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The millipede subfamily Aphelidesminae in Amazonia (Diplopoda, Polydesmida, Aphelidesmidae)

by

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Abstract

The Central and northern South American millipede subfamily Aphelidesminae appears to be represented in Amazonia by seven species in three genera, i.e. *Aphelidesmus junki* n.sp., from Loreto Province, Peru and the environs of Manaus, Brazil, *Ochrotropis elongata* (BRÖLEMANN, 1905), comb.n. ex *Aphelidesmus*; *Haematotropis octocentra* (BRÖLEMANN, 1905), *H. media* n.sp., all from near Manaus, Brazil, *H. macapa* n.sp., and *H. disjuncta* n.sp., both from Amapá state, Brazil. Considering also *H. bella* (ATTEMS, 1937) from Santarém, Brazil, a key has been compiled to these seven aphelidesmine species currently known to occur in Amazonia.
Keywords: **Diplopoda, Aphelidesminae, taxonomy, new species, key, Amazonia.**

Resumo

A sub-família de diplópodos Aphelidesminae, do centro e do norte da America do Sul, parece ser representada na Amazônia por sete espécies e tres gêneros: *Aphelidesmus junki* n.sp. da província de Loreto, Peru, e dos arredores de Manaus, Brasil, *Ochrotropis elongata* (BRÖLEMANN, 1905), comb.n. ex *Aphelidesmus*; *Haematotropis octocentra* (BRÖLEMANN, 1905), *H. media* n.sp., todos das vizinhanças de Manaus, *H. macapa* n.sp. e *H. disjuncta* n.sp., ambos do estado de Amapá, Brasil. Considerando também *H. bella* (ATTEMS, 1937) de Santarém, Brasil, foi elaborada uma chave de identificação para as sete espécies amazônicas atualmente conhecidas.

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Introduction

The Central and northern South American millipede family Aphelidesmidae is currently divided into two subfamilies, both recently reviewed. The slightly more diverse Amplininae comprises several genera and nearly four dozen species, many of which apparently endemic in Amazonia (VOHLAND 1998; GOLOVATCH et al. 1998). The Aphelidesminae consists of three genera and about three dozen nominate species (JEEKEL 2000), but only five species have heretofore been reported from Amazonia. Of them, *Haematotropis bella* (ATTEMS, 1937) has been described from Taperinha, vicinity of Santarém, Brazil (ATTEMS 1937). Of the other four species, all from the environs of Manaus, Brazil (HOFFMAN et al. 2002), only two have been named, *Aphelidesmus elongatus* (BRÖLEMANN, 1905) and *Haematotropis octocentra* (BRÖLEMANN, 1905), while further two *Aphelidesmus* forms have remained unidentified.

The present paper puts on record the rather abundant material of Aphelidesminae accumulated at the Max-Planck-Institute for Limnology, Plön, the State Natural History Museum in Karlsruhe, and by one of us (DS) over the past few years. In addition, some relevant type material has been revised. As a result, four species described below have been found as new to science. Likewise, four species actually inhabit the environs of Manaus alone.

Material

The bulk of material has largely been deposited in the collection of the Instituto Nacional de Pesquisas da Amazônia (INPA), Manaus, Brazil, with a few specimens retained for the collections of Museo Nacional de Historia Natural (MHML), Lima, Peru; Museu Paraense Emílio Goeldi (MPEG), Belém, Brazil; Instituto de Estudos e Pesquisas Tecnológicos do Amapá (IEPA), Macapá, Brazil; Virginia Museum of Natural History (VMNH), Martinsville, Virginia, U.S.A.; Zoological Museum of the Moscow State University (ZMUM), Moscow, Russia; Museum für Naturkunde der Humboldt-Universität, Berlin (ZMHB), Berlin, Germany; Zoologische Staatssammlung, Munich (ZSM), Germany, and the ADIS Collection (CA). Two relevant old types as well as a few paratypes of some newly described species are deposited in Museu de Zoologia, University of São Paulo (MZSP), São Paulo, Brazil. Further revised type material is in the collections of Muséum d'histoire naturelle, Geneva (MHNG), Switzerland and Muséum national d'Histoire naturelle (MNHN), Paris, France.

Taxonomy

Aphelidesmus junki GOLOVATCH, HOFFMAN & SPELDA, n.sp. (Figs. 1-10)

Holotype ♂ (INPA), Brazil, Amazônas, environs of Manaus, 3°20'S, 60°17'W, Lago Janauarí, mixedwater inundation forest (água mista), on tree trunk, 14.05.1996, leg. K. VOHLAND.

Paratypes: 5 ♂, 8 ♀ (INPA), 1 ♂, 1 ♀ (ZMUM), 1 ♂, 1 ♀ (VMNH), 1 ♂, 1 ♀ (CA), same locality, together with holotype. - 3 ♀, 1 juv. (INPA), same locality and habitat, under bark, 18.01.1996. - 1 juv. (INPA), 31.01.1996. - 1 ♀ (INPA), same locality and habitat, 15.03.1996. - 1 ♂, 1 ♀ juv. (19 segm.) (INPA), same locality and habitat, 21.06.1996. - 1 ♂ (MPEG), same locality and habitat, 18.08.1996. - 1 ♀ (INPA), same locality and habitat, 28.09.1996. - 1 ♀ (INPA), same locality and habitat, 18.02.1997. - 1 ♂ (MZSP), same locality and habitat, 22.05.1997. - 10 ♂, 10 ♀, 4 juv. (INPA), same locality and habitat, 3.07.1997. - 2 ♀ (INPA), same locality and habitat, 16.07.1997. - 1 ♀ (INPA), same locality and habitat, 16.08.1997; all leg. K. VOHLAND. - 1 ♂ (CA), same locality and habitat, água mista, 13.03.1996, leg. J. ADIS et al.

Non-types: 1 ♀ (MHNL), Peru, Loreto Prov., Yanamono Explorama Lodge, whitewater inundation forest (várzea), on fallen tree, 11.1998. - 1 ♂ (MHNL), same locality and habitat, 13.12.1998, all leg. A. MÁRMOL. - 1 ?♂, 1 ♀ (MHNL), Loreto Prov., near Iquitos, Indiana, ca. 24 m above river level, terra firme, 22.03.1998, leg. A. MÁRMOL, J. ADIS & S.I. GOLOVATCH. - 1 ♂, 2 ♀ (MHNL), 3 ♂ (VMHN),

4 ♂, 1 ♀ (ZMHB), Loreto Prov., near Iquitos, Rio Nanay, Padre Cocha, 10.08.1996. - 2 ♂ (MHNL), same locality, 12.08.1996, all leg. K. VOHLAND.

Name: Honours Prof. Dr. Wolfgang J. JUNK, Head of the Tropical Ecology Working Group at the Max-Planck-Institute for Limnology, Plön, Germany for his outstanding contributions to the ecology and limnology of Amazonia.

Diagnosis: Differs from congeners by the particularly strongly reduced gonopod femur and the peculiar solenophore conformation (see also Description and Key below).

Description of type material: Length ca. 30-34 mm, width of midbody pro- and metazona normally 2.9-3.1 and 4.7-5.0 (♂), 3.6-3.9 and 4.8-5.1 mm (♀), respectively, up to 3.5 and 5.1 (♂) or 4.9 and 5.8 (♀), respectively. Holotype ca. 32 mm long, 3.0 and 4.9 mm wide on pro- and metazona, respectively. Subadult juvenile (♀) up to 23 mm long, 2.5 and 3.3 mm wide on pro- and metazona, respectively. Coloration in alcohol more or less dark castaneous brown, pattern often annulate due to a particularly dark region of sticture between pro- and metazona plus entirely dark prozona with bases of paraterga, paratergal calluses, epiproct both dorsally and ventrally, antennae, legs and sterna as well as often metazona contrastingly pallid yellowish to light brownish. Head dark brown, labral part usually lighter, tip of antenna entirely pallid. Subadults entirely pallid to beige.

Antennae relatively short, slightly clavate (Fig. 1), antennomere 6 ca. 1/3 longer but scarcely broader than any of subequal antennomeres 2-5. Head normal, vertigial region bare, almost smooth, with a very deep epicranial suture extending down to between antennal sockets; clypeolabral region setose; interantennal isthmus with an evident elevation carrying 1+1 setae. Body with strongly developed paraterga. In width, head << collum <2<3<4<5 = 16, onward trunk tapering gradually and gently. Dorsum strongly convex (Fig. 1), surface smooth, polished, shining, at places extremely delicately rugulose, only below paraterga rather finely microgranulate. Collum rather broadly and regularly rounded laterally; subsequent few paraterga particularly strongly declivent, more angulate and invariably narrowly rounded caudolaterally, devoid of a denticle at anterolateral margin, slightly produced caudad beyond rear tergal contour starting from ring 4 (Fig. 1), especially well so on rings 15-18. Midbody paraterga set low, at about 1/2 metazonal height (Fig. 3), somewhat declivent ventrad; ozopores lateral, invisible from above (Fig. 2), each lying inside an ovoid cavity; calluses in dorsal view very wide (♂) to wide (♀), subequal on all paraterga but in lateral view slightly thicker on pore-bearing rings than on poreless ones, each distinctly set off dorsally (Fig. 2), almost not bordered ventrally, their anterior and posterior margins finely crenulate. Tergal setae completely abraded but sometimes traceable as insertion points. Stricture between pro- and metazona very deep, narrow, extremely finely striolate. Midline absent. Limbus inconspicuous, complete, even, translucent. Pleurosternal carinae wanting. Epiproct broadly spatulate, normal (Fig. 4). Hypoproct semicircular, 1+1 setigerous knobs at caudal margin strongly separated (Fig. 4).

Sterna glabrous, usually with strong cross-impressions and two rather distinct knobs near each coxa (Fig. 5), knobs missing between ♂ coxae 6 and 7 only, onward invariably present. Legs relatively short and incrassate (♂) (Fig. 5) or slender (♀), even pregonopodial tibiae and tarsi moderately setose.

Gonopods (Figs. 6-8) typical of the genus but femur especially short and stout; solenophore (= tibiotarsus) characteristically subsecuriform.

Remarks: In the non-types, such basic characters of the species as gonopod structure, shape of the collum, sternal tuberculation, a missing anterolateral denticle on the paraterga, etc., remain constant as in the typical population from Lago Janauarí. What varies strikingly is, body size, colour pattern and, very modestly, shape of some paraterga and the degree of setation of some pregonopodial legs. However, as this variation is strictly populational, we presume that all these samples are conspecific.

Thus, in specimens from Padre Cocha the background blackish or dark brown coloration strongly contrasts the wide, lateral, pallid yellowish spots covering on all segments but collum not only the calluses but also the bases of as well as the region below the paraterga (Figs. 9 & 10). Body somewhat larger, length ca. 40-44 mm, width of pro- and metazona 4.2-4.6 and 7.0-7.3 (♂), 4.9 and 7.0 mm (♀), respectively. The caudolateral corners of paraterga are generally somewhat better produced behind the rear tergal contour (Fig. 10).

In Yanamono material, the body is uniform dark to piceous castaneous brown, both the venter and the

tip of the epiproct are light brown while the antennae and legs are contrastingly whitish. Body larger, length ca. 45-46 mm, width of pro- and metazona 4.6 and 7.6 mm (♂), 5.8 and 8.0 (♀), respectively.

In the sample from Indiana, the pattern is basically the same as in the Yanamono population but the caudolateral tips of all paraterga but collum (♂) or of all paraterga starting from the 4th (♀) are yellowish while the underside of these paraterga is light brown. ♂ legs 1-3 particularly strongly and densely setose ventrally. The size is closer, however, to that of the population from Padre Cocha, i.e. length 3.8 (♂) or 44 (♀), width of pro- and metazona 4.2 and 7.0 (♂), 4.9 and 7.3 mm (♀), respectively.

A. junki n.sp. seems to be particularly close to *A. hermaphroditus* BRÖLEMANN, 1898, the type species of *Aphelidesmus* BRÖLEMANN, 1898, described from Venezuela (BRÖLEMANN 1898) and, later, found in many places in Colombia, both lowland and high-montane (CARL 1914). A complete nomenclatural history of *A. hermaphroditus* as well as the other Aphelidesminae can be found in JEEKEL (2000). However, all material from Colombia referred to *A. hermaphroditus* by CARL (1914), who noted its profound variation and even discriminated three colour morphs, and even some from Venezuela (det. Jean-Paul MAURIÈS, MNHN Collection) must be rechecked as these samples might prove to be different from, and thus not conspecific with, the true *A. hermaphroditus*. New illustrations of gonopod structure taken from the lectotype of *A. hermaphroditus* (MNHN Collection) are provided here for comparative purposes (Figs. 53-55). As one can readily see, there are minor but stable differences traced between the two species compared, in particular in length of the gonofemoral part and in shape of the apical part of the solenophore. In general, *A. hermaphroditus* seems to be somewhat larger in size, ca. 6 mm wide and 46 mm long.

Based on the particularly short gonofemorite and the subsecuriform distal part of the solenophore, *A. junki* n.sp. comes very close to *A. rivicola* (SILVESTRI, 1898), from Ecuador, but both species differ slightly in coloration and minor details of gonopod structure, in particular the configuration of the solenophore tip (cf. SILVESTRI 1898). New illustrations taken from a syntype (MHNG) are presented here for comparative purposes (Figs. 56 & 57).

Biological observations show that, in mixed water inundation forests of Central Amazonia, *A. junki* n.sp. is univoltine and reproduces on the forest floor, mostly in decomposing soft wood. Adults pass the aquatic phase on tree trunks above the water level. The development of this species is fast enough to populate the places where inundation, due to the flood pulse, lasts about five months. In areas situated lower, with longer inundation periods, this species is not capable of survival (ADIS & VOHLAND unpubl.). As the closest relatives of *A. junki* n.sp. seem to be confined to the Andean regions of Venezuela, Ecuador and Colombia (cf. BRÖLEMANN 1898; SILVESTRI 1898; CARL 1914), its morphological characters, geographical distribution and natural history seem to be similar to those of the confamilial species *Pycnotropis tida* (CHAMBERLIN, 1941) (GOLOVATCH et al. 1998; VOHLAND & ADIS 1999). Variation in body structure in *A. junki* n.sp. as well as its rather vast distribution seem to be related to a recent occupation of new areas and habitats in Peruvian Amazonia, where channel changes of meandering rivers are very common. Non-flooded upland habitats thus being transformed into floodplain forests and vice versa within a relatively short time, subsequent downstream colonization along the Solimões-Amazon River could easily have occurred. Among various groups of Polydesmida, the taxa that apparently had to become adapted to new environments tend to change their external structures more quickly than the gonopods (HOFFMAN 1990). Genetic data for *P. tida* confirm that individuals from upland and floodplain habitats in the Manaus area belong to populations of a single species. Genotypic structuring among and within local populations indicates processes of genetic differentiation attributed to the migration ability in this species (BACHMANN et al. 1998).

Ochrotropis elongata (BRÖLEMANN, 1905), comb.n. (Figs. 11-15 & 22-30)

Euryurus elongatus BRÖLEMANN, 1905: 77 (description).

Aphelidesmus elongatus - CARL 1914: 937 (listed); ATTEMS 1937: 132 (description); SCHUBART 1945: 48 (listed); JEEKEL 2000: 90; HOFFMAN et al. 2002: 533 (listed).

Holotype ♀ (MZSP), "Euryurus elongatus Bröl., Manaos No. 4, Bicego leg., Type".

Additional material: ♂ (INPA), Brazil, Amazônas, environs of Manaus, EMBRAPA-CPAA, *Bactris*

gasipaes palm litter, 15.07.1999. - 1 ♂ (ZSM-20035415), same locality and habitat, 07.1999. - 1 ♀ (INPA), road-km 13 from Presidente Figueredo to Balbina, banana plantation, litter, 5.07.1999, all leg. D. SEITZ.

Diagnosis: Differs from both currently known congeners chiefly by certain details of gonopod structure (see also Description, Remarks and Key below).

Description: Length ca. 55-60 mm, width of midbody pro- and metazona 5.5 and.7.5 (♂), 6.5-7.0 and 8.0-9.0 mm (♀), respectively. Coloration in alcohol rather uniform dark castaneous brown but with antennae, legs, region just below paraterga, and bases of paraterga (especially widely caudolaterally - Fig. 25) more or less contrastingly yellowish, caudolateral spots often whitish like epiproct beneath and broadly along caudal and lateral margins, venter yellow-brown.

All main characters like in the previous species (Figs. 22-30) but collum a little to considerably more narrowly rounded laterally (Figs. 22 & 23), subsequent paraterga slightly declined and considerably thinner (in ♂ only - cf. Figs. 12 & 24) in lateral view, more strongly produced caudally (also in ♂ only - cf. Figs. 12, 24 & 25), calluses somewhat less prominent in dorsal view, tip of paratergal caudolateral corner often almost pointed (especially so in ♂) (Figs. 24 & 25), metatergal texture delicately leathery (Fig. 25), sternal tubercle between ♂ coxae 6 particularly prominent, yet that between ♂ coxae 7 barely traceable; sternal cones starting from ring 4 and present throughout, in ♀ especially poorly developed (cf. Figs. 15 & 27).

Gonopods (Figs. 28-30) particularly elaborate, especially so due to a strongly ramified solenophore.

Remarks: The original description of this species is quite accurate (BRÖLEMANN 1905), now supplemented with the necessary illustrations (Figs. 11-15) showing this large (length up to. 60 mm, width of midbody pro- and metazona in holotype 7.0 and 9.0 mm, resp.) and dark form possessing relatively narrowly rounded lateral flaps of the collum combined with indistinct sternal tubercles and complete lack of anterior denticles on paraterga subsequent to collum (see also Key below).

The long noted strong similarities existing between *O. elongata* and *O. convexa* (JEEKEL, 1950) (cf. JEEKEL 1950, 2000) are reconfirmed here. Indeed, both seem to be congeners. Furthermore, it is only through the discovery of virtually topotypic material of both sexes that the identity of *O. elongata*, previously an enigmatic species, could be established. The new samples match the holotype very closely, especially the ♂ and ♀ that show particularly narrowly rounded colla (cf. Figs. 22 & 23). So now there can be no doubt whatever that this material represents *O. elongata*.

The nomenclatural history of this species has also been presented by JEEKEL (2000), reiterated above to only emphasize the new combination. This transfer is proposed here based on the particularly complex solenophore structure shared by *O. elongata* with both *O. guianensis* (CHAMBERLIN, 1923), the type species from Guiana, and *O. convexa* (JEEKEL, 1950), from Surinam. However, no straightforward homologization of such structures of the solenophore as **b** and **d** seems possible in *O. elongata* (cf. JEEKEL 1950, 2000).

As an alternative, *O. elongata* could be assigned to *Aphelidesmus*, especially in view of the apparently rather close relationships *O. elongata* shows in solenophore structure with *Aphelidesmus junki* n.sp. and *A. rivicola*, but the solenophore in *O. elongata* is still more elaborate, and the gonofemorite much longer, compared to the corresponding parts in the gonopods of the typical *Aphelidesmus* species.

As both *Ochrotropis* JEEKEL, 2000 and *Haematotropis* JEEKEL, 2000 are feminine in gender, some of the specific names introduced by or referred to in JEEKEL (2000) must be rectified as follows: *O. convexa* (JEEKEL, 1950), *H. octocentra* (BRÖLEMANN, 1905), *H. bella* (ATTEMS, 1937), and *H. aurorea* JEEKEL, 2000.

O. elongata seems to represent a terricole restricted to non-flooded (= terra firme) uplands. Its occurrence in such disturbed habitats as palm and banana plantations is noteworthy.

Biological observations reveal a scattered distribution, individuals occurring singly and well separated spatially. Specimens were found among the endemic *Pycnotropis sigma* GOLOVATCH, VOHLAND & HOFFMAN, 1998 (EMBRAPA site) or in association with the dominant pantropical *Leptogoniulus sorornus* (BUTLER, 1876) and some *Haematotropis* specimens. They were spotted burrowing in damp, nutritious palm debris or banana trunk litter, where they were protected from the rather strong micro-climatic fluctuations in the area. They fed only after the material had been decayed bacterially, but

generally before it had been strongly degraded by other soil arthropods. The compact, rounded body shape, together with the conspicuous light calluses make this species well distinguishable in the field. Juveniles presumably belonging to this species were also found singly during quantitative sampling. These would then grow up in a damp but not wet environment with rather constant microclimatic conditions, as is the case for *Pycnotropis sigma*.

Haematotropis octocentra (BRÖLEMANN, 1905) (Figs. 16-21)

Euryurus octocentrus BRÖLEMANN, 1905: 74 (description).

Aphelidesmus octocentrus - ATTEMS 1914: 208 (listed); ATTEMS 1937: 134 (description); SCHUBART 1945: 49 (listed).

Haematotropis octocentrus (sic!) - JEEKEL 2000: 90 (listed).

Haematotropis octocentra - HOFFMAN et al. 2002: 531 (listed).

Lectotype ♂ (MZSP), "Euryurus octocentrus Bröl., Manaos No. 3, Bicego leg., Type" (lectotype designated herewith). - Paralectotype: subad. ♀ (MZSP), "Euryurus octocentrus Bröl., Manaos No. 3, Bicego leg. Type" (paralectotype designated herewith, removed from the tube now containing the lectotype only).

Additional material: 4 ♂ (VMNH), Brazil, Amazônas, environs of Manaus, Rio Tarumã Mirím, capoeira, 24.06.1984, leg. E. FRANKLIN & J.W. DE MORAIS. - 1 ♂, 1 ♀ juv. (19 segm.) (INPA), environs of Manaus, Lago Janauarí, capoeira (terra firme), 28.01.1996, leg. K. VOHLAND. - 1 ♂, 1 ♀ (ZMUM), 1 ♀ (CA), environs of Manaus, road-km 22 from Presidente Figueredo to Balbina, banana plantation, litter, 4.07.1999. -1 ♂, 4 ♀, 1 juv. (INPA), 1 ♂ (ZSM-20035416), road-km 13 from Presidente Figueredo to Balbina, banana plantation, litter, 5.07.1999. - 1 ♂ (CA), EMBRAPA-CPAA, *Bactris gasipaes* palm plantation, litter, 27.07.1999. - 1 ♂ (INPA), near EMBRAPA-CPAA, rotten wood, compost, 07.07.1999, all leg. D. SEITZ.

Diagnosis: Differs from congeners by the relatively large size combined with the relatively narrowly rounded lateral ends of the collum, presence of anterolateral denticles on each of paraterga 2 to 4, particularly shaped gonopod solenophore, etc. (see also Redescription, Remarks and Key below).

Redescription: Like the above *Aphelidesmus junki* n.sp. except for its subangular to narrowly rounded collum (Fig. 16), the anterolateral denticle present on paraterga 2-4 (Fig. 16), the somewhat higher and mostly subhorizontal paraterga (Fig. 17), the smooth and shining metaterga with delicate microgranulation beneath paraterga (Fig. 17), the rather large body size (length of adults 47-60 mm, width of midbody pro- and metazona 4.5-5.3 and 8.0-8.3 (♂), 5.6-6.0 and 8.8-9.0 mm (♀), respectively; length of subadults 33-43 mm, width of midbody pro- and metazona 3.7 and 5.0 mm, respectively), the peculiar colour pattern (background coloration usually dark to piceous castaneous brown with pale brownish to brown venter and legs, contrastingly pinkish antennae and rear halves of most calluses and, above all, a yellowish, subtriangular, strongly transverse, median spot covering rear half of each postcollar metatergum; even subadults mostly brown; rarely nearly entirely pallid), only one sternal tubercle each present nar ♂ coxae 3-7 and 9 but two cones on all subsequent sterna (Fig. 19), the ♂ coxae 3-7 somewhat swollen ventrally, legs a little longer but in ♂ slightly incrassate, and the characteristic gonopod structure (Figs. 20 & 21).

Remarks: Lectotype designation is necessary as the larger syntype is not only the only adult but also the only male in the sample. It is this male that has served as the basis for the original description (BRÖLEMANN 1905), in full accordance with the word "type" reading on the label.

The species seems to be particularly close to *H. callipus* (PETERS, 1864), from Surinam, as redescribed by JEEKEL (2000), due to the gonopods showing both the distofemoral portion and the midway dorsal process of the solenophore somewhat enlarged and complex. An updated nomenclatural history of *H. octocentra* is given above.

H. octocentra seems to represent still another terricolous diplopod restricted to non-flooded (= terra firme) uplands. Its occurrence in such disturbed habitats as palm and banana plantations is likewise noteworthy. However, there is little doubt that this species is native in the Manaus region.

Biological observations reveal this species to be highly vagile/mobile, with certain habitat plasticity. Specimens were found in groups under tree logs near a house and in litter heaps on a farm ground at km

22 of the road to Balbina. The logs probably served as shelter and yielded diverse communities of larger Polydesmida and Spirostreptida showing nocturnal surface activity. Others occurred in association with *Leptogoniulus sorornus* in banana trunk litter, while a single specimen was found together with the following species in a layer of ground on a rotting lining board of an abandoned garden. Single individuals were revealed occasionally in *Pycnotropis sigma* communities at EMBRAPA, probably as migrants from the nearby forest. The striking bright orange antennae and calluses can be seen in any body position and thus might be aposematic in function. *H. octocentra* prefers damp, climatically stable habitats but seems to tolerate stronger moisture fluctuations. It was found feeding on various food sources, including material from banana already degraded by *L. sorornus* and on microbially decayed 'cupuaçu' leaves and wood. Juveniles presumably belonging to this species were observed in banana litter and remained burrowed in or under decaying banana trunks with microclimatically more constant conditions.

Haematotropis media GOLOVATCH, HOFFMAN & SPELDA, n.sp. (Figs. 31-38, 58)

Holotype ♂ (INPA), Brazil, Amazônas, environs of Manaus, near EMBRAPA-CPAA, EMBRAPA-CPAA, road-km 29 of A-010 highway Manaus–Itacoatiara, rotten wood, compost, 07.1999, leg. W. HANAGARTH.

Diagnosis: Differs from congeners by the presence of a small but distinct anterolateral denticle on paraterga 2-4 coupled with the peculiar, relatively simple gonopod solenophore (see also Description, Remarks and Key below).

Description: Body length ca. 42 mm, width of midbody pro- and metazona 5.0 and 7.4 mm (♂), respectively. Coloration rather uniform castaneous brown with contrastingly pallid to pale yellowish brown antennae, legs, venter, paraterga, tip and underside of epiproct; calluses particularly pallid.

All structures like in *Aphelidesmus junki* n.sp., but paraterga on collum not so broadly rounded (Fig. 31), paraterga 2-4 each with a very faint anterolateral denticle (Fig. 31). Calluses in dorsal view equally very wide caudally on pore-bearing and poreless paraterga, only a little thinner on poreless paraterga in lateral view (Figs. 32 & 33). Paraterga considerably declivent, starting protruding caudally beyond rear tergal contour from ring 5 (Figs. 32 & 33), largely quite modestly so, especially strongly so but still very narrowly rounded on rings 16-18.

Sternal cones (Fig. 35) starting from ring 5 (one cone near each coxa), missing on 6th and between coxae 9, onward present as two quite faint cones. Legs rather slender, modestly long (Fig. 32), coxae without modifications, pregonopodial telopodites particularly densely setose but even there without tarsal brushes, onward only tarsi considerably setose ventrally.

Gonopods (Figs. 36-38, 58) not quite typical of the genus, femur strongly elongate, slender, slightly enlarged distad; solenophore relatively simple, bilobate at tip, with neither medial lobule nor midway dorsal process.

Remarks: This new form seems to be a somewhat disjunct *Haematotropis*, the only congener devoid of a midway or parabasal dorsal outgrowth on the solenophore. However, as in most species this outgrowth is quite inconspicuo s, it can hardly be treated as a generic-level character. Based on the prominent sheath lobe observed more or less laterally on the solenophore, *Aphelidesmus* may also prove to be an option to place this new species in, but the slender and elongate gonofemorite, the somewhat more elaborate solenophore and the tooth on paraterga 2-4 seem to be more consistent with the current *Haematotropis* concept (cf. JEEKEL 2000). In general, the accepted generic classification of Aphelidesminae might prove unsatisfactory with further accumulation of relevant data.

H. media n.sp. seems to be a purely terricolous species restricted to terra firme habitats.

Biological observations are like those given for *H. octocentra*, i.e. this species has also been taken from a habitat describable as an ancient garden.

Haematotropis macapa GOLOVATCH, HOFFMAN & SPELDA, n.sp. (Figs. 39-46)

Holotype ♂ (IEPA), Brazil, Amapá, Macapá, a house "jambeiro", in litter of *Eugenia* sp. (Myrtaceae), 14.02.2000, leg. E.L. OLIVEIRA.

Paratypes: 1 ♂, 1 ♀ (MPEG), 1 ♂ (incomplete, lacking anterior body portion) (IEPA), same locality and habitat, together with holotype.

Diagnosis: Differs from congeners by the presence of a small but distinct anterolateral denticle on paratergum 3 only, coupled with the characteristic gonopod solenophore (see also Description and Key below).

Description: Body length 30-35 mm, width of midbody pro- and metazona 2.5-2.8 and 4.2-4.4 (♂), 3.6 and 5.0 mm (♀), respectively. Holotype ca. 32 mm long, 2.7 and 4.4 mm on midbody pro- and metazona, respectively. Coloration uniform gray-brown, region of stricture between pro- and metazona dark brown, venter and sterna pale gray-brown, distal podomeres sometimes pinkish, antennae and paratergal calluses orange pink, usually brighter than distal podomeres. Head, hypo- and paraprocts uniform brown to gray-brown, epiproct almost entirely brown, gray-brown distally to almost entirely light gray-brown. Paraterga, starting from collum, usually a little lighter near calluses. Tip of antenna entirely pallid.

All structures like in *Aphelidesmus junki* n.sp., but paraterga on collum and on a few subsequent body rings a little more strongly angular caudolaterally, paratergum 3 with a small but evident anterolateral denticle (Fig. 39). Calluses on pore-bearing paraterga considerably wider and thicker than on poreless ones (Figs. 40 & 41). Paraterga mostly relatively slightly declivent, starting protruding caudally beyond rear tergal contour from ring 5 (♂) or 7 (♀) (Figs. 40 & 41), especially strongly so and nearly beak-shaped on rings 16-18.

Sternal cones in ♂ (Fig. 43) starting from ring 5, missing on 6th, again present from between coxae 9 on. Legs rather slender and modestly long, ♂ legs slightly incrassate and elongate compared to ♀, pregonopodial telopodites particularly densely setose, onward only ♂ tarsi considerably setose ventrally (Fig. 40); ♂ coxae 5-7 each with a distinct ventral swelling. ♀ legs uniform, unmodified.

Gonopods (Figs. 44-46) typical of the genus, femur elongate and slightly enlarged distad; tip bifid, curved frontomedially, with a conspicuous subdistal medial lobule; midway dorsal process on solenophore simple and modest.

Remarks: Based both on peripheral and gonopod traits as well as sympatry, this species seems to be particularly close to *H. disjuncta* n.sp. (see below). Based chiefly on gonopod structure, close resemblance is also observed between *H. macapa* n.sp. and *H. bella* (ATTEMS, 1937), the latter form from near Santarém, Brazil (ATTEMS 1937). However, both these species differ strongly enough in size (= 5 vs. 7.7 mm wide, respectively), coloration (without vs with lighter median spots on metaterga, respectively), tergal structure (paraterga slightly declined vs. subhorizontal, and paratergum 3 with vs. without an anterolateral denticle, respectively) and gonopod conformation (tip of solenomerite nearly bifid vs. broadly emarginated, respectively).

Apparently, *H. macapa* n.sp. is another terricole known yet from an urban area in eastern Amazonia.

Haematotropis disjuncta GOLOVATCH, HOFFMAN & SPELDA, n.sp. (Figs. 47-52)

Holotype ♂ (IEPA), Brazil, Amapá, road-km 94 of BR-156 highway, in rotten palm leaves of *Elaeis oleifera* and *E. guineensis*, 14.02.2000, leg. E.L. OLIVEIRA.

Paratypes: 1 ♂, 3 ♀ (IEPA), 3 ♂, 1 ♀ (MPEG), 1 ♂, 2 ♀ (INPA), 1 ♂, 1 ♀ (MZSP), 1 ♂, 2 ♀ (MHNG), 1 ♂ (VMNH), 1 ♂ (ZMUM), 3 ♂, 2 ♀, 4 juv. (CA), same locality and habitat, together with holotype.

Diagnosis: Differs from the closest, both structurally and geographically, *H. disjuncta* n.sp. by a small but distinct anterolateral denticle present on each of paraterga 2-4 coupled with a peculiar structure of the gonopod solenophore (see also Description, Remarks and Key below).

Description: Body length 37-39 mm, width of midbody pro- and metazona 3.0-3.7 and 5.7-6.0 (♂), 3.8

and 6.0 mm (♀), respectively. Holotype ca. 39 mm long, 3.7 and 6.0 mm on midbody pro- and metazona, respectively. Dorsum, vertex, entire prozona, hypo- and paraprocts rather dark castaneous brown; clypeolabral part of head, genae, four distal podomeres, bases of and region below paraterga light brown; subventral parts of paraterga, sterna and basal podomeres grayish pallid; tip of antenna pallid; remaining antennomeres, calluses and immediate bases of paraterga, starting from collum, contrastingly orange.

Paraterga 2-4 each with a small but distinct anterolateral denticle (Fig. 47). Paraterga 5-19 subhorizontal though set low as usual (Fig. 48), only from ring 8 on rather slightly produced caudad beyond rear tergal contour (Fig. 49), much better so on rings 16-18; calluses in dorsal view subequally broad on all paraterga but a little thicker in lateral view on pore-bearing rings, ozopores sometimes traceable as a midway sinuosity in dorsal view (Fig. 49).

Sterna and legs like in *H. macapa* n.sp., setation of three distal podomeres and in distal part of femur in ♂ only on pregonopodial legs, onward gradually reduced and present on tarsi only, in ♀ uniform throughout, unmodified.

Gonopods (Figs. 50-52) with a subsecuriform, strongly recurved, midway process of solenophore and a couple of distinct, slightly curved prongs distally.

Remarks: The species seems to be particularly close to *H. macapa* n.sp., this being revealed by a similar, generally smaller body size, relatively broad paratergal calluses and, above all, gonopod structure. The latter is so close in both these species that only a few details of configuration of the solenophore's distalmost part make these taxa distinct (cf. Figs. 44-46 & 50-52).

H. disjuncta n.sp. seems to be one more purely terricolous species in Amazonia. Eventually its occurrence in such a disturbed habitat as palm plantation might be evidence of its introduction. Palm seeds imported from Peruvian Amazonia are known to have been planted for palm oil production on that particular plot (ca. 5,000 ha, 143 trees per ha) in Amapá in about 1968 (OLIVEIRA personal commun.). Considering the particularly close relationships revealed between *H. disjuncta* and *H. macapa* n.spp., we must admit that either both could have been introduced to Amapá state from somewhere upstream the Amazon due to human agency or both are local, possibly endemic to eastern Amazonia, yet with inclinations to synanthropization. The latter option seems more plausible, however, as many other aphelidesmid and larger non-aphelidesmid millipedes are known to dwell in Amazonia in more or less heavily disturbed habitats as well (cf. GOLOVATCH et al. 1998; VOHLAND 1998).

Key to Amazonian Aphelidesminae

1 - Usually one or several of postcollar paraterga with a more or less distinct anterolateral denticle; gonopod femorite elongate, subcylindrical, considerably longer than a relatively short prefemoral portion; solenophore more elongate and, subapically, largely elaborate. . . . . *Haematotropis* (2)

\- Paraterga without anterolateral denticles; gonopod femorite usually stout and much shorter than an enlarged prefemoral portion; solenophore shorter and, at least subapically, less elaborate. 6

2 - Postcollar paraterga without anterolateral denticle; tip of solenophore broadly emarginated; environs of Santarém. . . . . *H. bella*

\- At least paratergum 3 with an evident anterolateral denticle; tip of solenophore different. 3

3 - Collum especially narrowly rounded laterally; anterolateral denticles on paraterga 2-4 especially evident (Fig. 17); midway dorsal process on solenophore particularly prominent (Figs. 20 & 21). . . . . *H. octocentra*

\- Collum broadly rounded laterally; anterolateral denticles on paraterga 2-4 less evident, sometimes retained on paratergum 3 only; midway dorsal process on solenophore less prominent to missing. 4

4 - Body larger: >7 mm in width; sternal cones very modest even in male (Fig. 35); midway dorsal process on solenophore missing (Figs.36-38); environs of Manaus. . . . . *H. media*

\- Body smaller: = 6 mm in width; sternal cones well-developed in both sexes (Fig. 43); midway dorsal process on solenophore present but relatively small; Amapá. 5

5 - Anterolateral denticle retained on paratergum 3 only (Fig. 39); paraterga mostly slightly declined (Fig. 40); midway dorsal process on solenophore simple and nearly straight, distalmost part of solenophore also relatively simple (Figs. 44-46). . . . . *H. macapa*

- Anterolateral denticle present on paraterga 2-4 (Fig. 47); paraterga mostly subhorizontal (Fig. 48); midway dorsal process on solenophore subunciform, distalmost part of solenophore more elaborate (Figs. 50-52). ..... *H. disjuncta*

6 - Collum mostly very broadly rounded laterally (Figs 1 & 9); knobs between ♂ coxae 6 missing; solenophore more simple (Figs. 6-8). ..... *Aphelidesmus junki*

- Collum mostly narrowly rounded laterally (Figs. 11, 22 & 23); knob between ♂ coxae 6 prominent; solenophore more elaborate (Figs. 28-30). ..... *Ochrotropis elongata*

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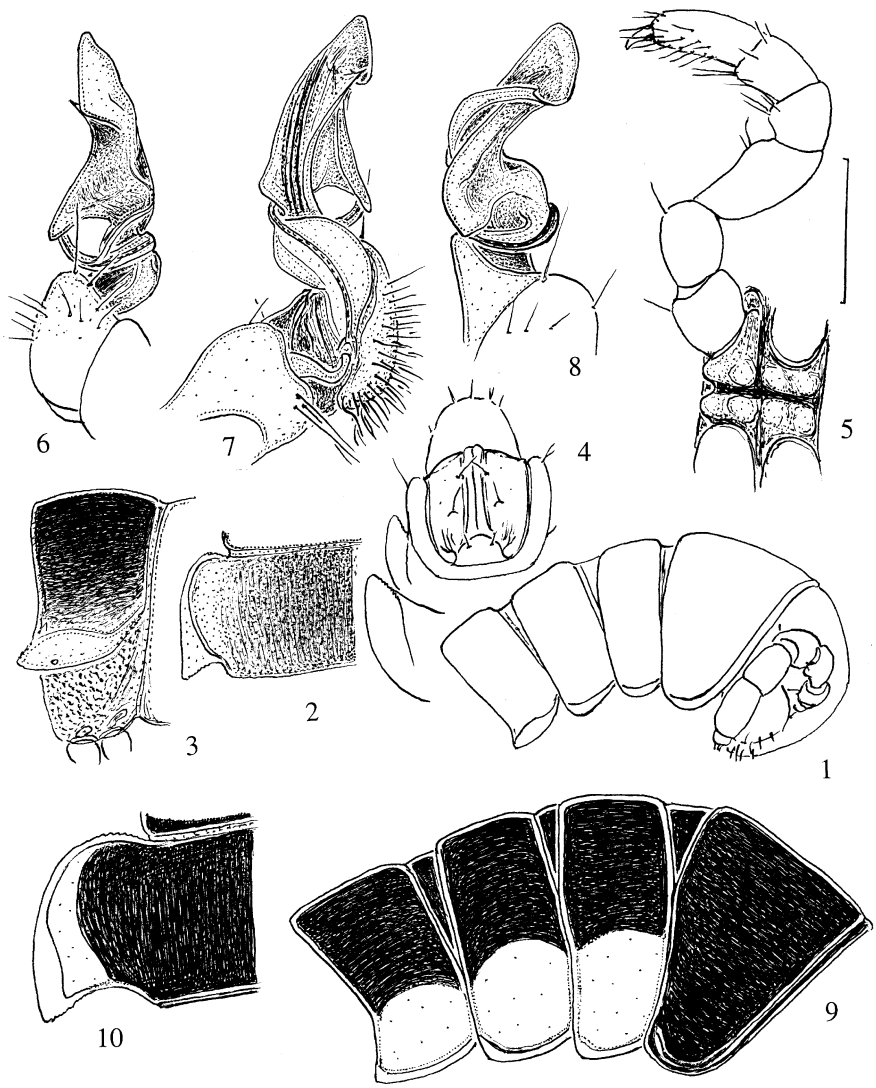
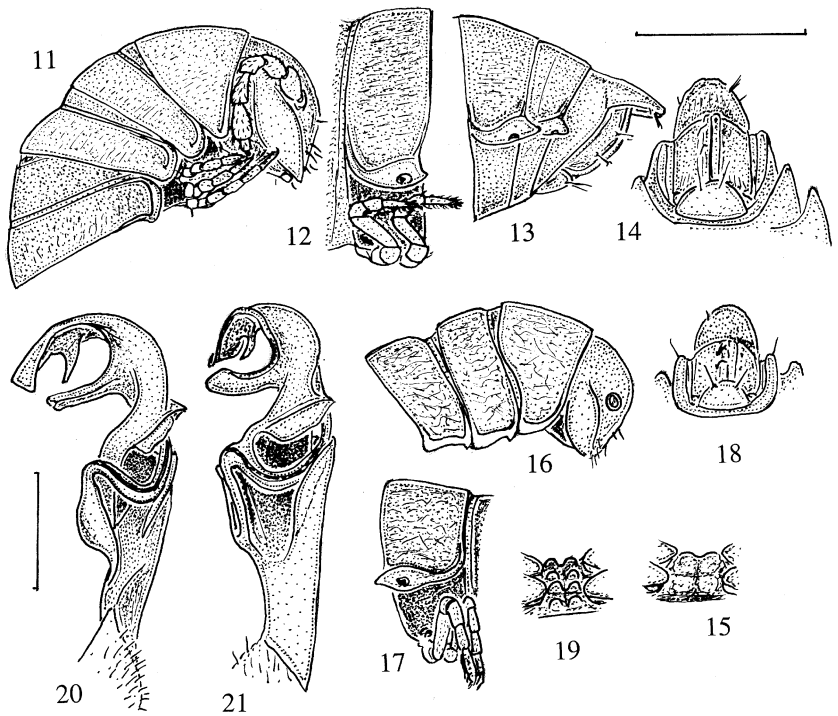
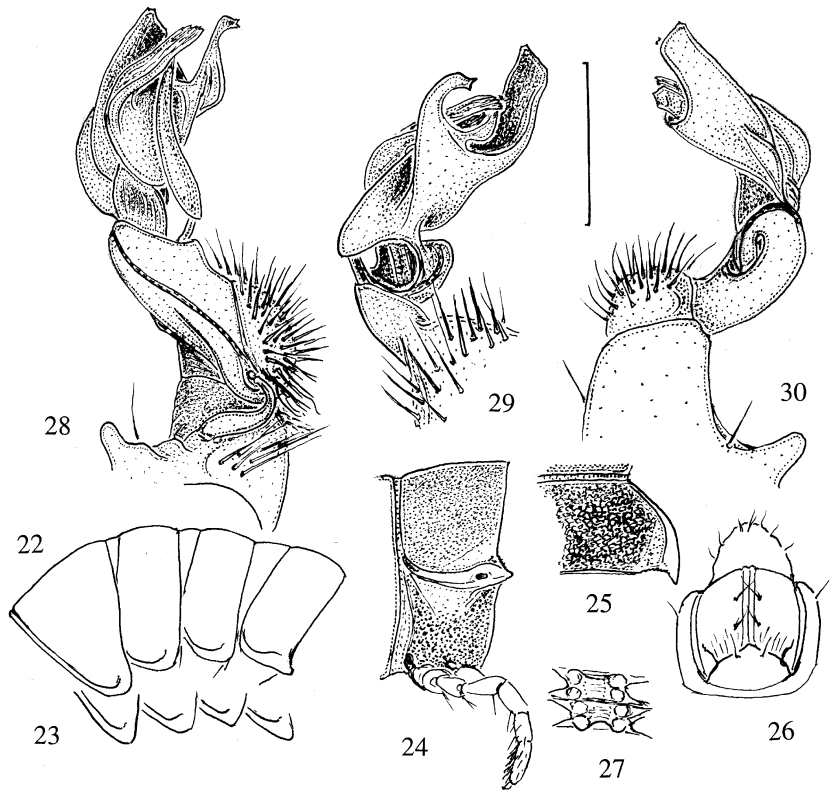


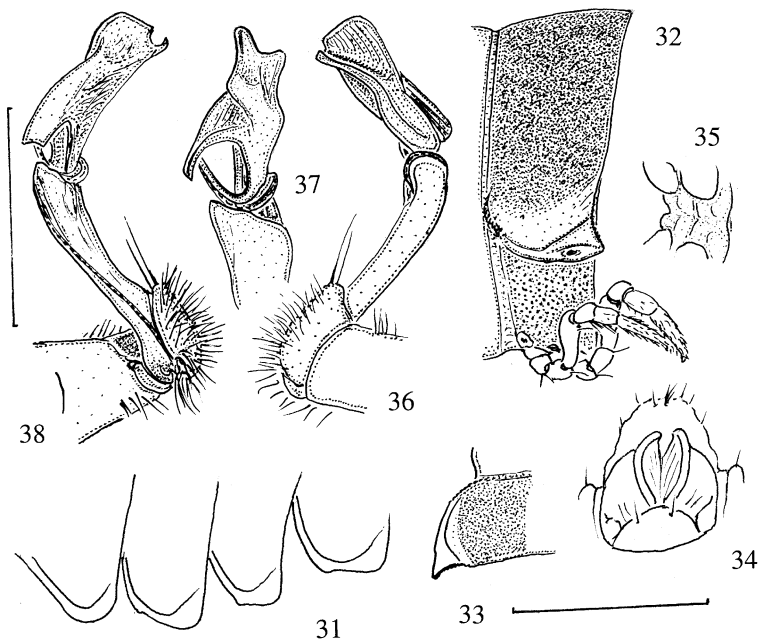
Figs. 1-10:
Aphelidesmus junki n.sp., ♂ paratype from Lago Janauarí (1-8), ♂ from Padre Cocha.
1 & 9: anterior body portion, lateral; **2 & 10**: left half of metatergum 10, dorsal; **3**: metasomite 10, lateral; **4**: posterior body end, ventral; **5**: sternal structure of ring 8 and leg 11, ventral; **6-8**: left gonopod, lateral, medial, and subventral, respectively. Scale bar 0.5 (6-8), 1.0 (5) and 2.0 mm (1-4, 9, 10). Del. S. GOLOVATCH.



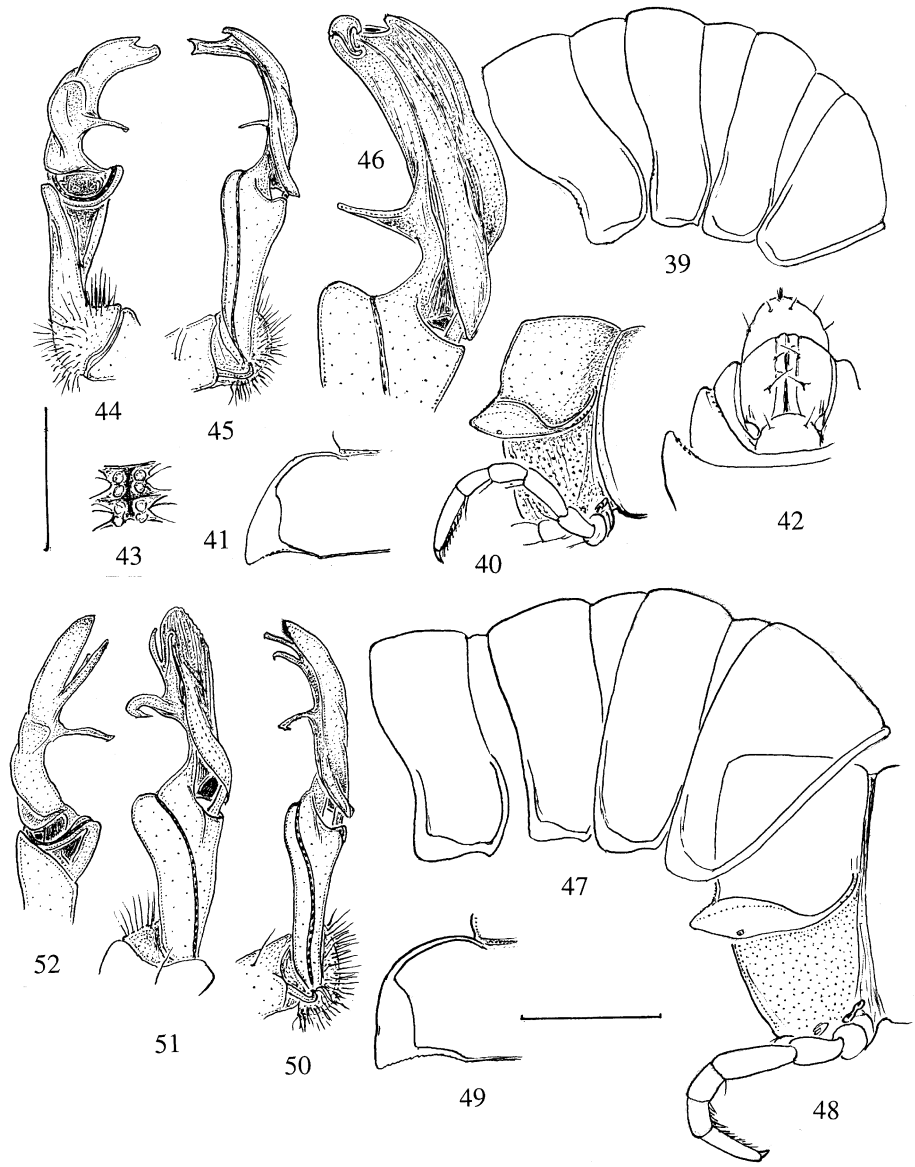
Figs. 11-21:
Ochrotropis elongata (BRÖLEMANN, 1905), ♀ holotype from Manaus (11-15), and *Haematotropis octocentra* (BRÖLEMANN, 1905), ♂ lectotype from Manaus (16-21).
11 & 16: anterior body portion, lateral; **12 & 17**: metasomite 10, lateral; **13**: posterior body portion, lateral; **14 & 18**: telson, ventral; **15 & 19**: midbody sterna, ventral; **20 & 21**: right gonopod, frontolateral and frontal, respectively. Del. S. GOLOVATCH. Scale bars 1.0 (20-21) and 5.0 mm (11-19).



Figs. 22-30:
Ochrotropis elongata (BRÖLEMANN, 1905), ♂ from EMBRAPA-CPAA (22, 24-30) and ♀ from between Presidente Figueredo and Balbina (23).
22 & 23: contours of anterior body portion, lateral; **24**: metasomite 10, lateral; **25**: right paratergum 10, dorsal; **26**: telson, ventral; **27**: midbody sterna, ventral; **28-30**: left gonopod, submedial, frontal, and lateral, respectively. Del. S. GOLOVATCH. Scale bars 1.0 (28-30) and 5.0 mm (22-27).



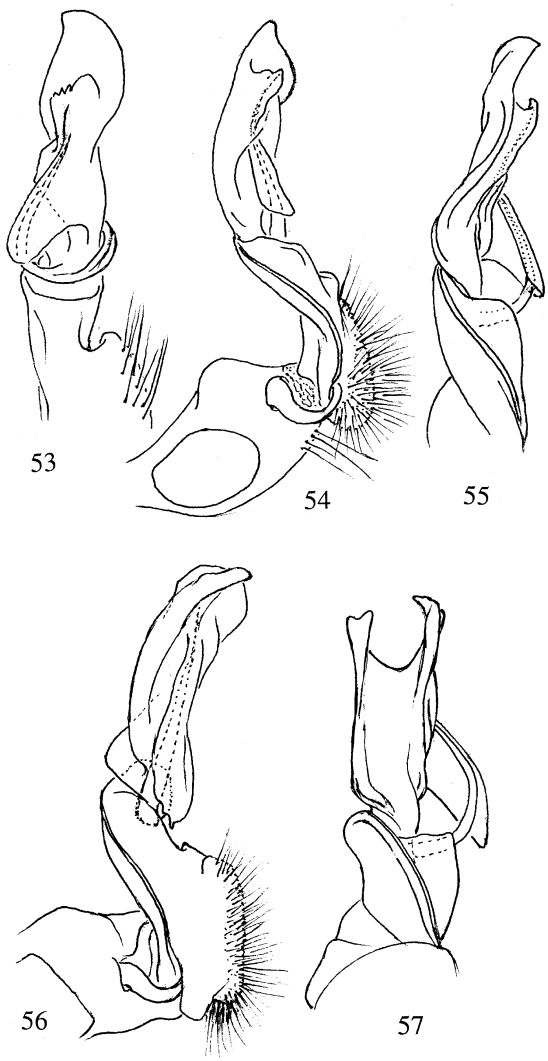
Figs. 31-38:
Haematotropis media n.sp., ♂ holotype from EMBRAPA-CPAA.
31: contours of anterior body portion, lateral; **32**: metasomite 10, lateral; **33**: left paratergum 10, dorsal; **34**: telson, ventral; **35**: midbody sterna, ventral; **36-38**: left gonopod, submedial, frontal, and lateral, respectively. Del. S. GOLOVATCH. Scale bars 2.0 (36-38) and 4.0 mm (31-35).



Figs. 39-52:

Haematotropis macapa n.sp., ♂ paratype from Macapá (39-46) and *Haematotropis disjuncta* n.sp., ♂ paratype from Amapá (47-52).

39 & 47: anterior body portion, lateral; **40 & 49**: metasomite 10, lateral; **41**: left paratergum 10, dorsal; **42**: telson, ventral; **43**: midbody sterna, ventral; **44-46 & 50-52**: left gonopod, lateral, medial, subfrontal, medial, subventral, and sublateral, respectively. Del. S. GOLOVATCH. Scale bars 0.25 (46), 0.5 (44-45, 50-52) and 1.0 mm (39-43, 47-49).



Figs. 53-57:
Left gonopods of *Aphelidesmus hermaphroditus* BRÖLEMANN, 1898, ♂ lectotype (MNHN) (53-55), and *Aphelidesmus rivicola* (SILVESTRI, 1898), ♂ syntype (MHNG) (56-57), ventral, medial, dorsal, dorsal, and medial views, respectively. Del. R. HOFFMAN. Drawn not to scale.

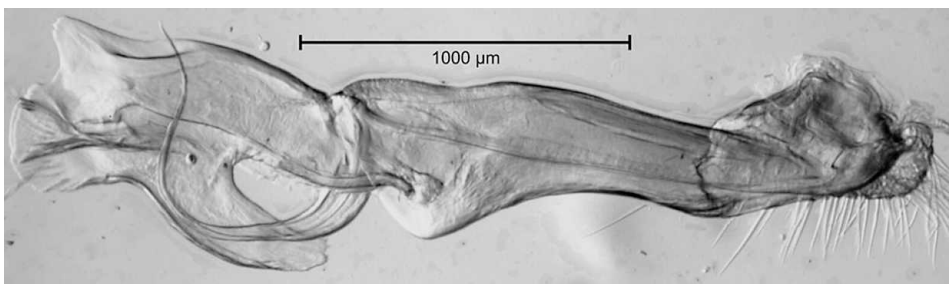


Fig. 58:
Right gonopod of *Haematotropis media* n.sp., ♂ holotype from EMBRAPA-CPAA, caudal view.
Photo J. SPELDA.