

- MUMA, M. H. 1966a: Burrowing habits of some North American Solpugida (Arachnida). *Psyche, Camb.* **73**: 251–260.
- MUMA, M. H. 1966b: Egg deposition and incubation of *Eremobates durangonus* with notes on the eggs of other species of *Eremobates* (Arachnida: Solpugida). *Fla Ent.* **49**: 23–31.
- MUMA, M. H. 1966c: The life cycle of *Eremobates durangonus* (Arachnida: Solpugida). *Fla Ent.* **49**: 233–242.
- MUMA, M. H. 1967: Basic behavior of North American Solpugida. *Fla Ent.* **50**: 115–123.
- NØRGAARD, E. 1951: On the ecology of two lycosid spiders (*Pirata piraticus* and *Lycosa pullata*) from a Danish sphagnum bog. *Oikos* **3**: 1–21.
- PULZ, R. 1987: Thermal and water relations. In W. Nentwig (ed.), *Ecophysiology of spiders*: 26–55. Springer-Verlag, New York.
- PUNZO, F. 1989: Comparative temperature and water relations and hemolymph osmoregulation in the desert insects, *Taeniopoda eques* and *Schistocerca vaga* (Orthoptera, Acrididae). *Comp. Biochem. Physiol.* **93A**: 751–755.
- PUNZO, F. 1991: Intraspecific variation in response to thermal stress in the tarantula, *Dugesia echina* (Orthognatha, Theraphosidae). *Bull. Br. arachnol. Soc.* **8**(9): 277–283.
- PUNZO, F. & HUFF, G. 1989: Comparative temperature and water relations and the effects of thermal acclimation on *Tenebrio molitor* and *Tenebrio obscurus* (Coleoptera: Tenebrionidae). *Comp. Biochem. Physiol.* **93A**: 527–533.
- PUNZO, F. & JELLIES, J. 1983: Comparative water relations of araneid and lycosid spiderlings. *Comp. Biochem. Physiol.* **74A**: 981–988.
- PUNZO, F. & MUTCHMOR, J. A. 1980: Effects of temperature, relative humidity and period of exposure on the survival capacity of *Tenebrio molitor* (Coleoptera: Tenebrionidae). *J. Kans. ent. Soc.* **53**(2): 260–270.
- PUNZO, F. & ROSEN, L. 1984: Comparative temperature and water relations of *Tenebrio obscurus* larvae. *Comp. Biochem. Physiol.* **77A**: 779–785.
- SCHMOLLER, R. R. 1970: Terrestrial desert arthropods: fauna and ecology. *Biologist (Urbana)* **52**(3): 77–98.
- SEYMOUR, R. S. & VINEGAR, A. 1973: Thermal relations: water loss and oxygen consumption of a North American tarantula. *Comp. Biochem. Physiol.* **44A**: 83–96.
- SOKAL, R. R. & ROHLF, F. J. 1981: *Biometry*, 2nd ed. W. H. Freeman & Co., New York.
- TINKAM, E. R. 1948: Faunistic and ecological studies on the Orthoptera of the Big Bend Region of Trans Pecos Texas. *Am. Midl. Nat.* **40**: 521–563.
- WINSTON, P. W. & BATES, D. H. 1960: Saturated salt solutions for the control of relative humidity in biology research. *Ecology* **41**: 232–237.

Bull. Br. arachnol. Soc. (1994) **9** (8), 262–266

On the spider genus *Zimiromus* (Araneae: Gnaphosidae) in Central Amazonia

Antonio D. Brescovit

Museu de Ciências Naturais,
Fundação Zoobotânica do Rio Grande do Sul,
C.P. 1188, 90690-000 Porto Alegre, RS, Brazil

and

Hubert Höfer

Staatliches Museum für Naturkunde,
Erbprinzenstr. 13, 76042 Karlsruhe, Germany

Summary

We describe for the first time the male of *Zimiromus boistus* Platnick & Höfer, 1990 and the female of *Zimiromus beni* Platnick & Shadab, 1981, from a whitewater inundation forest near Manaus. A female from Bolivia, originally described as *Zimiromus beni*, is redescribed as *Zimiromus platnicki*, new species.

Introduction

The genus *Zimiromus* Banks, 1914 contains about forty neotropical species (Platnick & Shadab, 1976; 1979; 1981; Platnick & Höfer, 1990; Buckup & Brescovit, 1993). Platnick & Höfer (1990) described three *Zimiromus* species: *Z. atrifus*, *Z. boistus* (♀ only) and *Z. cristus*, from a blackwater inundation forest near Manaus. During further evaluation of material collected during the same ecological study (Höfer, 1990), we found males and females of two very similar, but different, species. The females of one species proved to be *Z.*

boistus Platnick & Höfer, 1990 and the males of the other species were *Z. beni* Platnick & Shadab, 1981. The male holotype of *Z. beni* was described from a specimen collected in the Beni department (Río Baures, Río Iténez), Bolivia. The original description included a female paratype collected near this locality (Pampa de Meio, Río Iténez). However, this female is not conspecific with either species from Manaus.

The whitewater inundation forest near Manaus was studied by an intensive ecological sampling programme, using various types of traps during a complete non-inundated period (Höfer, 1990). In spite of that we are unable to match males and females of the two species, because all males and females occurred in the same stratum (ground surface and tree trunks) within the same period (October to January). Therefore we propose the most parsimonious procedure and put the undescribed female together with the described male of *Z. beni* and the undescribed male together with the described female of *Z. boistus*. Both species belong to the same species group within the genus, characterised by a single short retrolateral tibial apophysis on the male palp and a distinct, but unstriated epigynal scape. The female originally described as *Z. beni* belongs to another species group, characterised by a striated epigynal scape, and is now redescribed as *Zimiromus platnicki*, new species.

Study area, methods and material

Spiders were collected in an area of approximately 2 ha of a whitewater-inundation forest (várzea) on the first island upstream from Manaus in the Rio Solimões. This island “Ilha da Marchantaria” is a traditional study area of the Max-Planck working group “Tropical

Ecology" and is described by Martius (1989). In most years the whole ground of the island is inundated for at least a few months.

Collections were made by circular pitfall traps (Platnick & Höfer, 1990), ground-photoelectors (emergence traps, see Adis, 1981) and arboreal funnel traps (Adis, 1981; Funke, 1971) during a whole non-inundated period (September 1987–March 1988).

Zimioromus specimens were found in all three trap types: six males of *Z. beni* were trapped between 9 October and 17 November 1987 by a circular pitfall trap with an imitation tree trunk, one male was caught by a circular pitfall trap without such an imitation trunk between 21 October and 3 November 1987, and one male between 11 and 18 December 1987 in an arboreal funnel trap 3 m above ground. Four females of *Z. beni* were caught in the pitfall trap with imitation trunk (21 September–17 November 1987). Males of *Z. boistus* appeared in the same circular pitfall traps between 15 October 1987 and 19 January 1988 (two males in the trap with imitation trunk, two males in the trap without imitation trunk). The female of *Z. boistus* was originally described from a specimen from the same area hand-collected on 24 November 1987 (Platnick & Höfer, 1990). Four females of *Z. boistus* were collected from inundated trees on the edge of a blackwater inundation forest at Rio Tarumã Mirim in May 1987. From October to December eight juvenile specimens appeared in ground-photoelectors and from January to February seven juveniles appeared in arboreal funnel traps. These juveniles could not be assigned to one of the two species.

The material examined is deposited in the following collections: AMNH, American Museum of Natural History, New York (N. Platnick); INPA, Instituto Nacional de Pesquisas da Amazônia, Manaus (C. Magalhães); SMNK, Staatliches Museum für Naturkunde, Karlsruhe (H. Höfer); MCN, Museu de Ciências Naturais, Fundação Zoobotânica do Rio Grande do Sul, Porto Alegre (E. Buckup); MZSP, Museu de Zoologia da Universidade de São Paulo (J. L. Leme). All measurements are in mm.

***Zimioromus beni* Platnick & Shadab, 1981 (Figs. 1–4, 9–11)**

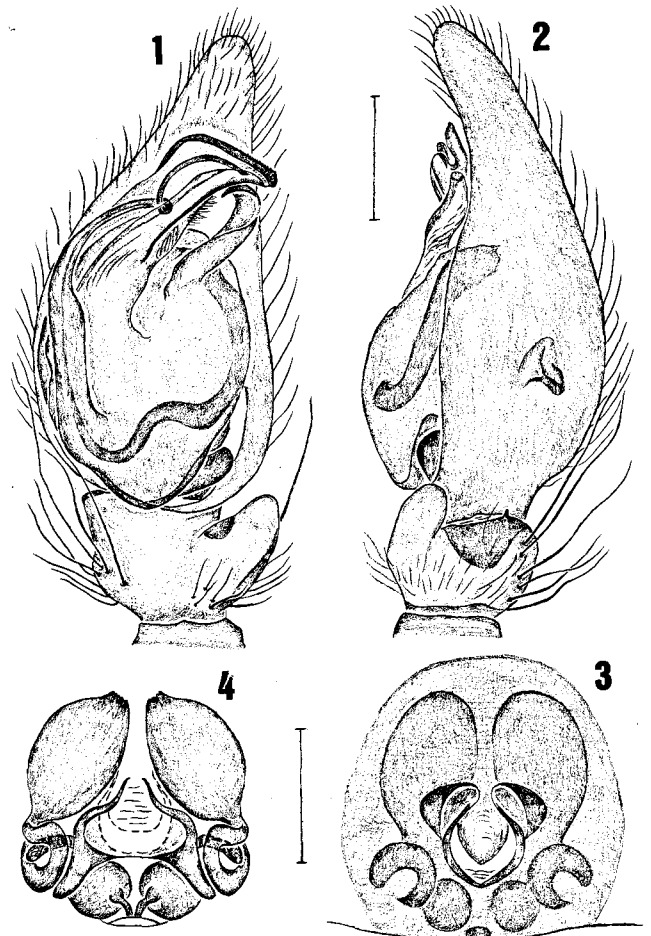
Zimioromus beni Platnick & Shadab, 1981: 195–196, figs. 21–22 (male holotype from mouth of Río Baures, Ró Iténez, El Beni, Bolivia, 29 September 1964, Bouseman and Lussenhop coll.) and figs. 23–24 (female paratype from Pampa de Meio, Río Iténez, El Beni, Bolivia, 10–14 September 1964; Bouseman and Lussenhop coll.), both deposited in AMNH, examined, in part, only the male. The female is here described as *Zimioromus platnicki*, new species.

Diagnosis: *Zimioromus beni* seems closest to *Z. lubricus* (Simon) (see Platnick & Shadab, 1976: 17, figs. 41–44), but males can be distinguished by the coiled embolus and a conductor with enlarged tip (Figs. 1–2, 10), females by a rounded epigynal atrium and a conical epigynal scape (Figs. 3–4).

Male (Ilha da Marchantaria, Rio Solimões): Total length 5.10. Carapace 2.10 long, 1.60 wide. Eye sizes and

interdistances: AME 0.17, ALE 0.18, PME 0.17, PLE 0.16; AME-AME 0.08, AME-ALE 0.03, PME-PME 0.07, PME-PLE 0.05, ALE-PLE 0.03; MOQ length 0.42, front width 0.40, back width 0.41. Leg formula 4123. Length I/II/III/IV: femora 1.90/1.70/1.60/2.10; patellae 0.90/0.80/0.70/0.90; tibiae 1.40/1.25/1.10/1.60; metatarsi 1.55/1.45/1.40/2.20; tarsi 1.05/0.90/0.75/0.90; total 6.80/6.10/5.55/7.70. Leg spination: femora I d1-1-1, II p0-1-1, r0-1-1, III r0-1-1, IV p0-1-1; tibiae I v2-2-1p, II p0, v2-2-1p; III-IV p1-1-0, r1-1-0; metatarsi III p0-1-1, v2-1r-1r, r0-1-1, IV p1-1-1, v1r-1r-1r, r1-0-1. Embolus coiled, conductor enlarged with serrated tip (Figs. 1, 9–10). Ventral lobe of retrolateral tibial apophysis rounded, dorsal lobe very small (Figs. 2, 11). Palpal femur with distal retrolateral rounded ledge, without tooth.

Female (same locality): Total length 5.60. Carapace 2.20 long, 1.70 wide. Eye sizes and interdistances: AME 0.15, ALE 0.18, PME 0.16, PLE 0.14; AME-AME 0.10, AME-ALE 0.03, PME-PME 0.10, PME-PLE 0.06, ALE-PLE 0.03; MOQ length 0.41, front width 0.40, back width 0.43. Leg formula 4123. Length I/II/III/IV: femora 2.00/1.90/1.60/2.25; patellae 0.90/0.80/0.75/1.00; tibiae 1.60/1.40/1.20/1.70; metatarsi 1.60/1.50/1.50/2.20; tarsi 1.05/1.00/0.80/1.00; total 7.15/6.60/5.85/8.15. Leg spination: femora I d1-1-1, II p0-1-1, r0-1-0, III r0-1-1, IV p0-1-1; tibiae I v2-2-1p, II p0, v2-2-1p, III-IV p1-1-0,



Figs. 1–4: *Zimioromus beni* Platnick & Shadab. 1 Male left palpus, ventral view; 2 Ditto, retrolateral view; 3 Epigynum, ventral view; 4 Ditto, dorsal view. Scale lines = 0.25 mm.

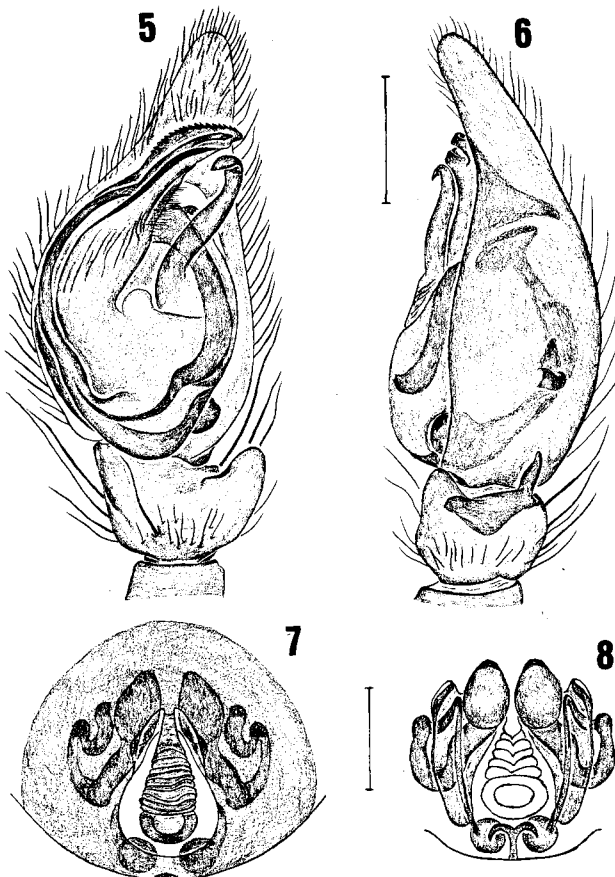
v1p-1p-2, r1-1-0; metatarsi III p0-1-1, v1p-1r-1r, r0-1-1, IV p0-1-1, r0-1-1. Epigynal scape unstriated, small, with conical tip and rounded atrium (Fig. 3). Median epigynal ducts short and folded (Fig. 4).

Material examined: Brazil: Amazonas, Rio Solimões, Ilha da Marchantaria (59° 58' W, 03° 15' S) from várzea inundation forest, 6♂ 4♀ (circular pitfall traps with imitation tree trunk), 21 September–17 November 1987, H. Höfer coll. (INPA; SMNK 976, 977, 978; MCN 22536, 22537, 22538), 1♂ (circular pitfall trap), 3 November 1987, H. Höfer coll. (INPA); 1♂ (arboreal eclector), 18 December 1987, H. Höfer coll. (INPA); Pará, Oriximina, Lago Jacupa, 1♂, 11 February 1967, H. Britski coll. (MZSP 11702); Bolivia: El Beni, Río Iténez, Río Baures, 1♂ (holotype), 29 September 1964, Bouseman and Lussenhop coll. (AMNH).

Distribution: Pará and Amazonas, northern Brazil and Bolivia.

***Zimiromus boistus* Platnick & Höfer, 1990 (Figs. 5–6, 12–14)**

Zimiromus boistus Platnick & Höfer, 1990: 8–10, figs. 17, 18 (female holotype from várzea inundation forest on Ilha da Marchantaria, Rio Solimões, Amazonas, Brazil, 24 November 1987, H. Höfer coll. (INPA), examined.



Figs. 5–6: *Zimiromus boistus* Platnick & Höfer. 5 Male left palpus, ventral view; 6 Ditto, retrolateral view. Scale lines = 0.25 mm.

Figs. 7–8: *Zimiromus platnicki*, new species, female holotype. 7 Epigynum, ventral view; 8 Ditto, dorsal view. Scale lines = 0.25 mm.

Diagnosis: *Zimiromus boistus* seems closest to *Z. iotus* (Banks) (see Platnick & Shadab, 1976: 11, figs. 21–22) but can be distinguished by the long and narrow conductor, with serrated tip (Figs. 5, 13).

Male (Ilha da Marchantaria, Rio Solimões): Total length 4.50. Carapace 2.00 long, 1.60 wide. Eye sizes and interdistances: AME 0.15, ALE 0.15, PME 0.17, PLE 0.13; AME-AME 0.07, AMB-ALE 0.03, PME-PME 0.05, PME-PLE 0.05, ALE-PLE 0.03; MOQ length 0.38, front width 0.37, back width 0.41. Leg formula 4123. Length I/II/III/IV: femora 1.70/1.55/1.40/2.00; patellae 0.80/0.75/0.60/0.80; tibiae 1.40/1.20/1.00/1.50; metatarsi 1.45/1.30/1.20/1.90; tarsi 0.90/0.85/0.70/0.85; total 6.25/5.65/4.90/7.05. Leg spination: femora I d1-1-1; III r0-1-1; IV p0-1-1; tibiae II p0, v1r-1r-1p; III-IV p1-1-0, r1-1-0; metatarsi III p1-1-0, v1p-1r-1p; r1-1-0; IV p1-1-1, r1-1-0. Palpal conductor with serrated tip, median apophysis relatively long (Figs. 5, 12–13). Retrolateral tibial apophysis with short dorsal prong widely separated from ventral lobe (Figs. 6, 14). Palpal femur with distal retrolateral rounded ledge.

Female: Described by Platnick & Höfer (1990).

Material examined: Brazil: Amazonas, Rio Solimões, Ilha da Marchantaria, 4♂, 15 October 1987–19 January 1988, H. Höfer coll. (pitfall traps) (INPA; SMNK 979; MCN 23021).

Distribution: Known only from Amazonas, Brazil.

***Zimiromus platnicki*, new species (Figs. 7–8)**

Zimiromus beni Platnick & Shadab, 1981: 195–196, figs. 23–24 (female only).

Type: Female holotype from Bolivia: Pampa de Meio, Río Iténez, El Beni, 10–14 September 1964, Bouseman and Lussenhop coll., deposited in AMNH.

Etymology: The specific name is a patronym in honour of Dr Norman I. Platnick, who first described the specimen.

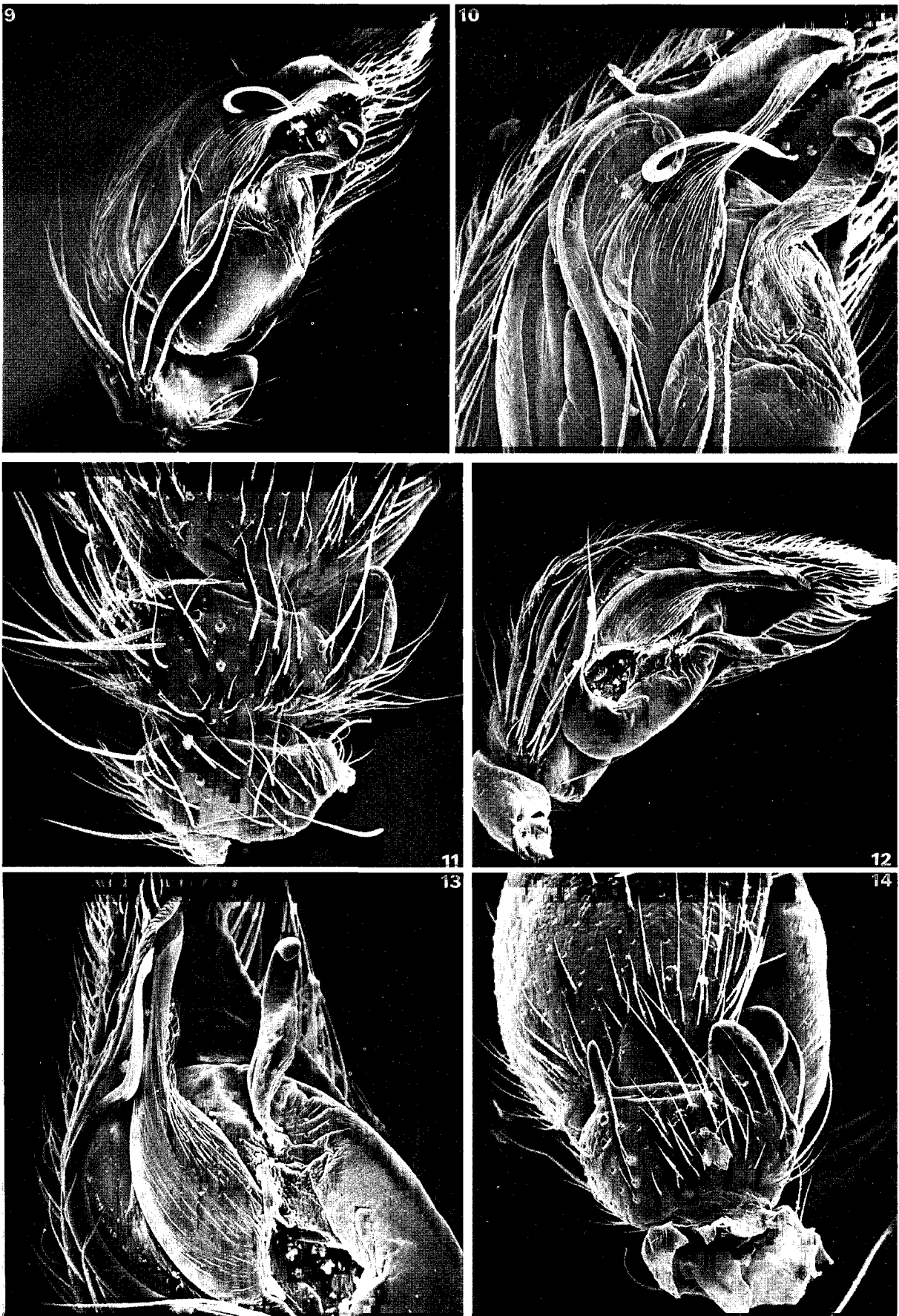
Diagnosis: *Zimiromus platnicki* seems closest to *Z. eberhardi* Platnick & Shadab (see Platnick & Shadab, 1976: 10, figs. 19–20) but can be distinguished by the smaller spermathecae (Fig. 7).

Female (holotype): Total length 5.80. Carapace 2.10 long, 1.60 wide. Eye sizes and interdistances: AME 0.11, ALE 0.12, PME 0.13, PLE 0.12; AME-AME 0.12, AME-ALE 0.04, PME-PME 0.08, PME-PLE 0.05, ALE-PLE 0.04; MOQ length 0.40, front width 0.38, back width 0.58. Leg formula 4123. Length I/II/III/IV: femora 1.90/1.70/1.50/2.00; patellae 1.00/0.90/0.80/1.05; tibiae 1.50/1.20/1.00/1.60; metatarsi 1.50/1.30/1.30/2.00; tarsi 1.15/0.85/0.80/1.25; total 7.05/5.95/5.40/7.90. Leg spination: femora III r0-1-1; IV p0-1-1; tibiae IV d1-1-0; metatarsi III v2-1r-1p; IV v1p-2-1p. Epigynal scape striated, widest posteriorly (Fig. 7). Spermathecae small, connected by long and coiled ducts (Fig. 8).

Material examined: Only the holotype from Bolivia.

Ecology

Ground emerged from below water at the beginning of September 1987 on Ilha da Marchantaria. Most



Figs. 9–11: *Zimiromus beni* Platnick & Shadab. 9–10 Male left palpus, ventral view; 11 Retrolateral tibial apophysis, prolateral view, arrow indicates dorsal lobe.

Figs. 12–14: *Zimiromus boistus* Platnick & Höfer. 12–13 Male left palpus, ventral view; 14 Retrolateral tibial apophysis, prolateral view.

Zimiromus specimens (adults) appeared in October and November. Males were captured in larger numbers, probably because of their high activity during the search for females. By the time that the ground was inundated in February 1988, juveniles of the new generation seem to have already migrated to the trunk region. Only one adult was caught in two arboreal funnel traps. Both species were active on the ground surface during the non-inundated period, reproduced there in October/November and migrated to the trunk area several weeks before water reached the forest floor. This is more or less the same life cycle as for *Z. atrifus* in a blackwater inundation forest (Platnick & Höfer, 1990). The two species of *Zimiromus* are obviously identical in external morphology, apart from the described differences in the sexual organs. They are practically the same size and showed no difference in their life histories. They seem to use the same space during the same time. There may be unrevealed differences in how they use these resources, avoiding interference and competition; or, more likely, the main resources — food and space — are not limited in this habitat. Space may be sufficient for the two species even during inundation, because of their observed low relative abundance (total catch of both: 32 ind.=1.7% of all spiders). Food also seems to be sufficiently available, at least during inundation, when arthropods concentrate on the resting area and high activity of insects emerging from the litter occurs (Adis, 1981; pers. obs.). Predation by other spiders and by vertebrates and invertebrates may also play an important role in preventing competition.

During a comparative study of a blackwater inundation forest at Tarumã Mirim (Höfer, 1990) three species of *Zimiromus* were observed: *Z. atrifus*, *Z. boistus* and *Z. cristus*, but only *Z. atrifus* was frequent (131 ind.=1.0% of all spiders) in the samples. The only three specimens of *Z. cristus* were caught in 1976 and the only four females of *Z. boistus* were collected on the edge of the study site of Tarumã Mirim. In a terra firme forest (Reserva Ducke) none of these species was observed during a one-year sampling period using the same methods, but five other species of the genus were taken (pers. obs.).

Acknowledgements

The ecological study was financed by the German Max-Planck-Society. We are grateful for the research permit and facilities during this project, provided by INPA (Instituto Nacional de Pesquisas da Amazônia) and the working group "Tropical Ecology" of the Max-Planck-Institut für Limnologie, Plön. We thank especially the technical staff at INPA, Manaus, for valuable help in the field. We thank Alexandre Bonaldo, Erica Buckup and Dr Norman Platnick for comments on the manuscript and Dr Platnick for the loan of the types of *Z. beni*.

References

- ADIS, J. 1981: Comparative ecological studies of the terrestrial arthropod fauna in Central Amazonian Inundation-Forests. *Amazoniana* **7**(2): 87–173.
- BANKS, N. 1914: Notes on some Costa Rican Arachnida. *Proc. Acad. nat. Sci. Philad.* **65**: 676–687.
- BUCKUP, E. H. & BRESCOVIT, A. D. 1993: Aranhas do gênero *Zimiromus*, seis novas espécies do Brasil (Araneae, Gnaphosidae). *Revta bras. Ent.* **37**: 181–187.
- FUNKE, W. 1971: Food and energy turnover of leaf-eating insects and their influence on primary production. *Ecol. Stud.* **2**: 81–93.
- HÖFER, H. 1990: The spider community (Araneae) of a Central Amazonian blackwater inundation forest (igapó). *Acta zool. fenn.* **190**: 173–179.
- MARTIUS, C. 1989: *Untersuchungen zur Ökologie des Holzabbaus durch Termiten (Isoptera) in zentralamazonischen Überschwemmungswäldern (Várzea)*. 1–285. Dissertation, AFRA, Frankfurt a.M.
- PLATNICK, N. I. & HÖFER, H. 1990: Systematics and ecology of ground spiders (Araneae, Gnaphosidae) from Central Amazonian inundation forests. *Am. Mus. Novit.* **2971**: 1–16.
- PLATNICK, N. I. & SHADAB, M. U. 1976: A revision of the neotropical spider genus *Zimiromus*, with notes on *Echemus* (Araneae, Gnaphosidae). *Am. Mus. Novit.* **2609**: 1–24.
- PLATNICK, N. I. & SHADAB, M. U. 1979: A revision of the neotropical spider genus *Echemoides*, with notes on other echemines (Araneae, Gnaphosidae). *Am. Mus. Novit.* **2669**: 1–22.
- PLATNICK, N. I. & SHADAB, M. U. 1981: New species and records of neotropical Gnaphosidae (Arachnida, Araneae). *Bull. Am. Mus. nat. Hist.* **170**(1): 189–196.