

**UNIVERSIDAD SAN FRANCISCO DE QUITO USFQ**

**Colegio de Ciencias Biológicas y Ambientales**

**A new species of small-headed fly (Acroceridae, Panopinae) from  
Ecuador**

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**HOJA DE CALIFICACIÓN  
DE TRABAJO DE FIN DE CARRERA**

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Quito, 14 de mayo de 2021

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## RESUMEN

Se describe a *Camposella mindoensis* sp. nov. (Acroceridae, Panopinae) a partir de un espécimen recolectado en la región de los Andes tropicales. Se proporcionan fotografías y medidas del espécimen. También se reporta el hallazgo de un segundo espécimen *de C. insignata* Cole en un museo ecuatoriano. Finalmente, discutimos la posible función de los flagelos antenales agrandados de especies dentro de este género, y damos algunas recomendaciones sobre futuros esfuerzos de recolección para aumentar el conocimiento sobre este enigmático género.

**Palabras clave:** Andes tropicales, *Camposella*, endoparásito, Ecuador, antenas, Mygalomorphae.

## ABSTRACT

*Camposella mindoensis* sp. nov. (Acroceridae, Panopinae) is described from a specimen collected at the Tropical Andes region. Pictures and measurements of the specimen are provided. We also report the finding of a second specimen of *C. insignata* Cole at an Ecuadorian museum. Finally, we discuss the possible function of the enlarged antennal flagella of species within this genus and give some recommendations on future collection efforts to increase knowledge about this enigmatic genus.

**Keywords:** Tropical Andes, Camposella, endoparasite, Ecuador, antennae, Mygalomorphae.

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## INTRODUCTION

Acroceridae is a cosmopolitan family of flies whose first instar larva emerge as mobile planidia completing their development as endoparasites of spiders (Gillung & Borkent 2017; Nartshuk 1997; Schlinger 1987). Adults are easily identified by their small-sized head, swollen abdomen, hunchbacked thorax and, in most species, elongated mouthparts used for nectar-feeding (Schlinger 1981). They originated in the late Mesozoic and diversified during the Cretaceous (Gillung & Winterton 2018; Winterton *et al.* 2007). Their monophyly is well supported based on morphological characters, endoparasitic lifestyle (Winterton 2012; Woodley 1989; Yeates 2002), and molecular evidence (Winterton *et al.* 2007). There are approximately 530 extant species, included in 60 genera traditionally classified within 3 subfamilies: Acrocerinae, Panopinae, and Philopotinae (Schlinger 1981) (Schlinger *et al.* 2013). Recent studies, however, split them into five: Acrocerinae, Cyrtinae *stat. rev.*, Ogcodinae *stat. rev.*, Panopinae, and Philopotinae (Gillung *et al.* 2018; Gillung & Winterton 2019).

In the Neotropical region, the family is represented by 19 genera and 100 species. Given their rarity (Luz 2004), studies on these flies have been scarce. In the last years, however, taxonomic studies on local faunas (Gillung *et al.* 2017; Gillung & de Carvalho 2009; González *et al.* 2018), new species descriptions (Barneche *et al.* 2013; Schlinger *et al.* 2013), and generic revisions (Gillung & Nihei 2016) have increased the interest on this group. The Panopinae are specialized parasitoids of spiders within five families of Mygalomorphae (Antrodiaetidae, Ctenizidae, Dipluridae, Euctenizidae, Migidae, and Theraphosidae) (Barneche *et al.* 2013; Schlinger 1987; Winterton *et al.* 2007). Morphologically they can be diagnosed by a cylindrical or paddle-shaped flagellum that lacks an arista, postpronotal lobes

widely separated, presence of tibial spines, and wing venation with cells *m3*, *b*, *bm*, and basal *r4+5* present (Borkent *et al.* 2016; Winterton 2012).

Panopinae is the most species-rich subfamily in the Neotropics with ten genera, six of which are endemic: *Archipialea* Schlinger, 1973; *Camposella* Cole, 1919; *Exetasis* Walker, 1852; *Lasioides* Gil Collado, 1928; *Coquena* Schlinger, 2013; *Pialea* Erichson, 1840; and *Pteropexus* Macquart, 1846. Since the work of Schlinger in 1956, no taxonomic studies on Acroceridae have been published for Ecuador. Five species, however, have been reported within Panopinae: *Lasia ecuadorensis* Bequaert, 1931; *Pialea ecuadorensis* Schlinger, 1956; *Ocnaea falcifer* Aldrich, 1928; *O. gigas* Aldrich, 1928; and *Camposella insignata* Cole, 1919.

*Camposella* is related to *Lasia* and *Eulonchus*, based on morphological features (Gillung & Winterton 2019). It includes a single species, *C. insignata* Cole that, besides its lack of pulvilli and ocelli, can be readily identified by its enlarged antennal flagella modified into paddle-like plates (Brunetti 1926; Cole 1919; Gillung & Winterton 2019). The holotype was sent from Guayaquil to the United States National Museum (nowadays the National Museum of Natural History, Smithsonian Institution) by Francisco Campos-Rivadeneira, a prolific Ecuadorian entomologist (Ramón *et al.* 2019), and described by Frank Cole (1919). This specimen is currently deposited at the National Museum of Natural History (GBIF-Secretariat 2020). A few years later, another specimen, probably also collected by Campos-Rivadeneira, was reported from the National Museum of Natural History, France (Brunetti 1926). However, we were unable to confirm its existence at the Museum's database (MNHN 2020). No other records of this species have been reported ever since. In this paper, the finding of a

new *C. insignata* museum specimen is reported, and *Camposella mindoensis* sp. Nov. is described

## METHODS

We follow the terminology used by Schlinger *et al.* (2013) and references therein (Cumming & Wood 2009; Gillung & Winterton 2011; Schlinger 1981; Winterton 2012). Specimens of *C. insignata* are deposited at the Invertebrate Section Collection of the Museum of Zoology, Pontifical Catholic University of Ecuador (QCAZ), and the holotype of *C. mindoensis* at the Museo de Zoología, Universidad San Francisco de Quito (ZSFQ).

Specimen coloration is described following Köhler's Color Catalogue for Field Biologists (2012). Specimen images were taken at different focal points using an Olympus DP73 digital camera adapted to an Olympus SZX16 stereo microscope with a combined magnification power of 115X. To obtain images with greater focus depth, they were merged using the Z-Stack function within the process manager incorporated in the cellSens Dimensions v1.8.1 © software (Olympus Corp. 2009-2013).

Using the measurement module within this software, the following set of measurements were taken from each specimen:

1. Head capsule length (HCL): In front view, length from the dorsal occipital border to the inferior head border.
2. Head capsule width (HCW): In front view, length across the head's widest part (including eyes).
3. Third antennal segment length (TAS): In lateral view, length from the middle of the antenna base to the most distal tip.

4. Antennal length (ANL): In lateral view, length from the middle of the first antennal segment base to the antenna's most distal tip.
5. Antennal width (ANW): In lateral view, length across the broadest part of the antenna.
6. Proboscis length (PL): In ventral view, length from the proboscis base to its most distal tip.
7. Thorax length (TL): In dorsal view, length from the pronotum's anterior border to the posterior border of the scutellum.
8. Abdomen length (AL): In dorsal view, length from the first abdominal segment's anterior border to the posterior border of the last abdominal segment (excluding genitalia).
9. Abdomen width (AW): In dorsal view, length across the broadest part of the abdomen.

All measurements were taken independently five times by the same researcher (AT). For each one, the mean (n=5) and standard deviation are reported in millimeters.

A difficulty that I had for carrying out this work was that the antennae of the type specimen were broken during handling after pictures and measurements were taken. One of the antennae was glued back to the specimen and the other is kept on an Eppendorf tube properly labeled and associated with the specimen.

## RESULTS

*Camposella insignata* Cole, 1919: 272

**References.** Holotype male. Cole, 1919:272 (ECU); Brunetti 1926: 576 (ECU: “? Quito”).

**Material examined.** Male: Top label: “ECUADOR COTOPAXI/OTONGA

2000m/23JAN1994 GOnore”. Second label: “QCAZ I/259302”. Male: Top label: “Ecuador

Pichincha/El Pahuma 1941m/0.0258638 -78.63236/29Ene.12 A.Péres”. Second label: “QCAZ I/259303”.

*Camposella mindoensis* sp. nov. Tadashima et al.

**Type material. Holotype** Male: Top label “Ecuador Pichincha/Mindo 1460 m/Lat: - 0.037892°; Lon: -78.761611°/S. Ramos 21Oct2017”. Second label: “SR061”. Third label: “Net collecting/ Bushes next to road/Secondary forest” (Figure 1).



**Figure 1.** Collection site of *Camposella mindoensis* sp. Nov. In a road crossing a secondary forest near the town of Mindo, province of Pichincha, Ecuador. Photo (A): GR., and collection site map (B): (Google Earth, n.d.).

**Diagnosis.**

This new species can be separated from the only other congeneric species, *C. insignata*, based on the following suite of characters: 1) antennae contiguous and visible from a dorsal viewpoint and separated by a medial ridge, 2) second antennal segment shaped like a trapezoid and tapering towards distal portion, 3) second antennal segment with short setae light chrome-orange colored, 4) proboscis olive-brown throughout its length and somewhat lighter towards the tip, 5) proboscis covered with very short sulfur-yellow setae, 6) posterior half of thorax dorsum with disperse pilosity, not extending towards anterior half, 7) abdominal tergites 1-4 with setae, 8) on wings, upper branch of  $M_1$  continuous with lower branch almost straight, not making contact with wing's lower margin, 9) discal cell not directly in contact with basal medial cell but connected through a short vein.

**Measurements.** HCL=  $2.88 \pm 0.04$  mm; HCW=  $2.94 \pm 0.1$  mm; TAS=  $5.69 \pm 0.02$  mm; ANL=  $5.93 \pm 0.02$  mm; ANW=  $2.50 \pm 0.01$  mm; PL=  $4.22 \pm 0.02$ ; TL=  $7.63 \pm 0.24$  mm; AL=  $8.82 \pm 0.07$  mm; AW=  $8.98 \pm 0.06$  mm.

**Description (Figures. 2, 3, 4).** Male: *Head.* Head capsule and eyes dusky brown, eyes covered with proclinate thin dark grayish brown pilosity. Orbital setae behind eyes dark grayish brown, posterior setae immediately behind and extending towards occipital border longer, proclinate and light chrome orange in color. Inner and outer occipital margins visible in frontal view and meeting below head capsule into a pointed plate with numerous dark grayish brown long setae. From a frontal viewpoint, eyes contiguous above antennal insertions separating at about the upper third section, and widely separated below antennae. From a dorsal viewpoint, antennae visible contiguous at the base, separated by a medial ridge. First joint lacking setae and visible, trapezoidal in shape, base dusky brown turning

walnut brown towards the distal part. Plate immediately above the antennal base and between eyes with similar characteristics as the first segment. Second segment about a third longer than first segment, trapezoidal shape tapering towards the distal section, dusky brown with short setae light chrome orange in color, originating from the midline and reaching the distal border. Third joint as wide as second segment at its base, tapering until forming a thin plate of uniform width throughout all its length. From a lateral viewpoint it expands to form a paddle-like plate about twice as long as the head capsule, and its width less than half its length, fuscous in color and bare. Proboscis rudimentary, olive-brown throughout most of its length and somewhat lighter towards the tip, slender, cylindrical and pointed, covered with very short sulfur-yellow setae. The region below the antennae deeply excavated. Occiput is slightly swollen. Ocellar triangle rudimentary, the same color as the head capsule, with a small central concavity with numerous dark grayish brown setae; ocelli absent.

*Thorax.* In dorsal view, thorax large and inflated with a rounded profile. About two-thirds of the anterior half of dorsum covered with abundant medium chrome orange long pilosity that, when looked under microscope lightning and from certain angles, changes to light chrome orange. Posterior dorsum of thorax with disperse dark grayish brown pilosity, not extending towards anterior half. Thorax vandyke brown in color as postalar callus, latter also covered with dark grayish brown setae. Scutellum flattened and sub-rectangular in shape from a dorsal viewpoint; coloration and pilosity similar to thorax, except for lateral and posterior margins with lighter setae. In dorsal view, postpronotal lobes inflated and covered with similar pilosity as that covering thorax; in lateral view, triangular shape and with dense pilosity at the upper margin and towards lower half with a dense group of setae at the lower corner. Upper pleura inflated, uniformly maroon with medium chrome orange pilosity anterodorsally and dusky brown elsewhere. Squamae smoky white at the base, and with long dusky-brown setae becoming hyaline towards the posterior region, and with short dispersed

setae over its surface. Inferior margin of squamae with long dusky brown setae and posterior margin with short ones.

*Legs.* Coxae uniformly maroon with light orange-yellow setae more abundant towards lateral and ventral margins. Femora uniformly maroon, anterior with long reclinate light orange-yellow setae and medium and hind ones with long reclinate dusky brown ones. Tibiae with maroon coloration at the base and becoming lighter towards distal portion; most distal portion of the tibia wider, particularly hind leg. Tibiae with an acute apical spur present on fore and medium legs, and blunter on hind legs, reclinate dusky-brown setae present on all tibia but decreasing on longitude and density from fore tibiae towards the hind tibiae, which only have a few short setae. Tarsi cream-yellow with simple tarsal claws and no empodia or pulvilli.

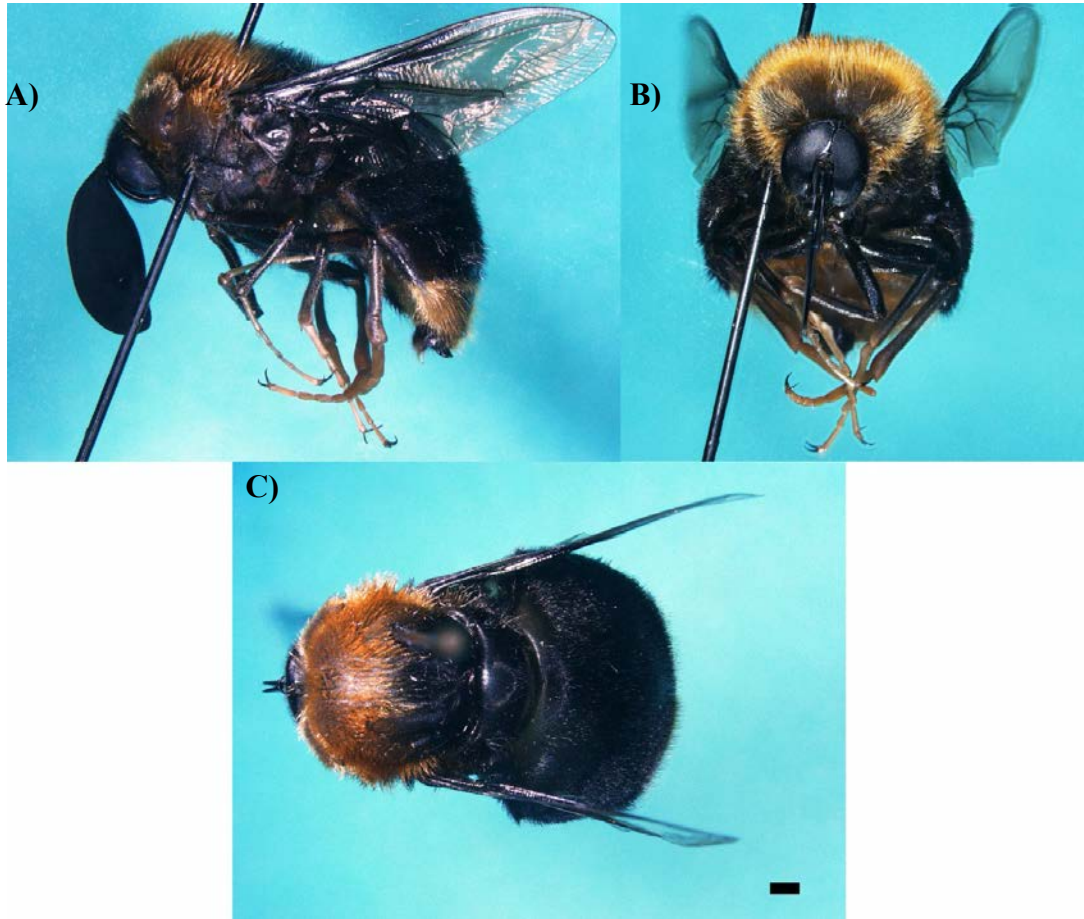
*Abdomen.* In dorsal view tergites one to four vandyke-brown, rounded and broader than thorax, covered with dusky brown short setae, except for medial zone in which setae are not as dense. In lateral view, abdomen curved. Tergite five covered with long light chrome orange setae. Sternum concave covered with light chrome orange pilosity, except for the median line, which is devoid of setae and towards the sides in which setae are dusky brown.

*Genitalia:* In lateral view, epandrium dusky brown with upper side concave and lower side convex, both converging on a pointed apex. Gonocoxite cuticle raw umber and covered in vandyke brown and light chrome orange setae, upper and lower margin parallel, and posterior margin convex. Gonostylus hyaline concave, darker at the tip. Phallus dusky brown thin and, when looked dorsally, ending in two divergent tips.

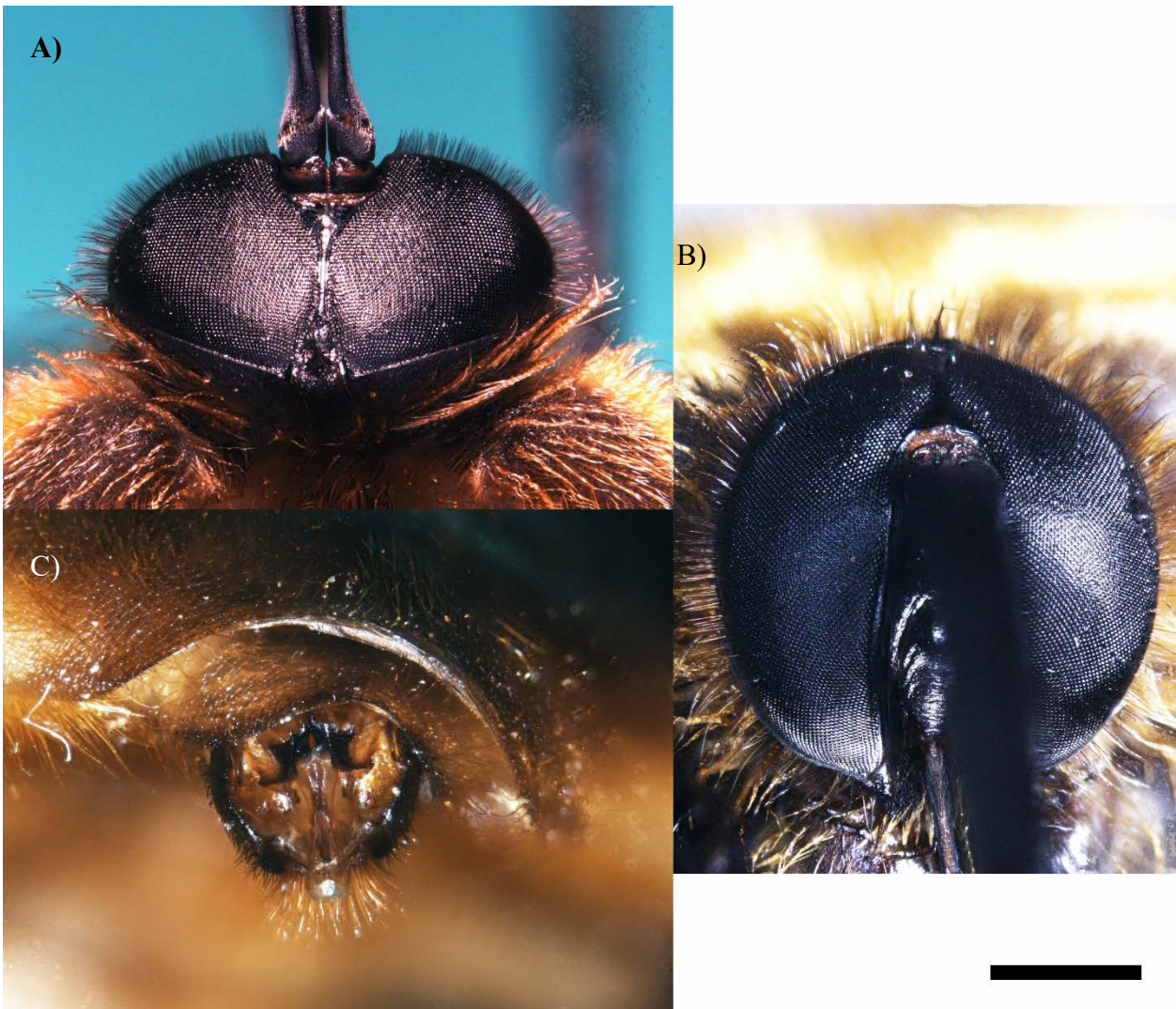
*Wings:* Wings brownish hyaline, somewhat darker towards the base, without markings or microtrichia. Veins sepia colored. Wing venation as in *C. insignata*, but the upper branch of  $M_1$  is continuous with lower branch, almost straight and not making contact with the wing's lower margin. Discal cell not directly in contact with basal medial cell but connected through



a short vein.  $R_4$  not straight as in *C. insignata*, but wavy, with the proximal half pointing towards the wing's dorsum and the distal half towards the wing's ventral margin.

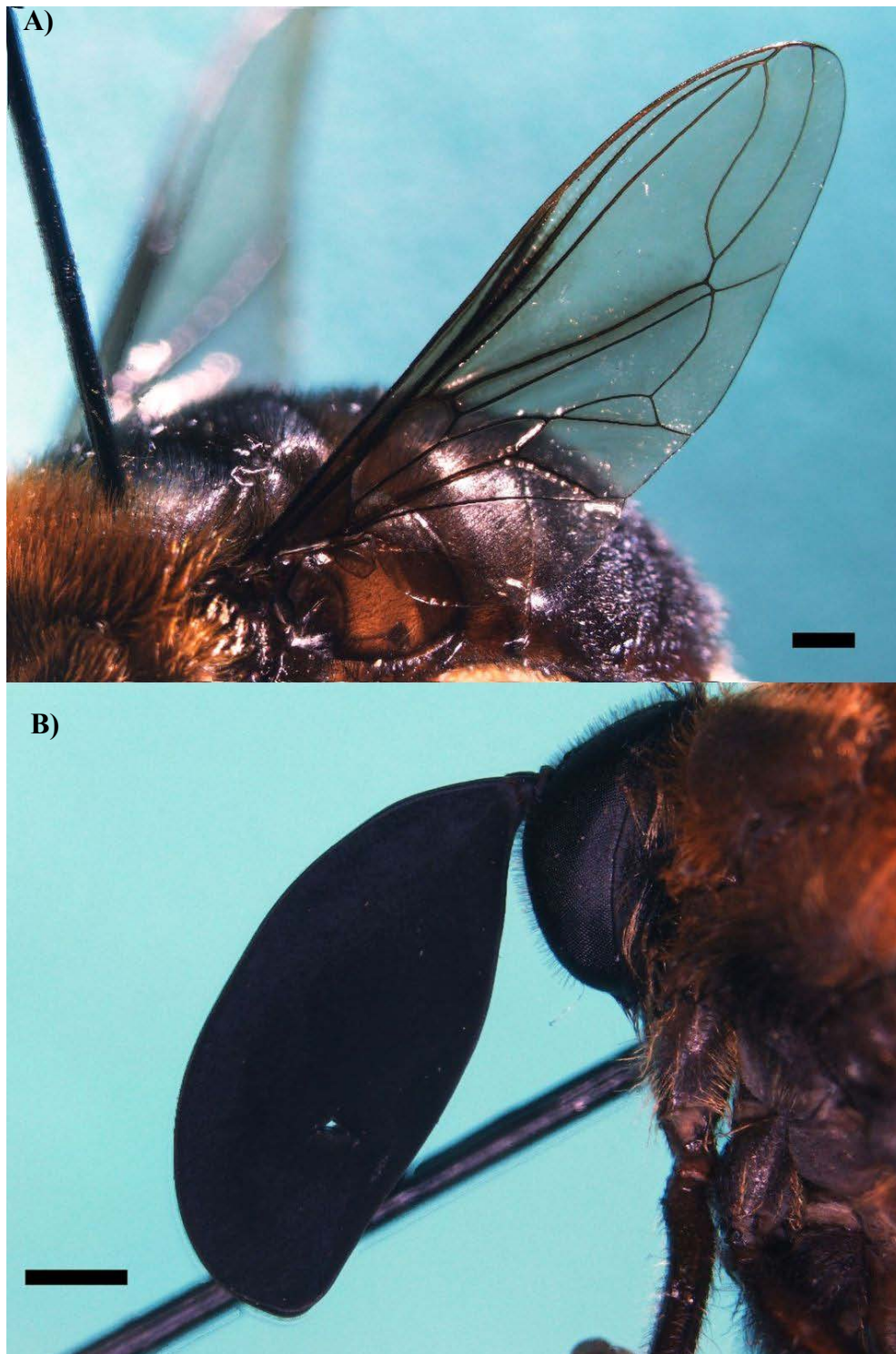


**Figure 2.** Photographs of the holotype of *Camposella mindoensis* sp. nov. Lateral (A), frontal (B), and dorsal (C). Scale bar: 1 mm.



**Figure 3.** Photographs of the holotype of *Camposella mindoensis* **sp. nov.** Dorsal view of the cephalic capsule (A), head frontal view (B), and dorsal view of male pygidium showing genitalia (C). Scale bar: 1 mm.





**Figure 4.** Photographs of the holotype of *Camposella mindoensis* **sp. nov.** Wing dorsal view (A), and head in lateral view showing the antenna (B). Scale bars: 1 mm.

**Etymology.** This new species is named after the type locality. The town of Mindo is a biologically diverse area about 80 km northwest of Quito (Cuesta *et al.* 2017), Ecuador's capital city. Its name meaning "originating in Mindo".

## DISCUSSION

The function of enlarged flagella can only be hypothesized since these flies are so rare on the field. Cole (1919) mentioned that such structures might be a product of sexual selection, as females would prefer males with larger antennae. Antennae would be antler-like extensions of the head capsule, a disadvantage that would indicate male quality (Wilkinson & Dodson 1996). There are several examples of sexually selected characters in flies; for example, eye-stalks have appeared independently on several families such as: Tephritidae, Richardiidae and Platystomatidae, but have been studied mostly on diopsids (Wilkinson & Dodson 1996; Warren & Smith 2007). Enlarged head morphology might represent a case of hypercephaly, but in contrast to stalk-eyed flies, the tendency would be for structures (e.g., antennal flagella) to develop anteriorly instead of laterally. *In situ* studies of the reproductive fitness of males with varying flagella size would help to test this hypothesis. Another hypothesis by Cole (1919) is that flagella might increase antennae's surface area. Increasing surface might help males locate females (Cole 1919), probably because a greater surface would enhance olfactory function by accommodating more olfactory sensilla and detecting female pheromones more easily (Wicker-Thomas 2007). An increased olfactory function might also be useful for *Camposella* to locate their hosts or oviposition sites from where planidia could reach their hosts (Schlinger 1987). Studies on the morphology of antennae and the

ultrastructure of antennal sensilla would help better understanding their role on host location and olfaction in this genus.

## CONCLUSION

Within Panopinae, *Camposella* is the most remarkable genus given its enlarged paddle-like flagella. As with *C. insignata*, the specimen of *C. mindoensis* **sp. nov.** described here is a male. Through this investigation, I learned that the two species of *Camposella* mentioned are the only two described in the world and so far and, they have only been recorded in Ecuador. In addition, there are no studies of these species related to the function of flagella in adults and there is a lack of studies of the behaviour of endoparasite larvae of *Camposella* that use Mygalomorphae spiders as hosts (Annex A).

The function of the enlarged flagella can only be hypothesized as mentioned in the discussion since these flies are very rare in the field and on entomological collections. Further field studies on this region might reveal more specimens, other species within this subfamily, and even more acrocerids. A possible strategy could be to rear spider hosts until final-instar larvae emerge, pupate and develop into adults, as Barneche *et al.* (2013) did to describe *Exetasis jujuyensis* Gillung. On the other hand, on the Andean slopes of northwestern Ecuador, where *C. mindoensis* was collected, there are at least eight described mygalomorph spider species that might serve as hosts for panopines. Unfortunately, information on Mygalomorph spiders from Ecuador is limited, and many species remain reported as little-known or undescribed. More species might be added, as this region encompasses the richest and most diverse biodiversity hotspot on Earth, the Tropical Andes (Mittermeier *et al.* 2004). The description of *Camposella mindoensis* sp. nov. is an important contribution towards the knowledge of the taxonomy of the Acroceridae and the diversity of the Diptera of Ecuador and the neotropics.

## ACKNOWLEDGMENTS

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**ANNEX A: SPECIES OF MYGALOMORPH SPIDERS FOUND ON THE ANDEAN SLOPES OF NORTHWESTERN ECUADOR**

**Table 1.** Species of Mygalomorph spiders found on the Andean slopes of northwestern Ecuador, where *Camposella mindoensis* and *C. insignata* have been collected, and that might serve as their hosts and for other panopines.

<b>Species</b>	<b>Family</b>	<b>Record localities</b>	<b>Province</b>	<b>Source</b>
<i>Idiophthalma ecuadoriensis</i>	Barychelidae	Santo Domingo de los Colorados	Santo Domingo de los Colorados	Berland 1913
<i>Ischnothele caudata</i>	Ischnothelidae	Slopes of Pichincha volcano	Pichincha	Coyle 1995
<i>Linothele pukachumpi</i>	Dipluridae	Reserva Biológica Otonga	Cotopaxi	Dupérré & Tapia 2015
<i>L. quori</i>	Dipluridae	La Florida, Alluriquín, San Francisco de las Pampas	Santo Domingo de los Colorados, Cotopaxi	Dupérré & Tapia 2015
<i>L. tsachilas</i>	Dipluridae	La Florida, Alluriquín	Santo Domingo de los Colorados	Dupérré & Tapia 2015
<i>L. yanachanka</i>	Dipluridae	San Francisco de las Pampas	Cotopaxi	Dupérré & Tapia 2015
<i>L. zaia</i>	Dipluridae	La Florida, Alluriquín	Santo Domingo de los Colorados	Dupérré & Tapia 2015
<i>Linothele</i> spp.	Dipluridae	Mindo	Pichincha	Unidentified species recorded by authors
<i>Paratropis elicioi</i>	Paratropididae	Reserva Biológica Otonga	Cotopaxi	Dupérré & Tapia 2015
<i>Paratropis</i> spp.	Paratropididae	Mindo	Pichincha	Unidentified species recorded by authors
<i>Neischnocolus</i> spp.	Theraphosidae	Mindo	Pichincha	Unidentified species recorded by authors
<i>Pamphobeteus</i> spp.	Theraphosidae	Mindo	Pichincha	Unidentified species recorded by authors