

Research article

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Two new species of *Exetastes* (Hymenoptera: Ichneumonidae: Banchinae) from the Peruvian AndesAlexey RESHCHIKOV ^{1,*} & Mabel ALVARADO ²¹Institute of Eastern-Himalaya Biodiversity Research, Dali University, Dali, Yunnan, China.²Universidad Nacional Mayor de San Marcos, Museo de Historia Natural, Departamento de Entomología, Av. Arenales 1256 Jesús María, Lima 14, Peru.*Corresponding author: alexey.reshchikov@eastern-himalaya.cn²Email: malvaradog@unmsm.edu.pe¹urn:lsid:zoobank.org:author:C1DCCD18-C213-4454-99BB-D0BACA05D7BD²urn:lsid:zoobank.org:author:969AA574-A398-4087-BCF9-98CB8ABDC91F

Abstract. Two new species of *Exetastes* Gravenhorst, 1829 from the Peruvian Andes are described and illustrated: *E. andensis* sp. nov. and *E. tullu* sp. nov. Presently, 38 species of *Exetastes* have been recorded in the Neotropical region. Our discoveries are the first records of the genus in Peru and the Andean region.

Keywords. Banchini, Darwin wasps, parasitoid, Peru, Cloud Forest, Neotropics, mountains.

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Introduction

Exetastes Gravenhorst, 1829 (Hymenoptera Linnaeus, 1758, Ichneumonidae Latreille, 1802, Banchinae Wesmael, 1845, Banchini Wesmael, 1845) is a rather large banchine genus, currently comprising 169 species (Yu *et al.* 2016; Watanabe & Sheng 2018; Watanabe 2020). They are koinobiont endoparasitoids of Lepidoptera Linnaeus, 1758 (Fitton 1978; Townes & Townes 1978; Slovak 1983; Gauld *et al.* 2002; Khalaim & Ruiz-Cancino 2012), present worldwide except the Australasian region (Gauld 1984). In the Neotropical region 36 species were previously known: two species in Brazil (Brullé 1846), 18 species in Costa Rica (Cameron 1886; Gauld *et al.* 2002), one species in Cuba (Alayo 1970), and 20 species in Mexico (Khalaim & Ruiz-Cancino 2012). Gauld proposed four species groups for the Costa Rican fauna (Gauld *et al.* 2002) but the two species described here do not fit into these proposed groupings (Table 1).

Exetastes had not been recorded in Peru or any other Andean region prior to our discoveries. The aim of the present work is to describe and illustrate two new species of Peruvian *Exetastes* and to discuss their placement within the species groups proposed for the Neotropical region.

Table 1. Comparison of features of Neotropical region species groups and new Peruvian species of *Exetastes* Gravenhorst, 1829 (after Gauld *et al.* 2002 and Khalaim & Ruiz-Cancino 2012).

Feature	<i>amancoi</i> species group	<i>eithus</i> species group	<i>mexicanus</i> species group	<i>pivai</i> species group	<i>E. andensis</i> sp. nov.	<i>E. tullu</i> sp. nov.
Scutellum	convex to abruptly convex	convex	from weakly to strongly convex, rarely abruptly convex	thorn-like spine	abruptly convex (pyramidal in profile)	abruptly convex (pyramidal in profile)
Ovipositor	long, stout, decurved	slender, straight, elongated, tapered, needle-like at apex	short, slightly compressed and decurved	moderately long and rather slender, decurved	stout, compressed, decurved	stout, compressed, decurved
	with subapical notch	lacking distinct dorsal subapical notch	with subapical notch	with subapical notch	with subapical notch	with subapical notch
Tergite I	1.3–1.5 times length of hind tibia	0.4–0.6 times length of hind tibia	0.3 times length of hind tibia	0.7 times length of hind tibia	0.8 times length of hind tibia	1.0 times length of hind tibia
	1.6–1.8 times as long as posteriorly wide	2.1–2.5 times as long as posteriorly wide	1.8–2.5 times as long as posteriorly wide, (but 2.9–3.4 in <i>E. ometus</i> Gauld & Ugalde, 2002)	2.5–2.6 times as long as posteriorly wide	2.8 times as long as posteriorly wide	4.1 times as long as posteriorly wide
Fore tibia	slender, unspecialized	with a distinct subbasal swelling	slender, unspecialized	slender, unspecialized	slender, unspecialized	slender, unspecialized

Material and methods

Specimens of the new taxa were sampled in Andean Cloud Forest at Wayquecha Biological Station (Cusco Region) by Malaise traps (Fig. 1) at elevations of 2692 m and 2865 m a.s.l. Images were acquired using a Leica M205 C stereo microscope and stacking software LAS ver. 4 at increments of 20–50 steps, and with a Canon EOS T3 digital camera attached to an Infinity K-2 long-distance microscopic lens at the MUSM. The morphological terminology follows Gauld (1991).

Morphological abbreviation

T = metasomal tergites, with T1 being the anterior-most tergite

Institutional and other abbreviations

MUSM = Natural History Museum of the Universidad Nacional Mayor de San Marcos, Lima, Peru (<https://museohn.unmsm.edu.pe/> curator Dr Gerardo Lamas)



Fig. 1. Image of the pre-montane forest habitat in which *Exetastes andensis* sp. nov. was collected.

Results

Class Insecta Linnaeus, 1758
Order Hymenoptera Linnaeus, 1758
Superfamily Ichneumonoidea Latreille, 1802
Family Ichneumonidae Latreille, 1802
Subfamily Banchinae Wesmael, 1845
Tribe Banchini Wesmael, 1845

Genus *Exetastes* Gravenhorst, 1829

Exetastes Gravenhorst, 1829: 395. Type species: *Ichneumon fornicator* Fabricius, 1781, by subsequent designation (Westwood 1840: 60).

Leptobatus Gravenhorst, 1829: 432. Type species: *Leptobatus zeigleri* Gravenhorst, 1829, by subsequent designation (Viereck 1914: 83).

Semnophrys Förster, 1869: 158. Type species: *Exetastes notatus* Holmgren, 1860, by subsequent designation (Perkins 1962: 451).

Rhimphalea Förster, 1869: 202. Type species: *Rhimphalea brevicorpa* Davis, 1897 (= *bioculatus* Cresson, 1872), by subsequent inclusion (Davis 1897: 274).

Icyona Cameron, 1903: 340. Type species: *Icyona rufipes* Cameron, 1903 (= *E. longipes* (Smith, 1878)), by monotypy.

Allexetastes Kokujev, 1904: 106. Type species: *Exetastes (Allexetastes) komarovi* Kokujev, 1904, by subsequent designation (Viereck 1914: 8).

Rhynchexetastes Cameron, 1906: 102. Type species *Rhynchexetastes violaceipennis* Cameron, 1906, by monotypy.

Tegona Morley, 1913: 251. Type species: *Tegona rufipes* Morley, 1913 (= *E. longipes* (Smith, 1878)), by monotypy.

Pseudexetastes Meyer, 1927: 308, Type species: *Pseudexetastes diakonovi* Meyer, 1927, by original designation.

Diagnosis (updated from Gauld *et al.* 2002; Watanabe 2020)

Moderate to large body size wasps. Metasoma usually slightly posteriorly compressed. Clypeus in lateral view from weakly convex basally, to almost pyramidal, without a subapical median swelling, in anterior view, not strongly transverse, margin usually fairly evenly sclerotized but thin, slightly concave. Mandibles weakly and evenly tapered apically, lower tooth equal in length, or slightly shorter or slightly longer than upper tooth; both teeth pointed or with the apex of the upper tooth broad and obliquely chisel-shaped (Townes 1970; Khalaim & Ruiz-Cancino 2012). Occipital carina dorsally complete, its lower part joining hypostomal carina a little above base of mandible. Antenna slender. Scape apically obliquely truncated. Mesosoma short, with the epicnemium sloping slightly backwards ventrally. Pronotum short, anteriorly with a transverse groove before broadly concave hind margin, its upper hind corner bluntly lobed, covering spiracular sclerite. Epomia absent or present as short trace-like ridge. Notauli absent. Mesopleuron with subalar prominence present as a low rounded to sharp promontory. Epicnemium without a distinct vertical tooth-like lamella near lower corner of pronotum. Posterior transverse carina of mesosternum entirely absent. Metanotum with hind rim simple or with a small tooth-like projection posteriorly. Metapleuron with submetapleural carina narrow, only slightly and evenly broadened anteriorly. Metasternum with weak ridges between coxal insertions. Propodeum short and quite steeply declivous. All propodeal carinae (except sometimes the pleural carina) absent. Propodeal spiracle subcircular to slightly oval. Legs slender with tibial spurs long. Hind leg very long and strong, with enlarged coxa. All tarsomeres cylindrical. Tarsal claws simple. Mid tibia without distinct denticles on outer surface. Fore wing with a large kite-shaped areolet. 2m-cu slightly sinuous, with single but long bulla. Usually cu-a opposite or slightly

distal to base of Rs and M. Hind wing with distal abscissa of Cu1 joining cu-a close to M. Upper outer corner of subbasal cell almost right-angled, 95–100°. T1 with spiracle in anterior or central part. Glymma vestigial. Sclerotized part of first sternite not reaching spiracle. T2 slightly elongate (1.1–1.4 times as long as broad), with broad shallow thyridium anteriorly. Laterotergites of T2–3 indistinct, laterotergites of T4–5 not distinctly separated. Female hypopygium rather large and completely sclerotized. Ovipositor short to moderately long (0.3–1.3 times as long as hind tibia), usually curved downward, compressed basally, its apex usually with a distinct dorsal subapical notch, without teeth on distal end of upper valve; rarely apically elongate tapered with a vestigial apical notch. Male with genital capsule short with a broad shallow notch ventrally.

Exetastes andensis sp. nov.

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Figs 2, 4B

Etymology

The specific name is the Latin adjective ‘*andensis*’ and refers to this species’ Andean distribution.

Type material

Holotype

PERU • ♀; Cusco Region, Wayquecha Biological Station, Andean Cloud Forest; 13.17448° S, 71.58691° W; 2865 m a.s.l.; 21 Jul.–8 Aug. 2014; Malaise trap; J. Bergsten *et al.* leg.; MUSM.

Paratypes

PERU • 1 ♀; same collection data as for holotype; MUSM • 1 ♀; same collection data as for holotype but 13.18333° S, 71.58691° W; 2865 m a.s.l.; MUSM • 1 ♀; same locality as for holotype but 13.183° S, 71.583° W; 2800 m a.s.l.; 11 Sep. 2007; sweep net; C. Castillo leg.; MUSM.

Description

Female (holotype)

MEASUREMENT. Fore wing length 12 mm.

HEAD. Clypeus, in profile, basally weakly convex, subapically slightly concave; 1.5 times as wide as high. Mandible (Fig. 2D) with upper tooth large, obliquely chisel-shaped, and weakly subdivided; basally coriaceous and punctate, smooth on apical third. Malar space 0.7 times basal width of mandible. Face, frons, vertex, and gena finely granulate, matt, finely and somewhat indistinctly punctate. Face (Fig. 2D) with weak median convexity. Gena, in lateral view, 0.4 times as long as compound eye. Antenna (Fig. 2A) setaceous with 46 flagellomeres; ratio of length vs width from second to fourth flagellomeres: 2.8:2.5:2.5, ratios of those around 0.7 of way along flagellum: 1.2, ratio of subapical flagellomere: 1.2. Ocellar-ocular distance 1.5 times maximum diameter of lateral ocellus (Fig. 2B).

MESOSOMA. Mesosoma entirely granulate, matt, mostly finely and densely punctate. Epomia and notaulus absent (Fig. 2B). Scutellum (Fig. 4B) pyramidal in profile. Subalar prominence strongly raised and sharply rounded. Metapleuron evenly convex, with submetapleural carina moderately raised, extending about 0.6 of length of pleuron. Propodeum (Fig. 2E) granulate, with reticulate sculpture; pleural carina absent anteriorly, strong posteriorly. Fore tibia slender, unspecialized. Hind femur 5.8 times as long as its maximum width in lateral view. Tarsal claw simple. Fore wing with 3rs-m meeting Rs without joining 2rs-m, enclosing an areolet that is narrowly truncate above, with abscissa of M between 2rs-m and 2m-cu as long as abscissa of M between 2m-cu and 3rs-m; cu-a more or less opposite base of Rs and M.

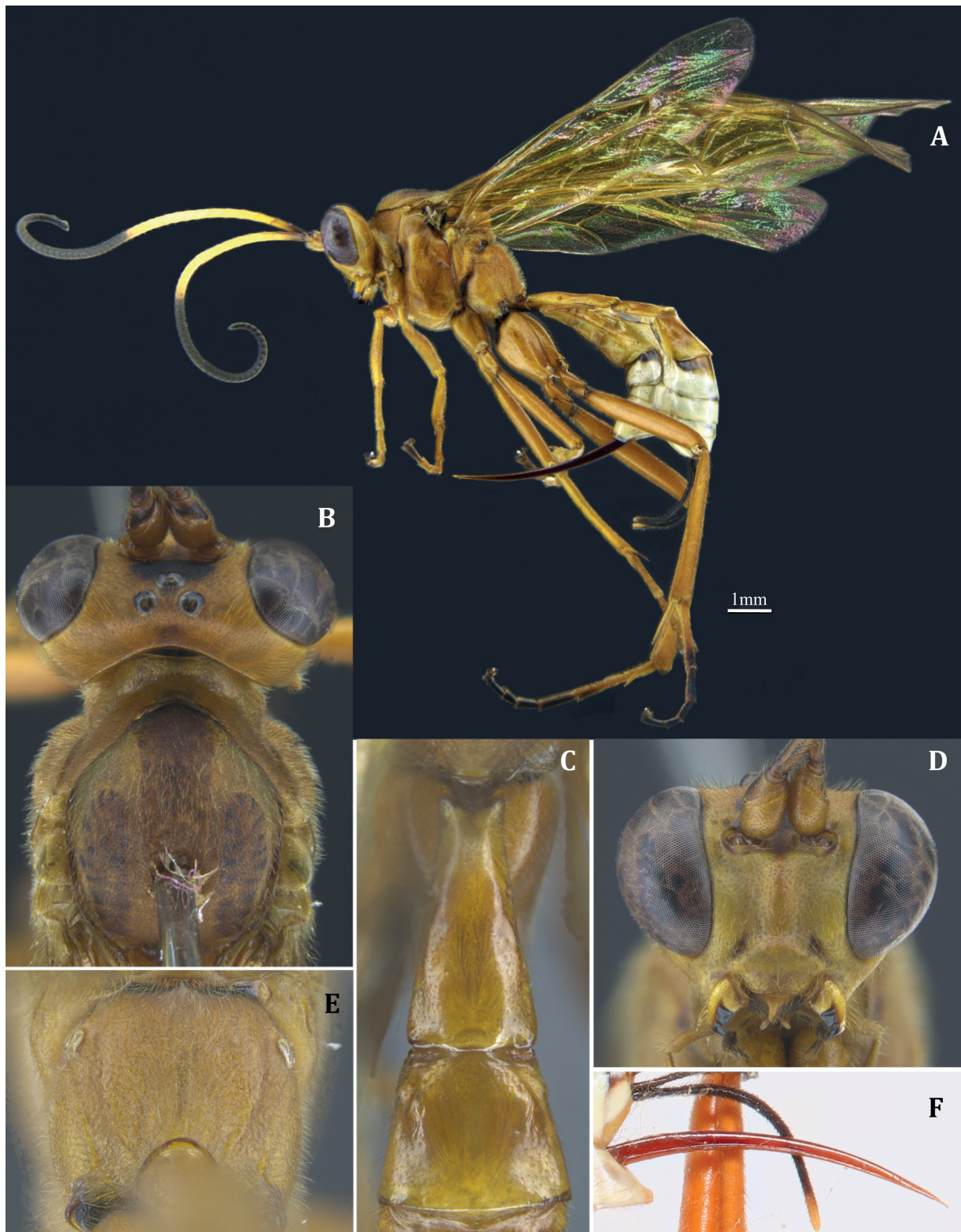


Fig. 2. *Exetastes andensis* sp. nov., holotype, ♀ (MUSM). **A.** Habitus, in lateral view. **B.** Head, in dorsal view and mesoscutum. **C.** T1–2. **D.** Face. **E.** Propodeum. **F.** Ovipositor. B–F not to scale.

METASOMA. T1 2.8 times as long as posteriorly wide; with spiracle positioned in anterior 0.46; granulate, matt, mostly finely and densely punctate (Fig. 2C). T2 0.9 times as long as posteriorly wide; granulate, matt, mostly finely and densely punctate. Ovipositor sheath elongate and slim, with transverse striation on outer surface. Ovipositor (Fig. 2F) projecting beyond apex of subgenital plate by 0.8 times length of hind tibia; stout, compressed, decurved, with subapical notch.

COLOR. Coloration reddish-yellow (Fig. 2A), except for following which are marked with black: 15–46th flagellomeres of antenna, teeth of mandibles, frons, groove between postscutellum and propodeum, groove between lower part of mesopleuron and metapleuron (Figs 2E, 4B), anteroventral part of hind coxa, dorsal part of fifth tarsomere of fore leg, dorsal parts of second to fifth tarsomeres of middle and hind legs, first sternite of metasoma, ventral edges of laterotergites of T2–3, anterolateral part of fifth sternite, anterolateral spots of T4, setae on T4–7, T8 entirely, cerci, ovipositor sheath except for pale apical tip, ovipositor; and following which are marked with bright yellow: 1st–14th flagellomeres of antenna, tip of ovipositor sheath (Fig. 2F); T4–7 and corresponding sternites which are white (Fig. 2A).

Variation

The paratype has the scuto-scutellar groove and anterior edge of T5–7 black.

Exetastes tullu sp. nov.

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Figs 3, 4A

Etymology

The specific epithet ‘*tullu*’ means ‘thin’ in Quechua, noun in apposition.

Type material

Holotype

PERU • ♀; Cusco Region, Wayquecha Biological Station; 13.175° S, 71.581° W; 2692 m a.s.l.; 22 Oct. 2007; Malaise trap; C. Castillo leg.; MUSM.

Paratype

PERU • 1 ♀; same collection data as for holotype; MUSM.

Description

Female (holotype)

MEASUREMENT. Fore wing length 8.2 mm.

HEAD. Clypeus, in profile, basally weakly convex, subapically slightly concave; 1.5 times as wide as high. Mandible with upper mandibular tooth as large as lower tooth, without subdivision; basally coriaceous and punctate, smooth on apical half. Malar space 0.6 times basal width of mandible. Face (Fig. 3C), frons, vertex (Fig. 3B), and gena finely granulate, matt, finely and somewhat indistinctly punctate. Face with weak median convexity. Gena, in lateral view, 0.4 times as long as compound eye. Antenna setaceous with 52 flagellomeres (paratype with 50 flagellomeres); ratio of length vs width from second to fourth flagellomeres: 3.6:3.0:2.9, ratio of those around 0.7 of way along flagellum: 1.5, subapical flagellomere: 1.2. Ocellar-ocular distance 1.9 times maximum diameter of lateral ocellus (Fig. 3B).

MESOSOMA. Mesosoma entirely granulate, matt, mostly finely and densely punctate. Epomia absent. Notaulus faint (Fig. 3B). Scutellum, in profile, pyramidal (Fig. 4A). Subalar prominence strongly raised, sharply rounded. Upper half of metapleuron convex, lower half concave, upper margin scrobiculate, with

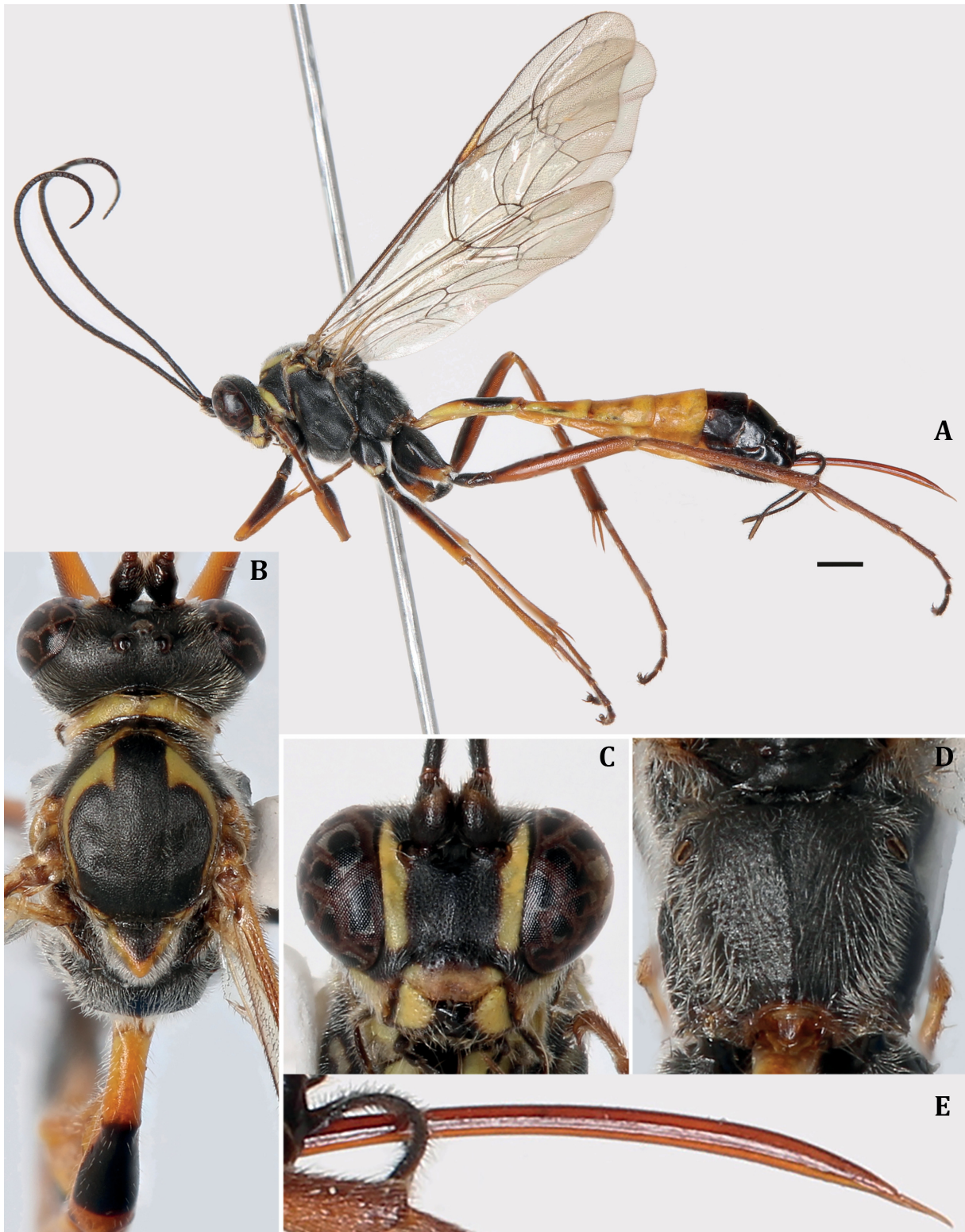


Fig. 3. *Exetastes tullu* sp. nov. holotype, ♀ (MUSM). **A.** Habitus, in lateral view. **B.** Head, mesosoma and T1 in dorsal view. **C.** Face. **D.** Propodeum. **E.** Ovipositor. B–F not to scale.

submetapleural carina moderately raised extending about 0.7 of length of pleuron. Propodeum (Fig. 3D) granulate, matt, mostly finely and densely punctate; pleural carina present anteriorly, absent posterior to spiracle. Fore tibia slender, unspecialized. Hind femur 7.9 times as long as its maximum width in lateral view. Tarsal claw simple. Fore wing with 3rs-m meeting Rs without joining 2rs-m, enclosing an areolet that is narrowly truncate above; abscissa of M between 2rs-m and 2m-cu shorter than abscissa of M between 2m-cu and 3rs-m; cu-a distal to base of Rs and M.

METASOMA. T1 (Fig. 3B) 4.1 times as long as posteriorly wide; with spiracle positioned in anterior 0.46; granulate, shiny, mostly finely and densely punctate. T2 1.8 times as long as posteriorly wide, granulate, shiny, mostly finely and densely punctate. Ovipositor sheath elongate and slim, with transverse striation on outer surface. Ovipositor (Fig. 3A, E) projecting beyond apex of subgenital plate by 1.0 times length of hind tibia; stout, compressed, decurved, with subapical notch.

COLOR. Coloration black (Fig. 3A), except for following which are marked with yellow: lower half of clypeus, mandibles (except teeth), facial orbit (Fig. 3C) reaching upwards to lower part of frons, malar space, anterior margin of pronotum, along with its posterior margin dorsally and posterodorsally (Fig. 3D), propleuron, mesoscutum anterolaterally, transverse median stripe on scutellum, anterior edge of mesopleuron, a mark at end of epicnemial carina, subalar prominence, mesepisternum, ventral part of fore coxa, fore and mid femur and tibia ventrally, mid coxa ventrodorsally, anterior third of T1 (Fig. 3B), lateral edges and distal edge, T2–4, and sternite 1–5; and following parts which are brown (Figs. 3A, 3E): fore and mid femur dorsally and extreme, fore and mid femur, tibia dorsally, hind femur, hind tibia, tarsomere, and ovipositor.

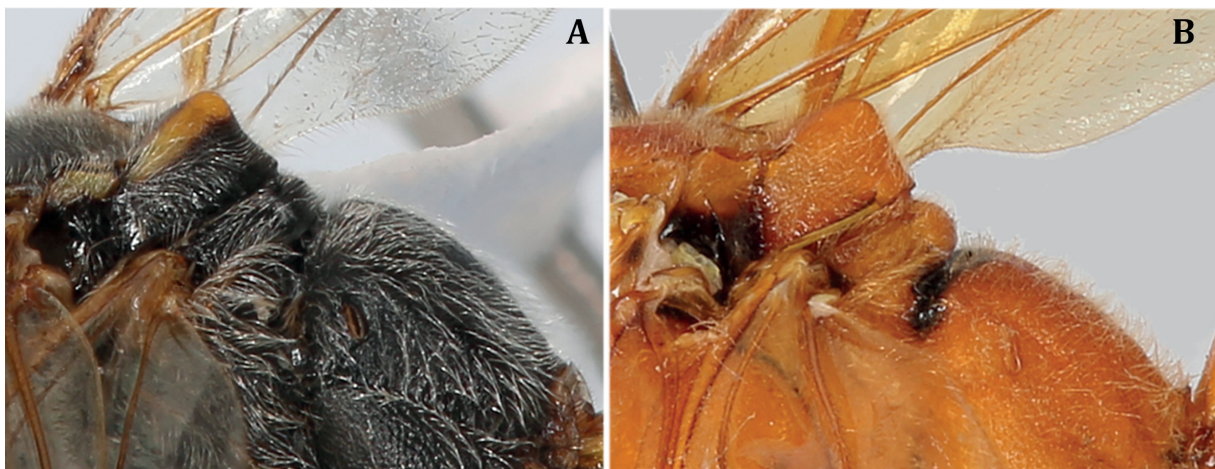


Fig. 4. Lateral view of scutellum. **A.** *Exetastes tullu* sp. nov. holotype, ♀ (MUSM). **B.** *Exetastes andensis* sp. nov. paratype, ♀ (MUSM).

Discussion

The species groups proposed by Gauld *et al.* (2002) are mainly distinguished by the shape of the scutellum and the length and shape of the ovipositor (see Table 1 for additional characters). The new Peruvian species do not fit within any of these species groups and are too heterogeneous to be placed in their own species group, suggesting the need for a reassessment of the features used to establish the species groups, ideally within a phylogenetic context.

The Peruvian Andes are one of the regions where Darwin wasps are least studied and may include numerous species of *Exetastes* that do not agree with the diagnostic features of the genus. For example, *Exetastes andensis* sp. nov. has the upper mandibular tooth broad and weakly subdivided (Fig. 2D), a feature which is also present in the *Banchus* genus group. However, genera of this group have large metasomal laterotergites which meet ventrally (Broad 2010), whereas *Exetastes* has laterotergites of T2 and T3 narrow, less than 0.3 times as broad as long (Townes 1970). The mandibles of *Exetastes* have a variety of shapes and proportions: lower tooth equal in length to upper tooth; lower tooth slightly shorter or longer than upper tooth; both teeth pointed; or with the apex of the upper tooth broad and obliquely chisel-shaped (Townes 1970; Khalaim & Ruiz-Cancino 2012). It is assumed the shape found in *E. andensis* sp. nov. is just part of this variability.

Exetastes tullu sp. nov. has mandibles with their upper and lower teeth equal in length, and without subdivisions, as in many species of *Exetastes*. This species has a highly distinctive elongate body but with a relatively short ovipositor (Fig. 3A). The length of the ovipositor of both new species does not fit with any of the species groups as defined by Gauld *et al.* (2002), being somehow intermediate between species of the ‘*amancoi*’ group and species belonging to the other groups (Table 1).

This is the second time that members of the genus are reported from South America, after two Brazilian species previously known from subtropical coastal Guaratuba, Paraná (Brullé 1846). For the Central American fauna it was mentioned that many species are restricted to higher altitude sites, around 1500–2000 m a.s.l. (Gauld *et al.* 2002; Veijalainen *et al.* 2014). This is probably also the case for species of *Exetastes* in the Andes. The Neotropical fauna of Banchinae is expected to be one of the most speciose ones (Klopfstein *et al.* 2019). The present work provides a significant improvement to the knowledge of biodiversity in the Andean region and to the morphological features characterizing the genus *Exetastes*, and it is hoped that more interest in the study of these Darwin wasps will arise from continued documentation of their diversity.

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