



## New species of and taxonomic notes on *Anastrepha* (Diptera: Tephritidae)

ALLEN L. NORRBOM<sup>1</sup> & CHESLAVO A. KORYTKOWSKI<sup>2</sup>

<sup>1</sup>Systematic Entomology Lab., USDA, ARS, c/o Smithsonian Institution, P.O. Box 37012, MRC 168, Washington, DC 20013-7012, USA. E-mail: allen.norrbom@ars.usda.gov

<sup>2</sup>Programa de Maestría en Entomología, Vice-Rectoría de Investigación y Post-Grado, Universidad de Panamá, PANAMÁ. E-mail: cheslavok@cableonda.net

### Abstract

Seven new species of *Anastrepha* are described and illustrated: *A. conflua* (Costa Rica), *A. levefasciata* (Perú), *A. nolazcoae* (Perú), *A. parudentata* (Mexico), *A. raveni* (Perú), *A. trivittata* (Brazil: Amazonas), and *A. woodleyi* (Bolivia). *Anastrepha nunezae* Steyskal, 1977, is recognized as a synonym of *A. mucronota* Stone, 1942, and *A. pseudanomala* Norrbom is recorded for the first time from Ecuador.

**Key words:** fruit flies, taxonomy

### Introduction

*Anastrepha* Schiner is the most diverse genus of fruit flies (Diptera: Tephritidae) in the American tropics and subtropics with more than 230 described species (Norrbom *et al.* 1999a, b, Norrbom & Korytkowski 2009). It is also the most economically important genus of fruit flies in this region, including a number of major fruit pests (Norrbom 2004). Despite its importance, many species remain undescribed, and the native host plant relationships are poorly known. In this paper we describe seven species to make their names available for a forthcoming interactive identification system and key for the genus.

### Material and methods

We follow the morphological terminology of White *et al.* (1999). The names for the wing bands follow Stone (1942) and are shown in Figure 11. Wing length was measured from the base of the costa to the wing apex in cell  $r_{4+5}$ ; wing width was measured at the broadest part, distal to the apex of vein  $R_1$  to the margin of cell  $cu_1$ . The position of the apex of vein  $R_1$  is the ratio of the distance from the base of the costa to the apex of vein  $R_1$  divided by wing length. The width of cell  $r_{4+5}$  at the level of dm-cu was measured on a line directly anterior to the junction of vein M and dm-cu. Its apical width was measured on a line from the apex of vein  $R_{4+5}$  and the junction of vein M and the wing margin. The width of the distal part of the S-band was measured perpendicular to the band at the apex of vein  $R_{2+3}$ , and the width of cell  $r_{2+3}$  was measured along the same line. Oviscape length was measured medially on the ventral side from the concavity in the base to the apex, including the medial lobe. The length of the aculeus tip was measured ventrally from the inner (proximal) margin of the sclerotized part to the extreme apex.

Label data for all examined specimens will be made available in the New World fruit fly specimen database on the Systematic Entomology Laboratory web site (see [www.sel.barc.usda.gov:591/diptera/Tephritidae/TephIntro.html](http://www.sel.barc.usda.gov:591/diptera/Tephritidae/TephIntro.html)). A USNM barcode label was added to many specimens that previously lacked a barcode label. These labels do not indicate ownership; they are simply unique specimen identifier numbers. In the Type data and Specimens examined sections the barcode number is listed following the depository acronym for each specimen or series.

Acronyms for institutions where specimens are deposited follow Norrbom *et al.* (1999a): CNC—Canadian National Collection, Ottawa; INBio – Instituto de Biodiversidad, Santo Domingo de Heredia, Costa Rica; MEUP—Museo de Entomología, Universidad de Panamá; SENASA—Servicio Nacional de Sanidad Agraria, Lima; and USNM—National Museum of Natural History, Smithsonian Institution, Washington.

***Anastrepha conflua*, new species**

Figs. 1, 7, 19, 26–28



**FIGURE 1.** Habitus: *A. conflua* (Costa Rica: Tierras Morenas, INBioCRI000949584).

**Diagnosis.** *Anastrepha conflua* belongs to the *doryphoros* species group, which also includes *A. doryphoros* Stone and *A. freidbergi* Norrbom. These species differ from other species of *Anastrepha* by the following combination of characters (Norrbom *et al.* 1999b): eversible membrane with an elongate pattern of small scales (unique to this group); aculeus tip tapered, then parallel-sided, then tapered; scutum with nonmicrotrichose vittae; wing pattern with apical part of S-band broadly fused to V-band (in *A. conflua* they are completely fused in cell  $r_{2+3}$  and are separated only by a hyaline area in cells  $r_{4+5}$  and  $m$  that does not extend to vein  $R_{4+5}$ , and the hyaline spot in cell  $m$  between the arms of the V-band does not extend beyond vein  $M$ ); hyaline marginal spot distal to the apex of vein  $R_1$  broad and semicircular, its apex or middle aligned with or distal to crossvein  $r-m$ ; and base of aculeus not abruptly expanded. *Anastrepha conflua* differs from *A. doryphoros* and *A. freidbergi* in that the basal part of the S-band is more narrowly connected to the C-band along vein  $R_{4+5}$  and there is a large hyaline area in cell  $br$ ; the hyaline area between the basal part of the S-band and the proximal arm of the V-band extends to vein  $R_{4+5}$ ; the S-band is constricted along vein  $R_{4+5}$  apical to crossvein  $r-m$  (unlike in *A. freidbergi*, in which this part of the S-band is broad; it is constricted or interrupted in *A. doryphoros*); and the hyaline spot at the apex of vein  $R_1$  extends to or almost to vein  $R_{4+5}$  (it extends only to  $R_{2+3}$  in *A. freidbergi*). The scutal microtrichia pattern also differs. In both *A. freidbergi* and *A. conflua* the scutum is mostly microtrichose, but in *A. conflua* there is a pair of very thin bare areas from the transverse suture to the dorsocentral seta, whereas in *A. freidbergi*, there is a broader pair of bare stripes from the anterior margin to beyond the transverse suture. The eversible membrane of *A. conflua* is more similar to that of *A. freidbergi*, but the aculeus tip has a distinct subapical indentation in the lateral margin as in *A. doryphoros*.

**Description.** Mostly orange to dark orange, with white to pale yellow markings. Setae dark brown to black. Head: Yellow to orange except brown ocellar tubercle. 3–4 frontal setae; 2 orbital setae, posterior seta well developed. Ocellar seta weak or absent, at most 1.5 times as long as ocellar tubercle. Facial carina, in profile, straight dorsally and medially. Antenna extended 0.57–0.63 distance to ventral facial margin.

Thorax (Fig. 1): Mostly orange to dark orange, without brown markings except one paratype with short, broad oval brown spot medially on scuto-scutellar suture; with following areas white to pale yellow (may be poorly differentiated in dry specimens): postpronotal lobe and lateral margin of scutum bordering it, not extending onto notopleuron; slender medial scutal vitta, only slightly and gradually expanded posteriorly, not extended laterally beyond acrostichal seta; paired sublateral scutal vitta from transverse suture to posterior margin, including base of intra-alar seta; entire scutellum; dorsal margins of anepisternum and katepisternum; katepimeron; and most of anatergite and katatergite. Subscutellum and mediotergite entirely orange. Mesonotum 4.70–5.00 mm long. Postpronotal lobe and scutellum entirely microtrichose; scutum entirely microtrichose or usually (3 of 4 specimens) microtrichose except for very narrow bare vitta along dorsocentral line from transverse suture to dorsocentral seta and very slightly more lateral, short vitta anterior to transverse suture; scutal setulae yellowish anteromedially, pale brownish posteriorly and laterally. Chaetotaxy typical for genus. Katepisternal seta absent.

Legs: Entirely yellow to orange.

Wing (Fig. 7): Length 11.5–12.4 mm, width 4.10–4.44 mm, ratio 2.67–2.82. Apex of vein  $R_1$  at 0.54–0.56 wing length. Cell  $c$  1.14–1.26 times as long as pterostigma; pterostigma 3.80–4.20 times as long as wide. Vein  $R_{2+3}$  without sharp bends or undulations. Crossvein  $r-m$  at 0.61–0.65 distance from  $bm-cu$  to  $dm-cu$  on vein  $M$ . Vein  $M$  moderately strongly curved apically; cell  $r_{4+5}$  0.91–1.00 times as wide at apex as at level of  $dm-cu$ . Cell  $bcu$  with distal lobe moderately long, length of  $bcu$  1.39–1.47 times as long as anterior margin. Wing pattern mostly orange and orange brown. C-band mostly orange, fainter in cell  $bc$  and pale orange to subhyaline in large posteromedial area in cell  $c$ , slightly darker orange brown in pterostigma, and moderate brown basally in cells  $c$ ,  $r_1$  and  $br$ . C-band and S-band broadly connected along vein  $R_{4+5}$ ; marginal hyaline area distal to apex of vein  $R_1$  broad and subovoid, gradually tapered posteriorly, extended to or almost to vein  $R_{4+5}$ , its apex aligned with or distal to crossvein  $r-m$ . Hyaline area in cell  $br$  large and elongate, reaching or narrowly separated from vein  $R_{4+5}$  and 1.5–2.0 times as long as distal colored area of cell; cell  $dm$  with basal hyaline area large. Basal half of S-band mostly orange, most of section in cell  $cu_1$  and narrow margins except proximal margin in cell  $dm$  orange brown; distal to crossvein  $r-m$  strongly constricted along vein  $R_{4+5}$ ; distal section orange to orange brown, extremely broad, covering all of distal half of cell  $r_{2+3}$ , separated from or narrowly touching apex of vein  $M$ ; hyaline area proximal to apex of band not extended to vein  $R_{4+5}$  (extending one-fourth to three-fourths across cell  $r_{4+5}$ ) and faintly pale brown. V-band complete; proximal arm broad, moderate brown posteriorly but with broad medial orange area bordering most of crossvein  $dm-cu$ , extremely broadly connected to S-band along vein  $R_{4+5}$ , on posterior margin with proximal extension half to three-

fourths distance to vein  $A_1+Cu_2$ , but fainter proximally; distal arm complete and broad, narrower posteriorly, broadly connected to proximal arm (connection extended slightly into cell m so that no hyaline area present between band and vein M) and to S-band anteriorly.

Abdomen: Mostly orange, without brown markings. Setulae brownish.

Female terminalia: Oviscape 10.5–12.2 mm long, 2.23–2.44 times as long as mesonotum, straight to slightly ventrally curved in lateral view, entirely dark orange; spiracle at basal 0.20–0.24. Eversible membrane (Fig. 19) with numerous short, triangular dorsobasal scales in elongate pattern ca. 1.5 mm long. Aculeus (Fig. 26) gradually ventrally curved in lateral view, 9.55 mm long (measured only on 1 paratype), 0.91 times oviscape length; in ventral view base (Fig. 27) very gradually expanded, 0.23 mm wide; shaft 0.13 mm wide at midlength; tip (Fig. 28) 0.29 mm long, 0.03 times aculeus length, 0.12 mm wide, 2.42 times as long as wide, rapidly tapered subbasally, then nearly parallel-sided until rapidly tapered again at distal three-fifths, then almost parallel-sided except for triangular apex, nonserrate, 0.07 mm wide in lateral view, 0.58 times ventral width. Spermathecae ovoid.

**Distribution.** *Anastrepha conflua* is known only from Costa Rica.

**Biology.** The host plants and other aspects of the biology of this species other than dates of capture of adults are unknown.

**Type data.** Holotype ♀ (INBio INBioCRI0004073743), COSTA RICA: Alajuela: Guatuso, Sitio Catarata Río Buenavista, LN 298474 428857, 700–800 m, Tp. Luz [light trap], 23 Mar 2007, J. A. Azoifeifa. Paratypes: COSTA RICA: Alajuela: Parque Nacional Volcán Tenorio, Río Roble - 3 cataratas, LN 296900 426100, 900–1000 m., Tp. Luz [light trap], 30 Jun 2006, J. A. Azoifeifa, 1 ♀ (USNM INBioCRI0004023086). Guanacaste: Parq. Nac. Guanacaste, 9 km. S of Santa Cecilia, Estación Pitilla, 11°N 85°26'W, LN 330200 380200, 700 m, 21 Mar – 6 Apr 1993, C. Moraga, 1 ♀ (USNM INBioCRI001391699); Zona Prot. Tenorio, Tierras Morenas, Río San Lorenzo, 10°34'N 85°2'W, LN 287800 427600, 1050 m, Nov 1992, G. Rodríguez, 1 ♀ (INBio INBioCRI000949584).

**Etymology.** The name of this species is a Latin adjective, meaning flowing together or uniting, in reference to the broadly connected S-band and V-band.

### *Anastrepha lefefasciata*, new species

Figs. 8–9, 21, 29–30, 41–42

**Diagnosis.** *Anastrepha lefefasciata* differs from most other species of *Anastrepha* in having the hyaline area between the C-band and S-band extending anteriorly into cell  $r_1$ , but not reaching or only very narrowly reaching the costa, and vein  $R_{2+3}$  sinuous. It resembles *A. loewi* Stone and especially *A. raveni*, n. sp., but differs in having longer terminalia (oviscape length greater than 8 mm vs. less than 4 mm; phallus greater than 10 mm vs. less than 5 mm) and the shape of the aculeus tip (lateral margins distinctly concave).

**Description.** Mostly yellow to orange, with white to pale yellow markings poorly differentiated in type specimens. Setae orange.

Head: Yellow to orange except brown ocellar tubercle. 2–3 frontal setae; 2 orbital setae, posterior seta well developed. Ocellar seta weak, 1.0–1.6 times as long as ocellar tubercle. Facial carina, in profile, straight to slightly convex dorsomedially. Antenna extended ca. 0.70–0.82 distance to ventral facial margin.

Thorax: Mostly yellow to orange, without brown markings, typical white to pale yellow areas poorly differentiated in type specimens; postpronotal lobe and scutellum entirely white. Subscutellum and mediotergite entirely orange. Mesonotum 3.40–4.12 mm long. Postpronotal lobe, scutum, and scutellum entirely microtrichose; scutal setulae yellowish. Chaetotaxy typical for genus. Katapisternal seta small and weak, barely differentiated from setulae.

Legs: Entirely yellow to orange.

Wing (Figs. 8–9): Length 8.98–10.20 mm, width 3.40–3.93 mm, ratio 2.45–2.67. Apex of vein  $R_1$  at 0.60–0.65 wing length, distal to crossvein r-m. Cell c 1.00–1.14 times as long as pterostigma; pterostigma 5.00–5.24 times as long as wide. Vein  $R_{2+3}$  moderately to strongly sinuous. Crossvein r-m at 0.64–0.67 distance from bm-cu to dm-cu on vein M. Crossvein dm-Cu 1.30–1.43 mm long. Vein M very strongly curved apically; cell  $r_{4+5}$  0.50–0.67 times as wide at apex as at level of dm-cu. Cell bcu with distal lobe moderately long, length of bcu 1.50–1.58 times as long as anterior margin. Wing pattern mostly yellow to moderate orange. C-band mostly yellow to orange, dark orange in pterostigma. C-band and S-band very narrowly separated or connected along costa by hyaline band that tapers

anteriorly in cell  $r_1$ , barely separated from or reaching costa and apex of vein  $R_1$ ; broadly separated along veins  $R_{2+3}$  and  $R_{4+5}$  by hyaline band that extends to cell  $bm$ ; C-band narrow and/or faint in basal part of cell  $r_{2+3}$ . Cell  $dm$  with basal hyaline area large. S-band slender, basal half mostly pale to moderate orange, posterodistal half of area in cell  $cu_1$  slightly darker orange brown; narrow or interrupted (1 female) in cell  $r_{2+3}$  anterior to crossvein  $r-m$ ; distal half mostly pale to moderate orange, apex in cell  $r_{4+5}$  usually orange brown, narrow in cells  $r_{2+3}$  and  $r_{4+5}$ , at apex of vein  $R_{2+3}$  0.38–0.44 times width of cell  $r_{2+3}$ , extended to or almost to apex of vein  $M$ ; hyaline area proximal to apex of band extending to vein  $R_{2+3}$  or slightly into cell  $r_1$ . V-band incomplete; proximal arm slender, diffuse, orange brown posteriorly, fading anteriorly and barely reaching vein  $M$ , absent in cell  $r_{4+5}$ , separate from S-band anteriorly, on posterior margin with short, faint, proximal extension one-third to half distance to vein  $A_1+Cu_2$ ; distal arm absent.

Abdomen: Mostly yellow, without brown markings.

Male terminalia: Lateral surstylus moderately long, extended beyond prenisetae by 2.0–2.5 times length of preniseta; in lateral view (Fig. 41) slender and slightly posteriorly curved; in posterior view (Fig. 42), lateral margin concave then almost parallel-sided, apex rounded, medial margin slightly concave to slightly convex. Proctiger with ventral and lateral sclerotized areas connected. Phallus 11.0 mm long, 2.80–2.95 times as long as mesonotum; glans 0.55–0.60 mm long, ca. 0.05 times as long as phallus.

Female terminalia: Oviscape 7.09–8.54 mm long, 1.98–2.18 times as long as mesonotum, straight in lateral view, entirely yellow to orange; spiracle at basal 0.18–0.20. Eversible membrane (Fig. 21) with ca. 25 strong, hook-like dorsobasal scales in 4 irregular rows in subtriangular to semicircular pattern. Aculeus ventrally curved in lateral view, 6.80–8.35 mm long, 0.95–1.00 times oviscape length; in ventral view base (Fig. 29) slightly expanded, 0.21–0.23 mm wide; shaft 0.095–0.110 mm wide at midlength; tip (Fig. 30) 0.26–0.34 mm long, 0.034–0.041 times aculeus length, 0.13–0.14 mm wide, 2.08–2.43 times as long as wide, lateral margin strongly convex, rapidly then gradually tapered, nonserrate, 0.08 mm wide in lateral view, 0.57–0.62 times ventral width. Spermathecae ovoid.

**Distribution.** *Anastrepha levefasciata* is known only from eastern Perú (Huánuco, Junín).

**Biology.** The host plants and other aspects of the biology of this species other than dates of capture of adults are unknown.

**Type data.** Holotype ♀ (SENASA USNMENT00671685), PERÚ: Junín: Chanchamayo, Pichanaki, Villa Santa María, 21 Oct 2008, J. Avalos. Paratypes: PERÚ: Huánuco: Huallaga Central, Aucayacu, Pueblo Nuevo, 20 Jan 2009, D. Damas, 1♀ (SENASA USNMENT00671682); Tingo Maria, [no date], G. Egoavil 1♀ (USNM USNMENT00213407). Junín: Chanchamayo, Pichanaki, Villa Santa María, 21 Oct 2008, J. Avalos, 1♀ (USNM USNMENT00671683); Villa Santa María, 21 Oct 2008, H. Riveros, 1♂ (USNM USNMENT00671857) 1♂ (SENASA USNMENT00671858).

**Etymology.** The name of this species is an adjective formed from the Spanish leve (slight or faint) and the Latin fascia (band) in reference to the faint wing pattern.

### *Anastrepha mucronota* Stone

Figs. 37–38

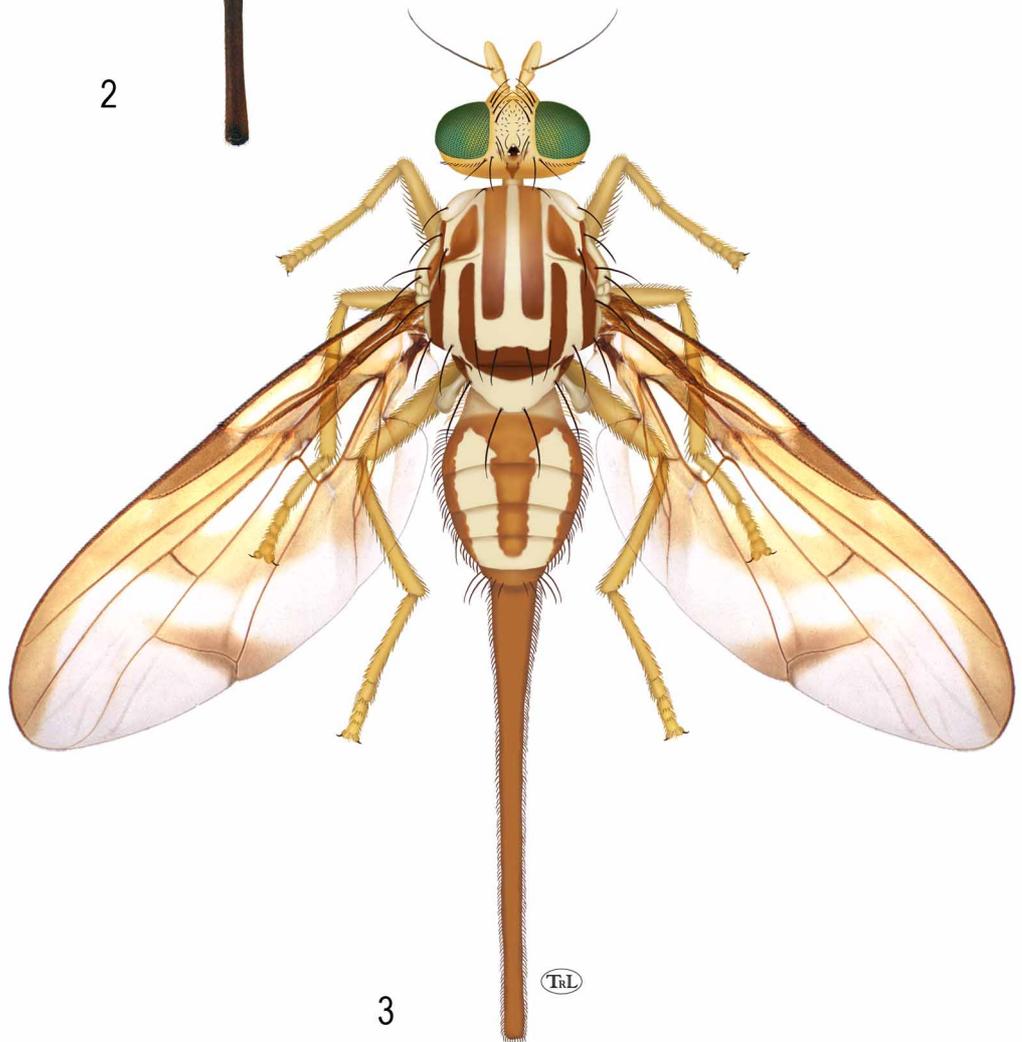
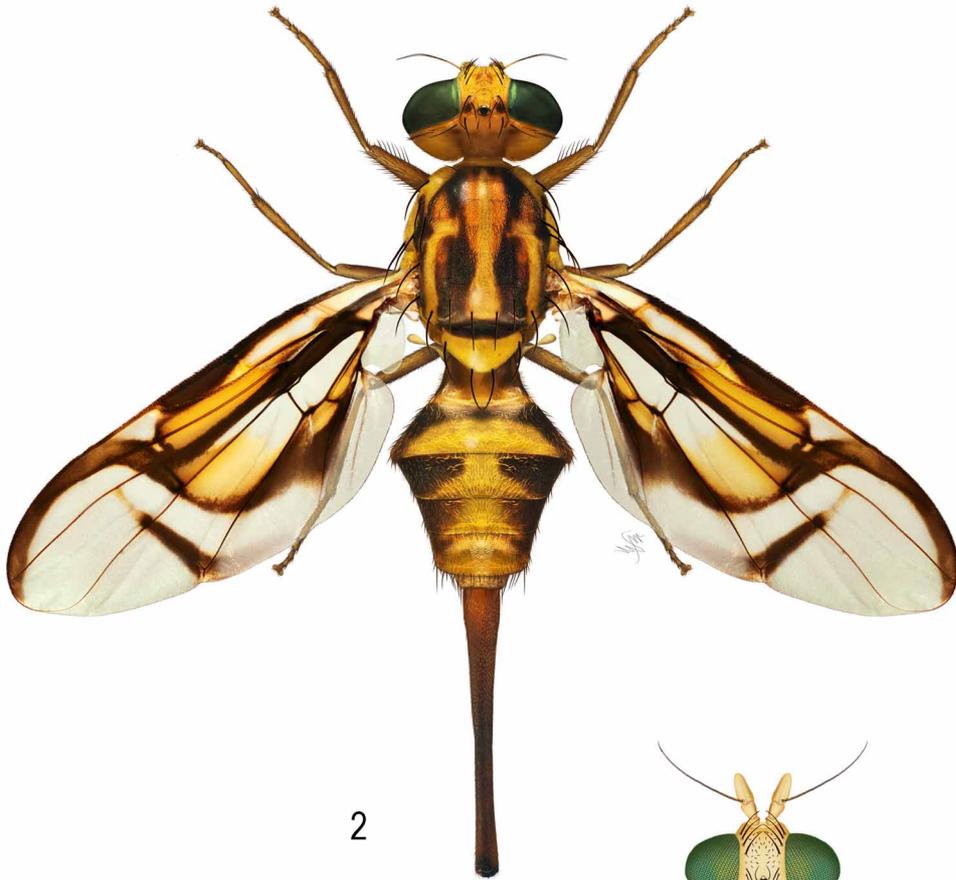
*Anastrepha mucronota* Stone 1942: 57 [description; Panamá]; Molineros *et al.* 1992: 16, 35 [host plants; Ecuador]; Bomfim *et al.* 2007: 220 [Brazil]; Zucchi 2007: 84 [host plant].

*Anastrepha nunezae* Steyskal 1977a: 77 [description; surstylus, eversion membrane, aculeus tip; host plant; Colombia]; Núñez Bueno 1981: 175, 178 [host plant; Colombia]; Yepes & Vélez 1989: 81 [host plant]; Carrejo & González 1994: 89 [host plant; Colombia]. **New synonym.**

**Distribution.** Brazil (Tocantins), Colombia, Ecuador, Panamá and Perú.

**Biology.** *Matisia cordata* Bonpl. (= *Quararibea cordata*) (Bombacaceae) has been reported as a host plant by multiple authors (Steyskal 1977a, Núñez Bueno 1981, Yepes & Vélez 1989, Molineros *et al.* 1992, Carrejo & González 1994). Molineros *et al.* (1992) also recorded *Annona cherimola* Mill. (Annonaceae) as a "circumstantial" host, based on one rearing. Zucchi (2007) reported *Salacia elliptica* (Mart. ex Schult.) G. Don (Celastraceae) as a host in Brazil.

**Type data.** *A. mucronota*: Holotype ♀ (USNM USNMENT00053706), Panamá: El Cermeño [8°44'N 79°51'W], fruit fly trap, 21 Nov 1939, J. Zetek 4596. *A. nunezae*: Holotype ♀ (USNM USNMENT0005910), Colombia: Cundinamarca: Cachipay, 10 Dec 1973, L. Núñez, reared from fruit of *Matisia cordata* Bonpl.



**FIGURES 2–3.** Habitus: 2, *A. woodleyi* (holotype); 3, *A. trivittata* (holotype).

**Comments.** In the original description of *A. nunezae* Steyskal (1977a) compared it only with *A. greenei* Lima. Females from Panama have on average longer longer female terminalia than those from Colombia (oviscape 4.57–5.40 mm long, mean = 4.99 mm, 1.28–1.40 times mesonotum length, mean = 1.36, n = 9, vs. oviscape 3.66–4.83 mm long, mean = 4.25 mm, 1.06–1.34 times mesonotum length, mean = 1.21, n = 10), but there is considerable overlap and we could find no other consistent or significant differences among specimens determined by Steyskal as *A. nunezae* and specimens of *A. mucronota*, including the holotypes of both species in the USNM. It is possible that these populations represent different species, but we regard the differences among them more likely to be geographic variation. We have treated these names as synonyms in a manuscript key (Korytkowski 2004: 23, 121) for some years and here formally recognize this synonymy.

### *Anastrepha nolazcoae*, new species

Figs. 4, 10–11, 22, 31–32, 39–40

*Anastrepha kuhlmanni*: Korytkowski 2001: 122 [misidentification].

**Diagnosis.** *Anastrepha nolazcoae* is among the species of *Anastrepha* having an uninterrupted hyaline area between the C-band and S-band that broadly reaches the costa and a simple, non-serrate aculeus tip. In the key of Steyskal (1977b) it runs to either *A. mucronota* Stone on page 13 or *A. aphelocentema* Stone, *A. greenei* Lima, or *A. nunezae* Steyskal (= *A. mucronota*) on page 15. It differs from all three species in scutal microtrichial pattern (microtrichose only medially, laterally, and posteriorly vs. entirely microtrichose in *A. aphelocentema* and *A. greenei* and microtrichose only laterally and posteriorly in *A. mucronota*) and surstylus shape (mesal margin concave, lateral margin convex (Fig. 40) vs. the opposite in *A. aphelocentema*; the shape is similar but the apex is much broader than in *A. greenei* and *A. mucronota* (Fig. 38)). The relative oviscape length in *A. nolazcoae* is also usually longer than in *A. mucronota* (1.40–1.70 vs. 1.07–1.42). *Anastrepha nolazcoae* differs from *A. kuhlmanni* Lima, with which it was confused by Korytkowski (2001), in having considerably fewer and stouter hooklike scales on the eversible membrane (Fig. 22; compare with Fig. 20 of syntype female in USNM of *A. kuhlmanni*) and much longer surstyli. It differs from *A. mikuymono* Tigrero (2007) in terminalia length (oviscape 4.12–5.60 mm long, 1.40–1.70 times as long as mesonotum vs. 3.57–3.80 mm, 1.19–1.20 times mesonotum; aculeus 4.10–5.25 mm long vs. 3.28–3.50 mm), surstylus shape (lateral margin concave, medial margin convex in *A. mikuymono*), and in having vein  $R_{2+3}$  slightly sinuous.

**Description.** Mostly yellow to orange, with white to pale yellow markings (sometimes poorly differentiated). Setae orange brown to dark red brown.

Head: Yellow to orange except brown ocellar tubercle. 3–4 frontal setae; 2 orbital setae, posterior seta well developed. Ocellar seta weak, at most 1.5 times as long as ocellar tubercle. Facial carina, in profile, straight to slightly concave dorsally and medially. Antenna extended 0.7–0.8 distance to ventral facial margin.

Thorax (Fig. 4): Mostly yellow to orange, without brown markings, with following areas (often poorly differentiated) white to pale yellow: postpronotal lobe and lateral margin of scutum bordering it; medial scutal vitta, slender except posterior sixth broadly and abruptly expanded, extended laterally almost to dorsocentral seta, subquadrate; paired, very slender, dorsocentral scutal vitta, sometimes interrupted or diffuse posteriorly; paired sublateral scutal vitta from transverse suture to posterior margin, including base of intra-alar seta; scutellum; dorsal margins of anepisternum and katapisternum; katapimeron; and most of anatergite and katatergite. Subscutellum and mediotergite entirely orange. Mesonotum 2.75–3.73 mm long. Postpronotal lobe and scutellum entirely microtrichose; scutum microtrichose on lateral and posterior margins and medially between acrostichal lines, sometimes extending irregularly and/or more sparsely to dorsocentral lines, especially posteriorly; scutal setulae yellowish, brown. Chaetotaxy typical for genus. Katapisternal seta weak, short to moderately long, a third to two-thirds as long as anepisternal seta, but much weaker, pale to moderate brown.

Legs: Entirely yellow to orange.

Wing (Figs. 10–11): Length 7.30–8.35 mm, width 2.65–3.29 mm, ratio 2.50–2.75. Apex of vein  $R_1$  at 0.55–0.61 wing length. Cell c 0.91–1.06 times as long as pterostigma; pterostigma 4.40–5.03 times as long as wide. Vein  $R_{2+3}$  slightly sinuous. Crossvein r-m at 0.67–0.72 distance from bm-cu to dm-cu on vein M. Vein M moderately strongly curved apically; cell  $r_{4+5}$  0.87–0.97 times as wide at apex as at level of dm-cu. Cell bcu with distal lobe



**FIGURE 4.** Habitus: *A. nolazcoae* (Peru: San Miguel La Cocha, USNMENT00671196).

moderately long, length of  $bcu$  1.50–1.72 times as long as anterior margin. Wing pattern mostly orange and orange brown. C-band with cells  $bc$  and  $c$  slightly paler orange; pterostigma slightly darker orange brown. C-band and S-band broadly separated by hyaline band extended from cells  $bm$  and  $dm$  to costa distal to apex of vein  $R_1$ , hyaline band not narrowed along veins  $R_{2+3}$  and  $R_{4+5}$ , at most slightly narrowed anteriorly in cell  $r_1$ . S-band with margins mostly narrowly pale brown, except proximal margin in cell  $dm$  and parts of distal margin in cells  $dm$  and  $r_{4+5}$ , posterior margin of basal part more broadly brown in cell  $cu_1$  and with weak or no incision in cell  $cu_1$ ; distal section of band moderately broad, at apex of vein  $R_{2+3}$  0.55–0.68 times width of cell  $r_{2+3}$ , even in width or slightly broadening

in cell  $r_{2+3}$ , well separated from apex of vein M, mostly orange, posterior margin and posterior part in cell  $r_{2+3}$  and most of area in cell m moderate brown; hyaline area proximal to apex of band extending to or almost to vein  $R_{2+3}$  or slightly into cell  $r_1$ . V-band complete, mostly moderate brown, proximal arm mostly orange anterior to vein M and with broad medial orange area extending most of length of dm-cu, separated from S-band along vein  $R_{4+5}$  and in cell  $r_{2+3}$ , relatively slender, and with basal extension along wing margin extending half to two-thirds distance to vein  $A_1+Cu_2$ ; distal arm slender, mostly brown, connected to proximal arm and extending to vein  $R_{4+5}$ .

Abdomen: Mostly orange, without brown markings.

Male terminalia (Korytkowski 2001, figs. 106–107, 110, 112): Lateral surstylus moderately long, extended beyond prenisetae by 1.8–2.5 times length of preniseta; in lateral view (Fig. 39) slender and slightly posteriorly curved; in posterior view (Fig. 40), lateral margin slightly convex, medial margin distinctly concave, apex relatively broad and bluntly rounded. Proctiger with ventral and lateral sclerotized areas connected. Phallus 6.30–6.60 mm long, 1.86–2.24 times as long as mesonotum; glans 0.50–0.60 mm long, 0.08–0.10 times as long as phallus.

Female terminalia: Oviscape 4.12–5.60 mm long, 1.40–1.70 times as long as mesonotum, straight in lateral view, entirely orange; spiracle at basal 0.22–0.25. Eversible membrane (Fig. 22) with 25–35 long, slender, hooklike scales in 3–4 irregular rows in subtriangular to subovoid pattern. Aculeus (Fig. 31) straight or slightly ventrally curved in lateral view, 4.10–5.25 mm long, 0.90–1.02 times oviscape length; in ventral view base strongly expanded, 0.20–0.24 mm wide; shaft 0.08–0.10 mm wide at midlength; tip (Fig. 32) 0.23–0.29 mm long, 0.046–0.062 times aculeus length, 0.10–0.12 mm wide, 1.92–2.76 times as long as wide, 0.06–0.07 mm wide in lateral view, 0.50–0.65 times ventral width, in ventral view elongate triangular, sometimes slightly expanded subbasally, then gradually tapered, lateral margin nearly straight or slightly convex or concave, nonserrate. Spermathecae not examined.

**Distribution.** *Anastrepha nolazcoae* is known only from Perú (Amazonas, Huánuco).

**Biology.** Part of the type series was reared from fruit of *Matisia cordata* Bonpl. (Bombacaceae) following the suggestion of Dante Damas, the SENASA identifier for the Tingo Maria area, who had previously reared specimens from this fruit. The very similar species *A. mucronota* has also been reared from this host plant (Steyskal 1977a).

**Type data.** Holotype ♀ (SENASA USNMENT00671975), PERÚ: Huánuco: Tingo Maria, La Chancadora, 9°11'2"S 75°57'34"W, 651 m, emerged 19 May – 10 Jun 2010 reared ex fruit of sapote, *Matisia cordata* [Bombacaceae] collected 21 Apr 2010, N. Nolazco & A.L. Norrbom. Paratypes: PERÚ: Amazonas: Marañón, Cumba, Piata, Trampa McPhail, 18 Oct 2005, 1♀ (SENASA USNMENT00671155). Huánuco: Aucayacu, San Miguel La Cocha, trampa McPhail, 8 May 2007, 2♂ 4♀ (SENASA) 5♂ 10♀ (USNM USNMENT00671195-209); Tingo Maria, La Chancadora, 9°11'2"S 75°57'34"W, 651 m, emerged 19 May – 10 Jun 2010 reared ex fruit of sapote, *Matisia cordata* [Bombacaceae] collected 21 Apr 2010, N. Nolazco & A.L. Norrbom, 2♂ 9♀ (USNM USNMENT00671965-74, USNMENT00671976).

**Other material examined.** PERÚ: Huánuco: Bella Rondos, 15 Apr 1973, T. Albornoz, 2♂ 1♀ (2 with puparia) (MEUP); Castillo, 3 Feb 1973, T. Albornoz, 1♀ (USNM USNMENT00104466); Puente Perez, 3 Feb 1973, T. Albornoz, 1♂ (MEUP).

**Etymology.** The name of this species is a genitive patronym in honor of Norma Nolazco, chief identifier in the SENASA fruit fly surveys.

### *Anastrepha parudentata*, new species

Figs. 5–6, 12, 33

*Anastrepha parudentata* Norrbom 1985: 124 [*nomen nudum*; wing, aculeus tip]; Korytkowski 1997: 47 [*nomen nudum*; in key], 2004: 22 [*nomen nudum*; in list].

**Diagnosis.** *Anastrepha parudentata* differs from other species of *Anastrepha* except *A. phaeoptera* Lima and *A. trivittata*, n. sp., by the color pattern of its scutellum, which has only the sides brown on the basal third. Species of the *daciformis* group have both the disc and the sides of the scutellum darker basally, and a few other *Anastrepha* species have the disc dark basally, but not the sides. *Anastrepha parudentata* differs from *A. phaeoptera* in having pale orange brown rather than dark brown wing bands, with the C-band and S-band separated, and from *A. trivit-*

*tata* in having a marginal hyaline area distal to the apex of vein  $R_1$  and lacking brown abdominal markings. The eversible membrane, with the dorsobasal scales all small and weak, the extremely slender aculeus, the short lateral surstylus, and the lack of a glans are all typical of the *dentata* group. Within that group, only *A. dentata* (Stone) has similar posterior scutal marks, but it differs from *A. paradentata* in having an entirely yellow scutellum, orange to red brown setae, and shorter female terminalia (oviscape 2.27–2.52 mm long, aculeus 1.85–1.90 mm long). In the key of Steyskal (1977b: 15), *A. paradentata* runs poorly to *A. insulae* Stone which has a broader aculeus, eversible membrane with large hooklike scales, and the distal arm of the V-band well developed. It might be confused with species of the *punctata* group which also have a pair of dark spots on the scutum posteriorly, but those species also lack scutellar brown markings and have eversible membranes with larger scales.

**Description.** Mostly orange to orange brown, with white to pale yellow markings. Setae dark red brown to black.

Head: Yellow to orange except brown ocellar tubercle. 3–5 frontal setae (fifth seta small if present); 2 orbital setae, posterior seta well developed. Ocellar seta weak, at most 1.5 times as long as ocellar tubercle. Facial carina, in profile, straight dorsally and medially. Antenna extended 0.78–0.87 distance to ventral facial margin.

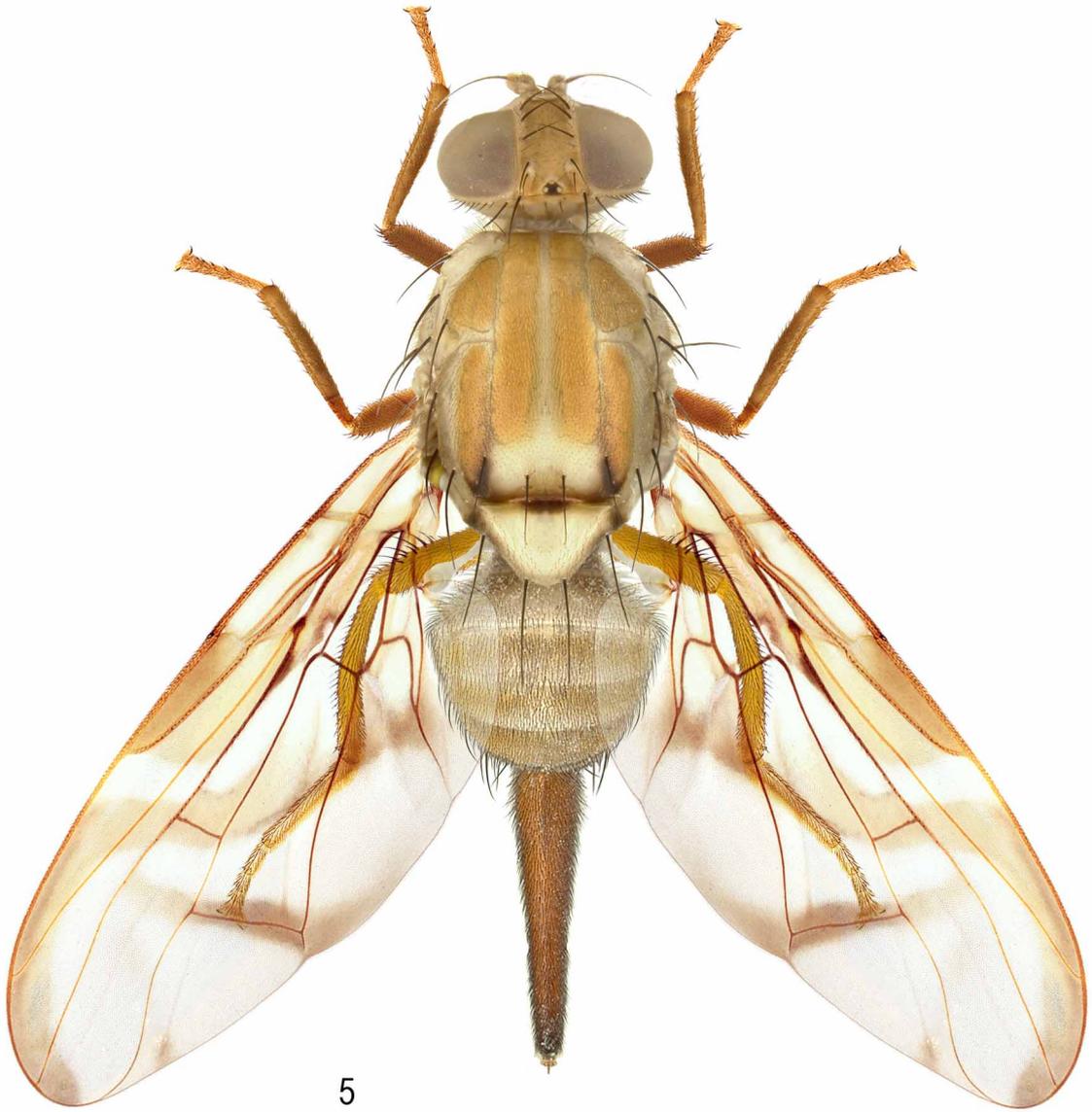
Thorax (Figs. 5–6): Mostly orange to orange brown with following areas white to pale yellow: postpronotal lobe and lateral margin of scutum bordering it, extending to presutural supra-alar seta, poorly differentiated on notopleuron; medial scutal vitta, slender except posterior sixth broadly and abruptly expanded, extended laterally almost to dorsocentral seta, subquadrate or somewhat bilobed, indented posteriorly by orange or brown area extended to or almost to acrostichal seta; paired, very slender, dorsocentral scutal vitta, sometimes interrupted or diffuse posteriorly; paired sublateral scutal vitta from transverse suture to posterior margin, including base of intra-alar seta; scutellum except narrow basal margin of disc and basal third or more of side; dorsal margins of anepisternum and katapisternum; katapisternum; and most of anatergite and katatergite. Posterior margin of scutum with paired, triangular or wedge-shaped dark brown mark, extending anteriorly to or slightly beyond dorsocentral seta, at most halfway to transverse suture; sometimes connected by dark brown along scuto-scutellar suture or latter sometimes with medial brown spot; lateral brown mark often with short, narrow lateral lobe along margin of white intra-alar vitta. Scutellum with basal third to half of side dark brown, extending beyond basal seta. Subscutellum and mediotergite entirely orange to orange brown or diffusely dark brown laterally. Mesonotum 3.60–3.93 mm long. Postpronotal lobe, scutum, and scutellum entirely microtrichose; scutal setulae yellow to orange medially, brownish laterally. Chaetotaxy typical for genus. Katapisternal seta undifferentiated or weak, at most half as long as largest anepisternal seta, but much weaker.

Legs: Entirely yellow to orange.

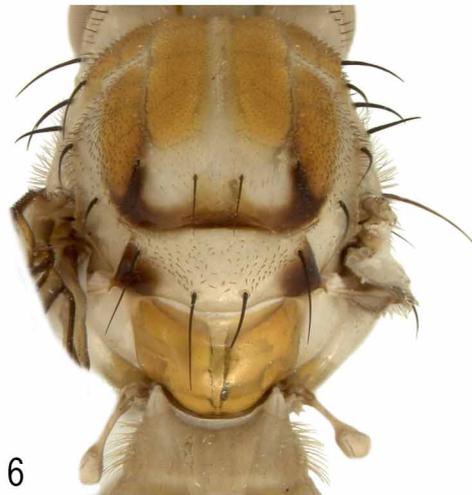
Wing (Fig. 12): Length 8.80–9.42 mm, width 3.30–3.70 mm, ratio 2.55–2.75. Apex of vein  $R_1$  at 0.57–0.61 wing length. Cell *c* 1.06–1.15 times as long as pterostigma; pterostigma 4.50–5.83 times as long as wide. Vein  $R_{2+3}$  without sharp bends or undulations. Crossvein *r-m* at 0.68–0.73 distance from *bm-cu* to *dm-cu* on vein *M*. Vein *M* moderately strongly curved apically; cell  $r_{4+5}$  0.82–0.95 times as wide at apex as at level of *dm-cu*. Cell *bcu* with distal lobe moderately long, length of *bcu* 1.43–1.62 times as long as anterior margin. Wing pattern mostly yellowish and orange brown. C-band mostly yellowish to orange, fainter in cells *bc* and *c*, and darker orange brown in pterostigma. C-band and S-band separated, sometimes more narrowly along vein  $R_{4+5}$ ; hyaline area in cell *br* large and elongate, reaching vein  $R_{4+5}$  and 3–5 times as long as distal colored area of cell; cell *dm* with basal hyaline area moderately large. Basal half of S-band relatively narrow, mostly yellowish to orange, posterior margin moderate brown, broadly in cell  $cu_1$ , narrowing in cell *dm*, anterior margin sometimes narrowly brown in cell *dm*; distal section orange to orange brown, medium width, at apex of vein  $R_{2+3}$  0.56–0.63 times width of cell  $r_{2+3}$ , slightly broadening or even in width, well separated from apex of vein *M*; hyaline area proximal to apex of band ending at vein  $R_{2+3}$  or occasionally extended slightly into cell  $r_1$ . V-band incomplete; proximal arm slender, moderate brown posterior to vein *M*, narrowly connected to or narrowly separated from S-band along vein  $R_{4+5}$ , on posterior margin with proximal extension at least halfway to vein  $A_1+Cu_2$ , but often fainter proximally; distal arm absent or occasionally reduced to marginal spot in cell *m*.

Abdomen: Mostly orange, without brown markings.

Male terminalia: Lateral surstylus very short and blunt, extended beyond prenisetae by less than length of preniseta; in posterior view with epandrium nearly oval in shape. Proctiger with ventral and lateral sclerotized areas connected but lateral areas separate dorsally. Phallus 0.75 mm long, 0.20 times as long as mesonotum; glans absent.



5



6

**FIGURES 5–6.** *A. paracentata* (Mexico: W El Palmito, USNMENT00214126): 5, habitus; 6, posterodorsal view of thorax.

Female terminalia: Oviscape 3.30–3.65 mm long, 0.89–0.96 times as long as mesonotum, straight in lateral view, entirely orange brown; spiracle at basal 0.25–0.28. Eversible membrane with all dorsobasal scales small and weak. Aculeus straight or slightly ventrally curved in lateral view, 2.47–2.67 mm long, 0.71–0.75 times oviscape length; in ventral view base strongly expanded, 0.15 mm wide; shaft 0.025–0.030 mm wide at midlength; tip (Fig. 33) with base difficult to distinguish (i.e., length of tip difficult to measure), 0.15–0.17 mm long, 0.06–0.07 times aculeus length, 0.025–0.030 mm wide, 5.3–6.2 times as long as wide, 0.025 mm wide in lateral view, 0.83–1.00 times ventral width, in ventral view weakly sagittate, expanded part 0.05 mm long, nonserrate but with slightly irregular margin. Spermathecae not examined.

**Distribution.** *Anastrepha paracentata* is known only from western Mexico.

**Biology.** The host plants and other aspects of the biology of this species other than dates of capture of adults are unknown. The larvae probably feed inside seeds of species of Sapotaceae as in other species of the *dentata* group for which host plants are known.

**Type data.** Holotype ♀ (USNM USNMMENT00213726), MEXICO: Michoacán: Tancítaro, McPhail traps, 2001–2002, M. Aluja. Paratypes: MEXICO: Michoacán: Tancítaro, McPhail traps, 2001–2002, M. Aluja, 3♂ 4♀ 1? (USNM USNMMENT00213727-734); Tancítaro, Huerta Nurite, McPhail trap 51, 10 Sep 2001, M. Aluja, 1♀ (IEXV USNMMENT00214986); same, 17 Sep 2001, 1♂ (USNM USNMMENT00213597); same, McPhail trap 4, 10 Sep 2001, 1♀ (IEXV USNMMENT00213594); same, trampa 24, 25 Sep 2001, 1♂ 1♀ 1? (IEXV USNMMENT00214719-21) 1♀ (USNM USNMMENT00214722); Uruapan, Huerta San Manuel, trap 16, 5 Sep 2001, M. Aluja, 1♂ (USNM USNMMENT00213607). Sinaloa: 15 mi. W of El Palmito, 5000 ft., 30 Jul 1964, W.R. Mason, 1♂ 1♀ (CNC); same, 20 Jul 1964, 1♀ (CNC).

**Etymology.** The name of this species is an adjective derived from the Greek *para*, meaning near, and *dentata*, the name of a closely related species.

**Comments.** This name was used in a doctoral dissertation and several manuscript keys used in training courses, but none of these are available for purposes of zoological nomenclature.

### *Anastrepha pseudanomala* Norrbom

Figs. 13, 23

*Anastrepha pseudanomala* Norrbom 2002: 415 [description; wing, eversible membrane, aculeus tip; Costa Rica, Panamá]; Korytkowski 2004: 22 [in list], 53 [in key].

**Partial description.** Wing (Fig. 13): Length 7.70 mm, width 3.06 mm, ratio 2.52. Apex of vein  $R_1$  at 0.55 wing length. Cell *c* 1.21 times as long as pterostigma; pterostigma 3.82 times as long as wide. Vein  $R_{2+3}$  without sharp bends or undulations. Crossvein *r-m* at 0.70 distance from *bm-cu* to *dm-cu* on vein *M*. Vein *M* strongly curved apically; cell  $r_{4+5}$  0.76 times as wide at apex as at level of *dm-cu*. Cell *bcu* with distal lobe moderately long, length of *bcu* 1.64 times as long as anterior margin. Wing pattern mostly dark brown and orange. C-band dark brown on anterior margin, more broadly in pterostigma, posterior margin including all of area in cell *br*, and on distal margin, orange medially, fading to subhyaline in cells *bc* and *c*. C-band and S-band broadly connected along vein  $R_{4+5}$ ; marginal hyaline area distal to apex of vein  $R_1$  subtriangular, constricted along vein  $R_{2+3}$ , extended almost to vein  $R_{4+5}$ , its apex aligned with crossvein *r-m*. Hyaline area in cell *br* narrow and elongate, well separated from vein  $R_{4+5}$  and 1.3–1.8 times as long as distal colored area of cell; cell *dm* with basal hyaline area relatively small. Basal half of S-band broad, mostly dark brown, orange in posterior half of cell *br* except proximal margin and in cell *dm* except distal margin, posterior margin with moderate sized incision in cell  $cu_1$ ; distal section of band dark brown, narrow, at apex of vein  $R_{2+3}$  0.45 times width of cell  $r_{2+3}$ , even in width, well separated from apex of vein *M*; hyaline area proximal to apex of band ending at vein  $R_{2+3}$ . V-band incomplete, proximal arm relatively slender, dark brown, fading in anterior half of cell  $r_{4+5}$ , extending to vein  $R_{4+5}$  but well separated from S-band, on posterior margin with long proximal extension almost to vein  $A_1+Cu_2$ ; distal arm absent.

Female terminalia: Oviscape 4.30 mm long, 1.24 times as long as mesonotum, mostly dark orange, ventral third yellow; spiracle at basal 0.33. Eversible membrane (Fig. 23) with ca. 30 moderately stout, hooklike dorso-basal scales in 3–4 irregular rows in triangular pattern. Aculeus [not dissected, but distal half extruded] slightly ventrally curved in lateral view; shaft 0.14 mm wide at midlength; tip 0.39 mm long, 0.158 mm wide, 2.47 times as

long as wide, very slightly tapered (width at base of serrate part 0.14 mm) then triangular, distal 0.64 finely serrate, 0.07 mm wide in lateral view, 0.35 times ventral width. Spermathecae not dissected.

**Distribution.** *Anastrepha pseudanomala* was previously known from Costa Rica and Panamá. It was recently found in Brazil (Jesus et al., in press). It is recorded for the first time from Ecuador.

**Biology.** The only known host plant for *A. pseudanomala* is *Couma utilis* (Apocynaceae) in Brazil (Jesus et al., in press).

**Material examined.** ECUADOR: Napo: Reserva Etnica Waorani, Onkone Gare Camp, 1 km S, Transect Ent., 0°39'10"S 76°26'W, Transect 7, Station 5, 220 m, insecticidal fogging, terra firme forest, 2 Jul 1995, T. L. Erwin et al. Project MAXUS lot 1065, 1 ♀ (USNM USNM00054542).

**Comments.** This species was adequately described by Norrbom (2002). A partial description and measurements for the Ecuador female are provided here to document the variation in this species.

### *Anastrepha raveni*, new species

Figs. 14–16, 24, 34–35, 43–44

**Diagnosis.** *Anastrepha raveni* differs from most other species of *Anastrepha* in having the hyaline area between the C-band and S-band extending anteriorly into cell  $r_1$ , but not reaching or only very narrowly reaching the costa, and vein  $R_{2+3}$  sinuous. It resembles *A. loewi* Stone and especially *A. levefasciata*, n. sp., but differs from the former in having a narrower aculeus tip and lacking the distal arm of the V-band and the male brown genal spot, and from *A. levefasciata* in having shorter terminalia (oviscape length less than 4 mm vs. greater than 8 mm; phallus less than 5 mm vs. greater than 10 mm) and the shape of the aculeus tip (lateral margins slightly convex, not distinctly concave).

**Description.** Mostly yellow to orange, with white to pale yellow markings poorly differentiated in type specimens. Setae pale to dark orange.

Head: Yellow to orange except brown ocellar tubercle. 2–3 frontal setae; 2 orbital setae, posterior seta well developed. Ocellar seta weak, about as long as ocellar tubercle. Facial carina, in profile, straight to slightly concave dorsally and medially. Antenna extended ca. 0.75 distance to ventral facial margin.

Thorax: Mostly yellow to orange, without brown markings, typical white to pale yellow areas poorly differentiated in type specimens. Subscutellum and mediotergite entirely orange. Mesonotum 2.25–3.98 mm long. Postpronotal lobe, scutum, and scutellum entirely microtrichose; scutal setulae yellowish. Chaetotaxy typical for genus. Katepisternal seta weak, at most slightly longer but weaker than postocellar seta, yellowish.

Legs: Entirely yellow to orange.

Wing (Figs. 14–16): Length 5.50–8.25 mm, width 2.05–2.90 mm, ratio 2.52–2.73. Apex of vein  $R_1$  at 0.58–0.65 wing length, distal to crossvein r-m. Pterostigma elongate; cell c 0.89–1.13 times as long as pterostigma; pterostigma 4.4–5.3 times as long as wide. Vein  $R_{2+3}$  strongly sinuous. Crossvein r-m at 0.63–0.69 distance from bm-cu to dm-cu on vein M. Vein M very strongly curved apically; cell  $r_{4+5}$  0.50–0.64 times as wide at apex as at level of dm-cu. Cell bcu with distal lobe moderately long, length of bcu 1.54–1.68 times as long as anterior margin. Wing pattern mostly orange, sometimes pale. C-band mostly orange, more opaque in pterostigma. C-band and S-band very narrowly connected or separated along costa by hyaline band that tapers anteriorly in cell  $r_1$ , reaching or almost reaching costa and apex of vein  $R_1$ ; broadly separated along veins  $R_{2+3}$  and  $R_{4+5}$  by hyaline band that extends to cell bm; C-band narrow in basal part of cell  $r_{2+3}$ . Cell dm with basal hyaline area small. Basal half of S-band mostly orange, posterodistal margin often orange brown in cells dm and  $cu_1$ ; distal section orange except orange brown apically in cells  $r_{2+3}$  and  $r_{4+5}$ , narrowing along vein  $R_{2+3}$  or in cell  $r_{2+3}$ , distal half relatively slender, at apex of vein  $R_{2+3}$  0.42–0.57 times width of cell  $r_{2+3}$ , extended to apex of vein M; hyaline area proximal to apex of band extending to vein  $R_{2+3}$ . V-band incomplete; proximal arm slender, diffuse, section bordering dm-cu orange brown, fading anteriorly, faint or absent in anterior half or more of cell  $r_{4+5}$ , separate from S-band anteriorly, on posterior margin with short, proximal extension at most one-third distance to vein  $A_1+Cu_2$ ; distal arm absent.

Abdomen: Mostly orange, without brown markings. Setulae yellow to orange.

Male terminalia: Lateral surstylus moderately long, extended beyond prenisetae by 2.0–2.5 times length of preniseta; in lateral view (Fig. 43) slender and slightly posteriorly curved; in posterior view (Fig. 44) tapering,

then almost parallel-sided subapically, lateral margin slightly concave, apex rounded or slightly truncate, medial margin gradually convex. Proctiger with ventral and lateral sclerotized areas connected. Phallus 4.0–4.7 mm long, 1.18–1.78 times as long as mesonotum; glans 0.55–0.60 mm long, 0.13–0.14 times as long as phallus.

Female terminalia: Oviscape 2.65–3.30 mm long, 0.93–1.06 times as long as mesonotum, straight in lateral view, entirely yellow to orange; spiracle at basal 0.26–0.33. Eversible membrane (Fig. 24) with 20–25 strong, hooklike dorsobasal scales in 4 irregular rows in subtriangular to semicircular pattern. Aculeus (Fig. 34) straight in lateral view, 2.85–3.24 mm long, 0.95–1.08 times oviscape length; in ventral view base strongly expanded, 0.19–0.22 mm wide; shaft 0.10–0.12 mm wide at midlength; tip (Fig. 35) 0.22–0.29 mm long, 0.07–0.10 times aculeus length, 0.10–0.12 mm wide, 1.91–2.70 times as long as wide, triangular, lateral margin slightly convex and gradually tapered to blunt apex, nonserrate, 0.06–0.07 mm wide in lateral view, 0.62–0.74 times ventral width. Spermathecae slightly coiled.

**Distribution.** *Anastrepha raveni* is known only from eastern Perú (Huánuco, Junín, Madre de Dios).

**Biology.** The host plants and other aspects of the biology of this species other than dates of capture of adults are unknown.

**Type data.** Holotype ♀ (USNM USNMMENT00671660), PERÚ: Huánuco: Tingo Maria, [no date], G. Egoavil, A001. Paratypes: PERÚ: Huánuco: Tingo Maria, [no date], G. Egoavil, A001, 1♂ (USNM USNMMENT00671661), 1♂ 2♀ (MEUP); Tingo María, [no date], G. Egoavil M001, 3♂ 2♀ (USNM USNMMENT00671677-81), 3♂ (SENASA). Junín: Satipo, McPhail trap, 17 May 1996, 1♂ (USNM USNMMENT00671657); Chanchamayo, San Ramon, Chincana, 7 Mar 2008, J. Cayo, 1♀ (SENASA USNMMENT00654975); Chanchamayo, Pichanaki, 2009, G. González, 4♂2♀ (USNM USNMMENT00671884-89) 1♂2♀ (SENASA); Chanchamayo, Pichanaki, Villa Santa María, 21 Oct 2008, J. Avalos, 1♂ (USNM USNMMENT00671684). Madre de Dios: Tambopata, Las Piedras, Mavila, 24 Nov 2006, N. Nolzco, 1♀ (SENASA USNMMENT00671686); Tambopata, Las Piedras, Planchón, 18 Nov 2005, N. Nolzco, 1♂ (SENASA USNMMENT00671634).

**Etymology.** The name of this species is a genitive patronym in honor of the late Klaus Raven Büller, Professor of Entomology at the Universidad Nacional Agraria and an early advisor of and inspiration to the junior author.

### *Anastrepha superflua* Stone

*Anastrepha superflua* Stone 1942: 33 [description; wing, aculeus tip; Panamá]; Steyskal 1977b: 9 [in key]; Norrbom 1997: 153 [revision; head, male terminalia, eversible membrane]; Norrbom *et al.* 1999a: 82 [catalog]; Korytkowski 2004: 46 [in key]; Norrbom 2004: 6604460 [database; Costa Rica].

**Distribution.** Costa Rica, Panamá. Norrbom (2004) listed Costa Rica in the distribution of this species, but without specimen data, which are reported here.

**Material examined.** COSTA RICA: Guanacaste: Parque Nacional Guanacaste, 9 km S of Santa Cecilia, Estación Pitilla, 11°0'N 85°26'W, LN 330200 380200, 700 m, Aug 1994, P. Rios 3171, 2♂ (INBio INBioCRI002050755, INBioCRI002050772).

### *Anastrepha trivittata*, new species

Figs. 3, 17

**Diagnosis.** *Anastrepha trivittata* differs from other species of *Anastrepha* by the color pattern of its abdomen, which has three orange brown vittae. It further differs from most species in having the side of the scutellum brown on the basal third and a “*grandis*-type” wing pattern, with a complete S-band broadly fused to the C-band along the costa with no marginal hyaline mark in cell  $r_1$ . Species of the *daciformis* group have both the disc and the side of the scutellum darker basally without an intervening yellow area at the corner as occurs in *A. trivittata*. *Anastrepha paracentata* and *A. phaeoptera* also have the side brown, but have a hyaline marginal area in cell  $r_1$ . The eversible membrane, with only one row of well developed dorsobasal scales, is also unusual although similar to those of *A. castilloi* Norrbom, which has a similar wing pattern, and *A. aberrans* Norrbom, which has similar thoracic coloration (Norrbom 1991, 1993).

**Description.** Dark orange brown to dark brown and orange, with pale yellow markings. Setae dark red brown. Head: Yellow to orange except elongate dark orange brown and brown mark on posterior side, broad and trilobed anteriorly, but not reaching lateral margin of frons, with lateral lobes extended to posterior parts of orbital plates and medial lobe including ocellar tubercle, mark tapering ventrally, almost wedge-shaped, extended to ventral margin of occiput. 4 frontal setae; 2 orbital setae, posterior seta well developed. Ocellar seta weak, 1.5 times as long as ocellar tubercle. Facial carina, in profile, straight dorsally and medially. Antenna extended 0.70 distance to ventral facial margin.

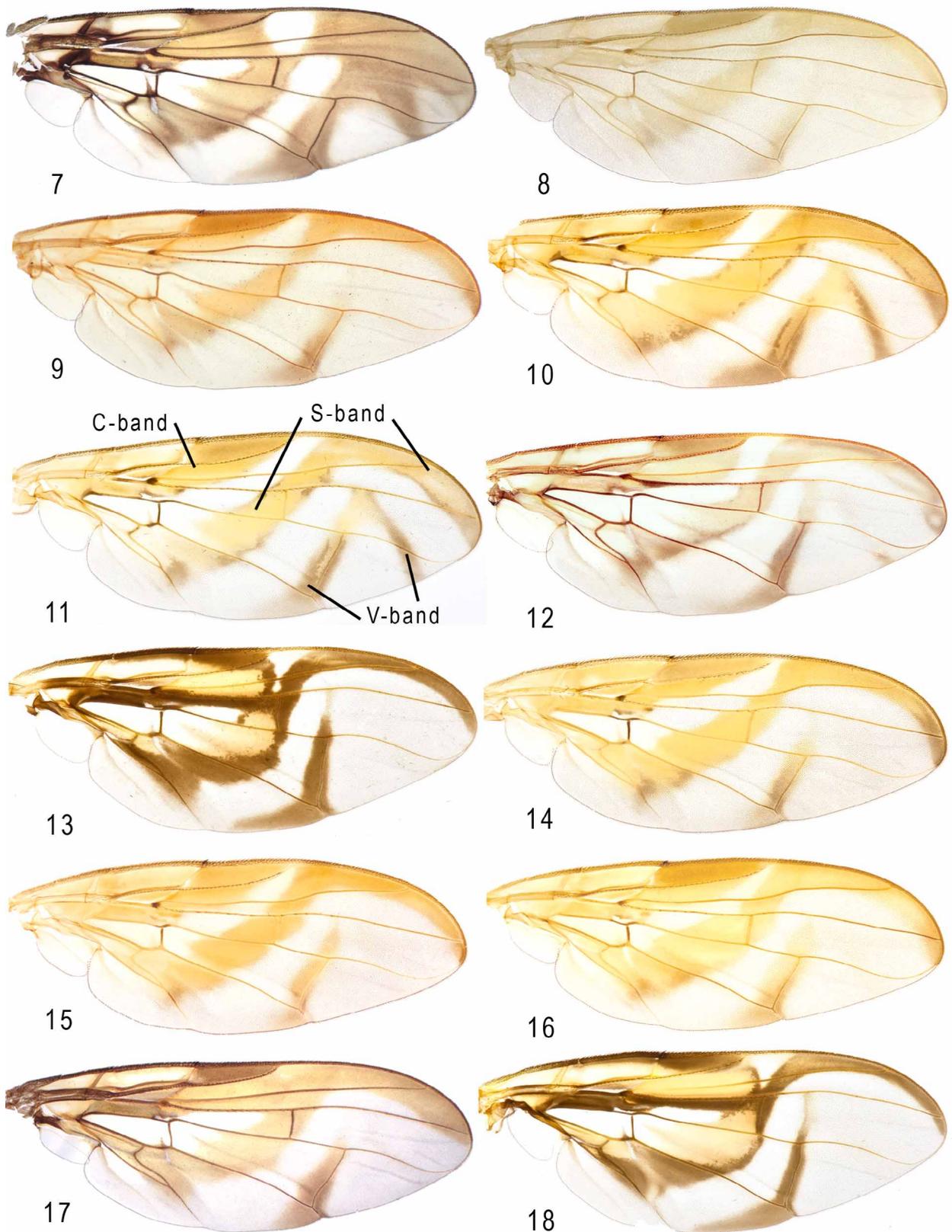
Thorax (Fig. 3): Mostly dark orange brown to dark brown with pale yellow areas as follows: postpronotal lobe and lateral margin of scutum bordering it, extending posteriorly to presutural supra-alar seta but interrupted before transverse suture and not extended onto notopleuron which is completely red brown; unpaired medial vitta extended from anterior margin, relatively narrow and very slightly expanding posteriorly to midway between transverse and scuto-scutellar sutures, then abruptly expanded and subrectangular, extended laterally to dorsocentral seta and posteriorly to acrostichal seta; paired dorsocentral vitta, connected anteriorly to yellow lateral area bordering postpronotal lobe and posteriorly to lateral posterior part of medial vitta; paired postsutural sublateral vitta, inverted L-shaped, connected to dorsocentral vitta along transverse suture, then extended along intra-alar line and including intra-alar seta to posterior margin; scutellum, except short semicircular brown basal area on disc, extended almost to level of basal seta, and basal third of side, extended slightly distal to basal seta, separated from brown area on disc at corner; propleuron; posterodorsal half and anteroventral margin of anepisternum; dorsal margin of katapisternum; and most of anatergite and katatergite. Scutum mostly dark orange brown to red brown, posterior margin and notopleuron diffusely darker brown. Anepisternum with dark orange brown band from anterodorsal corner to ventral end of phragma. Anepimeron dark brown except ventrally. Meron mostly brown. Anatergite and katatergite with large posteroventral dark brown spot. Subscutellum and mediotergite dark brown laterally, orange brown medially. Mesonotum 4.70 mm long. Postpronotal lobe, scutum, and scutellum entirely microtrichose; scutal setulae yellow. Chaetotaxy typical for genus. Katapisternal seta weak, yellow, ca. half as long as anepimeral seta.

Legs: Entirely yellow to orange.

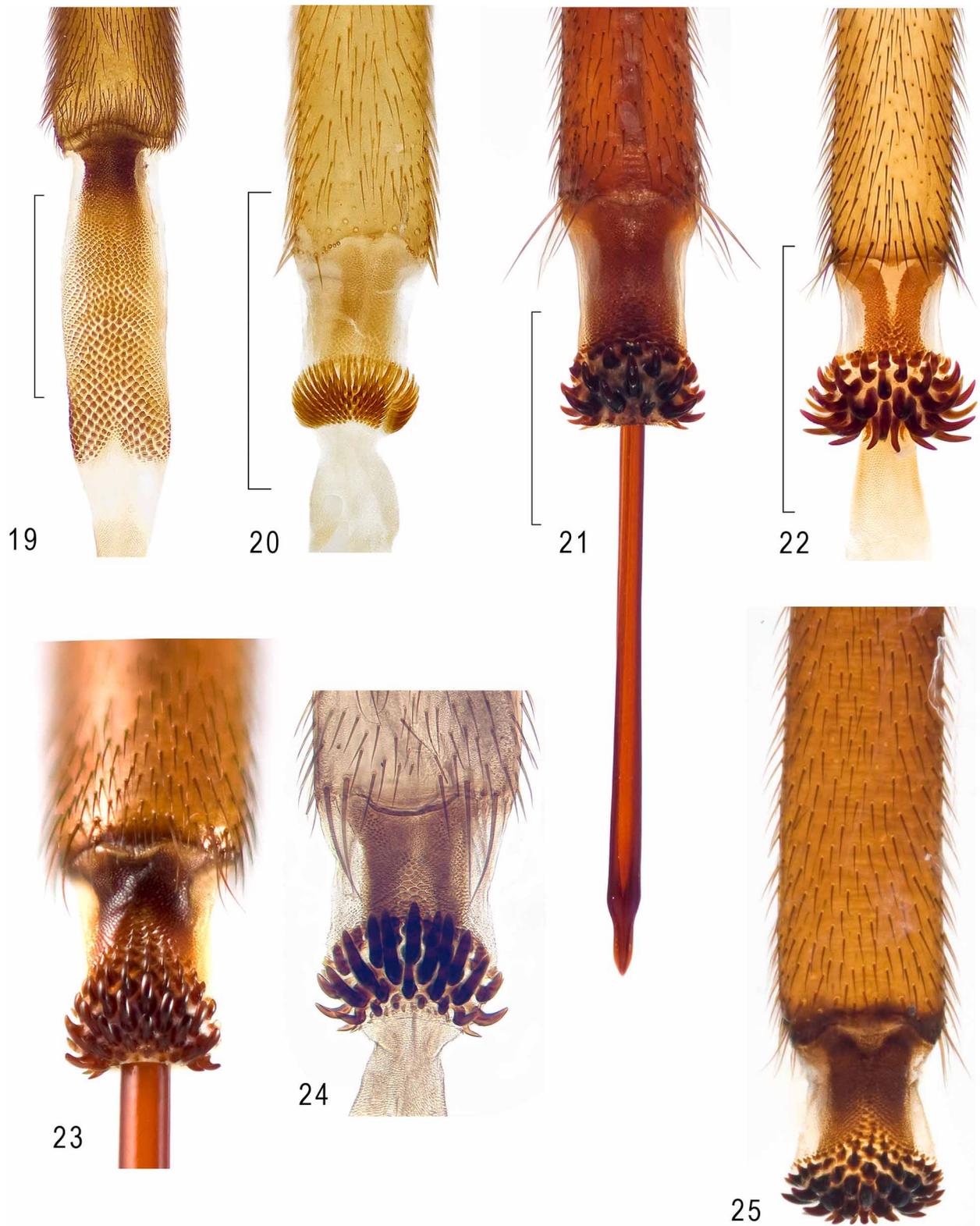
Wing (Fig. 17): Length 11.70 mm, width 4.35 mm, ratio 2.68. Apex of vein  $R_1$  at 0.57 wing length. Cell c 1.11 times as long as pterostigma; pterostigma 5.37 times as long as wide. Vein  $R_{2+3}$  without sharp bends or undulations. Crossvein r-m at 0.68 distance from bm-cu to dm-cu on vein M. Vein M moderately strongly curved apically; cell  $r_{4+5}$  0.91 times as wide at apex as at level of dm-cu. Cell bcu with distal lobe moderately long, length of bcu 1.61 times as long as anterior margin. Wing pattern mostly orange and orange brown. C-band mostly orange, slightly darker orange brown in pterostigma and parts of cells br and  $r_{2+3}$  aligned with cell bm, paler in cells bc and c, subhyaline in broad posterior medial area of cell c. C-band and S-band very broadly connected between vein  $R_{4+5}$  and costa; marginal hyaline area distal to apex of vein  $R_1$  absent. Hyaline area in cell br broad and elongate, very narrowly separated from vein  $R_{4+5}$  and more than 2.5 times as long as distal colored area of cell; cell dm with basal hyaline area moderately large. Basal half of S-band moderately broad, mostly orange, parts of posterior margin in cells dm and  $cu_1$  slightly darker, posterior margin without distinct incision in cell  $cu_1$ ; distal section of band orange, becoming slightly darker orange brown in distal part of cell  $r_1$ , and in much of cells  $r_{2+3}$  and  $r_{4+5}$ , moderately broad, at apex of vein  $R_{2+3}$  0.8 times width of cell  $r_{2+3}$ , nearly even in width, slightly broader along vein  $r_{4+5}$ , well separated from apex of vein M; hyaline area proximal to apex of band ending at vein  $R_{2+3}$ . V-band incomplete, proximal arm slender, mostly moderate brown, faint anterior to vein M and ending slightly anterior to it, well separated from S-band; relatively narrow along posterior wing margin, extending less than half distance to vein  $A_1+Cu_2$ ; distal arm absent.

Abdomen: Yellow with three dark orange brown vittae, connected medially on syntergite 1+2; unpaired medial vitta extending posteriorly to midlength of tergite 5, separated from narrower paired lateral marginal vittae by yellow area slightly broader than medial vitta. Tergite 6 also dark orange brown. Base of syntergite 1+2 yellow.

Female terminalia: Oviscape 9.90 mm long, 2.11 times as long as mesonotum, straight in lateral view, entirely dark orange; spiracle at basal 0.18. Eversible membrane with 11 long hooklike dorsobasal scales in single row distal to 2–3 irregular rows of short, weakly sclerotized scales. Aculeus broken in holotype (tip missing), at least 8.6 mm long, 0.87 times oviscape length; in ventral view base strongly expanded, 0.16 mm wide; shaft 0.05 mm wide at midlength. Spermathecae not dissected.



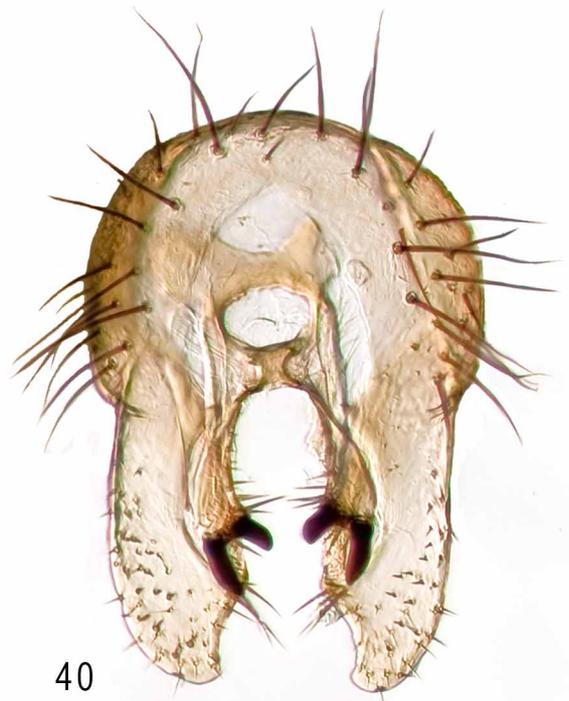
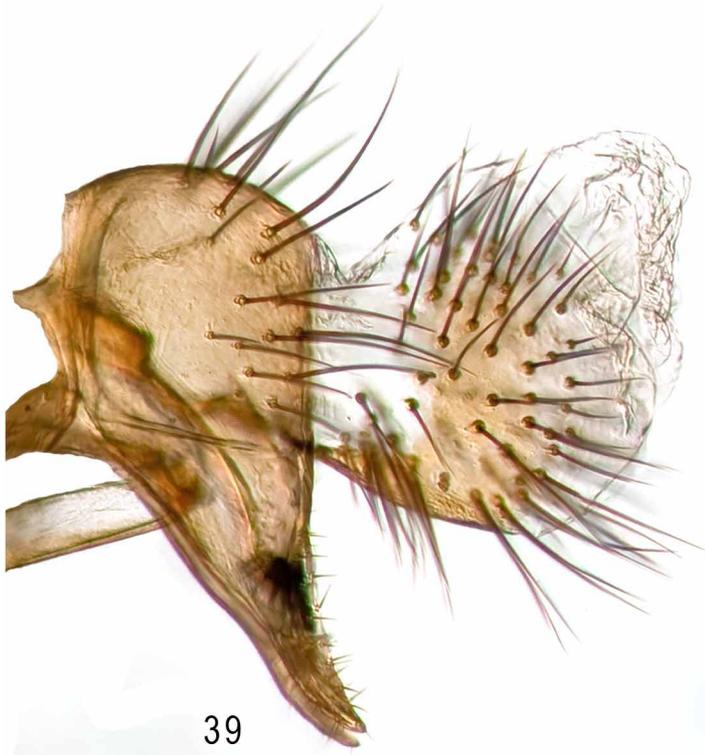
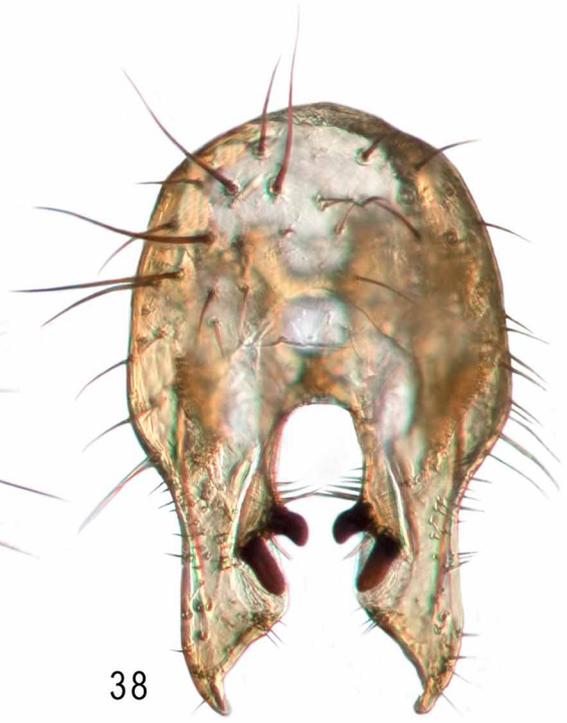
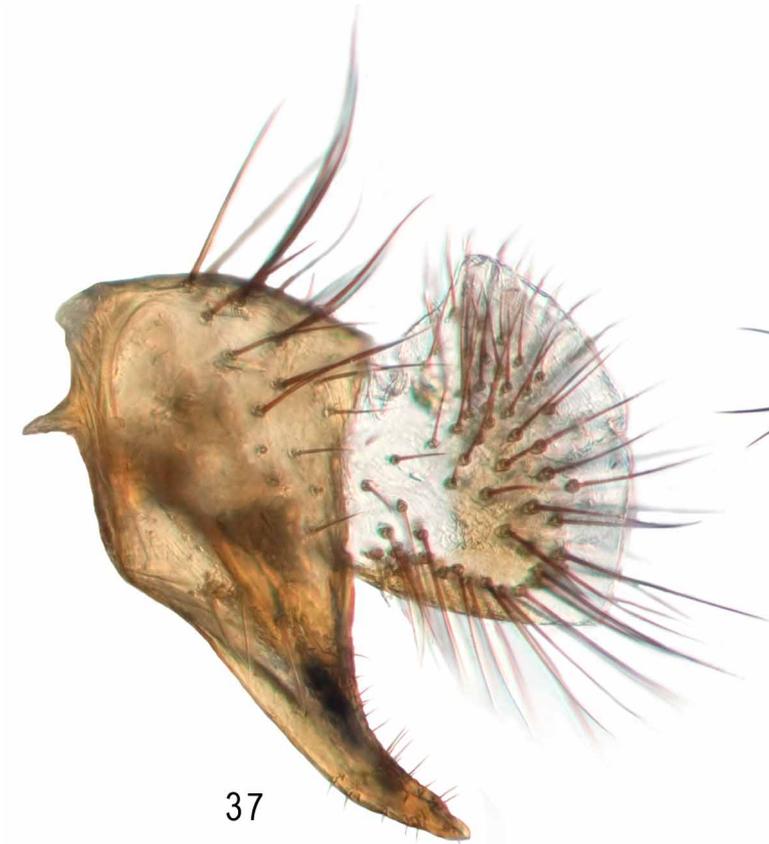
**FIGURES 7–18.** Wings: 7, *A. conflua* (Costa Rica: Est. Pitilla, INBioCRI001391699); 8–9, *A. levefasciata* (Peru: Tingo Maria, USNMENT00213407; Villa Santa María, USNMENT00671683); 10–11, *A. nolazcoae* (Perú: San Miguel La Cocha, USNMENT00671197, USNMENT00671195); 12, *A. paradentata* (Mexico: W of El Palmito); 13, *A. pseudanomala* (Ecuador: Onkone Gare Camp, USNMENT00054542); 14–16, *A. raveni* (Perú: Chincana, USNMENT00654975; Planchón, USNMENT00671634; Tingo Maria, USNMENT00671660); 17, *A. trivittata* (holotype); 18, *A. woodleyi* (Bolivia: Potrerillos del Guenda, USNMENT00104216).



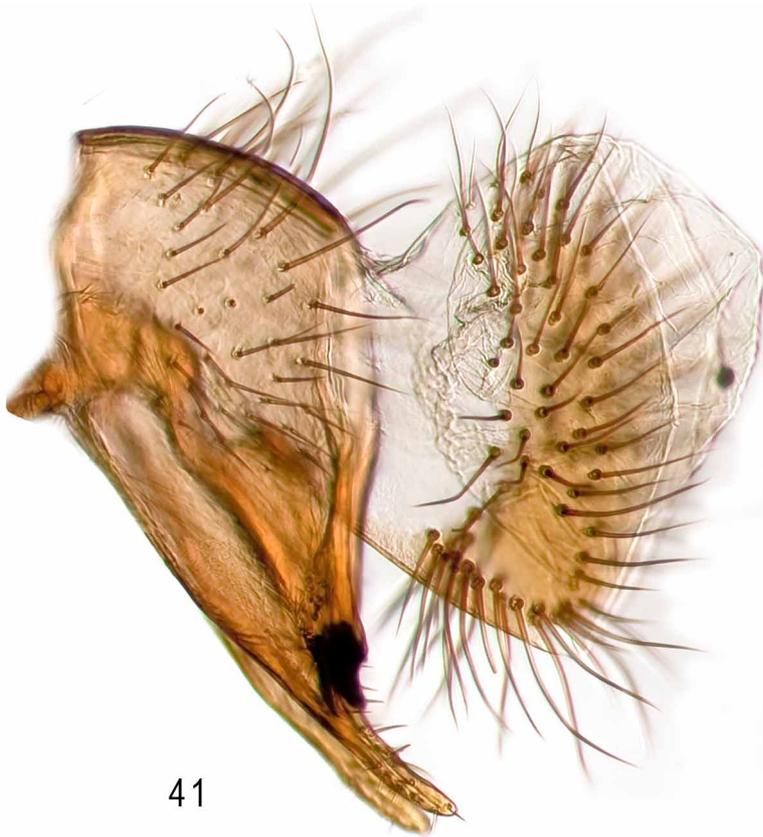
**FIGURES 19–25.** Eversible membranes: 19, *A. conflua* (Costa Rica: Est. Pitilla, INBioCRI001391699); 20, *A. kuhlmanni* (Brazil: Rio Trapicheiro); 21, *A. levefasciata* (Peru: Villa Santa María, USNMENT00671683); 22, *A. nolazcoae* (Perú: San Miguel La Cocha, USNMENT00671197); 23, *A. pseudanomala* (Ecuador: Onkone Gare Camp, USNMENT00054542); 24, *A. raveni* (Perú: Tingo María); 25, *A. woodleyi* (holotype); bar = 1.0 mm.



**FIGURES 26–36.** Aculei: 26–28, *A. conflua* (Costa Rica: Est. Pitilla, INBioCRI001391699), whole, base and tip; 29–30, *A. levefasciata* (holotype), base and tip; 31–32, *A. nolazcoae* (Perú: San Miguel La Cocha, USNMMENT00671197), whole and tip; 33, *A. paradentata* (Mexico: W of El Palmito, copied from Norrbom 1985, fig. 30C), tip; 34–35, *A. raveni* (Perú: Tingo Maria), whole and tip; 36, *A. woodleyi* (holotype), tip; bar = 0.10 mm.



**FIGURES 37–40.** Male terminalia (epandrium, surstyli and proctiger, lateral; epandrium and surstyli, posterior): 37–38, *A. mucronota* (Colombia: Cachipay, USNMENT00214070); 39–40, *A. nolazcoae* (USNMENT00671195).



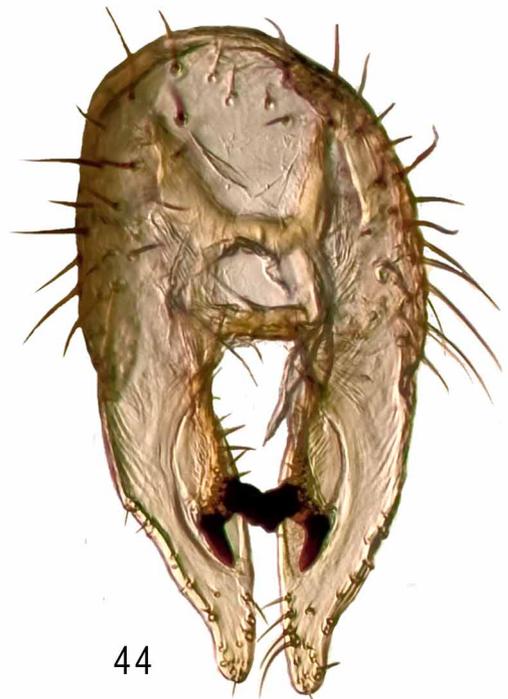
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**FIGURES 41–44.** Male terminalia (epandrium, surstyli and proctiger, lateral; epandrium and surstyli, posterior): 41–42, *A. levefasciata* (Peru: Villa Santa María, USNMENT00671857); 43–44, *A. raveni* (Peru: Villa Santa María, USNMENT00671684).

**Distribution.** *Anastrepha trivittata* is known only from northern Brazil (Amazonas).

**Biology.** The host plants and other aspects of the biology of this species other than dates of capture of adults are unknown.

**Type data.** Holotype ♀ (USNM USNM00051003) BRAZIL: Amazonas: ca. 60 km N of Manaus, Hwy ZF 2, km 19.5, 2°30'S 60°15'W, terra firme, canopy fogging project transect #10, col. by hand, 18 Aug 1979, Adis, Erwin, Montgomery, *et al.*

**Etymology.** The name of this species is a Latin adjective referring to the three stripes on the abdomen.

### *Anastrepha woodleyi*, new species

Figs. 2, 18, 25, 36

**Diagnosis.** *Anastrepha woodleyi* belongs to the *serpentina* species group based on having the abdominal tergites brown laterally and the mesonotum and mediotergite predominantly brown. Its wing pattern and aculeus tip are also similar to some of the species included in that group. In the key of Norrbom (2002) it runs to couplet 8 and differs from all of the species remaining in the key at that point in having longer terminalia (oviscape 8.0 mm long, 2.06 times as long as mesonotum vs. 2.58–5.51 mm long, 0.79–1.56 times mesonotum length).

**Description.** Mostly dark red brown, with pale yellow markings. Setae dark red brown to black.

Head: Mostly yellow; orbital plate with dark red brown spot not connected to brown ocellar tubercle; occiput with dark red brown spot lateral to suture ventral to lateral orbital seta. 4 frontal setae; 1–2 orbital setae, posterior seta well developed in female, absent in male. Ocellar seta weak, at most 1.5 times as long as ocellar tubercle. Facial carina, in profile, straight dorsally and medially. Antenna extended 0.67–0.86 distance to ventral facial margin.

Thorax (Fig. 2): Moderate to dark brown and orange with following areas yellow: postpronotal lobe and margin of scutum bordering it, extending almost to presutural supra-alar seta but not onto notopleuron which is completely brown; medial scutal vitta, slender except posterior sixth expanded and rounded to subtriangular, extended laterally almost midway between acrostichal and dorsocentral lines; paired postsutural sublateral scutal vitta from transverse suture to posterior margin, including base of intra-alar seta; scutellum except basal margin of disc with narrow brown semicircular area extended almost to level of basal seta; dorsal margins of anepisternum and katepisternum; katepimeron; and most of anatergite and katatergite. Notopleuron and most of scutum moderate to dark brown or sometimes partially orange, especially bordering anterior half of medial yellow vitta. Anepisternum with broad, oblique brown area. Most of anepimeron and large posteroventral spot on anatergite and katatergite dark brown. Subscutellum and mediotergite dark brown laterally, dark orange medially. Mesonotum 3.60–3.88 mm long. Postpronotal lobe, scutum, and scutellum microtrichose except large semicircular anterior area on scutum extended two-thirds distance to transverse suture and laterally beyond medial corner of postpronotal lobe; scutal setulae yellow medially, brownish on lateral margin. Chaetotaxy typical for genus. Katepisternal seta weak, yellow, no longer than postocellar seta, and much weaker.

Legs: Entirely yellow to orange.

Wing (Fig. 18): Length 8.40–9.05 mm, width 3.27–3.40 mm, ratio 2.57–2.66. Apex of vein  $R_1$  at 0.55–0.57 wing length. Cell c 1.10–1.19 times as long as pterostigma; pterostigma 4.44–4.59 times as long as wide. Vein  $R_{2+3}$  without sharp bends or undulations. Crossvein r-m at 0.72–0.74 distance from bm-cu to dm-cu on vein M. Vein M strongly curved apically; cell  $r_{4+5}$  0.83–0.87 times as wide at apex as at level of dm-cu. Cell bcu with distal lobe moderately long, length of bcu 1.45–1.57 times as long as anterior margin. Crossvein dm-cu slightly oblique, anterior end slightly more distal than posterior end. Wing pattern mostly dark brown and orange. C-band dark brown on anterior margin, more broadly in pterostigma, posterior margin including all of area in cell br, and narrowly on distal margin, orange medially, fading to subhyaline in cells bc and c. C-band and S-band broadly connected along vein  $R_{4+5}$ ; marginal hyaline area distal to apex of vein  $R_1$  triangular, not extended to vein  $R_{4+5}$ , its apex aligned with crossvein r-m. Hyaline area in cell br narrow and elongate, well separated from vein  $R_{4+5}$  and ca. 1.67 times as long as distal colored area of cell; cell dm with basal hyaline area moderately large. Basal half of S-band broad, mostly dark brown, orange in posterior half of cell br, in cell dm except distal margin, small basal area in cell  $cu_1$ , and in cell bcu except posteroapical lobe; posterior margin without distinct incision in cell  $cu_1$ ; distal section of band entirely dark brown or with medial orange area in cell  $r_1$  and  $r_{2+3}$  (part anterodistal to r-m), narrow, at apex of vein  $R_{2+3}$  0.38–0.44 times width of cell  $r_{2+3}$ , even in width, well separated from apex of vein M; hyaline area proximal to

apex of band ending at vein  $R_{2+3}$ . V-band incomplete, proximal arm slender, dark brown, fading anterior to vein M, extending to vein  $R_{4+5}$  but well separated from S-band, on posterior margin with long proximal extension almost to vein  $A_1+Cu_2$ ; distal arm absent.

Abdomen: Mostly orange. Syntergite 1+2 with medial dark red brown band, broadening posterolaterally, and pair of medial yellow areas, that on posterior margin trapezoidal and 0.85 as wide as tergite. Tergite 3 mostly paler red brown, and female tergites 4 and 5 dark orange brown, all with triangular medial yellow area almost half as wide as tergite. Female tergite 6 and male tergites 4 and 5 dark orange.

Male terminalia: Epandrium with dorsal posterior margin without medial indentation. Lateral surstylus very similar to *A. serpentina* (Wiedemann) (Norrbon 2002, figs. 7A–D), moderately long, extended beyond prenisetae by ca. 2.5 times length of prenisetae; in lateral view slightly curved; in posterior view with small basolateral lobe, main part triangular, medial margin convex, lateral margin distal to basolateral lobe slightly convex then slightly concave. Proctiger with ventral and lateral sclerotized areas separated. Phallus 11.3 mm long, 3.14 times as long as mesonotum; glans 0.65 mm long.

Female terminalia: Oviscape 8.00 mm long, 2.06 times as long as mesonotum, straight in lateral view, entirely dark orange; spiracle at basal 0.24. Eversible membrane (Fig. 25) with ca. 30 moderately stout, hooklike dorsobasal scales in 3–4 irregular rows in triangular pattern. Aculeus slightly ventrally curved in lateral view, 7.50 mm long, 0.94 times oviscape length; in ventral view base strongly expanded, 0.24 mm wide; shaft 0.11 mm wide at mid-length; tip (Fig. 36) 0.29 mm long, 0.04 times aculeus length, 0.125 mm wide, 2.32 times as long as wide, triangular, gradually tapered to blunt apex, distal 0.66 finely serrate, 0.085 mm wide in lateral view, 0.68 times ventral width. Spermathecae globose.

**Distribution.** *Anastrepha woodleyi* is known only from Bolivia.

**Biology.** The host plants and other aspects of the biology of this species other than dates of capture of adults are unknown.

**Type data.** Holotype ♀ (USNM USNMENT00104215), BOLIVIA: Santa Cruz: Andrés Ibañez, Potrerillos del Guenda, 17°40'S 63°27'W, 400 m, at light, 23 Oct 2007, N. E. Woodley. Paratype: same data as holotype except 26 Oct 2007, 1 ♂ (USNM USNMENT00104216).

**Etymology.** The name of this species is a genitive patronym in honor of the collector of the type specimens, Norman E. Woodley.

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