A new *Cibyra* Walker, 1856 from southern Brazil with taxonomic notes (first note) (Lepidoptera, Hepialidae)

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Abstract: A new species of *Cibyra* Walker, 1856 from southern Brazil is described: *Cibyra **meridionalis*** **sp. n.** The external morphology of head, thorax, and abdomen is presented. It differs from *C. ferruginosa* Walker, 1856, the most similar species, principally by features of the male genitalia and in the absence of an epiphysis. The male holotype is deposited in Collection Padre Jesus Santiago Moure at University Federal do Paraná, Curitiba, Brazil. *C. schausi* (Viette, 1952) **syn. n.** is recognized as a synonym of *C. ferruginosa*. **Lectotypes** of *C. ferruginosa* Walker, 1856 and *Dalaca dormita* Schaus, 1901 are **here designated** and figured for the first time.

Key words: morphology, Neotropical, taxonomy, DNA barcode.

Eine neue Art der Gattung *Cibyra* Walker, 1856 von Südbrasilien, mit taxonomischen Anmerkungen (erster Beitrag) (Lepidoptera, Hepialidae)

Zusammenfassung: Eine neue Art der Gattung *Cibyra* Walker, 1856 aus dem südlichen Brasilien wird beschrieben: *Cibyra **meridionalis*** **sp. n.** Der Habitus sowie die Morphologie des Exoskeletts von Kopf, Thorax und Abdomen werden beschrieben und abgebildet. Sie unterscheidet sich von der ähnlichen Art *C. ferruginosa* Walker, 1856 in erster Linie im männlichen Genitalapparat und dem Fehlen einer Epiphyse. Der männliche Holotyp wird in der Sammlung von Padre Jesus Santiago Moure in der Bundesuniversität von Paraná, Curitiba, Brasilien, deponiert. *C. schausi* (Viette, 1952) **syn. n.** wird neu als ein Synonym von *C. ferruginosa* erkannt. Die **Lectotypen** von *C. ferruginosa* Walker, 1856 und *Dalaca dormita* Schaus, 1901 werden **hier designiert** und zum ersten Mal abgebildet.

Introduction

Cibyra Walker, 1856 is an exclusively South American genus of small to medium-sized moths from Bolivia, Paraguay, Argentina and southern Brazil. According to C. Mielke & Grehan (2012), it is the most speciose genus of Hepialidae in the Neotropical region with a total of 13 species of no apparent economic importance, in contrast to the Chilean *Dalaca* Walker, 1856, represented by 10 species.

In its brief original description the genus was monotypic and distinguished mainly on a few adult features such as colour and size. There were no further improvements in the subsequent literature other than an indirect contribution by Viette (1951) who provided some additional information about the ♂ genitalia when describing *Xytrops* Viette (1951), which was later synonymized under *Cibyra* by C. Mielke & Grehan (2012). *Cibyra* was expanded by Nielsen et al. (2000) to encompass 15 other genera, but without systematic analysis. The genera were separated out again by C. Mielke & Grehan (2012), but they appear to represent a closely related group (Grehan 2012).

This article has two main goals. In addition to describing a new species which brings the total number of species within *Cibyra* to 14, the entire exoskeleton is characterized as a contribution towards the development of a better understanding of the remaining Neotropical genera that are poorly described other than those of southern Argentina and Chile reviewed by Nielsen & Robinson (1983). The new species is also compared to the similar *C. ferruginosa* Walker, 1856.

The morphological terms principally follow the treatments of Hepialidae by Nielsen & Kristensen (1989), Dugdale (1994), and Nielsen & Robinson (1983). Some terms also refer to morphological studies of ditrysian morphology by Casagrande (1979a–c) and Ehrlich (1958a–b), and some generic studies by Matsuda (1973), Niculescu (1973), Nielsen & Common (1991), Scoble (1992), Shepard (1930) and Snodgrass (1935, 1960).

Material and methods

This study was made possible by collecting and preparing a range of specimens, despite the natural scarcity of the adult stage in southern Brazil and the similarity of the species described here to all other hepialid species in this region. With the exception of *Trichophassus giganteus* Herrich-Schäffer, [1853] and an unidentified species-group, the ♂♂ and ♀♀ of all taxa in this region are attracted to light at dusk for no more than 20 min after sundown.

Specimens of *Cibyra meridionalis* sp. n. were obtained at several field sites in southern Brazil and immediately killed using ammonium to keep all structures intact for dissection. The scales of many hepialids are easily detached so that this treatment is almost a prerequisite for preserving their condition.

Wings were removed and the body and its appendices were heated in a solution of 10% KOH. The morphological description presented here is based on ♂♂ with additional reference to ♀♀ where differences were found. Adults are figured in life size. Scale lines refer to millimeter.

DNA was extracted from some recently collected specimens as an accurate method to match ♂ and ♀, which in some cases would not be possible using morphology alone. All taxa included in this study were sampled for

DNA, a partial COI mitochondrial gene sequence was amplified and used as the standard DNA animal barcode (Hebert et al. 2003). A single dry leg was used and processed at the Canadian Centre for DNA Barcoding (CCDB) following routine protocols as described in Vaglia et al. (2008) and Decaëns & Rougerie (2008). Specimen and sequence data are stored in the Barcode of Life Data Systems (Bold 2013, Ratnasingham & Hebert 2007) in public projects and in the GenBank with their code access cited for each specimen in the list of material examined.

Molecular sequence analyses were conducted by MEGA version 5 using the Maximum Likelihood (ML) phylogeny reconstruction method to infer the relationships between the specimens analyzed (Tamura et al. 2007, 2011). ML analysis included 37 terminals (36 of *C. meridionalis* sp. n. and one of *C. ferruginosa*) for which the best-fit model of molecular evolution was set as GTR+G+I after statistical test using jModelTest 0.1.1 (Guindon & Gascuel 2003, Posada 2008). Confidence values at each node of the tree were estimated using bootstrap re-sampling with 400 replications. The resulting tree (Text-Fig. 2, see below in systematic section) is displayed unrooted; its main focus is to represent the genetic segregation of species and not their relationships for which a more complete sampling of the group is preferable as well as a properly selected outgroup. The genetic distances between species were calculated using p-distances in MEGA5 and are reported.

Acronyms

BMNH	The Natural History Museum (formerly British Museum (Natural History)), London, England.
CGCM	Collection Carlos G. C. Mielke, Curitiba, Paraná, Brazil.
CMNH	Carnegie Museum of Natural History, Pittsburgh, Philadelphia, USA.
CMWM	Collection Museum T. J. Witt, München, Germany.
DZUP	Collection Padre Jesus S. Moure, Departamento de Zoologia, Universidade Federal do Paraná, Curitiba, Paraná, Brazil.
IOC	Collection Instituto Oswaldo Cruz, Rio de Janeiro, Rio de Janeiro, Brazil.
MNHN	Muséum National d'Historie Naturelle, Paris, France.
MZSP	Collection Museu de Zoologia, Universidade de São Paulo, São Paulo, São Paulo, Brazil.
NHMW	Naturhistorisches Museum Wien, Vienna, Austria.
SMFL	Senckenberg-Museum, Frankfurt am Main, Lepidoptera collection, Germany.
USMN	United States National Museum of Natural History, Washington D.C., USA
ZMHU	Museum für Naturkunde, Berlin (formerly Zoologisches Museum der Humboldt-Universität, Berlin), Germany.
ZSBS	Zoologische Sammlungen des Bayerischen Staates, Munich (München), Germany.

Further abbreviations

BC	specimens with a mtDNA barcode.
HT	holotype.
FW	forewing.
HW	hindwing.
LT	lectotype.
PT	paratype.

Systematic part

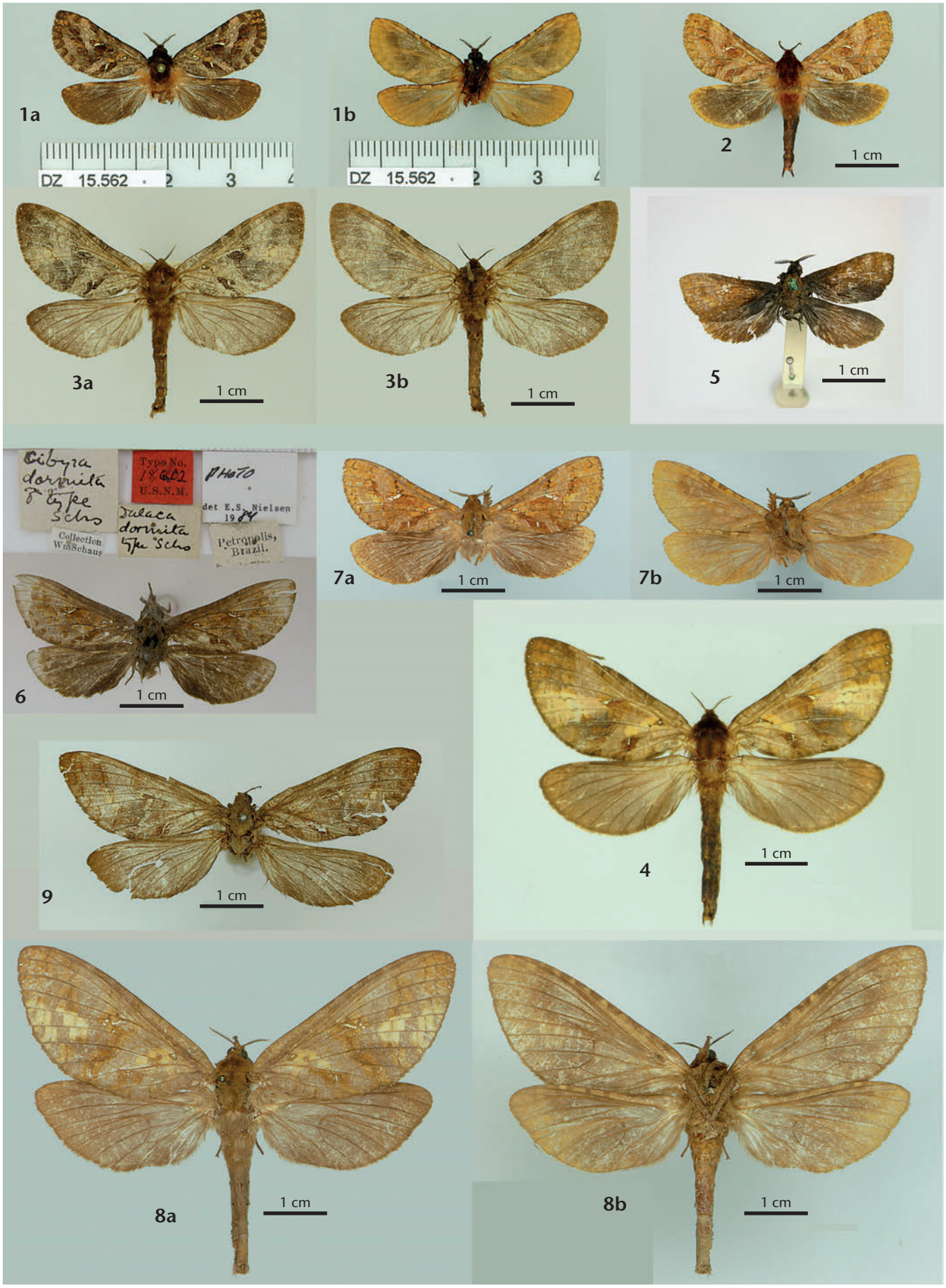
Cibyra meridionalis sp. n.

= *Cibyra ferruginosa:* Grehan (2010: 45), misidentification.

Figs. 1a, 1b, 2, 3a, 3b, 4, 10–41, Text-Figs. 1, 2.

Holotype ♂ with the following labels: /Holotypus, *Cibyra meridionalis* C. Mielke & Casagrande det. 2013/ Brasil, Santa Catarina, Urubici, Morro da Igreja, 1250 m, 26.–31. xii. 2001 (7). C. Mielke leg./ DZ 15.562/. — Donated by C. Mielke and deposited in DZUP. Figs. 1a, 1b, 34.

Paratypes (in total 600 ♂♂, 40 ♀♀), all **Brazil: Espírito Santo:** 1 ♂, Santa Teresa, 20. xii. 1966, C. & C. Elias leg. (DZ 15.566), mislabelled. — **Paraná:** 4 ♂♂, Quatro Barras, Banhado, 800 m, 7. ii. 1970, 7. iii. 1970, 27. xii. 1970, V. O. Becker & Larocca leg. (CGCM 14.418, 15.391, 15.546, 15.875). 4 ♂♂, 2 ♀♀, Curitiba, 920 m, 28. xii. 1974, 25. i. 1975, 10.–15. ii. 1975, V. O. Becker leg. (CGCM 14.645, 14.769, 15.420, 15.573, 15.626, 15.638). 11 ♂♂, 1 ♀, Tijucas do Sul, Vossoroca, 29. iii. 1987, 20. xii. 1987, 10. i. 1988, 10.–11. iii. 1989, C. Mielke leg. (CGCM 5876, 6059, 6062, 6211, 6769, 6994, 7089, 7260, 7392, 7835, 7836, 7988). 1 ♂, Campo do Tenente, Estr. Campo do Tenente-Piên, 6 km, 23. xi. 1997, C. Mielke leg. (CGCM 6559). 1 ♀, Lapa, 20. xii. 2003 (CGCM 23.194 [BC JX215605]). — **Santa Catarina:** 205 ♂♂, 16 ♀♀, São Bento do Sul, Rio Vermelho, 700–800 m, 14. iii. 1991, 12.–21. i. 1992, 18. ii. 1992, 2. iii. 1992, 26. xii. 1993, 11. iii. 1994, 20. xii. 1995, i. 1996, 2. ii. 1996, 10.–20. i. 1997, 9.–21. xii. 1997, 19. i. 1998, 21.–28. i. 1999, 9. ii. 1999, 26. xii. 1999, i.–ii. 2000, 25. xii. 2000, i.–ii. 2001, 21. iii. 2001, 20. xii. 2001, i.–ii. 2002, 15. iii. 2002, 20–24. xi. 2002, 10.–30. xii. 2002, i. 2003, 23. ii. 2003, 11. xii. 2003, i.–ii. 2004, 30. iii. 2004, 21. iv. 2004, 10. xii. 2005, 3.–15. ii. 2006, I. Rank leg. (CGCM 1901, 2015, 4035, 4065, 4068, 4082, 4160, 4163, 4164, 4222, 4229 [BC JX215583], 4283, 4290, 4299, 4305, 4331, 4335, 4365, 4400, 4419, 4445, 4450, 4459, 4563, 4576, 4627, 4654, 4665, 4671, 4711, 4773, 4788, 4826, 4847, 4911, 4918, 4942, 4945, 4964 [BC JX215622], 4969, 4982, 5003, 5002, 5004, 5012, 5013, 5023, 5047, 5049 [BC JX215632], 5105 [BC JX215677], 5122, 5134, 5150, 5229, 5246, 5289, 5354, 5361, 5365, 5372, 5373, 5381, 5404, 5413, 5416, 5453, 5473, 5477, 5478, 5500, 5565, 5574, 5579, 5583, 5590, 5597, 5630, 5638, 5661, 5764, 5773, 5791, 5810, 5861, 5863, 5877, 5915, 5923 [BC JX215610], 5974, 6012, 6089, 6137, 6155, 6167, 6254, 6263, 6298 [BC JX215676], 6306, 6320, 6346, 6357, 6382, 6403, 6407, 6493, 6513, 6550, 6562, 6578, 6628, 6658 [BC JX215590], 6671, 6678, 6688, 6715, 6761, 6771, 6785, 6813, 6816 [BC JX215628], 6829, 6823, 6831, 6859, 6865, 6898, 6912, 6927, 6935, 6940, 6949, 6986, 6998, 7011, 7038, 7049, 7087, 7106, 7166, 7233, 7235, 7249, 7283, 7339, 7343, 7398, 7412, 7413, 7423, 7483, 7508, 7511, 7538, 7548, 7553, 7601, 7649, 7703, 7706, 7751, 7768, 7809, 7817, 7904, 7936, 7958, 7976, 7978, 7981, 13.708, 13.742 [BC JX215603], 13.756, 13.772, 13.728, 13.788 [BC JX215674], 13.804, 13.816 [BC JX215675], 13.836, 13.848, 13.852, 13.868, 13.884, 13.900, 13.906, 13.916, 13.918, 13.922, 13.935, 13.967, 14.012, 14.015, 14.044, 14.060, 14.092, 14.108, 14.109, 14.143, 14.144, 14.159, 14.162, 14.173, 14.193, 14.194, 14.204, 14.239, 14.242 [BC JX215661], 14.257 [BC JX215644], 14.258, 14.273 [BC JX215627], 14.302, 14.305, 14.369, 14.385, 14.535, 14.710, 15.004, 15.031, 15.164, 20.354 [BC JX215604], 20.579 [BC JX215648], 20.690). 1 ♂, 1 ♀, São Bento do Sul, Rio Vermelho, 800 m, 14. ii. 1993, 17. xi. 1993, Mielke & Rank leg. (CGCM 6782, 7264). 1 ♀, São Bento do Sul, Rio Vermelho, 800 m, 20. i. 1988, Miers leg. (CGCM

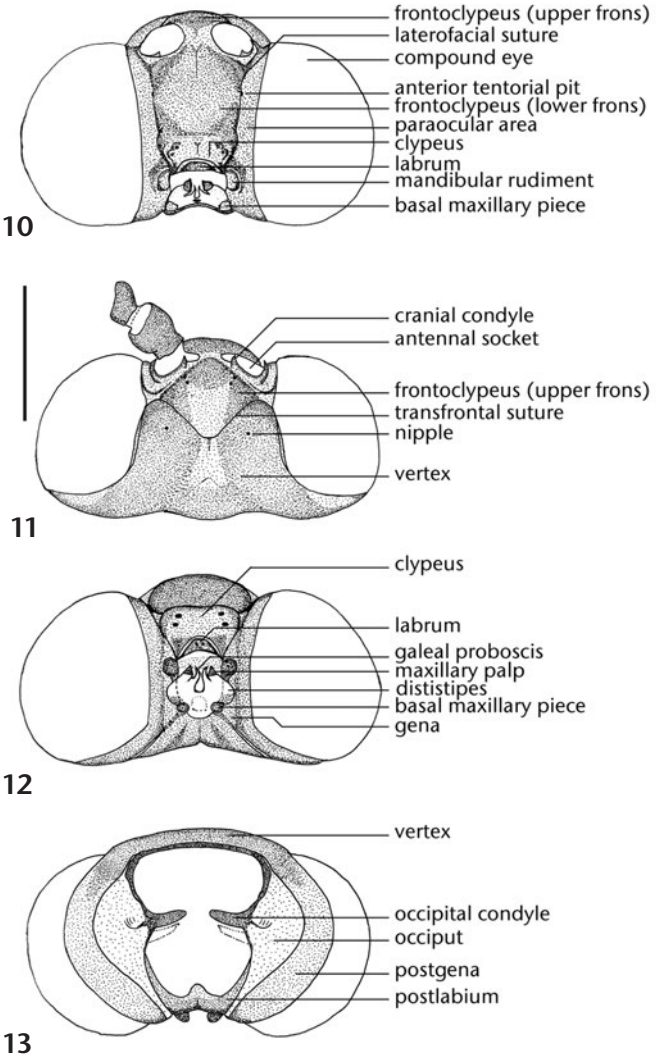


Colour plate: Specimens of *Cibyra*. **Figs. 1–4:** *Cibyra meridionalis* sp. n.; HT ♂ dorsal (**1a**), ventral (**1b**); PT ♂ dorsal (**2**); PT ♀ dorsal (**3a**), ventral (**3b**); PT ♀ dorsal (**4**). — **Figs. 5–9:** *Cibyra ferruginosa*; LT (here designated) ♂ dorsal (**5**); LT (of *C. dormita*, here designated) ♂ dorsal (**6**); ♂ dorsal (**7a**), ventral (**7b**); ♀ dorsal (**8a**), ventral (**8b**); HT ♀ (of *C. schausi*) dorsal (**9**). — Specimens (except HT *C. meridionalis,* slightly enlarged, scales in cm with subdivisions in mm) approximately at same size; scale bars = 1 cm.

5610). 164 ♂♂, 2 ♀, São Bento do Sul, Rio Vermelho, 700–800 m, 8. I. 1997, 26. I. 1999, 6. II. 2000, 2. III. 2000, 25. XII. 2000, 16. I. 2001, 3.–10. II. 2001, 20. XII. 2001, I.2002, 25. XII. 2002, I. 2003, I.–III. 2009, XII. 2009, I. 2010, 13. III. 2010, 19.–29. XI. 2010, XII. 2010, I. 2011, O. Rank leg. (CGCM 4089, 4097, 4114, 4135, 4142, 4333, 4440, 4468, 4477, 4527, 4535, 4537, 4648, 4752, 4789, 4791, 4820, 4827, 4854, 4915, 4919, 4984, 5010, 5056, 5076, 5145, 5242, 5293, 5329, 5345, 5394, 5461, 5532, 5603, 5632, 5681, 5848, 5887, 5951, 5978, 5981, 5985, 5988, 6010, 6069, 6112, 6426, 6484, 6497, 6529, 6598, 6608, 6626, 6661, 6724, 6766, 6810, 6812, 6909, 6915, 6950, 6957, 6962, 6990, 7207, 7252, 7316, 7401, 7475, 7614, 7643, 7654, 7698, 7777, 7810, 7888, 7956, 22.414, 22.687, 22.973, 23.226, 23.327, 23.376, 23.401, 23.728, 23.792, 23.853, 24.031, 24.063, 24.287, 24.349, 24.430, 24.511, 24.591, 24.639, 24.655. DZUP 9920–9924, 9928–9932, 9936–9940, 9944–9948, 9952–9956, 9960–9964, 9968–9972, 9976–9980, 9984–9988, 9992–9996, 15.741, 15.748, 15.755, 15.762, 15.769, 15.776; CLAM 305–307; 10 ♂♂ in CMNH, 10 ♂♂, 1 ♀ BMNH, 10 ♂♂ IOC, 9 ♂♂ MNHN, 10 ♂♂ MZSP [14.381–14.390], 10 ♂♂ NHMW, 10 ♂♂ SMFL, 10 ♂♂ ZMHU, 10 ♂♂ ZSBS, 10 ♂♂ CMWM). 59 ♂♂, 10 ♀♀, São Bento do Sul, Rio Natal, 550 m, 20.–26. XII. 1995, 10.–13. I. 1996, 20.–21. II. 1996, 28. XI. 1996, 2. XII. 1996, 1.–10. I. 1997, II. 1997, 15. XII. 1997, 20. VIII. 1998 (mislabelled), 21. XII. 1998, I. 2000. 3. XI. 2000, 18. XII. 2000, 28. I. 2001, 19. III. 2001, 23.–29. XII. 2001, 9. I. 2002, I.–III. 2004, 18. IV. 2004, XII. 2004, II. 2005, II. 2006, A. Rank leg. (CGCM 1603, 1693, 2166 [BC JX215630], 4138, 4308, 4404, 4428, 4484, 4530, 4553, 4637, 4639, 4697, 4797, 4950, 4953, 5039, 5058, 5063, 5109, 5126, 5152, 5210, 5241, 5243, 5255 [BC JX215646], 5291, 5304, 5315, 5378, 5419, 5470, 5512, 5755, 5804, 5916, 5982, 6057, 6195, 6270, 6377, 6485, 6691, 6706, 6716, 6970, 7062, 7071, 7184, 7205, 7336, 7604, 7676, 13.664, 13.672, 13.696, 13.721, 13.785, 13.807, 13.887, 13.897 [BC JX215626], 14.284, 17.637, 17.671 [BC JX215637], 17.989, 18.101, 19.576 [BC JX215621], 24.810). 2 ♂♂, São Bento do Sul, Rio Natal, 550 m, 27. VIII. 1998 (misllabeled), 28. XII. 1999, I. Rank leg. (CGCM 4387, 4736). 4 ♂♂, 3 ♀♀, São Bento do Sul, Rio Natal, 700 m, 4. I. 2005, 22.–28. II. 2005, O. Rank leg. (CGCM 17.655 [BC JX215599], 17.687 [BC JX215638], 17.733, 17.861, 18.085, 18.293, 24.493). 1 ♂, São Bento do Sul, Rio Natal, 500 m, 24. I. 2000, O. Mielke, Rank & Casagrande leg. (CGCM 6.730). 9 ♂♂, same data as the HT (CGCM 22.405, 22.670, 23.006, 23.184, 23.561, 23.898, 23.937 [BC GU661551], 23.994, 25.275). 22 ♂♂, 2 ♀♀, same locality as the HT, 21.–24. XII. 1998, 27.–29. XII. 1997, 18.–22. XII. 2000, Miers & C. Mielke leg. (CGCM 136, 217, 765, 858, 885, 1067, 1172, 1238, 1460, 1524, 1540 [BC JX215673], 1543, 1570 [BC JX215624], 6452, 6614 [BC JX215680], 6714, 6992, 7028, 7557, 7597, 7638 [BC JX215679], 22.682 [BC JX215643], 23.335, 24.811, 25.163). 9 ♂♂, Urubici, Serra do Panelão, 1250 m, 30. XII. 2007, 12.–14. I. 1998, Miers & C. Mielke leg. (CGCM 506, 571, 586, 598, 618, 678, 780, 4167, 5006). 1 ♂, Urubici, Serra do Panelão, 1250 m, 14.–16. II. 1999, C. Mielke leg. (CGCM 424 [BC JX215678]). 4 ♂♂, Urubici, Serra do Panelão, 1250 m, 12.–14. I. 1998, O. Mielke leg. (CGCM 4076, 4989, 5393, 5533). 1 ♂, Urubici, Alto Rio Canoas, 1160 m, 3. II. 2008, C. Mielke leg. (CGCM 23.938 [BC GU661571]). 1 ♀, São Joaquim, 1400 m, 2. II. 1993, V. O. Becker leg. (CGCM 15.798). — **Rio Grande do Sul:** 5 ♂♂, Cambará do Sul, Estância Cambará, 1040 m, 1.–4. I. 2006, 29°12′ S, 50°8′ W, C. Mielke leg. (CGCM 22.435 [BC JX215668], 22.770 [BC JX215662], 22.883 [BC JX215671], 23.140, 23.154 [BC JX215672]). 1 ♂, Lomba Grande, 150 m, 11. II. 2005, A. Moser leg. (CLAM 302). 2 ♂♂, Morro Reuter, Faz. Padre Eterno, 500 m, 3. XI. 1995, 7.–11. II. 1997, A. Moser leg. (CLAM 303, 304).

Etymology. The name refers to the species' meridional occurrence within Brazil.

Head (Figs. 10–16). Hypognathus almost all covered by scales with the following measures: width ca. 2.5 mm; distance between compound eyes at medium frons portion ca. 0.5 mm; compound eyes height ca. 0.8 mm; interocular index ca. 2.6 mm. In anterior view (Fig. 10), compound eyes globular, glabrous with its internal margin slightly concave. Frontoclypeus rectangular delimited laterally by the laterofacial suture which separates it from the paraocular area, dorsally by the V-shaped transfrontal suture, and ventrally by the labrum; it can be separated in upper and lower portions, the first, in dorsal view, lozenge-shape with two sensorial pits on each side; the latter bears marginally the tentorial pit and followed by the clypeus ventrally which differs by the texture since the frontoclypeal suture is not clear. Clypeus anteriorly projected, unscaled, and bearing two rimmed pits pairs latero-dorsally, one on each side. Labrum slightly projecting, transverse and separated from the clypeus by the clypeolabral suture. Mandibular rudiment located at the internal margin of the subgenal area, ovoid and well sclerotised. In dorsal view (Fig. 11), vertex dorsally bilobed with one pair of sensorial nipples, and latero-posteriorly separated from the post-gena by



Figs. 10–13: *Cibyra meridionalis* sp. n., ♂ head: anterior view (**10**), dorsal view (**11**), ventral view (**12**), posterior view (**13**). — Scale bar: 1 mm.

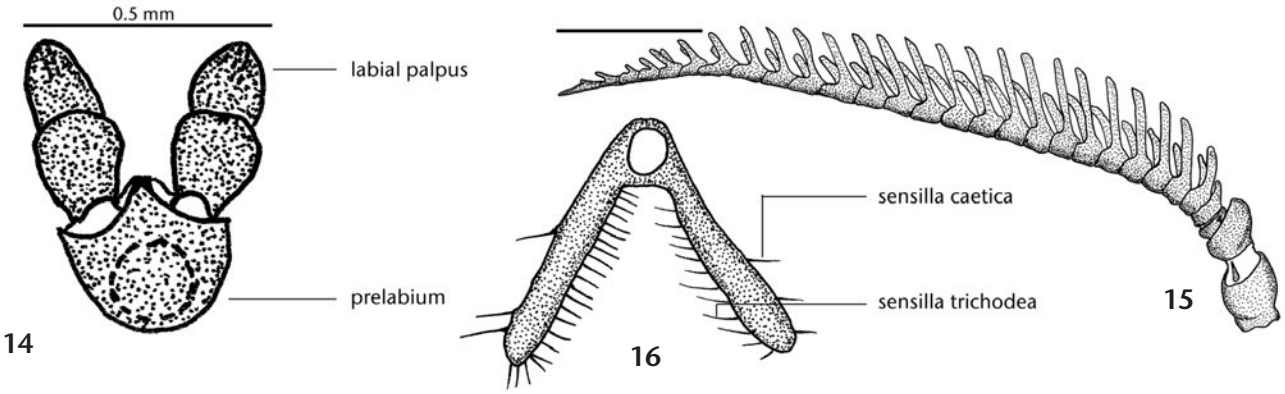
texture. Antennal sockets, between the lower and upper portions of the frontoclypeus, bear the developed dorsal and ventral cranial condyles. In ventral view (Fig. 12), internal margin of the compound eyes shows an open angle at the junction of occiput and post-gena areas ventrally. Central portion is occupied by the proboscidial fossa. Maxilla has a prominent and well sclerotised basal maxillary piece (probably a cardo- + basistipes; see Nielsen & Kristensen 1989: 9); dististipes tubular, membranous except slightly sclerotised base, followed by well sclerotised maxillary palp one-segmented; galeal proboscis vestigial, almost undiscernible. Prelabium (Fig. 14) with antero-lateral apertures with two-segmented labial palpi inserted; distal palpus with a vom Rath's organ; postlabium extends posteriorly to form the latero-ventral portion of the magnum foramen. In posterior view (Fig. 13), occiput located between the postgena and the magnum foramen, ventro-laterally connected to the postlabium, flat except for central concave area from which emerges the occipital condyle. Antenna (Fig. 15) with ca. 28 segments, scaled posteriorly, scape and pedicle larger than the flagellar segments; intercalary sclerite, tongue-shaped, present; flagellum, excluding the first and the last segments, bipectinate (Fig. 16); apical segment with two lateral processes and pointed apically; sensilla chaetica variable on each segment externally; sensilla trichodea covers internal surface. ♀ antenna with ca. 32 segments, bipectinate, but rami shorter than ♂♂.

Cervical region. Between the head and thorax, membranous area with paired cervical sclerite, a slender, well sclerotised, articulated anteriorly with occipital condyle, laterally with ventral arm of anterior dorsal plate of pronotum, and ventrally with anterior portion of prosternum.

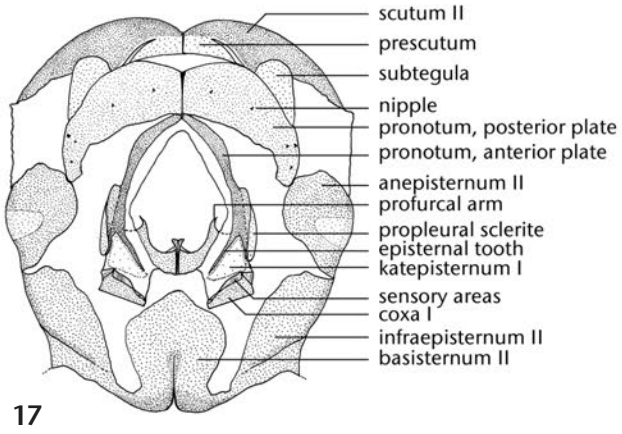
Thoracal region of body (Figs. 17–20, 29).

Prothorax (Figs. 17–20). Pronotum a composite of a pair of well sclerotised sclerites, posterior and anterior plates; the first, compound by two shield-shaped lobes, is separated by a ridge along the midline, slightly pronounced internally, where their dorsal margins are connected anteriorly and diverging posteriorly, four to five nipples present in each lobe; the second anterior plates, are also connected midline but not fused, laterally each extends downwards bifurcating to an anterior arm, a slender episternal tooth surrounding dorsally the kat-episternal scale-patch and posteriorly the sclerotised katepisternal basal margin, and to a posterior arm which fuses with the anterior margin of the partially unscaled propleura. Propleura reinforced posteriorly and fused to furcal arm. Prosternum narrow, invaginated to form the discrimen I, anteriorly upwards curved to meet the cervical sclerite ventrally in a pit, posteriorly projected laterally to produce the profurcal arms which reach the ventral portion of the propleura. Furscasternum and spinasternum synscleritous, narrow, which ends at the spina pit.

Mesothorax (Figs. 18–20). The largest thoracic segment. Notum divided into four sclerites: prescutum, scutum, scutellum and postnotum. Prescutum anterior, synscleritous to the scutum, and unscaled, extends ventro-laterally two slender and tapered processes, prealar arms, reaching the ventral corner of the unscaled and well sclerotised subtegula. Scutum divided midline by the mesoscutal suture incomplete posteriorly; lateral edges of the anterior portion are produced into sloping plates, posteriorly projecting, the suralars separated by the scutal suture from the posterior portion of prescutum to scutal incision; posteriorly and producing the articulation with the wings, the adnotal processes; laterally on the posterior portion, projected forward, emerging from the end of scutum-scutellar suture, the postalar plate which also projects a ventral process. Scutellum slightly less sclerotised than scutum, laterally produced well sclerotised to support the axillary cords. Postnotum located between the posterior margin of the scutellum and the metathorax, dorsally a strengthened divided sclerite into an anterior portion internally produced into the large second phragma and into an inverted U-shaped posterior portion fusing with the latero-anterior arm of the scutum III. Tegula, pad-like, is slightly sclerotised, densely covered by scales, and ellipse-shaped. Below wing base, the divided subalar. Mesopleura divided into episternum and epimeron by the pleural suture; the first into an anepisternum and an infraepisternal-basisternal plate. Anepisternum tumid



Figs. 14–16: *Cibyra meridionalis* sp. n., ♂ head appendices: prelabium and labial palpi (**14**), antennae dorsal view (**15**), antennal segment (**16**). — Drawings not to the same scale; scale bar Fig. 14 = 0.5 mm, Fig. 15 = 1 mm.



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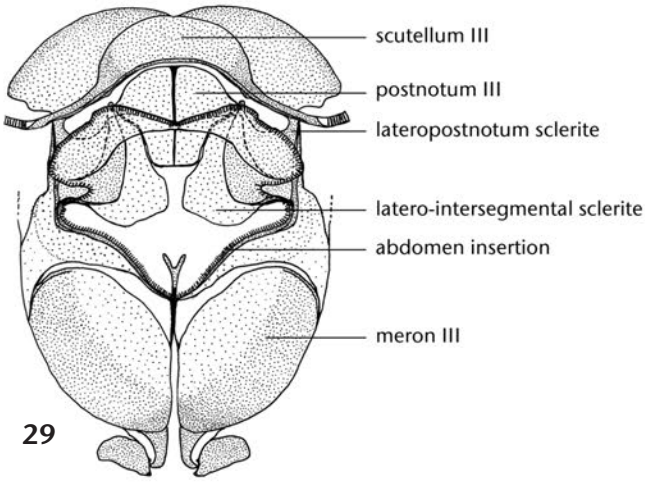

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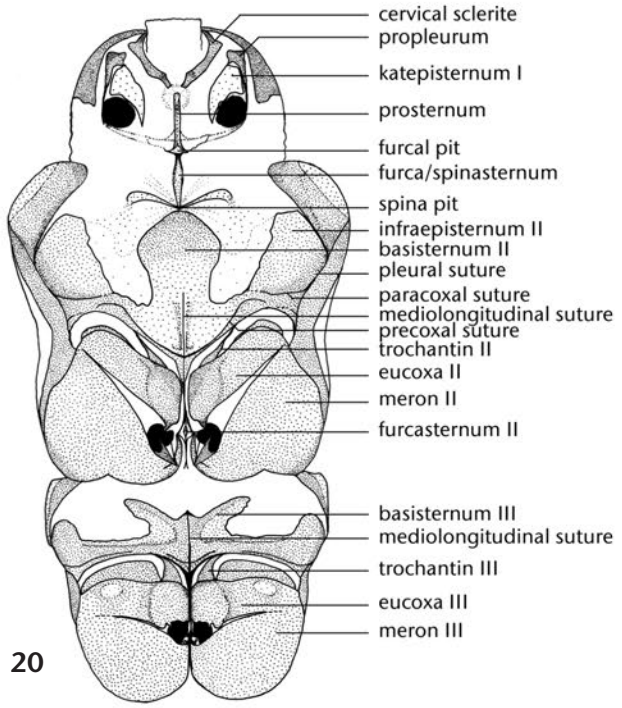

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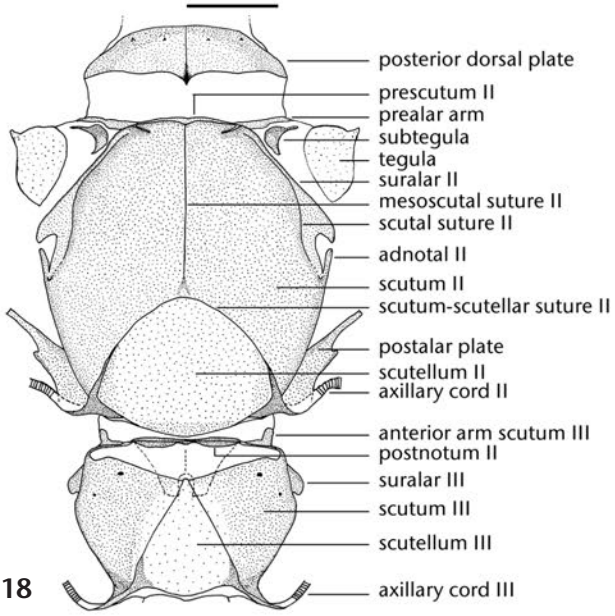

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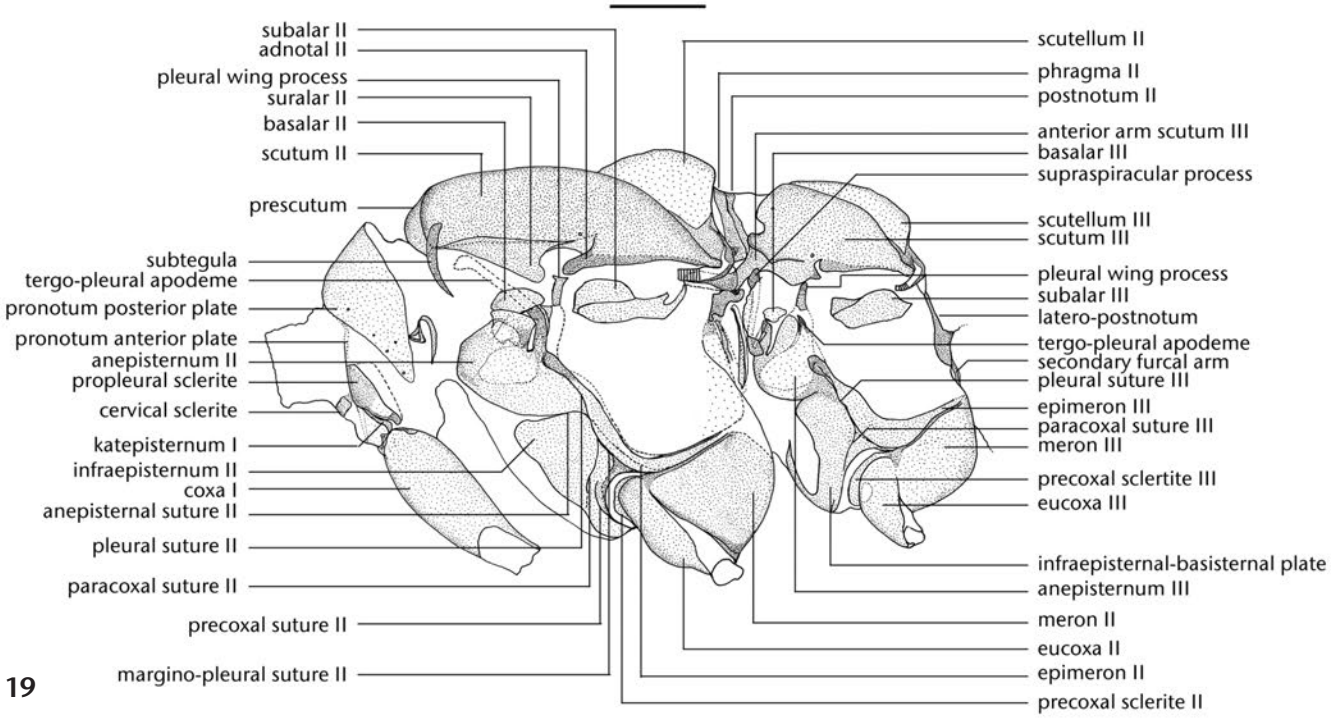

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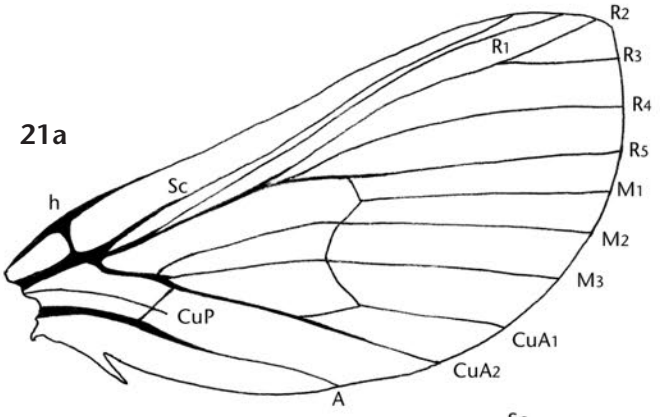
Figs. 17–20, 29: *Cibyra meridionalis* sp. n., ♂ thorax: prothorax anterior view (**17**), dorsal view (**18**), lateral view (**19**), ventral view (**20**), metathorax posterior view (**29**). — Scale bars in Figs. 18, 19 = 1 mm; other drawings at similar scale.

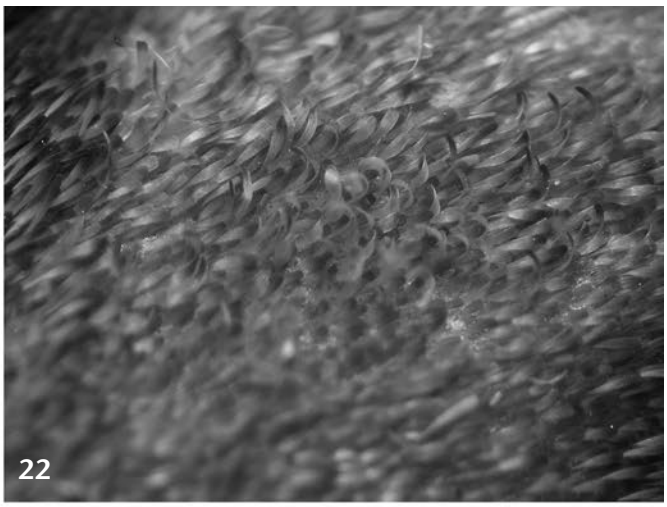
and centrally lesser sclerotised, posteriorly invaginated and fused to the antero-dorsal portion of the epimeron to produce the tergo-pleural apodeme and the pleural wing process; a latero-dorsal extension surrounds an almost membranous area and fuses again itself to the anterior portion which extends inside the body, dorsally to this extension, the rectangular, narrower posteriorly, the basalar. Paracoxal, precoxal and margino-pleural sutures incomplete. Basisternum and infraepisternum a single plate; the first partially divided midline by the mediolongitudinal suture, anterior portion is projected and wider anteriorly, pointed apically to meet the spinasternum I, a pair of transverse sclerites anteriorly seems to define an area with a different texture. Trocanthin is slender anteriorly placed between the infraepisternal-basisternal plate and coxa. Epimeron is a U-shaped sclerite diffused ventro-posteriorly with a parallel suture on its dorsal margin and thickened dorso-posteriorly to fuses with the posterior furcal arm. Spiracle long, parallel to the latter. On the dorsal portion of the epimeron and spiracle, a well sclerotised sclerite, the lateropostnotum fuses with the ventral process of the postalar, with the antero-ventral process of the scutum III, and the posterior margin of the epimeron.

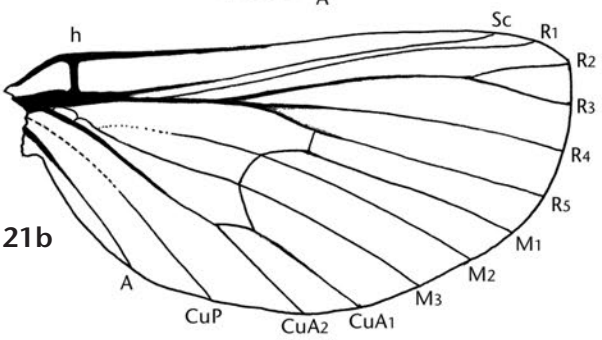
Metathorax (Figs. 19–20, 29). Notum divided into three sclerites: scutum, scutellum, and postnotum. Scutum almost or totally divided by the scutellum, therefore, mesoscutal suture absent; antero-ventrally produced, proximally fused to postnotum II; latero-ventrally, separated by the incomplete scutal suture, the suralars; a pair of pointed depressions present on each lobe. Scutellum triangular and slightly less sclerotised than scutum, laterally well sclerotised to support the axillary cords. Postnotum a transverse sclerite dorsally, projected ventrally into third phragma. Basalar as in the mesopleura, but smaller. Metapleura divided into an episternum and an epimeron by the pleural suture; the first into an anepisternum and an infraepisternal-basisternal plate. Anepisternum as in the FW, from its antero-dorsal portion (antero-ventral portion of the basalar) emerges a process downwards which forms, with the subtegula, the supraspiracular process surrounding a pad-like structure. Infraepisternal-basisternal plates fused ventrally by the complete mediolongitudinal suture; antero-ventrally W-shaped. Paracoxal and precoxal sutures incomplete; margino-pleural suture absent. Trocanthin as in mesothorax. Epimeron is a U-shaped sclerite diffused posteriorly. The secondary furcal arm, visible from only a small portion, articulates with the wide lateropostnotum.

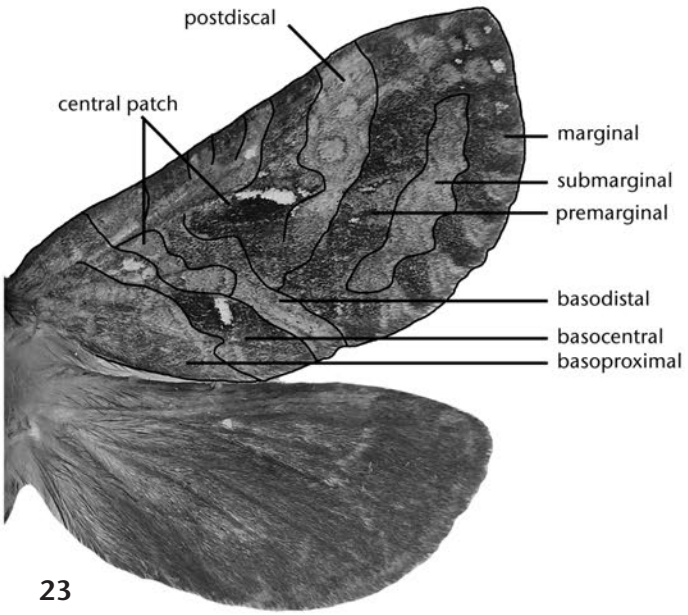
Wings (Figs. 21–23). FW length: ♂ 10–18 mm, ♀ 15–31 mm; wingspan ♂ 21–39 mm, ♀ 31–58 mm (majority being ♂ 25–35 mm, ♀ 40–50 mm); smaller wingspans rare. Wings elongated, tornus not discernible; outer and inner margins convex, apex angled and not pronounced; jugum finger-like on the inner margin of the FW. A few interspersed sensilla chaetica on the margin from the humeral to CuA_1-CuA_2 veins, although more often on the costal margin. Wing venation pattern "hepialine" sensu Dumbleton (1966) and both wings share almost the same basic venation, although few differences are observed (Fig. 21). Venation distances variable, are not treated here. Humeral vein present in both wings. Sc preapical and simple reaching the costal margin. R_1 and R_2 apical and the latter, with R_3 stalked. R_2+R_3 and R_4 divergent and not stalked. R_4 stalked with R_5 close to the base of R_2+ R_3 stalk. Cross-vein R–M_1, M_1–M_2, and M_2–M_3 weakly marked but tubular; on the HW, M_1–M_2 more oblique. M veins free, tubular and parallel. M_1 arises from the discal apex and closer to M_2 than M_2 to M_3. M_2 and M_3 reach the cubitus; on the HW, M_2 does not reach it clearly. Cross-veins M–Cu and CuA_1–CuA_2 weakly marked but tubular. CuA_1 and CuA_2 free. CuP on the FW hardly exceeds the insertion of both cross-veins CuA_2–CuP and CuP–A, both weakly marked; on the HW free and cross-veins absent. Anal vein (A) free, single on the HW. Dorsal FW mostly covered by spatulate scales, bright light yellow scales wider, without apical differentiation, some remarkable gray scales are iron filings-shaped (Fig. 22), ventrally with costal, marginal, and anal areas with spatulate scales and the remaining elongate, hair-like; dorsal HW only covered by elongate, hair-like scales, longer at the base, ventrally as the FW.

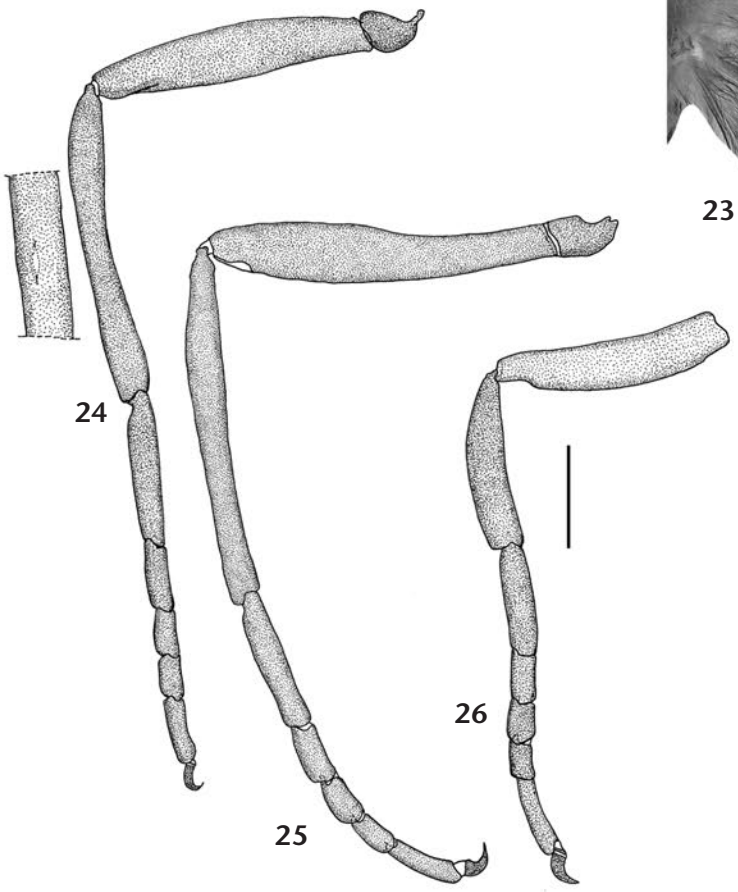
Male ornamentation. The dorsal ground colour is grayish brown to brown suffused with some dark orange patches and light bright yellow scales. FW can be divided into three main portions (Fig. 23): basal, central, and marginal. The first oblique and compound by three to four bands: baso-proximal, baso-central, baso-distal, and occasionally a distinct postbasal band, sometimes confused with the distal part; the central compound by the central patch where lies the stigma; and the distal by four bands, parallel to outer wing margin: postdiscal, premarginal, submarginal, and marginal; vestigial markings of further proximal bands present on the costal margin. Next to the stigma, divided into two to three spots on the distal portion of the discal cell, some other bright light yellow markings present on the baso-central band, on the proximal central patch, on the premarginal band, and close to the apex between R_2–R_3–R_4–R_5. Baso-proximal band grayish-brown with distal margin convex and with some vestigial rounded spots; baso-central band, distally to the former, brown and bearing several light golden markings; baso-distal band grayish-brown dividing the central patch into a proximal portion with some fused dark yellow rounded spots and a distal brown portion; postdiscal and submarginal bands grayish-brown, the former lighter, with water-markings of rounded spots; premarginal and marginal bands brown, merged anteriorly, the latter interspersed by distal grayish-brown spots located between each interveinal area starting being better discernible between R_5 and M_1; in some specimens premarginal band light orange between R_5 and M_2 with an impression of a transverse and divergent band from baso-proximal band. HW dark grayish brown without ornamentation, except lighter outer

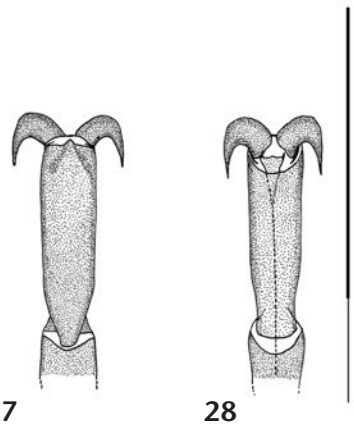




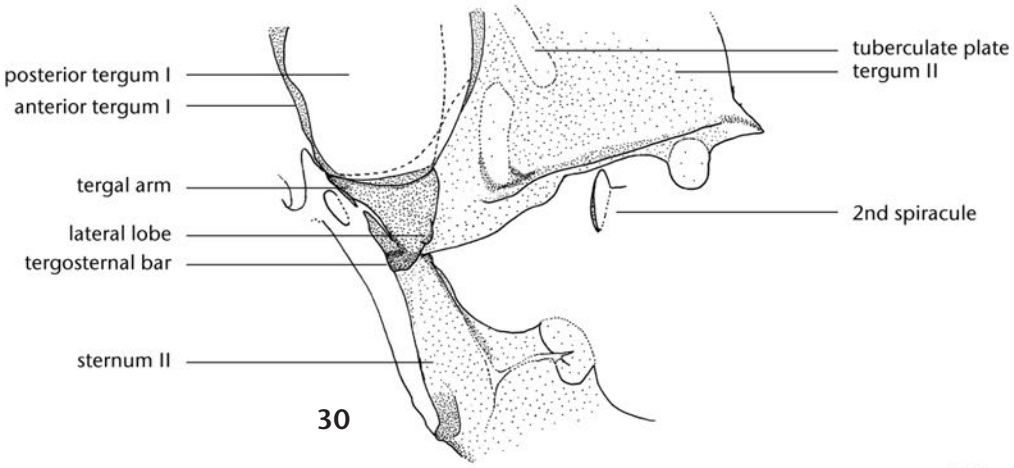








Figs. 21–28: *Cibyra meridionalis* sp. n. — **Figs. 21–23:** ♂ wings: venation FW (**21a**), venation HW (**21b**), fillings-scales (**22**), FW areas (**23**). — **Figs. 24–28:** ♂ leg: foreleg (**24**), mesoleg (**25**), metaleg (**26**); distitarsus of mesothoracal leg: dorsal (**27**), ventral (**28**). — Drawings at different scales; scale bars: 1 mm (for Figs. 24–26, for Figs. 27/28).



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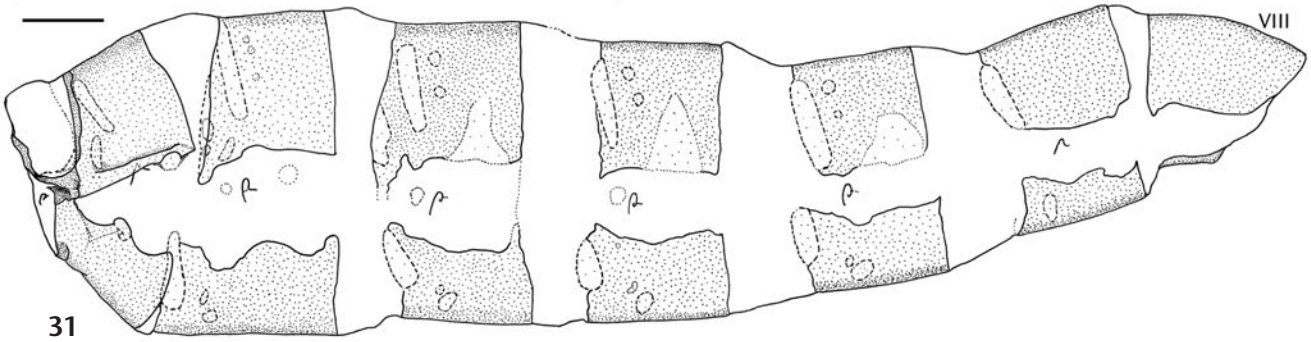

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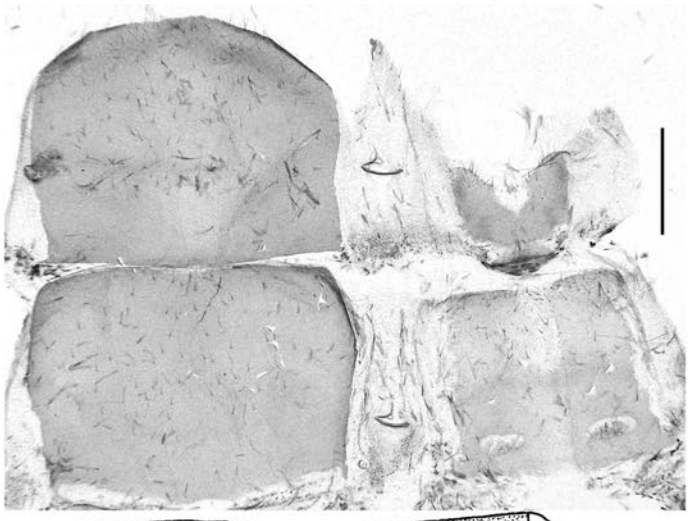

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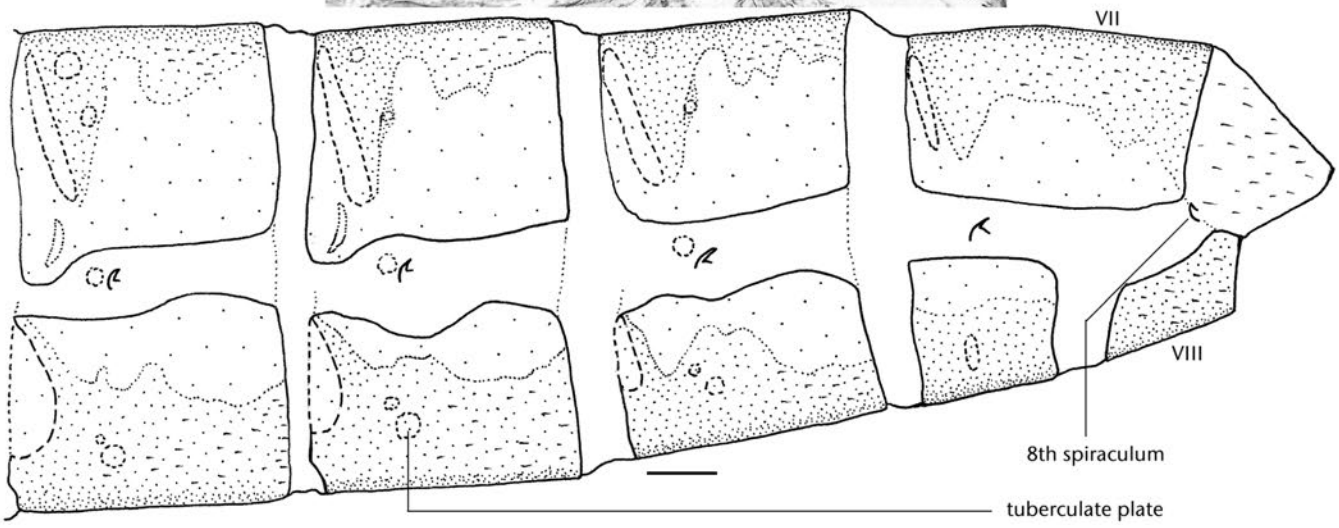

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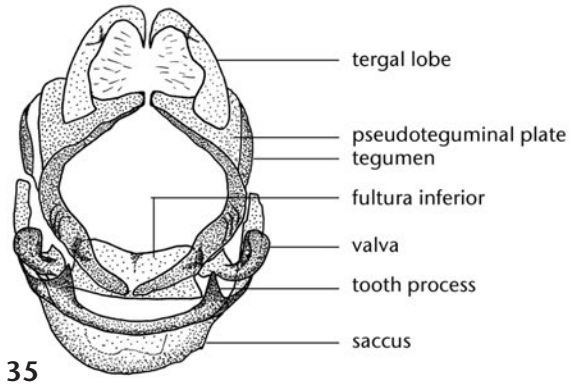
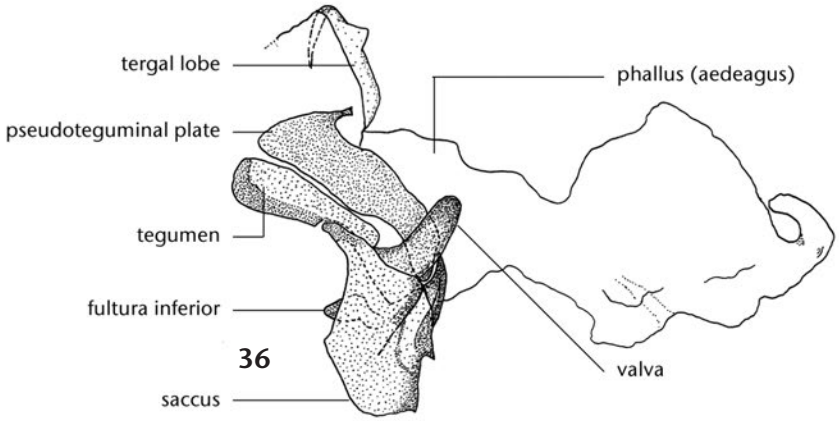
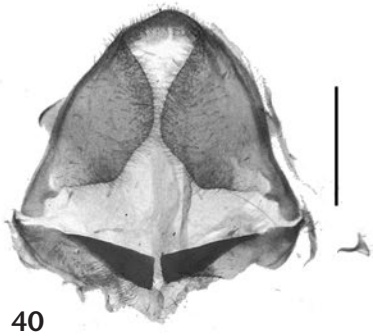
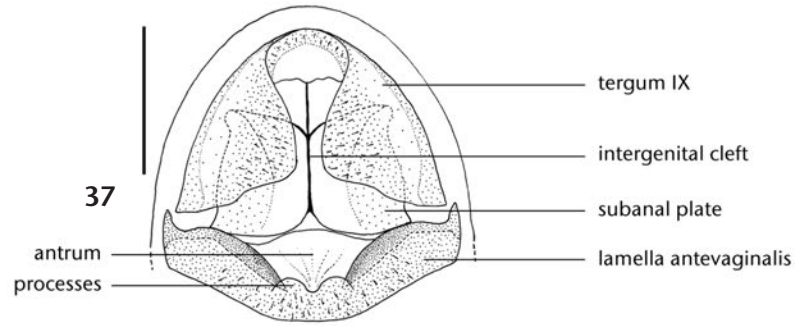
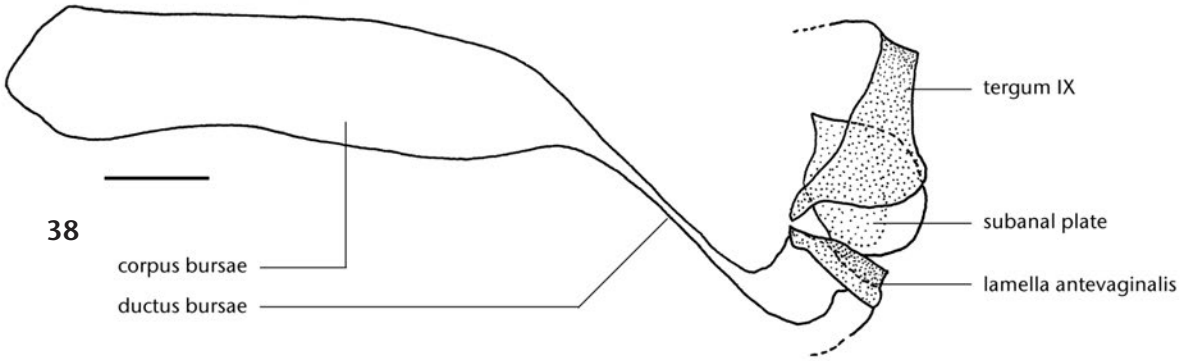
Figs. 30–33: *Cibyra meridionalis* sp. n., abdomen: tergum and sternum I (**30**), ♂ lateral view (**31a–b**), tergum and sternum VIII (**32**), ♀ lateral view (**33**). — Scale bars (where present): 1 mm.











Figs. 34–41: *Cibyra meridionalis* sp. n., ♂ and ♀ genitalia. — **Figs. 34–36:** ♂ genitalia, HT, ventral view (**34**), ventral view (**35**), lateral view (**36**). — **Figs. 37–41:** ♀ genitalia, ventral view (**37**), lateral view (**38**), PT ventral view (**39–41**). — Scale bars (where present): 1 mm.

and costal margins. Ventral side uniform brown to light brown, slightly marked by the lighter submarginal and marginal bands; costal margins marked with some darker patches.

Female ornamentation follows the ♂ pattern, but lighter, bringing a diffuse appearance. Light transverse yellowish-brown patch between R_5 and M_3 often present; sometimes arising posteriorly to the stigma and reaching the outer margin, sometimes restricted to the premarginal band. Light golden markings are reduced.

Legs (Figs. 24–28). Leg ratios (leg I, II, III — femur : tibia : tarsi) 0.88:0.72:0.82, 0.95:0.95:1, 1.32:0.75:0.57. ♂ leg length I, II, III (in mm) — femur: 1.12, 1.53, 0.95; tibia: 1.28, 1.60, 0.71; tarsi: 1.57, 1.60, 1.27. Leg II largest, being 1.61× and 1.35× larger than leg III and I, respectively. Epiphysis absent, although vestigial spot marked

on both sexes. Coxa II and III divided by the coxal suture into an anterior (eucoxa) and posterior (meron) portions; fused dorsally to the thorax, although separated by the pleural suture; in both segments, precoxal sclerite present; on the eucoxa III, latero-dorsally there is a rounded softly sclerotised spot; internal portion characterized by a membranous area; trochanter small, rounded, and articulated. Tarsi five segmented; ventrally, distitarsus most prominent structure, the unguitractor plate; distally, unspecialized tarsal claw (Figs. 27–28).

Thoraco-abdominal junction (Fig. 29). Thorax separated from abdomen by flat lateropostnotum laterally and the postnotum (phragma) mesally; former dorso-laterally and latter laterally connected each other; phragma with a midline lamella. From the lateral portion of the lateropostnotum emerges back and upwards a M-shaped sclerite, the anterior and sclerotised portion of the tergum I; abdominal membrane attached dorsally. The fusion of the lateropostnotum and the anterior portion of the tergum I comprise the latero-intersegmental sclerite weaker sclerotised ventro-proximally.

Abdomen (Figs. 30–33). The first abdominal segment modified as figured by Grehan (2010: 45, fig. b: referred to as *C. ferruginosa,* but actually *C. meridionalis* sp. n.). Tergum I compound by an anterior and sclerotised plate, a posterior only marginally sclerotised, and a ventro-lateral and detached plate. Main portion of the tergum I unsclerotised and lateral margins forming tergal arms projected anteriorly to meet the lateral lateropostnotum III. Ventrally projecting plate with lateral lobe; plate articulated with the antero-dorsal portion of the sternum II and posterior to the tergosternal bar, also connected to the edge of the sternum II (Fig. 30). Tergum II, as the following three segments, projected downwards antero-laterally and with two pairs of unscaled tuberculate plates anteriorly and one on the posterior ventral edge. Sternum II bears the same structure on its dorso-lateral edge. From the segment III to VII, tuberculate plates present and in the segments II to V, also in the pleura. Tergum VIII, tuberculate plate absent (Fig. 31a, b); the sternum VIII much reduced to an U- or V-shaped sclerite (Fig. 32). ♀ with segments slightly sclerotised, tergum VIII hardly differentiated from the pleural membrane, the presence of an anterior and tiny sclerotised band is variable, and sternum VIII subtriangular (Fig. 33); tuberculate plates present as in the ♂.

♂ genitalia (Figs. 34–36). Saccus U-shaped, not projecting anteriorly, with pair of tooth-like conical processes on the postero-dorsal edge. Tegumen vertical, rectangular, well sclerotised and projected ventrally beyond the articulation with saccus. Tergal lobes softly sclerotised, like protuberances located on the dorsal portion of the pseudoteguminal plates; C-shaped, not fused dorsally, with a small projection backward on the postero-dorsal margin. Pseudoteguminal plates tapered dorsally, not fused neither dorsally nor ventrally; antero-dorsally projected with rounded edges; ventral arms posteriorly projected, deeply sclerotised with some folds on the latero-ventral face; plates form a ring-like phallocrypt with the membrane attached. Fultura inferior rectangular, with dorsal margin slightly depressed midway. Valvae club-like, slightly curved inward. Phallus entirely membranous, tubular and when everted with rounded distal bladder with a right curved finger-like process (Fig. 36).

♀ genitalia (Figs. 37–41). Tergum IX (anal papillae) narrow dorsally, inverted U-shaped and articulated to the sternum IX or lamella antevaginalis; the former projected backwards, pad-like, slightly sclerotised, to cover the intergenital lobes. Latter with the subanal plates, oval and softly sclerotised, mesally fused to form the intergenital cleft; posterior apophysis minute. Lamella antevaginalis, a transverse sclerite with latero-posterior dorsal edge well sclerotised, convex or straight, and mesally lighter (Figs. 39–41); the former well separated from each other, but connected by a lighter transverse processes, bilobed and rounded or pointed apically, emerged from its inner margin (Fig. 37). Ductus bursae thin, 2–3 mm, corpus bursae tube-like, 3–5 mm (Fig. 38).

Ethology and geographical distribution. Both ♂♂ and ♀♀ are attracted to light just after dusk, the latter being much rarer. *C. meridionalis* sp. n. is the most common hepialid species in South Brazil during the summer (between December and March). It seems to be confined to the eastern part of the South Brazilian region (Text-Fig. 1) at altitudes between 700 and 1400 m, where Mixed Ombrophilous Forest is predominant. In southern South Brazil, it flies at lower altitudes, starting at 150 m.

Text-Fig. 1 (map): Geographical distribution of *Cibyra meridionalis* sp. n. and *Cibyra ferruginosa* in Brazil.

Cibyra ferruginosa Walker, 1856

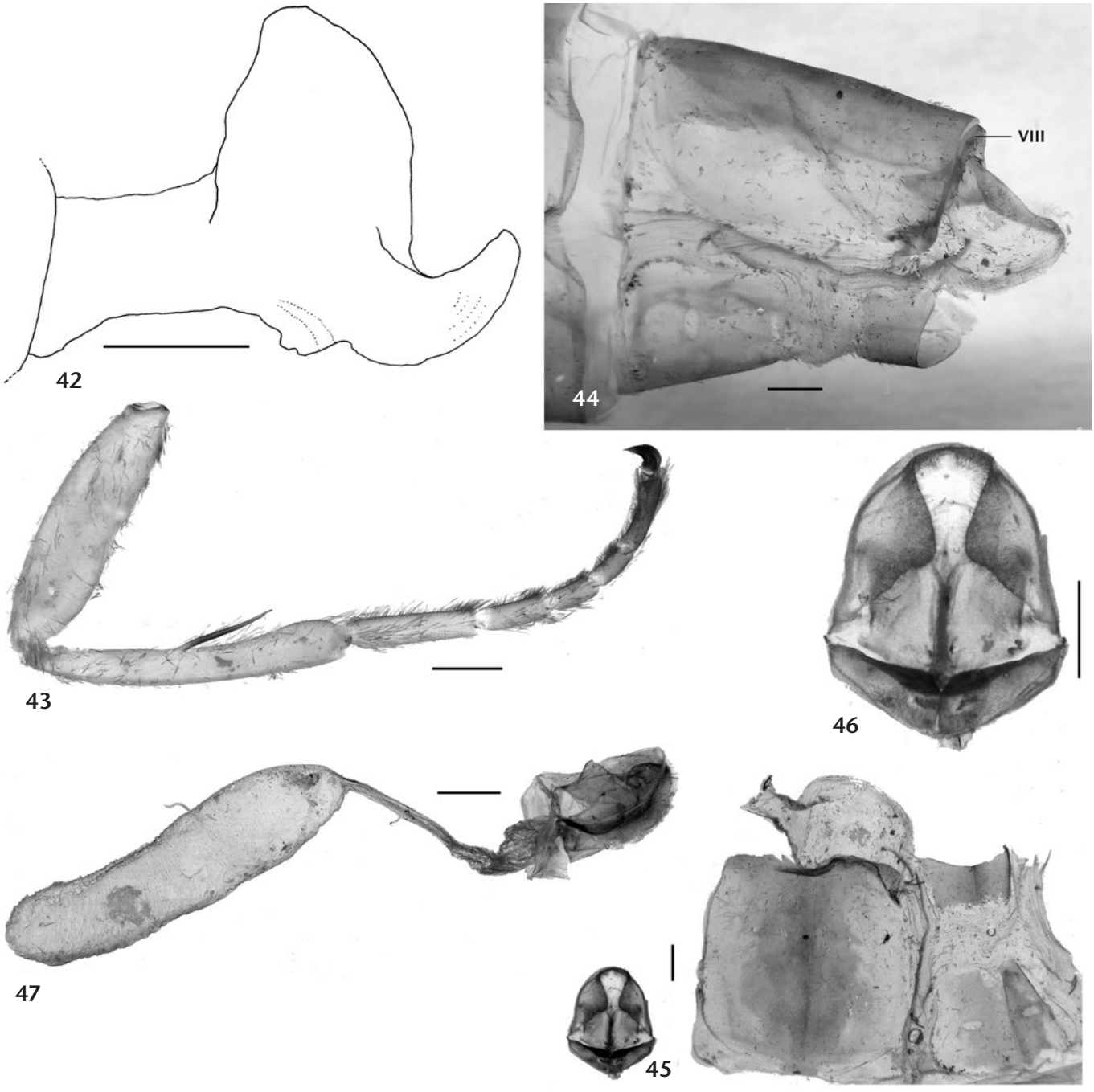
Figs. 5, 6, 7a, 7b, 8a, 8b, 9, 42–47.

Examined specimens (in total 16 ♂♂, 1 ♀), all **Brazil:** 1 ♂, without locality (LT). — **Rio de Janeiro**: 1 ♂, Petrópolis, ex coll. Schaus (USNM 18.602, see below). 1 ♂, Nova Friburgo, 800 m, 22. i. 1993, V. O. Becker leg. (CGCM 14.937). 2 ♂♂, Cachoeiras de Macacu, 600 m, 30. i. 1997, 18. i. 2002, N. Tangerini leg. (CGCM 004 [BC GU661544], 6361). 1 ♂, Petrópolis, 30. i. 1963, Gagarin leg. (DZ 15.667). 8 ♂♂, 1 ♀, Itatiaia, 700 m, 30. i., 15.–18. ii., 27. ii., 4. iii., 28. iii, 15. iii. 1931, 3. iii. 1936, ex. coll. J. F. Zikán (Z 4564, 4627, 4666, 4667, 4668, 4669, 4670, 4671, 4672; IOC). 1 ♂, Itatiaia, 1300 m, 3.–8. ii. 1951, Travassos & Albuquerque leg. (Z 4751). — **São Paulo**: 1 ♂, Campos do Jordão [*recte* Santo Antônio do Pinhal], Eugênio Lefévre, 1200 m, 13.–15. ii. 1953, Travassos F. & Travassos leg. (MZSP 14.415).

♂ (Fig. 5, 6, 7a, 7b). FW length: 16–22 mm; wingspan 35–48 mm. Habitus and ornamentation as in the previous species, except by epiphysis presence (Fig. 43).

♂ genitalia. The basic sclerotised structure is same as in the previous species. The phallus, when everted, is tubular anteriorly and enlarged to an egg-shaped posteriorly with a left and tapered latero-ventral process (Fig. 42).

♀ (Fig. 8a, 8b). FW length: 37 mm; wingspan 68 mm. Tergum VIII compound anteriorly by a narrow and well sclerotised band and posteriorly by very slightly sclerotised plate, mesally even lighter, differentiated from the pleural membrane by texture (Fig. 44); sternum VIII rectangular (Fig. 45).



Figs. 42–47: *Cibyra ferruginosa*. — **Fig. 42:** ♂ genitalia: phallus (everted), lateral view. — **Fig. 43:** ♂ foreleg. — **Figs. 44–45:** ♀, 8th abdominal segment. — **Figs. 46–47:** ♀ genitalia: ventral view (**46**), lateral view (**47**). — Scale bars: 1 mm.

♀ **genitalia** (Figs. 46–47). Lamella antevaginalis deeply invaginated mesally, forming an acute angle with its inner wall wavy on the dorsal part; two processes minute same shaped as the former (Fig. 46). Corpus bursae ca. 6 mm (Fig. 47).

Remarks. Walker (1856) described *C. ferruginosa* based on an uncertain number of specimens. One syntype ♂, figured here for the first time (Fig. 5), deposited in BMNH, bears the label "type". This specimen is **here designated as lectotype.** It has the following labels: / *ferruginosa*/ Brazil/ Type/ Lectotype, *Cibyra ferruginosa* Walker, 1856, C. Mielke & Casagrande det. 2013. It lacks the abdomen, as stated by Viette (1951) who studied the same material, so that the precise determination of what really is *C. ferruginosa* could be in doubt since no other method of determination is currently is available and no morphological structures present on the type are diagnostically informative other than the presence of the epiphysis and the habitus. A parallel situation applies to most of the Brazilian Saturniidae described by Walker in the 19th century, of which some are endemic to the SE Brazilian region until today. None of the endemic species from S Brazil were related at that time so the few available characters lead to the true identity of *C. ferruginosa*. This could be supported by the valuable work done by Zikán at the Itatiaia region (SW from Rio de Janeiro city), who prepared a great Lepidoptera collection from where most of the specimens examined were found and the absence of any other similar species.

Schaus (1901) described *Dalaca dormita* based on an uncertain number of specimens. One ♂ syntype, figured here for the first time (Fig. 6), is deposited in USNM and bears the label "type". This specimen is **here designated as lectotype** to stabilise the identity of the taxon. It has the following labels: /*Dalaca dormita* Schaus Type/ Petropolis, Brazil/ Type No. 18602 U.S.N.M/ Photo det. E. S. Nielsen 1984/ Collection WM Schaus/ Lectotype, *Dalaca dormita* Schaus, 1901, C. Mielke & Casagrande det. 2013. The synonymy by Viette (1951) is accepted.

Cibyra schausi (Viette, 1952) **syn. n.** (Fig. 9) was described based on a single ♀ from Araras, São Paulo state (Fig. 15), within *Paragorgopis* Viette, 1952 (subsequently replaced by *Vietteogorgopis* Özdikmen, 2007) and finally moved to *Cibyra* by C. Mielke & Grehan (2012). Examination of all holotypes and specimens deposited in collections leads to the conclusion that *C. schausi* (Viette, 1952) syn. n. is the same species as *C. ferruginosa*.

Ethology and geographical distribution. It is likely *C. ferruginosa* follows the previous species. Despite the scarcity of records, it seems to be confined to the eastern part of the southeast Brazilian region, more precisely to Rio de Janeiro State (Text-Fig. 1). There is no evidence of sympatry with *C. meridionalis* sp. n.

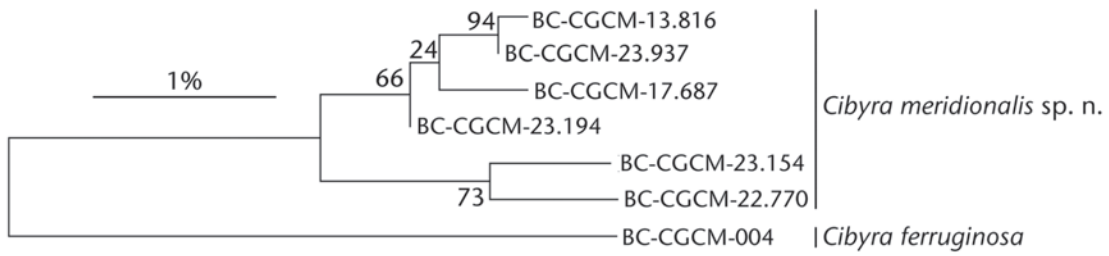
Discussion. A close relationship between *C. meridionalis* sp. n. and *C. ferruginosa* is suggested by their similarity in wing ornamentation and habitus, which the former is slightly smaller, but mainly by the ♂ genitalia. No differences have been found in the sclerotised structures, but the right curved finger-like process of the phallus is distal in the former and posterior, tapered and left curving in the latter. The presence of an epiphysis in *C. ferruginosa* is a good character to contrast with its absence in the ♂ and ♀ of *C. meridionalis* sp. n.

Although the presence and absence of an epiphysis allows the two species to be easily distinguished, it is quite surprising to have found important taxonomical differences in the membranous phallus. This feature has been largely overlooked in hepialid descriptions and raises a doubt about the regular mode of hepialid genitalia preparations using slide glasses where this character is possibly lost. Most of the dissected primary times examined are in this condition. There is considerable variation in the morphology of the phallus among species and genera of Hepialidae in South America (J. R. Grehan, personal communication) so this feature could represent a very important diagnostic and systematic character in future analyses.

The mitichondrial COI gene (DNA analysis) also indicates both taxa are clearly separated as shown in the tree (Text-Fig. 2). The minimum Kimura 2-parameter model method (%) see Table 1.

Table 1: The minimum Kimura 2-parameter model method (in %) between DNA barcodes of the two studied species and the maximum intraspecific variation is given in the diagonal (number of records within brackets).

%	*C. meridionalis* sp. n.	*C. ferruginosa*
C. meridionalis sp. n.	2.2 (36)	–
C. ferruginosa	5.6	N/A (1)



Text-Fig. 2: Unrooted bestscore ML tree for *Cibyra ferruginosa* and *Cibyra meridionalis* sp. n.; bootstrap values are given at each node, and terminals are identified by their sample ID-code referring to the records in the Barcode of Life Datasystems (Bold 2013).

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