NEW DATA ON THE NEOTROPICAL THYSANURANS (MICROCORYPHIA AND ZYGENTOMA, INSECTA)

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The author studies several samples of Microcoryphia and of Zygentoma collected in central and southern America (Costa Rica, Venezuela and Peru). *Heterolepisma horni* and the genus *Heterolepisma* are noticed as faunistic novelties to Venezuela, as are to Peru the genus *Nicoletia* and *Nicoletia* cf. *phytophila*. A new species, *Grassiella decui* (Ateluridae) is described from the Cueva del Guacharo, in Venezuela, and compared with the remaining species of the genus from the New World and from the Afrotropical Region; it seems particularly close to *G. artipoda* from Brazil and to *G. colimensis* from Mexico.

In the present paper a new account on the Central and South American thysanurans is given; the studied samples concern material obtained in Costa Rica, Venezuela and Peru. A new species, *Grassiella decui* n.sp. is described from the Cueva del Gaucharo, in Venezuela; *Heterolepisma horni* and the genus *Heterolepisma* are noticed as faunistic novelties to Venezuela and *Nicoletia* cf. *phytophila* and the genus *Nicoletia* noticed for the first time to Peru. The collected material belongs to the Institute of Speleology "Emil Racovitza", in Bucharest, Roumania (IER), to the Zoological Museum of Copenhague, Denmark (ZMC), to the Geneva Natural History Museum in Switzerland (MHNG), and to the University of the Studies in Padova, Italy (USP). The samples have been kindly loaned by Dr. Vasile Decu, from Bucharest, by Dr. Henrik Enghoff, from Copenhague, by Dr. Bernd Huaser, from Geneva and by Dr. M.G. Paoletti from Padova, to whom we are deeply indebted. A few duplicates have been deposited in the entomological collection of the Centro de Zoologia of the Instituto de Investigação Cientifica Tropical (CZ). We want to thank also Prof. L. Albuquerque, Dr. J. Crawford-Cabral and Mr. L. Mesquitela for their advices concerning the ancient sailing vessel routes and the ecological conditions in the Kunene River mouth and close angolan areas.

Order MICROCORYPHIA

Fam. MEINERTELLIDAE

Meinertellus pulvillatus Silvestri, 1904

Material examined: VENEZUELA — Rancho Grande (State of Aragua) (loc. 44 *in* Decu, Bordon&Linares, 1987), 10/XI/1982, leg. Decu, 2 ♀♀, 1 juv. (2 tubes) (IER), 1 ♀ (CZ); ibid., 17/XI/1982, 1 ♂ juv. — very damaged (IER); ibid., 19/XI/1982, 1 ♀, 5 juv. — very damaged (IER). La Cumbre, Rancho Grande, 1500 m, selva nublada (ombrella), II/1987, no. 40, leg. M.G. Paoletti, 2 juv. (USP). Cerro La Pastora (State of Falcón), 13/XI/1982, leg. Decu, 1 ♀ very damaged (IER). Pico Grande sotto musci albori, 27/XII/1985, no. 46, leg. M.G. Paoletti, 1 ♀ (USP). El Jarillo (State of Aragua), Colonia Tovar, on Bromeliaceae

round sorted, 1800 alt., no. 17, 65—4, 4/I/1986, leg. M.G. Paoletti, 1 ♀ (USP). Pico Rancho Grande, selva nublada, 18/VIII/1986, leg. M.G. Paoletti, 1 ♂, 1 juv. (USP). Guatopo, Agua Blanca (State of Miranda), 700 m, bosque humedo tropical, II/1987, leg. M.G. Paoletti, 1 ♀ (USP).

The species is the only one of the genus known from Venezuela, from where it has been noticed by Silvestri (1904), Paclt, (1969 (?) and Sturm (1974). The specimens agree well with the redescription of Sturm (*op. cit.*). As this author discusses, the references from Panama and Costa Rica (Paclt, 1969) are quite probably misidentifications.

Meinertellus sp.

Material examined: VENEZUELA — Bocono, Guaramacal, La Laguna, 2 000 m, bosque humedo montaña, 3/II/1987, no. 95, leg. M.G. Paoletti, 1 juv. (USP).

The only specimen of this sample is an immature male with strong pigment in the maxillary palp proximal articles, which morphological characteristics are not sufficient to allow an accurate specific determination. Since the collecting-site is unknown and the geographical origin completely different from the area from where *M. pulvillatus* is known, — not far from the colombian border — I prefer to consider this isolated specimen at the generic level only.

Order ZYGENTOMA
Fam. LEPISMATIDAE
Heterolepisma horni Stach, 1933

Material examined: VENEZUELA — Sombrero, 31/XII/1985, 2♀♀ (USP), 1 ♀ (CZ).

Heterolepisma horni was known to occur in Ecuador, from where it has been described (Stach, 1933) in Jamaica (?), where Wygodzinsky (1957) questions its presence based in not very well preserved material, and in the Lesser Antilles of Aruba, Curaçao, Bonaire, Las Aves, Los Roques, Orchila, Los Hermanos and Los Testigos (Wygodzinsky, 1959). It is now noticed for the first time to Venezuela, where no *Heterolepisma* has been noticed till now.

Acrotelsella impudica (Escherich, 1905)

Material examined: VENEZUELA — Cayo Chico, Parque Morrocoy, Falcón, on *Coccoloba uvifera* and logs, no. 63, 1, 3/I/1981, leg. M.G. Paoletti, 1 ♂ (USP).

The species, known to occur also in Colombia, from where it has been described (Escherich, 1905), in the Lesser Antilles of Aruba, Curaçao, Little Curaçao, Bonaire, Margarita, Los Frailles, Los Testigos and Trinidad (Wygodzinsky, 1959) and in Panama (Mendes, 1982 *b*), has already been noticed to Venezuela by Wygodzinsky (1959), Paclt (1966) and Mendes (1982 *b*).

Stylifera galapagoensis (Banks, 1901)

Material examined: PERU — Department of Arequipa, 15 Km SW of Atico, sea level, leg. O. Karsholt, no. 69, 10/IV/1987, 1 ♀ (ZMC).

The species, described from the Galapagos Islands (B a n k s, 1901), is known to occur also in coastal Peru, southwestern Angola and northwestern Namibia (I r i s h, 1988). As noticed (I r i s h, op. cit.) the reference of *Stylifera gigantea* (the only other described species in the genus) from Peru (W y g o d z i n s k y, 1951) must be understood as a misidentification. The Arequipa female, corresponding to the southernmost known geographical occurrence of the species, some 350 km only from the chilean-peruvian pacific border, agrees well with the detailed S t a c h 's (1932) redescription and with I r i s h's (1988) notes.

The presence of this species in South America and in southwestern Africa is analysed by I r i s h (op. cit.) and the hypothesis of natural or of unwilling man-made recent (historical) introductions are discussed and considered as improbable: the author sustains that the actual distribution of *S. galapagoensis* probably reflects no more than the continental drift effects and considers, then, both populations as quite probably autochthonous. It is to me impossible to accept one only species composed by two allopatric populations, completely isolated from some 120 = 80 MY (early to late Cretaceous) even if suffering parallel selective pressures (which are not certainly strictly the same) and even considering the Lepismatidae as integrating quite conservative taxa; I cannot imagine that no morphological differences would have appeared after a so long period of isolation. As I r i s h (1988), I refuse the idea of rafting between the peruvian coast and the Kunene mouth, due to the enormous remoteness between them. So, I stand up that the only possible explanation to such an actual geographical disjunction is, as it happens with a short number of further non-synanthropous silverfish, the indirect man action. Even excluding those species commonly found in human or peri-human environments, and that share extremely enlarged and diverse geographical ranges (v.g. *Lepisma saccharina*, *Acrotelsa collaris*, *Thermobia domestica*, *Ctenolepisma longicaudata*), several disjunct geographical distributions are known to occur in the family. All of them are undoubtedly due to involuntary human action, namely those of *Prolepismina pulchella* (Silvestri) in Peru and in the Cape Verde islands (S i l v e s t r i, 1901 and 1940 and M e n d e s, 1982 *a*) and of *Ctenolepisma dubitalis* Wygodzinsky, in the Lesser Antiles and in the Cape Verde archipelago (W y g o d z i n s k y, 1959, P a c l t, 1966 and M e n d e s, 1986); a further example is due to *Neoasterolepisma wasmannii* (M o n i e z), known along the Mediterranean basin (M e n d e s, 1988) but noticed as introduced in Peru (W y g o d z i n s k y, 1951).

I r i s h (1988) refers as one (or the main) reason to reject the unwilling human introduction hypothesis of *S. galapagoensis* in the Afrotropical Region the absence of safe harbours in the area, and considers that the only one is Walvisbay, clearly isolated from the actually known Namibian distribution patch; however, despite the Skeleton Coast dangers to navigation (the area is considered, besides, as out of the regular ship routes), three further more or less safe areas appear northwards,

namely the Baia dos Tigres, Porto Alexandre and Moça medes, all of them northwards to the Kunene river mouth, in Angolan soil. Interestingly, the two western most known collecting places of the species in Africa are located (I r i s h, op. cit.) in both banks of the Kunene, some 3 km inland only, eventually a recurrence secondary watering place, one of the few areas with fresh water in this coast, despite the q uite irregular flow of this river, often subterraneous only in inward areas.

Though I think that there is no precise date to the fact, it is known (R o m a n o w s k y et al, 1953) that in the late 18th century there were regular sailing vessel trips between Europe and Peru or pacific United States — first, the guano "cap-horniez" ships, four-mast clippers, later more recent merchandise and passenger sailing vessels correlated to the 19th century gold-prospection "race" to California — and certainly before that time more primitive vessels had certainly traveled these seas. Due to the main streams and the dominant system of winds, these ships must have done cabotage along the pacific South-American coast to its extreme South (Magellanes Straight or, more probably, Cape Horn), where they would "catch" the WSW-ENE Cape Horn (or Antartid) cold stream — or even southermost to this stream — from where, by the help of the dominant winds, they would be brought to the vicinity of the Cape of Good Hope; there, a new cold stream, the Benguela stream and the southeast coming trade winds, would allow their navigation SEE-NNW to the Guinea Gulf. Although Saldanha Bay (near the actual Cape Town) and Walvisbay had almost certainly been the main watering areas in southern Africa, it is not improbable that southern Angola named bays could also provide some protection during storms and/or served as areas for search of potable water and food, or even that several of these ships had sunk in the area. So, it is not surprising to me that either for regular or abnormal debarkations or by shipwreck, *S. galapagoensis* could have been introduced from its original geographical area (more precisely some region along the Peruvian coast) in southwest Africa, an area with not very different ecological conditions. The presence of the species in the Galapagos is quite probably also the result of an introduction but there by natural rafting from the Peruvian coast and along the cold water stream flowing SE-NW along the Pacific coast of South America, the Peruvian Stream.

Fam. A T E L U R I D A E

Grasiella decui n.sp.

Material examined: VENEZUELA — Cueva del Gaucharo (State of Monagas) (loc. 33 *in* D e c u, B o r d o n & L i n a r e s, 1987), 21/XII/1982, col. V. Decu, 1 ♂ holotypus (IER).

Body length: 8.7 mm; thorax length: 2.9 mm; thorax width: 2.5 mm; antennal maximum length: 4.4 mm; terminal filament and cerci damaged.

General shape of body typical, ateluroid. Hypodermal pigment absent, the body yellowish, very light. Scales without special features, the colour of the specimens when alive unknown, quite probably yellowish or ivory. Head exposed, typical, wider than long and with setae in the frontal area only; cephalic capsule scaly and with a few minute thin setae only. Antennae not intact, the most preserved distal chain with

3 subarticles, as in Fig. 1, the thin walled sensillae (mainly of the long and thin type) extremely abundant. Pedicellus of antenna (Fig. 2) with a distal inner conical apophysis as long as wide at base, attaining the level of the first flagellar article and with a very little anteapical cone and some strong setae; besides, in the medial dorsal inner area, not far from the apophysis base, a subovoid pit. Mandibles with well developed incisive and molar areas, as in Fig. 3. Maxillae typical, the galea with two apical cones, the maxillary palp robust and elongated (Fig. 4), with some short and very strong (almost spiniform) macrochaetae in the distal area of its second and third articles; terminal article clearly longer than the preceding one (1.3—1.5 longer) and about 7 times longer than wide. Labium and labial palp as in Fig. 5, the apical article of the palp ovoid and about 1.5 times longer than wide, with the typical sensorial papillae.

Nota typical, provided with setae and macrochaetae along the lateral borders only, the disc scaly and with a few scattered minute cilia (identical to those present in the cephalic capsule). Legs robust, typical, the only one dorsal and the 5—6 ventral tibial macrochaetae delicate and clearly shorter than the tibial diameter (Fig. 6); praetarsus simple and complete, the basal half of the lateral claws and almost all the empodium covered with microtrichia (Fig. 7).

Urosternites I—IX scaly, the macrochaetae present in the infralateral ventral area only. Urotergites I—VIII with one inner strong and long macrochaeta (less than 3 times shorter than the tergite) and 3 shorter outer macrochaetae (Figs. 8 and 9). IXth urotergite (Figs 10 and 11) not strongly produced in the posterolateral area, which is furnished with one robust and long macrochaeta and about 6 outer shorter and thinner setae. Xth urotergite as in Figs 12 and 13, the posterior notch wide and not specially deep, with a single row of marginal equally developed setae (there are not 1+1 posterolateral stronger and longer macrochaetae); ventral surface with abundant sclerotized cones, the most distal clearly stronger than the remainder; the cones are distributed along an angulous thin band, being in the proximal area thinner and disposed in a single file, and in the distal half irregularly distributed along 2—3 rows.

Urosternite I glabrous, the IInd provided with 1+1 submedian long and delicate macrochaetae (Fig. 14) and with 1+1 minute infralateral setae; IIIrd urosternite similar to the preceeding one but with 3+3 infralateral short setae; urosternites IV—VI (Fig. 15) styliferous and with 1+1 eversible vesicles; in the median area, 1+1 long macrochaetae; in the inner area close to the stylet insertion, a short and strong seta; above and in the inner area around the eversible vesicles, 5—6 setae shorter and thinner than the submedian macrochaetae; VIIth urosternite also styliferous, as in Fig. 15 with 1+1 pseudovesicles each one limited by one inner and one outer short seta and with 2+2 thin macrochaetae in the border between the pseudovesicles. Coxite VIII (Fig. 17) with the posterior border not clearly protruded and very weakly concave in the median area, provided with a row of short to medium size macrochaetae, the submedian ones not longer than the remainder and not stronger than these ones, the stylets stronger than the VIIth ones. IXth stylets (much more developed than the preceding pairs) provided with 3—4 strong ventral and one distal dorsal spiniform setae, the coxites without

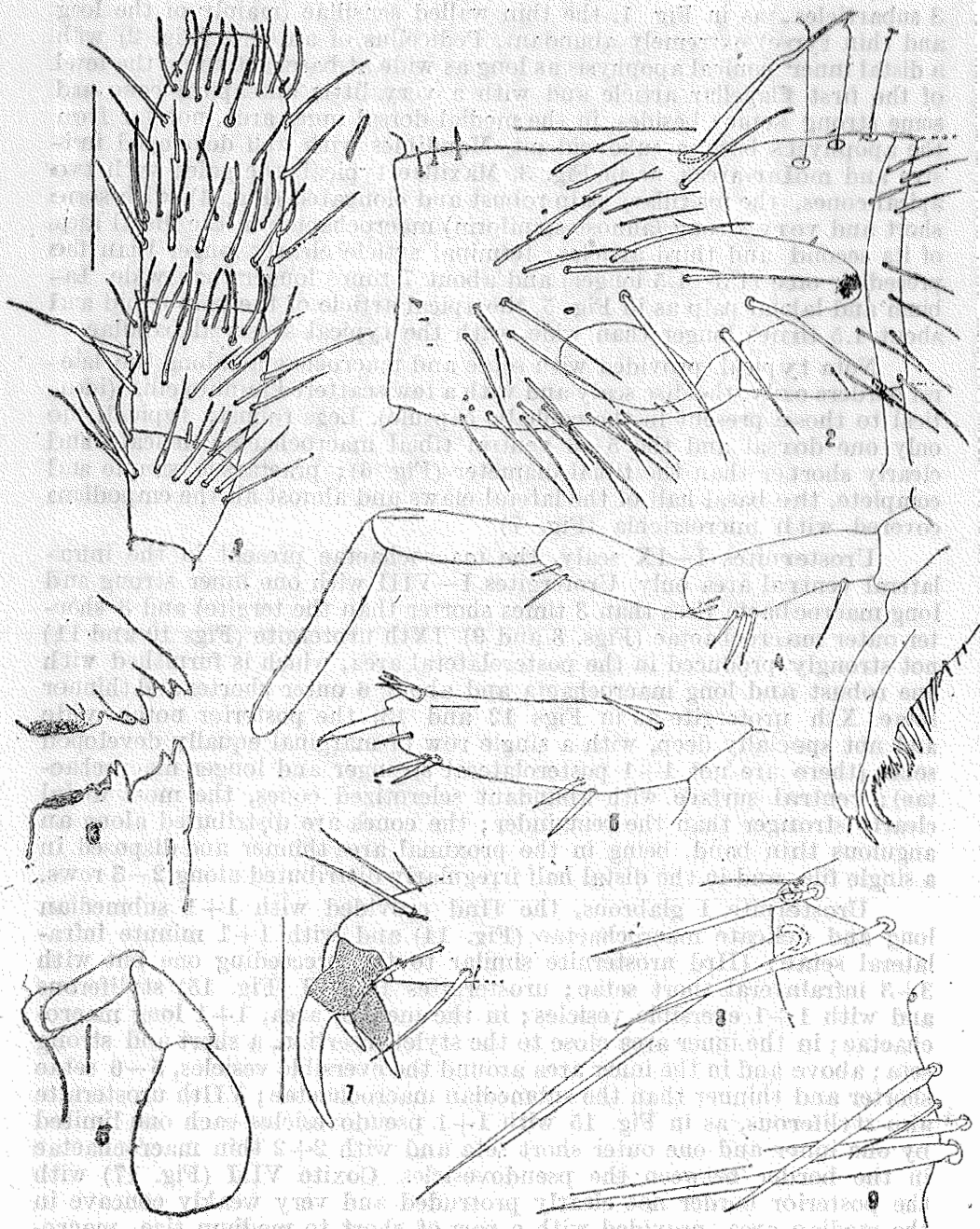

Plate 1

Figs. 1—9. *Grassiella decui* n.sp. ♂ — Fig. 1. — Distal antennal chain ; Fig. 2. — Pedicellus of antenna ; Fig. 3 — Mandibles ; Fig. 4 — Maxilla and maxillary palp ; Fig. 5 — Labial palp ; Fig. 6 — Tibia III ; Fig. 7 — Praetarsus of P II ; Fig. 8 — Ist urotergite, infralateral chaetotaxy ; Fig. 9 — IVth urotergite, infralateral chaetotaxy. Scales : 0.1 mm.

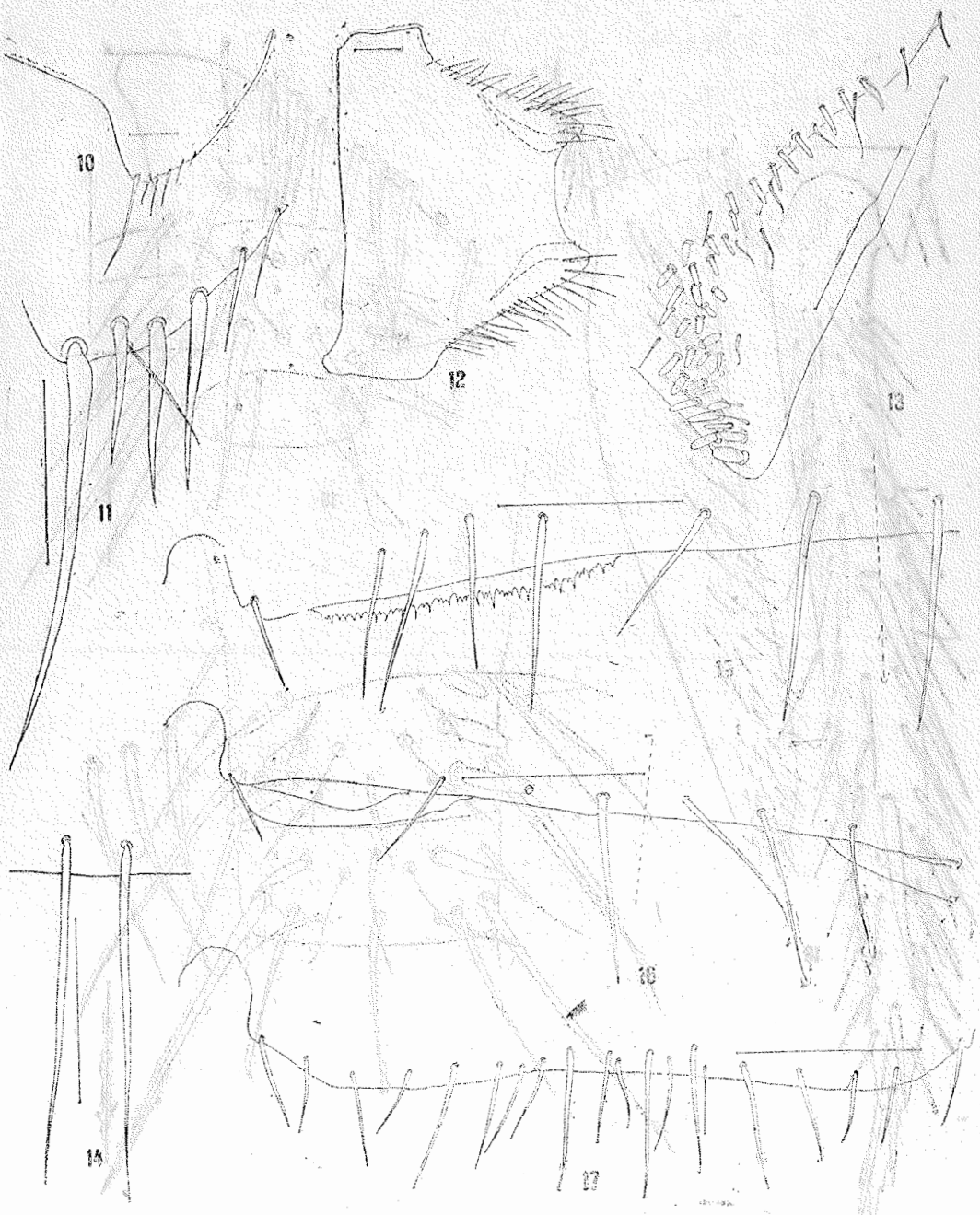

Plate 2

Figs. 10 — 17. *Grassiella decui* n.sp. ♂ — Fig. 10 — IXth urotergite, posterolateral area; Fig. 11 — Ibid., detail of the chaetotaxy; Fig. 12 — Xth urotergite, dorsal view; Fig. 13 — Ibid., ventral detail of the specialized chaetotaxy; Fig. 12 — Xth urotergite, dorsal view; Fig. 13 — Ibid., ventral detail of the specialized chaetotaxy; Fig. 14 — Median area of IInd urosternite; Fig. 15 — IVth urosternite, posterior border; Fig. 16 — VIIth urosternite, posterior border; Fig. 17 — VIIIth coxosternite, posterior border. Scales; 0.1 mm.

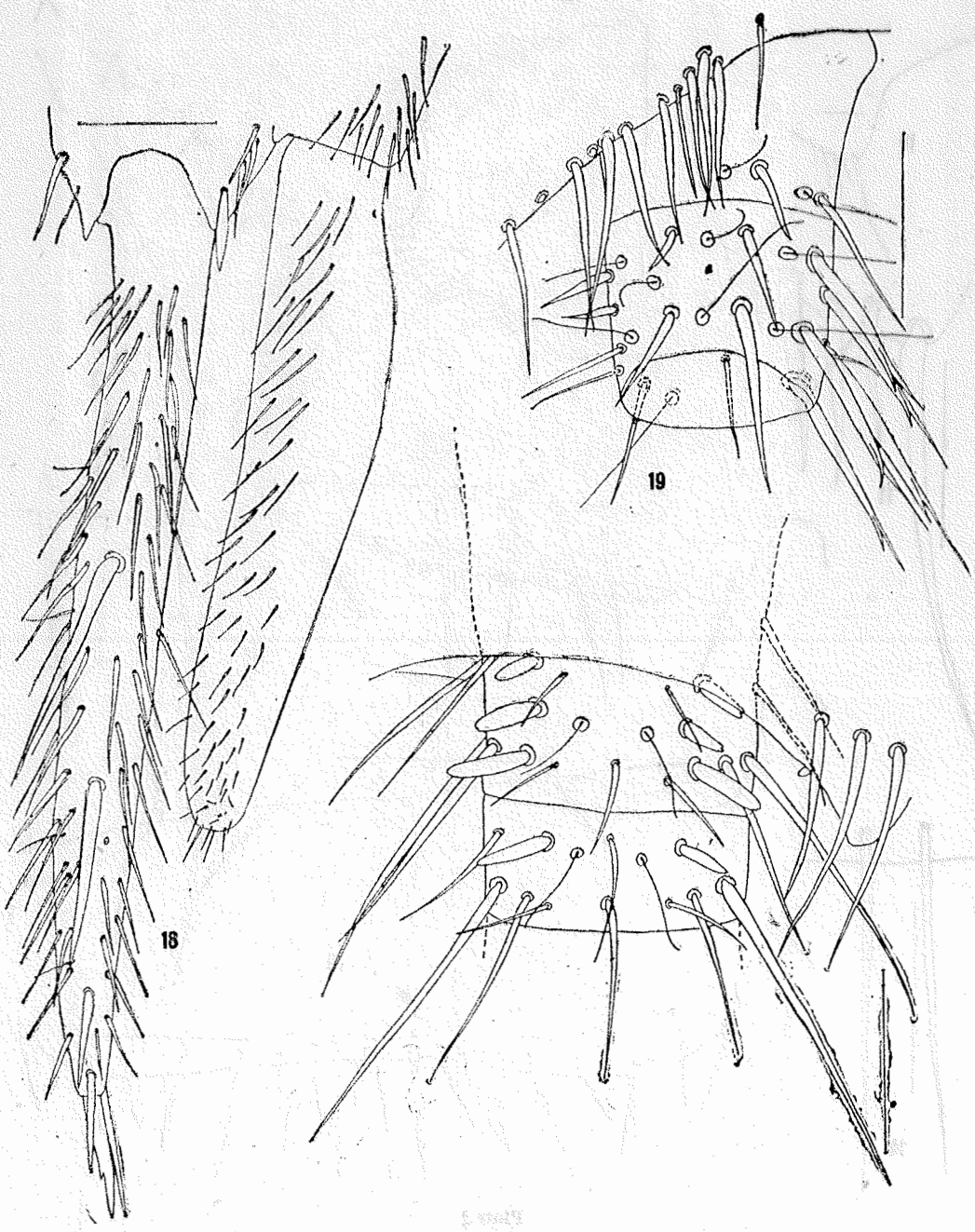

Plate 3

Figs. 18 — 20. *Grassiella decui* n.sp. ♂ — Fig. 18 — XIth coxite and stylet, and paramerum of right side, ventral view ; Fig. 19 — Preserved area of right cercus, dorsal view ; Fig. 20 — Posterior border of Xth urotergite, and basal portion of terminal filament, dorsal view. Scales : 0.1 mm.

special characteristics, as in Fig. 18. Paramera elongated, 5.5—6 times longer than wide and attaining about 2/3 of the IXth stylet length, provided with thin cilia along the outer ventral surface, the modified setae of the distal area very thin and scarce (Fig. 18).

Cerci almost completely broken, the maximum preserved corresponding to the two basal articles (Fig. 19), the cones absent in the preserved portion, though two spiniform setae (hyalin and acute-pointed) are present in the basal middle inner area of the second article. Terminal filament also seriously damaged, preserved only the basal area shown in Fig. 20, where 3+3 cones occur in the most proximal article and 1+1 in the second one.

NOTE: The gastric contents show several sclerotized integument particles, certainly not part of insects of this same group (it is not the result of a meal of its own old cuticle after moulting); some setae and a few scales (of Lepidoptera?) are also present, besides few minute mineral grains and non identifiable detritus.

DERIVATIO NOMINIS: The new species is named after its collector, the Roumanian zoologist Dr. Vasile Decu.

DISCUSSION: *Grassiella decui* n.sp. is the only species of the genus known so far from Venezuela. It seems particularly close to *G. artipoda*, *G. colimensis*, *G. dimorpha* and *G. wheeleri*, all from the Neotropical and southern Nearctic Regions, and to *G. eboris* and *G. villiersi* from the Afrotropical Region, on account of the type of dorsal chaetotaxy of the ♂ Xth urotergite (1+1 groups of equally developed setae, opposite to the 1+1 infralateral macrochaetae present in the remaining species whose males are described).

G. eboris Wygodzinsky, from Ivory Coast (Wygodzinsky, 1958 *b*). presents a quite distinct pedicellar apophysis, a clearly less elongated maxillary palp distal article, less elongated paramera and a very different specialized chaetotaxy in the ♂ Xth urotergite ventral surface, besides some minor differences.

G. villiersi Wygodzinsky, also from Ivory Coast (Wygodzinsky, *op. cit.*), with a quite different specialized chaetotaxy in the Xth urotergite ventral area is, furthermore, the only known species in the genus whose antennal pedicellus is devoid of distal apophysis.

Among the southern and central American known species, *G. dimorpha* Silvestri, from Mexico (Silvestri, 1912 and Wygodzinsky, 1958 *a*) presents a unique extremely developed and pointed pedicellar apophysis, is devoid of pedicellar fovea and presents shorter and thicker paramera. *G. wheeleri* (Escherich), from Texas—USA (Escherich, 1905), Louisiana — USA (Paclt, 1974) and from Mexico (Wygodzinsky, 1958 *a*), is also clearly different, mainly due to the unique shape of the VIIth urosternite, though other features like the robustness of the paramera and the ventral conules of the Xth urotergite are also distinct. *G. artipoda* Wygodzinsky, from Brazil (Wygodzinsky, 1958 *a*) and *G. colimensis* Wygodzinsky, from Mexico (Wygodzinsky, *op. cit.*) are undoubtedly the closer species; *G. colimensis* and the new *G. decui* share 3 subarticles in the antennal distal chain, though 4 subarticles are present in *G. artipoda*; however, the paramera are in the Venezuelan newly described species longer than in both these species, the spe-

cialized ventral Xth urotergal chaetotaxy is clearly different and the conules in the proximal area of the terminal filament much more numerous, particularly in the Mexican taxon; furthermore, there are no stronger setae in the VIIIth coxite posterior border in the Venezuelan new species (present in *G. artipoda*) and the marginal dorsal setae of the Xth urotergite are inserted along one only marginal row as in *G. colimensis*, but not as in the Brazilian taxon.

Grassiella spp.

Material examined: COSTA RICA — Puntarenas, Cueva de Damas, 3/III/1982, col. P. Strinati, 1 ♀ juv. (MHNG). VENEZUELA — State of Aragua, Pueblo Cuyagua (loc. 42 *in* Decu, Bordon&Linares, 1987), littera tamizada, 18/XI/1982, leg. V. Decu& C. Bordon, 1 ♀, 1♀ juv. (IER).

The specimen from Costa Rica is a very young female, being its body length of 2.45 mm only. The sample from Pueblo Cuyagua seems to be non-conspecific with the newly described *G. decui*, as in the distal flagellar chain there are 4 subarticles (and not 3, as in the other Venezuelan taxon); the absence of male sex makes a specific determination impossible. The genus has already been noticed to Costa Rica by Paclt (1974), who noticed there *G. praestans*.

Fam. NICOLETIIDAE
Subfam. NICOLETIINAE
Nicoletia cf. **phytophila** Gervais, 1844

Material examined: COSTA RICA — Cueva de Damas, Puntarenas, 3/III/1986, col. Strinati/Hug, 1 ♀ (MHNG). VENEZUELA — State of Sucre, Cueva de Las Báquiras (loc. 37 *in* Decu, Bordon&Linares, 1987), XII/1966, leg. J.A. Tronchoni, 2♀♀ (very damaged (IER); State of Monagas, Cueva del Guacharo (loc. 33 *in* Decu, Bordon& Linares, 1987), 2/XI/1982, col. V. Decu, 14 ♀♀, 2 juv. (IER), 3 ♀♀ (CZ). PERU — Cueva de las Lechuzas (loc. 9 *in* Decu, Bordon& Linares, 1987), 8/VI/1974, leg. Bordon, 10 ♀♀, 2 juv. (IER), 2♀♀ (CZ); ibid., 9/VI/1974, 2 ♀♀ (in two tubes) (IER).

The taxonomical study of the NICOLETIIDAE is very far from complete and the absence of males in all the samples makes impossible an accurate specific identification. *N. meinerti*, recently synonymized with *N. phytophila* (Wygodzinsky, 1980), has been noticed to Costa Rica (Paclt, 1974) and to Venezuela (Silvestri, 1904). The genus is now signalized for the first time to Peru.

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