

## Artículo científico

### Eight new species of the genus *Drosophila* (Diptera: Drosophilidae) from the Andes of southern Ecuador

### Ocho nuevas especies del género *Drosophila* (Diptera: Drosophilidae) de los Andes del sur de Ecuador

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**ABSTRACT.-** Eight new species of the genus *Drosophila* are described and illustrated: *Drosophila kingmani* sp. nov., *Drosophila malacatus* sp. nov., *Drosophila millmasapa* sp. nov., *Drosophila pichka* sp. nov., *Drosophila rusaryu* sp. nov., *Drosophila shunku* sp. nov., *Drosophila shunkuku* sp. nov. and *Drosophila taki* sp. nov. These species were collected in the cloud forests of Podocarpus National Park in the southern Ecuadorian Andes. The flies were captured using plastic bottles containing pieces of fermented banana with yeast.

**KEYWORDS:** Andean forest, Diptera, terminalia, Podocarpus National Park, taxonomy.

**RESUMEN.-** Ocho nuevas especies del género *Drosophila* fueron descritas e ilustradas: *Drosophila kingmani* sp. nov., *Drosophila malacatus* sp. nov., *Drosophila millmasapa* sp. nov., *Drosophila pichka* sp. nov., *Drosophila rusaryu* sp. nov., *Drosophila shunku* sp. nov., *Drosophila shunkuku* sp. nov. y *Drosophila taki* sp. nov. Las especies fueron colectadas en los bosques nublados del Parque Nacional Podocarpus en los Andes del sur de Ecuador. Las moscas fueron capturadas usando botellas plásticas cebadas con pedazos de banana fermentados con levadura.

**PALABRAS CLAVES:** Bosque andino, Diptera, terminalia, Parque Nacional Podocarpus, taxonomía.

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## INTRODUCTION

Species in the Drosophilidae have been described since 1787, when Fabricius described *Musca funebris*. This species was later moved to a new genus and became *Drosophila funebris*, the type species of the family (Brake and Bächli 2008). The Drosophilidae contains 3 952 species and 73 genera and are divided into two subfamilies, Steganinae and Drosophilinae (Bächli 2016). Drosophilinae is the most diverse subfamily and includes the genus *Drosophila*. The genus *Drosophila* is well known mainly because of the great interest in *Drosophila melanogaster* as a model organism and the vast knowledge of its biology and genetics of many of its members (Van der Linde and Houle 2008). The genus *Drosophila* has the most species with about 2 000

described species and comprises around 53 % of the total species and has been split of into 8 subgenera: *Drosophila*, *Sophophora*, *Chusqueophila*, *Dorsilopha*, *Dudaica*, *Phloridosa*, *Psilodorha* y *Siphlodora* (Brake and Bächli 2008).

Becker (1919) made the first record of the genus *Drosophila* in Ecuador. Until 2009, 112 species have been recorded from Ecuador and 92 of them belong to the subgenus *Drosophila* (Acurio and Rafael 2009). In subsequent years, studies of the diversity of the *Drosophila* in Ecuador have been set up as a priority. As a result of these investigations 38 new species have been described (Acurio et al. 2013; Cabezas and Rafael 2013, 2015; Cabezas et al. 2015; Céspedes and Rafael 2012a, 2012b; Figuero and Rafael

2011, 2013; Figuero et al. 2012a, 2012b; Llangari and Rafael 2017; Ramos and Rafael 2015, 2017, 2018; Peñafiel-Vinueza and Rafael 2018a, 2018b; Tamayo and Rafael 2016). Increasing the number of species reported in 2009 to 155. However, we believe there are many more species to be discovered in specialized habitats and remote, unexplored regions of Ecuador.

We describe eight new species of the genus *Drosophila*: *Drosophila kingmani* sp. nov., *Drosophila malacatus* sp. nov., *Drosophila millmasapa* sp. nov., *Drosophila pichka* sp. nov., *Drosophila rusaryu* sp. nov., *Drosophila shunku* sp. nov., *Drosophila shunkuku* sp. nov. and *Drosophila taki* sp. nov. Illustrations and photographs of the new species are included.

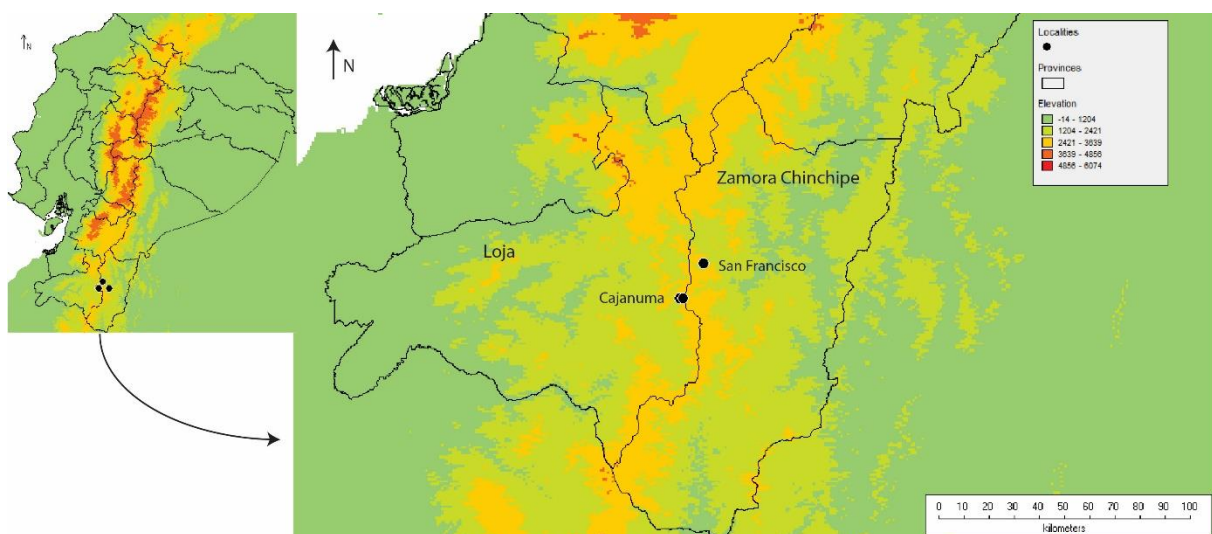
## MATERIAL AND METHODS

The flies were collected in Loja and Zamora Chinchipe Provinces of Ecuador, in the cloud forests of the Podocarpus National Park and the nearby vicinities. Collections were made at three localities (Figure 1). The first at San Francisco Scientific Station at 2 190 m (3°59'16.7"S; 79°5'35"W), in a montane cloud forest dominated by *Purdiaea nutans*, *Myrica pubescens*, *Myrsine andina* and families Myrsinaceae, Myricaceae, Melastomataceae, Bromeliaceae and Orchidaceae (Bussmann 2003). The two remaining locations in Cajanuma at 2 675 m

(4°6'53.7"S; 79°10'54.6"W) and Cajanuma at 2 800 m (4°6'58.9"S; 79°10'11.9"W) (Figure 2) in the high montane cloud forests dominated by arboreal species of the families Rosaceae, Rubiaceae, Ericaceae, Podocarpaceae, Melastomataceae, Arecaceae, Berberidaceae, Chloranthaceae, Lauraceae and Asteraceae (Lozano 2002). Fermented banana traps (15) were placed in each location ten meters apart from each other and a maximum of one meter above the base of the trees. Traps were made using recycled 500 ml plastic bottles and baited with banana pieces fermented with yeast 24 hours before placement in traps.

Flies were captured with an entomological aspirator and transferred to vials with gelatin-banana media (Rafael et al. 2000). Females were individually isolated to produce isofemale lines on fresh gelatin-banana media. Adult specimens were preserved in microcentrifuge tubes with ethanol (70-80 %) and glycerin (100 %) solution (Márquez-Luna 2005). Additionally, the baits were removed from the traps and placed inside glass jars sealed with cotton plugs. The bait material was transported to the laboratory where it was kept until emergence of adults.

External morphology of each fly was examined under a stereomicroscope (Zeiss; Discovery V8). Male and female terminalia were dissected and placed in 10 % KOH and boiled in a water bath for ten minutes.



**Figure 1.** Ecuador map showing Loja and Zamora Chinchipe provinces and collection localities Cajanuma and San Francisco.



**Figure 2.** Cloud montane forests of Cajanuma Valley (seen from Cajanuma trail), Podocarpus National Park, Province of Loja Ecuador, XII, 2016, D. Encalada-Bustamante photograh.

The terminalia were then placed in 60 % glycerin for females and 100 % for males. Terminalia were examined and compared with available literature to determine new species. The new species were illustrated using a microscope (Zeiss-46 70 86) with a camera lucida (Zeiss-47 46 20 9900). Measurements were made using the software Axio Vision V4. Indices of paratypes are presented in parentheses. Descriptive terms and indices follow the system of Bächli et al. (2004).

The holotypes and paratypes of the new species have been deposited in the Museo de Zoología-Invertebrados, Pontificia Universidad Católica del Ecuador, Quito (QCAZ-I).

## RESULTS

### *Drosophila kingmani* sp. nov.

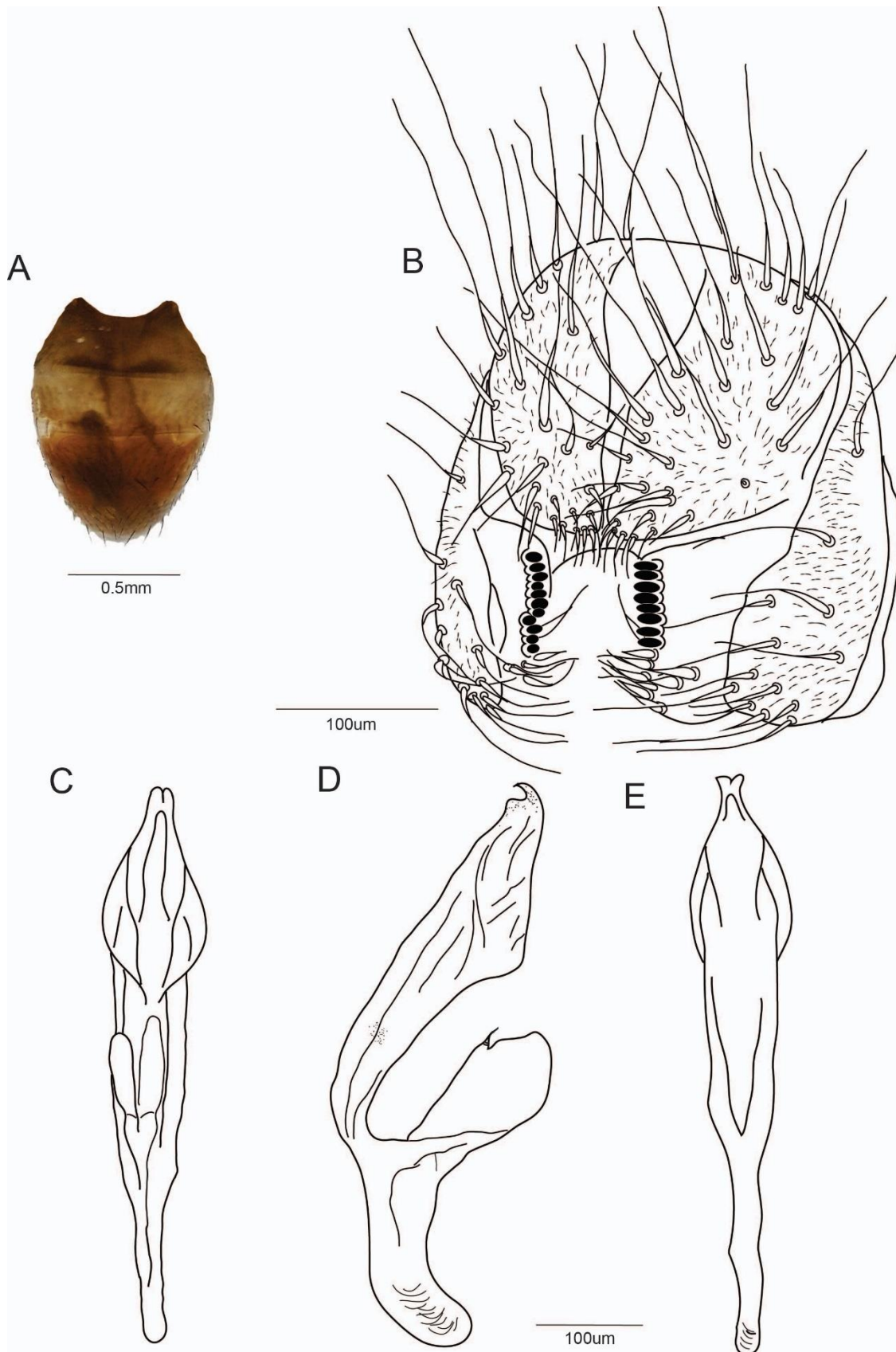
Figure 3 A-E

**Type material.-** Holotype male ♂ (dissected, terminalia in microvial, dry mounted), Ecuador, Zamora Chinchipe, San Francisco, 2 190 m, 3°59'16.7"S, 79°5'35"W, 19 Nov. 2015, A. Peñafiel col., A. Peñafiel & V. Rafael det. (QCAZ-I 3389).

**Diagnosis.-** Aristae with 5 dorsal and 2 ventral branches. One prominent oral bristles. Yellow wings. Thorax yellow. Abdomen yellow with dorsal midline, 1<sup>st</sup> tergite yellow, 2<sup>nd</sup> and 3<sup>rd</sup> tergites with triangular pigmentation in the posterior edge of each tergite. Cerci slightly fused to the epandrium. Hypandrium V-shaped, slightly sclerotized. Gonopod elongated bearing one long bristle. Aedeagus tubular, partially enlarged and membranous, slightly sclerotized (young specimen). Apex with two dorsally curved projections. Ventral rod well-developed. Paraphyses triangular bearing one bristle at the apex.

**Male description.-** Holotype external morphology: total length (body + wings) 4,30 mm, body length 3,01 mm. Body color yellow.

**Head.-** Aristae with 5 dorsal and 2 ventral branches plus terminal fork. Frontal length 0,29 mm, frontal index = 0,85; top to bottom width ratio = 1,47. Distance from or1 to or3 0,1 mm, distance from or3 to vtm 0,1; or1-or3 ratio = 0,45, or2-or1 ratio = 0,9, distance from postocellar setae 55,1 % of frontal length. Ocellar triangle black, 34,48 % of frontal length. vt index = 1. Cheek index = 7,28. One prominent oral bristle, vibrissal index = 0,37. Carina not prominent. Eye red, eye index = 1,59.



**Figure 3.** *Drosophila kingmani* sp. nov. Holotype ♂ **A** Abdomen **B** Epandrium, cerci, surstylus, decasternum **C**, **D**, **E** Aedeagus and paraphyses in ventral, lateral and dorsal view, respectively.

**Thorax.**- Yellow, thorax length 0,86 mm, acrostichal hairs in 8 irregular rows between the two anterior dorsocentral setae, h index = 1,25. Transverse distance of dorsocentrals 2,53x longitudinal distance. Distance between apical scutellar setae 95,2 % of that between apical and basal setae. Medial katapisternal seta  $\frac{1}{3}$  of the previous seta, sterno index could not be calculated (broken setae in holotype).

Legs yellow.

Wings yellow. Alar length 2,60 mm, alar width 1,14 mm. Alar indices: alar = 2,28; C = 4,67; ac = 1,59; hb = 0,46; 4c = 0,58; 4v = 1,51; 5x = 1,15; M = 0,40 and prox. x = 0,58.

**Abdomen.**- Yellow with dorsal midline, 1<sup>st</sup> tergite yellow, 2<sup>nd</sup> and 3<sup>rd</sup> tergites pigmented to the posterior edge of each tergite, 4<sup>th</sup> to 6<sup>th</sup> tergites yellow (Figure 3A).

**Male terminalia.**- Cerci partially fused to epandrium, ventral lobe with 17 lower bristles on the right and 14 bristles on the left side. Surstylus rectangular with 11 primary teeth on the right and 8 on the left side, 6 marginal bristles on the right and 9 on the left side (Figure 3B). Gonopod elongated bearing one long bristle.

**Aedeagus.**- Tubular, partially enlarged and membranous, slightly sclerotized (young specimen). Apex with two dorsally curved projections. Ventral rod well-developed. Paraphyses triangular bearing one bristle at the apex (Figure 3C-E).

**Etymology.**- The species name honors Eduardo Kingman (1913-1997). Kingman was a famous painter and muralist and was born in Loja. Kingman was a founder of the Ecuadorian impressionism movement.

**Distribution.**- Known only from the type locality.

**Biology.**- Unknown. The type specimen was in the banana-bait traps placed at the locality, which suggest that this species is a fermented fruit feeder as many other *Drosophila* species. The habitat is a well-preserved montane forest.

**Relationship to other species.**- This species belongs to the genus *Drosophila*. There is not an appropriate species-group where this species could be placed. However the male terminalia of *Drosophila sonora* Heed and Castrezana (2008) shows great similarity with *D. kingmani*. The general shape of the aedeagus of *D. kingmani* and

*D. sonora* is similar, and the aedeagus are dorsodistally bifid (see detailed illustrations from Vilela 2017 and figure 3C-E). But the differences between both species are greater. *D. sonora* is a cactophilic species captured mostly from deserts and cloud forests (Heed and Castrezana 2008; Vilela 2017), while *D. kingmani* is a fruit feeder species known from cloud forests where cactus is not found. The most important difference between *D. sonora* and *D. kingmani* is the external morphology. *D. sonora* has a spotted thorax and a conspicuous abdomen pattern, see figures 1 and 2 from Heed and Castrezana (2008), and *D. kingmani* thorax is yellow and the 2<sup>nd</sup> and 3<sup>rd</sup> tergites of abdomen have thin pigmented bands interrupted by a dorsal midline.

### *Drosophila malacatus* sp. nov.

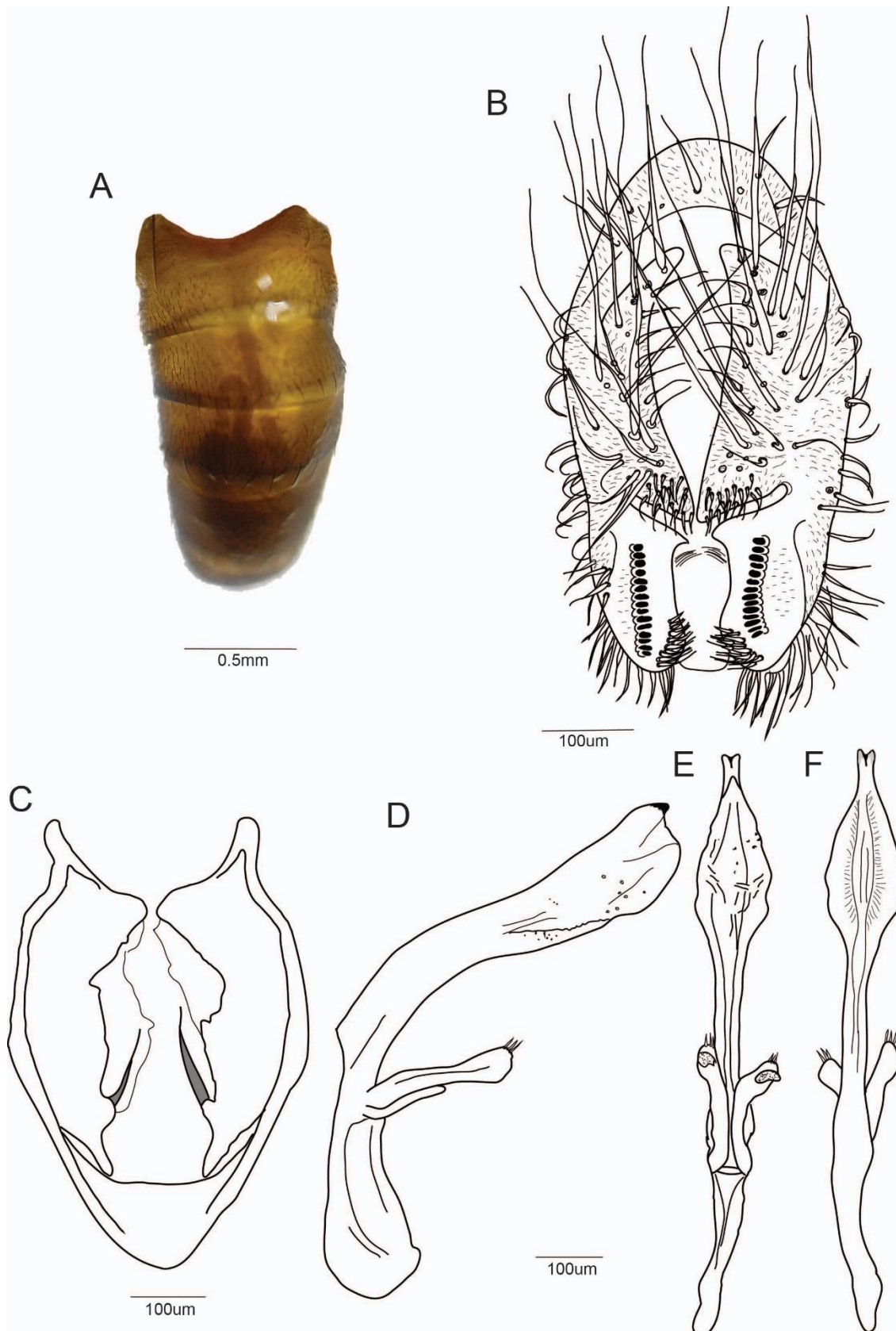
Figure 4 A-F

**Type material.**- Holotype male ♂ (dissected, terminalia in microvial, dry mounted), Ecuador, Loja, Cajanuma, 2 800 m, 4°6'58.9"S, 79°10'11.9"W, 19 Nov. 2015, A. Peñafiel col., A. Peñafiel & V. Rafael det. (QCAZ-I 3382).

**Diagnosis.**- Aristae with 4 dorsal and 2 ventral branches. One prominent oral bristle. Carina prominent and sulcate. Thorax yellowish brown. Wings, costal cell brown, marginal and submarginal cell slightly darker, dM-Cu slightly clouded. Abdomen yellow, 1<sup>st</sup> tergite yellow, 2<sup>nd</sup> to 6<sup>th</sup> tergites with posterior dark, thin pigmentation on each tergite. Cerci partially fused to epandrium. Hypandrium slightly sclerotized, vase-shaped. Gonopod bearing a long bristle. Paraphyses elongated bearing three small bristles. Aedeagus tubular, elongated and sclerotized, distally enlarged, with two lateral expansions with a wavy edge, ventrally membranous, apex bifid.

**Male description.**- Holotype external morphology: total length (body + wings) 5,15 mm, body length 3,74 mm. Body color yellowish brown.

**Head.**- Aristae with 4 dorsal and 2 ventral branches plus terminal fork, pedicel and flagellomere of the antenna yellowish brown. Orbital plate yellowish brown, frontal length 0,46 mm, frontal index = 0,93, top to bottom width ratio = 1,57. Medial vertical seta closer to lateral vertical seta; or1-or3 ratio = 0,84, or2-or1 ratio = 0,42. Ocellar triangle yellowish brown.



**Figure 4.** *Drosophila malacatus* sp. nov. Holotype ♂ **A** Abdomen **B** Epandrium, cerci, surstylus, decasternum **C** Hypandrium and gonopods in ventral view **D, E, F** Aedeagus and paraphyses in ventral, lateral and dorsal view, respectively.

Ocellus yellow. vt index, could not be calculated (broken setae on holotype). Frontal vitta yellowish brown.

Cheek index = 6,90. Carina prominent and sulcate. One prominent oral bristle; vibrissal index = 0,35. Eyes red, eye index = 1,33.

**Thorax.**- Yellowish brown, thorax length 1,30 mm, acrostichal hairs could not be recognized. h index = 1,19. dc index could not be calculated (broken bristles on holotype). Medial katepisternal seta  $\frac{1}{3}$  of the length of the previous seta, sterno index = 2,7.

Legs yellow.

Wings yellow. Alar length 4,21 mm, alar width 1,83 mm. Costal cell brown, marginal and submarginal slightly darker, dM-Cu slightly clouded. Alar indices: alar = 2,30; C = 5,20; ac = 1,45; hb = 0,60; 4c = 0,40; 4v = 1,05; 5x = 0,95; M = 0,26 and prox. x = 0,42.

**Abdomen.**- Yellow, 1<sup>st</sup> tergite yellow, 2<sup>nd</sup> to 6<sup>th</sup> tergites with posterior dark thin pigmentation on each tergite (Figure 4A).

**Male terminalia.**- Epandrium microtrichose, ventral lobe with 30 – 40 long bristles. Cerci partially fused to epandrium, microtrichose with long bristles and with a group of 16 small bristles. Surstylus rectangular, slightly microtrichose, with a row of 15 primary teeth on the right side and 14 on the left; 14 marginal bristles on each side (Figure 4B). Hypandrium slightly sclerotized, vase-shaped. Gonopod bearing one sclerotized long bristle (Figure 4C).

**Aedeagus.**- Sclerotized, elongated and tubular, distally enlarged, with two lateral expansions with a wavy edge, ventrally membranous, apex bifid. Ventral rod  $\frac{1}{2}$  the length of the paraphyses. Aedeagal apodeme wide and membranous. Paraphyses elongated bearing three small bristles (Figure 4D-F).

**Etymology.**- The species name refers to the Malacatos valley in Loja Province. The meaning of the word "Malacatos" comes from the name of the primitive indigenous tribe of the "Malacatus" who had the dominion over the Vilcabamba, Yangana and San Barnabas areas.

**Distribution.**- Known only from the type locality.

**Biology.**- Unknown. The type specimen was in the banana-bait traps placed at the locality, which

suggest that this species is a fermented fruit feeder as many other *Drosophila* species. The habitat is a well-preserved montane forest.

**Relationship.**- This species belongs to the genus *Drosophila*. There is not a species group where this species could be placed. There is not a similar species.

### *Drosophila millmasapa* sp. nov.

Figure 5 A-F

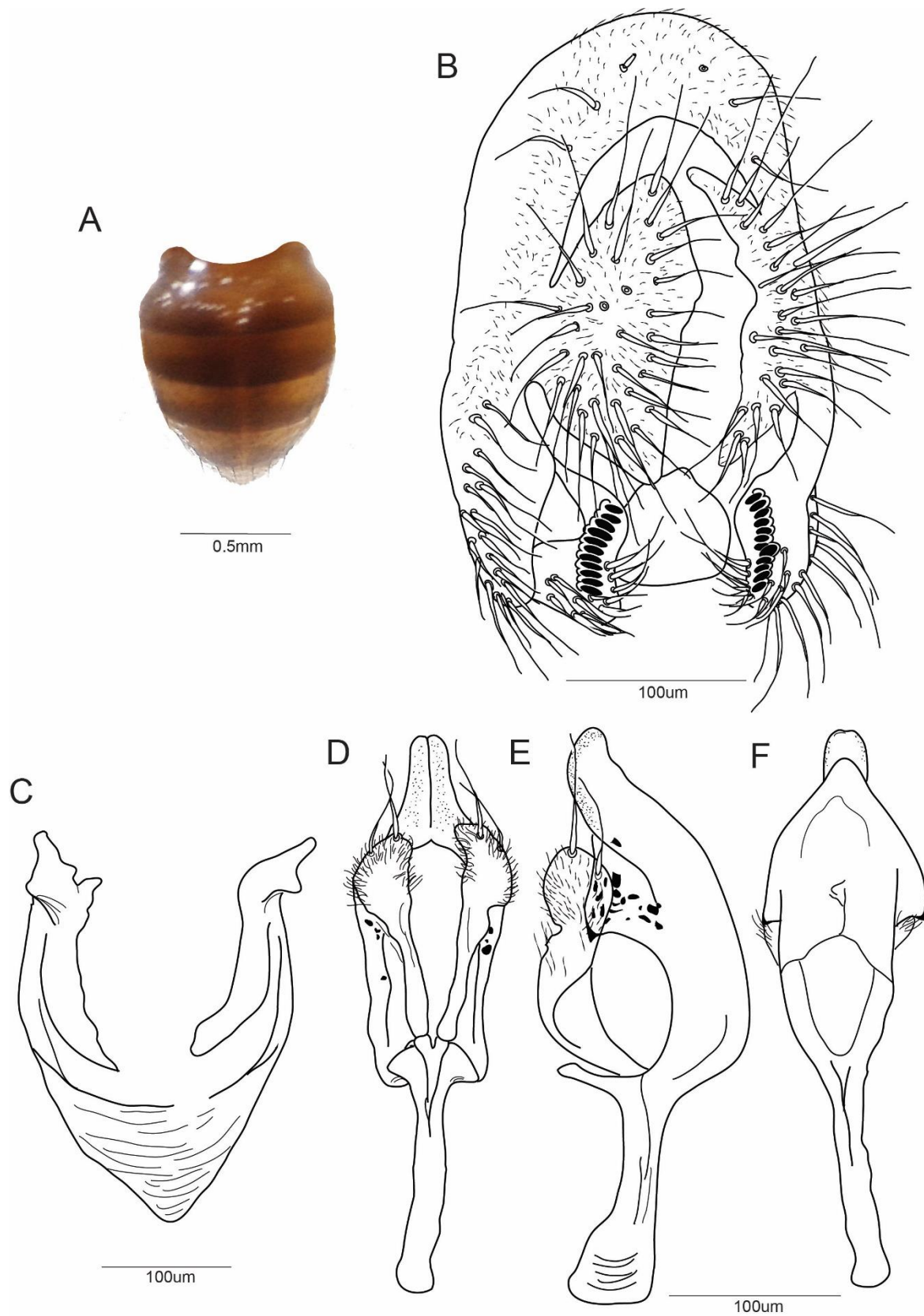
**Type material.**- Holotype male ♂ (dissected, terminalia in microvial), Ecuador, Zamora Chinchipe, San Francisco 2 190 m, 3°59'16.7"S, 79°5'35"W, 19 Nov. 2015, A. Peñafiel col., A. Peñafiel & V. Rafael det. (QCAZ-I 3390).

**Paratype.**- 1 ♂ (dissected, terminalia in microvial), Ecuador, Zamora Chinchipe, San Francisco, same data as holotype, A. Peñafiel col., A. Peñafiel & V. Rafael det. (QCAZ-I 3391)

**Diagnosis.**- Aristae with 3 dorsal and 2 ventral branches. One prominent oral bristle. Carina prominent and not sulcate. Thorax yellowish brown. Wings yellow. Abdomen yellowish brown with dorsal midline, 1<sup>st</sup> tergite brown; 2<sup>nd</sup> to 5<sup>th</sup> tergites with triangular pigmentation which becomes thinner laterally and 6<sup>th</sup> tergite yellow. Cerci microtrichose. Hypandrium V-shaped with sclerotized edge. Gonopod elongated. Aedeagus elongated and curved, with subapical tips, with small elongated and sclerotized projections, apex rounded dorsally curved. Paraphyses elongated, distally sclerotized and rounded, highly microtrichose, bearing two long bristles.

**Male description.**- Holotype external morphology: total length (body+wings) 4,40 mm, body length 2,86 mm. Body color yellowish brown.

**Head.**- Aristae with 3 dorsal and 2 ventral branches plus terminal fork and small hairs. Orbital plate yellowish brown, frontal length 0,55 (0,52) mm; frontal index = 1,44 (1,41); top to bottom width ratio = 1,47 (1,42). Medial vertical seta closer to lateral vertical seta and slightly towards the outer edge of the orbital plate; distance from or1 to or3 0,1 (0,1) mm, distance from or3 to vtm 0,13 (0,1) mm; or1-or3 ratio = 0,83 (0,79), or2-or1 ratio = 0,46 (0,41), distance from ocellar setae 43,6 (41) % of frontal length, distance from postocellar setae



**Figure 5.** *Drosophila millmasapa* sp. nov. Holotype ♂ **A** Abdomen **B** Epandrium, cerci, surstylus, deca sternum **C** Hypandrium and gonopods in ventral view **D, E, F** Aedeagus and paraphyses in ventral, lateral and dorsal view, respectively



64,5 (65) % of frontal length. Ocellar triangle brown, 25,4 (22,3) % of frontal length. Ocellus yellow; vt index = 0,90 (0,79). Frontal vitta yellowish brown. Gena and postgena yellowish brown, cheek index = 4,63 (4,28). One prominent oral bristle, vibrissal index = 0,26 (0,22). Carina prominent and no sulcate. Eyes deep red, eye index = 1,10 (1,08).

**Thorax.**- Yellowish brown, thorax length 0,88 (0,92) mm, acrostichal hairs in 10 rows between the two anterior dorsocentral setae, h index = 1,31 (1,25); Transverse distance of dorsocentrals 2,1x longitudinal distance, dc index = 0,64 (0,58). Distance between apical scutellar setae 94,7 (95,1) % of that between apical and basal setae. Scutellum yellowish brown, scut index = 0,78 (0,71). Medial katepisternal seta one fifth the length of the previous seta, sterno index = 5 (4,98).

Legs yellow.

Wings yellow. Alar length 2,77 (2,85) mm, alar width 1,14 (1,23) mm. Alar indices: alar = 2,42 (2,51); C = 1,68 (1,73); ac = 2,21 (2,25); hb = 0,41 (0,48); 4c = 0,69 (0,71); 4v = 1,64 (1,68); 5x = 1,25 (1,3); M = 0,46 (0,52) and prox. x = 0,64 (0,7).

**Abdomen.**- Yellowish brown with dorsal midline, 1<sup>st</sup> tergite yellowish brown, 2<sup>nd</sup> to 5<sup>th</sup> tergites with triangular pigmentation which becomes thinner laterally and 6<sup>th</sup> tergite yellow (Figure 5A).

**Male terminalia.**- Epandrium microtrichose with 6 upper and no lower bristles, 18 bristles on the ventral lobe. Cerci microtrichose partially fused to epandrium. Surstylus rectangular, 11 primary teeth on the right and 12 on the left, 12 marginal bristles on the right and 13 on the left (Figure 5B). Hypandrium V-shaped with sclerotized edge. Gonopod elongated (Figure 5C).

**Aedeagus.**- Elongated and curved, with subapical tips, with 17 small elongated and sclerotized spots on the left and 15 on the right, apex rounded dorsally curved covered in bright studs, with a medial suture. Paraphyses elongated, distally sclerotized and rounded, highly microtrichose, bearing two long bristles (Figure 5D-F).

**Etymology.**- In the Kichwa language, *millmasapa* = furry. The paraphyses are densely microtrichose.

**Distribution.**- Known only from the type locality.

**Biology.**- Unknown. The type specimen was collected in the banana-bait traps placed at the locality, which suggest that this species is a fermented fruit feeder as many other *Drosophila* species. The habitat is a relatively well-preserved montane forest.

**Relationship.**- This species belongs to the genus *Drosophila*. There is not an appropriate species-group where this species could be placed. Also, there is not a similar species.

### *Drosophila pichka* sp. nov.

Figure 6 A-F

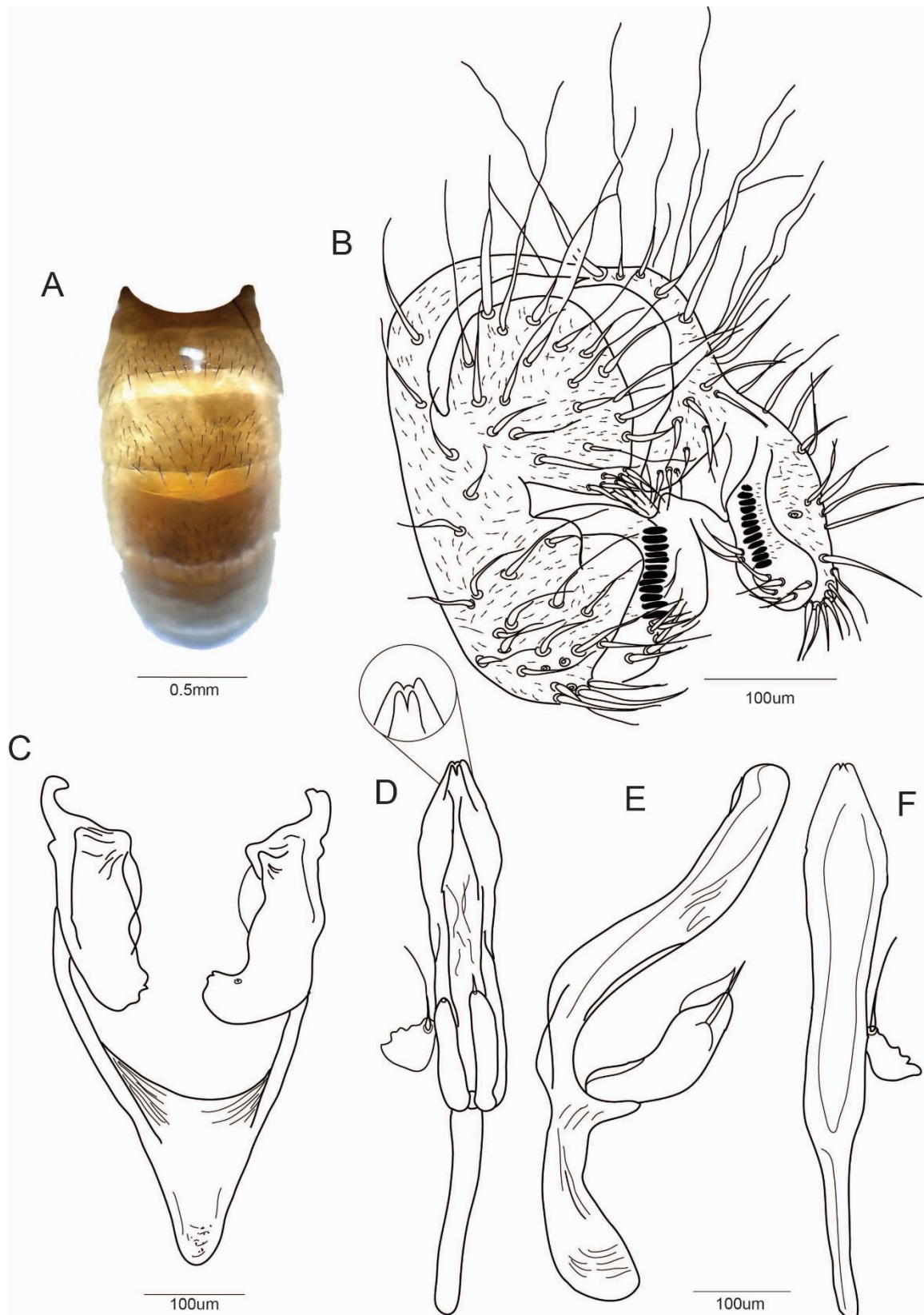
**Type material.**- Holotype male ♂ (dissected, terminalia in microvial), Ecuador, Loja, Cajanuma, 2 800 m, 4°6'58.9"S, 79°10'11.9"W, 19 Nov. 2015, A. Peñafiel col., A. Peñafiel & V. Rafael det. (QCAZ-I 3384).

**Paratype.**- 1 ♂ (dissected, terminalia in microvial, dry mounted), Ecuador, Napo, Río Guango, 2 548 m, 00°32'14"S, 77°57'13.4"W, 23 Sep. 2016, A. B. Manzano col., A. Peñafiel & V. Rafael det. (QCAZ-I 251243).

**Diagnosis.**- Aristae with 4 dorsal and 2 ventral branches. One prominent oral bristle. Thorax yellowish brown. Wings yellowish brown. Abdomen yellow, 1<sup>st</sup> tergite brown, 2<sup>nd</sup> to 6<sup>th</sup> tergites with central dark pigmentation which reaches the anterior and posterior edge. Cerci partially fused to epandrium. Aedeagus sclerotized, elongated and tubular, slightly curved. Ventrally, the apex has five ends barely perceptible. Paraphyses elongated bearing one distal small bristle. Hypandrium V-shaped, the edge is slightly sclerotized. Gonopod bearing one long bristle.

**Male description.**- Holotype external morphology: total length (body + wings) 4,88 mm, body length 3,25 mm. Body color yellowish brown.

**Head.**- Aristae with 4 dorsal and 2 ventral branches plus terminal fork and small hairs. Orbital plate yellowish brown, frontal length 0,29 (0,31) mm; frontal index = 1 (0,97); top to bottom width ratio = 1,86 (1,92). Medial vertical seta closer to lateral vertical seta; distance from or1 to or3 0,1 (0,1) mm, distance from or3 to vtm 0,11 (0,1) mm; or1 - or3 ratio = 0,58 (0,64),



**Figure 6.** *Drosophila pichka* sp. nov. Holotype ♂ **A** Abdomen **B** Epandrium, cerci, surstylus, decasternum **C** Hypandrium and gonopods in ventral view **D, E, F** Aedeagus and paraphyses in ventral, lateral and dorsal view, respectively.

or2-or1 = 0,57 (0,61). Distance from ocellar setae 103 (100) % of frontal length, distance from postocellar setae 96,5 (98) % of frontal length. Ocellar triangle brown, 44,82 (45) % of frontal length. Ocellus yellow. vt index = 1 (1). Frontal vitta yellowish brown. Cheek index = 6,71 (6,92). one prominent oral bristle, vibrissal index = 0,36 (0,41). Carina not sulcated and not prominent. Eyes red, eye index = 1,20 (1,05).

**Thorax.**- yellowish brown, thorax length 0,93 (0,98) mm, acrostichal hairs in 7 rows between the two anterior dorsocentral setae, h index = 0,97 (0,95). Transverse distance of dorsocentrals 1,52x longitudinal distance. Distance between apical scutellar setae 78,2 (79) % of that between apical and basal setae. Medial katapisternal seta one third of the previous one, sterno index = 2 (1,8).

Legs yellow.

Wings yellowish brown. Alar length 3,22 (3,15) mm, alar width 1,43 (1,5) mm. Alar indices: alar = 2,25 (2,28); C = 5,02 (5,05); ac = 1,54 (1,58); hb = 0,31 (0,36); 4c = 0,51 (0,54); 4v = 1,51 (1,52); 5x = 1,39 (1,42); M = 0,41 (0,46) and prox. x = 0,54 (0,59).

**Abdomen.**- Yellowish brown, from 1<sup>st</sup> to 6<sup>th</sup> tergites with central dark pigmentation which reaches the anterior and posterior edge, laterally not pigmented (Figure 6A).

**Male terminalia.**- Epandrium microtrichose with long bristles, laterally well-developed ventral lobe. Cerci microtrichose, partially fused to epandrium. Surstylus microtrichose and rectangular with 12 primary teeth on each side, on the left side with a gap between the 1<sup>st</sup> and 2<sup>nd</sup> teeth, 7 marginal bristles on the right and 8 on the left side (Figure 6B). Hypandrium V-shaped with sclerotized edge. Gonopod bearing one posterior long bristle (Figure 6C).

**Aedeagus.**- Slightly curved, sclerotized, elongated and tubular. Ventrally the apex has five small barely perceptible projections. Paraphyses elongated bearing one small, distal bristle. Aedeagal apodeme slightly sclerotized, wide and curved (Figure 6D-F).

**Etymology.**- In the Kichwa language. *pichka* = five. Since the apex of the aedeagus bears five small projections.

**Distribution.**- *Drosophila pichka* is known from two localities (elevation range is 2 548-2 800 m)

from Loja Province, Podocarpus National Park and Napo Province, Río Guango.

**Biology.**- Unknown. The type specimen was in the banana-bait traps placed at the locality, which suggest that this species is a fermented fruit feeder as many other *Drosophila* species. The habitat is a well-preserved montane forest.

**Relationship.**- This species belongs to the genus *Drosophila*. There is not an appropriate species group where this species could be placed. Also, there is not a similar species.

### *Drosophila rusaryu* sp. nov.

Figure 7 A-F

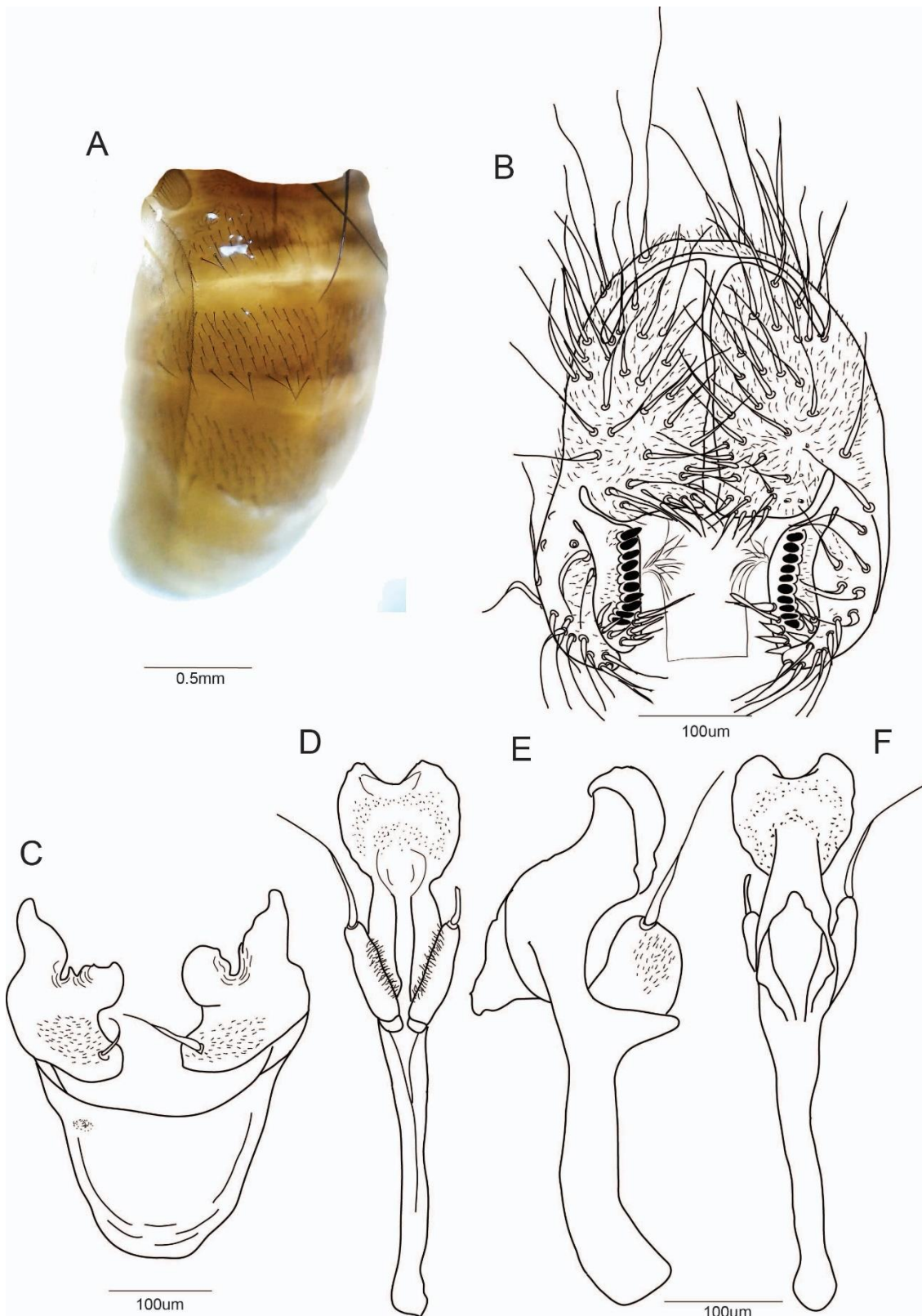
**Type material.**- Holotype male ♂ (dissected, terminalia in microvial, dry mounted), Ecuador, Loja, Cajanuma, 2 675 m, 4°6'53.7"S, 79°10'54.6"W, 19 Nov. 2015, A. Peñafiel col., A. Peñafiel & V. Rafael det. (QCAZ-I 3383).

**Paratype.**- 1 ♂ (dissected, terminalia in microvial, dry mounted), Ecuador, Loja, Cajanuma, 2 725 m, 4°7'4.6"S, 79°10'38.6"W, 27 Dic. 2016, D. Encalada col., A. Peñafiel & V. Rafael det. (QCAZ-I 251242).

**Diagnosis.**- Aristae with 5 dorsal and 3 ventral branches. One prominent oral bristle. Carina prominent and sulcate. Thorax yellowish brown. Wings, dM-Cu slightly clouded. Abdomen with dorsal midline, 2<sup>nd</sup> tergite with posterior dark pigmentation, 3<sup>rd</sup> tergite with dorsal midline with pigmentation which thins laterally, 5<sup>th</sup> and 6<sup>th</sup> tergites slightly pigmented. Cerci partially fused to epandrium. Gonopod microtrichose bearing one bristle. Hypandrium U-shaped. Aedeagus tubular and short, distal end enlarged, with two lateral wavy edge expansions. Paraphyses microtrichose and oval, bearing one long bristle at the apex.

**Male description.**- Holotype external morphology: total length (body + wings) 4,90 mm, body length 3,26 mm. Body color brown.

**Head.**- Arisae with 5 dorsal and 3 ventral branches plus terminal fork. Orbital plate yellowish brown, frontal length 0,44 (0,5) m; frontal index = 0,91 (0,88); top to bottom width ratio = 1,68 (1,71). Medial vertical seta closer to lateral vertical seta; distance from or1 to or3 0,11 (0,1) mm, distance from or3 to vtm 0,17 (0,2) mm; distance from ocellar setae 84 (82) % of frontal length, distance from postocellar setae



**Figure 7.** *Drosophila rusaryu* sp. nov. Holotype ♂ **A** Abdomen **B** Epandrium, cerci, surstylus, decasternum **C** Hypandrium and gonopods in ventral view **D, E, F** Aedeagus and paraphyses in ventral, lateral and dorsal view, respectively.

43,1 (44) % of frontal length. Ocellar triangle yellowish brown, 36 (35) % of frontal length. Ocellus yellow. vt index = 0,95 (0,98). Frontal vitta yellowish brown. Cheek index = 5 (5). One prominent oral bristle, vibrissal index = 0,29 (0,31). Carina prominent and sulcate. Eyes red, eye index = 1,27 (1,32).

**Thorax.**- yellowish brown, thorax length 0,98 (1,07) mm, acrostichal hairs in 8 rows between the two anterior dorsocentral setae, h index = 0,78 (0,82). Transverse distance of dorsocentrals 1,89x longitudinal distance, dc index = 0,98 (0,96). Distance between apical scutellar setae 95 (98) % of that between apical and basal setae. Scut index could not be calculated (broken bristles on holotype). Medial katapisternal seta one fifth of the previous seta, sterno index = 3,15 (2,98).

Legs yellow.

Wings yellow. Alar length 4,05 (4,15) mm, alar width 1,75 (1,82) mm. dM-Cu slightly clouded. Alar indices: alar = 2,31 (2,26); C = 4,64 (4,67); ac = 1,64 (1,62); hb = 0,34 (0,37); 4c = 0,50 (0,53); 4v = 1,32 (1,36); 5x = 1,25 (1,29); M = 0,35 (0,37) and prox. x = 0,44 (0,49).

**Abdomen.**- Yellow, with dorsal midline, 1<sup>st</sup> tergite light brown, slightly pigmented; 2<sup>nd</sup> tergite with posterior dark pigmentation, 3<sup>rd</sup> tergite with dorsal midline with pigmentation which thins laterally, from 4<sup>th</sup> to 6<sup>th</sup> tergites slightly pigmented (Figure 7A).

**Male terminalia.**- Cerci partially fused to epandrium. Ventral lobe of the epandrium with 16 bristles. Surstylus microtrichose with 10 primary teeth and 8 marginal bristles on each side. Decasternum rectangular fused to surstylus by a membrane (Figure 7B). Hypandrium slightly sclerotized, U-shaped. Gonopod microtrichose bearing one bristle and posterior stretch marks (Figure 7C).

**Aedeagus.**- Tubular and short, distal end enlarged, with two lateral wavy edge expansions. Paraphyses microtrichose and oval, bearing one long bristle at the apex. Ventral rod developed. Aedeagal apodeme long, straight and wide, distally membranous (Figure 7D-F).

**Etymology.**- In the Kichwa language, *rusaryu* = Rosario. Name is in honor of Sra. María Rosario Ibarra Bernal, a Colombian woman and educator who loved nature and always taught the importance of every living being.

**Distribution.**- Known only from the type locality.

**Biology.**- Unknown. The type specimen was in the banana-bait traps placed at the locality, which suggest that this species is a fermented fruit feeder as many other *Drosophila* species. The habitat is a well-preserved montane forest.

**Relationship.**- This species belongs to the genus *Drosophila*. There is not an appropriate species group where this species could be placed. There is not a similar species.

### *Drosophila shunku* sp. nov.

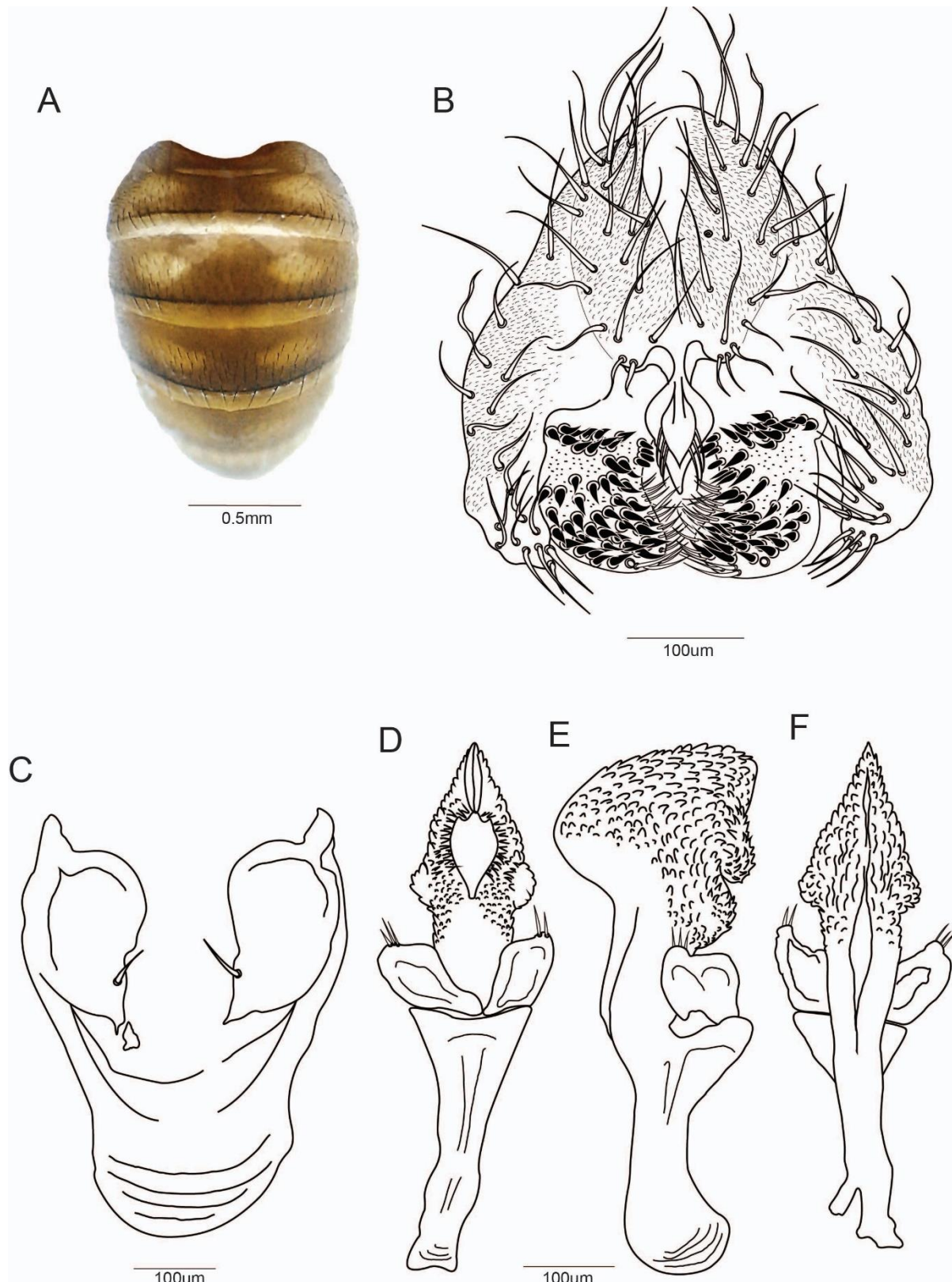
Figures 8 A-F and 9 A-B

**Type material:** Holotype ♂ (dissected, terminalia in microvial, dry mounted), Ecuador, Loja, Cajanuma, 2 675 m, 4°6'53.7"S, 79°10'54.6"W, 19 Nov. 2015, A. Peñafiel col., A. Peñafiel & V. Rafael det. (QCAZ-I 3360). Allotype ♀ (dissected, terminalia in microvial, dry mounted), Ecuador, Loja, Cajanuma, 2 800 m, 4°6'58.9"S, 79°10'11.9"W, 19 Nov. 2015, A. Peñafiel col., A. Peñafiel & V. Rafael det. (QCAZ-I 3361).

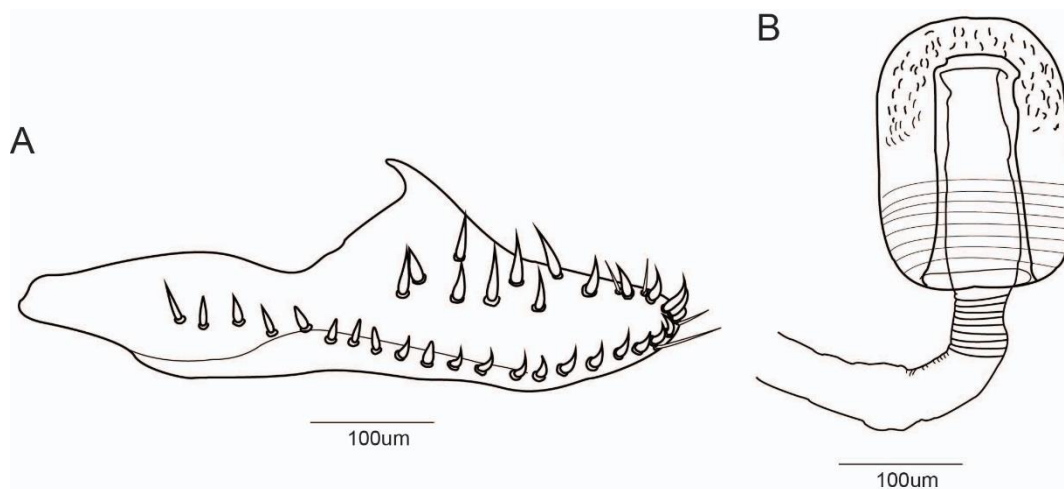
**Paratypes:** 9 ♂♂ and 9 ♀♀ (dissected, terminalia in microvial, dry mounted, descendants from an isofemale line F<sub>1</sub>), Ecuador, Loja, Cajanuma, 2 675 m, 4°6'53.7"S, 79°10'54.6"W, 19 Nov. 2015, A. Peñafiel col., A. Peñafiel & V. Rafael det. (QCAZ-I 3362 – 3370, 3371 – 3379).

**Diagnosis.**- Aristae generally with four dorsal and two ventral branches, plus terminal fork. One long oral bristle. Carina prominent and sulcate. Thorax brown. Wings yellowish brown. Abdomen yellow, 2<sup>nd</sup> to 5<sup>th</sup> tergites with hour-glass-shaped dark pigmented markings, with a white oval area on each side. Cerci small, microtrichose with a projection which holds a heart-shaped sclerotized structure bearing 3 bristles on each side. Surstylus rectangular with strongly sclerotized sharp teeth in two groups. Aedeagus sclerotized voluminous covered with spines, apex ends in a point, dorsally with a heart shaped opening. Hypandrium U-shaped bearing one bristle. Paraphyses rectangular bearing three small bristles.

**Male description.**- Holotype external morphology: total length (body + wings) 5,15 (4,86 – 5,18) mm, body length 3,26 (2,95 – 3,23) mm. Body color brown.



**Figure 8.** *Drosophila shunku* sp. nov. Holotype ♂ **A** Abdomen **B** Epandrium, cerci, surstylus, decasternum **C** Hypandrium and gonopods in ventral view **D, E, F** Aedeagus and paraphyses in ventral, lateral and dorsal view, respectively.



**Figure 9.** *Drosophila shunku* sp. nov. Allotype ♀ **A** Ovipositor **B** Spermatheca.

**Head.**- Aristae with 4 dorsal and 2 ventral plus terminal fork branches and small hairs. Orbital plate brown, frontal length 0,31 (0,38 – 0,4) mm; frontal index = 0,86 (0,79 – 0,85); top to bottom width ratio = 1,63 (1,35 – 1,42). Medial vertical seta was closer to lateral vertical seta and to the eye; distance from or1 to or3 0,11 (0,11 – 0,13) mm, distance from or3 to vtm 0,1 (0,14 – 0,18) mm; or1-or3 ratio = 0,63 (0,66 – 0,81), or2-or1 ratio = 0,42 (0,45 – 0,61), distance from ocellar setae 64,5 (80 – 84) % of frontal length, distance from postocellar setae 64,5 (55 – 65,7) % of frontal length. Ocellar triangle black, 41,9 (36,8 – 42,5) % of frontal length. Ocellus yellow. vt index = 0,97 (0,71 – 1,17). Frontal vitta dark brown. Cheek index = 8,42 (6,36 – 8,11). One prominent oral bristle, vibrissal index = 0,42 (0,41 – 0,61). Carina prominent and sulcate. Eyes wine red, eye index = 1,63 (1,14 – 1,26).

**Thorax.**- brown, thorax length 0,98 (1,13 – 1,25) mm, acrostichal hairs in 8 rows between the two anterior dorsocentral setae. h index = 1,04 (0,97 – 1,21). Transverse distance of dorsocentrals 2,15x (1,75x – 2,11x) longitudinal distance, dc index = 0,92 (0,67 – 0,73). Distance between apical scutellar setae 90,9 (96,4 – 120) % of that between apical and basal setae. Basal scutellar setae divergent, scut index = 1,24 (1,05 – 1,10). Medial katepisternal seta very small 1/8 of the length of the previous, sterno index = (2 – 3,9).

Legs yellow.

Wings yellowish brown. Alar length 2,95 (3,29 – 3,8) mm, alar width 1,43 (1,44 – 1,84) mm. Alar indices: alar = 2,06 (2,06 – 2,35); C = 4,41 (4,85

– 5,12); ac = 1,76 (1,48 – 1,81); hb = 0,39 (0,24 – 0,38); 4c = 0,61 (0,52 – 0,55); 4v = 1,61 (1,44 – 1,63); 5x = 1,3 (1,11 – 1,34); M = 0,52 (0,40 – 0,48) and prox. x = 0,58 (0,59 – 0,68).

**Abdomen.**- Yellow, 1<sup>st</sup> tergite slightly pigmented, 2<sup>nd</sup> to 5<sup>th</sup> tergites with hour-glass-shaped dark pigmentation and laterally darkened, with a white oval area on each side, 6<sup>th</sup> tergite brown (Figure 8A).

**Male terminalia.**- Epandrium microtrichose with numerous lower bristles. Cerci small microtrichose fused to epandrium by a sclerotized suture, with a projection with a heart-shaped sclerotized structure bearing 3 bristles on each side. Surstylus with granulations, with 4 primary teeth on each side and 49 secondaries strongly sclerotized sharp teeth on the right and 50 on the left side. Marginal bristles 27 (Figure 8B). Hypandrium U-shaped with sclerotized edge. Gonopod oval bearing one bristle (Figure 8C).

**Aedeagus.**- Voluminous, sclerotized covered in spines, ventrally with two subapical expansions covered in spines; ventrally apex ends in a point, with a heart-shaped opening. Paraphyses rectangular bearing three bristles. Ventral rod developed. Aedeagus apodeme sclerotized, slightly curved to ventral side (Figure 8D-F).

**Female.**- Allotype external morphology: total length (body + wings) 5,85 (5,67 – 6,05) mm, body length 3,69 (3,65 – 4,37) mm. Body color brown.

**External morphology.-** Same characteristics as the male.

**Head.-** Frontal length 0,4 (0,38 – 0,45) mm; frontal index = 0,8 (0,71 – 0,86); top to bottom width ratio = 1,38 (1,35 – 1,52). Distance from or1 to or3 0,12 (0,09 – 0,14) mm, distance from or3 to vtm 0,19 (0,15 – 0,18) mm; or1-or3 ratio = 0,65 (0,69 – 0,72), or2-or1 ratio = 0,48 (0,33 – 0,55), distance from ocellar setae 110 (92 – 100) % of frontal length, distance from postocellar setae 60 (55 – 69) % of frontal length. Ocellar triangle 40 (35 – 42,1) % of frontal length. Ocellus yellow. vt index = 0,95 (0,73 – 0,93). Cheek index = 9,87 (6,66 – 8,88). Vibrissal index = 0,37 (0,35 – 0,45). Eye index = 1,21 (1,15 – 1,26).

**Thorax.-** Length 1,27 (1,24 – 1,3) mm. h index = 0,93 (1,02 – 1,45). Transverse distance of dorsocentrals 1,79x (1,90x – 1,96x) longitudinal distance, dc index = 0,67 (0,70 – 0,76). Distance between apical scutellar setae 113 (107 – 117) % of that between apical and basal setae. Scut index = 1,04 (1,02 – 1,19). Sterno index = 3,9 (2,91 – 3,61).

Alar length 3,78 (3,55 – 4,01) mm, alar width 1,47 (1,49 – 1,65) mm. Alar indices: alar = 2,57 (2,29 – 2,43); C = 4,98 (4,8 – 5,03); ac = 1,77 (1,62 – 2,0); hb = 0,30 (0,25 – 0,32); 4c = 0,55 (0,54 – 0,56); 4v = 1,64 (1,52 – 1,61); 5x = 1,5 (1,02 – 1,42); M = 0,42 (0,40 – 0,49) and prox. x = 0,57 (0,57 – 0,67).

**Terminalia.-** Ovipositor elongated sclerotized with 24 marginal teeth, 10 discal teeth, one long bristle and three fine hairs (Figure 9A). Spermatheca sclerotized and elongated with longitudinal stretch marks towards the middle, duct deeply invaginated (Figure 9B).

**Etymology.-** In the Kichwa language, *shunku* = heart. The species name denotes the sclerotized area on the cercal projection and the heart-shaped opening on the aedeagus.

**Distribution.-** Known only from the type locality.

**Biology.-** Mostly unknown. The type specimen was in the banana-bait traps placed at the locality, which suggest that this species is a fermented fruit feeder as many other *Drosophila* species. The flies have being reared in the laboratory in

gelatin-banana media (Rafael et al. 2000). The habitat is a well-preserved montane forest.

Note. The allotype and paratypes were obtained from isofemale lines founded with flies born from the baits recovered in the field.

**Relationship.-** This species belongs to the subgenus *Drosophila*. But cannot be assigned to any of the recognized species groups of *Drosophila*. The most similar species is *Drosophila shunkuku* sp. nov. (Figure 10A-H) described in this paper.

### *Drosophila shunkuku* sp. nov.

Figure 10 A-H

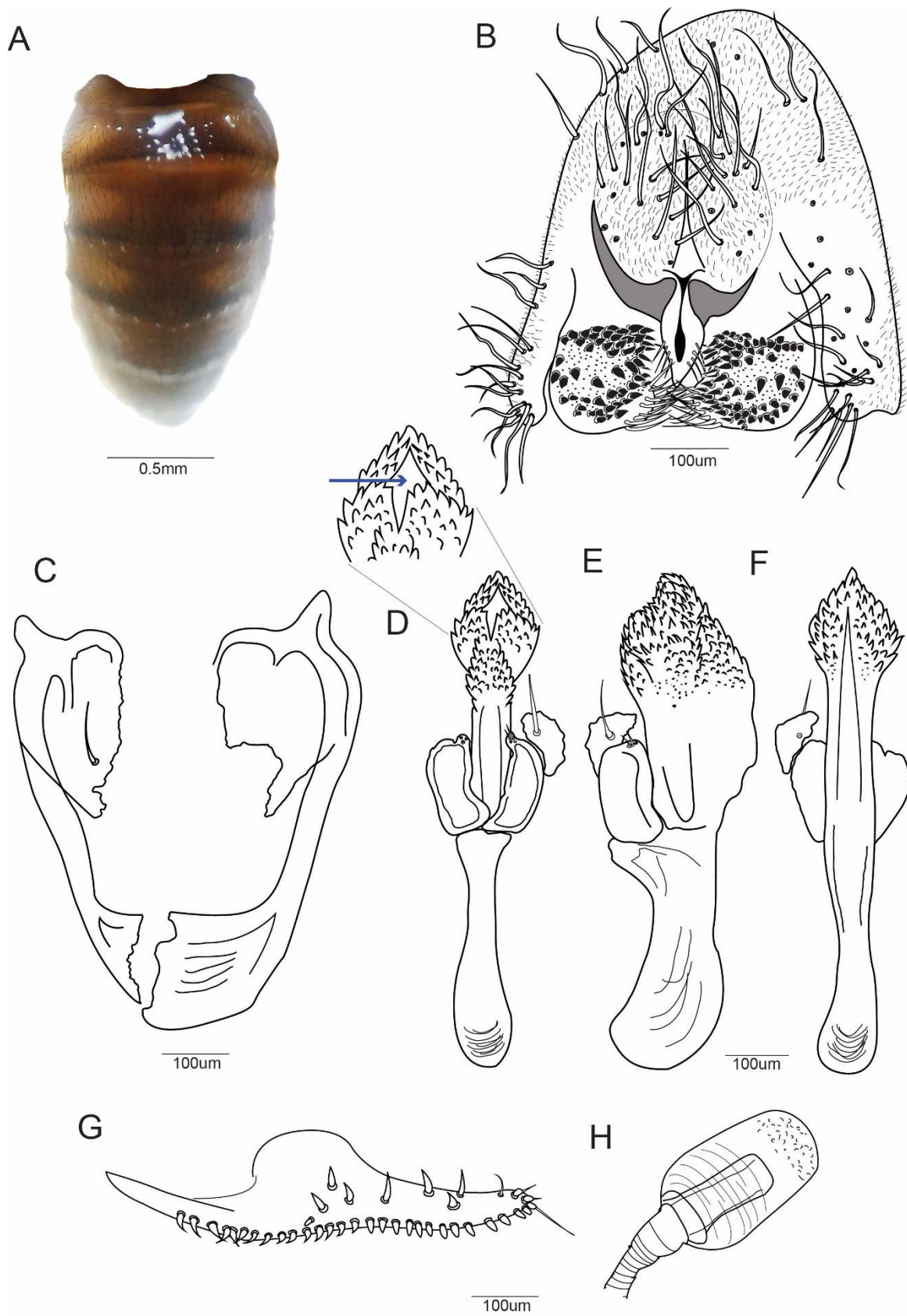
**Type material.-** Holotype ♂ (dissected, terminalia in microvial, dry mounted), Ecuador, Loja, Cajanuma, 2 800 m, 4°6'58.9"S, 79°10'11.9"W, XI.2015, A. Peñafiel col., A. Peñafiel & V. Rafael det. (QCAZ-I 3380). Allotype ♀ (dissected, terminalia in microvial, dry mounted), Ecuador, Loja, Cajanuma, same data as holotype, A. Peñafiel col., A. Peñafiel & V. Rafael det. (QCAZ-I 3381).

**Paratype.-** 1 ♂ (dissected, terminalia in microvial, dry mounted), Ecuador, Loja, Cajanuma, 2 900 m, 4°7'00.9"S, 79°10'7.2"W, XII.2016, D. Encalada col., A. Peñafiel & V. Rafael det. (QCAZ-I 251241)

**Diagnosis.-** Aristae with 3 dorsal and 2 ventral branches plus terminal fork, the 2<sup>nd</sup> and 3<sup>rd</sup> antennal segment brown. One prominent oral bristle. Carina sulcate. Abdomen yellowish brown, 2<sup>nd</sup> to 5<sup>th</sup> tergites with hour-glass-shaped dark pigmentation and a white oval area on each side. Cerci microtrichose fused to epandrium with a projection with a heart-shaped sclerotized structure bearing 4 bristles on each side. The surstylus is rectangular with 62 undifferentiated teeth on each side. Aedeagus sclerotized, tubular and voluminous covered in spines on the distal half of the aedeagus, laterally expanded with a subapical process. Paraphyses rectangular bearing two small bristles. A male and female were captured *in copula* in the field.

**Male description.-** Holotype external morphology: total length (body + wings) 4,68 mm, body length 3,32 mm. Body color brown.





**Figure 10.** *Drosophila shunkuku* sp. nov. Holotype ♂ **A** Abdomen **B** Epandrium, cerci, surstylus, decasternum. **C** Hypandrium and gonopods in ventral view **D, E, F** Aedeagus and paraphyses in ventral, lateral and dorsal view, respectively. Allotype ♀ **G** Ovipositor **H** Spermatheca.

**Head.**- Arista, pedicel and flagellomere of the antenna brown, with 3 dorsal and 2 ventral branches plus terminal fork and small hairs. Orbital plate brown, frontal length 0,37 (0,32) mm; frontal index = 0,90 (0,86); top to bottom width ratio = 1,46 (1,41). Medial vertical seta closer to lateral vertical seta; distance from or1 to or3 0,11 (0,1) mm, distance from or3 to vtm 0,13 (0,11) mm; or1-or3 ratio = 1,76 (1,71); or2-or1 ratio = 0,30 (0,26), distance from ocellar setae 89,1 (90) % of frontal length, distance from postocellar setae 64,8 (65) % of frontal length. Ocellar triangle dark brown, 40,54 (42,1) % of frontal length. Ocellus yellow. vt index = 0,93 (0,95). Frontal vitta yellowish brown. Cheek index = 6,3 (6,9). One prominent oral bristle, vibrissal index = 0,56 (0,51). Carina sulcate. Eyes red wine, eye index = 1,23 (1,08).

**Thorax.**- Brown, thorax length 1,04 (1,06) mm, acrostichal hairs in 8 rows between the two anterior dorsocentral setae. h index = 1,07 (1,01). Transverse distance of dorsocentrals 1,8x longitudinal distance, dc index = 0,76 (0,72). Distance between apical scutellar setae 108 (106) % of that between apical and basal setae. Basal scutellar setae divergent, scut index = 1,16 (1,2). Medial katapisternal seta  $\frac{1}{4}$  of the length of the previous, sterno index = 4,15 (4,1).

Legs yellow.

Wings yellowish brown. Alar length 3,35 (3,41) mm, alar width 1,47 (1,49). Alar indices: alar = 2,27 (2,31); C = 5,08 (5,12); ac = 1,85 (1,91); hb = 0,46 (0,51); 4c = 0,45 (0,49); 4v = 1,28 (1,32); 5x = 1,08 (1,11); M = 0,33 (0,39) and prox. x = 0,41 (0,46).

**Abdomen.**- Yellowish brown, 1<sup>st</sup> tergite slightly pigmented, 2<sup>nd</sup> to 5<sup>th</sup> tergites hour-glass-shaped dark pigmentation with a white oval area on each side and laterally darkened, 6<sup>th</sup> tergite dark (Figure 10A).

**Male terminalia.**- Epandrium microtrichose with numerous lower bristles. Cerci microtrichose fused to epandrium by a sclerotized suture, with a projection which holds a heart-shaped sclerotized structure bearing 4 bristles on each side. Surstylus fused to epandrium by thin filaments, with 62 undifferentiated teeth on each side, 20 marginal bristles on the right and 19 on the left (Figure 10B). Hypandrium slightly sclerotized. Gonopod bearing one bristle (Figure 10C).

**Aedeagus.**- Sclerotized tubular and voluminous covered in spines towards the distal half of the aedeagus, distal end rhomboid, laterally expanded with a subapical process. Paraphyses rectangular, bearing two small bristles. Ventral rod developed. Aedeagus apodeme sclerotized, apex membranous (Figure 10D-E).

**Female.**- Allotype (found mating with male, collected in the field). Allotype external morphology, total length (body + wings) 5,60 mm, body length 4,52 mm. Body color brown.

**External morphology.**- Same characteristics as the male.

**Head.**- Frontal length 0,37 mm; frontal index = 0,80; top to bottom width ratio = 1,52. Distance from or1 to or3 0,12 mm, distance from or3 to vtm 0,14 mm; or1-or3 ratio = 0,64, or2-or1 ratio = 0,63, distance from ocellar setae 83,7 % of frontal length, distance from postocellar setae 54 % of frontal length. Ocellar triangle 51,3 % of frontal length. Ocellus yellow. vt index = 0,54. Cheek index = 6,6. Vibrissal index = 0,56. Eye index = 1,5.

**Thorax.**- Length 1,13 mm. h index = 1,44. Transverse distance of dorsocentrals 1,88x longitudinal distance, dc index = 0,72. Distance between apical scutellar setae 100 % of that between apical and basal setae. Scut index = 1,02. Sterno index = 3,0.

Alar length 3,88 mm, alar width 1,48 mm. Alar indices: alar = 2,62; C = 4,94; ac = 1,9; hb = 0,35; 4c = 0,52; 4v = 1,46; 5x = 1,21; M = 0,31 and prox. x = 0,55.

**Terminalia.**- Ovipositor elongated and sclerotized with 30 marginal teeth, 9 discal teeth, one long bristle and 3 fine hairs (Figure 10G). Spermatheca elongated and sclerotized, with longitudinal stretch marks towards the bottom half, the upper half covered in bright studs, duct two-thirds invaginated (Figure 10H).

**Etymology.**- In the Kichwa language, *shunku* = heart, and the suffix *ku* forms the word *shunkuku* which means little heart. The cercal process and the aedeagus have heart-shaped sclerotized areas.

**Distribution.**- Known only from the type locality.

**Biology.**- Mostly unknown. The type specimen was found mating near the banana-bait traps, which suggest that, this species courtship takes place around the potential food and that this species is a fermented fruit feeder as many other

*Drosophila* species. The habitat is a well-preserved montane forest.

**Relationship.**- This species belongs to the genus *Drosophila*. There is not a species group appropriate for this species. The most similar species is *Drosophila shunku* sp. nov. (Figures 8A-F, 9A-B) described in this paper.

***Drosophila taki* sp. nov.**

Figure 11 A-F

**Type material:** Holotype male ♂ (dissected, terminalia in microvial, dry mounted), Ecuador, Loja, Cajanuma, 2 800 m, 4°6'58.9"S, 79°10'11.9"W, 19 Nov. 2015, A. Peñafiel col., A. Peñafiel & V. Rafael det. (QCAZ-I 3385).

**Paratypes.**- 2 ♂♂ (dissected, terminalia in microvial), Ecuador, Loja, Cajanuma, 2 800 m, same data as holotype, A. Peñafiel col., A. Peñafiel & V. Rafael det. (QCAZ-I 3386 – 3387). 1 ♂♂ (dissected, terminalia in microvial), Ecuador, Loja, Cajanuma, 2 675 m, 4°6'53.7"S, 79°10'54.6"W, 19 Nov. 2015, A. Peñafiel col., A. Peñafiel & V. Rafael det. (QCAZ-I 3388). 4 ♂♂ (dissected, terminalia in microvial), Ecuador, Napo, Río Guango, 2548 m, 00°32'14"S, 77°10'13.4"W, 27 Sep. 2016, A.B. Manzano col., A. Peñafiel & V. Rafael det. (QCAZ-I 251244 – 251247).

**Diagnosis.**- Aristaes with 4 dorsal and 2 ventral branches. One prominent oral bristle. Thorax yellowish brown. Wings yellow. Abdomen yellow with dorsal midline, 1<sup>st</sup> tergite yellowish brown, 2<sup>nd</sup> to 4<sup>th</sup> tergites with triangular pigmentation which reaches the anterior edge of each tergite, 5<sup>th</sup> and 6<sup>th</sup> tergites slightly pigmented. Cerci partially fused to epandrium. Aedeagus slightly sclerotized and elongated, apex pointed. Paraphyses triangular bearing one bristle. Hypandrium V-shaped, slightly sclerotized. Gonopod elongated bearing one bristle.

**Male description.**- Holotype external morphology: total length (body + wings) 5,55 mm, body length 3,70 mm. Body color yellowish brown.

**Head.**- Aristaes with 4 dorsal and 2 ventral branches plus terminal fork and small hairs. Orbital plate yellowish brown, frontal length 0,36

(0,31 – 0,35) mm; frontal index = 0,8 (0,89 – 0,93); top to bottom width ratio = 1,64 (1,56 – 1,72). Medial vertical seta closer to lateral vertical seta and towards the outer edge of the orbital plate; distance from or1 to or3 0,11 (0,09 – 0,11) mm, distance from or3 to vtm 0,13 (0,13 – 0,16) mm; or1-or3 ratio = 0,88, or2-or1 ratio = 0,33, distance from ocellar setae 86,1 % of frontal length, distance from postocellar setae 69,4 (65,7 – 85,2) % of frontal length. Ocellar triangle, 47,2 (42,8 – 45,1) % of frontal length. vt index = 1,02. Cheek index = 5,90 (7 – 9,4). One prominent oral bristle, vibrissal index = 0,38 (0,45 – 0,5). Carina not sulcate and not prominent. Eyes red, eye index = 1,71 (1,02 – 1,5).

**Thorax.**- Yellowish brown, thorax length 1,11 (1,06 – 1,28) mm, with acrostichal hairs in 7 rows between the two anterior dorsocentral setae, h index = 1,32. Transverse distance of dorsocentrals 1,82x (1,62x – 1,72x) longitudinal distance, dc index = 0,61. Distance between apical scutellar setae 90 (75 – 86,9) % of that between apical and basal setae. Scut index = 1,05. Medial katepisternal ¼ of the previous, sterno index = 4,14.

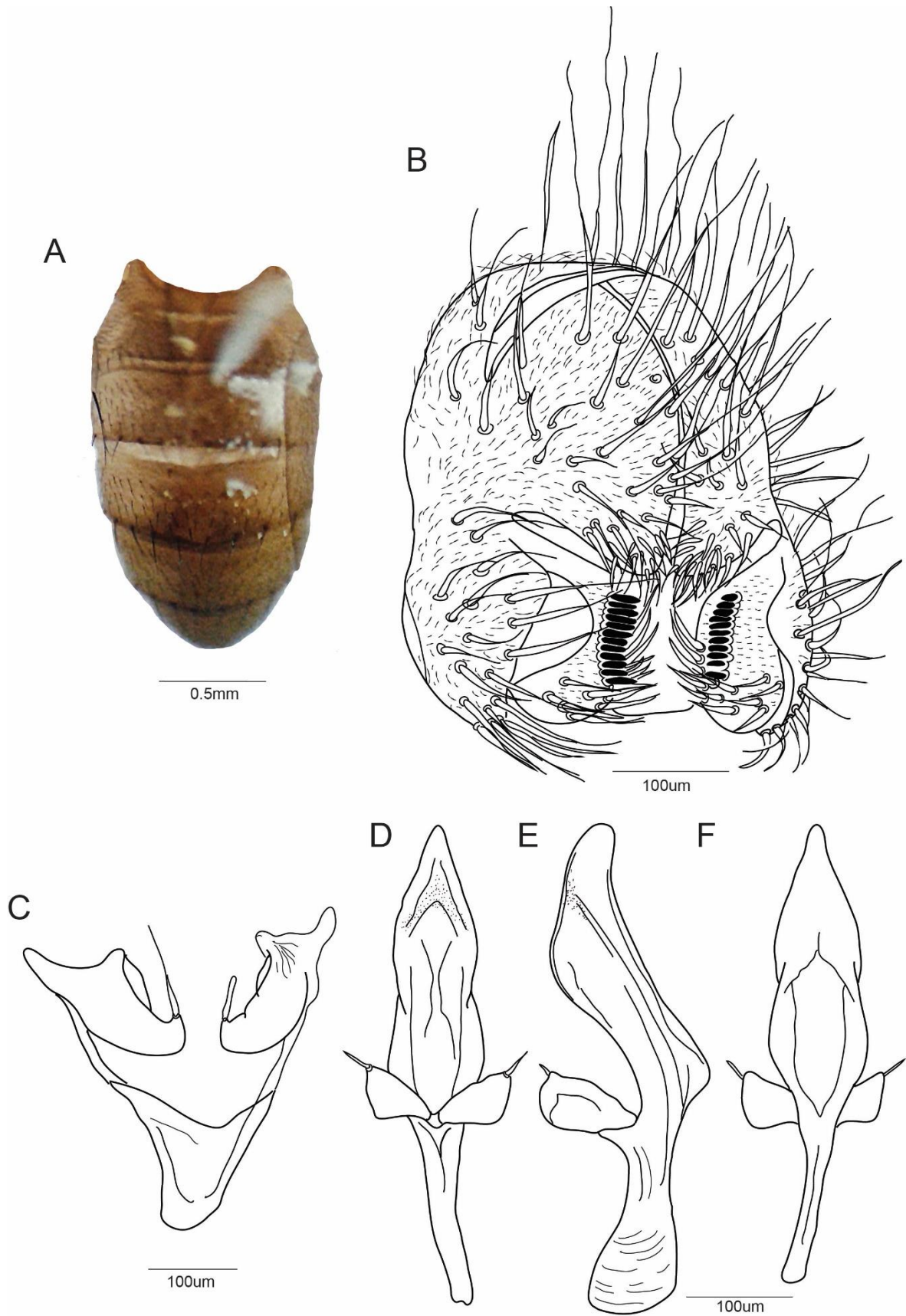
Legs yellow.

Wings yellow. Alar length 3,73 (3,45 – 3,96) mm, alar width 1,57 (1,44 – 1,71) mm. Alar indices: alar = 2,37 (2,19 – 2,44); C = 5,34 (4,32 – 6,2); ac = 1,51 (1,6 – 2,23); hb = 0,32 (0,24 – 0,33); 4c = 0,44 (0,42 – 0,53); 4v = 1,35 (1,30 – 1,48); 5x = 1,17 (1,21 – 1,69); M = 0,35 (0,37 – 0,4) and prox. x = 0,49 (0,40 – 0,59).

**Abdomen.**- Yellow with dorsal midline, 1<sup>st</sup> tergite yellowish brown, from 2<sup>nd</sup> to 4<sup>th</sup> tergites with triangular pigmentation which reaches the anterior edge of each tergite, 5<sup>th</sup> and 6<sup>th</sup> tergites slightly pigmented (Figure 11A).

**Male terminalia.**- Cerci partially fused to epandrium. Surstylus rectangular and microtrichose, with 12 primary teeth on the right and 11 on the left side and 15 marginal bristles (Figure 11B). Hypandrium V-shaped slightly sclerotized, with anterior stretch-marks. Gonopod elongated bearing one bristle (Figure 11C).

**Aedeagus.**- Slightly sclerotized and elongated, apex pointed. Paraphyses triangular bearing one bristle. Ventral rod undeveloped. Aedeagal apodeme sclerotized and straight (Figure 11D-F).



**Figure 11.** *Drosophila taki* sp. nov. Holotype ♂ **A** Abdomen **B** Epandrium, cerci, surstylus, decasternum **C** Hypandrium and gonopods in ventral view **D, E, F** Aedeagus and paraphyses in ventral, lateral and dorsal view, respectively.

**Etymology.**- In the Kichwa language *taki* = song. The city of Loja near to the collection point of this species, is the birthplace of many Ecuadorian musicians. Loja is considered the musical capital of Ecuador.

**Distribution.**- *Drosophila taki* is known from two localities (elevation range is 2 548–2 800 m) from Loja Province, Podocarpus National Park and Napo Province, Río Guango.

**Biology.**- Unknown. The type specimen was in the banana-bait traps placed at the locality, which suggest that this species is a fermented fruit feeder as many other *Drosophila* species. The habitat is a well-preserved montane forest.

**Relationship.**- This species belongs to the genus *Drosophila*. There is not an appropriate species-group where this species could be placed. Also, there is not a similar species.

## DISCUSSION

Eight new species of *Drosophila* have been described from southern Ecuador. They were grouped in *Drosophila* genus. They share the diagnosis characters of the genus *Drosophila* proposed by Sturtevant 1942. The arista is plumose. They have three orbital setae, one proclinate and two reclinate, three katepisternal setae; the 2<sup>nd</sup> is always smaller than the 1<sup>st</sup> seta. The scutellar setae are in two pairs and the acrostichal setulae are in rows of six or more setae. The species *Drosophila kingmani* sp. nov., *Drosophila malacatus* sp. nov., *Drosophila millmasapa* sp. nov., *Drosophila pichka* sp. nov., *Drosophila rusaryu* sp. nov. and *Drosophila taki* sp. nov. could not be assigned to any of the recognized species groups of the genus *Drosophila*.

The eight new species have been compared with the original descriptions of the Andean species described by Duda (1927) and redescribed by Vilela and Bächli (1990). Since six of the descriptions of our new species were based only in males, and the descriptions of the species of Duda are based in females. The external morphology of each fly was compared with the descriptions and redescriptions of *D. canescens* Duda, 1927; *D. fuscipennis* Duda, 1927; *D. latebuccata* Duda, 1927; *D. latecarinata* Duda, 1927; *D. obscuricolor* Duda, 1927; *D. peruviana* Duda, 1927; *D. pictifrons* Duda, 1927; *D. pulvereae* Duda, 1927; *D. scioptera* Duda, 1927 and *D. strigiventris* Duda, 1927. After comparing we conclude that the new species described in the

present paper do not correspond with the Andean species described by Duda in 1927.

*Drosophila shunku* is closely related to *Drosophila shunkuku*. Both species share similar external morphological characters. Therefore both species form a cluster. The main differences are in the male and female terminalia. *Drosophila shunku* has a voluminous aedeagus with an obvious ventral opening, while *Drosophila shunkuku* has a thinner aedeagus and the opening is smaller and is located almost at the tip of the aedeagus (as the blue arrow shows in figure 10D).

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