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Seven new *Helicopsyche* (*Feropsyche*) Johanson, 2002 from the Neotropical region and Nearctic Mexico (Insecta: Trichoptera: Helicopsychidae)

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Abstract

Seven new species of *Helicopsyche* (*Feropsyche*) Johanson 2002 (Helicopsychidae) are described from Mexico (*H. curvipalpia* new species), Panama (*H. blantoni* new species, *H. chiriquensis* new species, *H. linguata* new species, and *H. sanblasensis* new species), and Brazil (*H. paprockii* new species and *H. cipoensis* new species) based on adult material borrowed from the National Museum of Natural History (Smithsonian Institution), Washington, D. C. and the Illinois Natural History Survey, Champaign, Illinois, USA. New records are given for *H. sinuata* Denning & Blickle from Mexico, and *H. incisa* Ross and *H. woldai* Johanson from Panama.

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Key words: Trichoptera, Helicopsychidae, *Helicopsyche*, *Feropsyche*, Panama, Brazil, Mexico, new species, taxonomy

Introduction

The New World *Helicopsyche* (Helicopsychidae) of the subgenus *Feropsyche* includes 92 previously described species (Flint & Sykora 2004, Johanson 2002, Johanson 2003a, b, Johanson & Holzenthal 2004). With the publication of this paper, 99 species are now known from the continent. The Neotropical representation of the *Helicopsyche* fauna is clearly divided into an Antillean fauna with 33 species, Mesoamerican fauna with 25 species (the new species included), and the slightly richer remaining mainland South American fauna with 41 species (the new species included). The richest fauna has been reported from Venezuela with 28 species recorded (Flint *et al.* 1999, Johanson & Holzenthal 2004), followed by Mexico with 18 recorded species (Flint *et al.* 1999). No species have been recorded from Bolivia and Uruguay. Only one species, the widespread *H. vergelana* Ross, has been recorded from Guyana, Belize, and Surinam.

Helicopsyche is currently represented by 18 Mexican species: *H. borealis* (Hagen), *H. curvipalpia*, new species, *H. dampfi* Ross, *H. incisa* Ross, *H. mexicana* Banks, *H. montana* Felber, *H. pietia* Denning, *H. piroa* Ross, *H. planata* Ross, *H. quadrosa* Ross, *H. selanderi* Ross, *H. sinuata* Denning & Blickle, *H. tapadas* Denning, *H. temora* Denning & Blickle, *H. truncata* Ross, *H. tuxtlensis* Bueno-Soria, *H. vergelana*, and *H. villegasi* Denning & Blickle. The Panamanian fauna includes 11 *Helicopsyche* species (Flint *et al*. 1999, Johanson 2003b): *H. blantoni*, new species, *H. borealis*, *H. chiriquensis*, new species, *H. fridae* Johanson, *H. incisa*, *H. linguata*, new species, *H. sanblasensis*, new species, *H. truncata*, *H. tuxtlensis*, *H. vergelana*, and *H. woldai* Johanson. The Brazilian *Helicopsyche* fauna is presently poorly known and includes only 10 recorded species: *H. braziliensis* (Swainson), *H. cipoensis*, new species, *H. flinti* Johanson, *H. helicoidella* (Vallot), *H. monda* Flint, *H. muelleri* Banks, *H. paprockii*, new species, *H. planorboides* Machado, *H. valligera* Flint, and *H. vergelana*. Two species, *H. braziliensis* and *H. helicoidella*, were described from larval cases, but no adults were found. These species might represent species described as adults under other names (Johanson 2002). In addition, *H. vergelana* was originally described from Mexico and subsequently recorded from Brazil by Flint *et al.* (1999). The Brazilian fauna is possibly richer than the available data indicate.

Material

This study is based on material consisting of 2 males and 22 females from the Illinois Natural History Survey, Champaign, USA (INHS) and 28 males and 3 females from the National Museum of Natural History, Smithsonian Institution, Washington, D. C., USA

(NMNH). Some paratype material has been deposited in the Swedish Museum of Natural History, Stockholm, Sweden (NRM). The depository information is included under the species descriptions below. Terminology applied to morphological features follows that of Johanson (2002). The antennal flagellum is described when unbroken.

Systematics

Helicopsyche (Feropsyche) curvipalpia, new species

Fig. 1, 3–8, 60

Helicopsyche curvipalpia is very similar to *H. borealis* but is distinguished by having a curved basal maxillary palp segment (Fig. 1, 2), no sternal process of the sternite VI, and more slender gonocoxites.

Male head. Cephalic warts oval, postantennal warts erect and club-shaped. Antennal scape as long as eye diameter, with 39 flagellomeres, each flagellomere with distal ring of setae. Distal segment of maxillary palp slightly shorter than proximal joint and scape, basal segment curved inward as in Fig. 1 (arrow) and separate from that in *H. borealis* (Fig. 2).

Male wings. Venation as in Fig. 3. Forewing golden brownish, length 7.4 mm; hind wing length 5.5 mm, with 30 hamuli.

Male abdomen and genitalia (Fig. 4–8). Sternal process absent on segment VI. Anterior lobe of segment IX (Fig. 4) ellipsoid in lateral view and oriented anteriad in middle; anterodorsal margin nearly straight, anteroventral margin concave; in dorsal view, inner margin uniformly ellipsoid (Fig. 5); in ventral view, with small central posterior process (Fig. 6); lateral apodeme forms nearly horizontal, straight line at dorsal half (Fig. 4), tapering anteriorly and fading before meeting anterior margin; sub-marginal line absent; tergal transverse and sternal transverse apodemes absent. Tergum X oriented posteroventrad in lateral view (Fig. 4), slightly curved upward at apex, apex pointed; lateral margins parallel in dorsal view (Fig. 5), apical part weakly notched, with about 23 pairs of megasetae in group starting at midlength on segment, the lateral and dorsal megasetae about equally long. Superior appendage club-shaped (Fig. 4). Primary branch of gonocoxite, lateral view (Fig. 4), generally club-shaped, narrowest immediately before midlength, with sharply undulate dorsal margin due to erect setal bases, apex produced posteriorly and weakly curved medially, narrowest part of primary branch about as wide as maximum height and width of tergum X (Figs. 4, 5); anterodorsal margin sigmoid, smooth, posteroventral margin with single small erect setal basis bases at midlength. Basimesal lobe hidden behind primary branch in lateral view (Fig. 4); in ventral view, lobe wide and pointed dorsally, edged and smooth (Fig. 6), with about 21 megasetae on dorsal surface. Basal plate in lateral view (Fig. 4) nearly straight, wide along its length; sharply triangular in ventral view (Fig. 6). Phallus proximally wide in lateral view (Fig. 7), bent

posteroventrally at 1/5 of its length and nearly straight at median half, apex about as broad as base; in ventral view (Fig. 8) phallic basis absent; endotheca weakly produced, posteroventral part well sclerotized; sperm channel divided and angled at 1/5 of its length into narrow posterior and anterior parts.

Holotype male: MEXICO: Chih. Hwy 127, 27.7 mi SW La Junta, 0.5 mi N Sierra Alta Tarahumara, 6900 ft, UV light, 7.vii.1986 [S. McCleve & P. Jump] (INHS, alcohol).

Paratypes: same data as holotype—17 females (INHS, alcohol), 1 male, 5 females (NRM, alcohol).

Distribution. Mexico (Chihuahua) (Fig. 60).

Etymology. *curvipalpia*, from Latin, *curvus* meaning curved and *palpus* meaning palp, derived from the shape of the basal segment of the maxillary palps.

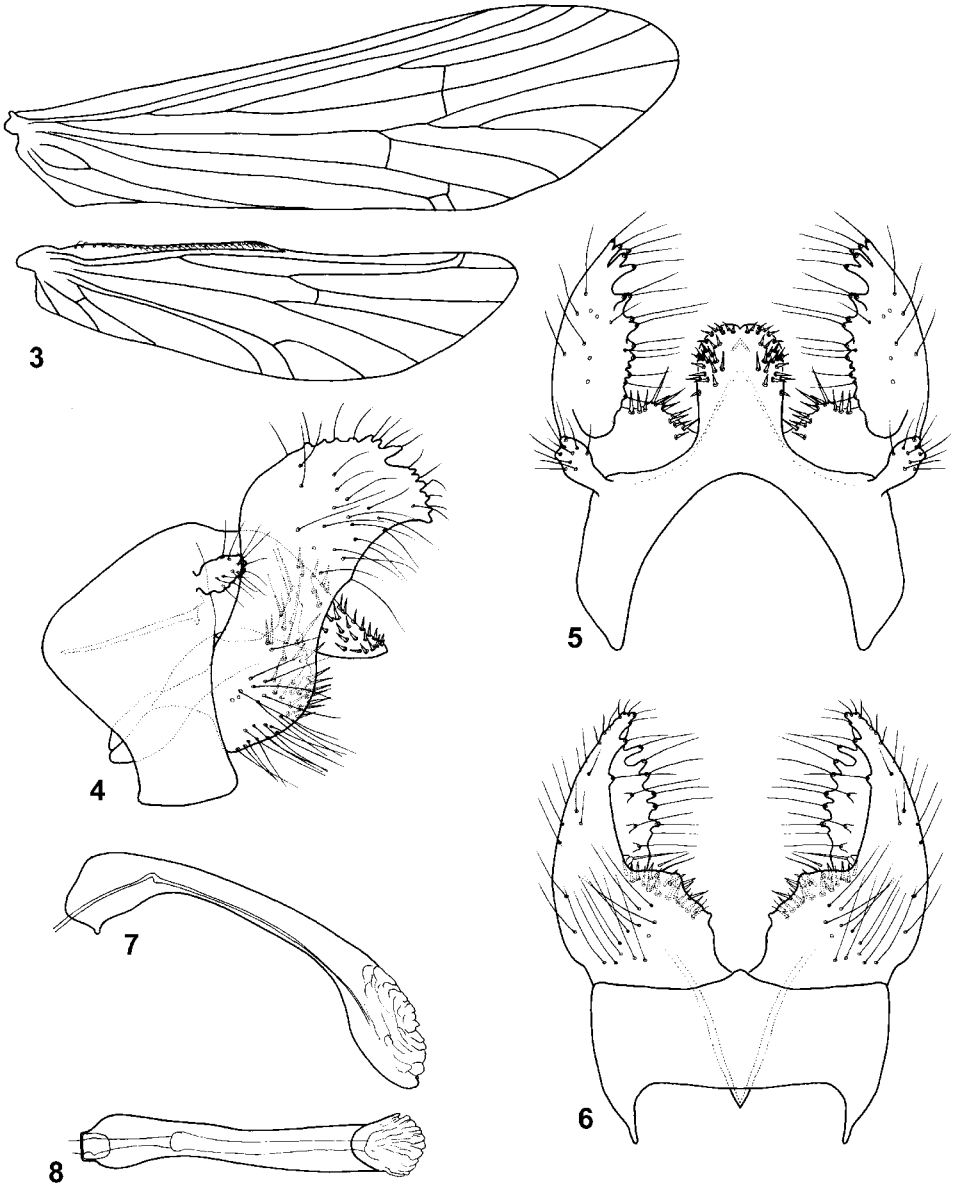
FIGURES 1–2. Head of 1—*Helicopsyche curvipalpia*, new species, holotype; 2—*Helicopsyche borealis* (Hagen), non-type. Arrow in Fig. 1 points at first segment of right maxillary palp. Scale bar 0.5 mm refers to both figures.

Helicopsyche (Feropsyche) blantoni, new species

Fig. 9–16, 61

Helicopsyche blantoni is unique among *Helicopsyche* by having a short segment IX; tergum X with only 8 pairs of megasetae; a short, broad basimesal lobe forming a flat plate with only 3 megasetae; and a thick phallus. With respect to the genitalia, especially the shape of the gonocoxite, *H. blantoni* is similar to *H. cubana* Kingsolver, *H. limnella* Ross,

H. breviterga Flint, *H. planata*, *H. valligera*, *H. molesta* Botosaneanu, *H. grenadensis* Flint & Sykora, *H. sucrensis* Johanson & Holzenthal, *H. disjuncta* Johanson & Holzenthal, and *H. paprockii*, new species. These species are all separated by genitalic characters as described in the remarks below.



FIGURES 3–8. *Helicopsyche curvipalpia*, new species, holotype. 3—right wings; 4—genitalia, lateral; 5—genitalia, dorsal; 6—genitalia, ventral; 7—phallus, lateral; 8—phallus, ventral.

Male head: Cephalic warts oval to almost circular, postantennal warts tubular, longer than scape width. Antenna with scape as long as eye diameter. Maxillary palp segments about equally long.

Male wings. Venation as in Fig. 9. Forewing grey brownish, length 3.6 mm; hind wing length 2.8 mm, with 21 hamuli.

Male abdomen and genitalia (Figs. 10–16). Sternal process of segment VI broken in both holotype and paratype (Fig. 10–11). In lateral view, segment IX (Fig. 12) with ellipsoid anterior lobe at middle, anterodorsal and anteroventral margins concave; in dorsal view (Fig. 13), with inner margin uniformly hyperboloid; in ventral view (Fig. 14) with central posterior process; in lateral view (Fig. 12), lateral apodeme forms nearly horizontal, straight line at middle, tapering anteriorly, fades and meets anterior margin; sub-marginal line present; tergal transverse apodeme absent; sternal transverse apodeme present along posterior margin. Tergum X (Fig. 12) oriented posteroventrad in lateral view, uniformly curved downward along its length, apex rounded; in dorsal view (Fig. 13), slightly narrowing distally, apical part weakly notched, with about 8 pairs of megasetae in dorsal group starting at midlength on segment, the lateral megasetae being about as long as the dorsal. Superior appendage (Fig. 12), club-shaped. Primary branch of gonocoxite, (Fig. 12) generally parallelogram-shaped in lateral view, narrowest immediately before midlength, dorsal margin slightly undulate, apex produced posteriorly, narrowest part of primary branch much wider than maximum height of tergum X and narrower than maximum width of tergum X (Fig. 12, 13); anterodorsal margin nearly straight, smooth; posteroventral margin slightly undulate. Basimesal lobe hidden between primary branches in lateral view (Fig. 12), wide, pointed posteriorly, slightly pointed in ventral view (Fig. 14); with 3 dorsally oriented megasetae on dorsal surface. Basal plate in lateral view (Fig. 12) nearly straight and tapering anteriorly; in ventral view (Fig. 14) wide along its length, apex rounded. Phallus in lateral view (Fig. 15) very thick and slightly curving posteroventrally along its length; apex nearly twice as broad as base in ventral view (Fig. 16). Phallic basis minute. Endotheca weakly produced, posteroventral surface well sclerotized. Sperm channel divided and angled outside phallus into thick posterior and narrow anterior parts.

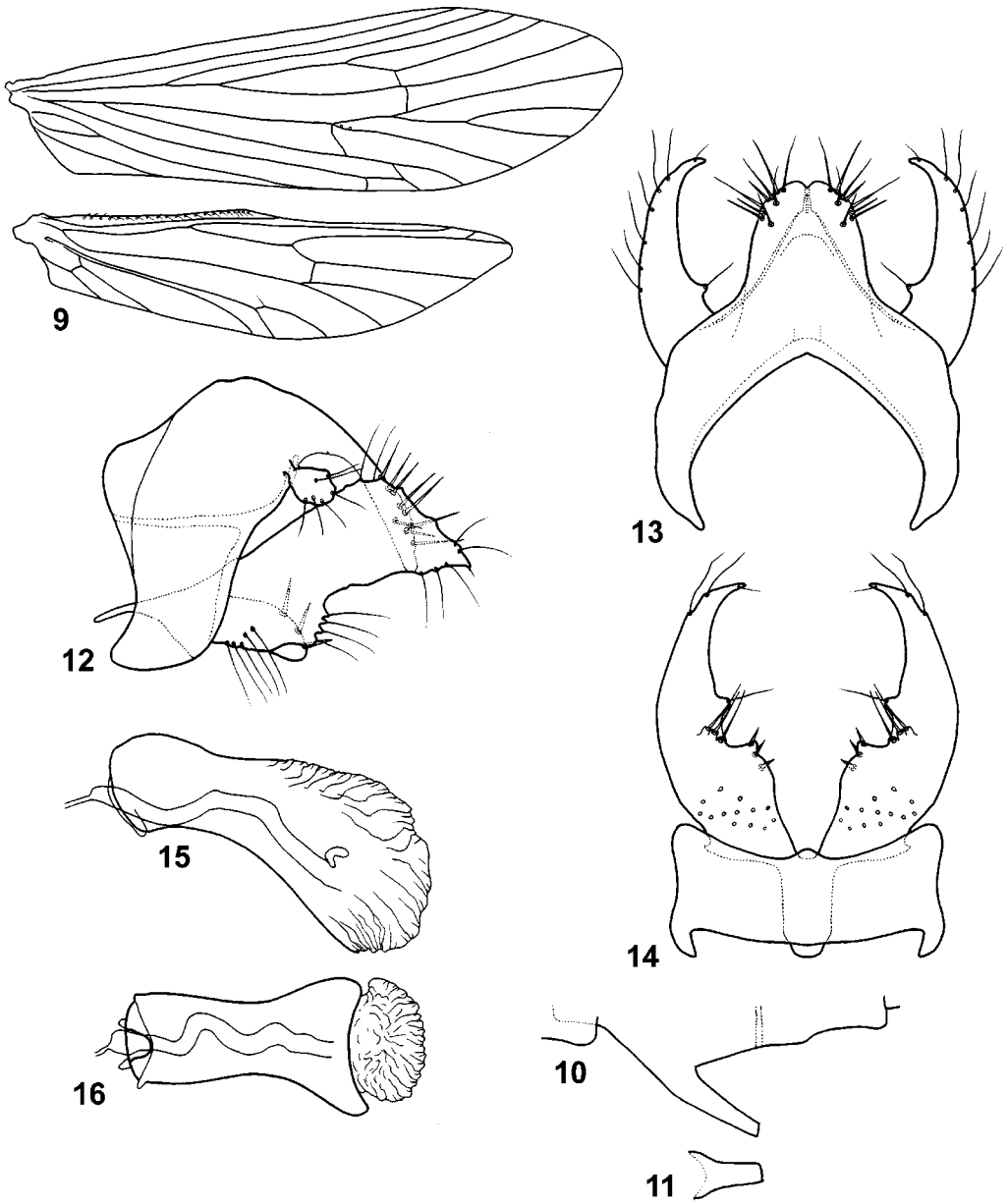
Holotype male: PANAMA: Cerro Campana: R. Panama, vii.1967, light trap [F. S. Blanton] (NMNH, alcohol).

Paratypes: Panama: Chiriqui: Fortuna Dam Site, nr. Hornitos, 1050 m , 8°55’N, 82°16’W, 20.ix–21.xi.1978, LT trap [H. Wolda] — 1 male (NMNH, in alcohol); ditto, except 10.i–20.ii.1979 — 1 male (NRM, alcohol).

Distribution: Panama (Cerro Campana and Chiriqui) (Fig. 61).

Etymology: *blantoni*, derived from the name of the collector of the holotype (F. S. Blanton).

Remarks: *Helicopsyche cubana* is distinguished from *H. lantoni* by its longer segment IX, 17 pairs of megasetae on tergum X, 14 megasetae on the posteriorly oriented basimesal lobe of the gonocoxite, and a more slender phallus. *Helicopsyche limnella* is distinguished by the presence of only about 12 pairs of megasetae on tergum X and 5



FIGURES 9–16. *Helicopsyche blantoni*, new species, holotype. 9—right wings; 10—VIth sternal process, lateral; 11—VIth sternal process, ventral; 12—genitalia, lateral; 13—genitalia, dorsal; 14—genitalia, ventral; 15—phallus, lateral; 16—phallus, ventral.

megasetae on a weakly posteriorly produced basimesal lobe, a strongly pointed basal plate, and a more slender phallus. *Helicopsyche breviterga* has 12 pairs of megasetae on tergum X, 9 pairs of megasetae on the basimesal lobe of the gonocoxite, a basal plate being anteriorly needle-shaped, a phallus that is narrowing apically in ventral view (in *H. blantoni* it becomes wider). In *H. planata* the anterior lobe of segment IX is located at the

dorsal half, it has a broad row of about 14 megasetae on tergum X and 11 megasetae on the slightly more posteriorly produced basimesal lobe, and a more slender phallus. *Helicopsyche valligera* has a slightly ventrally pointed anterior lobe (oriented anteriorly in *blantoni*), a row of about 11 megasetae on tergum X and many short megasetae along the inner margin of the basimesal lobe, and a more slender phallus. In *H. molesta* the anterior lobe of segment IX is located on the dorsal half, about 21 megasetae tergum X form a apicolateral group of short setae and a dorsal row nearly reaching the basis of the superior appendage, the slightly produced basimesal lobe includes about 20 megasetae, the basal plate is sharply pointed, and the phallus is more slender. *Helicopsyche grenadensis* has a truncate tergum X with a pair of distinct lateral rows of dorsal megasetae, a gonocoxite that is basally more slender and has a posteroventral margin with 3 distinct expansions associated with stout setae, and a more slender phallus. In *H. sucrensis* tergum X is thicker and has a truncate apex, the posterodorsal corner of the gonocoxite primary branch is longer and more produced, and the gonocoxite basimesal lobe has about 7 stout megasetae. *Helicopsyche disjuncta* has a thicker and more dorsally curving tergum X with a wide apical rectangular notch, a more triangular primary branch of gonocoxite, and a cone-shaped basimesal lobe of the gonocoxite. In *H. paprockii* the anterior lobe of segment IX is located at the ventral half, the gonocoxite is distally broader, the basal plate is anteriorly more slender, the megasetae of tergum X are oriented into a pair of marginal rows, the megasetae on the basimesal lobe are absent, and the phallus is more slender.

***Helicopsyche (Feropsyche) chiriquensis*, new species**
Fig. 17–25, 61

Helicopsyche chiriquensis is unique in having a relatively short Dc vein of the forewing, a very long and straight dorsal margin of segment IX, a half circle-shaped primary branch of gonocoxite in lateral view, 2 spines present apically on the primary branch of gonocoxite, and a short basimesal lobe of gonocoxite without megasetae. With respect to the genitalia, especially the shape of the gonocoxite, *H. chiriquensis* is very similar to *H. paralimnella* Hamilton, *H. umbonata* Hagen, *H. ochthephila* Flint, *H. propinqua* Botosaneanu & Flint, *H. tuxtlensis*, *H. planata*, *H. paucispina* Botosaneanu & Flint, *H. neblinensis* Johanson & Holzenthal, *H. lara* Johanson & Holzenthal, and *H. cipoensis*, new species, but it is separated by genitalic characters listed in the remarks below.

Male head. Cephalic warts oval, postantennal warts wart-like and small. Antenna with scape as long as eye diameter and maxillary palp segments.

Male wings. Venation as in Fig. 17 (holotype) and Fig. 18 (forewing of male paratype). Forewing grey brownish, length 3.8 mm; hind wing length 2.8 mm, with 21 hamuli.

Male abdomen and genitalia (Fig. 19–25). Sternal process VI (Fig. 19–20) about half as long as its segment length (Fig. 19–20), nearly straight in lateral view (Fig. 19), oriented posteroventrally and tuboid along its length, apex rounded and divided into lamellae (Fig.

20). Segment IX with anterior lobe hyperboloid in lateral view (Fig. 21), slightly oriented ventrad at middle, anterodorsal margin about as long as gonocoxite and nearly straight, anteroventral margin short and concave; in dorsal view (Fig. 22) with inner margin uniformly hyperboloid; in ventral view (Fig. 23) with central posterior process. In lateral view (Fig. 21), lateral apodeme oriented anteroventrally, nearly straight line at middle, tapering anteriorly, fades and meets anterior margin; sub-marginal line present; tergal and sternal transverse apodemes absent. Tergum X in lateral view oriented posteroventrad (Fig. 21), nearly straight along its length, apex truncate; in dorsal view, about equally wide along its length (Fig. 22), apical notch wide and shallow, with about 10 pairs of megasetae in dorsal line starting at anterior half of segment, and 3 pairs of megasetae in lateral line near apex; length of lateral and dorsal megasetae approximately equal. Superior appendage weakly club-shaped (Fig. 21). Primary branch of gonocoxite in lateral view generally half-circle shaped (Fig. 21), narrowest at base, with undulate dorsal margin resulting from produced setal bases; apex rounded posteriorly, with two stout megasetae, narrowest part of primary branch about as wide as maximum height of tergum X and narrower than width of tergum X (Figs. 21, 22); anterodorsal margin slightly convex, smooth, posteroventral margin long, nearly straight; basimesal lobe small, not protruding posterior of primary branch in lateral view (Fig. 21), without megasetae (Fig. 21, 23). Basal plate in lateral view (Fig. 21) nearly straight, tapering anteriorly; sharply triangular in ventral view (Fig. 23), with narrowly rounded anterior apex. Phallus in lateral view gently curved ventrally along its length (Fig. 24), equally wide along its length except slightly wider at base; in ventral view (Fig. 25), phallic basis well developed and forming a circular structure. Endotheca not produced, posteroventral part weakly sclerotized. Sperm channel divided inside phallus into thick posterior and narrow anterior parts.

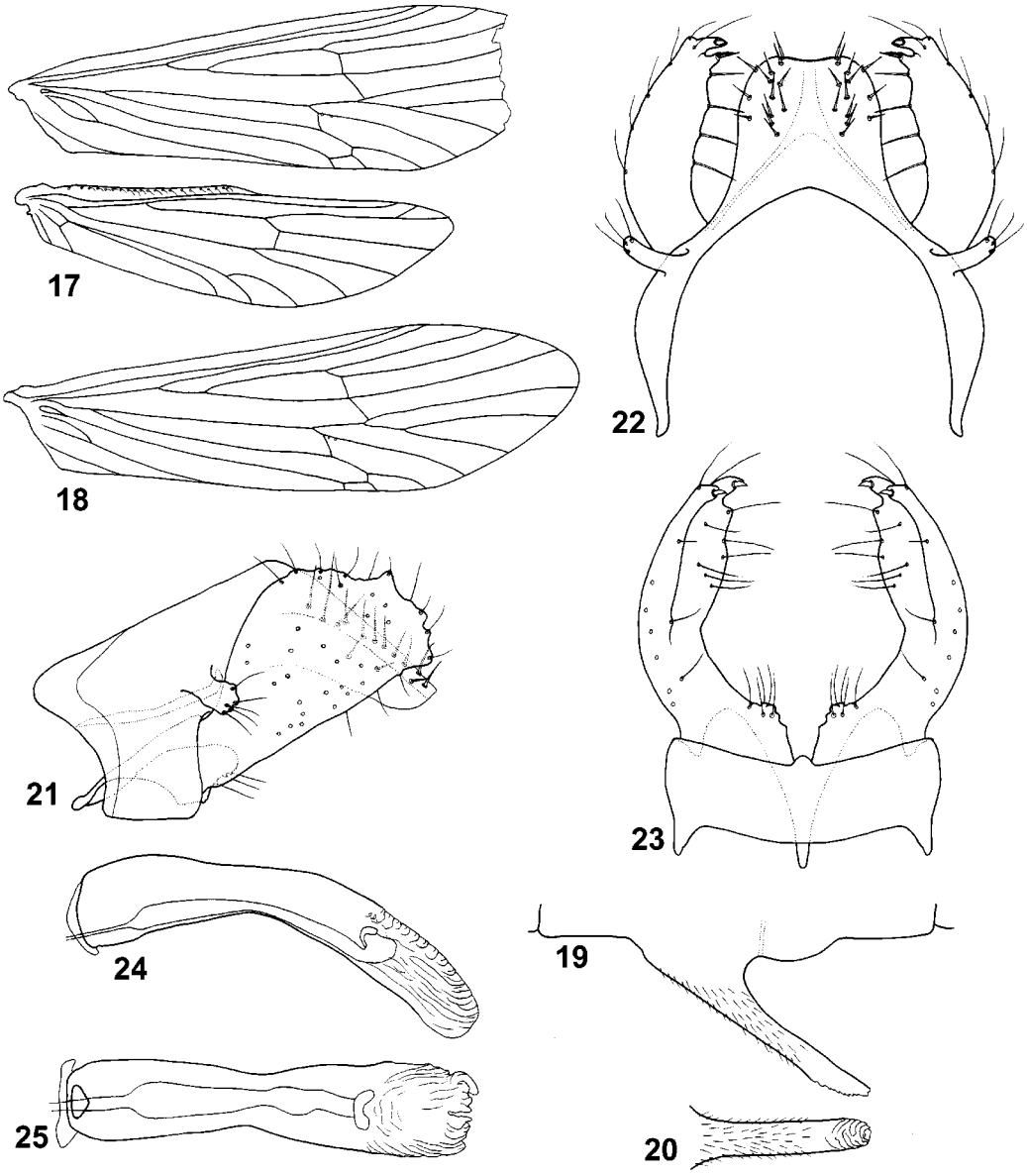
Holotype male: PANAMA: Chiriqui: Fortuna Dam Site, nr. Hornitos, 1050 m, 8°55’N, 82°16’W, 20.ix–21.xi.1978, LT trap [H. Wolda] (NMNH, alcohol).

Paratypes: same data as holotype — 1 male; ditto, except 2–15.v.1979 — 1 male, 2 males; ditto, except 19.x–1.xi.1977 — 1 female; ditto, except 18.v–7.vi.1977 — 2 males; ditto, except 24.viii–6.ix.1977 — 2 males, 1 female; ditto, except 19.x-1.xi.1977 — 2 males, 1 female (NRM, alcohol).

Distribution: Panama (Chiriqui) (Fig. 61).

Etymology: *chiriquensis*, derived from the Panaman province Chiriqui, the type locality of the species.

Remarks: *Helicopsyche chiriquensis* is separated from *H. paralimnella* by having sternal process VI with lamellate apex (spinose in *H. paralimnella*), a longer anterodorsal margin of segment IX, a more rounded apex of gonocoxite primary branch, the basimesal lobe not produced posteriorly and lacking megasetae, and an anteriorly pointed basal plate (rounded in *H. paralimnella*). It is distinguished from *H. umbonata* by having a posteroventral orientation of sternal process VI (ventrally in *H. umbonata*), a much longer anterodorsal margin of segment IX, an anteriorly oriented anterior lobe of segment



FIGURES 17–25. *Helicopsyche chiriquensis*, new species, holotype (except Fig. 18 from paratype). 17—right wings; 18—right forewing; 19—VIth sternal process, lateral; 20—VIth sternal process, ventral; 21—genitalia, lateral; 22—genitalia, dorsal; 23—genitalia, ventral; 24—phallus, lateral; 25—phallus, ventral.

IX, a shorter anteroventral margin of segment IX, a less setose tergum X, a more weakly developed basimesal lobe without megasetae, and a more slender phallus. It is separated from *H. ochthephila* by the absence of a brush of long setae at the basal segment of the maxillary palp, a shorter wing length (forewing 4.4 mm in *H. ochthephila*), a much shorter anteroventral margin of segment X, a much longer and straight anterodorsal margin of

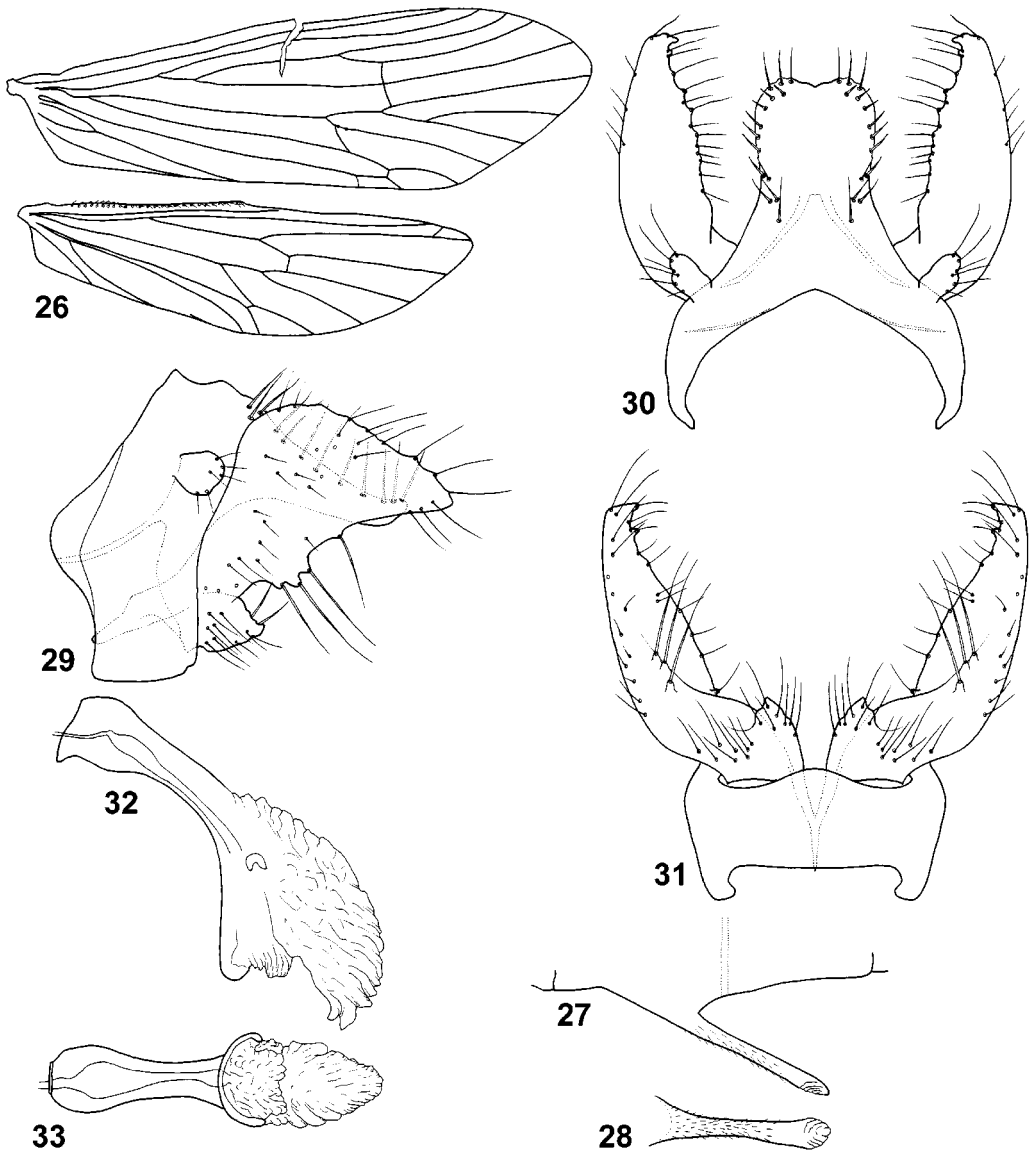
segment IX, absence of dorsal setae on tergite IX and basally on segment X, a short basimesal lobe without megasetae, and a more uniformly thick phallus. *Helicopsyche propinqua* also lacks the megasetae on its weakly developed basimesal lobe but has a much shorter anterodorsal margin of segment IX, and lacks the sternal process VI. *Helicopsyche chiriquensis* is separated from *H. tuxtlensis* by the absence of the prominent postantennal and cephalic warts on the head, narrower hyperboloid anterior lobe of segment IX, longer and straight anterodorsal margin of segment IX, a poorly developed basimesal lobe, and no megasetae present on the basimesal lobe. The larger *H. planata* (forewing length 4.8 mm) is separated also by having relatively longer forewing Dc, a spinose apex of the sternal process VI, a shorter segment IX having an anterior lobe located dorsally and with a convex anterodorsal margin, a less rounded dorsal margin of the gonocoxite primary branch, and a megaseta present on the basimesal lobe. In *H. paucispina* the sternal process VI is shorter and more horizontally oriented, tergum X is narrower in dorsal view, the primary branch of the gonocoxite is more produced apically, and the basimesal lobe has 2 minute megasetae. In *H. neblinensis*, the sternal process VI is more slender, segment IX has a shallowly concave anterodorsal and anteroventral margin, tergum X has 5 pairs of short megasetae, the gonocoxite primary branch is more triangular, and the basimesal lobe is produced posteriad and bears many megasetae. The larger *H. lara* (forewing length 5.1–5.4 mm) is also separated by having a horizontally oriented sternal process VI, shorter anterodorsal margin of segment IX, the more densely setose tergum X, a triangular primary branch of the gonocoxite, and the posteriorly produced basimesal lobes bearing many, minute megasetae. *Helicopsyche chiriquensis* is separated from *H. cipoensis* by having a longer anterodorsal margin of segment IX, a shorter row of megasetae on tergum X, and no prominently produced basimesal lobe.

***Helicopsyche (Feropsyche) paprockii*, new species**
Fig. 26–33, 62

Helicopsyche paprockii is unique by having a short segment IX, a slightly upward curving tergum X with a pair of megasetae rows along the lateral margins, and a short triangular basimesal lobe without megasetae. With respect to genitalia, especially the shape of the gonocoxite, *H. paprockii* is very similar to *H. cubana*, *H. limnella*, *H. planata*, *H. lambda* Flint, *H. incisa*, *H. flinti*, and *H. blantoni*, new species, but is separated by other genitalic characters further described in the remarks below.

Male head. Cephalic warts oval; postantennal warts tuboid, slightly longer than scape width. Antenna with scape as long as eye diameter and maxillary palp segments; antenna with 40 flagellomeres but no distal setae ring.

Male wings. Venation as in Fig. 26 (forewing is slightly damaged). Fore wing grey brownish, length 4.3 mm; hind wing length 3.4 mm, with 27 hamuli.



FIGURES 26–33. *Helicopsyche paprockii*, new species, holotype. 26—right wings; 27—VIth sternal process, lateral; 28—VIth sternal process, ventral; 29—genitalia, lateral; 30—genitalia, dorsal; 31—genitalia, ventral; 32—phallus, lateral; 33—phallus, ventral.

Male abdomen and genitalia (Fig. 27–33). Sternal process VI about half as long as its segment length (Fig. 27–28), straight in lateral view (Fig. 27), oriented posteroventrally, slightly narrowing towards middle, apex rounded, and divided into lamellae (Fig. 28). Anterior lobe of segment IX ellipsoid in lateral view (Fig. 29), oriented anteriad and slightly ventrally, anterodorsal margin slightly concave and longer than the concave anteroventral margin; in dorsal view (Fig. 30) inner margin uniformly hyperboloid; in ventral view (Fig. 31) central posterior process wide and posteriorly rounded. In lateral

view (Fig. 29), lateral apodeme oriented anteroventrally, slightly curving, equally wide along its length, uniformly strong toward anterior margin; sub-marginal line present; tergal transverse apodeme absent; sternal transverse apodemes weak. Tergum X oriented posteroventrad in lateral view (Fig. 29), curving slightly upward toward apex, apex rounded; in dorsal view (Fig. 30) about equally wide along its length, apical notch wide and shallow, with about 14 pairs of equally long megasetae in marginal line starting at anterior base of segment. Superior appendage short, thick, weakly club-shaped (Fig. 29). Primary branch of gonocoxite generally triangular in lateral view (Fig. 29), narrowest at base, dorsal margin weakly undulate; apex triangular and pointing posteriorly, narrowest part of primary branch about as wide as maximum height of tergum X and about half the tergum X width (Figs. 29, 30); anterodorsal margin nearly straight, smooth; posteroventral margin irregular with central group of 3 produced setal bases. Basimesal lobe small, without megasetae, produced in lateral view, triangular in lateral and ventral view, with divergent, curving median margins (Figs. 29, 31). Basal plate nearly straight in lateral view (Fig. 29), posterior half thick, anterior half tapering; sharply triangular in ventral view (Fig. 31) with needle-shaped apex. In lateral view (Fig. 32), ventral margin of phallus gently curved along its length; in lateral and ventral view (Fig. 32, 33) basal part nearly 2x thicker than narrowest central region. Phallic bases absent. Endotheca strongly produced, posteroventral part heavily sclerotized. Sperm channel divided inside phallus into thick posterior and narrow anterior part.

Holotype male: Brazil: Minas Gerais: Serra do Cipo, 28.ix.1994 [H. Paprocki] (NMNH, alcohol).

Distribution: Brazil (Minas Gerais) (Fig. 62).

Etymology: *paprockii*, derived from the name of the collector of the holotype (H. Paprocki).

Remarks: The gonocoxite primary branch of *H. paprockii* is similar to that of *H. cubana*, but *H. cubana* has a longer segment IX with dorsal anterior lobe, megasetae on tergum X arranged in a central row, and produced tuboid basimesal branches of gonocoxite having apical megasetae. Both *H. limnella* and *H. planata* are distinguished by their dorsally located anterior lobe of segment IX, a very long tergum X, a less sharply triangular primary branch of the gonocoxite, and a more triangular-shaped basal plate.

In *H. lambda* the sternal process VI is slightly curved more posteriorly and has a spinose apex, the primary branch of the gonocoxite is less triangular and has a deeper concave anterodorsal margin, the basimesal lobe is more strongly produced posteriorly in lateral view and bears about 4 long megasetae. *Helicopsyche paprockii* is separated from *H. incisa* by having a sternal process VI with lamellate apex (spinose in *H. incisa*), a ventrally located anterior lobe on segment IX, a concave tergum X bearing marginal megasetae in 2 rows, a more triangular basimesal lobe in lateral view, a longer basal plate, and a longer, more slender and evenly curved phallus. *Helicopsyche paprockii* is distinguished from *H. flinti* by the lamellate apex of the sternal process VI, the more

rounded anterior lobe of segment IX, the primary branch of the gonocoxite being more broadly pointed at apex and the presence of 3 produced setal bases at the posteroventral margin, and in lateral view the longer basimesal lobe. *Helicopsyche paprockii* is distinguished from *H. blantoni* by the anterior lobe of segment IX being located ventrally, the higher number of megasetae on tergum X, the primary branch of the gonocoxite with longer dorsal margin, the longer basimesal lobe without megasetae, and the slender phallus.

***Helicopsyche (Feropsyche) linguata*, new species**
Fig. 34–43, 61

Helicopsyche linguata, new species is unique in having a pair of very large bean- and tongue- shaped postantennal setal warts, elevated cephalic setal warts, a very short segment IX, a short and tapering tergum X, a sickle-shaped primary branch of the gonocoxite that is apically hooked medially, a long and almost straight inner margin of the basal part of the gonocoxite, a wide triangular basal plate, and a weakly curved phallus. With respect to the genitalia, especially the shape of the gonocoxite, *H. linguata* is very similar to *H. hageni* Banks, *H. guadeloupensis* Malicky, *H. molesta*, *H. rentzi* Denning & Blickle, and *H. linabena* Johanson & Holzenthal, but it is separated by other genitalic characters as described in the remarks below.

Male head (Fig. 34–35). Cephalic warts elevated, slightly shorter than eye radius, anteriorly straight and posteriorly rounded. Postantennal warts large, bean-shaped, and slightly elevated. Antenna with scape slightly longer than eye diameter. Maxillary and labial palps broken.

Male wings. Venation as in Fig. 36 (damaged right forewing). Fore wing grey brownish, length 4.2 mm; hind wing length 3.1 mm; number of hamuli not counted.

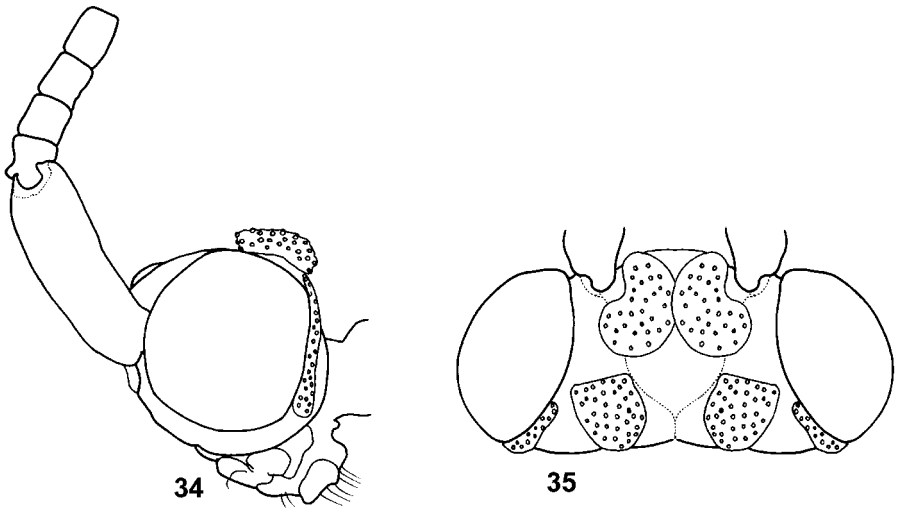
Male abdomen and genitalia (Fig. 37–43). Sternal process VI about half as long as its segment length; straight in lateral view (Fig. 37), oriented posteroventrally and tuboid along its length, with apex rounded and divided into lamellae (Fig. 38). Segment IX with anterior lobe shallowly ellipsoid in lateral view (Fig. 39), oriented anterodorsad and situated slightly dorsally on segment; anterodorsal margin slightly concave and shorter than anteroventral margin; inner margin narrowly ellipsoid in dorsal view (Fig. 40); central posterior process absent in ventral view (Fig. 41). Lateral apodeme oriented slightly anterodorsally in lateral view (Fig. 39), straight, equally wide along its length, meeting anterior margin; sub-marginal line absent; tergal transverse apodeme absent; sternal transverse apodemes weak. Tergum X oriented posteroventrad in lateral view (Fig. 39), curving slightly downwards towards wide apex; narrowing along its length in dorsal view (Fig. 40); apical notch small and shallow, with about 7 pairs of dorsal megasetae of differing length in central group. Superior appendage thick and weakly club-shaped in lateral view (Fig. 39). Primary branch of gonocoxite generally sickle-shaped in lateral

view (Fig. 39), narrowest at base; dorsal margin weakly undulating, apex strongly hooked inward and pointing anteriorly, narrowest part of primary branch narrower than maximum height of tergum X and about as wide as tergum X width (Fig. 39, 40); anterodorsal margin convex, nearly smooth; posteroventral margin concave along its length, without prominent undulations. Basimesal lobe small, protruding beyond edge of primary branch in lateral view and apically rounded in lateral and ventral view (Fig. 39, 41); median margins basally parallel, with convergent apices with about 14 megasetae (Fig. 41). Basal plate basally wide in lateral view (Fig. 39), strongly narrowing at midlength, with anterior half slender and slightly upturned (Fig. 39); wide, triangular with rounded apex in ventral view (Fig. 41). Ventral margin of phallus gently curved along its length in lateral view (Fig. 42); basal part slightly thicker than central region in lateral and ventral view (Fig. 42, 43). Phallic basis absent. Endotheca not produced, posteroventral part weakly sclerotized. Sperm channel division not observed.

Holotype male: PANAMA: Chiriqui: Fortuna Dam Site, nr. Hornitos, 1050 m, 8°55'N, 82°16'W, 13–19.vii.1977, LT trap [H. Wolda] (NMNH, alcohol).

Distribution: Panama (Chiriqui) (Fig. 61).

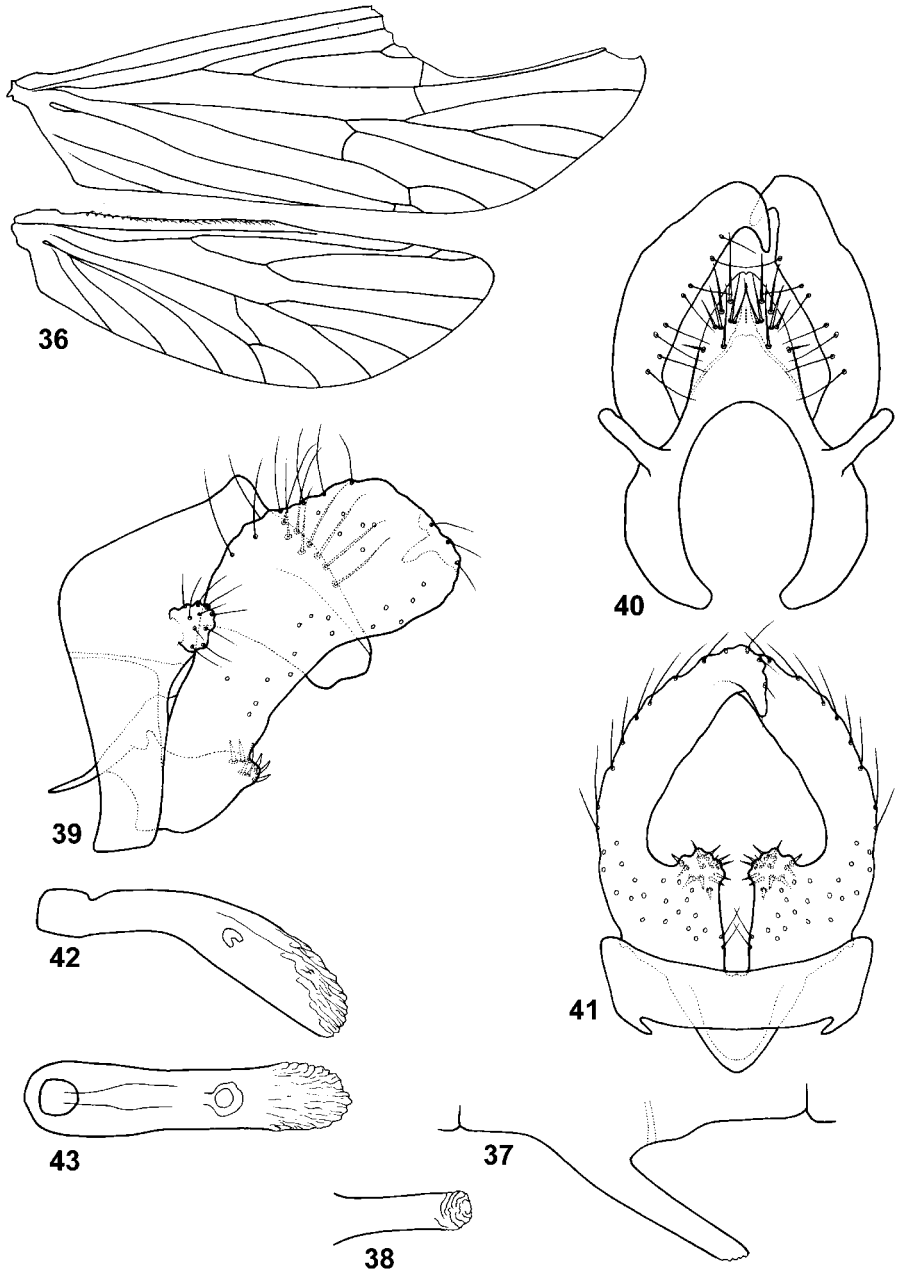
Etymology: *linguata*, derived from Latin *lingua*, tongue, referring to the bean- and tongue-shaped postantennal setal warts.



FIGURES 34–35. *Helicopsyche linguata*, new species, holotype. 34—head, lateral; 35—head, dorsal.

Remarks: In genitalia, *H. linguata*, new species is separated from *H. hageni* by the significantly shorter segment IX, the tapering tergum X, the hooked apex of the primary gonocoxite branch, and more weakly curved phallus. It is distinguished from *H. guadeloupensis* and *H. molesta* by the shorter segment IX, tergum X, and basimesal lobes, as well as the presence of a hooked gonocoxite apex. *Helicopsyche linguata* also has longer sternal process VI than in *molesta*. *Helicopsyche linabena* is very similar to *H.*

linguata, but *H. linguata* can be distinguished by having a hooked apex of the primary branch of the gonocoxite, a tapering tergum X, and the longer and parallel median margins of the basal part of the gonocoxites. Similar setal warts are also found on the head of *H. tuxtlensis* and *H. rentzi*, but in *H. linguata* the setal warts are less produced than in *H. tuxtlensis* and more produced than in *H. rentzi*.



FIGURES 36–43. *Helicopsyche linguata*, new species, holotype. 36—right wings; 37—VIth sternal process, lateral; 38—VIth sternal process, ventral; 39—genitalia, lateral; 40—genitalia, dorsal; 41—genitalia, ventral; 42—phallus, lateral; 43—phallus, ventral.

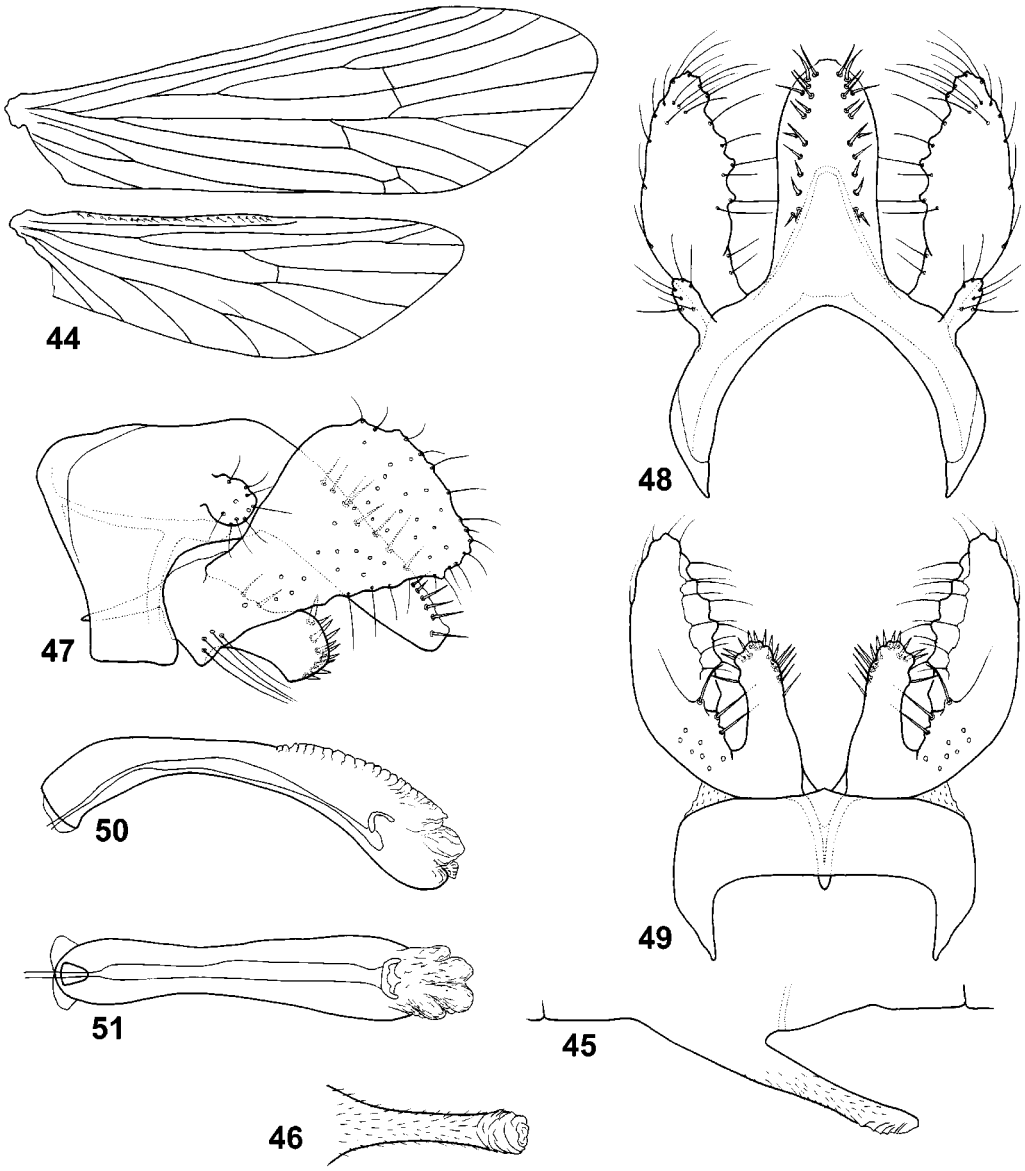
***Helicopsyche (Feropsyche) cipoensis*, new species**
Fig. 44–51, 62

Helicopsyche cipoensis, new species is unique by having the anterior lobe on segment IX located dorsally, a long and mostly parallel-sided tergum X, a nearly triangular primary branch of the gonocoxite, and long basimesal lobes with apical megasetae. With respect to the genitalia, particularly the shape of the gonocoxite, *H. cipoensis* is very similar to *H. sigillata* Botosaneanu & Flint, *H. mexicana*, *H. turbida* Navas, *H. centrocubana* Botosaneanu & Flint, *H. quadrosa*, *H. propinqua*, *H. planata*, *H. villegasi*, *H. neblinensis*, and *H. lara*, but is separated by other genital characters as expressed in the remarks below.

Male head. Cephalic warts oval and flat. Postantennal setal warts tuboid, slightly longer than the scape width. Antennal scape about as long as maxillary palp segments and eye diameter.

Male wings. Venation as in Fig. 44. Forewing brownish-grey, length 5.1 mm; hind wing length 3.8 mm, with 21 hamuli.

Male abdomen and genitalia (Fig. 45–51). Sternal process VI about half as long as segment VI (Fig. 45–46), straight in lateral view and oriented posteroventrally; tuboid along its length except slightly narrowing toward central part, with apex rounded and divided into lamellae (Fig. 46). Segment IX with anterior lobe hyperboloid in lateral view (Fig. 47) and oriented anterodorsally on segment; anterodorsal margin weakly undulating, about as long as slightly concave anteroventral margin; in dorsal view with inner margin ellipsoid (Fig. 48); in ventral view with minute central posterior process (Fig. 49). Lateral apodeme curving slightly anterodorsally in lateral view (Fig. 47) and slightly tapering, complete at anterior margin; sub-marginal line present; tergal transverse apodeme absent; sternal transverse apodemes present. Tergum X oriented posteroventrad in lateral view (Fig. 47), nearly straight, with wide somewhat truncate apex; parallel-sided along its length in dorsal view (Fig. 48) except narrowing near apex; apex with approximately 14 pairs of megasetae of equal length in longitudinal rows. Superior appendage thick and slightly club-shaped in lateral view (Fig. 47). Primary branch of gonocoxite generally triangular in lateral view (Fig. 47), narrowest at base, with rounded corners and weakly undulate margins except along anterodorsal margin; apex rounded, with narrowest part of primary branch as wide as height of tergum X and slightly narrower than tergum X width (Fig. 47, 48); anterodorsal margin nearly straight, posteroventral margin shallowly concave along its length. Basimesal lobe broad and apically rounded in lateral view (Fig. 47); apex rounded in ventral view, median margins basally diverging (Fig. 49) with about 15 megasetae, some along median margin. Basal plate nearly straight in lateral view (Fig. 47) and narrow along its length in ventral view, tapering apically (Fig. 49). Ventral margin of phallus gently curved along its length in lateral view (Fig. 50); basal part slightly thicker than central region in lateral and ventral view (Fig. 50, 51). Phallic basis present. E ndotheca slightly produced, posteroventral part weakly sclerotized. Sperm channel divides inside phallus into slender anterior part and thicker posterior part (Fig. 51).



FIGURES 44–51. *Helicopsyche cipoensis*, new species, holotype. 44—right wings; 45—VIth sternal process, lateral; 46—VIth sternal process, ventral; 47—genitalia, lateral; 48—genitalia, dorsal; 49—genitalia, ventral; 50—phallus, lateral; 51—phallus, ventral.

Holotype male: BRAZIL: Minas Gerais: Serra do Cipo, 28.ix.1994 [H. Paprocki] (NMNH, alcohol).

Distribution: Brazil (Minas Gerais) (Fig. 62).

Etymology: *cipoensis*, derived from the type locality of the species, Serra do Cipo.

Remarks: *Helicopsyche cipoensis* is distinguished from *H. sigillata* by the absence of long sensillae on the 1st maxillary palp segment and on the radial area of the forewing, and from *H. planata* by the absence of long sensillae on the scape. In the genitalia, *H.*

cipoensis is distinguished from *H. mexicana*, *H. centrocubana*, *H. planata*, *H. villegasi* and *H. turbida* by having a relatively narrower basis of the primary branch of the gonocoxite and presence of very prominent basimesal lobes. *Helicopsyche mexicana* and *H. turbida* also have an anterior lobe of segment IX is present medially, and tergum X is shorter and bears shorter megasetae. *Helicopsyche cipoensis* is separated from *H. centrocubana* by the apically narrowing tergum X; from *H. quadrosa* by the cone-shaped basimesal lobes and tergum X megasetae of various length; from *H. propinqua* by the dorsally located anterior lobe of segment IX, the absence of a sternal process VI, and the shape of the basimesal lobes; from *H. neblinensis* and *H. lara* by the more posteroventrally oriented sternal process VI and the longer basimesal lobes; and from *H. chiriquensis* by the shorter anterodorsal margin of segment IX, the longer tergum X, and the presence of prominent basimesal lobes.

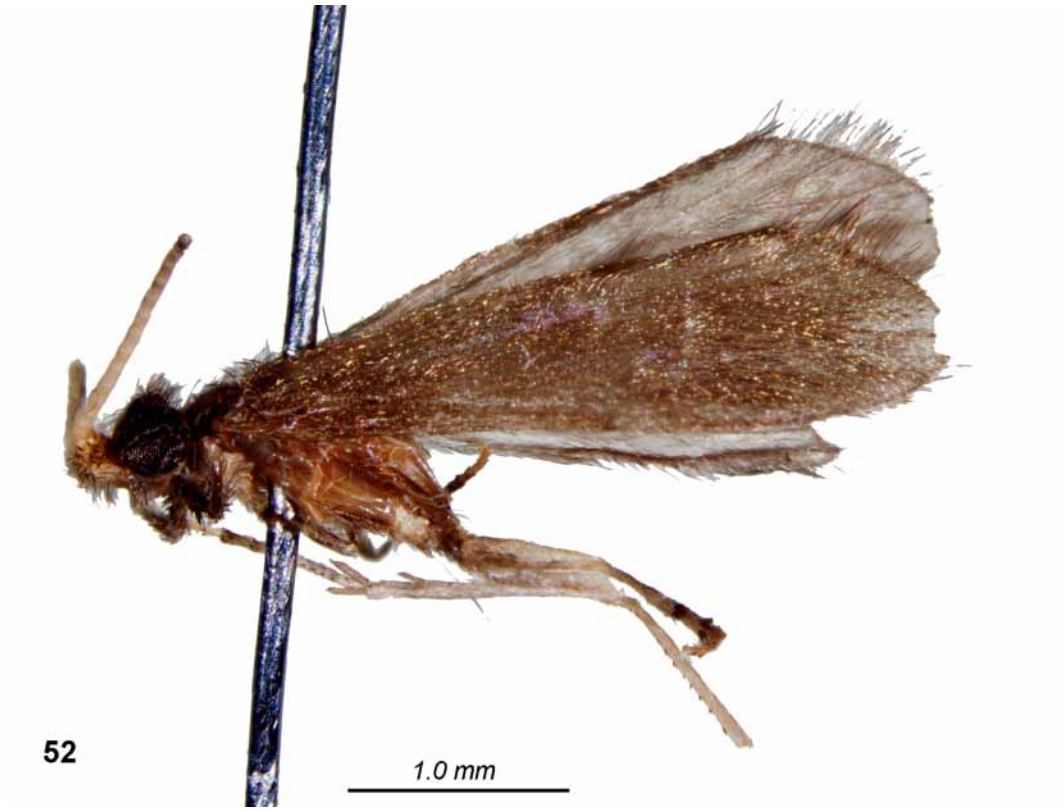


FIGURE 52. *Helicopsyche sanblasensis*, new species, holotype. 52—habitus, lateral.

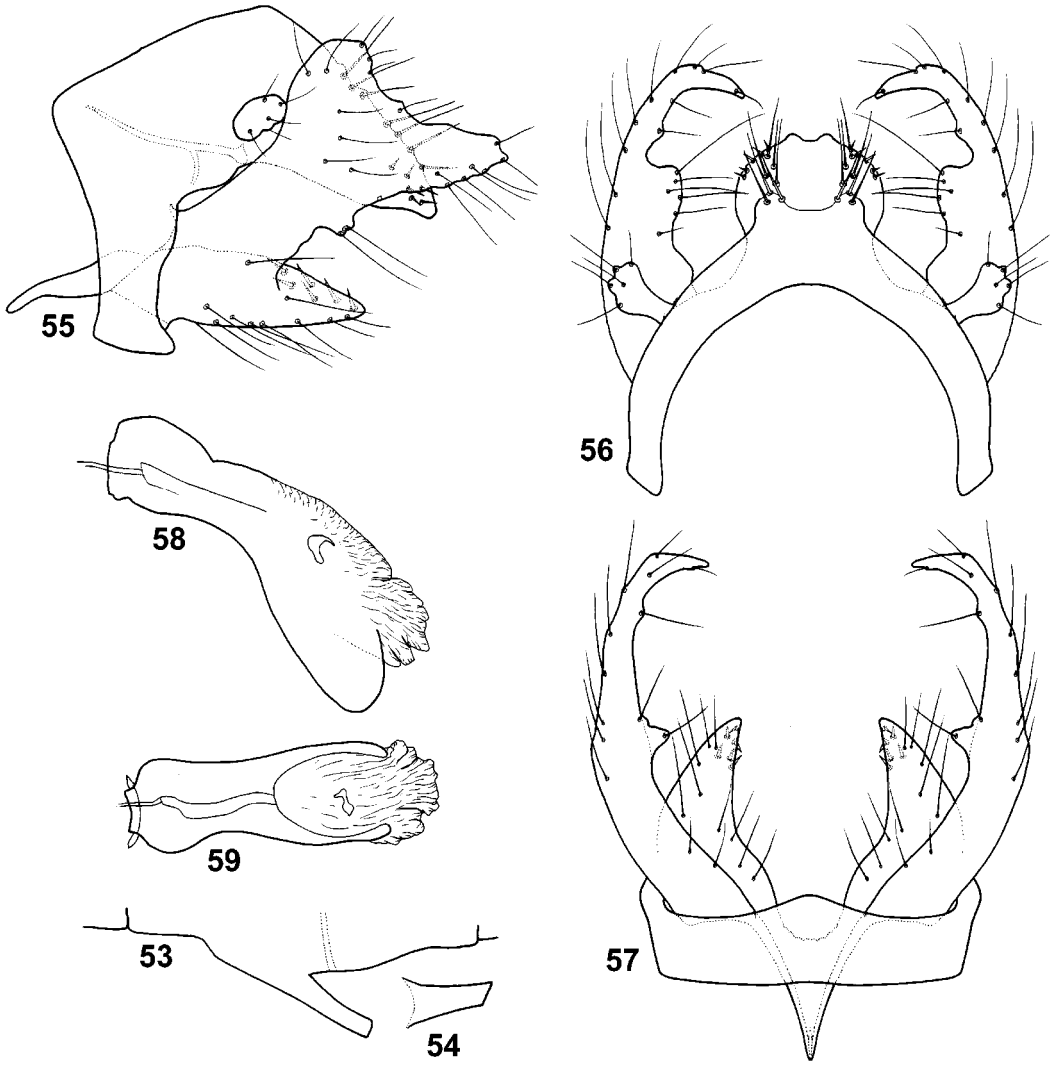
***Helicopsyche (Feropsyche) sanblasensis*, new species**
Fig. 52–59, 61

Helicopsyche sanblasensis, new species is unique in having a combination of a very short

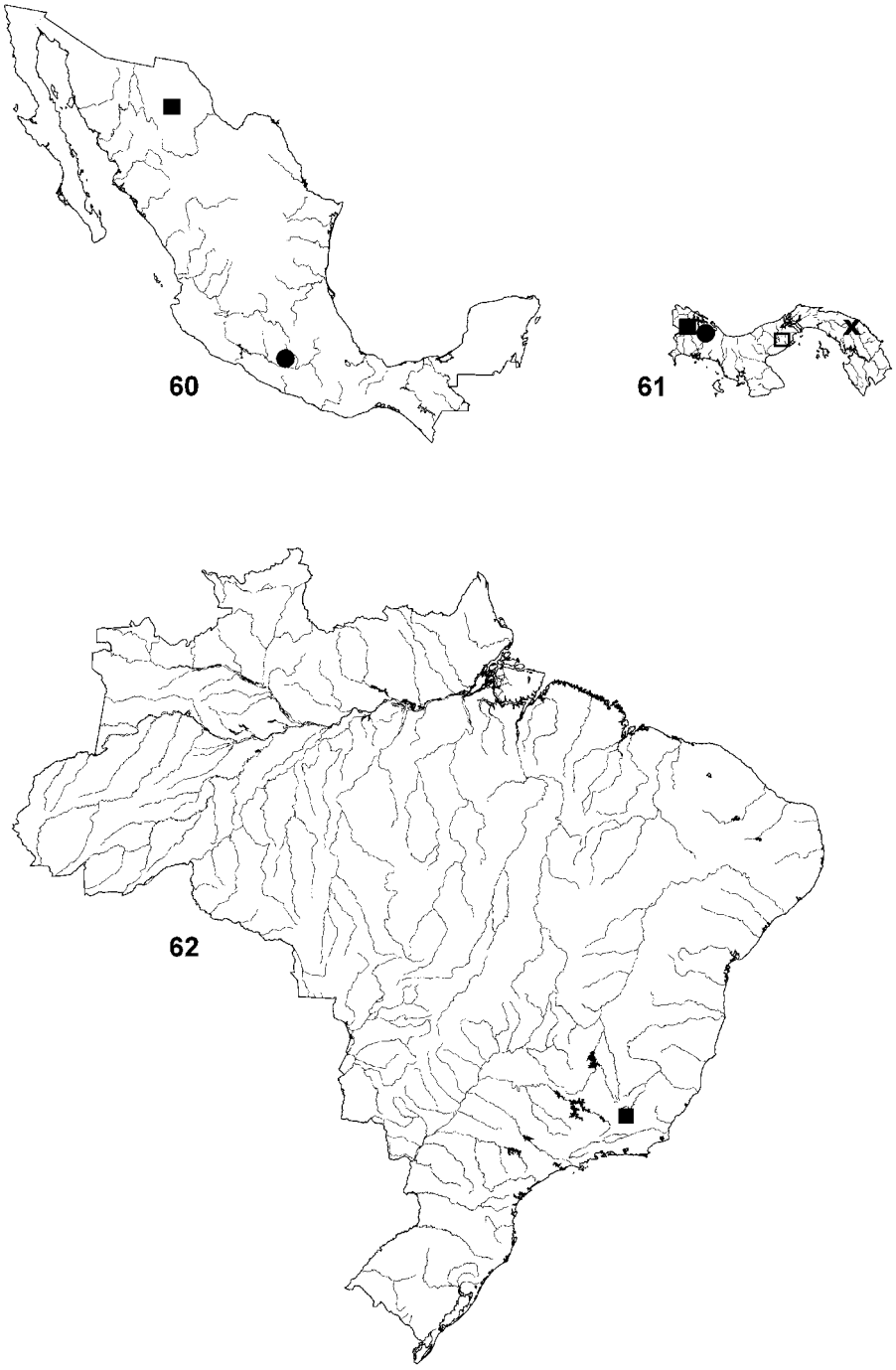
segment IX, a nearly 3-branched primary branch of the gonocoxite, and a very long, cone-shaped basimesal lobe. With respect to the genitalia, especially the shape of the gonocoxite, *H. sanblasensis* is similar to *H. extensa* Ross and *H. dampfi.*

Male head. Cephalic warts oval and flat. Postantennal setal warts not observed. Antennal scape about as long as each maxillary palp segment and eye diameter.

Male wings. Forewing (Fig. 52). Forewing brownish, length about 3.2 mm; hind wing length 2.3 mm. Hind wing venation and hamuli not observed.



FIGURES 53–59. *Helicopsyche sanblasensis*, new species, holotype. 53—VIth sternal process, lateral; 54—VIth sternal process, ventral; 55—genitalia, lateral; 56—genitalia, dorsal; 57—genitalia, ventral; 58—phallus, lateral; 59—phallus, ventral.



FIGURES 60–62. Distribution maps showing the localities of the new species and the new records. 60—Mexico, showing the distributions of *H. curvipalpia* (filled square) and *H. sinuata* (filled circle); 61—Panama, showing the distributions of *H. incisa* (filled square), *H. chiriquensis*, *H. linguata*, *H. woldai* and *H. incisa* (filled circle), *H. blantoni* and *H. woldai* (open square), and *H. sanblasensis* (cross); 62—Brazil, showing the distributions of *H. paprockii* and *H. cipoensis* (filled square).

Male abdomen and genitalia (53–59). Segment IV with broken process (Fig. 53–54). Segment IX (Fig. 55) with anterior lobe triangular in lateral view, oriented anteriad and located dorsally on segment; anterodorsal margin nearly straight, about as long as shallowly concave anteroventral margin; in dorsal view with inner margin widely ellipsoid (Fig. 56); in ventral view with wide central posterior process (Fig. 57). Lateral apodeme curving slightly anterodorsad in lateral view (Fig. 55), tapering and fading before anterior margin; sub-marginal line absent; tergal transverse apodeme absent; sternal transverse apodemes short. Tergum X oriented posteroventrally in lateral view (Fig. 55), nearly straight and cone-shaped, with apex pointed; widening at midlength and narrowing toward rounded apex in dorsal view (Fig. 56), apical notch shallow, with about 7 pairs long dorsal and 5 pairs short lateral megasetae. Superior appendage thick, slightly club-shaped in dorsal view (Fig. 55). Primary branch of gonocoxite with deeply concave posterodorsal margin in lateral view (Fig. 55) resulting in 3-branched gonocoxite (basimesal lobe included); narrowest distally to base, with weakly undulate margins; anterodorsal margin smooth, apex cone-shaped in lateral view and strongly curving mesally in dorsal and ventral view (Fig. 56, 57); narrowest part of primary branch as wide as height of tergum X and narrower than tergum X width (Fig. 55, 56); anterodorsal margin nearly concave, posteroventral margin shallowly concave along its length, with 2 prominently erect setal bases (Fig. 55). Basimesal lobe broadly cone-shaped and apically pointed in lateral and ventral view (Fig. 55, 57), with median margins basally divergent and distally parallel (Fig. 57), about 6 megasetae on dorsal face. Basal plate narrow, slightly undulate in lateral view (Fig. 55); strongly pointed anteriorly in ventral view (Fig. 57). Phallus with ventral margin curved at middle in lateral view (Fig. 58); in lateral and ventral view (Fig. 58, 59) basal part slightly thicker than central region. Phallic basis narrow (Fig. 59). Endotheca produced, posteroventral part strongly sclerotized. Sperm channel divided inside phallus into slender anterior part and thicker posterior part (Fig. 58, 59).

Male holotype: PANAMA: San Blas: 2 km S. Nusagandi, 3.iii.1985 [Flint & Louton] (NMNH, pinned, genitalia in glycerol).

Distribution: Panama (San Blas) (Fig. 61).

Etymology: *sanblasensis*, derived from the type locality of the species, San Blas in Panama.

Remarks: *Helicopsyche sanblasensis* can be separated from *H. extensa* by the shorter, cone-shaped apical branch of the primary gonocoxite branch, the cone-shaped tergum X in lateral view, and the long and cone-shaped basimesal lobes. It is distinguished from *H. dampfi* by the shorter segment IX, the cone-shaped apical branch of the primary branch of the gonocoxite, and the longer and cone-shaped basimesal lobe.

New species records

Helicopsyche (Feropsyche) woldai Johanson

Panama: Cerro Campana, 11–14.vii.1967 [O. S. Flint, Jr.] — 1 male (NMNH, pinned, genitalia in glycerol); Panama: Chiriqui, Fortuna Dam Site, nr. Hornitos, 1050 m, 8°55'N, 82°16'W, 20–26.vi.1979, LT trap [H. Wolda] — 1 male (NMNH, alcohol).

Remarks: This species is endemic to Panama (Johanson 2003b). The geographical position of the new records is given in Fig. 61.

Helicopsyche (Feropsyche) incisa Ross

Panama: Chiriqui, Guadalupe Arriba, 8°52'26''N, 82°33'13''W, 16–22.v.1984 [H. Wolda] — 1 male (NRM, in alcohol); ditto, except 7–20.iii.1984 — 3 males; Panama: Chiriqui, Fortuna Dam Site, nr. Hornitos, 1050 m, 8°55'N, 82°16'W, 2–15.v.1979, LT trap [H. Wolda] — 1 male (NMNH, in alcohol); ditto, except 28.xii.1977–3.i.1978 —1 male; ditto, except 10.i–20.ii.1979 — 1 male; ditto, except 4.i–7.iii.1978 — 1 male (NRM, alcohol).

Remarks: This species was previously known from Mexico, Panama (Flint *et al*. 1999), and Costa Rica (Johanson 2002). The geographical positions of the new records are given in Fig. 61.

Helicopsyche (Feropsyche) sinuata Denning & Blickle

Mexico: Taxco, Gro., viii.1955 [N. L. H. Kraws] — 1 male (NMNH, alcohol).

Remarks: This species has been previously recorded from USA (Johanson 2002). The geographical position of the new records is given in Fig. 60.

Acknowledgements

We are thankful to Dr. Oliver S. Flint, Jr. (NMNH) for his kindness in encouraging us to do this work, and for making available the very interesting material. I am also thankful to Mr. Colin Favret (INHS) for being helpful in making available the *Helicopsyche* material at INHS. Two anonymous referees gave valuable comments on the manuscript.

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