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## Two new species of *Andinopanurgus* (Hymenoptera: Andrenidae: Panurginae), with a description of the female of *A. amyae*

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**Abstract.** Two new species of *Andinopanurgus* Gonzalez & Engel are described: *Andinopanurgus chirosimpson* Packer, new species, from northwest Argentina extends the range of the genus south by more than 2000 km and *A. lynnae* Packer, new species, from Peru. The new species seem to belong to Gonzalez & Engel's "guarnensis species group" but differ from it in the highly modified setae on S4, which are divided into two to four branches (in *A. chirosimpson*, the four-branched ones of which look like a thumbless hand and are the source of the specific epithet) to two to five branches (in *A. lynnae*). The female of *A. amyae* (Gonzalez & Engel) is described for the first time.

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### INTRODUCTION

*Andinopanurgus* was described by Gonzalez & Engel (2011) as a subgenus of *Protandrena* Cockerell, based upon five previously described species (all by Gonzalez & Ruz, 2007) and two that they described as new. It was subsequently raised to generic rank with an eighth species being described (Gonzalez *et al.*, 2019). These authors also summarized the limited natural history information available for the group. *Andinopanurgus* ranges from Venezuela to Peru, occurring at moderate to high altitudes, from 1100 m to over 4000 m (Gonzalez & Engel, 2011; Gonzalez *et al.*, 2019). In this paper I describe the ninth and tenth species of *Andinopanurgus*, one of which extends the range of the genus substantially further south to Tucumán Province in Argentina. Previously, the southernmost record was from the Region of Apurimac in Peru, over 2000 km further north. Both new species have very unusual setae on the S4 of males. Additionally, I provide a description of the female of *Andinopanurgus amyae* (Gonzalez & Engel 2011), previously only known from the male.

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## MATERIAL AND METHODS

Morphological terminology follows Michener (2007) except that the term metapostnotum is used instead of basal area of the propodeum and the large basal process of the labrum is referred to as the basal box (Walker, 1995). Further, I follow Prentice (1998) in using the terms frontal, vertexal, and genal areas instead of frons, vertex, and gena, as in other recent papers from my laboratory (e.g., Mir Sharifi *et al.*, 2018; Packer & Graham, 2020). Flagellomeres, terga, and sterna are referred to as F, T, and S, respectively, each followed by the appropriate number; the diameter of the median ocellus is given as MOD and is used to assess relative lengths of pubescence. Puncture spacing is given in terms of the length of the spaces between punctures (given as  $i$  – for interspace) compared to the diameter of the punctures ( $d$ ). Surface sculpture terminology follows Harris (1979) except that, following normal practice in melittology, terms based upon “stria” relate to raised, rather than depressed, linear features. Sculpturing was observed using illumination from an energy saving bulb which throws light more evenly over the specimen making details much clearer than the more commonly used LED or fiber-optic lighting. In the second description, a few characteristics that are not discernible from the allotype female are described from the female paratype; such information is given in square brackets.

Measurements were taken with an ocular micrometer on a Leica MZ12.5 stereomicroscope. Microphotographs were taken with a Visionary Digital BK Plus imaging system and a Canon EOS 5D digital SLR camera. Environmental scanning electron micrographs (ESEMs) were taken with a Thermofisher Quanta 3D FEG DualBeam microscope with no coating and with Low Vacuum and Gaseous Sensory Electron Detectors. Image processing was performed with Adobe Photoshop CS6.

The distribution map for all species of the genus was obtained using Simplemappr (Shorthouse, 2010). Records from the literature that did not include GPS coordinates had these estimated from the locality description (e.g., 15k. E. Jaji) using Google Earth Pro version 7.3.3. Coordinates given as degrees, minutes, seconds were recalibrated to decimal degrees.

## SYSTEMATICS

Genus *Andinopanurgus* Gonzalez & Engel, 2011

*Andinopanurgus chirosimpson* Packer, new species

ZooBank: urn:lsid:zoobank.org:act:602929D3-03C0-459E-9641-5350C04C653C  
(Figs. 1–8, 24)

**DIAGNOSIS:** The new species, known only from the male, can be differentiated from all other bees except the second new species described below by the very unusual setal pattern on S4 (Figs. 4–5), which involves setae that are branched into two unequal halves or three or four more equal thirds or quarters respectively. Each branch is somewhat digitiform and the whole structure can look like a human hand (minus the thumb) or rake while the three-branched hairs look somewhat like tridents. There are weak longitudinal raised lines on these branches (Fig. 5). While some related species, *A. bachue* (Gonzalez & Ruz), *A. rangeli* (Gonzalez & Ruz), and *A. wayruronga* (Gonzalez & Ruz), have short, broad setae apicomediaally on S5, these species do not have unusual setae on S4 (they also differ in numerous other ways, but the details of the setation of S4



**Figures 1–8.** *Andinopanurgus chirosimpson*, new species, holotype male, light photomicrographs unless stated otherwise. **1.** Lateral habitus (scale bar = 1 mm). **2.** Head anterior view (scale bar = 1 mm). **3.** Apex of T7 to show straight and densely setose apical margin (scale bar = 0.5 mm). **4.** ESEM of part of S4 to show unique setal structure (scale bar = 300  $\mu$ m). **5.** ESEM of a single seta from S4 (scale bar = 50  $\mu$ m). **6.** S7 ventral view (scale bar = 0.25 mm). **7.** S8 dorsal view (scale bar = 0.25 mm). **8.** Genital capsule dorsal view (scale bar = 0.25 mm).

of the new species alone is sufficient to diagnose it). It can be differentiated from *A. lynnae*, described below, by the absence of the pale transverse clypeal marking that is present in *A. lynnae* and in details of the setation on S4 (compare Figs. 4–5 with Figs. 11–12).

**DESCRIPTION:** ♂: Body length 6.05 mm, forewing length 4.3 mm, head width 1.55 mm, intertegular distance  $\approx 0.9$ mm [thorax somewhat distorted by pin].

**Coloration.** Black, following parts dark red-brown: apex of mandible, base of labrum, legs, tegula, vein R and prestigma; apex of apical impressed areas of T4–T6, all of T7, apical impressed areas of S1–S5; all of S6; following parts dark yellow brown: reflexed sides of terga and most remaining wing veins and stigma; F2–F11 dark brown ventrally, black-brown dorsally; wing membranes pale yellow-brown.

**Pubescence.** Whitish with numerous short branches, sparse unless stated otherwise; longest less than 2.5MOD on face, mesoscutum and scutellum and relatively dense on sides and ventral surface of mesosoma including procoxa, protochanter, and metacoxa; shorter  $\approx 1.5$ MOD on genal area below, lateral surface of propodeum above; dense, somewhat anteriorly oriented and short  $\approx 1$ MOD on metanotum; metasomal terga with obscure hairs except T6–T7 with pale orange hairs  $\approx 1.5$ MOD; apex of T7 with dense cream-colored plumose short  $\approx 0.5$ MOD hairs obscuring underlying integument; S1 and apicolateral portions of S2–S6 with branched hairs  $\approx 1.5$ MOD; S4 apicomediaally with setae that are divided from near the base into two to four parallel, digitiform branches, setae up to  $\approx 0.3$ MOD wide, the four-branched ones are less than twice as long as the width of a seta; S5 with erect hairs broad at base  $\leq 1$ MOD. Hairs on vertex brown,  $< 1.5$ MOD.

**Surface sculpture.** Microsculpture absent on clypeus; weak lateral of lateral ocelli, on discs of mesoscutum and scutellum, T7 and S6; distinct, surface somewhat dull elsewhere except strong and surface dull on metanotum, metapostnotum and sides of mesosoma. Clypeal punctures large, elongate,  $i < d$  except almost impunctate apicomediaally; supraclypeal area impunctate medially, rest of face and genal area punctures shallow but distinct  $i \leq d$ , vertex less densely punctate  $i = 0.5-3d$ ; mesoscutum disc irregularly punctate  $i = 1-6d$ , margins of mesoscutum more densely punctate  $i \leq d$ , scutellum  $i = 0.5-1.5d$ , metanotum densely punctate  $i < 0.5d$ ; metapostnotum with a few radiating weak striae among crowded small punctures; mesopleuron punctures shallow obscure, metapleuron longitudinally rugoso-striate, propodeum with dense small punctures  $i < 0.5d$ ; T1 punctures distinct on anterior portion of disc  $i = 1-2d$ , sparser posteriorly; T2–T4 punctures shallow obscure among microsculpture  $i > d$ , T5–T7 punctures increasingly distinct, variable in size,  $i > d$  except towards side of T7  $i < d$ .

**Structure.** Head shorter than wide (59:78); labrum almost twice as wide as long (38:20), basal box surface concave, apically strongly ridged, sides divergent, apical margin convex; labial palpomere 1 almost as long as remaining 3 combined (25:28); clypeus  $2.5\times$  as wide as long 80:32; interantennal to antennocular distances (29:22); malar area linear; supraclypeal area slightly more protuberant than clypeus in profile; anterior tentorial pit at junction of outer subantennal and epistomal sulci; epistomal lobe absent, epistomal sulcus straight from junction with inner subantennal sulcus to close to lateral clypeal margin; compound eyes  $\approx 1.5\times$  as long as wide (78:50), much wider than genal area in lateral view (32); inner margin of compound eyes weakly concave, strongly convergent below, upper to minimum to lower interocular distances (60:39:44); inner and outer subantennal sutures outwardly concave, subantennal sclerite widest above midlength  $1.5\times$  antennal socket diameter (15:10); frontal line weakly raised except depressed just above bluntly rounded process above lower tangent of antennal sockets; facial fovea deep, oval  $1.5\times$  longer than wide (6:4); interocellar distance half ocellocular distance (18:36); vertex strongly convex in frontal view; flagellum longer than width of head (90:78); flagellum unmodified, not crenulate; F1 length and width subequal (13:14); F2 shorter than wide (10:14); F3 shorter than wide (13:15);

remaining flagellomeres with length and width subequal except F11 almost twice as long as wide (28:15).

Mesoscutum length and intertegular widths subequal (40:42), median line more than half length of mesoscutum, distinct, ending in small deep oval depression; parapsidal line  $\approx\frac{3}{4}$  as long as tegula (15:19); scutellum:metanotum:metapostnotum (29:18:25); legs unmodified, meso- and metatibial spurs weakly curved, ciliate; inner and outer rami of tarsal claws subequal in length; lengths of posterior margins of submarginal cells subequal (28:26); both recurrent veins entering second submarginal cell, first much further from first submarginal cross vein than second is from second submarginal crossvein (9:5); stigma  $\approx 2.5\times$  longer than maximum width (26:10); marginal cell  $\approx 3.5\times$  longer than maximum width (48:14), apex truncate.

T1 shorter than apical width (33:44); apical impressed areas distinct, on T2 as long as MOD; T2 lateral fovea weak, obscure; T2–T4 strongly transversely depressed anteriorly; T7 apex weakly concave; S1–S5 unmodified, S6 apically narrowly and weakly concave medially; S7 apical lobes subparallel to each other, irregularly and weakly narrowing posteriorly, apex briefly deflected ventrally; S8 apical lobe parallel-sided, apex broadly rounded; gonocoxa swollen at base of gonostylus medially; gonostylus fused to gonocoxa, in profile narrowing from base to acute apex, dorsal surface weakly concave, ventral surface convex; penis valves dorsoventrally flattened, gradually narrowed to acute apex.

♀: Unknown.

HOLOTYPE: ♂, ARGENTINA, Tucumán, Tafi de[l] Valle, sweep, 19.i.1996, M.J. Sharkey. The specimen is housed at the Packer Collection at York University (PCYU).

ETYMOLOGY: The species name refers to unique hairs on S4 some of which are quadrigitate, like the hands of cartoon characters such as in the television series, “The Simpsons”. “Cheiro” being Ancient Greek for hand.

COMMENTS: The town named as the type locality is slightly over 2000 m in altitude. This is lower than the altitudinal range for most species of the genus, although the two species of the *guarnensis* species group are known from similar, or even lower, elevations (Gonzalez *et al.*, 2013).

The setation of S4 seems unique among all bees, although those of the following new species are similar. Some Eucerini bear unusually thickly branched hairs, but these are on the legs, such as on the ventral surface of the mesotibia of *Svastrides melanura* (Spinola) (see Discussion, below).

### *Andinopanurgus lynnae* Packer, new species

ZooBank: urn:lsid:zoobank.org:act:0325CDA1-C217-48BC-8316-D386B243BEE1

(Figs. 9–15, 23, 24)

DIAGNOSIS: Males of the new species can be differentiated from all other bees by the combination of unusual setal structure on S4 (Figs. 11–12) and a white transverse marking on the clypeus (Fig. 10). Only *A. chirosimpson* has similarly unusual setae on S4 (Figs. 4–5) with short, thick forked setae, but that species has an entirely black clypeus (Fig. 2). The setal patterns are also different between the species (compare Figs. 4–5 with Figs. 11–12). The female has the following combination of character states that is unique among known females of the genus: antennal flagellum not crenulate, F1 clearly longer than F2 (Fig. 14), metatibia with white scopal hairs (Fig. 13), mesotibial spur as long as mesobasitarsus (Fig. 15), and pro- and mesotibiae lacking basodorsal pale mark (Fig. 13). It shares all but the last two features with *A. vargasillosai* Gonzalez

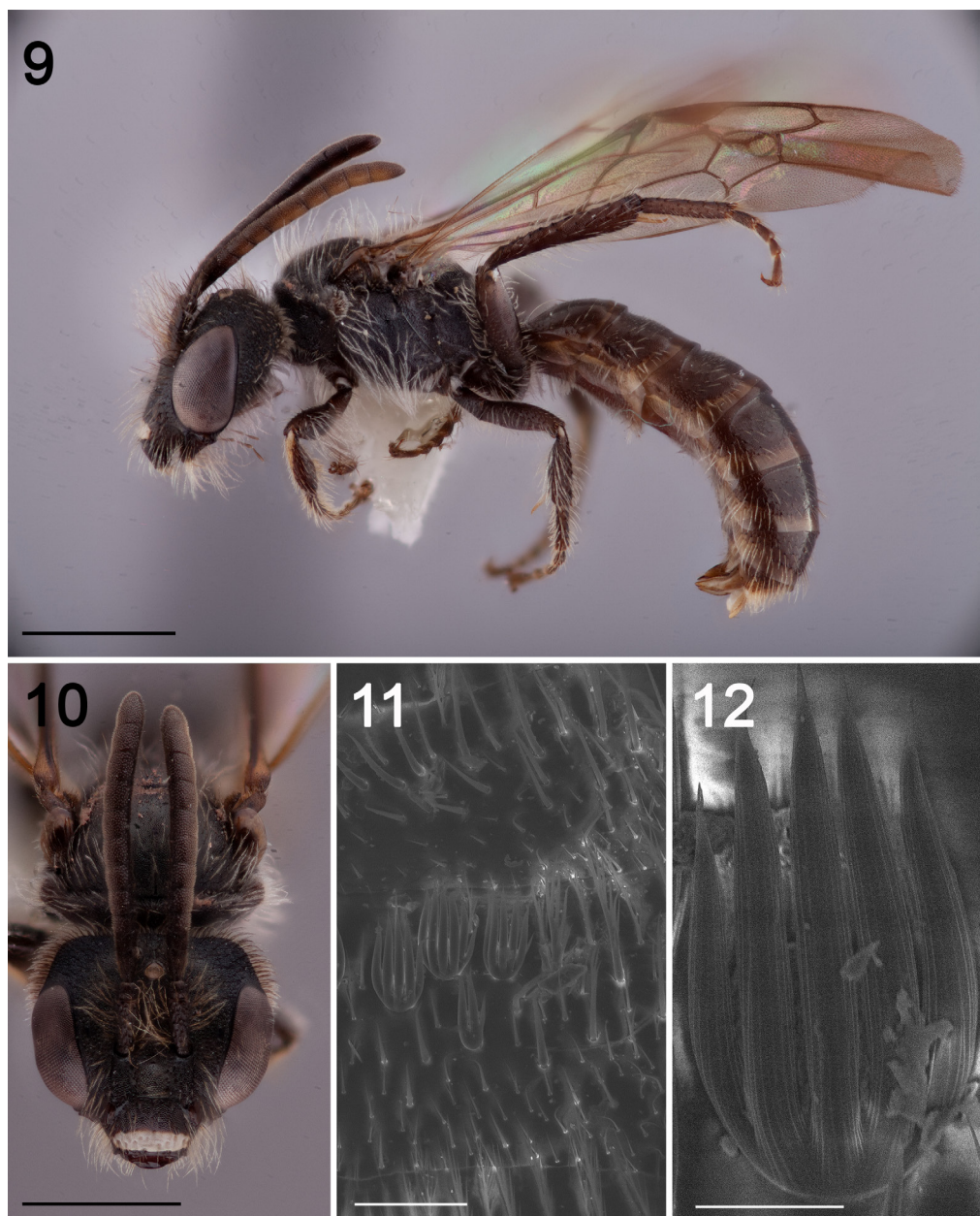
& Alvarado which has the mesotibial spur 0.8× as long as the mesobasitarsus and pale marked pro- and mesotibiae. An additional difference between females of *A. lynnae* and *A. vargasllosai* is the length to width of the facial fovea, >5:1 in *A. lynnae* versus 3.7:1 in *A. vargasllosai*.

**DESCRIPTION:** ♂: Body length 5.4 mm, forewing length 4.2 mm, head width 1.42 mm., intertegular distance 0.85 mm.

**Coloration.** Black to blackish-brown except as follows: dark red-brown on mandible, labrum, epistomal lobe, legs (except as noted below) and metasoma (except as noted below); orange-brown on pronotal lobe, apical impressed areas of metasomal terga; pale yellow-brown apicosubmedially on S6 and ventrally on F3–F11, area of flagellomere that is pale increasing from small subapical spot on F3 to entire ventral surface on F6–F10, F11 dark apicoventrally; lateral reflexed portions of metasomal terga and apical impressed areas of S1–S6 translucent pale brown; pale cream subapical transverse band on clypeus. Following parts yellow: narrow longitudinal stripe on protibia (absent for apical 1/5<sup>th</sup>), small basodorsal spot on mesotibia. Wing veins dark brown to level of base of stigma, remaining veins and stigma pale brown; membranes very pale yellow-brown.

**Pubescence.** Minute simple suberect hairs on mesoscutum, scutellum, metanotum and metasomal dorsum. Longer hairs pale brown erect with numerous short branches and sparse unless stated otherwise; longest ≈3MOD basoventrally on mandible, lower paraocular area (hairs blackish along inner margin of compound eye), gena below (becoming shorter ≈1MOD and dark brown above), scape, mesoscutum, scutellum, mesopleuron and profemur; ≈2MOD on vertex posteriorly, mesosomal venter, and metafemur; short, less plumose and blackish on frontal and vertexal areas; 1.5MOD on dorsolateral portion of propodeum. Metasoma hairs with branches mostly only on anterior surface of rachis <1.5MOD, longest on side of T3; T7 with whitish plumose apicomediaally oriented dense hair patch ≈1MOD; sterna with short subapressed hairs <1MOD, S1–S3, S5, and S6 with somewhat denser more erect hairs towards apex; S4 with highly modified setae, divided into two, three, five, or six branches.

**Surface sculpture.** Body surface dull due to microsculpture except absent surface shiny on labrum, epistomal lobe and tegula and weak on apical impressed areas of metasomal terga and sterna; imbricate and somewhat shiny on face below antennal sockets, genal area below, lower half of metapleuron, metapostnotum, sides of propodeum and metasoma; coarsely imbricate on upper paraocular area, lower parts of frontal area, mesoscutum and metanotum; coarsely imbricate on upper part of frontal and on vertexal areas and mesopleuron. Macrosculpture: punctures shallow and obscure, on clypeus large,  $i=1-4d$ ; on supraclypeal area small, almost absent on disc,  $i-d$  towards lateral margin; on subantennal sclerite small, irregularly spaced  $i=0.5-5d$ ; lower paraocular area punctures irregular in size,  $i=1-2d$ ; upper paraocular, frontal and vertexal areas punctures obscure among coarse microsculpture,  $i=0.5-5d$ ; mesoscutum punctures small,  $i=1-8d$ ; scutellum punctures larger,  $i=0.2-3d$ ; metanotum punctures obscure; hypoepimeral area densely punctate  $i-d$ ; rest of mesopleuron punctures small, more distinct,  $i=2-5d$ ; upper part of metapleuron longitudinally striate; lateral surface of propodeum impunctate below, sparsely punctate above  $i=2-4d$ ; metapostnotum weakly and sparsely striate. Metasoma obscurely punctate, punctures increasingly distinct on more apical terga, on T6  $i>4d$  on disc,  $i>2d$  towards sides; T7  $i>d$ ; sternal punctures minute and sparse on disc, increasingly large and dense towards apex of each sternum and from S1–S5, on S2  $i>2d$  apically, on S5  $i\geq d$ ; S6 almost impunctate.



**Figures 9–12.** *Andinopanurgus lynnae*, new species, holotype male, light photomicrographs unless stated otherwise. **9.** Lateral habitus (scale bar = 1 mm). **10.** Head anterior view (scale bar = 1 mm). **11.** ESEM of part of S4 to show unique setal structure (scale bar = 300  $\mu\text{m}$ ). **12.** ESEM of a single five-branched seta from S4 (scale bar = 50  $\mu\text{m}$ ).

**Structure.** Head shorter than wide (67:73); labrum less than twice as wide as long (20:13), basal box surface concave, apically strongly ridged, sides strongly convergent, apical margin feebly convex; labial palpomeres 1–4: 12:10:10:7; clypeus more than twice as wide as long (80:37); interantennal distance considerably greater than antennocular distance (34:20); malar area linear; supraclypeal area angularly raised

just below lower antennal socket tangent; anterior tentorial pit at junction of outer subantennal and epistomal sulci; epistomal lobe swollen  $\approx 135^\circ$ ; compound eye  $\approx 1.6\times$  as long as wide (78:48), wider than genal area in lateral view (31); inner margin of compound eyes weakly concave above, strongly convergent below, upper to minimum to lower interocular distances (73:50:57); inner and outer subantennal sutures outwardly concave, subantennal sclerite widest above midlength  $1.5\times$  antennal socket diameter (15:10); frontal line weakly raised except depressed just above bluntly rounded process above lower tangent of antennal sockets; facial fovea distinct, oval  $2.5\times$  as long as wide (7.5:3); interocellar distance less than half ocellocular distance (17:37); vertex swollen behind compound eyes, mostly transverse, weakly convex medially in frontal view; flagellum longer than width of head (88:73); flagellum unmodified, not crenulate; F1 almost twice as long as wide (17:9); remaining flagellomeres with length and width subequal except F11 almost twice as long as wide (23:12).

Mesoscutum slightly shorter than intertegular width (39:42), median line more than half length of mesoscutum, distinct, ending in small oval deep depression; parapsidal line  $\approx 1/2$  as long as tegula (10:20); scutellum:metanotum:metapostnotum (27:14:20); legs unmodified, posterior metatibial spur more strongly curved than anterior spur and mesotibial spur, ciliate; inner and outer rami of tarsal claws subequal in length, claws bifid; posterior margin of first submarginal cell longer than second (28:24); both recurrent veins entering second submarginal cell, first further from first submarginal cross vein than second is from second submarginal crossvein (6:4); stigma almost  $4\times$  longer than maximum width (30:8); marginal cell  $\approx 3.5\times$  longer than maximum width (43:12), apex truncate.

T1 shorter than apical width (40:52); apical impressed areas gradually depressed from disc, on T2 shorter than MOD (7.5:10); T2 lateral fovea weak, elongate, L:W (8:3) T2–T4 narrowly and weakly transversely depressed anteriorly; T7 apex concave; S1–S5 unmodified, S6 apically narrowly concave apicomediaally; S8 apical lobe weakly laterally expanded before rounded apex; gonostylus obliquely flattened, gradually narrowing to acute apex [genitalia not dissected in the sole known specimen].

♀: Body length 5.95 mm, forewing length 4.6 mm, head width 1.52 mm., intertegular distance 1.02 mm.

**Coloration.** Black to blackish-brown except as follows: red-brown on apex of mandible pronotal lobe, tegula, legs (suffused with blackish), apical impressed areas of metasomal terga, area anterior to impressed area on T3 and T4, most of T5, metasomal sterna (except apical impressed areas pale amber); ventral surface of F5–F10 pale orange-brown, pale area increasing in size from F5 to F9, F11 apex brown.

**Pubescence.** Minute simple suberect hairs on mesoscutum, scutellum, metanotum, and metasomal dorsum. Longer hairs pale brown erect with numerous short branches and sparse unless stated otherwise; longest  $\approx 3\text{MOD}$  on medial surface of scape and mesopleuron;  $\approx 2.5\text{MOD}$  basoventrally on mandible, genal area below (becoming shorter  $\approx 1.5\text{MOD}$  above), scutellum and apicoventrally on profemur, metacoxa;  $< 2\text{MOD}$  on lower paraocular area, vertexal area (where some hairs dark brown), mesoscutum, legs; shorter  $\leq 1.5\text{MOD}$  on metanotum and dorsolateral area of propodeum,  $\leq 1.5\text{MOD}$  and less plumose on frontal and vertexal areas. Metatibial scopal hairs mostly simple, long  $< 4\text{MOD}$ . Metasomal tergal hairs with branches mostly only on anterior surface of rachis  $\leq 1\text{MOD}$ , except towards sides, prepygidial fimbria and T6, plumose, longest on side of T5  $\leq 2.5\text{MOD}$ , prepygidial fimbria and T6 hairs brown,  $\leq 2\text{MOD}$  and  $\leq 1.5\text{MOD}$  respectively; metasomal sternal hairs mostly with branches only on anterior surface of rachis, increasing in length from anterior to posterior on





**Figures 13–15.** *Andinopanurgus lynnae*, new species, allotype female. **13.** Lateral habitus (scale bar = 1 mm). **14.** Head anterior view (scale bar = 0.5 mm). **15.** Part of midleg to show length of mesotibial spur and its teeth (scale bar = 0.5 mm).

each sternum, longest hairs  $<2\text{MOD}$ ; S5 with apical fringe of white appressed hairs  $\approx 1.5\text{MOD}$ .

**Surface sculpture.** As in male except microsculpture generally weaker throughout; macrosculpture: punctures shallow and obscure, on clypeus large,  $i=1-5d$ ; on supraclypeal area smaller,  $i=2-6d$  on disc,  $i \approx d$  towards lateral margin; on subantennal sclerite small, irregularly spaced  $i \approx d$ ; lower paraocular area punctures irregular in

size,  $i=1-6d$ ; upper paraocular and frontal area punctures obscure, vertexal area  $i \geq d$ ; mesoscutum and scutellum punctures bimodal in size, minute punctures  $i > d$ , larger punctures sparse; metanotum obscurely punctate; hypoepimeral area punctate-imbriate; rest of mesopleuron sparsely punctate  $i > 3d$ ; upper part of metapleuron longitudinally weakly striate; side of propodeum impunctate below, sparsely punctate above  $i > 3d$ ; metapostnotum with few longitudinal striae. Metasomal terga sparsely minutely punctate except T5  $i=2-5d$  on disc,  $i \approx d$  subapically.

**Structure.** Head shorter than wide (69:76); labrum  $\approx 1.5 \times$  as wide as long (23:16), basal box surface concave, apically strongly ridged, sides strongly convergent, apical margin feebly convex, ridge U-shaped; [first labial palpomere almost as long as remaining three combined, labial palpomeres 1-4: 24:9:8:7.5]; clypeus  $< 2.5 \times$  as wide as long 48:21; interantennal distance slightly less than antennocular distance (18:21); malar area linear; supraclypeal area shallowly convex in profile; anterior tentorial pit just above junction of outer subantennal and epistomal sulci; epistomal lobe swollen  $\approx 160^\circ$ ; compound eye  $< 2 \times$  as long as wide (71:37), wider than genal area in lateral view (30); inner margin of compound eyes weakly concave above, strongly convergent below, upper to minimum to lower interocular distances (95:78:88); inner subantennal sulcus straight, outer subantennal sulci outwardly weakly concave, subantennal sclerite widest above midlength,  $\approx$  antennal socket diameter (11:11); frontal line very short, weak; facial fovea distinct, parallel-sided, elongate  $\approx 5 \times$  as long as wide (24:5), widest just below upper extremity; interocellar distance  $\approx 0.5 \times$  ocellocular distance (19:36); frontal area weakly depressed above antennal sockets and below median ocellus, upper paraocular area weakly depressed; vertex swollen behind compound eyes, transverse in anterior view; flagellum length subequal to head width; F1 more than twice as long as wide (19:7); remaining flagellomeres with length and width subequal except F11  $\approx 1.5 \times$  as long as wide (20:13).

Mesoscutum shorter than intertegular width (70:83), median line more than half length of mesoscutum; parapsidal line  $1/2$  as long as tegula (10:20); scutellum:metanotum:metapostnotum (30:15:22); legs unmodified, mesotibial spur straight, as long as mesobasitarsus, with three long teeth, almost as long as mesobasitarsus (43:46); metatibial spurs strongly sclerotized, anterior spur more strongly curved and less weakly serrate than posterior one; tarsal claws with long tooth arising at or before midlength; posterior margin of first submarginal cell slightly longer than second (54:51); both recurrent veins entering second submarginal cell, first  $\sim$  twice as far from first submarginal cross vein than second is from second submarginal crossvein (15:8); stigma  $\approx 4 \times$  longer than maximum width (53:13); marginal cell  $\approx 4.5 \times$  longer than maximum width (49:13), apex truncate.

T1 apical width  $\approx 1.5 \times$  length (63:43); apical impressed areas distinct, on T2  $1.5 \times$  MOD; [T2 lateral fovea distinct, elongate, L:W 27:6, acutely narrowed anteriorly]; T2-T4 not noticeably transversely depressed anteriorly; pygidial plate weakly convex laterally, sides forming angle of  $\approx 45^\circ$ , apex rounded, surface raised medially sides of raised area concave; S6 with glabrous thickened apical lip, apex weakly convex.

**TYPE MATERIAL:** ♂, PERU, Cusco, Picol, 3782m, 12.ii.2005, L.S. Kimsey, malaise trap; allotype and second female paratype, same data as holotype. All specimens will be housed at the R.M. Bohart Museum of Entomology, University of California, Davis.

**ETYMOLOGY:** The specific epithet honours two people, Lynn Sophie Gail Quesney, the author's granddaughter, and Lynn Kimsey, the well known hymenopterist who collected the only known specimens of the species.

COMMENTS: The setation on S4 of the male is unique, though clearly shares some features with *A. chirosimpson* described above.

The female seems, superficially at least, similar to that of *A. vargasillosai*.

Female of *Andinopanurgus amyae* (Gonzalez & Engel)  
(Figs. 16–20, 24)

DIAGNOSIS: This is the only species of the genus in which the female has the hypostomal carina remarkably sinuate, concave anteriorly, more strongly convex posteriorly (Fig. 18).

DESCRIPTION: ♀: Body length 8.7 mm, wing length 7.2 mm, intertegular distance 1.8 mm, head width 2.48 mm.

**Coloration.** Body entirely black to blackish-brown except as follows: much of face except clypeus and supraclypeal area, vertex and hypoepimeral area with weak bronze-green reflections; red-brown subapical mark on mandible, dark orange-brown apical impressed areas of metasomal terga and dark yellow-brown apical impressed areas of metasomal sterna; wing membranes pale yellow-brown, veins mostly brown.

**Pubescence.** Black to blackish-brown and with numerous short branches unless stated otherwise: on face, scape, thoracic dorsum, profemur posteriorly, and metasomal venter  $\leq 2.5\text{MOD}$ , somewhat shorter on mesopleuron above; paler brown on genal area, paler brown and longer on mesosomal venter and metacoxa  $\leq 4\text{MOD}$ ; short  $< 1\text{MOD}$  and brown on posterior margin of pronotum, shorter  $< 0.7\text{MOD}$  on metanotum, somewhat longer on propodeum  $\approx 1\text{MOD}$ . Tibial scopal hairs black, simple  $\approx 3\text{MOD}$ . Scattered brown hairs on metasomal terga  $< 2\text{MOD}$  except longer towards sides of T5  $\approx 3\text{MOD}$ ; prepygidial fimbria dark brown  $\approx 2.5\text{MOD}$ .

**Surface sculpture.** Microsculpture imbricate unless stated otherwise; absent on clypeus and disc of supraclypeal area, increasingly strong dorsally, area around median ocellus dull; weak on genal area, shiny; stronger on hypostomal area, dull; strong and dull on mesosoma except somewhat shiny towards sides of disc of scutellum and metanotum; metapostnotum somewhat more shiny; metasomal terga weakly imbricate, strongly shiny; metasomal sterna more distinctly imbricate. Clypeal punctures large, elongate  $i \leq d$ ; supraclypeal area with a few obscure large punctures medially, more distinctly punctate laterally and above  $i \leq d$ ; subantennal sclerite and lower paracocular area punctures small  $i \leq d$ ; frontal area punctures small, dense  $i < 0.5d$ , smaller and crowded around median ocellus; vertexal area punctures larger, sparser  $i > 0.5d$ , larger and sparser still towards sides  $i = 1-5d$ ; mesoscutum densely and minutely punctate  $i = d$ ; scutellum and metanotum less regularly punctate  $i = 0.5-2d$ ; metapostnotum with a few radiating weak incomplete striae; mesopleuron punctures shallow obscure, more distinct below  $i = 0.5-2d$ ; metapleuron and propodeum punctures minute obscure; T1–T4 almost impunctate, T5 punctures increasing in size and density posteriorly,  $i = 3-8d$  towards base,  $i < d$  towards apex; S2–S5 punctures distinct, mostly  $i > 2d$ ; S5 more strongly and densely punctate  $i < 3d$  basally,  $i \leq d$  apically; S6 punctures scattered minute on disc, with apicolateral oval densely punctate area.

**Structure.** Head shorter than wide (48:62); labrum  $\approx 1.5\times$  as wide than long (38:25), basal box surface concave, sides convex, converging ventrally, apical margin strongly convex except narrowly transverse apically; labial palpomere 1 longer than remaining 3 combined, lengths of palpomeres 1–4 (34:12:8:7) respectively; clypeus almost  $3\times$  as wide as long (90:31); supraclypeal area strongly convex; anterior tentorial pit just



**Figures 16–20.** *Andinopanurgus amyae* Gonzalez & Engel, female. **16.** Lateral habitus (scale bar = 2 mm). **17.** Head anterior view (scale bar = 1 mm). **18.** Hypostomal area, lateral view of far side (it is mostly only the hypostomal area that is in focus in this image to make its shape more obvious) (scale bar = 0.5 mm). **19.** Metasomal S5–S6 to show broad apical impressed area to S5 and form of S6 (scale bar = 0.5 mm). **20.** Mesotibia and mesobasitarsus to show long teeth on mesotibial spur (scale bar = 0.5 mm).

above and lateral to junction of epistomal and outer antennal sulci; outer subantennal sulcus outwardly concave, inner subantennal sulcus outwardly convex, subantennal sclerite widest near base, somewhat wider than antennal socket (13:11); interantennal to antennocular distances (19:24); frontal fovea D-shaped, outer margin straight, twice as long as greatest width which is near midlength (14:29); malar area short, maximum

length  $\approx 0.5\text{MOD}$ ; compound eyes almost twice as long as wide (61:32), subequal to width of genal area in lateral view (30); inner margin of compound eyes convex, divergent below, upper to minimum to lower interocular distances (94:85:106); frontal line carinate above, a rounded weak ridge below; interocular distance less than half ocellocular distance (12:29); vertex weakly convex in frontal view; hypostomal carina strongly sinuate, concave anteriorly, strongly convex and lamellate posteriorly; flagellum shorter than width of head (58:62); F1 more than twice as long as wide (20:9); remaining flagellomeres with length and width subequal except F3 shorter than wide (10:14) and F10 almost twice as long as wide (21:11); F1–F5 weakly crenulate.

Mesoscutum shorter than wide (36:44), median line almost as long as mesoscutum, distinct, ending in small deep oval depression; parapsidal line  $\approx 2/3$  as long as tegula (25:37); scutellum:metanotum:metapostnotum (27:18:19); legs unmodified, mesotibial spur with seven long teeth; lengths of posterior margins of submarginal cells equal (49:49); both recurrent veins entering second submarginal cell, both far removed from respective submarginal cross veins; stigma narrow almost  $5\times$  longer than maximum width (50:11); marginal cell almost  $4\times$  longer than maximum width (78:20), apex broadly rounded, removed from costal margin.

T1 much shorter than apical width (70:108); apical impressed areas distinct, on T2  $\approx 2\text{MOD}$  (20:10); pygidial plate narrowing to broadly rounded apex; medial raised area triangular, apex acute; metasomal sterna apical impressed areas indistinct short, on S2  $< 1\text{MOD}$ , except distinct on S5  $\approx 1\text{MOD}$ ; S6 raised sublaterally delimiting oval densely punctate area.

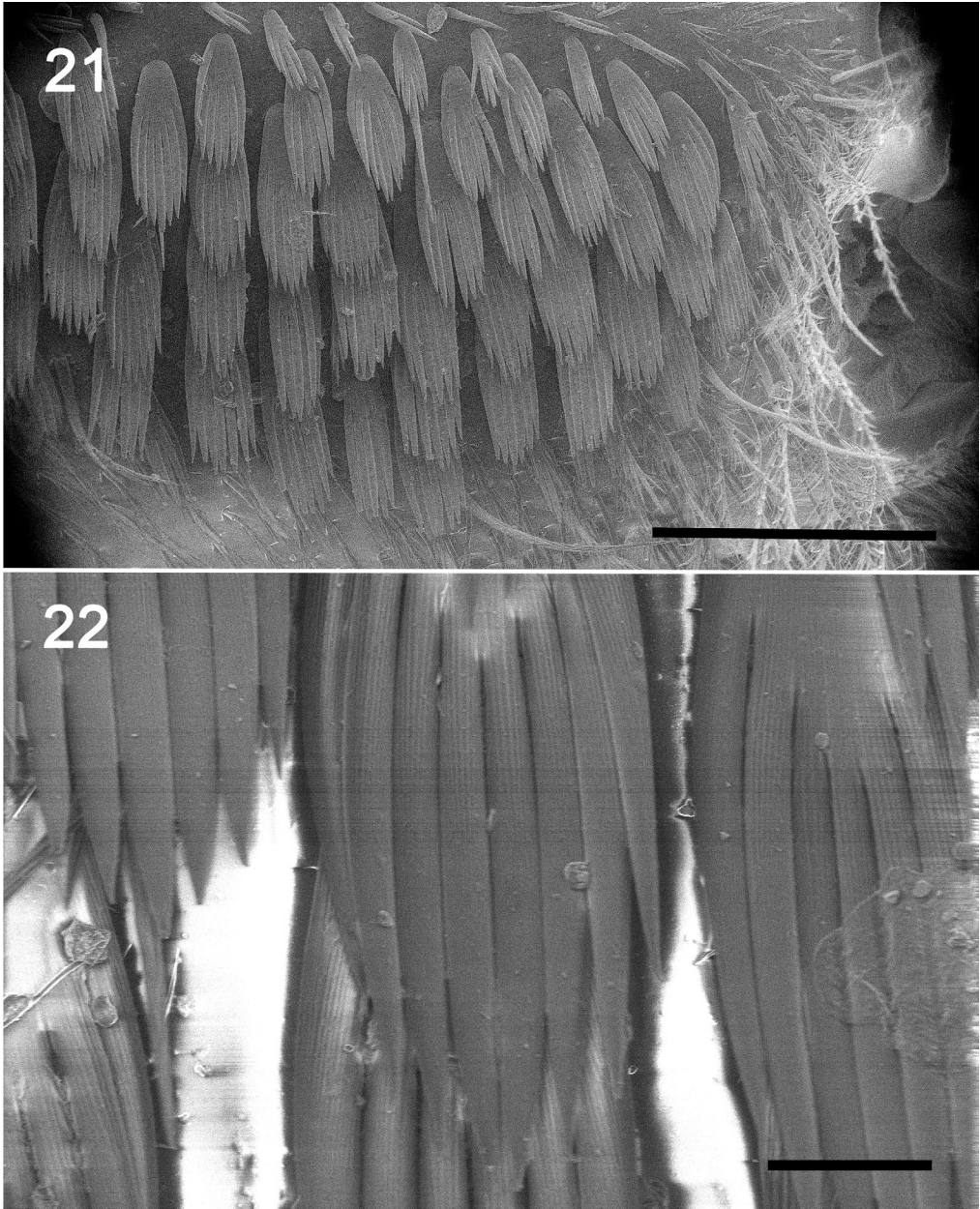
MATERIAL EXAMINED: ♀, ECUADOR, Napo, Termas de Papallacta, 00°21'29"S 78°08'52"W, 3520m, 3–4.iii.2005, YPT, L. Masner, elfin forest (PCYU).

COMMENTS: There are two species of the genus hitherto known only from males from precisely the area of provenance of this female. These are *A. wayruronga* and *A. amyae*. The type locality of the latter is less than 20 km from the locality of the paratype of the former (the holotype locality cannot be discerned precisely from the label data). Both are from between the Termas de Papallacta and halfway between Papallacta and Baeza to the East. The female described herein as belonging to *A. amyae* is from the higher elevation more western locality, whereas the paratype male of that species is from  $\sim 1000$  m lower down and slightly to the east. Based upon the structure of the female hypostomal area, I believe this specimen belongs to the latter species because its male is the only one with an angulation to the hypostomal carina (Gonzalez & Engel, 2011: fig. 4), the female has a strong convexity in the same place, a feature otherwise unknown in the genus and the details of the shape of the carina are remarkably similar (compare Fig. 18 herein with figure 4 in Gonzalez & Engel, 2011). Figure 23 shows the normal, straight hypostomal carina generally found in the genus.

#### Modifications for Identification Keys for *Andinopanurgus*

Insertion of the following couplets at the beginning of Gonzalez *et al.*'s (2019) key for *Andinopanurgus* males will enable the newly described species to be identified:

- A. S4 with highly modified branched setae, some of which are rake or trident-like (Figs. 4–5, 13–14) ..... B  
 —. S4 without highly modified setae, S5 sometimes with unusually structured setae ..... couplet 1 (page 215) of Gonzalez *et al.* (2019)



**Figures 21–22.** *Svastrides melanura* (Spinola) male mesotibia ventral surface to show unusual structure of hairs. **21.** Most of ventral surface of tibia (scale bar = 250  $\mu$ m). **22.** Close-up to show hair structure (scale bar = 25  $\mu$ m).

- B(A). Clypeus black, lacking apical transverse cream-colored band; S4 setae with from two to four branches (Figs. 4–5) [Argentina] ..... *A. chirosimpson*, n. sp.  
 —. Clypeus with apical transverse cream-colored band; S4 setae with from two to five branches (Figs. 11–12) [Peru] ..... *A. lynnae*, n. sp.



**Figure 23.** *Andinopanurgus lynnae*, new species, female, oblique ventral view of head to show straight hypostomal carina (scale bar = 0.5mm).

Insertion of the following couplet at the beginning of Gonzalez *et al.*'s (2019) key for *Andinopanurgus* females will enable identification of the female of *A. amyae*:

- A. Hypostomal carina strongly sinuate, concave anteriorly, strongly convex posteriorly (Fig. 18) ..... *A. amyae* (Gonzalez & Engel)
- Hypostomal carina linear (Fig. 23) ..... couplet 1 of Gonzalez *et al.* (2019: 216).

For identification of the female of *A. lynnae*, the following modifications are required to Gonzalez *et al.*'s (2019) key:

- 4. Metatibial scopal hairs whitish (Fig. 13) ..... 4A
- Metatibial scopal hairs brown-black (Fig. 16) ..... couplet 5 in Gonzalez *et al.* (2019: 216)
- 4A. Metasomal terga with apical impressed areas translucent, area immediately anterior to apical impressed areas somewhat orange clearly differing from dark brown of discs of terga (Gonzalez *et al.*, 2019: figs. 1b-d); facial fovea  $\approx 3.7\times$  longer than wide; mesotibial spur  $\approx 0.8\times$  length of mesobasitarsus ..... *A. vargasillosai* Gonzalez & Alvarado
- Metasomal terga with apical impressed areas red-brown, areas immediately anterior to apical impressed areas almost concolorous to discs of terga (Fig. 13); facial fovea  $\approx 5\times$  longer than maximum width; mesotibial spur  $\approx 0.95\times$  as long as mesobasitarsus (Fig. 15) ..... *A. lynnae*, n. sp.



**Figure 24.** Map showing the known localities for all *Andinopanurgus* species. Data taken from Gonzalez & Ruz (2007), Gonzalez & Engel (2011), Gonzalez *et al.* (2013, 2019), and herein. The circles for two species (*A. amyae* (Gonzalez & Engel) and *A. guarnensis* (Gonzalez & Ruz)) are somewhat larger than for the others to encompass multiple localities in moderately close proximity. The symbols for *A. lynnae*, new species, and *A. vargasllosai* Gonzalez & Alvarado and the southern two symbols for both *A. bachue* (Gonzalez & Ruz) and *A. rangeli* (Gonzalez & Ruz) are slightly further apart than they should be to facilitate visualization.

## DISCUSSION

The new species are clearly members of the genus *Andinopanurgus* by virtue of having all but one of the characteristics used by Gonzalez & Engel (2011) to diagnose the group: reduced pale coloration, two submarginal cells, metapostnotum glabrous and longer than metanotum, mesoscutum finely punctate, T7 apical margin straight (as opposed to convex although it is concave in some species in the group), S6 with apicomedial emargination, gonostylus simple without long apical setae and fused to



gonocoxa. The exception is that the anterior tentorial pit in the males of both species (but not the female of *A. lynnae*) is at the junction of the outer subantennal and epistomal sulci rather than being above that junction.

Gonzalez & Engel (2011) placed the seven species of *Andinopanurgus* into two species groups: the “*bachue*” and “*guarnensis* species groups”. However, *A. vargasillosai*, the eighth species (Gonzalez *et al.*, 2019), blurred the distinction between these two groups by having a combination of their defining characteristics and the authors suggested it might belong to a third species group without making any formal recommendation. *Andinopanurgus chirosimpson* seems to belong to the “*guarnensis* species group” in that it shares with members of that group an entirely dark clypeus, T7 with apical margin entire, and unmodified subapical hairs on S5. The second new species complicates matters in that the bizarre setation of the male S4 would certainly seem to be a synapomorphy uniting *A. chirosimpson* and *A. lynnae*. However, the latter has a pale-marked clypeus, indicative of the “*bachue*” species group, which in other ways it is quite dissimilar to (*e.g.*, it lacks crenulate antennae). A phylogenetic analysis of the genus would be useful.

The setation of S4 of both new species is remarkable. In *A. chirosimpson* some of the hairs are divided into two, others into three, but most are divided into four. Each hair arises from a single socket and each hair has minute longitudinal ridges. In *A. lynnae* these setae are two, three, five, or six branched (none are four-branched), but otherwise these setae are similar in shape and structure. I know of no other setae like them on the sterna of bees, although the metallic hairs on some species of *Thyreus* Panzer are thick and divided (Engel, pers. comm.) and some Eucerini males have thick divided hairs on the legs which also have minute longitudinal ridging (*e.g.*, Figs. 21, 22; Urban, 1972: figs. 2: 1–3).

Moderate to high altitudes in the Andes are proving to have a wealth of only recently discovered bees (Gonzalez & Ruz, 2007; Gonzalez & Engel, 2011; Packer & Dumesh, 2012; Packer *et al.*, 2017; Gonzalez *et al.* 2019; Mir Sharifi *et al.*, 2019), with some records extending the ranges of supraspecific taxa substantially further north (*e.g.*, Gonzalez *et al.*, 2014a, 2014b; Gonzalez & Engel, 2015; Dumesh & Packer, 2013), and others much further south (*e.g.*, Packer & Dumesh, 2019). This paper provides another example of such a range extension with *A. chirosimpson* coming from over 2000 km further south than the previously southernmost record for the genus which was in Pasco, Peru (Gonzalez & Engel, 2011).

The known distributions of *Andinopanurgus* species are shown in figure 24, which indicates the southerly extension of the range of the genus resulting from the discovery of *A. chirosimpson*. The map clearly shows the association of the genus with mountains and suggests that additional sampling, particularly in the highlands of Bolivia, should yield more species of the genus. It is also possible that additional material of it is to be found in Argentinean museums, as was the case for *Chilicola* (*Oroediscelis*) Michener (Michener, 2002), another group of mostly high-altitude bees (Packer & Dumesh, 2019). However, the chance of finding it on the western slopes of the Andes in Chile would seem low given the extensive sampling the author and his students have undertaken in this area in the past two decades (*e.g.*, Mir Sharifi *et al.*, 2019; Packer 2016; Packer & Dumesh, 2012; Packer *et al.*, 2017; Packer & Ruz, 2018; Packer & Graham, 2020), and interestingly, *C.* (*Oroediscelis*) has not been found on these western slopes either (Packer & Dumesh, 2019). Clearly there is great potential for the discovery of additional previously unknown species in this region as well as further docu-

mentation of potential biodiversity hotspots for bees as well as other parts of the biota (Mujica *et al.*, 2015; Packer, 2016).

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