VIERAEA	**Vol. 36**	1-28	Santa Cruz de Tenerife, octubre 2008	ISSN 0210-945X

Millipedes (Diplopoda) of the Canarian Islands: Checklist and key

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ARNDT, E., H. ENGHOFF & J. SPELDA (2008). Milípedos (Diplopoda) de las islas Canarias: Catálogo y clave. *VIERAEA* 36: 1-28.

RESUMEN: Se presenta una lista de 83 especies de milpiés para el archipiélago canario. 56 son consideradas endemismos canarios. La familia Fuhrmannodesmidae se cita por primera vez para las islas. Solamente se colectaron hembras, lo que hace imposible la determinación de géneros o especies. Se figuran las especies de Fuhrmannodesmidae y se proporciona una clave de todos los géneros de Diplopoda presentes en el archipiélago, y de todas las especies excepto las del prolífico género *Dolichoiulus*.

ABSTRACT: A list of the 83 millipede species known from the Canary archipelago is given. 56 species are regarded as Canarian endemics. The family Fuhrmannodesmidae (gen. and sp. indet.) was recorded first time on the islands. Only females were collected which makes the determination of species or genus impossible. The fuhrmannodesmid species is figured and a key to all genera of Diplopoda from the archipelago and all species except those of the prolific genus *Dolichoiulus* is provided.

INTRODUCTION

Millipedes (class Diplopoda) are one of the well known and diverse groups on the Canarian Islands. Vicente & Enghoff (1999) presented the first complete commented Canarian checklist of this group. Most recently Zurita & Oromi (2004) published an updated checklist including 82 species, 56 of which (68.3%) are regarded as Canarian endemics. The species number as well as the proportion of endemic taxa is very high in the archipelago

taking into account the small total land area of 7447 km^2. Millipedes are generally mesophilous and represent the decomposer assemblage. The majority of Canarian millipede species accordingly occurs in the forest belt of the western islands. The isolation of the seven major islands as well as the separation or fragmentation of forest areas by vulcanism and climatic changes in the younger geological history supported the species radiation and development of so-called "species swarms" in many groups. Canarian millipede swarms have developed in the genera *Dolichoiulus* Verhoeff, 1900 (Julidae), and *Glomeris* Latreille, 1803 (Glomeridae) (Enghoff, 1992a; Enghoff & Báez, 1993; Golovatch & Enghoff, 2003). *Acipes* Attems, 1937 (Blaniulidae) and *Cylindroiulus* Verhoeff, 1894 (Julidae) includes two further species swarms in a Macaronesian context (Enghoff, 1983, 1992b).

Nowadays, an increasing number of introduced species occur in the archipelago which additionally increase the species numbers of Canarian millipedes (Fig. 1). Zurita & Oromi (2004) list 15 species as probably or surely introduced by man.

One of us (EA) examined patterns of arthropod diversity as well as invasive species in Canarian laurel forests. During this study new faunistic data were obtained but an identification key to the millipede genera and species was missed. Therefore it is the aim of the present paper to publish faunistic data of millipedes from Canarian laurel forest and to give an identification key to the Diplopoda which will enable ecologists or zoologists to include the group in their studies.

MATERIAL AND METHODS

The new faunistic data published here were obtained in a field study by EA in laurel forests of La Palma, El Hierro, and La Gomera. Millipede material was collected by using pit fall traps and soil samples at 21 forests sites (12 sites on La Gomera, 5 sites on La Palma, 4 sites on El Hierro; for a detailed description of sites and sample methods see Arndt & Mattern, 2005) in the period 2002-2003, and additional collection by hand on the three islands as well as the Anaga mountains of Tenerife.

The millipede material collected by Erik Arndt is deposited in the Zoologische Staatssammlung München (Germany), and the Natural History Museum (Zoological Museum), University of Copenhagen (Denmark).

CHECKLIST OF DIPLOPODA OF THE CANARIAN ARCHIPELAGO

Abbreviations: C-Grand Canaria; F-Fuerteventura; G-La Gomera; H-El Hierro; L-Lanzarote; P-La Palma; T-Tenerife.

ORDER POLYXENIDA

Family Lophoproctidae

Lophoproctinus inferus (Silvestri, 1903) T C F

T, C, and F. Grassland, *Kleinia* and *Euphorbia* vegetation in lower regions. The West-Mediterranean species occurs with its North-west African ssp. *maurus* Marquet & Condé, 1950 in the archipelago (Nguyen Duy-Jacquemin, 1996).

Family Polyxenidae
Macroxenus enghoffi Nguyen Duy-Jacquemin, 1996
F. (Dry?) Habitats in lower regions and rock areas. The species is also known from Cape Verde Islands.

Polyxenus fasciculatus Say, 1821
P, H, G, T, C. Laurel forest belt and subalpine zone, a few specimens also known from drier and lower regions (a barranco on La Gomera, 550m). Probably introduced, also known from large parts of U.S.A., Bermuda isl., and Madeira (Vicente & Enghoff, 1999).

Polyxenus oromii Nguyen Duy-Jacquemin, 1996
Endemic on P, T, and F. In coastal (supralittoral) habitats.

ORDER GLOMERIDA

Family Glomeridae

Glomeris alluaudi Brölemann, 1901
Endemic on T. Various habitats.

Glomeris canariensis Golovatch, 1986
Endemic on G. In laurel and fayal-brezal forests.

Glomeris gomerana Attems, 1911
Endemic on G. In laurel, fayal-brezal, and pine forests.

Glomeris hierroensis Golovatch & Enghoff, 2003
Endemic on H. In laurel and fayal-brezal forests.

Glomeris speobia Golovatch & Enghoff, 2003
Endemic on T. In caves.

Glomeris vicenteae Golovatch & Enghoff, 2003
Endemic on C. In forests of different types.

ORDER POLYDESMIDA

Family Fuhrmannodesmidae
gen. and sp. indet., Figs 2-4.
Family, genus and species new for the Canary Islands!
Material studied: 15 spms La Palma, 300m (site code M1P; 28°37’14’’N 17°49’22’’W) and 500m (site code M2P; 28°37’25’’N 017°49’27’’W) north of Zona recreativa Pared Vieja (street Breña Alta-Cumbre Nueva), laurel forest, 1.200m, East-slope, tree coverage 85%, tree vegetation dominated by *Laurus novocanariensis* and *Myrica faya*, leaf litter about 3cm, March 2002, E. Arndt leg. – 6 spms La Palma, Montana Tagoja, (site code E1P; 28°43’06’’N 017°46’48’’W), “Fayal-Brezal” forest, 1000m, West-slope, tree coverage 80%, tree layer dominated by *Myrica faya*, *Erica arborea*, *Ilex canariensis* and *Laurus novocanariensis*, leaf litter 3cm, trees not older than 30 years, March 2002, E. Arndt leg. – 1 spm El Hierro, South of Tigaday (site code M3H; 27°44’20’’N 018°00’36’’W), “Fayal-Brezal” forest, 860m, North-Slope, tree coverage 50%, trees (shrubs) not older than 15

years, mono-dominated by *Myrica faya*, leaf litter 7-10cm, February 2003, E. Arndt leg. All specimens were obtained by searching soil samples (25x25x15 cm).

These localities are located in the laurel forest belt and are quite influenced by man. Co-occuring millipedes were *Brachydesmus superus* and *Ommatioulus moreleti* (at all sites extremely dominant), on La Palma also *Dolichoiulus typhlops*, and the isopod *Armadillidium vulgare* (Latreille). These are introduced species, like in all probability the fuhrmannodesmid.

All collected fuhrmannodesmid specimens are adult or juvenile females, or juvenile too young to be sexed, indicating parthenogenesis. This is the second parthenogenetic millipede species known from the Canary Island, the first being *Proteroiulus fuscus* (which is probably introduced as well).

Fuhrmannodesmidae is a very poorly known and quite poorly defined family. Species referred to Fuhrmannodesmidae have been described from the Oriental, Afrotropical and Neotropical regions (Hoffman, 1980).

The Canarian fuhrmannodesmid shows no striking morphological traits, with the exception of the peculiar 'knots' on the limbus shown in Figs. 3, 4 (the limbus is the more or less hyaline posterior rim of the body rings and is known to exhibit great variation among millipede taxa, see Schmidt, 1962).

Family Paradoxosomatidae
Oranmorpha guerinii (Gervais, 1837)
All islands except L. Various habitats, also in caves. An introduced species.

Oxidus gracilis (Koch, 1847)
P, G, T. Various, mostly dry and warm habitats, also in caves. An introduced species.

Stosatea italica (Latzel, 1866)
C. In shrubs and forests, probably introduced

Family Polydesmidae
Brachydesmus proximus Latzel, 1889
All islands except H. Various habitats, most common in laurel forests. An introduced species.

Brachydesmus superus Latzel, 1884
P, H, G, T. Various habitats including caves, very common in laurel forests. Probably introduced, widespread in laurel forests and fayal-brezal; co-occuring with *B. proximus*.

Polydesmus coriaceus Porat, 1871
P. In laurel forests. Probably introduced.

Propolydesmus dismilus (Berlese, 1891)
T. In forests. Probably introduced.

Propolydesmus laevidentatus (Loksa, 1967)
T. In forests and caves, most common in laurel forests. Until recently known only from Macaronesia but now also collected in continental Portugal and Spain. Possibly introduced to the Canary Islands and Macaronesia in general (Enghoff & Golovatch, 2003).

Proteroiulus fuscus (Am Stein, 1857)
P, H, G. In laurel forests, fayal-brezal, and pine forest. Probably introduced, widespread in Europe except the southern part. Parthenogenetic. Also known from Madeira and the Azores, introduced to many localities (Vicente & Enghoff, 1999).

Family Julidae

Anagaiulus blancatypa Enghoff, 1992
Endemic on T. Laurel forests (Anaga mountains).

Brachyiulus lusitanus (Verhoeff, 1898)
P, C. Laurel and fayal brezal forests. Introduced, widespread in south-west Europe. Also known from Madeira and the Azores, introduced to North-America (Vicente & Enghoff, 1999).

Brachyiulus pusillus (Leach, 1815)
P, H, G, T. Various habitats. Introduced, widespread in western Europe. Also known from Madeira and the Azores, introduced to many localities (Vicente & Enghoff, 1999).

Cylindroiulus britannicus (Verhoeff, 1891)
T. Laurel forest. Introduced, widespread in western and Central Europe. Also known from Madeira and the Azores, introduced to many localities (Vicente & Enghoff, 1999).

Cylindroiulus disjunctus Read, 1988
Endemic on H and P. Laurel and pine forest.

Cylindroiulus latestriatus (Curtis, 1845)
T. Leaf litter of several habitats in lower altitudes. Probably introduced, widespread in western and Central Europe. Also known from Madeira and the Azores, introduced to many localities (Vicente & Enghoff, 1999).

Cylindroiulus truncorum (Silvestri, 1896)
T, C. Several habitats including laurel forests. Probably introduced, widespread in North-western and Central Europe, as well as North-Africa. Also known from Madeira (Vicente & Enghoff, 1999).

Dolichoiulus altitenerife Enghoff, 1992
Endemic on T. Pine forest and *Spartocytisus* bushland in 1.300-2.200.

Dolichoiulus alluaudi Enghoff, 1992
Endemic on C. In *Euphorbia* habitats, grassland, bushland, and pine forests from 150-1.900m.

Dolichoiulus aquasilvae Enghoff, 1992
Endemic on T. Laurel forest, in logs.

Dolichoiulus architheca Enghoff, 1992
Endemic on C. In open habitats, typically in *Euphorbia* vegetation from 50-950m.

Family Pyrgodesmidae

Cynedesmus formicola Cook, 1896
G, T, C. Several habitats in low and warm regions. Also known from Madeira, regarded an Macaronesian endemic by Vicente & Enghoff (1999) but recently found in a greenhouse in Hungary (Korsós et al., 2002). This find gives rise to a suspicion that the Macaronesian occurrences may be due to introduction. Various habitats in low altidudes.

ORDER POLYZONIIDA

Family Siphonocryptidae

Hirudicryptus canariensis (Loksa, 1967)
G, T. In laurel forests. Also known from Madeira, probably a Macaronesian endemic (Vicente & Enghoff, 1999).

ORDER CHORDEUMATIDA

Family Opisthocheiridae

Ceratosphys poculifer (Brölemann, 1920)
C, H. In open forests and subalpine habitats between 1.000 and 2.000m. Probably introduced. New for El Hierro: Fuentes de los Reyes (leg. Arndt 2003). Beside the Canarian islands, it is known from the type locality in Ciudad Real, continental Spain (Vicente & Enghoff, 1999) and from farmland in Andalusia, Prov. Cordoba (Spelda, unpubl.).

ORDER JULIDA

Family Blaniulidae

Acipes franzi (Loksa, 1967)
P, H, G, T, C. Canarian endemic. Most common in laurel forest and fayal-brezal, also occurring in lower, dry areas (e.g. with *Kleinea* and *Rumex* vegetation (Vicente & Enghoff, 1999).

Blaniulus guttulatus (Fabricius, 1798)
P, H, G, T, C. Various habitats including caves. Introduced, widespread in western Europe. Also known from Madeira and the Azores (Vicente & Enghoff, 1999).

Choneiulus palmatus (Nemec, 1895)
T, C. In various habitats. Probably introduced, widespread in western Europe. Also known from Madeira and the Azores.

Choneiulus subterraneus (Silvestri, 1903)
T. In caves. Probably introduced, also occurring in France and Italy.

Nopoiulus kochii (Gervais, 1847)
P, T, C. In laurel forests and fayal-brezal, also in caves. Probably introduced, widespread from western Europe to the Caucasian region. Also known from Madeira and the Azores, introduced to many localities (Vicente & Enghoff, 1999).

Dolichoiulus axeli Enghoff, 1992
Endemic on T. Barren habitats, *Euphorbia* vegetation and bushland ("retamar"), from sea-level-970m.

Dolichoiulus baezi Enghoff, 1992
Endemic on T. Xerophytic vegetation.

Dolichoiulus canariensis (Pocock, 1893)
Endemic on T. In a variety of habitats, mostly in pine forests and bushland ("retamar"), but also known from open land near coast; from sea-level to 2.200m.

Dolichoiulus carolineae Enghoff, 1992
Endemic on C. Open and dry habitats, typically in *Euphorbia* vegetation in 50-120m.

Dolichoiulus chioensis Enghoff, 1992
Endemic on T. Only known from the type locality, a cave on western Tenerife.

Dolichoiulus dendromystax Enghoff, 1992
Endemic on T. Laurel forest.

Dolichoiulus dubiosus Enghoff, 1992
Endemic on G. Laurel forest.

Dolichoiulus fjellbergi Enghoff, 1992
Endemic on C. Dry rock area, only known from the type locality, 990m.

Dolichoiulus fuerteventurae Enghoff, 1992
Endemic on F. Open habitats with mosses, herbs and bushs.

Dolichoiulus gara Enghoff, 1992
Endemic on G. Laurel forest.

Dolichoiulus heliophilus Enghoff, 1992
Endemic on C. In arid habitats near the coast.

Dolichoiulus hyaena Enghoff, 1992
Endemic on T. Laurel forest.

Dolichoiulus ingeae Enghoff, 1992
Endemic on T. Habitats of lower regions, like *Euphorbia* vegetation, sea-level to 320m.

Dolichoiulus insularis (Brölemann, 1901)
Endemic on T. *Euphorbia* scrubland and bushland, also in caves.

Dolichoiulus jandiensis Enghoff, 1992
Endemic on F. Rock areas with moss and plant vegetation in about 700-800m of the type locality.

Dolichoiulus jonay Enghoff, 1992
Endemic on G. Laurel forest.

Dolichoiulus kraepelinorum (Latzel, 1895)
Endemic on T. In a variety of habitats, from coastal habitats, *Euphorbia* vegetation, bushland to pine forests; from sea-level to 2.200m.

Dolichoiulus labradae Enghoff, 1992
Endemic on T. In caves.

Dolichoiulus lasiurus Enghoff, 1992
Endemic on T. Laurel forest.

Dolichoiulus martini Enghoff, 1992
Endemic on C. Only known from the type locality, small ledges of bushy rocks in 1125m.

Dolichoiulus mystax (Brölemann, 1901)
Endemic on T. Laurel forest.

Dolichoiulus nemasoma Enghoff, 1992
Endemic on T. Open and dry habitats near the coast as lava fields and abandoned land (Enghoff, 1992).

Dolichoiulus oskari Enghoff, 1992
Endemic on C. Open, often *Euphorbia* dominated habitats; 50-900m.

Dolichoiulus parcestriatus (Brölemann, 1901)
Endemic on C. Open *Euphorbia* vegetation in 150-400m.

Dolichoiulus praesenilis Enghoff, 1992
Endemic on G. Laurel forests and pine plantations.

Dolichoiulus quasimystax Enghoff, 1992
Endemic on T. Laurel forest.

Dolichoiulus rectangulus Enghoff, 1992
Endemic on G. Laurel forest.

Dolichoiulus sansebastianus (Attems, 1911)
Endemic on G. Open and dry habitats, often in *Euphorbia* vegetation also littoral *Salsola* areas; 20-ca. 1.200m.

Dolichoiulus senilis (Attems, 1911)
Endemic on G. Laurel forest.

Dolichoiulus silvahierro Enghoff, 1992
Endemic on . Laurel and *Erica* forests.

Dolichoiulus silvapalma Enghoff, 1992
Endemic on P. Laurel and *Erica* forests.

Dolichoiulus tiendarius (Attems, 1911)
Endemic on T and G. Open and dry habitats, often in *Euphorbia* vegetation also littoral *Salsola* areas; 10-ca. 1.200m.

Dolichoiulus troglohierro Enghoff, 1992
Endemic on H. Only known from the type locality, a cave.

Dolichoiulus typhlops Ceuca, 1973
P, H. An introduced species. Caves and laurel forest.

Dolichoiulus ultimus Enghoff, 1992
Endemic on C. Dry bushland, only known from the type locality in 475m.

Dolichoiulus variabilis Enghoff, 1992
Endemic on G, T. Open habitats near coast.

Dolichoiulus vosseleri (Verhoeff, 1900)
Endemic on T. Open habitats in relatively humid regions from sea-level to 850m, but also in dead *Euphorbia canariensis* (Enghoff, 1992).

Dolichoiulus wunderlichi Enghoff, 1992
Endemic on L and the neighbouring small islets Alegranza and Montaña Clara. Habitats of dry vegetation, e.g. in *Sideritis* litter.

Dolichoiulus xerohierro Enghoff, 1992
Endemic on H. Open and coastal habitats from sea-level to 400m.

Dolichoiulus xeropalma Enghoff, 1992
Endemic on P. Open vegetation from 400-740m.

Dolichoiulus xylomystax Enghoff, 1992
Endemic on T. In laurel forest.

Dolichoiulus ypsilon Enghoff, 1992
Endemic on T. In caves.

Dolichoiulus zygodon Enghoff, 1992
Endemic on C. Moss pads in wet rock crevices outside a forest; only known from the type locality in 475m.

Ommatoiulus moreleti (Lucas, 1860)
All islands except L. Occurring in different habitats from settlements to laurel and pine forests, often very numerous. Introduced species.

KEY TO THE GENERA AND SPECIES (EXCEPT *DOLICHOIULUS*)

Note: "segment" is equivalent to "body ring" and includes a diplosegment or one of the four anterior, single segments. Operculum - anterior part of vulva. Gonopods - 8./9. pair of legs. Metazonite - posterior part of diplosegment. F - female; M - male.

1 Adult individuals very small (£ 3mm), with long groups of hairs laterally on body rings and at the end of abdomen (Fig. 5). (Polyxenida) 34

- Body of adult individuals longer, no remarkable groups of hairs. 2

2 Body with >>13 segments, more or less elongate. 8

- 11-13 segments, body short and wide, "half cylindrical" in cross-section, able to curl up into a sphere. (Glomerida: Glomeridae: *Glomeris* sp) 3

Note: The following key to *Glomeris* species is a simplified version of that presented by Golovatch & Enghoff (2003).

3 Body entirely pallid, only seldom distal halves of tarsi and/or lateralmost parts of terga slightly yellowish; ocelli largely depigmented, only occasionally discernible as pale brownish spotlets. Troglophile, Tenerife. ..... *G. speobia*

- Body at least partly pigmented (except for very early instars), patterns variable, ocelli always blackish brown. 4

4 Adults up to 11.5 (M) or 13.4 mm (F) long and 6.0 (M) or 6.4 mm (F) wide, body blackish, colour pattern usually absent but sometimes very vague, strongly marbled, paler spots/markings sublaterally on terga 2-10 discernible. ..... *G. canariensis*

- Adults usually smaller, pattern of clear yellowish spots or stripes always discernible against a darker (brown to black-brown) background, sometimes pallid even dominating (especially so in smaller individuals). 5

5 Midcaudal edge of terga 3(4) to 10 not sinuate; central pale spot on pygidium normally wide and trapeziform (Fig. 6). El Hierro. ..... *G. hierroensis*

- Midcaudal edge of terga 3(4) to 10 slightly but evidently sinuate; central spot if any on pygidium only seldom trapeziform, but even then not so wide at base. 6

6 Neither axial line nor row of pale spots on terga (Fig. 7). Gran Canaria. . *G. vicentae*

- Usually an axial row of pale spots on terga 2-10. 7

7 Body medium- to large-sized, 3.4-3.9 (M) or 3.5-5.1 mm (F) wide; venter and legs greyish to grey brown (Fig. 8). La Gomera. ..... *G. gomerana*

- Body generally smaller, 2.2-3.0 (M) or 2.3-3.5 mm (F) wide; venter and legs pallid to pale brown (Fig. 9). Tenerife. ..... *G. alluaudi*

8(2) Body flattened, band-like, head remarkably small and pointed. Yellowish brown, in the middle of metazonites a longish spot, two ocelli in a dark pigmented area. 6-9 mm. Tenerife. ..... *Hirudicryptus canariensis* (Polyzoniida: Siphonocryptidae)

- Body not band-like flattened, head not small and pointed. Other combination of remaining characters. 9

9 Body consisting of 30 segments; on each side of segments three tubercles with strong setae. Cheeks (basal part of mandibles in lateral view) not obviously divided (cf. Fig. 10). ..... *Ceratosphys poculifer* (Chordeumatida: Opisthocheiridae)

- Other combination of characters, usually more or less than 30 segments. Cheeks (basal part of mandibles in lateral view) divided into two or three parts in lateral view (Figs. 11, 12). 10

10 Body consisting of 18-20 segments, body rings laterally with wing-like or hump-like extensions. Eyes always lacking (Fig. 11). (Polydesmida) 11

- Body rings laterally not extended but circle round. Body consisting of more than 30 segments. Eyes usually present (Fig. 12). (Julida) 20

11 Collum very large, covering major part of head or head completely. Body up to 6 mm long (Fig. 13). ..... *Cynedesmus formicola* (Pyrgodesmidae)

- Collum smaller, head visible from above. 12

12 Paranota of 2nd segment more extended to ventral side than those of 3rd segment and lateral end of collum (visible in ventral view); gonopods never fused medially, dorsal setae of anal valves removed from caudal margin. (Paradoxosomatidae) 13

- Paranota of 2nd and 3rd segments at about the same level, those of most other body segments larger and stronger projecting laterad; upper setae of anal valves with different pattern. 15

13 Uniformly coffee brown to cream dorsally, dark longitudinal line not distinct. Ventral side and legs yellowish brown, antenna, especially distal half of the antennomeres, contrastingly darker. Head smooth without setae. Pleural ridges apparent up to segment 17. Gonopods as in Fig. 14. Body 20-25 mm long. ... *Oranmorpha guerinii*

- Dorsally with at least two shades of brown or beige-yellowish. Other combination of remaining characters. 14

14 Colour dark red brown to blackish brown dorsally; paranota, terminal antennal segments and ventral part of body contrastingly yellowish white. Posterior angles of paranota truncate in anterior part of body, pointed in posterior part. Collum with a row of small setae anteriorly and in the middle. Gonopods as in Fig. 15. Body 16-21.5mm long. ..... *Oxidus gracilis*

- Colour yellowish and read brown: lateral and central part of dorsal side brown, the parts between yellowish, giving the impression of two light longitudinal stripes in dorsal view. Posterior angles of lateral ridges on all segments rounded. Collum with 3 rows of small setae. Gonopods in Fig. 16. Body 12-14mm long. ..... *Stosatea italica*

15(12) Body narrow, not exceeding 6 mm length; colour pale, white-greyish white, tergites covered with short and stubby spines and with regular fields (Figs 2-4). .... Fuhrmannodesmidae gen. and sp. indet.

- Body wider and much longer, adults more than 11mm long. Dorsal part of body yellow, reddish, brown or black; tergites with irregular fields, paraterga with distinctly larger humps. (Polydesmidae) 16

16 Body including collum and telson with 20 segments. (*Polydesmus* and *Propolydesmus*) 17

- Body including collum and telson with 19 segments. (*Brachydesmus*). 19

17 Dorsum brown to dark brown, with rough and deep sculpture consisting of three distinct rows of tubercles. Gonopods as in Fig. 17. Body 10-16 mm long. .... *Polydesmus coriaceus*

- Dorsum paler yellow or red brown; sculpture less deep. Gonopods different. 18

18 Dorsum yellow to red brown. Gonopods as in Fig. 18. Body 15-23mm long. .... *Propolydesmus dismilus*

- Dorsum pale red brown. Gonopods as in Fig. 19; body 7-8 mm long. .... *Propolydesmus laevidentatus*

19(16) Lateral side of gonopod telopodite with a thin lamella (Fig. 20). Pale brown to white, body 7.5-10.0 mm long, 1.0-1.1 mm wide. Metazonites distinct but not coarsely sculptured, with comparable long setae. ..... *Brachydesmus superus*

- Lateral side of gonopod telopodite without a lamella. Yellowish white to yellowish brown, rarely reddish brown. Body 9-17mm long, 1.1-2.0mm wide. .... *Brachydesmus proximus* Latzel

20(10) Metazonites without longitudinal striae dorsally, body slender and graceful. Eyes when present in a single row or in a very narrow triangle. Relation length:width >15:1 (Blaniulidae). 21

- Metazonites with longitudinal striae all around, body less slender. Relation length:width about 10:1. Eyes usually present, in a triangular or ovoid group (Julidae). 26

21 Eyes lacking. Setae of body rings long, well visible. Pale greyish with a row of shining red spots laterally (colour disappearing and entire body quickly becoming dark purple in ethanol preserved specimens). 7-16mm long. ..... *Blaniulus guttulatus*

- Eyes present. 22

22 Relatively stout (Fig. 21), ocelli of adults in a very narrow triangle (Fig. 12). Parthenogenetic, males very rare. ..... *Proteroiulus fuscus*

- Very slender, ocelli of adults in a single line (rarely with a few extra ocelli beside the line). Bisexual, males and females usually about equally abundant. 23

23 Body rings with a posterior whorl of numerous very long setae (Fig. 22). Posterior gonopod tip like a regularly fringed funnel, visible without dissection (Fig. 23). Adults 5-12 mm long, 0.3-0.6 mm in diameter. ..... *Choneiulus palmatus*

- Body rings with fewer, shorter setae (as in Fig. 24). Posterior gonopod different. 24

24 Anterior gonopod coxal processes with sinuous lateral margin (Fig. 25). Posterior gonopod as in Fig. 26. Adults 8-14 mm long, 0.4-0.7 mm in diameter. .. *Acipes franzi*

- Anterior gonopod coxal processes with straight lateral margin, posterior gonopods different. 25

25 Apex of posterior gonopod like an irregular fringed funnel (Fig. 27). Anterior gonopod telopodites with setae (Fig. 28). Second antennal segment of females often S-shaped (Fig. 29). Adults 6-12 mm long, 0.4-0.7 mm in diameter. ... *Choneiulus subterraneus*

- Apex of posterior gonopod divided into a spiny branch and a smooth branch (Fig. 30). Anterior gonopod telopodites without setae (Fig. 31). Second antennal segment of females normal. Adults 5-13 mm long, 0.4-0.7 mm in diameter. ..... *Nopoiulus kochii*

26(20) Caudal projection of preanal ring long, pointed, curved upwards (Fig. 32). Large species (up to 40 mm); adults black with pinkish legs and antennae. Juveniles greyish brown with dark lateral spots and often with dark dorsal longitudinal stripe. .... *Ommatoiulus moreleti*

- Caudal projection of preanal ring absent or very rarely present but short and not curved. Other combination of remaining characters. 27

27 A pair of frontal setae on head. Body rings with a whirl of metazonital setae. Body not exceeding 15mm. (*Brachyiulus*). 28

- No frontal setae. Body usually naked (but telson with setae). Body often but not always>15mm. 29

28 Gonopods with lamellar, striate phylacum (Fig. 33). ..... *Brachyiulus lusitanus*

- Gonopods without phylacum. ..... *Brachyiulus pusillus*

29 Setae on anal valves only along free margin (rarely a few non-marginal setae in *C. disjunctus*). Gonopods consisting of a promerite with flagellum, an independent mesomerite and an opisthomerite (Fig. 34). (*Cylindroiulus*) 30

- Setae on anal valves not only along free margin. Gonopods consisting of a promerite without a flagellum, and an opisthomerite, no mesomerite (Fig. 35), flagellum lacking. 33

30 Anal valves each with 3 setae, body of uniform colouration, operculum of vulva with setae (Fig. 36). 31

- Anal valves usually with more than 3 setae each, when not, body with a variegated colour pattern, operculum of vulva without setae (Fig. 37). 32

31 Gonopod opistomerite with a slender apical appendage (Fig. 38). .... *Cylindroiulus britannicus*

- Gonopod opisthomerite without an apical appendage (Fig. 34). .... *Cylindroiulus latestriatus*

32 Body of uniform colouration, male metazonites with very deep striation, gonopods as in Fig. 39. ..... *Cylindroiulus truncorum*

- Body with a variegated colour pattern, male metazonites with normal striation, gonopods as in Fig. 40. ..... *Cylindroiulus disjunctus*

33(29) Whorl of short setae present on metazonite. Ocelli absent. Restricted to the Anaga mountain forests (Tenerife). ..... *Anagaiulus blancatypa*

- Metazonite without setae. Ocelli present in most species. ..... *Dolichoiulus*

Note: There are 46 species known from the archipelago, most of which are endemic and restricted to one island (see checklist). Enghoff (1992) presents a key to all species.

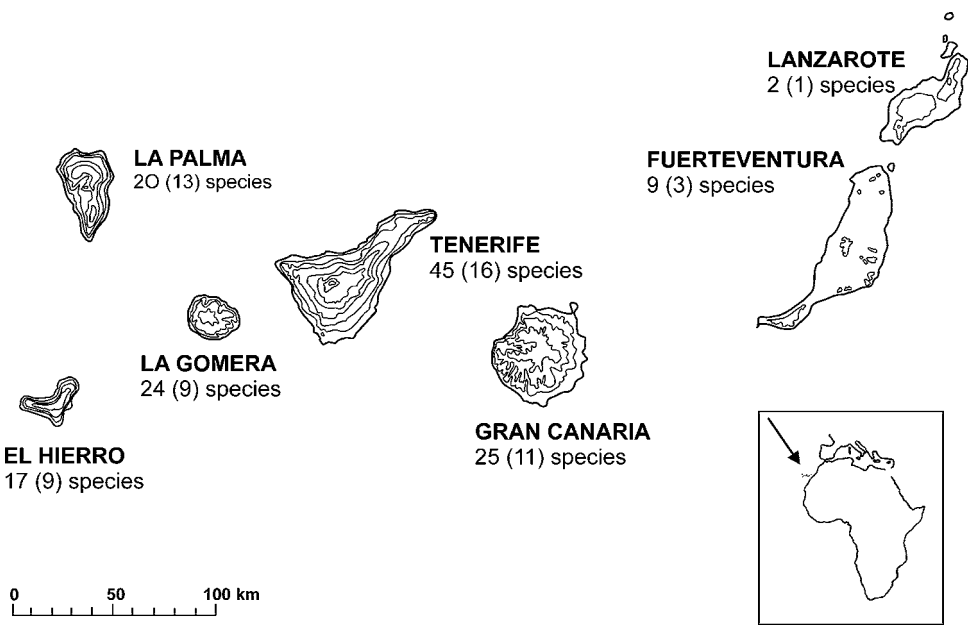
34(1) Last antennal segment about as long as penultimate. Gnathochilarium without palps. Claws simple. Eyes always lacking. ..... *Lophoproctinus inferus* (Lophoproctidae)

- Last antennal segment distinctly shorter than penultimate. Gnathochilarium with palps. Claws of legs with accessory lobes. Eyes often present. (Polyxenidae) 35

35 Telson with one tuft of fringed setae, these setae without barbs; fringed setae in anterior part of head long and thin. Palps of gnathochilarium with short sensory cones (sensillae) distributed over the whole surface (Fig. 41). 3 (M)-4 (F)mm long. .... *Macroxenus enghoffi*

- Telson with two tufts of fringed setae, some of these setae with barbs; fringed setae in anterior part of head wide and short. Palps of gnathochilarium with longer sensory cones (sensillae) (longer than diameter of gnathochilarium), but only distributed on ventral margin and apical tip. Body less than 2mm long. 36

36 Segments only with elongate club-shaped trichomes dorsally. .... *Polyxenus fasciculatus*



- Segments also with globular trichomes dorsally (anterior part of head and median row of collum). ..... *Polyxenus oromii*

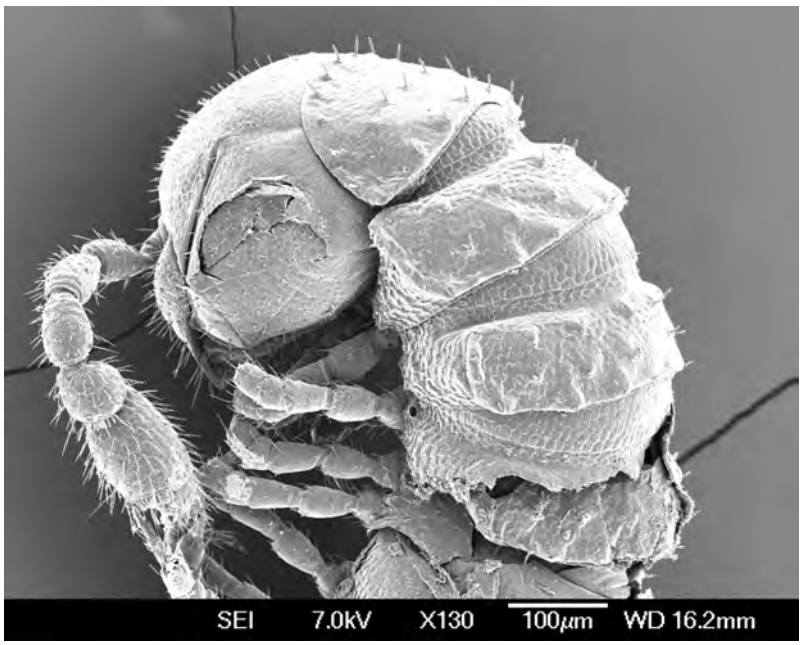


Fig. 1. Map of the Canary Islands with numbers of actually known species (number of probably introduced species in parenthesis).

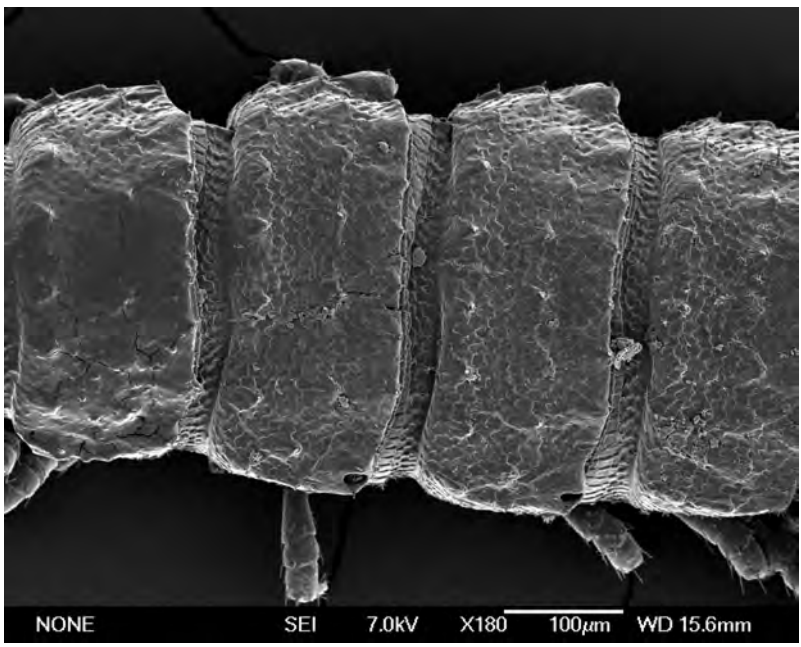


Fig. 2. Fuhrmannodesmidae gen. et sp. indet., head and first segments, lateral view.

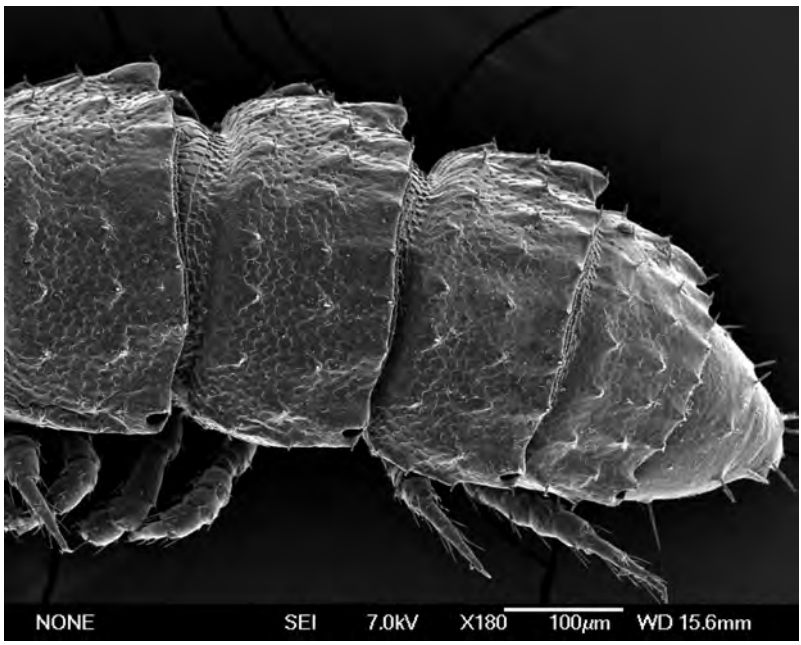


Fig. 3. Fuhrmannodesmidae gen. et sp. indet., body rings, dorsal view.

Fig. 4. Fuhrmannodesmidae gen. et sp. indet., posterior part of body, lateral view.

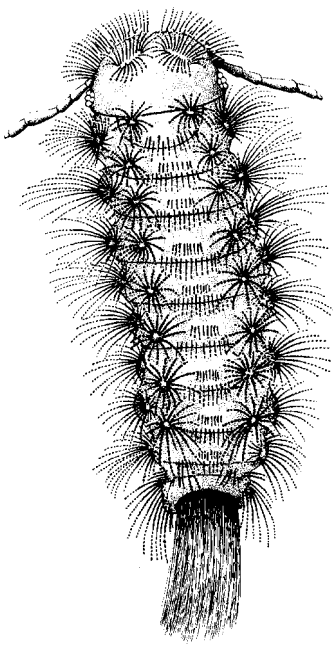


Fig. 5. *Macroxenus enghoffi* (redrawn from Nguyen Duy-Jacquemin, 1996).

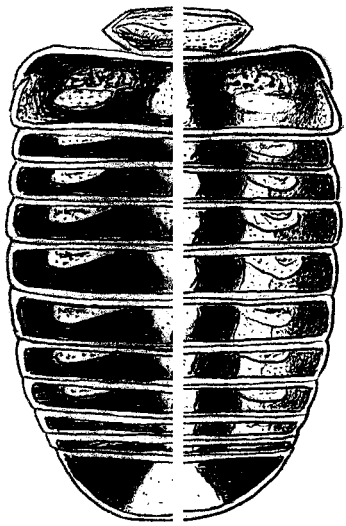


Fig. 6 *Glomeris hierroensis*, two colour pattern (redrawn from Golovatch & Enghoff, 2003).

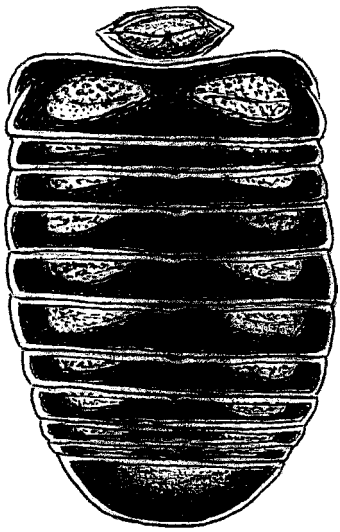


Fig. 7. *Glomeris vicentae* (redrawn from Golovatch & Enghoff, 2003).

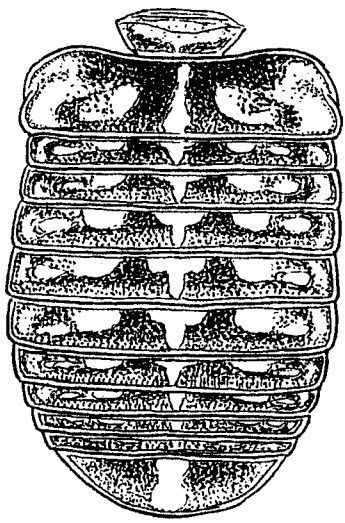


Fig. 8. *Glomeris gomerana* (redrawn from Golovatch & Enghoff, 2003).

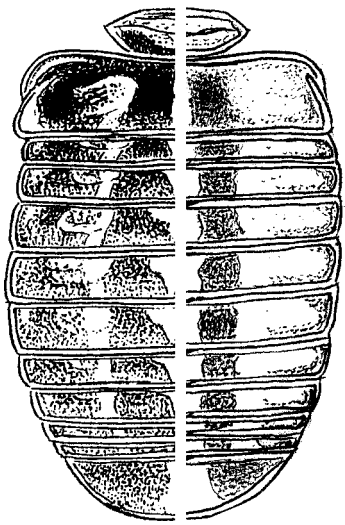


Fig. 9. *Glomeris alluaudi*, two colour pattern (redrawn from Golovatch & Enghoff, 2003).

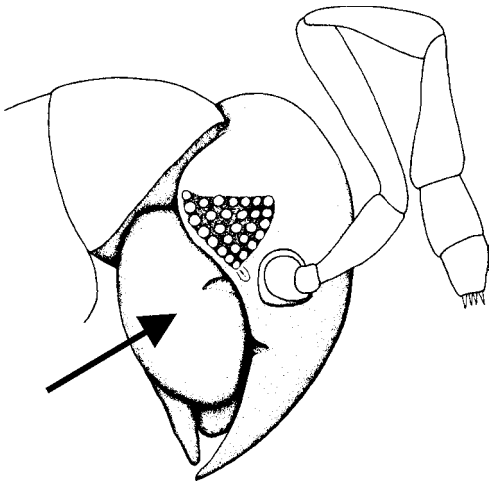


Fig. 10. Head of a Chordeumatida species in lateral view. Arrow indicates the apparently not divided basal part of mandible ("cheek" sensu Blower; redrawn from Blower, 1985).

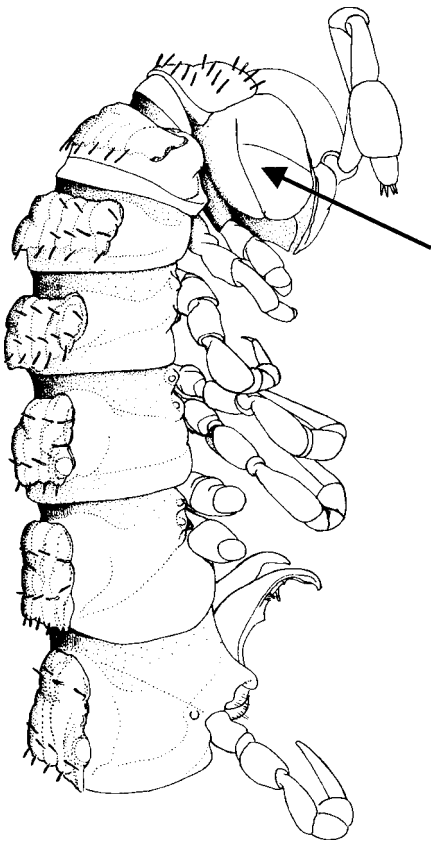


Fig. 11. *Brachdesmus superus*, head, lateral view. Arrow indicates the divided basal part of mandible (redrawn from Blower, 1985).

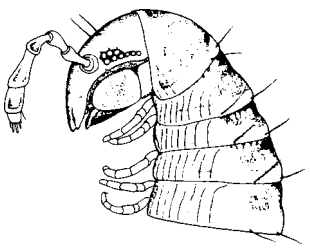


Fig. 12. *Proterulus fuscus*, lateral view of head and first segments (redrawn from Blower, 1985).

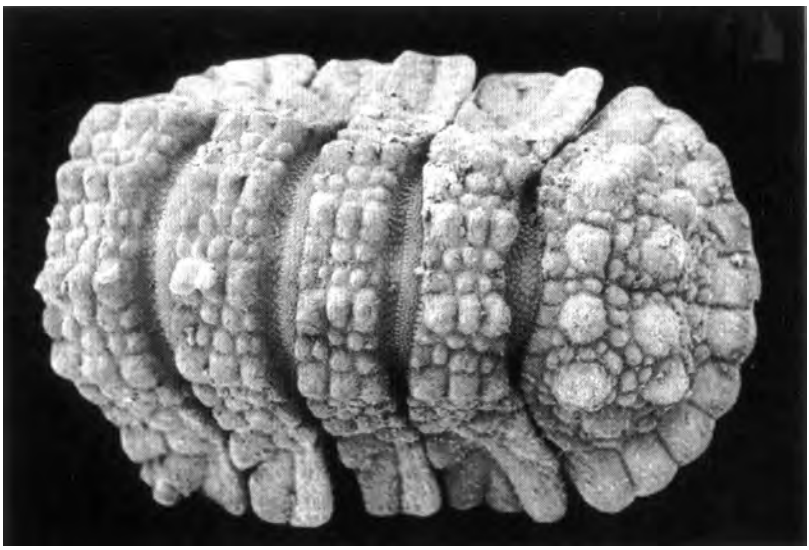


Fig. 13. *Cynedesmus formicola*, colum and body rings (redrawn from Vicente & Enghoff, 1999).

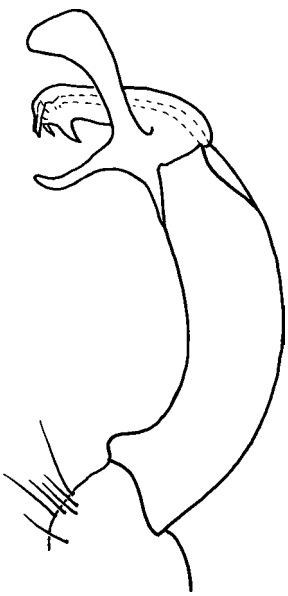


Fig. 14. Gonopods of *Oranmorpha guerini* (redrawn from Attems, 1937).

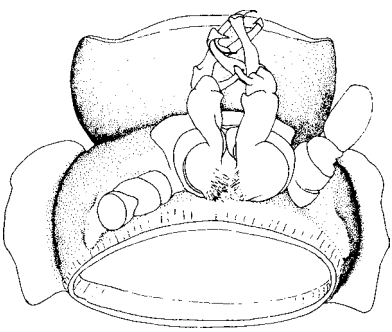


Fig. 15. Ventral view of body ring VII with gonopodes of *Oxidus gracilis* (redrawn from Blower, 1985).

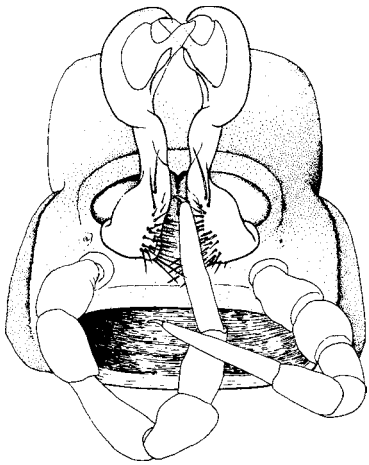


Fig. 16. Ventral view of body ring VII with gonopodes and leg 9 of *Stosatea italica* (redrawn from Blower, 1985).

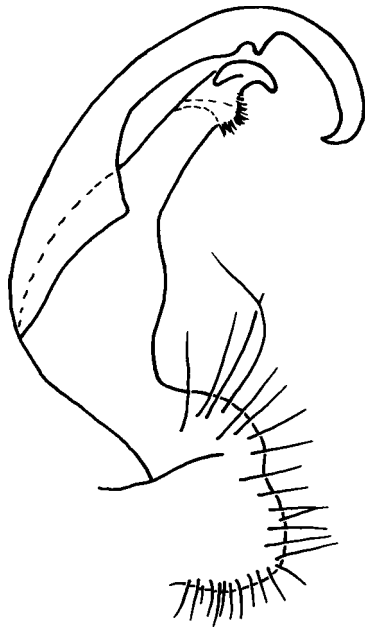


Fig. 17. Gonopods of *Polydesmus coriaceus* (redrawn from Attems, 1940).

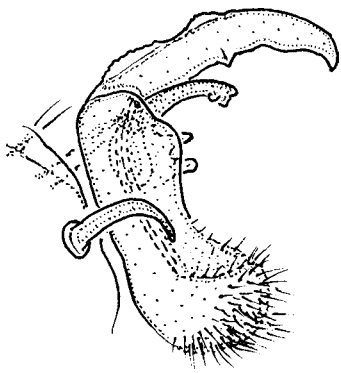


Fig. 18. Gonopods of *Propolydesmus dismilus* (redrawn from Enghoff & Golovatch, 2003).

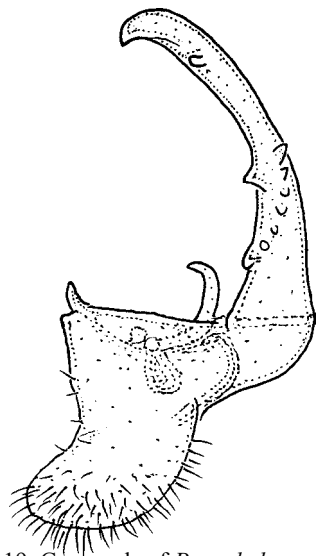


Fig. 19. Gonopods of *Propolydesmus laevidentatus* (redrawn from Enghoff & Golovatch, 2003).

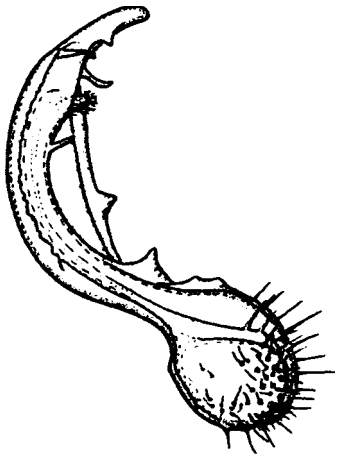


Fig. 20. Gonopods of *Brachydesmus superus* (redrawn from Meidell & Djursvoll, 2005).

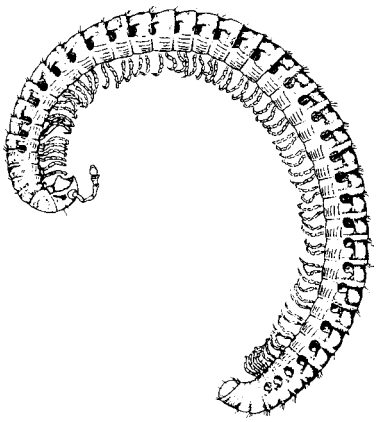


Fig. 21. *Proterulus fuscus* (redrawn from Blower, 1985).

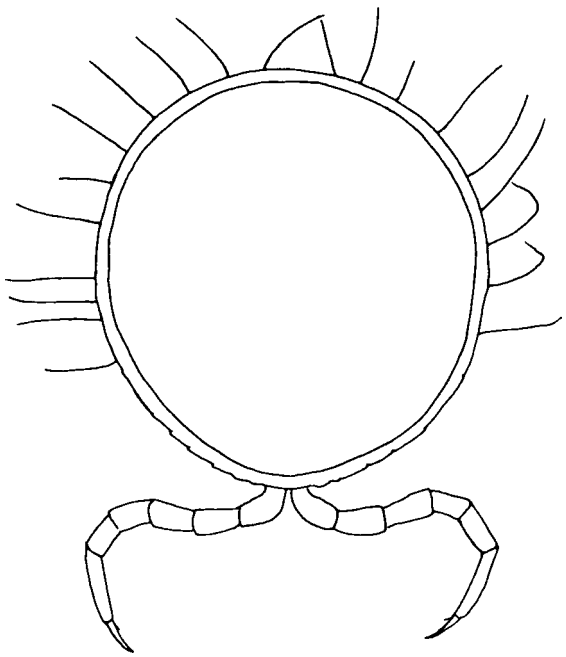


Fig. 22. Body ring of *Choneiulus palmatus* (redrawn from Enghoff & Shelley, 1979).

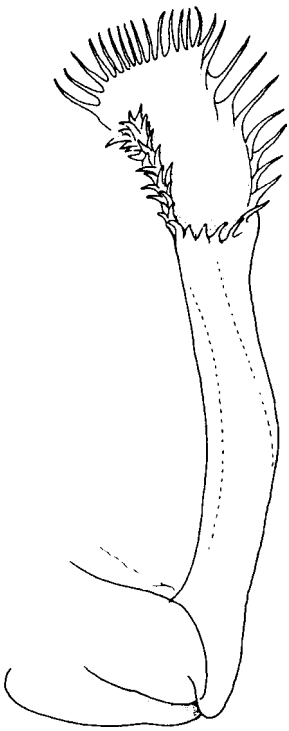


Fig. 23. Posterior gonopod of *Choneiulus palmatus* (redrawn from Blower, 1985).

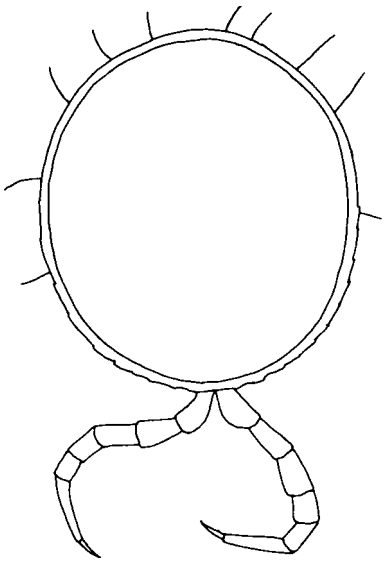


Fig. 24. Body ring of *Nopoiulus kochii* (redrawn from Enghoff & Shelley, 1979).

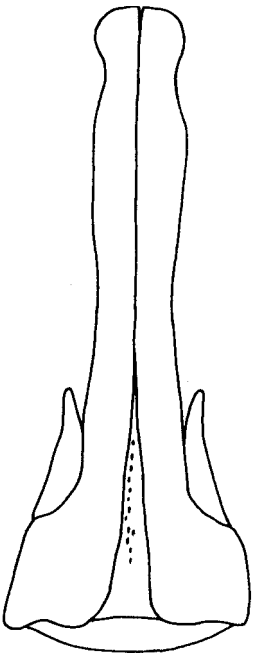


Fig. 25. Anterior gonopod of *Acipes franzi* (redrawn from Enghoff, 1983).

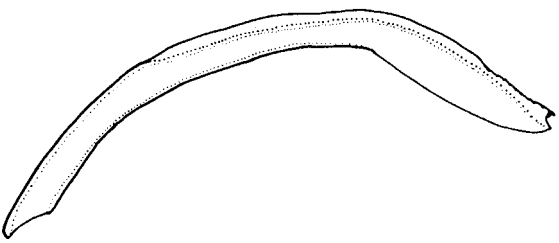


Fig. 26. Posterior gonopod of *Acipes franzi* (redrawn from Enghoff, 1983).

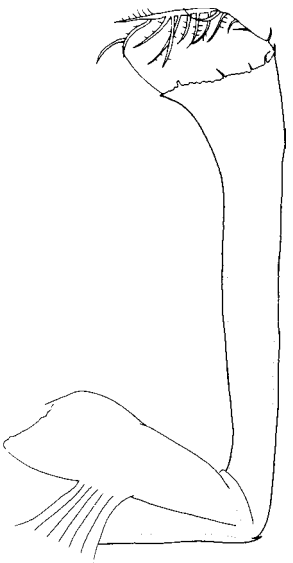


Fig. 27. Left posterior gonopod of *Choneiulus subterraneus* (redrawn from Enghoff, 1984).

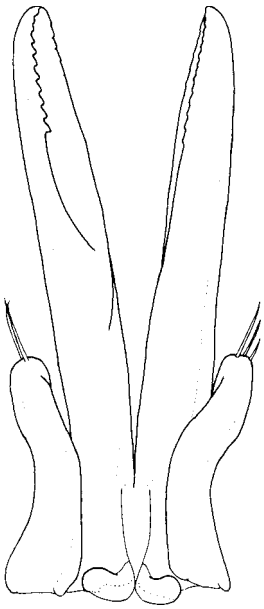


Fig. 28. Anterior gonopod of *Choneiulus subterraneus* (redrawn from Enghoff, 1984).

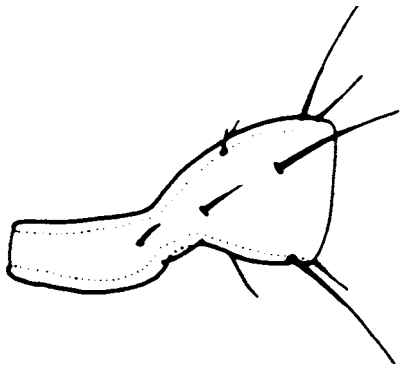


Fig. 29. Antennomere 2 of *Choneiulus subterraneus* (redrawn from Enghoff, 1984).

Fig. 30. Apex of posterior gonopods of *Nopoiulus kochii* (redrawn from Blower, 1985).

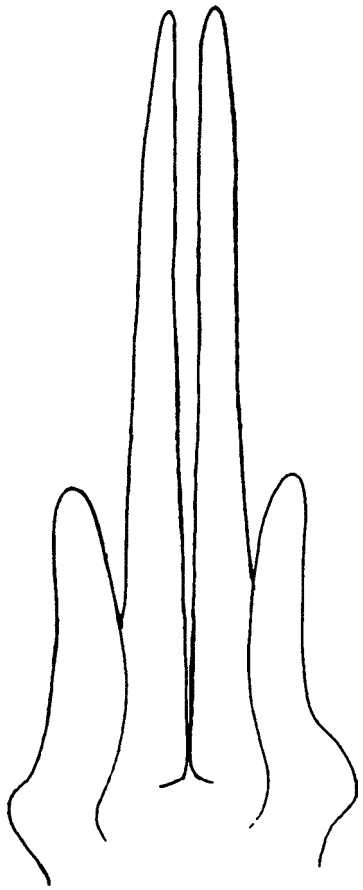


Fig. 31. Anterior gonopods of *Nopoiulus kochii* (redrawn from Blower, 1985).

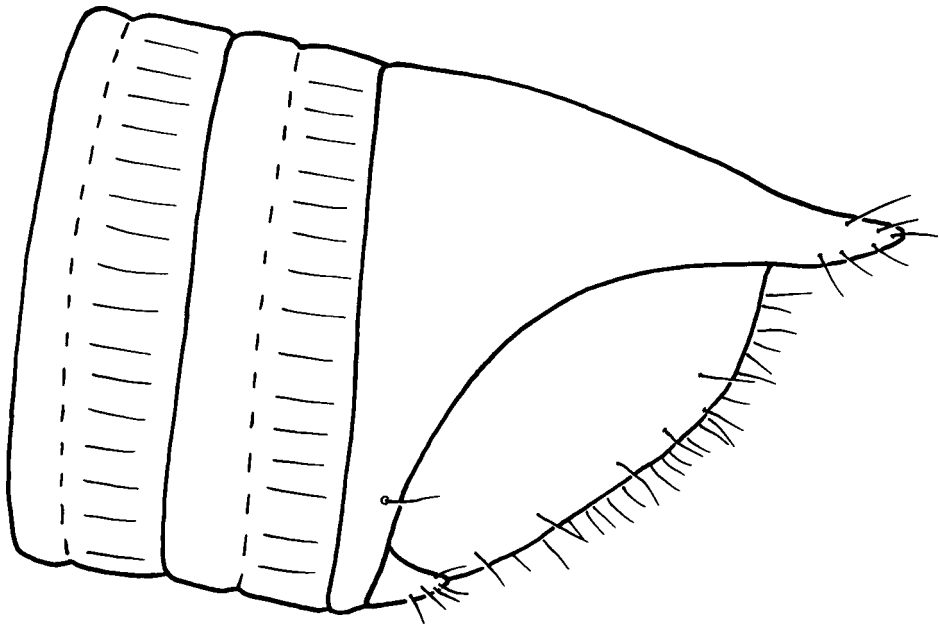


Fig. 32. Preanal and anal ring of *Ommatoiulus moreleti*, lateral view.

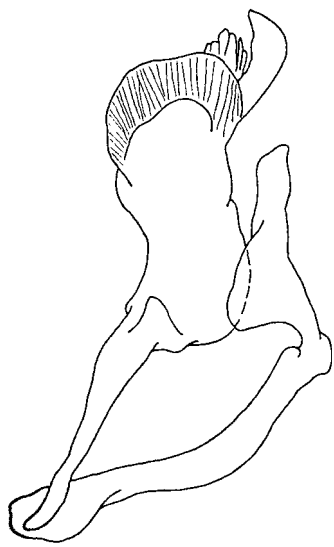


Fig. 33. Gonopods of *Brachyiulus lusitanus* (redrawn from Shelley, 1978).

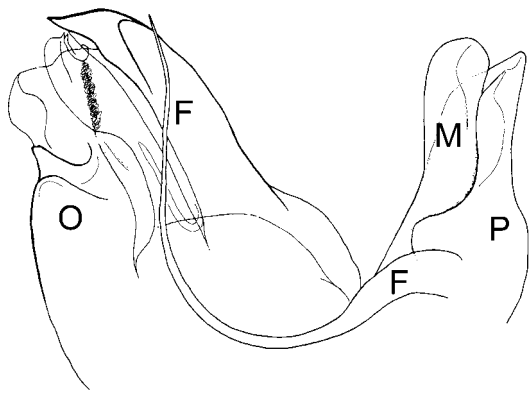


Fig. 34. Right gonopods of *Cylindroiulus latestriatus* (redrawn from Blower, 1985). F-flagellum, M-mesomerite, O-opisthomerite, P-promerite.

Fig. 35. Right gonopods of *Dolichoiulus sp.* (redrawn from Enghoff, 1992).

Fig. 36. Posterior view of left vulva of *Cylindroiulus latestriatus* (redrawn from Blower, 1985). Op-Operculum.

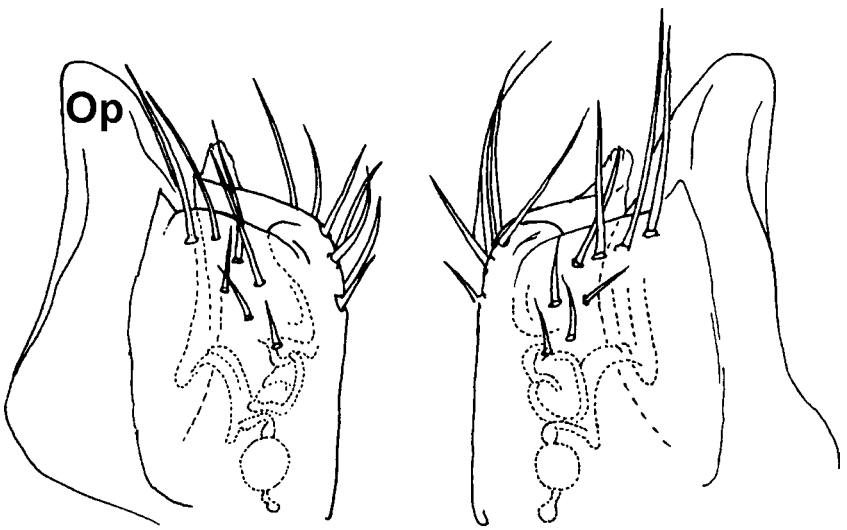


Fig. 37. Vulvae of *Cylindroiulus truncorum* (redrawn from Blower, 1985). Op-Operculum.

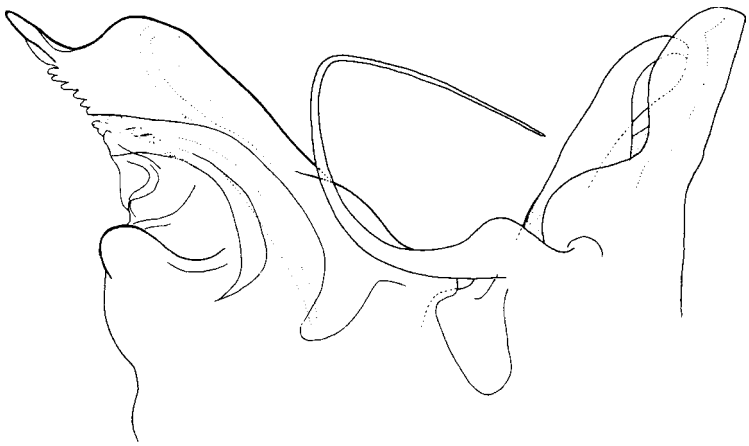


Fig. 38. Right gonopods of *Cylindroiulus britannicus* (redrawn from Blower, 1985).

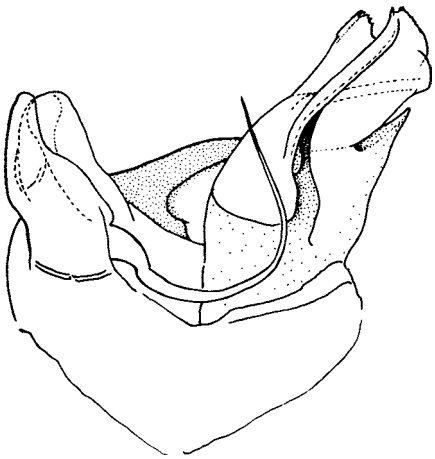


Fig. 39. Left gonopods of *Cylindroiulus truncorum* (redrawn from Blower, 1985).

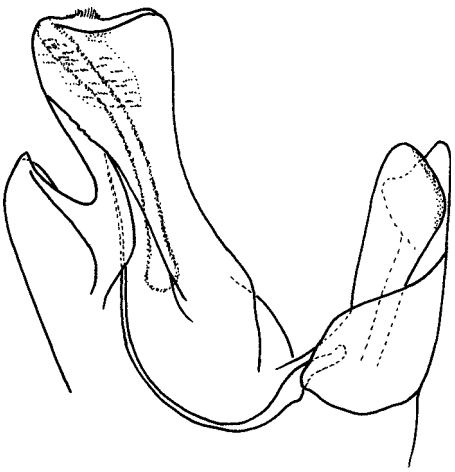


Fig. 40. Right gonopod of *Cylindroiulus disjunctus* (redrawn from Read, 1989).

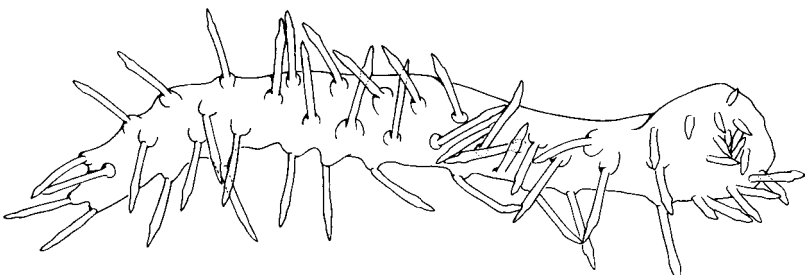


Fig. 41. Right palp of gnathochilarium of *Macroxenus enghoffi* (redrawn from Nguyen Duy-Jacquemin, 1996).

ACKNOWLEDGEMENTS

We thank Ángel Fernández and co-workers (Garajonay National Park, La Gomera), José-María Fernandez Palacios (University of La Laguna, Tenerife), and Antonio Machado (University of La Laguna, Tenerife) for the support of our field work. Birte Wisser, Michael Klemm, Pierre Angelo Cocco, and Stephan Fiedler (Anhalt University, Bernburg, Germany) carried out most of the field work spending much of their time in the project.

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Fecha de recepción: 19 septiembre 2007 Fecha de aceptación: 10 enero 2008