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## NOTES ON THE GENUS *APHISTOGONIULUS* SILVESTRI (DIPLOPODA, SPIROBOLIDA, TRIGONIULIDAE)

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### ABSTRACT

In this paper the species referable to the genus *Aphistogoniulus* Silvestri, 1897, are enumerated and their status is briefly discussed. *Mystalides* Attems, 1910, is a junior subjective synonym. Two species from Madagascar, *A. quadridentatus* (Attems, 1910) and *A. polleni* nov. spec., are described after material in the collection of the Zoological Museum, Amsterdam. The gonopods of a male from the type series of *A. hova* (De Saussure & Zehntner, 1897) are depicted. The name *A. brolemanni* nov. spec. is proposed for the material referred to *A. hova* by Brolemann, 1922.

In the course of routine work on tropical millipedes, the identification of two species of a genus of Malagasy Spirobolida presented some difficulties. Here, as in so many other cases, it was necessary to examine the whole literature on the genus involved before a conclusion as to the identity of the two species could be reached. Although a revision of the type material of all the species of the genus is greatly needed, lack of time prevents the writer to undertake this work. Some of the points which were discovered, however, seem worthwhile to be put on record.

### *Aphistogoniulus* Silvestri

1897 *Aphistogoniulus* Silvestri, *Annali Mus. civ. Stor. nat. Genova*, 38: 651.

1910 *Mystalides* Attems, in: Voeltzkow (ed.), *Reise in Ostafrika in den Jahren 1903 - 1905*, 3: 94. New synonymy.

Type-species. — *Trigoniulus sanguinamaculatus* Silvestri, 1897 (type-species of *Mystalides*: *M. quadridentatus* Attems, 1910).

The generic name *Aphistogoniulus* was proposed by Silvestri for a single species which he had described from Madagascar under the name of *Trigoniulus sanguinamaculatus* just a few months before. No diagnosis of the genus was given, and as the type-species was rather inadequately described and illustrated, it is no wonder that the generic name was almost completely forgotten. It is difficult to see why Silvestri did not discuss the relationship of his species, because it must have been clear then, just as it is now, that at the time at least two Malagasy spirobolids had already been described, which are quite closely related to the one described by him.

The name *Mystalides* was introduced into literature in a less casual way. Attems formally described the genus, gave a key to the five species for which it was intended, and gave also descriptions and drawings of three of these species. It is remarkable, however, that Attems too did not mention some of the earlier described species. In fact, it was Brolemann (1922) who eventually completed the list of species referable to Attems's genus. Unfortunately, however, Brolemann in his turn overlooked the existence of the name *Aphistogoniulus*. Since the type-species of *Aphistogoniulus* and *Mystalides* belong to the same generic category, *Mystalides* is a junior subjective synonym of *Aphistogoniulus*.

Besides a few incidental descriptions, the species of this genus have been treated in particular by De Saussure & Zehntner (1902), Attems (1910), and Brolemann (1922). According to these authors the genus embraces the following species, enumerated here in a chronological sequence and in the original binomina.

*Spirobolus bivirgatus* Karsch, 1881  
*Spirostreptus cowani* Butler, 1882  
*Spirobolus erythrocephalus* Pocock, 1893  
*Spirobolus hova* De Saussure & Zehntner, 1897  
*Spirobolus sakalava* De Saussure & Zehntner, 1897  
*Trigoniulus sanguinemaculatus* Silvestri, 1897  
*Spirobolus corallipes* De Saussure & Zehntner, 1902  
*Mystalides quadridentatus* Attems, 1910  
*Mystalides pumilus* Attems, 1910

Judging from the descriptions by Attems (1910), *bivirgatus* and *pumilus* probably belong to a different genus. The gonopods of these two species are notably different from the general type found in the others, and their size — width about 3 to 3.5 mm, which is less than half that of most of the other species — also makes them form a disjunct group. The remaining species on the other hand, form a cohesive category and are now considered to compose the genus *Aphistogoniulus*.

Unfortunately the policy of De Saussure & Zehntner and of Brolemann towards material of this genus was to adopt a rather broad species concept. Differences in coloration were discarded as "variation", and the specific boundaries of number of somites and of length and width were taken too wide. As the gonopods of the known species were generally illustrated with too little attention for important details, most of the species of *Aphistogoniulus* are inadequately defined, making it extremely difficult to identify correctly any unidentified material of the genus which may come to hand.

There is no doubt that colour in preserved diplopods is generally difficult to use as a taxonomic character, for the purely technical reason that it tends to change either by the action of the preserving fluid, or exactly by the lack of action of it. Only too often the intestinal contents disintegrates and destroys the colour of the specimen. It is, therefore, no wonder that authors have made little use of colour in their descriptions and even came to disregard the taxonomic importance of it. There is no reason for this, however, because, especially in the brightly coloured species of *Aphistogoniulus*, the character is quite useful and as important as any other character for the distinction of species or subspecies.

As regards the number of somites and size there is sufficient evidence at present that the variation is usually quite restricted. Adult specimens in these spirobolids in general show a difference in the number of somites of 2 or 3 within a population. If the range of variation is much wider, one should become suspicious of the systematic coherence of the material.

Therefore, it is necessary to review briefly the published descriptions of the species in order to ascertain their validity.

REVIEW OF PREVIOUSLY RECOGNIZED TAXA

*Aphistogoniulus cowani* (Butler)

1882 *Spirostreptus Cowani* Butler, Ann. Mag. nat. Hist., (5) 9: 328.  
1893 *Spirobolus Cowani*; Pocock, Ann. Mag. nat. Hist., (6) 11: 249, 251.

Distribution.- Madagascar: Ankafana, Betsileo country.

Although this species was based apparently on more than one specimen, nothing is known of the structure of its gonopods. In fact, the reference to the genus *Aphistogoniulus* mainly rest on Pocock's judgment. Important details in Butler's description are the coloration, which is described as black with head, antennae, collum, legs and anal somite, as well as the dorsal side of the anterior part of all somites, red; the number of somites: 53; the size: 114 mm length and 11 mm width.

*Aphistogoniulus erythrocephalus* (Pocock)

1893 *Spirobolus erythrocephalus* Pocock, Ann. Mag. nat. Hist., (6) 11: 250, pl. 16 fig. 2-2b.

Distribution.- North Madagascar.

Of this species at least the anterior gonopods have been illustrated, although quite insufficiently. Pocock compared his species with *cowani* and gave a few differential characters. Of importance is the coloration which differs in *erythrocephalus* by the collum having a large black patch on the sides connected across the middle line by an ill-defined dark band. Somites black at the sides, blood-red above with a median black spot, the red colour gradually disappearing in posterior somites. Anal somite black-brown. Number of somites 52, length 146 mm, width 10 mm.

The differences in colour seem of sufficient importance already to warrant the validity of *erythrocephalus* and *cowani* as different species. This is contrary to the opinion of Brolemann (1922) who attributed little systematic importance to the differences in colour, and tended to synonymize *erythrocephalus* and *cowani*.

*Aphistogoniulus hova* (De Saussure & Zehntner)

1897 *Spirobolus hova* De Saussure & Zehntner, in: Grandidier (ed.), Hist. phys. nat. polit. Madagascar, 27: pl. 11 fig. 44.  
1902 *Spirobolus* (*Trigoniulus*) *hova*; De Saussure & Zehntner, l. c.: 146.  
Not:  
1922 *Mystalides hova*; Brolemann, Bull. Soc. zool. Fr., 47: 241, figs. 18 - 25.

Distribution.- Madagascar.

Of this species the authors apparently had material from various localities which were not specified. From the recorded variation in colour one can only conclude that more than one species hides under the name *hova*. So-called variation in other characters, like for instance the length of the antennae, also reveals that several species are involved.

The colour in a part of the material of this species was described as entirely black, with the metasomites bright red above, the prosomites pale red, and the anal valves bright red. Head and anterior somites and the legs also red. An other "variety" was described as having on the dorsal side of the metasomites a black median spot flanked on either side by a red transverse band. The head and legs red, the anal valves yellowish. According to the authors the variation in colour was caused by preservation, but on the other hand they noted some morphological differences coinciding with the differences in colour.

The authors gave four drawings of the gonopods of *hova*, two of the anterior, and two of the pos-

terior gonopods. The first two represent anterior and posterior aspects of apparently a single pair of anterior gonopods. The two drawings of the posterior gonopods, on the other hand, might have been made after different species; moreover it is not certain if they actually represent the posterior gonopods of the same species of which the anterior gonopods were depicted. It is, therefore, not possible to restrict the concept of *hova* to one of the drawings without a revision of the type material.

Besides differences in colour and other characters, the number of somites and the size of the material of De Saussure & Zehntner give further prove of the heterogeneity of their material. They mention two males with 59 somites and a length of 158 to 160 mm, and a width of 12 mm. Furthermore a male with 57 somites, 110 mm long and 8 mm wide, and finally a female with 53 somites, 140 mm long and 10.5 mm wide. It seems likely that they had material of at least three species at hand.

Therefore, it is incorrect to synonymize *cowani*, *erythrocephalus*, *sanguinmaculatus*, and *hova* as was proposed by Brolemann (1922) when specific differences are so manifest and heterogeneity of material is so easily demonstrated. On the contrary, it is better to treat the material recorded and described by Brolemann (1922) under the name of *hova* as a distinct species, *A. brolemanni* nov. spec., vide infra.

*Aphistogoniulus sakalava* (De Saussure & Zehntner)

1897 *Spirobolus sakalava* De Saussure & Zehntner, in: Grandidier (ed.), Hist. phys. nat. polit. Madagascar, 27: pl. 11 fig. 46.

1902 *Spirobolus* (*Trigoniulus*) *sakalava*; De Saussure & Zehntner, l.c.: 138, pl. 13 fig. 1.

Distribution.- Madagascar: Forêt de Moyamanga.

In 1902, De Saussure & Zehntner brought *Trigoniulus sanguinmaculatus* Silvestri into the synonymy of *sakalava*. However, there seems to be little reason for this. The colour is described as black or brown, with the head, legs, anal somite and valves reddish brown. The collum is also reddish brown, but has a black hind margin. Dorsal part of the prosomites red, the extreme margin of the metasomites reddish brown. The number of somites in *sakalava* is 48, the length of the two females is 52 and 70 mm, the width 5 and 7.5 mm, so that this species appears to be considerably smaller than *sanguinmaculatus*. The male of *sakalava* is not known, and it remains to be seen whether the females were adult. Therefore, little can be said on the status of *sakalava*.

*Aphistogoniulus sanguinmaculatus* (Silvestri)

1897 *Trigoniulus sanguine - maculatus* Silvestri, Abh. Ber. k. zool. anthr.-ethn. Mus. Dresden, 6 (9): 18, pl. 3 figs. 18 - 20.

Distribution.- Madagascar.

Little can be said on the gonopod structure in this species because the drawings given by Silvestri are quite insufficient for the recognition of the species. On account of the colour as described by Silvestri and Butler one might consider *sanguinmaculatus* the same species as *cowani*. The number of somites, 50 or 51, and the measurements, 105 mm length and 10.5 mm width, do not oppose this possibility, which, however, can only be verified by an examination of the type material.

*Aphistogoniulus corallipes* (De Saussure & Zehntner)

1902 *Spirobolus* (*Trigoniulus*) *corallipes* De Saussure & Zehntner, in: Grandidier (ed.), Hist. phys. nat. polit. Madagascar, 27: 143, pl. 15 fig. 13.

Distribution.- Madagascar: Fort Dauphin.

This seems to be a well defined species judging from the characters given by the authors. Number of somites: 50, length 75 to 80 mm, width 7.5 to 9.5 mm. The colour is black-brown, with yellowish prosomites, and the clypeal region, the antennae, legs, and the margins of the anal valves or the entire valves red. The posterior gonopods were depicted by the authors, but not in a sufficiently detailed way to define the characteristics. The anterior gonopods seem to be fairly well characterized. If the drawing of the posterior gonopod is correct, the non-seminiferous branch is slightly bifurcate.

*Aphistogoniulus quadridentatus* (Attems)

1910 *Mystalides quadridentatus* Attems, in: Voeltzkow (ed.), *Reise in Ostafrika in den Jahren 1903 - 1905*, 3: 95, figs. 11 - 12, pl. 12 figs. 42 - 43.

Distribution.- Madagascar: Sakana.

In its coloration this species seems quite similar to *erythrocephalus*, except that the anal somite is red instead of dark brown. How far this might be due to preservation is not clear. Pocock's primitive drawing of the anterior gonopods of *erythrocephalus* nicely matches the drawing given by Attems. The given measurements and numbers of somites of the two species agree very well, and eventually *quadridentatus* might prove to be identical with *erythrocephalus*.

Summarizing the above review, the status of the previously described species is as follows:

*cowani* = ? *sanguinamaculatus*  
*erythrocephalus* = ? *quadridentatus*  
*hova*  
*sakalava*  
*corallipes*

In all probability *cowani*, *erythrocephalus*, *hova* and *corallipes* are valid species, with *sanguinamaculatus* and *quadridentatus* probably synonyms of the first two; the status of *sakalava* is quite doubtful.

DESCRIPTION OF MATERIAL AT HAND AND NEW TAXA

The collection of the Institute of Taxonomic Zoology (Zoological Museum) at Amsterdam has material of two species of *Aphistogoniulus*. One of these is identical with *quadridentatus*, the other appears to be an undescribed species, which is named here *A. polleni* nov. spec.

*Aphistogoniulus quadridentatus* (Attems)

Material.- Madagascar (leg. F. Pollen), 2 ♂♂.

Description. Colour.- Head and antennae bloodred. Collum bloodred with behind the middle a small black median spot and on both sides at the level of the eyes but nearer the posterior margin a larger black spot. Body somites black up to just dorsally of the pores, with a narrow dark reddish posterior margin. Dorsum bloodred with on the posterior portion of the prosomites and on the metasomites a rhomboid black median spot, broadest in the suture area. Anterior part of prosomites reddish all around, sternites also reddish. Legs bloodred. Anal somite, valves and scale bloodred.

Number of somites and width.- In both ♂♂: 52 (-1) somites, 10.8 mm.

Head and antennae.- Labrum with three rather weakly defined teeth. Labral emargination about 135°. Headplate smooth and shiny, above the labrum 2+2 foveolae. A median furrow, distinct although not sharply impressed, runs upward to just between the antennal sockets where it fades

away. A similar but weaker furrow on the vertex running downward to just between the eyes. Antennal sockets separated by somewhat more than three times the diameter of a socket or by slightly less than two times the length of the 2nd antennal article. Postantennal groove rather weakly defined. Eyes situated a little more close to each other than are the sockets, separated by slightly less than two times the largest diameter of an eye. Eyes composed of 5 rows of ocelli (10, 9, 8, 7, 4), the ocelli rather flat. Antennae rather long. Length of the second to the 6th articles slightly decreasing in that order, the 6th article about 65% of the length of the 2nd. The 5th and the 6th article somewhat thicker than the others. Proximal articles with some sparse hairs, the 5th and 6th moderately densely setiferous. Apical article with 4 sensory cones.

Collum.- Anterior border scarcely concave in the middle, a little convex behind the eyes, again a little concave towards the lateral edge. Posterior border practically straight, widely rounded towards the lateral edge. Lateral edge narrowly rounded. Surface smooth and shiny; along the anterior margin of the sides, from the eyes downward to the lateral edge, a fine premarginal sulcus.

Body somites.- Anterior, covered, part of the prosomites of the middle part of the body with a silky structure. Posterior part dorsally with two to four irregular, anastomosing and sometimes interrupted concentric lines, which become more numerous and densely arranged laterally and ventrally. Space between these lines, suture, and metasomites smooth and shiny. Suture dorsally indicated merely by a constriction but without definite sulcus. Below the pores the suture is faintly indicated by a fine sulcus, besides the constriction. Pores present from the 6th somite onwards, situated just in front of the deepest part of the constriction, and distinctly dorsally of the middle of the sides. At the level of the pores and downwards the prosomal lines are curving caudad, below the middle of the sides they are passing over into the metasomal striae. Ventral side of 2nd somite weakly concave.

Sternites and legs.- Sternites with about ten transverse striae. Legs rather long. Mostly hairless, except for a single ventro-distal hair on the five proximal articles, two to four hairs at the ventro-distal end of the tarsi, and a spinelike hair above the claw. Only the first two pairs of legs with more numerous setae. Tarsal pulvilli present from the 2nd to the last pair.

Anal somite.- Dorsal lappet acutely angular, the end narrowly rounded, the sides very weakly concave. Dorsal surface shiny, with some irregular transverse wrinkles. Valves weakly convex, with thick, simply rounded margins. No premarginal furrow, but a rather wide and distinct impression. Surface shiny, with numerous irregular small furrows. Scale smooth and shiny, broadly triangular. The obtuse posterior edge narrowly rounded, the sides very weakly concave.

Gonopods.- Anterior gonopods (fig. 1) with sternite narrowly rounded in the middle; a few indentations on each side of the middle. The telopodite ending in a regularly rounded knob, laterally produced into a triangular lappet. Posterior gonopods (fig. 2) with the seminiferous branch having on the outside near the end an area covered with minute scales or papillae. The end expanded into three triangular lappets.

*Aphistogoniulus polleni* nov. spec.

Material.- Madagascar (leg. F. Pollen), 1♂, holotype.

Description. Differing from the preceding species by the following characters. Colour.- Head and antennae red, the head above the antennal sockets reddish black. Collum black, with narrow dark reddish brown margins. Body somites black, with narrow reddish brown margins. The prosomites dorsad of the pores orange brown. Anterior portion of the covered part of the prosomites pale brownish all around. Sternites also pale brownish, the legs red. Anal somite black, the margins of

the ring and of the valves narrow brownish black.

Number of somites and width.- 54 (-1) somites, 11.8 mm.

Head and antennae.- Labral emargination about 120°. Headplate very finely punctulate - striolate. Median furrow rather deeply impressed just above the labrum. Antennal sockets separated by slightly less than three times the diameter of a socket or by somewhat more than two and a half times the length of the 2nd antennal article. Eyes separated by about one and three quarters of the diameter of an eye. Antennae notably shorter.

Collum.- Surface minutely punctulate.

Body somites.- Posterior part of prosomites dorsally with more numerous, about eight to ten lines. Space between the lines distinctly punctulate - striolate. Surface of suture also punctulate - striolate, of metasomites indistinctly striolate and minutely punctulate to smooth.

Sternites and legs.- Sternites with about twelve transverse striae. Legs shorter. Tarsal pulvilli absent in the first two and the last nine pairs of legs.

Anal somite.- Dorsal surface, besides some coarse transverse wrinkles, with rather numerous fine wrinkles and minute punctulae. Valves with the impression very weak. Surface punctulate and striolate. Scale also punctulate - striolate.

Gonopods.- Anterior gonopods (fig. 3) with the sternite broadly rounded in the middle. The telopodite distally irregularly rounded, the posterior side with a small separate triangular lappet pointing laterad. Posterior gonopods (fig. 4) with the seminiferous branch ending with a series of lappets on the inner side and an area covered with minute scales on the outer side. The other branch with a small indentation on the inner side.

Remarks.- On account of the structure of the anterior and posterior gonopods *A. polleni* is obviously closely related to *A. brolemanni* nov. spec., and to *A. hova* (Sauss. & Zehntner). This is shown in particular by the similarity of the posterior gonopods of the three species (figs. 4, 6, and Brolemann, 1922: 241 fig. 18). Differences between the species are found, besides perhaps in the details of the posterior gonopods, mainly in the shape of the distal portion of the telopodite of the anterior gonopods. This can easily be established on a comparison of the pertinent drawings (figs. 3, 5, and Brolemann, 1922: 241 fig. 19). Unfortunately it is not possible to say whether there are also important differences in the external morphology or in the colour of the three species, as these features are not known for *brolemanni*, and as the description of *hova* has been obviously based on heterogeneous material. The number of somites in *A. brolemanni* is higher (55 or 56) and the width of the male is considerably less (8.5 mm) than in *A. polleni*.

*Aphistogoniulus hova* (De Saussure & Zehntner)

Through the kindness of my colleague Dr. Richard L. Hoffman, Radford (Va.), U. S. A., I received some drawings of the gonopods of *hova*, made after a male of the type-series in the Geneva Museum. It is not clear, unfortunately, whether this male is the holotype, a paratype, or merely a syntype, but until this point is settled I tentatively restrict the concept of *hova* to the species characterized by the drawings given here (figs. 5 - 6).

*Aphistogoniulus brolemanni* nov. spec.

1922 *Mystalides hova*; Brolemann, Bull. Soc. zool. Fr., 47: 241, figs. 18 - 25.

Not:

1897 *Spirobolus hova* De Saussure & Zehntner.

Distribution.- Madagascar: Tananarive.

After comparison of the detailed drawings which Brolemann gave of the anterior and posterior gonopods of the material which he considered to belong to *A. hova*, with the original drawings published by De Saussure & Zehntner and the drawings of *hova* published in the present paper, there can be no doubt at all that the reference to *hova* by Brolemann was incorrect.

To unravel the confusion as regards the interpretation of *hova* it seems best to separate specifically the material recorded by Brolemann under a new name, *A. brolemanni* nov. spec. As holotype of this species I herewith designate the single adult male recorded by Brolemann, after which his figures 18 and 19 must have been made. The other specimens recorded by Brolemann, a juvenile male and two adult females, are designated as paratypes.

Although a coherent description of *A. brolemanni* does not exist, the species is already sufficiently characterized by the gonopod characters, and also by the number of somites (55 or 56) and the width ( $\sigma$ : 8.5 mm,  $\rho$ : 10.5 and 11.5 mm).

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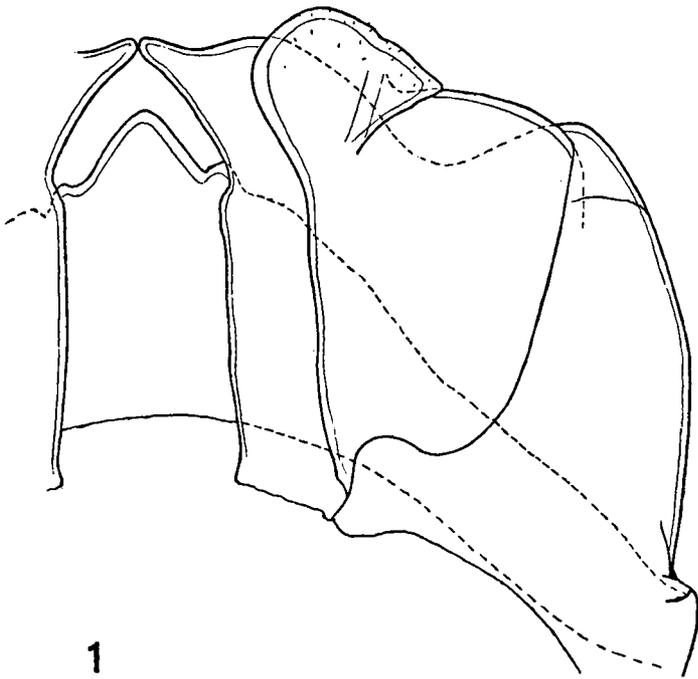
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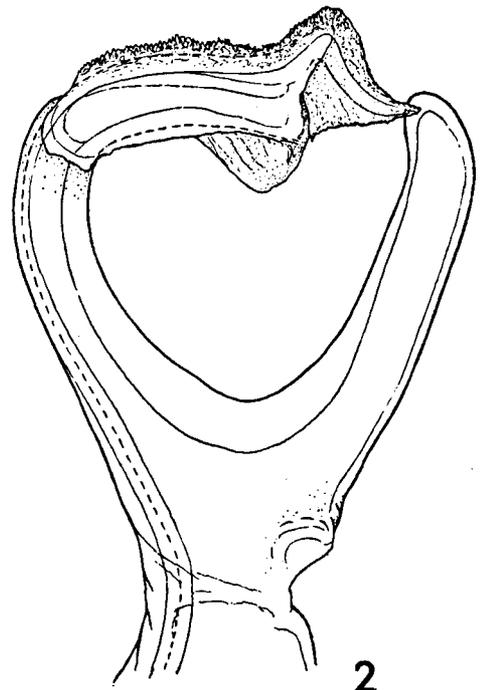
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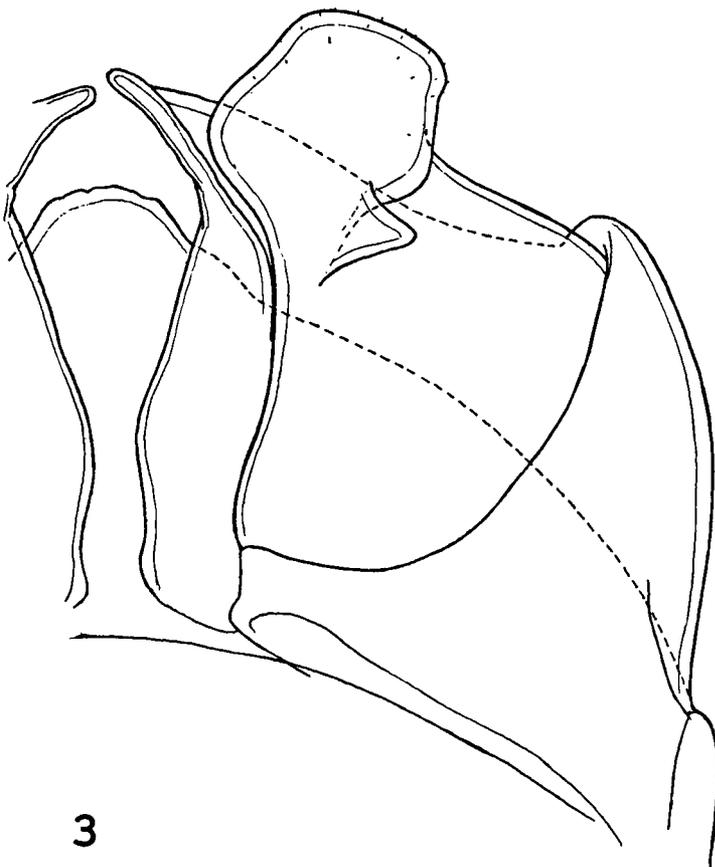
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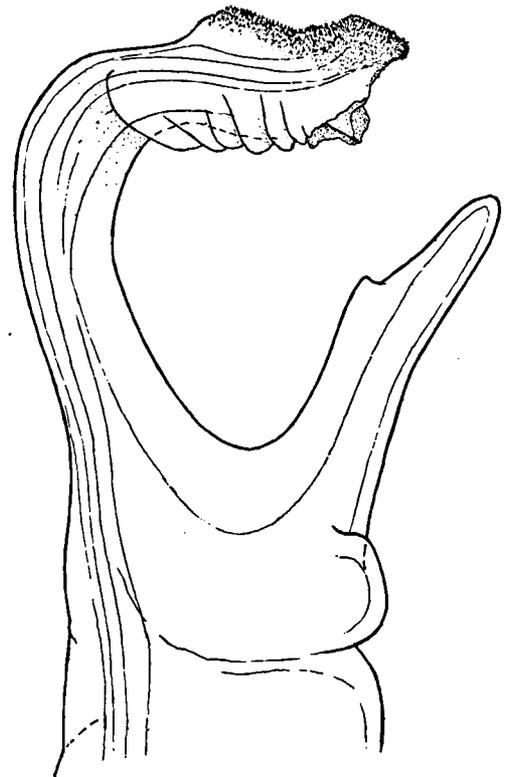
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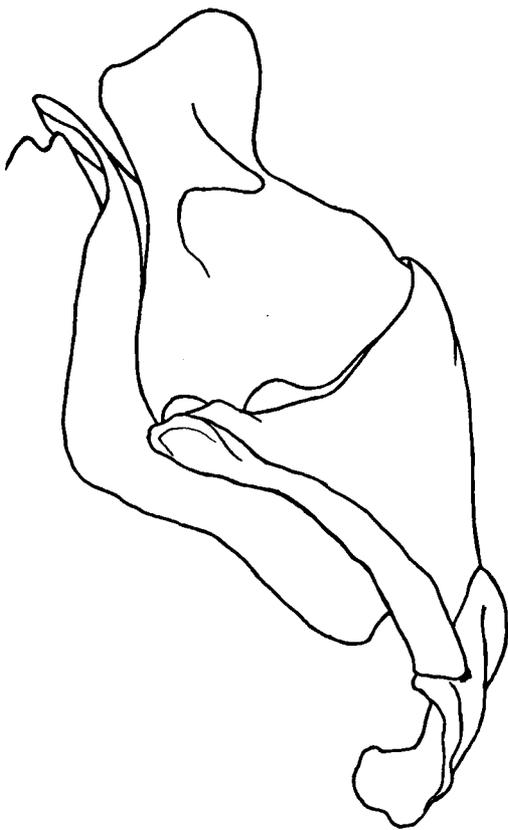
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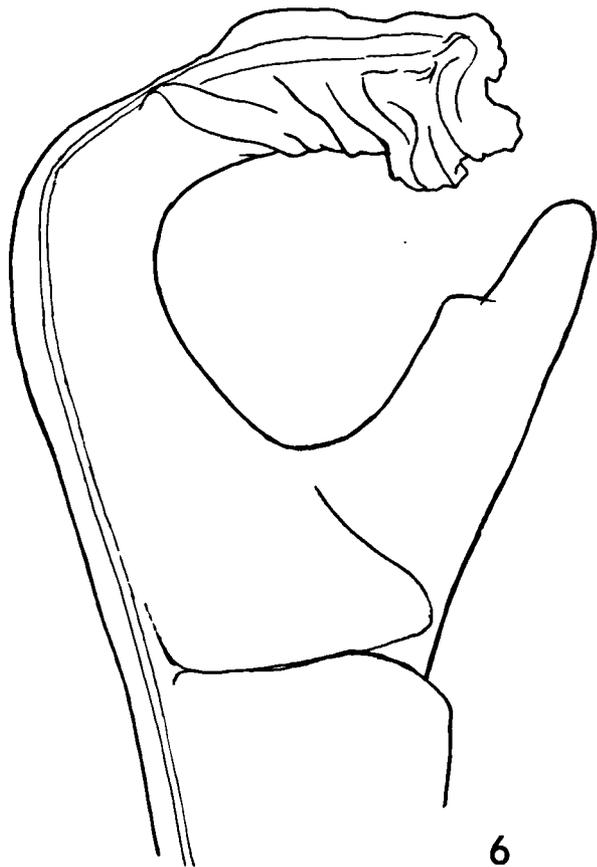
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**Figs. 1 - 2. *Aphistogoniulus quadridentatus* (Attems), ♂. 1: left half of the anterior gonopods, posterior aspect. 2: distal end of the telopodite of a posterior gonopod.**

**Figs. 3 - 4. *Aphistoniulus polleni* nov. spec., ♂ holotype. 3: left half of the anterior gonopods, posterior aspect. 4: distal end of the telopodite of a posterior gonopod.**



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**Figs. 5 - 6. *Aphistogoniulus hova* (De Saussure & Zehntner), ♂ of the type-series, Muséum d'Histoire Naturelle de Genève. 5: right half of the anterior gonopods, posterior aspect. 6: distal end of the telopodite of a posterior gonopod. (After a pencil drawing made by R.L. Hoffman).**