

FIRST KNOWN NEOTROPICAL SPECIES OF *BRUNETTIA* (DIPTERA: PSYCHODIDAE) FROM SOUTHEASTERN BRAZIL, WITH DESCRIPTION OF A NEW SUBGENUS AND SYSTEMATIC COMMENTS ON THE GENUS¹

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ABSTRACT

Brunettia caipira, sp.n. is described from southeastern Brazil. This is the first described species of the genus in the Neotropical region. A new subgenus, *Brunettia* (*Neobrunettia*) is proposed for this species. The remaining species of the genus are restricted to the Oriental, Afrotropical, Australian, and Palearctic regions, placed in seven subgenera. An analysis of the relationships among the subgenera of *Brunettia* is proceeded, which results in a partial solution for the phylogenetic relationships among the subgenera. *B. (Mirusiella)* appears as the sister-group of the set of the remaining subgenera; *B. (Campanulobrunettia)* composes a monophyletic arrangement with *B. (Maurobrunettia)*; *B. (Campanulobrunettia)*, *B. (Maurobrunettia)*, *B. (Brunettia)*, and *B. (Neobrunettia)* stand as a monophyletic unity. No synapomorphy was found for the typical subgenus, *B. (Brunettia)*, which most probably does not refer to a monophyletic arrangement; a polytomy including *B. (Atrichobrunettia)*, *B. (Plesiobrunettia)*, *B. (Horobrunettia)*, and the group of subgenera including *B. (Brunettia)* remains unresolved. Also, no synapomorphy was found for *B. (Mirusiella)*. The pantropical distribution for this group suggests that it has at least a Gondwanic origin.

KEYWORDS. Neotropical, Diptera, Psychodidae, *Brunettia*, Systematics.

INTRODUCTION

The genus *Brunettia* Annandale, 1910 as redefined by DUCKHOUSE (1966) most certainly correspond to a monophyletic taxon. The absence of setae on the gonocoxite and on the tergite 9 seems to be synapomorphic for the genus. The presence of these setae in five species included by DUCKHOUSE (1991) in the subgenus *B. (Horobrunettia)* Duckhouse, 1991 is interpreted by him as a secondary acquisition. Other six subgenera were recognized by DUCKHOUSE (1991): *Brunettia* (*Brunettia*) Annandale, 1910, *B. (Atrichobrunettia)* Satchell, 1953, *B. (Campanulobrunettia)* Duckhouse, 1991, *B. (Maurobrunettia)* Duckhouse, 1991, *B. (Mirusiella)* (Vaillant, 1974), and *B. (Plesiobrunettia)* Duckhouse, 1991. The monophyletism of these subgenera was not demonstrated. The phylogenetic relationships among the subgenera of *Brunettia* were also not determined to date.

Following DUCKHOUSE (1991), the genus *Brunettia* is absent only from the

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3. CAPES fellowship.

4. Researcher fellowship of CNPq; partially made under FAPESP grant 93/0954-9.

Nearctic region. There are some few species known from some Pacific islands, Japan, and New Zealand. Most species described are found in India, Papua-New Guinea, Southeast Asia, and Australia. DUCKHOUSE (1991) referred to two Neotropical species, but did not described them. A new species of *Brunettia* from southeastern Brazil is described, based on males and females, which is place in a new subgenus, *Neobrunettia*. A phylogenetic analysis is performed to determined the phylogenetic relationships among the subgenera of the genus.

The terminology for the thoracic pleural sclerites is reinterpreted based on a more general analysis of the Psychodomorpha morphology. Terminology for male terminalia morphology follows McALPINE (1981) and for female terminalia follows SAETHER (1977). The names for other structures follow DUCKHOUSE (1991). Types are deposited at the Museu de Zoologia, Universidade de São Paulo, São Paulo (MZSP). Some paratypes will be sent to The Natural History Museum (BMNH). All measurements are in millimeters.

***Brunettia* (*Neobrunettia*), subgen. n.**

Type species: *Brunettia* (*Neobrunettia*) *caipira*, sp.n., here designated.

This subgenus differs from the remaining subgenera by the following features (which are also diagnostic for the species): subcostal vein (Sc) absent, only a hair line of unsclerotized cuticula (h_1) seen under microscope. R_1 diffuse and wide basally, with a rupture in the basal fourth.

***Brunettia caipira*, sp. n.**

(Figs. 1-18)

Type locality: Brazil, State of São Paulo, Ribeirão Preto, Campus da Universidade de São Paulo.

Holotype: male, on slide-mounting, with the label: Brasil, State of São Paulo, Ribeirão Preto, 26.VI.1993, Freddy Bravo col. (MZSP); allotype: female, same data of holotype (on slide-mounting) (MZSP). Paratypes: BRAZIL, **Rio de Janeiro**: Rio de Janeiro, Represa Rio Grande, 22° 50' S; 43° 00' W [Malaise trap], 1♂, 10♀, II.1968, M. Alvarenga col. (MZSP); 1♂, 1♀, IX.1969 (MZSP); 1♂, 1♀, IV.1972 (MZSP). Silva Jardim, 22°00'S; 42°00'W [Malaise trap], 1♀, VII.1974, F.M. Oliveira col. (8 paratypes on slide-mountings) (MZSP). **São Paulo**: Ribeirão Preto (Campus of USP), 21° 15' S; 48° 00' W, 1♂, 2♀, 26.VI.1993, Freddy Bravo col. (MZSP); 1♂, 29.IV.1993 (MZSP); 1♀, 03.III.1993 (MZSP); 2♂, 1♀, 10.VII.1993 (MZSP); 1♂, 06.VIII.1993 (MZSP); 1♂, 27.VIII.1993 (MZSP); 1♂, 3♀, 19.III.1994 (MZSP); 1♂, 22.III.1994 (MZSP).

Diagnosis. Subcostal vein (Sc) absent, only a hair line of unsclerotized cuticula (h_1) seen under microscope. R_1 diffuse and wide basally, with a rupture in the basal fourth. Posthypandrium plate developed, covering aedeagus.

Description. Male. Tegument black; alar membrane hyaline-black. Body, alar veins and alar membrane covered with black setae. Frons with a patch of white setae. Length from thorax anteriorly to posterior end of abdomen, 2.19.

Head: subcircular, 0.38 mm long from vertex to clypeus distally; distance between eyes at most 0.37. A complete eye-bridge above antennae (figs. 1, 2). Palpus 1.0-3.4-4.0-4.4. Antenna with 15 articles, 1.19 long; distal flagellomeres shorter than basal ones;

flagellomeres eccentric, except for the last two; last flagellomere with apicule; ascoid paired, C-shaped (fig. 7). Labella fleshy, with 6 larger setae distributed on dorsal margin and some shorter ones ventrally; probably labela 1 and 2 fused (fig. 5). Maxilla small and round (fig. 4). Cibarium with strong walls (fig. 6).

Thorax: 0.73 long. Episternum I ventrally fused to antero-dorsal extension of katepisternum. Epimeron I including the spiracle, with an anterior protuberance. Anterior spiracle with membrane around. Stigmatic pore visible (fig. 8).

Wing: length, 1.87. Maximum width, 0.88. Sc absent. Rs pectinate. R₁, R₅, and CuA₁ well sclerotized (not so clear for R₁ in the drawing). R₅ reaching wing on apex. Humeral and anal regions slightly developed (fig. 10).

Abdomen: length, 1.46. Tergites and sternites mostly black, with a lighter region anteriorly.

Terminalia (figs. 15-18): length, 0.20; width, 0.25. Tergite 9 and gonocoxites without setae, gonostyles with only two distal setae. Cerci with apical retinacula, distal ones longer with fringed tips, and the others, more basally, short and straight (figs. 16-17). Tergite 9 with two small aperture basally (fig. 18). Sternite 9 with a post-hypandrial plate covering aedeagus (fig. 15). Sternite 10 with micropilosity (fig. 18). Aedeagus symmetrical, apically bifid. Parameres divergent.

Female. Similar to male except as follows. Length from thorax anteriorly to end of abdomen 2.27 (fig. 12). Epimeron I without an anterior protuberance (fig. 9). Eye bridge incomplete (fig. 3). Wing length 1.82, width 0.80; humeral and anal lobes seen in the males absent (fig. 11). Gonocoxite 8 covering sternite 9 (fig. 14). Cercus with a microsetose basal protuberance (fig. 13).

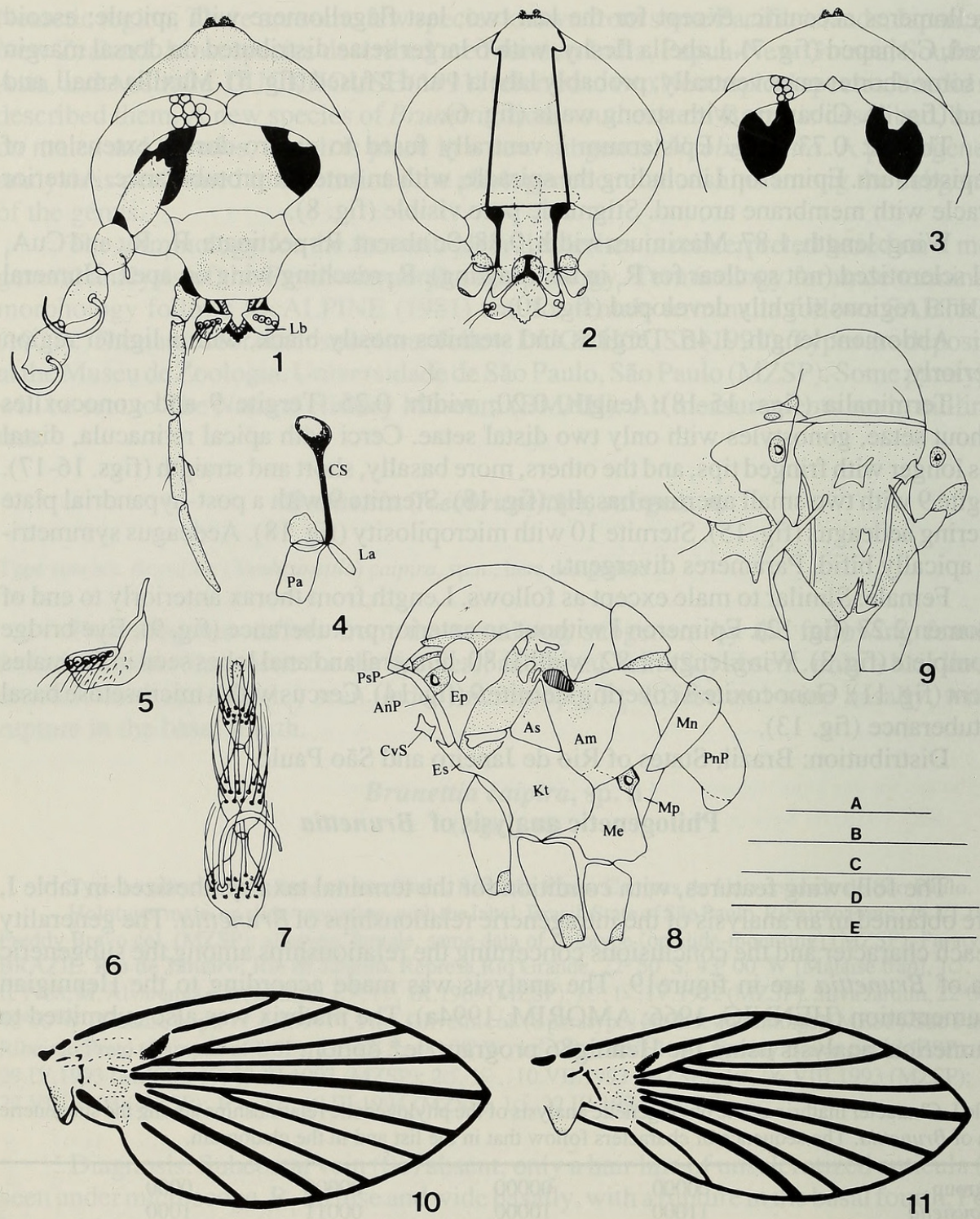
Distribution: Brazil, States of Rio de Janeiro and São Paulo.

Phylogenetic analysis of *Brunettia*

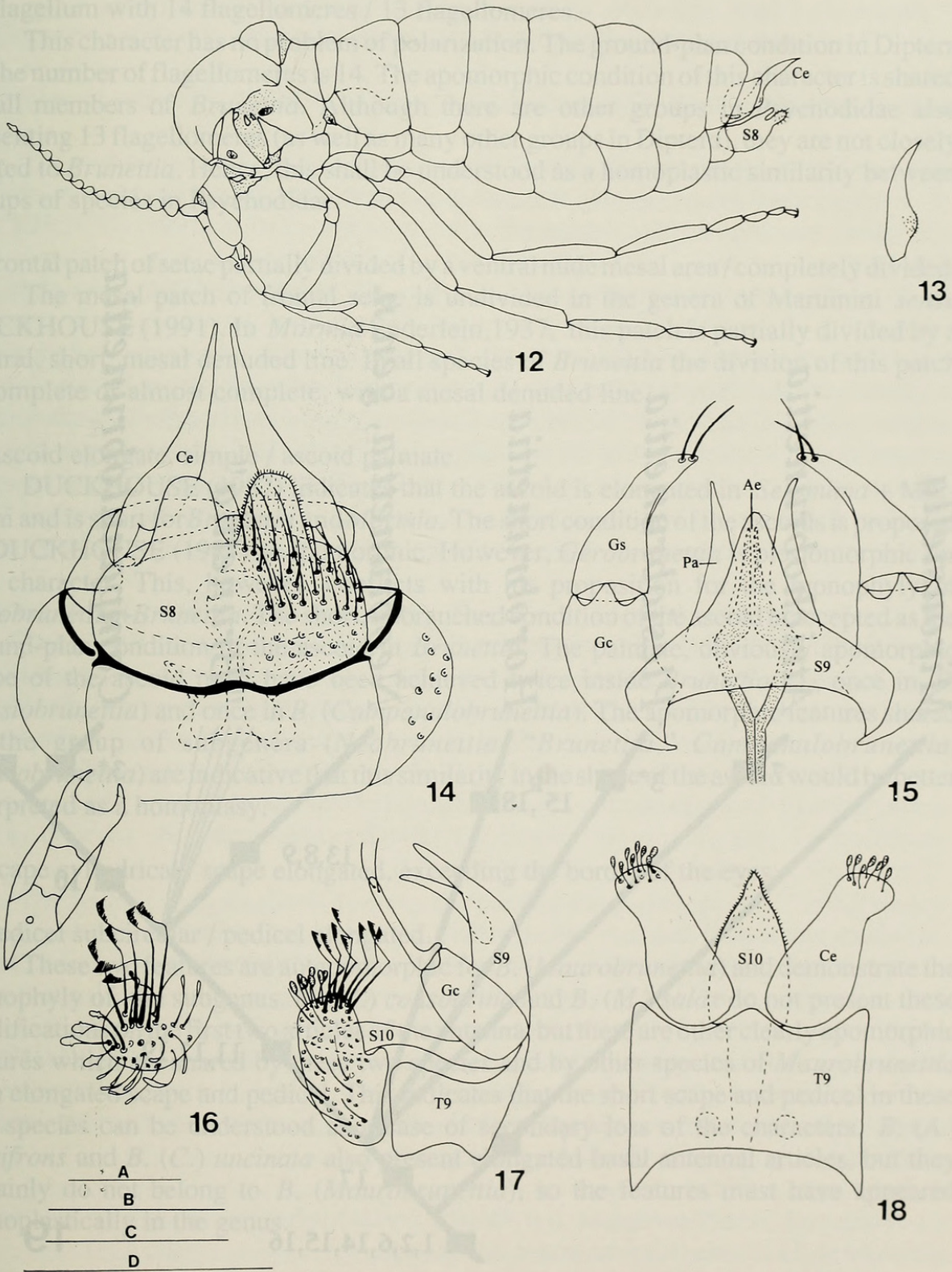
The following features, with condition for the terminal taxa synthesized in table I, were obtained in an analysis of the intrageneric relationships of *Brunettia*. The generality of each character and the conclusions concerning the relationships among the subgeneric taxa of *Brunettia* are in figure 19. The analysis was made according to the Hennigian argumentation (HENNIG, 1966; AMORIM, 1994a). The matrix was also submitted to a numerical analysis using the Hennig86 program, ie* option.

Table I. Character matrix of the phylogenetic analysis of the phylogenetic relationships among the subgeneric taxa of *Brunettia*. The sequence of characters follow that in the list and in the cladogram.

outgroup	00000	00000	00000	0000
<i>Mirousiella</i>	11000	10000	00011	1000
<i>Atrichobrunettia</i>	11000	11000	00011	1100
<i>Neobrunettia</i>	11000	10110	11111	1101
" <i>Brunettia</i> "	11000	10000	11011	1101
<i>Campanulobrunettia</i>	11100	10001	11011	1101
<i>Maurobrunettia</i>	11011	10001	11011	1101
<i>Plesiobrunettia</i>	11100	10000	00011	1100
<i>Horobrunettia</i>	11000	10000	00010	1110



Figs. 1-11. *Brunettia caipira* sp. n. Cephalic structures: 1-2, 5-7 holotype ♂; 3 allotype. ♀. Head: 1. anterior, 2. posterior, 3. anterior; 4. maxila (diagramatic); 5. labrum, lateral; 6. hypopharynx; 7. antennae, last three segments. Thoracic structures: 8. lateral (♂ paratype, Ribeirão Preto); 9. frontal (♀ paratype, Ribeirão Preto). Wing (right): 10. ♂ paratype, Ribeirão Preto; 11. ♀ paratype, Ribeirão Preto. (Am, anepimeron; AnP, antepronotum; As, anepisternum; Cs, cardo-stipes; CvS, cervical sclerite; Ep, epimeron I; Es, episternum I; Kt, katepisternum; La, lacinia; Lb, labella₁₊₂; Me, meron II; Mn, metanotum; Mp, metapleuron; Pa, maxillar palpus; PnP, postnotal phragma; PsP, postpronotum). Scales: A, 0.20mm (1-3); B, 0.20mm (5); C, 0.50mm (8-9); D, 0.20mm (6-7); E, 1.00mm (10-11).



Figs. 12-18. *Brunettia caipira* sp. n. 12, ♀ paratype, Ribeirão Preto, lateral. 13, cercus, ♀ paratype, Ribeirão Preto, lateral. 14, ♀ allotype, terminalia, dorsal. Terminalia of ♂ holotype: 15, S9, aedeagus, parameres, gonocoxites and gonostyles; 16, cercus tip; 17, terminalia, lateral; 18, T9, S10 and cercus. (Ae, aedeagus; Ce, cercus; Gc, gonocoxite; Gs, gonostylus; Pa, paramere; S8, sternite 8; S9, sternite 9; S10, sternite 10; T9, tergite 9). Scales: A, 0.10 mm (13); B, 0.10 mm (14); C, 0.10 mm (15-18); D, 1.00 mm (12).

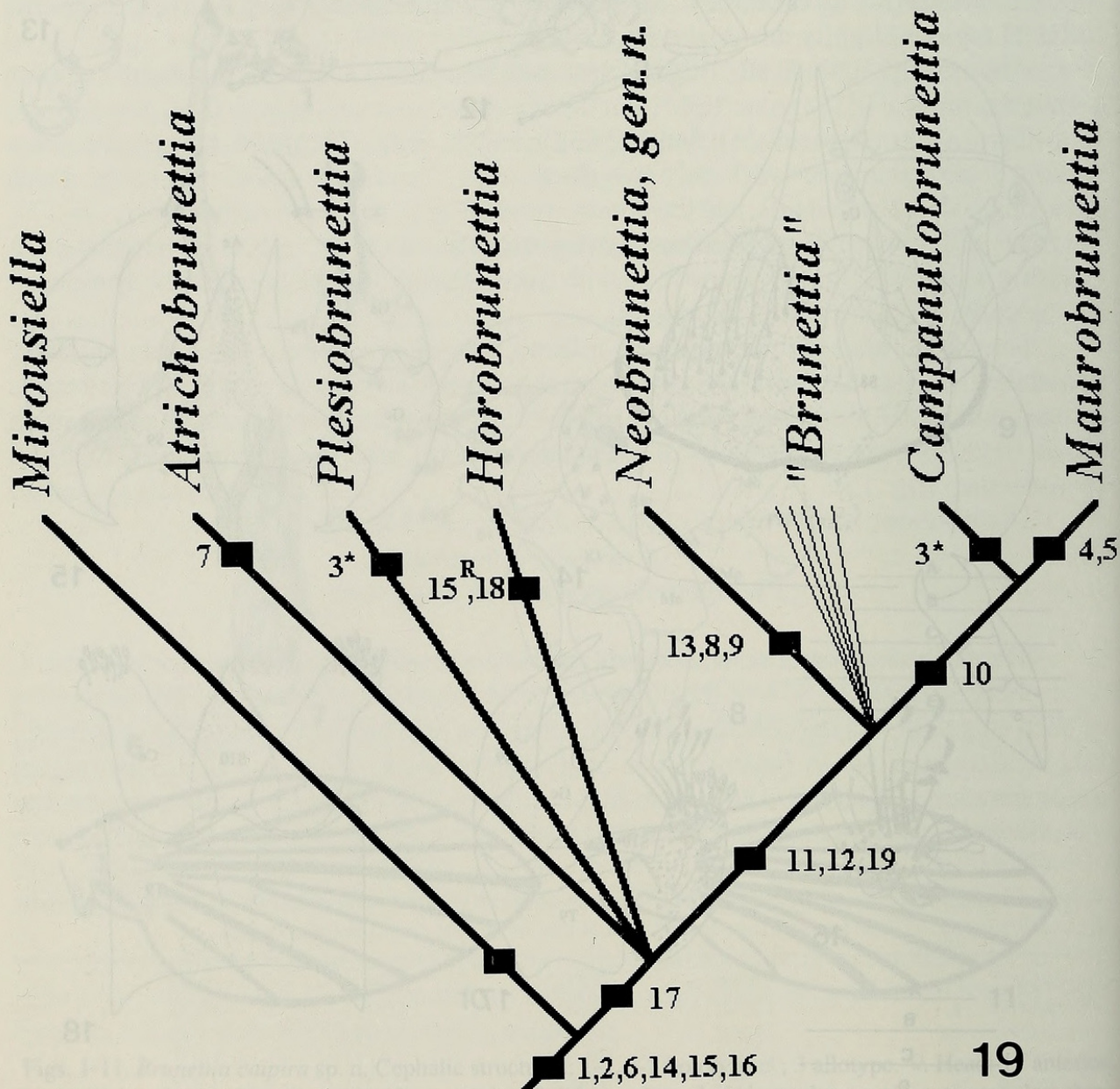


Fig. 19. Cladogram of *Brunettia*, depicting the phylogenetic relationships among the subgenera of the genus. Character numbers follow text.

1. Flagellum with 14 flagellomeres / 13 flagellomeres.

This character has no problem of polarization. The ground-plan condition in Diptera for the number of flagellomeres is 14. The apomorphic condition of this character is shared by all members of *Brunettia*. Although there are other groups in Psychodidae also presenting 13 flagellomeres (as well as many other groups in Diptera), they are not closely related to *Brunettia*. Hence, this shall be understood as a homoplastic similarity between groups of species in Psychodidae.

2. Frontal patch of setae partially divided by a ventral nude mesal area / completely divided.

The mesal patch of frontal setae is undivided in the genera of Maruinini *sensu* DUCKHOUSE (1991). In *Mormia* Enderlein, 1937, this patch is partially divided by a ventral, short, mesal denuded line. In all species of *Brunettia* the division of this patch is complete or almost complete, with a mesal denuded line.

3. Ascoid elongate, simple / ascoid palmate.

DUCKHOUSE (1987) indicates that the ascoid is elongated in *Setomima* + *Mormiini* and is short for *Brunettia* and *Mormia*. The short condition of the ascoids is proposed by DUCKHOUSE (1987) as apomorphic. However, *Gerobrunettia* is plesiomorphic for this character. This, however, conflicts with his proposition for the monophyly of *Gerobrunettia*+*Brunettia*. The short, unbranched condition of the ascoid is accepted as the ground-plan condition of the ascoid in *Brunettia*. The palmate, obviously apomorphic shape of the ascoid must have been achieved twice inside *Brunettia* s.l., once in *B. (Plesiobrunettia)* and once in *B. (Campanulobrunettia)*. The apomorphic features shared by the group of subgenera (*Neobrunettia*, "*Brunettia*," *Campanulobrunettia*, *Maurobrunettia*) are indicative that this similarity in the shape of the ascoid would be better interpreted as a homoplasy.

4. Scape cylindrical / scape elongated, exceeding the border of the eyes.

5. Pedicel subcircular / pedicel elongated.

These two features are autapomorphic for *B. (Maurobrunettia)* and demonstrate the monophyly of the subgenus. *B. (M.) consobrina* and *B. (M.) salax* do not present these modifications on the first two articles of the antenna, but there are other clearly apomorphic features which are shared by these two species and by other species of *Maurobrunettia* with elongated scape and pedicel. This indicates that the short scape and pedicel in these two species can be understood as a case of secondary loss of the characters. *B. (A.) albrifrons* and *B. (C.) uncinata* also present elongated basal antennal articles, but they certainly do not belong to *B. (Maurobrunettia)*, so the features must have appeared homoplastically in the genus.

6. Maxilla with the same length of the labrum/ maxilla reduced.

In the ground-plan of Psychodidae, the maxilla has about the same length than the labrum. The reduction in the length of the maxilla seems a synapomorphy of *Brunettia*. However, a more detailed study of other genera may still show that the feature is not restricted to *Brunettia*.

7. Presence of hairs and scales on the wing / hairs and scales absent on the wing.

This feature is an autapomorphy of *B. (Atrichobrunettia)*.

8. R_1 uniformly wide/ R_1 wide in the base

9. R_1 without a rupture/ with a rupture in the basal fourth.

These are two apomorphic features found in *B. (Neobrunettia)*. No other known species of *Brunettia* has these features.

10. R_1 and R_5 more strongly sclerotized than R_{2+3} / R_1 and R_5 sclerotized as remaining R_5 veins.

The apomorphic condition of this feature is actually a reversion of an earlier acquisition of the character. The strong sclerotization in veins R_1 , R_5 , and CuA_1 is found in other genera of Maruinini. Neither *B. (Campanulobrunettia)* nor *B. (Maurobrunettia)* present R_1 and R_5 stronger than the remaining radial veins. Hence, we interpret here that at this level the condition shared by *B. (Brunettia)* and *B. (Neobrunettia)* is plesiomorphic. The fact that both, *B. (Campanulobrunettia)* and *B. (Maurobrunettia)*, present CuA_1 stronger than the remaining veins seems to be an evidence that this interpretation is correct.

11. R_{2+3} forking near middle of the wing / R_{2+3} forking basally to the middle of the wing.

DUCKHOUSE (1991) includes this character as a key feature to *Brunettia (Brunettia)*, but compares the position of the radial fork to the position of the medial fork. However, the fork of M_{1+2} also presents a basal displacement in some groups, so many species with long fork of R_{2+3} do not fit in the key because the fork of M_{1+2} is also long. It is out of doubt that the short fork of R_{2+3} is plesiomorphic, as can be verified with the examination of the wings of other Psychodidae and of other basal Diptera. The apomorphic condition of this feature is shared by *B. (Neobrunettia)*, *B. (Brunettia)*, *B. (Campanulobrunettia)*, and *B. (Maurobrunettia)*.

12. Males with costal and anal cells normal / costal and anal cells developed.

It is well known that males of some species of *Brunettia* present enlarged costal and anal cells, giving to the wing a rather different shape. This is obviously an apomorphic condition that is shared at least by the species included by DUCKHOUSE (1991) in *B. (Brunettia)*, *B. (Campanulobrunettia)*, *B. (Maurobrunettia)*, as well by the new Neotropical species herein described. *B. (M.) consobrina* - which is also plesiomorphic for character the shape of the scape and pedicel - does not present the apomorphic condition of this character, possibly due to another reversion.

13. Subcostal vein incomplete, but clearly present / Sc absent, only a hair line of unsclerotized cuticula (h_1) seen under microscope.

This is a very obviously autapomorphic condition of the new subgenus *B. (Neobrunettia)*.

14. Setae normally distributed on the gonocoxites / gonocoxites complete nude of setae.

15. Tergite 9 with setae / setae on tergite 9 completely lost.

16. Gonostyle with setae on entire length / no setae basally on gonostyles.

17. 4-5 larger setae apically on the gonostyle / 2 setae apically on the gonostyle in outer side.

The lost setae on the gonocoxites, tergite 9, and on most of the extension of the gonostyles are convincing apomorphies. Hence, the whole set of taxa included by DUCKHOUSE (1991) in *Brunettia* most certainly compose a monophyletic group. The only exception is *B. (Horobrunettia)*, which present some setae on the tergite 9. DUCKHOUSE (1991) interprets this as a reversion to the plesiomorphic state of the character, position also adopted here. It is noteworthy that *B. (Mirousiella)* present 4-5 terminal larger setae on the gonostyle, while all remaining subgenera present typically only 2 apical setae. It seems clear that there is a transformation series reducing the number of setae on the gonostyle. Hence, the condition found in *B. (Mirousiella)* is plesiomorphic when compared to that with 2 setae. This indicates a sister-group relationship between this subgenus and the remaining subgenera.

18. Number of retinacula above 15 / retinacula not more than 5.

19. Retinacula straight / retinacula mesally folded.

The number of retinacula in the cerci in most species of *Brunettia* is rather high, about 15, with the exception of the species of *B. (Horobrunettia)*, which present a reduced number. The species of *B. (Neobrunettia)*, "*B. (Brunettia)*", *B. (Campanulobrunettia)*, and *B. (Maurobrunettia)* present very typical, elongated retinacula with a mesal fold, an additional apomorphy on the structure.

CONCLUSIONS

The mathrix analysis shows four equally parsimonious cladograms. The differences among them concerns only the position of *B. (Mirousiella)* and *B. (Horobrunettia)*. That is, *B. (Neobrunettia)*, "*B. (Brunettia)*", *B. (Campanulobrunettia)* e *B. (Maurobrunettia)* always compose a monophyletic group separate from *B. (Plesiobrunettia)* and *B. (Atrichobrunettia)*. This group is named here provisionally *B. (Neobrunettia)** using by AMORIM (1994b) artifact for phylogenetic sequenced classifications with polytomies.

The alternative topologies correspond to distinct interpretations of the evolution of characters 15 and 17. If the number of setae in the gonostyle is taken as having a single origin, as herein adopted, *B. (Mirousiella)* comes out as the sister group of the remainder of the genus, *B. (Horobrunettia)* being kept in a polytomy with *B. (Plesiobrunettia)*, *B. (Atrichobrunettia)* and the group *B. (Neobrunettia)**. If the reduction of the setae on tergite 9 is accepted as having a single origin, *B. (Horobrunettia)* would be the sister group of the set of the other subgenera, with *B. (Mirousiella)* in a polytomy with *B. (Plesiobrunettia)*, *B. (Atrichobrunettia)* and the group *B. (Neobrunettia)**. If we admit a homoplastic arrisal of the number of setae in the gonostyle, *B. (Horobrunettia)* would be the sister group of the rest of the genus, with *B. (Mirousiella)* as the sister group of this subset of *Brunettia*. Finally, if an homoplastic arrisal of the reduction of setae on tergite 9 is considered, *B. (Mirousiella)* would be the sister group of the remainder of the genus, and *B. (Horobrunettia)*

would be the sister group of the rest of subgenera inside this small group.

The analysis made here corroborates that *Brunettia sensu* DUCKHOUSE (1991) corresponds to a monophyletic unity. The character analysis presented above also demonstrate that all subgenera in the literature but *Brunettia* (*Brunettia*) are monophyletic. Moreover, they allow a partial solution for the phylogenetic relationships among the subgenera in the genus (fig. 19). Evidently, a more detailed study of *B. (Horobrunettia)* and of *B. (Mirousiella)* may help to better define the basal relationships in the genus.

The subgenus *B. (Brunettia)* presently contains a group of species which most certainly do not compose a monophyletic unity. No apomorphy was found shared by the Australian-Papuan species placed in the subgenus and neither any apomorphic feature gathering these species and those in the Afrotropical regions could be detected. Maybe some of the species in *B. (Brunettia)* would fit better in *B. (Campanulobrunettia)* or in *B. (Maurobrunettia)*. Actually, the systematics of the Oriental and Afrotropical species of the genus should be revised before additional conclusions about the internal relationships in the *Brunettia* can be inferred.

The new species herein presented under a new subgenus has a number of synapomorphic features that may show to be more general when other Neotropical species come to be described. These features, absent in the Australian/Oriental/Afrotropical species of the group, seem to justify the proposition of a new subgenus for this region. The discovery of Neotropical species of *Brunettia* (see also DUCKHOUSE, 1991) certainly changes the biogeographical interpretation of the group. If the distribution of the genus was restricted to the Old World, one could accept a rather recent origin for the group. However, the presence of Neotropical and Australian species together in the same monophyletic group (*Neobrunettia*, *Brunettia*, *Campanulobrunettia*, *Maurobrunettia*) would indicate that it is possibly Gondwanic in origin; stems originated in higher levels in the phylogeny of the genus may be Pangaeic.

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Bravo, Freddy and Amorim, Dalton de Souza. 1995. "First Known Neotropical Species Of Brunettia (Diptera: Psychodidae) From Southeastern Brazil, With Description Of A New Subgenus And Systematic Comments On The Genus." *Iheringia* 79, 149–158.

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