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Two new species of the genus *Polyphrix* Townes 1972 (Hymenoptera, Ichneumonidae, Cryptinae) from Peru

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Abstract

Polyphrix is a small neotropical genus comprising four species. Here, two new species from Peru are described and figured: *Polyphrix misa* **sp. nov.** and *Polyphrix tullu* **sp. nov.** The distribution of *P. varians* Townes 1970 in Peru is confirmed and *P. stellata* Tedesco & Santos 2009 is newly recorded for the country. Additionally, an updated key to species is presented.

Key words: Biodiversity, Ichneumonoidea, parasitoids, taxonomy

Introduction

Polyphrix Townes 1970 is a small genus that currently comprises four species (Santos *et al.* 2009). *Polyphrix varians* Townes 1970, type species of the genus, was described with Brazilian specimens but in the generic description was reported from Peru (Townes 1970) but subsequently the occurrence of the genus to Peru was discarded (Nogueira & Aguiar 2005); currently this species is only known from Brazil and Guyana (Santos *et al.* 2009). The other three species are only known from Brazil (Santos *et al.* 2009).

Polyphrix was found to be a monophyletic genus (Santos *et al.* 2009) and basal in the *Glodianus* group in the Cryptini (Santos 2017). A redescription of the genus was provided by Santos *et al.* (2009) and they noticed that its species present a highly uniform morphological structure: mandible strongly triangular, width of mandible apex less than 0.5 as wide as the base; epomia absent; hind wing with the length of vein 1-Cu nearly as long as crossvein cu-a; propodeum with anterior margin of concave and surface sculpturing behind anterior transverse carina with strong and widely spaced transverse wrinkles; thyridium distinctly longer than wide; and, ovipositor tip ending in a long and narrow point. *Polyphrix* can be distinguished from other Cryptini genera by the following combination of characters: dorsal margin of pronotum strongly and uniformly swollen; areolet transversely rectangular; transverse furrow at base of propodeum very wide, shallow, and almost completely smooth; and propodeum with stout, straight, transverse wrinkles (Santos *et al.* 2009).

This work aims also to describe two new species from Peru, update the distribution records and key to species.

Material and methods

Specimens studied herein are deposited in the Natural History Museum of the Universidad Nacional Mayor de San Marcos, Lima, Peru (MUSM). Type material of species was not examined as the original description are sufficient (Townes 1970, Nogueira & Aguiar 2005, Santos *et al.* 2009).

Morphological terminology and the biometric ratios used in descriptions follows Santos *et al.* (2009). The biometric ratios used are as follows: "CWH, clypeus maximum width/maximum height; CWW, clypeus maximum

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width/minimum width; MLW, mandible maximum length/maximum width; MWW, mandible minimum width/maximum width; MSM, malar space maximum width/basal width of mandible; FLW, hind femur maximum length/maximum width; SWL, propodeal spiracle maximum width/maximum length; APH, fore wing cell 1+2Rs (areolet) height/pterostigma maximum width; AWH, 1+2Rs maximum width/maximum height; HW1C, hind wing vein Cua/cu-a length; T1LW, first metasomal tergite maximum length/maximum width (dorsal view); T1WW, first metasomal tergite maximum width/minimum width (dorsal view); T2LW, second metasomal tergite maximum length/maximum width (dorsal view); T2WW, second metasomal tergite maximum width/minimum width (dorsal view); OST, ovipositor sheath length/hind tibia length" (Santos *et al.* 2009).

Multi-focus photomicrographs were taken using a Nikon SMZ745 microscope equipped with a microscope camera and stacked using Zerene Stacker. Distribution maps were prepared using SimpleMappr (Shorthouse 2010), based on specimen label data. The specimen labels are transcribed verbatim; if they include more than one label the information is separated by "//"; additional information is added between brackets.

Results

***Polyphrix misa* sp. nov.**
Figs 1–2, 4C

Material examined. Holotype: 1♀ "PERU: LO. Alto Nanay, Qda Lobillos, 120m 18M 0563775E, 9610397N 12.xii.2008, C. Castillo // Aguajal Mixto Colecta manual 11AB" (MUSM). **Paratype:** 1♀ and 1♂ similar to holotype, 1♂ "PERU: LO. Alto Rio Chambira 18M 569924E 9674657N 174m, 9.x.2008, F. Meza // Colinas fuertemnt disect, Yellow trap 11T32Y6", and 1♀ "PERU: MD, Manu, Rio Serjali 12º42'55.5"S 71º14'31.6"W 428m, 19-21.i.2011, J. Costa" (MUSM).

Diagnosis. *Polyphrix misa* **sp. nov.** may be distinguished from all other species by the combination of the following characters: mesosoma completely orange, metasomal tergites 2–8 black with apical white stripe and hind femur black. It is quite similar to *P. varians* but differs in having the hind femur black (vs. orange) and the genal orbits pale yellow but interrupted at mid gena (vs. completely white).

Description. Female holotype.

Fore wing 10.20 mm. Body entirely shiny, scarcely punctate and very sparsely pilose. *Head* (Figs 1A,B): antenna with 33 flagellomeres; clypeus scarcely punctate, CWH 2.00, CWW 1,26 apex slightly convex; mandible and palpi sparsely pilose; mandible moderately long, MLW 2.10, MWW 0.60, ventral tooth slightly longer and more robust than dorsal tooth; occipital carina moderately high, sharp, uniformly curved, ending far from hypostomal carina, at distance as large as basal width of mandible; MSM 0.50.

Mesosoma (Figs 1A, 1C,D): pronotum with weak and short wrinkles at posterior margin of collar inferiorly; dorsal margin regular, neither swollen nor prominent; mesoscutum subcircular; notaulus almost absent, traceable only in tangent anterior view; lateral carina of scutellum weak, distinct only on anterior 0.2; epicnemial carina restricted to ventral 0.70 of mesopleuron, almost straight, mesopleuron dorsad of carina giving rise to short and very weak transverse strigulation; mesopleural fovea shallow; mesopleural suture straight, narrow and crenulate; median portion of postpectal carina very weak, short and slightly arched forward; metapleuron smooth, shiny, with sparse hairs; justacoxal carina present only as very short subvertical ridge; transverse furrow at base of propodeum centrally 0.70 as long as distance anterior transverse carina to anterior margin of propodeum, measured centrally. *Legs*: hind pre-apical tarsomere not distinctly bilobed; FLW 7.40. Propodeum anterior margin centrally concave; SWL 2.00; anterior transverse carina straight, area behind it with 8 or 9 distinct straight transverse wrinkles, either complete or incomplete, posterior ones stronger and sharper. *Wings* (Figs 1A, 1E): fore wing vein 1-Rs+M distinctly sinuous, without bulla; crossvein 1m-cu uniformly arched, slightly shorter than 1-Rs+M; vein 1M+Rs anteriorly straight, posteriorly arched; crossvein 1cu-a straight, forming straight angle with M+Cu, ending basad of vein 1M+Rs by about 0.2 its own length; crossvein 2cu-a 0.25 as long as vein 2-Cu; cell 1+2Rs (areolet) of moderate size, APH 0.15, transversely rectangular, AWH 2.13; crossvein 3r-m spectral, distinctly longer than 2r-m; hind wing vein M+Cu forming straight angle with vein M; HW1C 0.89; vein 2-Rs entirely tubular; crossvein 1r-m with bulla at ventral 0.3; veins 1-Rs and 2-Rs distinctly angled; vein Cub straight, reaching about 0.8 of distance to wing margin; vein 2-1A reaching about 0.85 of distance to wing margin.

Metasoma (Figs 1A, 1D, 1F): first tergite elongate, slender, T1LW 3.64, T1WW 1.57; spiracle at center, slightly protuberant; T2LW 1.65, T2WW 1.85; tergites 3–8 smooth, shiny, pilose; OST 1.59; ovipositor moderately slender, straight, scarcely punctate, laterally strongly compressed; dorsal valve with nodus and notch, ventral valve with eight apical teeth; apex moderately long, pointed.

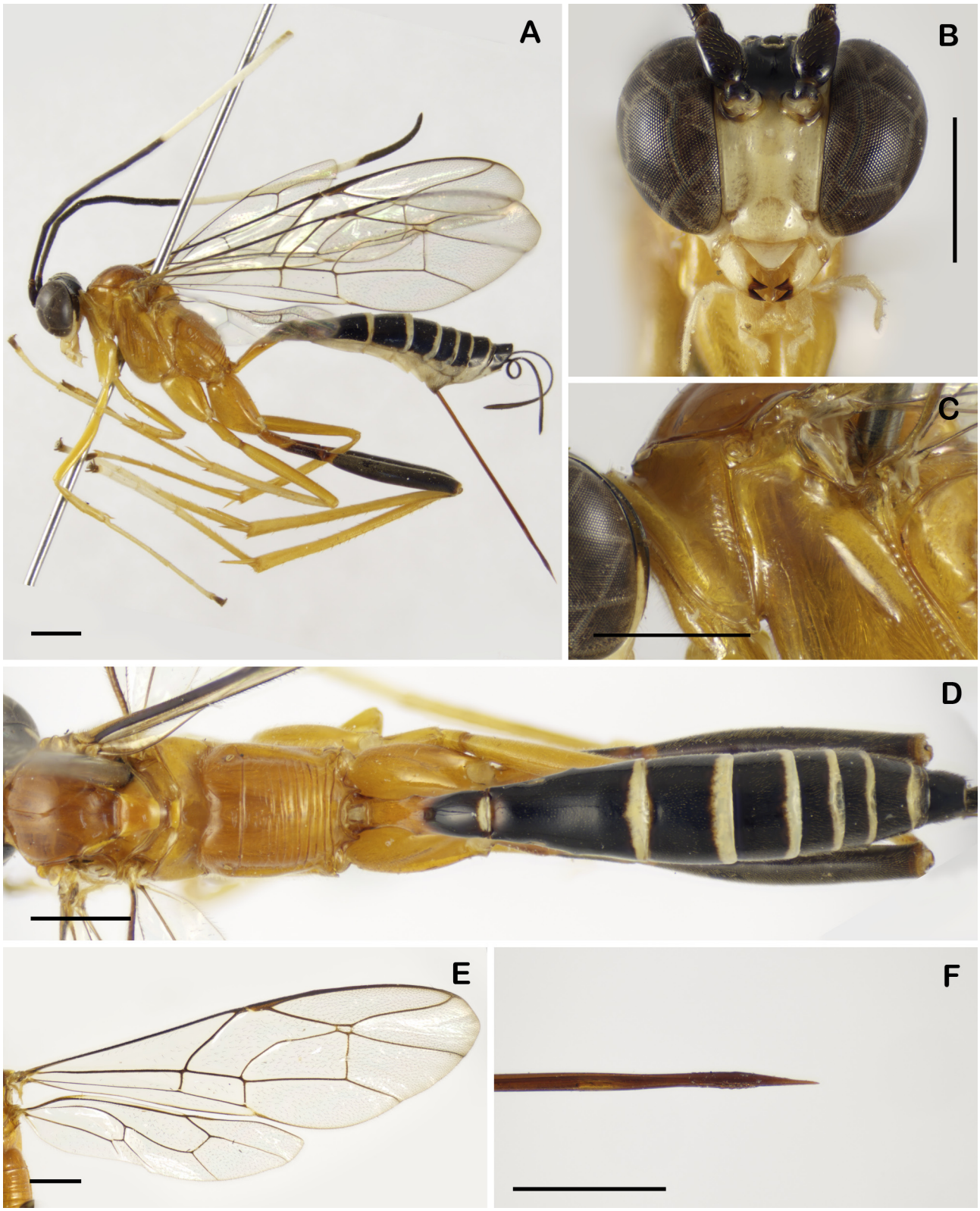

FIGURE 1. ***Polyphrix misa*** **sp. nov.**, female, holotype. **A.** habitus, lateral view; **B.** head, front view; **C.** pronotum, lateral view; **D.** mesosoma and metasoma, dorsal view; **E.** wings; **F.** ovipositor tip, lateral view. Scale bar = 1 mm

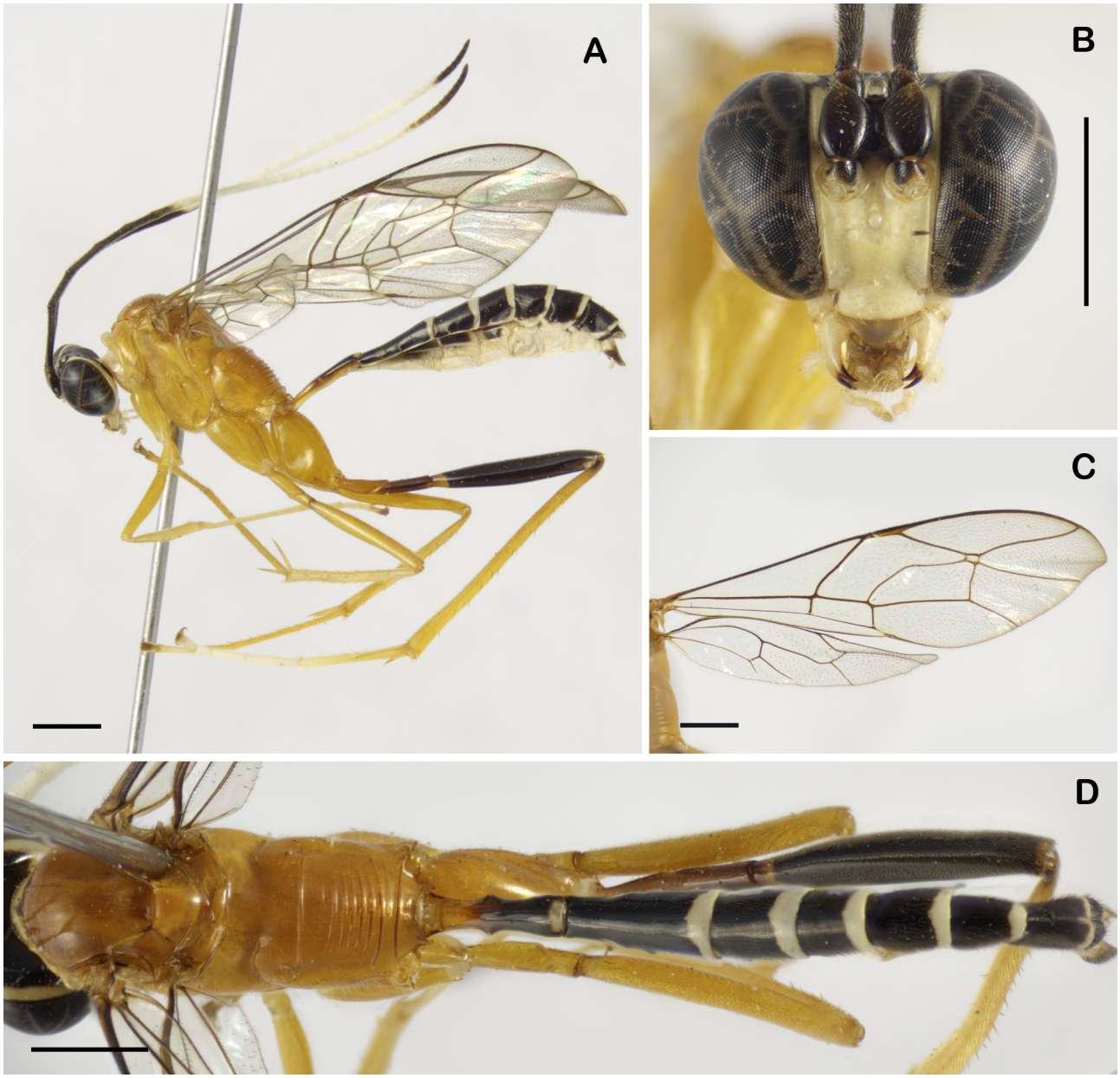

FIGURE 2. ***Polyphrix misa*** **sp. nov.**, male, paratype. **A.** habitus, lateral view; **B.** head, front view; **C.** wings; **D.** mesosoma and metasoma, dorsal view. Scale bar = 1 mm

Color (Fig. 1). Head: scape, pedicel and flagellomeres black except for flagellomeres T7–17, T6 distal end and T18–23 dorsally white, apically flagellomeres dark brown; supra-clypeal area, clypeus, mouth parts, malar space and orbital and gena band (interrupted at mid gena) pale yellow; apex of mandible dark brown; supra-antennal area, occiput, temple and except orbital band, black. Mesosoma: orange except for fore and mid legs with tibia and tarsomeres 1–4 pale yellow, tarsomere 5 brown; hind leg with trochantellus, femur and apical third of tarsomere 5 brown, tibia and basitarsus pale yellow, and tarsomeres 2–4 and tarsomere 5 (except distal third) white. Metasoma: Tergites usually black; T1 basally orange to apically black, apical stripe pale yellow; T2 basally (at the center) dark orange; T2–7 basally black with apical and lateral stripes pale yellow; T8 basally black with lateral stripes pale yellow; S1–3 pale yellow with small black stripes on the sides; ovipositor dark red, sheaths dark brown; wings hyaline.

Variation of female paratypes. Fore wing length 9.2–10.8 mm. They differ from the holotype in the following features: CWH 1.58–1.80, CWW 1.23–1.25, MLW 1.92–2.20, MWW 0.69–0.70, MSM 0.54–0.70; Mesosoma with legs FLW 6.80–7.64, SWL 1.80–2.00; fore wing APH 0.16–0.26, AWH 1.78–2.00; hind wing HW1C 1.00–1.15;

metasoma with T1LW 3.58–3.89, T1WW 1.80–2.00, T2LW 1.60–1.71, T2WW 1.56–1.81, OST 1.29–1.48. Within the coloration orbital and gena band complete or interrupted at middle, antenna with 33–34 flagellomeres with T18–21 dorsally white.

Male paratypes (Fig 2). Fore wing length 8.5–8.8 mm. They differ from the females in the following features: CWH 1.77–2.36, CWW 1.18–1.28, MLW 1.83–1.92, MWW 0.54–0.58, MSM 0.42–0.50; Mesosoma with legs FLW 7.44–8.00, SWL 1.40–1.50; fore wing APH 0.16–0.23, AWH 1.50–2.14; hind wing HW1C 1.15–1.60; metasoma with T1LW 4.33–4.41, T1WW 1.31–1.50, T2LW 2.60–3.08, T2WW 1.33–1.56. Antennal coloration differs as follows: pedicel and flagellomeres black except for flagellomeres T5–22, T6 distal half and T9, 23–27 dorsally white or flagellomeres T10–21, T6 distal half and T9, 22–23 dorsally whit, apically flagellomeres dark brown.

Distribution. Peru, Loreto and Madre de Dios Departments (Fig. 4C).

Etymology. The specific epithet '*misa'* means 'bicolor' in Quechua, noun in apposition.

Polyphrix stellata Tedesco & Santos 2009

Fig. 4A

Material examined. 1♀ "PERU, MD, Albergue Refugio Amazonas 12º52'30"/69º24'35" 231 m 01.vii.2017 D. Couceiro // WIRED AMAZON PROYECT PAN TRAP", 1♀ idem but 17.vii.2017, 1♀ idem but 21.vii.2017, 2♀♀ idem but 21.xi.2016, and idem but 2♀♀ 05.x.2016 (MUSM).

Comments: This species was collected in the same locality as one of the paratypes of *P. sefirot* **sp. nov.** This species was collected with yellow pan traps as were the type specimen of the species (Santos *et al.* 2009). We installed pan traps from February 2016 to December 2017, but this species was only collected during July, October and November and was absent during the rest of the year.

Distribution records. Brazil (Santos *et al.* 2009). In Peru is known to occur in the Madre de Dios Department (Fig 4A).

Polyphrix tullu sp. nov.

Figs 3, 4C

Material examined. Holotype: 1♀ "PERU: MD. Manu, Los Amigos Biological Station, 228m,12°33'25.7''S 70°04'46.6''W, 11.vi.2016, Yellow pan trap, N. Zenteno leg." (MUSM). **Paratype:** 1♀ similar to holotype but 21.vi.2016 and 1♀ "PERU, MD, Albergue Refugio Amazonas 12º52'30"/69º24'35" 231 m 24.ii.2016 J. Grados // WIRED AMAZON PROYECT PAN TRAP" (MUSM).

Diagnosis. *Polyphrix tullu* **sp. nov.** may be distinguished from all other species by the combination of the following characters: pronotum and mesoscutum mostly black, metasomal tergites 2–8 black with apical white stripe and hind femur orange. It is quite similar to *P. stellata* but differs in having the metasoma with tergites 2–8 black with apices white (vs. orange), and pronotum with upper margin black (vs. yellow).

Description. Female holotype.

Fore wing 9.5 mm. Body entirely shiny, scarcely punctate and very sparsely pilose. *Head* (Fig. 3B,D): antenna with 32 flagellomeres; clypeus scarcely punctate, CWH 1.56, CWW 1,22 apex slightly convex; mandible and palpi sparsely pilose; mandible moderately long, MLW 2.0, MWW 0.58, ventral tooth slightly longer and more robust than dorsal tooth; occipital carina moderately high, sharp, uniformly curved, ending far from hypostomal carina, at distance as large as basal width of mandible; MSM 0.67.

Mesosoma (Figs 3A, 3C,D): pronotum with very weak and short wrinkles at posterior margin of collar ventrally; dorsal margin regular, neither swollen nor prominent; mesoscutum subcircular; notaulus almost absent, traceable only in tangent anterior view; lateral carina of scutellum distinct only on anterior 0.2; epicnemial carina restricted to ventral 0.70 of mesopleuron, almost straight, mesopleuron dorsad of carina giving rise to short and very weak transverse strigulation; mesopleural fovea shallow; mesopleural suture straight, narrow and crenulate; median portion of postpectal carina very weak, short and slightly arched forward; metapleuron smooth, shiny, with sparse hairs; justacoxal carina present only as very short subvertical ridge; transverse furrow at base of propodeum centrally 0.7 as long as distance anterior transverse carina to anterior margin of propodeum, measured centrally.

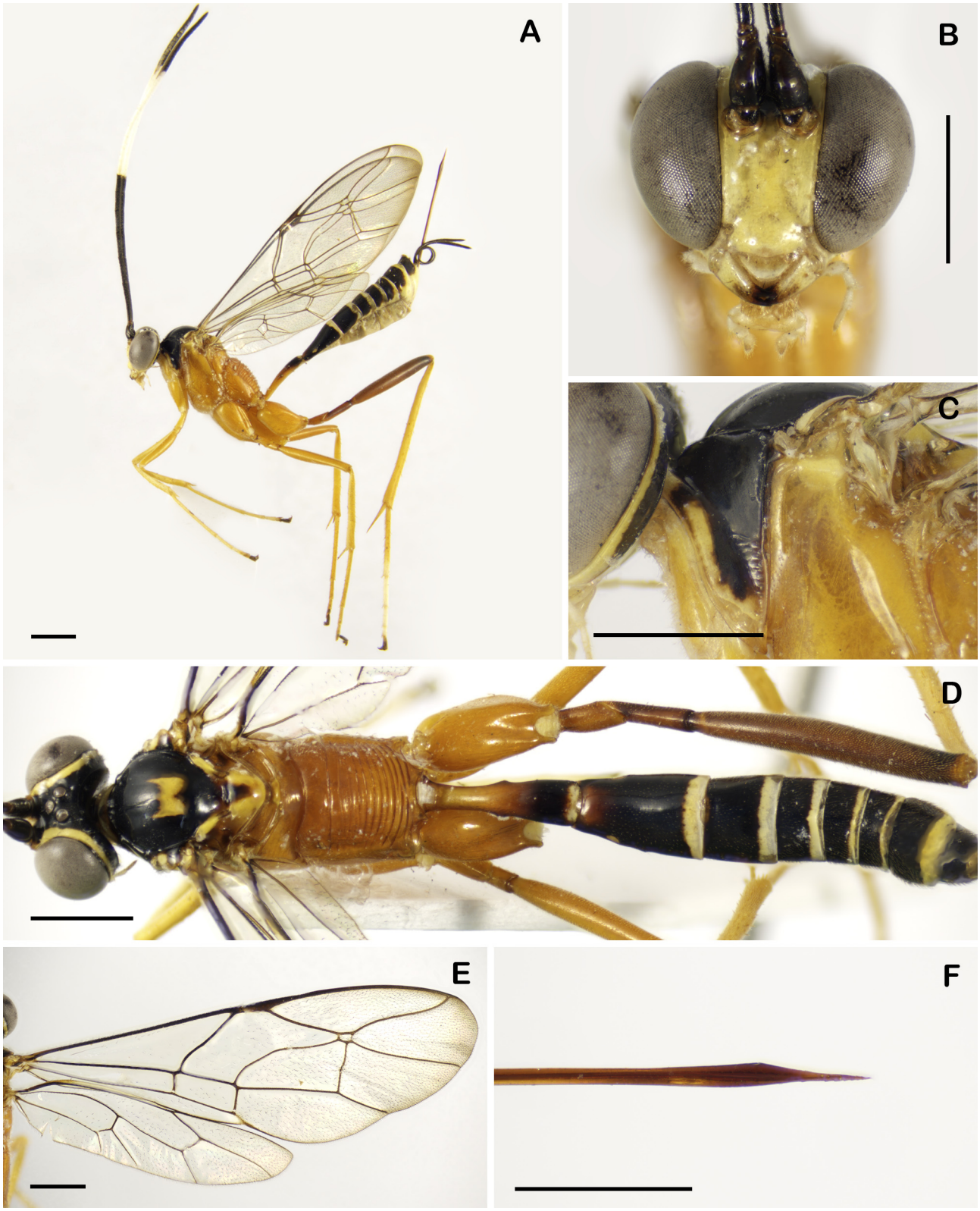

FIGURE 3. ***Polyphrix tullu*** **sp. nov.**, female, holotype. **A.** habitus, lateral view; **B.** head, front view; **C.** pronotum, lateral view; **D.** mesosoma and metasoma, dorsal view; **E.** wings; **F.** ovipositor tip, lateral view. Scale bar = 1 mm

Legs: hind pre-apical tarsomere slightly bilobed; FLW 7.50. Propodeum anterior margin centrally concave; SWL 2.33; anterior transverse carina straight, area behind it with 12 or 13 distinct straight transverse wrinkles, either complete or incomplete, posterior ones stronger and sharper. *Wings* (Figs 3A,E): fore wing vein 1-Rs+M distinctly

sinuous, without bulla; crossvein 1m-cu uniformly arched, slightly shorter than 1-Rs+M; vein 1M+Rs anteriorly straight, posteriorly arched; crossvein 1cu-a straight, forming straight angle with M+Cu, ending basad of vein 1M+Rs by about 0.2 its own length; crossvein 2cu-a 0.24 as long as vein 2-Cu; cell 1+2Rs (areolet) of moderate size, APH 0.20, transversely rectangular, AWH 1.50; crossvein 3r-m spectral, distinctly longer than 2r-m; hind wing vein M+Cu forming straight angle with vein M; HW1C 1.14; vein 2-Rs entirely tubular; crossvein 1r-m with bulla at ventral 0.3; veins 1-Rs and 2-Rs distinctly angled; vein Cub straight, reaching about 0.8 of distance to wing margin; vein 2-1A reaching about 0.85 of distance to wing margin.

Metasoma (Figs 3A,D,F): first tergite elongate, slender, T1LW 3.26, T1WW 2.09; spiracle at center, weakly protuberant; T2LW 1.10, T2WW 1.46; tergites 3–8 smooth, shiny, pilose; OST 1.14; ovipositor moderately slender, straight, scarcely punctate, laterally strongly compressed; dorsal valve with nodus and notch, ventral valve with eight apical teeth; apex moderately long, pointed.

Color (Fig. 3). Head mostly black, except for flagellomeres T7–19 white, apically flagellomeres dark brown; supra-clypeal area, clypeus, mouth parts, base of mandible, malar space and para-ocular stripe pale yellow. Mesosoma predominantly orange; pronotum black, except for anterior margin, pale yellow; mesoscutum black, centrally with large W-shaped pale-yellow mark; scutellum predominantly pale yellow, ventrally brown; tegula anteriorly pale yellow, posteriorly brown; subalar prominence pale yellow; fore leg predominantly orange, tibia and tarsomere 1–4 pale yellow, tarsomere 5 brown; mid leg predominantly orange, tarsomere 4–5 brown; hind leg with coxa and tibia orange, trochanter, trochantellus and femur dark orange, basitarsus pale yellow, tarsomeres 2–4 off-white tarsomere 5 brown. Metasoma: Tergites usually black; T1 basally orange to apically black, apical stripe pale yellow; T2 basally (at the center) dark orange; T2–7 basally black with apical and lateral stripes pale yellow; T8 basally black with lateral stripes pale yellow; S1–3 pale yellow with small black stripes on the sides; ovipositor dark red, sheaths dark brown; wings hyaline.

Variation of female paratypes. Fore wing length 8.9–10.2 mm. They differ from the holotype in the following features: head with antenna with 33 flagellomeres, CWH 2.00–2.36, CWW 1.18–1.26, MLW 1.92–2.10, MWW 0.54–0.60, MSM 0.50; Mesosoma with legs FLW 7.40–7.44, SWL 1.40–2.00, area behind it with 8 or 9 distinct straight transverse wrinkles; fore wing APH 0.15–0.23, AWH 1.50–2.13; hind wing HW1C 0.89–1.15; metasoma with T1LW 3.64–4.33, T1WW 1.50–1.57, T2LW 1.65–2.60, T2WW 1.56–1.85, OST 1.59. Within the coloration varies in having the pronotum with anterior margin pale yellow, solely ventrally (not along the entire margin); one individual with trochantellus and femur brown.

Male. Unknown.

Distribution. Peru, Madre de Dios Department (Fig. 4C).

Etymology. The specific epithet '*tullu'* means 'thin' in Quechua, noun in apposition.

Polyphrix varians **Townes 1970**

Fig. 4B

Material examined. 1♀ "PERÚ: MD, Reserva Comunal Amarakaeri, 70°45'35.64"W/ 13º3'25.78" S 445m. 09.xi.2010 M. Vilchez y C. Castillo // PM16, B, 11/08, Y3.", 1♀ "PERU: MD, Rio los Amigos CICRA 14.ix.2006, 208m 12º34'3"/ 70°5'46.7" Malaise L. Huerto", 1♀ "PERU: LO. Alto Amazonas, 76º18'34"W/ 5º27'7.8"S 190m 01.x.2012. yellow pan trap, C. Espinoza", 1♂ "PE: Loreto, Maynas 18M 532239E, 9583762N 118m, 18.vii.2008, C. Castillo", and 1♂ "PE: Loreto, Maynas 18M 532239E,9583762N 118m, 18.vii.2008, C. Castillo." (MUSM).

Comments: Townes (1970) mentioned that *P. varians*, the only known species at that time and type species of the genus, occurred in Peru in the genus description but the type material used to described the species was collected in Brazil and no specimen collected from Peru was included. Later, in the list provided by Carrasco (1972), it was mentioned as occurring in Peru but acknowledging the lack of data. Rodriguez-Berrio *et al.* (2009) considered in their catalogue of Peruvian Ichneumonidae as present in Peru, ignoring the fact that Nogueira and Aguiar (2005) refuted the presence of this species in Peru. Here we found several specimens of *P. varians* widely distributed in Peruvian Amazon Basin; all specimens were collected between 112–445 m.

Distribution records. Brazil, Guyana (Santos *et al.* 2009). In Peru it is known to occur in the Cusco, Madre de Dios and Loreto Departments (Fig. 4B).

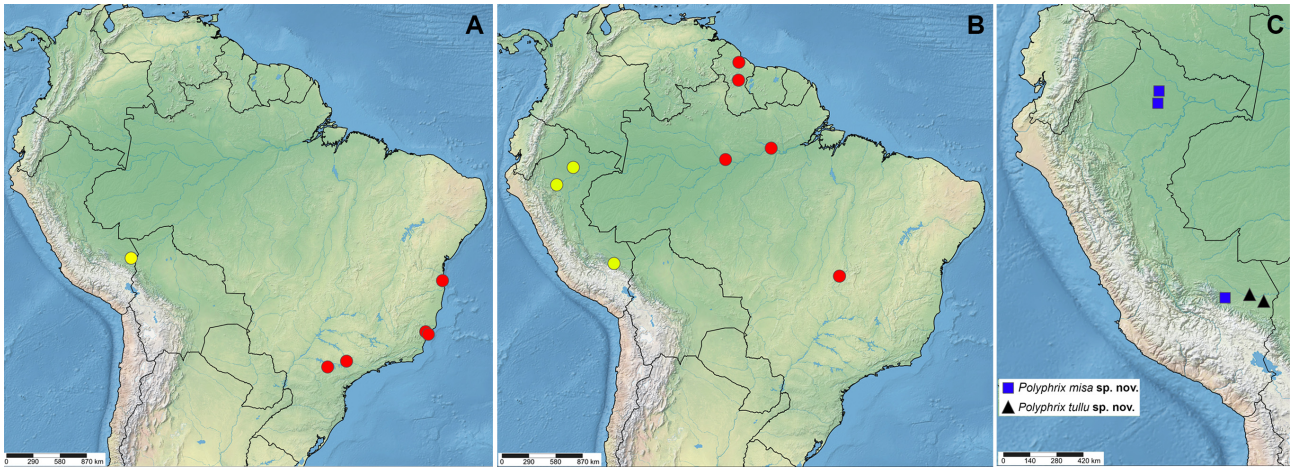

FIGURE 4. Geographic records of *Polyphrix*. A. *Polyphrix stellata*; **B.** *Polyphrix varians.* **C.** *Polyphrix misa* **sp. nov.** and *Polyphrix tullu* **sp. nov.** Yellow circles represent new records and red represent previous records.

Key to the species of *Polyphrix* Townes (modified from Nogueira and Aguiar (2005) and Santos *et al.* (2009))

1. Propodeum with one or two pairs of somewhat oval dark spots, a pair behind anterior transverse carina and with or without a pair in front of anterior transverse carina; hind trochanter, and trochantellus dark brown; mesoscutum completely black 2
- Propodeum uniformly orange, without dark spots; hind trochanter and trochantellus entirely yellowish; mesoscutum not completely black 3
2. Paraocular stripe complete; pronotum with strong and distinct submarginal lamellar protuberance; anterior margin of propodeum centrally distinctly concave; ovipositor slender, dorsal valve with nodus, ventral valve with nine apical teeth, apical 3–4 teeth weak . . . . ***Polyphrix cristata* Nogueira & Aguiar**
- Paraocular stripe interrupted from supraclypeal area to posterior orbit; pronotum with very weak submarginal protuberance; anterior margin of propodeum weakly sinuous; ovipositor thick, dorsal valve without nodus, ventral valve with seven apical teeth . . . . ***Polyphrix atlantica* Nogueira & Aguiar**
3. Pronotum and mesoscutum completely orange (Figs 1A,D, & 2A,D) 4
- Pronotum and mesoscutum mostly black, with small yellow marks (Figs 3A,D) 5
4. Transverse furrow at base of propodeum, measured centrally, about 1.2 as wide as basal area of propodeum; metafemur entirely yellowish. . . . . ***Polyphrix varians* Townes**
- Transverse furrow at base of propodeum, measured centrally, about 0.7 as wide as basal area of propodeum; metafemur entirely blackish (Figs 1A, 2A) . . . . ***Polyphrix misa* sp. nov**
5. Metasomal tergites 2–8 black with apical white stripe (Figs 3A,D); transverse furrow at base of propodeum, measured centrally, as wide as basal area of propodeum (Fig. 3D) . . . . ***Polyphrix tullu* sp. nov**.
- Metasomal tergites 2–8 entirely orange; transverse furrow at base of propodeum, measured centrally, about 0.7 as wide as basal area of propodeum . . . . ***Polyphrix stellata* Tedesco & Santos**

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