Notes about *Cibyra* Walker, 1856 (third note), with description of three new species from southeastern and southern Brazil (Lepidoptera, Hepialidae)

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Abstract: Three species of *Cibyra* Walker, 1856 from southeastern and southern Brazil are described: *Cibyra endyra* sp. n. (from Minas Gerais and São Paulo states), *C. ykeyra* sp. n. (from Paraná and Santa Catarina states) and *C. ybyra* sp. n. (from Santa Catarina and Rio Grande do Sul states). Percentage differences of the partial COI mitochondrial gene sequences (DNA barcode) are presented for all species. All male holotypes are deposited in Col. Padre Jesus Santiago Moure at Universidade Federal do Paraná, Curitiba, Brazil.

Keywords: morphology, Neotropical, taxonomy, DNA barcoding.

Introduction

In the third note about *Cibyra* Walker, 1856, three species from southeastern and southern Brazil are described as new, raising the number of species within the genus to 18. The terminology of the morphological structures follows Mielke & Casagrande (2013). Only the relevant and/or diagnostic characters of each species are mentioned.

Mitochondrial DNA was extracted for all taxa involved in this study and interpreted as explained in Mielke & Casagrande (2013).

Abbreviations used

Collections

NMUK The Natural History Museum (formerly British Museum (Natural History) = BMNH), London, U.K.

CEIOC Entomological Collection of Oswaldo Cruz Institute, Rio de Janeiro, Rio de Janeiro, Brazil.

CGCM Collection Carlos G. C. Mielke, Curitiba, Paraná, Brazil.

CLAM Collection Alfred Moser, Novo Hamburgo, Rio Grande do Sul, Brazil.

DZUP Collection Padre Jesus S. Moure, Departamento de Zoologia, Universidade Federal do Paraná, Curitiba, Paraná, Brazil.

MZSP Museu de Zoologia, Lepidoptera collection, Universidade de São Paulo, São Paulo, São Paulo, Brazil.

SMFL Senckenberg-Museum, Lepidoptera collection, Frankfurt am Main, Germany.

Further abbreviations

BC Specimens with a mtDNA barcode, followed by GenBank access number [in square brackets].

FW Forewing.

HT Holotype.

HW Hindwing.

PT Paratype.

Systematic part

*Cibyra endyra* sp. n.

Figs. 1a, 1b, 2a, 2b, 14, 15, 16, 23, Text-Fig. 1.


Etymology. *Endyra* means “sister”, translated from the old Tupi language (native from America) due to its resemblance with the other two described species here.

♀ (Figs. 1a, 1b, 14). FW length: 16–22 mm; wingspan: 34–42 mm. Antenna with 25–28 segments. Epiphysis absent. Thorax dark orange dorsally, lighter ventrally. Legs coloured as the thorax. FW ground colour orangish-brown dorsally; baso-proximal, central patch, pre-marginal, and marginal bands compound by orangish-brown rounded spots; baso-central, baso-distal, post-distal, and submarginal hands brown; stigma oblique, bright light yellow partially surrounded by dark brown scales; the thin baso-central band sometimes with tiny spots coloured as the stigma. HW light orangish-brown to brown. Sternum VIII V-shaped (Fig. 14).

♂ genitalia (Figs. 15, 16). Postero-dorsal edge of the saccus bent mesally and projected posteriorly. Tergal lobes flattened, crab-claw shaped. Fultura inferior bilobed dorsally. Valvae finger like. Phallus everted with a distal bladder, compound mainly by three lobes, two downwards and one backward, without symmetrical pro-
cesses. The insertion of the ductus ejaculatorius may be developed into a fourth lobe (Fig. 16).

♀ (Figs. 2a, 2b). FW length: 31 mm, wingspan: 58 mm. Antennae bipectinate, but rami shorter than \( \sigma \), lacking the last segments. Thorax pale orangish-brown. FW with the same rounded spots as on the \( \sigma \), but much paler; postdiscal band distinct and reaching the inner margin; light transverse light-brown patch between \( R_5 \) and \( M_3 \) present. HW light orangish-brown.

**Diagnosis**

*C. endyra* sp. n. is recognized by the combination of the following characters: absence of epiphysis, projection and shape of the postero-dorsal edge of the saccus, and the phallos shape when everted. The postero-dorsal edge of the saccus bent seems to be unique within the genus.

**Ethology and geographical distribution**

The few records available are all from the summer and the recent collected specimens were attracted to UV lights at dusk. *C. endyra* sp. n. seems to be confined to the Mantiqueira Mountains (Fig. 23) at altitudes ranging from 800 to 1800 m. It is sympatric to *C. ferruginosa* from 800 to 1800 m. It is sympatric to the previous species, means “young brother”, translated from the old Tupi language.

**ethymology**

*Ykeyra* sp. n. seems to be closely related since their obvious similarity, however, the shape of the postero-dorsal edge of the saccus is distinct to determine the species.

**Diagnosis**

*C. ykeyra* sp. n. and *C. endyra* sp. n. seem to be closely related since their obvious similarity, however, the shape of the postero-dorsal edge of the saccus is distinct to determine the species.

**Ethology and geographical distribution**

Flight activity follows the same pattern as mentioned above for the previous species. *C. ykeyra* sp. n. seems to be confined to the eastern part of the states Paraná and Santa Catarina (Fig. 23) at altitudes between 600 and 1000 m. It is sympatric and synchronic with *C. ochracea*, *C. meridionalis* C. Mielke & Casagrande, 2013, *C. monargentaeus* (Viette, 1951), and *C. tessellata* C. Mielke, 2014 in several places in Paraná and Santa Catarina.

**etymology**

*Ybyra* sp. n. 8a, 8b, 9, 10, 11, 12a, 13b, 20, 21, 22, Text-Fig. 1.

**Hologype** \( \sigma \) with the following labels (separated by forward slashes): "Holotypus, *Cibyra ybyra* C. Mielke det. 2014/ Brazil, SC, São Bento do Sul, Rio Vermelho, 700 m, 8. ii. 2006, I. Rank leg. / CGCM 19.962 / DZ 15.534 / BC-CCGM / [BC-JX215634]. Donated by the author and deposited in DZUP.

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**etymology**

*Ykeyra* means “oldest brother”, translated from the old Tupi language, as the previous species.

\( \sigma \) (Figs. 3a, 3b, 4, 5, 6, 17). FW length: 17–29 mm; wingspan: 34–57 mm. Antenna with 27-30 segments. Epi-

physis absent. Thorax, legs, wing ornamentation, and abdomen as the previous species. However, most of the examined material (ca. 70%) shows the rounded spots suppressed, especially on the baso-proximal, baso-central, and postdiscal bands; the latter pronounced and reaching the inner margin. Two standardized phenotypes are presented without clear intermediate forms.

**genitalia** (Figs. 18, 19). General apparatus as the previous species. Postero-dorsal edge of the saccus slightly curved, not bent, and projected posteriorly.

♀ (Figs. 7a, 7b). FW length: 32 mm; wingspan: 58 mm. Similar to the previous species.

**Diagnosis**

*C. ykeyra* sp. n. and *C. endyra* sp. n. are closely related since their obvious similarity, however, the shape of the postero-dorsal edge of the saccus is distinct to determine the species.
♂ (Figs. 8a, 8b, 9, 10, 11, 12, 20). FW length: 13–21 mm; wingspan: 26–42 mm. Antenna with 24–27 segments. Epiphysis present. Thorax, legs, wing ornamentation, and abdomen as the previous species, including the same two phenotypes.

♀ (Figs. 1–2, Cibyra endyra sp. n. HT ♂ dorsal (1a), ventral (1b); PT ♀ dorsal (2a), ventral (2b). — Figs. 3–7: Cibyra ykeyra sp. n. HT ♂ dorsal (3a), ventral (3b); PT ♂ dorsal (4); PT ♂ dorsal (5); PT ♂ dorsal (6); PT ♂ dorsal (7a), ventral (7b). — Figs. 8–13: Cibyra ybyra sp. n. HT ♂ dorsal (8a), ventral (8b); PT ♂ dorsal (9); PT ♂ dorsal (10); PT ♂ dorsal (11); PT ♂ dorsal (12); PT ♂ dorsal (13a), ventral (13b). — Fig. 23: Distribution of C. endyra sp. n., C. ykeyra sp. n. and C. ybyra sp. n. in SE- and S- Brazil. — All specimens approximately to natural size; scale bars = 1 cm.

♂ genitalia (Figs. 21, 22). General apparatus as the previous species, except by the tergal lobes pronounced and the postero-dorsal edge of the saccus slightly curved and slightly pronounced. Phallus everted with a rectangular distal bladder, compound by two lobes, the
posterior bigger which bears two ear-like processes on each side postero-dorsally (Fig. 21).

♀ (Figs. 13a, 13b). FW length: 25 mm; wingspan: 49 mm. Thorax dark brown. Wing ornamentation as the previous species.

Diagnosis

*C. ybyra* sp. n. is similar to the previous species, but can be easily distinguished by the presence of an epiphysis and the slightly projection of the postero-dorsal edge of the saccus. The ear-like processes on the phallus when everted seems to be related to the one of *C. tesselata*, although the bladder shape is unique within the genus.

Ethology and geographical distribution

It follows the same pattern as mentioned for the two previous species. *C. ybyra* sp. n. seems to be confined to the Serra Geral of Santa Catarina and Rio Grande do Sul, on the southeastern part of former and on the northeastern part of the latter (Fig. 20) at altitudes between 1000 and 1400 m. It is sympatric and synchronous with *C. meridionalis* and *C. monoargenteus*.

DNA analysis

In order to facilitate the comparison with other *Cibyra* species cited by C. Mielke & Casagrande (2013) and C. Mielke (2014), their distances are transcribed in Table 1, and for building the tree, the same vouchers are used.
Text-Fig. 1: Unrooted bestscore ML tree for *C. meridionalis*, *C. ferruginosa*, *C. monoargenteus*, *C. tessellata*, *C. ochracea*, *C. endyra* sp. n., *C. ykeyra* sp. n. and *C. ybyra* 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).

Table 1: Minimum p-distance (%) between DNA barcodes of the studied species. Maximum intraspecific variation is given in the diagonal (light grey; number of records within parentheses).

<table>
<thead>
<tr>
<th></th>
<th>% C. meridionalis</th>
<th>% C. ferruginosa</th>
<th>% C. monoargenteus</th>
<th>% C. tessellata</th>
<th>% C. ochracea</th>
<th>% C. endyra sp. n.</th>
<th>% C. ykeyra sp. n.</th>
<th>% C. ybyra sp. n.</th>
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<tbody>
<tr>
<td>C. meridionalis</td>
<td>2.3 (36)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>C. ferruginosa</td>
<td>5.6</td>
<td>N/A (1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. monoargenteus</td>
<td>3.9</td>
<td>4.4</td>
<td>0.5 (13)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. tessellata</td>
<td>6.6</td>
<td>6.9</td>
<td>6.0</td>
<td>0.0 (3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. ochracea</td>
<td>4.7</td>
<td>5.0</td>
<td>6.6</td>
<td>6.9</td>
<td>1.5 (19)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. endyra sp. n.</td>
<td>3.3</td>
<td>5.2</td>
<td>4.4</td>
<td>5.3</td>
<td>5.7</td>
<td>0.3 (2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. ykeyra sp. n.</td>
<td>3.7</td>
<td>4.7</td>
<td>3.6</td>
<td>5.3</td>
<td>5.3</td>
<td>1.5</td>
<td>0.2 (6)</td>
<td></td>
</tr>
<tr>
<td>C. ybyra sp. n.</td>
<td>3.9</td>
<td>6.0</td>
<td>4.5</td>
<td>5.7</td>
<td>6.2</td>
<td>3.2</td>
<td>2.9</td>
<td>3.3 (14)</td>
</tr>
</tbody>
</table>

Specimen and sequence data are stored in the Barcode of Life Data Systems (BOLD 2013, Ratnasingham & Hebert 2007) in public projects and in GenBank with their code access cited for each specimen in the list of material examined.

The mitochondrial COI gene as well indicates that the taxa treated in the present publication are clearly separated as shown in the tree (Text-Fig. 1). The minimum interspecific distances and the maximum intraspecific distances between DNA barcodes of the treated species are shown in Table 1.

Regarding internal relationships according to the phylogenetic hypothesis proposed here, *C. endyra* sp. n. is placed as a sister of *C. ykeyra* sp. n. supported by the same branch. *C. ybyra* sp. n. is on the same way placed as a sister group of the clade compound by the two previous species. These relations are corroborated by the morphology examined. Within *C. ybyra* sp. n., there are

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two well defined barcode clusters with over 3% differences. Including these three specimens in the type series is the result of no evidence of any difference in the morphological characters observed.

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References


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