

Two new Neotropical species of *Drosophila peruensis* species group (Diptera, Drosophilidae)

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ABSTRACT. The *Drosophila peruensis* species group was recently proposed and includes four taxa: *D. atalaia* Vilela & Sene, 1982, *D. boraceia* Vilela & Val, 2004, *D. pauliceia* Ratcov & Vilela, 2007, and *D. peruensis* Wheeler, 1959. All these species have most of setae or setulae of mesonotum arising from dark spots, wings with crossveins darker (except in *D. atalaia*) and hypandrium squared-shaped mostly fused to gonopods. Here, we describe two new species, *Drosophila itacorubi* sp. nov. and *Drosophila paraitacorubi* sp. nov., belonging to this species group. The male genitalia of these species are figured. An identification key to the *D. peruensis* species group is provided.

KEYWORDS. Atlantic Rainforest, male genitalia, mangrove, southern Brazil, spotted thorax.

RESUMO. Duas novas espécies neotrópicas do grupo de espécies *Drosophila peruensis* (Diptera, Drosophilidae). O grupo de espécies *Drosophila peruensis* foi proposto recentemente e inclui quatro táxons: *D. atalaia* Vilela & Sene, 1982, *D. boraceia* Vilela & Val, 2004, *D. pauliceia* Ratcov & Vilela, 2007, *D. peruensis* Wheeler, 1959. Todas possuem a maioria das cerdas do mesonoto emergindo de manchas escuras, veias transversais esfumadas (com exceção de *D. atalaia*) e hipândrio com formato quadrado e fortemente fusionado aos gonópodes. Neste artigo são descritas duas novas espécies, *Drosophila itacorubi* sp. nov. e *D. paraitacorubi* sp. nov., pertencentes a este grupo de espécies. A genitália masculina destas espécies são ilustradas. Uma chave de identificação para as espécies do grupo *D. peruensis* é fornecida.

PALAVRAS-CHAVE. Genitália masculina, manguezal, Mata Atlântica, Sul do Brasil, tórax manchado.

Since the beginning of the twentieth century the male genitalia of drosophilids was considered important to separate sibling species (STURTEVANT, 1921) and several authors described this apparatus (HSU, 1949). In the middle of that century, Hsu (1949) compared the external genitalia of about 170 species and concluded that close related species shows a striking similarity and this trait should be considered important to systematics. However, this author noticed that this apparatus was insufficient to distinguish some couples of species and, on that basis, the internal structures of the male genitalia became drawn (FROTA-PESSOA, 1954).

Nowadays, descriptions in the field of taxonomy have been focused on both internal and external morphology of the male genitalia (VILELA, 1983). It was observed that, on the morphological level, many of the species of *Drosophila* could be distinguished only by the analysis of such structure and mainly by the internal genitalia (aedeagus) (VILELA, 1992). For this reason, the male genitalia, and specially the aedeagus, became the most important character used by taxonomists to recognize and describe species (VILELA & BÄCHLI, 1990). The use of this structure as a morphological character to delimit species is considered effective because, in a large number of animal groups, are under strong selection and evolve rapidly (EBERHARD, 1985).

The *Drosophila peruensis* species group was recently proposed by RATCOV & VILELA, (2007) to include four species: *D. atalaia* Vilela & Sene, 1982, *D. boraceia* Vilela & Val, 2004, *D. pauliceia* Ratcov & Vilela, 2007 and *D. peruensis* Wheeler, 1959. The first described species, *D. peruensis*, was formerly described as *D. maculipennis* by DUDA (1927) based on a single female

and ascribed to *D. repleta* species group by STURTEVANT (1942) probably due to its spotted thorax. Later, the absence of known males and the misidentification of specimens of *D. tucumana* Vilela & Pereira, 1985 and *D. urubamba* Vilela & Pereira, 1993 (both belonging to the *D. guarani* species group) as *D. peruensis* has caused it to be included in the *D. guarani* species group by VILELA (1983). In more recent analysis, RATCOV & VILELA (2007) noted that *D. peruensis* is closely related to *D. atalaia*, *D. boraceia* and to an undescribed species (actually described as *D. pauliceia*), and assigned them to a new group, the *D. peruensis*.

Up to now, the *D. peruensis* group was recorded only in South America. *Drosophila peruensis* were recorded in Peru and Colombia (DUDA, 1927; VILELA & BÄCHLI, 1990), *D. boraceia* and *D. pauliceia* in Brazil (states of São Paulo and Santa Catarina) (VILELA & VAL, 2004; GOTTSCHALK *et al.*, 2007; RATCOV & VILELA, 2007; DÖGE *et al.*, 2008), and *D. atalaia* in Brazil (states of Espírito Santo, Rio de Janeiro and Mato Grosso do Sul), Argentina and El Salvador (VILELA & SENE, 1982).

This paper presents the description of two new species from the *D. peruensis* species group, focusing on external morphology and traits of the internal and external genitalia, and proposes an identification key to the *D. peruensis* species group.

MATERIAL AND METHODS

The postabdomen of specimens were removed and dissected and male and female genitalia are stored in microtubes with glycerol and attached to their respective specimens. The material studied is

deposited in the Museu de Ciências Naturais of the Fundação Zoobotânica do Rio Grande do Sul (MCNZ, Porto Alegre, Brazil). Pigmentation of specimens was observed on dried individuals. The terminology was based on VILELA & BÄCHLI (2000) and indexes on VILELA & BÄCHLI (1990) and VILELA (1983). Averages are followed by ranges (in parenthesis) when two or more specimens were analyzed. Illustrations were drawn using a microscope with a 20x magnification object lens and a camera lucida.

***Drosophila itacorubi* sp. nov.**

(Figs. 1, 3, 5, 7-15)

Drosophila sp. 1 SCHMITZ *et al.*, 2007:57 (tab. 1), 61.

Type material. Holotype ♂ (postabdomen dissected), labelled “Brasil. SC. Florianópolis. Manguezal do Itacorubi, 27°34'14”S 48°30'33”W, H. J. Schmitz col. 22.IV.2005 / *Drosophila itacorubi* Döge, Gottschalk & Valente ♂ Holótipo”. Paratypes: 2♀ labeled “Brasil. SC. Florianópolis. Manguezal do Itacorubi, 27°34'14”S 48°30'33”W, H. J. Schmitz col. 22.IV.2005 / *Drosophila itacorubi* Döge, Gottschalk & Valente ♀ Parátipo” and 2♀ labeled “Brasil. SC. Florianópolis. Manguezal do Rio Tavares, 27°39'13”S 48°32'12”W, H. J. Schmitz col. 21.IV.2005 / *Drosophila itacorubi* Döge, Gottschalk & Valente ♀ Parátipo”, one of them with the postabdomen dissected. Type locality: Manguezal do Itacorubi, Florianópolis, state of Santa Catarina, Brazil.

Diagnosis. Main color yellowish brown. Frons yellowish brown; arista with 5-6 dorsal and 2-3 ventral branches, plus terminal fork. Most setae and setulae of the thorax and head arising from dark brown spots; two large prescutellars. Wings with both main crossveins darker than longitudinal ones, with lappet (not so evident). Surstylus mostly microtrichose; hypandrium somewhat square-shaped; aedeagus stout.

Description. ♂. Head (Fig. 1). Main color yellowish brown. Frons yellowish brown. Frontal length = 0.50 mm. Frontorbital plates yellowish brown, with dark brown spots at base of orbital setae. Anterior

recline orbital setae behind proclinate one. Length ratio of mid to anterior orbital = 0.76. Length ratio of mid to posterior orbital = 0.76. Vt index = 1.02. Frontal triangle dark brown, medially interrupted by a yellowish brown strip. Ocellar triangle yellowish brown with dark brown spots around the ocelli, about 53.1% of frontal length. Face brown. Facial carina prominent, sulcate, and slightly darker than face. Antennae, proboscis, palps and gena yellowish brown. Palps cleft-shaped with two prominent setae, one terminal and another subterminal. Red eyes, with short black pile. Cheek index = 9.86. Eye index = 1.44. Aristae with 5-6 dorsal and 2-3 ventral branches, plus terminal fork.

Thorax (Fig. 3). Ground color yellowish brown, with dark brown spots at the base of each setae. Length = 1.57 mm. Width = 1.04 mm. Eight irregular rows of acrostichals. Two large prescutellars. Dc index = 0.58. Scutellum dark brown with one central spot at the base, and five little spots in the marginal area. Basal scutellar setae convergent. Scut position index = 0.79. Scut index = 0.76. Two prominent katepisternal with a row of setulae between both. Anterior katepisternal about 84.8% of the posterior one. Pleura brown with yellowish spots, somewhat fused. Halteres light brown. Trochanter, coxae and femur brown, tibia yellowish brown and tarsi yellow.

Wing (Fig. 5). Main color light brown. Crossveins slightly darker than longitudinal veins. Lappet present but not so evident. Length = 2.39 mm. Length to width ratio = 1.83. Indices: C = 3.15; 4v = 1.29; 5x = 1.05; 4c = 0.67; M = 0.41; hb = 0.39; prox. x = 0.70.

Abdomen. Ground color yellowish brown. Tergites with broad posterior dark brown bands enlarged paramedially (but medially interrupted in tergite 2), which bends towards and reaches anterior margin at angle of tergites, leaving a yellowish area laterally. Body length = 3.15 mm.

Terminalia (Figs 7-14). Epandrium mostly microtrichose. Ventral lobe not covering surstylus. Cerci mostly microtrichose, anteriorly fused with epandrium at lower half (Fig. 7). Tip of cerci with about seven small setae. Surstylus mostly microtrichose with 17

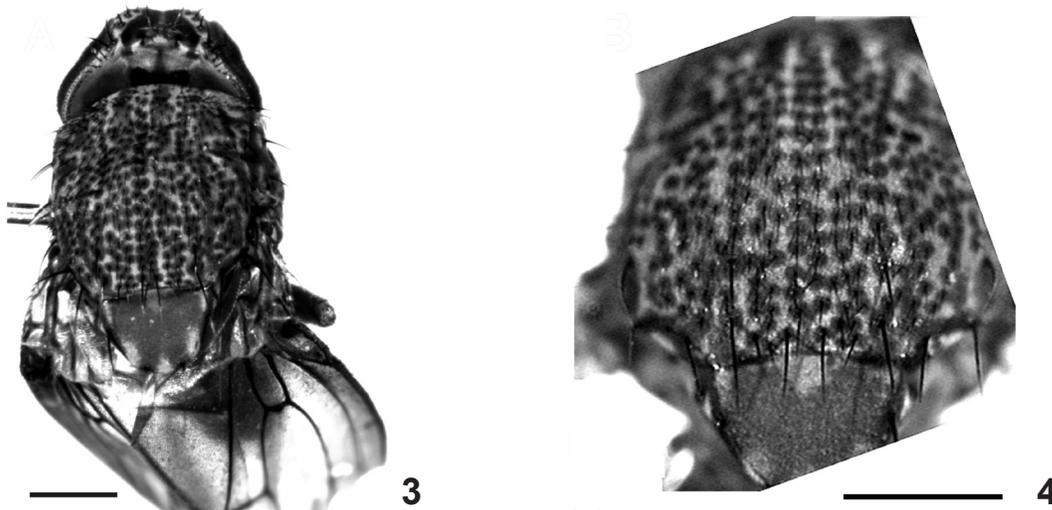


1



2

Figs. 1, 2. Frontal view of head: 1, *Drosophila itacorubi* sp. nov.; 2, *Drosophila paraitacorubi* sp. nov. Bars = 0.5 mm.



Figs. 3, 4. Dorsal view of thorax: 3, *Drosophila itacorubi* sp. nov.; 4, *Drosophila paraitacorubi* sp. nov. Bars = 0.5 mm.

prensisetae, about nine long outer and ten long inner setae (Fig. 8). Hypandrium square-shaped, shorter than epandrium (Fig. 9). Dorsal arch absent. Gonopod mostly fused with hypandrium. Aedeagus expanded at extremity, rounded at tip and with a little invagination, and slightly curved in profile (Figs 10-14). Dorsal cleft partially covered with a membranous tissue and showing a reduced anterior opening, close to the fusion of aedeagus and aedeagal apodeme. Aedeagal apodeme shorter than aedeagus, flattened laterally and curved in profile. Ventral rod robust and fused with aedeagal apodeme. Paraphysis slightly pointed at distal portion and proximally rounded, with one large and curved subapical setae.

♀. Differences from male: The two prominent setae of palps smaller. Posterior band in Tergite 1 medially interrupted in one female. Measurements: Frontal length = 0.61 (0.59 – 0.61) mm. Length ratio of mid to anterior orbital = 0.69 (0.56 – 0.88). Length ratio of mid to posterior orbital = 0.65 (0.59 – 0.76). Vt index = 1.04 (0.93 – 1.12). Ocellar triangle about 57.4% (54.5 – 62.0%) of frontal length. Cheek index = 9.90 (9.07 – 11.06). Eye index = 1.30 (1.27 – 1.32). Thorax length = 1.74 mm (1.55 – 1.89). Thorax width = 1.39 mm (1.26 – 1.63). Dc index = 0.70 (0.64 – 0.73). Scut position index = 0.69 (0.59 – 0.80). Scut index = 0.92 (0.88 – 0.99). Anterior katapisternal about 76.1% (68.8 – 87.7%) of the posterior one. Wing length = 3.05 mm (2.92 – 3.14). Length to width ratio = 2.05 (2.00 – 2.08). Indices: C = 3.40 (3.20 – 3.76); 4v = 1.44 (1.32 – 1.55); 5x = 0.87 (0.85 – 0.89); 4c = 0.72 (0.60 – 0.79); M = 0.39 (0.33 – 0.45); hb = 0.50 (0.43 – 0.61); prox. x = 0.58 (0.56 – 0.61). Body length = 3.87 mm (3.66 – 4.05).

Terminalia (Fig. 15). Valves of oviscapt apically rounded with about 17 marginal and seven discal heavily sclerotized, stout and peg-shaped ovisensilla (the three discal ovisensillas closer to the valves apex are setae-shaped but not so large). One large and two tiny setae at apex of valves.

Etymology. The species name refers to the type locality Manguezal do Itacorubi.

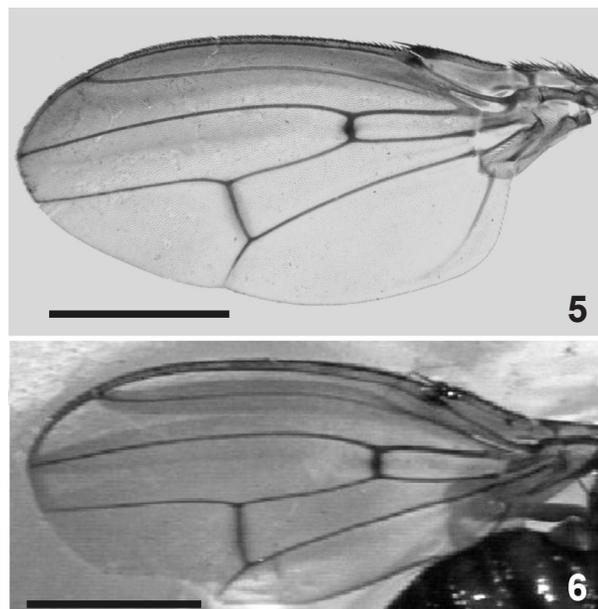
***Drosophila paraitacorubi* sp. nov.**

(Figs. 2, 4, 6, 16-21)

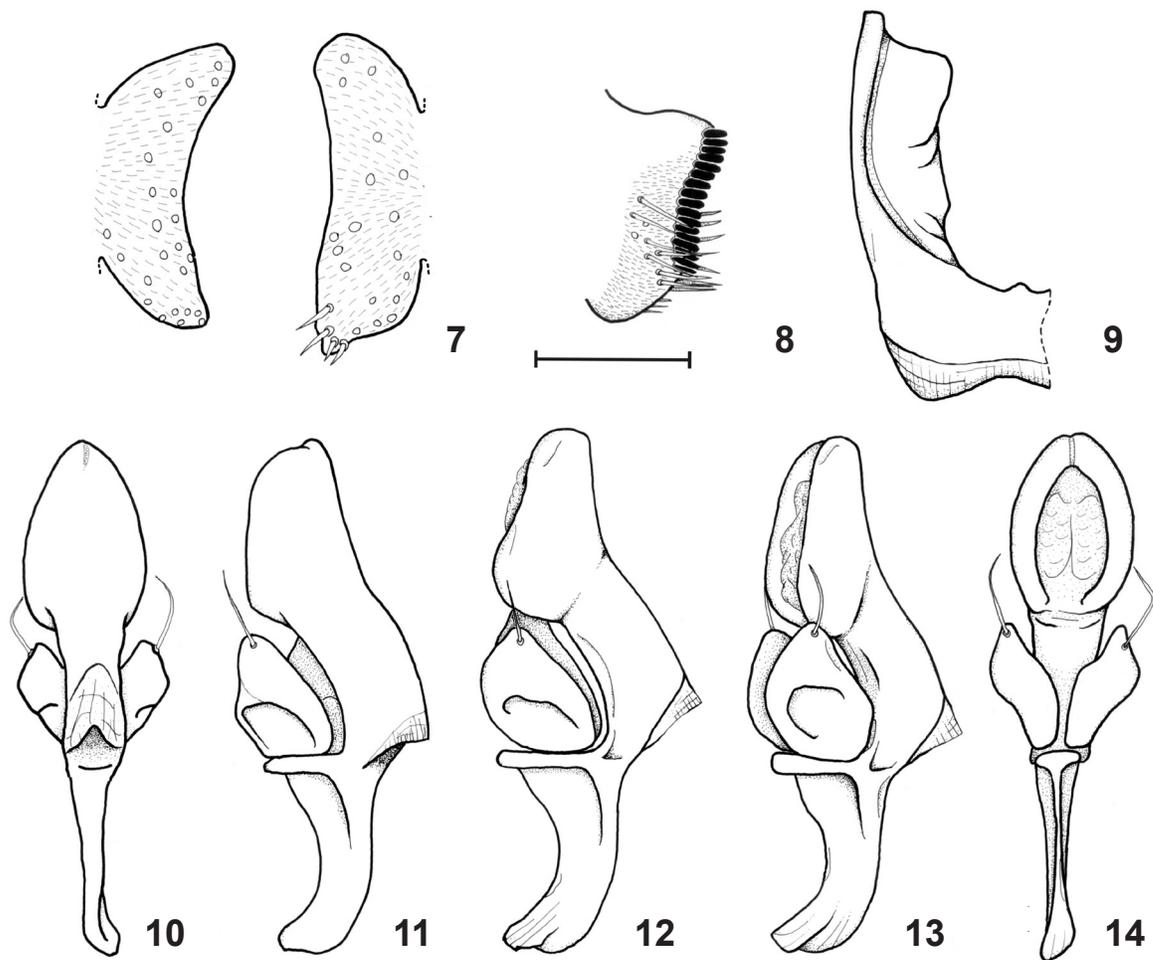
Drosophila sp.bo3 DÖGE *et al.*, 2008:620 (tab. II).

Type material. Holotype ♂ (postabdomen dissected), labelled “Brasil. SC. Joinville. Pirai. 26°17'15”S 49°01'00”W, J. S. Döge col. 27.II.2005 / *Drosophila paraitacorubi* Döge, Gottschalk & Valente ♂ Holótipo”. Type locality: Pirai, Joinville, state of Santa Catarina, Brazil.

Diagnosis. Main color yellowish brown. Frons yellowish brown, arista with 6 dorsal and 2 ventral branches, plus terminal fork. Most setae and setulae of the thorax and head arising from dark brown spots; basal



Figs. 5, 6. Wings: 5, *Drosophila itacorubi* sp. nov.; 6, *Drosophila paraitacorubi* sp. nov. Bars = 1.0 mm.



Figs. 7-14. *Drosophila itacorubi* sp. nov., holotype ♂: 7, cerci, posterior view; 8, surstylus, posterior view; 9, hypandrium and gonopod, posterior view; 10-14, aedeagus, aedeagal apodeme and parameres, several views. Bar = 0.1 mm.

scutellar setae convergent; two large prescutellars. Wings with both main crossveins darker than longitudinal ones, with lappet (not so evident). Surstylus mostly microtrichose; hypandrium somewhat square-shaped; aedeagus stout. Female unknown.

Description. ♂. Head (Fig. 2). Main color yellowish brown. Frons yellowish brown. Frontal length = 0.54 mm. Frontorbital plates yellowish brown, with dark brown spots at base of orbital setae. Anterior reclinate orbital setae behind proclinate one. Ratio of mid to anterior orbital = 0.93. Ratio of mid to posterior orbital = 0.72. Vt index = 1.11. Frontal triangle dark brown, medially interrupted by a yellowish brown strip. Ocellar triangle yellowish brown with dark brown spots around the ocelli, about 72.45% of frontal length. Face brown. Facial carina appears prominent, sulcate, and slightly darker than face. Antennae, proboscis, palps and gena yellowish brown. Palps clef-shaped with two prominent setae, one terminal and another subterminal. Red eyes, with short black pile. First genal setae about half length of the vibrissae, and stout. Cheek index = 7.89. Eye index = 1.43. Aristae with 6 dorsal and 2 ventral branches, plus terminal fork.

Thorax (Fig. 4). Ground color yellowish brown,

with dark brown spots at the base of each setae. Length = 1.65 mm. Width = 1.18 mm. Eight irregular rows of acrostichals. Two large prescutellars. Dc index = 0.61. Scutellum dark brown with one central spot at the base, and about five little spots in the marginal area. Basal scutellar setae convergent. Scut position index = 0.68. Two prominent katepisternal with a row of setulae between them. Anterior katepisternal about 75.16% of the posterior one. Pleura brown with yellowish spots, somewhat fused. Halteres light brown. Trochanter, coxae and femur brown, tibia yellowish brown and tarsi light yellow.

Wing (Fig. 6). Main color light brown. Crossveins slightly darker than longitudinal veins. Lappet present but not so evident. Length = 2.86 mm. Length to width ratio = 2.22. Indices: C = 3.37; 4v = 1.38; 5x = 0.79; 4c = 0.67; M = 0.34; hb = 0.48; prox. x = 0.64.

Abdomen. Ground color yellowish brown. Tergites with broad posterior dark brown bands paramedially enlarged (but medially interrupted in tergites 2 and 3), which bends towards and reaches anterior margin at angle of tergites, leaving a laterally yellowish area. Body length = 3.27 mm.

Terminalia (Figs 16-21). Epandrium mostly

microtrichose, no upper setae, 11 lower setae (Fig. 16). Ventral lobe not covering surstylus. Cerci mostly microtrichose, anteriorly fused with epandrium at lower half. Tip of cerci with seven small setae. Surstylus mostly microtrichose with 18 prensisetae, about eight long outer and seven long inner setae. Hypandrium square-shape, shorter than epandrium (Fig. 17). Dorsal arch absent. Gonopods mostly fused with hypandrium. Aedeagus expanded at extremity, slightly rounded at tip and with a little invagination, and curved in profile (Figs. 18-21). Dorsal cleft partially covered with a membranous tissue and showing a reduced anterior opening, close to the fusion of aedeagus and aedeagal apodeme. Aedeagal apodeme shorter than aedeagus, flattened laterally and curved in profile. Ventral rod robust and fused with aedeagal apodeme. Paraphysis slightly pointed at distal portion and proximally rounded, with one large and curved subapical setae.

♀. Unknown.

Etyymology. The species name refers to its sibling species *D. itacorubi* sp. nov.

Notes. As the other species from the *D. peruensis* group, the species described here have most of the setae and setulae of the thorax arising from dark spots; wings with crossveins clouded; surstylus mostly microtrichose; hypandrium square-shaped, mostly fused with the gonopods, without a dorsal arch. The aedeagus is stout, but devoid the pair of ventral, subapical spurs. This last character is inconstant among the species of the *D. peruensis* group, once *D. boraceia* have tiny spurs, while *D. atalaia* and *D. pauliceia* have large spurs. *Drosophila itacorubi* sp. nov. and *D. paraitacorubi* sp. nov. are very similar in morphology (and probably close related), but their affinity with the other members from *D. peruensis* species group is uncertain.

The distinction between *D. itacorubi* sp. nov. from the other species from the *D. peruensis* species group can be based on some external morphological traits and by the male and female terminalia morphology. Among these species, *D. itacorubi* sp. nov. differs from *D. atalaia* and *D. peruensis* by the prescutellars setae, which is absent in the last species; from *D. boraceia* and *D. paraitacorubi* sp. nov. by the presence of first genal setae about half length of the vibrissae, and stout; from *D. boraceia* by the absence of two lines between dorsocentral setae and two interrupted ones outside dorsocentral setae formed by dark brown spots at the base of each setae on scutum; and from *D. pauliceia* by the yellowish brown antennae, instead of dark brown. Wings with both main crossveins darker than longitudinal ones, but not in *D. atalaia*. Regarding the male terminalia traits, *D. itacorubi* sp. nov. differs from *D. paraitacorubi* sp. nov. by the presence of 17 prensisetae, about nine long outer and 10 long inner setae, instead of 18 prensisetae, about eight long outer and seven long inner setae, as in the latter; the aedeagus of *D. itacorubi* sp. nov. is more rounded at the tip than

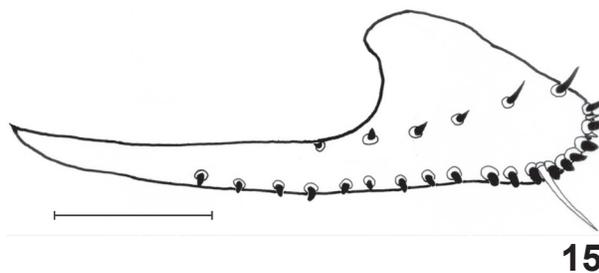
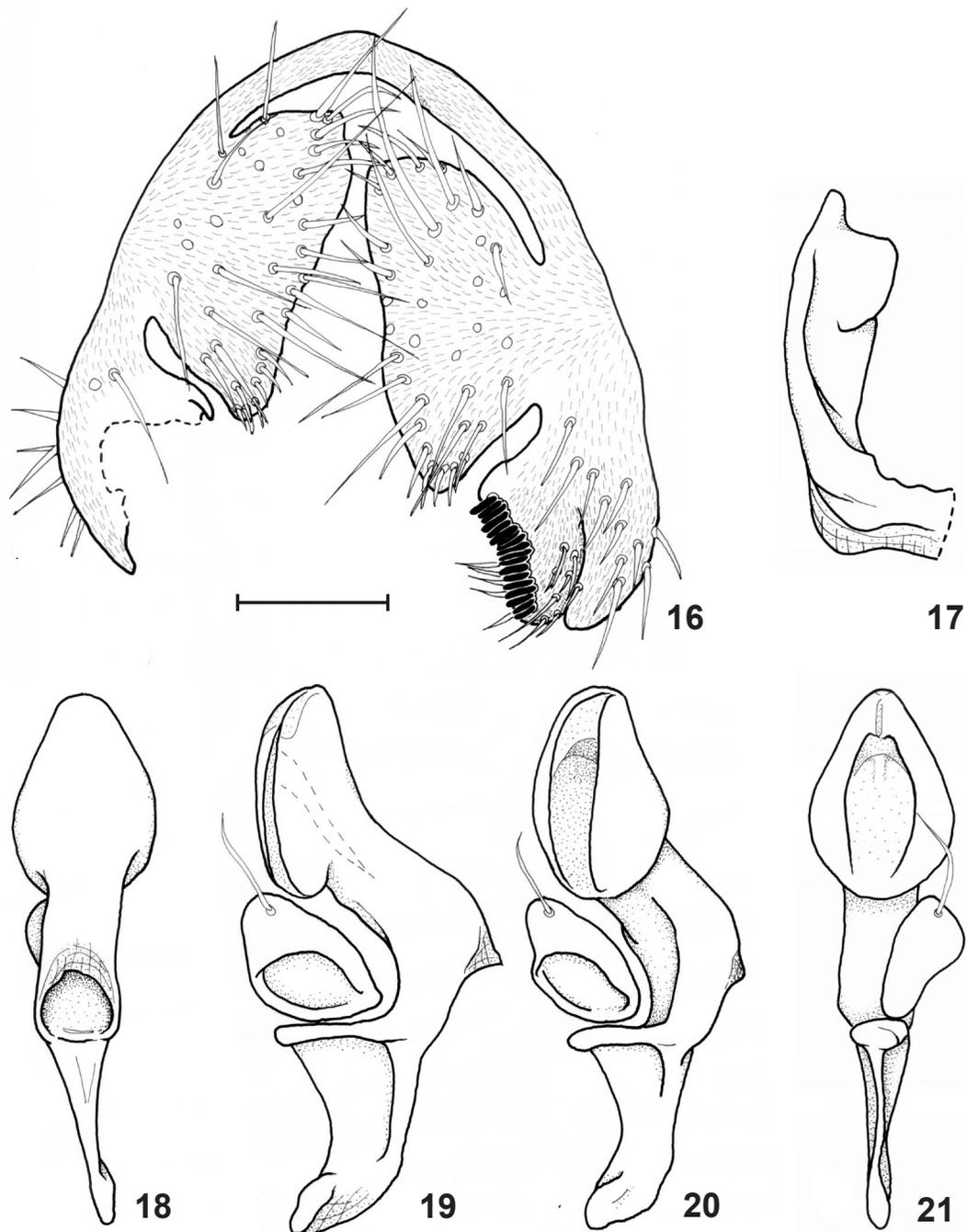


Fig. 15. *Drosophila itacorubi* sp. nov., paratype ♀: left ovipositor plate, lateral view. Bar = 0.1 mm.

that from the *D. paraitacorubi* sp. nov., and it exhibits a more curved profile in *D. paraitacorubi* sp. nov. than in *D. itacorubi* sp. nov.; differently of *D. atalaia*, *D. pauliceia* and *D. boraceia*, *D. itacorubi* sp. nov. does not possess subapical spurs in the aedeagus; *D. atalaia* and *D. pauliceia* possesses a series of small lateral spur-like ornamentation (= scales, RATCOV & VILELA, 2007), which are absent in *D. itacorubi* sp. nov. The aedeagus shape of *D. itacorubi* sp. nov. is significantly similar to that of *D. paraitacorubi* sp. nov., and these species do not possess setae in the gonopods. The female terminalia of *D. itacorubi* sp. nov. differs from *D. peruensis*, *D. pauliceia* and *D. atalaia* in the number of marginal and discal ovisensilla of oviscapt. The former species has 17 marginal and seven discal ovisensilla, while *D. peruensis* has 14-15 marginal and three discal, *D. pauliceia* has 12 marginal and four discal, and *D. atalaia* has 10 marginal and three discal ovisensilla, respectively.

As for *D. itacorubi* sp. nov., the distinction between *D. paraitacorubi* sp. nov. from the other species from the *D. peruensis* group can be based on external morphological and in the male terminalia traits. *Drosophila paraitacorubi* sp. nov. differs from *D. atalaia* and *D. peruensis* by the prescutellars setae, present in the new species; from *D. atalaia*, *D. pauliceia* and *D. itacorubi* sp. nov. by the presence of a small first genal setae, instead of a long one as in the last species; from *D. boraceia* by the absence of two lines between dorsocentral setae and two interrupted ones outside dorsocentral setae formed by dark brown spots at the base of each setae on scutum; from *D. pauliceia* by the yellowish brown antennae, instead of dark brown. See the *D. itacorubi* sp. nov. diagnosis on the male terminalia traits for differences between *D. itacorubi* sp. nov. and *D. paraitacorubi* sp. nov.

Probably the species mentioned by VILELA & CUNHA (2006) as undescribed *Drosophila* sp.1, illustrated by Marta E. Breuer and collected in Angra dos Reis (state of Rio de Janeiro), belongs to *D. itacorubi* sp. nov. or *D. paraitacorubi* sp. nov. The male genitalia of the Marta Breuer's specimen (shown in fig. 9d, VILELA & CUNHA, 2006) and the few traits (characterized in one of her sketchbooks), though, are insufficient to certificate this statement. Such traits are "anterior scutellars divergent; main wing crossveins clouded; setae (and setulae?)



Figs. 16-21. *Drosophila paraitacorubi* sp. nov., holotype ♂: 16, posterior view of epandrium, cerci and surstylus; 17, hypandrium and gonopod, posterior view; 18-21, aedeagus, aedeagal apodeme and paramere, several views. Bar = 0.1 mm

arising from dark spots” (VILELA & CUNHA, 2006). The first of these traits is inconsistent with our observations but there is a high similarity between the male genitalia drawn of “Undetermined *Drosophila* sp. 1” and the male genitalia of both new species described here. Based on Breuer’s sketchbooks, these authors also point out that the male specimen (probably only one) was collected at Angra dos Reis, state of Rio de Janeiro, Brazil, on an unspecified date (“before March 2nd, 1959 [date of the terminalia drawing]”). Additionally, RATCOV & VILELA (2007) suggest that the species belongs to *D. peruensis* species group.

Key to species of the *Drosophila peruensis* species group

1. Prescutellars absent. 2
- 1'. Prescutellars present. 3
2. Transverse veins of wing not clouded . . . *D. atalaia*
- 2'. Transverse veins of wing clouded *D. peruensis*
3. First genal setae less than half of the length of vibrissae. Tergites with a broad marginal brown band, medially interrupted 4
- 3'. First genal setae as long as vibrissae. Tergites with a broad or narrow marginal brown band, medially interrupted 5

4. The spots of the anterior area of the thorax are fused, what gives rise to four narrow lines. Surstylus with about 11 prenisetae. Aedeagus with a pair of short subapical spurs *D. boraceia*
- 4'. The spots of the thorax are not fused. Surstylus with about 17 prenisetae. Aedeagus without subapical spurs. *D. itacorubi* sp. nov.
5. Pleura with spots. Tergites with a broad marginal brown band, medially interrupted. Surstylus with about 18 prenisetae. Aedeagus without subapical spurs. *D. paraitacorubi* sp. nov.
- 5'. Pleura without spots. Tergites with a narrow marginal brown band. Surstylus with about 11 prenisetae. Aedeagus with a pair of subapical spurs. *D. pauliceia*

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