

***Balbagathis janjezeki* sp. nov., a new species of moth fly from Mexico (Diptera: Psychodidae: Psychodinae)**

Sergio IBÁÑEZ-BERNAL & Teresa SUÁREZ-LANDA

Red Ambiente y Sustentabilidad, Instituto de Ecología, A.C. (INECOL). Antigua carretera a Coatepec
No. 351, El Haya, Xalapa, Veracruz, CP 91070, México; e-mail: sergio.ibanez@inecol.mx

Abstract. A new species of the Neotropical genus *Balbagathis* Quate, 1996 is described and illustrated. *Balbagathis janjezeki* Ibáñez-Bernal sp. nov. is the 12th species described in this genus, and the second recorded in Mexico. Some new faunistic records of *Balbagathis sylvatica* Quate, 1996 in the state of Veracruz are also added.

Key words. Diptera, Psychodidae, Maruinini, Setomimini, taxonomy, description, new species, morphology, Mesoamerica, Neotropical Region

Introduction

In his treatment of Psychodidae of Costa Rica, QUATE (1996) described the genus *Balbagathis* based in two species: *Balbagathis sylvatica* Quate, 1996, only known by female specimens and considered as type species, and *B. talamanca* Quate, 1996, only described with male specimens. At the time of publication, Quate included this genus in Maruinini Enderlein, 1937 (following DUCKHOUSE 1987) based on the presence of radial and medial forks of the wing being basal in position, male terminalia with a median keel which connects the gonocoxal condyles (apodemes) to the broad base of aedeagus (basiphallus), and surstylus with only one tenaculum. It is important to point out that DUCKHOUSE (1987) redefined the tribe Maruinini, indicating that antennal flagellomeres are barrel-shaped or flask-shaped but retaining a form that remember the common barrel-shape, wing with radial fork generally basad to medial fork, and both placed rather basally of wing, but especially by the form of basiphallus which is broad, dorso-ventrally flattened, and the large gonocoxal condyles (apodemes), with a median dorsal structure which is ball-like in dorsal view, fitting into a concavity on underside of basiphallus. Three years later, DUCKHOUSE (1990) made some precisions, including that the first flagellomere retained its fusiform condition, the last 2–3 flagellomeres are reduced and do not have ascoids, the base of phallus sheath sometimes sclerotized to form a post-hypandrial plate, attached ventrally on either side to posterior gonocoxal apodemes, and mentioned that, at least the Australasian forms have the epandrium naked, a single pseudospiracular

opening, and cercopods (or surstyli) with one apical retinaculum (or tenaculum, according to the different morphological nomenclature of authors). Separately, VAILLANT (1982) proposed the tribe Setomimini, attributing it erroneously to Enderlein, and preserved this tribe until 1990 (VAILLANT 1990). QUATE & BROWN (2004) published a revision of the Neotropical tribe Setomimini Vaillant, 1982, in which they include 15 genera, one of which is *Balbagathis*, distinguishing them from Maruinini Enderlein, represented only by genus *Maruina* Müller, 1895. In spite of the presence of the internal expanded anterior gonocoxal apodemes, they considered Setomimini as a separate tribe because the possession of an aedeagal sheath in males and the morphological adaptations of immatures to aquatic habitats. Probably this kind of apomorphies (some considered by DUCKHOUSE 1990 and QUATE & BROWN 2004), are not adequate to support the tribal level, as some genera have characters not fitting with tribal definitions and for which many of them are usually considered as exceptions according to the tribal diagnoses, and with no defined limits with other tribes as discussed by DUCKHOUSE (1990) and JEŽEK et al. (2011).

QUATE & BROWN (2004) added eight new species to the two already known species of *Balbagathis*. In the same year, BRAVO (2004) described another species from Brazil, and finally, IBÁÑEZ-BERNAL (2008) collected specimens of both sexes of *B. sylvatica* in Mexico and described by first time the male. Currently there are 11 species distributed from southern Mexico to northeastern Brazil, but in this work, a new species of *Balbagathis* from Mexico is described and illustrated; in addition, new collection data of *Balbagathis sylvatica* are provided.

Materials and methods

Specimens were obtained under the project “Estratificación de tres enfermedades prioritarias en áreas de riesgo con base en sus insectos vectores en el estado de Veracruz, México” (FOMIX-CONACYT-Gobierno de Veracruz, 68317). Haematophagous (see IBÁÑEZ-BERNAL et al. 2011) and non-hematophagous psychodids (under study) were collected from various localities in the central portion of the state of Veracruz between February 2008 and February 2011. Localities were selected to represent different altitude, climate and landscapes on two transects, five collection sites of the northern slope (Misantla basin) and five of the southern slope (Actopan basin) of Sierra Chiconquiaco, which divides the state in two physiographic regions.

Specimens were captured by Centers for Disease Control (CDC) miniature UV-light traps (John W. Hock Company, Gainesville, FL) and Malaise traps (John W. Hock Company, Gainesville, FL), then preserved in 70% ethanol (those from Malaise traps) or stored dry (those from CDC light traps), and later processed to be mounted on microscope slides following the method described by IBÁÑEZ-BERNAL (2005) using Euparal (Bioquip Products) as permanent mounting medium.

We follow the general morphological nomenclature of QUATE & VOCKEROTH (1981), in accordance with McALPINE et al. (1981). However, we adopted some characters and terminology of male terminalia as explained and figured here.

Taxonomy

Balbagathis Quate, 1996

Balbagathis Quate, 1996: 31. Type species: *Balbagathis sylvatica* Quate, 1996, by original designation.

Balbagathis: QUATE & BROWN (2004): 59 (diagnosis, original description of 8 species, keys); BRAVO (2004): 439 (description of a Brazilian species); IBÁÑEZ-BERNAL (2008): 92 (Mexican record of *B. sylvatica* and description of male).

Diagnosis. A Neotropical genus of Maruinini (*sensu* DUCKHOUSE 1987, 1990) by the presence of wing with R fork basad to M fork, and both placed rather basally of wing, by the form of basiphallus which is broad, dorso-ventrally flattened, and gonocoxal condyles large, with a median dorsal structure which is ball-like in dorsal view, fitting into a concavity on underside of basiphallus, which can be separated from other genera of the tribe by the following adult characteristics (QUATE & BROWN 2004): vertex about twice to three times of eye-bridge height; eyes nearly contiguous with upper and lower corners angulated, separated by less than one facet diameter and with a short simple interocular suture; eye-bridge with 3–4 facet rows; antenna longer than wing width and shorter than wing length; flagellomere 1 reduced as an oval article, shorter than following flagellomeres; flagellomeres 2–13 strongly nodiform with long internode and nodes excentric to somewhat extent; ascoids simple, considerably longer than respective flagellomeres and curled; labella expanded; palpus much shorter than antenna; anepisternum with a patch of alveoli on posterior one-half; wings clear, radial fork basad of medial, both in basal half of wing; R_5 ending at wing tip; male hypandrium ‘a band between gonocoxites with posterior projections’ (see comments below), aedeagus asymmetrical, surstylus with one tenaculum, and ventral epandrial sclerites V-shaped.

Comments. *Balbagathis* can be considered as a member of tribe Maruinini only by the wing branch pattern of veins R and M, and in the male by the plate-like gonocoxal condyles. All other characteristics included in the diagnosis of this tribe by DUCKHOUSE (1987, 1990) cannot be appreciated in this genus.

Balbagathis is the sole Neotropical genus currently known to possess a small oval flagellomere 1. This characteristic combined with flagellomeres (except flagellomere 1) bearing a pair of extremely long (at least 3 times the length of the respective flagellomere) curled ascoids, a nearly contiguous eye-bridge with angulate corners, antenna shorter than wing length, wing with Sc short which ends before of the base of R_5 , and R_5 ending at wing tip, suffice to separate it from all other known genera of Neotropical Maruinini.

Male terminalia are characteristic as well, but their complexity has been a reason of different interpretations according to authors. Female terminalia (at least in the species in which females are known) has a structure, mentioned as chitinous arch by QUATE & BROWN (2004) greatly exposed distally between the lobes of the subgenital plate.

Balbagathis janjezeki Ibáñez-Bernal, sp. nov.

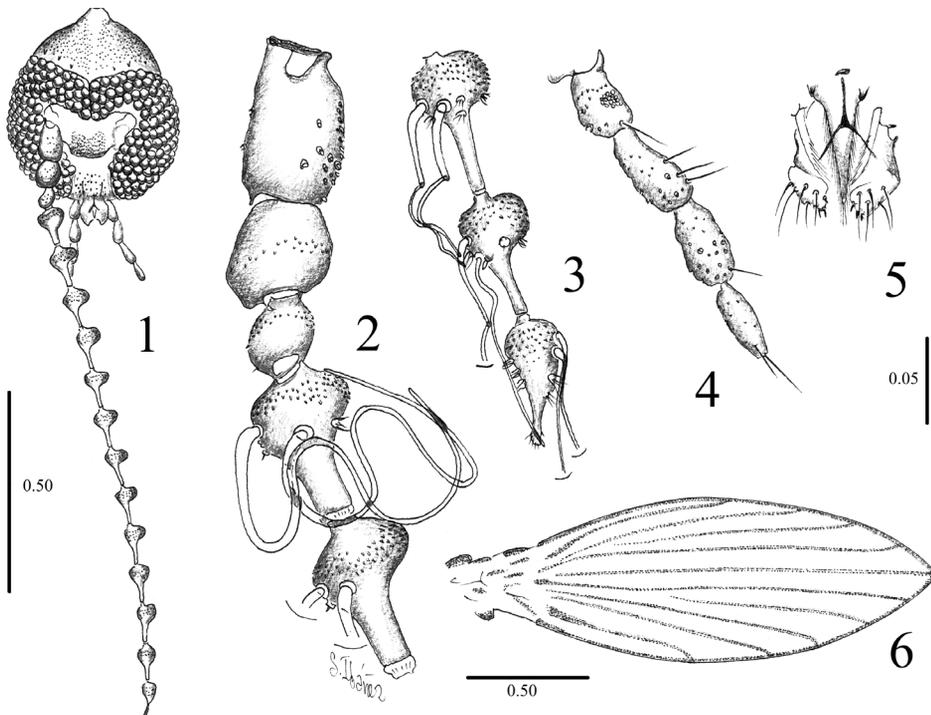
(Figs 1–11)

Type locality. Mexico, Veracruz, Municipality of Atzalan, Plan de Arroyos (19°53'41"N, 97°06'30"W, 820 m a.s.l.).

Type material. HOLOTYPE: ♂, ‘Mexico, Veracruz, Municipality of Atzalan, Plan de Arroyos, 27.ii.2008, Jurisdicción Sanitaria V, col. Malaise trap’. PARATYPES: 2 ♂♂, same data as holotype; 4 ♀♀, same data as holotype except 26.ii.2008,

CDC miniature UV light trap; 2 ♀♀, same data as holotype except 2.ix.2008, CDC miniature UV light trap; 2 ♀♀, same data as holotype except 15.v.2008, CDC miniature UV light trap 1 ♀, same data as holotype except 16.v.2008. All specimens are deposited in the Psychodidae collection of Instituto de Ecología, A. C., Xalapa, Veracruz, Mexico.

Description. Male. Head (Fig. 1) nearly rounded in frontal view, with a slightly expanded vertex. Eyes nearly contiguous, with the eye bridge formed by 3 rows of facets, except the last line that has 4 facets; interocular suture short and simple arched; 2–3 large supraocular alveoli, frons and vertex with two patches of small alveoli regularly spaced, finely and not at all clearly divided at center by a nude line which expands dorsally at vertex; frons below eye-bridge and between antennae with a patch of seta alveoli forming a bilobed superior margin; clypeus with a patch of larger alveoli evenly distributed on the inferior two-thirds of the sclerite. Mouthparts shorter than clypeus; labium with an inverted-Y-shaped sclerotization, labella expanded, each labellum with 3–4 short spiniform setae at internal margin and some simple setae distributed over all its surface (Fig. 5); palpus about as long as flagellomeres 1–3 (Fig. 1), with four segments; relative proportion of palpal segments 1.0 : 1.3 : 1.2 : 1.1; first palpal segment with a small patch of sensory rods (Newstead's sensillae) near the center



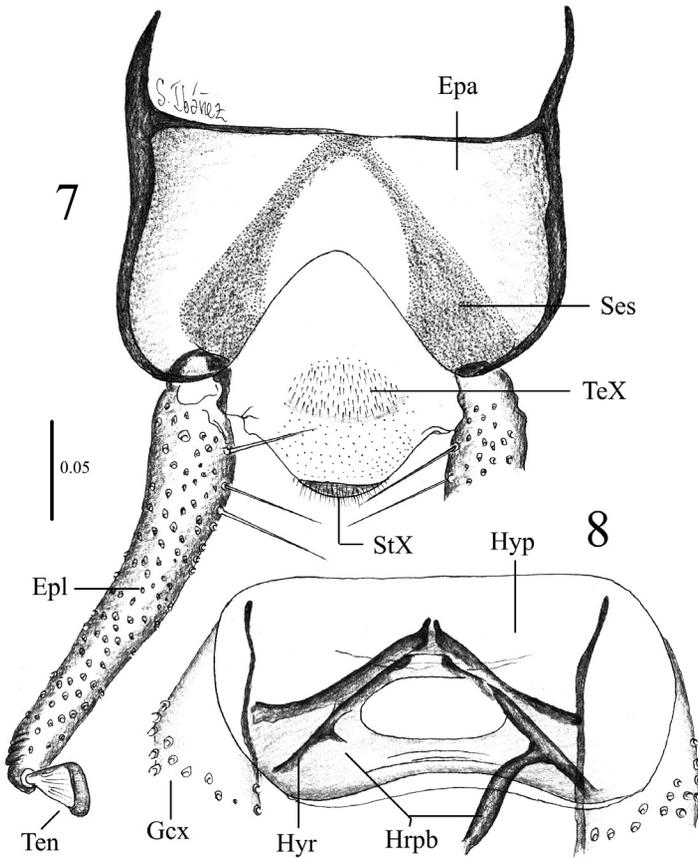
Figs 1–6. *Balbagathis janjezeki* sp. nov., male, holotype. 1 – head, frontal view; 2 – basal portion of antenna (scape, pedicel and flagellomeres 1–3 (ascoids of flagellomere 3 not completely drawn); 3 – apical portion of antenna, flagellomeres 12–14 (not all ascoids completely drawn); 4 – right palpus; 5 – mouthparts; 6 – wing. Figures 2–5 at same scale; all measurements in millimeters.

over the internal face; all palpal segments with 1–3 long setae, apical segment rigid without striations (Fig. 4). Antenna about 0.75 the length of wing, composed by a nearly cylindrical scape, an oval pedicel, and 14 flagellomeres (Fig. 1); scape about as long as pedicel + flagellomere 1; flagellomere 1 oval, small, about 0.5 the length of flagellomere 2 and without ascoids (Fig. 2); flagellomeres 2–13 nodiform and excentric, flagellomere 14 with a long apiculus (Fig. 3); flagellomeres 2–14 each with a pair of extremely long and tortuose simple ascoids (Figs 2 and 3).

Wing narrow, as long as 2.86 its maximum width; membrane uniformly clear; basal costal nodes well visible; Sc short, ending about level of the distal end of the third costal node; R_1 ending distal to middle of wing and before the level of CuA_1 apex; radial fork basad to medial fork; R_3 and M_2 with bases incomplete, just insinuated but without alveoli; R_5 ending at wing apex; A_1 present but short (Fig. 6).

Thorax without scent or specialized organs. Anepisternum with a vertical patch of setae alveoli. All coxae with a vertical row of seta alveoli on external surface; proportion of femur, tibia, and tarsomere 1: front leg 1.6 : 2.1 : 1.0; mid leg: 1.8 : 2.3 : 1.2; hind leg: 2.0 : 3.0 : 1.1; fore tibial claws nearly straight just with a small insinuated discontinuity at inferior margin.

Terminalia as in Figs 7–9. Epandrium about 2.0 times wider than long, surface without setae alveoli and no pseudospiracular opening, anterior margin nearly straight, reinforced, and thicker at midline from which the pair of subepandrial tongue-like sclerites originate and diverge posteriorly to the epandrial lobe bases (surstyli), posterior margin deeply concave, reaching one-half the maximum length of epandrium, leaving greatly exposed tergum and sternum 10, both distally rounded; epandrial lobes 1.5 times as long as epandrium, narrow and tapered, with 2–3 perennial setae at base on internal margin, evenly distributed alveoli all over its surface and ending in a single clavate tenaculum (Fig. 7); gonostylus nearly straight tapering to apex and about 0.75 the maximum length of gonocoxite; gonocoxite about as long as epandrium, simple, without lobes or special features except 3 long rigid setae originated basally on internal margin; gonocoxites anterior condyles expanded as large plates, with the anterior-external margin rounded, and meeting each other at midline as a T-shaped keel; gonocoxites posterior condyles articulating with the hypandrial preapical reinforcement and also with the posthypandrial aedeagal sheath (Fig. 9); hypandrium a large transversal oval transparent plate, which is about the same size of epandrium, very difficult to see (probably this is the reason by which this structure only is mentioned as a band between gonocoxites), having a pair of preapical transversal sclerotized reinforcements which articulate with the union of basiphallus with distiphallus; the reinforcement of one side has a small posterior blurred branch that lost its darkness before it is fused with the paramere of the same side, and the reinforcement of the other side has a longer sclerotized fusiform branch that is apically fused with the other paramere (Figs 8 and 9); posthypandrial sheath formed by two asymmetric claw-like parameres, both with basal half wide and abruptly thinning with apex directed to the same side in dorsoventral view, one about as long as gonocoxite and the other shorter, about 0.75 its length; the pair of parameres flanking a short membranous distally truncate periaedeagal membrane, that surround the short curled distiphallus, which is displaced to the shorter paramere side; basiphallus large, flared anteriorly, and with anterior border sclerotized and forming a keel at midline (Fig. 9).



Figs 7–8. *Balbagathis janjezeki* sp. nov., male, holotype. 7 – epandrium and segment X; 8 – hypandrium. Abbreviations: Epa – epandrium; Epl – epandrial lobe; Gcx – gonocoxite; Hrbp – hypandrial reinforcement posterior branches; Hyp – hypandrium; Hyr – hypandrial reinforcement; Ses – subepandrial sclerite; StX – sternum X; Ten – tenaculum; TeX – tergum X. At same scale; all measurements in millimeters.

Female. As in male except for the following characteristics: eye-bridge with 3 rows of facets; antenna with first and last flagellomeres without ascoids. Female terminalia (Figs 10–11): subgenital plate triangular in general view, anterior margin sclerotized, lateral margins nearly straight without angles or strong curvature, external surface with setae alveoli on apical three-fourths; subgenital plate lobes heavily setose, relatively wide and separated each other by a space similar to the width of one lobe, lobe base diagonal with the external anterior angle ending at 0.75 the length of lateral margin of plate from base to its apical margin; chitinous arch more or less rhomboid in outline with rounded apex, laterally articulated with cerci and anteriorly projected as a tubular structure ending anteriorly as a nipple; subgenital plate internal surface with a sclerotized transversal reinforcement that surrounds two oval translucent spaces, each of them with three translucent pores; genital chamber very complex with a group of three sclerites at each side one inverted Y-shaped sclerite at midline and between the oval pair of anterior structures, which has the external margin striated and are crossed by a sclerotized strut.

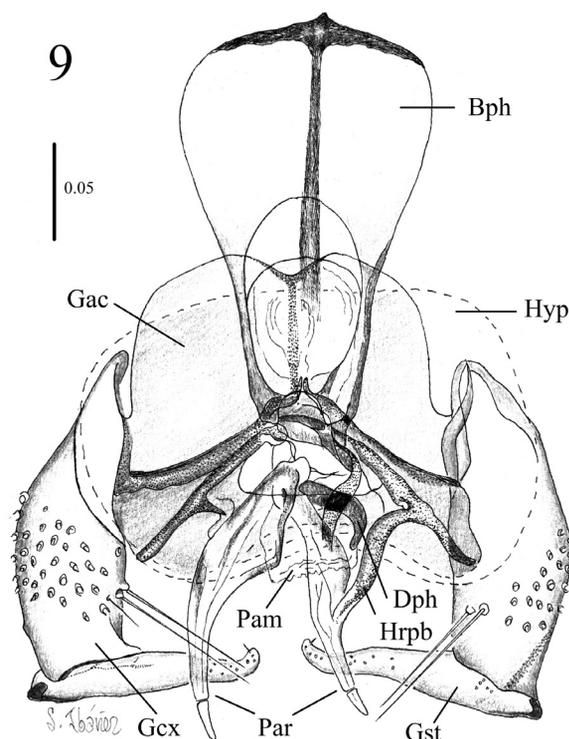
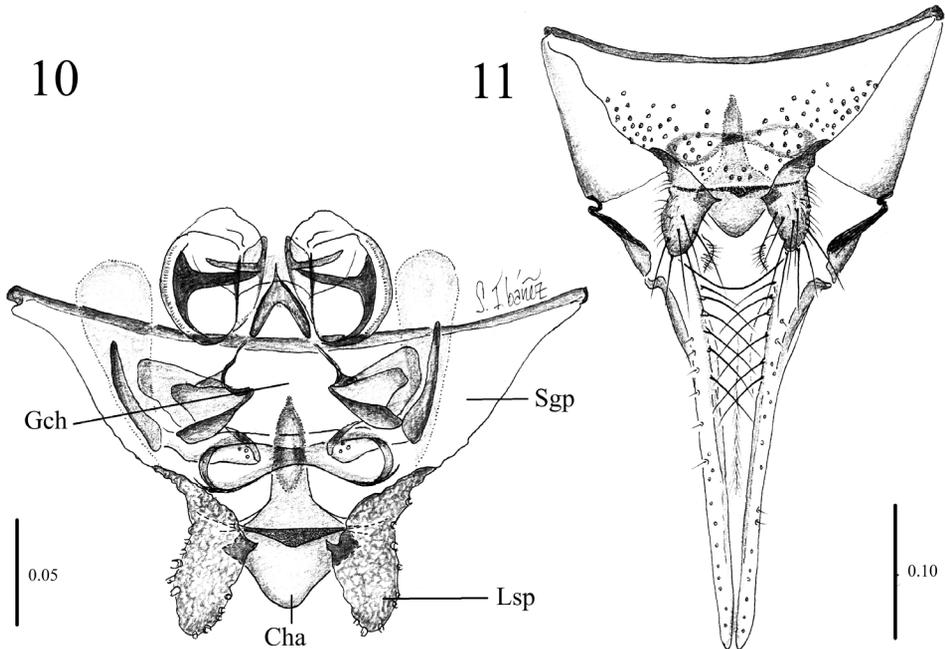


Fig. 9. *Balbagathis janjezeki* sp. nov., male, holotype. Terminalia, epandrium retired. Abbreviations: Bph – basiphallus; Dph – distiphallus; Gac – gonocoxite anterior condyle; Gcx – gonocoxite; Gst – gonostylus; Hrbp – hypandrial reinforcement posterior branch; Hyp – hypandrium; Pam – periaedeagal membrane; Par – parameres. Measurement in millimeters.

Measurements (in mm). *Male*: Head height: 0.40; proboscis length: 0.05; palpus length: 0.21; antenna length: 1.45; wing length: 1.97; wing width: 0.69; gonocoxite length: 0.16; gonostylus length: 0.12; epandrial lobe length: 0.26; aedeagus length: 0.26. *Female*: Head height: 0.38, proboscis length: 0.07; palpus length: 0.22; antenna length: 1.60; wing length: 1.86; wing width: 0.70; cercus length: 0.30; subgenital plate (from anterior border to lobe apex): 0.17; subgenital plate width (anterior margin): 0.25.

Etymology. This species is dedicated to our friend Jan Ježek, a prolific contributor to the knowledge of World Psychodidae, on the occasion of his 70th birth anniversary.

Differential diagnosis. The male of *Balbagathis janjezeki* sp. nov. can be separated from *B. discusspis* Quate & Brown, 2004, *B. sinuosa* Quate & Brown, 2004, and *B. trispica* Quate & Brown, 2004, because in these species the hypandrium reinforcements do not produce branches posteriorly; additionally, *B. discusspis* has the gonostylus nearly straight but has a long distiphallus, whereas *B. sinuosa* and *B. trispica* have a strongly sinuous gonostylus. *Balbagathis barva* Quate & Brown, 2004 differs principally by the eye-bridge with 4 rows and by the hypandrial posterior reinforcement branches that are claw-like, curved toward midline. *Balbagathis talamanca* Quate, 1996, and *B. dissimilis* Quate & Brown, 2004, are different because the periaedeagal membrane is triangular and long (described by QUATE & BROWN (1996), as a central triangular projection of hypandrium), in spite that the hypandrial



Figs 10–11. *Balbagathis janjezeki* sp. nov., female, paratype. 10 – ventral view of terminalia, cercus retired; 11 – terminalia, complete view showing the proportion of cerci. Abbreviations: Cha – chitinous arch; Gch – genital chamber; Lsp – lobe of the subgenital plate; Sgp – subgenital plate. Measurements in millimeters.

posterior reinforcement branches are similar to those observed in *B. janjezeki* which has an intermediate branch size, but both species possess a median long shaft apparently attached to the posterior portion of basiphallus (interpreted as distiphallus by QUATE & BROWN 2004). *Balbagathis manuensis* Quate & Brown, 2004, has the hypandrial posterior reinforcement branches similar in shape and size with rounded tips, whereas *B. agrestis* Quate & Brown, 2004 has long distiphallus shafts and parameres, the central one long, reaching or surpassing the level of gonostyli tips. *Balbagathis confraga* Quate & Brown, 2004 has the hypandrial posterior reinforcement branches similar in size but triangular in shape. *Balbagathis intricata* Bravo, 2004, differs because the hypandrial posterior reinforcement branches are very long, one wider at middle and the other near the apex.

The females of *B. sylvatica*, *B. sinuosa*, *B. barva*, *B. talamanca*, *B. dissimilis*, and *B. agrestis* are known. In these species the subgenital plate has the lateral margin nearly straight converging distally (except *B. agrestis* and *B. talamanca* which has an angle or curvature near middle), the chitinous arch is exposed between the lobes, the latter usually being slender, compact, and widely separated. The form and separation of the subgenital

plate lobes differs enough to separate the species, in addition to the very complex internal structures that are evidently different between species, but difficult to interpret. The female of *Balbagathis janjezeki* sp. nov., is similar to *B. sylvatica*, but differs by having the subgenital plate lobes wider, separated by one lobe basal width (transversally measured), with their bases externally beginning in the apical third of the distance between the internal base of lobe and the anterior margin of the subgenital plate, whereas in *B. sylvatica* the lobes are slender, separated by 3–4 basal width of lobe (transversally measured), and with their bases externally beginning at middle of the distance between the internal base of lobe and the anterior margin of the subgenital plate.

Balbagathis sylvatica Quate, 1996

Balbagathis sylvatica Quate, 1996: 32 (female description). Type locality: Costa Rica, Heredia, Estación de Biología La Selva.

Balbagathis sylvatica: COLLANTES & MARTÍNEZ-ORTEGA (1999): 25 (Nicaragua records); QUATE & BROWN (2004): 66 (diagnosis); IBÁÑEZ-BERNAL (2008): 92 (Mexican record, description of male, male and female figures).

Material examined. MEXICO: VERACRUZ: Municipality of Misantla, Paso Blanco (19°51'55.8"N, 96°52'23.4"W, 600 m a.s.l.), 25.ii.2008, Jurisdicción Sanitaria IV, col. Malaise trap, 3 ♂♂ 1 ♀; 14.v.2008, Jurisdicción Sanitaria IV, col., CDC UV ligh trap, 5 ♂♂; 15.v.2008, Jurisdicción Sanitaria IV, col. Malaise trap, 6 ♂♂, same but with CDC UV ligh trap, 2 ♂♂ 1 ♀, Municipality of Atzalan, Plan de Arroyos (19°53'41"N, 97°06'30"W, 820 m a.s.l.), 16.v.2008, Jurisdicción sanitaria IV, col. Malaise trap, 7 ♂♂ 1 ♀; 2.ix.2008, Jurisdicción Sanitaria V, col. Malaise trap, 5 ♂♂, CDC UV ligh trap, 1 ♀. Municipality of Vega de Alatorre, E. Carranza (19°57'59.8"N, 96°36'39.8"W, 60 m a.s.l.), 13.v.2008, Jurisdicción Sanitaria IV, col. Malaise trap, 1 ♂. Municipality of Teocelo, Texin (19°22'0.2.2"N, 97°00'04.6"W, 1260 m a.s.l.), 12.ii.2008, Jurisdicción Sanitaria V, col., Malaise trap, 2 ♂♂; 13.v.2008, Jurisdicción Sanitaria V, col., Malaise trap, 1 ♂; same but 14.v.2008, 1 ♂. All specimens are deposited in the Psychodidae collection of Instituto de Ecología, A. C., Xalapa, Veracruz, Mexico.

Remarks. IBÁÑEZ-BERNAL (2008) erroneously indicated 1994, instead of 1996 as the date of description of *Balbagathis sylvatica*. In all specimens studied here, the hypandrium is apparently a very narrow plate, just as a band, and the posterior reinforcement projections are free and pointed.

Discussion

Balbagathis is placed in tribe Maruinini *sensu* DUCKHOUSE (1987, 1990) by the anterior plate-like gonocoxal condyles, basiphallus broad, and the branch pattern of wing veins. Nevertheless, antennal flagellomeres are not barrel-shaped or flask-shaped, being nodiform with excentric node and well defined internode, with flagellomere 1 very small and oval not retaining the fusiform condition, the last three flagellomeres are not reduced, at least the male of *B. janjezeki* present a pair of ascoids also in the apical flagellomere, being flagellomere 1 the only one which does not have ascoids, and the pseudospiracular opening is absent, differing by these respects of the tribal diagnosis of DUCKHOUSE (1987, 1990). In *Balbagathis janjezeki* sp. nov. the hypandrium is a transparent transverse oval plate with transversal preapical sclerotized reinforcements which normally produce branches posteriorly that are not free processes as found in other species; the reinforcement branches apparently support the hypandrial plate, whereas the apical branches reinforce the aedeagal

membrane in combination with the parameres. Interpretations and terminology of previous authors about male terminalia of *Balbagathis* are different and a revision examining the homology of these structures is needed.

Acknowledgements

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