

## Taxonomic notes on the *Polistes stigma* group (Hymenoptera, Vespidae: Polistinae) from continental Southeast Asia, with descriptions of three new species and a key to species

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**Abstract.** Taxonomic notes are presented on the *Polistes stigma* species group of the subgenus *Polistella* Ashmead, 1904, of the genus *Polistes* Latreille, 1802, in continental Southeast Asia. Three new species are described and illustrated: *Polistes brunus* Nguyen & Carpenter, new species; *P. communalis* Nguyen, Vu & Carpenter, new species; and *P. tenebris* Nguyen & Lee, new species. A key to these species is provided. Their nests are also described.

**Key words.** Vespidae, *Polistes stigma*, paper wasps, new species, nest, key, Vietnam, Singapore

### INTRODUCTION

*Polistella* is one of the four subgenera of the genus *Polistes* and presently contains 86 species and 34 subspecies distributed from Africa to Australia (Carpenter, 1996b, updated). *Polistella* was divided into four species groups, namely the *P. adustus* group, *P. stigma* group, *P. sagittarius* group, and so-called “*Stenopolistes*,” by Carpenter (1996a). The *P. stigma* group includes the species with an apically spotted fore wing, and originally contained two species (Das & Gupta, 1989): *P. stigma* (Fabricius, 1793) and *P. latinis* Das & Gupta, 1989. Its composition was modified by Carpenter (1996a), with three additional species included (Carpenter, 1996b). The group is Indo-Australian, with *P. stigma* itself comprising many subspecies.

In continental Southeast Asia only one species in the *Polistes stigma* group, *P. stigma*, has been recorded. For example, in Vietnam, *P. stigma* was recorded from Dong Nai province by Nguyen & Kojima (2014). In Singapore, Dover (1929) listed *Polistes marginalis* var. *stigma* and *Polistes maculipennis* but the latter is now a subspecies of *P. stigma*.

In this study, based on specimens deposited in the Institute of Ecology and Biological Resources (IEBR) and the Vietnam National Museum of Nature (VNMN), Vietnam, the Zoological Reference Collection (ZRC) of the Lee Kong Chian Natural History Museum, National University of Singapore and the Insect Diversity Laboratory reference collection (IDL), National University of Singapore, three new species belonging to this species group are described as new to science. A key to the known species and subspecies of the group in continental Southeast Asia is also presented.

### MATERIAL & METHODS

The adult morphological and colour characters except for male terminal sterna and genitalia were observed on pinned and dried specimens under a stereomicroscope. Apical parts of male metasomata were dissected for the terminal sterna and genitalia. They were put in 10% lactic acid for several hours, washed in distilled water, and observed in glycerin under a stereomicroscope. The terminology of male genitalia follows Kojima (1999). Drawings were made with the aid of a drawing tube. Photos were taken with a Panasonic Lumix DMC-FX 100 (Kadoma, Osaka, Japan) and a Leica M80 Digital Stereo Microscope (Leica Microsystems GmbH, Wetzlar, Germany), using LAS exclusive microscopy software (LAS EZ 3.1.1).

In the descriptions of morphology, the following abbreviations are used: POD, distance between the inner margins of the posterior ocelli; OOD, distance between the outer margin of the posterior ocellus and the inner margin of the eye at vertex; Od, transverse diameter of the posterior ocellus.

The parts measured for the morphometrics are defined as follows: body length = the lengths of head, mesosoma and first two metasomal segments combined; clypeus width = the distance between the uppermost part where clypeus touches the eyes; clypeus height = the distance from the bottom of

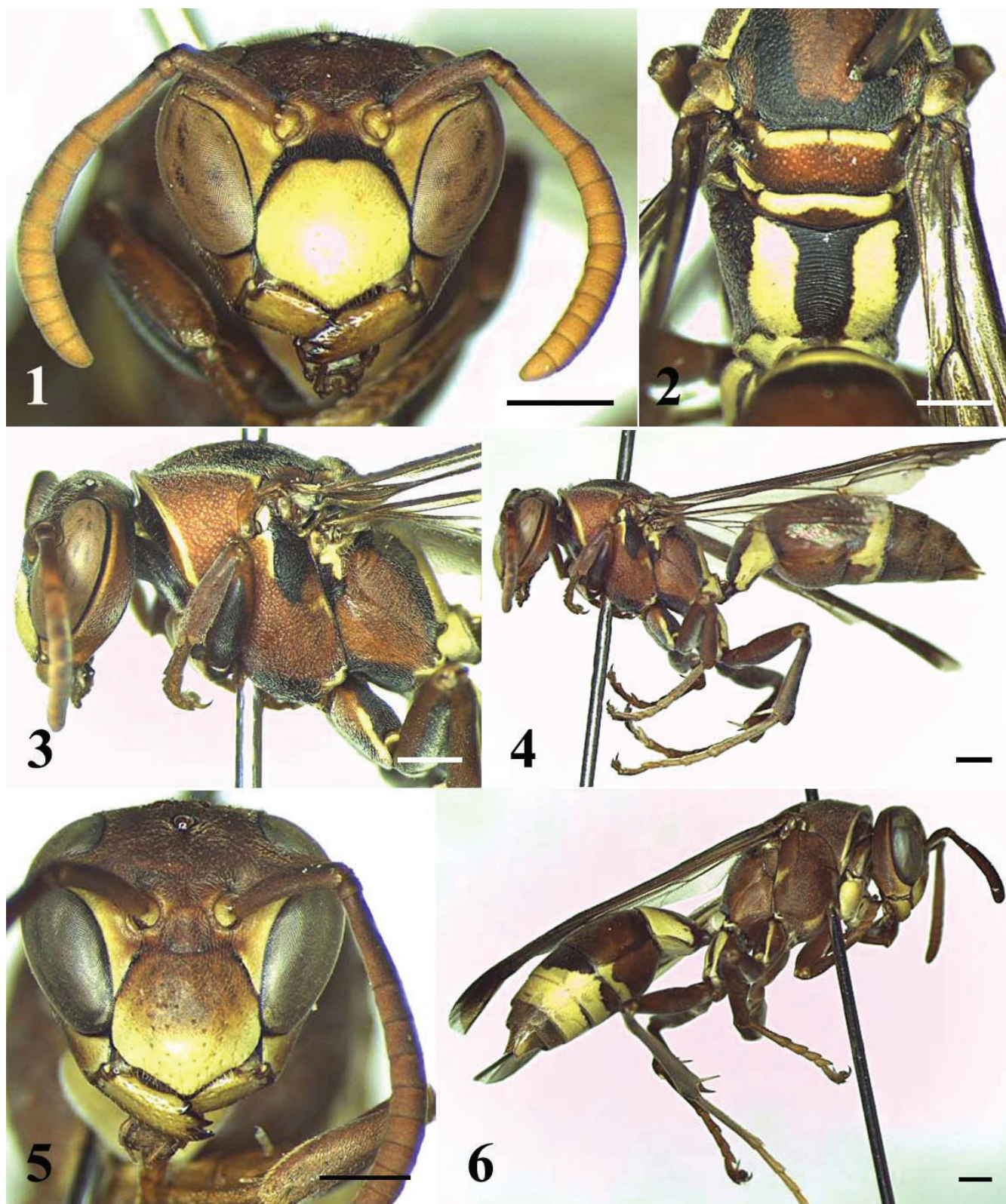
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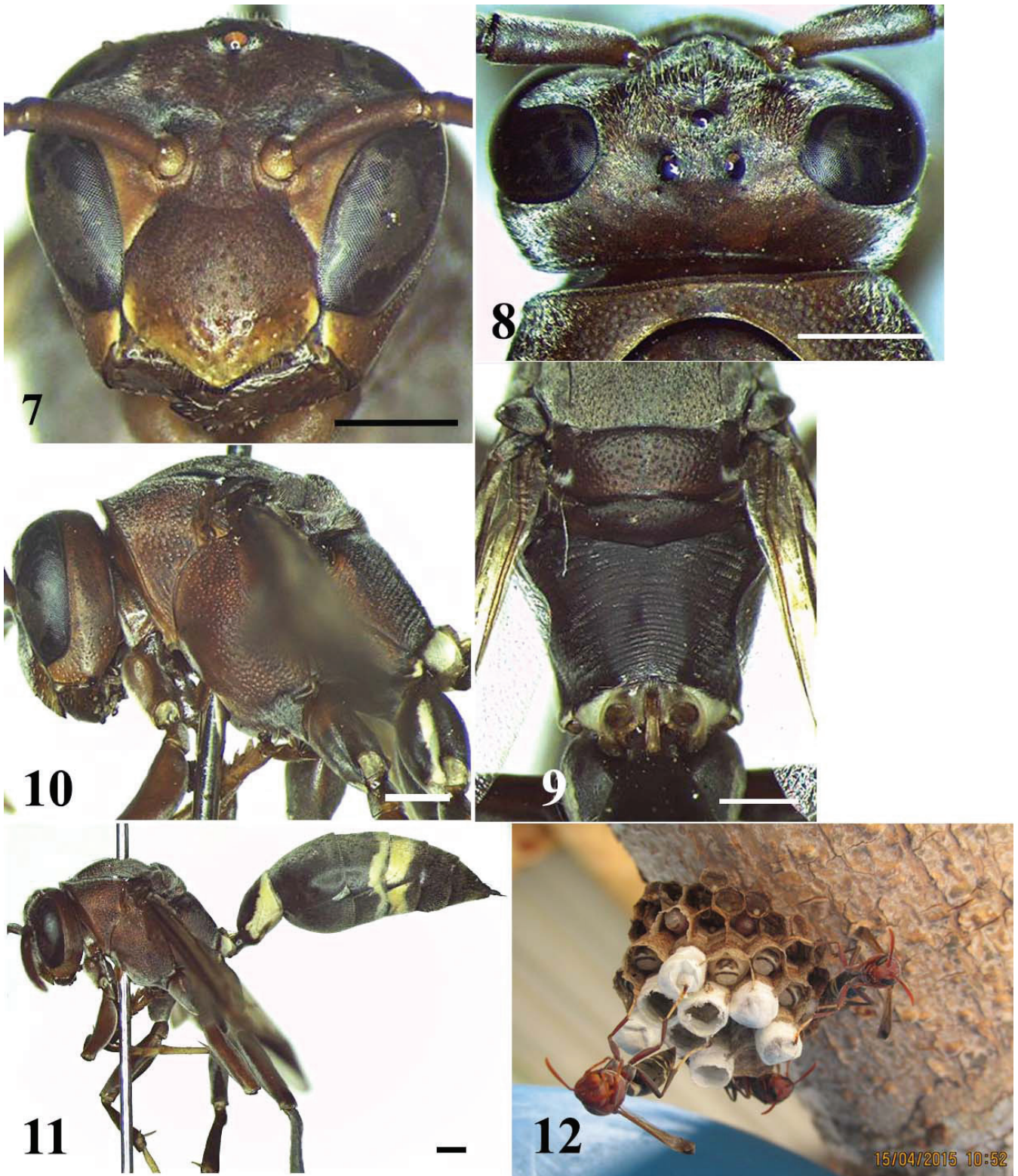


Figs. 1–6. *Polistes stigma*. 1–4, *Polistes s. stigma*, female. 1, Head, frontal view; 2, Propodeum, dorsal view; 3, Head & thorax, lateral view; 4, Habitus. 5–6, *P. s. tamulus*, female. 5, Head, frontal view; 6, Habitus. Scale bar = 1 mm.

the dorsal emargination to the apex; distance between inner eye margins at vertex and at clypeus = the distance between the inner eye margins at the level of the anterior ocellus in frontal view of the head and at the level where the inner eye margins approach each other most closely; interantennal and antennocular distances = the distance between the inner margins of antennal sockets and between the outer margin of

the antennal socket and inner eye margin at the level of the middle of the antennal socket, respectively; antennal socket width = the transverse diameter; eye width = the maximum width of the eye in strictly lateral view of the head; gena width = the maximum width of the gena in strictly lateral view of the head; metasomal tergum 1 length = the distance in lateral view from the posterior end of the basal slit for





Figs. 7–12. *Polistes brunus*, new species, female. 7, Head, frontal view; 8, Vertex, dorsal view; 9, Propodeum, dorsal view; 10, Head & thorax, lateral view; 11, Habitus. Scale bar = 1 mm. 12, Nest.

the reception of the propodeal suspensory ligament to the posterodorsal end of the tergum; metasomal tergum 2 length = the distance in lateral view from the bottom of the basal depression or “neck” to the posterodorsal end of the tergum; metasomal tergum 1 and 2 width = the maximum width for each in dorsal view.

The nest characters, including measurements of various parts given below, were examined after the immatures had been extracted and the nests air-dried. The length and thickness (minimum and maximum thicknesses at the mid-length) of a nest pedicel and the distance between opposite sides of a cell containing a pupa or having the trace of a cocoon cap (“cell width”) were measured to the nearest 0.1 mm with

Vernier calipers. The thickness of a cell wall was taken with a micrometer to the nearest 0.01 mm. The terminology of nest characters follows Wenzel (1998). In the description of nest comb shapes, “ventral” and “dorsal” refer to the directions corresponding to cell openings and cell bottoms, respectively.

Abbreviations are as follows: Institute of Ecology and Biological Resources, IEBR; National Park, NP; National Reserve, NR; National University of Singapore, NUS.

## TAXONOMY

### *Polistes (Polistella) stigma stigma* (Fabricius, 1793) (Figs. 1–4)

*Vespa stigma* Fabricius, 1793: 275 – “in India orientali” (The lectotype was designated by Petersen (1987: 234), in the Fabrician collection in Copenhagen).

**Material examined.** VIETNAM (IEBR): **Dong Nai:** 5 females, Nam Cat Tien NP, Tan Phu, Nest#VNM-Poli-2005-4, 8 August 2005, coll. L.T.P. Nguyen & J. Kojima; **Son La:** 1 female, Quang Huy, Phu Yen, 21°15'50"N, 104°38'56"E, 18 June 2015, coll. D.D. Nguyen, IEBR. SINGAPORE (ZRC): Jalan Bahar: 1 female, Jalan Bahar, Lorong Danau, 1°21'32.0"N, 103°41'27.9"E, 3 March 2012, coll. J.X.Q. Lee; 1 female, Mandai, Night Safari, 1°24'10.9"N, 103°47'15.1"E, 11 August 2015, coll. J.X.Q. Lee; 1 female, Pasir Ris Park, 1°22'45.8"N, 103°56'59.3"E, 29 May 2014, coll. J. S. Ascher, E. J. Y. Soh, S. X. Chui et al.; 1 male, 2 females, Kranji Nature Trail, coordinates unknown, 15 March 2008, collected by Sungei Buloh Wetland Reserve volunteers, NUS.

**Distribution.** Thailand; Malaysia; Singapore; Indonesia: Sumatra, Java, Bali, Lombok; China: Hongkong; Taiwan; Vietnam.

### *Polistes (Polistella) stigma tamula* (Fabricius, 1798) (Figs. 5, 6)

*Vespa tamula* Fabricius, 1798: 263 – “In India Orientali” (Copenhagen).

**Material examined.** VIETNAM (IEBR): **Hai Phong:** 2 females, Dao Khi, Cat Ba NP, Cat Hai, 20°43'81"N, 107°4'74"E, ca 30 m, 26 July 2013, coll. L.T.P. Nguyen & D.D. Nguyen.

**Distribution.** India: Himachal Pradesh, Delhi, Bihar, West Bengal, Goa, Maharashtra, Karnataka, Kerala, Tamil Nadu; Sri Lanka; Vietnam (new record).

### *Polistes (Polistella) brunus* Nguyen & Carpenter, new species (Figs. 7–12)

**Material examined.** HOLOTYPE: 1 female, pinned (deposited in the Institute of Ecology and Biological

Resources, Hanoi). Original label: “VIETNAM, Dak Lak, Ea Kar, Ea So, Ea So NP station 5, 12°55'24.3"N, 108°33'04"E, 95 m, Nest# VN-TN-2015-P-02, 15.IV.2015, L.T.P. Nguyen, D.D. Nguyen & M.P. Nguyen”. PARATYPES: VIETNAM (IEBR): **Dak Lak:** 7 females, 1 queen, same data as holotype; 4 females, Station 5, Ea So natural reserve, Ea So, Ea Kar, 12°55'24.3"N, 108°33'04"E, 95 m, Nest# VN-TN-2015-P-03, 13 April 2015, coll. L.T.P. Nguyen, D.D. Nguyen & M.P. Nguyen; 3 females, Yok Don NP station, Buon Don, 12°52'19.1"N, 107°48'25.9"E, ca 190 m, 9 June 2013, coll. L.T.P. Nguyen; 2 females, Buon Don, 28 April 2008, coll. H.T. Ngo; **Gia Lai:** 2 females, Ia Pal, Chu Se, 13°39'46.2"N, 108°08'04"E, ca 370 m, 25 July 2012, coll. L.T.P. Nguyen; **Quang Tri:** (1 female, A Ngo, Dak Rong, 150–200 m, 31 May 2006; 1 female, Ta Rut, Dak Rong, 300 m, 2 May 2006) Insect Systematic Department collectors.

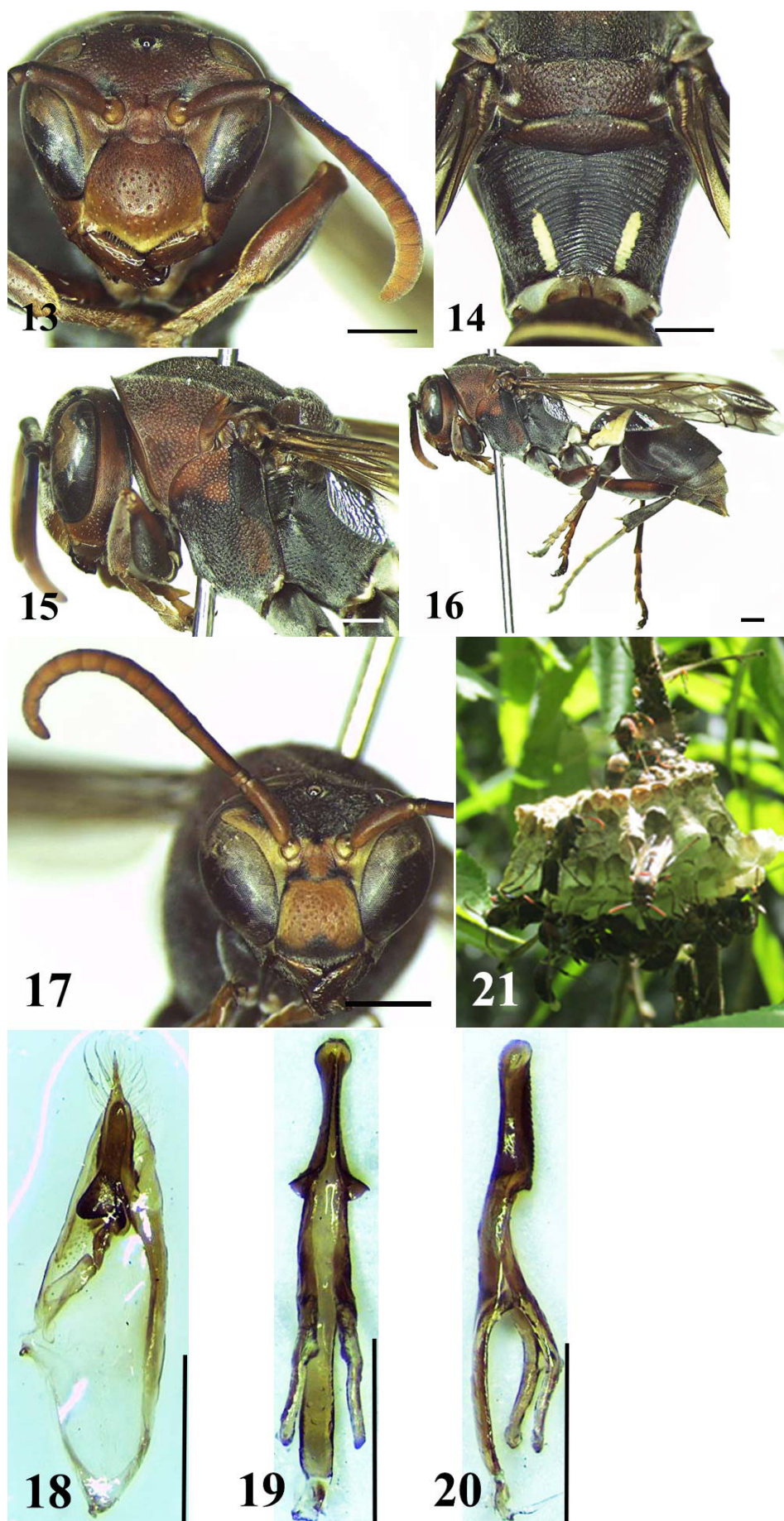
**Diagnosis.** This species can be distinguished from congeners by the following combination of characters: Gena in lateral view about 0.8 times as wide as eye; length of lateral margin of clypeus lying along inner eye margin slightly shorter than diameter of antennal socket and about as long as the length of malar space; flagellomere I 2.8 times as long as its maximum width; body coarsely punctate, mainly brown.

**Female.** Body length 10.1–13.7 mm (holotype: 11.9 mm); fore wing length 9.2–13.4 mm (holotype: 11.3 mm).

Head in frontal view about 1.1 times as wide as high (Fig. 7); in dorsal view weakly swollen laterally behind eyes, then narrowed posteriorly, with posterior margin shallowly and broadly emarginate. Vertex slightly raised in area within ocelli, slightly declivous behind posterior ocelli towards occipital carina; with two small foveae just behind posterior ocelli (Fig. 8); POD : OOD = about 1 : 1.5; POD about 2.1 times Od (Fig. 8). Gena, in lateral view about 0.8 times as wide as eye (Fig. 10); occipital carina fine, evanescent on ventral third of gena. Inner eye margins weakly convergent ventrally, in frontal view about as far apart from each other at clypeus as at vertex. Antennal sockets closer to inner eye margin than to each other; the distance from anterior tentorial pit to antennal socket as far as to inner eye margin; interantennal space weakly raised. Clypeus in frontal view slightly wider than high, produced ventrally into blunt angle (Fig. 7); in lateral view strongly swollen anteriorly; length of lateral margin of clypeus lying along inner eye margin slightly shorter than diameter of antennal socket and about as long as the length of malar space. Antenna: scape 2.8 times as long as its maximum width; flagellomere I 2.8 times as long as its maximum width, about 1.3 times as long as the length of flagellomeres II and III combined; flagellomere II and III longer than wide; flagellomere IV–IX wider than long, terminal flagellomere bullet-shaped, about 1.2 times as long as its basal width.

Pronotal carina sharply raised, produced dorsally into thin lamella in dorsal part, slightly sinuate backward on lateral side, nearly reaching ventral corner of pronotum. Mesoscutum strongly convex, as long as wide between tegulae; anterior margin broadly rounded. Scutellum convex, slightly concave





Figs. 13–21. *Polistes communalis*, new species. 13–16, female. 13, Head, frontal view; 14, Propodeum, dorsal view; 15, Head & thorax, lateral view; 16, Habitus. 17–20, male. 17, Head, frontal view; 18–20, Genitalia. 18, Inner aspect of paramere with digitus and volsella; 19, 20, Aedeagus (19, Ventral view; 20, Lateral view). Scale bar = 1 mm. 21, Nest.

medially. Metanotum weakly convex, with strongly depressed anterior margin. Propodeum short (Fig. 9); posterior face widely (about half the maximum width of propodeum) and shallowly excavated medially, more or less smoothly passing into lateral faces; propodeal orifice elongate, about 1.8 times as long as wide (measured at widest part), somewhat narrowed in dorsal half. Wings hyaline, jugal lobe of hind wing large and pointed.

Metasomal tergum I short, about 0.9 times as long as its apical width, in lateral view abruptly swollen dorsally just behind basal slit for reception of propodeal suspensory ligament; corner between anterior and dorsal faces rounded. Sternum II in lateral view swollen ventrally in smoothly curved line to apical margin.

Clypeus with scattered large punctures, each bearing sharply pointed golden bristle; tomentum on clypeus covering approximately dorsal half of clypeus. Mandible with scattered medium deep punctures. Frons covered with shallow punctures. Vertex and gena with sparse small and shallow punctures; area around ocelli almost smooth, with several shallow punctures close to median ocellus; ventral third of gena with scattered coarse punctures. Pronotum with dense, coarse flat-bottomed punctures (Fig. 10). Mesoscutum with dense, medium, shallow punctures. Punctures on scutellum denser and coarser than those on mesoscutum. Punctures on metanotum sparser and shallower than those on scutellum. Mesepisternum with dense, coarse, well-defined punctures in posterodorsal part (punctures in dorsal margin similar to those on pronotum), scattered punctures in anteroventral part; border between posterodorsal and anteroventral parts indistinct. Dorsal metapleuron with several short and weak striae; ventral metapleuron with sparse shallow punctures. Propodeum with strong transverse striae (Fig. 9), striae weaker laterally. Metasomal segments with minute punctures in addition to scattered small punctures (stronger and larger on sterna); sternum V–VI covered with long hairs.

**Colour.** Dark brown; following parts yellow to orange-yellow: apical margin of clypeus, spot at base of mandible, band along inner eye margin extending from bottom of frons to middle of eye emargination; valvula; apical band of tergum I extending laterally toward its base, a medial band on tergum IV; thin longitudinal stripe on hind coxae; middle and hind tarsi; following parts black: propodeum posteriorly, abdomen except yellow parts, all legs except tarsi.

**Male.** Unknown.

**Nest.** Nest#VN-TN-2015-P-02 (Fig. 12) was collected together with eight females. The nest was attached to a woody crossbeam of a house, at about 2 m above the ground, and has 56 cells, with four pupae. Nest#VN-TN-2015-P-03 was collected with five adult female wasps. The nest was attached to a ceiling of a store, about 1.3 m above the ground, and has 58 cells, with six pupae. The structural and morphological characters are as follows: Comb tough, pliable “paper”-like in texture, more or less uniformly gray in cell wall, subcircular (about 23 × 20 mm for Nest#VN-TN-2015-P-02 and about

26 × 23 mm for Nest#VN-TN-2015-P-03) in view from side of cell opening, expanded concentrically from the single petiole, with surface corresponding to cell bottom slightly convex. The two nests have the single petiole central; in Nest#VN-TN-2015-P-02 it is 3.2 mm long and 1.0 × 0.9 mm thick, and in Nest#VN-TN-2015-P-03 it is 4.8 mm long and 1.3 × 0.9 mm thick at the mid-length of petiole, with a thin central core of plant fibers, enlarged strictly with adult oral secretion, dark brown and lustrous, secretion coat expanded on comb back around the petiole and on substrate in a thin film about 2 × 2.5 mm. Cells are generally arranged in regular rows, hexagonal at open end when surrounded by other cells, with free margins rounded; for Nest#VN-TN-2015-P-02 each cell expanded towards open end, 4.7 mm (range 4.2–5.7 mm; n=10) wide at open end, 11.7 (range 10–13.3 mm; n=10) mm deep in full grown cells, cell wall about 0.08 mm thick, for Nest#VN-TN-2015-P-03 each cell expanded towards open end, 4.5 mm (range 4.0–5.6 mm; n=10) wide at open end, 14.5 mm (range 10.8–16 mm; n=10) deep in full grown cells, cell wall about 0.09 mm thick. Cocoon caps white, produced beyond rim of cell by 1–4 mm, slightly domed.

**Distribution.** Known only from localities in Vietnam listed above.

**Etymology.** The specific name, *brunus*, is a Latin adjective, referring to the brown body colour.

***Polistes (Polistella) communalis* Nguyen, Vu &  
Carpenter, new species  
(Figs. 13–21)**

**Material examined.** HOLOTYPE: female, pinned (deposited in the Institute of Ecology and Biological Resources, Hanoi). Original label: “VIETNAM, Son La, Phu Yen, Gia Phu, Vo Nguyen Giap forest, 21°13'07.9"N, 104°32'39.7"E, 350 m, Nest# VN-SL-2015-P-02, 18-VI-2015, D.D. Nguyen”. PARATYPES (IEBR): VIETNAM: **Dak Lak:** 1 female, Station 9, Ea So natural reserve, Ea So, Ea Kar, 12°59'15"N, 108°40'18"E, ca 350 m, 15 April 2015, coll. L.T.P. Nguyen, D.D. Nguyen & M.P. Nguyen; **Nghe An:** 1 female, Pu Mat NP, Con Cuong, 27 July 2004, coll. L.T.P. Nguyen; **Son La:** 5 females, 6 males, same data as holotype; Vo Nguyen Giap forest, Gia Phu, Phu Yen, 21°13'07.9"N, 104°32'39.7"E, 350 m (1 female, 18 June 2015, coll. D.D. Nguyen; 1 female, 17 June 2015, coll. D.T. Nguyen); **Tuyen Quang:** 10 females, Bac Vang ranger station, Na Hang national reserve, Na Hang, 22°29'43"N, 105°25'26.8"E, ca 150 m, 10 June 2015, coll. L.T.P. Nguyen, D.D. Nguyen & L.X. Truong; 1 female, Na Hang NR, Son Phu ranger station, 22°20'52.6"N, 105°25'49"E, ca 120 m, Nest#VN-TQ-2015-P-02, 10 June 2015, coll. L.T.P. Nguyen, D.D. Nguyen & L.X. Truong; (VNMN): **Tuyen Quang:** 5 females (VNMN\_E 000.000.130, VNMN\_E 000.000.131, VNMN\_E 000.000.132, VNMN\_E 000.000.133, VNMN\_E 000.000.134). Bac Vang ranger station, Na Hang national reserve, Na Hang, 22°29'43"N, 105°25'26.8"E, ca 150 m, 10 June 2015, coll. L.T.P. Nguyen, D.D. Nguyen & L.X. Truong.



**Other material examined.** VIETNAM (IEBR): **Bac Giang:** Thanh Son, Son Dong, 1 female, 7 July 2010, coll. D.D. Tran; 1 female, 300m, 1 July 2010, coll. H.P. Pham; 1 female, Khe Vang, An Lac, Son Dong, 21°18'N, 106°56'E, 4 June 2014, coll. L.T.P. Nguyen, D.D. Nguyen & D.D. Tran; **Ha Giang:** 1 female, Tung Ba, Vi Xuyen, 24 June 2013, coll. T.T. Van; **Ha Noi:** 7 females, 4 males, Ba Vi NP, Van Hoa, Ba Vi, 3 June 2001, coll. L.T.P. Nguyen; 1 female, Khoang Xanh, Yen Hoa, 100 m, 1 June 2001, coll. L.T.P. Nguyen; **Hai Phong:** Cat Ba NP, Cat Hai, 1 female, 15–18 July 2003, coll. L.T.P. Nguyen; **Hoa Binh:** 1 female, 2 males, Lac Village, Chieng Chau, Mai Chau, 600 m, 10 June 2008, coll. L.T.P. Nguyen; P.H. Pham; Da Phuc, Yen Thuy (1 female, 4 May 2002, coll. T.V. Hoang; 3 females, 16 July 2000, coll. L.X. Truong; 1 female, Malaise trap, 1–10 June 2002); Ninh Binh: Cuc Phuong NP (1 female, 1 May 2002; 1 female, 9-V-2002), coll. T.V. Hoang; **Lang Son:** 1 female, Dinh Lap, Nong Truong, 16 May 2013, coll. D.D. Tran; **Lao Cai:** 1 female, Ban Xeo, Bat Xat, 23 June 2008; coll. L.T.P. Nguyen & P.H. Pham; **Thai Nguyen:** 1 female, Phuc Xuyen, Dai Tu, 23 April 2012, coll. L.D. Khuat; 1 female, Xom O, Yen Lac, Phu Luong, 2 June 2014, coll. L.T.P. Nguyen & T.T. Van; **Thanh Hoa:** Xuan Lien NR, Hon Can, Van Xuan, Thuong Xuan, ca. 110m, 19°52'27.5"N, 105°14'20.8"E, 23 August 2012, coll. L.T.P. Nguyen; 6 females, Xuan Hoa, Nhu Xuan, light trap, 29 May 2008; 1 female, Lung Cao, Ba Thuoc, 500 m, 12 June 2003, coll. L.T.P. Nguyen; **Vinh Phuc:** 1 female, Me Linh, Vinh Yen (3 female, 22 August 2000, coll. L.T.P. Nguyen; 1 female, 10 June 2014, coll. D.D. Nguyen); 1 female, Tam Dao NP, <50 m, 21 August 2005, coll. L.T.P. Nguyen & J. Kojima, **Phu Tho:** 6 females, Ha Hoa, 19 May 2016, coll. T. T. Vu.

**Diagnosis.** This species can be distinguished from congeners by the following combination of characters: Gena in lateral view slightly wider than eye; length of lateral margin of clypeus lying along inner eye margin 0.7 times as long as diameter of antennal socket and the length of the malar space; flagellomere I 3 times as long as its maximum width; body with coarse punctures and extensive brown marks; wings light yellow except dark spots at apical margins of fore wings.

**Female.** Body length 10.1–12.7 mm (holotype: 12.3 mm); fore wing length 9.8–12.4 mm (holotype: 12.1 mm).

Structure as in *Polistes brunus*, new species, but differing as follows: POD : OOD = about 1 : 1.5; POD about 2 times Od. Gena in lateral view slightly wider than eye (Fig. 15). Inner eye margins in frontal view slightly further apart from each other at vertex than at clypeus. Clypeus in frontal view slightly wider than high (Fig. 13), length of lateral margin of clypeus lying along inner eye margin 0.7 times as long as diameter of antennal socket and the length of malar space. Antenna: flagellomere I 3 times as long as its maximum width.

Body punctures slightly coarser than in *P. brunus*, especially punctures on frons and mesoscutum much coarser than those on frons and mesoscutum of *P. brunus*. Dorsal metapleuron with longer and wider striae than in *P. brunus*.

**Colour.** Black; following parts yellow: apical margin of clypeus, a faint narrow band along inner eye margin extending from bottom of frons to end of eye emargination; two short and narrow bands at basal margin of metanotum; two longitudinal narrow strips on posterior face of propodeum; valvula; apical band of tergum I (extending laterally toward its base); thin longitudinal stripe on hind coxae; following parts brown to dark brown: head including antenna beneath, pronotum, two large spots on mesepisternum, two oblique bands on mesoscutum, scutellum, metanotum, two faint marks on tergum I, a band at apical margin of terga V–VI, stripe on outer side of all tibiae and femora and all tarsi.

**Male.** Body length 10.7 mm–11.5 mm; fore wing length 10.5 mm–11.3 mm.

Similar to female, but differing as follows: head about 1.2 times as wide as high in frontal view (Fig. 17); eye strongly swollen laterally; inner eye margins 1.3 times as far from each other at vertex as at clypeus; gena in lateral view about half as wide as eye; clypeus (Fig. 17) in frontal view slightly wider than high, only slightly produced ventrally, evenly and slightly convex apically, in lateral view weakly convex in dorsal part. Antenna (Fig. 17) more slender than in female; scape about 2.7 times as long as its maximum width; flagellomere I longer than length of flagellomeres II and III combined; flagellomeres II–X longer than wide; terminal flagellomere elongate, slightly curved, about 2.2 times as long as its basal width. Metasomal sternum VII depressed medially, without tubercle.

Body surface sculpture as in female, but clypeus with scattered medium punctures, densely covered with short silver hairs together with long golden bristles, and with a faint longitudinal ridge medially.

Colour and marking pattern similar to females, but more extensively marked with black as follows: apical and basal margins of clypeus, frons, gena except a narrow brown band along eye margin, mandible, mesoscutum entirely, metanotum except two short and narrowed yellow bands at basal margin, tergum I entirely.

**Male genitalia.** Lamina volsellaris desclerotised and fused with cuspis. Digitus in inner aspect of paramere (Fig. 18) about 3.1 times as long as wide (measured at widest part), distinctly swollen near base, gradually narrowed apically to mid-length, then slightly swollen towards the rounded apex. Aedeagus (Figs. 19, 20): penis valves about 0.6 times as long as basal apodeme, in ventral view narrowest near mid-length, weakly swollen proximally from mid-length then distinctly produced laterally near proximal margin, in lateral view slightly thickened in proximal one fourth and with dorsal margin weakly sinuate, with proximoventral corner produced into obtuse angle (Fig. 20); ventral margins of penis valves finely serrate along entire length.

**Nest.** Nest#VN-SL-2015-P-02 (Fig. 21) was collected together with six females and six males. The nest was attached to a tree of the genus *Boehmeria* (family Urticaceae),

at about 1.5 m above the ground, and has 119 cells, with six pupae, without eggs. The structural and morphological characters are as follows: Comb “paper”-like in texture, made mainly of long, fine plant fibers and wasp adult oral secretion, more or less uniformly brownish-grey in cell walls, suboval (about 55 × 40 mm) when viewed from side of cell opening, expanded excentrically from the single terminal petiole, with surface corresponding to cell bottom weakly convex; Petiole single, terminal, attached to the border between bottoms of the first three cells, 4.3 mm long and 1.1 mm × 1.9 mm thick at the mid-length, with thin central core of plant fibers, enlarged strictly with adult oral secretion, blackish brown and lustrous, secretion coat widely expanded on comb back around the petiole and on substrate in thin film; Cells generally arranged in regular rows, hexagonal at open end when surrounded by other cells, with free margins rounded, each cell weakly expanded towards open end, 4.5 mm (range 4.1 mm–5.9 mm; n=10) wide at open end, 3.5 mm (range 2.6–4.2 mm; n=10) wide at bottom and 15.6 mm (range 14 mm–17.3 mm; n=10) deep in cells containing pupae or having produced adult, cell wall about 0.2 mm thick; Cocoon cap white, produced beyond rim of cell by 0.5–4.5 mm, slightly domed.

**Distribution.** Known only from localities in Vietnam listed above.

**Etymology.** The specific name, *communalis*, is a Latin adjective, referring to the commonality of the species in Vietnam.

***Polistes (Polistella) tenebris* Nguyen & Lee, new species**  
(Figs. 22–30)

**Material examined.** HOLOTYPE: female, pinned (deposited in the Lee Kong Chian Natural History Museum (LKCNHM), National University of Singapore (NUS), Singapore. Original label: “JXQL#0056, SINGAPORE, Tampines Street 41, 1°21'32.2"N, 103°56'41.9"E, 19 m, Nest#Singapore-2012-P-01, 6.VI.2012, John L.”. PARATYPE: (NUS, tentatively in IEBR on long-term loan from NUS): 4 females, 8 males, same data as holotype; 1 female, Mandai Road, 14 June 2014, coll. J.X.Q Lee; 2 females, 1 male, Sungei Buloh, Wetland Reserve, Nest#Singapore-2013-P-02, 5 November 2013, coll. John L; SINGAPORE (NUS): 1 female, Nee Soon, coordinates unknown, 5 September 2012, coll. Z.W.W. Soh; 1 female, Kent Ridge, National University of Singapore, School of Design and Environment, 1°17'51.4"N, 103°46'13.8"E, 14 July 2015, coll. M.S. Chua; 1 female, Holland Woods, 1°19'58.1"N, 103°46'52.3"E, 1 October 2014, collector unknown; 1 female, Orchard Central, 1°18'00.0"N, 103°50'27.6"E, 30 April 2015, coll. C. Roscoe, NUS.

**Diagnosis.** This species can be distinguished from congeners by the following combination of characters: Gena in lateral view about 0.8 times as wide as eye; length of lateral margin of clypeus lying along inner eye margin as long as diameter of antennal socket and slightly shorter than the length of

malar space; flagellomere I slightly greater than 3 times as long as its maximum width; body with dense and coarse punctures; body nearly entirely black; wings transparent except dark spots at apical margins of fore wings.

**Female.** Body length 10–11 mm (holotype: 10.6 mm); fore wing length 9.8–10.8 mm (holotype: 10.4 mm).

Structure as in *Polistes communalis*, new species and *P. brunus*, new species, but differing as follows: POD : OOD = about 1 : 1.3; POD about 2 times Od. Gena in lateral view about 0.8 times as wide as eye (Fig. 24). Inner eye margins, in frontal view 1.1 times further apart from each other at vertex than at clypeus. Clypeus in frontal view as wide as high (Fig. 22), length of lateral margin of clypeus lying along inner eye margin as long as diameter of antennal socket and slightly shorter than the length of the malar space. Antenna: scape 2.9 times as long as its maximum width; flagellomere I slightly greater than 3 times as long as its maximum width; terminal flagellomere as long as its basal width.

Body punctures denser and coarser than in *P. communalis*, new species. Dorsal metapleuron with short and thin striae.

**Colour.** Black; following parts orange-yellow: apical margin of clypeus, a narrow band along inner eye margin extending from bottom of frons to middle of eye emargination; a short narrow band on gena along eye margin, lower part of gena close to eye and clypeus, a narrow band at basal margin of metanotum; two longitudinal narrow stripes on posterior face of propodeum; valvula; apical band of tergum I (extending laterally toward its base) and tergum IV; thin longitudinal stripe on hind coxae; following parts dark brown: mandible, tergum VI and hind femora.

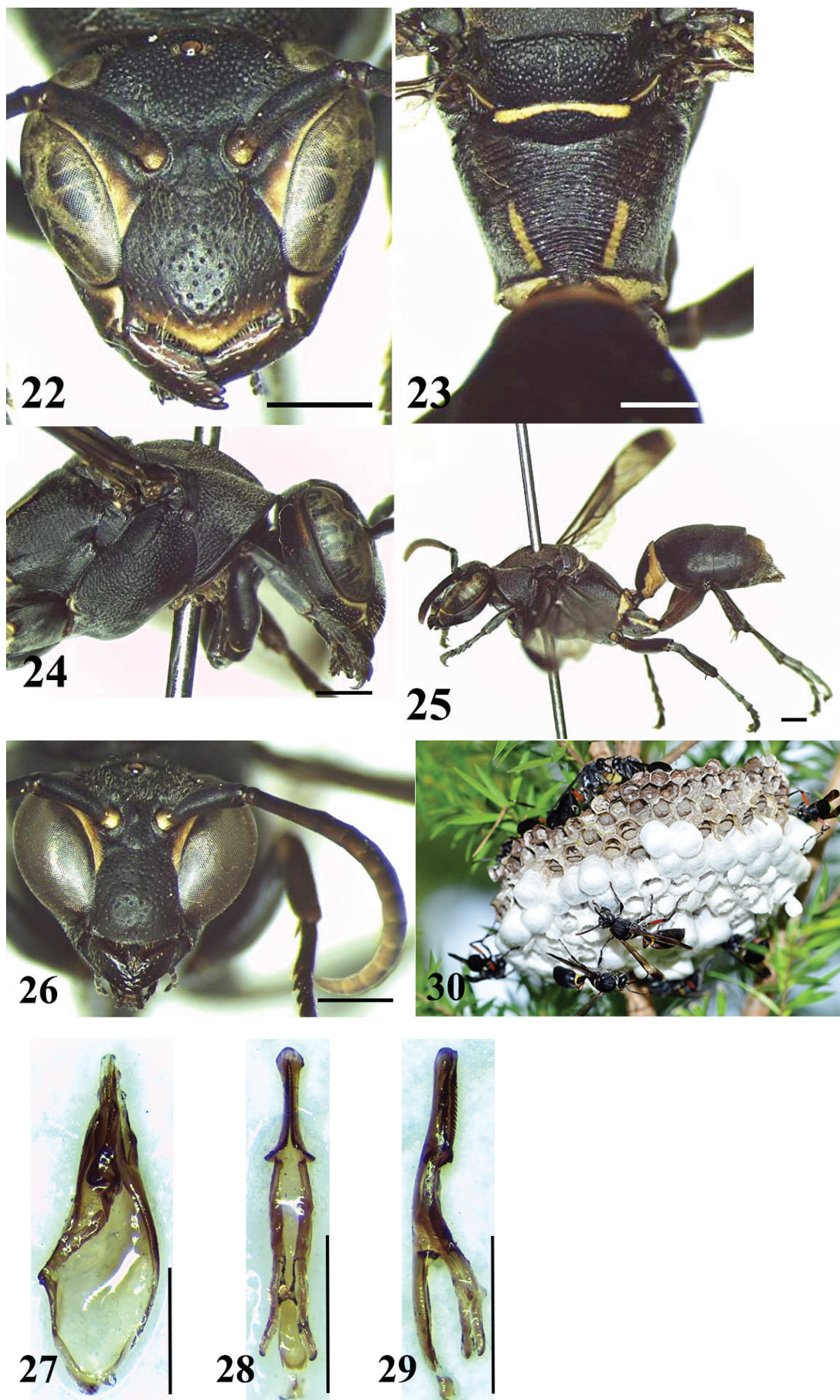
**Male.** Body length 9.0 mm–10 mm; fore wing length 8.8 mm–9.8 mm.

Similar to female, but differing from the latter as follows: head about 1.2 times as wide as high in frontal view (Fig. 26); inner eye margins 1.3 times as long from each other at vertex as at clypeus; gena in lateral view about 0.4 times as wide as eye; clypeus (Fig. 26) in frontal view 1.1 times as high as wide, only slightly produced ventrally, evenly and slightly convex apically, in lateral view weakly convex in dorsal part. Antenna more slender than in female; scape short, about 2.5 times as long as its maximum width; flagellomere I longer than length of flagellomeres II and III combined; terminal flagellomere elongate, slightly curved, about 2 times as long as its basal width. Metasomal sternum VII depressed medially, without tubercle.

Body surface sculpture as in female, but clypeus with scattered medium punctures, densely covered with short silver hairs together with long golden bristles, and with a faint longitudinal ridge medially.

Colour and marking pattern similar to female, but clypeus and mandible entirely black.





Figs. 22–30. *Polistes tenebris*, new species. 22–25, female. 22, Head, frontal view; 23, Propodeum, dorsal view; 24, Head & thorax, lateral view; 25, Habitus. 26–29, male. 26, Head, frontal view; 27–29, Genitalia. 27, Inner aspect of paramere with digitus and volsella; 28, 29, Aedeagus (28, Ventral view; 29, Lateral view). Scale bar = 1 mm. 30, Nest.

**Male genitalia.** Lamina volsellaris desclerotised and fused with cuspis. Digitus in inner aspect of paramere (Fig. 27) about 3.3 times as long as wide (measured at widest part), distinctly swollen near base, gradually narrowed apically to mid-length, then slightly swollen towards the rounded apex. Aedeagus (Figs. 28, 29): penis valves about 0.6 times as long as basal apodeme, in ventral view narrowest near mid-length, weakly swollen proximally from mid-length then distinctly produced laterally near proximal margin, in lateral view slightly thickened in proximal one fourth and with dorsal margin weakly sinuate, with proximoventral corner produced into obtuse angle (Fig. 29); ventral margins of penis valves finely serrate along entire length.

**Nest.** The first nest (Fig. 30) was a mature one found on 4 June 2012 built in a tree of *Melaleuca bracteata* (var. "Revolution Gold") at a height of approximately 2.2 m. It was subsequently collected on 6 June 2012, with eight wasps. Some of the cells were accidentally crushed during the collection, so the total number of cells was estimated to be between 125 and 140. Approximately 60 cells had produced adults at least once; 42 cells contained pupae; the rest contained eggs or larvae. Nest description as follows: Comb roughly oval (approximately 51 × 39 mm) in view from side of cell opening, colour ranging from light gray-brown to medium reddish-brown, paper-like in texture, being made mainly of plant fibers and oral secretions from the adult wasps. The nest was joined directly to the tree by a single petiole positioned slightly excentrically; The petiole was broken and lost during the collection process, but was approximately 3 mm long. Cells were built away from the petiole and sloping downwards in the center but curving upwards again from cells being built higher up and at an angle facing outwards diagonally from the inner cells, roof dark and shiny due to secretions from adult wasps, cells generally arranged in roughly regular rows, hexagonal at open end when surrounded by other cells, free margins generally rounded, weakly expanded towards open end, 3.9 mm (range 3.7–4.3 mm; n=10) wide at open end, and 15.5 mm (range 15–17 mm; n=10) deep in cells containing pupae or having produced adults, not including cocoon caps; Cocoon caps white, slightly domed, produced beyond rim of cell by 1–3 mm.

The second nest was a young one found on 5 November 2013 built on the underside of a leaf of *Dillenia suffruticosa*, at a height of approximately 2.5 m, and was collected on the same day. Three adult wasps were found on the nest, one of which was clearly the foundress. Five cells had produced adults, out of which four had larvae inside and one with an egg. However, after approximately 45 minutes of observation prior to collecting the nest, no other adults returned. The nest consisted of 21 completed cells and 12 incomplete ones. Among the complete cells, 11 contained pupae, eight contained larvae and two contained eggs. The 12 incomplete cells were occupied by eggs or small larvae. Nest description as follows: Comb roughly spherical, approximately 30 × 30mm, paper-like in texture, being made mainly of plant fibers and oral secretions from the adult wasps. Colour light gray-brown. The nest was joined

to the underside of the leaf by a single petiole positioned centrally. Again, the petiole was broken and lost during the collection process, but was approximately 3 mm long. The roof is dark and shiny due to a covering of secretions from adult wasps, though not as much as the first nest; Cells are generally arranged in roughly regular rows, hexagonal at open end when surrounded by other cells, free margins generally rounded, weakly expanded towards open end, 3.8 mm (range 3.7–4.1 mm; n=5) wide at open end, and 15.3 mm (range 15–17 mm; n=5) deep in cells containing larvae or pupae or having produced adult, not including cocoon caps; Cocoon caps white, slightly domed, produced beyond rim of cell by 1–2.7 mm.

**Distribution.** Known only from localities in Singapore listed above.

**Etymology.** The specific name, *tenebris*, is a Latin adjective, referring to the black body of the species.

#### Key to species of the *Polistes stigma* group from continental Southeast Asia

The characters used are applicable to both sexes unless the sex is specified.

1. Body with coarse punctures. Propodeum with strong transverse striae.  
Body with yellow markings reduced, clypeus entirely or largely brown or black .....2
- Body with weaker punctures. Propodeum with weaker transverse striae.  
Body with extensive yellow or reddish marks.....4
2. Female: Flagellomere I 2.8 times as long as its maximum width. Frons and mesoscutum with less coarse punctures.  
Body mainly brown.....*Polistes brunus*, new species
- Female: Flagellomere I 3 times or slightly greater than 3 times as long as its maximum width. Frons and mesoscutum with coarse punctures.  
Body mainly black .....3
3. Female: Inner eye margins in frontal view 1.1 times further apart from each other at vertex than at clypeus; clypeus in frontal view as wide as high; gena in lateral view narrower than eye. Dorsal metapleuron with short and weak striae. Wing transparent except dark spots at apical margin of fore wings.  
Body nearly entirely black.....*Polistes tenebris*, new species
- Female: Inner eye margins in frontal view about as far apart from each other at clypeus as at vertex; clypeus in frontal view slightly wider than high; gena in lateral view slightly wider than eye. Dorsal metapleuron with longer and thicker striae. Wing light yellow except dark spots at apical margin of fore wings.  
Body with extensive brown marks .....*Polistes communalis*, new species
4. Tergum IV without apical yellow band. Sterna II with posterolateral spots & III with narrow apical yellow band.....
- Tergum IV with apical broad yellow band. Sterna II–IV with very broad apical yellow bands .....*Polistes stigma stigma* (Fabricius)
- Tergum IV with apical broad yellow band. Sterna II–IV with very broad apical yellow bands .....*Polistes stigma tamula* (Fabricius)



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