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Whartonstigma subgen. nov., a new subgenus of the genus *Orthostigma* Ratzeburg, 1844 from Australasia (Hymenoptera: Braconidae: Alysiinae)

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Abstract

The new subgenus *Whartonstigma* **subgen. nov.**, with type species *Orthostigma gallowagi* Wharton 2000, of the genus *Orthostigma* Ratzeburg, 1844 is described and illustrated. Two new species: *Orthostigma* (*Whartonstigma*) *longipede* **sp. nov.** and *O.* (*W.*) *papuae* **sp. nov.** are described from Papua New Guinea. A key to all known species of the subgenus *Whartonstigma* is provided.

Key words. Braconidae, parasitoid of Diptera, *Aspilota*-complex, *Orthostigma*, Papua New Guinea, new subgenus, new species, key

Introduction

Since Königsmann (1969), the genus *Orthostigma* Ratzeburg 1844 with currently more than 60 worldwide known species (Yu *et al.*, 2016), has been well established and separated from other genera of the *Aspilota*-complex on the basis of the mandible having distinct, complete, transverse carina and third tooth usually very wide and lobe-shaped (Fischer 1971, 1975; Wharton 1980; Tobias 1986; van Achterberg 1988).

However, different additional characters have been used over the years to establish an improved classification in subfamily Alysiinae. Fischer (1995) suggested the size ratio of the first and second flagellomeres (first shorter than second) as a main character in *Orthostigma*-group for separating of species of the subgenus *Africostigma* Fischer, 1995. Also, Fischer (1995) described the genus *Patrisaspilota* from a single specimen collected in Sri Lanka having notauli almost completely developed on mesoscutum and almost reaching the mesoscutal pit. Despite existing doubts about the taxonomic placement of this taxon, Peris-Felipo *et al.* (2019) reduced the status of *Patrisaspilota* to the subgenus level in *Orthostigma* and described a new species of this subgenus from Papua New Guinea.

The genus *Neorthostigma* Belokobylskij, 1998 was considered during last several years as only a subgenus of *Orthostigma* because both shared the peculiar mandible structure, a distinct transverse curved carina. However, the combination of such valuable diagnostic characters widely used in the subfamily Alysiinae, notably absence of oblique sulcus between eye and antennal socket, enlarged anterior tentorial area almost reaching inner margin of eye, together with lack of medio-posterior mesoscutal pit (Belokobylskij, 1998) clearly showed the separate position of *Neorthostigma* at the generic level (Belokobylskij *et al.*, 2019; Peris-Felipo *et al.*, in preparation).

Thanks to the material collected during recent biological expeditions carried out in Papua New Guinea by the Muséum National d'Histoire Naturelle (Paris, France) in 2012, a new subgenus is described in this paper, *Whartonstigma* **subgen. nov.** (with type species *Orthostigma gallowagi* Wharton, 2002), together with the descriptions of two new species, *Orthostigma* (*Whartonstigma*) *longipede* **sp. nov.** and *O.* (*W.*) *papuae* **sp. nov.**. As result, four subgenera are now established within *Orthostigma* Ratzeburg 1844, namely *Africostigma* Fischer, 1995, *Orthostigma* s.str., *Patrisaspilota* Fischer, 1995, and *Whartonstigma* **subgen. nov.**. A key to species of the subgenus *Whartonstigma* is also provided.

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Materials and methods

Specimens were collected with Malaise traps during the expedition "Our Planet Reviewed—Papua New Guinea" between 25 October and 10 November 2012, at eight sites located every 500 m along an altitudinal transect set up on the north-eastern face of Mt Wilhelm and at Wanang (Swire) Research Station (175 m asl) a lowland forest distant of 63 km north of Mt Wilhelm. At each sampling site, four Malaise traps were set up every 100 m following the same contour line. The captures were preserved with 90% ethyl alcohol (Robillard *et al*., 2016).

For the terminology of morphological features, sculpture and measurements (including for mandibles) see Peris-Felipo *et al*. (2014); for wing venation nomenclature see van Achterberg (1993); for measurements of the marginal cell see Peris-Felipo and Belokobylskij (2017). Material was imaged using a Digital Microscope Keyence® VHX-2000 and Adobe Photoshop® imaging system. The types of studied species are deposited in the collection of the Australian National Insect Collection (Canberra, Australia; ANIC), the Muséum National d'Histoire Naturelle (Paris, France; MNHN), the Queensland Museum (Brisbane, Australia; QMBA), the Zoological Institute of the Russian Academy of Sciences (St Petersburg, Russia; ZISP), and the F.J. Peris-Felipo Entomological Collection (Basel, Switzerland; PFEC).

Taxonomy

Class Hexapoda Blainville, 1816

Order Hymenoptera Linnaeus, 1758

Family Braconidae Nees, 1811

Subfamily Alysiinae Leach, 1815

Tribe Alysiini Leach, 1815

Genus *Orthostigma* Ratzeburg, 1844

Ratzeburg, 1844: 53; Königsmann, 1969: 2; Shenefelt, 1974: 997; Wharton, 1980: 85; Tobias, 1986: 117; van Achterberg, 1988: 44; Chen & Wu, 1994: 99; Fischer, 1995: 670; Belokobylskij, 1998: 209; Fischer, 2002: 102; Wharton, 2002: 91; Belokobylskij & Tobias, 2007: 10; Yu *et al.*, 2016; Zhu *et al.*, 2017: 68.

Type species. *Aphidius flavipes* Ratzebrug, 1844: 71.

Synonyms. *Delocarpa* Foerster, 1863; *Ischnocarpa* Foerster, 1863; *Africostigma* Fischer 1995; *Patrisaspilota* Fischer, 1995.

Diagnosis. Mandibles small, simple, tridentate, weakly curved outwards, with complete transverse curved carina on anterior third or submedially; upper (first) tooth smallest, narrow and acuminate, middle (second) rather long and acuminate, lower (third) tooth widest, evenly rounded. Paraclypeal fovea short, far removed from edge of eyes. Mesoscutum always with midpit; notauli usually not developed on most part of dorsal surface of mesoscutum, but sometimes rather well developed, almost complete and joined posteriorly with mesoscutal pit or at least sometimes reaching more than half of mesoscutum; precoxal sulcus present and usually wide; propodeum with different types of sculpture, often without areas. In fore wing marginal cell not shortened; vein 2-SR present and distinctly sclerotized; veins m-cu and cu-a always postfurcal; first subdiscal cell closed postero-apically by vein CU1a. Metasoma more or less distinctly compressed laterally. Ovipositor sheath not longer than metasoma, often upcurved.

Key to subgenera of *Orthostigma*

1. First flagellomere distinctly shorter than second flagellomere (Fig. 1A) [South Africa] . . . . . ***Africostigma*** Fischer
- First flagellomere about as long as or longer than second flagellomere (Fig. 1B, C). **2**

2(1). Vein 2-SR present and distinct (Fig. 2A). **3**
- Vein 2-SR completely absent (Fig. 2B). [Australia, Papua New Guinea] . . . . . ***Whartonstigma* subgen. nov.**
3(1). Notauli dorsally rather well developed on mesoscutum and usually reaching mesoscutal pit (Fig. 3A). . . . . ***Patrisaspilota*** Fischer
- Notauli dorsally absent on most part of mesoscutum (Fig. 3B). . . . . ***Orthostigma* s. str.**

FIGURE 1. First and second flagellomeres of antenna. **A.** First flagellomere shorter than second flagellomere [*Orthostigma* (*Africostigma*) *karkloofense* Fischer, 1995]. **B, C.** First flagellomere as long as or longer than second flagellomere [B: *O.* (*Whartonstigma*) *longipede* **sp. nov.**; C: *O.* (*Orthostigma*) *mandibulare* (Tobias, 1962)].

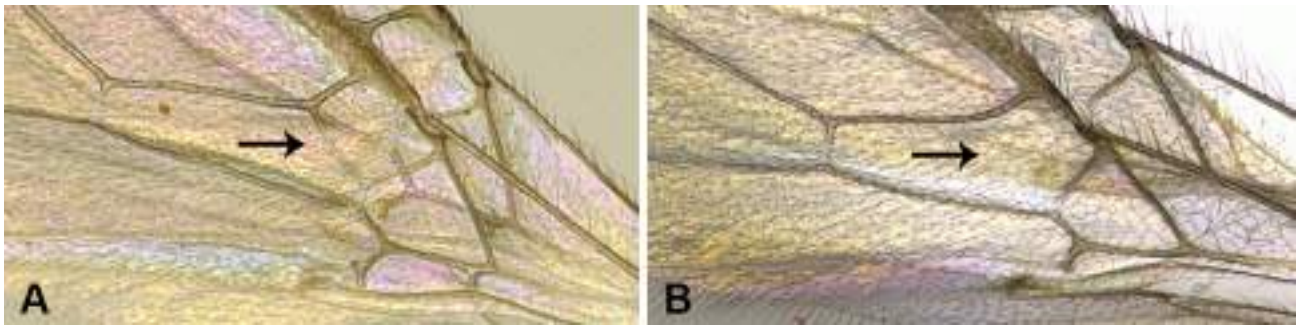

FIGURE 2. Fore wing. **A.** Vein 2-SR present [*Orthostigma* (*Orthostigma*) *mandibulare* (Tobias, 1962)]. **B.** Vein 2-SR absent [*Orthostigma (Papuastigma) papuae* **sp. nov.**].

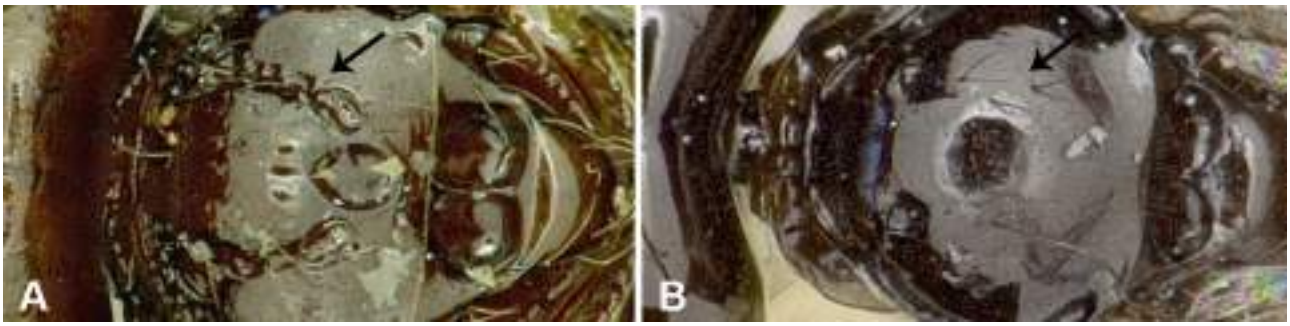

FIGURE 3. Mesoscutum in dorsal view. **A.** Notauli well developed dorsally and almost complete [*Orthostigma (Patrisaspilota) glabrifaciale* (Fischer, 2010)]. **B.** Notauli absent dorsally on most part of mesoscutum [*O. (Papuastigma) papuae* **sp. nov.**].

Subgenus *Whartonstigma* Peris-Felipo, subgen. nov.

Type species. *Orthostigma gallowagi* Wharton 2002.

Diagnosis of subgenus. First flagellomere about as long as or longer than second flagellomere (Fig. 1B, C). Mandibles small, with distinct complete transverse curved carina; its upper (first) tooth smallest, narrow and pointed, middle (second) rather long and acuminate, lower (third) tooth widest, evenly rounded. Paraclypeal fovea short, far removed from edge of eyes. Mesoscutum without midpit; notauli not developed dorsally on most part of mesoscutum; precoxal sulcus present, usually wide; propodeum usually without areas. In fore wing marginal cell not shortened; vein 2-SR absent (Fig. 2B), first and second submarginal cells fused. Metasoma more or less distinctly compressed laterally. Ovipositor sheath shorter than metasoma, often up-curved.

Remarks. Members of this subgenus are characterised by having the first flagellomere about as long as or longer than second flagellomere and by the absence of vein 2-SR with fused first and second submarginal cells.

Hosts. Unknown.

Etymology. Named in honour Dr Robert A. Wharton, well-known American hymenopterist for his contribution into the study of the World Braconidae, especially Alysiinae and Opiinae.

Included species. *Orthostigma* (*Whartonstigma*) *gallowagi* Wharton, 2002, *O. (W.) longipede* Peris-Felipo, **sp. nov.**, *O. (W.) papuae* Peris-Felipo, **sp. nov.**, *O.* (*W.*) *tropicale* Wharton, 2002.

Orthostigma (*Whartonstigma*) *gallowagi* Wharton, 2002

(Figs 4, 5)

Orthostigma gallowagi Wharton, 2002: 94; Yu *et al*., 2016.

Material examined. Australia: 1 female (holotype), Queensland, Wongabel S. F., 6 km S of Atherton, 12.xi–1.xii.1983, Storey and Brown. M.T. (QMBA); 1 female, 1 male (paratypes), same data as holotype [No.111581] (ANIC).

Re-description. Female (holotype).

Length. Body 1.6 mm, fore wing 1.6 mm, hind wing 1.1 mm.

Head. In dorsal view, 1.7 × as wide as long, 1.4 × as wide as mesoscutum, smooth, with temple rounded behind eyes. Eye in lateral view 1.3 × as high as wide and 1.8 × as wide as temple medially. POL equal to OD; OOL 2.5 × OD. Face 1.6 × as wide as high, with sparse setae, almost entirely smooth; inner margins of eyes subparallel. Clypeus 3.0 × as wide as high, slightly concave ventrally. Paraclypeal fovea small, not reaching half distance between clypeus and inner border of eye. Mandible almost parallel-sided, 1.5 × as long as its maximum width; its middle tooth narrow and rather long, directed forwards, lower tooth evenly curved on outside margin. Antenna with 16 antennomeres, 0.7 × as long as body. Scape 1.5 × as long as pedicel. First flagellomere 2.8 × as long as its maximum width, about as long as second flagellomere. Second flagellomere 2.4 ×, third to 12th flagellomeres 2.2–2.3 ×, 13th flagellomere 1.9 ×, and 14th (apical) flagellomere 3.0 × as long as their maximum width.

Mesosoma. In lateral view 1.2 × as long as high. Mesoscutum (dorsal view) 0.9 × as long as its maximum width, smooth. Notauli present only on vertical anterior surface of mesoscutum. Prescutellar depression (scutellar sulcus) smooth, with median carinae, about as long as its maximum width. Precoxal sulcus wide, oblique, almost smooth, not reaching anterior and posterior margins of mesopleuron. Posterior mesopleural furrow smooth. Propodeum smooth, with complete wide median longitudinal carina. Propodeal spiracles very small, its diameter 0.2 × distance from spiracle to anterior margin of propodeum.

Wings. Length of fore wing 3.1 × its maximum width. Marginal cell ending on apex of wing, 4.6 × as long as its maximum width. Vein SR1 3.2 × as long as vein 3-SR. First subdiscal cell 4.0 × as long as its maximum width. Hind wing 6.9 × as long as its maximum width.

Legs. Hind femur 4.5 × as long as its maximum width. Hind tibia weakly widened to apex, 7.7 × as long as its maximum subapical width, about as long as hind tarsus. First tarsomere of hind tarsus 2.0 × as long as second tarsomere.

Metasoma. First tergite almost parallel-sided, 2.8 × as long as its apical width, weakly striate. Ovipositor 1.5 × as long as first tergite, 0.4 × as long as metasoma, 1.1 × as long as hind femur.

Colour. Body dark brown. Metasoma, mandible, flagellomeres, pterostigma, and legs light brown. First metasomal tergite darker than second and third tergites. Wings almost hyaline.

Variation. Body length 1.3–1.5 mm, fore wing 1.4–1.6 mm, hind wing 1.0–1.1 mm. Antenna 15–16 antennomeres. Mandible 1.5–1.6 × as long as its maximum width. First tergite 2.5–2.8 × as long as its apical width. Mesosoma 1.2–1.3 × as long as high. Otherwise similar to holotype.

Male. Body length 1.5 mm, fore wing 1.6 mm, hind wing 1.1 mm. Antenna 17–18 antennomeres. Otherwise similar to female.

Comparative diagnosis. The species is similar to *Orthostigma* (*Whartonstigma*) *papuae* **sp. nov.** (Papua New Guinea), but differs from it in having the clypeus 3.0 × as wide as high (2.0 × in *O. papuae*), mandible 1.5 × as long as its maximum width (1.1–1.2 × in *O. papuae*), marginal cell of fore wing 4.6 × as long as its maximum width (4.0

× in *O. papuae*), propodeum with complete wide median longitudinal carina, without emerging carinae (with short emerging carinae and not reaching propodeal edges in *O. papuae*), and first tergite 2.8 × as long as its apical width (2.0 × in *O. papuae*) almost parallel-sided (widened towards apex in *O. papuae*).

Distribution. Australia.

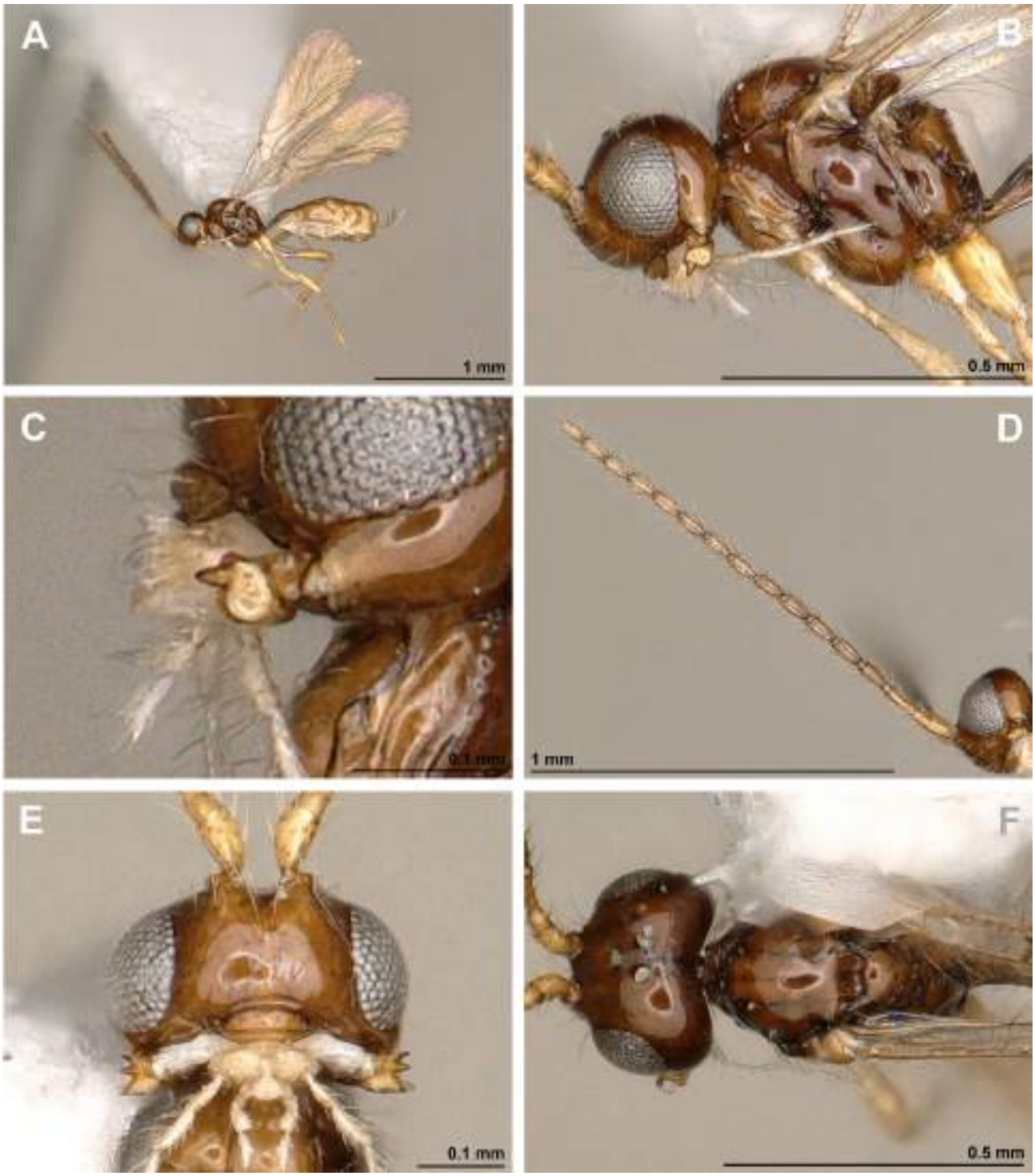

FIGURE 4. *Orthostigma (Whartonstigma) gallowagi* Wharton, 2002 (holotype, female). **A**. Habitus, lateral view. **B**. Head and mesosoma, lateral view. **C**. Mandible. **D**. Antenna. **E**. Head, front view. **F**. Head and mesonotum, dorsal view.

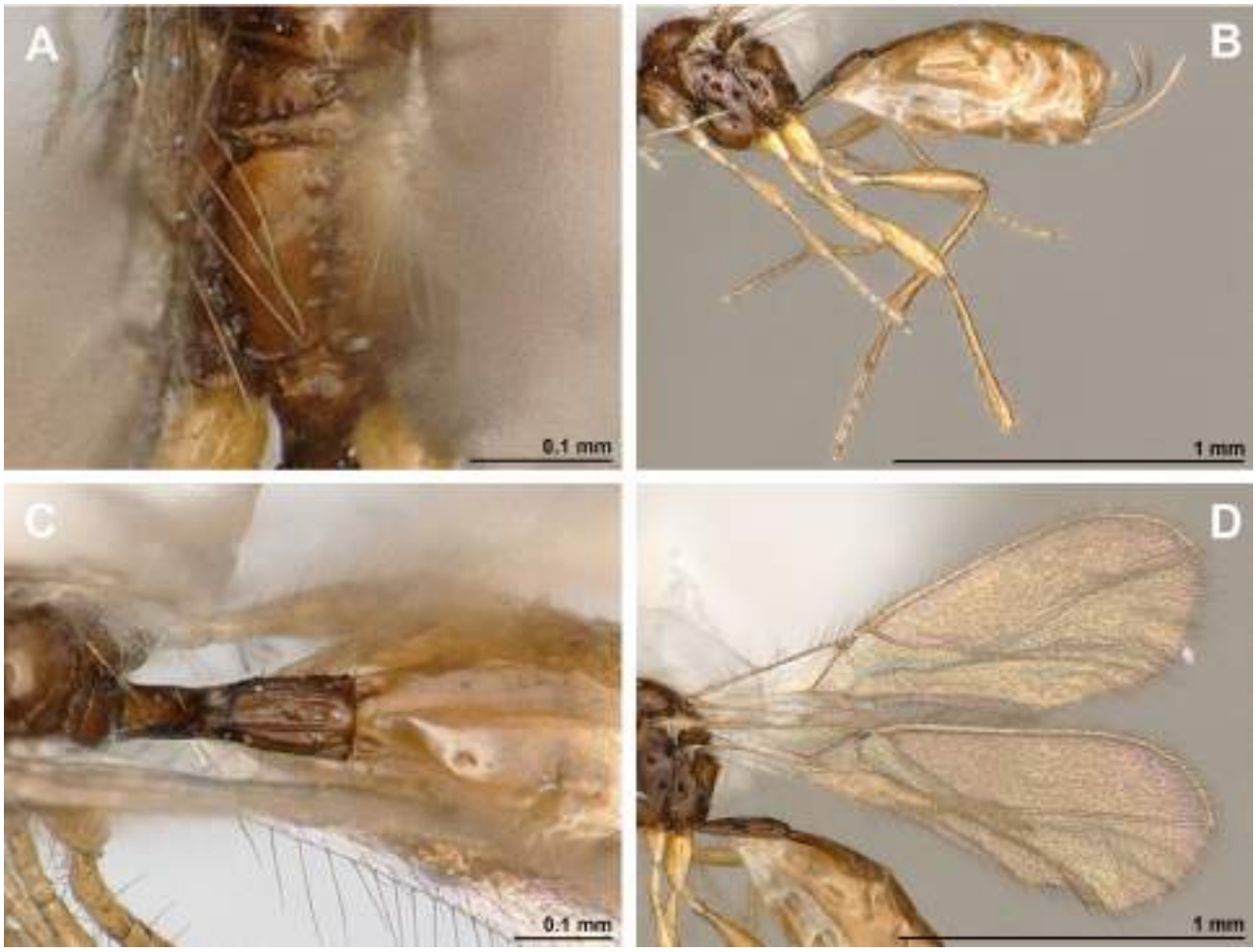

FIGURE 5. *Orthostigma (Whartonstigma) gallowagi* Wharton, 2002 (holotype, female). **A**. Propodeum. **B**. Legs, metasoma and ovipositor, lateral view. **C**. First metasomal tergite. **D**. Fore and hind wings.

Orthostigma (*Whartonstigma*) *longipede* Peris-Felipo, sp. nov.

(Figs 6, 7)

Type material. Holotype: female, Papua New Guinea, Mt Wilhelm, UTM (-5.731961, 145.2522), 700 m, 19–20.x.2013, understorey, Coll. by Sam *et al*., site: MW0700-03, P4739; vial: 20848, MAL-MW0700'C-07/16-d07 (MNHM).

Paratypes: 1 female, same data as holotype, but MW0700-04, P4755; vial: 20855, MAL-MW0700'D-07/16-d07 (MNHM); 1 female, same data as holotype, but 8–9.xi.2012, Plot 2, understorey, leg. Keltim, Uma, Novotny, Leponce; Malaise—MAL-MW0700'B-15/16-d15 (PFEC).

Description. Female (holotype).

Length. Body 1.9 mm, fore wing 1.9 mm, hind wing 1.3 mm.

Head. In dorsal view, 2.0 × as wide as long, 1.4 × as wide as mesoscutum, smooth, with temple rounded behind eyes. Eye in lateral view 1.5 × as high as wide and 2.0 × as wide as temple medially. POL 1.1 × OD; OOL 2.7 × OD. Face 1.4 × as wide as high, entirely smooth; inner margins of eyes subparallel. Clypeus 2.6 × as wide as high, slightly concave ventrally. Paraclypeal fovea small, reaching half distance between clypeus and inner border of eye. Mandible almost parallel-sided, 1.1 × as long as maximum width; its middle tooth narrow and rather short, directed forwards, lower tooth evenly curved on outside margin. Antenna with 20 antennomeres, 1.1 × as long as body. Scape 2.0 × as long as pedicel. First flagellomere 3.8 × as long as its maximum width, 0.9 × as long as second flagellomere. Second flagellomere 3.9 × , third flagellomere 3.0 ×, fourth to 12th flagellomeres 2.5–2.7 ×, 13th to 17th flagellomeres 2.2–2.3 ×, and 18th (apical) flagellomere 2.8 × as long as their maximum width.

Mesosoma. In lateral view 1.2 × as long as high. Mesoscutum (dorsal view) 0.8 × as long as its maximum width, smooth. Notauli present only on vertical anterior surface of mesoscutum. Prescutellar depression (scutellar sulcus) smooth, with median carinae, 1.2 × as long as its maximum width. Precoxal sulcus wide, oblique, almost smooth, not reaching anterior and posterior margins of mesopleuron. Posterior mesopleural furrow smooth. Propodeum smooth, with complete wide median longitudinal carina. Propodeal spiracles very small, its diameter 0.2 × distance from spiracle to anterior margin of propodeum.

Wings. Length of fore wing 2.5 × its maximum width. Marginal cell ending on apex of wing, 4.3 × as long as its maximum width. Vein SR1 2.8 × as long as vein 3-SR. First subdiscal cell 3.0 × as long as its maximum width. Hind wing 6.8 × as long as its maximum width.

FIGURE 6. *Orthostigma (Whartonstigma) longipede* Peris-Felipo, **sp. nov.** (holotype, female). **A**. Habitus, lateral view. **B**. Head and mesosoma, lateral view. **C**. Mandible. **D**. Antenna. **E**. Head, front view. **F**. Head and mesonotum, dorsal view.

Legs. Hind femur 3.8 × as long as its maximum width. Hind tibia weakly widened to apex, 6.5 × as long as its maximum subapical width, about as long as hind tarsus. First tarsomere of hind tarsus 1.8 × as long as second tarsomere.

Metasoma. First tergite weakly evenly widened towards apex, 2.2 × as long as its apical width, weakly striate. Ovipositor 1.6 × as long as first tergite, 0.6 × as long as metasoma, 1.3 × as long as hind femur.

Colour. Body, mandible, flagellomeres of antenna, pterostigma, and legs dark brown to black. Fore and middle tarsus light brown. First metasomal tergite similar colour to second and third tergites. Wings almost hyaline.

Variation. Body length 1.9–2.0 mm Antenna 19–20 antennomeres. Otherwise similar to holotype.

Male. Unknown.

Etymology. The name is related to the long size of the legs.

Comparative diagnosis. The new species is similar to Australian *Orthostigma* (*Whartonstigma*) *tropicale* Wharton, but differs from it in having the eye in lateral view 2.0 × as wide as temple medially (1.3 × in *O. tropicale*), precoxal sulcus almost smooth and not reaching posterior margin of mesopleuron (crenulate and reaching posterior margin of mesopleuron in *O. tropicale*), first subdiscal cell of fore wing 3.0 × as long as its maximum width (2.1 × in *O. tropicale*), hind tibia 6.5 × as long its maximum subapical width (7.5 × in *O. tropicale*).

Distribution. Papua New Guinea.

FIGURE 7. *Orthostigma (Whartonstigma) longipede* Peris-Felipo, **sp. nov.** (holotype, female). **A**. Propodeum. **B**. Legs, metasoma and ovipositor, lateral view. **C**. First metasomal tergite. **D**. Fore and hind wings.

Orthostigma (*Whartonstigma*) *papuae* Peris-Felipo, sp. nov.

(Figs 8, 9)

Type material. Holotype: female, Papua New Guinea, Mt Wilhelm, UTM (-5.731961, 145.2522), 700 m, 25–

26.v.2013, understorey, Coll. by Sam *et al*., site: MW0700-03, P4745; vial: 20602, MAL-MW0700'C-13/16-d13 (MNHM).

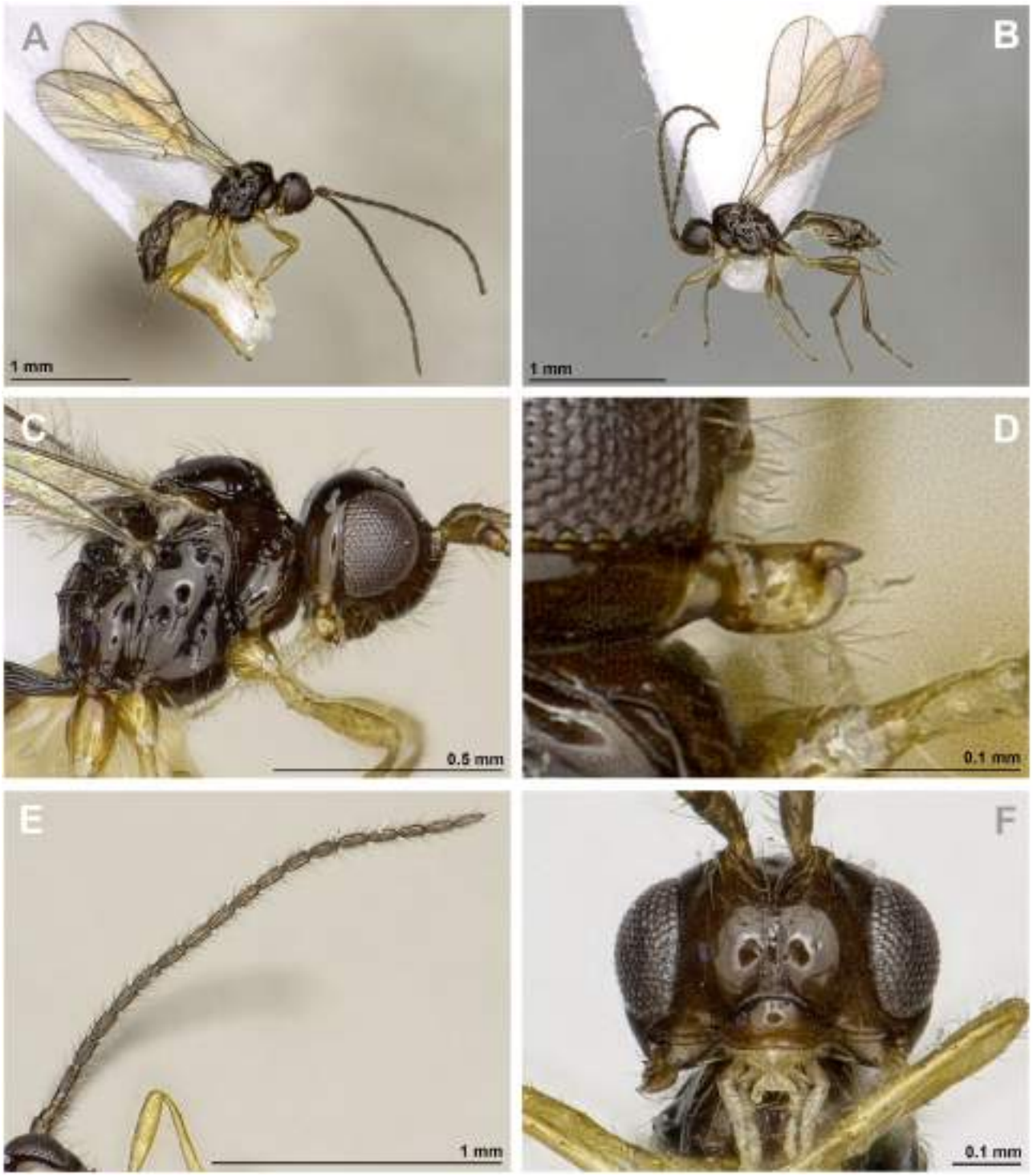

FIGURE 8. *Orthostigma (Whartonstigma) papuae* Peris-Felipo, **sp. nov.** (A, C–F holotype, female; B paratype, female). **A**. Habitus, lateral view. **B.** Habitus variety legs dark. **C**. Head and mesosoma, lateral view. **D**. Mandible. **E**. Antenna. **F**. Head, front view.

Paratypes: 1 female, same locality as holotype but, UTM (-5.22767, 145.0797), 175 m, 23–24.xi.2012, leg. Gewa, Damag, Novotny, Leponce, Plot 4, MAL-WAN-D-08/16-d08 (MNHM); 3 females, same locality as holotype, but UTM (-5.741031, 145.3294), 200 m, 2–3, 8–9, 30–31.xi.2012, leg. Dilu, Ray, Novotny, Leponce, MAL-MW0200B-09/16-d09, -15/16-d15, -06/16-d06 (MNHM, ZISP, PFEC); 1 female, same data as holotype, but MW0700-02, P4729; vial: 20610, MAL-MW0700'B-13/16-d13 (MNHM); 2 females, same data as holotype, but

7–8, 8–9.ix.2012, leg. Keltim, Uma, Novotny, Leponce, MAL-MW0700A-14/16-d14 and MAL-MW0700B-15/16-d15 (PFEC); 1 female, same data as holotype, but 22–23.v.2012, MW0700'C-10/16-d10 (ZISP); 1 female, same locality as holotype, but UTM (-5.721022, 145.2703), 1200 m, 26–27-x.2012, leg. Philip, Alois, Novotny, Leponce, MAL-MW1200B-02/16-d02 (MNHM); 2 females, same locality as holotype, but UTM (-5.759269, 145.2356), 1700 m, 25–26.x.2012 and 2–3.xi.2012, leg. Valeba, Tulei, Novotny, Leponce, MAL-MW1700A-01/16-d01 and MAL-MW1700C-09/16-d09 (MNHM, ZISP).

Description. Female (holotype).

Length. Body 1.7 mm, fore wing 1.9 mm, hind wing 1.3 mm.

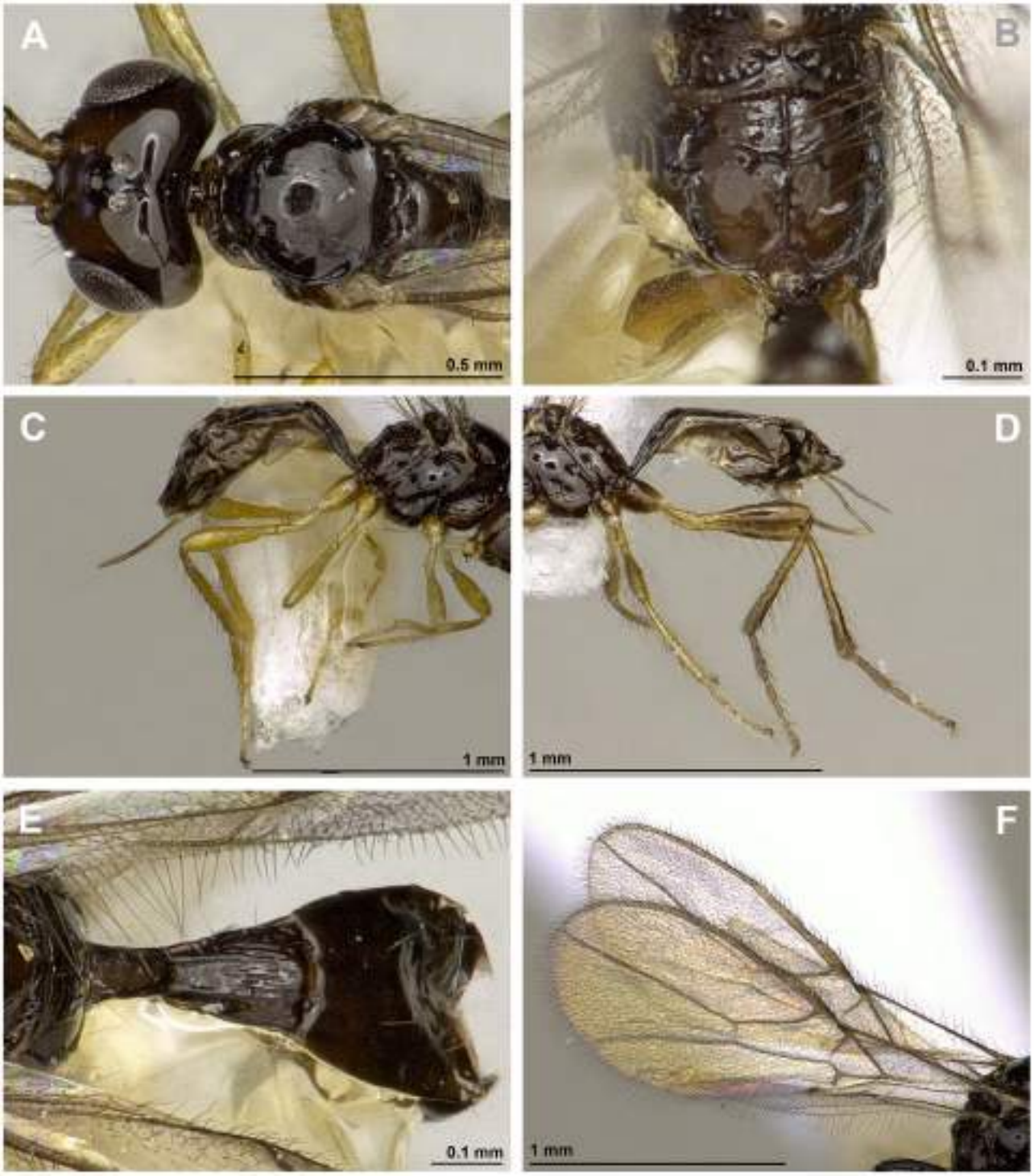

FIGURE 9. *Orthostigma (Whartonstigma) papuae* Peris-Felipo, **sp. nov.** (A–C, E–F, holotype, female; D, paratype, female). **A**. Head and mesonotum, dorsal view. **B.** Propodeum. **C**. Legs, metasoma and ovipositor, lateral view. **D.** Legs, dark variety. **E**. First metasomal tergite. **F**. Fore and hind wings.

Head. In dorsal view, 1.9 × as wide as long, 1.4 × as wide as mesoscutum, smooth, with temple rounded behind eyes. Eye in lateral view 1.4 × as high as wide and 1.7 × as wide as temple medially. POL 0.7 × OD; OOL 2.5 × OD. Face 1.6 × as wide as high, with very sparse setae laterally, almost entirely smooth; inner margins of eyes subparallel. Clypeus 2.0 × as wide as high, slightly concave ventrally. Paraclypeal fovea small, not reaching half distance between clypeus and inner border of eye. Mandible almost parallel-sided, 1.1 × as long as its maximum width; its middle tooth wide and rather short, partly directed below, lower tooth evenly curved on outside margin. Antenna with 19 antennomeres, 1.1 × as long as body. Scape 1.5 × as long as pedicel. First flagellomere 3.2 × as long as its maximum width, 1.3 × as long as second flagellomere. Second to 10th flagellomeres 2.3–2.4 ×, 11th to 16th flagellomeres 2.0 ×, and 17th (apical) flagellomere 3.0 × as long as their maximum width.

Mesosoma. In lateral view 1.1 × as long as high. Mesoscutum (dorsal view) about as long as its maximum width, smooth, sparsely setose. Notauli present only on vertical anterior surface of mesoscutum. Prescutellar depression (scutellar sulcus) smooth, only with median carina, 0.7 × as long as its maximum width. Precoxal sulcus wide, oblique, almost smooth, not reaching anterior and posterior margins of mesopleuron. Posterior mesopleural furrow smooth. Propodeum smooth, with complete median longitudinal carina, with short emerging carinae and not reaching propodeal edges. Propodeal spiracles very small, its diameter 0.2 × distance from spiracle to anterior margin of propodeum.

Wings. Length of fore wing 2.6 × its maximum width. Marginal cell ending on apex of wing, 4.0 × as long as its maximum width. Vein SR1 3.0 × as long as vein 3-SR. First subdiscal cell 3.8 × as long as its maximum width. Hind wing 6.4 × as long as its maximum width.

Legs. Hind femur 4.4 × as long as its maximum width. Hind tibia distinctly widened to apex, 7.7 × as long as its maximum subapical width, 1.1 × as long as hind tarsus. First tarsomere of hind tarsus 1.5 × as long as second tarsomere.

Metasoma. First tergite weakly evenly widened towards apex, 2.0 × as long as its apical width, striate. Ovipositor 1.3 × as long as first tergite, 0.4 × as long as metasoma, as long as hind femur.

Colour. Body, head, antennal segments and pterostigma dark brown. Mandible and legs light brown. First metasomal tergite similar colour to second and third tergites. Wings almost hyaline.

Variation. Body length 1.5–1.7 mm, fore wing 1.6–1.9 mm, hind wing 1.1–1.3 mm. Antenna with 16–19 antennomeres. First flagellomere 3.0–3.2 × as long as its maximum width. Mandible 1.1–1.2 × as long as its maximum width. Hind femur 4.0–4.4 × as long as its maximum width. Legs light brown to brown. Otherwise similar to holotype.

Male. Unknown.

Etymology. The name is referring to the inhabitants of Papua New Guinea, "Papú".

Comparative diagnosis. This new species is similar to Australian *Orthostigma* (*Papuastigma*) *gallowagi* Wharton; differences between both species are described under the latter species and in the key below.

Distribution. Papua New Guinea.

Orthostigma (*Whartonstigma*) *tropicale* Wharton, 2002

(Figs 10, 11)

Orthostigma tropicale Wharton, 2002: 95; Yu *et al*., 2016.

Material examined. Australia: 2 females (holotype and paratype), Queensland, 'Iron Range, Cape York Pen., N. Qld 1–9.vi.1971, S. R. Monteith' (ANIC); 1 male (paratype), 9 km ENE of Mt.Tozer, 5–10.vii.1986, coll. Cardale (ANIC).

Re-description. Female.

Length. Body 1.5–1.6 mm, fore wing 1.7–1.8 mm, hind wing 1.1–1.2 mm.

Head. In dorsal view, 2.0 × as wide as long, 1.4 × as wide as mesoscutum, smooth, with temple rounded behind eyes. Eye in lateral view 1.7 × as high as wide and 1.3 × as wide as temple medially. POL 0.7 × OD; OOL 2.7 × OD. Face 1.6 × as wide as high, almost entirely smooth; inner margins of eyes subparallel. Clypeus 2.7 × as wide as high, slightly concave ventrally. Paraclypeal fovea small, not reaching half distance between clypeus and inner border of eye. Mandible almost parallel-sided, about as long as its maximum width; its middle tooth wide and rather

short, partly directed below, lower tooth evenly curved on outside margin. Antenna with 20 antennomeres, 1.2 × as long as body. Scape 2.0 × as long as pedicel. First flagellomere 3.6 × as long as its maximum width, 0.9 × as long as second flagellomere. Second flagellomere 3.7 ×, third and fourth flagellomeres 3.0 ×, fifth to 16th flagellomeres 2.5–2.6 ×, 17th flagellomere 2.2 ×, and 18th flagellomere 3.0 × as long as their maximum width.

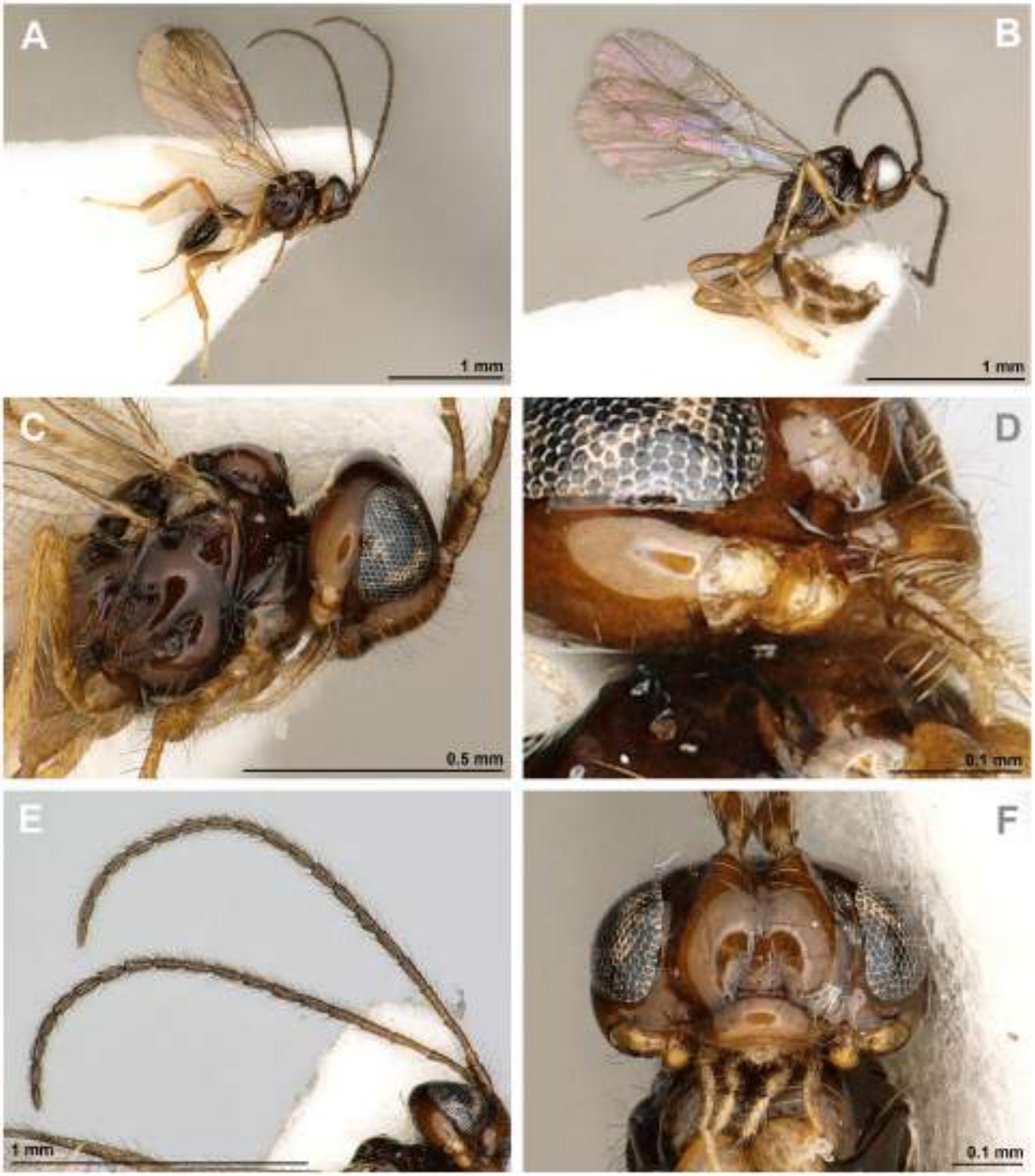

FIGURE 10. *Orthostigma (Whartonstigma) tropicale* Wharton, 2002 (A, C–F, holotype, female; B, paratype, male). **A–B**. Habitus, lateral view. **C**. Head and mesosoma, lateral view. **D**. Mandible. **E**. Antenna. **F**. Head, front view.

Mesosoma. In lateral view 1.2 × as long as high. Mesoscutum (dorsal view) 0.8 × as long as its maximum width, smooth. Notauli present only on vertical anterior surface of mesoscutum. Prescutellar depression (scutellar sulcus) smooth, only with median carina, 1.2 × as long as its maximum width. Precoxal sulcus wide, oblique, curved below, crenulate, reaching posterior margins of mesopleuron. Posterior mesopleural furrow crenulate below. Propodeum

smooth, with complete median longitudinal carina. Propodeal spiracles very small, its diameter 0.2 × distance from spiracle to anterior margin of propodeum.

Wings. Length of fore wing 2.1 × its maximum width. Marginal cell ending on apex of wing, 3.8 × as long as its maximum width. Vein SR1 2.5 × as long as vein 3-SR. Vein r longer than pterostigma width. First subdiscal cell 2.1 × as long as its maximum width. Hind wing 6.0 × as long as maximum width.

Legs. Hind femur 3.8 × as long as its maximum width. Hind tibia distinctly widened to apex, 7.5 × as long as its maximum subapical width, 1.1 × as long as hind tarsus. First tarsomere of hind tarsus 2.0 × as long as second tarsomere.

FIGURE 11. *Orthostigma (Whartonstigma) tropicale* Wharton, 2002 (holotype, female). **A**. Head and mesonotum, dorsal view. **B.** Propodeum. **C**. Legs, metasoma and ovipositor, lateral view. **D**. First metasomal tergite. **E**. Fore and hind wings.

Metasoma. First tergite weakly evenly widened towards apex, 2.1 × as long as its apical width, weakly striate. Ovipositor 1.2 × as long as first tergite, 0.5 × as long as metasoma, as long as hind femur.

Colour. Body, head, antennal segments, mandible and pterostigma brown to dark brown. Legs light brown. First metasomal tergite similar colour to second and third tergites. Wings almost hyaline.

Male. Body length 1.5 mm, fore wing 1.6 mm, hind wing 1.1 mm. Antenna with 21 antennomeres. First flagellomere 0.8 × as long as second flagellomere. Second flagellomere 4.3 × as long as width. Otherwise similar to female.

Comparative diagnosis. This species is similar to *Orthostigma* (*Whartonstigma*) *longipede*, **sp. nov.**; and differences between both species are described under the latter species and in the key below. On other hand, this species differs from *Orthostigma* (*Whartonstigma*) *gallowagi* (Wharton, 2002) and *Orthostigma* (*Whartonstigma*) *papuae*, **sp. nov.** having the clypeus 2.7 × as wide as high (2.0 × in *O. papuae*), eye in lateral view 1.3 × as wide as temple medially (3.0 × in *O. gallowagi* and 2.0 × in *O. papuae*), first flagellomere 3.6 × as long as its maximum width (2.8 × in *O. gallowagi* and 3.0–3.2 × in *O. papuae*), second flagellomere 3.7 × as long as its maximum width (2.4 × in *O. gallowagi* and *O. papuae*), first metasomal tergite 2.1 × as long as its apical width (2.5–2.8 × in *O. gallowagi*), hind femur 3.8 × as long as its maximum width (4.5 × in *O. gallowagi*), and precoxal sulcus crenulated and reaching posterior margins of mesopleuron (not reaching in *O. gallowagi* and *O. papuae*).

Distribution. Australia.

Key to species of *Orthostigma* (*Whartonstigma*)

1. Eye in lateral view 1.3 × as wide as temple medially (Fig. 10C). Precoxal sulcus crenulated and reaching posterior margins of mesopleuron (Fig. 10C). Body length 1.5–1.6 mm. Australia. . . . . ***O.* (*W.*) *tropicale*** (Wharton) (♀♂)
- Eye in lateral view 1.7–2.0 × as wide as temple medially (Fig. 4B, 6B, 8C). Precoxal sulcus almost smooth and not reaching anterior and posterior margins of mesopleuron (Fig. 4B, 6B, 8C). **2**
2(1). Head in lateral view distinctly and sublinearly narrowed dorsally (Fig. 6B). First flagellomere 3.8 × as long as its maximum width (Fig. 6D). Second flagellomere 3.9 × as long as its maximum width (Fig. 6D). First subdiscal cell of fore wing 3.0 × as long as its maximum width (Fig. 7D). Hind tibia 6.5 × as long its maximum subapical width (Fig. 7B). Body length 1.9–2.0 mm. Papua New Guinea. . . . . ***O.* (*W.*) *longipede* sp. nov.** (♀)
- Head in lateral view weakly and roundly narrowed dorsally (Figs 4B, 8C). First flagellomere 2.8–3.2 × as long as its maximum width (Fig. 4D, 8E). Second flagellomere 2.4 × as long as its maximum width (Fig. 4D, 8E). First subdiscal cell of fore wing 3.8–4.0 × as long as its maximum width (Fig. 5D, 9F). Hind tibia 7.7 × as long its maximum subapical width (Fig. 5B, 9C-D). **3**
3(2). First metasomal tergite 2.0 × as long as its apical width, widened towards apex (Fig. 9E). Mandible 1.1–1.2 × as long as its maximum width (Fig. 8D). Clypeus 2.0 × as wide as high (Fig. 8F). Marginal cell of fore wing 4.0 × as long as its maximum width (Fig. 9F). Propodeum with emerging carina from median longitudinal carina, with short emerging carinae (Fig. 9B). Body length 1.5–1.7 mm. Papua New Guinea. . . . . ***O.* (*W.*) *papuae* sp. nov.** (♀)
- First metasomal tergite 2.5–2.8 × as long as its apical width, almost parallel-sided (Fig. 5C). Mandible 1.5–1.6 × as long as its maximum width (Fig. 4C). Clypeus 3.0 × as wide as high (Fig. 4E). Marginal cell of fore wing 4.6 × as long as its maximum width (Fig. 5D). Propodeum without emerging carina from median longitudinal carina, without short emerging carinae and not reaching propodeal edges (Fig. 5A). Body length 1.5–1.7 mm. Australia. . . . . ***O.* (*W.*) *gallowagi*** (Wharton) (♀♂)

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