

**Four new species of Psychodinae (Diptera: Psychodidae)  
from the Brazilian semiarid region,  
with contributions to supraspecific classification  
of Trichopsychodina and a redefinition of *Feuerborniella***

Danilo CORDEIRO<sup>1)</sup>, Freddy BRAVO<sup>2)</sup> & Cínthia CHAGAS<sup>3)</sup>

<sup>1)</sup>Coordenação de Biodiversidade, Instituto Nacional de Pesquisa da Amazônia, Av. André Araújo, 2936, Aleixo, CEP 69060-001, Manaus, AM, Brazil; CP: 2223; e-mail: d.pacheco.c@gmail.com

<sup>2)</sup>Departamento de Ciências Biológicas, Universidade Estadual de Feira de Santana, Av. Universitária s/n, CEP 44031-460, Feira de Santana, BA, Brazil; e-mail: fbravo@uefs.br

<sup>3)</sup>Polícia Civil do Estado do Amazonas, Departamento de Polícia Técnico Científica, Instituto de Criminalística, Av. Noel Nutels, 300, Cidade Nova, CEP 69040-000, Manaus, AM, Brazil; e-mail: cinthia\_chagas@yahoo.com.br

**Abstract.** The collection of psychodids of the Brazilian semiarid region, deposited at the Museu de Zoologia da Universidade Estadual de Feira de Santana (MZFS), was revisited, and four new species of Psychodinae are herein described: *Feuerborniella jezeki* Cordeiro & Bravo sp. nov., *Feuerborniella concava* Cordeiro & Bravo sp. nov. and *Alepia janjezeki* Cordeiro & Bravo sp. nov., from the state of Bahia, and *Feuerborniella pilosella* Cordeiro & Bravo sp. nov., from the state of Paraíba. The morphology of the new species of Trichopsychodina raised questions about the supraspecific classification on this subtribe. These questions are discussed, concerning mainly the Neotropical fauna, and *Feuerborniella* Vaillant, 1974 is redefined, including species of *Bahisepedon* Omelková & Ježek, 2012. Based on this synonymy the following new combinations are made: *Feuerborniella amblytes* (Quate, 1999) comb. nov., *F. ancepitis* (Quate, 1996) comb. nov., *F. bicuspis* (Quate, 1996) comb. nov., *F. hamata* (Quate, 1996) comb. nov., *F. oblongola* (Bravo, Chagas & Cordeiro, 2006) comb. nov., *F. opposita* (Banks, 1901) comb. nov., *F. pandiculata* (Quate, 1996) comb. nov., *F. retusa* (Quate, 1996) comb. nov., *F. uncinata* (Bravo, Chagas & Cordeiro, 2006) comb. nov., and *F. vieirai* (Chagas, Bravo & Rafael, 2009) comb. nov. Moreover, one species known so far only from Costa Rica, *Feuerborniella pollicaris* (Quate, 1996) comb. nov., is transferred from *Philosepedon* Eaton, 1904, being the first record from Brazil, in semiarid areas of the states of Bahia and Ceará.

**Key words.** Diptera, Psychodidae, moth flies, taxonomy, new species, new combination, Northeastern Brazil, Neotropical Region

## Introduction

The Brazilian semiarid region is delimited by the Federal Government as including areas of less than 800 mm of annual rainfall (BRASIL 2005). This region has approximately the same limits as the Caatinga biome with some peripheral areas only included in the semiarid region (BRASIL 2005, VELLOSO et al. 2002). However, the Brazilian semiarid region is heterogeneous with a mosaic of vegetation types which includes interior mountains with humid forest over 500 m a.s.l. (ANDRADE-LIMA 1982, PAGANO & ARAÚJO 2011, SANTOS et al. 2007).

BRAVO & ARAÚJO (2014) listed 43 species of Psychodidae (exclusive of Phlebotominae) from the Brazilian semiarid region; 34 species were Psychodinae, eight *Trichomyia* Haliday, 1839, and one *Sycorax* Haliday, 1839. In this paper four new species of Psychodinae from the semiarid region are described, and one species known from Costa Rica is also recorded from this region. These species raise a discussion on the generic placement of the Neotropical species of Trichopsychodina, and aspects of the supraspecific classification of this subtribe, proposed by JEŽEK (1985), are discussed.

## Material and methods

All specimens were collected with a light trap and mounted on microscope slides with Canada balsam. We follow the morphological terminology of CUMMING & WOOD (2009), except for thoracic chaetotaxy where we follow the proposal of GALATI (2003). The type specimens are deposited in the Prof. Johann Becker Entomology Collection at the Zoological Museum of the Universidade Estadual de Feira de Santana, Brazil (MZFS).

## Taxonomy of Neotropical Trichopsychodina

The subtribe Trichopsychodina was established by JEŽEK (1985) and includes species whose antennae have apical flagellomeres reduced, ascoids with two or three branches, last segment of palps not annulated, labellum bulbous with short spines but not apical digitiform setae ('teeth'), Sc vein short, and  $R_5$  ending at acute apex of wing. Taxonomy of the Neotropical species of Trichopsychodina, mainly those regarded as *Philosepedon sensu lato* (CHAGAS et al. 2009), has been notably debated and there is no consensus as to the limits of the genera proposed in this group. CHAGAS et al. (2009) placed 30 Neotropical species in a broadly defined *Philosepedon* Eaton, 1904. Some of them have been placed in other genera, such as *Eurygarka helicis* (Dyar, 1929), *Feuerborniella spathipennis* (Duckhouse, 1968), *Feuerborniella plaumanni* (Duckhouse, 1968), *Quatiella cubana* Botosaneanu & Vaillant 1970, and *Quatiella fumata* (Knab, 1914) (QUATE 1959; BOTOSANEANU & VAILLANT 1970; DUCKHOUSE 1973, as subgenus *Quatiella*; VAILLANT 1974). *Philosepedon aliciae* Ibáñez-Bernal & Cáceres, 2005 seems to belong to *Eurygarka* Quate, 1959, but IBÁÑEZ-BERNAL & CÁCERES (2005) stated its aedeagus is different from this genus. Among the remaining 24 species, four were considered members of *Philosepedon* (*Bahisepedon* Omelková & Ježek, 2012) by OMELKOVÁ & JEŽEK (2012), but the other 20 species stayed without a subgeneric placement, mainly because their number of tenacula is not two (except for *Philosepedon duacopsis* Quate, 1999 and *Philosepedon*

*mauroae* Wagner & Masteller, 1996, but these two were not treated by these authors). Two tenacula of the same length is one of the diagnostic characters used by OMELKOVÁ & JEŽEK (2012) for *Philosepedon* [following VAILLANT (1972, 1973) and JEŽEK (1985)], and species without this feature were not treated in that paper.

The definitions of *Philosepedon* by VAILLANT (1973) and JEŽEK (1985) were not accepted by some taxonomists dealing mostly with the Neotropical and Nearctic faunas (QUATE 1996, 1999; BRAVO et al. 2006; CHAGAS et al. 2009), who used *Philosepedon* in a broader sense (1–7 tenacula). Many Neotropical species with the number of tenacula different from two share all characteristics of *Philosepedon sensu* OMELKOVÁ & JEŽEK (2012), including the membranous ventral epandrial plate. Therefore, the number of tenacula is rather dubious for delimitating *Philosepedon*, and QUATE (1955) even relates that in *Philosepedon oppositum* (Banks, 1901) the cercus usually has two tenacula, but it may rarely have three.

VAILLANT (1972, 1973), followed later by JEŽEK (1985), classified the species of Trichopsychodina with three tenacula in the genus *Threticus* Eaton, 1904, accepting in *Philosepedon* only species with two or groups of paired tenacula. More recently, two more genera with three tenacula were described from this group, *Matuna* Stebner & Kraemer, 2014, from fossil specimens from Mexico, and *Soeliella* Kvifte, 2015, from Tanzania (STEBNER & KRAEMER 2014, KVIFTE 2015). It is important to point out that when defining *Philosepedon*, Vaillant and Ježek did not use only the number of tenacula in their diagnoses, but also the shape of ascoids and symmetry of male genitalia.

Some apparently apomorphic characters have been used for the genera already proposed in *Philosepedon sensu lato*: the peculiar ascoid of *Eurygarka*, a single tenaculum at cercus of *Quatiella* Botosaneanu & Vaillant, 1970, two basally directed branches of ascoids of *Nielsenella* Vaillant, 1972, the conspicuous shape of antennal articles of *Matuna*, broad plate-like aedeagus of *Soeliella*, and fusion of preapical flagellomeres, deeply emarginated epandrium, single tenaculum at cercus (homoplasious with *Quatiella*) and posteriorly projected epiproct of *Feuerborniella* Vaillant, 1974. These characters suggest these genera are monophyletic, although this is still an untested hypothesis. While the recognition of these groups is very important for the classification of Trichopsychodina, we are still not able to place the remaining species of *Philosepedon sensu lato* in this system. Yet, it is more worrying that there is no character supporting *Philosepedon* as a monophyletic group in any of the available proposals. Both broad and strict definitions use a combination of characters that are homoplasious with many other genera of Trichopsychodina. One probably apomorphic character was proposed by OMELKOVÁ & JEŽEK (2012) for a supraspecific taxon including *Philosepedon* type species, the inconspicuous aedeagal complex of the subgenus *Philosepedon s. str.*, but it has been only used to delimit the subgenus, not the genus. This may be an important character and future authors should consider using it for future classification proposals for *Philosepedon*.

Considering these arguments, the number of tenacula should not be imperative for diagnosing *Philosepedon* in future studies, at least not without a clear explanation which features would be apomorphic for this group. It is clear that many species regarded in *Philosepedon* s.l. by OMELKOVÁ & JEŽEK (2012) must be placed in new or already described genera to meet the phylogenetic principles of classification.

Among the subgenera proposed by OMELKOVÁ & JEŽEK (2012) in *Philosepedon* s.l., *Bahisepedon* is the only one with fusion of preapical flagellomeres. This subgenus was also keyed based on a combination of the following characters: ‘eyes separated, ascoids Y-shaped, wing membrane bare, aedeagal complex simple, free, symmetrical, narrowly or widely spatulate, parameres bulbous basally, straight or slightly curved terminally, tapering to their apices’. The species of *Bahisepedon* share the characteristics of apex of antenna and parameres with *Feuerborniella*. This is likely to be result of putative synapomorphy rather than convergence, as there is no unique and exclusive feature that links this subgenus with other subgenera of *Philosepedon* (the number of tenacula (two), the subquadrate epandrium without deep posterior emargination, and the epiproct rounded posteriorly may be ancestral characters, as they are shared with many other species of *Philosepedon sensu lato*). Therefore, *Feuerborniella sensu* CORDEIRO et al. (2014) must be a monophyletic group, but it would be a subgroup of a larger (also monophyletic) group characterized by the apomorphic features of apex of antenna and parameres. No putative apomorphy was found for *Bahisepedon* itself, so it must be paraphyletic in relation to *Feuerborniella*. For this reason, we propose that *Feuerborniella* should be considered a senior synonym of *Bahisepedon*, syn. nov., in accordance with ICZN.

Two species treated in the present paper have the characteristics proposed for *Philosepedon* (*Bahisepedon*), but they have three tenacula, which would place them outside *Philosepedon sensu* OMELKOVÁ & JEŽEK (2012). They also share with the species previously included in this subgenus the broadly separated gonocoxites, with hypandrium in between them, and there is no reason to classify them in different genera, based only on the number of tenacula. A unique combination of the following characters separates the group herein proposed from all other *Philosepedon sensu lato*: fused preapical flagellomeres (always separated from the apical), separated eyes (generally very proximate), separated gonocoxites, aedeagus narrowly or widely spatulate and subconical parameres tapering at apex, female cercus long and gradually tapered. The previous definitions of *Feuerborniella* delimits a very characteristic subgroup, defined by reduction of the number of tenacula to one (and its relatively short size in comparison to the length of cercus), deep emargination of epandrium and posterior projection of epiproct, all probably apomorphic characters for this level.

### *Feuerborniella* Vaillant, 1974

*Feuerborniella* Vaillant, 1974: 119. Type species: *Psychoda obscura* Tonnoir, 1919, by monotypy.

*Bahisepedon* Omelková & Ježek, 2012, **syn. nov.** Type species: *Philosepedon oblongolum* Bravo, Chagas & Cordeiro, 2006, by original designation.

**Diagnosis.** Antenna with 13–14 flagellomeres, 11<sup>th</sup> always fused with proceedings, terminal always separated; ascoids Y-shaped; eyes separated, generally proximate; labella compact, slightly fleshy, with short spines on inner margin; wing membrane generally bare; gonocoxites separated; epandrium subquadrate, deeply emarginated posteriorly; cercus with 1–3 tenacula apically; aedeagal complex simple, free, generally symmetrical, narrowly or widely spatulate; parameres bulbous basally, straight or slightly curved terminally, tapering to their apices; female cercus long (longer than width of female genitalia) and gradually tapered.

**Included species.** *Feuerborniella amblytes* (Quate, 1999) comb. nov., *F. ancepitis* (Quate, 1996) comb. nov., *F. bicuspis* (Quate, 1996) comb. nov., *F. concava* Cordeiro & Bravo sp.

nov., *F. hamata* (Quate, 1996) comb. nov., *F. jezeki* Cordeiro & Bravo sp. nov., *F. malayensis* (Satchell, 1955), *F. oblongola* (Bravo, Chagas & Cordeiro, 2006) comb. nov., *F. obscura* (Tonnoir, 1919), *F. opposita* (Banks, 1901) comb. nov., *F. pandiculata* (Quate, 1996) comb. nov., *F. paramuna* Cordeiro, 2014, *F. pilosella* Cordeiro & Bravo sp. nov., *F. plaumanni* (Duckhouse, 1968), *F. pollicaris* (Quate, 1996) comb. nov., *F. retusa* (Quate, 1996) comb. nov., *F. spathipennis* (Duckhouse, 1968), *F. uncinata* (Bravo, Chagas & Cordeiro, 2006) comb. nov., *F. veracruzana* Ibáñez-Bernal, 2004, and *F. vieirai* (Chagas, Bravo & Rafael, 2009) comb. nov.

***Feuerborniella pollicaris* (Quate, 1996) comb. nov.**

(Figs 1–6)

**Material examined.** 1 ♂ (MZFS): **BRAZIL: BAHIA:** Senhor do Bonfim, Serra de Santana, 24.ix.2009, F. Bravo col.; 1 ♂ (MZFS): **BRAZIL: CEARÁ:** Parque Nacional Ubajara, 3°50'21.2"S 40°54'6.7"W, 22–29.x.2011, E. Nascimento and A.M. Silva-Neto cols. The holotype was also examined.

**Diagnosis.** Antenna with scape of about same length of pedicel and 14 flagellomeres, 11–13 fused, 14 separated; seta patch of anepisternum strongly reniform; cerci with three tenacula; gonostylus with apex bifid; aedeagus asymmetrical; parameres paired, horn-shaped.

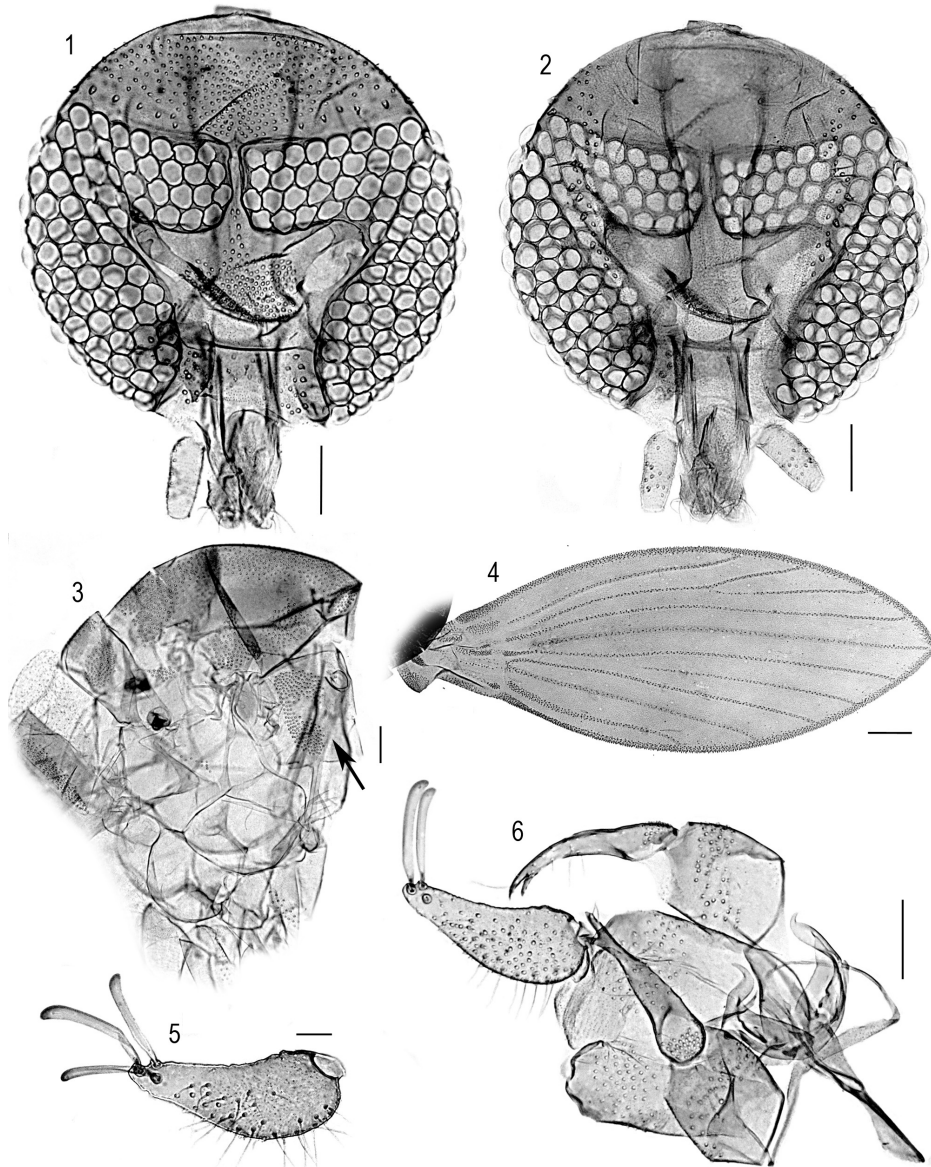
**Additional characters. Male.** Head (Fig. 1): vertex seta patch continuous laterally with setae of posterior margin of eye (Fig. 2); 7–9 supraocular setae (5 on specimen from Ceará), 4–5 larger occipital alveoli; clypeus wider than long with a lateral row of 6–8 larger alveoli; frontoclypeal suture absent; antenna with scape cylindrical, as long as subspherical pedicel; labellum with three spines and 7 lateral setae. Thorax (Fig. 3): pre-sutural setae very close to supraalar setae but clearly separated in the holotype; seta patch of anepisternum strongly reniform; pteropleurite longer than wide, anterior margin around 2× shorter than posterior margin; long but incomplete transverse suture on upper margin of katapisternum. Wing (Fig. 4): wing membrane bare except on veins; second costal node absent; vein sc short, not extending beyond line of bases of veins Rs, M and CuA<sub>1</sub>; R<sub>1</sub> ending beyond level of CuA<sub>2</sub>; radial fork incomplete (complete on specimen from Bahia) and apical to incomplete medial fork. Legs: distitarsi with apical projection. Male terminalia: Epandrium subquadrate with one small foramen; hypandrium micropilose, separating gonocoxites (Fig. 6); gonocoxites with seta patch on outer margin and two isolated setae on inner margin; gonostylus with apex bifid, slightly longer than gonocoxite, with group of setae on external side of base and several setae sparsely distributed throughout its length, with subapical larger sinuous setiform sensillum; gonocoxal bridge bilobed anteriorly and not expanded posteriorly; cercus conical (Fig. 5), about same length of epandrium, with one apical and two subapical tenacula and three subapical papilla. Apical tenaculum is slightly longer than other two, all tenacula around half length of cercus; epiproct nearly triangular; hypoproct ellipsoid, almost 2× wider than long; aedeagus asymmetrical, aedeagal apodeme simple, around half length of aedeagus; pair of sinuous parameres lateral to aedeagus, with conspicuously curved apex (Fig. 6); parameres are continuous dorsal to aedeagus.

**Female.** Unknown.

**Differential diagnosis.** This species is similar to *F. uncinata* and *F. opposita* in the shape of parameres and appearance of eye bridge, but it can be easily separated from them by the

bifid gonostylus and number of tenacula, although QUATE (1955) says that *F. opposita* may rarely have three tenacula.

**Distribution.** Costa Rica (QUATE 1996), Brazil (Bahia, Ceará) (new records).



Figs 1–6. *Feuerborniella pollicaris* (Quate, 1992) 1 – head, anterior view; 2 – head, posterior view; 3 – thorax; 4 – wing; 5 – male cerci; 6 – male terminalia, dorso-lateral view. Scale bars = 0.1 mm (4), 0.02 mm (5), other figures 0.05 mm.

***Feuerborniella jezeki* Cordeiro & Bravo, sp. nov.**

(Figs 7–13)

**Type material.** HOLOTYPE: ♂, BRAZIL: BAHIA: Pindobaçú, 10°39'S 40°21'W, 26.ix.2009, 500 m a.s.l., light trap, F. Bravo col. (MZFS).

**Diagnosis.** Dorsal extension of frons seta patch not reaching eye bridge; scape of about same length of pedicel, flagellomeres 11–13 fused together; subapical enlargement on veins  $R_2$  and  $M_3$ , infuscation on veins  $R_5$ ,  $CuA_1$  and basal half of  $CuA_2$ ; cerci short, not longer than epandrium, with two tenacula; gonocoxal bridge W-shaped.

**Description. Male. Head.** Frons seta patch slightly divided basally but extending upwards in thin stripe, not reaching eye bridge (Fig. 7); eye bridge with 4 facet rows, separated by half facet diameter, vertex seta patch continuous laterally with setae of posterior margin of eye (Fig. 8); 8 supraocular setae, 1 larger occipital alveolus; interocular suture present with short dorsal extension; clypeus wider than long with lateral row of 4 larger alveoli; frontoclypeal suture present; antenna with cylindrical scape, about same length as subspherical pedicel, and apparently 14 flagellomeres (terminal flagellomere probably lost during preparation), 12 and 13 reduced, 11, 12 and 13 fused together (Fig. 9); ascoids Y-shaped; palpal formula 1.0 : 1.8 : 1.8 : 1.9 (Fig. 10); labellum with 3 spines and 3 lateral setae.

*Thorax* (Fig. 11). Presutural setae join supraalar setae; pteropleutite longer than wide, anterior margin around 1.5× shorter than posterior margin; long and complete transverse suture on upper margin of katapisternum.

*Wing* membrane bare except on veins; second costal node absent; sc vein short; radial fork complete and apical to incomplete medial fork; subapical enlargement of vein  $M_3$ ; costal cell slightly darkened.

*Legs.* Distitarsi with apical projection.

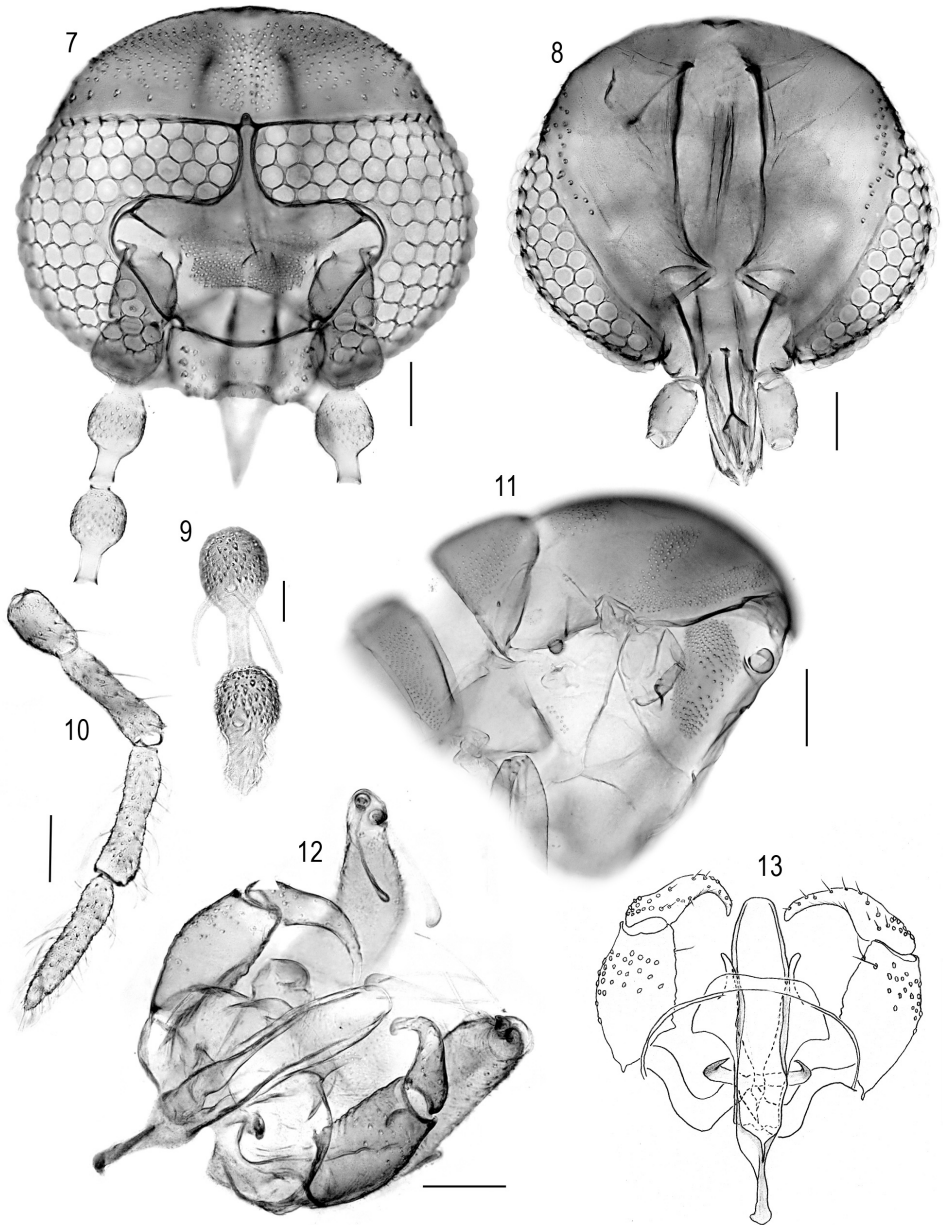
*Male terminalia.* Epandrium subquadrate with concave posterior margin and one small foramen; hypandrium narrow, separating gonocoxites (Fig. 13); gonostylus about length of gonocoxite, with group of setae on external side of base of gonocoxite and several setae sparsely distributed throughout its length with one longer seta at apex; gonocoxal apodemes meet medially to form W-shaped gonocoxal bridge; cercus about same length as epandrium, with two apical tenacula and two subapical papillae (Fig. 12); epiproct not projecting posteriorly; hypoproct simple; aedeagus symmetrical, aedeagal apodeme simple and short, around 1/3 length of aedeagus; pair of conical parameres latero-ventral to aedeagus, with apex slightly pointing to outer side (Fig. 13); parameres are continuous with large stripe dorsal to aedeagus, forming aedeagal 'ring'; parameres articulated basally with base of aedeagus and gonocoxal apodemes.

*Female.* Unknown.

**Differential diagnosis.** Wing is not illustrated as both wings are damaged on holotype, but the described characteristics can be seen on the parts of wings mounted on the slide. *F. jezeki* is very similar to *F. opposita* but it can be separated from it by the shape of aedeagus, which is spatulate in the new species and very narrow and rod-like on *F. opposita*.

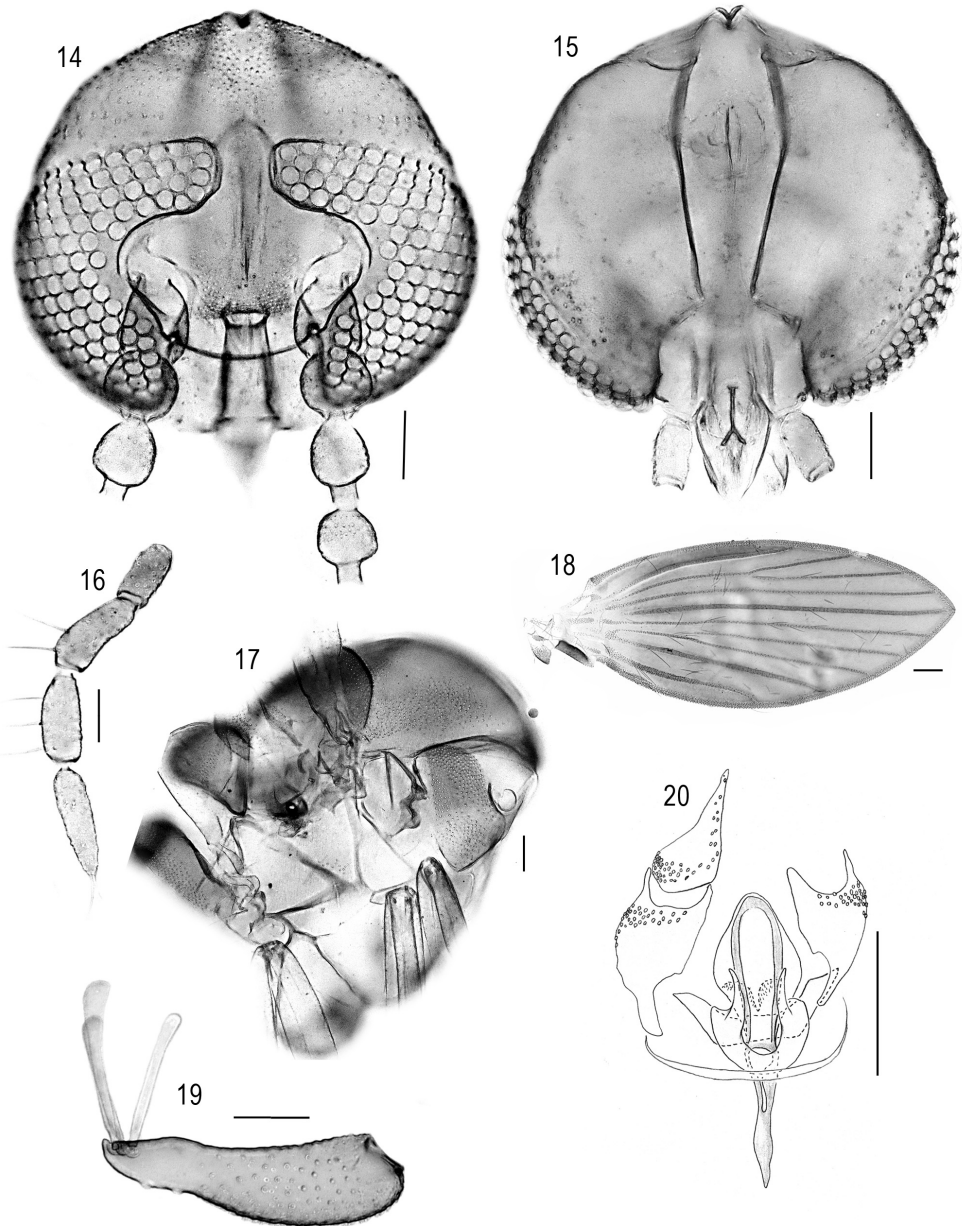
**Etymology.** The species epithet is given in honor of Dr. Jan Ježek for his enormous contribution to the taxonomy of the family Psychodidae.

**Distribution.** Brazil (Bahia).

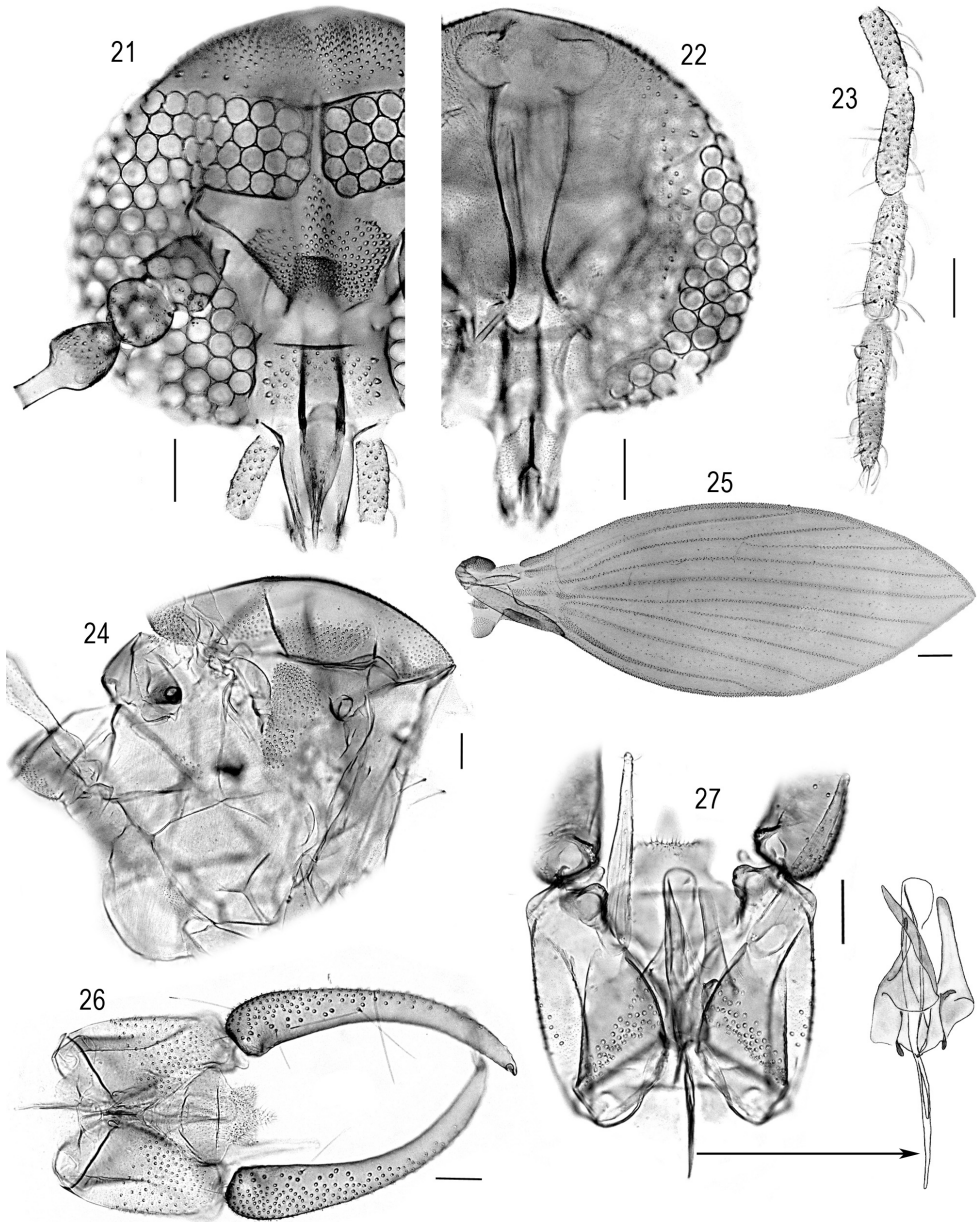


Figs 7–13. *Feuerborniella jezeki* Cordeiro & Bravo, sp. nov. 7 – head, anterior view; 8 – head, posterior view; 9 – antenna, flagellomeres 10–13; 10 – palpus; 11 – thorax; 12 – male terminalia, dorso-lateral view; 13 – detail of hypandrium, gonopods and aedeagal complex. Scale bars = 0.02 mm (9), 0.1 mm (11, 13), other figures 0.05 mm.





Figs 14–20. *Feuerborniella concava* Cordeiro & Bravo, sp. nov. 14 – head, anterior view; 15 – head, posterior view; 16 – palpus; 17 – thorax; 18 – wing; 19 – male cerci; 20 – detail of hypandrium, gonopods and aedeagal complex, right gonostyle obliterated. Scale bars = 0.04 mm (16, 19), 0.1 mm (18, 20), other figures 0.05 mm.



Figs 21–27. *Feuerborniella pilosella* Cordeiro & Bravo, sp. nov. 21 – head, anterior view; 22 – head, posterior view; 23 – palpus; 24 – thorax; 25 – wing; 26 – male terminalia, ventral view. 27 – male terminalia, dorsal view, with detail of aedeagal complex indicated by the arrow. Scale bars = 0.05 mm.

***Feuerborniella concava* Cordeiro & Bravo, sp. nov.**

(Figs 14–20)

**Type material.** HOLOTYPE: ♂, BRAZIL: BAHIA: Senhor do Bonfim, 24.i.2006, Vieira R. & Chagas C. cols (MZFS)

**Diagnosis.** Eyes separated by 4 facet diameters; costal cell and veins  $R_1$ ,  $R_5$ ,  $CuA_1$  and  $CuA_2$  darkened; cerci with three apical tenacula; aedeagus symmetric, spoon-shaped; pair of subconical parameres, with curved and acute apex.

**Description. Male. Head.** Frons seta patch extending to superior margin of eye bridge; eye bridge with four facet rows, separated by 4.0 facet diameter (Fig. 14); vertex seta patch continuous laterally with setae of posterior margin of eye (Fig. 15); supraocular setae forming two irregular antero-lateral rows and apparently 2 larger occipital alveoli can be seen in posterior view, but they look continuous with supraocular setae; interocular suture present; clypeus wider than long with row of 3 larger lateral alveoli; frontoclypeal suture present; antenna with cylindrical scape slightly longer than spherical pedicel (Fig. 14), flagellomeres beyond 7 lost during preparation; ascoids Y-shaped; palp segment 1 with sensory organ, palpal formula 1.0 : 1.4 : 1.4 : 1.7 (Fig. 16). Labellum compact, slightly fleshy, with three spines on inner margin and three lateral setae.

**Thorax** (Fig. 17). Pre-sutural setae join supraalar setae; pteropleutite longer than wide; long transverse suture on upper margin of katapisternum.

**Wing** (Fig. 18). Wing membrane bare except on veins; second costal node absent; Sc vein short ending before base of  $R_1$ ;  $R_1$  ending beyond level of  $CuA_2$ ; radial fork complete and apical to incomplete medial fork; costal cell and veins  $R_1$ ,  $R_5$ ,  $CuA_1$  and  $CuA_2$  darkened; basal half of  $CuA_2$  enlarged.

**Legs** short in comparison to body length, distitarsi with short apical projection.

**Male terminalia.** Epandrium subquadrate with one large foramen; hypandrium narrow, separating gonocoxites (Fig. 20); gonostylus about same length as gonocoxites, with acute apex, group of setae on external side of base and several small setae sparsely distributed on internal side throughout its length; gonocoxal bridge subquadrate anteriorly, pilose and bilobed posteriorly; cercus around same length as epandrium, wider on basal 2/3, with 3 apical tenacula (around 0.4× length of cercus) and 3 subapical papillae (Fig. 19); epiproct not projecting posteriorly; hypoproct wider than long; aedeagus symmetric, spoon-shaped; aedeagal apodeme simple, around half length of aedeagus; pair of subconical parameres lateral to aedeagus, with slightly curved and acute apex (Fig. 20); the parameres are continuous with stripe dorsal to aedeagus, forming aedeagal sheath; ventrally base of parameres articulated with base of aedeagus.

**Female.** Unknown.

**Comments.** The spatulate aedeagus and the symmetrical simple, slightly curved and medially joined parameres are typical for *Feuerborniella*, but the antennal apex of this species is unfortunately unknown. This species has three tenacula as in *F. pollicaris*, but can be differentiated from it by the distance of eyes and the shape of gonostylus.

**Etymology.** The species epithet is derived from the Latin *concavus*, adjective, in allusion to the spoon-like format of aedeagus.

**Distribution.** Brazil (Bahia).

***Feuerborniella pilosella* Cordeiro & Bravo, sp. nov.**

(Figs 21–27)

**Type material.** HOLOTYPE: ♂, BRAZIL: PARAÍBA: Areias, Brejo paraibano, 06°58'S 39°44'W, 567 m a.s.l., 25.–29. ix.2011, Nascimento, E. & Silva-Neto, A. Cols (MZFS). PARATYPES: 1 ♂, same data as holotype (MZFS); 1 ♀, BRAZIL: PARAÍBA: Santa Terezinha, Faz. dos Franceses, 07°00'57.2"S 37°24'29.8"W 258 m a.s.l., 6.v.2011, Lima & Brito cols. (MZFS).

**Diagnosis.** Wing membrane pilose at veins and on midline between veins; hypoproct subquadrate posteriorly; pair of asymmetric conical parameres latero-ventral to aedeagus which are continuous basally with dorsal sheath to aedeagus.

**Description.** *Head.* Frons seta patch extending in thin stripe between eyes, reaching second row of facets on eye bridge (Fig. 21); eye bridge with 4 facet rows, separated by half facet diameter, vertex seta patch weakly continuous laterally with setae of posterior margin of eye (Fig. 22); 6–8 supraocular setae, 3–4 (1–2 in female) larger occipital alveoli; interocular suture present; clypeus wider than long with lateral row of 3 larger alveoli; frontoclypeal suture present; antenna with cylindrical scape, slightly longer than subspherical pedicel, flagellomeres apical to 8<sup>th</sup> lost during preparation; ascoids Y-shaped; palpal formula 1.0 : 1.4 : 1.6 : 1.9 (Fig. 23); labellum with 2–3 spines and 6 lateral setae.

*Thorax* (Fig. 24). Pre-sutural setae join supraalar setae; pteropleurite longer than wide, anterior margin shorter than posterior margin; long transverse suture on upper margin of katepisternum.

*Wing* (Fig. 25). Wing membrane pilose at veins and on midline between veins; second costal node absent; sc vein short, not extending beyond line of base of veins Rs, M and CuA1; R1 ending beyond level of CuA2; radial fork complete and apical to incomplete medial fork.

*Legs.* Distitarsi with apical projection.

*Male terminalia.* Epandrium subquadrate with concave posterior margin (almost V-shaped) and one small foramen; hypandrium narrow, separating proximate gonocoxites (Fig. 27); gonostylus slightly longer than gonocoxite, with several setae sparsely distributed throughout its length; gonocoxal bridge bilobed anteriorly; cercus conical, long, almost 2× length of epandrium (Fig. 26), with one apical tenacula and three subapical papillae, epiproct triangular; hypoproct subquadrate posteriorly; aedeagus asymmetric, aedeagal apodeme simple, short, less than half length of aedeagus; pair of asymmetric conical parameres latero-ventral to aedeagus, one shorter and the other longer, with truncate apex; one dorsal shaft to aedeagus, connected to one paramere by membrane (Fig. 27); base of parameres continuous dorsally to aedeagus; parameres articulating baso-dorsally with aedeagus and baso-ventrally with gonocoxal apodemes.

*Female terminalia.* Subgenital plate wider than long, bilobed posteriorly; ovipositor long, around 1.5 width of subgenital plate at base.

**Differential diagnosis.** This species is similar to *F. paramuna* in the characteristic vestiture of the wing, asymmetric aedeagus, large subconical parameres and the presence of a dorsal shaft to aedeagus, but it can be differentiated from it by the asymmetrical parameres, and the subquadrate hypoproct.

**Etymology.** The species epithet is derived from Greek *pilos*, in allusion to the pilose wing; adjective.

**Distribution.** Brazil (Paraíba).

***Alepia Enderlein, 1937***

*Alepia Enderlein, 1937: 94. Type species: Alepia scripta Enderlein, 1937, by original designation.*

**Diagnosis** [adapted from QUATE & BROWN (2004)]. Large fusiforme flagellomeres, wing almost always distinctly patterned, males with multiple accessory tenacula bearing modified tips, which are often confined to basal, black pad on cercus; small, rod-like apical tenaculum may be present; females with expansion on lateral margin of genital ducts with fringed or serrate margin.

***Alepia janjezeki Cordeiro & Bravo, sp. nov.***

(Figs 28–36)

**Type material.** HOLOTYPE: ♂, BRAZIL: BAHIA: Piatã, Cachoeira do Patrício, light trap, 5.xi.2013, cols. Menezes E., Nascimento F., Carvalho J., Cordeiro D. & Bravo F. (MZFS). PARATYPE: 1 ♀, same place, data and collectors as holotype (MZFS).

**Diagnosis.** Eyes widely separated; wing membrane with setae on base of costal cell; cercus conical, with dark area at base bearing 25 long clavate tenacula; pair of well sclerotized parameres lateral to aedeagus.

**Description.** *Head.* Frons seta patch slightly divided (Figs 28 and 29); eye bridge short, eyes widely separated; no larger alveoli on area of supraocular setae and occipital setae (Figs 28–30); interocular suture present; clypeus wider than long; antenna with cylindrical scape 2× (male, Fig. 28) or 2.5× (female, Fig. 29) length of spherical pedicel, 14 flagellomeres with pair of digitiforme ascoids on the same side, apical flagellomere with apiculus around 0.4× length of whole flagellomere (Fig. 31); palpal formula 1.0 : 2.1 : 2.1 : 2.3. Labellum bulbous, with short spines on inner margin and several lateral setae.

*Thorax* (Fig. 32). Pre-sutural setae separated from supraalar setae; seta patch of anepisternum divided.

*Wing* (Fig. 33). Wing membrane bare except on veins and base of cell C, with pattern of infuscation as illustrated; vein Sc short; R<sub>1</sub> ending beyond level of CuA<sub>2</sub>; radial fork complete and basal to complete medial fork; base of M<sub>2</sub> weakened.

*Legs.* Distitarsi with apical projection (Fig. 34).

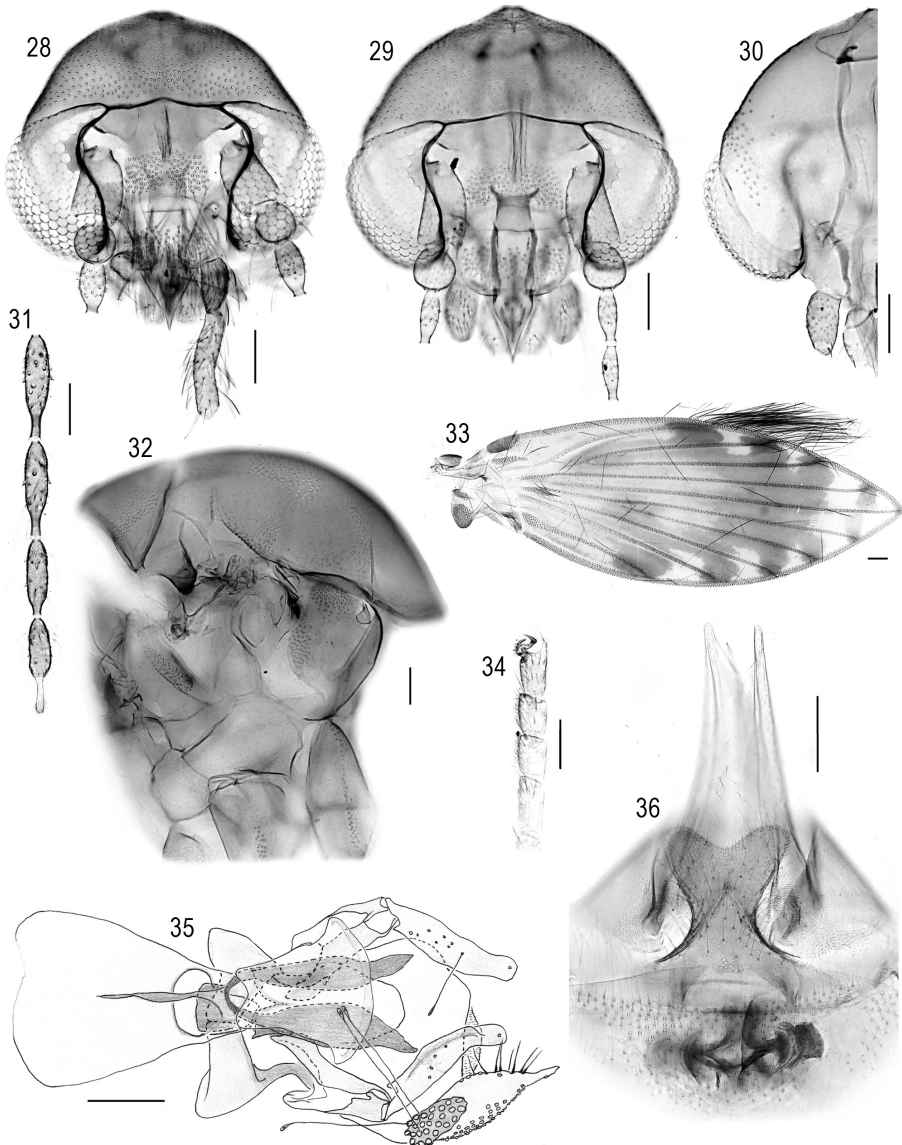
*Male terminalia* (Fig. 35). Hypandrium straight, separating gonocoxites; gonostylus spatulate with several small setae sparsely distributed throughout its length; gonocoxal apodemes large, expanding anteriorly and meeting at midline to form gonocoxal bridge; cercus conical, with dark area at base bearing 25 long clavate tenacula; aedeagus symmetric; aedeagal apodeme large; pair of well sclerotized parameres lateral to aedeagus; parameres have continuous apodemes at base, dorsally to aedeagus.

*Female terminalia* (Fig. 36). Subgenital plate bilobed; ovipositor almost reaching 1.4 length of subgenital plate; genital chamber with expansion on lateral margin.

**Differential diagnosis.** This species is morphologically close to *Alepia copelata* Quate, 1999, in the eyes widely separated, and the shape of aedeagal complex, with two large well sclerotized parameres, but they can be differentiated by the shape of gonostylus and the number of tenacula in the dark area at the base of cercus.

**Etymology.** The species epithet is given in honor to Dr. Jan Ježek for his enormous contribution to the taxonomy of family Psychodidae.

**Distribution.** Brazil (Bahia).



Figs 28–36. *Alepia janjezeki* Cordeiro & Bravo, sp. nov. 28 – male head, anterior; 29 – female head, anterior; 30 – female head, posterior; 31 – antenna apex; 32 – thorax; 33 – wing; 34 – tarsomeres II–V; 35 – male terminalia, dorsal view; 36 – female terminalia, ventral view. Scale bars = 0.05 mm (31), other figures 0.1 mm.

## Acknowledgments

We thank Manuel Zumbado and Annia Picado who provided the loan of the type specimen from the INBIO collection, and Sergio Ibáñez-Bernal and Gunnar M. Kvifte for their contributions to the manuscript and suggestions on classification of Trichopsychodina. We are also thankful for the financial support provided by Programa de Pesquisa em Biodiversidade (PPBio/MCTI, N° 457471/2012-3); the first author had a post-doc fellowship from the agreement Fapesb/CAPES; the second author has a research grant from CNPq N° (305055/2012-7).

## References

- ANDRADE-LIMA D. 1982: Present day forest refuges in northeastern Brazil. Pp. 245–251. In: PRANCE G. T. (ed.): *Biological diversification in the tropics*. Columbia University Press, New York.
- BOTOSANEANU L. & VAILLANT F. 1970: Trois Diptères Psychodidae nouveaux de Cuba. *Travaux du Laboratoire d'Hydrobiologie et de Pisciculture de l'Université de Grenoble* **61**: 173–183.
- BRASIL (Ministério de Integração Nacional) 2005: *Nova delimitação do Semi-árido brasileiro*. MIN/Secretaria de desenvolvimento regional, Brasília, 33 pp.
- BRAVO F. & ARAÚJO M. X. 2014: Psychodidae não Phlebotominae (Diptera) do semiárido. Pp. 279–284. In: BRAVO F. & CALOR A. (eds): *Artrópodes do semiárido: biodiversidade e conservação*. Print Mídia, Feira de Santana, 298 pp.
- BRAVO F., CHAGAS C. & CORDEIRO D. 2006: Two new species of Philosepedon Eaton (Diptera: Psychodidae: Psychodinae) from the Atlantic Coastal Rain Forest of northeastern Brazil. *Zootaxa* **1206**: 63–68.
- CHAGAS C., BRAVO F. & RAFAEL J. A. 2009: A new species of Philosepedon Eaton, 1904 (Diptera, Psychodidae) from Brazil. *Biota Neotropica* **9**: 99–102.
- CORDEIRO D., BRAVO F., WOLFF M. & CARVALHO C. J. B. 2014: A new species of Feuerborniella (Diptera: Psychodidae) from the paramo of Colombia. *Acta Entomologica Musei Nationalis Pragae* **54**: 377–382.
- CUMMING J. M. & WOOD D. M. 2009: Adult morphology and terminology. Pp. 9–50. In: BROWN B. V., BORKENT A., CUMMING J. M., WOOD D. M., WOODLEY N. E. & ZUMBADO M. A. (eds): *Manual of Central American Diptera. Volume 1*. NRC Research Press, Ottawa, Ontario, Canada, 714 pp.
- DUCKHOUSE D. A. 1973: *A catalogue of Diptera of the Americas South of the United States. 6A Family Psychodidae. Subfamilies Bruchomyiinae, Trichomyiinae, Sycoracinae and Psychodinae*. Museu de Zoologia, Universidade de São Paulo, São Paulo, 29 pp.
- DUCKHOUSE D. A. 1985: A re-examination of Neomaruina (Diptera, Psychodidae), with observations on its lifehistory and affinities and redefinition of the tribe Psychodini. *Annals of the Natal Museum* **26**: 601–620.
- ENDERLEIN G. 1937: Klassifikation der Psychodidae (Dipt.). *Deutsche Entomologische Zeitschrift* **1936**: 81–112.
- GALATI E. A. B. 2003: Morfologia e taxonomia. Pp. 23–206. In: RANGEL E. F. & LAINSON R. (eds.): *Flebotomíneos do Brasil*. Editora Fiocruz, Rio de Janeiro, 367 pp.
- IBÁÑEZ-BERNAL S. & CÁCERES A. G. 2005. Philosepedon aliciae sp. nov. de Psychodidae del Perú (Diptera: Psychodidae). *Folia Entomologica Mexicana* **44**: 157–164.
- JEŽEK J. 1985: Contribution to the knowledge of the new subtribe Trichopsychodina (Diptera, Psychodidae) from Czechoslovakia. *Časopis Národního Muzea, Řada Přírodovědná* **40**: 65–92.
- KVIFTE G. M. 2015: The Afrotropical genera of Psychodini: redefinition of the tribe, first afrotropical record of Perithreticus Vaillant, 1973 and description of *Soeliella* gen. nov. (Diptera: Psychodidae: Psychodinae). *Zootaxa* **3986**: 115–126.
- OMELKOVÁ M. & JEŽEK J. 2012: Two new species of Philosepedon Eaton (Diptera, Psychodidae, Psychodinae) from Europe, with comments on subgeneric classification. *Zootaxa* **3275**: 29–42.
- PAGANO M. & ARAÚJO F. 2011: Semi-arid vegetation in Brazil: biodiversity, impacts and management. Pp. 99–114. In: DEGENOVINE K. M. (ed.): *Semi-arid environments: agriculture, water supply and vegetation*. Nova Publishers, New York, 201 pp.

- QUATE L. W. 1955: A revision of the Psychodidae (Diptera) in America North of Mexico. *University of California Publications in Entomology* **10**: 103–273.
- QUATE L. W. 1959: Classification of the Psychodini (Psychodidae: Diptera). *Annals of the Entomological Society of America* **54**: 444–451.
- QUATE L. W. 1996: Preliminary taxonomy of the Costa Rican Psychodidae (Diptera), exclusive of Phlebotominae. *Revista de Biología Tropical* **44**: 1–81.
- QUATE L. W. 1999: Taxonomy of Neotropical Psychodidae. (Diptera) 3. Psychodines of Barro Colorado Island and Can Blas, Panama. *Memoirs on Entomology International* **14**: 409–441.
- QUATE L. & BROWN B. 2004: Revision of Neotropical Setomimini (Diptera: Psychodidae: Psychodinae). *Contribution in Science: Natural History Museum of Los Angeles* **500**: 1–117.
- SANTOS A. M. M., CAVALCANTI D. R., SILVA J. M. C. & TABARELLI M. 2007: Biogeographical relationships among tropical forests in north-eastern Brazil. *Journal of Biogeography* **34**: 437–446.
- STEBNER F. & KRAEMER M. M. S. 2014: Systematic and palaeoecology of Psychodidae (Insecta: Diptera) from Miocene Mexican amber. *Palaeontographica Abteilung A: Palaeozoology – Stratigraphy* **303**: 1–21.
- TONNOIR A. 1922: Synopsis des espèces européennes du genre Psychoda (Diptères). *Annales de la Société Entomologie de Belgique* **62**: 49–88.
- VAILLANT F. 1971–1983: 9d. Psychodidae – Psychodinae (not finished). In: LINDER E. (ed) *Die Fliegen der Palearktischen Region*. Stuttgart: E. Schweizerbartsche Verlagsbuchhandlung, 358 pp. Vols. 287 (1971): 1–48, 291 (1972): 49–78, 292 (1972): 79–108, 305 (1974): 109–142, 310 (1975): 143–182, 313 (1977): 183–206, 317 (1978): 207–238, 320 (1979): 239–270, 326 (1981): 271–310, 328 (1983): 311–357.
- VAILLANT F. 1973: Some new Psychodidae Psychodinae from the United States (Diptera). *Annales de la Société Entomologie de France, Nouvelle Série* **9**: 345–379.
- VELLOSO A. L., SAMPAIO E. V. S. B. & PAREYN F. G. C. 2002: *Ecorregiões: Propostas para o bioma Caatinga. Associação Plantas do Nordeste*. Instituto de Conservação Ambiental, The Nature Conservancy do Brasil, 76 pp.