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Gibocercus Szumik and *Biguembia* Szumik (Embioptera, Archembiidae): new species and the potentiality of female traits

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Abstract

Two new species of *Biguembia* Szumik (*B. mirador* **n. sp.** and *B. troncol* **n. sp.**) and one new species of *Gibocercus* Szumik (*G. podamita* **n. sp.**) from Brazil are described and illustrated. The female of *Gibocercus chaco* Szumik is described for the first time. Female terminalia of both genera are redefined and redescribed for *B. copo*, *G. chaco* and *G. beni*. Additionally, a cladistic analysis using almost 100 morphological characters was developed. Both genera appear monophyletic and well supported by several synapomorphies. The results also indicate that some species are unjustified and therefore they are synonymized: *Gibocercus magnus* Ross, 2001 = *Gibocercus beni* Szumik, 1997; *Gibocercus flavipes* Ross, 2001 = *Gibocercus nanai* Szumik, 1997; *Gibocercus napoa* Ross, 2001 = *Gibocercus sandrae* Ross, 2001, all new synonymies. The relationships of the new species are discussed as well as the potentiality of female traits.

Key words: Webspinners, Neotropical, Archembiidae, taxonomy, cladistic analysis

Introduction

The South American embiopteran genera *Gibocercus* Szumik, 1997 and *Biguembia* Szumik, 1997 were originally described for four and two species, respectively, from Argentina, Bolivia, Brazil and Peru. These species are quite rare in collections, related (according to our experience in the field) to the apparent fact that they are also uncommon in nature. They are very specific for biogeographic regions that are not well conserved, as in the case of the dry Chaco in Argentina, where *Gibocercus chaco* Szumik, 1997 lives. The formal descriptions of these species with a few specimens was clearly supported by the unique characteristics of these genera. In that opportunity, a cladogram showing the monophyly and the relationships of both genera with their counterparts was presented (Fig. 1). At that time these genera were part of the polyphyletic family Embiidae (see Szumik 1997:140). A few years later Ross (2001) added five new species to *Gibocercus* and one to *Biguembia*, resulting in a near-doubling of the known species. Later, a cladistic analysis focused on the delimitation of the Neotropical Embiidae was carried out; both of these South American genera plus some African genera were transferred to the new family Archembiidae (Szumik 2004). Subsequently, an analysis on the whole order (Szumik *et al*. 2008) indicated that both genera continued to be monophyletic and sister groups to each other (Fig. 2). However, not all of the species of *Gibocercus* and *Biguembia* were included in the analyses. There is no doubt regarding the monophyly of the two genera but the intrageneric relationships were not well-understood. With the addition of three new species, as well as new evidence from female terminalia, an inclusive cladistic analysis of both genera is presented here.

Materials and methods

The material from Brazil used here was offered for study by Dr. José Rafael (deposited at Instituto Nacional de Pesquisas da Amazônia, INPA) and the material from Argentina was collected during the last 20 years for Szumik and her students (deposited at Instituto – Fundación Miguel Lillo, IFML).

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All measurements are given in millimeters. Ocular ratio (OR) is defined as in Szumik (1991); features of the wing base union are presented in Szumik (1996). The abbreviations used are: Mm, mentum; Sm, submentum; 10L, tenth left hemitergite; 10R, tenth right hemitergite; 10Lp1, caudal process of the 10L; 10Rp1, caudal process of the 10R; 10Rp2, anterior process of the 10R; Ep, epiproct; Lpp, left paraproct; Rpp, right paraproct; H, hypandrium or 9º sternite; Hp, process of H; LC1, basal left cercus; LC1dp, distal process of LC1; LC1bp, basal process of LC1; LC2, caudal left cercus; 1ºVfs, rudiments of first valvifers; 2ºVfs, rudiments of second valvifers.

The data matrix consisted of 96 morphological characters for 20 taxa (Tables 1, 2). For the root, four taxa were selected: one species of Clothodidae, *Clothoda nobilis* (Gerstaecker, 1888) and three species of Archembiidae, *Archembia kotzbaueri* (Navás, 1925), *Pararhagadochir trinitatis* (De Saussure, 1896) and *Pararhagadochir trachelia* (Navás, 1925). The program used for the cladistic analysis was TNT ver. 1.5 (Goloboff *et al.* 2003a; 2008; Goloboff & Catalano 2016), the algorithms used for searching for the optimal trees were new technology (Goloboff 1999) and the analysis was stopped when the optimal trees were hit 20 times. Three measures of group support were used: absolute and relative Bremer Support using TBR from optimal tree (Goloboff & Farris 2002) and 300 replications of symmetric resampling using group frequencies difference (Goloboff *et al.* 2003b).

TABLE 1. List of 96 morphological characters used in a cladistics analysis of *Gibocercus* and *Biguembia.*

No.	Character states
0	Number of molar teeth on left and right mandibles. (0) 2–1; (1) 1–1.
1	Interocular elliptical area (males, additive). (0) inconspicuous; (1) present, lightly depigmented area; (2) present, strongly depigmented area.
2	Interocular elliptical area (females, additive). (0) inconspicuous; (1) present, lightly depigmented area; (2) present, strongly depigmented area.
3	Anterior margin of the clypeus (males). (0) concave; (1) straight.
4	Epistomal sulcus (males). (0) discontinuous; (1) continuous.
5	Ecdysial suture (males). (0) as a pigmented line; (1) absent.
6	Ecdysial suture (females, additive). (0) as a strong keel; (1) as a pigmented line; (2) absent.
7	Postocular suture (males, additive). (0) nocks; (1) partial suture (inconspicuous on the anterior half of the head); (2) suture full developed.
8	Postocular suture (females, additive). (0) absent; (1) notched; (2) partial suture (inconspicuous on the anterior half of the head); (3) suture full developed.
9	Apical antennomere pigmentation (male). (0) unpigmented; (1) uniformly pigmented.
10	Apical antennomere pigmentation (female). 0) unpigmented; (1) uniformly pigmented.
11	Prothorax pigmentation (male). (0) unpigmented; (1) pigmented.
12	Prothorax pigmentation (female). (0) unpigmented; (1) pigmented.
13	Mm sclerotized. (0) no; (1) yes.
14	Anterior margin of Sm. (0) membranous, not well defined; (1) straight and well defined; (2) concave.
15	Sm, base. (0) broad, wider than anterior margin; (1) narrow, same width as anterior margin.
16	Sm pilose. (0) no; (1) yes.
17	Sm surface (additive). (0) two deep concavities; (1) a shallow concavity; (2) not concave.
18	C2 pigmented. (0) unpigmented; (1) same as C1.
19	Mesoacrotergite (additive). (0) one plate; (1) partially divided; (2) divided into two plates.
20	Medial bladder size (male). (0) large, more than 50% of the width of the basitarsus; (1) small, less than 40% of the width of the basitarsus.
21	Medial bladder position (male, additive). (0) basal; (1) medial, (2) apical.
22	Medial bladder position (female, additive). (0) basal; (1) medial, (2) apical.
23	Hind basitarsus (male). (0) broad; (1) narrow.
24	Hind basitarsus number of anterolateral rows of setae (male, additive). (0) one; (1) two; (2) three; (3) four; (4) five.

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TABLE 1. (Continued)

No.	Character states
25	Hind basitarsus number of retrolateral rows of setae (male, additive). (0) none; (1) one; (2) two.
26	Hind basitarsus number of anterolateral rows of setae (female, additive). (0) one; (1) two; (2) three; (3) four; (4) five; (5) six; (6) seven; (7) eight.
27	Hind basitarsus number of retrolateral rows of setae (female, additive). (0) none; (1) one; (2) two; (3) three.
28	Cu forked (additive). (0) no; (1) yes, with 2 veins; (2) yes, with 3 veins.
29	Cua forked (additive). (0) absent; (1) unforked; (2) yes, 2 veins; (3) yes, three veins.
30	Cross-veins present between R1-Rs. (0) no; (1) 1; (2) 2; (3) 3; (4) 4; (5) 5; (6) 6 ; (7) 7.
31	Cross-veins present between Rs-Ma. (0) no; (1) 1; (2) 2; (3) 3.
32	Cross-veins present between Rs-Ma1. (0) no; (1) 1; (2) 2; (3) 3; (4) 4; (5) 5.
33	Cross-veins present between Ma-Mp. (0) no; (1) 1; (2) 2; (3) 3; (4) 4; (5) 5.
34	Cross-veins present between Ma1-Ma2. (0) no; (1) 1; (2) 2.
35	Cross-veins present between Ma2-Mp. (0) no; (1) 1; (2) 2.
36	Cross-veins present between Mp-Cua. (0) no; (1) 1; (2) 2; (3) 3.
37	Ma1 degree of development (additive). (0) conspicuous; (1) same but only on the basal 2/3; (2) same but only on the basal 1/3; (3) no, diffuse.
38	Ma2 degree of development (additive). (0) conspicuous; (1) same but only on the basal 2/3; (2) same but only on the basal 1/3; (3) no, diffuse
39	Mp degree of development (additive). (0) conspicuous; (1) same but only on the basal 2/3; (2) same but only on the basal 1/3.
40	Cua degree of development (additive). (0) conspicuous; (1) same but only on the basal 2/3; (2) same but only on the basal 1/3; (3) no, diffuse.
41	Anal. (0) conspicuous; (1) diffuse.
42	Ma1 reaching wing edge. (0) no; (1) yes.
43	Ma2 reaching wing edge. (0) no; (1) yes.
44	Mp reaching wing edge. (0) no; (1) yes.
45	Cua reaching wing edge. (0) no; (1) yes.
46	Abdominal laterotergite (male). (0) one plate; (1) two plates.
47	Abdominal laterotergite (female). (0) one plate; (1) two plates.
48	Central plate prominent. (0) no; (1) yes.
49	1ºVfs (additive). (0) inconspicuous, differentiated from central plate by the degree of pigmentation (1) partially differentiated from central plate; (2) well developed and clearly separate from the central plate.
50	2ºVfs. (0) membranous band; (1) sclerotized band.
51	Secondary gland with a basal pouch. (0) conspicuous; (1) inconspicuous.
52	Longitudinal ratio between basal and apical left cerci. (0) apical longer than basal left cerci; (1) both with the same length.
53	Cerci length related to 10º tergite. (0) longer; (1) normal.
54	Distal process of LC1 quadrangular. (0) no; (1) yes
55	LC1dp conical. (0) no; (1) yes.
56	Position of LC1dp. (0) apical; (1) medial.
57	LC1dp depressed. (0) no, (1) yes.
58	Semiglobose convexity on dorsal LC1. (0) present; (1) absent.
59	Basal nodule on left cercus. (0) absent; (1) present, with setae.
60	Rp2 (additive). (0) absent, (1) present, as a small node; (2) present, well developed.
61	10Rp2 with longitudinal and laminate keels. (0) no; (1) yes.

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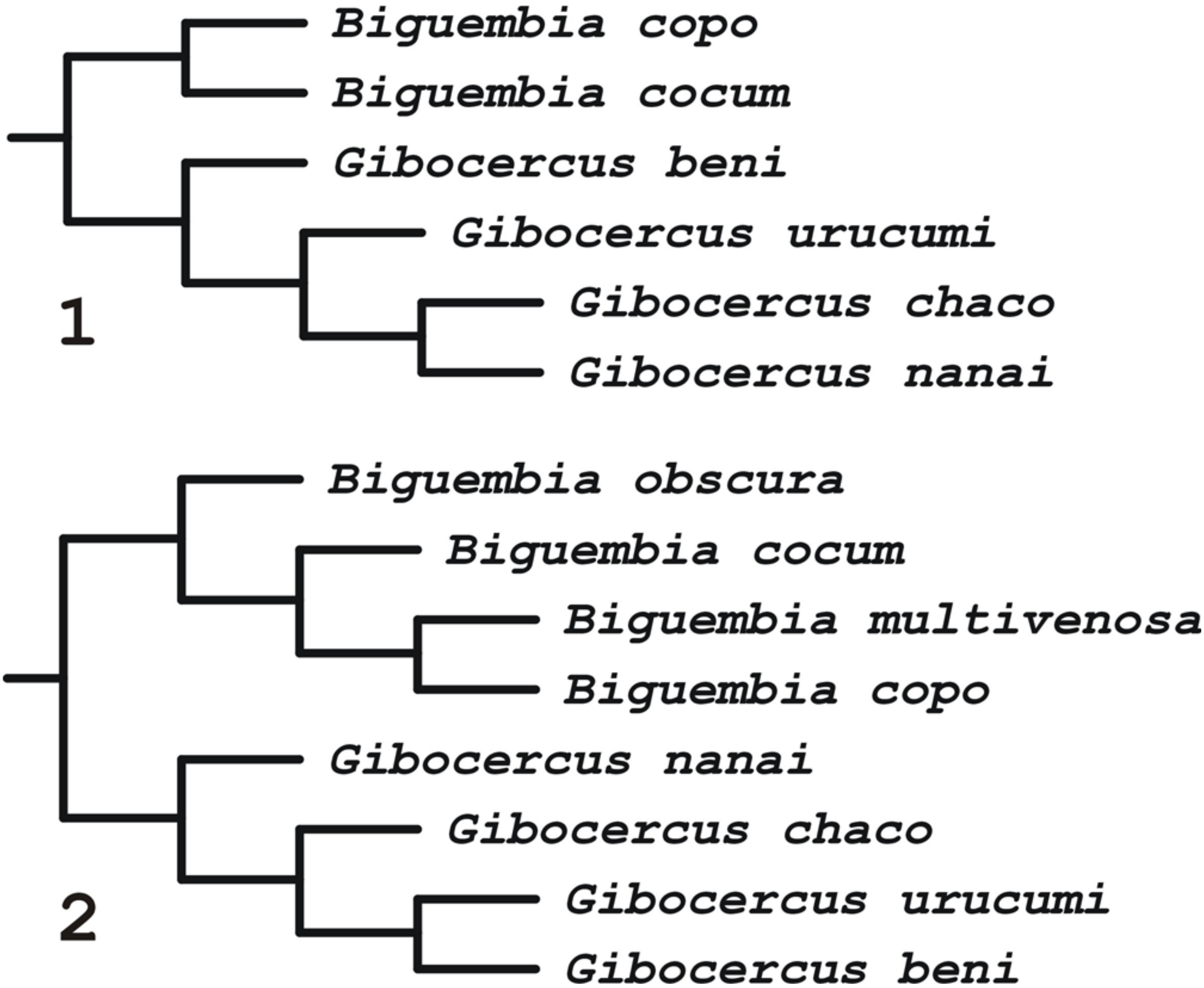
TABLE 1. (Continued)

No.	Character states
62	Basal area of 10R membranous (additive). (0) no; (1) yes, but only a small area; (1) yes, but a larger area.
63	Rp2 shape. (0) flap-like; (1) stick-like.
64	10Rp2 broad and discoidal. (0) no; (1) yes.
65	Inner basal angle of 10L excavate. (0) no; (1) yes.
66	Caudal margin of 10L. (0) straight; (1) concave.
67	10Lp1. (0) absent; (1) small lobe; (2) bare complex.
68	10Lp1 trait (see Szumik 2004, additive). (0) absent; (1) flat and straight stick; (2) internal hook and flat lobe separated; (3) internal and external tips longer and conical; (4) inner tip broad and sclerotized and outer reduced; (5) same as (4) but internal tip hyperdeveloped.
69	10Lp1 base. (0) absent; (1) short; (2) longer.
70	Depression between 10Lp and 10L. (0) no; (1) yes.
71	10Rp1 with an acute, sharp and well sclerotized apex (see Szumik, 2004, additive). (0) no; (1) yes; (2) but dorsal tip well developed.
72	Base of 10Rp1 prolonged. (0) no; (1) yes
73	Microtrichia in 10Rp1. (0) no; (1) yes.
74	10Rp1 with a basal dome. (0) no; (1) yes.
75	Node with microtrichia between LC1 and 10L. (0) no; (1) yes.
76	Lpp shape. (0) partially membranous; (1) a well sclerotized plate.
77	Internal caudal angle of Lpp (additive). (0) without a process; (1) with a prominent node; (2) with a flat hook.
78	Microtrichia in Lpp. (0) no; (1) yes.
79	Hp well developed, starts in the middle of H. (0) yes; (1) yes, conspicuous but starting on the right side of the H; (2) yes, conspicuous but starting on the left side of the H.
80	Hp with transversal keels. (0) no; (1) yes.
81	Shape of Ep (additive). (0) inconspicuous; (1) broad and sclerotized plate; (2) narrow sclerotized band, sticklike
82	Ep elevated caudally. (0) no; (1) yes.
83	Abdominal lateral white band (females). (0) no; (1) yes.
84	Size sexual dimorphism (additive). (0) same length; (1) males small (4/5 of the female length); (2) males very small (less than 3/5 of the female length).
85	Membranous area around 10Rp2 with microtrichia. (0) no; (1) yes.
86	Proportion of outer and inner tips of 10Lp. (0) subequal; (1) outer shorter than inner tip; (2) inconspicuous.
87	Inner node shape LC1. (0) absent; (1) conspicuous; (2) differentiated by the setae.
88	Dorsal keels on RP1. (0) no; (1) yes.
89	Keels on inner tip of 10Lp1. (0) no; (1) yes.
90	Male edges. (0) OP>0.50; (1) OP<0.6.
91	Lpp hyperdeveloped. (0) no; (1) yes
92	10Lp1 turned obliquely. (0) yes; (1) no.
93	Lpp node caudally prolonged. (0) yes; (1) no.
94	Inner edge of 10R strongly well sclerotized. (0) no; (1) yes.
95	Open longitudinal channel on inner tip of 10Lp1. (0) no; (1) yes.

Results

Cladistic results. Two optimal trees were obtained (consensus tree, Fig. 3) with a length of 330 steps. Both genera appeared monophyletic, and as sister groups of each other were well supported (Fig. 4). The synapomorphies that support *Biguembia* + *Gibocercus* are male abdominal laterotergite divided into two plates (ch. 46); female 8º sternite hyperdeveloped (ch. 48); tips of 1ºVfs free (ch. 49); 2ºVfs as a well sclerotized and conspicuous band (ch. 50); female secondary gland conspicuous (ch. 51); keels on 10Rp2 present (ch. 61); 10Lp forked with internal and external tips conical (ch. 68); depression between 10Lp and 10L present (ch. 70); base of 10Rp1 prolonged, longer than length of 10R (ch. 71); convexity on base of 10Rp1 present (ch. 72); male OR more than 0.5 (ch. 90) and node of Lpp caudally projected (ch. 93). The internal relationships, as well as the synapomorphies of each genus, are discussed below.

Female terminalia traits. The three most conspicuous traits of female terminalia (ch. 49–51) listed above are clear unique conditions of both genera regarding the rest of the order. Although the females of some species of *Gibocercus* and *Biguembia* are unknown, the female terminalia are quite conservative at species level, making it possible to characterize them according to these few cases. The 1ºVfs (Figs. 5–7) appear almost free, well developed with a membranous and globose tip. The central plate is hyperdeveloped, clearly distinguishable from the 1ºVfs (Fig. 5), and entirely depigmented with the caudal edge more sclerotized. The 2ºVfs (Fig. 6) is a conspicuous broad band, extremely sclerotized on the caudal edge and with a central and square plate more or less sclerotized where the spermathecal oviduct opens (according to terminology of Klass & Ulbricht 2009). The secondary gland (which opens on the anterior margin of the 9º sternite) is not visible and perhaps absent in this group. In the other genera of Archembiidae 1ºVfs is not well defined and free, the 2ºVfs is a regular membranous band and the secondary gland is always clearly visible.



FIGURES 1–2. *Gibocercus* and *Biguembia* relationships. 1. According to Szumik (1997); 2. According to the phylogeny of Embioptera in Szumik *et al.* (2008).

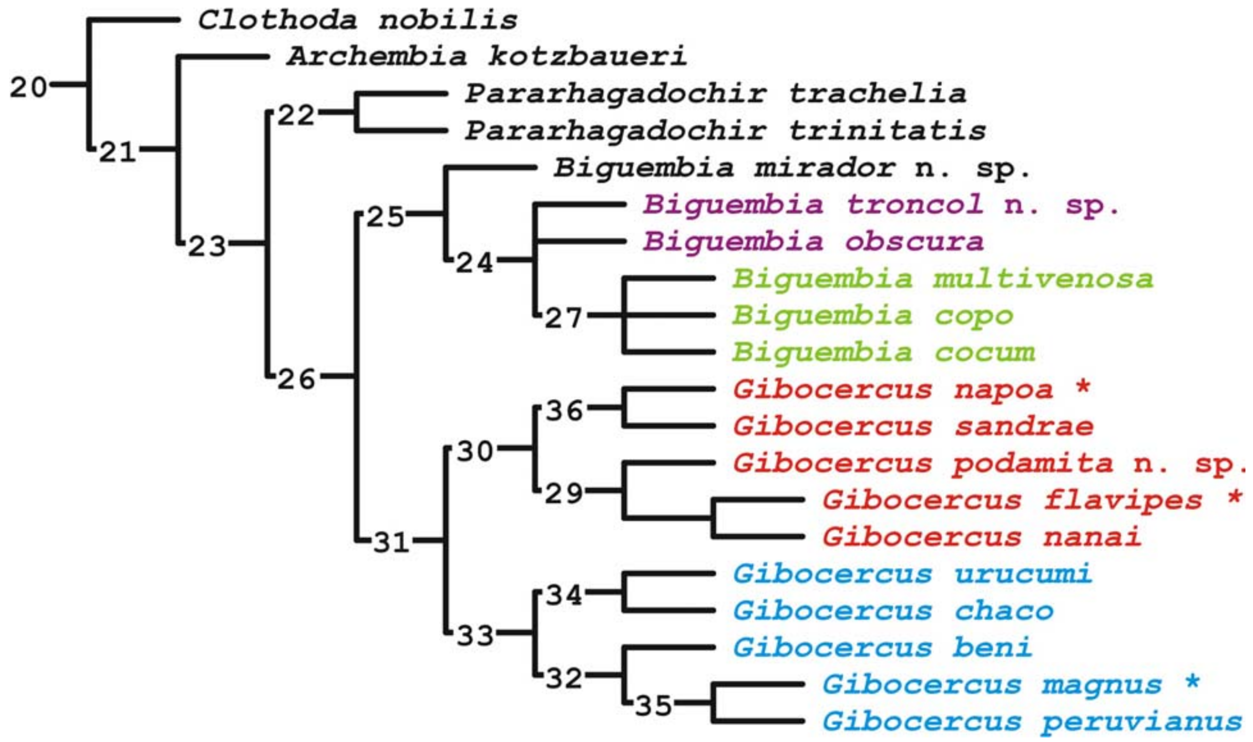


FIGURE 3. Consensus tree of the two optimal trees. Asterisks (*) indicate junior synonyms.

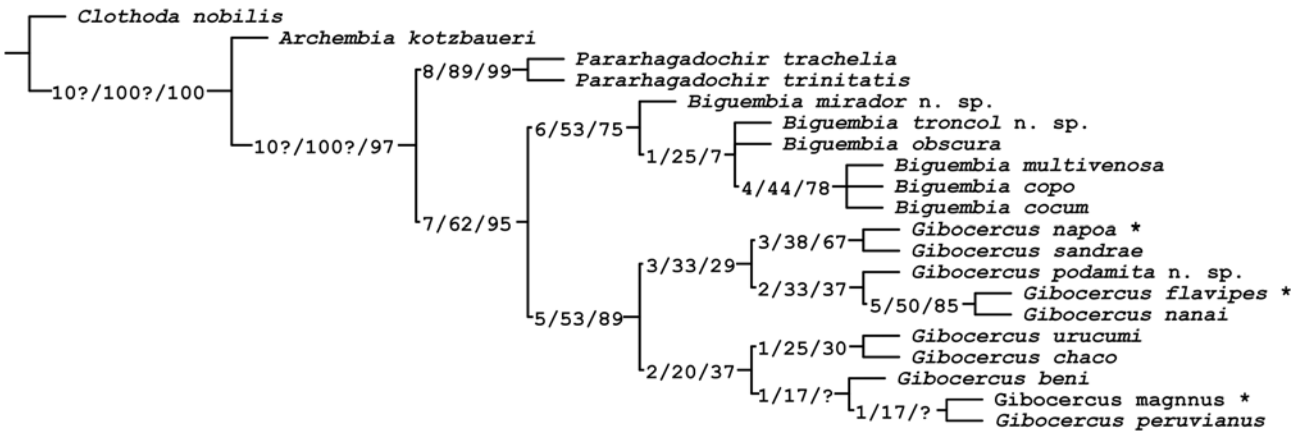
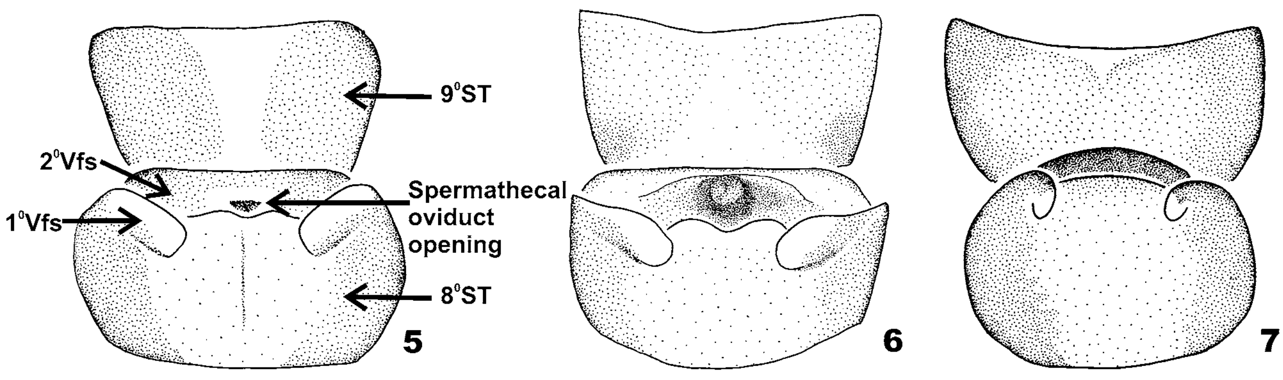


FIGURE 4. Bremer support, Relative Bremer support and symmetric resampling. Asterisks (*) indicate junior synonyms.



FIGURES 5–7. Female terminalia. 5. *Gibocercus chaco*; 6. *Gibocercus beni*; 7. *Biguembia copo*.

TABLE 2. Data matrix of 20 taxa and 96 characters used in a cladistic analysis of *Gibocercus* and *Biguembia*. Polymorphisms: A=[01], B=[0123]; C=[12]; D=[123]; E=[12345]; F=[23]; G=[2345]; H=[34]; I=[345]; J=[456].

	Character State									
Species	0–9	10–19	20–29	30–39	40–49	50–59	60–69	70–79	80–89	90–95
Clothoda nobilis	0221102121	0111211012	011021211F	41BCAA1000	0010000000	000000?000	000000?000	0?00000000	000010?0??	10?000
Archembia kotzbaueri	1021101210	0101011211	1101102011	H11C000121	1010000001	0000001000	1010000112	0000000011	110110?00?	100000
Pararhagadochir trinitatis	1001010011	0001200110	1001114211	D020000332	3000000101	0001000000	2021011222	0100011200	121011?000	100000
Pararhagadochir trachelia	1000101011	1000200212	1101317F00	IACA0A0122	?100000101	0011000000	2021010222	0100011210	121021?000	100000
Biguembia obscura	00010011?1	0101010211	0??????11	0111AA0???	??????1112	1111101100	2120010231	1210101111	1200100010	020200
Biguembia cocum	00?110?2?1	?1?1010110	02?021??11	7A21111010	0110001???	??11100100	2110010231	1210101112	120??00011	010201
Biguembia copo	0001100211	1111010110	0110314211	J03CCCD110	011AA11112	1111100100	2110010231	1210101112	1200100011	010201
Biguembia multivenosa	0001000031	0111010210	0?1???522C	2132121000	0111111112	1111100101	2110010231	1210101112	1200100111	010211
Biguembia mirador **n. sp.**	00?100?1?1	?1?1210110	12?011??11	I031A00022	0010011???	??11100100	2010010231	1210101110	120??00010	120210
Biguembia troncol **n. sp.**	10?111?2?1	?0?1110110	0??????11	4111100020	0100001???	??11100100	2110010231	1210101110	021??00010	020200
Gibocercus nanai	122100?0?0	0100000201	01?021??11	D021000111	3010001112	1100010010	2120111251	1211001112	1201101001	001100
Gibocercus beni	0111001230	0011010211	1200204121	4021A00000	2011101112	1100010011	2020111251	1211001110	1201202100	100100
Gibocercus chaco	0110001201	0011010211	1100427311	FF11010000	2010001112	1101010011	2020111251	1211001111	1210201101	100100
Gibocercus urucumi	01?100?2?1	?1?1010211	00?041??11	H1GE1AA000	30111011??	??01010011	2020111251	1211001110	120??01101	000100
Gibocercus peru	12100011?0	0011200211	0??0???11	??????????	??????1112	1100010011	2020110251	1211001100	1201001200	101100
Gibocercus flavipes	122100?0?0	010?000201	0??0??6211	10211AA???	?01??01112	1100010010	2120111251	12110011?2	1201101001	001100
Gibocercus magnus	022100?2?0	0011000201	1??0???21	5040200000	2011101112	1100010011	2020111251	1211001100	1201202200	000100
Gibocercus sandrae	12210??2?1	0111010211	0??0???11	20210010??	?0????1112	1111010010	2120010241	1211001101	1201002000	001100
Gibocercus napoa	11210??2?0	0001110201	0??0???11	2041001???	??1???1112	1111010010	2120011241	1211001101	1201002000	000100
Gibocercus podamita **n. sp.**	12?100?2?1	?0?1010201	01?022??11	401100A011	3010001???	??00010010	2120010251	1211001112	120??01001	001100

Gibocercus Szumik, 1997

Gibocercus Szumik, 1997:141, Ross, 2001: 35 (genus composition); Szumik, 2002: 444 (family composition); Szumik, 2004: 229 (phylogeny); Szumik, *et al*., 2008: 1003 (phylogeny); Szumik, 2012: 352 (family composition).
Type species: *Gibocercus chaco* Szumik, 1997 by original designation.

Diagnosis. *Gibocercus* is clearly distinguished by the shape of the 10Lp with the inner tip hyperdeveloped and the outer tip very short, fleshy and conical; the length of the conical LC1dp is more than twice the width of the LC1, and has few setae and a clear, rounded convexity on the dorsal face of the process (Szumik 1997).

Composition and distribution. Some of the species described by Ross (2001) are sympatric with species previously described by Szumik or species described by himself. Surprisingly, Ross did not make any reference to their geographic distribution, neither to their clear similarity; in fact there are no diagnoses for any of them. With the exception of *G. sandrae* Ross, 2001, his new species are described without any illustration, as in *G. flavipes* Ross, 2001 sympatric with *G. nanai* Szumik, 1997; *G. magnus* Ross, 2001 sympatric with *G. beni* Szumik, 1997; and *G. napoa* Ross, 2001 sympatric with *G. sandrae* Ross, 2001. *Gibocercus flavipes* differs from *G. nanai* only on coloration details and the sympatric distributions of the two species were not discussed by Ross. According to our cladistic study these species are sisters (Fig. 3); therefore *G. flavipes* is proposed as a junior synonym of *G. nanai*. A similar situation occurs with *G. napoa* and *G. sandrae*, given that both species were described by Ross in 2001; *G. napoa* is the junior synonym of *G. sandrae* based on page priority (*G. sandrae* is described on page 39 and *G. napoa* on page 41), and because *G. sandrae* was illustrated. The synonymy of *G. magnus* with *G. beni* is discussed below under *G. beni*.

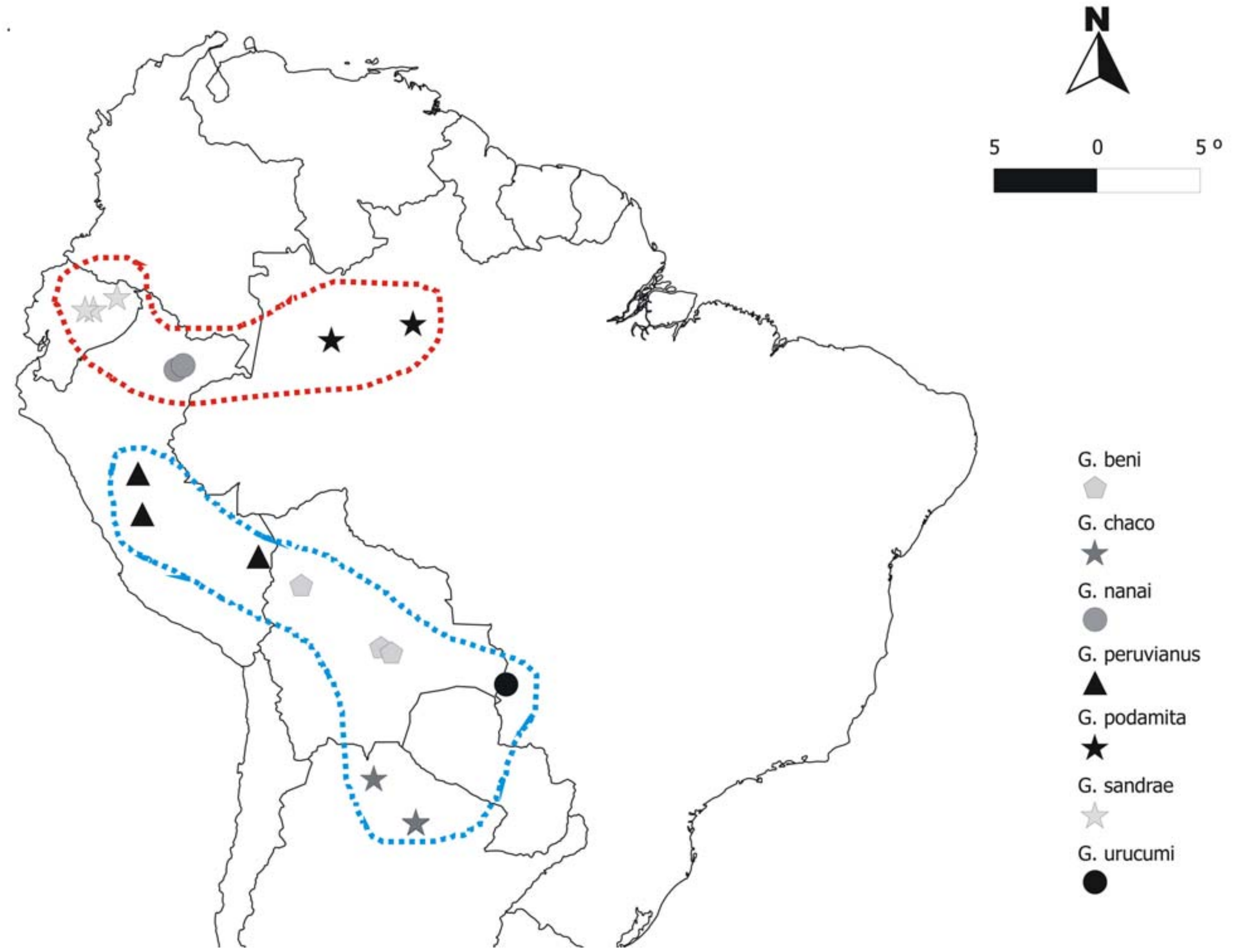


FIGURE 8. Map with records for the seven described species of *Gibocercus*.

The low number of localities, with some of the species known from just one or two records, suggests that they are quite rare and sensitive to environmental changes; at least this is the case for the species present in Argentina. Perhaps the sensitivity condition is connected with the large size of the specimens; they take almost a year to develop from egg to adult, whereas the life cycle in other species take less than three months. After synonymization, the genus *Gibocercus* includes 7 species: *G. chaco* from the Dry Chaco region of Argentina, *G. beni* mostly from Bolivian rain forest, *G. nanai* and *G. peruviana* from the North and South Amazon Basins of Peru, respectively, *G. sandrae* from the Amazon Basin of Ecuador, *G. urucumi* from the Pantanal of Brazil and *G. podamita* **n. sp.** from the Amazon region of Brazil (Fig. 8). However, given that there are only a few locality records it is not possible to make a deep biogeographic discussion.

Relationships. According to the phylogenetic analysis *Gibocercus* is a well supported, monophyletic genus (Fig. 4). The synapomorphies that define the genus are: male interocular elliptical area lightly depigmented (ch. 1), male postocular suture full developed (ch. 7); Ma2 vein developed on the basal two-thirds (ch. 38); LC1dp conical (ch. 55), LC1dp with a convexity on the de dorsal face (ch. 58); 10Lp1 with inner tip hyperdeveloped (ch. 68), and microtrichia on 10Rp1 present (ch. 73). Ross (2001) described a few species and divided the genus into two subgenera, *Gibocercus* and *Amazonembia*. According to our phylogenetic analysis *Amazonembia* is a paraphyletic group in terms of *Gibocercus*. Ross's proposal should be abandoned as there is no need to retain the paraphyletic *Amazonembia*. Instead, two clades are recognized in *Gibocercus*. One clade contains species present in a "southern" sector (Fig. 8, *G. chaco*, *G. urucumi*, *G. beni*, *G. peruviana*) supported by female prothorax pigmented (ch. 12); Ma2 and Mp completely developed (chs. 38 and 39); basal node of LC1 present (ch. 59); 10Rp2 broad and discoidal (ch. 64) and very small males (ch. 84). The other clade includes species present in a "northern" sector (Fig. 8, *G. sandrae*, *G. nanai*, *G. podamita* **n. sp.**) supported by having females with interocular elliptical area strongly depigmented (ch. 2); males with a large bladder on the hind basitarsus (ch. 20); 10Rp2 with longitudinal keels (ch. 61); Hp started on right side of H (ch. 79) and male's eyes with OR>0.5 (ch. 90).

Gibocercus podamita n. sp.

(Figures 9–14)

Type material. Male holotype, Brazil: Amazonas, Fonte Boa, Estr. Manopina, 02º 32' 27'' S 66º 04' 08'' W, 23-28-IX-2005, at light, J.A. Rafael & F.F. Xavier. Deposited in INPA.

Etymology. This species is dedicated to Lucia (Claudia's daughter) and her childhood; *podamita* means *pomadita* (ointment in diminutive).

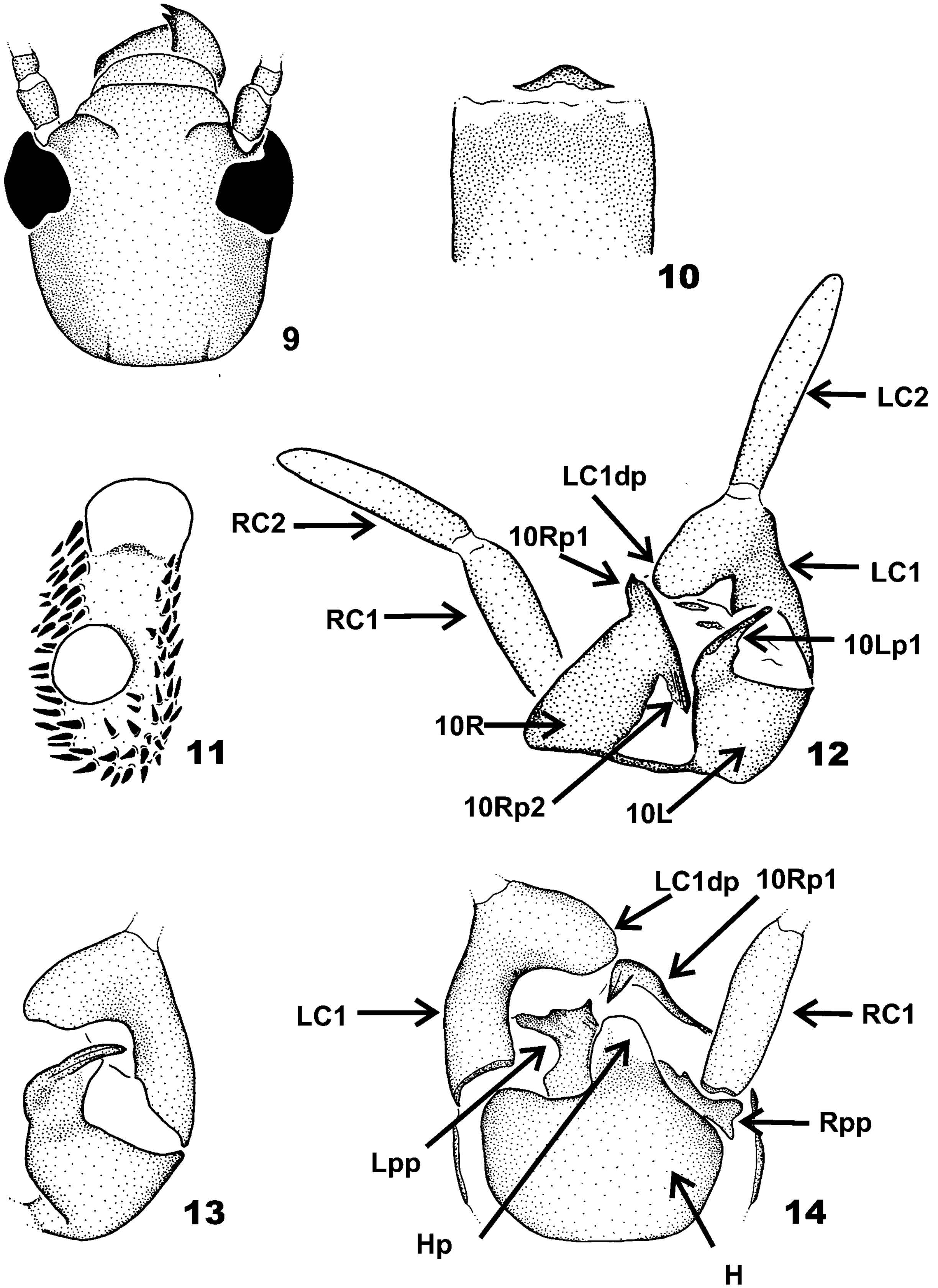
Diagnosis. *Gibocercus podamita* can be distinguished from the other species of the genus by having 10Lp1 oblique with respect to 10L, and strongly sclerotized; 10Lp1 outer tip globose and LC1dp with a well defined notch at the apex. Additionally, *G. podamita* differs from the similar species *G. nanai* by having the apex of the antenna pigmented (not pigmented in *G. nanai*); Sm with broad base (narrow in *G. nanai*); 2 retrolateral rows of setae on the hind basitarsus (1 retrolateral row in *G. nanai*); 10Rp2 not discoidal (discoidal in *G. nanai*); LC1dp conical, not extremely prolonged and tubular as in *G. nanai*.

Male (holotype). Head, antennae and terminalia light brown; prothorax, legs and pleurites not pigmented; the rest of the body brownish white. Head with a diffuse unpigmented area between the eyes on dorsal view.

Total length 10.51 mm. Head (Fig. 9) width/length = 0.93; OR = 0.52; Md with 3–2 incisor teeth and 1–1 molar tooth; Mm clearly defined, Sm quadrangular with anterior margin membranous (Fig. 10). Forewing length 6.8 mm, hindwing length: 6.33 mm. Wing venation: Sc, R1, Rs, Ma, Ma1 and A conspicuous; Ma2 and Mp clearly not reaching wing edge; Cua diffuse. Cross-veins in forewing: R1-Rs: 4; Rs-Ma1: 1; Ma-Mp: 1; Mp-Cua: 0–1. Basitarsus of hind leg narrow (Fig. 11): length 0.32 mm, width/length = 0.38. medial bladder diameter/ basitarsus width = 0.68; medial bladder well developed; 2 rows of setae on retrolateral face, 3 rows on anterolateral face, 4 rows on ventrobasal face, 6–8 setae between bladders on retrolateral face (Fig. 11).

Terminalia (Figs. 12–14) with 10Lp oblique in reference to 10L (Fig. 12), in outer lateral view inner tip strongly developed and sclerotized with longitudinal keels (Fig. 13), outer tip small and membranous. 10R with a small membranous area, 10Rp2 broad and rounded with several longitudinal keels, 10Rp1 with dorsal tip with a clear longitudinal keel. Hp unpigmented caudally with transversal keels. Inner node of Lpp small but strongly sclerotized, keels on Lpp present (Fig. 14). LC1 with apical process, basal process absent, longitudinal ratio of

LC1/LC2 = 0.85, LC1dp conical and long, dorsal giba present; LC1dp/LC1width = 2.93, LC1dp almost three times longer than the width of LC1.



FIGURES 9–14. *Gibocercus podamita* **n. sp.** 9, Head; 10, Mentum + submentum; 11, Left hind basitarsus, ventral view; 12, Male Terminalia, dorsal view; 13, Detail of 10Lp; 14, Male Terminalia, ventral view.

Female. Unknown.

Additional records. Brazil: same data as holotype, 3 male paratypes, INPA; 1 male paratype, Japurá, Est. Ecol. Juami-Japurá, 01º 45’ 14’’ S 62º 06’ 58’’ W, 23-29-IX-2004, F.F. Xavier, INPA.

Gibocercus chaco Szumik, 1997

(Figures 5, 15)

Gibocercus chaco Szumik, 1997: 143; Ross, 2001: 36 (genus composition); Szumik, 2004: 230 (phylogeny); Szumik *et al.*, 2008: 1003 (phylogeny)

Description of the female. General coloration in dorsal view blackish brown, ventral view brown; tarsi, membranous areas and cerci tips orangish brown. Antennomeres 1–22 brown, antennomeres 23 and 24 half brown and half without color, antennomeres 25–30 whitish. Head in dorsal view with two diffuse, unpigmented spots.

Total length 20.35 mm. Head width/length = 0.97, OR = 0.81. Bladder on medial tarsal segment of hind leg with conspicuous microtrichia on anterolateral side. Basitarsus of hind leg broad (Fig. 15): length 0.67 mm, width/ length = 0.46, medial bladder diameter/ basitarsus width = 0.45; both bladders well developed; 3 rows of setae on retrolateral face, 6 rows on anterolateral face, 6 rows on ventrobasal face, 18–20 setae between bladders on retrolateral face (Fig. 15).

Apical cerci shorter than basal cerci. Ninth sternite brownish with a diffuse longitudinal yellowish band; medial plate (8ºS) orangish yellow, 1º and 2º Vfs brownish, tip of 1ºVlfs whitish; medial plate clearly differentiated from the 1ºVlfs (Fig. 5), caudal margin of medial plate with a small notch, 1ºVfs hyperdeveloped (Fig. 5); 2ºVlfs a broad band more or less sclerotized. Secondary gland covered by 2ºVlfs.

Biology. Nets made by *G. chaco* were found in litter below *Bromelia* sp. or fallen trunks, in the biogeographic area is known as Dry Chaco. Almost all of the specimens collected in 1997 and 2000 were maintained in culture to obtain a good sample of adult males and females. Development time from egg to adult was 320 to 380 days.

Additional records. Argentina: Salta, Lomas de Olmedo, 5 Km E Cruce RP5 and RP13, -23.815583 -64.015111, 28-IV-2007, Szumik, Rajmil, Cuezzo, 27 males, 10 females, 11 juveniles, IFML; Santiago del Estero, 23Km NW Km346 RN16, -25.969408 -61.9694306, 17-XII-2000, 2 males, 2 females, Szumik, IFML.

Gibocercus beni Szumik, 1997

(Figures 6, 16)

Gibocercus beni Szumik, 1997: 146; Ross, 2001:35 (genus composition); Szumik, 2004:230 (phylogeny); Szumik, 2008:1003 (phylogeny)

Gibocercus magnus Ross, 2001: 38 **junior synonym**

This emended description provides new female characters.

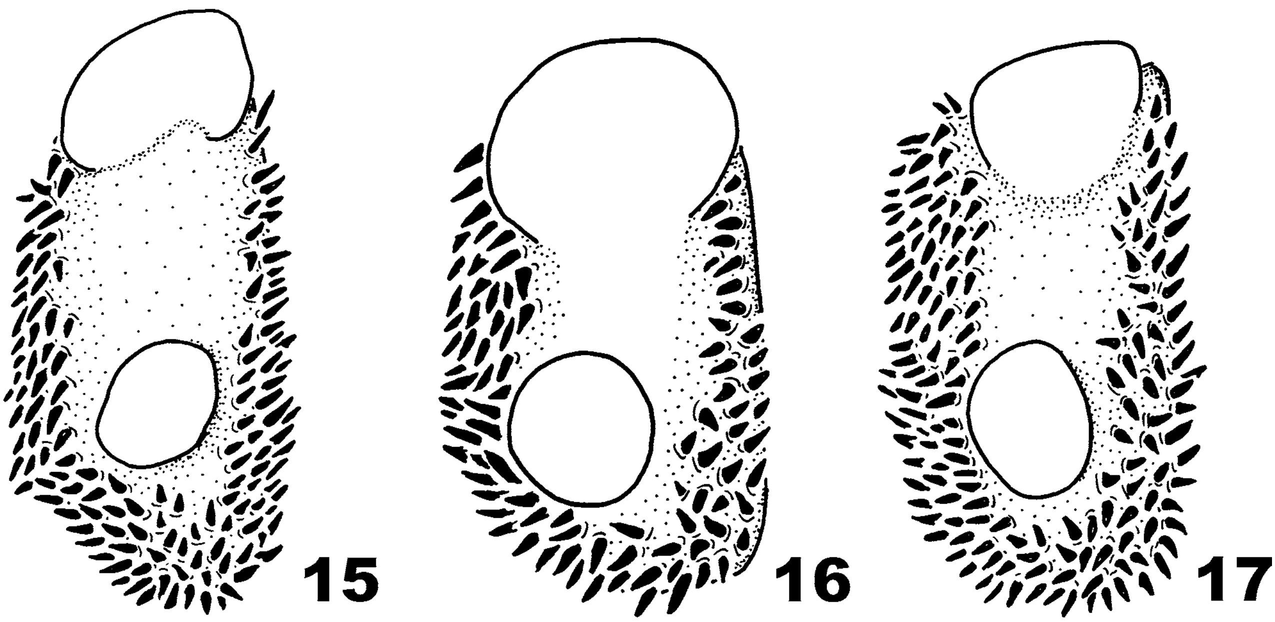
Female. In dorsal view, head blackish brown with a transvers area unpigmented, thoracic and abdominal tergites brown with light brown borders. Antennomeres brown with whitish membranous areas. Legs orange-brownish, 10T and apical cerci orangish yellow. Ventrally, abdomen light brown with a whitish pleural band.

Total length: 20.16 mm. Head width/length = 0.76, OR = 0.73. Microtrichia of hind leg present on anterolateral side of the bladder of medial tarsus. Basitarsus broad (Fig. 16) length: 0.49 mm, width/length = 0.51, medial bladder diameter/ basitarsus width = 0.64; both bladders strongly developed; 2 rows of setae on retrolateral face, 5–6 rows on anterolateral face, 4 rows on ventrobasal face, 15–18 setae between bladders on retrolateral face (Fig. 16).

Apical cerci shorter than basal cerci. 9º sternite light brown with a clear triangular yellowish longitudinal band; medial plate (8ºS) whitish with caudal border unpigmented, 1ºVlfs brownish with tips unpigmented; medial plate clearly differentiated from the 1ºVlfs (Fig. 6), 1ºVfs hyperdeveloped (Fig. 6); 2ºVlfs are a broad band clearly sclerotized at the center as a second plate. Opening of spermathecal oviduct strongly sclerotized (Fig. 6).

Relationships. The description of *G. magnus* by Ross (2001) did not include illustrations. Ross indicated that his new species and *G. beni* occurred in the same region; they are actually sympatric. The characters used by Ross to distinguish this species (coloration details, cross veins, "size" of the outer tip of 10Lp) are not relevant, as they are typical intraspecific differences. Therefore, thus, *G. magnus* Ross is considered a junior synonym of *G. beni* Szumik.

Additional records. Bolivia: Santa Cruz, Provincia Sara, Steinbach, 1 male, CMNH; San Miguel de Monte Grande, Camiri road Km 35, 12-I-1991, Goloboff, Santisteban & McHugh, 4 females, IFML.



FIGURES 15–17. Female hind basitasus. 15, *Gibocercus chaco*; 16, *Gibocercus beni*; 17, *Biguembia copo*.

Biguembia Szumik, 1997

Biguembia Szumik,1997:149; Ross, 2001: 60 (genus composition); Szumik, 2002: 444 (family composition); Szumik, 2004: 229 (phylogeny); Szumik *et al.*, 2008: 1003 (phylogeny); Szumik, 2012: 352 (family composition).
Type species: *Biguembia copo* Szumik, 1997
= *Aphanembia* Ross, 2001: 64; Szumik, 2004: 229 (junior synonym of *Biguembia*).

Diagnosis. LC1dp strongly quadrate and flattened. 10Rp caudally extended as an arm with a hunch on its base. 10Lp with a short base; tips of 10Lp1 similar in shape, thin and tubular, inner tip more sclerotized and with longitudinal keels (see Szumik 2004).

Composition and distribution. In a cladistic analysis of the family Archembiidae (Szumik 2004) *Biguembia* was limited to four species: *Biguembia copo* Szumik, 1997 from the Dry Chaco region of Argentina; *B. cocum* Szumik, 1997 from the Pantanal region of Brazil; *B. multivenosa* from the Caatinga of Brazil and *B. obscura* from the Amazonian region of Peru and Brazil (Ross 2001). Two new species are described from Brazil in this paper: *B. mirador* **n. sp.** from the Cerrado region and *B. troncol* **n. sp.** from Amazonia.As with *Gibocercus*, the species of *Biguembia* are known from only a few localities and records (Fig. 18).

Relationships. The cladistic analysis indicates that *Biguembia* is a monophyletic genus supported by Cua vein completely developed (ch. 40); LC2-LC1 almost with the same length (ch. 52); LC1dp quadrangular and dorsally flattened (chs. 54 and 57); base of 10Rp1 with a convexity (ch. 74), 10Rp1 with a longitudinal carinae (ch. 88); 10Lp hyperdeveloped (ch. 91) and node of Lpp non caudally directed (ch. 93). The monophyly of the genus is well supported (Fig. 4) but there are two optimal resolutions for the relationships inside the genus (Figs. 4, 19, 20). *B. copo*, *B. cocum* and *B. multivenosa* appears always as a monophyletic and well supported group (Fig. 4). The two resolutions differ also on the position of *B. troncol* and *B. obscura*. This is more a case of ambiguity and perhaps with additional data from females this problem could be solved (from the six known species four of them have unknown females). Unlike *Gibocercus*, the *Biguembia* clade and the distribution of its species is less clear. The apical clade of *B. copo*, *B. cocum* and *B. multivenosa* apparently has a roughly south to east distribution (Fig. 18) while the other three species at the base of the clade (not a monophyletic group) mostly have a western distribution equivalent to the Cerrado with an eastern extension represented by *B. mirador* (Fig. 18).

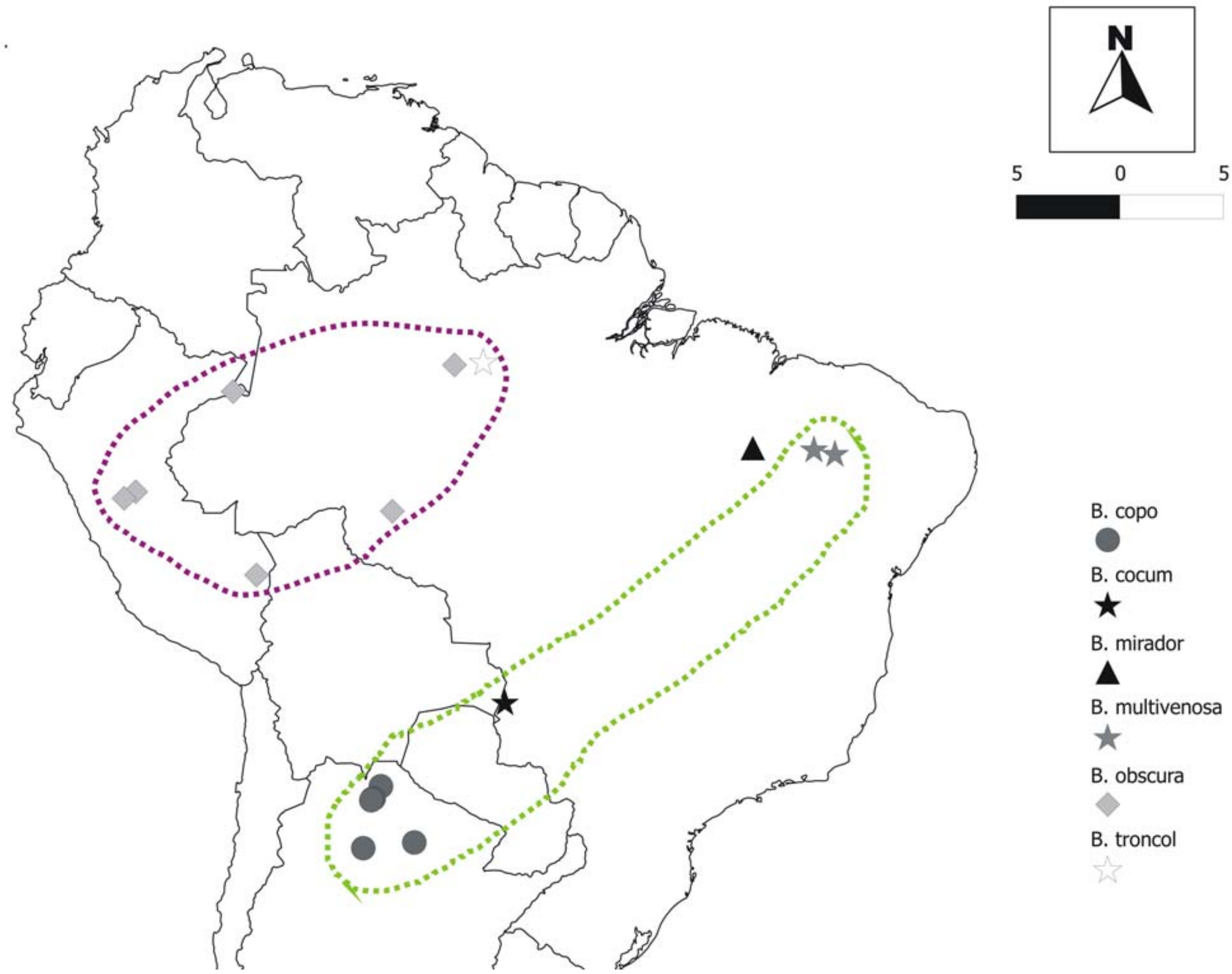


FIGURE 18. Map with records for the six described species of *Biguembia*.

***Biguembia mirador* n. sp.**
(Figures 21–26)

Type material. Male holotype and one male paratype, Brazil: Maranhao, Mirador, Parque Estadual Mirador, Base de Generaldina, 06º 37’ 26’’ S 45º 52’ 09’’ W, 28-30-IX-2006, J.A. Rafael & F.L. Oliveira, at light. Deposited in INPA.

Etymology. The specific name refers to the type locality, Mirador National Park.

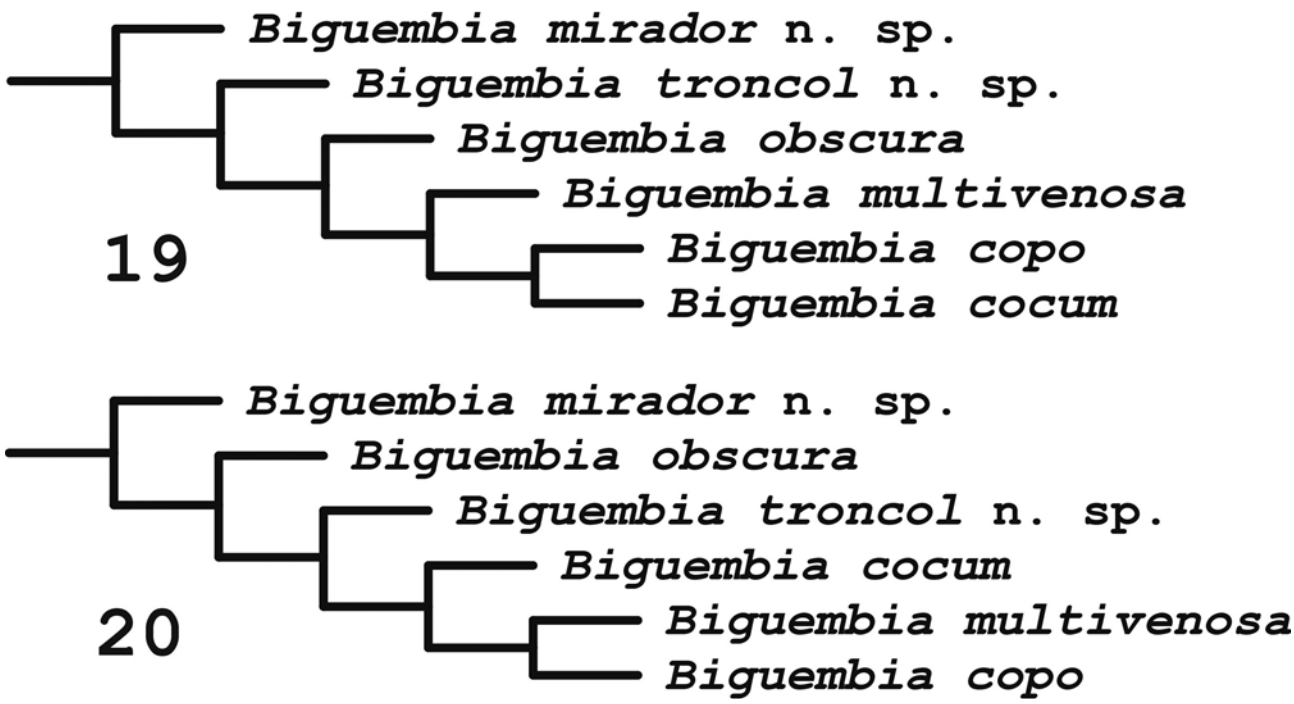
Diagnosis. *Biguembia mirador* **n. sp.** can be distinguished from the other species of the genus by the shape of the submentum (Fig. 22); 10R extremely globose; tips of the 10Lp characteristic of the genus but quite small (less than half of the width of 10Lp, instead of longer than 10Lp).

Male holotype. General coloration light brown. First 9º antennomeres brownish yellow; mesothorax and metathorax lighter than the rest of the body. Total length 5.97 mm. Head almost rectangular (Fig. 21), width/length = 0.80; OR = 0.59; Md with 3–2 incisor teeth and 1–1 molar teeth; Mm diffuse, Sm with anterior margin strongly concave, with a small convexity (Fig. 22), caudally constricted (Fig. 22). Forewing length 4.82 mm; hindwing 4.10 mm. Wing veins Sc, R1, Rs, Ma, Ma1, Cu and A conspicuous; Ma2 and Mp clearly not reaching the wing edge; Cua diffuse. Cross-veins in forewing as follows, R1-Rs: 3–5, Rs-Ma1: 3, Ma-Mp: 1, Ma1-Ma2: 0–1. Basitarsus of hind leg narrow (Fig. 23), length 0.27 mm, width/length = 0.30, medial bladder diameter/ basitarsus width 0.50

mm, medial bladder close to the apex; 1 row of setae on retrolateral face, 2–3 rows on anterolateral face, 2 rows on ventrobasal face, 5–6 setae between bladders on retrolateral face (Fig. 23).

Terminalia (Figs. 24–26) with tips of 10Lp subequal, inner tip with longitudinal keels, outer tip not membranous (Figs. 24, 25). 10R well developed, membranous area very small; 10Rp2 covered by 10Lp; 10Rp1 shorter (Fig. 24) but with a longitudinal keel. Inner node of Lpp well defined (Fig. 26), Hp with transverse keels. Longitudinal ratio of LC1/LC2 = 1.08, LC1dp quadrangular and short, LC1dp/LC1width = 1.70; thus, length of LCdp is less than twice the width of LC1.

Female. Unknown.



FIGURES 19–20. Two optimal resolutions for *Biguembia*.

Biguembia troncol n. sp.
(Figures 27–31)

Type material. Male holotype from Brazil: Amazonas, Itacoatiara, 02º 45' 10'' S 58º 39' 11'' W, 29-30-XI-2005, at light, J.A. Rafael, R.J.P. Machado, A. Silva. Deposited in INPA.

Etymology. This species is dedicated to Victoria (Claudia's daughter) and her childhood; *troncol* means control (and here implies a television remote control).

Diagnosis. *Biguembia troncol* **n. sp.** differs from *B. obscura* in having a submentum with a broad base; the shape and position of LC1dp, which is quadrangular and apical; the 10Rp2 long and straight (Fig. 30); the outer tip of 10Lp1 small (less than the half of the inner tip); and the presence of a deep depression between 10Lp1 and 10L.

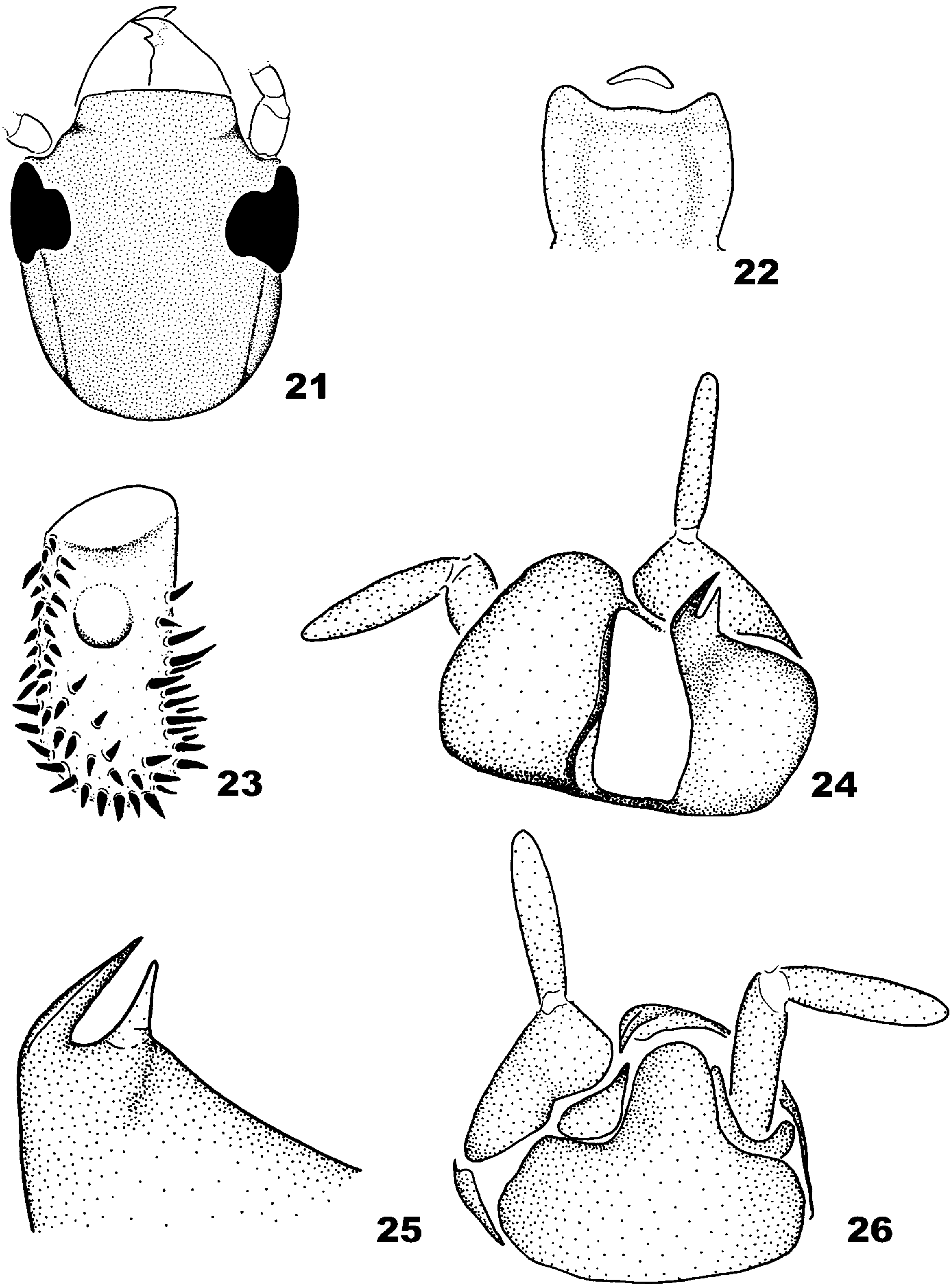
Male holotype. Head, antenna and terminalia yellowish brown, the rest of the body yellowish white.

Total length 7.01 mm. Head almost quadrangular (Fig. 27), width/length = 0.90,; OR = 0.44; Md with 3–2 incisor teeth and 1–1 molar teeth; Mm conspicuous, Sm quadrangular with anterior margin membranous (Fig. 28). Forewing length 5.89 mm, hind wing 4.85 mm. Wing veins Sc, R1, Rs, Cu and A conspicuous; Ma1, Ma2 and Mp clearly not reaching wing edge; Cua diffuse. Cross-veins forewing, R1-Rs: 4, Rs-Ma: 1, Rs-Ma1: 1, Ma-Mp: 1, Ma1-Ma2: 1. Hind legs lost.

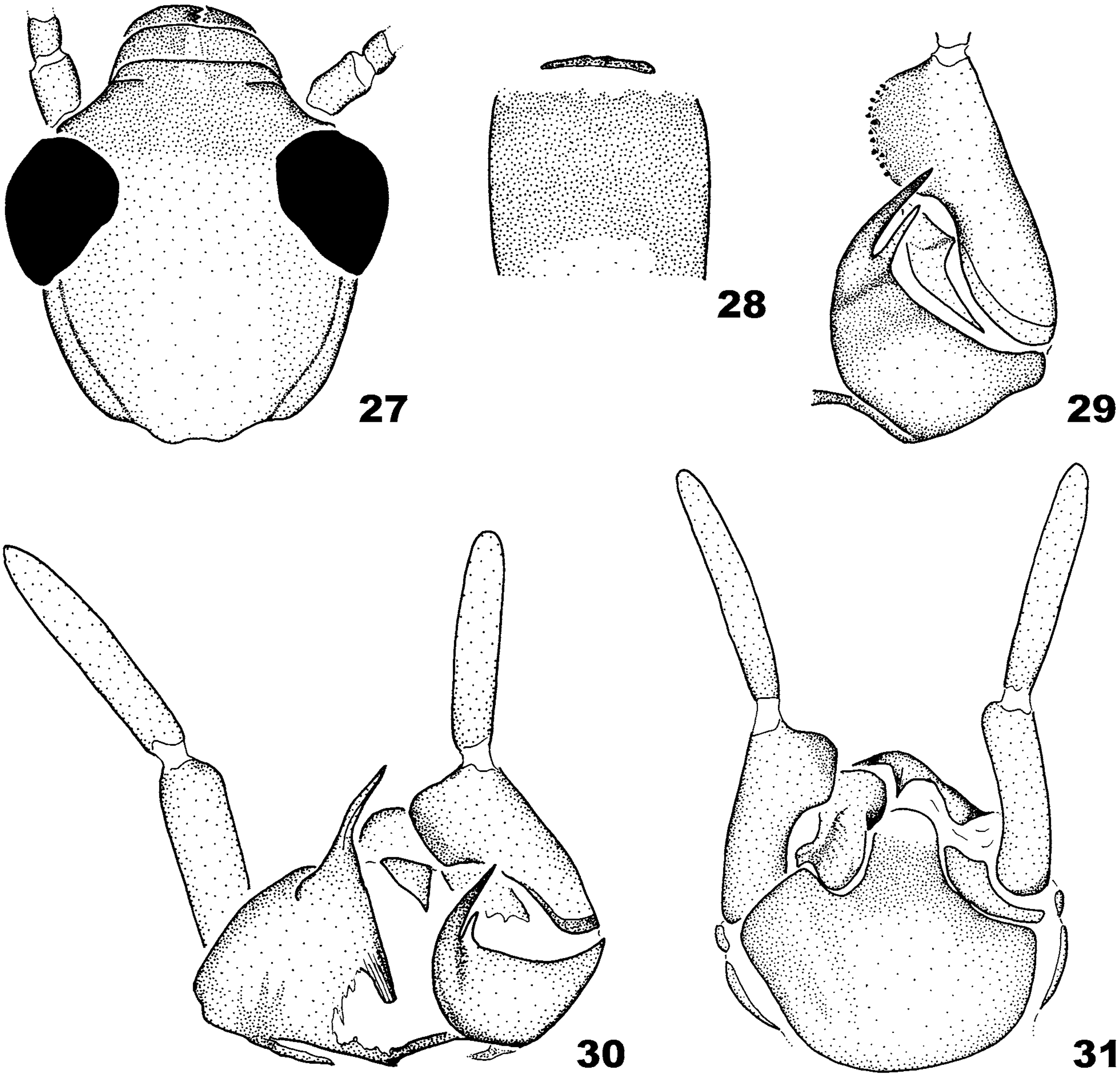
On terminalia (Figs. 29–31) 10R with membranous area almost absent (Fig. 30). 10Rp1 well developed with longitudinal keels (Figs. 29 and 30), both tips sclerotized; microtrichia present between 10R and 10Rp2. Outer tip of 10Lp conical and membranous, little shorter than the inner tip (Fig. 31). Hp apically unpigmented; inner node of Lpp conspicuous (Fig. 31). Longitudinal ratio of LC1/LC2 = 0.75, LC1dp quadrangular, LC1dp/LC1width = 2 (length of LCdp twice the width of LC1).

Female. Unknown.

Additional records. There are two localities from Amazonia of Brazil (Fig. 18) listed by Ross (2001) as specimens of *B. obscura* but is probable that those specimens belong to *B. troncol*. Future study of this material is needed to confirm this statement.



FIGURES 21–26. *Biguembia mirador* **n. sp.** 21, Head; 22, Mentum + submentum; 23, Left hind basitarsus, ventral view; 24, Male Terminalia, dorsal view; 25, detail of 10Lp; 26, Male terminalia, ventral view.



FIGURES 27–31. *Biguembia troncol* **n. sp.** 27, Head; 28, Mentum + submentum; 29, detail of 10Lp; 30, Male terminalia, dorsal view; 31, Male terminalia, ventral view.

Biguembia copo Szumik, 1997

(Figures 7, 17)

Biguembia copo Szumik, 1997: 149; Ross, 2001: 60 (genus composition); Szumik, 2004: 229 (phylogeny); Szumik *et al.*, 2008: 1003 (phylogeny).

This emended description provides new female characters.

Female. In dorsal view, head blackish brown without any unpigmented area, prothorax and legs light brown, mesothorax, metathorax and first abdominal tergite brown, rest of the body light brown. Antennae yellowish brown, femora and abdominal sternites brown.

Total length 15.42 mm. Head width/length = 0.98, OR = 0.86. Medial tarsal segment on hind leg with microtrichia on anterolateral side of the bladder. Basitarsus broad (Fig. 17), length 0.42 mm, width/length = 0.48, medial bladder diameter/basitarsus width = 0.50; both bladders extremely developed; 3–4 rows of setae on retrolateral face, 6–7 rows on anterolateral face, 5 rows on ventrobasal face, 22–24 setae between bladders on retrolateral face (Fig. 17).

Ninth sternite blackish brown; medial plate (8ºS) whitish brown, 1ºVfs blackish brown with tips not pigmented; medial plate clearly differentiated from the 1ºVlfs (Fig. 7), 2ºVlfs a broad, clearly sclerotized band (Fig. 7). Opening of spermathecal oviduct covered by the central plate.

Additional records. Argentina: Salta: 3 Km W Hickman RN81, -23.20825 -63.59743, 260 m, 25-II-2007, Szumik, Molina, Cuezzo, 2 females, 1 juv., IFML; Lomas de Olmedo, 18 Km E Cruce RP5 and RP13, -23,804 -63,94375, 28-IV-2007, Szumik, Rajmil, Cuezzo, 1 female, IFML; Lomas de Olmedo, 5 Km E Cruce RP5 and RP13, -23.815533 -64.015111, 28-IV-2007, Szumik, Rajmil, Cuezzo, 1 male, 2 females, 6 juvs., IFML; RP5 Km 205, -23.883833 -64.058722, 28-IV-2007, Szumik, Rajmil, Cuezzo, 1 male,1 female, IFML. Santiago del Estero: 18.6 Km SW El Mojon, RP37, -26.198528 -64.446056, 394 m, 1-VII-2016, Szumik, 1 male, IFML.

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