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Identities of the milliped genera *Spirostreptus* Brandt, 1833 and *Spiropoeus* Brandt, 1833 (Diplopoda, Spirostreptida, Spirostreptidae)

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ABSTRACT

The identities of two of the oldest genus-group names in the milliped family Spirostreptidae and order Spirostreptida are established. *Spirostreptus* Brandt, 1833 (type species: *S. sebae* Brandt, 1833) is shown to be a senior subjective synonym of the well-known Afrotropical genus *Triaenostreptus* Attems, 1914 (type species: *Spirostreptus triodus* Attems, 1909), **syn.n.**, with *sebae* itself a senior subjective synonym of *T. petersi* Attems, 1914, **syn. n.** This synonymy stabilizes spirostreptidan nomenclature but results in the following nomenclatorial changes: Spirostreptini Brandt, 1833 = Triaenostreptini Attems, 1914, and Spirostreptinae = Triaenostreptinae, **syn. n.** Numerous Afrotropical species heretofore assigned to *Spirostreptus* sensu auctorum must be relegated to other genera, both established or still unpublished. Finally the name *Triaenostreptus triodus* Attems, 1909, is shown to be a junior subjective synonym of *Spirostreptus heros* Porat, 1872, **syn. n.**

Spiropoeus Brandt, 1833 (type species: *S. fischeri* Brandt, 1833), is a monotypic West African genus, with *Spirostreptus (Nodopyge) parilis* Karsch, 1881, *S. (N.) lingulatus* Karsch, 1881, *S. liber* Porat, 1888, *Mardonius piceus* Attems, 1952, *M. parilis acuticonus* Attems, 1914, and *M. parilis sternalis* Brolemann, 1926, transferred to *Spiropoeus*, all **comb. n.**, as junior subjective synonyms of *Spiropoeus fischeri*, **syn. n.**

INTRODUCTION

Ever since their original proposal (Brandt, 1833), the identities of the milliped genera *Spirostreptus* Brandt, 1833 and *Spiropoeus* Brandt, 1833, both amongst the

oldest names available in the family Spirostreptidae, and the order Spirostreptida as a whole, have remained problematic or totally enigmatic (Golovatch & Hoffman, 2001).

Spirostreptus was based – by subsequent designation of Pocock (1894) – on *S. sebae* Brandt, 1833, the type material of which being only the dry and badly fragmented female holotype of unknown provenance in the collection of the Zoological Institute (ZIN) of the Russian Academy of Sciences in St. Petersburg (Golovatch & Hoffman, 2001). The inadequate original description, devoid of any meaningful illustrations coupled with an unknown type locality (Brandt, 1833, 1841), has apparently discouraged any revisionary attempt from the very start, resulting in two retypifications of *Spirostreptus*, which as an indispensable name had to be treated in one way or another. Thus, Silvestri (1895) designated *Spirostreptus vittatus* Newport, 1844, and Attems (1950) selected *Spirostreptus amandus* Attems, 1914, be “substitute type species” of *Spirostreptus*, both acts invalid (Jeekel, 1971), since neither species was originally included in the genus, and since Pocock had already correctly selected *S. sebae* as type in 1894.

With modern diplopod taxonomy largely relying on gonopod conformation and a number of other, mainly male characters, and the characters of *Spirostreptus sebae* remaining unknown to previous workers, they had virtually no option but to arbitrarily select a male-based spirostreptid species to provide an identity for the genus and ultimately a classification of the family Spirostreptidae. The latest treatise by Krabbe (1982) dismissed any attempt at identification of the female holotype as futile (even suggesting the possibility that it might be a harpagophorid), thus uncritically perpetuating Attems’ “typification” of *Spirostreptus*. Only recently has the holotype of *S. sebae* been revised, and a new description and the first meaningful illustrations published (Golovatch & Hoffman, 2001). The unusually large size of the holotype (well over 20 cm long) coupled with certain peripheral features like shape of the collum, telson, antennae, gnathochilarium and legs, the striation pattern of body segments, and the metatergal sigilla, have long been deemed as characters very useful in finding a match to something already described amongst the present-day spirostreptid diversity (about 100 genera, over 800 species: Hoffman, 1980; Krabbe, 1982).

The name *Spiropoeus* has likewise remained in complete oblivion even though its type, and only, species *S. fischeri* Brandt, 1833 was based on a male holotype (without provenance), for which the original description clearly depicted the antenna, the gnathochilarium with its shelf-like structure on the mentum, and the very long, acuminate, and medially distant prefemoral processes of the 1st male legs. However, as in the case with *Spirostreptus*, no revisionary attempt has ever been endeavored. Again, it has only been recently that a detailed redescription and new illustrations of the holotype of *Spiropoeus fischeri* appeared (Golovatch & Hoffman, 2001).

Regrettably, the gonopods of the holotype appear to have been lost, apparently by Brandt himself while preparing the original description, hence delaying an immediate match and identity clarification.

It must be recalled that both these specimens were part of the Seba Cabinet purchased by the orders of Russian tsar Peter I to become part of the famous *Kunstkammer*, Russia's first museum (Golovatch & Hoffman, 2001). Neither holotype bears any locality or collector data, and both currently are in pretty poor condition, completely dry and fragmented. It cannot be ruled out that they could have been brought to the Netherlands to reach merchant Albert Seba by the end of the 17th century! Even if they made part of the last purchase known to have taken place in 1752, after the death of Seba, these are among the oldest millipeds ever collected and described in a scientific way. In fact Seba quite beautifully illustrated a couple of millipeds, including the future holotype of *Spirostreptus sebae*, in his *Thesauri* in 1734 (see Golovatch & Hoffman, 2001).

It was partly with the aim of matching the available illustrations and descriptions both of *Spirostreptus sebae* and *Spiropoeus fischeri* with specimens and library resources at the Virginia Museum of Natural History that the second author paid a short visit to Martinsville in March 2000. The results of the investigation are presented below. With Hoffman (1991) having finally cleared up the confusion concerning the identity of *Odontopyge* Brandt, 1841 (albeit with several radical if not draconian nomenclatorial changes resulting), and now *Spirostreptus*, a genus central to classification of the entire order Spirostreptida, also clarified, we claim to have achieved a fair degree of nomenclatural stability in the Spirostreptida. Only the Brandtian names *Nodopyge* and *Spirocyclistus* remain as unresolved enigmata.

TAXONOMIC PART

Spirostreptus Brandt, 1833

Spirostreptus Brandt, 1833, Bull. Soc. Imp. Natural. Moscou, 6: 203. Proposed with two new species. Type species, *Spirostreptus Sebae*, by subsequent designation of Pocock, 1894.

Triaenostreptus Attems, 1914, Zoologica, 25 (65/66): 149. Proposed for four species. Type species, *Triaenostreptus triodus* Attems, 1914, by subsequent designation of Jeekel, 1971. **New synonymy!**

Triaenostreptus: Krabbe, 1982: Abh. Naturw. Ver. Hamburg, NF 24: 279.

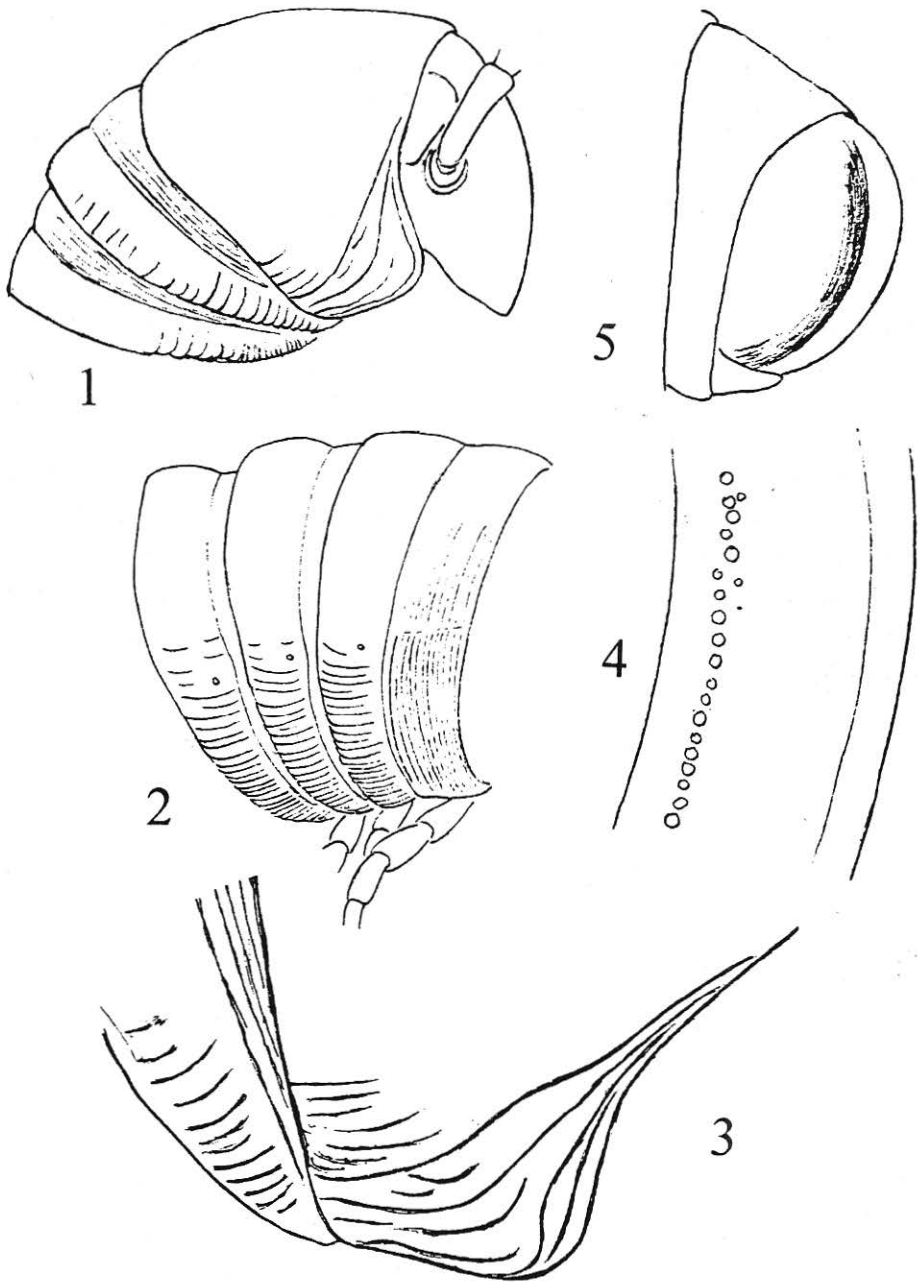
The true identity of *Spirostreptus sebae* Brandt, 1833 has always been crucial to spirostreptidan nomenclature (e.g., Krabbe, 1982), as this species is the type of a genus which is the type of a family, Spirostreptidae, and of an order, Spirostreptida.

To justify the above generic synonymy, one must consider several points. First, the recently redescribed holotype female of *S. sebae* is among the largest diplopods ever recorded (Golovatch & Hoffman, 2001). With its body reaching a length of 22.5 cm, *S. sebae* has long been suspected to actually represent a species of what is currently attributed to either *Archispirostreptus* Silvestri, 1895 or *Triaenostreptus* Attems, 1914 (e.g., Hoffman & Howell, 1996). Both these dominantly African polytypic genera are chiefly composed of large to very large species. Second, with the increasing demand/pressure for a stable classification of the Diplopoda (perhaps the third largest class in terms of diversity among all terrestrial Arthropoda) and keeping in mind that the genus-level nomenclature of the large superfamily Odontopygoidea has recently been settled (Hoffman, 1991), it is now desirable to finally formalize the actually long suspected synonymy. By pooling the resources available in our respective institutions, the search for a plausible match to the holotype of *sebae*, among known species, has proven to be successful with a high degree of confidence.

By the processes of comparison and elimination, of both literature accounts and specimens in hand, we were able to establish that among the numerous species large enough to conform to the dimensions of the type of *sebae*, the closest agreement in documented structural characters focussed on the ten species currently assigned to the genus *Triaenostreptus*: large and often abundant animals widely distributed in southern Africa. Members of the related genus *Archispirostreptus* were excluded by different conformations of the antennae and collum. Our opinion of this generic identity is shared by our colleague J.-P. Mauriès (in litt.) on the basis of his own experience with these genera.

Within the known makeup of *Triaenostreptus*, *T. petersi* (Karsch, 1881) provided the closest match. An element of doubt remained, however, in that the type of *sebae* is female, and the characters of that sex have never been published. This difficulty was resolved, however, by access of the third author to females in the Natal Museum authoritatively identified as *petersi*. Comparison of this material with drawings made from the *sebae* type showed essential identity; a few discrepancies were resolved by her drawings sent in turn to Moscow for direct comparison with the type. By this cross-reference comparison, complete identity could be established: we are now fully confident of the synonymy of the two names *sebae* and *petersi*. As the latter species is universally considered to be congeneric with *T. triodus* (Cook & Collins, 1894), the type species of *Triaenostreptus*, it follows that the latter name in turn becomes a junior subjective synonym of *Spirostreptus*.

One consequence of the foregoing association is that the taxon names Triaenostreptini (Hoffman, 1971) and Triaenostreptinae (Attems, 1914) must be replaced in future usage by Spirostreptini and Spirostreptinae. Since the internal



Figs. 1 - 5. *Spirostreptus sebae* Brandt, peripheral structure of female from Gowke, Zimbabwe (Natal Museum 9010). 1. Head and anteriormost four body segments, lateral aspect. 2. Lateral end of collum, enlarged. 3. Three midbody segments. 4. Sigilla from midbody segment (posterior to right). 5. Last segment, with paraprocts. Figures 1, 2, and 5 to same scale, 3 and 4 enlarged about 2X. M. Hamer del.

classification of the Spirostreptidae must yet be accomplished almost *de novo*, it is by no means assured that either will survive with anything like the previous generic components. We consider it premature to suggest substitute group names for the numerous "non-triaenostreptine" genera listed by Krabbe (1982) under Spirostreptinae.

That author (1982: 196-214) included 39 species names in her very inclusive concept of *Spirostreptus*. Since none of them are zoologically congeneric with *sebae*, they cannot remain in the new context of that genus, and must be reallocated into a number of other genera, some of which have already been rescued from synonymy under *Spirostreptus*, some remaining to be diagnosed and published. Of course, until this resettlement is completed, a number of the erstwhile "Spirostreptus" names will remain of uncertain generic position, and may be relegated to a category of "Spirostreptidae of Uncertain Generic Position". Placing them indiscriminantly into the next oldest available name (*Analcostreptus* Silvestri, 1910) would serve no practical purpose and only complicate their nomenclatorial histories.

Inasmuch as the name *Triaenostreptus* is here declared to be a subjective junior synonym of *Spirostreptus*, we take this opportunity to document another nomenclatorial change affecting the type species of the former.

Spirostreptus sebae Brandt, 1833

Figs. 1-5

Spirostreptus Sebae Brandt, 1833, Bull. Soc. Imp. Natural. Moscou, 6: 203, pl. 5, figs. 40-45. Golovatch & Hoffman, 2001, Fragm. faun., 43 (Suppl.): 240, figs. 1-8.

Spirostreptus Petersi Karsch, 1881, Zeitschr. ges. Naturw., 59: 30. Male holotype (ZMB 477) from Tete, Moçambique, W. C. H. Peters leg. **New Synonymy!**

Triaenostreptus Petersi: Attems, 1914, Zoologica, 65/66: 152, pl. 7, figs. 150-152.

Triaenostreptus petersi: Krabbe, 1982, Abh. Naturw. Ver. Hamburg, NF 24: 282, fig. 200.

Triaenostreptus petersi: Attems, 1928, Ann. South African Mus., 26: 367, fig. 321.

Triaenostreptus petersi: Hoffman, 1971, Rev. Zool. Bot. afr., 83: 219.

This largest of all African spirostreptoids is documented for Beira and Tete, Moçambique, and Mazoe (?river) and Gokwe in Zimbabwe, remarkably few sites for such an enormous animal. The first three places cited are either coastal or in the Zambeze drainage basin; that for Gokwe is well inland in western Zimbabwe. Perhaps it is undercollected on the assumption that so large a creature must be common and well-known. The type female could have been collected almost anywhere along the coast of southern Moçambique, presumably at one of the established trade centers of that time.

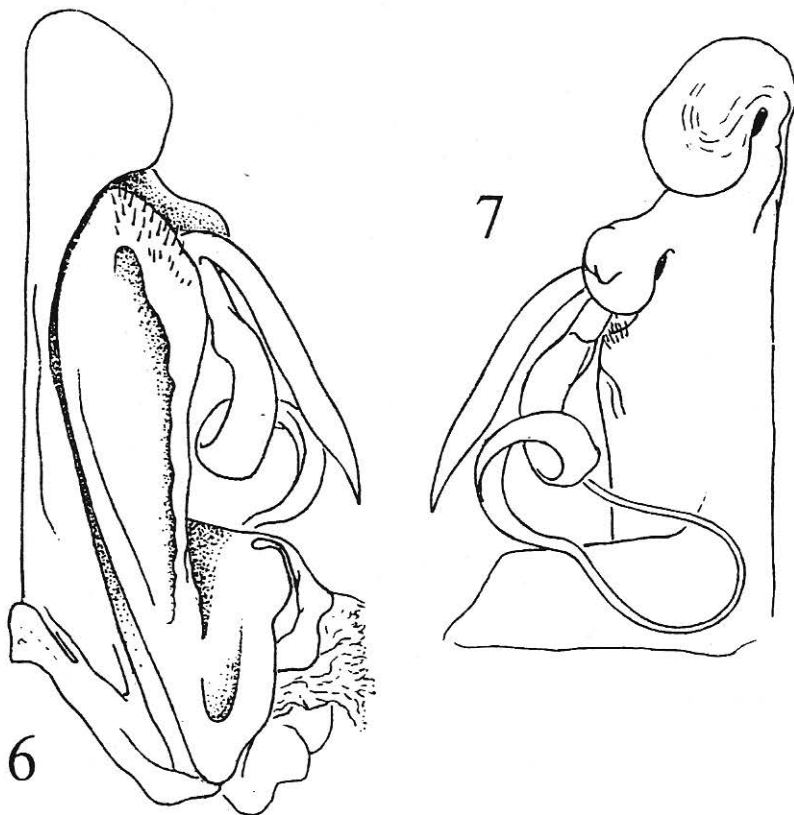
Spirostreptus heros Porat, 1872

Figs. 6-7

Spirostreptus heros Porat, 1872, Öfvers. Kongl. Vetensk.-Akad. Förh., 5: 29. Two male syntypes (Naturhist. Riksmus. Stockholm, revised by RLH) labeled only "Caffraria, Wahlberg."

Triaenostreptus triodus Attems, 1909, Denkschr. mediz.-naturw. Gesellsch. Jena, 14: 46, pl. IV, figs. 76-79. Syntypes (Naturh. Mus. Wien, from the Kalahari Desert, Botswana, not revised). **New synonymy!**

The lack of a precise locality for Wahlberg's specimens of *heros* is regrettable, but presumably they were collected in the southern part of the species' extensive range, perhaps in the Orange River valley. As shown by the drawings (Figs. 6, 7) made from one of the male syntypes, the gonopods are virtually identical with those illustrated by Attems in 1909 and 1914.



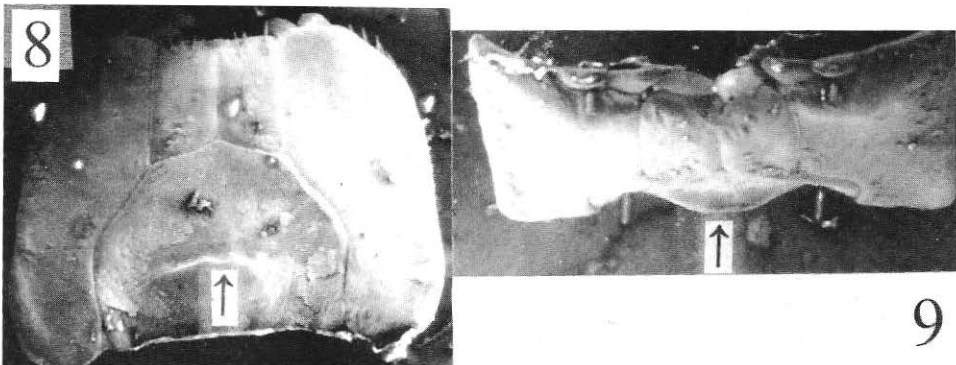
Figs. 6, 7. *Spirostreptus heros* Porat. 6. Right gonopod, anterior aspect. 7. The same gonopod, posterior aspect. Drawings from type specimen.

Spiropoeus Brandt, 1833

Spiropoeus Brandt, 1833, Bull. Soc. Imp. Natural. Moscou, 6: 204. Type species, *Spirostreptus fischeri* Brandt, 1833, by monotypy.

Although not without its own difficulties, the case of *Spiropoeus* has fallen before our analysis with an even greater degree of confidence than was possible for *Spirostreptus*. The diagnostic characters of this taxon were even evident in the original description, in which the structure of the gnathochilarium and first male legs was clearly depicted, and only through the neglect of these parts by later authors did the identity of *Spiropoeus fischeri* remain obscure (cf. Krabbe, 1982). As a point of fact, *fischeri* is a not-uncommon animal in West Africa and has been re-named at least four times.

The second author's examination of the male holotype, still extant at the St. Petersburg collection, found it to remain in fair condition except that the gonopods are missing, presumably removed for study by Brandt himself and subsequently lost. The mouthparts and first male legs are just as originally drawn (cf. new figures in Golovatch & Hoffman, 2001), and collectively narrow the field of possible match-ups down to a very limited number. By scanning relevant drawings in the literature, and unpublished sketches in the VMNH files, we were soon able to arrive at a perfect concordance in the form of a species which, under its name *parilis* Karsch, 1881 or a synonym, has resided in several genera, most recently *Mardonius* Attems, 1914 (cf. Krabbe, 1982: 429), none of them being the correct one! We provide here the pertinent literature relating to the species and its nomenclatorial history, and some



Figs. 8, 9 *Spiropoeus fischeri* Brandt, SEM photographs of gnathochilarium. 8. Entire structure, posterior view. 9. Tangential aspect along outer surface. Projecting "shelf" of mentum indicated by arrows. Specimen (VMNH) from Parc National de Comoe, Ivory Coast (D. Mahsberg leg.)

new illustrations that show the features of this so-far monotypic genus, now clarified after 170 years of neglect. The features that make *Spiropoeus* distinct from other spirostreptid genera lie in the peculiar and prominent shelf-like structure on the male mentum (Figs. 8, 9), the peculiar, coniform and rather widely separated prefemoral processes on the male legpair 1 (Fig. 10), and the gonotelopodite, which is not torsate for a considerable distance beyond its exertion from the gonocoel, and is distally sigmoidally curved without subapical modifications (Fig. 11).

Spiropoeus fischeri Brandt, 1833

Figs. 8-11

Spiropoeus fischeri Brandt, 1833, Bull. Soc. Imp. Natural. Moscou, 6: 204, pl. 5, figs. 37-39. – Golovatch & Hoffman, 2001, Fragm. faun. 43 (Suppl.): 245, figs. 17-25.

Spirostreptus (Nodopyge) parilis Karsch, 1881, Zeitschr. ges. Naturw., 54: 36. Male and female syntypes (Berlin Museum, ZMB 834, revised by RLH!) from "Liberia" without further data. **New synonymy!**

Spirostreptus (Nodopyge) lingulatus Karsch, 1881, Zeitschr. ges. Naturw., 54: 45. Male holotype (Berlin Museum, ZMB 678, revised by RLH!) labeled "Congo" without further data. **New synonymy!**

Spirostreptus liber Porat, 1888, Ann. Soc. entom. Belgique, 32: 222. Female holotype (Brussels Museum) from "Liberia" without further data. – Golovatch, 1997, Bull. Inst. R. Sci. Nat. Belg., Ent., 67: 99, figs. 19-21 (redescription and new synonymy under *parilis*). **New synonymy!**

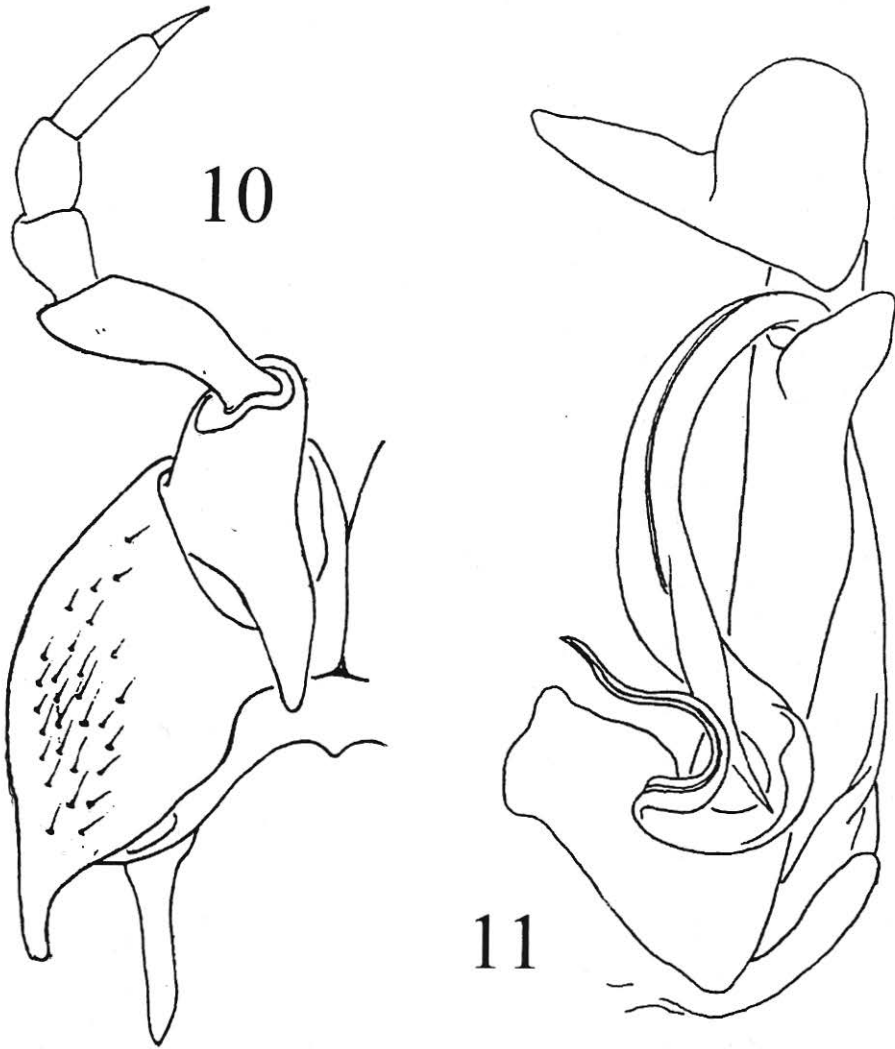
Mardonius parilis acuticonus Attems, 1914, Zoologica, 25 (65/66): 88, fig. 68. Male and female syntypes (Vienna Museum, NHMW, not revised) from N'Young, Cameroon. **New synonymy!**

Mardonius parilis sternalis Brolemann, 1926, Arch. Zool. exp. gén., 65: 56, figs. 46-49. Female holotype (Paris Museum, MHNP, not revised) from Athiéme, Dahomey. **New synonymy!**

Mardonius piceus Attems, 1952, Bull. Mus. Natn. Hist. Nat., Paris, (2) 24: 280, figs. 1-3. Syntypes (Paris and Vienna museums, MHNP, NHMW, not revised) from Dalao, Kamerun. – Demange & Mauriès, Ann. Mus. Roy. Afr. Centr., (8, Zool.) 212: 41 (new synonymy under *parilis*). **New synonymy!**

The known range of this species appears to fall into two discrete areas, the larger being in West Africa from French Guinea and Liberia to Dahomey, the other

east of the Niger River in Cameroon. The status of the two subspecific names proposed by Brolemann and Attems requires clarification by a general revision of this species; possibly either or both may prove to be valid at some taxonomic level.



Figs. 10, 11. *Spiropoeus fischeri* Brandt. 10. Right side of 1st legs of male, aboral aspect. 11. Left gonopod, anterior aspect. Both drawings from holotype of *Spirostreptus lingulatus* Karsch, Berlin Museum 678)

Despite the implications of the foregoing synonymies, *Mardonius* (at least in the sense of its type species *M. sculpturatus* Attems, 1914) is not a junior subjective synonym of *Spiropoeus*, differing in many respects including the details of gnathochilarium, first male legs, and gonopods.

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