On type material and the identity of several *Iulus* species described by Paul Gervais, in the collection of the Muséum national d'Histoire naturelle in Paris (Diplopoda, Spirostreptida, Spirobolida)

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ABSTRACT
Type material of 20 species described in the genus *Iulus* by Paul Gervais (1837 & 1847) is still preserved in the collections of the Laboratoire de Zoologie-Arthropodes (Muséum national d'Histoire naturelle, Paris, France). This material, examined here, is related, except a single case, to the tropical millipede orders Spirostreptida and Spirobolida. For eight taxa represented only by females or immatures, it is impossible to class them below the level of family or even order: thus *Iulus botta* can be placed in Iulida; *I. lagurus* and *I. leucopus* to Spirostreptida; *I. madagascariensis*, *I. philippensis*, *I. roseus* and *I. sumatrensis* in Spirobolida. *I. vermiformis* is a mixing of Polydesmida and Spirostreptida. Five other taxa were reviewed in the recent past; thus *Iulus bipulvillatus* Gervais, 1847 is a junior synonym of *Remulopygus javanicus* (Brandt, 1841) (Harpagophoridae); *I. chilensis* Gervais, 1847, became *Autostreptus chilensis* (Spirostreptidae); *I. corallinus* Gervais, 1847, became *Trigoniulus corallinus* (Pachybolidae); *I. haitensis* Gervais, 1847, became *Haitibolus haitensis* (Rhinocricidae); and *I. palmiger* Gervais, 1847 is a junior synonym of *Narceus americanus* (Palisot de Beauvois, 1817). The six remaining taxa have never been reviewed; they enter into the following new

combinations and synonymies: *Iulus sublaevis* (mislabeled "Chili") becomes *Gymnostreptus sublaevis* (Gervais, 1847) n. comb., with a new synonym *Gymnostreptus microps* (Porat, 1872) (Brazil); *I. trimarginatus* (Brazil) becomes *Gymnostreptus trimarginatus* (Gervais, 1847) n. comb. (Spirostreptidae); *I. verreauxii* (Tasmania) becomes *Amastigogonus verreauxii* (Gervais, 1847) n. comb. (Iulomorphidae). *I. striolatus* ("Amérique méridionale") becomes *Neocricus striolatus* (Gervais, 1847) n. comb. (Rhinocricidae) and is very close to *Neocricus instabilis* (Carl, 1941) n. comb. (Colombia); *I. Eydouxii* (Vietnam) becomes *Eucarlia eydouxii* (Gervais, 1847) n. comb., and is a senior synonym of *Eucarlia charactopyga* Attems, 1938 (Pachybolidae) n. syn.; *I. spinicaudus* (Southern India) becomes *Carlogonus spinicaudus* (Gervais, 1847) (Harpagophoridae) n. comb., and may be a senior synonym of *Carlogonus subvalidus* (Carl, 1941).

KEY WORDS
Myriapoda,
Diplopoda,
Gymnostreptus,
Amastigogonus,
Neocricus,
Eucarlia,
South America,
Tasmania,
Vietnam,
India.

RÉSUMÉ

Sur l'identité de plusieurs espèces décrites dans le genre Iulus *par Paul Gervais : révision du matériel type conservé au Muséum national d'Histoire naturelle à Paris (Diplopoda, Spirostreptida, Spirobolida).*

Les matériaux types de 20 espèces décrites dans le genre *Iulus* par Paul Gervais en 1837 et 1847, encore préservés dans les collections du Laboratoire de Zoologie-Arthropodes du MNHN (Paris, France), sont examinés ici. Ils se rapportent, sauf une exception, aux deux grands ordres tropicaux de Diplopodes Iuliformes : les Spirostreptida et les Spirobolida. Huit de ces taxons, représentés par seulement des femelles et des immatures sont impossibles à classer en dessous du niveau familial, voire même ordinal : *Iulus botta* se rapporte aux Iulida, *I. lagurus* et *I. leucopus* aux Spirostreptida, *I. madagascariensis, I. philippensis, I. roseus* et *I. sumatrensis* aux Spirobolida ; *I. vermiformis* est un mélange de Polydesmida et Spirostreptida. Cinq autres taxons ont été révisés dans un passé récent : ainsi *Iulus bipulvillatus* Gervais, 1847, synonyme plus récent de *Remulopygus javanicus* (Brandt, 1841) (Harpagophoridae) ; *I. chilensis* Gervais, 1847, devenu *Autostreptus chilensis* (Spirostreptidae) ; *I. corallinus* Gervais, 1847, devenu *Trigoniulus corallinus* (Pachybolidae) ; *I. haitensis* Gervais, 1847, devenu *Haitibolus haitensis* (Rhinocricidae) et *I. palmiger* Gervais, 1847, synonyme plus récent de *Narceus americanus* (Palisot de Beauvois, 1817). Enfin, six taxons n'avaient encore jamais été revus ; ils entrent dans les combinaisons nouvelles et synonymies ci-après : *Iulus sublaevis* (signalé du Chili par erreur) devient *Gymnostreptus sublaevis* (Gervais, 1847) n. comb. ; il a pour n. syn. : *Gymnostreptus microps* (Porat, 1872) (Brésil). *I. trimarginatus* (Brésil) devient *Gymnostreptus trimarginatus* (Gervais, 1847) n. comb. (Spirostreptidae). *I. verreauxii* (Tasmanie) devient *Amastigogonus verreauxii* (Gervais, 1847) n. comb. (Iulomorphidae). *I. striolatus* (« Amérique méridionale ») devient *Neocricus striolatus* (Gervais, 1847) n. comb. (Rhinocricidae) ; ce taxon est très proche de *Neocricus instabilis* (Carl, 1941) n. comb. (Colombie). *I. Eydouxii* (Viêt-Nam) devient *Eucarlia eydouxii* (Gervais, 1847) n. comb., et synonyme plus ancien et sympatrique de *Eucarlia charactopyga* Attems, 1938 (Pachybolidae) n. syn. *I. spinicaudus* (Sud de l'Inde) devient *Carlogonus spinicaudus* (Gervais, 1847) (Harpagophoridae) n. comb. ; très proche sinon synonyme de *Carlogonus subvalidus* (Carl, 1941).

MOTS CLÉS
Myriapoda,
Diplopoda,
Gymnostreptus,
Amastigogonus,
Neocricus,
Eucarlia,
Amérique du Sud,
Tasmanie,
Vietnam,
Inde.

INTRODUCTION

In the 1830's to 1850's, Paul Gervais, one of the founders of myriapodology in France, described lots of species in the then nearly all-embracing genus *Iulus* (currently corresponding to the millipede orders Julida, Spirostreptida, Stemmiulida and Spirobolida!), with only very few of these having been subsequently revised and properly assigned to modern genera. The original descriptions have been scattered in several papers (Gervais 1837, 1847 ; Gervais & Goudot 1844), with some of the species subsequently redescribed, mostly verbatim, and, in part, depicted by the author himself (Gervais 1847, 1849, 1859). Also, Gervais selected a few of his nominal *Iulus* taxa as type species of new subgenera, i.e. *Stemmiulus* Gervais, 1844 (the type species: *Iulus bioculatus* Gervais & Goudot, 1844) and *Glyphiulus* Gervais, 1847 (the type species: *Iulus granulatus* Gervais, 1847); both are currently accepted as "good" genera in two different orders. Most of the type material was originally specified as part of the collection of the Muséum national d'Histoire naturelle in Paris, but only relatively few of the *"Iulus"* types seem to have actually survived here.

Generally, any attempt at revising diplopod type material of Gervais as well as of virtually all of his predecessors and contemporaries is bound to face a good number of difficulties. First, few of the ancient types have survived. Secondly, even the surviving specimens are often in poor condition. Thirdly, even among those few that have survived the greater part are represented by females and/or juveniles, hence of very limited value for drawing solid conclusions, as modern millipede systematics is largely based on male genitalia structure. Fourthly, none of those early masters of diplopod systematics cared to select types, while Gervais usually failed to specify even the sex and the number of specimens he used for descriptions. Finally, revisions are often hampered by lack of information on extant museum collections, and regrettably the MNHN of Paris is among the bulk whose type collections remain unpublished. Furthermore, even if one spot an old type sample he wishes to revise, there might be severe restrictions as to getting material on loan (e.g., the types of Linnaeus housed by the Royal Linnean Society in London). Without further effort to revise all available type material of ancient species, however, no real progress can be expected with regard to stabilizing millipede nomenclature. Hence the basic objective of this paper is to clarify the identity of another six exotic species of *Iulus* described by Gervais (1847), and housed in the collection of the MNHN of Paris. Regrettably, many of Gervais' millipede types are no longer in Paris, yet several originally indicated as kept here are actually in the collection of the Natural History Museum in London. Perhaps some additional type material of Gervais will be recovered in other museums as well. In any event, the following list will inform the reader on what exactly is still available at Paris, with the respective entry numbers added.

TYPE MATERIAL OF THE *IULUS* SPECIES DESCRIBED BY PAUL GERVAIS AND STILL AVAILABLE AT THE PARIS MUSEUM

1) IA 072: *Iulus bipulvillatus* Gervais, 1847, erroneously stated as coming from Brazil, actually from Java, a male holotype, currently referred to as a junior synonym of *Remulopygus javanicus* (Brandt, 1841) (Hoffman 1975b ; Hoffman & Golovatch 1998);

2) EB 040*: Iulus botta* Gervais, 1837 is represented in the Paris collection by samples (one juvenile male and four adult females) in very poor condition, collected near Tripoli (previously in Syria, now in Lebanon) by Mr P. E. Botta. They are evidently Iulidae (after examination of the gnathochilaria), perhaps referable to the genus *Catamicrophyllum*. The subsequent usage of the name as *I. bottoe* (or *I. bottae*), first by Gervais himself (1847), and later by other authors, is incorrect. The original name, *I. Botta*, is correct, since the name of the collector is here treated as a noun in apposition to the generic name;

3) IB 282: *Iulus chilensis* Gervais, 1847, five tubes, including a male lectotype, two male and at least four female paralectotypes, from Chile,

presently known as *Autostreptus chilensis* (Gervais, 1847) (Demange & Silva 1971);
4) H 037: *Iulus corallinus* Gervais, 1847, from Mauritius and Réunion islands, currently referred to as *Trigoniulus corallinus* (Gervais, 1847), a pantropical "tramp" species (Mauriès & Geoffroy 1999 ; Shelley & Lehtinen 1999);
5) H 160: *Iulus eydouxii* Gervais, 1847, a male lectotype and numerous paralectotypes, from Vietnam (see below);
6) GA 013: *Iulus granulatus* Gervais, 1847, has since been referred to as *Glyphiulus granulatus* (cf. Mauriès 1970);
7) H 159: *Iulus haitensis* Gervais, 1847, a male lectotype and a female paralectotype, from Haiti, currently referred to as *Haitobolus haitensis* (Gervais, 1847) (Mauriès & Hoffman 1998);
8) IA 098: *Iulus lagurus* Gervais, 1847, a juvenile female holotype, from Singapore, actually a species of Harpagophoridae (Spirostreptida);
9) GB 019: *Iulus leucopus* Gervais, 1847, a fragment of a female holotype, from Colombia, likely a species of the order Spirostreptida;
10) H 162: *Iulus madagascariensis* Gervais, 1847, juvenile female syntype, from Madagascar, the species stated to be a *"Spirostreptus"* but in fact is a species of Spirobolida unidentifiable below the ordinal level;
11) H 165: *Iulus palmiger* Gervais, 1847, female holotype, from French Guyana, obviously mislabeled as being the same as the North American *Narceus americanus* (Palisot de Beauvois, 1817) (Hoffman 1999);
12) H 119: *Iulus philippensis* Gervais, 1847, two female syntypes, from Manila, actually a species of Spirobolida unidentifiable below the ordinal level, though at least one male is said to have been in the type series (cf. Gervais 1847);
13) H 132: *Iulus roseus* Gervais, 1847, female holotype, from Colombia, actually an unidentified "*Rhinocricus*" species (Rhinocricidae, Spirobolida);
14) IA 097: *Iulus spinicaudus* Gervais, 1847, male holotype, from South India (see below);
15) H 157: *Iulus striolatus* Gervais, 1847, male holotype, from South America (see below);
16) IB 248: *Iulus sublaevis* Gervais, 1847, one male lectotype, one female paralectotype, erroneously stated to derive from Chile (see below);
17) H 158: *Iulus sumatrensis* Gervais, 1847, female holotype, from Sumatra, a species of Spirobolida not identifiable below the ordinal level;
18) IB 103: *Iulus trimarginatus* Gervais, 1847, four tubes, from Brazil (see below);
19) GA 031: *Iulus verreauxii* Gervais, 1847, male holotype, from Tasmania (see below);
20) IB 195: *Iulus vermiformis* Gervais, 1847, two tubes, from Colombia, one with a Polydesmida (!), the other syntype a female of ?*Orthoporus* (Spirostreptidae).

SYSTEMATICS

Order SPIROSTREPTIDA Brandt, 1833
Family HARPAGOPHORIDAE Attems, 1909
Genus *Carlogonus* Demange, 1962

Carlogonus spinicaudus
(Gervais, 1847) n. comb.

Iulus spinicaudus Gervais, 1847: 165.

TYPE MATERIAL. — N° IA 097, 1 ♂ holotype.

TYPE LOCALITY. — The holotype derives from the Malabar coast of South India, collected by Dussumier (or Duffumier?).

REMARKS

The male holotype (holotype status presumed from the original description alone that gives no size variation), is very close to if not identical with *Carlogonus subvalidus* (Carl, 1941), from India, hence the new combination in the genus created by Demange (1961). A final decision about synonymy of the two names should be preceded by comparison of their type specimens (cf. Carl 1941).

Family SPIROSTREPTIDAE Brandt, 1833
Genus *Gymnostreptus* Brölemann, 1902

Gymnostreptus sublaevis (Gervais, 1847), n. comb. (Fig. 1)

Iulus sublaevis Gervais, 1847: 194; 1859: 24.

Julus sublevis [sic!] – Gervais 1849: 62, fig. 4.

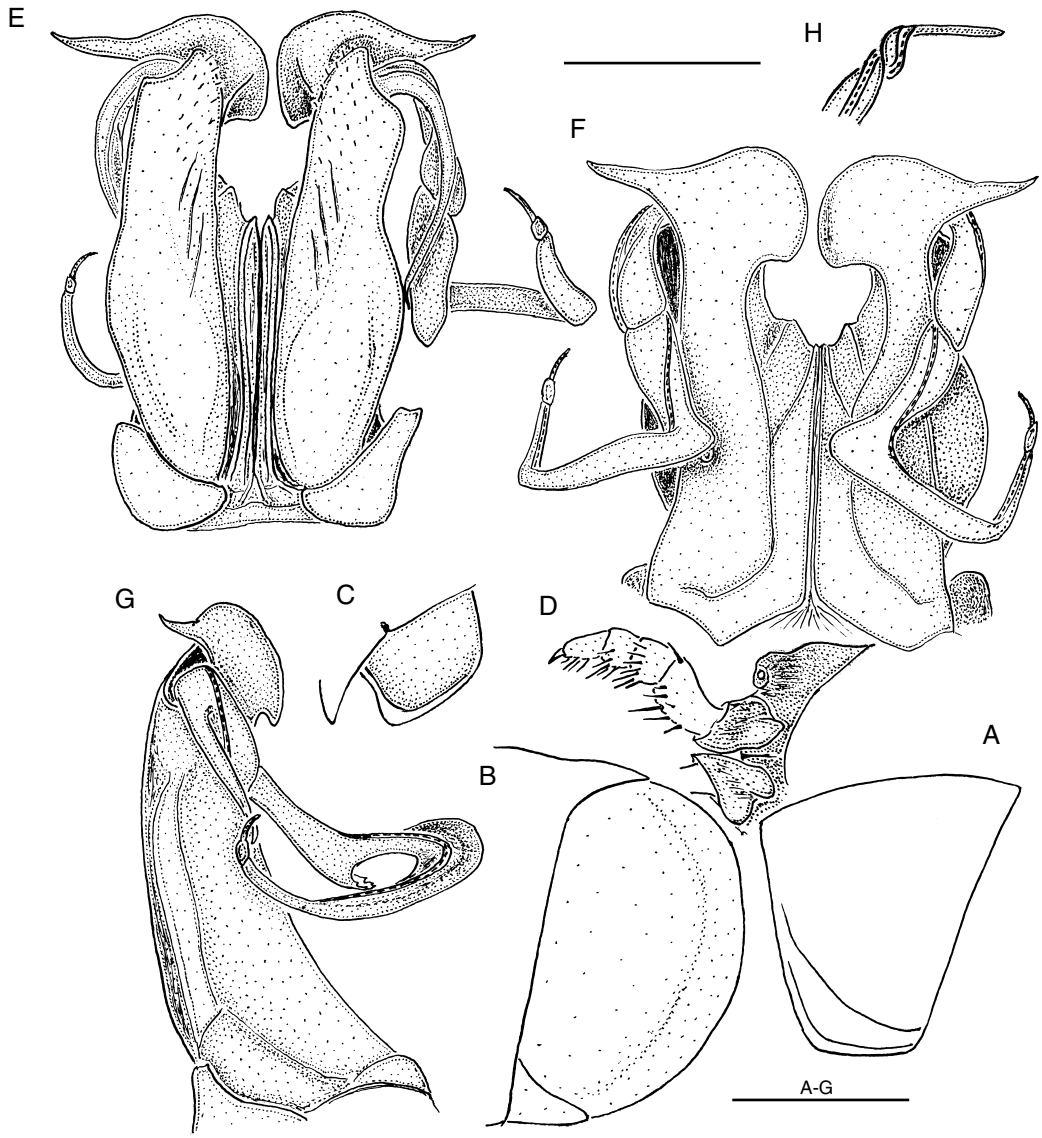

FIG. 1. — *Gymnostreptus sublaevis* (Gervais, 1847), ♂ lectotype (A, C-H) and female paralectotype (B); **A**, collum (lateral view); **B**, telson (lateral view); **C**, gena (lateral view); **D**, leg 1 (front view); **E**-**G**, gonopods (front, lateral, and caudal views, respectively, with lateral folds of paracoxites broken off); **H**, tip of solenomerite (drawn not to scale). Scale bars: A-G, 2.0 mm; H, 1.0 mm.

Gymnostreptus microps (Porat, 1872) n. syn.

Gymnostreptus legationis (Attems, 1950) n. syn.

TYPE MATERIAL. — N° IB 248, 1 ♂ lectotype, 1 ♀ paralectotype.

TYPE LOCALITY. — With the above evidence at hand, there can be little doubt that the type material of *I. sublaevis* must have been mislabeled. A search for information about Gaudichaud who obtained several of the Gervaisian "Chile" types including *I. sublaevis*, showed the correct name of the collector to be Charles Gaudichaud-Beaupré, who made several voyages to South America and ended his career at the Paris Museum as a botanist. In 1831-1833 he was naturalist on the frigate *L'Herminie*, which put in at Rio, São Paulo (probably Santos), and Santa Catarina (probably

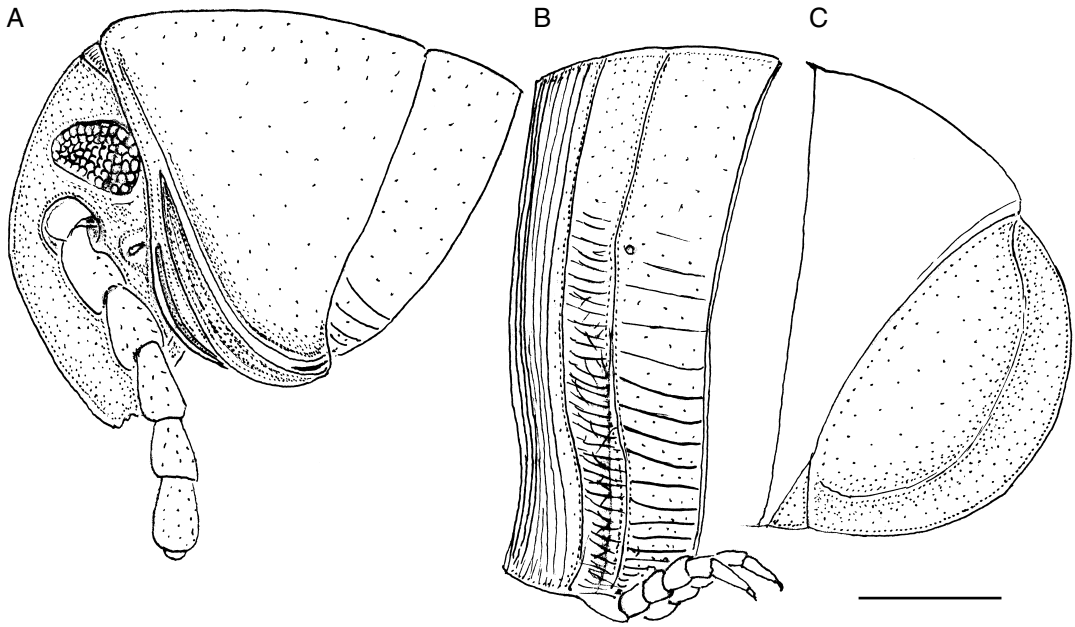

FIG. 2. — *Gymnostreptus trimarginatus* (Gervais, 1847), ♀ lectotype; **A**, anterior body end (lateral view); **B**, midbody segment (lateral view); **C**, telson (lateral view). Scale bar: 2.0 mm.

Florianopolis), as well as several ports in Chile and Peru. A later trip on *La Bonite*, 1836-1837, touched only at Montevideo before going on to Valparaiso (Papavero 1971). So the mislabeling of a *Gymnostreptus* as being from Chile seems likely to have occurred with the earlier material. Probably it would be safe to assume that *sublaevis* was taken around Rio de Janeiro, Brazil.

REMARKS

The type material contains one male lectotype and one female paralectotype, both designated herewith, which are stated to be derived from Chile, and collected by Gaudichaud.

Restudy of the types, of the lectotype in particular, has revealed that this species actually belongs to the large and obviously composite genus *Gymnostreptus* Brölemann, 1902, with *c.* 20 species (cf. Hoffman 1980) known from eastern, central and southern Brazil as well as Paraguay (cf. Krabbe 1982; Hoffman 1975a, 1997). Furthermore, as evident from Fig. 1, *G. sublaevis* is a senior synonym of *G. microps* (Porat, 1872) n. syn., which, in its turn, is a strict synonym of *G. legationis* (Attems, 1950), both latter from Rio de Janeiro (cf. Hoffman 1997). The only minor discrepancy concerns the subterminal coil of the solenomerite (Fig. 1H) which is rather distinct in both the lectotypes of *sublaevis* and *microps* but seems to be absent (overlooked?) in *legationis*. A complete bibliography concerning *Gymnostreptus* and the specific names concerned can be found in Krabbe (1982) and Hoffman (1975a, 1997).

Gymnostreptus trimarginatus
(Gervais, 1847) n. comb.
(Fig. 2)

Iulus trimarginatus Gervais, 1847: 189; 1859: 22, pl. 3, fig. 2.

TYPE MATERIAL. — N° IB 103, 1 subadult ♂ lectotype, 4 ♀ ♀ paralectotypes.

TYPE LOCALITY. — The samples are said to derive from Brazil, collected by Wauthier (recte: Vauthier), a French traveler who visited Brazil in 1831-1833 (Papavero 1971). He apparently collected chiefly around Rio, but also in Minas Gerais around Diamantina. So whatever *Gymnostreptus* anyone tries to match up with *trimarginatus* would probably be one occurring in one of those two regions.

REMARKS

Though type material of this species contains a single subadult male and four fragmented females (with the anterior body part of one of the latter selected herewith as lectotype, the other specimens as paralectotypes), it appears possible to safely attribute *trimarginatus* to *Gymnostreptus* as well. New illustrations are provided here for comparative purposes (Fig. 2), yet already Gervais' figure 4 in the 1859 paper clearly shows the collum to have a conspicuous caudolateral emargination that seems characteristic only of very few nominal *Gymnostreptus* species. Thus, a virtually identical to highly similar condition is found in *G. bovei* (Silvestri, 1895), from Paraguay and Argentina (Hoffman 1997), *G. deserticola* (Brölemann, 1902), from Sertão de Pernambuco, Brazil (only known from the female sex, too, hence treated as *incertae sedis* by Krabbe 1982), and *G. iheringi* (Brölemann, 1902), from many places in Brazil (cf. Krabbe 1982, who assigned this species to *Hemigymnostreptus* Schubart, 1950, although Hoffman 1975a treated it as a *Gymnostreptus*). Yet it would seem premature to synonymize any of these names as there are minor differences in somatic characters expressed between them. Judged from peripheral features alone, especially the pattern of collumnar striation and the strongly margined anal valves, *G. trimarginatus* seems to come closest to, if not identical with *G. iheringi*. Further material is necessary to finally resolve the riddle of the identity of both *G. trimarginatus* and *G. deserticola*. Indeed, the conspicuously emarginate collum might prove to be a good character reflecting phylogenetic relations between congeners, in spite the unsettling case related by Krabbe & Enghoff (1985).

Family IULOMORPHIDAE Verhoeff, 1924
Genus *Amastigogonus* Brölemann, 1913

Amastigogonus verreauxii (Gervais, 1847) n. comb.
(Fig. 3)

Iulus Verreauxii Gervais, 1847: 175.

TYPE MATERIAL. — N° GA 031, 1 ♂ holotype.

TYPE LOCALITY. — The sample is stated to derive from the slopes of Mont Wellington, Tasmania (which is near Hobart), collected by Jules Verreaux.

REMARKS

Re-examination of the male holotype (holotype status presumed from the original description that gives variation neither in leg counts nor size has revealed that this species unquestionably is referable to *Amastigogonus* Brölemann, 1913. This small genus has hitherto contained three valid species, all apparently endemic in Tasmania (cf. Hoffman 1980). Further, *Iulus verreauxii* has long been recognized as a cambaloid, yet without any taxonomic specification (Jeekel 1981). So this is the first formal reallocation of this enigmatic species since its original description.

Judged from the illustrations presented here (Fig. 3), *A. verreauxii* seems to have no junior synonyms, being distinguished by the presence of a very faint axial line along the prementum (comparable to an incomplete line only known in *A. hardyi* [Chamberlin, 1920] as illustrated by Verhoeff [1944] for its junior synonym *A. nicholsii* Verhoeff, 1944 [cf. Hoffman 1972]), the peculiar shape of the terminal telopoditomeres of the male leg-pair 1, the subequally long branches of the anterior gonopods and, above all, by the securiform distal end of the solenomerite *(vs* long and flagelliform in the type-species *A. tasmanianus* Brölemann, 1913 or shorter and flagelliform both in *A. hardyi* and *A. fossuliger* Verhoeff, 1944 [cf. Brölemann 1913; Verhoeff 1944; Hoffman 1972]).

The rudimentary posterior gonopods (Fig. 3H) appear to be attached like forceps to the wall at the very base of the caudomedian ridges of the anterior gonopods (Fig. 3E).

Order SPIROBOLIDA Bollman, 1893
Family PACHYBOLIDAE Cook, 1897
Genus *Eucarlia* Brölemann, 1913

Eucarlia eydouxii (Gervais, 1847) n. comb.

Iulus eydouxii Gervais, 1847: 166.

Eucarlia charactopyga Attems, 1938: 257, n. syn.

TYPE MATERIAL. — N° IA 097, 1 ♂ lectotype, fragmented females lectotypes.

TYPE LOCALITY. — Touranne (= Da Nang, Vietnam).

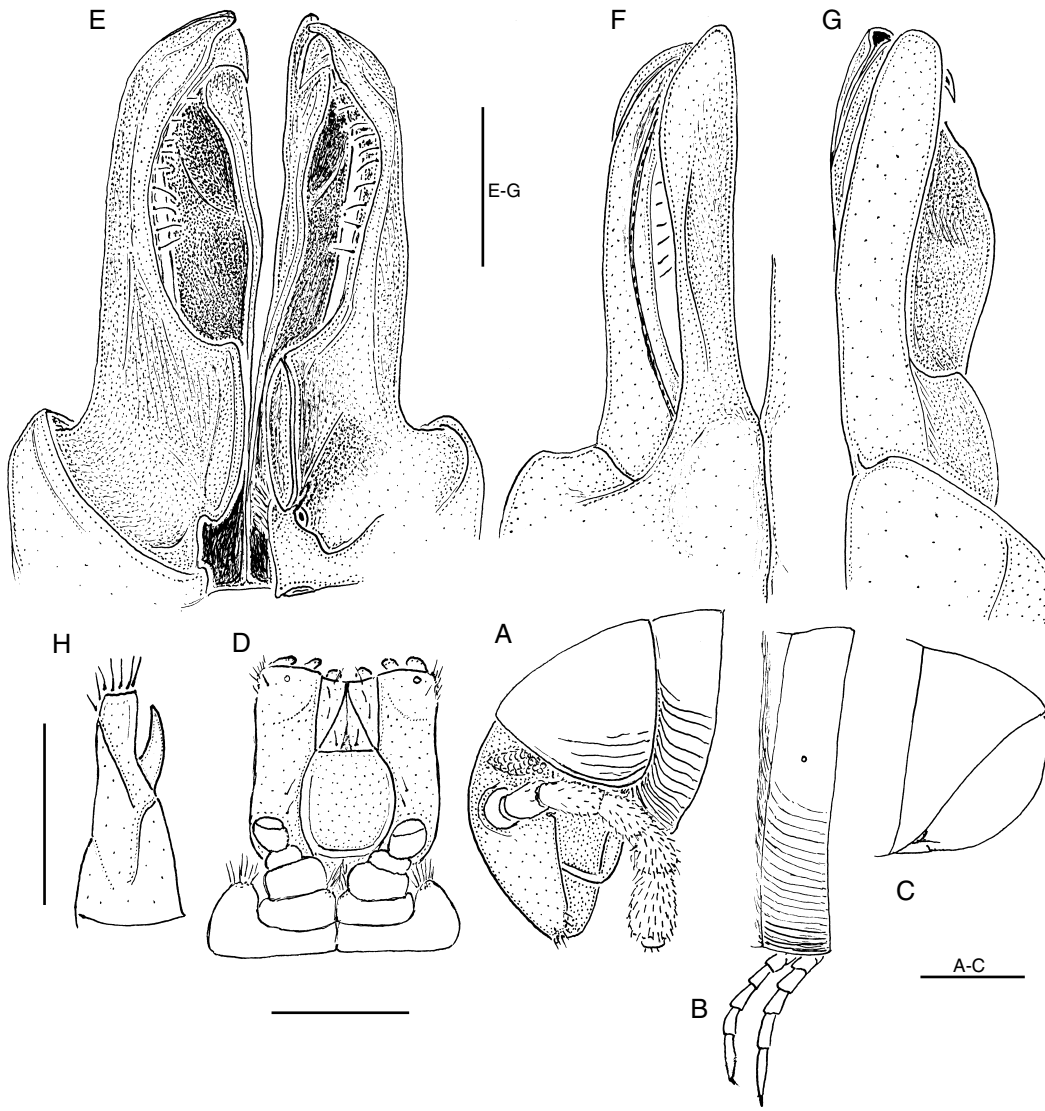

FIG. 3. — *Amastigogonus verreauxii* (Gervais, 1847), ♂ holotype; **A**, anterior body end (lateral view); **B**, midbody segment (lateral view); **C**, telson (lateral view); **D**, leg-pair 1 and gnathochilarium (caudal view); **E**, gonopods (caudal view); **F**, **G**, anterior gonopod (front and lateral views, respectively); **H**, left posterior gonopod (caudal view). Scale bars: A-D, 1.0 mm; E-H, 0.5 mm.

REMARKS

Based upon a restudy of the male lectotype and numerous, mostly fragmented female paralectotypes, all designated herewith, this hitherto enigmatic species is definitely conspecific with the topotypic *Eucarlia charactopyga* Attems, 1938. Hence the new combination and synonymy advanced here (cf. Attems 1938).

Because the taxonomy of this rather large, basically Oriental genus is badly confused, the above reassignment is tentative.

Family RHINOCRICIDAE Brölemann, 1913
Genus *Neocricus* Chamberlin, 1941

Neocricus striolatus
(Gervais, 1847) n. comb. (Fig. 4)

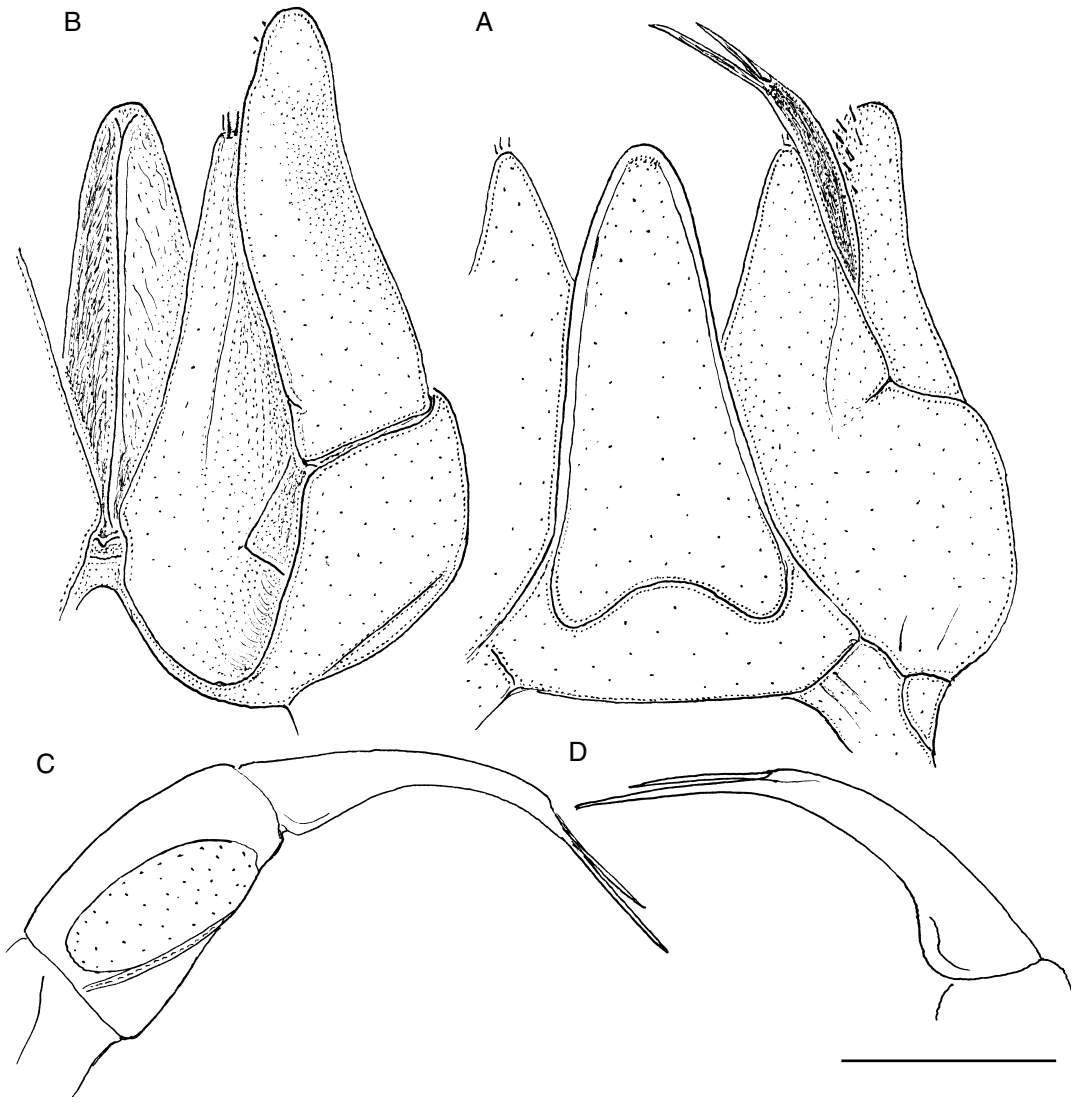

FIG. 4. — *Neocricus striolatus* (Gervais, 1847), ♂ holotype; **A**, gonopods (front view); **B**, anterior gonopods (caudal view); **C**, **D**, left posterior gonopod (lateral and mesal, respectively). Scale bar: 2.0 mm.

Iulus striolatus Gervais, 1847: 192; 1859: 23, pl. 4, fig. 2.

TYPE MATERIAL. — N° H 157, 1 ♂ holotype.

TYPE LOCALITY. — Presumption of Colombia as the country of origin of *N. striolatus* seems warrantable, as three other *Iulus* species described by Gervais (1847) are based on Colombian material, all taken by Justin Goudot, i.e. *I. roseus*, *I. vermiformis*, and *I. leucopus*.

REMARKS

The male holotype (holotype status presumed from absence of data on variation in neither in size, segment counts, nor leg number in the descriptions alone [Gervais 1847, 1859]), is stated to derive from South America, with neither a more precise indication of country or collector.

Study of the structure of the posterior gonopods (Fig. 4C, D) of *striolatus* leaves no doubt that it is a species of *Neocricus* Chamberlin, 1941. This genus currently comprises 13 nominal species, most of them obviously synonyms, in Colombia and Venezuela (Hoffman 1980). Judged from the

shape of the median sternal process and the conspicuously setose distal part of the median piece of the anterior gonopod coxite (Fig. 4A, B), *N. striolatus* seems very close to if not identical with *Rhinocricus instabilis* Carl, 1914, from Colombia. However, it is premature to synonymize these names until the respective types have been re-examined side-by-side for possible differences in body form. Based on the original description and illustrations of *instabilis* (Carl 1914), it is likewise impossible to extract all details of gonopod structure necessary for comparative study. Thus, in *N. striolatus* both anterior and posterior gonopods seem considerably stouter, and the distal part of the femorite of the anterior gonopods is setose like the medial coxal piece. The close similarity of *Neocricus striolatus* to *Rhinocricus instabilis* provides further circumstantial evidence.

Since *R. instabilis* has not been relocated into a "modern" genus, our present placement in *Neocricus* constitutes a new combination.

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