

A taxonomic review of the genus *Netelia*, subgenus *Monomacrodon* (Hymenoptera: Ichneumonidae: Tryphoninae), with description of a new species

Kazuhiko Konishi¹, Hsuan-Pu Chen² & Nhi Thi Pham^{3*}

Abstract. The third species of the subgenus *Monomacrodon*, *Netelia* (*M.*) *maculata* new species is described from the montane areas of Laos and Vietnam. In addition, *N. (M.) bicolor* is newly recorded from Taiwan and Vietnam. The ovarian eggs of this subgenus are described and figured for the first time. A key to three known species of the subgenus *Monomacrodon* is presented.

Key words. description, Oriental, taxonomy, new species, parasitoid

INTRODUCTION

Monomacrodon is one of 12 subgenera of the genus *Netelia*. Unlike the other subgenera of the genus *Netelia*, species of *Monomacrodon* are not uniformly brownish-yellow insects but yellow with brown to black markings on the body. Up to the present, only two species, *N. (M.) bicolor* (Cushman, 1934) and *N. (M.) elumbis* (Tosquinet, 1903), have been recognised at relatively high elevations (from 700 m to 2,000 m alt.) of the Oriental and Australasian regions (Gauld, 1983; Yu et al., 2012).

Monomacrodon can be easily distinguished from other subgenera by combination of the hind tarsal claw with pectination extending beyond true apex of claw and the absence of the fore wing vein 3rs-m (Bennett, 2015). The exceptionally simple male clasper is also characteristic of this subgenus and this character state is considered to be due to secondary loss of structures such as pad and brace (Townes, 1938; Gauld, 1983).

As per Gauld (1983), who stated it is quite probable that other species await discovery, we found some specimens of this subgenus with peculiar markings among recent collections of

Ichneumonidae from Laos and Vietnam, which could not be assigned to both known species. In this paper, we describe a new species on the basis of these specimens. In addition, we record *N. (M.) bicolor* (Cushman, 1934) from Taiwan and Vietnam for the first time. A key modified from Gauld (1983) to all three species of the subgenus *Monomacrodon* is added.

MATERIAL AND METHODS

The specimens used in this study are deposited in the collections of Ehime University Museum, Matsuyama, Japan (EUMJ), Institute of Ecology and Biological Resources, Hanoi, Vietnam (IEBR), and Taiwan Agricultural Research Institute, Taichung, Taiwan (TARI). Other collections referred to in this paper are the National Museum of Natural History, Washington D.C., USA (NMNH) and the National Museum of Natural Science, Taichung, Taiwan (NMNS).

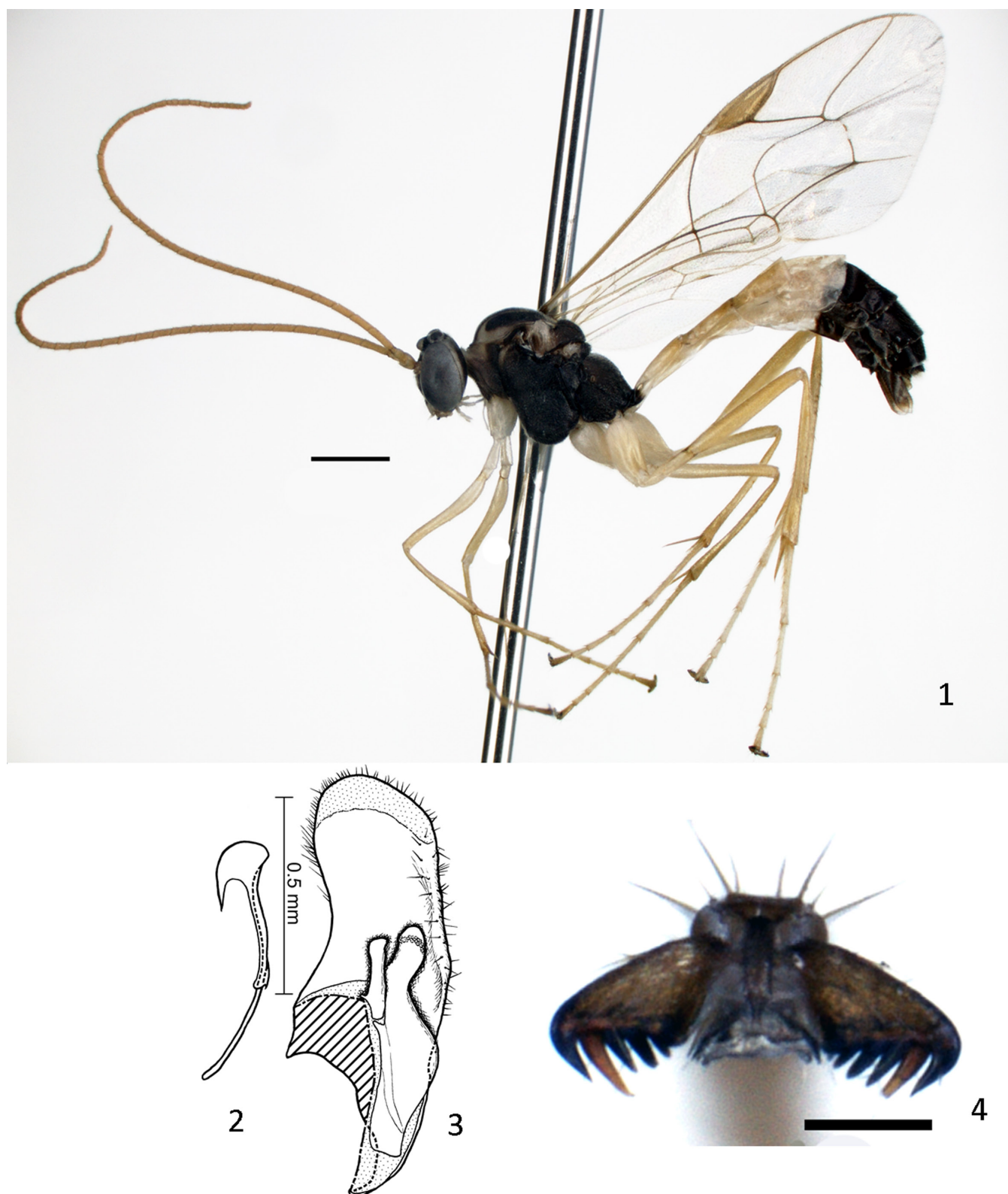
Morphological nomenclature in this work follows that of Gauld (1991). We refer to Snodgrass (1941) for terminology of male genitalia and to Eady (1968) for microsculpture description. The methods for observation and preservation of male genitalia, the measurements of head and mesosoma and indices are as in Konishi (1985, 2005). The images of the male holotype/paratype of *Netelia* (*Monomacrodon*) *maculata* were taken with a Nikon SMZ800N M80 stereomicroscope and a Canon 700D camera. Images of the female paratype were taken with a Nikon Digital Sight DS-Fi1 camera attached to a Leica S8APO stereomicroscope. Image of the ovarian egg was taken under a digital microscope HiROX KH-1300 and the image captured with the 2D measurement software SHX-13M ver. 2.9.0. Several partially focused images were combined and post-processed using Adobe Photoshop CS6.

Accepted by: Ang Yuchen

¹Entomological Laboratory, Faculty of Agriculture, Ehime University, Tarumi 3-5-7, Matsuyama, Ehime 790-8566, Japan; Email: konishi@agr.ehime-u.ac.jp; <https://orcid.org/0000-0002-3077-3376>

²Department of Entomology, National Taiwan University, Taipei, Taiwan; Email: pooh890510@gmail.com; <https://orcid.org/0000-0002-5605-5153>

³Institute of Ecology and Biological Resources, Vietnam Academy of Science and Technology, 18 Hoang Quoc Viet, Hanoi, 10072, Vietnam; Email: ptnhi2@yahoo.com; <https://orcid.org/0000-0001-9304-9863> (*corresponding author)



Figs. 1–4. *Netelia (Monomacrodon) bicolor*, male from Taiwan: 1. Habitus in lateral view (scale bar = 1 mm); 2. Aedeagus in lateral view; 3. Paramere in median view; 4. Hind tarsal claws (scale bar = 0.1 mm).

TAXONOMY

Genus *Netelia* Gray, 1860

Netelia Gray, 1860: 341. Type species: *Paniscus inquinatus* Gravenhorst, 1829.

Subgenus *Monomacrodon* Cushman, 1934

Monomacrodon Cushman, 1934: 2 (as genus). Type species: *Monomacrodon bicolor* Cushman, 1934.

Diagnosis. This subgenus can be easily distinguished from any other subgenera of the genus *Netelia* by possession of a combination of following character states: Lateral carina of scutellum extending to apex of scutellum; hind tarsal claw with the pectination projecting beyond the claw apex; vein 3rs-m of fore wing entirely absent; cell 1A of fore wing without band of setae; hind wing with 3–4 distal hamuli; ovipositor twice as long as apical height of metasoma and the crease separating the epipleurum of third metasomal tergite extending the full length of the tergite. In male genitalia, the paramere is without pad and brace and shoulder of the basivolsella is weak.

Remarks. Among the characteristics enumerated above, the specialised hind tarsal claw is shared by *Monomacrodon* and *Apatagium*. Based on this, Gauld (1983) considered *Monomacrodon* + *Apatagium* as a monophyletic (holophyletic in Gauld (1983)) group. He listed eight characters as differences between them in the cladogram. Among them, *Monomacrodon* possesses seven apomorphic and one plesiomorphic character states while the only apomorphy of *Apatagium* is the absence of the occipital carina. However, in *Monomacrodon*, the occipital carina is present in *N. (M.) bicolor* and absent in *N. (M.) elumbis*. Thus, it is possible that *Apatagium* is paraphyletic with respect to *Monomacrodon*. On the other hand, Coronado-Rivera (2009) considered there to be no sister group relationship between *Monomacrodon* and *Apatagium* as a result of cladistic analysis based on morphological characters. Further research is needed to clarify taxonomic relationships of the subgenera within the genus *Netelia*, particularly based on molecular data.

Key to species of *Monomacrodon* (modified from Gauld, 1983)

1. Mesopleuron smooth and polished; occipital carina absent; upper valve of ovipositor ridged (Brunei, Sabah, Papua New Guinea) *N. (M.) elumbis* (Tosquinet)
- Mesopleuron coriaceous-rugulose or reticulate rugose, matt; occipital carina present; upper valve of ovipositor simple 2
2. Smaller species, fore wing length 6.4–8.0 mm; metasoma with 1st and 2nd tergites sometimes with black markings, 3rd and 4th tergites without darker markings and tergites 5+ entirely blackish brown; ovarian eggs 0.4–0.5 mm long, surface smooth dorsally and laterally, ventrally reticulate sculptured (Brunei, Mainland China, India, Myanmar, Taiwan, Vietnam) *N. (M.) bicolor* (Cushman)

- Larger species, fore wing length 9.0–11.6 mm; all metasomal tergites with blackish brown markings, tergites 5+ largely yellowish white with brown markings; ovarian eggs 0.8 mm long, surface smooth dorsally, laterally and ventrally reticulate sculptured (Laos, Vietnam) *N. (M.) maculata*, new species

Netelia (Monomacrodon) bicolor (Cushman, 1934)

(Figs. 1–11, 26)

Monomacrodon bicolor Cushman, 1934: 3. Holotype: Female CHINA (NMNH).

Netelia (Monomacrodon) bicolor (Cushman): Townes, 1938: 186; Gauld, 1983: 128.

Material examined. 1 female (TARI), TAIWAN, Kuandouchi, Ren'ai Township, Nantou County, 9–15 March 1971, Malaise trap, unknown collector; 1 male (NMNS ENT 5719-22), TAIWAN, Juiyenhsi Station (= Cuifeng), Ren'ai Township, Nantou County, ca. 2200 m alt., 14–15 March 2007, Mercury light, H. H. Liang coll.; 1 male (TARI), TAIWAN, Lixing Industry Rd., Ren'ai Township, Nantou County, N24°4'25.6" E121°9'31.9", ca. 1600 m alt., 1–2 October 2016, light trap, Shimizu S. coll.; 1 male (IEBR), VIETNAM, Lao Cai Province, Bat Xat Nature Reserve, N22°37'37" E103°37'32", 1840 m alt, 28 May 2022, light trap, Pham T.N. & Dang T.H. coll.

Additional description based on Taiwanese and Vietnamese specimens. This species has been described in detail by Gauld (1983). Here we show the ovarian egg morphology of the female specimen from Taiwan and intraspecific variation of wing venation observed in the examined material. Fore wing (Fig. 10) with abscissa of M between 2rs-m and 2m-cu varying from slightly shorter to apparently longer than 2rs-m; hind wing (Fig. 11) with NI 0.3–0.5. Ovarian egg 0.4–0.5 mm long, 0.2 mm high, with a stalk on caudal end and with surface smooth on dorsal 2/3 and reticulate on ventral 1/3 (Fig. 26).

Distribution. Previously known from Brunei, Mainland China, India, and Myanmar (Gauld, 1983; Yu et al., 2012). These are the first records of this species from Taiwan and Vietnam.

Remarks. As described above, the wing venation exhibits wide range variation even in the Taiwanese population. Thus, differences of wing venation seem to not be available for distinguishing species in *Monomacrodon*.

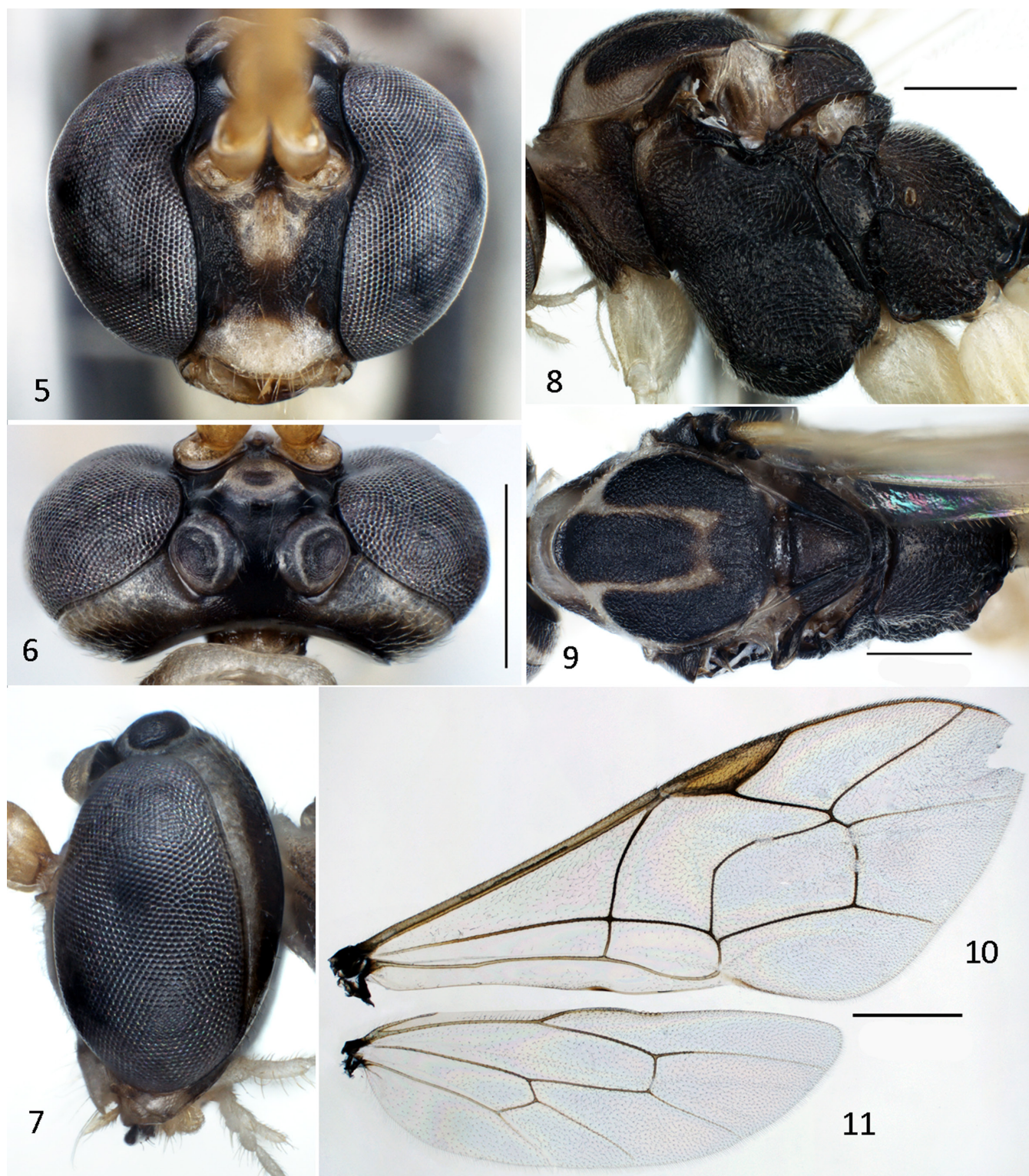
Netelia (Monomacrodon) elumbis (Tosquinet, 1903)

Ophion elumbis Tosquinet, 1903: 33. Holotype: Male PAPUA NEW GUINEA (Genoa Museum).

Netelia (Apatagium) elumbis (Tosquinet): Townes, Townes & Gupta, 1961: 94.

Netelia (Monomacrodon) elumbis (Tosquinet): Gauld, 1983: 127.

Material examined. None. See Gauld (1983) for detailed description and illustrations.



Figs. 5–11. *Netelia (Monomacrodon) bicolor*, male from Taiwan: 5. Head in frontal view; 6. Head in dorsal view; 7. Head in lateral view; 8. Mesosoma in lateral view; 9. Mesosoma in dorsal view; 10. Fore wing; 11. Hind wing. Scale bars: Figs. 6, 8, 9 = 0.5 mm; Figs. 10, 11 = 1 mm.



12

Fig. 12. *Netelia (Monomacrodon) maculata* new species, male holotype, habitus in lateral view. Scale bar = 1 mm.

Distribution. Brunei, Papua New Guinea, Sabah (Gauld, 1983).

***Netelia (Monomacrodon) maculata*, new species**
(Figs. 12–25, 27)

Material examined. Holotype: Male (IEBR), VIETNAM, Cao Bang Province, Phia Oac-Phia Den National Park, N22°36.477' E105°52.186', 1605 m asl., 25 May 2020, light trap, Hoang V.T. & Pham V.P. coll.; Paratypes: 3 males (IEBR), same data as holotype; 1 male (IEBR), same locality, 8 June 2020, light trap, Nguyen Q.C. coll.; 2 females (EUMJ), LAOS, Xieng Khouang Province, Phou Samsoum, N19°08.444' E103°47.137', 2064 m asl., 28 May 2013, light trap, T. Mita coll.

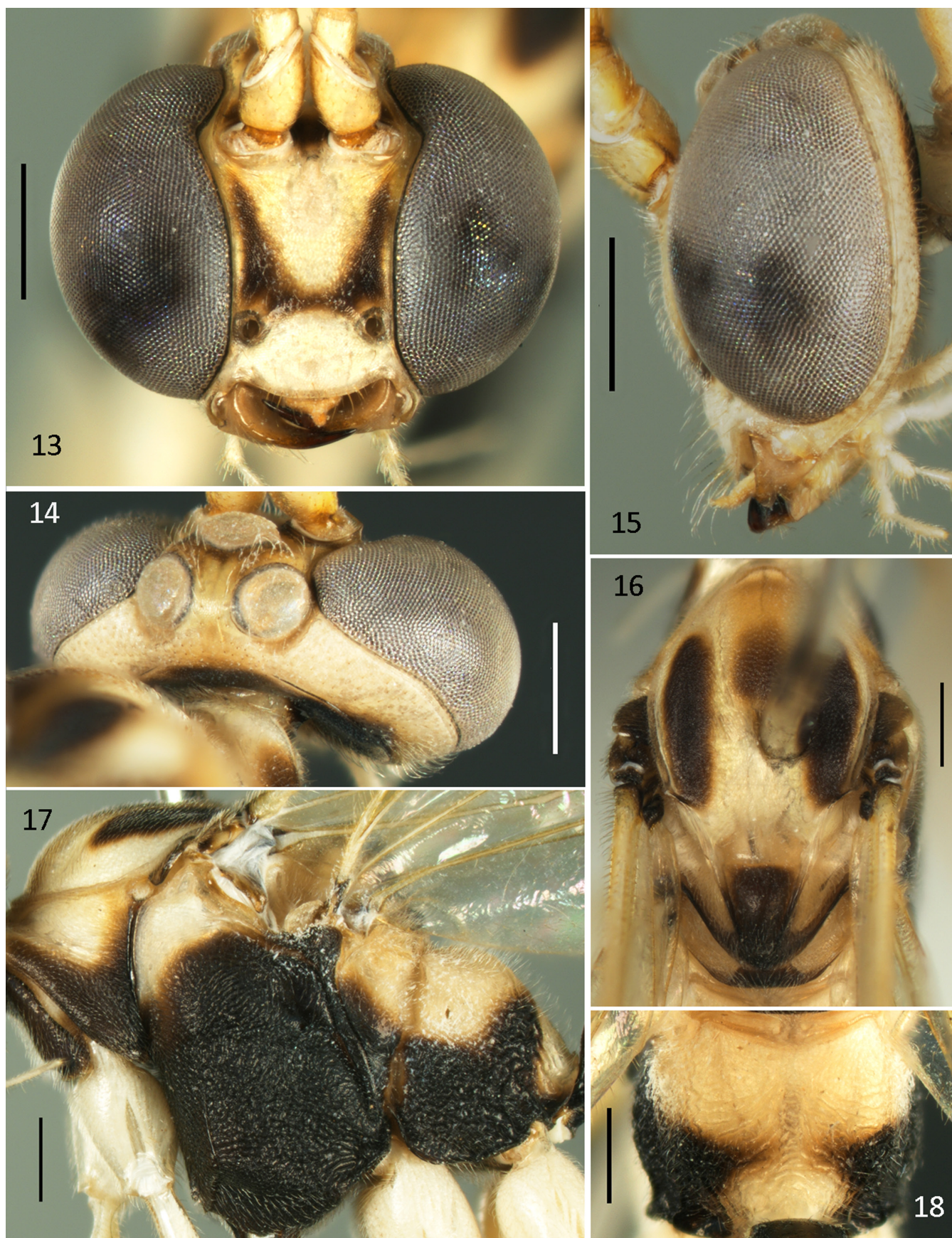
Description of male holotype. Head (Figs. 13–15) 1.8 times as wide as long; vertex in dorsal view slightly convex; occipital carina present, incomplete dorsally; occiput polished; interocellar area, vertex and gena weakly coriaceous and subpolished, setose; geno-orbital index 5.0; frons, face and clypeus granulate; frons with trans-striae; face 1.4 times as

wide as long; supraclypeal suture weak; clypeus 1.7 times as wide as long, with apical margin rounded; antenna with 44 flagellomeres, 1st flagellomere 1.5 times as long as the 2nd, the 2nd 3.0 times as long as wide.

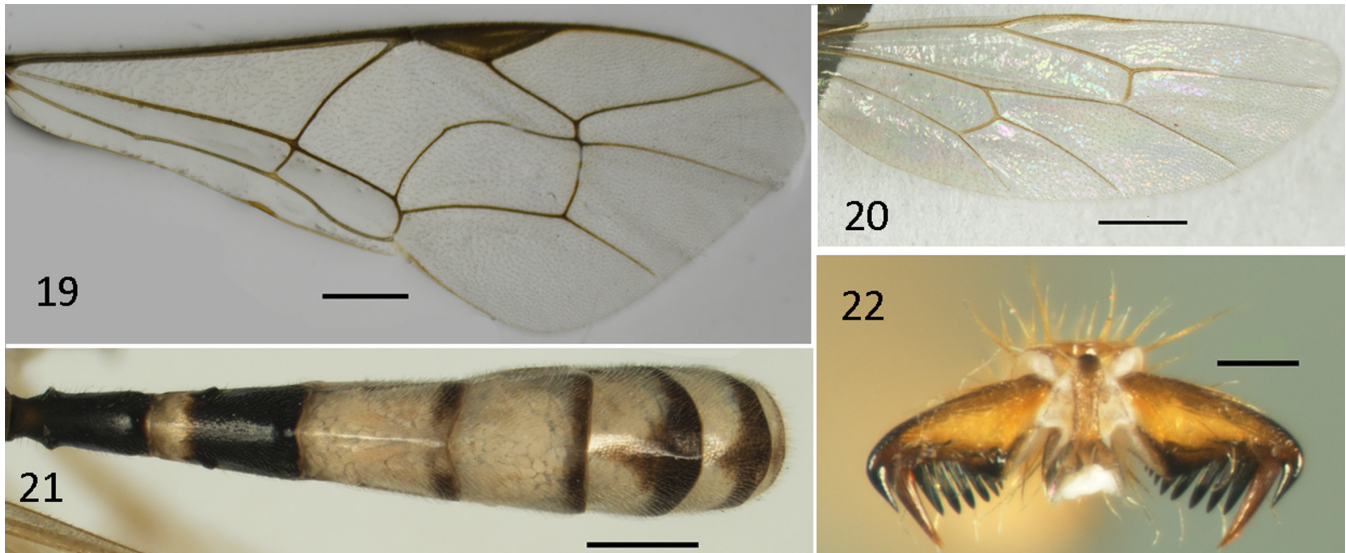
Mesosoma (Figs. 16–18) mat; pronotum weakly coriaceous and subpolished medially and striate laterally; mesoscutum granulate, 1.2 times as long as wide, with notaulus weak and fading out before level of anterior margin of tegula; scutellum weakly coriaceous, setose, posteriorly rugose, 1.45 times as long as distance between lateral carinae at its base, lateral carina extending entire length of scutellum; mesopleuron, metapleuron and propodeum reticulate rugose; propodeum without sublateral crest.

Fore tibial spur about 0.3 times as long as 1st tarsomere, which is 13.1 times as long as wide; fore tarsal claw with 13 pectines; mid tarsal claw with 9 pectines; hind tarsal claw with 11 pectines (Fig. 22).

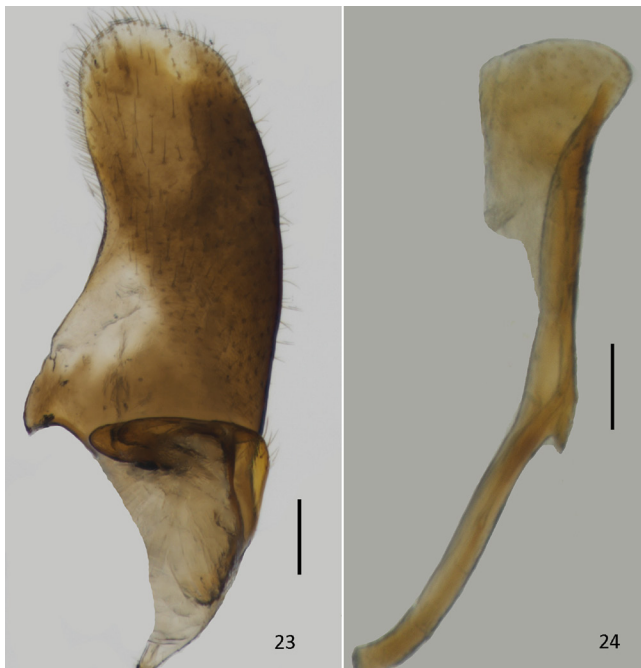
Fore wing 9.2 mm, 2.6 times as long as wide, abscissa of M between 2m-cu and 2rs-m distinctly shorter than 2rs-m,



Figs. 13–18. *Netelia (Monomacrodon) maculata* new species, male holotype: 13. Head in frontal view; 14. Head in dorsolateral view; 15. Head in lateral view; 16. Mesonotum; 17. Mesosoma in lateral view; 18. Propodeum in dorsal view. Scale bars = 0.5 mm.



Figs. 19–22. *Netelia (Monomacrodon) maculata* new species, male holotype: 19. Fore wing; 20. Hind wing; 21. Metasomal tergites; 22. Hind tarsal claws. Scale bars: Figs. 19–22 = 1 mm; Fig. 22 = 0.1 mm.



Figs. 23–24. *Netelia (Monomacrodon) maculata* new species, male paratype: 23. Paramere in median view; 24. Aedeagus in lateral view. Scale bars = 0.2 mm.

cu-a opposite Rs&M, slightly reclivous (Fig. 19); cell 1A with scattered setae and without band of setae; hind wing with 4 distal hamuli, nervellar index 0.7 (Fig. 20).

Metasoma coriaceous, densely setose; 1st tergite 3.1 times as long as apical width and 1.2 times as long as the 2nd (Fig. 21); paramere without marginal spine, pad and brace (Fig. 23); penis valve of aedeagus weakly widened apically and with dorsal margin short (Fig. 24); aedeagus with basal apodeme parallel sided and slightly curved (Fig. 24).

Colour. Yellowish white to brownish white except for the following black markings: apex of mandible, U-shaped marking on face, frons area behind antennal sockets, narrow

marking behind median ocellus, occiput, three stripes on mesoscutum, tegula, scutellum, postscutellum, propleuron, mesopleuron except antero-dorsal part, mesosternum, metapleuron, two large spots on propodeum laterally, 1st tergite entirely and 2nd tergite except basal part blackish brown and basal 0.3 of 1st sternite; posterior margins and distal half laterally of 3rd–4th tergites, lateral, median and posterior margins of 5th–7th tergites, 5th–8th sternites blackish brown; legs yellowish white, teeth of tarsal claws black. Wings hyaline; vein C, Sc+R and stigma of fore wing brownish yellow, other veins brown except basal part blackish.

Variation. Male paratypes have head from 1.7–1.8 times as wide as long; geno-orbital index 5.0–5.5; face 1.3–1.4 times as wide as long; clypeus 1.7–1.8 times as wide as long; antenna with 41–44 flagellomeres, the 2nd flagellomere 2.6–2.9 times as long as wide; fore wing length 9.0–9.5 mm, 2.6–2.8 times as long as wide, cu-a opposite to distad of Rs&M; hind wing with nervellar index 0.48–0.72; fore tarsal claw of one male paratype with 13 pectines; face blackish brown to black markings; propodeum with two lateral black spot to a black transversely stripe medially; terminal metasomal tergites with blackish brown to black markings.

Females (Figs. 25, 27). Similar to males, except geno-orbital index 5.8–6.8; 2nd flagellomere 3.1–3.2 times as long as wide; scutellum 1.6–1.7 times as long as distance between lateral carinae at its base; fore tarsal claw with 7–8 pectines; mid tarsal claw with 8–9 pectines; hind tarsal claw with 10–11 pectines; fore wing length 10.7–11.6 mm; hind wing with nervellar index 0.6. Ovipositor about twice as long as apical height of metasoma, with upper valve slightly ridged. Ovarian egg 0.8 mm long and 0.3 mm high, with a stalk on caudal end and with reticulate surface sculpture except dorsal 1/4 smooth (Fig. 27). Metasoma with posterior margins of 3rd–5th tergites, lateral portions of 3rd–8th tergites, cercus and 4th–5th sternites brown; ovipositor sheath brownish yellow with apical part brown.



25

Fig. 25. *Netelia (Monomacrodon) maculata* new species, female paratype, habitus in lateral view. Scale bar = 1 mm.



26



27

Figs. 26–27. Ovarian egg in lateral view: 26. *Netelia (Monomacrodon) bicolor*; 27. *Netelia (Monomacrodon) maculata* new species (scale bar = 0.1 mm).

Comparative notes. The new species resembles *Netelia (Monomacrodon) bicolor* in having the occipital carina present, the mat surface sculpture on the mesopleuron, the reticulate surface sculpture of the ovarian egg and the simplified paramere. It can be distinguished from the latter by the larger body size (fore wing length 9.0–11.6 mm vs 6.0–8.0 mm), bigger ovarian egg size (0.8 mm long vs 0.4–0.5 mm), the sculpture of the ovarian egg and the colour pattern as mentioned in the key. As for the paramere, the contours are very similar to each other in addition to the lack of pad and brace, so it seems that the male genitalia cannot be used to distinguish species in this subgenus.

Etymology. Named after the yellowish white and blackish brown markings of the body.

Distribution. Currently known from Laos and Vietnam. The new species represents the first record of the subgenus *Monomacrodon* from these countries.

ACKNOWLEDGEMENTS

This research was funded by the Vietnam National Foundation for Science and Technology Development (NAFOSTED) under grant number 106.05-2019.304 for the third author.

The first author was supported by the Grant-in-Aid for JSPS KAKENHI Grant number 19H00942. We would like to express our sincere thanks to T. Mita (Kyushu University), S. Shimizu (Kobe University), Chi-Feng Lee (TARI), Jing-Fu Tsai (NMNS) and colleagues from IEBR for offering us specimens and allowing us to examine specimens under their care.

LITERATURE CITED

- Coronado-Rivera J (2009) Filogenia de avispa del género *Netelia* (Hymenoptera: Ichneumonidae) con énfasis en las especies costarricenses. *Revista de Biología Tropical*, 57: 213–238.
- Cushman RA (1934) New Ichneumonidae from India and China. *Indian Forest Records*, 20: 1–8.
- Eady RD (1968) Some illustrations of microsculpture in the Hymenoptera. *Proceedings of the Royal Entomological Society of London*, 43: 66–72.
- Gauld ID (1983) *Netelia* species of the subgenera *Apatagium* Enderlein and *Monomacrodon* Cushman (Hymenoptera: Ichneumonidae) of Brunei with a re-assessment of the supraspecific classification. *Brunei Museum Journal*, 5(2): 123–143.
- Gauld ID (1991) The Ichneumonidae of Costa Rica 1. *Memoirs of the American Entomological Institute*, 47: 1–589.
- Konishi K (1985) A revision of the subgenus *Parabates* Foerster of the genus *Netelia* Gray from Japan (Hymenoptera, Ichneumonidae). *Kontyu*, 53: 616–624.
- Konishi K (2005) A preliminary revision of the subgenus *Netelia* of the genus *Netelia* from Japan (Hymenoptera, Ichneumonidae, Tryphoninae). *Insecta Matsumurana (new series)*, 62: 45–121.
- Snodgrass RE (1941) The male genitalia of Hymenoptera. *Smithsonian Miscellaneous Collections*, 99(14): 1–86, 33 pls.
- Tosquinet J (1903) Ichneumonides nouveaux. *Mémoires de la Société Entomologique de Belgique*, 10: 1–403.
- Townes H (1938) The Nearctic species of *Netelia* (*Paniscus* of authors) and a revision of the genera of Netelini. *Lloydia*, 1: 168–231.
- Yu DS, van Achterberg K & Horstmann K (2012) Taxapad 2012, Ichneumonoidea 2011. Database on flash-drive. Ottawa, Ontario, Canada. <http://www.taxapad.com>