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Taxonomy of *Liphanthus* Reed (Hymenoptera: Andrenidae) in Peru, with notes on floral associations and new distribution records

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Abstract. A new species of *Liphanthus* Reed (Andrenidae: Panurginae: Protandrenini), ***Liphanthus mabelae*** Romero & Calizaya, new species, is described from mid- to high-elevation localities (2500–4000 m) in southern Peru (Arequipa, Moquegua, and Tacna). The previously unknown female of *Liphanthus cuscoensis* Gonzalez, Rasmussen & Engel, 2014 is also described, based on specimens collected 2 km from the type locality in Cusco Province. Although superficially similar, the two species belong to distinct DNA barcode clusters (BINs) and can be readily distinguished by differences in the proportions of male F11; the yellow colouration patterns on the pronotal lobe and metatibia of males; and the degree of yellow pigmentation on the ventral surface of the flagellum in both sexes. Diagnostic images of these characters are provided to facilitate identification of the two Peruvian species. Floral associations are documented for each species. These findings enhance our understanding of Peruvian bee diversity and emphasize the need for continued sampling across the heterogeneous high-Andean landscapes of Peru, including western and eastern slopes, inter-Andean valleys, and puna–páramo ecosystems.

Resumen. Se describe una nueva especie de *Liphanthus* Reed (Andrenidae: Panurginae: Protandrenini), ***Liphanthus mabelae*** Romero & Calizaya, especie nueva, procedente de localidades de elevación media a alta (2500–4000 m) en el sur del Perú (Arequipa, Moquegua y Tacna). También se describe la hembra previamente desconocida de *Liphanthus cuscoensis* Gonzalez, Rasmussen & Engel, 2014, basada en ejemplares recolectados a 2 km de la localidad tipo en la provincia de Cusco. Aunque ambas especies son superficialmente similares, pertenecen a distintos clústeres de códigos de barras de ADN (BINs) y pueden distinguirse fácilmente por diferencias en las proporciones del F11 del macho; la coloración amarilla en el lóbulo pronotal y la metatibia de los machos; y el grado de pigmentación amarilla en la superficie ventral del flagelo en ambos sexos. Se proporcionan imágenes diagnósticas de estos caracteres para facilitar la identificación de las dos especies peruanas del género. Se documentan asociaciones florales para cada especie. Estos hallazgos amplían nuestro conocimiento sobre la diversidad de abejas en el Perú y enfatizan la necesidad de continuar el muestreo en los paisajes heterogéneos de los Andes peruanos, incluyendo las vertientes occidentales y orientales, los valles interandinos y los ecosistemas de puna y páramo.

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INTRODUCTION

The South American bee genus *Liphanthus* was described by Reed (1894) based on a male specimen of the type species, *L. sabulosus* Reed, 1894. The first comprehensive revision of the genus was conducted by Ruz & Toro (1983), who recognized 26 species, all but one of which were assigned to seven subgenera. Over the following three decades, 23 additional species were described by Toro (1989), Tapia & Ruz (2003), Vivallo (2008), Gonzalez *et al*. (2014), and Mir Sharifi *et al*. (2019). Until recently, two species of *Liphanthus* were recorded from Peru, one from Cusco Province (Gonzalez *et al*., 2014) and another from Ancash Province (Mir Sharifi & Packer, 2019). However, recent morphological and molecular phylogenetic analyses have demonstrated that the species from Ancash belongs to the genus *Incasarus* Gonzalez, Rasmussen & Engel, to which it is being transferred along with five other Andean species from Bolivia and Argentina (Romero & Packer, 2026). Following this reclassification, *L. cuscoensis* Gonzalez *et al*., 2014, which is currently known only from the male holotype, remained the sole confirmed Peruvian representative of *Liphanthus*.

Herein, we describe a second Peruvian species, *L. mabelae* Romero & Calizaya, new species, collected from high-elevation localities across three provinces in southern Peru. We also describe the previously unknown female of *L. cuscoensis* and provide new floral associations and additional locality records based on recently collected material and museum specimens. An expanded diagnosis of *L. cuscoensis*, incorporating female characters and new images, is presented to facilitate its differentiation from *L. mabelae*. Additional comments and distributional records are also provided.

Liphanthus cuscoensis and *L. mabelae* are assigned to the genus *Liphanthus* based on the presence of the diagnostic features defined by Ruz & Toro (1983): (i) a narrow pterostigma, nearly as narrow as the prestigma; (ii) a straight inner margin of the pterostigma within the marginal cell; and (iii) a deep postgradular area on the second tergum (T2), particularly well developed in males. Within Protandrenini, the first two characters also occur in *Incasarus* (Gonzalez *et al*., 2013; Romero & Packer, 2026). However, *L. cuscoensis* and *L. mabelae* do not belong to that genus, as they possess three submarginal cells, a deep postgradular area on T2, and a sternum seventh (S7) apical lobe differentiated from the apodeme. In contrast, *Incasarus* is characterized by two submarginal cells, a shallow postgradular area on T2, and an S7 apical lobe fused to the apodeme (see figs. 5 and 15 in Gonzalez *et al*., 2013).

The males of *L. cuscoensis* and *L. mabelae* share the following combination of morphological characteristics not observed in any other described *Liphanthus*: a) First to fifth sterna with well-defined apicomedial depressions (Fig. 1), b) Sixth sternum (S6) with disc bearing strongly modified spatulate setae (Figs. 2–4), and c) S6 with apicomedial margin thickened, ventrally recurved and rounded (Fig. 2). Although superficially similar, we demonstrate that *L. cuscoensis* and *L. mabelae* are two distinct species based on morphological features and cytochrome c oxidase subunit I (COI) barcode analysis.

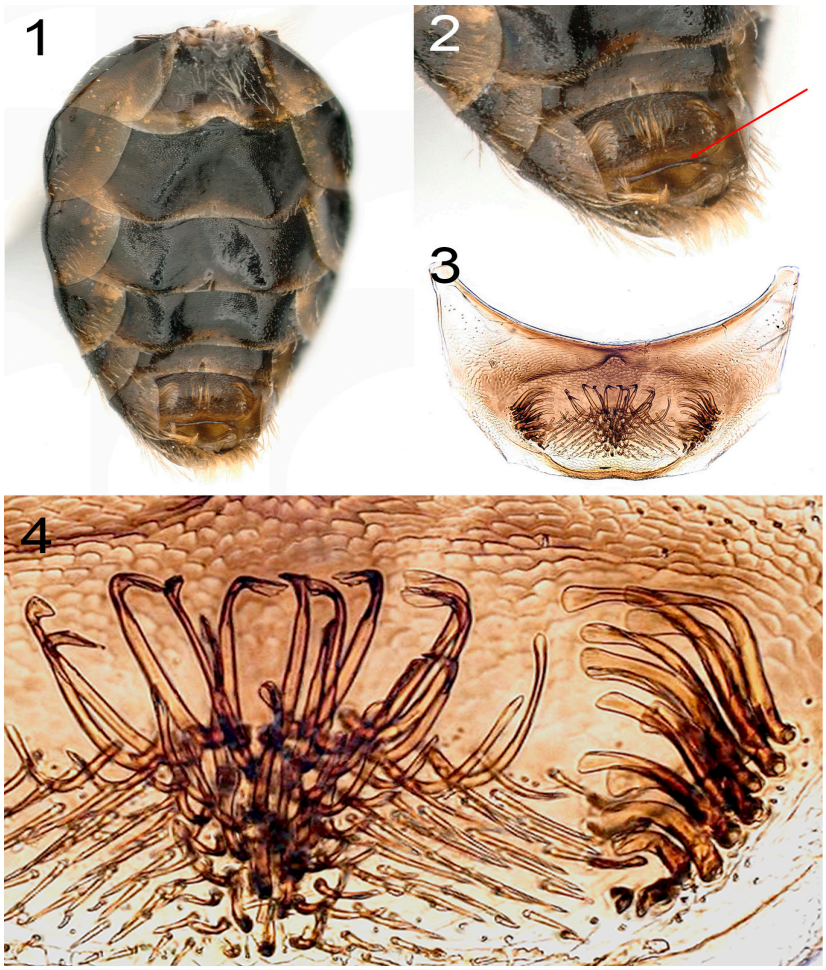
MATERIAL AND METHODS

MATERIAL EXAMINED: Specimens were collected from various localities in Southern Peru, specifically in the Provinces of Arequipa, Moquegua, and Tacna (Fig. 5). Sampling methods included coloured bowl traps (pans and cups) and vane traps with pure propylene glycol as a preservative, as well as spot-netting (Packer & Darla-West, 2021). Additionally, we examined specimens from the following repositories, with location and curators responsible acknowledged: EACSAU: Universidad Nacional San Agustín de Arequipa, Entomology and Acarology Collection, Arequipa, Peru, Javier Huanca Maldonado; MUSA (UNSA): Museo de Historia Natural de la Universidad Nacional

San Agustín de Arequipa, Arequipa, Peru, José Cerdeña; MUSM: Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima, Peru, Mabel Alvarado.

Morphology: The external morphology of adults was examined using Nikon DMS1000 and Nikon SMZ25 stereomicroscopes. For male terminalia, specimens were relaxed prior to dissection following the method described by Plant & Dubitzky (2008) or by placing them overnight at room temperature in a relaxing chamber. The apical metasomal terga and sterna were then removed and cleared in approximately 5–10% KOH solution (1 pellet KOH per mL H_2O) for 6 to 12 hours, depending on the degree of sclerotization, and subsequently transferred to glycerine in the wells of a ceramic plate for examination and imaging.

Images: Images of male whole specimens and larger body structures were taken with a Keyence VHX-6000 digital microscope equipped with a VH-Z20R universal lens, providing up to 200× magnification. Images were captured using 3D stitching settings to obtain extended fields of view. Male terminalia were photographed at 300–400× magnification using the VH-ZST dual-objective lens under fine depth-composition and transmitted-light settings. Images of female *L. cuscoensis* were taken with a Leica



Figures 1–4. Characteristics in the metasomal sterna shared by the two species of *Liphanthus* known in Peru. **1, 2**. *L. mabelae* showing strong medial depressions and thickened and ventrally recurved apical margin of S6 (red arrow). **3, 4**. *L. cuscoensis*, cleared preparation of S6 showing highly modified setae.

DMS1000 digital microscope. Final images were edited and assembled into figure plates using Adobe Photoshop v.26.3.0. Images of flowers in the field were taken with a cellphone.

TERMINOLOGY: Except where indicated otherwise, we follow the general morphological terminology of Michener (2007), with specific terminology for *Liphanthus* proposed by the formats of Ruz & Toro (1983) and Mir Sharifi *et al*. (2019). Following earlier publications from the Packer Lab (*e.g*., Ferrari & Packer, 2020; Packer, 2021) and based on Prentice (1998), we use the terms *genal*, *frontal*, and *vertexal* areas rather than *gena*, *frons*, and *vertex*. In contrast to the aforementioned works, we revert to the term *dorsal surface of the propodeum* instead of *metapostnotum* (Brothers, 1976), following the interpretation of Meira *et al*. (2024). Terminology for surface sculpture follows Harris (1979), except in the case of *striae*, which in melittology refers to raised rather than depressed linear features (Ferrari & Packer, 2020). Puncture density is expressed as the ratio of the distance between punctures *i* to puncture diameter *d*; for example, i=3d indicates that the interspace between punctures is three times the puncture diameter.

The following abbreviations are used: AOD: antennocular distance, the shortest distance between the antennal socket and the inner margin of the compound eyes; IAD: interalveolar distance, the minimum distance between antennal sockets; IOC: interocellar distance, the minimum distance between lateral ocelli; ITW: intertegular width, the minimum distance between tegulae; LOD: lower interocular distance, the minimum distance between inner orbits of compound eyes, below the level of emargination; MOD: median ocellar diameter, used to indicate length of pubescence; OOC: ocellocular distance, the minimum distance between lateral ocellus and compound eye; UOD: upper interocular distance, the minimum distance between inner orbits of compound eyes, above the level of emargination; F: antennal flagellomere; T: metasomal tergum; S: metasomal sternum.

Body length was measured in lateral view. Because of the common disposition of pinned specimens in which the tagma or even parts of the metasoma are not in the same plane, body length was the sum of different measurements, usually including 1) the head, excluding antenna and mouthparts, 2) the mesosoma, and 3) one or two measurements of the metasoma, depending on the degree of curvature. Head length is the maximum distance in a straight line from the posterior margin of the vertexal area to the apical margin of the clypeus, in frontal view. Head width is the maximum distance in a straight line between the outer margins of the compound eyes, in frontal view. Wing length is the maximum distance in a straight line from the posterior margin of the tegula to the apex, in dorsal view.

DNA BARCODING: DNA barcodes were obtained from a single midleg removed from each specimen and placed in a 96-well plate containing 95% ethanol for processing at the Biodiversity Institute of Ontario (https://biodiversity.uoguelph.ca). DNA extraction, PCR amplification, and sequencing of the COI barcode region followed standard protocols (Hebert *et al*., 2003; Ivanova *et al*., 2006). Resulting sequences were uploaded to the Barcode of Life Data System (BOLD) (Ratnasingham *et al*., 2024; http://www.boldsystems.org), along with collection data and specimen images. Two built-in frameworks in BOLD were used for clustering sequences and species delimitation: 1) COI sequences (usually >500 bp) were assigned Barcode Index Numbers (BINs) (Ratnasingham & Hebert, 2013); and 2) Taxon ID trees were generated to cluster sequences into species containing similar sequences and BINs. The final tree was obtained based upon neighbour-joining trees output from MEGA v.12 (Kumar *et al*., 2024) and annotated using Adobe Illustrator v.29.25.1.

DISTRIBUTION RECORDS: Label information is transcribed as it appears on the original labels, except for data enclosed in square brackets, which indicate amendments to clarify or standardize the format or units of measurement throughout the document. BOLD sample ID(s) for barcoded specimens are included in the material studied section of each species description. The coordinates given were used to prepare a distribution map using Simplemappr (Shorthouse, 2010).

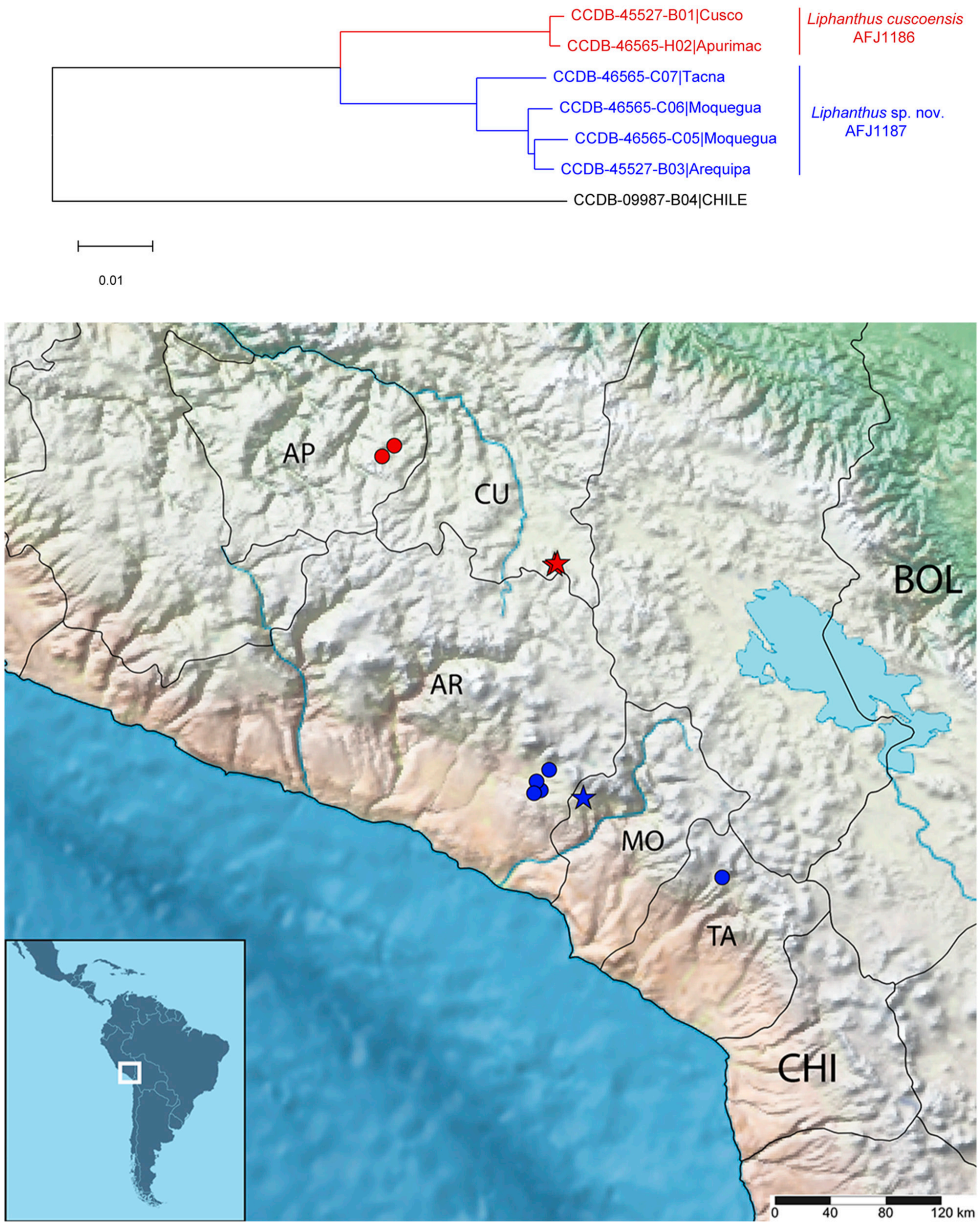


Figure 5. Neighbour-joining tree reconstructed from COI barcode data (top) and geographic distribution of *Liphanthus* in Peru (bottom). Taxon labels are coloured to correspond with their respective geographic sampling locations. Red are *L. cuscoensis*; blue are *L. mabelae*. Outgroup is a Chilean *Liphanthus*. Bordering countries are Bolivia (BOL) and Chile (CHI). Stars indicate type localities.

RESULTS

Species delimitation through DNA barcoding revealed two well-supported genetic clusters corresponding to distinct BINs: AFJ1186 and AFJ1187, with a K2P distance of 4.79% between them (Fig. 5). BIN AFJ1186 includes specimens from Cusco and Apurímac provinces and exhibits an average within-cluster K2P divergence of 1.36%. The BIN AFJ1187, comprising specimens from Arequipa, Moquegua, and Tacna provinces shows an average within-cluster K2P divergence of 0.36%. These results are also consistent with morphological findings, particularly in the dimensions of F11 and yellow marking patterns of the metatibia of males, which are discussed in detail below.

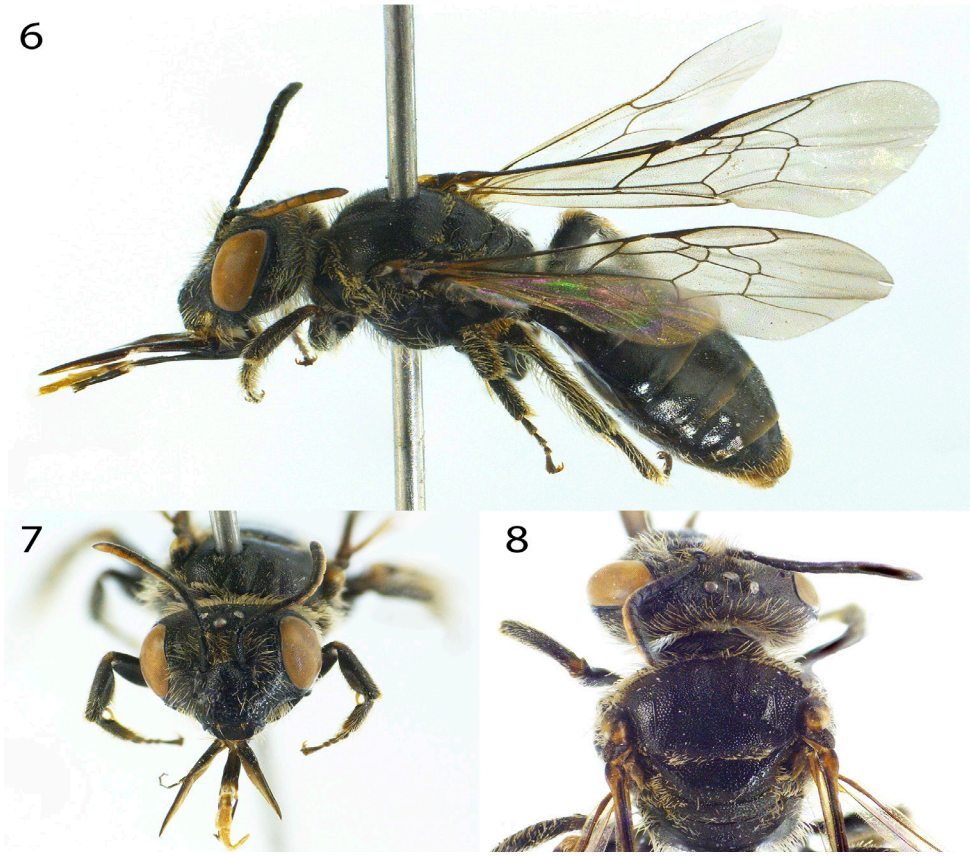
Liphanthus cuscoensis and *L. mabelae* can be identified as *Liphanthus* by the presence of a narrow pterostigma, nearly as narrow as the prestigma, with the margin of the pterostigma within the marginal cell straight, and by T2 bearing a deep postgradular area, especially distinct in males (Ruz & Toro 1983; Ruz 1986). *Liphanthus cuscoensis* was placed in the subgenus *Melaliphanthus* Ruz & Toro by Gonzalez *et al*. (2014). This subgenus was established based on two Chilean species, *L. atratus* (Ruz & Toro, 1983) and *L. penai* (Ruz & Toro, 1983), to which a third Argentine species, *L. inornatus* (Vivallo, 2008), was later added. However, ongoing morphological phylogenetic work on *Liphanthus* by Romero & Packer (in prep.) suggests that *L. cuscoensis*, *L. inornatus*, and *L. mabelae*, together with three undescribed species from Argentina and one from Bolivia, form a well-supported monophyletic group that is widely separated from the lineage containing *L. penai* and *L. atratus* (understood here as *Melaliphanthus*).

Morphologically, both sexes of this lineage differ from *Melaliphanthus* by having generally deep and dense punctation with weak to absent surface sculpture between punctures, rather than the strongly areolate integument with fine and sparse punctation typical of *Melaliphanthus*. Males additionally possess a tuft of hairs on the mandibular outer groove (Mir Sharifi *et al*., 2019, see their fig. 3), and lack an apicomedial process on S2, whereas males of *Melaliphanthus* lack a mandibular hair tuft and bear a distinct apicomedial process on S2 (Ruz & Toro 1983, see their figs. 92, 99). Females are further distinguished by a flat epistomal lobe, which is swollen in those of *Melaliphanthus*. The taxonomic treatment of this new lineage is currently in progress (Romero & Packer, in prep.) and is beyond the scope of the present study; therefore, no new subgeneric assignment is proposed herein.

SYSTEMATICS

Genus *Liphanthus* Reed, 1894
Liphanthus cuscoensis Gonzalez, Rasmussen & Engel, 2014
(Figs. 3–4, 6–12, 30, 32, 34)

DIAGNOSIS: Except for *L. mabelae*, males of *L. cuscoensis* can be readily separated from all other species in the genus, including three undescribed but closely related species from Argentina and one from Bolivia, by the combination of the following characters: three submarginal cells; S1–S5 with strong apicomedial depressions; S6 disc bearing strongly modified spatulate setae; and the apicomedial margin of S6 thickened, ventrally recurved, and medially rounded (Figs. 1–4). Males of *L. cuscoensis* can be distinguished from those of *L. mabelae* by a dark pronotal lobe (Fig. 30) and a darker metatibia (excluding the basitibial plate), with yellow markings small or absent (Figs. 9–11, 32). In contrast, *L. mabelae* has a yellow pronotal lobe, and the metatibia bears yellow markings that extend along the dorsal surface and reach both the anteroapical and ventral surfaces (Figs. 14, 33). Additionally, F11 is longer in males of *L. cuscoensis*, approximately 3× as long as its greatest width, whereas it is shorter in males of *L. mabelae*, approximately 2.4× as long as its greatest width. Both sexes of *L.*



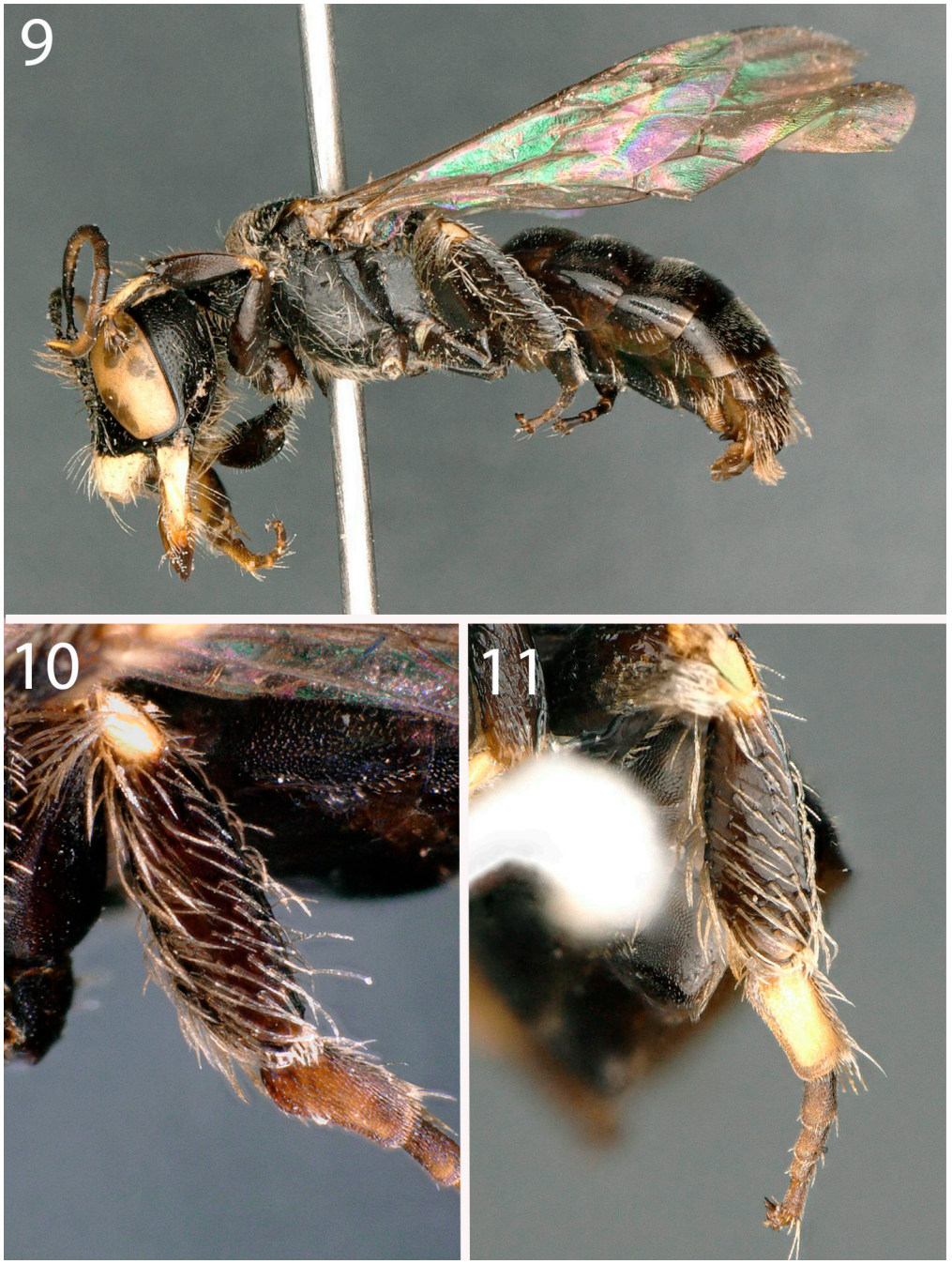
Figures 6–8. Female *Liphanthus cuscoensis* from Espinar, Cusco. **6.** Lateral habitus. **7.** Head in frontal view. **8.** Mesosoma in dorsal view.

cuscoensis can be distinguished from *L. mabelae* by the ventral surface of the flagellum being more extensively pale yellow to light brown (Figs. 6, 34), whereas it is brown in *L. mabelae* (Fig. 35).

Female description: Body length: ~6.4 mm; head width: ~1.9 mm; forewing length: ~4.9 mm; ITW ~1.4 mm. Colouration. Integument black except as follows: mandible brown at apex; compound eyes and basitibial plate brown. F5–F10 light brown to dark yellow ventrally. Tegula and impressed areas of metasomal terga and sterna translucent yellow to brown. Pygidial plate brown (except apex black).

Sculpture. Clypeus weakly to moderately imbricate on basal half, becoming unsculptured towards apex; punctures large and dense (i<1d), some fused. Legs imbricate, dull, except anterior surfaces of metatibia and metabasitarsus weakly sculptured and shiny. T1–T4 increasingly weakly to moderately imbricate, somewhat shiny (except medially on discs, unsculptured and shiny); punctures dense (i=0.5–1d). T4 moderately imbricate, with shallow, somewhat obscure, irregularly spaced punctures (i=0.5–2d). T5 strongly imbricate, punctures sparse on disc (i=2d), becoming nearly crowded (i<0.5d) subapically. Sterna moderately imbricate, somewhat shiny; punctures dense (i=0.5–1d) laterally and along preapical margin, sparse (i=2–3d), obscure medially.

Pubescence. Generally yellowish and short-branched unless otherwise stated. Mesofemur anteroventral surface with dense, erect, light brown setae (1–2MOD). Metatibial scopal hairs thin, simple, long (≤ 3.5MOD), except short (1MOD) basally, thick along dorsal tibial margin. Prepygidial fimbria with long, branched, light



Figures 9–11. Male of *Liphanthus cuscoensis* showing variation in yellow markings in the metabasitarsi. **9.** Lateral habitus of specimen from Apurímac Province. **10.** Hind leg of specimen from Apurímac Province. **11.** Hind leg of specimen from Cusco Province.

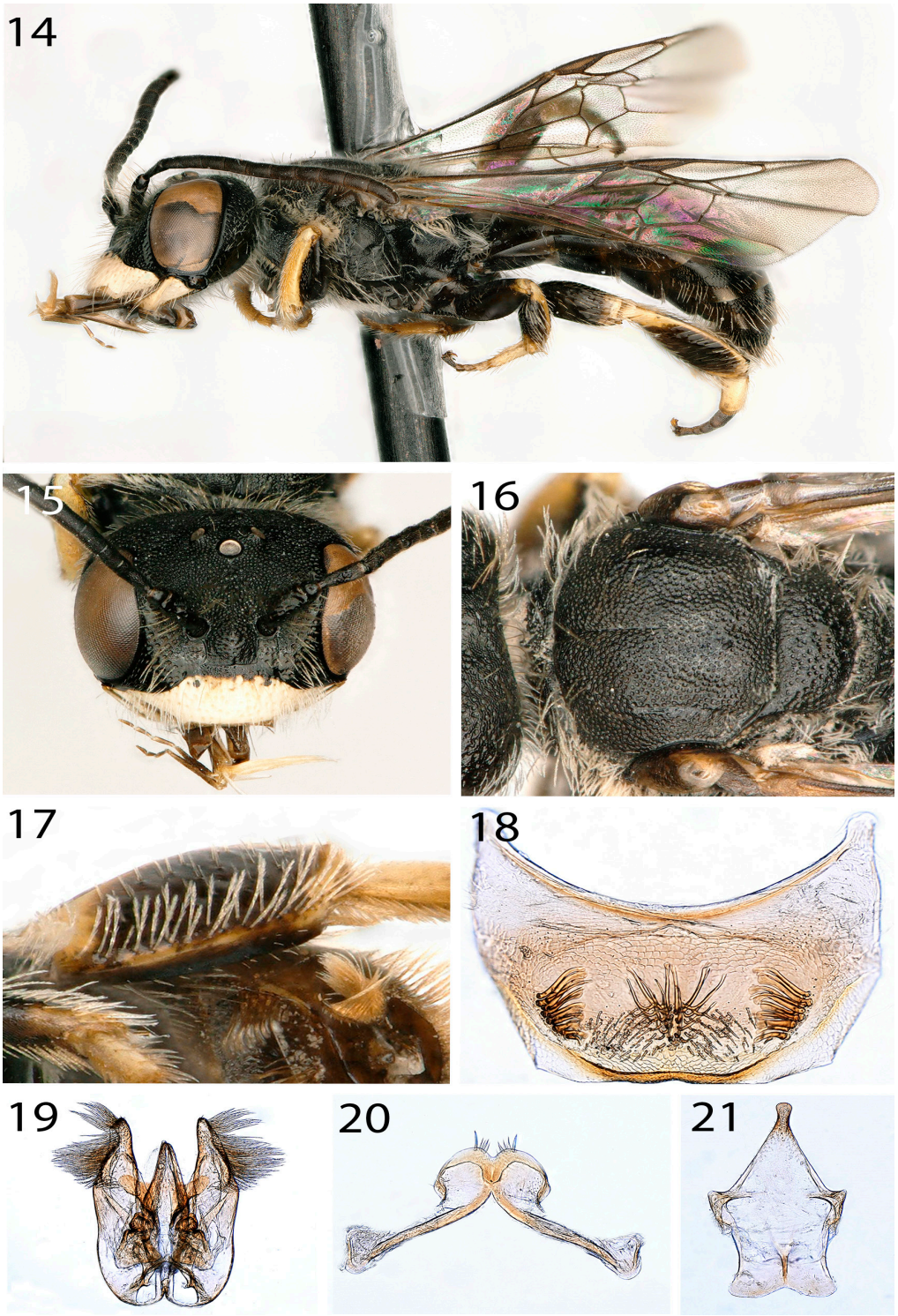
Figures 12, 13. Flower visits records of females of *Liphanthus cuscoensis*. **12.** *Acaulimalva engleriana* (Ulbr.) Krapov (Malvaceae). **13.** *Gentiana sedifolia* Kunth (Gentianaceae).

brown hairs (<3MOD). S2–S4 with sparse, short (~1MOD), posteriorly directed hairs subapically, denser and longer (1.5MOD) laterally and on S5–S6.

Structure. Head: ~1.3× as wide as long, mandible ~2.9× longer than basal depth (64:22). Labral process with narrow, raised medial longitudinal line. Clypeus ~2.4× as wide as long (107:45), convex in profile; medial longitudinal line shallow but distinct; apicomedial margin straight in frontal view; apicolateral margins mostly straight in frontal view, weakly recurved in ventral view. IAD=AOD (36:36). Inner margins of compound eyes weakly divergent below; UOD<LOD (121:136). Facial fovea narrow, ~6× longer than greatest width (30:5). IOC<OOC (26:37). Scape ~6× as long as greatest width (48:8); F1 ~3.2× longer than wide (29:9); F2 length and width subequal (12:11); remaining flagellomeres 1.3× longer than wide, except F10 almost 2× as long as greatest width (20:12). Mesosoma. Mesoscutum ~1.5× as wide as long. Length of scutellum subequal to metanotum and dorsal side of propodeum combined, ratios 20:10:10. Marginal cell shorter than distance between its apex and wing tip (19:22). Metafemur ~2.1× longer than greatest width (97:46), unmodified. Metatibia ~4.7× longer than greatest width (147:31). Metabasitarsus ~3.1× longer than wide at midlength (57:18). Metasoma. Broadest at midlength of T2. Pygidial plate subtriangular, sides mostly straight, apex transverse, plate raised medially. S1 and S6 unmodified, remaining sterna with weak medial depressions, visible at certain angles.

Variation: In males, the yellow colouration of the metabasitarsus ranges from entirely dark (Fig. 9) to partially or entirely yellow (Figs. 10–11). The yellow markings on other parts of the body are consistent among all males. The clypeus is completely dark in most females, while some specimens have a small apicomedial yellow smudge.

Material examined: This species was described based on a sole male specimen from PERU, CU [Cusco], Espinar, Qbda [Quebrada] Chaisamayo, 14°59’46.15”S, 71°15’25.93”W [-14.996 -71.257], 4167m, 16–17.iii.2011, Pastizal [grassland], M. Alvarado. Although this specimen could not be located at MUSM where it was reportedly deposited (Mabel Alvarado, pers. comm.; Victor Gonzalez, pers. comm.), we found two undetermined male *L. cuscoensis* specimens bearing identical label information to that of the holotype. It is possible that these specimens were processed separately, and as a result, not included in the original species description. One of these specimens was included in the barcode analysis (BOLD sample ID: CCCB-45527-B01).



Figures 14–21. *Liphanthus mabelae*, holotype male, from Puquina, Moquegua, except paratype in Figs. 19–21. **14.** Lateral habitus. **15.** Head in frontal view. **16.** Mesosoma in dorsal view. **17.** Metatibia in ventral view. **18.** Spatulate setae on S6. **19.** Genital capsule. **20.** S7. **21.** S8.

New locality records: 1♂: PERU, AP [Apurímac], Challhuahuacho, CCPP [Centro Poblado] Cconchacota, 14°11'17.6"S, 72°24'5.4"W [-14.188 -72.401], 4156 m, 12–13.iii.2015, L. Sulca and I. Medina, BOLD sample ID: CCCB-46565-H02, deposited in Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima, Peru. 1♂: PERU, AP [Apurímac], Cotabambas, Challhuahuacho, Socorro, 14°7'46"S, 72°19'0.94"W [-14.118 -72.317], 4384 m, 18.iii.2021, R. Coronel. Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima, Peru. 14♀♀: PERU, Cusco, Espinar, Near Machaicato, -15.006 -71.271, 4149 m, 27.iii.2025, Y. Calizaya, on *Acaulimalva engleriana* (Ulbr.) Krapov, *Gentiana sedifolia* Kunth, and *Hypochaeris* cf. *sessiliflora* Kunth (Table 1; Figs. 12–13), deposited in Museo de Historia Natural de la Universidad Nacional San Agustín de Arequipa, Arequipa, Peru. 3♀♀: the same data, deposited in the Packer Collection at York University, Toronto.

DNA Barcodes: Two full-length sequences are available in BOLD for this species. Its BIN is AFJ1186.

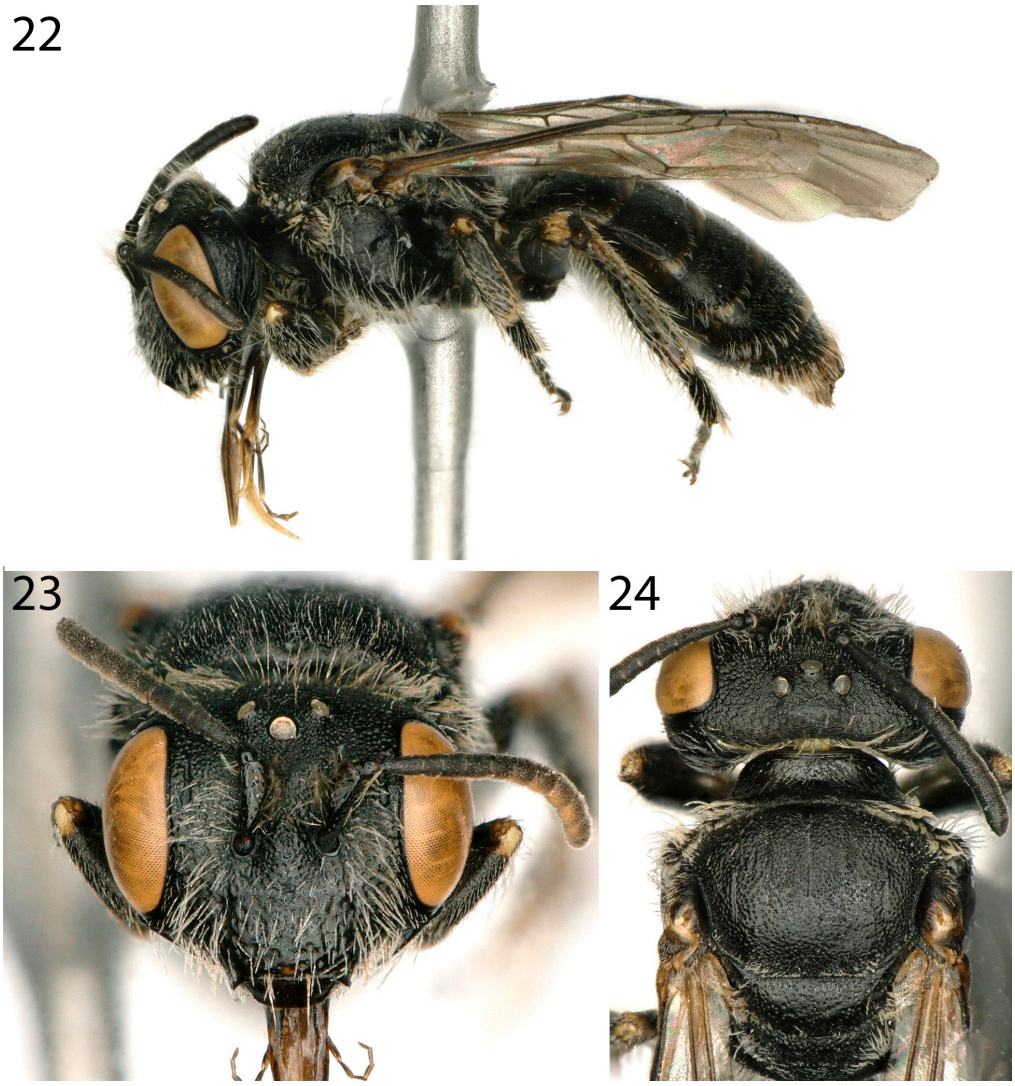
Table 1. Floral associations recorded for Peruvian species of *Liphanthus*. Ecosystems and their elevational ranges follow the updated ecoregional classification for Peru, based on floristic distribution patterns proposed by Britto (2017), as well as Brako & Zarucchi (1993), and specific literature for each plant taxon.

Species	Sex	Behaviour	Plant taxon	Plant family	Ecosystem and elevational range	References
Liphanthus cuscoensis	♀	Foraging pollen	*Acaulimalva engleriana* (Ulbr.) Krapov	Malvaceae	Humid and dry puna: 3350–4100 m	Krapovickas (1974)
	♀	Visit	*Gentiana sedifolia* Kunth	Gentianaceae	Humid to dry puna and páramo: 2800–4600	Pfanzelt & von Hagen (2016); Mendoza *et al.* (2024)
	♀	Visit	*Hypochaeris* cf. *sessiliflora* Kunth	Asteraceae	Humid to dry puna and páramo: 2500–4000 m	Urtubey *et al.* (2009)
Liphanthus mabelae	♀, ♂	Visit	*Tarasa capitata* (Cav.) D.M. Bates	Malvaceae	Western Andean slope, eastern Andean slope, and inter-Andean valleys: 2000–4000 m	Mazzei (2023)
	♀, ♂	Foraging pollen and nectar	*Tarasa tenuis* Krapov	Malvaceae	Western slopes and dry puna: 2000–4100 m	Mazzei (2023)
	♀	Visit	*Dalea cylindrica* Hook	Fabaceae	Western Andean slopes and inter-Andean valleys: 2000–3600 m	Baldeón *et al.* (2006)

Liphanthus mabelae Romero & Calizaya, new species
(Figs. 1, 2, 14–24, 27–28, 31, 33, 35)

ZooBank: urn:lsid:zoobank.org:pub:18A932AF-4F46-4E7A-9E8E-E4CB4794B9C1

Diagnosis: Males of *L. mabelae* can be distinguished from those of *L. cuscoensis* by their yellow pronotal lobe (Fig. 31), more extensive yellow markings on the



Figures 22–24. *Liphanthus mabelae*, paratype female from Puquina, Moquegua**. 22.** Lateral habitus. **23.** Head in frontal view. **24.** Vertexal area and mesosoma, in dorsal view.

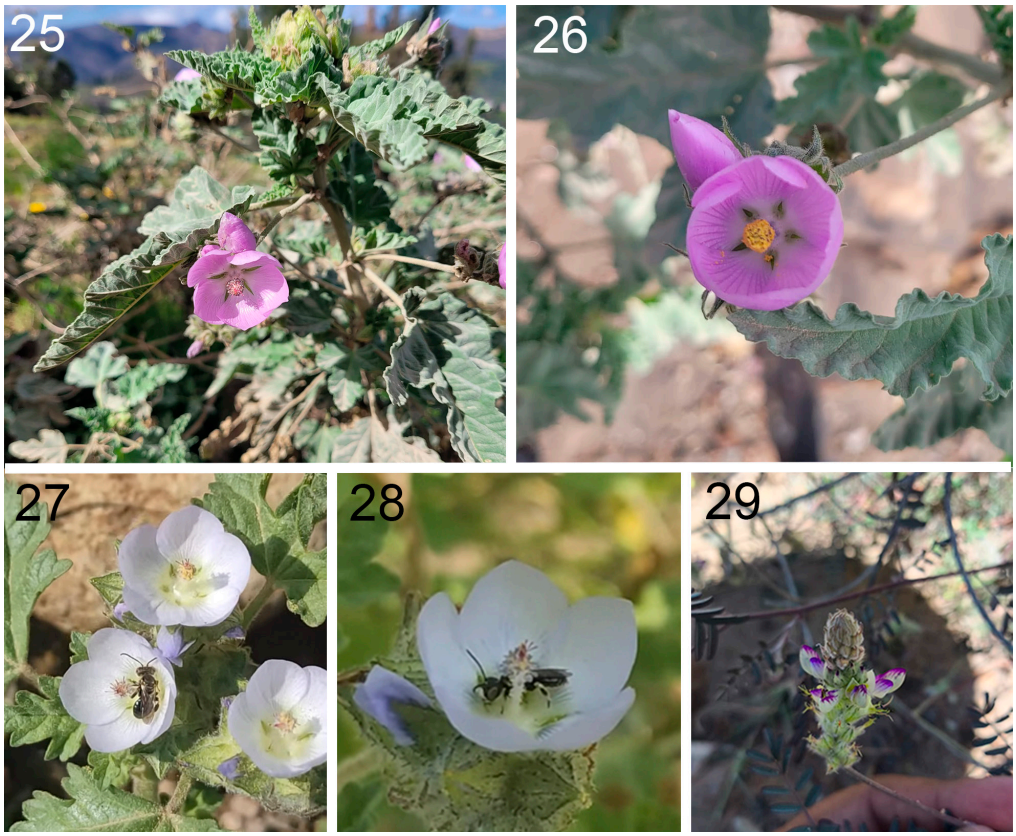
metatibia (excluding the basitibial plate), which extend along the dorsal surface and reach both the anteroapical and ventral surfaces (Figs. 14, 33), and by a shorter F11, approximately 2.4× as long as its greatest width. In contrast, males of *L. cuscoensis* have a dark pronotal lobe (Fig. 30), a darker metatibia, with yellow colouration restricted to a narrow basal spot that does not extend onto other surfaces (Fig. 32), and a longer F11, approximately 3× as long as its greatest width. In both sexes of *L. mabelae*, the ventral surface of the flagellum is darker, bearing only slight yellowish hues (Fig. 35), whereas in *L. cuscoensis* it shows more distinct and extensive yellow to light brown markings.

HOLOTYPE MALE DESCRIPTION: Body length: ~6.5 mm; head width ~1.8 mm; forewing length ~4.2 mm; ITW ~1.1 mm. Colouration. General integument black to dark brown. The following parts yellow: mandible (becoming orange subapically, apex red); labrum; clypeus (irregular small dark marking basomedially); pronotal

lobe; all femora apical 1/3 anterodorsally, extreme apices posteriorly; protibia (dark posteroventrally); mesotibia dorsally and anterior half ventrally; metatibia basally extending along dorsal surface onto anteroapical and ventral surfaces (dark brown on both anterior and posterior surfaces); all basitarsi and second tarsomeres (third and fourth light brown, pretarsi dark). Tegula translucent light brown; impressed areas of terga reddish-orange. F8–F11 weakly light-brown marked ventrally.

Sculpture. Mandible below outer ridge with weak microsculpture, somewhat shiny, punctures fine, sparse (i=3–4d). Labrum unsculptured, shiny, except punctate below process (i=1–1.5d). Clypeus weakly imbricate, somewhat shiny (except apical 1/5 unsculptured and shiny), punctures sparse medially (i<1–3d), moderately dense (i<1–2d) apicolaterally. Supraclypeal area, subantennal sclerite and lower paraocular area moderately strigate to imbricate, somewhat dull, punctures large and irregularly spaced (i=0.5–2d), becoming unsculptured and shiny posterolaterally where punctures are smaller and denser (i=0.5–1d). Rest of face dull. Frontal and upper paraocular areas strigate between coarse and dense punctures (i<0.5d). Vertexal area imbricate to strigate, punctures irregularly spaced (i=0.5–2d). Genal and hypostomal areas imbricate, somewhat shiny, punctures small and dense adjacent to compound eye (i=0.5–2d), large and sparse (i=2–4d) elsewhere. Pronotum imbricate, somewhat shiny. Mesoscutum anterior 1/3, posterior and lateral 1/5 dull due to coarse, dense to crowded punctures (i<0.5d); disc weakly sculptured, somewhat shiny between dense punctures (i=0.5–1d). Scutellum weakly sculptured, somewhat shiny, punctures larger and sparser than on mesoscutum (i=1–2d). Metanotum strigate, dull between irregularly sparse punctures (i=0.5–2d). Pre- and mesepisternum strigate to imbricate, becoming shiny ventrally, punctures shallow, sparse (i=2–4d). Metepisternum imbricate, somewhat shiny, impunctate. Propodeum dorsal surface irregularly rugosostriate, somewhat shiny; dorsolateral slope, posterior and lateral surfaces imbricate, somewhat dull. Legs moderately imbricate, somewhat shiny, except metatibia anterior surface weakly imbricate to unsculptured, shiny. T1–T5 moderately imbricate, somewhat shiny, punctures dense (i=0.5–1d) except medially on discs shiny, punctures fine and sparse (i=2–3d); T6–T7 imbricate, punctures large, irregular in shape and spacing. Sterna imbricate, somewhat dull, except medially on discs weakly imbricate, shiny, with punctures shallow, difficult to detect.

Pubescence. Generally white. Mandible with a tuft of branched hairs on outer groove, around midlength. Labrum, below process, with erect simple hairs (≤1.5MOD), except laterally bearing a few scattered, short (≤0.5MOD), branched hairs. Clypeus, scape, lower paraocular, vertexal, genal, and hypostomal areas with moderately dense hairs (≤2MOD). Remaining areas of face with scattered minute hairs. Mesosoma with sparse branched hairs (≤2MOD), except as follows: mesoscutum and scutellum with minute simple hairs on disc, intermixed with scattered long simple hairs (≤2MOD); pronotum dorsolaterally, pronotal lobe, and posterolateral slope of propodeum hairs dense (≤2MOD); mesoscutum on antero- and posterolateral margins, anterior margin of metanotum, and laterodorsal surface of propodeum with dense, short (≤0.5MOD) hairs; metafemur dorsal and anterior surfaces with sparse short (≤0.5MOD) hairs, increasingly dense and longer (≤2.5MOD) apically, posterior surface hairs dense (≤1MOD) and ventrally oriented, in ventral view appearing as a row of short hairs on posteroventral margin; metatibia dorsal and anterior surfaces with robust, dorsally oriented simple hairs, increasingly longer ventrally (≤1–2MOD) (Figs. 14, 33); anteroventral margin with a row of long (≤2.5MOD) dorsally oriented, branched setae (Figs. 17, 33). Metasomal terga with minute, simple, moderately dense hairs, except as follows: anterior declivitous surface of T1 and lateral reflexed portions of T3–T5 with branched, long (~1.5MOD) hairs; preapical margins of T4 with simple, short (≤0.5MOD) hairs laterally, preapical margins of T5–T6 with simple, long (≤2MOD) hairs; T7 with dense strongly branched hairs. Sterna with sparse minute hairs, except S2–S5 lateral



Figures 25–29. Flower visits records of *Liphanthus mabelae*. **25, 26.** *Tarasa capitata* (Cav.) D.M. Bates, the plant from which the holotype male and paratype female were collected. **27, 28.** Males on flowers of *T. tenuis* Krapov. **29.** Inflorescence of *Dalea cylindrica* Hook, from which a female was collected.

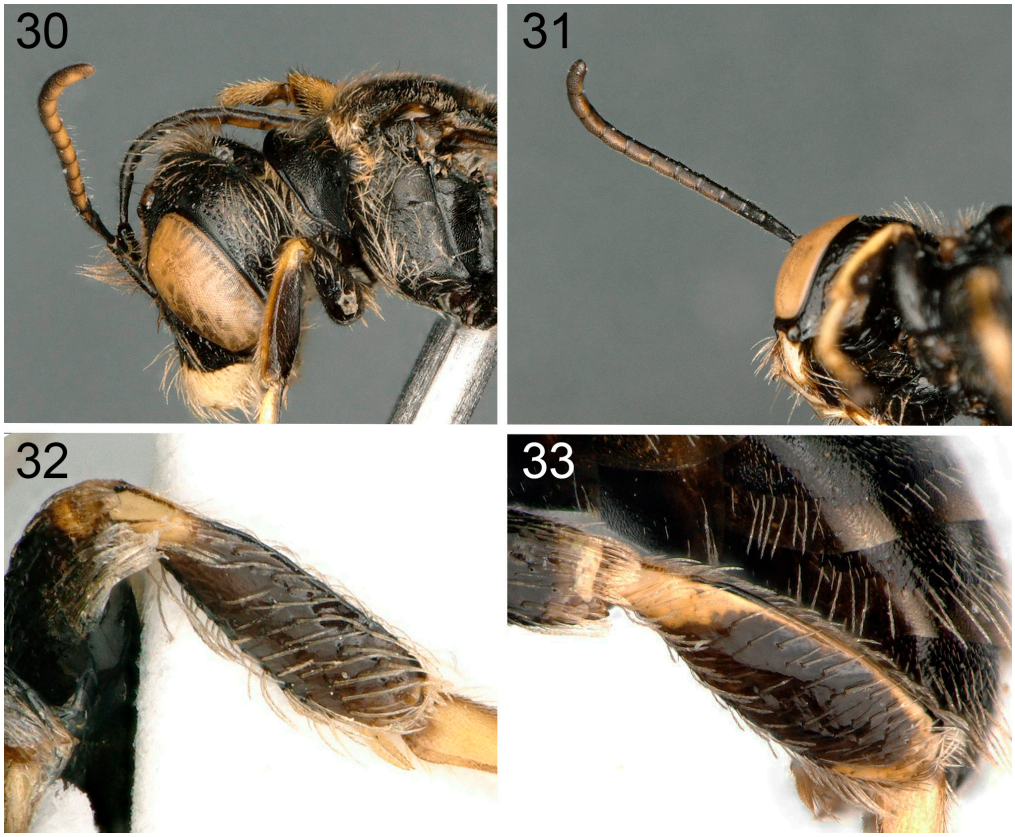
to the depressed area of disc, with moderately dense and long hairs (≤2MOD), and S6 with light brown spatulate setae (Fig. 18).

Structure. Head ~1.3× as wide as long (90:69). Mandible ~4.2× longer than basal depth (50:12). Labrum ~2× as wide as long (23:11); process margins weak, without subapical carina delimiting pubescent portion of apical 1/3. Clypeus ~2.7× as wide as long (70:26), convex in profile; apicomedial margin straight, in frontal view, apicolateral margins mostly straight in frontal view, recurved in ventral view. Outer subantennal suture almost straight, inner subantennal suture moderately outwardly convex. Anterior tentorial pit deep, at junction of outer subantennal and epistomal sutures. Epistomal suture transverse between inner subantennal sutures. Frontal line indistinct and flat above, distinct and raised between antennal sockets. IAD:AOD subequal (20:19). Inner margins of compound eyes subparallel to weakly divergent, UOD<LOD (50:52). Facial fovea small, 0.4× as long as scape (10:25), slit-like (16:2). IOC<OOC (20:25). Scape ~2× as long as greatest width (25:12); pedicel length and width subequal (8:8); F1 ~2.5× longer than wide (20:8); F2 slightly longer than wide (10:9); remaining flagellomeres 1.4–1.8× longer than wide, except F11 ~2.2× as long as greatest width (27:12). Mesosoma: Mesoscutum ~1.2× as wide as long (60:50). Length of scutellum subequal to metanotum and dorsal side of propodeum combined, ratios 20:11:10. Marginal cell shorter than the distance between its apex and wing tip (40:46). Submarginal cells three. Metafemur 1.9× longer than greatest width (45:23), convex

dorsally, flattened ventrally, posteroventral margin carinate. Metatibia ~2.7× longer than greatest depth (65:24). Metatibial spurs not curved apically, posterior spur longer than the anterior. Metabasitarsus weakly produced basally, ~2.5× longer than wide at mid-length (30:12). Metasoma: Broadest at midlength of T2. S1 unmodified. S2–S5 strongly depressed medially (Figs. 1–2), apical margins mostly straight; S6 apicomedially swollen with two lateral patches and one medial patch of spatulate setae, and shorter, sparser and acute setae between these patches (Figs. 2, 18). S6 apicomedial margin thickened and strongly recurved posteriorly, rounded medially (Fig. 2). Terminalia as in Figs. 19–21.

Paratype female description: Approximate body length: ~6.2 mm; head width ~1.9 mm; forewing length ~4.2 mm; ITW ~1.2 mm. Colouration. Integument black except as follows: mandible medial 1/3 orange-reddish, clypeus with a small yellow-orange subapical medial smudge (Fig. 23) and pro- and mesotibiae yellow basal spot. F5–F10 light-brown to brown ventrally. Tegula and impressed areas of terga translucent yellow-brown. Pygidial plate reddish (apex darker).

Sculpture. Clypeus weakly to moderately imbricate on basal half, becoming unsculptured towards apex, punctures large and dense (i<1d), with some punctures



Figures 30–33. Diagnostic features distinguishing males of the two *Liphanthus* species from Peru. **30.** *L. cuscoensis*, head in profile view showing a dark pronotal lobe (indicated by arrow) flagellum with more distinct yellow hues ventrally. **31.** *L. mabelae*, head in profile view showing yellow pronotal lobe (indicated by arrow) and darker flagellum ventrally**. 32.** Anterior surface of the metatibia of *L. cuscoensis* with sparse yellow markings. **33.** Anterior surface of the metatibia of *L. mabelae* with more extensive yellow markings.

fused. Legs imbricate, somewhat dull, except anterior surfaces of metatibia and metabasitarsus weakly sculptured, shiny. T1–T4 increasingly weak to moderately imbricate, somewhat shiny (except medially on discs, unsculptured and shiny), punctures dense (i=0.5–1d); T4 moderately imbricate, punctures shallow, somewhat obscure, irregularly spaced (i=0.5–2d). T5 strongly imbricate, punctures sparse (i=2d), becoming almost crowded (i<0.5d) subapically. Sterna moderately imbricate, somewhat shiny, punctures dense (i=0.5–1d) laterally and along preapical margin, sparse (i=2–3d) medially.

Pubescence. Generally white except when stated otherwise. Mandible with tuft of branched hairs on outer groove not as dense and conspicuous as in male. Mesofemur anteroventral surface with dense, light-brown, erect setae (0.5–1MOD). Metatibial scopal hairs thin, simple, long (≤2.5MOD), except short (1MOD) basally and thick along dorsal margin. Prepygidial fimbria hairs light brown, branched, long (<2MOD). S2–S4 with sparse, posteriorly oriented, short (<1MOD) hairs along subapical margins, denser and longer (1.5MOD) laterally and on S5–S6.

Structure: Head*:* Mandible ~2.9× longer than basal depth (50:17). Labral process with narrow raised medial longitudinal line, strong ridge delimiting pubescent 1/3 apicomedial portion, weak laterally. Clypeus ~2.7× as wide as long (70:26), convex in profile; apicomedial margin straight, in frontal view, apicolateral margins mostly straight in frontal view, weakly recurved in ventral view. IAD and AOD subequal (20:21). Inner margins of compound eyes slightly divergent, UOD<LOD (50:55). Facial fovea ~5× as long as greatest width (20:4), ~0.6× as long as scape (20:33). IOC<OOC (20:28). Scape ~2.5× as long as greatest width (33:13); F1 ~2× longer than wide (20:10); F2 as long as wide (11:11); remaining flagellomeres 1.1–1.2× longer than wide, except F10 ~1.8× as long as greatest width (24:13). Mesosoma: Mesoscutum ~1.2× as wide as long (70:56). Marginal cell shorter than the distance between its apex and wing tip (40:44). Metafemur ~2.1× longer than greatest width (40:19), unmodified. Metatibia ~5.4× longer than greatest width (65:24). Metabasitarsus ~5× longer than wide at midlength (40:8). Metasoma: Broadest at midlength of T2. T2 lateral fovea deep, margins sharp, oval, ~6× longer than greatest width (30:5). Pygidial plate subtriangular, sides mostly straight, apex rounded, plate raised medially. S1 and S6 unmodified, remaining sterna with weak medial depressions, visible at certain angles.

VARIATION: In females, the clypeus is completely dark in most specimens, while others have a small apicomedial yellow mark (Fig. 23).

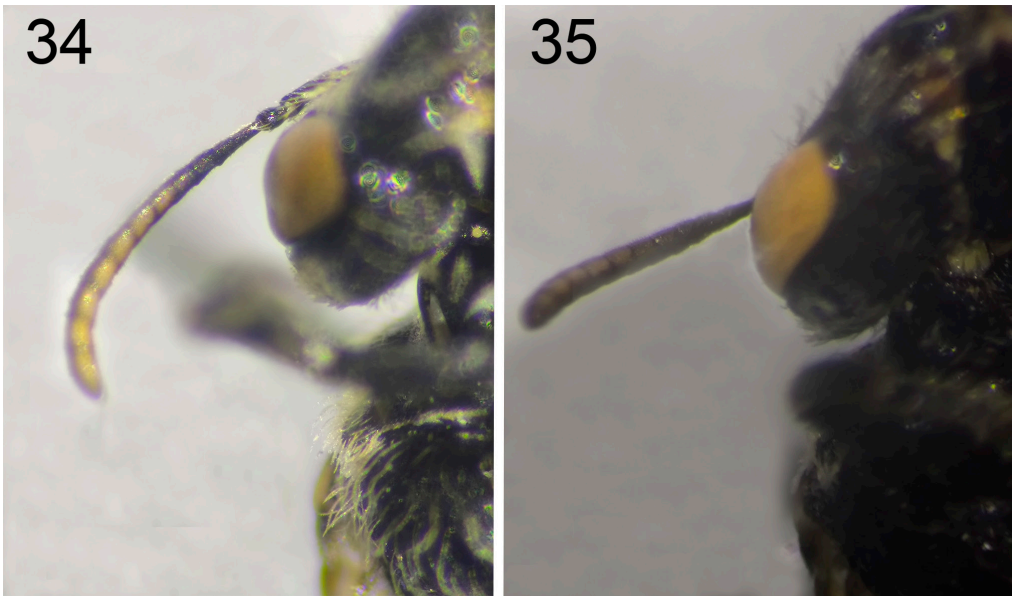
MATERIAL EXAMINED: Holotype ♂ and paratype ♀: PERU, MO [Moquegua], Puquina, -16.607 -71.193, 3214 m, 13.i.2023, Y. Calizaya & N. Romero both specimens were collected on *Tarasa capitata* (Cav.) D.M. Bates (Malvaceae) (Table 1; Figs. 25–26), both deposited in Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima.

PARATYPES: 4♂♂1♀: PERU, MO [Moquegua], Puquina, -16.607 -71.193, 3214 m, 13–26.i.2023, Y. Calizaya & N. Romero (1♂ and ♀ paratype with BOLD ID: CCDB-46565-C05 and CCDB-46565-C06, respectively), deposited in the Packer Collection at York University, Toronto. 1♂, 1♀: PERU, TA [Tacna], Candarave, -17.231 -70.259, 3749 m, 27.i–8.ii.2023, Y. Calizaya & N. Romero (1♀ with BOLD ID: CCDB-46565-C07), deposited in the Packer Collection at York University, Toronto. 2♂♂, 2♀♀: PERU, AR [Arequipa], Chiguata, Zona I, Puente, 3503 m, -16.408 -71.423, 24.iii.2024, L. Packer, (1♂ with BOLD ID: CCDB-45527-B03), deposited in Universidad Nacional San Agustín de Arequipa, Entomology and Acarology Collection, Arequipa. 4♂♂, 10♀♀: PERU, AR [Arequipa], Socabaya, 1.8km SE of Plaza Socabaya, -16.481 -71.519, 2339 m, 28.iii.2024, Y. Calizaya, on *Tarasa tenuis* Krapov (Figs. 27–28), deposited in Museo de Historia Natural de la Universidad Nacional San Agustín de Arequipa, Arequipa. 2♂♂, 1♀: PERU, AR [Arequipa], Yarabamba, 4.5 km W of Plaza Yarabamba -16.551 -71.522, 2476

m, 23.iv.2025, Y. Calizaya, 1♂ found on *T. tenuis* (Figs. 27–28), ♀ on *Dalea cylindrica* Hook (Fig. 29), deposited in Museo de Historia Natural de la Universidad Nacional San Agustín de Arequipa, Arequipa. 4♂, 10♀♀: PERU, AR [Arequipa], Yarabamba, 1.6 km NW of Plaza Yarabamba, -16.538 -71.487, 2435 m, 23.iv.2025, Y. Calizaya, found on *T. tenuis* (Figs. 27–28), deposited in Museo de Historia Natural de la Universidad Nacional San Agustín de Arequipa, Arequipa.

DNA Barcodes: Four full-length sequences are available in BOLD for this species. Its BIN is AFJ1187.

Etymology: The species is named *mabelae* in honour of Alessandra Mabel Calizaya, the junior author's daughter, and Mabel Alvarado, Peruvian hymenopterologist who collected the male holotype and is a curator at MUSM. She facilitated the loan of specimens, enabling their thorough study and inclusion in this work.



Figures 34–35. Diagnostic features distinguishing females of the two *Liphanthus* species from Peru, ventral view of the flagellum. **34.** *L. cuscoensis*, showing more distinct yellow markings. **35.** *L. mabelae*, showing darker colouration.

FLORAL RECORDS

Prior to this study, plant associations of *Liphanthus* species from Peru had not been documented. Here, we report for the first time observations of foraging behavior and flower visits (Table 1) for females of *L. cuscoensis* and for both sexes of *L. mabelae*. "Foraging" refers to instances in which bees were observed collecting floral resources, whereas "visits" refer to observations of bees on flowers without apparent resource collection. Females of *L. cuscoensis* were observed actively visiting flowers and foraging for pollen and nectar from *Acaulimalva engleriana* and *Gentiana sedifolia* (Figs. 12, 13), as well as frequently visiting flowers of *Hypochaeris* cf. *sessiliflora* in Espinar, Cusco; however, no males were observed. The holotype male and paratype female of *L. mabelae* were collected on *Tarasa capitata* (Figs. 25–26) in Puquina, Moquegua. In addition, in different localities in Arequipa, both sexes of *L. mabelae* were observed actively foraging and visiting flowers of *Tarasa tenuis* (Figs. 27–28). Females of *L. mabelae* were also observed on the inflorescences of *Dalea cylindrica* (Fig. 29), from which one female was collected.

DISCUSSION

Moderate to high elevations in the Andes are generally under-represented for bee specimens in collections despite this area being a known biodiversity hotspot (Myers *et al*., 2000). Nevertheless, recent discoveries have shown that these regions can harbor a considerable diversity of bee species (Gonzalez & Ruz, 2007; Gonzalez & Engel, 2011; Gonzalez *et al*., 2013; Gonzalez *et al*., 2014; Packer & Ruz, 2017; Gonzalez *et al*., 2019; Mir Sharifi *et al*., 2019; Packer & Dumesh, 2019; Packer & Graham, 2020; Apaza *et al*., 2024). *Liphanthus mabelae* represents the ninth Peruvian described species belonging to the tribe Protandrenini, following *L. cuscoensis*, *Incasarus garciai* Gonzalez, Rasmussen & Engel, *I. ancashensis* (Mir Sharifi & Packer), *Andinopanurgus femoralis* (Gonzalez & Engel), *A. lynnae* Packer, *Cisanthrena perforata* Ramos & Melo, *Luisanthrena vargasllosai* (Gonzalez & Alvarado), and *Rhophitulus pygidialis* (Vachal). We hope that this study encourages further exploration across the diverse high-Andean ecosystems of Peru, including the western and eastern Andean slopes, inter-Andean valleys, and puna and páramo environments, which remain insufficiently studied.

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