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More than *Olceclostera bifenestrata*: New species and morphology of immature stages of *Olceclostera* Butler, 1879 (Lepidoptera: Bombycoidea, Apatelodidae)

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Abstract

Apatelodidae is a family of Neotropical bombycoids that still needs to be studied in several aspects, as many groups of species have not yet undergone a careful systematic revision. On the other hand, recent studies showed that some species known to be widely distributed in fact form species complexes. Until now, *Olceclostera bifenestrata* Schaus, 1912, described from Costa Rica, supposedly has a wide distribution, reaching the south of Brazil. We reviewed specimens from South America identified as *O. bifenestrata*. Using morphological data and DNA barcodes, we discovered that South American specimens belong to four new species: *Olceclostera jairana* **sp. nov.**, *Olceclostera quilombola* **sp. nov.**, *Olceclostera xeta* **sp. nov.** and *Olceclostera wayana* **sp. nov.** The four species can be distinguished mainly by characters of genitalia, mostly in aedeagus structures. However, wing characters (number of hyaline spots) and abdomen characters (number of patches of larger scales) may be useful for classifying species groups in *Olceclostera*. Additionally, we illustrate and describe for the first time all the life stages of an *Olceclostera* species, including its chaetotaxy and life history, and provide the first SEM images of the egg of an Apatelodidae species. We present a discussion about the morphological characters of adults and immatures and their relevance to the systematics of Apatelodidae.

Keywords

American silkworm moth, *Olceclostera jairana* **sp. nov.**, *Olceclostera quilombola* **sp. nov.**, *Olceclostera wayana* **sp. nov.**, *Olceclostera xeta* **sp. nov.**, systematics, taxonomy

1. Introduction

Apatelodidae is a family of Neotropical bombycoids (Lepidoptera: Bombycoidea) that lacks conspicuous colors or economic or medical importance. As a consequence, the group has been largely neglected in biodiversity studies, especially if compared to other large-sized Bombycoidea (e. g. Saturniidae and Sphingidae) (Kitching et al. 2018; Ballesteros Mejia et al. 2020). More recently, some taxonomic efforts carried out mainly by Herbin (Herbin 2015, 2017, 2018, 2021a, 2021b; Herbin and Monzon Sierra 2015; Herbin and Beccacece 2018; Herbin and Mielke 2018; Herbin et al. 2021) have shown that the family is more diverse than previously thought. The study of the male and female genitalia structures and the use of molecular tools has shown that many species comprise cryptic species complexes (Herbin 2017; Herbin et al. 2021; Orlandin and Carneiro 2021). Currently, the family comprises 200 species and ten subspecies, distributed in 13 genera (Kitching et al. 2018; Hamilton et al. 2019; Herbin 2021a, 2021b; Herbin et al. 2021; Orlandin and Carneiro 2021) but studies testing the monophyly of the genera are lacking.

The genus *Olceclostera* Butler, 1879, was described in Notodontidae, based on *Olceclostera irrorata* Butler, 1879 and subsequently transferred to Lasiocampidae as a synonym of *Parathyris* Hübner 1819 (Kirby 1892). However, the synonymy was ignored by Schaus, who first described species of *Olceclostera* in Bombycidae (Schaus 1892) but later in Eupterotidae (Schaus 1894, 1900, 1905, 1910, 1912, 1920). Subsequently, Draudt (1929) transferred *Olceclostera* to Zanolinae (Bombycidae), currently a synonym of Apatelodidae (Zwick 2011), where the genus stands. *Olceclostera* harbors 31 species (Kitching et al. 2018; Herbin, 2021a, 2021b), 27 described until 1929 (Draudt 1929), based only on a few external characters (e. g. color, wing shape, and the number of hyaline spots). Based on Draudt (1929), some species are still believed to have a wide distribution. An example of this is *Olceclostera bifenestrata* Schaus, 1912. Described from Costa Rica, *O. bifenestrata* is cited as a widely distributed species (Draudt 1929; Biezanko 1986), and specimens from South America are identified as this species in collections.

The immature stages of *Olceclostera* species are also poorly known. Only the larvae of two North American species have been described (Lintner 1874; Packard 1895; Franclemont 1973; Stehr 1987; Peigler 1994; Wagner 2005), and additional images of some species from Central America can be found in online databases (Janzen and Hallwachs 2009). Also, host plant records are only available for a few species (Franclemont 1973; Biezanko et al. 1974; Wagner 2005; Janzen and Hallwachs 2009; Robinson et al. 2010; Diniz et al. 2013). However, none of the studies provides a detailed description of all immature stages, including the larval chaetotaxy, an important set of characters that contribute to the systematics of many groups of Lepidoptera (Peterson 1962; Scoble 1992) and which have shown substantial differences when comparing the immatures of some genera of Apatelodidae (Orlandin et al. 2021, 2022a, 2022b).

Aiming to test if the specimens from South America recognized as *O. bifenestrata* belong to this species, the morphology of males and females, including genitalia, was studied. To confirm if this morphological similarity reflects a close relationship, we perform a molecular analysis based on COX1 (barcode region, 658pb). Additionally, we describe in detail all immature stages from one of these new species adding a discussion of its relevance to the systematics of Apatelodidae.

2. Material and methods

2.1. Specimens examined

About 200 specimens, including all *Olceclostera* types, were examined directly or indirectly from the following collections (abbreviations used throughout the text):
CDH – Personal collection of Daniel Herbin; Garidech, France. **CUIC** – Cornell University Insect Collection; Ithaca, New York, United States of America. **DD** – Personal collection of Diego Rodrigo Dolibaina; Vitória, Espírito Santo, Brazil. **DZUP** – Coleção Entomológica Padre Jesus Santiago Moure, Departamento de Zoologia, Setor de Ciências Biológicas, Universidade Federal do Paraná; Curitiba, Paraná, Brazil. **MACN** – Museo Argentino de Ciencias Naturales “Bernardino Rivadavia”; Buenos Aires, Argentina. **MfN** – Museum für Naturkunde; Berlin, Germany. **MHNG** – Muséum d’histoire naturelle de Genève; Geneva, Switzerland. **MNRJ** − Museu Nacional da Universidade Federal do Rio de Janeiro; Rio de Janeiro, Brazil. **NHMUK** – The Natural History Museum; London, United Kingdom. **USNM** − National Museum of Natural History, Smithsonian Institution; Washington, D.C., United States of America. **VOB** − Personal collection of Vitor Osmar Becker, Reserva Serra Bonita; Camacan, Bahia, Brazil. **ZSM** − Zoologische Staatssammlung München; Munich, Germany.

In addition, we accessed all original descriptions of *Olceclostera* species (Walker 1855, 1865; Grote 1864; Packard 1864; Butler 1879; Edwards 1886; Druce 1890; Schaus 1892, 1894, 1900, 1905, 1910, 1912, 1920, 1927; Dyar 1906; Jones 1908; Draudt 1929; Herbin 2018, 2021; Herbin and Mielke 2018). In the section “Material examined” where the information on the types is provided, the labels are separated from one another by transverse bars.

2.2. Morphology

Immature. The first instar was illustrated with and without the long setae that ornamented the body. These setae were carefully removed using tweezers to allow the visualization of its insertions and other structures present along the body. Images of the eggs were taken using scanning electron microscopy (SEM-JEOL JSM 6360-LV). Images of the egg 1st, and 2nd instars, and pupa were taken using an optical stereomicroscope adapted with focus stacking (Leica Application Suite Version 4.12.0 [Build 86]), and subsequent instars were recorded with a Sony DSC-HX100V digital camera. We used ImageJ Software (Schneider et al. 2012) to measure the eggs, cephalic capsules, larvae, and pupae. The terminology follows Peterson (1962) and Stehr et al. (1987).

Adults. For the description of adults, the head, palpi, legs, and abdomen were detached, soaked in hot 10% potassium hydroxide solution (KOH) for approximately 3 min, washed in water, examined, illustrated, and then stored in glass vials containing glycerin. Images were taken using an optical stereomicroscope adapted with focus stacking (Leica Application Suite Version 4.12.0 [Build 86]) and a Sony DSCHX100V digital camera. The terminology follows Kristensen (2003), but the term "fultura inferior" (= juxta) is applied *sensu* Petersen (1904); the term aedeagus is applied *sensu* Snodgrass (1935); and followed Zwick (2009) for the terminology of the semi–oval sclerotized plates located ventrally of the subscaphium [gnathos] (Fig. 1).

2.3. Immatures rearing

A female was collected using a reflective sheet placed adjacent to light during sampling at Nova Petrópolis, Joaçaba, Santa Catarina, Southern Brazil (27°06'02"S, 51°36'32"W) on 21–31 December 2019. The female was placed in a plastic container for oviposition. After hatching from the eggs, a set of hostplant species, including *Allophylus* sp. (Sapindaceae), *Duranta erecta* L. (Verbenaceae), *Handroanthus* sp. (Bignoniaceae), *Ilex paraguariensis* A. St.-Hil. (Aquifoliaceae), *Persea americana* Mill. (Lauraceae), *Psidium cattleyanum* Sabine (Myrtaceae) and *Schinus terebinthifolia* Raddi (Anacardiaceae) were offered to the larvae. These hostplant species were chosen based on previous records of Apatelodidae host plants (Biezanko et al. 1974; Janzen and Hallwachs 2009; Robinson et al. 2010; Orlandin et al. 2021, 2022a, 2022b). The larvae were reared with the chosen hostplant species until pupae. Whenever necessary, the branches were replaced to maintain fresh, abundant, and high-quality leaves for the immatures. Immediately after each moult, the dry head capsules were retained and stored in glass vials. From the fifth instar on, the larvae were transferred to similar containers with the hostplant branches and a layer of dark soil beneath. A few specimens from each immature stage were killed through immersion in boiling

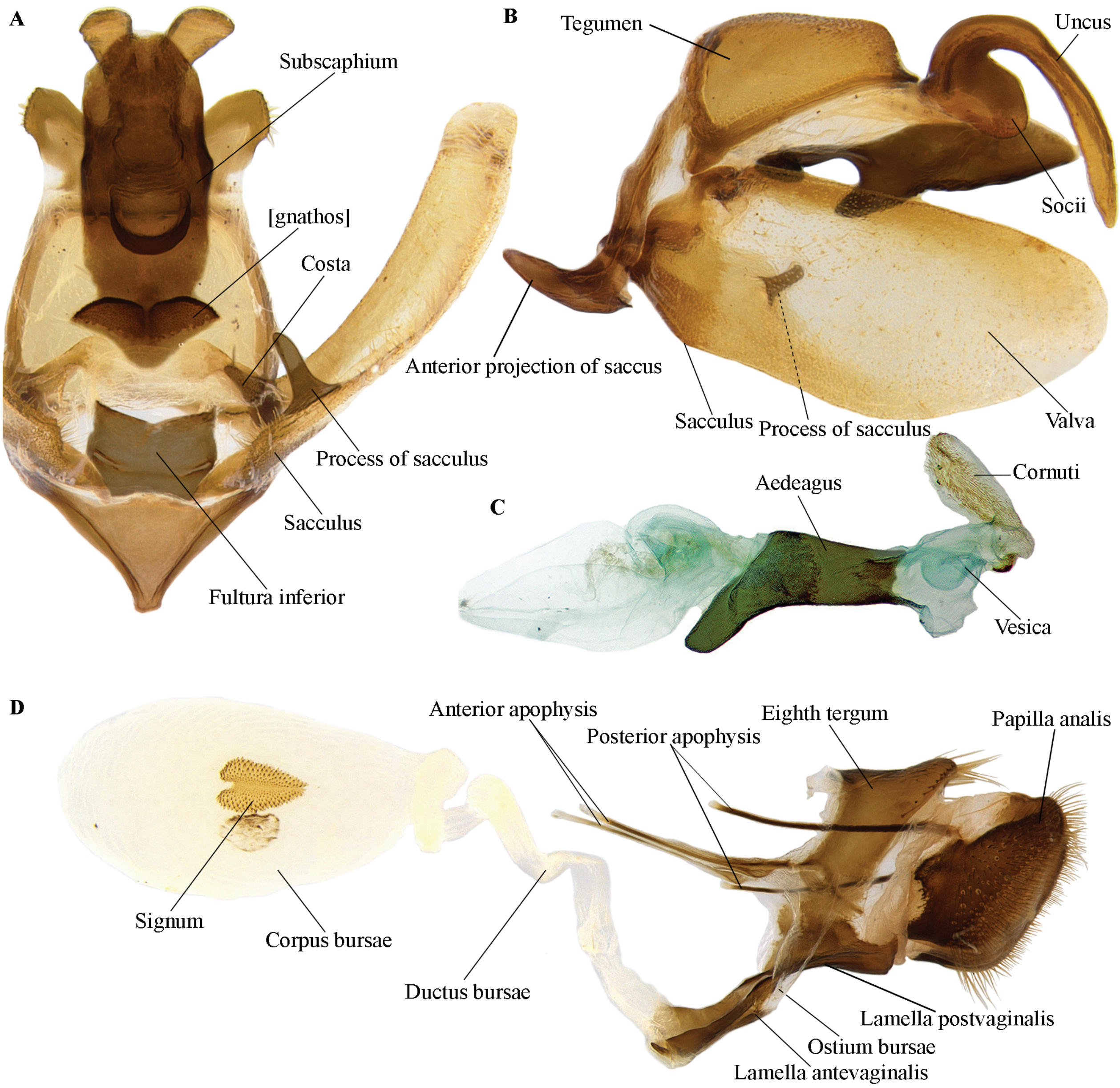

Figure 1. Terminology adopted for *Olceclostera* genitalia: **A** male, ventral view; **B** male, lateral view; **C** male, phallus, lateral view; **D** female, lateral view.

water, fixed in Kahle-Dietrich 10% (Borror and deLong 1971) for 72 h, subsequently preserved in ethanol 70%, and then deposited in the Immature Collection of Lepidoptera from the Entomological Collection "Pe. Jesus Santiago Moure, Universidade Federal do Paraná" under voucher number DZUPIL 0170.

2.4. Genetic divergence and phylogenetic inference

A series of 30 Apatelodidae specimens were selected for DNA sequencing. A leg was removed and sent for sequencing of the COX1 (barcode region, 658pb) at the Canadian Center for DNA Barcoding (CCDB) (Hebert et al. 2003). DNA extraction, PCR amplification, and sequencing of the COX1 (barcode region, 658pb) followed standard protocols (CCDB 2013). Posteriorly, we accessed the Barcode of Life Data Systems (BOLD) (Ratnasingham and Hebert 2007) and mined the FASTA files of the COX1 (barcode region, 658pb) of the Apatelodidae, mainly *Olceclostera* species. Sequence data of specimens analyzed here are available on GenBank and/or BOLD Systems (for GenBank and BOLD Systems accession numbers, see Table S1).

Alignment was then performed with MAFFT (Katoh and Standley 2013). The most optimal model of nucleotide evolution was selected by ModelFinder (Kalyaanamoorthy et al. 2017) using the AICc criterion, and the best fit model according to AICc was GTR+F+I+G4. The tree was rooted with *Drepatelodes friburgensis* (Schaus, 1924) following Hamilton et al. (2019) that recovered *Drepatelodes* as the sister group of other Apatelodidae genera. Maximum likelihood phylogenies were inferred using IQ-TREE v. 1.6.8 (Nguyen et al. 2015), with branch supports reported as 5,000 standard bootstraps. Alignment, model selection, and phylogenetic analyses were performed in the multifunctional platform PhyloSuite (Zhang et al. 2020).

Genetic distances of the "*O. bifenestrata* group" were calculated by the Tamura-Nei distance model (Tamura and Nei 1993) in MEGA11 (Tamura et al. 2021).

3. Results

3.1. "*Olceclostera bifenestrata* group"

Comments. The "*Olceclostera bifenestrata* group" comprises eight species, namely: *Olceclostera angelica* (Grote, 1864), *Olceclostera bifenestrata*, *Olceclostera indistincta* (Edwards, 1886), *Olceclostera jairana* **sp. nov.**, *Olceclostera quilombola* **sp. nov.**, *Olceclostera seraphica* Dyar, 1906, *Olceclostera wayana* **sp. nov.** and *Olceclostera xeta* **sp. nov.**

Diagnosis. This group of species is easily distinguished from other species of *Olceclostera* by the following combination of characters: forewings grayish, with sinuous brownish lines, two subapical hyaline spots, and one pair of large patches of broader scales laterally on the abdomen. The South American species are reliably separated from the North American species *O. angelica*, *O. indistincta* and *O. seraphica* by their larger size, less grayish coloring (the North American species are light grey) (see Franclemont 1973: plate 3, figs 14–16), molecular distance (Table 1), and geographic distribution (Schaus 1912; Franclemont 1973). They can be distinguished from *O. bifenestrata* (Fig. 2A, B) by the sclerotized subscaphium region with a narrow median ventral hook (Fig. 3).

3.1.1. *Olceclostera jairana* Orlandin and Piovesan sp. nov.

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Figures 2C, D, 4A, B, 5, 6A, 7–16

Type locality. Parque Estadual do Guartelá, Tibagi Municipality, Paraná State, Brazil.

Diagnosis. *Olceclostera jairana* **sp. nov.** differs from *O. quilombola* **sp. nov.** by external and genitalia characters: on the forewing of *O. jairana* **sp. nov.**, the two subapical hyaline spots between M_1 and M_3 are rounded, with the one between M_2–M_3 smaller and almost unnoticeable in some cases. Otherwise, these spots are rectangular and always visible in *O. quilombola* **sp. nov.** In the dorsal forewing, posterior to the hyaline spots, *O. jairana* **sp. nov.** has a sinuous band of light gray scales, absent in *O. quilombola* **sp. nov.** (Fig. 2C–F). *Olceclostera jairana* **sp. nov.** has all tibias with a band of long scales with light brown apex, while *O. quilombola* **sp. nov.** presents these scales with dark brown apex (Fig. 6A, B). In the genitalia, *O. jairana* **sp. nov.** presents, in lateral view, a more rounded tegumen, narrower socii, and a more elongated uncus, and, in ventral view, the anterior projection of the saccus is thinner than in *O. quilombola* **sp. nov.** The aedeagus of *O. jairana* **sp. nov.** presents apex with a lateral projection bearing one to three spines, while in *O. quilombola* **sp. nov.** this projection has no spines (Figs 10, 17).

Externally, *O. jairana* **sp. nov.** is very similar to *O. xeta* **sp. nov.** and *O. wayana* **sp. nov.**, but *O. jairana* **sp. nov.** has all tibias with a band of long scales with light brown apex while *O. xeta* **sp. nov.** and *O. wayana* **sp. nov.** present these scales with grayish brown apex (Fig. 6A, C). Dorsally, the abdomen of *O. jairana* **sp. nov.** has a copper color, while *O. xeta* **sp. nov.** and *O. wayana* **sp. nov.** have a grayish color (Fig. 2C, D, G–J). The genitalia of *O. jairana* **sp. nov.** present, in lateral view, a narrower socci than *O. xeta* **sp. nov.** and *O. wayana* **sp. nov.**, and the process of sacculus is about twice as big as in *O. xeta* **sp. nov.** and *O. wayana* **sp. nov.** The aedeagus of *O. jairana* **sp. nov.** has an apex with spines and vesica without cornuti, while in *O. xeta* **sp. nov.** and *O. wayana* **sp. nov.** the aedeagus does not have spines and the bas-

Figure 2. Adult male of *Olceclostera* species: *Olceclostera bifenestrata* from Costa Rica. **A** dorsal view; **B** ventral view. *Olceclostera jairana* **sp. nov.** Holotype male from Parque Estadual do Guartelá, Tibagi, Paraná, Brazil. **C** dorsal view; **D** ventral view. *Olceclostera quilombola* **sp. nov.** Holotype male from Parque Estadual das Lauráceas, Adrianópolis, Paraná, Brazil. **E** dorsal view; **F** ventral view. *Olceclostera xeta* **sp. nov.** Holotype male from RPPN Fazenda da Mata, Querência do Norte, Paraná, Brazil. **G** dorsal view; **H** ventral view. *Olceclostera wayana* **sp. nov.** Holotype male from French Guiana. **I** dorsal view; **J** ventral view.

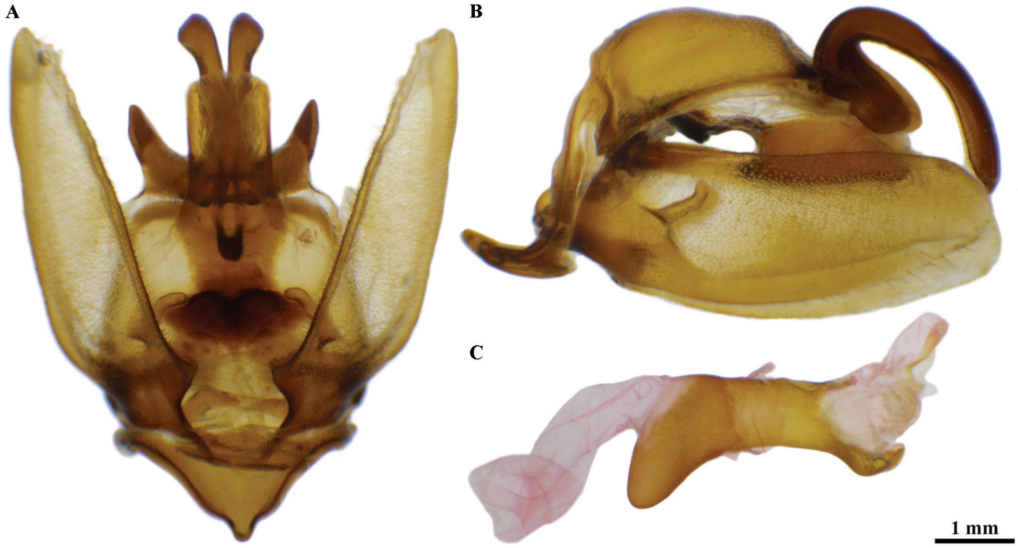

Figure 3. Male genitalia of *Olceclostera bifenestrata*. **A** ventral view; **B** lateral view; **C** aedeagus, lateral view.

Figure 4. Adult female of *Olceclostera* species: *Olceclostera jairana* **sp. nov.**, from Nova Petrópolis, Santa Catarina, Brazil. **A** dorsal view; **B** ventral view. *Olceclostera quilombola* **sp. nov.**, from São Luís do Paraitinga, São Paulo, Brazil. **C** dorsal view; **D** ventral view. *Olceclostera xeta* **sp. nov.**, from Estancia Dimas, Alto Paraná, Paraguay. **E** dorsal view; **F** ventral view.

Table 1. Pairwise genetic distances (%) for COX1 gene (barcode region, 658pb) sequences among *Olceclostera bifenestrata* group and the new species of *Olceclostera*.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	PLABO847-19 – *O. bifenestrata*																				
2	MIAPD354-10 – *O. bifenestrata*	0,000																			
3	CNCLB1187-14 – *O. angelica*	0,043	0,043																		
4	CNCLB1186-14 – *O. angelica*	0,041	0,041	0,002																	
5	HKONS703-08 – *O. indistincta*	0,045	0,045	0,002	0,003																
6	HKONS704-08 – *O. indistincta*	0,045	0,045	0,002	0,003	0,000															
7	HKONB247-09 – *O. seraphica*	0,046	0,048	0,046	0,048	0,048	0,048														
8	HKONB248-09 – *O. seraphica*	0,044	0,046	0,045	0,047	0,047	0,047	0,005													
9	OR094868 – *O. jairana* **sp. nov.**	0,100	0,099	0,091	0,088	0,093	0,093	0,098	0,100												
10	OR094867 – *O. jairana* **sp. nov.**	0,100	0,099	0,091	0,088	0,093	0,093	0,098	0,100	0,000											
11	OR094854 – *O. jairana* **sp. nov.**	0,100	0,099	0,091	0,088	0,093	0,093	0,098	0,100	0,000	0,000										
12	OR094855 – *O. jairana* **sp. nov.**	0,102	0,101	0,095	0,092	0,097	0,097	0,098	0,100	0,000	0,000	0,000									
13	OR094853 – *O. jairana* **sp. nov.**	0,092	0,091	0,090	0,088	0,093	0,093	0,090	0,096	0,009	0,009	0,009	0,010								
14	OR094852 – *O. jairana* **sp. nov.**	0,096	0,095	0,090	0,088	0,093	0,093	0,095	0,100	0,016	0,016	0,016	0,016	0,009							
15	OR094851 – *O. jairana* **sp. nov.**	0,095	0,095	0,091	0,088	0,093	0,093	0,092	0,097	0,017	0,017	0,017	0,018	0,011	0,017						
16	OR094850 – *O. quilombola* **sp. nov.**	0,090	0,090	0,083	0,081	0,085	0,085	0,086	0,090	0,063	0,063	0,063	0,062	0,058	0,058	0,060					
17	OR094849 – *O. quilombola* **sp. nov.**	0,090	0,089	0,087	0,085	0,089	0,089	0,090	0,094	0,067	0,067	0,067	0,066	0,062	0,058	0,063	0,003				
18	OR094856 – *O. xeta* **sp. nov.**	0,105	0,104	0,111	0,108	0,114	0,114	0,099	0,103	0,092	0,092	0,092	0,092	0,081	0,088	0,087	0,068	0,071			
19	OR094897 – *O. xeta* **sp. nov.**	0,106	0,105	0,098	0,101	0,101	0,101	0,097	0,101	0,095	0,095	0,095	0,095	0,089	0,096	0,091	0,074	0,078	0,009		
20	OR094898 – *O. xeta* **sp. nov.**	0,106	0,105	0,103	0,105	0,105	0,105	0,097	0,101	0,095	0,095	0,095	0,095	0,089	0,096	0,091	0,074	0,078	0,005	0,003	
21	OR094899 – *O. wayana* **sp. nov.**	0,116	0,115	0,115	0,118	0,118	0,118	0,107	0,110	0,102	0,102	0,102	0,102	0,096	0,099	0,098	0,079	0,080	0,035	0,038	0,034

al portion of the vesica is covered by small cornuti (Figs 10, 19, 21).

Description of adults (Figs 2C, D, 4A, B, 5, 6A, 7–11). ***Head*.** **MALE.** Vertex and frons pinkish beige; compound eyes naked; antenna approximately 1/3 the length of the costal margin of the anterior wing, bipectinate from the base to apex, ventrally naked, dorsally covered by pearl scales; labial palpus dorsally covered by brown scales, ventrally covered by a compact block of pinkish beige scales (Fig. 5A); first and second segment thick and slightly curved, the second about twice the length of the first, third segment reduced and oval (Fig. 5B); proboscis absent. **FEMALE.** Similar to the male, slightly smaller than the male's head; antenna, pecten shorter than the male's pecten; palpus thinner and shorter than the male's palpus (Fig. 4A, B). — ***Thorax.*** **MALE.** Dorsally and ventrally gray; dorsally with a longitudinal medial brownish line. — ***Legs*.** All legs smooth, femur and tibia gray; tibias with a band of long scales with light brown apex projecting towards the posterior region (Fig. 6A); tarsomeres brownish. Foreleg: coxa thick, developed, approximately 3/4 the length of the femur; femur about the same length as the tibia; tibia anteriorly flattened, epiphysis approximately half-length of the tibia (Fig. 7A). Midleg: femur slightly smaller than the tibia; distally tibia bears a pair of spurs, the inner one longer than the outer one (Fig. 7B). Hindleg: femur smaller than the tibia; distal half of tibia bears two pair of spurs, the inner longer than the outer ones (Fig. 7C). All tarsomeres have a similar length, posteriorly with scattered small spines; tarsal claws simple. **FEMALE.** Similar to the male, epiphysis approximately 1/3 the length of the tibia, narrower than the male; ventral surface distitarsus of fore, mid, and hindlegs with a patch of small spines and an inner row with four conspicuous spines (Fig. 7D). — ***Wings shape and venation*.** Venation (Fig. 8), same as that described for *Olceclostera* sp. by Costa-Lima (1950). **MALE.** Forewing length: 14–19.5 mm (n = 10); elongated triangular shape. Upperside: Ground color grayish with scattered black scales; basal region limited by a fine irregular black line; discal region marked between two sinuous brownish lines; on dcm, a patch of black scales surrounded by a patch of light gray scales; post-discal region with a thin irregular black line; two rounded subapical hyaline spots, between M_1 and M_3; posterior to the hyaline spots a sinuous band of light gray scales; apical region light gray; between M_2 and CuA_2 marginal region with black scales and outer margin slightly crenulated and marked with black scales. Underside: Ground color similar to the upperside but more brownish; post-discal region with a sinuous brownish line followed by a thin, sinuous black line. Hindwing. Frenulum long and simple (Fig. 8). Upperside: Ground color grayish brown; on dcm, a faint black dot; postdiscal region with two faint sinuous brownish lines; outer margin, between M_3 and CuA_2, slightly crenulated and marked with black scales. Underside: Similar to the upperside, but with scattered black scales; dots and lines more marked; inner margin lighter. **FEMALE.** Forewing length: 19–22 mm (n = 06); general color similar to the male, the apex is more acute than in males; on dcm, the patch of black scales is smaller than in the male and absent on the underside; hyaline spot between M_2–M_3 reduced. Hindwing. Frenulum grayish brown, as multiple bristles, similar to other female Apatelodidae species (Orlandin et al. 2021, 2022a). Similar to the male, but on dcm the dot of black scales is smaller than in the male. — ***Abdomen*. MALE.** Dorsally coppery and gray, ventrally gray with scattered black scales; pleural region of segments A1 to A3 with patches of broader scales, creamy at the base and apically coppery (Fig. 9A); into this patch, on A2 and A3, a row of white scales (Fig. 9B). **FEMALE.** Dorsally grayer than the male; at the posterior region of each segment, a band of light gray scales; ventral and pleural region similar to the male. — ***Genitalia*. MALE** (Fig. 10). Tegumen shield-like, sclerotized in all its extension; anterior projection of saccus tapered, dorsally curved; ventrally, the posterior margin of saccus has a semicircular projection projected posteriorly; uncus dorsoventrally flattened, ventrally projected, 3/4 bifid V-shaped, with a pair of laterally flattened socii at the base; subscaphium sclerotized, with a median ventral hook, proximal region, ventrally with two semi-oval sclerotized plates [gnathos] with numerous tiny spines; valva less sclerotized than uncus and tegumen, rectangular, tongue-like, laterally covering the uncus apex; costa (= processus superior) forming a slightly sclerotized process bearing some setae; sacculus (= processus inferior) slightly more sclerotized than valva; process of sacculus finger-like, projected at 90º from the valva; fultura inferior sclerotized and rectangular; aedeagus cylindrical with truncated caecum, ventrally projected forming a protuberance; in lateral view, apex with a projection bearing one to three spines (more frequently two); these structures are best seen when the vesica is everted. **FEMALE** (Fig. 11). Eighth tergum formed by a trapezoidal plate bearing wide lateral arms ventrally reaching the lamella antevaginalis; anterior apophysis thin and cylindrical, slightly spatulate at the tip; lamella antevaginalis flat, almost as long as the lamella postvaginalis; lamella postvaginalis sclerotized, rectangular; ductus bursae about two times the length of corpus bursae, approximately the same diameter for the entire length; corpus bursae ovoid, membranous with a signum heart-shaped, bearing inward-pointing spines and with the central portion less sclerotized with fewer spines; papilla analis dorsoventrally elongated, sclerotized and covered with setae.

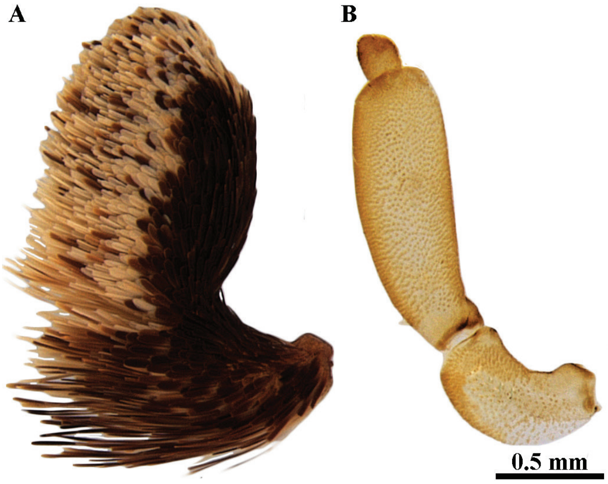

Figure 5. Male labial palpus of *Olceclostera jairana* **sp. nov. A** with sclaes; **B** without scales.

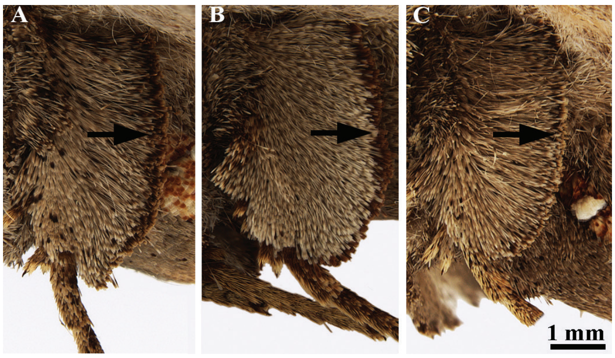

Figure 6. Lateral view of the scales that cover the tibia of *Olceclostera*. **A** *Olceclostera jairana* **sp. nov.**; **B** *Olceclostera quilombola* **sp. nov.**; **C** *Olceclostera xeta* **sp. nov.** The arrow points to the apex of the scales, which shows a different brown hue in each species.

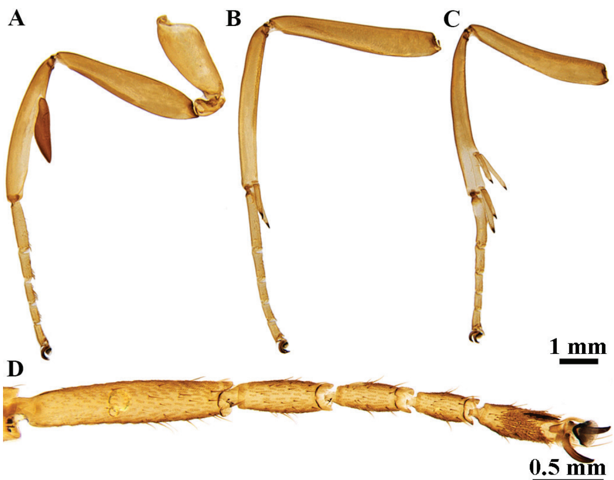

Figure 7. Legs of *Olceclostera jairana* **sp. nov. A** male foreleg, lateral view; **B** male midleg, lateral view; **C** male hindleg, lateral view; **D** female, foreleg tarsomeres.

Description of immature stages (Figs 12–16). ***Eggs*** (Fig. 12). Average duration (from oviposition to hatching): approximately 15 days (n = 110); pie-shaped 1.5–

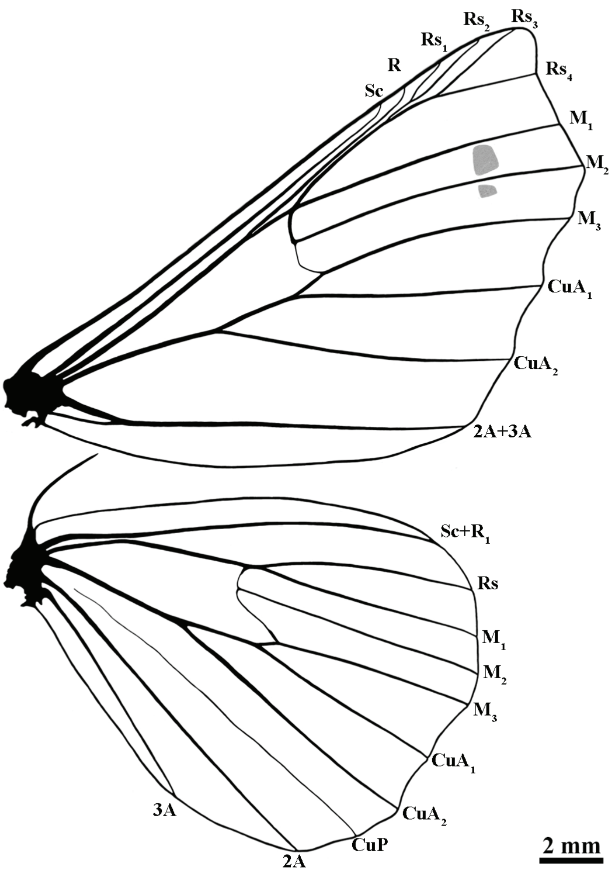

Figure 8. *Olceclostera jairana* **sp. nov.** male wing shape and venation.

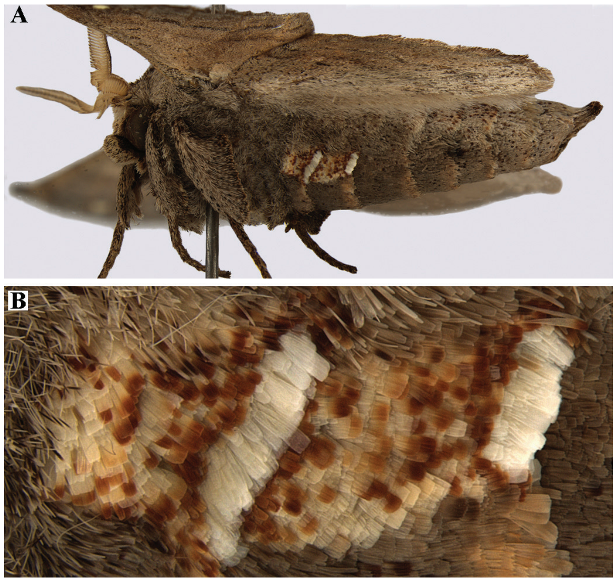

Figure 9. *Olceclostera jairana* **sp. nov.** Large patch of broader scales on the abdomen. **A** lateral view; **B** detail.

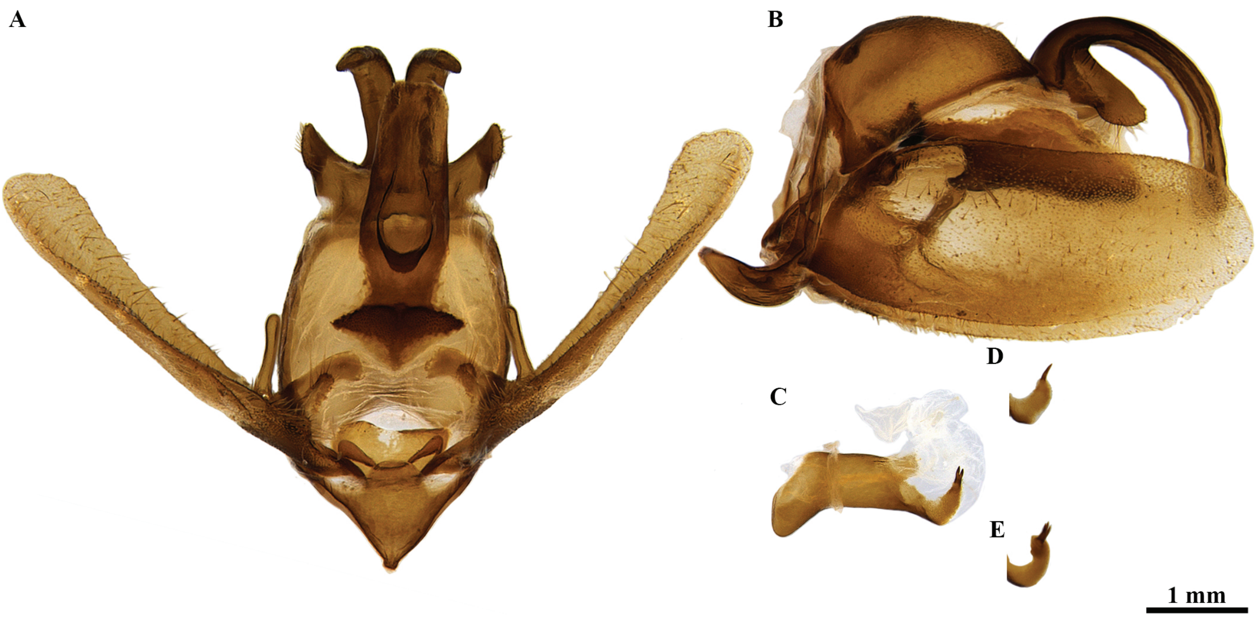

Figure 10. Male genitalia of *Olceclostera jairana* **sp. nov.** **A** ventral view; **B** lateral view; **C** aedeagus, lateral view, apex with two spines; **D** aedeagus, apex with one spine; **E** aedeagus, apex with three spines.

1.7 mm in diameter and 0.4 mm in height (n = 10); chorion transparent without visible ornamentation; yolk greenish during the first days of development, becoming pale greenish-yellow before eclosion (Fig. 12A–C). The micropylar area bears seven petal-shaped rosette cells of distinct sizes; around the micropylar rosette, there are ten secondary cells (Fig. 12D); these micropylar cells surround the six openings (Fig. 12E). Aeropyles rounded, organized forming geometric shapes, in this region the egg is quite rough (Fig. 12F, G).

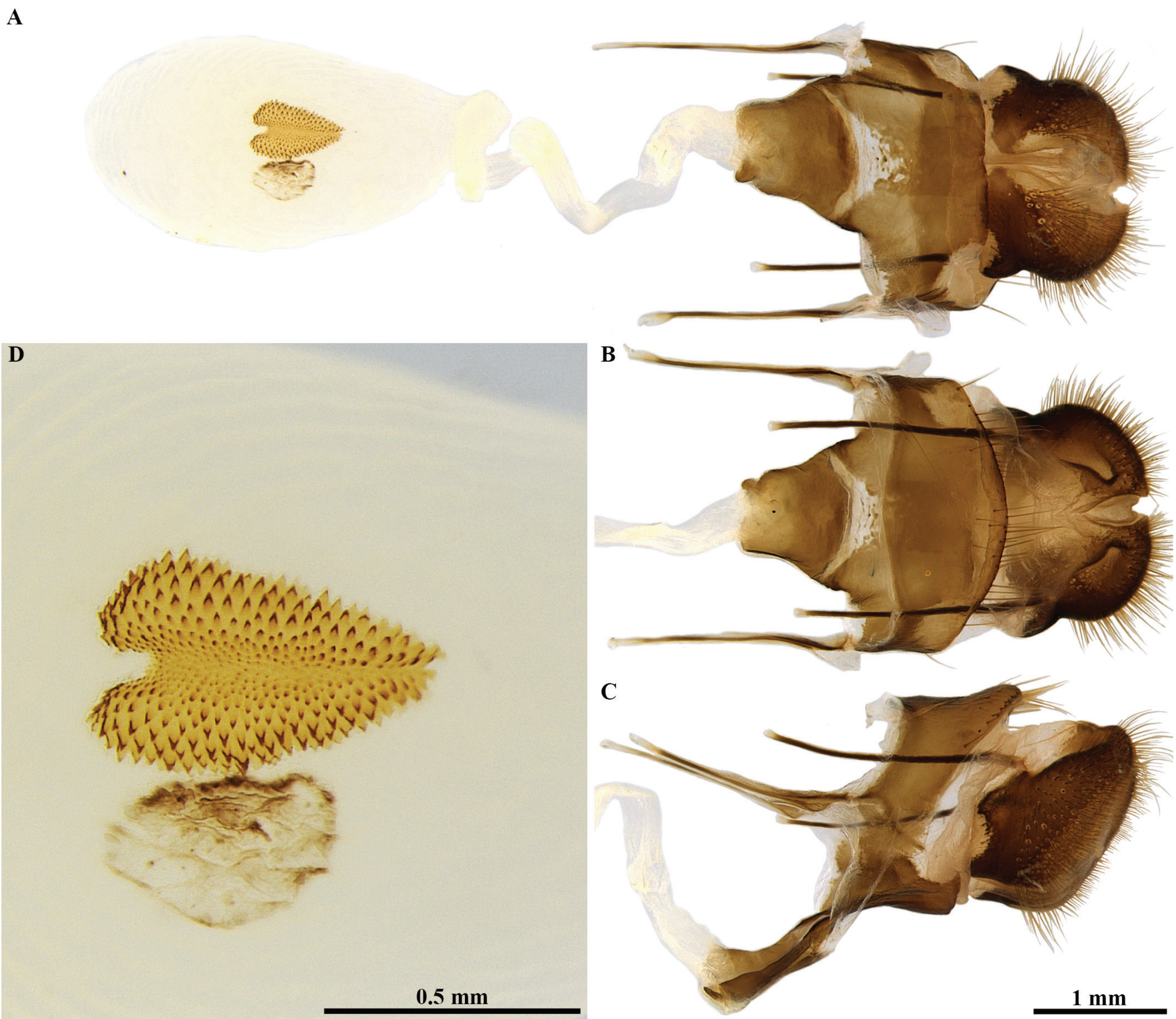

Figure 11. Female genitalia of *Olceclostera jairana* **sp. nov. A** ventral view; **B** dorsal view; **C** lateral view; **D** signum detail.

First instar (Fig. 13A, B). Average duration: approximately five days (n = 94); body length 4.8–5.1 mm (n = 3); head capsule width 0.54–0.57 mm (n = 4), hypognathous, slightly flattened in front, yellowish with brownish spots and stripes, stemma 3 larger than the other stemmata, ventral margin of labrum moderately notched; head bears only primary setae (see chaetotaxy below). Body yellow, cylindrical, dorsally with faint black stripes, laterally, with black stripes on subdorsal, lateral, and subventral regions; long setae cover the whole body, except ventrally; dorsally and subdorsally covered with black and yellow setae, laterally and subventrally only with yellow setae, most of them grouped over verrucae; spiracles elliptical, T1 and A8 ones larger than the others; abdominal prolegs fully developed on A3–A6 and A10, with two sclerotized plates, one anterior and one posterior; crochets in biordinal mesoseries. — **Chaetotaxy. *Head.*** (Fig. 14) One pair of frontal setae (F1), between them one pair of frontal pores (Fa); two pairs of adfrontal setae (AF1, AF2), between them one pair of adfrontal pores (AFa); three anterior pairs of setae (A1, A2, A3) and one pair of pores (Aa) above A2; two pairs of posterior setae (P1, P2) and two pairs of pores (Pa, Pb); three pairs of microdorsal setae (MD1, MD2, MD3), and a pair of pores (MDa) between MD2 and MD3; on clypeus, two pairs of setae (C1, C2); on labrum three central (Lrm1, Lrm2, Lrm3) and three lateral pairs of setae (Lrl1, Lrl2, Lrl3). Laterally, one pair of lateral setae (L1) and one pair of pores (La); three stemmatal pairs of setae (S1, S2, S3), and two pairs of stemmatal pore (Sa, Sb); three substemmatal pairs of setae (SS1, SS2, and SS3), and a pair of microgenal pores (MGa). — **Body** (Fig. 15). ***Thorax.*** T1. pronotal plate brownish, weakly sclerotized; XD setae located in the anterior area of the pronotal plate close to four secondary setae; D1 and D2 setae solitary, located in the posterior region of the pronotal plate; SD1 and SD2 setae solitary, SD1 seta at the margin of the pronotal plate; L setae grouped with numerous secondary setae on a conspicuous spherical grayish yellow verruca; SV setae grouped with numerous secondary setae on a large yellowish verruca; V setae grouped with some secondary setae on a sclerotized grayish plate. T2. D1 seta solitary on a reduced grayish yellow plate, D2 seta grouped with a secondary seta on a grayish yellow plate; SD setae grouped with numerous secondary setae on a grayish yellow verruca; L setae grouped with numerous secondary

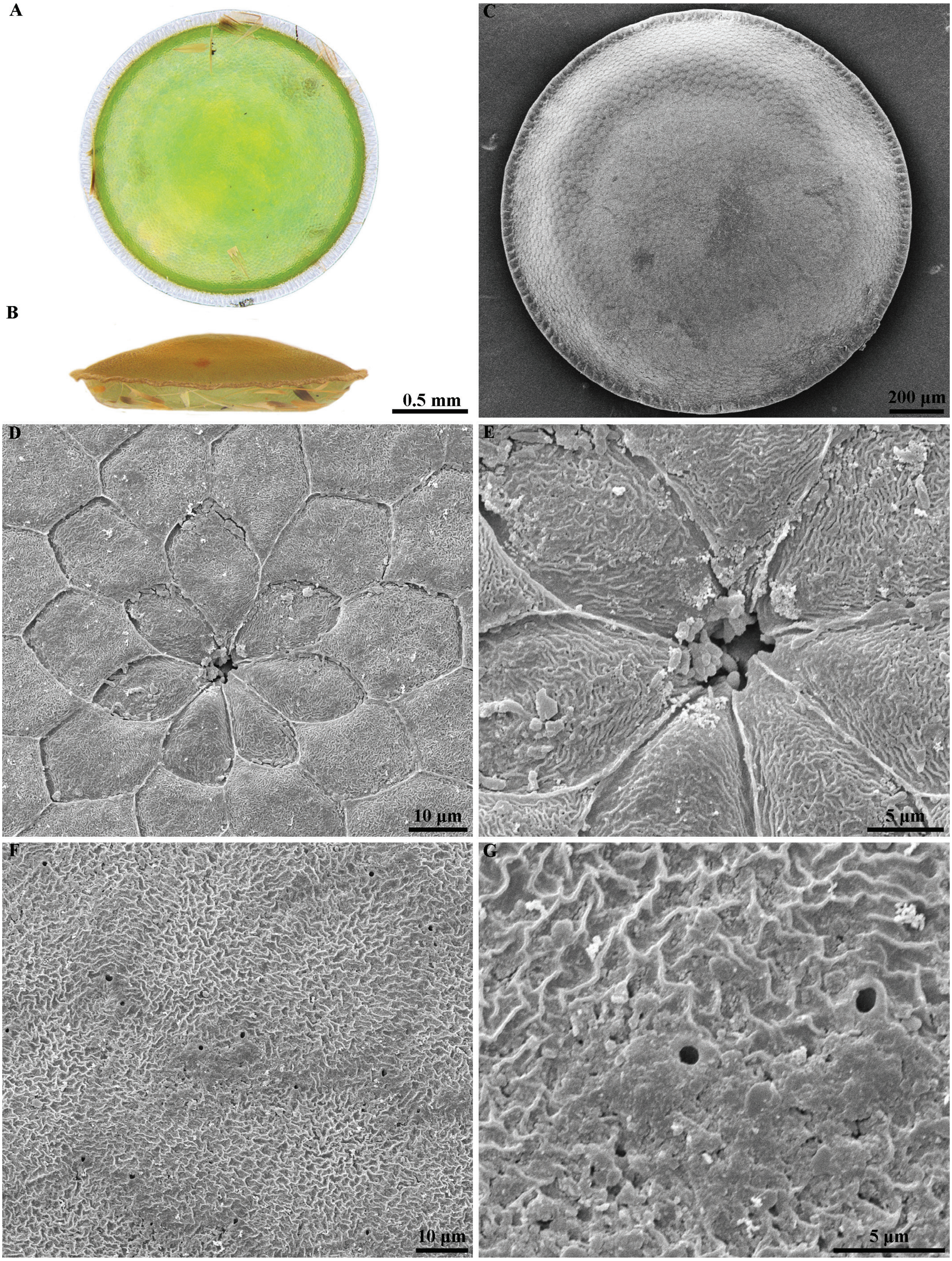

Figure 12. Egg of *Olceclostera jairana* **sp. nov.** **A** three days after oviposition, dorsal view; **B** close to eclosion, lateral view; under scanning electronic microscopy (SEM) **C** dorsal view; **D** rosette cells; **E** micropylar openings; **F** aeropyles; **G** magnification of the aeropyles.

setae on a grayish verruca; SV setae grouped with numerous secondary setae on a grayish verruca; V setae grouped with some secondary setae on a sclerotized grayish plate.

T3. D1 seta grouped with a secondary seta on a grayish yellow plate, D2 as D1; SD setae grouped with numerous secondary setae on a grayish verruca; L, SV, and V setae

Figure 13. Immature stages of *Olceclostera jairana* **sp. nov. A** first instar, dorsal view; **B** first instar, lateral view; **C** second instar, dorsal view; **D** second instar, lateral view; **E** third instar, dorsal view; **F** third instar, lateral view; **G** fourth instar, dorsal view; **H** fourth instar, lateral view; **I** fifth instar, dorsal view; **J** fifth instar, lateral view.

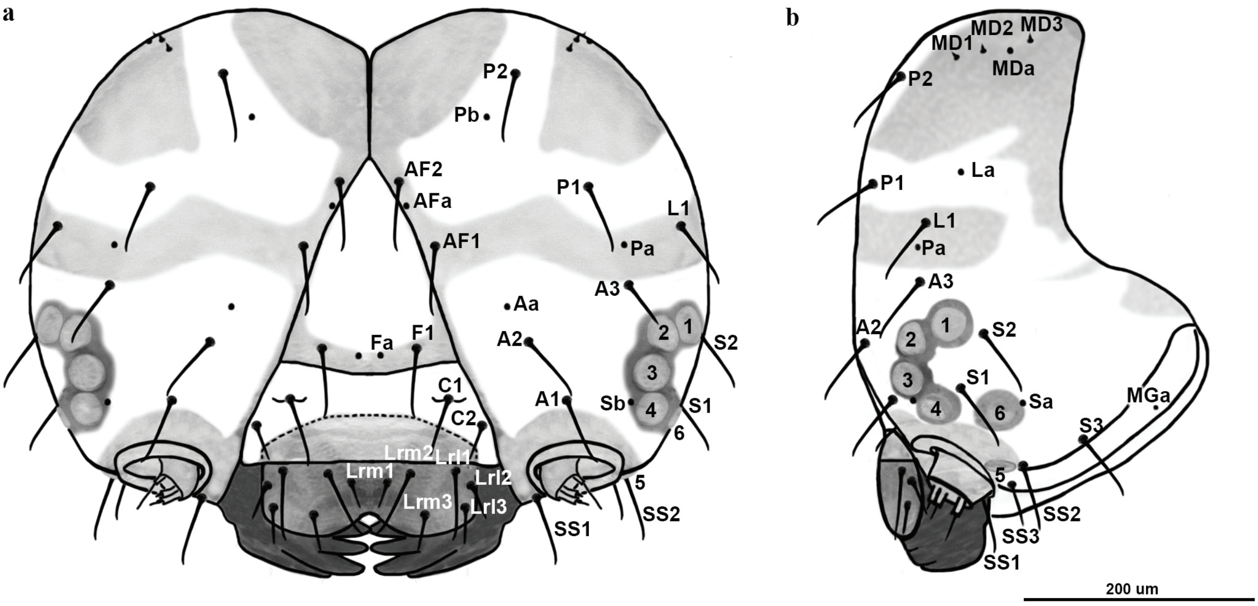

Figure 14. Head chaetotaxy of first instar of *Olceclostera jairana* **sp. nov. A** frontal view; **B** lateral view.

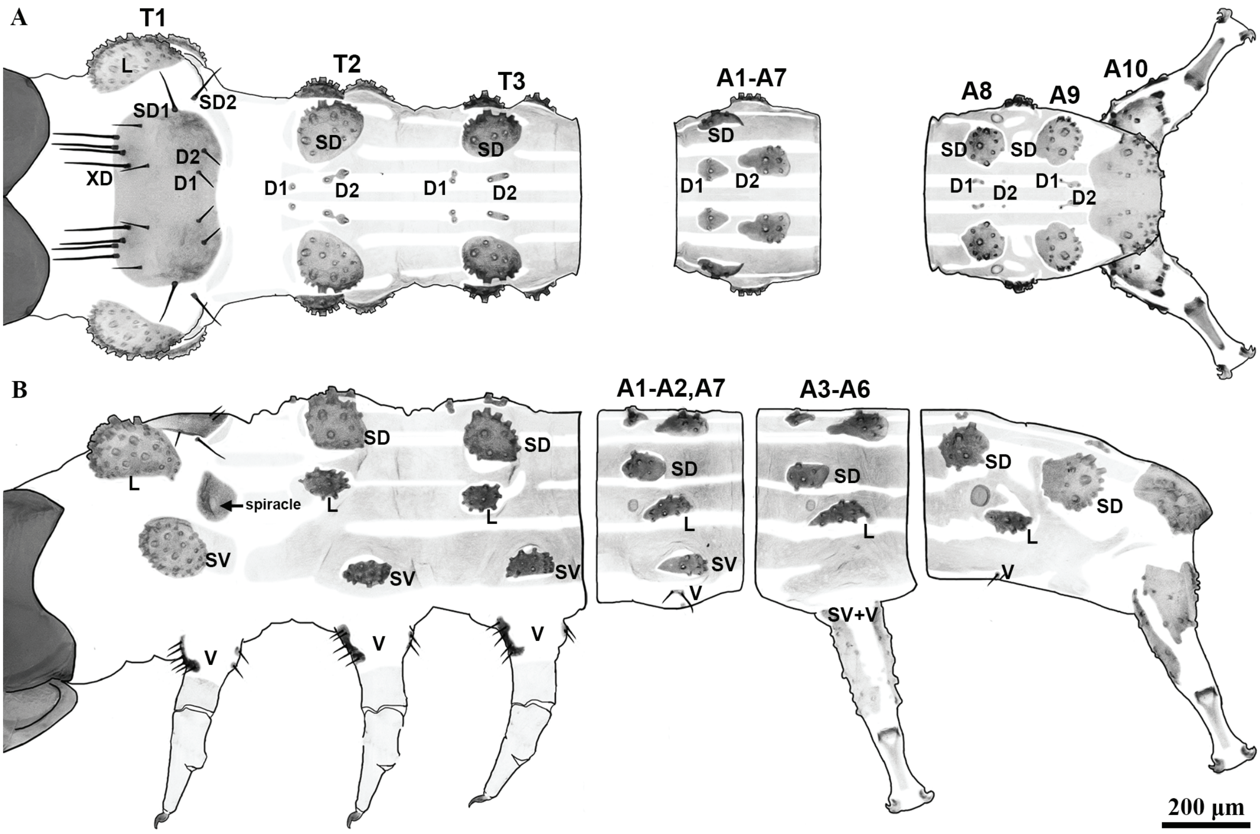

Figure 15. Body chaetotaxy of first instar of *Olceclostera jairana* **sp. nov. A** dorsal view; **B** lateral view.

as in T2. — ***Abdomen*.** A1, A2 and A7. D1 seta grouped with two secondary setae on a dark gray plate, D2 seta grouped with six secondary setae on a dark gray verruca; SD setae grouped with eight secondary setae on a dark gray verruca; L setae grouped with seven secondary setae on a dark gray verruca; SV setae grouped with seven secondary setae on dark gray verruca; V seta grouped with a secondary seta on a grayish plate. A3–A6. D1, D2, and L setae as in segments A1, A2, and A7; SD setae grouped with five secondary setae on a dark gray verruca; SV and V setae on the prolegs on two dark grey plates with some secondary setae. A8. D1 seta grouped with a secondary seta on a grayish yellow plate, D2 seta solitary; SD setae grouped with numerous secondary setae on a grayish yellow verruca; L setae as in the other abdominal segments; SV setae not visible; V seta isolated. A9. D1 and D2 setae grouped with a secondary seta on a grayish yellow plate; SD setae grouped with numerous secondary setae on a

Figure 16. Pupa of *Olceclostera jairana* **sp. nov. A** dorsal view; **B** lateral view; **C** ventral view; **D** details of male genital scars; **E** details of female genital scars.

grayish yellow verruca; SV and V setae not visible. A10. D1, D2, and SD setae arranged on a large grayish-yellow anal plate; L and SV setae on the proleg on two grayish plates with some secondary setae.

Second instar (Fig. 13C, D). Average duration: 6–8 days (n = 68); head capsule width 1.1–1.2 mm (n = 5); body length 14.2–14.7 mm (n = 2); head brownish with yellowish spots and stripes; with numerous secondary setae. Body gray with yellow stripes; setae grayish shorter than the first instar; T1–T3 and A8–A10 dorsally darker; between T1 and T2, dorsally with a sparse tuft of reddish setae; A1–A7, D1, and D2 verrucae reddish; legs and abdominal prolegs reddish.

Third instar (Fig. 13E, F). Average duration: 6–8 days (n = 30); head capsule width 1.63–1.75 mm (n = 7); body length 21 mm (n = 1); head color as in second instar. Body gray with yellowish stripes, dorsally with darker spots; setae grayish shorter than the second instar; T1 and T2 with setae anteriorly projecting; between T2 and T3, dorsally with a tuft of red setae; A3–A5, and A8 dorsally with a perceptible tuft of dark setae; A9–A10 with longer setae posteriorly projecting; legs and abdominal prolegs red.

Fourth instar (Fig. 13G, H). Average duration: 9–11 days (n = 18); head capsule width 2.24–2.41 mm (n = 10); body length 29 mm (n = 1); head color as in third instar. Body gray sprinkled with dark and yellowish spots; T1–T3 bears long gray setae anteriorly projecting, covering the head; between T2 and T3, dorsally with a tuft of bright red setae; A1–A8, dorsally with a tuft of dark setae, longer on A3–A5, and A8; A9 and A10 with longer setae posteriorly projecting; legs and abdominal prolegs dark red.

Fifth instar (Fig. 13I, J). Average duration: 9–11 days (n = 15); head capsule width 3.6–3.8 mm (n = 2); body length approximately 45.4–45.9 mm (n = 2); head color as in fourth instar. Body as in the fourth instar, but with smaller setae. Prepupa, average duration: 2–4 days.

Pupae (Fig. 16). Average duration: 58–60 days (n = 10); length 21–22 mm (n = 2), obtect, stout, heavily sclerotized, all appendages concealed to the body; antennae broad at the base, tapering rapidly to the apex, reaching two thirds the length of the wings; eyes small; proboscis not visible, wings short with truncated apex; margin of segments A1–A6 notched; spiracles narrowly elliptical; without cremaster or anal hooks. The first imagos emerged 60 days after pupation.

Life history. After being collected, the female was placed in a plastic container where it oviposited 110 eggs on the container wall. After about 15 days, the larvae hatched from the egg by cutting a small semicircular opening on the dorsal surface of the chorion. The larvae preferred to feed on *Handroanthus* sp. (Bignoniaceae). During the first and second instars, larvae fed by scraping both the adaxial and abaxial surfaces of the leaf; from the third on, larvae ate the entire leaf.

During the first and second instars, the larvae were very active all day and night, and when threatened, they released themselves from the host plant to the ground by a silk strand. From the third instar on, the larvae were less active during the day, spending this period resting on the branches of the host plant. In the last instar, when threatened, the larvae bristled the dorsal setae of the thoracic segments, making visible the arrangement of the red setae located in this region.

When larvae reached the prepupa, they left the host plant and walked on the soil of the container, burying in it after a few hours to pupate. The underground chamber was not found. After pupating, the earlier imagos emerged in about 60 days, while the latter in about 120 days. There was no difference between the emergence time of females and males. When both emerged on the same night, they immediately mated. An unmated female oviposited about 130 eggs, while a female that had copulated oviposited about 270 eggs.

Distribution. Based on museum records, the species is present in the Argentina state of Entre Ríos and the Brazilian states of Espírito Santo, Minas Gerais, Paraná, Rio de Janeiro, Santa Catarina, and São Paulo (Fig. 22).

Etymology. This species is named in honor of the parents of the first author, who always encouraged the first and second authors to persist in their studies; the specific epithet is a combination of their first names, Jair and Ana.

Material examined. ***Holotype***. (Fig. 2C, D) BRAZIL. 1 ♂; Parque Estadual do Guartelá, 980 m, Paraná, deposited at the DZUP, with the following labels: / Holotypus/ Parque Estadual do Guartelá, Tibagi, Paraná, Brasil 11–12.X.2018, 980 m, 24°33'59.85"S 50°15'25"W, Carneiro, Venâncio, Moreira and Orlandin leg/ Holotypus *Olceclostera jairana* Orlandin and Piovesan det. 2023/ DZ 43.101/ BC-DZ/ Gen. Prep. E. Orlandin 2021/ DZ 43.101♂ *Olceclostera jairana* Orlandin and Piovesan det. 2023/.— ***Paratypes***. ARGENTINA. *Entre Ríos*: Parque Nacional El Palmar, Intendencia, trampa de luz 26 m, 31°52.126'S 58°12.502'W, E. Núñez Bustos, C. Kopuchian and N. García leg. 2 ♂♂, MACN-Bar-Lep 01621 (Sample ID)/ MACN-En 24657 (Voucher Museum) and MACN-Bar-Lep 01742/ MACN-En 25200 (MACN). BRAZIL. *Espírito Santo*: **Santa Teresa**, Curva do Violão, 690–890 m, 19°59'16.01"S 40°33'3.97"W 1 ♂ 29–30.VI.2019, D. Dolibaina leg. (DD). *Minas Gerais*: **Aiuruoca** 1300 m, 22°00'S 44°38'W 1 ♂ 10–12.X.2018, Col. Becker 157220 (VOB). **Espera Feliz**, Sítio Sereno, 1200 m, 20°21'27.78"S 41°51'3.93"W, 3 ♂♂ 11–14.I.2021, D. Dolibaina leg. (DD). *Paraná*: **Adrianópolis**, Parque Estadual das Lauráceas 24°48'45.90"S, 48°41'9.54"W 1 ♂ 18–20.IV.2018, O. Mielke, Casagrande, Carneiro, Piovesan, Dantas and Santos leg./ DZ 45.719/ Gen. Prep. E. Orlandin 2021/ DZ 45.719♂ *Olceclostera jairana* Orlandin and Piovesan det. 2023; 1 ♂ 18–20.IV.2018, O. Mielke, Casagrande, Carneiro, Piovesan, Dantas and Santos leg./ DZ 45.813/ Gen. Prep. E. Orlandin 2021/ DZ 45.813♂ *Olceclostera jairana* Orlandin and Piovesan det. 2023; 1 ♂ 26–29.X.2019, Orlandin E. and Cafisso C. leg./ DZ 52.855/ Gen. Prep. E. Orlandin 2021/ DZ 52.855♂ *Olceclostera jairana* Orlandin and Piovesan det. 2023; 1 ♂ 26–29.X.2019, Orlandin E. and Cafisso C. leg./ DZ 52.856 (DZUP). **Campina Grande do Sul**, 897 m, 25°15'11.1"S 48°52'59.14"W 2 ♂♂ 10.XI.2017 (CDH). **Guaratuba**, 622 m, 25°49'55.30"S 48°55'48.51"W 1 ♂ 20.X.2011/ genitalia prep. D. Herbin, ref H. 966; 840 m, 25°51'47.55"S 48°55'01.87"W 1 ♂ 12.XI.2017. **Ponta Grossa**, Parque Estadual de Vila Velha, 1.060 m, 25°14'34"S, 50°0'14"W 1 ♂ 23–25.I.2020, E. Orlandin and C. Cafisso leg./ BC-DZ/ DZ 40.950; 1 ♂ 23–25.I.2020, E. Orlandin and C. Cafisso leg./ DZ 52.863; 1 ♂ 14–20.XII.2020, E. Orlandin, M. Piovesan and C. Cafisso leg./ DZ 52.869/ Gen. Prep. E. Orlandin 2021/ DZ 52.869♂ *Olceclostera jairana* Orlandin and Piovesan det. 2023/ (DZUP). **São José dos Pinhais**, Chácara Corta-Vento, 970 m, 25°42'09.3"S, 49°04'19.3"W 1 ♂ 24–25.II.2020, E. Orlandin and C. Cafisso leg./ BC-DZ/ DZ 52.186; 1 ♂ 16.XI.2020, E. Orlandin, C. Cafisso and M. Piovesan leg./ DZ 53.021/ Gen. Prep. E. Orlandin 2021/ DZ 53.021♂ *Olceclostera jairana* Orlandin and Piovesan det. 2023; 1 ♂ 17–18.IX.2020, E. Orlandin, C. Cafisso and M. Piovesan leg./ DZ 52.317 (DZUP). **Tibagi**, Parque Estadual do Guartelá, 975 m, 24°33'59"S, 50°15'26"W 1 ♂ 18.I.2012/ genitalia prep. D. Herbin, ref H. 1652; 4 ♂♂ 18.I.2012 (CDH); 950–1000 m, 24°33'44"S, 50°15'33"W 1 ♂ 25–27.VII.2017, Dantas, Dias, Dolibaina and Queiroz-S Leg./ DZ 45.810/ Gen. Prep. E. Orlandin 2021/ DZ 45.810♂ *Olceclostera jairana* Orlandin and Piovesan det. 2023; 1 ♀ 25–27.VII.2017, Dantas, Dias, Dolibaina and Queiroz-S Leg./ DZ 45.742 (DZUP). **Rio de Janeiro**: **Cachoeiras de Macacu**, Valério 1 ♂ 10.XII.2011, N. Tangerini col./ Ex. Coleção Nirton Tangerini/ DZ 45.752/ Gen. Prep. E. Orlandin 2021/ DZ 45.752♂ *Olceclostera jairana* Orlandin and Piovesan det. 2023 (DZUP). **Itatiaia**, Parque Nacional do Itatiaia, 1000 m, 22°26'55.9"S 44°36'39.5"W 1 ♂ 10–20.I.2021, A.H.B Rosa leg./ DZ 52.287/ Gen. Prep. E. Orlandin 2021/ DZ 52.287♂ *Olceclostera jairana* Orlandin and Piovesan det. 2023 (DZUP); 910 m 1 ♂ 4–8.XII.2019, A. Soares, G. Marconato, M. A. Costa and N. Tangerini col., COL MNRJ H/N° 0601108, MN-LEP 0001686, 807 m, 22°27'16"S 44°36'29"W; 2 ♂♂ 7–8.IV.2021, T. Zacca leg./ MN-LEP 0002166 and MN-LEP 0002264/ T. Zacca prep. 2021, DNA-LAPEL 0000000243 and DNA-LAPEL 0000000280 (MNRJ). **Petrópolis**, 1 ♂ 6.VI.1959, Gagarin leg./ Ex. Col. Gagarin/ DZ 45.722/ Gen. Prep. E. Orlandin 2018/ DZ 45.722♂ *Olceclostera jairana* Orlandin and Piovesan det. 2023 (DZUP). *Santa Catarina*: **Joaçaba**, Nova Petrópolis, 811 m, 27°6'20.09"S, 51°37'14.83"W 1 ♂ 02.IV.2020, E. Orlandin leg., Ex. Larvae, DZ 52.191/ BC-DZ; 1 ♀ (Fig. 4A, B) 02.VI.2020, E. Orlandin leg., Ex. Larvae, DZ 52.194/ BC-DZ/ Gen. Prep. E. Orlandin 2021/ DZ 52.194♀ 1 ♀ 20.VII.2020, E. Orlandin leg., Ex. Larvae, DZ 52.182; 800 m, 27°06'20.6"S 51°37'15.3"W 1 ♂ 02.IV.2020, A.H. Schneeberger, V.O. Souza and E. Orlandin leg./ DZ

53.111/ Gen. Prep. E. Orlandin 2021/ DZ 53.111♂ *Olceclostera jairana* Orlandin and Piovesan det. 2023 (DZUP). Immature stages: 001.1 – 141 eggs 26 first instar; 001.2 – 3 second instar; 001.3 – 1 third instar; 001.4 – 1 fourth instar; 001.5 – 2 fifth instar 2 pupae; 001.6 – 4 first instar head capsule; 001.7 – 6 second instar head capsule; 001.8 – 11 third instar head capsule; 001.9 – 11 fourth instar head capsule; 001.10 – 2 fifth instar head capsule; 001.11 – 2 pupa exúvia. PARATYPUS, *Olceclostera jairana*, XII.2019–IV.2020, Nova Petrópolis, Joaçaba, Santa Catarina, Brasil, 811 m, 27°6'20"S 51°37'14"W, E. Orlandin leg. / PARATIPO / DZUPIL 0170 (DZUPIL). **São Bento do Sul**, Rio Vermelho, 3 ♂♂, .X.2004; 503 m, 26°20'00.77"S, 49°18'28.25"W 1 ♂ 23.X.2011/ genitalia prep. D. Herbin, ref H. 970; 9 ♂♂ 23.X.2011 (CDH). *São Paulo*: **Caconde**, 21°28'45"S, 46°35'34"W 1 ♂ 10–14.I.2018, L. Venancio leg./ DZ 52.943/ Gen. Prep. E. Orlandin 2021/ DZ 52.943♂/*Olceclostera jairana* Orlandin and Piovesan det. 2023 (DZUP). **Jundiaí**, Japi, 23°13'S 46°56'W, 900 m 1 ♂ 13–16.II.2001, V.O. Becker col., Col. Becker 131737 (VOB). **Ribeirão Grande**, Intervales, 24°16'12"S 48°24'36"W, 1000 m 1 ♂, 06–07.XI.2021, V.O. Becker col., Col. Becker 165410 (VOB).

Remarks. We found at the same locality specimens with one, two, or three spines at the apex of the aedeagus. However, specimens with a different number of spines present a molecular difference of less than 2% (Table 1).

3.1.2. *Olceclostera quilombola* Orlandin, Piovesan and Carneiro sp. nov.

https://doi.org/zoobank.org/BAA7EC5F-9C6C-4BEB-B466-135E7316F719

Figures 2E, F, 4C, D, 17, 18

Type locality. Parque Estadual das Lauráceas, Adrianópolis Municipality, Paraná State, Brazil.

Diagnosis. *Olceclostera quilombola* **sp. nov.** differs from *O. jairana* **sp. nov.** by the following characters: on the forewing of *O. quilombola* **sp. nov.** the two subapical hyaline spots between M_1 and M_3 are rectangular and always visible, while these spots are rounded, with the one between M_2–M_3 almost unnoticeable in some cases in *O. jairana* **sp. nov.** (Figs 2C, D, 4A, B). *Olceclostera quilombola* **sp. nov.** has all tibias with a band of long scales with dark brown apex, while *O. jairana* **sp. nov.** presents these scales with light brown apex (Fig. 6A, B). In the genitalia, *O. quilombola* **sp. nov.** presents, in lateral view, a more flat tegumen, wider socii, and a less elongated uncus, and, in ventral view, the anterior projection of the saccus is wider than *O. jairana* **sp. nov.** The aedeagus of *O. quilombola* **sp. nov.** is thinner than that of *O. jairana* **sp. nov.** and does not have spines at the apex (Figs 10, 17).

Olceclostera quilombola **sp. nov.** differs from *O. xeta* **sp. nov.** and *O. wayana* **sp. nov.** by external and genitalia characters: on the forewing of *O. quilombola* **sp. nov.**, the two subapical hyaline spots, between M_1 and M_3, are rectangular and always visible, while in *O. xeta* **sp. nov.** and *O. wayana* **sp. nov.**, these spots are rounded and shorter. *Olceclostera quilombola* **sp. nov.** has all tibias with a band of long scales with dark brown apex, while *O. xeta* **sp. nov.** and *O. wayana* **sp. nov.** present these scales with grayish brown apex (Fig. 6B, C). Dorsally, the abdomen of *O. quilombola* **sp. nov.** has a copper color, while *O. xeta* **sp. nov.** and *O. wayana* **sp. nov.** have a grayish color (Fig. 2E–J). The genitalia of *O. quilombola* **sp. nov.** presents, in lateral view, the socci apex narrower and triangular, while *O. xeta* **sp. nov.** and *O. wayana* **sp. nov.** have the socci apex rounded. The process of sacculus of *O. quilombola* **sp. nov.** is about twice as big as that of *O. xeta* **sp. nov.** and *O. wayana* **sp. nov.** The aedeagus of *O. quilombola* **sp. nov.** has vesica without cornuti, while in *O. xeta* **sp. nov.** and *O. wayana* **sp. nov.** the basal portion of the vesica is covered by small cornuti (Figs 17, 19, 21).

Description (Figs 2E, F, 4C, D, 6B, 17, 18). ***Head.*** **MALE.** As in *O. jairana* **sp. nov. Female.** Similar to the male, slightly smaller than the male's head; antenna, pecten shorter than the male's pecten; palpus, thinner and shorter than the male's palpus. — ***Thorax.*** **MALE and FEMALE.** As in *O. jairana* **sp. nov.** — ***Legs.*** As in *O. jairana* **sp. nov.**, but all tibias with a band of long scales with dark brown apex projecting towards the posterior region (Fig. 6B). — ***Wings shape and venation.*** As in *O. jairana* **sp. nov.** (Figs 2E, F, 4C, D). **MALE.** Forewing length: 18–20.5 mm (n = 10). Upperside: As in *O. jairana* **sp. nov.**, but ground color gray; subapical region with two rectangular hyaline spots between M_1 and M_3; outer margin crenulated. Underside: Similar to *O. jairana* **sp. nov.** Hindwing. Upperside and underside: Similar to *O. jairana* **sp. nov.**, but the outer margin crenulated between M_3 and CuA_2. **FEMALE.** Forewing length: 25.8 mm (n = 01); similar to *O. jairana* **sp. nov.**; general color similar to the male, the apex is more acute than in males; on dcm, the patch of black scales and the hyaline spots are broader than in the male. Hindwing. Similar to the male, but on dcm, the dot of black scales is broader than in the male. — ***Abdomen.*** **MALE and FEMALE**. As in *O. jairana* **sp. nov.** — ***Genitalia.*** **MALE** (Fig. 17). Similar to *O. jairana* **sp. nov.**, but the aedeagus is thinner and does not have spines at the apex. **FEMALE** (Fig. 18). As in *O. jairana* **sp. nov.**, but the eighth tergum and the ostium bursae are narrower.

Distribution. Based on museum records, the species is present in the Brazilian states of Brasília, Espírito Santo, Minas Gerais, Paraná, Rio de Janeiro, and São Paulo (Fig. 22).

Etymology. This species is named in honor of the quilombola communities that inhabit the region of the "Parque Estadual das Lauráceas" the type locality of this species.

Material examined. ***Holotype***. (Fig. 2E, F) BRAZIL. 1 ♂; Parque Estadual das Lauráceas, Adrianópolis, 900 m, Paraná, Brazil, deposited at the DZUP, with the following labels: / Holotypus/ P[ar]q[ue] Est[adual] das Lauráceas, Adrianópolis, Paraná, Brasil 26–29.X.2019,

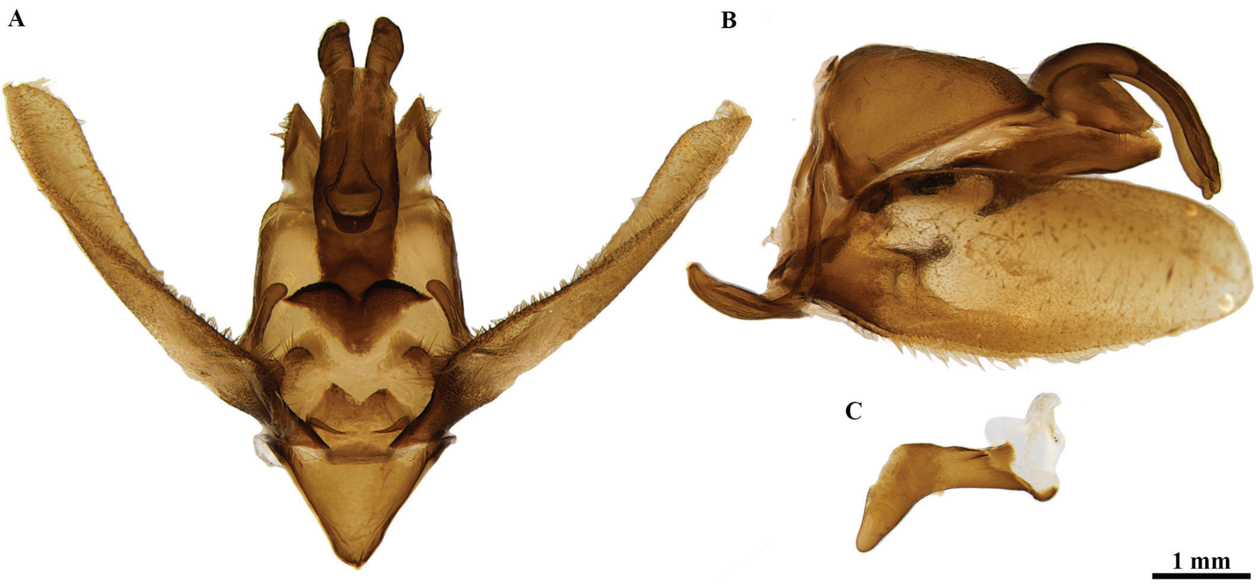

Figure 17. Male genitalia of *Olceclostera quilombola* **sp. nov. A** ventral view; **B** lateral view; **C** aedeagus lateral view.

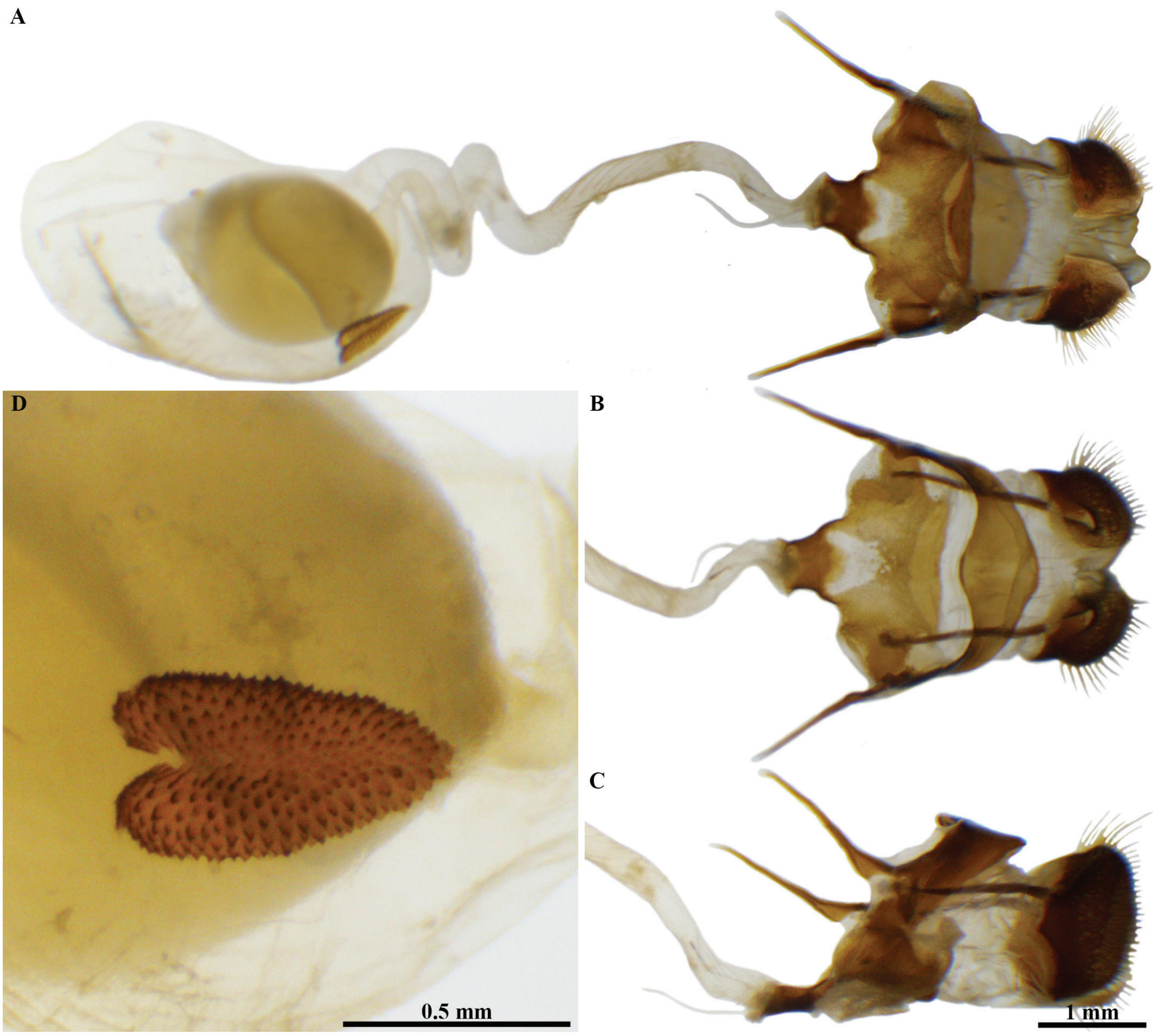

Figure 18. Female genitalia of *Olceclostera quilombola* **sp. nov. A** ventral view; **B** dorsal view; **C** lateral view; **D** signum detail.

900m 24°48'45.90"S, 48°41'9.54"W, Orlandin E. and Cafisso C. leg./ Holotypus *Olceclostera quilombola* Orlandin, Piovesan and Carneiro det. 2023/ DZ 51.895/ BC-DZ/ Gen. Prep. E. Orlandin 2021/ DZ 51.895♂ *Olceclostera quilombola* Orlandin, Piovesan and Carneiro det. 2023/.— ***Paratypes.*** BRAZIL. **Brasília: Planaltina**, 1000 m, 15°35'S 47°42'W 1 ♂ 15.V.1982, V.O. Becker col., Col. Becker 40190 (VOB). *Espírito Santo*: 1 ♂ 2741, CUIC 000060413 (CUIC). **Santa Teresa**, Reserva Biológica de Augusto Ruschi, 839 m, 19°54'19"S 40°34'07"W 1 ♂ 13–16.XI.2012; 841 m, 19°54'50"S 40°31'58"W 1 ♂ 15.XI.2012/ genitalia prep D. Herbin, ref H. 1651; 19°53'21"S 40°32'41"W 1 ♂ 16.XI.2012 (CDH). *Minas Gerais*: **Alto Caparaó**, Parque Nacional do Caparaó, 1309 m, 20°25'09"S 41°51'04"W 1 ♂ 11.XI.2012/ Gen. Prep. D. Herbin H1658 (CDH). **Caraça**, 1300 m 1 ♂ 07–10.V.1996, Becker col., Col. Becker 112800 1 ♂ 19.I.1998, V.O. Becker col., Col. Becker 112710 (VOB). **Espera Feliz**, Sítio Sereno, 1200 m, 20°21'27.78"S 41°51'3.93"W 2 ♂♂ 11–14.I.2021, D. Dolibaina leg. (DD). **Itamonte**, Pousada Fazenda Serra Bonita, 1400 m, 22°14'34.7"S 44°43'11.9"W 1 ♂ 08–11.I.2021, A. H. B. Rosa leg./ DZ 52.292/ Gen. Prep. E. Orlandin 2021/ DZ 52.292♂ *Olceclostera quilombola* Orlandin, Piovesan and Carneiro det. 2023 (DZUP). **Paraná: Adrianópolis**, 900 m, 24°48'45.90"S, 48°41'9.54"W 1 ♂ 26–29.X.2019, Orlandin E. and Cafisso C. leg./ DZ 52.854 (DZUP). **Curitiba**, 920 m, 1 ♂ 20.XII.1974, V.O. Becker col., Col. Becker N°563 1 ♂ 13.IX.1974, V.O. Becker col., Col. Becker N°564 (VOB). **Guaratuba**, 600 m, 1 ♂, 05.VIII.1975, V.O. Becker col., Col. Becker N°529 (VOB). **São José dos Pinhais**, Chácara Corta-Vento, 970 m, 25°42'09.3"S, 49°04'19.3"W 1 ♂ 29.I.2020, Orlandin E., Cafisso C. and Carneiro E. leg./ DZ 47.920/ BC-DZ; 1 ♂ 29.I.2020, Orlandin E., Cafisso C. and Carneiro E. leg./ DZ 52.857; 1 ♂ 25–26.II.2020, E. Orlandin and C. Cafisso leg./ DZ 53.030/ Gen. Prep. E. Orlandin 2021/ DZ 53.030♂ *Olceclostera quilombola* Orlandin, Piovesan and Carneiro det. 2023; 2 ♂♂ 25–26.II.2020, E. Orlandin and C. Cafisso leg., DZ 52.942 and DZ 53.029; 1 ♂ 17–18.IX.2020, E. Orlandin C. Cafisso and M. Piovesan leg./ DZ 52.320; 1 ♂ 16.XI.2020, E. Orlandin C. Cafisso and M. Piovesan leg./ DZ 53.020 (DZUP). **Rio de Janeiro: Itatiaia**, Parque Nacional do Itatiaia, Cascata de Maromba, 1177 m, 22°25'45"S 44°37'08"W 1 ♂ 6.XI.2012/ genitalia prep D. Herbin, ref H. 1659 (CDH). **Nova Friburgo**, 1100 m 1 ♂ 21.I.1998, V.O. Becker col., Col. Becker 10796 1 ♂ 10.X.1998, V.O. Becker col., Col. Becker 117489 (VOB). **Petrópolis**, 1 ♂ 16.X.1955, D'Almeida col./ DZ 45.718/ Gen. Prep. E. Orlandin 2018/ DZ 45.718♂ *Olceclostera quilombola* Orlandin, Piovesan and Carneiro det. 2023; 1 ♂ 30.X.1953, D'Almeida and Berla col./ DZ 45.748 (DZUP). **Teresópolis**, 1000 m 1 ♂ 15.I.1985, V.O. Becker col., Col. Becker 54762, Genitália 2644 (VOB). **São Paulo: Apiaí**, 750 m 17 ♂♂ 15.VII.2005; 4 ♂♂ 12.X.2006; 4 ♂♂ 2.XI.2007, Coll. D. Herbin (CDH). **Campos do Jordão**, 1600m, 22°46'S 45°31'W 1 ♂ 23–27.I.2001, V.O. Becker col., Col. Becker 130775 (VOB). **Capão Bonito**, Intervales, 900 m, 24°16'S 48°24'W 1 ♂, 05–07.XII.2001, V.O. Becker col., Col. Becker 134144 (VOB). **Guapiara**, Paivinha, 800 m 2 ♂♂ 6–8.III.2005; 2 ♂♂ 2–5.IV.2005; 5 ♂♂ 25–27.VII.2005; 3 ♂♂ 16–19.IX.2005; 1 ♂ 23–25.X.2005; 3 ♂♂ 14–16.II.2006, Coll. D. Herbin (CDH). **Guaratinguetá**, S[anta] Maria da Serra, 1900 m, 22°25'S 45°25'W, 3 ♂♂ 24–26.III.2022, V.O. Becker col., Col. Becker 165753 (VOB). **Salesópolis**, [Estação Biológica de] Boracéia 1 ♂ 05.IX.1942, D'Almeida col./ DZ 45.789; 1 ♂ 27.IX.1948, D'Almeida col./ DZ 45.830 (DZUP). **São José do Barreiro**, 1640 m, 22°43'26"S 44°36'57"W 2 ♂ .X.2021, V.O. Becker col., Col. Becker 164501 (VOB). **São Luís do Paraitinga**, 900 m, 23°20'S 45°06'W 1 ♂ 12–17.XI.2001, V.O. Becker col., Col. Becker 133834, 700 m, 23°20'S 39°03'W 1 ♀ (Fig. 4C, D) 26.X.2019, V.O. Becker col., Col. Becker 160738 (VOB).

3.1.3. *Olceclostera xeta* Orlandin, Herbin and Carneiro sp. nov.

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Figures 2G, H, 4E, F, 19, 20

Type locality. RPPN Fazenda da Mata, Querência do Norte Municipality, Paraná State, Brazil.

Diagnosis. Externally, *O. xeta* **sp. nov.** can be distinguished from *O. jairana* **sp. nov.** by all tibias with a band of long scales with grayish brown apex, while *O. jairana* **sp. nov.** presents these scales with light brown apex (Fig. 6A, C). Dorsally, the abdomen of *O. xeta* **sp. nov.** has a grayish color, while *O. jairana* **sp. nov.** has a copper color (Fig. 2C, D, G, H). The genitalia of *O. xeta* **sp. nov.** presents, in lateral view, a wider socci than *O. jairana* **sp. nov.**, and the process of sacculus is half the length of that of *O. jairana* **sp. nov.** The aedeagus of *O. xeta* **sp. nov.**, does not have spines, and the basal portion of the vesica is covered by small cornuti (Figs 10, 19).

Olceclostera xeta **sp. nov.** differs from *O. quilombola* **sp. nov.** by external and genitalia characters: on the forewing of *O. xeta* **sp. nov.** the two subapical hyaline spots, between M_1 and M_3, are rounded and smaller. Otherwise, these spots are rectangular in *O. quilombola* **sp. nov.** Dorsally, the abdomen of *O. xeta* **sp. nov.** has a grayish color, while *O. quilombola* **sp. nov.** has a copper color (Fig. 2E–H). *Olceclostera xeta* **sp. nov.** has all tibias with a band of long scales with grayish brown apex, while *O. quilombola* **sp. nov.** presents these scales with dark brown apex (Fig. 6B, C). The genitalia of *O. xeta* **sp. nov.** presents the process of sacculus with half of the length of *O. quilombola* **sp. nov.**, and the basal portion of the vesica is covered by small cornuti, while the aedeagus of *O. quilombola* **sp. nov.** has vesica without cornuti (Figs 17, 19).

Olceclostera xeta **sp. nov.** is similar to *O. wayana* **sp. nov.**, but slightly darker gray and smaller in size (17 mm forewing length). The subapical hyaline spots are slightly larger. In the genitalia, *O. xeta* **sp. nov.** differs from *O. wayana* **sp. nov.** by the presence of a protrusion on the apex of the aedeagus.

Description (Figs 2G, H, 4E, F, 6C, 19, 20). ***Head.*** **MALE.** As in *O. jairana* **sp. nov. FEMALE.** Antenna, pecten shorter than the male's pecten. — ***Thorax.*** **MALE and FEMALE**. As in *O. jairana* **sp. nov.** — ***Legs.*** All tibias with a band of long scales with grayish-brown apex projecting towards the posterior region (Fig. 6C). — ***Wings shape and venation.*** **MALE and FEMALE.** As in *O. jairana* **sp. nov.** (Figs 2G, H, 4E, F). **MALE.** Forewing length: 16.5–17 mm (n = 03). Upperside and underside: Similar to *O. jairana* **sp. nov.** Hindwing. Upperside and underside: Similar to *O. jairana* **sp. nov. FEMALE.** Forewing length: 17–21 mm (n = 03); general color similar to the male, the apex is more acute than in males; lighter grey than the female of *O. jairana*

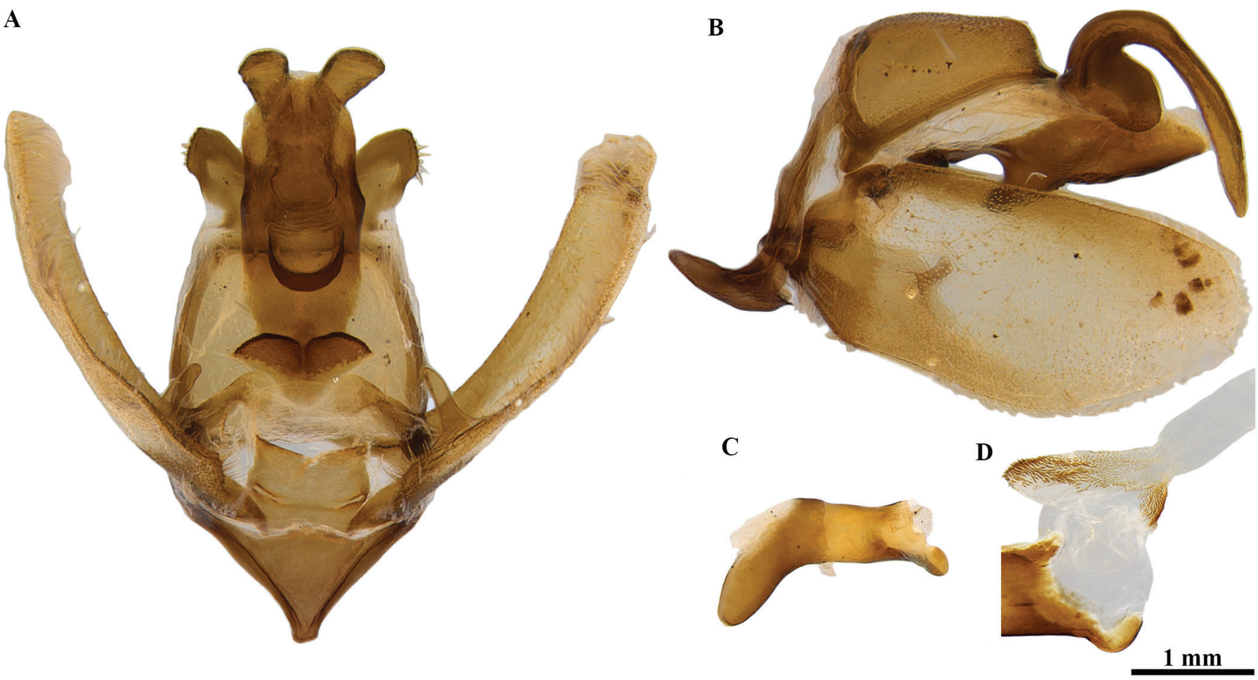

Figure 19. Male genitalia of *Olceclostera xeta* **sp. nov. A** ventral view; **B** lateral view; **C** aedeagus lateral view; **D** cornuti detail.

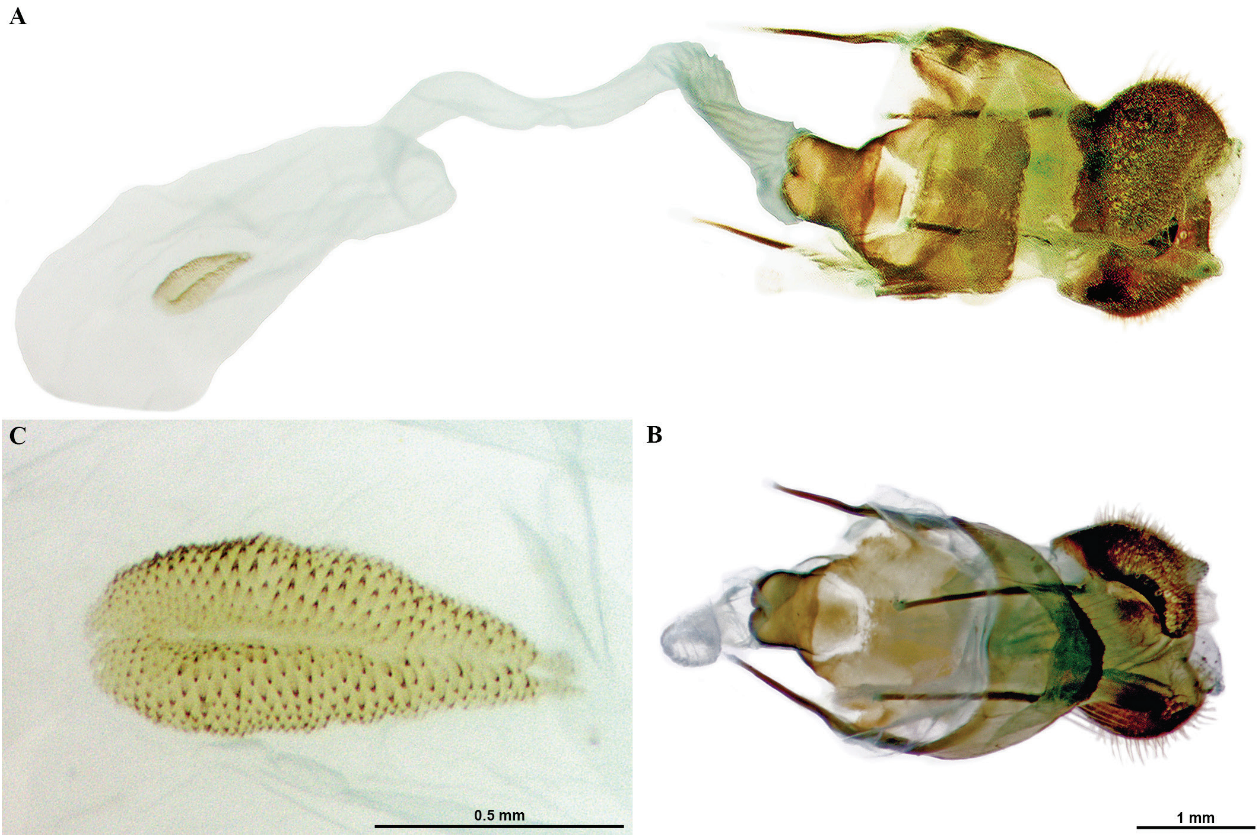

Figure 20. Female genitalia of *Olceclostera xeta* **sp. nov. A** latero-ventral view; **B** dorsal view; **C** signum detail.

sp. nov. and *O. quilombola* **sp. nov.** The hyaline spot between M_1–M_2 is small than in males, and the hyaline spot between M_2–M_3 is reduced or absent. Hindwing. As in male. ***Abdomen*. MALE and FEMALE.** Similar to *O. jairana* **sp. nov.**, but dorsally gray. — ***Genitalia*. MALE.** (Fig. 19). Similar to *O. jairana* **sp. nov.**, but aedeagus without spines; vesica with the basal portion covered by small cornuti. **FEMALE.** (Fig. 20). Similar to *O. jairana* **sp. nov.**, but the ostium bursae are broader and the signum leaf-shaped.

Distribution. Based on museum records, the species is present in the Brazilian states of Paraná and the Paraguayan provinces of Alto Paraná, Canindeyú, Concepción, Cordillera, Hayes, and Paraguarí (Fig. 22).

Etymology. This species is named after the Xetá indigenous people. The Xetá were original inhabitants of the northwestern Paraná and the last ethnic group in the state to come into contact with white colonizers (in 1954) who invaded their territory and decimated the Xetá population.

Material examined. ***Holotype***. (Fig. 2G, H) BRAZIL. 1 ♂; RPPN Fazenda da Mata, Querência do Norte 280 m, Paraná, Brazil, deposited at the DZUP, with the following labels: / Holotypus/ Brasil, Paraná, Querência do Norte, RPPN Faz[enda] da Mata 280 m, 13.IX.2020 22°56'15"S 53°32'05"W, Casagrande, Mielke, Carneiro and Orlandin leg./ Holotypus *Olceclostera xeta* Orlandin, Herbin and Carneiro det. 2023/ DZ 52.940/ BC-DZ./.— ***Paratypes.*** BRAZIL. **Paraná: Querência do Norte**, RPPN Fazenda da Mata 280 m, 22°56'15"S 53°32'05"W 2 ♂♂ 13.IX.2020, Casagrande, Mielke, Carneiro and Orlandin leg./ DZ 43.365 and DZ 52.158/ Gen. Prep. E. Orlandin 2018 and Gen. Prep. E. Orlandin 2021/ DZ 43.365♂ and DZ 52.158♂ *Olceclostera xeta* Orlandin, Herbin and Carneiro det. 2023 (DZUP). PARAGUAY. **Cordillera: Takuara Renda**, 25°39'S 56°55'W 14 ♂♂ 1 ♀ 05–08.VIII.2011, 3 ♂♂ 10–14.XI.2011, Leg. U. Drechsel, Coll. D. Herbin (CDH). **Pirareta**, 25°29'S 56°56'W 1 ♂ 28.VII.2010; 1 ♂ 14–18.VII.2011; 3 ♂♂ 24–28.VII.2011; 3 ♂♂ 31.VIII.2011, Leg. U. Drechsel, Coll. D. Herbin (CDH). **Puerto Naranjahay**, 62 m, 24°58'S 57°12'W 1 ♂ 1.VI.2015, Leg. U. Drechsel, Coll. D. Herbin (CDH). **Alto Paraná: Estancia Dimas**, 25°33'S 55°13'W 2 ♂♂ 19–22.VII.2012; 2 ♂♂ 6–8.VII.2013; 1 ♂ 10–12.III.2011, Leg. U. Drechsel, Coll. D. Herbin 1♀ (Fig. 4E, F), Leg. U. Drechsel/ Gen. Prep. D. Herbin H1660/ (CDH). **Limoy**, 245 m, 24°45'S 54°27'W 1 ♂ 6–8.III.2014, Leg. U. Drechsel, Coll. D. Herbin (CDH). **Hayes: Chaco Lodge**, 115 m, 22°30'S 59°18'W 1 ♂ 1 ♀ 4–6. XI.2015, Leg. U. Drechsel, Coll. D. Herbin (CDH). **Concepción: San Luis**, 170 m, 22°24'S 57°28'W 2 ♂♂ 12–14.V.2016, Leg. U. Drechsel, Coll. D. Herbin (CDH). **Canindeyú: Mbaracayú**, 194 m, 24°08'S 55°31'W, 3 ♂♂ 27–29.XI.2013, Leg. U. Drechsel, Coll. D. Herbin (CDH). **Carapá**, 240 m, 24°22'S 54°23'W 2 ♂♂ 1–4.IV.2009, Leg. U. Drechsel (CDH). **Paraguarí: Mbatoví**, 383 m, 25°35'S 57°05'W 2 ♂♂ 17–18.IV.2014, Leg. U. Drechsel, Coll. D. Herbin/ BC-Her 4924 and BC-Her4695 (CDH).

3.1.4. *Olceclostera wayana* Herbin, Orlandin and Carneiro sp. nov.

https://zoobank.org/6B8921EC-5000-42F4-B471-61EB664978E4

Figures 2I, J, 21

Type locality. Piste Patagai-Counamama, French Guiana.

Diagnosis. Externally, *O. wayana* **sp. nov.** is similar to *O. xeta* **sp. nov.**, slightly lighter grey and larger (21 mm forewing length). The two subapical hyaline spots between M_1 and M_3 are tiny. In the genitalia, *O. wayana* **sp. nov.** differs from *O. xeta* **sp. nov.** by the absence of a protrusion on the apex of the aedeagus and vesica with a plate with minute teeth.

Description (Figs 2I, J, 21). ***Head.*** **MALE.** As in *O. xeta* **sp. nov. FEMALE.** Unknown. — ***Thorax.***—As in *O. xeta* **sp. nov.** — ***Legs.*** As in *O. xeta* **sp. nov.** — ***Wings shape and venation.*** As in *O. jairana* **sp. nov.** (Fig. 2I, J). Forewing length: 21 mm (n = 04). Upperside and underside: Similar to *O. xeta* **sp. nov.**, slightly lighter grey. The subapical hyaline spots between M_1 and M_3 are tiny. Hindwing. Upperside and underside: Similar to *O. xeta* **sp. nov.** — ***Abdomen.*** Similar to *O. xeta* **sp. nov.** — ***Genitalia.*** (Fig. 21). Similar to *O. xeta* **sp. nov.**, but bigger, without a protrusion on the apex of the aedeagus and vesica with a plate with minute teeth.

Distribution. French Guiana.

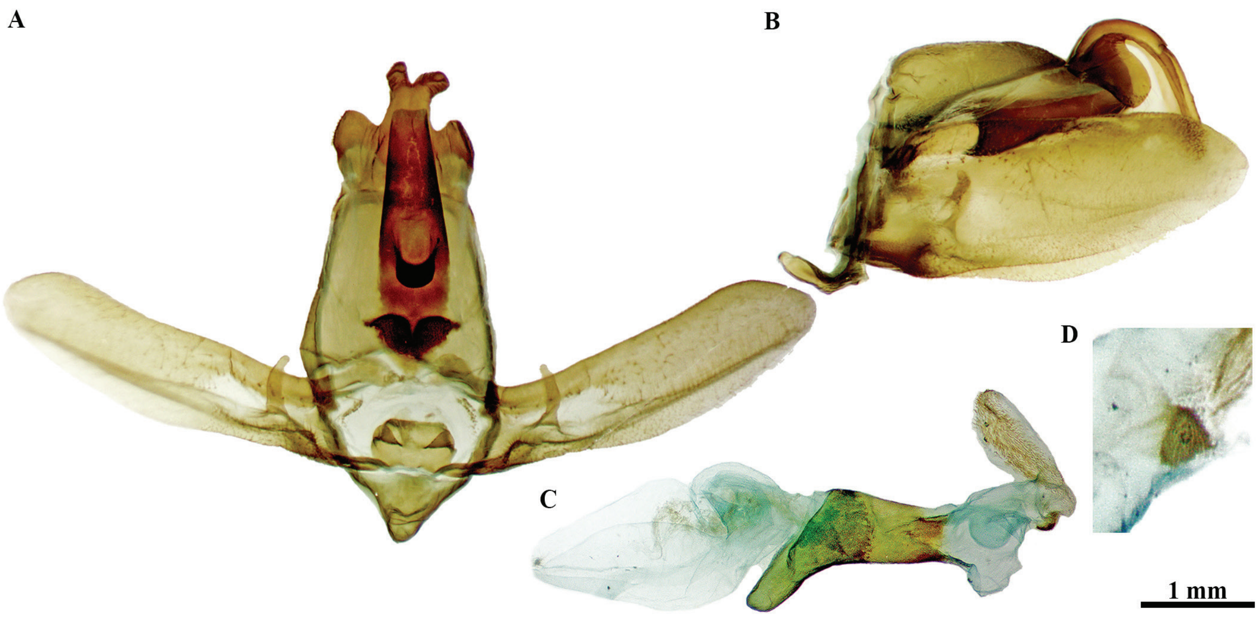

Figure 21. Male genitalia of *Olceclostera wayana* **sp. nov. A** ventral view; **B** lateral view; **C** aedeagus lateral view; **D** detail of vesica with a plate with minute teeth.

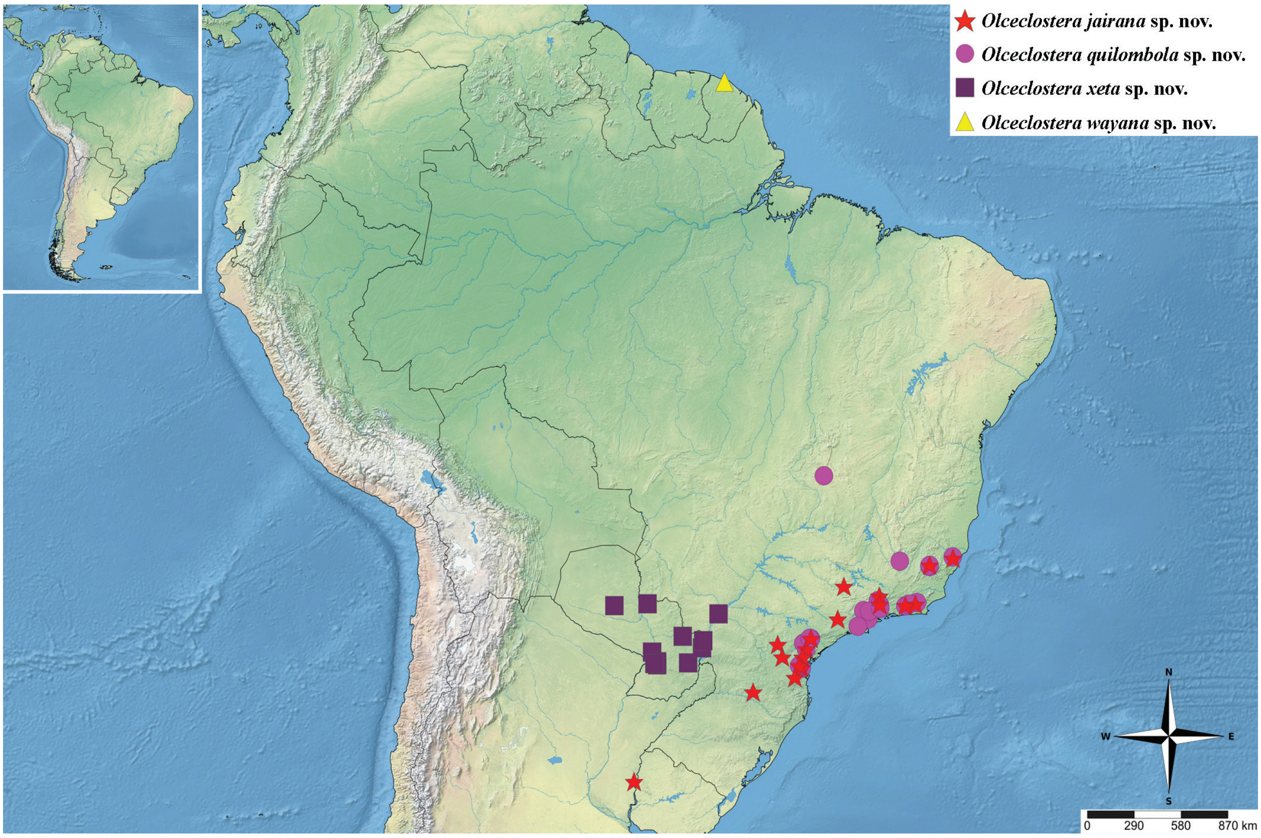

Figure 22. Geographical distribution of new species of *Olceclostera*.

Etymology. This species is named after the Wayana indigenous people, inhabiting along the Maroni River, at the border between French Guiana and Suriname.

Material examined. ***Holotype***. (Fig. 2I, J) FRENCH GUIANA. 1 ♂; French Guiana, deposited in MNHN, with the following labels: / Holotype, *Olceclostera wayana*, des. Herbin, Orlandin and Carneiro 2023 / Guyane Française, Piste Patagai-Counamama, 05°22'59.51"N 53°12'27.25"W, Alt. 49 m 23.XI.2013, leg. D. Herbin / genitalia prep. D. Herbin ref. H.1166 / BC-Her4834 / CDH 3.042.—***Paratypes.*** FRENCH GUIANA. **Piste Paul Isnard**, PK 34 1 ♂ 28.VII.2001, leg. M. Laguerre, Coll. D. Herbin, genitalia prep. D. Herbin ref. H.1702 (CDH). Citron 1 ♂ 11–17.III.1986, leg. G. Tavakilian, Coll. D. Herbin (CDH). **Piste Patagai-Counamama**, 05°20'34.23"N 53°12'47.86"O, Alt. 58m 1 ♂ 02.XI.2013, leg. O. Felis, Coll. D. Herbin, genitalia prep. D. Herbin ref. H.1703 (CDH).

3.2. Maximum Likelihood Tree

Based on sequences of the mitochondrial COX1 gene (barcode region, 658pb), our reconstructed tree recovers *O. jairana* **sp. nov.** and *O. quilombola* **sp. nov.** as a sister group to *O. xeta* **sp. nov.** and *O. wayana* **sp. nov.**, although this relationship is not well supported. This clade is sister to a cluster that includes the Central American *O. bifenestrata* and the North American *O. angelica*, *O. indistincta*, and *O. seraphica* (Fig. 23). This relationship, however, shows low support. The topology obtained between the *Olceclostera* new species supports their distinctiveness, whose genetic distances ranged from 3.4% to 10% (Table 1).

4. Discussion

Olceclostera jairana **sp. nov.**, *O. quilombola* **sp. nov.**, *O. xeta* **sp. nov.** and *O. wayana* **sp.nov.** are morphologically similar to the North American species *O. angelica*, *O. indistincta*, and *O. seraphica* (see Franclemont 1973). The four new species are cryptic with the Central American species *O. bifenestrata* and are identified as this species in the collections and in the few studies in which it was cited (Draudt 1929; Biezanko 1986). In fact, the new South American species cluster together with *O. bifenestrata*, *O. angelica*, *O. indistincta*, and *O. seraphica*, thus forming a monophyletic group well differentiated from the other 16 species of the genus analyzed and the outgroup. Although our COX1 tree showed a low support value for this clade, there are morphological characters that corroborated this group. These eight species share traits such as the presence of two hyaline spots on the forewings and only one pair of large patches of broader scales laterally on the abdomen. Hyaline spots on the

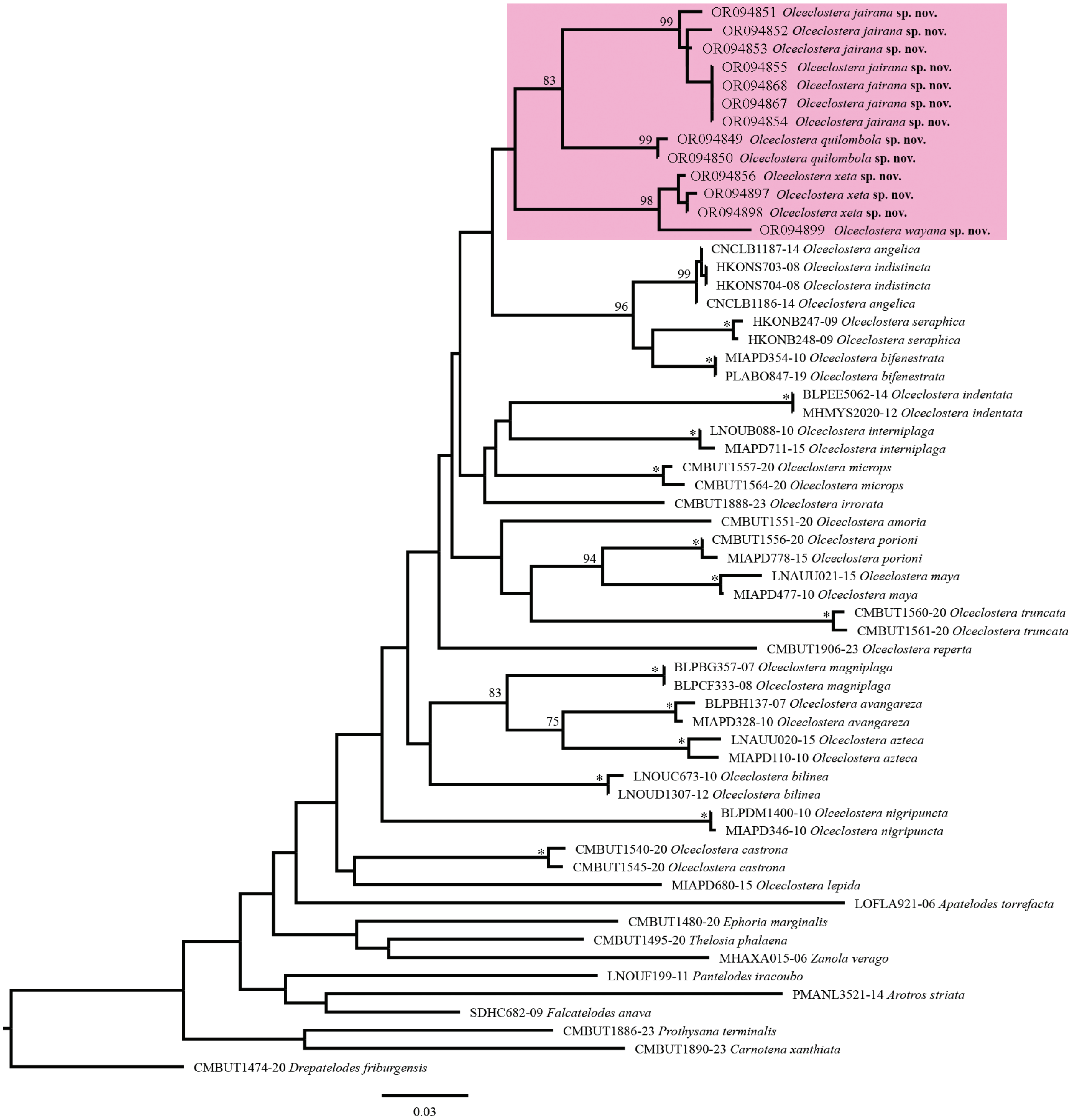

Figure 23. Maximum likelihood phylogenetic tree, inferred with IQ-TREE, based on cytochrome c oxidase subunit I (COX1, barcode region, 658pb) showing the relationship among new species of *Olceclostera*, twenty other species of *Olceclostera*, and representatives of ten genera of Apatelodidae as outgroups. Numbers indicate ML ≥ 70, and * indicates maximum support of 100. Low support values were not shown. The scale bar represents the expected number of nucleotide substitutions per site.

forewings and patches of broader scales on the abdomen are also present in the other *Olceclostera* species but with different configurations. These characters, together with characters of the genitalia (uncus bifid V-shaped, gnathos converted to sclerotized plates, and subscaphium sclerotized), are proposed as diagnostic of the genus.

The configuration of the hyaline spots and the number of patches of broader scales laterally on the abdomen can be used to distinguish groups of species of *Olceclostera*. For example, some species have only a yellowish hyaline spot on their forewings and one pair of large patches of broader scales laterally on each abdominal segment (e. g. *Olceclostera guanduna* Drautd, 1929, *Olceclostera indentata* Schaus, 1910, *O. irrorata*, *Olceclostera leticiensis* Herbin, 2021, *Olceclostera microps* (Walker, 1855) and *Olceclostera reperta* (Walker, 1865)), while others have only a whitish hyaline spot on their forewings and two pairs of large patches of broader scales laterally on the proximal abdominal segments (e. g. *Olceclostera amoria* Druce, 1890, *Olceclostera azteca* Schaus, 1894, *Olceclostera magniplaga* Schaus, 1910 and *Olceclostera porioni* Herbin and Mielke, 2018). Although the patches of larger scales on the abdomen call us attention, these patches are mentioned in the descriptions of only seven species (*O. angelica*, *O. irrorata*, *O. azteca*, *O. magniplaga*, *O. reperta*, *O. indentata*, *O. microps*). However, these spots are not present in all the species of the genus. Therefore the phylogenetic significance of this character requires further studies.

Knowledge about immature traits is essential to understanding the Lepidoptera evolution (Balcázar-Lara and Wolfe 1997; Freitas and Brown 2004). In this study, we describe for the first time the morphology of all immature stages of one *Olceclostera* species and illustrate for the first time images of the egg of an Apatelodidae species using SEM. In dorsal view, the egg of *O. jairana* **sp. nov.** is similar to that described for *O. seraphica*, *Apatelodes*, and *Thelosia* species (Packard 1895; Peigler 1994; Thomazini 2010; Herbin 2020; Orlandin et al. 2022a, 2022b) appearing to be flattened as cited for these species. However, the lateral view of the eggs of *O. jairana* **sp. nov.** shows that the micropylar pole is concave (pie-shaped) and not flattened (coin-shaped). This finding is important because it demonstrates that there are a greater variety of egg shapes in Apatelodidae than previously thought since we found dome-shaped eggs in *Drepatelodes* (Orlandin et al. 2021) and coin-shaped eggs in *Apatelodes* (Packard 1895; Orlandin et al. 2022a, 2022b). To infer the evolutionary significance of the egg morphology in Apatelodidae, eggs of more species of the different genera should be obtained, and these eggs must be studied in detail (e. g. using SEM), including records in lateral view.

The chaetotaxy of *O. jairana* **sp. nov.** is very similar to the chaetotaxy of other Apatelodidae species, which were described in detail (Orlandin et al. 2021, 2022a, 2022b). The head shows only primary setae, as the other species already studied. On the body, the known species have secondary setae, mostly arranged on large verrucae. However, the most striking difference in the chaetotaxy of *O. jairana* **sp. nov.** is the lack of L2 on A1–A8 isolated, while in *Apatelodes je* Orlandin, Piovesan & Carneiro, 2022, *Apatelodes kotzschi* Draudt, 1929, and *D. friburgensis*, L2 is isolated (Orlandin et al. 2021, 2022a, 2022b). Additionally, first instar larvae of Apatelodidae also seem to present a great variation in the number of secondary setae grouped with D1 and D2 on the thorax and the abdomen. *Olceclostera jairana* **sp. nov.** has on T2–T3 segments, D1 seta solitary and D2 seta arranged with only one secondary seta, while *A. je* also has D1 seta solitary but D2 seta on a verruca with about six secondary setae (Orlandin et al. 2022a). On the other hand, in *A. kotzschi*, D1 seta is on a verruca with three secondary setae, and D2 seta is on a verruca with about six secondary setae (Orlandin et al. 2022b), while *D. friburgensis* has D1 seta on a verruca with two or three secondary setae, and D2 seta next to a secondary seta (Orlandin et al. 2021). Between A1–A7, *O. jairana* **sp. nov.** presents D1 seta on a verruca with two more secondary setae and D2 seta on a verruca with about six secondary setae. Unlike this configuration, *A. je* and *A. kotzschi* have both D1 and D2 setae on each verruca with five to seven secondary setae, and *D. friburgensis* has D1 seta on a verruca with about five secondary setae and D2 seta solitary (Orlandin et al. 2021, 2022a, 2022b). In A8, the configuration of dorsal setae is very similar, and all species have the D1 seta with one to three secondary setae and solitary D2 seta. Here we emphasize that the chaetotaxy of Apatelodiade still requires a broader study to evaluate its diagnostics and phylogenetic relevance to delimit monophyletic groups in the family.

The available information on the immature stages of *Olceclostera* allows us to make some comparisons between the species of the genus. In the last larval instars, *O. jairana* **sp. nov.** is very similar to *O. bifenestrata* and *O. seraphica*, differing from them by the more brownish color, by the dorsal region of the body with smaller yellow spots (larger in *O. bifenestrata*) and by the absence of orange spots on the dorsal region of the body (present in *O. seraphica*) (Peigler 1994; Janzen and Hallwachs 2009). The color pattern, the slightly flattened dorsoventrally body, and the pattern in the setae distribution make these species very similar to larvae of some species of *Euglyphis* (Lasiocampidae) (Janzen and Hallwachs 2009). *Euglyphis* caterpillars are known for having urticating setae (Specht et al. 2008), absent in the *Olceclostera* genus, which may constitute a Batesian-type mimicry. In Apatelodidae, this type of mimicry seems to be common, with caterpillars mimicking larvae of Megalopygidae, Arctiinae, and Lasiocampidae (Orlandin et al. 2021, 2022a).

Olceclostera jairana **sp. nov.** pupates in the soil like other known Apatelodidae species. This trait appears to be shared by most species in the family, as, so far, only *Prothysana* is known to make cocoons (Becker and Orlandin in press). The pupa of *O. jairana* **sp. nov.** is similar to that described for *O. seraphica* and to the other species of Apatelodidae (Peigler 1994; Janzen and Hallwachs 2009; Thomazini 2010; Orlandin et al. 2021, 2022a, 2022b). However, the absence of a rudimentary cremaster and the almost smooth body (few punctuations) makes it much more similar to the pupae of *D. friburgensis* (Orlandin et al. 2021).

Apatelodidae, like most moth groups, has been neglected in worldwide collections, although they belong to one of the most collectible moth groups in the world, the Bombycoidea (e. g. Saturniidae, Sphingidae, Brahmaeidae). As for these groups, detailed investigation on male genitalia showed that some old recognized wide-spread species comprise a set of cryptic species whose geographic distribution is much more restricted than previously thought. This is the case of South American specimens formerly identified as *O. bifenestrata*, that currently are the type series of *O. jairana* **sp. nov.**, *O. quilombola* **sp. nov.**, *O. xeta* **sp. nov.**, and *O. wayana* **sp. nov.**, whose differences in genitalia morphology are corroborated by great genetic distances in COX1 (barcode region, 658pb) sequences. The accumulated knowledge, especially in recent years, shows that there is still much to be studied to understand the evolutionary relationships between Apatelodidae lineages.

5. Competing interests

The authors have declared that no competing interests exist.

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Supplementary Material 1

Table S1

Authors: Orlandin E, Piovesan M, Herbin D, Carneiro E (2023)
Data type: .xlsx
Explanation note: GenBank and BOLD Systems accession numbers of Olceclostera specimens used in the Maximum likelihood phylogenetic tree, based on cytochrome c oxidase subunit 1 (COX1) (DNA barcode).

Link: https://doi.org/asp.81.e107507.suppl1