Revision of the genera of Polyxenidae bearing pseudoarticulated gnathochilarial sensilla (Diplopoda, Polyxenida, Polyxenidae), with the description of two new species

Monique NGUYEN DUY-JACQUEMIN
Muséum national d'Histoire naturelle, Département Systématique et Évolution,
Zoologie – Arthropodes,
case postale 53, 57 rue Cuvier, F-75231 Paris cedex 05 (France)
monguyen@mnhn.fr

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ABSTRACT
Examination of the syntypes of the species *Chilexenus rosendinus* (Silvestri, 1903) and *Macroxenodes meinerti* (Silvestri, 1898) has allowed the revision of the four genera of the subfamily Macroxeninae Condé, 2008 bearing pseudoarticulated gnathochilarial sensilla. The diagnostic characters of each of these four tropical or subtropical genera – *Chilexenus* Silvestri, 1948, *Macroxenodes* Silvestri, 1948, *Macroxenus* Brölemann, 1917 and *Afraustraloxenodes* Nguyen Duy-Jacquemin, 2003 – are redefined and two new species of *Macroxenodes* are described: *M. navassaensis* n. sp. from Navassa Island (Greater Antilles) and *M. jahynyi* n. sp. from Uberlândia, Brazil. Identification keys to the genera and species are given.

KEY WORDS
Myriapoda,
Diplopoda,
Polyxenida,
Chilexenus,
Macroxenus,
Macroxenodes,
Afraustraloxenodes,
identification keys,
distribution,
new species.

RÉSUMÉ
Révision des genres de Polyxenidae porteurs de sensilles gnathochilariaux pseudoarticulés (Diplopoda, Polyxenida, Polyxenidae), avec description de deux espèces nouvelles.
L'examen des syntypes des espèces *Chilexenus rosendinus* (Silvestri, 1903) et *Macroxenodes meinerti* (Silvestri, 1898) a permis la révision des quatre genres porteurs de sensilles gnathochilariaux pseudoarticulés appartenant à la sous-famille Macroxeninae Condé, 2008. Les caractères propres à chacun de ces quatre genres tropicaux ou sub-tropicaux : *Chilexenus*, *Macroxenodes*, *Macroxenus* Brölemann, 1917 et *Afraustraloxenodes* Nguyen Duy-Jacquemin, 2003 sont redéfinis et deux nouvelles espèces : *Macroxenodes navassaensis* n. sp. from Navassa Island et *M. jahynyi* n. sp. d'Uberlândia au Brésil sont décrites. Des clés d'identification sont données pour les quatre genres et pour les espèces à l'intérieur de chaque genre, à l'exception de *Chilexenus* monospécifique.

MOTS CLÉS
Myriapoda,
Diplopoda,
Polyxenida,
Chilexenus,
Macroxenus,
Macroxenodes,
Afraustraloxenodes,
clés d'identification,
répartition,
espèces nouvelles.

FIG. 1. — *Afraustraloxenus namibiensis* Nguyen Duy-Jacquemin, 2003: **A**, left palpus of gnathochilarium in adult male; **B**, detail of a sensillum of the extremity of the same. Scale bars: A, 10 µm; B, 1 µm.

INTRODUCTION

Four genera of Penicillata all of which belong to the family Polyxenidae, have pseudoarticulated sensilla on the palpi of the gnathochilarium. These are *Macroxenus* Brölemann, 1917 (type species *Polyxenus rubromarginatus* Lucas, 1846, from Algeria), *Macroxenodes* Silvestri, 1948 (type species *Polyxenus meinerti* Silvestri, 1898, from Venezuela), *Chilexenus* Silvestri, 1948 (type species *Polyxenus rosendinus* Silvestri, 1903, from Chile) and *Afraustraloxenodes* Nguyen Duy-Jacquemin, 2003 (type species *A. namibiensis* Nguyen Duy-Jacquemin, 2003 from Namibia). In addition to the gnathochilarial pseudoarticulated sensilla (Fig. 1), these genera have other characters in common: eight ocelli; same telson type (type II: Condé 1970 and Condé & Nguyen Duy-Jacquemin 2008); same structure of pretarsus and ornamented surface of labrum with lamellate processes along entire anterior margin. *Polyxenus rosendinus* and *Polyxenus meinerti* have not been revised since their creation in 1903 and 1898 by Silvestri, hence descriptions of the syntypes are given here. New material from Central and South America allows the description of two new species of *Macroxenodes*; material of *Macroxenus rubromarginatus* from Gozo and Portugal allows a comparison with *Macroxenus caingangensis* (Schubart, 1944). Keys are given for the identification of genera and species.

ABBREVIATIONS

ad.	adult;
l.p	lateral protuberance on collum.

Antenna

a	anterior sensillum basiconicum;
c	sensillum coeloconicum;
E	short and thick sensilla basiconica;
i	intermediate sensillum basiconicum;
p	posterior sensillum basiconicum;
s	setiform sensillum.

Telson

a1-aX	insertions of barbate trichomes of each dorsal anterior row of telson;
b-c	grouped insertions of trichomes *b* and *c*;
v1-vX	insertions of barbate trichomes on the ventral edge of the penicillus.

Institutions

MNHN	Muséum national d'Histoire naturelle, Paris;
MZUSP	Museu de Zoologia da Universidade de São Paulo;
ZMUC	Natural History Museum, University of Copenhagen.

SYSTEMATICS

Order POLYXENIDA Lucas, 1840
Superfamily POLYXENOIDEA Lucas, 1840
Family POLYXENIDAE Lucas, 1840

Subfamily MACROXENINAE Condé, 2008

REMARKS

Silvestri (1948) characterized three genera of Polyxenidae bearing pseudoarticulated gnathochilarial sensilla: *Chilexenus*, *Macroxenodes* and *Macroxenus*. He distinguished *Chilexenus* as provided with "3 sensillis bacilliformibus" on antennal article VI, as opposed to more than three in *Macroxenodes* and *Macroxenus*. Silvestri's distinction between *Macroxenodes* and *Macroxenus* was based on the length and structure of the hooked trichomes of the caudal penicillus – characters that are no

longer valid. Because of this and the addition of a fourth genus, *Afraustraloxenodes*, bearing pseudoarticulated gnathochilarial sensilla, a new identification key is necessary. Recently these four genera have been combined in a subfamily Macroxeninae Condé, 2008 (Condé & Nguyen Duy-Jacquemin 2008).

Other differences between the four genera

Only in *Macroxenus* are all the trichomes of the tergites oriented towards the telson (Fig. 11B). In *Macroxenus*, the ratio length/diameter of tergal trichomes is larger than in *Macroxenodes* and *Afraustraloxenodes*. In the only examined syntype of *Chilexenus*, the length of trichomes seems similar to that of *Macroxenus*.

KEY TO THE GENERA OF THE SUBFAMILY MACROXENINAE CONDÉ, 2008

1. Spine on metatarsus (tarsus II) 2
— Setiform sensilla on metatarsus 3

2. Short distance between oval lateral tufts of trichomes. Three sensilla basiconica on antennal article VI ..... *Chilexenus*
— Large distance between oval lateral tufts of trichomes. More than three sensilla ..... *Macroxenus*

3. Antennal, prefemoral, femoral and tibial setiform sensilla ending in three or four spines ..... *Macroxenodes*
— Antennal, prefemoral, femoral and tibial setiform sensilla ending in a single spine ..... *Afraustraloxenodes*

Genus *Chilexenus* Silvestri, 1948

REMARKS

Silvestri (1903) described *Polyxenus rosendinus* from specimens collected under bark of trees at San Rosendo, Chile, and later (Silvestri 1905: 722, 723, pl. 36 figs 38-41) added drawings of antennal articles VI to VIII, telotarsus, one external barbate and one internal hooked caudal trichome. In 1948 he created the genus *Chilexenus* for this species.

Chilexenus rosendinus (Silvestri, 1903) (Figs 2; 3)

Polyxenus rosendinus Silvestri, 1903: 16, 17.

MATERIAL EXAMINED. — **Chile.** S. Rosendo, adult ♀ syntype, mounted on slide in Canada balsam (Museo civico di Storia Naturale di Genova). The label reads "*Polyxenus rosendinus* Silv. Cotypus!!, S. Rosendo". The thick microscope preparation does not allow a detailed observation of the ventral face.

REVISED DESCRIPTION

Coloration: Body and some trichomes pale yellowish; other trichomes varying from clear greyish to dark brown; pigmentation only present around ocelli.

Measurements: Body length (without caudal penicillus) 2.70 mm; caudal penicillus length 0.90 mm. Length of tarsus II of 13th leg: 160 µm.

Head: Eight ocelli on each side. Vertex with one pair of posterior tufts consisting of two rows: anterior row with 18 (right) and 19 (left), posterior row with 10 trichomes. The small distance between each tuft and the length of the trichomes as shown in Figure 3F.

Length of antenna 0.50 mm; proportions of antennal articles as shown in Figure 3A; length of article VI twice its diameter. Antennal article VI with three, thick, dorsal sensilla basiconica: posterior sensillum slightly longer than the subequal anterior and median ones (Fig. 3C, E); one posterior sensillum coeloconicum. Antennal article VII with two dorsal sensilla basiconica: posterior one slightly shorter than anterior on left article (Fig. 3D); on right article, anterior sensillum is

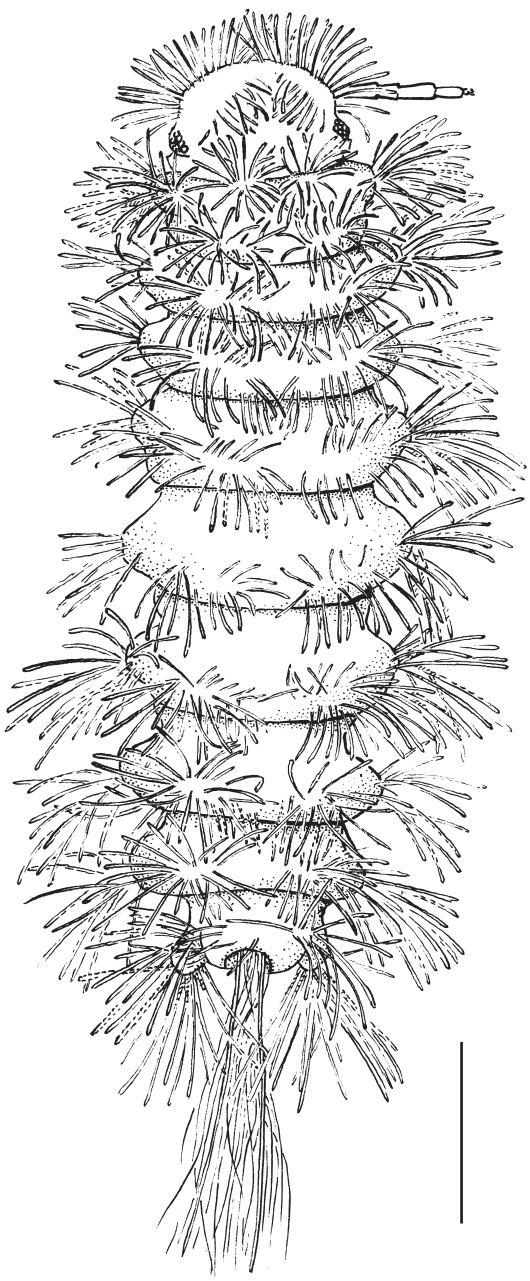

FIG. 2. — *Chilexenus rosendinus* (Silvestri, 1903), adult female syntype from S. Rosendo, dorsal view. Drawing by M. Bertoncini. Scale bar: 0.50 mm.

broken (Fig. 3B); one posterior sensillum coeloconicum. Three trichobothria of equal size, with cylindrical funiculi.

Clypeo-labrum with 12 setae along posterior margin and 12 lamellar teeth on anterior margin. External structure of labrum not visible. Lateral expansion of gnathochilarial palp with 18 pseudoarticulated sensilla on the right and 14 visible on the left; middle palpus with 20 (21? on left) visible (Fig. 3G).

Trunk: Tergal trichomes arranged in two, long, oval tufts separated by a short space – sometimes occupied by two or more trichomes directed towards the telson (Figs 3H; 11A) – and one, uninterrupted, sinuous posterior row of trichomes directed towards the telson, running along posterior margin of tergite (Fig. 11A); about 146 trichomes on tergite VIII.

Legs: (Fig. 3I). Trochanter and prefemur bearing one seta, coxa with one to three setae with slightly oval base. It is not possible to observe the small setae on femur and tibia. Second tarsus with a spine longer than the claw. Posterior lamellar process longer than claw; other process of telotarsus not visible.

Telson: Type II (Condé 1970) characteristic of the subfamily: two latero-dorsal penicilli of hooked trichomes joined side by side; dorsal face of telson with a row of ten and 11 barbate trichomes *a* on each side of median plate (Fig. 3K); two subcircular groups composed of 10 barbate trichomes *c*, and one barbate antero-internal trichome *b* (Fig. 3K); on ventral face the usual subrectilinear row of barbate trichomes located at edge of penicillus of hooked trichomes is not visible. A large part of caudal penicillus is lacking; the left hooked trichomes have two hooks (Fig. 3J).

REMARKS

Tarsi II of *Chilexenus rosendinus* each bear one spine (as in *Macroxenus*), hence *Chilexenus* differs from *Macroxenodes* and *Afraustraloxenodes*, both of which have a seta rather than a spine on tarsus II. *Chilexenus* differs from *Macroxenus* in the different arrangement of the tergal trichomes: long oval lateral tufts separated by a short space and reduced anterior and posterior rows in *Chilexenus* (Fig. 11A), long space between lateral tufts connected by an anterior row and a posterior row in *Macroxenus* (Fig. 11B).

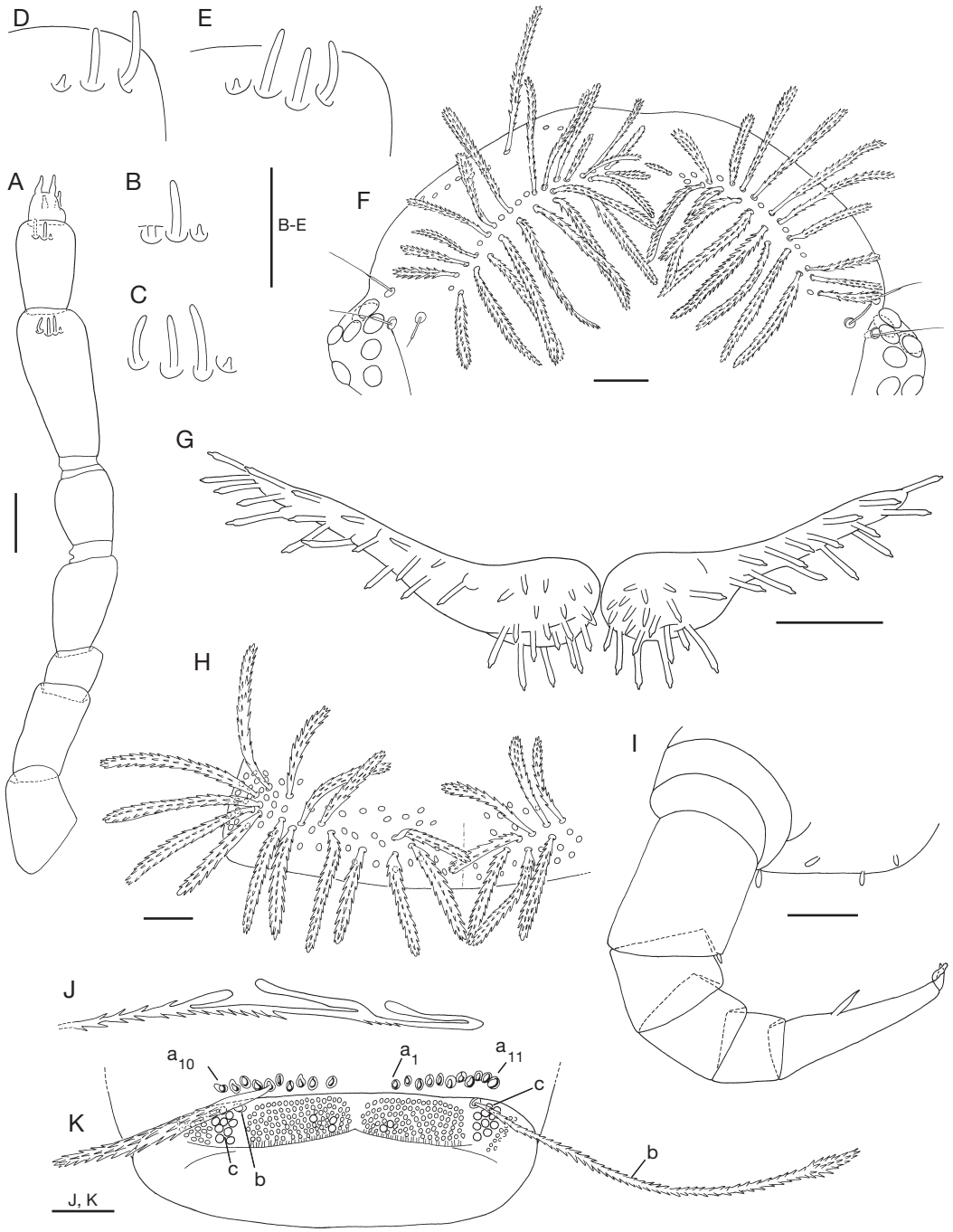

FIG. 3. — *Chilexenus rosendinus* (Silvestri, 1903): **A**, right antenna; **B**, **C**, details of sensilla basiconica and coeloconica on articles VII and VI of antenna A; **D**, **E**, detail of the same sensilla on left antennal articles VII and VI; **F**, head, dorsal view; **G**, palpi of gnathochilarium; **H**, left part of tergite II; **I**, right leg XI; **J**, distal part of hooked trichome; **K**, end of telson with posterior part of its tergite. Abbreviations: $\boldsymbol{a_1}$-$\boldsymbol{a_{11}}$, insertions of barbate trichomes *a*; ***b***, insertion and trichome *b*; ***c***, groups of trichomes *c*. Scale bars: A, F-I, K, 50 µm; B-E, J, 25 µm.

Genus *Macroxenodes* Silvestri, 1948

TYPE SPECIES. — *Polyxenus meinerti* Silvestri, 1898.

REDEFINITION OF THE GENUS

Trichomes short and thick.

Setiform sensilla with three spines on antennal articles, with three or four spines on prefemora, femora and tibiae.

Head: eight ocelli on each side. Vertex with one pair of posterior tufts not separated from the anterior tufts and consisting of two rows (anterior and posterior).

Antennal article VI with five or more sensilla basiconica, one setiform sensillum between the two anterior sensilla basiconica and one sensillum coeloconicum on the distal row of sensilla basiconica (Figs 4E, D; 7C, D; 9C, E). Antennal article VII with two short, thick sensilla basiconica, one setiform sensillum between them and one sensillum coeloconicum posterior (Figs 4C; 7B; 9B). Three trichobothria of equal size with cylindrical funiculi (Figs 4A; 7E).

Whole area of labrum clothed with numerous small and varied cuspidate papillae (also called cuticular setae), in addition to two to six rows of larger spherical papillae (Figs 5A; 7F; 9D) and armed with lamellar teeth on anterior margin. Outer palpus of gnathochilarium with sensilla pseudoarticulated at apex and middle palpus with pseudoarticulated sensilla except for 7-9 short antero-median sensilla.

Trunk: two lateral tufts of trichomes on each tergite connected by trichomic rows. Tergites II to VIII or IX with three trichomic rows: an anterior row with trichomes directed anteriorly towards the head, a median and a posterior row directed towards the telson. The posterior row is sinuous and uninterrupted; trichomes of middle row more spaced than in the anterior and posterior rows (Fig. 11C).

Legs: setae on coxae, trochanters and prefemora with subcylindrical, elongated, naked funiculi (Figs 5F, G; 7J). Other small, oval setae (= setiform sensilla) on prefemora, femora and tibiae (Figs 5D, E; 7H, I). Tarsi II with one seta ending in a point (Figs 5H; 7K; 9F). Pretarsus bearing an anterior process with a spinous projection slightly longer than the claw and posterior lamellar process longer than the claw, with thickened and pleated basal part. Claw with two strongly pointed and subequal anterolateral and posterolateral teeth (Figs 5I; 7L; 9G).

Telson: two latero-dorsal penicilli of hooked trichomes joined side by side. Dorsal face of telson with a few barbate trichomes *a*, one oval-shaped group composed of barbate trichomes *c* and one barbate antero-internal trichome *b* (Fig. 6D). Ventral face with a subrectilinear row of barbate trichomes (*v*: Fig. 6C, E) located on edge of penicillus of hooked trichomes, usually with two to three hooks (Fig. 6B).

KEY TO THE SPECIES OF THE GENUS *MACROXENODES* SILVESTRI, 1948

1. Antennal article VI with two groups (dorsal and postero-ventral) of sensilla basiconica 2
— Antennal article VI with dorsal row(s) of sensilla basiconica 3

2. Postero-ventral group with 2 sensilla basiconica; outer palpus of gnathochilarium with less than 20 sensilla basiconica ..... *M. navassaensis* n. sp.
— Postero-ventral group with 4-7 sensilla basiconica; outer palpus of gnathochilarium with more than 20 sensilla basiconica ..... *M. amazonicus*

3. 3 rows of sensilla basiconica on antennal article VI ..... *M. jahynyi* n. sp.
— 1 or 2 rows (antero-distal and proximal) of sensilla basiconica on antennal article VI . 4

4. 1 dorsal row of sensilla basiconica on antennal article VI ..... *M. poecilus*
— 2 dorsal rows of sensilla basiconica on antennal article VI 5

5. 2 or 3 rows of spherical papillae on anterior labral margin ..... *M. meinerti*
— 4 or 5 rows of spherical papillae on anterior labral margin ..... *M. bartschi*

Macroxenodes meinerti (Silvestri, 1898)
(Figs 4-6)

Polyxenus meinerti Silvestri, 1898: 53.

MATERIAL EXAMINED. — **Venezuela.** Los Teges (Caracas), Meinert, 12.VI.1891, 2 ad. ♀♀ (nos. 1 and 3), 1 ad. ♂ (no. 2) syntypes "Cotypes" (ZMUC).

REVISED DESCRIPTION

Coloration: white-yellowish, due to prolonged preservation in alcohol.

Measurements: Body length (without caudal penicillus): syntypes females 3.90 and 4.00 mm; syntype male 3.60 mm. Caudal penicillus length 0.90-1.00 mm. Tarsus II of 13th leg: female 176 µm, male 153 µm long.

Head: Eight ocelli on each side. Vertex with one pair of posterior tufts consisting of two rows: anterior row with 15 or 16 trichomes, posterior row with 8-13 trichomes, last trichome in front of internal trichobothrium (Fig. 4A). Distance between tufts small.

Proportions of antennal articles as shown in Figure 4B; length/diameter ratio of article VI = 1.6-2.0. Antennal article VI with 12-16 dorsal sensilla basiconica: two anterior (E: Fig. 4E) thicker and shorter than the others (sometimes the first anterior longer than the second) (E: Fig. 4D); one proximal sensillum coeloconicum *c* above third or fourth anterior sensillum basiconicum; one trifid setiform sensillum *s* between two short anterior sensilla E, but more basal (Fig. 4D, E). Antennal article VII with two dorsal sensilla basiconica: posterior one shorter than anterior; one posterior sensillum coeloconicum and one trifid setiform sensillum between the two sensilla basiconica (Fig. 4C). Three trichobothria of equal size, with cylindrical funiculi (Fig. 4A).

Entire surface of labrum with numerous, small, cuspidate papillae in addition to two or three anterior rows of spherical papillae (Fig. 5A); 15-17 lamellar teeth on anterior margin. Clypeo-labrum with 12 or 13 setae along posterior margin. Outer palpus of gnathochilarium with 16 sensilla pseudoarticulated at apex and middle palpus with 20 (male: Fig. 5B) or 21 sensilla (females), comprising 14 long pseudoarticulated sensilla and 7 short, non-articulated sensilla at apex.

Trunk: except on collum and tergite X, trichomes arranging in two lateral tufts with 15-36 trichomes connected by three uninterrupted trichomic rows (Fig. 11C): anterior row with 13-21 trichomes (male), 17-23 and 19-35 (females) directed towards the head; middle row with 11-26 trichomes and sinuous posterior row with 25-48 trichomes directed towards telson (see Fig. 4A). On some tergites the anterior and middle rows are slightly sinuous. No middle row on tergite IX except in female no. 3. Total number of tergal trichomes as follows: I (collum), 70-93; II to VIII, 84-153; IX and X, 58-99. Lateral protuberance of tergite I with 4 or 5 trichomes in a row (l.p: Fig. 4A).

Legs (Fig. 5C): all articles of legs with sensory setae, except first tarsus. Coxa, trochanter and prefemur each bearing a seta with an oval base furnished with apical acute process (Fig. 5F, G). Chaetotaxy as follows: coxae I with one seta, II-XIII with 2 to 5 setae (except 6 setae on left VI in one female and 1 seta on XIII in male); trochanters with 1 seta; in male, prefemora of legs I and XIII with 1 seta, those of legs II-XII with 1 seta and 1 or 2 small, trifid, aligned setae; in females, prefemur of leg I with 1 seta, those of legs II-XIII with 1 seta and 2 or 3 (4 and 1 in three cases) small, trifid or quadrifid aligned setae (Fig. 5D); almost all femora and tibiae with same small seta as prefemur (Fig. 5E). Second tarsus with a small seta as shown in Figure 5H. Telotarsus bearing an anterior process with a spinous projection slightly longer than claw, two subequal latero-anterior and posterior spiniform processes; posterior lamellar process thickened and pleated basally (Fig. 5I).

Three or four setae above anal valve in females.

Male: all areas of penis with cuticular setae and about 10 small, oval setae. Coxal glands on legs VIII and IX.

Telson: 10 and 12 trichomes *a* (male: Fig. 6D), 12-14 (females); one trichome *b* inner to group of 23 or 24 (male), 12 and 17 (female no. 1) trichomes *c* (Fig. 6D). Ventral face with a subrectilinear row of 9 and 7 barbate trichomes *v* in male (Fig. 6C), 5-7 in females paratypes located on edge of penicillus of hooked trichomes, usually with two hooks (Fig. 6B).

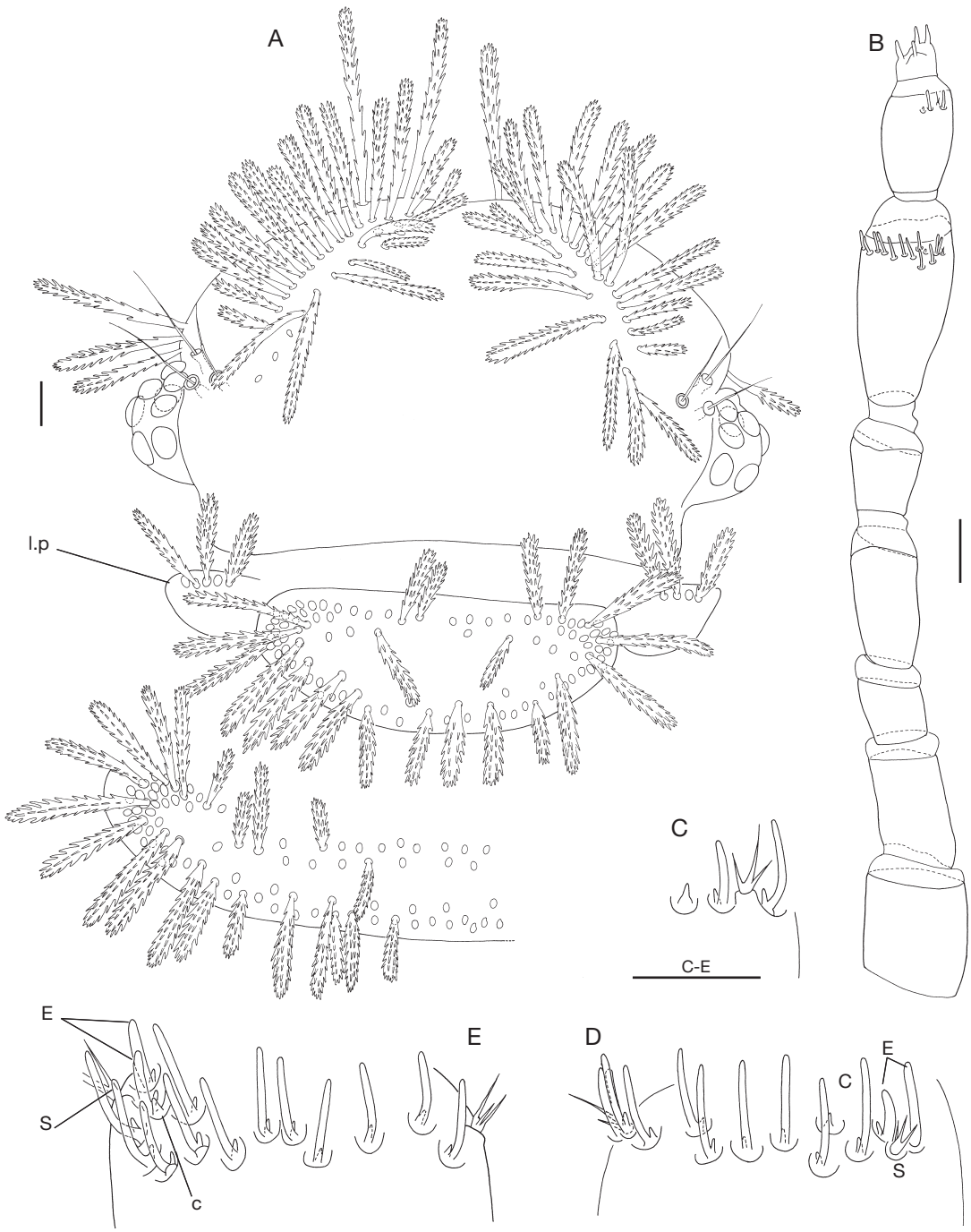

FIG. 4. — *Macroxenodes meinerti* (Silvestri, 1898): **A**, vertex, collum and left part of tergite II of female no. 3; **B**, left antenna of female no. 1; **C**, **D**, sensilla on left antennal articles VII and VI of the male; **E**, sensilla on right antennal article VI of the female no. 1. Abbreviations: ***c***, sensillum coeloconicum; ***E***, short and thick sensilla basiconica; ***l.p***, lateral protuberance on collum; ***s***, setiform sensillum. Scale bars: A, B, 50 µm; C-E, 25 µm.

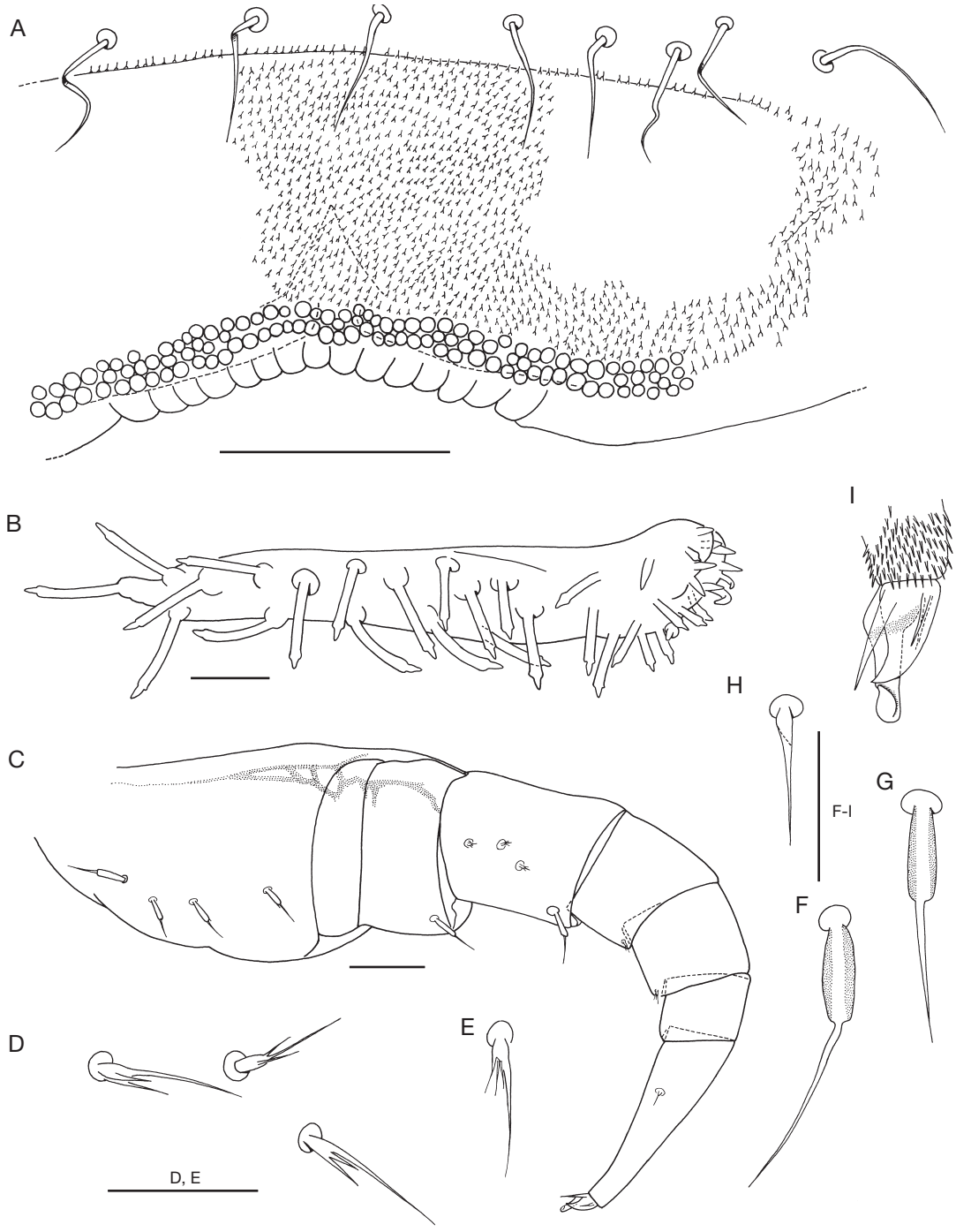

FIG. 5. — *Macroxenodes meinerti* (Silvestri, 1898): **A**, labrum of male, only part of cuticular and posterior setae shown; **B**, right palp of male; **C**, left leg V of female no. 3; **D**, three small prefemoral setae of the same leg; **E**, tibial seta of the same leg; **F**, **G**, large setae of prefemur and trochanter of the same leg; **H**, **I**, seta of tarsus II and telotarsus of left leg V of male. Scale bars: A, B, D-I, 25 µm; C, 50 µm.

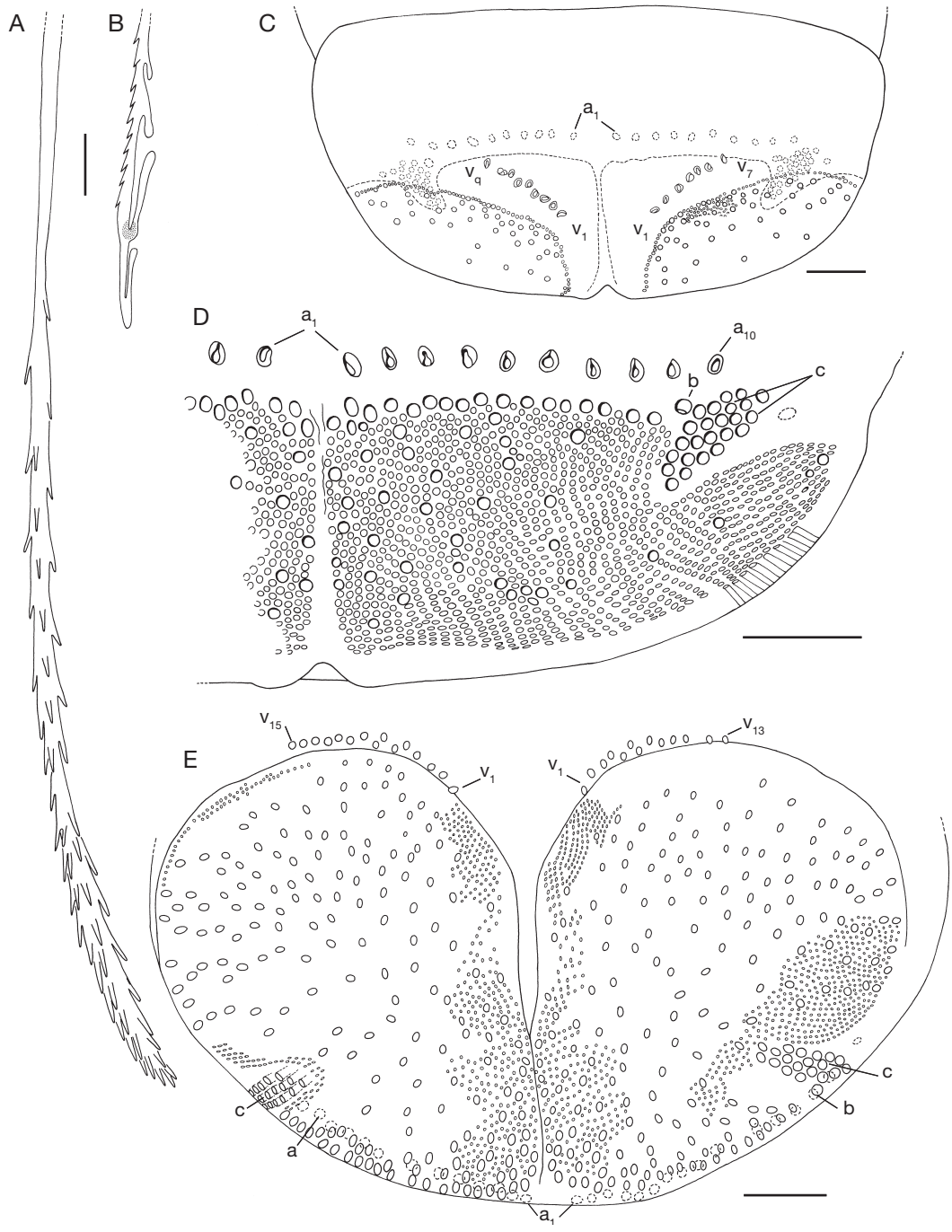

FIG. 6. — **A**-**D**, *Macroxenodes meinerti* (Silvestri, 1898); **A**, **B**, distal parts of barbate and hooked trichomes of caudal penicillus of male; **C**, ventral face of telson of male, dorsal trichomes shown with dotted lines; **D**, dorsal face of telson of male; **E**, *M. navassaensis* n. sp., caudal view of female paratype. All the biggest insertions belonging to barbate trichomes are shown; only part of insertions of hooked trichomes shown; dorsal trichomes *a* with dotted lines. Abbreviations: ***a*$_1$-*a*$_{10}$**, insertions of barbate trichomes *a*; ***b***, insertion of trichome *b*; ***c***, group of trichomes *c*; ***v*$_1$-*v*$_X$**, insertions of ventral barbate trichomes on edge of penicillus. Scale bars: A, B, D, 25µm; C, E, 50 µm.

AFFINITIES

Macroxenodes meinerti is very similar to *M. bartschi* (Chamberlin, 1923), which was redescribed by Nguyen Duy-Jacquemin & Condé (1984). The two species differ only in the number of sensilla on the outer expansions of the gnathochilarial palpi (16 in *meinerti*, versus 13 *in M. bartschi*) and the number of anterior rows of spherical papillae on the labrum (only in 3 *meinerti*, as opposed to 4 or 5 in *M. bartschi*).

Macroxenodes navassaensis n. sp.
(Fig. 7)

TYPE MATERIAL. — **Greater Antilles.** Navassa Island, Clench coll., I.1930., holotype ad. ♀ and paratype ad. ♀ very near to moulting, both mounted on slides (MNHN).

ETYMOLOGY. — The name refers to the island where the type specimens were collected.

DESCRIPTION OF FEMALE ADULTS

Measurements: body length (without caudal penicillus): 3.10 mm (holotype) and 3.50 mm (paratype). Tarsus II length of 13th leg: 143 µm (holotype) and 146 µm (paratype).

Head: Eight ocelli on each side. Vertex with one pair of posterior tufts, consisting of two rows: anterior row with 13-18, posterior row with 8 or 9 trichomes, the last in front of internal trichobothrium (Fig. 7E); the insertions of two last trichomes of posterior row are oriented perpendicularly to others (Fig. 7E). The distance between tufts is small.

Proportions of antennal articles as shown in Figure 7A; length of article VI about twice its diameter. Antennal article VI with two groups of dorsal and postero-ventral sensilla: dorsal group composed of three thick sensilla basiconica: anterior *a*, intermediate *i* and posterior *p* (*i* being shorter than *a* and *p*), one posterior sensillum coeloconicum *c* and one trifid setiform sensillum *s* between *a* and *i* (Fig. 7C, D); postero-ventral group composed of two similar, thick sensilla basiconica, shorter than *a* and *p*. Antennal article VII with two subequal, thick, dorsal sensilla basiconica, one posterior sensillum coeloconicum and one trifid setiform sensillum between the two sensilla basiconica (Fig. 7B). Three trichobothria of equal size, with cylindrical funiculi (Fig. 7E).

Labrum clothed with numerous small cuspidate papillae in addition to three rows (four towards lateral side) of spherical papillae (Fig. 7F). 6+6 (holotype) and 8+8 (Fig. 7F) lamellar teeth on anterior margin. Clypeo-labrum with 13 and 14 setae along posterior margin. In holotype, lateral expansions of gnathochilarium with 14 and 15 sensilla pseudoarticulated at apex (Fig. 7G) and middle palpus with 21 sensilla, comprising 12 long, pseudoarticulated sensilla and 9 short sensilla not articulated at apex; gnathochilarial sensilla cannot be counted in paratype.

Trunk: trichomes are lacking; however, their orientation can be estimed thanks to their insertion. Except on collum and tergites IX and X, trichomes arranged in two lateral tufts with 16-33 trichomes connected by three trichomic rows: anterior row with 19-40 trichomes directed towards head; middle row with 7-21 trichomes and a sinuous posterior row with 42-74 trichomes directed towards telson; anterior and posterior rows uninterrupted. On some tergites the anterior and middle rows are slightly sinuous. Total number of tergal trichomes as follows: I (collum), 103 (holotype) or 123; II to VIII, 109 or 178; IX and X, 85 or 76. Lateral protuberance of tergite I with 5 (holotype) or 6 trichomes in a row.

Legs: all articles of legs bearing sensory setae, first tarsus excepted. Setae on coxa, trochanter and prefemur with an oval base, provided with an apical process (Fig. 7J). Chaetotaxy as follows: coxae II to XII with 2 setae (1 seta in six cases, 3 setae in one case); trochanters with 1 seta; prefemora leg I to XIII with 1 seta and 1 or 2 small, trifid setae (Fig. 7H, I); almost all femora and tibiae with same small seta as prefemur. Second tarsus with a small seta as shown in Figure 7K. Telotarsus bearing an anterior process with a spinous projection longer than claw, two subequal latero-anterior and posterior spiniform processes; posterior lamellar process thickened and basally pleated (Fig. 7L).

Four setae above the anal valve in paratype.

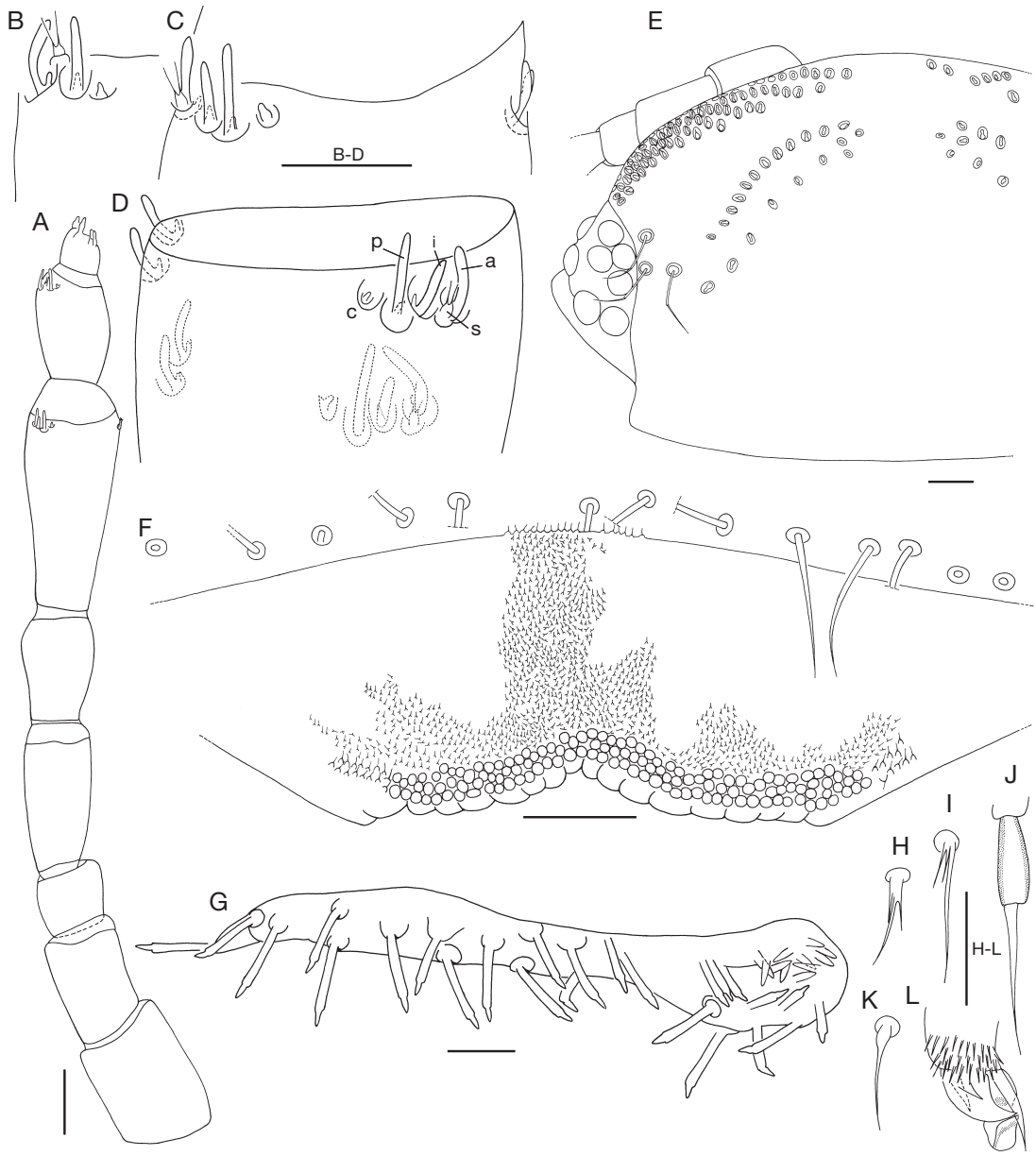

FIG. 7. — *Macroxenodes navassaensis* n. sp.: **A**, right antenna of paratype; **B**, **C**, sensilla on right antennal articles VII and VI of holotype; **D**, sensilla on left antennal article VI of paratype, the new sensilla shown with dotted lines will appear after exuviation; **E**, left part of head of holotype with insertions of dorsal trichomes; **F**, labrum of paratype, only part of cuticular setae shown; **G**, right palpus of gnathochilarium of holotype; **H**-**L**, holotype; **H**, **I**, small setae of prefemora of right legs III and VII; **J**, coxal seta of right leg I; **K**, seta of tarsus II of right leg VI; **L**, telotarsus of right leg III. Abbreviations: ***a***, anterior sensillum basiconicum; ***c***, sensillum coeloconicum; ***i***, intermediate sensillum basiconicum; ***p***, posterior sensillum basiconicum; ***s***, setiform sensillum. Scale bars: A, E, 50 µm; B-D, F-L, 25 µm.

Telson: dorsal face of telson with 13-16 barbate trichomes *a*; one trichome *b* inner to group of 19 trichomes *c* observed in paratype. Ventral face with a subrectilinear row of 14+14 barbate trichomes *v* in holotype and 13+15 in paratype (Fig. 6E), located on the edge of the insertions of fallen hooked trichomes.

AFFINITIES

This species is close to *Macroxenodes amazonicus* Ishii, Nguyen Duy-Jacquemin & Condé, 1999. However, there are significant differences between them. The postero-ventral group of antennal sensilla of article VI has only two sensilla, as opposed to 4-7 in *M. amazonicus*. There are three anterior rows of spherical papillae on the labrum, whereas in *M. amazonicus* there are only two. The new species has 15 sensilla at most on the lateral palp expansion, compared to 21-23 in *M. amazonicus*. The median interruption of the anterior trichomic row of the tergites of *M. amazonicus* is not present in the new species.

Macroxenodes jahynyi n. sp.
(Figs 8; 9)

TYPE MATERIAL. — **Brazil.** Minas Gerais, Uberlândia, Estação Ecologica do Panga, Mata de cerrado, 19°10'59.62"S, 48°24'4.30"W, altitude 830 m, 28.XI.2005, R. Pacheco do Nascimento and B. Jahyny coll., 2 ad. ♀♀ anaesthetized in a nest (cavity in soil near surface) of *Thaumatomyrmex mutilatus* Mayr, 1887 (Insecta, Hymenoptera, Formicidae, a specialized predator of Penicillata): ♀ holotype of which the head is mounted on 2 slides, the trunk being in alcohol (MZUSP); 1 ♀ paratype mounted on 3 slides (MNHN).

OTHER MATERIAL EXAMINED. — **Brazil.** Sao Paulo, Rio Claro-UNESP, litter (termite mound), X. 2003, B. Jahyny col., 1 ad. ♀ (MNHN). — Uberlândia, 1 ♀ from the same nest as holotype and paratype (MNHN).
Argentina. Diamante, près de l'Institut, 1.XII.1997, N. Fernandez coll., leg. Y. Coineau, 1 ad. ♀ (MNHN).

ETYMOLOGY. — This species is named after one of its collectors, B. Jahyny.

DESCRIPTION

Coloration: brownish, darker on lateral sides of tergites; many trichomes dark brown.

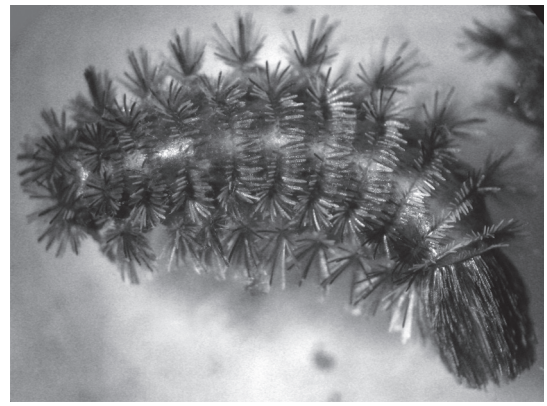

FIG. 8. — *Macroxenodes jahynyi* n. sp., adult female, habitus, dorsal view, 5 mm in length. Photograph by B. Jahyny.

Measurements: body length (without caudal penicillus) 3.90 (holotype) and 4.70 mm (paratype), 4.50 mm in female from Rio Claro, 5 mm in female from Diamante; caudal penicillus length 1.10 mm; head-trichomes length 0.30 mm. Tergites V and VI width 1.40 mm. Tarsus II of 13th leg 224 µm long in paratype, 192 µm in female from Rio Claro, 180 µm in female from Diamante.

Head: eight ocelli on each side. Vertex with one pair of posterior tufts consisting of two rows: anterior sinuous row with 17-22 (left row with 24 in female Rio Claro), posterior row with 6-8 trichomes, the latter in front of internal trichobothrium. Distance between tufts equal to half a row-length.

Proportions of antennal articles as shown in Figure 9A; article VI 1.25-1.5 times as long as wide. Antennal article VI with three rows of sensilla (see Fig. 9C): anterior part of distal row with 2 shorter and thicker basiconica sensilla E, a trifid setiform sensillum s between and below the thick sensilla and one sensillum coelonicum *c* posterior to E; the other sensilla basiconica generally longer and thinner: 18 on the left antenna (Fig. 9C) and 19 on the right antenna in holotype; 19 and 21 in paratype; 15 and 17 in female from Rio Claro; 14 and 15 in female from Diamante. Antennal article VII with two subequal, thick, dorsal sensilla basiconica, one posterior sensillum coeloconicum *c*

and one trifid setiform sensillum *s* between the two sensilla basiconica (Fig. 9B). Three trichobothria of equal size.

Labrum clothed with numerous small cuspidate papillae in addition to three rows of spherical papillae (Fig. 9D); 8+8 lamellar teeth on anterior margin. Clypeo-labrum with 14 setae along posterior margin. Lateral expansions of gnathochilarium 4 times as long as the diameter of middle palp, with 27 or 28 sensilla pseudoarticulated at apex (22 and 25 in female from Diamante), middle palpus with 21 sensilla, comprising in holotype 14 long pseudoarticulated sensilla and 7 short sensilla non-articulated at apex (Fig. 9E).

Trunk: observed only in paratype. Except on collum and tergites IX and X, trichomes arranged in two lateral tufts of 20-30 trichomes connected by three trichomic rows: anterior row with 18-27 trichomes directed towards the head, middle row with 10-14 trichomes and uninterrupted, sinuous, posterior row with 27-39 trichomes directed towards telson; on some tergites, anterior row slightly. Tergites IX and X with only anterior and posterior rows. Anterior row and middle row interrupted in the middle, trichomes of anterior row closer together than those of middle row. Collum with two lateral tufts of 35 trichomes, anterior row of 10 trichomes, middle row of six trichomes, posterior row of 26; lateral protuberance of tergite I with 5 (right) and 7 (left) trichomes in a row.

Legs: in paratype, all articles of the legs bear sensory setae, except first tarsus. Setae on coxa, trochanter and prefemur with an oval base, provided with an acute apical process. Chaetotaxy: coxa I, 1 seta; coxae II to XII, 2 setae (3 setae in four cases); trochanters, 1 seta; prefemora of legs I to XIII, 1 seta and 1-3 (generally 2) small, trifid setae (Fig. 9H); almost all femora and tibiae with same small seta as prefemur. Second tarsus with a small seta as shown in Figure 9F. Telotarsus bearing an anterior process with a spinous projection longer than claw, two subequal latero-anterior and posterior spiniform processes; posterior lamellar process thickened and basally pleated (Fig. 9G).

Five setae above the anal valve observed in paratype (3 right + 2 left).

Telson: characteristic of the subfamily. Dorsal face of telson with 13 + 13 trichomes *a*. Trichomes of caudal penicillus with 2 or 3 hooks.

Remarks

The left antenna of the adult female from Rio Claro is regenerated, with 19 sensilla basiconica and left lateral expansion of gnathochilarium shorter and deformed; right antennal article VI with 17 sensilla on two rows; right lateral expansion of gnathochilarium with 17 sensilla.

Affinities

This species is near to *Macroxenodes bartschi* (Chamberlin, 1922), as redescribed by Nguyen Duy-Jacquemin & Condé (1984). The antennal sensilla of article VI are more numerous in the new species, always including two shorter and thicker sensilla basiconica on anterior part of the distal row; these two sensilla are not always present in *M. bartschi*, sometimes there is only one shorter (Fig. 9I). The lateral palp expansion of the gnathochilarium is longer in *M. jahynyi* n. sp., with a maximum 28 sensilla, as opposed to 13 in *bartschi*. There are only 3 anterior rows of spherical papillae on the labrum, whereas *M. bartschi* has 4 or 5 rows.

The two new species *M. navassaensis* n. sp. and *M. jahynyi* n. sp. are the fifth and sixth species included in genus *Macroxenodes*. The others are *meinerti*, the type species, from Venezuela (Caracas); *M. bartschi* from the Florida Keys; *M. poecilus* (Chamberlin, 1923), redescribed by Condé & Nguyen Duy-Jacquemin (1987), from Santa Inez Island, Gulf of California; and *M. amazonicus* (Ishii *et al.* 1999) from Brazil, Amazonas, Ilha de Marchantaria and environs of Manaus.

Genus *Macroxenus* Brölemann, 1917

Type species. — *Polyxenus rubromarginatus* Lucas, 1846.

Species included. — *Macroxenus rubromarginatus*; *M. caingangensis* (Schubart, 1944); *M. enghoffi* Nguyen Duy-Jacquemin, 1996.

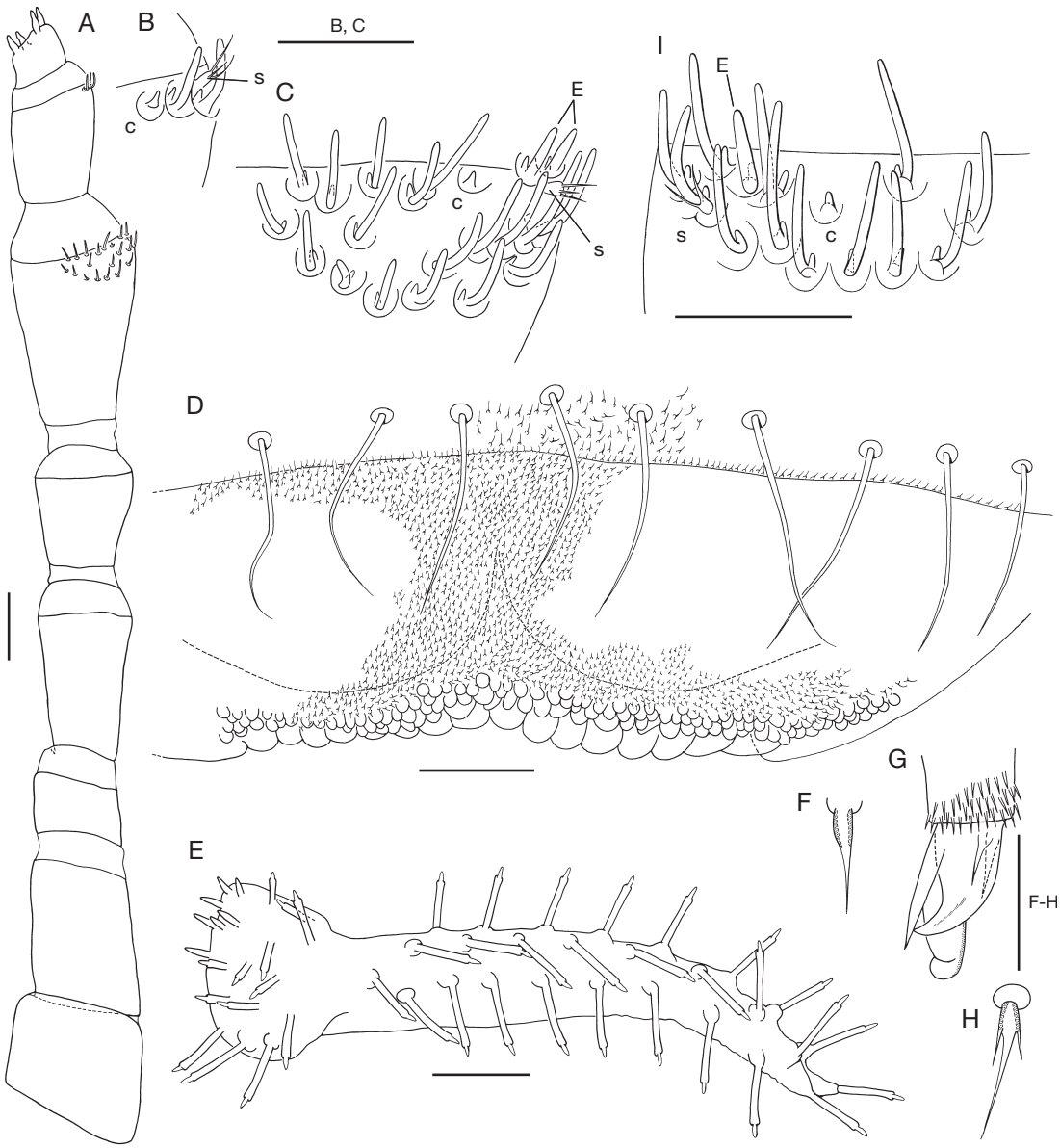

FIG. 9. — *Macroxenodes jahynyi* n. sp.: **A**-**E**, female holotype; **A**, left antenna; **B**, **C**, detail of sensilla on articles VII and VI of same antenna; **D**, labrum, only part of cuticular setae shown; **E**, left palpus of gnathochilarium; **F**-**H**, female paratype; **F**, seta of tarsus II telotarsus of left leg XI; **G**, telotarsus of same leg; **H**, seta of prefemur of left leg VI; **I**, right antennal article VI of male no. 2 of *M. bartschi* (Chamberlin, 1923) (after Nguyen Duy-Jacquemin & Condé 1984). Abbreviations: ***c***, sensillum coeloconicum; ***E***, short and thick sensilla basiconica; ***s***, setiform sensillum. Scale bars: A, E, 50 µm; B-D, F-I, 25 µm.

REMARKS

This genus was created by Brölemann (1917) for the type species *Polyxenus rubromarginatus* Lucas, 1846 from Algeria (environs of Oran). Brölemann (1917) redescribed this species from material collected at Blida (alt. 1500 m).

KEY TO THE SPECIES OF THE GENUS *MACROXENUS* BRÖLEMANN, 1917

1. 1 dorsal row of 5-7 sensilla basiconica on antennal article VI 2
— 1 dorsal group with 13 or more sensilla basiconica on antennal article VI ... *M. enghoffi*

2. Antennal sensilla basiconica thick and short ..... *M. rubromarginatus*
— Antennal sensilla basiconica thin and long ..... *M. caingangensis*

Macroxenus caingangensis (Schubart, 1944)

Monographis caingangensis Schubart, 1944: 331, 332, figs 4, 5.

TYPE MATERIAL. — **Brazil.** Oriental part of plateau de São Paulo, Mun. Pirassununga, Mogi-guassú, Sta. Rita, Pôrto Ferreira, syntypes (number of syntypes not mentionned in the original description) (Musée de Zoologie de São Paulo; after Condé 1971).

This species has been redescribed by Condé & Massoud (1974) based on the following material: **Brazil.** Rio de Janeiro Prov., Restinga de Jacarapagua, 2 ad. ♂, 5 ad. ♀♀, 1 juvenile with 10 pairs of legs.

The species *M. rubromarginatus*, from North Africa, and *M. caingangensis*, from South America, are very similar. The following material was examined to determine the morphological characters allowing their separation.

MATERIAL EXAMINED. — *Macroxenus rubromarginatus*: Maroc, Ifrane (alt. 1650 m), 2 ad. ♂♂ (MNHN) (Condé 1954).
New material: **Malte.** Gozo, Kantura, 15.II.1992, leg. D. Mifsud, 1 ad. ♂ (ZMUC). — Portugal, Praia de Lourenço, Val de Parra, west of Albufeira, Algarve, coastal cliffs, 29.V.2004, A. P. Fowles coll., D. Kime leg., 1 ad. ♀ (MNHN).
Macroxenus caingangensis: **Brazil.** Rio Janeiro Province, Restinga de Jacarapagua, 13.V.1959, 1 ad. ♀, 1 ad. ♂ (MNHN).
New material: **Brazil.** Serra of triunfo, Nova Olinda, Cearà, 25.I.2004, P. Selden leg., 1 ad. ♀, 1 ad. ♂ (MNHN).
Venezuela. Carácas, Rio Naùacho, 13.VII.1891, Meinert, 1 ♀ with 12 pl. (MNHN).

REMARKS
Macroxenus rubromarginatus and *M. caingangensis* are very similar. Nevertheless, they differ in the shape of the antennal basiconica sensilla (Fig. 10): these sensilla are thicker in *M. rubromarginatus* (Fig. 10A-E) than in *M. caingangensis* (Fig. 10F-H), i.e. the ratio length/diameter is higher in *M. caingangensis*.

Macroxenus enghoffi
Nguyen Duy-Jacquemin, 1996

Macroxenus enghoffi Nguyen Duy-Jacquemin, 1996: 117-121, figs 16-26.

TYPE MATERIAL. — **Canary Islands.** Fuerteventura, cumbre Jandia, 14.II.1977, P. Oromí leg., 3 ad. ♂♂, 3 ad. ♀♀ (MNHN).

NEW MATERIAL. — **Canary Islands.** Fuerteventura, Betancuria, 9.II.1997, P. Oromí leg., 1 ad. ♀, 1 ad. ♂ (MNHN). — Lanzarote, Montaña Clara, 23-27.XI.2002, Pérez leg., 1 ad. ♀ (MNHN).

Genus *Afraustraloxenodes*
Nguyen Duy-Jacquemin, 2003

Afraustraloxenodes Nguyen Duy-Jacquemin, 2003: 72, 73.

Chilexenus – Lawrence 1984: 105.

TYPE SPECIES. — *Afraustraloxenodes namibiensis* Nguyen Duy-Jacquemin, 2003.

SPECIES INCLUDED. — *Afraustraloxenodes namibiensis* (Namibia: Rehoboth and west of Windhoek); *A. coineaui* Nguyen Duy-Jacquemin, 2003; *A. hulleyi* Nguyen Duy-Jacquemin, 2003 (South Africa, Port Alfred); *A. schultzei* (Attems, 1909).

DISTRIBUTION. — All known representatives of this genus are from Southern Africa.

KEY TO THE SPECIES OF THE GENUS *AFRAUSTRALOXENODES* NGUYEN DUY-JACQUEMIN, 2003

1. Antennal article VI with five or more sensilla basiconica ..... *A. namibiensis*
— Antennal article VI with three or four sensilla basiconica 2

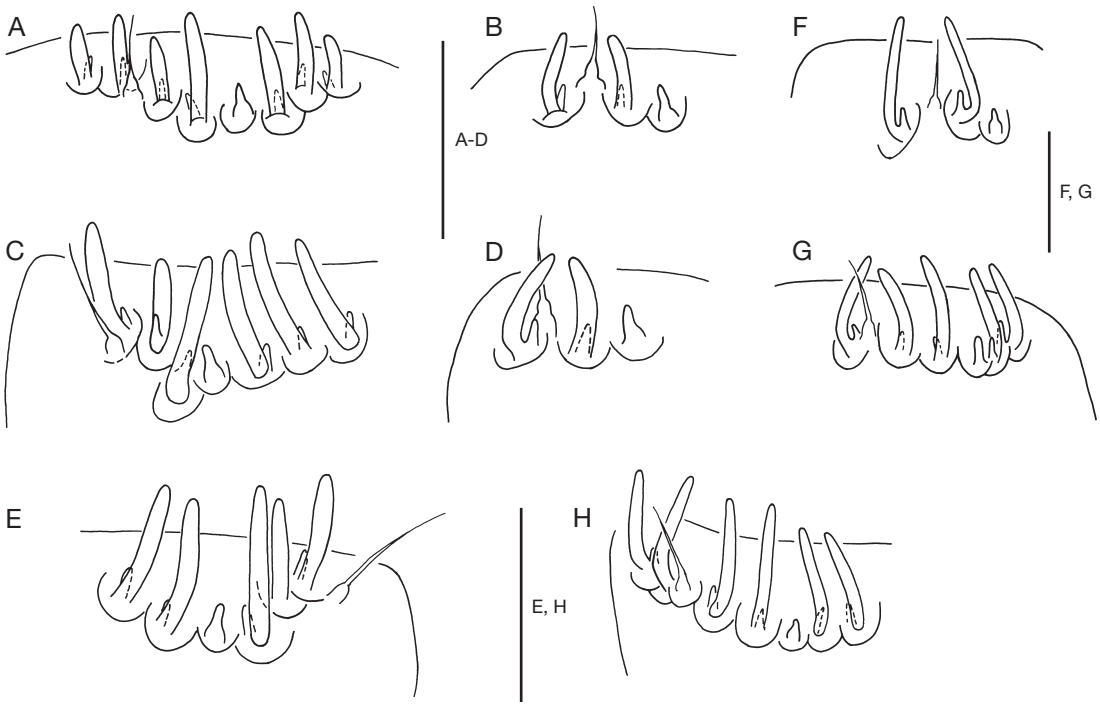

FIG. 10. — Antennal sensilla of *Macroxenus caincangensis* (Schubart, 1944) (**A**-**E**) and *M. rubromarginatus* (Lucas, 1846) (**F**-**H**); **A**, **B**, sensilla on right antennal articles VI and VII of adult male, Gozo; **C**, **D**, sensilla on right antennal articles VI and VII of adult male no. 2, Ifrane; **E**, sensilla on left antennal article VI of adult male no. 2, Ifrane; **F**, **G**, sensilla on right antennal articles VII and VI of adult male from Triunfo; **H**, sensilla on right antennal article VI of adult male from Restinga de Jacarapu. Scale bars: 25 µm.

2. Antennal article VI with four sensilla basiconica ..... *A. hulleyi*
— Antennal article VI with three sensilla basiconica 3

3. The 3 sensilla basiconica subequal ..... *A. coineaui*
— The 2 anterior sensilla basiconica clearly shorter than the posterior one ..... *A. schultzei*

Afraustraloxenodes coineaui Nguyen Duy-Jacquemin, 2003

NEW MATERIAL. — **Namibia.** NW Keetmannshoop (different pitfall traps), Distr. Gellap Ost, 17-25.II.2002, leg. A. Hoffmann, 1 ad. ♀ (MNHN). — 4-8.IV.2002, leg. Schultz, 1 ad. ♀ (MNHN). — Dist. Nabaos, 4-8.IV.2002, leg. M. Uhlig, 12 ad. ♂♂ and ♀♀ (MNHN).

DISTRIBUTION. — Namibia: Hamilton range, NW Gobabeb, Mirabib Rock and NW Keetmannshoop; Angola.

Afraustraloxenodes schultzei (Attems, 1909)

NEW MATERIAL. — **South Africa.** Mahlakura pan (N.28), on the eastern boundary of Kruger National Park, 24.XI.63, leg. L. F. Lawrence, 1 adult ♀ (MNHN).

DISTRIBUTION. — South Africa: Cape province, Prince Albert; Kruger National Park.

REMARK

The adult female *A. schultzei*, mentioned under New material was recently identified by the author: 5.30 mm in length (head trichomes and caudal penicillus included); tarsus II of 13th leg of 138 µm; with 14 and 15 sensilla on outer palpi of gnathochilarium.

AFFINITIES

Contrary to the statement by Nguyen Duy-Jacquemin (2003: 86), the setiform sensillum of antennal article

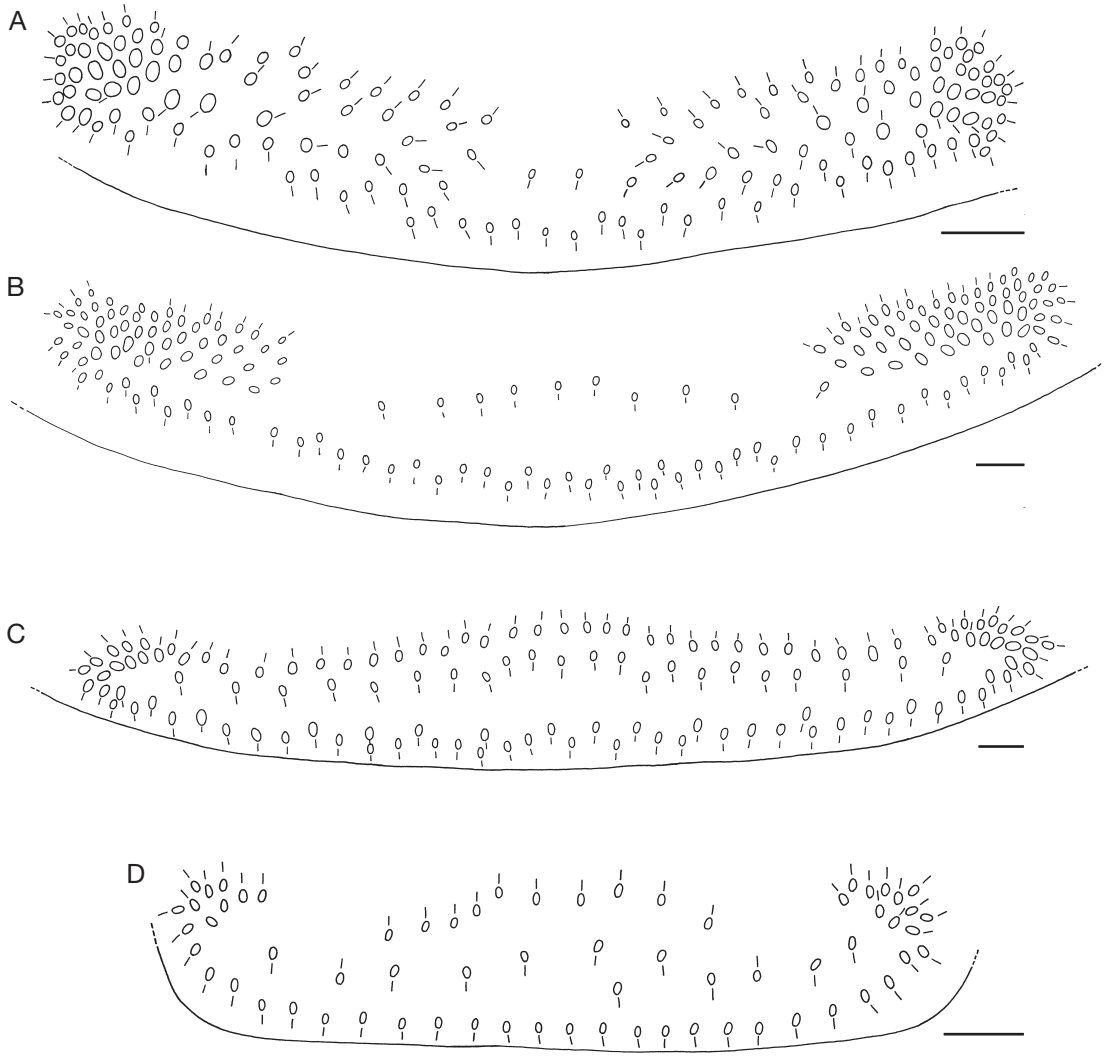

FIG. 11. — Insertions of trichomes on tergite VIII in adult females: **A**, *Chilexenus rosendinus* (Silvestri, 1903), lectotype; **B**, *Macroxenus rubromarginatus* (Lucas, 1846), from Ifrane; **C**, *Macroxenodes meinerti* (Silvestri, 1898), cotype; **D**, *Afraustraloxenodes namibiensis* Nguyen Duy-Jacquemin, 2003, paratype. Scale bars: 50 µm.

VI has the same position in both species, i. e. between the two anterior sensilla basiconica.

GEOGRAPHICAL DISTRIBUTION AND CONCLUSIONS

All members of the subfamily Macroxeninae live between the 40th N and S parallels, in tropical, sub-tropical and warm-temperate regions (Fig. 12). *Afraustraloxenodes*, as its name suggests, is known only from Southern Africa (Angola, Namibia and South Africa). *Chilexenus* has been collected only in Chile (San Rosendo), with more collecting necessary to obtain a better idea of its distribution. *Macroxenus* is the only genus found simultaneously in the Americas, Africa and Europe: *M. rubromarginatus* and *M. enghoffi* are found in the

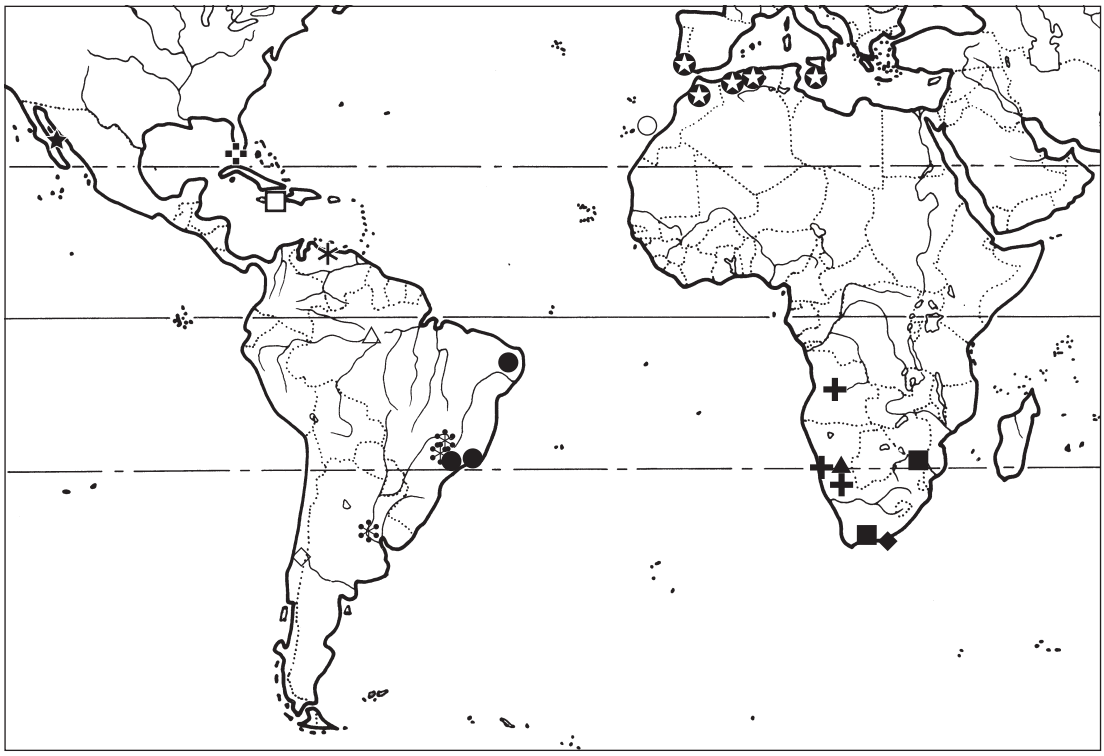

FIG. 12. — Geographical distribution of species belonging to the four genera of Polyxenidae bearing pseudoarticulated gnathochilarial sensilla: ✱ *Macroxenodes meinerti*; ✣, *Macroxenodes bartschi*; ★, *Macroxenodes poecilus*; △, *Macroxenodes amazonicus*; □, *Macroxenodes navassaensis* n. sp.; ❊, *Macroxenodes jahynyi* n. sp.; ▲, *Afraustraloxenodes namibiensis*; ✚, *Afraustraloxenodes coineaui*; ◆, *Afraustraloxenodes hulleyi*; ■, *Afraustraloxenodes schultzei*; ◇, *Chilexenus rosendinus*; ✪, *Macroxenus rubromarginatus*; ●, *Macroxenus caincangensis*; ○, *Macroxenus enghoffi.*

Northern Hemisphere, around the Mediterranean Basin, while *M. caingengensis* is known from South America (Brazil,Venezuela). *Macroxenodes* is found in the New World on both sides of the equator and extends beyond the tropics (*M. bartschi* and *M. poecilus* in the North and *M. jahynyi* n. sp. in the South); *M. amazonicus* has been collected in abundance from around Manaus. *Macroxenodes* and *Macroxenus* have been found in ant nests: juveniles of *Macroxenodes* sp. and *Macroxenus caingangensis* have been collected from nests of *Camponotus rufipes* (Fabricius, 1775) (Condé 1971) in Brazil; *M. rubromarginatus* (Lucas, 1846) has been found in nests of *Camponotus cruentatus* (Latreille, 1802) and *Pheidole megacephala* (Fabricius, 1793) in Morocco, Ifrane (Condé 1971) while *M. jahynyi* n. sp. occurs in nests of *Thaumatomyrmex mutilatus* Mayr, 1887 (Formicidae) (Jahyny, unpubl. obs.).

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