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CHELODESMID STUDIES. IX. A SYNOPSIS OF THE NEW BRAZILIAN TRIBE ARTHROSOLAENOMERIDINI (DIPLOPODA, POLYDESMIDA)

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ABSTRACT

The new tribe Arthrosolaenomeridini is proposed to accommodate the Brazilian genera Arthrosolaenomeris, Gangugia, and Angelodesmus. The species of these genera are characterized especially by the gonopod structure, the coxae with fields of macrosetae but lacking coxal apophysis; telopodite simples, laminate, with cingulum on lateral side but no evident torsion; prefemoral process long, slender, usually simple, with a dorsal basal lobe. Gonopod aperture large and oval; anterior sterna with four low conical lobes in both sexes; legs of males without modifications. Gangugia simplex is elevated from subspecific to specific rank and recorded from Goiás. The two new species Angelodesmus cataractae and A. defensor are described from the vicinity of Jataí, Goiás, and the species planaltensis Schubart, 1960, is transferred from Arthrosolaenomeris to Angelodesmus. So far this tribe is known from the upper drainage basins of the Paraná and Araguaia rivers. Keys to the three genera and eight species are given, with literature reference and generic diagnoses.

The purpose of the present paper is to define a small but quite distinct and homogeneous group of chelodesmoids occurring in the Brazilian states of Goiás and Mato Grosso. These millipeds belong to the group of genera in which the paranota are fairly large and transverse, the legs lack pads or processes, the gonopod coxae have no trace of dorsal apophysis, and a large gonopodal sternal element is present.

Continued investigations on the classification of Neotropical Chelodesmidae have advanced the knowledge of this great ensemble to the point at which a number of tribal groupings can be distinguished, and present indications suggest that no fewer than 24 tribes will be

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required to accommodate the already-known genera. A start in this direction has been made in the recent past, with the definition of the tribes Batodesmini, Trachelodesmini, Trichomorphini, and Lepturodesmini in the north-Andean fauna, but heretofore no attempt has been made to render into infrafamilial categories the great bulk of the Andobrazilian fauna of this family. Unfortunately, no general revision can be made at this time, owing to the lack of critical material. A viable alternative, however, seems to be the treatment of small groups for which specimens are available. An eventual synthesis can be essayed at some future time, and data are currently being assembled with such an enterprise in mind.

The present synopsis, as with its predecessors treating the Brazilian chelodesmids, was made possible by the cooperation of the Museu de Zoologia, Universidade de São Paulo, through the direct interest of Dr. G. R. Kloss. Types of the two new species named here are deposited in that institution.

Arthrosolaenomeridini, trib. n.

Components: *Arthrosolaenomeris* Schubart, 1943; *Gangugia* Schubart, 1947; *Angelodesmus* Schubart, 1962.

Diagnosis A group of moderate-sized to large chelodesmids with the following characters: body slender, widest across 2nd or 3rd segment, paranota well-developed, set high on sides and nearly horizontal or slightly depressed, their anterior and posterior edges arcuate and so imparting a greater length than at middorsal region; paranotal edges smooth, scapulae submarginal at base, anterior corners rounded, without marginal dentation, posterior corners rounded back to about segment 14 or 16, thence increasingly angular; posterior edge set off by marginal groove continuous with that of peritreme. Pore formula normal, pores set dorsolaterally in slight convexity; peritreme continuous, not set off from anterior edge. Metaterga relatively smooth, at most with light vermiculate texture; stricture distinct around segments but without sharply defined anterior edge, not or only very faintly costulate. Epiproct small, conical, sides appearing concave laterally, the apex cylindrical and very slightly deflexed, none of the tubercles enlarged. Paraprocts and hypoproct without special modification, the latter usually with median projection. Sides of segments usually with moderate pleurosternal carinae, often cristulate, back as far as midbody segments; stigmata small, unmodified, elliptic-ovoid, set in the normal position. Legs relatively long and slender, especially those of posterior segments, without tibial pads or preforemoral button, anterior legs of males without internal glands and adenostyles, but tarsal claws distinctly larger than on more posterior legs. Anterior sterna of male only slightly modified, usually with a small compressed median lobe between legs of 3rd pair (= 4th segment); 5th and sometimes 6th segments with four conical subcoxal processes, those of the anterior pair slightly the larger. Gonopod aperture large, extending nearly across surface of prozona and often infringing between bases of 8th leg pair, the edges only rarely elevated or flared. A prominent gonosternum present, widely separating coxae; latter moderate to large in size, with numerous dorsal, and often also lateral and medial macrosetae; sometimes a little produced laterally, without dor-

sal apophysis or other modification. Telopodite set at various angles against end of coxa, but prefemur usually continuing coxal axis to some extent and always with a long, slender process, latter usually with a basal enlargement subtended by a constriction; acropodite long and slender, simple and laminate or branched, with a very distinct cingulum on lateral side. Prostatic groove visible in medial aspect for most of its length; telopodite without evident torsion. No accessory subterminal processes.

Distribution. So far as known, the species of this tribe occur in the interior region of Brasil, in the states of Mato Grosso and Goiás, and the western part of São Paulo.

KEY TO GENERA

1. Prefemoral process of gonopod long and slender, its distal half notably crenulate along the inner curvature; telopodite with a prominent sigmoid curvature near midlength *Gangugia*
 Prefemoral process shorter and/or laminate, without crenulated edge; telopodite lacking medial sigmoid curvature 2
2. Prefemoral process with prominent subterminal spiniform branch; cingulum of telopodite located at or beyond midlength; coxa without macrosetae on distomedial surface; prefemora of legs with acute ventral spines *Arthrosolaenomeris*
 Prefemoral process simple, slender, evenly acuminate or very slightly expanded near apex, without trace of branching; cingulum of telopodite located near its base, at end of prefemoral region; coxa with one or more prominent macrosetae subtending cannula on medial surface; prefemora of legs without distal spine ...
 *Angelodesmus*

Angelodesmus Schubart, 1962

Angelodesmus Schubart, 1962: 258 (Monobasic, with a new species. Type-species, *Angelodesmus costalimai* Schubart, by original designation).

Diagnosis. A genus of small to moderate sized species (25-50 mm in length) distinguished by chiefly gonopod characters. Coxae of moderate size, a little flattened dorsoventrally, without dorsal apophysis, sternal apodeme small and straight, a dense field of very large macrosetae on lateral and dorsal surfaces, occasionally one or two setae on medial surface. Telopodite usually set on coxa at about 130° angle, somewhat reflexed beyond end of prefemur, usually flattened and laminate without processes or torsion; prostatic groove visible for entire length in medial aspect. Prefemoral process long and slender, unbranched, usually confined to median side of telopodite, only rarely recurved laterad, always with subtriangular basal lobe on the dorsal side.

Distribution. The Brazilian states of Goiás and São Paulo. Three of the four recognized species have been taken in the vicinity of Jataí, and if this be any indication, one can surmise that a large number of additional species remain to be discovered in these two states.

Remarks. This genus was proposed for a single species, and oriented in Schubart's "Grupo Camptomorphoides" which was defined "... pela presença de um telopodito simples e de um processo prefemoral." Schubart recognized the Brazilian genera in this assemblage, and provided in his 1962 paper a key for their separation. Regrettably any group based upon such simplistic characters would naturally be very heterogeneous, and in my view the ten genera mentioned may actually be dispersed through no less than six tribes. In the key, *Angelodesmus* is paired in couplet 5/6 with *Leptherpum*, to which it is only distantly related, whilst the actual geminate group — *Gangugia* — is located in couplet 10/11.

KEY TO SPECIES

1. Acropodite of gonopod slender, attenuated, apically narrower than prefemoral process when seen in mesal aspect *costalimai*
Acropodite laminate-expanded, much broader than prefemoral process 2
2. Laminate expansion of acropodite continued distad nearly to apex, well beyond end of the relatively short prefemoral process ...
..... *cataractae*
Laminate expansion of acropodite ending subterminally, the prostatic groove carried on further by an apically slender solenomerite; prefemoral process longer than acropodite 3
3. Prefemoral process remaining on medial side of acropodite
..... *planaltensis*
Prefemoral process curving to lateral side of acropodite
..... *defensor*

Angelodesmus cataractae, sp. n.

(Figs. 1-6)

Type specimens: Male holotype and female paratype (MZUSP 1235-36), from Fazenda Cachoeirinha near Jataí, Goiás, Brasil, XI.1962 (Expd. Dep. Zool.).

Diagnosis. This species differs from the three others referred to *Angelodesmus* chiefly by the characters outlined in the foregoing key.

Holotype: adult male, approximately 34 mm in length; width of body segments across paranota (in mm) as follows: segment 1, 5.4; 2, 5.9; 4, 6.0; 6, 5.8; 8, 5.6; 10, 5.6; 12, 5.5; 14, 5.3; 16, 5.1; 18, 3.6. Width/length ratio at midbody \pm 16.5%. Body widest at segment 3, tapering abruptly to segment 6, thence very gradually back to segment 17, afterwards very abruptly to end of epiproct.

Coloration in life unknown, at present specimen almost uniformly sordid yellowish brown (probably originally light brown).

Head normal in appearance, surface smooth and polished, not strongly convex, epicranial suture moderate; width across genal apices 3.3 mm, genae flattened, with weak lateral margination. Facial setae: 2+2 epicranial, forming a transverse line; 1+1 interantennal; 1+1 frontal,

set somewhat closer than the interantennals; three poorly defined transverse series of clypeofrontals, about 5+5 in the upper and middle rows, and about 12+12 in the lowest; about 15+15 labral setae. Rim of antennal socket high and prominent. Interantennal space 0.9 mm, only a little greater than length of 1st antennomere, and about 27% of head width. Antennae moderately long (6.7 mm) and slender, extending back to middle of paranota of 4th segment, none of the articles notably clavate, basalmost two virtually glabrous, setation thereafter increasing distally, 6th article uniformly covered with short declivent hairs. 7th article short, hemispheric, with small lateral sensory area; four terminal sensory cones, edges of last article inturned between them forming two unequal diads. Articles 3-6 virtually identical in size and shape, each 1.1 mm in length, article 2 longer, 1.5 mm, article 6, 1.4 mm, article 1, 0.6 mm, article 7, about 0.2 mm. Collum large, smooth and polished, wider than head, lateral ends strongly depressed, anterior edge set off by fine marginal groove up to level of mandibles. Dorsum of body segments smooth and polished, without transverse sulcus of rows of setae. Prozona set off by a moderate constriction, telescoped into preceding metazona to give fairly compact appearance to body. Stricture distinct around segments but anterior edge not sharply set off, without costulation. Sides of metazona slightly coriaceous, those anterior to gonopods with moderately well-defined short, posteriorly upturned pleurosternal carinae. Paranota set high on body and nearly horizontal, the dorsum thus appearing almost flat. Paranota of segments 2-5 bent slightly cephalad, the anterior corners acutely rounded, projecting further laterad than posterior (Fig. 1); paranota of segments 6-14 mostly transverse, with anterior corner less prominent, posterior corner becoming gradually more produced, both anterior and posterior edges arcuate, paranota thus somewhat longer than median length of metazona; paranota of segments 15-17 large, triangular, projecting caudad, those of segment 19 strongly reduced, just large enough to accommodate peritreme. Epiproct small, conical, cylindrical, very slightly decurved. Paraprocts and hypoproct unmodified, the latter with acute median projection; paramedian setae not borne on marginal tubercles. Podosterna of posterior segments low, poorly-defined, sparsely setose, without transverse grooves or subcoxal spines; on anterior segments podosterna well developed, those of segments 8-10 with a low conical projection at base of each leg, smooth, sparsely setose. Legs relatively short and robust anteriorly (Fig. 3), becoming longer and more slender posteriorly (Fig. 4); podomeres very sparsely setose, their length relationships: $3 > 6 > 5 = 2 > 4 = 1$. Legs of anterior segments relatively stout, prefemora with conspicuous knob on dorsal side, dorsal end of femora projecting above base of postfemora; tarsal claws of anteriormost legs nearly one-third tarsal length, all claws nearly straight, acute, compressed, without basal whorl of setae. Gonopod aperture large, broadest posteriorly, extending back between legs of the 8th pair, edges not notably elevated or flared. Gonopods large, of the form shown in Figs. 5 and 6; the relatively short prefemoral process seems characteristic of this species; acropodite terminating in a broad apically truncated lamina, with a small slender triangular solenomerite formed from the medial edge.

Etymology: the species name is a rather free Latinization of the type locality.

Angelodesmus defensor, sp. n.

(Figs. 7-10)

Type specimens: Male holotype and male paratype (MZUSP 1315-1316), male and female paratype (Coll. Hoffman) from Fazenda Aceiro near Jataí, Goiás, Brasil, XI.1962 (Exped. Dep. Zool.).

Diagnosis. Differing from the other three known members of this genus primarily in characters of the gonopods as mentioned in the foregoing key; from *A. cataractae* which occurs in the same region it differs also in several respects summarized in the following paragraph.

Holotype: adult male, approximately 33 mm in length, widths of body segments (in mm) as follows: segment 1, 4.8; 2, 5.1; 4, 5.3; 6, 5.4; 8, 5.3; 10, 5.4; 12, 5.1; 14, 5.0; 16, 4.8; 18, 3.5. Width/length ratio at midbody, $\pm 16.3\%$. Body widest at segment 3, tapering abruptly to segment 6, thence gradually back to segment 17 whereafter again abruptly to end of epiproct.

Coloration in life unknown; material now chiefly light yellowish brown with peritrematic regions paler yellow, underparts nearly uniform whitish.

Details of body structure essentially as described above for *A. cataractae* with the following exceptions: Interantennal isthmus relatively somewhat broader (1.0 mm), about 50% greater than length of 1st antennal article and 30% of head width (vs. 27% in *cataractae*). Anterior corners of segments 2-5 broadly rounded (Fig. 7), not forming an obtuse lateral angle in front pore. Paranota of midbody segments (Fig. 8) with anterior corners more gradually rounded and posterior more abruptly rounded than in *cataractae*, the peritremata also somewhat different in appearance. Podosterna of midbody and posterior segments with small but distinct conical lobes at bases of all four legs. Pleurosternal carinae more prominent than in *cataractae*, posteriorly curving upward about halfway to level of paranota and distinct back as far as 11th segment instead of only the 7th. Lateral edges of gonopod aperture distinctly flared upward. Gonopods of the form shown in Figs. 9 and 10, generally similar to those of the much larger *A. planaltensis* but the prefemoral process curved to the lateral side of the telopodite instead of remaining medial to it as is the case in *A. cataractae* also.

Etymology: the specific name is loosely derived from that of the type locality ("aceiro" meaning a cleared belt surrounding a plantation, helping protect it from animal pests).

Angelodesmus planaltensis (Schubart, 1960), comb. n.

Arthrosolaenomeris planaltensis Schubart, 1960: 463, figs. 1, 2 (Holotype male, MZUSP, from Jaci, Mun. Mirassol, São Paulo, Brasil).

Arthrosolaenomeris Schubart, 1943

Arthrosolaenomeris Schubart, 1943: 143 (Proposed with two new species. Type-species, *A. chapadensis* Schubart, by original designation).

Diagnosis. Large chelodesmids easily distinguished from the other members of the tribe by the combination of spined prefemora, branched prefemoral process of the gonopods, and position of the cingulum near midlength of the telopodite.

Distribution. Southern and eastern regions of Mato Grosso, Brasil.

KEY TO SPECIES

1. Larger species, males from 60 to 70 mm in length; prefemoral process of gonopod only slightly longer than apex of telopodite, its lateral branch originating proximad to level of telopodite cingulum *chapadensis*
 Smaller species, length of males from 45 to 55 mm; prefemoral process projecting far beyond apex of telopodite, its lateral branch originating distad to level of telopodite cingulum
 *pantanalensis*

Arthrosolaenomeris chapadensis Schubart, 1943

Arthrosolaenomeris chapadensis Schubart, 1943: 144, figs. 28-38 (Holotype male, MZUSP, from Indubrasil, near Campo Grande, Mato Grosso, Brasil).

Arthrosolaenomeris pantanalensis Schubart, 1943

Arthrosolaenomeris pantanalensis Schubart, 1943: 145, figs. 39-45 (Holotype male, MZUSP, from São Luiz de Cáceres, Mato Grosso, Brasil).

Since the original description, this species has subsequently been reported (Schubart, 1958) from Chavantina, 100 km north of Araçaras, in eastern Mato Grosso.

Gangugia Schubart, 1947

Gangugia Schubart, 1947: 7 (Monobasic with a new species. Type-species, *Gangugia tapirapensis* Schubart, by original designation).

Diagnosis. A genus of relatively large species (males 50-70 mm in length) distinguished primarily by gonopod structure: coxae prominently enlarged and subglobose (Figs. 12, 13), without dorsal apophysis, sternal apodemes very short and robust, a long series of macrosetae on both median and lateral surfaces near the distal margin. Telopodite set against coxa at a right angle, essentially straight, with a distinct basal cingulum on lateral side and sigmoid flexure near midlength

(Fig. 12), no processes or other modifications. Prefemoral process large, abruptly flexed across medial part of telopodite just distal to prefemur and thence curved abruptly proximad more or less parallel to telopodite, apical third crenulated; entire process simple, slender, without branches or processes except for a prominent triangular basal lobe similar to that occurring in *Angelodesmus*.

Distribution. Central Brasil, Mato Grosso and Goiás, in the upper basins of the Araguaia and Paraná rivers.

Remarks. The relationships of this striking and unusual genus have never been previously established. When first describing *Gangugia* in 1947, Schubart stated "Este gênero pertence ao grupo com distribuição normal dos poros e com o solenomerito em forma de um semicírculo" and compared it with such diverse taxa as *Fontaria*, *Apheloria*, *Japonaria*, *Levizonus*, *Amphelictogon*, *Chonaphe*, *Cyrtaphe*, and *Cyclorhabdoides*. Actually the definition of a "group" on the basis of two such superficial characters both subject to random duplication in a variety of unrelated lines, could only be unsatisfactory, particularly on taking the geographical factors into account. It must be remembered, however, that in that time Schubart had little experience with chelodesmoids generally and was following the 1938 classification of Attems as authoritative. He would have been more successful by searching in the Brazilian fauna for related taxa in which the solenomerite did not necessarily form a "semicircle".

I think it is now manifest that the presence of a basal gonopodal cingulum and the development of a triangular lobe on the base of the prefemoral process clearly allied this genus with *Angelodesmus*, and that the latter in its turn is related closely to *Arthrosolaenomeris*. Actually the new species *Angelodesmus defensor* embodies a number of gonopod characters reminiscent of *Gangugia*. (compare Figs. 9 and 12), and it would not be greatly surprising if these two genera are eventually merged by the discovery of other intermediate species.

Exactly as one might expect from current evolutionary theory, all of these three genera with their several species occupy the same general area of Brasil, suggesting their common origin and differentiation there.

So far, one species and a subspecies have been described in *Gangugia*. But the opportunity to study material of the latter form convinces me that it is entirely worthy of separate specific status. Some of the notable differences in gonopod structure, based on comparison of the appendages as viewed in mesal aspect, may be set forth here.

KEY TO SPECIES

1. Coxa with apparently a triangular lobe on dorsal side near end (requires confirmation); prefemoral process distinctly longer than acropodite and curved around to a position laterad to it, the apical fourth strongly curved; acropodite somewhat bisinuate distad to median flexure *tapirapensis*
- Coxa without trace of lobe on dorsal side; prefemoral process shorter than acropodite, curved only to its ventral side and thence paralleling it, the apical fourth not curved; acropodite evenly attenuated distad to flexure *simplex*

Gangugia simplex Schubart, 1958, stat. n.

(Figs. 11-13)

Gangugia tapirapensis simplex Schubart, 1958: 216, fig. 14 (Holotype male and two male paratypes, MZUSP, from Aragarças, Goiás, Brasil).

I have examined three specimens (2 ♂, 1 ♀) of this form, collected at Fazenda Nova Orlândia, Jataí, Goiás, I.1964 (Exped. Dep. Zool.), autopsied for parasites by Dr. Kloss and sent for identification. This appears to be the second known locality for *simplex*, and is located about 225 km southeast of the type locality.

Schubart's original illustration of the gonopods depicts these appendages only in situ, ventral aspect, and I take this opportunity to provide several drawings to show the gonopod structure in several other views for better comparison with other species.

Gangugia tapirapensis Schubart, 1947

Gangugia tapirapensis Schubart, 1947: 8, figs. 4-8 (Male and female syntypes, Museu Nacional, Rio de Janeiro and MZUSP, from Barra do Tapirapé, Parque Nacional do Araguaia, Mato Grosso, Brasil).

Comparison of Schubart's Fig. 6 in the original description with Fig. 12 of this paper will show a number of small differences in the shape and position of the telopodite and prefemoral process, and I think that the two forms may justifiably be regarded as separate species.

So far as I know, this form has not been reported since 1947, and is thus known only from the valley of the Araguaia in extreme northeastern Mato Grosso.

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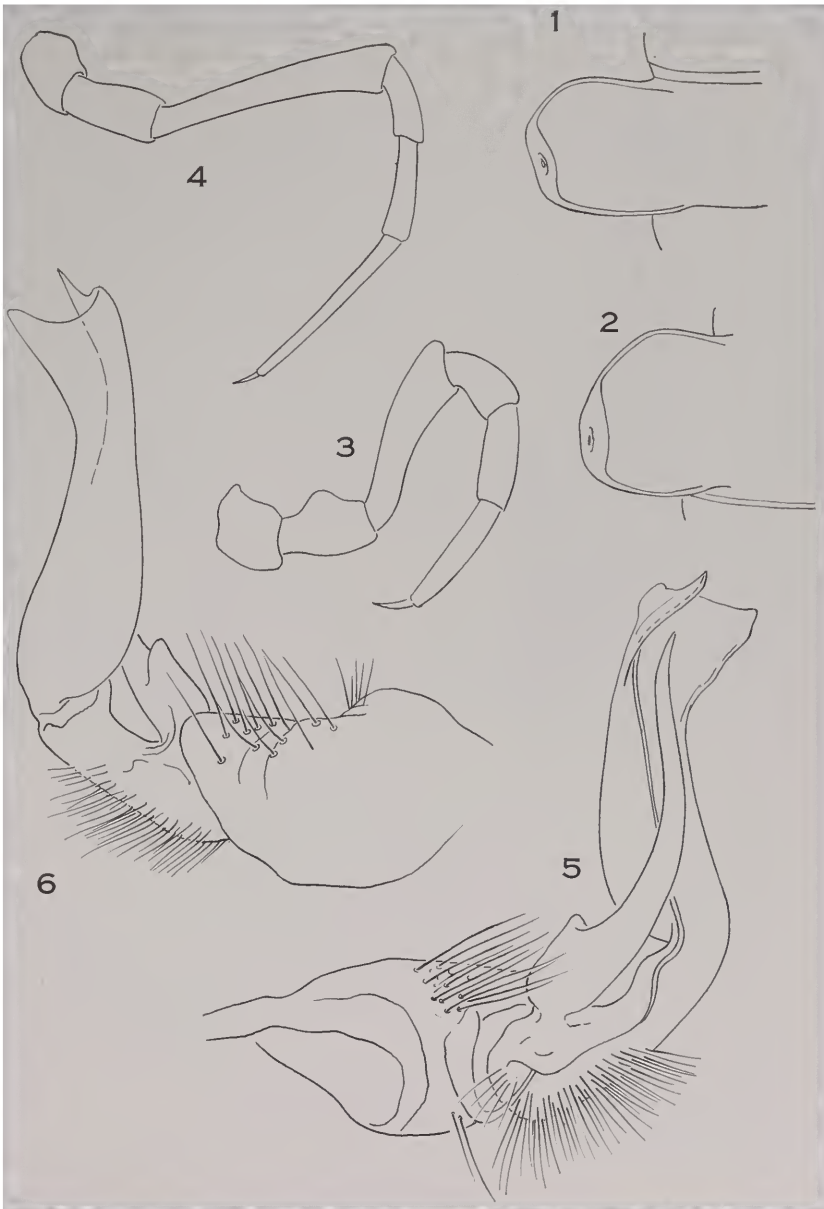
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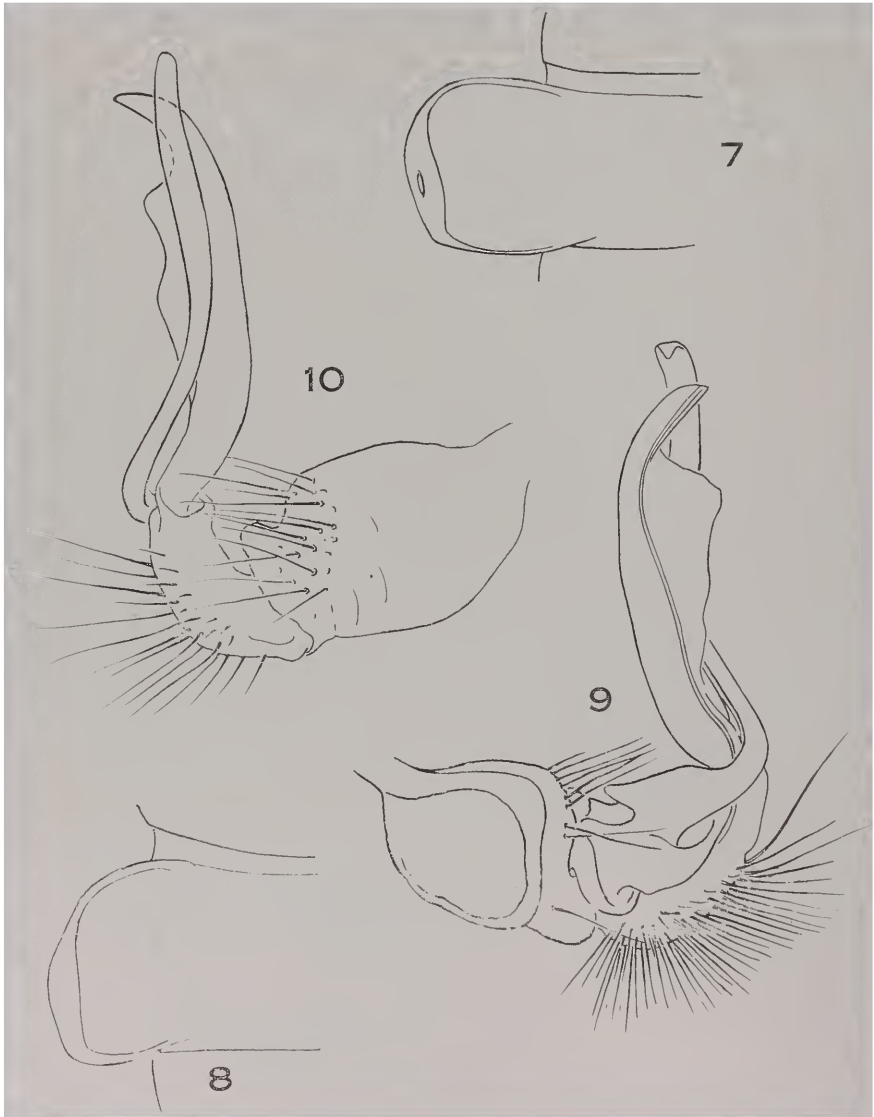
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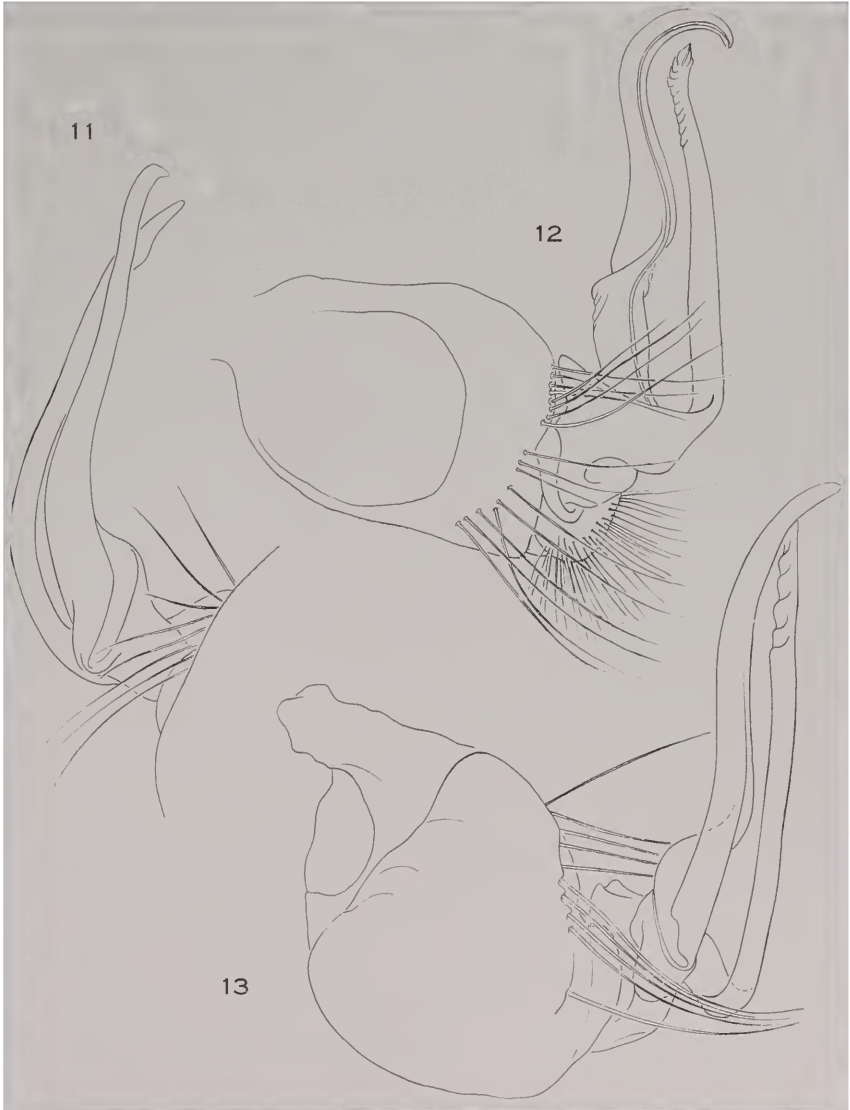
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Angelodesmus cataractae, male holotype. 1, left paranotum of 5th body segment, dorsal aspect. 2, left paranotum of 12th body segment, dorsal aspect. 3, leg from 6th segment. 4, leg from 19th segment. 5, left gonopod, mesal aspect. 6, left gonopod, lateral aspect. Figs. 1 and 2 drawn (X15), figs. 3 and 4 (X45), figs. 5 and 6 (X90).



Angelodesmus defensor, male holotype. 7, left paranotum of 5th segment. 8, left paranotum of 12th segment. 9, left gonopod, mesal aspect. 10, left gonopod, lateral aspect. Figs. 7 and 8 (X 15), figs. 9 and 10 (X 90).



Gangugia simplex Schubart. 11, telopodite of left gonopod, dorsal aspect. 12, left gonopod, mesal aspect. 13, left gonopod, lateral aspect.

