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Millipedes (Diplopoda) of the Brazilian Pantanal

by

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Abstract

A review is given of the diplopod fauna of Mato Grosso and Mato Grosso do Sul, Brazil, with special reference to that of the periodically inundated areas of the Pantanal. The Mato Grosso list is rich and diverse (at least 85 species, about 34 genera), but clearly biased toward fewer higher groups that only contain species of larger size: four orders and seven families, with only four really small-bodied (<10 mm long) species yet encountered (one in Polyxenidae and three in Pyrgodesmidae, including *Poratia salvator* GOLOVATCH & SIERWALD, 2001, which is new to the fauna of Brazil). In contrast to Amazonia, the lack in the Pantanal of various types of inundation forest side by side with the selva on terra firme (= non-flooded upland forests), the prevalence of grasslands on sandy soils (the latter often too poor in nutrients to support a fauna of such a soil/litter-dwelling group as Diplopoda), the too few and sparse/scattered woodlands, the wild fires and the profound seasonality due to both the more southern lie and the dominance of open terrain seem to account for the diplopods generally being uncharacteristic as a Pantanal fauna element.
Keywords: **Millipeds, biodiversity, floodplain, inundation forest, Mato Grosso, Brazil.**

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Resumo

É apresentada uma revisão da fauna de diplópodos dos estados do Mato Grosso e Mato Grosso do Sul (Brasil), com ênfase nas áreas periodicamente inundadas do Pantanal. A lista de espécies do Mato Grosso é rica e diversa (no mínimo 85 espécies, cerca de 34 gêneros), mas tem predomínio nítido de poucos taxa mais elevados que só contém espécies de tamanho maior: quatro ordens e sete famílias, com somente quatro espécies de tamanho coporal realmente pequeno (<10mm de comprimento), encontradas pela primeira vez (uma em Polyxenidae e três em Pyrgodesmidae, incluindo *Poratia salvator* GOLOVATCH & SIERWALD, 2001, que é um registro novo para a fauna do Brasil). Contrastando com a Amazônia, os diplópodos não são um elemento característico da fauna do Pantanal, o que pode ocorrer devido à ausência de vários tipos de florestas inundáveis lado a lado com selva de terra firme (florestas não inundadas de áreas elevadas); prevalência de campos herbáceos em solo arenoso (o último sendo muitas vezes excessivamente pobre em nutrientes para suportar uma fauna de solo e serapilheira, como os Diplopoda); muito poucas áreas com florestas, e, quando presentes, esparsas/dispersas; ocorrência de incêndios naturais; e acentuada sazonalidade, devida tanto à sua localização geográfica mais ao sul, quanto ao predomínio de áreas abertas no Pantanal.

Introduction

The Pantanal, the globe's largest wetland, is situated in the depression of the upper Paraguay River 16-20°S and 55-58°W that extends between the old crystalline shield of central Brazil and its transitional zone to the foothills of the geologically young Andes. The upper Paraguay River catchment area covers about 496,000 km^2, the Pantanal about 160,000 km^2, of which about 140,000 km^2 belong to Brazil, 15,000 km^2 to Bolivia and 5,000 km^2 to Paraguay (Map).

The climate in the Pantanal is characterized by strong seasonality, with a pronounced dry season from May to September and a rainy season from October to April. Annual rainfall decreases from 1,250 mm in the northern part near Cáceres to 1,089 mm in the southern part near Corumbá. Near Cuiabá, the mean monthly temperature varies between 27.4 °C in December and 21.4 °C in July. Flood levels vary from a few centimeters to about five meters. The flood pulse in the northern part (Poconé: December-March, up to 1.5 m) coincides with the rainy season, but there is a lag of about 3 months between rainy season and flooding in the southern part, with a nearly complete flooding to a greater depth during 4-5 months (see HAMILTON et al. 1996; JUNK & DA SILVA 1995; JUNK et al. 2005).

Studies on the millipede fauna of Mato Grosso (partly including the present-day Mato Grosso do Sul) in general, and of the Pantanal in particular, have a long history, which was reviewed by SCHUBART (1947, 1958). Only very few papers have since appeared (SCHUBART 1962; HOFFMAN 1965, 1980, 2000, 2002, 2005; ADIS et al. 2001; GOLOVATCH & ADIS 2004) that update the list or add new taxa or records. The present work also puts on record still another diplopod species new to the fauna of Brazil: *Poratia salvator* GOLOVATCH & SIERWALD, 2001, hitherto known only from the original description from El Salvador (GOLOVATCH & SIERWALD 2001). We also correct here the mistake by MAREK et al. (2003), who erroneously reported "*Rhinocricus*" *aragarcensis* SCHUBART, 1962 from Mato Grosso, a species originally described and still known only from Aragarças, Goiás (SCHUBART 1962).

Only a single contribution concerns the ecology and survival strategies of terricolous Diplopoda in the Pantanal in response to the flood pulse (ADIS et al. 2001). Although these observations deal with only two species encountered at Pirizal, northern Pantanal, they show that millipedes make vertical migrations to temporarily pass the aquatic phase

at non-flooded sites like tree trunks.

The present work summarizes all available evidence concerning the diplopods populating the Pantanal, in particular its periodically flooded parts. Since most of the area, especially the Pantanal's central parts, remain unknown with respect to millipedes, our attempt must only be understood as provisional. The same concerns the key completing this paper.

Material

An abundant millipede material was collected in several regularly inundated places at Corumbá: capão (19°30'S, 57°00'W & 19°35S, 56°55'W), Pirizal: acurizal, cambarazal and landi (17°54'S, 56°36'W), and Piuval: sambaqui (16°22'S, 56°37'W). These data are summarized in the key presented below. The collecting techniques used in the Pantanal were the same as those applied in Amazonia (ADIS 2002) as well as manual sampling (standing crop).

Results and conclusions

The diplopod fauna of Mato Grosso appears to be rich and diverse (Table 1), but evidently biased toward fewer higher groups that only contain larger-bodied species: four orders and seven families. Only four really small-sized (<10 mm long) species have been encountered there, one in Polyxenida and three in Pyrgodesmidae. However, this great area, which supports the bulk of the Pantanal, is still poorly prospected, numerous identifications are incomplete or dubious, and undoubtedly many more species, including smaller ones, are still to be revealed there. On the other hand, the predominance of species with larger bodies is hardly random, thus requiring an explanation.

Since the fauna of the Pantanal proper (Table 1, shown boldface), i.e. the regularly inundated territories, appears to be especially poor, containing just a handful of species, of which several are widespread colonists, the underlying reasons for such a strongly depauperate list must be sought in the region's history and present-day ecology. Indeed, this situation differs markedly from that observed in Amazonia, which supports a far richer fauna (>100 species in the environs of Manaus alone (HOFFMAN et al. 2002; GOLOVATCH et al. 2004; BERGHOLZ et al. 2004, 2005), nearly twice as many near Iquitos), including several dozen forms more or less tolerant to flooding (HOFFMAN et al. 2002). Furthermore, even the survival strategies of millipedes in Amazonian floodplain forests appear to be more diverse and elaborate. Thus, most of the species escape the flood phase on tree-trunks at various instars, some remain dormant or even active underwater, and some more are purely canopy-dwellers (ADIS 1997; ADIS & MESSNER 1997). Since the average annual amplitudes of inundation are much greater in Amazonia than in the Pantanal, this stress factor seems to have only enhanced the diversity of diplopods and their survival strategies in Amazonia.

The diplopod faunas of Mato Grosso and the Manaus region differ markedly in structure as well (Table 2). Not only does the Pantanal list appear impoverished, but also the families showing the maximum specific and generic diversity are Chelodesmidae and Spirostreptidae, which only contain larger-bodied species, versus Pyrgodesmidae and Fuhrmannodesmidae in Amazonia, which are usually composed of very small-sized species. The predominance of small diplopods in Amazonia is another important feature, implying at least an easier microhabitat choice and partitioning. It would be important to learn more to compare the life histories of the millipedes inhabiting both these regions, because, generally, in smaller-bodied species they tend to be shorter, hence their rates of evolution being enhanced.

Since the two regions are sufficiently ancient and comparable in geological age, it is the more adverse environmental conditions in the Pantanal, both in the past and at present, that seem to provide the only feasible explanation for the differences observed. The most prominent reason for the apparent paucity both of the number of the diplopod species tolerant to inundation and of their survival strategies seems to lie in insular forests and wild fires. The lack of various types of inundation forest side by side with the selva on terra firme (= non-flooded upland forests), the prevalence of grasslands on sandy soils (the latter often too poor in nutrients to support a fauna of such a soil/litter-dwelling group as Diplopoda), the too few and sparse/scattered woodlands, the profound seasonality due to both the more southern lie and the dominance of open terrain seem to account for the diplopods generally being uncharacteristic as a Pantanal fauna element.

Indeed, unlike equatorial Amazonia with its fairly stable and humid climate retained even over the Pleistocene, during the last glacial period the amount of rainfall in the Pantanal is known to have been very much lower than today. Alternating extremely dry and wet periods of varying duration, often decades long, must have rendered dramatic effects on fauna and flora. Hardly surprisingly, there are very few endemic species of plants and animals recorded in the Pantanal. A time span of about 8,000 to possibly even some 1,500 years after the last long-term dry period has obviously been too short to result in considerable endemism (JUNK et al. 2005).

Based on the relatively well-studied plant and animal groups, the biota of the Pantanal is generally a derivative of the following, more or less adjacent diversification centres: Amazonian and/or Atlantic forests, as well as Cerrado, Caatinga and/or Gran Chaco savannahs (Map). As regards the diplopod fauna, it is so poorly known (Table 1) that any zoogeographical speculations seem premature. Numerous millipede species have hitherto been described or recorded from Mato Grosso alone (Table 1), but their endemicity, including those known in the Pantanal proper, remains to be proved. Some direct faunal comparisons appear to solely be possible with Amazonia, Table 2 showing clear relationships only at the familial and ordinal levels. Based on the known distributions, however, a few species and genera in the Pantanal that also appear in Bolivia, Paraguay and Argentina can be suggested to represent Chaco elements, whereas several more that occur also in the Cerrado of central Brazil as Cerrado elements. A few species are definitely introductions through human agency.

Much more work is needed to properly assess the millipede fauna and ecology of Mato Grosso, including the true Pantanalians, however few.

Table 1: A checklist of the Diplopoda of Mato Grosso (and of Mato Grosso do Sul), including those given in bold that occur in the Pantanal proper.

Order POLYXENIDA

Family POLYXENIDAE

1. **Gen. sp.** - Pirizal

Order POLYDESMIDA

Family CHELODESMIDAE

2. *Angelodesmus* sp. - Guaporé

3. *Arthrosolenomeris chapadensis* SCHUBART, 1943 - Chapada dos Guimarães
4. *Arthrosolenomeris pantanalensis* SCHUBART, 1943 - São Luiz de Cáceres & Nova Xavantina
5. *?Arthrosolenomeris* sp. - Guaporé
6. *Brachyurodesmus bivelatus* (SCHUBART, 1947) - Barra do Tapirapé, Aldeia dos Tapirapés
7. *Brachyurodesmus chavantinus* (SCHUBART, 1952) - Nova Xavantina
8. *Brachyurodesmus parallelus* (ATTEMS, 1898) - terra firme island near Corumbá, Urucum (also known in Paraguay)
9. *Brachyurodesmus* sp. 1 - Serra do Amolar
10. *Brachyurodesmus* sp. 2 (aff. *paralellus*) - Serra do Amolar
11. *Camptomorpha ornithopus* (BRÖLEMANN, 1902) - Salobra (also in SP, though slightly different!)
12. *Dioplosternus salvatrix* HOFFMAN, 2005 - Guaporé
13. *Euthydesmus acicarina* SILVESTRI, 1902 - terra firme island near Corumbá, Urucum
14. *Gangugia simplex* SCHUBART, 1947 - Fundação Brasil-Central, Nova Xavantina, Jacaré, also Goiás State
15. *Gangugia tapirapensis* SCHUBART, 1947 - Barra do Tapirapé, Aldeia dos Tapirapés
16. *Leiodesmus carcani* (SILVESTRI, 1902) - Urucum
17. *Leiodesmus orlandi* (SILVESTRI, 1902) - Corumbá, Carandazinho & Serra do Amolar
18. *Leiodesmus postillonus* (ATTEMS, 1931) - Salobra, Urucum (also in Bolivia, Agrentina and N-Paraguay)
19. *Leiodesmus validus* (ATTEMS, 1898) - cerrado along Brazil-Bolivia Railway, Miranda, Salobra & Camapuã; Pantanal São Lourenço, Piquiri, Porto Jofre, Carandazinho, Corumbá & Murtinho
20. "*Leptodesmus*" *coriaceus* SCHUBART, 1947 - Barra do Tapirapé, Aldeia dos Tapirapés
21. "*Leptodesmus*" sp. 1 - Tapirapé
22. "*Leptodesmus*" sp. 2 - Tapirapé
23. *Manfrediodesmus passarellii* (SCHUBART, 1943) - São Luiz de Cáceres
24. *Oreodesmus travassosi* SCHUBART, 1958 - Urucum
25. ***Pantanalodesmus marinezae* HOFFMAN, 2000** - Pirizal
26. *Telonychopus klossae* HOFFMAN, 1965 - Santo Antônio do Leverger
27. *Telonychopus meyeri* VERHOEFF, 1951 - Acurizal
28. *Vanzolegulus limbatus* HOFFMAN, 2002 - Vila Bela da Santíssima Trindade on Rio Guaporé
29. Gen. nov. sp. near *Vanzolegulus* - Guaporé

Family PARADOXOSOMATIDAE

30. *Catharosoma palustre* SCHUBART, 1943 - cerrado along Brazil-Bolivia Railway, Miranda, Salobra & Camapuã
31. *Catharosoma paraguayense* (SILVESTRI, 1895) - Pantanal São Lourenço, Piquiri, Porto Jofre, Carandazinho, Corumbá & Murtinho (also Paraguay and Argentina)
32. *Mestosoma bicolor* SILVESTRI, 1898 - Corumbá, Urucum
33. *Mestosoma femorale* (SCHUBART, 1943) - cerrado along Brazil-Bolivia Railway, Miranda, Salobra & Camapuã
34. *Mestosoma truncatum* (SCHUBART, 1943) - sources of Rio Paraguay, Porto Espiridião, São Luiz de Cáceres, Cuiabá & Acurizal
35. *Orthomorpha coarctata* (DeSAUSSURE, 1860) - Serra do Amolar; sources of Rio Paraguay, Porto Espiridião, São Luiz de Cáceres, Cuiabá & Acurizal; Fundação Brasil-Central, Nova Xavantina, Jacaré, also Goiás State (pantropical introduction)
36. ***Promestosoma boggianii* (SILVESTRI, 1898)** - Corumbá (also in Paraguay)

Family PYRGODESMIDAE

37. ***Myrmecodesmus hastatus* (SCHUBART, 1945)** - Cuiabá (also over much of South America, introduction)
38. *Plagiotropidesmus convexus* SILVESTRI, 1901 - sources of Rio Paraguay, Porto Espiridião, São Luiz de Cáceres, Cuiabá & Acurizal
39. ***Poratia salvator* GOLOVATCH & SIERWALD, 2001** - Pirizal (?introduction)

Order SPIROBOLIDA

Family RHINOCRICIDAE

40. *Anadenobolus chavantinus* SCHUBART, 1958 - Nova Xavantina
41. *Anadenobolus nattereri* (HUMBERT & DeSAUSSURE, 1870) - Rio Salobra, Miranda (also in São Paulo State)
42. *Anadenobolus punctatofasciatus* (SCHUBART, 1958) - Porto Espiridião
43. *Anadenobolus sagatinus* SCHUBART, 1958 - Salobra
44. *Anadenobolus urukumui* SCHUBART, 1947 - Barra do Tapirapé along Rio Araguaia to Nova Xavantina
45. ***Anadenobolus* sp. 1** - Pirizal, also in Guaporé and Serra do Amolar
46. ***Anadenobolus* sp. 2** - Pirizal
47. *Anadenobolus* sp. 3 - Guaporé
48. *Argentocricus nodulipes* (SILVESTRI, 1897) - Urucum (also in Bolivia and N. Argentina)

Order SPIROSTREPTIDA

Family SPIROSTREPTIDAE

49. *Gymnostreptus olivaceus* SCHUBART, 1944 - Porto Primavera, Mun. Bataguaçu, forests in Rio Paraná Valley (also in São Paulo State)
50. *Gymnostreptus pictus* (SCHUBART, 1945) - Barra do Tapirapé, Aldeia dos Tapirapés
51. *Gymnostreptus* sp. 1 - Serra do Amolar
52. *Gymnostreptus* sp. 2 - Serra do Amolar
53. *Gymnostreptus* sp. 3 - Serra do Amolar
54. *Gymnostreptus* sp. 4 - Serra do Amolar
55. *Heteropyge araguayensis* (SCHUBART, 1947) - Barra do Tapirapé
56. ***Heteropyge paraguayensis* (SILVESTRI, 1895)** - Corumbá, also in Guaporé, Serra do Amolar, Urucum, Itaisi, Cuiabá (also in Paraguay)
57. *Nanostreptus libertinus* (SILVESTRI, 1895) - Corumbá (also in Bolivia)
58. *Oreastreptus* sp. - Serra do Amolar
59. ***Orthoporus* aff. *americanus* (SILVESTRI, 1895)** (? = *O. americanus perproximus* SILVESTRI, 1902) - Corumbá, Pirizal, also in Carandazinho, Guaporé, Serra do Amolar, Miranda (also in São Paulo State, Argentina and Paraguay)
60. *Orthoporus urucumensis* SCHUBART, 1958 - Urucum
61. ?*Orthoporus fulvomaculatus* (SCHUBART, 1958) - Nova Xavantina, Rio das Mortes, also in Goiás State
62. ?*Orthoporus helicterus* (SCHUBART, 1958) - Jacaré, Alto Xingu
63. ?*Orthoporus torquatus* (SCHUBART, 1958) - Nova Xavantina, Rio das Mortes
64. ?*Orthoporus* sp. - Urucum
65. *Plusioporus giglitosi* SILVESTRI, 1902 - Urucum, Corumbá
66. *Plusioporus minor* (SCHUBART, 1958) - Rio São Lourenço, Vale Pocuba-Xoréu
67. *Plusioporus nigricollis* (SCHUBART, 1947) - left bank of Rio Araguaia, downstream of Leopoldina
68. *Plusioporus salvadorii* SILVESTRI, 1895 (? = *P. sicki* SCHUBART, 1950) - Serra do Amolar and Nova Xavantina, Rio das Mortes, also in Goiás State (also in Paraguay and Argentina)
69. *Plusioporus* sp. 1 - Chapada dos Guimarães
70. *Plusioporus* sp. 2 - Rio Piquiri & Rio Cuiabá, Porto Jofre & Cuiabá; banks of Rio Lourenço; São Luiz de Cáceres
71. "*Spirostreptus*" sp. 1 - Urucum
72. "*Spirostreptus*" sp. 2 - Salobra
73. *Trichogonostreptus* (s. str.) *ternetzi* CARL, 1918 - Salobra, Urucum (also in Paraguay)
74. ***Trichogonostreptus (Oreastreptus) mattogrossensis* (SILVESTRI, 1902)** - Pirizal, Corumbá, also in Guaporé, Serra do Amolar, Carandazinho, Itaisi and Cuiabá

75. *Trichogonostreptus (Ptenogonostreptus) unilineatus* (SCHUBART, 1945) - Barra do Tapirapé
76. *Urostreptus carvalhoi* (SCHUBART, 1947) - Barra do Tapirapé, Aldeia dos Tapirapés
77. *Urostreptus tampiitauensis* (SCHUBART, 1947) - Barra do Tapirapé
78. ***Urostreptus* sp. 1** - Pirizal
79. *Urostreptus* sp. 2 - Guaporé
80. *Urostreptus* sp. 3 - Nova Xavantina, Rio das Mortes
81. *Urostreptus* sp. 4 - Alto São Lourenço, Vale Pocuba-Xoréu

Family PSEUDONANNOLENIDAE

82. *Pseudonannolene leucomelas* SCHUBART, 1947 - Barra do Tapirapé, Aldeia dos Tapirapés
83. *Pseudonannolene occidentalis* SILVESTRI, 1895 - Salobra and Ipiava
84. *Pseudonannolene pusilla* SILVESTRI, 1895 - Fundação Brasil-Central, Nova Xavantina, Jacaré, also Goiás State
85. *Pseudonannolene* sp. - Guaporé, Serra do Amolar

Table 2: Comparison between the millipede faunas of Mato Grosso and the Manaus region, Amazonia.

	Mato Grosso	**Manaus region**	**Shared**
Species	85	112	2 or 3 introductions
Genera	ca 34, mainly in Chelodesmidae (16) & Spirostreptidae (8)	ca 58, mainly in Pyrgodesmidae (11) & Fuhrmannodesmidae (8)	9
Families	7	18	7
Orders	4	8	4

Provisional practical key to Diplopoda of the Pantanal (Cuiabá & Corumbá regions)

Key to orders and families:

1. Body soft, small (3-6 mm long), with tufts of serrate hollow setae all over (Fig. 1) . . . . . Order Polyxenida
- Body hard, impregnated with calcite, without such setae 2
2. Body cylindrical, vermiform (Fig. 2), normally with >40 segments 3
- Body segments ≤20, with lateral expansions (= paraterga) on metaterga (Fig. 3), often, however, very small . . . . . Order Polydesmida, ... 5
3. Labrum with an axial suture (Fig. 4); eye patches roundish (Fig. 5); prozona usually with a paramedian pair of pits (= scobinae) at anterior margin (Fig. 15); gnathochilarium as in Fig. 6; legs (Fig. 16) and antennae very short . . . . . Order Spirobolida, Family Rhinocricidae
- Labrum without axial suture; eye patches subtriangular; scobinae missing; gnathochilarium as in Fig. 7 . . . . . Order Spirostreptida, ... 4
4. Mentum of gnathochilarium divided medially into **m** and **pr** parts (Fig. 8) . . . . . Family Pseudonannolenidae, **Pseudonannolene* sp.
- Mentum of gnathochilarium not divided . . . . . Family Spirostreptidae

5. Collum covering the head dorsally, lobulate at anterior margin (Fig. 9); body very small, <10 mm long ..... Family Pyrgodesmidae
- Collum not covering the head from above, adults >20 mm long 6
6. Adult body 20-25 mm long; paratergites of body segment 2 lying much lower than collum (Fig. 10) ..... Family Paradoxosomatidae
- Adult body >40 mm long; paratergites 2 level to collum and paratergites 3; paraterga wide but with relatively small, lateral, more or less discoid calluses (Fig. 11) ..... Family Chelodesmidae, *Pantanalodesmus marinezae* HOFFMAN, 2000

Key to species of Rhinocricidae:

1. Epiproct (= "tail") prominent; head, antennae, central part of collum, prozona and legs blackish, strongly contrasting to orange or yellowish anterior, lateral and caudal parts of collum, to most of metazona and epiproct (Figs. 12-14); gonopods as in Figs. 17-19 ..... *Anadenobolus* sp. 1
- Epiproct less prominent; body uniformly blackish except for a narrowly pale, grayish margin of body segments; gonopods slightly different ..... *Anadenobolus* sp. 2

Key to species of Spirostreptidae:

1. Paraprocts (= anal valves) with a small but evident tooth dorsally at margin (Fig. 22); collum with slightly different striation patterns in male and female (Figs. 20 & 21); gonopod as in Figs. 23-25 ..... *Heteropyge paraguayensis* (SILVESTRI, 1895)
- Paraprocts normal, regularly rounded, devoid of any teeth; gonopods different 2
2. Epiproct prominent, with a middorsal carina (Fig. 27); adult body large (=10 mm in diameter), entirely black; collum with two distinct striae laterally (Fig. 26) ..... *Urostreptus* sp.
- Epiproct small, body smaller, yellowish to gray-brown 3
3. Body dark grey-brown; collum in male and female equal, with several distinct striae laterally (Fig. 28); epiproct as in Figs. 29 & 30; gonopod as in Figs. 31 & 32 ..... *Orthoporus* aff. *americanus* (SILVESTRI, 1895)
- Body usually lighter, pattern cingulated; collum markedly lobe-shaped anteroventrally in male compared to female 4
4. Collum with two curved striae laterally (Figs. 33, 34, 36, 37, 39 & 40); paraprocts more convex, epiproct shorter and slightly narrower (Figs. 41 & 42); gonopods as in Figs. 35, 38, 43 & 44 ..... *Plusioporus salvadorii* SILVESTRI, 1895 (? = *P. sicki* (SCHUBART, 1950))
- Collum usually with three curved striae (Figs. 45 & 46); paraprocts less convex, epiproct more like in *Orthoporus* (Figs. 47 & 48); gonopod as in Fig. 49 ..... *Trichogonostreptus (Oreastreptus) mattogrossensis* (SILVESTRI, 1902)

Key to species of Pyrgodesmidae:

1. Adults with 19 body segments, including telson; ozopores on porosteles situated between lateral lobulations; parthenogenetic (males extremely rare) ..... *Poratia salvator* GOLOVATCH & SIERWALD, 2001
- Adults with 20 segments; ozopores on porosteles situated behind lobulations at caudolateral corner of paraterga; populations bisexual (males rather common), gonopod telopodites with a conspicuous hairy flagellum at about midway ..... *Myrmecodesmus hastatus* (SCHUBART, 1945)

Key to species of Paradoxosomatidae:

2. Paraterga relatively well-developed (pantropical, anthropochoric introduction) (Fig. 50) ..... **Orthomorpha coarctata* (DeSAUSSURE, 1860)
- Paraterga very poorly developed, scarcely visible, body subcylindrical (Fig. 51); gonopod as in Fig. 52 (indigenous) ..... *Promestosoma boggianii* (SILVESTRI, 1898)

Two of the above taxa, each marked by an asterisk, have not yet formally been recorded in the Pantanal but, as both occur in the immediate environs, they have also been incorporated in the above key as potential members of the fauna.

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List of the species occurring in the Pantanal

List of the species occurring only in the Pantanal:
§ = Corumbá: capão (19°30'S, 57°00'W & 19°35'S, 56°55'W)
$ = Pirizal: acurizal, cambarazal, landi (17°54'S, 56°36'W) & Piuval: sambaqui (16°22'S, 56°37'W)

Shared species occurring also in Mato Grosso and Mato Grosso do Sul outside the Pantanal:
* = UHE Guaporé (15°07'S, 58°57'S)
" = Serra do Amolar (17°55'S, 57°35'W)

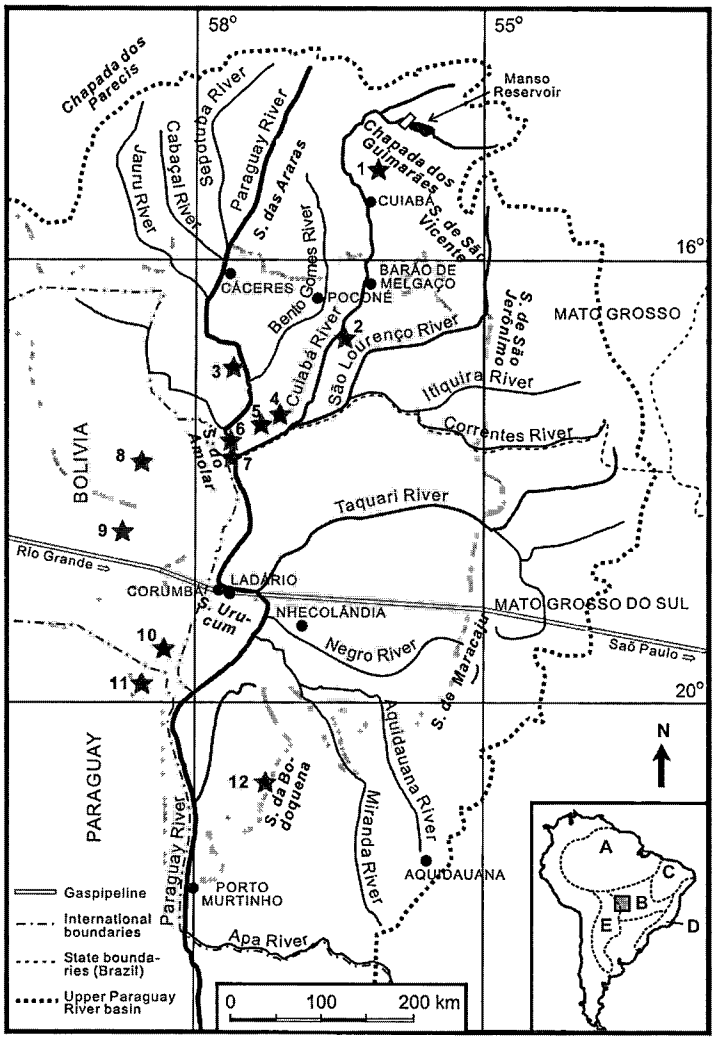
Species occurring only outside the Pantanal
* = UHE Guaporé (15°07'S, 58°57'W)
" = Serra do Amolar (17°55'S, 57°35'W)
' = Chapada dos Guimarães (15°26'S, 55°47'W)

Order **Polyxenida**
Family ?
$ Gen. sp.
Order **Polydesmida**
Family Paradoxosomatidae
§ *Promestosoma boggianii* (SILVESTRI, 1898)
Family Pyrgodesmidae
§$ *Poratia* sp.
Family Chelodesmidae
§ *Pantanalodesmus marinezae* (HOFFMAN, 2000)
Order **Spirobolida**
Family Rhinocricidae
$ *Anadenobolus* sp. 1
$ *Anadenobolus* sp. 2
Order **Spirostreptida**

Order **Spirobolida**
Family Rhinocricidae
*" *Anadenobolus* sp. 1
Order **Spirostreptida**
Family Spirostreptidae
*" *Heteropyge paraguayensis*" (SILVESTRI, 1895)
*" *Orthoporus* aff. *americanus* (SILVESTRI, 1895)
" *Plusioporus salvadorii* SILVESTRI, 1895 (? = *P. sicki* (SCHUBART, 1950)
" *Trichogonostreptus (Oreastreptus) mattogrossensis* (SILVESTRI, 1902)

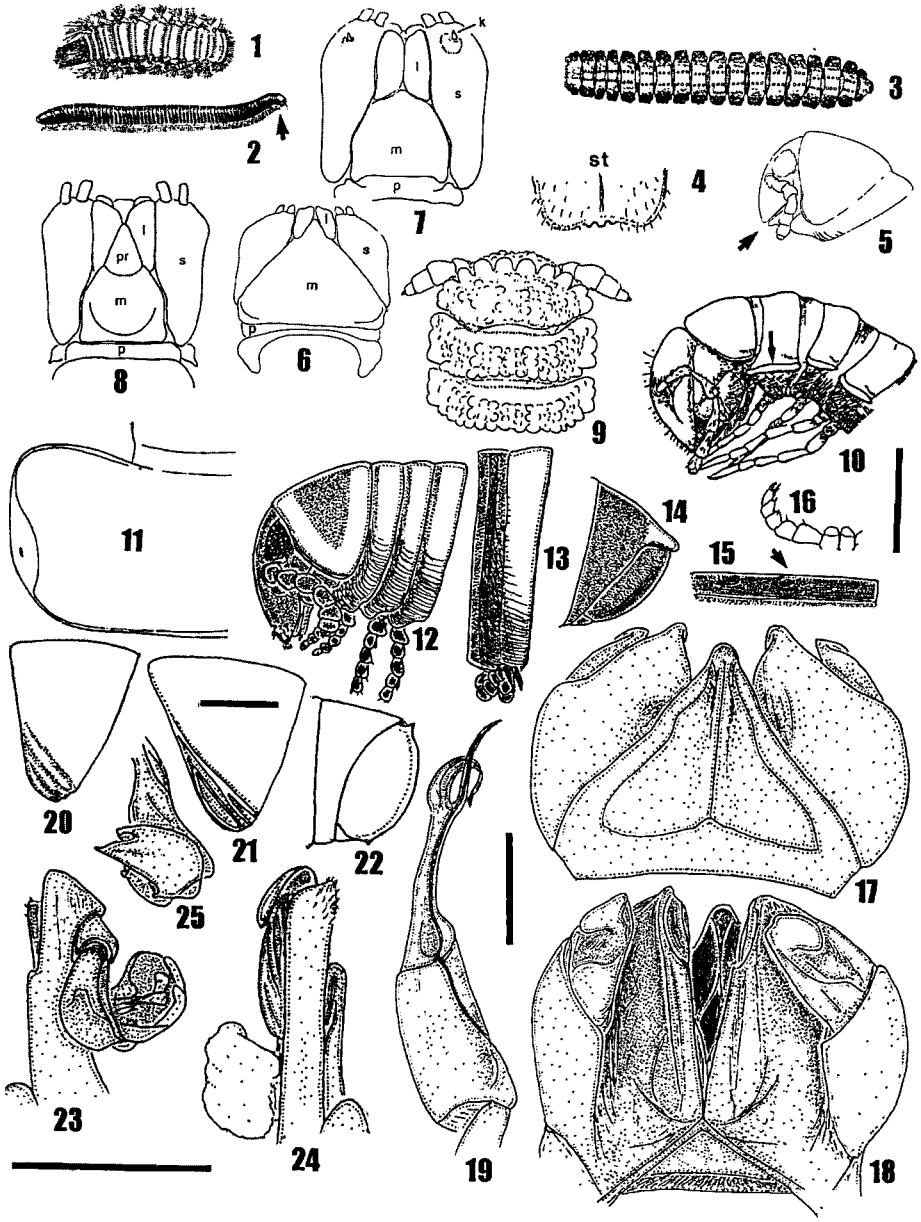
Order **Spirobolida**
Family Rhinocricidae
* *Anadenobolus* sp. 3
Order **Polydesmida**
Family Paradoxosomatidae
" *Orthomorpha coarctata* (DE SAUSSURE, 1860)
Family Chelodesmidae
* ?*Angelodesmus* sp.
* *Arthrosolenomeris* sp.
" *Brachyurodesmus* sp. 1
" *Brachyurodesmus* sp. 2 (aff. *parallelus*)
" *Corumbaia ordlandi* (SILVESTRI)
* Gen.nov., near *Vanzolegulus*
Order **Spirostreptida**
Family Spirostreptidae
" *Gymnostreptus* sp. 1

Family Spirostreptida
§ *Heteropyge paraguayensis* (SILVESTRI, 1895)
§§ *Orthoporus* aff. *americanus* (SILVESTRI, 1895)
$ *Trichogonostreptus (Oreastreptus mattogrossensis* (SILVESTRI, 1902)
$ *Urostreptus* sp. 1
" *Gymnostreptus* sp. 2
" *Gymnostreptus* sp. 3
" *Gymnostreptus* sp. 4
" *Oreastreptus* sp.
· *Plusioporus* sp. 1
* *Urostreptus* sp. 2
Family Pseudonannolenidae
*" *Pseudonannolene* sp.

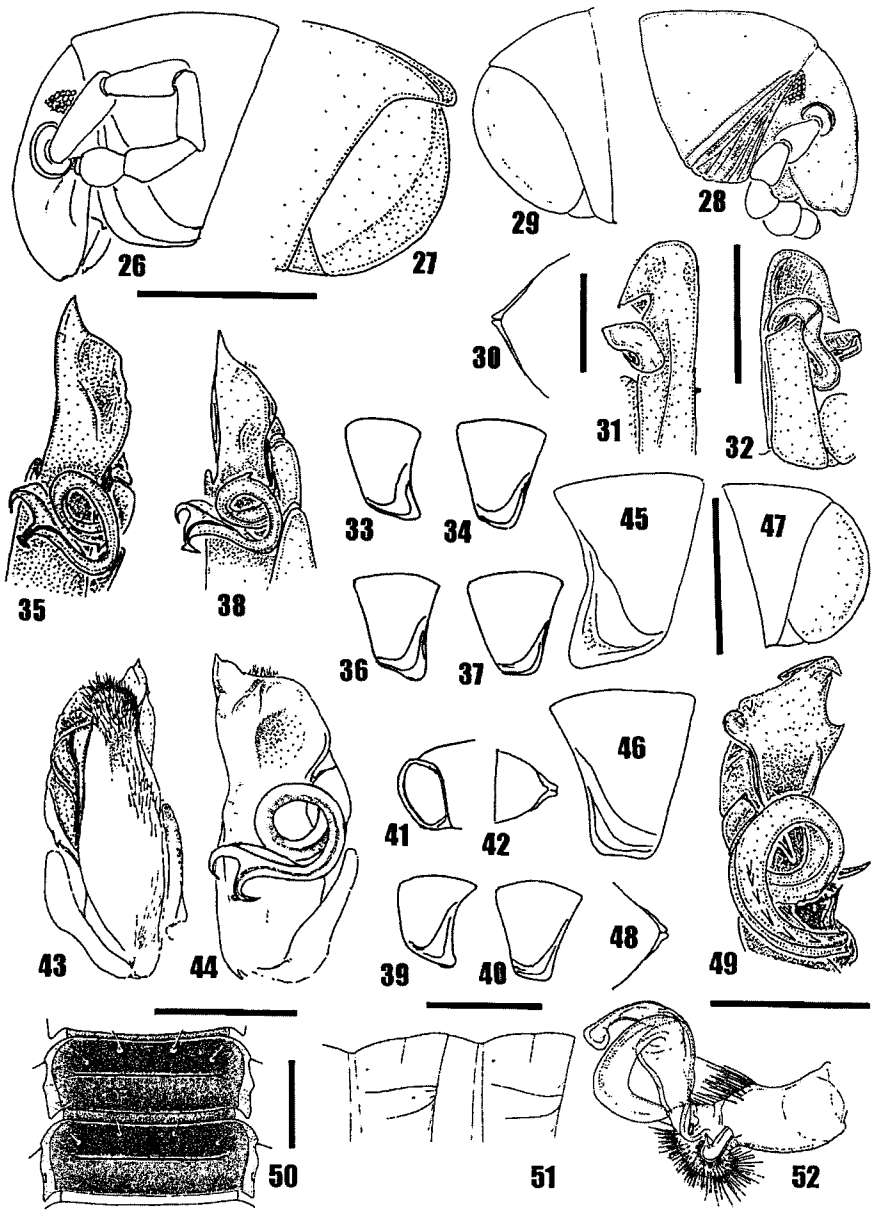


Map:

Map of the Pantanal and its catchment area and position of protected areas. **1** = PN Chapada dos Guimarães; **2** = RPPN-SESC Pantanal; **3** = EE Taiamã; **4** = RPPN Dorochê; **5** = PN do Pantanal; **6** = RPPN Acurizal; **7** = RPPN Penha; **8** = ANMI San Matias; **9** = Reserva Municipal del Valle de Tucavaca; **10** = PN-ANMI Otuquis; **11** = PN Rio Negro; **12** = PN Serra da Bodoquena. The small map indicates the position of the Pantanal in South America and the main biomes: **A** = Amazon forest; **B** = Cerrado; **C** = Caatinga; **D** = Atlantic forest; **E** = Chaco (from JUNK et al. 2005).



Figs. 1-25: For legend see page 288.



Figs. 26-52: For legend see page 288.

Figs 1-25:
1: Habitus drawing to illustrate species of Polyxenida (tufted); **2**: habitus drawing to illustrate species of Spirobolida and Spirostreptida (vermiform); **3**: habitus drawing to illustrate species of Polydesmida (with more or less pronounced lateral keels or swellings, or paraterga, on metatergites); **4**: median suture (**st**) on labrum below antennae in Spirobolida (exact position shown by arrow in Fig. 5); **5**: front body part of Spirobolida (to show roundish eye patches); **6, 7 & 8**: gnathochilarium of Spirbolida, Spirostreptidae and Pseudonannolenidae, respectively (homologous parts designated equally, exact position shown by arrow in Fig. 2); **9**: front body part of Pyrgodesmidae (including *Poratia* sp., to show collum, or tergite 1, to nearly completely cover the head dorsally); **10**: front body part of Paradoxosomatidae (arrow to show paratergite 2 lying considerably below collum); **11**: left half paratergite (= segment 5) of *Panztalodesmus marinezae* in dorsal view; **12-19**: *Anadenobolus* sp. 1, front body part (**12**), midbody segment (**13**) and telson (= last segment) (**14**) in lateral view (to show structure and colour pattern), right part of a midbody prozonite in dorsal view (to show scobinae; see arrow) (**15**), midbody leg (**16**), anterior gonopods (= leg-pair 8) (frontal and caudal views, respectively) (**17 & 18**) and left posterior gonopod (= leg 9), medial view (**19**); **20-25**: *Heteropyge paraguayensis*, lateral view of collum of male and female, respectively (to show striation patterns) (**20 & 21**), telson in lateral view (to show a dorsocaudal denticle on each paraproct) (**22**), left gonopod in frontal and caudal views, respectively, and calyx (= a scoop-shaped distalmost piece) in lateral view (**23-25**). Scale bars: 3.0 (12-16) and 1.0 mm (17-25).
Figs 1-5 & 6-10 after HOFFMAN et al. (2002); 11 after HOFFMAN (2000); 12-25 original.

Figs. 26-52:
26 & 27: *Urostreptus* sp., front body part (**26**) and telson (**27**) in lateral view (to show elongated antennae, striation pattern on collum and middorsal crest on epiproct); **28-32**: *Orthoporus* aff. *americanus*, front body part (**28**) and telson (**29 & 30**) in lateral and dorsal views, respectively (to show shorter antennae, striation pattern on collum, and a shorter and somewhat wider epiproct), and left gonopod (to show a modest and simple calyx); **33-44**: *Plusioporus salvadorii* from Serra do Amolar, MS (**33-35**), Pirizal, MT (**36-38**), and (? = *P. sicki*) Passo do Lontra, MS (**39-44**), collum of male (**33, 36 & 39**) and female (**34, 37 & 40**) in lateral view (to show striation patterns), telson (**41 & 42**) in lateral and dorsal views, respectively (to show more convex paraprocts and a short and relatively narrow epiproct), and left gonopod (**35, 38, 43 & 44**) in caudal (**35, 38 & 44**) and frontal views (**43**); **45-49**: *Trichogonostreptus (Oreastreptus) mattogrossensis*, collum of male (**45**) and female (**46**) (to show striation patterns), telson in lateral and dorsal views, respectively (**47 & 48**) (to show convex paraprocts and a short and wide epiproct), and right gonopod in caudal view (**49**) (to show a slender and spinigerous distal shaft devoid of a scoop); **50**: *Orthomorpha coarctata*, body segments 7 & 8 in dorsal view (to show relatively well-developed paraterga); **51 & 52**: *Promestosoma boggianii*, paraterga 10 and 11 in lateral view (**51**) (to show they are scarcely visible) and right gonopod in medial view (to show a large lateral process in distal part).
Scale bars: 3.0 (26, 27, 33, 34, 36, 37, 39-42), 2.0 (28-32, 45-48) and 1.0 mm (35, 38, 43, 44, 49 & 50).
Fig. 50 after SHELLEY & LEHTINEN (1998); 51 & 52 after JEEKEL (1965); 26-49: original.