台灣農業研究 (J. Taiwan Agric. Res.) 73(1):11–23 (2024)
https://doi.org/10.6156/JTAR.202403_73(1).0002

Research Article

The Newly Recorded Genus *Nipponaetes* Uchida (Hymenoptera: Ichneumonidae: Phygadeuontinae) from Taiwan Based on Redescriptions of Two Species, with Notes on Their Morphological Variations

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Abstract

Chen, H. P. and S. F. Shiao. 2024. The newly recorded genus *Nipponaetes* Uchida (Hymenoptera: Ichneumonidae: Phygadeuontinae) from Taiwan based on redescriptions of two species, with notes on their morphological variations. J. Taiwan Agric. Res. 73(1):11–23.

The genus *Nipponaetes* Uchida, 1933 was first reported from Taiwan, including two species: *N. haeussleri* (Uchida, 1933) and *N. striatus* Momoi, 1970. They were redescribed mainly based on the Taiwanese specimens, with special notes on the variations of the sculpture of metasomal tergite II. The species boundary between both species was also discussed based on extensive morphological and comparative study.

Key words: Redescription, New records, Ichneumonidae, Taxonomy, Taiwan.

INTRODUCTION

Nipponaetes Uchida, 1933 is composed of five described species, *N. haeussleri* (Uchida, 1933), *N. inelegans* (Seyrig, 1952), *N. fessus* (Townes, 1958), *N. striatus* Momoi, 1970, and *N. hansoni* (Gauld, 1997) and distributed pantropically, spanning the Oriental, Afrotropical, Neotropical, and Oceanic regions (Yu *et al*. 2016). The phylogenetic position and generic limits of *Nipponaetes* were previously discussed by Broad *et al*. (2004). By using morphological and molecular (28S D2–D3 ribosomal DNA) evidence, a neotropical tryphonine genus *Zurquilla* Gauld, 1997 was synonymized with *Nipponaetes*, and the suprageneric placement of *Nipponaetes* within Phygadeuotinae (tribe Phygadeuontini in subfamily Cryptinae *sensu* Broad *et al*. (2004)) rather than Tryphoninae was supported. Previous records indicated that *Nipponaetes* is associated with rice field agroecosystems (Momoi 1966; He 1984). It was reported to attack a wide range of hosts, including the pupae of Oriental fruit moth *Grapholitha molesta* (Busck, 1916) (Uchida 1933), cocoons of braconid wasp *Cotesia ruficrus* (Haliday, 1834) (He 1984; He *et al*. 1996), and egg sacs of Arachnids (Broad *et al*. 2004).

By examining the specimens obtained from a rice field arthropods biodiversity survey in Taiwan and specimens preserved in different museums, *Nipponaetes* Uchida was confirmed as a newly recorded genus in Taiwan, and *N. haeussleri* (Uchida, 1933) and *N. striatus* Momoi, 1970 were recorded for the first time in Taiwan. Two species were redescribed based on Taiwanese specimens. Morphologi-

Received: November 6, 2023; Accepted: December 19, 2023.
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cal variations and species boundaries of two species were also discussed based on detailed morphological examinations and multivariate analysis of the measurements.

MATERIALS AND METHODS

Morphological examination

Morphological terminology followed Broad *et al*. (2018), and the measurements followed Konishi (1985) in this study. Description of the cuticular microsculpture followed Eady (1968). The abbreviations and newly proposed measurements used in this study are listed below: post ocellus diameter (**OD**); posterio-ocellar line (**POL**); ocello-ocular line (**OOL**); basal width of areola (**ABW**); medial width of areola, the width of areola at the middle position of anterior transverse carina (costula) (**AMW**); apical width of areola (**AAW**); length of areola (**AL**). The materials examined in this study were deposited in the following institutes:

TARI: Taiwan Agricultural Research Institute, Taichung, Taiwan.

SEHU: The Laboratory of Systematic Entomology, The Hokkaido University Museum, Sapporo, Japan.

MNHAH: Museum of Nature and Human Activities, Sanda, Hyogo, Japan.

BM: Bishop Museum, Honolulu, Hawaii, USA.

Specimens were examined and measured by the microscope LEICA S8AP0 with an electronic micrometer (TEKFAR Inc., Taichung, Taiwan). Photographs were taken by LEICA DMC5400 adjacent to LEICA Z16 APO with auto-stacking system LAS V4.13 (Leica Microsystems, Wetzlar, Germany). All figures were edited and arranged into figure plates by Adobe Illustrator CC and Photoshop CC (Adobe Systems Inc., San Jose, CA, USA). The Latin term *ibidem*, meaning "same as previous except as follows", was used for compressing the locality information in the materials examined section.

Measurements and statistical analysis

Descriptive statistics was performed by Microsoft Excel (Microsoft, Redmond, WA, USA). Principal component analysis (PCA) and biplots of first and second principal components (PC1 and PC2) of 21 variates (including OD, head width/length, POL/OD, OOL/OD, face width/height, clypeus width/height, malar space length/basal mandibular width, mesuscutum length/width, scutellum length/width, fore wing distance between Rs&M and cu-a/ cu-a length, tergite I length/ apical width, tergite II length/ apical width, tergite II basal width/apical width, hind femur length/width, first flagellomere length/width, second flagellomere length/width, hind basitarsus length/second tarsomere length, ABW/AL, AMW/AL, AAW/AL, ABW/AMW) from 30 female *Nipponaetes* specimens were performed in R 4.2.1 (R Core Team 2022).

RESULTS

Taxonomy

Genus *Nipponaetes* Uchida, 1933 [角臉姬蜂屬]

Nipponaetes Uchida, 1933:160. Type species: *Hemiteles* (*Nipponaetes*) *haeussleri* Uchida, 1933, by original designation.

Potia Seyrig, 1952:36. Type species: *Potia inelegans* Seyrig, 1952, by original designation. Synonymized with *Nipponaetes* by Townes *et al*. 1965:136.

Thalops Townes, 1958:57. Type species: *Thalops fessus* Townes, 1958, by original designation. Synonymized with *Potia* by Townes *et al*. 1961:124.

Zurquilla Gauld, 1997:404. Type species: *Zurquilla hansoni* Gauld, 1997, by original designation. Synonymized with *Nipponaetes* by Broad *et al*. 2004:653.

Diagnosis.

This genus can be separated from other phygadeuontine genera by the combinations of

the following characteristics: face usually with compressed convexity medially; clypeus truncate; notauli extend after half of mesoscutum and joining together posteriorly; scutellum with lateral carina; propodeum without distinct apophyses; postpectal carina complete; lateral longitudinal carina of propodeum present before spiracle; fore wing 2m-cu fully developed with one bulla; hind wing nervellus distinctly inclivous and intercepted; tergites II and III separated and unspecialized.

Key to Taiwanese species of *Nipponaetes*

(1) Malar space with single yellow marking (Fig. 1D); hind coxa reddish brown (Fig. 1A); hind tibia and femur with black or blackish brown marking distinct (Fig. 1A); convexity of middle face triangular (Fig. 1D); metasomal tergite II with granulated type (Fig. 1E)..... *N. haeussleri* (Uchida, 1933).

(2) Malar space black without single yellow

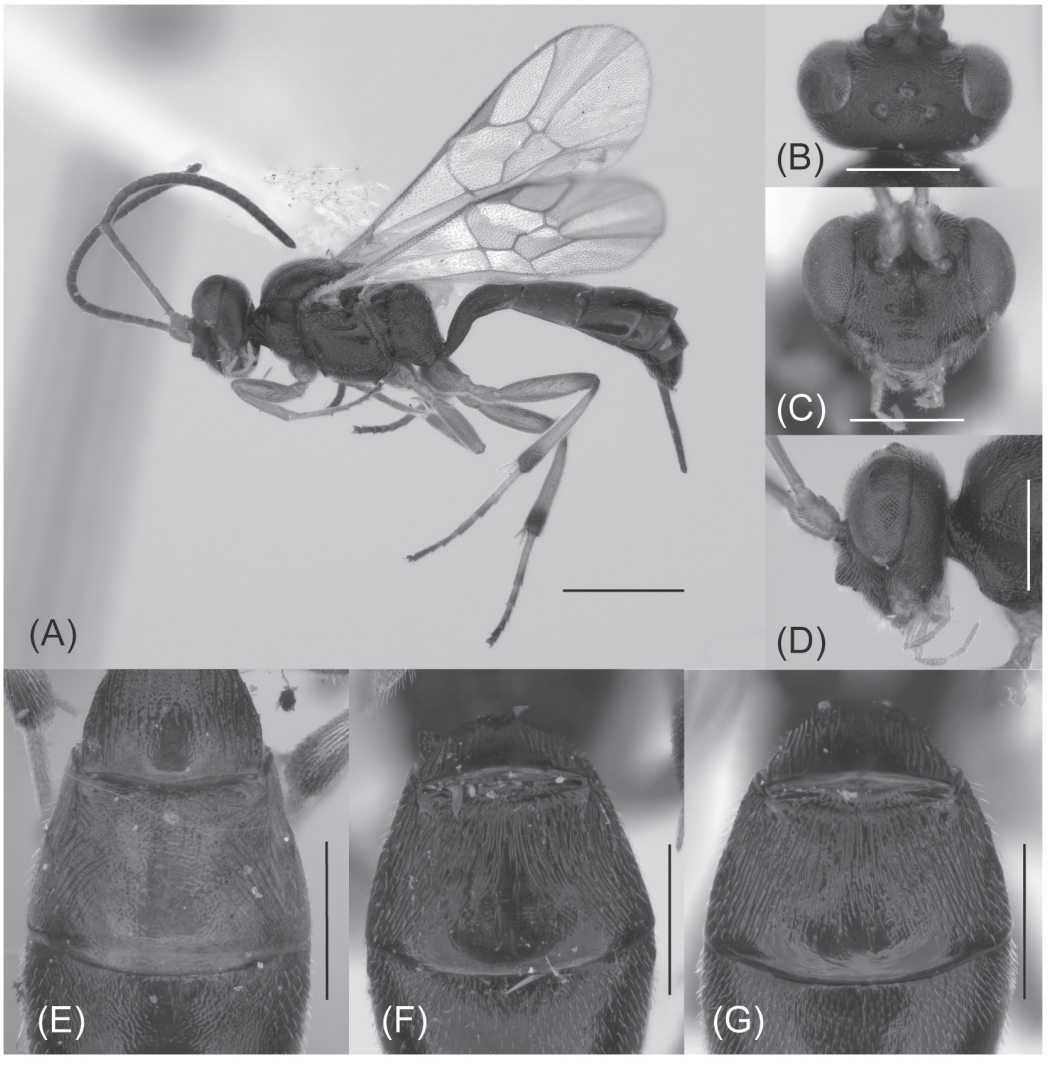

Fig. 1. *Nipponaetes haeussleri* (Uchida, 1933), female (TARI). (A) lateral habitus; (B) head in dorsal view; (C) head in anterior view; (D) head in lateral view; (E) metasomal tergite II, Type I; (F) ditto, Type II; (G) ditto, Type III. Scale bars: (A) 1 mm; (B)–(G) 0.5 mm.

marking (Fig. 2D); hind coxa blackish brown (Fig. 2A); hind tibia and femur with blackish brown marking gradually faded (Fig. 2A); convexity of middle face short and blunt (Fig. 2D); metasomal tergite II not granulated..... *N. striatus* Momoi, 1970.

***Nipponaetes haeussleri* (Uchida, 1933) 黑角臉姬蜂**

Hemiteles (*Nipponaetes*) *haeussleri* Uchida, 1933:159.

Nipponaetes haeussleri–Townes, 1957: 113.

Diagnosis.

This species can be separated from other Asian congeners, *N. fessus* (Townes, 1958) and *N. striatus* Momoi, 1970, by the combination of the following characters: malar space with a yellow marking; fore wing cu-a slant outward; hind coxa reddish brown; metasomal tergite II with granulated type.

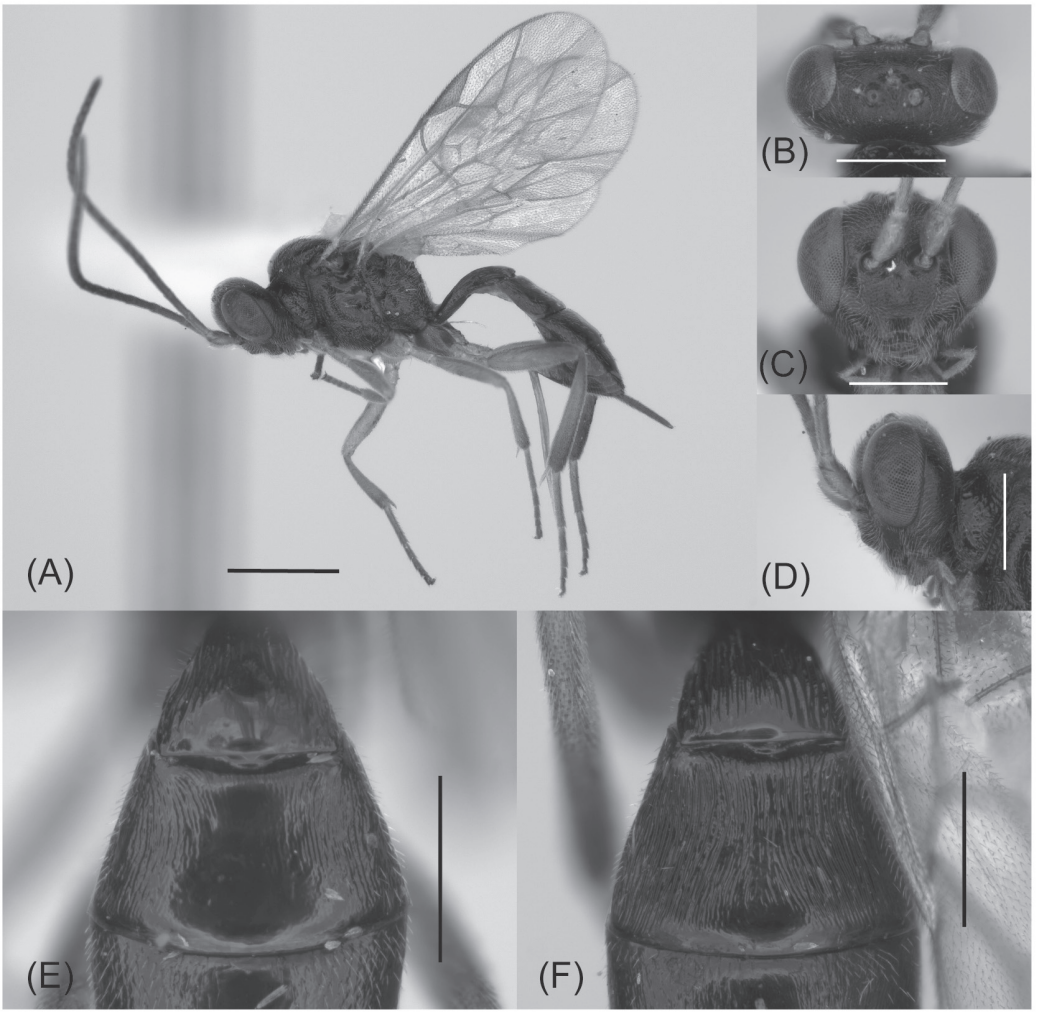

Fig. 2. *Nipponaetes striatus* Momoi, 1970, female (TARI). (A) lateral habitus; (B) head in dorsal view; (C) head in anterior view; (D) head in lateral view; (E) metasomal tergite II, Type I; (F) ditto, Type II. Scale bars: (A) 1 mm; (B)–(F) 0.5 mm.

Materials examined.

Type material. Holotype: 1♀ (SEHU), "Suigen (= Su-Won), Keikiko, Chosen (= Korea)", 30.X.1932, G. J. Haessler leg., Reared from pupae of *G. molesta* (*Grapholitha molesta*). **Non-type materials.** 1♂ (TARI, NP16), "C. Taiwan (= Central Taiwan), Taichung (TAEs)", 11.V.1976, K. S. Lin leg., Rice field; 1♀ (TARI, NP08), "C. Taiwan, Wangfeng Hill, Taichung Hsien (= Taichung county)", 30.XII.1982, K. C. Chou, S. P. Huang leg.; 1♂ (TARI, NP15), "C. Taiwan, Wangfeng, Taichung Hsien", 31.XII.1979, K. S. Lin leg.; 1♀ (TARI, NP35), "N. Taiwan (= Northern Taiwan), Sintien [新店]", 20.XII.1968, K. H. Chang leg.; 1♀ (TARI, NP05), "E. S. Taiwan (= Eastern South Taiwan), Chihpen [知本], Taitung Hsien (= Taitung County)", 17–18.XI.1982, L. Y. Chou, K. C. Chou leg.; 1♂, 2♀♀ (TARI, NP23–25), "Formosa, Kagi (= Chiayi)", M. Kato leg., "蜘蛛巢寄生 [parasiting the nest of spider]"; 1♀ (TARI, NP34), "Kueishan, Taiwan", 1.III.1963, S. C. Chiu leg.; 2♀♀ (TARI, NP12, 29), "N. Taiwan, Taipei", 26.XI.1968, K. H. Chang leg.; 5♀♀ (TARI, NP09–11, 13, 21), "S. Taiwan (= Southern Taiwan), Chishan [旗山], Pingtung Hsien (= Pingtung County)", 25.III.1982, K. C. Chou, C. C. Pan leg.; 4♀♀ (TARI, NP01, 03, 04, 19), "S. Taiwan, Lanyu [= Orchid Island; 蘭嶼], Taitung Hsien", K. S. Lin, K. C. Chou, S. C. Lin, C. C. Pan leg.; 3♂♂ (TARI, NP07, 18–20), *ibidem*, 13–18.IV.1981, K. S. Lin, L. Y. Chou, T. Lin, S. C. Lin leg.; 2♀♀ (TARI, NP02, 06), "S. Taiwan, Shantimen [三地門], Pingtung Hsien", 24.III.1982, K. C. Chou, C. C. Pan leg.; 1♂, 1♀ (TARI, NP14, 36), *ibidem*, 1–5.III.1982; 1♂ (TARI, NP22), "Taihoku", 16.XI.1920, J. Sonan leg.; 1♂ (TARI, NP32), "Taiwan, Kuanhsi [關西]", 13.XII.1968, Unknown collector, Malaise trap; 1♂ (TARI, NP28), "Taiwan, Sintien", 9.IV.1968, S. H. Lin leg.; 1♀ (TARI, NP30), *ibidem*, 20.XII.1968, K. H. Chang leg.; 1♀ (TARI, NP27), "Taiwan, Taichung, Wangfeng", 24.III.1979, K. S. Lin leg.; 1♀ (TARI, NP26), "Taiwan, Taipei", 6.VIII.1960, K. S. Lin leg., Rice field; 1♀ (TARI, NP31), *ibidem*, 24.XI.1962, H. H. Cheng leg.; 1♀ (TARI, NP33), *ibidem*, 29.VII.1967, K. C. Chou; 1♂ (TARI, NP17), *ibidem*, 15.IV.1963, H. H. Cheng leg.; 1♂ (TARI), "Taiwan, Miaoli County, Yuanli Township, 24.378030 N, 120.697275 E, LC-1", 1.XI.2019, C. L. Huang leg., Rice field; 1♂ (TARI), "Taiwan, Miaoli County, Yuanli Township, 24.368548 N, 120.705008 E, LO-3", 26.VI.2019, C. L. Huang leg.

Redescription.

The redescription was based on Taiwanese specimens (25 females, 12 males).

Female. Head granulated, 1.57–2.13 (1.85 ± 0.17) times as wide as long; face polished, densely punctate with setae, 1.58–2.45 (1.99 ± 0.20) times as wide as height, with single compressed convexity medially, triangular in lateral view; eyes bare; malar space 1.08–2.00 (1.44 ± 0.21) times of basal mandibular width; clypeus polished, sparsely punctate with setae, 1.67–2.88 (2.11 ± 0.33) times as wide as height, apically truncate, convex medially in lateral view, apical margin with long setae; mandible bidentate, with upper tooth longer than lower tooth; occipital carina joined with hypostomal carina behind mandible base; OD 0.05–0.08 (0.06 ± 0.01) mm; POL/OD = 1.38–3.00 (2.15 ± 0.43); OOL/OD = 1.00–2.00 (1.46 ± 0.32); flagellomeres 20; first flagellomere 4.00–6.25 (4.91 ± 0.59) times as long as wide, 0.86–1.22 (1.04 ± 0.09) times as long as second; second flagellomere 4.00–5.80 (4.72 ± 0.44) times as long as wide.

Mesosoma granulated; pronotum polished, with short transverse carina at upper- and lower-posterior corners; epomia present; mesuscutum 0.87–1.08 (0.95 ± 0.06) times as long as wide; notauli distinct, extend after 0.5 of mesoscutum and joining together posteriorly; scutellum polished, granulated or rugose, 0.63–1.14 (0.87 ± 0.15) times as long as wide, with lateral carina extends to its apex; mesopleurum smooth at ventral posterior corner, with weakly and oblique striate medially; speculum polished and smooth; epicnemial carina strong, extend to about 0.6 anterior

height of mesopleurum; sternaulus extend above 0.7 lengths of mesopleurum; propodeum rugoso-punctate; propodeal spiracle circular; all carinae complete and strong; ABW/AL = 0.27–0.73 (0.45 ± 0.12); AMW/AL = 0.80–1.50 (1.13 ± 0.18); AAW/AL = 0.60–1.25 (0.86 ± 0.15); ABW/AMW = 0.27–0.56 (0.40 ± 0.07).

Fore wing length 2.16–3.11 (2.81 ± 0.21) mm; cu-a slant outward, distad Rs&M 0.14–0.33 (0.24 ± 0.06) by its length; areolet absent, 2r-m length subequal to first abscissa (1/M); 2m-cu slant outward with one bulla; hind wing nervellus inclivous, intercepted at about lower 0.2.

Legs with coxa polished and punctate; tibial spurs equal length in mid legs, outer slightly longer than inner in hind legs; hind femur 4.00–5.69 (4.62 ± 0.48) times as long as wide; hind basitarsus 1.89–2.88 (2.32 ± 0.23) times as long as second; tarsal claws simple.

Metasoma with tergite I dorsally curved in lateral view, 0.96–1.69 (1.35 ± 0.20) times as long as apical width, highly variable in sculpture, ranging from granulated to smooth; petiole with longitudinal striae at middle area, postpetiole with longitudinal striae at lateral area; glymma absent; latero-median carina and dorsolateral carina present; tergite II 0.49–0.71 (0.61 ± 0.05) times as long as apical width, basal width 0.64–0.76 (0.69 ± 0.03) times as wide as apical width, sculpture highly variable, ranging from granulated to smooth, with weak to strong longitudinal striae at basal 0.7–0.9, straight basally and oblique laterally, or oblique laterally that forming a triangle area, or straight; thyridium present; tergite III granulate or striate at basal 0.5, smooth at apical 0.5; tergites after IV polished and smooth; ovipositor sheath straight, slightly tapered apically; ovipositor straight, without nodus, lower valve longer than upper valve, with proximal tooth apically.

Colors: head black; scape, pedicel, and basal 3–5 flagellomeres reddish brown, another part black or blackish brown; malar space with single triangular yellow marking; mandible yellowish brown, reddish brown at apex; maxillary and labial palps yellow; mesosoma black except tegula reddish brown or yellow; legs yellowish brown, except coxae reddish brown, apical part of hind femora, basal and apical part of hind tibia distinctly black or blackish brown, and tarsus except basal part of hind basitarsus blackish brown; wing hyaline; wing veins pale brown; metasomal tergites black, blackish brown tinged with reddish brown, or reddish brown; ovipositor sheath blackish brown; ovipositor yellowish brown.

Male. Male coloration and body structures were mostly similar to females except the following measurements: head 1.68–2.09 (1.88 ± 0.14) times as wide as long; face 1.57–2.05 (1.83 ± 0.16) times as wide as long; clypeus 1.67–2.88 (2.08 ± 0.35) times as wide as long; malar space 1.09–1.67 (1.41 ± 0.18) as long as basal mandibular width; OD = 0.04–0.08 (0.06 ± 0.01) mm; POL/OD = 1.71–3.00 (2.33 ± 0.43); OOL/OD = 1.00–2.00 (1.52 ± 0.30); first flagellomere 3.33–5.50 (4.04 ± 0.66) times as long as wide, 0.69–0.85 (0.74 ± 0.04) times as long as second; second flagellomere 2.57–4.75 (3.18 ± 0.57) times as long as wide; mesoscutum 0.88–1.03 (0.95 ± 0.05) times as long as wide; scutellum 0.71–1.03 (0.85 ± 0.11) times as long as wide; fore wing length 2.23–3.00 (2.69 ± 0.23) mm; cu-a distad Rs&M 0.14–0.33 (0.25 ± 0.05) by its length; basitarsus 2.00–3.38 (2.37 ± 0.39) times as long as second tarsomere; BW/AL = 0.43–0.73 (0.56 ± 0.11); AMW/AL = 0.85–1.55 (1.16 ± 0.18); AAW/AL = 0.73–1.18 (0.85 ± 0.12); ABW/AMW = 0.40–0.62 (0.49 ± 0.07).

Distribution. China (Guangdong, Hubei, Jiangsu, Zhejiang) (He 1984; He *et al*. 1996; He *et al*. 2004), India (Momoi 1966), Japan (Honshu, Kyushu, Amamioshima Is., Okinawajima Is.) (Momoi 1970; Watanabe 2021), Korea (Uchida 1933), Philippine (Luzon Is.) (Momoi 1966), Thailand (Broad *et al*. 2004), new to Taiwan (Taipei, Hsinchu, Miaoli, Taichung, Chiayi, Pingtung, Taitung, Lanyu Is.).

Bionomics. Hosts: *Grapholitha molesta* (Busck, 1916) (Uchida, 1933); *Cotesia ruficrus* (Haliday, 1834) (He 1984; He *et al*. 1996); egg sacs

of Arachnids (Broad *et al*. 2004; this study). This species was reported to be associated with rice field agroecosystem (Momoi 1966).

Remarks. The sculpture of metasomal tergite II was observed to be highly variable in this species. It was summarized to three types: **Type I**, same as holotype, granulated with weak and dense longitudinal striae at basal 0.7–0.9, straight basally and oblique laterally (n = 25) (Fig. 1E); **Type II**, polished and smooth, with weak longitudinal striae at basal 0.7, oblique laterally and forming a smooth triangle area apically (n = 4) (Fig. 1F) and **Type III**, polished and smooth, with strong and straight longitudinal striae at basal 0.7 (n = 8) (Fig. 1G).

High variation of measurements and metasomal tergite II sculptures might indicate hidden diversity within this species. The measurements of samples from different metasomal tergite II types are summarized in Table 1.

Chinese vernacular name. The current Chinese vernacular name of *N. haeussleri* was mentioned in He (1984) and He *et al*. (1996), representing both the black body color and transliteration of the eponymous specific name.

Nipponaetes striatus Momoi, 1970 條背角臉姬蜂

Nipponaetes striatus Momoi, 1970:346.

Table 1. Measurements of different tergite II types in Taiwanese *Nipponaetes* females.

Species	*N. haeussleri*			*N. striatus*	
	Type I	Type II	Type III	Type I	Type II
Tergite type	n = 17	n = 4	n = 4	n = 6	n = 1
OD (mm)	0.05–0.07	0.07	0.06–0.08	0.07–0.08	0.08
OOL/OD	1.14–2.20	1.00–1.57	1.00–1.50	1.00–1.43	1.00
POL/OD	1.71–2.80	1.57–2.57	1.38–3.00	1.25–1.71	1.38
Head width/length	1.57–2.08	1.76–2.13	1.70–1.95	1.78–2.05	1.84
Face width/height	1.58–2.20	1.82–2.28	1.95–2.45	2.00–2.50	2.00
Clypeus width/height	1.67–2.88	1.85–2.42	1.80–2.08	1.82–2.50	2.31
Malar space/mandible width	1.08–2.00	1.17–1.78	1.36–1.42	1.33–1.80	1.33
First flagellomere length/width	4.17–6.25	4.40–5.00	4.00–5.80	3.50–5.00	5.00
Second flagellomere length/width	4.00–5.80	4.00–5.40	4.50–5.60	4.40–5.75	4.50
First flagellomere length/second	0.86–1.22	0.93–1.14	0.89–1.08	0.91–1.11	1.11
Mesoscutum length/width	0.87–1.08	0.90–0.98	0.92–1.05	0.86–1.05	0.96
Scutellum length/width	0.70–1.14	0.74–0.89	0.63–0.88	0.71–0.96	0.83
Fore wing length (mm)	2.16–2.98	2.85–3.11	2.85–3.07	2.52–3.00	3.00
Distance between Rs&M and cu-a/cu-a length	0.14–0.33	0.17–0.29	0.14–0.27	0.18–0.33	0.18
ABW/AL	0.27–0.64	0.42–0.73	0.41–0.64	0.40–0.75	0.75
AMW/AL	0.80–1.42	1.08–1.50	1.06–1.36	1.00–1.25	1.25
AAW/AL	0.60–1.25	0.67–1.09	0.73–0.92	0.73–0.94	0.88
ABW/AMW	0.27–0.56	0.33–0.50	0.39–0.50	0.35–0.60	0.60
Tergite I length/width	0.96–1.69	1.04–1.30	1.15–1.57	1.39–1.83	1.80
Tergite II length/width	0.49–0.71	0.60–0.65	0.54–0.62	0.51–0.75	0.67
Tergite II basal/apical width	0.64–0.76	0.65–0.75	0.65–0.75	0.62–0.70	0.62
Hind femur length/width	4.19–5.69	4.13–5.23	4.00–4.59	3.95–4.93	4.23
Hind basitarsus length/second tarsomere	1.89–2.58	2.20–2.62	2.11–2.88	2.20–2.47	2.43

Diagnosis.

This species can be separated from other Asian congeners by the combination of the following characteristics: malar space without yellow marking; fore wing cu-a slant outward; hind coxa blackish brown or black; metasomal tergite II not granulated.

Materials examined.

Type material. Holotype: 1♂ (BM, Bishop 9140, temporarily deposited in MNHAH), "Kara-yama, Ishigaki Is., Ryukyu Is.", 14–18. III.1964, C. M. Yoshimoto, J. Harrell leg., Malaise Trap. (by Photos). **Non-type materials.** 1♀ (TARI, NP44), "C. Taiwan, Lushan [廬山], 1000 m, Nantou Hsien", 27–31.V.1980, K. S. Lin, L. Y. Chou leg.; 1♀ (TARI, NP43), "C. Taiwan, Tungpu [東埔], 1200m, Nantou Hsien", 5–8. X.1981, T. Lin, W. S. Tang leg.; 1♀ (TARI, NP37), "N. Taiwan, Wufeng [五峰], 400m, Hsinchu Hsien", 14–16.VII.1982, K. C. Chou, C. C. Pan leg.; 1♀ (TARI, NP38), "S. Taiwan, Shantimen, Pingtung Hsien", 31.I–4.II.1983, K. C. Chou, S. P. Huang leg.; 2♀♀ (TARI, NP41–42), *ibidem*, 1–5.III.1982, K. C. Chou, C. C. Pan leg.; 1♂, 1♀ (TARI, NP39–40), "S. Taiwan. Lanyu, Taitung Hsien", 4–9.V.1982, K. S. Lin, K. C. Chou, S. C. Lin, C. C. Pan leg.; 1♀ (TARI, NP45), "東埔 [Dongpu]", 28.XI.1957, F. L. Ye leg.

Redescription.

The redescription was based on Taiwanese specimens (7 females, 2 males).

Female. Head granulated, 1.78–2.05 (1.91 ± 0.11) times as wide as long; face polished, densely punctate with setae, 2.00–2.50 (2.20 ± 0.16) times as wide as height, with single compressed convexity medially, short and blunt in lateral view; eyes bare; malar space 1.33–1.80 (1.50 ± 0.16) times of basal mandibular width; clypeus polished, sparsely punctate with setae, 1.82–2.50 (2.14 ± 0.28) times as wide as height, apically truncate, convex medially in lateral view, apical margin with long setae; mandible bidentate, with upper tooth longer than lower tooth; occipital carina joined with hypostomal carina behind mandible base; OD 0.07–0.08 (0.08 ± 0.005) mm; POL/OD = 1.25–1.71 (1.52 ± 0.16); OOL/OD = 1.00–1.43 (1.21 ± 0.18); flagellomeres 20; first flagellomere 3.50–5.00 (4.36 ± 0.45) times as long as wide, 0.91–1.11 (0.97 ± 0.07) times as long as second; second flagellomere 4.40–5.75 (4.75 ± 0.47) times as long as wide.

Mesosoma granulated; pronotum polished, with short transverse carina posteriorly; epomia present; mesuscutum 0.86–1.05 (0.94 ± 0.07) times as long as wide; notauli distinct, extend after 0.5 of mesoscutum and joining together posteriorly; scutellum polished, rugose with transverse carina, 0.71–0.96 (0.86 ± 0.08) times as long as wide, with lateral carina extends to its apex; mesopleurum smooth at ventral posterior corner, with weakly and oblique striate medially; speculum polished and smooth; epicnemial carina strong, extend to 0.8 anterior height of mesopleurum; sternaulus extend above 0.7 length of mesopleurum; propodeum rugoso-punctate; propodeal spiracle circular; all carinae complete and strong; ABW/AL = 0.40–0.75 (0.52 ± 0.13); AMW/AL = 1.00–1.25 (1.11 ± 0.08); AAW/AL = 0.73–0.94 (0.86 ± 0.08); ABW/AMW = 0.35–0.60 (0.47 ± 0.09).

Fore wing length 2.52–3.00 (2.71 ± 0.20) mm; cu-a slant outward, distad Rs&M 0.18–0.33 (0.25 ± 0.05) by its length; areolet absent, 2r-m length subequal to first abscissa (1/M); 2m-cu slant outward with 1 bulla; hind wing nervellus inclivous, intercepted at about lower 0.2.

Legs with coxa polished and punctate; tibial spurs equal length in mid and hind legs; hind femur 3.95–4.93 (4.28 ± 0.33) times as long as wide; hind basitarsus 2.20–2.47 (2.34 ± 0.11) times as long as second; tarsal claws simple.

Metasoma with tergite I dorsally curved in lateral view, 1.39–1.83 (1.67 ± 0.15) times as long as apical width, polished and smooth; petiole and postpetiole with longitudinal striae medially; glymma absent; latero-median cari-

na and dorso-lateral carina present; tergite II 0.51–0.75 (0.66 ± 0.08) times as long as apical width, basal width 0.62–0.70 (0.64 ± 0.03) times as wide as apical width, sculpture variable, polished and smooth, with weak to strong longitudinal striae at basal 0.7–0.9, completely straight or oblique laterally; thyridium present; tergite III smooth; tergites after IV polished and smooth; ovipositor sheath straight, slightly tapered apically; ovipositor straight, without nodus, lower valve longer than upper valve, with proximal tooth apically.

Colors: head black; scape, pedicel, and basal 2 flagellomeres reddish brown, another part black or blackish brown; malar space black without pale marking; mandible, maxillary and labial palps reddish brown; mesosoma black except for tegula reddish to blackish brown; legs reddish brown, except fore and mid coxa reddish brown, hind coxae blackish brown, apical part of hind femora, basal and apical part of hind tibia graduated blackish brown, and tarsus except for basal part of hind basitarsus blackish brown; wing hyaline; wing veins pale brown; metasomal tergites black, blackish brown tinged with reddish brown, or reddish brown; ovipositor sheath blackish brown; ovipositor yellowish brown.

Male. Male coloration and body structures were mostly similar to females except for the following measurements: head 1.80–1.97 times as wide as long; face 2.04–2.20 times as wide as long; clypeus 2.25–2.31 times as wide as long; malar space 1.30–1.40 as long as basal mandibular width; OD = 0.07–0.08 mm; POL/OD = 1.50–1.57; OOL/OD = 0.88–1.29; first flagellomere 3.00–3.50 times as long as wide, 1.11 times as long as second; second flagellomere 3.17–3.80 times as long as wide; mesoscutum 0.95–0.96 times as long as wide; scutellum 0.93–0.97 times as long as wide; fore wing length 2.54–2.73 mm; cu-a distad Rs&M 0.23–0.29 by its length; basitarsus 2.35–2.47 times as long as second tarsomere; BW/AL = 0.50–0.57; AMW/AL = 1.08–1.21; AAW/AL = 0.67–0.79; ABW/AMW = 0.46–0.47.

Distribution. Japan (Honshu, Ishigaki Is., Iriomote Is.) (Momoi 1970; Konishi *et al*. 2014), new to Taiwan (Hsinchu, Nantou, Pingtung, Lanyu Is.).

Bionomics. Unknown.

Remarks. The sculpture of metasomal tergite II was observed variable in this species and summarized as two types: **Type I**, same as holotype, polished, smooth with weak and oblique striae laterally (n = 6) (Fig. 2E) and **Type II**, polished, with strong and straight striae, smooth middle-posteriorly (n = 3) (Fig. 2F). Another type with metasomal tergite II smooth without striae was reported in one Japanese (Honshu) individual (Konishi *et al*. 2014). The measurements of samples from different metasomal tergite II types were summarized in Table 1.

According to the original designation, the holotype deposition should be BM but currently deposited in MNHAH since the type labels of Momoi's types were not attached (Watanabe & Ito 2023). Further confirmation of the deposition of Momoi's type series should be made in the future (Watanabe personal communication).

Chinese vernacular name. This species does not have Chinese vernacular name in the past. The Chinese vernacular name is proposed for the first time according to the etymology of specific name, representing its striate metasomal tergite II.

Multivariate statistical analysis

Morphometric measurements of female *Nipponaetes* form four clusters in the PCA biplot: *N. haeussleri* Type I, II, III, and *N. striatus* Type I (Fig. 3). The 0.68 confidence ellipses of *N. haeussleri* Type II and III are mostly overlapped with those of *N. haeussleri* Type I and *N. striatus* Type I (Fig. 3). The higher scores of the first principal component (PC1: 20.8% of overall variation explained) suggests higher values of OD, ABW/AMW, face width/

length ratio, and ABW/AL, which mainly contributes to the separation of the *N. haeussleri* Type I and *N. striatus* Type I clusters. The second principal component (PC2: 15.6% of overall variation explained) is positively influenced by the ratio of head width/length, AMW/AL and AAW/AL. Principal component analysis also shows that over 90% of the variance in morphometrics can be summarized within PC1 through PC11.

DISCUSSION

Significant morphological variations, particularly on the sculpture of metasomal tergite II and measurements, were observed in both *Nipponaetes* species from Taiwan. Excluding the yellow marking on the malar space and the colors of the hind legs, the metasomal tergite II and measurements of Types II and III in *N. haeussleri* overlap with those of *N. striatus* (Fig. 3; Table 1), making morphological species delimitation of both species unclear. However, the measurements of Type I in both species are the most numerous and separated in the PCA biplot (Fig. 3), allowing for partial differentiation using the OD and POL/OD ratios (Table 1). In contrast, Types II and III in *N. haeussleri* display intermediate characteristics between these clusters.

Since *N. haeussleri* has a broad distribution across East Asia (Yu *et al*. 2016), the expansive distribution range combined with significant morphological variations suggests hidden species diversity within this species that might be uncovered by using integrated taxonomic approaches (e.g., Veijalainen *et al*. 2011; Barão *et al*. 2014; Rougerie *et al*. 2014; Fusu 2017, etc.). If further subdivisions within both species are made, the Type I might be considered typical. It is also noteworthy that the holotype of a Madagascan species, *N. in-*

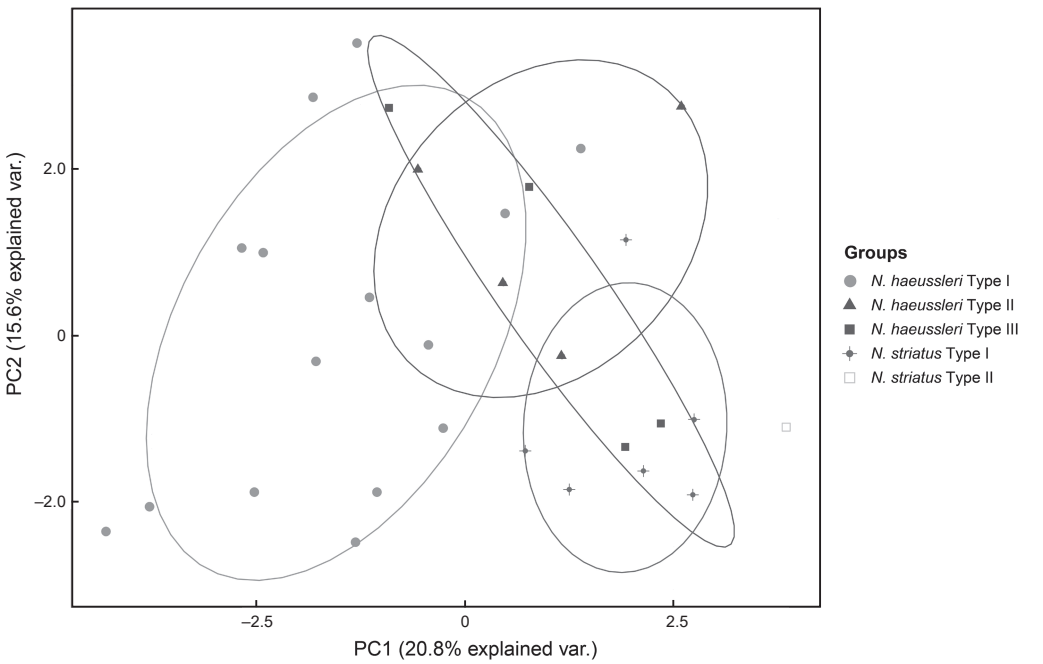

Fig. 3. Principal component (PC) analysis biplot of Taiwanese *Nipponaetes* females. Samples of different metasomal tergite II types were marked and grouped by different colors.

elegans (Seyrig, 1952) (Holotype photos are available at https://science.mnhn.fr/institution/mnhn/collection/ey/item/ey10870?fbclid=IwAR25OcJooMdvklEmWy23XS4TxLK2i0hjeFOu-wGX5RvSCG0cC1Zmo5RRp-Y), is similar to the Type III of *N. haeussleri*. However, their vast geographical distance suggests they may not be conspecific.

While the morphological species boundaries between *N. haeussleri* and *N. striatus* overlap (Konishi *et al*. 2014; Watanabe 2021; this study), we refrain from making taxonomic treatment in this study due to the limited geographic sampling area and the absence of molecular evidence. Further sampling across a broader geographic range and DNA data are necessary to revise the taxonomy of Asian *Nipponaetes*. The results of the present study fill the distribution gap for *N. haeussleri* and provide the first detailed description of their morphological variations. This contributes to understanding the taxonomy within this group and enhances our knowledge of biodiversity in the rice field agroecosystems in Taiwan.

ACKNOWLEDGEMENTS

We would like to express our sincere thanks to Kyohei Watanabe (Kanagawa Prefectural Museum of Natural History, Odawara, Kanagawa, Japan) for providing photos of the type of *N. striatus* and information; Chi-Feng Lee (TARI), Masahiro Ohara, and Juriya Okayasu (SEHU) for their help during the specimen investigations of the first author; Taiwan Entomological Society for the travel funding to the first author in SEHU; Shipher Wu (National Taiwan Museum, Taipei, Taiwan) for suggestions to our manuscripts; Chi-Wei Tsai and Chi-Lun Huang (Department of Entomology, National Taiwan University) for providing the specimens collected in the project "The Strategic Development and Operation Model Trials for the Strengthening and Completion of Form and Function of Rural Ecosystem Services" (project number: 108AS-4.2.2-ST-a1).

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臺灣新紀錄屬── 角臉姬蜂屬 (膜翅目：姬蜂科：粗角姬蜂亞科) 兩物種之重新描述暨其形態變異註記

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摘要

陳玄樸、蕭旭峰。2024。臺灣新紀錄屬── 角臉姬蜂屬 (膜翅目：姬蜂科：粗角姬蜂亞科) 兩物種之重新描述暨其形態變異註記。台灣農業研究 73(1):11–23。

本文首次記錄角臉姬蜂屬 (*Nipponaetes* Uchida, 1933) 於臺灣的分布，包含 2 物種：黑角臉姬蜂 (*N. haeussleri* (Uchida, 1933)) 與條背角臉姬蜂 (*N. striatus* Momoi, 1970)，並依據臺灣產標本對該二物種進行重新描述。本研究著重描述兩物種在後軀第二背板刻紋的形態變異，依據形態檢查與測量值的多變數統計分析，針對兩物種之形態界定進行討論。

關鍵詞：重新描述、新紀錄、姬蜂科、分類學、臺灣。

投稿日期：2023 年 11 月 6 日；接受日期：2023 年 12 月 19 日。

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