

Notes on the paper wasp genus *Polistes* (*Polistella*) (Hymenoptera: Vespidae: Polistinae) from the northern part of Vietnam with description of males and nests

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Abstract. Additions to the knowledge of the paper wasp genus *Polistes* (*Polistella*) (Hymenoptera: Vespidae: Polistinae) from the northern part of Vietnam are presented. The males of two species, *P. affinis* Gusenleitner, 2006, and *P. curcipunctum* Nguyen, Kojima & Saito, 2011, are described for the first time. The nests of *P. affinis* Gusenleitner, 2006, and *P. nippensis* Pérez, 1905, are also described.

Key words. paper wasp, Vespidae, *Polistes*, *Polistella*, male description, nest, northern Vietnam

INTRODUCTION

Among the social wasps, the genus *Polistes* Latreille, 1802, the only cosmopolitan genus in the subfamily Polistinae, has been the focus of the vast majority of behavioural investigations on social wasps. Their relatively small colonies (usually with less than 100 individuals) and unenveloped nests often made on human constructions allow us to make detailed behavioural observations. Due to these and other reasons, *Polistes* has been the genus of choice for both experimental and theoretical investigations of social behaviour. Clearly, *Polistes* has served behaviourists as well as a model group for studying social evolution. With more than 200 species, the *Polistes* is subdivided into four monophyletic subgenera, with their relationships expressed as (*Gyrostoma* + [*Polistella* + [*Polistes* s. str. + *Aphanilopterus*]]]) (Carpenter, 1996). *Gyrostoma*, *Polistella* and *Polistes* s. str. are primarily of the Old World (including Australia) with a few species in *Gyrostoma* and *Polistes* s. str. introduced into the New World, and *Aphanilopterus* is exclusively New World. The subgenus *Polistella*, with 85 species and 34 subspecies distributed from Africa to Australia (Carpenter, 1996, updated), is the largest of the three subgenera and endemic to the Old World. Located in the easternmost part of the eastern slope of the Himalayas, the *Polistella* fauna in Vietnam is key to understanding the process of forming the current distribution pattern of these *Polistella* wasps (Nguyen & Kojima, 2014).

The *Polistella* fauna in northern Vietnam has been studied recently, with five species recognised in the “*Stenopolistes*” species-group (Nguyen & Carpenter, 2016), and 21 species have been recognised in the northern parts (Nguyen & Kojima, 2014; Nguyen et al., 2011). In this study, based mainly on the material collected during several research trips to northern Vietnam made in 2012, 2014 and 2015, two males of *Polistella* are described for the first time. Nests of two species are also described.

MATERIAL & METHODS

The material examined in the present study are deposited in the collections of the Institute of Ecology and Biological Resources (IEBR), Hanoi, Vietnam.

The adult morphological and color characters except for male genitalia were observed on pinned and dried specimens under a stereoscopic dissecting microscope. Apical parts of male metasoma were dissected for the terminal sterna and genitalia. They were put in lactic acid for several hours, washed in distilled water, and observed in glycerin under a stereoscopic dissecting microscope. The terminology of male genitalia follows Kojima (1999). Drawings were made with the aid of a drawing tube installed on the stereoscopic dissecting microscope.

In the descriptions of adult 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 morphometric characters referred to in the descriptions are defined as in Nguyen et al. (2011).

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The nest characters, including measurements of various parts given below, were examined after the immatures had been taken out and the nests had been 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 the 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.

TAXONOMIC ACCOUNTS

Subgenus *Polistella* Ashmead, 1904

Polistella Ashmead 1904: 133, as genus. Type species: *Polistes manillensis* de Saussure 1853, by original designation.

1) *Polistes (Polistella) affinis* Gusenleitner, 2006

Polistes affinis Gusenleitner 2006: 672, female, holotype, Phongsaly environment, Prov. Phongsaly, 1500 m, Laos (Oberösterreich Landesmuseum, Linz, Austria).

Remarks. *Polistes affinis* was described by Gusenleitner (2006) based on a single female specimen (holotype) from Phongsaly env., Phongsaly province (Laos), and three females (paratypes) of the same data as the holotype, which are housed in Oberösterreich Landesmuseum, Linz, Austria. Later, this species was recorded from the northwestern part of Vietnam (Nguyen et al., 2011), and no further information on this species has been added since then. The male and a nest of this species are described here for the first time.

One nest (Nest#TD-2012-P-01) collected at Tam Dao National Park was examined. As described below, the male is similar to the female both in structure and coloration except for some characters.

Material examined. 17 females, 13 males (IEBR), Tam Dao NP, Vinh Phuc, alt. 900–1200 m, Nest#TD-2012-P-01, 30.vii-3.viii.2012, T.D. Tran. 2 females (IEBR), Tam Dao NP, Vinh Phuc, alt. 1000 m, 16.vii.2015, L.T.P. Nguyen.

Description. Male. (male hitherto unknown), (female characters in square brackets). Body length 12.5–13.5 mm (13.3–13.8 mm); fore wing length about 13.4–14 mm (14.2–14.8 mm).

Head in frontal view (Fig. 1) 1.4 times (1.2 times [Fig. 8]) as wide as high. Vertex slightly raised area between ocelli; POD : OOD = 1 : 1.6 (1 : 1.9 [Fig. 2]); POD 1.4 times Od in both sexes. Eye much more strongly swollen laterally than in female; inner eye margins 1.4 times (0.9 times) further apart from each other at vertex than at clypeus. Gena narrow (more or less wide), in lateral view (Fig. 3) 0.3 times (0.8 times [Fig. 9]) as wide as eye; weakly raised blunt ridge present,

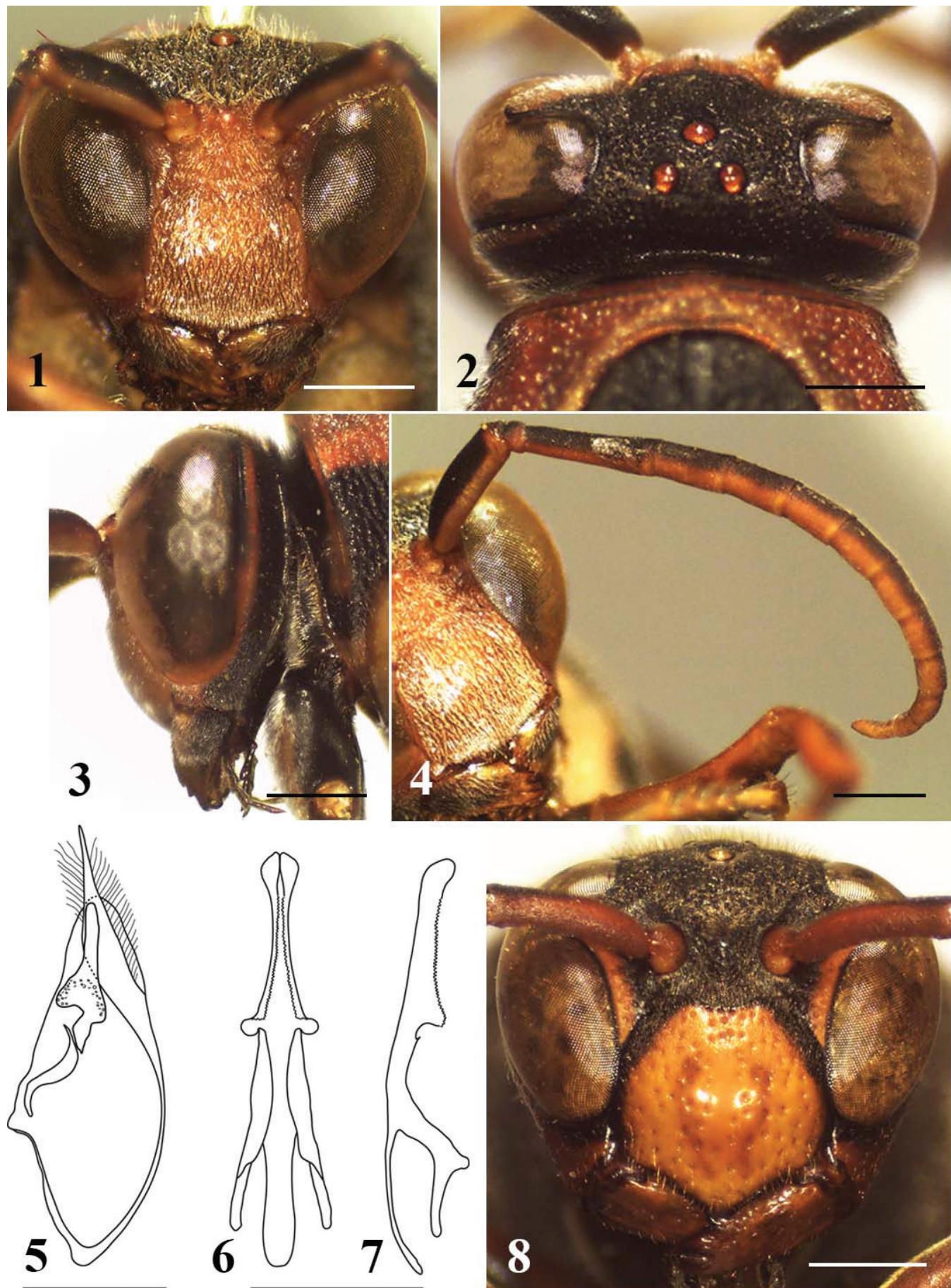
running along posterior margin of eye (slightly raised only at mid-dorsal part). Clypeus in frontal view (Fig. 1) as wide as high, apical margin slightly produced, broadly rounded (pointed apically [Fig. 8]); in lateral view (Fig. 3) strongly convex (weakly swollen anteriorly); surface with dense short golden hairs (surface with scattered deep large punctures each bearing sharply pointed golden bristle). Antenna (Fig. 4) with slenderer flagellum than in female; scape short and thick, 2.7 times (2.6 times) as long as its maximum width; flagellomere 1 as long as (much longer than) length of flagellomeres 2 and 3 combined; flagellomeres 4–6 each longer than wide (as long as wide); terminal flagellomere slightly curved (bullet shaped), 2.6 times longer than (1.1 times) its basal width.

Mesosoma as in female. Pronotal carina sharply raised, produced into thin lamella in dorsal part, slightly sinuate on lateral sides, reaching ventral corner of pronotum. Mesoscutum convex, about as long as wide between tegulae; anterior margin broadly rounded. Disc of scutellum slightly concave, in lateral view at higher level than mesoscutum. Metanotum weakly concave, strongly depressed along anterior margin. Propodeum short; posterior face widely (about two thirds the maximum width of propodeum) and shallowly excavated medially, more or less smoothly passing into lateral faces; propodeal orifice elongate, about 1.9 times as long as wide (measured at widest part), somewhat narrowed in dorsal half. Jugal lobe of hind wing large, rounded.

Metasoma except terminal two segments as in female. Tergum 1 distinctly shorter than 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 bluntly angled. Sternum 2 in lateral view strongly swollen ventrally in anterior one-third, then ventral margin bluntly angled into nearly straight line parallel to ventral margin of the tergum. Metasomal sternum 7 depressed medially, without tubercle.

Body surface sculpture as in female, except for densely-setose clypeus. Mandible with scattered shallow punctures. Frons and vertex up to level of posterior ocelli with close fine punctures. Vertex behind posterior ocelli and gena with sparse fine punctures; spaces between punctures smooth. Pronotum with dense deep punctures; spaces between punctures very narrow, slightly raised to form reticulate pattern. Mesoscutum, scutellum and metanotum with dense deep flat-bottomed punctures. Mesepisternum with coarse dense well-defined punctures, spaces between punctures similar to those on pronotum. Dorsal metapleuron with fine punctures; ventral metapleuron with shallow large punctures. Propodeum with distinct transverse striation and punctures between striae on lateral faces; interpuncture spaces weakly raised to interconnect striae. Metasomal segments covered with scattered small punctures.

Color. Similar to female (body black, with following orange-yellow markings: antennal scape except a black band along upper part, flagellum beneath; clypeus except black margin, mandible except black margin, narrow band along inner



Figs. 1–8. *Polistes affinis*. 1–7, Male. 1, Head, frontal view; 2, Vertex, dorsal view; 3, Head, lateral view; 4, Left antenna. 5–7, Genitalia. 5, Inner aspect of paramere with digitus and volsella; 6, 7, Aedeagus (6, Ventral view; 7, Lateral view); 8, Female. Head, frontal view. Scale = 1 mm.



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Figs. 9–10. *Polistes affinis*. 9, Female habitus; 10, Nest.

eye margin extending from bottom of frons to middle of eye emargination, broad band on gena along posterodorsal margin of eye, narrow band along pronotal carina, dorsal part of pronotum, scutellum except a narrow black band at basal and apical margin, paired small lateral spots on metanotum, scrobal spot on mesepisternum, apical margin of metasomal terga and sterna 1–5, nearly whole of tergum 6; legs black except all tibiae, upper part of all femora orange-yellow; paired small lateral spots on propodeum [absent in some specimens] and propodeal valvula yellow) but more extensively marked with yellow as follows: clypeus entirely, mandible except for small basal black spot, ventral half of frons, narrow long band on gena along posterior margin of eye, ventral part of mesepisternum, ventral face of fore coxa and spot on mid-coxa; antennal flagellum reddish brown to dark yellow beneath; paired lateral orange-yellow spots on metanotum much reduced in size (absent in many specimens).

Male genitalia. Lamina volsellaris desclerotised and fused with cuspis. Digitus in inner aspect of paramere (Fig. 5) slightly more than 3.0 times as long as wide (measured at widest part). Aedeagus (Figs. 6, 7): penis valve about 0.9 times as long as basal apodeme, in ventral view swollen laterally in proximal one third and distinctly produced laterally near proximal margin, in lateral view slightly thickened in proximal one fourth and with dorsal margin weakly and smoothly sinuate, with proximoventral corner produced into a right angle (Fig. 7); ventral margin of penis valve finely serrated along entire length.

Nest. The nest had ten pupae as immatures, and was attached to a thin branch of a shrub about 1.5 m above the ground. The nest characteristics are as follows: Petiole single, terminal, 2.8 mm long, 1.9×2.2 mm thick at the mid-length, enlarged strictly with adult salivary secretion, brown and lustrous; salivary coating extended onto substrate and back of comb. Comb rather tough, pliable paper-like in texture, more or less uniformly brown in cell wall, subcircular (about 59 mm \times 55 mm) in view from side of cell opening, ventral surface slightly convex, dorsal surface deeply concave. Cells arranged in regular rows and round at open end; each cell gradually

expanded towards open end, 3.8 mm (range 3.1–4.7 mm; n=10) wide at bottom and 6.3 mm (range 6.0–6.9 mm; n=10) wide at open end, 18.3 mm (range 16.2–19.9 mm; n=10) deep; cell wall about 0.03 mm thick. Cocoon caps slightly domed beyond rim of cell, yellow.

Distribution. Laos; northern Vietnam (Nguyen et al., 2011).

2) *Polistes (Polistella) curcipunctum* Nguyen, Kojima & Saito, 2011

Polistes curcipunctum Nguyen, Kojima & Saito, 2011: 15, female, holotype Tam Dao NP, Vinh Phuc (Vietnam), (IEBR).

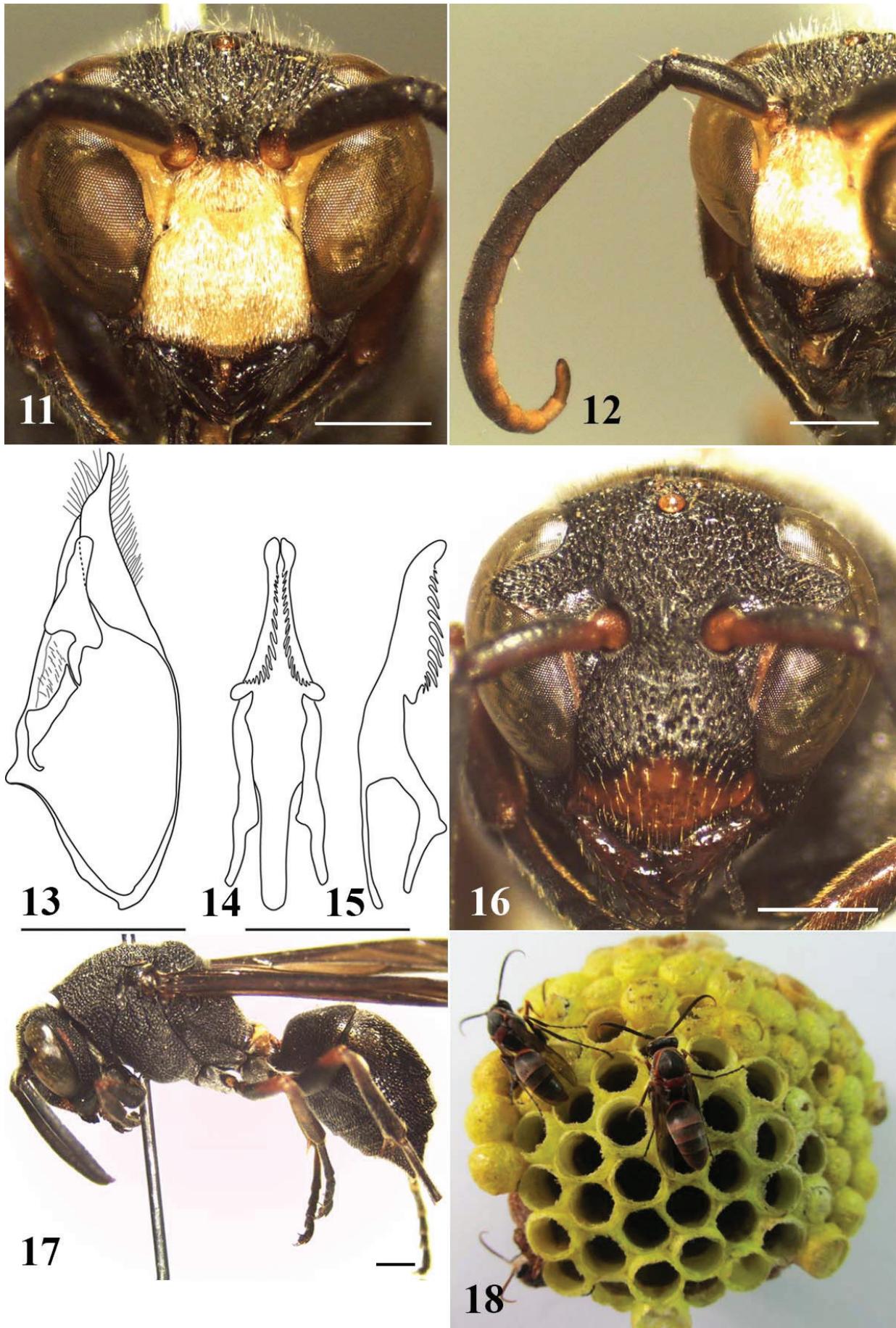
Remarks. *Polistes curcipunctum* was described by Nguyen et al. (2011) based on a single female specimen (holotype) from Tam Dao NP, Vinh Phuc (Vietnam), which are housed in the Natural History Collection at Ibaraki University (IUNH), Mito, Japan as long term loan from IEBR, and 5 female paratypes from different provinces in Vietnam.

The male specimen we examined was also collected in Tam Dao NP similar to the female both in structure and coloration except for some characters.

Material examined. 1 male (IEBR), Tam Dao NP, Vinh Phuc, alt. 800–1200 m, 30.vii–3.viii.2012, T.D. Tran.

Description. Male. – Body length 10.7 mm; forewing length 11.3 mm.

Structure as in female, but differing from the latter as follows: head proportionally smaller, transverse, 1.4 times as wide as high in frontal view (Fig. 11); eye strongly swollen laterally; inner eye margins strongly convergent, 1.2 times further apart from each other at vertex than at clypeus; gena narrow, in lateral view 0.4 times as wide as eye, with weakly raised blunt ridge running along posterior margin of eye; clypeus in frontal view 1.1 times as wide as high (Fig. 11), strongly produced ventrally with rounded apex, in lateral view weakly convex dorsally, bent backward ventrally. Antenna slenderer



Figs. 11–18. 11–17, *Polistes curcipunctum*. 11–15, Male. 11, Head, frontal view; 12, Right antenna. 13–15, Genitalia. 13, Inner aspect of paramere with digitus and volsella; 14, 15, Aedeagus (14, Ventral view; 15, Lateral view). 16–17, Female. 16, Head, frontal view; 17, Habitus. Scale = 1 mm. 18, *Polistes nipponensis*, nest.

than in female (Fig. 12); scape short, 2.6 times as long as its maximum width; flagellomere 1 slightly shorter than the length of flagellomeres 2 and 3 combined; flagellomeres 2 and 3 each longer than wide; terminal flagellomere elongate, slightly curved, 3 times as long as its basal width. Metasomal sternum 7 depressed medially, without tubercle.

Body surface sculpture as in female, but clypeus with scattered small punctures and densely covered with long golden hairs.

Color. Similar to female, but reddish-brown markings on head and legs reduced, while more extensively marked with yellow as follows: clypeus entirely, ventral half of frons, antennal scape beneath, spot on propodeal valvula; antennal flagellum reddish-brown to dark yellow beneath.

Male genitalia. Lamina volsellaris desclerotised and fused with cuspis. Digitus in inner aspect of paramere (Fig. 13) about 2.8 times as long as wide (measured at widest part). Aedeagus (Figs. 14, 15): penis valves about 0.9 times as long as basal apodeme, swollen laterally in proximal one fourth and distinctly produced laterally near proximal margin, in lateral view gradually thickened to proximal position and with dorsal margin strongly sinuate, with proximoventral corner produced into single tooth-like projection (Fig. 15); ventral serration of penis valves coarse and strong along entire length.

Distribution. Northern Vietnam (Nguyen et al., 2011).

3) *Polistes (Polistella) nippensis* Pérez, 1905

Polistes nippensis Pérez 1905: 82, female, holotype, Yokohama, Japan (Muséum National d'Histoire Naturelle, Paris).

Remarks. This species was recorded from Vinh Phuc, Hai Phong, Hoa Binh and Ninh Binh (Nguyen et al., 2011). In this study, this species is also recorded from Cao Bang, the northernmost province of Vietnam, together with its nest.

Material examined. 19 females, 25 males, Phia Oac, Pha Den, Nguyen Binh, Cao Bang, 22°35'07.7"N 105°51'59.8"E, alt. 900–1100m, Nest#VN-CB-2014-P-01, 25–28.v.2014, T.V. Hoang.

Nest. A nest (Nest#VN-CB-2014-P-01) (Fig. 18) collected in Phia Oac NP, Cao Bang was examined.

The nest was at the fully-developed stage and had a comb comprised of mainly long cells, collected together with 19 females and 15 males. Ten males emerged later when the nest was brought back to the laboratory and was being kept in a nylon bag. The nest was found under the broad leaf of a tree about 3 m above the ground. The nest characteristics are as follows: Petiole single, terminal, with thick central core of plant fibres, enlarged strictly with adult salivary

secretion, black and lustrous, 4.2 mm long, 2.2 × 6.8 mm thick; salivary coating extended onto substrate and largely onto back of comb. Comb tough, pliable in texture, brown, subcircular (about 52 mm × 50 mm) in view from side of cell opening; ventral surface convex; dorsal surface deeply concave. Nest cells generally arranged regularly and round at open end, but partly irregularly arranged, where some cells are pentagonal; cell expanded towards open end, 3.4 mm (range 2.5–4.6 mm; n=10) wide at bottom and 5.6 mm (range 5.1–6.3 mm; n=10) wide at open end, 14.5 mm (range 13.0–16.2) mm; n=10) deep; cell wall about 0.02 mm thick. Cocoon caps slightly domed beyond rim of cell, yellow.

Distribution. China; Japan; Vietnam (Nguyen et al., 2011, present study).

ACKNOWLEDGMENTS

I am very grateful to James M. Carpenter (American Museum of Natural History, New York) for his English proofreading on the manuscript. The present study was supported by the grant from the Vietnam National Foundation for Science and Technology Development (NAFOSTED: no. 106-NN.05-2014.40).

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