pirapetinga	21°17'S; 42°58'W	X	
	Astolfo Dutra	21°17'S; 42°56'W	X	X
Dois Rios	Pogo Dantas	21°38'S; 41°51'W	X	X
Negro	Itaocara	21°45'S; 41°57'W	X	
	Itaocara	21°49'S; 42°07'W	X	
	Duas Barras	22°00'S; 42°27'W	X	
Grande	São Sebastião do Alto	21°52'S; 42°02'W	X	
	São Sebastião do Alto	21°56'S; 42°07'W	X	X
	São Sebastião do Alto	22°00'S; 42°07'W	X	X
	São José	22°12'S; 42°24'W	X	
Paraíba do Sul	São Fidélis	21°40'S; 41°45'W	X	X
Muriaé	Itaperuna	21°15'S; 41°45'W	X	X
São Domingos	Itaperuna	21°16'S; 41°47'W	X	
	Itaperuna	21°16'S; 41°48'W		X
Glória	Muriaé	21°08'S; 42°20'W	X	
Paraíba do Sul	Cataia	21°41'S; 41°08'W	X	

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RESUMO

É apresentada a revisão taxonômica das espécies nominais do gênero *Hypostomus* (Loricariidae) do trecho inferior do rio Paraíba do Sul, Estado do Rio de Janeiro, Brasil. A análise de grande amostra (mais de 2'000 exemplares), coletada mensalmente entre março de 1989 e fevereiro de 1990, revelou que apenas duas espécies são encontradas na área. *Hypostomus affinis* (Steindachner, 1876) e *Hypostomus luetkeni* (Steindachner, 1877) são os nomes aplicáveis a essas espécies. Lectótipos são designados e são apresentadas as sinonimias, redescriçoes e illustrações. A atual posição taxonômica de todas as espécies nominais é discutida.

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New species and records of Scaritinae from the Himalayas (Coleoptera, Carabidae)

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New species and records of Scaritinae from the Himalayas (Coleoptera, Carabidae). – Five new species of Scaritinae from the Himalayas are described and illustrated: *Haplogaster granulipennis* spec. nov. (Bhutan), *Dyschirius sonamargensis* spec. nov. (Kashmir), *D. (Reicheiodes) convexipennis* spec. nov. (Nepal), *D. (R.) loebli* spec. nov., (Nepal) and *D. (R.) marginicollis* spec. nov. (Nepal). Their relationships to other species are discussed. In addition, new records of 21 species of Scaritinae from the Himalayas are given.

Key-words: Coleoptera - Carabidae - Scaritinae - Taxonomy - Himalayas.

INTRODUCTION

Information on material of Himalayan Scaritinae beetles is too scarce for a comprehensive faunal revision. New records and descriptions are rare since ANDREWES (1926, 1929, 1930, 1936) with some by ZNOIKO (1930), LANDIN (1955), JEDLICKA (1964, 1965), HABU (1973), and CASALE (1979, 1980).

Examination of undetermined material of Scaritinae from different regions of the Himalayas and from southern feet of these mountain chains revealed new records and five remarkable new species. The specimens had been collected during eight expeditions between 1976 and 1988, performed by the Muséum d'Histoire naturelle, Genève, Staatliches Museum für Naturkunde, Stuttgart[1], and Naturhistorisches Museum Basel. The new species are described and compared to related species. Additional material was studied from five private expeditions, carried out separately by Mr. K. Werner, Peiting near Munich, and Dr. F. Baum, Staufen near Freiburg (both Germany), carried out between 1984 and 1991.

The material at hand consists of 259 specimens belonging to 26 species.

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[1] Results of the Himalaya Expeditions of J. Martens.

Manuscript accepted 21.04.1993.

Material is deposited in following collections:

CBA	Collection of author (Denzlingen near Freiburg, Germany)
CBS	Collection Dr. Frank Baum (Staufen near Freiburg, Germany)
MHNG	Muséum d'Histoire Naturelle (Genève, Switzerland)
NHMB	Naturhistorisches Museum Basel (Switzerland)
SMNS	Staatliches Museum für Naturkunde (Stuttgart, Germany)

General distribution are cited from ANDREWES (1929), BÄNNINGER (1937, 1938), KULT (1951), and my own notes, made according to determinations during the past few years.

Haplogaster ovata Chaudoir (Figs 1-4)

1879 *Haplogaster ovatus* Chaudoir, Monogr. des Scaritides (Scaritini). Prem. partie, 22: 150.

Material examined: E. Nepal, Arun Vally, Arunthan Mure, 1300 m, 09.VI.1983. Mure-Chichila, 1800-1900 m, 18.VI.1983; Mure, 2000 m, 02-08.VI.1983, all leg. M. Brancucci (NHMB/CBA); Centr. Nepal, Marsyandi Valley, Khudi, forest, 1500 m, 02.VI.1982, leg. F. Baum (CBS); Nepal, Sankhua Distr., Arun Valley between Mure and Hurure, mixed broad-leaved forest, 2050-2150 m, 09-17.VI.1988, leg. J. Martens & W. Schawaller (SMNS); W. Nepal, Chitre-Tatopani, 1100-2500 m, 11.VI.1984, leg. C.J. Rai (NHMB).

Remarks: The species is distributed in North-East India, Nepal, and Bhutan.

Among these 32 specimens examined (♂ and ♀) some variability could be observed in the base of pronotum (more or less produced), the number of setigerous punctures on the third interval of elytra, and the form and surface of intervals at apex. This seems to be typical for the species and had been reported also by ANDREWES (1929) and BÄNNINGER (1935, 1937).

In addition, it has been observed that in the anterior three-quarters of elytra, the form and surface of intervals do not show this variability. The reticulation between all striae consists of fine isodiametric meshes, the surface is smooth and granulation is only present at base and marginal channel. The whole surface is a little bit dull but not completely; the light still reflects and making the surface therefore a bit shiny.

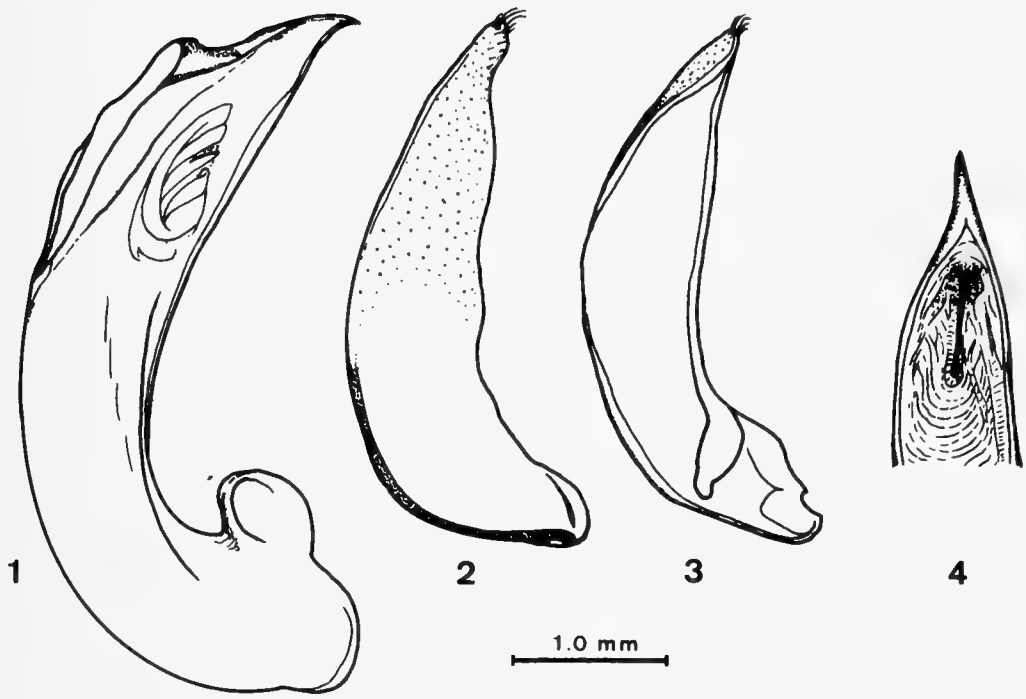
Ala atrophied to minute rudiment. Aedeagus (Figs 1, 4) big, strongly sclerotized, evenly curved at middle, acute and curved at apex (lateral view), nearly straight at apex (dorsal view). Parameres (Figs 2, 3) broad, conspicuous punctures on apical half of dorsal and ventral surface respectively, spatulate at apices. Left paramere twisted at apex.

Haplogaster granulipennis spec. nov. (Figs 5-8)

Type material: Holotype: ♂, Bhutan, Domphu-Gopani, 1400 m, VII-IX.1983, leg. C.J. Rai (NHMB).

DESCRIPTION:

Measurements: Length without mandibles 20.7 mm, including opened mandibles 24.4 mm, width 7.5 mm, ratio length/width of pronotum 0.65, ratio length/width of elytra 1.56.



FIGS 1-4

Haplogaster ovata Chaudoir, 1879 - 1) Aedeagus, left lateral view - 2, 3) Right and left paramere; - 4) Apex of aedeagus, dorsal view.

C o l o u r : Black; head and pronotum dull shiny, elytra dull without any lustre; palpi fuscous, apex of four posterior tibiae and tarsi fuscous; ventral surface black.

H e a d : Rectangular, a third wider than long. Anterior margin of clypeus bidentate; clypeal suture distinct in total, some striae laterally to clypeal setigerous punctures and at middle. Supraantennal plates vaulted, smooth, projecting a little laterally as obtuse preocular angles, margined finely from angles to eyes, truncate and unmargined from angles to base of mandibles. Frontal furrows deep, straight, posteriorly reaching level of hind eye margin, converging a little posteriorly, prolonged to neck in some fine converging and diverging longitudinal striae. Frons between frontal furrows with one fine stria parallel to each furrow, thought furrows doubled, nearly smooth; some longitudinal weak striae between frontal furrows and eyes. Genae as long as eyes, not projecting higher than eyes, separated from eyes by a obtuse furrow, second stria-like weak furrow at middle, surface covered with fine isodiametric meshes. Neck with some short irregular striae, very fine isodiametric meshes at sides. Mandibles (opened position) as long as head, strongly curved in apical third, striate with exception of longitudinal field between median and lateral carina, with wide bifid basal tooth each, left one separated from very small apical tooth by deep emargination, right one with conspicuous apical tooth. Mentum covered

densely with granula and fine isodiametric meshes, not sharp but distinctly margined from base to tooth, margin interrupted at apex of lobes, carina of conspicuous tooth prolonged to two-thirds of mentum.

P r o n o t u m : Convex, cyathiform, a seventh wider than head, a third wider than long, nearly as wide as elytra. Sides evenly rounded from anterior angles to knob-like tooth at hind angles, gently rounded to base without angle at tooth. Front angles conspicuous, faintly rounded. Base not produced, nearly straight, margin thickened, crenate. Sides with one anterior and one postangular setigerous puncture. Anterior transverse line distinct, interrupted at middle, broader at sides, joining lateral channel in front angles. Median line conspicuous, passing shortly through anterior transverse line without joining it. Basal foveae clearly visible, densely transversally striate. Basal area flattened, scabrous. Anterior margin covered closely by longitudinally sharp striae. Surface with some fine transverse wrinkles, more distinct at median line, covered in total by fine isodiametric reticulation.

E l y t r o n : Anterior half flattened, convex at side, strongly convex in posterior half; a third longer than width of both elytra, widest shortly behind middle. Side evenly rounded from humeral tooth to apical fourth, more strongly rounded from humeral tooth to base and in apical fourth. Margin reflexed, carinate. Humerus somewhat rounded, humeral tooth conspicuous, formed by thickened margin. Base formed by obtuse rectangular carina, very steeply declivity from carina to pedunculus, small umbilicate area posteriorly to carina. Striae moderately deep, impunctate, 1 to 5 reaching umbilicate area at base, striae 2 and 5, 3 and 4 joining at apex, 6 and 7 shortened apically. Intervals moderately convex, 1 and 2 somewhat flattened. Four to five discal setigerous punctures adjoining stria 3. Surface scabrous, covered by fine isodiametric reticulation, finely granulate in total, more densely at base and in marginal channel; surface absolutely dull, light not reflecting.

A l a : Atrophied to spatulate rudiment of 1.1 mm in length.

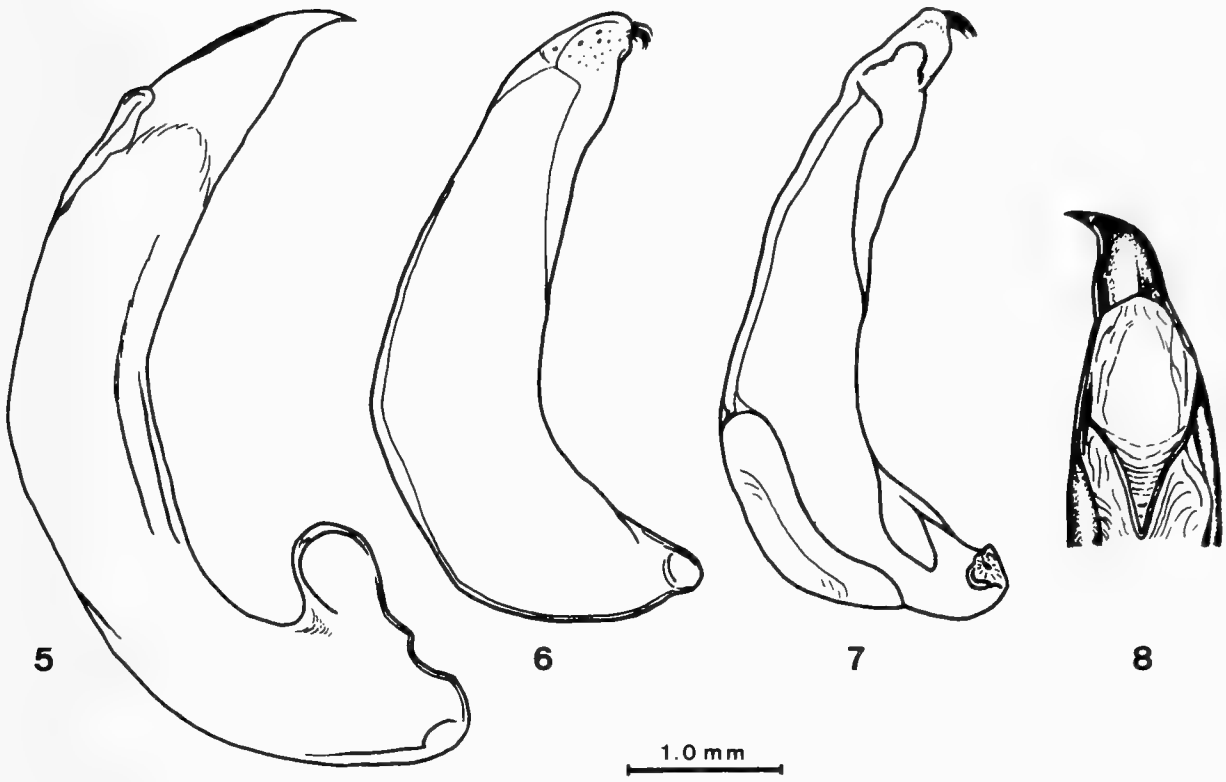
L e g s : Anterior tibia with two lateral preapical denticles, denticulation acute, curved ventrally. Mesotibia with two spurs, apical one elongate, three times longer than width at base, somewhat removed from apex; preapical spur scharp, a little longer than width at base, at some distance from other much smaller lateral denticulation; teeth of lateral denticulation close together, saw-like, each of them shorter than width at base.

A e d e a g u s (Figs 5-8): Big, strongly sclerotized, curvature slightly fractue at middle, acute and curved at apex (lateral view), strongly arcuate at apex (dorsal view). Both parameres big, broad, not spatulate at apex, some punctures on ventral surface of right paramere visible et apex (arrangement see figs. 6, 7).

D e r i v a t i o n o f n a m e : The name refers to the presence of granula within reticulation of elytra.

R e m a r k s : *Haplogaster granulipennis* spec. nov. seems to be closely related to *Haplogaster ovata* Chaudoir 1879. It differs from *H. ovata* in the surface of elytra, mentum, and base of pronotum. Beside this *H. granulipennis* possesses a second spur at mesotibia and the shape of aedeagus and parameres is different.

(It should be mentioned that in ANDREWES (1929) p. 222, Fig. 37 does not give a realistic impression of *Haplogaster ovata* Chaudoir.)



FIGS 5-8

Haplogaster granulipennis spec. nov., holotype. - 5) Aedeagus, left lateral view; - 6, 7) Right and left paramere; - 8) Apex of aedeagus, dorsal view.

Scarites (Parallelomorphus) inconspicuus Chaudoir

1855 *Scarites inconspicuus* Chaudoir, Bull. Soc. Imp. Nat. Moscou, 28 (1): 82.

Material examined: India, Uttar Pradesh, Rishikesh, VII. 1986, leg. K. Werner (CBA).

Remarks: The species is distributed from Northeast India and parts of Central India to Kashmir.

Scarites (Parallelomorphus) indus Olivier

1795 *Scarites indus* Olivier, Ent. Hist. Ins., Paris, III: (36): 9;
1813 *Scarites mancus* Bonelli, Mém. Acad. Sci. Turin, 20: 473;
1921 *Scarites terricola* Andrewes, Rec. Indian Mus., 22: 339.

Material examined: India: Kashmir, Jammu, VII. and VIII. 1986, leg. K. Werner; Uttar Pradesh, Rishikesh, VII. 1986, leg. K. Werner (all CBA).

Remarks: Apparently a very common species, which is distributed from Assam, Sikkim, Nepal to Kashmir, and in whole Central and South India. Recorded in Sri Lanka also.

Scarites (Parallelomorphus) subnitens Chaudoir

1855 *Scarites subnitens* Chaudoir, Bull. Soc. Imp. Nat. Moscou, 28 (1): 87.

Material examined: India, Uttar Pradesh, Rishikesh, VIII. 1984, leg. K. Werner (CBA).

Remarks: The record belongs to the west border of the distribution area. The species occurs in Bruma, northern and middle parts of India and Nepal.

Scarites (Parallelomorphus) punctum Wiedemann

1823 *Scarites punctum* Wiedemann, Zool. Mag., 2 (1): 38;
1855 *Scarites opacus* Chaudoir, Bull. Soc. Imp. Nat. Moscou, 28 (1): 88.

Material examined: Nepal, Dhading Distr., Ankhu Khola Valley, Ankhu Sangu to Sellentar, bank of river, cultivated land, 530-750 m, 26.VI.1983, leg. J. Martens & W. Schawaller (SMNS); India, Uttar Pradesh, Rishikesh, 450 m, 03-10.VII.1988, and VII. 1991, leg. K. Werner; 500 m, 03-10.VII.1988, leg. Richter (all in CBA). W. Nepal, Kashi Distr., Kali Gandaki, Suikhet-Chandrakot, 1000-1600 m, 08.VI.1986, leg. C. Holzschuh (NHMB).

Remarks: The species is distributed in Assam, Bengal, Nepal, and Punjab.

Scarites (Distichus) laticeps Andrewes

1929 *Scarites laticeps* Andrewes, Fauna Brit. Ind., Col.: Carab., I: 283.

Material examined: Nepal, Gorkha Distr., Darondi Khola between Doreni and Motar, open forest/cultivated land, 750-900 m, 13.VIII.1983, leg. J. Martens & W. Schawaller (SMNS).

Remarks: The occurrence is known in Central India and Madras and has now been the first time recorded in Nepal.

Scarites (Distichus) picicornis Dejean

1831 *Scarites picicornis* Dejean, Spec. gen., Paris, 5: 493.

Material examined: India, Darjeeling Distr., Kalimpong, Purbong, 950 m, VI.1982, leg. C.J. Rai (NHMB/CBA).

Remarks: The species has a disjunct distribution. It occurs in Bengal, Bihar, Northwest India, and Sri Lanka, and has been recorded also in East Africa from Abyssinia to Natal and in Senegal.

Scarites (Distichus) rectifrons Bates

1892 *Distichus rectifrons* Bates, Ann. Mus. Civ. Stor. Nat. Genova, 12 (32): 272.

Material examined: Nepal, Kathmandu Valley, Nagarjung, Jamacok, secondary forest, 1400-1600 m, 18.VIII.1983, leg. J. Martens & W. Schawaller (SMNS).

Remarks: *Scarites rectifrons* belongs to a small group of the subgenus which are interestingly characterized by the lack of setigerous punctures on clypeus and the buccal fissure is not prolonged beyond the base of mentum.

This is the first record for Nepal, hithero known from Indochina and Sikkim.

Scarites (Scarites s. str.) trachydermon Andrewes

1936 *Scarites trachydermon* Andrewes, Ann. Mag. Nat. His., (10) 18: 58-59.

Material examined: Nepal, Annapurna, S.E., between Marsyandi- and Begnas-Valley, 1000 m, 03.V.1982, leg. F. Baum (CBA).

Remarks: First record after the description from North of Assam.

Parathlibops wittmeri Casale

1980 *Parathlibops wittmeri* Casale, Ent. Basil., 5: 5-9.

Material examined: India, Darjeeling distr., Pedong, 12.VII.1981, leg. B. Bhakta; E. Nepal, Thamur Valey, Dhankuta-Hile, 1150-2000 m, 24-25.V.1983, leg M. Brancucci; E. Nepal, Koshi, Mutidhunga-Hile, 2200 m, 27.V.1985, leg. M. Brancucci (NHMB/CBA).

Remarks: These are the first records after the description. Occurrence is known so far from West Bhutan, Darjeeling, and East Nepal.

Coryza semirubra Andrewes

1926 *Coryza semirubra* Andrewes, Ent. Month. Mag., 62: 71.

Material examined: Nepal, Marsandi Valley, bank of a brook near Khudi, 1000 m, 01.V.1982, leg. F. Baum (CBS/CBA).

Remarks: The species is known from Uttar Pradesh and Punjab and is here firstly recorded for Nepal. (One of the four examined specimens bears a label "det. A. Casale 1984".)

Clivina attenuata Herbst

1806 *Scarites attenuata* Herbst, Natur. Syst. Ins. Käf., 10: 264;
1813 *Clivina picipes* Bonelli, Mém. Acad. Sci. Turin, 20: 481;
1846 *Clivina melanaria* Putzeys, Mém. Soc. Sci. Liège, 2: 586.

Material examined: India, Darjeeling Distr., Rangpo, 400 m, 10.X.1978, leg. I. Löbl & C. Besuchet (MHNG); Nepal, Trisuli, 570-1200 m, 02.VI.1978, leg. B.C. Bhakta (NHMB/CBA).

Remarks: So far recorded for Indochina and Malaysia, northern parts of India to Iran. According to Kult (1951) the species is distributed in India only.

Clivina sp.

Material examined: Nepal, Dhading Distr., Samrai Banjyang, cultivated landscape, 1000-1300 m, 23.VII.1983, leg. J. Martens & W. Schawaller (SMNS).

Remarks: The single specimen (♀) seems to be *Clivina striata* Putzeys 1846, but I am not able to identify the specimen at this time.

Clivina tranquebarica Bonelli

1813 *Clivina tranquebarica* Bonelli, Mem. Acad. Sci. Turin, 20: 484;
1861 *Clivina cordicollis* Motchulsky, Bull. Soc. Nat. Moscou, 34 (I): 102;
(?) 1861 *Clivina rufipes* Motchulsky, Bull. Soc. Nat. Moscou, 34: (I): 102;
1863 *Clivina foveicollis* Putzeys, Mém. Soc. Roy. Sci., Liège, 18: 61;
1866 *Clivina placida* Putzyes, Ann. Soc. Ent. Belg., X: 134;
1866 *Clivina stigmatica* Putzeys, Ann. Soc. Ent. Belg., X: 134;
1892 *Clivina scuticeps* Bates, Ann. Mus. Civ. Stor. Nat. Genova, 12 (32): 280.

Material examined: India, Uttar Pradesh, Rishikesh, 450 m, VII.1991, leg. K. Werner (CBA).

Remarks: This very common species is found in India, Sri Lanka, Indochina and Malaysia and in parts of Indonesia.

Pseudoclivina assamensis Putzeys

1846 *Clivina assamensis* Putzeys, Mém. Soc. Sci. Liège, 2: 584.

Material examined: India, Uttar Pradesh, Rishikesh, 450 m, VII.1991, leg. K. Werner (CBA).

Remarks: The occurrence is known so far from Assam, Bengal, Bihar, and Orissa to Madras.

Trilophus interpunctatus Putzeys

1866 *Dyschirius hispidulus* Putzeys, Ann. Soc. Ent. Belg., X: 98;
1867 *Dyschirius interpunctatus* Putzeys, Ann. Soc. Ent. Belg., X: 97-98;
1868 *Dyschirius impunctatus* Putzeys, Ann. Soc. Ent. Belg., XI: 10;
1877 *Dyschirius schmidti* Putzeys, Ann. Soc. Ent. Belg. (Compt. Rend.), 20: 16;
1892 *Oxydrepanus birmanicus* Bates, Ann. Mus. Civ. Stor. Nat. Genova, 12 (32): 283;
1926 *Oxydrepanus interpunctatus* Andrewes, Ann. Mag. Nat. Hist., 9 (17): 378;
1927 *Trilopus interpunctatus* Andrewes, Ann. Mag. Nat. Hist., (9) 20: 263-265.

Material examined: India, Assam, Manas, 200 m, 22.X.1978, leg. I. Löbl & C. Besuchet (MHNG); Darjeeling Distr., Teesta and Singla, 250-300 m, 10/17.X.1978, leg. I. Löbl & A. Smetana (MHNG); Kaziranga, 75 m, 07-09.V.1976, leg. W. Wittmer & C. Baroni (NHMB/CBA); Nepal, Dhading Distr., Samari Banjyang, cultivated land, 1000-1300 m, 23.VII.1983, leg. J. Martens & W. Schawaller (SMNS); Kathmandu, Gokaruaban, 12.IV.1976, leg. W. Wittmer & C. Baroni (NHMB/CBA); Kathmandu Distr., Gokarna Forest and Godwari, 1300-1600 m, 31.III.1981, 20.X.1983 and 31.X.1984, all leg. I. Löbl & A. Smetana (MHNG); Bagmati, Nagarjun forest near Kathmandu, 1650 m, 02.IV.1981, Burlang, Bhanjyang, 2600 m, 05.IV.1981, below Tarke Ghyang, 2600 m, 25.IV.1981, Malemchi Khola near Malemchi, 2100m, 15.IV.1981,all leg. I. Löbl & A. Smetana (MHNG); Terhathum Distr., Nessum, cultivated land with trees, 1750 m, 16.IX.1983, leg. J. Martens & Daams, (SMNS); India, Uttar Pradesh, Kumaon, Bhim Valey, 1500 and 1800 m, 04.X.1979, leg. I. Löbl & A. Smetana (MHNG); Pakistan, Punjab, Rawalpindi lake, 03. and 24.IV.1986, leg. S. Vit (MHNG); Chitral, Madaglasht, 2700 m, 26.V.1986, Chitral, Kalas, 1900 m, 28.V.1983, all leg. I. Löbl & C. Besuchet (MHNG); Swat, Marghuzar, 1300 m, 08.V.1983, leg. I. Löbl & C. Besuchet (MHNG); Dir, Dir, 1500 m, 20.V.1983, leg. I. Löbl & C. Besuchet (MHNG).

Remarks: The genus is widely distributed from North of Pakistan to Java. ANDREWES (1927, 1929) recognizes only one species and distinguishes four varieties

which should be distributed in different but neighbouring regions. What kind of status these varieties do have taxonomically has to be investigated.

Dyschirius speculifer Andrewes

1929 *Dyschirius speculifer* Andrewes, Fauna Brit. Ind., Col.: Carab., I: 403-405.

Material examined: India, Assam, Gauhati, 200 m, 24.X.1978, leg. I. Löbl, & C. Besuchet (MHNG).

Remarks: Distributed in Bengal and Northwest India.

Dyschirius variabilis Andrewes

1929 *Dyschirius variabilis* Andrewes, Fauna Brit. Ind. Col.: Carab., I: 405-406.

Material examined: Nepal, Annapurna S.W., near Gandrung, 2000 m, 14.IV.1982, leg. F. Baum (CBS/CBA).

Remarks: Distributed in Bengal and Northwest India, and now found in Nepal also.

Dyschirius constrictus Andrewes

1929 *Dyschirius constrictus* Andrewes, Fauna Brit. Ind., Col.: Carab., I: 408-409.

Material examined: India, Assam, Kaziranga, 75 m, 07-09.V.1975, leg. W. Wittmer & C. Baroni (NHMB/CBA); Gauhati, 200 m, 24.X.1978, leg. I. Löbl & C. Besuchet (MHNG/CBA); E. Nepal, Kosi Pagma, 1700 m, 04.IV.1984, leg. I. Löbl & A. Smetana (MHNG); Nepal, Gorkha Distr., Darondi Khola, between Naya and Gorkha, brook valley, 1200 m, 14.VIII.1983, leg. J. Martens & W. Schawaller (SMNS); Ilam Distr., 5 km N. Sanishare, feet of Siwalik Mts., mixed Shorea forest, 270-300 m, 03-05.IV.1988, leg. J. Martens & W. Schawaller (SMNS/CBA).

Remarks: Distributed in Assam, Bengal, Bihar, and in Northwest India.

Dyschirius sonamargensis spec. nov. (Figs 9, 10)

Type material: Holotype: ♂, Kashmir, Sonamarg, 17.VII.1976, 2600-2750 m, leg. W. Wittmer, (NHMB).

Paratypes: 1 ♂, 1 ♀, same data as holotype (♀ NHMB; ♂ CBA).

DESCRIPTION:

Measurements: Length 2.45-2.75 mm, width 0.70-0.75 mm, ratio length/width of pronotum 0.91-0.96, ratio length/width of elytra 1.58-1.61.

Colour: Head, pronotum, elytra, and ventral surface dark brown, ferrugineous, shiny. Mouthparts, four posterior legs, and two basal segments of antennae testaceous. Clypeus, frons, anterior parts of antennae, anterior legs, and basis of elytra middle brown.

H e a d : Anterior margin of clypeus without median tooth, truncate, very finely bordered, separated from frons by deep, nearly straight transversal suture. Clypeal field trapezoidal, ascending evenly from anterior clypeal margin and falling in last quarter to transversal suture. Frons moderately convex, with scattered, minutely sticked punctures. Supraantennal plates convex, bordered indistinct laterally. Frontal furrows as deep as transversal suture. Neck constriction absent, two diverged longitudinal sulci posterior eyes. Eyes developed regularly for genus.

P r o n o t u m : Subglobose. Third wider than head, little wider than long, maximum width at middle. Sides evenly rounded from anterior angles to posterior setigerous puncture. Lateral margin complete, reaching posterior setigerous puncture, more indistinct in posterior half. Median line visible throughout, very fine at middle, deeper in posterior third. Disk with irregular very finely sticked punctures and few fine cross wrinkles laterally. Anterior transverse line deep, joining median line. Proepisternum impunctate.

E l y t r o n : Anterior third flattened, evenly convex in posterior two-thirds. Oval, evenly rounded from humerus to apical setigerous punctures. Base margined, basal granula absent. Humerus distinct (angle 130°). Basal setigerous puncture absent. Three subhumeral and two preapical setigerous punctures. Striae 1 to 6 deep, first curves slight medially at base; stria 7 striate-punctate, 8 reduced to 5-6 fine punctures at middle of elytron; all striae shallower in posterior third, 1st reaching apex, all other disappearing to end of third quarter. Punctures of striae arranged more regularly. Two discal setigerous punctures, situated in middle of interval 3 (holotype), second puncture approching 2nd stria (paratypes). Posterior setigerous puncture absent. Intervals moderately convex, flattered in apical half.

A l a : Macropterous.

P r o t i b i a : Lateral upper spine turned strongly ventral, movable spur one fourth shorter than spine. Preapical lateral denticle sharp and well developed, 2nd intimated but well visible.

A e d e a g u s (Fig. 10). Short, stronger arcuate at basal half, apex widely explanate. Right paramere twisted, one long seta at apex.

D e r i v a t i o n o f n a m e : After the village Sonamarg, 30 miles NE Srinagar in Kashmir, where the types had been found.

R e m a r k s : *Dyschirius sonamargensis* spec. nov. is next related to *D. ladakensis* Andrewes 1929 and has similarities to *D. minutus* Dejean 1825 (syn. *D. punctatus* Dejean 1825, nec PUTZEYS 1867 as indicated in MÜLLER, 1922 p. 47). It differs from *D. ladakensis* in having a deep and nearly straight transverse suture of chypeus, in the lack of the third (posterior) setigerous puncture of elytron and in its smaller size. Unlike *D. sonamargensis*, *D. ladakensis* shows the following most striking characters. The pronotum ist widest at basal third, the median line of pronotum passes through the anterior transverse line without joining it and is prolonged anteriorly, the elytra have parallel sides and are not margined at base, and there is only one preapical setigerous puncture present. *D. minutus* as well as its subspecies *albanicus* Müller 1922 is distinct from *D. sonamargensis* in its more elongate head, pronotum, and elytron, which causes its bigger size also. In *D. minutus*

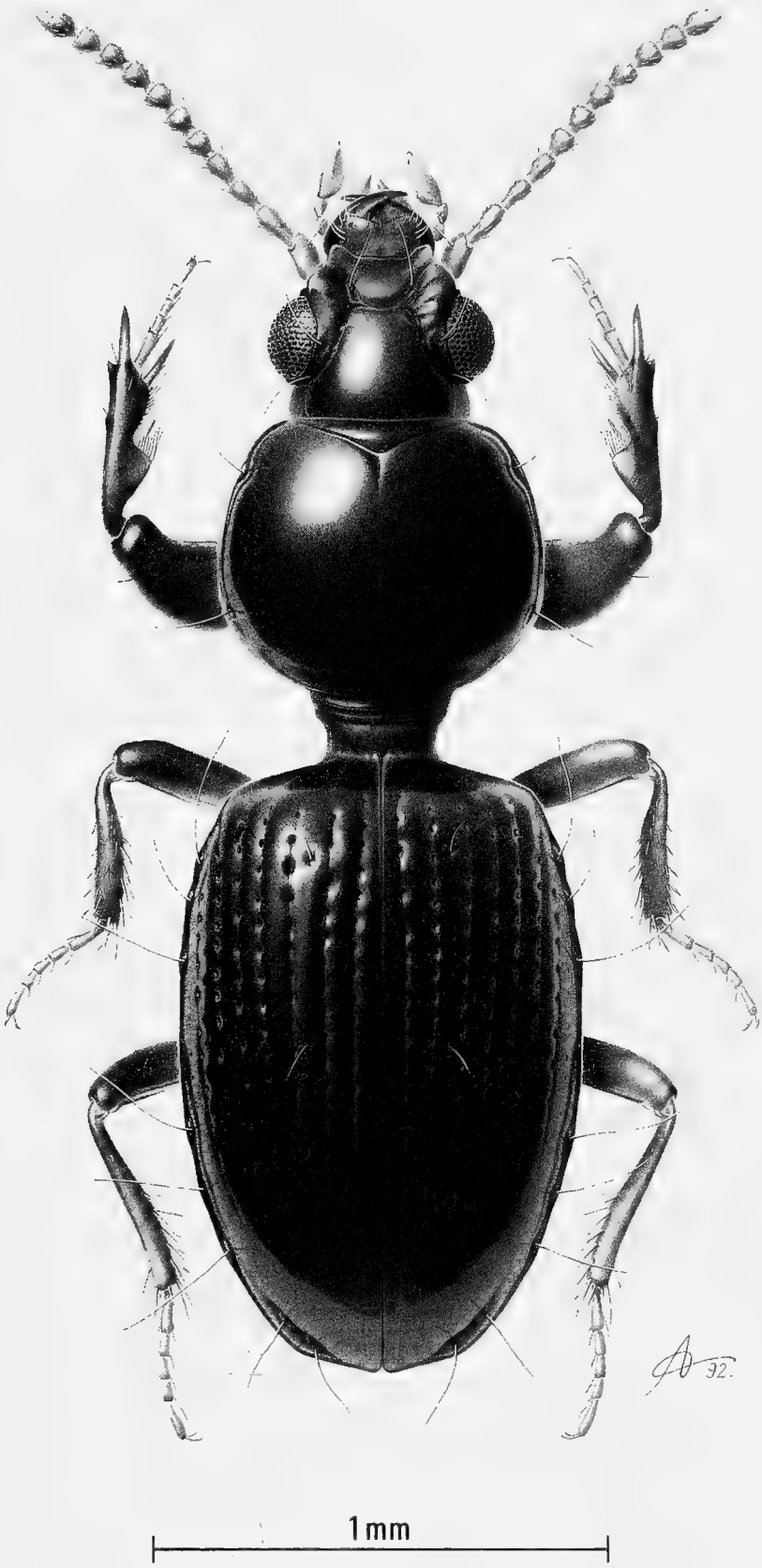
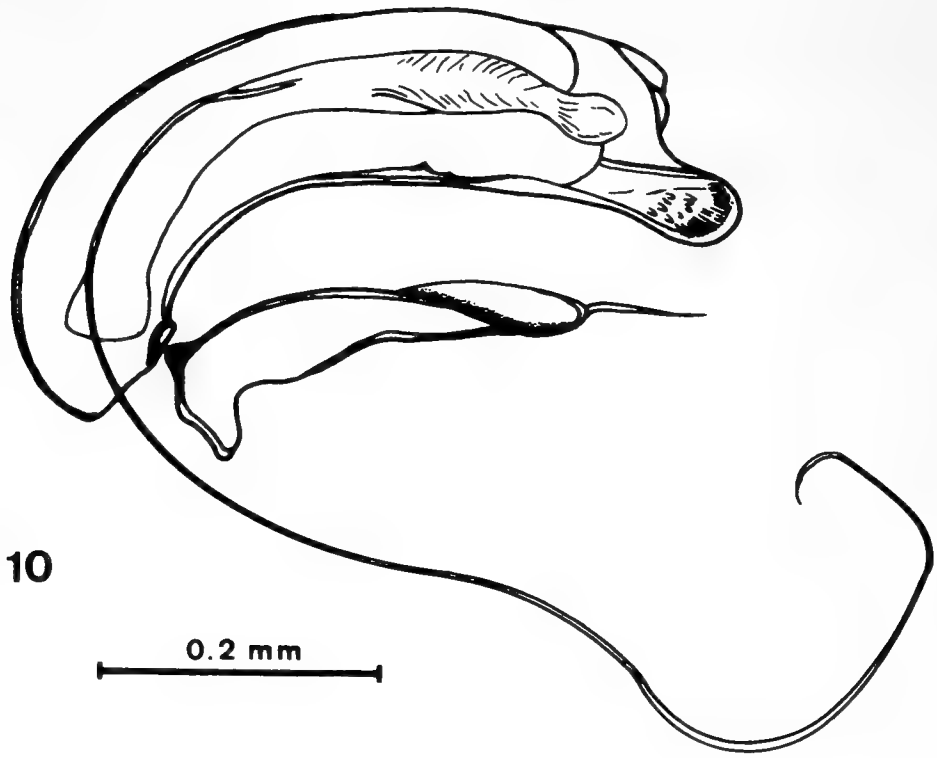


FIG. 9

Dyschirius sonamargensis spec. nov., holotype ♂, habitus.



FIGS 10

Dyschirius sonamargensis spec. nov. holotype, aedeagus with right paramere, left lateral view.

the transversal suture of head is not deep, the median line of pronotum is more distinct, the base of elytron is unmargined, respectively a weak margin is suggested only in some specimens, the humerus is more slanting, and the punctures of striae of elytron are not as dense as in *D. sonamargensis*.

D. ladakensis is only known from the type locality (Ladakh, Kashmir / ANDREWES 1929), which is located northeast of Sonamarg on the other side of the main Himalayan chain. Because of the very different ecological conditions on both slopes it may be suggested that both sepcies are separated by the high mountain chain. *D. minutus* is a palaearctic species, occurring in the Northern Mediterranean area (MÜLLER 1922).

Dyschirius disjunctus Andrewes

1929 *Dyschirius disjunctus* Andrewes, Fauna Brit. Ind., Col.: Carab., I: 411-412.

Material examined: Nepal, Dahding Distr., Gorkha, Buri Gandaki, between Jagat and Pangshing, cultivated land, 1300-1650 m, 31.VII.1983, leg. J. Martens & W. Schawaller (SMNS).

Remarks: Distributed in Bengal and in Northwest India.

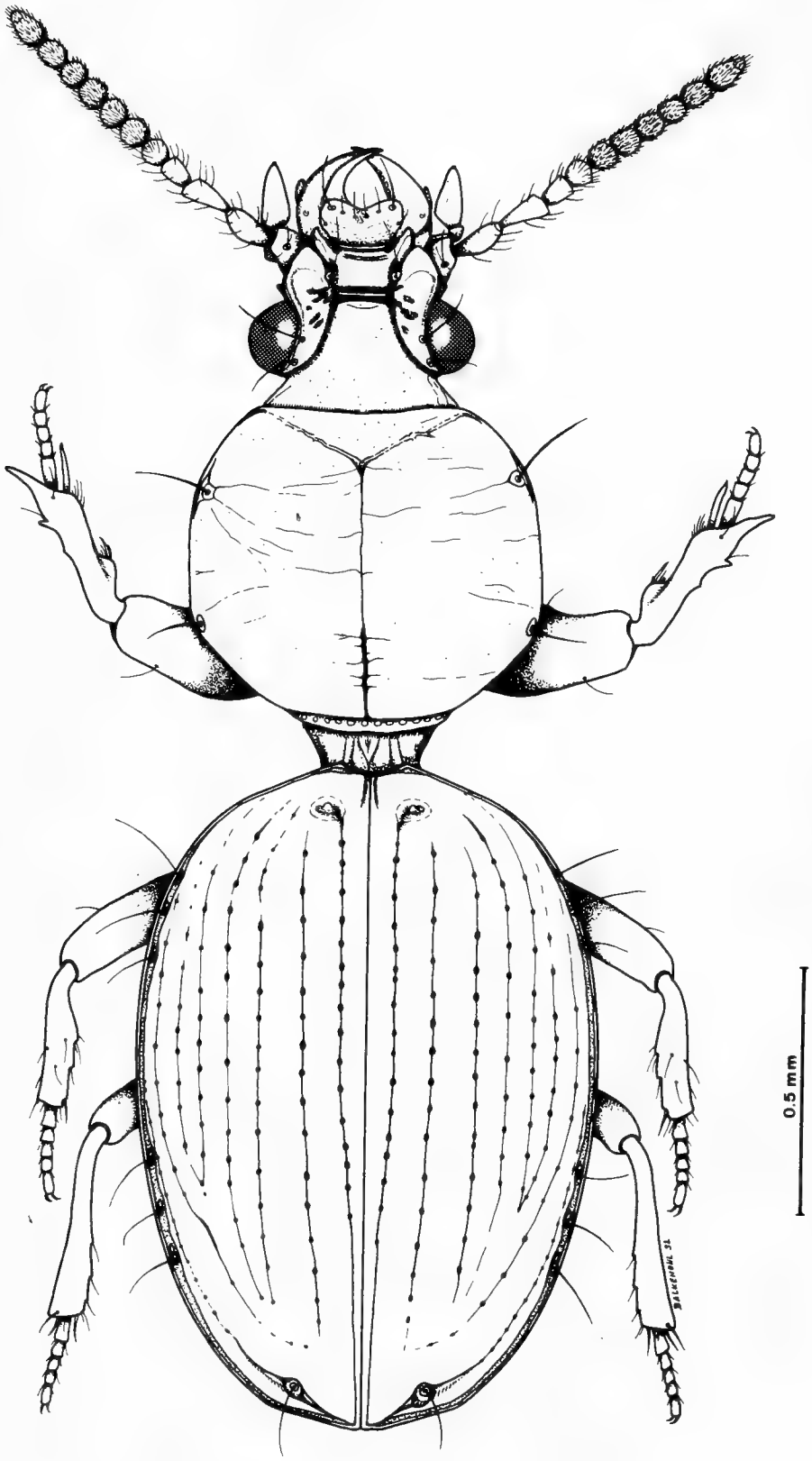


FIG. 11

Dyschirius (Reicheiodes) convexipennis spec. nov., holotype ♂, habitus.

Dyschirius nov. spec.

Material examined: India, Assam, Manas, 200 m, 23.X.1978, leg. I. Löbl (SMNS).

Remarks: The unmargined pronotum of this single specimen (♂) is conspicuously punctate and without transverse impression. The head has four ridges which meet at middle. Therefore this species can be placed near to *Dyschirius porosus* Putzeys 1877. Like in *D. porosus* it can be stated that "the unusual characters detailed above indicate that a new genus will probably be required here" (ANDREWES 1929). The types of *D. porosus* are not available. Therefore a description is omitted.

Dyschirus (Reicheiodes) convexipennis spec. nov. (Figs 11, 12).

Type material: Holotype: ♂, Nepal, Panchthar Distr., Dhorpar Kharka, mature *Rhododendron-Lithocarpus* forest, 2700 m, 13-16.IV.1988, leg. J. Martens & W. Schawaller", (SMNS).

Paratype: 1 ♂, India, W. Bengal, Darjeeling Distr., Tonglu, 2700 m, 16.X.1978, leg I. Löbl & C. Besuchet (MHNG).

DESCRIPTION

Measurements: Length 2.55-2.60 mm (including mandibles), width 0.95 mm, ratio length/width of pronotum 0.95, ratio length/width of elytra 1.41.

Colour: Elytra dark brown, strongly shiny, apex slightly lighter. Pronotum piceous, shiny. Clypeus, supraantennal plates, mouthparts, first four segments of antennae, and legs fuscuous. Frons, anterior segments of antennae, and anterior legs darker. Ventral surface dark brown.

Head: A third smaller than pronotum. Anterior margin of clypeus without median tooth, bordered finely. Clypeal field square, convex, with fine carina anteriorly, separated from frons by deep straight transverse suture (paratype), suture interrupted transversally by very fine carina, thought suture seems doubled (holotype). Frons evenly convex, with scattered, finely sticked punctures over whole surface. Supra-antennal plates vaulted, with some rugae and longitudinal punctures at eye level. Frontal furrows deep, brought anteriorly to transverse suture. Neck constriction absent, few longitudinal sulci posterior eyes. Antennae medium sized, reaching posterior setigerous punctures of pronotum. Eyes well developed.

Pronotum: Strikingly depressed for genus in anterior two-thirds, convex in posterior third only. Nearly as long as wide, maximum width at middle. Lateral border barely rounded between setigerous punctures, strongly rounded from anterior setigerous punctures to anterior angles, almost straightly narrowed from posterior setigerous punctures to base. Lateral margin inconspicuous, visible at level of anterior setigerous puncture only, and shortly before and in anterior angles. Median line complete, very fine at middle, deeper at posterior third. Anterior transverse line broad, subcrenulate, joining median line and lateral margin in anterior angles. Surface with

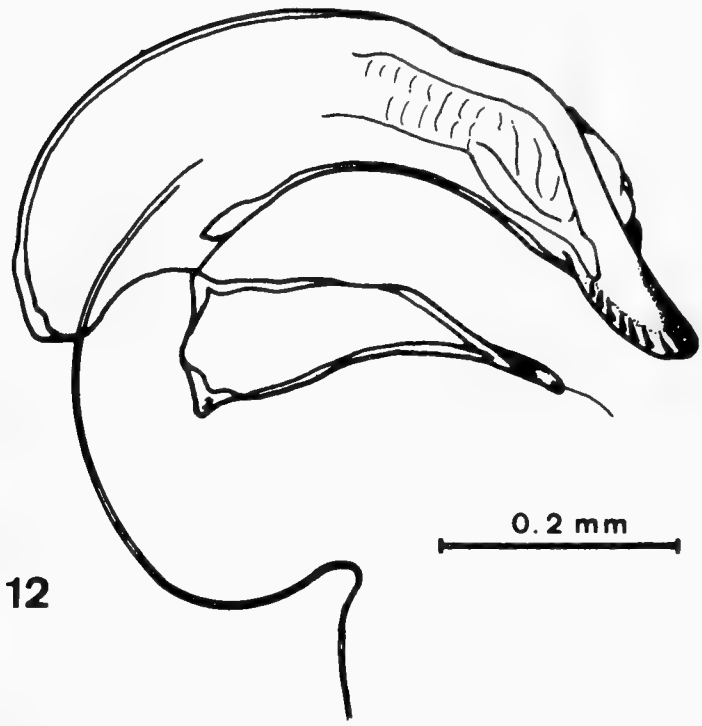


FIG. 12

Dyschirius (Reicheiodes) convexipennis spec. nov., holotype, aedeagus with right paramere, left lateral view.

some transverse wrinkles and scattered, finely sticked punctures. Proepisternum impunctate.

E l y t r o n : Lateral view intensively ovate, strongly falling to base. Outline evenly oval, maximum width at middle. Evenly margined from pedunculus to apical setigerous puncture. Humerus invisible. Basal granula absent. Basal setigerous puncture evident, situated between projected extension of 1st and 2nd stria. Three subhumeral and three umbilical setigerous punctures, one evidently developed preapical setigerous pore situated in prominent furrow of 8th stria. Dorsal punctures absent. Short but conspicuous longitudinal scutellar stria-like impression at steep declivity, close to suture. First stria deep, adjoining basal setigerous puncture, reaching apex. Punctures of first 3 rows formed as striae due to more-or-less distinct impressions, other striae appearing as rows of slightly connected punctures, striae fade to apex but visible completely. Arrangement of punctures somewhat irregular. Stria 2 and 7, 3 and 4, 5 and 6 adjoining more or less in posterior third of elytron. Striae not reaching base with exception of 5th. Invervals slightly convex, flattened at apex.

A l a : Atrophied.

P r o t i b i a : Lateral upper spine turned very slightly lateral and moderately ventral. Movable spur very slightly curved, as long as lateral spine. Preapical lateral denticle well developed, 2nd much smaller, not sharp but clearly visible.

A e d e a g u s (Fig. 12): Short, moderately arcuate, narrowing in apical half, apex asymmetrically spatulate. Rights paramere broad at base, twisted shortly before apex, one fine apical seta.

H a b i t a t : The specimens were extracted from litter at an altitude of 2700 m; the holotype in a primary *Rhododendron-Lithocarpus* forest with solitary *Magnolia* and *Tsuga* in April, and the paratype in a *Quercus semecarpifolia* forest in October.

D e r i v a t i o n o f n a m e : The name is derived from the extremely convex raised elytra which is mostly conspicuous in lateral view.

R e m a r k s : See remarks of *Dyschirius marginicollis* spec. nov.

Dyschirius (Reicheiodes) loebli spec. nov. (Figs 13, 14)

T y p e m a t e r i a l : Holotype: ♂, Nepal, Prov. Bagmati, Yardang Ridge NE Barahbise, 3250 m, 05.V.1981, leg. I. Löbl & A. Smetana (MHNG).

DESCRIPTION

M e a s u r e m e n t s : Length 2.50 mm, width 0.88 mm, ratio length/width of pronotum 0.99, ratio length/width of elytra 1.61.

C o l o u r : Pronotum and elytra dark brown, shiny; paler at margin and apex of elytra; frons fuscus; clypeus supraantennal plates, and mouthparts paler; first segments of antennae fulvus ventrally and darker dorsally; legs and epipleura testaceus; ventral surface dark brown.

H e a d : A third smaller than pronotum. Anterior margin of clypeus without median tooth, conspicuously bordered. Clypeal field square, convex, separated from frons by deep, broad, and straight transverse suture. Frons convex, with second weak transverse suture, invisible at middle, with few scattered, very minutely sticked punctures over surface of frons. Supraantennal plates vaulted, with carina on eye level and suture on level of anterior supraorbital seta, bordered weekly laterally. Frontal furrows deep, diverging anteriorly and posteriorly of transverse suture. Neck constriction absent, few flat longitudinal rugae posterior eyes. Antennae just reaching posterior setigerous punctures of pronotum. Eyes well developed.

P r o n o t u m : Evenly convex. Outline subcircular, as slong as wide, maximum width at middle. Lateral border evenly rounded, reflexed margin complete, prolonged over posterior setigerous puncture. Lateral channel deep, moderately broad. Median line complete, indistinct at middle, deeper and broader at posterior fourth. Anterior transverse line distinct, joining median line, not joining lateral margin at extremity. Surface with fine transverse wrinkles and scattered, minutely sticked punctures. Proepisternum impunctate.

E l y t r o n : More flat but evenly convex from base to apex. Outline oblong-oval, maximum width at middle, margined from pedunculus to apex. Humerus very slightly suggested at level of subhumeral setigerous puncture. Basal granula absent. Basal setigerous puncture isolated, situated between projected extension of 1st and 2nd stria. One subhumeral setigerous puncture, two umbilical setigerous punctures

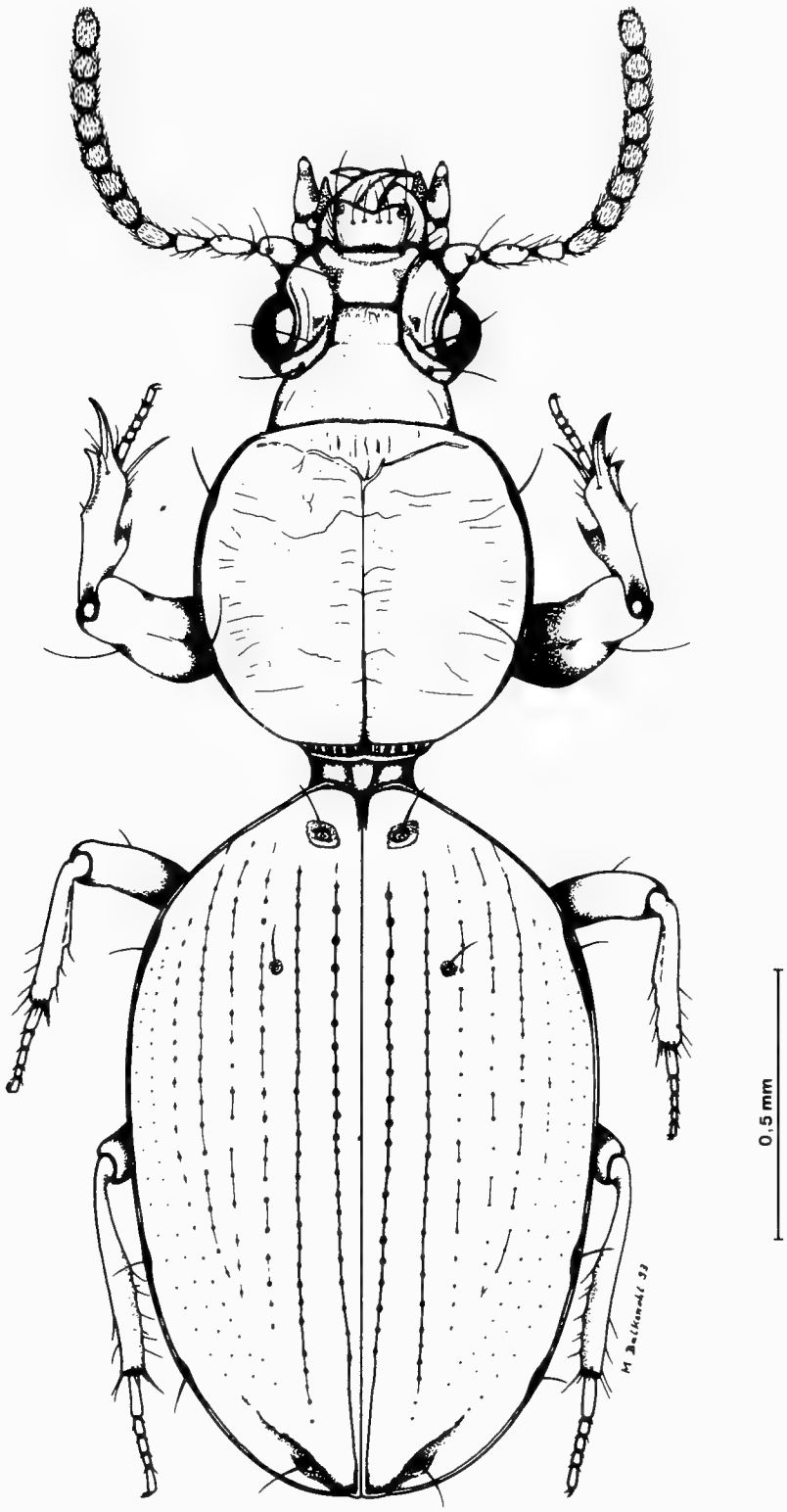


FIG. 13

Dyschirius (Reicheiodes) loebli spec, nov., holotype ♂, habitus.

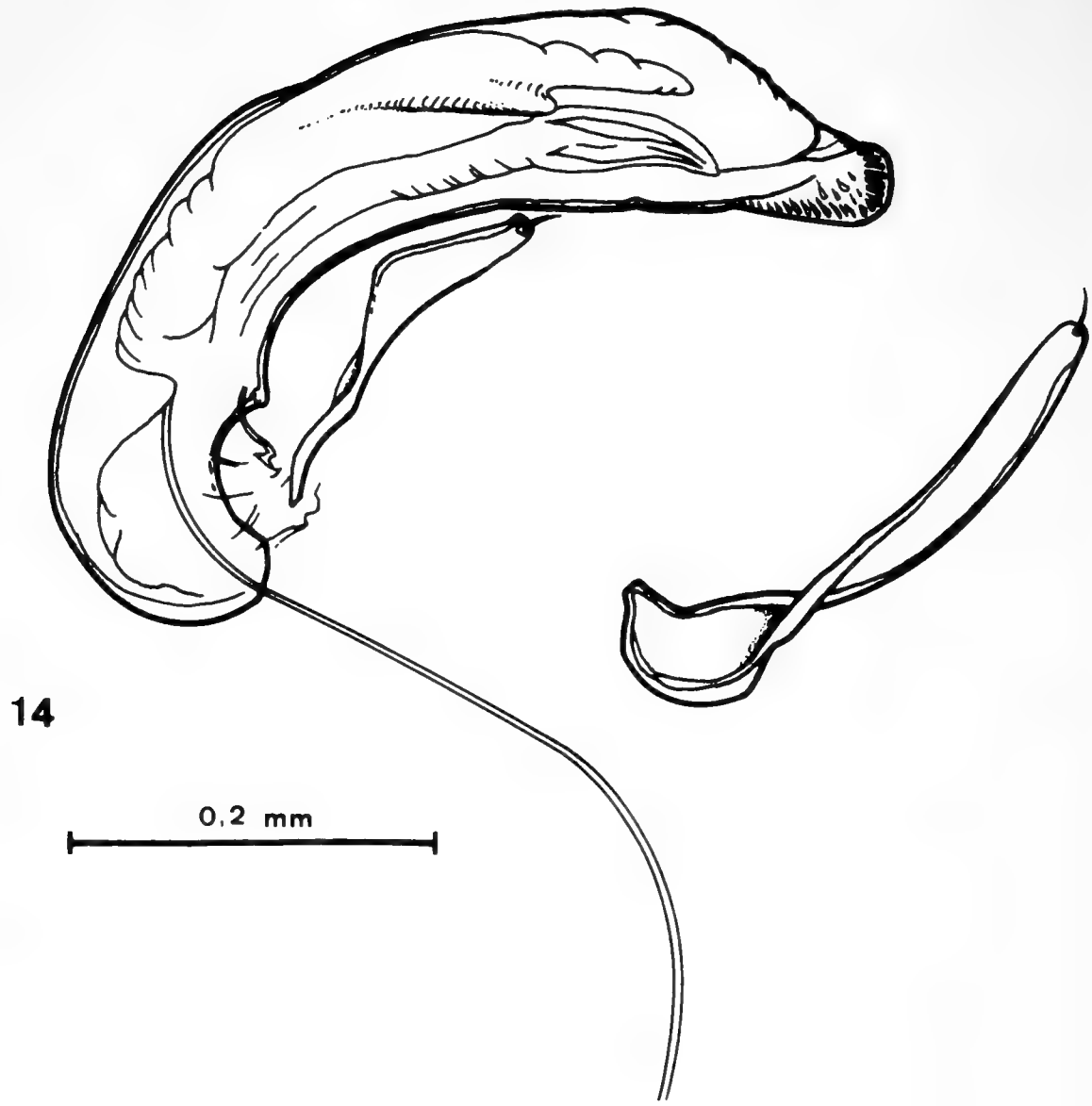


FIG. 14

Dyschirius (Reicheiodes) loebli spec. nov., holotype, aedeagus with parameres, left lateral view.

near epex, one preapical setigerous puncture situated in furrow of 8th stria, one (anterior) dorsal puncture. Short longitudinal impression at base close to suture. Stria 1 deep, 2nd stria fairly deep, both punctate, other striae developed as rows of punctures, punctures of 3rd to 6th stria partly connected by slight impressions; striae 2 to 7 fade to apex, completely, 3 and 6, 4 and 5 adjoining more or less in posterior third of elytron. Stria 1 and 8 adjoining conspicuously at apex. Striae not reaching base with exception of 5th. Invervals 1 to 3 not as flatened as others. Arrangement of punctures somewhat irregular.

A l a : Atrophied.

P r o t i b i a : Lateral upper spine curved moderately lateral and ventral. Movable spur nearly straight, as long as lateral spine. Preapical lateral denticle conspicuously sharp, 2nd scarcely developed.

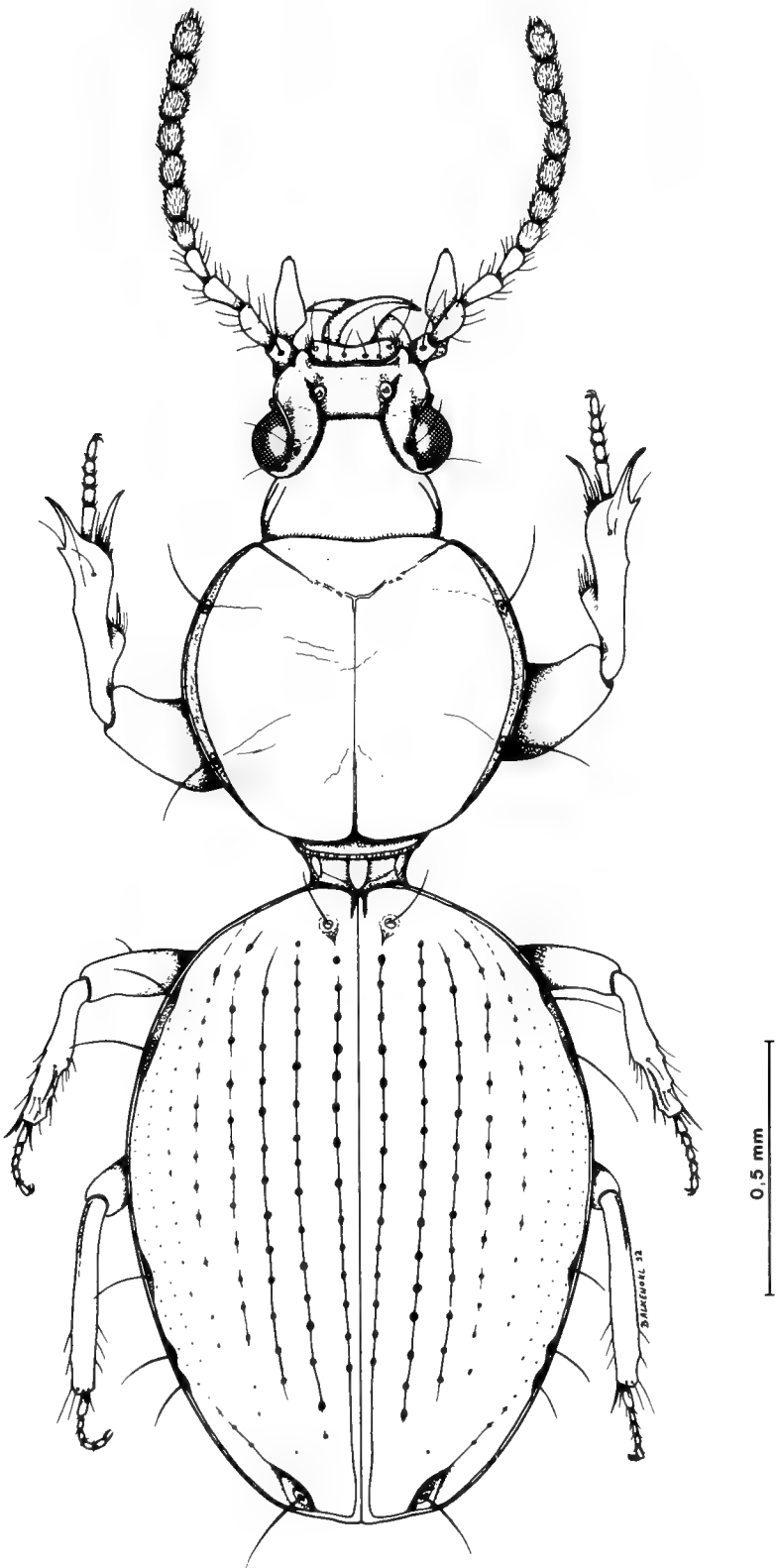


FIG. 15

Dyschirius (Reicheiodes) marginicollis spec. nov., holotype ♂, habitus.

Aedeagus (Fig. 14): Short, moderately arcuate, not narrowed in apical half, apex explanate. Right paramere twisted at basal third, one apical seta.

Habitat: The specimen was sifted in humid leaf litter in an *Abies-Rhododendron* forest in May. Altitude 3250 m.

Derivation of name: The species is dedicated to Dr. Ivan Löbl, who found three new *Reicheiodes* species in the Himalayas by applying intensive sifting methods.

Remarks: See remarks of *Dyschirus marginicollis* spec. nov.

Dyschirius (Reicheiodes) marginicollis spec. nov. (Figs 15, 16)

Type material: Holotype: ♂, Nepal, Patan Distr., Phulcoki, 2600-2700 m, 15.X.1983, leg. I. Löbl & A. Smetana (MHNG).

Paratypes: 1 ♂, same data as holotype, but 2650 m; 1 ♀, same data as holotype; 1 ♀, same data as holotype but 2600 m, 16.X.1983, 1 ♀, same data as holotype but 2550 m, 17.X.1983. 1 ♀, Nepal, Kathmandu Distr., Phulcoki, 2500 m, 28-29.IV.1984; 1 ♀, Siwapuri Dara, 2400 m, 30.IV.1985; all leg. I. Löbl & A. Smetana (MHNG and CBA).

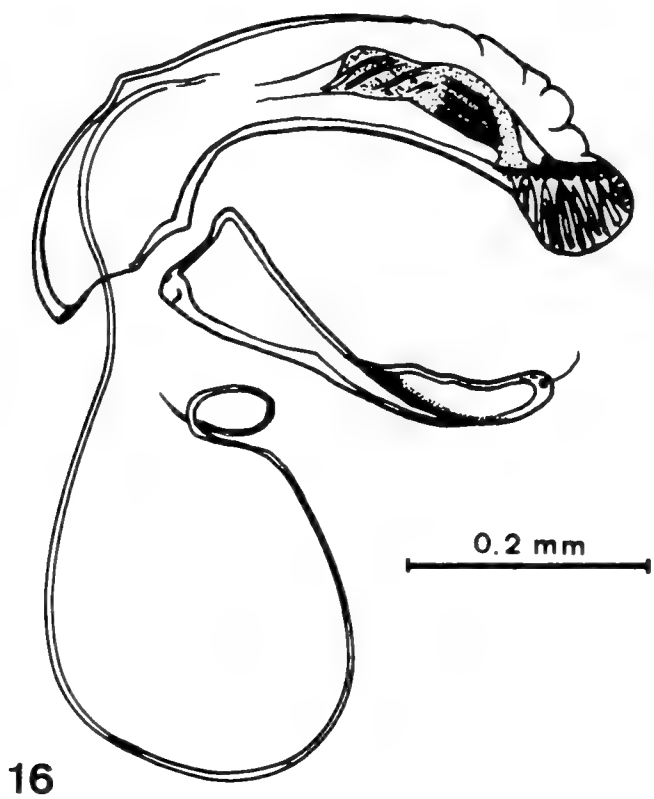


FIG. 16

Dyschirius (Reichiodes) marginicollis spec. nov., holotype, aedeagus with right paramere, left lateral view.

DESCRIPTION

M e a s u r e m e n t s : Length 2.35-2.50 mm ($\bar{x}$ = 2.45 mm*; including mandibles), width 0.91-0.97 mm ($\bar{x}$ = 0.94 mm*), ratio length/width of pronotum 0.92 - 0.96 ($\bar{x}$ = 0.94*), ratio length/width of elytra 1.35-1.44 ($\bar{x}$ = 1.39*); (*n = 6).

C o l o u r : Fuscuous, shiny; mouthparts, clypeus, three posterior segments of antennae, and legs paler.

H e a d : More than a third smaller than pronotum. Anterior margin of clypeus without median tooth, bordered. Clypeal field square, convex, separated from frons by deep, broad, and straight transverse suture. Frons evenly convex, with scattered, minutely sticked punctures. Supraantennal plates vaulted, some fine rugae at eye level. Frontal furrows deep, broad. Neck constriction absent, few fine longitudinal sulci posterior eyes. Antennae not reaching posterior setigerous punctures of pronotum. Eyes well developed.

P r o n o t u m : Evenly convex. Outline subcircular, little wider than long, maximum width at end of anterior third. Lateral border evenly rounded, reflexed margin reaching from anterior angles nearly up to base. Lateral channel deep, conspicuously broad, narrowed from anterior setigerous puncture to anterior angles and from posterior setigerous puncture up to end of margin. Median line complete, distinct, deeper and broader at posterior fourth. Anterior transverse line distinct, not deep, joining median line and lateral margin. Surface with few fine transverse wrinkles and scattered, minutely sticked punctures. Proepisternum impunctate.

E l y t r o n : Conspicuously convex from base to apex. Outline evenly oval, maximum width before middle, margined from pedunculus to apex. Humerus nearly invisible. Basal granula absent. Basal setigerous puncture situated in projected extension of 1st stria. Two subhumeral and three umbilical setigerous punctures, one preapical setigerous puncture situated in furrow of 8th stria, dorsal punctures absent. Short and conspicuous scutellar stria-like longitudinal impression at base close to suture. Stria 1 to 3 fairly deep, punctate, other striae developed as rows of punctures, 4th and 5th partly connected by slight impressions; striae disappearing in apical fourth. Stria 1 and 8 adjoining at apex. Striae not reaching base with exception of 5th. Arrangement of punctures somewhat irregular. Intervals 1 to 3 not as flatened as others.

A l a : Atrophied.

P r o t i b i a : Lateral upper spine turned moderately lateral and ventral. Movable spur curved slightly mesial at apex. Preapical lateral denticle sharp, 2nd much smaller, not sharp but clearly visible.

A e d e a g u s (Fig. 16): Short, moderately arcuate, not narrowed in apical half, apex widely explanate. Right paramere twisted at middle, one fine apical seta.

H a b i t a t : The specimens were sifted in humid leaf litter in a *Quercus semecarpifolia* forest in April and October. Attitude 2500-2700 m.

D e r i v a t i o n o f n a m e : The name is derived from the margin of pronotum which is very broad and prolonged nearly up to base.

R e m a r k s : The three species, *Dyschirius convexipennis* spec. nov., *D. loebli* spec. nov., and *D. marginicollis* spec. nov. are assigned to the subgenus *Reicheiodes*

Ganglbauer 1892. Members of *Reicheiodes* are restricted to mountain environments and inhabiting the Sierra de Gerez and Sierra de Marao (North of Portugal), parts of the Alps, Croatia, and Caucasus and were hithero unknown from the Himalayas. The described Himalayan species can be distinguished from other species of that subgenus by the short basal longitudinal impression of elytron, by the 5th stria of elytron which reaches up to base, and by characters of their pronotum. These characters probably point to an own phylogenetic unit. In *D. convexipennis* the lateral margin of pronotum is inconspicuous and developed in the anterior angles and at the level of the anterior setigerous puncture only. In *D. loebli* and *D. marginicollis* the lateral margin is broad and conspicuously deep and is prolonged strikingly over the posterior setigerous puncture. In other species of this subgenus the lateral margin of pronotum reaches to the posterior setigerous puncture homogeneously, is narrow, and not deep.

As in other members of the subgenus *Reicheiodes* the three new species bear fine and very short pili on the whole elytra, situated in each puncture of stria (much more finer and shorter than the setae of dorsal punctures). These pili, which are visible under yellow light against a dark background, and the evenly oval outline of elytra can not be found in other known members of the genus *Dyschirius*. Therefore the subgenus may have the status of a genus of its own which has to be investigated in detail.

ACKNOWLEDGEMENTS

I would like to thank the following curators for the opportunity of examining the material: Dr. I. Löbl, Muséum d'Histoire naturelle Genève, Switzerland; Dr. W. Schawaller, Staatliches Museum für Naturkunde Stuttgart, Germany; Dr. M. Brancucci, Naturhistorisches Museum Basel, Switzerland. Thanks are also due to K. Werner, Peiting near Munich, Germany, for all of his material and to Dr. F. Baum, Staufen near Freiburg, Germany, for the loan of his specimens. The habitus painting of *Dyschirius sonamargensis* spec. nov. was done by A. Coray, Basel, Switzerland. Syamsundar De helped me in the geographical assignment of localities.

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REVUE SUISSE DE ZOOLOGIE, 101 (1) : 43-45; mars 1994

Dicranomyia (Glochina) staryi sp. n. (Diptera, Limoniidae) from Mallorca

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Discranomyia (Glochina) staryi **sp. n. (Diptera, Limoniidae) from Mallorca.** - *Dicranomyia (Glochina) staryi* sp. n. is described. The new species is very close to *Dicranomyia (Glochina) mediterranea* Lackschewitz & Pagast, 1942, another mediterranean species.

Key-words: Diptera - Limoniidae - Taxonomy - Mallorca - Spain.

INTRODUCTION

This paper belongs to a broad project on mediterranean limoniids fauna. The craneflies of Mallorca are very poorly known, and the discovery of this new *Glochina*, one of the more thermophilous genus amongst the Limoniinae, is particularly interesting.

DESCRIPTION

***Dicranomyia (Glochina) staryi* sp. n.** (Figs. 1-4)

General appearance: basic coloring of body yellowish brown. Wings hyaline. Halteres white. Wing length: 8 mm. Head dark brown, slightly grey pruinose. Palpi and antennae yellowish. Scapus elongated, pedicellus and proximal flagellomeres subglobular, distal ones oval to spindle-shaped. Thorax yellowish brown, other parts of legs yellowish to yellowish brown. Wing veins yellow. Stigma very pale, yellow. Abdomen yellowish brown. Male genitalia brownish. Tergite 9 with a small, shallow V-shaped emargination on posterior margin. Gonocoxite (GX) with a small, short and poorly setiferous tubercle on distal dorsomesal angle, and with another one, somewhat longer but thiner, situated more ventrally on mesal face of GX. Ventromesal lobe of GX more or less cylindrical to suboval, broadly rounded at apex, with an hairy lobule near base. Outer gonostyles (OG) yellow, with main body subspherical, as long as GX,

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lobed dorsally. Rostrum shorter than the main body of OG. It is ending in an obtuse yellowish brown tip, slightly bent dorsally if viewed from the inner side. Rostral spines curved, yellow, strongly divergent, anterior shorter than posterior, situated more or less one behind the other, at mid-length of rostrum, on distinct and unfused basal tubercles. Inner gonostyles (IG) curved, ending in an acute black tip. Parameres as in fig. 1.

Holotype ♂. Spain, Mallorca N of Soller, 750 m, 1-6.10.81 (H. Malicky). Preserved in alcool 70°, deposited at the Musée d'Histoire naturelle, Neuchâtel.

Paratypes. 2♂, same data as holotype, coll. H. Mendl, Kempten, Germany.

Similar species

D.(G.) staryi sp. n. is very close to *D.(G.) mediterranea* Lackschewitz & Pagast, 1942. The differential diagnosis, based mostly on male genitalia, is as follows:

staryi

general colouring yellowish brown
ventral setiferous tubercle of GX longer than dorsomesal one
rostrum relatively short
rostral spines yellowish, curved, on short tubercles placed relatively far apart

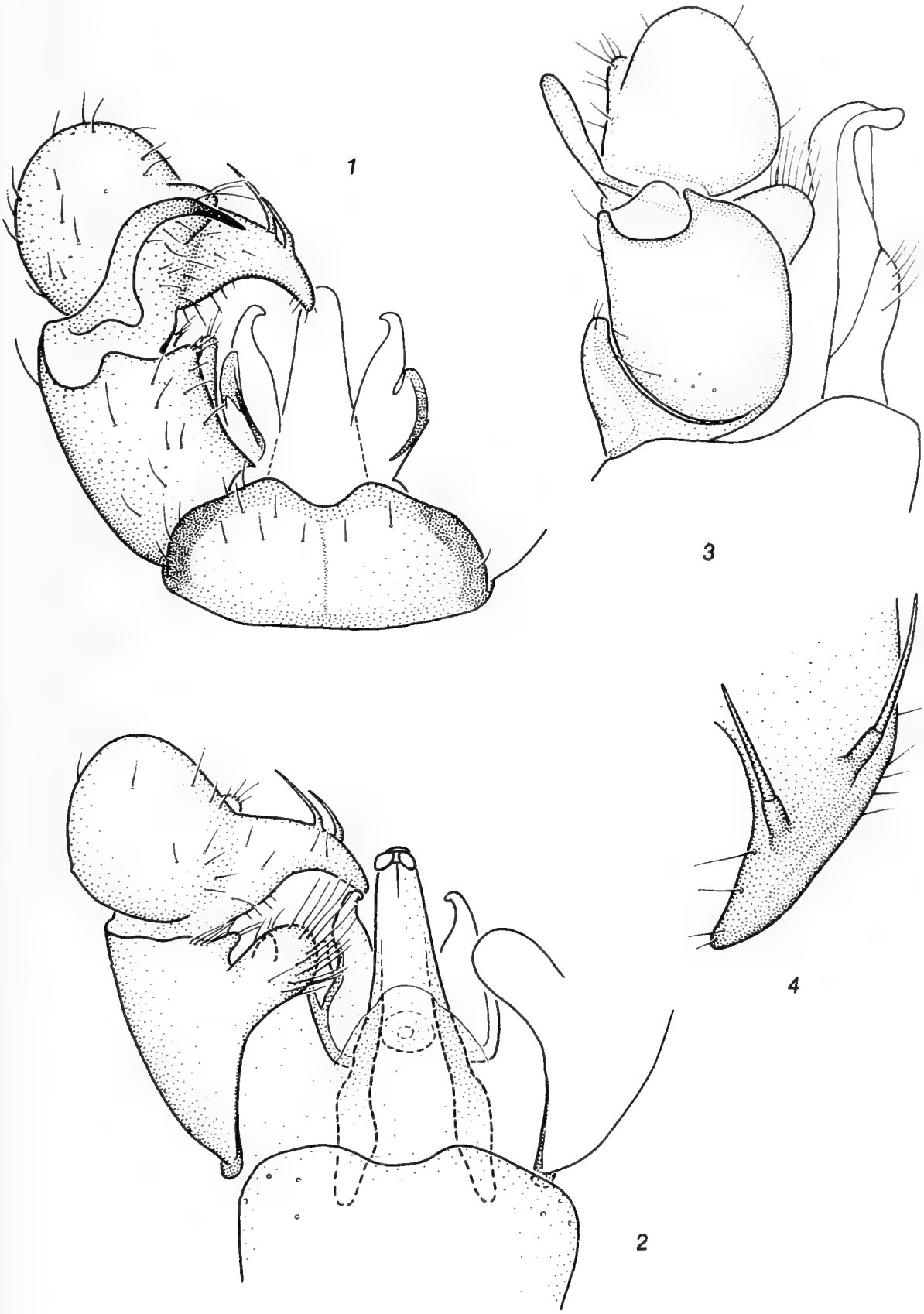
mediterranea

general colouring dark brown, grey dusted
ventral setiferous tubercle of GX stouter and shorter than dorsomesal one
rostrum relatively long
rostral spines brown, straight, on long tubercles placed near one another

Derivatio nominis: We are very pleased to dedicate this species to Dr. Jaroslav Stary, Olomouc, Tchek Republic, eminent specialist of palaearctic Limoniidae.

Acknowledgements

Our thanks to Dr J. Stary (Olomouc) for valuable comments, to Y. Borcard (Neuchâtel) for drawing of figs 1-4.



FIGS 1-4

Dicranomyia (Glochina) staryi sp. n. male genitalia. Holotype, Mallorca. 1-3: general view, dorsal (1), ventral (2), and lateral (3). 4: rostrum, lateral view.

REVUE SUISSE DE ZOOLOGIE, 101 (1) : 47-88; mars 1994

Oribatids from Madagascar II. (Acari: Oribatida).

(New and interesting mites from the Geneva Museum LXXIX.)

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Oribatids from Madagascar II (Acari: Oribatida). – Seventeen species are listed, fifteen of them are new to science. Six new genera are established, one in the family *Otocepheidae* (*Didierotocepheus* gen. n.), four in the family *Oppiidae* (*Lemuroppia* gen. n., *Pustuloppia* gen. n., *Radamoppia* gen. n. and *Fossoppia* gen. n.) and one (*Nosybelba* gen. n.) representing a new family (*Nosybelbidae* fam. n.).

Key-words: Acari - Oribatida - Taxonomy - new species, new genera, new family - Madagascar.

INTRODUCTION

The author describes several new oribatid taxa from Madagascar, based on material collected by the Geneva Expedition to Madagascar in 1989 by Dr. Bernd Hauser & Dr. Charles Lienhard. The present study is part of a joint research project[1] with the Arthropod Department of the Geneva Natural History Museum on soil mites of this region, a project which was outlined in the first part (MAHUNKA 1993).

Representatives of 17 species have been studied; 15 of them were found to be new to science. For six new species new genera had also to be established and one of them is considered as type genus of a new family within the superfamily Oppioidea Grandjean, 1951.

In the descriptions I generally apply the terminology used in several publications by NORTON (e.g. 1982), BEHAN-PELLETIER (e.g. 1984) and NORTON & BEHAN-PELLETIER (1986) based on Grandjean's work. The pilosity of the different 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 +.

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[1] A research program sponsored also by the Hungarian National Scientific Research Foundation (OTKA 3165).

Manuscript accepted 21.09.1993.

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 excluding pteromorphae). The family arrangement generally follows MARSHALL & al. (1987).

LIST OF LOCALITIES

Mad-89/2: MADAGASCAR: (prov. Tamatave: Sous-préf. Moramanga): Réserve spéciale "Analamazoatra" [anciennement Perinet] près d'Ândasibe, forêt primaire, prélèvement de sol dans les angles formés par les contreforts de *Oetece* sp. (*Lauraceae*), 960 m, extraction par appareil Berlese, 21.XI.1989, leg. B. Hauser.

Mad-89/3: MADAGASCAR: (Prov. Tamatave: Sous-préf. Moramanga): Réserve spéciale "Analamazoatra" (anciennement Perinet) près d'Andasibe, forêt primaire, prélèvement de sol au pied de *Ravensara* sp. (*Lauraceae*), 1020 m, extraction par appareil Berlese, 21.XI.1989, leg. B. Hauser.

Mad-89/29: MADAGASCAR: (Prov. Antsiranana [anciennement Diego-Suarez]): Sous-préf. Andoany [anciennement Hell-Ville]): Ile de Nosy Be, Réserve naturelle intégrale "Lokobe", forêt primaire près d'Ampasindava, prélèvement de sol dans les angles formés par les contreforts d'un grand arbre, extraction par appareil Berlese, 28.XI.1989, leg. B. Hauser.

Mad-89/43: MADAGASCAR: (Prov. Toliara [anciennement Tulear]: Sous-préf. Tôlanaro [anciennement Fort-Dauphin]): à 45 km de Tôlanaro sur la route vers Amboasary, forêt de *Didiereaceae*, prélèvement de sol, 65 m, extraction par appareil Berlese, 4.XII.1989, leg. B. Hauser.

Mad-89/49: MADAGASCAR: (prov. Toliara [anciennement Tulear]: Sous-préf. Tôlanaro [anciennement Fort-Dauphin]): à 53 km de Tôlanaro sur la route vers Amboasary, forêt de *Didiereaceae*, prélèvement de sol, 75 m, extraction par appareil Berlese, 5.XII.1989, leg. B. Hauser.

Mad-89/52: MADAGASCAR: (Prov. Tamatave: Sous-préf. Ambodifotatra): Ile de Nosy Boraha [anciennement Ile Sainte-Marie], région de "La Crique", forêt de "Kalalao" au sud-est de Lonkintsy, forêt primaire, prélèvement de sol dans les angles formés par les contreforts d'un grand arbre, 80 m, extraction par appareil Berlese, 7.XII.1989, leg. B. Hauser.

Mad-89/54: MADAGASCAR: (Prov. Tamatave: Sous-préf. Ambodifotatra): Ile de Nosy Boraha [anciennement Ile Sainte-Marie], région de "La Crique", forêt de "Kalalao" au sud-est de Lonkintsy, forêt primaire, prélèvement de sol dans les angles formés par les contreforts d'un grand arbre, 105 m, extraction par appareil Berlese, 7.XII.1989, leg. B. Hauser.

LIST OF SPECIES

APHELACARIDAE Grandjean, 1954

Aphelacarus acarinus (Berlese, 1910)

Locality: Mad-89/49.

Distribution: holarctic [MARSHALL & al. (1987)]; **new for Madagascar**.

PROTOPLOPHORIDAE Ewing, 1917

Bursoplophora madagassica sp. n.

Localities: Mad-89/43; Mad-89/49.

EREMULIDAE Grandjean, 1965
Caveremulus cordisetus Mahunka, 1983
Locality: Mad-89/29.
Distribution: Madagascar (MAHUNKA 1983, 1993).

OTOCEPHEIDAE Balogh, 1961
Didierotocepheus berndi gen. n., sp. n.
Localities: Mad-89/29; Mad-89/43.
Papillocepheus decoratus sp. n.
Locality: Mad-89/54.
Papillocepheus reductus sp. n.
Locality: Mad-89/2.

OPPIIDAE Grandjean, 1951
Brachioppiella boraha sp. n.
Locality: Mad-89/54.
Lanceoppia cucheana sp. n.
Localities: Mad-89/2; Mad-89/3.
Lemuroppia helleri gen. n., sp. n.
Locality: Mad-89/2.
Pustuloppia madagassica gen. n., sp. n.
Locality: Mad-89/2.
Radamoppia ravenala gen. n., sp. n.
Locality: Mad-89/2.
Radamoppia vanga gen. n., sp. n.
Locality: Mad-89/54.
Ramusella aepyornis sp. n.
Locality: Mad-89/49.
Striatoppia luisae sp. n.
Localities: Mad-89/3; Mad-89/52.
Fossoppia calcarata gen. n., sp. n.
Locality: Mad-89/29.
Fossoppia pirata gen. n., sp. n.
Locality: Mad-89/54.

NOSYBELBIDAE fam. n.
Nosybelba oppiana gen. n., sp. n.
Locality: Mad-89/2.

DESCRIPTIONS OF THE NEW TAXA

Bursoplophora madagassica sp. n.

Measurements. - Length of aspis: 145-174 µm, length of notogaster: 242-247 µm, width of notogaster: 249-271 µm.

Integument: Cerotegument not observable. Cuticle: pygidial part with comparatively large but flat areolae, stripes not observable. Some very fine and irregular spots present on aspis and notogaster (see BERNINI 1983: 49).

Aspis: Anterior rostral margin rounded, not incised. Five pairs of prodorsal setae and a spindle-shaped sensillus present. Very great difference observable between the two pairs of exobothridial setae, *exa* very small, but *exp* extremely long and pilose (Fig. 2). Sensillus with some fine cilia on its distal part.

N o t o g a s t e r : Fourteen pairs of notogastral setae present, displaying great differences among themselves. Setae of series *c*, *h* and *ps* very short, *e* and *f* much longer than the preceding ones, setae e_1 and f_1 slightly dilate, spindle-shaped, the other two pairs simple (Fig. 7). The distance between the two setae e_1 and between setae e_1 and e_2 very small, these setae stand conspicuously near each other. Among the setae on the segment *F* the same arrangement observable. Transversal ridges, along the insertion of setae *f*, long, reaching to lateral margin (Fig. 1).

C o x i s t e r n a l r e g i o n : Epimeral setal formula: 3-2-2-3 (Fig. 3), most of these setae rigid and comparatively thick. Seta *4a* appearing on the median margin of epimere 4.

A n o g e n i t a l r e g i o n : The posterior tectum of genital plates very large, covering the anterior part of the ano-genital plates (Fig. 6). Eight (exceptionally 9) pairs of genital setae present. Anoadanal plates oblong, posterior part conspicuously protruding in lateral aspect, this part with 6 (exceptionally 5) pairs of short and simple anal setae. Hollow on the anoadanal plates indistinct, just observable.

L e g s : Legs tridactylous, a strong heterodactyly is present; central claw much larger than lateral ones. Leg setal formulae:

I: 0-2-3-4+1-3
III: 2-2-2-2+1-12-3
IV: 2-2-3-1+1-11-3 (Figs 4-5)

Solenidium of tibia III long, tubuliform. Some crests visible on femora III and IV ventrally.

M a t e r i a l e x a m i n e d : Holotype: Mad-89/49, 4 paratypes from the same sample; 5 paratypes: Mad-89/43. Holotype and 5 paratypes: MHNG[3] and 4 paratypes (1401-PO-1991): HNHM[4].

R e m a r k s : A survey of the genus *Bursoplophora* Subias & Pérez-Iñigo, 1978 was given recently by Bernini (1983). He described two new species and mentioned some differential characters of the known species. The new species is characterized by: 1. the position of setae *e* and *f*, 2. the number of the epimeral setae, 3. the strong pygidial sculpture and 4. the setation of leg IV.

Didierotocepheus gen. n.

D i a g n o s i s : Family *Otocepheidae*. Rostrum conspicuously flat and wide. Wide lamellae and tutoria well developed; lamellar setae arising on lamellar, rostral setae on the tutorial cusps. Median prodorsal condyles and both pairs of notogastral condyles absent. Eleven pairs of phylliform notogastral setae. Anogenital setal formula: 3-1-2-3. Lyrifissures *iad* in apoanal, setae ad_1 in postanal position.

T y p e s p e c i e s : *Didierotocepheus berndi* sp. n.

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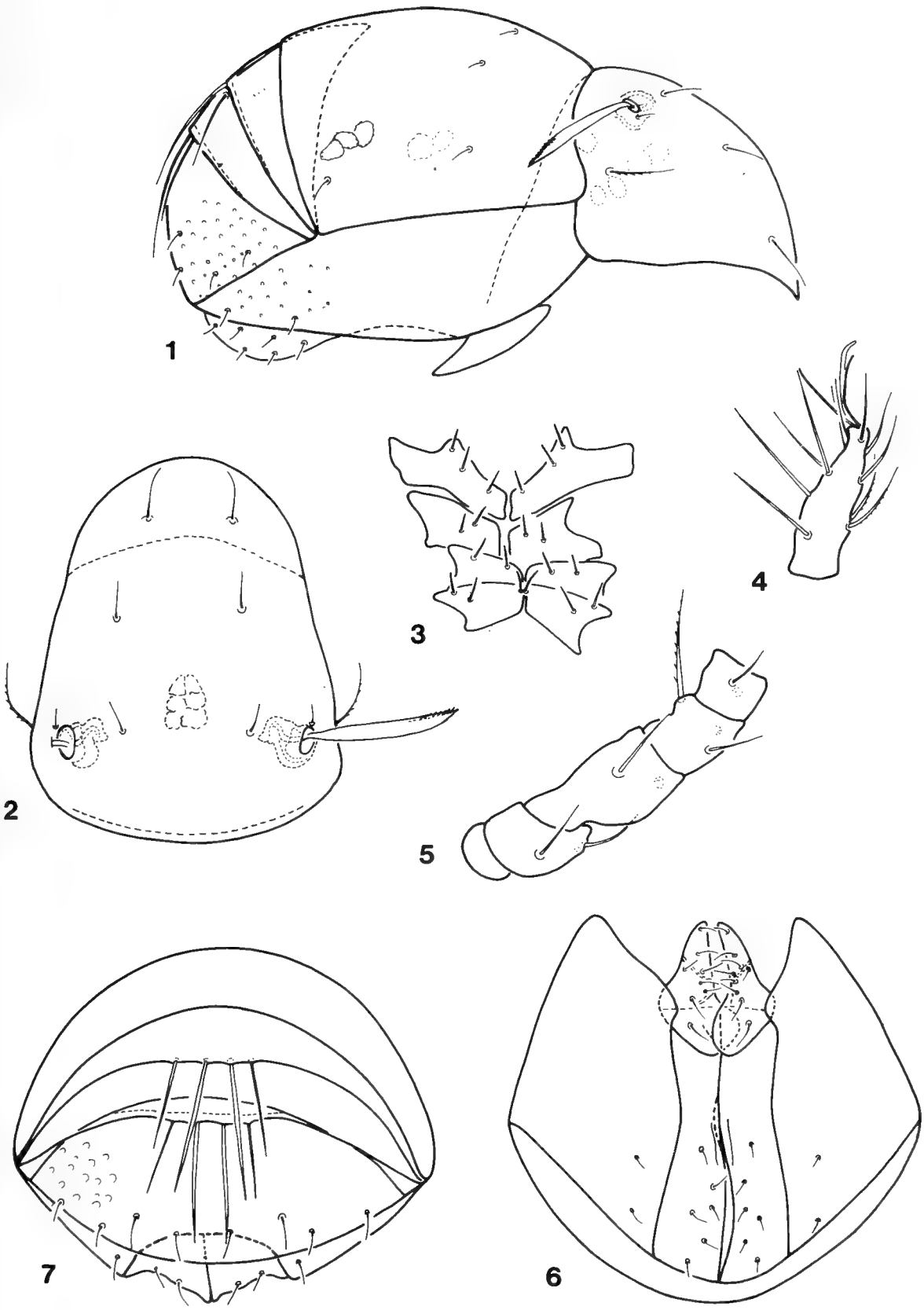
[3] MHNG = deposited in the Muséum d'Histoire naturelle, Genève.

[4] HNHM = deposited in the Hungarian Natural History Museum, Budapest, with identification number of the specimens in the Collection of Arachnida.



FIGS 1-7

Bursoplophora madagassica sp. n. - 1: body in lateral aspect, 2: aspis, 3: coxisternal region, 4: tarsus of leg IV, 5: basal joints of leg IV, 6: anogenital region, 7: pygidial region.

R e m a r k s : In the family *Otocepheidae* Balogh, 1961 the genus *Pseudotocepheus* Balogh, 1960, was described from Madagascar; it was the first to have 3 pairs of genital setae. Since then some other genera have been established, characterized by 3 pairs of genital setae, but none of them has eleven pairs of phylliform notogastral setae and none lacks prodorsal and notogastral condyles.

The first part of the name is an allusion to *Didiereaceae*, an endemic family of spiny trees in Southern Madagascar.

Didierotocepheus berndi sp. n.

M e a s u r e m e n t s . - Length of body: 551-674 µm, width of body: 275-350 µm.

I n t e g u m e n t : Body covered by a very thick cerotegument layer, its sculpture mostly resembling the sculpture of the cuticle ornamented by large alveoli.

P r o d o r s u m : Lamella comparatively short, wide, lacking sharp cuspis. Tutorium well developed, slightly arched laterally (Fig. 8). Median prodorsal condyles absent, lateral pair (*co. pl.*) well developed. Surface generally reticulate (alveolate), in the interbothridial region a series of pairs of larger alveoli. Rostral setae slightly thinner and shorter than the lamellar ones and arising on the distal end of tutorium (Fig. 12): the latter setae originating on the lamellar surface. Interlamellar setae the longest of all, reaching to the rostral apex. All prodorsal setae - excepting the minute exobothridial ones - finely spiculate or barbed. Sensillus very short, clavate, its surface smooth or only finely roughened.

N o t o g a s t e r : No condylus on the anterior margin of notogaster, but the shoulder slightly protruding anteriorly. Eleven pairs of long, slightly dilated, willow-leaf-shaped notogastral setae, resembling the prodorsal ones. Their whole surface spiculate. Lyrifissures *ih* stand near to *im*, before setae h_3 (sometimes behind it) (Fig. 9).

L a t e r a l p a r t o f p o d o s o m a : Pedotecta 1 large, pedotecta 2-3 and the discidium well developed. Setae *1c* arising on the pedotecta 1 (Fig. 12), directed forwards and smaller than *3c* or *4c*.

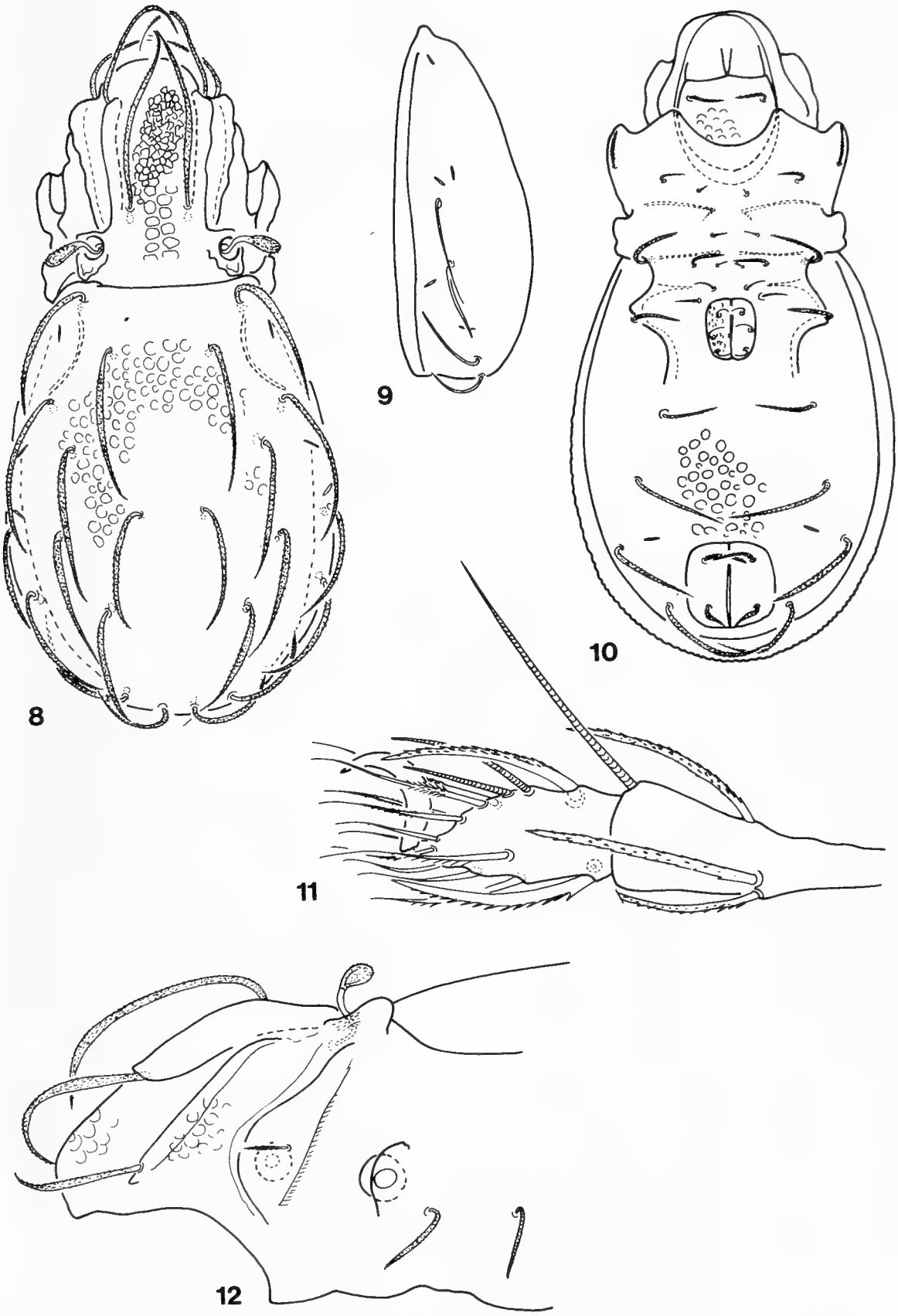
C o x i s t e r n a l r e g i o n : Epimeral borders only partly observable. Some of the setae narrow-phylliform (Fig. 10).

A n o g e n i t a l r e g i o n : Surface of genital plates ornamented by small foveolae, ventral and anal plates by alveoli. Anogenital setal formula: 3-1-2-3. All setae finely barbed.

G n a t h o s o m a : Mentum conspicuously alveolate. Other structures with the normal otocepheoid characters. Palp 5-segmented, palpal setal formula 0-2-1-3-8+1. Eupathidia u_1 and su_1 very short, solenidium in normal position.

L e g s : The leg setal formulae shows a weak reduction (genu and tibia of legs III-IV):

I: 1- 4-3+2-16+2-1
II: 1- 4-3+1-3+1-15+2-1
III: 2-3-0(?)+1-2+1-14-1
IV: 1-2-1-2+1-12-1



FIGS 8-12

Didierotocepheus berndi gen. n., sp. n. - 8: dorsal side, 9: notogaster in lateral aspect, 10: ventral side, 11: leg II, 12: podosoma in lateral aspect.

Setae *ft*" of all tarsi very strong, thick, directed forwards (Fig. 11).

Material examined: Holotype: Mad-89/29; 5 paratypes from the same sample; 4 paratypes: Mad-89/43. Holotype and 6 paratypes: MHNG and 3 paratypes (1402-PO-1991): HNHM.

Remarks: See the remarks after the generic diagnosis.

Papillocepheus decoratus sp. n.

Measurements. - Length of body: 482-517 µm, width of body: 221-266 µm.

Integument: Thick cerotegument layer covering the whole body surface. This layer particularly thick on the rostral, sejugal and pedotectal regions, mostly consisting of filaments and of different kinds of granules. Cuticle ornamented with differing, mostly irregular alveoli.

Prodorsum: Rostrum widely rounded. Lamellae slightly convergent anteriorly. A thin translamella connecting the lamellar cusps. Interlamellar region with some weak longitudinal laths (Fig. 13). Major part of this surface reticulate, medially a series of stronger alveoli observable. Rostral and lamellar setae willow-leaf-shaped, first ones thinner than the latter; interlamellar setae also dilate, but their basal part strongly narrowed, like a peduncle. Sensillus short, clavate. Its surface and that of all these setae distinctly spiculate or barbed. Bothridium opening laterally, its posterior part connected with the large outer prodorsal concyles (*co.pl.*).

Notogaster: Ten pairs of spoon-shaped setae of different size present, their peduncle short, their head mostly round. Notogastral surface ornamented by irregular alveoli.

Lateral part of podosoma: Pedotecta 1 large, conspicuously foveolate. Setae *1c* arising at their basis behind the acetabulum (Fig. 17). Pedotecta 2-3 small, rounded.

Coxisternal region: Epimeral border wide. Epimeral setal formula: 2-0-3-2. Setae *1a* usually represent only by indistinct alveoli.

Anogenital region: Genital plates dark, with 3 pairs of setae. Their alveoli conspicuously strongly framed. The position of the anal and adanal setae, and of the lyrifissures *iad* shown in Fig. 15.

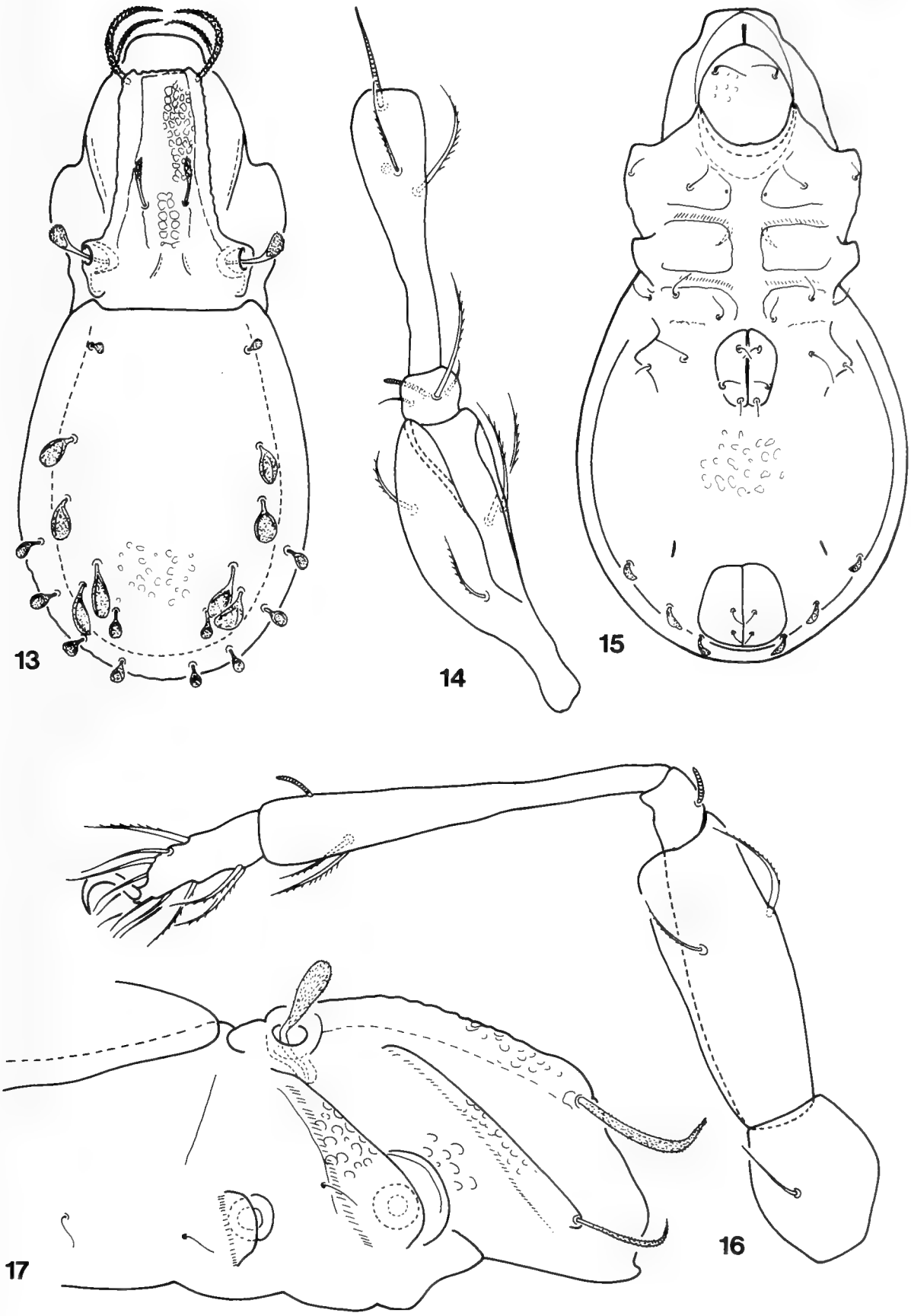
Gnathosoma: Mentum very highly arched anteriorly (nearly of "galumnoid-type").

Legs: Type of the ultimate setae L-L-L-L. Leg setal formulae:

I: 1- 4-3+1-4+1-16+2-1
II: 1- 4-3+1-3+1-15+2-1
III: 2-3-1(?)+1-2+1-15-1
IV: 1-2-1(?)-2+1-12-1 (Fig. 16)

All femora have a blade-like ventral formation and a deep fossa on the genu and tibia (Fig. 14).

Material examined: Holotype: Mad-89/54; 1 paratype from the same sample. Holotype: MHNG and the paratype (1403-PO-1991): HNHM.



FIGS 13-17

Papillocepheus decoratus sp. n. - 13: dorsal side, 14: basal joints of leg II, 15: ventral side, 16: leg IV, 17: podosoma in lateral aspect.

R e m a r k s : The differential diagnosis will be given following the next *Papillocepheus* species.

Papillocepheus reductus sp. n.

M e a s u r e m e n t s : Length of body: 565-620 µm, width of body: 206-261 µm.

P r o d o r s u m : Conspicuously large, with a very wide cervical region behind the prodorsal condyles. Rostral region bent down, well visible in lateral aspect (Fig. 20), therefore the whole body angulate, "brick-shaped". Rostrum widely rounded, lamellae ending far from the rostrum, without a sharp lamellar cusp. Interlamellar region smooth, only a pair of weak longitudinal crests observable on it. Tutorium strong, arched forwards. Rostral and lamellar setae narrow, willow-leaf-shaped, interlamellar ones setiform, all three pairs barbed. Sensillus very short, fusiform, its surface also barbed. Cervical region pustulate laterally.

N o t o g a s t e r : Anterolateral condyles (*co.nl.*) absent. Only eight (!) pairs of notogastral setae present. Four pairs of them spoon-shaped, four pairs in posteromarginal position fine, simple, smooth (Fig. 18).

L a t e r a l p a r t o f p o d o s o m a : Pedotecta 1 and pedotecta 2-3 large, completely covering the acetabula in lateral view (Fig. 20).

C o x i s t e r n a l r e g i o n : Very similar to that of *Papillocepheus decoratus*. Lateral setae of epimeres (*1c*, *3c*, *4c*) shorter than their inner pairs (*1b*, *3b*, *4b*).

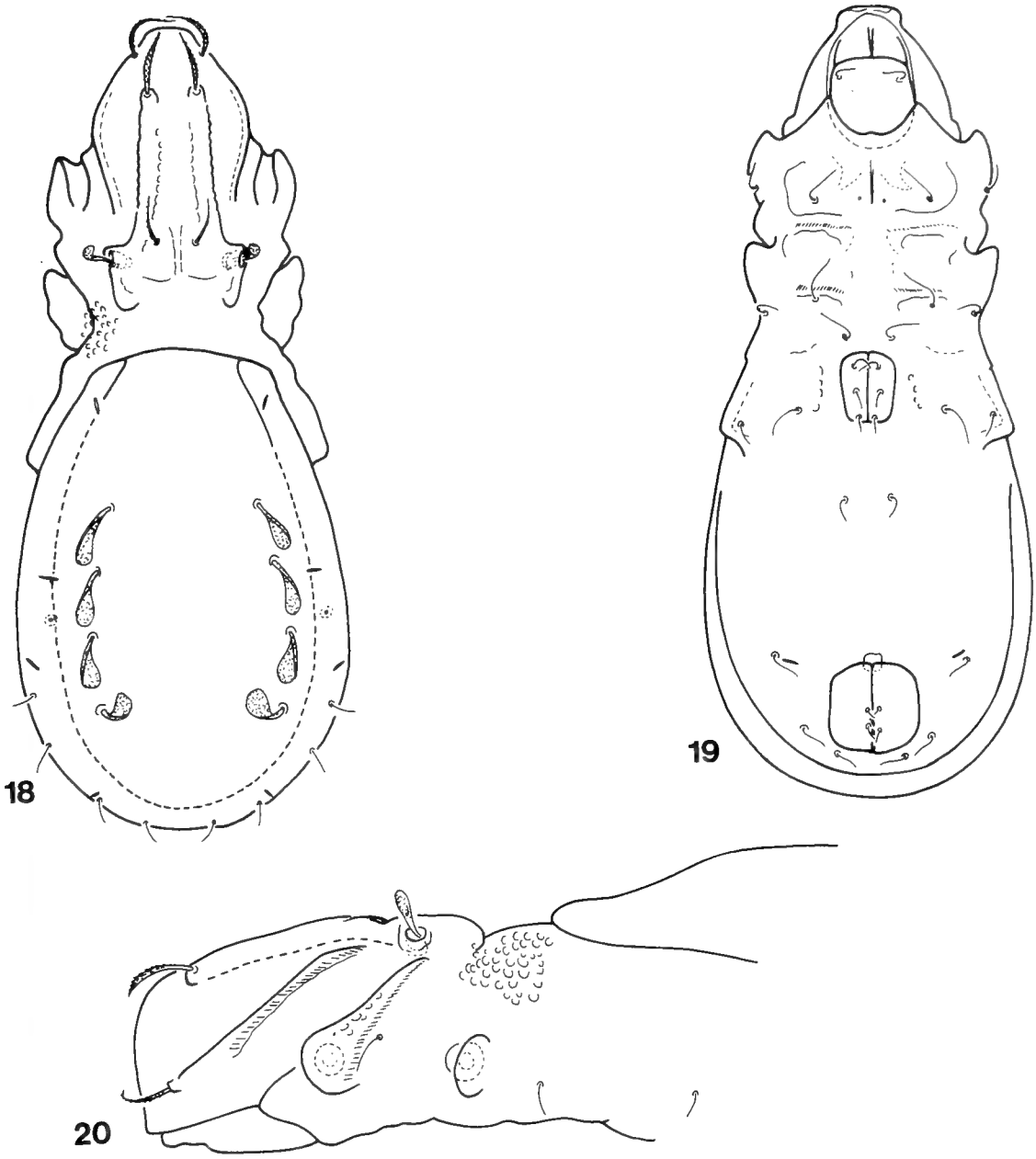
A n o g e n i t a l r e g i o n : the number and position of the lyrifissures corresponding to those of the other *Papillocepheus* species. Genital plates dark, genital setae comparatively long, adanal setae simple, setiform (Fig. 19).

G n a t h o s o m a : Anterior margin of mentum only weakly arched forwards. No peculiar differential characters against the other *Papillocepheus* species present.

L e g s : Form and chaetotaxy very similar to those of *Papillocepheus decoratus*. Femur III with 3 setae (I was unable to find the setae on genu III and IV, only the solenidium on genu III was clearly observable).

M a t e r i a l e x a m i n e d : Holotype: Mad-89/2, 1 paratype from the same sample, 2 paratypes: Mad-89/54. Holotype and 1 paratype: MHNG and 2 paratypes (1404-PO-199): MNHM.

R e m a r k s : Hitherto in the genus *Papillocepheus* Balogh & Mahunka, 1966 only two species were known, one from South Africa (the type species: *Papillocepheus heterotrichus* Balogh & Mahunka, 1966) and one from Kenya (*P. areolatus* Mahunka, 1987). On the basis of the number of notogastral setae and the 4 pairs of simple setae in posteromarginal position, one (*P. reductus*) of the two new specis stands far from the others. The other new species (*P. decoratus*) stands nearer to the earlier described ones, but it may easily be distinguished from *P. areolatus* by the irregular and smaller areolae on the notogaster, and from *P. heterotrichus* Balogh & Mahunka, 1966, by the ratio of the notogastral setae and the form of the setae in the posteromarginal position (they are smaller, shorter and rounder in the new species, elongated and longer in *P. heterotrichus*).



FIGS 18-20

Papillocepheus reductus sp. n. - 18: dorsal side, 19: ventral side, 20: podosoma in lateral aspect.

Brachioppiella boraha sp. n.

M e a s u r e m e n t s . - Length of body: 290-305 µm, width of body. 145-152 µm.

P r o d o r s u m : Rostrum rounded. Lamellar line (or a weak costula) with arched transcostula present. In the interlamellar region two pairs of spots and a pair of strong longitudinal laths at the basis of interlamellar setae also observable. The prodorsal surface, along the longitudinal costulae and laterally, conspicuously pustulate

or granulate (Fig. 21). Setae *ro* the longest of all prodorsal setae and distinctly ciliate, setae *le* thin, setiform, setae *in* erect, pin-shaped. Sensillus slightly dilated, on this dilated part unilaterally 7 diversely long branches.

N o t o g a s t e r : Ten pairs of simple notogastral setae present, c_2 minute, setae *lp* originating far anteriorly, near *lm* (Fig. 21).

L a t e r a l p a r t o f p o d o s o m a : Exobothridial and sejugal region fairly granulate or pustulate. This granulation is separated from that of the lamellar region (Fig. 23). Pedotecta 1 normal, discidium flat, slightly rounded, without projecting cuspis.

C o x i s t e r n a l r e g i o n : Epimeral borders well developed, apodemata 4 strongly arched posteriorly, behind the genital aperture, *bo.4* composing a transversal band (Fig. 22). On the sejugal region a pair of tubercles directed forwards. All epimeral setae simple, or slightly ciliate. Setae *1c* arising on pedotecta 1.

A n o g e n i t a l r e g i o n : Anogenital setal formula 5-1-2-3. Setae ad_1 in post-, ad_3 in preanal, lyrifissures *iad* in inverse apoanal, position. Setae ad_3 arising far laterally, only slightly behind the aggenital setae.

G n a t h o s o m a : The structure of this region shows the normal "oppioid" characters. The solenidium of the palpus is also in the normal position.

L e g s : All legs show the normal oppioid morphology. The femora with conspicuously porose area dorsally. Leg setal formulae:

I: 1-5-2+1- 4-20+2-1 (Fig. 24)
II: 1-5-2+1- 4+1-14+2-1
III: 2-3-1+1-3+1-13-1
IV: 1-2-2-3+1-10-1 (Fig. 25)

M a t e r i a l e x a m i n e d : Holotype: Mad-89/54; 5 paratypes from the same sample. Holotype and 3 paratypes: MHNG and 2 paratypes (1405-PO-1991): HNHM.

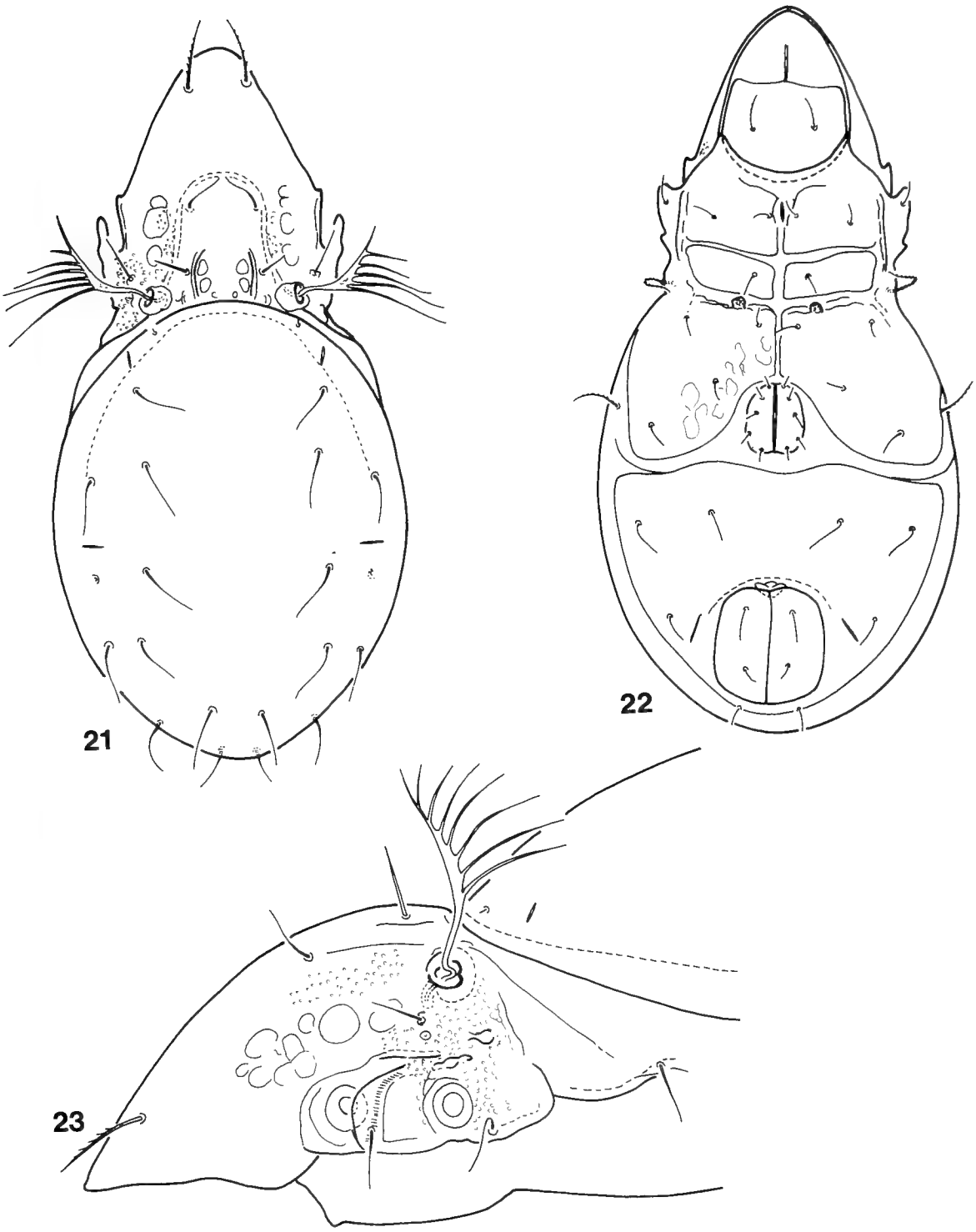
R e m a r k s : The new species is provisionally placed in the genus *Brachioppiella* Hammer, 1962; however, it is distinguishable from the hitherto known species by the form of the epimeral borders (it rather resembles the form known in the genus *Gittela* Hammer, 1961), the presence of setae c_2 and by the granulation of the lamellar region.

The species is named after the island of Nosy Boraha (formerly Ile Sainte-Marie).

Lanceoppia cucheana sp. n.

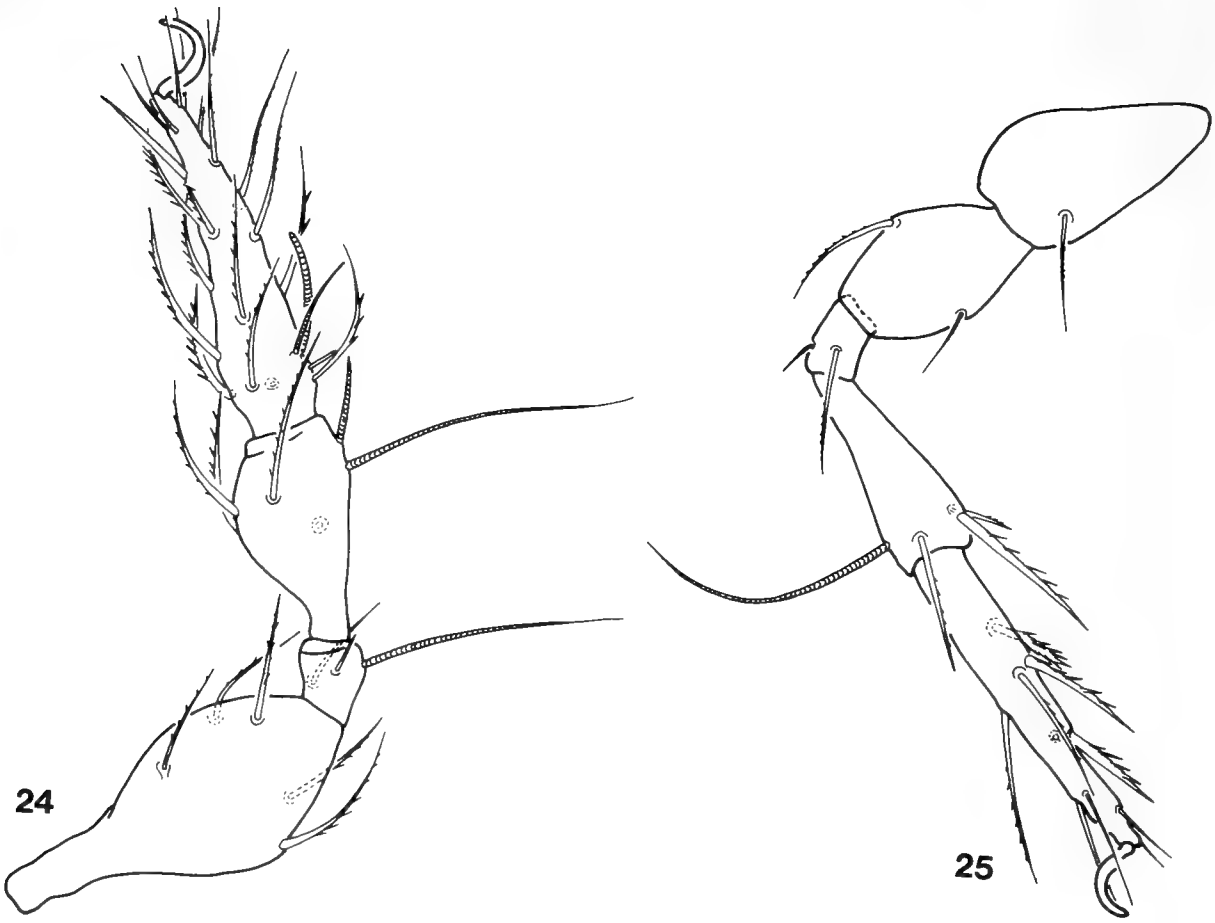
M e a s u r e m e n t s . - Length of body: 438-517 µm, width of body: 258-320 µm.

P r o d o r s u m : Rostral apex elongated, nasiform in dorsal view (Fig. 26). Longitudinal costula or lamellar lines absent, but a weak transversal ridge observable in front of the lamellar setae. A pair of triangular apophyses and some spots are present in the interbothridial region. Lateral part of prodorsum distinctly but finely granulate. Rostral setae thicker than the other prodorsal setae, interlamellar and exobothridial ones very short. Sensillus long, gradually dilated distally, with some minute spines on its



FIGS 21-23

Brachioppiella boraha sp. n. - 21: dorsal side, 22: ventral side, 23: podosoma in lateral aspect.



FIGS 24-25

Brachioppiella boraha sp. n. - 24: leg I, 25: leg IV.

distal end. A pair of conspicuous, round structures, like porose areas, observable in the dorsosejugal region.

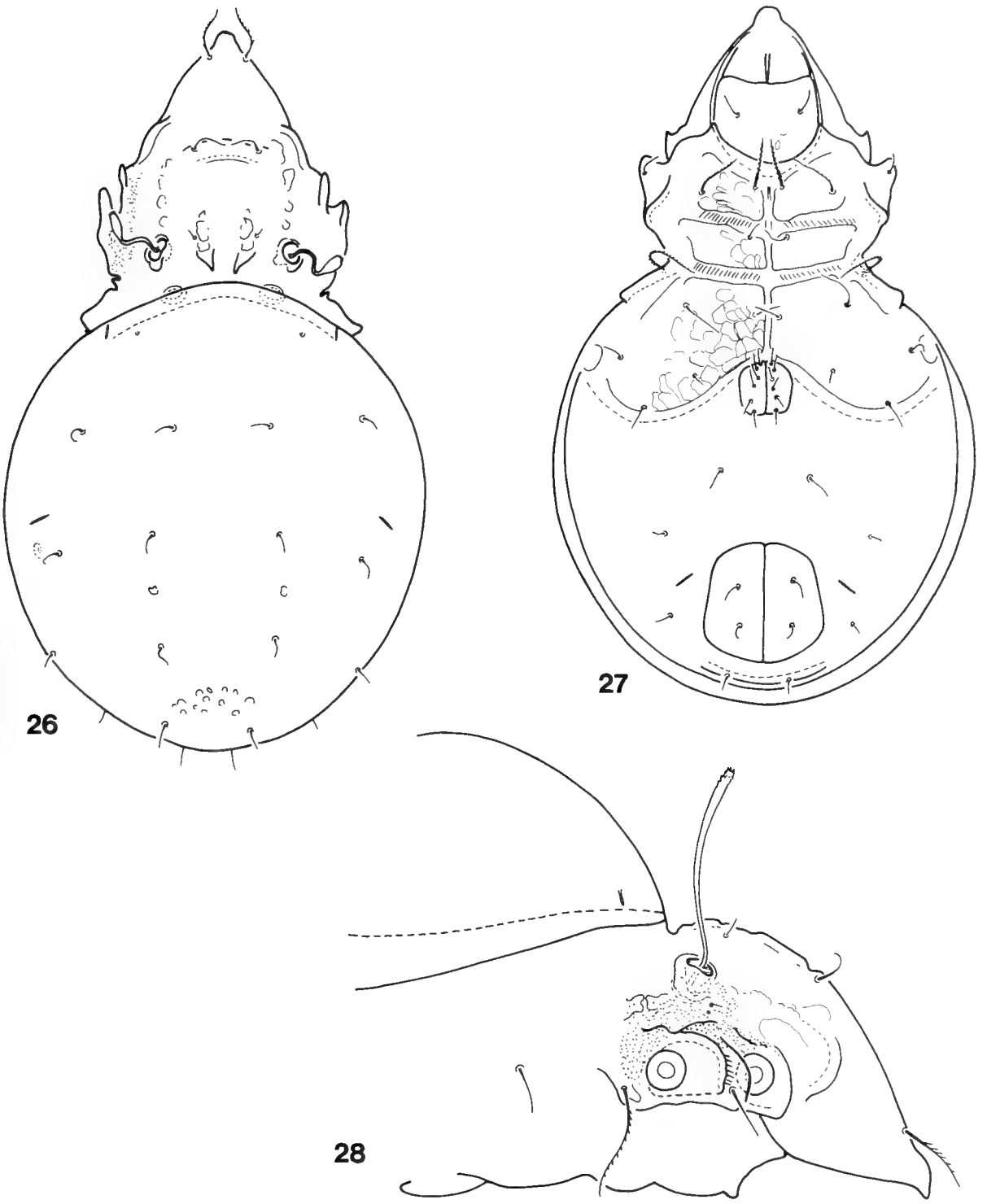
N o t o g a s t e r : Nine pairs of very short and simple setae and the alveoli of setae c_2 present. The latter sometimes completely reduced.

L a t e r a l p a r t o f p o d o s o m a : The fine granulation spreading also over the sejugal region, but lacking around leg III (Fig. 28). Pedotecta 1 small, squamiform, pedotecta 2-3 and the discidium reduced, not observable.

C o x i s t e r n l r e g i o n : Epimeral borders well developed, all epimeres framed. The shape of the epimeral setae characteristic for this species. Setae *1a* very long, directed forwards, setae *1b* and *3c* also long, but *1c* and the setae on epimere 4 short, e.g. *4b* and *4c* longer than *2a* (Fig. 27).

A n o g e n i t a l r e g i o n : Genital aperture small and originating anteriorly between the epimeral borders 4. Anogenital setal formula: 6-1-2-3. Setae ad_1 in postanal position, arising in a short arched lath.

G n a t h o s o m a : No particularly interesting structures in this region. Palpal setal formula: 2-1-3-9+1. Palpal solenidium in normal position.



FIGS 26-28

Lanceoppia cucheana sp. n. - 26: dorsal side, 27: ventral side, 28: podosoma in lateral aspect.

L e g s : Narrow and slender, legs III-IV conspicuously long. Leg setal formulae:

I: 1-5-2+1-4+2-20+2-1 (Figs 29-30)
II: 1-5-2+1-4+1-14+2-1
III: 2-3-1+1-3+1-13-1 (Fig. 31)
IV: 1-1-2-3+1-10-1 (Fig. 32)

Trochanter III with a strong spur. Some setae on tibia and tarsus of legs II-IV erect, spiniform, pike-shaped (Fig. 31) and some (*v*) on tarsi II and IV plumose.

M a t e r i a l e x a m i n e d : Holotype: Mad-89/2; 5 paratypes from the same sample; 2 paratypes: Mad-89/3. Holotype and 4 paratypes: MHNG and 3 paratypes (1406-PO-1991): HNHM.

R e m a r k s : On the basis of the prodorsal sculpture and the characteristic spiniform setae on leg III, the new species resembles *"Oppia" spinipes* Balogh, 1962, described from Madagascar. But the new species can be distinguished from it by the shape of the sensillus (simple, fusiform in *O. spinipes*) and the position of the lyrifissures (adanal in *O. spinipes*).

I dedicate the new species to Mrs T. Cuche, the assistant of Dr. B. Hauser at the Geneva Museum, for her help in our scientific work.

Lemuroppia gen. n.

D i a g n o s i s : Family *Oppiidae*. Notogaster strongly convex (Fig. 36). Prodorsal apex without incision. A short costula present, notogastral crista absent. Sensillus very long, slightly fusiform. Thirteen pairs of notogastral setae with strong heterotrichy present. Setae c_2 reduced. Setae *1c* arising far from pedotecta 1. Gnathosoma and legs typical, with the "oppiid" characters.

T y p e s p e c i e s : *Lemuroppia helleri* sp. n.

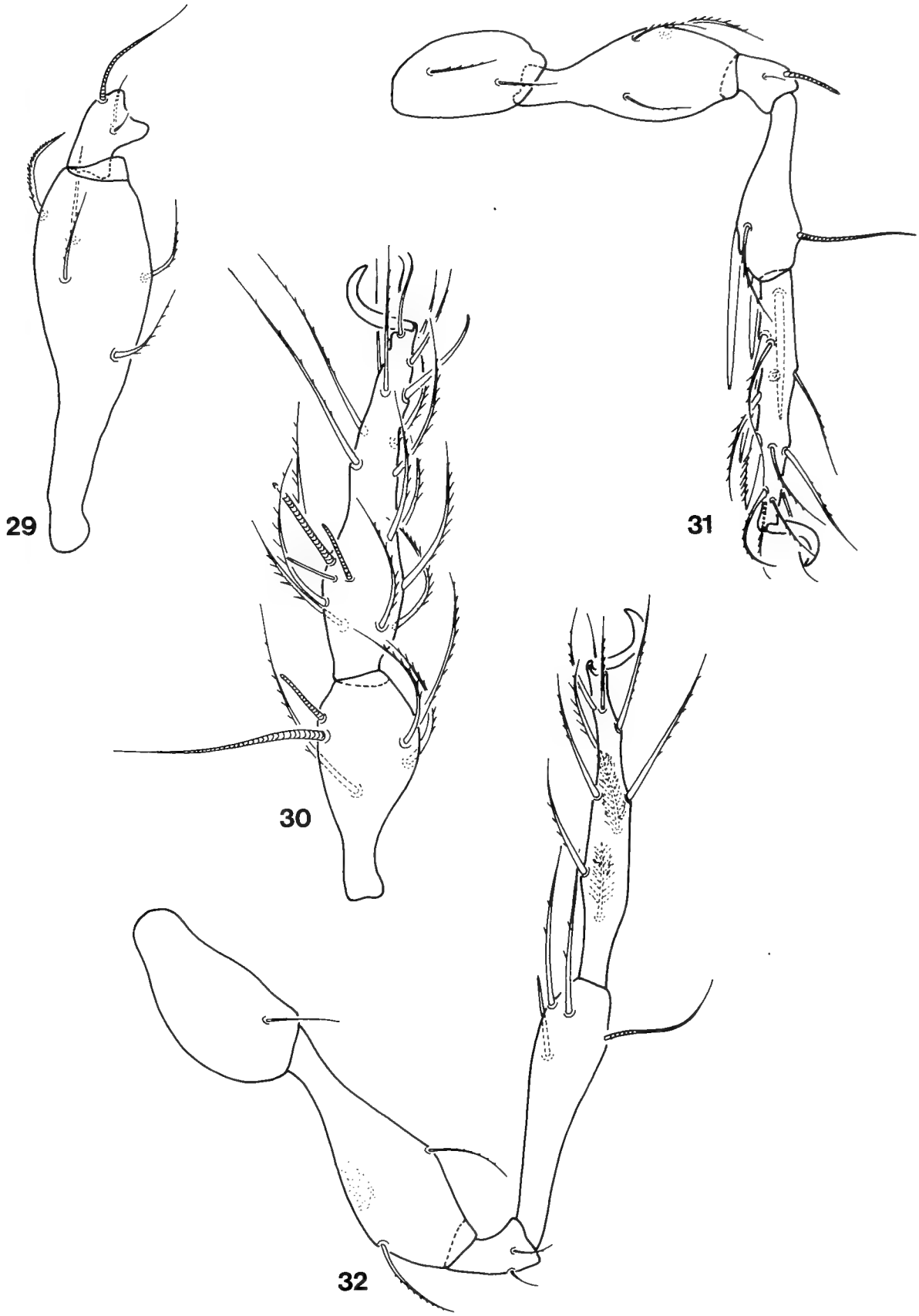
R e m a r k s : On the basis of the elongate legs, the long sensillus and the notogastral heterotrichy the new species should be assigned to the genus *Lasiobelba* Aoki, 1959. However, all heretofore known species of this genus have ten pairs of notogastral setae and their prodorsum never display any lamellar lines or costulae. Accordingly, the erection of a new supraspecific taxon is unavoidable.

The first part of the name alludes to the lemurs, a group of primates endemic to Madagascar.

Lemuroppia helleri sp. n.

M e a s u r e m e n t s . - Length of body: 251-143 µm, width of body: 286-162 µm.

P r o d o r s u m : Rostrum rounded, without any incision or indentation. A short lamellar line, or weak costula present (Fig. 33), the thin, simple lamellar setae arising on its distal end. Rostral setae originating on the dorsal surface of prodorsum, comparatively near to each other, much thicker than the lamellar setae. Interlamellar setae completely reduced, represented only by alveoli. Exobothridial setae very long and thin, inserted inconspicuous protuberances. Bothridium with a basal tubercle,



FIGS 29-32

Lanceoppia cucheana sp. n. - 29-30: leg I, 31: leg III, 32: leg IV.

sensillus (Fig. 35) characteristic of species: nearly spindle-shaped, but blunt at tip, with some spicules on its whole surface. Some irregular alveoli visible in the interlamellar region.

Notogaster: Thirteen pairs of notogastral setae present, c_2 reduced, represented only by their alveoli. Among the notogastral setae an extreme heterotrichy observable, two pairs of setae very long, pilose, all others short and simple (Fig. 33).

Lateral part of podosoma: Exobothridial region (Fig. 37) granulated. Pedotecta 1 small, seta *1c* arising far from it. Setae *3c* and *4c* very long, ciliate.

Coxisternal region: Epimeres 2 and epimeres 3-4 not touching medially. Among the epimeral borders *bo.2.* and *bo.sej.* well developed, one pair of robust tubercles visible on the latter (Fig. 34). Setae *1b* much longer than *1c*; setae *3b*, *3c*, *4b*, *4c* also long, like *1b*.

Anogenital region: Anogenital setal formula: 5-1-2-3. Genital plates slightly incised on their anteromedian margin. Setae g_1 not longer than g_5. Adanal setae and lyrifissures *iad* in normal position, (setae ad_1 in postanal, ad_2 and ad_3 in paraanal position).

Legs: All legs very long, the setal formulae are:

I: 1-5-2+1- 4+2-20+2-1 (Fig. 38)
IV: 1-2-1+1-3+1-10-1 (Fig. 39)

Two ventral setae of tarsus IV plumose.

Material examined: Holotype: Mad-89/2, 25 paratypes from the same sample. Holotype and 15 paratypes: MHNG and 10 paratypes (1407-PO-1991): HNHM.

Remarks: See after the generic diagnosis.

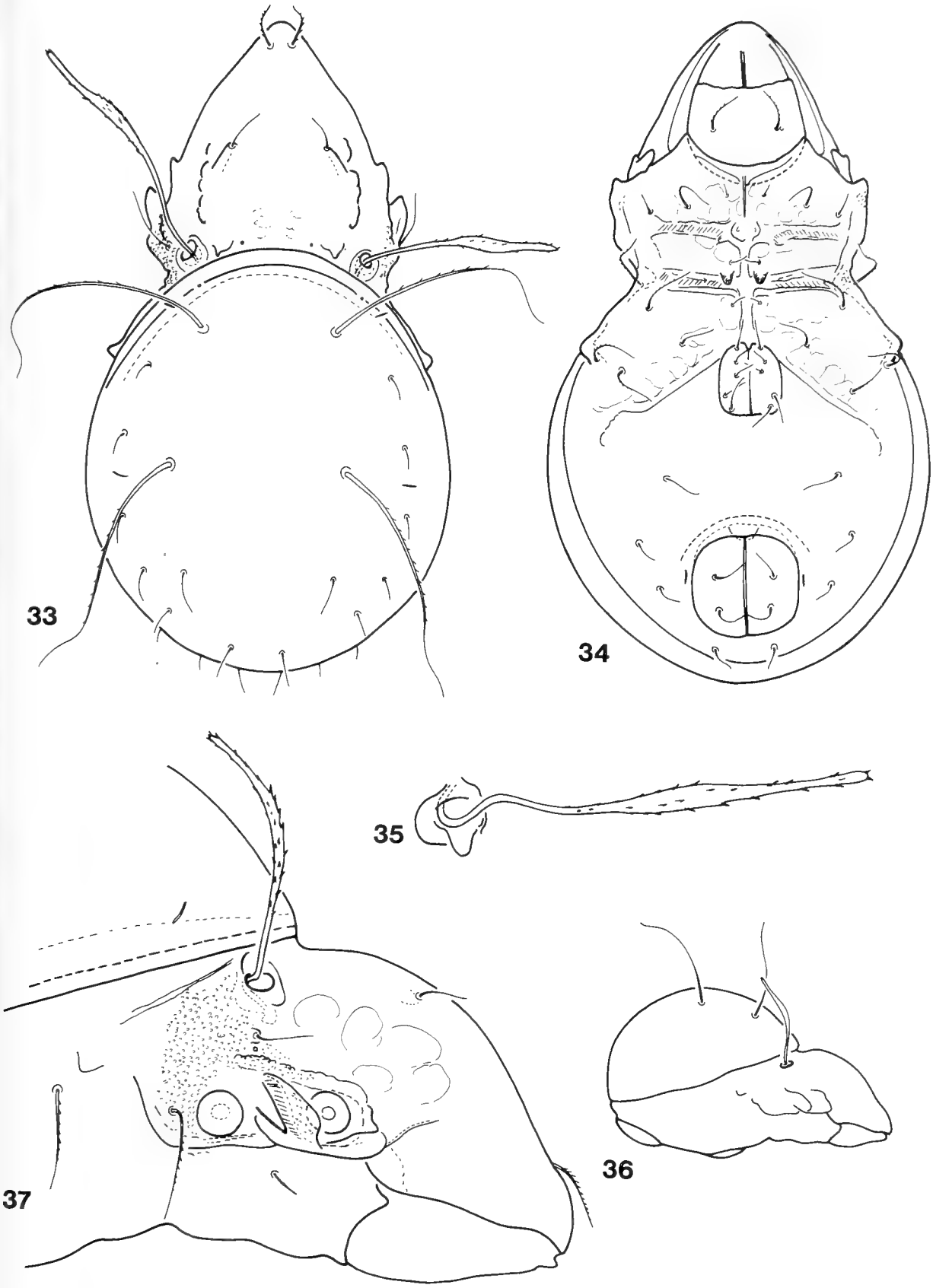
I dedicate the new species to Max Heller, chargé d'affaires of the Swiss Embassy in Antananarivo, who contributed decisively to the success of the Geneva Expedition by his invaluable help.

Pustuloppia gen. n.

Diagnosis: Family *Oppiidae*. Prodorsum rounded, without any incision. Prodorsal surface without lamellar lines or costulae. Small crests in the interbothridial region and behind it a conspicuous unpaired tubercle in basal position. Sensillus very long, spindle-shaped. Strong notogastral neotrichy, 1 pair of setae long and fairly plumose, nine pairs very short. Setae c_2 minute. Podosoma strongly granulated. Setae *1c* arising on pedotecta 1, discidium normally developed. Epimeral region heavily sclerotized. Anogenital setal formula: 5-1-2-3. Lyrifissures *iad* in inverse apoanal, setae ad_1 in postanal position. Legs very long, their chaetotaxy with typical "oppiid" characters.

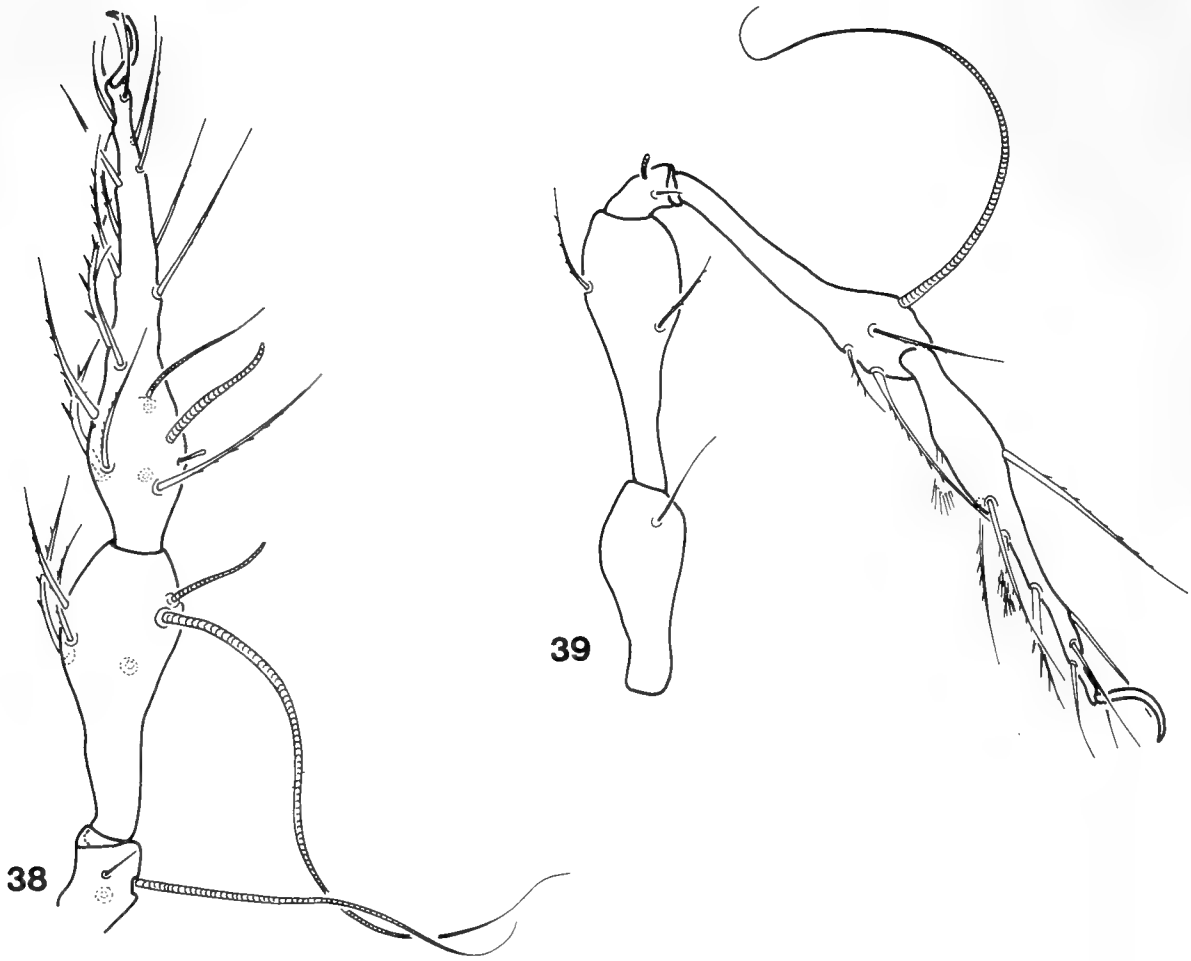
Type species: *Pustuloppia madagassica* sp. n.

Remarks: On the basis of the shape of prodorsum, the strong notogastral neotrichy and the form of the sensillus the new species might be relegated to the genus *Lasiobelba* Aoki, 1959. However, on the basis of the position of the adanal lyrifissures and the interbothridial protuberances, a new genus has to be erected for this new species.



FIGS 33-37

Lemuroppia helleri gen. n., sp. n. - 33: dorsal side, 34: ventral side, 35: sensillus, 36: body, 37: podosoma in lateral aspect.



FIGS 38-39

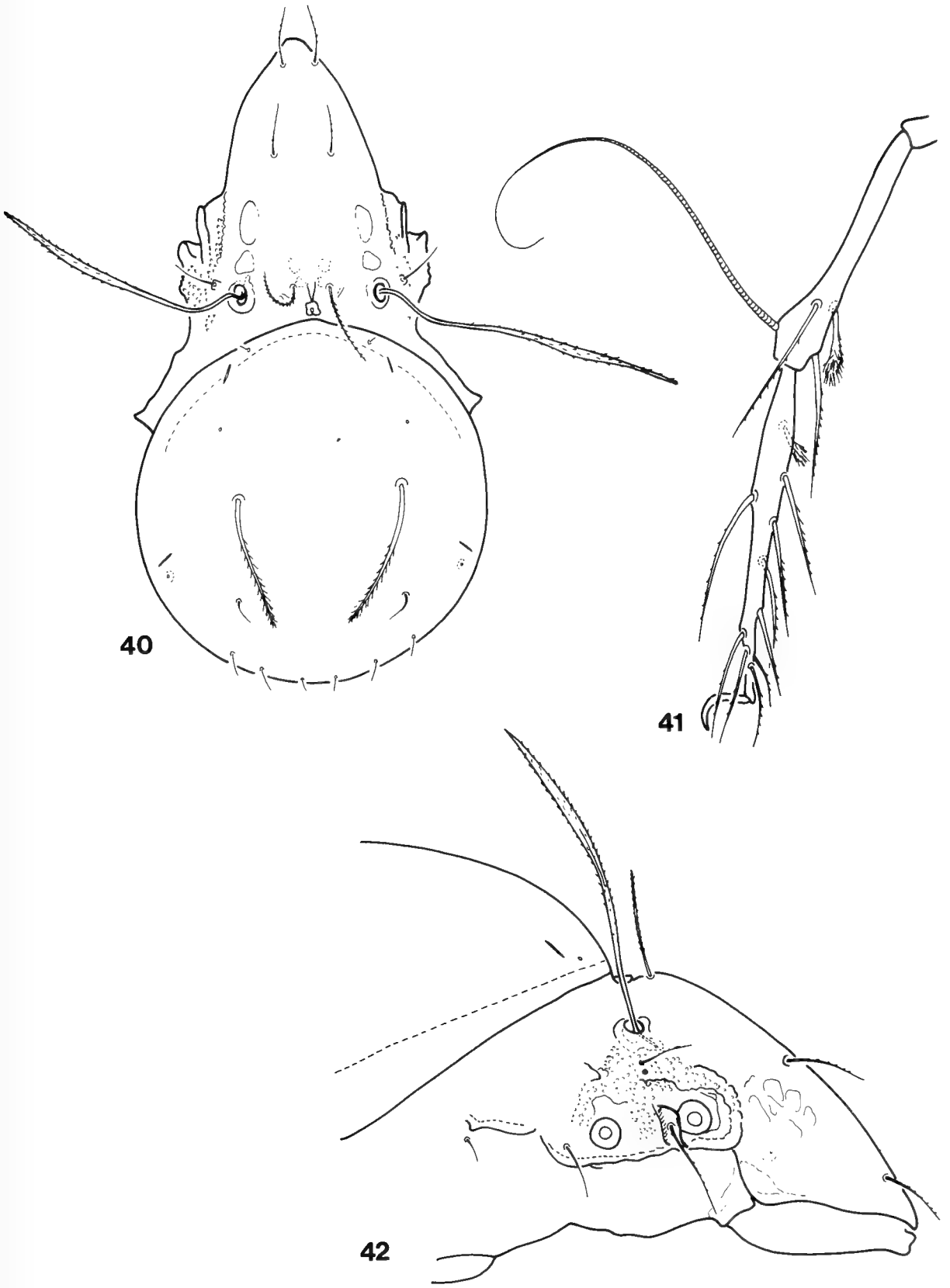
Lemuroppia helleri gen. n., sp. n. - 38: leg I, 39: leg IV.

Pustuloppia madagassica sp. n.

M e a s u r e m e n t s : Length of body: 325-349 µm, width of body: 177-197 µm.

P r o d o r s u m : Rostral part elongate, with blunt rostral apex. Prodorsal surface lacking lamellar line but with an unpaired flower-shaped tubercle basally and three small crests before it in the interbothridial region (Fig. 40). There are two pairs of irregular areolae in this region and some other ones also present before the bothridium. Lateral part of prodorsum partly granulate (Fig. 42). Rostral setae arising on the prodorsal surface, slightly thicker than the lamellar ones. Interlamellar setae more robust and more distinctly ciliate than the lamellar ones, exobothridial setae thin and simple. Sensillus very long, directed outwards, slightly incrassate medially, its whole surface conspicuously ciliate.

N o t o g a s t e r : Ten pairs of notogastral setae present: one pair (*la*) long and strong, ciliate, nearly plumose at its distal end, one pair (c_2) minute and hardly visible, the other eight pairs short and simple (Fig. 40).



FIGS 40-42

Pustuloppia madagassica gen. n., sp. n. - 40: dorsal side, 41: tarsus and tibia of leg IV, 42: podosoma in lateral aspect.

Lateral part of podosoma: Exobothridial region granulate, exobothridial setae arising on the surface, their basal tubercles absent. Setae *1c* originating on pedotecta 1, they are much longer than setae *3c*; setae *4c* very short.

Coxisternal region: Anteromedian margin of epimeres 1 with strong tubercles, setae *1a* arising on them (Fig. 43). Epimeral borders (and apodemes) well observable, *bo.4*. distinctly arched posteriorly (Fig. 43), behind the genital aperture. Epimeres not touching medially. Epimeral surface ornamented by weak irregular spots.

Anogenital region: Anogenital setal formula: 5-1-2-3. Among the genital setae g_5 much longer than g_4 or g_3. Adanal setae conspicuously short, much shorter than the aggenital or anal ones. Lyrifissures *iad* in inverse apoanal position.

Legs: All legs very long, their chaetotaxy with the normal "oppioid" characters (Figs 41, 44-46).

Material examined: Holotype: Mad-89/2; 28 paratypes from the same sample. Holotype and 17 paratypes: MHNG and 11 paratypes (1408-PO-1991): HNHM.

Remarks: See the remarks after the generic diagnosis.

Radamoppia gen. n.

Diagnosis: Family *Oppiidae*. Rostrum without incision. Prodorsum with median, interbothridial condyles. Notogaster with 9 pairs of setae, setae c_2 absent, but represented by their alveoli. Podosoma with a heavy sculpture, this region framed dorsally and the whole surface granulate and/or pustulate. Pedotecta 1 very small, not covering the acetabulum of leg I in lateral aspect, setae *1c* arising on it. Epimeral borders protruding, like a tectum, *bo.1* arched medially. Anogenital setal formula: 6-1-2-3, setae ad_1 postanal, ad_3 paraanal and lyrifissures *iad* in inverse apoanal position. Palp tarsus with a globularly dilated solenidium, originating anteriorly. Legs with "oppiid" characters (tarsus I much longer than tibia I). Setae *p* on tarsus II-IV present, spiniform.

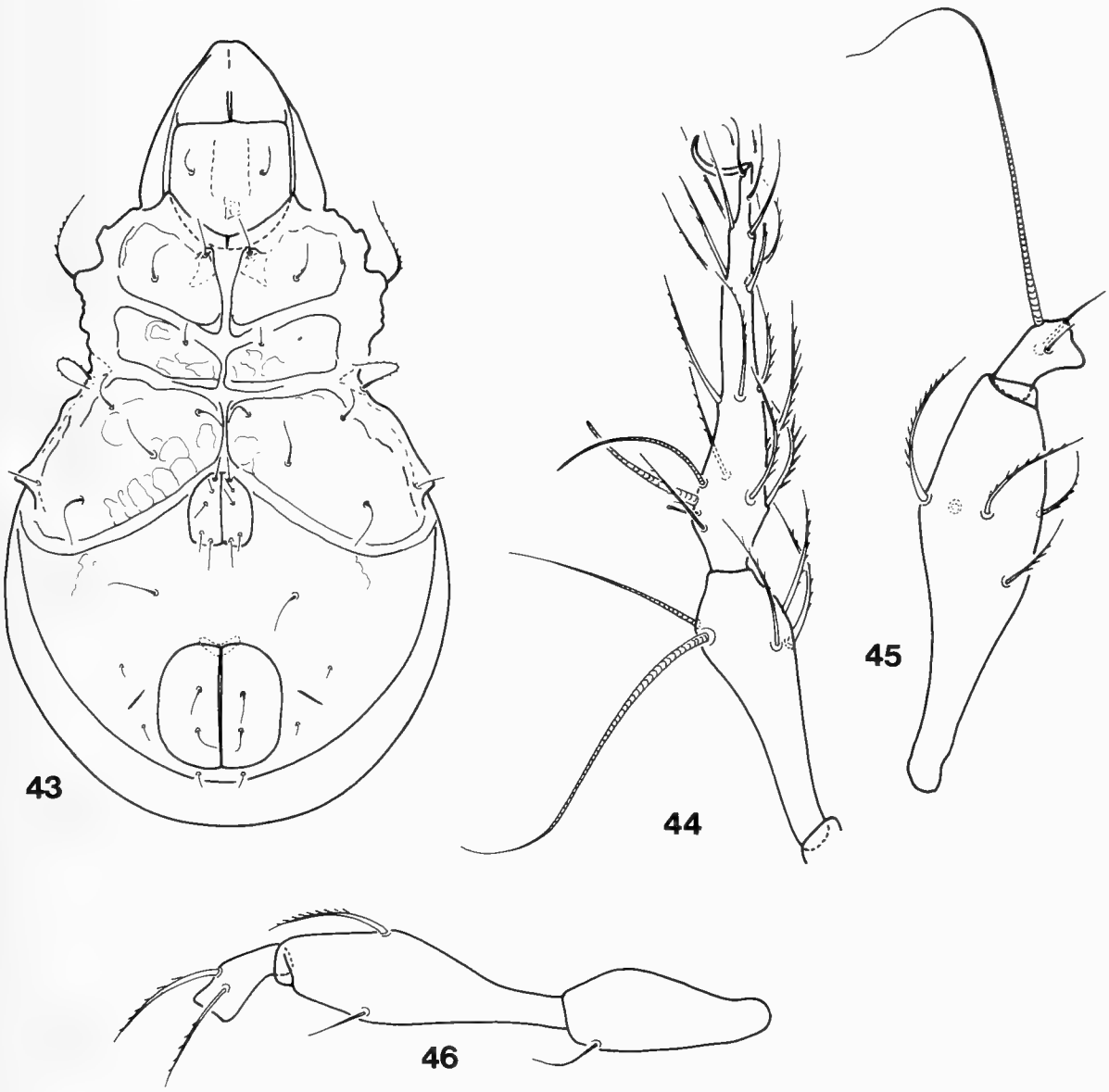
Type species: *Radamoppia ravenala* sp. n.

Remarks: The characteristic structure on the notogaster was hitherto unknown in this family. This genus comprises two species, which are described below. They can be separated by the sculpture of the notogaster, the position of the notogastral setae (*la*, *lm*) and the granulation of the podosoma (finer or rougher). The relationship of the new genus is rather problematic, but on the basis of the position of the adanal setae and the lyrifissures *iad*, it can provisionally be considered as a member of the "lanceoppioids" (sensu SUBIAS & BALOGH 1989).

The first part of the name remembers the King Radama I (1810-1828), the first monarch to unite Madagascar.

Radamoppia ravenala sp. n.

Measurements. - Length of body: 630-681 µm, width of body: 380-405 µm.



FIGS 43-46

Pustuloppia madagassica gen. n., sp. n. - 43: ventral side, 44-45: leg I, 46: basal joints of leg IV.

P r o d o r s u m : Rostrum with strongly projecting, nasiform apex (Fig. 47), this part beak-shaped in lateral aspect (Fig. 51). Costula or lamellar lines absent, some transversal lines or band with weak irregular sculpture present in the lamellar region. One pair of prodorsal condyles and some irregular alveoli and spots present in the interbothridial region. Exobothridial region heavily granulate, this sculpture spreading over the anterolateral margin of prodorsum (Fig. 51). Setae *ro* the thickest among the prodorsal setae, but slightly shorter than *le*. Setae *in* reduced, represented only by their alveoli. Exobothridial setae short, arising on small tubercles. Sensillus long, its distal half spindle-shaped, whole surface spiculate.

N o t o g a s t e r : Nine pairs of very fine and simple notogastral setae present and c_2 represented only by alveoli.

Lateral part of podosoma: Surface surrounding the acetabula I-III granulate or pustulate extending to the exobothridial region. This region well framed above acetabulum III. Pedotecta 1 small, squamiform, pedotecta 2-3 absent, discidium well observable as a triangular apex.

Coxisternal region: Epimeral region, especially the epimeral borders characteristic of this species (Fig. 49). Anterior margin slightly protruding and covering the surface like a tectum. *Bo.1* and *bo.2* arched inwards, *bo.4* reaching behind the genital aperture. Epimeral setae long, setae *1c* and *3c* the longest of all; setae of epimere 4 shorter than the others.

Anogenital region: Genital aperture comparatively small, originating between *bo.4*. Anogenital setal formula: 6-1-2-3, all setae thin and simple. Setae ad_1 in postanal position, arising on a small ridge. Lyrifissures *iad* in inverse apoanal position.

Gnathosoma: Chelicera normal (Fig. 48) with long tegula and dentate digit. Palpal setal formula: 2-1-3-9+1. Palpal solenidium originating on the distal end of tarsus, near the eupathidia, its distal end dilated, globular (Fig. 50).

Legs: All legs very long, leg IV only scarcely shorter (580 µm) than the total length of body. All joints, but principally the joints of leg III and IV conspicuously slender. The setal formulae are:

I: 1-5-2+1- 4+2-20-1 (Figs 52-53)
II: 1-5-2+1- 4+1-16-1
III: 2-3-1+1-3+1-15-1
IV: 1-2-2-3+1-12 (Figs 54-55)

On the tarsus of leg II-IV there are two setae more than in the other "oppiid" species, because the setae *p* of the tarsi are conspicuous as strong spines. Two ventral setae on tarsus IV plumose.

Material examined: Holotype: Mad-89/2, 5 paratypes from the same sample. Holotype and 3 paratypes: MHNG and 2 paratypes (1409-PO-1991): HNHM.

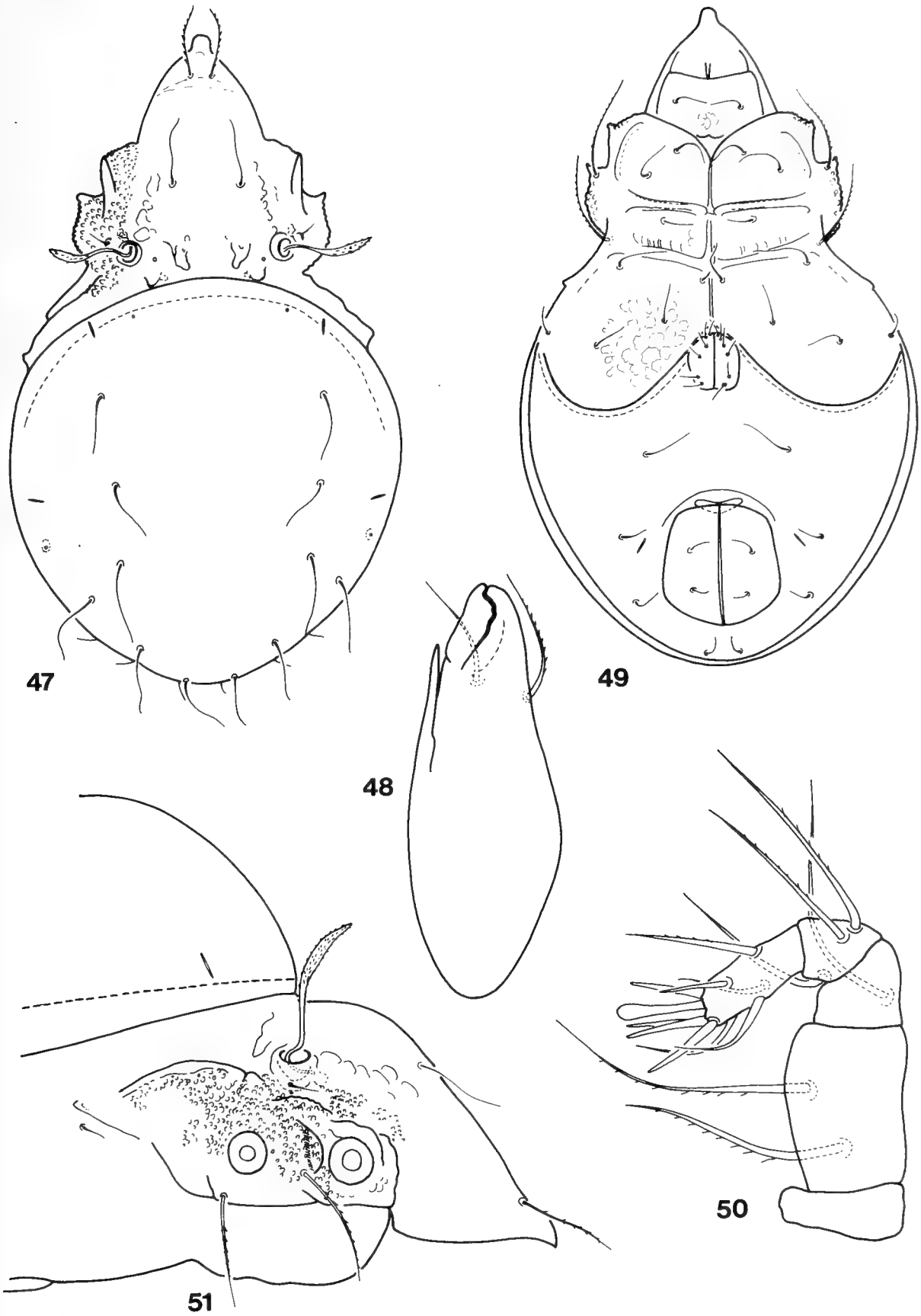
Remarks: See after the description of the next *Radamoppia* species.

The species is named after the Traveller's Palm (*Ravenala madagascariensis*), the symbol of Madagascar.

Radamoppia vanga sp. n.

Measurements. - Length of body: 623-632 µm, width of body: 380-384 µm.

Prodorsum: Rostral apex nasiform, deeply bent downwards like a beak. Lamellar lines or longitudinal costulae absent, but a transversal costula in front of the lamellar setae well visible. A heavy sculpture present in interbothridial position (Fig. 56), it consists of one pair of robust basal tubercles, some smaller ones or wrinkles before them and stronger crests around the interlamellar setae. Some irregular spots visible in this region. On the inner margin of bothridium some projections or tubercles also observable. No great difference in length among the prodorsal setae. Setae *ro* thicker and more distinctly pilose than the others. Setae *le* very thin, flagellate, setae *in*



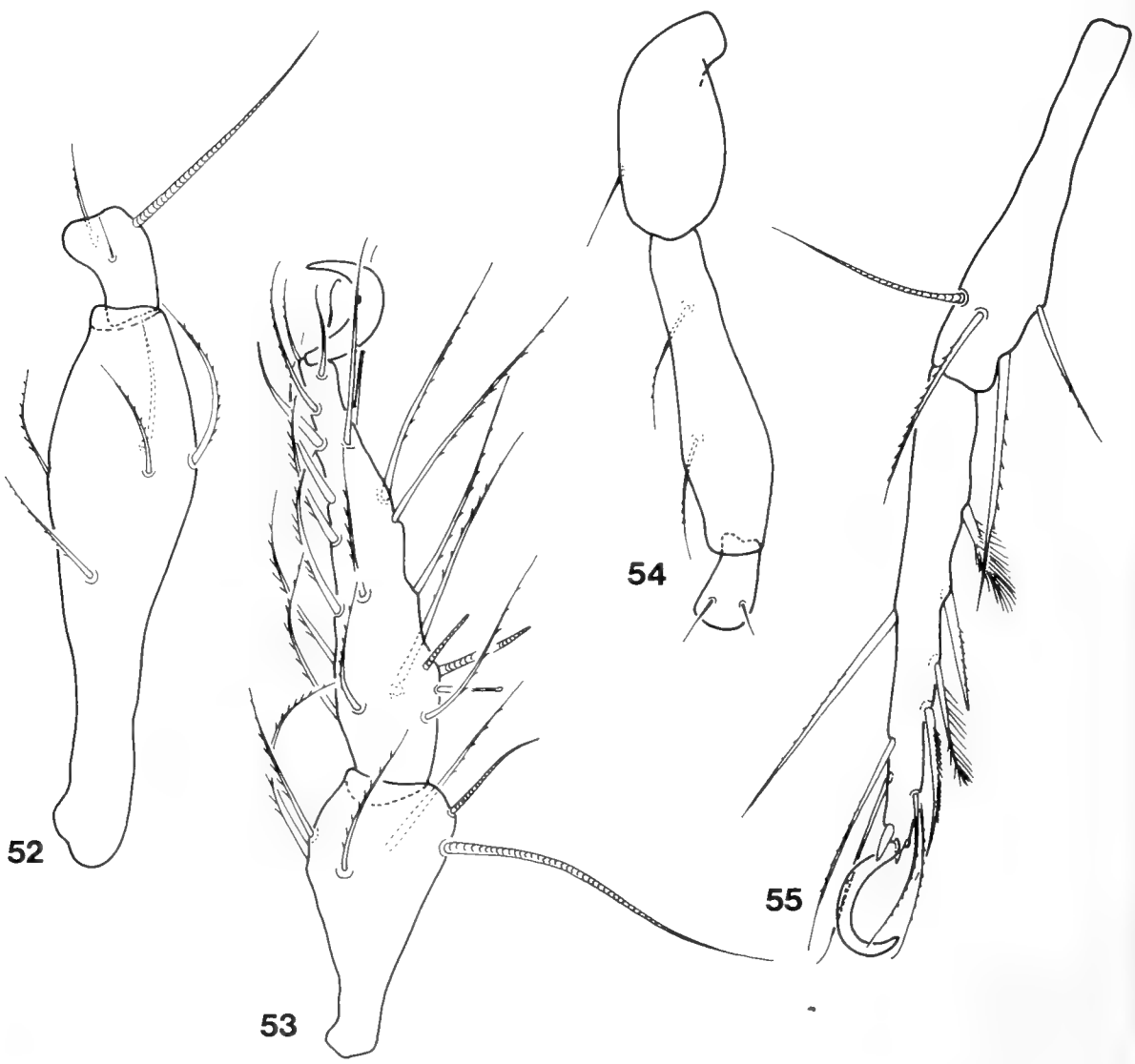
FIGS 47-51

Radamoppia ravenala gen. n., sp. n. - 47: dorsal side, 48: chelicera, 49: ventral side, 50: palp, 51: podosoma in lateral aspect.

pin-shaped. Sensillus long, hardly dilated, well spiculate. Lateral art of prodorsum fairly granulate and/or pustulate.

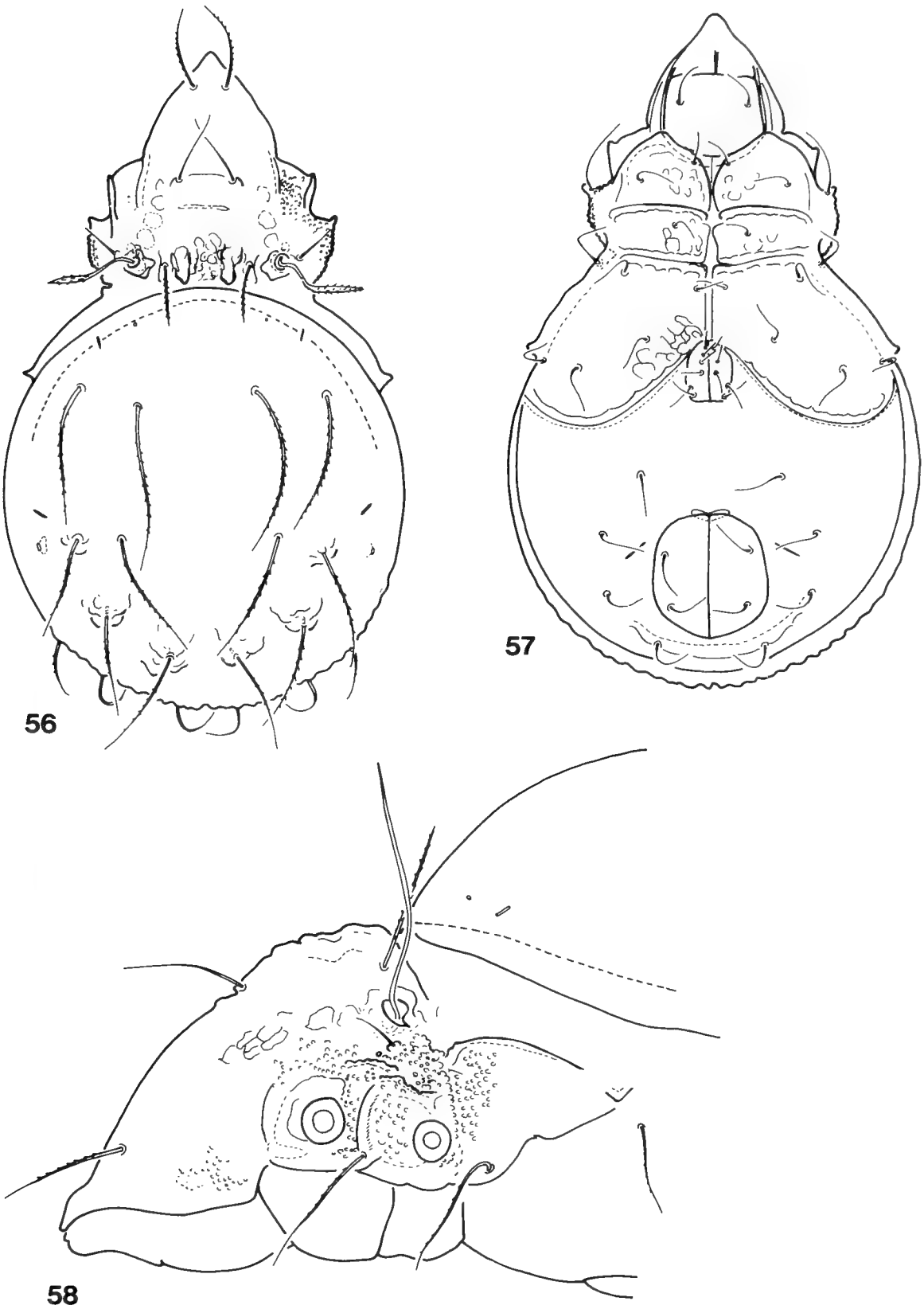
N o t o g a s t e r : Posterior part and the posterolateral margin of the notogaster with characteristic sculpture (Fig. 61), consisting of tubercles and wrinkles. On the median surface they compose a larger protuberance bearing the notogastral setae. Short, mostly longitudinal wrinkles are visible on the posterolateral margin. Nine pairs of long and finely ciliate notogastral setae present and the tenth c_2 represented only by alveoli. All setae arising on tubercles, except setae *la* and *lm*.

L a t e r a l p a r t o f p o d o s o m a : Pedotecta 1 small, squamiform, setae *1c* arising on its anterior margin, pedotecta 2-3 absent, discidium with sharp cuspis. The whole surface - excepting the posterior part behind the legs III - fairly pustulate and/or granulate (Fig. 58).



FIGS 52-55

Radamoppia ravenala gen. n., sp. n. - 52-53: leg I, 54-55: leg IV.



FIGS 56-58

Radamoppia vanga gen. n., sp. n. - 56: dorsal side, 57: ventral side, 58: podosoma in lateral aspect.

Coxisternal region: All epimeral borders protruding, like a tectum (see also in *R. ravenala* sp. n.), *bo.1* and *bo.2* conspicuously arched, epimeral shields not touching medially. *Bo.5* strongly arched posteriorly, reaching behind the genital aperture. Epimeral setae long, setae *1c* the longest of all, setae *4c* shorter than *4b* or *3b*!

Anogenital region: Between the genital and anal apertures great and conspicuous differences exist (Fig. 57). A strong crest behind the anal aperture present, setae ad_1 arising on it. Anogenital setal formula: 6-1-2-3. Lyrifissures *iad* in inverse apoanal position.

Gnathosoma: All details of this region (e.g. the form of the palpal solenidium) similar to the preceding species.

Legs: The form and chaetotaxy of the legs are also similar to the preceding species. The leg setal formulae are:

I: 1-5-2+1- 4+2-20+2-1
II: 1-5-2+1- 4+1-16+2-1
III: 2-3-1+1-3+1-15-1
IV: 1-2-2-3+1-12-1

Famulus (ϵ) on tarsus I very long, nearly as long as ω_2 (Fig. 60). Setae *p* on tarsus II-IV spiniform. Two setae on tarsus IV (Fig. 59) dilated, plumose.

Material examined: Holotype: Mad-89/54; 1 paratype from the same sample. Holotype: MHNG and the paratype (1410-PO-1991): HNHM.

Remarks: These newly described *Radamoppia* species are easily distinguishable by the form of the interlamellar sculpture.

This species is named after the Vangas, a bird family of 14 species endemic to Madagascar.

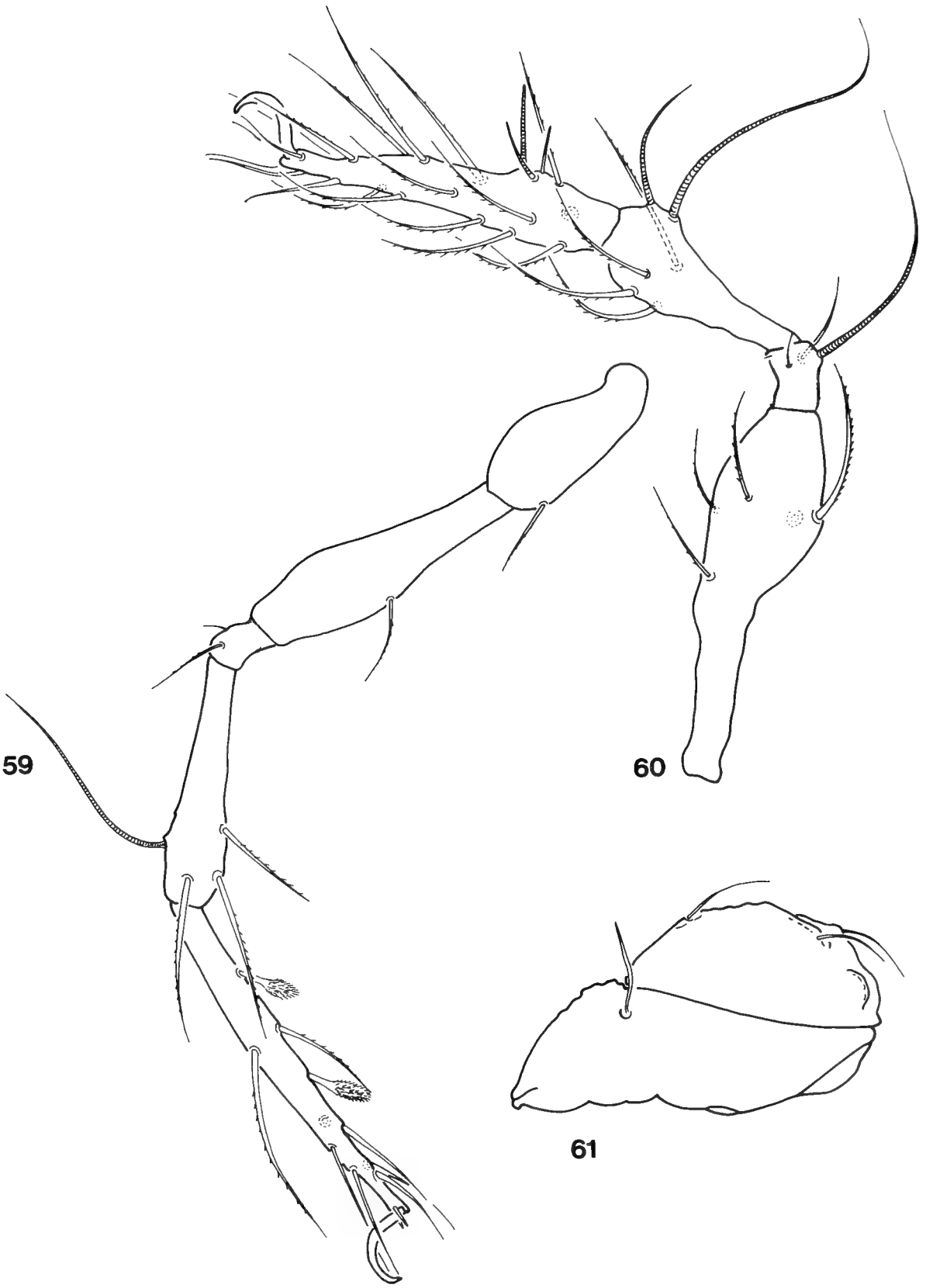
Ramusella aepyornis sp. n.

Measurements. - Length of body: 417-458 µm, width of body: 215-237 µm.

Prodorsum: Rostrum widely rounded. Short and sharp lamellar lines present on the prodorsal surface, decurrent from the bothridium and directed to the insertion of lamellar setae, but not reaching it. Some lateral pairs of spots and some in interbothridial position. Prodorsal setae varying (Fig. 64) in length and thickness, *ro* thicker and more distinctly pilose than *le*. Sensillus very long, setiform, directed outwards, with some shorter cilia laterally and 2-3 longer distally.

Notogaster: Setae c_2 represented only by their alveoli, the other 9 pairs of notogastral setae sparsely ciliate, fine. Setae *la* - *lm* and *lp* - r_3 originating nearly at the same transversal level (Fig. 62).

Lateral part of podosoma: Pedotecta 1 comparatively large, setae *1c* arising far from it. Pedotecta 2-3 triangular, well visible in ventral aspect (Fig. 63). Discidium with a long, sharp, arched apex. Exobothridial region lightly and partly granulated, but around the acetabula of legs I-II and in front of leg III a well granulated area present (Fig. 64).



FIGS 59-61

Radamoppia vanga gen. n., sp. n. - 59: leg IV, 60: leg I, 61: body in lateral aspect.

Coxisternal region: Some peculiar characters are present on this part: e. g. a characteristic, triangular field medially between the two first and partly between the second epimeres (Fig. 63); one pair of median tubercles on the sejugal borders; epimeres 4 not touching medially, the sternal apodemata well visible between them. The setae of this region are also characteristic: setae *1b* much longer than *1c*, the latter originating far from pedotecta 1, on longitudinal crests. Setae *3c* the longest of all, more ciliate than the others.

Anogenital region: Genital aperture small, originating anteriorly between the arches of epimeral borders 4. Anal aperture very large. Anogenital setal formula: 5-1-2-3. The position of setae and lyrifissures shown in Fig. 63.

Gnathosoma: The structure of this region shows the typical "oppiid" characters. Palpal setal formula: 0-2-1-3-9+1.

Legs: All legs long, narrow, with the typical "oppiid" chaetotaxy. The setal formulae are:

I: 1-5-2+1-4+2-20-1
II: 1-5-2+1-4+1-14-1
III: 2-3-1+1-3+1-13-1
IV: 1-2-2-3+1-10-1

Famulus (ϵ) stands at the basis of ω_1. Both setae (*ft*) arising on the basal part of tarsus I (Fig. 65) behind ω_2. All setae of femora I and II distinctly pilose. Trochanter III with a strong and long dorsobasal spur. Two ventral setae of tarsus IV plumose (Fig. 66).

Material examined: Holotype: Mad-89/49, 11 paratypes from the same sample. Holotype and 6 paratypes: MHNG and 5 paratypes (1411-PO-1991): HNHM.

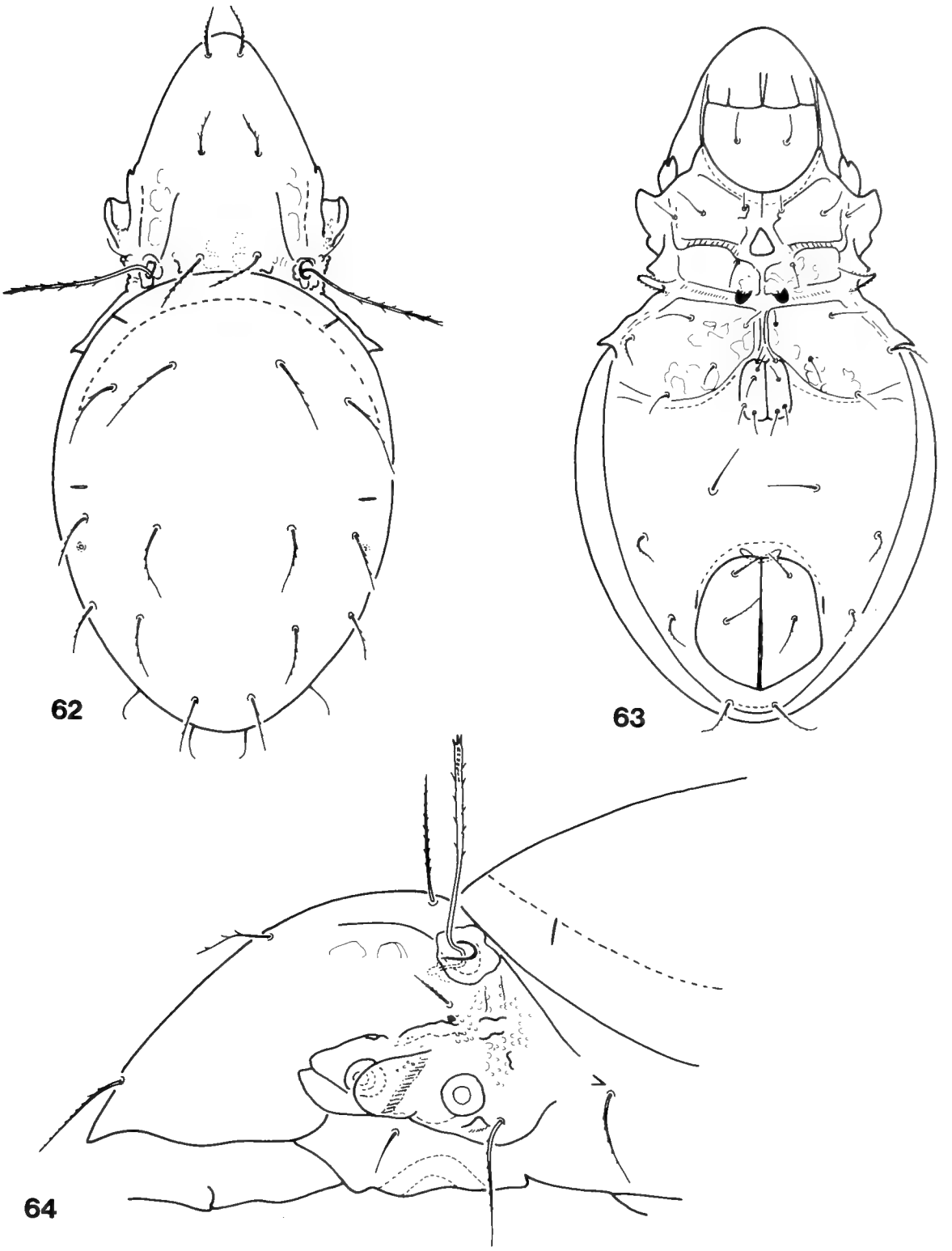
Remarks: The position of this new species is problematic, but it seems to be related to the *Ramusella* genus group. I place it provisionally in the genus *Ramusella* Hammer, 1962. The species is well characterized by the shape of the sensillus and by the shape of the epimeral borders. On this basis it can be distinguished from all congeners.

This species is named after the famous elephant bird (*Aepyornis*), a group of extinct giant birds, endemic to Southern Madagascar.

Striatoppia luisae sp. n.

Measurements. - Length of body: 244-278 µm, width of body: 125-146 µm.

Prodorsum: Rostrum rounded. Lamellae, translamella and prolamellae wide, well developed (Fig. 67). Rostral setae originating on the cuspis of prolamellae, lamellar setae on the translamella. One pair of strong crests in the interbothridial region, between them two pairs of spots visible. The minute interlamellar setae arising outside of these crests. The surface between the prolamellae polygonate, lace-like, lateral part granulate or pustulate. Bothridium with strong condylus posteriorly, standing opposite to the notogastral apophyses. Sensillus sickle-shaped with strong spines arranged in 5-6 longitudinal rows.



FIGS 62-64

Ramusella aepyornis sp. n. - 62: dorsal side, 63: ventral side, 64: podosoma in lateral aspect.

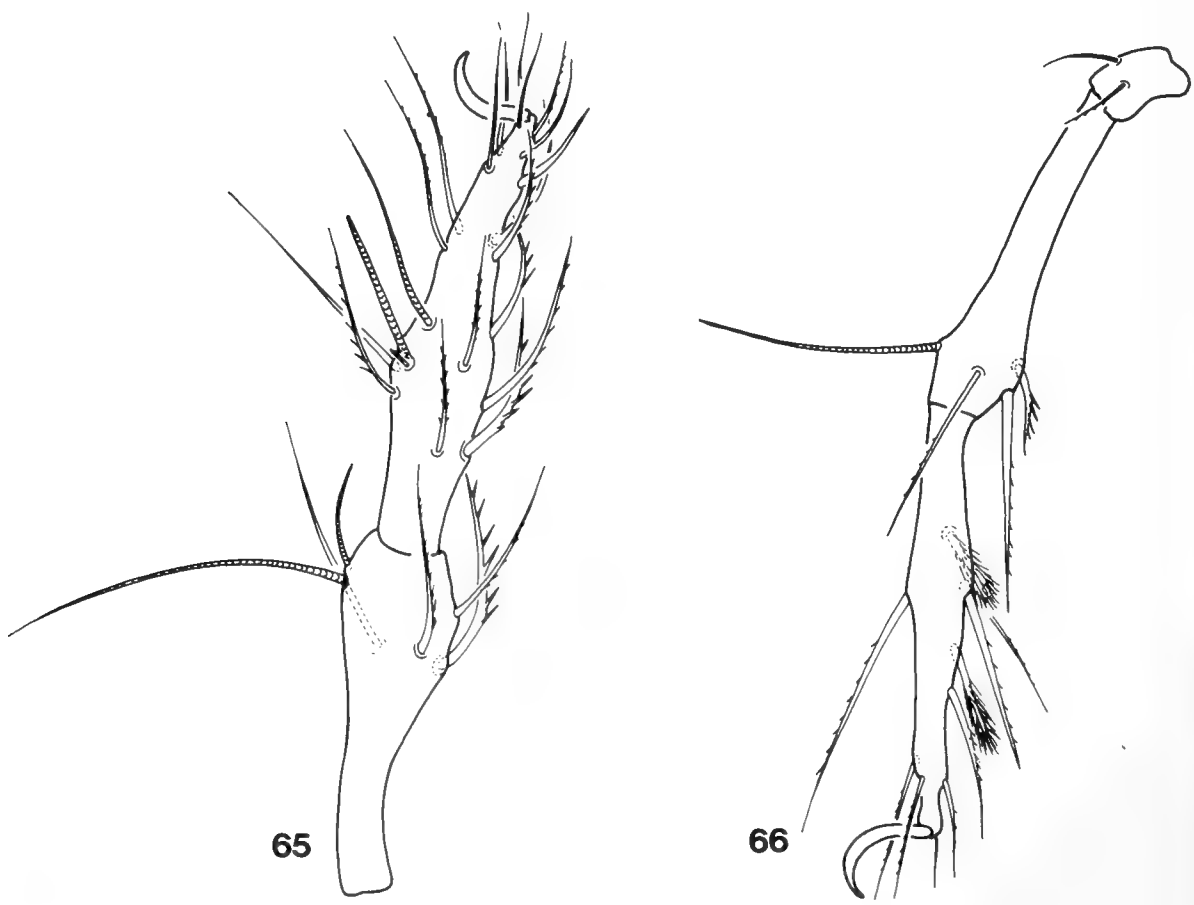
N o t o g a s t e r : Dorsosejugal suture projecting forwards, into a short median apex (Fig. 67). One pair of well developed lateral apophyses present, setae c_2 arising on them. Entire surface reticulate. Ten pairs of wide, phylliform notogastral setae present, their surface spiculate or squamose.

L a t e r a l p a r t o f p o d o s o m a : Whole surface granulate (anteriorly) or pustulate (posteriorly). Pedotecta 1 and discidium well developed, pedotecta 2-3 reduced (Fig. 70).

C o x i s t e r n a l r e g i o n : The whole region with strong, rough sculpture. Epimeral borders well observable, but the anterior part of this region with a median hollow (Fig. 68), epimeral areas not touching medially. Epimeral setae short, simple.

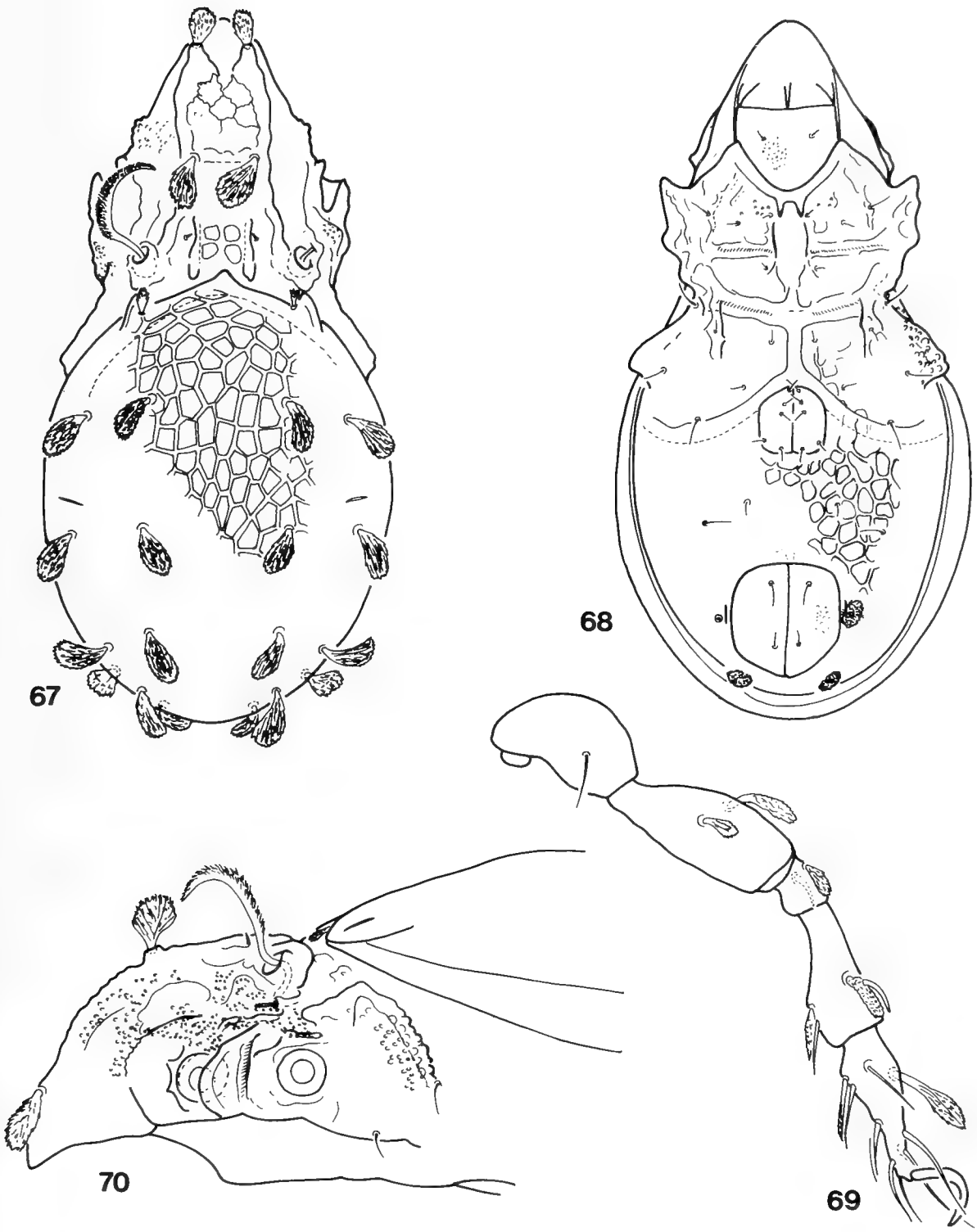
A n o g e n i t a l r e g i o n : Whole surface with reticulate sculpture as notogastral. Anogenital setal formula: 5-1-2-3. Genital, anal and setae ad_3 simple, ad_1 and ad_2 phylliform, similar to the notogastral setae.

G n a t h o s o m a : Palp setal formula: 0-2-1-9+1. All eupathidia conspicuously long, nearly equal in length. Solenidium originating in the basal part of tarsus.



FIGS 65-66

Ramusella aepyornis sp. n. - 65: tibia and tarsus of leg I, 66: genu, tibia and tarsus of leg IV.



FIGS 67-70

Striatoppia luisae sp. n. - 67: dorsal side, 68: ventral side, 69: leg IV, 70: podosoma in lateral aspect.

L e g s : All joints of legs with typical phylliform setae (Fig. 69). Their setal formulae:

I: 1-5-2+1- 4+2-20+2-1
II: 1-5-2+1- 4+1-14+2-1
III: 2-3-1+1-3+1-12-1
IV: 1-2-2-2+1-10-1

Solenidium of tibia I arising on a heavy process. Distal end of tarsal solenidia strongly arched.

M a t e r i a l e x a m i n e d : Holotype: Mad-89/52; 8 paratypes from the same sample; 1 paratype: Mad-89/3. Holotype and 6 paratypes: MHNG and 3 paratypes (1412-PO-1991): HNHM.

R e m a r k s : All heretofore known species of the genus *Striatoppia* Balogh, 1958, have the typical, lineolate sculpture on the notogaster. Accordingly, all congeners are distinguishable from the new species.

I dedicate this new species to my wife for her continuing help and scientific assistance.

Fossoppia gen. n.

D i a g n o s i s : Family *Oppiidae*. Rostrum with a long, spiniform apex. Prodorsum with heavy costulae, interbothridial spots present. Sensillus long, setiform, pectinate. In the sejugal region one pair of large, round foramina observable. Dorso-sejugal suture arching forwards, interrupted medially. Notogastral crista absent. A pair of long, curved spinae adnatae present. Ten to thirteen pairs of long notogastral setae. Pedotecta 1 large, setae *1c* arising on it. Apodemes and epimeral borders weakly developed, partly absent. All epimeral setae long. Anogenital setal formula: 6-1-2-3. Genital-aggenital region with striation. Setae ad_1 in post-, setae ad_3 in preanal position. Lyrifissures *iad* far from the anal aperture, in direct apoanal or paraanal position. Gnathosoma normal, chelicerae well developed. Legs of normal "oppiid" type, setal formula also of normal type - except tibia III-IV, which have four setae.

T y p e s p e c i e s : *Fossoppia calcarata* sp. n.

R e m a r k s : The relationship of the new genus is rather problematic. It has a number of particularly interesting features which are inconsistent with the recent system of the family *Oppiidae* (Woas 1986). But the establishment of a further new subfamily in the deplorably confused situation within the family offers no acceptable solution.

There is no doubt that the two species described below are closely related to each other, though well distinguishable. There are, however, two characteristics which are occasionally used also at the generic level: the notogastral setal number and the position of the lyrifissures *iad*. One of the new species assigned to the new genus bears ten, the other thirteen notogastral setae. In one species the lyrifissures *iad* lie in direct apoanal, in the other in unequivocally paraanal position, although far removed from the anal aperture. In the case of setal numbers Bernini (1973) already presumed the possibility of variation, even intraspecifically (*O. confinis*) — a problem which needs further studies on a larger series.

Fossoppia calcarata sp. n.

Measurements. - Length of body: 305 µm, width of body: 162 µm.

Integument: Whole surface covered by a cerotegument layer with different granules adhering to it. In the rostral, sejugal, abjugal region, around the acetabula and on the posterior end of the notogaster it consists mostly of filaments.

Prodorsum: Rostrum with a narrow, long, sharply pointed median apex (Fig. 73). A pair of strong median costulae connected by a much weaker transcostula present. Behind the bothridium a pair of convergent laths also observable and laterally, near the sejugal region one pair of well framed, round "foramina" observable (Fig. 71). Rostral setae arising laterally far from each other. Exobothridial setae also setiform, lamellar and interlamellar ones pin-shaped. Bothridium angular, sensillus very long, directed outwards, subsequently inwards, unilaterally bearing strong cilia of varying length.

Notogaster: Anterior margin strongly convex, narrowing anteriorly. Long spinae adnatae present on the anterolateral margin (Fig. 71), in front of the lyrifissures *ia*, much shorter but thicker than the notogastral setae. Ten pairs of notogastral setae present, all very long and distinctly ciliate. Lyrifissures *im* located very near to the insertion of seta *lp*.

Lateral part of podosoma: Pedotecta 1 normal, bearing setae *1c*. Pedotecta 2-3 small, discidium very large, but short.

Coxisternal region: Apodemes and epimeral borders reduced, sternal borders and apodemes absent, epimeres mostly opened medially (Fig. 72). In some specimens a weak border observable between epimeres 1. and 2. Epimeral setae very long, all directed inwards and/or forwards.

Anogenital region: Genital plates with 4-5 longitudinal crests, some striation also visible along the genital aperture. Genital setae short, all other setae comparatively long but varying in length, e.g. ad_1 much shorter than ad_3, an_1 shorter than an_2. Lyrifissures *iad* in direct apoanal or paraanal position, but far from the anal aperture.

Gnathosoma: Chelicerae (Fig. 76) and palps (Fig. 77) show the normal "oppiid" characters. Palpal setal formula 0-2-1-3-8+1.

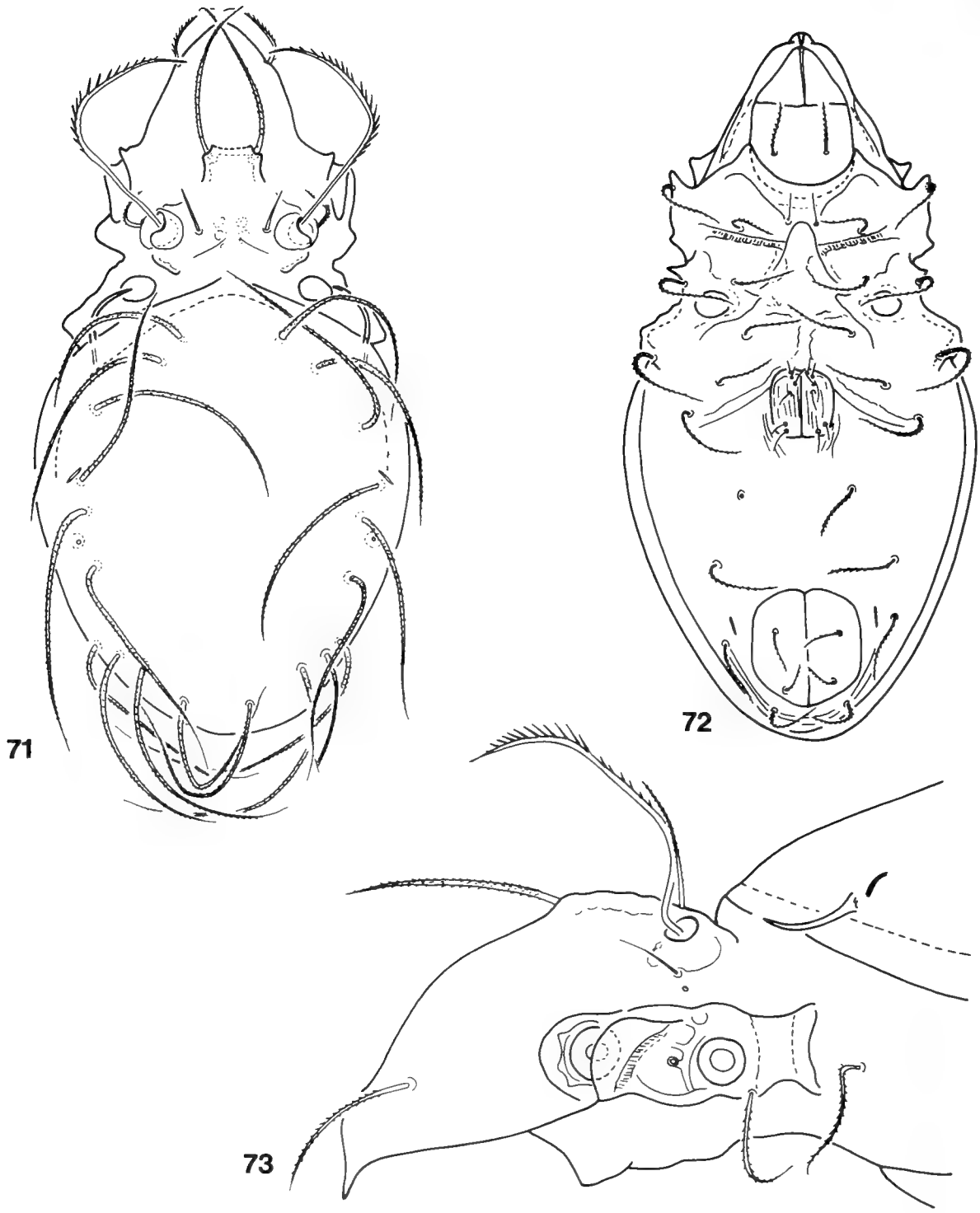
Legs: Leg surface ornamented by a fine reticulation. With a few exceptions legs setae are robust and long, distinctly ciliate. Leg setal formulae are:

I: 1-5-2+1- 4+2-20+2-1 (Fig. 74)
II: 1-5-2+1- 4+1-14+2-1
III: 2-3-1+1- 4+1-13-1
IV: 1-2-2-4+1-10-1 (Fig. 75)

These are nearly the typical "oppiid" formulae, but the number of setae on the third and fourth tibiae are unique in the family.

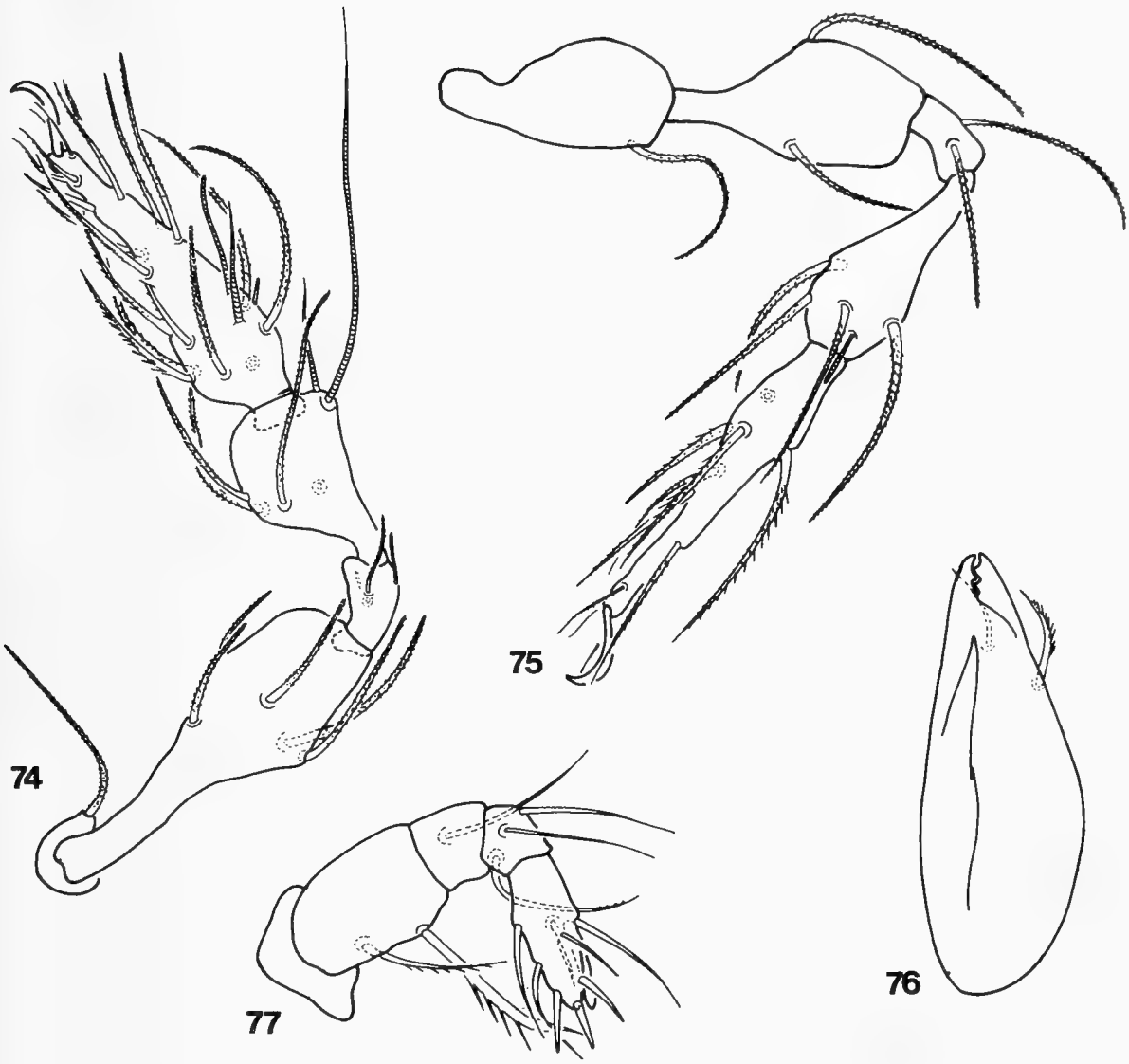
Material examined: Holotype: Mad-89/29: MHNG.

Remarks: See after the next species.



FIGS 71-73

Fossoppia calcarata gen. n., sp. n. - 71: dorsal side, 72: ventral side, 73: podosoma in lateral aspect.



FIGS 74-77

Fossoppia calcarata gen. n., sp. n. - 74: leg I, 75: leg IV, 76: chelicera, 77: palp.

Fossoppia pirata sp. n.

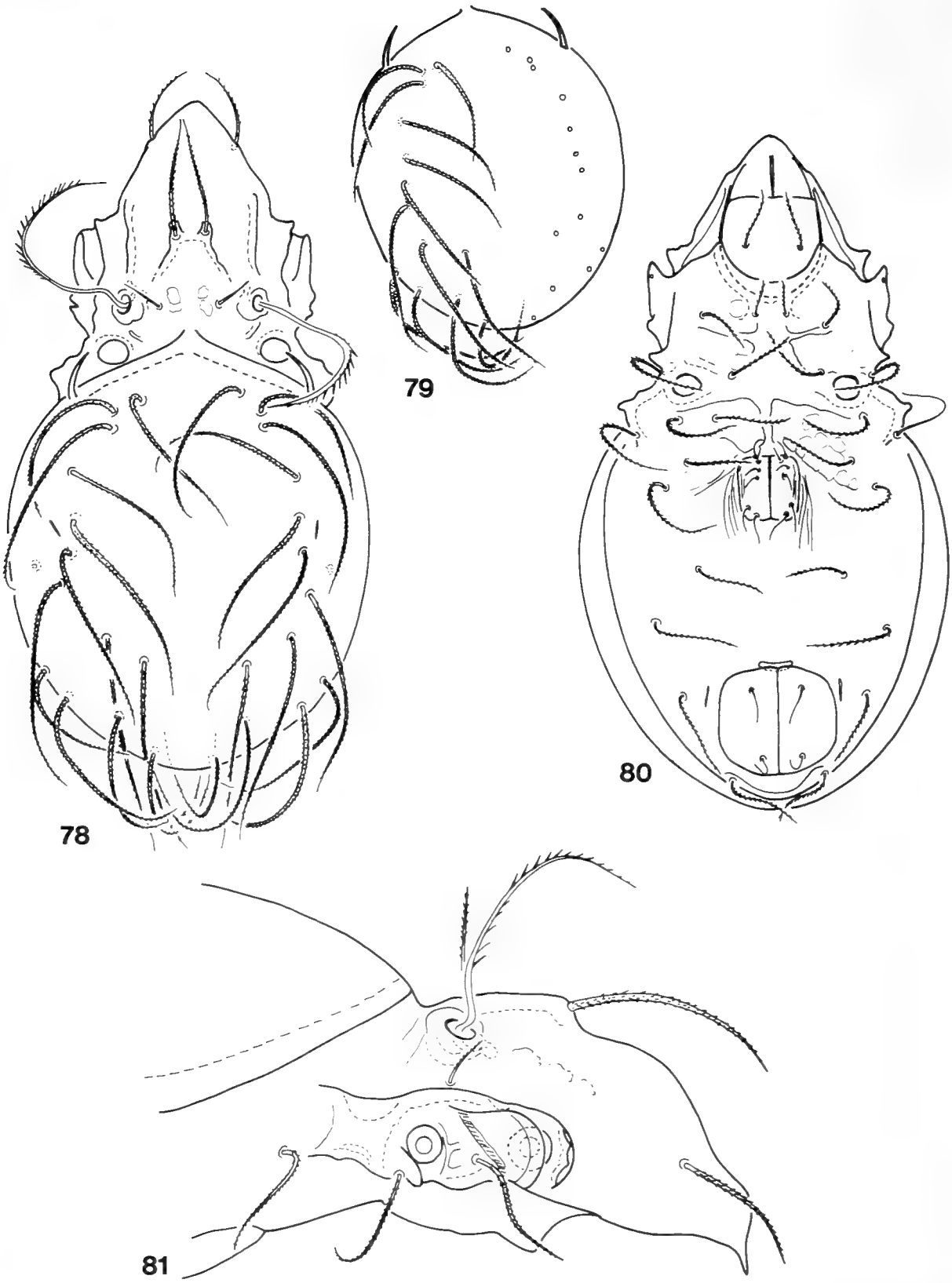
This species is in many respects very similar to the preceding one. Therefore, only the main differential characters are mentioned in the following description.

Measurements: Length of body: 290 µm, width of body: 162 µm.

Prodosum: Lamellar costula continued anteriorly in front of the insertion of the lamellar setae (Fig. 78). Transversal costula clearly interrupted medially. Lamellar setae shorter, not reaching to rostrum (Fig. 81).

Notogaster: Spinae adnatae strong, curved inwards (Fig. 79). Thirteen pairs of very long notogastral setae present.

Coxisternal region: Sternal borders as shown in Fig. 80.



FIGS 78-81

Fossoppia pirata gen. n., sp. n. - 78: dorsal side, 79: chaetotaxy of notogaster, 80: ventral side, 81: podosoma in lateral aspect.

A n o g e n i t a l r e g i o n : Genital plates smooth medially, only 1-2 longitudinal striae present laterally.

G n a t h o s o m a and l e g s : As in the preceding species. Both setae of genu IV very long, well ciliate.

M a t e r i a l e x a m i n e d : Holotype: Mad-89/54, 4 paratypes from the same sample. Holotype and 2 paratypes: MHNG and 2 paratypes (1413-PO-1991): HNHM.

R e m a r k s : The two new *Fossoppia* species can be distinguished as follows:

calcarata sp. n.	*pirata* sp. n.
1. Costulae short, ending at the insertion of lamellar setae.	1. Costulae longer, continuing anteriorad after the insertion of lamellar setae.
2. Lamellar setae long, reaching beyond the apex of rostrum.	2. Lamellar setae short, not even reaching the rostral apex.
3. Ten pairs of notogastral setae present.	3. Thirteen pairs of notogastral setae present.
4. Surface of genital plates with 5-6 longitudinal striae.	4. Surface of genital plates with 1-2 longitudinal striae.

Nosybelbidae fam. n.

D i a g n o s i s : Superfamily *Oppioidea*. "Oppioid" habitus. Pedotecta 1 and discidium well developed, pedotecta 2-3 absent. Epimeres 3-4 with a strong secondary crest, parallel with the discidium. Suctorial anarthric infracapitulum, rutellum reduced. Chelicerae modified, digiti without teeth, but with two (*cha*, *chb*) setae. Palp with two setae on tibia. Tarsus of all legs short, much shorter than the tibiae. Tibia I with a robust process, solenidia arising on it.

T y p e g e n u s : *Nosybelba* gen. n.

R e m a r k s : Discussion after the diagnosis of the new genus.

Nosybelba gen. n.

D i a g n o s i s : Rostrum rounded. Prodorsum with a peculiar median structure, lamellar setae arising on it. Three pairs of prodorsal setae present (exobothridial setae represented only by alveoli) and nine pairs of notogastral setae (c_2 completely absent). Epimeral region heavily sclerotized, resembling the "suctobelboid" type. Epimeral setal formula: 3-1-3-3. Setae *1c* arising on pedotecta 1. Anogenital setal formula: 4-1-2-3. Setae ad_1 postanal, setae ad_3 preanal, lyrifissures *iad* in paraanal position. Claw of all legs very strong, legs with nearly normal "oppioid" setal formulae.

T y p e s p e c i e s : *Nosybelba oppiana* sp. n.

R e m a r k s : The new taxon may be characterized by several features which seem transitional between the *Suctobelbidae*, *Quadropiidae* and *Oppiidae*, but also by some unique characters (e.g. form of mentum and chelicerae, form of tibia and tarsus of leg I). The form of the mentum resembles that of the genus *Quadroppia*, but all other characters (e.g. chaetotaxy of legs) do not correspond to this genus. The insertion of the

new taxon in one of the hitherto known families is not possible, therefore a new genus and a new family is here established.

The first part of the name (Nosy) means "island", in the Malagasy language.

Nosybelba oppiana sp. n.

M e a s u r e m e n t s . - Length of body: 374-399 µm, width of body: 221-246 µm.

P r o d o s u m : Rostrum rounded, rostral setae arising near the rostral apex, on the dorsal surface. Prodorsum with a strong median, nearly horseshoe-shaped costula without connection to the bothridium (Fig. 82). A short lamellar line also observable, decurrent from the bothridium anteriorly. Some median spots (in interbothridial position) and some lateral spots present. Prodorsal setae short and simple. Rostral setae the strongest and longest of all, interlamellar setae very short and exobotridial setae represented only by their alveoli. Sensillus lanceolate, its surface fairly spiculate.

N o t o g a s t e r : Nine pairs of short, mostly equally long notogastral setae, the tenth pair (c_2) is only represented by their alveoli.

L a t e r a l p a r t o f p o d o s o m a : Pedotecta 1 and discidium well developed (Fig. 87). Exobothridial region and a field around the legs II well granulate. This sculpture not extending along leg I.

C o x i s t e r n a l r e g i o n : This region of the "suctobelboid"-type (Fig. 85). The epimeral borders and the apodeme all heavily sclerotized. Sternal apodema thick anteriorly, epimeres 1 and 2 not touching medially. On the epimeres 3 and 4 a characteristic secondary longitudinal crest present.

A n o g e n i t a l r e g i o n : Anogenital setal formula: 4-1-2-3. Setae ad_1 in postanal, ad_3 in preanal position. Lyrifissures *iad* in adanal position.

G n a t h o s o m a : Suctorial labiogenal articulation (Fig. 83). Chelicerae (Fig. 84) slightly elongate, without teeth either on the digitus fixus nor on the digitus mobilis. Palp (Fig. 86) five-jointed with the following setal formula: 0-2-1-2-7+1 (!).

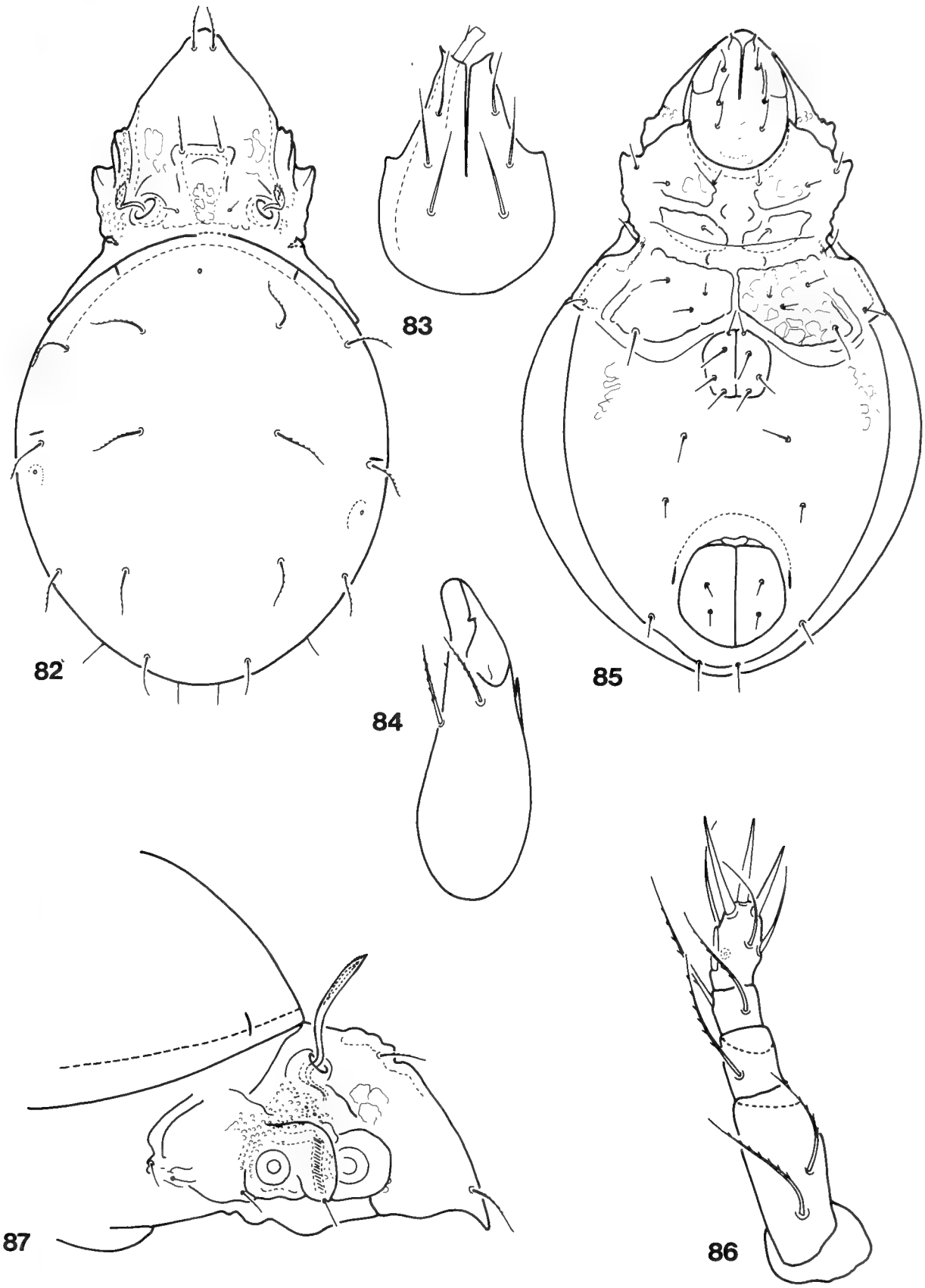
L e g s : Tarsus of all legs short, much shorter than the tibia, tarsus I (Fig. 88) peculiarly compressed longitudinally. Tibia I with long process, which reaches far over the tarsus. Solenidium ω_2 on tarsus II arising from a small tubercle. Leg setal formulae:

I: 1-5-2+1- 4+2-19+2-1 (Fig. 88-89)
II: 1-5-2+1- 4+1-14+2-1
III: 2-3-1+1-3+1-13-1
IV: 1-2-2-3+1-10-1 (Fig. 90)

Setae *tc*" on tarsus I absent.

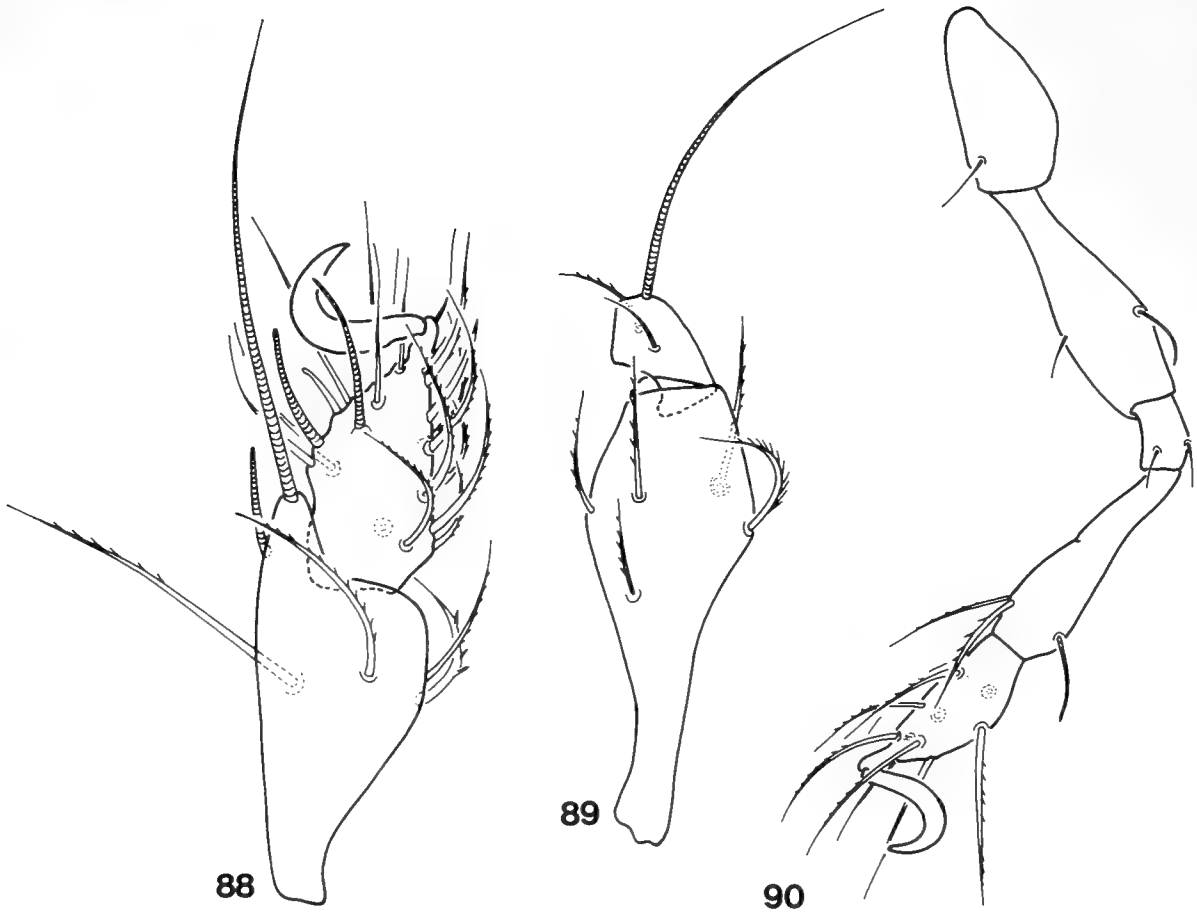
M a t e r i a l e x a m i n e d : Holotype: Mad-89/2, 20 paratypes from the same sample. Holotype and 12 paratypes: MHNG and 8 paratypes (1414-PO-1991): HNHM.

R e m a r k s : See after the generic diagnosis.



FIGS 82-87

Nosybea oppiana gen. n., sp. n. - 82: dorsal side, 83: mentum, 84: chelicera, 85: ventral side, 86: palp, 87: podosoma in lateral aspect.



FIGS 88-90

Nosybea oppiana gen. n., sp. n. - 88: tibia and tarsus of leg I, 89: femur and genu of leg I, 90: leg IV.

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On New and Old-Known Oligochaeta Genera from Paraiba State, Brazil

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On New and Old-Known Oligochaeta Genera from Paraiba State, Brazil. – The Glossoscolecidae *Cirodrilus aidae* n. sp. is described. The Ocnerodrilidae genera *Ocnerodrilus* and *Liodrilus* are reevaluated. *O. potyura* n. sp. and *L. mendesi* n. sp. are described. *Lourdesia* n. gen., near to *Ilyogenia* and *Temanonegia*, is established for *L. paraibaensis* n. sp. All studied species came from Paraiba State, Brazil.

Key-words: Oligochaeta - Glossoscolecidae - Ocnerodrilidae - Taxonomy - Brazil.

INTRODUCTION

I am very grateful to Dr. Rafael Angel Torquemada Guerra (Federal University of Paraiba, Brazil) for the opportunity of studying this very interesting earthworms collection from Paraiba State, Brazil, and to Dr. John Milton (University of São Paulo) for English language corrections.

Since the beginning of the century the genera *Ocnerodrilus* and *Liodrilus* have received several inconsistent interpretations so that they need an anatomical reevaluation to establishing their characteristics and their boundaries from *Ilyogenia* and *Gordiodrilus*, which make with them a very homogeneous group with African and American representatives.

MATERIAL AND METHODS

The animals were collected manually and fixed by formalin 10%. The studies were made by dissections, pieces mounted in glycerin-water (1:1) and serial microscopical sections (10 µm) stained by Mallory's triple method (PANTIN, 1964).

Manuscript accepted 00.00.000.

The figures were made with camera lucida. A part of the material is deposited in the Department of Zoology - University of S. Paulo (ZU) and the other part is in the Muséum d'Histoire naturelle Genève (MHNG).

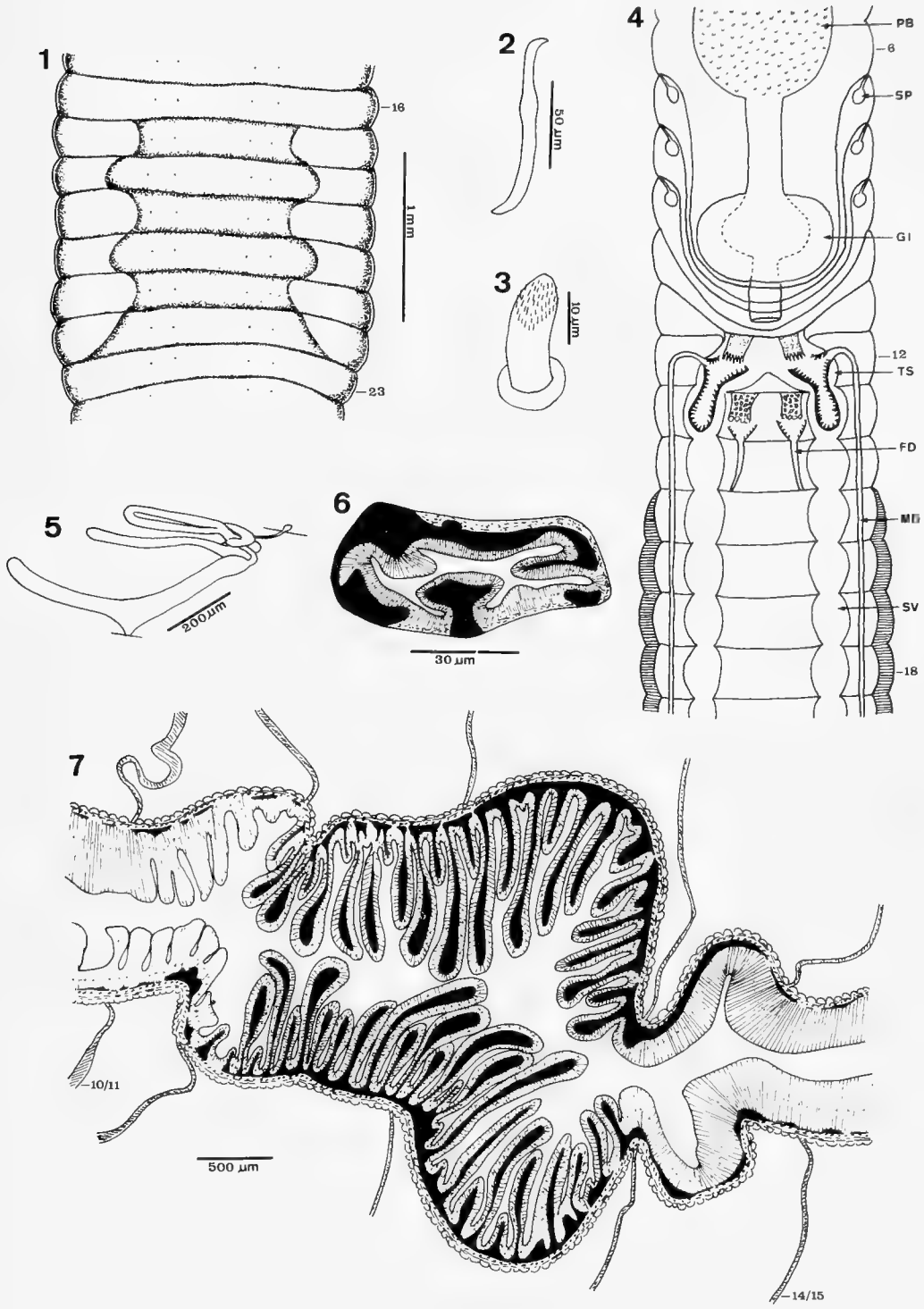
GLOSSOSCOLECIDAE

Cirodrilus aidae, n. sp. (Figs 1-8)

MATERIAL - Brazil: Paraiba State. João Pessoa, sand soil with a low moisture, 1 clitellate specimen (Holotype ZU-1272A) and 2 clitellate specimens (Paratypes ZU-1272B; MHNG-992-133), Everaldo G. da Silva col. 22.II.1992.

DESCRIPTION - Length 42 - 52 mm. Mid-body diameter 1.2 - 1.3 mm. Number of segments 191 - 215. There are no pigments. The short tentacular prostomium and the rudimentary segment I are invaginated. The segment II has numerous thin longitudinal grooves and a pair of nephribuccal furrows. The setae are arranged in 4 pairs of regular lengthwise series from II to the back. The setal relations are in the middle-body region (segments LXX - LXXX) *aa* : *ab* : *bc* : *cd* : *dd* = 4.3 : 1.0 :5.5 : 1.0 : 18.5 and in the posterior region (CLXX - CLXXX) = 3.5 : 1.0 : 3.5 : 1.0 : 10.3, in both regions *ab* = 80 µm. The setae are lengthened sigmate; their nodulus is slightly distal (Fig. 2) and the convex sub-apical surface has a wide group of small thorns (Fig. 3). The setae length varies from 102 - 118 µm throughout the body. There are no differentiated genital setae. The clitellum is saddle-shaped on segments XV - XXIV (= 10). One pair of puberal ridges extends from XVII - XXII (fig. 1); the medial margin of the ridges is wavy at the side of the setae *b* line and the lateral margin is straight on the nephridiopore line. The ridges are associated with glandular clusters which protrude slightly into the body cavity. The ventral body surface between the puberal ridges is thickened in XVII, XIX and XXI. The nephridiopores are intersegmental in *cd*. The genital pores are microscopical. The male pores lie in the ventral half of the puberal ridges in the posterior region of XVIII. The female pores are in the posterior half of XIV aligned with setae *a*. Three pairs of spermathecal pores are in *cd* of 6/7 - 8/9.

The septa are thin and fragile, mainly the 6/7 - 8/9; septa 6/7 - 10/11 are like interpenetrated cones and the others are flat. One rounded and strongly muscular gizzard lies in the cavity of VI but, due to its size and to the septa shape, it corresponds to parietal segments IX - X (Fig. 4). Two pairs of calciferous glands open into the posterior region of the oesophagus in VIII and IX at the sides of its mid-ventral line. They are small club-shaped and hidden by the oesophagus; the glands are curved forward and downward in VIII and forward and upward in IX. The glands have a wavy slit-like cavity circumscribed by 3 - 5 parietal longitudinal trabeculae of variable height and width (Fig. 6). The oesophagus swells in XII and much more in XIII. In these segments the inner oesophageal surface, excepting for its mid-dorsal and mid-ventral lines, is raised up in very numerous high and very vasculose transverse lamellae (Fig. 7) making an intramural calciferous tissue. The transition



FIGS 1-7

Cirodrilus angeioi: 1. Ventral surface of the segments XVI - XXIII. 2. Posterior seta. 3. Apex of one seta. 4. Diagram of the organization of the segments VI - XVIII, reconstructed from serial sections. 5. Post-clitellar nephridium. 6. Mid cross section of a calciferous gland. 7. Horizontal section of the oesophagus in XI - XIV. FD – female duct. GI = gizzard. PB = pharyngeal bulb. MD = male duct. SP = spermatheca. SV = seminal vesicle.

oesophagus-intestine is in 16/17. The typhlosole begins in XVIII; it is a longitudinally wavy dorsal blade as high as 1/4 of the intestinal diameter. There are no intestinal caeca. Three pairs of thin lateral-hearts are in VII - IX and two pairs of bulky oesophageal-hearts link the mid-dorsal line of the oesophageal blood-plexus with the ventral vessel in X and XI. There is one holonephridia pair in each segment. The post-clitellar nephridia (Fig. 5) have a minute preseptal funnel connected with the post-septal main portion, which is composed of two loops united to the mid-ventral extremity of the bladder.

The pair of testes is attached to the posterior face of the conic septum 10/11 so that the vetrally coalesced testis sacs are protrude laterally into the space of the parietal segments XII-XIII (Fig. 4). The pair of band-like seminal vesicles presents strong intersegmental constrictions; the vesicles continue laterally to the intestine to LIX. The pair of male ducts is superficial on the body wall to XVI and intraparietal at the back. The pair of ovaries and female funnels are ventral in XIII. The ovaries are wide with the eggs irregularly distributed. The spermathecae (Fig. 8) have a well demarcated globular ampulla and a slightly shorter duct.

REMARKS - The genus *Cirodrilus* Righi, 1975 had only one species, *C. angeloi* Righi, 1975 known from Brazil, Amapá State. The two now known species are distinguished by the following characteristics: *C. aidae* - puberal ridges in XVII-XXII (*C. angeloi* - puberal ridges in XIV, XV-XXI); genital setae absent (genital setae present); common setae ornamented with a wide group of thorns (with 6 aligned thorns); male pores in the posterior half of XVIII (in the posterior half of XVI); spermathecae pores in 6/7 - 8/9 (in 5/6 - 8/9); intramural calciferous glands in XII - XIII (in X - XIV).

The name of the new species was given in memory of Mrs. Aida Prioli Righi.

OCNERODRILIDAE

Ocnerodrilus Eisen, 1878

Ocnerodrilus Eisen, 1878: 1

Ocnerodrilus (part.); EISEN, 1893; 272; 1900: 110; BEDDARD, 1895: 510; MICHAELSEN, 1900: 377; COGNETTI, 1905b: 50; STEPHENSON, 1923: 484; 1930: 860; GATES, 1972: 273; 1973: 23, 25; RIGHI, 1990: 69.

DIAGNOSIS - Eight setae per segment. Dorsal pores absent. One pair of prostate pores in 1/2 XVII and one pair of male pores (vasa deferentia openings) close or coalesced with the prostate ones; or male pores in 17/18 united to the prostate ones by short seminal grooves; or two pairs of prostate pores in XIX and XX and one pair of male pores coaleced with the first pair of prostate pores. Gizzard absent. One pair of calciferous glands in IX with separated oesophageal openings, exceptionally with a common opening. The calciferous gland cavity is wide and undivided and has a number of independent lengthwise parietal-lamellae or folds; exceptionally the cavity is smooth. Two pairs of testis and male funnels in X and XI. Prostates, one pair in XVII or absent, occasionally two pairs in XIX and XX. Ovaries, one pair in XIII.

Spermathecae, one pair in 8/9 without diverticles or seminal chambers or spermathecae absent.

TYPE - *Ocnerodrilus occidentalis* Eisen, 1878.

SPECIES AND OCCURRENCES

O. paraguayensis Rosa, 1895 - Paraguay: Central Prov.: Assuncion (ROSA, l.c.; 1896). Argentina: Jujuy Prov.: San Lorenzo. Bolivia: Santa Cruz Dept.: Aguajrenda (COGNETTI, 1902).

O. ibemi Righi, 1968 - Brazil: São Paulo State: São Sebastião (RIGHI, l.c.).

O. simplex Cognetti, 1904 - Costa Rica: San Jose (COGNETTI, l.c.; 1905b). Canary Islands (COGNETTI, 1906).

O. potyuara, n. sp. - Brazil: Paraiba State: Mari.

O. calwoodi Michaelsen, 1899 - Caribbean Islands: St. Thomas (Michaelsen, l.c.); Cuba (MICHAELSEN, 1924). Colombia: Antioquia Dept.: near Medellin (MICHAELSEN, 1913). Canary Islands (COGNETTI, 1906).

O. jeanneli Michaelsen, 1914 - Kenya: Mount Kenya (MICHAELSEN, l.c.; 1915).

O. occidentalis Eisen, 1878 - Worldwide in tropical and hot-temperate zones (RIGHI, 1984).

O. andinus Righi, 1981 - Equador: Pichincha Dept.: Los Tayos Cave near Quito (RIGHI, l.c.).

O. cunningtoni Beddard, 1906 - Zaire: Lake Tanganyika (BEDDARD, l.c.).

O. sabanae Cognetti, 1905 - Panama: Darien: Punta de Sabana (COGNETTI, 1905a, b).

O. alox Righi & Fraile-Merino, 1987 - Costa Rica: Heredia Prov.: San Francisco (RIGHI & FRAILE-MERINO, l.c.).

O. overlaeti (Michaelsen, 1936) - Zaire: Sandoa (MICHAELSEN, l.c.).

REMARKS

1. - STEPHENSON (1930) recognized three subgenera of *Ocnerodrilus* (viz. *Ocnerodrilus* s.s., *Ilyogenia* Beddard, 1892 and *Liodrilus* Eisen, 1900) distinguished by the number (0, 1 or 2 pairs) and position (7/8 or 7/8 and 8/9 intersegments) of the spermathecae, seminal vesicles (present or absent) and spermatozoan maturation (intra- or extra-gonadal). JAMIESON (1971) elevated the subgenera to genera rank. The distinction of subgenera or genera based upon negative characteristics or on characteristics associated with non-crossed reproduction had to be made because of the type-species, *Ocnerodrilus occidentalis* were known only through morphs with very degenerated sexual apparatus. The finding of an *O. occidentalis* population of degenerated and undegenerated specimens and the study of some new *Ocnerodrilus* species (RIGHI, 1981; 1984; RIGHI & FRAILE-MERINO, 1987) showed that the sexual organs, especially the spermathecae, have some meaning in distinguishing the three genera. However the closest affinities between the species are seen in the calciferous

glands structure as follow: the cavity of the calciferous glands in *Ocnerodrilus* is undivided and its inner surface is smooth or pleated lengthwise. The glandular cavity in *Ilyogenia* is divided by longitudinal ridges merged medially; it results a system of longitudinal chambers or tubes placed aroud a "solid" core. The glands of *Liodrilus* have a panicled-tubular strucutre (see below).

2. - The structure of the calciferous glands is unknown to *O. paraguayensis*, *O. ibemi*, *O. simplex* and *O. sabanae*. It was assumed they have the *Ocnerodrilus* trabecular type because the first three species have affinities with *O. calwoodi* and the last one with *O. alox*.

3. - *O. overlaetti* has a single position in *Ocnerodrilus* owing to its two pairs of prostates in XIX and XX and the vasa deferentia opening coalescing with the first prostatic pores. Therefore MICHAELSEN (1936) described it in the unharmonious genus *Gordiodrilus*; where it was the only species with a pair of calciferous glands. The number of calciferous glands and presence of spermathecae led JAMIESON (1963) to transfer *overlaetti* into *Ilyogenia*; from where it was now removed to *Ocnerodrilus* by the calciferous gland structure.

4. - *O. cunningtoni* (with the two calciferous glands confluent into a common oesophageal opening) has an intermediary position between *Ocnerodrilus* (with two independent calciferous glands) and *Gordiodrilus* (with an odd calciferous gland).

5. - O. alox shows a slight inner division in the ental portion of its calciferous glands. This reinforces the idea of the relationship among *Ocnerodrilus*, *Ilyogenia* and *Liodrilus*. The occurrence of *O. alox* in Central America (Costa Rica) is coincident with the *Ilyogenia* territory and is not far away from *Liodrilus* region, which goes from Guyana to NE Brazil (Pará and Paraiba States).

6. - The chambers inside the spermathecae duct of *O. potyuara* (see below) may be seen as a preliminary sketch of the diverticula; which characterize *Pygmaeodrilus*. Moreover the occurrence of *O. potyuara* in NE Brazil is not far away from *Pygmaeodrilus amapaensis* Righi, 1988, known from Amapá State, Brazil.

7. - The genus *Ocnerodrilus* (without the anthropochoric species) is found in Central and South America and in Africa. The American occurrences are in Argentina (Jujuy Prov.), Paraguay, Bolivia (Santa Cruz Dept.), Brazil (S. Paulo and Paraiba States), Equador (Pichincha Dept.), Colombia (Antioquia Dept.), Costa Rica and the Caribbean Islands (St. Thomas and Cuba). The African occurrences are in Kenya and Zaire. Amphiatlantic distribution among the Ocnerodrilidae is also known to *Ilyogenia* (Stephenson, 1930), *Pygmaeodrilus* (Righi, 1988) and *Gordiodrilus* (Righi, 1990). Similarities in the anatomy and in the geographical distribution of these four genera suggest they make up a closely related group, very old (before the Atlantic opening), and which have a very slow evolutionary rate.

8. - The structure of the calciferous glands is a valuable practical characteristics to distinguish the genera *Ocnerodrilus*, *Ilyogenia* and *Liodrilus*. However I am mot quite sure about its applicability to recognize the philetic relationships between the other Ocnerodrilidae genera. The descriptive anatomy of the calciferous glands of *Ocnerodrilus potyuara*, *Liodrilus mendesi* and *Lourdesia paraibaensis* (see below) and the comparative anatomy (*O. alox* presents slight ental division of the

glands cavity) suggest that the growing and differentiation of the calciferous gland is a phenomenon of their apical region, i.e. ental. So it is easy to understand that the structural type of unilocular wide cavity with or without lengthwise parietal trabeculae or folds, presented by *Ocnerodrilus*, is the simplest one. The medial coalescence of the trabeculae would give rise to the plurilocular type with the "solid" core of *Ilyogenia*. And several longitudinal coalescences of the trabeculae would give the panicled-tubular structure of *Liodrilus*. Fusion of the gland pair into an odd calciferous gland and thickening of its stroma leaving a thin axial cavity would give the *Gordiodrilus* type. However the other genus of the group, *Pygmaeodrilus*, is characterized by the spermathecal diverticles and not by its calciferous glands structure (JAMIESON, 1957). Some *Pygmaeodrilus* species have glands of the *Ocnerodrilus* type (viz. *P. budduensis* Michaelsen, 1911), others species have the *Ilyogenia* type (viz. *P. quilimanensis* Michaelsen, 1890) and others the *Gordiodrilus* type (viz. *P. amapaensis* Righi, 1988). This makes us to conclude that the spermathecae diverticles or the calciferous glands structural type would have originated more than one time. In any case *Pygmaeodrilus* is not an homogeneous grouping.

KEY TO *Ocnerodrilus* SPECIES

1 Prostates, two pairs in XIX and XX . . . . . *O. overlaeti*
- Prostates, one pair in XVII 2
2 One pair of short seminal furrows uniting the prostatic pores in 1/2 XVII to the male pores (vasa deferentia openings) in 17/18 3
- Prostate and male pores side by side or coalesced in 1/2 XVII 4
3 Wide glandular cushion in XVII. Ampulla and duct of the spermathecae well demarcated . . . . . *O. alox*
- Glandular cushion absent. Spermathecae without distinction between ampulla and duct . . . . . *O. sabanae*
4 Spermathecae absent . . . . . *O. occidentalis*
- Spermathecae present 5
5 Setae bicuspidate. Calciferous gland with a common oesophageal opening . . . . . *O. cunningtoni*
- Setae unicuspidate. Calciferous glands with independent opening 6
6 Calciferous glands cavity of smooth surface, i.e. without trabeculae or folds . . . . . *O. andinus*
- Calciferous glands cavity with lengthwise trabeculae or folds 7
7 Setae a and b of XVII present . . . . . *O. occidentalis*
- Setae a and / or b of XVII absent 8
8 In the mid-body region *aa* = *bc* 9
- In the mid-body region *aa* > *bc* 10
9 Vasa deferentia with distal muscular thickening . . . . . *O. jeanneli*
- Vasa deferentia without distal muscular thickening . . . . . *O. calwoodi*
10 Arciform musculature (intracoelomic oblique muscle bands) in one or more segments from XV - XVIII associated with ventral depression of the clitellum 11

- Arciform musculature absent; ventral surface of the clitellum is not depressed 12
11 Spermathecae with well demarcated ampulla and duct. Arciform musculature in XV - XVIII . . . . . *O. potyuara*
- Spermathecae without distinction between duct and ampulla. Arciform musculature in XVII . . . . . *O. simplex*
12 Wide glandular cushion in XVII. Prostates with well demarcated duct and gland . . . . . *O. ibemi*
- Glandular cushion absent. Prostates without distinction between duct and gland. . . . . *O. paraguayensis*

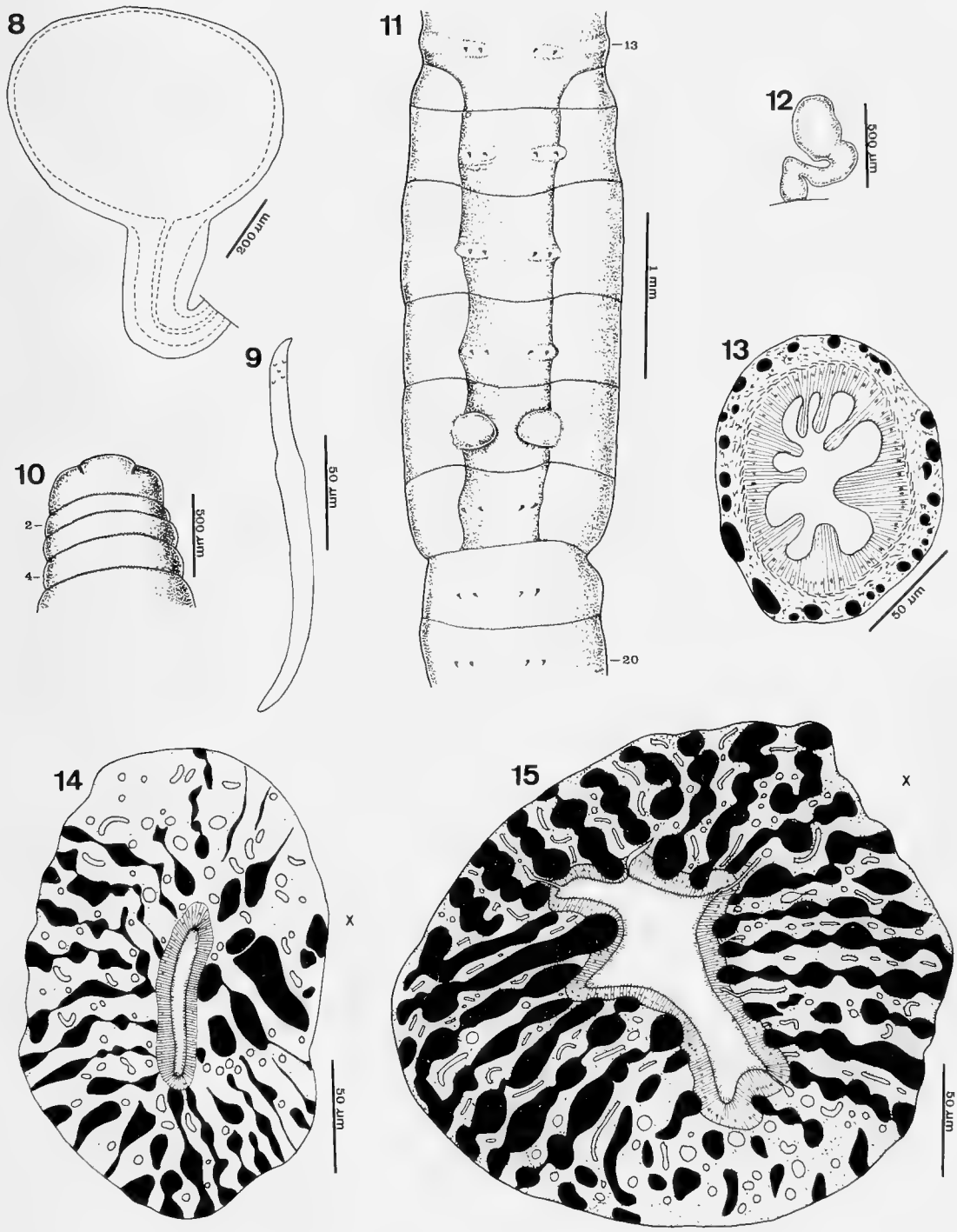
Ocnerodrilus potyuara, n. sp. (Figs 9-15)

MATERIAL - Brazil: Paraiba State: Mari, moist sandy soil with sweet-potato tillage near a dam, holotype 1 clitellate worm (ZU-1276A), paratypes 2 clitellate and 2 mature aclitellate worms (ZU-1276B), 1 clitellate and 2 mature aclitellate worms (MHNG 990.124)); Rafael A. T. Guerra col. 24.XI.1990.

DESCRIPTION - The clitellate worms are 28 - 57 mm long by 0.9 - 1.1 mm wide in the middle-body region. Number of segments 87 - 165. There are no pigments. The prostomium (Fig. 10) is epilobic 1/3 of open tongue. The setae start from II and are arranged in regular lengthwise rows. There are no ventral setae in XVII or modified genital setae. The relationships between the setae are in the mid-body region (segments XXV - XXX) *aa* : *ab* : *bc* : *cd* : *dd* = 3.1 : 1.0 : 5.0 : 0.9 : 16.6 (*ab* = 90 µm) and in the posterior region (XC - C) = 3.8 : 1.0 : 3.9 : 1.0 : 11.5 (*ab* = 77 µm). The setae (Fig. 9) are sigmoid, unicuspidate, with a small distal nodulus. The subapical portion of the mid-body setae has some semilunar excavations open to the apex and irregularly placed. The greater number of posterior setae are smooth, i.e. not ornamented. The setae length varies in the mid-body region from 148 - 186 µm (M = 161 µm) and in the posterior region from 126 - 141 µm (M = 134 µm).

The saddle-shaped clitellum is ventrally open in *bb*; it extends from 1/3 XIII, XIV - XVIII (= 5 - 5 1/3 segments); its intersegmental furrows are inconspicuous. The ventral surface of XV, XVI - XVIII (Fig. 11) varies from slightly to very depressed. This is related to the oblique muscle bands (arciform muscles) running from the ventral to the lateral body walls in the coelomic cavity of XV - XVIII. The male pores are situated on a pair of rounded to egg-shaped papillae in *ab* of XVII. The female pores lie on two minute milk-white papillae in line *c* just after intersegment 13/14. One pair of spermathecal pores open on line *b* of 8/9, inside a small egg-like area. The nephridiopore were unrecognized.

The septa 6/7 - 8/9 are very thick and muscly, the 5/6 a little less and the others are thin and fragile. Septal glands are well developed in V - VIII; they diminish in size from front to rear. The gizzard is absent. The pair of calciferous glands open ventro-laterally into the posterior region of the oesophagus in IX. Each gland has a short peduncle pointing downwards. It continues forwards by the egg-shaped gland



FIGS 8-15

Cirodrilus angeloi: 8. Spermatheca of 6/7. *Ocnerodrilus potyuara*: 9. Mid-body seta. 10. First four segments in dorsal view. 11. Ventral surface of the segments XIII - XX. 12. Spermatheca. 13. Cross section of the spermatheca duct in its widened ectal part. 14. Cross section of a calciferous gland in the ectal half. 15. The same in the ental half.

body; which is as long as 2/3 IX, so that it does not attain septum 8/9. The gland body presents a thick stroma with lengthwise wavy non-ciliated canaliculi; which grow in size towards the anterior (i.e. distal) region of the gland, where they open into the gland cavity. The cavity is central axial throughout the gland, presenting high ciliated ephitelium. It is narrow and slit-like ectally (Fig. 14) widening and making some longitudinal folds entalwards (Fig. 15). The transition oesophagus - intestine is in XII. There are no typhlosole or intestinal caeca. There is a bulky supra-oesophageal vessel in X - XI, linked to two oesophageal-hearts of thin walls. One pair of lateral-hearts is posterior in IX; its dorsal half is thin but with very muscular thick walls, and its ventral half is turgid with thin walls. There are one pair of avesiculated holonephridia per segment.

Two pairs of testis and male funnels are ventral in X and XI. There are no testis sacs and the spermatozoan fill up the cavity of both the segments. Two pairs of lobular seminal vesicles are in IX and XII. Those of XII are the bigger ones; they stretch the septum 12/13 out to occupy XII - XIII. The two male ducts of every side run along the body wall in a common sheath; they coalesce inside the papilla of XVII a little before joining the corresponding prostate duct, and open through the male pore. Each prostate has a small thin muscular duct as long as one segment and without ectal dilation. It follows the glandular part; which is tubular, about two times thicker and ending in XXII after some turns below the intestine. One pair of ovaries and female funnels are ventral in XIII. The spermathecae pair in IX (Figs 12) has egg-shaped ampulla well separated from the duct; which is about 1.5 times longer and widened in its ectal portion. The duct has a connective very vascularized coat over thin muscular sheath. In its widened portion the connective coat is a little thicker and the high inner epithelium build up 7 - 8 chambers widely opened into the duct cavity (Fig. 13). The longer non-widened ental portion of the duct has a smooth inner surface. Free spermatozoan are found throughout the duct, in the ampulla they are surrounded by an amorphous pale-blue stained mass.

REMARKS - *Ocnerodrilus potyuara* is set apart from the other species of the genus by the intraparietal chambers in the widened ectal part of the spermathecae duct. This characteristic places it on the bordering zone to *Pygmaeodrilus*, characterized by possessing diverticles in the spermathecae. Outside this, *O. potyuara* is near to *O. calwoodi* and *O. simplex*. Other main characteristics to distinguish these species from *O. potyura* are: *O. calwoodi* - setal space *aa* = *bc*; male porophores taking over all XVII length and a little more. *O. simplex* - Arciform muscles only in XVII; spermathecae without distinction between duct and ampulla. The name of the new species is that of an indian group of the region, also named "Potyguara".

Liodrilus Eisen, 1900

Ocnerodrilus (part.); Beddard, 1891: 56.
Ocnerodrilus (Leiodrilus) Eisen, 1900: 112.
Ocnerodrilus (Liodrilus); Michaelsen, 1900: 378; Stephehson, 1930: 861.
Ocnerodrilus (Guamaia) Righi, 1975: 77.

DIAGNOSIS - Setae, eight per segment. Dorsal pores absent. One pair of joined male and prostatic pores in XVII with ou without copulatory chambers. One or two pairs of spermathecal pores in 7/8 or 7/8 and 8/9. Gizzard absent. One pair of calciferous glands in IX of panicled-tubular structure. One pair of ovaries in XIII. Spermathecae without diverticles or seminal chambers.

TYPE - *Ocnerodrilus eiseni* Beddars, 1891.

REMARKS - Until now *Liodrilus* has been known only by the type-species as no more have been found since the original description. BEDDARD (1891) wrote about the calciferous gland structure of *L. eiseni* - "their lumen is divided by a network of anastomosing folds of epithelium, the subdivisions being more complete towards the blind end of the gland. The epithelium of the glands appears to be everywhere ciliated..." This description fits the structure of the glands in *Ocnerodrilus (Guamaia) ipu* Righi, 1975, therefore the proposed synonymy, notwithstanding the difference in the spermathecae number.

SPECIES AND OCCURRENCES

L. eiseni (Beddard, 1891) - Guyana.
L. ipu (Righi, 1975) - Brazil: Pará State: Belém.
L. mendesi, n. sp. - Brazil: Paraiba State. João Pessoa.

TABLE FOR THE *Liodrilus* SPECIES

Species	*eiseni*	*ipu*	*mendesi*
Clitellum	XIII - XVIII	XIII - XIX	XIV - XX
Glandular cushion	absent	absent	XVI - XVIII, aa
Spermathecal pores	7/8, *ab*	7/8 and 8/9, *b*	7/8 and 8/9, *b*
Spermathecae shape	Rounded, sessile	Flattened globular ampulla, short straight duct	Cylindrical ampulla, bent long duct.
Setae	closely paired	widely paired	widely paired

Liodrilus mendesi, n. sp. (Figs 16-26)

MATERIAL - Brazil: Paraiba State: João Pessoa, moist sandy soil, holotype 1 clitellate worm (ZU-1275A), paratypes I clitellate and 1 mature aclitellate worms (MHNG 992.134) and 2 mature aclitellate worms (ZU-1275B), Everaldo G. da Silva col. 24.IV. 1992.

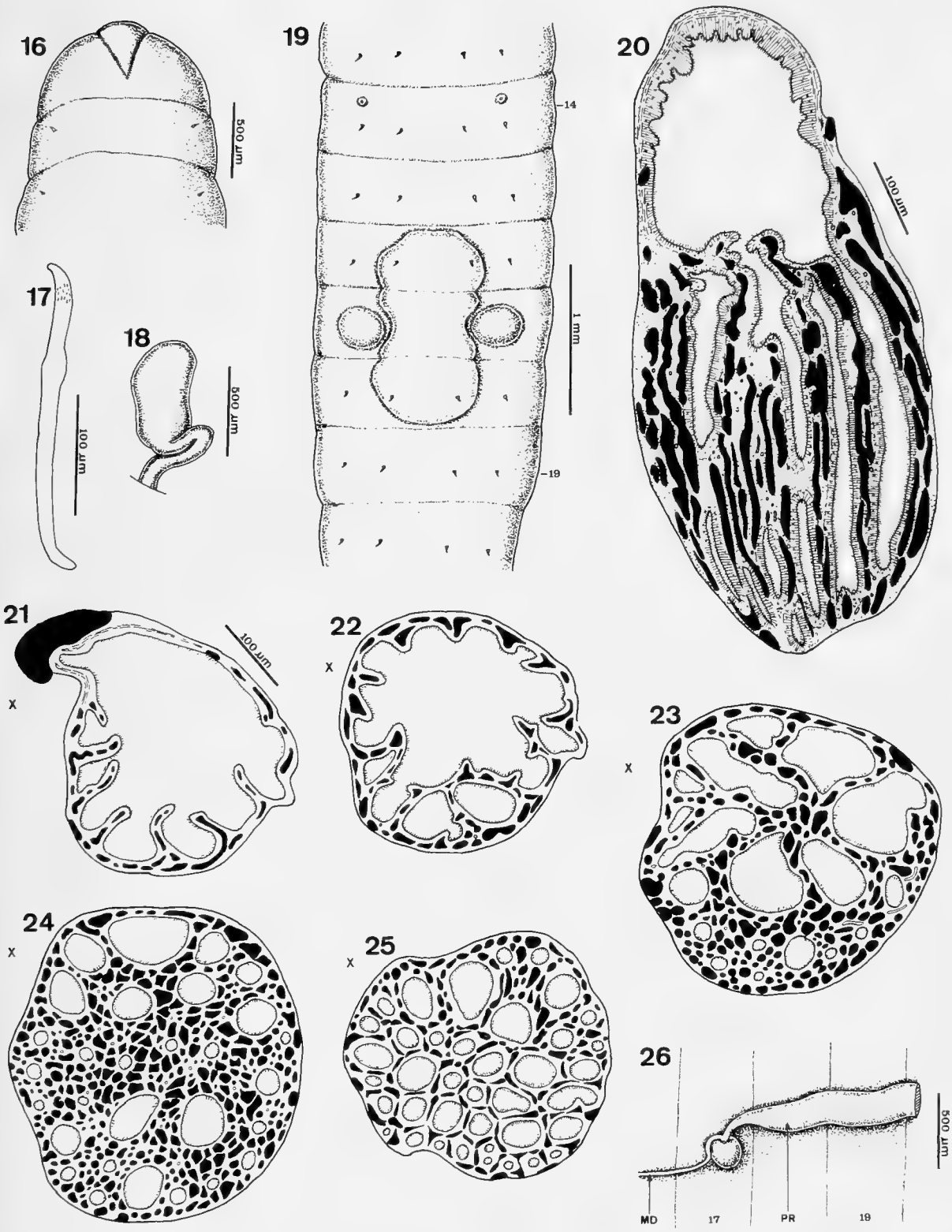
DESCRIPTION - Length 50 - 60 mm. Mid-body diameter 1.3 - 1.4 mm. Number of segments 155 - 175. The pre-clitellar dorsal region is violet-blue like no. 590 of Sèguy (1936); the remaining part is dirty white. The prostomium is epilobous 2/3 of V-like tongue (Fig. 16). The setae are arranged in four pairs of longitudinal series starting from II. There are no ventral setae in XVII or modified genital setae. The setal

relations are in the mid-body region (segments LXV - LXXV) *aa* : *ab* : *bc* : *cd* : *dd* = 1.42 : 1.00 : 1.90 : 1.35 : 1.55 (*ab* = 399 µm) and in the posterior region (CXL - CL) = 1.44 : 1.00 : 1.42 : 1.08 : 1.27 (*ab* = 309 µm). The setae (Fig. 17) are lengthened sigmoid with a distal nodulus and unicuspidate apex. The subapical part has small marks which are a little longer than they are wide and irregularly placed or in more or less oblique rows. The setae length varies in the mid-body region from 235 - 256 µm (M = 242 µm) and in the posterior region from 225 - 245 µm (M = 236 µm).

The clitellum extends on XIV - XX (= 7 segments) and is ventrally opened in *bb*; its intersegmental furrows are unrecognizable. The male pores are situated on a pair of rounded to eggshaped papillae in XVII *ab*. One glandular area is prominent on the ventral face of XVI - XVIII (Fig. 19) of clitellate and mature aclitellate worms. This area shows small indents in the intersegments and a strong waist between the male papillae. The female pores are on small papillae in the fore part of XIV, line *b*. Two pairs of minute spermathecal pores open out on line *b* of 7/8 and 8/9. Nephridiopores are not visible.

The septa 4/5 and 5/6 are very thin and 6/7 - 8/9 are thick and muscular. The following septa become thinner and thinner to 11/12 and the other ones are very slender. The septal glands extend up to VII. The pharyngeal bulb distends the septa backwards extending to parietal segment VI. There is no gizzard. One pair of calciferous gland open into the posterior portion of the oesophagus in IX. Each gland has a short peduncle turned forwards and downwards and gradually enlarges. Its inner epithelium is high and ciliated building up two small irregular folds. The transition between peduncle and glandular body forms a small angle without a sharp change in diameter. The egg-shaped gland body grows downwards and forwards did not reaching the septum 8/9. The most ectal region of the gland (Figs 20 - 21) has a wide cavity with lengthwise trabeculae. The trabeculae coalesce entalwards successively two by two (Fig. 22) originating peripherical longitudinal ducts. Afterwards the trabeculae coalesce medially giving rise to more central ducts (Fig. 23). All ducts are longituidnal; they undergo dichotomies forming other thinner ducts (Fig. 24); which may widen in the ental region (Fig. 25). The surface of the ectal cavity and ducts are ciliated everywhere. Among the ducts there is a stroma of loose connectiive tissue with numerous lengthwise blood spaces. Rare and minute canaliculi are seem in the stroma; they may be real or only technical artifacts. Rounded to egg-shaped spaces are sporadically seen inside the ducts walls; their diameter varies between 6 - 10 µm, and they contain very small grey to black granules. Similar granules are found in all duct lumen. The transition oesophagus - intestine is in 12/13. There are no typhlosole or caeca. Two pairs of bulky hearts are in X and XI and one pair of avesiculate holonephridia in each segment.

Two pairs of testis and male funnels are ventral in X and XI; there are not testis sacs, the cavity of the segments are full of spematozoan. Two pairs of nodular surface seminal vesicles are in IX and XII; there are no seminal vesicles in X and XI. The two male ducts on each side have a common sheath. They run straight along the body wall to 1/2 XVII, where they bend medialwards and ascend slightly into the body cavity. Then they coalesce and the sheath becomes two times thicker and



FIGS 16-26

Liodrilus mendesi: 16. First three segments in dorsal view. 17. Posterior seta. 18. Spermatheca of 7/8. 19. Ventral view of the segments XIV - XIX. 20. Sagittal section of a calciferous gland. 21 - 25. Cross sections of a calciferous gland from ectal (21) to ental (25) regions; same scale. 26. Terminal part of the male apparatus in inner view. MD = male duct. PR = Prostate X = position of the oesophagus.

muscular. The resulting single duct coalesce with the corresponding prostatic duct and penetrates medially into the rounded and very muscular copulatory chamber or ejaculatory bulb (Fig. 26). Each prostate of XVII has a short and little muscular duct; it continues without transition through the tubular glandular portion; which extends to XXVII ventrally. One pair of fan-shaped ovaries and female funnels lie in XIII and two pairs of spermathecae in VIII and IV. On each spermatheca (Fig. 18) the duct is muscular folded and as long as the cylindrical to fusiform ampulla.

The name of the new species is an homage to Prof. Erasmo Garcia Mendes.

Lourdesia, n. gen.

DIAGNOSIS - Setae, eight per segment. Dorsal pores absent. One pair of united male and prostatic pores in XVII. One pair of spermathecal pores in 8/9. Gizzards, three in VI, VII and VIII. One pair of calciferous gland in IX; their cavity is wide in the peduncle and divided into 7 - 8 longitudinal ducts in circular arrangement to each other inside the gland body stroma. One pair of free testis and male funnels in XI. Male and prostatic ducts without special ectal differentiation. One pair of ovaries in XIII. One pair of spermathecae without diverticles or seminal chambers in IX.

TYPE - *Lourdesia paraibaensis*, n. sp.

REMARKS - *Lourdesia* has affinities to *Ilyogenia* Beddard, 1892 (= *Phoenicodrilus* Eisen, 1895; Gates, 1977), known from Africa and Tropical America, and to *Temanoegia* Gates, 1979, endemic in Hispaniola Island (Dominican Republic). The main characteristics to distinguish these two genera from *Lourdesia* are: *Ilyogenia* - Gizzard absent; testis in X and XI. *Temanonegia* - Gizzards, two in VI and VII; "solid" calciferous gland, i. e. there are no cavity.

The name of the new genus is an homage to Dr. Lourdes Abbut Righi.

Lourdesia paraibaensis, n. sp. (Figs 27-31)

MATERIAL - Brazil: Paraiba State: João Pessoa, most sandy soil of forest; holotype 1 clitellate worm (ZU-1274A), paratypes 2 clitellate worms (ZU-1274B) and 1 clitellate worm (MHNG 993.124). Rafael A. T. Guerra col. 29.V.1992.

DESCRIPTION - Length 32 - 42 mm. Mid-body diameter 0.8 - 0.9 mm. Number of segments 92 - 101. Pigments absent. Protomium epilobus 1/3 of V-shaped tongue. The setae are placed in 4 longituidnal series beginning from II. There are no ventral setae in XVII. The setal relations are in the mid-body region (segments XXV - XXX) *aa* : *ab* : *bc* : *cd* : *dd* = 9.8 : 1.0 : 9.6 : 1.0 : 15.6 and in the posterior region (LXXX - XC) = 4.8 : 1.0 : 5.4 : 1.0 : 8.8 (*ab* = 64 µm in both regions). The setae (Fig. 30) are sigmate with a short distal curve and a wide proximal one; their unicuspidate apex is not ornamented. The setae length varies in the mid-body region from 82 - 97 µm (M = 88 µm) and in the posterior region from 117 - 148 µm (M = 131 µm). There are no

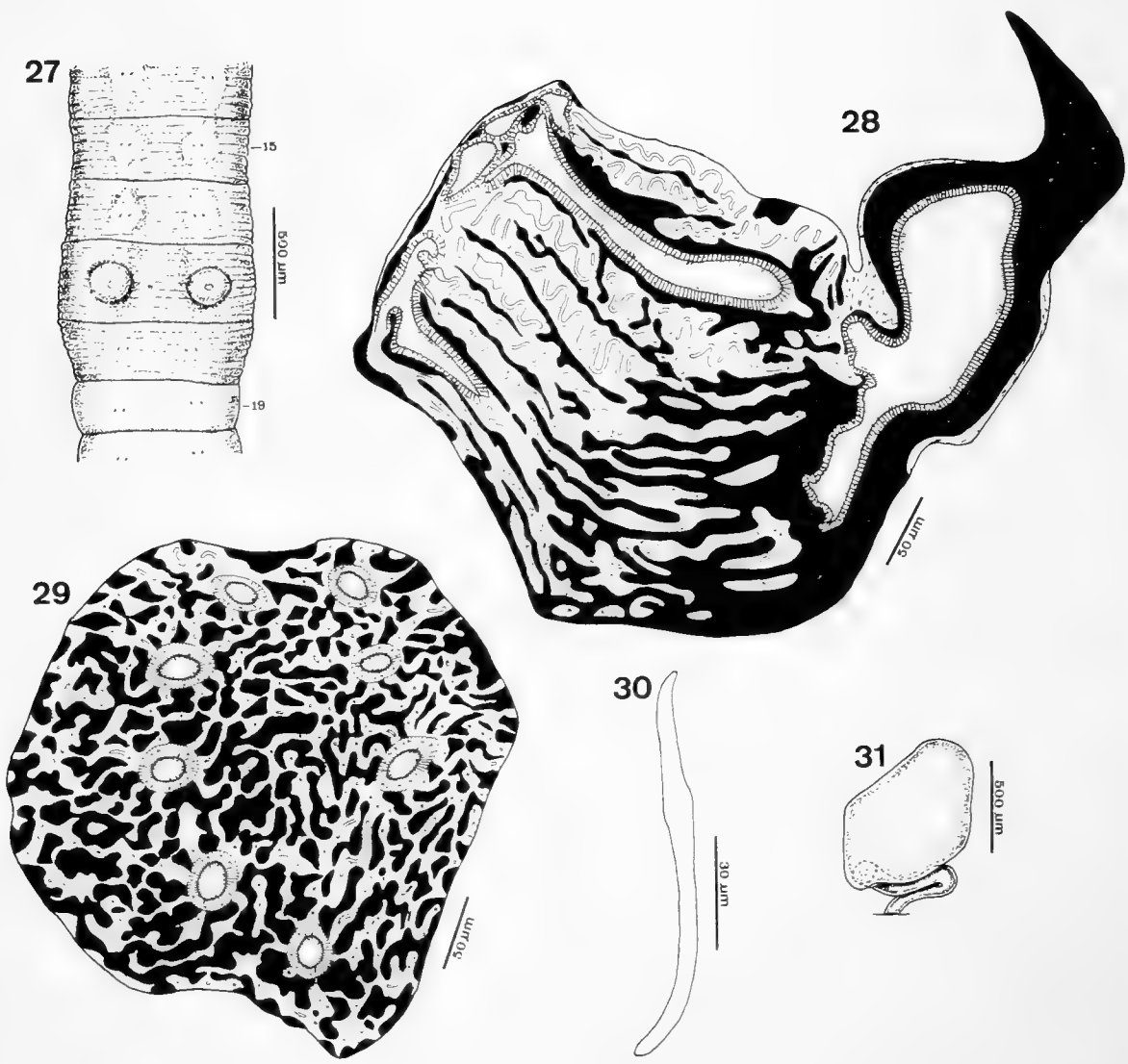
genital setae. The ring-shaped clitellum is thicker dorsally and goes from XIV - XVIII (= 5 segments); it may be also slightly differentiated in XIII. In three worms the surface of the clitellum has a lot of annular furrows deeper in the flat or slightly sunk ventral face. The voluminous conical male papillae are in XVII; their center is on line *b* or just laterally (Fig. 27). The female pores lie in the anterior third of XIV, laterally to *b* line; sometimes they are like a small papilla. One pair of spermathecal pores open in 1/2 *bc* of 8/9. They are like small transverse slits sometimes with slightly tumid lips and sometimes not. There are no dorsal pores. The nephirdiopores are unrecognizable.

The septa 5/6 - 11/12 are conical, the others are flat. The septa 5/6 - 7/8 are very thick and muscly, the followings thin successively to 10/11 or 11/12 and the others are slender and fragile. A lot of oblique muscular bands (arciform musculature) join the lateral body walls to the ventral one at the sides of the nerve-cord in XIV - XVIII; the bands are more numerous in XVII. The pharyngeal bulb extends to V; its glands make a covering over the anterior oesophagus; which makes a dorsal loop in V. Three wide egg-shaped very muscular gizzards lie in VI - VIII; they are separated by short oesophageal portions. One pair of calciferous glands opens into the postero-ventral region of the oesophagus in IX. On each gland the peduncle is at a right angle to the gland body; which is egg-shaped, almost as wide as it is long, and its length is 1/2 - 3/4 of the IX segment length. The main cavity of the gland is restricted to the peduncle (Fig. 28). In the proximal part of the gland body the cavity splits out into 7 - 8 lengthwise ducts (Figs 28 - 29) 19 - 30 µm wide. The ducts have circular disposition to each other. A lot of longitudinally wavy canaliculi follow at the sides of the ducts; their diameter is 3 - 5 µm in the mid part of the gland widening towards the distal (i. e. anterior in the worm) part of the gland; where they join to the ducts. There also seem to be cross communications between the canaliculi. Ducts and canaliculi are intremingled with loose connective tissue and legthwise blood spaces with cross connections. The main cavity of the calciferous gland and its ducts are ciliated but not the canaliculi. The oesophagus is simple to 12/13 where the intestine begins. There is no typhlosole or intestinal caeca. The intestine is filled up by vegetables debris and some sand grains. Two pairs of voluminous oesophageal-hearts lie in X and XI. There are one holonephria pair on each segment.

One pair of large testis are fastened to the postero-ventral surface of the septum 10/11; the cavity of XI is filled up by developing spermatozoan. One pair of shield-like seminal vesicles are in XII. The wide and folded male funnels of XI continue along the male ducts; these lie on the body wall right to XVII, where they pierce the corresponding male papillae. The pair of prostates extends from XVII - XXIV, XXV. On each prostate the duct is limited to XVII and it is 1/2 as wide as the prostate glandular region. This is simple tubular and ventral to the intestine. Each male papila is a massive muscular structure and protrudes somewhat into the body cavity. The male and prostate ducts run side by side through the papilla; their lumina coalesce at the epithelium level or just below. One pair of thin conical ovaries are in XIII; each one has only one apical mature egg. The pair of spermathecae is very voluminous in IX. Each spermatheca (Fig. 31) is made up of a folded long duct without diverticles or seminal chambers and of a wide irregularly egg-shaped ampulla

of thin wall. The ampulla is filledl up by spermatozoan balls intermingled with a pale-blue stained mucous mass. The duct contain free spermatozoan.

The name of the new species is that of the place of collection.



FIGS 27-31

Lourdesia paraibaensis: 27. Ventral view of the segments XV - XIX. 28. Sagittal section of a calciferous gland. 29. Mid-cross section of a calciferous gland. 30. Mid-body seta. 31. Spermatheca.

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Notes sur les Psélaphides néotropicaux (Coleoptera) 9 - Le genre *Metopiosoma* de la tribu des Metopiasini

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Muséum d'Histoire naturelle, Case postale 6434, CH-1211 Genève 6

Notes on Neotropical pselaphids (Coleoptera) 9 - The genus *Metopiosoma* tribe Metopiasini. - The genus *Metopiosoma* is characterised. *M. pacificum* and *M. barretoi* are redescribed and lectotypes are designated for both species. *M. adisi* sp. n., *M. amazonicum* sp. n., *M. brasiliense* sp. n., *M. inerme* sp. n., *M. parvum* sp. n. and *M. priminens* sp. n. are described.

Key-words: Coleoptera - Pselaphidae - Metopiasoma - Taxonomy - Neotropics.

INTRODUCTION

Le genre Metopiosoma a été créé par RAFFRAY en 1908, pour *Metopias pacificum* Westwood. BRUCH, en 1924 a ajouté l'espèce myrmécophile *barretoi*. J'ajoute à ce genre six espèces nouvelles: *adisi*, *amazonicum brasiliense*, *inerme*, *parvum* et *prominens* provenant toutes, comme les deux précédentes, d'Amérique du Sud. Les dessins des mêmes pièces sont à la même échelle. Je remercie Monsieur G. Roth pour la mise au net de ces dessins.

Les abbréviations suivantes ont été utilisées: OXUM = Hope Entomological Collections, Oxford; INPA = Instituto Nacional des Pesquisas da Amazonia, Manaus; MACN = Museo Argentino de Ciencias Naturales, Buenos-Aires; MHNG = Muséum d'histoire naturelle, Genève.

Les espèces de *Metopiosoma* présentent les caractères suivants:

– Antennes (figs 9 à 14) avec l'article 2 très long; les articles 3 et 4 au moins de moitié moins long; l'article 4 un peu moins long que le 3; les articles 3 et 4 ensemble sont moins longs que l'article 2.

– Tête avec, au milieu du vertex, une petite dent plus ou moins sombre (sauf l'espèce *inerme*).

– Les hanches I et II sont contigues; les hanches III sont séparées de 3 à 4 fois leur diamètre.

En outre: le tégument est lisse et brillant; la pilosité est claire; le pronotum est cordiforme, plus large que long; les élytres réunis sont aussi longs que larges (sauf

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inerme où ils sont plus longs que larges); de chaque côté de la suture, à la base, une fossette de taille variable, prolongée en arrière par une strie ou un sillon.

Metopiosoma pacificum (Westwood)

T ê t e (fig. 1) avec de gros yeux formés d'une quinzaine d'ommatidies. Tégument avec quelques fins points épars. Pilosité assez longue, très fine et très éparse. Antenne (figs 9 et 10) à tégument granuleux, plus fortement vers la base et à pilosité peu visible.

P r o n o t u m partagé longitudinalement au milieu par un sillon plus profond en avant. Tégument ponctué granuleux; la ponctuation est peu dense et les granulations sont écrasées. Pilosité très éparse, plus dense sur les côtés.

Elytres très rétrécis à la base avec leur plus grande largeur au quart apical. Fossette suturale profonde. Sillon sutural fin atténué vers l'apex. Angle huméral très arrondi mais bien marqué. Tégument très finement ponctué granuleux. Pilosité assez courte, peu dense, dirigée vers l'arrière.

A b d o m e n . Tergites sans rebords latéraux, finement et éparsément ponctués; leur pilosité courte et peu dense, dirigée vers l'arrière. Derniers sternites (fig. 15).

P a t t e I : trochanter avec une forte apophyse dirigée vers l'avant.

L o n g u e u r de l'unique exemplaire ♂: 1,45 mm environ.

E d é a g e : figs 18 et 19: longueur 0,22 mm.

♂ l e c t o t y p e : Brésil, Amazone (leg. Bates) (OXUM), par la désignation présente.

Métopiosoma adisi n. sp.

T ê t e du ♂ (fig. 2) avec de gros yeux (♂ et ♀) formés d'une quinzaine d'ommatidies. Tubercule antennaire avec un profond sillon médian longitudinal prolongé sur la tête jusqu'au tiers postérieur. Tégument finement et éparsément ponctué granuleux. Pilosité longue, fine et peu dense, dirigée vers l'extérieur. Antenne (figs 11 et 12) à tégument granuleux, plus fortement et densément vers la base. Pilosité très fine et assez longue, dirigée vers l'apex.

P r o n o t u m partagé longitudinalement au milieu par un large sillon. Tégument peu densément ponctué granuleux. Pilosité longue et fine comme celle de la tête, dirigée vers l'arrière.

E l y t r e s avec leur plus grande largeur près de l'apex. Fossette suturale profonde. Sillon sutural bien marqué à la base, s'effaçant progressivement près de l'apex. Angle huméral très arrondi. Une faible carène suit l'angle de l'élytre et disparaît avant la moitié de celui-ci. Tégument avec une fine ponctuation éparse. Pilosité fine et longue, plus dense sur les côtés et en arrière, dirigée vers l'extérieur.

A b d o m e n . Les trois premiers tergites apparents avec un faible rebord latéral, plus marqué sur le premier. Tégument très finement et éparsément ponctué. Pilosité longue et fine, assez dense, dirigée obliquement vers l'arrière.

L o n g u e u r : ♂, 1,75 mm. ♀, 1,75 et 1,90 mm.

E d é a g e : fig. 20; longueur 0,29 mm.

♂, h o l o t y p e : Taruma Mirin s/Rio Negro, région de Manaus, Brésil (leg. J. Adis) (INPA).

P a r a t y p e s : 2 ♀, même provenance (INPA et MHNG). Cette espèce est dédiée au Dr Joachim Adis, de Plön.

Metopiosoma amazonicum n. sp.

T ê t e (fig. 3) avec des yeux assez gros (♂ et ♀) formés d'une quinzaine d'ommatidies. Tégument très finement et éparsément ponctué. Pilosité longue, fine et très éparse, plus dense en arrière et sur les côtés.

P r o n o t u m très arrondis sur les côtés, partagé longitudinalement au milieu par une dépression s'étendant sur toute sa longueur. Tégument finement et peu densément ponctué. Pilosité longue et fine, assez éparse, plus dense sur les côtés.

E l y t r e s avec leur plus grande largeur vers l'apex. Fossette suturale ovale. Sillon sutural déjà effacé vers le milieu de l'élytre. Angle huméral assez marqué, souligné sur la cassure de l'élytre par une très fine arête. Tégument finement ponctué, à faible et peu dense granulation aplatie. Pilosité très fine, assez longue, éparse, plus dense sur les côtés.

A b d o m e n avec une crête sombre au bord externe; cette crête est très marquée au premier tergite apparent, plus faible au second et réduite à quelques traces au troisième. Une seconde crête parallèle, plus faible, s'étend sur les deux premiers tergites apparents. Tégument finement et éparsément ponctué. Pilosité longue et fine, dirigée un peu obliquement vers l'apex. Derniers sternites (fig. 16).

L o n g u e u r : ♂ 1,63 mm, ♀ 1,60 mm.

E d é a g e : figs 21 et 24; longueur 0,31 et 0,35 mm.

♂, h o l o t y p e : Environs de Manaus, Amazonas, Brésil (leg. Beck) (MHNG).

P a r a t y p e s : 1 ♂ 1 ♀, Rio Solomoes, région de Manaus, Amazonas, Brésil (leg. J. Adis) (INPA).

Metopiosoma barretoi Bruch

T ê t e (fig. 4) avec des yeux assez petits formés d'une dizaine d'ommatidies. Sillon longitudinal médian marqué, plus profond en arrière. Tégument éparsément ponctué granuleux par place, plus fortement sur le vertex. Pilosité moyenne, éparse, plus dense sur les côtés et à la base antennes (figs 13 et 14).

P r o n o t u m partagé au milieu par un sillon longitudinal assez profond. Tégument ponctué granuleux; ponctuation assez éparse, granulation écrasée. Pilosité plus longue que celle de la tête, plus dense sur les côtés et en arrière.

E l y t r e s avec leur plus grande largeur au quart apical. Fossette suturale petite, allongée et profonde. Strie suturale ponctuée atteignant l'apex. Dessus des

élytres très vaguement et légèrement strié longitudinalement. Angle huméral très arrondi, souligné par une crête assez effacée. Tégument irrégulièrement ponctué granuleux. Pilosité longue, comme celle du pronotum, dirigée en arrière.

Abdomen. Premier tergite apparent avec un rebord peu marqué, mais souligné intérieurement et extérieurement d'une fine carène, celle de l'extérieur plus marquée et plus sombre. Tégument comme les élytres. Pilosité longue et fine, dirigée un peu obliquement vers l'arrière, plus dense sur les côtés.

Longueur des ♀: 1,4 mm.

♀, Lectotype: Argentine, Fives Lille, Santa Fe (leg. Weiser) (MACN); cet exemplaire porte une étiquette «Syntypus» et une autre «Typus».

Paralectotype: 1 ♀, même provenance, avec seulement une étiquette «Typus» (MACN). Ce sont les deux seuls exemplaires signalés par Bruch. Désignés ici.

Metopiosoma brasiliense n. sp.

Tête (fig. 5) avec les yeux assez gros (♂ et ♀) formés d'une quinzaine d'ommatidies. A l'avant de la tête, une petite côte claire, plus large en avant, de chaque côté du sillon médian. Tégument avec quelques points épars, un peu plus denses sur les côtés. Pilosité assez longue, fine et très éparse.

Pronotum avec les angles latéraux assez marqués, partagé longitudinalement au milieu par un sillon net qui aboutit en arrière dans une profonde fossette. Tégument ponctué granuleux, surtout sur le dessus; côtés, l'avant et l'arrière parsemés de très petites dents pointues et sombres. Pilosité assez longue, fine, dirigée vers l'arrière.

Elytres avec leur plus grande largeur au quart apical. Fossette suturale petite. Sillon sutural peu profond, déjà effacé vers le milieu de l'élytre. Angle huméral bien marqué. Une fine arête arrondie partant de la base longe la cassure de l'élytre et s'efface progressivement après l'angle huméral. Tégument finement bosselé et ridé avec des lignes de points très fins, plus ou moins orientés longitudinalement. Pilosité assez longue, fine, dirigée vers l'apex.

Abdomen. Premier tergite apparent avec un fin rebord latéral plus large à la base. Tégument à fine ponctuation éparse. Pilosité couchée, fine et longue, dirigée vers l'apex. Derniers sternites (fig. 17).

Longueur: ♂, 1,40 à 1,55 mm.; ♀, 1,50 à 1,65 mm.

Edéage: figs 22 et 23; longueur 0,30 à 0,33 mm.

♂, holotype: Capoeira/Taruma Mirin, Amazonas, Brésil (leg. J. Adis) (INPA).

Paratypes: 16 ♂ 3 ♀, même provenance; 8 ♂ 14 ♀, Igapó/Taruma Mirin, Amazonas (leg. J. Adis); 3 ♂ 1 ♀, Rio Negro /Taruma Mirin, Amazonas (leg. J. Adis); 1 ♂ 1 ♀, environs de Manaus, Amazonas (leg. L. Beck); 1 ♀, Jacaré/P.N. Xingu, Mato Grosso, Brésil (leg. Alvarenga et Werner); tous ces paratypes ((INPA et MHNG).

Metopiosoma inerme n. sp.

T ê t e (fig. 6) avec des yeux assez gros formés d'une douzaine d'ommatidies. Pas de dent sur le vertex. Tégument à granulation fine et serrée. Pilosité peu visible.

P r o n o t u m à peine déprimé longitudinalement au milieu. Tégument comme celui de la tête, plus fortement granuleux à la base. Pilosité peu visible.

E l y t r e s plus longs que larges, très rétrécis à la base avec leur plus grande largeur à l'apex. Fossette suturale profonde suivie d'une autre plus petite contiguë. Sillon sutural très profond à l'avant, doublé, surtout vers la base, d'une fine côte. Tégument avec des granulations irrégulières créant de faibles reliefs transversaux. Pilosité courte, espacée, formant des lignes longitudinales.

A b d o m e n . Tergite avec un large rebord latéral plat; la largeur de ce rebord diminue du 1er tergite apparent au 3ème et est faible au 4ème. Tégument très finement et densément granuleux. Pilosité fine et assez courte, plus visible sur le tiers apical des tergites.

L o n g u e u r : 1,35 mm.

E d é a g e : fig. 25; longueur 0,26 mm.

♂, h o l o t y p e : Petare, Etat de Miranda, Vénézuela (leg. Bordon) (MHNG).

Metopiosoma parvum n. sp.

T ê t e (fig. 7) avec d'assez gros yeux formés d'une quinzaine d'ommatidies. Entre les yeux, au milieu, une longue dépression longitudinale. Dent du vertex aiguë dirigée vers la base. Tégument avec quelques fins points épars. Pilosité fine, longue et éparse, dirigée obliquement vers l'arrière et les côtés où elle est un peu plus dense. Pronotum avec une dépression longitudinale médiane plus marquée à l'avant. Tégument comme celui de la tête. Pilosité comme celle de la tête mais dirigée vers l'arrière et plus dense sur les côtés et à la base.

E l y t r e s très rétrécis vers la base avec leur plus grande largeur à l'apex. Dépression suturale petite mais profonde, ronde et inégale; une autre dépression ronde, un peu moins grande et moins marquée, au milieu de la base. Sillon sutural fin, atténué en allant vers l'apex. Angle huméral souligné par une très fine côte longitudinale, mais les épaules sont assez effacées. Tégument très finement, éparsément et irrégulièrement ponctué granuleux. Pilosité peu dense, longue et fine, dirigée très obliquement des côtés vers l'arrière.

A b d o m e n . Premier tergite apparent avec un fin rebord latéral en gouttière, plus large à la base. Tégument et pilosité comme les élytres.

L o n g u e u r : 1,35 et 1,45 mm.

E d é a g e : fig. 26; longueur 0,22 mm.

♂, h o l o t y p e : Rio Taruma Mirim/Iguapó, Amazonas, Brésil (leg. J. Adis) (INPA).

P a r a t y p e , 1 ♂, même provenance (MHNG).

Metopiosoma prominens n. sp.

T ê t e (fig. 8) avec de gros yeux formés d'une douzaine d'ommatidies. Sillon longitudinal médian, entre les yeux, assez profond. Tégument avec quelques fins points épars et par place une fine granulation écrasée. Pilosité longue, plus dense sur les côtés et à la base.

P r o n o t u m partagé au milieu par un sillon longitudinal très marqué. Tégument ponctué granuleux. Pilosité longue et fine comme celle de la tête.

E l y t r e s avec leur plus grande largeur à l'apex. Fossette suturale bien marquée. Sillon sutural effacé vers l'apex. Angle huméral en bosse arrondie allongée mais bien maqruée. Tégument assez régulièrement et densément ponctué granuleux. Pilosité fine et longue dirigée vers l'arrière.

A b d o m e n . Premier tergite apparent avec un léger rebord latéral, plus large à la base, souligné à l'extérieur par une fine carène sombre. Tégument finement ponctué. Pilosité fine et longue, dirigée obliquement des côtés vers l'apex.

M é t a s t e r n u m avec, au milieu, une forte lame longitudinale, tronquée au sommet, qui se termine par un replat pileux.

P a t t e I : trochanter du ♂ avec une forte apophyse dirigée vers l'avant et terminée par un faible replat.

L o n g u e u r : 1,50 à 1,70 mm.

E d é a g e : figs 27 et 28; longueur 0,24 à 0,28 mm.

♂, h o l o t y p e : Brésil, Amazonas, environs de Manaus (leg. L. Beck) (MHNG).

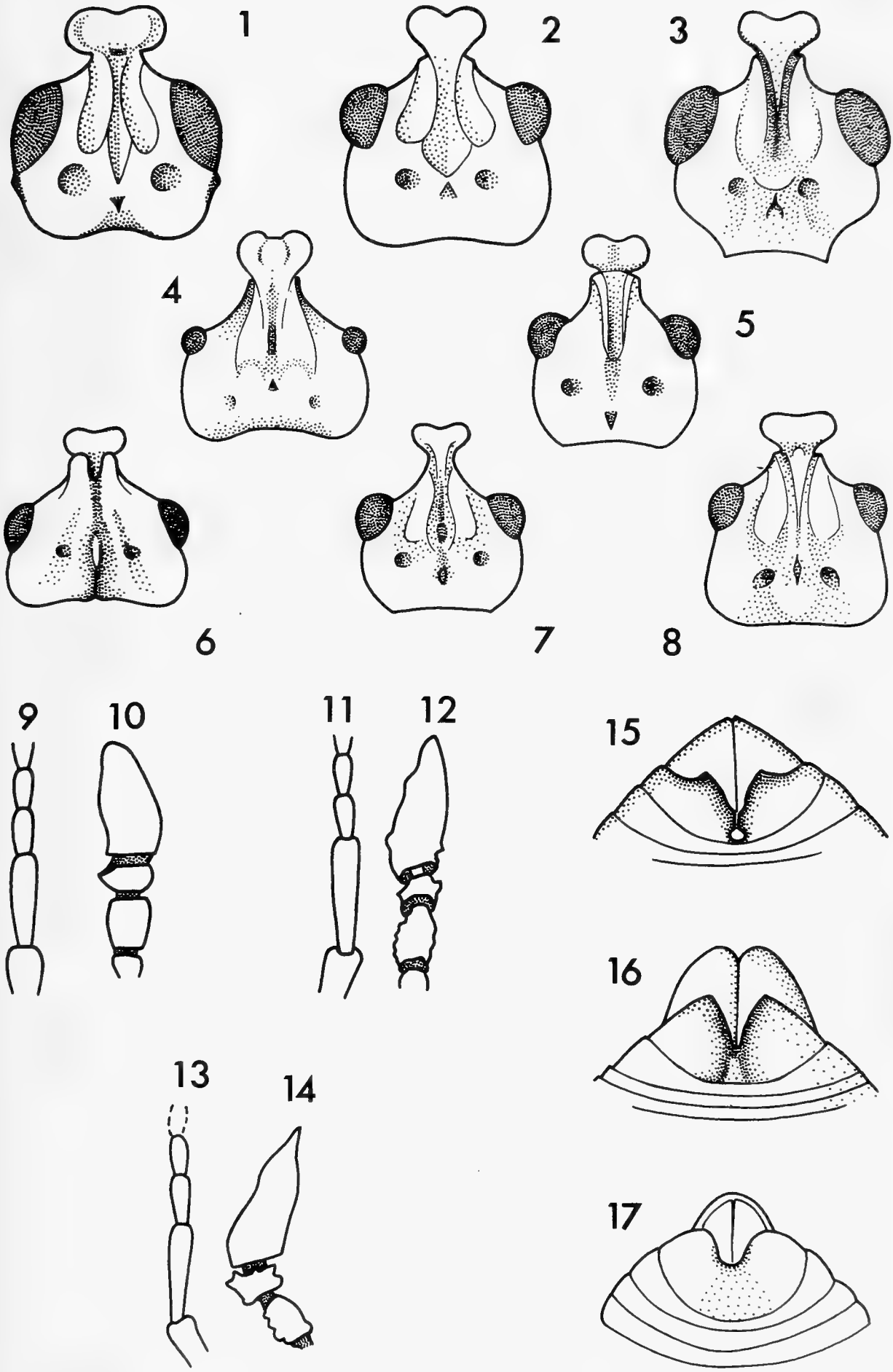
P a r a t y p e s : 2 ♂, même provenance (MHNG).

FIGS 1-17

Dessus de la tête: 1, *Metopiosoma pacificum* (Westwood); 2, *M. adisi* n. sp.; 3, *M. amazonicum* n. sp.; 4, *M. barretoi* Bruch; 5, *M. brasiliense* n. sp.; 6. *M. inerme* n. sp.; 7, *M. parvum* n. sp.; 8, *M. prominens* n. sp.. Antennes: *M. pacificum* (Westwood), 9, articles 2, 3 et 4, 10, massue; *M. adisi* n. sp., 11, articles 2, 3 et 4, 12, massue; *M. barretoi* Bruch, 13, articles 2, 3 et 4, 14, massue. Derniers sternites: 15, *M. pacificum* (Westwood), 16, *M. amazonicum* n. sp., 17, *M. brasiliense* n. sp.

FIGS 18-28

Edéages: *M. pacificum* (Westwood), 18; profil, 19: face; *M. adisi* n. sp.; 20, face; *M. amazonicum* n. sp.; 21: face,; 24: autre position; *M. brasiliense* n. sp.; 22: profil, 23: face; *M. inerme* n. sp.; 25: profil; *M. parvum* n. sp.; 26 face: *M. prominens* n. sp.; 27: profil; 28: face.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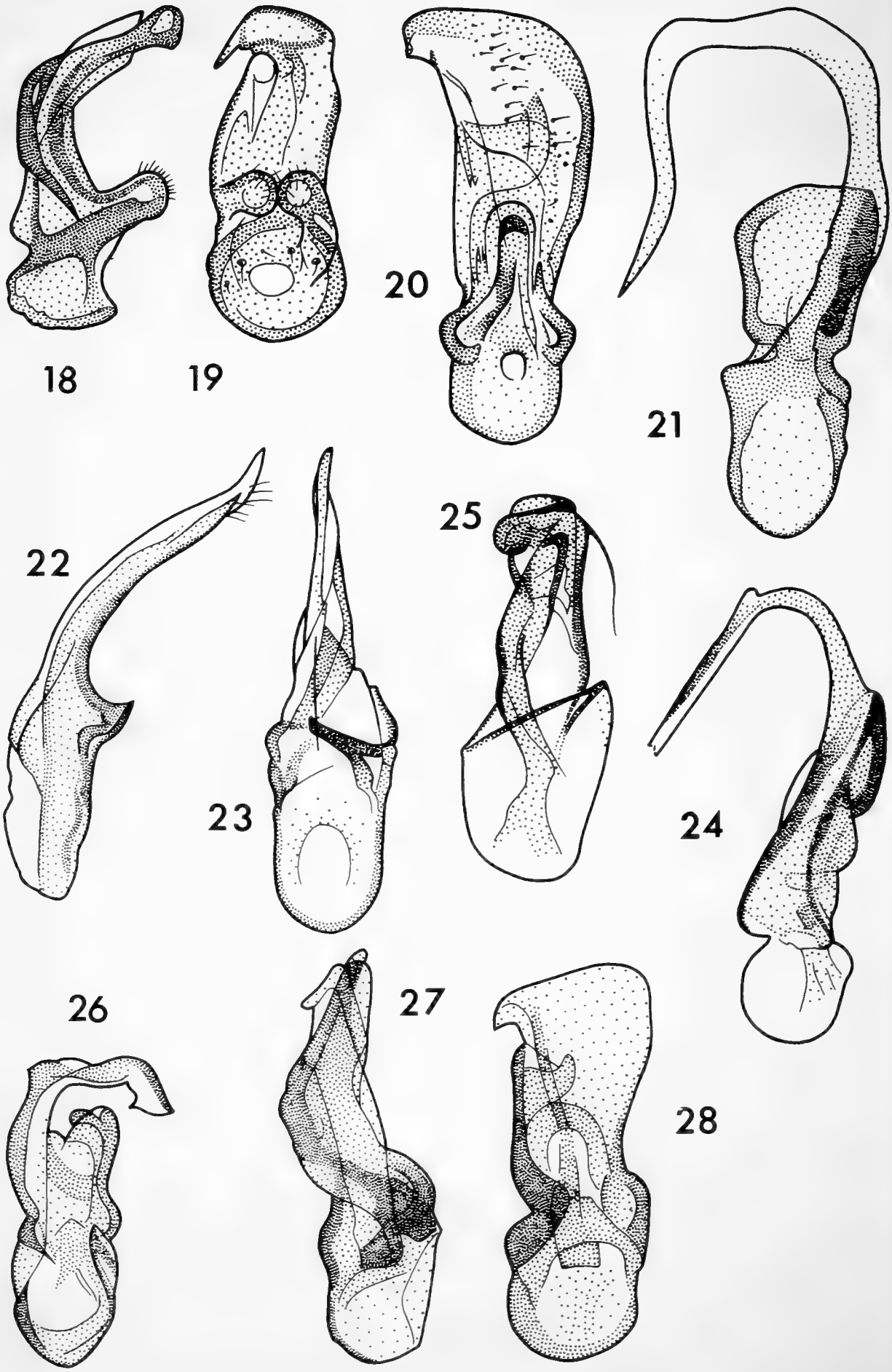
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REVUE SUISSE DE ZOOLOGIE, 100 (4) : 117-193; mars 1994

Aleocharinae della Sottoregione Africana Orientale al Museo di Ginevra (Coleoptera, Staphylinidae) Parte I [1]

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Aleocharinae from Eastern African Subregion in the Geneva Museum (Coleoptera, Staphylinidae). Part I. - In this paper, based on the study of 76 species of the tribe Myllaenini, Diglottini, Oligotini, Gyrophaenini, Homalotini, Bolitocharini, Diestotini, Pronomaeini, Corotocini, Eusteniamorphini, Falagriini and Deremini, 59 species are described as new. A key to the known species of the genera *Myllaena*, *Gyrophaena*, *Brachida*, *Neobrachida* and *Eustenidia* from Eastern African Subregion and from Malgasy Subregion, is given. Additional descriptions of four new apterous species of *Myllaena* from Madagascar, of four new species of *Eustenidia* from Madagascar and of two new species from Gabon, of four new species of *Brachida* from Madagascar and of *Pseudosilusa mindanaoicola* sp. n. from the Philippines, are presented. Illustrations for twelve holotypes or lectotypes of species described by Fauvel, Bernhauer, Eichelbaum and Eppelsheim, are given.

Key-words: Coleoptera - Staphylinidae - Aleocharinae - Taxonomy - East Africa.

INTRODUZIONE

Le Aleocharinae della Sottoregione Africana Orientale sono state oggetto di ricerca e di studio non occasionale ad iniziare dagli ultimi anni del XIX secolo e i primi del XX. Gli autori più attivi che hanno studiato alcune specie dal punto di vista della sistematica sono FAUVEL (1904, 1905, 1907) e BERNHAUER (1915, 1934, 1940). Altri contributi recenti sono quelli di TOTTENHAM (1957) e di me (PACE, 1985, 1986, 1991). Nonostante la pubblicazione dei lavori di questi autori e di altri la fauna delle Aleocharinae dell'Africa Orientale è ancora poco nota. A dimostrare ciò è sufficiente l'esame di nuovo materiale raccolto in recenti missioni di ricerca. E' questo anche il caso delle ricerche svolte in Kenya e in Rwanda dal Museo di Storia Naturale di Ginevra: esse permettono di aggiungere nuove conoscenze sulle Aleocharinae afri-

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[1] 117° Contributo alla conoscenza delle Aleocharinae.
Manoscritto accettato il 06.07.1993..

cane orientali. Il materiale riportato da queste ricerche del Museo di Storia Naturale di Ginevra è oggetto prevalente del presente lavoro e di futuri rendiconti.

Dato il numero esiguo di specie già note e grazie alla pubblicazione da parte di Bernhauer e di Tottenham di chiavi di determinazione per alcuni generi, lo studio sulla sistematica del nuovo materiale del Museo di Ginevra, è stato meno gravato da difficoltà. Tuttavia per una parte considerevole di specie critiche, è stato necessario l'esame dei tipi al fine di conoscere la forma dell'edeago e/o della spermateca, indispensabile attualmente al fine di un riconoscimenti sicuro delle specie in esame.

Al fine di rendere noti i caratteri dell'edeago e della spermateca, come del VI urotergo libero dei tipi esaminati, qui di seguito è presentata una parte del lavoro dedicata ad essi, con relativi disegni degli edeagi e delle spermateche. I tipi pubblicati appartengono solo alle tribù trattate nel presente lavoro.

Per alcuni generi propongo qui delle chiavi di determinazione. Al fine di renderle complete, ho aggiunto la descrizione di alcune specie, per lo più del Madagascar, restate "in litteris" per molti anni.

Al materiale del Museo di Ginevra ho aggiunto alcune specie raccolte nel corso di una spedizione in Kenya del Dr. Luca Bartolozzi del Museo Zoologico "La Specola" dell'Università di Firenze e due specie regalatemi prima della sua morte dal noto stafilinidologo Dr. H. Coiffait, provenienti da una spedizione in Gabon diretta dall'illustre zoologo Grassé.

La quasi totalità degli holotypi delle nuove specie è conservata nel Museo di Storia Naturale di Ginevra (MG). Altri holotypi o materiale tipico sono conservati nei seguenti Musei e collezioni private: Museo Zoologico "La Specola" dell'Università di Firenze (MF), Muséum National d'Histoire Naturelle di Parigi (MNP), Institut Royal des Sciences Naturelles di Bruxelles (IRSNB), Field Museum of Natural History di Chicago (FMC), British Museum (Natural History) (BM), "Zoologisches Museum" dell'Università Humboldt di Berlino (ZMB), "Naturhistorisches Museum" di Vienna (NMW), Deutsches Entomologisches Institut di Eberswalde (DEI), Museo Civico di Storia Naturale di Verona (MV), Collezione Lecoq, Paris (CLQ).

Paratypi si conservano nel Museo di Ginevra, negli Istituti sopra elencati e in collezione dell'autore (CPA).

ELENCO SISTEMATICO DEI GENERI E DELLE SPECIE

Myllaenini

Myllaena rangirensis sp. n. (Figg. 1-4)
Myllaena kayovensis sp. n. (Figg. 5-8)
Myllaena mussardi sp. n. (Figg. 11-12)

Diglottini

Bryothinusa perexilis sp. n. (Figg. 13-16)

OLIGOTINI

Cypha lamuensis sp. n. (Figg. 17-19)
Cypha mahnerti sp. n. (Figg. 20-24)

Oligota (s. str.) **fageli** Williams, 1979

Oligota fageli Williams, 1979: 181
1 ♀, Kenya, Nakuru, Lac Elmenteita, 1800 m, 7.XI.1977 (Mahnert & Perret leg.); 1 ♀, Kenya, Tambach, E Elboret, 2000 m, 17.XI.1974 (Mahnert & Perret leg.).

Specie largamente diffusa nella Regione Etiopica: Sudafrica, Tanzania, Sant'Elena (Williams, 1979). Nuova per il Kenya.

Oligota (s. str.) **tanzaniensis** Pace, 1986

Oligota (s. str.) *tanzaniensis* Pace, 1986:89
1 ♂, Kenya, Lac Nakuru, 6.XI.1974 (Mahnert & Perret leg.).

Specie finora nota di una sola località: Kibosho.

Oligota (s. str.) *longicornis* sp. n. (Fig. 25)
Oligota (Holobus) kiambuensis sp. n. (Figg. 26-27)

GYROPHAENINI

Gyrophaena (Phaenogyra) embuorum sp. n. (Figg. 33-38)
Gyrophaena (Phaenogyra) mahnerti sp. n. (Figg. 39-45)
Gyrophaena (Phaenogyra) nyandaruensis sp. n. (Figg. 46-48)

Brachida nairobiensis Pace, 1985

Brachida nairobiensis Pace, 1985: 117
19 es., Kenya, Narokdisch., près de Narok, 2000 m, 3.XI.1977 (Mahnert & Perret leg.); 1 ♀, Kenya, Nairobi, 3.XI.1974 (Mahnert & Perret leg.).

Specie finora nota solo dei dintorni di Nairobi.

Brachida kaszabi Pace, 1986

Brachida kaszabi Pace, 1986: 90
1 ♀, Kenya, Embu, Kirimiri Forest, 1500 m, 13.X.1977, (Mahnert & Perret Leg.); 2 ♀♀, Kenya, Kisumu, Chemelil, 8.XI.1974 (Mahnert & Perret leg.).

Specie finora nota di una sola località: Arusha.

Brachida shimbaensis sp. n. (Figg. 49-53)
Brachida embuensis sp. n. (Figg. 54-57)
Brachida masai sp. n. (Figg. 58-60)
Brachida kirimirensis sp. n. (Figg. 61-68)

Brachida africana (Bernhauer & Scheerpeltz, 1926) (Figg. 65-68)

Gyrophaena convexicollis Bernhauer, 1915: 157

Brachida africana, Ashe, 1984: 235; Pace, 1986: 108
1 ♀, Kenya, Narok, Loita Hills, sous Morijo, 2050 m, 5.X.1977, (Mahnert & Perret leg.).
Specie finora nota solo di Pangani in Tanzania.

Brachida lamuensis sp. n. (Figg. 74-76)
Brachida makadarana sp. n. (Figg. 77-78)
Brachida rangirensis sp. n. (Figg. 79-80)
Brachida erythraea sp. n. (Figg. 81-82)

Afrobrachida absurda Pace, 1985

Afrobrachida absurda Pace, 1985: 119
2 ♂♂, Kenya, Embu, ouest Ishiara, 900 m, 14.X.1977, (Mahnert & Perret leg.).
Specie finora nota solo dei dintorni di Trika, Kenya.

Neobrachida umtaliensis sp. n. (Figg. 83-85)
Neobrachida tanensis sp. n. (Figg. 86-87)

HOMALOTINI

Placusa (s. str.) *somala* sp. n. (Figg. 97-98)
Placusa (Calpusa) ruandensis sp. n. (Figg. 99-102)
Homalota mutarensis sp. n. (Figg. 103-106)
Homalota bicristata sp. n. (Figg. 107-111)
Cameronium lamuense sp. n. (Figg. 112-114)

BOLITOCHARINI

Linoglossa (Lophoglossa) kamerunensis (Bernhauer, 1915)

Leptusa kamerunensis Bernhauer, 1915: 163
Linoglossa (Lophoglossa) kamerunensis, Pace, 1982: 163; Pace, 1989: 23
4 es., Kenya, Miss. Kaimosi, NE Kisumu, 1650 m, 11.XI.1974, (Mahnert & Perret leg.).
Specie finora nota solo del Camerun.

Linoglossa (Lophoglossa) collaris sp. n. (Figg. 118-119)
Linoglossa (Lophoglossa) kayovensis sp. n. (Figg. 127-129)
Linoglossa (s. str.) *spinosa* sp. n. (Figg. 120-122)
Linoglossa (s. str.) *abaluya* sp. n. (Figg. 123-126)

DIESTOTINI

Diestota bifurcata sp. n. (Figg. 149-152)
Diestota mombasaensis sp. n. (Figg. 153-154)

PRONOMAEINI

Tomoxelia zerchei sp. n. (Figg. 155-156)

Tomoxelia kenyana sp. n. (Figg. 157-161)
Tomoxelia nairobiensis sp. n. (Figg. 162-163)
Tomoxelia tambachensis sp. n. (Figg. 164-166)
Tomoxelia kisumuensis sp. n. (Figg. 167-168)
Nopromaea umtaliensis sp. n. (Figg. 175-176)

COROTOCINI

Millotoca kenyana sp. n. (Figg. 177-180)

EUSTENIAMORPHINI

Eustenidia (s. str.) *makadarica* sp. n. (Figg. 181-184)
Eustenidia (s. str.) *zimbabwensis* sp. n. (Figg. 185-186)
Eustenidia (s. str.) *kisumuorum* sp. n. (Figg. 190-191)
Eustenidia (s. str.) *grassei* sp. n. (Figg. 191-192)
Eustenidia (s. str.) *coiffaiti* sp. n. (Figg. 193-196)
Eustenidia (Microeustenidia) umtaliensis sp. n. (Figg. 187-188)

AUTALIINI

Autalia tetracarinata Cameron, 1950

Autalia tetracarinata Cameron, 1950: 48
92 es., Kenya, Mt. Aberdare, Parc National, 2300 m, 25.XI.1974, (Mahnert & Perret leg.); 40 es., Kenya, Embu, Irangi Forest St., 2000 m, 11.X.1977, (Mahnert & Perret leg.); 3 es., Kenya, Miss. Kaimosi, NE Kisumu, 1650 m, 11.XI.1974 (Mahnert & Perret leg.).

Specie finora nota dello Zaire.

FALAGRIINI

Cordalia csikii (Bernhauer, 1915)

Cardiola csikii Bernhauer, 1915: 158; Jeannel & Paulian, 1945: 111
Cordalia csikii, Tottenham, 1957: 110; Pace, 1985: 121; Pace, 1986: 85
1 ♀, Kenya, Lac Naivasha, 5 Km Fischerman's Camp, 5.XI.1974, (Mahnert & Perret leg.); 4 es., Kenya, Miss. Kaimosi, NE Kisumu, 1650 m, 11.XI.1974 (Mahnert & Perret leg.); 2 es, Kenya, Taita, Tsavo east Nat. Park, 30.X.1977 (Mahnert & Perret leg.); 1 ♀, Zimbabwe (Rhodésie), Umtali, II.1969, (P. Mussard leg.).

Specie diffusa sul Kilimangiaro, sull'Elgon e sul Mte. Monduli. Nuova per la Rodesia.

Cordalia shimbaensis sp. n. (Figg. 197-199)
Cordalia nakuruensis sp. n. (Figg. 200-203)

Falagria (s. str.) **kaszabi** Pace, 1986

Falagria (s. str.) *kaszabi* Pace, 1986: 93
9 es., Kenya, Nairobi, 2-4.XI.1974, (Mahnert & Perret leg.); 1 es., Nairobi, Rosselyn, 1750 m, 8.X.1977, (Mahnert & Perret leg.); 82 es., Kenya, Kiambu, Kikuyu Escarp., 2000 m, 9.XI. 1977, (Mahnert & Perret leg.); 1 es., Kenya, Lac Naivasha, 5 Km Fisherman's Camp, 5.XI.1974, (Mahnert & Perret leg.); 1 es., Kenya, Kiambu, près de Limuru, 2300 m, 2.XI.1977, (Mahnert & Perret leg.); 1 es., Kenya, Narok, Loita Hills, 4.XI.1977, (Mahnert & Perret leg.).

Specie finora nota solo della Tanzania.

Falagria (s. str.) **dilaticollis** Tottenham, 1957 (Figg. 204-207)

Falagria (s. str.) *dilaticollis* Tottenham, 1957: 92
1 ♂ e 3 ♀♀, Zimbabwe (Rhodésie), Umtali, II.1969, (R. Mussard leg.).

Specie finora nota solo del Ruanda-Urundi.

Falagria (s. str.) **coarcticollis** Fauvel, 1898

Falagria coarcticollis Fauvel, 1898: 121
Falagria (s. str.) *coarcticollis*, Bernhauer & Scheerpeltz, 1926: 575; Pace, 1984: 251
28 es., Rwanda, Kayove, 2100 m, 29.IV-15.V.1973, (Werner leg.).

Specie già nota dell'Africa Orientale. Presente anche nel Madagascar, Mascarene e Seychelles.

Falagria (Myrmecocephalus) bipunctata Tottenham, 1957 (Figg. 212-215)

Falagria (Falagrioma) bipunctata Tottenham, 1957: 104
3 ♂♂ e 1 ♀, Zimbabwe (Rhodésie), Umtali, II.1969, (P. Mussard leg.).

Specie finora nota solo del Kenya.

Falagria (Myrmecocephalus) nakuruensis sp. n. (Figg. 223-224)
Falagria (Melagria) embuensis sp. n. (Figg. 219-222)
Myrmecopora cephalotes sp. n. (Figg. 225-226)

DEREMINI

Longiprimitarsus amaniensis (Eichelbaum, 1913) (Figg. 230-233)

Dorylonia amaniensis Eichelbaum, 1913: 151
Longiprimitarsus amaniensis, Bernhauer & Scheerpeltz, 1926: 574
1 ♂, Kenya, Miss. Kaimosi, NE Kisumu, 1650 m, 11.XI.1974, (Mahnert & Perret leg.).

Specie finora nota di una sola località: Amani.

Longiprimitarsus praestabilis Pace, 1985

Longiprimitarsus praestabilis Pace, 1985: 123
2 ♀♀, Kenya, Mt. Aberdares, Parc National, 2300 m, 25.XI.1974, Mahnert & Perret leg.).

Specie finora nota solo del Mt. Monduli in Tanzania.

Longiprimitarsus franzi Pace, 1985

Longiprimitarsus franzi Pace, 1085: 121
2 ♂♂, Kenya, Narok, Loita Hills, 2300 m, 4.XI.1977, (Mahnert & Perret leg.); 1 ♂ e 1 ♀, Kenya, Thomson's Falls (= Nyahururu) 2350 m, 20.XI.1974, (Mahnert & Perret leg.).

Specie finora nota solo del Kenya meridionale.

Longiprimitarsus cristatus sp. n. (Figg. 234-237)
Derema rangirensis sp. n. (Figg. 238-239)
Medera absurdior sp. n. (Figg. 240-242)

Rylodophila kalongeana (Bernhauer, 1934) (Figg. 243-246)

Demera (Demerina) kalongeana, Bernhauer, 1934: 210
Derema (Demerina) kalongeana, Seevers, 1965: 292
Rylodophila kalongeana, Kistner & Jacobson, 1979: 302
1 ♂ e 1 ♀, Rwanda, Rangiro, 1800 m, I. 1976, (Werner leg.).

Specie diffusa nello Zaire, Repubblica Centrale Africana, Kenya e Angola.

Rylodophila nakuruensis sp. n. (Figg. 247-250)
Rylodophila nanyukiensis sp. n. (Figg. 251-254)
Rylodophila embuensis sp. n. (Figg. 255-258)
Derelina umtaliensis sp. n. (Figg. 259-261)
Demerinda embuensis sp. n. (Figg. 262-263)

MATERIALE TIPICO ILLUSTRATO, CON COMBINAZIONI NUOVE E DESCRIZIONE DI *Pseudosilusa mindanaoicola* sp. n.

MYLLAENINI

Myllaena apicicornis Fauvel, 1907 (Figg. 9-10)

Myllaena apicicornis Fauvel, 1907: 52; Bernhauer & Scheerpeltz, 1926: 505
MATERIALE ESAMINATO: holotypus ♀, cosi etichettato: Afrique Or. Allemande, Wa-Kikuyu et Masai, Ch. Alluaud, II sem. 1903, Myllaena apicicornis Fvl (IRSNB).

Spermateca fig. 10.

OLIGOTINI

Cypha tanzaniensis (Pace, 1986), comb. n.

Hypocyphtus tanzaniensis Pace, 1986: 89

Cypha abyssiniensis (Pace, 1986), **comb. n.**

Hypocyphtus abyssiniensis Pace, 1986: 89

GYROPHAENINI

Gyrophaena (s. str.) **aenescens** Bernhauer, 1915 (Figg. 28-32)

Gyrophaena aenescens Bernhauer, 1915: 157
Gyrophaena (s. str.) *aenescens*, Bernhauer & Sceerpeltz, 1926: 528
MATERIALE ESAMINATO: 1 ♂ e 1 ♀, cosi etichettati: D. Ostafrika, Methner, *Gyrophaena aenescens* Brnh., Typ., (FMC). Lectotypus ♂, presente designazione.

Edeago figg. 29-30, spermateca fig. 31, VI urotergo libero del ♂ fig. 32.

Brachida africana (Bernhauer & Scheerpeltz, 1926) (Figg. 65-68)

Gyrophaena convexicollis Bernhauer, 1915: 157
Gyrophaena africana, Bernhauer & Scheerpeltz, 1926: 529
Brachida africana, Ashe, 1984: 235; Pace, 1986: 108
MATERIALE ESAMINATO: holotypus ♂, così etichettato: Africa Or., Pangani, 1905.V.10, Katona, *Gyrophaena convexicollis* Brnh., Typ., (FMC).

Edeago figg. 66-67.

A questa specie attribuisco una femmina del Kenya, Narok. Spermateca fig. 68.

HOMALOTINI

Placusa (s. str.) **nairobiana** Fauvel, 1907 (Figg. 88-91)

Placusa nairobiana Fauvel, 1907: 52
MATERIALE ESAMINATO: holotypus ♂, così etichettato: Afrique Or. Allemande, Nairobi, Wa-Kikuyu et Masai, Ch. Alluaud, II sem 1903, *Placusa nairobiana* Fvl., (IRSNB).

Edeago figg. 89-90, VI urotergo libero del ♂ fig. 91.

Placusa (s. str.) **simulans** Fauvel, 1904 (Figg. 92-96)

Placusa simulans Fauvel, 1904: 286
MATERIALE ESAMINATO: 2 ♂♂ e 1 ♀, così etichettati: Usambara, Derema, 850 m, 16-9/7-10.1891, Conradt S., *Placusa simulans* Fvl. (IRSNB).

Lectotypus ♂, presente designazione, con edeago di figg. 93-94; spermateca fig. 95, VI urotergo libero del ♂ fig. 96.

BOLITOCHARINI

Linoglossa (s. str.) **arrowi** (Bernhauer, 1940), comb. n. (Figg. 116-117)

Phloeopora arrowi Bernhauer, 1940: 144
Anebolura arrowi, Pace, 1086: 108
MATERIALE ESAMINATO: holotypus ♀, così etichettato: Kenya, Aberdare Range, Nov. 1934, B. M. E. Afr. Exp., 1935, on Lobelia, 10-11.000 ft., Nov. 1934, A.S.F. Gedye, *Homalota* (cancellata), *Phloeopora arrowi* Brnh. Type (BM).

Spermateca fig. 117.

Pseudosilusa rudis (Fauvel, 1905) (Figg. 130-134)

Alianta rudis Fauvel, 1905: 198
Pseudosilusa rudis, Pace, 1986: 109

MATERIALE ESAMINATO: 1 ♂ e 1 ♀, così etichettati: Zanzibar, *Alianta rudis* Fvl; 1 ♂, Bogos, 1500 m; 1 ♂, Badumbé, Ht. Sénégal, Rufisque, baobab mort; 1 ♀, Gabon, Questi esemplari sono syntipi. 1 ♀, Biafra, (IRSNB).

Lectotypus ♂ dello Zanzibar con edeago come da figg. 131-132; spermateca fig. 133.

NOTE SUL GENERE *Pseudosilusa* BERNHAUER, 1915

Il genotipo di *Diestota* Mulsant & Rey, 1870 è *Diestota mayeti* Mulsant & Rey, 1870, sinonimo di *Diestota testacea* (Kraatz, 1859). Questa stessa *Diestota testacea* è scelta erroneamente da BLACKWELDER (1952) come genotipo di *Pseudosilusa* Bernhauer, 1915. Data la sinonimia di *Diestota mayeti* con *Diestota testacea*, il genotipo di *Pseudosilusa* deve essere *Pseudosilusa trifoveolata* Bernhauer, 1915 per conseguente designazione. Infatti Bernhauer dopo aver descritto il genere *Pseudosilusa*, descrive *Pseudosilusa trifoveolata*.

Pseudosilusa trifoveolata Bernhauer, 1915 (Figg. 135-137)

Pseudosilusa trifoveolata Bernhauer, 1915: 124

METERIALE ESAMINATO: 1 ♂, così etichettato: Los Baños, P. L. Baker, *Leptusa trifoveolata* Bernhauer (ZMB).

Lectotypus ♂, presente designazione.

Edeago figg. 135-136.

Delle Filippine ho esaminato anche una specie non della località tipica, Los Baños, di *P. trifoveolata*, ma di Mindanao. Nonostante fosse determinata *P. trifoveolata*, si tratta di specie differente che descrivo qui di seguito.

Pseudosilusa mindanaoicola sp. n. (Figg. 138-142)

TIPO. Holotypus ♂, Mindanao, P. Bango, (ZMB).

DESCRIZIONE. Lungh. 2,2 mm. Corpo bruno-rossiccio; capo e IV urite libero rossicci; antenne brune con i quattro antennomeri basali rossicci; zampe giallo-rossicce. Il capo presenta punteggiatura ombelicata robusta solo sulla metà posteriore: su quella anteriore è assai svanita; il fondo è reticolato in modo superficiale. Tubercoletti fitti, ma poco salienti e una reticolazione assai netta e fine coprono il pronoto. Le elitre non presentano distinti tubercoletti, ma punteggiatura irregolare e reticolazione superficiale composta di maglie grandi. Edeago figg. 140-141, VI urotergo libero del ♂ fig. 142.

COMPARAZIONI. Del genere *Pseudosilusa* attualmente sono note due specie e la nuova, di cui qui è pubblicato l'edeago. Il confronto di questi organi è sufficiente a cogliere con immediatezza le differenze specifiche.

Coenonica aethiopica Fauvel, 1904 (Figg. 143-144)

Coenonica aethiopica Fauvel, 1904: 284

MATERIALE ESAMINATO: 2 ♀♀, così etichettati: Usambara, Derema, 850 m, 16.9-7.10.1891, Conradt S., *Coenonica aethiopica* Fvl., (IRSNB).

Lectotypus ♀, presente designazione con spermateca di figg. 143-144.

DIESTOTINI

Diestota scotti (Bernhauer, 1931) (Figg. 145-148)

Hypselusa scotti Bernhauer, 1931: 593
Diestota scotti, Pace, 1986: 108

MATERIALE ESAMINATO: 1 ♂ e 1 ♀, così etichettati: Abyssinia, Djem-Djem For., c. 8.000 feet, 7.X.1926, from decaying wood, Dr. Scott, *Hypselusa scotti* Brnh., (FMC).

Lectotypus ♂, presente designazione con edeago come da figg. 146-147; spermateca fig. 148.

CARATTERI DIFFERENZIALI TRA DIESTOTINI E BOLITOCHARINI

Constatata la difficoltà nell'attribuzione tribale tra Bolitocharini e Diestotini, è qui proposta una chiave basata sui caratteri più stabili finora osservati.

1 Palpi labiali di 2 articoli; ligula sempre divisa all'apice; spermateca composta da un tubulo avvolto a matassa o in numerose spire. . . . . DIESTOTINI

- Palpi labiali di 3 o di 2 articoli; ligula divisa o intera; spermateca composta da un bulbo distale di norma molto sviluppato, da une parte mediana spesso cortissima e da un bulbo prossimale poco distinto. . . . . BOLITOCHARINI

PRONOMAEINI

Nopromaea africana (Eppelsheim, 1895), **comb. n.** (Figg. 169-172)

Pronomaea africana Eppelsheim, 1895: 120; Bernhauer & Scheerpeltz, 1926: 510

MATERIALE ESAMINATO: 1 ♂, così etichettato: West-Africa, Togo, Cuno, *africana* Fauvel in Litt., *Pronomaea africana* Eppelsheim, Typ., ded. Kraatz, (NMW); 2 ♂♂ e 2 ♀♀, Afr. Occ., Gabon, Libraville, Mocqueris, (NMW).

Lectotypus ♂ del Togo, Cuno con edeago come da figg. 170-171; spermateca fig. 172.

Nopromaea fortepunctata (Eichelbaum, 1913), **comb. n.** (Figg. 173-174)

Pronomaea fortepunctata Eichelbaum, 1913: 135; Bernhauer & Shceerpeltz, 1026: 510

MATERIALE ESAMINATO: 1 ♀, così etichettato: Amani, VII.IX.1905, syntypus, *Pronomaea fortepunctata* m. Type, Eichelbaum det. (DEI).

Lectotypus ♀ di Amani, presente designazione, con spermateca come da fig. 174.

NOTA SUI GENERI *Tomoxelia* E *Nopromaea*

Il genere *Tomoxelia* Bernhauer, 1901, fu descritto come presentante formula tarsale 4-4-5. Pertanto fu collocato accanto al genere *Silusa* Erichson, 1837, da BERNHAUER & SCHEERPELTZ (1926). In realtà, dopo esame del genotipo *T. tropica* Bernhauer, 1901, il genere *Tomoxelia* presenta formula tarsale 4-5-5. Pertanto, per la forma delle parti boccali si colloca senza difficoltà accanto al genere *Nopromaea* Cameron, 1930. I due generi si distinguono come segue:

1 Spermateca composta di numerose spire o avvolta a matassa. . . . . *Tomoxelia* Bernhauer

\- Spermateca semplice, con bulbo distale dilatato e prossimale distinto. . . . . *Nopromaea* Cameron

FALAGRIINI

Falagria (Myrmecocephalus) alluaudi Fauvel, 1907 (Figg. 216-218)

Falagria alluaudi Fauvel, 1907: 61
Falagria (Stenagria) alluaudi, Bernhauer & Scheerpeltz, 1926: 576

MATERIALE ESAMINATO: holotypus ♂, cosi etichettato: Nairobi, Wa-Kikuiu et Masai, II sem. 1903, Ch. Alluaud, *Falagria alluaudi* Fvl., typ., (IRSNB).

Edeago figg. 217-218.

DEREMINI

Longiprimitarsus longipennis Bernhauer, 1934 (Figg. 226-229)

Longiprimitarsus longipennis Bernhauer, 1934: 212

MATERIALE ESAMINATO: 2 ♂♂ e 1 ♀, cosi etichettati: Mombassa, 36 Km S Lubero, 26.11.VIII.1932, L. Burgeon, myrmecophile avec *Doryle*, *Longiprimitarsus longipennis* Brnh., typ., *longipennis longipennis*, det. D. Kistner, 1964, (FMC).

Edeago figg. 227-228, spermateca fig. 226.

Longiprimitarsus amaniensis (Eichelbaum, 1913) (Figg. 230-233)

Dorylonia amaniensis Eichelbaum, 1913: 151
Atheta (Longiprimitarsus) amaniensis, Eichelbaum, 1915: 121
Dorylonia (Longiprimitarsus) amaniensis, Eichelbaum, 1915a: 121
Longiprimitarsus amaniensis, Bernhauer& Scheerpeltz, 1926: 574

MATERIALE ESAMINATO: 1 ♀, così etichettata: Amani, X.1909, *amaniensis* Eich., Eichelbaum det., (DEI).

Lectotypus ♀, presente designazione, con spermateca come da fig. 233.

A questa specie attribuisco un ♂ del Kenya con edeago come da figg. 231-232.

DESCRIZIONI E CHIAVI

Myllaena rangirensis sp. n. (Figg. 1-4)

Tipi. Holotypus ♂, Rwanda, Rangiro, 1800 m, 14.IX.1976, (Werner leg., (MG).
Paratypi: 24 es., stessa provenienza, ma 20.VIII-14.IX.1976 (MG, CPA).

DESCRIZIONE. Lungh. 1,5 mm. Corpo giallo-rossiccio sporco; elitre e uroterghi liberi 2° e 3° bruno-rossicci; antenne giallo-brune con antennomero basale giallo; zampe gialle. Gli occhi sono molto ridotti, composti di 4-5 ommatidi. Tutto il corpo è coperto di pubescenza sericea.

Edeago figg. 2-3, spermateca fig. 4.

COMPARAZIONI. Si veda sotto la chiave delle specie di *Myllaena* attere della Regione etiopica.

Myllaena kayovensis sp. n. (Figg. 5-8)

TIPI. Holotypus ♂, Rwanda, Kayove, 2100 m, 29.IV.1973, (Werner leg., MG).
Paratypi: 192 es., stessa provenienza, ma anche 15-29.IV.1973, (MG, CPA).

DESCRIZIONE. Lungh. 1.6 mm. Corpo bruno rossiccio; antenne giallo-rossicce; zampe gialle. Gli occhi sono molto ridotti. Il capo e il pronoto sono coperti di tubercoletti distinti. Tutto il corpo presenta pubescenza sericea.

Edeago figg. 6-7, spermateca fig. 8.

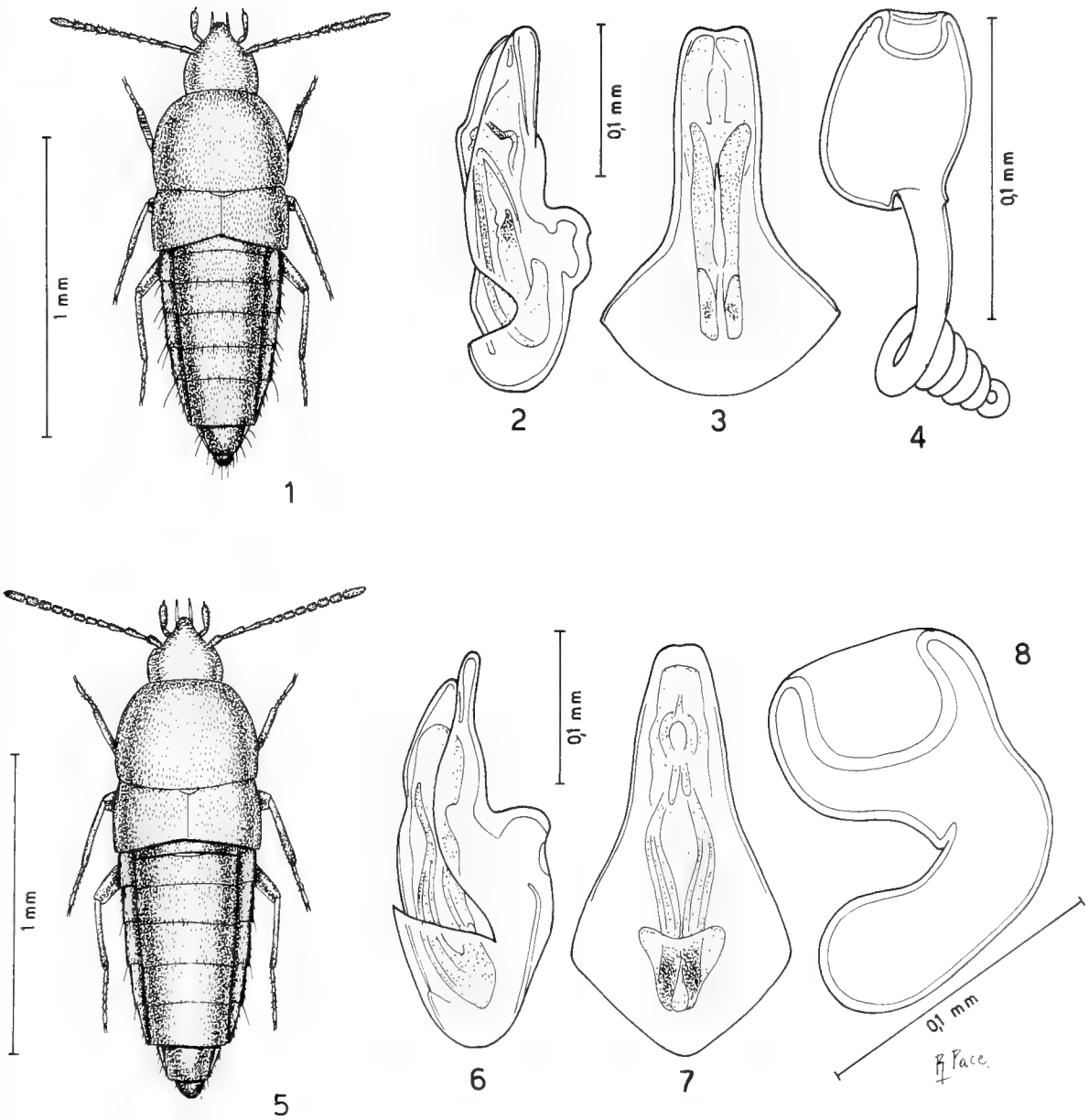
COMPARAZIONI. Nella seguente chiave riassumo i caratteri distintivi delle specie del genere *Myllanea* che presentano atterismo e spinta microftalmia.

In base alla forma della spermateca in questo gruppo convergono specie appartenenti a gruppi tra loro distinti a cui appartengono anche specie alate, con elitre più lunghe del pronoto.

Al fine di rendere più completo il quadro di queste specie attere, anticipo qui nella chiave la descrizione preliminare di alcune specie del Madagascar.

CHIAVE DELLE SPECIE ATTERE DI *Myllaena* DELLA REGIONE ETIOPICA.

1 Elitre poco più corte del pronoto, 1/6 a 1/5 più corte del pronoto. 2
- Elitre molto più corte del pronoto, circa 1/3 più corte del pronoto. 5
2 Occhi lunghi quanto le tempie. 3
- Occhi molto più corti delle tempie. 4
3 Addome rossiccio; edeago molto più piccolo, con gibbosità ventrale accentuata e flagello del sacco interno sottile e sporgente dall'orifizio apicale. Lungh. 1,8 mm. Maurice: Balaclava. . . . . *mauritiana* Pace
- Addome bruno con margini posteriori rossicci; edeago nettamente più sviluppato, con gibbosità ventrale appena distinta e con stilo mediano del sacco interno lungo dal bulbo basale dell'edeago all'orifizio apicale, ma non sporgente. Lungh. 2,7 mm. Holotypus: Madagascar, Angavokely (vicino al villaggio di Carion), A. Peyrieras leg., MNP); paratypi: Cirque Manjarivolo, 1200 m, (Lecoq leg., CLQ). . . . . *atratula* sp. n.



FIGG. 1-8

Habitus, edeago in visione laterale e ventrale e spermateca. 1-4: *Myllaena rangirensis* sp. n.; 5-8: *Myllaena kayovensis* sp. n.

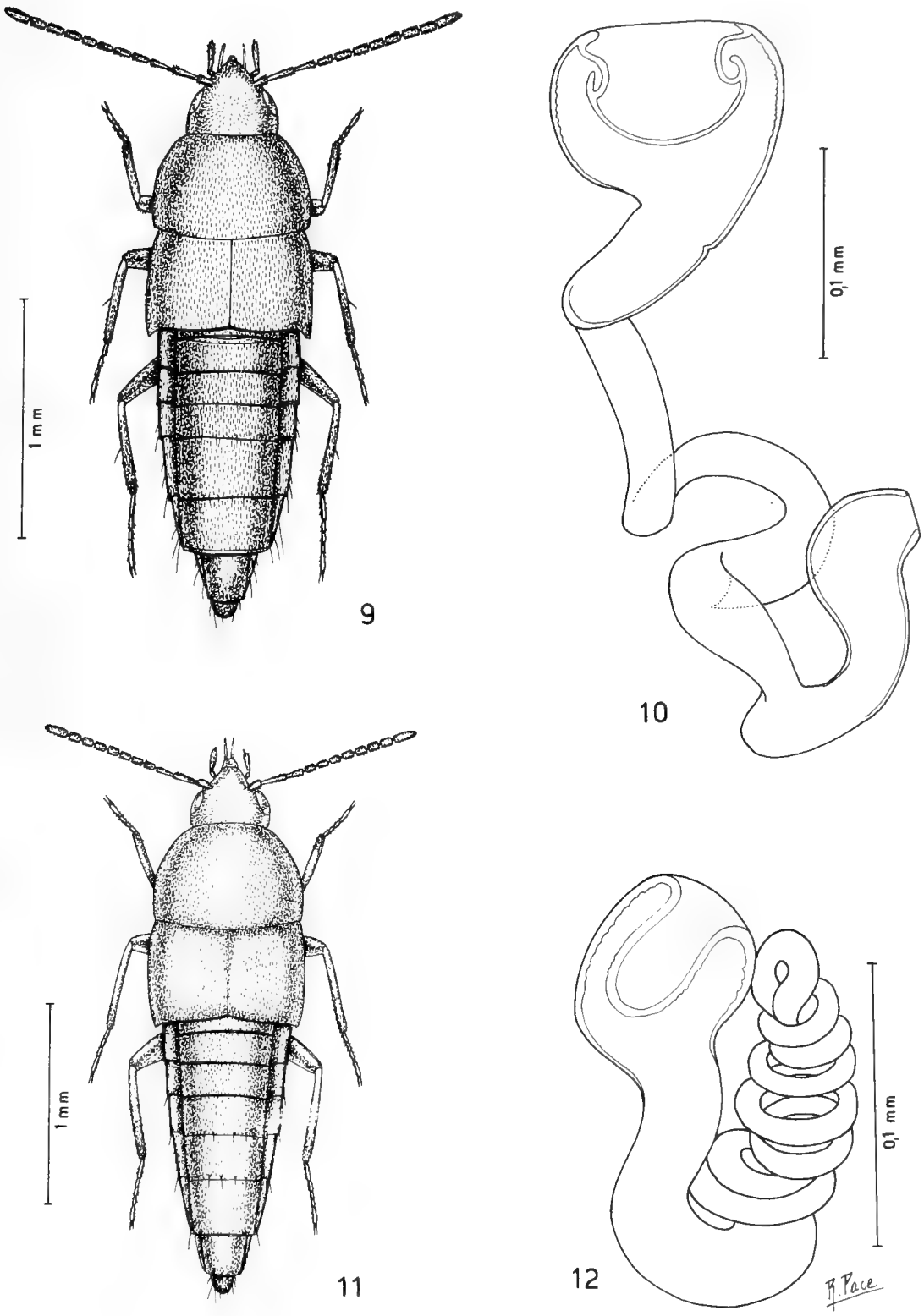
4 Parte prossimale della spermateca descrivente circa 10 spire; maschio sconosciuto. Lungh. 2,8 mm. La Réunion: Piton des Neiges. . . . . *nivium* Pace
- Parte prossimale della spermateca descrivente una sola spira. Lungh. 2,0 mm. Maurice: Mt. Cocotte. . . . . *gomyi* Pace
5 Occhi estremamente ridotti, composti da circa 4-6 ommatidi. 6
- Occhi poco ridotti, composti di più di 8 ommatidi. 8
6 Tre penultimi antennomeri più lunghi che larghi; edeago mai distintamente ricurvo al lato ventrale. 7
- Tre penultimi antennomeri lunghi quanto larghi; edeago profondamente ricurvo al lato ventrale, con gibbosità ventrale appena distinta; parte prossimale della spermateca descrivente due spire e bulbo distale poco sviluppato, sferico e senza introflessione apicale. Lungh. 1,5 mm. Holotypus: Madagascar, Massif de l'Ankaratra, Majakatompo, (Lecoq leg., MNP); paratypi: Forêt d'Ambitsika, (Lecoq leg., MNP). . . . . *lecoqi* sp. n.
7 Edeago con estesa gibbosità ventrale; parte prossimale della spermateca descrivente 5 spire. Lungh. 1,5 mm. Rwanda: Rangiro. . . . . *rangirensis* sp. n.
- Edeago con debole gibbosità ventrale; spermateca non descrivente spire. Lungh. 1,6 mm. Rwanda: Kayove. . . . . *kayovensis* sp. n.
8 Penultimi antennomeri trasversi; taglia ridotta, sia del corpo che dell'edeago. Lungh. 1,3 mm. Holotypus: Madagascar, Massif du Marojejy, Ambinanitelo (A. Peyrieras leg., MNP). . . . . *marojejyiensis* sp. n.
- Penultimi antennomeri più lunghi che larghi. 9
9 Parte prossimale della spermateca descrivente molte spire. 10
- Parte prossimale della spermateca descrivente una sola spira. Lungh. 2,0 mm. La Réunion: Piton des Neiges. . . . . *reunionensis* Pace
10 Addome rossiccio; parte mediana e spire della spermateca sottili; edeago con debole gibbosità ventrale. Lungh, 1,8 mm. Holotypus: Madagascar, Massif de l'Ankaratra, forêt d'Ambitsika, (Lecoq leg, MNP) . . . . . *ankaratrensis* sp. n.
- Addome bruno; parte mediana e spire della spermateca larghi; edeago privo di gibbosità ventrale. Lungh. 2,0 mm. Mt. Kenya. . . . . *kenyensis* Pace

Myllaena mussardi sp. n. (Figg. 11-12)

Tipo. Holotypus ♀, Zimbabwe (Rhodésie), Umtali, II.1960, (R. Mussard leg., MG).

Descrizione. Lungh. 2,6 mm. Corpo bruno-rossiccio; antenne bruno-rossicce con antennomero basale giallo-rossiccio; zampe giallo-rossicce. Tutto il corpo è coperto di pubescenza sericea. Spermateca fig. 12.

Comparazioni. Il tipo di spermateca della nuova specie è simile a quello della paleartica *M. dubia* Gravenhorst, 1806, presente anche in Nordafrica. Infatti queste due specie presentano la parte prossimale della spermateca avvolta a spirale. Tutta via *M. dubia* è priva della profonda introflessione apicale del bulbo distale della spermateca e la lunghezza della sutura delle elitre è più breve della lunghezza del pronoto (sutura delle elitre lunga quanto il pronoto in *dubia*).



FIGG. 9-12

Habitus e spermateca. 9-10: *Myllaena apicicornis* Fauvel, holotypus; 11-12: *Myllaena mussardi* sp. n.

Bryothinusa perexilis sp. n. (Figg. 13-16)

TIPI. Holotypus ♂, Somalia, Sar Uanle, 11.VI.1973, (S.B.S. (P.L.) leg., MF).

Paratypi: 16 es., stessa provenienza, ma anche 29.VI.1973, 10.VI.1973, 31.V.1973, 18.VIII.1975, 26.VI.1973, 1.VI.1973, 21.VI.1973, 10.XI.1973, (MF, CPA, MG).

DESCRIZIONE. Lungh. 1,1-1,2 mm. Corpo debolmente lucido d'aspetto immaturo, a tegumenti sottili, giallo comprese zampe e antenne, con uriti liberi 3° e 4° bruno-rossicci. La superficie del corpo è coperta di reticolazione distinta, senza traccia di tubercoletti o di punteggiatura. Pubescenza fitta e cortissima. Il pronoto presenta un solco mediano sulla metà posteriore. Occhi molto ridotti, tempie lunghissime. Edeago figg. 14-15, spermateca fig. 16.

COMPARAZIONI. Specie che per l'esigua taglia è avvicinabile a *B. subtilissima* (Cameron, 1904) (olim *Diglossa*, vedi Haghebert, 1991), delle coste del Mar Rosso. *B. perexilis* sp. n. è distinta da essa per gli occhi molto ridotti e per il capo nettamente più lungo che largo. Haghebert che ha designato il lectotypus di *B. subtilissima*, purtroppo non ha descritto, nè figurato l'edeago o la spermateca.

Cypha lamuensis sp. n. (Figg. 17-19)

TYPO. Holotypus ♂, Kenya, Lamu, près de Witu, 26.X.1977, (Mahnert & Perret leg., MG).

DESCRIZIONE. Lungh. 1-3 mm. Corpo lucidissimo e giallo-rossiccio; elitre e uriti liberi 3° e 4° rossicci; antenne gialle con 9° antennomero rossiccio; zampe gialle. Il capo e il pronoto sono privi di distinta punteggiatura e di reticolazione. Le elitre e gli uroterghi liberi 1° a 4° coperti di scultura a V. Edeago figg. 17-18.

COMPARAZIONI. Si veda sotto la chave delle specie del genere *Cypha* Stephens, 1832, della Regione etiopica.

Cypha mahnerti sp. n. (Figg. 20-24)

TIPI. Holotypus ♂, Kenya, Shimba Hills, Makadara For., 30.XI.1974, (Mahnert & Perret leg., MG).

Paratypus: 1 ♀, stessa provenienza, (CPA).

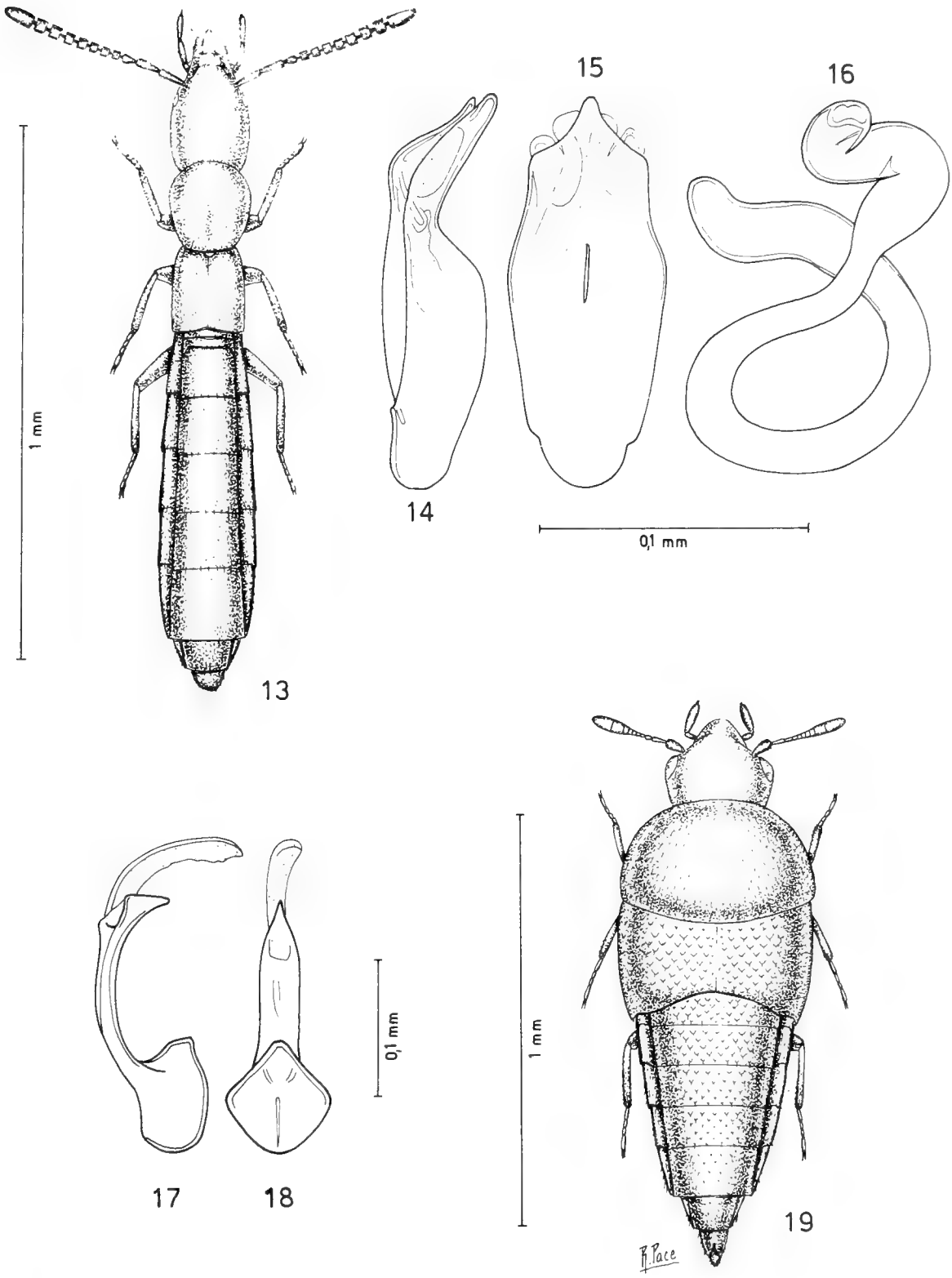
DESCRIZIONE. Lungh. 1,2-1,3 mm. Corpo lucido e giallo-rossiccio; elitre brune; addome rossiccio con estremità distale giallo-rossiccia; antenne brune con i 5 antennomeri basali gialli; zampe gialle. Il capo, il pronoto e le elitre sono privi di punteggiatura e di reticolazione. La stria suturale delle elitre non raggiunge la base presso lo scutello. L'addome è coperto di reticolazione distinta.

ETIMOLOGIA. Specie dedicata al Dr. Mahnert del Museo di Storia Naturale di Ginevra che l'ha raccolta insieme al Dr. Perret.

COMPARAZIONI. La nuova specie e la precedente *C. lamuensis* sp. n. si distinguono dalle altre specie dell'Africa Orientale in base alla seguente chiave.

CHIAVE DELLE SPECIE DEL GENERE *Cypha* DELLA SOTTOREGIONE AFRICANA ORIENTALE

1 Antennomeri 8°, 9° e 10° non conformati a clava. 2
- Antennomeri 8°, 9° e 10° conformati a clava. 3



FIGG. 13-19

Habitus, edeago in visione laterale e ventrale e spermateca. 13-16: *Bryothinusa perexilis* sp. n.: 17-19: *Cypha lamuensis* sp. n.

2 Taglia maggiore (lungh. 2,0 mm); capo e pronoto bruno-rossicci; addome bruno con estremità gialla. Abissinia. . . . . *abyssiniensis* Pace
- Taglia minore (lungh. 1,7 mm); capo e pronoto gialli; addome bruno-rossiccio con estremità rossiccia. Tanganyka: Mr. Meru. . . . *tanzaniensis* Pace
3 Elitre più lunghe del pronoto; edeago non o appena ricurvo al lato ventrale . . 4
- Elitre più corte del pronoto; edeago ampiamente ricurvo al lato ventrale. Lungh. 1,3 mm. Kenya: Lamu. . . . . *lamuensis* sp. n.
4 Pronoto finemente punteggiato; elitre con maglie embricate; edeago con lama sternale rettilinea e "crista apicalis" indistinta. Lungh. 1,0-1,2 mm. Europa, Nordamerica e Kilimangiaro. . . . . *laeviuscula* Mannerheim
- Pronoto privo di distinta punteggiature; edeago con lama sternale sinuosa e "crista apicalis" assai sviluppata. Lungh. 1,2-1,3 mm. Kenya: Shimba Hills. . . . . *mahnerti* sp. n.

Oligota (s. str.) **longicornis** sp. n. (Fig. 25)

TIPO. Holotypus ♀, Kenya, Taita, Tsavo East Nat. Park, 30.X.1977, (Mahnert & Perret leg., MG).

DESCRIZIONE. Lungh. 1,5 mm. Corpo lucido e giallo-rossiccio, comprese antenne e zampe, solo gli occhi sono neri. Il capo e il pronoto sono coperti di punteggiatura estremamente fine. Le elitre presentano tubercoletti e reticolazione assai superficiali. Gli uroterghi sono coperti di tubercoletti distinti e di reticolazione svanita. Spermateca non rinvenuta.

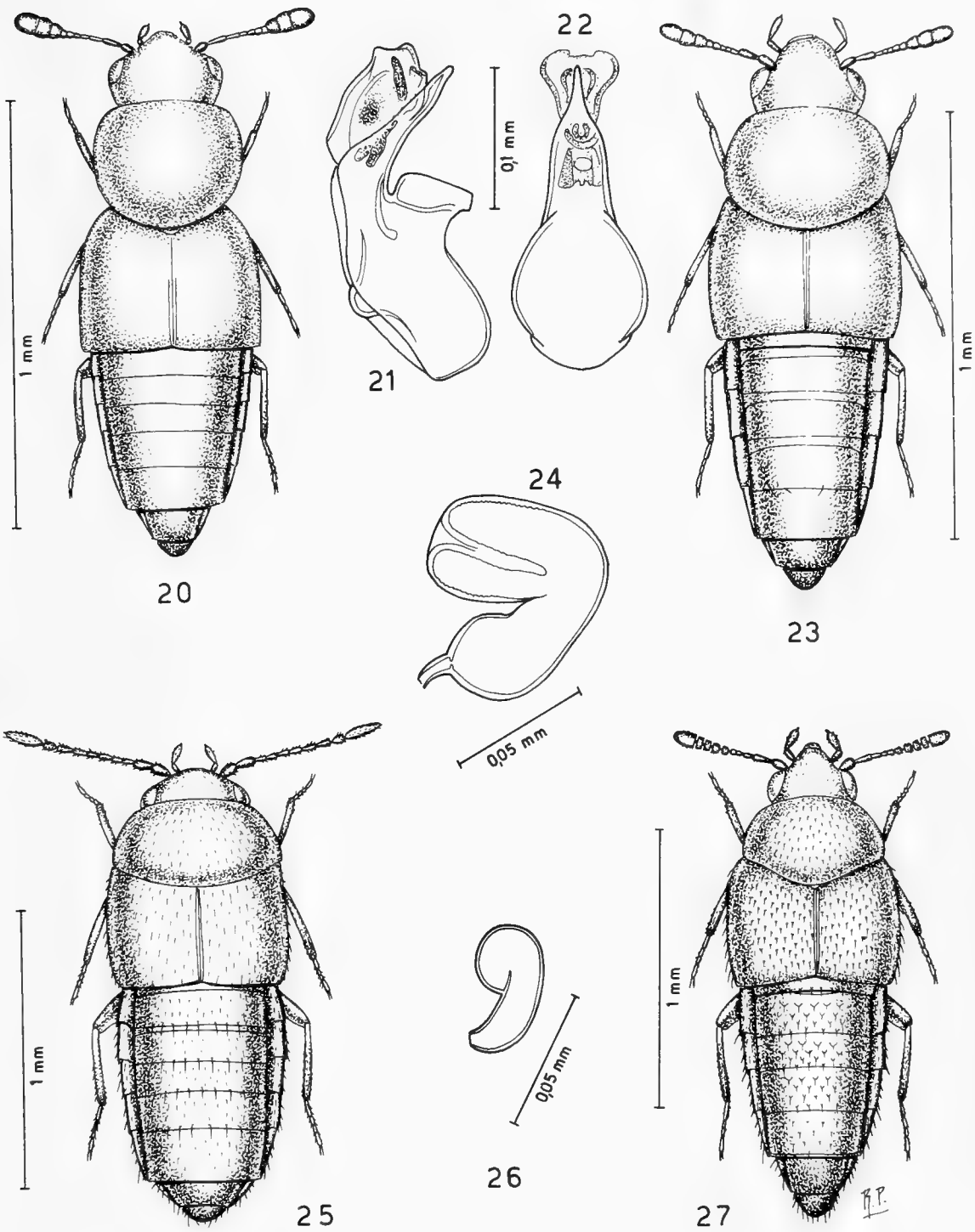
COMPARAZIONI. A motivo delle antenne assai lunghe, composte di antennomeri nettamente più lunghi che larghi, la nuova specie è distinta da tutte le specie note sia della Regione etiopica che della Regione Paleartica.

Oligota (Holobus) kiambuensis sp. n. (Figg. 26-27)

TIPO. Holotypus ♀, Kenya, Kiambu, près de Limuru, 2300 m, 2.XI.1977, (Mahnert & Perret leg., MG).

DESCRIZIONE. Lungh. 1,6 mm. Corpo lucido e nero; angoli posteriori del pronoto ed estremità addominale rossicci; antenne giallo-rossicce con 10° antennomero bruno; zampe rossicce con tarsi giallo-rossicci. Il capo presenta tubercoletti e reticolazione svaniti. Tubercoletti distinti e reticolazione molto svanita coprono il pronoto. Le elitre presentano tubercoletti e reticolazione netti. Gli uroterghi liberi 1°, 2° e 3° hanno scultura embricata. Spermateca fig. 26.

COMPARAZIONI. Specie simile a *O. gabonensis* Williams, 1978, a motivo della conformazione dei penultimi antennomeri, per il colore del corpo e per l'assenza di carene sugli uroterghi. La nuova specie è differente per la taglia maggiore e per il sistema di colorazione del pronoto e delle antenne: pronoto nero con angoli posteriori rossicci e antenne gialle con 10° antennomero bruno nella nuova specie e pronoto bruno-rossiccio e antenne giallicce con gli ultimi 6 antennomeri oscuri in *gabonensis*. Purtroppo di *gabonensis* non è nota la femmina e della nuova specie il maschio è sconosciuto.



FIGG. 20-27

Habitus, edeago in visione laterale e ventrale e spermateca. 20-24: *Cypha mahnerti* sp. n. (20: maschio; 23: femmina).; 25: *Oligota* (s. str.) *longicornis* sp. n.; 26-27: *Oligota (Holobus) kiambuensis* sp. n.

Gyrophaena (Phaenogyra) embuorum sp. n. (Figg. 33-38)

TIPI. Holotypus ♂, Kenya, Embu, Irangi forest, 2000 m, 11.X.1977, (Mahnert & Perret leg., MG).

Paratypi: 2 ♀♀, stessa provenienza, (MG, CPA).

DESCRIZIONE. Lungh. 2,7 mm. Corpo lucido e giallo-rossiccio; elitre rossicce; antenne bruno-rossicce con i due antennomeri basali gialli; zampe giallo-rossicce. La punteggiatura del capo è netta e assente sul disco. La punteggiatura del pronoto è come da fig. 33. La punteggiatura delle elitre è netta e più fitta sul terzo posteriore. Gli uroterghi sono coperti di reticolazione svanita. Il 5° urotergo libero del maschio ha una carena mediana saliente e reticulazione netta. Edeago figg. 34-35, spermateca fig. 36, 6° urotergo libero del maschio fig. 37, sesto urotergo libero della femmina fig. 38.

COMPARAZIONI. Due sono le specie etiopiche note di *Gyrophaena* del sottogenere *Phaenogyra*: *G. polystictorum* Eichelbaum, 1913 e *G. polystictipersoonii* Eichelbaum, 1913. I tipi di entrambe le specie sono andati distrutti durante un bombardamento della II Guerra Mondiale. In base alle descrizioni la nuova specie si distingue agevolmente da entrambe per la presenza sul 5° urotergo libero del maschio di una carena mediana saliente e lunga, mentre in *polystictorum* esiste sull'analogo urotergo un piccolissimo granulo mediano e su quello di *polystictipersoonii* esistono due fini carene allungate, all'indietro un po' salienti.

Gyrophaena (Phaenogyra) mahnerti sp. n. (Figg. 39-45)

TIPI. Holotypus ♂, Kenya, Alamu, près de Witu, 26.X.1977, (Mahnert & Perret leg., MG).

Paratypus: 1 ♀, Kenya, Shimba Hills, Makadara Forest, 30.XI.1974, (Mahnert & Perret leg., CPA).

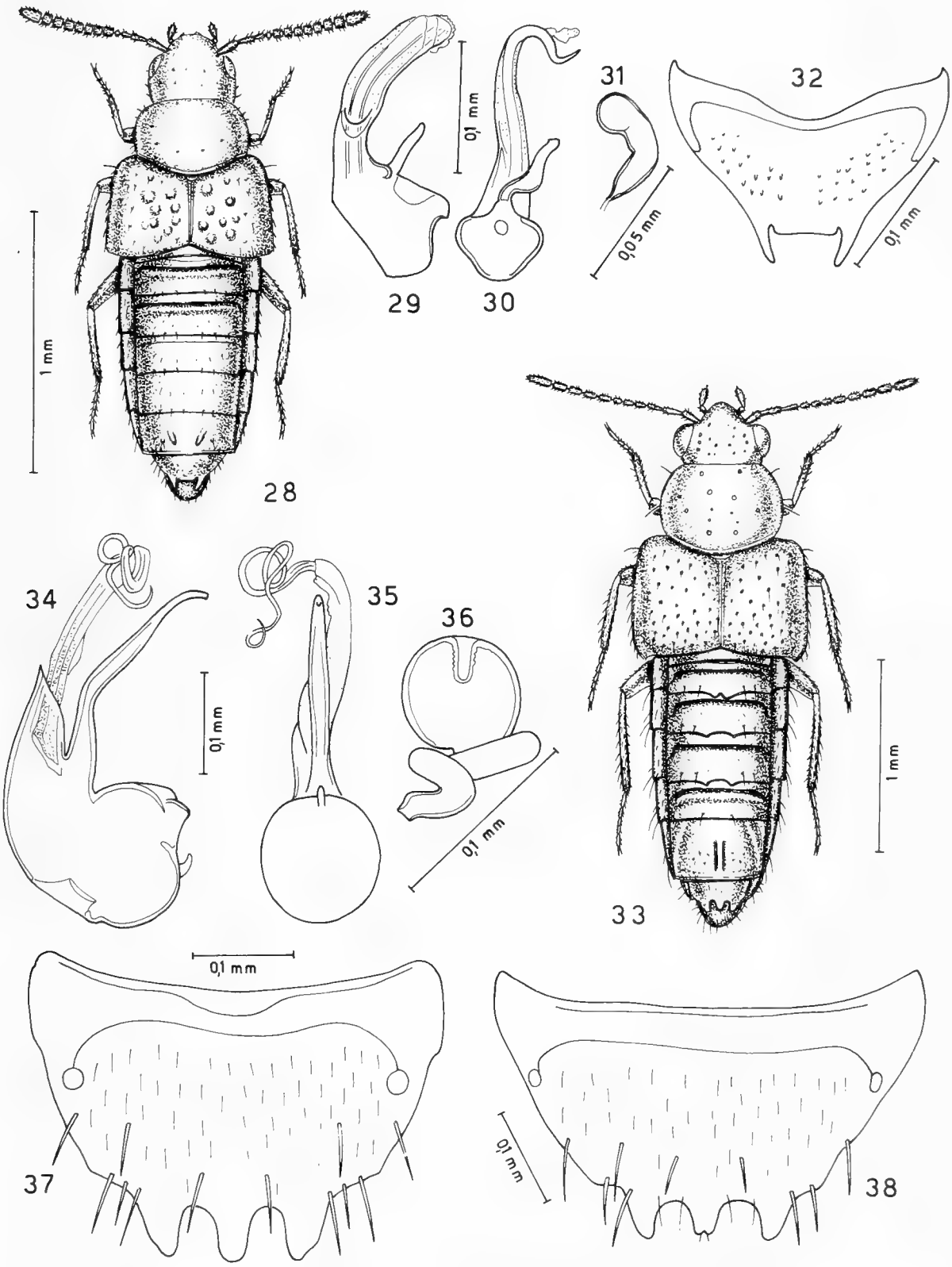
DESCRIZIONE. Lungh. 2,5 mm. Corpo lucidissimo e rossiccio; capo, metà posteriore delle elitre e uriti liberi 3° e 4° bruno-rossicci; antenne e zampe giallo-rossicce. L'avancorpo è privo di reticolazione, l'addome presenta reticolazione distinta. La punteggiatura del capo e del pronoto è assai rada e distribuita come da fig. 39. La punteggiatura delle elitre è assai rada ai lati. Il 5° urotergo libero del maschio è coperto di reticolazione vigorosa, quello della femmina di reticolazione distinta. Edeago figg. 40-41, spermateca fig. 44, 6° urotergo libero del maschio fig. 42.

COMPARAZIONI. Un'altra specie dell'Africa orientale mostra occhi enormemente sviluppati, come nella nuova specie: *G. polystictorum* Eichelbaum, 1913. la nuova specie è ben distinta da questa per l'assenza di un tubercolo mediano sul 5° urotergo libero del maschio e per la presenza di due solchi obliqui sullo stesso urotergo.

Gyrophaena (Phaenogyra) nyandaruensis sp. n. (Figg. 46-48)

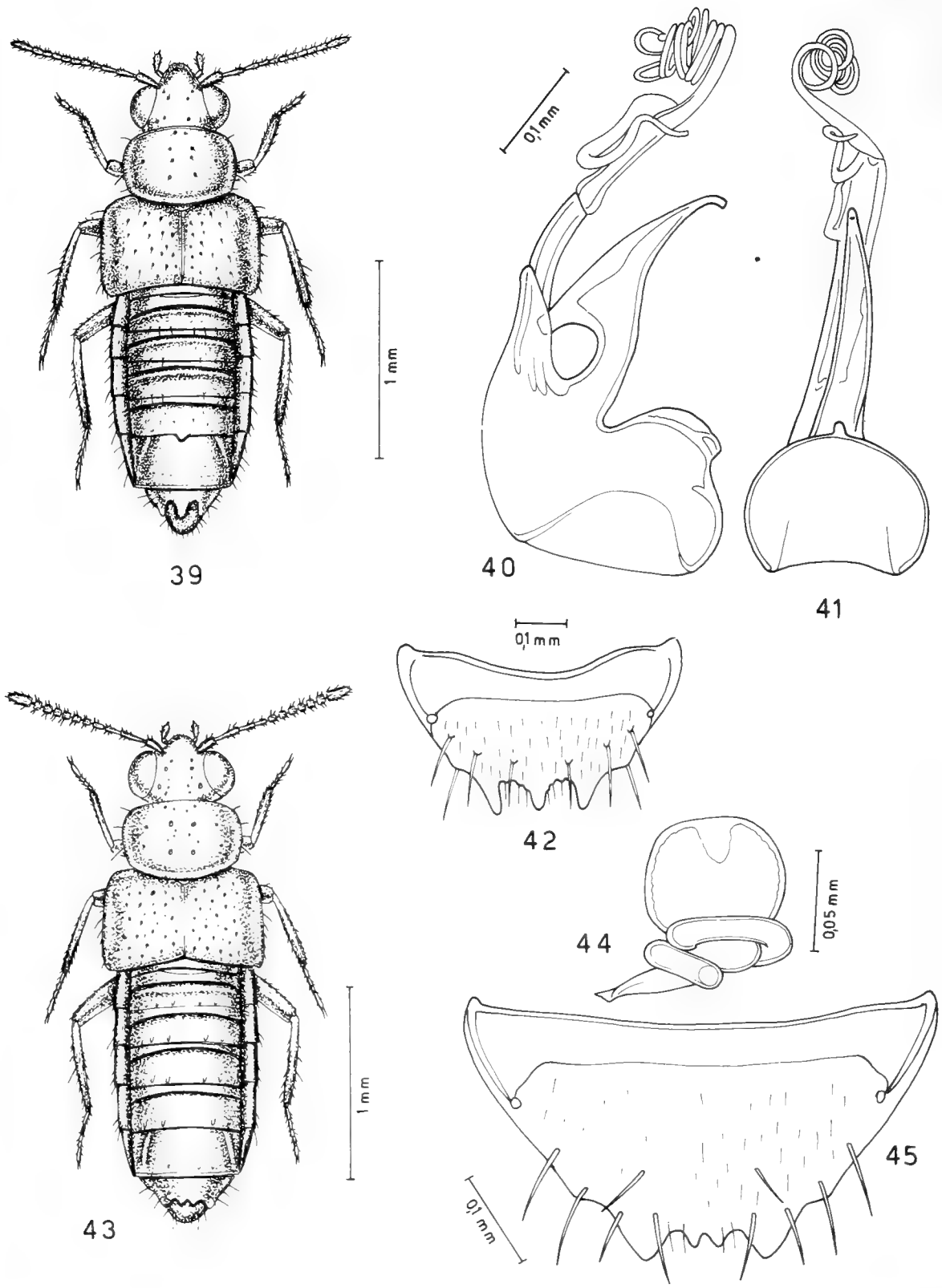
TIPO. Holotypus ♀, Kenya, Nyandarua, South Kingangop, 2550, 9.XI.1977, (Mahnert & Perret leg., MG).

DESCRIZIONE. Lungh. 2,5 mm. Corpo lucido e bruno-rossiccio; metà posteriore delle elitre bruna; antenne rossicce con i due antennomeri basali e la base del terzo giallo rossicci; zampe giallo-rossicce. La reticolazione del capo è svanita, quella del



FIGG. 28-38

Habitus, edeago in visione laterale e ventrale, spermateca, sesto urotergo libero del ♂ e della ♀. 28-32: *Gyrophaena* (s. str.) *aenescens* Bernhauer, lectotypus ♂ e paralectotypus ♀, (32: 6° urotergo libero del ♂); 33-38: *Gyrophaena (Phaenogyra) embuorum* sp. n. (37: 6° urotergo libero del ♂, 38: 6° urotergo libero della ♀).



FIGG. 39-45

Habitus, edeago in visione laterale e ventrale, spermateca e 6° urotergo libero del ♂ e della ♀. 39-45: *Gyrophaena (Phaenogyra) mahnerti* sp. n., (39: maschio; 43: femmina; 42: 6° urotergo libero del maschio; 45: 6° urotergo libero della femmina).

pronoto e delle elitre è netta, quella degli uroterghi è vigorosa. La punteggiatura del capo e del pronoto è rada e distribuita come da fig. 46. Le elitre sono coperte di tubercoletti salienti. Spermateca fig. 47, 6° urotergo libero della femmina fig. 48.

COMPARAZIONI. Specie distinta da *G. polystictorum* Eichelbaum, 1915, di Amani, per gli occhi meno sviluppati e per il 5° antennomero per nulla molto più largo e più lungo del 4° come in *polystictorum*.

CHIAVE DELLE SPECIE DI *Gyrophaena* DELLE SOTTOREGIONI AFRICANA ORIENTALE E MALGASCIA

Gyrophaena s. str.

CHIAVE DEI MASCHI

1 Quinto urotergo libero senza tubercolo mediano. 2
- Quinto urotergo libero con un tubercolo mediano. Lungh. 1,5 mm. Usambara: Kwai. . . . . *usambarae* Bernhauer
2 Sesto urotergo libero con un dente mediano corto al margine posteriore; edeago provvisto di setole sulla parte distale. Lungh. 2,4 mm. La Réunion. . . . . *gomyi* Pace
- Sesto urotergo libero con 2 a 5 denti al margine posteriore. 3
3 Sesto urotergo libero con 5 denti al margine posteriore; secondo urotergo libero con due callosità mediane al margine posteriore. Lungh. 3,0 mm. Amani. . . . . *bicallosa* Eichelbaum
- Sesto urotergo libero con 2 a 4 denti al margine posteriore. 4
4 Sesto urotergo libero con 3-4 denti al margine posteriore. 5
- Sesto urotergo libero con due denti laterali sottili e lunghi. Lungh. 1,7 mm. Dar-Es-Salam. . . . . *aenescens* Bernhauer
5 Sesto urotergo libero con 4 denti al margine posteriore 6
- Sesto urotergo libero con 3 denti al margine posteriore. 8
6 I due denti mediani del sesto urotergo libero molto corti. 7
- I due denti mediani del sesto urotergo libero, lunghi quasi quanto i laterali che spesso sono assai lunghi. Lungh. 0,8 mm. Africa orientale. . . . . *vosseleri* Eichelbaum
7 Denti laterali del sesto urotergo libero ottusi e corti. Dar-Es-Salam e Africa occidentale. . . . . *angularis* Eppelsheim
- Denti laterali del sesto urotergo libero lunghi e stretti. Lungh. 1,2 mm. Arusha. . . . . *kaszabi* Pace
8 Sesto urotergo libero con tre corti e larghi denti al margine posteriore: tra essi esistono 2 dentini assai poco distinti. Lungh. 4,0 mm. Amani. . . . . *eichelbaumi* Wendeler (= *dispar* Eichelbaum)
- Almeno 2 denti al margine posteriore del sesto urotergo libero, sono lunghi. . 9
9 Tutti e tre, i denti del sesto urotergo libero sono molto lunghi e sottili. Lungh. 1,8 mm. Kilimanjaro. . . . . *kilimanjaroensis* Pace

- Sesto urotergo libero con i due denti laterali lunghi e con il mediano largo e ottuso. Lungh. 2,5 mm. Dar-Es-Salam. . . . . *aemula* Eichelbaum

Gyrophaena s. str.

CHIAVE DELLE FEMMINE

1 Quinto urotergo libero con due impressioni oblique basali; bulbo distale della spermateca campaniforme. Lungh. 2,4 mm. La Réunion. . . . . *gomyi* Pace
- Quinto urotergo libero senza impressioni basali; bulbo distale della spermateca subsferico. 2
2 Margine posteriore del quinto urotergo libero con una fitta fila di tubercoletti; spermateca molto più sviluppata, con presenza di apofisi del bulbo basale. Lungh. 1,8 mm. Moshi. . . . . *katonai* Pace
- Margine posteriore del quinto urotergo libero con qualche tubercoletto; spermateca molto piccola, priva di apofisi del bulbo prossimale. Lungh. 1,7 mm. Dar-Es. Salam. . . . . *aenescens* Bernhauer

Gyrophaena Subgen. *Phaenogyra*

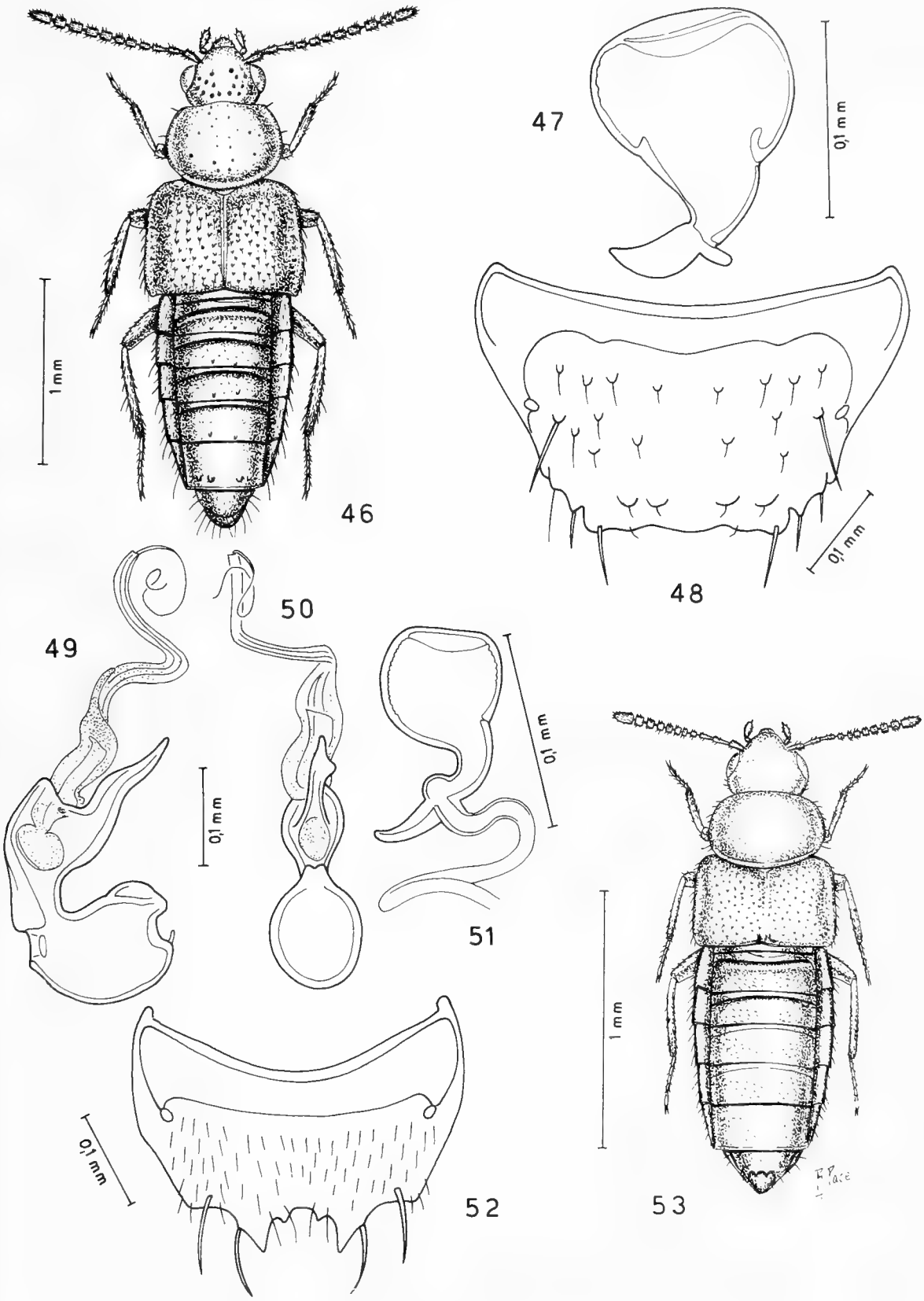
CHIAVE DEI MASCHI

1 Quinto urotergo libero con tubercolo o carena mediani evidenti. 2
- Quinto urotergo libero senza tubercoli o carene. Lungh. 2,5 mm. Kenya: Alamu. . . . . *mahnerti* sp. n.
2 Quinto urotergo libero con carena mediana. 3
- Quinto urotergo libero con un tubercolo mediano presso il margine posteriore. Lungh. 0,7 mm. Amani. . . . . *polistictorum* Eichelbaum
3 Quinto urotergo libero con una distinta carena mediana. Lungh. 2,7 mm. Kenya: Embu. . . . . *embuorum* sp. n.
- Quinto urotergo libero con due fini carene mediane, all'indietro salienti. Lungh. 0,65 mm. Amani. . . . . *polystictipersoonii* Eichelbaum

Gyrophaena Subgen. *Phaenogyra*

CHIAVE DELLE FEMMINE

1 Sesto urotergo libero senza denti al margine posteriore. 2
- Sesto urotergo libero con denti al margine posteriore. 3
2 Pronoto poco trasverso; elitre coperte di tubercoli salienti e di reticolazione netta. Lungh. 2,5 mm. Kenya: Nyandarua. . . . . *nyandaruensis* sp. n.
- Pronoto molto trasverso; elitre coperte di punteggiatura superficiale e prive di netta reticolazione. Lungh. 3,0 mm. Tanzania: Usa River. . . . . *fluviatilis* Pace
3 Pronoto più trasverso; sesto urotergo libero con 4 denti al margine posteriore. Lungh. 2,5 mm. Kenya: Alamu. . . . . *mahnerti* sp. n.



FIGG. 46-53

Habitus, edeago in visione laterale e ventrale, spermateca e 6° urotergo libero del ♂ e della ♀. 46-48: *Gyrophaena (Phaenogyra) nyandaruensis* sp. n., (48: 6° urotergo libero della ♀). 49-53: *Brachida shimbaensis* sp. n., (52: 6° urotergo libero del ♂).

- Pronoto meno trasverso; sesto urotergo libero con 3 denti al margine posteriore: il mediano è incavato all'apice. Lungh. 2,7 mm. Kenya: Embu. . . . . *embuorum* sp. n.

Brachida shimbaensis sp. n. (Figg. 49-53)

TIPI. Holotypus ♂, Kenya, Shimba Hills, S Mombasa, 29.XI.1974, (Mahnert & Perret leg., MG).

Paratypi: 1 ♂ e 1 ♀, stessa provenienza, (MG, CPA).

DESCRIZIONE. Lungh. 1,8 mm. Corpo lucido e giallo-rossiccio; elitre, tranne gli omeri, bruno-rossicce; antenne brune con i tre antennomeri basali gialli; zampe giallo-rossicce. L'avancorpo è privo di reticolazione, l'addome, invece, è coperto di reticolazione netta. La punteggiatura del capo e del pronoto è svanita, quella delle elitre è distinta. Edeago figg. 49-50, spermateca fig. 51, sesto urotergo libero del maschio fig. 52.

COMPARAZIONI. I caratteri differenziali sono posti in evidenza nella chiave che segue.

Brachida embuensis sp. n. (Figg. 54-57)

TIPI. Holotypus ♂, Kenya, Embu, Kirimiri Forest, O de Runyenje, 1550 m, 13.X.1977, (Mahnert & Perret leg., MG).

Paratypi: 2 ♀♀, stessa provenienza, (MG, CPA); 1 ♀, Kenya, Kiambu, près de Limuru, 2300 m, 2.XI.1977, (Mahnert & Perret leg., MG).

DESCRIZIONE. Lungh. 2,1 mm. Corpo lucido e rossiccio; capo, elitre tranne la base e 5° urite libero bruno-rossicci; antenne brune con antennomero basale giallo-bruno e i due seguenti gialli; zampe giallo-rossicce. Solo l'addome è coperto di reticolazione netta, l'avancorpo è privo di reticolazione e presenta punteggiatura svanita. Le elitre del maschio portano un tubercolo all'angolo posteriore interno. Edeago figg. 55-56, spermateca fig. 57.

COMPARAZIONI. Si veda la chiave delle specie più sotto.

Brachida masai sp. n. (Figg. 59-60)

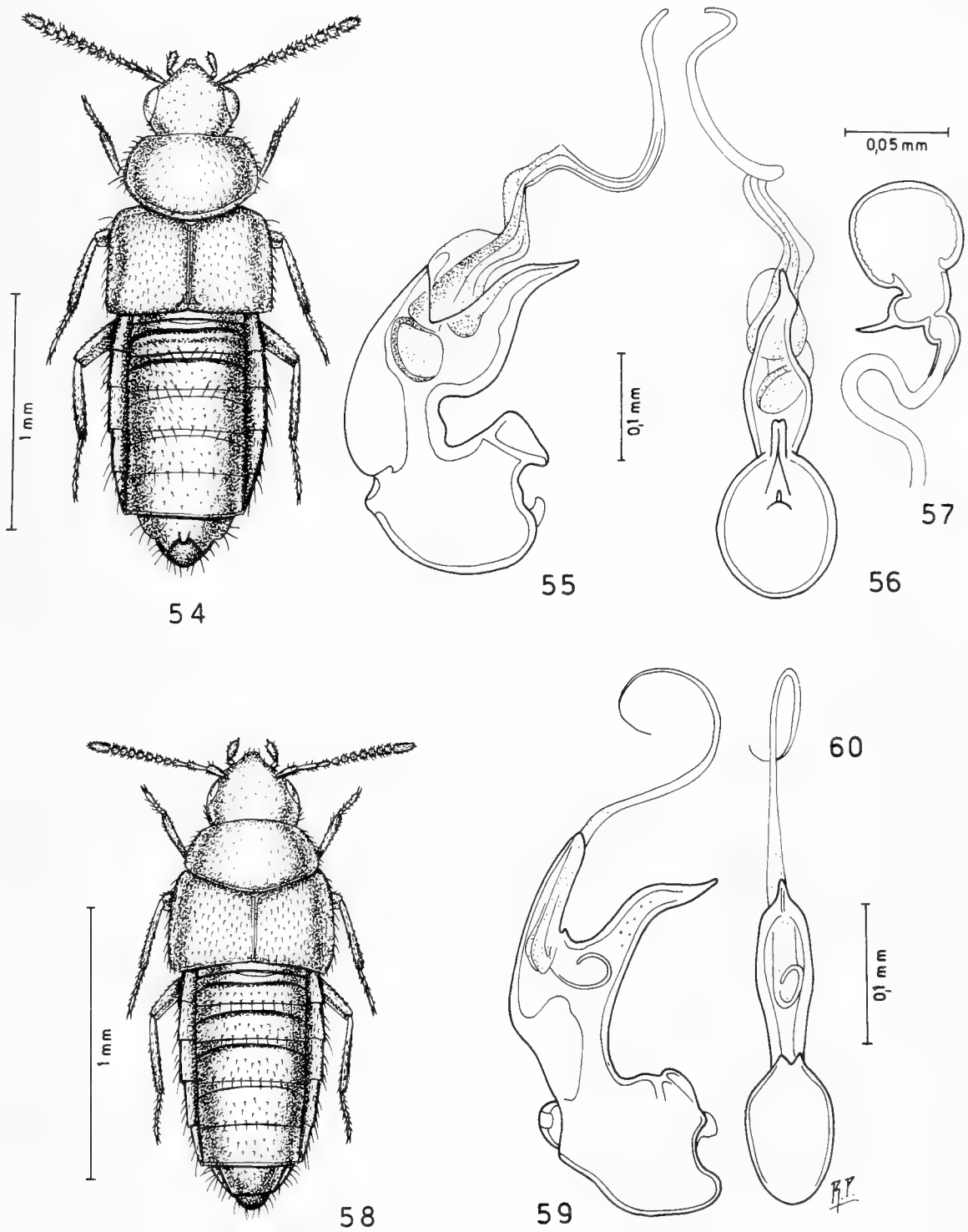
TIPO. Holotypus ♂, Kenya, Nairobi, Rosselyn, 1750 m, 8.X.1977, (Mahnert & Perret leg., MG).

DESCRIZIONE. Lungh. 1,7 mm. Corpo lucido e bruno-rossiccio; capo e uriti liberi 3°, 4° e 5° bruni; antenne bruno-rossicce con i tre antennomeri basali giallo-rossicci e antennomeri 4° a 7° rossicci; zampe giallo-rossicce. L'avancorpo è privo di reticolazione; l'addome invece presenta reticolazione netta sui due uroterghi basali e reticolazione vigorosa sui restanti uroterghi. Il capo e il pronoto sono coperti di punteggiatura svanita. Le elitre portano tubercoletti svaniti. Edeago figg. 59-60.

COMPARAZIONI. Si veda sotto la chiave delle specie.

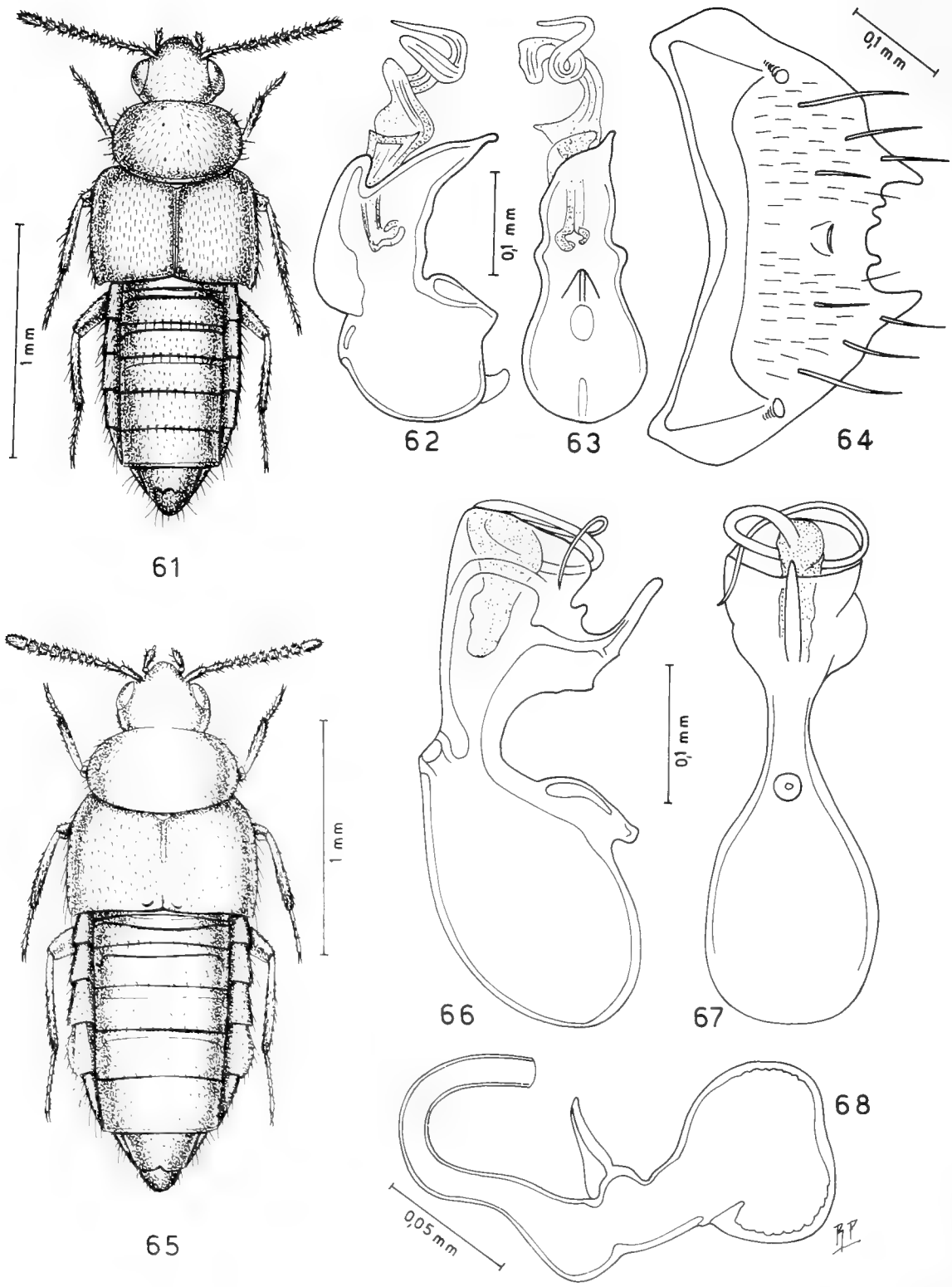
Brachida kirimirensis sp. n. (Figg. 61-64)

TIPO. Holotypus ♂, Kenya, Embu, Kirimiri Forest, O de Runyenje, 1550 m, 13.X.1977, (Mahnert & Perret leg., MG).



FIGG. 54-60

Habitus, edeago in visione laterale e ventrale e spermateca. 54-57: *Brachida embuensis* sp. n.; 58-60: *Brachida masai* sp. n.



FIGG. 61-68

Habitus, edeago in visione laterale e ventrale, spermateca e 6° urotergo libero del maschio. 61-64: *Brachida kirimirensis* sp. n.; 65-68: *Brachida africana* (Bernhauer & Scheerpeltz), holotypus ♂, (68: ♀ di Narok, Kenya).

DESCRIZIONE. Lungh. 2,0 mm. Corpo lucido e giallo-rossiccio; 4° urotergo libero bruno, ma non ai lati; antenne rossicce con i tre antennomeri basali gialli; zampe giallo-rossicce. L'avancorpo non presenta reticolazione, l'addome invece è coperto di reticolazione distinta. Una punteggiatura fine sta sul capo; sul pronoto è estremamente svanita. Tubercoletti svaniti coprono le elitre che hanno nel maschio un tubercoletto all'angolo posteriore interno. Edeago figg. 62-63, 6° urite libero del maschio fig. 64.

COMPARAZIONI. Si veda oltre la chiave delle specie.

Brachida tanensis sp. n. (Figg. 69-73)

TIPI. Holotypus ♂, Kenya, Tana River, 10 Km N de Garsen, 23.X.1977, (Mahnert & Perret leg., MG).

Paratypus: 1 ♀, Kenya, Tana River, Wema, 24.X.1977, (Mahnert & Perret leg., CPA).

DESCRIZIONE. Lungh. 1,8 mm. Corpo lucido e giallo-rossiccio; capo e uriti liberi 3°, 4° e 5° bruno-rossicci; antenne brune con i tre antennomeri basali giallo-rossicci; zampe giallo-rossicce. L'avancorpo è privo di reticolazione; il primo urotergo libero presenta reticolazione svanita, mentre gli uriti restanti hanno reticolazione vigorosa. Il capo e le elitre sono coperti di punteggiatura superficiale; il pronoto porta una punteggiatura distinta. Un tubercolo appena distinto sta all'angolo posteriore interno delle elitre del maschio. Edeago figg. 70-71, spermateca fig. 72, 6° urotergo libero del maschio fig. 73.

COMPARAZIONI. Si veda sotto la chiave delle specie.

Brachida lamuensis sp. n. (Figg. 74-76)

TIPO. Holotypus ♂, Kenya, Lamu, près de Witu, 26.X.1977, (Mahnert & Perret leg., MG).

DESCRIZIONE. Lungh. 2,0 mm. Corpo lucido e giallo-rossiccio; antenne bruno-rossicce con i tre antennomeri basali gialli; zampe giallo-rossicce. La punteggiatura del capo è ombelicata e svanita, quella del pronoto e delle elitre è assai svanita. Solo l'addome à nettamente reticolato. Il solco basale del secondo urotergo libero è molto più profondo di quello del primo urotergo. Edeago figg. 74-75.

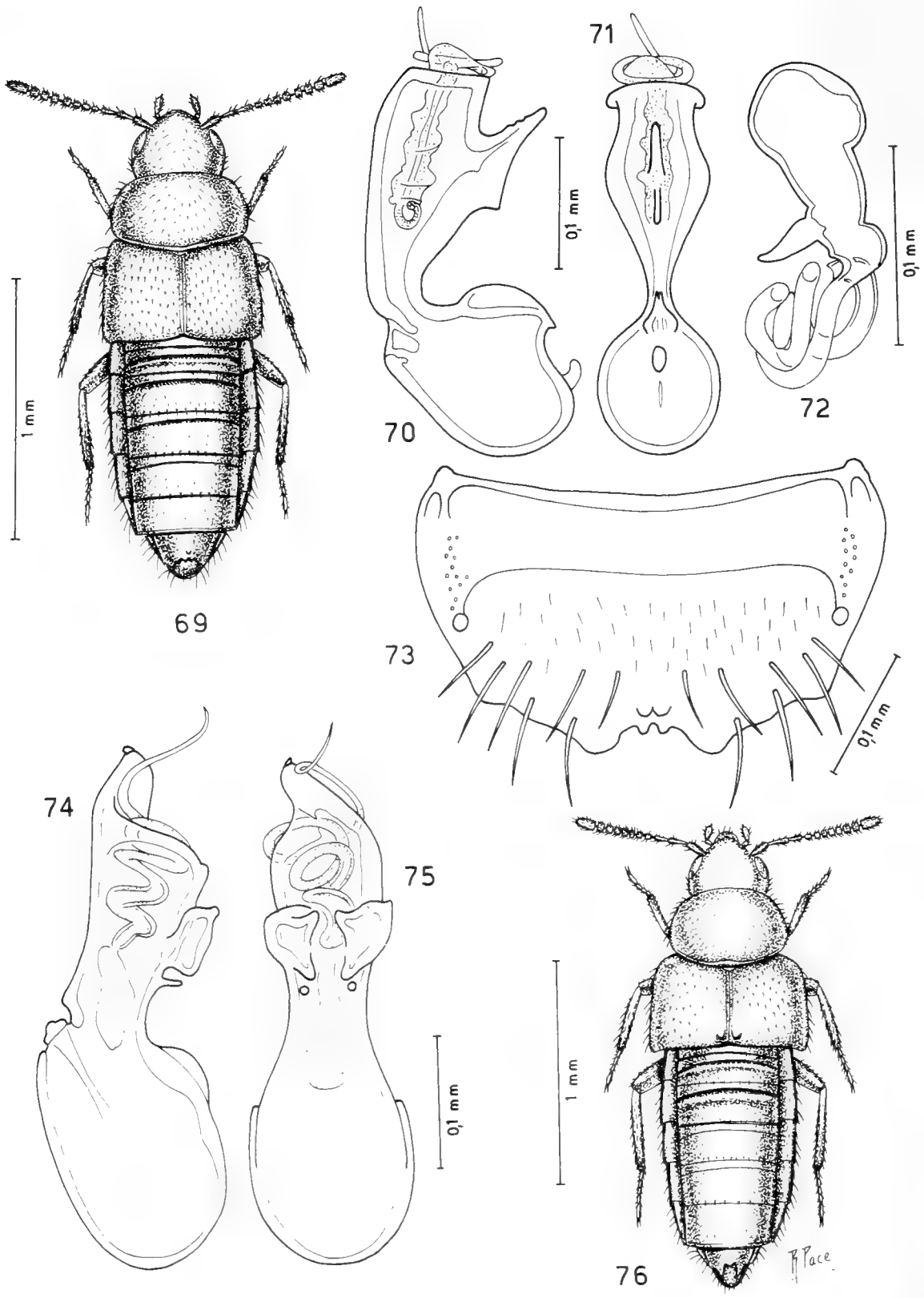
COMPARAZIONI. Si veda sotto la chiave delle specie.

Brachida makadarana sp. n. (Figg. 77-78)

TIPO. Holotypus ♀, Kenya, Shimba Hills, Makadara Forest, 30.XI.1974, (Mahnert & Perret leg., MG).

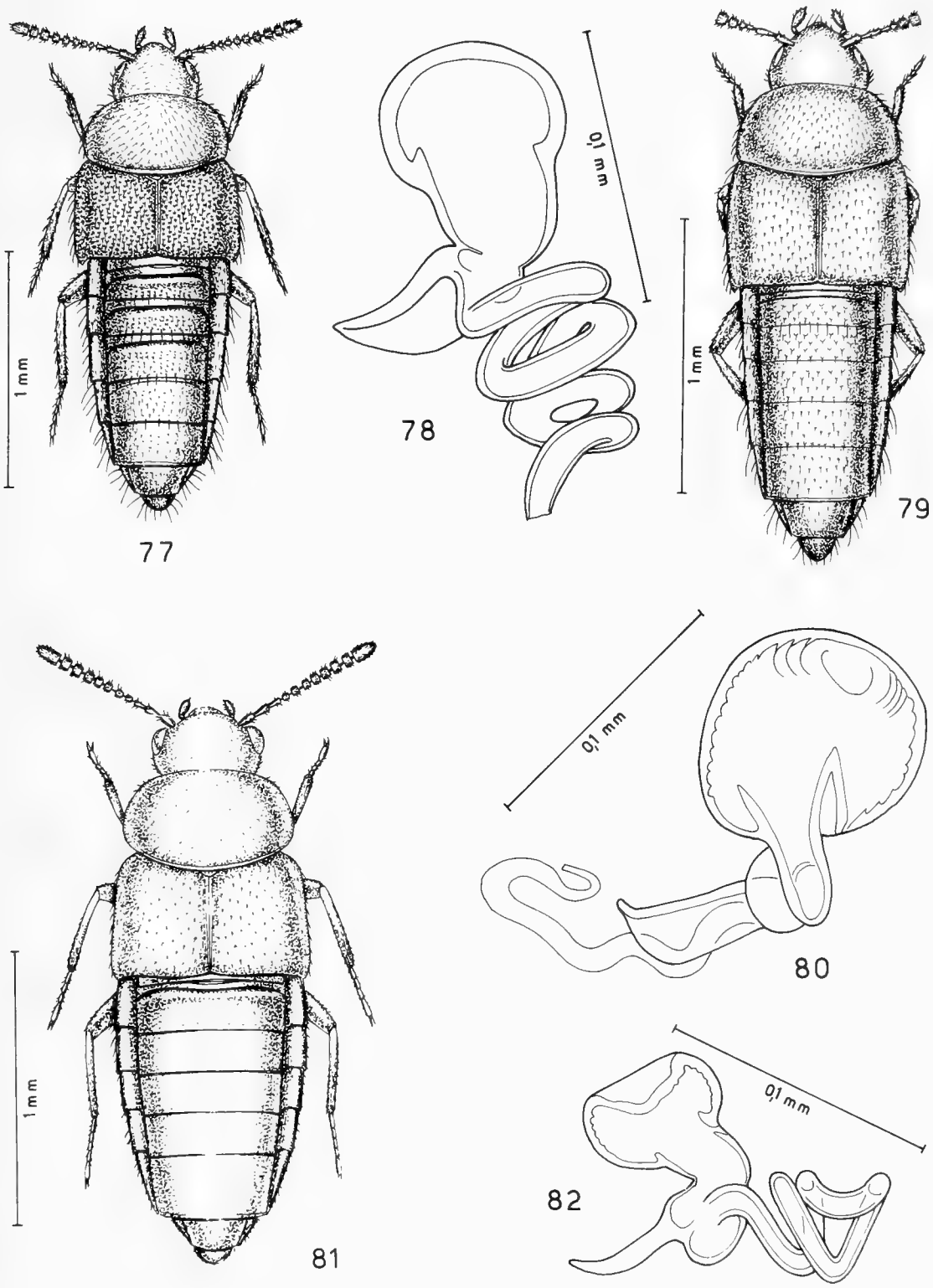
DESCRIZIONE. Lungh. 2,0 mm. Corpo lucido e rossiccio, comprese antenne e zampe. Tutta la superficie del corpo è priva di reticolazione distinta. La punteggiatura del capo è svanita. Il pronoto è coperto di tubercoletti svaniti, le elitre e l'addome presentano tubercoletti salienti. Spermateca fig. 78.

COMPARAZIONI. Si veda sotto la chiave delle specie.



FIGG. 69-76

Habitus, edeago in visione laterale e ventrale, spermateca e 6° urotergo libero del maschio. 69-73: *Brachida tanensis* sp. n.; 74-76: *Brachida lamuensis* sp. n.



FIGG. 77-82

Habitus e spermateca. 77-78: *Brachida makadarana* sp. n.; 79-80: *Brachida rangirensis* sp. n.; 81-82: *Brachida erythraea* sp. n.

Brachida rangirensis sp. n. (Figg. 80-81)

TIPO. Holotypus ♀, Rwanda, Rangiro, 1800 m, 25.III.1973, (Werner leg., MG).

DESCRIZIONE. Lungh. 2,0 mm. Descrizione su esemplare sciupato, privo di zampe medie e posteriori e di parte di antenne. Corpo lucido e giallo-rossiccio; antennomeri 1°, 2° e 3° gialli, antennomeri 4°, 5° e 6° bruno-rossicci; zampe giallo rossicce. La punteggiatura del capo è svanita. Il pronoto e le elitre sono coperti di tubercoletti fini e distinti. Gli uroterghi basali presentano scultura a forma di squame. Spermateca fig. 80.

COMPARAZIONI. Si veda sotto al chiave delle specie.

Brachida erythraea sp. n. (Figg. 81-82)

TIPO. Holotypus ♀, Eritrea, Adi-Caiè, VIII.1902, (Dr. A. Andreini leg., MF 285).

DESCRIZIONE. Lungh. 2,0 mm. Corpo lucido e giallo-rossiccio; capo nero; uriti liberi 3°, 4° 5° bruni; antenne bruno-rossicce con i 4 antennomeri basali giallo-rossicci; zampe giallo-rossicce. L'avancorpo è privo di reticolazione; l'addome presenta reticolazione distinta. La punteggiatura del capo è svanita, quella delle elitre indistinta. Il pronoto è coperto di tubercoletti finissimi. Spermateca fig. 82.

COMPARAZIONI. Le specie sopra descritte si distinguono tra loro e da altre con la seguente chiave.

SPECIE DI *Brachida* DELLE SOTTOREGIONI AFRICANA ORIENTALE E MALGASCIA

CHIAVE DEI MASCHI

1 Edeago robusto a pareti fortemente ispessite, con netto angolo pre-apicale ventrale. 2
- Edeago mai con tutti i caratteri insieme come sopra. 4
2 Edeago profondamente ricurvo al lato ventrale, con base della parte apicale della lama sternale, poco larga. 3
- Edeago fortemente ricurvo al lato ventrale, con base della parte apicale della lama sternale, assai larga. Lungh. 2,3 mm. Kenya: Nairobi. . . . . *nairobiensis* Pace
3 Parte apicale dell'edeago, in visione laterale, assai stretta; presenza di un'apofisi nell'incavatura apicale dell'edeago. Lungh. 2,2 mm. Africa Or.: Pangani. . . . . *africana* Bernhauer & Scheerpeltz (= *convexicollis* Bernhauer)
- Parte apicale dell'edeago, in visione laterale, larga; assenza di apofisi nell'incavatura apicale dell'edeago. Lungh. 1,8 mm. Kenya: Tana River. . . . . *tanensis* sp. n.
4 Edeago, in visione ventrale, per lo più fortemente e bruscamente ristretto a metà. 5
- Edeago, in visione ventrale, non o appena ristretto a metà. 10
5 Parte libera del flagello del sacco interno dell'edeago descrivente una o più spire. 6

- Parte libera del flagello del sacco interno dell'edeago lineare. 9
6 In visione laterale, edeago strettamente e profondamente incavato al lato ventrale. 7
- In visione laterale, edeago assai largamente ricurvo al lato ventrale. Lungh. 1,7 mm. Kenya: Nairobi. . . . . *masai* sp. n.
7 Apice dell'edeago subtronco; incavatura ventrale dell'edeago meno profonda. Lungh. 1,8 mm. Kibosho. . . . . *opportuna* Pace
- Apice dell'edeago appuntito; incavatura ventrale dell'edeago profonda. 8
8 In visione laterale, parte mediana dell'edeago stretta; flagello del sacco interno terminante con un pezzo filiforme. Lungh. 1,8 mm. Kenya: Shimba Hills. . . . . *shimbaensis* sp. n.
- In visione laterale, parte mediana dell'edeago larga; flagello del sacco interno privo di pezzo filiforme apicale. Lungh. 2,1 mm. Kenya: Embu, Kirimiri Forest. . . . . *embuensis* sp. n.
9 Edeago poco sviluppato e poco profondamente ricurvo al lato ventrale che è bisinuoso; pezzo copulatore del sacco interno robusto e corto: la sua parte sporgente dall'orifizio apicale, sinuosa. Lungh. 2,0 mm. Madagascar. Holotypus: Route Lavato (Peyrieras leg., CLQ). *properans* sp. n.
- Edeago ben sviluppato, ampiamente e profondamente ricurvo al lato ventrale; pezzo copulatore del sacco interno, robusto e lungo: la sua parte sporgente dall'orifizio apicale, appena ricurva. Lungh. 1,9 mm. Madagascar: Maroantsetra, Ft. Dauphin. . . . . *madecassa* Pace
10 Edeago robusto, con due ispessimenti chitinosi e due apofisi preapicali ventrali; parte basale del pezzo copulatore del sacco interno, descrivente alcune spire. Lungh. 2,0 mm. Kenya: Lamu. . . . . *lamuensis* sp. n.
- Edeago privo di ispessimenti chitinosi preapicali ventrali; parte basale del pezzo copulatore del sacco interno, rettilinea. 11
11 Penultimo antennomero lungo quanto largo; angolo posteriore interno delle elitre con tubercolo; edeago più sviluppato, fortemente ispessito al lato dorsale e parte sporgente del pezzo copulatore del sacco interno, descrivente due spire. Lungh. 2,0 mm. Kenya: Embu, Kirimiri Forest. . . . . *kirimirensis* sp. n.
- Penultimo antennomero trasverso; angolo posteriore interno delle elitre senza tubercolo; edeago poco sviluppato; parte sporgente del pezzo copulatore del sacco interno, ricurva. Lungh. 1,9 mm. Madagascar. Holotypus: Ankarafantsika, (Peyrieras leg., CLQ). . . . . *lemuriae* sp. n.

CHIAVE DELLE FEMMINE

1 Spermateca con due apofisi: una del bulbo distale e una del bulbo prossimale. Lungh. 2,0 mm. Arusha. . . . . *kaszabi* Pace
- Spermateca con una sola apofisi, quella del bulbo prossimale. 2
2 Spermateca di piccole o medie dimensioni (bulbo distale con asse maggiore di 0.04-0,06 mm). 3

- Spermateca di grandi dimensioni, (bulbo distale con asse maggiore di 0,07-0,10 mm). 9

3 Bulbo distale della spermateca ovale allungato; apofisi del bulbo prossimale nettamente ricurvo a gomito. Lungh. 2,0 mm. Madagascar. Holotypus: Manaskara, (Gomy leg., MG). . . . . *malgascia* sp. n.

- Bulbo distale della spermateca sferico o subsferico; apofisi del bulbo prossimale, appena ricurva. 4

4 Bulbo distale della spermateca simmetrico. 5

- Bulbo distale della spermateca asimmetrico. 6

5 Bulbo distale della spermateca senza introflessione apicale; apofisi del bulbo prossimale, sottile. Lungh. 2,1 mm. Kenya: Embu, Kirimiri Forest. . . . . *embuensis* sp. n.

- Bulbo distale della spermateca con corta introflessione apicale; apofisi del bulbo prossimale, larga. Lungh. 2,3 mm. Kenya: Nairobi. . . . . *nairobiensis* Pace

6 Apofisi del bulbo prossimale della spermateca corto (0,02 mm). 7

- Apofisi del bulbo prossimale della spermateca lungo, (0,038 mm). 8

7 Bulbo distale della spermateca più ovale trasverso; corpo mediano della stessa spermateca più dilatato. Lungh. 1,9 mm. Madagascar. Paratypi: Ankarafantsika, (Peyrieras leg., CLQ). . . . . *lemuriae* sp. n.

- Bulbo distale della spermateca, meno ovale trasverso; parte mediana della spermateca stessa, meno dilatata. Lungh. 1,9 mm. Madagascar: Maroantsetra. . . . . *madecassa* Pace

8 Bulbo distale della spermateca subsferico; parte mediana della spermateca stessa, assai stretto. Lungh. 1,8 mm. Kenya: Shimba Hills. . . . . *shimbaensis* sp. n.

- Bulbo distale della spermateca, trasverso; parte mediana della spermateca stessa, assai larga. Lungh. 1,8 mm. Kenya: Tana River. . . . . *tanensis* sp. n.

9 Docce interne del bulbo distale della spermateca, molto sviluppate. Lungh. 2,0 mm. Rwanda: Rangiro. . . . . *rangirensis* sp. n.

- Docce interne de bulbo distale della spermateca, assenti o poco sviluppate. 10

10 Introflessione del bulbo distale della spermateca, presente 11

- Introflessione del bulbo distale della spermateca, assente. 12

11 Introflessione del bulbo distale della spermateca, ipertrofica: essa occupa quasi interamente il volume interno del bulbo stesso. Lungh. 2,5 mm. Tanzania: Mt. Meru. . . . . *meruensis* Pace

- Introflessione del bulbo distale della spermateca, poco sviluppata. Lungh. 2,0 mm. Eritrea: Adi-Caiè. . . . . *erythraea* sp. n.

12 Apofisi del bulbo prossimale della spermateca, larghissima. Lungh. 2,0 mm. Kenya: Shimba Hills, Makadara Forest. . . . . *makadarana* sp. n.

- Apofisi del bulbo prossimale della spermateca, stretto. 13

13 Bulbo distale della spermateca più sviluppato (asse maggiore di 0,09 mm) e ovale trasverso; "ductus" largo e corto. Lungh. 2,2 mm. Kenya: Narok, Malindi. . . . . *africana* Bernhauer & Sch.

- Bulbo distale della spermateca meno sviluppato, (asse maggiore di 0,07 mm), e ovale allungato; "ductus" fine e avvolto in numerose ampie spire. Lungh. 1,7 mm. Kenya: Malindi. . . . . *bartolozzii* Pace

Neobrachida umtaliensis sp. n. (Figg. 83-85)

TIPO. Holotypus ♂, Zimbabwe (Rhodésie), Umtali; II. 1969, (R. Mussard leg., MG).

DESCRIZIONE. Lungh. 1,7 mm. Corpo lucido e giallo-rossiccio; antenne bruno-rossicce con i tre antennomeri basali gialli; zampe gialle. La punteggiatura del capo è fine. Il pronoto e le elitre sono coperti di tubercoletti distinti. Tutto il corpo presenta reticolazione distinta. Edeago figg. 84-85.

COMPARAZIONI. Il genere *Neobrachida* Cameron, 1920, finora noto solo della Sottoregione Indiana (Sri-Lanka), con le due specie nuove qui descritte, viene per la prima volta compreso anche nella fauna della Regione Etiopica. Ciò è indubbio, dato che ho esaminato e dissezionato l'holotypus di *Neobrachida castanea* Cameron, 1920, dello Sri-Lanka, che è il tipo del genere. Per le comparazioni si veda la chiave data sotto.

Neobrachida tanensis sp. n. (Figg. 86-87)

TIPO. Holotypus ♀, Tana River, Wema, 24.X.1977, (Mahnert & Perret leg., MG).

DESCRIZIONE. Lungh. 1,2 mm. Corpo lucidissimo e bruno; antenne giallo-brune con i due antennomeri basali gialli e l'undicesimo antennomero bruno; zampe gialle. Il capo è privo di reticolazione; il pronoto, le elitre e l'addome sono coperti di reticolazione molto svanita. La punteggiatura del capo e del pronoto è fine. Le elitre mostrano tubercoletti distinti su tutta la loro superficie. Spermateca fig. 87.

COMPARAZIONI. La nuova specie si distingue dalle altre specie in base alla seguente chiave.

CHIAVE DELLE SPECIE DI *Neobrachida* DELLA SOTTOREGIONE INDIANA E DELLA REGIONE ETIOPICA.

1 Taglia maggiore: 2,1 mm; antenne interamente gialle; uroterghi coperti di scultura a squame e privi di microscultura reticolare; spermateca con bulbo distale molto sviluppato (asse maggiore di 0,09 mm), ovale trasverso, con introflessione apicale rettangolare assai lunga (0.04 mm) e larga (0,023 mm), ad angoli quasi retti; parte mediana della spermateca cortissima; edeago sconosciuto. Lungh. 2,1 mm. Sri-Lanka: Bogawantalawa. . . . . *castanea* Cameron

- Taglia minore: 1,2-1,7 mm; antenne brune of giallo-brune; uroterghi privi si microscultura a squame e con microscultura reticolare. 2

2 Taglia maggiore: 1,7 mm. Corpo giallo-rossiccio; tempie più corte degli occhi che sono sporgenti; reticolazione degli uroterghi distinta; femmina sconosciuta. Rhodesia: Umtali. . . . . *umtaliensis* sp. n.

- Taglia minore: 1,2 mm. Corpo bruno; tempie lunghe quanto gli occhi che sono appena sporgenti; reticolazione degli uroterghi svanita; maschio sconosciuto. Kenya: Tana River. . . . . *tanensis* sp. n.

Placusa (s. str.) **somala** sp. n. (Figg. 97-98)

TIPO. Holotypus ♀, Somalia, Sar Uanle, 27.V.1973, (S.B. S. leg., MF).

DESCRIZIONE. Lungh. 1,8 mm. Corpo lucido e bruno; elitre giallo-brune; base e apice dell'addome bruno-rossicci; antenne brune; femori giallo-bruni, tibie e tarsi gialli. Tutto il corpo è coperto di tubercoletti fitti e salienti. Spermateca fig. 98.

COMPARAZIONI. Per avere le elitre lunghe quanto il pronoto e gli occhi più lunghi delle tempie, la nuova specie sembra sistematicamente vicina a *P. nairobiana* Fauvel, 1907. Se ne distingue per l'habitus più robusto, per gli antennomeri 4° a 10° nettamente più trasversi e per l'undicesimo antennomero appena più lungo che largo, e non due volte più lungo che largo come in *nairobiana*.

Placusa (Calpusa) ruandensis sp. n. (Figg. 99-102)

TIPI. Holotypus ♂; Rwanda, Kayove, 2100 m, 15.V.1973, (Werner leg., MG).
Paratypi: 13 es., stessa provenienza, (MG, CPA); 1 ♂ e 3 ♀♀, Rwanda, Rangiro, 1800 m, 6.VIII.1973, (Werner leg., MG).

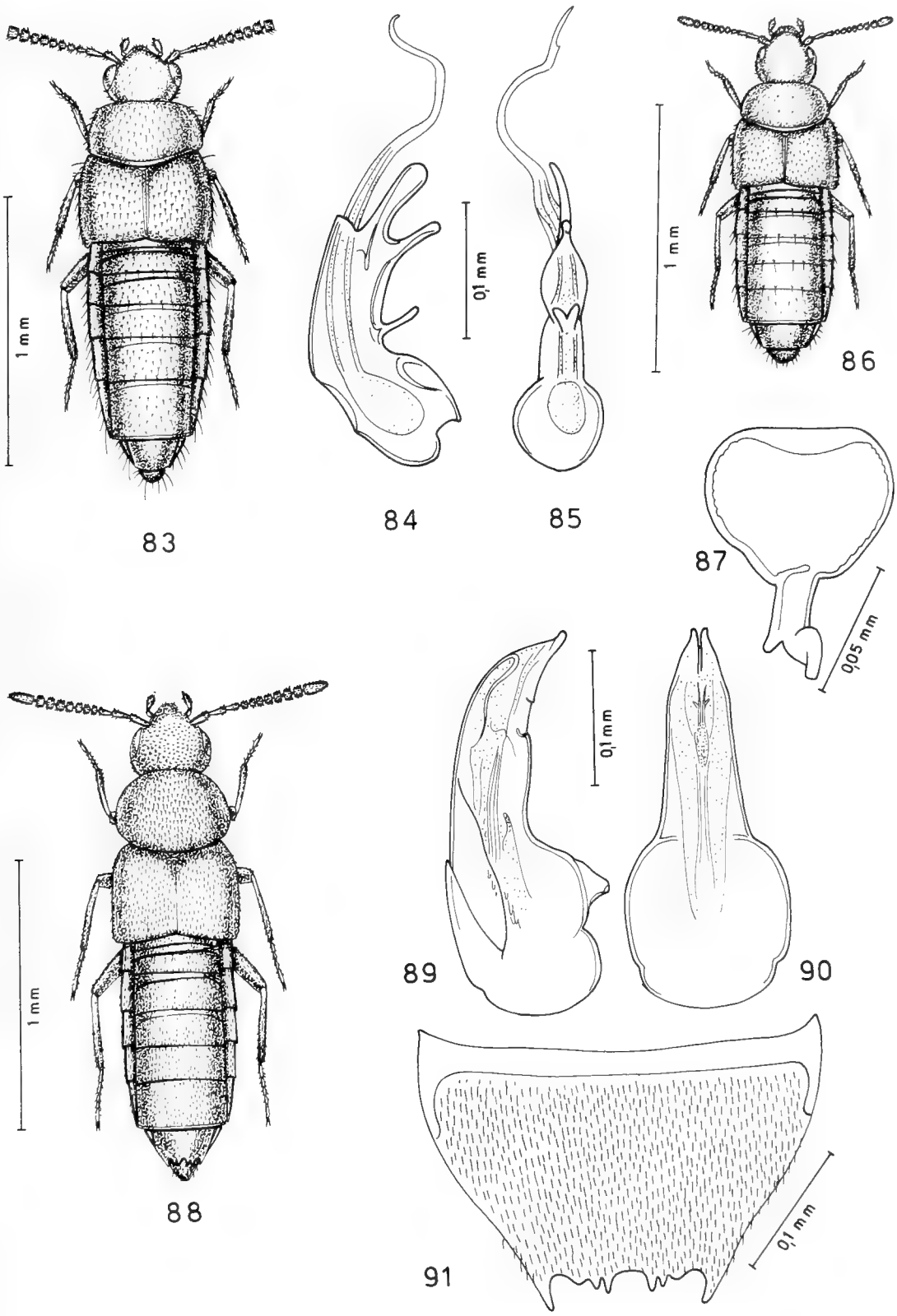
DESCRIZIONE. Lungh. 1,2 mm. Corpo lucido e bruno; estremità addominale giallo-rossiccia; antenne brune; zampe giallo-brune. Il corpo è privo di reticolazione. La punteggiatura del capo è superficiale. Il pronoto presenta tubercoletti svaniti; le elitre sono coperte di tubercoletti distinti. Sugli uroterghi basali i tubercoletti sono più salienti di quelli sui restanti uroterghi. Edeago figg. 99-100, spermateca fig. 101.

COMPARAZIONI. A motivo della taglia assai ridotta, per la presenza di una profonda fovea discale sul capo e per l'assenza di caratteri sessuali secondari evidenti sul 6° urotergo libero del maschio, la nuova specie è differente da *P. adscita* Erichson, 1840, presente nel Nordafrica, come pure dalle specie della Sottoregione Indiana *P. insigniventri* Cameron, 1939, *P. fratercula* Cameron, 1939 e *P. intermedia* Cameron, 1921.

Homalota mutarensis sp. n. (Figg. 103-106)

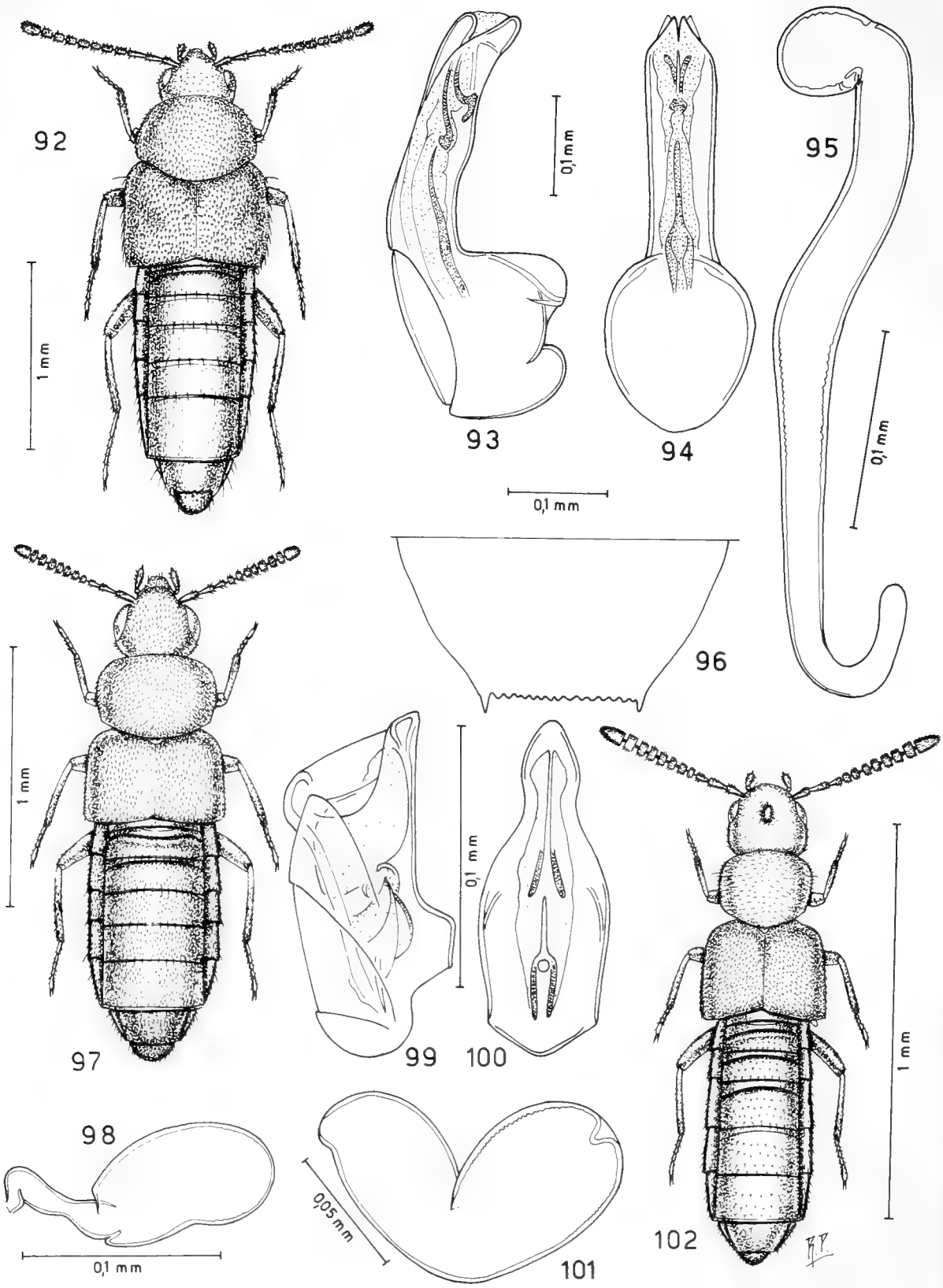
TIPI. Holotypus ♂, Zimbabwe (Rhodésie), Umtali, II. 1969, (R. Mussard leg. MG).
Paratypi: 3 es., stessa provenienza, (MG, CPA).

DESCRIZIONE. Lungh. 1,9 mm. Corpo debolmente appiattito, piuttosto opaco con addome un po'lucido, e rossiccio; elitre, tranne la base, e 4° urite libero bruno-rossicci; antenne brune con i tre antennomeri basali e l'undicesimo rossicci; zampe giallo-rossicce. Il capo e il pronoto sono coperti di punteggiatura fittissima e netta. Le elitre sono coperte di punteggiatura distinta e di reticolazione evidente. La reticolazione degli uroterghi è distinta. Edeago figg. 104-105, spermateca fig. 106.



FIGG. 83-91

Habitus, edeago in visione laterale e ventrale, spermateca e 6° urotergo libero del ♂. 83-85: *Neobrachida umtaliensis* sp. n.; 86-87: *Neobrachida tanensis* sp. n.; 88-91: *Placusa* (s. str.) *nairobiana* Fauvel, holotypus.



FIGG. 92-102

Habitus, edeago in visione laterale e ventrale, spermateca e 6° urotergo libero del ♂. 92-96: *Placusa* (s. str.) *simulans* Fauvel, lectotypus ♂ e paralectotypus ♀; 97-98: *Placusa* (s. str.) *somala* sp. n.; 99-102: *Placusa (Calpusa) ruandensis* sp. n.

ETIMOLOGIA. La nuova specie prende nome dalla città di Mutare, odierno nome di Fort Umtali, località tipica.

COMPARAZIONI. Per il colore del corpo la nuova specie appare simile a *H. seminigriventris* Bernhauer, 1932 dello Zaire, ma questa specie ha il terzo antennomero più corto del secondo, mentre la nuova specie ha il terzo antennomero più lungo del secondo. Il pronoto di *seminigriventris* è circa la metà più largo che lungo e non solo 1/5 più largo che lungo come nella nuova specie. L'edeago è simile nella struttura generale a quello di *H. brodschildi* Bernhauer, 1901, del Madagascar, ma questa specie ha il pezzo copulatore del sacco interno molto corto e i due sessi presentano due tubercoli salienti su ciascuno degli uroterghi liberi 2°, 3° e 5°.

Homalota bicristata sp. n. (Figg. 107-111)

TIPI. Holotypus ♂, Kenya, Narok, Morijo, Loita Hills, 2300 m, 4.XI.1977, (Mahnert & Perret leg., MG).

Paratypus: 1 ♀, stessa provenienza (CPA).

DESCRIZIONE. Lungh. 1,9 mm. Corpo debolmente appiattito, lucido e giallo-rossiccio; capo, elitre tranne la base e 4° urite libero bruni; antenne brune con antennomero basale giallo-rossiccio; zampe gialle. La reticolazione del capo è svanita, quella del pronoto vigorosa e quella delle elitre netta. La punteggiatura del capo è netta. Tubercoletti poco distinti stanno sul pronoto; le elitre sono coperte di tubercoletti distinti. Edeago figg. 108-109, spermateca fig. 110, 6° urotergo libero del maschio fig. 111.

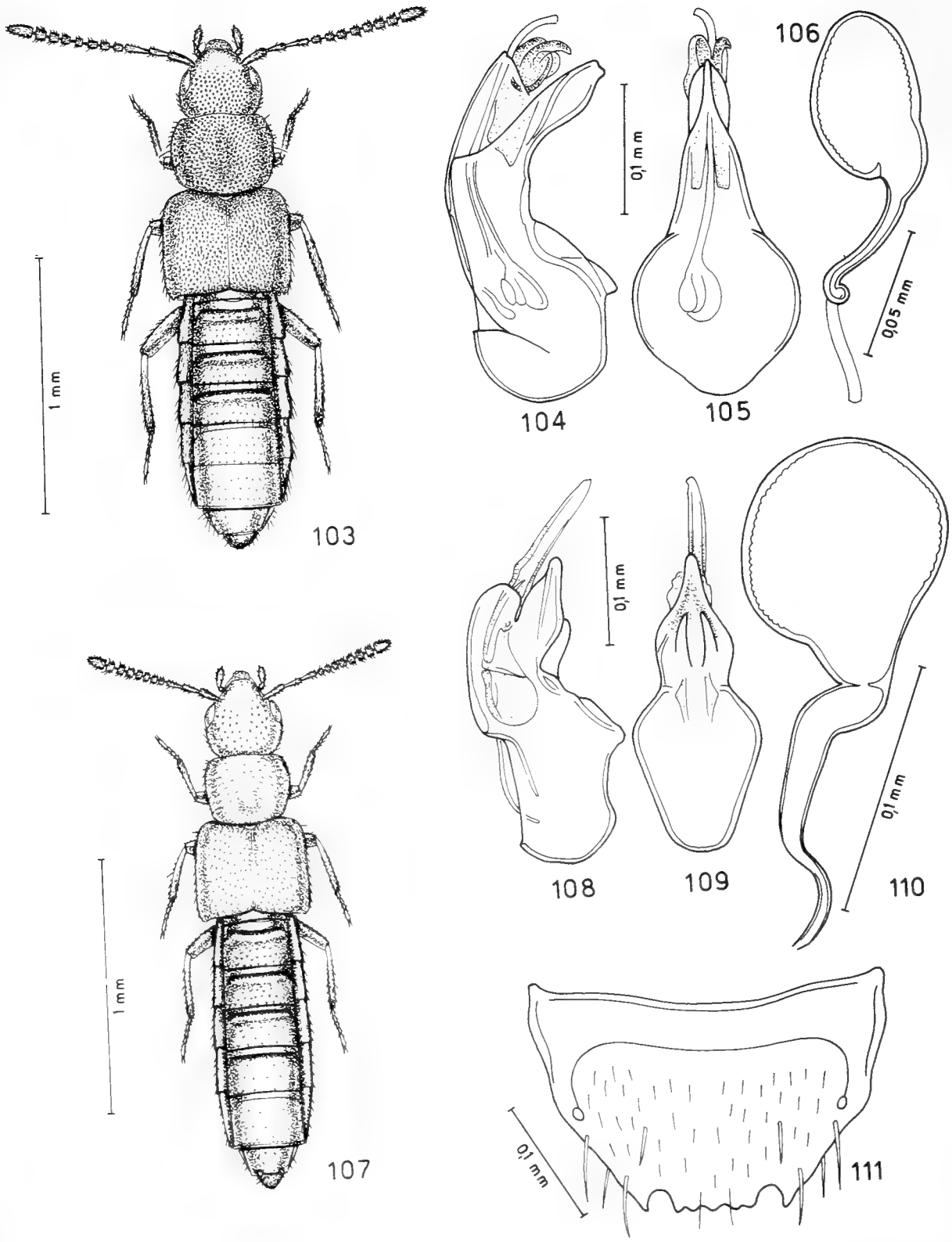
COMPARAZIONI. Il colore del corpo della nuova specie è simile a quello di *H. seminigriventris* Bernhauer, 1932 dello Zaire, tuttavia il pronoto assai poco trasverso della nuova specie e i caratteri del 6° urotergo libero del maschio, sono elementi sufficienti, tra l'altro, a distinguere la nuova specie dalle varie specie della Regione Malgascia e della Sottoregione Africana Orientale.

Cameronium lamuense sp. n. (Figg. 112-115)

TIPO. Holotypus ♂, Kenya, Lamu, S de Mpekaton, 26.X.1977, (Mahnert & Perret leg., MG).

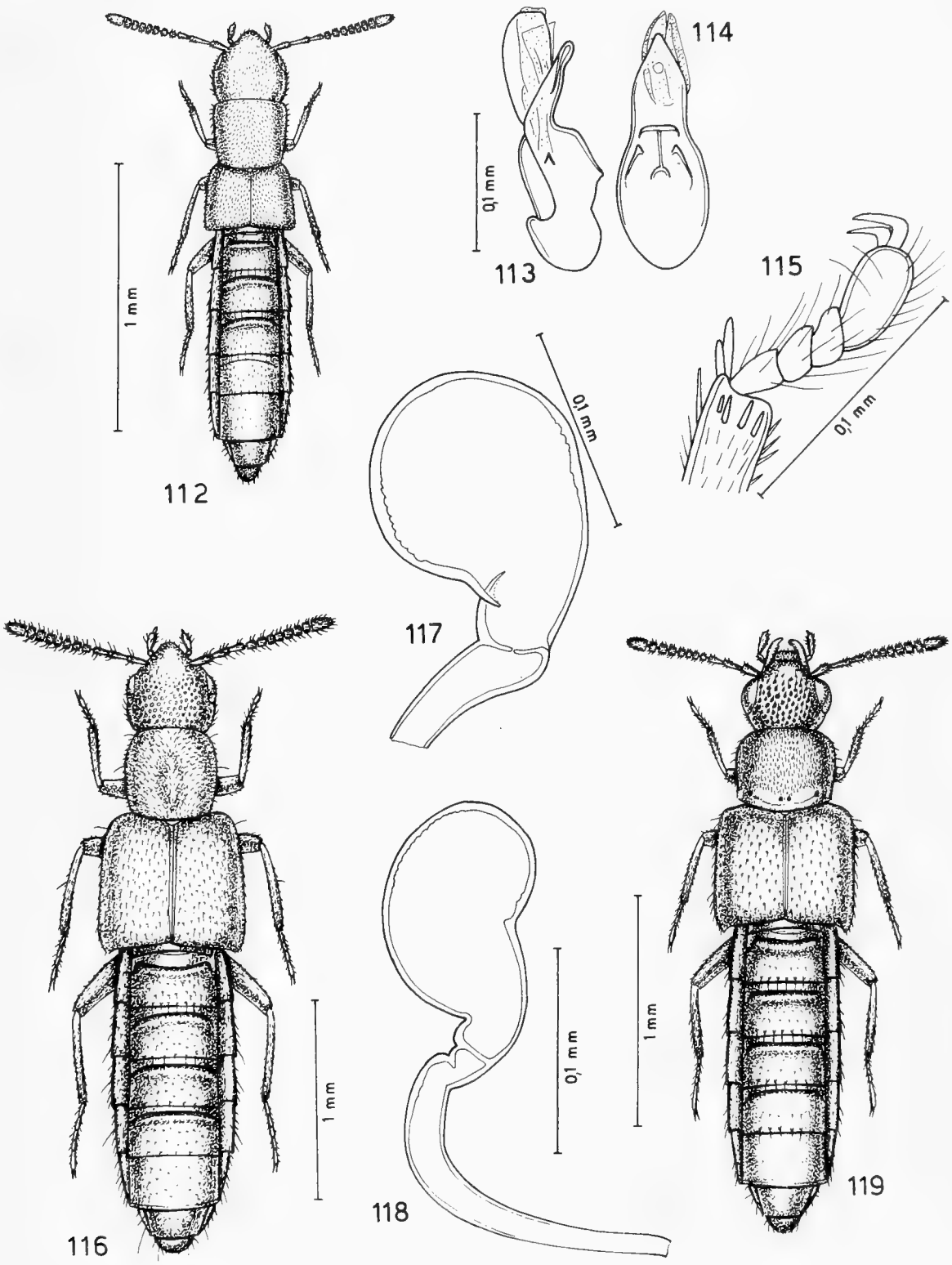
DESCRIZIONE. Lungh. 1,6 mm. Avancorpo debolmente opaco, addome lucido. Corpo giallo-rossiccio; 4° urite libero e metà basale del 5° bruno-rossicci; antenne rossicce con i due antennomeri basali giallo-rossicci; zampe gialle. Una reticolazione svanita copre tutto il corpo. Il capo presenta punteggiature fitta, le elitre punteggiatura svanita. Il pronoto è coperto di tubercoletti confusi nella reticolazione svanita e presenta una debole depressione longitudinale mediana posteriore. I tre uroterghi basali sono coperti di tubercoletti ben salienti, gli uroterghi liberi 4° e 5° hanno tubercoletti distinti. Edeago figg. 113-114.

COMPARAZIONI. Un'altra specie del genere *Cameronium* Koch, 1936, presenta elitre appena più corte del pronoto: *C. malindense* Pace, 1991, pure del Kenya. La nuova specie si distingue da esso soprattutto perché presenta un dente a ciascun lato dell'edeago.



FIGG. 103-111

Habitus, edeago in visione laterale e ventrale, spermateca e 6° urotergo libero del ♂. 103-106: *Homalota mutarensis* sp. n.; 107-111: *Homalota bicristata* sp. n.



FIGG. 112-119

Habitus, edeago in visione laterale, spermateca e tarsi anteriori. 112-115: *Cameronium lamuense* sp. n.; 116-117: *Linoglossa* (s. str.) *arrowi* (Bernhauer), holotypus.; 118-119: *Linoglossa (Lophoglossa) collaris* sp. n.

Linoglossa (Lophoglossa) collaris sp. n. (Figg. 118-119)

TIPO. Holotypus ♀, Kenya, Miss. Kaimosi, 1650 m, 10.XI.1974, (Mahnert & Perret leg. MG).

DESCRIZIONE. Lungh. 2,6 mm. Corpo lucido, tranne il pronoto che è opaco. Corpo giallo-rossiccio; antenne bruno-rossicce con antennomeri 1°, 2° e 11° giallo-rossicce; zampe rossicce. Il capo è privo di reticolazione, tranne tra le antenne dove esiste una reticolazione distinta, la sua punteggiatura è profonda e fittissima. Il pronoto presenta superficie rugosa, tranne una fascia posteriore coperta di reticolazione molto superficiale. Le elitre sono coperte di punteggiatura netta e di reticolazione distinta. I tre uroterghi basali presentano reticolazione svanita, i tre seguenti reticolazione vigorosa. Spermateca fig. 118.

COMPARAZIONI. La nuova specie è distinta da *L. kamerunensis* (Bernhauer, 1915), per avere gli occhi più lunghi delle tempie, per il sistema di punteggiatura del pronoto e delle elitre e per la forma della spermateca che, benché simile nelle due specie, in *kamerunensis* presenta lunghe docce interne del bulbo distale (assenti nella spermateca della nuova specie) e parte prossimale avvolta a spirale.

Linoglossa (Lophoglossa) kayovensis sp. n. (Figg. 127-129)

TIPO. Holotypus ♀, Rwanda, Kayove, 2100 m, 15.V.1973, (Werner leg., MG).

DESCRIZIONE. Lungh. 2,2 mm. Corpo lucido e rossiccio scuro; pronoto bruno rossiccio; estremità addominale giallo-rossiccia; antenne bruno-rossicce con i tre antennomeri basali rossicci; zampe giallo-rossicce. Il capo presenta punteggiatura ombelicata netta, tranne sulla fronte dove la punteggiatura è indistinta per la presenza di reticolazione vigorosa. Il pronoto è coperto di granuli robusti e ha una depressione posteriore. Tubercoletti netti su un fondo a reticolazione distinta, stanno sulle elitre. Gli uroterghi sono distintamente reticolati, tuttavia sui tre basali la reticolazione è superficiale. Spermateca figg. 127-128.

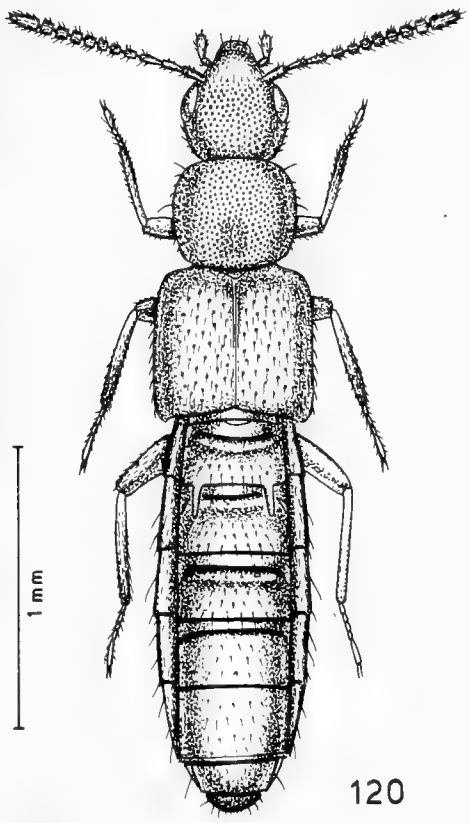
COMPARAZIONI. La nuova specie è ben distinta da *L. kamerunensis* (Bernhauer, 1915), per avere le elitre nettamente meno larghe rispetto la larghezza del pronoto e per la presenza di granuli robusti sul pronoto (punteggiatura fitta sul pronoto di *kamerumensis*). Inoltre il bulbo distale della spermateca è subsferico nella nuova specie e ovale in *kamerunensis*; la parte prossimale della spermateca è sublaminare nella nuova specie e tubulare e avvolta a spirale in *kamerunensis*.

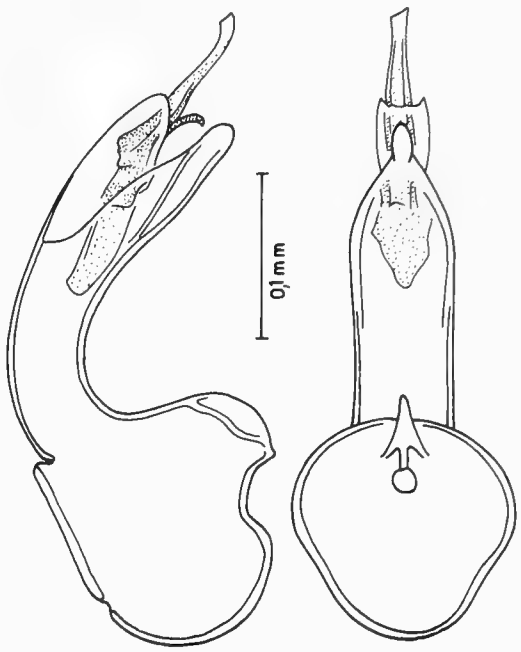
Linoglossa (s. str.) **spinosa** (Figg. 120-122)

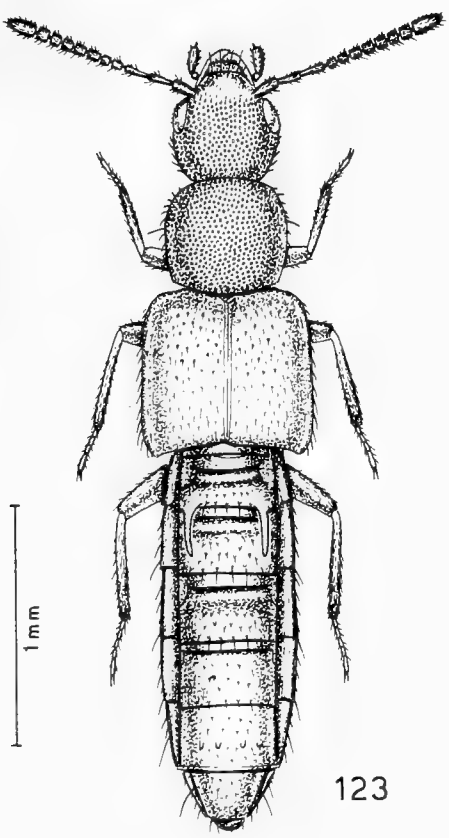
TIPI. Holotypus ♂, Kenya, Mt. Aberdare, Parc National, 1200 m, 25.XI.1974, (Mahnert & Perret leg., MG).

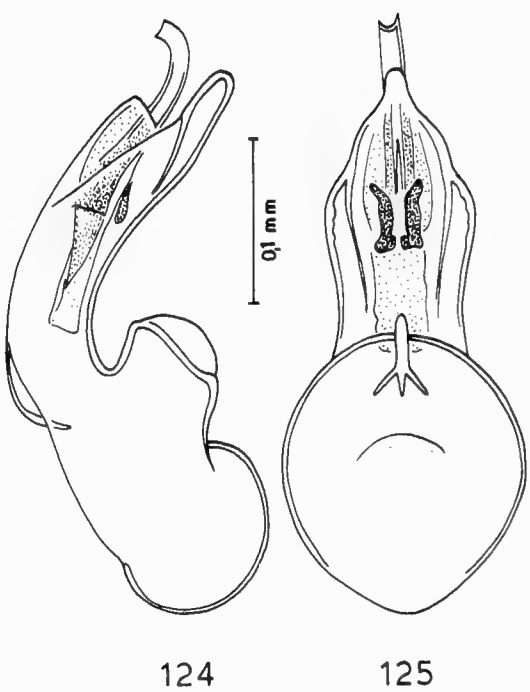
Paratypus: 1 ♂, Kenya, Embu, Irangi Forest, 2000 m, 11.X.1977, (Mahnert & Perret leg., CPA).

DESCRIZIONE. Lungh. 2,8 mm. Capo e pronoto debolmente lucidi, elitre e addome lucidi. Corpo bruno-rossiccio; metà posteriore delle elitre e uriti liberi 3° e 4° bruni; antenne bruno-rossicce con i due antennomeri basali gialli; zampe rossicce. La punteggiatura del capo è netta, quella del pronoto e delle elitre è distinta. Il capo e il pronoto non presentano distinta reticolazione, presente invece sulle elitre. I tre



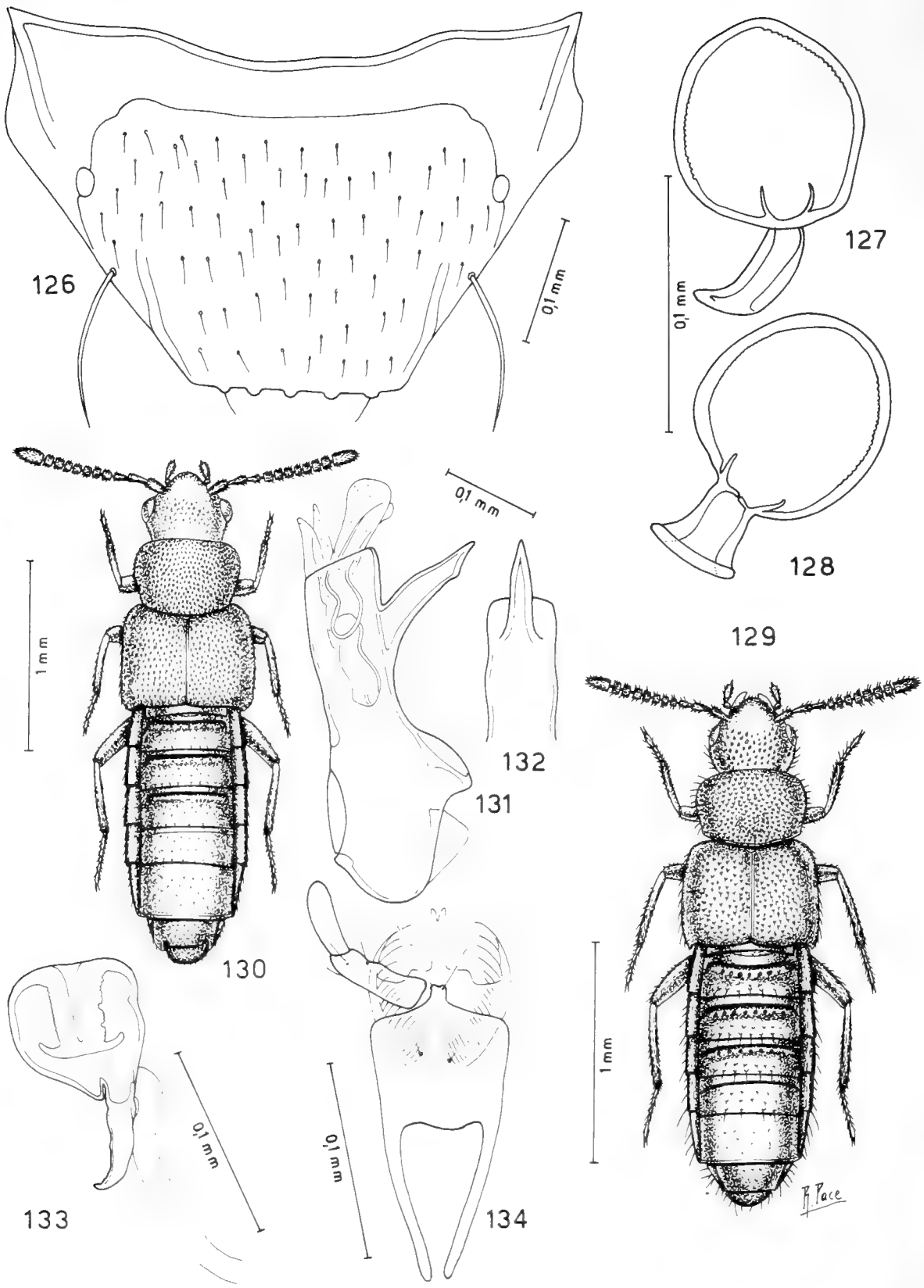






FIGG. 120-125

Habitus ed edeago in visione laterale e ventrale. 120-122: *Linoglossa* (s. str.) *spinosa* sp. n.: 123-125: *Linoglossa* (s. str.) *abaluya* sp. n.



FIGG. 126-134

Sesto urotergo libero della ♀, spermateca, habitus, edeago in visione laterale e suo apice in visione ventrale e labio con palpo labiale. 126: *Linoglossa* (s. str.) *abaluya* sp. n.; 127-129: *Linoglossa (Lophoglossa) kayovensis* sp. n.; 130-134: *Pseudosilusa rudis* (Fauvel), lectotypus ♂ e paralectotypus ♀.

uroterghi basali sono coperti di reticolazione svanita; gli uroterghi liberi 4° e 5° hanno reticolazione vigorosa. Edeago figg. 121-122.

COMPARAZIONI. Specie simile a *L. arrowi* (Bernhauer, 1915), pure del Kenya, ma la nuova specie ha le elitre meno sviluppate, con punteggiatura netta e sparsa (punteggiatura fittissima, confusa nella reticolazione, in *arrowi*).

Linoglossa (s. str.) **abaluya** sp. n. (Figg. 123-126)

TIPO. Holotypus ♂, Kenya, Mt. Elgon, Forest Reserve, 2400 m, 14.XI.1974, (Mahnert & Perret leg., MG).

DESCRIZIONE. Lungh. 3,1 mm. Capo e pronoto opachi, elitre debolmente lucide, addome lucido. Corpo giallo-rossiccio con uriti liberi 3°, 4° e 5° bruno-rossicci; antenne bruno-rossicce con i due antennomeri basali e la base del terzo gialli; zampe gialle con tibie bruno-rossicce. a reticolazione del capo e del pronoto è netta e fine, quella delle elitre è vigorosa. La punteggiatura del capo e del pronoto è distinta, quella delle elitre è netta sulla metà basale e svanita sul resto delle elitre. I tre uroterghi basali presentano reticolazione svanita, gli uroterghi 4° e 5° reticolazione vigorosa. Edeago figg. 124-125, 6° urotergo libero del ♂ fig. 126.

ETIMOLOGIA. La nuova specie prende nome dagli Abaluya, sottogruppo etnico dei Bantu, stanziato presso il Mt. Elgon, località tipica.

COMPARAZIONI. Specie simile alla precedente *L. spinosa* sp. n.. Da essa è distinta perché presenta elitre punteggiate nettamente solo alla metà basale ed edeago molto meno ampiamente ricurvo al lato ventrale e più largo nella regione apicale, se visto ventralmente.

Diestota bifurcata sp. n. (Figg. 149-152)

TIPO. Holotypus ♂, Kenya, Shimba Hills, 29.XI.1974, (Mahnert & Perret leg., MG).

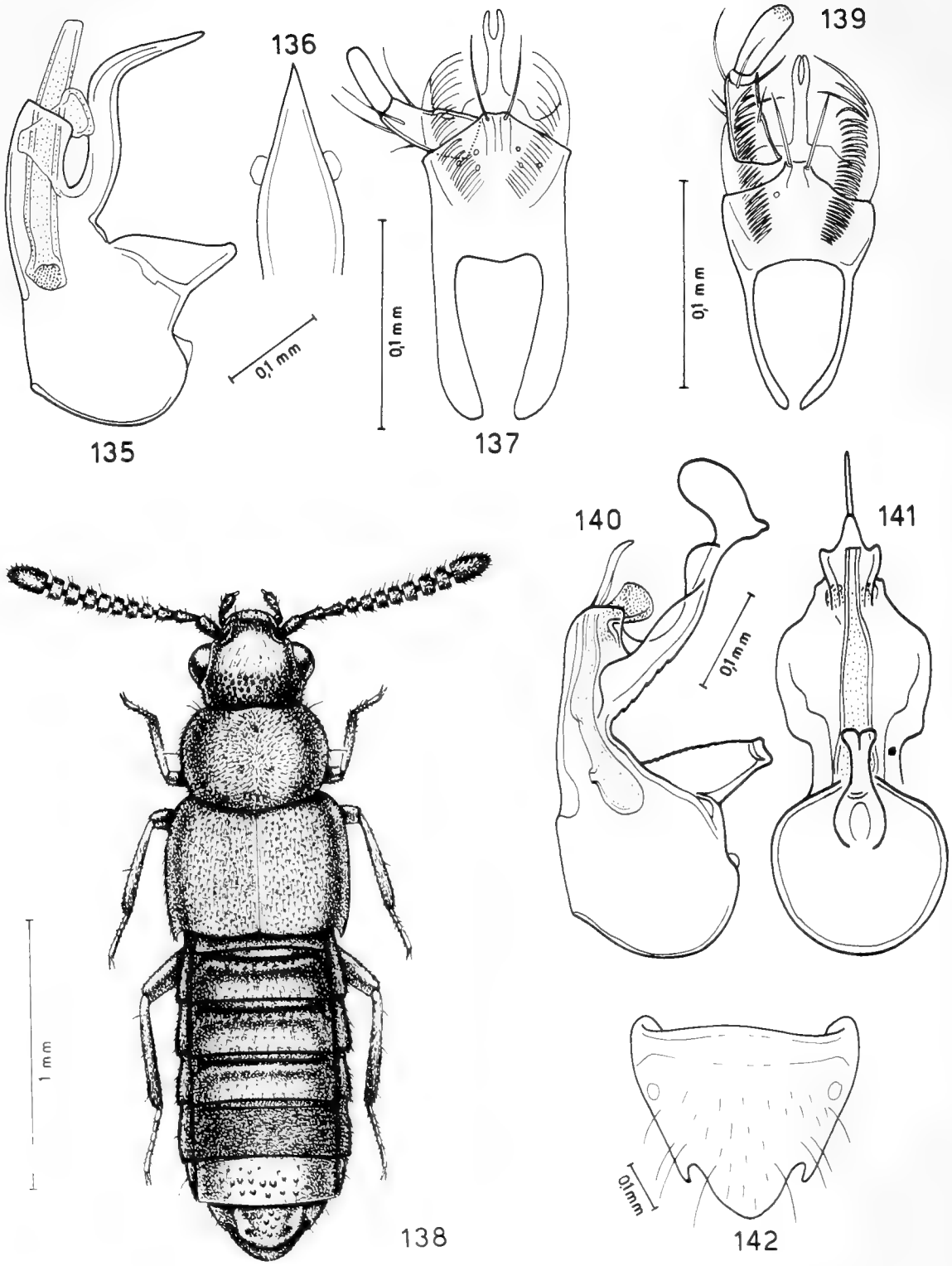
DESCRIZIONE. Lungh. 1,9 mm. Corpo lucido e giallo-rossiccio; capo e uriti liberi 3°, 4° e 5° bruni; antenne brune con i tre antennomeri basali gialli; zampe gialle. La reticolazione del capo e delle elitre è distinta, quella del pronoto netta, quella degli uroterghi svanita. La punteggiatura del capo è ombelicata e netta, quella del pronoto è indistinta, quella delle elitre svanita. Edeago figg. 150-151, 6° urotergo libero del maschio fig. 152.

COMPARAZIONI. Specie affine a *D. africana* Pace, 1986, a motivo della forma simile dell'edeago e dell'habitus. La nuova specie differisce da essa per avere gli antennomeri 4° e 5° nettamente trasversi (e non lunghi quanto larghi come in africana), per i caratteri del 6° urotergo libero del maschio e per l'edeago non fortemente ristretto a metà, in visione ventrale, con il bulbo basale non così molto sviluppato come in *africana*.

Diestota mombasaensis sp. n. (Figg. 153-154)

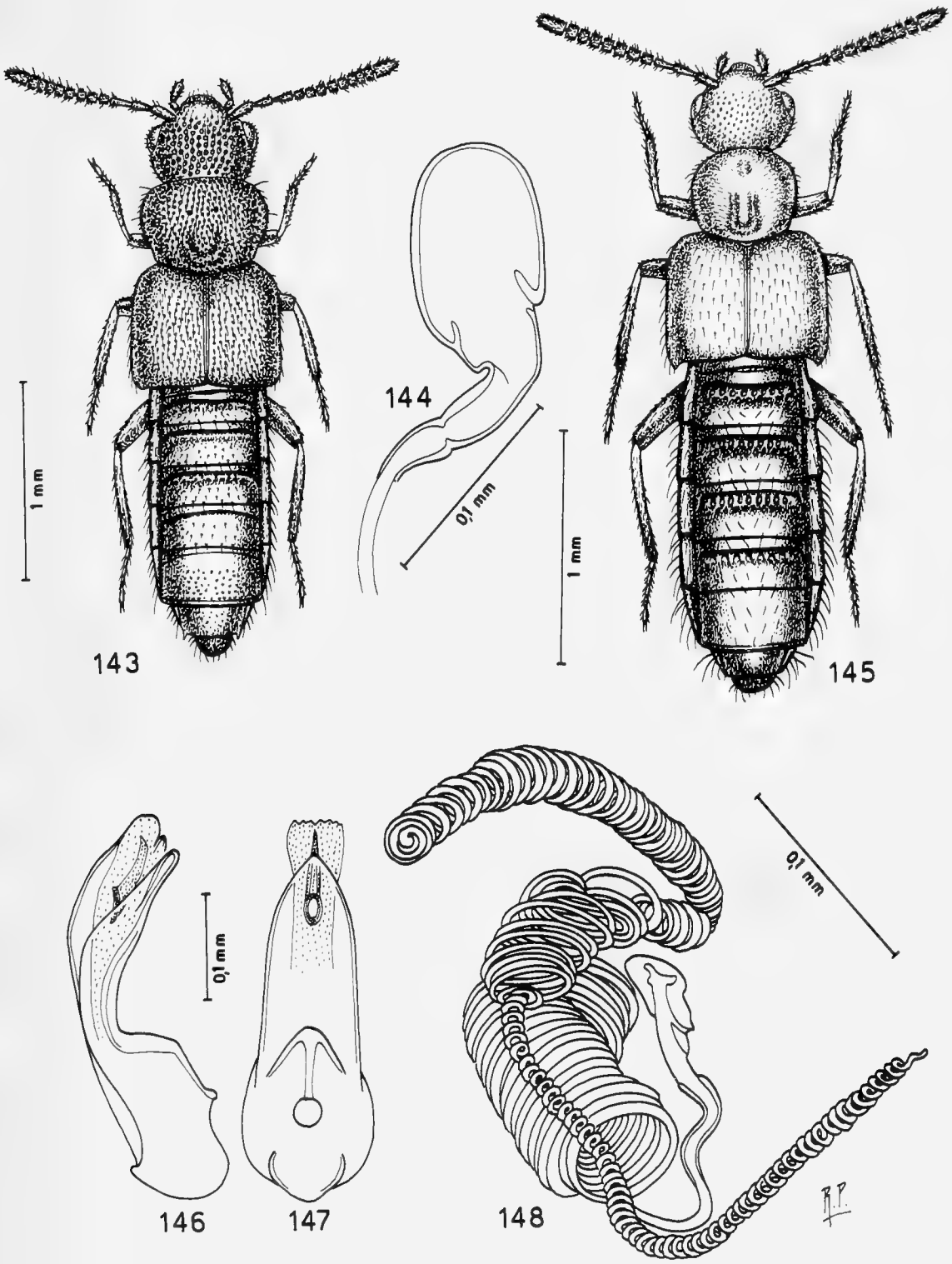
TIPI. Holotypus ♀, Kenya, Ile Mombasa, 29.XI.1974, (Mahnert & Perret leg., MG).
Paratypus: 1 ♀, stessa provenienza, (CPA).

DESCRIZIONE. Lungh. 1,9 mm. Corpo lucido e giallo-rossiccio; metà posteriore delle elitre bruno-rossiccia; antenne brune con i due antennomeri basali e base del



FIGG. 135-142

Edeago in visione laterale e suo apice in visione ventrale, labio con palpo labiale, habitus, edeago in visione ventrale e 6° urotergo libero del ♂. 135-137: *Pseudosilusa trifoveolata* Bernhauer, lectotypus ♂; 138-142: *Pseudosilusa mindanaoicola* sp. n.



FIGG. 143-148

Habitus, spermateca ed edeago in visione laterale e ventrale. 143-144: *Coenonica aethiopica* Fauvel, lectotypus ♀; 145-148: *Diestota scotti* (Bernhauer), lectotypus ♂ e paralectotypus ♀.

terzo giallo-rossicci; zampe gialle. La punteggiatura ombelicata del capo è distinta. Il pronoto non presenta tubercoletti e reticolazione distinti. La punteggiatura delle elitre è molto sparsa e netta su un fondo a reticolazione assai poco distinta. Spermateca fig. 154.

COMPARAZIONI. Per l'eccezionale spermateca, grandissima in rapporto alla ridotta taglia dell'Insetto e per la presenza di una fossetta mediana anteriore sul pronoto, questa nuova specie non è identica ad alcuna altra specie nota della Regione Etiopica.

Tomoxelia zerchei sp. n. (Figg. 155-156)

TIPO. Holotypus ♀, Tanzania, Usambara, (coll. Kraatz, DEI).

DESCRIZIONE. Lungh. 3,7 mm. Capo e pronoto opachi, elitre debolmente lucide, addome lucido. Corpo bruno; elitre bruno-giallicce; margini posteriori degli uroterghi rossicci; antenne brune con i tre antennomeri basali giallo-rossicci; zampe gialle. Il capo e il pronoto presentano punteggiatura estremamente svanita, confusa nella netta reticolazione. Tubercoletti poco distinti e confusi nella vigorosa reticolazione stanno sulla superficie delle elitre. Gli uroterghi sono coperti di reticolazione estremamente svanita, a maglie trasverse. Spermateca fig. 156.

ETIMOLOGIA. Specie dedicata al Dr. Lothar Zerche del Deutschen Entomologischen Institut di Eberswalde, che me l'ha data in esame.

COMPARAZIONI. La nuova specie sembra più affine a *T. tropica* Bernhauer, 1901, del Madagascar, a motivo del corpo debolmente punteggiato, che a *T. bisulcata* Bernhauer, 1930, *T. schoutedeni* Bernhauer, 1930 e *T. parvipennis* Bernhauer, 1930, tutte dello Zaire che hanno corpo fortemente punteggiato o hanno pronoto solcato. Il grande sviluppo della spermateca indica che la nuova specie non è uguale a *T. tropica* che ha spermateca poco sviluppata.

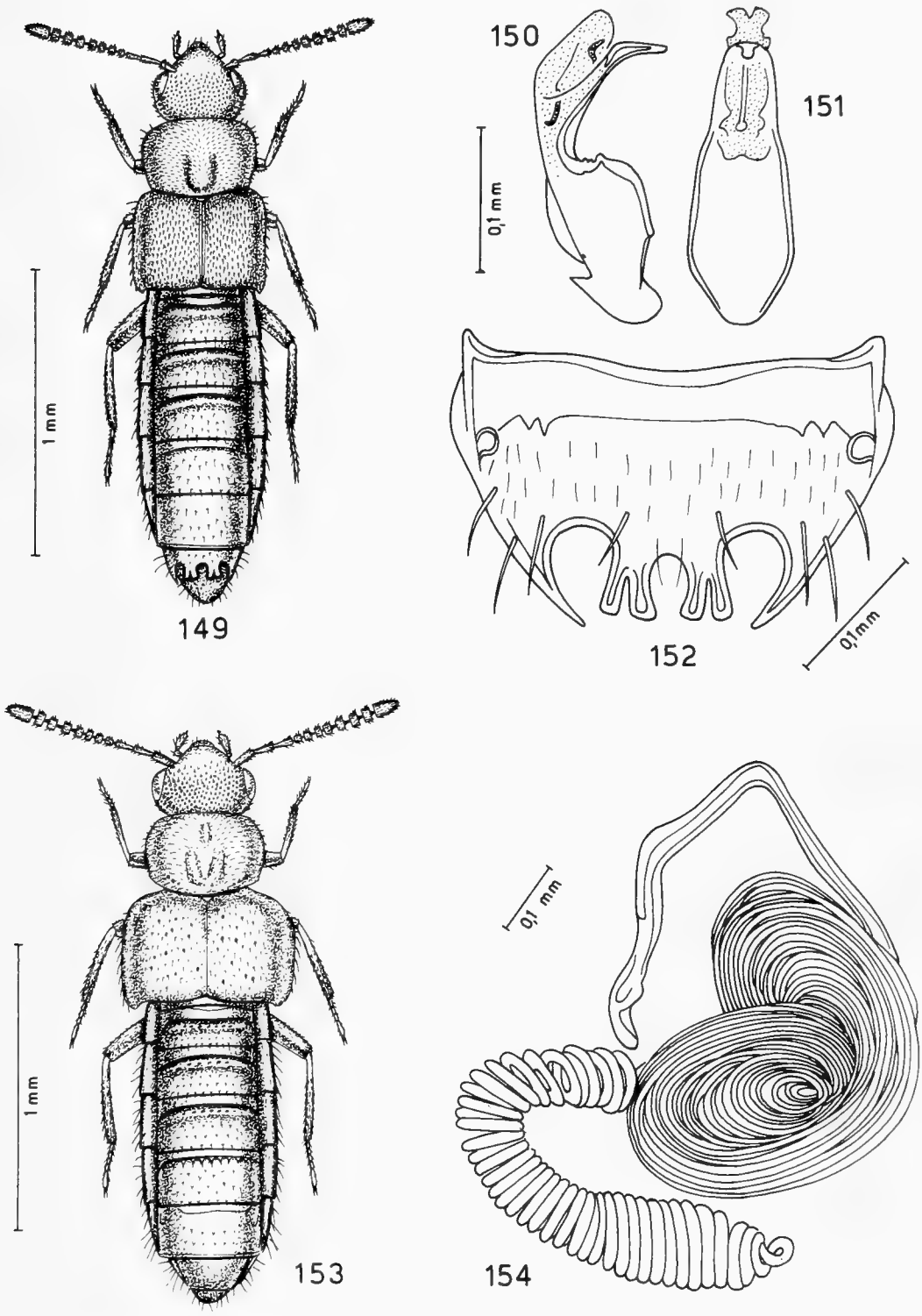
Tomoxelia kenyana sp. n. (Figg. 157-161)

TIPI. Holotypus ♂, Kenya, Shimba Hills, Makadara Forest, 30.XI.1874, (Mahnert & Perret leg., MG).

Paratypus: 1 ♀, stessa provenienza, (CPA).

DESCRIZIONE. Lungh. 2,6 mm. Pronoto molto opaco, resto del corpo lucido. Corpo bruno-rossiccio; capo, pronoto, 4° urite libero e base del 5° bruni; antenne brune con i due antennomeri basali e l'apice dell'undicesimo giallo-rossicci; zampe giallo-rossicce. La punteggiatura ombelicata del capo è netta. Il pronoto presenta una fascia longitudinale mediana e larga di reticulazione vigorosa e fine che dà quasi un aspetto vellutato alla superficie; ai lati di questa fascia la superficie presenta punteggiatura svanita. Le elitre sono coperte di punteggiatura e reticolazione svanite. Edeago figg. 158-159, spermateca fig. 160, 6° urotergo libero del maschio fig. 161.

COMPARAZIONI. Specie esternamente simile a *T. tropica* Bernhauer, 1901, del Madagascar. Tuttavia la presenza di un lieve tubercolo mediano sul quinto urotergo libero del maschio della nuova specie e la presenza di 4 denti smussati al margine posteriore del 6° urotergo libero del maschio della nuova specie (e non di 6 denti



FIGG. 149-154

Habitus, edeago in visione laterale e ventrale, 6° urotergo libero del ♂ e spermateca. 149-152: *Diestota bifurcata* sp. n.; 153-154: *Diestota mombasaensis* sp. n.

come in *tropica*) sono caratteri sufficienti a distinguere le due specie. L'edeago della nuova specie, inoltre, rispetto quello di *tropica* è 1/3 più breve, con bulbo basale poco sviluppato (molto sviluppato in *tropica*).

Tomoxelia nairobiensis sp. n. (Figg. 162-163)

TIPO. Holotypus ♀, Kenya, Mt. Aberdare, Parc National, 2300 m, 25.XI.1974, (Mahnert & Perret leg., MG).

DESCRIZIONE. Lungh. 4,0 mm. Corpo lucido e bruno-rossiccio; capo e uriti liberi 3°, 4° et5° bruni; antenne bruno-rossicce con i tre antennomeri basali rossicci; zampe rossicce. La punteggiatura del capo e del pronoto è ombelicata e netta, quella delle elitre è svanita. Il corpo è privo di reticolazione. Spermateca fig. 163.

COMPARAZIONI. Poiché la nuova specie presenta il 4° antennomero più lungo che largo e spermateca composta di spire ampie, essa si distingue agevolmente sia dalle due nuove specie precedentemente descritte, sia da *T. tropica* Bernhauer, 1091, del Madagascar.

Tomoxelia tambachensis sp. n. (Figg. 164-166)

TIPO. Holotypus ♀, Kenya, Tambach, E Eldoret, 2000 m, 17.XI.1974, (Mahnert & Perret leg., MG).

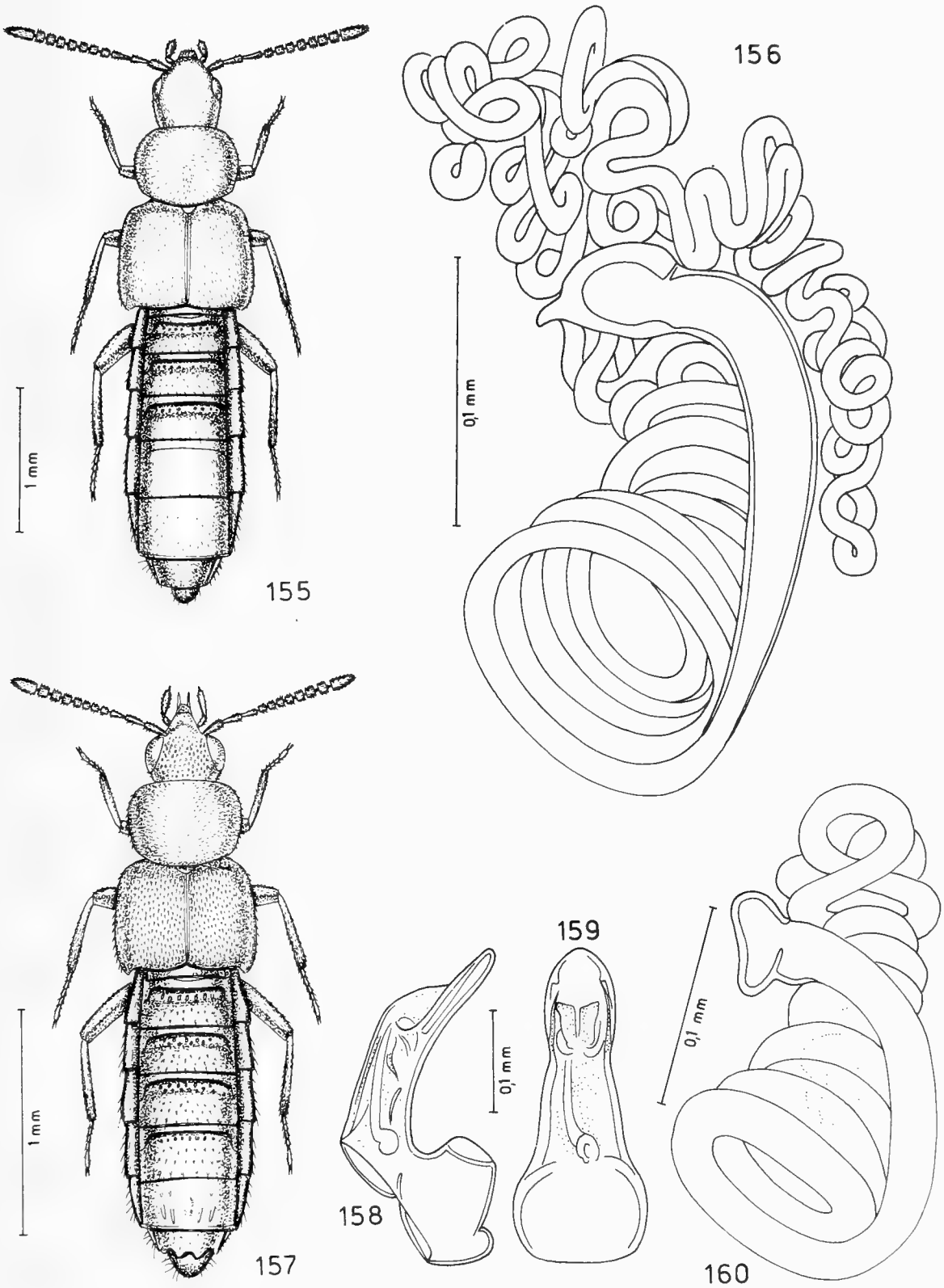
DESCRIZIONE. Lungh. 3,3 mm. Avancorpo debolmente opaco, addome lucido. Corpo giallo-rossiccio; antenne rossicce con i due antennomeri basali giallo-rossicci; zampe giallo-rossicce. L'avancorpo è coperto di reticolazione svanita, l'addome è privo di reticolazione. il capo e il pronoto sono coperti di punteggiatura ombelicata distinta. Tubercoletti svaniti coprono le elitre. Spermateca fig. 165, 6° urotergo libero della femmina fig. 166.

COMPARAZIONI. Il corpo giallo-rossiccio, la punteggiatura del capo e del pronoto distinta, i caratteristici tre denti al margine posteriore del 6° urotergo libero della femmina e la spermateca composta di tubulo spesso e di tubulo sottile avvolti a spirale o a matassa, sono i caratteri distintivi rispetto a *T. tropica* Bernhauer, 1901, del Madagascar, e *T. schoutedeni* Bernhauer, 1930, *T. bisulcata* Bernhauer, 1930, *T. parvipennis* Bernhauer, 1930, dello Zaire.

Tomoxelia kisumuensis sp. n. (Figg. 167-168)

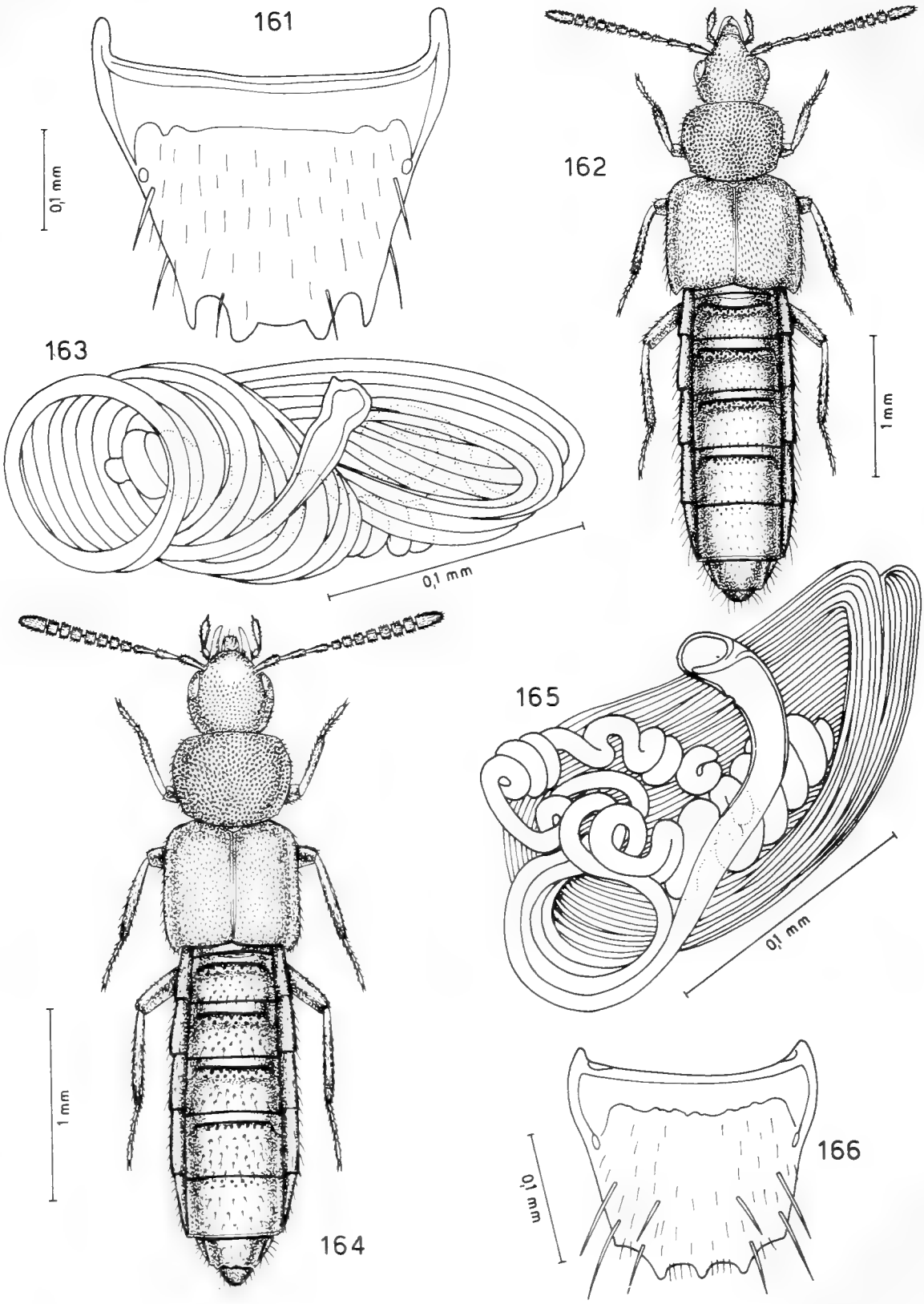
TIPO. Holotypus ♀, Kenya, Miss. Kaimosi, NE Kisumu, 1650 m, 11.XI.1974, (Mahnert & Perret leg., MG).

DESCRIZIONE. Lungh. 2,9 mm. Pronoto opaco, resto del corpo lucido. Corpo giallo-rossiccio; elitre, tranne la base, 4° urite libero e base del 5° bruno-rossicci; antenne brune con i due antennomeri basali e la metà apicale dell'undicesimo, giallo-rossicci; zampe giallo-rossicce. La punteggiatura del capo è ombelicata e netta su un fondo a reticolazione distinta. Il pronoto presenta una larga fascia mediana di reticulazione vigorosa, ai lati della quale è visibile una distinta punteggiatura. Una punteggiatura distinta copre le elitre. Spermateca fig. 168.



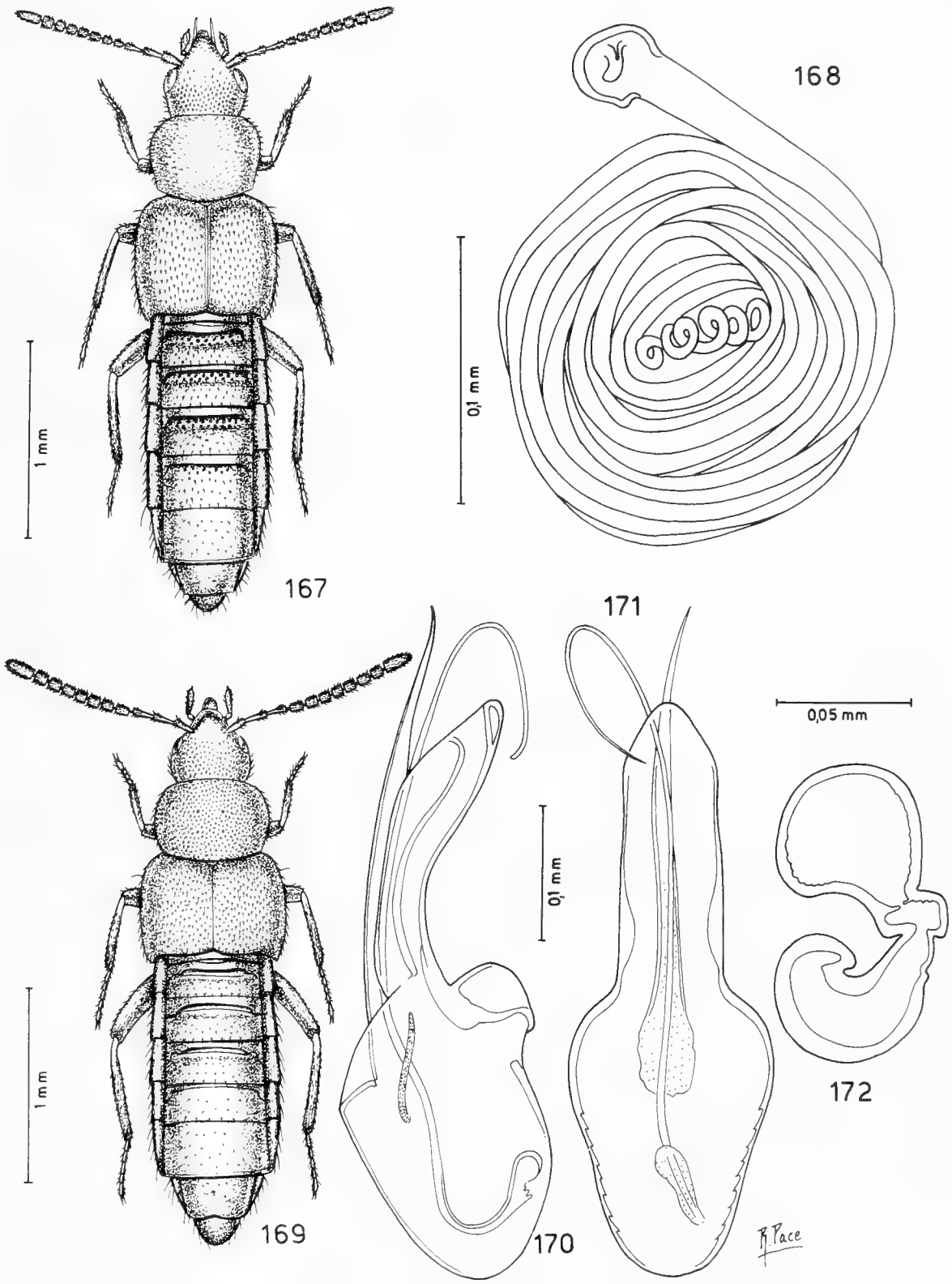
FIGG. 155-160

Habitus, spermateca ed edeago in visione laterale e ventrale. 155-156: *Tomoxelia zerchei* sp. n.; 157-160: *Tomoxelia kenyana* sp. n.



FIGG. 161-166

Sesto urotergo libero del ♂, spermateca e habitus. 161: *Tomoxelia kenyana* sp. n.; 162-163: *Tomoxelia nairobiensis* sp. n.; 164-166: *Tomoxelia tambachensis* sp. n.



FIGG. 167-172

Habitus, spermateca ed edeago in visione laterale e ventrale. 167-168: *Tomoxelia kisumuensis* sp. n.; 169-172: *Nopromaea africana* (Eppelsheim), lectotypus ♂ e paralectotypus ♀.

COMPARAZIONI. Un'altra specie presenta, come la nuova, il 4° antennomero più lungo che largo: *T. nairobiensis* sp. n., sopra descritta. Tuttavia la nuova specie presenta una fascia vigorosamente reticolata sul pronoto, mentre *T. nairobiensis* ha il pronoto uniformemente punteggiato. Inoltre la spermateca della nuova specie è molto meno sviluppata ed è composta di ampie spire.

Nopromaea umtaliensis sp. n. (Figg. 175-176)

TIPO. Holotypus ♀, Zimbabwe (Rhodésie), Umtali, II.1969, (R. Mussard leg., MG).

DESCRIZIONE. Lungh. 3,6 mm. Corpo lucido e bruno; margine posteriore degli uriti bruno-rossiccio; antenne rossicce con i due antennomeri basali giallo-rossicci; zampe rossicce. L'avancorpo è coperto di punteggiatura profonda. Il pronoto presenta una fascia posteriore priva di punteggiatura e due solchi mediani posteriori lievemente divergenti in avanti. Spermateca fig. 176.

COMPARAZIONI. La nuova specie è affine a *N. fortepunctata* (Eichelbaum, 1913), pure dell'Africa Orientale, a motivo della forma della spermateca e per il corpo fortemente punteggiato. Ne è distinta, tra l'altro, per avere la parte prossima e della spermateca assai poco sviluppata (nettamente sviluppata in *fortepunctata*, fig. 174) e il 4° antennomero più lungo che largo (trasverso in *fortepunctata*).

Millotoca kenyana sp. n. (Figg. 177-180)

TIPI. Holotypus ♂, Kenya, Shimba Hills, Makadara Forest, 30.XI.1974, (Mahnert & Perret leg., MG).

Paratypus: 1 ♀, stessa provenienza, (CPA).

DESCRIZIONE. Lungh. 2,4 mm. Corpo lucidissimo e giallo-rossiccio; elitre rossicce; antenne gialle; zampe giallo-rossicce. La reticolazione del capo è poco distinta, quella degli uroterghi è a maglie irregolari e trasverse; sul resto del corpo è assente. Il capo non è punteggiato e presenta una bozza tra le antenne e una profonda depressione posteriore trasversa. Il pronoto ha una profonda cavità discale nei due sessi ed è privo di punteggiatura. Un profondo solco longitudinale sta su ciascuna elitra dei due sessi. Edeago figg. 178-179, spermateca fig. 180.

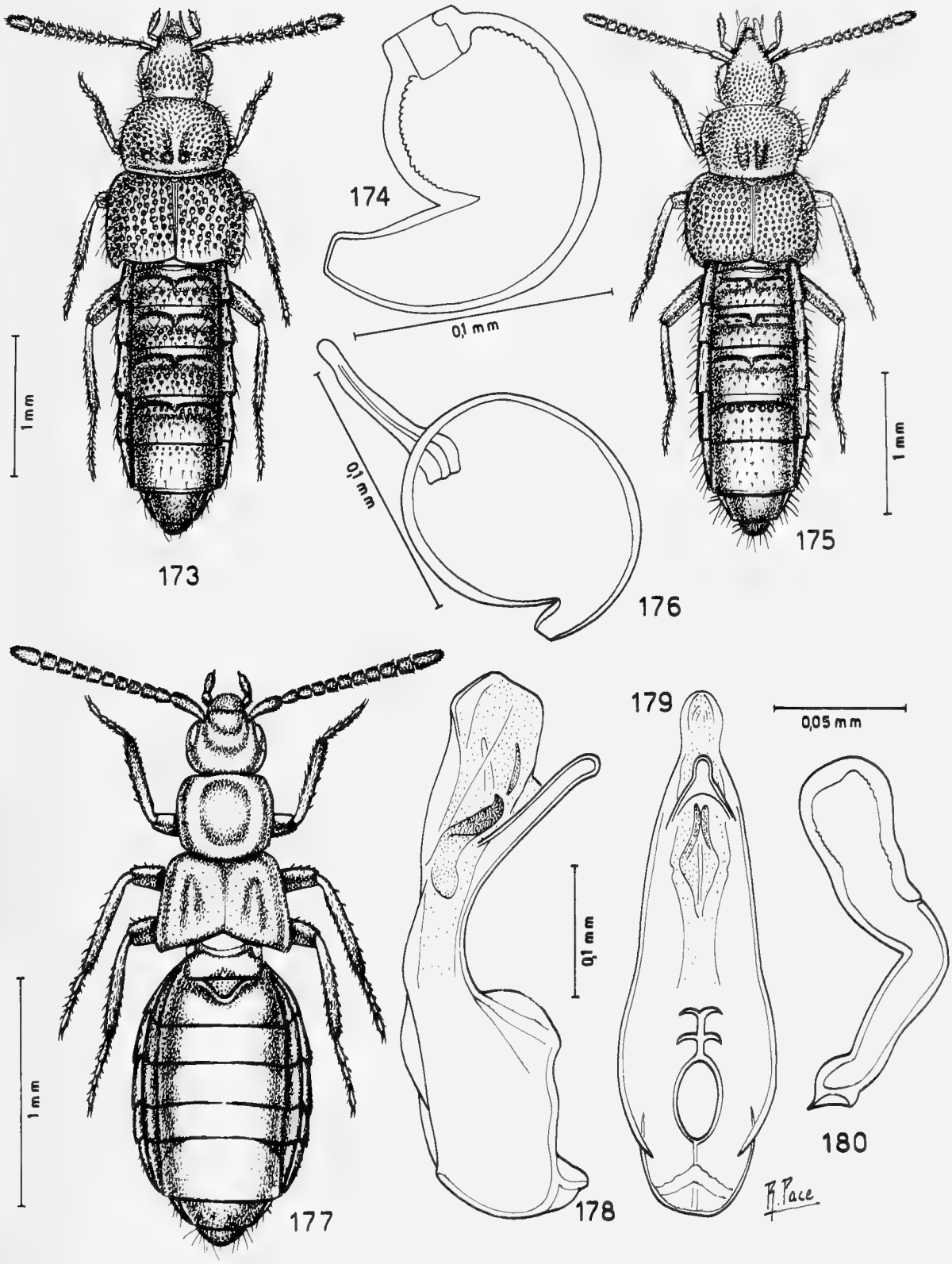
COMPARAZIONI. Specie affinea *M. tanganikae* Seevers, 1957, pr la forma delle antenne e per il pronoto impresso. Se ne distingue per la taglia minore (2,4 mm invece di 3,0 mm) e per le elitre appena più lunghe del pronoto (e non 1/4 più lunghe del pronoto come in *tanganikae*), per il pronoto circa 1/8 più largo che lungo (e non 1/7 come in *tanganikae*). Purtroppo Seevers non ha figurato né edeago, né spermateca, né indicati il sesso degli esemplari di *M. tanganikae*.

Eustenidia (s. str.) **makadarica** sp. n. (Figg. 181-184)

TIPI. Holotypus ♂, Kenya, Shimba Hills, makadara For., 30.XI.1974, (Mahnert & Perretleg., MG).

Paratypi: 6 es., stessa provenienza, (MG, CPA).

DESCRIZIONE. Lungh. 1,3 mm. Corpo lucido e giallo-rossiccio; antenne rossicce con i due antennomeri basali giallo-rossicci; zampe giallo-rossicce. La punteggiatura



FIGG. 173-180

Habitus, spermateca ed edeago in visione laterale e ventrale. 173-174: *Nopromaea fortepunctata* (Eichelbaum), lectotypus ♀; 175-176: *Nopromaea umtaliensis* sp. n.; 177-180: *Millotoca kenyana* sp. n.

del capo è distinta. Tubercoletti salienti coprono il pronoto, le elitre e l'addome. Il solco mediano del pronoto non raggiunge il margine anteriore, né il posteriore. Posteriormente il solco mediano del pronoto è delimitato da due deboli depressioni longitudinali. Edeago figg. 182-183, spermateca fig. 184.

COMPARAZIONI. Si veda sotto la chiave delle specie.

Eustenidia (s. str.) **zimbabwensis** sp. n. (Figg. 185-186)

TIPO. Holotypus ♀, Zimbabwe (Rhodésie), Umtali, II.1969, (R. Mussard leg., MG).

DESCRIZIONE. Lungh. 1,3 mm. Corpo lucido e giallo-rossiccio; elitre bruno-rossicce; antenne rossicce; zampe giallo-rossicce. La punteggiatura del capo è fitta e netta. Quella del pronoto è netta solo in avanti, ai lati e posteriormente, cioè sul disco essa è fine e superficiale. Tubercoletti netti coprono le elitre. Tutto il corpo è privo di reticolazione. Spermateca fig. 186.

COMPARAZIONI. Si veda sotto la chiave delle specie.

Eustenidia (s. str.) **kisumuorum** sp. n. (Figg. 190-191)

TIPI. Holotypus ♀, Miss. Kaimosi, NE Kisumu, 1650 m, 11.XI.1974, (Mahnert & Perret leg., MG).

Paratypus: 1 ♀, stessa provenienza, (CPA).

DESCRIZIONE. Lungh, 2,0 mm. Corpo lucido e giallo-rossiccio; metà posteriore delle elitre, bruno-rossiccia; antenne bruno-rossicce con i due antennomeri basali e la metà apicale dell'undicesimo antenomero, giallo-rossicci; zampe giallo-rossicce. Il capo presenta punteggiatura netta, assente sul disco che è convesso. La punteggiatura del pronoto è netta, ma assente su una fascia lungo il margine posteriore. La punteggiatura delle elitre è netta e irregolarmente distribuita. Tutto il corpo è privo di reticolazione. Spermateca fig. 190.

COMPARAZIONI. Si veda sotto la chiave delle specie.

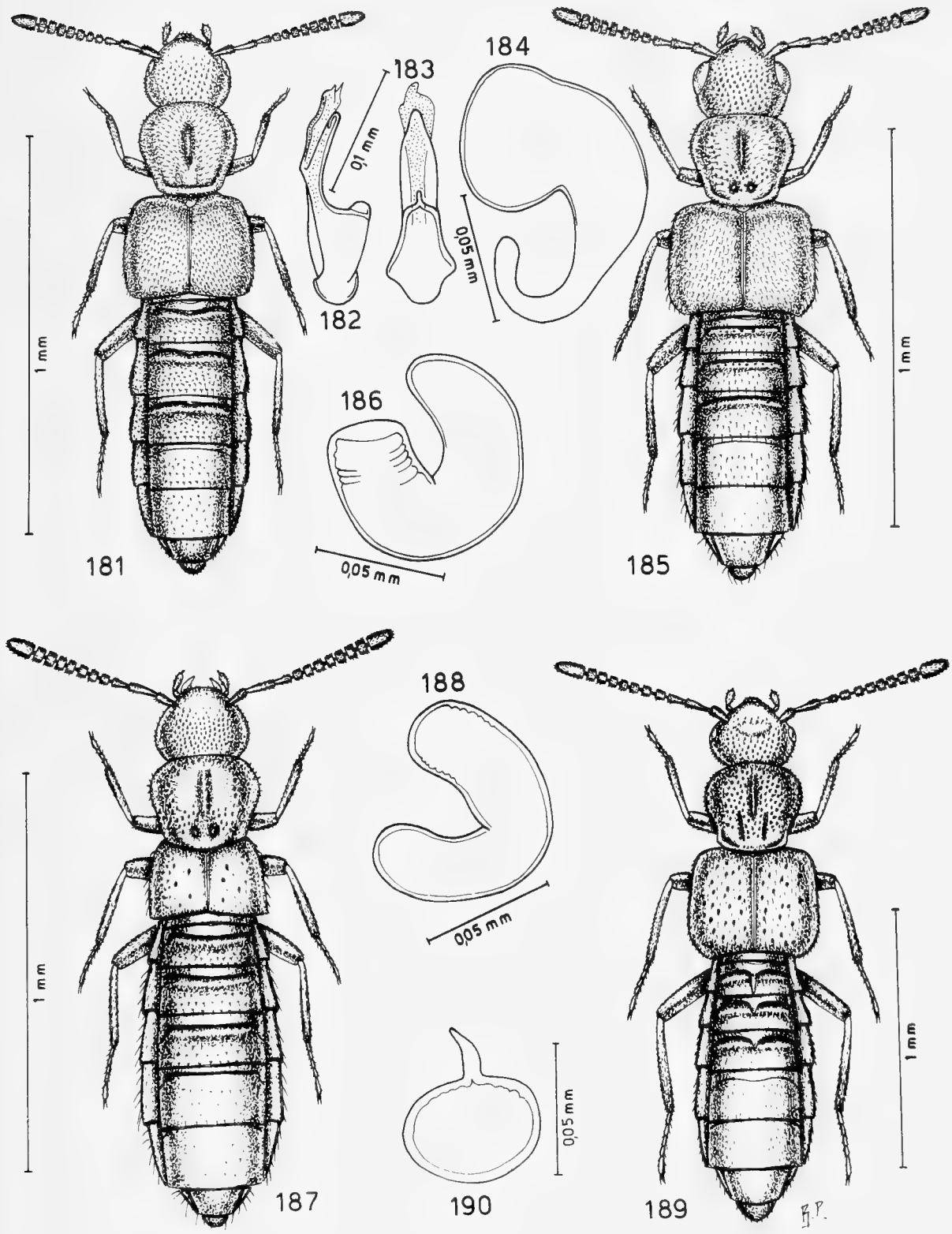
Eustenidia (s. str.) **grassei** sp. n. (Figg. 191-192)

TIPO. Holotypus ♀, Gabon, Belinga, 25.III.1963, (Coiffait leg., Mission Biologique au Gabon, P.P. Grassé directeur, MV).

DESCRIZIONE. Lungh. 2,0 mm. Capo e pronoto opachi, resto del corpo lucido. Corpo rossiccio; elitre sfumate di bruno dal disco alla base; uriti liberi 4° e base del 5° bruni; antenne e zampe rossicce. La punteggiatura del capo è profonda e assente sulla metà anteriore. La punteggiatura del pronoto è pure profonda, ma assente a ciascun lato del solco mediano, ai lati e lungo il margine posteriore del pronoto stesso. La punteggiatura delle elitre è profonda e irregolarmente distribuita. Tutto il corpo è privo di reticolazione. Spermateca fig. 192.

ETIMOLOGIA. Specie dedicata all'illustre zoologo francese Pierre Paul Grassé, direttore della Missione Biologica nel Gabon durante la quale è stata raccolta la nuova specie.

COMPARAZIONI. Si veda sotto la chiave delle specie.



FIGG. 181-190

Habitus, edeago in visione laterale e ventrale e spermateca. 181-184: *Eustenidia* (s. str.) *makadarica* sp. n.; 185-186: *Eustenidia* (s. str.) *zimbabwensis* sp. n.; 187-188: *Eustenidia* (*Microeustenidia* Subg. n.) *umtaliensis* sp. n.; 189-190: *Eustenidia* (s. str.) *kisumuorum* sp. n.

Eustenidia (s. str.) **coiffaiti** sp. n. (Figg. 193-196)

TIPI. Holotypus ♂, Gabon, Belinga, 10.II.1963, (Coiffait leg., Mission Biologique au Gabon, P. P. Grassé directeur, MV).
Paratypus: 1 ♀, stessa provenienza, ma 12.II.1963, (CPA).

DESCRIZIONE. Lungh. 1,5 mm. Capo e pronoto opachi, resto del corpo lucido. Corpo rossiccio; elitre bruno-rossicce; addome giallo-rossiccio con urite libero 4° bruno-rossiccio; antenne rossicce; zampe gialle. I tubercoletti che coprono la superficie del capo sono salienti, fitti e diradati sul disco; quelli del pronoto sono robusti, salienti e assenti a ciascun lato del pronoto che mostra due deboli solchi posteriori e un superficiale solco trasverso basale. Tutto il corpo è privo di reticolazione. Edeago figg. 194-195, spermateca fig. 196.

ETIMOLOGIA. Specie dedicata alla memoria del suo raccoglitore, il Dr. H. Coiffait, noto specialista di Staphylinidae dell'Università di Tolosa. Egli mi ha generosamente donato i due esemplari di *Eustenidia* qui descritti, insieme ad altri esemplari di Aleocharinae, ai primi sintomi della sua malattia che gli ha impedito di continuare i suoi studi sugli Staphylinidae.

COMPARAZIONI. Si veda sotto la chiave delle specie.

Eustenidia (**Microeustenidia** subgen. n.) **umtaliensis** sp. n. (Figg. 187-188)

TIPI. Holotypus ♀, Zimbabwe (Rhodésie), Umtali, II.1969, (R. Mussard leg., MG).
Paratypus: 1 ♀, stessa provenienza, (CPA).

DESCRIZIONE. Lungh. 1,3 mm. Corpo lucido e giallo-rossiccio; antenne bruno-rossicce con i due antennomeri basali e l'undicesimo antennomero rossicci; zampe rossicce. La punteggiatura del capo è fitta e netta. Gli occhi sono molto ridotti, composti di circa 4 ommatidi. La punteggiatura del pronoto è distinta, ma assente a ciascun lato del solco mediano, ai lati e al margine posteriore del pronoto stesso. Tubercoletti salienti stanno solo ai lati delle elitre: verso la sutura sono assai superficiali, ma tra essi esistono alcuni punti grandi. Solo sul fondo dei solchi trasversi basali degli uroterghi è visibile una netta reticolazione. Spermateca fig. 186.

COMPARAZIONI. La nuova specie è distinta dalle precedenti descritte e da altre già note delle sottoregioni africana orientale e malgascia in base ai caratteri esposti nella seguente chiave.

CHIAVE DELLE SPECIE DI *Eustenidia* DELLE SOTTOREGIONI AFRICANA ORIENTALE E MALGASCIA

1 Elitre più lunghe o lunghe quanto il pronoto. Ligula lunga, con due setole laterali. . . . . *Eustenidia* s. str.
(Typus subgeneris: *E. gomyi* Pace)

\- Elitre più corte del pronoto. Ligula corta e larga, senza setole ai lati. . . . . Subgen. *Microeustenidia* n.
(Typus subgen.: *E. mayottensis* Pace)

Sottogenere *Eustenidia* s. str.

1 Elitre più lunghe del pronoto. 2

- Elitre lunghe quanto il pronoto. 6
2 Elitre coperte di punteggiatura molto grossolana e profonda. Lungh. 2,1 mm. Madagascar: Joffreville. . . . . *gomyi* Pace
- Elitre coperte di punteggiatura distinta, ma non grossolana. 3
3 Pronoto bruscamente ristretto all'indietro; bulbo distale della spermateca molto sviluppato, con docce interne presenti. Lungh. 2,0 mm. Gabon: Belinga. . . . . *grassei* sp. n.
- Pronoto dolcemente ristretto all'indietro; bulbo distale della spermateca poco sviluppato, privo di docce interne 4
4 Taglia maggiore: 2,0 mm; punteggiatura delle elitre rada; spermateca ovale. Kenya: Kisumu. . . . . *kisumuorum* sp. n.
- Taglia minore: 1,3-1,5 mm; punteggiatura delle elitre fitta; spermateca a tubulo allungato. 5
5 Taglia minore: 1,3 mm; occhi più lunghi delle tempie; quarto antennomero trasverso; spermateca corta. Rodesia: Umtali. . . . . *zimbabwensis* sp. n.
- Taglia maggiore: 1,5 mm; occhi più corti delle tempie; quarto antennomero più lungo che largo; spermateca lunghissima. Gabon: Belinga. . . . . *coiffaiti* sp. n.
6 Taglia maggiore: 2,2 mm; occhi più sviluppati e sporgenti; quarto antennomero più lungo che largo; a ciascun lato del pronoto esiste un'area priva di punteggiatura. Madagascar: Manangotry (Ft. Dauphin). . . . . *franzi* Pace
- Taglia minore: 1,3 mm; occhi ridotti; quarto antennomero lungo quanto largo; pronoto uniformemente punteggiato. Kenya: Makadara For. . . . . *makadarica* sp. n.

Sottogenere *Microeustenidia* n.

1 Occhi grandi; tempie lunghe quanto gli occhi o lunghe due volte la lunghezza degli occhi. 2
- Occhi estremamente ridotti, poco distinti. 3
2 Pronoto in avanti più largo e all'indietro più ristretto; tubercoletti salienti presso il solco mediano anteriore; edeago più sviluppato e meno profondamente ricurvo al lato ventrale. Lungh. 1,5 mm. Madagascar: Col de Manangotry (Ft. Dauphin). . . . . *manangotryiensis* Pace
- Pronoto in avanti meno largo e all'indietro meno ristretto; tubercoletti molto superficiali presso il solco mediano anteriore; edeago ridotto e più profondamente ricurvo al lato ventrale. Lungh. 1,5 mm. Holotypus: Madagascar: Andasyll Res. Nat., (P. Soga leg., MNP). . . . . *sogai* sp. n.
3 Pronoto coperto di tubercoletti fini e superficiali. 4
- Pronoto coperto di tubercoletti salienti, almeno ai lati. 5
4 Solco mediano anteriore del pronoto, largo; fossette posteriori mediane del pronoto, lunghe; edeago maggiore, meno ampiamente ricurvo al lato ventrale e, in visione ventrale, a lati convergenti verso l'apice.

Lungh. 1,4 mm. Holotypus: Madagascar: Ampitamiolika, (E.R. leg., MNP). . . . . *microps* sp. n.

- Solco mediano anteriore del pronoto, stretto; fossette posteriori mediane, corte; edeago minore, più ampiamente ricurvo al lato ventrale e, in visione ventrale, a lati paralleli nella porzione mediana. Lungh. 1,2 mm. Holotypus: Madagascar: Marojejy Res. Nat., (P. Soga leg., MNP). . . . . *marojejyiensis* sp. n.

5 I tubercoletti presso il solco mediano anteriore del pronoto sono salienti; spermateca ricurva in due parti asimmetriche: la parte comprendente il bulbo distale è molto più lunga della parte comprendente il bulbo prossimale. Lungh. 1,3 mm. Madagascar: Ft. Dauphin. . . . . *dauphinensis* Pace

- I tubercoletti presso il solco mediano anteriore del pronoto sono svaniti; spermateca ricurva in due parti simmetriche. 6

6 Undicesimo antennomero nettamente più lungo dei due antennomeri precedenti considerati insieme; tubercoletti delle elitre assai svaniti sul disco e verso la sutura; bulbo distale della spermateca non dilatato, perciò non distinto dal tubulo mediano della spermateca stessa. Lungh. 1,3 mm. Rodesia: Umtali. . . . . *umtaliensis* sp. n.

- Undicesimo antennomero lungo quanto i due antennomeri precedenti considerati insieme; tubercoletti delle elitre presenti su tutta la superficie. . . . 7

7 Edeago minore, in visione ventrale nettamente stretto; parte terminale del flagello del sacco interno non descrivente 2 spire. Lungh. 1,2 mm. Mayotte: Convalescence. . . . . *mayottensis* Pace

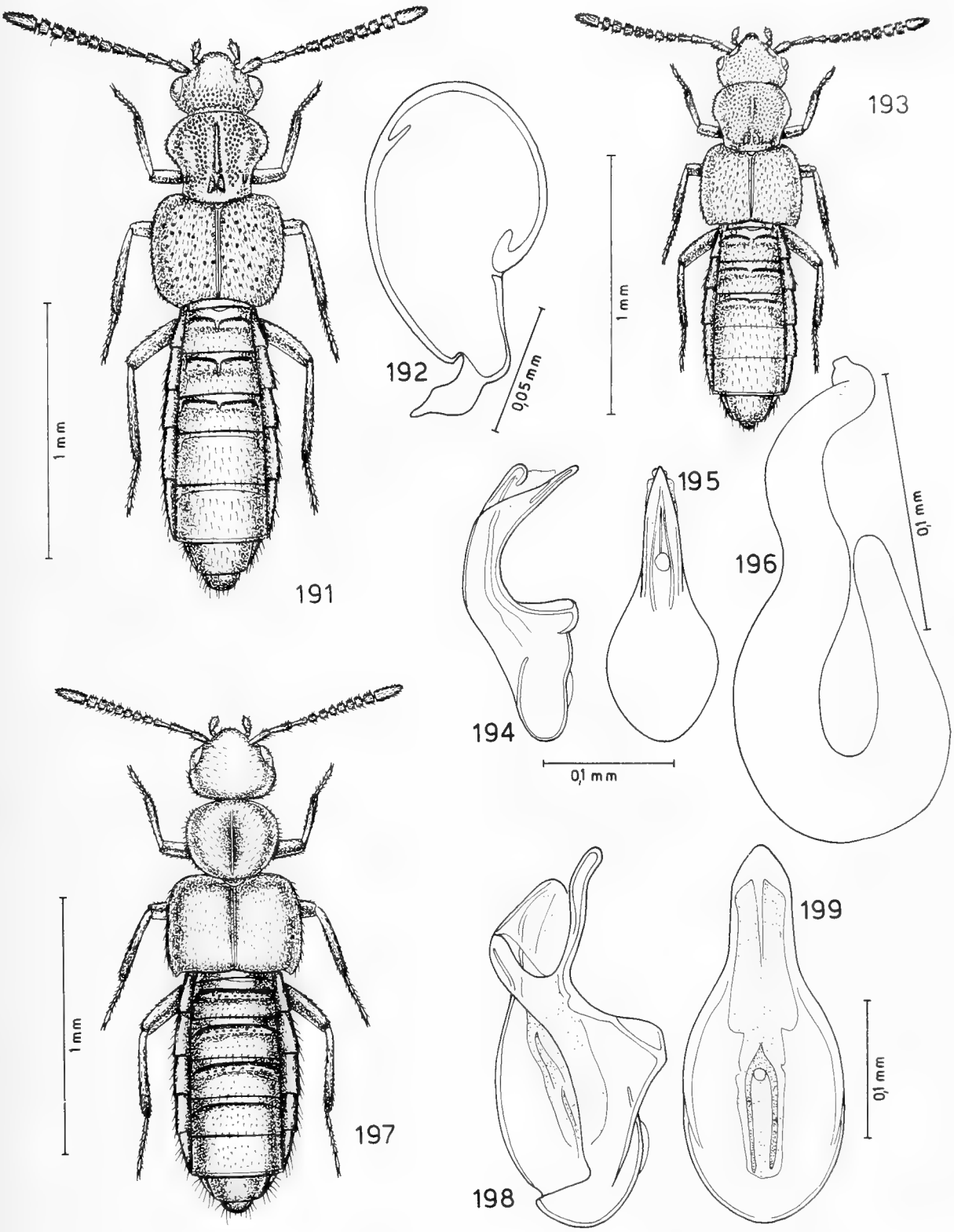
- Edeago maggiore, in visione ventrale largo; parte terminale del flagello del sacco interno descrivente 2 ampie spire. Lungh. 1,15 mm. Holotypus: Madagascar: Ambitsika, (E.R. leg., MNP.). . . . . *pusilla* ps. n.

Cordalia shimbaensis sp. n. (Figg. 197-199)

Tipo. Holotypus ♂, Kenya, Shimba Hills, S Mombasa, 29.XI.1974, (Mahnert & Perret leg., MG).

Descrizione. Lungh. 1,9 mm. Corpo lucido e giallo-rossiccio; capo rossiccio; antenne bruno-rossicce con i due antennomeri basali rossicci e l'undicesimo rossiccio; zampe giallo-rossicce. La punteggiatura del capo è svanita, quella del pronoto è distinta. Le elitre presentano tubercoletti svaniti e sono prive della fossetta basale tipica delle specie del genere: il tipo di edeago e altri caratteri permettono l'attribuzione generica proposta. Tutto il corpo è privo di reticolazione della superficie. Edeago figg. 198-199.

Comparazioni. A motivo dell'assenza di una piccola depressione basale delle elitre, la nuova specie si distingue dalle specie africane. Per la forma dell'edeago e del pronoto è specie nettamente distinta da *C. csikii* Bernhauer, 1915, del Kenya e della Tanzania, mentre appare affine a *C. depressicollis* Pace, 1986 della Tanzania. Tuttavia questa specie ha taglia maggiore (3,0-3,1 mm), il 4° urotergo libero del



FIGG. 191-199

Habitus, edeago in visione laterale e ventrale e spermateca. 191-192: *Eustenidia* (s. str.) *grassei* sp. n.; 193-196: *Eustenidia* (s. str.) *coiffaiti* sp. n.; 197-199: *Cordalia shimbaensis* sp. n.

maschio con spina mediana (assente nella nuova specie) ed edeago di 1/3 più sviluppato, con apice bruscamente ristretto (a forma ovigale nella nuova specie).

Cordalia nakuruensis sp. n. (Figg. 200-203)

TIPI. Holotypus ♂, Kenya, Lac Nakuru Parc Nat., 6.XI.1974, (Mahnert & Perret leg., MG).

Paratypi: 1 ♂ e 1 ♀, stessa provenienza, (MG, CPA).

DESCRIZIONE. Lungh. 3,0 mm. Corpo lucido e giallo-rossiccio; capo e 4° urite libero bruno-rossicci; antenne bruno-rossicce con i due antennomeri basali e l'undicesimo giallo-rossicci; zampe giallo rossicce. L'avancorpo è coperto di punteggiatura distinta e fine. Il capo presenta una depressione mediana protratta posteriormente fino quasi al collo. Il pronoto ha un solco mediano che è interrotto sul quarto posteriore. Tutto il corpo ha superficie priva di reticolazione. Edeago figg. 201-202, spermateca fig. 203.

COMAPARAZIONI. A motivo dei caratteri dell'esoscheletro, dell'edeago e della spermateca, la nuova specie è affine a *C. depressicollis* Pace, 1986, delle Tanzania. Ne è distinta per il pronoto distintamente meno trasverso, per la "crista apicalis" dell'edeago meno sviluppata, per l'apice dell'edeago, in visione ventrale, di forma ogivale (bruscamente ristretto in *depressicollis*) e per l'appuntita introflessione apicale del bulbo distale della spermateca (introflessione largamente smussata in *depressicollis*).

Falagria (Melagria) embuensis sp. n. (Figg. 219-222)

TIPI. Holotypus ♂, Kenya, Embu, Kirimiri Forest, O de Runyeje, 1550 m, 13.X.1977, (Mahnert & Perret leg., MG).

Paratypi: 9 es., stessa provenienza, (MG, CPA).

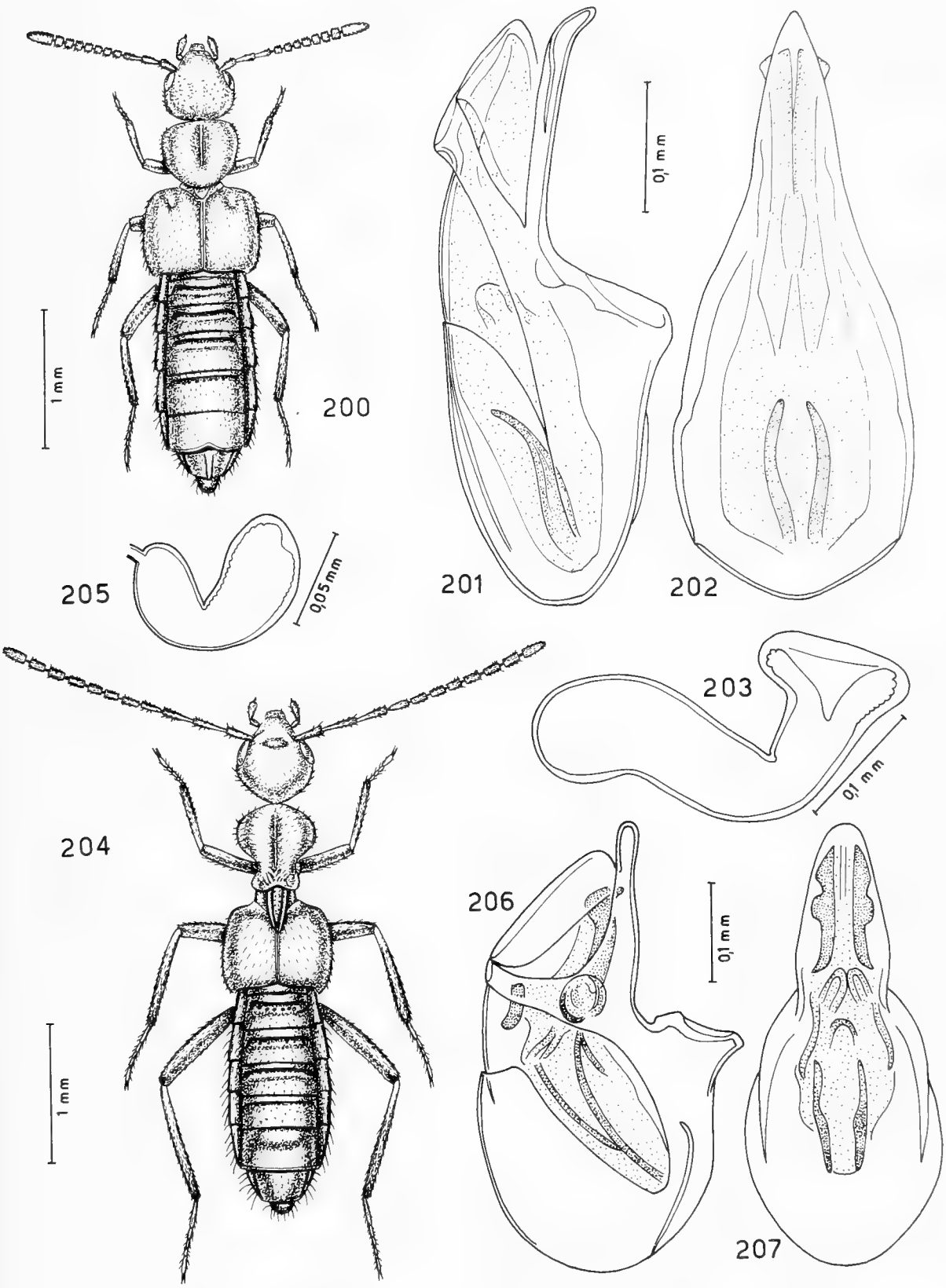
DESCRIZIONE. Lungh. 1,8 mm. Corpo lucido e bruno-rossiccio; uriti liberi 4° e 5° bruni; antenne bruno-rossicce con i due antennomeri basali rossicci e l'undicesimo giallo; zampe giallo-rossicce. L'avancorpo è coperto di tubercoletti fini e poco distinti. Lo scutello e l'addome presentano tubercoletti salienti. Edeago figg. 220-221, spermateca fig. 222.

COMPARAZIONI. Specie che si differenzia da *F. cribrata* Pace, 1984 di "La Réunion" per il corpo radamente coperto di tubercoletti, per l'edeago esile e largo in visione ventrale (stretto in *cribrata*) e per il grande sviluppo della spermateca.

Falagria (Myrmecocephalus) nakuruensis sp. n. (Figg. 223-224)

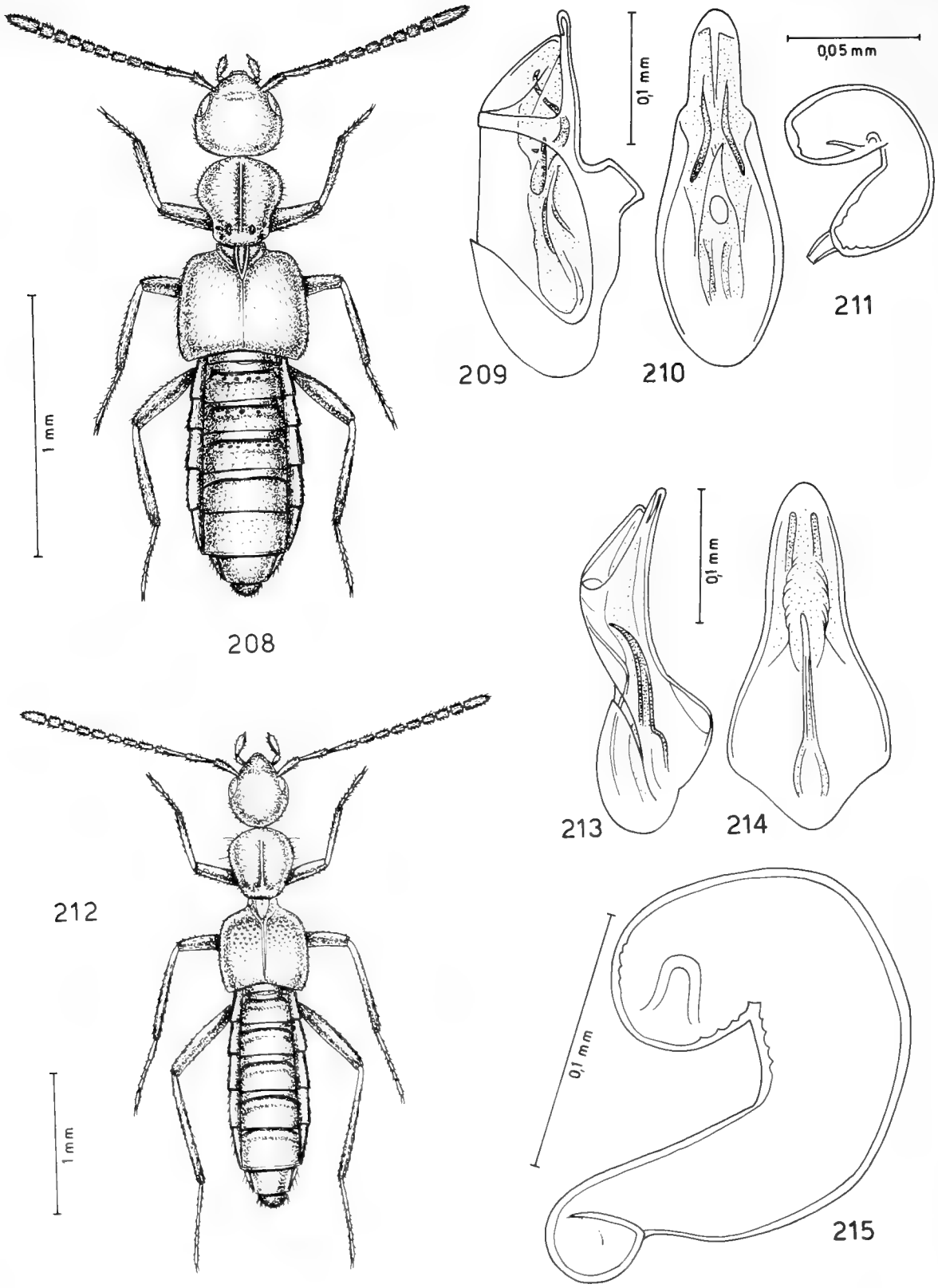
TIPO. Holotypus ♀, Kenya, Lac Nakuru, 6.XI.1974, (Mahnert & Perret leg., MG).

DESCRIZIONE. Lungh. 2,8 mm. Corpo lucido e bruno-rossiccio; omeri e uriti liberi 1° e 2° gialli; antenne bruno-rossicce con i due antennomeri basali gialli: solo l'antenna destra ha gli antennomeri 10° e 11° gialli; zampe giallo-brune con tarsi e base dei femori gialli. Tutta la superficie del corpo presenta tubercoletti svaniti. Il capo e il pronoto sono coperti di reticolazione distinta, l'addome di reticolazione svanita. Le elitre sono prive di reticolazione. Spermateca fig. 224.



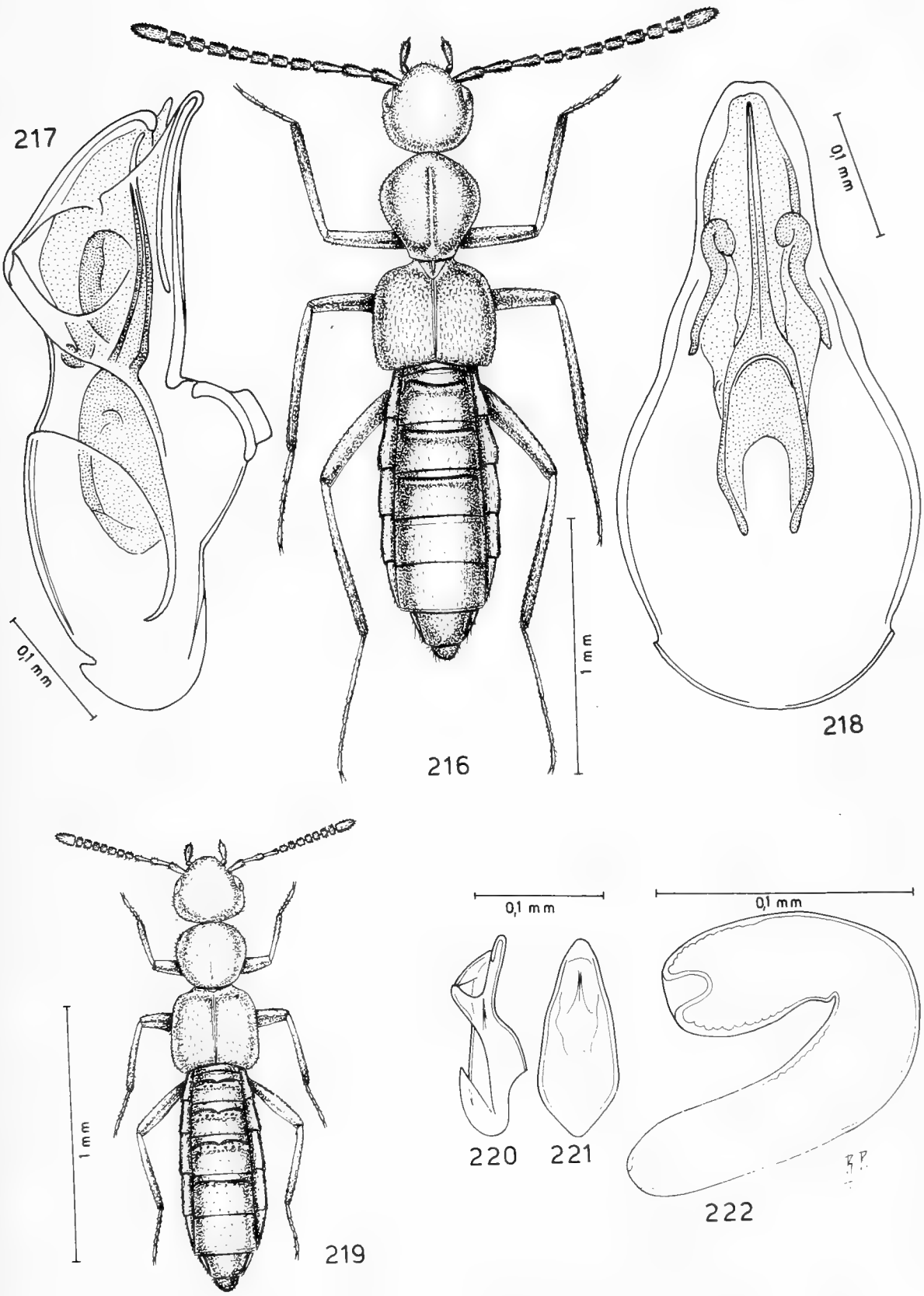
FIGG. 200-207

Habitus, edeago in visione laterale e ventrale e spermateca. 200-203: *Cordalia nakuruensis* sp. n.; 204-207: *Falagria* (s. str.) *dilaticollis* Tottenham.



FIGG. 208-215

Habitus, edeago in visione laterale e ventrale e spermateca. 208-211: *Falagria* (s. str.) *coarcticollis* Fauvel; 212-215: *Falagria (Myrmecocephalus) bipunctata* Tottenham.



FIGG. 216-222

Habitus, edeago in visione laterale e ventrale e spermateca. 216-218: *Falagria (Myrmecocephalus) alluaudi* Fauvel, holotypus ♂; 219-222: *Falagria (Melagria) embuensis* sp. n.

COMPARAZIONI. Specie simile a *F. alluaudi* Fauvel, 1907, di Nairobi, ma distinta per la taglia più grande per i tubercoletti del capo e del pronoto svaniti (e non distinti come in *alluaudi*), per le tempie più arcuate, per le antenne brune con i due antennomeri basali gialli (e non antenne interamente rossicce come in *alluaudi*). La femmina di *F. alluaudi* è sconosciuta.

Myrmecopora cephalotes sp. n. (Figg. 225-226)

TIPO. Holotypus ♀, Kenya, Embu, près Ishiara, 900 m, 14.X.1977, (Mahnert & Perret leg., MG).

DESCRIZIONE. Lungh. 1,8 mm. Corpo lucido e bruno; estremità addominale giallo-rossiccia; antenne brune; zampe gialle. L'intero corpo è coperto di tubercoletti fitti e distinti su un fondo non reticolato. Il solco mediano del pronoto è poco profondo. Spermateca fig. 226.

COMPARAZIONI. A motivo della taglia ridotta, per il capo largo quanto il pronoto e per le antenne corte, la nuova specie è ben distintata *M. basalis* Cameron, 1926, dello Zaire, unica specie nota del genere della regione etiopica. La nuova specie, per la forma della spermateca, potrebbe essere sistematicamente avvicinata a *M. crassiuscula* Aubé, 1850, dell'Europa sudorientale, ma questa specie ha taglia maggiore, tempie arcuate(e non parallele come nella nuova specie), antenne molto lunghe e taglia e spermateca più grandi.

Longiprimitarsus cristatus sp. n. (Figg. 234-237)

TIPI. Holotypus ♂, Rwanda, Rangiro, 1800 m, 26.VIII.1976, (Werner leg., MG).
Paratypi: 4 es., stessa provenienza, ma anche 25.III.1973, (MG, CPA).

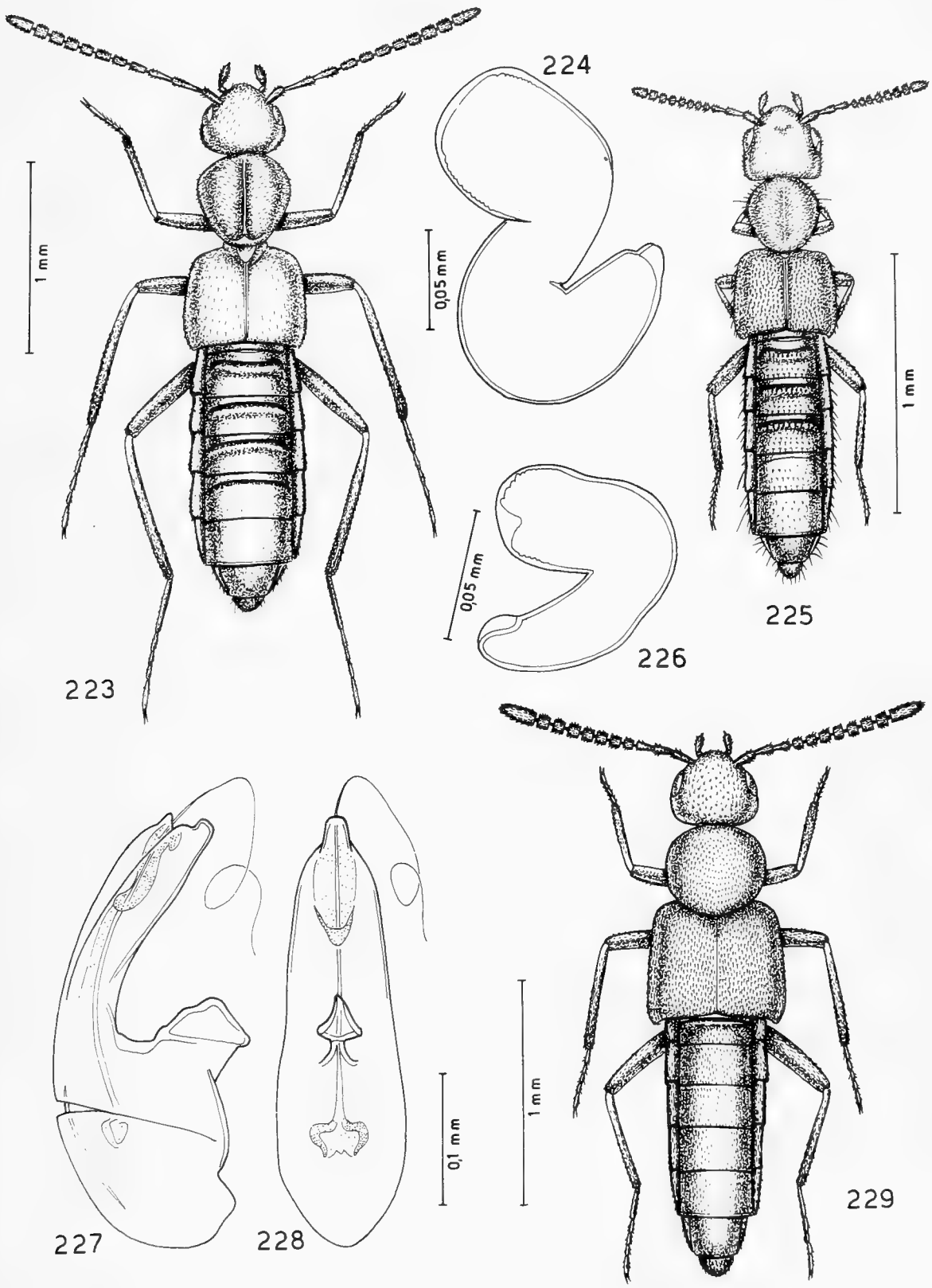
DESCRIZIONE. Lungh. 2,8 mm. Corpo debolmente lucido e bruno, comprese le antenne; zampe giallo-rossicce. Il capo e il pronoto presentano tubercoletti fitti e svaniti su una superficie a reticolazione superficiale. Tubercoletti e reticolazione distinti coprono le elitre. L'addome è coperto di pubescenza sericea fitta. Edeago figg. 234-235, spermateca fig. 236.

COMPARAZIONI. A motivo del grande sviluppo della "crista apicalis" dell'edeago, per lo scarso sviluppo del bulbo distale della spermateca, rispetto al grande sviluppo del bulbo prossimale della stessa spermateca e per la presenza di due distinti punti sul pronoto, la nuova specie è distinta da tutte le specie presenti nella regione etiopica.

Derema rangirensis sp. n. (Figg. 238-239)

TIPO. Holotypus ♀, Rwanda, Rangiro, 1800 m, 25.III.1973, (Werner leg., MG).

DESCRIZIONE. Lungh. 1,9 mm. Corpo debolmente lucido e giallo-bruno; capo bruno-rossiccio; addome giallo con uriti liberi 3° e 4° bruni; antenne brune con antennomero basale e apice dell'undicesimo antennomero rossicci; zampe gialle. Tutto il corpo è coperto di punteggiatura fittissima e distinta. Il pronoto presenta un debole solco mediano posteriore e a ciascun lato di esso un poco distinto breve solco. Spermateca fig. 239.



FIGG. 223-229

Habitus, spermateca ed edeago in visione laterale e ventrale. 223-224: *Falagria (Myrmecocephalus) nakuruensis* sp. n.; 225-226: *Myrmecopora cephalotes* sp. n.; 227-229: *Longiprimitarsus longipennis* Bernhauer, syntypus.

COMPARAZIONI. Come hanno dimostrato KISTNER & JACOBSON (1979), le specie del genere *Derema* Fauval, 1899, si separamo tra loro essenzialmente per mezzo della struttura della spermateca. La nuova specie mostra una spermateca differente da tutte le specie note, ma è avvicinabile per la forma di quest'organo, a *D. simplicicollis* Jacobson & Kistner, 1979, della Liberia e del Ghana. Tuttavia questa specie ha pronoto meno trasverso e spermateca con bulbo prossimale meno lungo di quello della nuova specie e bulbo distale nettamente meno prolungato.

Medera absurdior sp. n. (Figg. 240-242)

TIPO. Holotypus ♂, Rwanda, Rangiro, 1800 m, 14.IX.1976, (Werner leg., MG).

DESCRIZIONE. Lungh. 3,4 mm. Capo debolmente opaco resto del corpo lucido. Corpo bruno; addome giallo-rossiccio con uriti 3° e 4° rossicci; antenne brune con i tre antennomeri basali rossicci; zampe giallo-rossicce. I tubercoletti del capo sono fitti e distinti, quelli del pronoto sono salienti e quelli degli uroterghi evidenti. Le elitre sono coperte di punteggiatura distinta e di reticolazione netta. Il capo presenta un'ampia concavità discale. Il pronoto è percorso da tre solchi sulla parte posteriore. L'addome non è reticolato. Edeago figg. 241-242.

COMPARAZIONI. Specie simile, anche per la forma dell'edeago, a *M. grandis* Kistner & Jacobson, 1979, dello Zaire. Ne è distinta per la maggiore taglia, per il disco del capo concavo, per la presenza di tre solchi sul pronoto. Inoltre la lunghezza del pronoto è di 0,52 mm, invece di 0,37-0,45 mm come in *grandis*.

Rylodophila nakuruensis sp. n. (Figg. 251-252)

TIPI. Holotypus ♂, Kenya, Lac Naivasha, 5 Km Fisherman's Camp, 5.XI.1974, (Mahnert & Perret leg., MG).

Paratypi: 9 es., stessa provenienza, ma anche 8.XI.1974, (MG, CPA); 14 es., Kenya, Nakuru, Lac Naivasha, près de Mundui Estate, 8.XI.1977, (Mahnert & Perret leg., MG, CPA).

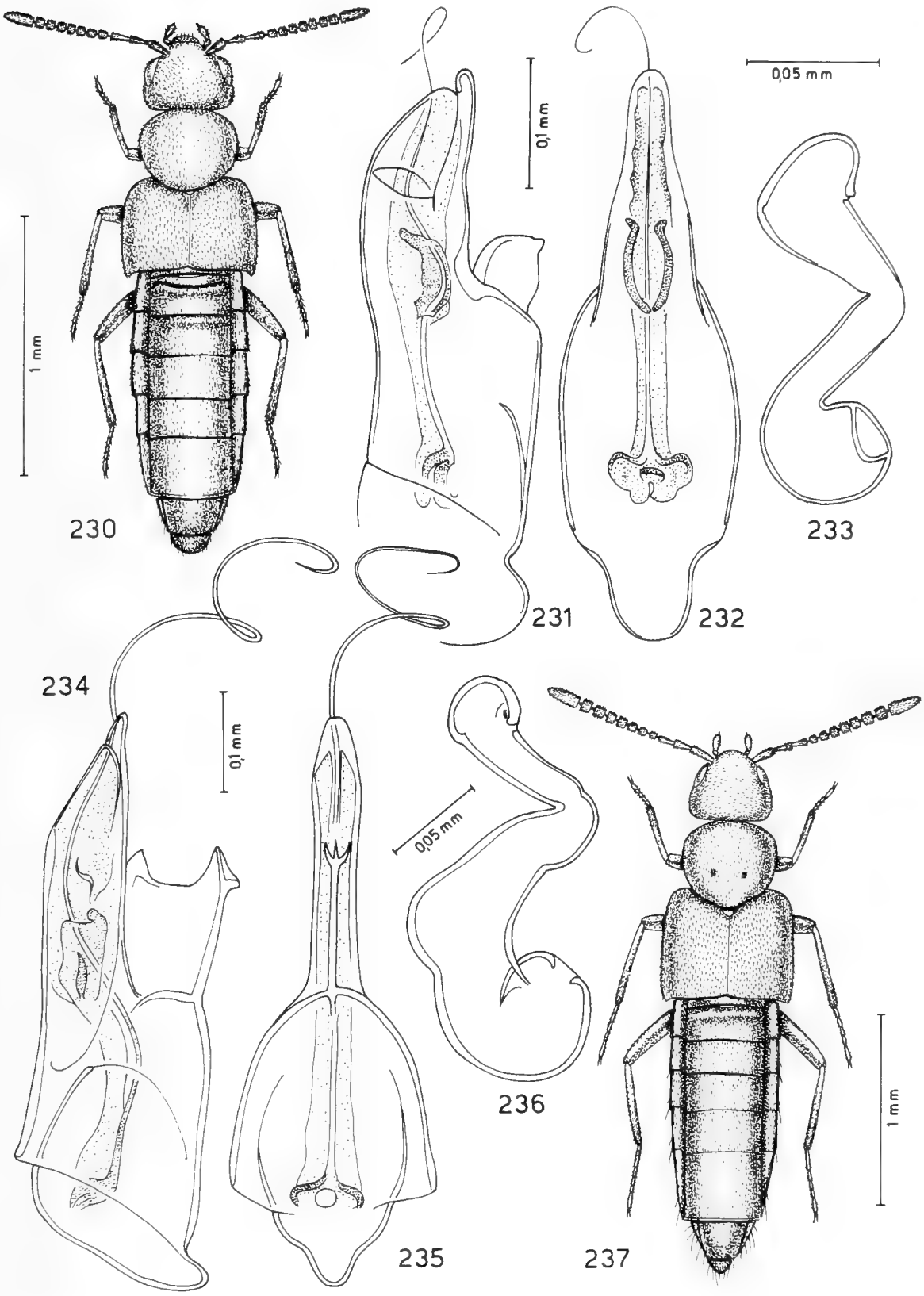
DESCRIZIONE. Lungh. 2,0 mm. Corpo lucido e giallo-sporco; capo, elitre, metà posteriore degli uroterghi e 5° urotergo libero, tranne la base, bruno-giallicci; antenne brune con i due antennomeri basali giallo-rossicci; zampe giallo-rossicce. Il capo è coperto di reticolazione distinta, ma non è visibile la punteggiatura. Il pronoto e le elitre presentano tubercoletti svaniti e sono privi di reticolazione. Tubercoletti distinti coprono gli uroterghi. Edeago figg. 247-248, spermateca fig. 249.

COMPARAZIONI. Tra le varie specie del genere *Rylodophila* Kistner & Jacobson, 1979, una sola presenta elitre più corte del pronoto come la nuova specie: *R. obongenensis* (Cameron, 1934), dello Zaire. La nuova specie si distingue da *R. obongenensis* per la forma della spermateca che ha bulbo distale molto trasverso (campaniforme asimmetrico in *obongenensis*) e la parte mediana della spermateca stessa, tra i due bulbi distale e prossimale, più lunga e snella. L'edeago di *obongenensis* è sconosciuto.

Rylodophila nanyukiensis sp. n. (Figg. 251-254)

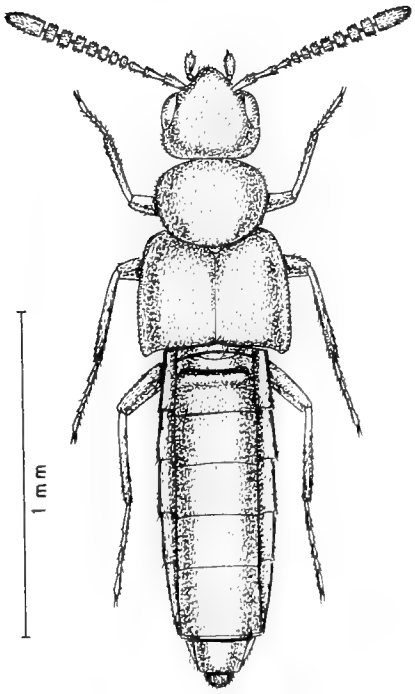
TIPI. Holotypus ♂, Kenya, env. Nanyuki, 2000 m, 24.XI.1974, (Mahnert & Perret leg., MG).

Paratypi: 12 es., stessa provenienza, (MG, CPA).



FIGG. 230-237

Habitus, edeago in visione laterale e ventrale e spermateca. 230-233: *Longiprimitarsus amaniensis* (Eichelbaum), lectotypus ♀ (232-232: maschio del Kenya); 234-237: *Longiprimitarsus cristatus* sp. n.



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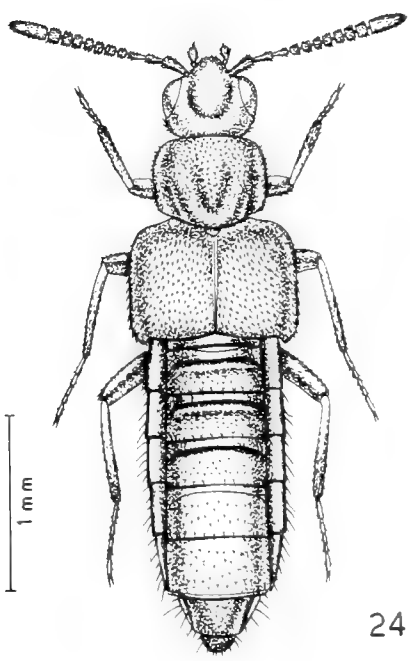

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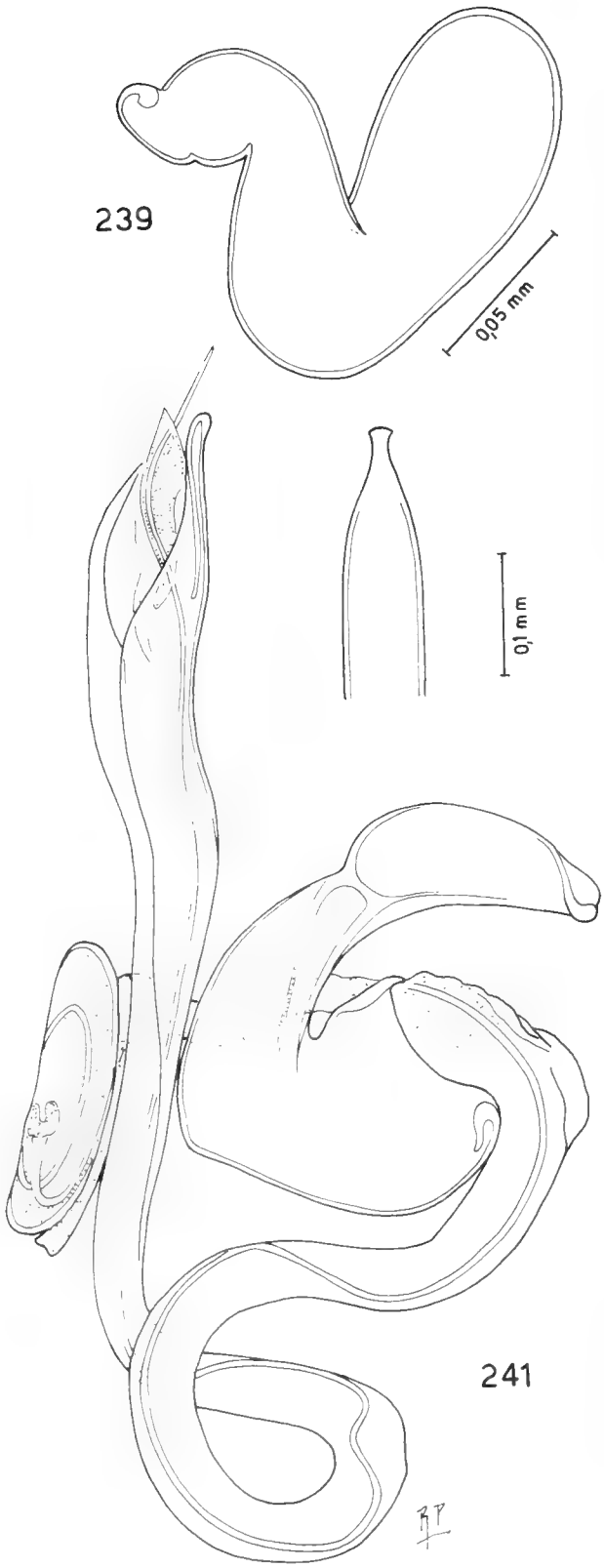
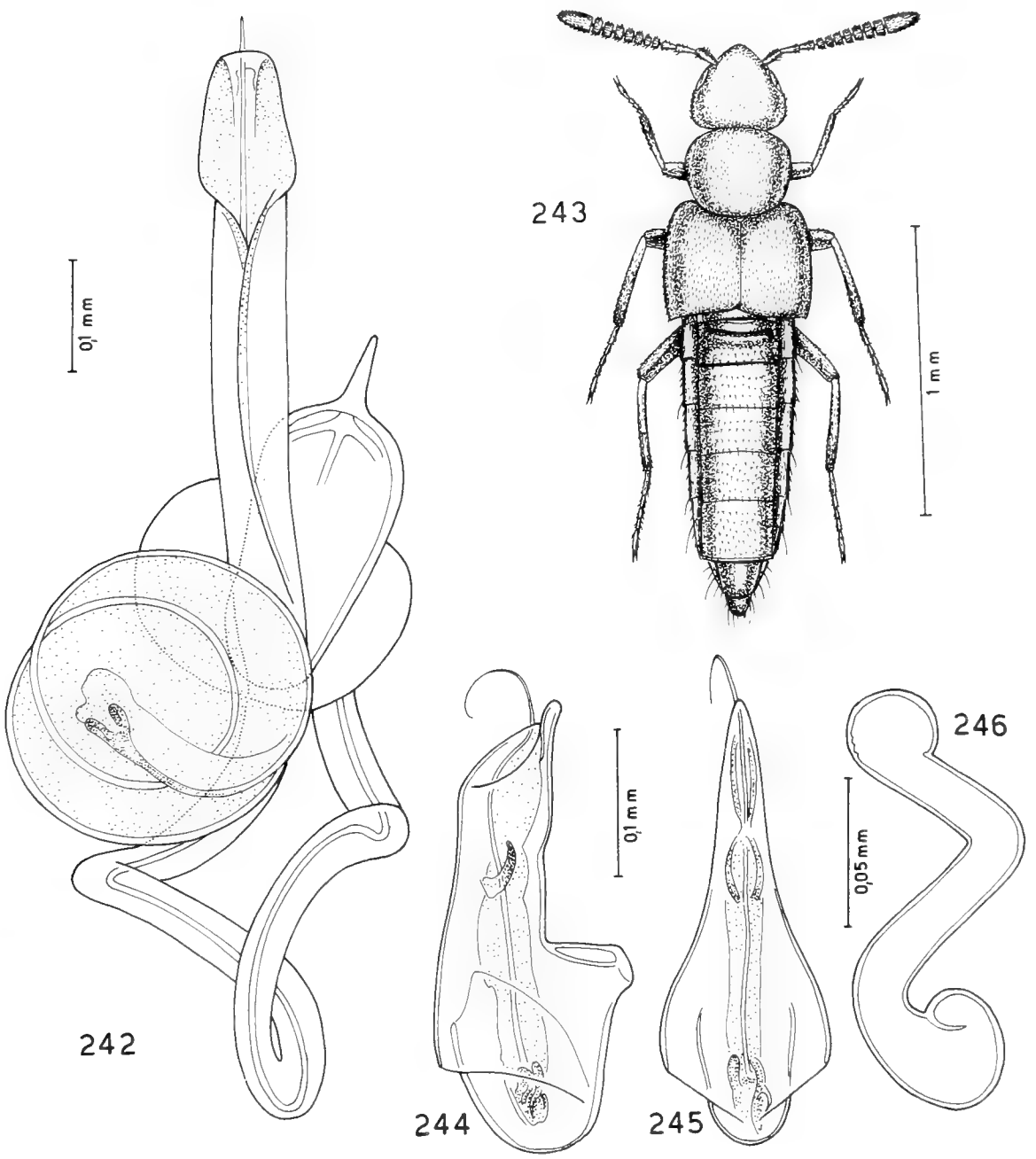


FIGG. 238-241

Habitus, spermateca ed edeago in visione laterale. 238-239: *Derema rangirensis* sp. n.; 240-241: *Medera absurdior* sp. n.



FIGG. 242-246

Edeago in visione laterale e ventrale, habitus e spermateca. 242: *Medera absurdior* sp. n. (edeago in visione dorsale); 243-246: *Rylodophila kalongeana* (Bernhauer).

DESCRIZIONE. Lungh. 2,0 mm. Corpo lucido e giallo-rossiccio; capo, elitre e metà posteriore degli uroterghi, bruni; antenne nero-brune con i due antennomeri basali giallo-rossicci; zampe giallo-rossicce. La punteggiatura del capo è molto svanita e fitta, quella delle elitre e dell'addome è distinta. Tubercoletti svaniti su una superficie non reticolata stanno sul pronoto. Sul capo esiste una reticolazione superficiale; su elitre e su addome non esiste reticolazione. Edeago figg. 251-254, spermateca fig. 253.

COMPARAZIONI. Anche questa nuova specie, come la precedente *R. nakuruensis* sp. n., presenta elitre più corte del pronoto. E' distinta da essa per l'edeago strettamente ricurvo al lato ventrale (largamente ricurvo in *nakuruensis*) e per il bulbo basale della spermateca globulare. Quest'ultimo carattere permette di distinguere la nuova specie anche da *R. obongenensis* (Cameron, 1934) dello Zaire, che ha pure elitre più corte del pronoto e che ha bulbo prossimale della spermateca a forma di largo crescente.

Rylodophila embuensis sp. n. (Figg. 255-258)

TIPI. Holotypus ♂, Kenya, Embu, 10 Km O Ishiara Mi, 900 m, 14.X.1977, (Mahnert & Perret leg., MG).

Paratypi: 10 es., stessa provenienza, (MG, CPA).

DESCRIZIONE. Lungh. 1,9 mm. Corpo lucido e giallo-rossiccio; capo ed elitre, tranne la base, bruni; antenne giallo-brune con i due antennomeri basali gialli; zampe gialle. La punteggiatura del capo e delle elitre è distinta. Tubercoletti svaniti coprono il pronoto e tubercoletti fini e distinti stanno sugli uroterghi. Solo il capo è coperto di reticolazione svanita, sul resto del corpo non è visibile la reticolazione. Edeago figg. 256-257, spermateca fig. 258.

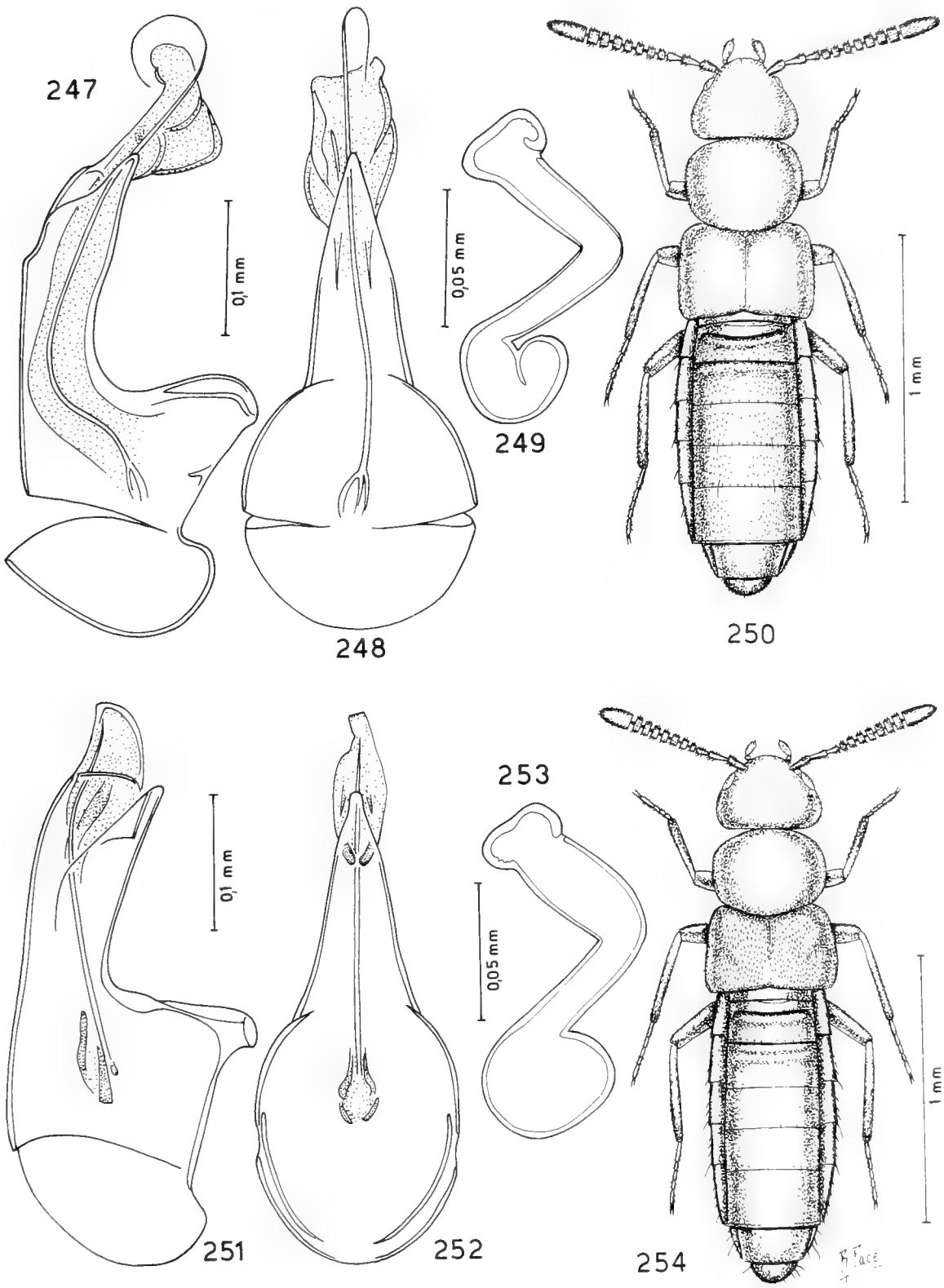
COMPARAZIONI. L'edeago della nuova specie è largamente ricurvo al lato ventrale, come quello di *R. nakuruensis* sp. n. sopra descritta, ma le sue dimensioni sono nettamente ridotte nella nuova specie; inoltre la spermateca ha bulbo distale subsferico, mentre è trasverso in *nakuruensis* e il bulbo prossimale della spermateca è ben più voluminoso nella nuova specie che in *nakuruensis*. Per il medesimo carattere e per la brevità complessiva della spermateca, la nuova specie è distinta pure da *R. nanyukiensis* sp. n., sopra descritta, e da *R. obongenensis* (Cameron, 1934), dello Zaire. Quest'ultima specie ha bulbo prossimale della spermateca a forma di largo crescente, mentre nella nuova specie il bulbo prossimale è globulare allungato.

Derelina umtaliensis sp. n. (Figg. 259-261)

TIPO. Holotypus ♂, Zimbabwe (Rhodésie), Umtali, II.1969, (R. Mussard leg., MG).

DESCRIZIONE. Lungh. 2,4 mm. Corpo debolmente lucido e bruno; antenne bruno-rossicce; zampe giallo-rossicce. L'avancorpo è coperto di punteggiatura assai svanita e di reticolazione netta. Tubercoletti fini su un fondo non reticolato, coprono l'addome. Edeago figg. 260-261.

COMPARAZIONI. L'edeago della nuova specie ha struttura generale e flagello del sacco interno simili a quelli di *D. flavelytra* Kistenr & Jacobson, 1979, dell'Angola.



FIGG. 247-254

Edeago in visione laterale e ventrale, spermateca e habitus. 247-250: *Rylodophlila nakuruensis* sp. n.; 251-254: *Rylodophila nanyukiensis* sp. n.

Tuttavia l'edeago di questa specie presenta "crista apicalis" strettissima e non assai larga come nella nuova specie e il colore delle elitre di *flavelytra* è giallo-bruno e non bruno come nella nuova specie. Inoltre il 3° antennomero è lungo quanto largo in *flavelytra*, mentre è nettamente più lungo che largo nella nuova specie.

Demerinda embuensis sp. n. (Figg. 262-263)

TIPO. Holotypus ♀, Kenya, Embu, près Kogari, 500 m, 15.X.1977, (Mahnert & Perret leg., MG).

DESCRIZIONE. Lungh. 2,3 mm. Corpo lucido e giallo-rossiccio; capo ed elitre bruno-rossicci; antenne bruno-rossicce con i due antennomeri basali rossicci; zampe giallo-rossicce. L'intera superficie del corpo è coperta di tubercoletti distinti. Solo sul capo è presente una reticolazione che è distinta; sul resto della superficie del corpo non vi è traccia di reticolazione. Spermateca fig. 263.

COMPARAZIONI. In base alla forma della spermateca, la nuova specie sembra affine a *D. termitophila* Cameron, 1927, dell'India. Tuttavia la nuova specie presenta tempie angolose, pronoto più trasverso, antenne più lunghe, elitre più lunghe del pronoto (e non appena più lunghe come in *termitophila*) e per la presenza di una bozza presso il bulbo prossimale della spermateca, assente in *termitophila*.

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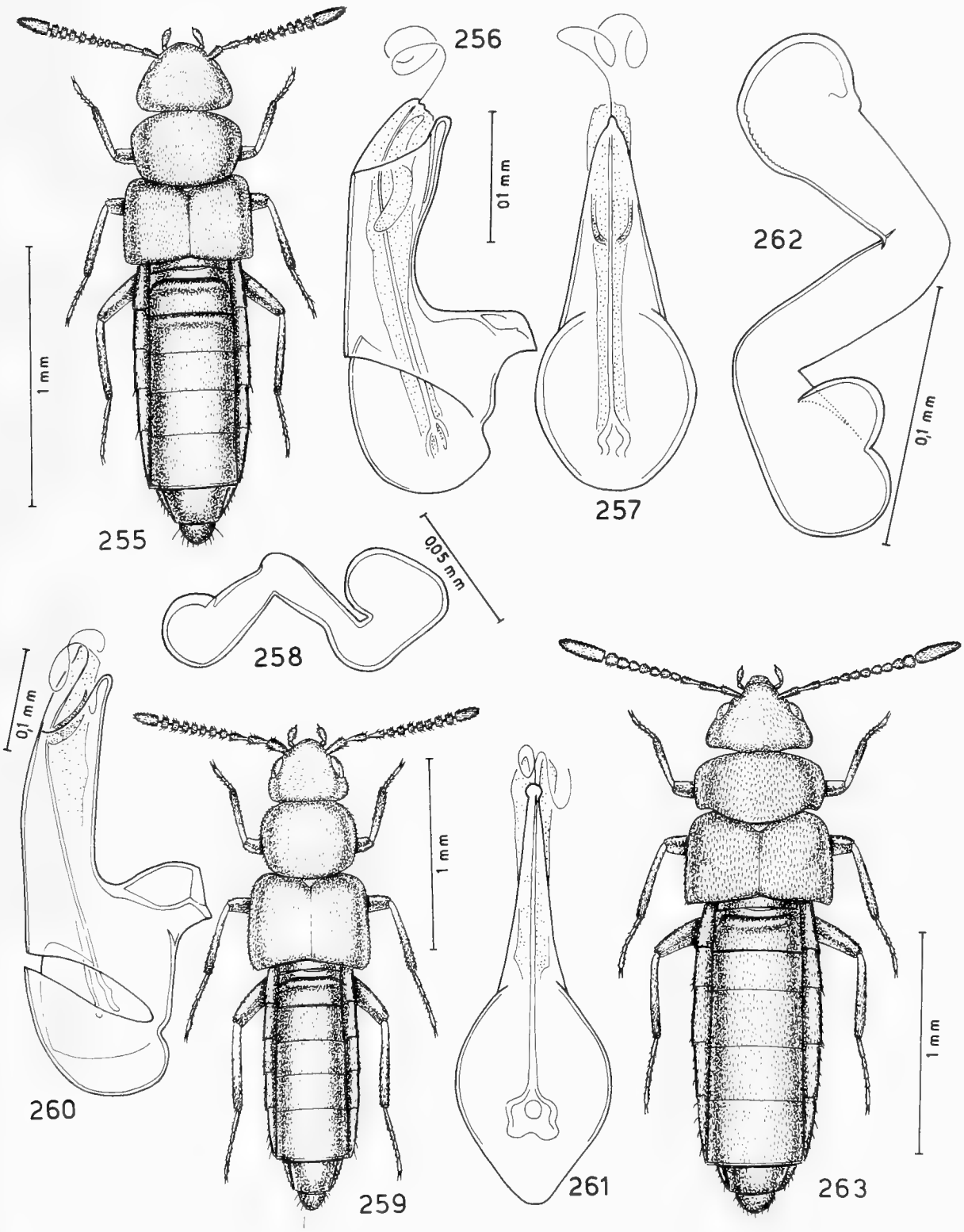
Rivolgo vivi e cordiali ringraziamenti al Dr. I. Löbl e al Dr. C. Besuchet del Museo di Storia Naturale di Ginevra che mi hanno affidato in studio il materiale che è prevalente oggetto del presente lavoro. Ringrazio pure molto cordialmente il Dr. L. Bartolozzi del Museo Zoologico de "La Specola" dell'Università di Firenze per il materiale del Kenya e Somalia datomi in studio e per avermi concesso in studio i tipi di Aleocharinae dell'Africa Orientale conservati nel suo Istituto. Per il prestito di tipi e di materiale di studio rivolgo sentiti ringraziamenti al Dr. L. Baert dell'"Institut Royal des Sciences Naturelles de Belgique" di Bruxelles, allo scomparso Dr. Z. Kaszab e al Dr. Müller del Museo Ungherese di Storia Naturale di Budapest, al Dr. A F. Newton del "Field Museum of Naturale History" di Chicago, al Dr. H. Schönmann del "Naturhistorisches Museum" di Vianna, al Dr. M. Uhlig del museo Zoologico dell'Università Humboldt di Berlino, al Dr. L. Zerche dell'"Institut f. Pflanzenschutzforschung Kleinmachnow" di Eberswalde e alla Dssa. N. Berti del "Muséum National d'Histoire Naturelle" di Parigi.

RÉSUMÉ

Les Aleocharinae constituent un des groupes de Coléoptères les plus mal connus de la faune de la sous-région africaine orientale. Ce travail énumère 76 espèces, dont 59 sont décrites comme nouvelles. Elles appartiennent aux tribus Myllaenini, Ologotini, Gyrophaenini, Homalotini, Bolitocharini, Diestotini, Pronomaeini, Corotocini, Eusteniamorphini, Autaliini, Falagriini et Deremini. Nous y avons inclus les tableaux de détermination des espèces des sous-régions africaine orientale



FIGG. 255-263

Habitus, edeago in visione laterale e ventrale e spermateca. 255-258: *Rylodophila embuensis* sp. n.; 259-261: *Derelina umtaliensis* sp. n.; 262-263: *Demerinda embuensis* sp. n.

et malgache des genres *Myllaena*, *Gyrophaena*, *Brachida*, *Neobrachida* et *Eustenidia*. Sont décrits aussi: 4 *Myllaena* aptères malgaches, 4 *Eustenidia* de Madagascar et 2 du Gabon, 4 *Brachida* de Madagascar et *Pseudosilusa mindanaoicola* sp. n. des Philippines. Douze types ou lectotypes d'espèces décrites par Fauvel, Bernhauer, Eichelbaum et Eppelsheim, sont illustrés.

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REVUE SUISSE DE ZOOLOGIE, 101 (1) : 195-213; mars 1994

Three new species and genera of Dilepididae (Cestoda, Cyclophyllidea) from neotropical Picidae (Aves).

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Three new species and genera of Dilepididae (Cestoda, Cyclophyllidea) from neotropical Picidae (Aves). – The three new genera testify a high diversification of cestodes from Piciformes (Picidae) in South America, reveal some new important characters and show how detailed a generic diagnosis has to be in order to emphasize differences and similarities in related genera. *Apokrimi* n. gen., a monotypical genus, differs from all other Dilepididae in its enormous "sucker-like" pseudoscolex cutting off the scolex. *Krimi* Burt, 1944 is the nearest genus to it as to anatomy and hosts; moreover, the swelling of the neck in some of its species seems to prelude the appearance of the pseudoscolex of *Apokrimi*, an extreme apomorphy. *Apoliga* n. gen. differs from all other Dilepididae in its atrio-genital complex: atrial cavity proper with long bristle-like spines, ductus masculinus well-defined, unarmed, cirrus with extremely long, strong, bristle-like spines. Diagnosis confirmed by 5 cogeneric species, observed in addition to the type species and not yet described. Highly specific of Picidae. *Monoliga* n. gen., a monotypical genus, is similar to *Liga*; it differs in the single hooks crown, ovary in the poral half of the medulla, cirrus pouch backward inclined in adult proglottides and other more subtle character states.

Key-words: Cestoda - Cyclophyllidea - Dilepididae - Birds - Taxonomy - Neotropic.

INTRODUCTION

Some cestodes of birds recently collected prove that in the neotropical region there is a very large number of yet unknown species. Moreover, interesting instances of a strict hostgroup specificity of the cestode genus and a wide diversification of cogeneric cestode species in a given family of birds emerge.

Manuscript accepted 17.08.1993.

The adopted generic diagnosis does not exactly follow the traditional scheme. Characters are dealt with in a different succession in order to help the identification, and the possible grouping of genera in higher taxa. More characters than in traditional diagnoses have been used and their description is much detailed. Owing to such diagnoses, genera have become more restrictive, which was necessary in the revision of Dilepididae we carried out (Bona, 1994, in press).

Out of the three new genera described here, *Apokrimi* and *Monoliga* are monotypical, whereas *Apoliga* consists of numerous new species which will be described elsewhere. The genera mentioned in the discussions were revised before comparing them with the new ones, by studying the original type and cogeneric species in old or recently collected material, except for *Ivritaenia* Singh, 1962, in whose case we had to keep to the literature. This is an important premise to the discussions because comparisons are made either with characters that are sometimes disregarded in old species descriptions and in generic diagnoses, or with emended characters.

Some of the described material comes from the Peruvian Amazon, some from the Argentine pampa; the former was gathered during an expedition in the Province of Madre de Dios (Perù) organized by the "Fonds Leopold III pour l'exploration et la conservation de la nature" (Belgium), and headed by Prof. Xavier Misonne (Brussels) and during another one in the Province of Loreto (Perù) with my colleague Dr. Claude Vaucher from the Museum of Natural History (Geneva); the latter, from Argentina, during a stay in the Province of Buenos Aires, through the support of Prof. José M. Gallardo, director of the Museo Argentino de Ciencias Naturales.

MATERIAL AND METHODS

Specimens were rapidly cleaned in tap water, fixed for 12-24 h. (or longer) in a solution of 5% mercury bichloride ($HgCl_2$) plus 7% formol, and stored until the end of the journey in 70° alcohol with addition of some drops of Lugol's solution, to remove the mercury salt. Then preserved in 70° alcohol. Stain was carried out with hydrochloric-acid carmine or very diluted Delafield haematoxylin, both differentiated in acidulate 70° alcohol (0,25% hydrochloric acid), transferred to tap water and mounted in Canada balsam. Hooks were mounted with the scolex in Canada balsam or squashed in modified Berlese fluid, slightly diluted to permit a better dispersion and flattening of the hooks (formula to avoid precipitates: dist. water 50 ml; chloral hydrate 200 gr; gum arabic pulv. 30 gr; glycerol 20 gr).

Measures in µm if not otherwise stated; measures or numbers in brackets added to an observed range are unusually low or high data.

Apokrimi n. gen.

DIAGNOSIS - Rostellar apparatus muscular, very delicate. Pouch very small, wall thin. Rostellum very small, normal shape. Hooks unknown. Strobila very small; neck

forming a huge, spherical, glandulo-muscular, sucker-like pseudoscolex cutting off the scolex. Scolex very small. Suckers proportionally large. Genital pores irregularly alternate, anterior. Genital ducts between (most commonly) or dorsal to excretory vessels, in the same strobila. Vagina posterior to cirrus pouch, in same horizontal plane. Uterus ventral, reticulate, then persistently labyrinthine. Eggs small; embryophore robust, outer coat reduced, adhering to embryophore. Genital atrium small; no ductus masculinus. Ovary with pronounced anterior and posterior indenture; short, clear isthmus; small lobules, compact. Vitellarium lobular, central. Testes numerous, small, postovarian. Cirrus pouch small, subspherical, wall thin; antero-poral to ovary. Cirrus short; fine bristle-like spines, in a small, narrow, straight bundle, slightly protruding beyond the pouch orifice when withdrawn. Vagina transverse, in front of poral ovarian lobe; orifice at the atrium bottom, posterior, near the male one; proximal part sinuous; wall thick. Seminal receptacle in the ovary anterior indenture; separated from vitellarium. Vas deferens median, farther on than ovary and seminal receptacle, lengthwise elongate; prostatic cells. In Piciformes, Picidae. Neotropical. Type species: *Apokrimi pseudoscolecis* n. sp.

Apokrimi pseudoscolecis n. sp. (Figs 1-7)

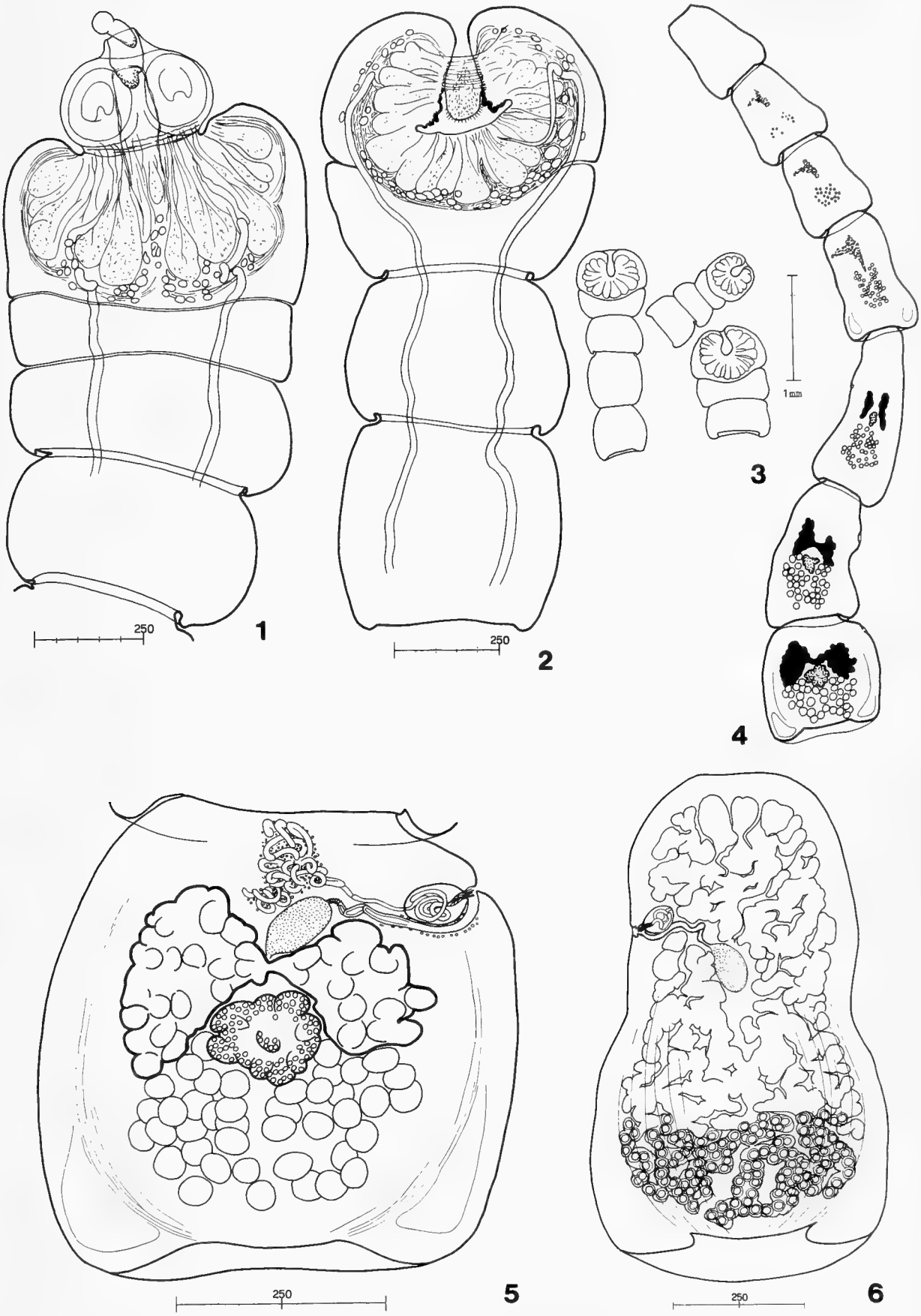
DESCRIPTION - Very small, thin, straight strobila; neck transformed into a big, spherical sucker-shaped pseudoscolex, beheading the strobila and substituting the scolex in its anchoring function. Proglottides slightly craspedote, longer than wide; adult ones trapeziform or rectangular with blunted corners; gravid ones much larger, long oval. First segment short, about as wide as the pseudoscolex. Proportionally long chain of juvenile segments followed by suddenly mature ones (semi-adult and adult proglottides, 2-3 in all); adult proglottides suddenly much larger than the preceding, semi-adult ones. Gravid proglottides detached early; there seems to be a precocious fissure between proglottides which hastens this process. Specimens at the same maturation degree can vary considerably in size of strobila and pseudoscolex. Pore anterior; organs not heaped; cortex scarce; longitudinal musculature weak, arranged like meridians round the medulla; excretory vessels sinuous even in stretched proglottides. Scolex very small, delicate; suckers very large with respect to scolex. Rostellum pouch very small, wall thin, glandular component not observed. Rostellum very small, musculature weak, but normally shaped, possibly armed, but hooks missing. The pseudoscolex consists of a swollen neck which pushes forward and forms a calix behind the scolex. Then the calix rim infolds, takes the shape of a "sucker", contracts and finally stretches and rips the peduncle that still kept the scolex attached. The cavity of the pseudoscolex is more like a longitudinal fissure and the rim seems to work like pliers having lateral lips.

Genital pores irregularly alternate. Genital ducts between (most common) or dorsal to excretory vessels, in the same strobila. Vagina, with respect to cirrus pouch, posterior and in same horizontal plane, or indifferently a little ventral or dorsal.

Uterus ventral, first finely reticulate, then persistently labyrinthine with irregular tubes; wall thin but firm; no uterine capsules are formed (anyway fully gravid proglottides are not available). Eggs small, numerous; embryophore fairly robust, outer coat delicate, reduced, at the end adhering to embryophore; no polar processes. Genital atrium simple, wall hardly noticeable, with a delicate sleeve of circular fibres near the bottom, thus forming a small cavity in front of the sexual orifices; no ductus masculinus. Ovary clearly bilobed, isthmus thin; deep anterior and posterior indenture; lobes symmetrical, at times lengthwise elongate, pointed at the anterior and posterior ends; lobules small, subspherical, thick; outline not deeply lobulate; pre-equatorial, surrounding laterally the vitellarium; just reaching excretory vessels but far from the anterior margin of the proglottis; in young proglottides, partly reticulate. Vitellarium rather large, central, lobulate, irregular in outline; in the posterior indenture of the ovary. Testes numerous, in a varying number, rather small, postovarian; clear field, close to ovary and vitellarium, not overlapping them. Cirrus pouch small, subspherical or oval, transverse; wall thin; reaches, sometimes crosses the excretory vessels; antero-poral with respect to the ovarian lobe; heaped, small cells in its distal third. Cirrus short, delicate; limited to a small, narrow, straight, homogeneous bundle of fine bristle-like spines, when withdrawn; after the terminal narrowing of the withdrawn cirrus, a part of the internal vas deferens seems to bear very thin setae. Vagina transverse, curved along the posterior rim of the cirrus pouch and in front of the ovarian lobe, at times sinuous or even coiled before seminal receptacle; longer than cirrus pouch; probably very thin setae in its distal part, proximal end dilatable; orifice posterior, at the atrium bottom, just in front of the male one, so that there is no ductus masculinus; wall rather thick, cellular, with fine annular fibres, forming a noticeable sleeve before the seminal receptacle. Seminal receptacle median, in the anterior indenture of the ovray, diagonal axis, separated from the vitellarium. Internal vas deferens long, with convolutions in the proximal half of the pouch; lumen rather wide, regular. Vas deferens median, anteriorly isolated, lengthwise elongate; in front of the seminal receptable, reaching the anterior margin of the proglottis; widespread, fairly thick prostatic cells.

NUMERICAL DATA

Strobila, excluded gravid proglottides, always detached, 4,5-6,5 mm; 13-15 proglottides; Adult proglottis, in large strobilae 945-990x636-509 (preceding semi-adult segment, width only 172-190); in small strobilae 709x500 (preceding semi-adult segment, width only 136); Scolex width 194 (n=1); Rostellum pouch 72 x 43; Rostellum 58-60x20 (stem), 27 (apical pad); Suckers 86-102x74-95; Hooks unknown; Pseudoscolex, after scolex was cut off, 190-275x346-395 (n=6); Pseudoscolex, depth of the groove, 97-134 (n=6); Cirrus pouch 74-97x52-56 (n=6); Cirrus withd rawn, bundle of bristle-like spines, (30)34-38x6-7,5 (n=6); Testes (32)37-47(51) (n progl. =15), diam. 35-52x29-46 (n=30, in several proglottides); Genital atrium, depth 35-45; Ovary (254)282-346x236-388 (n=5);



FIGS 1-6

Apokrimi pseudoscolecis n. gen., n. sp.: 1, scolex before beheading, initial stage of pseudoscolex; 2, pseudoscolex after beheading, "sucker-like"; 3, pseudoscoleces of different sizes, the most common aspect in a population; 4, strobila, long fragment, without anterior segments and gravid proglottides; 5, adult proglottis, slightly contracted; 6, gravid proglottis, labyrinthine uterus.

Available material: 4 complete strobilae without gravid proglottides, several loose gravid proglottides; 1 scolex, several pseudoscoleces. Specimens still moving 9 hours after death of the host!

Host: *Phloeoceastes melanoleucos* (Gmelin, 1788) ♂ (Picidae)

Locality: Rio Samiria, Province of Loreto, Peru; 29-10-1980

Site of infection: first 1/5 of the intestine.

Collection sample n° 160. Holotype and paratypes at the Museum d'Histoire naturelle of Geneva (Switzerland), MNHG 980.630-631.

Discussion

The most similar and probably phylogenetically related genus, to which *Apokrimi* has to be compared, is *Krimi* Burt, 1944 (Figs 8-9). It has to be stated beforehand that *Krimi*, even if the make up of the genus has to be wholly revised, is valid, and different from *Choanotaenia* Railliet, 1896 and *Liga* Weinland, 1857, even though Spasskaya & Spasskii (1971) considered *Krimi* synonymous with *Liga* (see emended generic diagnoses in Bona, 1994, in press). It is somewhat difficult to distinguish *Krimi* from both these genera, but our opinion is supported by the revision of the original type material of *infundibuliformis* Goeze, 1782, (Fig. 10), the true revalidated type species of *Choanotaenia* (different from *infundibulum* Block, 1779 which will be redescribed elsewhere), and of the genus *Liga* on its whole (first note; Bona & Bionaz 1990).

The anatomy of *Apokrimi* (even details concerning genital atrium, ovary, cirrus armature, uterus and eggs), the pattern of maturation, the habitus of strobila and proglottides, and additionally the host group (Picidae) are identical with those of *Krimi*. Its South American provenance corresponds to an area where the genus *Krimi* has greatly differentiated (unpublished observations), and supplies indications of progressive change in some characters, in different species. The reduction in size of the hooks or the swelling of the neck, preludes the appearance of extreme character states, surely apomorphic, namely the disappearance of hooks (but not of the rostellum itself) in a few species and the formation of the huge pseudoscolex in *Apokrimi*. The presence of the pseudoscolex, the only instance known in Dilepididae, justifies the erection of a new genus, in order to emphasize such an extraordinary structure.

A pseudoscolex was mentioned among Dilepididae in *reductorhyncha* (see Spasskaya, 1957 and 1959), type species of *Emberizotaenia* Spasskaya 1970, a totally different genus, because of the particular swelling its neck sometimes under-

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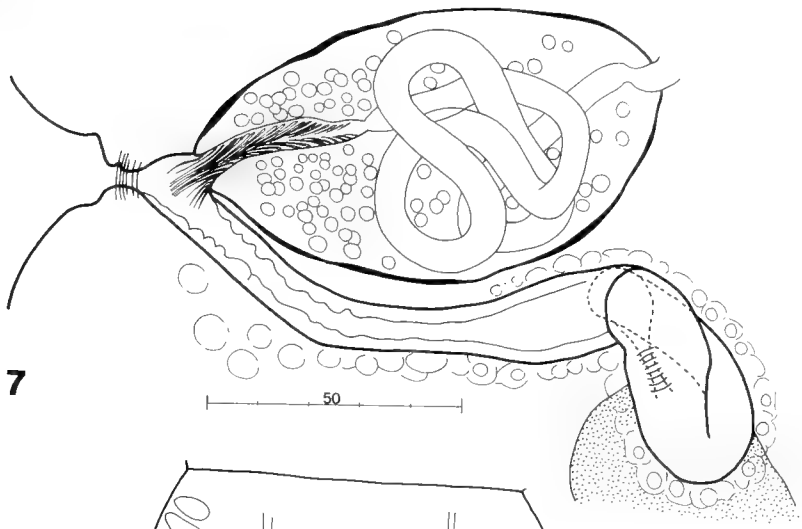
Figs 7-9

Apokrimi pseudoscolecis n. gen., n. sp.: 7, detail of atrium, cirrus pouch, cirrus and vagina. *Krimi chrysocolaptis* Burt, 1944. Type. Nat. Hist. Museum (London) n° 1983-7-12-1.: 8, adult proglottis; 9, strobila with swollen neck.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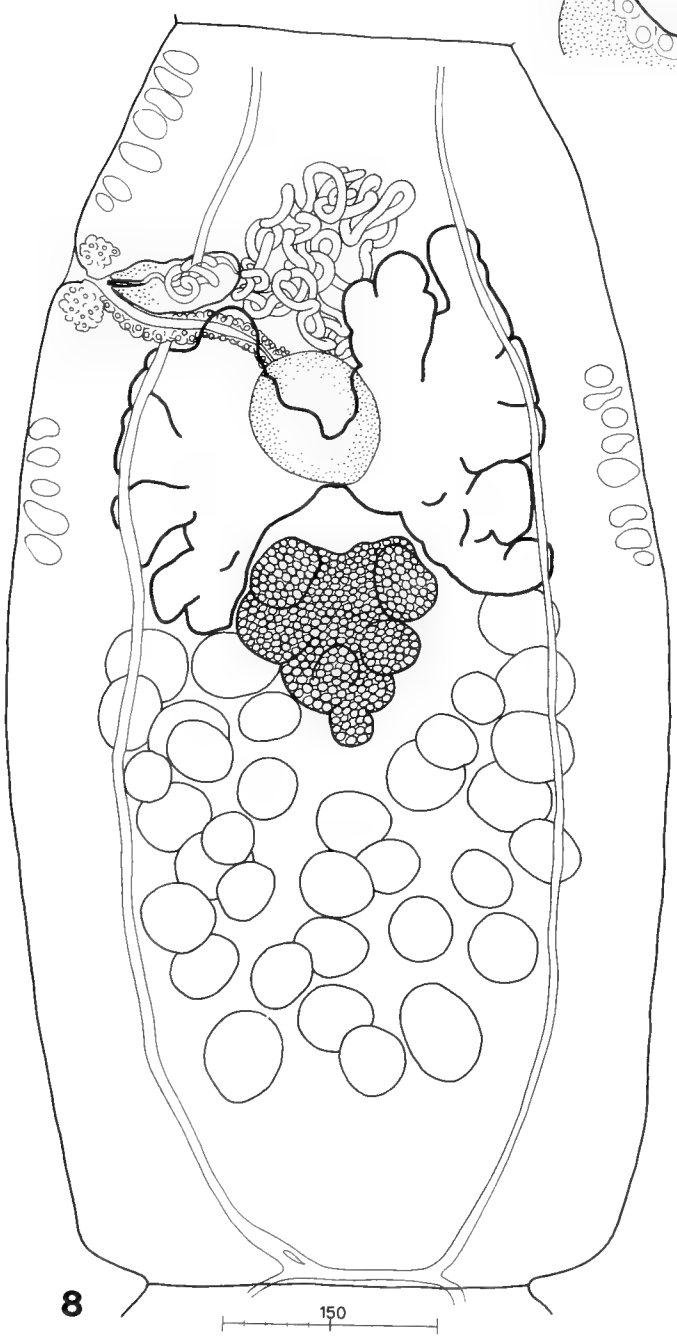
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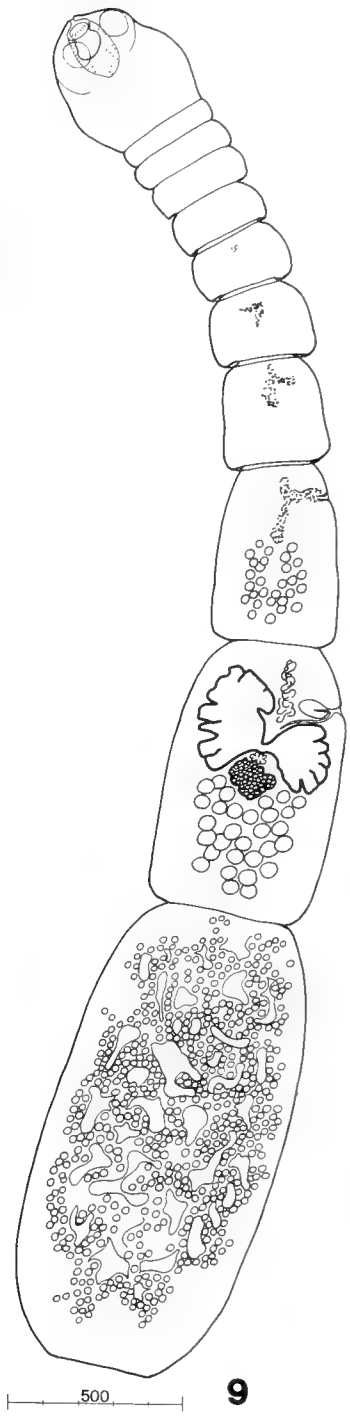
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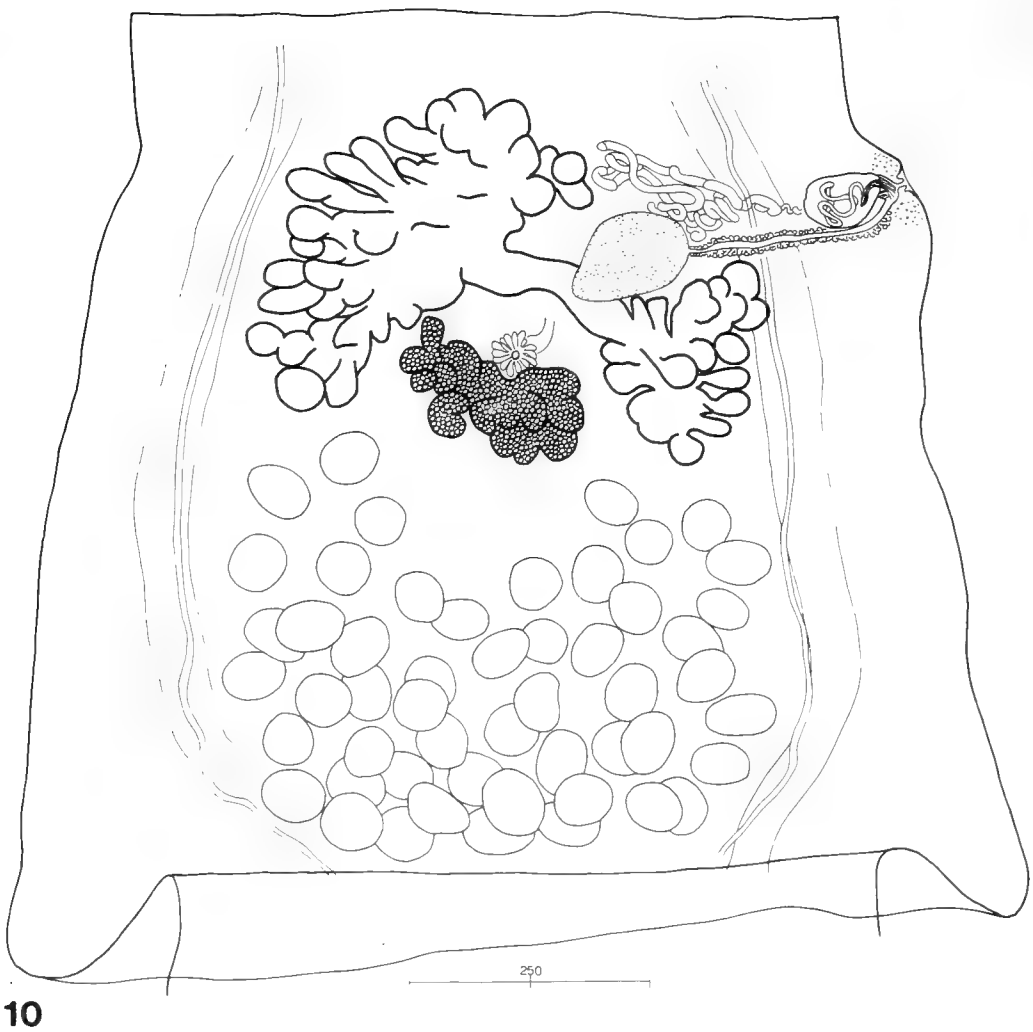


FIG. 10

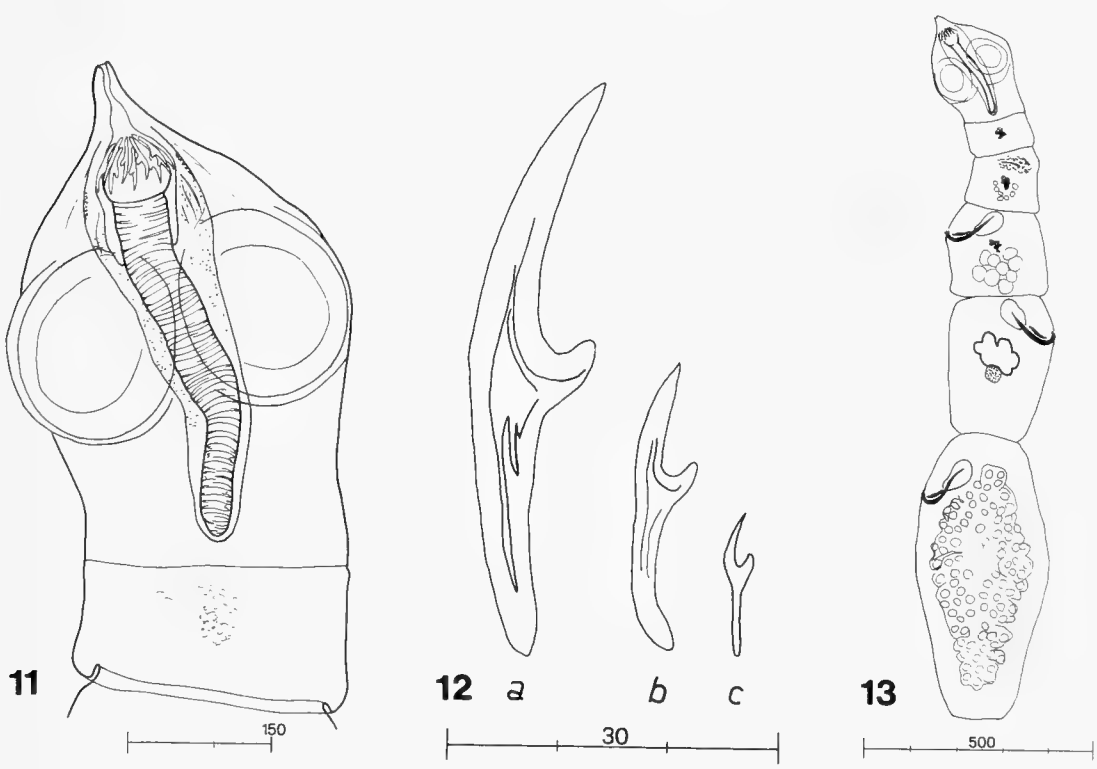
Choanotaenia infundibuliformis (Goeze, 1782). Revalidated as type species of the genus. Original material of the type preserved in alcohol. Goeze's collection, vial n° 264, from the Institute of Zoology, University of Pavia (Italy). Adult proglottis.

goes. In such instances, like in species belonging to other genera (*Unciunia* Skrjabin, 1914), the neck is actually much swollen, and subtegumental glands may appear in it. This swelling however, has no constant aspect and structure of its own. Such a neck cannot be considered as a pseudoscolex, because it does not take the place of the scolex. Anyway, as we saw in *Krimi*, the simple swelling of the neck is perhaps an intermediate character state between a normal neck and a true specialized pseudoscolex, and is worth mentioning in a generic diagnosis.

Apoliga n. gen.

DIAGNOSIS - Rostellar apparatus musculo-glandular. Pouch very long, far beyond suckers. Rostellum long, narrow, rivet-shaped, at times wider, stronger. Hooks in 2 circles (20). Strobila extremely small (0,4-2,3 mm), stiff; proglottides very few, hardly craspedote, poral side slightly bulging, producing a little, alternate, side-

ways shifting of the proglottides along the strobila, gravid ones much larger, long oval; usually clearly proterandrous, testes get much smaller or disappear when ovary fully ripe; cortex wide. Genital pores regularly alternate. Genital ducts dorsal, to excretory vessels. Vagina posterior to cirrus pouch, in same horizontal plane. Uterus labyrinthine with large pouches, then sacciform, tightly septate; wall persistent, at times adhering to eggs, simulating uterine capsules. Eggs rather scarce; embryophore strong; outer coat large, often shrivelled amongst eggs. Genital atrium very deep, forwards inclined; ductus masculinus well-defined, firm-walled, spineless; atrium proper (distal part to the vagina orifice) with bristle-like spines; just before pore, on its anterior face, one or two characteristic folds with modified tegument. Ovary bilobed, small; few, close lobules; central, far from anterior margin of proglottis. Vitellarium small, subspherical, smooth, central. Testes few (8-12), posterior, at times also lateral and partly dorsal to ovary (exceptionally an antero-aporal element). Cirrus pouch spherical or elongate oval, wall firm; deep into the parenchyma, anterior, transverse or forwards inclined. Cirrus short; very long, bristle-like spines in a forwards bent bundle, largely engaged in the atrium when organ withdrawn. Vagina short, very sinuous; vagina and cirrus pouch divaricate. Seminal receptacle oval, usually between ovarian lobes; axis inclined or longitudinal; farther back than the cirrus pouch. Vas deferens lengthwise elongate, median and in front of the aporal lobe, posterior and medial to cirrus pouch. In Piciformes, Picidae. Neotropical. Type species: *Apoliga imperialis* n. sp.

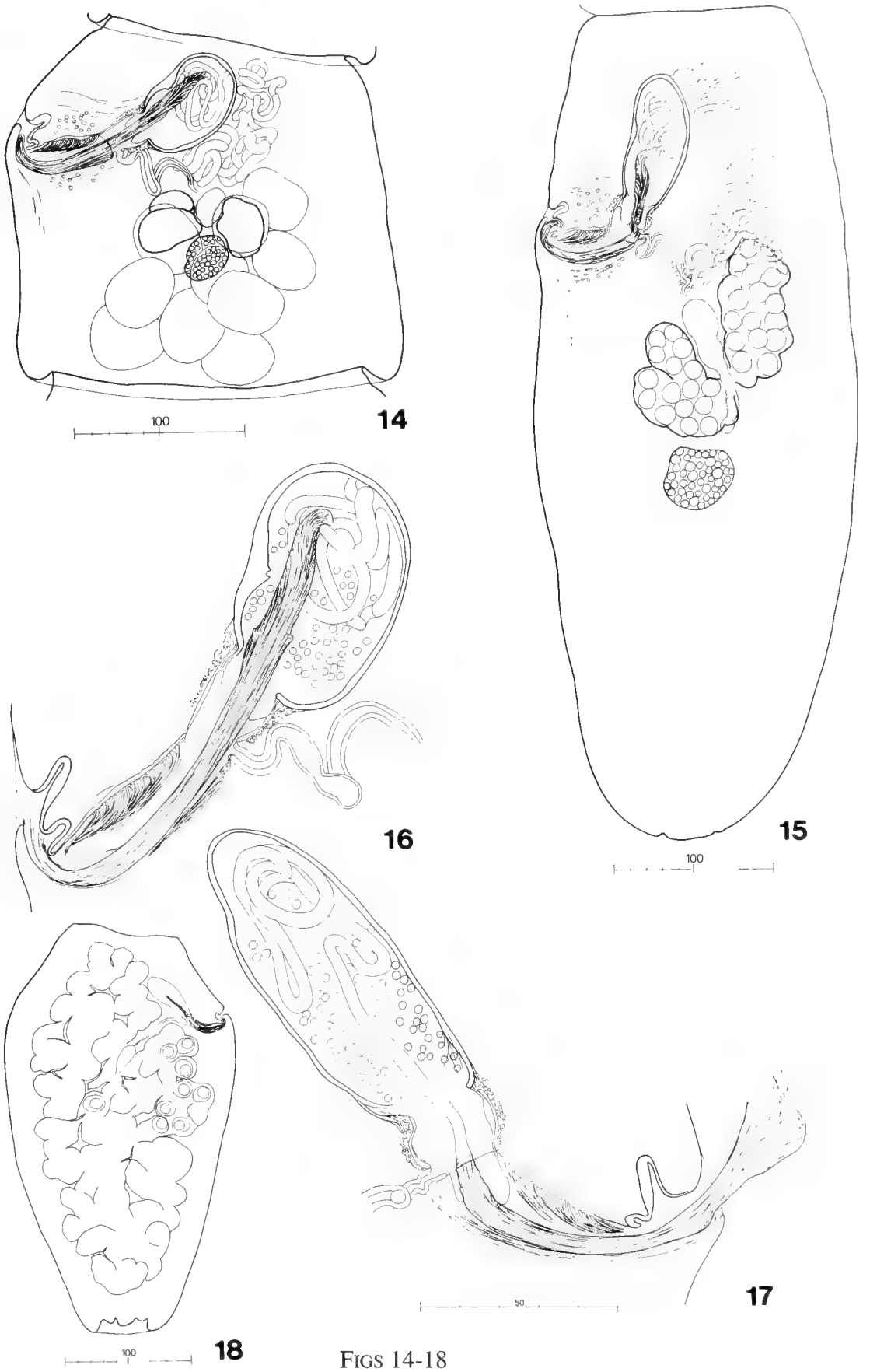


FIGS 11-13

Apoliga imperialis n. gen., n. sp.: 11, scolex; 12, hooks of *imperialis* (b), *Apoliga* sp. I (a). *Apoliga* sp. II (c); 13, strobila with its gravid proglottis.

Apoliga imperialis n. sp. (Figs 11-17)

DESCRIPTION - Strobila extremely small, thin, rather stiff; neck short, wide; segmentation very neat from the beginning; markedly proterandrous, testes early ripe, when ovary still very small (adult male proglottis), and effaced when ovary ripe (adult female proglottis), leaving empty the posterior part of the proglottis; only 1 male, 1 female adult proglottis and 1 gravid proglottis per strobila. Proglottides slightly craspedote, male one about as wide as long, female one much longer than wide, often oval; poral side slightly longer and bulging, so that the strobila shows a typical, alternate, slightly lateral shifting of the proglottides; cortex wide, anatomy clear. Scolex tapering, suckers relatively large. Rostellar apparatus musculo-glandular, with reduced glandular component; glands not visible in the rostellum proper. Pouch very long, narrow, reaching far beyond suckers, wall thin; anterior external cavity deep round the distal part of the retracted rostellum (common aspect in *Apoliga* species having a long, narrow rostellum). Rostellum long; stem narrow, apical pad small; rivet-shaped. Hooks in 2 circles, regular (20), no differences between the two crowns: blade fairly shorter than handle. Genital pores regularly alternate. Genital ducts dorsal to excretory vessels. Vagina posterior to and in same horizontal plane as cirrus pouch. Uterus and eggs: see generic diagnosis and fig. 18. Genital atrium deep, complex; wrapped up in a large, transparent, spherical mass of nuclei and spaced meridian fibres, reaching the poral extremity of the cirrus pouch; just preceding the pore, in the anterior face, 2 superficial folds with thickened modified tegument, the distal one larger; atrium cavity, between distal folds and vagina orifice, with very long spines, stronger on the anterior face, where a well-outlined "brush" is formed, thinner, squeezed between wall and the long cirrus bristles, on the posterior face, becoming at times difficult to observe; proximal end of the cavity prolonged into a ductus masculinus – the vagina orifice being more distal than the orifice of the cirrus pouch – spineless, wall strong, annular fibres, and connected to the wall of the cirrus pouch; on a level with the distal folds, 2 delicate muscular bundles, one directed backwards and most evident, one forwards, both parallel to proglottis surface. Ovary bilobed, very small; few eggs; thin isthmus, deep anterior identure; hardly lobulate when ripe, inclined axis with aporal lobe more in front; central. Vitellarium small, subspherical, smooth, central, clearly separated from ovary. Testes few, posterior, lateral and dorsal to ovary, disappearing when ovary fully ripe. Cirrus pouch subspherical or oval, deep in the parenchyma, reaching the median line, forwards inclined, at times nearly longitudinal when ovary fully ripe, far in front with respect to ovary and seminal receptacle; wall fairly contractile, size very variable, not necessarily in relation with cirrus evagination; contracted wall particularly firm, refracting, showing a longitudinal striation. Cirrus short, wide; very long, fairly stiff, bristle-like spines in a thick bundle, decidedly longer than the cirrus pouch, reaching the genital pore even when cirrus withdrawn, absent at the base of evaginated organ; wall thin, deformable, often very close to the wall of the ductus masculinus. Vagina shorter than cirrus pouch, sinuous, with a posterior, at times elongate loop in front of the ovarian poral lobe; wall firm; vagina and cirrus pouch divaricate. Seminal receptacle rather small, axis



FIGS 14-18

Apoliga imperialis n. gen., n. sp.: 14, adult proglottis, male, ovary still very small; 15, adult proglottis, female, testes already effaced; 16, atrio-genital complex, totally withdrawn cirrus; 17, atrio-genital complex, partly evaginated cirrus. *Apoliga* sp. II: 18, gravid proglottis uterus stage between labyrinthine with large pouches and sacciform septate.

longitudinal; in the anterior indenture of ovary, decidedly posterior to cirrus pouch. Internal vas deferens much coiled in the posterior half of the pouch; lumen regular, narrow. Vas deferens median, lengthwise elongate, nearly reaching the anterior margins of the proglottis, in front of the ovary aporal lobe, when ripe; main mass close to posterior rim of cirrus pouch, that can be nearly longitudinal in long, female proglottides.

Numerical data

Strobila 1,4-1,6 mm (n=3); 4-5 proglottides; Adult proglottides (258)274-502(574)x(171)198-342 (n str.=8, n progl.=8); Scolex, width 175-217 (n=6); Rostellum pouch 165-220x57-76 (n=6); Rostellum (171)179-220x25-34 (stem), 36-46(apical pad) (n=6); Suckers 68-103x68-95 (n scol.=6); Hooks, 20 (n.scol.=4); length in both circles, 27-28(29), blade (l) 9-10, handle (m) 19-20, l/m 0,481-0,500 (n scol.=2, n hooks=7); Genital atrium, length of the ductus masculinus 17-29 (n str.=9, n progl.=17); Genital atrium, length of the anterior "brush" of long spines (31)34-48 (n str.=9, n progl.=17); Cirrus pouch (55)60-96x36-50 (n str.=9, n progl.=17); Cirrus withdrawn, bundle of bristle-like spines (101)110-134 (n str.=9, n progl. n=17); Testes 8-9 (n str.=10, n progl.=12), diam. 32-41 (43) x 29-38 (n = 20, n str. 6); Ovary, width 96-168(180) (n str.=8, n progl.=8); Vitellarium, largest diameter 46-47 (n str.=8, n progl.=8); Seminal receptacle, length 41-72 (n str.=8, n progl.=8);

Host: *Chrysoptilus melanolaimus* (Malherbe, 1857) [the synonymity with *C. melanochlorus* (Gmelin, 1788) is still under discussion].

Locality: Monte, Province of Buenos Aires, Argentina; 28-9-1982.

Site of infection: intestine, mixed with another *Apoliga* sp.

Holotype and paratypes at the Muséum d'Histoire naturelle of Geneva (Switzerland), MNHG 982.1859; 1861.

Discussion

Apoliga differs from all other genera of Dilepididae particularly in the structure of the atrio-genital complex and its kind of spinosity. However, a comparison with few other genera must be made. If we take into account only a few important traditional characters (number of hooks circles, position of genital pores, position of genital ducts, uterus) we would not be able to tell *Apoliga* from *Liga*. Moreover, the two genera have the same host group, are even found in the same host, and both show a large diversification of neotropical species.

Apoliga differs from *Liga* (see Figs 25-26) as follows: last adult proglottis (ripe ovary) longer than wide, pronounced proterandrous maturation, smaller testes number [8-12, instead of (9)14-25], atrium proper deep, forwards directed, heavily spined, ductus masculinus strong and spineless, bundle of bristle-like spines of the cirrus stiff, very long, engaged, when organ withdrawn, in the whole atrial cavity, vagina very sinu-

ous, vagina and cirrus pouch divaricated, main mass of vas deferens along the posterior rim of the cirrus pouch (rather than in front of the pouch), seminal receptacle roundish or lengthwise elongate (instead of transverse), situated in the anterior indenture of ovary.

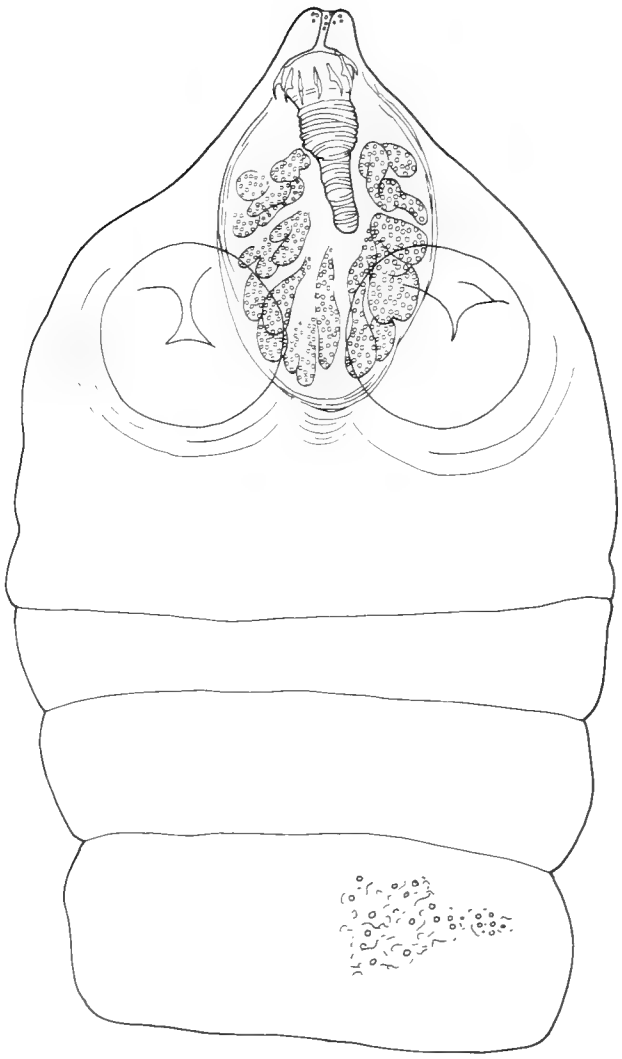
As to *Chitinorecta* Meggitt, 1927 and *Dictymetra* Clark, 1952, the structure and spinosity of the atrio-genital complex (including the ductus masculinus) and some other important characters are different, as resulting from a revision of the two genera whose diagnoses were, emended (Bona, 1994, in press).

Some notes must be added, taking into account also 5 other new species of *Apoliga*, often mixed, we were able to examine. The protandry, with a pronounced regression or disappearence of testes when the ovary reaches ripeness, occurs in 4 out of the 6 known species and proves to be an interesting physiological character; in the 2 species where it is less accentuated, testes only get smaller in the adult female proglottis, without disappearing. In such a case, even the appearance of the uterus is more gradual, with the interposition of a semi-gravid proglottis between the female adult one and the fully gravid one (in the other species the gravid proglottis suddently appears at a stage of advanced maturation of the uterus, immediately after the female adult one). Proglottides number in a strobila, from 5 to 8. Excretory vessels thin, often very sinuous even in wholly extended proglottides. Sometimes the genital pore seems to be partially covered with a posterior flap of the proglottis wall. When the cirrus is withdrawn, only a small part of the bundle of bristle-like spines sinks into the pouch, the remaining part being external to the pouch, inside the ductus masculinus and atrium. Cirrus spines are rather apical (better seen in evaginated cirri), leaving a smooth, unarmed proximal part of different lengths according to species. Base of evaginated cirrus at times swollen, filling the whole ductus masculinus, getting close to its wall and hindering a neat distinction among ductus, cirrus and, consequently, cirrus pouch. Vagina orifice usually very narrow. The 2 fine muscular bundles round the atrium near the pore, an apparently unimportant character, can be observed in every species of *Apoliga*.

These 5 species fit perfectly into the diagnosis made on the basis of the type species, and confirm its validity. They show the high homogeneity of such clearly outlined genera and the constant appearance, in every species, of character states that traditional diagnoses either do not take into account, or do so only incidentally, as such characters are not usually considered valid on the generic level. It is also worth observing how the six species, inside such a rigid and restrictive diagnosis, differ from each other.

Monoliga n. gen.

DIAGNOSIS – Rostellar apparatus weakly muscular, glandular. Pouch oval, wall thin. Rostellum small, stem narrow, apical pad well-defined. Hooks in 1 circle, few (12-14). Strobila very small, brittle; no neck; proglottides hardly craspedote, much wider than long, often crescent-shaped, anterior concavity; pore anterior. Scolex wide, posteriorly not well-defined. Genital pores regularly alternate. Genital ducts dorsal to excretory vessels. Vagina posterior, proximal course mainly ventral, to cirrus pouch. Uterus closely labyrinthine; eggs end in the parenchyma. Embryophore thin, outer



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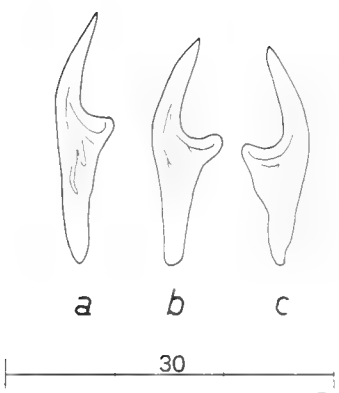

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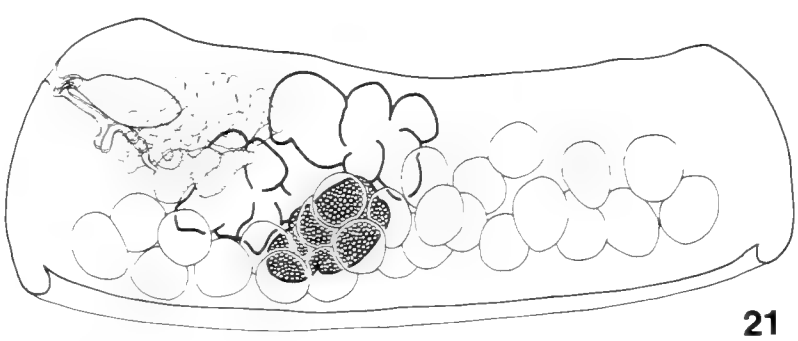

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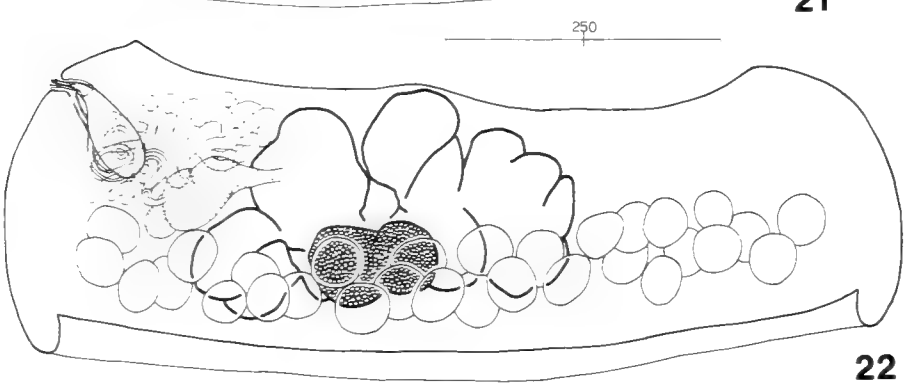

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coat hardly developed. Genital atrium simple, unarmed; extremely reduced ductus masculinus. Ovary bilobed, large, bulky; lobules few, large; nearly wholly in the poral half of the medulla when ripe. Vitellarium in the back, in the posterior indenture of the ovary; lobules large. Testes numerous, postovarian, dorsal to vitellarium and partly to ovary; field transverse, more extended aporally to ovary. Cirrus pouch small, oval; wall thin; much backward inclined in adult proglottides. Cirrus short; armed with long, bristle-like spines, engaged in atrium, even when cirrus withdrawn. Vagina along posterior rim of cirrus pouch, then backward directed; proximal part sinuous; wall firm. Seminal receptacle poral, transversely elongate, wide, sinuous; in front of poral end of ovary. Vas deferens antero-poral, surrounding and overlapping proximal part of cirrus pouch and vagina; anterior and close to seminal receptacle. In Piciformes, Picidae. Neotropical. Type species: *M. amazonica* n. sp.

Monoliga amazonica n. sp. (Figs 19-24)

Description – Strobila very small; proglottides few (8-10), fully gravid ones detached; brittle; neck absent; triangular, rapidly widening when proglottides become semi-adult and adult; musculature weak. Proglottides hardly craspedote, much wider than long, often crescent-shaped with anterior concavity, rounded sides; fully gravid ones often longer than wide; pore far anterior; cortex scarce; rather wide, free medullar area in front of aporal testes. Scolex wide as much as the first segment, not well-defined from strobila, at times dome-shaped. Rostellar apparatus weakly muscular, heavily glandular; pouch subspherical, large but not reaching beyond suckers; wall thin; glandular follicles – if well preserved – radiate round retracted rostellum; anterior cavity round apex of retracted rostrellum not very deep; longitudinal external muscular bundles from the neck (generally reaching the pouch wall) seem absent or reduced to fine fibres. Rostellum proportionally small, muscular structure normal; rather narrow stem, well-defined apical pad; plunged into a glandular mass. Hooks in 1 circle, regular; few [(10?) 12-14], spaced; small but strong; blade slender, shorter than handle; rather varying in shape in the same scolex, major differences in the thickness of the stretch between guard and handle. Genital pores regularly alternate; far in front. Genital ducts dorsal to excretory vessels. Vagina posterior to cirrus pouch; porally in same horizontal plane, proximally mainly ventral. Uterus ventral, closely labyrinthine, fairly persistent, with mainly longitudinal tubes and mamillated walls, then apparently sacciform, deeply septate and, in the end, eggs loose in the parenchyma, mixed with residues of septa; it promptly occupies the whole medulla. Eggs: embryophore thin, outer layer of inner coat adheres to embryophore as a second firm layer, outer coat scarcely developed, hardly visible. Genital atrium simple, not

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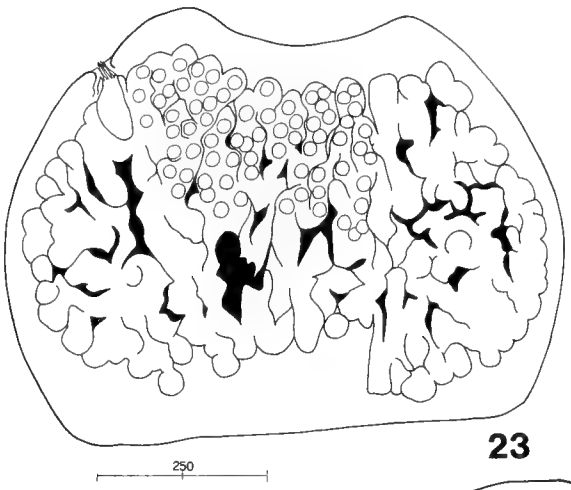
Figs 19-22

Monoliga amazonica n. gen., n. sp.: 19, scolex; 20, hooks, two scoleces, (b) and (c) of the same scolex; 21, semi-adult proglottis; 22, fully adult proglottis, ovary larger, testes smaller than in the semi-adult one;

very deep; wall and musculature unnoticeable; unarmed; extremely reduced ductus masculinus, because the female orifice opens posteriorly in the lowest part of the atrium, just more porally than the male orifice and slightly extended along the atrium wall; furthermore, at the bottom of the atrium (not on its wall), round cirrus base, there are bristle-like spines, shorter than those of the cirrus and easily mistaken for them. Thus, in *amazonica*, there is an extreme reduction or disappearance of the ductus masculinus, but some details, well-defined in *Liga*, persist. Ovary bilobate, massive with large, irregular, not very numerous lobules; when fully ripe, the isthmus is hardly visible and the two lobes meet anteriorly; initially central, when ripe nearly wholly in the poral half of the medulla; nearing the anterior and posterior margin of the proglottis but not reaching the poral excretory vessel; backward extended laterally to vitellarium. Vitellarium close to ovary, in its posterior indenture; far in the back; smooth, with some large lobules. Testes numerous, postovarian, even lateral in semi-adult proglottides; transverse field in the posterior half of the medulla, reaching excretory vessels on both sides, more extended aporally to ovary; dorsal to vitellarium and to posterior rim of ovary; slightly proterandrous, largest size just before ovary reaches full ripeness. Cirrus pouch small, subspherical or oval; wall thin with a very delicate sleeve of circular fibres just behind orifice; nearly transverse in semi-adult proglottides, decidedly backward inclined in adult ones, at times parallel to the proglottis side. Cirrus small, short, truncated cone; wall thin; long bristle-like spines on its whole length, jutting out from pouch orifice and partly engaged in atrium even when organ withdrawn. Vagina long; distal part straight, along the posterior rim of the pouch, then sinuous, backward inclined; wall distally thin, then robust with circular fibres. Seminal receptacle poral; rather long, transversely elongate, wide, irregular, sinuous; in front of and lateral to ovarian poral lobe; sometimes hidden in the coils of the vas deferens; rather far from vitellarium. Internal vas deferens long, coiled, regular lumen; in proximal half of cirrus pouch. Vas deferens antero-poral, in the corner of the medulla; extended from anterior margin of proglottis to poral testes; in front of the poral ovarian lobe, surrounding and overlapping the proximal part of the cirrus pouch and vagina, anterior and close to seminal receptacle.

FIGS 23-27

Monoliga amazonica n. gen., n. sp.: 23, gravid proglottis; 24, atrio-genital complex, cirrus partly evaginated. *Liga ransomi* Spasskii, Reznik, 1966 (syn. *Liga punctata* (Weinland, 1856) Weinland, 1857, unavailable name because originally homonymous with *Taenia punctata* Rudolphi, 1802; *L. brasiliensis sensu* Ransom, 1909, *nec* Parona, 1901, *nec* Fuhrmann, 1907), material of Ransom, U.S.A.H.C. 4577, considered as neotype of the type species of the genus; 25, adult proglottis; 26, atrio-genital complex; cirrus partly evaginated, some bristle-like spines at the bottom of the ductus masculinus, round the cirrus base, have been drawn; 27, *Ivritaenia mukteswarensis* Singh, 1962, from Singh's drawing.



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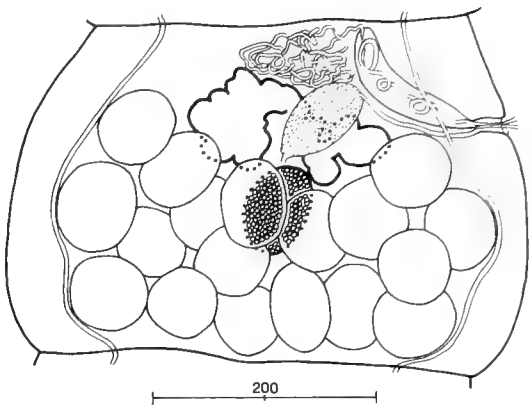

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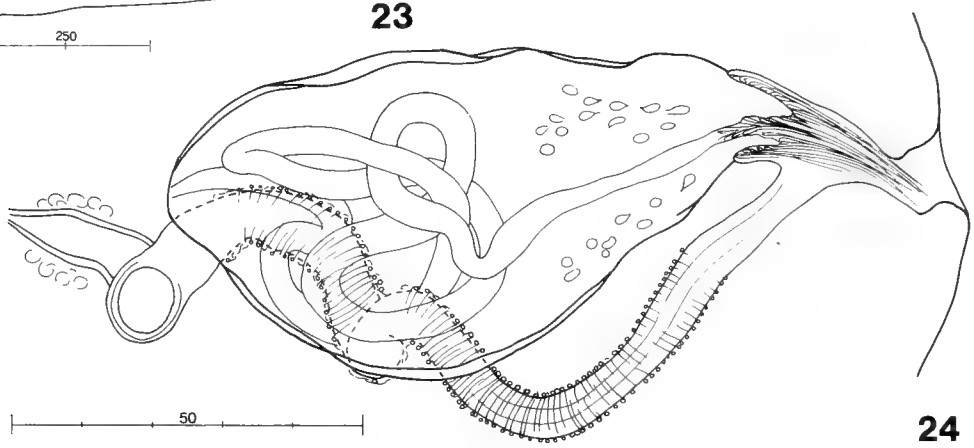

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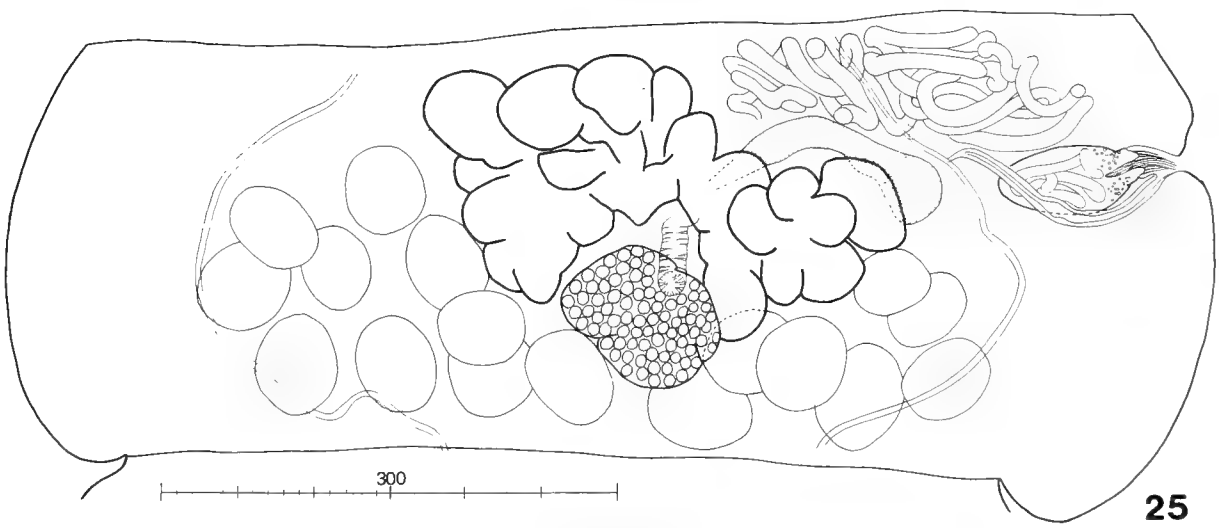

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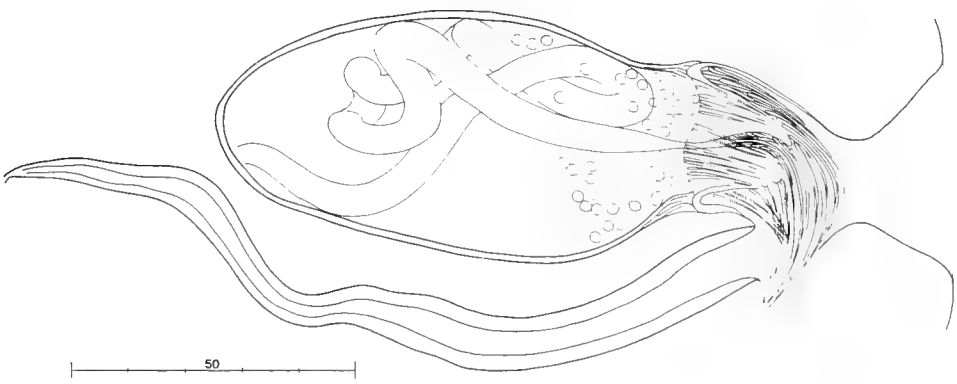

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NUMERICAL DATA

Strobila (including first gravid proglottides) about 2,3 mm; Adult proglottides (length measured along the sides) 207-275(320)x550-740(800) (n=10); Gravid proglottides from 665x835 to 730-1035x475-600 (n=10); Scolex, width 275-318 (n=3); Suckers 96-106x90-101 (n=8); Rostellum pouch (143)152-180x103-115 (n=5); Rostellum 92-104x32(stem), 38-44(apex), if not particularly contracted (n=3); Hooks, 12-14 (n scol.=3); length 19-22, even in the same scolex (n=12); Cirrus pouch (75)81-93(98)x38-46(52) (n=14); Cirrus withdrawn, tuft of bristle-like spines, 29-32x6(n=6); Testes 27-31 (n progl.=6), diameter, 51-64x37-60 (n=12); Ovary, width 220-260(320) (n=6); Vitellarium 70-83x110-133 (n=6).

Host: *Celeus flavus* (Müller, 1766).

Locality: Rio Molinowsky, Province of Madre de Dios, Peru; 3-12-1982.

Site of infection: first 1/10 of intestine.

Collection sample n° 146. Holotype and paratypes at the Museum d'Histoire naturelle of Geneva (Switzerland) MHNG 982.1860, 1862.

DISCUSSION

Monoliga has the same hosts and morphological habitus as *Liga* Weinland, 1857 (Figs 25-26) (see RANSOM 1909). It differs in the simple crown, instead of double, with few, spaced hooks, the poral position of the ovary and backward directed cirrus pouch in adult proglottides, the markedly sinuous vagina, seldom appearing in *Liga*, the backward extension of the vas deferens overlapping part of cirrus pouch and vagina. The differences from *Ivritaenia* Singh, 1962 (Fig. 27), which, like *Monoliga*, has a simple crown, regularly alternate pores and genital ducts dorsal to excretory vessels, are more subtle. *Monoliga* differs in the lower number of hooks (12-14 instead of 24), in the anatomical topography as a whole, in much wider than long proglottides, poral ovary, testicular field more extended aporally to the ovary, vitellarium situated deep in the posterior indenture of the ovary instead of clearly posterior, seminal receptacle more extended porally beyond ovary, vas deferens more poral, surrounding and overlapping the proximal part of the cirruspouch and squeezed between cirrus pouch and seminal receptacle, reaching backward almost the poral testes, cirrus pouch backward, and not forward, inclined. The differences from *Krimi* Burt, 1944 lie in regularly alternate pores, genital ducts dorsal to excretory vessels, and not in between, as mostly happens in *Krimi*, anatomical topography as a whole (Fig. 8) ovary poral, testes dorsal to vitellarium and partly to the posterior rim of the ovary and more extended aporally, backward directed cirrus pouch. Most differences from *Choanotaenia* Railliet, 1896 are the same as those from *Krimi*; it can be added, that in *Monoliga* the vagina is much more sinuous, the vitellarium has not so small lobules, the ovarian lobes are not clearly divided by a rather long isthmus, the eggs are without polar processes and not mixed with granular cells to the ripe uterus. Moreover hosts seem not to be Galliformes.

ACKNOWLEDGMENT

To Dr Claude Vaucher, with whom I had interesting discussions about the genus concept in cestodes, friendly thanks for the revision of the text.

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REVUE SUISSE DE ZOOLOGIE, 101 (1) : 215-231; mars 1994

Revision der Gattung *Benhamia* Michaelsen, 1889 (Oligochaeta: Octochaetidae)

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Revision of the genus *Benhamia* Michaelsen, 1889 (Oligochaeta: Octochaetidae). – An overall revision of this heterogenous, catch-all genus has been carried out: the genus *Benhamia* Michaelsen (type species *B. rosea* Michaelsen) is redefined, three new genera are established: *Benhamiona* n. gen. (type species *Benhamia baumanni* Mich.), *Guineoscolex* n. gen. (type *Dichogaster inaequalis* Mich.), and *Monothecodrilus* n. gen. (type species *Dichogaster scherbroensis* Mich.). The type species of the genera *Omodeona* Sims, 1967 and *Dichogaster* Beddard, 1888 are redescribed. Three new species are described in the new genus *Benhamiona*.

Key-words: Oligochaeta - Octochaetidae - Taxonomy - *Benhamia* - Revision.

EINLEITUNG

Die Gattung *Benhamia* wurde von MICHAELSEN (1889) mit der Typusart *B. rosea* aufgestellt, von ihm selbst jedoch (1900) mit der Sammelgattung *Dichogaster* vereinigt. Im Zuge der Revision der Gattung *Dichogaster* rehabilitiert OMODEO (1955) *Benhamia* wieder und reiht ihr 30 westafrikanische Arten ein, bei denen sich 3 Paare Kalkdrüsen im 14.-16. Segment befinden, im Gegensatz zu den *Dichogaster*-Arten, die sie im 15.-17. Segment besitzen.

Die Gattung *Benhamia* war jedoch bezüglich ihrer morphologischer Kennzeichen nicht einheitlich (OMODEO 1958), es lassen sich anhand der Samentaschen-Formen drei Artengruppen unterscheiden:

a. - *rosea*-Gruppe: Kopulationsborsten neben den Samentaschen und freie Samentaschendivertikel fehlen, Samentaschenkämmerchen sind in der Wand des Ausführganges vorhanden.

Manuskript angenommen an 03.06.1993.

b. - *hupferi*-Gruppe: Kopulationsborsten neben den Samentaschen vorhanden, Samenkämmerchen in der Wand des Ausführganges erkennbar.

c. - *inaequalis*-Gruppe: Kopulationsborsten fehlen, Samentaschen mit zwei (oder mehreren) kolbenförmigen Divertikeln.

In der Folgezeit wird die Zahl der *Benhamia*-Arten durch Sims (1967) bereichert, der auch die Gattung *Omodeona* Sims, 1967 abtrennt, die sich von *Benhamia* durch den Besitz von nur 2 Paaren Kalkdrüsen im 15. und 16. Segment unterscheidet, in allen anderen Merkmalen jedoch mit ihr grosse Aehnlichkeit aufweist.

Die Kalkdrüsen von *Benhamia rosea*, der Typusart, liegen nicht im 14.-16. Segment, wie irrtümlich in der Originalbeschreibung erwähnt, sondern im 15.-17. Segment, wie eine Nachprüfung der Typen ergab (Csuzdi 1992). In diesem Merkmal stimmt sie damit mit den Arten der Gattung *Dichogaster* überein; sie unterscheidet sich eindeutig davon durch die Anatomie des Exkretionssystems, wie nachfolgende Revision ergibt. Die bisher in *Benhamia* geführten Arten mit Kalkdrüsen im 14.-16. Segment werden davon abgetrennt.

Für die Überlassung von Typen-Material danken wir den Herren Prof. Dr. M. Dzwillo, Zoologisches Institut und Museum der Universität, Hamburg, Dr. G. Hartwich, Zoologisches Museum und Institut für Spezielle Zoologie der Humboldt Universität, Berlin, und Dr. A. Rolando, Museo ed Istituto di Zoologica Sistematica della Universita, Torino. Für die Überlassung von Material sei den Herren Dr. Cl. Vaucher, Naturhistorisches Museum, Genf, Dr. F. Puylaert, Musée Royal de l'Afrique Centrale, Tervuren, und Prof. Dr. T. Pócs, Botanischer Lehrstuhl der Hochschule, Eger, ebenfalls bestens gedankt. Das Material wird aufbewahrt im Tiersystematischen und Ökologischen Lehrstuhl der Universität Budapest (AF), im Muséum d'Histoire naturelle Genf (MHNG) und im Musée royal de l'Afrique centrale Tervuren (MRAC).

BEARBEITUNG DES MATERIALS

Benhamia rosea zeigt Abweichungen in einigen Merkmalen von einem Teil der übrigen *Dichogaster*-Arten (Csuzdi, 1992). Besonders Kennzeichnend sind aber die Unterschiede in der Ausbildung des Exkretionssystems.

Bei den terrestrischen Oligochaeten unterscheiden wir zwei Hauptformen des Nephridialsystems: 1. holonephridisches System oder auch meganephridisches genannt, wo in jedem Segment ein Paar Holonephridien vorkommen, 2. meronephridisches System, wo in jedem Segment mehrere oder eine verschiedene Zahl von Meronephridien vorkommen. Letztere sollen sich nachweislich durch Trennung von Holonephridien gebildet haben und sind jüngeren Ursprungs (Michaelsen 1934). Die Nephridien können geschlossen sein, wo der Flimmertrichter (Nephrostoma) fehlt oder offen ist falls dieser vorhanden ist. Die Nephridien münden entweder durch die Leibeswand nach aussen, oder in den Darm (exonephridisch oder enteronephridisch).

Die Kombination dieser Merkmale führt zu reichen Verschiedenheiten im Nephridialsystem dieser Tiere.

BAHL (1946) teilt die Meronephridien in 3 verschiedene morphologische Gruppen:

a. - Megameronephridien: vergrösserte, offene exonephridisch Meronephridien, die in zahlreichen Gattungen der Familie Octochaetidae und Megascolecidae vorkommen und im hinteren Teil des Körpers medioventral in je einem Paar pro Segment anzutreffen sind. JAMIESON (1971) hat die Gattungen der Familie Octochaetidae mit Megameronephridien dem Tribus Dichogastrini der Familie Megascolecidae, zusammen mit den diese Merkmale besitzenden Gattungen dieser Familie, einverleibt.

b. - Sackförmige Meronephridien: offene exonephridische Meronephridien. Diese, die Gattung *Dichogaster* kennzeichnenden Meronephridien, sollen nach JAMIESON (1971) und SIMS (1986) geschlossen sein, wir haben ebenfalls keine Flimmertrichter (Nephrostoma) nachweisen konnen (Abb. 1).

c. - Tubulare (doppelarmige) Meronephridien: exonephridische Meronephridien. Sie kommen bei mehreren Gattungen in der Familie Octochaetidae, so z. B. in den Gattungen *Eutyphoeus* und *Omodeona* vor (Abb. 2).

Ein vierter Typ der Meronephridien wird auch als diffuse Nephridien oder Plectonephridien bezeichnet. Diese Benennung der Nephridien wurde zuerst von BEDDARD (1985) und BENHAM (1890) benützt und bezog sich auf das miteinander verbundene Netzsystem von Meronephridien. Das Vorkommen von solchen Gebilden wird von BAHL (1946) nicht anerkannt. Bei der Beschreibung von *Dichogaster jaculatrix* hat BAYLIS (1915 bereits darauf hingewiesen, dass das Exkretionssystem dieser Art sehr kompliziert ausgebildet sei, es sollen auf einem Mesenterium eine Menge kleiner Läppchen angehäftet sein. Da wir bei der Untersuchung der Exkretionsorgane verschiedener *Benhamia*- und *Dichogaster*-Arten bei einem Teil der Spezies (z. B. *Dichogaster itoliensis*, *Benhamia rosea*) ebenfalls nachweisen konnten, dass auf der Membran des Bindegewebes der einzelnen Segmente sich tubulare Nephridien befinden und miteinander in Verbindung stehen und herauspräpariert werden können, sind wir der Meinung, dass dieser Typ von Nephridien unter der alten Benennung Plectonephridien geführt werden soll (Abb. 3).

Da auch die Typus-Art *B. rosea* sich in der Form der Nephridien von den meisten *Dichogaster* Arten unterscheidet, kann die Gattung *Benhamia* unter Berücksichtigung dieses Merkmales auch weiterhin aufrecht erhalten bleiben, alle Arten der Gattung *Dichogaster* hingegen die über plectonephridische Nephridien verfügen, müssen in der Zukunft der Gattung *Benhamia* eingereiht werden.

Ein Teil der Gattung *Benhamia* angehörenden Arten jedoch bildet noch immer keine homogene Gruppe, da man einerseits Taxa mit paarigen und unpaarigen Samentaschen vorfinden kann, anderseits kann die Zahl der Kalkdrüsen bei einigen Arten und nicht zuletzt auch die Struktur der Samentaschen verschieden sein.

Deswegen schlagen wir unter Berücksichtigung der vorausgehend angeführten Unterschiede vor, die Gattung *Benhamia* in homogene Einheiten aufzuteilen.

Gattung **Benhamia** Michaelsen, 1889, emend.

G a t t u n g s d i a g n o s e : Borsten eng gepaart, sämtliche ventral gelegen. Weibliche Poren im 14. Segment, paarig oder unpaarig. Männliche Poren auf dem 18. Segment von den Prostataporen getrennt. 2 Paare Prostataporen auf dem 17. und 19. Segment. 2 Paare Samentaschenporen auf Intersegmentalfurche 7/8, 8/9. Zwei kräftig entwickelte Muskelmagen im 5.-6. Segment oder etwas weiter nach hinten gelegen. Kalkdrüsen mit paarigen Ausbuchtungen im 15.-17. Segment. Exkretionssystem meronephridisch mit vielen miteinander verbundenen Plectonephridien, denen sich im hinteren Teil des Körpers in jedem Segment ein Paar medioventrale Megameronephridien anschliessen.

T y p u s - A r t : *Benhamia rosea* Michaelsen, 1889

W e i t e r e A r t e n : *Benhamia itoliensis* Michaelsen, 1889, *Dichogaster pinguis* Cognetti, 1910, *Dichogaster terraenigrae* Omodeo et Vailland, 1967.

V e r b r e i t u n g : Tropisches Westafrika

Benhamia rosea Michaelsen, 1889

Dichogaster rosea MICHAELSEN, 1900, 1915, non *Dichogaster rosea* Michaelsen, 1935 = *Dichogaster hamburgensis* Omodeo, 1958. *Benhamia rosea* Cszudi, 1992.

F u n d o r t : MHNG 970/135 1 Ex. Cote d'Ivoire, Forest de la Meno près du Cavally. XI.1970. leg. E. Binder.

Benhamia itoliensis Michaelsen, 1892

Dichogaster itoliensis: MICHAELSEN, 1900, 1931, 1935, 1937. Syn.: *Benhamia johnstoni* Beddard, 1901, *Benhamia mollis* Beddard, 1901, *Benhamia moorei* Beddard, 1901, *Dichogaster jaculatrix* Baylis, 1915.

F u n d o r t : AF/2317 1 Ex. Zaire, Prov. Kivu, Kahuzi-Biega Nationalpark, NW von Bukavu, Bambuswald, 2400 m, 28-30.VIII.1991. leg. T. Pócs.

Benhamia pinguis (Cognetti, 1910)

Dichogaster pinguis Cognetti, 1910

In der Sammlung von Torino lag ein grosses juveniles Tier unter Inv. Nr. OL 82 vor, welches mit einem roten Zettel als Typus bezeichnet wurde und die Beschriftung: "*Dichogaster pinguis* Cogn., Typus, S. Thome, Agua Ize, L. Fea, 1900" führte. In einem anderen Glas (Inv. Nr. 83) fanden wir ebenfalls *Dichogaster pinguis* Cogn. mit der Bezeichnung 'Typus" vor, hier war der Fundort "Isola Principe L. Fea, 1901" angeführt. Auch dieses Glas war mit einem roten Typus-Zettel versehen und beinhaltete 3 Exemplare. Ausser den Museumetiketten lagen in beiden Gläsern noch weitere Zettel vor, die wahrscheinlich die Handschrift von Cognetti aufwiesen. Auf dem einen

Zettel (Inv. Nr. 82) stand "*Dichogaster pinguis* Cogn. S. Thome, Agua Ize 400-700 m, L. Fea, 1900", auf dem anderen (Inv. Nr. 83) "*Dichogaster princeps* Cogn. Typi Is. Principe L. Fea I.-III., 1901". Nach einer Nachbestimmung der Tiere konnte festgestellt werden, dass unter Inv. Nr. OL. 82 der typus von *D. pinguis*, unter Inv. Nr. OL. 83 die Typen-Exemplare von *D. princeps* untergebracht waren. Die Etikette von *D. pinguis* im Glas OL. 83 gelang sicherlich durch Irrtum bei einer späteren Beschriftung des Materials in die Phiole.

Nachstehend sollen einige Ergänzungen der Originalbeschreibung von *D. pinguis* angeführt werden.

Länge des Tieres 240 mm, Dicke 10 mm, Segmentzahl 267. (die Angabe über die Länge des Tieres in der Originalbeschreibung 16-24 mm muss ein Druckfehler sein, es muss sich um 160-240 mm handeln). Paarige weibliche Poren auf dem 14. Segment, etwas medial von der Borstenlinie *aa*. Die beiden Muskelmagen liegen im 5.-6. Segment. Exkretionssystem meronephridisch mit seitlichen Plectonephridien, denen sich im Ende des Körpers in jedem Segment medioventral je ein Paar Megameronephridien anschliessen.

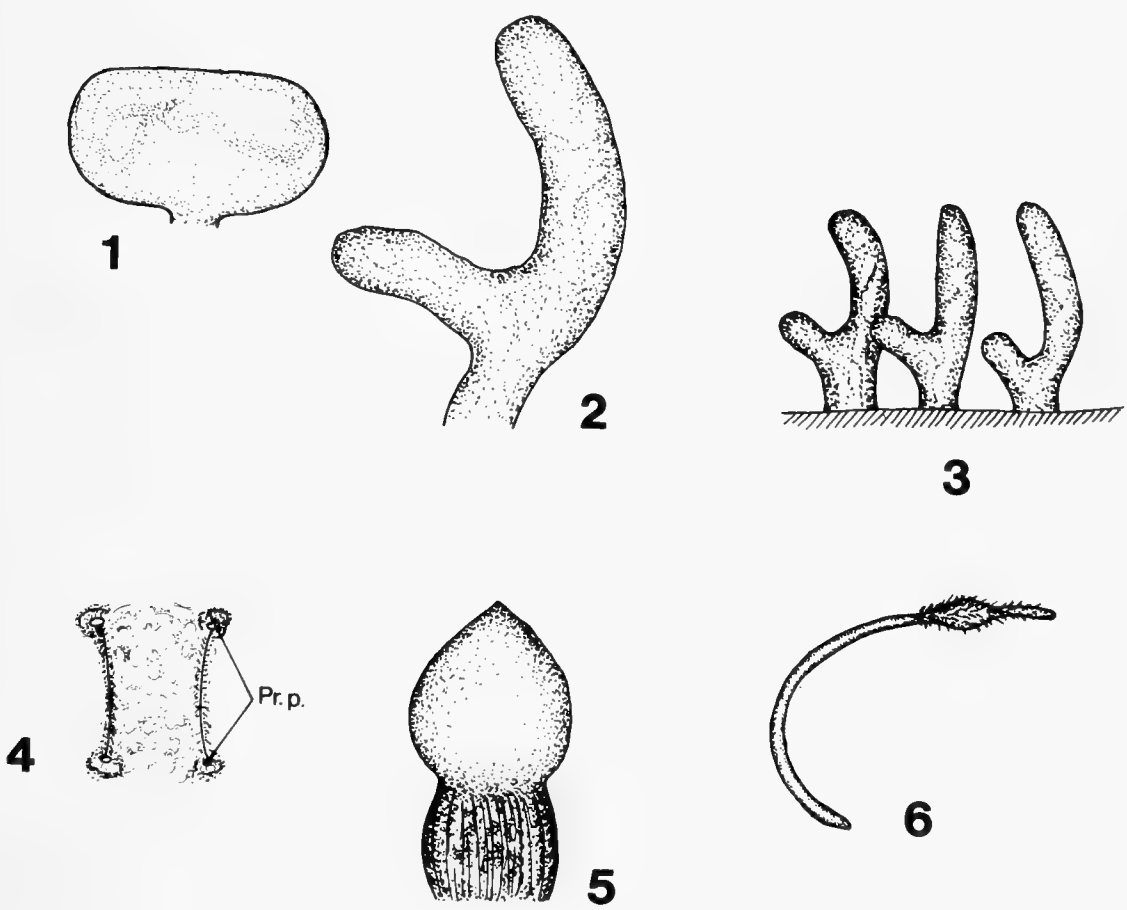

ABB. 1-6

1. Sackförmiges Meronefridium - 2. Tubulares Meronefridium - 3. Plektonefridium; *Benhamia* sp. - 4. Männliches Geschlechtsfeld - 5. Samentasche - 6. *Benhamiona ornata*, Penialborste.

Benhamia sp.

In der Sammlung von Tervuren liegt ein mächtiges, auf der Ventralseite am Vorderkörper beschädigtes Exemplar vor, dem der vordere Darmkanal-Teil fehlt. Da das Tier vorzüglich konserviert ist, soll eine kurze Beschreibung nachtehend erfolgen.

Länge des in Alkohol zusammengeschrumpften Tieres 550 mm, Dicke 25 mm, Segmentzahl 450. Farbe hellgelb.

Kopf prolobisch Erster Rückenporus in Intersegmentelfurche 20/21. Borsten eng gepaart, sämtlich ventral gelegen. Borstendistanz hinter dem Gürtel *aa*:*ab*:*bc*:*cd*:*dd* wie 35:4:32:3:250. Weibliche Poren wegen der Beschädigung nicht genau zu erkennen, scheinen paarig und ventral von der Borstenreihe *aa* auf dem 14. Segment zu liegen. Zwei Paar Samentaschenporen auf Intersegmentalfurche 7/8 und 8/9. Der Gürtel erstreckt sich vom 14.-22. Segment, ventral auf dem 17.-19. Segment ein ziegelförmiges Geschlechtsfeld, in den Ecken des Geschlechtsfeldes liegen die Prostataporen. Die beiden Öffnungen der gleichen Seiten werden durch eine schwach gebogene Samenrinne verbunden (Abb. 4).

Innere Organisation. Aus den vorderen 50-60 Segmenten fehlt der Darmkanal vollkommen. Ein Muskelmagen lag abgerissen ausserhalb des Körpers, der andere fehlte offensichtlich. 5 kräftige Dissepimente liegen vor dem 17. Segment, die genaue Lage ist nicht feststellbar. Von den 4 Prostata waren nur die stark gewundenen Ausführungsgänge im 17. und 19. Segment vorhanden, Drüsenteile lagen abgerissen auf den verdickten Dissepimenten hängend. Penialborsten schienen vollkommen zu fehlen, da keine Borsten und auch keine Borstensäcke erkannt werden konnten. Exkretionssystem meronephridisch mit in Reihen stehenden Plectonephridien, die im Körperende von je ein Paar Megameronephridien begleitet werden.

Samentaschen spindelförmig mit zylinderartigem muskulösen Ausführungsgang und einer etwas eingeschnürten, dünnwandigen, kegelförmigen Ampulle. Ausführungsgang mit Sammenkämmerchen versehen (Abb. 5).

Anhand der vorhandenen Organe steht sie *B. rosea* Michaelsen, 1889 sehr nahe, unterscheidet sich jedoch deutlich in der Grösse, in der Form des Geschlechtsfeldes, ferner dadurch, dass eine Paarigkeit der weiblichen Poren angenommen wird und eventuell durch ein Fehlen der Penialborsten.

Fundort: MRAC 37030. 1 Ex. Cote d'Ivoire, Adiopodoume, 1969 leg. Bellier.

Gattung **Benhamiona** gen. n.

Gattungsdiagnose: Borsten eng gepaart, sämliche ventral gelegen. Weibliche Poren im 14. Segment, paarig oder unpaarig. Männlicher Geschlechtsapparat entweder rein acanthodrilin oder mit balantiner bzw. microscoleciner Reduktion. Samentaschendivertikel fehlen. Samenkämmerchen in der Wandung des Ausführungsganges. Zwei kräftig entwickelte Muskelmagen im 5.-6. Segment oder etwas weiter nach hinten reichend. Kalkdrüsen mit paarigen Ausbuchtungen im 14.-16.

Segment. Exkretionssystem meronephridisch mit mehreren miteinander verbundenen Plektonephridien, denen sich im Ende des Körpers in jedem Segment medioventral gelegene Megameronephridien anschliessen.

Typus-Art: *Benhamia baumanni* Michaelsen, 1897

Andere Arten: *Benhamia budgetti* Beddard 1900, *Benhamia balantina* Omodeo 1958, *Acanthodrilus beddardi* Horst 1888, *Dichogaster biggei* Michaelsen 1915, *Acanthodrilus büttikoferi* Horst 1884, *Benhamia capilliseta* Omodeo 1958, *Dichogaster esca* Stephenson 1931, *Benhamia gambiana* Beddard 1902, *Benhamia guineana* Omodeo 1958 stat. nov., *Dichogaster hansi* Michaelsen 1914, *Benhamia horsti* Michaelsen 1898, *Dichogaster hupferi* Michaelsen 1891, *Dichogaster kindiana* Michaelsen 1914, *Benhamia liberiensis* Horst 1895, *Benhamia michaelseni* Beddard 1902, *Dichogaster misaensis* Michaelsen 1897, *Dichogaster ornata* Sciacchitano 1952, *Dichogaster robertsiana* Michaelsen 1922, *Dichogaster schomburgki* Michaelsen 1913, *Dichogaster stockhauseni* Michaelsen 1913, *Benhamiona murithae* sp. n., *Benhamiona puylaerti* sp. n., *Benhamiona pitti* sp. n.

Verbreitung: Tropisches Westaffika

Benhamiona baumanni (Michaelsen 1897)

Dichogaster baumanni: Michaelsen 1900, *Benhamia baumanni:* Omodeo 1955, 1958.

Von dieser Art sind mehrere gut konservierte Tiere im Museum von Tervuren vorgefunden worden. Ein Vergleich mit dem Typenmaterial aus Berlin (Inv. Nr. 3058 und 3043) und Hamburg (Inv. Nr. V. 4519) ermöglichte unser Material einwandfrei dieser Art zuzuordnen.

Der Originalbeschreibung sollen nachstehend nur einige Ergänzungen beigefügt werden.

Erster Rückenporus in Intersegmentalfurche 19/20, die Poren sind winzig und nur in der Mitte des Körpers deutlich zu erkennen. Weibliche Poren paarig auf dem 14. Segment, an der Basis der Borsten *aa*.

Zwei kräftige Muskelmagen im 5.-6. Segment. Kalkdrüsen im 14.-16. Segment, die des 14. Segmentes winzig. Exkretionssystem meronephridisch, auf jeder Seite mit zahlreichen, in 2 Reihen stehenden Plectonephridien, im hinteren Teil des Körpers in jedem Segment mit je einem Paar Megameronephridien.

Fundorte: MRAC 34326: 2 Ex., Togo Missahöhe, 6-8.VIII.1969, leg. F. Pulayert. AF2455: 2 Ex. Fundort wie zuvor. MRAC 34151: 1 Ex., Côte d'Ivoire, Lamto, 4.VIII.1969, leg. L. Van Mol.

Benhamiona ornata (Sciacchitano 1952)

Dichogaster ornata: Schiacchitano 1952

Seit der Ertstbeschreibung ist dies der erste Wiederfund der Art, unser Exemplar stimmt mit der Originalbeschreibung gut überein und auch der Fundort ist derselbe (Côte d'Ivoire, Adiopodoumé). Der Originalbeschreibung sollen anhand unseres Examplares einige Ergänzungen beigefügt werden.

Das Tier ist 200 mm lang, 8 mm dick, Segmentzahl 233. Erster Rückenporus in Intersegmentalfurche 19/20. Weibliche Poren paarig auf dem 14. Segment, zwischen der Borstenlinie *aa*. Paarige Papillen auf 11/12-15/16 zwischen der Borstenlinie *b-c* sowie auf 19/20-22/23 zwischen der Borstenlinie *a-a*.

Zwei grosse Kalkdrüsen im 5.-6. Segment. Drei Paare Kalkdrüsen im 14.-16. Segment, die des 14. Segmentes winzig. Letztes Paar Herzen im 12. Segment. Exkretionssystem meronephridisch mit seitlich, in 2 Reihen angeordneten Plectonephridien, denen sich im hinteren Teil des Körpers in jedem Segment je ein Paar medioventral gelegene Megameronephridien anschliessen. Zwei Paare sehr stark aufgerollte Prostata, die bis ins 26. Segment reichen, öffnen sich im 17. und 19. Segment. Jeder Prostata gehört je ein Penialsack an, in dem 8-10 Borsten liegen. Die adulten Borsten sind 4,5 mm lang und in der Mitte 0,04 mm dick. Spitze der Borsten zugespitzt, vor der Spitze mit einem 0,6 mm dicken kräftigen Nodulus versehen. Oberer Spitzenteil der Borste mit Haaren stark ornamentiert (Abb. 6).

Fundort: MHNG 979180: 1 Ex., Côte d'Ivoire, Adiopodoumé, Abidjan, 1953, leg. V. Allen.

Bemerkung: Dieses Tier lag im Naturhistorischen Museum von Genf mit der Beschriftung "*B. hupferi* sp. cf. Easton 1979 det." vor.

Benhamiona murithae sp. n.

Länge des Holotypus 215 mm, Dicke 6 mm, Segmentzahl 180. Farbe in alkohol hellgelb.

Kopf prolobisch. Borsten eng gepaart,, sämtlich ventral gelegen. Borstendistanz hinter dem Gürtel *aa*:*ab*:*bc*:*cd*:*dd* wie 17: 4,5:16:4,5:160. Erster Rückenporus in Intersegmentalfurche 20/21. Weibliche Poren unpaarig auf dem 14. Segment, medioventral gelegen. Ein Paar Samentaschenporen in Intersegmentalfurche 8/9 in der Borstenlinie *b*.

Gürtel vom 14.-19. Segment, ventral wird er von einem ovalen Geschlechtsfeld im 15.-19. Segment unterbrochen. Im 17. Segment liegen am Rand die Prostataporen, auf dem 16. und 19. Segment je ein Paar kreisförmige Papillen vorhanden. Weitere kreisförmige Papillen befinden sich paarweise im 11/12, 12/13, und 19/20, Segment, eine unpaarige medioventral gelegene Papille im 9. Segment. (Abb. 7).

Innere Organisation. Vordere Dissepimente sehr fein, nicht verdickt. Dissepimente 10/11-12/13 etwas verdickt. Muskelmagen wahrscheinlich im 6.-7. Segment gelegen. Drei Paare Kalkdrüsen im 14.-16. Segment, nach hinten zu grösser werdend. Letztes Paar Herzen im 12. Segment. Typhlosolis im 21. Segment beginnend, nur schwach entwickelt. Exkretionsorgen meronephridisch mit in zwei Reihen angeordneten Plectonephridien, denen sich je 1 Paar medioventral gelegene Megameronephridien im hinteren Teil des Körpers in jedem Segment anschliessen.

Zwei Paar Hoden und Samentrichter im 10. und 11. Segment, die in mächtige, perioesophageale Testikelblasen eingeschlossen sind. Diese Gebilde reichen bis in die Höhe der Muskelmagen hinauf. Zwei Paare traubenförmige Samensäcke im 9. und 12. Segment. Ein Paar kleine Ovarien im 13. Segment, ein unpaariger Eitrichter

medioventral gelegen im 14. Segment. Ein Paar mehrfach eingerollte Prostata öffnen sich im 17. Segment und reichen bis ins 22. Segment. Je ein Paar Borstensäcke mit 7-8 Borsten schliessen sich den Prostataöffnungen an. Die Borsten sind von gleicher Form, die adulten 7 mm lang, 0,04 mm dick, stark gebogen am Ende hakenförmig. Abgesehen vom Basalteil (2 mm) kräftig behaart (Abb. 8).

Samenleiter kräftig, gerade verlaufend, die beiden Leiter vereinen sich nur im 17. Segment, wo sie einen muskulösen "Ductus ejaculatorius" bilden und separiert von den Prostata ausmünden.

Samentaschen im 8. Segment, pilzförmige Gebilde. Muskulöser Ausführungsgang mit einer Ampulle. Der Ausführungsgang besitzt vor dem Ansatz der Ampulle 2 muskulöse Fortsätze, die mit Samenkämmerchen gefüllt sind (Abb. 9).

Die neue Art steht *B. ornata* (Sciacchitano, 1952) am nächsten, unterscheidet sich jedoch von ihr durch die unpaarigen weiblichen Poren, durch das Fehlen der Kopulationstasche und durch die Grösse und Form der Penialborsten.

Die neue Art wird zu Ehren des Sammlers Frau D. Murith benannt.

F u n d o r t : Holotypus MHNG 975131 1 Ex. Côte d'Ivoire, Adiopodoumé, 1975 IX. leg. D. Murith.

B e m e r k u n g . Diese Art lag in der Sammlung des Naturhistorischen Museums Genf als "*Benhamia* sp. of *hupferi*, det. Easton, 1979" vor. Die Art gehört nicht dem Artenkreis von *hupferi* an (Omodeo 1958), da ihr die Kopulationsborsten aus dem Umkreis der Samentaschenregion fehlen.

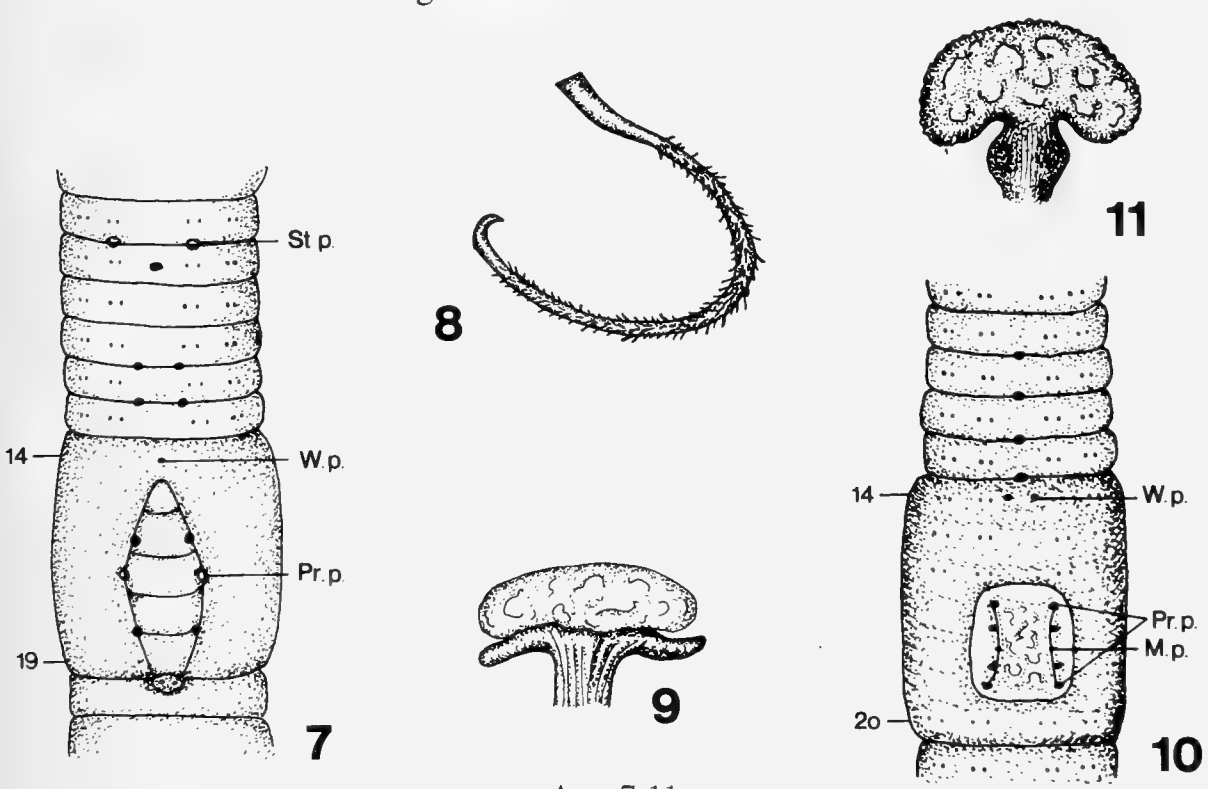

ABB. 7-11

Benhamiona murithal sp. n. - 7. Ventralansicht mit dem Gürtelorgan, Wp: Weibliche Poren, Pr. p. : Prostataporen - 8. Penialborste - 9. Samentasche.
Benhamiona pitti sp. n. 10. Ventralansicht mit dem Gürtelorgan, Wp.: Weibliche Poren, Pr. p.: Prostataporen - 11. Samentasche.

Benhamiona pitti sp. n.

Länge des Holotypus 125 mm, Dicke hinter dem Gürtel 5 mm, Segmentzahl 178. Paratypen. Länge 110 bzw. 115 mm, Dicke hinter dem Gürtel 4-5 mm, Segmentzahl 188 bzw. 180. Farbe der in Alkohol konservierten Tiere braun.

Kopf prolobisch. Erster Rückenporus in Intersegmentalfurche 20/21. Borsten gepaart, sämtliche ventral gelegen, Borstendistanz hinter dem Gürtel *aa*:*ab*:*bc*:*cd*:*dd* wie 12,5:3:13:2,5:90.

Weibliche Poren paarig auf dem 14. Segment etwas medial von der Borstenlinie *aa*. Samentaschenporen in Intersegmentalfurche 7/8-8/9 in der Borstenlinie *ab*.

Paarige akzessorische Pubertätsorgane sind im 17/18-18/19. Segment, unpaarige Papillen im 10/11-13/14 Segment vorhanden.

Gürtel ventral weniger stark ausgebildet vom 14.-20. Segment. Im 17.-19. Segment ein quadratförmiges Geschlechtsfeld zu erkennen, in dessen Ecken sich die Prostataöffnungen befinden. Die Öffnungen werden beiderseits durch eine leicht gewölbte Samenrinne verbunden. In der Mitte der Samenrinne, im 18. Segment, liegen die männlichen Poren (Abb. 10).

Innere Organisation. Erstes erkennbares Dissepiment in 6/7. Keine verdickten Dissepimente vorhanden. Zwei grosse Muskelmagen im 5.-6. Segment. Drei Paare Kalkdrüsen im 14.-16. Segment, die des 14. Segmentes am kleinsten. Letztes Paar Herzen im 12. Segment. Typhlosolis im 23. Segment beginnend, wellenförmige Furche. Exkretionssystem meronephridisch mit in einer Reihe stehenden Plectonephridien, denen sich im hinteren Teil des Körpers medioventral gelegen in jedem Segment ein Paar Megameronephridien anschliessen.

Zwei Paare Hoden und Samentrichter im 10. und 11. Segment, die in perioesophageale Testikelblasen eingeschlossen sind. Zwei Paare grosse traubenförmige Samensäcke im 11. und 12. Segment. Traubenförmige Ovarien im 13. Segment, ein Paar kleine Eitrichter im 14. Segment. Zwei Paare Prostata im 17. und 19. Segment, etwas zurückgebogen, sie sind auf die betreffenden Segmente beschränkt. Penialborsten fehlen. Samenleiter verlaufen gewunden, separiert, und treten im 18. Segment aus.

Samentaschen im 8. und 9. Segment. Spindelförmiger Ausführungsgang mit einer pilzförmigen, dünnwandigen Ampulle, die gefurcht ist. In der Mitte des Ausführungsganges beiderseits gewölbte Ausbuchtungen, in denen die Samenkämmerchen liegen (Abb. 11).

Die neue Art ähnelt *B. hansi* (Michaelsen, 1914) am meisten, unterscheidet sich jedoch von dieser durch die akzessorischen Papillen, durch die Form der Samentaschen sowie durch das Fehlen der Penialborsten.

Die neue Art wird zu Ehren des Sammlers D. Olu-Pitt benannt.

F u n d o r t : Holotypus MRAC 37017/a Sierra Leone, Fourach Bay College, Botanical Garden, III. 1976, leg. D. Olu-Pitt. Paratypen MRAC 37017/b. 1 Ex., AF/2456 1 Ex. Fundort wie beim Holotypus.

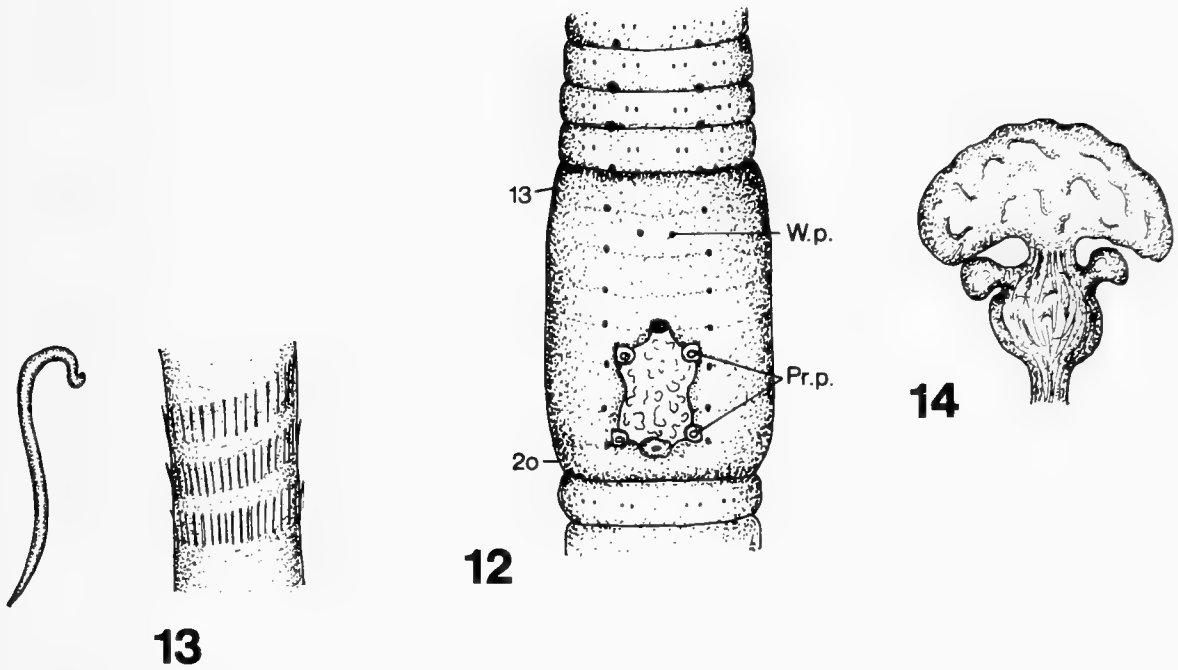

ABB. 12-14

Benhamiona puylaerti sp. n. - 12. Ventralansicht mit dem Gürtelorgan, Wp.: Weibliche Poren, Pr. p. : Prostataporen - 13. Penialborste - 14. Samentasche.

Benhamiona puylaerti sp. n.

Benhamia robertiana var. OMODEO 1958

Holotypus nicht vollständig, Länge 130 mm, Dicke hinter dem Gürtel 6 mm, Segmentzahl 134. Farbe in Alkohol konserviert braun.

Kopf prolobisch. Erster Rückenporus in Intersegmentalfurche 20/21. Borsten eng gepaart, sämtliche ventral gelegen. Borstendistanz hinter dem Gürtel *aa*:*ab*: *bc*:*cd*:*dd* wie 23:5:15:3:180. Weibliche Poren paarig auf dem 14. Segment etwas medial von der Borstenlinie aa. Zwei Paare Samentaschenporen in Intersegmentalfurche 7/8-8/9 in der Borstenlinie b. Paarige Papillen auf dem 10/11-19/20. Segment in der Borstenlinie *b*. Unpaarige medioventrale Papillen auf dem 16/17 und 19/20. Segment. OMODEO erwähnt bei *B. robertiana* unpaarige Papillen auf dem 13/14. und 14/15. Segment medioventral, paarige Papillen auf dem 16/17. und 19/20. Segment etwas dorsal von der Borstenlinie *ab*.

Gürtel nicht vollkommen ausgebildet, vom 13.-20. Segment. Auf dem 17.-19. Segment ein rechteckförmiges Geschlechtsfeld zu erkennen, in dessen Ecken auf kleinen Papillen die Prostataöffnungen sitzen (Abb. 12).

Innere Organisation. Verdickte Dissepimente fehlen, erstes erkennbares Dissepiment 6/7. Zwei grosse Muskelmagen im 5.-6. Segment. Drei Paare Kalkdrüsen im 14.-16. Segment, erstes Paar am kleinsten. Letztes Paar Herzen im 13. Segment. Typhlo-

solis klein, im 21. Segment beginnend. Exkretionssystem meronephridisch mit in einer Reihe stehenden Plectonephridien, denen sich im hinteren Teil des Körpers medioventral gelegen in jedem Segment je ein Paar Megameronephridien anschliessen.

Zwei Paare Hoden und Samentrichter im 10. und 11. Segment, die in perioesophageale Testikelblasen eingeschlossen sind. Ein Paar grosse traubenförmige Samensäcke im 12. Segment. Ovarien im 13. Segment, Ovarientrichter klein, im 14. Segment. Zwei Paare Prostata im 17. und 19. Segment, denen sich je ein Borstensack anschliesst, in dem 2 gleichförmige Penialborsten stecken. Penialborsten 2,6 mm lang, in der Mitte 0.05 mm dick. Bei OMODEO (1958) Länge der Borsten 3,1-3,33 mm, Dicke 0,056 mm. Oberes Drittel der Borste von ringförmig angeordneten Härchen besetzt. Ende der Borste hakenförmig gebogen, apikaler Teil zurückgebogen (Abb. 13). Samenleiter bis zum 17. Segment verdoppelt verlaufend, treten im 18. Segment aus.

Zwei Paare Samentaschen im 8. und 9. Segment. Muskulöser kurzer Ausführungsgang mit einer dünnwandigen, knopfförmigen Ampulle. Beim Anschluss der Ampulle an den Ausführungsgang eine kragenförmige Verdickung mit Samenkämmerchen gefüllt, über diesen seitlich 2 halbkreisförmige Ausbuchtungen, die ebenfalls mit Samenkämmerchen gefüllt sind (Abb. 14).

Die neue Art unterscheidet sich von *B. robertiana* var. nur in der Anordnung der Papillen und in der Grösse der Penialborsten. Da unser Exemplar nicht vollkommen adult ist, kann der Unterschied in der Borstengrösse erklärt werden, die Anordnung der Papillen variieren auch innerhalb einer Population. Von *B. robertiana* Michaelsen, 1922 (Holotypus, Inv. Nr. V. 9313) aus der Sammlung von Hamburg, der die neue Art am nächsten steht, unterscheidet sie sich in der Form der Penialborsten und in der Gestaltung der Samentaschen.

Die neue Art wird zu Ehren von Herrn Dr. F. Puylaert (MRAC) mit bestem Dank für das anvertraute Material benannt.

Fundort: Holotypus MRAC 37017/D: 1 Ex. Sierra Leone, Fourach Bay College, Botanical Garden, III. 1976, leg. D. Olu-Pitt.

Gattung **Omodeona** Sims, 1967

Gattungsdiagnose: Borsten eng gepaart, sämtliche ventral gelegen. Weibliche Poren im 14. Segment. Männlicher Geschlechtsapparat acanthodrilin mit microscoleciner Reduktion. Paarige Samentaschendivertikel vorhanden. Zwei kräftig entwickelte Muskelmagen im 5.-6. Segment oder etwas weiter nach hinten reichend. Kalkdrüsen mit paarigen Ausbuchungen im 15.-16. Segment. Exkretionssystem meronephridisch, seitlich mit einigen tubularen Meronephridien, denen sich im hinteren Teil des Körpers in jedem Segment je ein Paar Megameronephridien anschliessen.

Typus-Art. Dichogaster fallax (Cognetti, 1910)

Verbreitung: Tropisches Westafrika

Omodeona fallax (Cognetti, 1910)

Dichogaster fallax: COGNETTI 1910
Syn. nov. *Omodeona proboscoides* Sims, 1967.

In der Sammlung von Torino konnte unter Inv. Nr. OL 64 (Bolama, Guinea, leg. L. Fea) der Typus von *Dichogaster fallax* Cognetti, 1910 nachbestimmt werden. Das Tier war in 3 Stücke zerlegt, doch einwandfrei nachbestimmbar. Die Beschreibung von *Omodeona proboscoides* Sims, 1967 weist dazu nur Unterschiede in der Lage der Samentaschenporen auf. Nach SIMS sollen diese in Intersegmentalfruche 7/8 und nicht wie bei *fallax* in 8/9 liegen. Anhand der Typenmateriales (BMNH 1966. 30.483-512) konnte inzwischen nachgeiwesen werden, dass die Sammentaschenporen in 8/9 liegen. Da für die microscolecine Reduktion ein Verschwinden der Samentaschenporen aus der 7/8. Intersegmentalfurche kennzeichnend ist, muss angenommen werden, dass´es sich in Fall von *O. proboscoides* um einen Druckfehler handelt. Daher betrachten wir *O. proboscoides* als Synonym von *O. fallax* (Cognetti, 1910).

Omodeona braunsi (Michaelsen, 1895) comb. n.

Dichogaster braunsi Michaelsen, 1895

Diese Art wurde von MICHAELSEN auf Grund eines Exemplares beschrieben. In der Michaelsen-Sammlung in Hamburg konnten wir das Originalstück nicht ausfindig machen. Dies wäre schon deswegen wichtig gewesen, da Michaelsen sich in der Lage der Kalkdrüsen nicht sicher war und sie im 14. und 15. Segment gelegen angibt. Da die Art ansonst einwandfrei die Kennzeichen der Gattung *Omodeona* angehörenden Arten führt, stellen wir sie zu dieser Gattung, under der Annahme, dass die Kalkdrüsen im 15. und 16. Segment gelegen sind.

Guineoscolex gen. n.

Gattungsdiagnose. Borsten eng gepaart, sämtliche ventral gelegen. Weibliche Poren im 14. Segment. Männlicher Geschlechtsapparat acanthodrilin mit microscoleciner Reduktion. Paarige Samentaschendivertikel vorhanden. Zwei kräftig entwickelte Muskelmagen im 5.-6. Segment oder etwas weiter nach hinten reichend. Kalkdrüsen mit paarigen Ausbuchtungen im 14.-16. Segment. Exkretionssystem meronephridisch, seitlich mit einigen tubularen Meronephridien, denen sich im hinteren Teil des Körpers in jedem Segment je ein Paar Megameronephridien anschliessen.

Typus Art: *Dichogaster inaequalis* Michaelsen, 1914
(**Syn. nov.** *Benhamia inaequalis* f. *nimbai* Omodeo, 1958)

Andere Arten: *Dichogaster bolamensis* Cognetti 1910 (= **Syn. nov.** *Benhamia fula* Sims, 1967, *Benhamia mandinka* Sims, 1967) *Benhamia coronata* Omodeo, 1958, *Benhamia mamillata* (Omodeo 1958), *Benhamia microscolecina* Omodeo, 1958, *Benhamia minuscula* Omodeo, 1958, *Dichogaster silvestri* Michaelsen, 1914.

Verbreitung: Oberguinea.

Die Selbstständigkeit dieser Gruppe wurde bereits von MICHAELSEN (1914) erkannt, später schlägt OMODEO (1958) vor, sie als Untergattung oder sogar als Gattung zu betrachten. Durch die kennzeichnenden paarigen Divertikel der Samen-

taschen steht sie der Gattung *Omodeona* Sims, 1967 und *Monothecodrilus* gen. n. am nächsten, unterscheidet sich jedoch von der ersten durch die Lage der Kalkdrüsen, von der letzten durch die Paarigkeit der Samentaschen.

B e m e r k u n g . Die Art *Dichogaster kakulimana* Michaelsen, 1914 wurde von OMODEO (1958) in die inaequalis-Artengruppe aufgenommen. Die generischen Merkmale dieser Art lassen sich nicht einwandfrei bestimmen, da beim einzigen juvenilem Tier die Geschlechtsmerkmale nicht vollkommen entwickelt waren und so auch nicht mit Sicherheit bestimmt werden konnten. In der Sammlung von Hamburg konnten wir das Originalstück nicht ausfindig machen. Wir betrachten die Art als *species incertae sedis.*

Monothecodrilus gen. n.

G a t t u n g s d i a g n o s e . Borsten eng gepaart, sämtliche ventral gelegen. Weibliche Poren im 14. Segment. Männlicher Geschlechtsapparat acanthodrilin mit gänzlicher oder teilweiser microscoleciner oder balantiner Reduktion. Samentaschen unpaarig, paarige Samentaschendivertikel vorhanden. Zwei kräftige Muskelmagen im 5.-6. Segment oder etwas weiter nach hinten reichend. Kalkdrüsen mit paarigen Ausbuchtungen im 14.-16. Segment. Exkretionssystem meronephridisch, seitlich mit einigen tubularen Meronephridien, denen sich im hinteren Teil des Körpers in jedem Segment ein Paar Megameronephridien anschliessen.

T y p u s A r t : *Dichogaster scherbroensis* Michaelsen 1910

A n d e r e A r t e n : *Benhamia monotheca* Omodeo, 1958, *Benhamia reducta* Sims, 1967.

V e r b r e i t u n g : Tropisches Westafrika

Die neue Gattung *Monothecodrilus* steht mit ihrer unpaarigen, medioventral gelegener Samentasche den Vertretern der Gattung *Wegeneriella* Michaelsen und *Wegeneriona* Černosvitov am nächsten. Sie unterscheidet sich jedoch von diesen durch das Vorhandensein von 3 Paaren Kalkdrüsen und 2 Muskelmagen. Von den in Afrika verbreiten Arten der Gattung *Wegeneriella* unterscheidet sie sich auch durch das meronephridische Exkretionssystem. Bei *M. scherbroensis* Michaelsen konnten wir leider die Exkretionsorgane der Typenexemplare (Museum Hamburg, Inv. Nr. V. 408) nicht nachbestimmen, da sie in sehr schlechter Erhaltung sind.

Innerhalb der Gattung *Dichogaster* (sensu lato) wurde noch eine Art mit unpaarigen Samentaschen beschrieben: *Balanta wenkei* Michaelsen, 1931. Eine Nachbestimmung der Typenexemplare erbrachte den Nachweis, dass die Beschreibung einige Fehler enthält, sodass sie nicht zur Gattung *Monothecodrilus* gehört. Nachstehend soll eine ausführliche Beschreibung dieser Art erfolgen.

Gattung **Dichogaster** Beddard, 1888

Dichogaster wenkei (Michaelsen, 1931)

Balanta wenkei Michaelsen, 1931.

In der Sammlung von Hamburg lagen unter Inv. Nr. V. 11279 2 Exemplare vor, die als "*Dichogaster roenkei* Michaelsen, Franz. Kongo, südl. von Banja am Sanga, Max Wenke 1/d" beschriftet waren und keine rote Markierung am Glas führten. Der Sammler und der Fundort stimmen vollkommen mit der bei *Balanta wenkei* angeführten Angaben überein (MICHAELSEN 1931). Die beschriftete Etikette des Glases weist mit Sicherheit nicht die Handschschrift Michaelsen's auf. Es ist anzunehmen, dass bei einer späteren Beschriftung des Materials der Artname falsch angeführt wurde.

Von den beiden vorliegenden Exemplaren war eines geöffnet, diesem fehlten sämtliche inneren Organe. Das andere Tier war nicht geöffnet, dies wurde aufgeschnitten und bestimmt. Es wird unter Inv. Nr. V. 11279/a als Lectotypus designiert: Länge 65 mm, Dicke 2 mm, Segmentzahl 143. Farbe des Tieres in Alkohol konserviert gelblichbraun, der Gürtel orangenfarbig.

Kopf eingezogen, erstes Segment V-förmig im 1/3 ausgeschnitten. Erster Rückenporus in Intersegmentalfurche 12/13. Borsten eng gepaart, sämtliche ventral gelegen, Borstendistanz hinter dem Gürtel *aa*:*ab*:*bc*:*cd*:*dd* wie 8:2:8:1,5:70.

Unpaarige medioventrale Papillen auf dem 8., 18/19. und 19/20. Segment. Paarige Papillen sind auf dem 7/8., 18., 19. und 21. Segment oberhalb der Borstenlinie *b*.

Weiblicher Porus unpaarig auf einer ovalen Papille am 14. Segment. Ein Paar Samentaschenporen in Intersegmentalfurche 7/8 in der Borstenlinie *a*. (MICHAELSEN hielt wahrscheinlich die unpaarige Papille des 8. Segmentes für die Samentaschenöffnung). Gürtel sattelförmig auf dem 1/2 13.-1/2 20. Segment, ventral bis zur Borstenlinie *b* reichend.

Prostataporen auf dem 19. Segment auf einer kreisförmigen Papille in der Borstenlinie *ab*. Aus beiden Poren stehen die Penialborsten hervor.

Innere Organisation. Vordere Dissepimente sehr zart, kaum zu erkennen. Dissepimente 11/12 schwach, 12/13-13/14 stärker verdickt. Zwei kräftige Muskelmagen im 6.-7. Segment, 3 Paare Kalkdrüsen im 15.-17. Segment. Vordere beiden Kalkdrüsenpaare etwas kleiner, voll mit Kristallen, drittes Paar gross, lappenförmig, ohne Kristalle (MICHAELSEN 1931) verfehlte wahrscheinlich - wie auch von ihm erwähnt - die Lage des Präparates und hielt deswegen das erste Kalkdrüsenpaar für das grösste).

Exkretionsorgan meronephridisch, seitlich mit sackförmigen Meronephridien, die in 5 Linien angeordnet sind, denen sich im hinteren Körperteil in jedem Segment 1 Paar medioventrale Megameronephridien anschliessen. Typhlosolis im 23. Segment beginnend, wellenförmig verlaufende Furche. Letztes Paar Herzen im 12. Segment.

Zwei Paare Hoden und Samentrichter im 10. und 11. Segment in perioesophageale Testikelblasen eingeschlossen. Zwei Paare Samensäcke im 11. und 12. Segment, die des 11. Segmentes sehr klein. Traubenförmige Ovarien im 13. Segment, ein Paar kleine Ovarientrichter im 14. Segment. Ein Paar aufgerollte grosse Prostata öffnen sich im 19. Segment, sie reichen bis ins 23. Segment hinunter. An jede Prostata schliesst sich ein Borstensack an, in dem 4-5 Penialborsten stecken. Borstensack im 23. Segment befestigt. Adulte Penialborste 2,25 mm lang und 0,025

mm dick. Borste am Ende sichelförmig gebogen. Spitze der Borste im oberen Drittel mit verstreuten sägezahnfömigen Zähnen ornamentiert (Abb. 13).

Ein Paar Samentaschen im 8. Segment. Sie bestehen aus einem Ausführungsgang und einer zweigeteilten Ampulle, die so gross wie der Ausführungsgang ist. An der Grenze der beiden geht aus der Ampulle ein kennzeichnendes, zusammengesetztes Divertilkulum hervor. Dieses besitzt einen kurzen Stiel, der sich in zwei Arme teilt, und diese teilen sich wiederum in zwei Teile, sodass 4 rohrförmige Gebilde entstehen, aus deren Wänden die Samenkämmerchen hervorstehen und so ein traubenförmiges Aussehen besitzen. Michaelsen hat allen Anschein nach die zweite Samentasche nicht erkannt, da diese nach Öffnen des Tieres vollkommen aufeinander gelegen sind, und die besondere Struktur des Divertikels hielt er für eine Verschmelzung. Beim Lectotypus konnte eindeutig erkannt werden, dass es sich um zwei Samentaschen handelt und beide ein kompliziertes traubenförmiges Divertikulum besitzen.

Bestimmungsschlüssel der Unterfamilie Benhamiinae

1 2 Paare Kalkdrüsen vorhanden 2
– 3 Paare Kalkdrüsen vorhanden 7
2 Kalkdrüsen im 15.-16. Segment . . . . . *Omodeona* Sims, 1967
– Kalkdrüsen im 14.-15. Segment 3
3 Samentaschen paarig 4
– Samentaschen unpaarig 6
4 Exkretionssystem meronephridisch . . . . . *Neogaster* Černosvitov, 1934
– Exkretionssystem holonephridisch 5
5 Samentaschen mit Divertikel . . . . . *Pickfordia* (*Pickfordia*) Omodeo, 1958
– Samentaschen ohne Divertikel
. . . . . *Pickfordia* (Omodeoscolex) Csuzdi & Zicsi, 1991
6 Exkretionssystem holonephridisch . . . . . *Wegeneriella* Michaelsen, 1931
– Exkretionssystem meronephridisch . . . . . *Wegeneriona* Černosvitov, 1934
7 Kalkdrüsen im 15.-17. Segment 8
– Kalkdrüsen im 14.-16. Segment 13
8 Intestinale: Blinddärme vorhanden 9
– Intestinale: Blinddärme fehlen 10
9 Typhlosolis fehlt, Muskelmagen reduziert
. . . . . *Agastrodilus* Omodeo & Vaillaud, 1967
– Typhlosolis und kräftiger Muskelmagen vorhanden . . *Milsonia* Beddard, 1894
10 Muskulöser Vormagen im 5. Segment, 2 Muskelmagen im 6.-7. Segment . . 11
– Muskulöser Vormagen fehlt 12
11 Penialborsten vorhanden . . . . . *Eutrigaster* (Graffia) Csuzdi & Zicsi, 1991
– Penialborsten fehlen . . . . . *Eutrigaster* (*Eutrigaster*) Sioms, 1987
12 Exkretionssystem meronephridisch mit sackförmigen Meronephridien
. . . . . *Dichogaster* Beddard, 1888
– Exkretionssystem meronephridisch mit Plectonephridien . . . . . .
. . . . . *Benhamia* Michaelsen, 1897

13 Samentaschen unpaarig ..... *Monothecodrilus* gen. n.
– Samentaschen paarig 14
14 Divertikel der Samentaschen fehlen ..... *Benhamiona* gen. n.
– Paarige Samentaschendivertikel vorhanden ..... *Guineoscolex* gen. n.

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REVUE SUISSE DE ZOOLOGIE, 101 (1) : 233-263; mars 1994

Palpigrades cavernicoles et endogés de Thaïlande et de Célèbes (2e note)

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Endogean and cave dwelling Palpigrades from Thailand and Sulawesi (Second contribution). - Carrying on my examination of Palpigrades from Thailand (6 specimens) and Sulawesi (42 specimens) five species of the genera *Eukoenenia* (2), *Koeneniodes* (1) and *Prokoenenia* (2) were identified, three of them being undescribed. The first known adult males in the genus *Koeneniodes* were found in two localities on Sulawesi and belong to *K. frondiger* Remy; unfortunately, the most conspicuous taxonomic criteria are wanting in that sex.

Key-words: Palpigrades - Taxonomy - Thailand and Sulawesi.

Dans la première partie de ce travail (1992) six espèces de Palpigrades, quatre du genre *Eukoenenia* et deux du genre *Koeneniodes* ont été prises en considération. Deux d'entre elles (*Eukoenenia thais* Condé, 1988; *Koeneniodes spiniger* Condé, 1984b) qui étaient déjà connues, ont fait l'objet d'observations complémentaires. Les quatre autres (*Eukoenenia deleta*, *lyrifer* et cf. *lyrifer*, *maros*; *Koeneniodes leclerci*) étaient inédites, l'une d'elles, *E. maros*, étant le premier Palpigrade connu de Sulawesi (Célèbes).

Le présent travail résulte de l'examen de 48 spécimens récoltés en Thaïlande (6) et à Sulawesi (42) par P. Leclerc, soit dans les grottes, soit dans le milieu endogé au voisinage des entrées. Ils appartiennent aux genres *Eukoenenia*, 2 espèces dont une nouvelle, *Koeneniodes*, 1 espèce, et *Prokoenenia*, 2 espèces inédites.

L'existence de *Prokoenenia* dans la région orientale est une acquisition récente, due aux récoltes de B. Hauser et C. Lienhard à Java, dans le milieu artificiel du Jardin Botanique de Bogor (CONDÉ 1990). Nous avons ici la preuve de son existence dans la nature, en Thaïlande et à Sulawesi, dans les domaines hypogé et endogé.

Une autre découverte d'importance est celle des premiers mâles adultes du genre *Koeneniodes*, ceux-ci présentant un dimorphisme sexuel qui affecte les sternites IV à VI de l'opisthosome, mais aussi le basitarse IV (CONDÉ 1993: 68).

Manuscrit accepté le 18.07.1993.

Tous les matériaux sont déposés au Muséum d'Histoire naturelle de Genève, Département des Arthropodes et d'Entomologie II.

La mise au propre de l'illustration est due au talent de Madame E. Searoui que je remercie chaleureusement.

Eukoenenia maros Condé, 1992

SULAWESI. Province de Sulawesi-sud, District de Maros, village de Bantimurung. Grotte de Gua B2, petite cavité très concrétionnée, sur la paroi, 8.VII.86, P. Leclerc leg.: 1 femelle adulte.

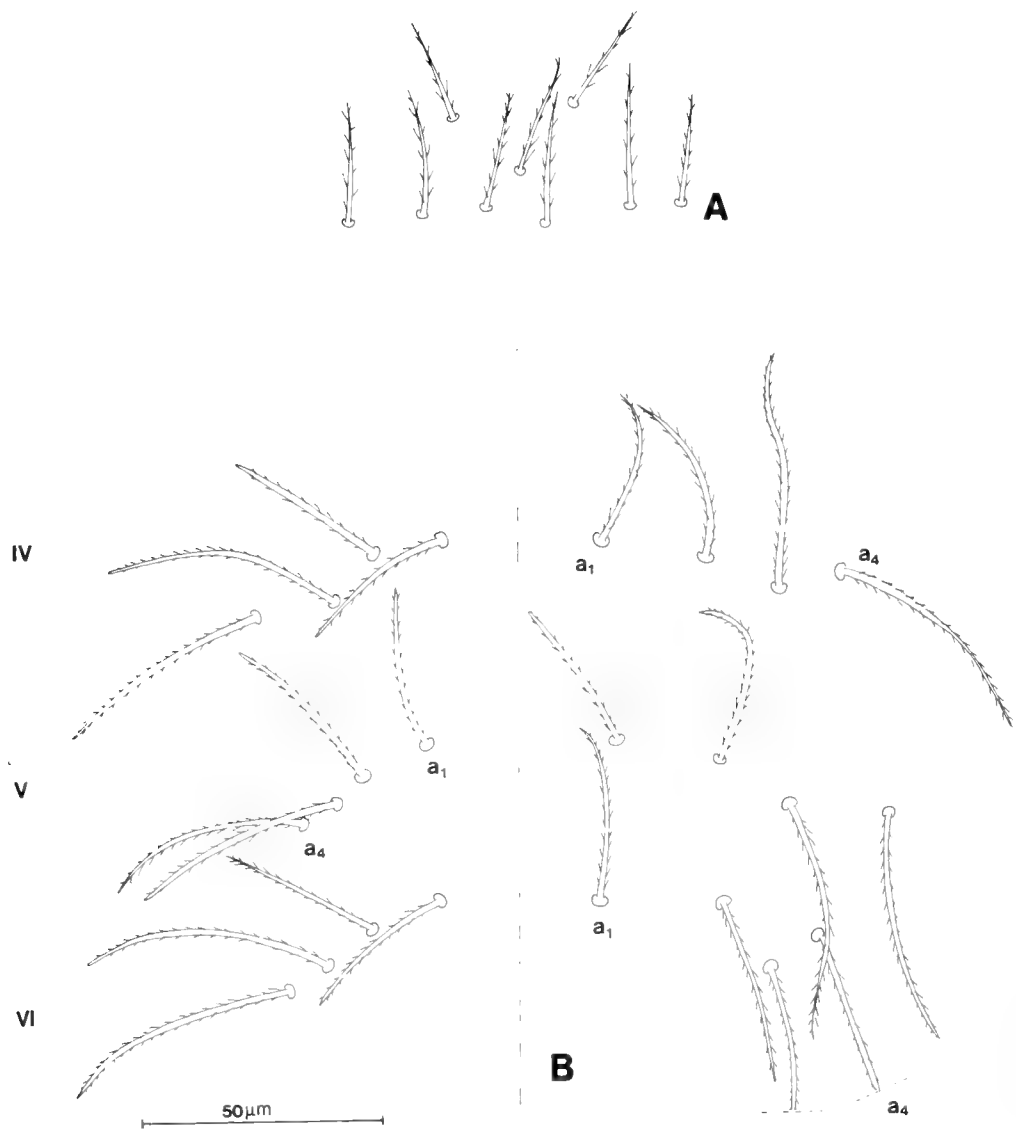

FIG. 1

Eukoenenia maros Condé, femelle adulte de la grotte de Gua B2, Bantimurung: *A*. Soies du deuto-tritosternum. - *B*. Phanères des sternites opisthosomiens IV, V et VI. Explication des lettres dans le texte.

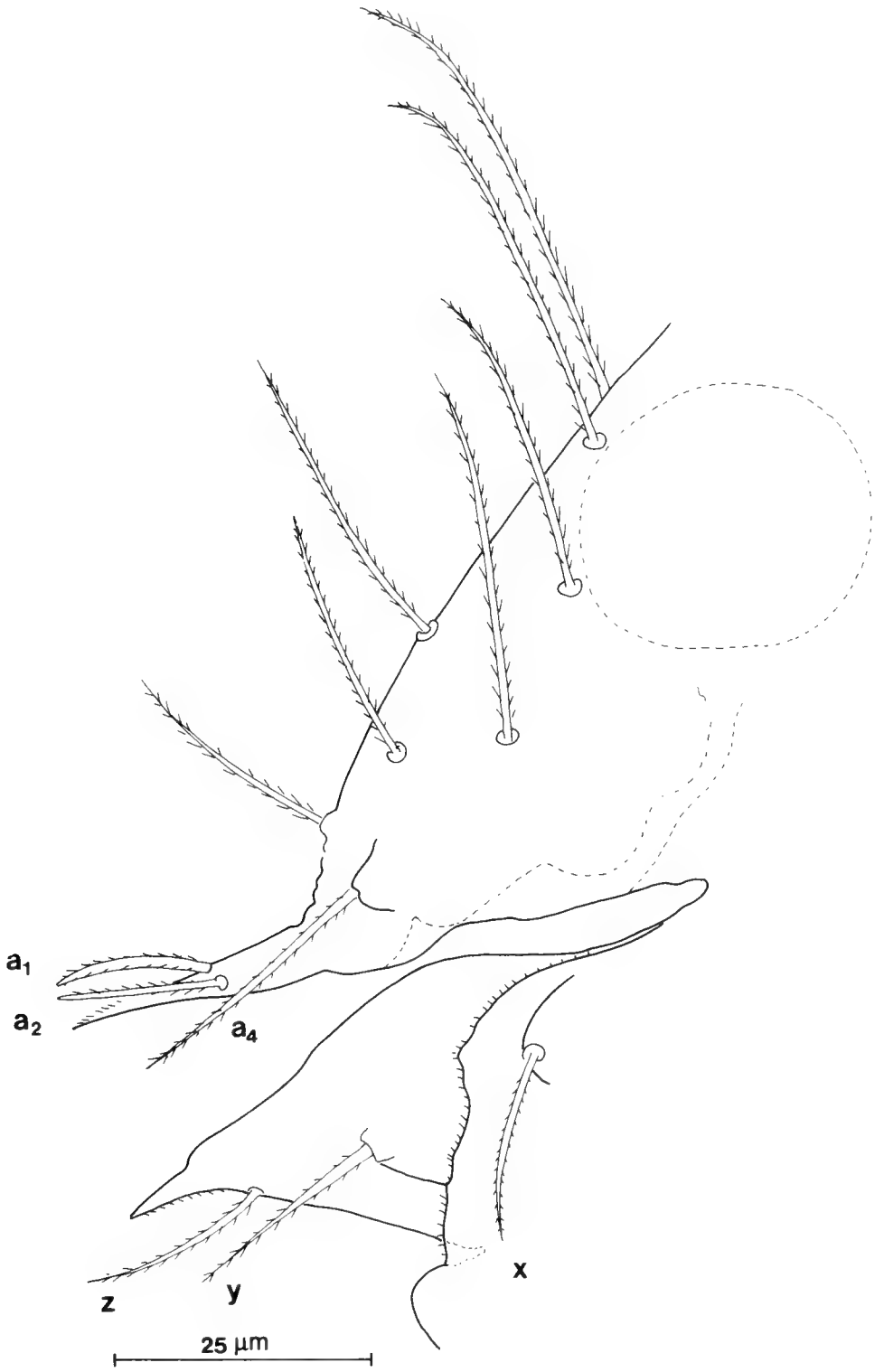

FIG. 2

Eukoenenia maros Condé, femelle adulte de la grotte de Gua B2, Bantimurung. Volets génitaux de profil. Explication des lettres dans le texte.

Remarques. - Deuxième spécimen connu de cette espèce, il permet d'apporter d'utiles compléments à la description originale. Toutefois, la présence de corps parasitaires réfringents non identifiés[1], serrés les uns contre les autres, qui emplissent la totalité de l'opisthosome (quelques-uns dispersés dans le prosome et les appendices), contrarient l'observation. Les valeurs entre parenthèses sont celles de l'holotype.

Longueurs. - Corps: 1 mm en extension moyenne (0,98); bouclier prosomien: 0,29 mm (0,25); basitarse IV: 152 µm (133); patte IV à partir du tibia: 0,45 mm (0,40); B/bta = 1,90 (1,87); bta/ti = 0,84 (0,88).

Prosoma. - 5 éléments aux organes latéraux dont 2 plus petits à droite. 9 soies deuto-tritosternales: 2 antérieures, 1 médiane intermédiaire, 6 postérieures sur un rang; on peut aussi considérer, comme dans la description de l'holotype, que le phanère médian est un émigré de la rangée postérieure d'où la formule 1+1/3+1+3.

Au basitarse IV, L/l = 9,42 (8,80); t/r = 2,27 (2,40); t/er = 2,32 (2,18); gla/grt = 1,21 à gauche et 1,11 à droite (1,05); à droite, *grt* est proximale à *gla*, comme chez l'holotype, à gauche elle est au même niveau.

Opisthosoma. - Au deuxième volet génital, *x* et *y* sont de même longueur (40,41), *z* étant un peu plus court (36); le diverticule signalé à la face dorsale des lobes terminaux de l'holotype n'existe pas.

Les sternites IV à VI portent chacun 4+4 phanères longs et grêles, ceux des deux paires médiales plus courts que ceux des deux paires latérales (moyennes respectives 40 et 44; 57,6 et 61,6). L'écartement des médiaux est sensiblement égal à leur longueur (moyenne: 40,6). Les phanères des deux paires médiales sont a_1 et a_2, et ceux des deux paires latérales correspondent plus vraisemblablement à a_3 et a_4 qu'à des soies grêles latérales (s_1, s_2) modifiées. Comme il n'y a qu'une seule paire de soies *s* chez des espèces voisines (*E. thais*, *E. lyrifer*) on peut penser à un renforcement du processus de régression.

Eukonenia paulinae n. sp.

SULAWESI. Province de Sulawesi-sud, District de Maros, Chef-lieu de Camba, forêt de Samaenre, sous les pierres, 12.VII.88, P. Leclerc leg.: 1 femelle adulte (holotype).

Longueurs. - Corps: 0,89 mm; bouclier prosomien: 0,23 mm; patte IV à partir du tibia: 0,21 mm; basitarse IV: 65,5 µm; B/bta = 3,50; bta/ti = 0,79.

Prosoma. - Organe frontal médian environ 3 fois plus long que large; ses branches, à bords subrectilignes, terminées par une courte pointe. Organes latéraux comprenant 3 éléments étroits et allongés, environ 8 fois plus longs que larges, terminés par une longue pointe.

Bouclier avec 10+10 soies assez courtes. Segment libre avec 3+3 phanères, l'intermédiaire (t_2) presque une fois et demie plus long que le médial (t_1) , lui-même

[1] Spores ou kystes à contours ovalaire ou circulaire, à coque très épaisse et contenu granuleux, sans structure visible. Des parasites identiques ont envahi un Campodéidé (*Lepidocampa*) dans une grotte voisine.

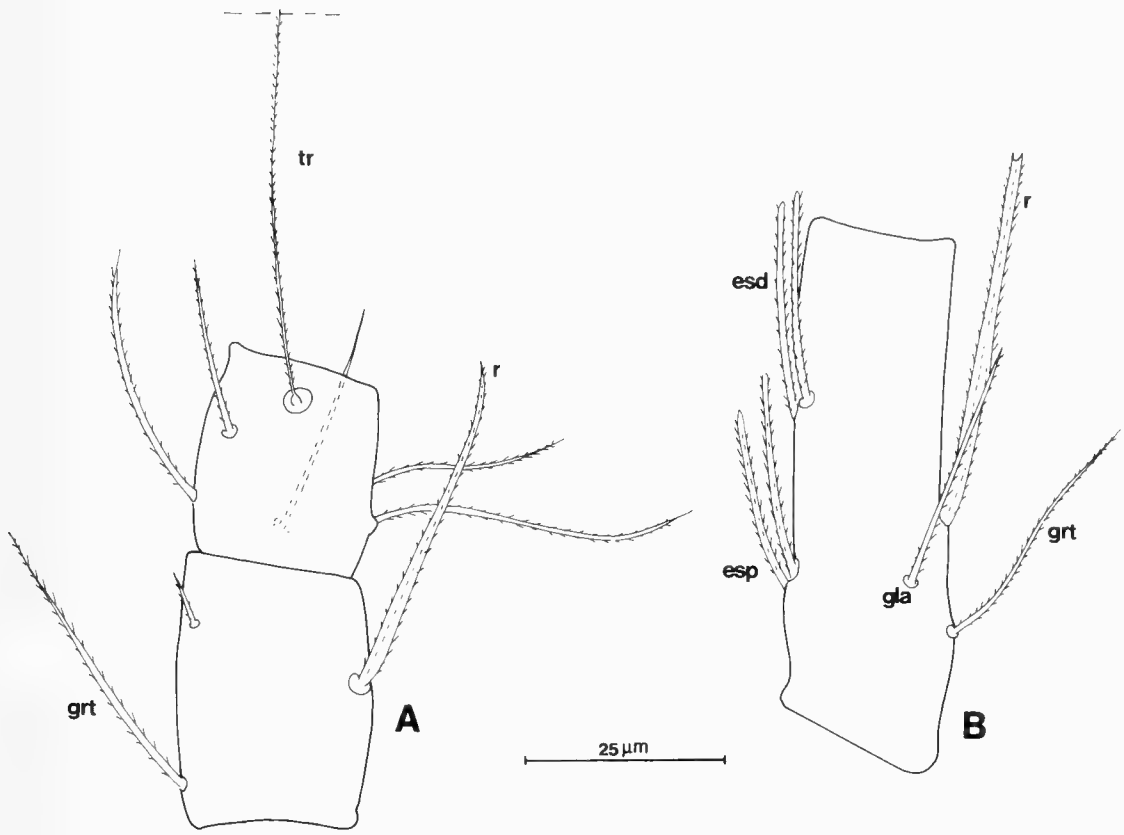

FIG. 3

Eukoenenia paulinae n. sp., femelle adulte holotype de la forêt de Samaenre: *A*. Basitarses 3 et 4 de la patte locomotrice I. - *B*. Basitarse de la patte locomotrice IV. tr = trichobothrie. Explication des autres lettres dans le texte.

un peu plus long que le latéral (t_3): 105, 73, 65. 9 soies deuto-tritosternales: 2 antérieures, 1 médiane intermédiaire, 6 postérieures sur un rang (1+1/1/3+3).

Chélicères avec 9 dents à chaque mors. Trois phanères rigides sur l'article basal, de longueurs croissantes du proximal au distal (50, 62, 96, appendice droit); le proximal et le distal sont barbelés sur la plus grande partie de leur longueur; l'intermédiaire est presque glabre, tronqué à l'apex qui présente 2 ou 3 denticules (brisé ? les phanères de la chélicère gauche, vus de bout, semblent plus semblables entre eux).

Pédipalpes et pattes locomotrices I et IV. Longueurs relatives des articles:

pédipalpes: ti = 150, bta 1 = 64, bta 2 = 77, ta 1 = 48, ta 2 = 51, ta 3 = 65; pattes I : ti = 156, bta 1+2 = 130, bta 3 = 68, bta 4 = 57, ta 1 = 36, ta 2 = 47, ta 3 = 126; pattes IV : ti = 161, bta = 127, ta 1 = 47, ta 2 = 81.

Certains articles, surtout le tibia des pédipalpes et les tarses 2 et 3 de la patte I, ne sont pas tout à fait plans, ce qui compromet la précision de la mesure, mais il n'a pas été jugé souhaitable de comprimer davantage le spécimen.

Aux pattes I, la soie raide du basitarse 3, environ une fois 1/4 plus longue que le bord tergal de l'article (84/65, t/r = 0,77) est insérée un peu en deçà du tiers distal du bord sternal (34/58, s/er = 1,70).

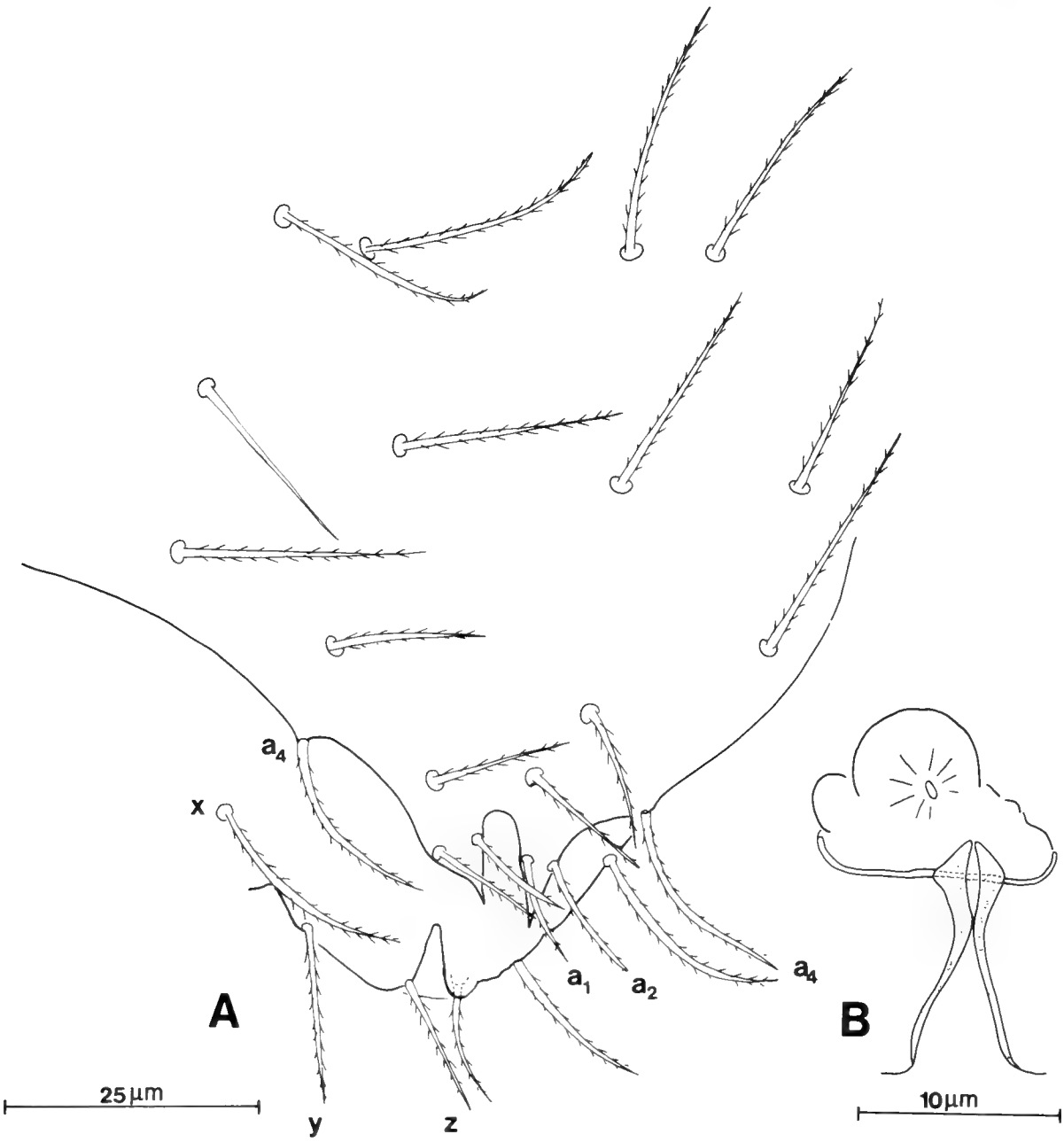

FIG. 4

Eukoenenia paulinae n. sp., femelle adulte holotype de la forêt de Samaenre: *A*. Volets génitaux, les lobes apicaux du deuxième volet non représentés. - *B*. Sclérifications du deuxième volet. Explication des lettres dans le texte.

Aux pattes IV, le basitarse est plus court que le tibia (bta / ti = 0,79) et, mesuré au niveau de *r*, presque 3 fois et demie plus long que large; la soie raide (*r*) est environ une fois 2/5 plus courte que le bord tergal de l'article (92/127, t/r = 1,38) et est insérée un peu en deçà du milieu de ce bord (60/127, t/er = 2,11). La soie grêle tergale (*grt* = 64) est proximale par rapport à la soie grêle latérale (*gla* = 61), cette

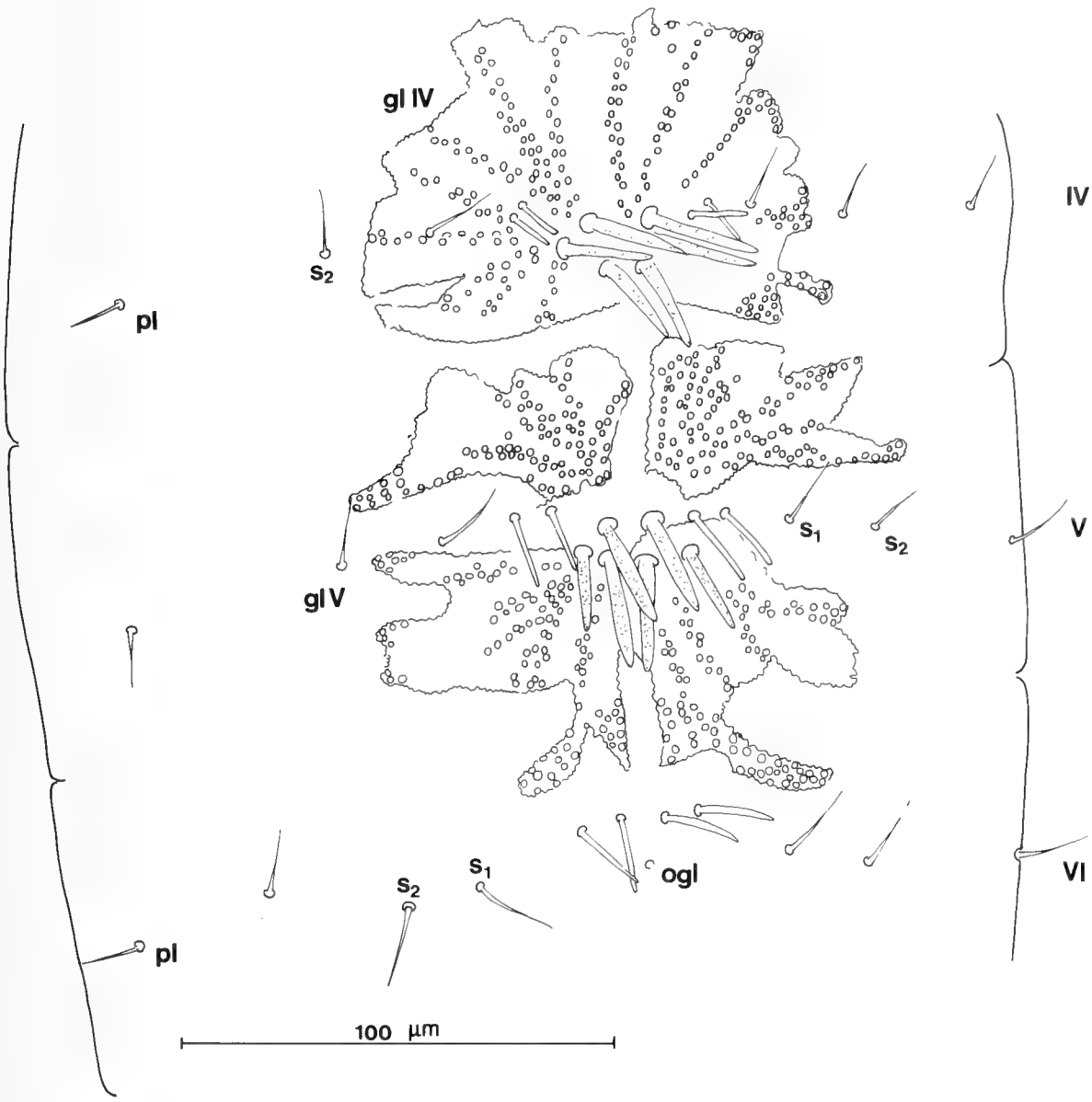

FIG. 5

Eukoenenia paulinae n. sp., femelle adulte holotype de la forêt de Samaenre. Sternites IV à VI de l'opisthosome; *olg* = orifice présumé glandulaire, pl = phanère pleural. Explication des autres lettres dans le texte.

dernière à égale distance de *grt* et de *r*. Les deux paires de soies sternales (*esp*, *esd*), sont de longueurs comparables (47-53).

Opisthosoma. - Tergites III à VI avec une rangée de 3+3 phanères *t* (t_2 présents) dont la longueur moyenne augmente un peu de t_1 à t_3 (40,25; 47; 55,50); une soie grêle (*s*) de part et d'autre; tergite VII avec 4+4 phanères de type *t*, le plus latéral à la place du *s* des tergites précédents. SegmentsVIII à XI avec respectivement 16 (8+8), 15 (7+ *s* + 7), 12 (6+6), 10 (5+5) et 11 (5 + *s* +5) phanères.

Premier volet génital avec 10+10 soies (les a_3 manquent); à la rangée distale, les a_1 sont très légèrement plus courts que les a_2 (23, 26) et les a_4 presque deux fois plus

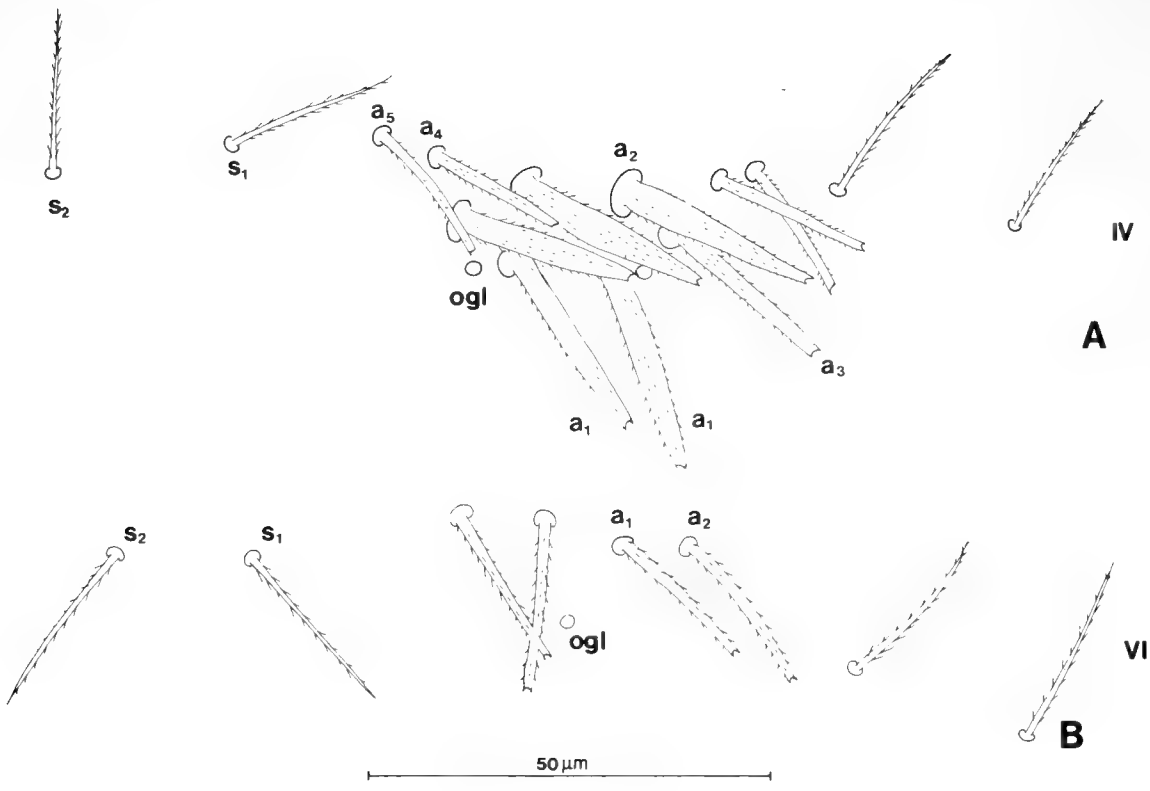

FIG. 6

Eukoenenia paulinae n. sp. Phanères des sternites IV et VI de l'opisthosome; *ogl* = orifice présumé glandulaire. Explication des autres lettres dans le texte.

longs (44), la distance a_2-a_4 étant presque 5 fois supérieure à la distance a_1-a_2 (33/7). Une large échancrure à fond arrondi sépare les a_1; les petits lobes apicaux ainsi formés sont triangulaires et terminés en une courte pointe aiguë. Aucun orifice glandulaire n'est visible. Le deuxième volet porte sur chaque moitié les 3 soies habituelles qui sont de longueurs décroissantes (x = 47, y = 40, z = 30); de petits lobes triangulaires prolongent l'organe. L'orientation ne permet pas de décrire les structures sclérifiées de l'appareil génital; on distingue néanmoins un épaississement du bord interne des volets qui rejoint, vers l'avant, un ensemble plus complexe ressemblant un peu à une coupe largement ouverte. Ces images rappellent celles que j'ai observées chez *E. maros*.

Les sternites IV et V sont identiques et présentent une chétotaxie tout à fait remarquable. Deux groupes de 3 très grosses soies coniques, à embases disposées en triangle, sont très rapprochés l'un de l'autre vers le plan sagittal, donnant l'impression d'un massif unique médian. Latéralement, au même niveau que la paire de phanères coniques la plus antérieure, 2+2 soies subcylindriques, beaucoup plus minces que les phanères précédents, mais présentant l'apex tronqué des phanères glandulaires. Plus latéralement, les 2 soies grêles (s_1, s_2) et, sur la région pleurale, un court phanère inhabituel. Un énorme massif glandulaire, plurilobé, est sous-jacent à chacun des ensembles de phanères en IV et en V. Les phanères glandulaires sont homologues à ceux d'autres espèces et comme leur implantation suit en fait une ligne brisée, les 3

phanères coniques sont nommés a_1, a_2, a_3, les 2 phanères subcylindriques étant a_4 et a_5. Sternite VI avec une seule rangée de 4 phanères subcylindriques, identiques aux a_4 et a_5 des sternites précédents, sans trace de massif glandulaire associé; 2+2 soies *s* et 2+2 phanères pleuraux. Sternite VII avec 2+2 phanères ordinaires et 2+2 *s*.

Une paire d'orifices présumés glandulaires en IV et V, à l'extérieur de l'embase du phanère conique le plus postérieur (a_1); un orifice médian en VI, en arrière des embases des phanères de la paire médiale[2].

AFFINITÉS. - La présence de volumineux phanères coniques sur les sternites opisthosomiens est connue chez deux espèces d'Afrique occidentale: *Eukoenenia angolensis* (Remy, 1956) et *E. hesperia* (Remy, 1953), de Côte d'Ivoire. Chez la première, il y a un rang de 4 phanères coniques sur chacun des sternites IV, V et VI. Chez la seconde, comme chez la nouvelle espèce, ils sont limités aux sternites IV et V, mais en nombres impairs (5, 3), le poil médian sur le plan sagittal; en V, il y a en outre une paire de poils subcylindriques plus longs que les précédents phanères, et en VI on trouve seulement une rangée de 4 poils subcylindriques, comme chez la nouvelle espèce également.

Ces ressemblances ne sont peut-être que superficielles. Il faut souligner, en revanche, des similitudes avec *E. maros*, espèce à première vue très différente, au niveau des volets génitaux: forme générale, absence exceptionnelle de a_3, sclérifications du deuxième volet. Il reste que la disposition des phanères de la face ventrale de l'opisthosome est unique dans le groupe.

Derivatio nominis. L'espèce est dédiée à la mémoire de Mademoiselle Paulette Coine, Technicienne de l'Université de Nancy I, de 1961 à 1990, ma collaboratrice dans l'étude des micro-Arthropodes.

Eukoenenia sp.

SULAWESI. Camba, forêt de Samaenre, sous les pierres, avec *Koeneniodes frondiger* et *Eukoenenia paulinae*, 12-VII-88, P. Leclerc leg.: 1 immature *A*.

Longueurs. - Corps: 0,71 mm (en extension); bouclier prosomien: 0,19 mm; basitarse IV: 38,5 µm; B/bta = 4,93.

Prosoma. - Organes latéraux avec un seul élément long et étroit, terminé par une longue pointe. 3 soies deuto-tritosternales sur un V renversé (1/1+1).

Soie raide du basitarse IV sensiblement de même longueur que le bord tergal de l'article (t/r = 0,98), insérée au milieu de ce bord (t/er = 2,08).

Opisthosoma. - Sternite II avec 2+2 phanères grêles; sternites IV à VI semblables entre eux, avec une rangée de 2+2 phanères subcylindriques, épais, subégaux, chaque paire latérale surmontant un massif glandulaire. Les médiaux (a_1) sont un peu plus courts que leur écartement (33/35) et les latéraux (a_2) un peu plus longs que la distance a_1-a_2 (32/20).

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[2] En IV et V, ces formations peuvent être difficiles à observer, car elle sont masquées par les granulations des massifs glandulaires sous-jacents et, éventuellement, cachées sous la tige d'un gros phanère conique; en VI, l'orifice médian est très clairement visible.

DISCUSSION. - Cet immature pourrait appartenir à l'espèce précédente qui est la seule *Eukoenenia* de cette localité; il y a correspondance entre la forme du phanère de l'organe latéral et la chétotaxie du sternite VI. Les phanères a_1 et a_2 de IV et V pourraient correspondre aux a_4 et a_5 de l'adulte, les grosses soies coniques (a_1-a_3) étant acquises plus tard.

Koeneniodes frondiger Remy, 1950

SULAWESI. Province de Sulawesi-sud, District de Watampone (Bone), Chef-lieu de Tacipi, village de Lampo à quelques km de Tacipi, grotte inférieure de Lampo, petite cavité fossile, sous les pierres posées sur l'argile au bout de la galerie, 17.VII.86, P. Leclerc leg.: 1 mâle adulte, 3 femelles juvéniles *B*. - District de Maros, Kappang, sous des pierres enfoncées près de l'entrée de Gua Salukkan Kallang, 21.VII. 86, P. Leclerc leg.: 2 femelles adultes, 1 femelle juvénile *B*, 1 immature *A*. - Kappang, dans les éboulis sous une forêt primaire claire, assez humide, près de l'entrée de Gua K9, 11.VII.86, P. Leclerc leg.: 4 mâles adultes, 3 femelles adultes, 1 mâle juvénile *C*, 3 immatures *A*. - Bantimurung, sous pierres enfoncées, 5.VII.88, P. Leclerc leg.: 1 femelle juvénile *B*. - Chef-lieu de Camba, forêt de Samaenre, 12.VII.88, P. Leclerc leg.: 12 femelles adultes, 2 femelles juvéniles *B*, 3 immatures *A*.

Au total 37 spécimens: 5 mâles adultes, 1 mâle juvénile *C*, 17 femelles adultes, 7 femelles juvéniles *B*, 7 immatures *A*.

Longueurs. - Mâles adultes. Corps: 0,73-0,93 mm (extension moyenne); bouclier prosomien: 0,26-0,27 mm; basitarse IV: 76,5-87 µm, X = 82 (n = 5); B/bta: $\bar{X}$ = 3,17.

Femelles adultes. Corps: 0,86-0,99 mm (extension moyenne) bouclier prosomien: 0,25-0,27 mm; basitarse IV: 83,4-92,2 µm, $\bar{X}$ = 86,5 (n = 10); B/bta: $\bar{X}$ = 2,98.

Mâle juvénile *C*. Corps: 0,60 mm (contracté); bouclier prosomien: 0,22 mm; basitarse IV: 64,6 µm; B/bta: 3,40.

Femelles juvéniles *B*. Corps: 0,79-0,86 mm (extension moyenne); bouclier prosomien: 0,22-0,25 mm; basitarse IV: 61,3-72,5 µm, $\bar{X}$ = 66,7 (n = 6); B/bta: $\bar{X}$ = 3,49.

Immatures *A*. Corps: 0,56-0,61 mm; bouclier prosomien: 0,19 mm; basitarse IV: 43,2-49,3 µm, X = 46,8 (n = 7); B/bta: X = 4,05.

Mâles adultes

Prosoma. - Organe frontal médian à branches terminées par une courte pointe. Organes latéraux avec un seul élément à longue pointe apicale. Bouclier avec 10 +10 soies courtes, celles des deux paires médianes antérieures étant toutefois environ 2 fois plus longues que les autres. 8 (une fois) ou 10 soies deuto-tritosternales dont la disposition sur 2 ou 3 rangs est peu régulière (4/4, 5/2/3).

Au basitarse IV, la soie raide (*r*) est très robuste, presque 1 fois 1/2 plus courte que le bord tergal de l'article, le rapport t/r étant remarquablement constant (1,38-1,39). Le point d'insertion est en revanche assez variable, entre le milieu et le 1/7 proximal du bord (t/er = 2-2,40: $\bar{X}$ = 2,22); chez le spécimen de Lampo, *r* est au milieu du bord tergal à la patte droite et un peu en deçà des 2/5 proximaux à la patte gauche (t/er = 2,05 et 2,62). La soie grêle tergale (*grt*) s'insère au voisinage de *r* (au

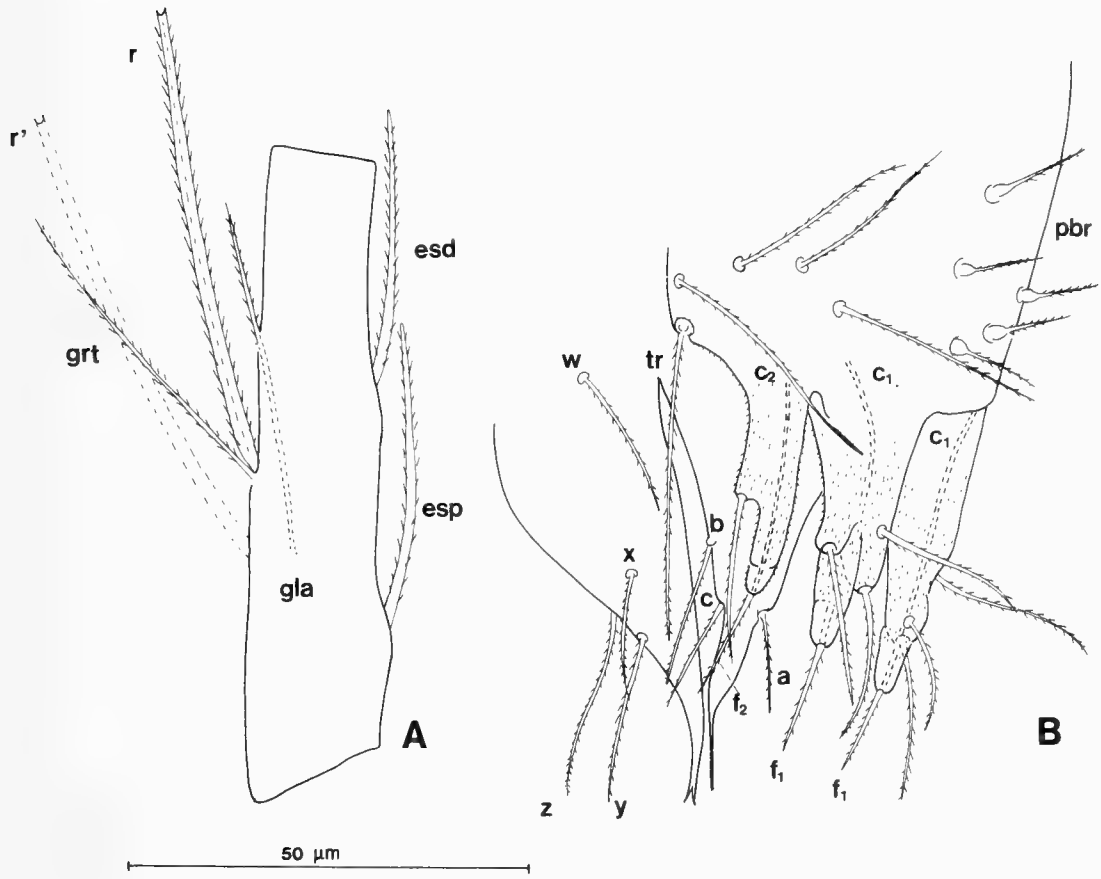

FIG. 7

Koeneniodes frondiger Remy: *A*. Basitarse IV droit du mâle adulte de la grotte inférieure de Lampo; *r'* = position de la soie raide au basitarse gauche. - *B*. Volets génitaux d'un mâle adulte de Kappang (n° 2) en vue latérale; c_1, c_2 = canaux évecteurs des fusules f_1, f_2; *pbr* = phanères à base renflée; *tr* = phanère à aspect de trichobothrie; explication des autres lettres dans le texte.

même niveau, légèrement distale ou proximale); la soie grêle latérale (*gla*), est, elle aussi, près de *r* ou proximale à elle; *grt* et *gla* sont de même longueur à Lampo, mais à Kappang, *grt* est plus courte (gla/grt = 1,28-1,65: $\bar{X}$ = 1,45 (n = 4).

Opisthosoma. - Tergites II à VI avec une rangée transverse de 2+2 poils (t_1, t_3) subégaux (65-70), comprise entre 1+1 soies plus grêles (*s*). Segment VIII et IX à XI avec respectivement 12 (6+6) et 8 (4+4) phanères.

Les volets génitaux appartiennent à un type à 18 phanères sur chaque moitié, soit 11 + 3 + 4, auxquels s'ajoutent 5 ou 6 phanères à base renflée disposés sans ordre précis sur la région centrale de la portion indivise du premier volet. Un peu en arrière, les lobes sont bien séparés l'un de l'autre sur la ligne médiane, chacun d'entre eux étant profondément échancré entre les fusules qui sont portées à l'extrémité de deux paires de tubercules, les médians plus volumineux et trapus, pourvus de 3 soies ordinaires, les latéraux, étroits et allongés, avec une seule soie. La base des fusules est dilatée avec un étranglement plus ou moins marqué vers la moitié de sa longueur; le

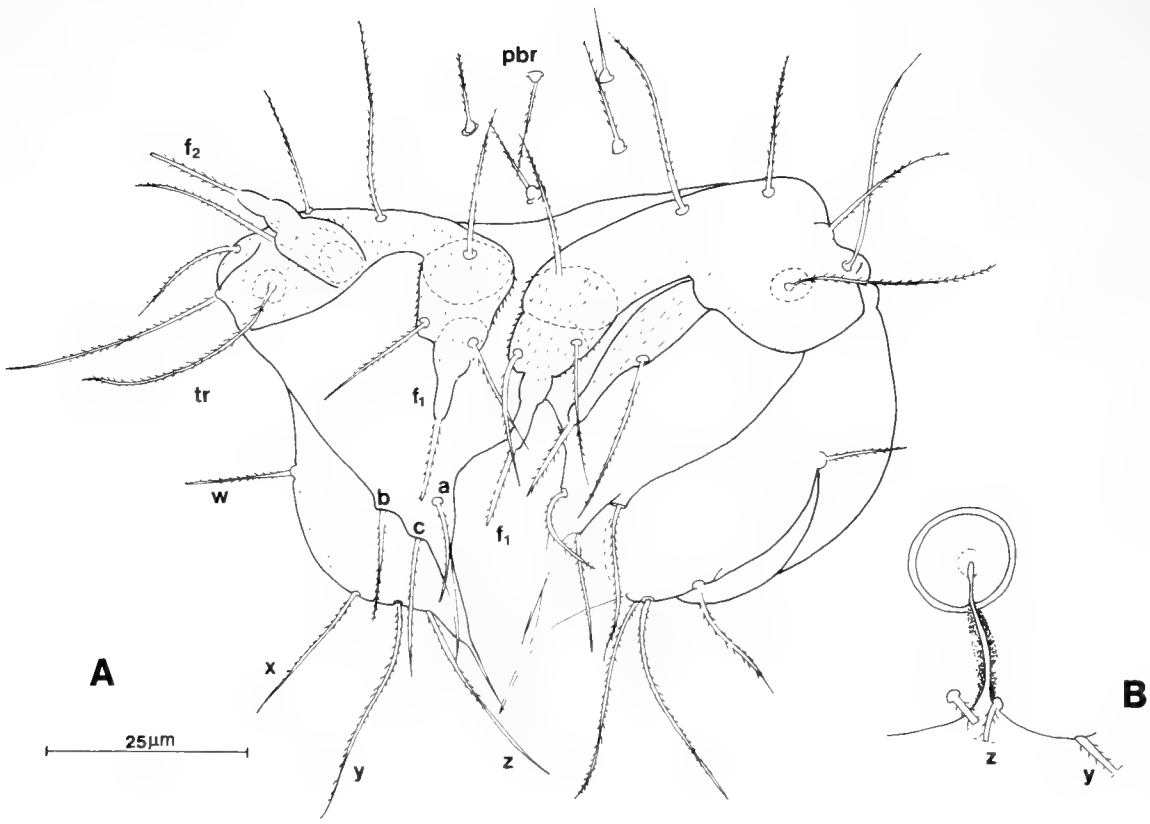

FIG. 8

Koeneniodes frondiger Remy: *A*. Volets génitaux du mâle adulte de la grotte inférieure de Lampo; la bifurcation de l'apex du 3e volet n'est pas visible sous cette orientation. Explication des lettres comme sur la figure 7 et dans le texte. - *B*. Portion de la région médio-postérieure du deuxième volet génital d'une femelle adulte de Kappang (n° 3), montrant un grand réceptacle.

segment sétiforme qui lui fait suite sans transition est finement pubescent. Les autres phanères de chaque lobe se répartissent entre une rangée de 4 soies ordinaires et, latéralement, un phanère à large embase ayant l'aspect d'une trichobothrie, quoique sa tige soit beaucoup plus courte et un peu plus épaisse que celle des trichobothries décrites jusqu'ici (p. I et parfois p. IV). Chaque moitié du deuxième volet, subtriangulaire et terminée en une pointe aiguë, porte 3 soies (*a*, *b*, *c*); de même, chaque moitié du troisième volet se termine en une pointe brièvement bifide et possède les 4 soies habituelles, les proximales (*w*, *x*) un peu plus courtes (34, 38) que les distales (*y*, *z* = 42, 45).

Sternites IV et V comme chez les juvéniles *B* ou *C*, soit 3+3 phanères grêles de longueurs croissantes de a_1 à a_3 (ca 20-36-33 à Lampo et 20-30-42 à Kappang), sans appareil glandulaire décelable. En VI, une rangée de 4 poils glandulaires épais, subcylindriques et dressés, dont les embases tuberculées sont jointives et surmontent un massif glandulaire un peu saillant.

Femelles adultes

Prosoma. Soies deuto-tristosternales au nombre de 8 à 13,9 ou 10 le plus souvent, disposées grosso modo sur 2 rangs plus ou moins égaux en nombre de phanères (5/3, 5/4, 5/5, 5/6, 6/7).

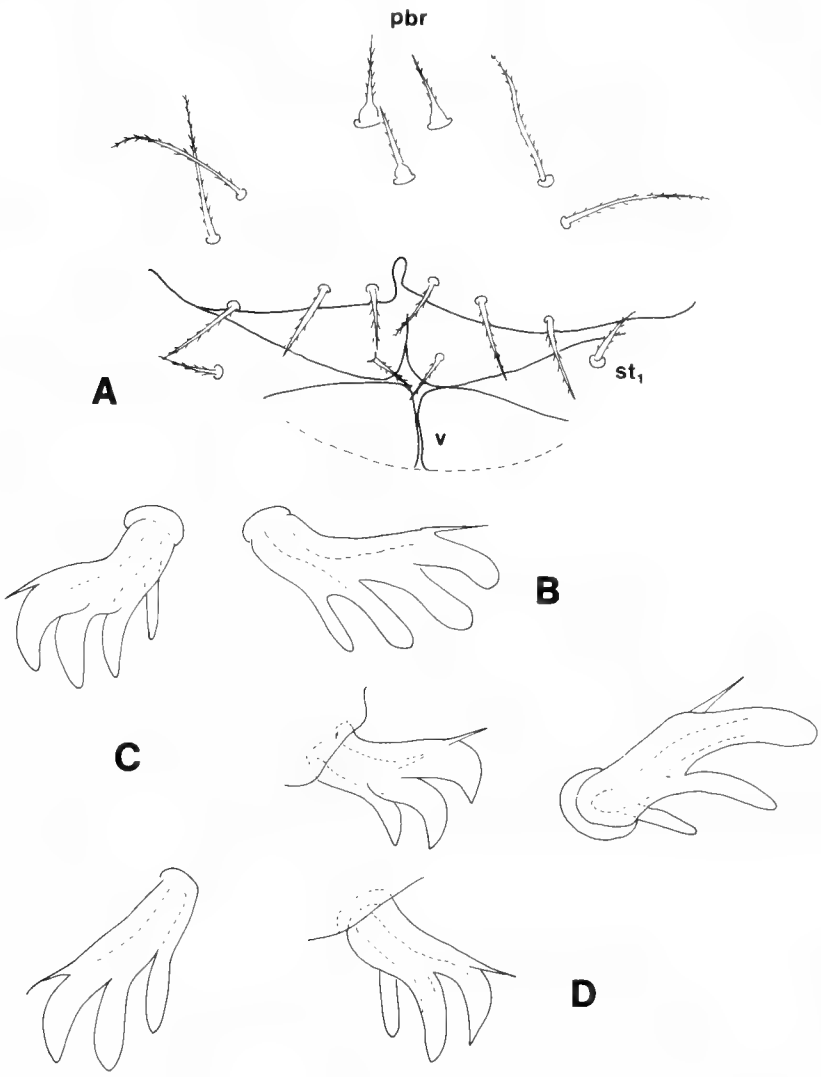

FIG. 9

Koeneniodes frondiger Remy: *A*. Aire génitale du mâle juvénile *C* de Kappang, entrée de Gua K9. - *B*, *C*, *D*. Crochets droits et gauches du sternite V de trois femelles adultes de la forêt de Samaenre (n° 7 et n° 4) et de l'entrée de Gua Salukkan Kallang (n° 2); *v* = ébauche du 3e volet; st_1 = phanère du sternite III.

Au basitarse IV, la longueur relative de la soie raide (*r*) est comparable à celle des mâles (t/r = 1,23-1,44: $\bar{X}$ = 1,32 (n = 10), mais sa position varie encore davantage, en se rapprochant de la base de l'article (t/er = 2,09-2,93: $\bar{X}$ = 2,52 (n = 10). La soie grêle latérale (*gla*) s'insère au voisinage de *r*, comme chez les mâles, mais la soie grêle tergale (*grt*) est le phanère le plus distal de l'article et il est beaucoup plus court que *gla* chez tous les spécimens (gla/grt = 1,87-2,41; $\bar{X}$ = 2,08 (n = 9). Chez un spécimen de Kappang (n° 11), le basitarse gauche porte 2 *gla*, l'une proximale à *r*, l'autre distale; cette duplication est bilatérale chez un individu de Samaenre (n° 4).

Opisthosoma. - 5,4 ou 3 (une fois) phanères à base renflée sur la région médiane du premier volet génital. Chez les 3 spécimens de Kappang, récoltés en compagnie de mâles, le deuxième volet renferme un grand réceptacle parfaitement circulaire, à paroi épaisse, de 13,5 µm de diamètre.

Les crochets du Ve sternite, outre les modifications apparentes de leur forme en fonction de l'orientation, s'écartent un peu, pour la plupart, de celui que j'ai représenté d'après un spécimen de Bali (1990: 682, fig. 1, E) et qui était conforme aux types de Madagascar (Remy 1950: 156, fig. 11), ce qui est aussi le cas d'individus de Samaenre (n° 7) et de Kappang (n° 11). Chez d'autres, il y a 4 dents par crochet, au lieu de 5, l'une ou l'autre des proximales faisant défaut; les deux crochets d'un même spécimen sont semblables.

Le seul flagelle complet appartient à un individu de Gua Salukkan (n° 1). Long de 0,48 mm et égal aux 5/9 du corps, il comporte 13 articles subégaux dont les I, II, III, V, VII, IX possèdent un verticille apical d'épines.

Mâle juvénile C.

Prosoma. - Deuto-tritosternum avec 7 soies (3/1/3). L'orientation défectueuse des deux basitarses IV compromet un peu l'exactitude des mesures: t/r = 1,36; t/er = 2,30; gla/grt = 1,45. Au basitarse IV gauche, la soie grêle tergale (*grt*) est proximale aux phanères *r* et *gla* dont les embases sont très proches l'une de l'autre; au basitarse droit, les embases des trois phanères sont sensiblement au même niveau.

Opisthosoma. - Aire génitale semblable à celle de *K. berndi* (Condé 1988: 748, fig. 18, A), sauf la présence de 3 phanères à base renflée (vs 2).

Femelles juvéniles B.

Prosoma. - Deuto-tritosternum avec 6 soies (3/3) le plus souvent, 5 (2/3) une fois et 4 (1/3) une fois. Au basitarse IV, t/r = 1,14-1,26: $\bar{X}$ = 1,20 (n = 6); t/er = 2,11-3:$\bar{X}$ = 2,51 (n = 6); gla/grt = 1,44-1,64: $\bar{X}$ = 1,54 (n = 6). La soie grêle tergale (*grt*) est toujours distale à *r*, moins cependant que chez les femelles adultes.

Opisthosoma. - Premier volet génital avec 2, 3 et parfois 4 phanères à base renflée.

Immatures A.

Prosoma. - Deuto-tritosternum avec 2 soies médianes (1/1). Au basitarse IV, t/r = 1,05-1,16: $\bar{X}$ = 1,10 (n = 7); t/er = 2,28-2,51: $\bar{X}$ = 2,36 (n = 7).

Opisthosoma. 4 phanères à base renflée sur le sternite II. Flagelle de 0,30 mm (corps/flagelle = 1,9) formé de 7 articles subégaux (38, 39,43, 38, 39, 34, 29), les trois premiers présentant un verticille apical d'épines.

Discussion. - Un seul mâle du genre *Koeneniodes* a été signalé jusqu'à présent (juvénile de *K. berndi* Condé, de Bornéo), alors que 247 femelles (69 adultes et 178 juvéniles *B*), réparties entre les 7 espèces du genre, ont été répertoriées. La découverte des premiers mâles adultes dans deux populations de Sulawesi est donc digne d'intérêt. Deux points méritent une attention particulière. Tout d'abord, le dimorphisme sexuel des basitarses IV que l'on pouvait déjà soupçonner en comparant cet

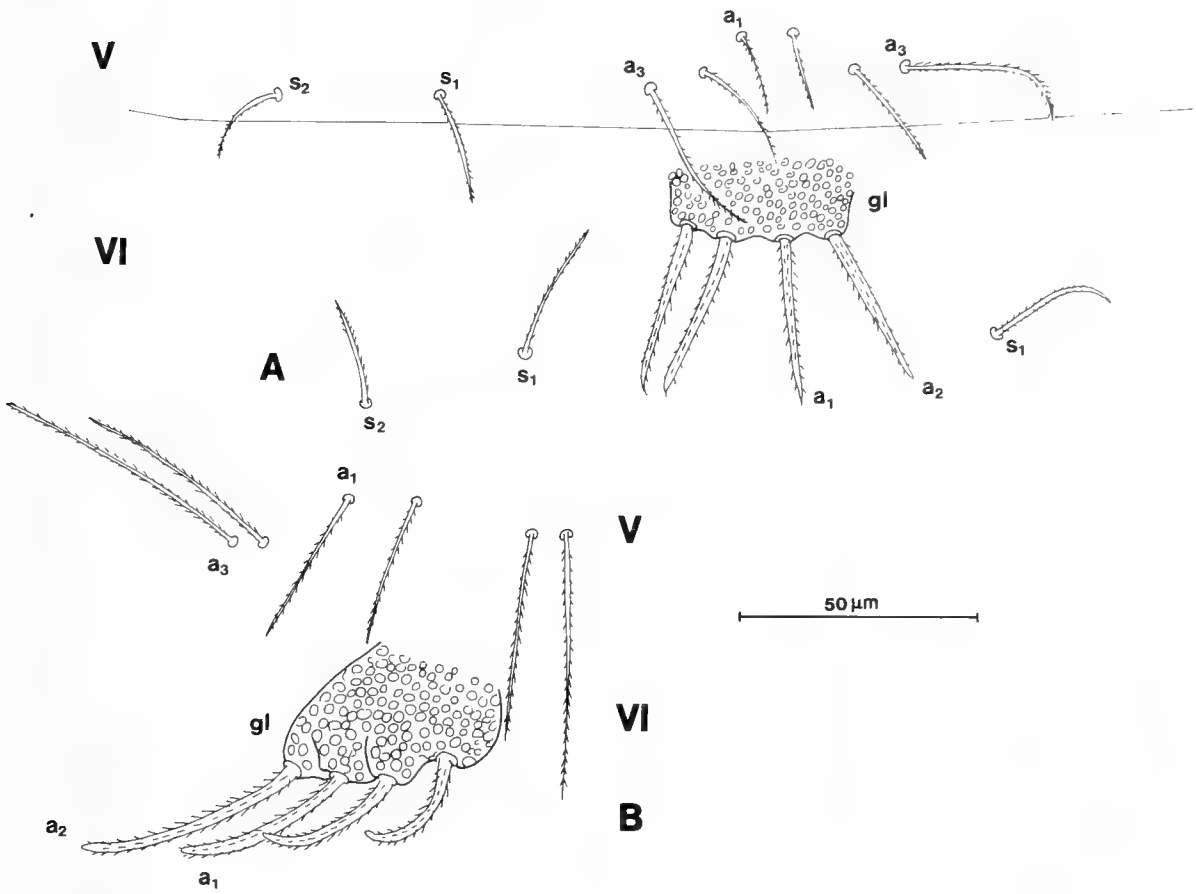

FIG. 10

Koeneniodes frondiger Remy, sternites opisthosomiens V et VI de mâles adultes: *A*. Mâle de la grotte de Lampo. - *B*. Mâle de Kappang (n° 2), entrée de Gua K9. *gl* = massif glandulaire médian; explication des autres lettres dans le texte.

article chez les juvéniles *B* et *C* de *K. berndi* (CONDÉ 1988: 743, fig. 14, C et D). Le déplacement de *grt* vers l'apex, caractéristique de la femelle, s'accentue entre le juvénile *B* et l'adulte, en même temps que s'élève le rapport gla/grt (1,54 à 2,08). Ensuite, les sternites IV à VI du mâle adulte sont identiques à ceux des juvéniles *B* ou *C*, en particulier le VIe conserve son massif glandulaire médian et les 4 phanères excréteurs subcylindriques, ces derniers remplacés par des phanères courts et dilatés chez la femelle adulte.

Les crochets du sternite V des femelles sont un peu variables à Sulawesi, mais quelquefois identiques à ceux des types de *frondiger* et, lorsqu'ils s'en écartent, ils en demeurent plus proches que de ceux de *berndi*, l'espèce la plus voisine. En revanche, les valeurs de t/r ou de t/er ne permettent pas de séparer clairement ces deux espèces, même si celle de t/er est dans l'ensemble plus élevée chez *K. frondiger*.

Une dernière remarque concerne le réceptacle du 2e volet génital, minuscule chez les types de *K. frondiger* (REMY 1950: 155, fig. 10,4) et de *K. berndi* (3,5 µm

chez ce dernier, CONDÉ 1988: 744 et 748, fig. 18, D), mais beaucoup plus grand (ca 13 µm) chez les femelles de Kappang.

L'identification des espèces de *Koeneniodes* repose, par la force des choses, sur les caractères frappants de l'opisthosome des femelles adultes; or ceux-ci n'ont aucun correspondant chez le premier mâle connu qui, à part les volets génitaux, ressemble à un juvénile *B* ou *C*. La détermination d'un mâle isolé, comme celui de Lampo, était donc incertaine. La description du mâle des autres espèces suppose donc que nous disposions, comme ici, d'une population mixte et monospécifique.

Le tableau ci-dessous regroupe les valeurs moyennes des stades connus des deux espèces les plus voisines.

TABLEAU I

		bta IV (µm)	t/r	t/er	gla/grt	
K. frondiger						
Sulawesi	Mâles ad.	82	1,38	2,22	1,45	(Kappang)
					1	(Lampo)
	Femelles ad.	86,5	1,32	2,52	2,08	
	Mâle C	64,6	1,36	2,30	1,45	
	Femelles B	66,7	1,20	2,51	1,54	
	Immatures A	46,8	1,10	2,36	—	
Java, Bali	Femelles ad.	84,5	1,19	3,02	1,78	
	Femelle B	62,5	1,12	2,55	1,30	
K. berndi						
Bornéo	Femelles ad.	87	1,43	2,37	2,21	(holo.)
	Mâle C	61,8	1,53	2,03	1,36	
	Femelles B	68,9	1,41	1,94	1,74	
	Immature A	49,5	1,20	2	—	

Prokoenenia asiatica n. sp.

THAILANDE. Province de Phangnga (Sud), résurgence de Tham Sam, à l'ouest de la ville de Phangnga, sous des plaques de dessication de l'argile remouillées, au bord du ruisseau, 9.VIII.85, P. Leclerc leg.: 1 femelle adulte (holotype).

Province de Chiang Mai (Nord-Ouest), à la limite territoriale des sous-préfectures de Chiang Dao et de Fang, devant l'entrée de la perte de la rivière souterraine de Tham Klaeb, sous des rochers enfoncés dans la terre, sous couvert forestier dense, 3.VIII.85, P. Leclerc leg.: 1 mâle juvénile *C*, 1 femelle juvénile *B*.

Province de Mae Hong-Son (Nord-Ouest), village de Ban Tham, grotte de Tham Lot, 26.VI.86, P. Leclerc leg.: 1 mâle juvénile *C*. - Village de Ban Tham, endogé près de la grotte de Tham Houd, 27.VI.86, P. Leclerc leg.: 1 immature A_2.

Province de Lampang (Nord-Ouest), village de Ban Ngao, endogé devant l'entrée de la grotte de Tham Pha Taï, 6.VIII.85, P. Leclerc leg.: 1 mâle juvénile *C*.

Longueurs. - Femelle adulte. Corps: 1,19 mm (contracté); bouclier prosomien: 0,40 mm; basitarse IV: 205,7 µm; patte IV, à partir du tibia: 0,58 mm; B/bta = 1,94; bta/ti = 0,94.

Femelle juvénile *B*. Corps: 1 mm (contracté); bouclier prosomien: 0,32 mm; basitarse IV: 149,5 µm; patte IV, à partir du tibia: 0,42 mm; B/bta = 2,12; bta/ ti = 1.

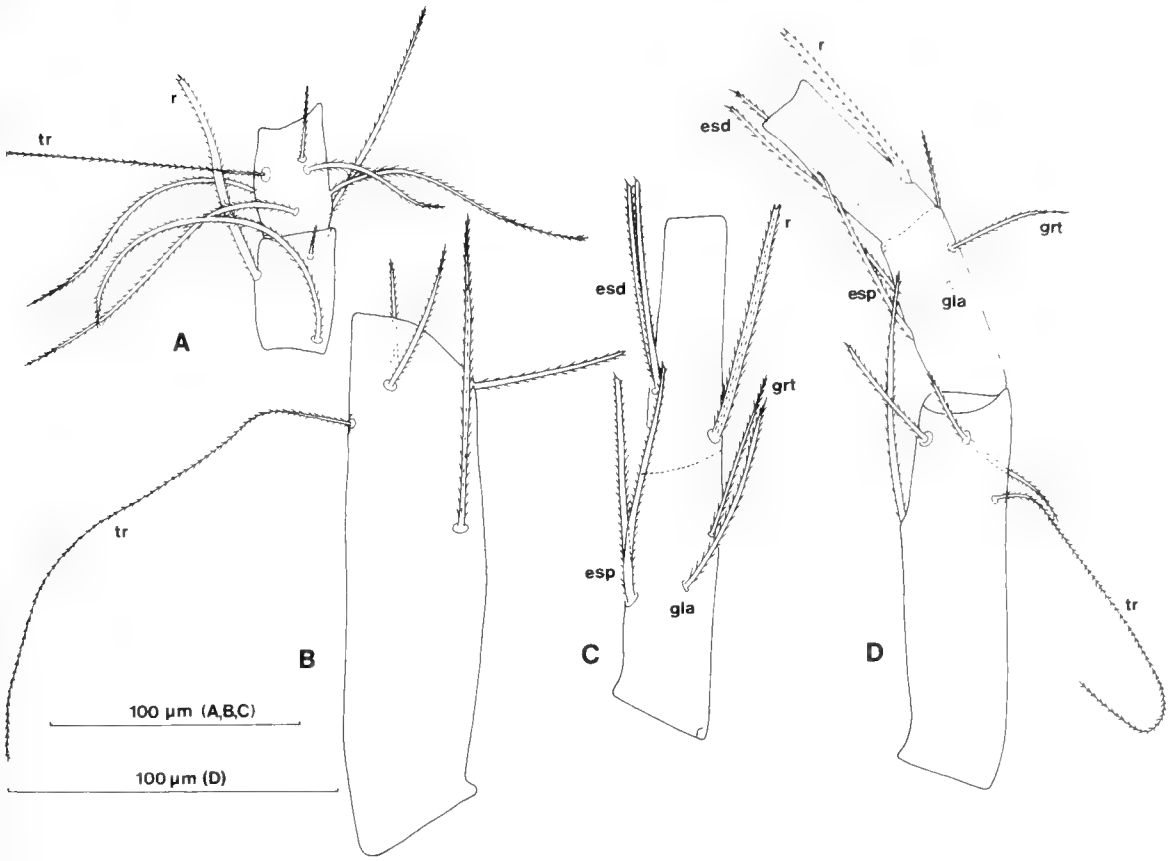

FIG. 11

Prokoenenia asiatica n. sp., femelle adulte holotype de la résurgence de Tham Sam: *A*. Basitarses 3 et 4 de la patte locomotrice I. - *B*. Tibia de la patte locomotrice - *C*. Basitarse de la patte locomotrice IV. Mâle juvénile *C* de Tham Lot Ban Tham: *D*. Tibia et basitarse de la patte locomotrice IV. Explication des lettres dans le texte.

Mâles juvéniles *C*. Corps: 1,02-1,04 mm (extension moyenne); bouclier prosomien: 0,25-0,32 mm; basitarse IV: 117; 119,6; 142,2 µm; patte IV, à partir du tibia: 0,33-0,42 mm; B/bta = 2,10-2,53; bta/ti = 0,95-0,97.

Immature A_2. Corps: 0,89 mm; bouclier prosomien: 0,21 mm; basitarse IV: 88,7 µm; patte IV à partir du tibia: 0,28 mm; B/bta = 2,36; bta/ti = 1,05.

Femelle holotype

Remarque. Ce spécimen, de couleur brunâtre, était très cassant et semblait avoir subi une dessication, ce que suggèrent les conditions de capture sous une plaque d'argile sèche; le pédipalpe et la première patte locomotrice droits étaient sectionnés.

Prosoma. - Organe frontal médian 2 fois 3/4 (2,70) aussi long que large; ses branches, à bords subrectilignes, atténuées à l'apex, mais dépourvues de pointe nette; la base est courte, égale au 1/6 de la longueur totale de l'organe. Organes latéraux avec 5 éléments assez courts et larges. Bouclier avec 7 + 7 soies très courtes, sauf celles des deux paires antérieures et de la paire externe de la 3e rangée qui sont 2 à 3 fois plus

longues (9-14/4-5). Segment libre sans t_1; les intermédiaires (t_2) très robustes, un peu plus de une fois et demie (1,58) aussi longs que les latéraux (t_3). 6 soies deuto-tritosternales (3+3) sur un rang transversal.

Chélicères avec 8 dents à chaque mors. Trois longs phanères, barbelés presque dès la base, sur l'article basal.

Pédipalpes et pattes locomotrices I et IV. Longueurs relatives des articles: pédipalpes: ti = 110, bta 1 = 56, bta 2 = 41, ta 1 = 24, ta 2 = 26, ta 3 = 46; pattes I: ti = 113, bta 1 + 2 = 100 (80 + 20), bta 3 = 26, bta 4 = 27, ta 1 = 25, ta 2 = 20, ta 3 = 72; pattes IV: ti = 114, bta = 107, ta 1 = 36, ta 2 = 49.

Aux pattes I, la soie raide du basitarse 3 est presque une fois 3/4 aussi longue que le bord tergal de l'article (101/59; t/r = 0,58) et est insérée vers le tiers distal du bord sternal (35/50, s/er = 1,42), son apex atteignant presque la moitié de la longueur du tarse 1.

Aux pattes IV, le basitarse est un peu plus court que le tibia (107/114, bta/ti = 0,94) et, mesuré au niveau de *r*, environ 8 fois aussi long que large; la soie raide (*r*) est 2 fois plus courte que le bord tergal de l'article (115/237, t/r = 2,06), insérée vers les 3/5 distaux de ce bord (135,5/237, t/er = 1,75), son apex dépassant le bord distal de l'article. Les 6 autres phanères sont la soie grêle tergale (*grt*, 74), la soie grêle latérale (*gla*, 108) et les 2 paires de soies sternales (*esp*, *esd*), les éléments de chaque paire insérés au même niveau. Une pseudo-articulation est visible juste en deça de l'insertion de *r*, les deux moitiés du basitarse formant entre elles un angle faible. Le tibia porte, sur la région distale de la face tergale, la trichobothrie décrite chez *P. javanica* Condé (1990: 688-689), la longueur de la tige sensiblement égale à celle de l'article; comme chez *P. javanica*, la trichobothrie remplace l'un des quatre courts phanères du verticille subapical présent chez les autres espèces.

Opisthosoma. - Tergites II à VI avec une seule paire de poils épais, très robustes (sans doute t_3), comprise, aux tergites II à V, entre une paire de soies grêles (*s*); en II, ils sont égaux à leur écartement (80/81); de III à VI ils sont à la fois plus courts et plus éloignés l'un de l'autre (moyenne 66,25/120,25; extrêmes 64-68/99-135); les phanères *s* ont tous sensiblement la même longueur (44 - 46). En VII, il y a 2 paires (t_1, t_3) de phanères, ceux de la paire médiane un peu plus courts que leur écartement (63/70).

Segments VIII à X avec respectivement 10 (5+5), 8 (4+4) et 6 (3+3) phanères, ceux des deux paires tergales de chacun beaucoup plus longs que les autres. Segment XI avec 3 + *t* + 3, les phanères de la paire sternale étant les plus courts et le médian tergal un peu plus court que ses voisins (65/78,5). Anneau basal du flagelle égal au quart environ de la longueur du XIe segment, avec un seul phanère court.

Premier volet génital avec 11 + 11 soies (a_4 présentes); à la rangée distale les phanères sont relativement grêles et de longueurs légèrement croissantes de a_1 à a_4 (32, 36, 41, 42). Le deuxième volet génital porte sur chaque moitié 2 phanères distaux subégaux (*y*, *z* : 46) et un phanère proximal (*x* : 58) qui semble être sur le sternite, un peu à l'extérieur du volet, comme son homologue (st_1) des juvéniles *B* ou *C*; st_2 est dédoublé; st_3 est présent.

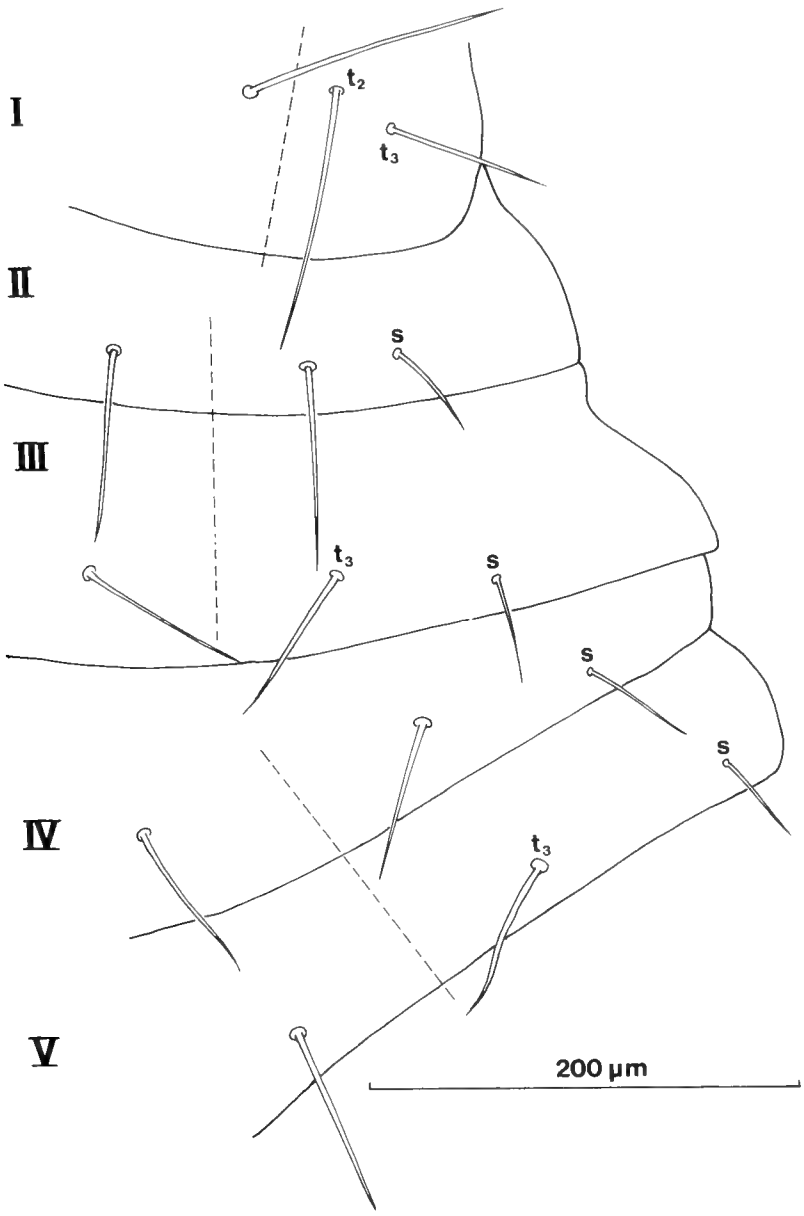

FIG. 12

Prokoenenia asiatica n. sp., femelle adulte holotype. Cinq premiers tergites. Explication des lettres dans le texte.

Sternites IV et V avec deux groupes parasagittaux de 4 très grosses soies glandulaires (a_1 - a_4), paraissant cannelées en raison de l'alignement des barbules en rangées longitudinales; une soie plus grêle et plus longue que toutes les autres (ω) s'insère dans une dépression au-dessous de la soie externe (a_4), au bord interne de l'orifice de la vésicule exsertile (v); 3 soies latérales ordinaires (l_1 à l_3) forment une rangée transverse au-dessus de l'orifice de la vésicule, l_1 se trouvant au voisinage de la base de ω et de a_4; latéralement, 2 à 4 phanères pleuraux correspondant aux paires s_1 et s_2 habituelles; en VI, les groupes parasagittaux ne comptent chacun que 3 soies glandulaires (a_1 - a_3), le phanère ω manque et il n'y a qu'une soie l (l_3) et une seule soie s. Sternite VII avec une rangée de 7 poils (3 + 1 + 3), ceux des 2 paires latérales

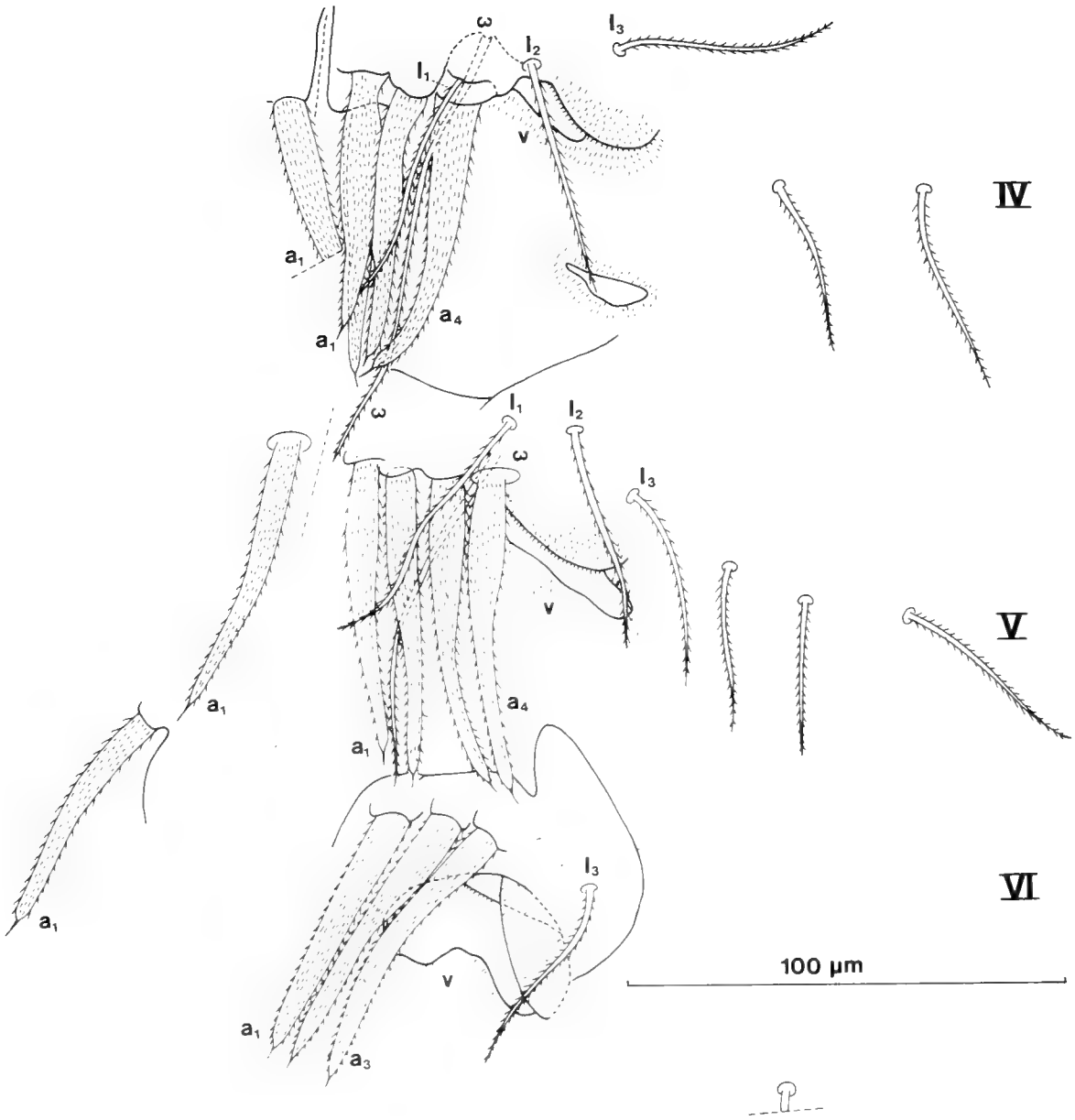

FIG. 13

Prokoenenia asiatica n. sp., femelle adulte holotype. Sternites IV à VI de l'opisthosome. Explication des lettres dans le texte.

longs (56-60) et relativement épais, le médian et ceux de la paire médiale plus courts (35) et minces.

Mâles juvéniles C.

Remarque. Le mâle de Tham Klaeb se distingue par ses grandes dimensions qu'il partage avec la femelle juvénile *B* de la même localité (bta IV: 142,2 et 149,2 µm).

Prosoma. - Organes latéraux avec 2 ou 3 (Tham Klaeb) éléments. 6 (3+3) ou 7 (3+1+3, Tham Klaeb) soies deuto-tritosternales en une rangée transversale.

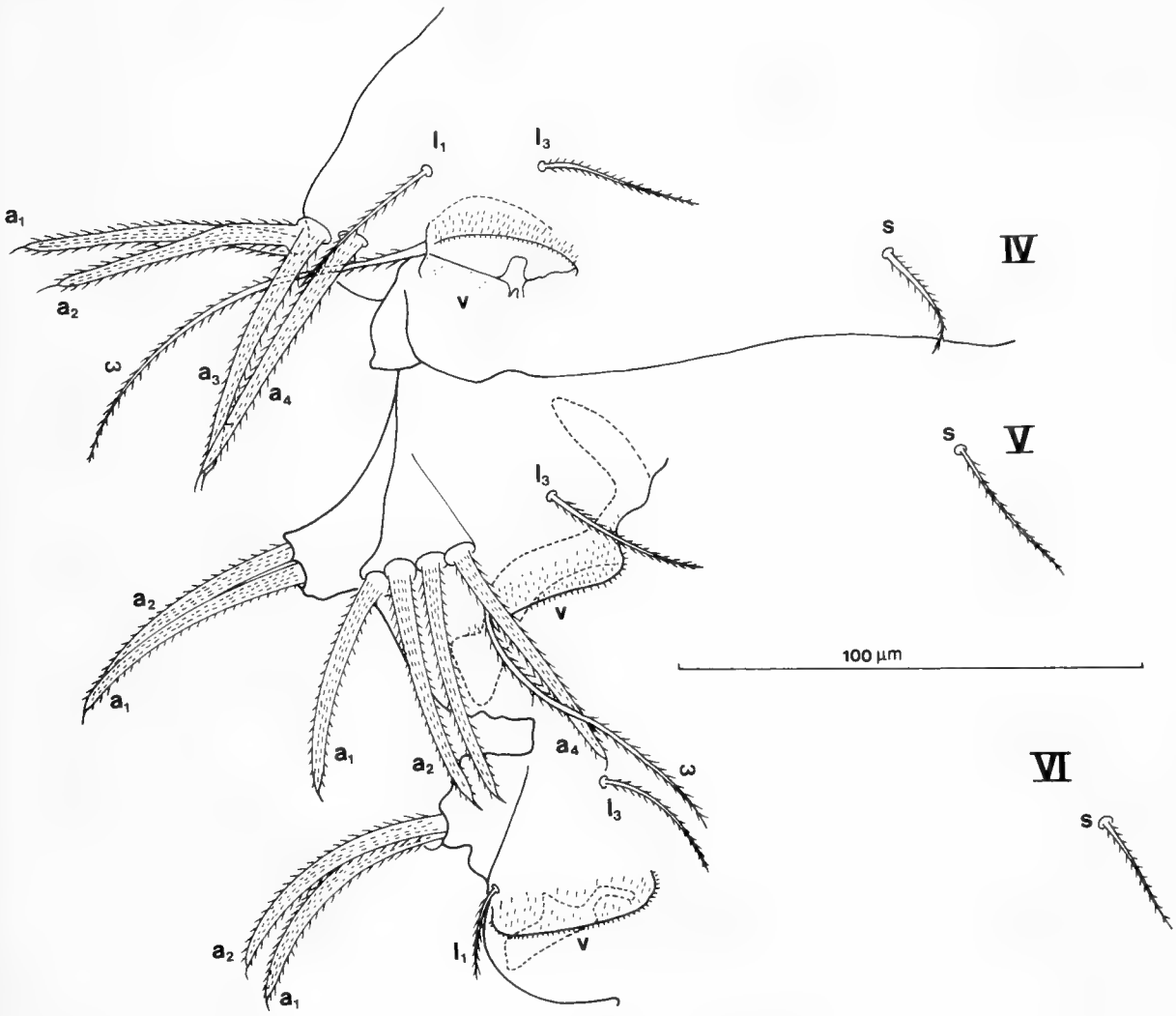

FIG. 14

Prokoenenia asiatica n. sp., mâle juvénile *C* de Tham Lot Ban Tham. Sternites IV à VI de l'opisthosome. Explication des lettres dans le texte.

Chélicères avec 8 dents à chaque mors.

Aux pattes IV, la tige de la trichobothrie tibiale est un peu plus longue (152/141) que l'article; les 4 phanères subapicaux sont présents. Le basitarse qui présente une pseudo-articulation très nette, possède déjà le même nombre de phanères que l'adulte; t/r = 1,98-2,07; t/er = 1,63-1,64.

Opisthosoma. - Tergites III à VI avec 2 paires de soies subégales (t_1, t_3), comprises entre une paire de soies grêles (*s*). Segments IX à XI avec chacun 7 phanères (3+*t*+3). L'anneau basal du flagelle, pourvu de 4 phanères courts et couchés, n'est séparé du premier article (qui subsiste seulement chez le mâle de Tham Lot) que par une limite très discrète et il est égal à la moitié environ de la longueur de l'article.

Volets génitaux correspondant à la variante 3 (CONDÉ 1984: 387), avec 6 + 6 longues soies sur le premier volet et 2 + 2 courtes sur le second. Sternite III avec

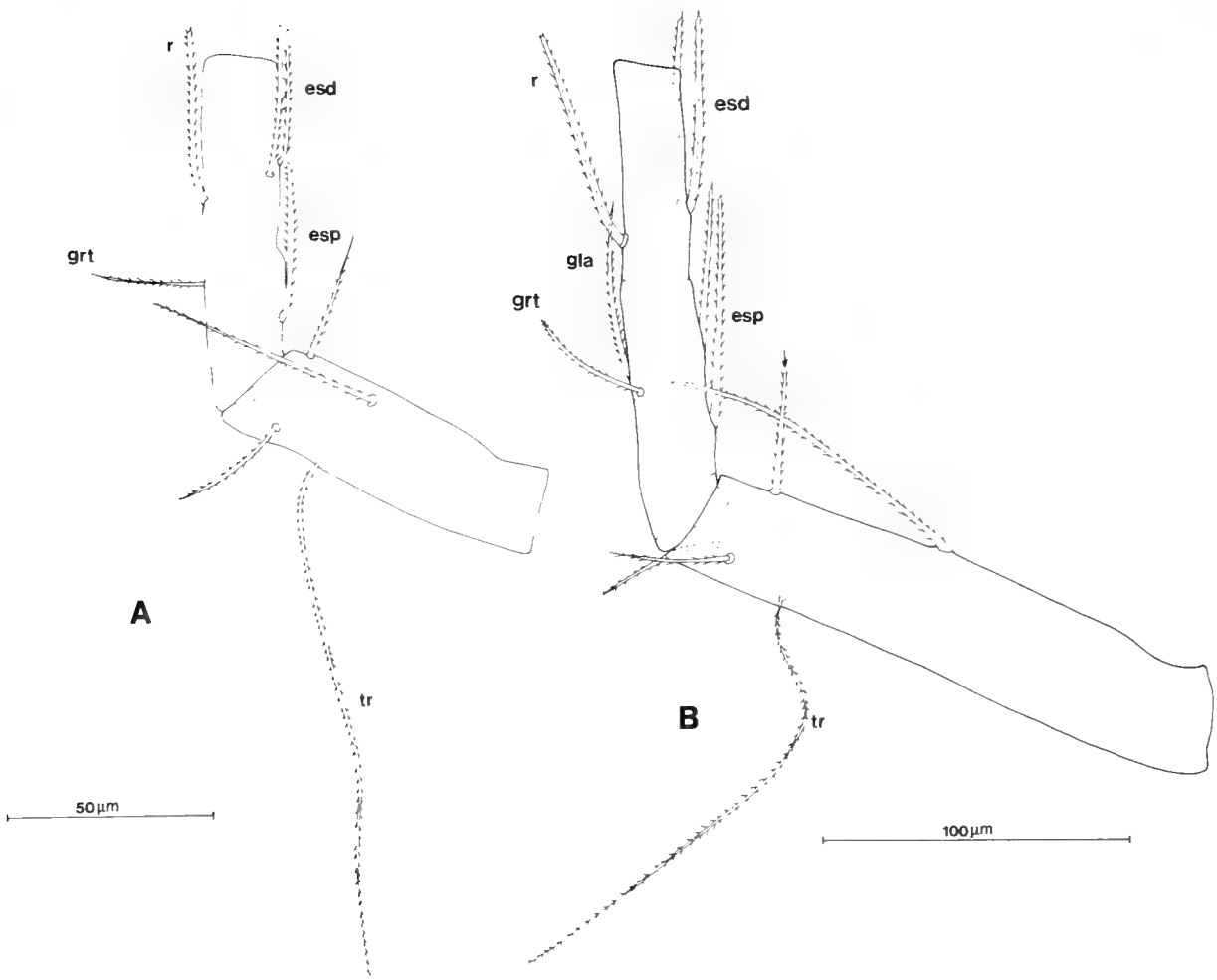

FIG. 15

Prokoenenia asiatica n. sp., immature *A2* de Tham Houd Ban Tham: *A*. Tibia et basitarse de la patte locomotrice IV. - *Prokoenenia celebica* n. sp., femelle adulte holotype de la grotte de Gua Mampu Uloe: *B*. Tibia et basitarse de la patte locomotrice IV. *tr* = trichobothrie. Explication des autres lettres dans le texte.

jusqu'à 5 + 5 phanères *st*. Vésicules exsertiles de IV à VI, ces sternites portant deux groupes parasagittaux de 4 grosses soies glandulaires en IV et V, et de 2 en VI; ces groupes surmontent chacun un volumineux massif glandulaire. 2 soies latérales (l_1, l_3) en IV et VI, une seule (l_3) en V; une soie *s* à chaque sternite; soies ω comme chez l'adulte.

Femelle juvénile B.

Prosoma. - Organes latéraux avec 3 éléments à gauche et 4 à droite, petits et arrondis du bout, comme les branches de l'organe médian. 7 soies deuto-tritosternales (3+1+3, le phanère le plus proche du médian, à gauche, déplacé vers l'avant).

Chélicères et basitarse IV comme chez les mâles *C*; t/r = 1,98; t/er = 1,72.

Opisthosoma. - Tergites et sternites comme chez les mâles *C*. Volets génitaux correspondant à la variante 3 (CONDÉ 1984: 387), avec 4+4 longues soies sur la

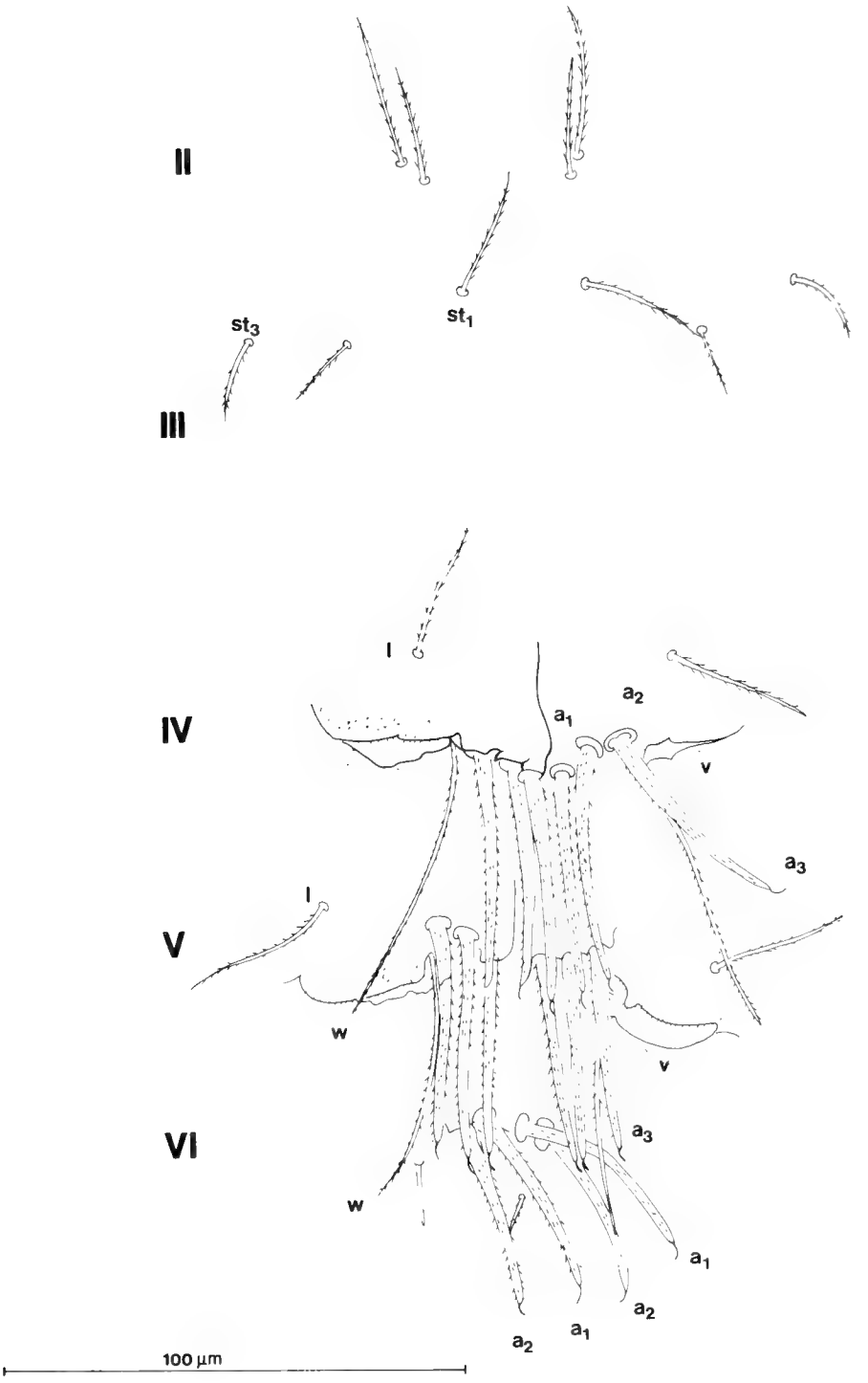

FIG. 16

Prokoenenia asiatica n. sp., immature *A2* de Tham Houd Ban Tham. Sternites II à VI de l'opisthosome. Explication des lettres dans le texte.

portion principale du premier volet et 2 + 2 phanères courts au bord interne de l'échancrure marginale postérieure qui est ici très bien marquée.

Immature A_2.

Prosoma. - Organes latéraux avec 2 éléments ovalaires. 2 + 2 soies deuto-tritosternales, écartées les unes des autres, en une rangée transverse.

Chélicères avec 7 dents à chaque mors.

Aux pattes IV, la tige de la trichobothrie tergale est environ 1 fois 1/2 aussi longue (148/97) que l'article; les 4 phanères subapicaux sont présents. Le basitarse présente, pour tout indice de pseudo-articulation, une petite dépression vers le milieu du bord sternal; t/r = 2,08; t/er = 1,67. L'apex de *r* dépasse sensiblement le bord distal de l'article; une soie proximale (*esp*), les deux soies distales (*esd*) et la soie grêle tergale sont présentes, soit 5 phanères en tout.

Opisthosoma. - Tergites III à VI avec une paire de soies (t_3), de une fois 3/4 à presque deux fois plus courtes que leur écartement, comprise entre une paire de soies grêles (*s*). Segments VIII à X avec chacun 3 + 3 poils, ceux de la paire latéro-tergale plus développés que les autres; XI avec 7 phanères (3 + *t* + 3), le médian plus court. Anneau basal du flagelle bien individualisé.

Sternites II et III avec respectivement une rangée transverse de 2 + 2 et 3 + 3 phanères (st_1 à st_3), sans volets génitaux différenciés. Une paire de vésicules exsertiles en IV et V. 3 + 3 soies épaisses en IV et V, et 2 + 2 en VI qui surmontent de gros massifs glandulaires. Une soie ω en IV et V, et une soie latérale (*l*) de IV à VI. Sternite VII avec 2 + 2 soies ordinaires.

Discussion

L'histoire du stade que j'ai proposé de nommer A_2 (Condé 1984*a* : 141) et qui n'avait plus été observé depuis sa description, due à A. Rucker (1903) et fondée sur deux spécimens seulement de *Prokoenenia wheeleri*, a été évoquée lors de la découverte de ce stade chez *Triadokoenenia millotorum* (Remy, 1950, sous *Prokoenenia*), (Condé 1991).

Chez *P. wheeleri*, Rucker a mentionné et figuré (pl. 21,2) deux minuscules ébauches de volets génitaux, pourvus chacun de 2 soies courtes, au bord postérieur du sternite II; elle indique aussi, sans les représenter, deux minuscules lobes, pourvus chacun d'une soie, au bord postérieur du sternite III. Je n'ai rien observé de semblable sur le spécimen décrit ici, mais le nombre de phanères des deux sternites (2 + 2, 3 + 3) correspond presque aux illustrations de Rucker (2 + 2, 2 + 2), quoique leurs longueurs relatives soient tout à fait différentes.

Une comparaison avec le stade A_1 de *Prokoenenia javanica* (Condé 1990: 694, sous «immature *A*») montre que, l'acquisition des deux premières paires de vésicules mise à part, il existe une progression de la chétotaxie: 4 soies deuto-tritosternales (une seule), 4 soies subapicales au tibia IV (3), phanère *grt* au basitarse IV (0), 3 + 3 phanères glandulaires aux sternites IV et V (2 + 2). La position

intermédiaire de A_2, entre A_1 et *B-C*, est ainsi bien définie, mais cette étape n'a pas d'équivalent connu chez les genres de Palpigrades dépourvus de vésicules exsertiles.

AFFINITÉS

Prokoenenia asiatica n. sp. doit être comparée à *P. javanica* Condé 1990, du Jardin botanique de Bogor, l'espèce qui est à la fois sa proche voisine géographique et dont la description prend en compte les mêmes critères. La taille est plus grande et, en particulier, les pattes locomotrices de la dernière paire sont plus longues (0,58 mm vs 0,42 mm à partir du tibia) et le basitarse IV (205,7 µm vs 148-150,5 µm) est environ 8 fois aussi long que large, au lieu de 5 fois 1/3, l'insertion de la soie raide (*r*) étant plus proche de la pseudo-articulation que chez *P. javanica*. 5 éléments, au lieu de 3, à chaque organe latéral de l'adulte. Chez les femelles adultes, les soies glandulaires des sternites sont au nombre de 4,4 et 3 par demi-sternite de IV à VI, au lieu de 2,6-7 et 5-7, la formule des juvéniles *B* et *C* étant déjà presque identique (4, 4, 2 au lieu de 2, 3, 2 chez *P. javanica*).

L'allongement des appendices et les phanères plus nombreux aux organes latéraux pourraient être l'indice d'une évolution souterraine par rapport à *P. javanica*, mais les espèces de *Prokoenenia* sont encore trop mal connues pour en juger.

Prokoenenia celebica n. sp.

SULAWESI. Province de Sulawesi-sud, District de Watampone (Bone), village de Uloe, grotte de Gua Mampu, cavité abritant de très nombreuses colonies de Chauves-Souris, 16.VIII.86, P. Leclerc leg.: 1 femelle adulte (holotype).

Province de Sulawesi-sud, District de Maros, village de Kappang. Grotte de Gua Salukkan Kallang (Kl), rivière des prismes, dans un niveau fossile, sous une pierre sur l'argile, 21.VII.86, P. Leclerc leg.: 1 femelle juvénile *B*.

Longueurs. - Femelle adulte. Corps: 1,69 mm (en extension); bouclier prosomien: 0,38 mm; basitarse IV: 163,5 µm; patte IV, à partir du tibia: 0,48 mm; B/bta = 2,36; bta/ti = 0,87.

Femelle juvénile. Corps: 1,05 mm (en extension); flagelle: 1,65 mm; bouclier prosomien: 0,33 mm; basitarse IV: 156 µm; patte IV, à partir du tibia: 0,47 mm; B/bta = 2,13; bta/ti = 0,89.

Femelle adulte

Prosoma. - Organe frontal médian trapu, environ 2 fois aussi long que large (1,95); ses branches, à bords subrectilignes, peu atténuées vers l'apex qui est arrondi; la base est courte, égale au 1/5 de la longueur totale de l'organe. Organes latéraux comprenant 5 éléments en ligne, à très courte pointe apicale. Bouclier avec 7 + 7 soies courtes, sauf celles des deux paires antérieures qui sont presque 2 fois plus longues que les autres (11-11,5/6). Segment libre sans t_1, les intermédiaires (t_2) 1 fois 1/3 (1,35) aussi longs que les latéraux (t_3). 9 soies deuto-tritosternales (4 + 1 + 4) en une rangée transversale.

Chélicères avec 8 dents à chaque mors. Trois longs phanères, barbelés sur leurs 2/3 distaux, sur l'article basal.

Pédipalpes et pattes locomotrices I et IV. Longueurs relatives des articles (moyenne des appendices droits et gauches):

pédipalpes: ti = 87, bta 1 = 41,5, bta 2 = 33,5, ta 1 = 18,5, ta 2 = 24, ta 3 = 45,5; pattes I: ti = 98,5, bta 1 + 2 = 88, bta 3 = 21,5, bta 4 = 26, ta 1 = 20,5, ta 2 = 22,5, ta 3 = 62; pattes IV: ti = 97, bta = 85, ta 1 = 29,5, ta 2 = 39,5.

Aux pattes I, la soie raide du basitarse 3 est 1 fois 3/5 aussi longue que le bord tergal de l'article (65/40, t/r = 0,61) et est insérée vers le 1/5 distal du bord sternal (25/31, s/er = 1,24) son apex atteignant environ la moitié de la longueur du tarse 1.

Aux pattes IV, le basitarse est un peu plus court que le tibia (85/97, bta/ ti = 0,87) et, mesuré au niveau de *r*, environ 7 fois 1/2 aussi long que large; la soie raide (*r*) est un peu plus de 2 fois plus courte que le bord tergal de l'article (71/156, t/r = 2,2) et est insérée aux 2/3 distaux de ce bord (101/156, t/er = 1,54), son apex dépassant le bord distal de l'article. Les 6 autres phanères sont la soie grêle tergale, dressée et courte (*grt*, 48), la soie grêle latérale (*gla*, 70) et les 2 paires de soies sternales (*esp*, *esd*), les éléments de chaque paire un peu décalés et subégaux (70 - 68, 61 - 65). Une pseudo-articulation nettement en deçà de l'insertion de *r*, l'angle formé par les deux moitiés du basitarse étant faible. Le tibia porte une trichobothrie tergale dont la tige a sensiblement la même longueur (90/97) que l'article.

Opisthosoma. - Tergites II à IV avec une paire de poils assez robustes (t_3), comprise entre une paire de soies grêles (*s*); en II, ils sont un peu plus courts que leur écartement (63/71,5); en III, ils sont à la fois plus courts et plus éloignés l'un de l'autre (54/79) et en IV ils sont 2 fois plus courts que leur écartement (50/100). En V, un phanère asymétrique (t_3) se trouve à gauche, entre t_1 et *s*; en VI et VII, t_1 et t_3 sont présents, les t_3 presque 3 fois plus courts que leur écartement. Segments VIII à XI avec respectivement 5 + 5, 4 + 4, 4 + 4 et 3 + *t* + 3, le phanère tergal médian et ceux de la paire sternale plus courts que leurs voisins.

Premier volet génital avec 11 + 11 soies (a_4 présents); à la rangée distale, les phanères sont de longueurs à peine croissantes de a_1 à a_4 (58, 58, 61, 66).

Deuxième volet avec 3 phanères sur chaque lobe, *x* étant le plus long (90) et *y*, *z* subégaux(65,61). Le bord interne de chaque lobe présente un épaississement sclérifié étroit qui rejoint son symétrique vers la moitié de sa longueur. L'extrémité antérieure de cette formation est au contact d'une petite boutonnière qui donne peut-être accès au réceptacle ovalaire, beaucoup plus vaste, situé en avant d'elle (les deux cavités ont la même réfringence). En profondeur, on distingue le contour sclérifié d'une sorte de coupe dont le fond est plus épais que les parois latérales. Au-dessus de ces formations, l'épicuticule présente un champ de minuscules épines à pointe dirigée vers l'arrière.

Latéralement, une rangée de 6 phanères grêles, correspondant aux st_2 et st_3 des autres genres, soit pl_2 à pl_7.

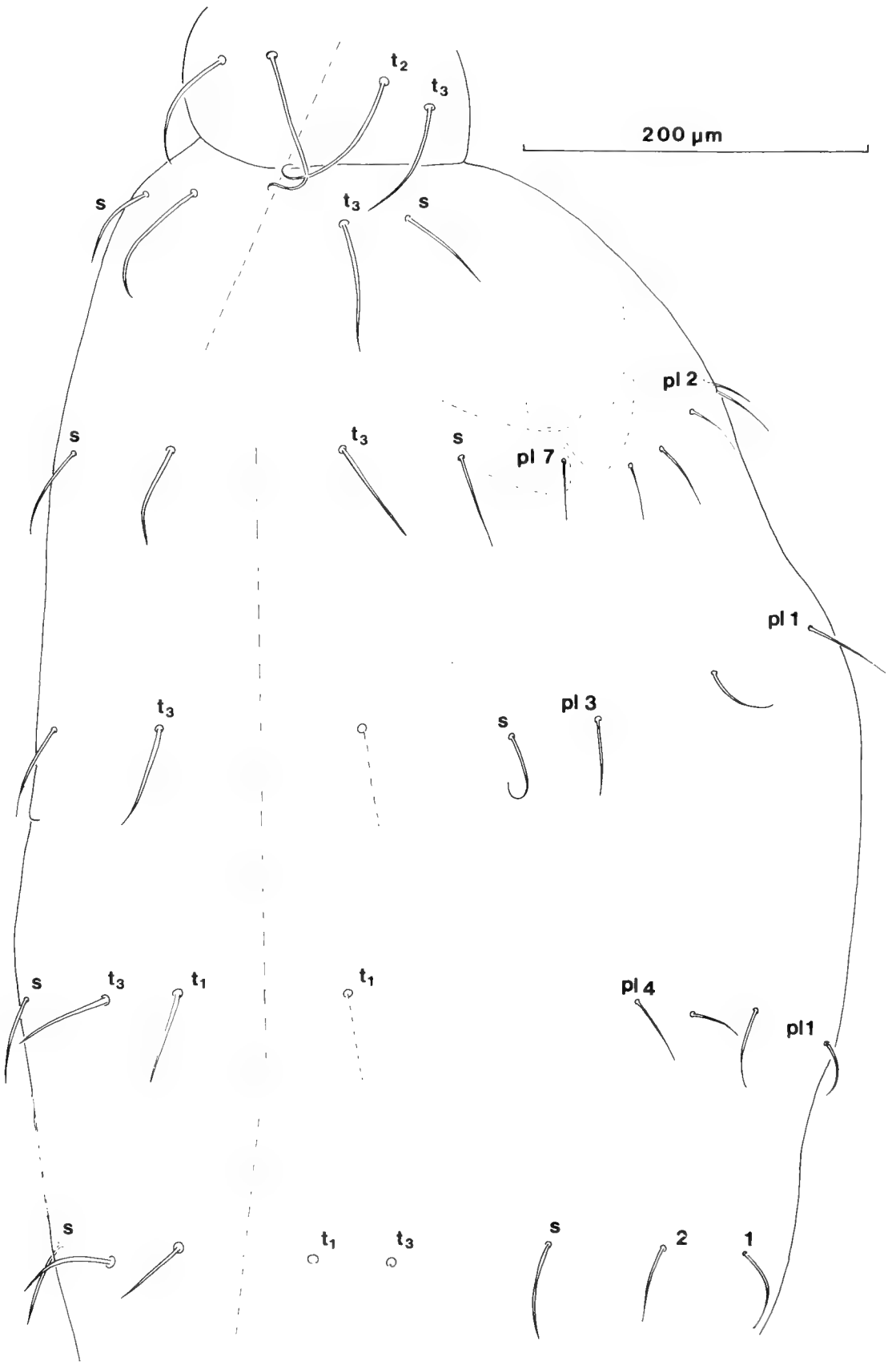

FIG. 17

Prokoenenia celebica n. sp., femelle adulte holotype de la grotte de Gua Mampu Uloe. Tergites I à VI. *pl* = phanère pleural. Explication des autres lettres dans le texte.

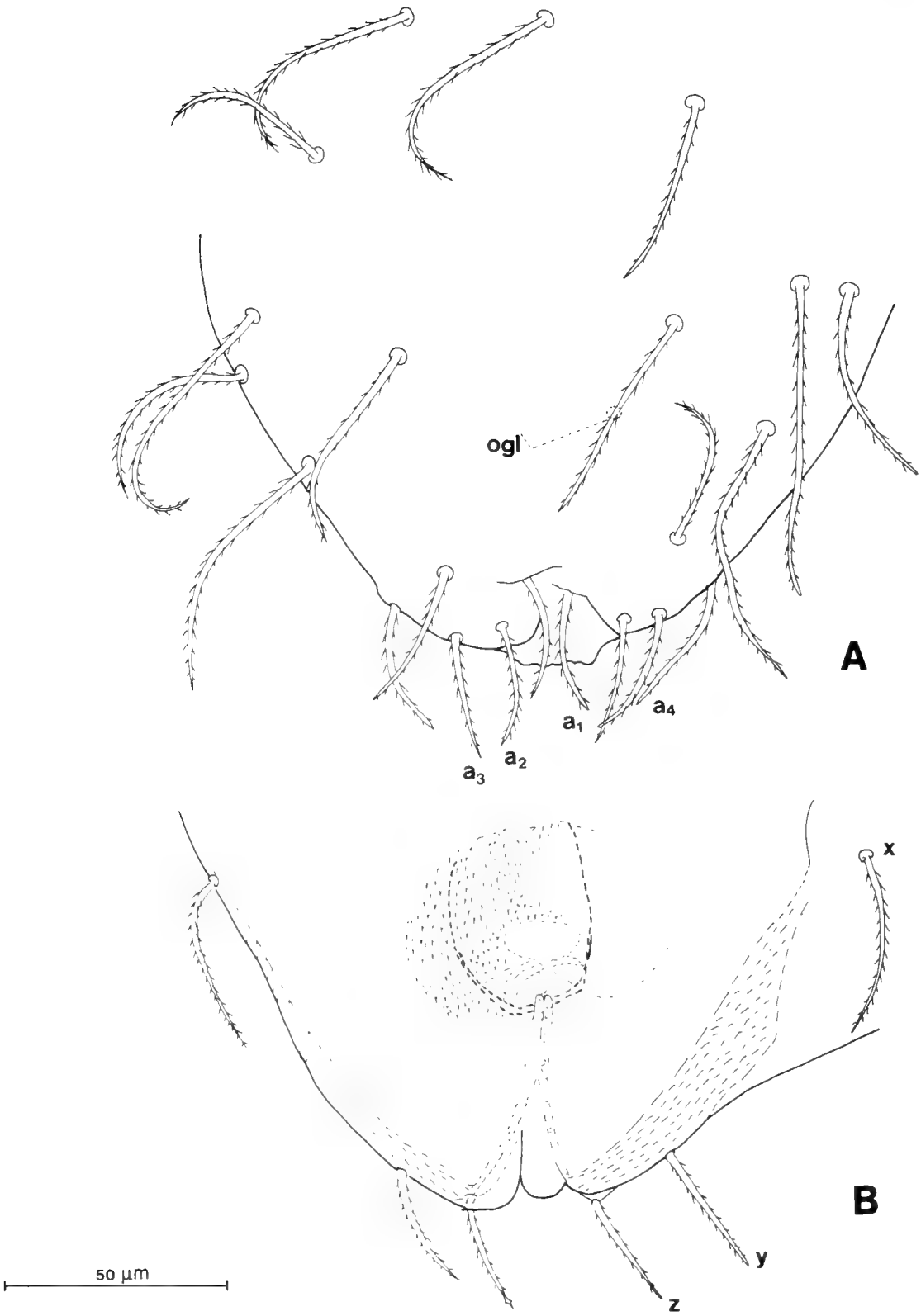

FIG. 18

Prokoenenia celebica n. sp., femelle adulte holotype de la grotte de Gua Mampu Uloe: *A*. Premier volet génital. - *B*. Portion postérieure du deuxième volet génital et sclérifications internes. *ogl* = orifices présumés glandulaires. Explication des lettres dans le texte.

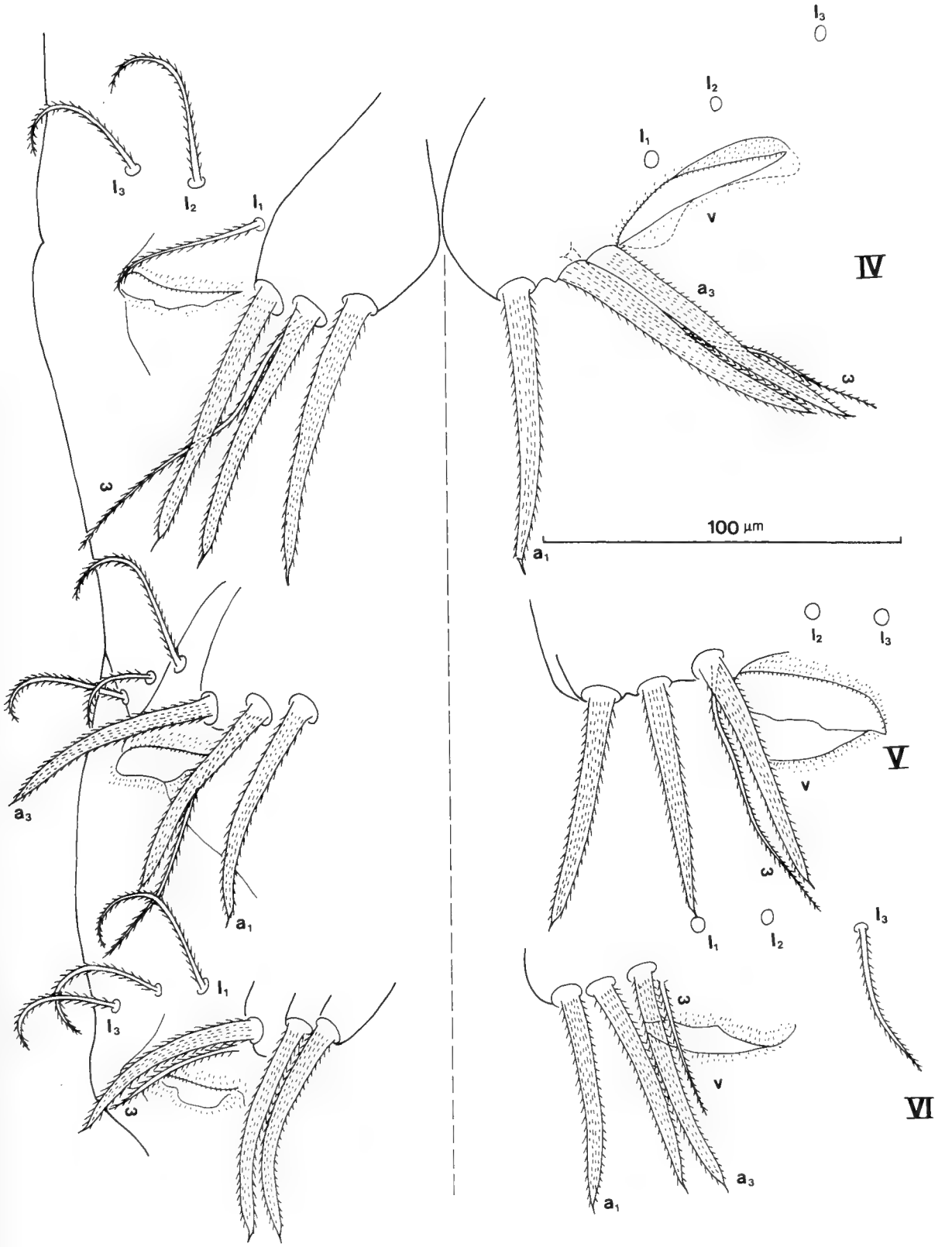

FIG. 19

Prokoenenia celebica n. sp., femelle adulte holotype de la grotte de Gua Mampu Uloe. Sternites IV à VI de l'opisthosome. Explication des lettres dans le texte.

Sternites IV à VI avec deux groupes parasagittaux de 3 très grosses soies glandulaires (a_1 - a_3) et une soie grêle (ω), un peu plus longue qu'elles en IV et V, égale à leurs 2/3 seulement en VI; 3 soies latérales ordinaires (l_1 à l_3), généralement dressées, 2 au-dessus de l'orifice de la vésicule exsertile (v), la 3e à l'extérieur; 3 et parfois 2 ou 4 phanères pleuraux, entre l_3 et s, correspondant aux paires s_1, s_2 des autres genres de Palpigrades. Sternite VII avec une rangée de 5 phanères dont le médian est un peu plus court.

Femelle juvénile B.

Prosoma. - 5 éléments à l'organe latéral droit. 6 (3 + 3) soies deuto-tritosternales en une rangée transverse.

Chélicères avec 8 dents à chaque mors.

Basitarse IV un peu plus court que le tibia (0,89), avec une pseudo-articulation très nette et les mêmes phanères que l'adulte; t/r = 2,48; t/er = 1,41.

Opisthosoma. - Tergites III à VI avec une paire de longs phanères latéraux (t_3), comprise entre une paire de soies plus grêles (s). Segments IX à XI avec chacun 7 phanères dont le médian est sternal en IX et X, et tergal en XI.

Volets génitaux conformes à la variante 3 (CONDÉ 1984*b*: 387). Sternites IV à VI semblables à ceux de l'adulte, avec 3 + 3 grosses soies glandulaires (a_1-a_3) et une soie ω bien développée en IV et V, mais beaucoup plus courte en VI. Les massifs glandulaires sous-jacents sont très volumineux. Une paire de soies ordinaires (l) en avant de l'orifice de la vésicule.

Flagelle. Egal à une fois et demie environ la longueur du corps (1,57). L'anneau basal, pourvu de 4 phanères courts, n'est séparé du premier article du flagelle que par une limite très discrète, sa longueur étant égale à la moitié environ de celle de l'article (23/43). Longueurs relatives des 13 articles: 66 (dont 23 pour l'anneau basal), 44, 57, 48, 44, 57, 52, 66, 57, 80, 97, 88, 110. Les articles I, II, III, V, VII et IX présentent un verticille apical de longues épines; tous possèdent un verticille de longs phanères qui est subapical aux dix premiers et devient proximal aux trois derniers; l'article terminal est pourvu, en outre, d'un verticille distal, situé au-delà d'un étranglement que l'on peut considérer comme la limite d'un très court (28) XIVe article.

AFFINITÉS. L'espèce est proche de *Prokoenenia asiatica* n. sp. Les principales différences sont les suivantes: au basitarse IV, la soie raide est un peu plus courte et surtout plus distale, nettement au-delà de la pseudo-articulation (t/r et t/er = 2,2 et 1,54, au lieu de 2,06 et 1,75); les phanères des tergites sont moins longs et robustes; les sternites IV et V ont 3 + 3 phanères a, au lieu de 4 + 4; une soie ω est présente en VI.

Le tableau II présente quelques caractères discriminants des adultes et des juvéniles *B* et *C* des trois espèces de *Prokoenenia* de la région orientale.

TABLEAU II

	o.l.	d.t.	IV	V	VI	t
P. JAVANICA ♀ (B)	3	7-8 (6)	2	6-7 (3)	5-7 (2)	13-16 (7)
P. ASIATICA ♀ (B, C)	5 (2-4)	6 (6-7)	4	4	3 (2)	11 (10)
P. CELEBICA ♀ (B)	5	9 (6)	3	3	3 *	9

o.l. = organes latéraux; *d.t.* = deuto-tritosternum; IV-VI = poils glandulaires par demi-sternite de l'opisthosome; *t* = total des poils glandulaires par demi-sternite; nombres entre parenthèses = juvéniles *B* ou *C*, s'ils diffèrent de l'adulte; * = soie ω en VI.

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Phylogenetic and taxonomic considerations on the variability of cuticular surface micromorphology within one species, *Aphodius (Nialus) varians* Duftschmid (Insecta: Coleoptera: Scarabaeidae: Aphodiinae)

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Phylogenetic and taxonomic considerations on the variability of cuticular surface micromorphology within one species, *Aphodius (Nialus) varians* Duftschmid (Insecta: Coleoptera: Scarabaeidae: Aphodiinae) – The polygonal microreticulation of the cuticular surface found in most Insecta and "Myriapoda", in some Crustacea and even in the Loricifera is considered the basic cuticular surface pattern for all arthropodal, i.e. chitinous cuticulae for morphogenetic reasons. It is based on the economic close packing pattern of epidermal cells. The reticulation can be modified to an alveolate pattern by buckling the polygon surfaces possibly caused by the non-tensed epidermis during the deposition of the epicuticula. The elytra of different specimens of *Aphodius (Nialus) varians* Duftschmid (Insecta: Coleoptera: Scarabaeidae: Aphodiinae) show the reticulate pattern, the alveolate pattern and many transitional forms. Hence, the surface microsculpture is not constant within one species. Considering morphological and ecological results, the extreme alveolate form, *Aphodius (Nialus) venyigei* Endrődi, is downgraded to a morph of *A. varians*. Additionally, the first record of *Aphodius (Melinopterus) reyi* Reitter for Greece is given.

Key-words: Coleoptera - Scarabaeidae - *Aphodius* - Micromorphology - Taxonomy - Morphogenesis.

INTRODUCTION

"Variation is not merely the spice of life,
it is the very essence of living".
(TURRILL 1952: 391)

In taxonomic literature, cuticular surface structures are often used as species specific characters in Coleoptera and other groups, but detailed descriptions or figures

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of the cuticular micromorphology are usually lacking. Sometimes authors content themselves with attributes like "bright", "opaque" or "with/without microsculpture". Causal and functional aspects of surface patterns are generally neglected by taxonomists. As far as I know, in the pre-SEM time, only SCHULZE (1914, 1915; *Cicindela*, cf. also SCHULZE 1913), ZIMMERMANN (1917; Hydradephaga), NETOLITZKY (1935; general remarks), and BALFOUR-BROWNE (1940; Hydradephaga) carefully considered the microsculpture in Coleoptera from the taxonomist's point of view. Prior to these taxonomic studies NETOLITZKY (1911) had shown the usefulness of the cuticular microsculpture for pharmacognostic purposes, to identify the Spanish Fly. LINDROTH (1974; Carabidae), LARSON (1975; Dytiscidae), KHALAF (1980; various families), WOLFE & ZIMMERMAN (1984; Dytiscidae: Hydroporinae; perhaps following publications of WOLFE), and TAMURA & TAMURA (1986, 1987, 1988; Cerambycidae) carried out taxonomical studies on the cuticular microsculpture by SEM. Likewise MATTA & WOLFE (1981) showed some SEM photographs of the polygonal surface pattern in the species of *Hydroporus (Heterosternuta)* (Dytiscidae) but without giving detailed descriptions. In Thysanoptera, MOUND (1977) analysed the surface reticulation of many Glyptothripini. In the present paper, the variability of cuticular microsculpture within one species is shown. To determine the taxonomic and phylogenetic value of this character, the morphogenesis and the ecological-adaptive relations of the cuticular surface sculpture are reviewed.

MATERIAL, METHODS, AND TERMINOLOGY

Specimens of *Aphodius (Nialus) varians* Duftschmid, *A. (N.) venyigei* Endrődi, and *A. (N.) rugosopunctatus* Petrovitz from different localities were studied. They are deposited in the following collections:

HFBC: Private collection of Dr. Hans Fery, Kornblumenring 107, D-12357 Berlin;
HNHM: Zoological Department, Hungarian Natural History Museum, Baross utca 13, H-1088 Budapest;
ISZP: Polish Academy of Sciences, Institute of Systematics and Evolution of Animals [the former Institute of Systematic and Experimental Zoology], ul. Sławkowska 17, PL-31-016 Kraków;
MNHG: Muséum d'Histoire naturelle, Route de Malagnou 1, CH-1211 Genève 6;
SMNS: Staatliches Museum für Naturkunde Stuttgart, Rosenstein 1, D-70191 Stuttgart.

Specimens were studied and photographed by means of the incident-light microscope Leitz Ortholux 3. Due to the necessity to study primary type-material, it was not possible to use an SEM to ensure comparability. The incident-light or metallurgic microscope is a workable alternative for the study of uncoated specimens. It is an old optical concept but is rarely used in the age of electron microscopy. Recently even a "rediscovery" of the metallurgic microscope for coleopterological purposes was published (SCHNEIDER 1990). The pros and cons of this method are discussed there. The extremely low depth of focus causes some difficulties to the interpretation

of three-dimensional structures. If convex or even tuberculous structures are photographed in oblique view, an irreal spatiality caused by the obliquity of the focus plane can result. The impression of the spaciality of surface structures can become very realistic by focussing during study.

The photographed individuals were collected and are deposited as follows:

No. 1: ♂: Holotype of *A. venyigei* Endrődi. HUNGARIA, Berettyóújfalu, leg. L. Venyige 25.IV.1967; HNHM.

No. 2: ♀: *A. varians* morph *venyigei*. GRAECIA, east of Igumenitsa, in sheep droppings, leg. H. Fery 13.IV.1984; HFBC.

No. 3: ♂: Holotype of *A. rugosopunctatus* Petrovitz. ANATOLIA, Prov. Içel, Namrun, 1200 m, leg. C. Holzschuh 18.-22.V.1969; MHNG (coll. Petrovitz).

No. 4: ♀: *A. varians* morph *rugosopunctatus*. POLONIA, Kraków, Sikornik, leg. Mazur 8.VI.1936, ISZP (coll. Mazur et Mazurowo).

No. 5: ♀: *A. varians*. AUSTRIA, environs of Wien, leg. Baderle; SMNS (coll. Stegmann) [var. fabricii d'Orb.].

No. 6: ♂: *A. varians*. AUSTRIA, Burgenland, Apetlon, leg. Ulbrich 17.V.1974; SMNS (coll. Ulbrich).

No. 7: ♂: *A. varians*. AUSTRIA, Graz, leg. Mosbrugger, MHNG (coll. Petrovitz).

The terminology of the cuticular surface microsculpture was established in taxonomic descriptions. Typological taxonomists traditionally ignore morphogenetic or phylogenetic aspects of these patterns, their interrelations and transitions, and confine themselves to the classification of character states into separate, clearly discernable groups. HARRIS (1979) in his glossary of surface sculpturing works in the same tradition, but he tries to clarify and standardize the terminology, so his glossary is valuable. I adopt some of his terms, but the terms alone are not sufficient as they comprise no causal aspects. Instead, comparative descriptions of the patterns are necessary. HARRIS (l.c.) distinguished between micro- and macrosculpturing by the structures' visibility or invisibility at 100 x magnification. This may be practical but is not a biological criterion. A more heuristic criterion is used by BYERS & HINKS (1973). Those "having relatively large units, each being produced by an epidermal cell" are called "macro types", "those having smaller units, of which a number are produced by each cell" are called "micro types". However some sculpturings such as diffraction gratings can not be assigned clearly to one of these groups. But this does not affect us here. In the following I shall study only macro type sculpturings and the common scratched pattern, called aciculate by HARRIS (l.c.).

A CASE STUDY: *Aphodius (Nialus) varians* **Duftschmid** (INSECTA: COLEOPTERA: SCARABAEIDAE) AND ITS MORPHS

In the palearctic dung beetle species *Aphodius varians* we find morphs with different cuticular surface sculpture. The most extreme forms were described as distinct species (*rugosopunctatus, venyigei*). The elucidation of their ontologic and taxonomic status is the intention of the present investigation.

If we inspect the surface of the elytral intervals of these forms, we always find a reticulate pattern consisting of polygons. The polygons are sometimes convex and distinctly visible (alveolate pattern sensu HARRIS l.c.), sometimes flat and indistinct (reticulate pattern). Apart from these patterns, we find many small superficial scratches showing no preferential directions (aciculate pattern). On the pronotum, the reticular pattern is usually less distinct than in the elytra, but the scratches are very pronounced. In the following we shall study the different states of distinctness of these microsculptures in some individuals of *Aphodius varians* and some of its morphs (or related species ?). Although the taxonomic status of the taxa of the *A. varians*-group will be discussed later, we call them all morphs.

1. DESCRIPTION OF THE CUTICULAR MICROSCULPTURE OF "*Aphodius venyigei* Endrődi" (figs 1-9)

In 1969, ENDRŐDI described *Aphodius venyigei* as a distinct species based on a single male specimen from Hungary. According to ENDRŐDI, it seems to be most closely related to *Aphodius varians*, but: "Die neue Art unterscheidet sich aber von dieser u.a. durch die Skulptur des Kopfes und der Flügeldecken und durch die Form des Kopulationsapparates auf den ersten Blick". The aedoeagus (figs 30-31) which is in fact indistinguishable from that of *A. varians* will be treated below. The head of *A. venyigei* is very distinctly shagreened ("sehr deutlich chagriniert"; alveolate pattern), the elytra are shagreened, similar to the head, and totally flat ("ganz flach, ähnlich chagriniert wie der Kopf"). So, besides the flatness of the elytral intervals, the (micro)sculpture of the head and the elytra are the only two character states which distinguish it from *A. varians* (see below).

Indeed, in a series of *A. varians* s.l., *A. venyigei* is identifiable at first glance by its specific silky lustre, caused by the strong microsculpture of the flat elytral intervals (figs 1, 5). Could this peculiar microsculpture be a species-constitutive character state?

In fact, the polygons of the elytral intervals are most convex in *A. venyigei* (figs 2, 6, 9), and the intervals themselves are the flattest (figs 1, 2, 5), compared to all other morphs of *A. varians*. The scale-like shape of the polygons at the lateral parts of the photographs 1 and 5 is an optical artifact, but shows the three-dimensionality of the surface sculpturing. Around the interval punctures, the (mostly eight) polygons are arranged like the petals of a blossom (fig. 6). Scratches are very rare and short (figs 8, 9). The second interval of the holotype's right elytron shows an irregularity, formed like an impression with radiating folds (fig. 1: IR).

The holotype's (♂) pronotum is smooth with a reticulate sculpturing (fig. 3). Scratches are very rare. However, on the surface of the female's pronotum the polygons are visible only on the margins of the points (fig. 7). The whole surface is covered with scratches. The sculpturing of the epicranium is slightly but distinctly alveolate (fig. 4).

A three-dimensional (alveolate) microsculpture also exists in the hollowed areas of the metasternum.

2. DESCRIPTION OF THE CUTICULAR MICROSCULPTURE OF "*Aphodius rugosopunctatus* Petrovitz" (figs 10-18)

In 1971 PETROVITZ described *Aphodius rugosopunctatus* as a distinct species based on one male specimen from Turkey. According to the original description this taxon differs from *A. varians* by the totally flat elytral intervals, the shagreened surface and a few other character states which are, however, highly variable in *A. varians* s.l. STEBNICKA (1982: 79) mentioned three additional specimens of this form from Poland and synonymized *A. rugosopunctatus* with *A. varians* without having explicitely considered the cuticular microsculpture.

The elytral intervals of the *A. rugosopunctatus* holotype are just as flat as in *A. venyigei* and the microsculpture is also very pronounced (fig. 16). However, their lustre is not silky but normally shiny (figs 10-11). The punctures are more impressed. Therefore the surface is slightly uneven (figs 10-12, 16). In the specimen from Poland, all the intervals exept the sutural interval (SI) are strongly wrinkled and uneven (figs 17-18). The holotype shows more scratches in the intervals than *A. venyigei* (figs 15-16), but they are less distinct than in typical *A. varians* (compare figs 10-12 and 23+26).

The holotype's (♂) relatively smooth pronotum (not figured) shows an indistinctly reticulate pattern and some scratches.

3. DESCRIPTION OF THE CUTICULAR MICROSCULPTURE OF "TYPICAL" *Aphodius varians* Duftschmid (figs 19-29)

Generally the surface of *Aphodius varians* is very shiny. The polygons of the reticulation are clearly visible (figs 19-21), sometimes indistinct (fig. 26), sometimes hardly visible (figs 23-25). In summary, it can be said that there is a wide variability in the surface sculpturing. In specimen no. 5 the elytral surface seems to be very slightly alveolate (fig. 19). In specimen no. 7 the polygons are plane, their edges are sometimes carved like the scratches, especially their cranial and caudal edges (figs. 27-29). Specimen no. 6 shows a completely plane reticulation. The edges of the plane polygons ar very fine (figs 24-25). The intervals of *A. varians* are more or less convex.

One pronotum (♂) is documented (fig. 22). The reticulation is not visible, but the scratches are frequent and extended.

4. COMPARATIVE SUMMARY

Summing up my observations, I postulate that the more convex the elytral intervals are the less visible is the reticulation, the more frequent and extended are the scratches, the more glossy is the cuticula seen with the naked eye. The extreme morphs, *A. venyigei* and the typical *A. varians*, show a clearly distinct appearance like many other closely related species in *Aphodius*, but there are transitional forms, too.

In the specimens investigated, I see no correlation between the surface pattern of the pronotum and the patterns of the other surface regions.

For the taxonomic interpretation of the present observations we have to explain the variability considering their morphogenetic causes and the possible consequences for the organism.

THE CUTICULAR SURFACE MICROSCULPTURE: PHYSIOLOGICAL AND MORPHOGENETIC FUNDAMENTALS

1. The reticulation

The polygonal, mostly hexagonal cuticular microsculpture, first recognized[1] by Meyer (1842), is the most common cuticular surface structure in the Insecta Ectotropha (= Ectognatha) (Hinton 1970, see also Richards 1951: 267). Kölliker (1858: 75) was the first to postulate that the contour of each polygon represents the contour of an underlying epidermis cell. Half a century later Warren (1903) who studied the *Daphnia* integument (Cladocera) corroborated Kölliker's statement. Blaney & Chapman (1969: 513) and Hinton (1970: 41) correlated the number of epidermal nuclei with the number of polygons in the same area of the insect integument. Their results supported Kölliker's hypothesis for insects as well, which was confirmed by detailed histological (Heims 1956: 544) and morphogenetic studies (Locke 1967, Locke 1990). The cuticulin layer of the epicuticle (or the "outer epicuticle" sensu Neville 1975, Hepburn 1985) which forms the surface polygons alone (Locke 1967: 44)[2] is the first layer of a new cuticle to arise on the surface of the epidermal plasma membrane plaques. "The plaques are [...] determinants of cuticular surface patterns. The pattern over the epithelium comes from the surface presented by all plaques and depends upon the shape of each component cell." (Locke 1990: 197, cf. Okada 1982: 99). The plaques' pattern depends on the pattern of the microvilli caused by the structure of the intracellular microfilamental apical web (see Bereiter-Hahn 1987: 23).

But why do the epidermal cells form a polygonal net? The hexagonal net is the most economic pattern for a close-packing of circles in a plane (for a detailed discussion of the geometrical fundamentals and additional references see Meretz 1962, 1963). This close-packing pattern can be extrapolated to the dorsal surface of single-layered insect epidermis which could be considered in simplified terms to be a two-dimensional plane. If we understand the epidermal cells as pneus (sensu Otto 1986: 74f) due to their hydrostatic pressure (Bereiter-Hahn 1986), their ideal close-packing results in six-sided prisms with hexagons at the interface, which is formed by

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[1] in insects; to satisfy priority, it should be mentioned that in Crustacea, Valentin described and figured "sechseitige, dicht bei einander liegende Zellen" on the inner side of the outermost layer of the *Astacus* cuticle as early as 1836.

[2] However, Hass (1917) stated for *Gryllotalpa* (Caelifera): "Ist die Behaarung gering [...], so zeigt auch die Pigmentschicht [i.e. the layer beyond the outer epicuticle] eine bisweilen verzerrte, so doch deutlich erkennbare Felderung [i.e. polygons]".

the apical part of the epidermal cytoskeleton. The proximal plane shows different structures, e.g. dorsal feet, which do not matter here. HONDA (1983: 198) showed by photograph the result of vertical pressure of a plane single-layer of close-packed fat clay spheres: a regular hexagonal net on the upper and lower surfaces. Furthermore, a honeycomb pattern is formed when the boundary length of the cells is minimized by contraction of the microfilament bundles running along lateral boundaries of the epidermal cells (HONDA et al. 1986: 1; cf. DELHANTY & LOCKE 1990: 179).

If the epidermis does not form an ideal plane but a bulging shape, the ideal close packing net contains not only hexagons but also pentagons (see PYSHNOV 1980: 193; TARNAI 1984; OTTO 1986: 85) or other compensation figures as well. The densest spherical circle-packing is still a mathematical problem, known to mathematicians as the TAMMES problem (see e.g. TARNAI 1984 and CLARK & KEPERT 1986). As the insect integument contains very large bulges in relation to the small epidermal cells, i.e. a big radius of the sphere in relation to minute circles to be packed on the sphere, the ideal close packing pattern approximates a regular hexagon net where only a few compensating figures are necessary. During cell division, one hexagon turns into two pentagons at first. According to the model of PYSHNOV (l.c.: 190) "after any division two neighboring cells acquire one more side each, so pentagons become hexagons". Other models (ABBOTT & LINDENMAYER 1981) can explain the predominance of hexagons in many epidermal single-layers as well. As in every living system, however, the geometrical pattern of the arthropod epidermis during epicuticula secretion is not ideal. Mathematical models can only be approximations to explain our observations without the possibility for generalization or general predictability for other cases.

Summing up, the regular, polygonal net is the primary close packing pattern in the insect epidermis (constructional/morphogenetic constraint sensu REIF et al. 1985: 241). However, cytoskeletal and tension influences may modify this network into e.g. a scale like pattern, sometimes with a minute overlapping of the polygons; the polygons can be transversely elongate or form a zig-zag pattern (WOLFE & ZIMMERMAN 1984: 374-377) and so on.

Convexity or other three-dimensional surface sculptures of the polygons can be caused by simple buckling due to different rates of cuticulin secretion in different parts of the epidermal cell surface or by the surface shape of the epidermal cell during the cuticulin deposition (LOCKE 1967: 47), eventually modified by the smoothing and buckling actions of inter- and intracellular vacuoles (WIGGLESWORTH 1973; *Rhodnius*). In *Tenebrio molitor* the surface shape of the epidermal cells is of primary importance for building the cuticulin sculpture (DELACHAMBRE 1970: 393).

Hence, the cuticulin layer is a replica of the outer epidermal surface, showing the cell borders and the microvilli distribution (and their secretory activity!) at the epidermal apical plane. The folded surface of the elytral intervals of the *A. rugosopunctatus* from Poland (figs 17-18) was probably caused by the increased epidermal surface area in the intervals. The alveolate surface sculpture may be caused by the convex apical surface of the cells of the epidermis forming a non-tensed cell

sheet because of the increased surface area. This increase is either founded on mutation or on exogene physiological disturbance during metamorphosis.

To explain the correlations shown in the "Comparative summary" on page 269. I propose the following hypothesis. The epidermis of convex intervals forms a tensed cell sheet with plane apical cell surfaces. When the intervals are flat, their surface area is smaller. If their epidermal surface area is as large as in the case of convex intervals, the epidermis is no longer tensed. Hence, the apical cell surfaces are convex and their cuticular depositions form an alveolate pattern. The extreme case, an enlarged epidermal area in flat intervals is shown in the specimens of the morph *rugosopunctatus* from Poland. The intervals are folded and alveolate.

2. Obscuring the hexagonal net

The cuticulin layer is not the outermost cuticular layer in insects. After ecdysis the outermost layer is mostly the cement layer followed by the wax layer. The former is probably formed during or just after ecdysis, the latter just prior to ecdysis (Neville 1975: 10f; Hepburn 1985: 4f). The wax covers the cuticulin layer with its sculpture, "often obscuring microstructural detail" (Hadley 1984), which was impressively demonstrated[3] in a black widow spider, *Latrodectus hesperus* Chamb. & Ivie (Araneae: Theridiidae), by Hadley (1981) himself. The cement layer can obscure the surface pattern as well. As Malek (1958: 266 and p. 20) points out the cement layer "fills in the depressions at the boundaries of the polygonal areas".

The wax layer is an important factor in controlling water movement through the cuticle and is protected against possible abrasive or impact damage by the cement layer. The thickness of both varies highly within arthropods, even in different parts of the same individual (Hadley 1984, Hepburn 1985). In the mature bloodsucking bug *Rhodnius prolixus* Stål (Heteroptera: Reduviidae), the wax layer is repaired after abrasion, the cement layer not (Wigglesworth 1975). Consequently, lipid secretion forming the wax layer is feasible after ecdysis. Maybe it continues throughout the whole adult life, as supposed for *Schistocerca gregaria* (Forskål) (Caelifera: Acridoidea) by Malek (1958: 567) and for *Periplaneta americana* (L.) (Blattaria: Blattidae) by Kramer & Wigglesworth (1950, "presumably").

It is not known if in *Aphodius* the thickness of the wax layer and therefore the degree of obscuring reticulation is constant or changes during imaginal life. But the whole surface variability cannot be explained by simple variation of wax thickness because of the different degrees of convexity of the polygons.

In the studied specimens of the lamellicorn subfamilies Aphodiinae and Dynastinae, I frequently found many short and sharp cut-like fissures with upturned, ridge-like edges (figs 16, 24; fig. 78 in Krell 1992: 346; aciculate pattern sensu Harris l.c.). It is not known how deep these fissures are. If they are only formed by the cement- and the wax-layer, they might be the results of contractions during the

[3] provided that the wax layers in spiders and insects are homologous.

solidification of the wax secretions. If they go deeper, then they could be the results of abrasions as shown by WIGGLESWORTH (1944). However, scratches caused by careless surface cleaning with a forceps (fig. 11) appear more like furrows than cuts. The first possibility is more likely because in a smooth reticulate pattern where the wax layer is distributed evenly over the whole surface, the scratches are more frequent than on the alveolate surface where the wax may be distributed mainly at the lower-lying borders of the polygons.

PHYLOGENETIC AND TAXONOMIC VALUE OF THE CUTICULAR SURFACE PATTERN

1. HISTORICAL-PHYLOGENETIC ASPECTS

The polygonal macro-type sculpturing (sensu BYERS & HINKS 1973) is interpreted as plesiomorphic for insects by HINTON 1970 ("a fundamental or primitive pattern"). This is undoubtedly true because a polygonal surface pattern is also found in the Chilopoda and in the Progoneata, the presumable adelphotaxon of the Insecta (FUHRMANN 1922: 6-7[4]; EISENBEIS & WICHARD 1985: 128-155). Beyond that, equivalent structures are described in some Crustacea Decapoda, the "cuticular prisms" described e.g. by DENNEL (1947: 494-497), in the Ostracoda (OKADA 1981, 1982), furthermore in "nearly all terrestrial isopods"[5] (SCHMALFUSS 1978), in the Amphipoda Gammaridea (SAUDRAY 1972), and in the Cladocera (CLAUS 1876: 364, pl. 25; WARREN 1903; see also FREY 1987: pl. 5, fig. 64).

The polygonal surface pattern is the result of the cuticle deposition mechanism which works in the same way in all Arthropoda classes (GNATZY & ROMER 1984: 646; cf. OKADA 1982, LOCKE 1990) (and also in the Pentastomida (RILEY & BANAJA 1975)). Even in the Loricifera, whatever they are, the same surface pattern exists (KRISTENSEN 1983: 173f). "The honeycomb structure of the lorica, seen in both adults and larvae [...], is only a surface structure involving the outermost layer of the epicuticle [...]; the structure never involves deeper cuticular layers." (KRISTENSEN 1991a: 364). This could be an indication for the homology of the arthropod cuticle and the chitinous loriciferan cuticle (cf. KRISTENSEN 1991b: 244f). If it is only an analogy, it may be an indication for a constructional/morphogenetic constraint (sensu REIF et al. 1985: 241) of formation of a chitinous cuticle by an epidermal cell layer. The cuticle of Nematomorpha showing polygonal reticulation as well is a non-chitinous, completely different structure (BRESCIANI 1991).

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[4] "Wie bei allen Chilopoden ist - im Gegensatz zu den Diplopoden - die kutikulare Oberfläche der Antenne in unregelmäßige hexagonale Felder eingeteilt, deren jedes einer darunterliegenden Epidermiszelle entpricht, wie man besonders auf Tangentialschnitten feststellen kann." (p. 7). EISENBEIS & WICHARD (1984): 144-155) however, show the polygonal surface sculpture in Diplopoda as well. ATTEMS (1926: 49) denies (without giving reasons) any correlation between cell contours and polygons within the Diplopoda.

[5] if we are right in the interpretation that the "scales" are derivates of the primary polygons or are induced by the constructional constraint of cuticular polygons, respectively.

The polygonal surface pattern as a plesiomorphic character state has no phylogenetical value to constitute monophyla within the Arthropoda. Maybe it can help to clarify the relationships of the Arthropoda.

The shaping, the modification, or the absence of a polygonal surface pattern is more interesting for taxonomic and phylogenetic analyses within lower categories. As shown above, however, the reticulate and the alveolate pattern are not distinct forms. They merge into one another.

2. Ecological-adaptive aspects

Netolitzky (1935) claimed that the microsculpture is a constant character of a taxon of the species-group: "Die Untersuchung dieser Mikroskulptur hat nun ergeben, daß sie für die einzelnen Arten und sogar für Rassen [sic!] konstant ist. Damit gewinnen wir ein neues und sehr wertvolles, wenn natürlich auch kein absolut zuverlässiges Merkmal (...).". Sometimes there is constant sexual dimorphism in the microsculpture, as in *Bembidion glaciale* (Carabidae): "die Weibchen besitzen sehr deutliche Netzmaschen auf den Flügeldecken, während die Männchen hier spiegelglatt sind.". Larson (1975: 264), however, noticed that in the water beetle genus *Hygrotus* (Dytiscidae) "females of certain species vary greatly in sculpture, punctation and colour. Certain species include two forms of females, with some resembling the male in sculpture while others having the entire body covered with fine dense microsculpture." If the taxonomic interpretation of these females is correct, this is a case of dimorphism in the surface sculpturing. In *Hygrotus impressopunctatus* (Schaller) transitional forms between the two morphs exist: "some females similar to males [without microsculpture on elytra], or with microsculpture restricted to apical one third of elytron; many females with dense microsculpture over entire disc of elytron" (Larson l.c.: 276). Mound (1977) stated an intraspecific phylogenetic oscillation of character states of the surface "reticulation" in leaf litter Thysanoptera. In the studied specimens of *Aphodius varians*, the cuticular microsculpture shows a wide non-clinal variability within one species. It is not always a constant species-specific character. Hence, its autecological significance may be very low.

Moreover it is not known if the thickness of the wax layer has any considerable effect on transpiration through the cuticle. "Attempts to correlate thickness of cuticular wax deposits and transpiration (...) have generally been unsuccessful (...)." (Hadley 1977).

THE TAXONOMICAL CONSEQUENCES: ON THE ONTOLOGY OF *Aphodius venyigei* Endrődi

1. Chorological and ecological aspects

Until now only two records of *Aphodius (Nialus) venyigei* Endrődi, 1969, have been published:

Hungaria, Berettyóújfalu [locus typicus] (47°14'N, 21°32'E; UTM ET43; under cattle pad, 1 ♂ leg. Venyige 25.IV.1967) (Endrődi 1969).

HUNGARIA, Nógrádverőce [nowadays: Verőcemaros], at the foot of the Börzsöni Mountains (UTM CT59), collector, number and sex of specimens not stated. From the same locality many records of *A. varians* are documented (ENDRŐDI 1979: 29).

ENDRŐDI (1979: 29) considered the species to be endemic in Hungary ("csak Magyarországon?").

Dr. H. Fery, Berlin, discovered, syntopic with a great number[6] of "typical" *Aphodius varians*, two ♀♀ which show the characteristic silky lustre caused by flat intervals and alveolate microsculpture (see p. 268):

GRAECIA, east of Igumenitsa, in sheep droppings, 2 ♀♀ 13.IV.1984. (1 in HFBC; 1 in coll. Baraud, Toulouse, not seen).

Accompanying fauna: *Aphodius (Colobopterus) erraticus* (L.) [12 specimens], *A. (Acrossus) luridus* (F.) [12 spm.], *A. (Melinopterus) prodromus* (Brahm) [ca. 100 spm.], *A. (M.) reyi* Reitter [23 spm.][7], *A. (M.) stolzi* Reitter [14 spm.], *A. (M.) pubescens* Sturm [1 spm.], *A. (M.) consputus* Creutzer [2 spm.], *A. (Phalacronothus) paracoenosus* Balthasar & Hrubant [49 spm.], *A. (Ph.) quadrimaculatus* ab. *quadrisignatus* Brullé [17 spm.], A. *(Eudolus) quadriguttatus* (Herbst) [8 spm.]; *Caccobius schreberi* (L.) [4 spm.]; *Euonthophagus amyntas* f. *alces* (F.) [6 spm.]; *Onthophagus* (s.str.) *taurus* (Schreber) [1 spm.], *O. (Palaeonthophagus) lemur* (F.) [1 spm.], *O. (P.) fissicornis* (Steven) [19 spm.], *O. (P.) lucidus* (Sturm) [3 spm.], *O. (P.) sericatus* Reitter [50 spm.], *O. (P.) verticicornis* (Laicharting) [4 spm.], *O. (P.) ruficapillus* Brullé [19 spm.]; *Euoniticellus fulvus* (Goeze) [3 spm.]; *Copris hispanus* (L.) [2 spm.]; *Typhaeus lateridens* (Guérin) [1 spm.] (Fery det., teste Fery in litt. 10.IX.1990).

The syntopy with the "typical" *A. varians* indicates at least overlapping autecological requirements. However, syntopy allows no conclusions on the ontology of *A. venyigei*. It can indicate the existence of distinct morphs in one population or a character displacement of two sibling species in the same biotope.

Chorological and synecological data show no significant differences between *A. varians* and *A. venyigei*.

2. MORPHOLOGICAL ASPECTS

Aphodius varians is higly variable in colouration and surface microsculpture. As shown on pages 268-270 the degree of convexity of the elytral intervals is variable in *A. varians*, but on an average it is distinctly higher than in the two specimens of *A. venyigei*. The holotype of *A. rugosopunctatus* shows similar plane intervals.

ENDRŐDI's (1969) aedoeagus figure of *A. venyigei* seems to have been drawn from the dried object. In soaked condition (figs 30, 31), it shows no character which is outside the variability of the *A. varians*-aedoeagus. The epipharynx of *A. venyigei* lies in the range of variability of *A. varians* as well. It almost coincides with the figure in DELLACASA (1983: 293), but the epipharynx of the *A. venyigei* holotype shows seven short, thick bristles with cup-like base in the anterior region of the haptomerum (terminology after DELLACASA 1978). Three of them are mediadly displaced. Another

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[6] 48 specimens preserved in HFBC.

[7] The distribution map of RESSL (1983: 107) shows no records between Turkey and Italy. I do not know any other records of this species from Greece, so *Aphodius reyi* Rttr. is new to Greece.

one of these bristles is situated among the finer bristles of the chaetopedium. The epipharynx of the *A. venyigei* ♀ bears only two thick bristes at the left margin of the anterior region of the haptomerum and a caudomediad row of three thick bristles among the fine ones of the chaetopedium. These patterns are within the variability of *A. varians*. The number of the thick bristles of haptomerum and median part of the chaetopedium is highly variable and generally shows no bilateral symmetry. The author is not able to verify DELLACASA's figure which shows no thick haptomerum bristles.

The lock and key hypothesis as mechanical isolation mechanism between species has been sufficiently refuted (cf. EBERHARD 1985). Moreover it is commonplace that the genitalia of different species need not be perceptibly different. So the aedoeagus gives us no indication for the ontology of *A. venyigei*. The other morphological differences are extreme states of a continuous variability. If the silky lustre of *A. venyigei* has any biological effects on this morph apart from being recognized by taxonomists cannot be settled at the moment. There are no reasons to diagnose *A venyigei* as a biological species.

3. THE TAXONOMICAL STATUS OF ***Aphodius (Nialus) venyigei*** Endrődi, 1969

Except for the distinguishable appearance of the extreme varieties there is no reason to consider *A. venyigei* a distinct species. Therefore I downgrade *Aphodius venyigei* Endrődi, 1969, to the infrasubspecific status of a morph:

Aphodius (Nialus) varians Duftschmid, 1805, morph **venyigei** Endrődi, 1969

This is in fact a synonymization, but to obtain further information on *A. venyigei* in future, I sustain this name in the infrasubspecific category of a morph. Furthermore this name keeps species rank in the author's revision of Middle European Lamellicornia (KRELL & FREY 1992: 234) as most taxonomists do not take the infrasubspecific categories seriously.

For the same reason it may be opportune not to treat *Aphodius rugosopunctatus* Petrovitz as a simple junior synonym of *A. varians*, but to grant it infrasubspecific status of a morph instead. Before this (unprotected) nomenclatural-taxonomical act can be carried out, the types of the other morphs of this species (*punctatellus* Mulsant, 1842; *punctulatus* Mulsant & Rey, 1869) have to be studied if they still exist. DELLACASA (1988: 387) considered *A. rugosopunctatus* to be identical with the morph *punctulatus*, the latter having priority. In the present paper I am satisfied with the nomenclatural sloppiness to write about the "morph *rugosopunctatus*".

OUTLOOK

By means of light microscope techniques, we cannot find significant diagnostic differences between *A. varians* and *A. venyigei*. However, these two forms are easily distinguishable with the naked eye because of the typical silky lustre of the latter. This silky lustre may indicate any micro-type surface sculpturing (sensu BYERS

& HINKS 1973). These structures are not visible by light microscopy but may have an eminent influence on the mode of light reflection. If more material of extreme forms of *A. varians*, especially of *A. venyigei* becomes available, SEM studies will be the only way to obtain further results. Another elucidating experiment would be the removal of the wax layer with solvents.

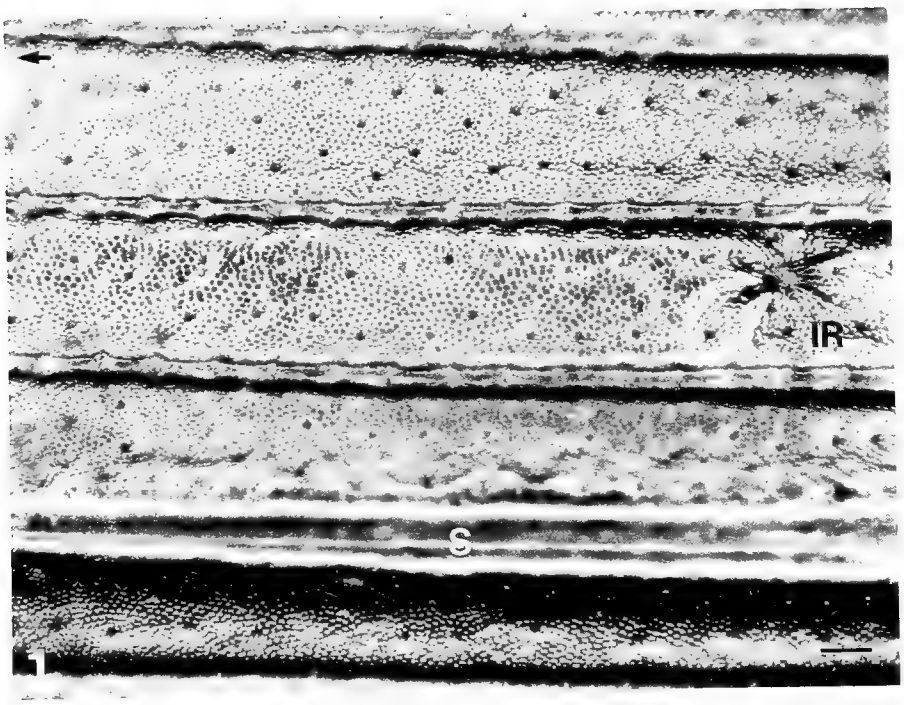
Taxonomists should investigate the intraspecific variability of surface microsculpture to evaluate the taxonomic weight of this frequently superficially used character within their groups. Bearing in mind that a polygonal surface pattern is basic, likely in most cases plesiomorphic, an analysis of this character might result in taxonomic reinterpretations.

ACKNOWLEDGMENTS

I would like to thank Dr. O. Merkl, Zoological Department of the Hungarian Natural History Museum, Budapest, for the loan of the holotype of *Aphodius venyigei* Endr. and for informations about the type locality. Dr. H. Fery, Berlin, sent me one female of the *venyigei*-habitus for study and gave exact collection data. Dr. C. Besuchet, Muséum d'Histoire Naturelle Genève, loaned specimens from the Petrovitz collection. Dr. Z. Stebnicka, Kraków, sent me a few aberrant specimens of *Aphodius varians* and read the manuscript. Dr. W. Schawaller, Staatliches Museum für Naturkunde Stuttgart, was always very indulgent to an inexorable petitioner. Prof. Dr. Habermalz and Mr. Neugebauer, Institut für Wissenschaftliche Mikroskopie der Universität Tübingen, allowed and helped me to work with their Leitz Ortholux 3 incident-light microscope. All photographic laboratory work was carried out excellently by Mrs. M. Hohloch, Zoologisches Institut der Universität Tübingen. The whole manuscript was constructively criticized by Dr. habil. M. Schmitt, Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn.

ZUSAMMENFASSUNG

Bei den meisten Insecta und "Myriapoda", bei einigen Crustacea und sogar bei den Loricifera finden wir eine retikuläre Mikroskulptur der Cuticula-Oberfläche. Aufgrund morphogenetischer Überlegungen betrachte ich dieses Muster als ursprünglich für alle Arthropoden- bzw. chitinigen Cuticulae. Das retikuläre Muster gründet auf der ökonomischen, dichtesten Packung der Epidermiszellen. Die Retikulation kann in ein alveoläres Muster modifiziert werden durch Aufwölbung der Polygonoberflächen, hervorgerufen durch eine nicht gespannte Epidermis während der Sezernierung der Epicuticula. Bei den Elytren verschiedener Individuen von *Aphodius (Nialus) varians* Duftschmid (Insecta: Coleoptera: Scarabaeidae: Aphodiinae) finden wir retikuläre und alveoläre Muster neben vielen Übergansformen. Die Mikroskulptur der Oberfläche der Cuticula ist demnach intraspecifisch nicht konstant. Unter Berücksichtigung morphologischer und ökologischer Befunde wird die Form mit extrem alveolären Muster, *Aphodius (Nialus) venyigei* Endrődi, zur Morphe von *A. varians* degradiert. *Aphodius (Melinopterus) reyi* Reitter wird erstmals in Griechenland nachgewiesen.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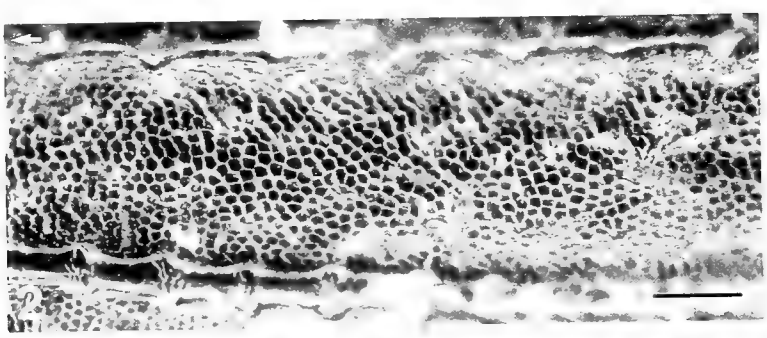
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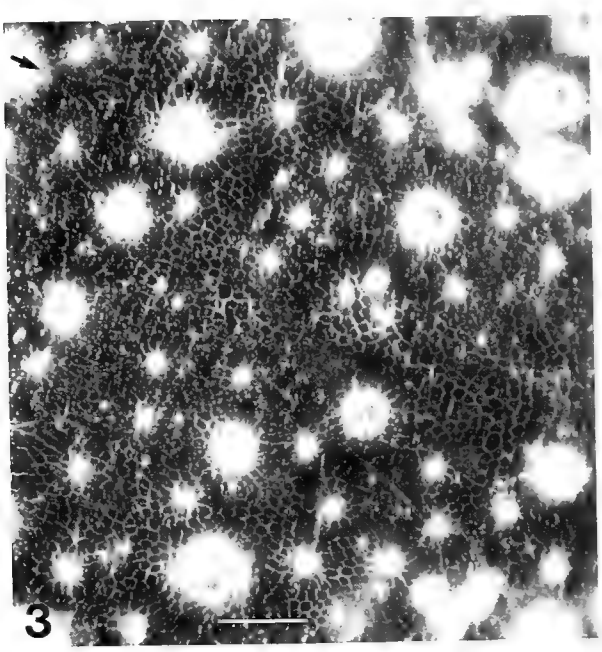
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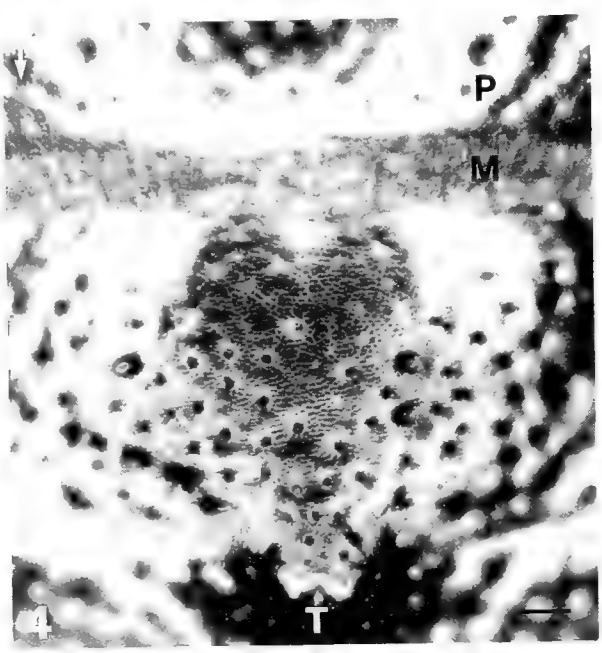
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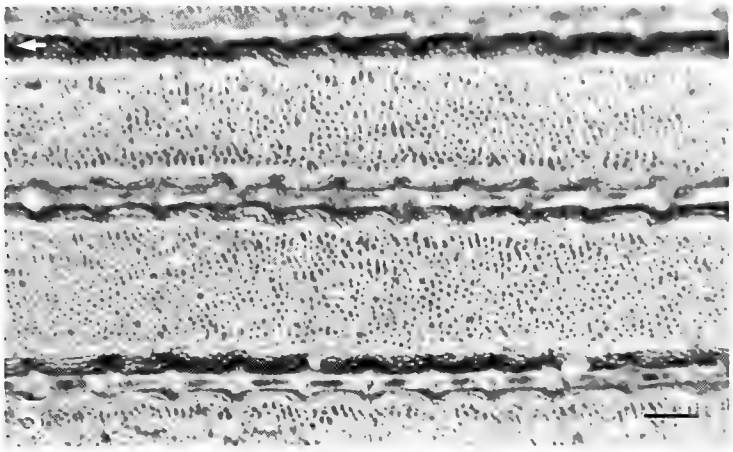

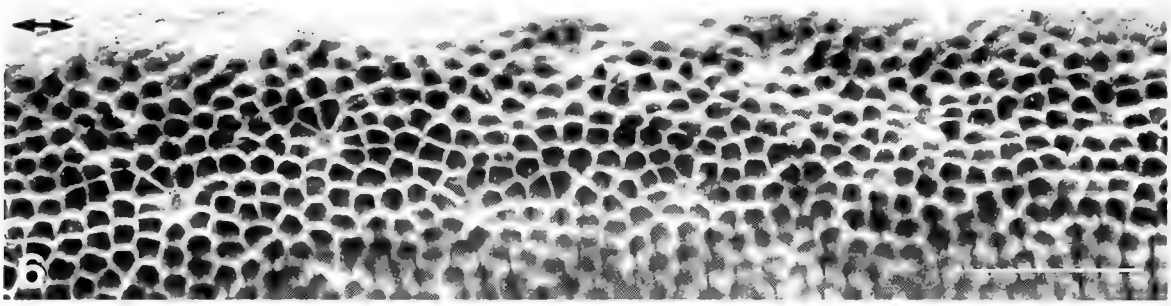
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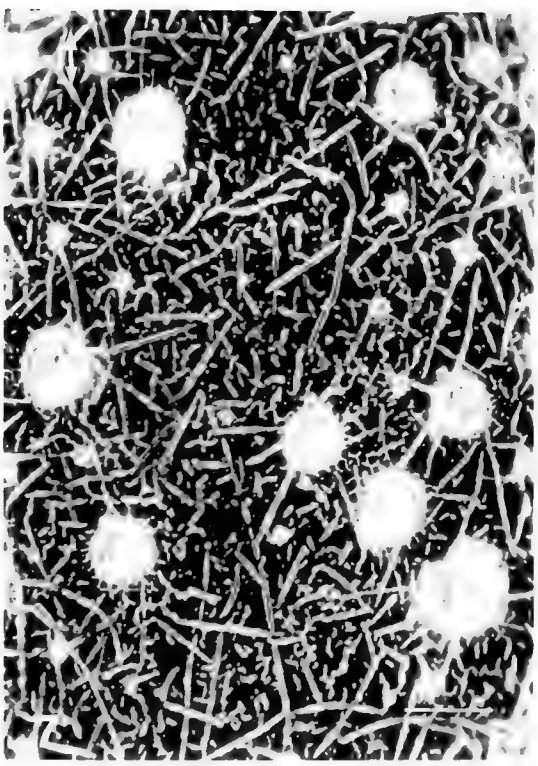

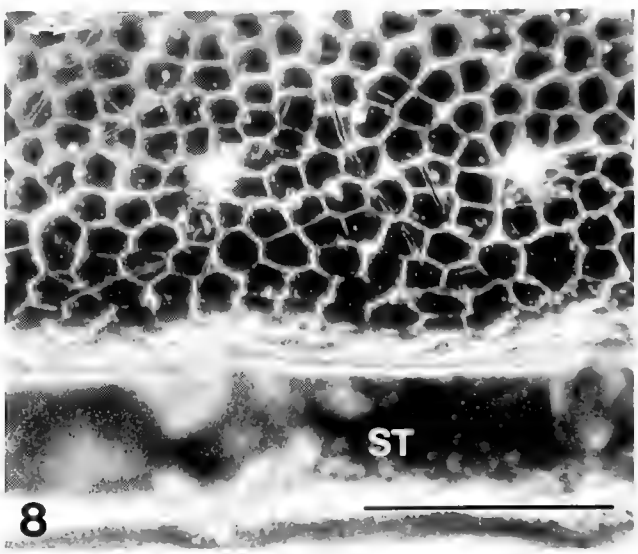
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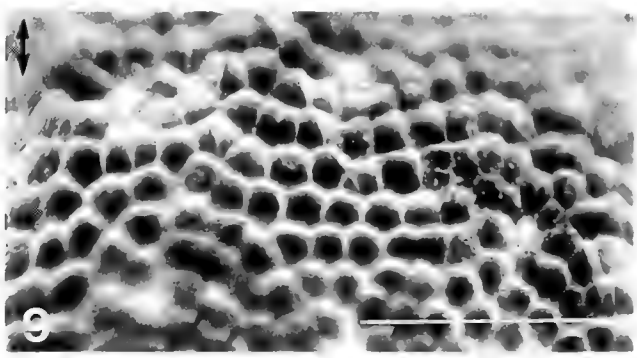
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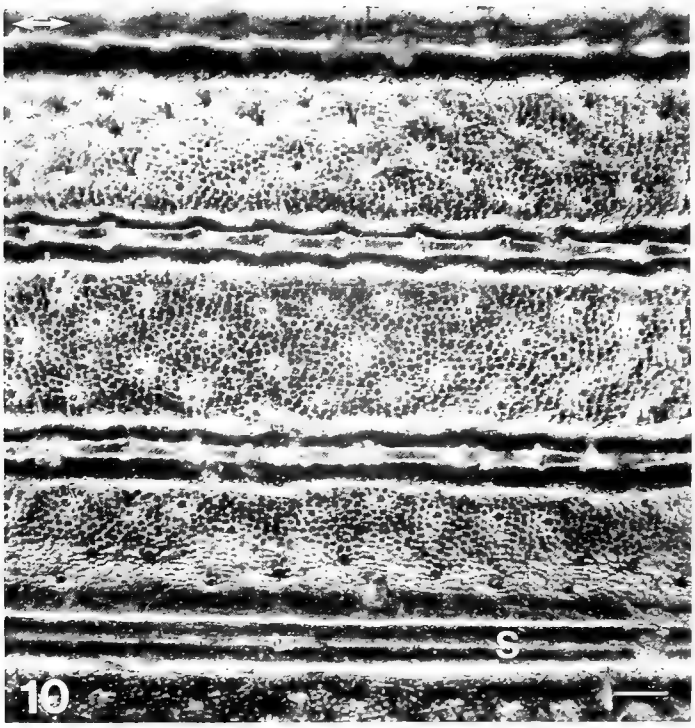
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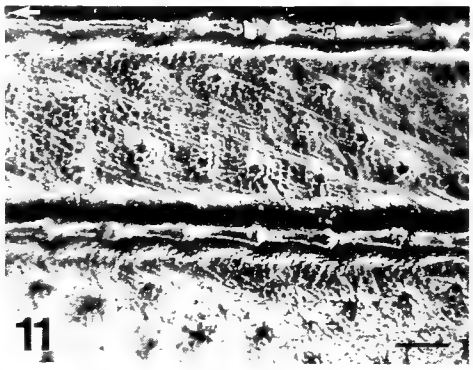
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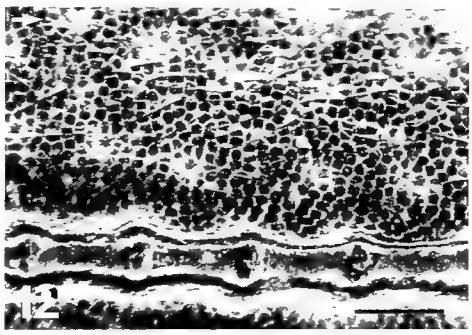
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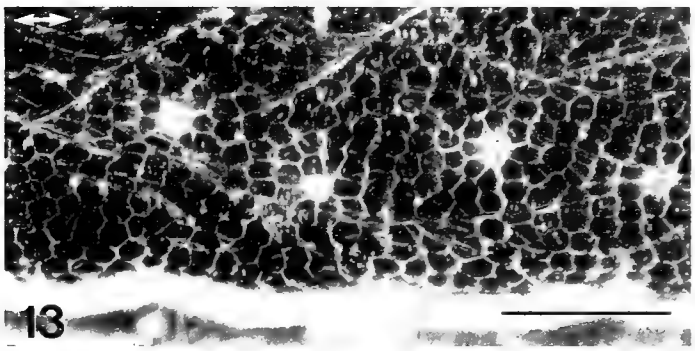
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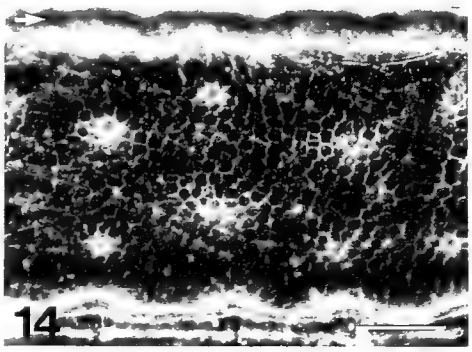
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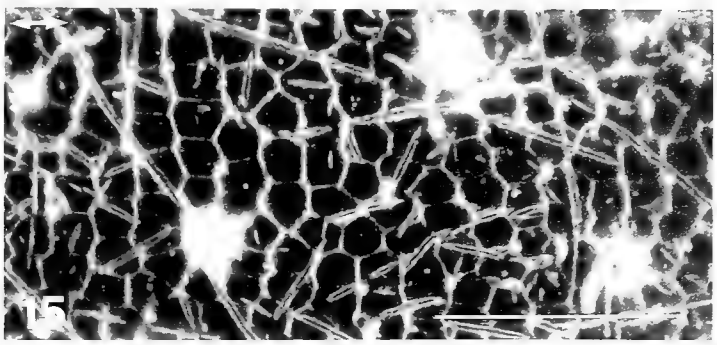
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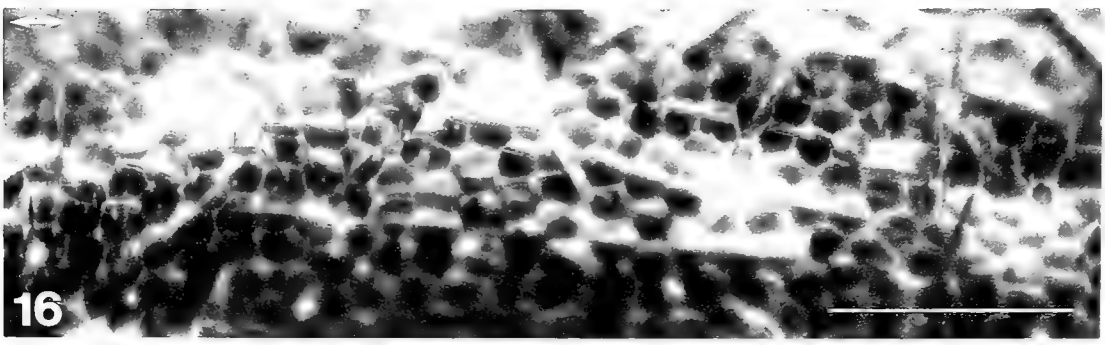
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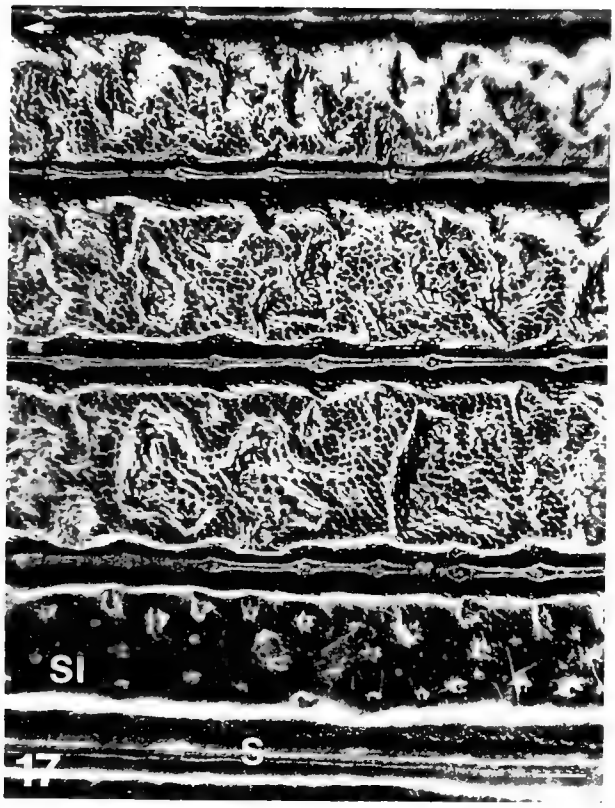
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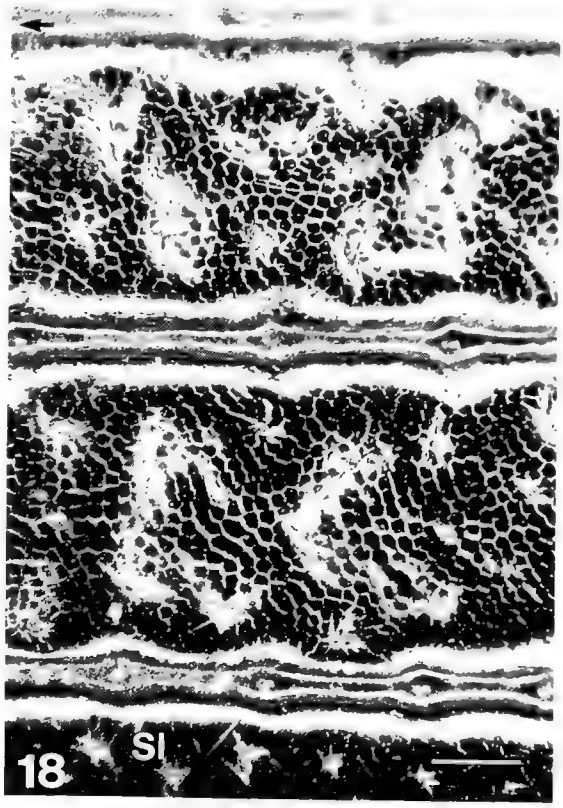
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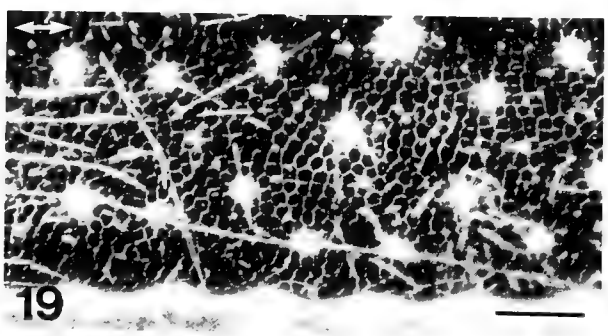
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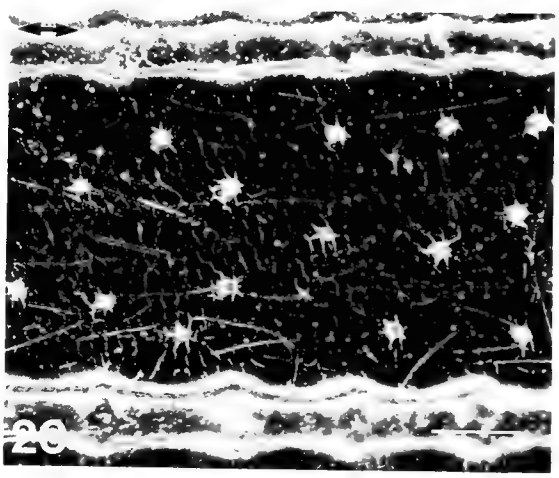
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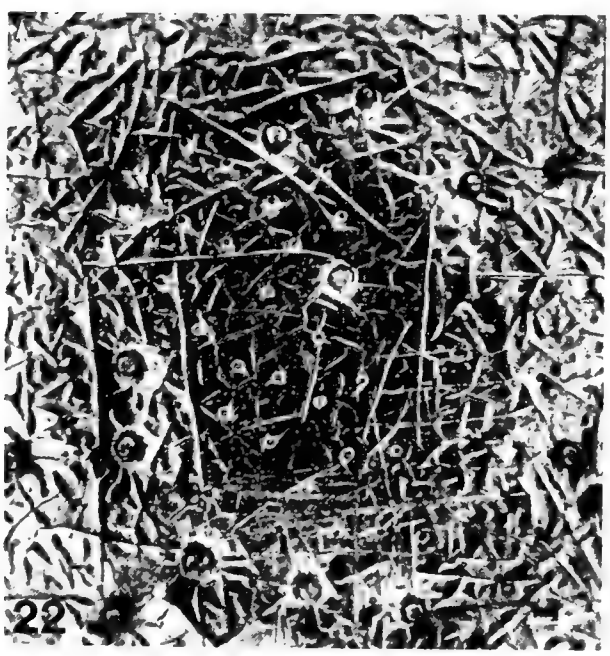
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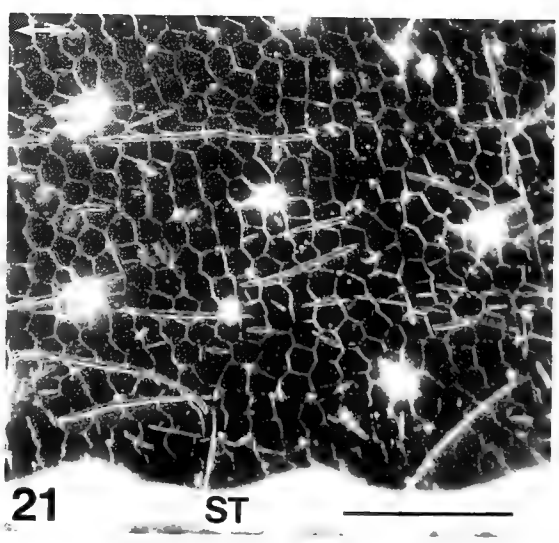
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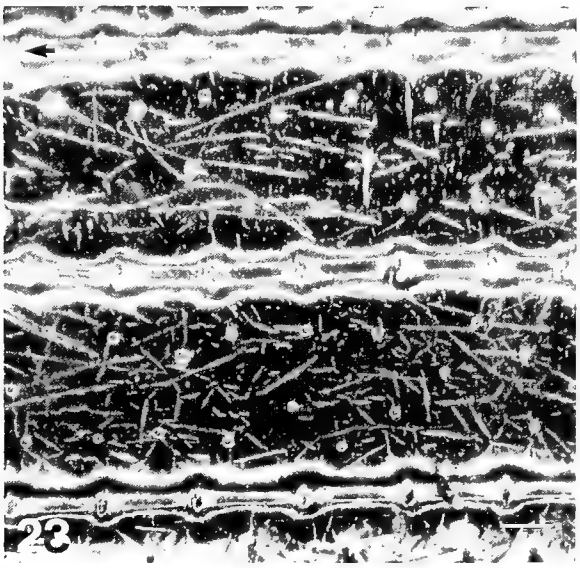
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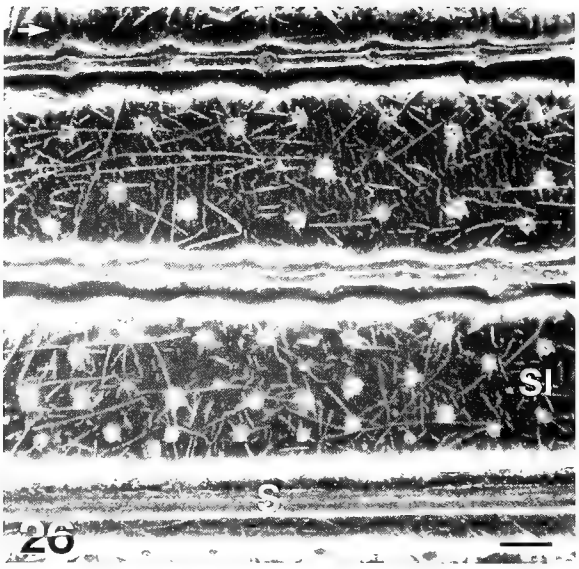
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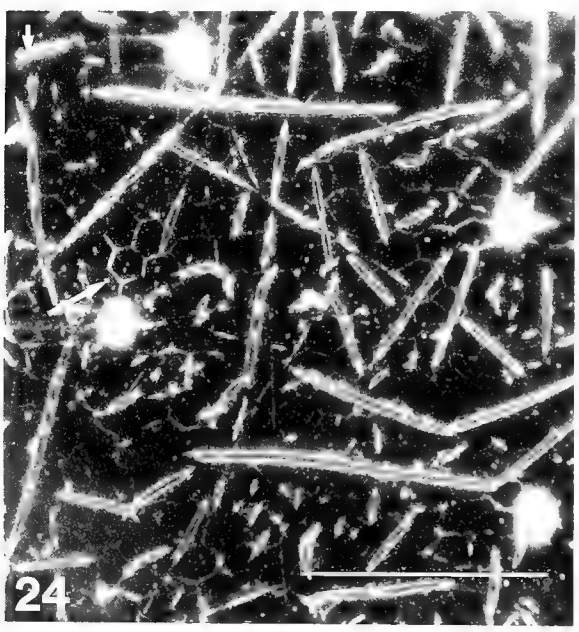
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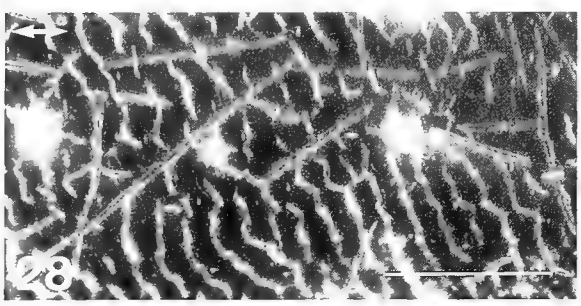
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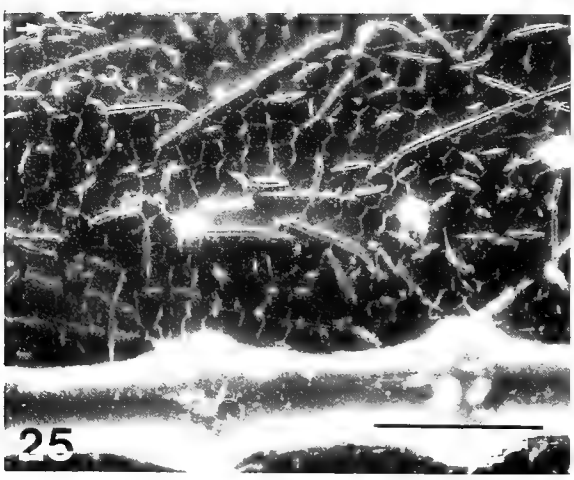
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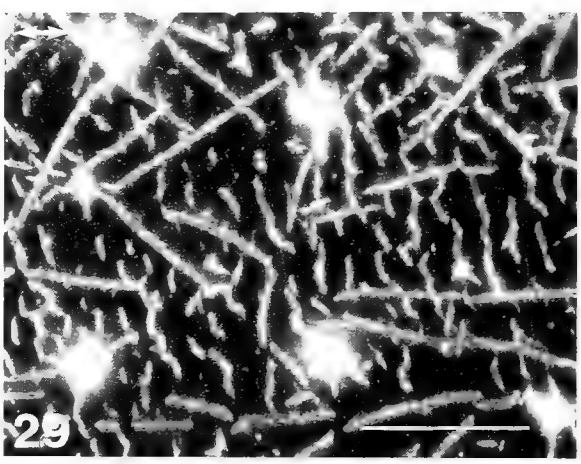
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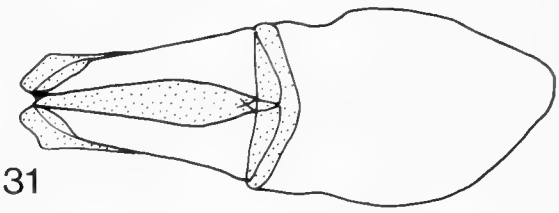

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FIGURES:

FIGS 1-4: *Aphodius varians* morph *venyigei* Endrődi, Holotype, ♂, No. 1. - 1: right elytron and sutural interval of the left elytron; S: elytral suture; IR: irregularity. - 2: right elytron, second interval near the scutellum. - 3: pronotum, discal, double punctate. - 4: caudodorsal part of the caput; T: epicranial tubercle; P: pronotum; M: transparent, craniomarginal zone of the pronotum. - By accident, some topographical data of the photographs were lost. Therefore, the topographical precision is not consistent in all photographs. However, this does not impair their meaningfulness and significance for the present study because the integumental antero-posterior polarity (CALS 1973) is not studied and is not significant in the present case. The orientation of the photographs conforms to the perspective, not to correspondence. The cranial-caudal direction is indicated by double arrows placed in the left upper corner of each photograph. If the cranial direction can be determined, the arrow points craniad only. The scale, placed in the right lower edge, is always 50 µm.

FIGS 5-9: *Aphodius varians* morph *venyigei* Endrődi, ♀, No. 2. - 5: right elytron, cranial third, second to fifth interval. - 6: elytron, non-sutural interval. - 7: pronotum, discal. - 8-9: left elytron, second interval; ST: stria. - Scale = 50 µm.

Figs 10-16: *Aphodius varians* morph *rugosopunctatus* Petrovitz, holotype, No. 3. - 10: left elytron; S: elytral suture. - 11: left elytron with mechanically induced scratches (by forceps), second and third interval, just behind scutellum. - 12: left elytron, anterior half, second or third interval. 13: left elytron. - 14: left elytron, second interval, just behind scutellum, anterior to fig. 11. - 15-16: left elytron, median part. - Scale = 50 µm.

Figs 17-18: *Aphodius varians* Duftschmid, ♀, No. 4. - 17: right elytron, first (sutural) to fourth interval; S: elytral suture; SI: sutural interval. - 18: right elytron, first to third interval; SI: sutural interval. - 19-21: *Aphodius varians* Duftschmid, ♀, No. 5. - 19: second elytral interval. - 20: right elytron. - 21: right elytron; ST: stria. - 22: *Aphodius varians* Duftschmid, ♂, No. 6, pronotum, central-discal. - Scale = 50 µm.

Figs 23-25: *Aphodius varians* Duftschmid, ♂, No. 6. - 23: left elytron, second to fourth interval, just behind scutellum. - 24: left elytron, third interval, in the middle of the elytron (arrow: polygons). - 25: left elytron, third interval, at the end of the cranial third. - 26-29: *Aphodius varians* Duftschmid, ♂, No. 7. - 26: left elytron, first and second interval; S: elytral suture; SI: sutural interval. - 27: left elytron, high reflecting illumination; ST: stria. - 28: right elytron. - 29: elytron. - Scale = 50 µm.

Fig. 30-31: Aedoeagus of *Aphodius varians* morph *venyigei* Endrődi, holotype. - 30: lateral view. - 31: dorsal view.

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SOCIÉTÉ SUISSE DE ZOOLOGIE
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REVUE SUISSE DE ZOOLOGIE, 101 (2) : 289-297; juin 1994

The systematic position of Colilodionini with description of a new species (Coleoptera, Pselaphidae)

Ivan LÖBL
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Case postale 6434, 1211 Genève 6, Switzerland.

The systematic position of Colilodionini with a description of a new species (Coleoptera, Pselaphidae). - *Colilodion wuesti* sp.n. from West Malaysia is described and a key to species of *Colilodion* is given. The morphological characters of the group are discussed. No convincing synapomorphy is found to link Colilodionini with the Clavigerinae. But, in absence of new evidence, the group is kept in that subfamily.

Key-words: Coleoptera - Pselaphidae - *Colilodion* - taxonomy - Malaysia.

INTRODUCTION

Myrmecophily is wide-spread among Coleoptera and has, in some groups, led to remarkable modifications in the external morphology. Adaptive characters often obscure phylogenetic relationships. This is nicely illustrated by the Oriental pselaphid genus *Colilodion* which comprises four species, each known from a single specimen. Based on a comparative morphological analysis, BESUCHET (1991) concluded that *Colilodion*, is to be placed in the Clavigerinae and established for it the new tribe Colilodionini, even though this group shares some characters with the Pselaphinae.

Colilodion exhibits several unusual morphological characters. The most striking features are the head with narrow, dorsally expanded vertex (Figs 1 to 3), the presence of gular and prosternal keels, and the trichomes found on the head and prothorax (Figs 1, 2, 4), in addition to those on elytra and/or abdomen.

On a recent trip with F. Calame (Geneva) to West Malaysia I collected another specimen of *Colilodion* from a sample of forest litter, extracted by Winkler-Moczarski devices (LÖBL, 1992). The specimen, representing a new species which is described below, encourages me to supplement the generic description of BESUCHET (1991) and reanalyse the phylogenetic relationships of this group.

Manuscript accepted 13.10.1993.

Colilodion wuesti sp.n.

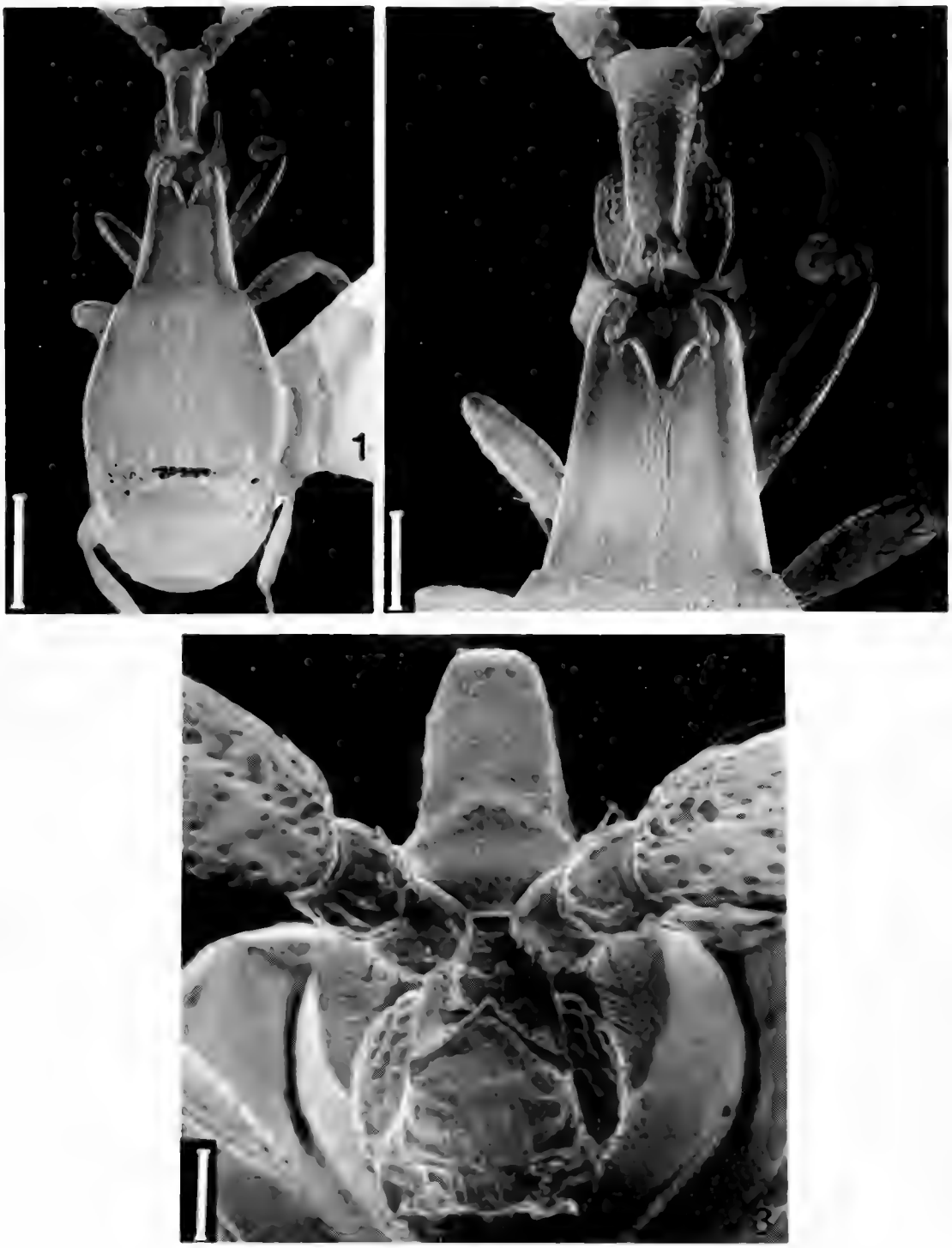
Length 2.27 mm. Body red-brown. Head 0.47 mm long (including trichomes), 0.27 mm wide, 0.60 mm high. Vertex long, strongly raised dorsally, with dorsal surface gradually narrowed apically, dorsal margin convex in lateral view, situated well above level of pronotum; posterior margin vertical, truncate, almost in level with apical pronotal margin, bearing two compact, short trichomes oriented posteriorly and curved ventrally at tip. Lateral surface of vertex vertical. Postero-lateral margin of vertex bearing a long flat trichome oriented laterally and followed ventrally by a very short trichome. Lower posterior portion of vertex strongly narrowed, keel-like. Temporal area concave beyond eye. Eye as in other species. Genal keel absent. Fronto-clypeal disc oblique, flat, raised dorsally, with upper margin triangular (Fig. 3). Frontal notch margined laterally. Punctation extremely fine, pubescence very short, decumbent. Gular grooves deep, diverging anteriorly. Gular process 0.11 mm high, thickened in middle, with sharp margins, ventral margin almost horizontal, anterior margin vertical in lateral view. Occipital constriction impunctate, shiny, with a small lateral protuberance at each side; at narrowest point 0.05 mm wide in dorsal view and 0.19 mm high.

A n t e n n a e with segment 2 cylindrical, somewhat larger than scape, wider than long. Segment 3 large, 0.82 mm long, 0.20 mm wide, subparallel, flattened dorsally, slightly thickened apically, with apical sensilla bearing a bifid flattened seta (Fig. 5).

P r o n o t u m 0.55 mm long, 0.46 mm wide, gradually narrowed apically. Median groove evenly narrow, sharply delimited, extending almost to basal pronotal margin. Apical notch deep, trilobed, with median lobe larger than lateral lobes, striate medially. Dorsum margined laterally, extremely finely punctured and with very short pubescence. Lateral pronotal surface shining. Latero-basal lobe distinct. Apico-lateral pronotal margin oblique; upper half of latter bearing a conspicuous flat trichome oriented obliquely upward and forming a point. Center of dorso-apical margin bearing two short trichomes oriented anterad. Lower half of latero-anterior pronotal margin bearing a very short trichome.

E l y t r a 0.66 mm long at suture, combined elytral width 0.83 mm. Basal half of elytral disc almost flat, barely alutaceous, apical 2/5 of disc strongly inclined. Lateral margin finely keeled between base and mid-third of lateral length, rounded beyond. Discal striae straight, not extended over inclined apical portion of disc (Fig. 6). Inner stria parallel to suture. Pair of central striae slightly divergent apically. Outer apical angle of elytron extended, bearing a large trichome oriented medio-apically. Punctation obsolete on inner portion of disc, distinct although very fine on outer portion, consisting of punctures which are much smaller than intervals. Pubescence much longer than that of pronotum, on inner portion of disc longer than on outer portion, semi-erect and arranged in rows with setae alternatively oriented obliquely in and outwardly. Pubescence on inclined apical portion particularly long.

P r o s t e r n u m with small oblique process pointed at tip, arising from anterior margin, and large vertical process raising from posterior margin. Median area bearing a



FIGS. 1-3

Colilodion wuesti sp.n., habitus, scale bar = 500 µm (1), head and pronotum, scale bar = 200 µm (2), head frontal, scale bar = 100 µm (3). Uncoated.

large trichome. Anterior mesosternal margin strongly raised, pointed in centre. Mesocoxal process covered by a trichome. Metasternum extremely finely punctate, with decumbent, very short pubescence. Anterior metasternal margin moderately raised.

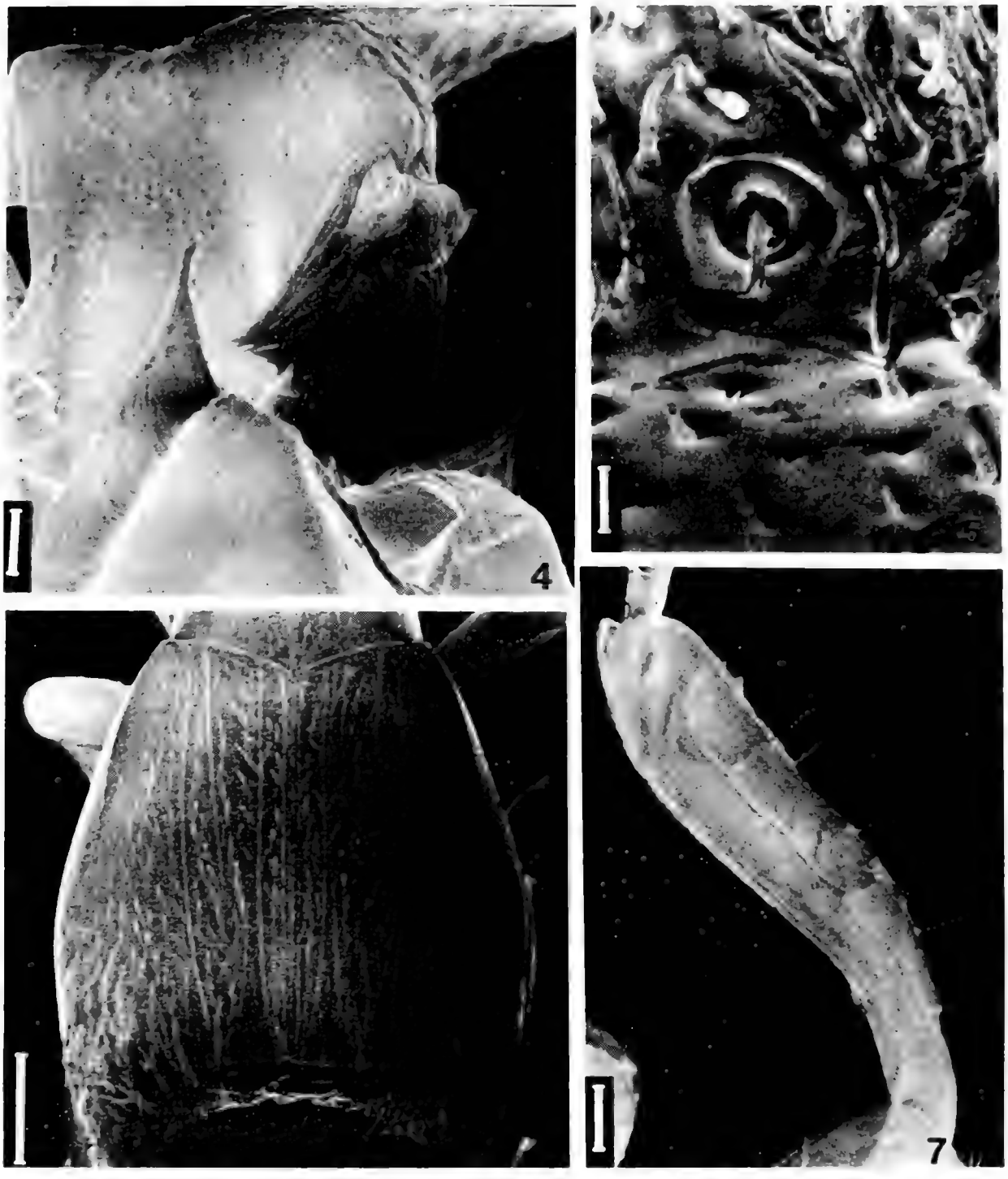
A b d o m e n with 1st visible tergite deeply impressed between latero-basal elongate protuberances bearing large trichomes; discal microsculpture absent; apical margin truncate; pubescence consisting mostly of short, recumbent setae, few lateral and apical setae long and erected. Following tergites vertical, in angle with 1st tergite; tergite 2 bearing a row of long, erect apical setae; lateral tubercles distinct. Pubescence and punctation on abdominal venter as that on metasternum.

T i b i a e distictly microsculptured, with erect spines (Fig. 7).

M a t e r i a l . Holotype, female: West Malaysia, Pahang, Genting Highlands, 1550 m, 5.IV.1993, leg. Löbl & Calame (MHNG).

B i o l o g y . The collecting site was a minute remnant of a degraded forest wedged between a road and a construction site. Most of the sifted material was taken around an old, moist stump, but some was also from moist palm leaves lying beneath secondary growth of palms a few meters from the stump. Thus the precise habitat of *Colilodion* remains unknown. It is noteworthy that other congeners were also found in degraded forests. The presence of trichomes and the strongly reduced mouthparts indicate myrmecophily. *Colilodion* and/or its host possibly require more open habitats than generally available in tropical submontane and montane forests and appear to be rare or they occur in rarely explored habitats. The four specimens found by the Geneva team on three of the twelve trips to South East Asia were extracted from hundreds of kg of sifted forest floor litter and represent approximatively 0.05% of the pselaphids collected at that time.

D i s c u s s i o n . Five species of *Colilodion* are now described. In addition to characters mentioned in the generic description (BESUCHET, 1991) all have the oral orifice oriented ventrally, a fine epipleural stria, an apical antennal sensillum, and a pair of lateral tubercles on the second visible abdominal tergite. Three of the species, *C. inopinatus* Besuchet, *C. mirus* Besuchet and *C. concinnus* Besuchet are each known from a single male, while *C. incredibilis* Besuchet and *C. wuesti* sp.n. are only known from female specimens. Thus, it is difficult to evaluate sexual dimorphism. The antennae do not appear to be sexually modified. In *C. inopinatus* and *C. concinnus* the apical antennal segment is concave dorsally and most of its dorsal surface is occupied by four shallow impunctate impressions (they do not indicate the limits of the primitive segments as has been suggested). In the remaining species, the apical antennomere is subcylindrical or dorsally flattened, without any trace of impunctate impressions, independent of sex. Apart from the genital segments, apparently there are no morphological characters associated with sex. Structures such as the gular and prosternal processes, and the shape of the trichomes provide excellent species characters. The hypothetic function of the gular process as support of the head "rendue fragile..." is unfounded.
Colilodion wuesti may be readily distinguished from all members of the genus by the rounded and amarginate postocular area, and by the shape of the upper fronto-clypeal



FIGS 4-7

Colilodion wuesti sp.n., cephalic and pronotal trichomes, scale bar = 50 µm (4), sensillum on antennal apex, scale bar = 20 µm (5), elytra, scale bar = 200 µm (6), mesotibia, scale bar = 50 mµ (7). Uncoated.

margin, which is triangular in the new species but straight or concave in the others. This species resembles *C. mirus* and *C. incredibilis* in the 3rd antennal segment lacking smooth impressions and in the presence of elytral trichomes. It differs from the latter in the dorsally flattened 3rd antennomere, the presence of a prosternal trichome, the shape of the gular and prosternal processes, the shortened marginal keel of the elytron, the fine punctation, and the smaller body size.

Key to Colilodion species

1 Apical antennal segment with impressed dorsal surface divided into smooth fields. Elytra lacking trichome at latero-apical margins. 2
- Apical antennal segment subcylindrical or dorsally flattened, without smooth, impressed fields. Elytra with trichome at latero-apical margins. 3
2 Punctation on first visible tergite obsolete, much finer than that of elytra and pronotum. . . . . *C. inopinatus*
- Punctation on first abdominal tergite distinct, similar to that of elytra and pronotum. . . . . *C. concinnus*
3 Apical antennal segment flattened dorsally. Marginal keel short, evanescent before reaching mid-length of elytron. . . . . *C. wuesti*
- Apical antennal segment subcylindrical. Marginal keel extended apically beyond mid-length of elytron. 4
4 Apical antennal segment distinctly curved, longer than half of body length. . . . . *C. mirus*
- Apical antennal segment barely curved, shorter than half of body length. . . . . *C. incredibilis*

RELATIONSHIPS OF COLILODIONINI

Pselaphids with comparatively elongate mesotrochanters, distant metacoxae and the parameres of asymmetrical aedeagus originating ventrally are currently placed in the division Macroscelia, comprising the Pselaphinae and the Clavigerinae (Newton & Chandler, 1989; Newton & Thayer, 1992). Possibly all Clavigerinae are intergrated myrmecophils. Conspicuous features of the clavigerines are the reduced mouthparts, the reduced number of antennal segments, the presence of trichomes on the elytra and on the base of the abdomen, and the reduced number of visible abdominal tergites. All these characters are considered adaptive and are attributed to association with ants. The group has been placed by some authors outside the Macroscelia as a subfamily (Raffray, 1908) or family (Paulian, 1988). Pselaphinae on the other hand are defined by the presence of the primitive states of the characters of the Clavigerinae.

Colilodion exhibits characters of both the Clavigerinae and Pselaphinae. Besuchet analysed 11 character complexes and showed that the more parsimonious

TAB. 1. Distribution of character complexes.

		1	2	3	4	5	6	7	8	9	10	11
1	Pselaphinae	0	0	0	0	0	0	1	0	1	1	0
2	Clavigerinae	0	1	1	1	0	1	0	1	0	1	1
3	Colilodion	1	1	1	1	1	1	1	1	1	1	1

solution is to group *Colilodion* with the Clavigerinae rather than with Pselaphinae. Test of these character complexes results in a tree of 13 steps (Tab. 1) while 18 steps are necessary to produce a tree with *Colilodion* + Pselaphinae as sister group of Clavigerinae. However, many of the characters used are strongly dependent on myrmecophily or are autapomorphies, and one of them is a mis-observation:

No. 1. Head with occipital area strongly constricted, vertex narrow and strongly raised, and robust gular process are unique features of *Colilodion.*

No 2. Antennae. Reduction of the number of antennal segments is a common feature in pselaphids. In the division Brachyscelia the number varies from 5 to 11, in the Pselaphinae from 7 to 11, and in the Clavigerinae from 3 to 6. *Colilodion* is similar to many Clavigerinae in possessing only 3 antennal segments, but has the basal segment exposed (the latter is exceptionally exposed and large in a few clavigerine genera, e. g. *Apoderiger*, *Neofustiger*). The apex of the large, elongate apical antennal segment in Clavigerinae is truncate, marginate, and usually bears concentric short setae (not so in *Anaclasiger*). These setae are associated with pores. In *Claviger testaceus* the pores are the orifices of glands (CAMMAERTS, 1974). In *Colilodion* the apex of the apical antennal segment bears a sensillar pit with a raised margin and an erect seta. The latter is flat and bifid in *C. wuesti*. This apical sensillum is present in all five species of *Colilodion*, and it is not similar nor homologous ("analogue, sinon homologue...") with the condition found in all 73 genera of Clavigerinae examined.

No 3. Mouthparts. They are small and retracted in *Colilodion* as they are in Clavigerinae. This is an adaptive character associated with the feeding habits. In Staphylinoidea it is common that the mouthpart morphology is dependent on trophic behaviour (LESCHEN, 1993). Hence, the reductions found in both groups may be convergent. The oral orifice is oriented apically in Clavigerinae, ventrally in *Colilodion.*

No 4. The maxillary palpus is discussed by BESUCHET separately from the other mouthparts (for discussion of number of segments see COULON, 1989). In *Colilodion* the maxillary palpus is small and consists of, as in *Claviger*, a single segment.

No 5. The shape of the prothorax in *Colilodion* is unique within the pselaphids.

No 6. The size of the trochanters is variable in Macroscelia. Significant is the distance of the basal margin of the mesotrochanter from the coxa. In Clavigerinae the mesotrochanters are perhaps statistically longer in comparison with femora than in Pselaphinae, although they are relatively short in some clavigerine genera (i.e. in *Semiclaviger*). Random measurements have not confirmed BESUCHET's statement of trochanters in Clavigerinae "still longer than those in Pselaphids Macroscelia" (sic). In

Lasinus (Pselaphinae, Tyrini), the mesotrochanter is 3/5 as long as the mesofemur, in *Cyathiger/Paracyathiger* sp. from Malaysia (Pselaphinae, Cyathigerini) it is less than 1/3 the length of the mesofemur whilst in *Claviger testaceus* it is about 1/2 as long as the mesofemur.

No 7. Clavigerinae have the 1st and 2nd tarsomeres short, the 3rd long, as in the Faronini. In Pselaphinae, as in most other pselaphids, the 2nd tarsomere is long. This character state shows little variation within the subfamilies, and does not appear to be adaptive. In *Colilodion* the 2nd tarsomere is elongate as in Pselaphinae.

No 8. The visible abdominal tergum in Clavigerinae is formed by a large plate consisting of the fused tergites 4 to 6, and by two narrow apical tergites (tergites 7 and 8). The base of the visible tergum is depressed. The same condition is found in *Colilodion*. Compared with Pselaphini (BESUCHET, l.c.), which may have a basal depression on the first visible tergite, the Clavigerinae and *Colilodion* exhibit decidedly very distinct abdomina. However, the abdominal tergites are fused in Cyathigerini of the Pselaphinae which do not share any other character with the Clavigerinae. The 3rd abdominal sternite is in *Colilodion* and in Clavigerinae rounded and fully developed as in the Euplectinae and Faroninae, and different from that in the Pselaphinae.

No 9. In male *Colilodion*, the 9th abdominal ventrite, the "operculum" is free, as in many Pselaphinae. This condition is not found in the Clavigerinae.

No 10. The aedeagi are highly variable in Pselaphidae. In Pselaphinae the parameres are almost always free, in *Colilodion* they are partly fused, and in Clavigerinae completely fused.

No 11. Trichomes occur in more groups of myrmecophilous beetles than assumed by BESUCHET. They are present in Pselaphinae: Tyrini (CHANDLER, pers. comm.) and Attapseniini (PARK, 1942), and are well developed in such unrelated superfamilies of beetles as are the Caraboidea, Staphylinoidea, Scarabaeoidea and Dermestoidea. The presence of trichomes indicate ecologcal rather than phylogenetic relationship. However, it is noteworthy that cephalic and pronotal trichomes are present in *Colilodion*, but absent from Clavigerinae.

CONCLUSION

The monophyly of the Clavigerinae is supported by the completely fused abdominal tergites 4 to 6, the form of the tarsi and the loss of the 9th sternite. With *Colilodion*, the presence of additional trichomes on the head and prothorax and the position of the mouth are possibly autapomorphous. The form of the antennae in *Colilodion* is suggestive for Clavigerinae, except for the presence of the apical sensillum in the former taxon. However, the anatomy of the antennal apex was investigated in Claviger only. *Colilodion* shares with Clavigerinae the fused abdominal tergites and the fully developed 3rd sternite. The presence of the 9th sternite in male and of the long 2nd tarsomere are primitive and do not necessarily indicate phylogenetic relationship. Awaiting new evidence, the classification of Besuchet is followed.

ACKNOWLEDGEMENTS

My thanks are due to my colleague J. Wüest who provided the scanning electron micrographs. The new species is named in his honour. F. Calame made the 1993 trip to West Malaysia more pleasant. D. H. Burckhardt, D. S. Chandler, N. D. Springate, M. Uhlig and L. Zerche read the manuscript and their suggestions led to its improvement.

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REVUE SUISSE DE ZOOLOGIE, 101 (2) : 299-313; juin 1994

Terriculous Oligochaeta (Glossoscolecidae) of the Venezuelan Llanos

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Terriculous Oligochaeta (Glossoscolecidae) of the Venezuelan Llanos.- From the Venezuelan Llanos in Barinas State seven Glossoscolecidae species are recorded. The genus *Anteoides* Cognetti is reevaluated and differences between all known species are emphasized. *Anteoides kino* n. sp., *Cirodrilus venezuelanus* n. sp., *Glossodrilus guahibo* n. sp. and *Glossodrilus cornutus* n. sp. are described. Important morphological variations are recorded in *Diaguita vivianeae* Righi.

Key-words: Oligochaeta - Glossoscolecidae - Taxonomy - Venezuelan Llanos.

INTRODUCTION

Studies upon Oligochaeta have increased during the last years due to its practical significance (fertilization and conservation of the soils) allied to its academical importance (reconstitution of the zoological history of the world - Phylogeny and Zoogeography). Nevertheless, the knowledge of the neotropical earthworms is still fragmentary due to species richness and great diversity of biotopes; so that just now there are not yet secure earthworm records from the Venezuelan Llanos.

Working under the orientation of Prof. Wilfredo Franco (Universidad de los Andes, Mérida, Venezuela) one of us (Saul Molina) collected earthworms from May 1987 to March 1988 in the Ticoporo Forestal Reserve (7°43' - 8°12' N by 70°36' - 70°53' W), a part of the Venezuelan Llanos in Barinas State. The collecting area is named "Unidad II" and it is from 100-150 m above sea level occupying an area of 40,775 ha. It is limited at east, south and west by the Michay, Suripá and Quiú rivers respectively, which flow from the Andean Cordillera. The mean-annual temperature is 27°C; there are two well-demarcated seasons, a dry-season (January to March) and a rainy-season (April to December), and the mean-annual rainfall is 2,078 mm. The collecting localities are the following:

Manuscript accepted 24.01.1994.

Locality A - clayish oxic dystropepts soil with Verbenaceae, *Tectona grandis* (teak tree) plantation since 1973.

Locality B - clayish oxic dystropepts soil with Pinaceae, *Pinus* sp. (pine tree) plantation since 1971.

Locality C - typic clayish tropaquepts soil of heterogeneous forest with Boraginaceae, *Cordia alliodora* (pardillo tree) prevalence since 1976.

The soil characteristics follow Soil Survey Service (1960). The worms were fixed in ethanol - formol - water mixture (7:2:1). The studies were made by dissections, slides of microscopical pieces mounted in glycerin - water (1:1) and serial microscopical sections (10 µm) stained by Mallory's triple method (PANTIN, 1964). The figures were made with camera lucida. The material is deposited in the Department of Zoology - University of São Paulo (ZU) and in the Muséum d'Histoire Naturelle, Genève (MHNG).

Anteoides Cognetti

Anteoides Cognetti, 1902: 4; 1906: 165; 1907: 798; MICHAELSEN, 1918: 247; CORDERO, 1945: 3; JAMIESON, 1971: 733. Type species *A. rosai* Cognetti, 1902.

DIAGNOSIS:

Setae, 8 per segment disposed in regular series or some regular and others irregular. Dorsal pores present or absent. Intraclitellar male pores. Four pairs of calciferous glands of ventral origin in VII-X structured by longitudinal trabeculae. Intramural calciferous tissue of juxtaposed transverse lamellae. Testes in XI without testis sacs. Seminal vesicles long, extending through several segments, or short, restrict to XII in athecal species. Ovaries in XIII. Spermathecae present or absent.

SPECIES AND OCCURRENCES:

A. rosai Cognetti, 1902 - Argentina: Jujuy Prov.: San Lorenzo. Bolivia: Santa Cruz Dept.: Aguajrenda (COGNETTI 1902; 1906; 1907).

A. desartsi Cognetti, 1907 - Paraguai: Puerto Max on the river Paraguay (Cognetti 1907; MICHAELSEN 1918).

A. pigy Righi, 1982 - Brazil: Pará State: Amazônia-Tapajós National Park (RIGHI 1982).

A. kino, n. sp. - Venezuela: Barinas State: Ticoporo Forestal Reserve.

REMARKS:

1. *Anteoides* belongs to the group of *Perolofius* Righi & Nemeth (1983), *Diachaeta* Benham (1887), *Cirodrilus* Righi (1975) and *Periscolex* Cognetti (1905) characterized by calciferous glands of trabecular structure. *Perolofius* has 8 pairs of glands in VII-XIV; *Anteoides* 4 pairs in VII-X; *Diachaeta* 3 pairs in VII-IX; *Cirodrilus* 2 pairs in VIII-IX and *Periscolex* 1 pair in VII. *Perolofius*, *Anteoides* and *Cirodrilus* have only one pair of testes in XI whereas *Diachaeta* and *Periscolex* have two pairs in X-XI. The setae have lumbricine disposition excepting some *Periscolex*

species that increase the number of setae per segment up to a perichaetine arrangement.

2. Differentiated genital setae are found only in *A. kino*. The other *Anteoides* species may have some clitellar setae bigger than the other ones; but they are alike in shape.

3. Dorsal pores occur in the clitellar and some post-clitellar intersegments of *Anteoides kino*; the pores are absent in the other three species.

4. *Anteoides rosai* and *A. desartsi* have not spermathecae and their small botryoidal seminal vesicles are restricted to XII. The seminal vesicles are long, extending far back by penetration of the successive septa up to XX in *A. kino* and up to XL-L in *A. pigy*.

5. The four known *Anteoides* species live in the overflowing lowlands that extend mid longitudinally in South America, from the northern part of the Llanos in Venezuela to the southern region of the Chaco in Argentina. One abnormal very macerated specimen from Caracas (Venezuela) was doubtfully assigned to *Anteoides* by OMODEO (1955).

TABLE TO *Anteoides* SPECIES

Anteoides	*rosai*	*desartsi*	*kino*	*pigy*
setae arrangement	regular series	regular series	regular series	regular and irregular series
setae ornamentation	semilunar excavations	semilunar excavations	aemilunar excavations	thorns on the convex side
mid-body aa : ab : bc	5.0 : 1.0 : 8.4	8.0 : 1.0 : 9.0	5.0 : 1.0 : 7.5	1.4 : 1.0 : 1.2
Genital setae	undifferentiated	undifferentiated	differentiated	undifferentiated
Clitellum	XIV - XXI	XIV - XXI	XIV - XXII	XVII - XXXII
Male genital field	puberal ridges in 1/4 XVII - 1/4 XIX	glandular rings in XVII or XVIII	puberal furrows in XVIII - XIX	puberal furrows in 1/n XXV - XXVII
Male pores	XVIII	XVII or XVIII	XVIII	25/26
Spermathecae	absent	absent	7/8 - 9/10	6/7 - 8/9
Hearts	VII - XIII	VII - XIII	VII - XIII	VII - XI

Anteoides kino n. sp. (Figs. 1-8)

M a t e r i a l : Locality B, depth 0-10 cm, 1 clitellate specimen (Holotype, ZU-1277).

DESCRIPTION:

Length 62 mm. Mid-body diameter 2.7 mm. Colour whitish. Number of segments 135. The tentacular prostomium invaginated in the oral cavity is as long as I-1/2 III; its longitudinal musculature is continuous with that of IV. The basal half of the

prostomium is separated from the buccal cavity by a semicircular sheath. The setae are disposed in 4 pairs of regular lengthwise series from II onwards. The setal relations are in the middle-body region (segments L-LX) *aa* : *ab* : *bc* : *cd* : *dd* = 5.0 : 1.0 : 7.5 : 1.0 : 20.5 (*ab* = 160 µm) and in the posterior region (CXX-CXXX) = 3.3 : 1.0 : 4.5 : 0.8 : 13.5 (*ab* = 180 µm). The common setae (Fig. 6) are sigmoid almost straight with a distal nodulus and unicuspidate apex; their apical 1/6 presents numerous semilunar excavations opened towards the apex and out of alignment. The setae's length varies in the mid-body from 281-353 µm (M = 310 µm) and in the posterior region from 296-363 µm (M = 322 µm). The left *a* and *b* setae of XVII and the right ones of XVIII are transformed into genital setae (Fig. 7). They are slightly sigmoid, more curved in the proximal 1/4, and get thinning up to a slight apical enlargement. The distal 1/3 of the convex side has a lengthwise groove; which becomes deeper towards the apex (Fig. 8); one margin of the groove is regular and the other one is slightly lowered just before the apical enlargement. The narrow spatulate apex has slightly prominent angles. At the sides of the groove there are two alternate series of semilunar excavations; there are 8-10 excavations per series. The genital setae's length varies from 849-874 µm. The clitellum extends on XIV-XXII (= 9 segments) without well-defined margins. Milk-white, little prominent, egg-shaped papillae contain every couple of genital setae. A pair of E-shaped puberal furrow (Fig. 1) lies in XVIII-XIX (= 2 segments) in the dorsal half of *bc*, on a milk-white, little prominent, rectangular area. Small egg-shaped thickenings contain the three tips of the puberal E. The two puberal areas are associated with two rectangular fields of gland cells; which are little prominent in the body cavity of 1/2 XVII-XIX. The male pores open in the posterior half of XVIII, inside the lengthwise arm of the puberal furrows. Female pores were not seen. Three pairs of spermathecae open in 7/8-9/10, line *c*. The nephridiopores are in *cd* just after the intersegments. The first dorsal pore is in 12/13; the pores are well seen in the clitellar intersegments and some posterior ones, but they are unrecognizable in the greater number of intersegments.

The septa 6/7-11/12 are thick, muscular and disposed like interpenetrated cones; the 7/8-9/10 are the thickest; the other septa are slender and fragile. The pharyngeal bulb extends ventrally to the level of the parietal segment V and dorsally to VI. The long anterior oesophagus is bent across as a tightened S. The wide rounded and very muscular gizzard lies in VI but, due to its size and septa's shape, it corresponds to the parietal segments VII-1/2 VIII. There are four pairs of calciferous glands in VII-X; they open into the oesophagus close to its mid-ventral line and ascend laterally beyond the oesophagus. The glands are sack-like, curved and voluminous (Fig. 2). Their structure is made of longitudinal trabeculae of different

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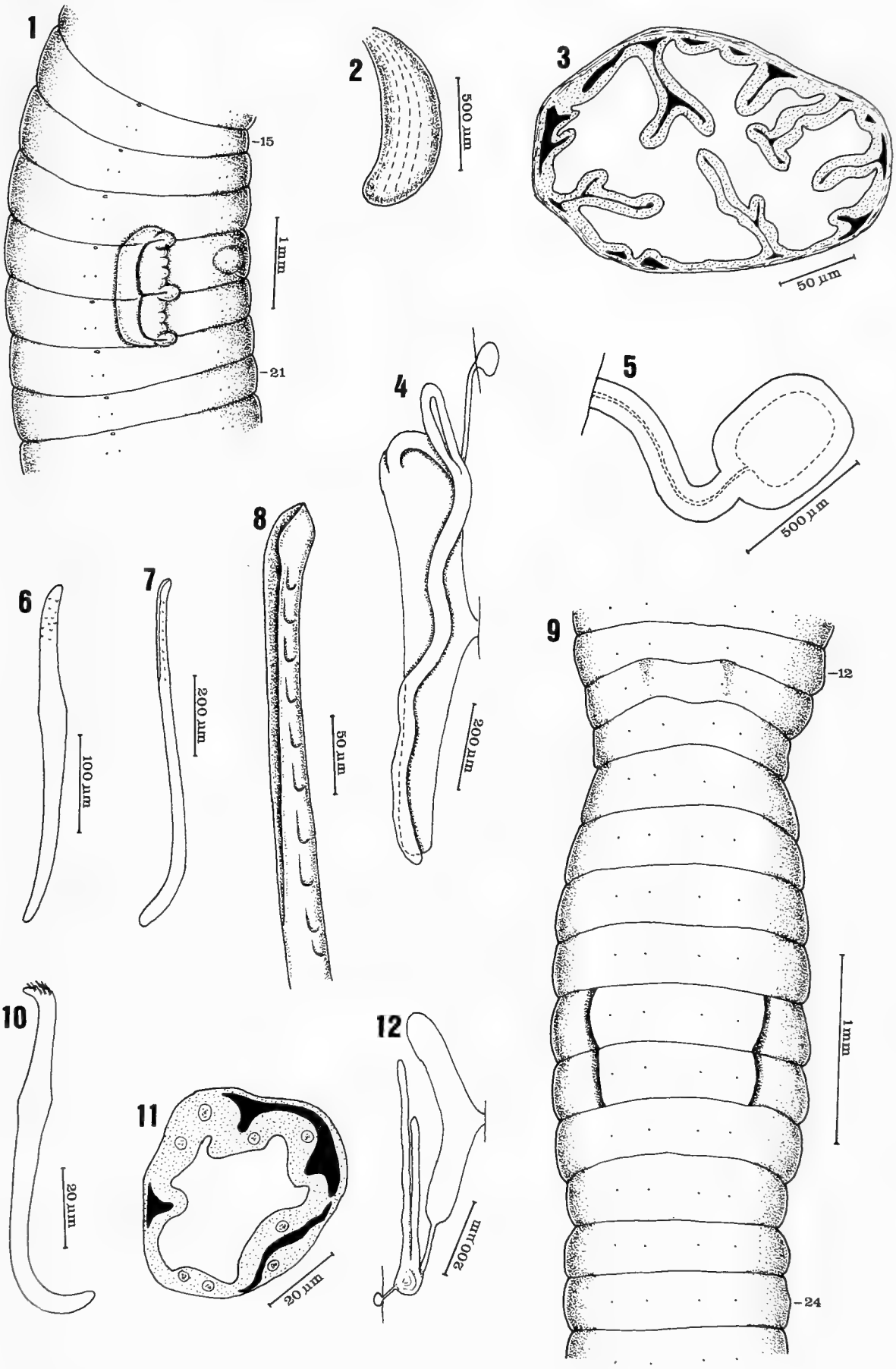
FIGS 1-12

Anteoides kino n. sp.: 1 - Lateral view of the segments XV-XXI. 2 - Calciferous gland of X. 3 - Cross section of a calciferous gland of IX. 4 - Nephridium of XL. 5 - Spermatheca of 9/10. 6 - Mid-body seta. 7 - Genital seta of XVII. 8 - Apex of the same. *Cirodrilus venezuelanus* n. sp.: 9 - Ventral view of the segments XII-XXIV. 10 - Mid-body seta. 11 - Cross section of a calciferous gland of VIII. 12 - Post-clitellar nephridium.


1
-15
1 mm
-21
2
500 µm
3
50 µm
4
200 µm
5
500 µm
6
100 µm
7
200 µm
8
50 µm
9
-12
1 mm
-24
10
20 µm
11
20 µm
12
200 µm

length; in cross sections some trabeculae are simple and others branched (Fig. 3). The oesophagus presents strong intersegmental constrictions setting apart segmental chambers in XIII-XVII. The side walls of the chambers in XIII-XVI make a lot of high and very vasculose cross lamellae (= intramural calciferous tissue). The oesophageal mucosa of XVII forms some low lengthwise folds. The transition oesophagus-intestine is in 17/18. The typhosolis begins in XXII. It is a thick dorsal blade as high as half intestinal diameter. There are no intestinal caeca. The dorsal blood vessel is moniliform from XVII forwards in a zigzag course over the oesophagus. There are three pairs of thin lateral hearts in VII-IX and four pairs of thick intestinal hearts in X-XIII. One subneural vessel is recognized in the clitellar segments. There is one pair of holonephridia on each segment. The nephridia of VI and anterior ones are gathered at the sides of the oesophagus. In the post-clitellar nephridia (Fig. 4) the loop I is twisted or not and turned downwards. The loop II follows the inner edge of the loop III (= bladder) ending far away. The wide duct to the bladder has not glandular differentiations. One pair of testes and seminal funnels lie in the cavity of XI full of spermatozoa. The pair of silvery tubular seminal vesicles make some irregular turns around the oesophagus and intestine up to XX. The thick vas deferentia run on the body wall in 1/2 *bc* up to 1/2 XVIII where they pierce the parietes. The pair of laminar ovaries and female funnel are in XIII. The three pairs of spermathecae are alike one another in VII-IX. Each spermatheca (Fig. 5) has a somewhat flattened quadrangular ampulla full of spermatozoa and one little longer duct. Ampulla and duct have thick walls but there are not seminal chambers or diverticles.

The name of the new species was taken from the Indian group "Kinó" belonging to the Arawak.

Cirodrilus venezuelanus n. sp. (Figs. 9-12)

M a t e r i a l : Locality A, depth 0-10 cm, 1 clitellate specimens (Holotype, ZU-1278). Locality B, depth 0-10 cm, 2 clitellate specimens (MHNG-987.485).

DESCRIPTION:

Length 24-26 mm. Mid-body diameter 0.9-1.0 mm. Number of segments 87-136. There are not pigments. The prostomium and the segment I are invaginated in the three worms; the prostomium is a voluminous dorsal lobe in the oral cavity. The setae are arranged in 4 pairs of regular series starting from II. The setal relations are in the mid-body (segments XXX-XL) *aa* : *ab* : *bc* : *cd* : *dd* = 1.4 : 1.0 : 1.8 : 0.4 : 6.0 (*ab* = 193 µm) and in the posterior region (LXX-LXXX) = 1.5 : 1.0 : 1.6 : 0.5 : 4.2 (*ab* = 167 µm). The common setae are straight with the ends turned in opposite directions and a small nodulus in the distal third. Their subapical convex side has a group of slender thorns (Fig. 10). The length of the setae varies in the mid-body among 82-97 µm (M = 84 µm) and in the posterior region among 61-87 µm (M = 72 µm). There are not genital setae. The clitellum lies on XIV-XXII (= 9 segments); it is ring-shaped with a flattened little thick ventral surface. A pair of puberal furrows (Fig. 9) occurs in

1/2 *bc* of XIX-XX (= 2 segments). The genital pores are microscopical. The male pores are in 19/20 inside the puberal furrows and the female ones are in line *a* of 14/15. There are not spermathecal pores. The nephridiopores are intersegmental in the setae's *d* line.

The anterior septa are very thin, fragile and recognized only in histological sections. The first septum well seen in dissection is 12/13. The septa 12/13-14/15 are thick and muscular, the followings are thin. One wide globular and strongly muscular gizzard belongs to segment VI but, due to the elongated shape of the septa, it is on level with the parietal segments IX-X. The oesophagus is very large in VII-VIII; it decreases up to XII and remains uniform backwards. The inner oesophageal surface rises up in very vascular cross lamellae (intramural calciferous tissue) in VII-XI, XII; the lamellae are more numerous in VII-X. Two pairs of calciferous glands open near the mid-ventral line of the oesophagus in VIII-IX. The glands are small pear-shaped and structured by low lengthwise trabeculae (Fig. 11). The transition oesophagus-intestine is in 15/16. There are not intestinal caeca. The typhlosole begins in XX; it is a thick dorsal blade as high as half intestinal diameter. The dorsal vessel is moniliform from XV forwards. Three pairs of thin lateral hearts are in VII-IX and two pairs of thick intestinal hearts in X- XI. The nephridia are one pair on each segment; those of VI and anterior ones are intermingled at the sides of the oesophagus. The post-clitellar nephridia (Fig. 12) are formed by a small pre-septal funnel and a main post-septal part constituted by two loops connected to the ventral end of the bladder. The pair of testis sacs are ventrally melted in XI and laterally they rise up to the ventral 1/4 of the oesophagus. The pair of seminal vesicles extends laterally up to XIV. The vas deferentia run straightforward on the body wall to 19/20. The pair of bulky ovaries attacks post-ventrally to the septum 12/13. There are not spermathecae.

REMARKS:

The genus *Cirodrilus* Righi (1975) contains three species viz. *C. angeloi* Righi (1975) known in Brazil: Amapá State; *C. aidae* Righi (1994) known in Brazil: Paraiba State and *C. venezuelanus*. The three species may be distinguished by the following table.

TABLE TO *Cirodrilus* SPECIES

Cirodrilus	*angeloi*	*aidae*	*venezuelanus*
Setal relations in the mid-body	*aa* > 4 *ab*	*aa* > 4 *ab*	*aa* < 1.5 *ab*
Clitellum	XIII, XIV - XXI	XV - XXIV	XIV - XXII
Male genital field	puberal ridges in XIV, XV - XXI	puberal ridges in XVII - XXII	puberal furrows in XIX - XX
Male pores	posterior in XVI	posterior in XVIII	19/20
Spermathecae	5/6 - 8/9	6/7 - 8/9	absent

Onychochaeta windlei (Beddard, 1890)

Diachaeta windlei Beddard, 1890: 159, pl. 20, figs. 1-15.
Onychochaeta windlei; Righi, 1989: 1079, figs. 39-47.

M a t e r i a l : Locality A, depth 0-10 cm, 2 clitellate and 1 young specimens (MHNG-987.480). Locality B, depth 0-20 cm, 2 clitellate and 3 young specimens (ZU-1260). Locality C, depth 0-10 cm, 1 clitellate specimen (MHNG-987.479).

Pontoscolex (P.) corethrurus (Müller, 1857)

Lumbricus corethrurus Müller, 1857: 113.
Pontoscolex (P.) corethrurus; Righi, 1984a: 163.

M a t e r i a l : Locality A, depth 0-10 cm, 1 clitellate and 4 young specimens (MHNG-987.478). Locality B, depth 0-20 cm, 5 clitellate and 4 young specimens (MHNG-987.482). Locality C, depth 0-10 cm, 6 clitellate and 2 young specimen (ZU-1281).

Glossodrilus guahibo n. sp. (Figs. 13-18)

M a t e r i a l : Locality A, depth 0-30 cm, 29 clitellate, 1 aclitellate mature and 3 young specimens (Holotype ZU-1279A; paratypes ZU-1279B). Locality B, depth 0-50 cm, 7 clitellate and 1 young specimen (MHNG-987.484). Locality C, depth 0-10 cm, 2 clitellate specimens (MHNG-987.483); all paratypes.

DESCRIPTION:

Length 33-57 mm. Mid-body diameter 1.0-1.2 mm. Number of segments 90-121. There are not pigments. The prostomium, when retracted, is a small lobe in the roof of the buccal cavity; when extroverted it is nearly hemispherical, a little longer than wide. The setae begin in II and are disposed in 4 pairs of regular lengthwise series. The relations among the setae are in the middle body region (segments XXXV-XL) *aa* : *ab* : *bc* : *cd* : *dd* = 17.5 : 1.0 : 3.7 : 1.0 : 20.0 (*ab* = 80 µm) and in the posterior region (C - CX) = 12.3 : 1.0 : 3.8 : 1.0 : 8.0 (*ab* = 119 µm). The common setae (Fig. 17) are sigmoid of distal nodulus and unicuspidate do not ornamented apex; the setae's length varies from 96-129 µm throughout the body. The lateral setae of X are modified into genital setae (Fig. 18). They are almost straight with proximal nodulus; theirs distal 1/3-1/4 is ornamented with small excavations of crenulate margins opened towards the apex and out of alignment. The genital setae's length varies among 344-368 µm. The strong musculature associated to their follicles makes outstanding rectangular structure; which occupies all the segment length. The clitellum lies on segments XV-XXI, XXII (= 7-8) with a little thickened ventral surface in the greater number of specimens. One pair of puberal ridges (Fig. 13) extends from 1/2 XVI-1/2 XVIII. They are wide and little thick; their lateral margin is nearly straight close to a longitudinal furrow in 1/2 *bc* and the curved medial margin is wider in XVII. The mid-longitudinal line of the ridges is in *ab*. In a few number of specimens with clitellum equally thick all around, the puberal ridges are recognized only by a slight difference in tonality and by the limiting lateral furrow. The genital pores are microscopical. The male pores are on the puberal ridges in 16/17 slightly

medial from *a*. The female pores open just in front of the setae *a* in 1/2 XIV. One pair of spermathecal pores are aligned with the setae *c* in 9/10. The nephridiopore are intersegmental in line *b*.

The septa 6/7-10/11 are thick, muscular and like interpenetrated cones; the other septa are thin and flat. The glandular cells of the pharyngeal bulb grow dorsally up to the anterior half of the gizzard. The cylindrical, short, wide and very muscular gizzard lies in VI. The two calciferous glands open side by side into the mid-dorsal line of the oesophagus in XI; the glands are elongated and due to the septa shape they are at level of the parietal segments XII-XIV. Each gland (Fig. 14) is club-shaped with a ventral glandular part of composite tubular structure and a dorsal membranous sac (calciferous reservoir) which opens anteriorly into the oesophagus. The transition oesophagus-intestine is in 14/15. The typhlosole begins at 15/16; in the post-clitellar region it is a dorsal thick blade as high as 1/3 of the intestinal diameter. There are not intestinal caeca. Three pairs of lateral hearts are in VII-IX and two pairs of intestinal hearts in X-XI. There are one pair of holonephridia on each segment. Each post-clitellar nephridium (Fig. 15) presents a small pre-septal funnel and three post-septal loops. The loop I is short and covered by loop II; which is long, folded and makes a tour around the dorsal end of III (= bladder). The duct to the bladder is long, wide and silvery-white. There are not testis sacs, the pair of testes and wide folded male funnels are free in XI which cavity is full of spermatozoa. The pair of seminal vesicles is flattened tubular with intersegmental constrictions and reaching up to XXII-XXVII. The pair of vas deferentia runs straightforward between the setal follicles *a* and *b* up to 16/17. The pair of ovaries and female funnels are in XIII. There is one pair of spermathecae in X. Each spermatheca (Fig. 16) has a somewhat flattened globular ampulla full of spermatozoa and a thin duct as long as 1.5-2 times the greatest ampulla diameter.

REMARKS:

Glossodrilus guahibo has affinities to *G. antisanae* Zicsi (1989) known in Ecuador. The main *antisanae* characteristics to distinguish from the new species are: rectangular puberal ridges ventral to *a* setae; genital setae absent; rounded calciferous gland without membranous sac (reservoir); peri-oesophageal testis sac present.

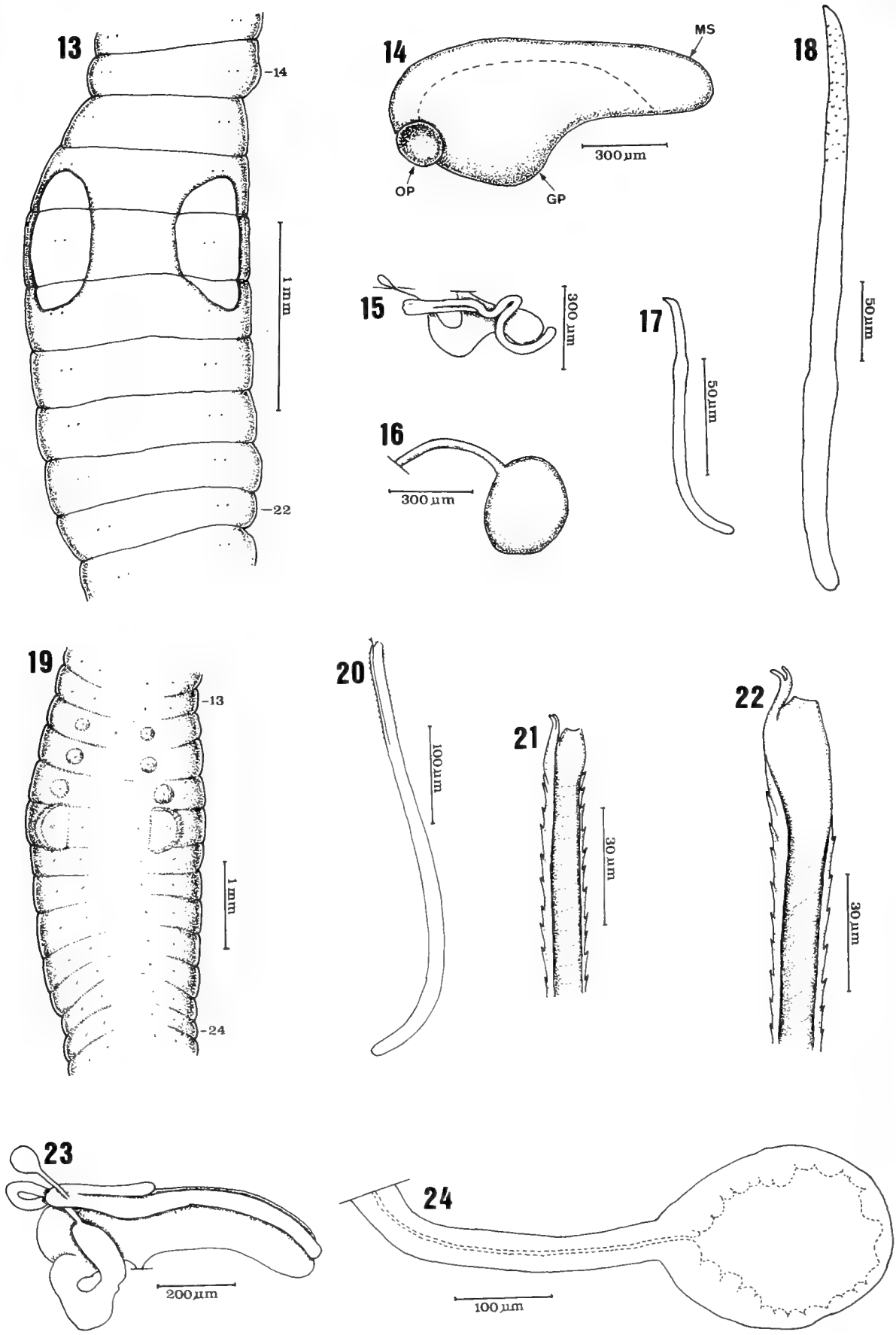
The new species name was taken from an Indian group nomadic throughout the Llanos.

Glossodrilus cornutus n. sp. (Figs. 19-24)

Material: Locality A, depth 0-10 cm, 2 clitellate and 1 young specimens (Holotype ZU-1280; paratypes MHNG-987.481).

DESCRIPTION:

Length 24-32 mm. Mid-body diameter 1.0-1.4 mm. Number of segments 100-124. Pigments absent. The partially invaginated prostomium is calotte-form as long as


13
-14
1 mm
-22
14
MS
300 µm
OP
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15
300 µm
16
300 µm
17
50 µm
18
50 µm
19
-13
1 mm
-24
20
100 µm
21
30 µm
22
30 µm
23
200 µm
24
100 µm

wide. There are 8 lengthwise series of setae beginning in segment II. The setal relations are in the mid-body region (segments LV-LXV) *aa* : *ab* : *bc* : *cd* : *dd* = 2.9 : 1.0 : 1.1 : 1.0 : 2.9 (*ab* = 347 µm) and in the posterior region (CX-CXX) = 2.7 : 1.0 : 1.0 : 0.8 : 2.7 (*ab* = 360 µm). The common setae are sigmate of distal nodulus and unicuspidate apex. The setae's length varies in the mid-body from 118-135 µm (M = 125 µm) and in the posterior region from 143-204 µ (M = 159 µm). The setae *a* from XIV-XVI are modified into genital setae 404-419 µm long. Theirs proximal 2/3-3/4 is curved and the distal part straight (Fig. 20). The distal 1/3-1/4 (Figs. 21-22) has a wide lengthwise groove with the outer convex surface ornamented by many low scale-like semicircles. The apex divides in two teeth; one of them is three times wider than the other one. The wide tooth is spatulate with a mid anterior notch; the thin tooth is two times longer, nearly cylindrical, curved and forked. The clitellum extends from XIV-XXII (= 9 segments); it is ring-shaped, thin in the ventral surface and very thick above *b* line. One pair of semilunar puberal tubercles occupies all segment XVII length from 1/2 *ab*-1/2 *bc* (Fig. 19). The tubercles are associated with wide groups of gland cells prominent in the body cavity. Three pairs of conical papillae contain the genital setae of XIV-XVI. Papillae and tubercles are milk-white. The male pores lie in line *b* of 1/2 XVII on the puberal tubercles. The single female pore is mid-ventral in XIV. One pair of minute spermathecal pores is in line *b* of 9/10. The nephridiopores are intersegmental in line *b*.

The septa 6/7-9/10 are thick and muscular, the following ones are thin and fragile. The voluminous conical pharyngeal bulb extends over the anterior oesophagus up to the level of the parietal segment VII. The voluminous, very muscular conic gizzard is wider anteriorly; it belongs to segment VI but, due to the elongated anterior septa, corresponds to the parietal segments VIII-IX. One pair of rounded calciferous gland is dorsal in XII. They have composite-tubular structure without membranous sac (calcareous reservoir) and have a common opening into the mid-dorsal line of the oesophagus in 11/12. The transition oesophagus-intestine is in 14/15. The typhlosole begins in XV; it is a thick dorsal blade as high as 1/2 intestinal diameter. There are not intestinal caeca. Three pairs of lateral hearts are in VII-IX and two pairs of bulky intestinal hearts in X-XI. There is a pair of holonephridia per segment. In the post-clitellar nephridia (Fig. 23) the short loop I achieves just to the nephridiopore level and loop II and III are equal in length. The duct to III is voluminous twisted and milk-white. The pair of testis sacs melts ventrally in XI then rises at the oesophagus sides tapering up to near its mid-dorsal line. The vas deferentia run on the body wall above setae *b* line up to XVII where they go among the gland cells of the puberal tubercles.

FIGS 13-24

Glossodrilus guahibo n. sp.: 13 - Ventral surface of the segments XIV-XXII. 14 - Medial view of a calciferous gland. 15 - Post-clitellar nephridium. 16 - Spermatheca. 17 - Ventral seta of the mid-body. 18 - Lateral seta of X. *Glossodrilus cornutus* n. sp.: 19 - Ventral surface of the segments XIII-XXIV. 20 - Genital seta of XVI. 21 - Apex of the same. 22 - Apex of a genital seta of XV. 23 - Post-clitellar nephridium. 24 - Spermatheca. (GP - Glandular part. MS - Membranous sac. OP - Opening into the oesophagus).

The seminal vesicles are tubular, somewhat flattened and irregularly folded up to XIII. There are a pair of ovaries and female funnels in XIII and a pair of spermathecae in X. On each spermathecae (Fig. 24) the ampulla is rounded to pear-shaped whith thick glandular walls; the duct is a little longer than the greater ampulla diameter.

REMARKS:

Glossodrilus cornutus has affinities to *G. orosi* Righi & Fraile-Merino (1987) known in Costa Rica. They are the only two *Glossodrilus* species with grooved genital setae. The two species may be distinguished by the shapes of the male genital field, of the spermathecae and of the genital setae's apex.

The name of the new species refers to the apex of the genital setae.

Diaguita vivianeae Righi, 1984 (Fig. 25, A-K)

Diaguita vivianeae Righi, 1984b: 207, figs. 23-30; Righi & Guerra, 1985: 154.

M a te r i a l : Locality A, depth 0-10 cm, 4 clitellate specimens (ZU-1281). Locality C, depth 0-10 cm, 7 clitellate specimens (MHNG-987.477).

OBSERVATIONS:

The species were known only in Brazil: Mato Grosso State. The Venezuelan worms present variations of the puberal markings not yet recorded. The body length varies from 35-125 mm; the mid-body diameter from 2.3-3.5 mm and the number of segments from 77-230. The ring-shaped clitellum extends on XIV, XV-XXII, XXIII (= 9-10 segments); its ventral side is little thickened without the well-demarcated mid-ventral naked area on XIV-XVII, XVIII of the Brazilian animals. The puberal furrows are curved like parentheses from XIX, 1/2 XIX-XX. The 11 examined specimens differ one from another by the number and position of the puberal papillae. The papillae may be paired in VII-X, XV-XVIII, 20/21, XXII-XXIV and single mid-ventral in XI-XIV. The variations are demonstrated in Fig. 25, A-K.

GENERAL REMARKS

Just now there were not any secure record of Oligochaeta species to the Venezuelan Llanos. Seven earthworms are now registered in the "Unidad II" of the Ticoporo Forestal Reserve, viz.: 1. *Anteoides kino*, 2. *Cirodrilus venezuelanus*, 3. *Onychochaeta windlei*, 4. *Pontoscolex (P.) corethrurus*, 5. *Glossodrilus guahibo*, 6. *G. cornutus*, 7. *Diaguita vivianeae*. Six of these species (n° 2-7) inhabit Locality A; five species (n°1-5) live in Locality B and four species (n°3,4,5,7) inhabit Locality C. The species poorness in Locality C is probably related with the little aired soil type.

Three species are not significant to the faunistic characterization of the region due to wide geographical distribution. *P. (P.) corethrurus* is a well-known pan-tropical peregrine species. *O. windlei* is known in several regions of Venezuela and in Surinam, Saint Thomas Island, Haiti, Cuba and Bermuda Islands (RIGHI in press). *D.*

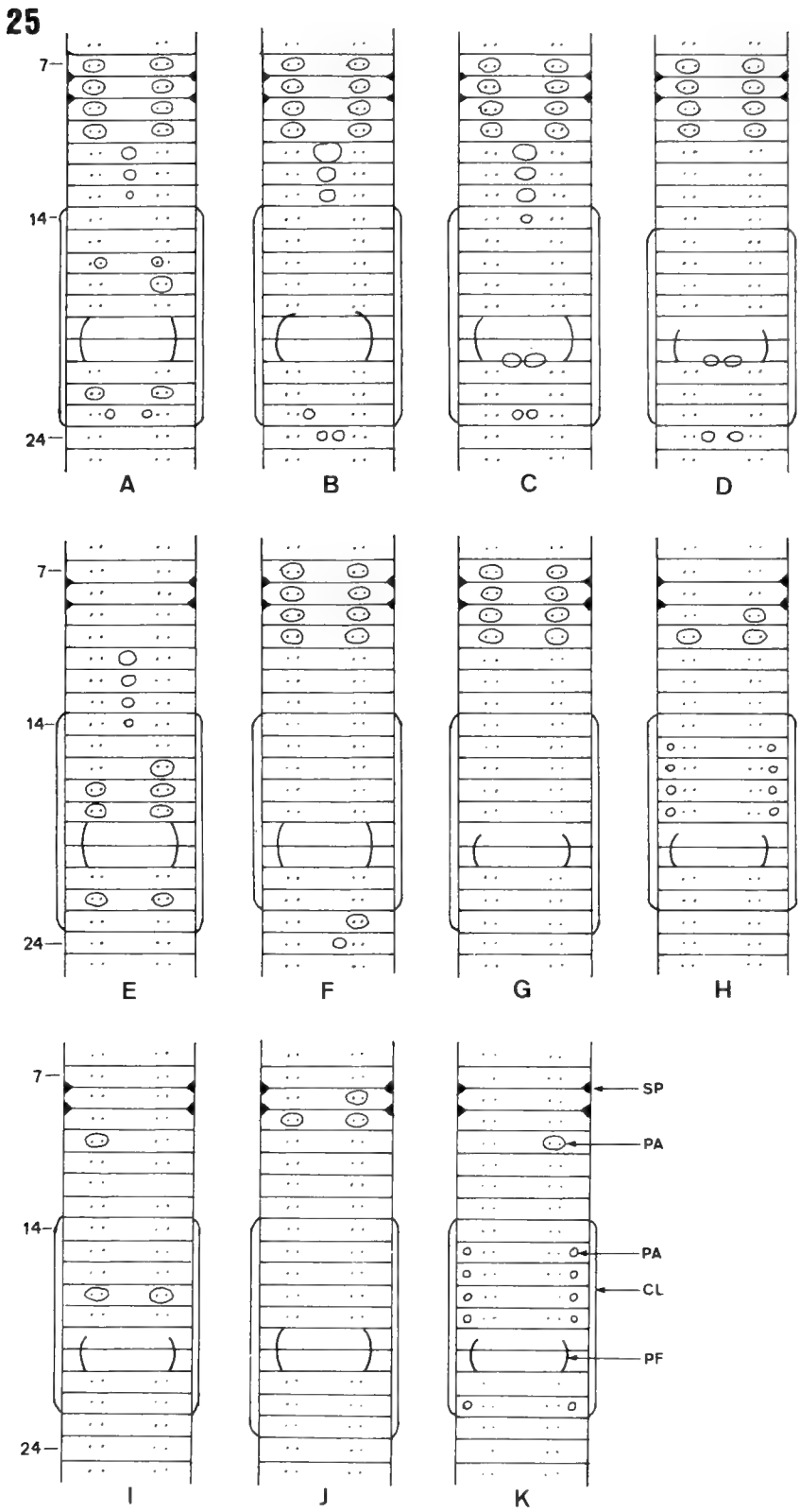

FIG. 25

Diaguita vivianeae Righi: 25, A-K - Variations in the puberal markings of 11 specimens (CL - clitellum. PA - Papilla. PF - Puberal furrow. SP - Spermathecal pore).

vivianeae is also known in the "Pantanal", a part of the "Chaco" in Brazil, Mato Grosso State. *A. kino*, *C. venezuelanus*, *G. guahibo* and *G. cornutus* are characteristic to the studied region. *G. guahibo* is the most characteristic species because it lives in the three sampled localities and from 0-40 cm deep in the soil. The other three species have more restrictive distribution, *A. kino* lives in Locality B, *C. venezuelanus* in Localities A and B, and *G. cornutus* in Locality C, all them in depths from 0-10 cm.

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Contribution to the knowledge of European Bourletiellidae (Collembola, Symphypleona). II. Redescription of three species and description of three new species of *Fasciosminthurus*.

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Contribution to the knowledge of European Bourletiellidae (Collembola, Symphypleona). II. Redescription of three species and description of three new species of *Fasciosminthurus*.- A further information is given on the following species of *Fasciosminthurus*: *F. cugnyi* (Nayrolles, 1987), *F. quinquefasciatus* (Krausbauer, 1902), and *F. raynalae* (Nayrolles, 1987). Three new species are described: *F. bedosae* n. sp., *F. cassagnaui* n. sp., and *F. longisetus* n. sp.

Key-words: Collembola - Symphypleona - Bourletiellidae - *Fasciosminthurus* - new species - Europe.

The appendicular chaetotaxy - included its ontogeny - of six European species belonging to the genus *Fasciosminthurus* Gisin, 1960, *sensu* Bretfeld, 1992 is described according to a standard, as table-form, already displayed in a previous paper (NAYROLLES 1993). Concerning the chaetotaxy of the rest of the body, only the trichobothrial pattern and setae on the small abdomen were studied. The trichobothrial pattern is described from BETSCH & WALLER (1989) criteria. Trichobothria A, B, and C emerge at second instar, and D and E are primary. The antennal chaetotaxic variables, *h**, *ISh**, and *RSh* are explained in NAYROLLES (1993). The type of setal ontogeny (see NAYROLLES 1993) is given by letters: P = primary seta, D = seta of 2nd instar, T = seta of 3rd instar, and Q = seta of 4th instar (adult in Bourletiellidae). When a seta is variable at the instar in which it appears, the letters that symbolizes this instar is written between parentheses; if in a latter instar it becomes constant, this instar is given as well. All the species were collected in the South of France and in the North-East of Spain.

The following abbreviations are used: abd. = abdomen — ad. = adult — an. app. = anal appendage — ant. = antennal segment — ceph. diag. = cephalic diagonal — cup = cup-like organ — juv. = juvenile — ov. org. = oval organ — st. = instar.

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The material is deposited in the following data-collections: 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) — Instituut voor Taxonomische Zoölogie (Zoologisch Museum) Universiteit van Amsterdam, the Netherlands (ZMA).

Fasciosminthurus quinquefasciatus (Krausbauer, 1902) (Figs 1-2; Table I)

Material

Collected in several places in the South-West of France and in the North-East of Spain; collected with a net. 12 juv. and 10 ad. mounted.

Deposit of material. — All the material in LEITT.

Description

Development. — Number of juv. st. = 3.

Size ad. — ♂: 0.6 - 0.65 mm; ♀: 0.6 - 0.85 mm.

Color. — Very characteristic, with white cross stripes on dark background. Great abd. with a pair of very lateral white spots in posterior area, small abd. with another pair on abd. V (as in *F. cugnyi*). Both spots on abd. V can be joined with two light circular spots often present on the upper anal flap. Literature provides good drawings of this species (especially JEANNENOT 1956).

Great abd. — Trichobothria: A, B, and C in linear pattern. Dorsal setae: mesochaetae.

Antennae. — Antennal ratios: in ♀, ant. I : II : III : IV = 1 : 1.9 : 2.8 : 5.7 and ant.: ceph. diag. = 1.5 ; in ♂, ant. I : II : III : IV = 1 : 2.0 : 2.9 : 6.2 and ant. : ceph. diag. = 1.6. Chaetotaxic variables: for *G*: m = 91.6 / min = 86 / max = 96 ; m(*ISh**) = 0.81 ; m(*RSh*) = 0.51.

FIGS 1-6

Figs 1-2: *Fasciosminthurus quinquefasciatus* (Krausbauer, 1902) ad.; 1: praetarsus, tibiotarsus and femur of hindleg, anterior view. On the femur, arrows point at setae ai3 and ai4 which are lacking in *raynalae* (compare with fig. 3); 2: schematic representation of hindtibiotarsus in anterior view (from fig. 1), setae of Ge and Gi as well as the 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 ring for a primary seta, a triangle for a secondary seta, the setae belonging to a same whorl are linked together by a line which is continuous on the anterior side and discontinuous on the other side.

Figs 3-6: *Fasciosminthurus raynalae* (Nayrolles, 1987) ad.; 3: praetarsus, tibiotarsus and femur of hindleg, anterior view; 4: schematic representation of hindtibiotarsus in anterior view (from fig. 3), same legend as in fig. 2; 5: ant. III, anterior view; 6: schematic representation of fig. 5, 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 ring for a primary seta, a triangle for a secondary seta, the symbols of secondary setae belonging to a same generatrix are linked together by a line which is continuous on the anterior side and discontinuous on the other side.

Head. — Eyes: 8+8; eyepatch with two setae. Cephalic setae: mesochaetae. 2+2 ov. org. behind the head. Labral formula: 6/5-5-4.

Legs (figs 1-2). — Femur: cup present. Numbers of obliquely truncated setae on fore, meso and hindtibiotarsi: 8, 11, 9. Claw with a tooth on its inner crest. Empodial filament thick, S-curved, clavate, and overhanging the claw.

Ventral tube. — Sacs warty from 2nd st. Chaetotaxy: apical flaps with one pair of primary setae, corpus without seta.

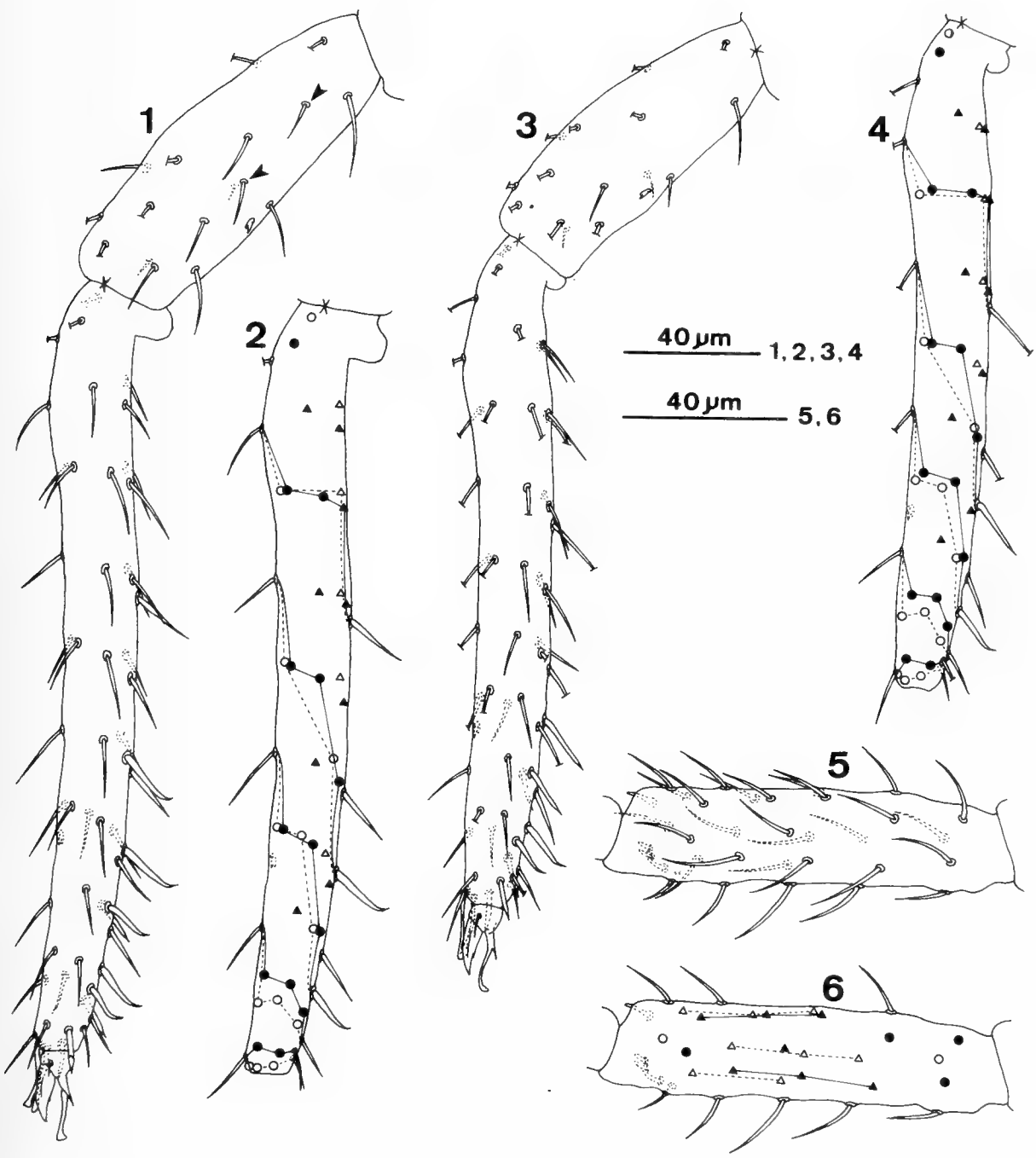


Table I. Appendicular chaetotaxy of *Fasciosminthurus quinquefasciatus*

AP	Δ	—
AD	Π	—
	Δ	D: i0 T: i+1 (T)Q: e+1 (oc = 0.8) Q: i-1, pe+1 Ai is a trichobothrium.
AT	Π	—
	Δ	Other setae: Q: pe+2, pe+3 oc(i+1) = 0.6

	Ge	Gae	Ga	Gai	Gi	Gpi	Gp	Gpe
Setae -1	Q	T		T	T	T	T	T
Setae 0	Q	D	D	Q	D	D	T	D
Setae +1		T		T	(T)Q		Q	T

AQ	str		B is completely zoned. Section M euwhorled with 5 whorls. Right euwhorlation. Subsegmentation formula: 1 + 5 + 1 = (A) + (M1, 5) + B. Right subsegmentation.
	A	Π	AIa
		H	AIIIeae, AIIIppe
		Δ	Apical bulb: in part invaginated Subapical organ: very small D: AIai AIIpe is a blunt microchaeta
	M & B	H	Occurrences of H setae on M & B: for Heae 1-1-1-1-0.6/0, for Hipi 1-1-0-0-0/0, and for Hppe 1-1-1-1-0.7/0.3. m(*h**) = 4.8.
		G	Setae of BB: P: BBe, BBae, BBa, BBp, BBpe / BA: complete whorl / n80%(*BM*) = 11-17 / n80%(*B*) = 23-30 / all G setae on M are present / n80%(*G*) = 87-94. BBae is a blunt microchaeta on large base. This seta undergoes a reduction size during its development. BBa is a cucumiform seta on large base.

SB	prc	—	—	—
	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: ai2, Oi1 (T)Q: a (oc = 0.7)
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, pe2, Op Q: ai2, pe4	T: a5, ai2, pe2 Q: ai3, ai4, pe4, Oi
TI	V	Ia	Ia, Vp	Ia, IVp, Vp
	K	—	—	—
	FP	+	+	+
	Δ	T: 4ai1, Vai, Vpi, FSa, O2pe Q: 3a, 3p, 4a1, 4pi1, 4p1, 4ai2, 4pi2, FSai, FSpi Ipi, Ip and Ipe are spatulate setae. Iai, IIai, IIpi, IIIai, IIIpi, IVai, IVi, IVpi are obliquely truncated setae.	T: 4ai1, 4i1, Vai, Vpi, FSa, O2pe (T)Q: 3a (oc = 0.7), 4a1 (oc = 0.8) Q: 4pi1, 4ai2, 4pi2, FSai, FSpi (Q): 3p (oc = 0.7), 4p1 (oc = 0.5) Ipi, Ip and Ipe are spatulate setae. Iai, IIai, IIpi, IIIai, IIIpi, IVai, IVi, IVpi, Vi, 4ai1, 4i1 are obliquely truncated setae.	T: 2a, 3a, 3ai, 3i, 4a1, 4ai1, 4i1, Vai, Vpi, FSa, O2pe (T)Q: 4pi1 (oc = 0.3) Q: 3pi, 4ai2, 4pi2, FSai, FSpi Ip and Ipe are spatulate setae. Iai, Ipi, IIai, IIpi, IIIai, IIIi, IIIpi, IVai, IVi are obliquely truncated setae.

MA	Π	—
	Δ	T: pe3 Q: pe2
DE	Δ	Other setae: P: 2pe oc(Vpe) = 0.2

		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
	III			P				P	P
	IV			P				P	P
	V						T	T	(T)Q
	VI.						Q		T
Whorl B		T		P			P	P	P

MU	Δ	Chaetotaxy: — Morphology: anterior lamella double, outer and inner lamellae smooth.

Retinaculum. — At 1st st. rami tridentate, bidentate from 2nd. Chaetotaxy: on anterior lobe two setae appear at 3rd st. and another one in ad.

Furcula. — Generatrix Gpi on dens with IIIpi and IVpi lacking.

Small abd. — Made up of abd. V + abd. VI. Trichobothria: D and E. Genital papilla of ♂ with 16-18 setae. An. app. spine-like, straight. Ratio an. app. : mucro = 0.55.

Fasciosminthurus cugnyi (Nayrolles, 1987)

Material

Collected in several places in Spain (regions of Cataluña and Aragon), included the type station. Type station (LE2, Collado de Perves, prov. Lérida, Spain): type material (4-VII-1986) as well as two other collections collected with a net on unselected plants. 30-V-1990: 5 juv. and 1 ♂; all mounted. 19-VI-1990: 21 specimens; 7 juv. and 8 ad. mounted. — Prov. Lérida, between Coll de Nargó and Collado de Bóixols, alt. 900 m; calcareous garrigue with many *Aphyllanthes monspeliensis* and *Thymus vulgaris*, and few *Lavandula latifolia*; collected with a net on unselected plants (LE24). 30-V-1990: 3juv., 1 ♀, and 1 ♂; 3 juv. and 1 ♀ mounted. 19-VI-1990: 5 specimens. — Prov. Tarragona, between El Pla de Santa Maria and El Pont d'Armentera, alt. near 400 m; scattered very short grass grazed by sheep; collected with a net on unselected plants (TA14). 3-IX-1987: 5 juv.; 1 mounted. 20-VI-1990: 6 specimens; 1 juv. and 3 ad. mounted. — Prov. Tarragona, between Santa Coloma de Queralt and Les Piles, near Santa Coloma de Queralt, alt. 700 m; calcareous garrigue with some maritime pines, scattered vegetation with *Thymus vulgaris*, *Genista scorpius*, *Onobrychis caput-galli*, etc.; collected with a net on unselected plants (TA30). 20-VI-1990: 7 specimens; 2 juv. mounted. — Prov. Huesca, between Ontiñena and Candasnos, alt. 300 m; salty soil, collected on *Thymus vulgaris* with a net (HU21a). 21-VI-1990: 17 specimens; 2 juv. and 4 ad. mounted.

Deposit of material. — All the material of the original description was deposited in LEITT by Nayrolles (1987). — New material: MHNG: station HU21a, 21-VI-1990, 5 specimens in alcohol. — MNHN: station HU21a, 21-VI-1990, 3 specimens in alcohol. — ZMA: station HU21a, 21-VI-1990, 3 specimens in alcohol. — LEITT: the rest of the material.

Description

Concerning the appendicular chaetotaxic table, refer to *quinquefasciatus*' one, with the following differences:

Antennae. (AD)e+1 : ontogeny type T — (AT)e0 : ontogeny type (Q), oc = 0.8 — (AT)i+1 : ontogeny type T — The occurrences of H setae on M & B are: for Heae 1-1-1-0.9-0.4/0, for Hipi 1-0.9-0.1-0-0/0, and for Hppe 1-1-1-0.9-0.7/0. m(*h**) = 4.5 — n80%(*BM*) = 10-17 ; n80%(*B*) = 24-30 ; n80%(*G*) = 88-94.

Legs. (TI2)3a : ontogeny type (T)Q, oc = 0.8 — (TI2)4a1 : ontogeny type (T)Q, oc = 0.6 — (TI2)3p : ontogeny type (Q), oc = 0.3 — (TI2)4p1 : ontogeny type (Q), oc = 0.7 — (CX3)a : ontogeny type T — (TI3)4pi1 : ontogeny type (T)Q, oc = 0.5 — Obliquely truncated setae, on TI1: Iai, IIai, IIIai, IVai, IIpi, IIIpi, IVpi, IVi; on TI2: Iai, IIai, IIIai, IVai, IIpi, IIIpi, IVpi, IVi; on TI3: Iai, IIai, IIIai, IVai, Ipi, IIpi, IIIpi, IIIi, IVi.

Furcula. (MA)pe3 : ontogeny type (T)Q, oc = 0.8 — (DE)Vpe : ontogeny type (T)Q, oc = 0.5.

Development. — Number of juv. st. = 3.

Size ad. — ♂: 0.5 - 0.7 mm; ♀: 0.6 - 1.1 mm.

Color. — I give a supplement of the original diagnosis (NAYROLLES 1987). Very often four light spots take place behind the great abd., two being very lateral. The other two correspond to pure white spots probably composed of uric crystals. Their whiteness contrasts with the very dark background.

Great abd. — Trichobothria: A, B, and C in linear pattern. Dorsal setae: mesochaetae.

Antennae. — Antennal ratios: in ♀, ant. I : II : III : IV = 1 : 1.9 : 2.7 : 5.5 and ant. : ceph. diag. = 1.5 ; in ♂, ant. I : II : III : IV = 1 : 2.0 : 2.9 : 6.0 and ant. : ceph. diag. = 1.5. Chaetotaxic variables: for *G*: m = 90.0 / min = 85 / max = 95 ; m(*ISh**) = 0.74 ; m(*RSh*) = 0.48.

Head. — Eyes: 8+8; eyepatch with two setae. Cephalic setae: mesochaetae. 2+2 ov. org. behind the head. Labral formula: 6/5-5-4.

Legs. — Femur: cup present. Numbers of obliquely truncated setae on fore, meso and hindtibiotarsi: 8, 8, 9. Claw with a tooth on its inner crest. Empodial filament thick, S-curved, clavate, and overhanging the claw.

Ventral tube. — Sacs warty from 2nd st. 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 another one in ad.

Furcula. — In the original description of *F. cugnyi* (NAYROLLES 1987), the drawing of furcula corresponds to an aberrant specimens, so it being to be not considered.

Small abd. — Made up of abd. V + abd. VI. Trichobothria: D and E. Genital papilla of ♂ with 17-18 setae. An. app. spine-like, straight. Ratio an. app. : mucro = 0.58.

Fasciosminthurus raynalae (Nayrolles, 1987) (Figs 3-6; Table II)

Material

Type material as well as several specimens collected in June and July 1990 in the type station (Plateau of Aumar, Massif of Néouvielle, dép. Hautes-Pyrénées, France); collected with a net. 14 juv. and 17 ad. mounted.

Deposit of material. — All the material of the original description was deposited in LEITT by NAYROLLES (1987). — New material: MHNG: type station, 5-VII-1990, 5 specimens in alcohol. — LEITT: the rest of the material.

Description

Development. — Number of juv. st. = 3.

Size ad. — ♂: 0.45 - 0.55 mm; ♀: 0.5 - 0.7 mm.

Color. — Refer to the original description.

Great abd. — Trichobothria: A, B, and C in linear pattern. Dorsal setae: mesochaetae.

Antennae (figs 5-6). — Antennal ratios: in both sexes, ant. I : II : III : IV = 1 : 1.9 : 2.7 : 5.1; ant. : ceph. diag. = 1.5 in ♀ and 1.6 in ♂. Chaetotaxic variables: for *G*: m = 84.5 / min = 81 / max = 89 ; m(*ISh**) = 0.58 ; m(*RSh*) = 0.43.

Table II. Appendicular chaetotaxy of *Fasciosminthurus raynalae*

AP	Δ	—
AD	Π	—
	Δ	D: i0 T: i+1 Q: i-1, e+1, pe+1 Ai is a trichobothrium.
AT	Π	—
	Δ	Other setae: — oc(e-1) = 0.3

	Ge	Gae	Ga	Gai	Gi	Gpi	Gp	Gpe
Setae -1	(Q)	T		T	Q	Q	T	T
Setae 0		D	D	Q	D	D	T	D
Setae +1		Q		T	Q		Q	T

AQ	str		B is completely zoned. Section M euwhorled with 5 whorls. Right euwhorlation. Subsegmentation formula: 1 + 5 + 1 = (A) + (M1, 5) + (B). Right subsegmentation.
	A	Π	Alp
		H	Allleae, Alllppe
		Δ	Apical bulb: in part invaginated Subapical organ: very small D: Alai Allpe is a blunt microchaeta
	M & B	H	Occurrences of H setae on M & B: for Heae 1-1-1-1-0 / 0, for Hipi 0-1-1-0-0 / 0, and for Hppe 1-1-1-0-0 / 0. m(*h**) = 3.5.
		G	Setae of BB: P: BBe, BBae, BBa, BBp, BBpe / BA: complete whorl / n80%(*BM*) = 6-11 / n80%(*B*) = 18-24 / all G setae on M are present / n80%(*G*) = 82-88. BBae is a blunt microchaeta on large base. This seta undergoes a reduction size during its development. BBa is a cucumiform seta on large base.

SB	prc	—	—	—
	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: pe4	T: a5, pe2, Op Q: pe4	T: a5, ai2, pe2 Q: pe4, Oi
TI	V	Ia	Ia, Vp	Ia, IVp, Vp
	K	—	—	—
	FP	+	+	+
	Δ	T: 4ai1, Vai, Vpi, FSa, O2pe Q: 3a, 3p, 4a1, 4pi1, 4ai2, 4pi2, FSai, FSpi (Q): 4p1 (oc = 0.5) Ipi, Ip and Ipe are spatulate setae. Iai, IIai, IIpi, IIIai, IIIpi, IVai, IVpi are obliquely truncated setae.	T: 4ai1, 4i1, Vai, Vpi, FSa, O2pe Q: 3a, 4a1, 4pi1, 4ai2, FSai, FSpi (Q): 4pi2 (oc = 0.8) Ipi, Ip and Ipe are spatulate setae. Iai, IIai, IIpi, IIIai, IIIpi, IVai, IVi, IVpi are obliquely truncated setae.	T: 3ai, 3i, 4ai1, 4i1, Vai, Vpi, FSa, O2pe Q: 2a, 3a, 4a1, 4pi1, 4ai2, 4pi2, FSai, FSpi Ip and Ipe are spatulate setae. Iai, Ipi, IIai, IIpi, IIIai, IIIi, IIIpi, IVai, IVi are obliquely truncated setae.

MA	Π	—
	Δ	(T)Q: pe3 (oc = 0.4)
DE	Δ	Other setae: P: 2pe oc(VIpe) = 0.6

		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
	IV			P				P	P
	V						T	T	
	VI						Q		(T)Q
Whorl B		T		P			P	P	P

MU	Δ	Chaetotaxy: — Morphology: anterior lamella double, outer and inner lamellae smooth.

Head. — Eyes: 8+8; eyepatch with two setae. Cephalic setae: mesochaetae. No ov. org. behind the head. Labral formula: 6/5-5-4.

Legs (figs 3-4). — Femur: cup present. Numbers of obliquely truncated setae on fore, meso and hindtibiotarsi: 7, 8, 9. Claw with a tooth on its inner crest. Empodial filament thick, S-curved, clavate, and overhanging the claw.

Ventral tube. — Sacs probably warty from 2nd st. (unrealized observation). 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 another one in ad.

Furcula. — pe2 of manubrium lacking. Generatrix Gpi of dens with IIpi, IIIpi, and IVpi lacking; Vpe also lacking.

Small abd. — Made up of abd. V + abd. VI. Trichobothria: D and E. Genital papilla of ♂ with 18 setae. An. app. spine-like, rather long and curved in sagittal plane. Ratio an. app. : mucro = 0.8.

Fasciosminthurus longisetus n. sp. (Figs 7-20; Table III)

Material

Type material. — SPAIN, prov. Zaragoza, between Caspe and Candasnos, Refugio Cruz de San Vincente, alt. 300-400 m; very dry calcareous plateau with some scattered *Pinus halepensis*, and with *Rosmarinus officinalis*, *Stœhelina dubia*, *Pistacia lentiscus*, *Thymus vulgaris*, *Brachypodium ramosum*, *Phillyrea angustifolia*, *Quercus coccifera*, *Globularia alypum*, *Leuzea conifera*, etc.; collected with a net on unselected plants (SA25). 21-VI-1990. Syntypes: 428 specimens; 13 juv. and 11 ad. mounted.

Deposit of material. — MHNG: 50 specimens of the type material in alcohol. — MNHN: 50 specimens of the type material in alcohol. — ZMA: 50 specimens of the type material in alcohol. — LEITT: the rest of the material.

Description

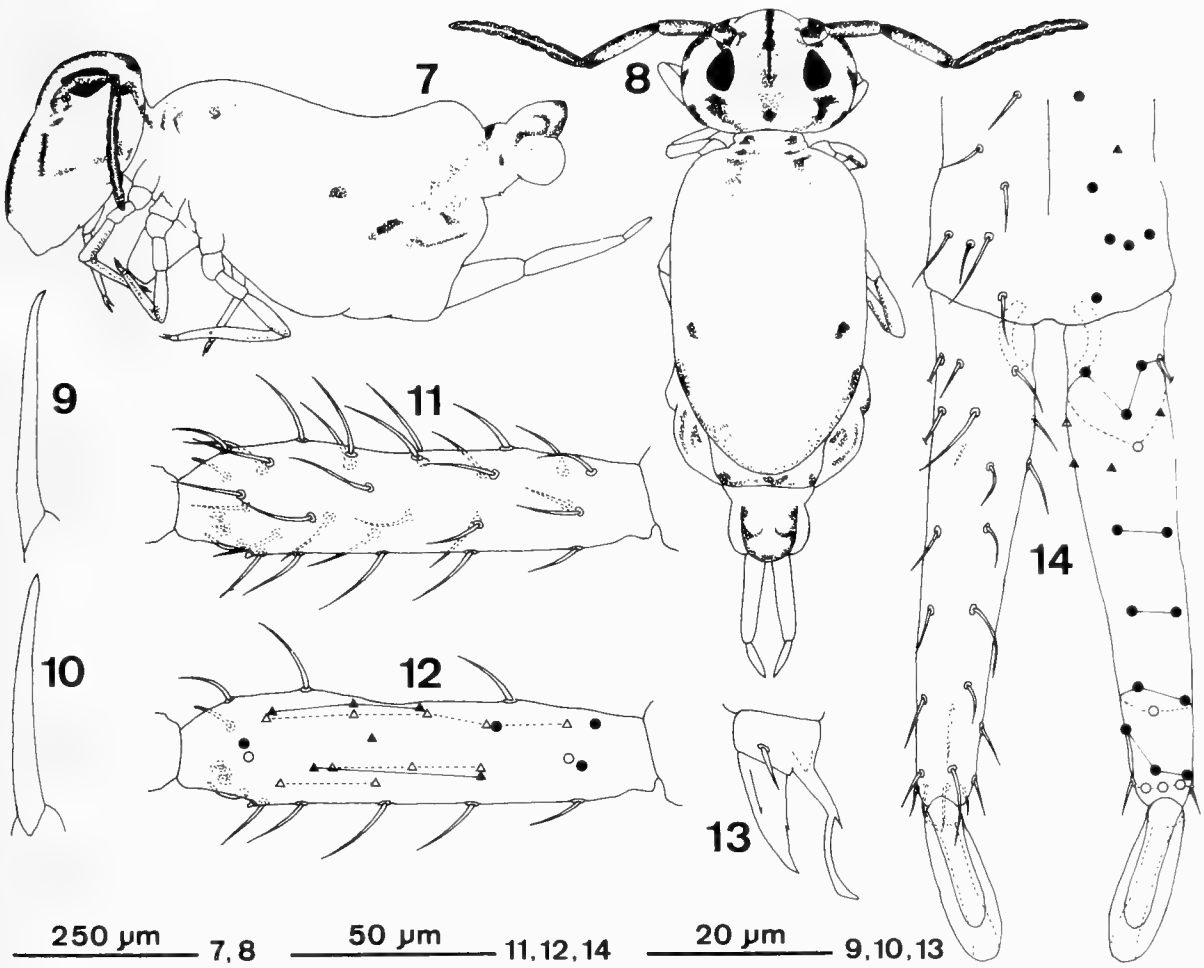
Development. — Number of juv. st. = 3.

Size ad. — ♂: 0.55 - 0.65 mm; ♀: 0.6 - 0.85 mm.

Color (figs 7-8). — Background yellowish white with black or very dark brown spots. Postero-lateral area of great abd. with some elongated flecks. Small abd. with a transversal median fleck and two lateral spots on abd. V. Upper anal flap with a pair of lateral stripes joining behind each other, and in their half making each a pointed forward hook-shaped patch. Head with three longitudinal stripes: one being median, the other two broken by eyes. Direction of lateral stripes changes below eyes in an exterior curving. The median stripe reaches labrum, and above eyes broadens and lightens with brown-ochre. Three first antennal segments black flecked, the fourth dark brown. Eyepatches black. Some traces of pigment on legs. Furcula unpigmented. Very often adults have their great abd. with white marks made up of uric crystals.

Great abd. — Rather long with the back concave. Trichobothria: A, B, and C in linear pattern. Dorsal setae: mesochaetae.

Antennae (figs 11-12). — Antennal ratios: in ♀, ant. I : II : III : IV = 1 : 2.0 : 2.7 : 5.5 and ant. : ceph. diag. = 1.7 ; in ♂, ant. I : II : III : IV = 1 : 2.0 : 2.7 : 5.9 and ant. :



FIGS 7-14

Fasciosminthurus longisetus n. sp. ad.; 7-8: habitus ♀; 9: an. app., lateral view; 10: an. app., frontal view; 11: ant. III, anterior view; 12: schematic representation of fig. 11, same legend as in fig. 6; 13: forepraetarsus, anterior view; 14: 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 ring for a primary seta, a triangle for a secondary seta. On the dens, for the whorls I to IV and B, the setae belonging to a same whorl are linked together by a line which is continuous on the posterior side and discontinuous on the other side.

ceph. diag. = 1.8. Chaetotaxic variables: for *G*: m = 79.5 / min = 78 / max = 83 ; m(*ISh**) = 0.33 ; m(*RSh*) = 0.30.

Head. — Eyes: 8+8; eyepatch with two setae. Cephalic setae: mesochaetae. No ov. org. behind the head. Labral formula: 6/5-5-4.

Legs (figs 13 & 15-20). — Femur: cup present. Special curved shape of meso and hindtibiotarsi. Numbers of obliquely truncated setae on fore, meso and hindtibiotarsi: 7, 8, 9. Setae on outer side of meso and hindtibiotarsi undergo an increasing heterochaetosis occurring in 1st molt. Claw with a small tooth on its inner crest. Empodial filament thick, curved on one direction, overhanging the claw, and with a subterminal thickening.

Table III. Appendicular chaetotaxy of *Fasciosminthurus longisetus* n. sp.

AP	Δ	—
AD	Π	—
	Δ	D: i0 T: i+1, e+1 Q: pe+1 (Q): i-1 (oc = 0.8) Ai is a trichobothrium.
AT	Π	—
	Δ	Other setae: Q: pe+2 (Q): pe+3 (oc = 0.6) oc(ai-1) = 0.8

	Ge	Gae	Ga	Gai	Gi	Gpi	Gp	Gpe
Setae -1	Q	T		(T)Q	Q	T	T	T
Setae 0		D	D		D	D	T	D
Setae +1		Q		Q	Q		Q	T

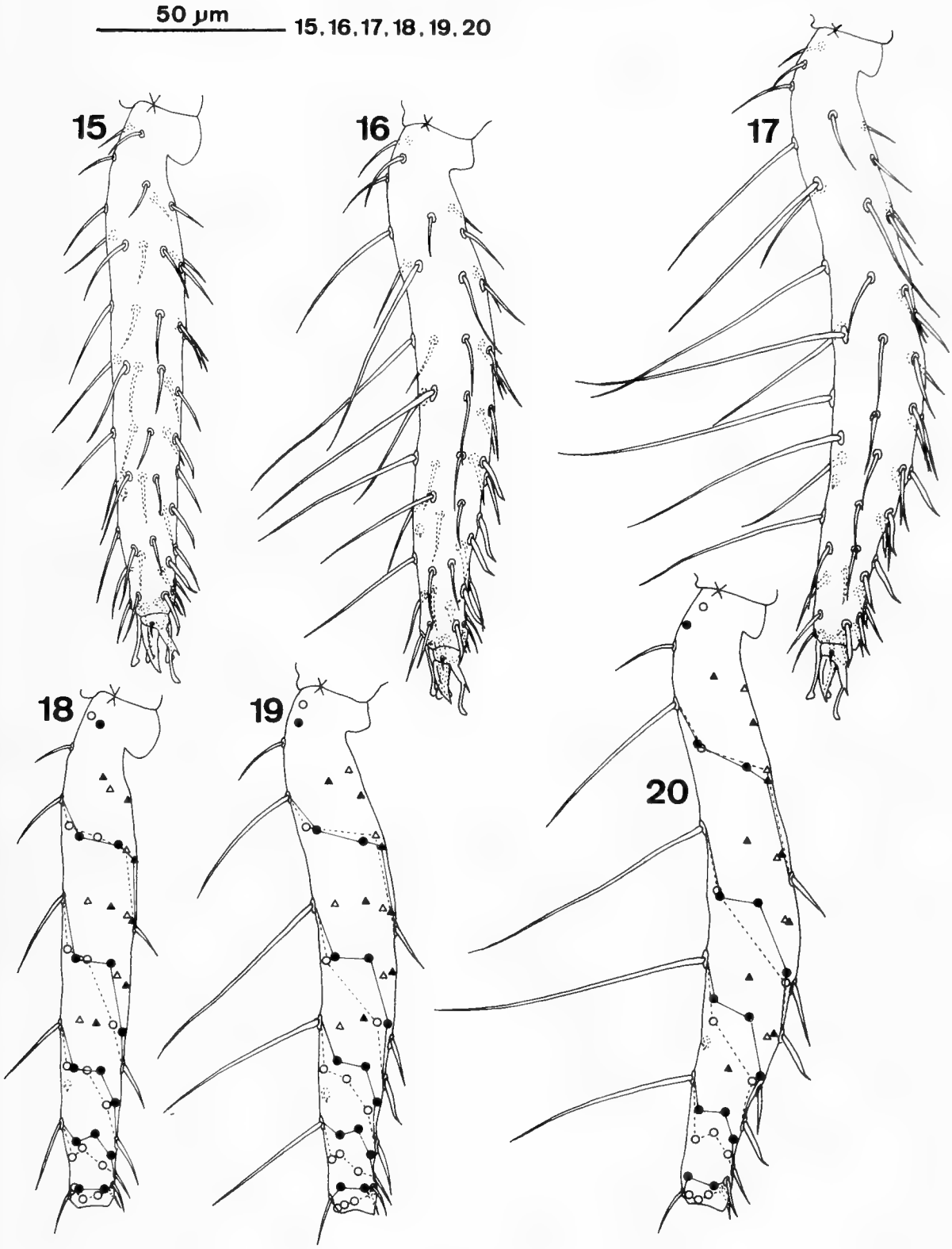
AQ	str		B is completely zoned. Section M euwhorled with 5 whorls. Right euwhorlation. Subsegmentation formula: 1 + 5 + 1 = (A) + (M1, 5) + (B). Right subsegmentation.
	A	Π	AIp
		H	AIIIeae, AIIIppe
		Δ	Apical bulb: jointed to the apex Subapical organ: very small D: AIai AIIpe is a blunt microchaeta
	M & B	H	Occurrences of H setae on M & B: for Heae 1-1-1-0-0/0, for Hipi 1-1-0-0-0/0, and for Hppe 1-0-0-0-0/0. m(*h**) = 2.0.
		G	Setae of BB: P: BBe, BBae, BBa, BBp, BBpe / BA with several variable setae / n80%(*BM*) = 4-6 / n80%(*B*) = 15-18 / some G setae on M are sometimes absent / n80%(*G*) = 78-82. BBae is a blunt microchaeta on large base. This seta undergoes a reduction size during its development. BBa is a cucumiform seta on large base.

SB	prc	—	—	—
	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: ai2, Oi1 (T)Q: a (oc = 0.3)
TR	Π	—	—	—
	Δ	T: Oi1, Oi2	T: Oi1, Oi2 Q: ae, a2	T: a2, Oi1, Oi2 Q: ae
FE	Π	—	—	pe1
	Δ	delayed primordial seta: Q: ae3 T: pe2, Op Q: pe4 (Q): ai2 (oc = 0.6)	T: a5, pe2, Op Q: ai2, pe4	T: a5, ai2, pe2 Q: ai4, pe4, Oi (Q): ai3 (oc = 0.6)
TI	V	Ia	Ia, IVp, Vp	Ia, IIIp, IVp, Vp
	K	—	—	—
	FP	+	+	+
	Δ	T: 4ai1, Vai, Vpi, FSa Q: 3a, 3p, 4a1, 4pi1, 4p1, 4ai2, 4pi2, FSai, FSpi, O2pe Ipi, Ip and Ipe are spatulate setae. Iai, IIai, IIpi, IIIai, IIIpi, IVai, IVpi are obliquely truncated setae.	T: 4ai1, 4i1, Vai, Vpi, FSa Q: 3a, 3p, 4a1, 4pi1, 4p1, 4ai2, 4pi2, FSai, FSpi, O2pe Ipi, Ip and Ipe are spatulate setae. Iai, IIai, IIpi, IIIai, IIIpi, IVai, IVi, IVpi are obliquely truncated setae. IIe, IIIe, IVe, Ve, IIIae, IVae, Vae of male and IIIe, IVe, IVae, Vae of female are macrochaetae.	T: 3ai, 3i, 4ai1, 4i1, Vai, Vpi, FSa Q: 2a, 3a, 3pi, 4a1, 4pi1, 4ai2, 4pi2, FSai, FSpi, O2pe Ip and Ipe are spatulate setae. Iai, Ipi, IIai, IIpi, IIIai, IIIi, IIIpi, IVai, IVi are obliquely truncated setae. IIe, IIIe, IVe, Ve, IIIae, IVae, Vae of male and IIe, IIIe, IVe, IIIae, IVae, Vae of female are macrochaetae.

MA	Π	—
	Δ	Q: pe3
DE	Δ	Other setae: — oc(Vp) = 0.7 oc(Be) = 0.7

		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
	III							P	P
	IV							P	P
	V						T	(T)Q	
	VI						Q		Q
Whorl B		(Q)		P			P	P	P

MU	Δ	Chaetotaxy: — Morphology: anterior lamella double, outer and inner lamellae smooth.



FIGS 15-20

Fasciosminthurus longisetus n. sp. ad. ♂; 15: praetarsus and tibiotarsus of foreleg, anterior view; 16: praetarsus and tibiotarsus of mesoleg, anterior view; 17: praetarsus and tibiotarsus of hindleg, anterior view; 18: schematic representation of fig. 15, same legend as in fig. 2; 19: schematic representation of fig. 16, same legend as in fig. 2; 20: schematic representation of fig. 17, same legend as in fig. 2.

Ventral tube. — Sacs very slightly warty from 1st st., and wholly warty from 2nd. 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 sometimes (2 cases out of 10) another one in ad.

Furcula (fig. 14). — On manubrium pe2 lacking. The paurochaetosis of the dental chaetotaxy is remarkable, the following setae are lacking: IIpi, IIIpi, IVpi, Vpe, IIae, IIIa, IVa, and 2pe.

Small abd (figs 9-10). — Made up of abd. V + abd. VI. Trichobothria: D and E. Genital papilla of ♂ with 14-16 setae. An. app. spine-like, straight, rather short. Ratio an. app. : mucro = 0.50.

Etymology

longisetus with reference to the long macrochaetae on meso and hindtibiotarsi.

Discussion

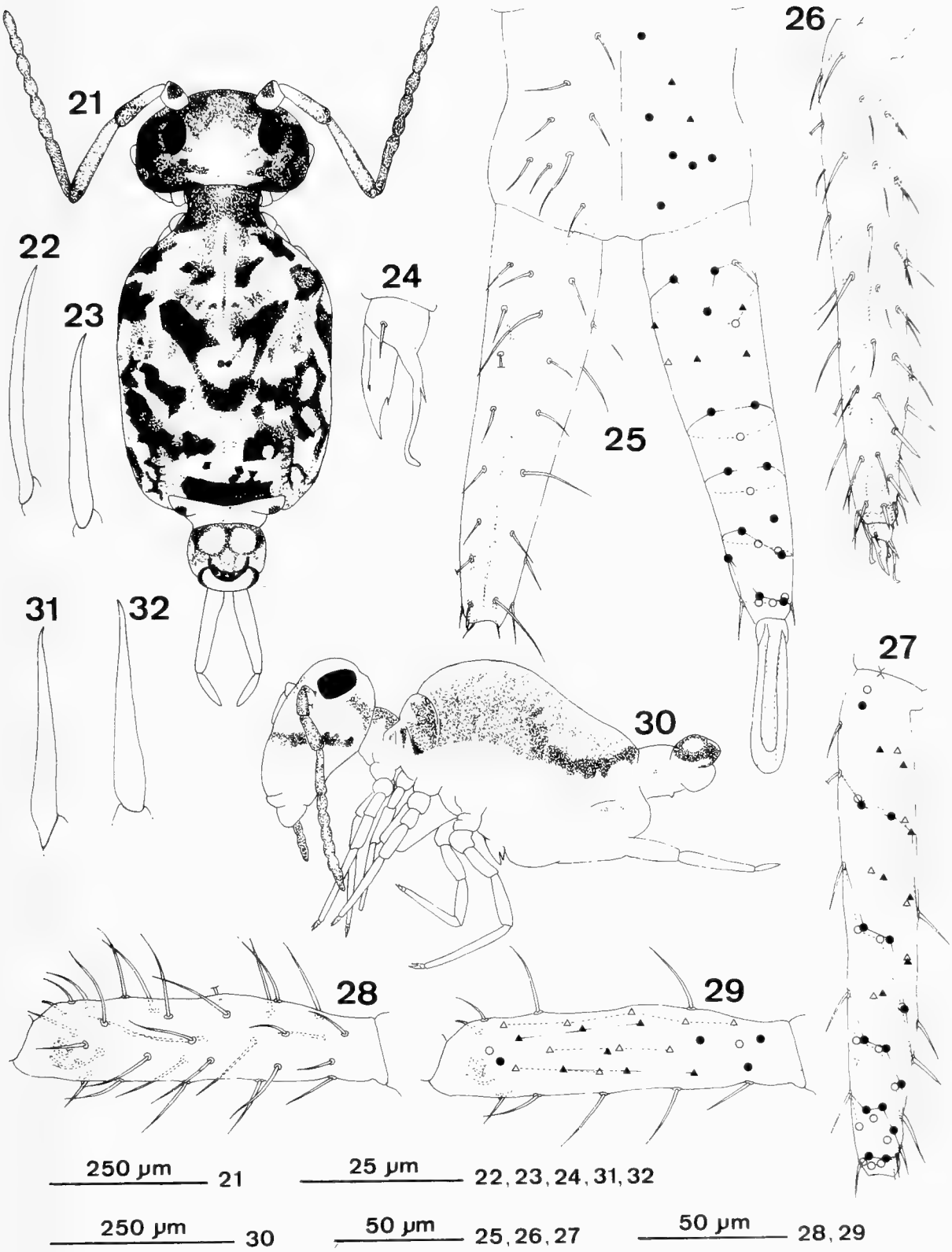
Fasciosminthurus longisetus n. sp. is easily distinguishable from all the other species of its genus by the presence of long macrochaetae on meso and hindtibiotarsi. The coloring as well as the concave form of its back allow to recognize this species with the lens.

Fasciosminthurus bedosae n. sp. (Figs 21-29; Table IV)

Material

Type material. — SPAIN, prov. Huesca, between Ontiñena and Candasnos, alt. 300 m; salty soil, collected on *Thymus vulgaris* with a net (HU21a). 21-VI-1990. Syntypes: 86 specimens; 10 juv., 3 ♀, and 3 ♂ mounted.

Other material. — SPAIN, prov. Huesca, road between Seira and Barbaruéns, alt. near 800 m; steppic vegetation on calcareous clay, with *Genista scorpius*, *Aphyllanthes monspeliensis*, *Bupleurum rigidum*, *Thymus vulgaris*, *Kœleria valesiaca*, *Buxus sempervirens*, *Arrhenaterum elatius*, *Leuzea conifera*, etc.; collected with a net on unselected plants (HU15). 31-VII-1987: 3 ad.; 1 ♂ and 1 ♀ mounted. — Prov. Huesca, road C1310 near Sesa, alt. near 400 m; short meadow of *Brachypodium ramosum* with *Lavandula vera*, *Thymus vulgaris*, *Festuca* sp, *Genista scorpius*, etc.; collected with a net on unselected plants (HU22). 1-VIII-1987: 6 ad.; 1 ♀ mounted. — Prov. Barcelona, between Súria and Balsareny, alt. 400 m; very open pinewood with *Rosmarinus officinalis*, *Thymus vulgaris*, *Lavandula latifolia*, *Dorycnium pentaphyllum*, *Brachypodium phœnicoides*, etc.; collected with a net on unselected plants (BA12). 3-IX-1987: 1 juv. and 1 ♀; 1 juv. mounted. — Prov. Zaragoza, between Fraga and Caspe near Mequinenza, alt. 200 m; garrigue with *Brachypodium ramosum*, *Pistacia lentiscus*, *Rosmarinus officinalis*, *Juniperus phœnicea*, *Echinops sp*, *Aristolochia pistolochia*, etc.; collected with a net on unselected plants (SA1). 15-VI-1987: 1 juv. mounted. 20-VI-1990: 15 juv. — Prov. Zaragoza, between Zuera and Las Pedrosas, near Zuera, alt. near 300 m; calcareous garrigue with *Brachypodium ramosum*, *Dorycnium pentaphyllum*, *Thymus vulgaris*, *Quercus coccifera*, *Pinus halepensis*, *Juniperus oxycedrus*, etc.; collected with a net on unselected plants (SA5). 15-VI-1987: 5 ad.; 1 ♂ and 1 ♀ mounted. — Prov. Zaragoza, between Erla and Valpalmas, near Erla, alt. near 450 m; calcareous garrigue with *Brachypodium ramosum*, *Rosmarinus officinalis*, *Thymus vulgaris*, *Genista scorpius*, *Buxus sempervirens*, etc.; collected with a net on unselected plants (SA6). 15-VI-1987: 1 juv. mounted. — FRANCE, dép. Pyrénées Orientales, near Pézilla-de-Conflent, alt. 350 m;



FIGS 21-32

Figs 21-29: *Fasciosminthurus bedosae* n. sp. ad.; 21: habitus ♀; 22: an. app., lateral view; 23: an. app., frontal view; 24: mesopraetarsus, anterior view; 25: furcula, posterior view, schematic representation with the same legend as in fig. 14; 26: praetarsus and tibiotarsus of mesoleg, anterior view; 27: schematic representation of fig. 26, same legend as in fig. 2; 28: ant. III, anterior view; 29: schematic representation of fig. 28, same legend as in fig. 6.

Figs 30-32: *Fasciosminthurus cassagnaui* n. sp. ad.; 30: habitus ♀; 31: an. app., lateral view; 32: an. app., frontal view.

Table IV. Appendicular chaetotaxy of *Fasciosminthurus bedosae* n. sp.

AP	Δ	—
AD	Π	—
	Δ	D: i0 T: i+1 Q: i-1, e+1, pe+1 Ai is a trichobothrium.
AT	Π	—
	Δ	Other setae: Q: pe+2, pe+3 oc(ae+1) = 0.6

	Ge	Gae	Ga	Gai	Gi	Gpi	Gp	Gpe
Setae -1	Q	T		T	Q	T	T	T
Setae 0		D	D	Q	D	D	T	D
Setae +1		(T)Q		T	T		Q	T

AQ	str		B is completely zoned. Section M euwhorled with 5 whorls. Right euwhorlation. Subsegmentation formula: 1 + 5 + 1 = (A) + (M1, 5) + (B). Right subsegmentation.
	A	Π	AIp
		H	AIIIeae, AIIIppe
		Δ	Apical bulb: in part invaginated 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 1-1-0-0-0 / 0, and for Hppe 1-1-0.9-0.1-0 / 0. m(*h*") = 3.5.
		G	Setae of BB: P: BBe, BBae, BBa, BBp, BBpe / BA with several variable setae / n80%(*BM*) = 8-13 / n80%(*B*) = 20-25 / all G setae on M are present / n80%(*G*) = 84-91. BBae is a blunt microchaeta on large base. This seta undergoes a reduction size during its development. BBa is a cucumiform seta on large base.

SB	prc	—	—	—
	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, pe2, Op Q: ai2, pe4	T: a5, ai2, pe2 Q: ai3, ai4, pe4, Oi
TI	V	Ia	Ia, Vp	Ia, IVp, Vp
	K	—	—	—
	FP	+	+	+
	Δ	T: 4ai1, Vai, Vpi, FSa Q: 3a, 3p, 4a1, 4pi1, 4p1, 4ai2, FSai, FSpi, O2pe (Q): 4pi2 (oc = 0.8) Ipi, Ip and Ipe are spatulate setae. Iai, IIai, IIpi, IIIai, IIIpi, IVai, IVpi are obliquely truncated setae.	T: 4ai1, 4i1, Vai, Vpi, FSa Q: 3a, 3p, 4a1, 4pi1, 4p1, 4ai2, 4pi2, FSai, FSpi, O2pe Ipi, Ip and Ipe are spatulate setae. Iai, IIai, IIpi, IIIai, IIIpi, IVai, IVi, IVpi are obliquely truncated setae.	T: 3ai, 3i, 4ai1, 4i1, Vai, Vpi, FSa Q: 2a, 3a, 3pi, 4a1, 4pi1, 4ai2, 4pi2, FSai, FSpi, O2pe (Q): 3p (oc = 0.6), 4p1 (oc = 0.5) Ip and Ipe are spatulate setae. Iai, Ipi, IIai, IIpi, IIIai, IIIi, IIIpi, IVai, IVi are obliquely truncated setae.

MA	Π	—
	Δ	(T)Q: pe3 (oc = 0.7) Q: pe2
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
	IV			P				P	P
	V						T	T	Q
	VI						Q		T
Whorl B		T		P			P	P	P

MU	Δ	Chaetotaxy: — Morphology: anterior lamella double, outer and inner lamellae smooth.

calcareous garrigue with *Quercus ilex*, *Quercus coccifera*, *Lavandula latifolia*, *Bupleurum fruticosum*, *Brachypodium ramosum*, *Cistus albidus*, *Cneorum tricoccum*, *Ruta angustifolia*, *Leuzea conifera*; *Thymus vulgaris*, etc.; collected with a net on unselected plants (PO16). 24-VI-1987: 1 juv. mounted.

Deposit of material. — MHNG: 15 specimens of the type material in alcohol. — MNHN: 15 specimens of the type material in alcohol. — ZMA: 15 specimens of the type material in alcohol. — LEITT: the rest of the material.

Description

Development. — Number of juv. st. = 3.

Size ad. — ♂: 0.45 - 0.55 mm; ♀: 0.55 - 0.8 mm.

Color (fig. 21). — Merging of white and more or less dark gray. The dark color is well-developed on the flanks of great abd.; flecks on the back being lighter with brown-ochre shades. These flecks going on darker in old specimens and they stand out against pure white spots made up of uric crystals. Dark gray flecks and black flecks are placed side by side forming a variable between specimens pattern. Small abd. with one pair of latero-dorsal small dark spots on abd. V, and with generally a median spot. Upper anal flap dark with a pair of circular light spots. Head with the median and most dorsal area white and with orangey tint between antennae, the rest of the head being rather dark. Eyepatches black, antennae brown, legs and furcula without pigment.

Great abd. — Trichobothria: A, B, and C in linear pattern. Dorsal setae: mesochaetae.

Antennae (figs 28-29). — Antennal ratios: in ♀, ant. I : II : III : IV = 1 : 1.9 : 2.9 : 6.0 and ant. : ceph. diag. = 1.6 ; in ♂, ant. I : II : III : IV = 1 : 1.9 : 2.9 : 6.4 and ant. : ceph. diag. = 1.6. Chaetotaxic variables: for *G*: m = 86.8 / min = 83 / max = 91 ; m(*ISh**) = 0.58 ; m(*RSh*) = 0.41.

Head. — Eyes: 8+8; eyepatch with two setae. Cephalic setae: mesochaetae. 2+2 ov. org. behind the head. Labral formula: 6/5-5-4.

Legs (figs 24 & 26-27). — Femur: cup present. Numbers of obliquely truncated setae on fore, meso and hindtibiotarsi: 7, 8, 9. Claw with a tooth on its inner crest. Empodial filament thick, S-curved, overhanging the claw, and with a slight subterminal thickening.

Ventral tube. — Sacs very slightly warty at basis from 1st st., and wholly warty from 2nd. 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 sometimes (4 cases out of 10) another one in ad.

Furcula (fig. 25). — Generatrix Gpi on dens with IIpi, IIIpi and IVpi lacking.

Small abd (figs 22-23). — Made up of abd. V + abd. VI. Trichobothria: D and E. Genital papilla of ♂ with 18 setae. An. app. spine-like, straight. Ratio an. app. : mucro = 0.54.

Etymology

This species is dedicated to Dr. A. Bedos.

Discussion

Into the *Fasciosminthurus* genus, the seta (DE)IIpi is always lacking in the following species* : *sauteri* (Nayrolles & Lienhard, 1990), *raynalae* (Nayrolles, 1987), *virgulatus* (Skorikow, 1899), *albanicus* (Stach, 1956), *pontignanoi* Bretfeld, 1992, stat. Nayrolles, 1993, *longisetus* n. sp., *bedosae* n. sp., and *cassagnaui* n. sp. Among these species, only *bedosae* has 2+2 ov. org. behind the head (considerations based on BRETFELD's observations (1990, 1992), on observations included in the present paper, and on unpublished data for *sauteri*). The coloring also allows to distinguish this species.

Fasciosminthurus cassagnaui n. sp. (Figs 30-32; Table V)

Material

Type material. — SPAIN, prov. Lérida, between Coll de Nargó and Collado de Bóixols, alt. 900 m; calcareous garrigue with many *Aphyllanthes monspeliensis* and *Thymus vulgaris*, and few *Lavandula latifolia*; collected with a net on unselected plants (LE24). 19-VI-1990. Syntypes: 3 juv. and 10 ad.; 3 juv., 1 ♂, and 1 ♀ mounted.

Other material. — Same station. 30-V-1990: 2 juv., 2 ♂, and 4 ♀; all the ad. and 1 juv. mounted. — Prov. Barcelona, between Tona and Puerto de la Pollosa, alt. 750 m; scattered vegetation on calcareous clay, with *Thymus vulgaris*, *Festuca sp*, *Lavandula latifolia*, *Linum salsoloides*, *Aphyllanthes monspeliensis*, etc.; collected with a net on unselected plants (BA5). 25-VI-1987: 1 juv. and 5 ad.; 1 juv., 1 ♂, and 1 ♀ mounted. — Prov. Tarragona, between Vilalba dels Arcs and La Fatarella, alt. 500 m; steppic vegetation with *Bromus madritensis* and *Brachypodium ramosum*; collected with a net on unselected plants (TA7a). 2-IX-1987: 3 ad.; 1 ♂ mounted. 20-VI-1990: 4 ♀, 1 mounted. — Prov. Tarragona, between El Pla de Santa Maria and El Pont d'Armentera, alt. near 400 m; scattered very short grass grazed by sheep; collected with a net on unselected plants (TA14). 20-VI-1990: 1 juv., 1 ♂, and 1 ♀; 1 juv. mounted. — FRANCE, dep. Var, district Le Cannet-des-Maures, track between La Grande Pièce and La Basse Verrerie, alt. 70 m; short garrigue, steppic vegetation with some maritime pines and holm oaks, graminae and *Lavandula stœchas*, *Cistus salviæfolius*, *Cistus monspeliensis*, etc.; collected with a net on unselected plants (VA5). 13-VI-1992: 127 specimens; 1 juv. mounted.

Deposit of material. — MHNG: station VA5, 13-VI-1992, 20 specimens in alcohol. — MNHN: station VA5, 13-VI-1992, 20 specimens in alcohol. — ZMA: station VA5, 13-VI-1992, 20 specimens in alcohol. — LEITT: the rest of the material.

Description

Development. — Number of juv. st. = 3.

Size ad. — ♂: 0.5 mm; ♀: 0.5 - 0.6 mm.

Color (fig. 30). — Great abd. with two juxtaposed contrasted colors: white or yellow on ventral side, and gray – more or less dark and more or less tinged with

* This character is the 11th in BRETFELD's list (1992, p. 27), it is noted "Dens row J". In BRETFELD's system (see BRETFELD 1990) "2..1" means that BRETFELD's row J bears two basal setae and, aside from the distal whorl, only one apical seta, this apical seta, J1 in BRETFELD's system, being my Ipi seta (see NAYROLLES 1990). Remark that Bretfeld's seta J0 is included in the apical whorl (setae of this whorl being numbered 0 by BRETFELD) and corresponds to my seta Ii. "2..2" means that BRETFELD's row J bears two basal and, aside from the distal whorl, two apical setae, the second apical seta, J2 for BRETFELD, being my IIpi seta. Thus, the state written "2..1" by BRETFELD corresponds to the absence of IIpi, and *virgulatus*, *albanicus* and *pontignanoi* have the "2..1" state in BRETFELD's list.

Table V. Appendicular chaetotaxy of *Fasciosminthurus cassagnaui* n. sp.

AP	Δ	—
AD	Π	—
	Δ	D: i0 T: i+1 (T)Q: e+1 (oc = 0.3) Q: i-1, pe+1 Ai is a trichobothrium.
AT	Π	—
	Δ	Ge Gae Ga Gai Gi Gpi Gp Gpe Setae -1: Q T T Q (T)Q T T Setae 0: D D Q D D T D Setae +1: Q T (T)Q Q T Other setae: Q: pe+2, pe+3 oc(pi-1) = 0.8 oc(i+1) = 0.5
AQ	str	B is completely zoned. Section M euwhorled with 5 whorls. Right euwhorlation. Subsegmentation formula: 1 + 5 + 1 = (A) + (M1, 5) + (B). Right subsegmentation.
	A Π	Alp
	A H	Allleae, Alllppe
	A Δ	Apical bulb: in part invaginated Subapical organ: very small D: Alai Allpe is a blunt microchaeta
	M & B H	Occurrences of H setae on M & B: for Heae 1-1-1-1-0 / 0, for Hipi 1-1-0-0-0 / 0, and for Hppe 1-1-0.3-0-0 / 0. m(*h**) = 3.2.
	M & B G	Setae of BB: P: BBe, BBae, BBa, BBp, BBpe / BA with several variable setae / n80%(*BM*) = 8-11 / n80%(*B*) = 19-23 / all G setae on M are present / n80%(*G*) = 83-88. BBae is a blunt microchaeta on large base. This seta undergoes a reduction size during its development. BBa is a cucumiform seta on large base.

SB	prc	—	—	—
	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: ai2, Oi1 (T)Q: a (oc = 0.8)
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, pe2, Op Q: ai2, pe4	T: a5, ai2, pe2 Q: ai3, pe4, Oi (Q): ai4 (oc = 0.8)
TI	V	Ia	Ia, Vp	Ia, IVp, Vp
	K	—	—	—
	FP	+	+	+
	Δ	T: 4ai1, Vai, Vpi, FSa Q: 3a, 3p, 4a1, 4pi1, 4p1, 4ai2, FSai, FSpi, O2pe (Q): 4pi2 (oc = 0.5) Ipi, Ip and Ipe are spatulate setae. Iai, IIai, IIpi, IIIai, IIIpi, IVai, IVpi are obliquely truncate setae.	T: 4ai1, 4i1, Vai, Vpi, FSa Q: 3a, 3p, 4a1, 4pi1, 4p1, 4ai2, FSai, FSpi, O2pe (Q): 4pi2 (oc = 0.6) Ipi, Ip and Ipe are spatulate setae. Iai, IIai, IIpi, IIIai, IIIpi, IVai, IVi, IVpi are obliquely truncated setae.	T: 3ai, 3i, 4ai1, 4i1, Vai, Vpi, FSa Q: 2a, 3a, 3p, 4a1, 4pi1, 4ai2, FSai, FSpi, O2pe (Q): 3pi (oc = 0.8), 4pi2 (oc = 0.8), 4p1 (oc = 0.2) Ip and Ipe are spatulate setae. Iai, Ipi, IIai, IIpi, IIIai, IIIi, IIIpi, IVai, IVi are obliquely truncated setae.

MA	Π	—
	Δ	(T)Q: pe3 (oc = 0.5) (Q): pe2 (oc = 0.6)
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 III P P P P IV P P P P V (T)Q T (Q) VI Q (T)Q Whorl B T P P P P Other setae: P: 2pe oc(Vpi) = 0.5 oc(Vpe) = 0.5 oc(VIpe) = 0.5
MU	Δ	Chaetotaxy: — Morphology: anterior lamella double, outer and inner lamellae smooth.

yellow – on dorsal side. Two small spots, in very lateral position, on furcular segment. Small abd. with often a pair of latero-dorsal spots on abd. V. Upper anal flap showing a gray background with three light spots: two at basis with circular shape and marked outline, and one less well delimited at apex. Head light with a transversal gray stripe under antennae, a pair of gray spots behind eyes, and orangey ochre between antennae. Eyepatches black, antennae gray-brown, legs and furcula white.

Great abd. — Trichobothria: A, B, and C in linear pattern. Dorsal setae: mesochaetae.

Antennae. — Antennal ratios near the same in both sexes, ant. I : II : III : IV = 1: 2.0 : 2.9 : 6.5 and ant. : ceph. diag. = 1.6. Chaetotaxic variables: for *G*: m = 84.8 / min = 82 / max = 89 ; m(*ISh**) = 0.53 ; m(*RSh*) = 0.39.

Head. — Eyes: 8+8; eyepatch with two setae. Cephalic setae: mesochaetae. No ov. org. behind the head. Labral formula: 6/5-5-4.

Legs. — Femur: cup present. Numbers of obliquely truncated setae on fore, meso and hindtibiotarsi: 7, 8, 9. Claw with a tooth on its inner crest. Empodial filament thick, S-curved, overhanging the claw, and with a slight subterminal thickening.

Ventral tube. — Sacs smooth at 1st st. and warty from 2nd. 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 another one in ad.

Furcula. — Generatrix Gpi on dens with IIpi, IIIpi and IVpi lacking.

Small abd (figs 31-32). — Made up of abd. V + abd. VI. Trichobothria: D and E. Genital papilla of ♂ with 16-18 setae. An. app. spine-like, straight, sharply thickened at basis. Ratio an. app. : mucro = 0.61.

Etymology

This species is dedicated to Pr. P. Cassagnau.

Discussion

Among the species of *Fasciosminthurus*, two show a thickened an. app., they are: *F. cassagnaui* n. sp. and, from BRETFELD 's redescription (1992), *F. circumfasciatus* (Stach, 1956). Coloring as well as two other criteria allow to separate these species: *circumfasciatus* has 2+2 ov. org. behind the head and (DE)IIpi present, whereas *cassagnaui* has no ov. org. behind the head nor the seta (DE)IIpi.

RÉSUMÉ

Nous complétons la description des espèces de *Fasciosminthurus* suivantes: *F. cugnyi* (Nayrolles, 1987), *F. quinquefasciatus* (Krausbauer, 1902) et *F. raynalae* (Nayrolles, 1987). Trois nouvelles espèces sont décrites: *F. bedosae* n. sp., *F. cassagnaui* n. sp. et *F. longisetus* n. sp.

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Nouveaux Campodéidés endogés de Thaïlande

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New endogean Campodeidae from Thailand. - *Apistocampa leclerci* a new genus and species, and four other new species belonging to the genera *Cocytocampa* sp., *Eutrichocampa* sp. and *Lepidocampa* sp. are described from endogean biotopes in Thailand, in spite of the poor condition of most specimens, because very few is known about Campodeids in this part of the world.

INTRODUCTION

Au cours de missions étalées de 1980 à 1986, L. Deharveng, A. Gouze et P. Leclerc ont récolté de nombreux Campodéidés dans l'humus forestier, sous des rochers ou des pierres enfoncées dans le sol, notamment au voisinage d'entrées de grottes sous couvert forestier, et dans la litière superficielle et plus sèche. Parmi de nombreux *Lepidocampa* du complexe de *weberi* Oudemans qui représentent la majorité, et parfois la totalité, des récoltes dans les zones intertropicales, 5 espèces inédites ont été découvertes, réparties entre 4 genres, dont un nouveau. Ces espèces ne sont malheureusement représentées que par 1, 2 ou 5 spécimens chacune (10 individus au total) souvent en fort mauvais état: épilés en partie et mutilés (cerques, antennes, pattes). Leur originalité et plus encore le caractère rudimentaire de nos connaissances sur cette province zoologique nous ont incité à décrire ces espèces qui ont en commun des processus télotarsaux lamellaires et pubescents, les 3 Campodéinés rejoignant ainsi les 2 Lepidocampinés, sous-famille dans laquelle ce type de processus est le seul représenté.

Tous les spécimens sont déposés au Muséum d'Histoire naturelle de Genève, Département des Arthropodes et d'Entomologie II.

Manuscrit accepté le 12.10.1993.

DESCRIPTIONS

Apistocampa n. gen.

Les caractères du genre sont ceux de la seule espèce connue. On retiendra en particulier la présence de 3 macrochètes tergaux aux fémurs II et III; la duplication des macrochètes latéraux antérieurs du mésonotum et la présence d'une paire de ces macrochètes au métanotum; trois paires de macrochètes latéraux postérieurs au méso- et deux au métanotum, le pronotum conservant les trois paires de macrochètes de la plupart des Campodéidés. Cette combinaison de caractères est unique et justifie l'établissement du nouveau genre proposé.

Espèce type: *leclerci* n. sp., par monotypie.

Etymologie: du grec *apistos*, incroyable et, par extension, inespéré.

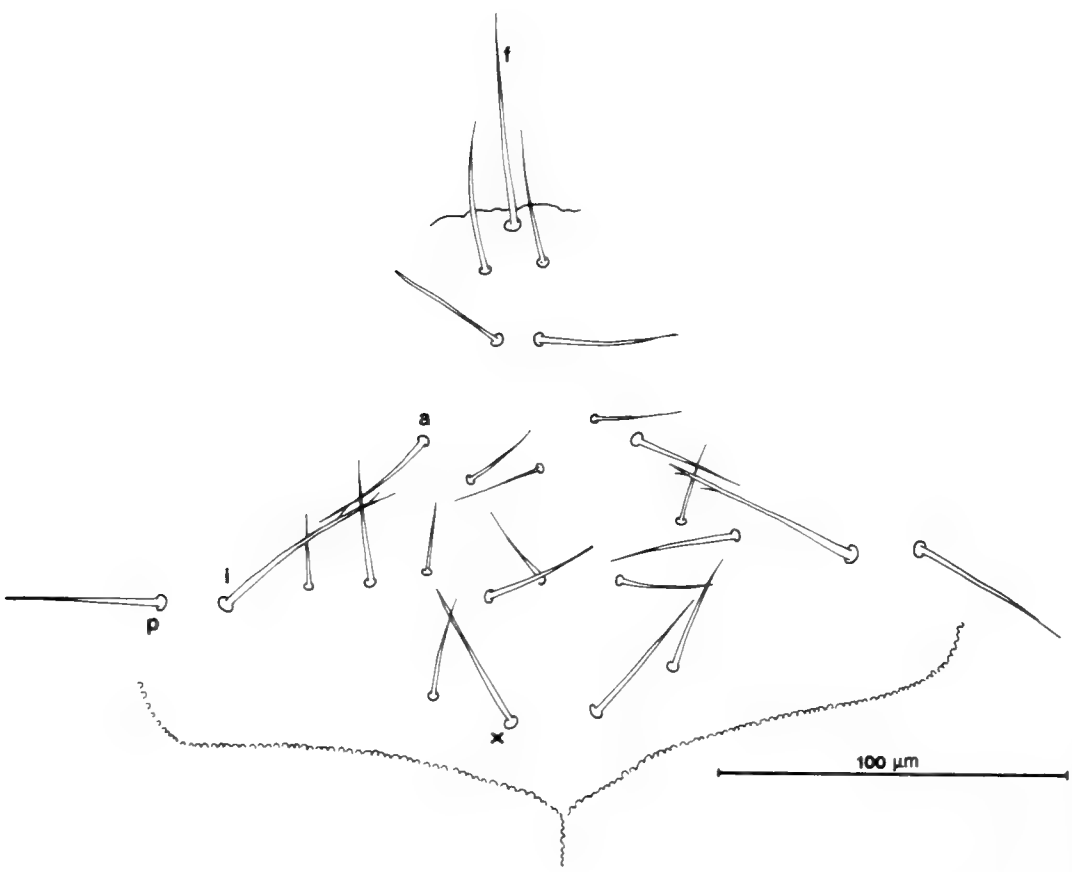

FIG. 1

Apistocampa leclerci n. gen., n. sp., holotype. Portion frontale de la capsule céphalique. *a*, *i*, *p*, *f*, *x* = macrochètes antérieur, intermédiaire, postérieur, frontal, sutural.

Apistocampa leclerci n. sp.

THAILANDE. Province de Chiang Mai (nord-ouest), à la limite entre les sous-préfectures de Chiang Dao et de Fang, devant l'entrée de la perte de la rivière souterraine de Tham Klaeb, sous des rochers enfoncés dans la terre, sous couvert forestier dense, 3.VIII.85, P. Leclerc leg.: 2 larves dont la plus petite est en mue, avec deux Palpigrades du genre *Prokoenenia*.

Longueurs. - 2,37 mm (holotype) et 1,54 mm (paratype); cerques absents; patte III à partir du trochanter 0,85 mm.

Téguments. - Epicuticule sans ornementation. Soies de revêtement glabres.

Tête. - Les trois antennes intactes ont 26 articles, la gauche du plus petit spécimen brisée après la 19e. L'organe cupuliforme de l'article apical est peu volumineux et peu profond (1/9 à 1/10 seulement de la longueur de l'article); il renferme 7 sensilles (1 central et 6 en couronne), petits à une seule collerette, aux deux antennes de l'holotype. Le sensille du IIIe article antennaire est postéro-sternal (entre *d* et *e*), subcylindrique, mince et court (11,7 µm). Sensille latéro-externe du palpe labial à peine plus court que celui de l'antenne (10,4 µm), celui du palpe maxillaire étant le plus court (8,2 µm). Palpe labial ovalaire, avec un rang de 5 ou 6 poils banaux le long de son bord antérieur et 65/72 phanères gustatifs (holotype).

Processus frontal portant 5 phanères glabres, l'antérieur, médian, environ 1 fois 1/2 aussi long que les autres (34/22). Les macrochètes bordant la ligne d'insertion des antennes ressemblent aux précédents; seul l'intermédiaire possède une barbule subapicale, les autres étant complètement glabres; l'intermédiaire est environ 1 fois 1/2 aussi long que le postérieur, lui-même un peu plus long que l'antérieur (*i*=32, *p*=23, *a*=18); phanères *x* peu développés (22).

Thorax. - Tous les macrochètes sont très différenciés, grêles avec de fines barbules, bien distinctes les unes des autres, sur leur moitié distale au moins. Leur répartition et leurs longueurs relatives sont consignées dans le tableau I.

TABLEAU I

	ma	*la*	*lp*	*ma*	la_2	la_3	lp_1	lp_2	lp_3
Th. I	1+1	1+1	1+1	35	–	34	–	–	68
Th. II	1+1	2+2	3+3	33	40[1]	47,5[1]	48	64	72,5
Th. III	1+1	1+1	2+2	34,5	35,5	–	–	57	68

[1] Dans la description de *Leletocampa marthaleri* (1982: 744 et 746), j'ai nommé ces phanères la_1 et la_2. Comme la_1 n'est présent que chez les espèces possédant 3 paires de *la*, il semble plus correct de considérer les phanères de *Leletocampa* et *Apistocampa* comme représentant les paires 2 et 3.

Les soies marginales postérieures comprises entre les *lp* les plus proches du plan sagittal sont au nombre de 6+6, 4+4 et 5+5, respectivement aux pro- (entre lp_3), méso- (entre lp_1) et métanotum (entre lp_2); seules les plus latérales du pronotum possèdent quelques barbules.

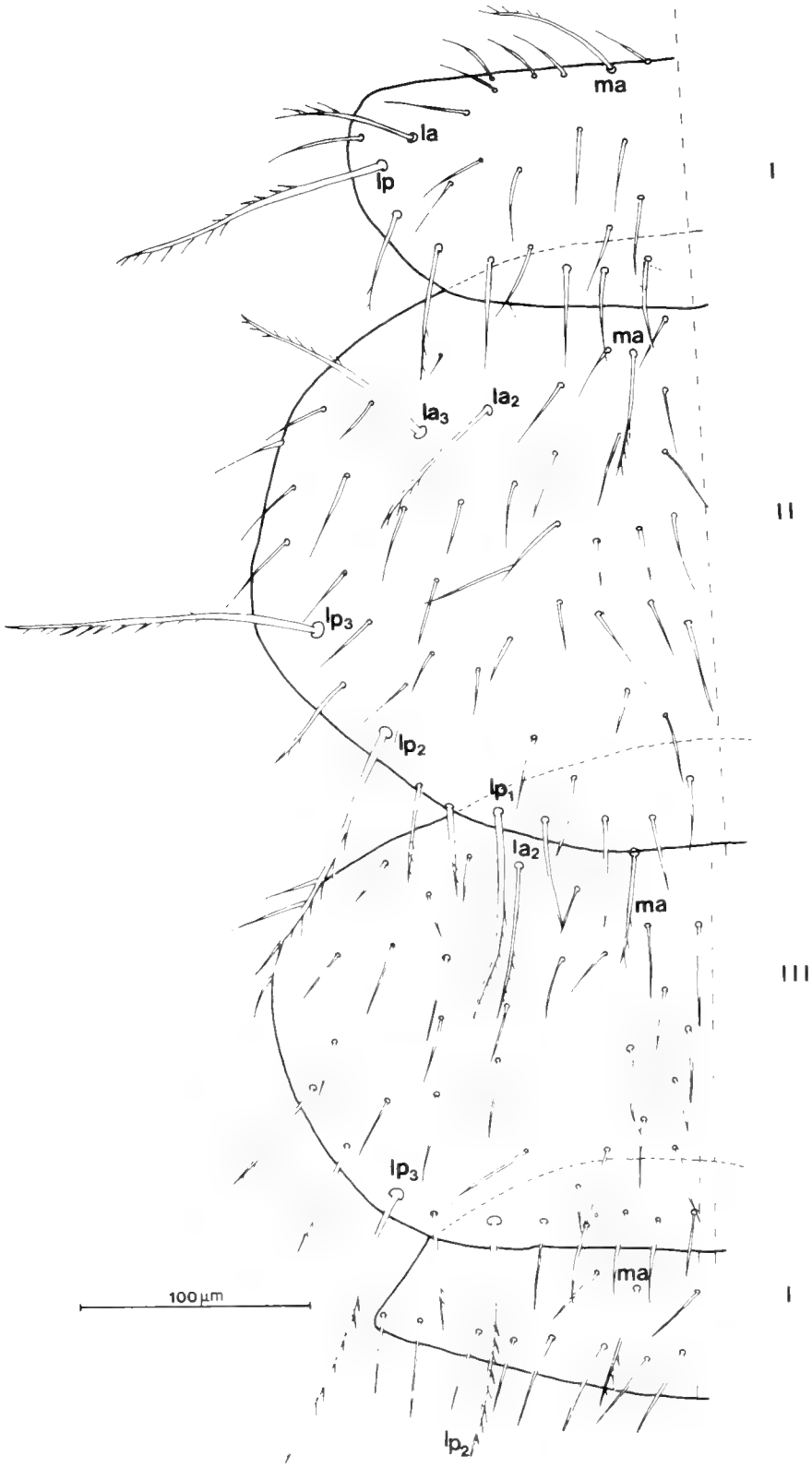

FIG. 2

Apistocampa leclerci n. gen., n. sp., holotype. Pro-, méso-, métanotum et premier urotergite. *ma*, *la*, *lp* = macrochètes médial antérieur, latéral antérieur, latéral postérieur.

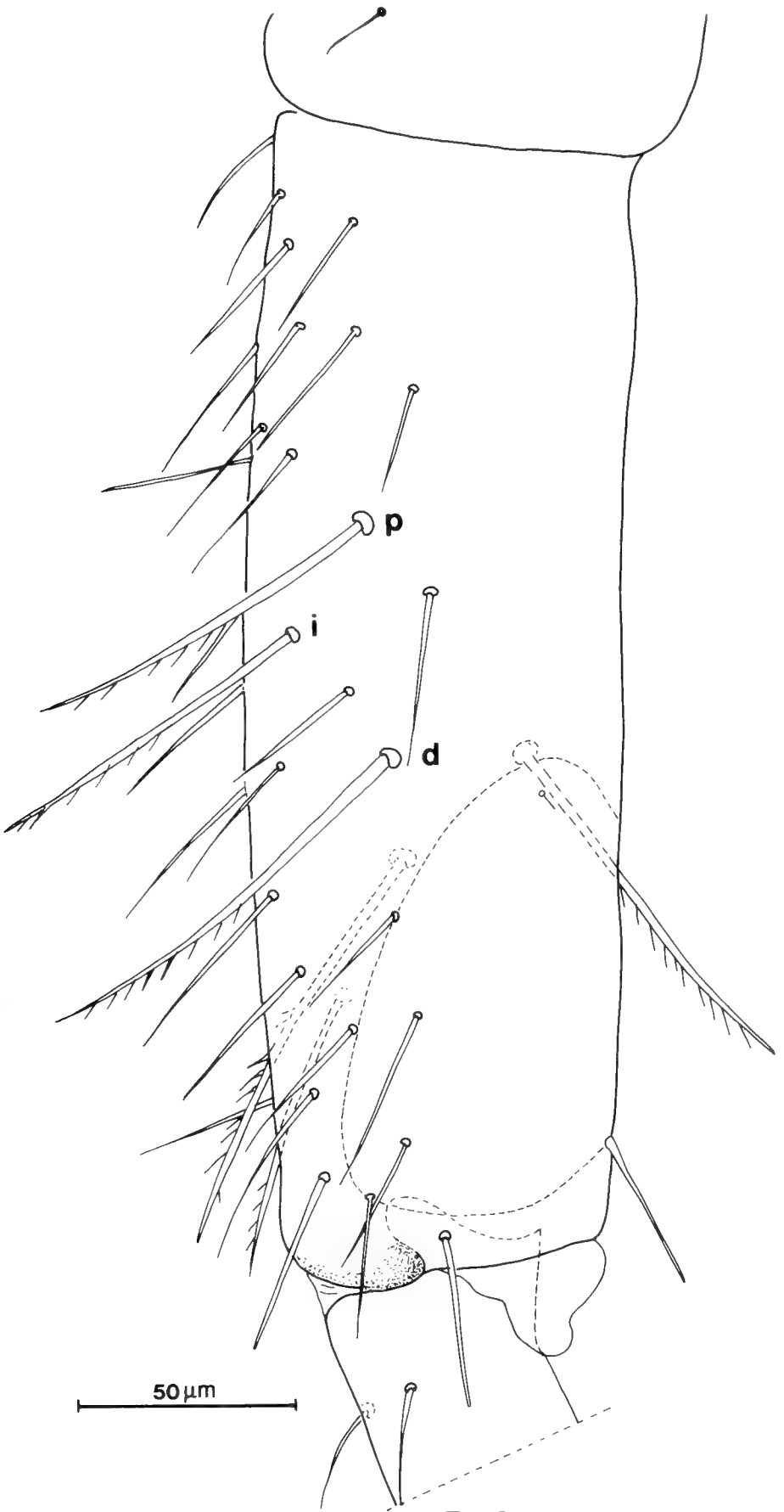

FIG. 3

Apistocampa leclerci n. gen., n. sp., holotype. Fémur III gauche, face postérieure. *d*, *i*, *p* = macrochètes tergaux proximal, intermédiaire, distal.

Les pattes métathoraciques atteignent le pord postérieur du VIIIe urotergite. Fémurs II et III avec 3 macrochètes tergaux insérés en triangle vers le milieu du bord de l'article, le plus distal légèrement plus long (96/80-85 en III) et plus épais que les autres; pas de macrochète sternal. Tibia avec 1 macrochète sternal vers la moitié de sa longueur. Tarse à région distale brusquement rétrécie par inflexion du bord tergal; soies des deux rangées sternales avec une barbule proximale, celles de la paire subapicale presque deux fois plus courtes, avec 2 ou 3 barbules; les 3 longues soies subapicales tergales épaisses et glabres. Télotarse de taille réduite; griffes simples, fortement et régulièrement arquées, présentant quelques stries sur la région basilaire. Pulvilli, atténués à l'apex, à longue pubescence ventrale et latérale.

Abdomen. - Tous les tergites portent des macrochètes dont la formule est la suivante:

	la	*ma*	*mp*	*post*
Ab. I	–	1 + 1	–	–
Ab. II	–	1 + 1	–	0 + 1 ($post_3$)
Ab. III	–	1 + 1	–	1 + 1 ($post_3$)
Ab. IV	–	1 + 1	–	2 + 2 ($post_{3,4}$)
Ab. V-VII	1 + 1	1 + 1	–	3 + 3 ($post_{3\text{-}5}$)
Ab. VIII	–	–	1 + 1	4 + 4 ($post_{2\text{-}5}$)
Ab. IX	–	–	1 + 1	6 + 6

Les *ma* sont sensiblement égaux à leur écartement à tous les tergites (29-34/28-34) et leur apex dépasse d'environ un tiers les embases des soies marginales postérieures, ce tiers apical au moins portant des barbules. En VIII, les *mp* sont semblables aux phanères postérieurs voisins.

Sternite I avec 7+7 macrochètes; ses appendices sont subcylindriques, de longueur égale aux 4/7 environ (1,80) de leur écartement, avec 11-12 phanères glandulaires (a_1) apicaux. Sternites II à VII avec 5+5 macrochètes et sternite VIII avec 1+1. Soie apicale des styles avec une seule longue dent basilaire, toutes les autres soies glabres.

AFFINITÉS. - L'extrémité étroite du tarse, le télotarse et ses grands pulvilli ressemblent à ceux des *Eutrichocampa* s. str. de Paclt 1957 (*chilensis* Silvestri, *hispanica* Silvestri, *birabeni* Wygodzinsky), mais aussi à ceux de *Lepidocampa* s. lat. Oudemans et de *Syncampa* Silvestri. Les représentants des deux derniers genres, pourvus d'un revêtement écailleux, ne peuvent être considérés comme proches parents du nouveau genre. On peut, en revanche, s'interroger sur les affinités de *Apistocampa* avec *Eutrichocampa* s. str., quoique la chétotaxie du méso- et du métanotum (6+6 et 4+4 vs 3+3 et 2+2), comme celle des fémurs II et III, et des urotergites IV à VII soient très différentes. Les deux paires de *la* au mésonotum et la présence d'une paire de ces phanères au métanotum, en combinaison avec une formule pronotale typique (3+3), rappelle *Leletocampa* Condé, 1982, genre monotypique d'une grotte de Nouvelle-Irlande. Les 3 macrochètes tergaux des fémurs sont un caractère unique dans le groupe, de même que les 5 phanères homologues de *Hystrichocampa* Condé.

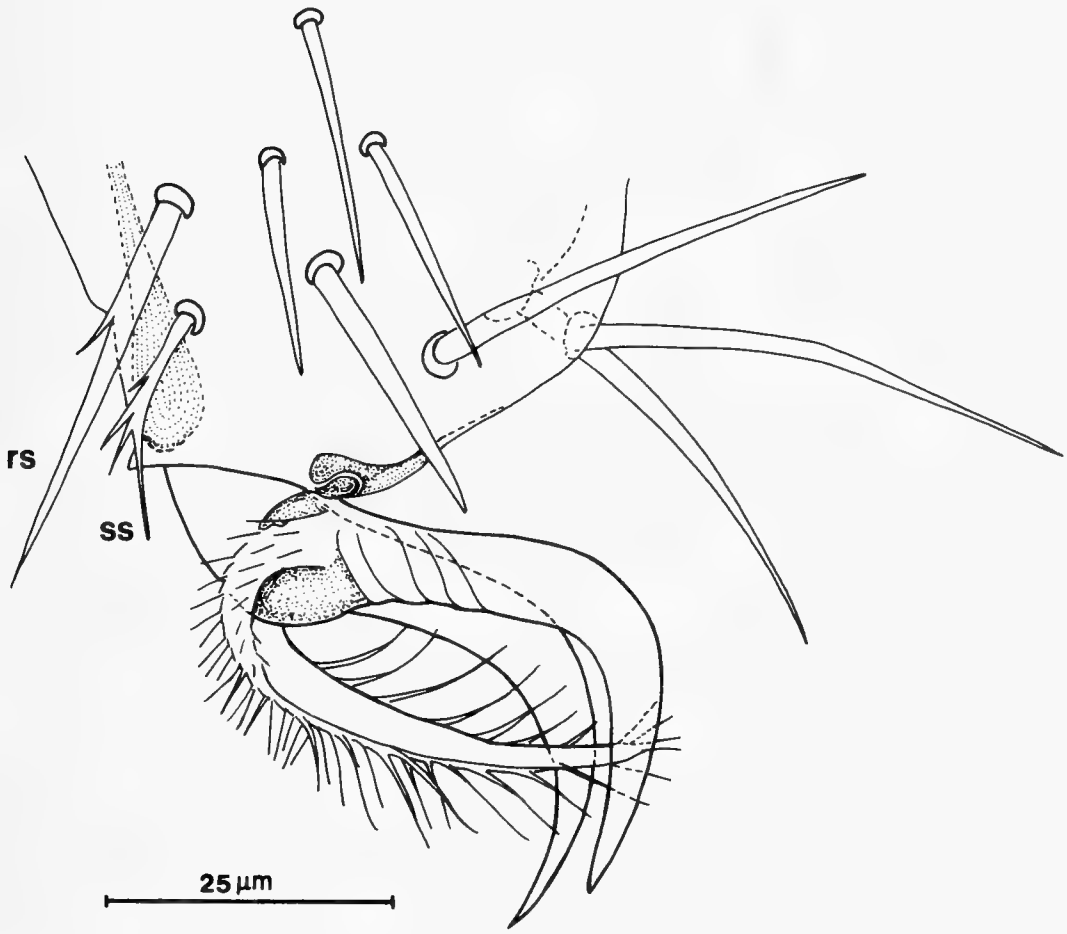

FIG. 4

Apistocampa leclerci n. gen., n. sp., holotype. Extrémité apicale du tarse et télotarse de la patte III gauche, face antérieure. *rs* = soie de la rangée sternale; *ss* = soie de la paire subapicale.

Cocytocampa eutrichoides n. sp.

THAILANDE. Province de Chom Thong, Doi Inthanou, humus, 2500 m, 9.I.81, L. Deharveng et A. Gouze leg.: 1 femelle ovigère.

Longueurs. - 2,6 mm; patte III à partir du trochanter: 0,57; cerques absents.

Téguments. - Epicuticule de la face dorsale de la tête et du tronc finement épineuse, les granules étant souvent pourvus d'une pointe dirigée vers l'arrière. Soies de revêtement particulièrement courtes et épaisses.

Tête. - Antennes brisées après le IIe article. Sensille du palpe maxillaire subrectiligne (10 µm), très largement dilaté. Palpe labial ovalaire, avec un rang de 7 poils banaux le long de son bord antérieur et 66 phanères gustatifs à droite et à gauche; sensille latéro-externe coudé à angle droit (ou presque), flanqué de 2 poils de garde, insérés de part et d'autre de sa base, et distants l'un de l'autre.

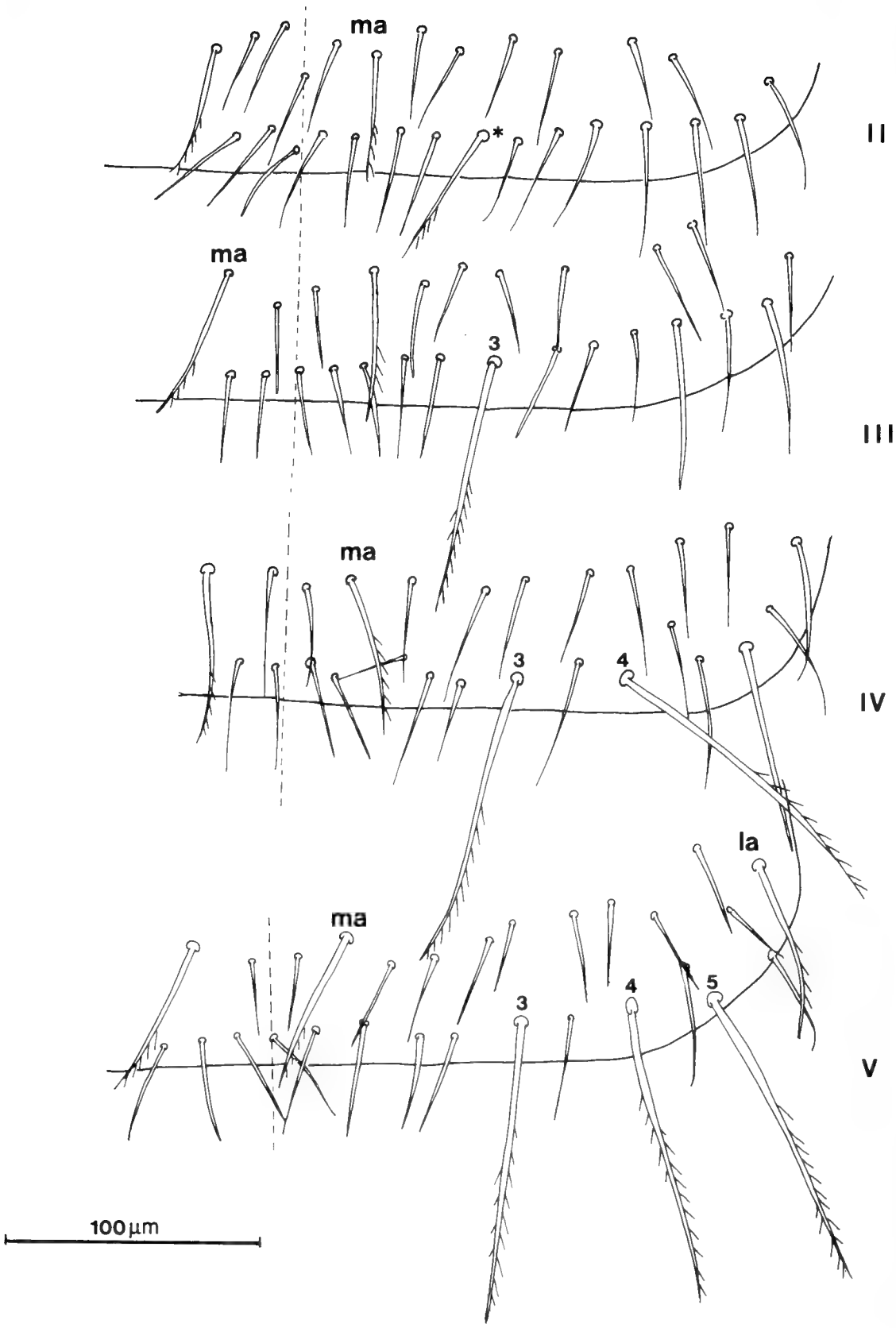

FIG. 5

Apistocampa leclerci n. gen., n. sp., holotype. Urotergites II-V. *la*, *ma* = macrochètes latéral antérieur, médial antérieur; 3 à 5 = macrochètes postérieurs. Le phanère asymétrique marqué d'un astérisque est un macrochète postérieur 3 faiblement différencié.

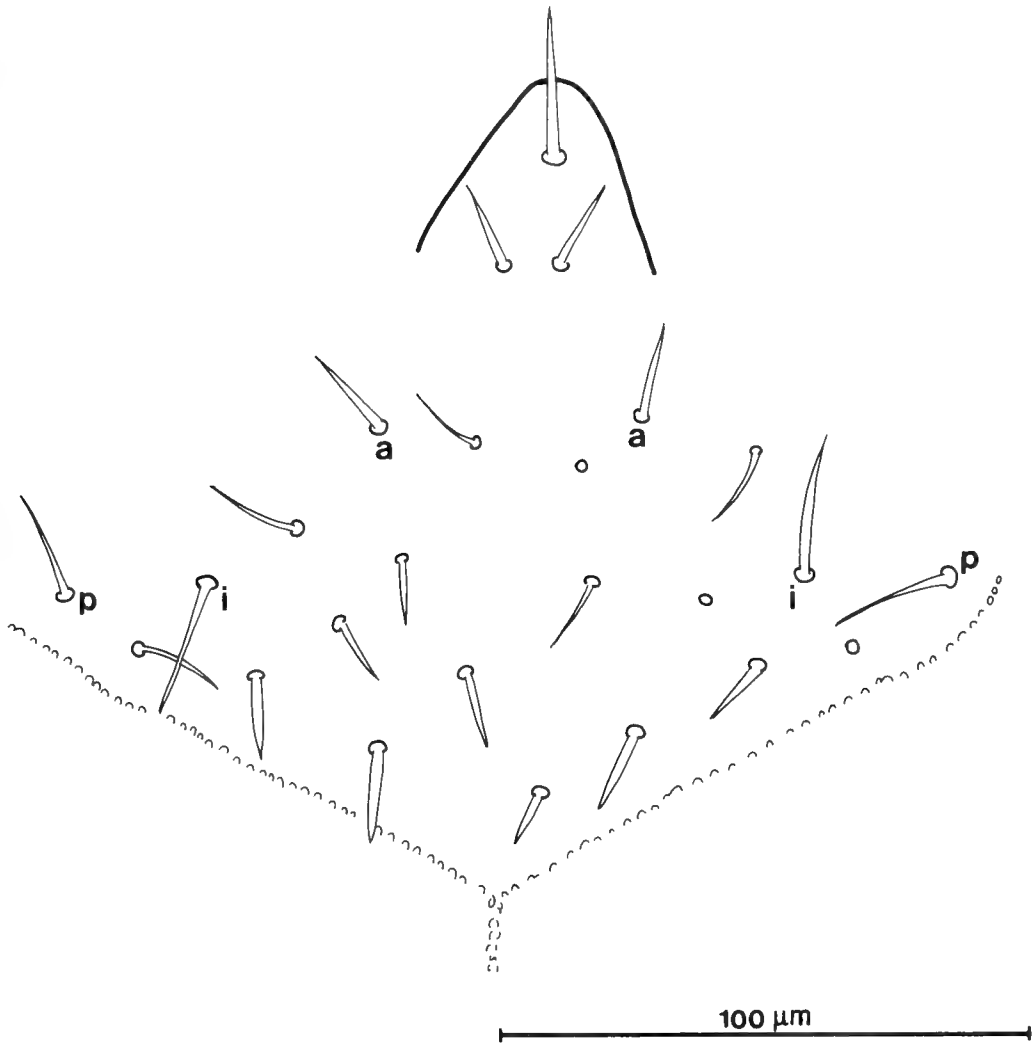

FIG. 6

Cocytocampa eutrichoides n. sp., femelle ovigère, holotype. Portion frontale de la capsule céphalique. *a*, *i*, *p* = macrochètes antérieur, intermédiaire, postérieur.

Processus frontal avec 3 phanères glabres, l'antérieur 1 fois 3/4 aussi long que les postérieurs (68/39). Les macrochètes bordant la ligne d'insertion des antennes ressemblent aux précédents, l'intermédiaire un peu plus long que les autres (56/40-49). Phanères *x* non différenciés.

Thorax. - Pronotum avec 2 paires de macrochètes courts et épais (*ma*/*lp*=1,18) avec 3-4 indentations; mésonotum avec des *la* égaux à moins du 1/5 de leur écartement (ϵ/*ma*=5,57) et ressemblant aux macrochètes pronotaux. Soies marginales postérieures peu différentes des soies de revêtement; quelques sensilles sétiformes courts et grêles.

Fémur III sans macrochète tergal; tibia avec un macrochète sternal à peine distinct des autres phanères, son apex très brièvement fendu, et calcars avec 2 ou 3 barbules. Soies des rangées sternales du tarse plus longues et épaisses, sauf celles de la paire subapicale, très courtes et grêles; toutes sont glabres. Griffes II et III (les I

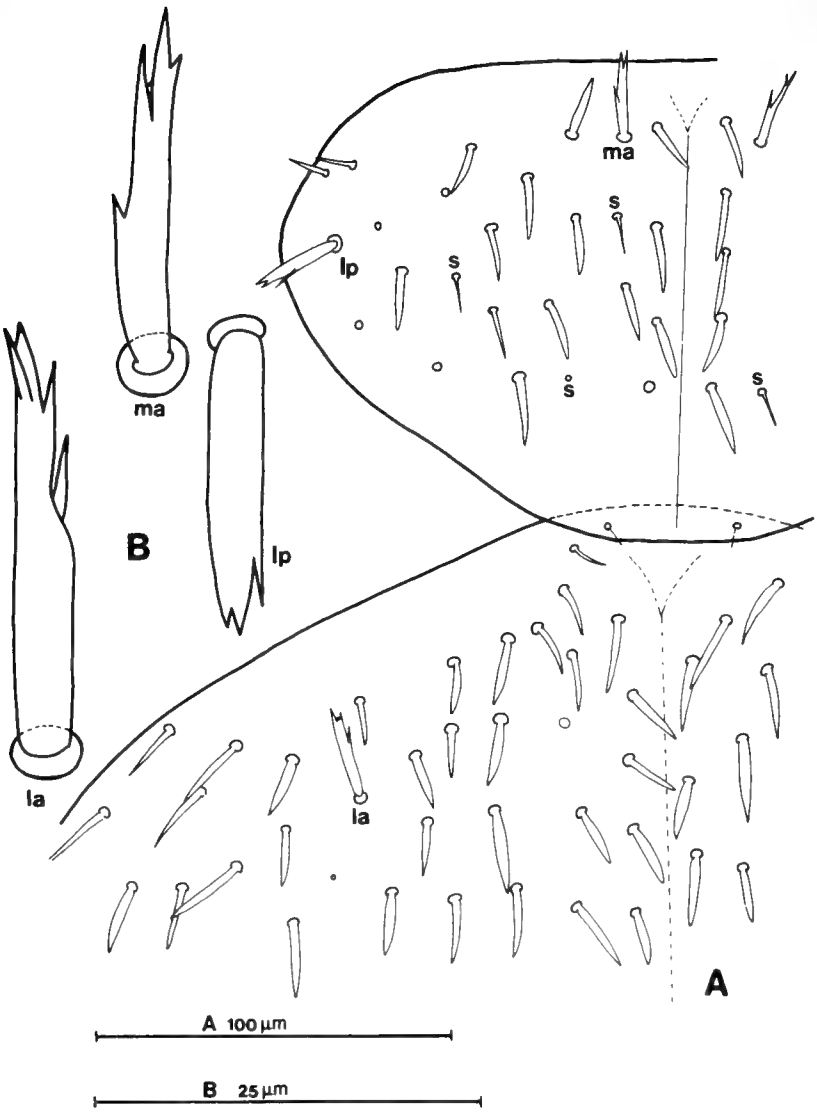

FIG. 7

Cocytocampa eutrichoides n. sp., femelle ovigère, holotype. A. Pronotum et portion antérieure du mésonotum. *ma*, *la*, *lp* = macrochètes médial antérieur, latéral antérieur, latéral postérieur; *s* = sensille sétiforme. - B. Détails des macrochètes précédents.

manquent) subégales, larges, coudées, avec des crêtes latérales réduites; les processus télotarsaux sont des pulvilli lamellaires très développés dont l'apex dépasse celui des griffes et qui portent une pubescence assez longue sur la face sternale et le bord apical.

Abdomen. - Tergite VIII avec 2+2 *lp* et segment IX avec 5+5 macrochètes (total); les *lp* du tergite VII sont tous arrachés; en IX, seuls les phanères de la paire la plus sternale sont présents et ressemblent à leurs homologues du sternite VIII.

Sternite I avec 6+6 macrochètes, les médiaux postérieurs présents; tous sont assez longuement barbelés sur leur moitié distale au moins; ses appendices sont

subcylindriques, arrondis à l'apex, environ 1 fois 1/2 plus longs que larges, leur base égale au 1/5 de leur écartement (43/217); 16 et 17 poils glandulaires (a_1) apicaux. Sternites II à VII avec 5+5 macrochètes; les styles sont arrachés, sauf 2 (sternites II et III) qui sont épilés. Sternite VIII avec 1+1 macrochètes; volets génitaux avec 4+3 phanères sur les volets et 3+3 sur le tubercule.

Etymologie. - *eutrichoides* pour rappeler la ressemblance superficielle avec des espèces du genre *Eutrichocampa* pourvus de volumineux pulvilli.

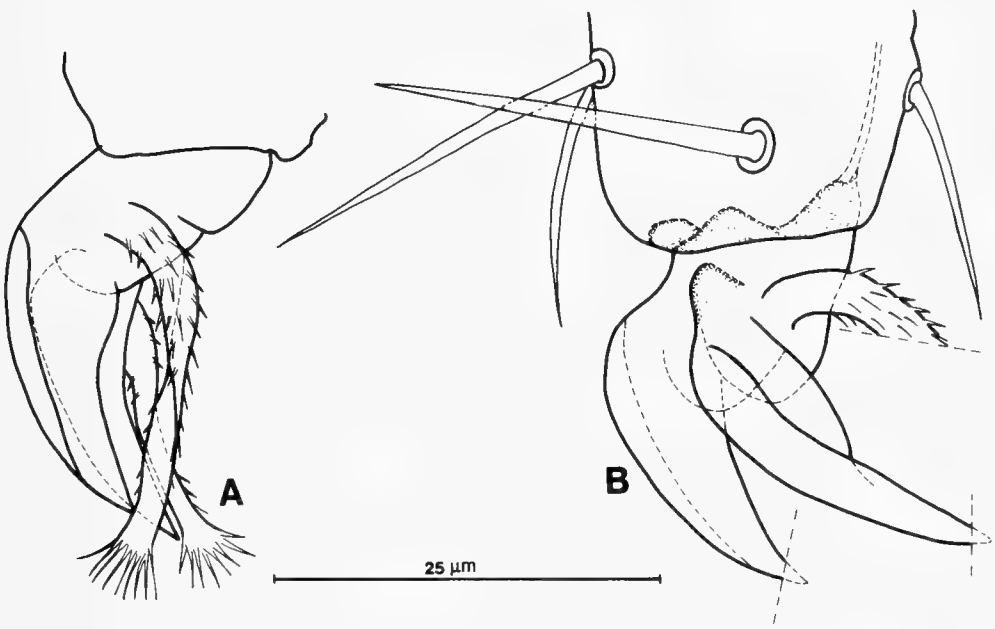

FIG. 8

Cocytocampa eutrichoides n. sp., femelle ovigère, holotype. Extrémité apicale du tarse et télotarse. A. Patte II droite, face, antérieure. - B. Patte III droite, face antérieure.

AFFINITÉS. - Les griffes coudées, à crêtes latérales réduites, sont conformes aux caractères du genre *Cocytocampa*, bien que nous n'ayons pas observé de lignes transverses saillantes sur le corps de la griffe. La chétotaxie thoracique est plus simple que chez les autres espèces (2, 1, 0 vs 3, 3, 2), les macrochètes étant aussi plus courts et plus épais. Chétotaxie sternale comme chez *C. perkinsi* Silvestri, l'espèce type du genre (des *mp* en I, pas de phanères coniques sur la région moyenne des sternites II à VII).

Les grands pulvilli constituent un caractère inédit chez *Cocytocampa* qui rend l'espèce immédiatement reconnaissable.

Le très mauvais état de conservation de l'unique spécimen disponible est compensé par son originalité qui justifie une description, même incomplète.

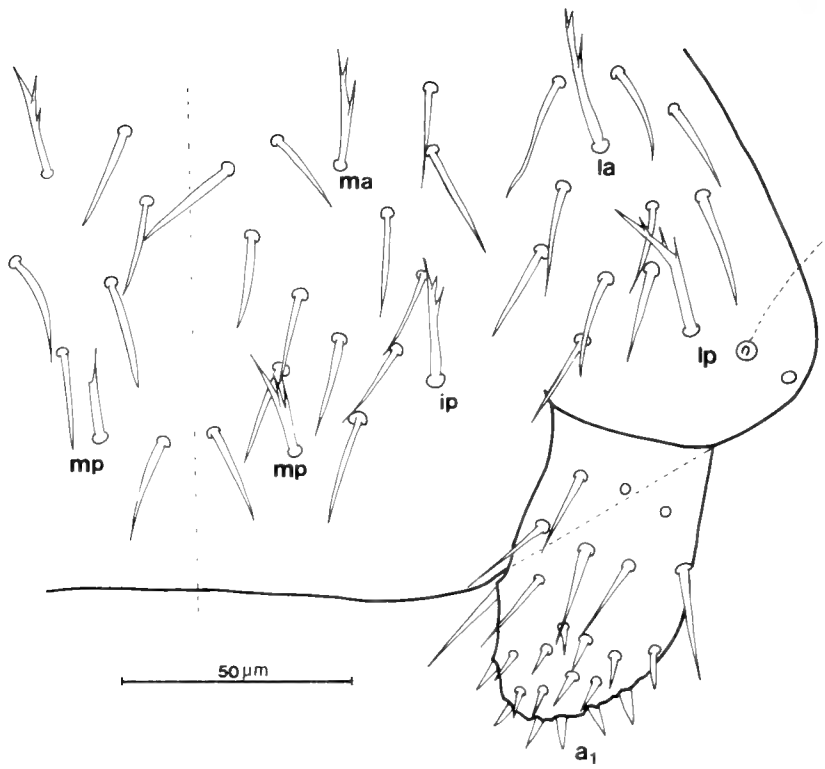

FIG. 9

Cocytocampa eutrichoides n. sp., femelle ovigère, holotype. Urosternite I. a_1 = phanères glandulaires; *ip*, *ma*, *mp*, *la*, *lp* = macrochètes intermédiaire postérieur, médial antérieur, médial postérieur, latéral antérieur, latéraux postérieurs (une paire).

Eutrichocampa inchoata n. sp.

THAILANDE. - Province de Nam Tok-Kanchanaburi, près de Soi Yok Noi, endogé, 15.VI.86, P. Leclerc leg.: 1 mâle.

Longueurs. - 1,28 mm; patte III, à partir du trochanter: 0,31 mm; cerques absents.

Tégument. - Epicuticule de la face dorsale de la tête et du tronc finement granuleuse. Soies de revêtement courtes et épaisses.

Tête. - Antennes brisées après les 4e et 5e articles. Le sensille du IIIe article est postéro-sternal (entre *d* et *e*), grêle, strictement bacilliforme, non mesurable avec précision, mais comparable, en encore plus ténu, aux sensilles des palpes maxillaire et labial longs de 4,5 µm. Palpe labial ovalaire avec un rang de 5 poils banaux le long de son bord antérieur et 9/12 phanères gustatifs seulement; sensille latéro-externe flanqué, vers l'extérieur, de 2 poils de garde proches l'un de l'autre.

Processus frontal avec 3 phanères glabres, l'antérieur légèrement plus long (36/32). Les macrochètes bordant la ligne d'insertion des antennes ressemblent aux précédents, l'intermédiaire un peu plus long que les autres (47/34-36); phanères *x* non différenciés.

Thorax. - Pronotum avec 3 paires de macrochètes peu différenciés, les *la* surtout, et glabres (*ma*=47, *la*=28, *lp*=65); mésonotum avec des *la* peu distincts des soies de revêtement, mais identifiables par leur position dressée; leur longueur (38-40) est égale au 1/5 de leur écartement (206). Les soies marginales postérieures sont semblables aux soies de revêtement. 2+2 (pro- et mésonotum) ou 1+1 (métanotum) sensilles sétiformes courts et grêles sont inclus dans la rangée marginale.

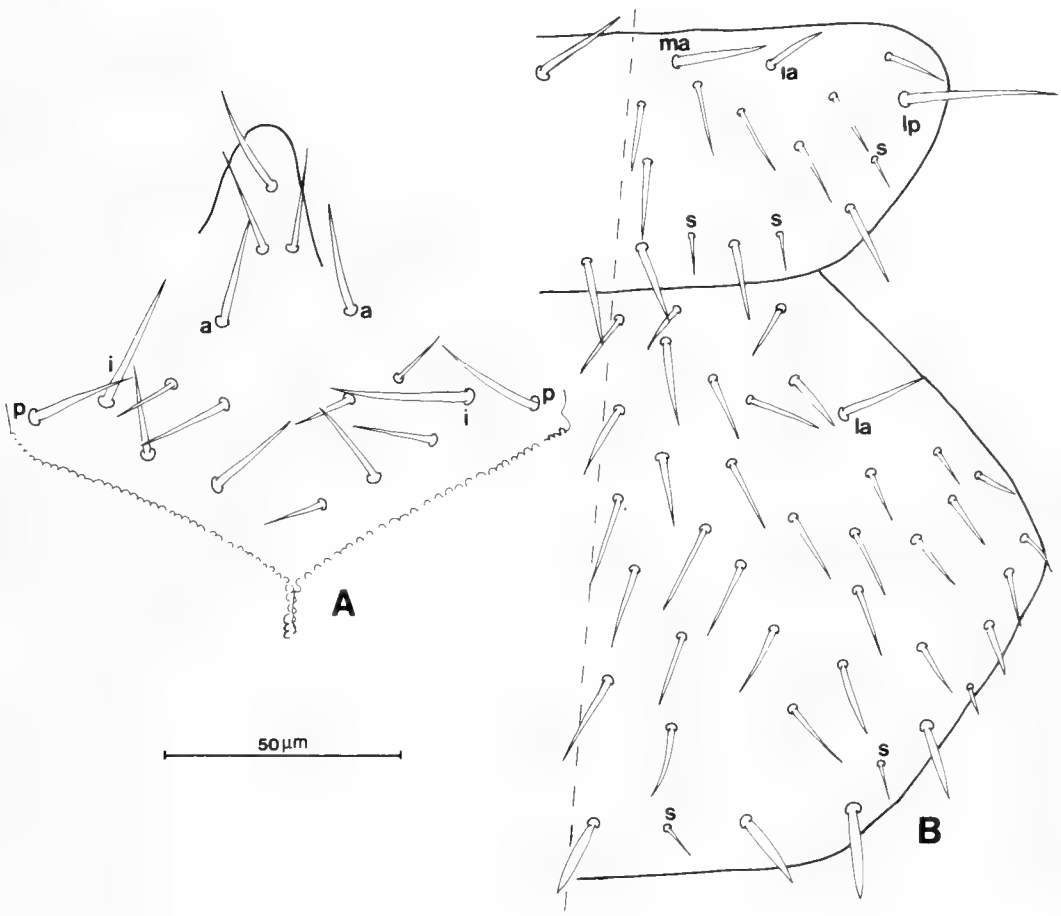

FIG. 10

Eutrichocampa inchoata n. sp., mâle holotype. A. Portion frontale de la capsule céphalique. *a*, *i*, *p* = macrochètes antérieur, intermédiaire, postérieur. - B. Pro- et mésonotum. *ma*, *la*, *lp* = macrochètes médial antérieur, latéral antérieur, latéral postérieur; s = sensille sétiforme.

Les granules tégumentaires des faces antérieure et dorsale du fémur III possèdent une pointe dirigée vers l'apex de l'appendice. Fémur sans macrochète tergal; tibia avec un macrochète sternal très faible et des calcars simplement fendus à l'apex. Soies des rangées sternales du tarse plus longues et épaisses, sauf celles de la paire subapicale, très courtes et grêles; toutes sont glabres. Griffes simples, faiblement arquées, avec un lobule interne terminé en une pointe bien nette; les processus télotarsaux sont des pulvilli lamellaires de dimensions réduites, égaux à un peu plus ou un peu moins de la moitié de la longueur de la griffe correspondante (1,83-2,38) et portant sur la face

sternale une pubescence rase qui ressemble, au plus fort grossissement, à une fine ponctuation; selon l'orientation, le bord apical apparaît subrectiligne ou arrondi.

Abdomen. - Macrochètes à partir du tergite VIII seulement qui possède 2+2 *lp* subégaux, fourchus à l'apex avec une barbule au-dessous de la bifurcation. Segment IX avec 4+4 macrochètes (total).

Sternite I avec 5+5 macrochètes tous fourchus, les médiaux postérieurs n'étant pas différenciés; ses appendices sont subrectangulaires, environ 1 fois 1/2 plus larges que longs (73/45), leur base égale aux 2/3 environ de leur écartement (73/115); une douzaine de poils glandulaires (a_1) apicaux; pas de champ glandulaire sur la marge postérieure du sternite. Sternites II à VII avec 5+5 macrochètes fourchus; styles avec une dent basale longue à la soie apicale, soies subapicale et moyenne sternale fourchues. Sternite VIII avec 1+1 macrochètes fourchus. Papille génitale glabre sur sa moitié proximale, avec 2 rangées de 6 et 3 poils courts de part et d'autre du gonopore qui est entouré d'une rosette de 6 phanères; aucun faisceau de spermatozoïdes n'était présent et il s'agit sans doute d'un individu juvénile.

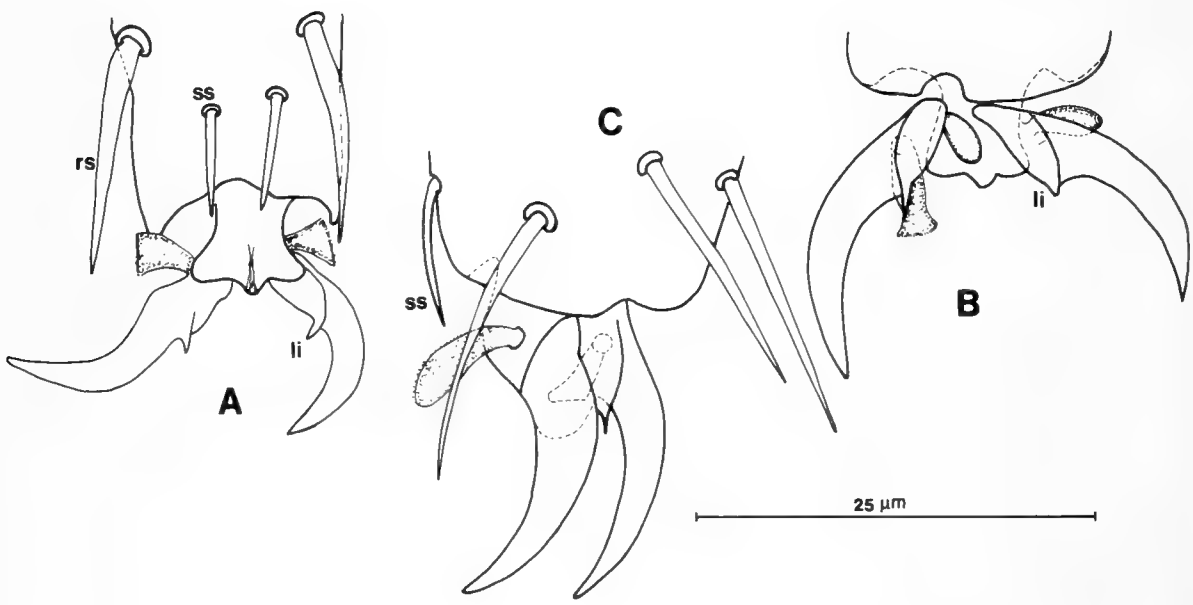

FIG. 11

Eutrichocampa inchoata n. sp., mâle holotype. Extrémité apicale du tarse et télotarse. A. Patte I droite, face sternale. - B. Patte II droite, face tergale. - C. Patte III gauche, face antérieure. *li* = lobule interne; *rs* = soie de la rangée sternale du tarse; ss = soie de la paire subapicale.

Etymologie. - Du latin *inchoatus*, imparfait, ébauché, en référence aux pulvilli rudimentaires.

AFFINITÉS. - En raison de ses processus télotarsaux pubescents et d'une certaine ressemblance avec *Eutrichocampa orientalis* Silvestri, du Yunnan (la chétotaxie

thoracique en particulier), mais surtout par commodité, la nouvelle espèce est rapportée au genre artificiel *Eutrichocampa* Silvestri dont les espèces ont été réparties par PACLT (1957: 28-30) entre deux genres comportant respectivement 5 et 2 sous-genres, tous monotypiques à l'exception de *Eutrichocampa* s. str. qui regroupe les trois espèces dont l'extrémité distale des tarses est étroite et les dimensions des télotarses réduites en conséquence.

La présence d'une seule paire de macrochètes mésonotaux (*la*) est partagée par *E. remyi* Condé et *E. orientalis* Silvestri, espèces rapportées respectivement aux sous-genres *Idiocampa* et *Leniwytsmania* de PACLT, dont la première surtout est bien distincte de la forme décrite ici. Sous *E. orientalis* var. *inferior* (deux spécimens de Yi Leang, Yunnan) SILVESTRI (1931: 306) a fait connaître une forme caractérisée, entre autres, par des processus télotarsaux sétiformes et pubescents, comme ceux des types de *orientalis*, mais très courts, ce qu'il attribue à une cause accidentelle. Rien ne permet cependant de penser que les processus rudimentaires de la nouvelle espèce aient une origine traumatique.

Le nombre restreint de macrochètes tergaux du thorax et de l'abdomen, ainsi que leur faible différenciation, évoquent le genre *Metriocampa* Silvestri, emend. Condé, 1956, bien représenté dans la région orientale (Chine, Corée, Japon) et dans l'Ouest de l'Amérique du Nord. Toutefois, des processus télotarsaux pubescents sont inconnus chez *Metriocampa*, étant représentés, quand ils existent, par une épine intégrée à la base de la griffe et exceptionnellement par une expansion sétiforme subrectiligne plus courte que la griffe.

Lepidocampa (s. str.) **armata** n. sp.

THAILANDE. - District de Krabi, au Sud de l'isthme de Kra. Forêt primaire sur des éboulis à la base d'un piton calcaire, à l'Ouest du village de Ban Ao Luk, sous des pierres enfoncées dans la terre, 12.VIII.85, P. Leclerc leg.: 1 femelle ovigère (avec *L. weberi borneensis*).

Longueurs. - 2,40 mm; patte III, à partir du trochanter: 0,55 mm; cerque (incomplet): 0,92 mm.

Tête. - Antenne droite de 18 articles, la gauche brisée après le Ve; le sensille du IIIe article, inséré entre *d* et *e*, est asssez long (8,7 µm) et très légèrement dilaté (fusiforme). Organe cupuliforme renfermant 4 petits sensilles simples.

Thorax. - Le macrochète médial antérieur gauche (seul présent) du mésonotum est grêle et très court (*ma*/*la*=0,50), barbelé sur sa moitié distale; celui du métanotum lui ressemble en un peu plus long. Longueurs relatives:

	ma/ϵ	*ma*/δ	$\frac{ma/\delta}{ma/\epsilon}$
Th. II	0,56	0,49	0,87
Th. III	0,54	0,58	1,07

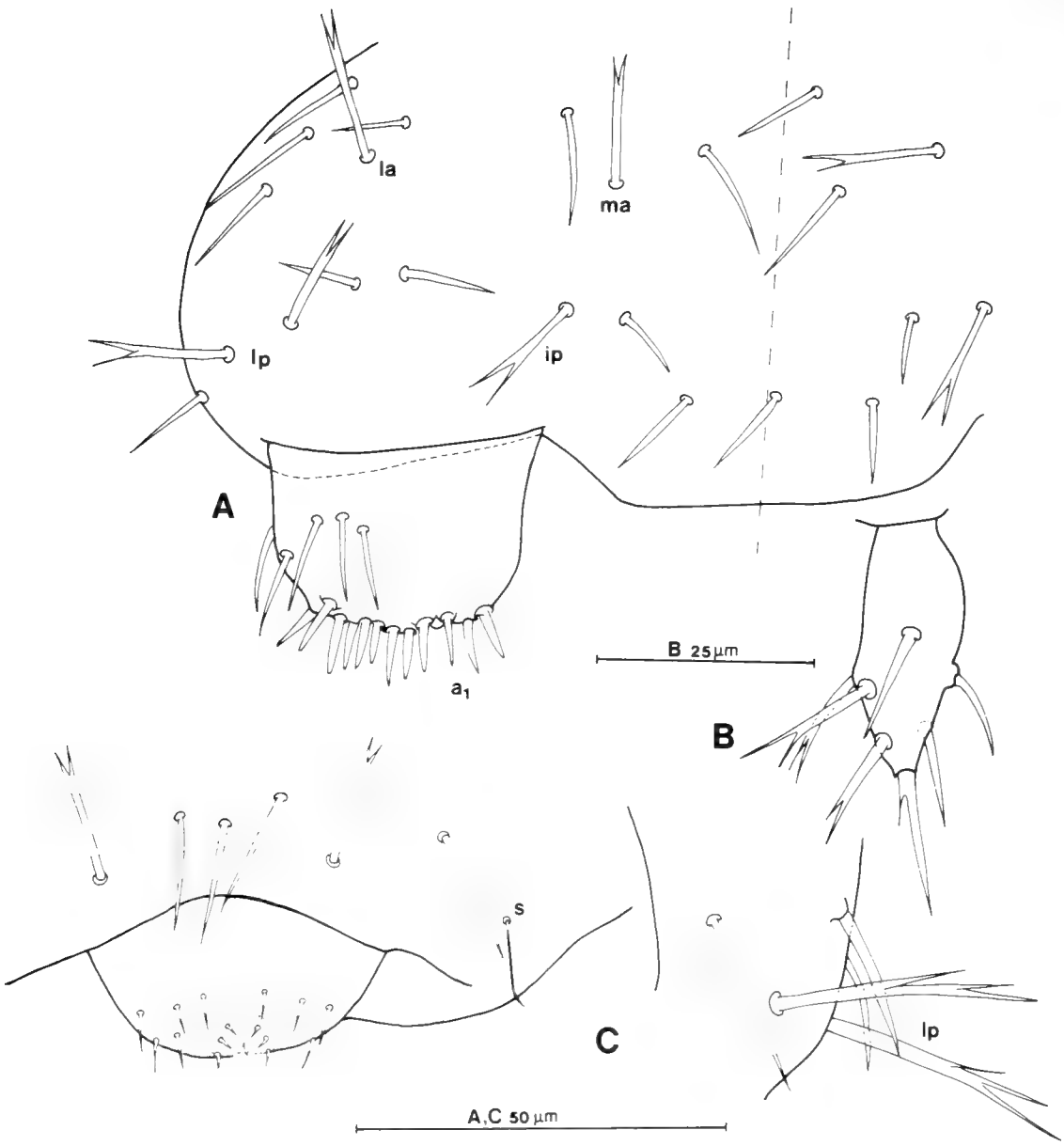

FIG. 12

Eutrichocampa inchoata n. sp., mâle holotype. A. Urosternite I, soies de revêtement non représentées sur la moitié interne de l'appendice. a_1 = phanères glandulaires; *ip*, *ma*, *la*, *lp* = macrochètes intermédiaire postérieur, médial antérieur, latéral antérieur, latéral postérieur. - B. Style V. - C. Urosternite VIII et portion latérale du tergite correspondant. *lp* = macrochètes latéraux postérieurs, *s* = sensille sétiforme.

Les macrochètes latéraux postérieurs des trois tergites sont densément et finement barbelés sur leurs 2/3 distaux au moins.

Toutes les griffes possèdent une forte épine latéro-externe, un peu en deçà du milieu du bord tergal; légèrement arquée ou subrectiligne, elle ne peut passer inaperçue, même à un examen sommaire ou sur des tarses mal orientés.

Abdomen. - Tergite IV avec 3+3 macrochètes, l'intermédiaire plus développé que les autres (36, 50, 34). Sternite I sans champ glandulaire, avec 7+7 macrochètes; appendices subcylindriques, de longueur égale au tiers de leur écartement, portant 6 et

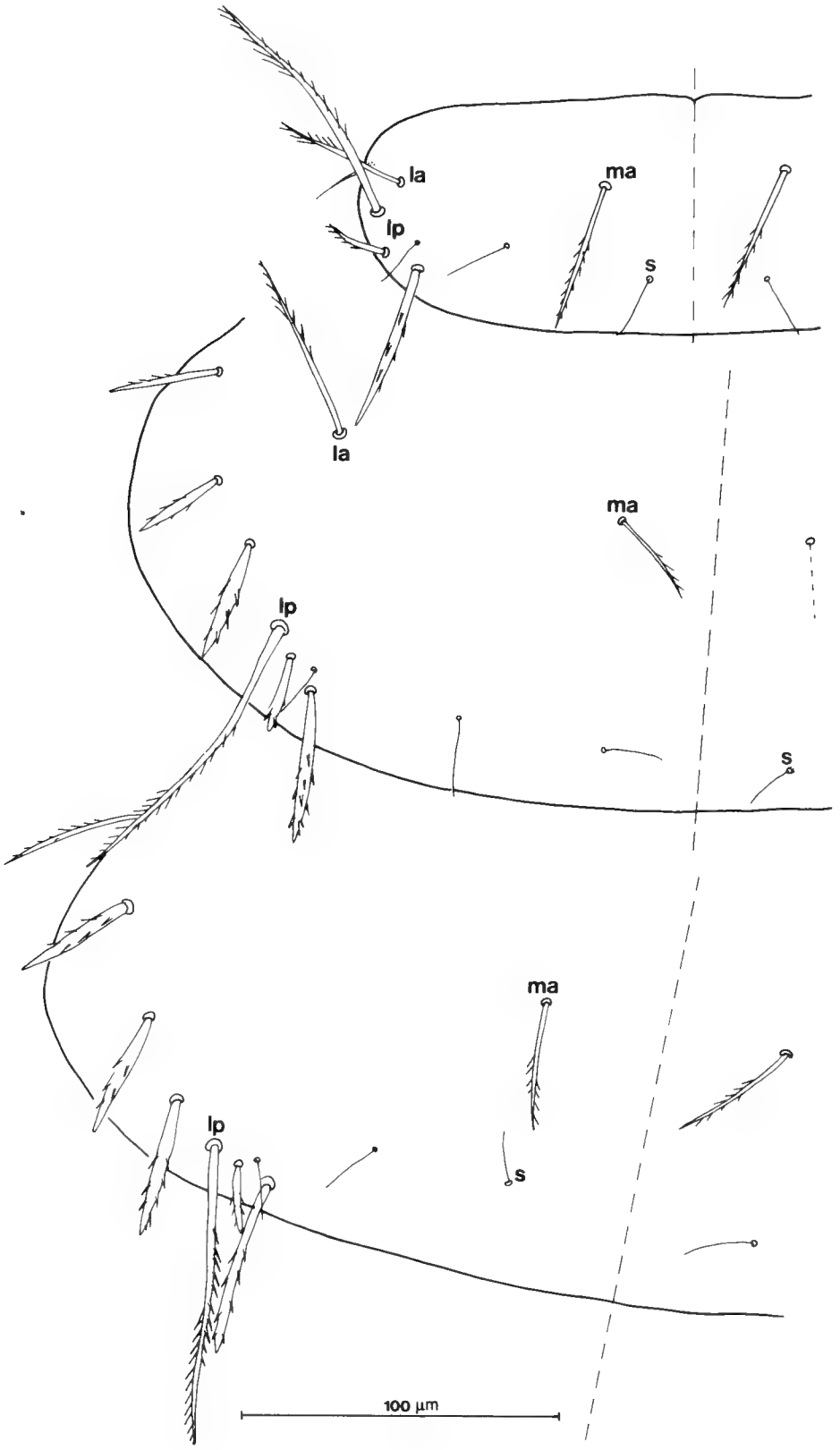

FIG. 13

Lepidocampa (*L.*) *armata* n. sp., femelle ovigère, holotype. A. Pro-, méso- et métanotum. *ma*, *la*, *lp* = macrochètes médial antérieur, latéral antérieur, latéral postérieur, *s* = sensille sétiforme. Ecailles non représentées.

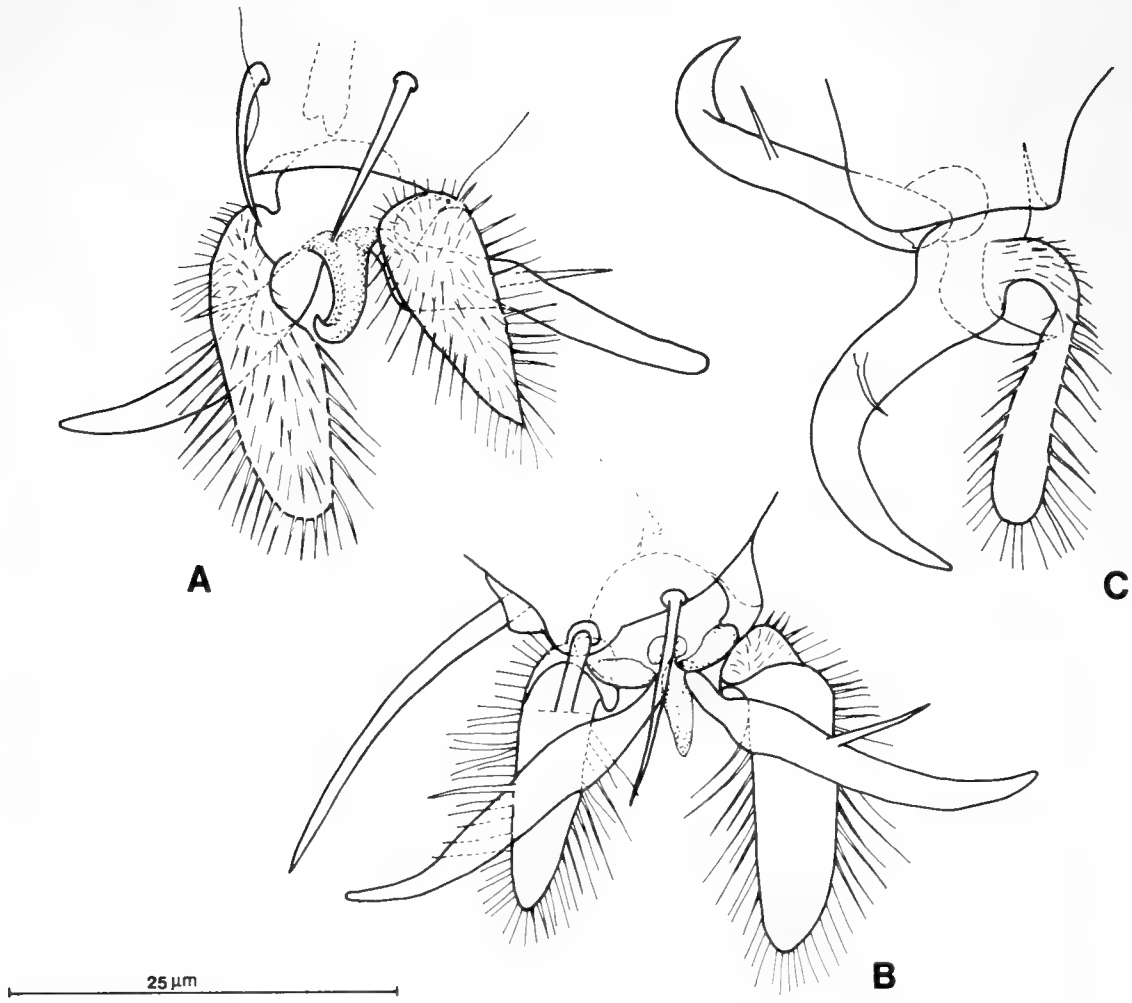

FIG. 14

Lepidocampa (*L.*) *armata* n. sp., femelle ovigère, holotype. Extrémité apicale du tarse et télotarse. A. Patte I gauche, face sternale. - B. Patte I droite, face tergale. - C. Patte II gauche, face latérale.

7 phanères glandulaires apicaux (a_1). 12 soies *C* glabres au sternite VIII, les sensilles *B* entre celles de la paire la plus latérale. 6 courts phanères sur chaque volet de la papille génitale et 3+2 poils seulement sur le tubercule médian.

Tous les macrochètes de la base du cerque (subdivisée en trois) et des 5 articles présents sont robustes et densément barbelés sur leur moitié distale au moins.

Etymologie. - Du latin *armatus*, armé, en référence à l'épine des griffes.

AFFINITÉS. - Le petite taille, les antennes courtes et le faible développement des macrochètes médiaux antérieurs du méso- et du métanotum rappellent *Lepidocampa angulata* Condé. Toutefois, la position sternale du sensille du IIIe article de l'antenne, inconnue jusqu'ici hors de l'Amérique centrale et méridionale, et des Galapagos (*L. zeteki* Folsom), écarte cette espèce de ses voisines géographiques, tandis que l'épine des griffes est unique chez *Lepidocampa*. Une formation tout à fait identique a été

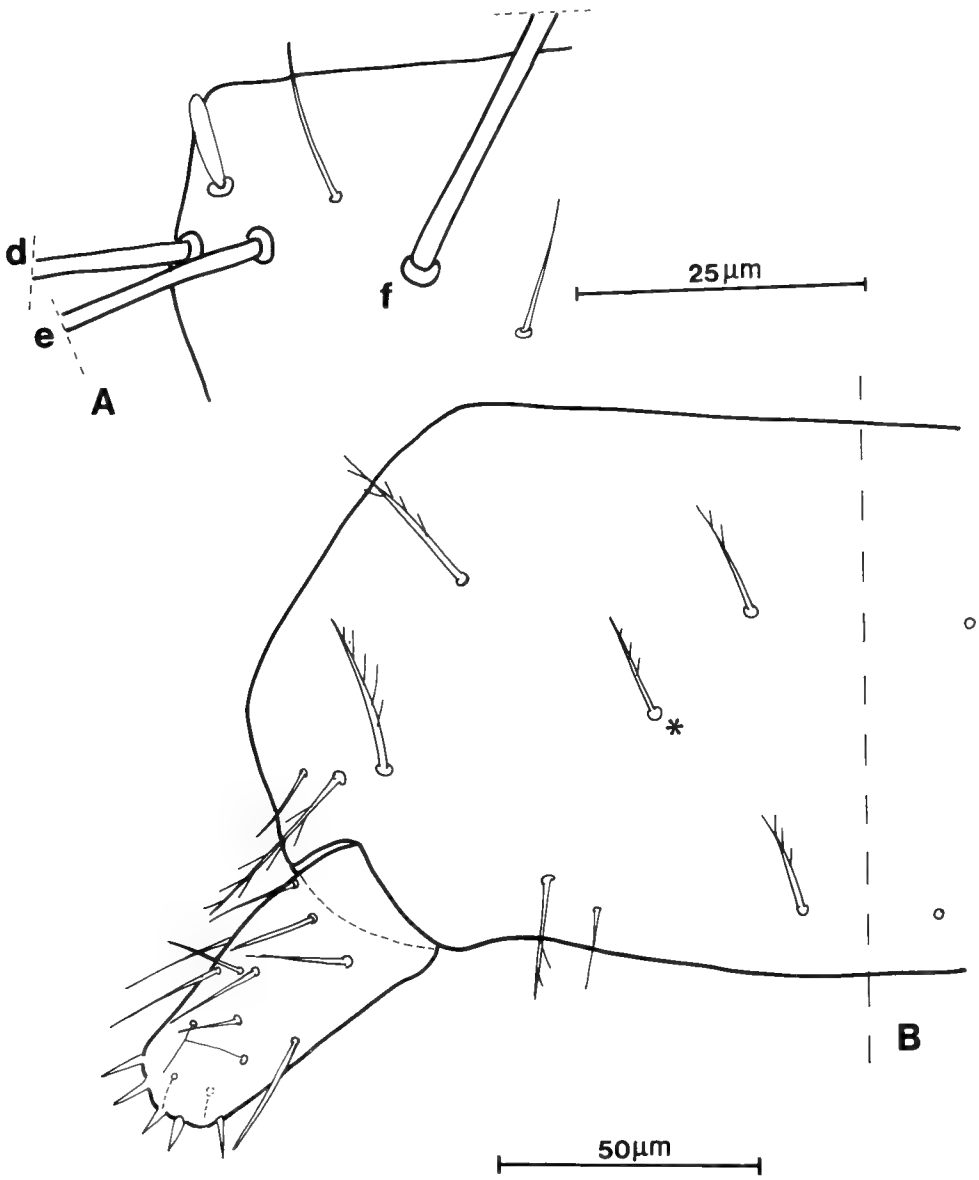

FIG. 15

Lepidocampa (*L.*) *armata* n. sp., femelle ovigère, holotype. A. Article III de l'antenne droite, bord postérieur. *d*, *e*, *f* = macrochètes. - B. Urosternite I; le macrochète marqué d'un astérisque manque généralement chez *Lepidocampa*.

décrite par SILVESTRI (1931) chez *Syncampa*, genre monotypique du Kwangtung, qui est par ailleurs dépourvu d'unguiculus et ne peut donc recevoir la présente espèce.

Lepidocampa (s. str.) **deharvengi** n. sp.

THAÏLANDE. - District de Chiang Dao, terre sous bloc calcaire, 500 m (THA 8), 17.XII.80, L. Deharveng et A. Gouze leg.: 1 mâle, 1 femelle, 1 larve.

Betong, Nam Ron Huaï Yot, litière, 16.VII.91, P. Leclerc leg.: 1 mâle juv., 1 femelle, 1 larve.

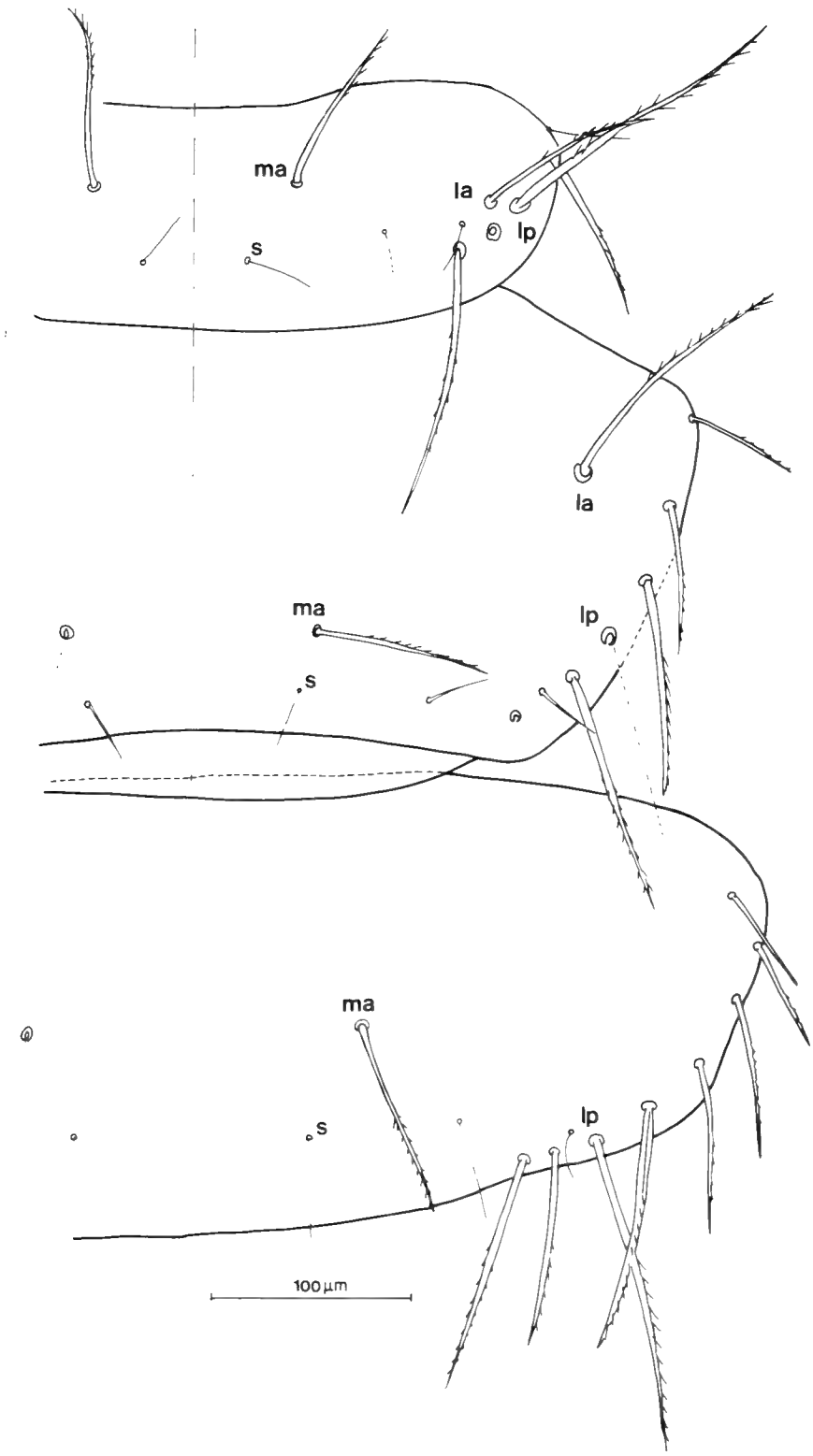

FIG. 16

Lepidocampa (*L.*) *deharvengi* n. sp., femelle holotype. Pro-, méso- et métanotum. *ma*, *la*, *lp* = macrochètes médial antérieur, latéral antérieur, latéral postérieur; *s* = sensille sétiforme. Ecailles non représentées.

Remarque. Les spécimens de Chiang Dao sont en très mauvais état, le thorax épilé et les antennes brisées, mais quelques détails permettent de les rapporter à la nouvelle espèce. Sauf indication contraire, ce sont les exemplaires de Betong qui sont décrits. La femelle de Betong est choisie comme holotype, les deux autres individus de cette localité sont des paratypes.

Longueurs. Les nombres se rapportent, dans l'ordre, au mâle de Chiang Dao, au mâle juvénile, à la femelle et à la larve de Betong. Corps: 2,03; 1,78; 2,65; 1,50 mm. Cerque (mâle juv.): 0,82. Patte III (depuis le subcoxa): 0,70; 0,61; 0,85; 0,45 mm.

Tête. - Antennes de 23 articles chez la femelle; 19 chez le mâle et 17 chez la larve. Le sensille du IIIe article antennaire, inséré entre *b* et *c*, est assez long (12-12,5 µm) et subcylindrique. Organe cupuliforme renfermant 4 petits sensilles simples. Les sensilles des palpes maxillaire et labial sont un peu plus courts (8,5-11 µm) que celui de l'antenne et plus ou moins dilatés, le labial des deux mâles en particulier. Les 3 soies proximales des processus palpiformes labiaux sont ramifiées.

Thorax. - Tous les macrochètes sont finement barbelés. Les médiaux antérieurs, surtout ceux du mésonotum, sont insérés très peu en avant d'une droite unissant les embases des macrochètes latéraux postérieurs; leur apex dépasse ainsi largement l'embase des sensilles sétiformes médiaux postérieurs, de sorte que le rapport *ma*/δ est ici beaucoup plus élevé que le rapport *ma*/ϵ (tableau II).

TABLEAU II

		soies *C*	*ma*/ϵ	*ma*/δ	*ma*/δ / *ma*/ϵ
Th. II	Larve	0	0,80	1,62	2,02
	Mâle	3	0,83	1,61	1,95
	Femelle	13	0,74	1,68	2,27
Th. III	Larve	0	0,70	1,76	2,51
	Mâle	3	0,68	1,80	2,65
	Femelle	13	0,59	1,67	2,81

Le macrochète tergal du fémur III est inséré aux 3/5 apicaux de l'article (73/124) et son apex atteint sensiblement celui de l'article; il est barbelé sur les 2/3 distaux. Un macrochète sternal, très net et barbelé vers l'apex, au tibia. Griffes et pulvilli typiques.

Abdomen. - Tergite IV avec 2+2 macrochètes subégaux et une paire de phanères latéraux courts et grêles qui évoluent en macrochètes aux tergites suivants (3+3); 4+4 en VIII; 5+5 (total) en IX.

Sternite I sans champ glandulaire chez la femelle (13*C*) et le mâle juvénile (3*C*) de Betong, mais avec 44 g_1 sur 2(3) rangs chez le mâle (9*C*) de Chiang Dao et une rangée de 6+7 poils banaux en avant des phanères glandulaires. 6+6 macrochètes. Les appendices sont subquadrangulaires dans les deux sexes, comme chez la larve, leur base étant égale ou un peu inférieure à la longueur et contenue 2 fois 1/2 à 3 fois

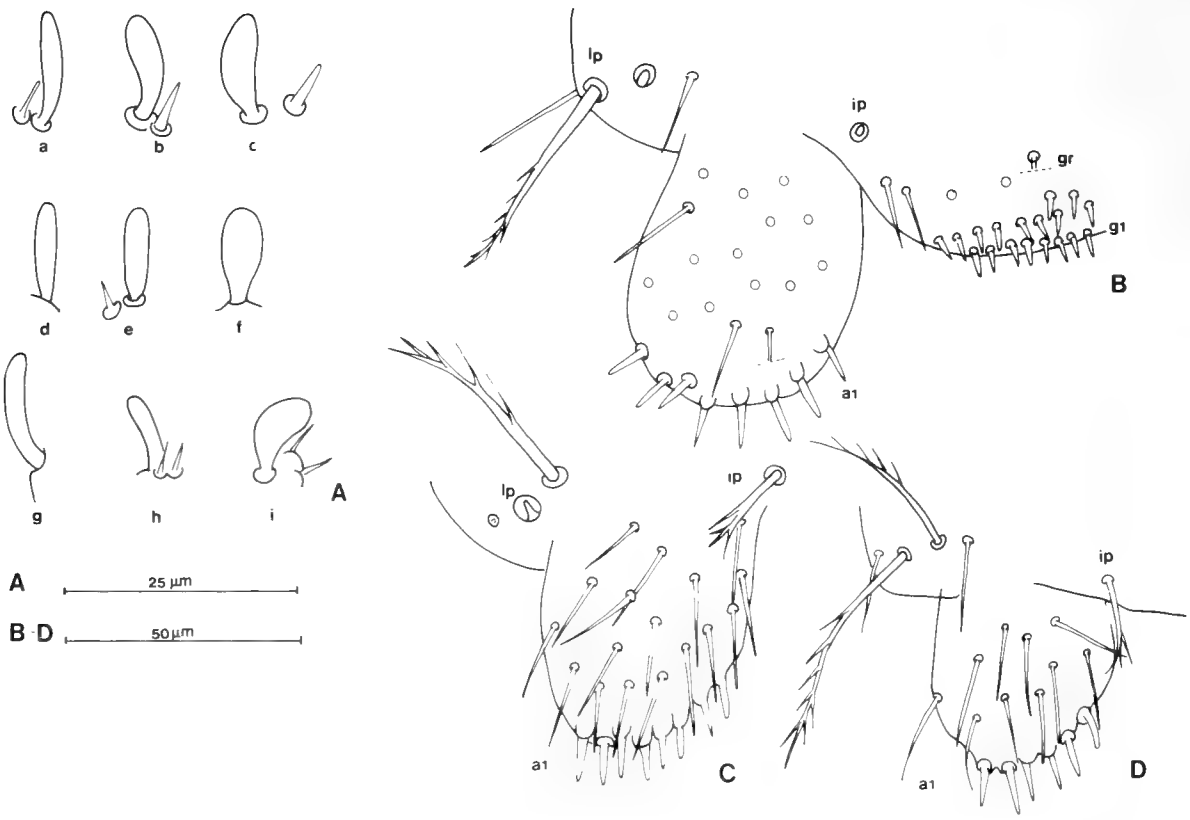

FIG. 17

Lepidocampa (L.) deharvengi n. sp. A. Sensilles de l'article III de l'antenne, des palpes maxillaire et labial: a à c, femelle holotype; d et e, sensilles maxillaires gauche et droit; f, sensille labial gauche, mâle à 9 soies *C*; g à i, mâle à 3 soies *C*. - Portion latérale postérieure de l'urosternite I: B. mâle à 9 soies *C*; C. femelle holotype; D. mâle à 3 soies *C*.

dans l'espace inter-appendiculaire. L'apex porte des phanères glandulaires (a_1) peu nombreux: 6, 8 et 5 à Betong, 8 chez le mâle de Chiang Dao.

Sternite VIII avec 0 soies *C* chez les larves, 3 et 9 chez les mâles, 13 et 14 chez les femelles. Les soies *C* du mâle le plus âgé sont robustes et densément barbelées, les *B* étant externes; chez les femelles ces soies sont grêles, les plus latérales seules pourvues de rares barbules, et les *B* sont entre celles de la paire la plus externe.

Soies de revêtement de la papille génitale mâle barbelées; les plus sternales, situées en avant du gonopore sont courtes, épaisses, leurs barbules pouvant diverger sur la portion apicale, l'ensemble évoquant un arbuscule; les phanères du pourtour apical sont plus longs, plus grêles et moins barbelés. 12 et 8 soies glabres à la rosette du gonopore.

Cerque comprenant une longue base (162), subdivisée en trois, et 4 articles (54, 60, 73, 78); tous les macrochètes sont longs et, à l'exception de ceux de l'article apical (glabres), ils sont finement barbelés sur leur moitié distale au moins.

AFFINITÉS. - Des soies barbelées sur la papille génitale mâle ne sont connues que chez *L. weberi nepalensis* Condé, 1993 où elles sont toutefois beaucoup plus grêles et

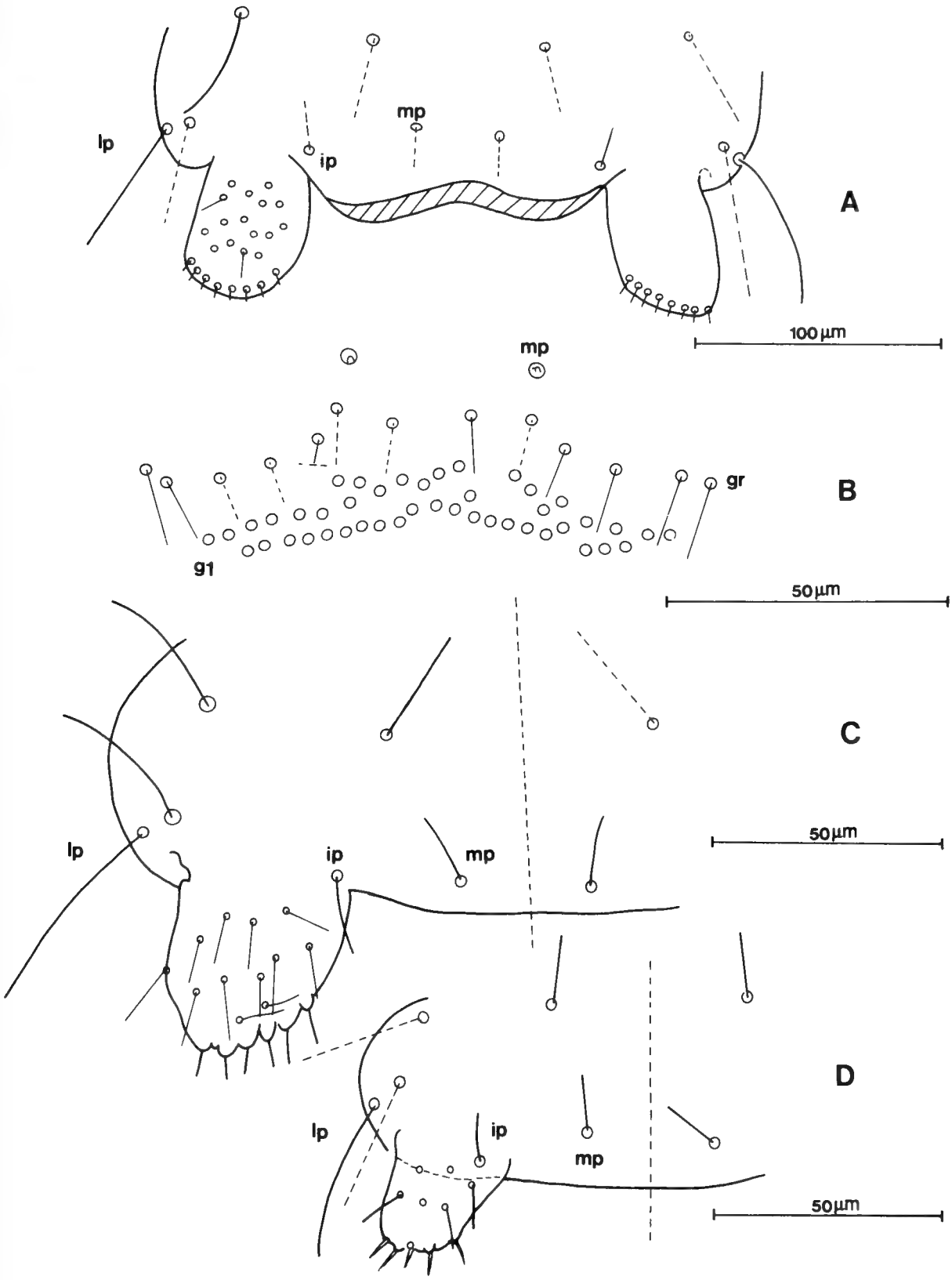

FIG. 18

Lepidocampa (L.) deharvengi n. sp., diagrammes des urosternites I. A. Mâle à 9 soies *C* (champ glandulaire en hachures). - B. Implantation des phanères marginaux de l'urosternite précédent. - C. Mâle à 3 soies *C*. - D. Larve à 0 soie *C*. g_1 = phanères glandulaires du sternite; *gr* = soies grêles; *ip*, *lp*, *mp* = macrochètes intermédiaire, latéral et médial postérieurs.

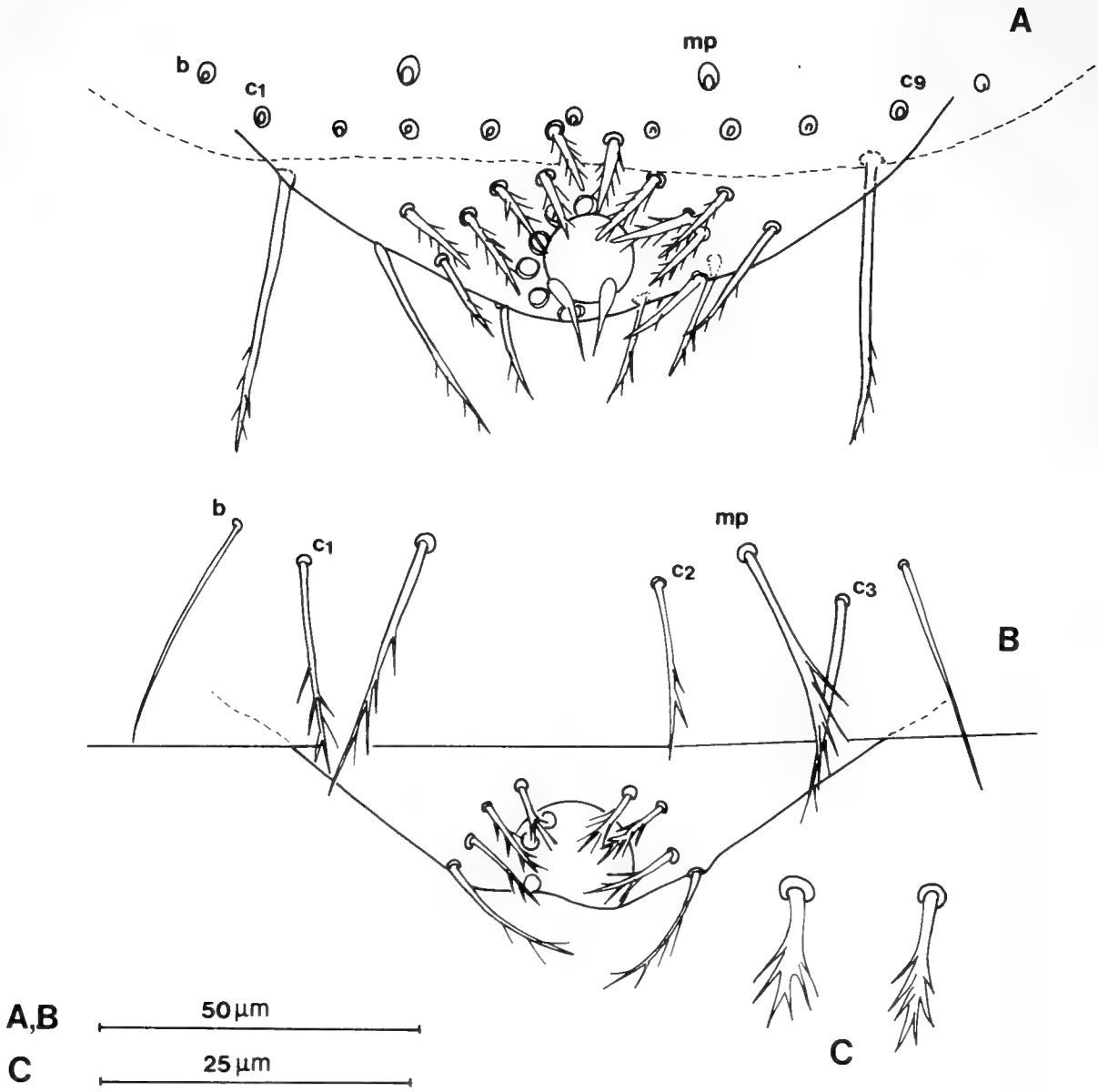

FIG. 19

Lepidocampa (L.) deharvengi n. sp. Urosternite et papille génitale. A. Mâle à 9 soies *C*; le bord postérieur du sternite est figuré en tireté. - B. Mâle à 3 soies *C*. - C. Détail de 2 soies ramifiées de la papille génitale du mâle précédent.

pourvues de barbules moins nombreuses, leur conférant un aspect très différent. La position et les longueurs relatives des *ma* mésonotaux sont également des critères différentiels, $\bar{X}$ *ma*/δ = 2,08 (marges: 1,95-2,27) chez *deharvengi*; 1,28 (marges: 1,17-1,52) chez *weberi nepalensis*[1]. Les appendices subquadrangulaires du sternite I de *deharvengi* s'opposent à ceux, étroits et plutôt atténués vers l'apex, de *weberi nepalensis*. Enfin, les macrochètes des cerques de *deharvengi* sont bien barbelés,

[1] Les valeurs de *ma*/ϵ et de *ma*/δ ont été établies respectivement sur 40 et 41 spécimens de *L. weberi nepalensis*.

tandis que ces mêmes phanères sont glabres ou faiblement barbelés sur la base et les premiers articles de *weberi nepalensis*, et complètement glabres sur les suivants.

REMERCIEMENTS

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REVUE SUISSE DE ZOOLOGIE, 101 (2) : 361-368; juin 1994

Proteocephalus sophiae n. sp. (Cestoda: Proteocephalidae), a parasite of the siluroid fish *Paulicea luetkeni* (Pisces: Pimelodidae) from the Brazilian Amazon

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Proteocephalus sophiae **n. sp. (Cestoda: Proteocephalidae), a parasite of the siluroid fish** *Paulicea luetkeni* **(Pisces: Pimelodidae) from the Brazilian Amazon.-** *Proteocephalus sophiae* n. sp. is described from the siluroid fish *Paulicea luetkeni* (Steindachner), caught in the Amazon river at Itacoatiara (Amazonas State, Brazil). Among the *Proteocephalus* species of neotropical freshwater fishes, the absence of preporal vitellaria in the new species is unique with the exception of *Proteocephalus macdonaghi* (Szidat & Soria) from which it differs in a series of other characters. Including *Proteocephalus sophiae*, seven species of Proteocephalidea each representing a different genus, are recorded from *Paulicea luetkeni*, which is a surprisingly high parasite diversity.

Key-words: Cestoda - Proteocephalidae - New species - Pimelodidae - Brazil.

INTRODUCTION

Many neotropical siluroid freshwater fishes, and in particular Pimelodidae, are heavely parasitised by proteocephalidean tapeworms. WOODLAND (1933 a, b, c; 1934 a, b, c, d; 1935 a, b) established the base of Monticelliidae taxonomy, one of the two proteocephalidean families. This base though is shady as many of his so-called types are mixtures of several species. This was an important conclusion which was drawn from a study of recently collected material. The specimens were collected in one of Woodland's type localities in the Amazonian region and processed according to present day standards for subsequent analysis. Among this material is a sample from *Paulicea luetkeni*, locally known as "Jau", which is a new species described below.

MATERIAL AND METHODS

204 specimens of 34 fish species were collected and examined. They were dissected in the field immediately after their death. The entire split digestive tract was

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fixed with hot 4% neutral formaldehyde solution. The parasitic worms were stained with Mayer's hydrochloric carmin solution, differentiated in acid alcohol, deshydrated in ethanol, cleared in Eugenol (clove oil) and mounted in Canada balsam. Transverse sections, twelve µm thick, were stained with Weigert's haematoxylin and counterstained with eosin. The parasites are stored in the Instituto Oswaldo Cruz (IOC) and in the Muséum d'Histoire naturelle, Geneva (MHNG).

All measurements are in µm unless otherwise noted; m = mean, n = number of measurements used, CV = coefficient of variation.

Proteocephalus sophiae n. sp.

Material studied

Brazil, Amazon river at Itacoatiara (AM), in *Paulicea luetkeni* (Steindachner, 1875), (Pimelodidae), 19.9.1992, leg A. de Chambrier & A. A. Rego.

Holotype MHNG No 992.135; 4 paratypes No MHNG 992.136, 992.137, 992.138; IOC No 33.114; other material MHNG No 992/139-142; IOC No 33.115-118.

Site of infection: Anterior intestine diverticles; Prevalence: 20%, n = 5 hosts; Intensity: 12 specimens; Abundance: 2.4.

Derivatio nominis: The new species is named in honour of Sophie, the daugther of one of the authors.

DESCRIPTION (based on five specimens)

Worm of medium size, flattened dorsoventrally. Strobila acraspedote, 60-130 mm long, bearing about 200 proglottids. Two mm unsegmented zone posterior to scolex. Immature proglottids wider than long. Mature proglottids quadrangular or longer than wide. Gravid proglottids longer than wide. Presence of some teratologic proglottids which are not considered in the description (e.g. hypertrophy of vitellaria).

Scolex conical, 525-670 in diameter, well separated from strobila, with conspicuous prominent apical structure similar to a rostellum which does not contain a sucker, 120-165 in diameter (Figs 1,10). Four prominent lateral suckers, opening slightly anteriorly, 255-355 (m=300, n=21) in diameter. External superior part of suckers each with two small inconspicuous protuberance, clearly visible in scolex well oriented and well fixed (Figs 1,11).

Internal longitudinal musculature well developed, forming anastomosed muscular fibres bundles (Figs 5-7). Ventral osmoregulatory canals 15-30 in diameter, dorsal osmoregulatory canals, 10-15 in diameter.

83-141 (m=110, n=39, CV=14.9) spherical oval medullary testes in two fields united anteriorly, extending to the excretory canal, without overlapping it (Figs 2, 3), 12-24 (m=18, n=39) preporal testes, 19-47 (m=32, n=39) postporal testes, 45-78 (m=60, n=39) antiporal testes, 45-80 in diameter.

Piriform thinly-walled cirrus pouch, with distal part angled anteriorly, 300-410 long and 100-145 wide (Fig. 4). Cirrus pouch length to proglottid width ratio 31-41% (m=36%, n=30, CV=6.65). Invaginated cirrus elongated 235-335 x 85-100 (x=290 x 90, n=30), thick-walled with its terminal part enlarged (Fig. 4). Cirrus occupying 75-90% (x=82%, n=30, CV=4.76) of cirrus pouch length.

Genitals ducts passing between the osmoregulatory canals. Ejaculatory duct long and coiled. Vas deferens coiled, occupying a rounded field extending between

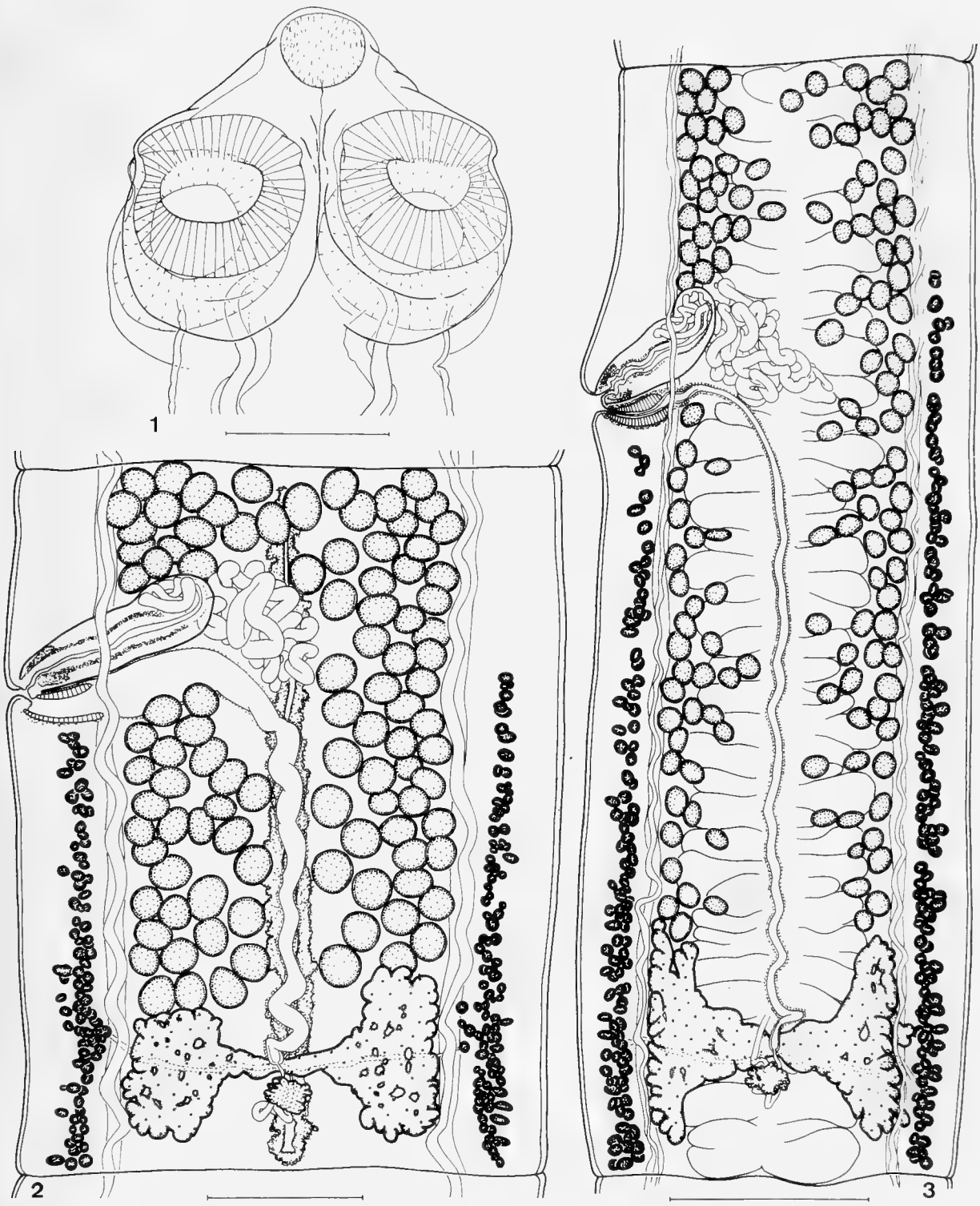


FIG. 1-3

Proteocephalus sophiae n. sp. 1. Scolex. Paratype, dorsal view, with conspicuous apical structure. 2. Mature proglottid, holotype, dorsal view, showing the posterior uterine position which overlapps the ovary and the absence of preporal vitellaria. 3. Holotype, gravid proglottid, dorsal view. The eggs are not figured. Scale: 1, 2 = 250 µm; 3 = 500 µm.

proximal part of cirrus pouch and median part of uterus, crossing over the latter in mature and gravid proglottids.

Genital atrium present. Genital pores irregularly alternate, situated anteriorly between 25% and 32% (m=28%, n=32) of proglottid length (Figs 2, 3).

Ovary medullary, biwinged, butterfly-shaped in gravid proglottids, 530-710 wide and 200-620 long. Ovary occupying 60-71% (m=66%, n=30, CV=4.33) of proglottid width (Figs 2, 3).

Vagina always posterior to cirrus pouch, with a powerful terminal vaginal sphincter (Fig. 4). Vagina and vaginal duct often dilated in mature proglottids (Fig. 2). Vaginal duct dorsal to uterus. Seminal receptacle present. Mehlis' gland 80-120 in diameter. Vitelline follicles medullar and paramuscular, i.e. situated near to the internal longitudinal musculature and extending into both the cortex and medulla (de Chambrier 1990, p. 92) (Figs 5-7). Vitellaria arranged in two lateral rows, absent from the preporal region (exceptionnally one to five preporal vitelline follicles present) and from the aporally anterior part of proglottids, with tendency to become more numerous posteriorly (Figs 2, 3). Postporal vitellaria occupying 61-69% (m=66%, n=29, CV=2.71) and aporal vitellaria occupying 69-82% (m=76%, n=29, CV=5.44) of proglottids length, respectively.

Uterus preformed, uterine stem cortical (Fig. 5). Uterine developed diverticula in medulla, invading in gravid proglottids the whole longitudinal median part of the medulla (Fig. 3). Uterus overlapping the ovary ventrally in immature proglottids and almost extending to the posterior part, occupying the entire length of gravid proglottids (Figs 2, 3). Uterus with 35-45 ramified lateral branches on each side (Fig. 3). Uterus occupying up to 75% of the gravid proglottid width. Eggs eliminated by a ventral longitudinal split along the entire length of proglottids. Eggs laying before ultimate proglottids which contains only a few eggs. Eggs with delicate external membrane, 60-70 in diameter, embryophore 20-22 in diameter, oncosphere 11-12 in diameter, hooks 5-7 long (Figs 8-9).

The new species is characterized by the following features: vitellaria absent preporally, distinctly shorter aporally than the total length of proglottid; vitellaria medullar and paramuscular; conspicuous apical structure; uterine stem cortical, uterine branches medullar; uterus occupying almost the entire length of proglottids in immature proglottids; powerful vaginal sphincter; vagina always posterior to cirrus pouch.

Discussion

The medullar position of vitellaria as well as the unarmed scolex and the form of the uniloculate suckers places the new species in the genus *Proteocephalus* Weinland 1858 (Schmidt 1986).

In this genus (as well as in the entire order of Proteocephalidea) the absence of preporal vitellaria is very scarce. Among members of *Proteocephalus* parasites in Neotropical freshwater fishes, only *P. macdonaghi* (Szidat & Nani, 1951), from *Basilichthys microlepidotus*, Argentina, shares the absence of preporal vitellaria with *P.*

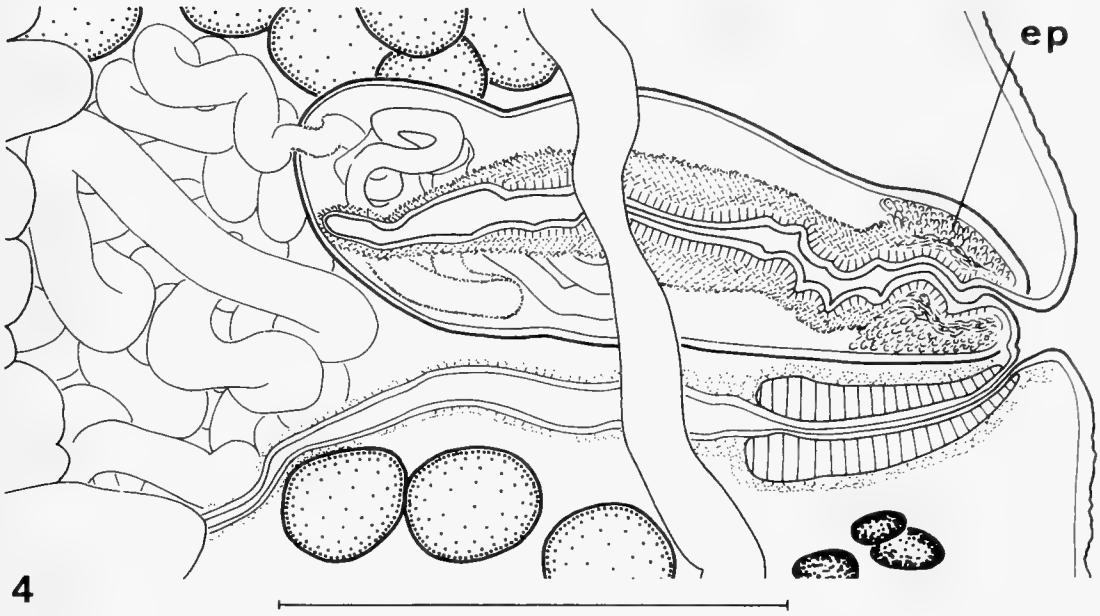


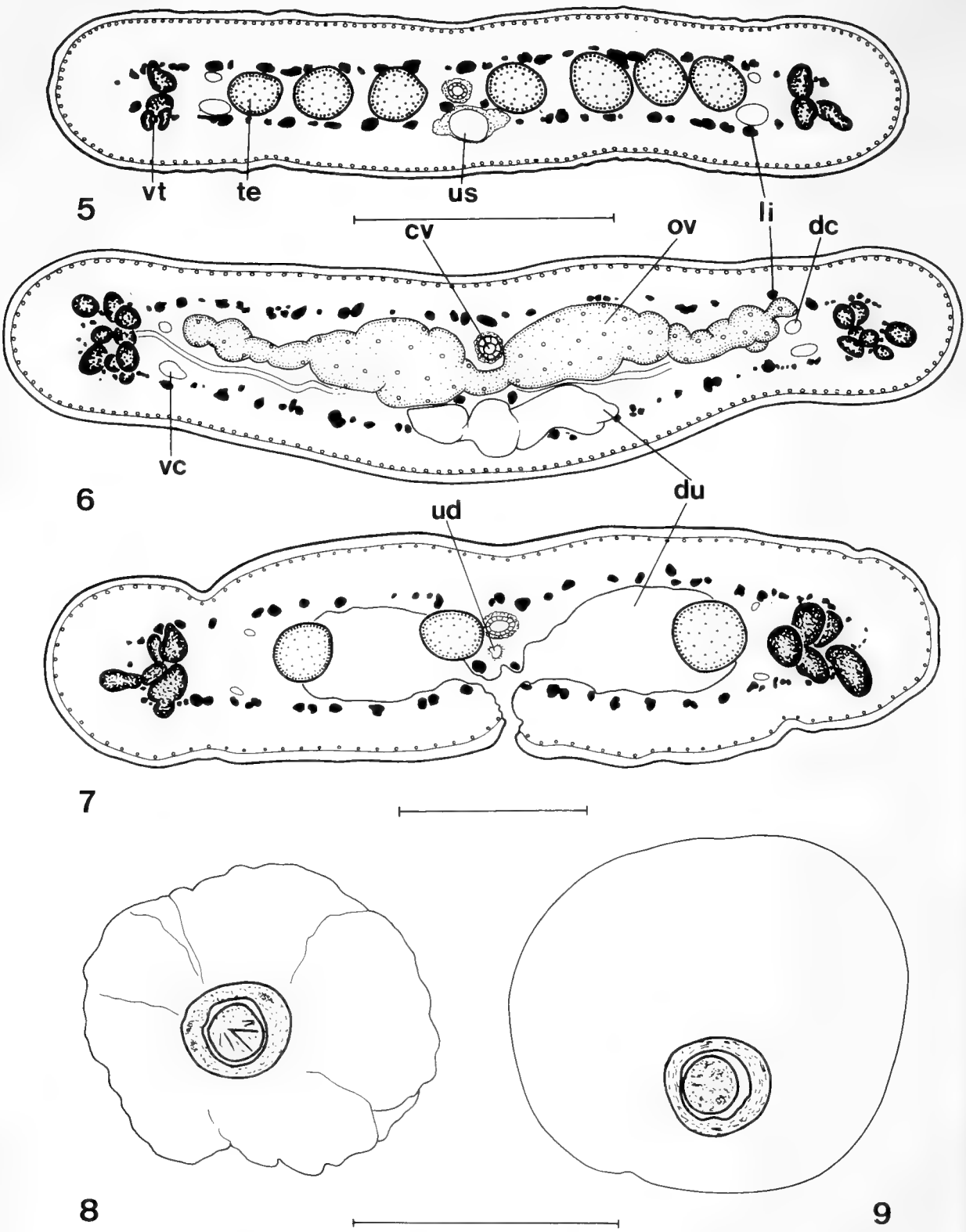
FIG. 4

Proteocephalus sophiae n. sp. Holotype, vagina and cirrus pouch, gravid proglottid, ventral view. Note the enlarged terminal part of cirrus and the conspicuous terminal vaginal sphincter; ep = enlarged terminal part of cirrus. Scale: 250 µm.

sophiae, but differs by the absence of an apical organ, shape of its eggs and the number of testes (SZIDAT & NANI 1951). Furthermore, *P. sophiae* is the only known species with an uterus which occupies almost the entire length of premature proglottids.

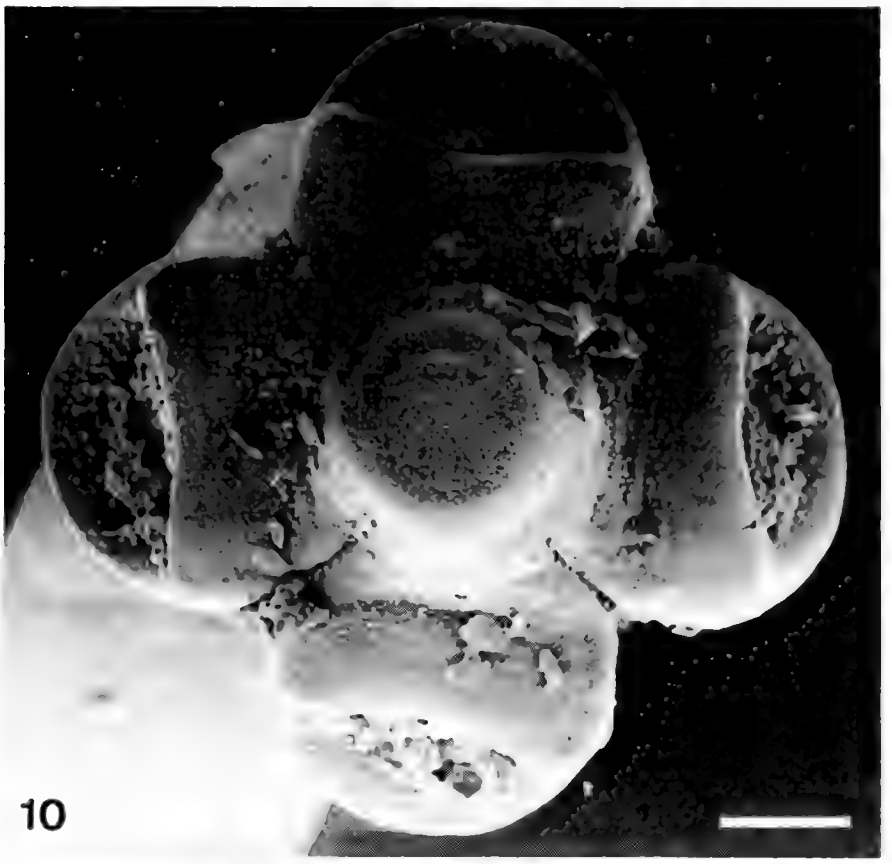
The cortical ventral position of uterine stem with development of medullar lateral branches was observed in *Proteocephalus paraguayensis* (Rudin, 1917) (see DE CHAMBRIER, 1990, fig. 4E). This character encountered for the second time may be more common than suspected by neotropical proteocephalids.

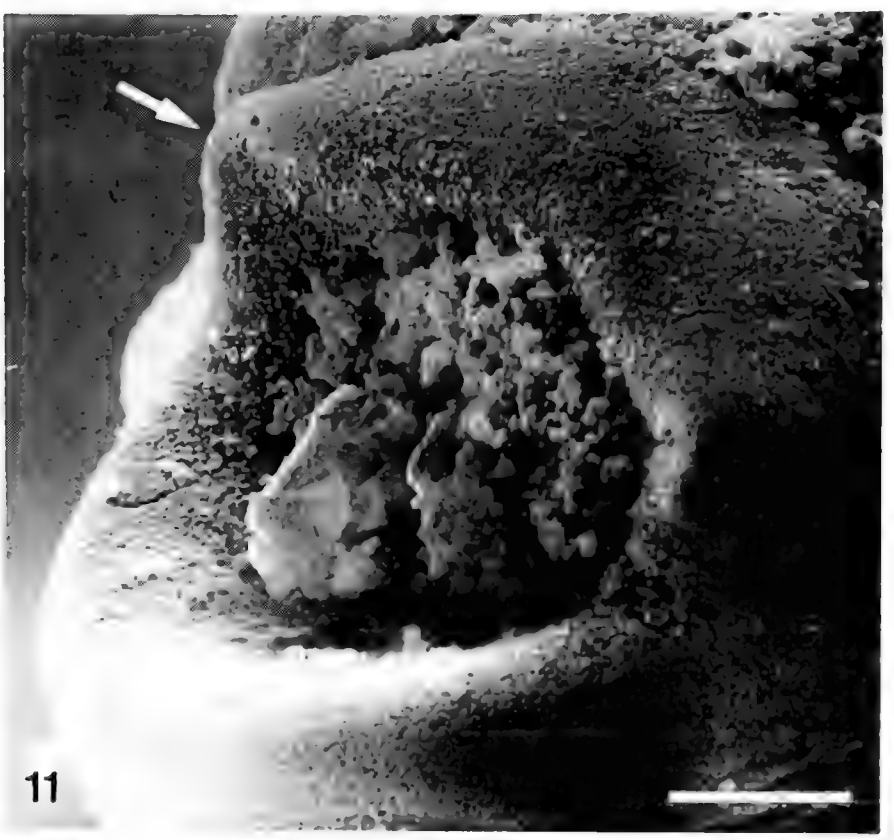
Proteocephalus sophiae n. sp. is the seventh species and genus known to parasitize *Paulicea luetkeni*. REGO & PAVANELLI (1992) listed six species from different genera in this host: *Choanoscolex abscisa* (Riggenbach, 1896); *Goezeella agostinhoi* Pavanelli & Machado dos Santos, 1992; *Jauella glandicephalus* Rego & Pavanelli, 1985; *Megathylacus brooksi* Rego & Pavanelli, 1985; *Peltidocotyle rugosa* Diesing, 1850; *Travassiella avitellina* Rego & Pavanelli, 1987. This diversity of Proteocephalidae at generic level for a single host species is comparable to that found in other siluroid hosts *Pseudoplatystoma fasciatum* and *P. coruscans* (Pimelodidae), each of which harbours six genera (see REGO & PAVANELLI, 1992). This situation confirms the impressive diversity of Proteocephalidea parasitizing Neotropical siluroid fishes. More than 75% of the recorded hosts are members of the Pimelodidae.



FIGS 5-9

Proteocephalus sophiae n. sp. Holotype. 5. Transverse section, mature proglottid. Note the cortical position of the uterine stem. 6. Transverse section at level of ovary, pregravid proglottid. 7. Transverse section, gravid proglottid with the medullar position of the uterine diverticles and the medullar-paramuscular position of vitellaria. 8, 9. Eggs; cv = vaginal canal; dc = dorsal osmoregulatory canals; du = uterine diverticle; li = internal longitudinal musculature; ov = ovary; te = testes; ud = uteroduct; us = uterine stem; vc = ventral osmoregulatory canals; vt = vitellaria; Scale: 5-7 = 250 µm; 8, 9 = 50 µm.





FIGS 10-11

Proteocephalus sophiae n. sp. Scolex. 10. Apical view. 11. Detail of one sucker, showing the upper protuberances (arrow). Scale: 10 = 100 µm; 11 = 50 µm.

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REVUE SUISSE DE ZOOLOGIE, 101 (2) : 369-411; juin 1994

Limites génériques et caractéristiques taxonomiques de plusieurs genres de la tribu des Chrysogasterini (Diptera, Syrphidae)[1]

III. Description des stades immatures de plusieurs espèces ouest-paléarctiques

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Generic limits and taxonomic features of some genera belonging to the tribe of Chrysogasterini (Diptera, Syrphidae). III. Description of immature stages of some west palaearctic species.- Following the recent revision of the generic limits of the genera *Lejogaster* Rondani, *Chrysogaster* Meigen and *Orthonevra* Macquart, with the revalidation of *Melanogaster* Rondani and the creation of a new genus *Riponnensia* (Maibach et al. 1994a), we present a morphological synthesis of all the immature stages of these genera known, at present, in the west palaearctic region. Besides the re-description of larvae and puparia of *Chrysogaster solstitialis* (Fallen), *Lejogaster metallina* (Fabricius), *L. tarsata* (Megerle in Meigen), *Melanogaster hirtella* (Loew), *M. nuda* (Macquart), *Orthonevra brevicornis* (Loew) and *Riponnensia splendens* (Meigen), we describe for the first time the immature stages of *Melanogaster aerosa* (Loew), *Orthonevra nobilis* (Fallen) and *O. onytes* (Séguy). Biological notes on the developmental stages are included, as well as a key to the identification of the presently known European larvae and puparia of the concerned genera.

Key-words: Diptera - Syrphidae - Chrysogasterini - Immature stages - Morphology - Taxonomy.

INTRODUCTION

Les caractéristiques taxonomiques des adultes, larves et pupes de plusieurs genres de la tribu des Chrysogasterini (*sensu* PECK 1988) ont fait l'objet d'une étude récente (MAIBACH et al. 1994a, b) avec pour résultats une redéfinition et une nouvelle délimitation des genres *Lejogaster* Rondani, *Orthonevra* Macquart et *Chrysogaster*

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[1] Travail réalisé grâce à une bourse de la Société Académique Vaudoise.

[2] Ce travail fait partie de la thèse de doctorat du premier auteur.

Manuscrit accepté le 24.06.1993.

Meigen, la revalidation du genre *Melanogaster* Rondani (regroupant plusieurs espèces pour la plupart rattachées auparavant au genre *Chrysogaster*), enfin la création d'un nouveau genre *Riponnensia* Maibach, Goeldlin de Tiefenau & Speight comprenant, à ce jour, 4 espèces.

Au sein de chaque genre, les stades immatures de certaines espèces sont déjà connus. Il convient de citer les descriptions de *Melanogaster nuda* (Macquart) par BELING (1888) et par HENNIG (1952), de *M. hirtella* (Loew) par VARLEY (1937) et par HARTLEY (1958, 1961), de peut-être *M. parumplicata* (Loew) (description très sommaire d'une pupe sous l'appellation *Chrysogaster macquarti* Loew) par LUNDRECK (1916). Nous mentionnerons enfin la synthèse de HARTLEY (1961) où sont décrites ou redécrites *M. hirtella* (Loew), *Chrysogaster solstitialis* (Fallen), *Lejogaster metallina* (Fabricius), *L. tarsata* (Megerle *in* Meigen), *Orthonevra brevicornis* (Loew) et *Riponnensia splendens* (Meigen).

Dans ce travail, nous avons repris et complété les descriptions de ces espèces. En outre, nous décrivons pour la première fois les larves et pupes de *Melanogaster aerosa* (Loew), d'*Orthonevra nobilis* (Fallen) et d'*O. onytes* (Séguy). Une note biologique ainsi qu'une clé de détermination des stades immatures actuellement connus pour la région paléarctique occidentale complète la présente étude.

MATÉRIEL ET MÉTHODE

Les larves ont été extraites du sol par tamisage ou par extracteur Berlese-Tullgren; les pupes ont été prélevées à vue ou proviennent de nos élevages.

Après lavage, le matériel larvaire a été trié puis élevé, le cas échéant préparé et conservé selon la méthode décrite par MAIBACH & GOELDLIN DE TIEFENAU (1992); l'ensemble du matériel est déposé dans les collections entomologiques du Musée cantonal de Zoologie à Lausanne (Suisse) (coll. MZL). Le nombre de spécimens de chaque espèce ainsi que leur provenance sont indiqués au début de chaque description; la date indiquée correspond à la date de la récolte du matériel sur le terrain et non à la date des transformations en pupe ou des émergences dans les élevages.

Plusieurs descriptions ont été complétées après examen de larves et pupes déposées dans la collection Hartley (Royal Museum of Scotland, Edinburgh, GB).

DESCRIPTION DES STADES IMMATURES

GENRE *Chrysogaster* Meigen, 1803

Chrysogaster solstitialis (Fallen, 1817)

[larve et pupe décrites auparavant par Hartley (1961)]

IRLANDE. - Co. Wicklow: Newtownmountkennedy, Kilpedder Wood; 6.IV.1989; P. Goeldlin, A. Maibach & M.C.D. Speight leg.; coll. MZL: 3 larves; 22 pupes. - Co. Wicklow: Kilmurry Swamp; 4.IV.1989; P. Goeldlin, A. Maibach & M.C.D. Speight leg.: 3

larves; 2 pupes. - Co. Wicklow: Glen of the Dawns, Bellevue Wood; 6.IV.1989; P. Goeldlin, A. Maibach & M.C.D. Speight leg.: 30 larves; 11 pupes.

SUISSE. - Vaud: Le Mont, Fontaine des Meules; 3-5.V.1989; P. Goeldlin leg.; coll. MZL: 5 larves; 6 pupes. - Vaud: Lausanne, Les Corbessières; 4-5.V.1989; P. Goeldlin leg.; coll. MZL: 11 larves; 15 pupes. - id.; 23.V.1990; A. Maibach leg.; coll. MZL: 2 larves.

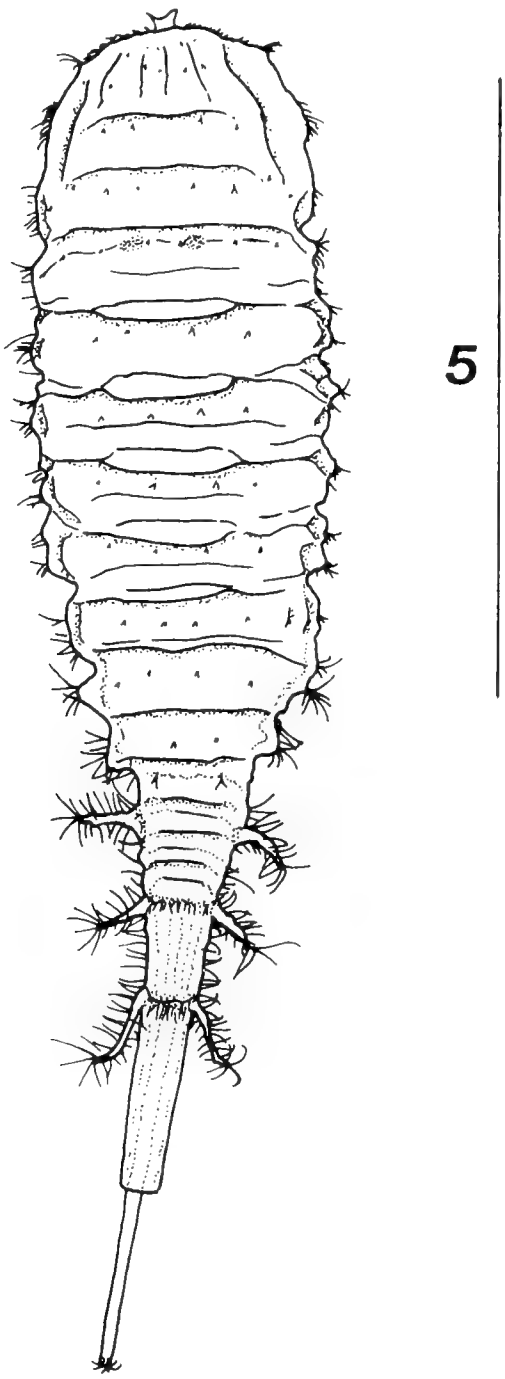


FIG. 1

Type larvaire caractéristique des genres *Chrysogaster*, *Lejogaster*, *Orthonevra* et *Riponnensia*; larve de dernier stade in toto; [larve de *Chrysogaster solstitialis* en vue dorsale; échelle en mm].

LARVE AU STADE III:

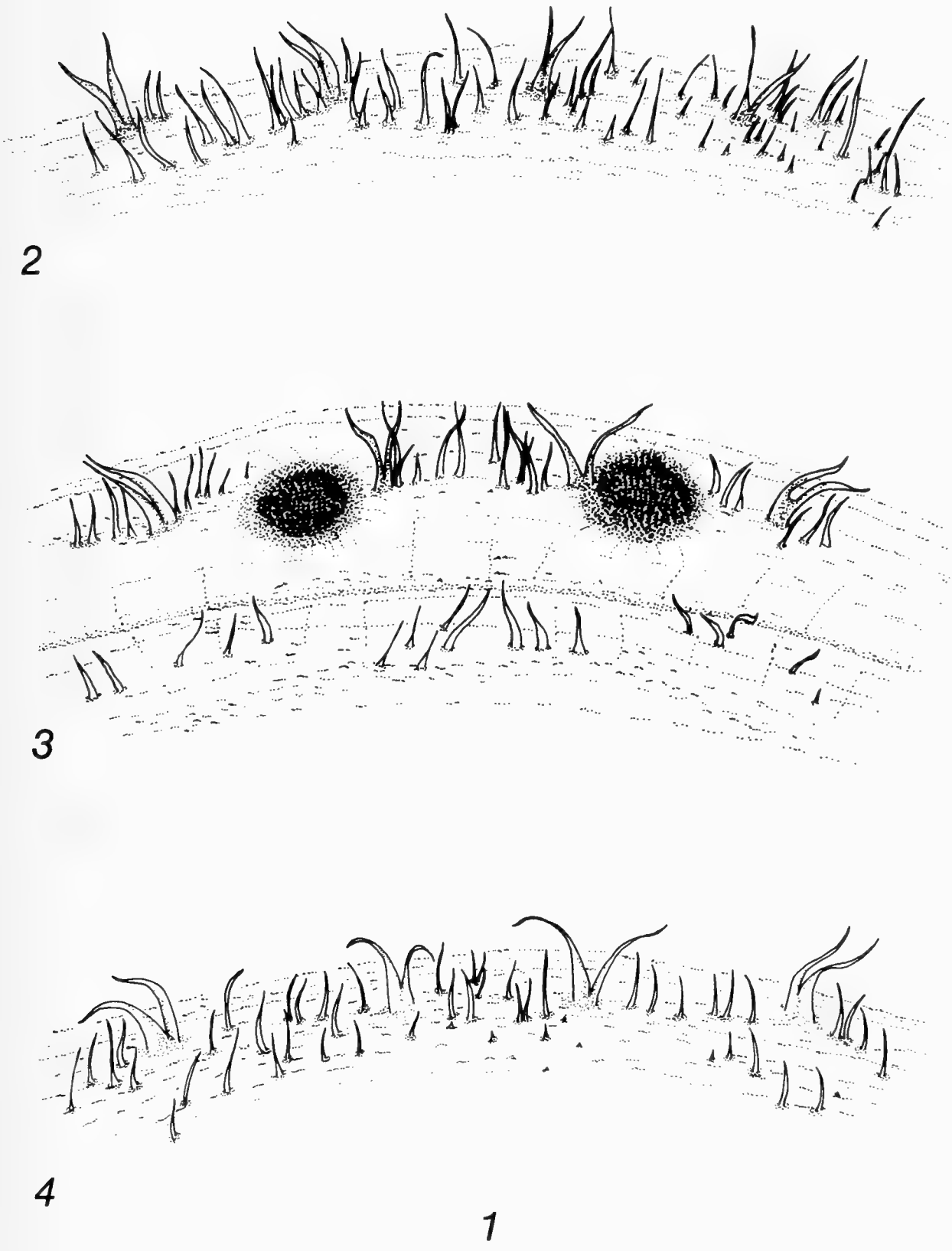
Longueur (prothorax-pédoncule L3 du seg. abd. 8): 8.5-9.8 mm; largeur: 2.5-2.9 mm; hauteur: 2.2-2.6 mm.

Larve métapneustique, fusiforme (fig. 1); bords subparallèles avec une largeur maximale au niveau du premier segment abdominal (abréviation: seg. abd.). Couleur générale blanchâtre à grisâtre; tégument blanchâtre, relativement transparent, laissant paraître par endroit les organes internes, tels les trachées dans la partie postérieure et, vers l'avant, les sacs trachéens sous forme de deux masses blanchâtres, donnant à la larve un aspect général de perle.

Corps de section plus ou moins circulaire, léger aplatissement dorso-ventral qui s'accentue au niveau des seg. abd. 6, 7 et 8; en vue dorsale, corps tronqué dans sa partie antérieure, rétrécissement progressif dès les seg. abd. 5 et 6 pour se terminer au niveau du seg. abd. 8 par un tube respiratoire court mais extensible (1.00-3.5 mm); troncs trachéens postérieurs (2) soudés en un tube fin, rigide, qui coulisse (0-3.5 mm) à l'intérieur du tube respiratoire. Plaques stigmatiques, situées à l'apex des troncs trachéens, ornées chacune de 4 soies plumeuses à caractère hydrophobe disposées en rosace.

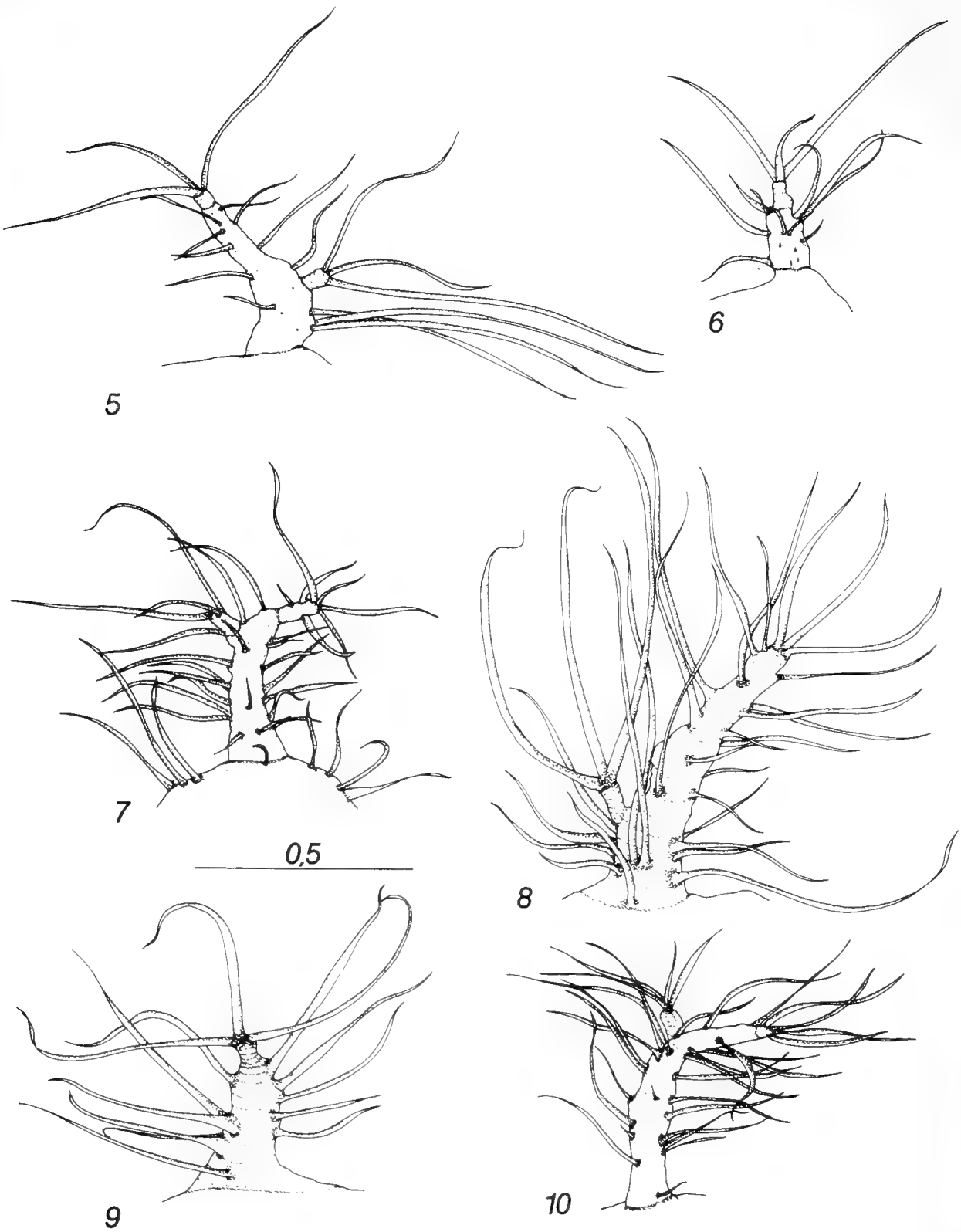
T é g u m e n t : surface du thorax d'aspect verruqueux, composée de micro-mamelons accolés les uns aux autres; tégument plus lisse sur les segments abdominaux (figs. 2-4). Dans la partie antérieure du prothorax, sommet de ces mamelons surmonté d'une minuscule soie noirâtre, dont la pointe est dirigée vers l'arrière; présence dans la région latérale du prothorax de part et d'autre de la cavité buccale, d'un bouquet de longues soies plus fortes orientées vers l'arrière.

M é t a m é r i s a t i o n : délimitation thorax-abdomen peu visible, mais aisée à situer par la présence sur le seg. abd. 1 de 2 taches dorsales circulaires, où seront localisées les futures cornes abdominales propres à la pupe. Corps distinctement plissé, plis à peine soulignés par des zones de dépôt de matière organique grisâtre. Segmentation masquée par une sous-segmentation en particulier dans la région dorsale: partie dorsale du prothorax légèrement plissée longitudinalement, la crête de chaque pli supportant l'arrangement des soies segmentaires dorsales; mésothorax sans sous-segmentation; en revanche métathorax ainsi que les seg. abd. 1 à 7 caractérisés par 3 sous-segments: le pli médian porte sur sa crête dorsale les soies segmentaires bifides, disposées au sein d'une mince bande de soies tégumentaires simples; les crêtes du troisième pli, ainsi que partiellement du premier, portent une bande de soies tégumentaires (*sensu* MAIBACH & GOELDLIN DE TIEFENAU 1989); ces trois bandes se rejoignent au niveau de la région dorso-latérale. Cette dernière comprend une succession de renflements latéraux peu développés, supportant les soies segmentaires latérales (*sensu* MAIBACH & GOELDLIN DE TIEFENAU 1989; arrangement et abréviations détaillés in MAIBACH *et al.* 1994a) (L1) et des groupes de soies tégumentaires, relativement longues, dont les pointes sont dirigées vers l'arrière. La partie médiane de la région latérale (supportant les soies L2 et L3) ainsi que la crête latéro-ventrale (support des soies segmentaires latéro-ventrales = VL) ont le même aspect et sont caractérisées par un arrangement tégumentaire comparable. Au niveau des seg. abd. 7 et 8, segmentation quasi invisible.



FIGS 2-4

Chrysogaster solstitialis, larve de dernier stade (échelle en mm); détail des ornementations segmentaires et tégumentaires dans la région dorsale. 2: métathorax; 3: segment abdominal 1; 4: segment abdominal 3.



FIGS 5-10

Type larvaire caractéristique des genres *Chrysogaster*, *Lejogaster*, *Orthonevra* et *Riponnensia*; pédoncules latéraux du segment abdominal 8 supportant les soies latérales (L); côté droit (échelle en mm). 5-7: *Lejogaster metallina*; 5: pédoncule latéral L1; 6: L2; 7: L3; 8-10: *Riponnensia splendens*; 8: pédoncule latéral L1; 9: L2; 10: L3.

Ornementation segmentaire, composée de soies bifides, blanchâtres: arrangement schématisé in HARTLEY (1961) et MAIBACH *et al.* (1994a). De part et d'autre du seg. abd. 8, soies latérales (L1, L2 et L3) insérées sur un pédoncule saillant (figs. 11, 12), véritable excroissance du tégument; ces pédoncules sont cylindriques, fins, relativement longs et ornés de longues soies (figs. 5-10): pédoncules de L1 et de L3 (parfois de L2) se divisant dans leur tiers terminal en 2 branches portant chacune un bouquet de 3 soies; soies latérales du seg. abd. 7 (L2 et L3 principalement) disposées à l'apex de pédoncules relativement courts.

Ornementation tégumentaire: sur le métathorax ainsi que sur les seg. abd. 1 à 6, limitée aux bandes de soies marquant les plis, espace entre ces bandes exempt de toute pilosité macroscopique; nombre de soies tégumentaires entre les soies dorsales D1 relativement élevé (figs. 3, 4): sur le seg. abd. 1 = 12-14 [13.2 ± 1.1; n = 10]; seg. abd. 3 = 11-14 [12.5 ± 1.1; n = 10]. Augmentation progressive de la longueur des soies du seg. abd. 1 jusqu'à l'extrémité de la larve. Présence de part et d'autre de la partie ventrale du seg. abd. 8, entre les pédoncules portant les soies latérales L1 et L2, d'une bande longitudinale de soies tégumentaires plus ou moins fortes; l'espace entre ces deux bandes de soies est couvert de soies tégumentaires plus petites; absence de soies tégumentaires sur la partie ventrale du seg. abd. 8 (tube respiratoire) entre L2 et L3 (figs. 11, 12).

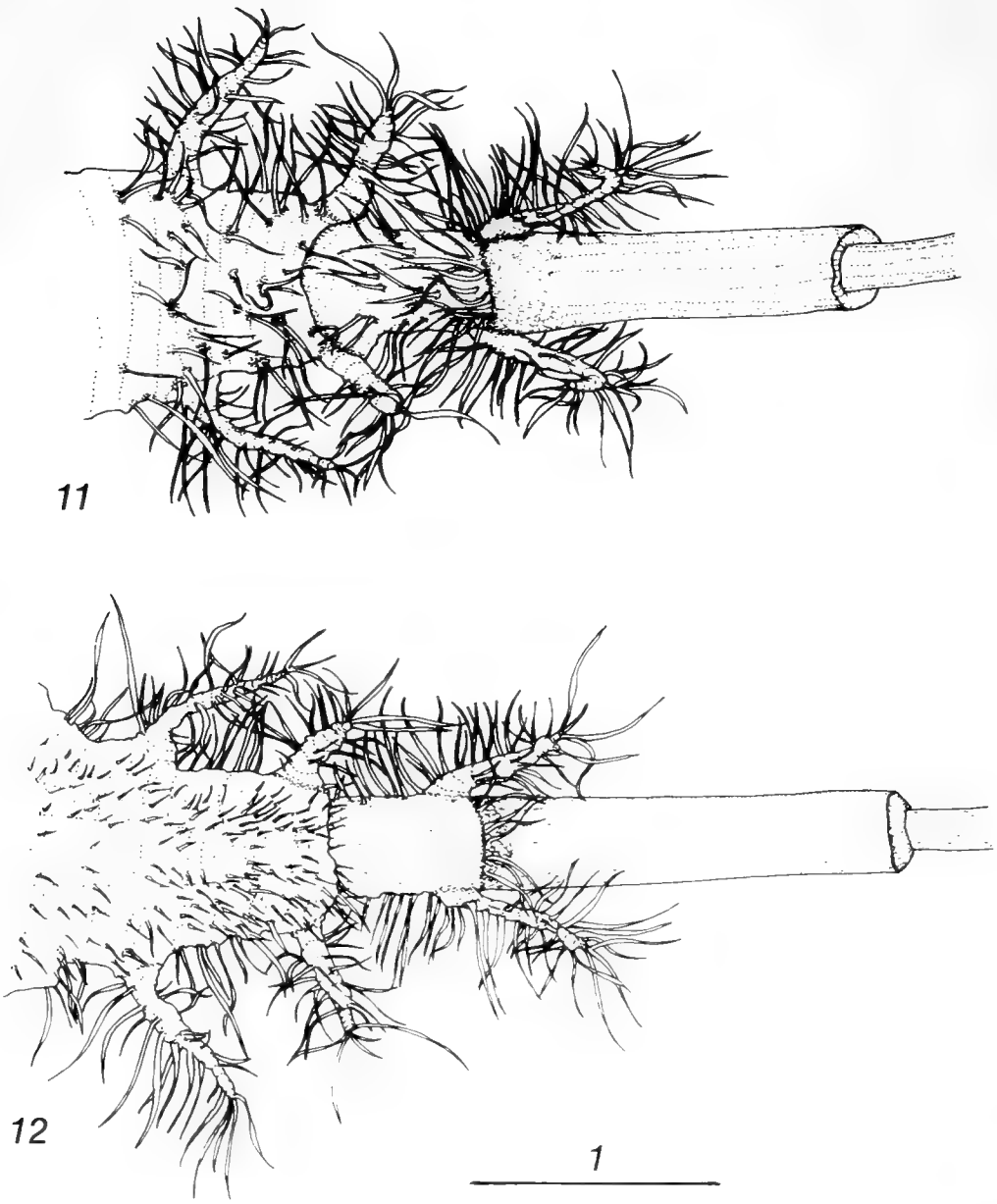
Pseudopodes: peu développés, présence d'une paire sous le mésothorax et sous chacun des seg. abd. 1-6; il s'agit de simples mamelons surmontés de soies peu sclérifiées sans disposition précise, pointes dirigées en général vers l'arrière; absence de pseudopodes sous les segments 7 et 8.

PUPE:

Longueur (tête - L3 du seg. abd. 8): 6.5-7.0 mm; largeur: 2.5-2.8 mm; hauteur: 2.1-2.8 mm.

Forme générale (figs. 13, 14): en vue dorsale, pupe ovale, prolongée vers l'arrière par l'étroit et relativement long processus respiratoire postérieur (les troncs trachéens sont entièrement dévaginés); de profil, ovale avec un applatissement ventral; le processus respiratoire postérieur est le plus souvent redressé perpendiculairement à la sole ventrale. Dans sa partie antérieure (thorax), pupe tronquée en biseau.

Tégument: de couleur brune à brun foncé, voire noirâtre, souvent plus claire dans la partie thoracique; verruqueux au niveau du thorax, plus finement sculpté au niveau de l'abdomen. Crêtes dorso-latérales et latéro-ventrales légèrement saillantes et souvent un peu plus claires. Segmentation marquée par des plis dans la région latérale, peu visible dorsalement mais néanmoins soulignée par la pilosité tégumentaire visible sous forme de bandes de soies claires ou transparentes, disposées transversalement sur chaque segment. Ornementation segmentaire bien visible seulement dans les régions dorsale et latérales; au niveau des seg. abd. 7 et 8, les pédoncules supportant les soies latérales L1, L2 et L3, ont séché et sont de ce fait peu visibles. Absence totale de soies tégumentaires sur la partie ventrale du seg. abd. 8 entre L2 et L3 (ce critère est toutefois difficile à observer).

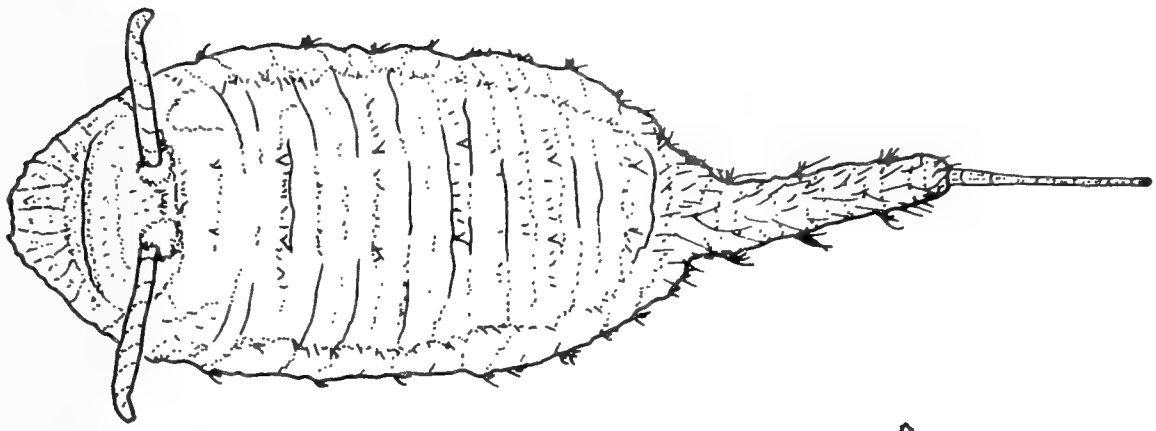


FIGS 11-12

Chrysogaster solstitialis, larve de dernier stade; segment abdominal 8 (échelle en mm). 11: vue dorsale; 12: vue ventrale.

P s e u d o p o d e s devenus quasi invisibles.

P r o c e s s u s s t i g m a t i q u e s : présence dorsalement (seg. abd. 1) de 2 processus (ou cornes stigmatiques) (figs. 13, 14) brun clair: forme et ornementation (disposition des orifices stigmatiques) caractéristiques de l'espèce (figs. 15, 16). Processus respiratoire postérieur le plus souvent redressés perpendiculairement à la sole ventrale; troncs trachéens entièrement dévaginés.



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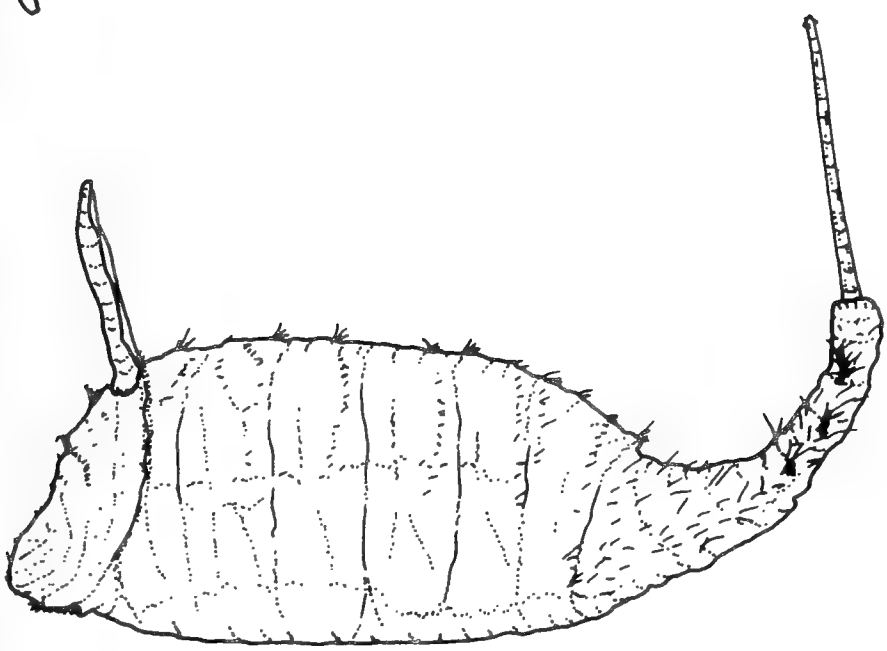

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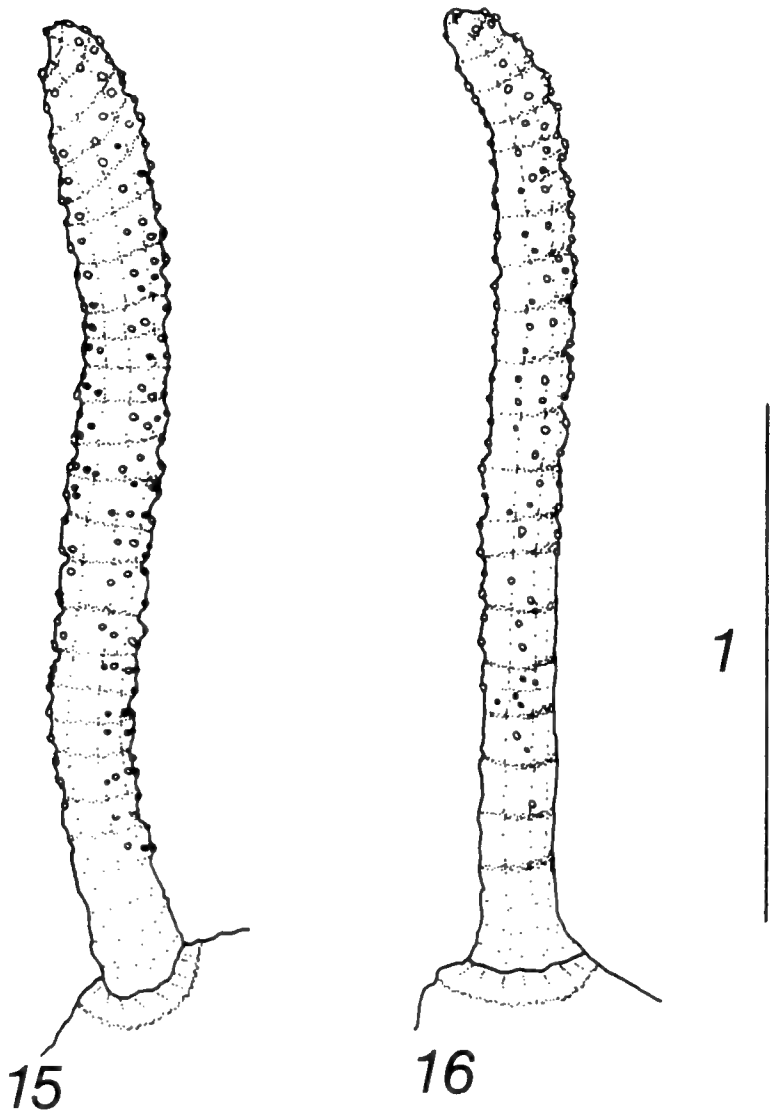
FIGS 13-14

Chrysogaster solstitialis, pupe (échelle en mm). 13: in toto en vue dorsale; 14: vue latérale.

NOTE BIOLOGIQUE:

Larve semi-aquatique: développement dans des dépressions humides en forêt souvent liées à des résurgences, dans des dépôts de matière organique le long de cours d'eau forestiers; les larves se développent sous à peine 1 à 2 cm de boue organique le plus souvent à l'écotone eau-rive. Passage de la période hivernale sous la forme de larves au stade III; apparition des pupes dès le début mai. Durée du développement pupal (T° moy.: 12-14°C) de 19.4 ± 1.1 jours (17-21; n = 28) avec l'apparition des processus stigmatiques dorsaux (seg. abd. 1) 4.9 ± 0.7 jours (4-6; n = 28) après la transformation en pupe. En Suisse occidentale, période de vol de mi-mai à fin août,



FIGS 15-16

Chrysogaster solstitialis, pupe: processus stigmatique dorsal du segment abdominal 1 (échelle en mm). 15: vue frontale (processus gauche); 16: vue latérale externe (processus droite).

amplitude altitudinale de 400 à 1200 m; l'espèce y est assez commune quoique localisée (Maibach et al. 1992); *C. solstitialis* semble être univoltine, voire facultativement bivoltine selon les années.

GENRE *Lejogaster* Rondani; 1857

Lejogaster metallina (Fabricius, 1781)

[larve et pupe décrites auparavant par HARTLEY (1961)]

ESPAGNE. - Segovia, Arroyo de Tejadilla ((940 m); 8.IV.1988; P. Goeldlin & A. Maibach leg.; coll. MZL: 5 larves; 37 pupes.

IRLANDE. - Co. Westmeath: Ballynafid Lake; 5.IV.1989; P. Goeldlin, A. Maibach & M.C.D. Speight leg.; coll. MZL: 3 larves; 9 pupes. - Co. Kildare: Newbridgefen; 8.IV.1989; P. Goeldlin, A. Maibach & M.C.D. Speight leg.; coll. MZL: 1 larve.

LARVE AU STADE III:

Longueur (prothorax - pédoncule L3 du seg. abd. 8): 9.4-11.5 mm; largeur: 2.4-2.8 mm; hauteur: 1.9-2.2 mm).

Larve métapneustique; forme générale, couleur, ornementations segmentaires (arrangement, disposition) ainsi que les caractéristiques morphologiques du seg. abd. 8 (tube respiratoire et troncs trachéens) comparables à celles de la larve de *Chrysogaster solstitialis* (fig. 1).

Tégument: verruqueux sur la partie thoracique, pratiquement lisse sur le reste du corps; dans la partie antérieure du prothorax et sur le mésothorax, sommet de ces micro-verrues surmonté d'une minuscule et forte soie dont l'extrémité est dirigée en général vers l'arrière.

Métamérisation: peu visible; seule l'ornementation segmentaire permet d'identifier chaque segment.

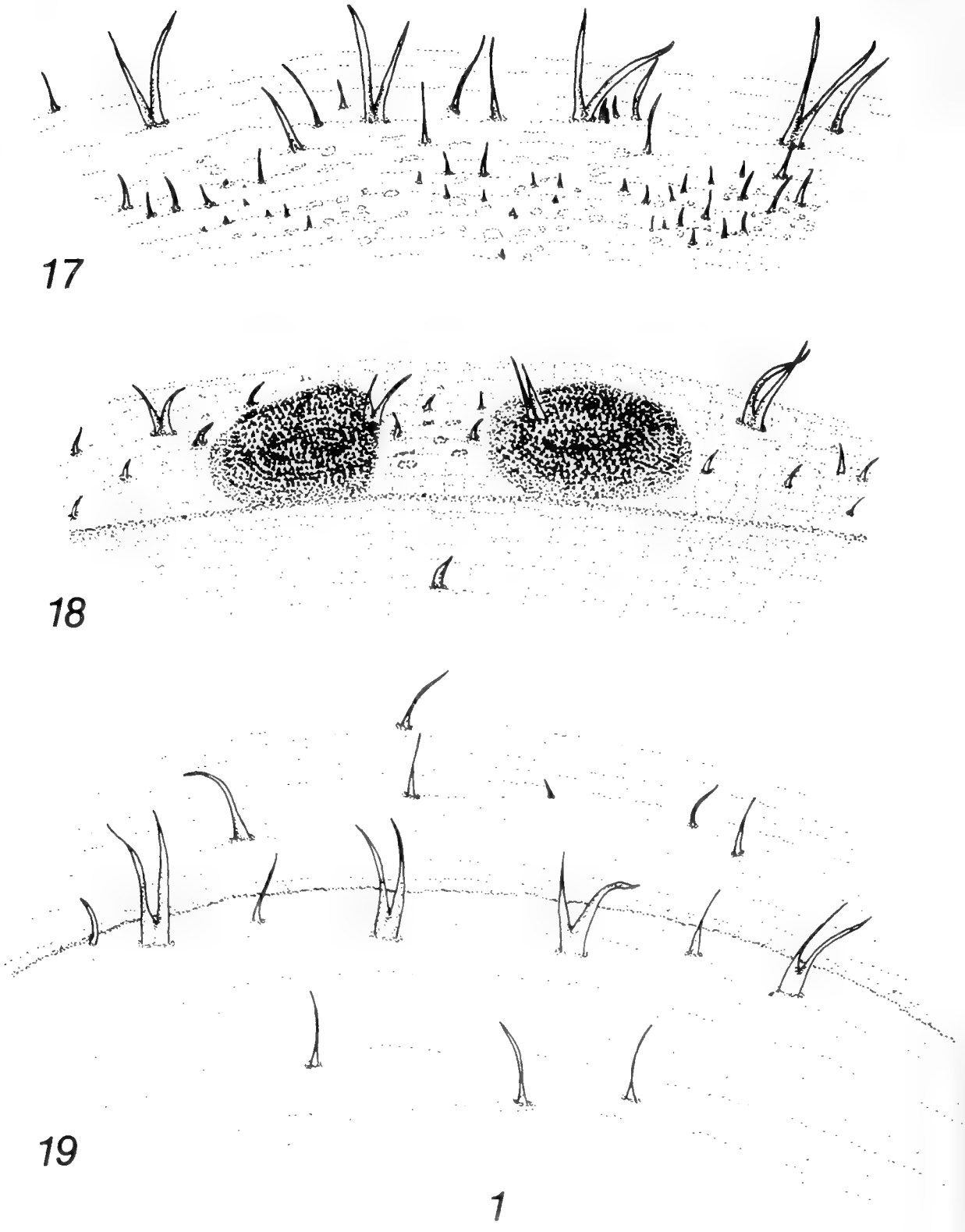
Ornementation segmentaire composée de soies bifides: arrangement comparable à celui des larves de *Chrysogaster, Lejogaster* et *Orthonevra*. Au niveau du seg. abd. 8, soies latérales L1, L2 et L3 disposées à l'extrémité de pédoncule (figs. 5-7, 20).

Ornementation tégumentaire pratiquement absente (figs. 17-19): présence de quelques soies entourant les soies segmentaires dorsales (D) du thorax; sur le reste du corps, densité très faible; elles ne sont en effet présentes qu'à raison de quelques-unes éparses sur chaque segment: çà et là dorsalement sur la crête des sous-segments, sous forme de bouquets de soies entourant D3, d'une bande peu dense le long des crêtes dorso-latérales et latéro-ventrales, de deux groupes de soies entourant respectivement les soies latérales L1 et L2-L3. A l'exception des pseudopodes, absence totale de soies sous les seg. abd. 1 à 6. Nombre de soies tégumentaires entre les soies dorsales D1 faible (figs. 17-19): seg. abd. 1 = 0 - 1 [0.3 ± 0.5; n = 6]; seg. abd. 3 = 0 - 4 [1.8 ± 1.3; n = 6]; d'une manière générale, le rapport des longueurs des soies tégumentaires/soies segmentaires se situe entre 0.75 et 1.0. La longueur et, dans une moindre mesure, la densité des soies tégumentaires augmentent cependant progressivement dès les seg. abd. 5 et 6 jusqu'à l'extrémité de la larve. Présence de part et d'autre de la partie ventrale du seg. abd. 8, entre les pédoncules portant les soies latérales L1 et L2, d'une bande longitudinale de soies tégumentaires relativement fortes; espace entre ces deux bandes de soies totalement dépourvu de soies tégumentaires (figs. 20, 21).

Pseudopodes: peu développés, emplacements respectifs signalés par la présence d'un groupe de crochets robustes et courts; absence de pseudopodes sous les seg. abd. 5 à 7.

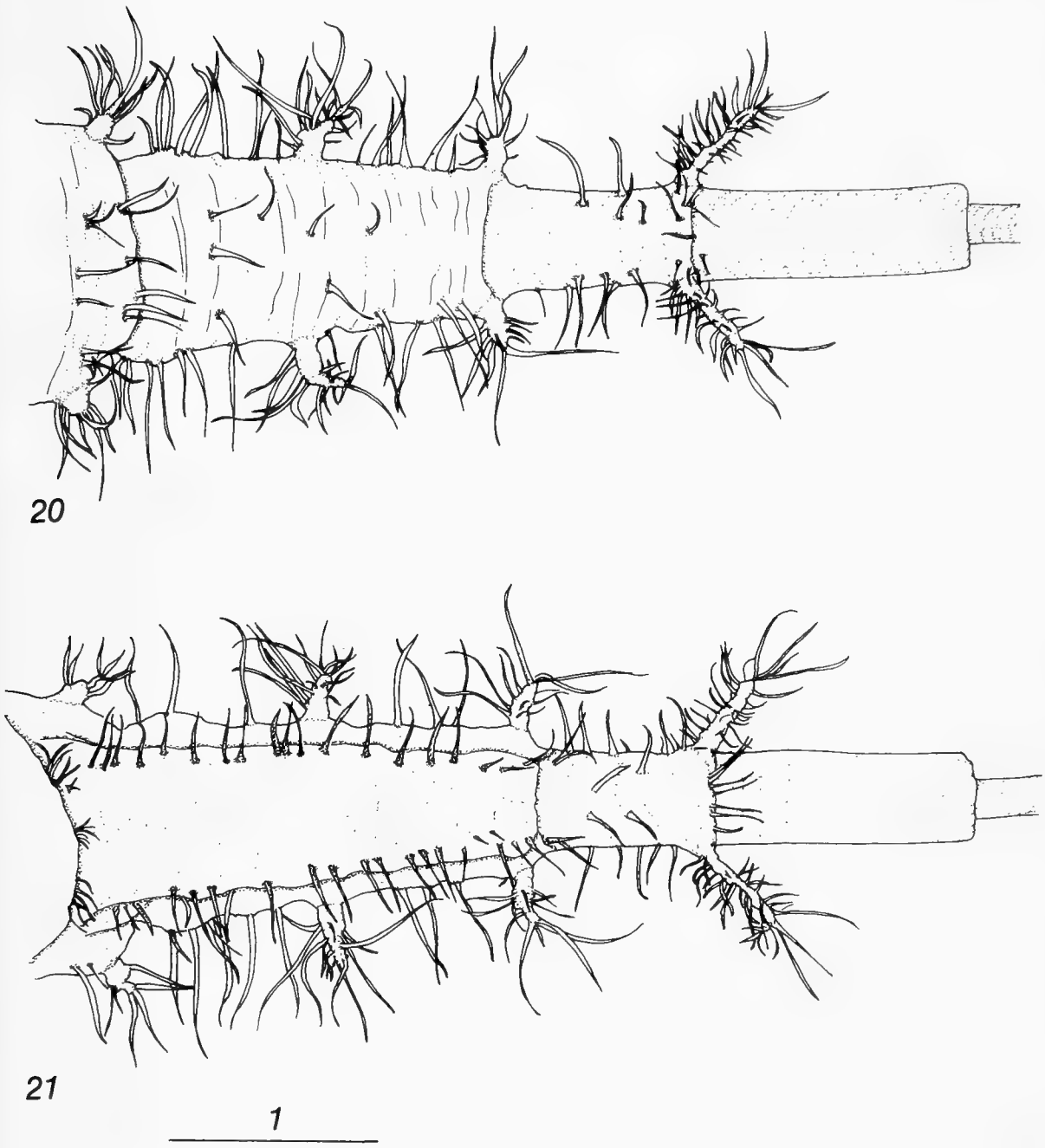
PUPE:

Longueur (tête - L3 du seg. abd. 8): 7.0-7.5 mm; largeur: 2.1-2.4 mm; hauteur: 2.1-2.3 mm.



FIGS 17-19

Lejogaster metallina, larve de dernier stade; détail des ornementations segmentaires et tégumentaires dans la région dorsale (échelle en mm). 17: métathorax; 18: segment abdominal 1; 19: segment abdominal 3.



FIGS 20-21

Lejogaster metallina, larve de dernier stade; segment abdominal 8 (échelle en mm). 20: vue dorsale; 21: vue ventrale.

Forme générale (contour et section) et couleur du tégument comparables à celles de la pupe de *Chrysogaster solstitialis* (figs. 13, 14).

T é g u m e n t : verruqueux au niveau du thorax, plus finement sculpté au niveau de l'abdomen, ce dernier présentant un aspect ligné transversalement plutôt que réticulé. Segmentation: visible de par la présence de fines lignes brunes transverses sur la région dorsale. Ornementations segmentaire et tégumentaire visibles

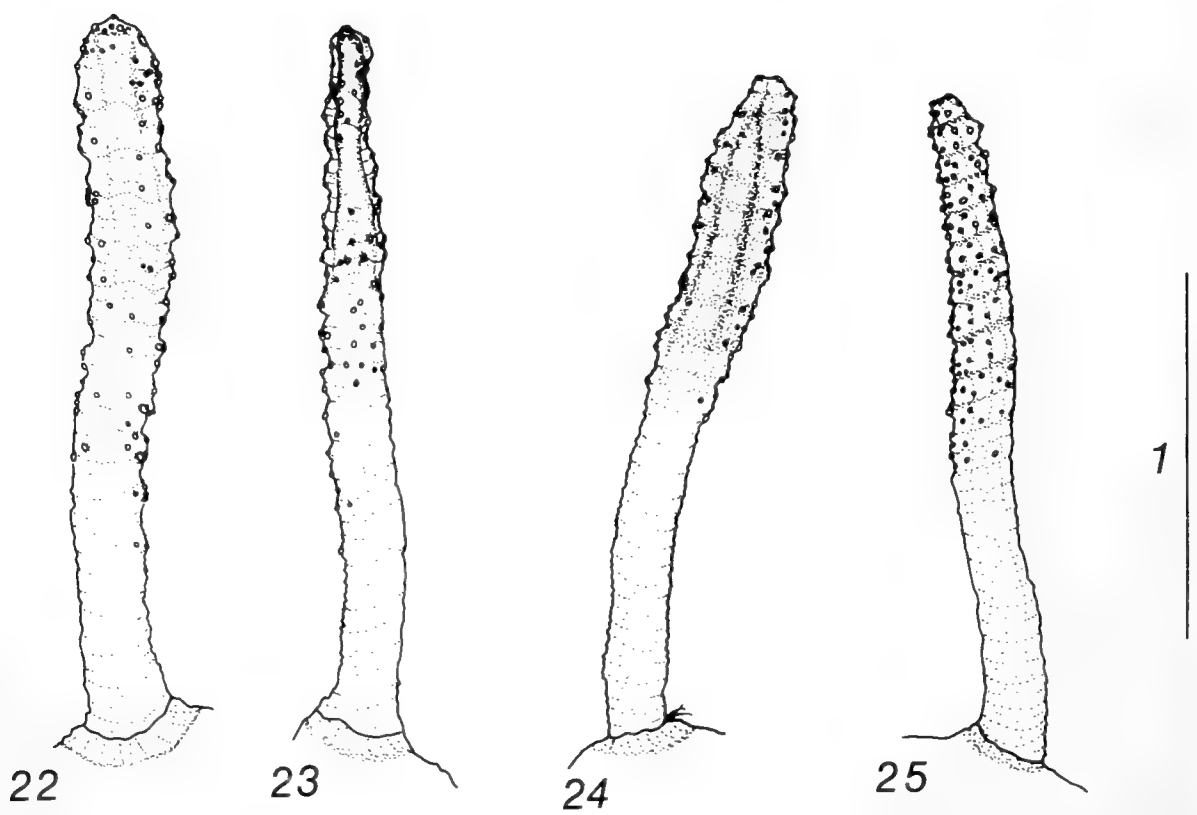
principalement dans la partie dorsale de la pupe sous forme de soies blanchâtres ou transparentes. Pédoncules latéraux des seg. abd. 8 ratatinés. Présence entre les 2 bandes de soies situées sous le seg. abd. 8, ventralement entre L2 et L3, d'un sillon libre de toute pilosité (ce critère est toutefois difficile à mettre en évidence).

Pseudopodes devenus quasi invisibles.

Processus stigmatiques: localisation comparable à celle de la pupe de *Chrysogaster solstitialis* (fig. 1); forme et ornementation (disposition des orifices stigmatiques) des 2 processus dorsaux du seg. abd. 1 caractéristiques de l'espèce (figs. 22, 23): en vue frontale, processus bruns, légèrement aplatis dans leur tiers apical; de profil, orifices stigmatiques présents dans le tiers apical mais n'étant pas disposés en anneaux superposés, comme c'est le cas chez *L. tarsata*.

NOTE BIOLOGIQUE:

Larve semi-aquatique se développant le long de la rive des ruisseaux et de fossés, dans des plages de limon riches en boue organique souvent colonisées par de la végétation aquatique. Les larves s'y développent entre 1 et 4 cm de profondeur,



FIGS 22-25

Lejogaster, pupe: processus stigmatique dorsal du segment abdominal 1 (échelle en mm). 22-23: *L. metallina*; 22: vue frontale (processus gauche); 23: vue latérale externe (processus droite). 24-25: *L. tarsata*; 24: vue frontale (processus gauche); 25: vue latérale externe (processus droite).

entre les racines. Passage de l'hiver au stade III; apparition des premières pupes dès la mi-avril. Durée du développement pupal (T° moy.: 12-14°C) de 17.2 ± 2.8 jours (13-23; n = 28) avec l'apparition des processus stigmatiques dorsaux 3.9 ± 0.9 jours (2-7; n = 35) après la pupaison. En Suisse occidentale, période de vol de début mai à fin août; cycle vraisemblablement univoltin; amplitude altitudinale de 420 à 1240 m, l'espèce y est considérée comme assez rare (MAIBACH et al. 1992).

Lejogaster tarsata (Megerle in Meigen,1822)

[larve et pupe décrites auparavant par Hartley (1961)]

GREAT BRITAIN.- Levedon Pond; 1.4.58; J.C. Hartley leg.; Coll. Hartley: 2 larves, 2 pupes.

LARVE AU STADE III:

Longueur (prothorax - pédoncule L3 du seg. abd. 8): 9.0-9.1 mm; largeur: 2.4-2.5 mm; hauteur: 1.9-2.0 mm.

Larve métapneustique; forme générale, couleur et ornementations segmentaires (arrangement, disposition) analogues à celles de la larve de *Lejogaster metallina*.

La larve de L. tarsata ne diffère de la précédente que par un tégument distinctement verruqueux (figs. 26-28), en particulier dans la région latérale, donnant à toute la surface du corps un aspect réticulé; par une densité de soies tégumentaires encore plus faible: entre les soies D1 du seg. abd. 1 = 0 [n = 2]; seg. abd. 3 = 0-1 (n = 3); par un rapport des longueurs des soies tégumentaires/soies segmentaires égal à 0.5, alors qu'il était proche ou supérieur à 0.75 chez *L. metallina*. Enfin, les bandes de soies longitudinales, situées dans la partie ventrale du seg. abd. 8, entre les soies latérales pédonculées L1 et L2, sont plus denses mais constituées de soies plus courtes.

PUPE:

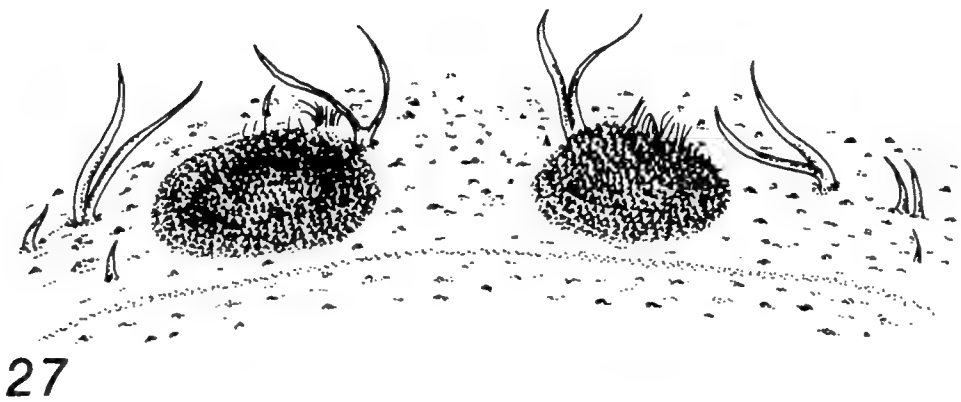
Longueur (tête - L3 du seg. abd. 8): 6.0-6.5 mm; largeur: 2.0-2.4 mm; hauteur: 2.0-2.2 mm.

Forme générale (contour et section) analogue à celle de la pupe de *L. metallina*.

Elle ne diffère de cette dernière que par un tégument verruqueux formant un réticule distinctement visible sur toute la surface du corps, ainsi que par la forme et les ornementations des processus stigmatiques du seg. abd. 1 (figs. 24, 25): en vue frontale, processus brun, aplati dans sa moitié apicale, orifices stigmatiques sur le pourtour; de profil, moitié apicale annelée présentant de nombreux orifices.

NOTE BIOLOGIQUE

Larves semi-aquatiques; selon HARTLEY (1961), elles se développent notamment dans des tapis flottants de végétation aquatique en décomposition, constitués principalement de rhizomes de *Typha*; la transformation en pupe a lieu à la surface du radeau, juste au-dessus du niveau de l'eau; quant aux œufs, ils sont pondus par paquets à la face inférieure des feuilles surplombant l'eau. Durée du



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FIGS 26-28

Lejogaster tarsata, larve de dernier stade; détail des ornementations segmentaires et tégumentaires dans la région dorsale (échelle en mm). 26: métathorax; 27: segment abdominal 1; 28: segment abdominal 3.

développement pupal inconnue; espèce vraisemblablement univoltine. En Suisse, cette espèce très rare, observée entre 600 et 700 m, vole de fin mai à début juin (MAIBACH et al. 1992).

GENRE *Melanogaster* Rondani, 1857

Melanogaster nuda (Macquart, 1829)

[larve et pupe décrites auparavant par Beling (1888) et par Hennig (1952)]

BELGIQUE.- Leefdal, Blankaart; 26.V.1988; A. Maibach leg.; coll. MZL: 1 pupe.

SUISSE.- Vaud: Ormonts, Pra Cornet/Les Mosses; 1.X.1986; A. Maibach leg.; coll. MZL: > 50 larves; 1 pupe. - id.: 20.V.1988; A. Maibach leg.; coll. MZL: 36 pupes. - id.: 22-23.V.1988; A. Maibach leg.; coll. MZL: 15 pupes. - id.: 9. VII.1988; A. Maibach leg.; coll. MZL: 12 pupes. - Vaud: Lausanne, Jorat, Moille Saugeon; 28.I.1989; A. Maibach leg.; coll. MZL: 4 larves; 32 pupes.- id.: 8.II.1989; P. Goeldlin & A. Maibach leg.; coll. MZL: 2 pupes. - id.: 3.IV.1990; P. Goeldlin & A. Maibach leg.; coll. MZL: 2 larves; 35 pupes. - Vaud: L'Etivaz, Pâquier-Mottier; 22.XII.1989; A. Maibach leg.; coll. MZL: 1 larve. - id.: 10.I.1990; A. Maibach leg.; coll. MZL: 3 larves;1 pupe.

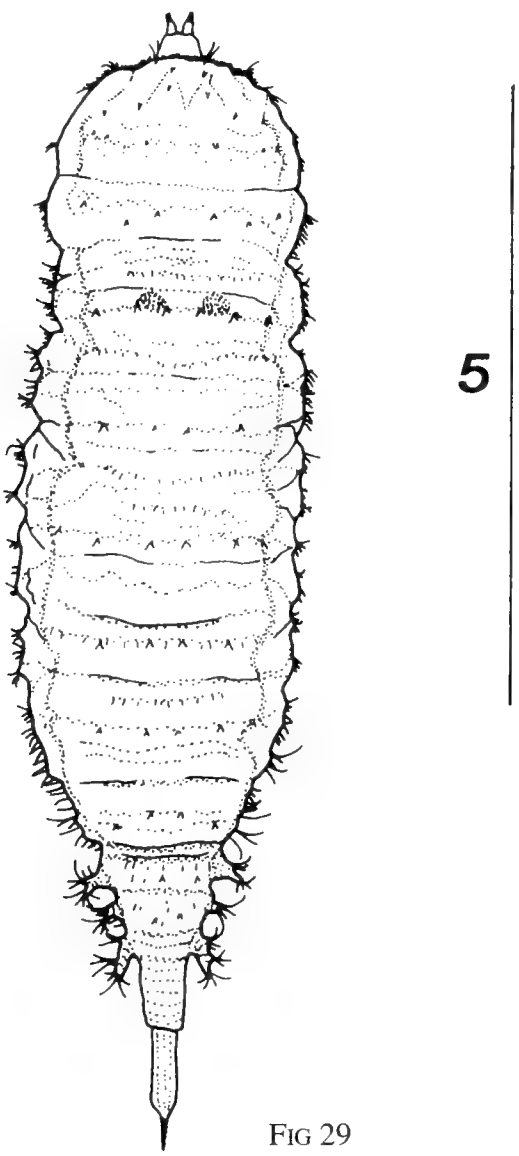


FIG 29

Type larvaire caractéristique du genre *Melanogaster*; larve de dernier stade in toto (*Melanogaster nuda* en vue dorsale; (échelle en mm).

LARVE AU STADE III:

Longueur (prothorax - pédoncule L3 du seg. abd. 8): 6.9-8.2 mm; largeur: 2.1-2.3 mm; hauteur: 2.0-2.3 mm.

Larve métapneustique; forme générale d'un gros crayon (fig. 29), avec une largeur maximale au niveau des seg. abd. 2-4. Tégument blanchâtre, translucide, laissant paraître par endroit les organes internes, tels les troncs trachéens dans la partie postérieure et, vers l'avant, les sacs trachéens sous forme de deux masses blanchâtres, donnant à la larve un aspect général de perle.

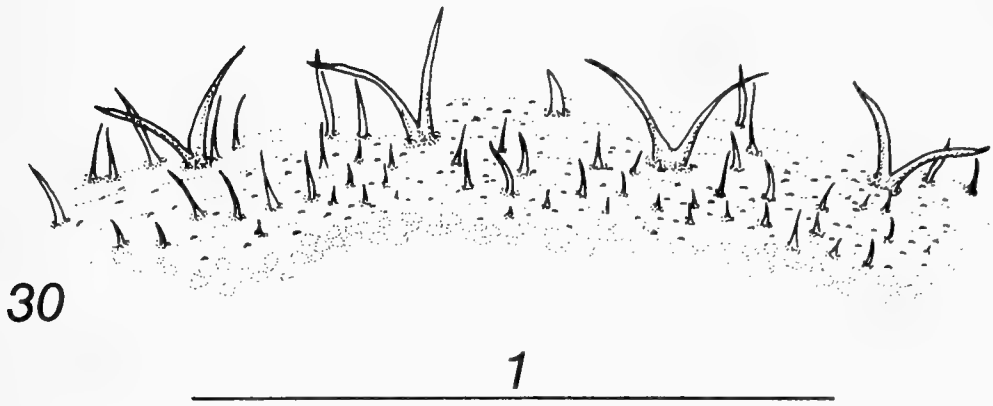
Corps de section plus ou moins circulaire, léger applatissement dorso-ventral qui s'accentue au niveau des seg. abd. 6, 7 et 8; en vue dorsale, corps tronqué à l'avant; il se rétrécit nettement dès le seg. abd. 7, pour se terminer au niveau du seg. abd. 8 par un tube respiratoire très court (0.2-0.7 mm); troncs trachéens postérieurs fusionnés, dont l'extrémité, constituée des deux plaques stigmatiques, est en forme de stylet sclérifié et rigide qui coulisse (0.3-0.9 mm) à l'intérieur du tube respiratoire; cette structure caractéristique a été décrite en détail pour la larve de *M. hirtella* par HARTLEY (1958). Plaques stigmatiques formant une pointe éffilée; plaques circulaires et orifices stigmatiques (*sensu* GOELDLIN DE TIEFENAU 1974) modifiés en fentes étroites, disposées longitudinalement sur les flancs du stylet: 4 fentes inférieures, 2 supérieures (HARTLEY *op. cit.*); absence totale de soies ou d'ornementations filamenteuses ou plumeuses à caractère hydrophobe sur le pourtour des plaques stigmatiques. Cet organe rigide (stylet) servirait à percer les tissus végétaux racinaires pour en extraire l'oxygène (VARLEY 1937).

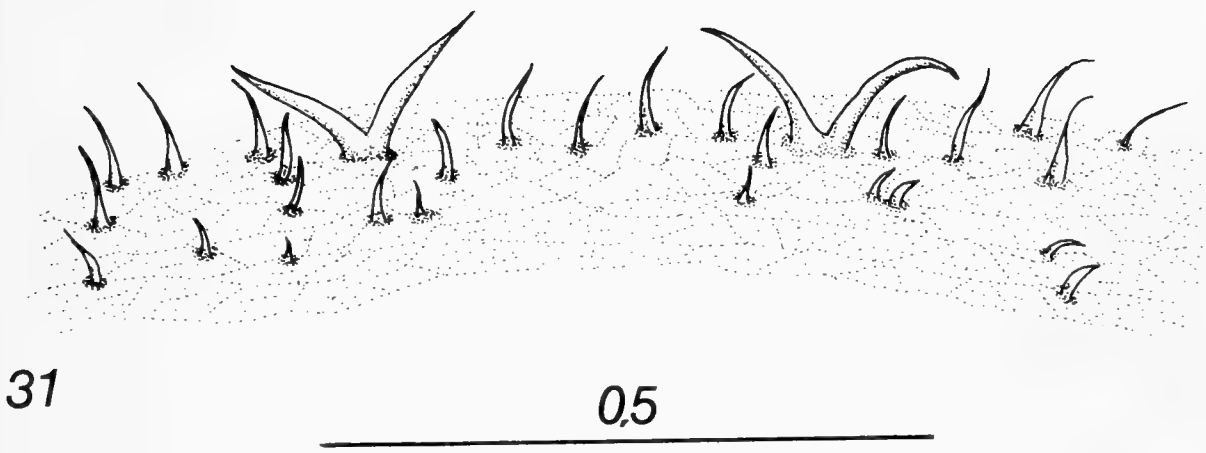
Tégument: surface d'aspect verruqueux, en particulier sur le thorax (principalement pro- et mésothorax); surface devenant progressivement lisse avec un aspect plutôt pavimenteux sur le métathorax et le seg. abd. 1, alors que les seg. abd. 3-7 paraissent, hormis la présence de plis transversaux, quasi lisses (figs. 30, 31). Dans la partie frontale du prothorax, sur le mésothorax et dans une moindre mesure sur le métathorax, sommet de ces micro-verrues surmonté d'une minuscule soie dont l'extrémité est dirigée vers l'arrière du corps; soies devenant très courtes, voire invisibles, en forme de crochets dont les extrémités sont dirigées vers l'arrière.

Ornementations segmentaires (composée de soies bifides blanchâtres): arrangement schématisé in MAIBACH et al. (1994a). De part et d'autre du seg. abd. 8, soies latérales L1, L2 et L3 insérées à l'extrémité de pédoncules (figs. 29, 32-34); pédoncules de L1 et L3 larges et aplatis, de section nettement ovale; pédoncule de L2 simple, en forme de cône aplati à son extrémité, surmonté de 3 à 5 longues soies radiales, blanchâtres; pédoncule de L1 subdivisé à sa moitié en deux branches, surmontées chacune de 3 à 5 longues soies radiales; la branche ventrale est fine et cylindrique, la branche dorsale conique; pédoncule de L3 fortement élargi orné de 3 excroissances surmontées de longues soies radiales.

Ornementation tégumentaire, constituée de soies simples, jamais bifides; arrangement détaillé ci-dessous. Augmentation progressive de la longueur des soies du seg. abd. 1 jusqu'à l'extrémité de la larve.

Métamérisation: délimitation thorax-abdomen peu visible, mais aisée à situer par la présence sur le seg. abd. 1 de 2 taches dorsales circulaires, localisant





FIGS 30-31

Melanogaster nuda, larve de dernier stade; détail des ornementations segmentaires et tégumentaires dans la région dorsale (échelle en mm). 30: métathorax; 31: segment abdominal 3.

l'emplacement des futures cornes abdominales propres à la pupe. Corps distinctement plissé, plis souvent soulignés par une bande brunâtre ou grisâtre. Segmentation masquée par une sous-segmentation, en particulier dans la région dorsale: partie dorsale du prothorax plissée longitudinalement, la crête de chaque pli portant l'arrangement des soies dorsales (D); absence de sous-segments sur le mésothorax; métathorax ainsi que les seg. abd. 1 à 7 caractérisés par 3 sous-segments: sous-segment médian portant sur sa crête les soies segmentaires bifides, disposées au sein d'une bande étroite de soies tégumentaires simples; crêtes du troisième pli, ainsi que partiellement du premier, portant une bande étroite de soies tégumentaires, ces trois bandes se rejoignant en dessous de la crête dorso-latérale. Cette dernière est constituée d'une succession de renflements latéraux peu saillants, portant les soies segmentaires latérales (L1) et un groupe de soies tégumentaires relativement longues, orientées vers l'arrière. La partie médiane de la région latérale (supportant les soies L2

et L3) ainsi que la crête latéro-ventrale (portant les VL) ayant le même aspect; elles sont caractérisées par un arrangement tégumentaire comparable. Au niveau des seg. abd. 7 et 8, segmentation devenant invisible. D'une manière générale, longueur des soies tégumentaires, entre les soies dorsales D1 des méso- et métathorax ainsi que des seg. abd. 1 à 4, inférieure ou au maximum égale à la moitié de la longueur des soies segmentaires bifides (≤ 0.5) (figs. 30, 31); nombre de soies tégumentaires entre les soies dorsales D1 relativement faible: sur le seg. abd. 1 = 7-13 [10.2 ± 2.1; n = 7]; seg. abd. 3 = 8-13 [10.4 ± 1.7; n = 7].

Pseudopodes: en forme de mamelons très aplatis; souvent seules quelques soies tégumentaires un peu plus fortes, sans disposition précise, marquent leurs emplacements respectifs; présence d'une paire sous le mésothorax et les seg. abd. 1-5; absence de pseudopodes sous le seg. abd. 6, les soies ventrales (V1, V2, V3) permettent toutefois de localiser leurs emplacements potentiels.

PUPE:

Longueur (tête - L3 du seg. abd. 8): 5.0-5.6 mm; largeur: 2.1-2.9 mm; hauteur: 1.8-2.0 mm.

Forme générale en vue dorsale ovoïde, mais terminée en pointe; de profil, net applatissement ventral, partie supérieure plate ou légèrement convexe (figs. 41, 42). Pupe nettement tronquée en biseau dans sa partie antérieure (thorax et seg. abd. 1) et prolongée vers l'arrière par le processus respiratoire postérieur relativement court dont le stylet est entièrement dévaginé (0.5 mm).

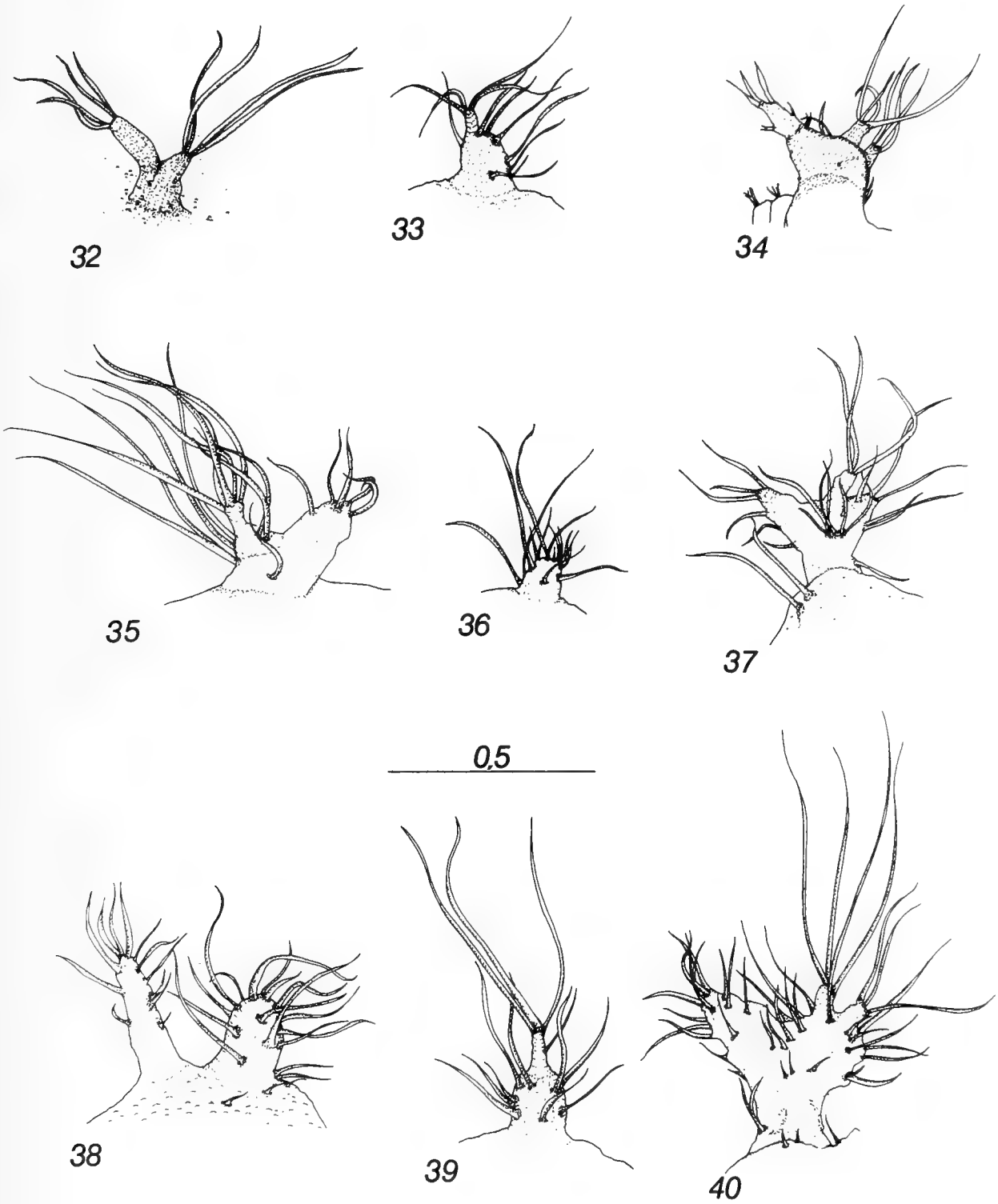
Tégument: brun à brun-noir, verruqueux sur le thorax, devenant progressivement lisse mais strié transversalement sur l'abdomen. Crêtes dorso-latérales et latéro-ventrales légèrement saillantes et souvent un peu plus claires. Segmentation: pratiquement invisible, mais soulignée par la pilosité tégumentaire. Cette dernière est présente sous forme de bandes transverses de soies transparentes et couchées vers l'arrière. Ornementation segmentaire bien visible uniquement dans les régions latéraless et dorsale. Pédoncules latéraux du seg. abd. 8 ratatinés.

Pseudopodes devenus quasi invisibles.

Processus stigmatiques: sur le seg. abd. 1, présence dorsalement d'une paire de processus (figs. 43, 44), brun clair; en vue frontale, processus en forme de S, orifices stigmatiques présents sur le pourtour du tiers apical. Processus respiratoire postérieur le plus souvent redressés perpendiculairement à la sole ventrale; stylet entièrement dévaginé.

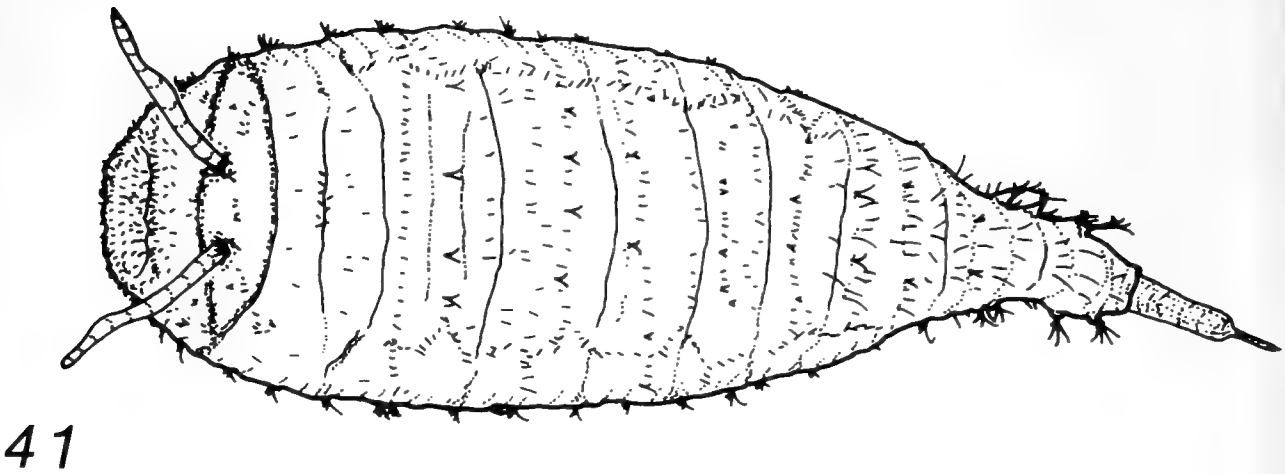
NOTE BIOLOGIQUE

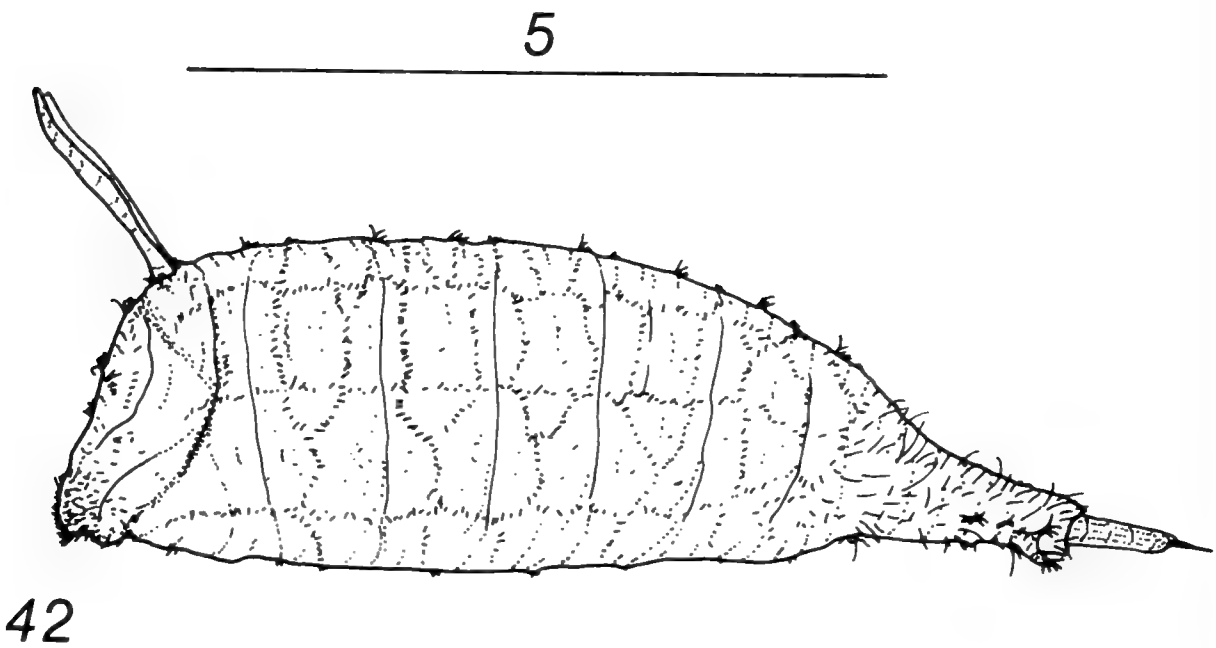
La larve, semi-aquatique, se développe dans et en marge de fossés riches en matière organique, dans des sols à influence alcaline. En plaine (< 800 m), les larves passent l'hiver en grande majorité (95%) au stade III, alors qu'en altitude (> 900 m env.) pratiquement la moitié des larves présentes sont au stade II. Apparition des premières pupes dès la mi-avril; durée du développement pupal (T° moy. 12-14°C) de 16.3 ± 2.4 jours (13-21; n = 22); apparition des processus stigmatiques dorsaux 4.4 ±



FIGS 32-40

Type larvaire caractéristique du genre *Melanogaster*; pédoncules latéraux du segment abdominal 8, supports des soies latérales (L) (échelle en mm). 32-34: *M. nuda*; 32: pédoncule latéral L1; 33: L2; 34: L3. 35-37: *M. hirtella*; 35: pédoncule latéral L1; 36: L2; 37: L3. 38-40: *M. aerosa*; 38: pédoncule latéral L1; 39: L2; 40: L3.





FIGS 41-42

Melanogaster hirtella, pupe (échelle en mm). 41: in toto en vue dorsale; 42: vue latérale.

0.9 jours (3-6; n = 17) après la pupaison. En Suisse occidentale, période de vol de fin avril à fin août avec une amplitude altitudinale allant de 370 à 2200 m (MAIBACH et al. 1992); *M. nuda* est univoltine en plaine, mais partivoltine en altitude dès 800-900 m où l'espèce est commune.

Melanogaster hirtella (Loew, 1843)

[larve et pupe décrites auparavant par VARLEY (1937) et par HARTLEY (1961)]

BELGIQUE. - Leefdal, Blankaart; 26.V.1988; A. Maibach leg.; coll. MZL: 1 larve; 2 pupes.

ESPAGNE. - Segovia, Arroyo de Tejadilla (940 m); 8.IV.1988; P. Goeldlin & A. Maibach leg.; coll. MZL: 6 larves; 1 pupe.

GRANDE-BRETAGNE. - Scotland, Midlothian, Crichton Glen; 3.V.1991; A. Maibach & G.E. Rotheray leg.; coll. MZL: 1 pupe.

IRLANDE. - Co Kildare: Newbridgfen; 8.IV.1989; P. Goeldlin, A. Maibach & M.C.D. Speight leg.; coll. MZL: 2 larves; 11 pupes. - Co. Westmeath: Ballynafid Lake; 5.IV.1989; P. Goeldlin, A. Maibach & M.C.D. Speight leg.; coll. MZL: 2 larves; 1 pupe. - Co Offaly: Clonmacnoise, Fin Lough; 10.IV.1989; P. Goeldlin, A. Maibach & M.C.D. Speight leg.; coll. MZL: 5 larves; 5 pupes.

SUISSE. - Vaud: Le Chenit, Pra-Rodet; 20.X.1987; A. Maibach leg.; coll. MZL: 1 pupe. - id.: 9.XI.1989; P. Goeldlin & A. Maibach leg.; coll. MZL: 2 pupes. - Vaud: Lausanne, Jorat, Moille Saugeon; 10.XII.1987; P. Goeldlin & A. Maibach leg.; coll. MZL:1 pupe. - id.: 28.I.1989; A. Maibach leg.; coll. MZL: 2 pupes. - Vaud: Lausanne, Jorat, Petites Côtes; 12.XII.1988; P. Goeldlin & A. Maibach leg.; coll. MZL: 2 pupes. - id.: 20.XII.1988; P. Goeldlin & A. Maibach leg.; coll. MZL: 2 pupes. - id.: 10.IV.1990; P. Goeldlin & A. Maibach leg.; coll. MZL: 4 pupes.

LARVE AU STADE III:

Longueur (prothorax - pédoncule L3 du seg. abd. 8): 6.5-7.5 mm; largeur: 2.2-2.4 mm; hauteur: 2.1-2.3 mm.

Larve métapneustique. Sa morphologie générale, l'aspect du tégument, l'arrangement des soies segmentaires et tégumentaires, sont analogues à ceux de la larve de *M. nuda*.

Elle diffère toutefois de l'espèce précédente par une forme générale plus trapue et par une pilosité tégumentaire plus dense, en particulier sur l'abdomen dès le seg. abd. 4; on note une nette transition entre l'avant relativement peu pileux et l'arrière densément couvert de longues soies. D'une manière générale, rapport des longueurs des soies tégumentaires/soies segmentaires situé entre 0.6 et 0.7, alors qu'il est proche ou inférieur à 0.5 chez *M. nuda*. Comparé à cette dernière, nombre de soies tégumentaires présentes entre les soies dorsales D1 plus élevé (figs. 49, 50): sur le seg. abd. 1 = 13 - 17 [15.2 ± 1.5; n = 6]; seg. abd. 3 = 12 - 14 [12.8 ± 1.0; n = 6]. Soies L1, L2 et L3 du seg. abd. 8 également disposées à l'extrémité de pédoncules latéraux charnus, particulièrement massifs et surmontés de soies extrêmement longues (figs. 35-37).

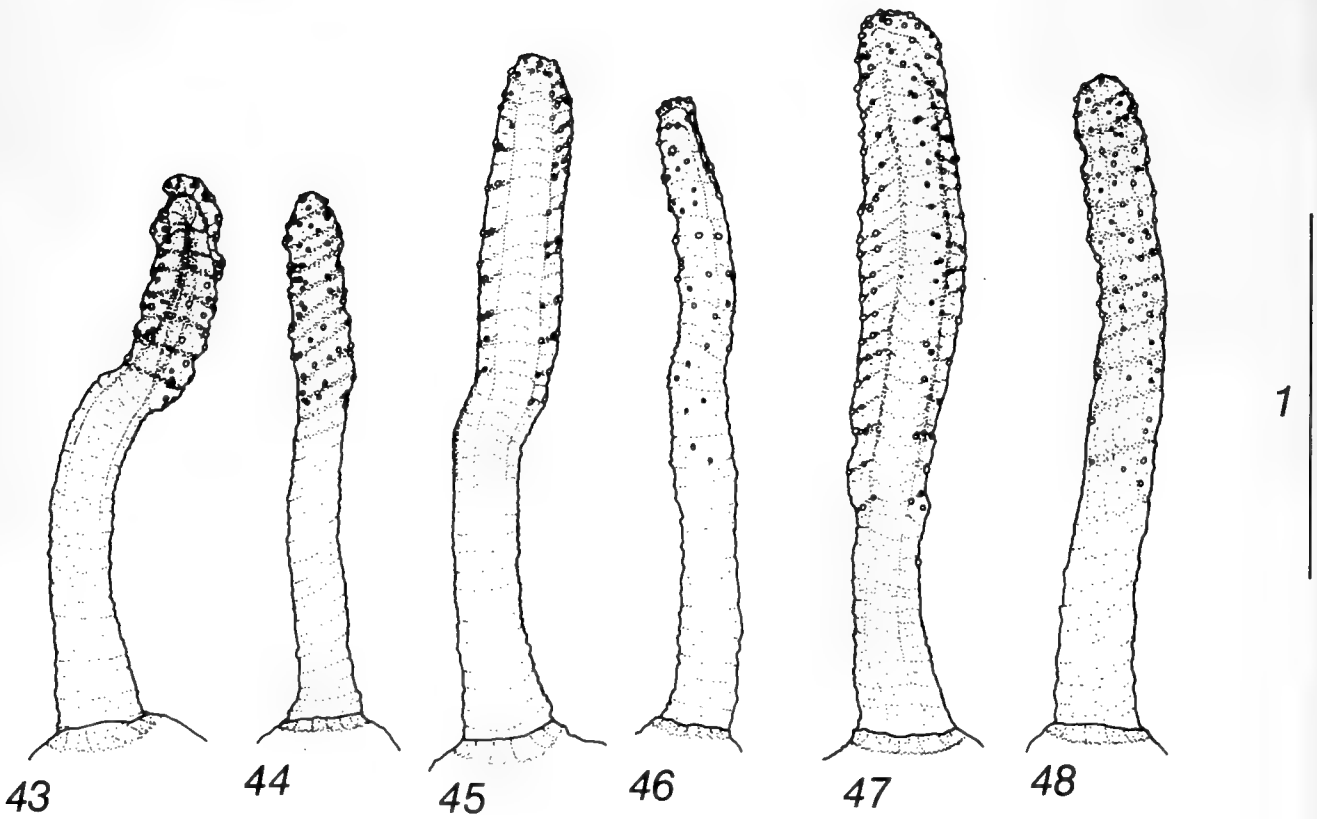
Pseudopodes souvent plus développés.

PUPE:

Longueur (tête - L3 du seg. abd. 8): 6.1-6.8 mm; largeur: 2.4-2.7 mm; hauteur: 2.1-2.3 mm.

Forme générale comparable à celle de *M. nuda* (figs; 41, 42).

T é g u m e n t : brun à brun-noir, crêtes dorso-latérales et latéro-ventrales légèrement saillantes et souvent un peu plus claires. Segmentation: à peine visible, mais soulignée par la pilosité tégumentaire; cette dernière est présente sous forme de bandes transverses de soies blanchâtres et couchées vers l'arrière. Ornementation segmentaire bien visible uniquement dans les régions dorsale et latérales. Pédoncules latéraux du seg. abd. 8 ratatinés.



FIGS 43-48

Melanogaster, processus stigmatique dorsal du segment abdominal 1 de la pupe (échelle en mm). 43-44: *M. nuda*; 43: vue frontale (processus gauche); 44: vue latérale externe (processus droite). 45-46: *M. hirtella*; 45: vue frontale (processus gauche); 46: vue latérale externe (processus droite). 47-48: *M. aerosa*; 47: vue frontale (processus gauche); 48: vue latérale externe (processus droite).

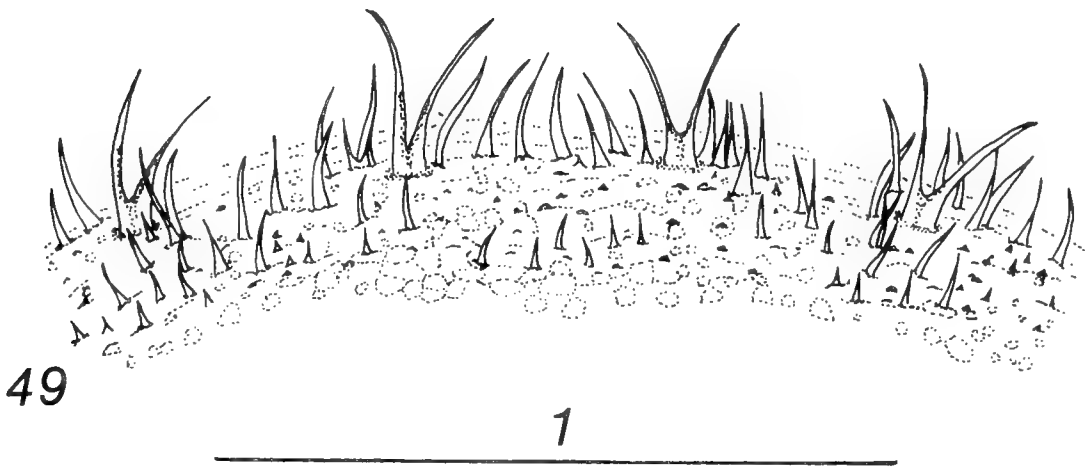
Pseudopodes invisibles.

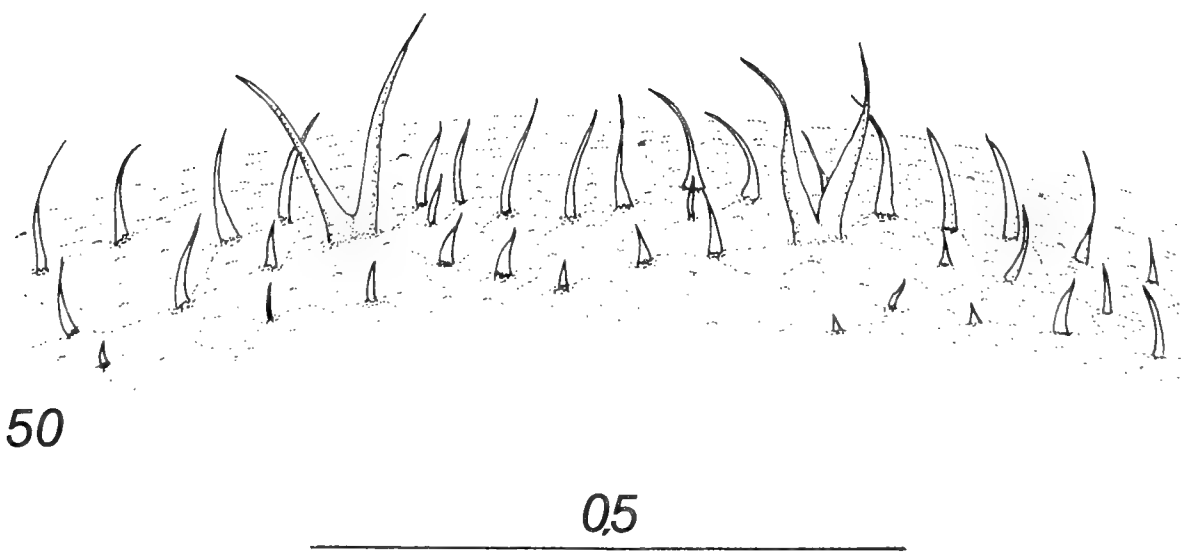
Processus stigmatiques: localisation comparable à celle des pupes de *Melanogaster nuda*; sur le seg. abd. 1, présence dorsalement d'une paire de processus (figs. 45, 46), brun clair à beiges; forme et ornementation (disposition des orifices stigmatiques) caractéristiques de l'espèce: en vue frontale, présence d'orifices stigmatiques sur le pourtour de la moitié apicale; processus présentant une courbure en S à sa mi-hauteur.

NOTE BIOLOGIQUE:

Développement de la larve dans des fossés de tourbières, dans des dépressions remplies de matière organique en forêt, dans des effondrements de la berge de petits ruisseaux. D'une manière générale, *M. hirtella* fuit toute influence alcaline. Les larves semblent passer l'hiver au stade III. Apparition des premières pupes dès la fin avril;

durée du développement pupal (T° moy. 12-14°C) de 18.7 ± 1.2 jours (17-21; n = 9); apparition des processus stigmatiques dorsaux 4.3 ± 0.5 jours (4-5; n = 10) après la transformation en pupe. En Suisse occidentale, l'espèce est rare, mais peut être très localement abondante; période de vol de fin mai à début juillet; espèce univoltine, peut-être partivoltine selon l'altitude; amplitude altitudinale allant de 550 à 1660 m (MAIBACH et al. 1992).





FIGS 49-50

Melanogaster hirtella, larve de dernier stade; détail des ornementations segmentaires et tégumentaires dans la région dorsale (échelle en mm). 49: métathorax; 50: segment abdominal 3.

Melanogaster aerosa (Loew, 1843)

Espèce revalidée et redécrite par MAIBACH et al. (1944b).

IRLANDE. - Co Offaly: Clonmacnoise, Fin Lough; 10.IV.1989; P. Goeldlin, A. Maibach & M.C.D. Speight leg.; coll. MZL: 2 larves; 2 pupes.

LARVE AU STADE III:

Longueur (prothorax - pédoncule L3 du seg. abd. 8): 9.5-11.0 mm; largeur: 2.8-3.0 mm; hauteur: 2.7-2.9 mm.

Larve métapneustique. Sa morphologie générale, l'arrangement des soies segmentaires et tégumentaires, sont comparables à ceux de *M. nuda* et de *M. hirtella*.

La larve de *M. aerosa* est cependant de dimensions plus élevées (> 20%), de forme ovale avec sa plus grande largeur au niveau des seg. abd. 4 et 5. Elle se distingue, des deux autres larves du genre actuellement connues, par un tégument noduleux (figs. 51, 52) et ceci sur toute la surface du corps, caractéristique nettement mise en évidence par coloration du tégument (MAIBACH & GOELDLIN DE TIEFENAU 1992). Densité des soies tégumentaires intermédiaire entre ce qui s'observe chez *M. nuda* et *M. hirtella* (figs. 51, 52); présence entre les soies dorsales D1 sur le seg. abd. 1 de 13 à 16 soies (n = 3), sur le seg. abd. 3 de 10 à 13 soies (n = 3); d'une manière générale, on note l'absence de soies en dehors des bandes de soies tégumentaires dont l'emplacement est comparable à celui des larves de *M. nuda*. Soies L1, L2 et L3 du seg. abd. 8 également disposées à l'extrémité de pédoncules latéraux charnus (figs. 38-40); signalons enfin un autre critère propre à cette larve, à savoir la présence de soies L1 disposées sur 2 pédoncules distinctement séparés (fig. 38) et non sur un même pédoncule bifide comme c'est le cas chez *M. nuda* et *M. hirtella* (figs. 32, 35).

PUPE:

Longueur (tête - L3 du seg. abd. 8): 6.4-7.1 mm; largeur: 2.7-3.1 mm; hauteur: 2.7-2.9 mm.

Forme générale comparable à celle des pupes de *M. nuda* et de *M. hirtella*. En vue dorsale, forme distinctement ovale avec sa largeur maximale au niveau des seg. abd. 4 et 5.

Tégument: brun à brun-noir, distinctement noduleux, recouvert sur toute la surface du corps de micromamelons bruns légèrement plus foncés que les interstices. Crêtes dorso-latérales et latéro-ventrales légèrement saillantes et souvent un peu plus claires. Segmentation: pratiquement invisible, mais soulignée par la pilosité tégumentaire; celle-ci est présente sous forme de bandes de soies blanchâtres, voire transparentes, disposées transversalement sur chaque segment. Chaque soie est implantée au sommet d'un micromamelon foncé. Ornementation segmentaire bien visible uniquement dans les régions latérales et dorsale. Pédoncules latéraux du seg. abd. 8 ratatinés.

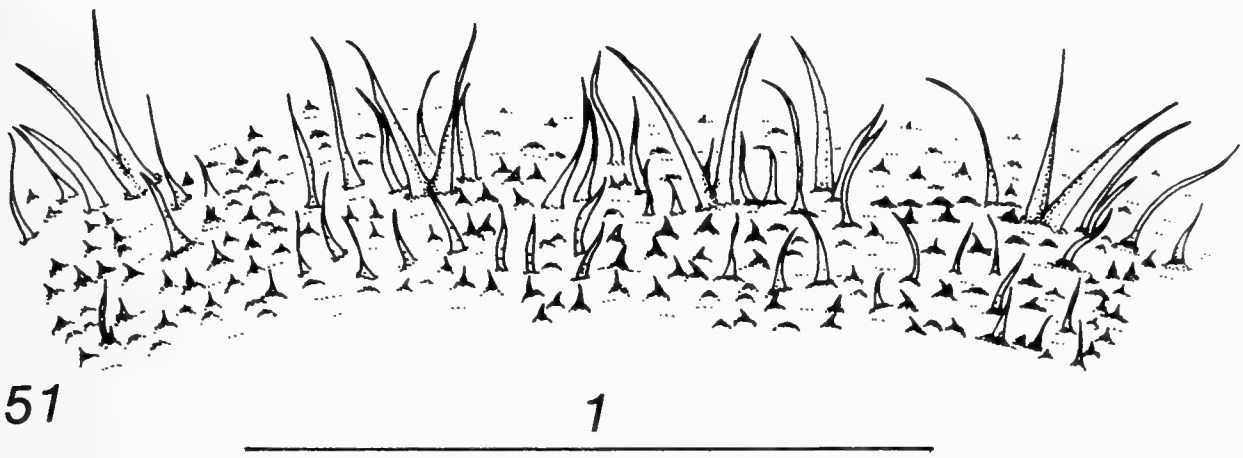
Pseudopodes invisibles.

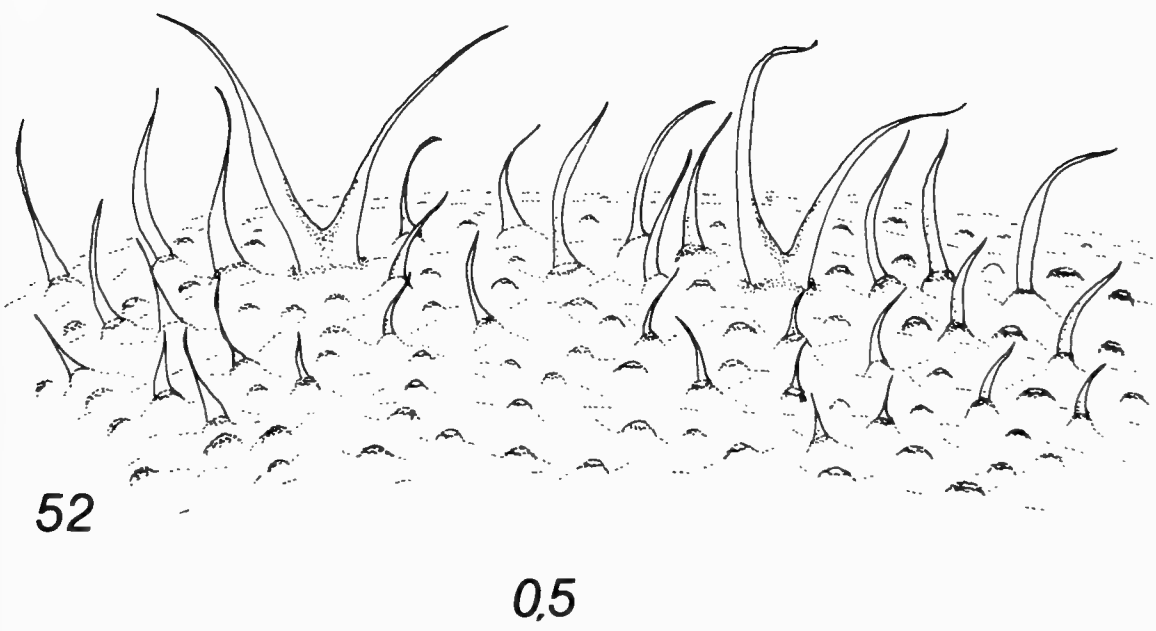
Processus stigmatiques: localisation comparable à celle des pupes de *Melanogaster hirtella* et *M. nuda*; sur le seg. abd. 1, présence dorsalement d'une paire de processus brun clair à beiges; forme et ornementation caractéristiques

(figs. 47, 48): en vue frontale processus légèrement aplati et spatulé; présence d'orifices stigmatiques sur les 2/3 apicaux.

NOTE BIOLOGIQUE:

Larves semi-aquatiques trouvées dans un bas-marais méso- à oligotrophe (limons organiques), dont la végétation était principalement constituée de prêles (*Equisetum* sp.) et de pesses vulgaires (*Hippuris vulgaris*). Les larves semblent passer





FIGS 51-52

Melanogaster aerosa, larve de dernier stade; détail des ornementations segmentaires et tégumentaires dans la région dorsale (échelle en mm). 51: métathorax; 52: segment abdominal 3.

l'hiver au stade III. Apparition des premières pupes dès la mi-mai; durée du développement pupal (T° moy. 12-14°C) de 16 à 17 jours (n = 2); apparition des processus stigmatiques dorsaux 3 à 4 jours (n = 2) après la pupaison. En Suisse occidentale, période de vol de fin avril à début juillet; espèce univoltine (ou partivoltine?); amplitude altitudinale de 430 à 1040 m (MAIBACH et al. 1992).

GENRE *Orthonevra* Macquart, 1829

Orthonevra nobilis (Fallen, 1817)

SUISSE. - Vaud: Lausanne, Jorat, Moille Saugeon; 20.I.1989; A. Maibach leg.; coll. MZL: 1 larve. - id.: 3.IV.1990; A. Maibach leg.; coll. MZL: 1 larve; 1 pupe. - Vaud: Ormonts, Pra-Cornet/Les Mosses; 16.X.1987; A. Maibach leg.. coll. MZL: 1 larve; 2 pupes.

LARVE AU STADE III:

Longueur (prothorax - pédoncule L3 du seg. abd. 8): 7.6-7.9 mm; largeur: 1.8-2.0 mm; hauteur: 1.87-2.1 mm.

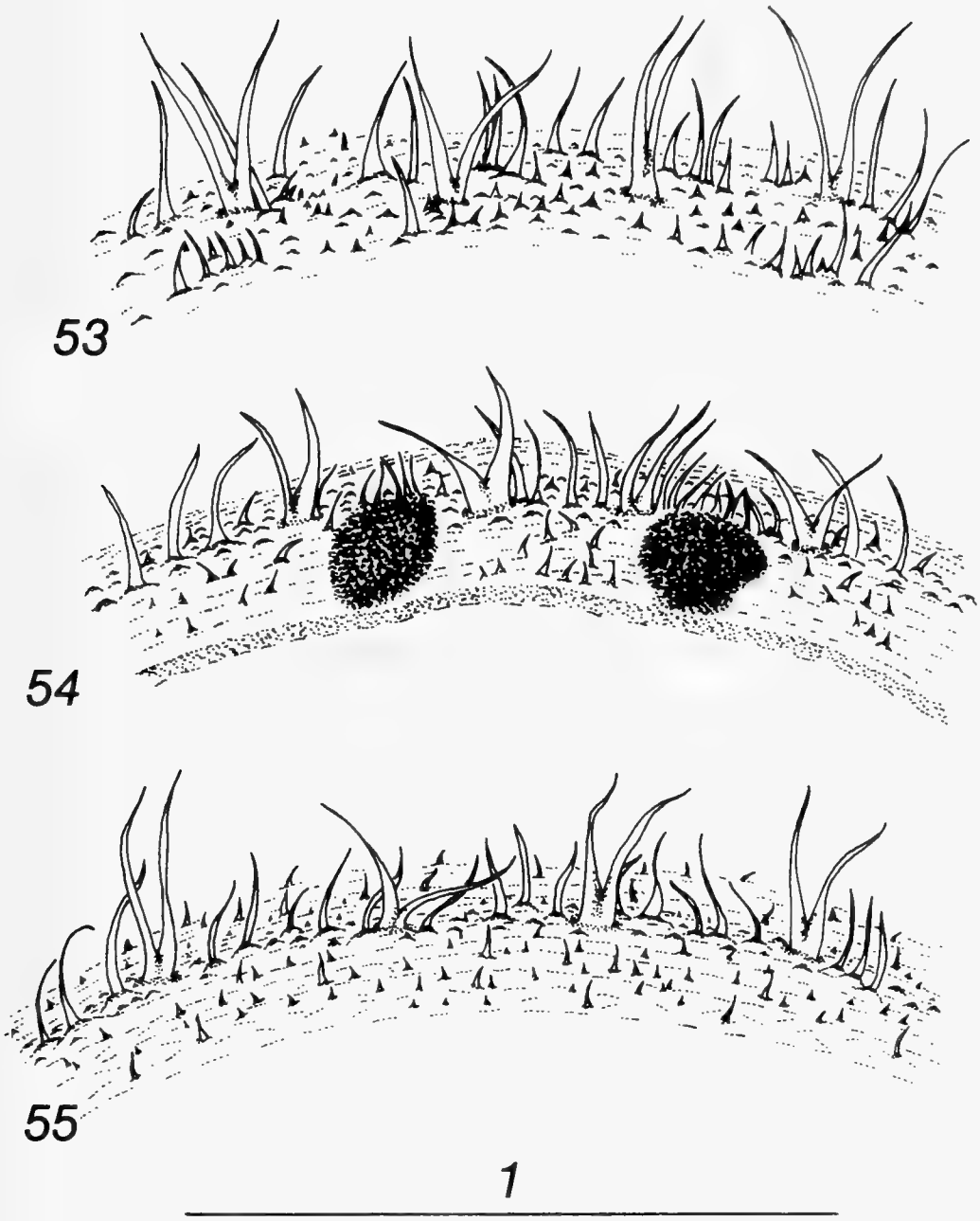
Larve métapneustique; forme générale, couleur, ornementations segmentaires (arrangement, disposition) ainsi que les caractéristiques morphologiques du seg. abd. 8 (tube respiratoire et troncs trachéens) comparables à celles des larves des genres *Chrysogaster* et *Lejogaster* (fig. 1).

Tégument: surface du thorax et dans une moindre mesure de l'abdomen couverte de micromamelons donnant un aspect verruqueux, voire noduleux (figs. 53-55); dans la région thoracique ainsi qu'à proximité immédiate des bandes de soies tégumentaires des segments abdominaux, micromamelons surmontés par une excroissance ou même par une courte soie souvent robuste; sur l'abdomen, sommets des micromamelons devenant arrondis, moins saillants, donnant après coloration (Maibach & Goeldlin de Tiefenau 1992) un aspect plutôt ponctué au sommet des sous-segments, alors que les plis ont une apparence pavimenteuse.

Métamérisation: délimitation thorax-abdomen peu visible mais aisée à situer par la présence sur le seg. abd. 1 de 2 taches dorsales circulaires, marquant l'emplacement des futures cornes abdominales propres à la pupe. Corps plissé, dont les plis sont en général soulignés par des zones de dépôts organiques grisâtres. Segmentation, sous-segmentation ainsi que la pilosité tégumentaire des renflements latéraux comparables à celles des larves des genres *Chrysogaster* et *Lejogaster*.

Ornementation segmentaire composée de soies bifides: arrangement comparable à celui des larves de *Chrysogaster* et *Lejogaster*. Le long de l'abdomen, soies latérales L1, L2 et L3 disposées au sommet de renflements latéraux développés.

Ornementation tégumentaire: densité des soies élevées; à l'exception du thorax, du seg. abd. 8 et de l'emplacement des pseudopodes, absence de pilosité dans la région ventrale; présence des soies tégumentaires ne se limitant pas aux bandes de soies propres à la crête dorsale ainsi qu'aux crêtes dorso-latérales et latéro-ventrales de chaque segment et sous-segment; elles sont en effet également



FIGS 53-55

Orthonevra nobilis, larve de dernier stade; détail des ornementations segmentaires et tégumentaires dans la région dorsale (échelle en mm). 53: métathorax; 54: segment abdominal 1; 55: segment abdominal 3.

présentes entre celles-ci sous forme de soies très courtes. Augmentation progressive de la longueur des soies tégumentaires du seg. abd. 1 jusqu'à l'extrémité de la larve.

Présence de part et d'autre de la partie ventrale du seg. abd. 8, entre les pédoncules portant les soies latérales L1 et L2, d'une bande longitudinale de soies tégumentaires plus ou moins fortes; espace entre ces deux bandes couvert de soies tégumentaires très courtes. Nombre de soies présentes dans la bande de soies tégumen-

taires reliant les soies segmentaires dorsales D1 relativement faible (figs. 53-55): sur le seg. abd. 1 = 5-7 (n = 3); sur le seg. abd. 3 = 5-7 (n = 3); dans la région dorsale des seg. abd. 1 à 4, rapport de la longueur des soies tégumentaires/soies segmentaires proche de 0.5-0.6. Ventralement, au niveau du seg. abd. 8, présence entre les supports de L2 et L3 de 6 à 8 soies (n = 3), dorsalement de 2 à 4 soies (n = 4).

Pseudopodes: présents sous le mésothorax et les seg. abd. 1 à 6; ils sont peu développés. Localisations respectives signalées uniquement par la présence d'un groupe de soies très courtes, en général robustes. Absence de pseudopodes sous les segments 7 et 8; emplacement potentiel des pseudopodes 7 marqué par la présence des soies ventrales V1 et V2 particulièrement longues, alors qu'elles sont minuscules sous les autres segments.

PUPE:

Longueur (tête - L3 du seg. abd. 8): 5.1-5.9 mm; largeur: 1.7-2.0 mm; hauteur: 1.6-1.9 mm.

Forme générale (contour et section) et couleur du tégument comparables à celles des pupes de *Chrysogaster* et de *Lejogaster* (figs. 13, 14).

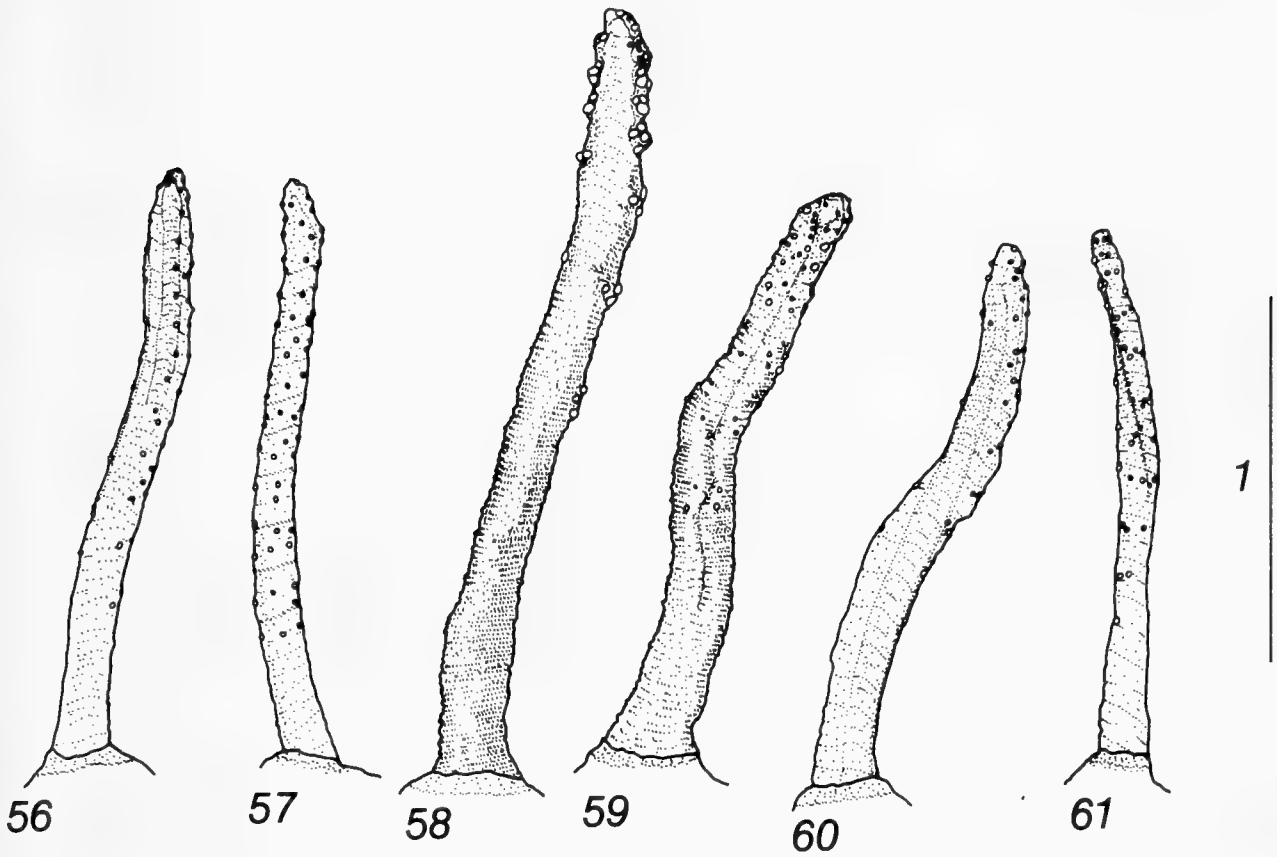
Tégument: brun, verruqueux sur le thorax, puis dès le seg. abd. 1 devenant finement ridé transversalement, les micromamelons ayant disparu. Crêtes dorso-latérales et latéro-ventrales peu saillantes, de même teinte que le reste du corps. Segmentation pratiquement invisible dans la partie dorsale, soulignée dans la région latérale par la présence de fins sillons à gorge lisse. Ornementation segmentaire discrète, formée de soies noires. Ornementation tégumentaire peu apparente, constituée de soies claires ou foncées; pédoncules latéraux du seg. abd. 8 ratatinés.

Pseudopodes devenus quasi invisibles, leurs emplacements respectifs marqués par des soies noirâtres.

Processus stigmatiques: localisation comparable à celle des pupes de *Chrysogaster* et de *Lejogaster*; forme et ornementation (disposition des orifices stigmatiques) des 2 processus du seg. abd. 1 caractéristiques de l'espèce (figs. 56, 57).

NOTE BIOLOGIQUE

Larve semi-aquatique se développant en marge de fossés, ainsi qu'en bordure de petits ruisseaux riches en matière organique souvent tourbeuse. A basse altitude, les larves passent l'hiver au stade III, alors qu'en altitude (dès 800-900 m env.) elles font leur cycle sur 3 ans, si bien qu'un certain pourcentage de larves passent l'hiver au stade II. Apparition des premières pupes dès la fin mai; durée du développement pupal (T° moy. 12-14°C) de 20 à 28 jours (n = 2); apparition des processus stigmatiques dorsaux 4 à 6 jours (n = 2) après la pupaison. En Suisse occidentale, période de vol de mi-mai à mi-septembre; *O. nobilis* est vraisemblablement univoltine en plaine jusqu'à environ 900-1000 m d'altitude, partivoltine au-dessus avec un cycle à cheval sur trois ans; amplitude altitudinale de 430-1930 m. L'espèce est peu commune (MAIBACH et al. 1992).



FIGS 56-61

Orthonevra, processus stigmatique dorsal du segment abdominal 1 de la pupe (échelle en mm). 56-57: *O. nobilis*; 56: vue frontale (processus gauche); 57: vue latérale externe (processus droite). 58-59: *O. brevicornis*; 58: vue frontale (processus gauche); 59: vue latérale externe (processus droite). 60-61: *O. onytes*; 60: vue frontale (processus gauche); 61: vue latérale externe (processus droite).

Orthonevra brevicornis (Loew, 1843)

[larve et pupe décrites auparavant par Hartley (1961)]

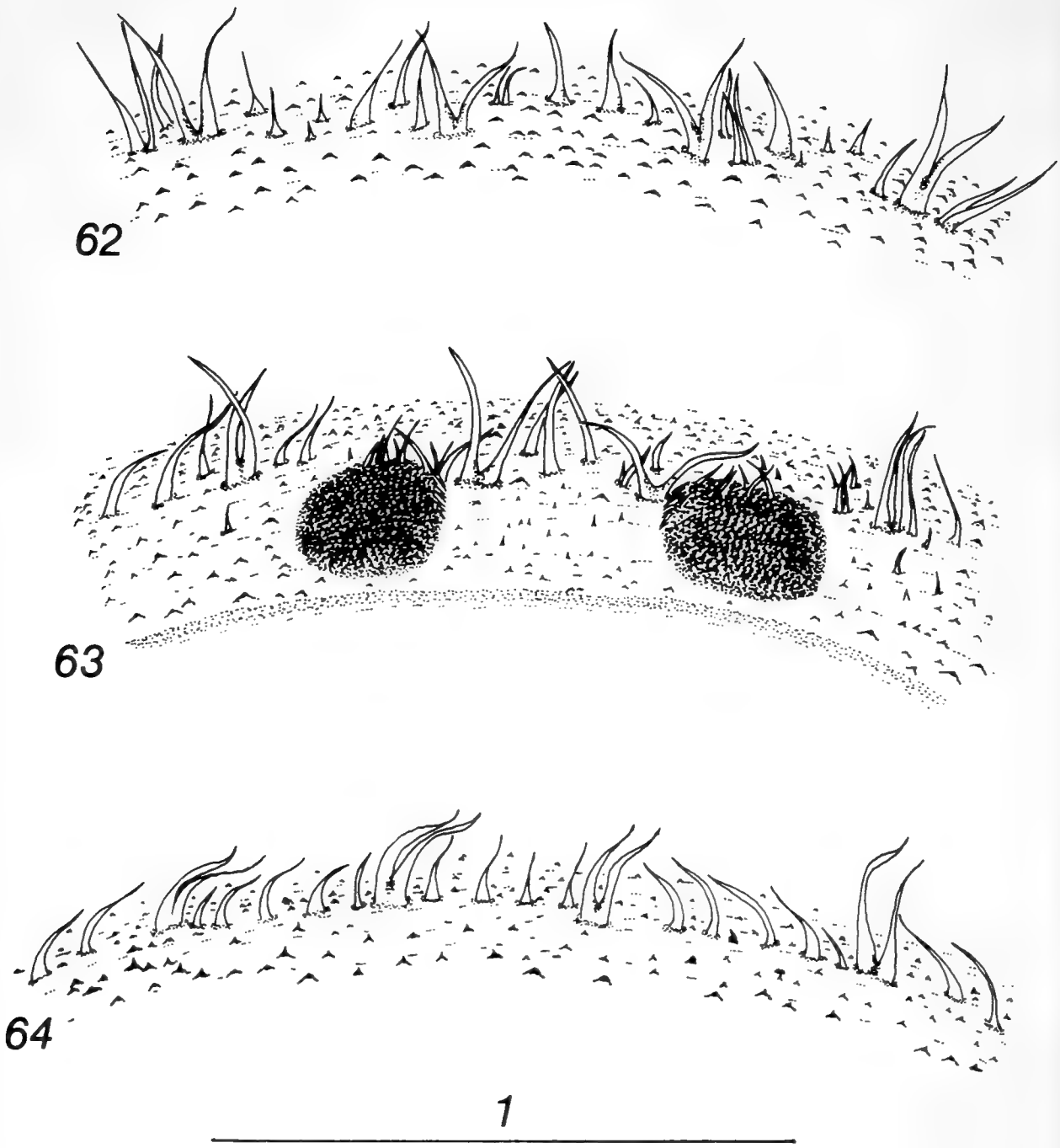
GRANDE-BRETAGNE. - Abbots pool Sorn, 7FE9; 27.II.57; J.C. Hartley leg.; Coll. Hartley: 8 larves; > 20 pupes.

LARVE AU STADE III:

Longueur (prothorax - pédoncule L3 du seg. abd. 8): 8.7-9.1 mm; largeur: 2.3-2.5 mm; hauteur: 1.8-2.1 mm.

Larve métapneustique. Forme générale, couleur, ornementations segmentaires (arrangement, disposition) ainsi que les caractéristiques morphologiques du seg. abd. 8 (tube respiratoire et troncs trachéens) analogues à celles de la larve d'*O. nobilis*.

T é g u m e n t distinctement verruqueux sur toute la surface du corps (figs. 62-64): présence de micromamelons surmontés de minuscules soies robustes uniquement dans la partie thoracique ainsi qu'à proximité immédiate des bandes transverses de soies tégumentaires, micromamelons nus sur le reste du corps.



FIGS 62-64

Orthonevra brevicornis, larve de dernier stade; détail des ornementations segmentaires et tégumentaires dans la région dorsale (échelle en mm). 62: métathorax; 63: segment abdominal 1; 64: segment abdominal 3.

Métamérisation: délimitation thorax-abdomen, segmentation, sous-segmentation ainsi que la pilosité tégumentaire des renflements latéraux comparables à celles de la larve d'*O. nobilis*. Tel est aussi le cas de la disposition de l'ornementation segmentaire.

Ornementation tégumentaire composée de soies plutôt massives, limitées aux bandes transverses dorsales et latérales ainsi qu'aux crêtes dorso-latérales et latéro-ventrales; de ce fait l'espace entre ces bandes est nu (figs. 62-64). Ornementation tégumentaire du thorax et des seg. abd. 7 et 8 comparable à celle d'*O. nobilis*. Sur les spécimens étudiés, soies tégumentaires présentes dorsalement sur les seg. abd. 2 à 6 très nettement couchées en direction du milieu du dos de la larve (fig. 64).

Nombre de soies présentes dans la bande de soies tégumentaires reliant les soies segmentaires dorsale D1 relativement faible (figs. 62-64): sur le seg. abd. 1 = 4-5 (n = 3); sur le seg. abd. 3 = 4-5 (n = 3); dans la région dorsale des seg. abd. 1 à 4, rapport des longueurs des soies tégumentaires/soies segmentaires proche de 0.75 à 0.8. Au niveau du seg. abd. 8, présence entre les supports de L2 et L3, ventralement de 1 à 3 soies (n = 4), dorsalement de 10 à 12 soies [11.0 ± 0.8; n = 5].

Pseudopodes: position, forme et aspect analogues à ceux d'*O. nobilis*.

PUPE:

Longueur (tête - L3 du seg. abd. 8): 6.5-7.1 mm; largeur: 1.9-2.4 mm; hauteur: 1.8-2.1 mm.

Forme générale (contour et section) et couleur du tégument comparables à celles de la pupe d'*O. nobilis*.

La pupe d'*O. brevicornis* se distingue de celle d'*O. nobilis* principalement par la structure du tégument, qui est nettement verruqueuse sur toute la surface du corps et par la forme générale des processus stigmatiques dorsaux (seg. abd. 1), légèrement spatulés dans leur tiers terminal, caractérisés de profil par leur courbure, alors que de face les orifices stigmatiques ne sont visibles que sur le pourtour des cornes (figs. 58, 59).

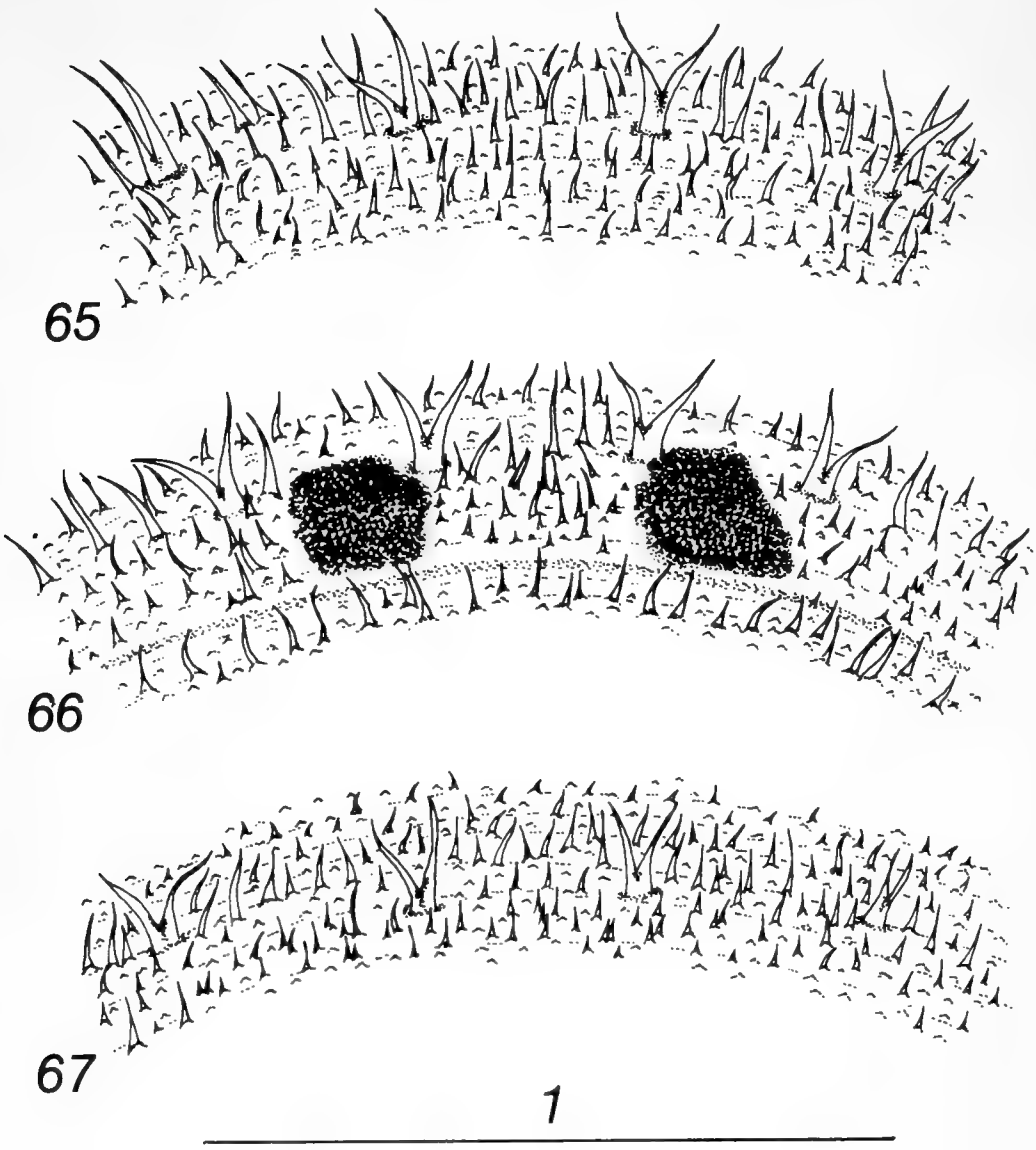
NOTE BIOLOGIQUE:

Selon HARTLEY (1961), la larve, semi-aquatique, se développe dans des dépressions humides remplies de boue organique, la plupart du temps dans des environnements boisés. En Suisse occidentale, *O. brevicornis* est selon toute vraisemblance univoltine; période de vol s'étalant de fin avril à fin juin; amplitude altitudinale de 430-1060 m; l'espèce y est rare (MAIBACH *et al.* 1992).

Orthonevra onytes Séguy, 1961

Il n'est pas exclu qu'*Orthonevra onytes* Séguy, 1961 soit un synonyme plus récent d'*O. tristis* (Loew, 1871) cf. MAIBACH et al. (1994a).

SUISSE. - Vaud: Ormonts, Pra-Cornet/Les Mosses; 14.VII.1987; A. Maibach leg.; coll. MZL: 3 larves; 5 pupes. - id..; 23..VII.1987; A. Maibach leg.; coll. MZL: 1 pupe. - Vaud: Ormonts, Lac Lioson/Les Mosses; 16.X.1987; A. Maibach leg.; coll. MZL: 1 larve. - id.: 19.VI.1989; A. Maibach leg.; coll. MZL: 1 pupe. - id.; 3.VII.1989; A. Maibach leg.; coll. MZL: 1 larve. - id.; 1.VII.1991; A. Maibach leg.; coll. MZL: 1 larve.



FIGS 65-67

Orthonevra onytes, larve de dernier stade; détail des ornementations segmentaires et tégumentaires dans la région dorsale (échelle en mm). 65: métathorax; 66: segment abdominal 1; 67: segment abdominal 3.

LARVE AU STADE III:

Longueur (prothorax - pédoncule L3 du seg. abd. 8): 8.8-9.3 mm; largeur: 2.2-2.4 mm; hauteur: 1.8-2.1 mm.

Larve métapneustique. Forme générale, couleur, ornementations segmentaires (arrangement, disposition) ainsi que les caractéristiques morphologiques du seg. abd. 8 (tube respiratoire et troncs trachéens) analogues à celles des larves d'*O. nobilis* et d'*O. brevicornis*.

T é g u m e n t distinctement verruqueux sur toute la surface du corps (figs. 65-67); présence de micromamelons surmontés chacun d'une courte soie large et robuste (base souvent foncée) sur les parties frontales et latérales du prothorax, sur les

parties latérales et dorsales des méso-, métathorax et des segments abdominaux; micromamelons surmontés chacun d'une soie courte et plus fine sur le reste du corps; tégument couvert de micromamelons sans soies uniquement dans les plis de chaque segment ainsi que dans la région ventrale, entre et autour des pseudopodes. Après coloration au bleu de méthylène (MAIBACH & GOELDLIN DE TIEFENAU 1992), surface du corps distinctement ponctuée; comparée aux larves d'*O. nobilis* et d'*O. brevicornis*, les micromamelons mis ainsi en évidence sont mieux circonscrits et forment une ponctuation ininterrompue.

Métamérisation: délimitation thorax-abdomen, segmentation, sous-segmentation ainsi que la pilosité tégumentaire des renflements latéraux comparables à celles des larves d'*O. nobilis* et d'*O. brevicornis*. Tel est aussi le cas de la disposition de l'ornementation segmentaire.

Ornementation tégumentaire particulièrement dense (figs. 65-67): corps (régions dorsales et latérales) entièrement couvert de soies; bandes de soies caractérisant chaque segment, en particulier les segments abdominaux (bandes dorsales et latérales transverses, dorso-latérales et ventro-latérales longitudinales), bordées de part et d'autre, sur toute la largeur des segments, par de nombreuses soies de très petite taille, disposées au sommet des micromamelons du tégument; ainsi, contrairement à ce qui s'observe chez les larves d'*O. nobilis* et d'*O. brevicornis*, ces bandes de soies sont plus diffuses et mal délimitées.

Nombre de soies présentes dans la bande de soies tégumentaires reliant les soies segmentaires dorsales D1 relativement élevé (figs. 65-67), supérieur à 10: sur le seg. abd. 1 = 13-17 (n = 4); sur le seg. abd. 3 = 12-18 (n = 4); dans la région dorsale des seg. abd. 1 à 4, rapport des longueurs des soies tégumentaires/soies segmentaires proche de 0.75 à 1.0. Au niveau du seg. abd. 8, présence entre les supports de L2 et L3, ventralement de 9 à 12 soies (n = 4), dorsalement de 8 à 13 soies (n = 4).

Pseudopodes: position, forme et aspect analogues à ceux d'*O. nobilis* et d'*O. brevicornis*.

PUPE:

Longueur (tête - L3 du seg. abd. 8): 5.8-6.2 mm; largeur: 1.9-2.3 mm; hauteur: 1.9-2.1 mm.

Forme générale (contour et section) et couleur du tégument comparables à celles des pupes d'*O. nobilis* et d'*O. brevicornis*.

La pupe d'*O. onytes* se distingue des pupes d'*O. nobilis* et d'*O. brevicornis* principalement par la structure du tégument nettement verruqueuse sur toute la surface du corps, par des crêtes latérales plus claires, par la présence sur le tégument au sommet des micromamelons d'une soie courte dont la base est noirâtre, par la forme générale des processus stigmatiques (seg. abd. 1) aplatie, en forme de S et par la disposition des orifices stigmatiques (figs. 60, 61).

NOTE BIOLOGIQUE:

L'unique site de développement identifié est un bas-marais de source en marge d'un lac alpin à quelque1800 m d'altitude. Développement sur 3 ans, une partie des

larves passant l'hiver au stade II, les autres au stade III. Apparition des premières pupes dès la fin mai-début juin; durée du développement pupal (T° moy. 12-14°C) de 14.0 ± 1.6 jours (12-16; n = 5); apparition des processus stigmatiques dorsaux 3.4 ± 0.6 jours (3-4, n = 5) après la pupaison. En Suisse occidentale, espèce partivoltine; période de vol allant de fin mai à mi-août; amplitude altitudinale de 900 à 2480 m; l'espèce est rare (MAIBACH et al. 1992).

GENRE *Riponnensia* Maibach, Goeldlin & Speight, 1994a

Riponnensia splendens (Meigen, 1822)

[larve et pupe décrites auparavant par Hartley (1961)]

ESPAGNE. - Segovia, Arroyo de Tejadilla (940 m); 8.VI.1988; P. Goeldlin & A. Maibach leg.; coll. MZL: 3 pupes.

IRLANDE. - Co. Wicklow: Kilmurry Swamp; 4.IV.1989; P. Goeldlin, A. Maibach & M.C.D. Speight leg.; coll. MZL: 11 larves; 5 pupes. - Co. Wicklow: Glen of the Dawns, Bellevue Wood; 6.IV.1989; P. Goeldlin, A. Maibach & M.C.D. Speight leg.; coll. MZL: 1 larve.

LARVE AU STADE III:

Longueur (prothorax - pédoncule L3 du seg. abd. 8): 7.8-10.0 mm; largeur: 1.9-2.2 mm; hauteur: 1.8-2.3 mm.

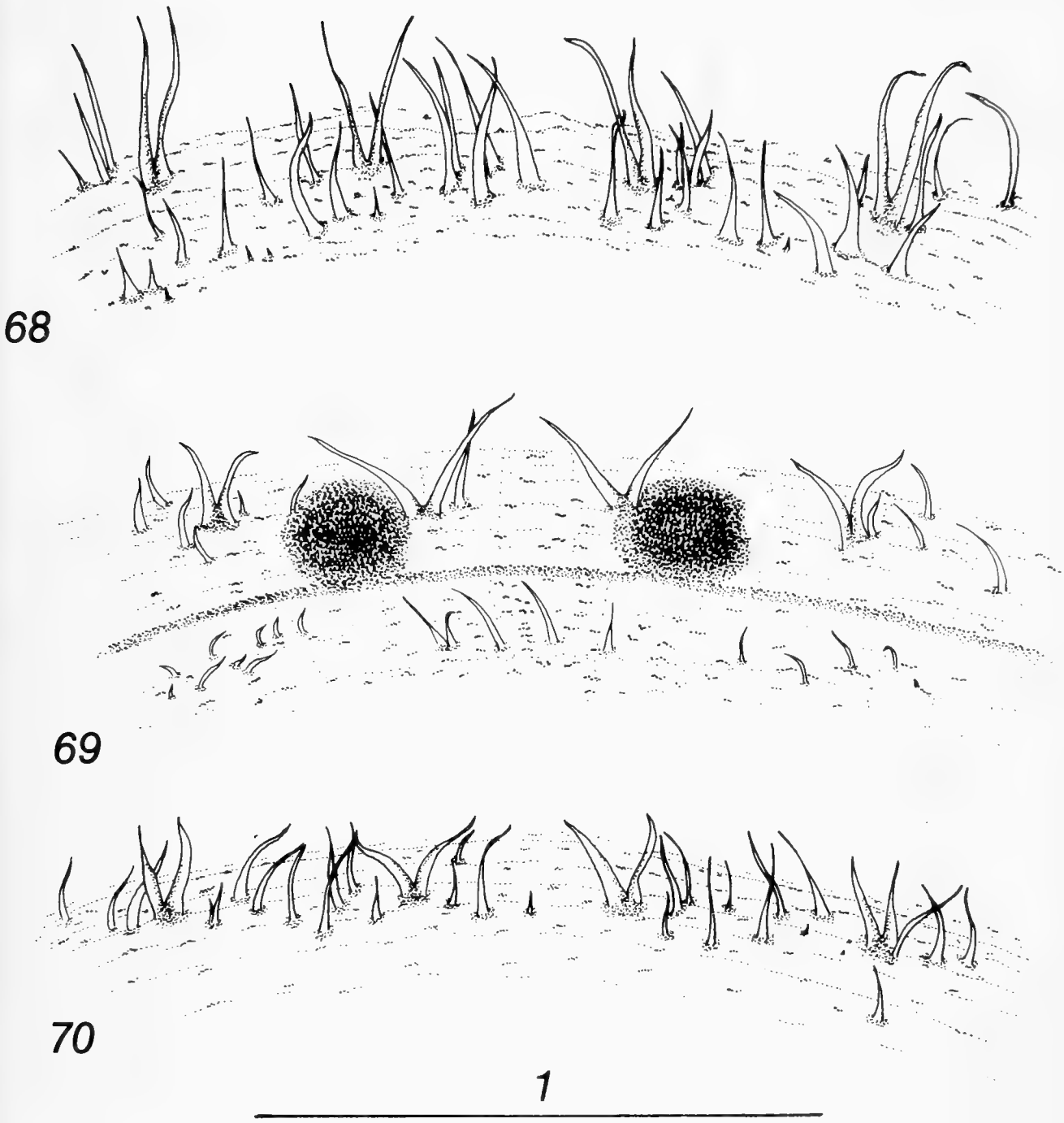
Larve métapneustique de relativement grande taille. Forme générale, couleur, ornementations segmentaires (arrangement, disposition) ainsi que les caractéristiques morphologiques du seg. abd. 8 (tube respiratoire et troncs trachéens) comparables à celles des larves des genres *Chrysogaster*, *Lejogaster* et *Orthonevra* (fig. 1).

Tégument: verruqueux (micromamelons) sur le thorax et les seg. abd. 1 à 4, légèrement verruqueux, voire relativement lisse sur le reste du corps (figs. 68-70). Micromamelons surmontés d'une minuscule soie sur le thorax, sur les bourrelets latéraux, le long des crêtes dorso-latérales et latéro-ventrales ainsi qu'autour des pseudopodes; sur le reste du corps, micromamelons apparemment sans soies apicales.

Métamérisation: délimitation thorax-abdomen peu visible mais aisée à situer par la présence sur le seg. abd. 1 de 2 taches dorsales circulaires, marquant l'emplacement des futures cornes abdominales propres à la pupe. Corps plissé, plis en général soulignés par des zones de dépôts grisâtres. Segmentation, sous-segmentation ainsi que la pilosité tégumentaire des renflements latéraux comparables à celles des larves des genres *Chrysogaster*, *Lejogaster* et *Orthonevra*.

Ornementation segmentaire composée de soies bifides: arrangement comparable à celui des larves de *Chrysogaster*, *Lejogaster* et *Orthonevra*. Au niveau du seg. abd. 8, soies latérales L1, L2 et L3 portées par des pédoncules très saillants (figs. 5-7).

Ornementation tégumentaire: limitée aux bandes transverses propres à chaque segment (régions dorsales et latérales), aux bandes longitudinales de soies (crêtes dorso-latérales et latéro-ventrales) ainsi qu'aux bourrelets latéraux du prothorax et de l'abdomen (figs. 68-70). Augmentation progressive de la longueur de ces soies dès les seg. abd. 4 et 5 jusqu'à l'extrémité de la larve.



FIGS 68-70

Riponnensia splendens, larve de dernier stade; détail des ornementations segmentaires et tégumentaires dans la région dorsale (échelle en mm). 68: métathorax; 69: segment abdominal 1; 70: segment abdominal 3.

Présence de part et d'autre de la partie ventrale du seg. abd. 8, entre les pédoncules des soies latérales L1 et L2, d'une bande longitudinale de soies tégumentaires relativement fortes; espace entre ces deux bandes de soies couvert de soies tégumentaires plus petites. Nombre de soies présentes dans la bande de soies tégumentaires reliant les soies segmentaires dorsales D1 faible (figs. 68-70): sur le seg. abd. 1

= 1-4 (n = 4); sur le seg. abd. 3 = 2-5 (n = 8); dans la région dorsale des seg. abd. 1 à 4, rapport des longueurs des soies tégumentaires/soies segmentaires proche de 0.5-0.75. Absence pratiquement totale de soies tégumentaires dans la partie ventrale du seg. abd. 8, entre L2 et L3 (fig. 71): 0-2 soies [0.5 ± 0.8; n = 8], présence dorsalement de 6 à 9 soies [7.2 ± 1.3; n = 5].

P s e u d o p o d e s : moyennement développés; présents par paire sous le mésothorax et les seg. abd. 1 à 6: il s'agit de simples mamelons surmontés de soies peu sclérifiées sans disposition précise, dont les extrémités sont dirigées principalement vers l'arrière. Absence de pseudopodes sous les segments 7 et 8.

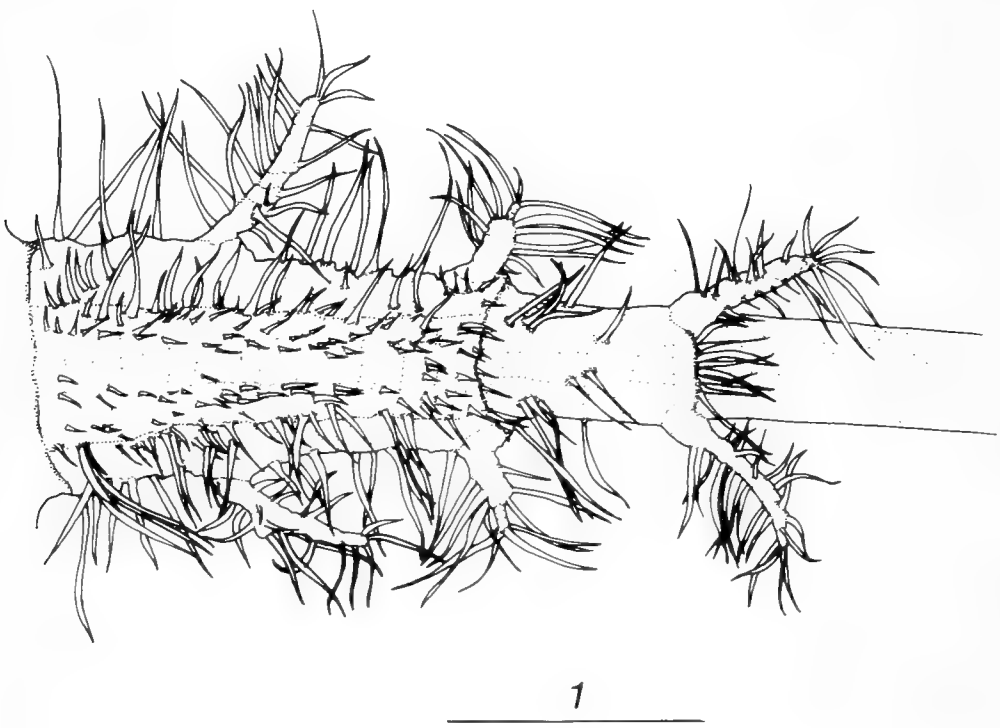


FIG. 71

Riponnensia splendens, larve de dernier stade; segment abdominal 8 en vue ventrale (échelle en mm).

PUPE:

Longueur (tête - L3 du seg. abd. 8): 5.5-6.2 mm; largeur: 2.5-2.7 mm; hauteur: 2.1-2.4 mm.

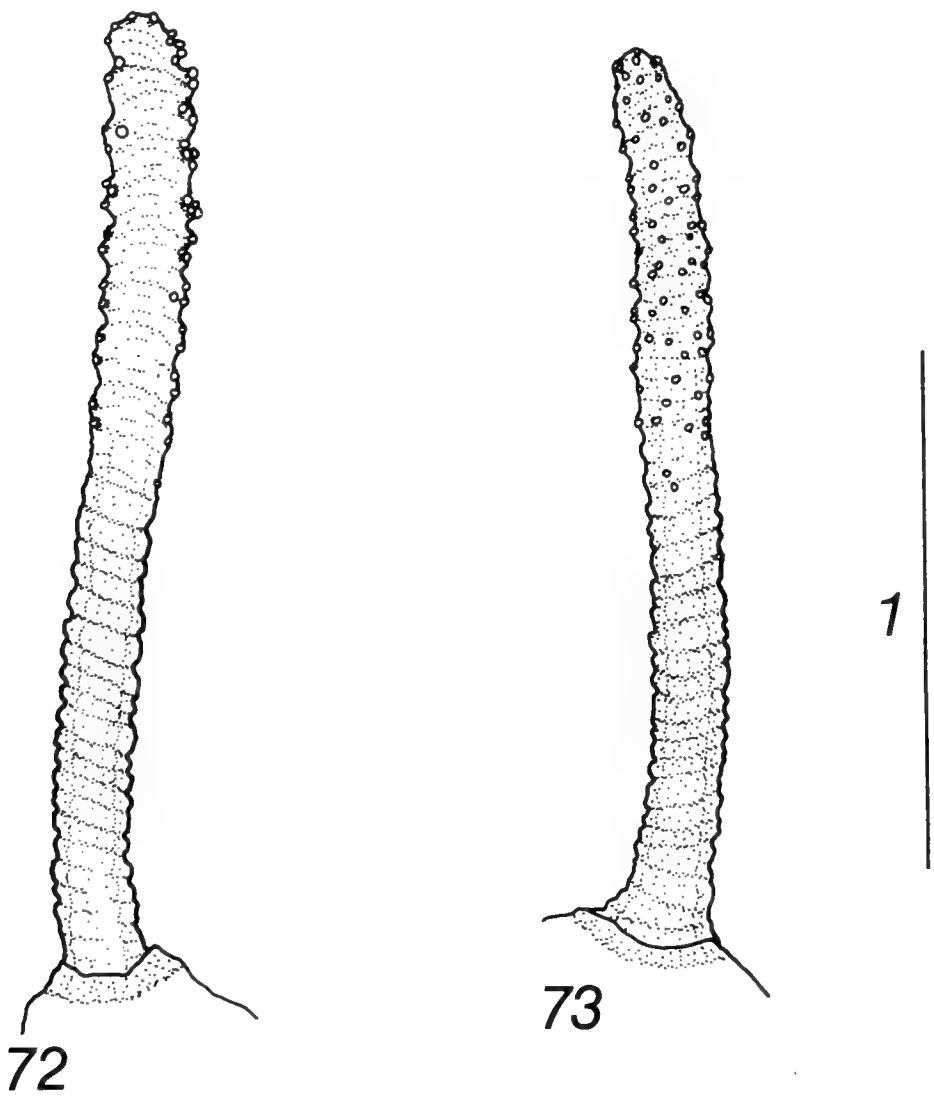
Forme générale (contour et section) et couleur du tégument comparables à celles des pupes de *Chrysogaster*, *Lejogaster* et *Orthonevra* (figs. 13, 14).

T é g u m e n t : verruqueux; crêtes dorso-latérales et latéro-ventrales légèrement saillantes et souvent un peu plus claires. Segmentation et sous-segmentation: peu visibles dorsalement, à peine soulignées par la présence de fines lignes noirâtres allant de part et d'autre de la région dorsale, mieux marquée latéralement par la présence de lignes brunes. Ornementations segmentaire et tégumentaire relativement difficiles à observer; elles apparaissent sous forme de bandes de soies noires ou plus

claires, disposées transversalement sur chaque tégument. Pédoncules latéraux des seg. abd. 7 et 8 ratatinés.

Pseudopodes: devenus quasi invisibles.

Processus stigmatiques: présence et disposition comparables à celles des pupes de *Chrysogaster*, *Lejogaster* et *Orthonevra*; forme et ornementation (disposition des orifices stigmatiques) des 2 processus du seg. abd. 1 caractéristiques de l'espèce (figs. 72, 73): ils sont en effet distinctement annelés dans leur moitié basale, alors qu'en vue frontale, les orifices stigmatiques ne sont visibles que sur le pourtour de la moitié apicale.



FIGS 72-73

Riponnensia splendens, processus stigmatique dorsal du segment abdominal 1 de la pupe (échelle en mm). 72: vue frontale (processus gauche); 73: vue latérale externe (processus droite).

NOTE BIOLOGIQUE:

Larves semi-aquatiques se développant sur les berges de petits ruisseaux, souvent en milieux forestiers. Un des sites identifiés (Irlande, Co. Wicklow: Kilmurry Swamp) est constitué d'une succession de poches de matière organique se déversant lentement les unes dans les autres en bordure d'un petit cours d'eau. Dans ce site, les larves passent l'hiver au stade III. Apparition des premières pupes dès la mi-mai; durée du développement pupal (T° moy. 12-14°C) de 17.6 ± 1.3 jours (15-19; n = 10); apparition des processus stigmatiques dorsaux 2 à 5 jours (n = 2) après la pupaison. D'après les courbes de vol données par STUBBS & FALK (1983) pour l'Angleterre (de mai à septembre) et celle indiquée par VERLINDEN & DECLEER (1987) pour la Belgique (de mai à octobre avec 2 pics: l'un à mi-juin, l'autre à mi-août), l'espèce pourrait être bivoltine. En Suisse occidentale, l'espèce est considérée comme très rare; elle est présente entre 500 et 600 m d'altitude (MAIBACH et al. 1992).

CLÉ DE DÉTERMINATION DES GENRES ET ESPECES

Larves au stade III et pupes

1. Troncs trachéens postérieurs (seg. abd. 8) soudés, en forme de stylet rigide; absence de soies à caractère hydrophobe sur le pourtour des plaques stigmatiques du tube respiratoire postérieur (fig. 29) . . . . . *Melanogaster* Rondani 2
- Troncs trachéens postérieurs (seg. abd. 8) soudés en un fin cylindre; pourtour des plaques stigmatiques du tube respiratoire postérieur orné de 8 soies plumeuses à caractère hydrophobe (fig. 1). 4
2. Tégument d'aspect noduleux (figs. 51, 52) sur la totalité du corps; soies L1 du seg. abd. 8 disposées sur 2 pédoncules séparés (fig. 38). Pupe: tégument noduleux; processus stigmatiques dorsaux (seg. abd. 1): figs. 47, 48 . . . . . *M. aerosa* (Loew)
- Tégument d'aspect verruqueux uniquement sur les pro- et mésothorax; sur le métathorax et sur l'abdomen, tégument pratiquement lisse; soies L1 du seg. abd. 8 disposées à l'extrémité d'un pédoncule unique mais dont l'extrémité est bifide (figs. 32, 35). Pupe: tégument ayant un autre aspect 3
3. Larve: rapport des longueurs (I) des soies tégumentaires/longueurs (L) des soies segmentaires (rapport l/L, région dorsale, seg. abd. seg. abd. 1-5) ≤ 0.5; nombre de soies tégumentaires entre les soies dorsales D1 relativement faible (figs. 30, 31): sur le seg. abd. 1 = 7-13; sur le seg. abd. seg. abd. 3 = 8-13; augmentation progressive de la longueur des soies tégumentaires jusqu'à l'extrémité de la larve. Pupe: processus stigmatiques dorsaux (seg. abd. 1): figs. 43, 44. . . . . *M. nuda* (Macquart)
- Larve: rapport l/L compris entre 0.6 et 0.7; nombre de soies tégumentaires entre les soies dorsales D1 plus élevé (figs. 49, 50): sur le seg. abd. 1 = 13-17; sur le seg. abd. 3 = 12-14. Pilosité nettement

plus longue et dense dès le seg. abd. 4, nette transition entre l'avant relativement peu pileux et l'arrière densément couvert de longues soies. Pupe: processus stigmatiques dorsaux (seg. abd. 1): figs. 45, 46 . . . . . *M. hirtella* (Loew)

4. Segment abdominal 8: espace ventral, entre les pédoncules portant les soies latérales L1 et L2, caractérisé par la présence de 2 bandes longitudinales de soies relativement fortes, et par l'absence totale de pilosité entre celles-ci (fig. 21). . . . . *Lejogaster* Rondani . . . 5

- Segment abdominal 8: espace ventral, entre les pédoncules portant les soies latérales L1 et L2, caractérisé par la présence de 2 bandes longitudinales de soies relativement fortes, et, par la présence entre celles-ci d'une pilosité courte et densee, toujours visible (figs. 12, 71) 6

5. Larve: tégument verruqueux sur toute la surface du corps (aspect réticulé) en particulier dans la région latérale (figs. 26-28); rapport l/L = 0.5; nombre de soies tégumentaires entre les soies dorsales D1 très faible: sur le seg. abd. 1 = 0; sur le seg. abd. 3 = 0-1. Pupe: tégument verruqueux réticulé; processus stigmatiques dorsaux (seg. abd. 1): figs. 24, 25) . . . . . *L. tarsata* (Megerle in Meigen)

- Larve/ tégument verruqueux sur le thorax, pratiquement lisse sur le reste du corps (figs. 17-19); rapport l/L ≥ 0.75; nombre de soies tégumentaires entre les soies dorsales D1 plus élevé: sur le seg. abd. 1 = 0-1; sur le seg. abd. 3 = 0-4. Pupe: tégument verruqueux sur le thorax, ligné transversalement sur l'abdomen, jamais réticulé; processus stigmatiques dorsaux (seg. abd. 1): figs. 22, 23. . . . . *L. metallina* (Fabricius)

6. Face ventrale du seg. abd. 8: absence totale de soies sur l'espace situé entre les pédoncules L2 et L3 (fig. 12). Pupe: processus stigmatiques dorsaux (seg. abd. 1): figs. 15, 16. . . . . *Chrysogaster* Meigen . . . . . [une seule espèce connue: *C. solstitialis* (Fallen)]

- Face ventrale du seg. abd. 8: présence de soies sur l'espace situé entre les pédoncules L2 et L3 (figs. 21, 71) 7

7. Face dorsale du seg. abd. 8: absence pratiquement totale de soies sur l'espace situé entre les pédoncules L2 et L3: 0-2 soies, présence dorsalement de 6 à 9 soies; rapport l/L compris entre 0.5 et 0.75; tégument verruqueux sur les seg. abd. 1 à 4, presque lisse sur le reste du corps (figs. 68-70). Pupe: tégument verruqueux; processus stigmatiques dorsaux (seg. abd. 1): figs. 72, 73 . *Riponnensia* Maibach, Goeldlin & Speight . . . . . [une seule espèce connue: *R. splendens* (Meigen)]

- Face dorsale du seg. abd. 8: présence de soies sur l'espace situé entre les pédoncules portant L2 et L3. . . *Orthonevra* Macquart 8

8. Tégument distinctement verruqueux sur toute la surface du corps entièrement recouvert de micromamelons surmontés d'une soie tégumentaire (figs. 65-67); nombre de soies tégumentaires entre les soies dorsales D1 élevé: > 10 (sur le seg. abd. 1: 13-17; sur le seg. abd. 3: 12-18); seg. abd. 8: espace ventral entre L2 et L3 surmonté de 9 à 12

soies, espace dorsal avec 8 à 13 soies. Pupe: processus stigmatiques dorsaux (seg. abd. 1): figs. 60, 61 ..... *O. onytes* Séguy

- Tégument verruqueux sur le thorax, devenant dès le seg. abd. 1 finement plissé transversalement avec absence de micromamelons (figs. 53, 55), ou, tégument verruqueux sur toute la surface du corps avec présence de micromamelons surmontés d'une soie uniquement sur le thorax ainsi qu'à proximité immédiate des bandes de soies tégumentaires (figs. 62-64); nombre de soies tégumentaires entre les soies dorsales D1 < 10 9

9. Tégument verruqueux sur le thorax, devenant dès le seg. abd. 1 finement plissé transversalement avec absence de micromamelons (figs. 53-55); seg. abd. 8: espace ventral entre L2 et L3 surmonté de 6 à 8 soies, espace dorsal avec 2 à 4 soies. Pupe: processus stigmatiques dorsaux (seg. abd. 1): figs. 56, 57 ..... *O. nobilis* (Fallen)

- Tégument verruqueux sur toute la surface du corps avec la présence de micromamelons surmontés d'une soie uniquement sur le thorax ainsi qu'à proximité immédiate des bandes de soies tégumentaires (figs. 62-64); seg. abd. 8: espace ventral entre L2 et L3 avec 1 à 3 soies, espace dorsal avec 10 à 12 soies. Pupe: processus stigmatiques dorsaux (seg. abd. 1): figs. 58, 59 ..... *O. brevicornis* (Loew)

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Résumé

Suite à la récente redéfinition des limites génériques des genres *Lejogaster* Rondani, *Chrysogaster* Meigen et *Orthonevra* Macquart, comprenant la revalidation du genre Melanogaster Rondani et la création d'un genre nouveau *Riponnensia* (Maibach et al. 1994a), nous présentons une synthèse de la morphologie de tous les stades immatures actuellement connus dans la région paléarctique occidentale. Nous redécrivons ainsi, au sein de ces genres, les larves et pupes de *Chrysogaster solstitialis* (Fallen), *Lejogaster metallina* (Fabricius), *L. tarsata* (Megerle in Meigen), *Melanogaster hirtella* (Loew), *M. nuda* (Macquart), *Orthonevra brevicornis* (Loew), *Riponnensia splendens* (Meig.) et décrivons pour la première fois les stades immatures de *Melanogaster aerosa* (Loew), *Orthonevra nobilis* (Fallen) et *O. onytes* (Séguy). Une note biologique complète chaque diagnose. Enfin, nous présentons une clé de détermination des larves et pupes des genres concernés actuellement connues en Europe.

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Japygidés du Sud-Est asiatique n° 6: Malaysia (Sabah) –*Dicellurata Genavensia* XIX–

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Japygidae from South-East Asia n° 6: Malaysia (Sabah) – *Dicellurata Genavensia* **XIX –.** Descriptions of new taxa from Sabah (East Malaysia, formerly North Borneo). Two *Indjapyx* Silv.: *I. yoshii* n. sp. and *I. crockerianus* n. sp. easily differenciated from the two "var." described from "Borneo" by Silvestri (*I. indicus* var. *borneensis* et var. *bidicola*) by their tergal abdominal chetotaxy. One new genus and species, *Kinabalujapyx disturbator* n. gen., n. sp., readily separated from other known genera by its tergal chetotaxy, cerci and very peculiar subcoxal organs.

Key-words: Diplura Japygidae - New genus and species - Borneo, East Malaysia.

A ma connaissance, six Japygoidea ont été décrits de Bornéo. Quatre Japygidae par SILVESTRI (1930): *Japyx beccarii* du Mont Dulit, *J. murudensis* du Mont Murud, *Indjapyx indicus* var. *borneensis* et *I.i.* var. *bidicola*, sans autre indication de provenance que "Borneo". Deux Parajapygidae par moi-même (PAGÉS 1987): *Parajapyx* (*Grassjapyx*) *sepilok* et *P.*(*G.*) *sabahnus* du Sabah.

Si la position générique des *Indjapyx*[2] et des *Parajapyx* ne pose aucun problème, il n'en va pas de même pour les deux *Japyx*. A mon avis ce genre est limité à une partie du bassin méditerranéen, peut-être présent en Amérique du Nord, et tous les *Japyx* décrits du reste du monde appartiennent à d'autres genres, existants ou à définir. Je ne puis cependant admettre sans réserve et sans avoir étudié des exemplaires topotypiques ou manifestement cospécifiques la décision de PACLT (1957) de placer *beccarii* parmi les *Indjapyx* Silv. sensu Paclt; d'après la description et les figures publiées, il ne présente ni le type chétotaxique des urotergites et du premier urosternite, ni la position si particulière de la trichobothrie *a* du quatrième article antennaire des *Indjypyx* sensu Silvestri; d'ailleurs Paclt inclut, par exemple, dans son genre *Indjapyx* qu'il définit entre autre par la présence de tubercules bisériés aux deux cerques, le *Japyx immsi* Silv. de

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[2] Voir dans ma note (PAGÉS 1978) ce que je pense des "var." de SILVESTRI (1930).

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l'Inde dont la trichobothrie *a* est certainement proximale comme chez les *Indjapyx* sensu Silv., mais dont les deux cerques n'ont qu'une rangée de tubercules; ce caractère devrait, d'après la clef dichotomique donnée par Paclt, en faire un *Burmjapyx* sensu Paclt, genre des plus hétéroclite s'il en est; *immsi* pourrait donc se retrouver avec *murudensis* dont les affinités avec les *Burmjapyx* sensu Silvestri me paraissent très peu probables.

J'étudie ici une partie des nombreux Japygidés récoltés en 1982 et 1983 à Bornéo par le Dr. B. Hauser, Conservateur du Département des Arthropodes et d'Entomologie I du Muséum d'Histoire naturelle de Genève et par le Dr. C. Lienhard, Chargé de Recherche dans le même service.

Cette note est consacrée uniquement aux individus provenant du Sabah. (East Malaysia, anciennement Bornéo septentrional); je les répartis entre 3 espèces: *Indjapyx yoshii* n.sp., *I. crockerianus* n.sp., *Kinabalujapyx disturbator* n.gen., n.sp.

Les holotypes et paratypes de ces espèces sont déposés dans les collections du Muséum d'Histoire naturelle de Genève.

Je tiens à remercier d'une part Mme I. Frieden d'avoir effectué la première frappe de mon manuscrit et, d'autre part, Mme M. Krähenbühl qui a eu la difficile tâche de mettre au net le texte définitif. Mes remerciements vont aussi à Mme E. Seraoui qui a reporté sur calque mes dessins originaux.

LISTE DES STATIONS

Toutes se situent au Sabah. J'ai conservé la numérotation chronologique et la description des stations telles qu'elles apparaissent sur les listes établies pour la mission entomologique au Sabah en 1982 par B. Hauser et pour la mission entomologique au Sabah et à Palawan en 1983 par B. Hauser (B.H.) et C. Lienhard (C.L.).

Les spécimens ont été capturés soit directement à vue, soit après traitement des prélèvements aux appareils de Berlese (B) ou de Winkler-Moczarski (W).

Sab-82/4. - S a n d a k a n R e s i d e n c y : Sepilok, "Kabili-Sepilok Forest Reserve" (= KSFR), forêt près de l'Orang-Utan Rehabilitation Station (= OURS), prélèvement de sol dans les angles formés par les contreforts ailés de grands arbres (*Dipterocarpaceae*), 23.IV. (B). (*Indjapyx yoshii* n. sp.: *Parajapyx* (*G.*) *sepilok* Pagés).

Sab-82/5. - -id.-: Sepilok, KSFR, forêt près de l'OURS, prélèvement de bois pourri, 23.IV. (B). (*Indj. yoshii* n. sp.).

Sab-82/7. - -id.-: Sepilok, KSFR, forêt près du Pond, tamisage de feuilles mortes et de bois pourri, 23.IV. (W). (*Indj. yoshii* n. sp.; *P.* (*G.*) *sepilok* Pagés).

Sab-82/27. - -id.-: Sepilok, KSFR, forêt près de l'OURS, tamisage de feuilles mortes et de bois pourri prélevés dans les angles formés par les contreforts ailés de grands arbres, 3.V. (W). (*Indj. yoshii* n. sp.).

Sab-82/33.- -id.-: Sepilok. KSFR, forêt près de l'OURS, prélèvement de sol dans la zone de transition vers la mangrove, 6.V. (B). (*Indj. yoshii* n. sp.).

Sab-82/34.- -id.-: Sepilok, KSFR, forêt près de l'OURS, prélèvement de sol dans le pré autour du "Cottage" (ancienne plantation d'Hévéas), 7.V. (B). (*Indj. yoshii* n. sp.; *P.* (*G.*) *sabahnus* Pagés)

Sab-82/42. - -id.-: Sepilok, KSFR, forêt près du Pond, prélèvement de feuilles mortes et de bois pourri au pied d'un arbre, 10.V. (B). (*Indj. yoshii* n. sp.).

Sab-82/43.- Interior Residency : route de Kimanis, à 16 miles de Keningau, héliport, tamisage en forêt brumeuse, 1380 m, 12.V. (W). (*Indj. crockerianus* n. sp.).

Pal-83/5. - Sandakan Residency: Kolapis, prélèvement de sol en forêt dégradée, 60 m, leg. B.H., 12.III. (B). (*Indj. yoshii* n. sp.).

Pal-83/8. - -id.-: Sepilok, KSFR, forêt près de l'OURS, prélèvement de sol dans les angles formés par les contreforts ailés d'*Eusideroxylon zwangeri* et *Pometia pinnata*, leg. B.H., 12.III. (B). (*Indj. yoshii* n. sp.; *P.* (*G.*) *sepilok* Pagés).

Pal-83/13. - Interior Residency : route de Kimanis, à 16 miles de Keningau, héliport, prélèvement de sol en forêt brumeuse, 1380 m, leg. B.H., 14.III. (B). (*Kinabalujapyx disturbator* n. gen., n. sp.).

Pal-83/40. - West Coast Residency : Mt. Kinabalu, Poring Hot Spring, près des cascades "Kipungit Falls", prélèvement de sol, 530 m, leg. B.H., 21.III. (B). (*Indj. yoshii* n. sp.).

Pal-83/41. - -id.-: Mt. Kinabalu, Poring Hot Springs, "Langanan Trail", sentier des "Kipungit Falls" aux "Bat Caves", 530-650 m, leg. C.L., 21.III. (*Indj. yoshii* n. sp.).

Pal-83/43. - -id.-: Mt. Kinabalu, Poring Hot Springs, "Langanan Trail", sentier entre la bifurcation pour les "Kipungit Falls" et les "Bat Caves", prélèvement de sol, 600 m, leg. B.H., 21.III. (B). (*Indj. yoshii* n. sp., *Kinabalujapyx disturbator* n. gen., n. sp.).

DESCRIPTION DES ESPÈCES

Indjapyx yoshii n. sp. (Figs 1-11)

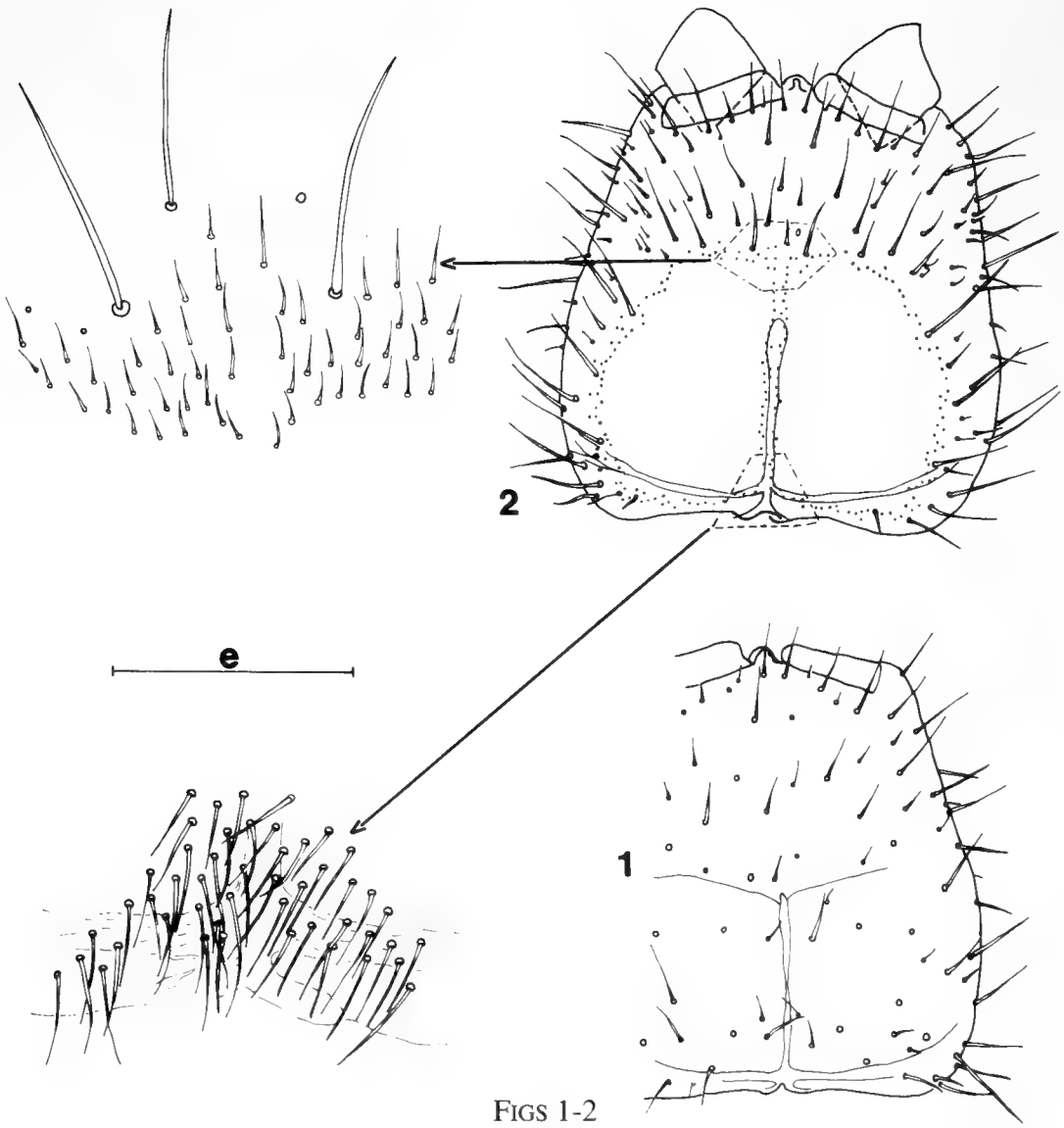
Sabah : Sab- 82/4 (3♂ de 5,7 à 5,8 mm); Sab-82/5 (1 $♂_1$ de 4,2mm); Sab-82/7 (1 st.IIIA contracté de 2,33 mm, 1 $♂_1$ de 3,8mm, 1 ♀ de 7,9 mm); Sab-82/27 (1 st.IIIA de 3,3 mm, 1 ♀ juv. de 3,73 mm, 1 ♀ de 5,9 mm, 1 $♂_1$ de 3,33 mm, 1 ♂ de 7,13 mm); Sab-82/33 (1 $♀_1$ de 4,2mm); Sab-82/34 (1 ♀ de 6mm, 1 ♂ de 6mm); Sab-82/42 (2 st.IIIA de 2,2 et 2,7 mm, 1 $♀_1$ de 3,1mm, 2♀ juv. de 3,9 et 4,5 mm); Pal-83/5 (1 stIIIA de 3,1mm, 1$♀_1$ de 4mm); Pal-83/8 (1 sexe? de 3,9 mm, 2 st.IIIA de 3,3 et 4,8 mm, 2 ♀ juv. de 4,2 et 5,1 mm, 1 ♀ de 6,6mm, 1 ♂ juv. de 4,73mm, 1 ♂ de 5,1mm); Pal-83/40 (1 $♂_1$ de 3,8 mm); Pal-83/41 (1 ♂ de 7mm); Pal-83/43 (2 st.IIIA de 2,7 et 2,8 mm, 1 ♂ de 4,2 mm). Soit au total 35 exemplaires (1 sexe ?, 9 st.IIIA, 3 $♀_1$, 6 ♀ juv., 3 ♀, 4 $♂_1$, 1 ♂ juv., 8 ♂).

Holotype : le ♂ de 4,2mm de la station Pal-83/43

Tête

Vertex : en conclusion de mon étude de la chétotaxie du vertex chez les *Indjapyx* (Pagés 1984), j'écrivais: "la chétotaxie du vertex ne paraît pas avoir une très grande valeur taxonomique puisque le nombre de phanères "typiques" varie au cours du développement postembryonnaire." Je pense maintenant, à la suite de nouvelles observations, qu'il n'y a pas un seul modèle de chétotaxie possible, mais que suivant les zones géographiques étudiées et les groupements de genres qu'elles renferment, on observe des schémas chétotaxiques particuliers; il est, par exemple, souvent très difficile d'appliquer le modèle "*Indjapyx*" aux genres du bassin méditerranéen; il en est de même pour celui proposé par Chou (1966), basé sur des espèces chinoises, Je ne décrirais dont plus en détail la chétotaxie du vertex, mais donnerais une figure de la face tergale de la capsule céphalique d'un individu que je considérerais comme typique de l'espèce étudiée.

Chez *yoshi*, le ♂ de 5,1 mm de Pal-83/8 montre les premiers signes d'une aire pileuse avec l'apparition de 5 soies courtes entre les S6 et s5; chez la ♀ de 6,6 mm de



FIGS 1-2

Indjapyx yoshii n. sp. ♂ holotype de 4,2 mm. - 1. Vertex, e = 298 µm. - 2. ♂ de 7 mm, vertex, e = 241 µm et détail des régions antérieure et postérieure de l'aire pileuse, e = 105 µm.

Pal-83/8, cette aire s'étend des apodèmes transversaux postérieurs aux M4 et le milieu de la branche postérieure de la suture métopique; le stade suivant se rencontre chez les 3 ♂ de Sab-82/4 de 5,7 à 5,8 mm, celui de 4,16 mm de Sab-82/43 et la ♀ de 7,9 mm de Sab-82/7; je n'ai pas observé d'intermédiaire entre cette petite aire pileuse et celle de la fig. 2 présentée par le ♂ de 7mm de Pal-83/4 qui s'étend jusqu'aux S3, M2, I4, I5, P2, s8 et s9; on remarquera que les soies les plus antérieures de l'aire sont beaucoup plus courtes que les plus postérieures qui restent très fines; enfin, le maximum d'extension observé est celui du ♂ de Sab-82/34 de seulement 5,1mm, dont l'aire s'étend jusqu'aux A1, M2, I4 I5, P1, P2, s8, s9 et au-delà de S2, tout près de A2.

Ce qui précède confirme de façon remarquable ce que j'écrivais en 1984: "... l'apparition et l'extension de cette aire pileuse ne paraissent être liées ni au sexe, ni obligatoirement aux stades postembryonnaires;..".

A n t e n n e s : de 36 articles à pilosité typique, vers l'apex de l'antenne le verticille proximal est constitué uniquement de sensilles sétiformes recourbées, le distal

présentant sur tous les articles un mélange de ces sensilles et de soies droites dont certaines peuvent être dirigées vers la base de l'antenne; aires pileuses peu nettes, même sur les exemplaires les plus "âgés", sur les articles 15 à 22 au maximum; les 13 trichobothries typiques, a[3] proximale, p = 0,28 (v. ex.= 0,20 - 0,33); 6 sensilles placoïdes en position typique sur l'article apical.

Pièces buccales : typiques de la famille; les 5 lames du lobe interne des maxilles pectinées; palpes labiaux 2 fois à 2 fois 1/3 aussi longs que larges à la base, les 2 soies subapicales sont en moyenne 1,4 fois aussi longues que le palpe qui les porte.

THORAX

Pronotum : les 5 + 5 M typiques, M_3 les plus longs; la longueur des M_1 égale en moyenne 1,1 fois l'écartement de leurs embases (v. ex.= 0,91 - 1,35); 5 + 5 soies assez longues, 4 - 5 + 4 - 5 autres assez courtes et, au maximum, une douzaine de soies très courtes.

Méso- et métanotum. Préscutum: 1+1 M longs et 1 + 1 soies courtes. Scutum: les 5 + 5 M typiques. M_3 très longs, M_1 et M_4 longs, les plus courts, les autres de tailles intermédiaires; typiquement 5 + 5 soies longues ou assez longues et environ 10 + 10 soies courtes ou très courtes.

Pattes : longues, les PIII dépassant le milieu de l'urosternite 3; 8 à 10 soies spiniformes aux tarses, dont ceux des PIII égalent à peu près les 2/3 de la longueur des tibias correspondants; unguiculus et griffes bien développés, la postérieure 1,5 fois aussi longue que l'antérieure.

ABDOMEN

Tergite 1. Préscutum: 1 + 1 M longs et au plus 1+1 soies assez courtes. Scutum: 2 + 2 M ($ma = M$, M_5) longs; mp assez courts, m_1 et m_3 très courts les autres sm irréguliers ou absents.

Tergite 2 : 4 + 4 M ($ma = M$, M_1, $M_{4\text{-}5}$) longs, M_4 les plus longs; ici, comme sur les tergites suivants, ce que je considére être des $ma = M$ sont insérés sur la ligne joignant les M_1 ou un peu en arrière; il semble que cela soit la règle chez de nombreuses espèces d'*Indjapyx* (cf. SILVESTRI, passim et PAGÉS 1984); m_1, m_3 longs, m_2 et mp assez longs, msa très courts comme environ 12-15 + 12-15 soies.

Tergites 3 à 7 : 6 + 6 M ($ma = M$, $M_{1\text{-}5}$), M_4 et M_5 longs, les autres assez longs, M_2 les plus courts, ma et m_3 assez longs, les autres sm courts ou très courts comme d'autres soies assez nombreuses.

Tergite 8 : environ 2 fois aussi large que long chez les sexués (v. ex. = 2,02-2,18) 1 fois 3/4 seulement chez les st.IIIA; 3 + 3 M longs homologues aux M_3, M_4 et M_5; 2 + 2 sm assez longs homologues aux m_2 et m_3; mp très courts comme environ

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[3] On trouvera la liste des abréviations et des rapports utilisés dans PAGÉS (1954) et PAGÉS & SCHOWING (1958); v. ex. = valeurs extrêmes.

8+8 autres soies situées sur les quarts latéraux du tergite et une vingtaine de soies extrêmement courtes réparties sans ordre bien apparent sur la moitié médiane du tergite.

Tergite 9 : 3,4 fois en moyenne aussi large que long (v. ex. = 3,03 - 3,82); sans *M*, mais avec une rangée postérieure de soies très courtes, les plus latérales étant cependant nettement plus longues que les autres.

Tergite 10 : à bords parallèles, 1,3 fois aussi long que large chez les adultes, (v. ex. = 1,23 - 1,33), 1 fois 1/5 chez les st.IIIA; carènes bien développées, convergentes, s'étendant sur les 2/3 antérieurs environ du tergite, elles sont nulles chez les st.IIIA; 3 + 3 *M* longs (discaux subantérieurs, sublatéraux antérieurs et latéraux intermédiaires); 1 + 1 soies discales postérieures longues, 1 + 1 soies latérales antérieures, 1 + 1 carénales subpostérieures et 2 + 2 soies latérales subpostérieures et postérieures assez longues ou longues; de nombreuses soies très courtes ou extrêmement courtes dont une vingtaine de part et d'autre de la ligne médiane.

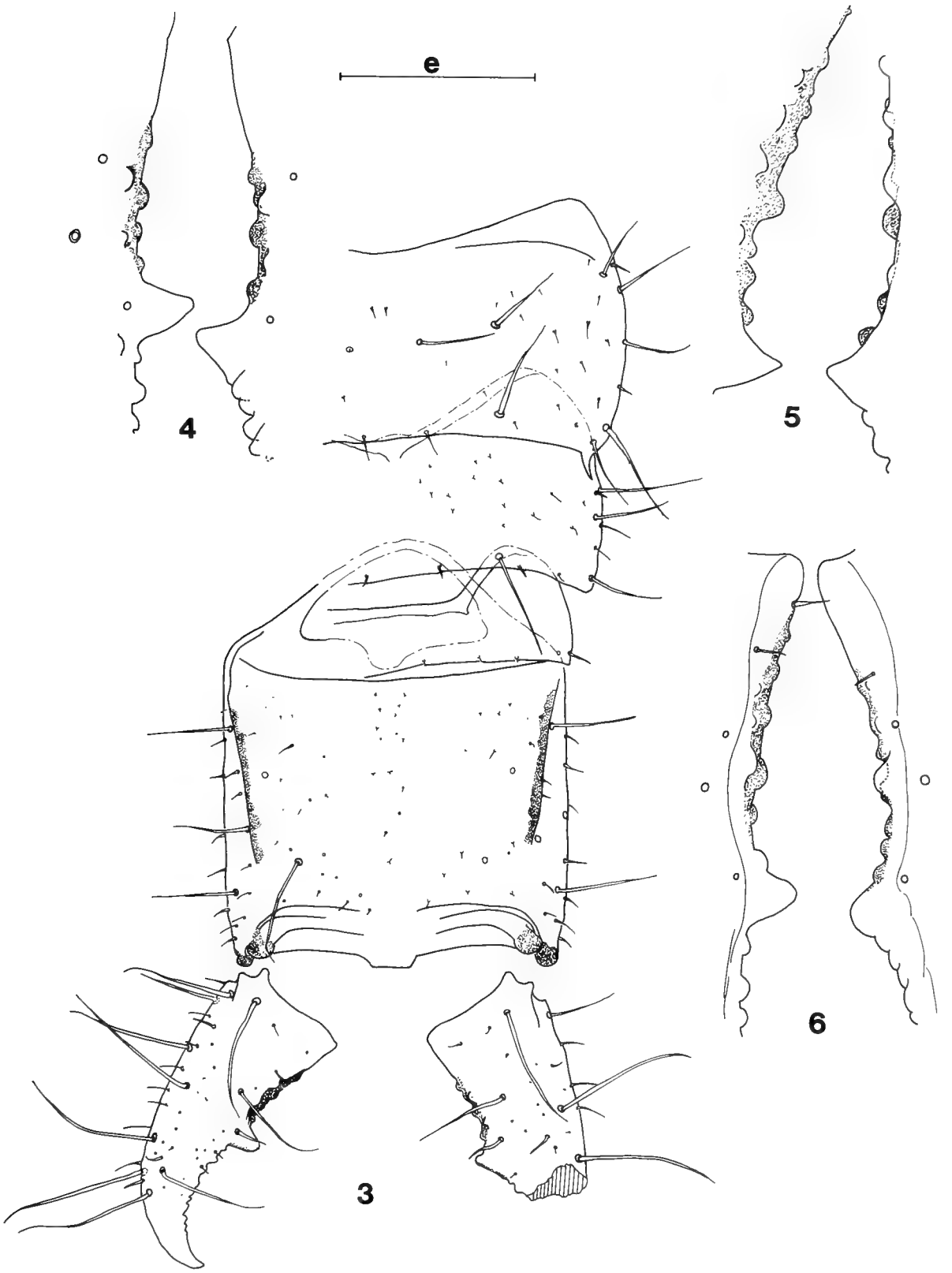
Angles latéraux postérieurs des tergites: nuls ou obtus aux tergites 1 à 6; en pointe triangulaire fine et aiguë au tergite 7; aux tergites 8 et 9, courts, peu saillants, mousses.

Acropyge : net, transverse à angles arrondis.

Longueurs relatives des segments 7 à 10: suivant le stade et le sexe, on observe les valeurs moyennes suivantes: st.IIIA = 50-56-27-100; ♀ = 40-39-20-100; ♂ = 43-45-24-100.

Sternite 1. Préscutum: 4 + 4 *M* longs; 4 + 1 + 4 soies assez longues, la médiane instable. Scutum: les 13 + 13 *M* typiques longs et 1 + 1 *M* supplémentaires entre C_3 et le style; un *M* supplémentaire peut aussi s'observer entre les deux C_1: une trentaine de soies à embase circulaire caractéristique, longues, régulièrement espacées, forment une rangée bien nette en avant des organes subcoxaux latéraux et de l'organe glandulaire médian; quelques soies de ce type sont réparties sans ordre entre cette rangée et les *C*; environ 15 + 1-3 + 15 soies ordinaires courtes ou très courtes sur le reste de la surface du scutum.

Organes subcoxaux latéraux : ils occupent environ le quart de la largeur interstylaire; chez les st.IIIA 5-6 soies glandulaires subégales et le même nombre de soies sensorielles, SG/ st_1 = 1,14 (v.ex. = 1,13-1,19), SS/st_1= 0,42 (v.ex. = 0,41-0,44), SG/SS= 2,74 (v.ex. = 2,70-2,76); les sexués les plus "jeunes" (♂$_1$ et ♀$_1$) ont 5 à 9 soies glandulaires peu inégales et 5-7 soies sensorielles; ces nombres s'accroissent au cours du développement post-embryonnaire; les soies glandulaires restent à peu près égales chez les ♀ qui possèdent au maximum 17 soies glandulaires et un nombre égal de soies sensorielles par organe; par contre, chez les ♂ on observe jusqu'à 35 soies glandulaires chez le ♂ de 7,1mm de Sab-82/27, le nombre le plus courant chez nos exemplaires est compris entre 11 et 18 avec presque constamment autant de soies sensorielles, cependant le ♂ de 5,7mm de Sab-82/4 s'écarte de cette règle en ayant 16 soies glandulaires et 10 soies sensorielles ainsi que le ♂ de 7mm de Pal-83/41 avec 21SG et 15SS à l'organe gauche et 19SG et 14SS au droit; chez les sexués on constate que, suivant la règle, ce sont les ♂ qui, à taille égale, ont le plus de ces phanères; SG/st_1 = 0,46-1,00, SS/st_1 = 0,29-0,36, SG/SS = 1,29-2,85.



FIGS 3-6

Indjapyx yoshii n. sp. ♂ holotype. - 3. Tergites 7 à 10 et les cerques, e = 298 µm. - 4. -id.-, détail des marges prédentales, e = 126 µm. - 5. ♂ de 7,13 mm, détail des marges prédentales, e = 105 µm. - 6. ♂ de 7 mm, détail des marges prédentales, e = 194 µm.

Organe glandulaire médian: saillant avec typiquement 1 + 1 soies extrêmement courtes insérées sur la ligne d'articulation de l'opercule; il peut y en avoir une supplémentaire située plus près des soies à embase circulaire caractéristique, sans emplacement précis; de 3 (st.IIIA) à 9 minuscules "pseudopori" disposés plus ou moins nettement par paires le long du bord distal de l'organe.

Sternites 2 à 7: 16 + 16 *M*, A_6 assez longs, les autres longs, B_4 et *C* de rangs pairs indifférenciés, assez longs ou courts; au plus 20 + 3-4 + 20 soies courtes ou très courtes.

Sternite 8: avec 7 + 7 *M* longs disposés par demi-sternite en 3 rangées longitudinales de 2,2 et 3 *M* en partant de l'extérieur vers la ligne médiane.

Paratergites 8: avec sur leur tiers postérieur 1 *M* long, 1 *sm* assez long et 3-4 soies courtes.

Sternopleurites 9: ils se rejoignent sur la ligne médiane par une large courbe, avec 1 *M* long et 3 soies courtes dans chacun des angles postérieurs.

Vésicules exsertiles: typiques aux urites 1 à 7.

Styles: allongés aigus, à pore énigmatique et cône secondaire normalement bien nets; s_1/st_1= 0,17-0,26, st_1/st_7 = 0,76-1,00, s_1/s_7 = 0,57-0,92, s_1/st_7 = 0,13-0,24.

Papilles génitales: typiques du genre. Appendices génitaux des ♂ coniques, 3 fois aussi longs que larges à la base.

CERQUES

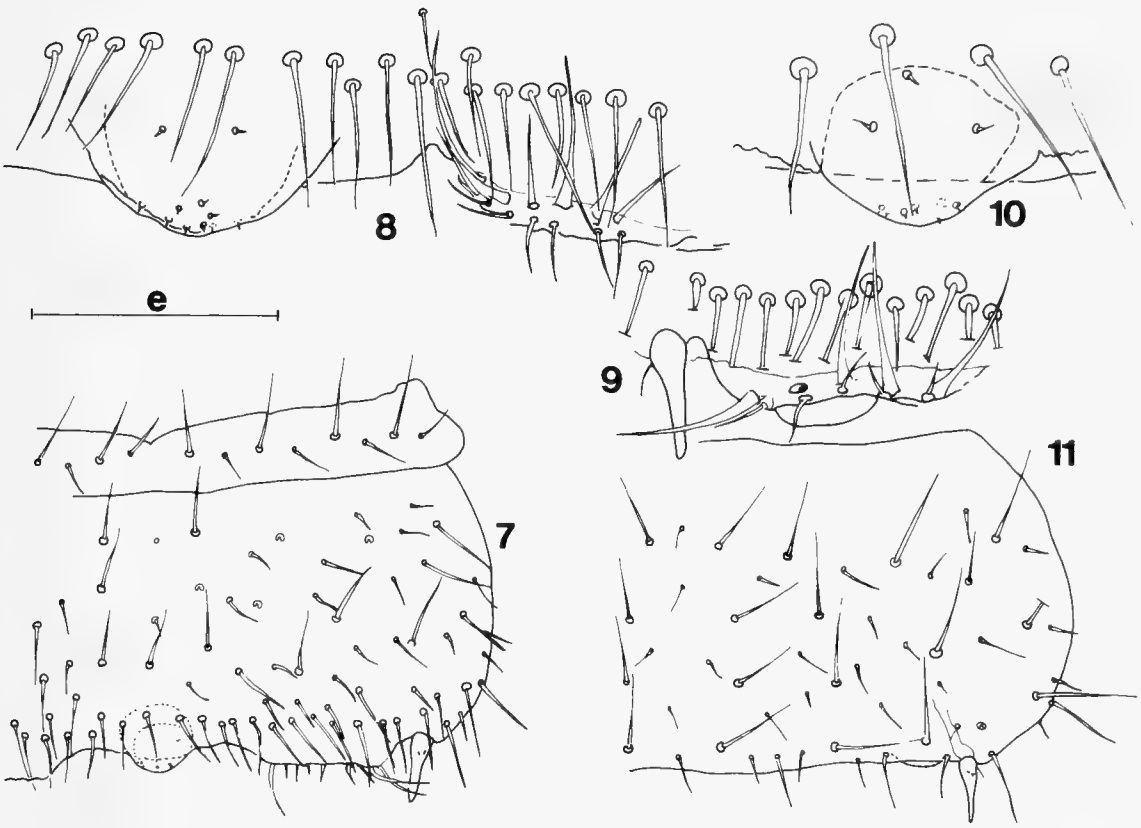
Aussi longs que la partie normalement découverte du tergite 10, peu élancés, L/1 = 2,2 (st.IIIA) - 2,1 (♀) - 2 (♂), recourbés, peu aigus; pour les 2 cerques et quel que soit le stade la largeur au niveau de la dent égale 0,8 fois celle à la base.

Cerque droit: à dent submédiane, r_d = 1,1, saillante, triangulaire à sommet peu aigu dirigé vers la base du cerque.

Cerque gauche: à dent submédiane, r_g = 1,1, très saillante, sa base plus petite que sa hauteur, son sommet aigu ou mousse dirigé vers la base du cerque.

Marges prédentales: elles sont d'abord rectilignes, puis s'incurvent graduellement vers la dent dans leur quart distal. L'armature en est très variable suivant le stade de développement, mais tous les tubercules et denticules sont arrondis. Chez les st.IIIA on observe aux 2 cerques 1/1 tubercules, l'inférieur pratiquement toujours plus développé que le supérieur. Dans les stades suivants on ne note pas de différence significative entre les 2 cerques.

Il y a presque toujours 2 tubercules supérieurs, dont le plus distal est plus développé que l'autre, mais on peut en observer jusqu'à 4 et dans ce cas c'est le troisième qui est le plus fort. Quant au nombre de tubercules inférieurs, il est en général de 4 dont 1, le second ou le troisième, nettement plus développé; le ♂ de 7,13 mm de Sab-82/27 montre l'armature prédentale la plus complexe observée chez mes spécimens: 4/6 tubercules à droite et 4/8 à gauche; c'est toujours le troisième supérieur qui est le plus important, mais dans la rangée inférieure c'est le quatrième à droite et le cinquième à



FIGS 7-11

Indjapyx yoshii n. sp. ♂ holotype. - 7. Urosternite 1, e = 207 µm. - 8. ♂ de 7 mm, détail de l'angle interne de l'organe subcoxal gauche et organe glandulaire médian, e = 105 µm. - 9. st. IIIA de 3,3 mm, organe subcoxal droit, e = 63 µm. - 10. ♂ holotype, organe glandulaire médian, e = 63 µm. - 11. -id.-, urosternite 3, e = 229 µm.

gauche qui prédominent; on note aussi que dans cette rangée les 2 ou 3 tubercules les plus distaux sont petits mais plus forts que les 3 ou 4 proximaux. Toutes les combinaisons paraissent possibles, mais toujours avec 1/1 forts tubercules à chaque cerque. Je n'avais encore jamais rencontré une telle variabilité chez les *Indjapyx* ou *Parindjapyx*.

Marges postdentales : régulièrement concaves avec un nombre restreint de denticules arrondis, en général 7-8; on notera qu'au cerque droit le troisième ou le quatrième denticule en partant de la dent est nettement plus développé que les autres alors que c'est presque toujours le second au cerque gauche.

Chétotaxie : typique, sans le *M* latéral antérieur et avec une dizaine de soies très courtes sur leur bord extérieur.

AFFINITÉS

Cette espèce est assez voisine de l'*Indjapyx indicus* var. *borneensis* Silv.; elle s'en distingue par sa chétotaxie tergale abdominale, son urosternite 1 et ses cerques nettement moins pileux; elle diffère de la var. *bidicola* Silv. surtout par ses cerques beaucoup moins élancés et aussi par la chétotaxie du tergite 10. Elle peut être rapprochée d'*Indj. loebli* Pgs. de Ceylan, mais s'en écarte par les mêmes caractères.

DERIVATIO NOMINIS

C'est avec grand plaisir que je dédie cette espèce au Prof. Ryozo Yoshii, spécialiste mondialement reconnu des Collemboles mais aussi un des pionniers de la biospéléologie au Japon. Sans son aide précieuse et sans sa grande connaissance de l'environnement dans lesquelles elles se sont déroulées, les missions dirigées par le Dr. B. Hauser dans le Sud-Est asiatique n'auraient pu se faire dans d'aussi bonnes conditions matérielles et humaines.

Indjapyx crockerianus n. sp. (Fig. 12-20)

Sabah: Sab-82/43 (1 ♂ de 8,8 mm).
Holotype: ce ♂.

TÊTE

Vertex: une aire pileuse de soies très courtes et fines occupe la surface délimitée par les branches antérieures de la suture en Y jusqu'à l'aplomb de V3, englobant M3, s'étendant entre M4 et M5 et dépassant en arrière l'apodème transversal postérieur.

Antennes: de 36 articles à chétotaxie typique du genre; aires pileuses du 16e au 23e article; les 13 trichobothries typiques, *a* proximale, *p* = 0,20; 6 sensilles placoïdes en position typique sur l'article apical.

Pièces buccales: typiques de la famille; les 5 lames du lobe interne des maxilles pectinées; palpes labiaux 2,8 fois aussi longs que larges à la base, les soies subapicales sont près de 1,5 fois aussi longues que le palpe qui les porte.

THORAX

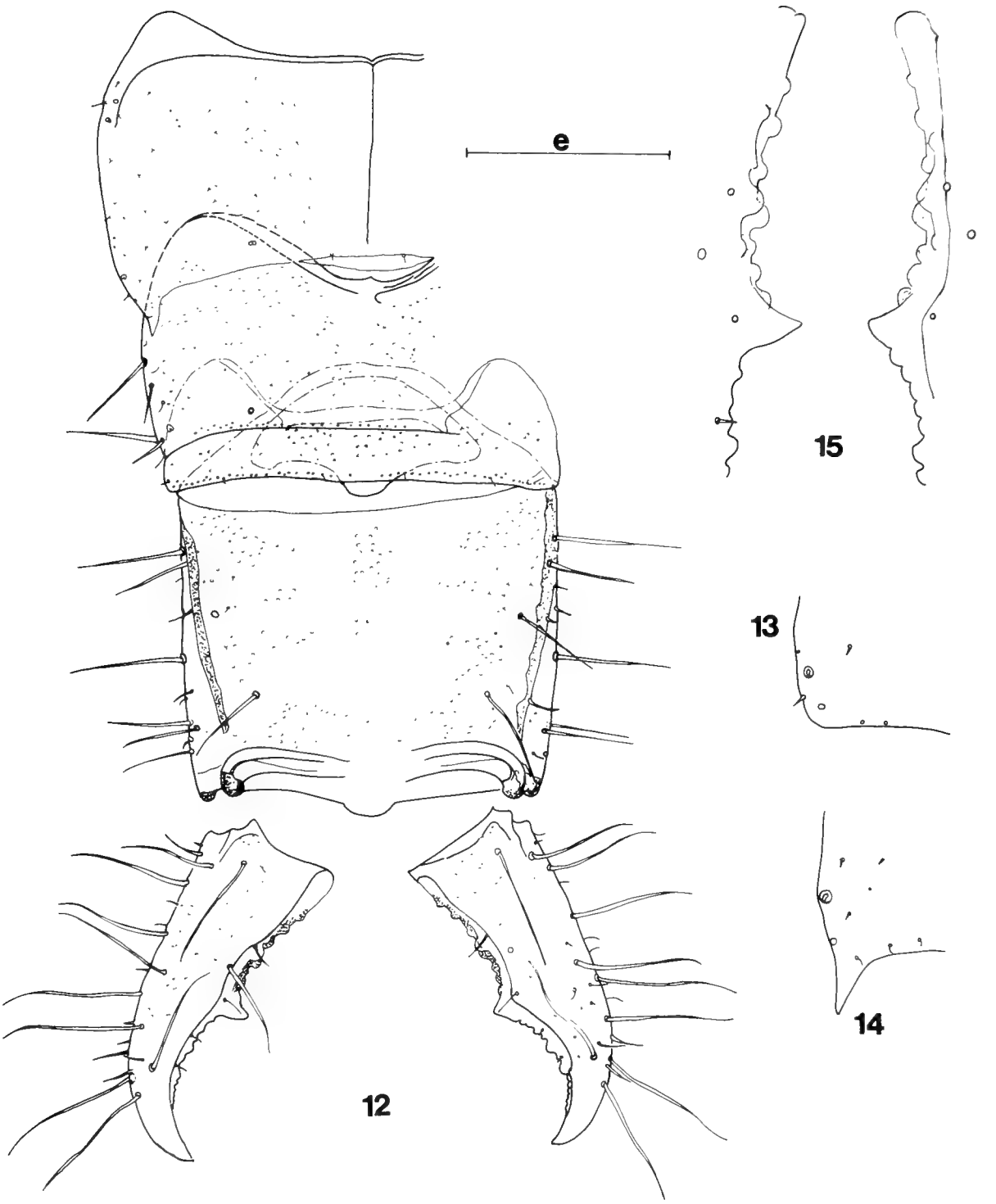
Pronotum: les 5 + 5 *M* typiques, les M_3 longs, les 4 + 4 autres très longs; la longueur des M_1 égale environ 1 fois un tiers l'écartement de leurs embases; 4 + 4 soies longues, 1 + 1 autres submédianes subpostérieures assez courtes et environ une demi-douzaine de soies très courtes disposées plus ou moins régulièrement par paires.

Méso- et métanotum. Préscutum: 1 + 1 *M* assez courts, celui de gauche du mésonotum fourchu. Scutum: les 5 + 5 *M* typiques, M_3 très longs, M_1 et M_5 assez longs; 6 + 6 soies assez longues ou assez courtes et environ une quarantaine de soies courtes ou très courtes réparties sans ordre apparent.

Pattes: longues, les PIII atteignant le milieu de l'urite 3; 8-9 soies spiniformes aux PI, 10 aux PII et 12 aux PIII; le tarse de cette dernière paire de pattes égale les 6/10 de la longueur du tibia correspondant; la griffe postérieure mesure entre la moitié et les 2/3 de la longueur du tarse, 1,8 fois celle de la griffe antérieure et 3,5 fois celle de l'unguiculus qui est bien différencié.

ABDOMEN

Tergite 1. Préscutum: 1 + 1 *M* assez longs. Scutum: 2 + 2 *M* (*ma* = *M*, M_5) longs, M_1 = *sm* courts comme 3-4 + 3-4 autres soies, *mp* seuls *sm* typiques reconnaissables assez longs.



FIGS 12-15

Indjapyx crockerianus n. sp. ♂ holotype de 8,8 mm. - 12. Tergites 7 à 10 et les cerques, e = 464 µm. -13. -id.-, angle latéral postérieur gauche du tergite 6, e = 253 µm. - 14. -id.-, celui du tergite 7, e = 253 µm. - 15. -id.-, détail des marges prédentales, e = 223 µm.

Tergite 2 : 4 + 4 *M* (*ma* = *M*, M_1, $M_{4\text{-}5}$) longs, *msa*, m_3 et *mp* assez courts, les autres *sm* et quelques soies plus ou moins régulièrement disposées par paires, très courtes.

Tergite 3 : 6 + 6 *M* (*ma* = *M*, $M_{1\text{-}5}$) longs; m_2, m_3 et *mp* assez courts, le reste des phanères courts ou très courts.

Tergite 4 : 6 + 5 *M*, le *ma* = *M* droit nul, le gauche assez long; les autres phanères comparables à ceux des tergites suivants.

Tergites 5 à 7 : 4 + 4 *M* longs (*ma* = *M* indifférenciés ou nuls, ainsi que les M_1); m_2 et m_3 assez courts, m_2 nuls au tergite 7; les autres *sm* très courts; un grand nombre de minuscules soies réparties sur tous les tergites.

Tergite 8 : un peu plus de 2 fois aussi large que long (1/L= 2,06); 4 + 4 *M* longs dont 3 + 3 homologables aux M_3, M_4 et M_5 et 1 + 1 *M* latéraux substernaux postérieurs; 1 + 1 *sm* homologables aux m_2, assez longs; 1 + 1 soies latérales postérieures courtes et une multitude de minuscules phanères répartis sans ordre apparent.

Tergite 9 : plus de 3 fois 1/3 aussi large que long (1/L = 3,37); pas de *M*, mais une rangée tout à fait postérieure de minuscules phanères dont 3 + 3 sont un peu plus développés.

Tergite 10 : à bords parallèles, 1,21 fois aussi long que large; carènes bien développées, occupant presque les 5/6 de la longueur de la partie normalement découverte du tergite; 3 + 3 *M* longs dont 1 + 1 discaux antérieurs, 2 + 2 latéraux antérieurs et intermédiaires; 4 + 4 soies presque aussi longues que les *M* dont 1 + 1 carénales antérieures, 1 + 1 discales subpostérieures, 2 + 2 latérales postérieures et subpostérieures; 5-6 + 5-6 soies courtes ou très courtes, dont 2 sur chacune des carènes; une multitude de minuscules phanères localisés entre les carènes.

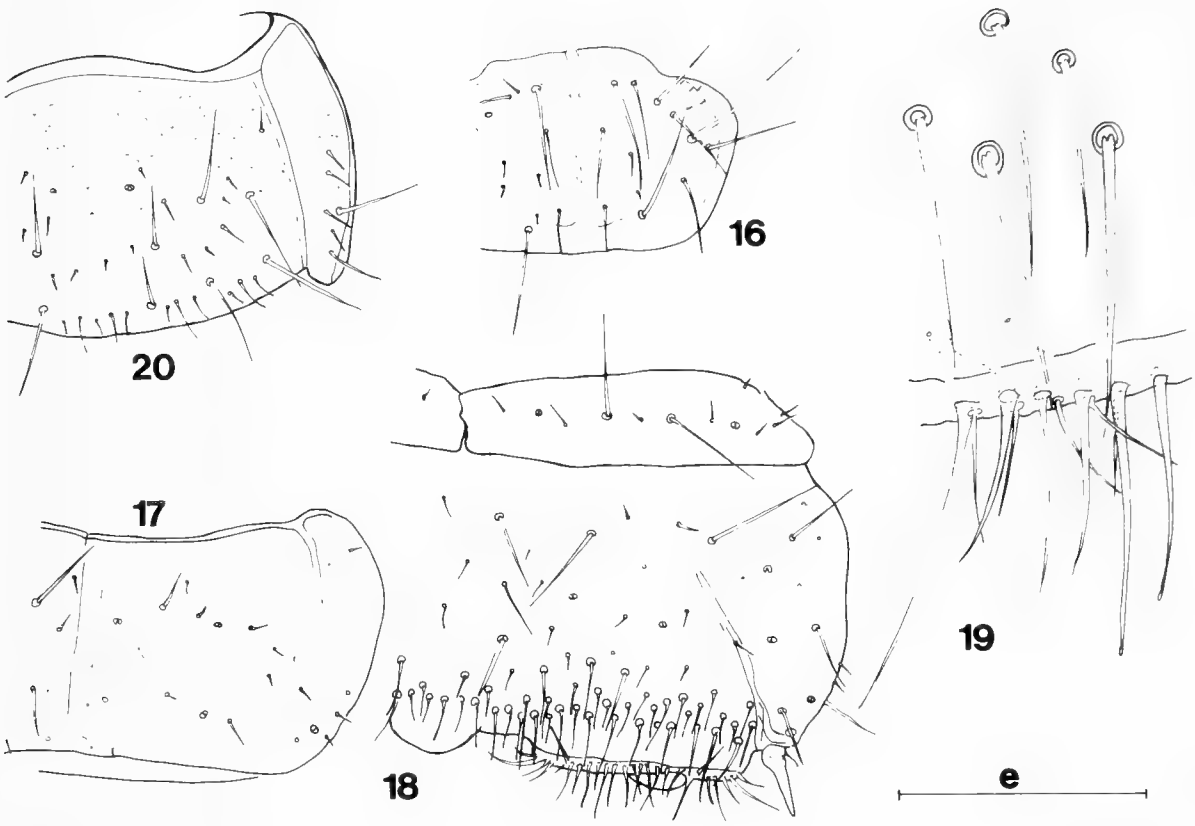
Angles latéraux postérieurs des tergites : nuls du tergite 1 au 5ème; en lobe obtus au 6ème; en pointe aiguë, longue et étroite, triangulaire, dirigée vers l'arrière au 7ème; en angles aigus peu saillants au 8ème; mousses au 9ème.

Longueurs relatives des segments 7 à 10 : 44-48-26-100.

Sternite 1. Préscutum: 4 + 4 *M* longs et 6 + 6 soies courtes. Scutum: 15 + 15 *M* longs ou assez longs dont les 13 + 13 typiques et 2 + 2 supplémentaires au-dessus des C_3; environ 20 + 20 soies courtes; les soies à embase circulaire caractéristique dessinent une rangée régulière en avant des organes glandulaires, d'autres, forment en arrière des *C* et au niveau de chacun des organes suboxaux latéraux, une plage d'une trentaine de soies bi- ou trisériées.

Organes subcoxaux latéraux : saillants, occupant un peu plus du quart de la largeur interstylaire; 30 soies glandulaires dont 6 plus longues que les autres qui se répartissent en 2 tailles assez régulièrement alternées, SG/st_1 = 0,9, 0,66 et 0,51; canal glandulaire égal à la moitié de la soie correspondante, terminé par un réservoir subsphérique à goulot net; 26-28 soies sensorielles; SS/st_1 = 0,33; SG/SS = 3, 2,13 et 1,42.

Organe glandulaire médian : saillant, l'opercule montre les 1 + 1 soies extrêmement courtes classiques insérées sur la ligne d'articulation; son bord libre



FIGS 16-20

Indjapyx crockerianus n. sp. ♂ holotype de 8,8 mm. - 16. Pronotum, e = 506 µm. - 17. -id.-, tergite 2, e = 464 µm. - 18. -id.-, moitié gauche de l'urosternite 1, e = 316 µm. - 19. -id.-, détail de l'organe subcoxal latéral droit, e = 63 µm. - 20. -id.-, moitié gauche de l'urosternite 8, e = 482 µm.

paraît très épais et strié, ce qui gêne beaucoup l'observation des "pseudopori" qui sont au moins au nombre de 6.

Sternites 2 à 7 : 16 + 16 *M* longs, B_4 et les *C* de rang pair indifférenciés; quelques soies courtes ou très courtes réparties en paires plus ou moins régulières.

Sternite 8 : 7 + 7 *M*, longs ou assez longs, répartis en 3 rangées longitudinales de 2,2 et 3 *M* en partant de l'extérieur vers la ligne médiane.

Paratergites 8 : avec sur leur tiers postérieur, 1 *M* assez long, suivi d'une soie (*sm*?) assez courte et 4-5 soies très courtes.

Sternopleurites 9 : se raccordant sur la ligne médiane, chacun avec 1 *M* latéral postérieur.

Vésicules exsertiles : typiques aux urites 1 à 7.

Styles : typiques avec pore énigmatique et cône secondaire bien différenciés; $s_1/st_1 = 0{,}22$, $s_1/s_7 = 0{,}77$, $st_1/st_7 = 0{,}70$, $s_1/st_7 = 0{,}16$.

Papille génitale ♂ : typique, pileuse; restée invaginée sous le sternite 8, je n'ai pu observer les lèvres de l'orifice génital; les appendices génitaux sont très grands, coniques, 2,5 fois aussi longs que larges à la base, très pileux.

CERQUES

Aussi longs que la partie normalement découverte du tergite 10, L_{cq}/L_{10d} = 1,04, assez élancés, L/1 = 2,4, peu recourbés à leur extrémité qui est aiguë; pour les deux cerques la largeur au niveau de la dent est égale à 0,3 fois celle à la base.

Cerque droit: à dent nettement postmédiane, r_d = 1,16, peu saillante, en triangle équilatéral, peu aiguë. Marge prédentale avec des tubercules bisériés arrondis; 3 supérieurs dont 1 très saillant entre 2 autres à peine marqués, 7 inférieurs dont un nettement plus développé, précédé de 3 tubercules plus petits, espacés, et suivis de 3 autres de même taille, subcontigus. Marge postdentale régulièrement concave, avec des denticules contigus arrondis, le 6ème en partant de la dent nettement plus saillant que les autres.

Cerque gauche: à dent de peu postmédiane, r_g = 1,09 très saillante, aiguë, à sommet dirigé vers la base du cerque. Marge prédentale avec des tubercules arrondis bisériés, les supérieurs au nombre de 4, dont un fort précédé de 2 plus petits et suivi de 1 tubercule minuscule, les inférieurs plus nombreux, 7, dont un très développé précédé de 3 tubercules nettement plus petits, espacés, et suivi de 3 autres de même taille, subcontigus. Marge postdentale peu concave armée de denticules arrondis, évanescents vers l'apex du cerque, le 4ème nettement plus saillant que les autres.

Chétotaxie: typique; pas de *M* latéral antérieur.

AFFINITÉS

Cette espèce qui se rapproche par ses cerques, surtout d'*Indj. indicus* var. *bidicola*, s'en écarte par sa chétotaxie abdominale tergale et son premier urosternite.

DERIVATIO NOMINIS

Le "Baniaran Crocker" est la chaîne de montagnes la plus importante du Sabah; elle s'étend à peu près du Mt. Kinabalu au N, à la frontière du Brunei au S. C'est sur ses pentes qu'ont été récoltés cette nouvelle espèce d'*Indjapyx* et des exemplaires du *Kinabalujapyx disturbator* n. gen., n. sp.

Kinabalujapyx n. gen.

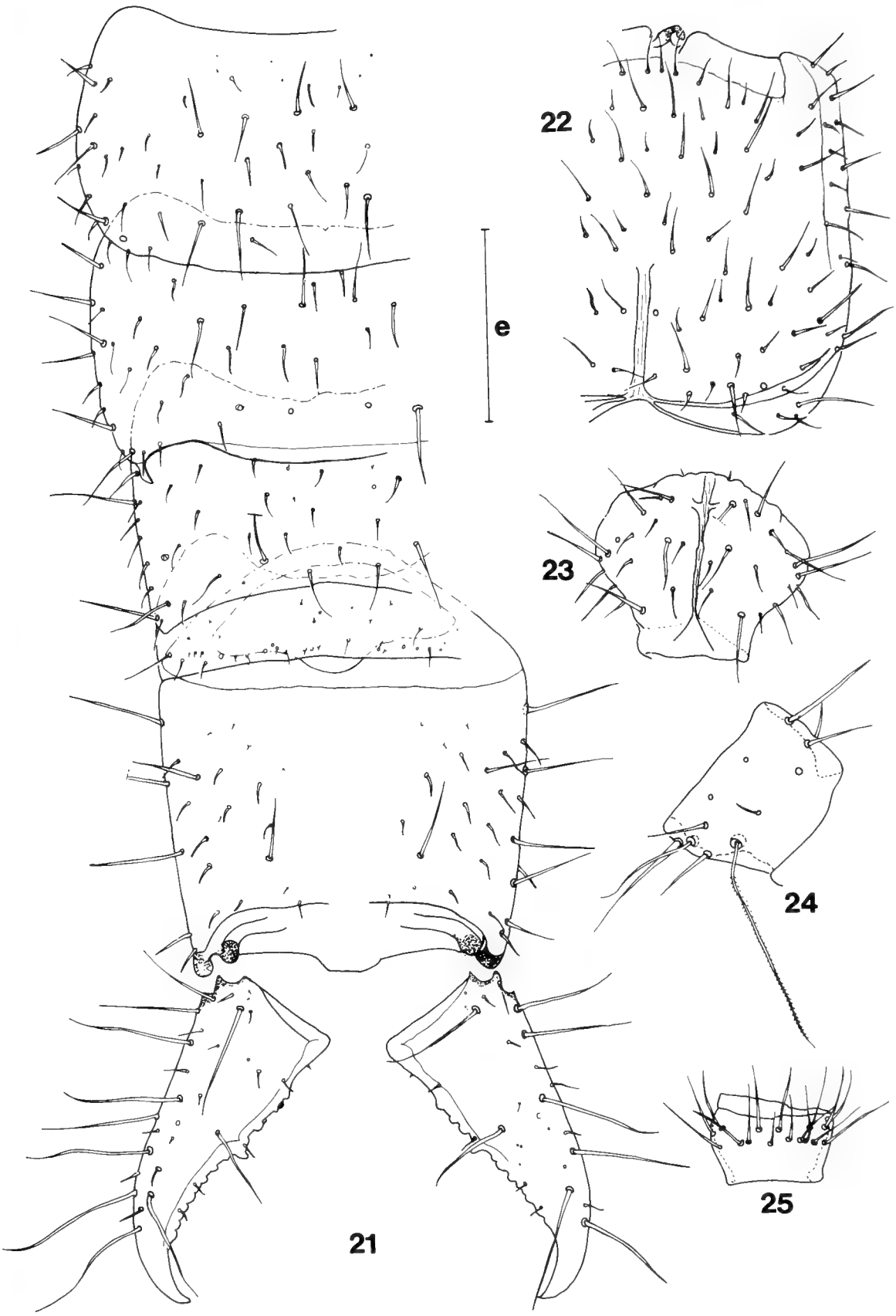
Appartient à la famille des Japygidae.

Habitus: normal; coloration du type habituel, mais plus claire.

TÊTE

Antennes: de 32 articles chez l'espèce type; les 13 trichobothries typiques, *a* proximale, *p* = 0,60-0,71; 6 sensilles placoïdes sur l'article apical.

Pièces buccales: typiques de la famille; les 5 lames des lobes internes des maxilles sont pectinées. Le stade III est du type B (à trichobothries très courtes et non plumeuses).



FIGS 21-25

Kinabalujapyx disturbator, n. gen., n. sp. ♂ holotype de 4,4 mm. - 21. Tergites 6 à 10 et les cerques, e = 253 µm. - 22. -id.-, vertex, e = 220 µm. - 23. -id.-, pronotum, e = 220 µm. - 24. -id.-, 4e article antennaire gauche, face tergale, e = 110 µm. - 25. -id.-, 15e article antennaire droit, face tergale, e = 110 µm.

THORAX

Chétotaxie: tergale typique.

ABDOMEN

Tergites 3 à 7: 7 + 7 *M* dont 4 + 4 correspondant sans aucun doute aux $ma = M$, M_1, M_4 et M_5; les 3 + 3 autres peuvent s'assimiler aux $m_1 = M$, M_2 et M_3 si l'on admet que les M_2 se déplacent vers m_2.

Tergite 10: sans carènes chez l'espèce type.

Angles latéraux postérieurs du tergite 7: en pointe étroite, longue, bien séparée du reste du tergite.

Acropyge: normal.

Sternites: à chétotaxie typique.

Organes subcoxaux latéraux: précédés d'une rangée assez régulière de soies à embase circulaire caractéristique dont 1 à 3 sont nettement plus longues que les autres; peu saillants, petits, à soies glandulaires courtes, larges à la base, rapidement acuminées, peu nombreuses; soies sensorielles au nombre de 2 ou 3, aussi longues que les soies glandulaires.

Organe glandulaire médian: très développé pourvu d'un opercule portant une dizaine de minuscules sensilles sétiformes ("pseudopori"?) réparties sans ordre apparent.

Papille génitale ♂: la moitié postérieure de sa base est triangulaire, recouverte de soies courtes; appendices génitaux peu allongés à sommet arrondis; en partie restée invaginée sous le sternite 8, il n'a pas été possible d'observer la chétotaxie de l'orifice génital.

Fossettes glandulaires sternales: absentes chez les ♂ connus.

Papille génitale ♀: typique.

Styles et vésicules exsertiles: typiques; les st_1 sans soie.

CERQUES

Chez les sexués, ils sont subsymétriques, à dent triangulaire peu saillante; les marges pré- et postdentales rectilignes, dans le prolongement l'une de l'autre; une seule rangée de tubercules arrondis à droite et 2 à gauche chez les adultes. Chez le st.IIIB, les 2 cerques sont symétriques avec 1 unique tubercule bien développé à chaque cerque, inséré à égale distance de la base du cerque et de la dent.

AFFINITÉS

Ce genre est bien caractérisé par la chétotaxie des tergites, les organes glandulaires du premier urosternite et ses cerques. Il me paraît très isolé parmi les formes connues. Ses organes suboxaux latéraux pourraient faire penser à ceux de *Japyx toccii* Silv. d'Indochine, mais tous les autres caractères l'en écartent. Il en est de même pour *Deutojapyx greeni* (Silv.).

DERIVATIO NOMINIS

Ce genre est dénommé d'après le Mt. Kinabalu, le plus haut sommet de Bornéo (4.101 m).

Kinabalujapyx disturbator n. gen., n. sp. (Figs 21-38)

S a b a h : Pal- 83/13 (1 sexe ? de 2,42 mm; 1 st.IIIB de 2,8 mm, 2 ♀$_1$ de 2,73 et 2,77 mm, 1 ♀ ad. contractée de 3,23 mm, 1 ♂$_1$ de 2,83 mm, 1 ♂ juv. de 3 mm, 1 ♂ ad. de 4,4 mm); Pal-83/43 (1 ♀ ad. de 3,4 mm, avec *Indj. yoshii* n.sp.). Soit au total 9 exemplaires.

H o l o t y p e : le ♂ ad. de 4,4 mm de Pal-83/13.

TÊTE

V e r t e x : à chétotaxie faite de nombreuses soies assez longues, disposées sur 5-6 rangées longitudinales, certains phanères peuvent être homologués à ceux des *Indjapyx*, comme par exemple ceux bordant la base des antennes (A1, A3, A4, s1 et s2) ou les S4, S5, V3 et V4 de part et d'autre des branches antérieures de la suture en Y, ou encore les M5 et la série des P1, P2, s6, s8 et s9.

A n t e n n e s : de 32 articles pileux; on notera que le 4ème article est plus large que long, contrairement à ce que l'on observe chez les *Indjapyx*; *a* proximale; 6 sensilles placoïdes en position typique; aires pileuses indistinctes.

P i è c e s b u c c a l e s : typiques du genre; les palpes labiaux ont un rapport L/1 très variable, de 1,6 chez les ♂ à 2,3 chez les ♀, les soies subapicales sont entre 1,5 et 2 fois aussi longues que le palpe qui les porte.

THORAX

P r o n o t u m : les 5 + 5 *M* typiques longs, M_3 les plus longs, M_1 et M_5 les plus courts; la longueur des M_1 est sensiblement égale à l'écartement de leurs embases; 4 + 4 soies presque aussi longues que les M_1 et 8-10 + 8-10 soies courtes ou très courtes.

M é s o - e t m é t a n o t u m . Préscutum: 1 + 1 *M* ou 2 + 2 *M* assez longs et un grand nombre de soies extrêmement courtes. Scutum: les 5 + 5 *M* typiques, les M_3 très longs, à peu près 2 fois plus développés que les autres *M*; environ 8 + 8 soies assez longues et environ le même nombre de soies courtes.

P a t t e s : assez longues, les PIII atteignant le milieu du troisième urite; 6 soies spiniformes aux PI et PII, 8 aux PIII; le tarse des PIII égale les 3/4 de la longueur du tibia correspondant; griffes bien développées aiguës, la griffe postérieure mesure entre la moitié et les 3/5 du tarse correspondant et égale 1,5 fois la longueur de la griffe antérieure; unguiculus très petit ne dépassant pas le 1/10 de la longueur de la griffe postérieure aux PIII, indistinct aux PI.

ABDOMEN

Tous les tergites portent de 12 + 12 à 20 + 20 soies de forme caractéristique assez courtes ou courtes, formant des paires plus ou moins nettes.

T e r g i t e 1 : la limite entre précutum et scutum est le plus souvent indistincte. Préscutum: 1 + 1 *M* longs et 1 + 1 + 1 soies de même taille. Scutum: 2 + 2 *M* (*ma* = *M*, M_5) longs; 1 + 1 soies (*sm* ?) longues entre les M_5, les autres *sm* et quelques soies courts ou très courts.

T e r g i t e 2 : 4 + 4 *M* (*ma* = *M*, M_1, $M_{4\text{-}5}$,) longs ainsi que les *msa*, 2 + 2 autres *sm* postérieurs; les autres submacrochètes courts ou très courts.

T e r g i t e s 3 à 7 : 7 + 7 *M* longs ou assez longs (*ma* et m_1 = *M*, $M_{1\text{-}5}$): *msa*, m_2, m_3 et *mp* de même taille que les *M*.

T e r g i t e 8 : 1,8 à 2,3 fois aussi large que long, avec 4 + 4 *M*, 1 + 1 latéraux subantérieurs, 1 + 1 sublatéraux intermédiaires, 2 + 2 postérieurs sublatéraux et submédians; des phanères homologables aux m_1, m_3, *mp* et 1 + 1 autres entre M_4 et M_5 longs ou assez longs.

T e r g i t e 9 : près de 3 fois aussi large que long (1/L = 2,9 en moyenne), sans *M*, mais avec une rangée postérieure de peu de soies assez courtes ou courtes dont les plus latérales sont les plus développées.

T e r g i t e 1 0 : légèrement trapézoïdal, à petite base postérieure, 1,20 - 1.25 fois aussi long que large; carènes nulles quel que soit le stade de développement; 5 + 5 *M* longs dont 2 + 2 *M* discaux subantérieurs et subpostérieurs et 3 + 3 latéraux antérieurs, subantérieurs et subpostérieurs, ces derniers presque sternaux; 2 + 2 soies latérales intermédiaires et postérieures longues.

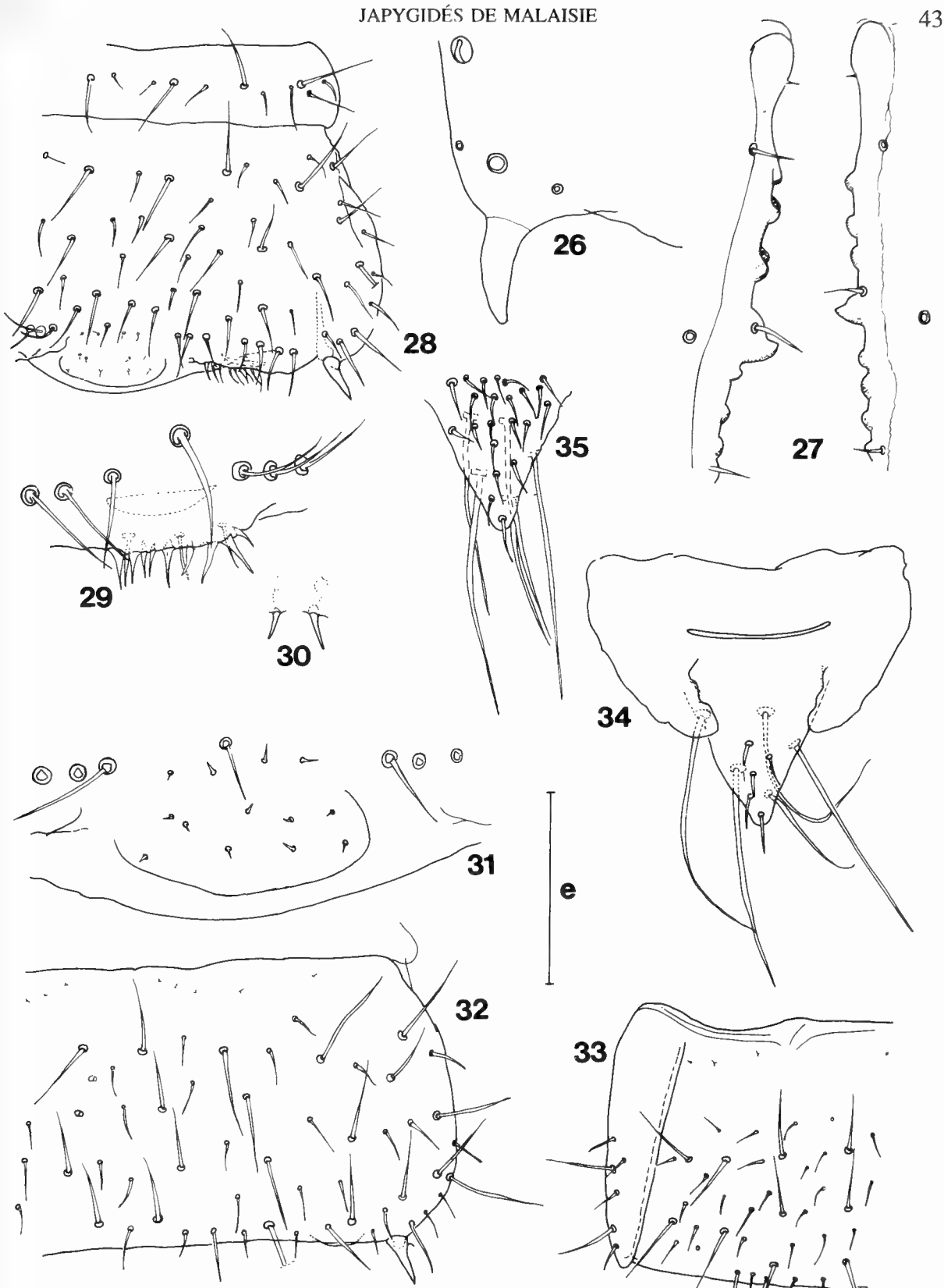
A n g l e s l a t é r a u x p o s t é r i e u r s d e s t e r g i t e s : nuls ou obtus aux tergites 1 à 6 et 9. Au tergite 7 ils forment une pointe étroite, nettement séparée du reste du tergite, de structure homogène, arquée vers le plan sagittal, à extrémité distale peu aiguë. En pointe large, aiguë, peu saillante au tergite 8.

A c r o p y g e : peu saillant, trapèzoïdal, celui du st.IIIB plus arrondi.

L o n g u e u r s r e l a t i v e s d e s s e g m e n t s 7 à 1 0 : 60-43-29-100 en moyenne.

S t e r n i t e 1 . Préscutum: 3 + 3 *M* longs et 5-6 + 5-6 soies assez longues ou courtes. Scutum: les 13 + 13 *M* typiques, longs, environ 20+2-3+20 soies courtes et une rangée postérieure assez régulière d'une vingtaine de soies à embase circulaire caractéristique dont 1 à 3 situées immédiatement en avant des organes subcoxaux latéraux sont nettement plus longues que les autres.

O r g a n e s s u b c o x a u x l a t é r a u x : petits, occupant au plus le huitième de la largeur interstylaire. Soies glandulaires courtes, de tailles peu inégales, larges à la base, peu aiguës en général, à canal glandulaire au plus aussi long que la soie correspondante, terminé par un réservoir sphérique à large goulot; le nombre de ces soies est très variable et apparemment sans rapport avec le stade ou le sexe; il varie de 2 pour la ♀ de Pal-83/43, à 10 pour le "sexe ?" de Pal-83/13. Soies sensorielles au nombre de 2 ou 3. SG / st_1 = 0,54 pour les plus longues, 0,33 en moyenne pour les plus courtes; SS/st_1 = 0,50 en moyenne (v. ex. = 0,38-0,65); SG/SS = 1,08 et 0,7.



FIGS 26-35

Kinabalujapyx disturbator n. gen., n. sp. ♂ holotype de 4,4 mm. - 26. Angle latéral postérieur gauche du tergite 7, e = 53 µm. - 27. -id.-, détail des marges prédentales, e = 88 µm. - 28. -id.-, urosternite 1, e = 156 µm. - 29. Sexe ? de 2,42 mm, organe subcoxal latéral gauche, e = 63 µm. - 30. -id.-, 2 soies glandulaires, e = 63 µm. - 31. ♂ holotype, organe glandulaire médian du premier urosternite, e = 63 µm. - 32. -id.-, urosternite 3, e = 156 µm. - 33. -id.-, urosternite 8, e = 211 µm. - 34. -id.-, contours de la papille génitale restée invaginée sous l'urosternite 8, e = 105 µm. - 35. -id.-, partie postérieure de la base de la papille génitale, e = 105 µm.

Organe glandulaire médian: très large et saillant, à opercule bien délimité; les 1 + 1 soies extrêmement courtes insérées sur la ligne d'articulation sont absentes; de 10 à 12 sensilles sétiformes ("pseudopori") réparties sans ordre apparent sur l'opercule.

Sternites 2 à 7 : 16 + 16 *M* longs, B_4 indifférenciés, courts; les *C* de rangs pairs sont des *sm* longs, environ 15+3-4+15 soies assez courtes ou courtes.

Sternite 8 : 7 + 7 *M* longs disposés par demi-sternite en 3 rangées longitudinales, respectivement de 2, 2 et 3 *M* en partant de l'extérieur vers la ligne médiane; de nombreuses soies assez courtes ou courtes.

Paratergites 8 : avec 2 *M* longs, intermédiaires et postérieurs et 3-4 soies courtes.

Sternopleurites 9 : largement séparés, ne se rejoignant pas sur la ligne médiane, pourvus chacun d'un *M* long, d'une soie assez longue et de 3-4 soies courtes ou très courtes.

Vésicules exsertiles: typiques aux urites 1 à 7.

Styles : typiques, aigus, cône secondaire et pore énigmatique bien développés; aux styles 1 ce pore est peu net et la soie peut manquer. $s_1/st_1 = 0{,}3$, $s_1/s_7 = 1{,}6$, $st_1/st_7 = 0{,}65$, $s_1/st_7 = 0{,}2$.

Papille génitale ♂ : restée en partie invaginée sous le sternite 8 de tous les exemplaires, je n'ai pu observer convenablement la chétotaxie, en particulier celle bordant l'orifice génital. Cette papille occupe environ le 1/3 de la largeur du sternite 8; la partie en arrière de l'orifice génital est très développée, arrondie postérieurement chez les $♂_1$; elle forme une pointe triangulaire très allongée chez les ♂ plus âgés; elle porte dorsalement 4-5 très longues soies et ventralement des soies courtes en nombre variable. Les appendices génitaux sont coniques, relativement gros, aussi longs que larges à la base, pileux, à sommet arrondi.

Papille génitale ♀ : typique de la famille.

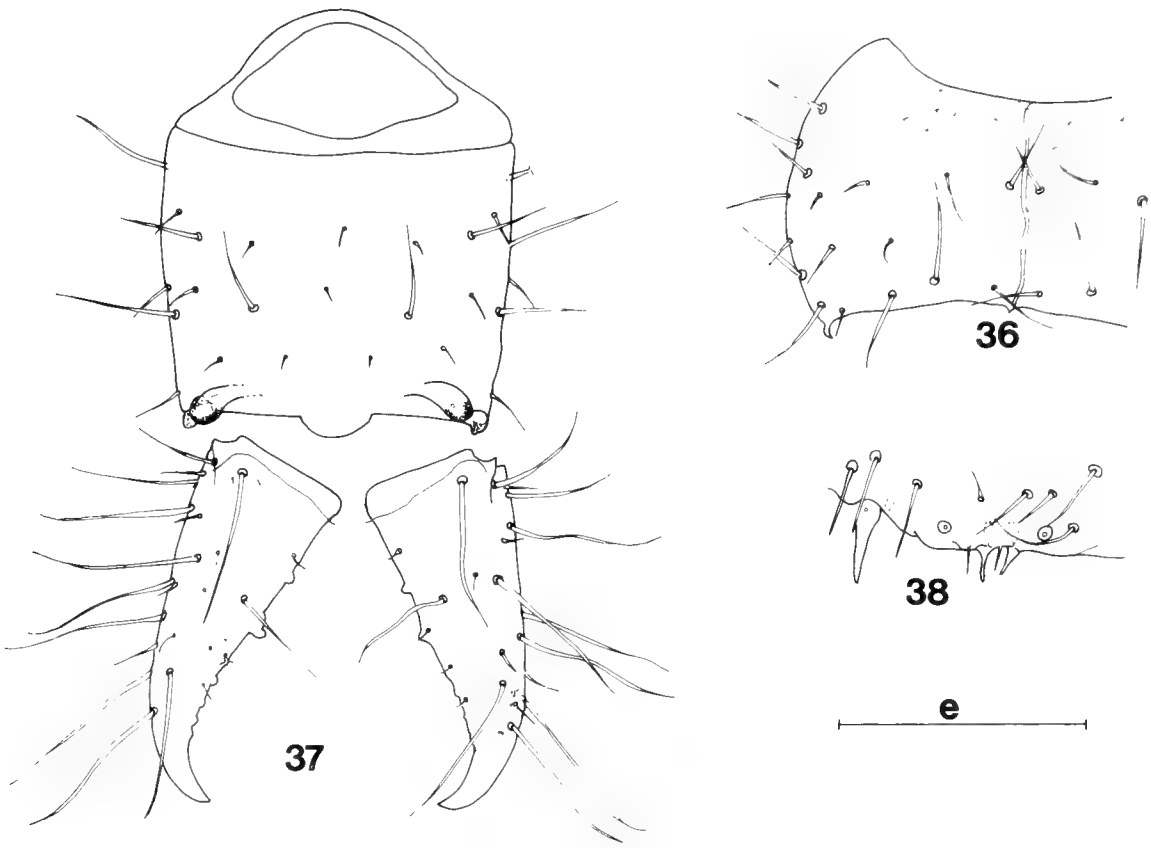
Fossettes glandulaires: absentes des sternites abdominaux des ♂.

CERQUES

Les 2 cerques sont subsymétriques, allongés, peu recourbés à l'apex qui est aigu, un peu plus longs que la partie normalement découverte du tergite 10, $L_{cq}/L_{10d} = 1{,}1$ en moyenne (v. ex. = 1,04 - 1,16); dents triangulaires, petites, mais bien nettes, prémédianes, $r_d = 0{,}88$ (v. ex. = 0,60 - 1,25), $r_g = 0{,}86$ (v. ex. = 0,77 - 1,0). Les marges pré- et postdentales sont rectilignes.

Cerque droit: marge prédentale avec 3-4 tubercules arrondis, espacés chez les stades les plus âgés. Marge postdentale avec 4-5 denticules chez les $♀_1$, $♂_1$ et ♂ juv., 8 à 11 chez les individus plus âgés; comme au cerque gauche, ces denticules sont souvent peu nets, simples ondulations de la marge.

Cerque gauche: marge prédentale semblable à celle du cerque droit pour les stades jeunes, avec 1-2/3 tubercules chez les adultes. Marge postdentale avec 3



FIGS 36-38

Kinabalujapyx disturbator n. gen., n. sp. ♀$_1$ de 2,77 mm. - 36. Tergite 7, e = 158 µm. - 37. -id., tergite 10 et les cerques, e = 158 µm. - 38. ♀ ad. de 3,4 mm, organe subcoxal latéral droit, e = 316 µm.

à 7 denticules plus ou moins nets. La ♀$_1$ de 2,77 mm de Pal-83/13 montre 1/5 petits denticules arrondis, le supérieur exactement au-dessus du premier inférieur.

C h é t o t a x i e : typique, mais sans le *M* latéral antérieur et seulement quelques soies courtes le long de la marge extérieure.

DERIVATIO NOMINIS

Le nom d'espèce *disturbator* est créé à partir du verbe "disturbare" qui signifie au sens figuré "bouleverser, détruire une loi, un jugement"; c'est ce que fait ce *Kinabalujapyx* par sa chétotaxie, ses organes glandulaires du premier sternite et l'évolution de l'armature de ses cerques.

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REVUE SUISSE DE ZOOLOGIE, 101 (2) : 435-440; juin 1994

Haroldius Boucomont nouveaux ou peu connus de la région Orientale (Coléoptères Scarabaeidae)

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New or little known Oriental species of *Haroldius* Boucomont (Coleoptera, Scarabaeidae).- Description of two new *Haroldius* species from Sumatra and Thailand, with notes on other species of the genus and records of *H. perroti* from Taiwan, and of *H. fleutiauxii* from Thailand.

Key-words: Coleoptera - Scarabaeidae - *Haroldius* - Taxonomy - Sumatra - Thailand.

Dans un article récent (PAULIAN 1993), l'auteur senior décrivait deux nouvelles espèces de *Haroldius* Boucomont, de Bornéo et donnait un tableau des quinze espèces de la région orientale connues à ce jour. A celles-ci doivent s'ajouter une espèce de Céram et une autre de Sulawezi, signalées, sans descriptions, par le Dr. J. Krikken.

Dans la région orientale, le genre *Haroldius* s'étend ainsi du Pakistan et du Sri-Lanka, jusqu'aux Philippines et à Céram. Il s'agit d'insectes rares dans les collections, généralement récoltés par tamisage des litières de forêts en exemplaires isolés. Dans certains cas il a été possible d'établir leurs relations avec des Fourmis des genres *Pheidole*, *Ponera* et *Diacamma*. Leur étude est rendue difficile par leur faible taille, leur rareté et par une variabilité intra-spécifique dont les limites sont encore très imprécises; cette variabilité porte sur la taille, mais également sur la striation et la chètotaxie des élytres.

C'est pourquoi la découverte de deux autres nouvelles espèces du genre dans les collections du Muséum de Genève nous a paru justifier une étude plus poussée des genitalia mâles, des pièces copulatrices et de la forme des pattes. Cette étude a confirmé que le genre, tel qu'il est actuellement défini et sans tenir compte ici des espèces africaines, comportait plusieurs groupes d'espèces bien caractérisés.

Le premier de ces groupes est défini par la forme du clypéus dont les côtés ne sont pas sinués en dehors des dents clypéales médianes et pas fortement élargis en dehors. Ce groupe réunit *Haroldius perroti* R. Paul. et *H. loebli* R. Paul., auxquels il faut ajouter *H. thailandensis* nov. sp., décrite ci-dessous et qui se distingue des deux autres espèces par la forme des côtés du pronotum, fortement dilatés en dehors en

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angle très marqué. Chez ces trois espèces les tibias antérieurs portent, à l'angle apico-externe, une très forte dent dirigée en dehors, suivie, parfois, vers la base, d'une plus petite. La face sternale de ces tibias présente une carène transverse subapicale.

L'ensemble des autres espèces orientales du genre ont le clypéus sinué en dehors des dents clypéales médianes et fortement élargi vers l'extérieur. Les tibias antérieurs portent une forte dent marginale externe qui est nettement subapicale et non apicale et que précède vers l'apex un lobe ou une très petite dent; cette forte dent est toujours suivie vers la base par une forte dent marginale; la face sternale des tibias ne porte pas de carène subapicale.

Parmi les espèces du second groupe, deux se détachent par la profonde ensellure de la base des élytres, accompagnée d'un très sensible approfondissement des stries élytrales dans la région basilaire. Il s'agit de *H. fleutiauxii* R. Paul. et de *H. sumatranus* nov. sp. décrite ci-dessous.

Les autres espèces se distinguent essentiellement les unes des autres par la forme des pattes postérieures, par la chagrination de la face dorsale et par la sculpture du pronotum et des élytres, en particulier par la disposition des points ou des lignes obliques qui marquent la base du pronotum.

Haroldius sumatranus nov. sp.

Holotype mâle: Sumatra Ouest, Anai Valley Nat. Res., 10 km ouest Pandangpanjan, 200 m, 17.XI.1989 (*Löbl*, *Agosti* et *Burckhardt*), Muséum d'Histoire Naturelle de Genève.

Deux paratypes femelles de même provenance et date, coll. Muséum National d'Histoire Naturelle de Paris et coll. Scheuern.

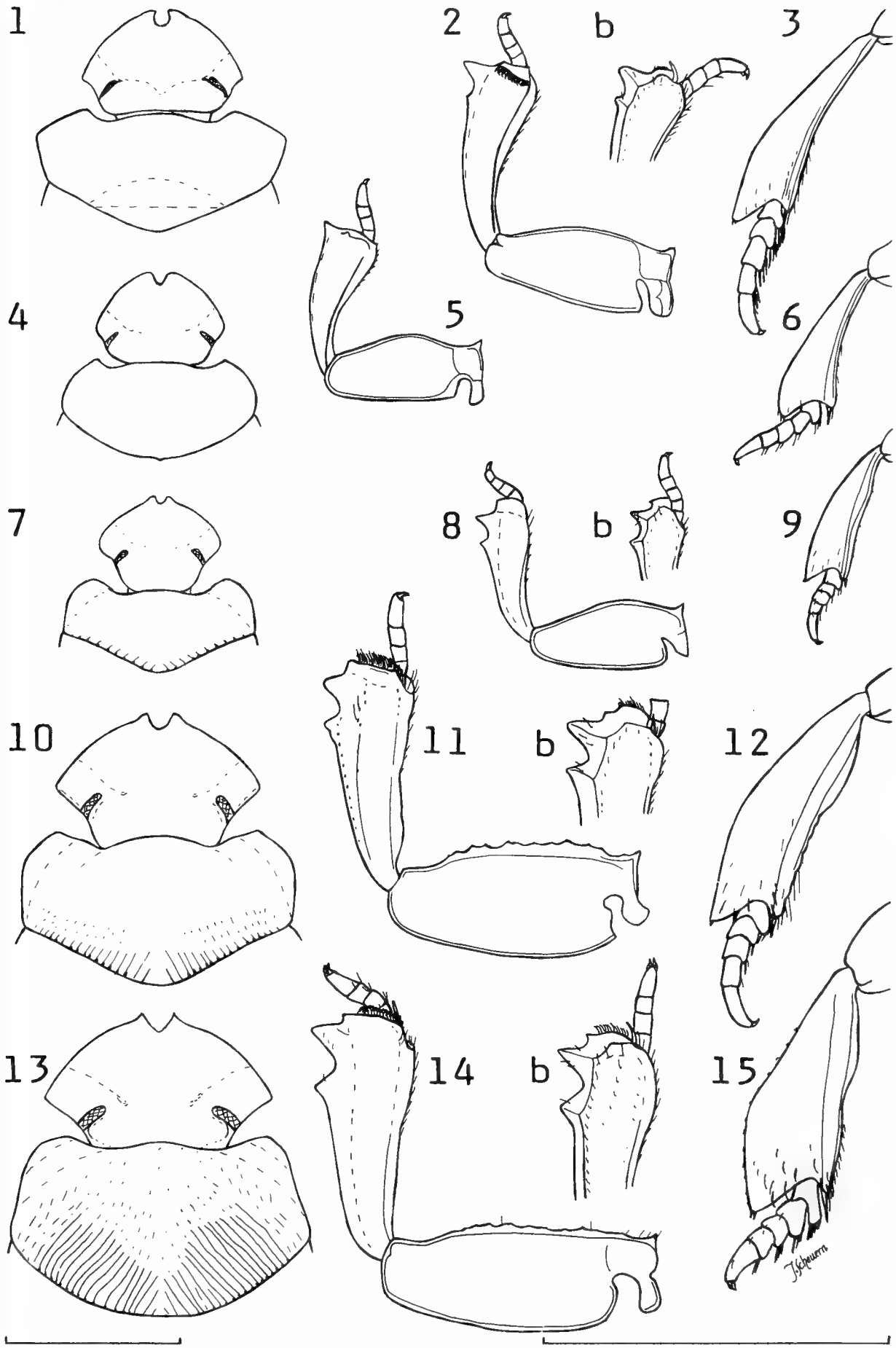
Description: Long. holotype: 1,7 mm - Corps brun-rouge, orbiculaire, convexe; appendices et bord antérieur du clypéus plus clairs. Surface à fine chagrination iso-diamétrale. Elytres à assez fortes soies dressées, pâles, éparses.

Clypéus transverse, bidenté en avant, à côtés fortement élargis vers l'arrière et joues bien marquées. Ponctuation fine et éparse.

Pronotum très transverse; base fortement étirée vers l'arrière, au milieu, en lobe largement tronqué; angles antérieurs très obtus; côtés en courbe régulière et peu marquée. Disque imponctué. Base marquée, de chaque côté, par six ou sept courtes stries obliques, fortes et très écartées.

FIGS 1-15

Tête, pronotum, tibia antérieur en vues ventrale et dorsale (*b*) de *Haroldius* mâles. - 1 à 3. *H. thailandensis* nov. sp., holotype Thaïland: Chieng Mai. - 4 à 6. *H. perroti* R. Paul., exemplaire de Taïwan. - 7 à 9. *H. sumatranus* nov. sp., holotype. - 10 à 12. *H. fleutiauxii* R. Paul., exemplaire de Thaïlande. - 13 à 15. *H. rugatulus* Boucomont, holotype de Singapour. - Echelle 1 mm.


1
2
b
3
4
5
6
7
8
b
9
10
11
b
12
13
14
b
15

Elytres fortement ensellés à la base, à stries simples, nettes, bien plus profondes à la base. Interstries un peu convexes, à points fins et épars.

Tibias antérieurs faiblement élargis vers l'avant; une forte dent marginale externe sub-apicale, suivie, vers la base, d'une seconde dent plus faible et aiguë; arête externe lisse ensuite.

Tibias postérieurs en triangle pas très large; angle apical externe aigu, saillant vers l'arrière.

Comme nous venons de l'indiquer, *H. sumatranus* nov. sp. appartient au groupe de *H. fleutiauxii* R. Paul., caractérisé par la profonde ensellure de la base des élytres et par la saillie postérieure de la base du pronotum. *H. sumatranus* diffère de cette espèce par sa taille bien plus faible, par l'absence de ponctuation sur le disque du pronotum et par les stries de la base du pronotum plus courtes et plus écartées.

Haroldius thailandensis nov. sp.

Holotype mâle : Thaïlande, Chiang Maï, Doi Suthep, 1180 m Barber F., VIII. 1986 (*P. Schwendinger*), Muséum d'Histoire Naturelle de Genève.

Description : Long. holotype: 2,3 mm - Corps orbiculaire, convexe, noir à appendices et bord du clypéus rougeâtres; de rares et assez courtes soies pâles dressées sur les élytres.

Clypéus profondément échancré et bidenté au milieu; les côtés faiblement élargis en dehors en arrière en courbe continue; joues effacées. Surface plane, à fins points épars. Front et vertex à fins points épars.

Pronotum très transverse; base en courbe marquée, vers l'arrière, par un angle très obtus; côtés fortement élargis en dehors des angles antérieurs qui sont droits, jusque peu avant le milieu de la longueur, formant, à ce niveau, un angle marqué, puis rétrécis fortement, en ligne presque droite, jusqu'à la base. Ni stries, ni lignes de gros points crénelant le rebord nasal. Disque imponctué. Base du pronotum avec une impression transverse nette, mais sans carène limitante.

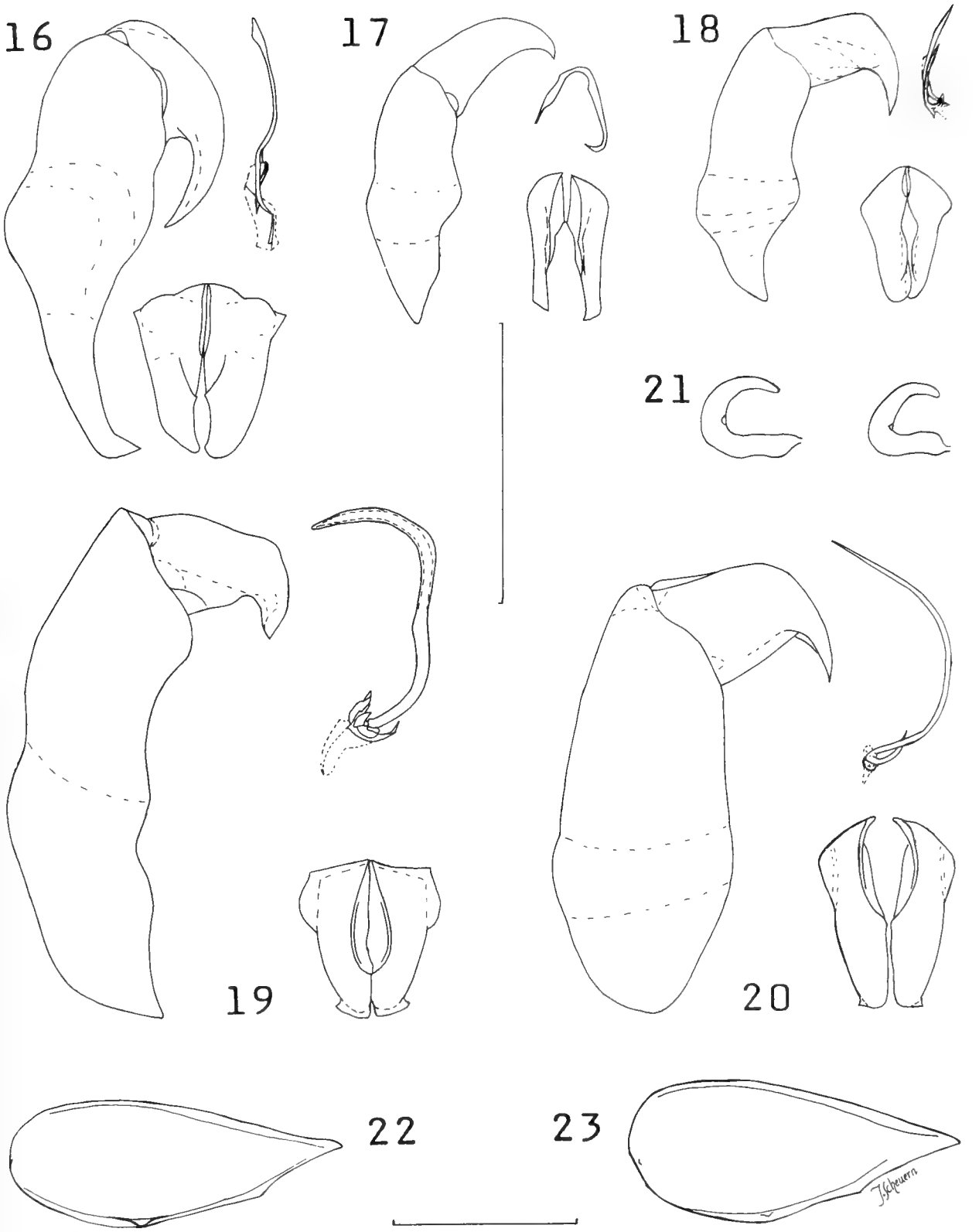
Elytres à stries bien marquées, larges, pas très profondes. Interstries plans, à chagrination iso-diamétrale et points moyens épars. Base des élytres très fortement ensellée.

Tibias antérieurs élargis vers l'avant; une forte dent marginale externe, pratiquement apicale, précédée, vers la base, d'une seconde dent obtuse. Bord externe lisse.

Tibias postérieurs en triangle large vers l'arrière; angle apical externe aigu, mais non saillant.

Cette espèce appartient au groupe de *H. perroti* R. Paul., mais est très nettement distincte des deux espèces connues jusqu'ici de ce groupe par la très forte saillie des côtés du pronotum.

Deux captures récentes de *Haroldius* orientaux méritent de retenir l'attention:



FIGS 16-23

Haroldius spp. - 16. Edéage, paramères vus de face et lamelle copulatrice du sac interne de *H. thailandensis* nov. sp., holotype. - 17. Id., de *H. perroti* R. Paul., de Taïwan. - 18. Id., de *H. sumatranus* nov. sp. holotype. - 19. Id., de *H. fleutiauxii* R. Paul. de Thaïlande. - 20. Id., de *H. rugatulus* Boucomont, holotype. - 21. Spermathèques de *H. sumatranus* nov. sp. - 22. Vue sternale du fémur antérieur, mâle de *H. fleutiauxii* R. Paul., de Thaïlande. - 23. Id., de *H. rugatulus* Boucomont, holotype. Echelle 0,5 mm.

- *H. perroti* R. Paul. L'espèce a été décrite du Vietnam. Un exemplaire, en provenance de Taïwan: Kaohsiung Hsien, Tengchin, 1565 m (A. Smetana (T. 18)), 23.IV.1990, déposé au Muséum d'Histoire naturelle de Genève, diffère, par quelques détails du type mais, dans l'état actuel de nos connaissances, semble bien devoir être rattaché à cette espèce. Il s'agit d'un individu mâle.

- *H. fleutiauxii* R. Paul., espèce décrite sur un exemplaire du Vietnam. La collection du Muséum de Genève en renferme un exemplaire mâle de Thaïlande: Chieng Mai, Doi Suthep, Barber F., 1180 m, VIII.1986 (P. Schwendinger) qui, malgré des différences de détail dans la chètotaxie et la striation des élytres, ne semble pas pouvoir en être séparé spécifiquement.

Notons enfin que quelques exemplaires de *H. stevensi* Arrow, de diverses stations indiennes et népalaises, présentent une très sensible variation de la taille et des détails de l'ornementation, sans que ces différences aient, semble-t-il, valeur taxonomique.

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REVUE SUISSE DE ZOOLOGIE, 101 (2) : 441-446; juin 1994

Paracerura virgata n.g., n.sp. (Collembola, Isotomidae), nouveau Collembole d'Amazonie centrale

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Paracerura virgata **n.g., n.sp. (Collembola, Isotomidae), new springtail of Central Amazonia.-** The new genus *Paracerura* is erected for a new species of Amazonian Isotomidae: *Paracerura virgata* n.g., n.sp. *Setocerura itatiaiensis* Arlé is also reported to this genus.

Key-words: Collembola - Isotomidae - *Paracerura* - Amazonia - Taxonomy.

Dans le cadre de l'étude des Collemboles d'Amazonie centrale que nous avons entreprise depuis 1987, l'un d'entre nous (E. OLIVEIRA) a réalisé quelques piégeages d'interception sans appât ("pitfall trap") dans les environs de Manaus, qui nous ont fourni une riche faune de Pseudachorutinae et d'Entomobryoidea. Cette méthode ne nous a procuré par contre qu'un petit nombre d'Isotomidae, parmi lesquels figurait une nouvelle espèce voisine de *Setocerura itatiaiensis*, décrite par ARLÉ (1959) d'un massif montagneux brésilien à 2000m d'altitude, près de Rio de Janeiro. Nous avons été amenés à cette occasion à revoir le genre *Setocerura*, et à isoler les deux espèces brésiliennes dans le nouveau genre *Paracerura* que nous décrivons ici.

LES GENRES **Setocerura** Salmon, 1949 et **Paracerura** n.g.

Au sein des Isotomidae austraux pourvus d'épines dentales, le genre *Setocerura* est caractérisé par un organe post-antennaire bien développé, des soies dorsales non ciliées et l'absence de trichobothries (SALMON, 1964, GREENSLADE, 1989). D'après ces caractères, *Setocerura itatiaiensis* Arlé, 1959 entrerait effectivement au sein des *Setocerura*, quoique ses épines dentales ne soient guère différentes de soies ordinaires. Par contre, notre nouvelle espèce ne possède pas d'épines

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dentales, et devrait de ce fait être placé dans les *Isotoma* du sous-genre *Desoria*. En réalité, ces 2 espèces brésiliennes sont extrêmement voisines, et possèdent plusieurs caractères remarquables qui les isolent à la fois de *Setocerura* et de *Desoria*, justifiant la création d'un nouveau genre: *Paracerura* n.g. que nous décrivons ci-dessous après avoir redéfini le genre *Setocerura*.

REDESCRIPTION DU GENRE **Setocerura** Salmon, 1949

Espèce type: *Tomocerura rubenota* Salmon,1941 (Nouvelle Zélande)

Matériel examiné: 4 paratypes de *T. rubenota* (dont le spécimen figuré dans la description originale et un paratype du même relevé que l'holotype) (Dominion Museum); 4 exemplaires appartenant à 2 espèces probablement inédites d'Australie (South Australian Museum).

Isotomidae de très grande taille à allure d'*Isotomurus*. Corps pigmenté. Segments abdominaux IV, V et VI séparés. 8+8 cornéules. OPA présent, elliptique, de petite taille (bien inférieur au diamètre d'une cornéule), situé à moins d'une longueur de cornéule de la cornéule la plus proche. Revêtement fortement plurichétotique. Pas de trichobothries. Mésochètes ordinaires des tergites lisses; macrochètes bien différenciés, ciliés. Mucron tri- ou quadridenté, sans soie. Dens longue, annelée, munie de nombreuses soies dorsales, certaines pouvant être spiniformes. Manubrium à soies dorsales très nombreuses, y compris dans la région apicale centrale. Pas d'ergots capités aux tibiotarses. Griffe munie d'une dent interne.

LISTE DES ESPECES

Setocerura rubenota (Salmon, 1941) = *Tomocerura rubenota* Salmon, 1941
Nouvelle Zélande

Setocerura maruiensis (Salmon, 1941) = *Tomocerura maruiensis* Salmon, 1941
Nouvelle Zélande

Setocerura wahlgreni (Womersley, 1939) = *Tomocerura wahlgreni* Womersley, 1939
Australie

DESCRIPTION DU GENRE **Paracerura** n.g.

espèce type: *Paracerura virgata* n.sp.

Isotomidae de taille moyenne à allure d'*Isotomurus*. Corps pigmenté. Segments abdominaux IV, V et VI séparés. 8+8 cornéules. OPA présent, elliptique, à bordure pourvue de rides chitineuses; sa taille est nettement supérieure au diamètre d'une cornéule, et il est situé à plus de 2,5 longueurs de cornéules de la cornéule la plus proche. Plurichétose faible. Pas de trichobothries. Mésochètes ordinaires des tergites

lisses; macrochètes peu différenciés et lisses. Mucron quadridenté, sans soie. Dens assez courte, annelée, munie de soies dorsales peu nombreuses (11-12 chez *virgata*); pas de soies ventrales spiniformes, ou quelques-unes peu différentes des soies ordinaires. Manubrium à soies dorsales peu nombreuses, en particulier aucune dans la région apicale centrale. Pas d'ergots capités aux tibiotarses.

Liste des espèces

Paracerura itatiaiensis (Arlé,1959) = *Setocerura itatiaiensis* Arlé,1959: Brésil (Rio de Janeiro), nov. comb.

Paracerura virgata n.sp.: Brésil (Amazonas)

Discussion

La taxonomie et la structure phylogénétique des Isotominae de l'hémisphère austral à 8+8 cornéules est particulièrement confuse (Greenslade, 1989). Les espèces sont très diversifiées, mais les genres insuffisamment caractérisés pour la plupart. Aucun d'entre eux ne présente la furca relativement réduite et la position particulière de l'OPA observées chez *Paracerura*. Ce dernier caractère sépare en outre notre nouveau genre des *Isotoma* Bourlet, 1839 sensu lato de la région holarctique. Rien ne peut être avancé en l'état actuel de nos connaissances sur les affinités de *Paracerura*, car les caractères phylétiquement importants au sein des Isotominae (chétotaxie des soies S notamment) n'ont été étudiés à ce jour que chez un très petit nombre d'espèces.

Paracerura virgata n.sp. (Fig. 1 à 10)

M a t é r i e l . - Holotype mâle et 7 paratypes: Manaus. Route ZF-02, km 14, forêt primaire, sol sablo-argileux. 06.XI.1992. E. Oliveira et C. Sena leg.

3 paratypes: Reserva Biológica da Campina, Autoroute 174, km 45, vegetation de caatinga amazonienne, sol sableux. 29.XII.1975. H. Schubart et E. Oliveira leg.

Coll. Coordenação de Pesquisas em Entomologia, INPA-Manaus (holotype et 2 paratypes); coll. Coordenação de Pesquisas em Ecologia, Laboratório de Pedobiologia, INPA-Manaus (2 paratypes); coll. Muséum d'Histoire Naturelle de Genève (2 paratypes); coll. Laboratoire de Zoologie de l'Université P. Sabatier (2 paratypes) et coll. d'Entomologie du Muséum National de Histoire Naturelle de Paris (2 paratypes).

Description

Longueur 0,7 à 1,1 mm. Coloration: face dorsale jaunâtre à violacé très pâle; bord postéro-latéral de th.III, abd.I, tiers postérieur d'abd.III, une bande antérieure, une bande latérale et un liséré postérieur sur abd.IV bleu-violets; subcoxae III bleuâtres; extrémité d'ant.II et d'ant.III, et moitié distale d'ant.IV bleuâtres.

Tête: 8+8 cornéules, G et H réduites. OPA très éloigné de la plaque oculaire, fusiforme, à bordure sclérifiée et cannelée, atteignant 1,5 à 2 fois le diamètre de la

cornéule A. Pièces buccales broyeuses classiques. Lobe externe de la maxille avec un palpe bilobé, et trois poils sublobaux. 3+3 soies ventrales le long de la linea ventralis. Ant. I avec 4 microchètes basaux (2 dorsaux et 2 ventraux), 16 mésochètes et 2 soies S subégales, grêles. Les microchètes basaux antennaires sont au nombre de 5 et 1 pour les articles II et III de l'antenne (aucun sur ant.IV). Les autres soies n'ont pas été dénombrées sur les articles II-IV de l'antenne, affectés par une plurichétose assez forte. On compte 2 soies S subégales, courtes et grêles sur ant.I; 3 mésochètes S grêles (2 internes distaux et 1 ventro-externe distal) sur ant.II; 2 soies S assez longues, subcylindriques et épaissies, non cachées par un repli tégumentaire, correspondant à S3 et S4, et plusieurs soies S (dont les 2 soies de garde) grêles et courtes sur ant.III. Ant. IV ne possède ni vésicule apicale ni "pin-seta". Labre avec 5,5,4 soies.

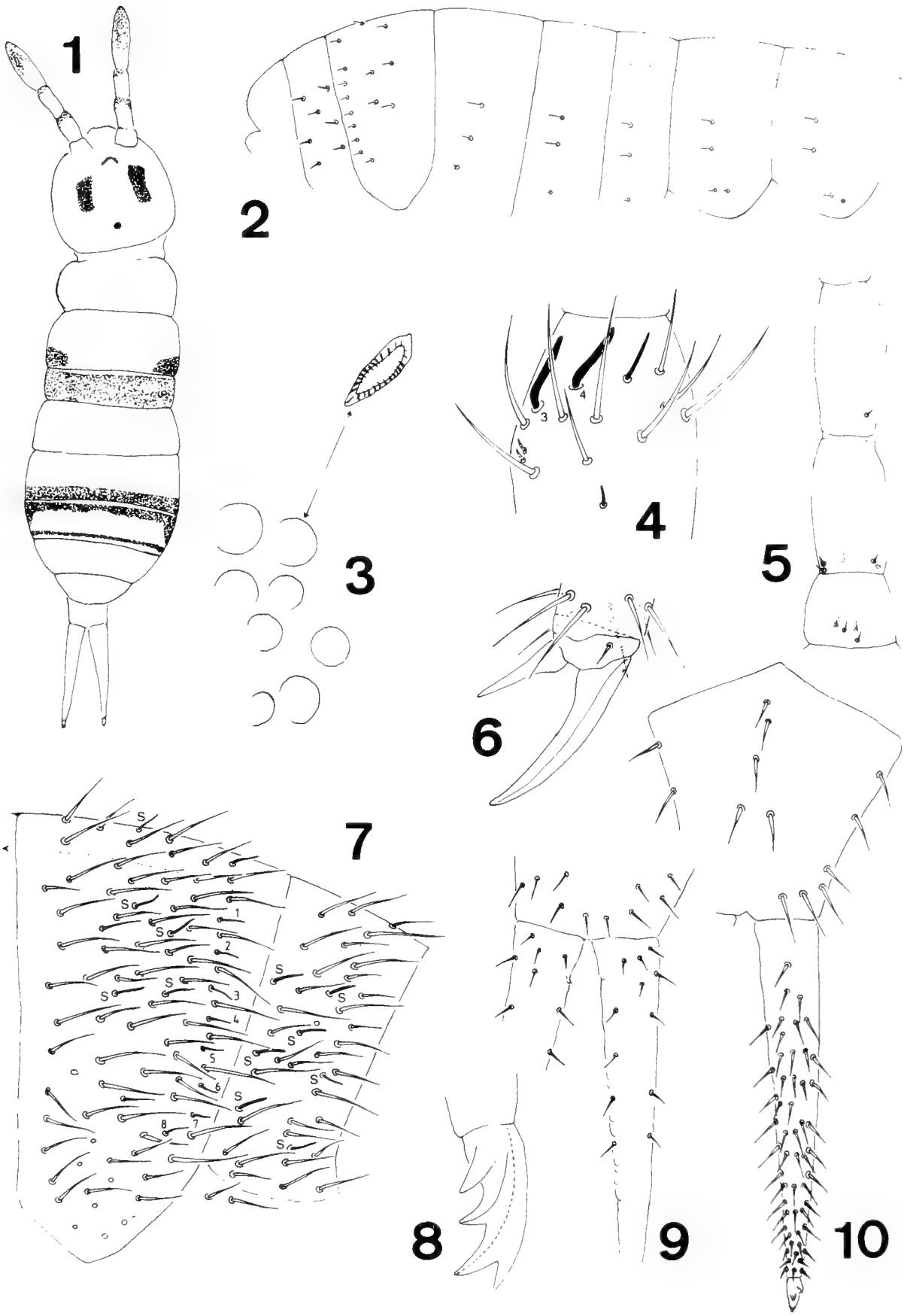
Soies ordinaires assez longues, subégales et lisses. Pas de macrochètes nettement différenciés sur les tergites. Par demi-tergite, les soies S sont réparties ainsi: (2 accp+2 al), (2 accp+2 al) / 3 accp, 3 accp, 3 accp, (8 accp+4 as), (3accp+4as); la plupart sont assez longues et fines, un peu plus épaisses sur abd.V; quelques-unes (une soie al sur th.II et th.III, la soie accp la plus latérale sur abd.I, abd.II et souvent abd.III) sont des microchètes.

Tibiotarses I et II non plurichétotiques, portant chacun 21 soies; tibiotarse III plus long, plurichétotique. Griffe droite, assez fine, longue, avec 1 dent interne petite, parfois inexistante, 1 dent externe basale et 1+1 dents latérales. Appendice empodial long et assez fin, étroit.

Tube ventral à 3+3 soies distales, 2-3+2-3 soies antérieures et 2+2 postérieures. Rétinacle à 4+4 dents et 4-5 soies. Subcoxa antérieure à 14-18 soies, subcoxa postérieure à 9-12 soies. Manubrium à 3-4+3-4 soies distales (aucune soie distale médiane), et 5-6 soies proximales centrales. Sclérifications distales du manubrium avec 1 dent peu nette. Dens relativement courte et assez trapue, avec 56-59 soies ventrales et 11-12 soies dorsales. Mucron à 4 dents, sans soie, du type *Isotomurus*.

D e r i v a t i o n o m i n i s. Du latin *virgatus*: rayé, en référence à la coloration dorsale de l'espèce.

Paracerura virgata n.g., n.sp.: 1 - Vue dorsale; 2 - Revêtement de soies S des tergites; 3 - Plaque oculaire; la double flèche souligne l'éloignement de l'OPA par rapport aux cornéules; 4 - Partie dorso-distale d'ant.III (3,4: soies internes S3 et S4 de l'organite d'ant.III); 5 - Microchètes de la base des articles antennaires I à III; 6 - Griffe et verticille distal du tibiotarse.III; 7 - Revêtement dorsal et latéral d'abd.IV-V (1 à 8: soies accp d'abd.IV; S: soies as sur abdIV; soies accp et as sur abd.V); 8 - Mucron; 9 - Chétotaxie dorsale de la dens; 10 - Chétotaxie furcale ventrale.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Discussion

Paracerura virgata est très voisine de *Paracerura itatiaiensis* Arlé par l'ensemble de ses caractères. Elle s'en distingue cependant d'emblée par sa coloration, et présente une chétotaxie furcale différente; en outre, ses soies S3 et S4 de l'organite d'ant.III sont nettement plus développées et non cachées derrière un repli tégumentaire (tableau 1). Nous ne connaissons malheureusement ni la disposition des soies S, ni la chétotaxie antennaire de *P. itatiaiensis*, qui seraient susceptibles de fournir des caractères différentiels supplémentaires entre nos deux espèces.

La nouvelle espèce a été récoltée au moyen de pièges sans appât disposés au sol, mais était absente de nos très nombreuses récoltes au berlese réalisées dans la même forêt. Signalons également que les exemplaires récoltés étaient tous des mâles.

Tableau 1: caractères différentiels entre *Paracerura virgata* et *P. itatiaiensis*

	Paracerura virgata	*Paracerura itatiaiensis*
Coloration		
Th.II	jaune pâle	violet-sombre
Abd.I	violet foncé	violet très clair
Arrière d'abd.III	violet foncé	violet très clair
Rapport S3/distance de S3 à la limite ant.III-ant.IV	1-1,2	2-2,5
Soies spiniformes/dens	non	oui
Face ventrale du manubrium		
soies centrales	5-6	1
soies latéro-distales	3-4	6

Résumé

Le nouveau genre *Paracerura* est décrit pour une nouvelle espèce amazonienne: *Paracerura virgata* n.g., n.sp. *Setocerura itatiaiensis* Arlé du Brésil est également rapporté à ce genre.

Remerciements

Le travail de terrain a pu être réalisé grâce à l'aide financière de l'INPA et du CNPq (Manaus) et à l'aide technique de Maria Lucia de Paula et Claudio Sena (laboratório de Pedobiologia do INPA). Nous remercions également ici le Museum of New Zealand Te Papa Tongarewa (Wellington), Penelope Greenslade (CSIRO) et le South Australian Museum qui nous ont transmis les exemplaires de *Setocerura rubenota* et *Setocerura* spp. utilisés pour ce travail.

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REVUE SUISSE DE ZOOLOGIE, 101 (2) : 447-464; juin 1994

Four new *Perania* (Araneae: Tetrablemmidae, Pacullinae) from Thailand and Malaysia

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Four new *Perania* (Araneae: Tetrablemmidae, Pacullinae) from Thailand and Malaysia. - Four new *Perania* species are described, *P. nasicornis* from northern Thailand, *P. siamensis* from southern Thailand, *P. cerastes* and *P. coryne* from peninsular Malaysia. Interspecific relationships are discussed, notes on natural history are given.

Key-words: Araneae - Tetrablemmidae - *Perania* - Southeast Asia - Taxonomy.

INTRODUCTION

Spiders of the genus *Perania* Thorell, 1890, the largest representatives among the armoured spiders (Tetrablemmidae), have only rarely become available for taxonomic studies. Following THORELL's early records of 1890 (*P. nigra*, *P. picea*) and 1898 (*P. birmanica*), HOGG (1920) described *P. korinchica* from the prosoma of a single female, which LEHTINEN (1981) later assigned to *P. picea*. It was not until quite recently that more substantial material was discovered in northern Thailand (SCHWENDINGER 1989; *P. nasuta*, *P. robusta*). Consecutive collecting has brought forth several more specimens from different parts of Thailand and, for the first time, also from Malaysia. An additional pair of these spiders from Malaysia was kindly left at my disposal by Mr. Joseph Koh (Singapore). It has now become quite obvious that *Perania* is by no means as rare as previously assumed. Attentive search, especially in mountainous regions, will most likely reveal further species from Southeast Asia. Because of their apparent diversity in the mountains, it is by no means improbable that Hogg's *P. korinchica*, from a different mountain than *P. picea*, is indeed a distinct species.

ABBREVIATIONS: CTh Collection Thaler, Innsbruck; MCSNG Museo Civico di Storia Naturale, Genova; MHNG Muséum d'Histoire naturelle, Genève; NHMW Natur-

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historisches Museum, Wien; ALE, PME, PLE anterior (posterior) median (lateral) eyes. All measurements are in mm.

Perania nasicornis sp. n. (Figs 1-14)

Holotype ♂: Thailand, Lamphun Province, Mae Tha District, Doi Khuntan National Park, 1250 m, 16 February 1992; MHNG.

Paratypes: From the type locality, 3 ♂, 1200-1300 m, 16 February 1992; 3 ♂, 4 ♀, 1000 m, 8 October 1992; MHNG, NHMW. All specimens leg. Schwendinger.

Comparative material: *Perania nasuta* Schwendinger, 1 ♂, 1 ♀ paratypes; CTh.

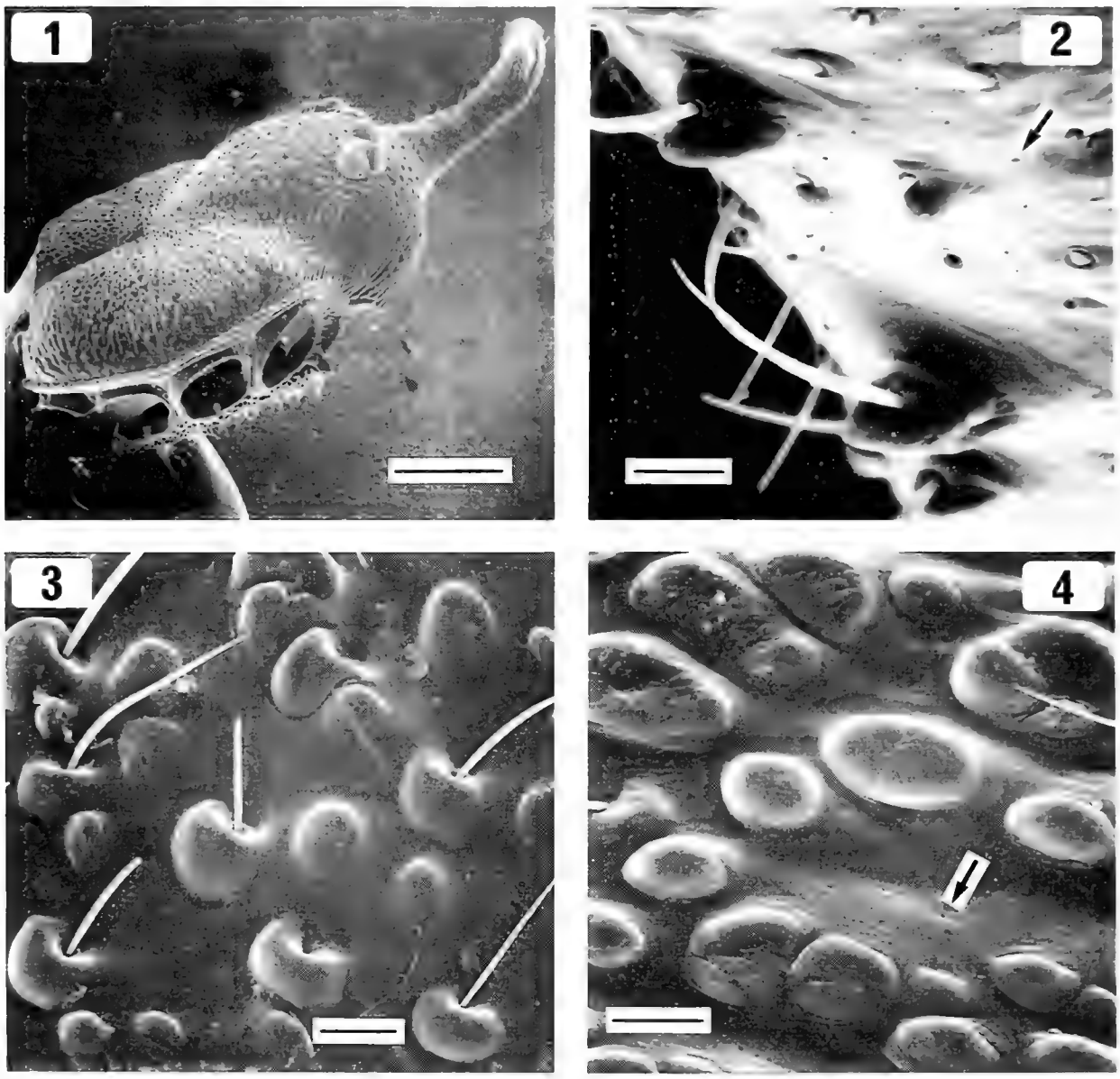
Etymology: Latin: *nasus* = nose, *cornu* = horn, antlers. Adjective; referring to clypeal process of males.

Diagnosis: Closely related to *P. nasuta*, males distinguished by a longer and distally broader clypeal process; embolus shorter, distally more scoop-shaped; subterminal lamella reaching apex. Females without cone-shaped lateral sclerites on posterior abdomen; vulva with spermathecae (receptacula seminis) widening in posterior portion, bearing only few gland pores.

Description:

MALE (holotype). Colour: sclerotised parts dark brown, membranous parts of abdomen orange-brown. Cuticle of carapace, including clypeal process, and legs penetrated by scattered pores (Figs 2, 4, see arrows). Possibly pheromone-emitting gland pores, as present in some lycosids (KRONESTEDT 1986). Total length, including clypeus process, 10.9. Carapace 6.4 long, 2.7 wide; pars cephalica covered with wart-like hair bases (Fig. 3), pars thoracica with cowdung-shaped tubercles lacking setae (Fig. 4). Spatulate median process rising from clypeus forewards and slightly upwards (Figs 1, 5-8). Fovea indistinct, longitudinal. Six oval eyes in three groups; laterals on common low tubercle, medians sessile. Eye sizes and interdistances: PME 0.23 long, separated by 0.14; ALE 0.21 long, ALE-PLE 0.11; PLE 0.23 long, separated by 1.11. Chelicerae without modifications. Labium 0.7 long, 1.0 wide. Sternum 2.6 long, 1.8 wide, fused to carapace and covered with warts as on cephalic region. Legs 1243. About 10-15 short spicules (conical hair bases; Fig. 2) proventrally and ventrally on metatarsus I, 20-25 in distal half of ventral tibia I. Paired leg claws with a row of 13-15 teeth on anterior legs, 9-12 on posterior legs; unpaired claw with one denticle. Leg and palp measurements:

	I	II	III	IV	Palp
Femur	4.6	3.5	2.6	3.4	1.2
Patella	1.7	1.4	1.1	1.2	0.6
Tibia	4.3	3.3	2.3	3.1	1.1
Metatarsus	3.0	2.6	2.2	3.0	–
Tarsus	1.4	1.2	0.9	1.0	1.0
Total	15.0	12.0	9.1	11.7	3.9

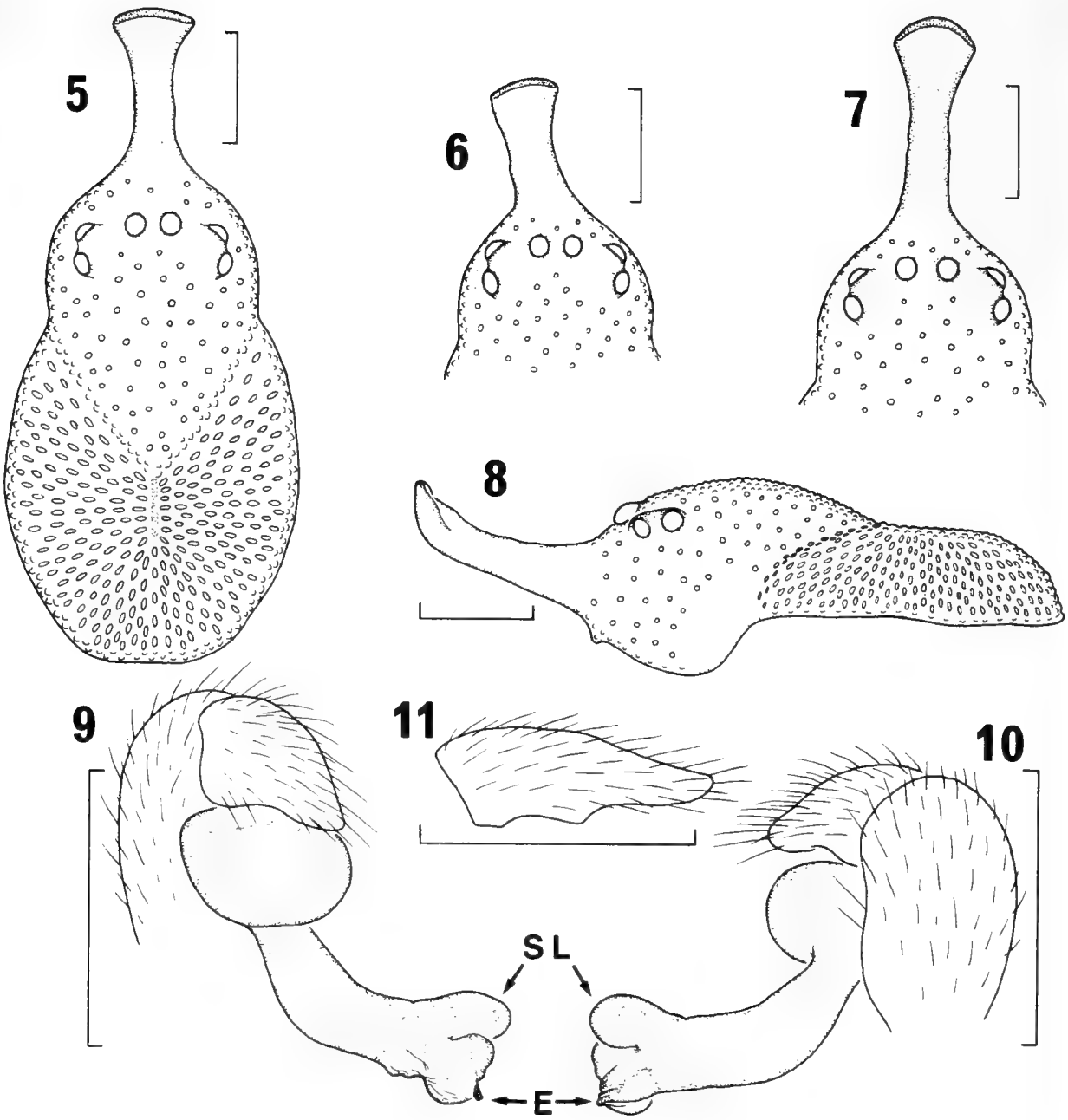


FIGS 1-4

Perania nasicornis sp. n. SEM micrographs of male. Prosoma, dorsolateral view (1). Conical hair bases on tibia I, ventral view (2). Wart-like hair bases on pars cephalica of carapace, dorsal view (3). Cowdung-shaped tubercles on pars thoracica, dorsal view (4). Presumed gland pores indicated by an arrow on Figs 2, 4. Scale lines 1.0 mm (1) and 50 µm (2-4).

Cymbium with short stout apex (Fig. 11), as in *P. nasuta*. Bulb small. Embolus large and bent, its apex scoop-shaped and broadly truncate; subterminal dorsal lamella (SL) and tip of embolus (E) at the same level (Figs 9, 10).

Abdomen 4.9 long, 3.0 wide. Dorsal scutum oval, 4.3 long, 2.9 wide, quite smooth, with only indistinct mosaic of low tubercles. Lateral sclerites in posterior half of abdomen not wart-like and not interconnected. Pulmonary plate 3.2 long, 2.5 wide, fused to spiracular plates; genital region flat. Postgenital plate reduced to a pair of paramedian patches. Preanal plate 0.3 long, 1.1 wide. Anal plate 1.0 long, 1.3 wide.



FIGS 5-11

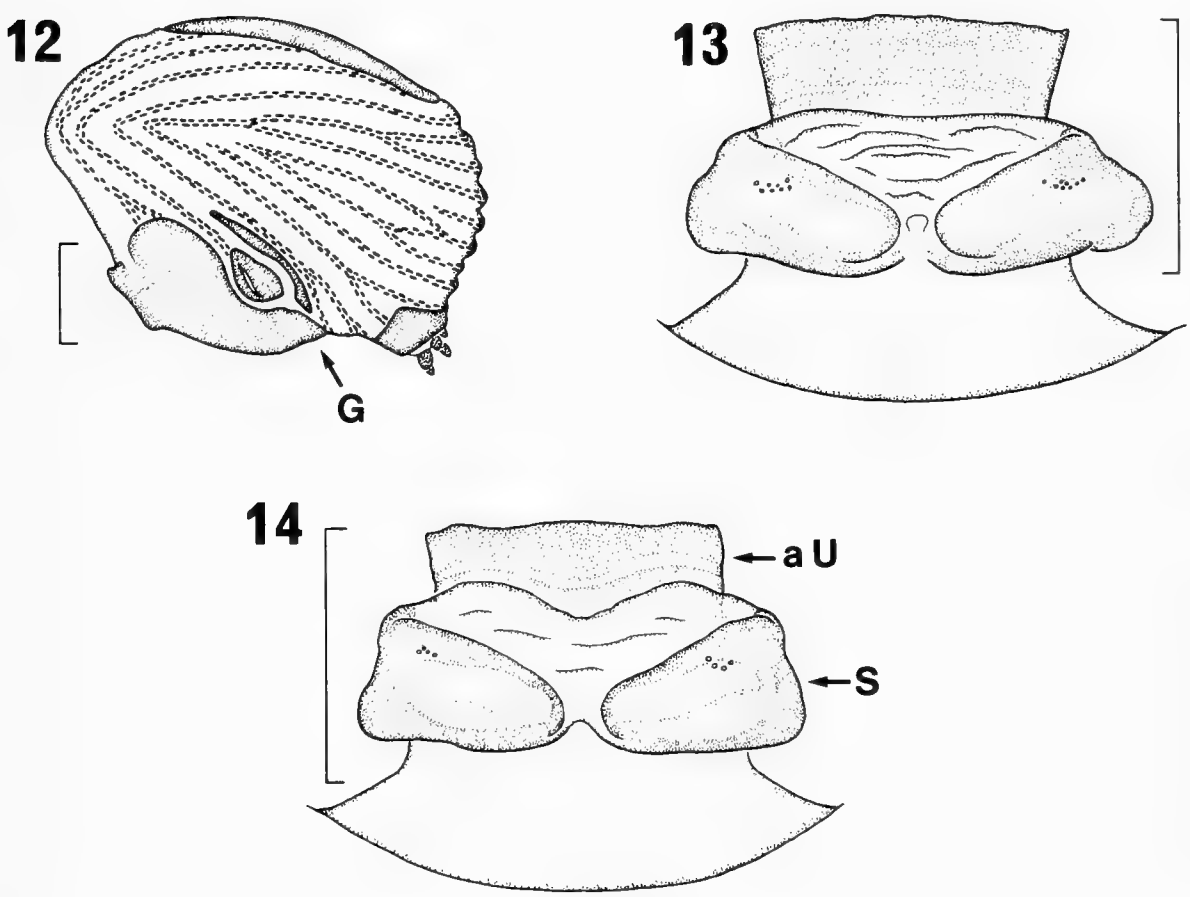
Perania nasicornis sp. n., male. Holotype (5, 8-11). Carapace, dorsal view (5). Clypeal process of two male paratypes (6, 7). Carapace, lateral view (8). Palp, prodorsal view (9), retrodorsal view (10). Cymbium prolateral view (11). E tip of embolus, SL subterminal lamella. Scale lines 1.0 mm.

FEMALE. As in the male, except for the following. Total length 7.6. Carapace 3.9 long, 2.4 wide; pars cephalica raised and arched, without clypeal process. PME 0.23 long, 0.21 apart; ALE 0.21 long, ALE-PLE 0.09; PLE 0.21 long, 1.28 apart. Labium 0.6 long, 1.0 wide. Sternum 2.2 long, 1.7 wide. Legs 1423; tibia and metatarsus I without spicules. Paired leg claws with a row of 11-13 teeth on anterior legs, 9-10 on posterior legs; unpaired claw with one denticle. Palpal tarsus without claw. Leg and palp measurements:

	I	II	III	IV	Palp
Femur	3.2	2.9	2.3	2.9	0.8
Patella	1.3	1.1	1.0	1.0	0.5
Tibia	3.0	2.5	1.8	2.5	0.7
Metatarsus	2.3	2.2	1.9	2.5	–
Tarsus	1.2	1.2	0.9	1.1	1.1
Total	11.0	9.9	7.9	10.0	3.1

Abdomen 4.4 long, 3.0 wide; few of the lateral sclerites in the posterior half wart-like but not interconnected as in females of *P. robusta* Schwendinger. Dorsal scutum 3.1 long, 2.0 wide. Pulmonary plate 2.1 long, 2.2 wide, completely separated from spiracular plates; genital region (G) short and almost flat (Fig. 12). Postgenital plate and preanal plate reduced to pairs of paramedian patches. Anal plate 0.8 long, 1.1 wide.

Vulva with fairly long anterior collar (aU, i.e. anterior uterus externus) and a pair of triangular spermathecae (S) close to each other, posteriorly widest, with only few gland pores (Figs 13, 14).



FIGS 12-14

Perania nasicornis sp. n., female. Abdomen, lateral view (12). Vulvae of two specimens, ventral view (13,14). G genital region of pulmonary plate, aU anterior collar of uterus externus, S spermathecae. Scale lines 1.0 mm (12) and 0.5 mm (13, 14).

V a r i a t i o n : Carapace measurements range: ♂: length 5.0-6.4, width 2.4-2.7 (n=8); ♀: length 3.8-4.1, width 2.4-2.6 (n=4). Clypeal process of variable length (Figs 5-7); one male with a short oblique, apparently malformed process (Fig. 6).

D i s t r i b u t i o n : Known only from Doi Khuntan National Park, northern Thailand (Fig. 43: 4).

N a t u r a l h i s t o r y : *Perania nasicornis* sp. n. occurs in evergreen hill forest between 1000-1300 m altitude. In open pine forest above and in dry dipterocarp forest below this zone they were not found. Humid conditions seem to be required. As in the other species from Thailand (SCHWENDINGER 1989) they ambush upside down in a loose, wide-meshed sheet web at night and hide in a retreat, connected to the web, during daytime. The exo-skeleton of a male (used for SEM-micrographs) was taken from the sheetweb of a *Psechrus* (Psechridae). It seemingly has entered the wrong web and fallen prey to the larger spider.

R e m a r k : Measurements of the female abdomen of *P. nasuta* in the original description (SCHWENDINGER 1989: 576) are wrong. Micrometer units were erroneously given instead of millimeters. It should read: abdomen 5.1 long, 3.3 wide.

Perania siamensis sp. n. (Figs 15-25)

H o l o t y p e ♂: Thailand, Ranong Province, about 4 km east of Ranong, on the road to Had Sompaen, 50 m, 18 September 1992; MHNG.
P a r a t y p e s : 1 ♂, 3 ♀, same data as for the holotype; MHNG, NHMW.

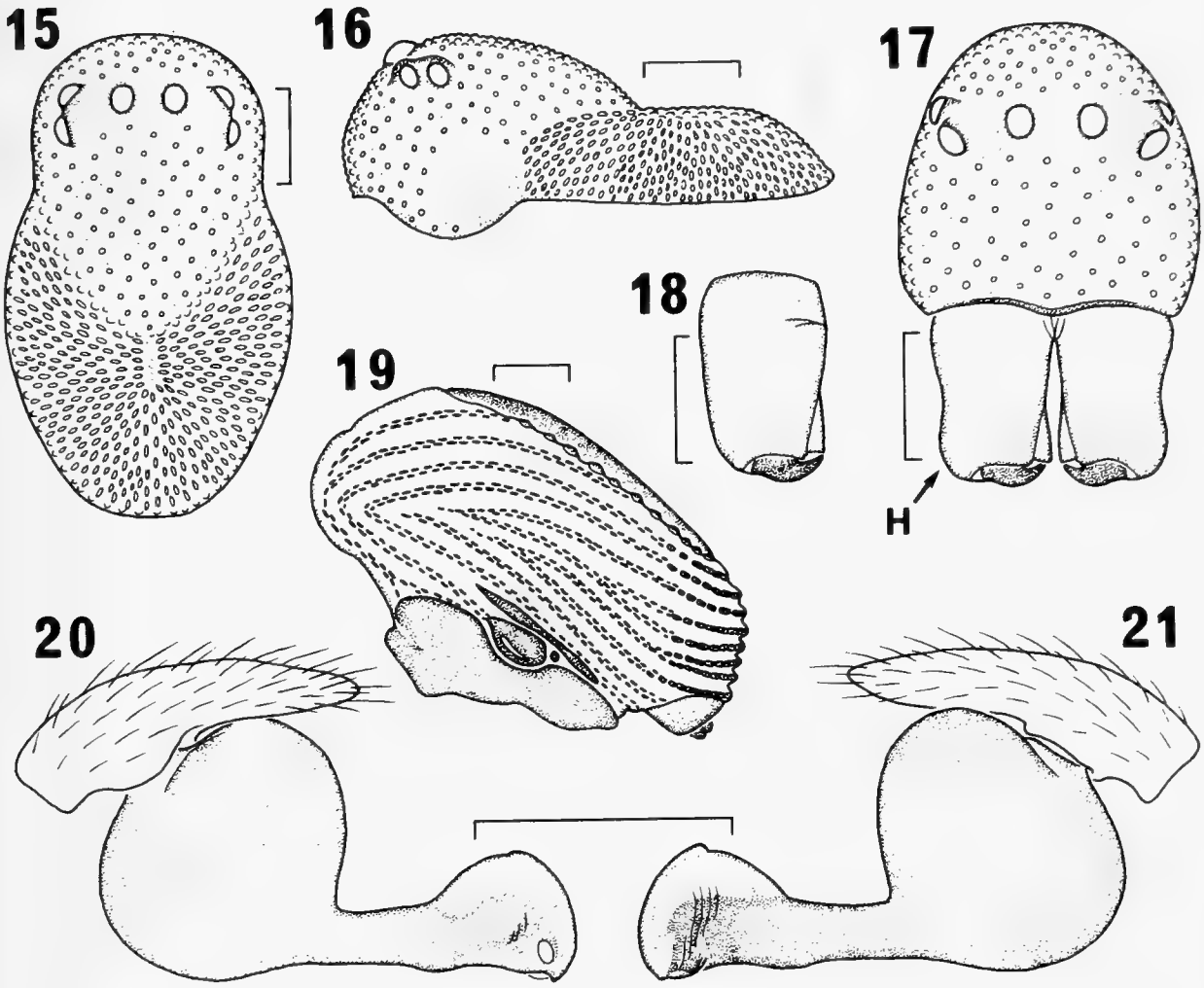
O t h e r m a t e r i a l : Prachuab Khiri Khan Province, Thap Sakae District, Huay Yang National Park, 1 ♂, 3 ♀, 700 m, 29 November 1991; 1 ♀, 1 juv., 550 m, 16 September 1992; 1 ♀, 550 m, 22 December 1992. Ranong Province, Kapoe District, Khlong Nakha Wildlife Sanctuary, 30 m, 3 ♀, 1 juv., 29 January 1991; 1 ♀, 7 December 1991. Krabi Province, Khao Phanom District, Khao Phanom Bencha National Park, 260 m, 1 ♂, 4 ♀, 22 September 1992; MHNG, NHMW. All specimens leg. Schwendinger.

C o m p a r a t i v e m a t e r i a l : *Perania robusta*, 1 ♂ paratype, 2 ♂, 3 ♀, from the type locality; MHNG, NHMW, CTh.

D i a g n o s i s : Close to *P. robusta*, males distinguished by a smaller disto-lateral hump on chelicerae; less spicules on tibia and metatarsus I; bulb more inflated; tip of embolus broad and truncate. Females with small cone-shaped sclerites along lateral margins of dorsal scutum; pulmonary plate longer and distinctly bulged in genital region; vulva with larger, almost adjoining spermathecae. Dorsal scutum in both sexes more strongly sculptured.

D e s c r i p t i o n :

MALE. Colour: sclerotised parts dark brown, membranous parts of abdomen orange-brown. Total length 9.5. Carapace 4.8 long, 3.1 wide, without clypeal process (Figs 15, 16); pars cephalica distinctly raised and arched, as in females. Six eyes, laterals on common tubercle. Eye sizes and interdistances: PME 0.26 long, separated by 0.34; ALE 0.26 long, ALE-PLE 0.17; PLE 0.26 long, separated by 1.57. Chelicerae with a



FIGS 15-21

Perania siamensis sp. n. Male (15-17, 20, 21), female (18, 19). Carapace dorsal view (15), lateral view (16). Carapace and chelicerae, frontal view (17). Right chelicera, frontal view (18). Abdomen, lateral view (19). Palp, prolateral view (20), retrolateral view (21). H lateral hump. Scale lines 1.0 mm.

small retrolateral hump (H) at distal corner (Fig. 17). Labium 0.9 long, 1.1 wide. Sternum 2.9 long, 1.9 wide. Legs 1423. About 10 fairly long proventral and ventral spicules on metatarsus I, 5 short ones in distal half of proventral tibia I. Paired leg claws with a row of 14-15 teeth on anterior legs, 9-11 on posterior legs; unpaired claw with one denticle. Leg and palp measurements:

	I	II	III	IV	Palp
Femur	4.9	3.9	3.2	4.0	1.3
Patella	1.7	1.5	1.2	1.3	0.6
Tibia	5.0	3.7	2.5	3.5	1.2
Metatarsus	3.2	2.8	2.4	3.3	–
Tarsus	1.2	1.2	1.1	1.1	1.4
Total	16.0	13.1	10.4	13.2	4.5

Cymbium with long apex, as in *P. robusta*. Bulb large, globular. Embolus axe-shaped, with wide truncate apex, lacking a separate subterminal dorsal lamella (Figs 20, 21).

Abdomen 5.0 long, 3.6 wide. Dorsal scutum oval, 4.3 long, 2.9 wide, with mosaic of low tubercles in a median line and paramedian curved cuticular folds, more distinct than in *P. nasicornis* sp. n. Pulmonary plate 3.4 long, 2.8 wide, fused to spiracular plates; genital region flat. Postgenital plate reduced to a small pair of patches. Preanal plate 0.3 long, 1.0 wide. Anal plate 1.0 long, 1.4 wide.

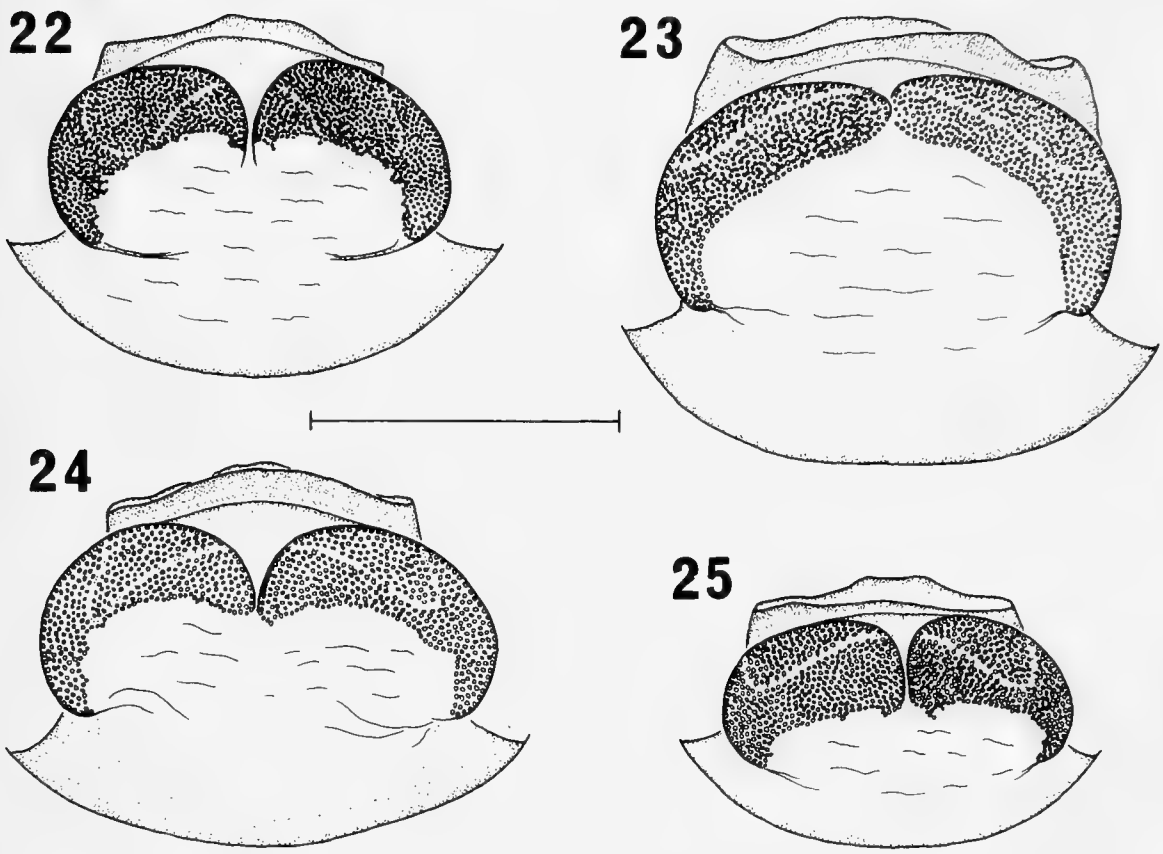
FEMALE. As in the male, except for the following. Total length 9.7. Carapace 4.8 long, 3.1 wide. PME 0.29 long, 0.24 apart; ALE 0.29 long, ALE-PLE 0.08; PLE 0.29 long, 1.67 apart. Chelicerae without disto-lateral hump (Fig. 18). Labium 0.9 long, 1.2 wide. Sternum 2.6 long, 2.0 wide. Legs 14=23; tibia and metatarsus I without spicules. Paired leg claws with a row of 13-15 teeth on anterior legs, 10-12 on posterior legs; unpaired claw with one denticle. Leg and palp measurements:

	I	II	III	IV	Palp
Femur	4.4	3.6	3.0	3.6	1.2
Patella	1.6	1.5	1.2	1.3	0.6
Tibia	4.3	3.4	2.3	3.3	0.9
Metatarsus	3.1	2.7	2.3	3.2	–
Tarsus	1.5	1.4	1.1	1.2	1.4
Total	14.9	12.6	9.9	12.6	4.1

Abdomen 6.4 long, 4.6 wide, with cone-shaped lateral sclerites along both sides of dorsal scutum and on posterior face of abdomen; small sclerites posteriorly interconnected. Dorsal scutum 4.0 long, 2.9 wide. Pulmonary plate 3.1 long, 2.9 wide, separated from spiracular plates; genital region long and distinctly bulged (Fig. 19). Postgenital plate and preanal plate reduced to pairs of paramedian patches. Anal plate 0.9 long, 1.3 wide.

Vulva wide, with large rounded spermathecae, little separated or adjoining, bearing large crescent-shaped patches of gland pores (Figs 22-25).

JUVENILES. The smaller juvenile (carapace length 1.25, width 0.94) from Khlong Nakha lacks carapace sculpture and distinct abdominal plates. Sclerotisation on abdomen developed only in a posteriorly broken ring around anus and spinnerets and in a small ventral plate behind the petiolus. The larger juvenile (carapace length 3.16, width 2.13) from Huay Yang already has the typical warty carapace surface but still lacks a fully developed abdominal sclerotisation. Dorsal scutum absent, small rounded sclerites present in that area instead; anal plate still broken by a narrow posterior gap; pulmonary plate separated into ventral sclerotisation behind petiolus, rounded plates above book lungs, smaller ones in genital region (equivalent to paired depressions in adults) and spiracular plates.



FIGS 22-25

Perania siamensis sp. n., vulvae of four females, ventral view. Specimen from Ranong (22), from Huay Yang (23), from Khao Phanom Bencha (24), from Khlong Nakha (25). Scale line 1.0 mm.

V a r i a t i o n : Carapace measurements range: ♂: length 4.9-5.4, width 3.0-3.3 (n=4); ♀: length 4.1-5.2, width 2.6-3.3 (n=16). The four females from Khlong Nakha are distinctly smaller than all others, carapace length 4.1-4.2, width 2.6-2.7, whereas the smallest specimen from the other localities measures 4.6 and 3.0 respectively. No significant differences in genitalia can be recognized (Figs 22-25). Specimens from Huay Yang with quite smooth dorsal scutum. Males from Khao Phanom Bencha and from Huay Yang with more (5-7) spicules on tibia I.

D i s t r i b u t i o n : Widely distributed at low altitudes (30-700 m) in southern Thailand. Most northern and most southern populations separated by about 380 km (Fig. 43: 5-8).

N a t u r a l h i s t o r y : All spiders were found in humid evergreen forests. Webs have the typical thin, wide-meshed sheet, running into a retreat in the soil or in decaying logs. A few webs had dead ants, one remnants of an opilionid (Laniatores) stored in the retreat.

Egg clusters are semi-globular, flat on top and spun together by fine threads. They are suspended inside the retreat and contain 38 (Ranong, 18 September) and 59

(Khao Phanom Bencha, 22 September) purple-brown eggs (becoming light green in alcohol) of 1.22-1.34 mm diameter.

Perania cerastes sp. n. (Figs 26-34)

Holotype ♂: Malaysia, Perak State, Taiping, Maxwell Hill (= Gunung Larut), 1200 m, 5 February 1991; MHNG.

Paratypes: 2 ♂, 2 ♀, same data as for the holotype; MHNG, NHMW. All specimens leg. Schwendinger.

Etymology: Greek: *kerastes* = horned; referring to clypeal process of males.

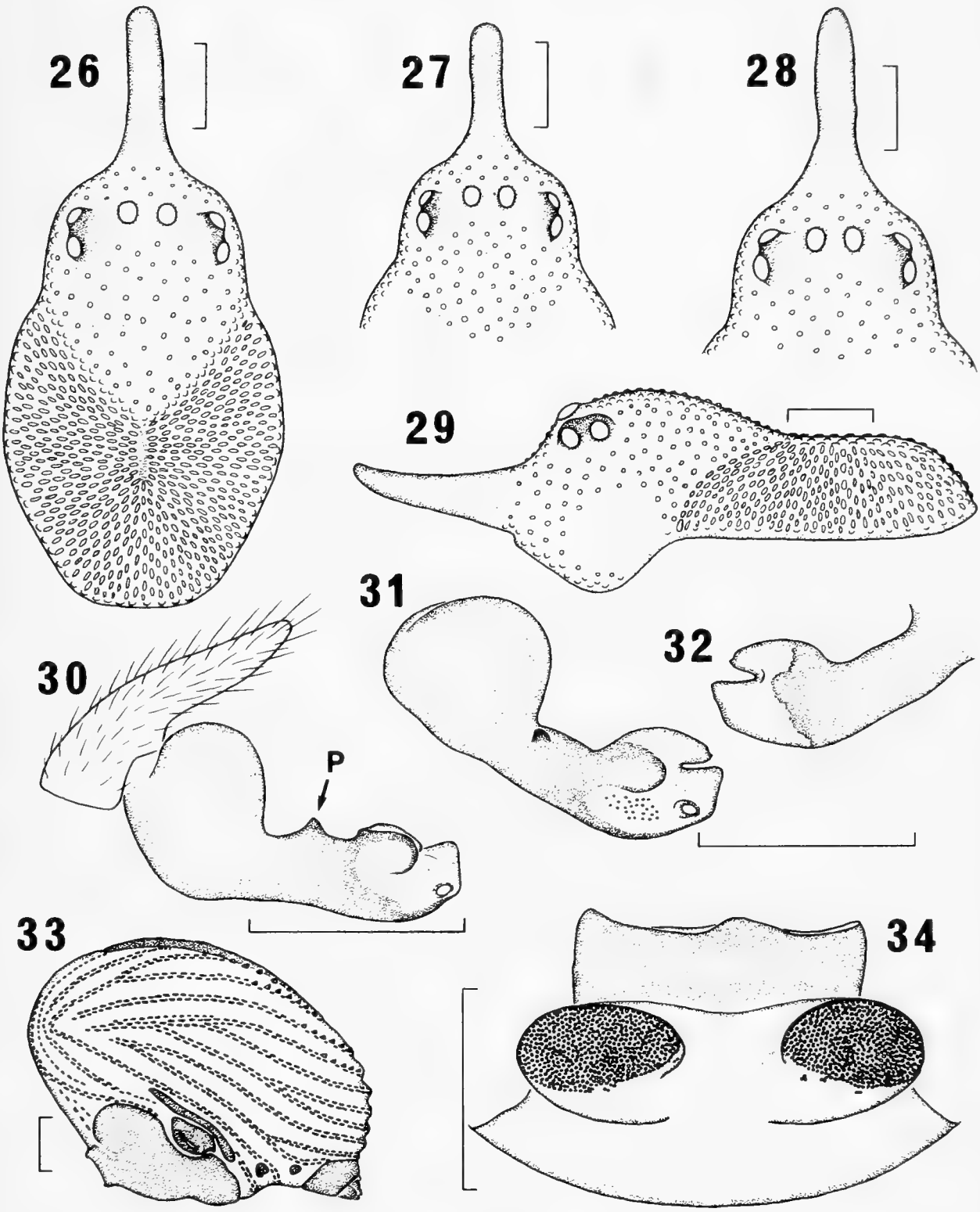
Diagnosis: Resembling *P. nasuta* and *P. nasicornis* sp. n. Males distinguished by: digitiform clypeal process; numerous spicules on tibia and metatarsus I; tooth-like process on dorsal ledge of embolus. Females with wide vulvae, bearing rounded, widely separated spermathecae.

Description:

MALE (holotype). Colour: sclerotised parts dark reddish-brown, distal joints of posterior legs slightly lighter; membranous parts of abdomen orange-brown. Total length, including clypeal process, 11.9. Carapace 6.8 long, 3.3 wide. Clypeal process smooth and digitiform, occupying about 1/4 of carapace length (Figs 26-29). Eye sizes and interdistances: PME 0.29 long, separated by 0.21; ALE 0.23 long, ALE-PLE 0.17; PLE 0.29 long, separated by 1.49; lateral eyes on common low tubercle. Chelicerae without modifications. Labium 1.0 long, 1.2 wide. Sternum 3.1 long, 2.2 wide. Legs 1423. About 50 short spicules of various sizes proventrally and ventrally on metatarsus I, about 20 on proventral tibia I. Paired leg claws with a row of 12-15 teeth on anterior legs, 9-10 on posterior legs; unpaired claw with one denticle. Leg and palp measurements:

	I	II	III	IV	Palp
Femur	5.9	4.5	3.8	4.7	1.2
Patella	2.2	1.7	1.4	1.5	0.6
Tibia	5.7	4.3	3.1	4.2	1.2
Metatarsus	3.8	3.4	3.0	3.9	–
Tarsus	1.8	1.6	1.2	1.3	1.4
Total	19.4	15.5	12.5	15.6	4.4

Cymbium with long apex. Bulb with broad embolus, bearing a tooth-like process (P) on its dorsal ledge (Fig. 30); apex bifurcate, composed of scale-like subterminal lamella and obliquely truncate embolus tip (Figs 31, 32). A subterminal rounded boss, with a patch of pit-like depressions below, present on prolateral face of embolus (Fig. 31).



FIGS 26-34

Perania cerastes sp. n. Male (26-32), female (33, 34). Holotype (26, 29). Carapace, dorsal view (26). Clypeal process of two paratypes, dorsal view (27, 28). Carapace, lateral view (29). Palp, prolateral view (30). Bulb, prodorsal view (31). Embolus, retrodorsal view (32). Abdomen, lateral view (33). Vulva, ventral view (34). P dorsal process. Scale lines 1.0 mm (26-33) and 0.5 mm (34).

Abdomen 5.7 long, 3.6 wide, lateral sclerites in posterior half not wart-like and not interconnected. Dorsal scutum 4.8 long, 3.0 wide, with mosaic of low tubercles and ridges. Pulmonary plate 3.3 long, 3.0 wide, fused to posterior part of spiracular plates; genital region flat. Postgenital plate reduced to a pair of patches. Preanal plate 0.3 long, 1.2 wide. Anal plate 1.2 long, 1.5 wide.

FEMALE. As in the male, except for the following. Total length 10.1. Carapace 4.9 long, 3.2 wide; pars cephalica raised and arched, without clypeal process. PME 0.30 long, 0.23 apart; ALE 0.26 long, ALE-PLE 0.18; PLE 0.27 long, 1.68 apart. Labium 1.0 long, 1.3 wide. Sternum 3.0 long, 2.2 wide. Legs 1423; about 50 small spicules on metatarsus I (also present but less distinct in females of *P. robusta*), tibia I without. Paired claws with a row of 14-16 teeth on anterior legs, 11-12 on posterior legs; unpaired claw with one denticle. Leg and palp measurements:

	I	II	III	IV	Palp
Femur	5.3	4.3	3.4	4.3	1.3
Patella	1.9	1.6	1.2	1.4	0.6
Tibia	4.8	3.7	2.6	3.6	1.0
Metatarsus	3.6	3.1	2.7	3.7	–
Tarsus	1.7	1.5	1.2	1.4	1.5
Total	17.3	14.2	11.1	14.4	4.4

Abdomen 6.2 long, 5.0 wide; several lateral sclerites in posterior half wart-like but not interconnected. Dorsal scutum 4.3 long, 2.8 wide. Pulmonary plate 3.1 long, 3.0 wide, completely separated from spiracular plates; genital region bulged (Fig. 33) but not elongated as in *P. siamensis* sp. n. Postgenital plate and preanal plate reduced to pairs of paramedian patches. Anal plate 1.4 long, 1.2 wide.

Vulva with anterior collar narrower than the pair of widely separated rounded spermathecae, which bear large ovoid patches of gland pores. Entire posterior part of vulva slightly sclerotised (Fig. 34).

Variation: Carapace measurements range: ♂: length 6.1-7.1, width 3.0-3.3 (n=3); ♀: length 4.7-4.9, width 3.1-3.2 (n=2). Clypeal processes vary only slightly in length and shape (Figs 26-28).

Distribution: Known only from Maxwell Hill, peninsular Malaysia (Fig. 43: 9).

Natural history: The spiders were collected at a roadside in montane rain forest. As in all other *Perania*, they can be seen outside the retreat, hanging upside down in the sheetweb, during their nocturnal ambush.

Perania coryne sp. n. (Figs 35-42)

Holotype ♂: Malaysia, Pahang State, Cameron Highlands, 14-20 April 1990, leg. V. & B. Roth, don. J. Koh; MHNG.

Paratype ♀ : Same data as for the holotype; MHNG.

Etymology : Greek: *koryne* = club, cudgel. Noun in apposition; referring to shape of male clypeal process.

Diagnosis : Closely related to *P. cerastes* sp. n., male distinguished by a club-shaped clypeal process; embolus distally narrower and rounded, without dorsal tooth; subterminal lamella small. Female with massive chelicerae; spermathecae little separated and narrower than anterior collar; poreplates small.

Description:

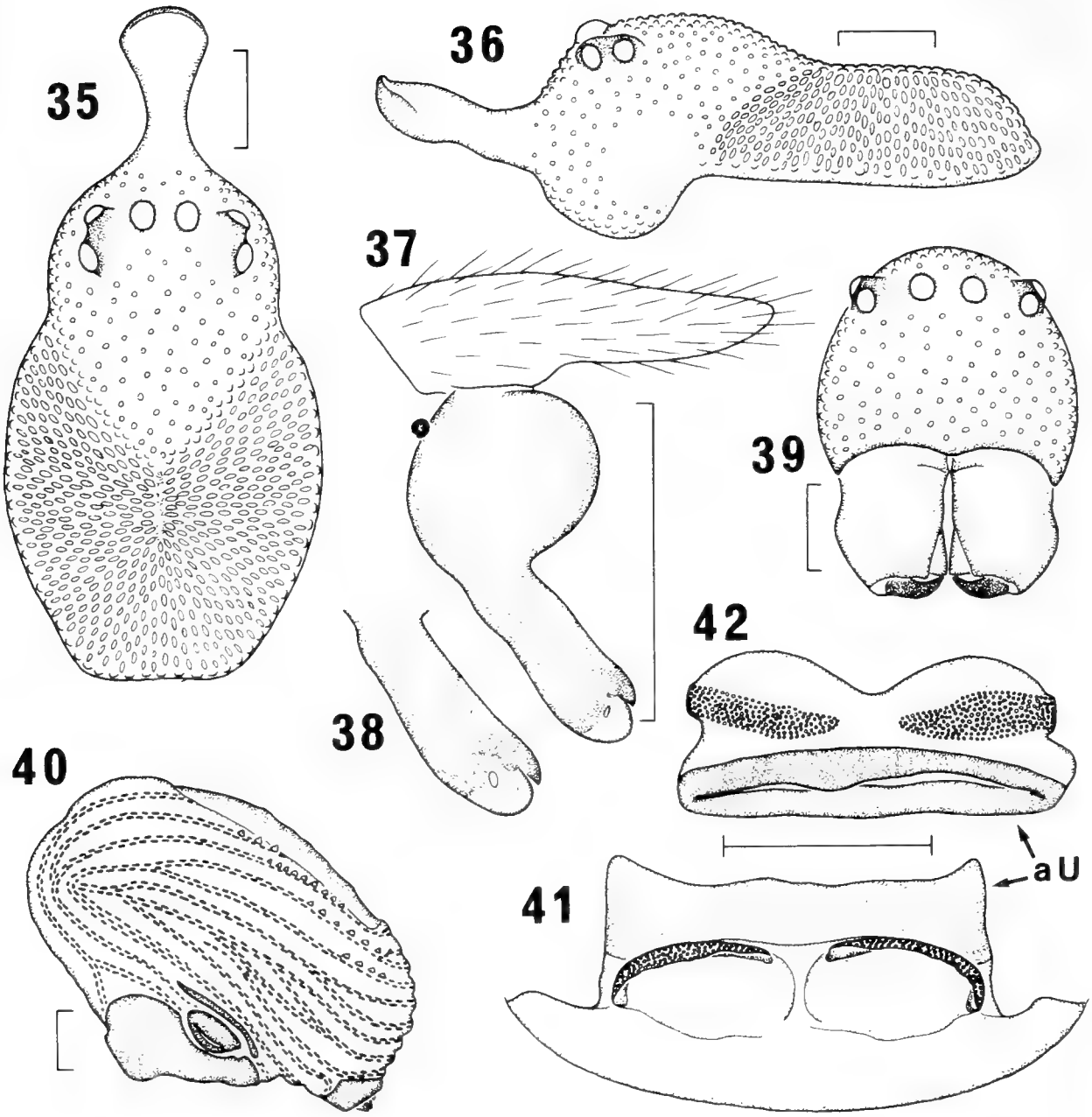
MALE (holotype). Colour: sclerotised parts dark reddish-brown, membranous parts of abdomen orange-brown. Total length, including clypeus process, 11.4. Carapace 6.7 long, 3.3 wide. Club-shaped, distally wide process on clypeus, occupying about 1/4 of carapace length (Figs 35, 36). Eye sizes and interdistances: PME 0.31 long, separated by 0.18; ALE 0.29 long, ALE-PLE 0.17; PLE 0.31 long, separated by 1.37; lateral eyes on common turbercle. Chelicerae weak. Labium 0.9 long, 1.2 wide. Sternum 3.3 long, 2.2 wide. Legs 1243. Four fairly long proventral and about 50 small ventral spicules on metatarsus I, 4-5 long ones on proventral tibia I. Paired leg claws with a row of 13-14 teeth on anterior legs, 10-11 on posterior legs; unpaired claw with one denticle. Leg and palp measurements:

	I	II	III	IV	Palp
Femur	5.8	4.5	3.8	4.6	1.2
Patella	2.4	1.9	1.5	1.6	0.7
Tibia	6.0	4.3	2.8	3.8	1.1
Metatarsus	3.6	3.2	2.7	3.6	–
Tarsus	1.5	1.4	1.2	1.4	1.4
Total	19.3	15.3	12.0	15.0	4.4

Apex of cymbium long. Bulb with broad embolus, distally divided into small pointed subterminal lamella and rounded embolus tip (Figs 37, 38).

Abdomen 5.2 long, 3.8 wide. Dorsal scutum 4.6 long, 3.6 wide, with only indistinct mosaic of low tubercles. Pulmonary plate 3.6 long, 3.2 wide, fused to posterior part of spiracular plates; genital region flat. Postgenital plate reduced to a pair of patches. Preanal plate 0.2 long, 0.9 wide. Anal plate 1.0 long, 1.3 wide.

FEMALE. As in the male, except for the following. Total length 10.5. Carapace 5.3 long, 3.5 wide; pars cephalica raised and arched, without clypeal process. PME 0.31 long, 0.24 apart; ALE 0.29 long, ALE-PLE 0.11; PLE 0.31 long, 1.66 apart. Chelicerae exceptionally massive (Fig. 39), more developed than in the male and than in females of other species examined. Labium 1.0 long, 1.4 wide. Sternum 3.2 long, 2.2 wide. Legs 1243; metatarsus I with about 50 small spicules, tibia I without. Paired leg claws with a row of 15-16 teeth on anterior legs, 10-13 on posterior legs; unpaired claw with one denticle. Leg and palp measurements:



FIGS 35-42

Perania coryne sp. n. Male holotype (35-38), female (39-42). Carapace, dorsal view (35), lateral view (36). Palp, prolateral view (37). Embolus, prodorsal view (38). Carapace and chelicerae, frontal view (39). Abdomen, lateral view (40). Vulva, ventral view (41), anterior view (42). aU anterior collar of uterus externus. Scale lines 1.0 mm (35-40) and 0.5 mm (41, 42).

	I	II	III	IV	Palp
Femur	5.6	4.3	3.5	4.3	1.4
Patella	2.3	1.9	1.4	1.6	0.7
Tibia	5.1	3.8	2.6	3.6	1.1
Metatarsus	3.5	3.1	2.6	3.5	–
Tarsus	1.5	1.4	1.2	1.3	1.6
Total	18.0	14.5	11.3	14.3	4.8

Abdomen 6.6 long, 4.8 wide; several lateral sclerites in posterior half wart-like but not interconnected. Dorsal scutum 4.0 long, 3.1 wide. Pulmonary plate 2.7 long, 3.0 wide, completely separated from spiracular plates; genital region short and quite flat (Fig. 40). Postgenital plate and preanal plate reduced to pairs of paramedian patches. Anal plate1.1 long, 1.3 wide.

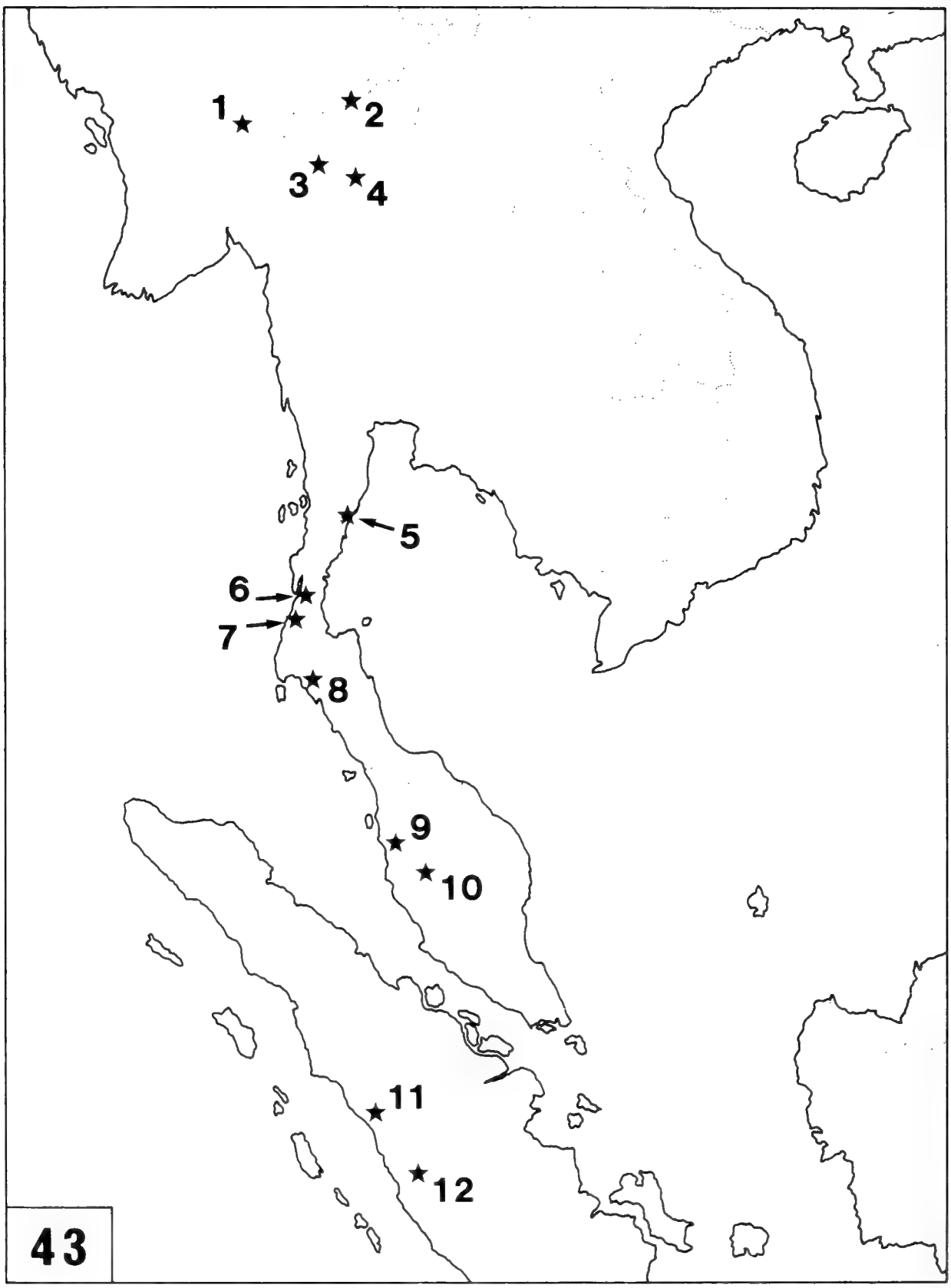
Vulva with a pair of little separated rounded spermathecae bearing narrow bands of pores in the anterior portion (Fig. 42). Anterior collar (aU) wider than pair of spermathecae. Posterior part of vulva with weak lateral sclerotisations (Fig. 41).

D i s t r i b u t i o n : Known only from the Cameron Highlands, peninsular Malaysia (Fig. 43: 10).

R e m a r k : No information on the habitat of *P. coryne* sp. n. is available but the spiders most likely occur in montane rain forest prevailing in the Cameron Highlands.

DISCUSSION

Perania nasuta and *P. nasicornis* sp. n. are obviously closely related. Males of both species possess a similar clypeal process (Figs 1, 5-8 and SCHWENDINGER 1989: Figs 6, 8), a fairly small bulb and a long bent embolus with bifurcate apex (Figs 9, 10 and SCHWENDINGER 1989: Figs 24, 25). Females have vulvae with a narrow, relatively long anterior collar and a pair of triangular spermathecae (Figs 13, 14 and SCHWENDINGER 1989: Fig. 17). A similar connexion is seen in *P. cerastes* sp. n. and *P. coryne* sp. n. Males possess a pronounced clypeal process, though different in shape (Figs 26-29 and 35, 36), their bulbs are larger than in the foregoing species and have a fairly short, wide and straight embolus with bifurcate apex (Figs 30-32 and 37, 38). Vulvae with a fairly long, wide anterior collar and rounded spermathecae (Fig. 34 and 41). *Perania robusta* and *P. siamensis* sp. n. resemble each other by males without a clypeal process but with a sexually dimorphous distolateral boss on chelicerae (Fig. 17 and SCHWENDINGER 1989: Fig. 14); bulbs large; embolus straight, with entire apex (Figs 20, 21 and SCHWENDINGER1989: Figs 26, 27). Vulvae furnished with a short, wide anterior collar and rounded spermathecae (Figs 22-25 and SCHWENDINGER 1989: Fig. 15). Judging from vulval and palpal structures, they are more closely related to *P. cerastes* sp. n. and *P. coryne* sp. n. than to *P. nasuta* and *P. nasicornis* sp. n.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Geographical proximity supports taxonomic relationship between *P. nasuta* and *P. nasicornis* sp. n. and between *P. cerastes* sp. n. and *P. coryne* sp. n. but not so for *P. robusta* and *P. siamensis* sp. n. The latter two species are separated by about 900 km (Fig. 43). Similar forms can be expected to occur in between their distribution areas.

The remaining species cannot be adjoined to those from Thailand and Malaysia at present. In *P. birmanica* (Thorell) (Burma) the male is unknown; the female holotype (in MCSNG, examined) was not dissected to study its vulval structure. Information on the remaining two species (both from Mt. Singalang, Sumatra; not examined) is incomplete as well. The male of *Perania nigra* (Thorell) has a small tooth-like clypeal process, that of *P. picea* (Thorell) lacks it (BOURNE 1980: Figs 6, 12). Their quite small, distinctly U-shaped bulbs with a long sigmoid embolus, however, indicate close relationship with each other. Vulval structures in both species are not yet known.

As large globular bulbs with short emboli are predominant in the Tetrablemmidae (except in *P. nigra*, *P. picea*, *P. nasuta*, *P. nasicornis* sp. n.) and vulvae with rounded spermathecae are present in all *Perania* females examined[1], except in *P. nasuta* and *P. nasicornis* sp. n., this is considered the plesiomorphic type within *Perania*. The four exceptions thus are apomorphic and presumably represent two derived species pairs at the northern and southern periphery of the distribution area of *Perania*.

None of the species treated in here have paired processes in the thoracic portion of the carapace, as present in *Mirania armata* (combination according to LETHINEN 1981), which also occurs at Mt. Singalang. Therefore this species appears less closely related to *Perania* than previously assumed (SCHWENDINGER 1989: 579). Further collections in Sumatra may provide new arguments for the evaluation of both genera.

[1] Apparently also in *P. picea* (BOURNE 1980: Fig. 11; LEHTINEN 1981: Fig. 7). *P. nigra* (BOURNE 1980: Fig. 19; LEHTINEN 1981: Fig. 6) and *P. birmanica* (SCHWENDINGER 1989: Fig. 21).

FIG. 43

Records of *Perania* in Southeast Asia. Burma: 1 = Mt. Carin Chebà (*P. birmanica*). Thailand: 2 = Doi Angkhang (*P. robusta*); 3 = Doi Inthanon (*P. nasuta*); 4 = Doi Khuntan (*P. nasicornis* sp. n.); 5 = Huay Yang, 6 = Ranong, 7 = Khlong Nakha, 8 = Khao Phanom Bencha (*P. siamensis* sp. n.). Malaysia: 9 = Maxwell Hill (*P. cerastes* sp. n.); 10 = Cameron Highlands (*P. coryne* sp. n.). Indonesia: 11 = Mt. Singalang (*P. nigra*, *P. picea*); 12 = Mt. Kerinci (*P. korinchica* Hogg = *P. picea*, according to LEHTINEN 1981).

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Type specimens of recent species of Pectinidae described by Lamarck (1819), preserved in the Muséum d'Histoire Naturelle of Geneva and the Muséum National d'Histoire Naturelle of Paris (with 30 plates)

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Types specimens of recent species of Pectinidae described by Lamarck (1819).- LAMARCK listed and described 60 species of recent Pectinidae (1 *Pedum* species, and 59 *Pecten* species) in 1819. Twenty-nine were newly described species, of which 4 are junior homonyms, 1 senior homonym, 11 junior synonyms, 1 possible junior synonym, 9 extant taxa, and 3 uncertain. He validated 9 non-binominal species, and one manuscript name of Péron. One type specimen (*P. pellucidus*) cannot be found. Nineteen primary types are present in the MHNG, and nine in the MNHN. Most of Lamarck's taxa were figured by BRUGUIERE (1797), DELESSERT (1841), and CHENU (1844-1845, 1862), but seven taxa were not illustrated. Two lectotypes previously selected by FLEMING (1951) and CLARKE (1965) are invalid, according to ICZN art. 74 (a)(v), and twenty lectotypes are herein selected. Five new type localities are also designated for species which had unknown or erroneous type localities. Seventeen varieties described by Lamarck as new are excluded from the type series, according to ICZN art. 72 (b)(i).

Key-words: Lamarck - Mollusca (Bivalvia : Pectinidae) - Type species - Taxonomy - Nomenclature.

INTRODUCTION

In 1793, Jean-Baptiste Pierre Antoine de Monet, Chevalier de Lamarck (1744-1829), was appointed as Professor in Zoology (Invertebrates) at the Muséum d'Histoire Naturelle in Paris. At the same time, Lamarck possessed a private collection of fossil and recent mollusca, which was offered in 1796 to the French government for 33.000 livres, but this collection was not accepted. In the meantime, Lamarck described many new molluscan taxa from his private collection and the

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collection of the MNHN, including Pectinidae, purchased or collected by French voyages around the world, among which the famous "Voyage aux Terres Australes" (1800-1804). In the volume 6 of his "Histoire Naturelle des Animaux sans Vertèbres" (1819), he described the recent Pectinidae, divided into two groups, i.e. "Auricles equal or nearly equal" and "Auricles inequal", listing 59 species based on material of "Mus. n°." [= MNHN] and "Mon cabinet" [= his private collection, now in MHNG]. During the last years of his life, he suffered with blindness, and his daughter Rosalie assisted him with his work, as indicated in a letter addressed to her sister Cornélie.

After Lamarck's death in 1829, his rich private collection (13.288 species) was purchased by Prince Masséna, Duke of Rivoli, in 1831. Afterwards, in 1840, Baron J.P.B. de Lessert (or Delessert) of Lyon acquired Lamarck's collection and joined it with his huge and impressive own collection. After his death, his brother Baron F. de Lessert inherited the collection, and in 1869 his widow and daughters, the baronesses Hottinger and Bartholdi, offered it to the city of Geneva. Lamarck's library was scattered after his death, and his private copy of the "Histoire Naturelle des Animaux sans Vertèbres" (1815-1822), with the marginal handwritten annotations made by Rosalie, went to Great Britain.

Fortunately, Delessert purchased this copy afterwards, and it is actually kept in the MHNG. The annotations made by Rosalie de Lamarck are important as they provide information on Lamarck's original collection and type series, which had been incorporated in the meantime with the Delessert collection, together with other material from Hwass, Prince Masséna and Solier de la Touche. In some cases, it was difficult to recognize the specimens of Lamarck in the Delessert collection, when the indications were not sufficient to permit to trace them; the Delessert collection may still contain overlooked material, especially when the number of specimens in the actual Lamarck collection is smaller than the number indicated by Rosalie. This was already pointed out by G. Mermod (manuscript notes), who worked for many years (1913-1955) on Lamarck's material in the MHNG, revising the Spondylidae and Pectinidae in 1947, but without publishing his notes.

MATERIAL STUDIED

In the volume 6 of "Histoire Naturelle des Animaux sans Vertèbres" (1819), Lamarck treated the family Pectinidae ("Les Pectinides"), and divided this family into seven genera: "Houlette" [= *Pedum*], "Lime" [= *Lima*], "Plagiostome" [= *Plagiostoma*], "Peigne" [= *Pecten*], "Plicatule" [= *Plicatula*], "Spondyle" [= *Spondylus*], and "Podopside" [= also *Spondylus*]. Actually only *Pedum* ("Houlette") and *Pecten* ("Peigne") are representative genera of the Pectinidae.

Lamarck listed and described 59 recent *Pecten* species, and divided these species in two groups, mainly based on the form of the auricles, and one *Pedum* species; 29 of these 59 *Pecten* species are new taxa, mostly figured in Bruguiere (1797), Delessert (1841), and Chenu (1844-1845, 1862). Lamarck studied material of his own collection ("Mon cabinet")(ca. 215 specimens) and material from the

Jean-Baptiste Pierre Antoine de Monet, Chevalier de Lamarck
(1744-1829)

MNHN. For the Pectinidae, he used the following previous publications as references: BONANNI (1681), LISTER (1685-1692), RUMPHIUS (1705), SEBA (1734-1765), GUALTIERI (1742), KNORR (1757-1772), REGENFUSS (1758), PENNANT (1777), DA COSTA (1778), D'ARGENVILLE (1780), BORN (1780), FABRICIUS (1780), CHEMNITZ (1784), BROWNE (1789), GMELIN (1791), POLI (1795), BRUGUIERE (1797), and MATON (1807). It has to be noted, that he did not refer to LINNAEUS' "Systema Naturae...", 10th ed. (1758), but only to GMELIN (13th ed., 1791).

In the volume 7 of the second edition of "Histoire Naturelle des Animaux sans Vertèbres" (1836), DESHAYES added several notes and references to Lamarck's species.

Lamarck clearly distinguished varieties among the species described in the text and on his labels. These varieties, for example *Pecten rastellum* var. [b], indicated by a letter in parentheses (Table IV) are here excluded from the type series, according to art. 72b,i (ICZN, 1985 : 141). However, letters in parentheses are sometimes indicated without mentioning a variation. These are included in the type series or regarded as different taxa, for example *Pecten unicolor* [a], and *Pecten opercularis luteus* [a]. Although Lamarck mentioned the size ("Largeur" = width) in millimetres of only one specimen, sometimes several (additional) specimens are present. For the designation of a lectotype, these measurements, together with Rosalie's annotations in the margin of Lamarck's own copy of the "Hist. Nat....", are of great importance.

He described 29 new taxa (actually 4 homonyms, 1 senior synonym, 11 junior synonyms, 1 possible junior synonym, 9 extant taxa, and 3 uncertain taxa), of which three are type species of nominal genera. Two lectotypes were erroneously designated by FLEMING (1951) and CLARKE (1965) respectively (art. 74 (a)(v), ICZN, 1985: 155). GRAU (1959) erroneously indicated a holotype for *Pecten purpuratus* Lamarck. Twenty lectotypes are herein selected (Table II), and eight holotypes mentioned. The type specimens of *Pecten pellucidus* Lamarck are absent, and could not be traced with certainty in the Delessert collection (MHNG). GRAU (1959) and CLARKE Jr. (1965) designated two type localities.

Handwritten numbers on the outer- or inner side of the shells mostly match the numbers indicated in LAMARCK (1819). These handwritten numbers are visible only on Lamarck's specimens and not on Delessert's specimens, nor on the pectinids of the MNHN. Sometimes larger numbers, of uncertain origin, are present on the shells.

As Mermod noted in a manuscript , the letters D (Delessert collection) or L (Lamarck collection) written on the cardboards, prepared by Lunel, are not always correct. No original label of Delessert is present.

ABBREVIATIONS

ICZN = International Code of Zoological Nomenclature
MHNG = Muséum d'Histoire Naturelle, Genève
MNHN = Muséum National d'Histoire Naturelle, Paris
NNM = Nationaal Natuurhistorisch Museum, Leiden

Ostrea plica. Lin. Gmel. n°. 14.
Rumph. Mus. t. 44. fig. O.
D'Argenv. Conch. t. 24. fig. C.
Chemn. Conch. 7. t. 62. f. 598. a, b.
Encyclop. pl. 212. f. 5?
[b] *Var. testâ purpureo-nigricante.*
Habite l'Océan indien. Mus. n°. Mon cabinet. Coquille oblongue-arrondie, à stries longitudinales bien marquées dans sa moitié supérieure. La variété [b] est rare, fort belle, large de 47 millimètres. Mus. n°. La base tronquée est étroite.

15 20. Peigne glabre. *Pecten glaber.*

P. testâ subæquivalvi; radiis 10 lævibus, supernè dilatato-evanidis, alternis minoribus; striis longitudinalibus ad interstitia.
Ostrea glabra? Lin. Gmel. n°. 50.
Bonan. recr. 2. f. 12.
Knorr. Vergn. 2. t. 10. f. 2; et 5. t. 10. f. 5, 6.
Chemn. Conch. 7. t. 67. f. 642. 643.
Encyclop. pl. 213. f. 1.
1 [b] *Var. testâ fulvâ, immaculatâ.*
Knorr. Vergn. 5. t. 9. f. 2.
Habite la Méditerranée. Mus. n°. Mon cabinet. Espèce commune dans les collections, très-variée dans ses couleurs et ses caractères, et fort difficile à circonscrire dans ses limites. Beaucoup de ses variétés sont fort jolies.

3 entiers et 2 valves. 21. Peigne sillonné. *Pecten sulcatus.*

P. testâ subæquivalvi, albâ, fusco maculatâ; radiis 10 æqualibus, undiquè convexis, uti interstitiis longitudinaliter sulcatis.
An Chemn. Conch. 7. t. 67. f. 641?
1 valve [b] *Var. testâ roseo tinctâ; flammulis albis transversis.*
Habite dans la Méditerranée, au golfe de Tarente. Mus. n°. Mon cabinet. Espèce jolie, variée, distincte de la précédente, ainsi que celles qui suivent.

1 22. Peigne vierge. *Pecten virgo.*

P. testâ tenui, pellucidâ, albâ, roseo partim tinctâ; radiis 10 convexiusculis interstitiisque glabris.
Gualt. test. t. 73. fig. H?
Habite la Méditerranée, au golfe de Tarente. Mon cabinet. Ses stries longitudinales sont peu distinctes. Largeur, 44 millimètres.

Marginal handwritten annotations of Rosalie de Lamarck

WAM = Western Australian Museum, Perth
ZMA = Zoölogisch Museum Amsterdam
ZMK = Zoologisk Museum København
D = Diameter: convexity of the shell
H = Height: dorsal to ventral margin of the shell
W = Width: anterior to posterior margin of the shell
l.v. = left valve
r.v. = right valve

All specimens treated are pairs of matching valves, unless otherwise mentioned (l.v. for left valve and r.v. for right valve).

THE SPECIES

Pecten medius Lamarck, 1819 (Figs. 1-3)

References:
CHEMNITZ, 1784 : 272-273, pl. 60, figs. 586, 587, 589?; LAMARCK, 1819 : 163, n° 2 (Orig. descr.); DEFRANCE, 1825 : 239; DESHAYES, 1832 : 715-716, n° 1; DESHAYES *in* Lamarck, 1836 : 130, n° 2; CHENU, 1843 : 2, pl. 4, figs. 2-6; FLEMING, 1951 : 129, pl. 17, figs. 1-4 (designation of lectotype [= error]).

Type locality: unknown.

Type material:
Specimens cited : "Mus. n°." [MNHN]
Size given : not indicated.

	H	W	D
1. MNHN, lectotype	93 mm	111 mm	24 mm
2. MNHN, paralectotype 1	85 mm	96.5 mm	18.5 mm
3. MNHN, paralectotype 2	75 mm	85.8 mm	24.5 mm
4. MNHN, paralectotype 3	70 mm	78.1 mm	17.5 mm

Other material:
MHNG n° 1088/8 53 mm 60 mm 13 mm
with a handwritten label of Lamarck.
(= *Pecten medius* Lamarck; erroneous designation of lectotype, see remarks below)
MHNG n° 1088/16 59 mm 64 mm 21 mm
(= *Pecten ziczac* var. [b] Lamarck)
MNHN 63 mm 68.5 mm 20 mm
(= *Pecten ziczac* var. [b] Lamarck)

REMARKS :

LAMARCK (1819 : 163) described this taxon as a species intermediate between *Pecten maximus* (Linnaeus, 1758), the former species (n° 1), and *Pecten jacobaeus* (Linnaeus, 1758), the following one (n° 3), without indicating the type locality. He referred to CHEMNITZ' figures 586, 587 and 589 with a questionmark. CHEMNITZ mentioned in his description that this species is a variety of *P. maximus* from the Red Sea, and collected by Forsskål (figs. 586 and 587) (ZMK). According to CHEMNITZ, fig. 589 is a *P. jacobaeus*.

The description of Lamarck was based on material from the MNHN (type series), indicated as "Mus. n°", without registration number. However, Rosalie de Lamarck's marginal annotations on Lamarck's personal copy of the sixth volume of "Histoire Naturelle des Animaux sans Vertèbres", suggest that there could be also a "type specimen" in Lamarck's collection, as she noted one specimen. It is quite possible that this specimen was observed after the description of *P. medius*, because in the original text there is no indication of "Mon cabinet", generally mentioned by Lamarck, when a species is described from his own collection. Thus, it cannot be proved whether this specimen really belongs to the type series (ICZN art. 74a.v), and therefore it must be considered as erroneously designated as lectotype by FLEMING (1951 : 129).

LAMARCK (1819 : 164) described *Pecten ziczac* var. [b] with the locality "Nouvelle Hollande" [= Australia]. Both specimens observed are typical for the Shark Bay area (W. Australia) and similar to *P. medius* Lamarck. It is possible that Péron and his party, on board of the French corvette "Le Naturaliste", collected these specimens in March 1803, because the ship anchored there for several days (CORNELL, 1974). Unfortunately neither accompanying labels nor notes of Péron are traced.

DESHAYES (1836 : 131) noticed that this variety is much like *Pecten medius*: "Nous avons vu cette variété dans la collection du Muséum et nous avons reconnu qu'elle n'appartenait pas au *Pecten ziczac*, mais au *Pecten medius* n° 2...."

CHENU (1843) described this variety as a distinct species: *Pecten lamarckii*, from the Atlantic Ocean (error); however this name was already preoccupied by a fossil pectinid from Malta (DEFRANCE, 1825 : 260).

The lectotype of *P. medius* Lamarck, herein selected, agrees to TATE's description of *Pecten meridionalis* (1887 : 115) from Tasmania. The first paralectotype is also similar to the lectotype. The second paralectotype is a typical pectinid from the South Australian area, and also described by TATE (1887 : 114) as *Pecten fumatus* var. *albus* (emend. for *alba*). It is quite possible that this material was also collected by the French expedition to Australia (1800-1804), because the corvettes anchored also in southwestern Australia and Tasmania (CORNELL, 1974).

NOMENCLATURAL STATUS :

COX (1929 : 203) noted that *P. medius* Lamarck is a homonym of *Pecten medius* Bosc, 1802, but IREDALE (1939 : 365) rejected it, because BOSC did not quote *Ostrea media* Gmelin, 1791. However, BOSC did not have the intention to describe new taxa, but he only redescribed former publications, such as of GMELIN, and they both only referred to GUALTIERI (pl. 74 figs. N, O). According to the ICZN art. 53c, *P. medius* Lamarck is a junior homonym of *P. medius* Bosc.

CURRENT TAXONOMIC POSITION AND DISTRIBUTION :

The valid name for this taxon is *Pecten fumatus* Reeve, 1852. The following names are synonyms: *Pecten medius* Lamarck, 1819 (preocc. by Bosc, 1802); *Pecten fuscus* [Klein] Sowerby II, 1842 (preocc. by BOSC, 1802); *Pecten bifidus* Menke, 1843 (preocc. by MÜNSTER in GOLDFUSS, 1836); *Pecten lamarckii* Chenu, 1843 (preocc. by

DEFRANCE, 1825); *Pecten modestus* Reeve, 1852 (preocc. by BOSC, 1802); *Pecten fumatus* var. *albus* Tate, 1887; *Pecten meridionalis* Tate, 1887 (preocc. by von EICHWALD, 1865); *Notovola preissiana* Iredale, 1949; *Pecten jacobaeus byronensis* Fleming, 1955.

WALLER (1991 : 73) mentioned three morphological or geographic clusters from Australia: *Pecten fumatus fumatus* Reeve, 1852, from eastern and southeastern Australia , *P. fumatus "meridionalis"* Tate, 1887 (non *P. meridionalis* von Eichwald, 1865), and *P. modestus* Reeve, 1852, from western Australia.

Recent protein electrophoresis relevant to the genetic relationships of southern Australasian *Pecten* (s.s.) by WOODBURN (1989 : 226) suggests that there is only one extant species in Australia, although somewhat different morphological features are observed within populations from Western Australia and Tasmania.

P. fumatus lives in shallow waters on muddy sand bottom from southern Queensland, New South Wales, and Tasmania to southwestern Australia. No records are known from northwestern, northern or northeastern Australia. *Notovola* Finlay, 1926 is a junior synonym of *Pecten* Müller, 1776.

Pecten bifrons Lamarck, 1819 (Figs. 4-8)

References:
LAMARCK 1819 : 164, n° 4 (Orig. descr.); DESHAYES in Lamarck 1836 : 131, n° 4; DELESSERT 1841 : pl. 15, figs. 5a-c, text; CHENU 1843 : 3, pl. 22, figs. 3, 3a-b; CHENU 1862 : 184, figs. 925-926.

Type locality: "Les mers australes et de la Nouvelle Hollande. *Péron*". [Only known from southern Australia, det. Dijkstra]

Type material:
Specimens cited : "Mus. n°." [MNHN], "Mon cabinet" [MHNG]
Size given : "Largeur [= width], 105 millimètres".

	H	W	D
1. MNHN, lectotype	101 mm	106 mm	32.5 mm
2. MNHN, paralectotype 1	96.5 mm	97.5 mm	28 mm
3. MNHN, paralectotype 2	82 mm	82.5 mm	25.5 mm
4. MNHN, paralectotype 3	60 mm	59 mm	21 mm
5. MHNG n° 1088/14/2, paral.	98.5 mm	100.5 mm	34.5 mm
illustr. DELESSERT (1841) : pl. 15, figs. 5a-c.			
illustr. CHENU (1843) : pl. 22, figs. 3, 3a-b.			
illustr. CHENU (1862) : figs. 925-926.			
6. MHNG n° 1088/14/1, ?paral.	106 mm	110 mm	32 mm

REMARKS :

Lamarck mentioned Péron in the original text, indicating that this material from southern Australia was collected by the French expedition (1800-1804) to Australia.

Although two specimens of *P. bifrons* are in the Lamarck collection (MHNG), having been isolated from the Delessert collection as Lamarck's specimens, only one was mentioned by Rosalie de Lamarck, and was figured by Delessert and Chenu.

CURRENT TAXONOMIC POSITION AND DISTRIBUTION :

P. bifrons Lamarck is the type species of *Equichlamys* Iredale (1929 : 162). This species occurs in shallow water off southern New South Wales, Tasmania and South Australia.

Pecten purpuratus Lamarck, 1819 (Figs. 9-11)

References:
LAMARCK, 1819 : 166, n° 11 (Orig. descr.); DESHAYES *in* Lamarck, 1836 : 134, n° 11; DELESSERT, 1841 : pl. 16, figs. 5a-c; CHENU, 1843 : 4, pl. 14, figs. 1-9; GRAU, 1959 : 103-105, pl. 34.

Type locality: "Les mers orientales et australes..... On le dit du Japon". Type locality designated by GRAU (1959 : 104) : Callao, Peru.

Type material:
Specimens cited : "Mus. n°. [MNHN], Mon cabinet" [MHNG]
Size given : "Largeur, 112 millimètres".

	H	W	D
1. MHNG n° 1088/20/2, lectotype	109 mm	114 mm	- (l.v.)
illustr. DELESSERT (1841) : pl. 16, fig. 5c.			
2. MHNG n° 1088/20/1, paralect.	66.5 mm	71 mm	24 mm
illustr. DELESSERT (1841) : pl. 16, figs. 5a-b.			
3. MNHN, paralectotype 1	87 mm	95 mm	- (r.v.)
4. MNHN, paralectotype 2	86 mm	90 mm	- (r.v.)

REMARKS :

The specimens in the Lamarck collection (1 complete specimen and 1 valve) correspond to the annotations made by Rosalie. The single left valve is closest to Lamarck's original measurement (112 mm), and is herein selected as lectotype. The paralectotypes are semi-adult specimens, and much smaller than the width mentioned by Lamarck.

CURRENT TAXONOMIC POSITION AND DISTRIBUTION :

The species is presently placed in *Argopecten* Monterosato, 1889, which is a senior synonym of *Plagioctenium* Dall, 1898. The geographical range is from Colombia to Chile, and living material is observed in shallow inshore waters on rocky and sandy bottoms.

Pecten lineolaris Lamarck, 1819 (Figs. 12-16)

References:
LAMARCK, 1819 : 166, n° 12 (Orig. descr.); DESHAYES *in* Lamarck, 1836 : 134, n° 12; DELESSERT, 1841 : pl. 15, figs. 3a-b, text; CHENU, 1843 : 4, pl. 15, figs. 1, 1a-b.

Type locality: unknown.

Type material:
Specimens cited : "Mon cabinet" [MHNG]
Size given: "Largeur, 26 ou 27 millimètres".

	H	W	D
1. MHNG n° 1088/21, holotype	25 mm	26.5 mm	13.5 mm
illustr. DELESSERT (1841) : pl. 15, figs. 3a-b.			
illustr. CHENU (1844) : pl. 15, figs. 1, 1a-b.			

REMARKS :

MERMOD isolated the type, a complete specimen from the Delessert collection, and it was also mentioned by Rosalie in the margin of Lamarck's personal copy. This holotype is illustrated by DELESSERT (1841) and CHENU (1844).

CURRENT TAXONOMIC POSITION AND DISTRIBUTION :

This species is placed in *Argopecten* Monterosato, 1889. *Aequipecten mayaguezensis* Dall & Simpson, 1901 is a junior synonym (ABBOTT, 1974 : 445). The geographical distribution is from SE Florida to the Caribbean region, and living specimens are observed from littoral depths on sandy or muddy sand bottoms.

Pecten rastellum Lamarck, 1819 (Figs. 17-26)

References:
LINNAEUS, 1758 : 698, n° 196? (sic, = 166?); LAMARCK, 1819 : 166-167, n° 14 (Orig. descr.); DESHAYES *in* LAMARCK, 1836 : 135, n° 14; DELESSERT, 1841 : pl. 16, figs. 1a-b, 2a-b, text; CHENU, 1844 : 5, pl. 15, figs. 2, 2a-b, 4, 4a.

Type locality: "Les mers du nord".
Lamarck's indication of locality is very confusing, as it could be either the northern Atlantic Ocean or the northern Pacific Ocean. This species does not exist in either region. Therefore a new type locality is here designated: Off Punta Engano, Mactan, Cebu, Philippines (ZMA coll.).

Type material:
Specimen cited : "Mon. cab." [MHNG]
Size given : "Largeur, 34 millimètres".

	H	W	D
1. MHNG n° 1088/24, holotype	32.5 mm	34.5 mm	8.5 mm

white specimen (large).
illustr. DELESSERT (1841) : pl. 16, figs. 2a-b.
illustr. CHENU (1845) : pl. 15, figs. 2, 2a-b.

Other material:
- *Pecten rastellum* var. [b] Lamarck [= *Pecten mirificus* Reeve, 1853][MHNG n° 1088/23, Lamarck collection] , red specimen (W= 32 mm) (figs. 22-26).
illustr. DELESSERT (1841) : pl. 16, figs. 3a-b.
illustr. CHENU (1845) : pl. 15, figs. 3, 3a.
- *Pecten rastellum* Lamarck [MHNG, Delessert collection]
(W= 46 mm).
illustr. DELESSERT (1841) : pl. 16, figs. 1a-b.
illustr. CHENU (1845) : pl. 15, figs. 4, 4a.

REMARKS :

In Lamarck's collection, there was one complete specimen, matching Lamarck's measurement cited in the text, and one complete specimen of var. [b], in agreement with Rosalie's marginal annotations. Although MERMOD treated *P. ratellum* var. "beta" as a type in his manuscript cardfile (MHNG), I.C.Z.N. (1985) article 72 (b)(i) clearly states that varieties mentioned by a letter should be excluded from the type series. In addition, the specimens and the original labels of Lamarck were reversed before MERMOD's registration, so that the holotype, which is the white

specimen 34.5 mm wide (MHNG 1088/24) was erroneously labelled and filed as the "var. [b]" in the Lamarck collection, while the smaller red specimen representing the true variety [b] (MHNG 1088/23), which is similar to *Pecten mirificus* Reeve, 1853, was erroneously labelled as the type of the nominal species. The MHNG registration numbers mentioned here are written on the inner side of the specimens.

CURRENT TAXONOMIC POSITION AND DISTRIBUTION :

DAUTZENBERG & BAVAY (1912 : 9) synonymized *P. rastellum* with *Ostrea squamata* Gmelin, 1791, which is similar to *Ostrea imbricata* Gmelin, 1791 (DIJKSTRA, 1991 : 48), and does not have the conchological features of *P. rastellum.*

Pecten amaliae Kobelt, 1887 is a junior synonym of *P. rastellum.*

Comptopallium spiceri described by REHDER (1944 : 52) from the Line Islands is also very similar to *P. rastellum*, and could be a geographic variant. Material observed from the Red Sea (ZMA, ZMK) belongs to a new subspecies of *P. rastellum* (DIJKSTRA & KNUDSEN, in prep.).

The recent species is presently placed in *Mirapecten* Dall, Bartsch & Rehder, 1938, a genus in the tribe Decatopectinini Waller, 1986.

P. rastellum ranges throughout the western, southwestern and central Pacific. Live specimens are found on sandy bottoms, usually attached by byssal threads to corals or coral rubble in littoral to sublittoral depths.

Pecten flagellatus Lamarck, 1819 (Figs. 27-31)

References:
LAMARCK, 1819 : 167, n° 16 (Orig. descr.); DESHAYES in Lamarck, 1836 : 135, n°16; DELESSERT, 1841 : pl. 16, figs. 4a-b, 7a-b, text; CHENU, 1844 : 5, pl. 16, figs. 1, 1a-b, 2, 2a, 3, 4, 4a-b, 5, 6, 6a.

Type locality: "La Méditerranée, dans le golfe de Tarente".

Type material:
Specimens cited : "Mon cabinet" [MHNG]
Size given : "Largeur, 24 millimètres".

	H	W	D
1. MHNG n° 1088/27, lectotype	23 mm	25 mm	- (l.v.)
illustr. DELESSERT (1841) : pl. 16, figs. 7a-b.			
2. MHNG n° 1088/27, paralect.	22 mm	24 mm	- (l.v.)

REMARKS :

Although Rosalie mentions two complete specimens, only two left valves are now in the Lamarck collection. The right valves could not be traced in the collection of Delessert. MERMOD had noted this discrepancy in his cardfile by a handwritten annotation, and had some doubts about the specimens selected from the Delessert collection, according to Lamarck's description, especially on the basis of the radial costae mentioned: "radiis quinque convexiusculis" (the selected specimens have 10 radial costae).

However, material of *Flexopecten hyalinus* (Poli, 1795) observed in the systematic collections of MNHN and ZMA shows a very variable sculpture, from a

nearly smooth surface with very weak radial costae (approximately ten), to more prominent (three of five, with intermediate radial riblets). Lamarck's description of the coloration matches better *F. hyalinus* than *Flexopecten flexuosus* (Poli, 1795), and corresponds to the colour of the largest left valve, which is therefore designated as lectotype.

CURRENT TAXONOMIC POSITION AND DISTRIBUTION :

P. flagellatus is similar to *Ostrea hyalina* Poli, 1795, and should be considered a junior synonym of that species. In the literature, many synonyms are known for *F. hyalinus*, because of the variability of this species and some similarity with the polymorphic species *Flexopecten glabe*r (Linnaeus, 1758) and *Flexopecten flexuosus* (Poli, 1795).

WALLER (1986 : 40) placed *Lissopecten* Verrill, 1897 in the synonymy of *Flexopecten* Sacco, 1897, which is a representative genus of the tribe Decatopectinini Waller, 1986.

F. hyalinus is known throughout the Mediterranean Sea and is attached with its byssus to corals, seaweeds or sponges, in littoral to sublittoral depths.

Pecten aspersus Lamarck, 1819 (Figs. 32-36)

References:
MÜLLER, 1776 : 25, pl. 60, figs. 1, 2; CHEMNITZ, 1784 : pl. 63, figs. 601, 602; SCHRÖTER, 1786 : 324, n° 5; GMELIN, 1791 : 3318, n° 10?, 3326, n° 56; CHEMNITZ, 1795 : 265, pl. 207, fig. 2043; BRUGUIERE, 1797 : pl. 212, fig. 6; DILLWYN, 1817 : 251, n° 9, 264, n° 38; LAMARCK, 1819 : 167, n° 17 (Orig. descr.); DESHAYES *in* Lamarck, 1836 : 136, n° 17; CHENU, 1844 : 5, pl. 16, figs. 7, 7a-b, 8, 9.

Type locality: unknown.

Type material:
Specimen cited : "Mon cabinet". [MHNG]
Size given : "Largeur, 38 millimètres".

	H	W	D
1. MHNG n° 1088/28, holotype	38 mm	38 mm	10 mm

?illustr. BRUGUIERE (1797) : pl. 212, fig. 6. The size of this illustration matches the size of the holotype, but the drawing is different.
illustr. CHENU (1844) : pl. 16, figs. 7, 7a-b.

REMARKS :

According to Rosalie's annotation, only one complete specimen was in her father's collection, and isolated by MERMOD from the Delessert collection as Lamarck's type specimen.

DESHAYES (1836) added many references to *P. aspersus* and noted : "Nous rapportons à cette espèce l'*Ostrea hybrida* de Gmelin en supprimant de sa synonymie la citation d'une figure de Lister, copiée par Klein, et représentant une espèce toute différente de celle de Chemnitz; nous ajoutons à notre synonymie le *Pecten danicus* de Chemnitz, lequel, selon nous, serait une variété à taches nombreuses de son *Pseudamusium*. C'est ce *Pecten danicus* qui, figuré dans l'Encyclopédie, a été nommé

aspersus par Lamarck. Il conviendra plus tard de rendre à cette espèce le nom de *pseudamusium* que Chemnitz, le premier, lui imposa".

However, *O. hybrida* Gmelin is in all conchological features similar to *Lissochlamis exotica* (Dillwyn, 1817) and different from Chemnitz' illustration (pl. 63, figs. 601, 602), which is *Pseudamussium septemradiatum* (Müller, 1776). GRAU (1959 : 57-63) detailed the differences, analysing the references concerning *O. hybrida*. *Ostrea triradiata* (sic) Müller is a synonym of *Palliolum tigerinum* (Müller, 1776) and also different from the holotype. Only the illustrations of CHEMNITZ (1795) (pl. 207, fig. 2043) and BRUGUIERE (1797) (pl. 212, fig. 6) clearly correspond to Lamarck's type. The other references used by DESHAYES are not relevant.

CURRENT TAXONOMIC POSITION AND DISTRIBUTION :

P. aspersus Lamarck is in all conchological characters similar to *Pseudamussium septemradiatum* (Müller, 1776) and therefore a junior synonym of the latter species. Many other synonyms and variations are known in the literature (SABELLI *et al.*, 1990 : 290; WAGNER, 1991 : 14). This species is distributed throughout the eastern Atlantic from the Arctic region to northwest Africa, and also in the western Meditteranean Sea. Live specimens are found on silty bottoms with sediments in sublittoral to bathyal depths.

Pecten flavidulus Lamarck, 1819 (Figs. 37-39)

References:
CHEMNITZ, 1784 : pl. 67, fig. 638 ?; LAMARCK, 1819 : 167, n° 18 (Orig. descr.); DESHAYES *in* Lamarck, 1836 : 136, n° 18; CHENU, 1844 : 5, pl. 16, figs. 10, 10a-b, 11, 11a.

Type locality: "Habite l'Océan atlantique, la Méditerranée". [living only in the Mediterranean Sea, det. Dijkstra].

Type material:
Specimens cited : "Mon cabinet". [MHNG]
Size given : "Largeur, 33 millimètres".

	H	W	D	
1. MHNG n° 1088/29/3, lectotype	32 mm	32 mm	-	(l.v.)
2. MHNG n° 1088/29/1, paralect.	23 mm	23 mm	9 mm	
3. MHNG n° 1088/29/2, paralect.	25.5 mm	26.8 mm	10 mm	
4. MHNG n° 1088/29/4, questionable paralectotype?	28 mm	31 mm	-	(r.v.)

REMARKS :

The 4 specimens of Lamarck isolated from the Delessert collection do not correspond entirely to the indication made by Rosalie de Lamarck : "2 entiers et une valve". The largest left valve is closest to the size given by Lamarck, and it matches the original description; it is therefore designated herein as lectotype.

Lamarck cited CHEMNITZ' fig. 638 of plate 67, which refers to *Ostrea solaris* Born, 1778 [*nomen dubium*]. In the original French description, Lamarck mentioned the similarity with *Ostrea citrina* Poli, 1795 (pl. 28, fig. 15), a junior synonym of *Flexopecten glaber* (Linnaeus, 1758).

CURRENT TAXONOMIC POSITION AND DISTRIBUTION :

P. flavidulus is a junior synonym of *Flexopecten glaber* (Linnaeus, 1758). The latter is a polymorphic species from the Mediterranean Sea, bearing many synonyms in the literature. WALLER (1986 : 40) placed *Flexopecten* Sacco, 1897 in the tribe Decatopectinini.

Living specimens are found on sandy, muddy sand or muddy bottoms amongst seaweed, in littoral to sublittoral depths.

Pecten sulcatus Lamarck, 1819 (Figs. 40-44)

References:
FAVANNE, J. de & J.G. de, 1780 : pl. 54, fig. L3; CHEMNITZ, 1784 : pl. 67, fig. 641?; LAMARCK, 1819 : 168, n° 21 (Orig. descr.); PAYRAUDEAU, 1826 : B.C., *Cat.*: 72, n° 134; DESHAYES *in* Lamarck, 1836 : 137-138, n° 21; CHENU, 1844 : 6, pl. 20, figs. 1, 1a, 2, 2a-b, 3, 3a-b, 4, 4a-b, 5, 5a-b; pl. 39, figs. 8, 9, 9a-b.

Type locality: "Habite dans la Méditerranée, au golfe de Tarente".

Type material:
Specimens cited : "Mus. n°. [MNHN], Mon cabinet" [MHNG]
Size : not indicated.

	H	W	D
1. MHNG n° 1088/40/1, lectotype	24.5 mm	25 mm	10 mm
2. MHNG n° 1088/40/2, paralect.	23.5 mm	23.5 mm	8 mm
3. MNHN, paralectotype	39 mm	37 mm	12 mm

Other material: *Pecten sulcatus* var. [b] Lamarck

MHNG n° 1088/39	17 mm	16 mm	- (l.v.)

REMARKS :

Although Rosalie's annotation states : "3 entiers et 2 valves", only two complete specimens from Lamarck were isolated from the Delessert collection. Perhaps other specimens still remain in this collection, but they could not be traced so far.

One specimen is preserved in the type collection of the MNHN, with an original label of Lamarck, but with no locality. It differs from the other type material of the MHNG, and is similar to *Bractechlamys vexillum* (Reeve, 1853). The type specimens in the MHNG are accompagnied by a Lamarck's handwritten label, with the locality : "golphe de tarente".

NOMENCLATURAL STATUS :

P. sulcatus Lamarck is a primary homonym of *Pecten sulcatus* Müller, 1776. BORN (1778 : 86) described *Ostrea sulcata*, a junior synonym of *Flexopecten glaber* (Linnaeus, 1758). However, *Ostrea sulcata* Born of GMELIN (1791) is a synonym of *Ostrea pyxidata* Born, 1778, and this was already noticed by DILLWYN (1817 : 255). BOSC (1802) used the same reference of CHEMNITZ, as did GMELIN (1791), and *Pecten sulcatus* Bosc is also a synonym of *O. pyxidata* Born. *Pecten sulcatus* Sowerby I, 1823 is a fossil and is a junior synonym of *Aequipecten opercularis* (Linnaeus, 1758).

CURRENT TAXONOMIC POSITION AND DISTRIBUTION :

P. sulcatus Lamarck is a junior synonym of *Flexopecten glaber* (Linnaeus, 1758). For further details, see *P. flavidulus* Lamarck.

Pecten virgo Lamarck, 1819 (Figs. 45-49)

References:
GUALTIERI, 1742 : pl. 73, fig. H?; LAMARCK, 1819 : 168, n° 22 (Orig. descr.); PAYRAUDEAU, 1826 : 72, n° 136; DESHAYES *in* Lamarck, 1836 : 138, n° 22; CHENU, 1844 : 6, pl. 20, figs. 6, 6a, 7, 7a-b.

Type locality: "Habite la Méditerranée, au golfe de Tarente".

Type material:
Specimen cited : "Mon cabinet" [MHNG]
Size given : "Largeur, 44 millimètres".

	H	W	D
1. MHNG n° 1088/41, lectotype	44.8 mm	44 mm	13 mm (l.v.)
paralect.?	43.5 mm	44.5 mm	13 mm (r.v.)

REMARKS :

Rosalie mentioned one specimen, which is in the Lamarck collection. However, the left and right valves are somewhat dissimilar (see above), but fit well. It is possible that the right valve belongs to another specimen, but there is no other right valve in the Delessert collection corresponding to the left valve.

The fig. H of GUALTIERI cited by Lamarck refers indeed to *P. virgo*, and it was confirmed by examination of the author of GUALTIERI's specimen (Museo di Storia Naturale e del Territorio, Certosa di Calci (Pisa)).

CURRENT TAXONOMIC POSITION AND DISTRIBUTION :

P. virgo Lamarck is a junior synonym of *Flexopecten glaber* (Linnaeus, 1758). For further information, see *P. flavidulus* Lamarck.

Pecten unicolor Lamarck, 1819 (Figs. 50-54)

References:
KNORR, 1757 : pl. 8, fig. 5; REGENFUSS, 1758 : pl. 11, fig. 60; LAMARCK, 1819 : 169, n° 23 (Orig. descr.); SOWERBY, J. & G.B., 1823 : fig. 5; PAYRAUDEAU, 1826 : 75, n° 144; DESHAYES *in* Lamarck, 1836 : 138, n° 23; DESHAYES, 1836 : 724, n° 23? (sic) [= 720, n° 15?]; CHENU, 1844 : 6, pl. 20, figs. 8, 8a-b, 9, 9a-b.

Type locality: "Habite la Méditerranée".

Type material:
Specimens cited : "Mus. n°. [MNHN], Mon cabinet". [MHNG]
Size given : "Largeur de la coquille [a], 43 millimètres" (= "*lutea*").
number of specimens mentioned by Rosalie de Lamarck : 4.

	H	W	D
yellow specimens :			
1. MHNG n° 1088/44/1, lectotype	43 mm	44 mm	16.5 mm
2. MHNG n° 1088/44/2, paralect.	37.5 mm	38 mm	15.5 mm
3. MHNG n° 1088/44/3, paralect.	36.5 mm	38 mm	15 mm
pink specimens :			
MHNG n° 1088/43/1, paralect.?	39.5 mm	39.5 mm	13 mm
MHNG n° 1088/43/2, paralect.?	41 mm	40 mm	13.5 mm

May be one of these two latter (pink) specimens was originally in the "rubra" series (see hereunder) that, according to Rosalie, contained three specimens, and is not to be considered properly a type specimen (as being a "var. b") ?

Other material: *Pecten unicolor* var. [b] Lamarck (="*rubra*").
number of specimens mentioned by Rosalie de Lamarck : 3.

	H	W	D
MHNG n° 1088/42/1	50 mm	48.5 mm	16.5 mm
MHNG n° 1088/42/2	39 mm	40 mm	14 mm
MNHN	44.5 mm	45 mm	14 mm

REMARKS :

Lamarck distinguished two different colorations ("lutea" and "rubrâ") in the original description, and designated "rubrâ" as the var. [b], which has no type status (see above).

The coloration "lutea" refers to uniform yellow specimens (lot MHNG 1088/44), but the rose-red specimens are also isolated from the Delessert collection as being possibly Lamarck's specimens of the nominal species (lot MHNG 1088/43). The original label (with lot MHNG 1088/44) mentions "*pecten unicolor*. coq. [a]" without "var.". On the other hand, the other original label (lot MHNG 1088/42, orange-coloured specimens) clearly mentions "*pecten unicolor* var. [b] *rubra*", matching Lamarck's separation. Therefore, material labelled "[a]" can be recognized as type material, and a lectotype is here selected from among the yellow specimens.

CURRENT TAXONOMIC POSITION AND DISTRIBUTION :

Pecten unicolor Lamarck is a junior synonym of *Flexopecten glaber* (Linnaeus, 1758). For further information see *P. flavidulus* Lamarck.

Pecten griseus Lamarck, 1819 (Figs. 55-59)

References:
BRUGUIERE, 1797 : pl. 213, fig. 7?; DILLWYN, 1817 : 264-265, n° 140 (sic) [= 40]; LAMARCK, 1819 : 169, n° 24 (Orig. descr.); PAYRAUDEAU, 1826 : 73, n° 139; DESHAYES, 1832 : 720-721, n° 16; DESHAYES *in* Lamarck, 1836 : 138, n° 24; CHENU, 1844 : 6, pl. 21, figs. 1, 1a, 2, 2a, 3, 4, 4a, 5, 5a, 6, 6a.

Type locality: "Habite la Méditerranée".

Type material:
Specimens cited : "Mon cabinet". [MHNG]
Size : Not indicated.

	H	W	D
1. MHNG n° 1088/45/1, lectotype	36 mm	40 mm	13 mm
illustr. CHENU (1845): pl. 21, figs. 1, 1a.			
2. MHNG n° 1088/45/2, paralect.	28 mm	29 mm	10.5 mm
illustr. CHENU (1845): pl. 21, figs. 5, 5a.			
3. MHNG n° 1088/45/3, paralect.	26 mm	27.5 mm	11 mm

Other material: *Pecten griseus* var. [b] Lamarck

MHNG n° 1088/46	41 mm	43.5 mm	17.5 mm
illustr. CHENU (1845) : pl. 21, figs. 6, 6a.			

REMARKS :

Lamarck also mentioned a "var. [c]", but although Rosalie's marginal annotation cites two complete specimens plus one valve for this variety [c], no specimen could be isolated from the Delessert collection. It is possible that these specimens are still in the Delessert collection, but it seems impossible to trace them. A specimen illustrated by CHENU (1845 : pl. 21, figs. 1, 1a) is here designated as lectotype.

CURRENT TAXONOMIC POSITION AND DISTRIBUTION :

Pecten griseus Lamarck is a junior synonym of *Flexopecten glaber* (Linnaeus, 1758). For further information see *P. flavidulus* Lamarck.

Pecten distans Lamarck, 1819 (Figs. 60-64)

References:
GUALTIERI, 1742 : pl. 74, figs. A, B; KNORR, 1757 : pl. 18, fig. 5; BRUGUIERE, 1797 : pl. 210, fig. 3?; LAMARCK, 1819 : 169, n° 25 (Orig. descr.); PAYRAUDEAU, 1826 : 73, n° 138; DESHAYES *in* Lamarck, 1836 : 139, n° 25; CHENU, 1844 : 6, pl. 21, figs. 11, 11a, 12, 12a, 13, 14.

Type locality: "Habite l'Océan atlantique" (sic) [= Mediterranean Sea, det. Dijkstra].

Type material:
Specimens cited : "Mus. n°. [MNHN], Mon cabinet". [MHNG]
Size given : "Largeur, 61 millimètres".

	H	W	D
1. MHNG n° 1088/47/2, lectotype	56 mm	61 mm	24 mm
2. MHNG n° 1088/47/1, paralect.	56 mm	58 mm	19.5 mm
3. MNHN , paralect. 1	47 mm	49 mm	20.5 mm
4. MNHN , paralect. 2	39 mm	39 mm	11.5 mm
5. MNHN , paralect. 3	38 mm	39 mm	11.5 mm

6. MNHN, paralectotypes: 3 complete specimens, 3 left valves and 4 right valves (juveniles).

REMARKS :

Although Rosalie mentioned the presence of three specimens, at present the Lamarck collection contains only two specimens with two original labels glued on a plate ("*pecten distans*." and "*distans*", the latter name having probably been written by Rosalie, as suggested by the handwriting of her annotations and letter to her sister (see above)). The third specimen of Lamarck could still be present in the Delessert

collection, but it could not be traced. The largest specimen present, which matches Lamarck's size indication, is here selected as lectotype.

The type collection of the MNHN contains two type lots, respectively with semi-adult and juvenile specimens; they are glued on cardboards, with an original label of Lamarck on the back of each of them. Additional notes on cardfiles of *P. distans* Lamarck are prepared by Dr B. Métivier (MNHN).

CURRENT TAXONOMIC POSITION AND DISTRIBUTION :

Pecten distans Lamarck is a junior synonym of *Flexopecten glaber* (Linnaeus, 1758). For further information see *P. flavidulus* Lamarck.

Pecten isabella Lamarck, 1819 (Figs. 65-69)

References:
LAMARCK, 1819 : 169, n° 26 (Orig. descr.); DESHAYES *in* Lamarck, 1836 : 139, n° 26; DELESSERT, 1841 : pl. 16, figs. 8a-b, 9, text; CHENU, 1844 : 6, pl. 21, figs. 7, 7a, 8, 9, 10, 10a.

Type locality: "Habite la Méditerranée, dans le golfe de Tarente".

Type material:
Specimens cited : "Mon cabinet". [MHNG]
Size given : "Largeur, 18 millimètres".

	H	W	D
1. MHNG n° 1088/48/1, lectotype	17.5 mm	18 mm	5 mm
illustr. DELESSERT (1841) : pl. 16, figs. 8a-b.			
illustr. CHENU (1845) : pl. 21, figs. 7, 7a.			
2. MHNG n° 1088/48/2, paralect.	15 mm	15.5 mm	4 mm
illustr, DELESSERT (1841) : pl. 16, fig. 9.			
illustr. CHENU (1845) : pl. 21, fig. 8.			

REMARKS :

The presence of two specimens in the Lamarck collection of the MHNG is in agreement with Rosalie's annotation. The largest specimen is here selected as lectotype.

CURRENT TAXONOMIC POSITION AND DISTRIBUTION :

P. isabella Lamarck is a junior synonym of *Flexopecten flexuosus* (Poli, 1795). This species is distributed throughout the Mediterranean Sea and the adjacent region of the eastern Atlantic Ocean. Living material is observed from littoral to sublittoral depths between seaweed, coral rubble or rocks, on muddy or sandy bottoms.

Pecten tigris Lamarck, 1819 (Figs. 70-74)

References:
CHEMNITZ, 1784 : pl. 64, fig. 608?; LAMARCK, 1819 : 171, n° 30 (Orig. descr.); DESHAYES in Lamarck, 1836 : 141, n° 30; CHENU, 1844 : 7, pl. 27, figs. 3, 3a, 4, 4a.

Type locality: "Habite..... l'Océan indien?"

Type material:
Specimens cited : "Mus. n°". [MNHN]

Size : Not indicated.

	H	W	D
1. MNHN, lectotype	43 mm	38 mm	13 mm
2. MNHN, paralectotype	39.5 mm	34 mm	11 mm

REMARKS :

No locality is provided on the original label, which is glued on the back of a cardboard plate, but the original description mentioned "l'Océan indien", with a questionmark. This locality is correct for *P. tigris*. An illegible inkwritten mark (311 or 34?) is present on the inner side of the left valve of the lectotype.

CURRENT TAXONOMIC POSITION AND DISTRIBUTION :

A possible senior synonym of *P. tigris* is *Ostrea flavicans* Linnaeus, 1758 (WALLIN, 1991 : 151), and this will be discussed elsewhere. *P. tigris* is placed in *Semipallium* (Jousseaume) LAMY, 1928.

The distribution of *S. tigris* (Lamarck) is throughout the Indo-Pacific. Living specimens are observed attached by their byssus under coral boulders or between coral rubble on sandy bottoms at littoral depths.

Pecten opercularis luteus Lamarck, 1819 (Figs. 75-78)

References:
DA COSTA, 1778 : pl. 9, fig. 5; LAMARCK, 1819 : 172, sp. 34 [a] (Orig. descr.); DESHAYES, 1832: 723, sp. 22 var. a.

Type locality: not indicated.

Type material:
Specimens cited : "Mon cabinet". [MHNG]
Size : not indicated.

	H	W	D
1. MHNG n° 1088/59/1, lectotype	58.5 mm	62.5 mm	21 mm
2. MHNG n° 1088/59/2, paralect.	52 mm	55.5 mm	19.5 mm
3. MNHN, paralectotype?	59 mm	63.5 mm	19 mm

REMARKS :

Although the original description cited only "Mon cabinet" [MHNG], one specimen with Lamarck's label ("*p. opercularis* [a]") is in the Lamarck collection of the MNHN.

Rosalie's marginal annotation cited "2 ent. et une valve.", but actually two complete specimens are in the Lamarck collection of the MHNG, together with the original labels. The specimen (MHNG 1088/59/1) is herein selected as lectotype.

NOMENCLATURAL STATUS :

Pecten opercularis luteus Lamarck and *Pecten opercularis albopurpurascens* Lamarck are nominal taxa, whereas *Pecten opercularis rufus* Lamarck is a *nomen nudum* (no description, nor a bibliographic reference)(ICZN, 51D, G).

Although Lamarck used [a] and [b] for these taxa, he clearly indicated the differences with *P. opercularis* var. [d].

P. opercularis luteus Lamarck is a junior homonym of *Pecten luteus* Bosc, 1802.

CURRENT TAXONOMIC POSITION AND DISTRIBUTION :

Pecten opercularis luteus Lamarck is a junior synonym of *Ostrea opercularis* Linnaeus, 1758. This taxon is now placed in *Aequipecten* P. Fischer, 1886.

The distribution of *A. opercularis* (Linnaeus) is throughout the eastern Atlantic from Norway to northwest Africa, and the Mediterranean Sea. Living specimens are observed from littoral to bathyal depths on muddy or sandy bottoms.

Pecten opercularis albopurpurascens Lamarck, 1819 (Figs. 79-82)

References:
LISTER, 1687 : 190, fig. 27; PENNANT, 1777 : 186, pl. 60, fig. 63; CHEMNITZ, 1784 : pl. 67, fig. 646; LAMARCK, 1819 : 172, sp. 34 [b] (Orig. descr.); DESHAYES, 1832 : 723, sp. 22, var. b.

Type locality: not indicated.

Type material:
Specimens cited : not indicated.
Size : not indicated.

	H	W	D
1. MHNG n° 1088/54/1, lectotype	38.5 mm	39 mm	13 mm
2. MHNG n° 1088/54/2, paralect.	33 mm	33 mm	10.5 mm
3. MHNG n° 1088/57 , paralect.	63.5 mm	70 mm	25.5 mm
4. MNHN, paralectotype 1	65 mm	69.5 mm	21.5 mm
5. MNHN, paralectotype 2	54 mm	58 mm	20 mm
6. MNHN, paralectotype 3	52 mm	53 mm	18 mm

REMARKS :

Although Rosalie's marginal annotation mentioned six specimens, only three are in the Lamarck collection, isolated from the Delessert collection of the MHNG as Lamarck's specimens. Other specimens could not be traced, because of lack of sufficient indications. For the 3 paralectotypes in the MNHN, the locality "de la Méditerranée" is indicated on the cardboard; the larger specimen (65 x 69.5 mm) has a small label glued on the inner side of the left valve, showing the number 128.

NOMENCLATURAL STATUS :

See *P. opercularis luteus* Lamarck.

CURRENT TAXONOMIC POSITION AND DISTRIBUTION :

P. opercularis albopurpurascens Lamarck is a junior synonym of *Ostrea opercularis* Linnaeus, 1758. For further information on distribution, see *P. opercularis luteus* Lamarck.

Pecten flabellatus Lamarck, 1819 (Figs. 83-87)

References:
LAMARCK, 1819 : 172, n° 36 (Orig. descr.); DESHAYES *in* Lamarck, 1836 : 143, n° 36.

Type locality: not indicated. However, on the back of the cardboard plate, Rousseau has mentioned: "des Mers de la Nouvelle Hollande par Péron et Lesueur 1803". On the front of the same cardboard plate: "Des Mers Australes par Péron et Lesueur 1803" is indicated. Designation of the type locality is herein: Shark Bay, W. Australia (see CORNELL, 1974 : 510). The conchological features of the observed material from that locality (WAM coll.) is similar to the type series.

Type material:
Specimens cited : "Mus. n°". [MNHN]
Size given : "Largeur, 73 millimètres".

	H	W	D
1. MNHN, lectotype	64.5 mm	73 mm	22 mm
2. MNHN, paralectotype	60 mm	65 mm	19 mm

CURRENT TAXONOMIC POSITION AND DISTRIBUTION :

P. flabellatus is placed in *Annachlamys* Iredale, 1939 (Dijkstra, 1991 : 42), an extant genus in the Decatopectinini Waller, 1986. Synonyms of *A. flabellata* (Lamarck) are *Pecten leopardus* Reeve, 1853 and *Annachlamys melica* Iredale, 1939.

The distribution of this species is western, northern and eastern Australia, and Indonesia. Living material is observed on sandy or muddy sand bottoms in littoral depths.

Pecten irradians Lamarck, 1819 (Figs. 88-92)

References:
LAMARCK, 1819 : 173, n° 37 (Orig. descr.); DESHAYES *in* Lamarck, 1836 : 143-144, n° 37; DELESSERT, 1841 : pl. 15, figs. 4a-b, text; CHENU, 1844 : 8, pl. 30, figs. 10, 10a-b, 11, 11a-b.

Type locality: not indicated; designated by A.H. Clarke Jr. (1965 : 177). Waquoit Bay, 7 mi. NE of Falmouth, Massachusetts, USA.

Type material:
Specimens cited : "Mon cabinet". [MHNG]
Size given : "Largeur, 74 millimètres".

	H	W	D
MHNG n° 1088/61/1, lectotype	70 mm	74 mm	38 mm
illustr. DELESSERT (1841) : pl. 15, figs. 4a-b.			

Other material:

MHNG n° 1088/61/2	63.5 mm	72.5 mm	24 mm
illustr. CHENU (1845) : pl. 30, figs. 10, 10a-b.			

REMARKS :

Rosalie's marginal annotation mentions one specimen, but there are two specimens isolated from the Delessert collection. The larger specimen, figured by DELESSERT (1841) matches Lamarck's measurement, and is here selected as lectotype. The smaller specimen, figured by CHENU (1845), corresponds neither with Lamarck's

measurement nor with Rosalie's annotation, and is not considered a type specimen. According to ICZN art. 74 a(v), the designation of the smaller specimen as lectotype by CLARKE (1965 : 176) is invalid.

CURRENT TAXONOMIC POSITION AND DISTRIBUTION :

P. irradians is placed in *Argopecten* Monterosato, 1889. For further information on synonymy and distribution, see CLARKE (1965).

Pecten dispar Lamarck, 1819 (Figs. 93-97)

References:
LAMARCK, 1819 : 173, n° 40 (Orig. descr.); DESHAYES *in* Lamarck, 1836 : 144-145, n° 40, 154-155, n° 60; DELESSERT, 1841 : pl. 15, figs. 2a-b, text; CHENU, 1844 : 8, pl. 31, figs. 1, 1a-b, 2, 2a-b, 3, 3a-b.

Type locality: not indicated.

Type material:
Specimens cited : "Mon cabinet" [MHNG]
Size given : "Largeur, 34 millimètres".

	H	W	D
MHNG n° 1088/64/2, lectotype	31.5 mm	32 mm	- (l.v.)
illustr. DELESSERT (1841) : pl. 15, fig. 2a.			
illustr. CHENU (1845) : pl. 31, figs. 3, 3b (part).			
illustr. CHENU (1862) : fig. 929.			
MHNG n° 1088/64/1, paralect.	31.5 mm	31.5 mm	- (r.v.)
illustr. DELESSERT (1841) : pl. 15, fig. 2b.			
illustr. CHENU (1845) : pl. 31, figs. 3a, 3b (part).			

REMARKS :

Rosalie's marginal annotation mentions one complete specimen as described by Lamarck, but CHENU (1844 : 8) mentioned the erroneous identification by Lamarck: "Lamarck a été victime d'une fraude malheureusement trop connue des marchands. La valve inférieure et rayonnée de son Peigne inégal n'appartient pas à cette espèce, mais bien au *P. lineatus* de Dacosta; elle a été adroitement substituée à celle qui manquait et qui faisait ainsi perdre beaucoup de sa valeur à une coquille singulière par la disposition de ses taches. Ce n'est donc qu'après avoir étudié avec soin toutes les espèces d'un genre si nombreux que j'ai pu rectifier l'erreur de Lamarck, celle que j'ai fait commettre à M. Benj. Delessert dans le recueil de coquilles décrites par Lamarck, mais non figurées par les auteurs, et rendre à cette espèce le nom que lui avait imposé Klein". The two valves belong to different species. The left one is similar to *Ostrea exotica* Dillwyn, 1817, and the right one to *Ostrea opercularis* Linnaeus, 1758. The left valve is herein designated as lectotype.

NOMENCLATURAL STATUS :

GRAU (1959 : 57) described extensively the nomenclatural position of *O. exotica* Dillwyn, which is treated in a very confusing way in the literature. However, he mentioned *Ostrea hybrida* Gmelin, 1791 as the "first binominal and first valid name",

but this taxon corresponds to CHEMNITZ' illustrations (pl. 63, figs. 601, 602), which are similar to *Pecten septemradiatus* Müller, 1776, also in agreement with GMELIN's type locality and additional Latin description. Although LISTER's illustration (1696 : pl. 173, fig. 10) is obscure, it is more similar to *O. exotica* Dillwyn, and does not correspond to GMELIN's diagnosis at all. For homonymy and synonymy, see KÜSTER (1859 : 65) and GRAU (1959 : 63).

CURRENT TAXONOMIC POSITION AND DISTRIBUTION :

P. dispar Lamarck is a junior synonym of *O. exotica* Dillwyn, 1817, which is now placed in *Lissochlamis* Sacco, 1897 (MARSHALL, 1991 : 109, 111).

The distribution of *L. exotica* is off western Africa from Mauritius to Angola (NICKLES, 1955). Living specimens are observed on muddy or muddy sand bottoms in littoral depths.

Pecten quadriradiatus Lamarck, 1819 (Figs. 98-100)

References:
LAMARCK, 1819 : 173, n° 41 (Orig. descr.); DESHAYES *in* Lamarck, 1836 : 145, n° 41.

Type locality: not indicated.

Type material:
Specimen cited : "Mus. n°." [MNHN]
Size given : "Largeur, 18 millimètres".

	H	W	D
MNHN, holotype	21 mm	18.5 mm	- (r.v.)

REMARKS :

As DESHAYES (1836 : 145) already observed, the holotype is in poor condition and hard to identify. However, Bavay identified it as *Pecten subplicatus* var. *quadriradiatus* (see additional label). The specimen was collected during a French expedition to Australia (1800-1803), as mentioned in the original text : "Du voyage de Péron". However, no specimen with the same conchological features are recorded nor observed from Australia. It is possible that this specimen is an aberrant beach specimen collected in Indonesia, atypical for *Decatopecten plica* (Linnaeus, 1758).

CURRENT TAXONOMIC POSITION :

A right valve of *Decatopecten* sp.

Pecten asperrimus Lamarck, 1819 (Figs. 101-105)

References :
Lamarck, 1819 : 174, n° 43 (Orig. descr.); DESHAYES, 1832 : 725, n° 25; DESHAYES *in* Lamarck, 1836 : 145-146, n° 43; DELESSERT, 1841 : pl. 15, figs. 1a-b, text; CHENU, 1844 : pl. 33, figs. 1, 2, 3, 4, 5, 5a, 6.

Type Locality: "Habite les mers australes, à la Nouvelle Hollande [= Australia], les côtes de Diémen [= Tasmania] Péron et Le Sueur ".

Type material:
Specimens cited : "Mus. n°. [MNHN], Mon cabinet" [MHNG]
Size given : "Largeur de la coquille, 80 à 90 millimètres".

	H	W	D
1. MNHN, lectotype	98 mm	88.5 mm	34 mm
(covered by a sponge)			
2. MNHN, paralectotype 1	76 mm	74 mm	31 mm
3. MNHN, paralectotype 2	51.5 mm	48 mm	19.5 mm
(covered by a sponge)			
4. MNHN, paralectotype 3	41 mm	38.5 mm	14.5 mm
5. MHNG n° 1088/66/1, paralect.	43 mm	41 mm	16.5 mm
6. MHNG n° 1088/66/2, paralect.	39.5 mm	38 mm	15 mm
illustr. Chenu (1845) : pl. 33, figs. 1, 2.			
7. MHNG n° 1088/66/3, paralect.	45.5 mm	42 mm	17 mm
8. MHNG n° 1088/66/4, paralect.	33 mm	32 mm	- (l.v.)
9. MHNG n° 1088/66/4, paralect.	34 mm	31 mm	- (r.v.)
(n° 8 and n° 9 are of different individuals)			
10. MHNG n° 1088/66/5, paralect.	36.5 mm	35 mm	12 mm
11. MHNG n° 1088/66/6, paralect.	30 mm	28 mm	11.5 mm
illustr. Chenu (1845) : pl. 33, figs. 3, 4.			

Other material: *Pecten asperrimus* var. [b] Lamarck

MNHN	36 mm	34 mm	12 mm

REMARKS :

Although Rosalie mentioned four specimens, five complete plus one left valve and one right valve are in the Lamarck collection. It is possible that specimens of Lamarck and Delessert were mixed up in the past, but there is no sufficient evidence to recognize the specimens, as MERMOD indicated in his cardfile. The largest specimen in the MNHN, covered with a sponge (*Hymedesmia* sp., det. van Soest, ZMA), is here selected as lectotype.

CURRENT TAXONOMIC POSITION AND DISTRIBUTION :

P. asperrimus is the type species of *Mimachlamys* Iredale, 1929. *Mimachlamys* Iredale is now treated as an extinct genus. The relationship between this taxon and *M. australis* (Sowerby II, 1842) and *M. scabricostata* (Sowerby III, 1915) will be discussed elsewhere.

The distribution of *M. asperrima* is from Victoria to Western Australia. Living specimens are observed attached to rocks and covered by sponges in littoral depths.

Pecten aurantius Lamarck, 1819 (Figs. 106-110)

References:
VALENTIJN, 1754 : pl. 13, figs. 1-2; CHEMNITZ, 1784 : pl. 65, fig. 618?; SCHRÖTER, 1786 : 327, n° 11; GMELIN, 1791 : 3327, n° 62; DILLWYN, 1817 : 257, n° 22;
LAMARCK, 1819 : 175, n° 45 (Orig. descr.); DESHAYES *in* Lamarck, 1836 : 146-147, n° 45.

Type locality: "Habite ..... l'Océan indien?"

Type material:
Specimen cited : "Mus. n°". [MNHN]
Size given : "Largeur, 52 millimètres".

	H	W	D
MNHN, lectotype	56.5 mm	51 mm	22 mm

REMARKS :

Although the original description did not mention "Mon cabinet", Rosalie mentioned one specimen in the collection of her father. MERMOD isolated one specimen without any original label from the Delessert collection, but pointed out in his manuscript cardfile that this specimen was dubious and probably had no type status; moreover, this specimen is not similar to *P. aurantius* (see the cardfile of MERMOD, and the additional label of WALLER, 25.viii.79). *P. aurantius* is not described nor illustrated by DESHAYES (1832), DELESSERT (1841), or CHENU (1844-1845).

NOMENCLATURAL STATUS :

Lamarck overlooked *Pecten aurantius* Bosc, 1802, a primary homonym of *Ostrea aurantia* Gmelin, 1791. GMELIN only referred to REGENFUSS (1758 pl. 11, f. 56), whose figure is similar to *Ostrea glabra* Linnaeus, 1758. Therefore *O. aurantia* Gmelin is a junior synonym of *Flexopecten glaber* (Linnaeus). On the other hand, Lamarck compared his species with *Ostrea citrina* Gmelin, who referred to VALENTIJN (1754 : pl. 13, f. 1) and CHEMNITZ (1784 : pl. 65, f. 618) as did Lamarck himself, again with a questionmark. These illustrations show an *Ostrea senatoria* Gmelin, 1791, as already noticed by DILLWYN (1817 : 257, n° 22) and DESHAYES (1836 : 146).

CURRENT TAXONOMIC POSITION AND DISTRIBUTION :

P. aurantius Lamarck is a secondary homonym of *P. aurantius* Bosc, 1802, and a junior synonym of *Mimachlamys senatoria* (Gmelin, 1791).

M. senatoria (Gmelin) has a widespread geographic distribution throughout the Indo-Pacific. Living specimens are observed attached to coral boulders or rocks in littoral depths, and are sometimes covered by sponges, like *Mycale* sp. (Indonesia) or *Callyspongia* sp. (Red Sea) (det. van Soest, ZMA).

Pecten florens Lamarck, 1819 (Figs. 111-114)

References:
LAMARCK, 1819 : 175, n° 46 (Orig. descr.); DESHAYES *in* Lamarck, 1836 : 147, n° 46; DELESSERT, 1841 : pl. 15, figs. 6a-b, text.

Type locality: "Habite..... l'Océan indien?"

Type material:
Specimen cited : "Mon cabinet". [MHNG]
Size : Not indicated.

	H	W	D
MHNG n° 1088/70, holotype	48 mm	48 mm	16 mm

illustr. DELESSERT (1841) : pl. 15, figs. 6a-b.

REMARKS :

Rosalie mentioned one specimen, isolated from the Delessert collection as Lamarck's type specimen, and illustrated by DELESSERT (1841). On the inner side of both valves, the number 46 written in ink is faintly visible. No original label was traced. Lunel's label glued on the back of the cardboard plate refers to the second edition.

CURRENT TAXONOMIC POSITION AND DISTRIBUTION :

P. florens Lamarck is a junior synonym of *Mimachlamys senatoria* (Gmelin, 1791). For further information on distribution and ecology, see *P. aurantius* Lamarck.

Pecten ornatus Lamarck, 1819 (Figs. 115-119)

References:
LISTER, 1687 : 175, fig. minor; CHEMNITZ, 1784 : pl. 66, fig. 625; BRUGUIERE, 1797 : 214, fig. 5; LAMARCK, 1819 : 176, n° 50 (Orig. descr.); DESHAYES, 1832 : 726, n° 27; DESHAYES *in* Lamarck, 1836 : 150-151, n° 50; CHENU, 1845 : pl. 35, figs. 3, 3a, 4, 4a, 5, 5a, 6, 6a; WALLER, 1993 : 221-223, figs. 6q, r; 7b, e, h, k; 9a, b (designation of a lectotype).

Type locality: "Habite l'Océan atlantique austral".

Type material:
Specimens cited : "Mus. n°. [MNHN], Mon cabinet". [MHNG]
Size given : "Largeur, 28 millimètres".

	H	W	D
1. MHNG n° 1088/75, lectotype (designated by WALLER, 1993) illustr. CHENU (1845) : pl. 35, figs. 3, 3a.	32 mm	28.5 mm	10 mm
2. MHNG n° 1088/73/1, paralect. illustr. CHENU (1845) : pl. 35, figs. 2, 2a.	24 mm	22 mm	6 mm
3. MHNG n° 1088/73/2, paralect. illustr. CHENU (1845) : pl. 35, figs. 6, 6a.	23 mm	21 mm	7 mm
4. MHNG n° 1088/73/3, paralect.	20.5 mm	16 mm	7 mm
5. MHNG n° 1088/73/4, paralect.	18.5 mm	16 mm	4.5 mm
6. MHNG n° 1088/73/5, paralect.	17 mm	14.5 mm	5 mm
7. MNHN, paralectotype	36 mm	32.5 mm	12 mm

REMARKS :

Although Lamarck mentioned *Pecten ornatus* var. [b] with a question mark, there is no original label referring to that material. It is possible that the variety cited by Lamarck in his original text is included among the type specimens isolated from the Delessert collection. However, Rosalie made no annotation, and this would mean that Lamarck did not have or did not separate specimens of the variety [b] in his own collection. Among the material isolated (six specimens, though Rosalie mentioned only five ones) are also two other distinct species, i.e. *Pecten rubromaculatus* Sowerby II, 1842 (1088/73/1 and 1088/73/4), and *Ostrea multistriata* Poli, 1795 (1088/73/3), which are somewhat similar to *P. ornatus* Lamarck. Lamarck mentioned the resemblance between *P. ornatus* and *Ostrea pellucens* L. (Gmelin, 1791: n° 45 var. "beta" (non Lamarck)), and used the same reference as GMELIN, whose taxon is different from *Ostrea pellucens* Linnaeus, 1758. The latter is similar to *Ostrea*

imbricata Gmelin, 1791 or *Ostrea hyalina* Poli, 1795 (under study). The specimen closest in size to that given by Lamarck is here selected as lectotype.

CURRENT TAXONOMIC POSITION AND DISTRIBUTION :

P. ornatus Lamarck is now placed in the genus *Chlamys* Röding, 1798 (non KOCH, 1801). This species is distributed from Florida through the West Indies to Brazil. Living specimens are observed in littoral areas, among coral rubble or attached to coral boulders or rocks, on sandy bottoms in shallow water.

Pecten pellucidus Lamarck, 1819

References:
POLI, 1795 : pl. 28, fig. 7?; LAMARCK, 1819 : 176, n° 51 (Orig. descr.);
PAYRAUDEAU, 1826 : 73, n° 40 (sic, = 140); DESHAYES *in* Lamarck, 1836 : 151, n° 51.

Type locality: "Habite la Méditerranée".

Type material:
Specimen cited : "Mon cabinet". [MHNG]
Size given : "Largeur, 23 millimètres".

REMARKS :

No specimen showing sufficient peculiar conchological features, or accompanied by an original label, could be traced in the Delessert collection to be isolated as Lamarck's specimen.

The original description does not correspond to the reference to POLI cited by LAMARCK, (1795 : pl. 28, f. 7), which seems to refer to *Aequipecten opercularis* (Linnaeus, 1758), as already observed by DESHAYES (1836). Lamarck's description could refer to *Flexopecten hyalinus* (Poli, 1795), but this species has generally fewer radial riblets than mentioned in the original description.

CURRENT TAXONOMIC POSITION : uncertain.

Pecten miniaceus Lamarck, 1819 (Figs. 120-124)

References:
LAMARCK, 1819 : 177, n° 54 (Orig. descr.); DESHAYES *in* Lamarck, 1836 : 152, n° 54; Delessert, 1841 : pl. 16, figs. 6a-b, text.

Type locality: not indicated.

Type material:
Specimen cited : "Mon cabinet". [MHNG]
Size given : "Largeur, 21 millimètres".

	H	W	D
MHNG n° 1088/72, holotype	24.5 mm	21.5 mm	8 mm

illustr. DELESSERT (1841) : pl. 16, figs. 6a-b.

REMARKS :

Rosalie mentioned one specimen, which was isolated from the Delessert collection as Lamarck's type specimen, together with the original label of Lamarck.

On the inner side of the right valve, the number 54 (inked) is vaguely identifiable. The species was illustrated only by DELESSERT (1841).

CURRENT TAXONOMIC POSITION AND DISTRIBUTION :

P. miniaceus Lamarck is similar to *Mimachlamys gloriosa* (Reeve, 1853) known from the western and southwestern Pacific, and *Mimachlamys nobilis* (Reeve, 1852) from the Japanese waters. Conchological features of juvenile specimens of both species are hard to identify without accurate locality. Therefore the taxonomic position of *P. miniaceus* still remains rather uncertain.

Pecten lividus Lamarck, 1819 (Figs. 125-129)

References:
LAMARCK, 1819 : 178, n° 58 (Orig. descr.); QUOY & GAIMARD, 1835 : 445-446, pl. 76, figs. 4, 5, 6; DESHAYES *in* Lamarck, 1836 : 154, n° 58; CHENU, 1844 : 6, pl. 22, figs. 2, 2a-b.

Type locality: "Habite les mers de la Nouvelle Hollande, au port du Roi Georges" [= Albany, W. Australia].

Type material:
Specimen cited : "Mus. n°". [MNHN]
Size given : "Largeur, 45 millimètres".

	H	W	D
MNHN, holotype	47 mm	46 mm	15 mm

REMARKS :

According to Métivier's note on the cardfile, Lamarck's and Dufresne's handwritings are on the original label.

CURRENT TAXONOMIC POSITION AND DISTRIBUTION :

P. lividus Lamarck is the type species of *Scaeochlamys* Iredale, 1929, which is actually treated as a synonym or a subgenus of *Chlamys*, or may be an extinct genus (under study). *Azumapecten* Habe, 1977 is a synonym of *Scaeochlamys*.

Ostrea tegula Wood, 1828, *Pecten foliaceus* Quoy & Gaimard, 1835, and *Scaeochlamys livida peroniana* Iredale, 1939 are junior synonyms of *S. livida*.

Although there is no evidence from precise material, it is quite possible that this species was collected by Péron at the anchorage of the two French corvettes, "Le Geographe" and "Le Naturaliste" at King George Sound, during the period from February 18 till March 1, 1803 (see CORNELL, 1974 : 483).

Material of *P. foliaceus* is collected from the same locality.

S. livida is distributed throughout the southwestern Pacific to New Caledonia. Living material is observed attached to rocks or large sponges on muddy sand or sandy bottoms, inside lagoons or bays in shallow water (littoral). Specimens are sometimes covered by sponges.

Pecten hexactes Péron *in* Lamarck, 1819 (Figs. 130-132)

References:
LAMARCK, 1819 : 178, n° 59 (Orig. descr.); DESHAYES *in* Lamarck, 1836 : 154, n° 59.

Type locality: "Habite les mers de la Nouvelle Hollande, au port du Roi Georges" [= Albany, W. Australia].

Type material:
Specimen cited : "Mus. n°". [MNHN]
Size given : "Largeur, 35 millimètres".

	H	W	D
MNHN, holotype	30 mm	32 mm	- (r.v.)

REMARKS :

Péron's handwritten label: "Port du Roi George. *Pecten Hexactes*" is glued on Lamarck's label: "peigne à-six-rayons. *p. hexactes*" on the back of a cardboard plate. There was no description published for this species, as it was a manuscript name.

During the visit to King George Sound (see above), Péron collected many shells along the shore, as reported in Baudin's journal: " ... He has one or two cases of broken shells, for in several places along the shore one can shovel them up...." (CORNELL, 1974 : 494).

CURRENT TAXONOMIC POSITION AND DISTRIBUTION :

P. hexactes Péron *in* LAMARCK is a senior synonym of *Pecten tasmanicus* Adams & Angas, 1863 (= *Chlamys anguineus* Finlay, 1927), and actually provisionally placed in *Notochlamys* Cotton, 1930 (under study).

N. hexactes (Péron *in* LAMARCK) is distributed along the coast of southern Australia from south Western Australia to Victoria and Tasmania. Living specimens are littoral to sublittoral, and are observed among rubble in silty reefs or under rocks on sandy bottoms.

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RÉSUMÉ

Ce travail consiste en une révision des espèces de Pectinidae de Lamarck, avec un inventaire du matériel-type recensé au Muséum d'Histoire Naturelle de Genève et au Muséum National d'Histoire Naturelle à Paris.

LAMARCK, dans son volume 6 d'*Animaux sans vertèbres* (1819), a recensé et décrit 60 espèces de Pectinidae récents (1 espèce de *Pedum* et 59 espèces de *Pecten*). Vingt-neuf de ces espèces étaient décrites comme nouveaux taxa (4 sont des homonymes plus récents, 1 est un synonyme plus ancien, 11 sont des synonymes plus récents, 1 est un synonyme possible plus récent, 9 sont des taxa actuels, et 3 sont d'indentité incertaine).

Lamarck a validé 9 espèces non binominales et un nom manuscrit de Péron. Dix-neuf types primaires sont présents au Muséum d'Histoire Naturelle de Genève, et neuf au Muséum National d'Histoire Naturelle de Paris. La plupart des taxa de Lamarck ont été figurés par BRUGUIERE (1797), DELESSERT (1841), et CHENU (1844-1845, 1862); 7 taxa ne furent cependant pas illustrés. Deux lectotypes désignés antérieurement par FLEMING (1951) et CLARKE JR. (1965) sont rendus invalides, d'après l'art. 74 (a)(v) du Code de Nomenclature Zoologique; 20 lectotypes sont sélectionnés dans le présent travail, et 5 nouvelles localités-type sont attibuées. Dix-sept variétés nouvellement décrites par Lamarck ne sont pas des taxa valides, selon les termes de l'art. 72 (b)(i) du Code de Nomenclature Zoologique, et le matériel originel est présentement exclu du matériel-type proprement dit.

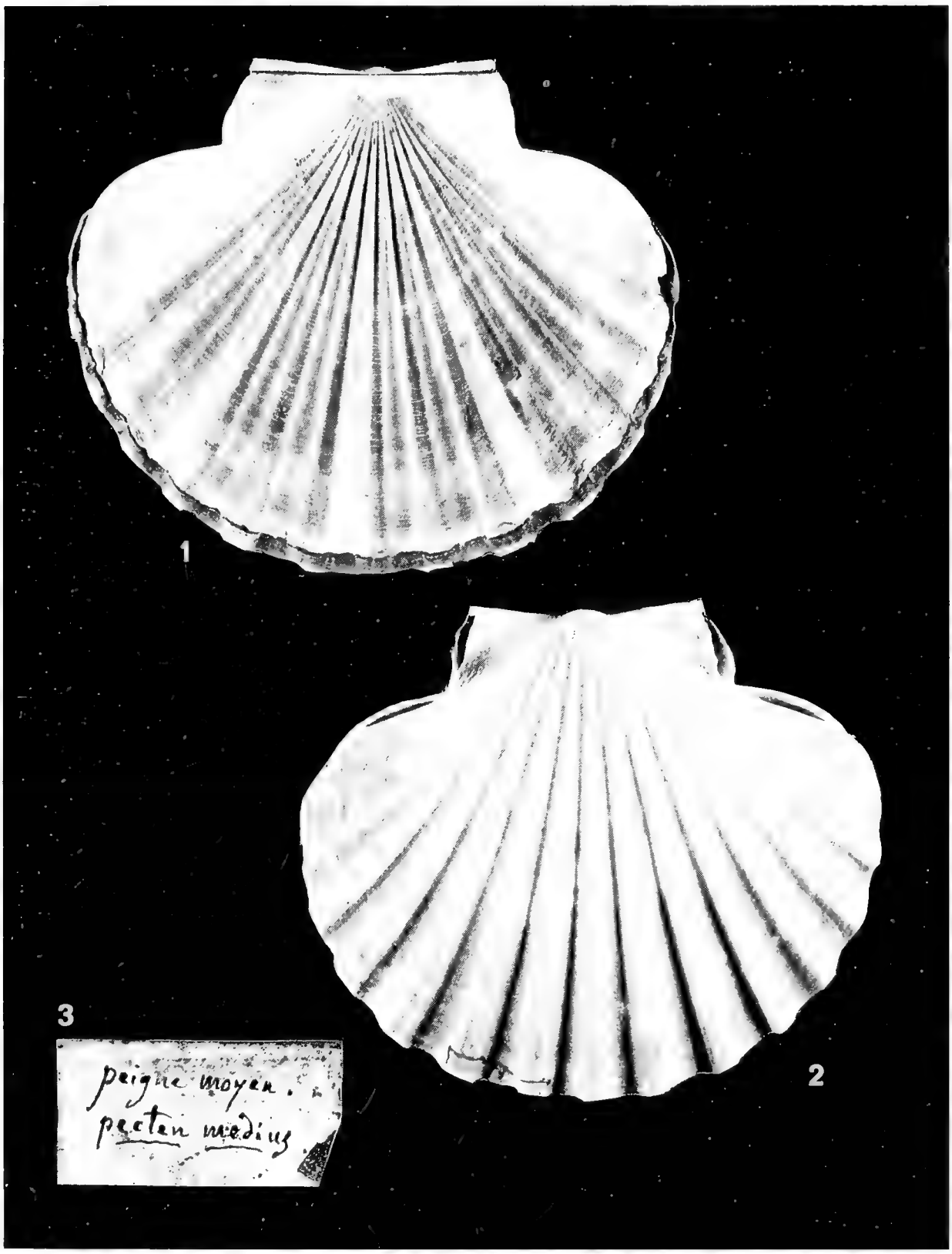

PLATE I

Pecten medius Lamarck, 1819. Lectotype MNHN (Paris); fig. 1 : left valve (exterior); fig. 2 : right valve (exterior); fig. 3 : original label of Lamarck.

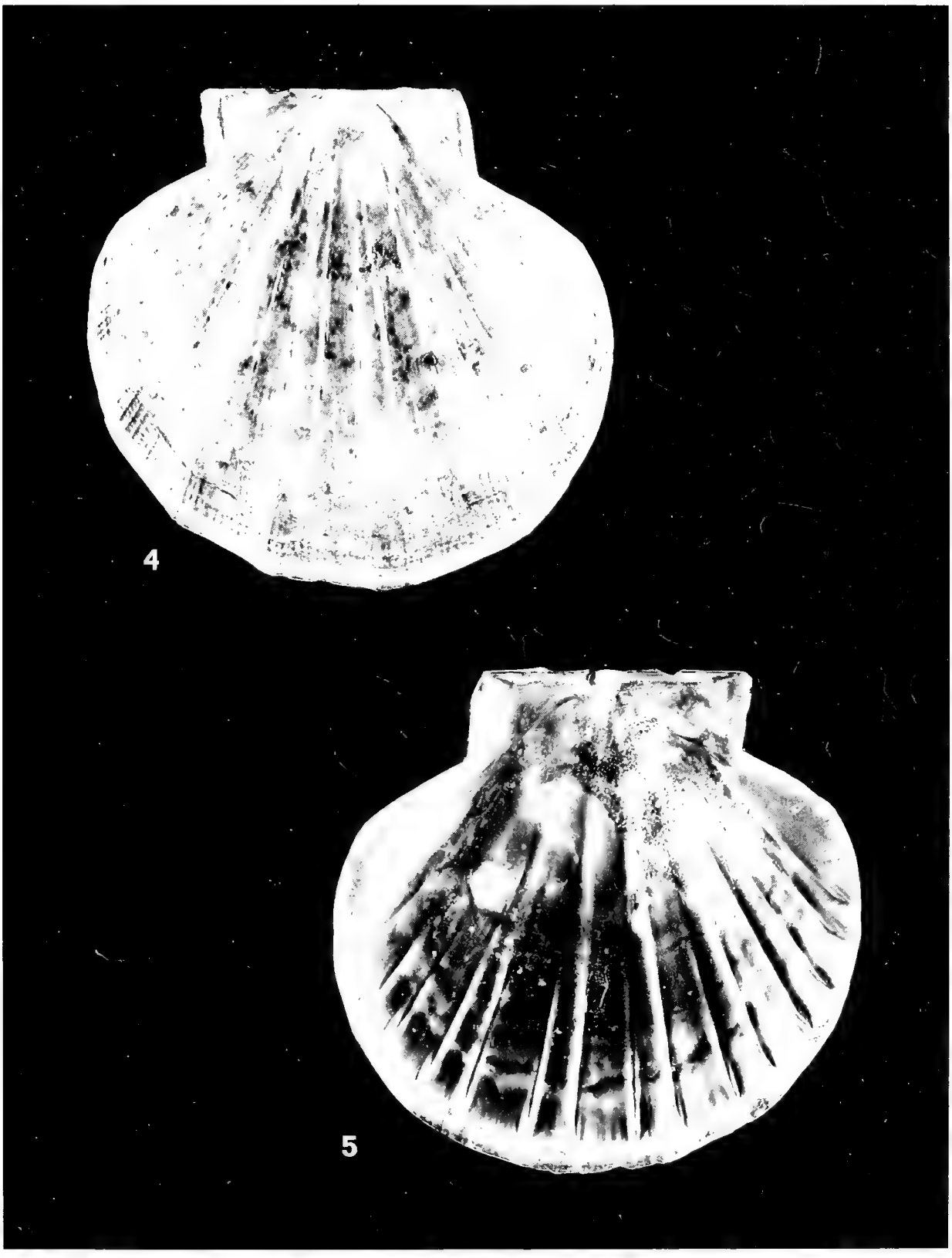

PLATE II

Pecten bifrons Lamarck, 1819. Lectotype MNHN (Paris); fig. 4 : left valve (exterior); fig. 5 : left valve (interior).

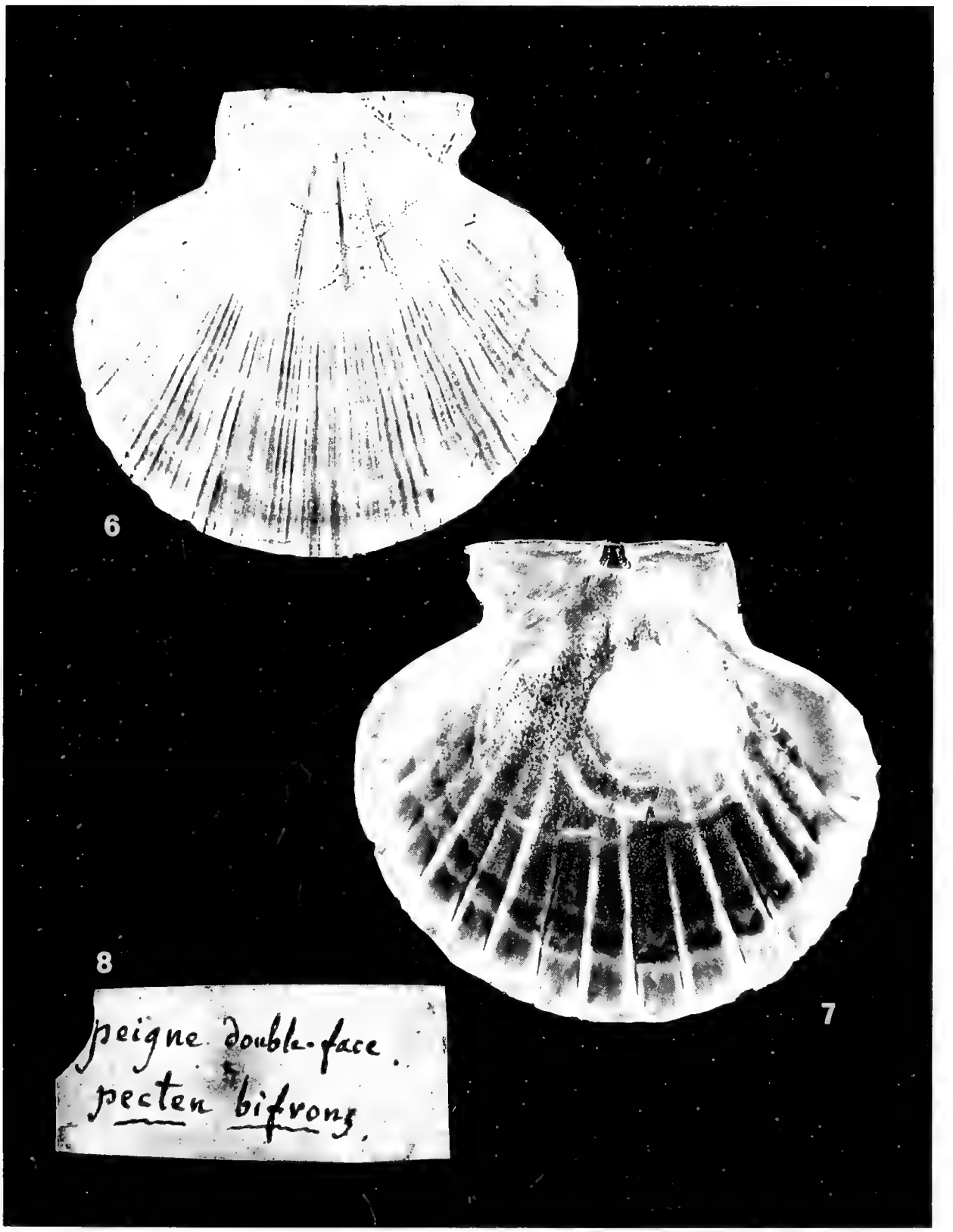

PLATE III

Pecten bifrons Lamarck, 1819. Lectotype MNHN (Paris); fig. 6 : right valve (exterior); fig. 7 : right valve (interior); fig. 8: original label of Lamarck.

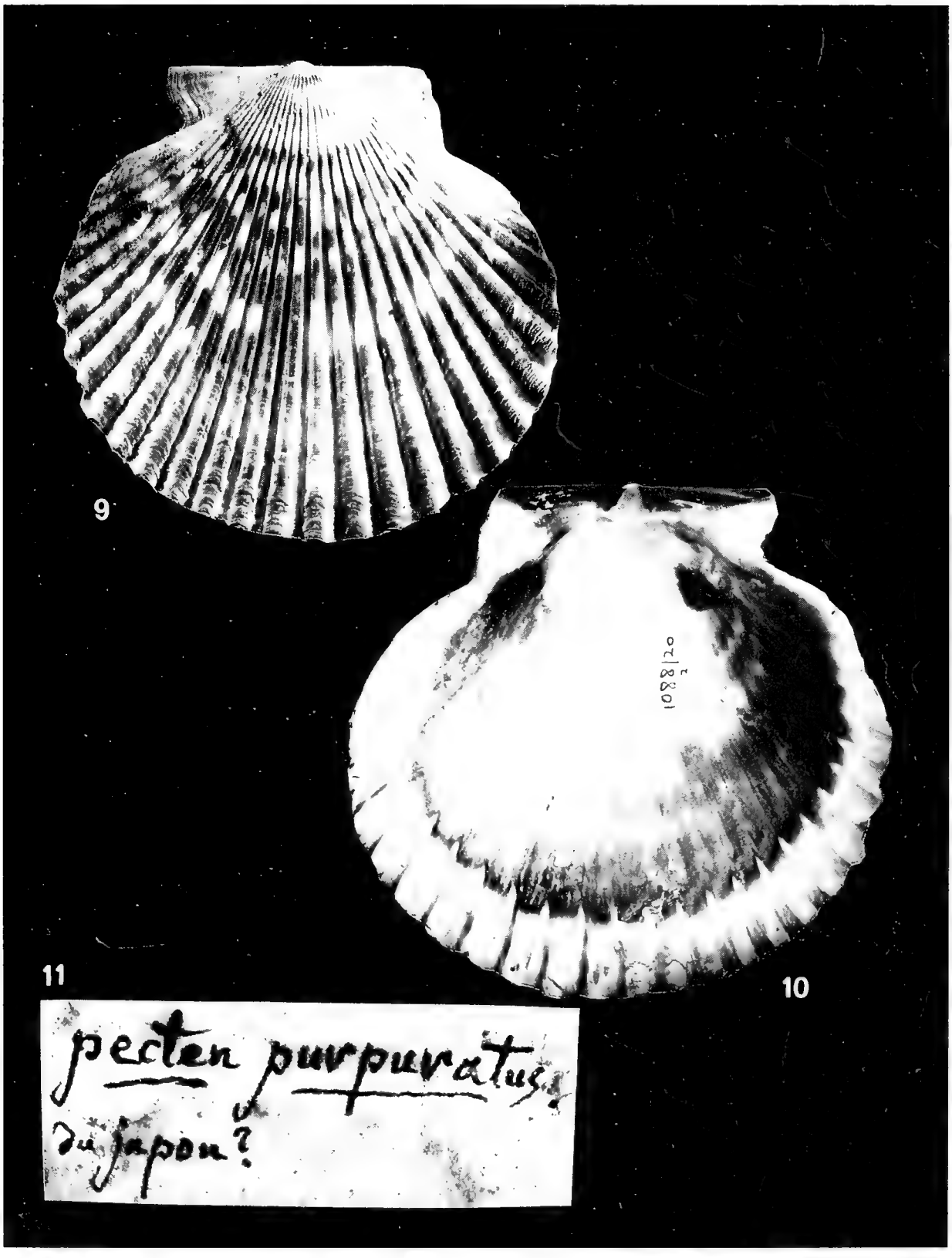

PLATE IV

Pecten purpuratus Lamarck, 1819. Lectotype MHNG 1088/20/2; fig. 9 : left valve (exterior); fig. 10 : left valve (interior); fig. 11 : original label of Lamarck.

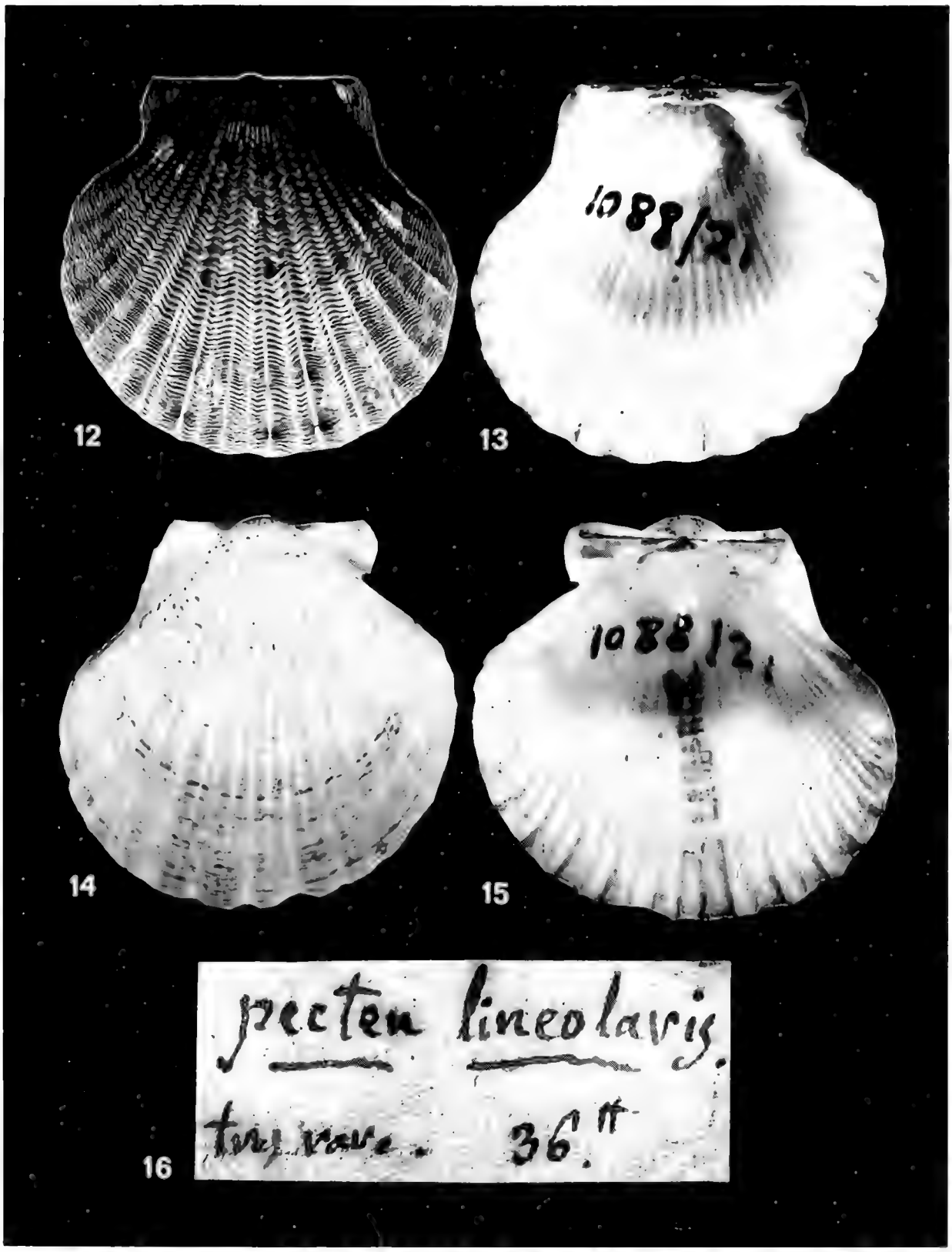

PLATE V

Pecten lineolaris Lamarck, 1819. Holotype MHNG 1088/21; fig. 12 : left valve (exterior); fig. 13 : left valve (interior); fig. 14 : right valve (exterior); fig. 15 : right valve (interior); fig. 16 : original label of Lamarck.

PLATE VI

Pecten rastellum Lamarck, 1819. Holotype MHNG 1088/24; fig. 17 : left valve (exterior); fig. 18 : left valve (interior); fig. 19 : right valve (exterior); fig. 20 : right valve (interior); fig. 21 : original label of Lamarck.

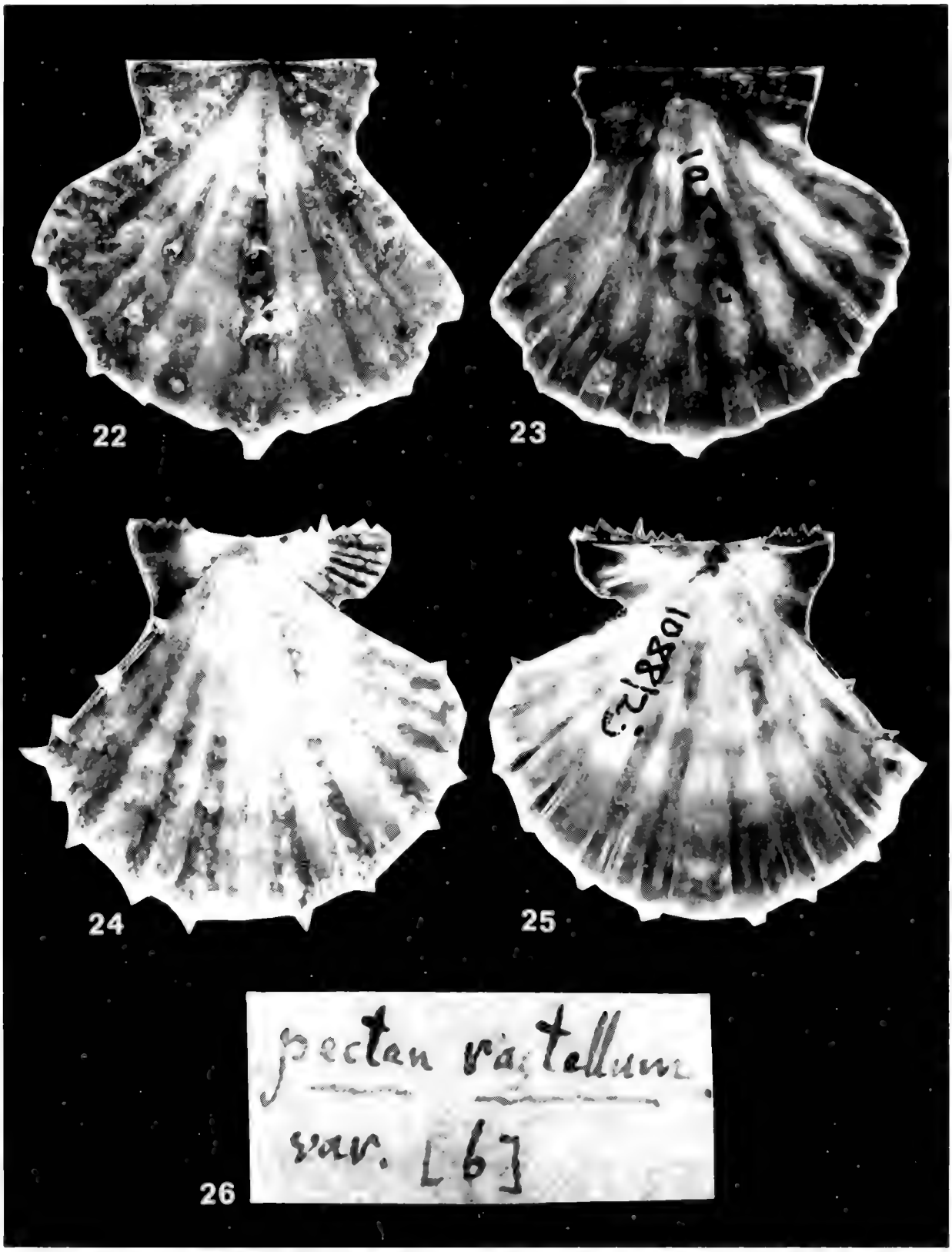

PLATE VII

Pecten rastellum var. [b] Lamarck, 1819. MHNG 1088/23; fig. 22 : left valve (exterior); fig. 23: left valve (interior); fig. 24 : right valve (exterior); fig. 25 : right valve (interior); fig. 26 : original label (var. [b]) of Lamarck.

PLATE VIII

Pecten flagellatus Lamarck, 1819. Lectotype MHNG 1088/27/1 (fig. 27 : left valve, exterior; fig. 28 : left valve, interior); paralectotype MHNG 1088/27/2 (fig. 29 : left valve, exterior; fig. 30 : left valve, interior); fig. 31 : original label of Lamarck.

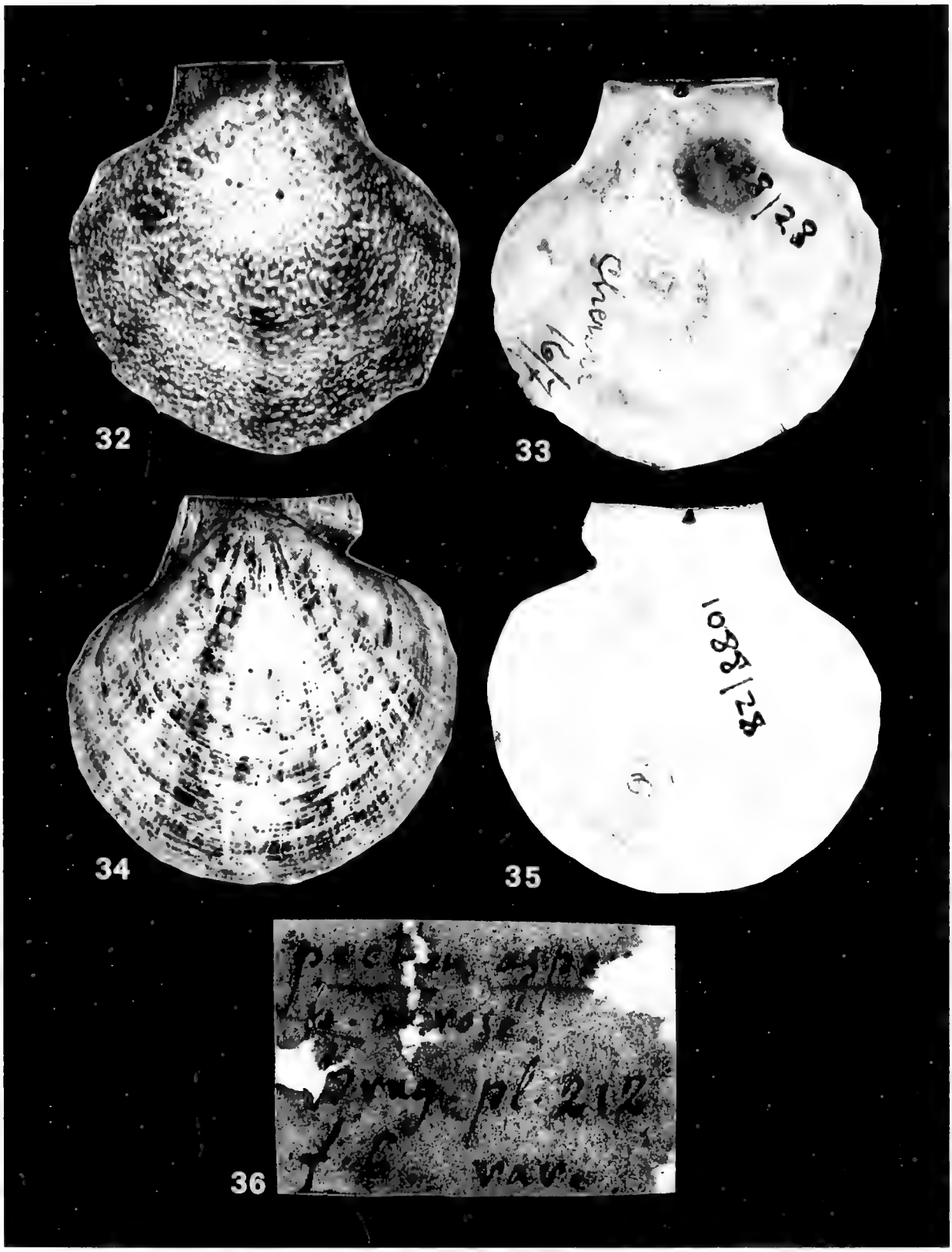

PLATE IX

Pecten aspersus Lamarck, 1819. Holotype MHNG 1088/28; fig. 32 : left valve (exterior); fig. 33 : left valve (interior); fig. 34 : right valve (exterior); fig. 35 : right valve (interior); fig. 36 : original label of Lamarck.

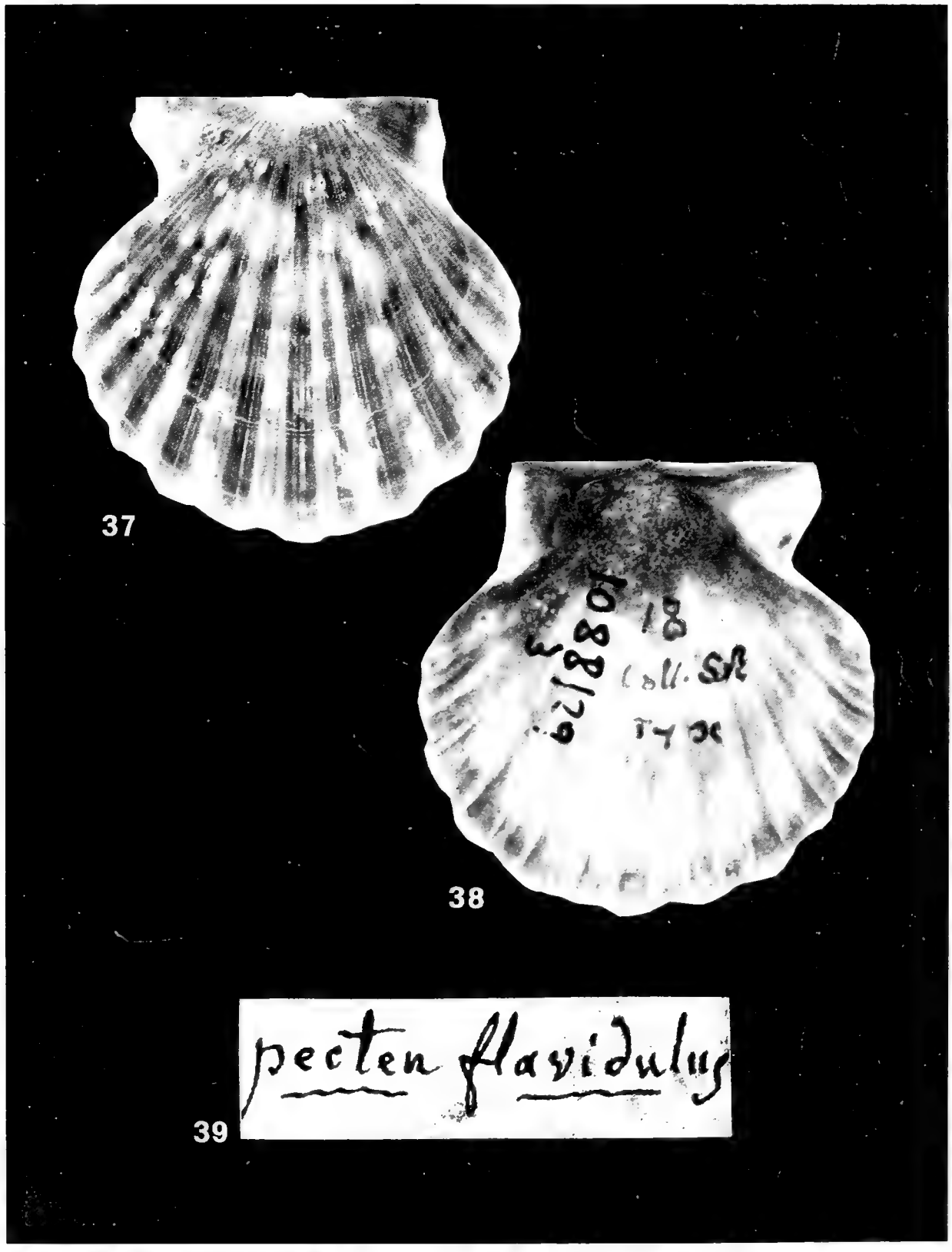

PLATE X

Pecten flavidulus Lamarck, 1819. Lectotype MHNG 1088/29/3 ; fig. 37 : left valve (exterior); fig. 38 : left valve (interior); fig. 39 : original label of Lamarck.

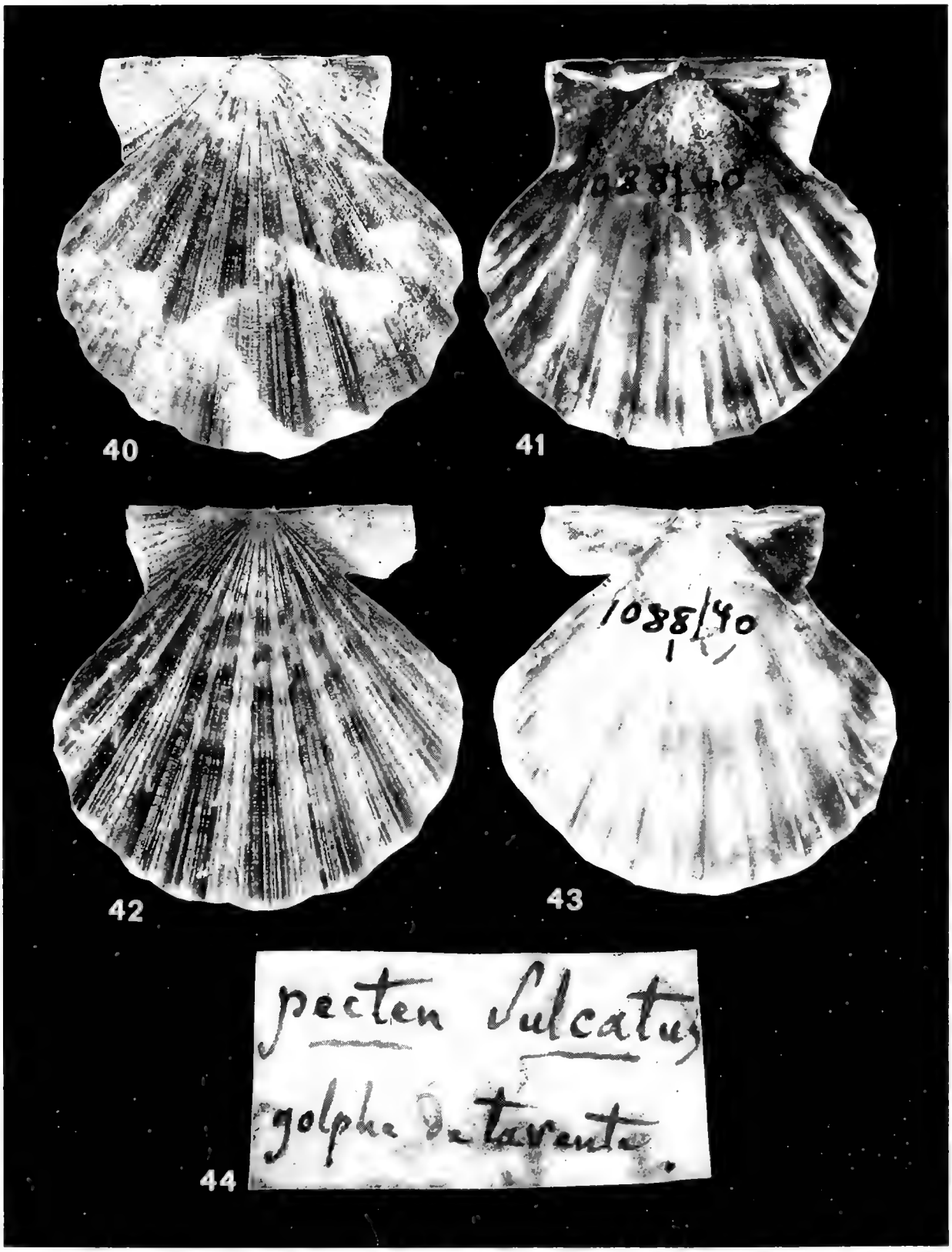

PLATE XI

Pecten sulcatus Lamarck, 1819. Lectotype MHNG 1088/40/1; fig. 40 : left valve (exterior); fig. 41 : left valve (interior); fig. 42 :right valve (exterior); fig. 43 : right valve (interior); fig. 44: original label of Lamarck.

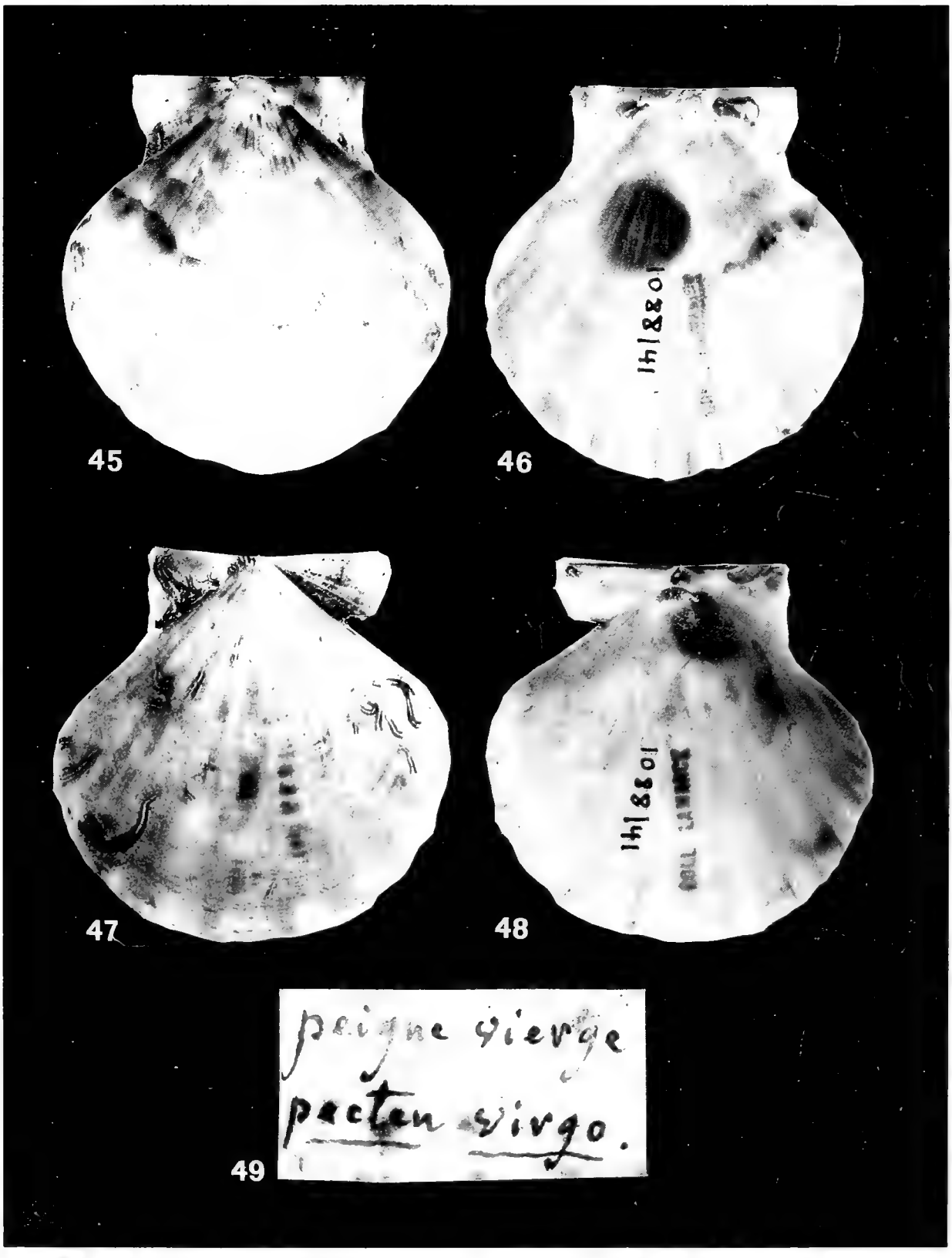

PLATE XII

Pecten virgo Lamarck, 1819. Lectotype MHNG 1088/41 (fig. 45 : left valve, exterior; fig. 46 : left valve, interior); ? paralectotype MHNG 1088/41 (fig. 47 : right valve, exterior; fig. 48 : right valve, interior); fig. 49 : original label of Lamarck.

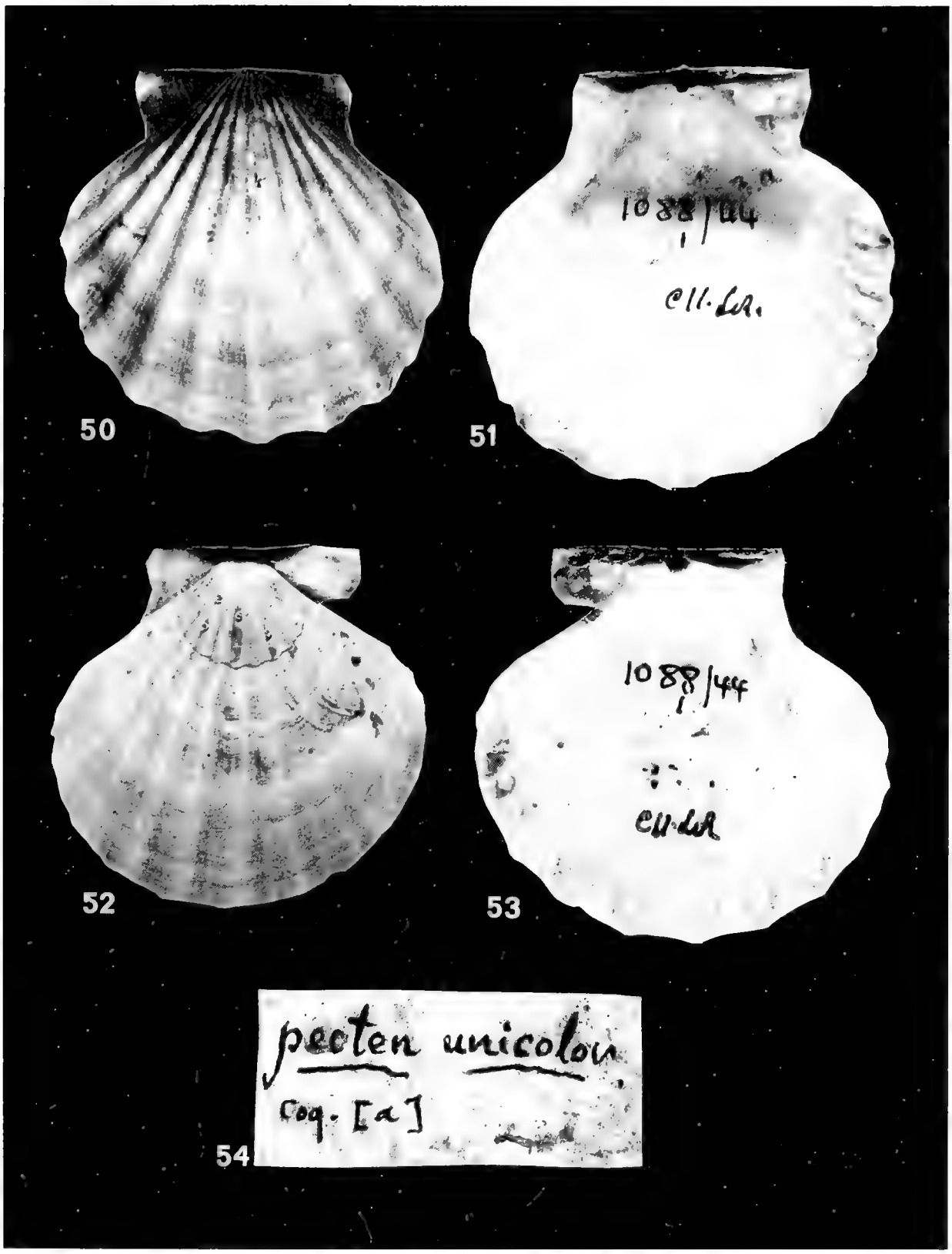

PLATE XIII

Pecten unicolor Lamarck, 1819. Lectotype MHNG 1088/44/1; fig. 50 : left valve (exterior); fig. 51 : left valve (interior); fig. 52 : right valve (exterior); fig. 53 : right valve (interior); fig. 54 : original label of Lamarck.

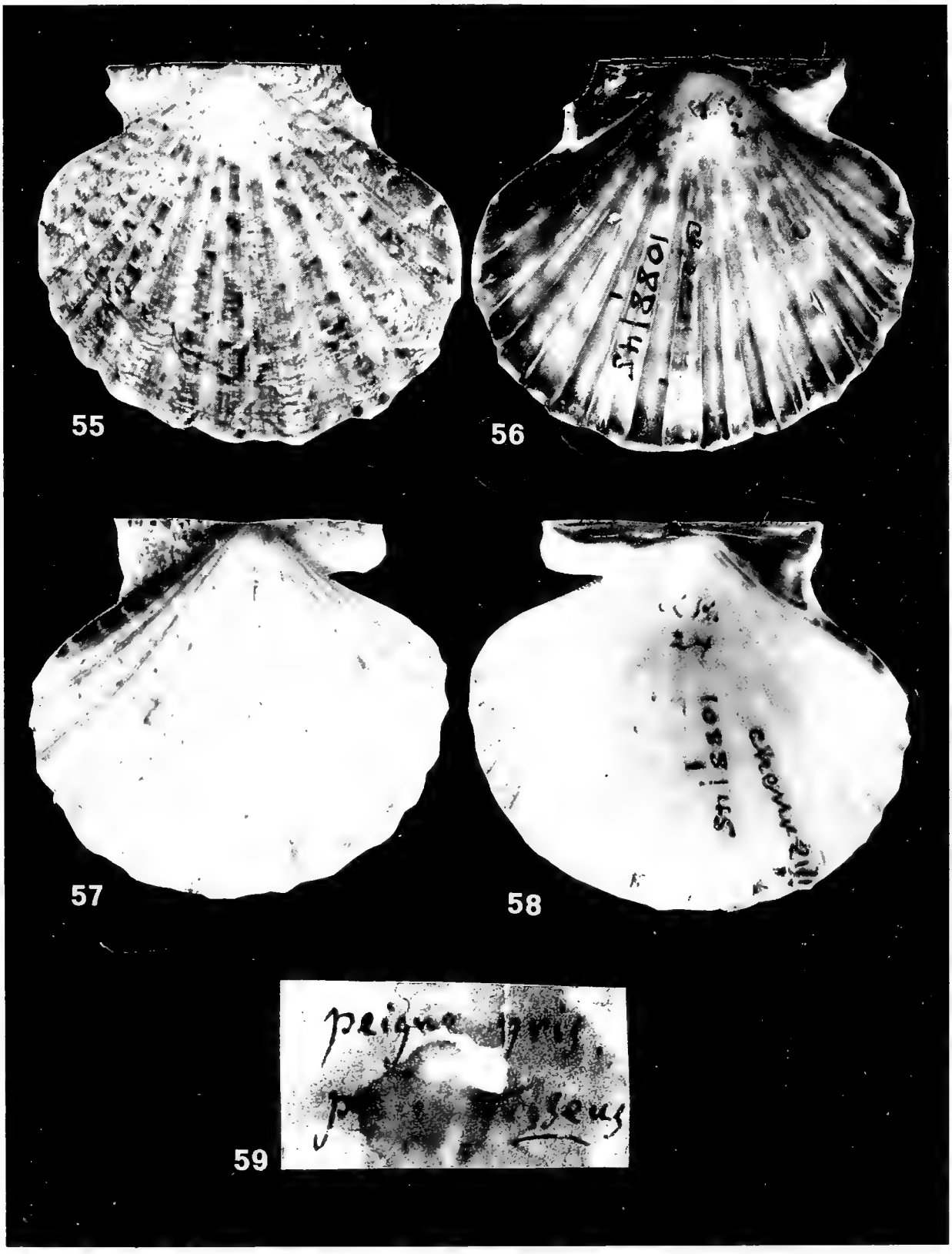

PLATE XIV

Pecten griseus Lamarck, 1819. Lectotype MHNG 1088/45/1; fig. 55 : left valve (exterior); fig. 56 : left valve (interior); fig. 57 : right valve (exterior); fig. 58 : right valve (interior); fig. 59 : original label of Lamarck.

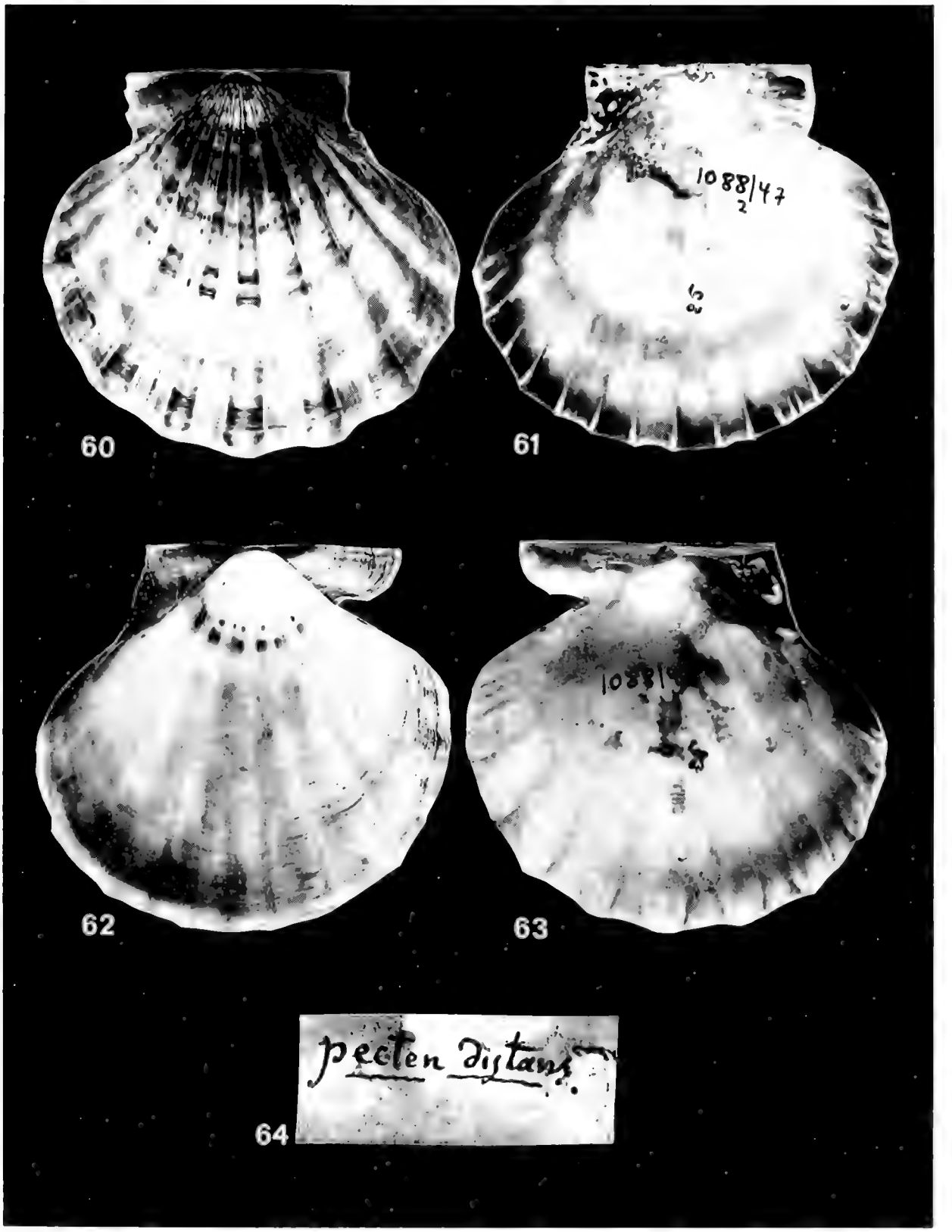

PLATE XV

Pecten distans Lamarck, 1819. Lectotype MHNG 1088/47/2; fig. 60 : left valve (exterior); fig. 61 : left valve (interior); fig. 62 : right valve (exterior); fig. 63 : right valve (interior); fig. 64 : original label of Lamarck.

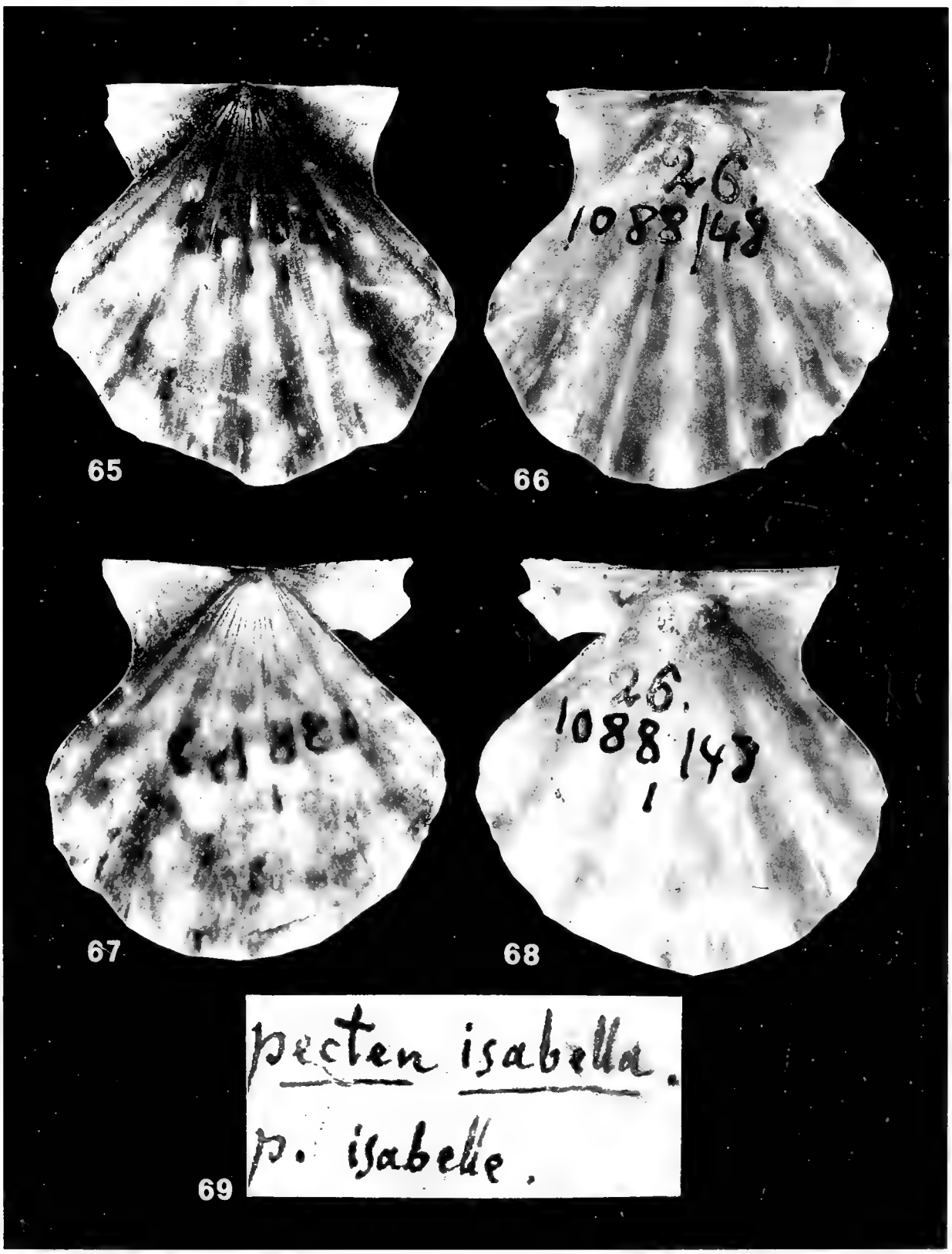

PLATE XVI

Pecten isabella Lamarck, 1819. Lectotype MHNG 1088/48/1; fig. 65 : left valve (exterior); fig. 66 : left valve (interior); fig. 67 : right valve (exterior); fig. 68 : right valve (interior); fig. 69 : original label of Lamarck.

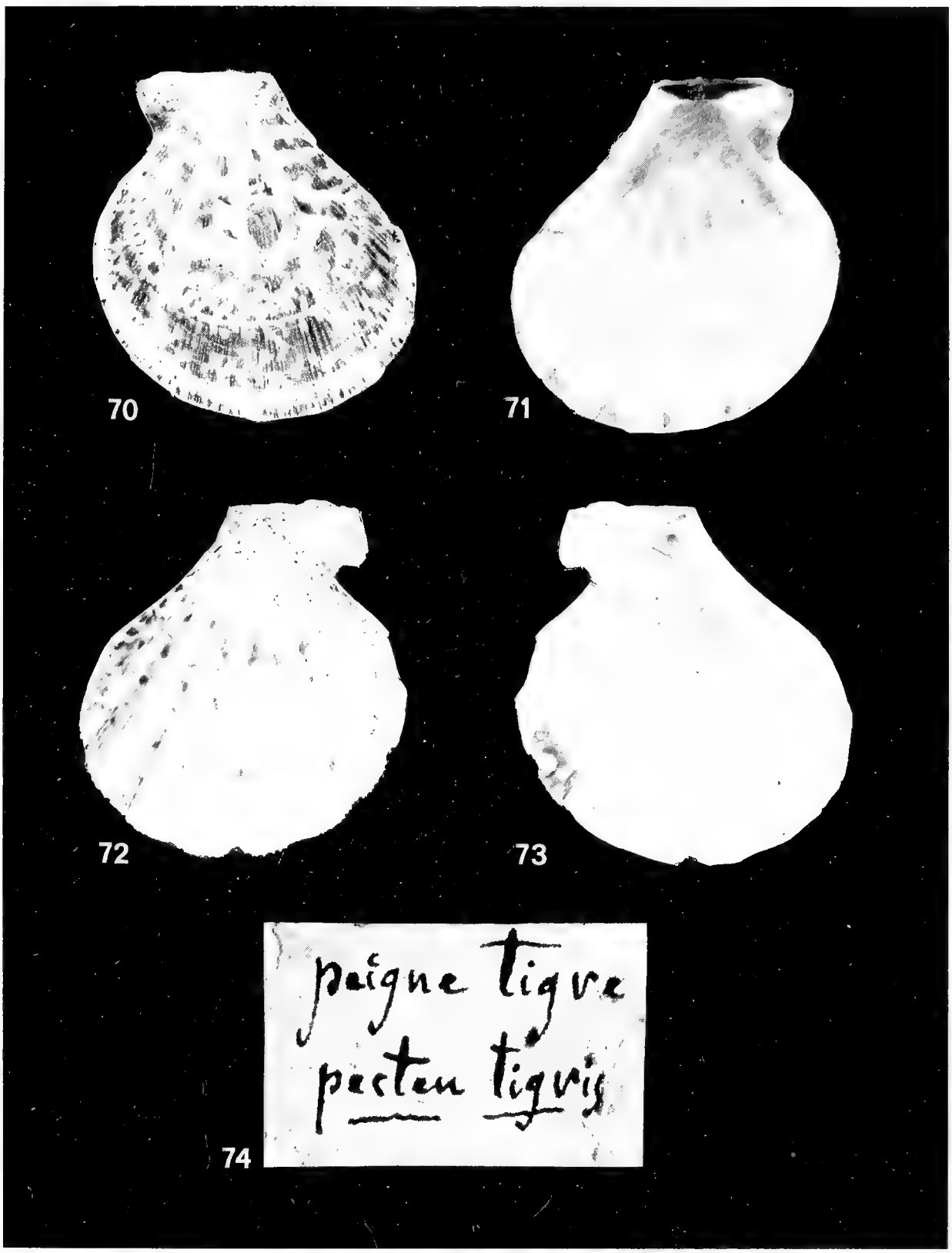

PLATE XVII

Pecten tigris Lamarck, 1819. Lectotype MNHN (Paris); fig. 70 : left valve (exterior); fig. 71 : left valve (interior); fig. 72 : right valve (exterior); fig. 73 : right valve (interior); fig. 74 : original label of Lamarck.

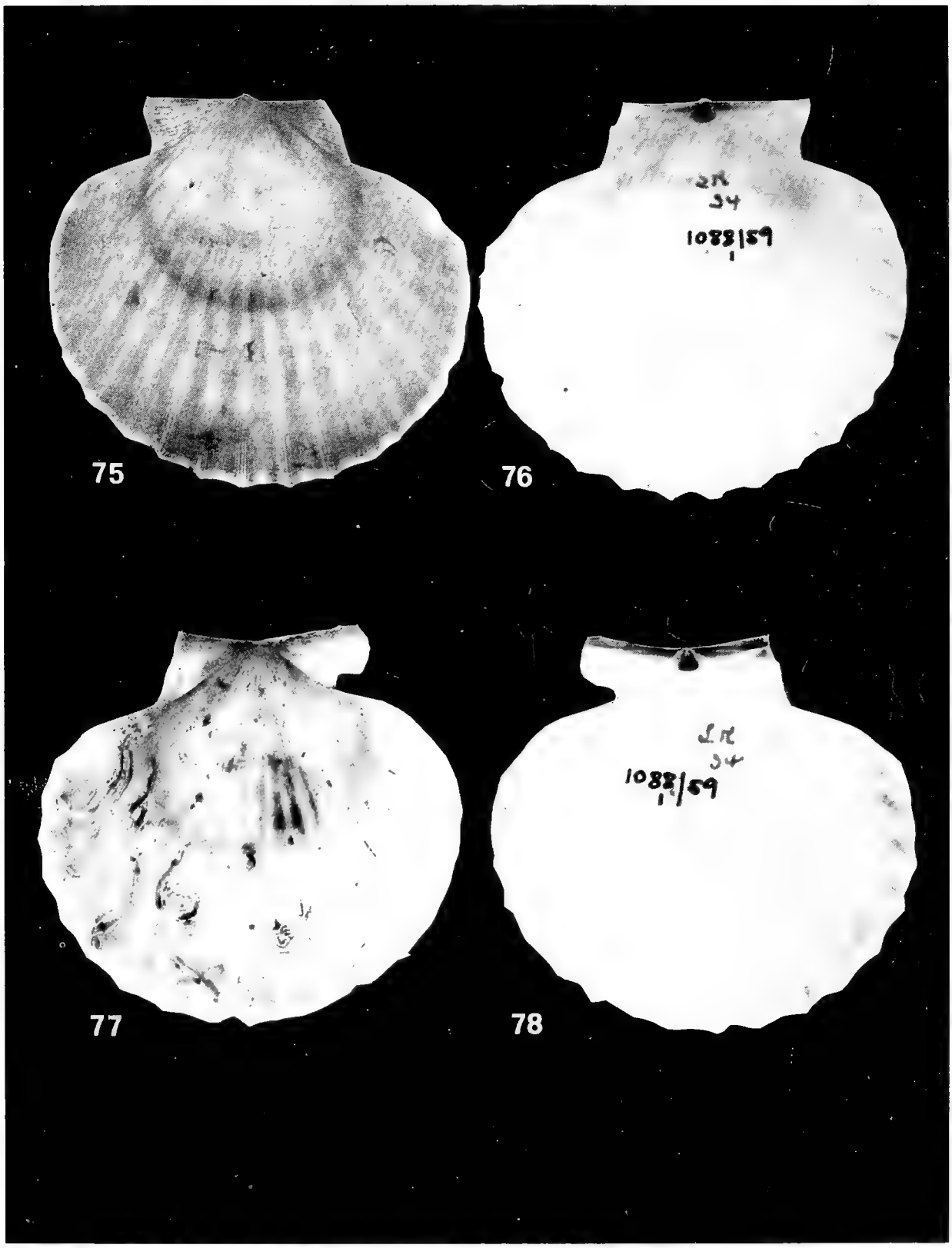

PLATE XVIII

Pecten opercularis luteus Lamarck, 1819. Lectotype MHNG 1088/59/1; fig. 75 : left valve (exterior); fig. 76 : left valve (interior); fig. 77 : right valve (exterior); fig. 78 : right valve (interior).

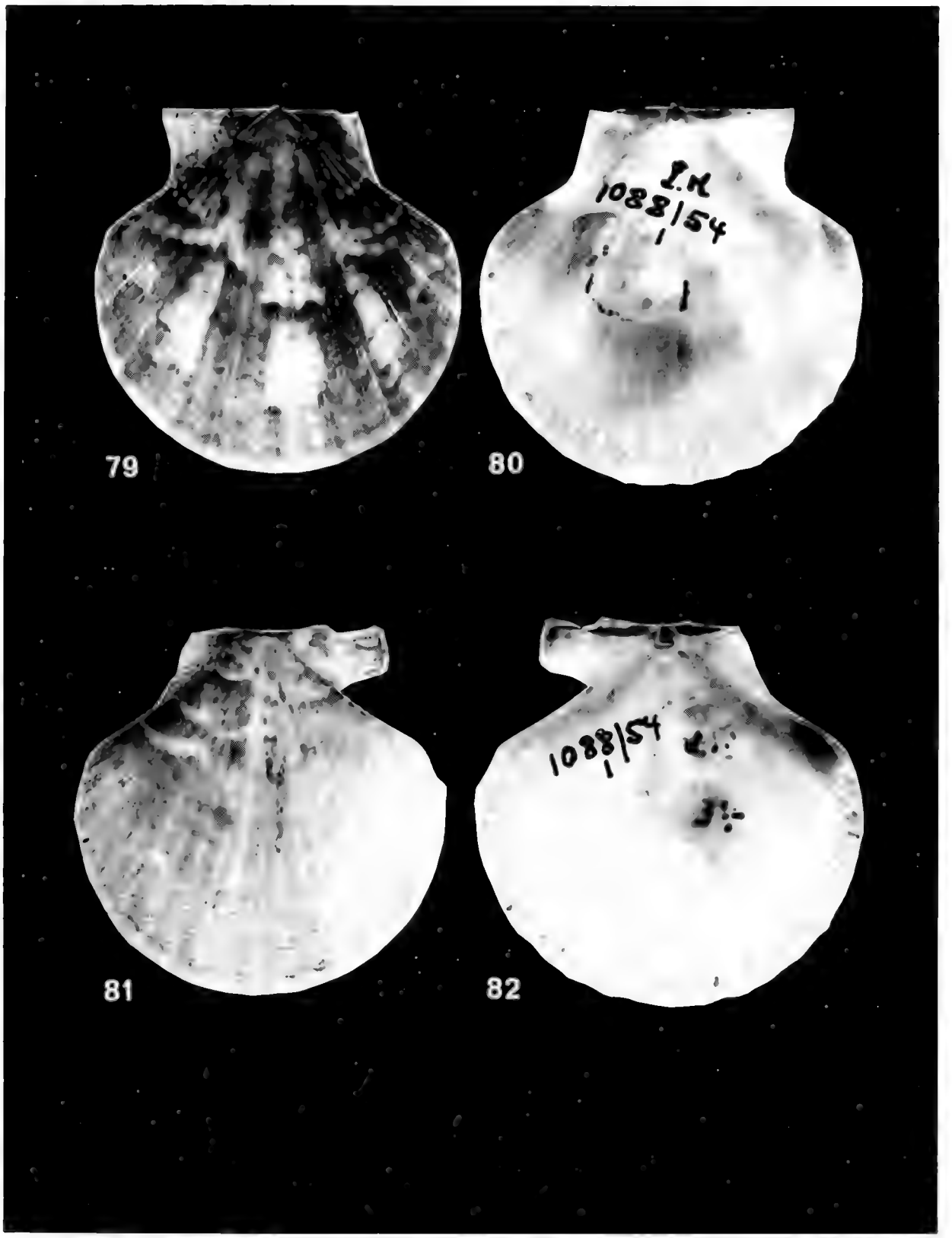

PLATE XIX

Pecten opercularis albopurpurascens Lamarck, 1819. Lectotype MHNG 1088/54/1; fig. 79 : left valve (exterior); fig. 80 : left valve (interior); fig. 81 : right valve (exterior); fig. 82 : right valve (interior).

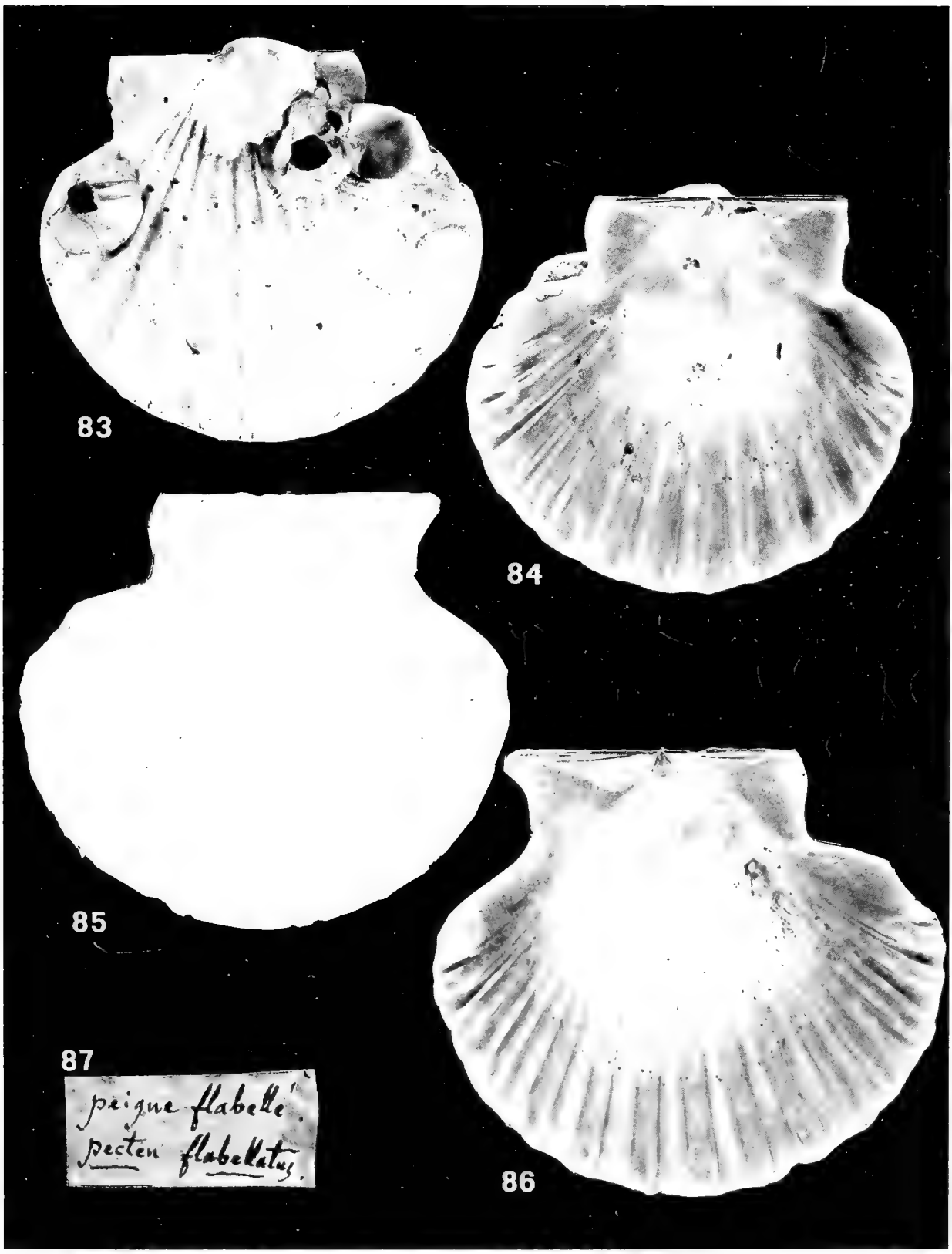

PLATE XX

Pecten flabellatus Lamarck, 1819. Lectotype MNHN (Paris); fig. 83 : left valve (exterior); fig. 84 : left valve (interior); fig. 85 : right valve (exterior); fig. 86 : right valve (interior); fig. 87 : original label of Lamarck.

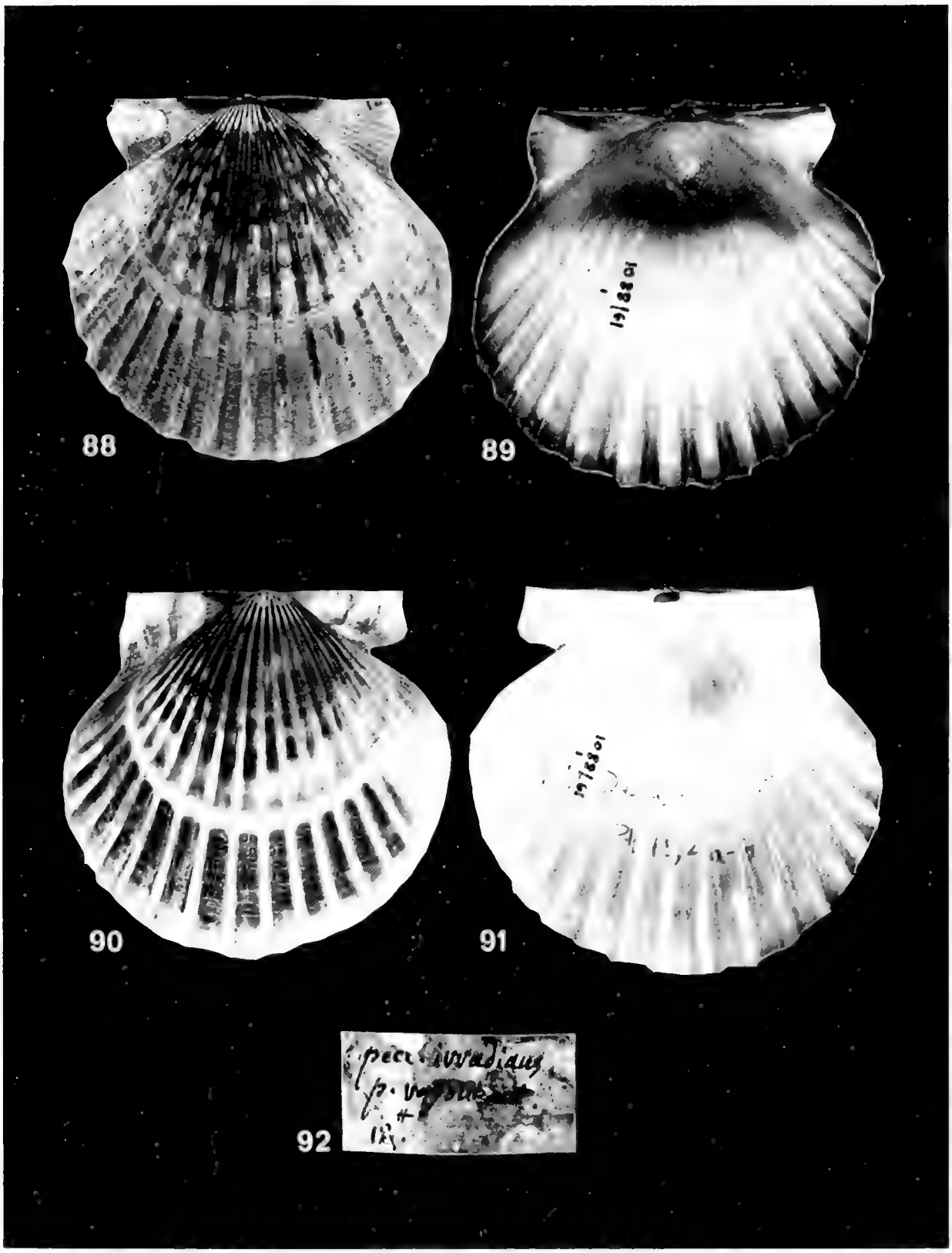

PLATE XXI

Pecten irradians Lamarck, 1819. Lectotype MHNG 1088/61/1; fig. 88 : left valve (exterior); fig. 89 : left valve (interior); fig. 90 : right valve (exterior); fig. 91 : right valve (interior); fig. 92 : original label of Lamarck.

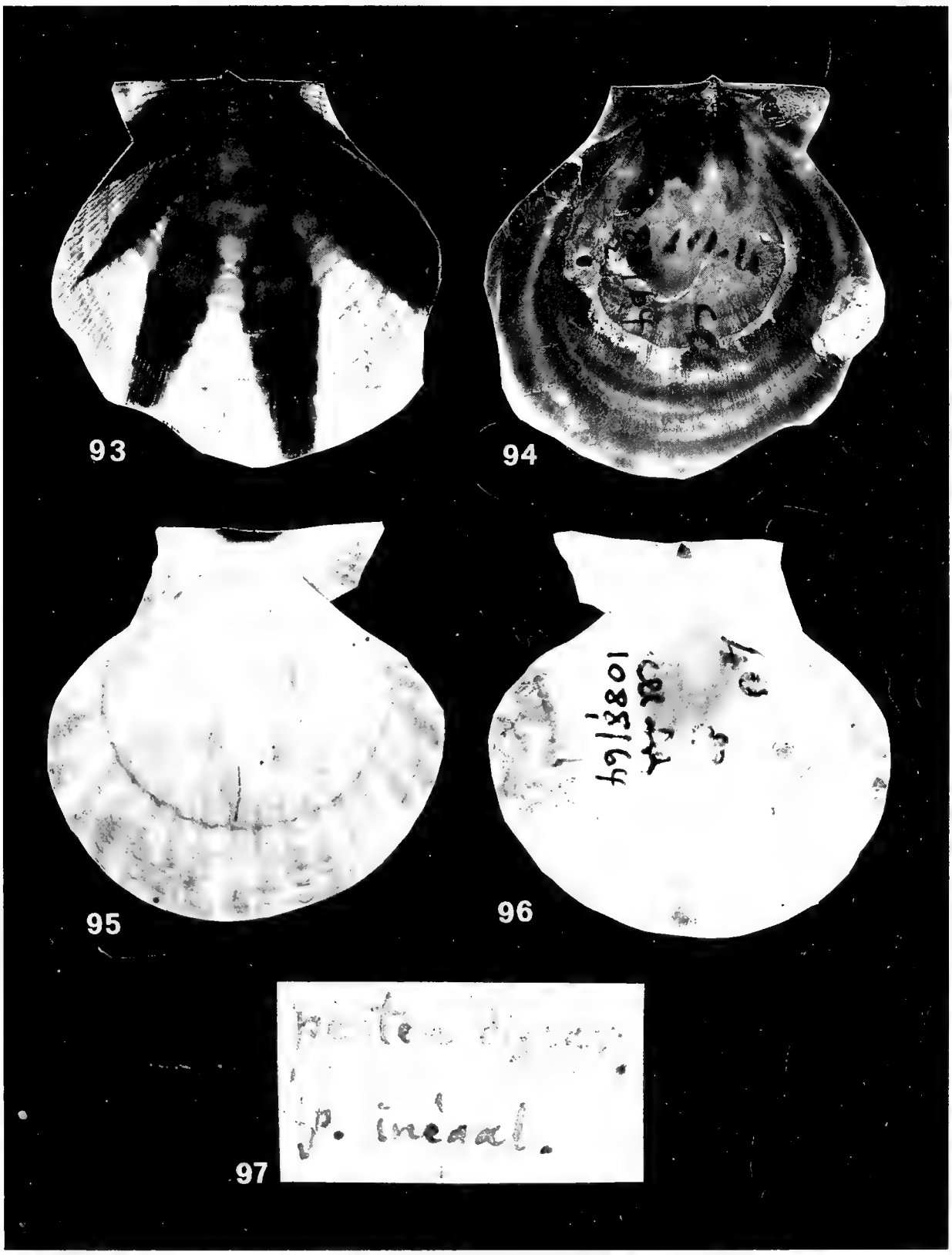

PLATE XXII

Pecten dispar Lamarck, 1819. Lectotype MHNG 1088/64/2 (fig. 93 : left valve, exterior; fig. 94 : left valve, interior); paralectotype MHNG 1088/64/1 (fig. 95 : right valve, exterior; fig. 96 : right valve, interior); fig. 97 : original label of Lamarck.

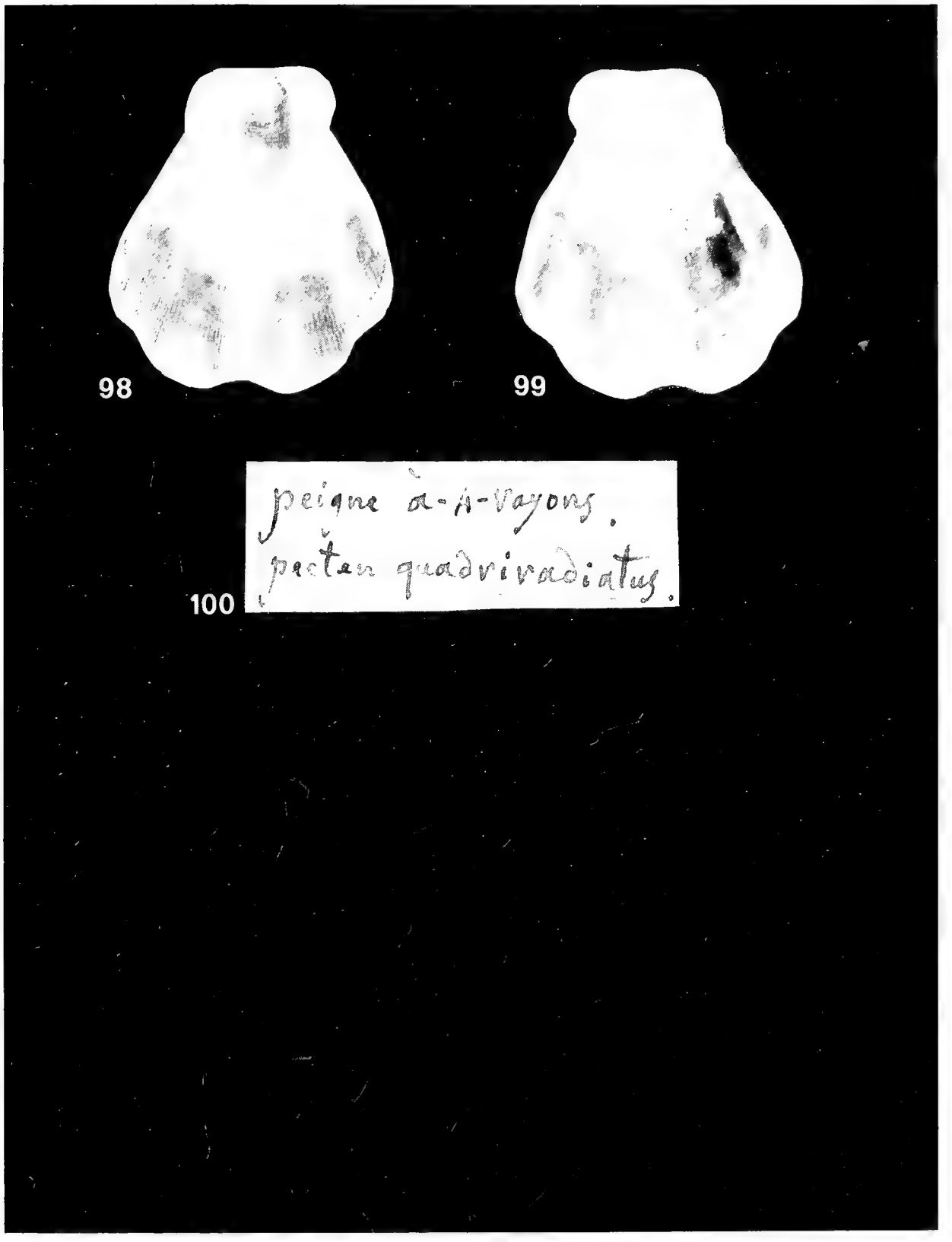

PLATE XXIII

Pecten quadriradiatus Lamarck, 1819. Holotype MNHN (Paris); fig. 98 : left valve (exterior); fig. 99 : left valve (interior); fig. 100 : original label of Lamarck.

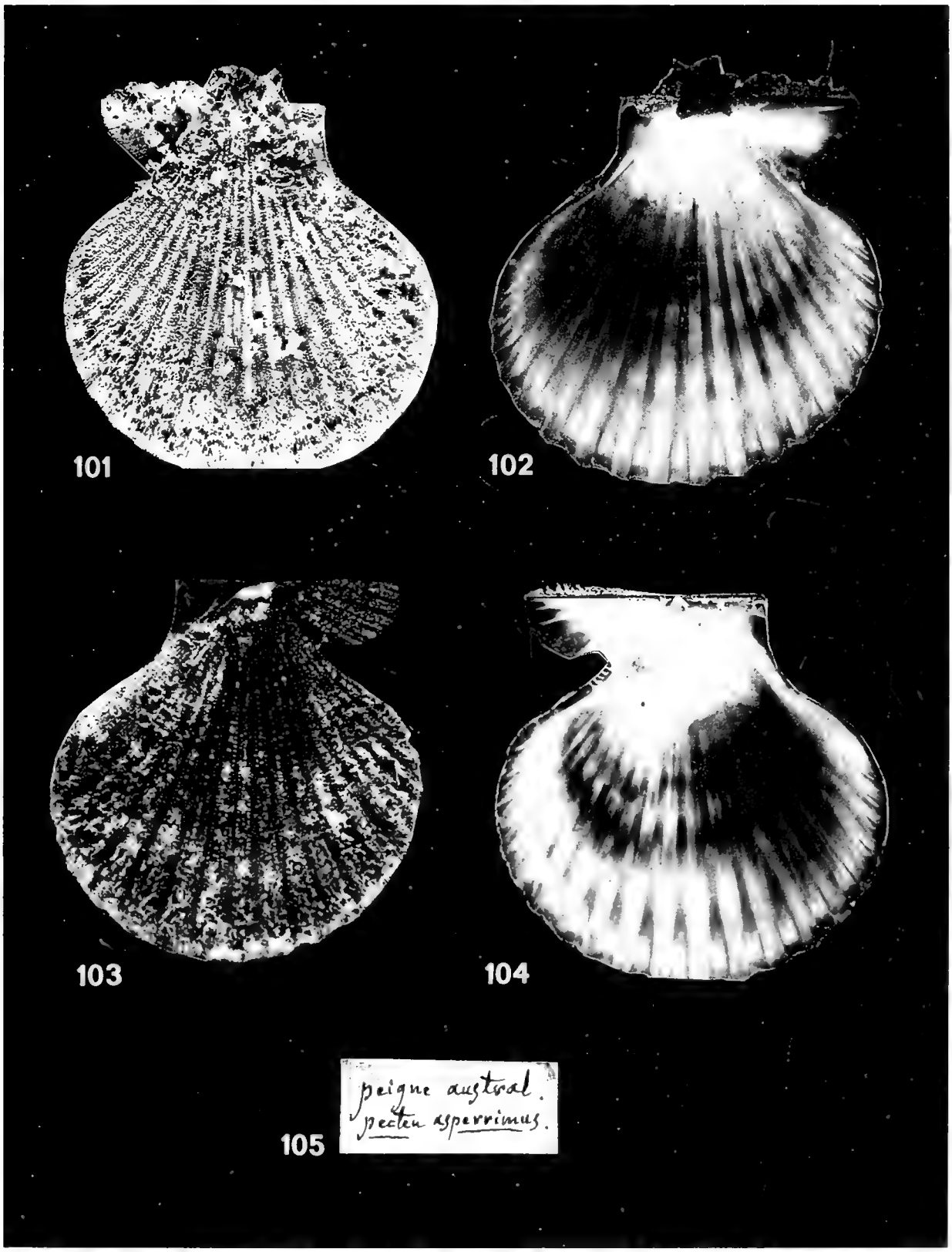

PLATE XXIV

Pecten asperrimus Lamarck, 1819. Lectotype MNHN (Paris); fig. 101 : left valve (exterior); fig. 102 : left valve (interior); fig. 103 : right valve (exterior); fig. 104 : right valve (interior); fig. 105 : original label of Lamarck.

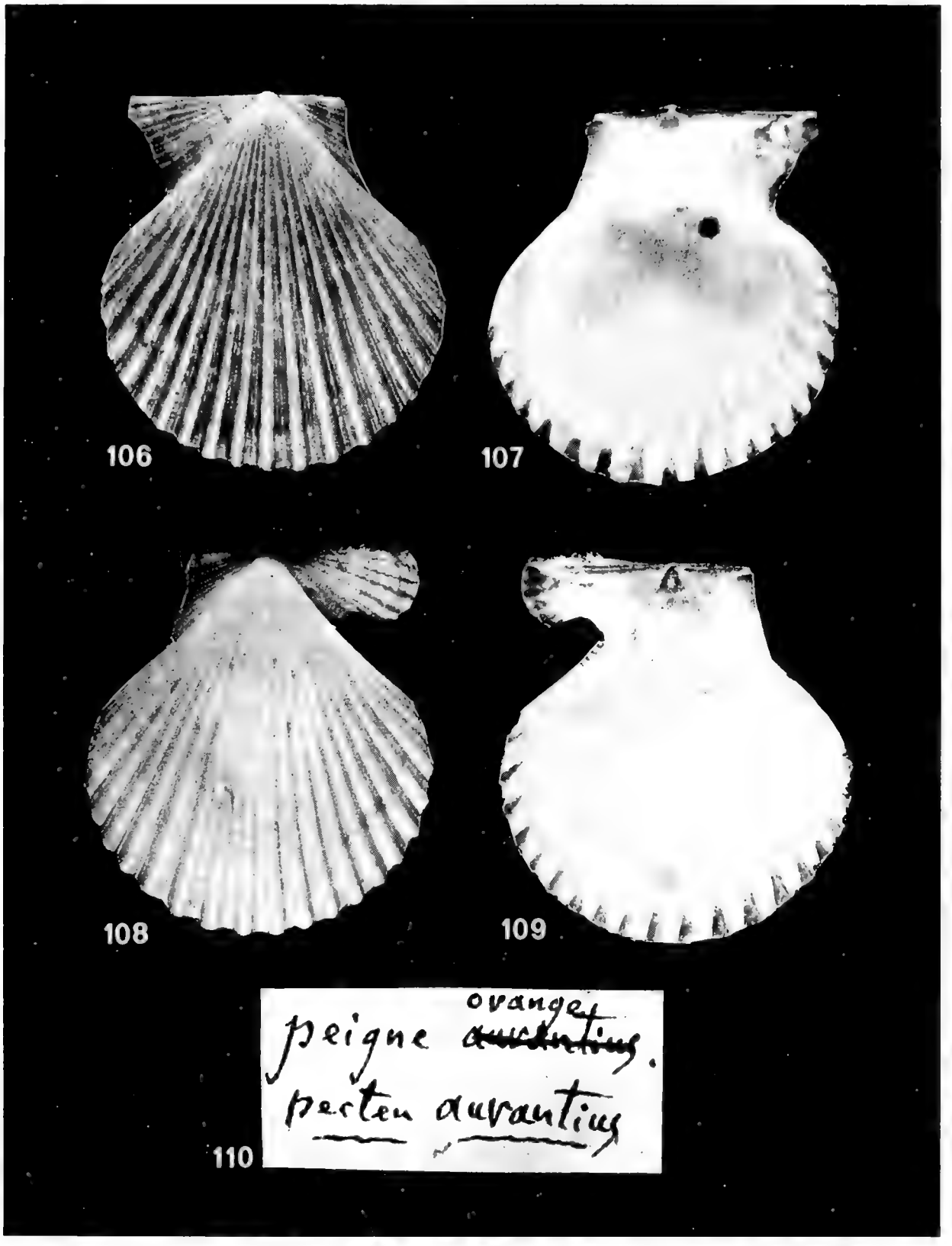

PLATE XXV

Pecten aurantius Lamarck, 1819. Lectotype MNHN (Paris); fig. 106 : left valve (exterior); fig. 107 : left valve (interior); fig. 108 : right valve (exterior); fig. 109 : right valve (interior); fig. 110 : original label of Lamarck.

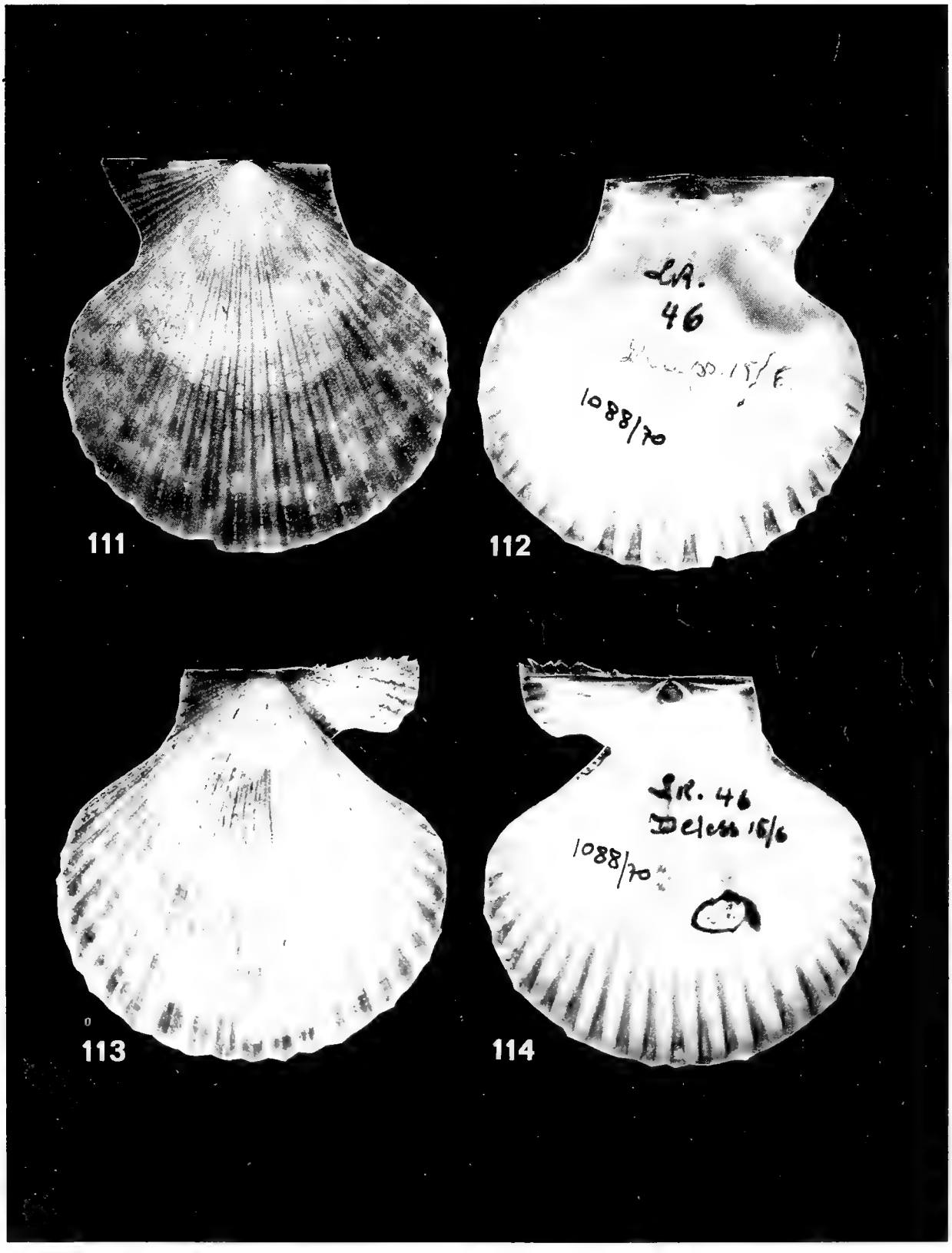

PLATE XXVI

Pecten florens Lamarck, 1819. Holotype MHNG 1088/70; fig. 111 : left valve (exterior); fig. 112 : left valve (interior); fig. 113 : right valve (exterior); fig. 114 : right valve (interior).

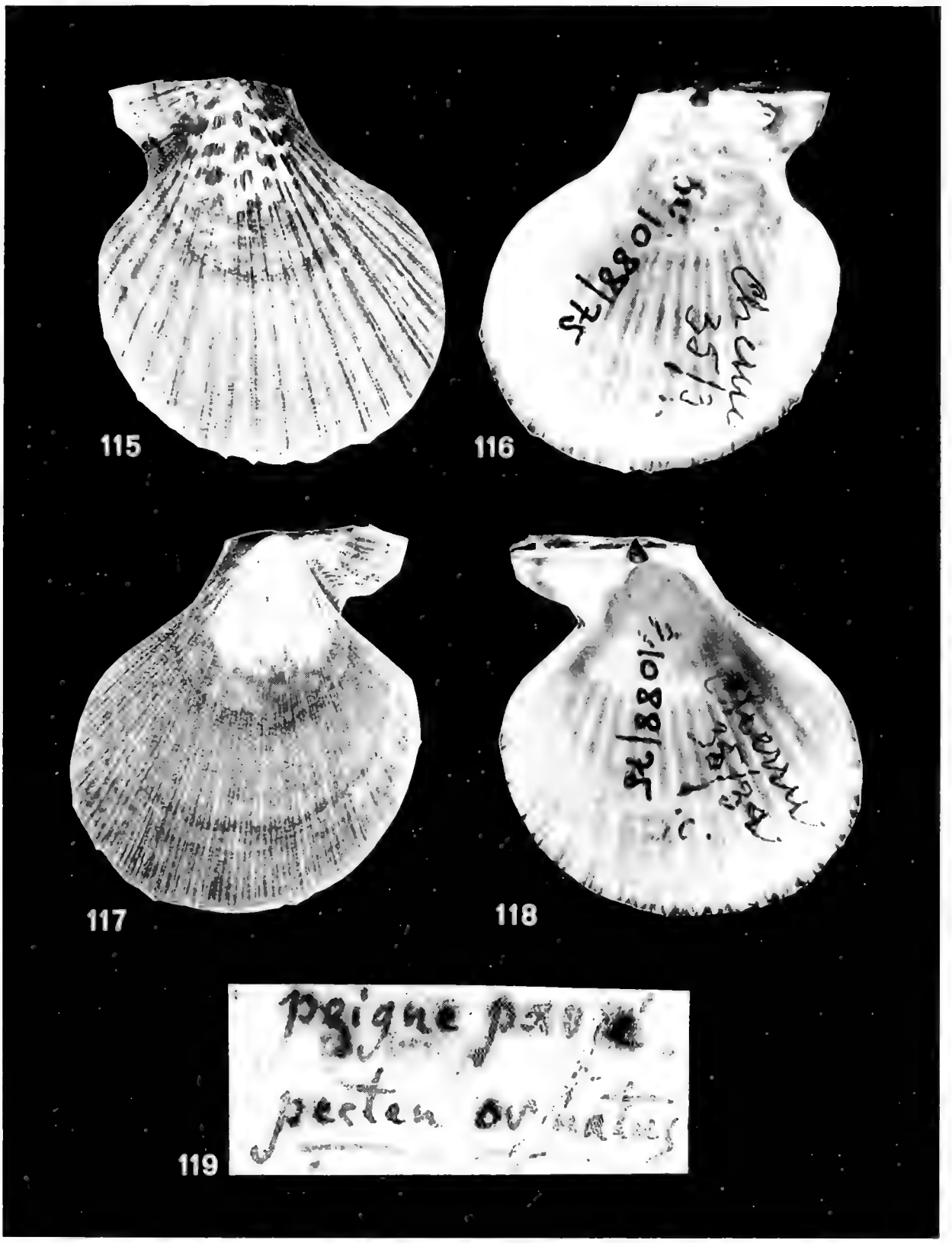

PLATE XXVII

Pecten ornatus Lamarck, 1819. Lectotype MHNG 1088/75; fig. 115 : left valve (exterior); fig. 116 : left valve (interior); fig. 117 : right valve (exterior); fig. 118 : right valve (interior); fig. 119 : original label of Lamarck.

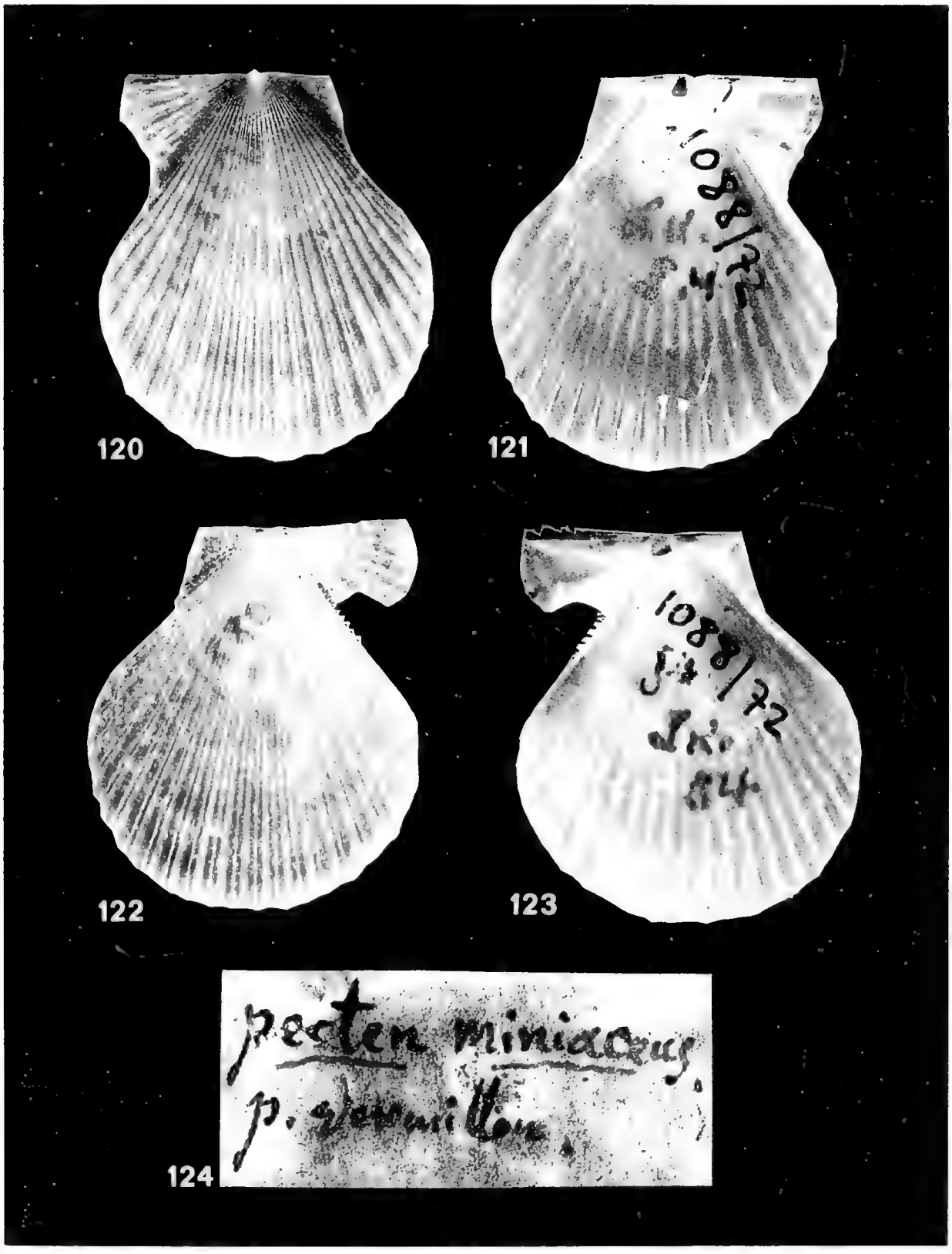

PLATE XXVIII

Pecten miniaceus Lamarck, 1819. Holotype MHNG 1088/72; fig. 120 : left valve (exterior); fig. 121 : left valve (interior); fig. 122 : right valve (exterior); fig. 123 : right valve (interior); fig. 124 : original label of Lamarck.

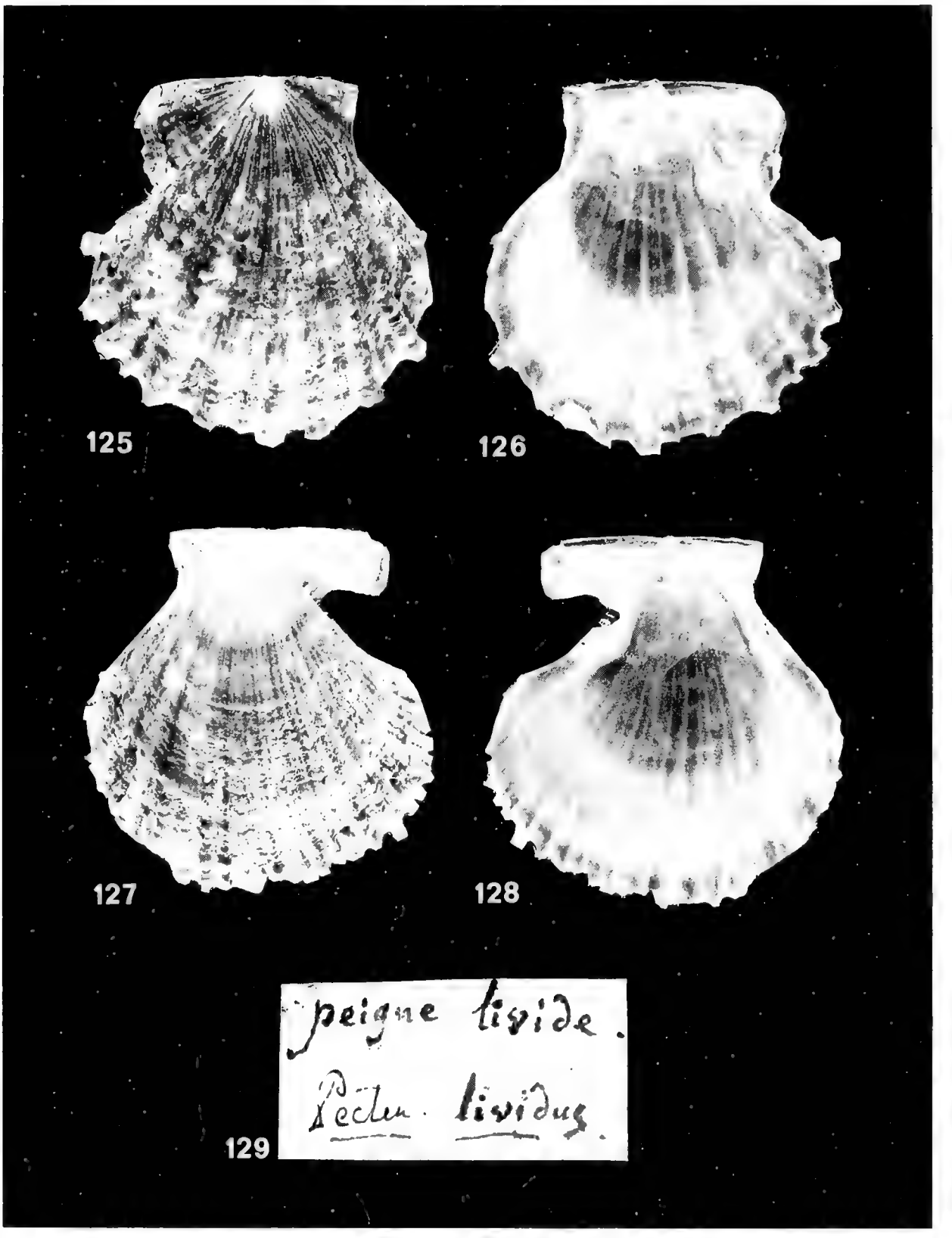

PLATE XXIX

Pecten lividus Lamarck, 1819. Holotype MNHN (Paris); fig. 125 : left valve (exterior); fig. 126: left valve (interior); fig. 127 : right valve (exterior); fig. 128 : right valve (interior); fig. 129: original label of Lamarck.

PLATE XXX

Pecten hexactes [Péron] Lamarck, 1819. Holotype MNHN (Paris); fig. 130 : right valve (exterior); fig. 131 : right valve (interior); fig. 132 : original labels by Péron and Lamarck.

TABLE I

Lamarck's new taxa of Pectinidae (1st ed., 1819; 2nd ed., 1836), figured in BRUGUIERE (1797), DELESSERT (1841), CHENU (1845, 1862)

Pages 1st ed. (1819)	2nd ed. (1836)	Number taxon	LAMARCK'S taxon	BRUGUIERE (1797)	DELESSERT (1841)	CHENU (1844-5)	CHENU (1862)
163	130	2	*P. medius*	-	-	pl.4 f.2-6	-
164	131	4	*P. bifrons*	-	pl.15 f.5	pl.22 f.3	f.925-6
166	134	11	*P. purpuratus*	-	pl.16 f.5	pl.14 f.1-9	-
166	134	12	*P. lineolaris*	-	pl.15 f.3	pl.15 f.1	-
166-7	135	14	*P. rastellum*	-	pl.16 f.1-2	pl.15 f.2-4	-
167	135	16	*P. flagellatus*	-	pl.16 f.4,7	pl.16 f.1-6	-
167	136	17	*P. aspersus*	pl.212 f.6	-	pl.16 f.7-9	-
167	136	18	*P. flavidulus*	-	-	pl.16 f.10-11	-
168	137-8	21	*P. sulcatus*	-	-	pl.20 f.1-6; pl.39 f.8-9	-
168	138	22	*P. virgo*	-	-	pl.20 f.6-7	-
169	138	23	*P. unicolor*	-	-	pl.20 f.8-9	-
169	138	24	*P. griseus*	pl.213 f.7?	-	pl.21 f.1-6	-
169	139	25	*P. distans*	pl.210 f.3?	-	pl.21 f.11-1	-
169	139	26	*P. isabella*	-	pl.16 f.8	pl.21 f.7-10	-
171	141	30	*P. tigris*	-	-	pl.27 f.3-4	-
172	142-3	34	*P. opercularis luteus*		-	-	-
			P. opercularis albopurpurascens			-	-
172	143	36	*P. flabellatus*	-	-	-	-
173	143-4	37	*P. irradians*	-	pl.15 f.4	pl.30 f.10-11	-
173	144-5	40	*P. dispar*	-	pl.15 f.2	pl.31 f.1-3	f.929
173	145	41	*P. quadriradiatus*-		-	-	-
174	145-6	43	*P. asperrimus*	-	pl.15 f.1	pl.33 f.1-6	-
175	146-7	45	*P. aurantius*	-	-	-	-
175	147	46	*P. florens*	-	pl.15 f.6	-	-
176	150-1	50	*P. ornatus*	pl.214 f.5	-	pl.35 f.3-6	-
176	151	51	*P. pellucidus*	-	-	-	-
177	152	54	*P. miniaceus*	-	pl.16 f.6	-	-
178	154	58	*P. lividus*	-	-	pl.22 f.2	-
178	154	59	*P. hexactes*	-	-	-	-

TABLE II

Lamarck's new taxa of Pectinidae

Lamarck's taxon	Current combination	Primary types (MNHN, MHNG)	Remarks
P. asperrimus	*Mimachlamys asperrima* (Lamarck, 1819)	lectotype (MNHN)	Type species of *Mimachlamys Iredale*, 1929 Lectotype covered with sponge: *Hymedesmia* sp. Perhaps some specimens in the Lamarck coll. (MHNG) do not belong to the original type series
P. aspersus	*Pseudamussium septemradiatum* (Müller, 1776)	holotype (MHNG no. 1088/28)	Junior synonym of *P. septemradiatum* (Müller, 1776)

Lamarck's taxon	Current combination	Primary types (MNHN, MHNG)	Remarks
P. aurantius	*Mimachlamys senatoria* (Gmelin, 1791)	lectotype (MNHN)	Junior synonym of *M. senatoria* (Gmelin, 1791; *Homonym of Pecten aurantius* Bosc, 1802
P. bifrons	*Equichlamys bifrons* (Lamarck, 1819)	lectotype (MNHN)	Type species of *Equichlamys Iredale*, 1929 One paralectotype *dubious* (MHNG)
P. dispar	*Lissochlamis exotica* (Dillwyn, 1817)	lectotype (MHNG no. 1088/64/2)	Junior synonym of *L. exotica* (Dillwyn,1817) The two valves are of different species, and erroneously treated as of the same species by Lamarck
P. distans	*Flexopecten glaber* (Linnaeus, 1758)	lectotype (MHNG no. 1088/47/2)	Junior synonym of *F. glaber* (Linnaeus, 1758) One specimen not traced in Delessert coll.
P. flabellatus	*Annachlamys flabellata* (Lamarck, 1819)	lectotype (MNHN)	
P. flagellatus	*Flexopecten hyalinus* (Poli, 1795)	lectotype (MHNG no. 1088/27)	Junior synonym of *F. hyalinus* (Poli, 1795) Right valves not traced in Delessert coll.
P. flavidulus	*Flexopecten glaber* (Linnaeus, 1758)	lectotype (MHNG no. 1088/29/3)	Junior synonym of *F. glaber* (Linnaeus, 1758) One paralectotype (rv) *dubious* (MHNG)
P. florens	*Mimachlamys senatoria* (Gmelin, 1791)	holotype (MHNG no. 1088/70)	Junior synonym of *M. senatoria* (Gmelin, 1791)
P. griseus	*Flexopecten glaber* (Linnaeus, 1758)	lectotype (MHNG no. 1088/45/1)	Junior synonym of *F. glaber* (Linnaeus, 1758)
P. hexactes	*Notochlamys tasmanica* (Adams & Angas, 1863)	holotype (MNHN)	Senior synonym of *N. tasmanica* (Adams & Angas, 1863); *Notochlamys* Cotton, 1930 under study Labels of Péron and Lamarck
P. irradians	*Argopecten irradians irradians* (Lamarck, 1819)	lectotype (MHNG no. 1088/61/1)	Designation of lectotype by CLARKE (1965: 176) in error, according to ICZN art.74a(v) Type loc. designation by CLARKE (1965: 177) Two spp. isolated, of which one is incorrect (MHNG)
P. isabella	*Flexopecten flexuosus* (Poli, 1795)	lectotype (MHNG no. 1088/48/1)	Junior synonym of *F. flexuosus* (Poli, 1795)
P. lineolaris	*Argopecten lineolaris* (Lamarck, 1819)	holotype (MHNG no. 1088/21)	
P. lividus	*Scaochlamys livida* (Lamarck, 1819)	holotype (MNHN)	Type species of *Scaeochlamys* Iredale, 1929 (under study)
P. medius	*Pecten fumatus* Reeve, 1852	lectotype (MNHN)	Designation of lectotype by FLEMING (1951: 129) in error, according to ICZN art.74a Homonym of *Pecten medius* Bosc, 1802 Original citation only "Mus.no." (MNHN)
P. miniaceus	Uncertain	holotype (MHNG no. 1088/72)	?*Mimachlamys nobilis* (Reeve, 1853) or *M. gloriosa* (Reeve, 1853)
P. opercularis albopur-purascens	*Aequipecten opercularis* (Linnaeus, 1758)	lectotype (MHNG no. 1088/54/1)	Junior synonym *A. opercularis* (Linnaeus, 1758)
P. opercularis luteus	*Aequipecten opercularis* (Linnaeus, 1758)	lectotype (MHNG no. 1088/59/1)	Junior synonym of *A. opercularis* (Linnaeus, 1758) Homonym of *luteus* Bosc, 1802

Lamarck's taxon	Current combination	Primary types (MNHN, MHNG)	Remarks
P. ornatus	*Chlamys ornata* (Lamarck, 1819)	lectotype (MHNG no. 1088/75)	Lectotype designated by Waller (1993); Also other species among the specimens isolated by us as paralectotypes (MHNG)
P. pellucidus	Uncertain	absent	?*Aequipecten opercularis* (L.) of *Flexopecten hyalinus* (Poli, 1795) Not traced in Delessert coll. (MHNG)
P. purpuratus	*Argopecten purpuratus* (Lamarck, 1819)	lectotype (MHNG no. 1088/20/2)	Indication holotype by GRAU (1959: 104) error; Type loc. designation by GRAU (1959: 104)
P.quadriradiatus	Uncertain	holotype (MNHN)	*Decatopecten* sp.
P. rastellum	*Mirapecten rastellum* (Lamarck, 1819)	holotype (MHNG no. 1088/23)	The specimens representing the nominal species and var. [b] and the original labels of Lamarck were inverted, so that the holotype was erroneously labelled and filed as the "var. [b]", and vice versa.
P. sulcatus	*Flexopecten glaber* (Linnaeus, 1758)	lectotype (MHNG no. 1088/40/1)	Junior synonym of *F. glaber* (Linnaeus, 1758); Homonym of *Pecten sulcatus* Müller, 1776; *Pecten subsulcatus* Locard, 1898: nom. nov. Only two spp. isolated from Delessert coll. Other specimens not traced (MHNG)
P. tigris	*Semipallium tigris* (Lamarck, 1819)	lectotype (MNHN)	Possible junior syn. of *Ostrea flavicans* Linnaeus, 1758 Type species of *Semipallium Lamy*, 1928
P. unicolor	*Flexopecten glaber* (Linnaeus, 1758)	lectotype (MHNG no. 1088/44 /1)	Junior synonym of *F. glaber* (Linnaeus, 1758) Two paralectotypes uncertain (MHNG)
P. virgo	*Flexopecten glaber* (Linnaeus, 1758)	lectotype (MHNG no. 1088/41)	Junior synonym of *F. glaber* (Linnaeus, 1758) Valves are dissimilar (MHNG)

TABLE III

Alphabetical index to Lamarck's described Pectinidae

No's	Species	An.s.Vert., no's	vol. 6 pages	Current pages
1	*Pedum spondyloideum* (Gmelin, 1791)	1	154- 5	-
2	*Pecten asperrimus* Lamarck, 1819	43	174	-
3	*Pecten aspersus* Lamarck, 1819 (= *Pecten septemradiatum* Müller, 1776)	17	167	-
4	*Pecten aurantius* Lamarck, 1819 (= *Ostrea senatoria* Gmelin, 1791)	45	175	-
5	*Pecten bifrons* Lamarck, 1819	4	164	-
6	*Pecten dispar* Lamarck, 1819 (= *Ostrea exotica* Dillwyn, 1817)	40	173	-
7	*Pecten distans* Lamarck, 1819 (= *Ostrea glabra* Linnaeus, 1758)	25	169	-
8	*Pecten flabellatus* Lamarck, 1819	36	172	-
9	*Pecten flagellatus* Lamarck, 1819 (= *Ostrea hyalina* Poli, 1795)	16	167	-
10	*Pecten flavidulus* Lamarck, 1819 (= *Ostrea glabra* Linnaeus, 1758)	18	167	-

No's	Species	An.s.Vert., no's	vol. 6 pages	Current pages
11	*Pecten flexuosus* (Poli, 1795)	38	173	-
12	*Pecten florens* Lamarck, 1819 (= *Ostrea senatoria* Gmelin, 1791)	46	175	-
13	*Pecten gibbus* (Linnaeus, 1758)	53	177	-
14	*Pecten glaber* (Linnaeus, 1758)	20	168	-
15	*Pecten griseus* Lamarck, 1819 (= *Ostrea glabra* Linnaeus, 1758)	24	169	-
16	*Pecten hexactes* (ex Péron ms) Lamarck, 1819 (= *Pecten tasmanicus* A.Adams & Angas, 1863)	59	178	-
17	*Pecten histrionicus* (Gmelin, 1791)	32	171	-
18	*Pecten hybridus* (Gmelin, 1791); Lamarck, 1819 (= *Ostrea squamosa* Gmelin, 1791)	56	177-8	-
19	*Pecten imbricatus* (Gmelin, 1791)	31	171	-
20	*Pecten inflexus* (Poli, 1795) (= *Ostrea flexuosa* Poli, 1795)	39	173	-
21	*Pecten irradians* Lamarck, 1819	37	173	-
22	*Pecten isabella* Lamarck, 1819 (= *Ostrea flexuosa* Poli, 1795)	26	169	-
23	*Pecten islandicus* Müller, 1776	42	174	-
24	*Pecten jacobaeus* (Linnaeus, 1758)	3	163	-
25	*Pecten japonicus* (Gmelin, 1791)	9	165	-
26	*Pecten laurentii* (Gmelin, 1791)	6	164	-
27	*Pecten lineatus* Da Costa, 1778 (= *Ostrea opercularis* Linnaeus, 1758)	35	172	-
28	*Pecten lineolaris* Lamarck, 1819	12	166	-
29	*Pecten lividus* Lamarck, 1819	58	178	-
30	*Pecten magellanicus* (Gmelin, 1791)	10	165-6	-
31	*Pecten maximus* (Linnaeus, 1758)	1	163	-
32	*Pecten medius* Lamarck, 1819 (= *Pecten fumatus* Reeve, 1852)	2	163	-
33	*Pecten miniaceus* Lamarck, 1819 (?= *Pecten nobilis* Reeve, 1852 or *Pecten gloriosus* Reeve, 1853)	54	177	-
34	*Pecten nodosus* (Linnaeus, 1758)	27	170	-
35	*Pecten obliteratus* (Linnaeus, 1758)	8	165	-
36	*Pecten opercularis* (Linnaeus, 1758)	34	172	-
37	*Pecten opercularis albopurpurascens* Lamarck, 1819 (= *Ostrea opercularis* Linnaeus, 1758)	34[b]	172	-
38	*Pecten opercularis luteus* Lamarck, 1819 (= *Ostrea opercularis* Linnaeus, 1758)	34[a]	172	-
39	*Pecten ornatus* Lamarck, 1819	50	176	-
40	*Pecten pallium* (Linnaeus, 1758)	28	170	-
41	*Pecten pellucidus* Lamarck, 1819 (?= *Ostrea opercularis* Linnaeus, 1758 or *Ostrea hyalina* Poli, 1795)	51	176	-
42	*Pecten pesfelis* (Linnaeus, 1758)	29	170-1	-
43	*Pecten pleuronectes* (Linnaeus, 1758)	7	164-5	-
44	*Pecten plica* (Linnaeus, 1758)	19	167-8	-
45	*Pecten purpuratus* Lamarck, 1819	11	166	-
46	*Pecten pusio* (Linnaeus, 1758)	55	177	-
47	*Pecten quadriradiatus* Lamarck, 1819 (?= *Ostrea plica* Linnaeus, 1758)	41	173	-
48	*Pecten radula* (Linnaeus, 1758)	13	166	-
49	*Pecten rastellum* Lamarck, 1819	14	166-7	-
50	*Pecten sanguineus* (Linnaeus, 1758) (?= *Ostrea senatoria* Linnaeus, 1758)	48	175	-
51	*Pecten sauciatus* (Gmelin, 1791); Lamarck, 1819 (= *Pecten ornatus* Lamarck, 1819)	33	171-2	-

No's	Species	An.s.Vert., no's	vol. 6 pages	Current pages
52	*Pecten senatorius* (Gmelin, 1791)	44	174	-
53	*Pecten sinuosus* (Gmelin, 1791)	49	175-6	-
	(= *Ostrea pusio* Linnaeus, 1758, pro parte)			
	(= *Pecten distortus* Da Costa, 1778)			
54	*Pecten sulcatus* Lamarck, 1819	21	168	-
	(= *Ostrea glabra* Linnaeus, 1758)			
55	*Pecten sulphureus* (Gmelin, 1758)	57	178	-
	(= *Ostrea superficialis* Forsskål, 1775)			
56	*Pecten tigris* Lamarck, 1819	30	171	-
57	*Pecten tranquebaricus* (Gmelin, 1791)	52	176-7	-
58	*Pecten turgidus* (Gmelin, 1791)	15	167	-
	(= *Ostrea gibba* Linnaeus, 1758)			
59	*Pecten unicolor* Lamarck, 1819	23	169	-
	(= *Ostrea glabra* Linnaeus, 1758)			
60	*Pecten varius* (Linnaeus, 1758)	47	175	-
61	*Pecten virgo* Lamarck, 1819	22	168	-
	(= *Ostrea glabra* Linnaus, 1758)			
62	*Pecten ziczac* (Linnaeus, 1758)	5	164	-

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The influence of air pollution on moss - dwelling animals: 1. Methodology and composition of flora and fauna

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The influence of air pollution on moss-dwelling animals: 1. Methodology and composition of flora and fauna. - This paper is part of a study investigating the suitability of the moss-dwelling fauna to act as a monitoring system for air pollution effects. The strategy developed to study the influence of air pollution on the fauna is introduced and ecological aspects of moss-invertebrate associations are presented. An attempt is made to characterise the flora and fauna as encountered in mosses from tiles and walls. Finally, the overall floristric and faunistic composition are given (including a complete list of species).

Key-words: Moss-dwelling animals - Air pollution - Moss species - Moss-invertebrate associations.

INTRODUCTION

The survey of pollution levels and of their effect on the biosphere is necessary to prevent injuries both to ecosystems and to human health. The physical and chemical monitoring of a few important pollutants is already well established in environmental surveys. Single species' tests are the major tools for estimating damage from environmental stress (CAIRNS 1983). However, the degree of reliability to predict response at the community level is relatively small (OKKERMAN *et al.* 1991). To allow accurate predictions, the study of ecosystem disturbances should be based on a multispecies approach (including bioindicators, sensu ARNDT *et al.* 1987) and on the lowest possible taxonomic level.

Ecological monitoring has been poorly developed, although it is successfully used to indicate water quality ("Saprobiensystem" described by KOLKWITZ 1959) and specific air pollutants (MUKAMMAL 1976; ARNDT *et al.* 1987). Lichens and mosses, for example, are often used in regional surveys to indicate SO_2 pollution (e.g. LE BLANC & DE SLOOVER 1970; HECK & BRANDT 1977). No equivalent monitoring system exists

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for soil ecosystems. Knowledge about terrestrial invertebrates as indices of environmental quality is alarmingly poor (SCHUBERT 1985; ARNDT *et al.* 1987). As the soil and its associated fauna are very complex, the use of simply structured, but similarly composed communities may provide an alternative for studying pollution effects on soil ecosystems.

Animal communities of moss cushions could be used for this purpose. The moss-dwelling fauna has a close similarity with the fauna of soils (NICHOLAS 1975). Epilithic (living on or among stone) moss cushions are abundant in urban as well as in rural environments (GILBERT 1968), thus allowing for comparative studies. An advantage of the moss-dwelling fauna is its availability for experimental purposes. Tegulous (living on tiles; from Latin: *tegula* = tile) moss cushions, for example, can easily be manipulated in the lab (e.g. fumigation with gaseous air pollutants) or transplanted to sites with different environmental characteristics.

The suitability of the moss-dwelling fauna to act as a monitoring system for air pollution effects was studied near Zürich from 1982 to 1989. The study involved three main approaches: 1) survey of natural communities in epilithic moss cushions, 2) fumigation (with SO_2) and 3) exposure of tegulous moss-invertebrate associations to different levels of air pollution in the field. The present paper introduces biological aspects of moss-invertebrate associations. It then describes the strategy developed to study effects of air pollution on the moss-dwelling fauna. Finally, the flora and fauna of both epilithic and tegulous moss cushions is characterised, and a list of species is presented.

MOSS-INVERTEBRATE ASSOCIATIONS

1. THE MOSSES AND THEIR ASSOCIATED FLORA

Mosses can be classified into three groups according to their moisture demands (RAMAZZOTTI 1972). In man-made environmental regimes, mosses of RAMAZZOTTI's groups "intermediate" and "dry" find a large variety of artificial substrata to colonise (SEAWARD 1979). Thus, only "intermediate" and "dry" mosses are considered in the present study, while the third group ("moist" mosses) is disregarded. The "moss cushion microcosm" comprises an autotrophic (i.e. algae, lichens and liverworts) and a heterotrophic microflora (i.e. bacteria, yeasts, and filamentous fungi). The latter is responsible for the primary decomposition of organic matter in analogy to decomposition in the soil ecosystem (DAVIS 1981). Thus, it is possible that both the moss and its associated microflora influence the moss-dwelling fauna.

2. THE MOSS-DWELLING FAUNA

Invertebrates associate with mosses wherever these grow (e.g. STAFANSKI 1923; TRAVÉ 1963; NIELSEN 1967; MCINNES 1991). According to GERSON (1982), the moss-invertebrate community includes the following taxa: Protozoans, rotifers, nematodes, tardigrades, and arthropods (especially mites and insects). TRAVÉ (1963)

pointed out that there are two more or less mutually exclusive faunas on mosses: Protozoans, rotifers, nematodes and tardigrades belong to the aquatic, arthropods to the terrestrial fauna.

The fauna of moss cushions is affected by a large number of interrelated abiotic and biotic factors. The moisture content of the microhabitat, probably along with the amount of insolation, seems to be the most important factor influencing the moss-dwelling fauna (TRAVÉ 1963; RAMAZZOTTI 1972). General aspects of the surroundings (open or covered areas), topographical location (height above ground, inclination), type of wall (sunken, freestanding or building), solar radiation and temperature are thus important as they regulate the water supply and/or evaporation (NIELSEN 1967; BERTRAND 1975). The moss-dwelling fauna does not appear to be specialised on any particular moss species (RAMAZZOTTI 1972; PÉREZ-IÑIGO 1975; GERSON 1982; KATHMAN & CROSS 1991). This may be partly understood by considering the moss cushion as a suitable microenvironment for the microflora and microfauna rather than as a main food source. Human activities may affect the bryofauna directly (e.g. release of animal toxic compounds) as well as indirectly (e.g. by releasing phytotoxic compounds, or by offering artificial substrata such as walls and roofs).

MATERIAL AND METHODS

1. GENERAL STRATEGY

In accordance with DIAMOND (1986), the present study included the following approaches: a) a survey of natural communities (faunistic survey), b) exposure experiments (field experiments), and c) fumigation experiments with SO_2 (laboratory experiments). The faunistic survey carried out simultaneously at all sites (main faunistic survey) allowed the comparison of natural moss-dwelling animal communities subjected to different air pollution levels (STEINER 1994, 1995*a*). The reliability of community analysis (terrestrial fauna) based on one single sampling was assessed by a second faunistic survey, carried out partly in the same locations (STEINER 1995*a*). The reliability of results on the aquatic fauna was estimated by investigating long-term dynamics (1984-1989) as well as annual fluctuation (1983-1985) of nematode and tardigrade populations (STEINER 1995*b*). In the exposure and fumigation experiments invertebrate communities of tegulous mosses were exposed to different levels of air pollution in the field (tab. 1, STEINER 1995*c*), and to different SO_2 levels in fumigation chambers, respectively (STEINER 1995*c*).

The following taxa were considered: Rotifers, nematodes and tardigrades as representatives of the aquatic fauna, mites (with emphasis on oribatid mites), insects (with emphasis on springtails) and other arthropods as representatives of the trerrestrial fauna. Identification to species level was carried out for nematodes, tardigrades, oribatid mites and springtails. Rotifers were analysed as a group because their determination is difficult (J. Donner, pers. comm.). Moss species were partially identified by E. Urmi and collaborators (Institut für Systematische Botanik).

2. Study site description

The study was conducted at urban sites in the city of Zürich and at rural sites in the canton of Zürich (tab. 1). "Study site" refers to an ancient or actual air pollution recording site, as well as to its direct surroundings, expected to have about the same pollution levels as the recording site itself. All study sites are situated at altitudes between 400 and 550 m above sea level, except site "A", which lies at an elevation of 800 m.

Tab. 1

Annual mean values of gaseous air pollutants at the study sites (SO_2, NO and NO_2 in µg/m^3, CO in mg/m^3; Abbr. = abbreviations for study sites, as used in text and figures; Year = period of air sampling; Type of study: fs = faunistic survey of October 1984, s = supplementary faunistic survey of June 1987, e = exposure experiments, dyn = study of seasonal and long-term population fluctuations, fum = fumigation experiments; urb. cat. = urbanisation categories: uht = urban high traffic, ult = urban low traffic, rlt = rural low traffic; - : not measured).

Study sites	Abbr.	Year	Type of study	SO_2	CO	NO	NO_2	urb. cat.**
Rosengartenstrasse	R	82/83	fs, s, e	47	4.4	357	87	uht
Weststrasse	W	82/83	fs, s	50	5.6	236	79	uht
Stampfenbachstrasse	T	82/83	fs, s, e	44	2.5*	157	54	uht
Überlandstrasse	U	82/83	fs, s	28	2.4	166	66	uht
Büchnerstrasse	B	82/83	fs, s	43	1.6	54	56	ult
Eglistrasse	E	82/83	fs, s	29	1.4	58	53	ult
Kaserne	K	82/83	fs, s, e	45	1.4	45	56	ult
Seefeldstrasse	S	82/83	fs, s	31	1.2	51	50	ult
Bachtel	A	84/86	fs	12	0.3	6	15	rlt
Höri Berg	H	84/86	fs	7	0.4	22	28	rlt
Männedorf	M	84/86	fs	15	0.4	16	30	rlt
Oberstammheim	O	84/86	fs	12	0.3	9	28	rlt
Rämistrasse	Rä	82/83	e	35	6.1	217	64	uht
Forchstrasse*	F	82/83	e	31	1.9	93	62	uht
Clausiusstrasse	C	84/85	e	43	1.9	44	61	ult
Mythenquai	Y	82/83	e	28	1.2	66	48	ult
Unterer Letten*	L	82/83	e	26	1.1	54	48	ult
Letzibad*	Z	82/83	e	27	1.2	50	50	ult
Karl Staufferstrasse*	KS	82/83	e	26	1.0	36	43	ult
Dübendorf	D	82/83	e	21	1.3	48	55	rlt
Tänikon	Tä	85	e	12	-	-	21	rlt
Hohenbühlstrasse*	Dyn	82/83	dyn	36	3.4	178	66	uht
Birmensdorf	Bi	84/85	fum	12	-	17	26	rlt

Levels of gaseous pollutants at the sites "D", "Tä" and "K" were continually monitored by the Swiss Federal Laboratory for Material Testing and Research (in Dübendorf), and at site "Bi" by Bleuler & Bucher (1984). Mean values for the sites A", "H", "M", and "O" were determined by a commercial institute of applied ecology (Oekoscience, Zürich). Pollution values for site "C" were given by Huter (1986) and for sites other than those mentioned above by the Air Pollution Control Agency of Zürich (Bachmann-Steiner *et al.* 1983).

*Annual mean values are estimated based on measurements and guidelines given by the Air Pollution Control Agency of Zürich (Bachmann-Steiner *et al.* 1983).

**Urbanisation categories are defined according to traffic volume (Bachmann-Steiner *et al.* 1983) and distance from the center of the city.

3. Sampling and sample processing

Sampling for the main faunistic survey was carried out in October 1984, for the second (supplementary) survey in June 1987, and for the study of population fluctuations between 1983 and 1989. Fumigation and exposure experiments were performed between 1982 and 1985.

The sampling unit size used for the analysis of the aquatic fauna was fixed empirically. As a general rule, a sampling unit should measure at least 20 times the length of the animals to be collected (Cochran 1963). A sampling unit with a diameter of 11 mm (cores of ca. one cm^2) for the aquatic fauna, and 25 mm (cores of five cm^2) for the terrestrial fauna was considered to satisfy this criterion and was used throughout the study.

The influence of moss cushion characteristics (e.g. size, thickness, orientation) and of the season on the aquatic fauna had been analysed in preliminary studies (Steiner 1990). In addition, the distribution of nematode and tardigrade species was investigated at different strata of the habitat (i.e. within moss cushions, within walls, and within sites). Sampling plans were then defined according to the aims of the different approaches (Steiner 1994, 1995*a*, *b*, *c*).

Samples for both the aquatic and the terrestrial fauna were taken from the same moss with cylindrical steel corers and passed immediately into glass vials for transport to the laboratory. The following sample sizes were used: 1) main and supplementary faunistic survey: four cm^2 for the aquatic fauna, ten cm^2 for the terrestrial fauna; 2) dynamics of the aquatic fauna: five cm^2; 3) fumigation and exposure experiments: one cm^2.

Extraction of the fauna started generally one day after sampling. The aquatic fauna was extracted using a modified version of Oostenbrink's funnel-spray method (Steiner 1990). Moss cores were moistened prior to extraction and were then mechanically macerated. After an extraction time of three days, the moss samples were analysed under a dissection microscope for remaining organisms. The extracted animals were killed in hot water (60°C for two min). After a minimum preservation time of one week in TAF (i.e. 14 parts formol 38%, four parts triethanolamine; 82 parts *Aq. dest.*), the total number of extracted animals was determined under a dissection microscope (magnification 40 x). Nematodes and tardigrades were dehydrated using the rapid method of Seinhorst (1959). A maximum of 300 randomly selected individuals per sample was permanently mounted in glycerine. Unidentified individuals were proportionally distributed to the taxa found in that sample.

Arthropods were extracted in a modified MacFadyen extractor (Bieri *et al.* 1978), gradually raising the temperature from 22 to 32°C during the extraction time of six days. Samples were moistened by spraying water every 12 hours. For the last four hours the temperature was increased to 50°C. The extracted arthropods were collected in isopropanol and counted under a dissecting microscope (magnification 40 x). Macroarthropods could be identified directly, whereas microarthropods had to be pretreated either with lactic acid or KOH. For identification, mites were temporarily

mounted in cavity slides. The immature stages of the Oribatulidae (Oribatida) were processed separately (STEINER 1989). Springtails were either mounted permanently in Hoyer (Berlese) medium, or for quick observation simply placed in cavity slides.

4. DATA PROCESSING

Whenever possible, unidentified individuals (mainly preimaginal forms) in a sample were assigned to related single taxa (STEINER 1989) or were proportionally distributed on groups of closely related taxa occurring in the same sample. Species with uncertain taxonomic status were treated as follows: the nematodes *Plectus acuminatus* Bastian and *P. cirratus* Bastian as *P. acuminatus s.l.*; *Plectus parietinus* Bastian and *P. silvaticus* Andrássy as *P. cf. parietinus*; juveniles of the closely related species of the genus *Plectus*, as well as first larval instars of *Chiloplectus cf. andrassyi* (Timm) as "*Plectus* (larvae; undetermined)"; the Neotylenchidae as different taxa, although the *Neotylenchidae sp. 1* and *Neotylenchidae sp. 2* consisted only of larvae, the remaining taxa of adults; the tardigrades *Hypsibius convergens* (Urbanowicz) and *H. dujardini* (Doyère) as *H. convergens s.l.*; the oribatid mites of the genus *Scutovertex* as *S. cf. sculptus* Michaël, a species typical of the habitat considered in this study (S. Woas, pers. comm.).

The sign test was applied to compare the ratio of higher taxonomic categories (main taxa) in epilithic and tegulous moss cushions.

FLORA

Species composition of the samples (epilithic mosses) taken in the main faunistic survey of 1984 is presented in tab. 2. More than 90% of the moss species belong to the Dicrananae, a superorder comprising mosses of acrocarpous growth form. *Bryum argenteum* Hedw. and *Tortula muralis* Hedw., are the most frequent species, accounting for 44% of the total number of samples. According to GILBERT (1971), the dominance of *B. argenteum* indicates both polluted conditions and a high nitrogen supply. Many of the species listed in tab. 2 seem to be typical of urban stonework, and are ubiquitous species (GILBERT 1971). The study of the fluctuations of the aquatic fauna (STEINER 1994) was confined to a large moss cushion of the species *Homalothecium cf. sericeum* (Hedw.).

Tegulous moss species sampled during fumigation and exposure experiments (STEINER 1995c) were dominated by the cosmopolitan species *Hypnum cupressiforme* Hedw. *s.l.*, *Tortula ruralis* Gärtn. Meyer & Scherb., *Bryum capillare* Hedw. *s.l.* and *Caratodon purpureus* (Hedw.). A very similar flora is found in roof habitats in England (GILBERT 1968) and Germany (VON DER DUNK 1988).

FAUNA

1. GENERAL ASPECTS

The present survey is the first comprehensive study of the fauna of epilithic mosses in Switzerland. In the past, surveys were either restricted to one or two main

Tab. 2

Overall species composition of moss samples taken from tiles during fumigation and exposure experiments (102 and 393 samples, respectively), and during the survey of natural communities carried out in October 1984 (216 samples; epilithic mosses). Systematic categories are according to FRAHM & FREY (1983).

Moss species		Relative abundance (%)	
SUPERORDER		Tegulous mosses	Epilithic mosses
Ceratodon purpureus (Hedw.)		16.4	6.5
Encalypta streptocarpa Hedw.			0.5
Tortula intermedia (Brid.)			0.9
Tortula muralis Hedw.			19.4
Tortula ruralis Gärtn. Meyer & Scherb.		16.6	
Barbula fallax Hedw.			0.9
Barbula hornschuchiana Schultz			0.5
Barbula rigidula (Hedw.)			12.0
Barbula sp.			0.5
Schistidium apocarpum (Hedw.)		8.4	11.6
Bryum argenteum Hedw.			25.0
Bryum capillare Hedw. *s.l.*		16.4	6.9
Bryum sp.			2.3
Orthotrichum anomalum Hedw.			1.4
Orthotrichum diaphanum Brid.			2.8
DICRANANAE	Σ acrocarpous mosses	57.4	91.2
Pseudoleskeella catenulata (Schrad.)			0.5
Amblystegium serpens (Hedw.)			6.5
Homalothecium sp.			0.5
Brachythecium sp.		14.1	
Rhynchostegium sp.			0.5
Hypnum cupressiforme Hedw. *s.l.*		28.5	0.5
Pylasia polyantha (Hedw.)			0.5
HYPNANAE	Σ pleurocarpous mosses	42.6	8.8

taxa, and/or the epilithic habitat was sampled only casually (AMMANN 1908; HEINIS 1908, 1910; GISIN 1943; SCHWEIZER 1949, 1951, 1956; BARTOS 1950; ALTHERR 1952; PSCHORN-WALCHER & GUNHOLD 1957).

A total of more than 230 taxa and close to 240'000 individuals was recorded (appendix k). Nematodes and tardigrades accounted for 75% of the total number of individuals. Diversity was highest within nematodes (56 taxa), followed by mites (47; ticks included, oribatid mites excluded), springtails and oribatid mites (39 each), arthropods (37; previous taxa excluded) and tardigrades (16). As low density species were by far more numerous than high density species, additional sampling would certainly reveal other species. Significant differences exist between the faunal composition of mosses from tiles and from walls. Among the aquatic fauna, nematodes dominate in epilithic mosses (sign test, $n=13$, $P < 0.05$), whereas tardigrades prevail in tegulous mosses (sign test, $n=16$, $P < 0.01$). Among the arthropods, mites (oribatid mites included) dominate quantitatively in mosses from walls (sign test, $n=13$, $P < 0.01$), whereas there was no significant trend for the ratio mites/springtails in mosses from tiles.

MAXIMUM DENSITY OF HIGHER TAXONOMIC CATEGORIES

Tab. 3

Maximum density values (number of individuals/cm^2) of higher taxonomic categories in tegulous and epilithic moss samples (Ori: oribatid mites).

Taxon	Tegulous mosses	Epilithic mosses
Rotifers	192	97
Nematodes	354	879
Tardigrades	927	227
Springtails	53	388
Oribatid mites	15	89
Mites (Ori excluded)	2	30
Arthropods*	8	3

* Taxa above excluded.

Tab. 3 shows the maximum density of main taxa for tegulous and epilithic moss cushions. Maximum densities of moss-dwelling rotifers (NIELSEN 1967; WRIGHT 1991), nematodes (NIELSEN 1967) and tardigrades (RAMAZZOTTI 1972; MORGAN 1977) approximate those recorded in the present study. The density of moss-dwelling springtails was several times higher in the present study than is reported in the literature (BENGTSON *et al.*, 1974, as cited by GERSON, 1982).

Comparison of the moss-dwelling fauna (tab. 3) with the fauna of soil (PETERSEN & LUXTON 1982) shows similar density values for rotifers and mites. Values reported by PETERSEN & LUXTON (1982) for tardigrades (10 individuals/cm^2) and springtails (70 individuals/cm^2) are smaller than corresponding values in tab. 3, whereas the density of soil-dwelling nematodes (3'000 individuals/cm^2) is about three times larger. Taking into account that soil samples are usually thicker than the moss samples (e.g. 1 - 2 cm in the present study), moss-dwelling invertebrates occur at higher densities (at least temporally) than soil-dwelling animals.

2. SPECIES COMPOSITION OF THE AQUATIC FAUNA

Rotifers

Rotifers were recorded in all epilithic moss cushions, as well as in all moss cushions on tiles, before the fumigation and exposure of the tiles started. The rotifers found in the present study belong mainly to the Bdelloidea. This group is especially abundant in bryophytes of the Temperate Zone (J. Donner, pers. comm.), and many bdelloid species have a cosmopolitan distribution (HYMAN 1951; DONNER 1965).

Nematodes

In tegulous mosses, bacterial feeders (i.e. Monhysterida, Araeolaimida, Rhabditida) were more abundant than predators such as *Paratripyla intermedia* (Bütschli) and *Prionchulus muscorum* (Dujardin), fungivorous (e.g. *Aphelenchoides*, Tylenchidae, and Neotylenchidae) and omnivorous nematodes (Dorylaimidae).

Chiloplectus cf. andrassyi was the most abundant species, followed by *P. intermedia*, other species of the family Plectidae (Araeolaimida), *Tylocephalus auriculatus* (Bütschli) and *P. muscorum* (appendix b). In epilithic mosses, fungivorous nematodes were predominant with *Aphelenchoides sp.* 5 being the most abundant species, except at site "Dyn". The high number of bacterial feeders in tegulous mosses and of fungivorous nematodes in epilithic mosses indicates that the microflora of the two habitats differs substantially.

Many of the numerically dominant species were also characterised by high frequencies in tegulous and/or in epilithic moss cushions (tab. 4). *Plectus acuminatus s.l.*, *P. parietinus*, *P. parvus* Bastian, *P. intermedia*, and *P. muscorum* seem to be ubiquitous (STEINER 1990). For *C. cf. andrassyi*, *Aphelenchoides sp. 4*, and *Aphelenchoides sp. 5* the actual distribution is unknown.

Nematodes are amongst the most numerous animals feeding on primary decomposers. By grazing on the microflora, nematodes can have considerable impact on the distribution and activities of bacteria and fungi (SCHIEMER 1982; ANDERSON 1988) and participate thus indirectly in the decomposition of dead plant material in the moss cushions.

Tab. 4

Moss-dwelling taxa frequently encountered (rf > 20%) either in tegulous (first sampling; 74 samples) or epilithic moss cushions (survey of natural communities; Ne and Ta: 120 samples, Ar: 96). (rf: relative frequency; Ne, Ta, Ar: nematodes, tardigrades, arthropods; - : not present).

Taxon		Tegulous mosses rf (%)	Epilithic mosses rf (%)
Ne	*Plectus acuminatus* Bastian *s.l.*	43	12
	Plectus cf. parietinus Bastian	16	38
	Plectus parvus Bastian	26	34
	Chiloplectus cf. andrassyi (Timm)	74	22
	Aphelenchoides sp. 4	3	32
	Aphelenchoides sp. 5	1	46
	Paratripyla intermedia (Bütschli)	58	18
	Prionchulus muscorum (Dujardin)	32	26
Ta	*Macrobiotus areolatus* Murray	69	4
	Macrobiotus cf. artipharyngis Iharos	50	-
	Macrobiotus hufelandi Schultze	78	44
	Macrobiotus persimilis Binda & Pilato	1	39
	Hypsibius convergens Urbanowicz *s.l.*	28	30
	Hypsibius oberhäuseri (Doyère)	27	30
	Milnesium tardigradum Doyère	3	36
	Echiniscus blumi Richters	68	2
Ar	*Camisia segnis* (Hermann)	1	34
	Tectocepheus sarekensis Trägårdh	19	81
	Scutovertex cf. sculptus Michaël	24	8
	Zygoribatula exilis (Nicolet)	-	39
	Trichoribates cf. trimaculatus (Koch)	-	52
	Eupodes sp.	-	62
	Tydeus sp.	-	35
	Bdella longicornis (L.)	-	23
	Polyxenus lagurus L.	-	31
	Xenylla brevisimilis Stach	31	9
	Chironomidae sp.	-	27
	Psychodidae sp.	-	27

Tardigrades

The Eutardigrada represented the major class of the phylum Tardigrada (appendix c). This is mainly due to the sampling plan having been restricted to northerly exposed habitats. Heterotardigrada occur preferentially in moss cushions exposed to direct solar radiation (RAMAZZOTTI 1972), which agrees with the high frequency of *Echiniscus blumi* Richters in tegulous moss cushions (tab. 4). *Macrobiotus hufelandi* Schultze was the most common tardigrade found in the present study (tab. 4, appendix c).

Most tardigrades listed in tab. 4 are cosmopolitan species (MAUCCI 1986). *Milnesium tardigradum* Doyère and certain *Macrobiotus* species found in this study (i.e. *M. areolatus* Murray, *M. hufelandi*, *M. persimilis* Binda & Pilato, and *M. richtersi* Murray) are predators of the aquatic fauna. It is believed, however, that some *Macrobiotus* species are actually non specialised feeders. For instance, individuals of *M. hufelandi* were observed to ingest filamentous algae. *Macrobiotus cf. artipharyngis* Iharos, as well as *Hypsibius* spp. probably ingest bacteria and/or cell contents of algae, fungi or moss leaves.

3. SPECIES COMPOSITION OF THE TERRESTRIAL FAUNA

Arthropods were the most diverse phylum of the terrestrial fauna, but poorer in numbers than representatives of the aquatic fauna (appendix k). Four classes of arthropods (i.e. arachnids, crustaceans, myriapods, and insects) were encountered (appendix d to i). Annelids and molluscs were extremely rare in the present study and are disregarded.

Arachnids

Araneae, Pseudoscorpiones, Opiliones and Acari are the four orders of the class Arachnida recorded in the present study (appendix d to g). The order Acari is the largest group represented by the suborders Gamasida, Ixodida, Actinedida, and Oribatida. While the presence of Ixodida in the moss habitat was unexpected, representatives of the other suborders are known to dwell in mosses (GERSON 1969, 1982; GERSON & SEAWARD 1977).

Oribatid mites reached the highest numbers of all arthropod taxa (appendix e). Most of the recorded oribatid species are microphytophages or non-specialised feeders with holarctic to world-wide distribution (WEIGMANN & KRATZ 1981). Oribatulidae (nine species) and Tectocepheidae (one species) were the numerically dominant families, while representatives of primitive oribatid families (supercohort Macropylides) were rare. Within the oribatid mites, five species are typical dwellers of epilithic or tegulous moss cushions (tab. 4). The most frequent and numerically dominant species in epilithic mosses (main survey of 1984) was *Tectocepheus sarekensis* Trägårdh (tab. 4, appendix e), closely related to *T. velatus* Michaël (KNÜLLE 1954). The latter species is one of the most common mite species occurring

in the soil, and is believed to reach greatest numbers in dry habitats (PSCHORN-WALCHER & GUNHOLD 1957; MURPHY & JALIL 1964). The exclusive occurrence and high frequency of *T. sarekensis* in mosses from tiles and walls (appendix e, tab. 4) can be explained by its higher resistance to desiccation as compared with *T. velatus* (JALIL 1972). Along with *T. sarekensis*, *Zygoribatula exilis* (Nicolet) was the most abundant mite species in epilithic moss cushions (appendix e). This agrees with the composition of epilithic and corticolous (i.e. living on bark) mosses in the region of Zürich (PSCHORN-WALCHER & GUNHOLD 1957) and in several European countries (STRENZKE 1952; PSCHORN-WALCHER & GUNOLD 1957; TRAVÉ 1963). The relative abundance of *Trichoribates cf. trimaculatus* (Koch) and *Camisia segnis* Hermann was low (appendix e). Nevertheless these species were frequently encountered in epilithic moss cushions (tab. 4). While *T. cf. trimaculatus* is known to dwell in this habitat (STRENZKE 1952; PSCHORN-WALCHER & GUNHOLD 1957), *C. segnis* is usually found in corticolous lichens (LEBRUN 1976; ANDRÉ *et al.* 1984). *Scutovertex cf. sculptus* was the only oribatid species in tegulous mosses with a relative frequency > 20% (tab. 4). Its related species *S. minutus* (Koch) seems to be typical of roof habitats (STRENZKE 1952; SMRZ 1992). According to S. Woas (pers. comm.), the two species are likely to be mixed up, and notes on their ecology are probably not very specific.

Gamasid mites (nine families) only occurred at low population densities (appendix f), with *Asca aphioides* (L.) the predominant species. Several of the recorded gamasid species prey upon diverse bryophagous taxa (WALLWORK 1967; GERSON 1972), including members of the aquatic fauna, enchytraeids, mites, as well as on eggs and larvae of higher insects.

Actinedid mites are usually represented in moss cushions by numerous species (SCHWEIZER & BADER 1963), however, their ecology is almost unknown (ANDRÉ 1986). In the present study, actinedid mite numbers (appendix g) were lower than those of oribatid mites (appendix e), but higher than those of gamasid mites (appendix f), complying with findings by ANDRÉ (1975) for the fauna of corticolous lichens. Among actinedid mites, three families (Eupodidae, Tydeidae, and Bdellidae) seem to be typical of epilithic moss cushions (tab. 4). Eupodid mites were the second most frequent arthropods in this habitat. They probably prey on other mites as indicated by KRANTZ (1978) for an eupodid species dwelling in mushroom beds. According to H. André (pers. comm.), at least two different *Eupodes sp.* were sampled in the present study. The Tydeidae were the most diverse actinedid family (appendix g). This agrees again with findings forthecorticolous fauna (ANDRÉ 1986). Tydeid mites probably prey on nematodes (SANTOS *et al.* 1981), which were very abundant in epilithic moss cushions of the present study (appendix b). The Bdellidae were dominated by the species *Bdella longicornis* (L.). This predatory species was common in epilithic mosses (tab. 4, appendix g) and was also found in terrestrial moss cushions (SCHWEIZER 1951). Predators like Bdellidae and Rhagidiidae (appendix g) probably form an important link between soft bodied oribatid mites on which they feed, and the larger carnivorous arthropods (WALLWORK 1967). As the latter group was scarce in epilithic and tegulous mosses (appendix d), the importance of predatory actinedid mites increases in these habitats.

Crustaceans

Only two copepods were found in epilithic mosses taken for preliminary studies. Malacostracans (i.e. isopods) were more abundant (appendix d). They were usually found under the moss cushions, using the moss as a refuge. According to GERSON (1982), copepods and malacostracans usually associate with aquatic mosses.

Myriapods

Chilopods and diplopods were collected in epilithic (appendix d) as well as in corticolous mosses (PSCHORN-WALCHER & GUNHOLD 1957). Predatory chilopods (i.e. Lithobiidae) and diplopods (other than *Polyxenus lagurus* L.) are probably occasional guests, while *P. lagurus* reached a relatively high frequency (tab. 4). According to DUNGER (1983), the latter species is typical of the corticolous habitat.

Insects

The Apterygota are usually more numerous in bryophytes than the Pterygota, with springtails representing the dominant group (GERSON 1982). In the present study, a total of 36 collembolan species of the suborder Arthropleona and three species of the suborder Symphypleona were recorded, most of them in epilithic moss cushions (appendix h). A similar species composition was found by GISIN (1943) on bark. *Xenylla brevisimilis* Stach was along with *S. cf. sculptus* the only arthropod species typical of tegulous mosses (tab. 4). According to ANDRÉ (1983), *X. brevisimilis* is frequently encountered in foliose lichens on bark. The high abundance of *Schoettella ununguiculata* (Tullberg) in the faunistic survey of 1984 is based on a single sample with an exceedingly high density (388 individuals/cm^2), but frequency of this species was low (8%). Many species of springtails are non-specific feeders (HALE 1967; VISSER 1985), ingesting dead plant matter, bacteria and fungi (PETERSEN & LUXTON 1983). Since enchytraeids, earthworms and large diplopods are usually absent from moss cushions, the contribution of springtails in particular and arthropods in general to the decomposition of organic material is far greater in mosses than in soil. By their high motility, springtails also play an important role in the dispersal of the microflora (CHRISTEN 1975; PETERSEN & LUXTON 1982).

The Pterygota were represented by ten insect orders (appendix i). Dipterans were the most conspicuous holometabolous insects in epilithic mosses (tab. 4, appendix i). They represent the insect order most intimately associated with bryophytes, though some taxa of springtails show a similar degree of association (GERSON 1982). Larvae of many dipteran families, including Chironomidae, Psychodidae and Cecidomyiidae, are known to dwell in bryophytes (BRAUNS 1976; GERSON 1982).

CONCLUDING REMARKS

Although epilithic and tegulous mosses are climatically extreme habitats (TRAVÉ 1963; RAMAZZOTTI 1972), the inhabiting fauna was surprisingly rich in taxa.

Based on the relationship between sample size and species number (the probability of a species' presence increases with sample size), and taking into account that several taxa were ignored in the present study, about 350 to 600 species can be expected to be found in dry mosses of central Europe (STEINER 1990). The high diversity (appendix a-i) as well as the high densities of moss-dwelling populations (tab. 3) indicate that mosses provide – at least temporally – favourable conditions for the associated fauna.

The wide ranging distribution of several taxa is probably a result of their mechanism of dissemination. Moss-dwelling animals evolved different adaptive life forms (eggs, cysts, tuns) to resist desiccation. These may be blown away by wind and can potentially reach any suitable habitat. Therefore, differences between mosses from roofs and walls (tabs. 3 and 4, appendix), or between study sites of a regional survey (STEINER 1994, 1995*a*) are unlikely to originate from limits to dispersal. The influence of air pollution, season and/or other environmental factors on moss-dwelling invertebrate communities is investigated by STEINER (1994, 1995*a*, *b*, *c*).

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APPENDIX: SPECIES LISTS

Total number of individuals: Rotatoria (a); Nematoda (b); Tardigrada (c); Arachnida (Acari excluded), Crustacea, and Myriapoda (d); Oribatida (e); Gamasida and Ixodida (f); Actinedida (g); Collembola (h), "other Insecta" (i) and "all taxa" (k) sampled in tegulous moss cushions of the fumigation and exposure experiments (STEINER 1995*c*), as well as in epilithic moss cushions of the survey of natural communities (STEINER 1994; STEINER, 1995*a*), and of the study of seasonal and long-term population dynamics (STEINER 1995*b*). Since identification to species level was not possible within each taxonomic group, indicated values for "∑ Taxa" are minimal values. (n = number of individuals; % = relative number of individuals; - = not analysed; + = less than 0.5%; ult = urban low traffic sites).

(a) Rotatoria		Tegulous moss cushions		Epilithic moss cushions					
				Survey 1984		Survey 1987		Dynamics	
		n	%	n	%	n	%	n	%
∑ Rotatoria	∑ Individuals	29796	100	6052	100	-	-	3140	100
(b) Nematoda									
Monhysterida									
Monhysteridae		53	+	15	+	-	-	7	+
Eumonhystera		4	+	61	+	-	-		
Eumonhystera cf. vulgaris (De Man)		1	+	6	+	-	-	113	1
Geomonhystera				293	2	-	-		
Geomonhystera australis (Cobb)		157	+	792	4	-	-		
Geomonhystera villosa (Bütschli)		695	2	126	1	-	-	1748	16
Theristus						-	-	1	+
Theristus cf. vesentiniae Andrássy				3	+	-	-		
Araeolaimida									
Plectidae		3	+	5	+	-	-		
Anaplectus granulosus (Bastian)				32	+	-	-	14	+
Ceratoplectus armatus (Bütschli)				6	+	-	-	1	+
Plectus cf. acuminatus Bastian *s.l.*		3174	8	82	+	-	-		
Plectus cf. parietinus Bastian		569	1	384	2	-	-	1102	10
Plectus parvus Bastian		663	2	315	2	-	-	203	2
"*Plectus* (larvae; undetermined)"		9122	24	1994	10	-	-	2995	27
Chiloplectus cf. andrassyi (Timm)		13276	34	590	3	-	-	2409	22
Tylocephalus auriculatus (Bütschli)		1836	5	882	5	-	-	255	2
Chromadorida									
Prodesmodora terricola Altherr				4	+	-	-		
Rhabditida									
Rhabditida sp. 1				1	+	-	-		
Teratocephalus terrestris (Bütschli)				2	+	-	-	1	+
Eucephalobus		1	+			-	-		
Eucephalobus striatus (Bastian)		3	+			-	-		
Cephalobus				8	+	-	-		
Acrobeloides				2	+	-	-		
Ypsilonellus						-	-	12	+
Ypsilonellus devimucronatus (Sumenkova)		5	+	4	+	-	-		
Ypsilonellus vexilliger (De Man)						-	-	1	+
Panagrolaimus		18	+	291	2	-	-	115	1
Panagrolaimus cf. rigidus (Schneider)		161	+	10	+	-	-	7	+
Panagrolaimus cf. rigidus (Schneider)				107	1	-	-	19	+
Protorhabditinae sp. 1				1	+	-	-		
Protorhabditis sp. 2				27	+	-	-		
Mesorhabditinae sp. 1				2	+	-	-		
Bursilla cf. monhystera (Bütschli)				2	+	-	-		
Tylenchida		1	+	7	+	-	-	1	+
Tylenchida sp. 1				1	+	-	-		

(b) Nematoda (continued)	Tegulous moss cushions		Epilithic moss cushions					
			Survey 1984		Survey 1987		Dynamics	
	n	%	n	%	n	%	n	%
Tylenchidae	7	+			-	-		
Tylenchus arcuatus Siddiqi			1	+	-	-		
Tylenchus elegans De Man			586	3	-	-		
Filenchus			5	+	-	-		
Haplolaimidae	2	+			-	-	10	+
Neotylenchidae			1	+	-	-		
Neotylenchidae sp. 1 larvae			209	1	-	-		
Neotylenchiade sp. 2 larvae			24	+	-	-		
Neotylenchidae sp. 3			16	+	-	-		
Neotylenchidae sp. 4			19	+	-	-		
Aphelenchoides	19	+	68	+	-	-	14	+
Aphelenchoides sp. 1	240	1	72	+	-	-	8	+
Aphelenchoides sp. 2			32	+	-	-		
Aphelenchoides sp. 3	17	+			-	-	3	+
Aphelenchoides sp. 4	31	+	2694	14	-	-	15	+
Aphelenchoides sp. 5	462	1	6736	35	-	-	633	6
Aphelenchoides sp. 6			507	3	-	-		
Laimaphelenchus	3	+	374	2	-	-	1	+
Laimaphelenchus sp. 1 (gr. pannocaudus Massey)			254	1	-	-		
Laimaphelenchus deconincki Elmiligy & Geraert			149	1	-	-	1	+
Enoplida								
Paratripyla intermedia (Bütschli)	6548	17	443	2	-	-	922	8
Dorylaimida								
Mononchidae	49	+	429	2	-	-		
Prionchulus muscorum (Dujardin)	956	2	144	1	-	-	63	1
Nygolaimus sp. 1			81	1	-	-		
Dorylaimidae	2	+	3	+	-	-	16	+
Dorylaimidae sp. 1			1	+	-	-		
Dorylaimidae sp. 2			45	+	-	-		
Eudorylaimus sp. 1			1	+	-	-		
Eudorylaimus sp. 2			53	+	-	-		
Eudorylaimus sp. 3			6	+	-	-		
Eudorylaimus sp. (gr. *carteri* [Bastian])					-	-	58	1
Eudorylaimus sp. (gr. *iners* [Bastian])					-	-	71	1
Mesodorylaimus sp. 1	19	+	1	+	-	-		
Mesodorylaimus sp. 2					-	-	6	+
Mesodorylaimus sp. 3					-	-	9	+
Labronema sp. 1					-	-	79	1
Nematoda (undetermined)	464	1	45	+	-	-	22	+
∑ Nematoda ∑ Individuals	38561	100	19054	100	-	-	10935	100
∑ Taxa	21		47		-		26	
Nematoda treated as a group (ult)			12350					
(c) Tardigrada								
Heterotardigrada								
Echiniscus blumi Richters	6790	8	11	+	-	-		
Echiniscus testudo (Doyère)	146	+	887	10	-	-		

(c) **Tardigrada** (continued)	Tegulous moss cushions		Epilithic moss cushions					
			Survey 1984		Survey 1987		Dynamics	
	n	%	n	%	n	%	n	%
Echiniscus trisetosus Cuénot			42	+	-	-		
Echiniscus	16	+	1	+	-	-		
Eutardigrada								
Macrobiotus areolatus Murray	19829	24	192	2	-	-		
Macrobiotus cf. artipharyngis Iharos	16254	19			-	-		
Macrobiotus hufelandi Schultze	27535	33	2880	33	-	-	202	9
Macrobiotus persimilis Binda & Pilato	788	1	2177	25	-	-	722	33
Macrobiotus richtersi Murray			1	+	-	-	33	1
Macrobiotus	1972	2	533	6	-	-	16	1
Hypsibius cf. bakonyiensis (Iharos)			29	+	-	-		
Hypsibius convergens Urbanowicz *s.l.*	3191	4	132	2	-	-	291	13
Hypsibius oberhäuseri (Doyère)	6490	8	933	11	-	-	921	42
Hypsibius cf. pallidus Thulin	22	+	8	+	-	-	12	1
Hypsibius	139	+	16	+	-	-	8	+
Diphascon pingue (Marcus)	195	+			-	-		
Ishypsibius prosostomus (Thulin)	30	+	279	3	-	-	10	+
Milnesium tardigradum Doyère	206	+	512	6	-	-		
Eutardigrada (undetermined)	9	+	3	+	-	-		
∑ Tardigrada ∑ Individuals	83612	100	8636	100	-	-	2215	100
∑ Taxa	12		13		-		7	
Tardigrada treated as a group (ult)			2706					
(d) Arachnida (Acari excluded) **Crustacea, and Myriapoda**								
Pseudoscorpiones								
Chthonius			1	12				
Araneae								
Theridiidae			1	12				
Micryphantidae			2	25				
Linyphiidae			2	25				
Agelenidae			1	12				
Opiliones								
Phalangiidae			1	12				
∑ Arachnida ∑ Individuals			8	100				
∑ Taxa			6					
Isopoda								
Oniscidae			24	100				
∑ Crustacea ∑ Individuals			24	100				
∑ Taxa			1					
Chilopoda								
Lithobiidae			4	4			1	17
Geophilidae			7	7				
Diplopoda								
Polyxenus lagurus L.	1		93	88	29	100	8	83
Blaniulidae			1	1				

(d) Arachnida (continued)		Tegulous moss cushions		Epilithic moss cushions					
				Survey 1984		Survey 1987		Dynamics	
		n	%	n	%	n	%	n	%
Pauropoda				1	1				
Σ Myriapoda	Σ Individuals	1	100	106	100	29	100	6	100
	Σ Taxa	1		5		1		2	
(e) Oribatida									
Brachychthoniidae						2	+		
Liochthonius				2	+				
Verachthonius laticeps (Strenzke)		2	+	10	+				
Camisia segnis (Hermann)				360	4	111	6	1	+
Trhypochthonius tectorum Berlese		283	30	221	2	3	+	16	5
Damaeus				3	+				
Eremaeus oblongus Koch				737	7	4	+		
Tectocepheus sarekensis Trägårdh		197	21	5866	57	1126	60	112	37
Oppiidae				8	+				
Oppia nitens (Koch)						1	+		
Opiella nova (Oudemans)				3	+				
Quadroppia quadricarinata (Michaël)				8	+			114	38
Oppia fasciata (Paoli)				1	+				
Suctobelba sarekensis Forsslund				2	+				
Cymberemaeus cymba (Nicolet)		1	+	8	+	5	+		
Micreremus brevipes (Michaël)		1	+			1	+		
Scutovertex cf. sculptus Michaël		292	31	36	+	4	+		
Dometorina plantivaga (Berlese)				1	+				
Oribatula tibialis (Nicolet)				132	1	131	7		
Phauloppia lucorum (Koch)		18	2	57	1	170	9	2	1
Phauloppia paspalevi Csiszar				1	+				
Scheloribates laevigatus (Koch)				23	+				
Scheloribates latipes (Koch)		9	1	410	4	17	1		
Zygoribatula exilis (Nicolet)				1903	19	78	4	27	9
Zygoribatula frisiae (Oudemans)		6	1	15	+				
Zygoribatula propinquus (Oudemans)		5	1	58	1	20	1		
Chamobates sp. 1				3	+				
Chamobates borealis Trägårdh				36	+			10	3
Ceratozetes cf. minutissimus Willmann				1	+				
Trichoribates cf. trimaculatus (Koch)		92	10	213	2	193	10	10	3
Mycobates parmeliae (Michaël)		2	+						
Minunthozetes pseudofusiger Schweizer				136	1				
Minunthozetes semirufus (Koch)				5	+				
Punctoribates punctum (Koch)				6	+				
Protoribates cf. capucinus Berlese						1	+		
Eupelops planicornis (Koch)						1	+		
Oribatella quadricornuta (Michaël)				3	+				
Galumna alatus (Hermann)				8	+				
Oribatida sp. 1				1	+				
Oribatida sp. 2				1	+				
Oribatida (undetermined)		45	5					9	3
Σ Oribatica	Σ Individuals	953	100	10278	100	1868	100	301	100
	Σ Taxa	12		33		17		8	

(f) Gamasida and Ixodida	Tegulous moss cushions		Epilithic moss cushions					
			Survey 1984		Survey 1987		Dynamics	
	n	%	n	%	n	%	n	%
Gamasida								
Laelaptidae			5	5				
Hypoaspis	1	14						
Hypoaspis claviger Karg			3	3				
Phytoseiidae	2	29			1	11		
Amblyseiulus	1	14			1	11		
Amblyseiulus murteri (Schweizer)			5	5				
Typhlodromus	1	14						
Typhlodromus andrei Karg			9	8				
Lasioseius fimetorum Karg			3	3				
Halolaelaps			1	1				
Asca aphioides (L.)			33	30	4	44		
Arctoseius cetratus Sellnik			2	2				
Zerconidae			3	3				
Zercon montanus Willmann			3	3				
Rhodacaridae			2	2				
Dendrolaelaps			6	5	2	22		
Gamasellus falciger (Can.)	1	14						
Parasitidae			4	4				
Pergamasus crassipes (L.)			6	5				
Gamasina (undetermined)	1	14	12	11	1	11		
Uropodidae			6	5				
Uroobovella notabilis Berlese			4	4				
Ixodida								
Ixodidae			3	3				
∑ Gamasida + Ixodida ∑ Individuals	7	100	110	100	9	100	0	
∑ Taxa	4		12		3		0	
(g) Actinedida								
Pachygnathidae			1	+				
Nanorchestidae	1	4	22	2	6	2		
Eupodes			454	36	71	27	4	8
Penthalodidae			1	+				
Penthaleidae			70	6				
Paratydaeolus			12	1				
Tydeidae	3	11	71	6	59	23	11	23
Triophtydeus			10	1				
Microtydeus			3	+				
Tydeus bedfordiensis Evans			14	1				
Tydeus (type Lorryia 2)			12	1				
Tydeus (Type Paralorryia 1)			9	1				
Tydeus (Type Paralorryia 2)			7	1				
Tydeus (Type Tydeus sp. V)			32	3				
Tydeus (Type Tydeus sp. A)			23	2				
Bdellidae	2	7	1	+			17	35
Bdella longicornis (L.)			103	8	17	7		
Cyta			65	5	2	1	1	2
Spinibdellinae	1	4	2	+				
Cunaxidae	4	15	13	1	26	10		
Cunaxoides			8	1				

(g) Actinedida	Tegulous moss cushions		Epilithic moss cushions					
			Survey 1984		Survey 1987		Dynamics	
	n	%	n	%	n	%	n	%
Pygmephoroidea			3	+				
Pygmephoridae			4	+				
Scutcaridae			1	+				
Tarsonemidae	1	4	289	23	1	+	1	2
Raphignathidae	1	4	2	+				
Cryptognathidae					2	1	4	8
Caligonellidae					2	1		
Stigmaeidae			5	+				
Bryobia			6	+	6	2		
Tenuipalpidae	1	4						
Eriophidae	1	4						
Erythraeidae	5	19			60	23		
Johnstonionidae					2	1		
Podotrombidiidae			1	+				
Trombidiidae	1	4	4	+	1	+		
Actinedida (undetermined)	6	22	8	1	4	2	10	21
∑ Actinedida ∑ Individuals	27	100	1256	100	259	100	48	100
∑ Taxa	11		29		13		6	
(h) Collembola								
Arthropleona								
Hypogastrura			16	+				
Hypogastrura sp. 1					2	1		
Hypogastrura assimilis Krausbauer			5	+				
Hypogastrura cf. elevata Cassagnau			3	+				
Hypogastrura engadinensis Gisin			1	+				
Hypogastrura tullbergi Schäffer					25	12	47	73
Hypogastrura vernalis (Carl)			74	2	2	1		
Schoettella ununguiculata (Tullberg)			4047	88	52	25		
Xenylla			6	+				
Xenylla boerneri Axelson			1	+				
Xenylla brevisimilis Stach	1130	95	43	1	55	26	11	17
Xenylla welchi Folsom			11	+				
Willemia anophthalma Börner			1	+				
Friesea claviseta Axelson			31	1	1	+		
Brachystomella parvula (Schäffer)			4	+				
Neanura muscorum (Templ.)					1	+		
Onychiuridae			4	+	2	1		
Mesaphorura			6	+				
Mesaphorura krausbaueri Börner			20	+				
Folsomides angularis Axelson	18	2						
Folsomia similis Bagnall			3	+				
Isotomiella paraminor Gisin			2	+				
Proisotoma hankoi Stach					1	+		
Isotoma arborea (L.)			18	+				
Isotoma viridis Bourlet			1	+				
Parisotoma notabilis (Schäffer)			29	1	5	2		
Isotomurus plumosus Bagnall			1	+				
Isotomurus palustris (Müller)			6	+	1	+		
Pseudisotoma sensibilis (Tullberg)			2	+				

(h) Collembola (continued)	Tegulous moss cushions		Epilithic moss cushions					
			Survey 1984		Survey 1987		Dynamics	
	n	%	n	%	n	%	n	%
Entomobrya			16	+	2	1		
Entomobrya multifasciata (Tullberg)			97	2	20	10		
Entomobrya nivalis (L.)			16	+	20	10		
Entomobrya marginata (Tullberg)			61	1	8	4		
Orchesella			1	+				
Orchesella cincta (L.)			25	1				
Willowsia buski (Lubbock)			35	1	4	2	3	5
Willowsia nigromaculata (Lubbock)			3	+				
Lepidocyrtus			2	+				
Lepidocyrtus gr. servicus-pallidus					1	+		
Lepidocyrtus lignorum (Fabricius)			1	+				
Lepidocystus cyaneus Tullberg			1	+				
Pseudosinella			12	+				
Pseudosinella sp. 1			4	+				
Pseudosinella-Lepidocyrtus			2	+				
Symphypleona								
Sminthurinus	10	1			1	+		
Sminthurinus aureus (Lubbock)			1	+				
Sminthurinus bimaculatus (Axelson)			3	+	4	2		
Bourletiella					1	+		
Collembola (undetermined)	36	3	2	+			3	5
∑ Collembola ∑ Individuals	1194	100	4617	100	208	100	64	100
∑ Taxa	3		32		18		3	
(i) Insecta (Collembola excluded)								
Diplura			2	1				
Psocoptera	4	10	7	4				
Thysanoptera			6	3				
Heteroptera			2	1	1	3		
Anthocoridae			1	1				
Homoptera								
Coccina			4	2				
Aleyrodina			5	3				
Aphidina			4	2				
Coleoptera			2	1				
Staphylinidae	1	3	4	2	2	5		
Curculionidae					1	3		
Ptiliidae					1	3		
Neuroptera								
Chrysopa					1	3		
Coniopterygidae			1	1				
Hymenoptera	3	8	1	1				
Mymaridae			8	4				
Braconidae			1	1				
Scelionidae			2	1				
Diptera	11	28	16	8	2	5	3	75
Chironomidae	19	49	41	21	20	50		

(i) **Insecta** (continued)	Tegulous moss cushions		Epilithic moss cushions					
			Survey 1984		Survey 1987		Dynamics	
	n	%	n	%	n	%	n	%
Psychodidae			32	17	4	10		
Cedicomyiidae			17	9	3	8		
Sciaridae	1	3	20	10	1	3		
Scatopsidae			1	1				
Drosophilidae			1	1				
Trichoptera								
Hydroptila sparsa Curtis			2	1				
Hydroptila pulchicornis Pictet			1	1				
Lepidoptera								
Lepidoptera (larvae)			9	5	2	5	1	25
Insecta (undetermined)			1	1	2	5		
∑ **Insecta** ∑ Individuals	39	100	191	100	40	100	4	100
∑ Taxa	5		21		10		2	

(k) **All taxa**		Tegulous moss cushions	Epilithic moss cushions			Total
			Survey 1984	Survey 1987	Dynamics	
∑ Aquatic fauna	∑ Individuals	151'969	48'798	-	16'290	217'057
	∑ Taxa	34	61	-	34	72
∑ Terrestrial fauna	∑ Individuals	2'221	13'103	2'413	423	21'647
	∑ Taxa	36	133	62	21	162
∑ Aquatic + terrestrial fauna	∑ Individuals	154'190	6'421	2'413	16'713	238'704
	∑ Taxa	70	194	62	55	234

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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 Mus. Nat. Hist. Chicago, XII+ 861 pp.

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