

Korean Species of the Genus *Taeniogonalos* (Hymenoptera: Trigonalidae: Trigonalinae) with a New Record

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ABSTRACT

In this study, we conduct a review of the genus *Taeniogonalos* Schulz, 1906, which belongs to the subfamily Trigonalinae (Hymenoptera: Trigonalidae) from Korea. The genus *Taeniogonalos* Schulz is recognized as a relatively small genus. *Taeniogonalos* comprises 53 described species worldwide, including nine species identified in the Eastern Palaearctic region. A total of four species have been recognized from Korea. This paper enumerates the known species in Korea, including the new record. We provide the diagnosis and photographs for the newly recorded species. Additionally, we present a key to the Korean species of *Taeniogonalos* Schulz, 1906.

Keywords: *Taeniogonalos*, Trigonalidae, Hymenoptera, new record, Korea

INTRODUCTION

Taeniogonalos is a small and extremely rare genus of the subfamily Trigonalinae, comprising 120 described species in 16 genera worldwide (Carmean and Kimsey, 1998; Smith and Stocks, 2005; Santos et al., 2012; Smith and Tripotin, 2012; Smith et al., 2012; Chen et al., 2014; Yamane, 2014; Smith and Tripotin, 2015; Tan et al., 2017; Lelej, 2019; Chen et al., 2020). Among the species of Trigonalinae, *Taeniogonalos* comprises 53 described species worldwide. Thus far, nine species of the genus have been recorded in the Eastern Palaearctic region.

Biologically, trigonalid wasps are unusual. They lay thousands of eggs on the leaves, which are eaten by lepidopterans or directly laid in their host (sawfly larvae). The eggs hatch in the larva's body and attack any other parasitoid larvae: Hymenoptera (Ichneumonidae, Braconidae) or Diptera (Tachinidae) (Chen et al., 2014). Therefore, they are parasitoids or hyperparasitoids, but in a manner virtually unique among insects, in that a host must swallow the eggs, and even more

unusual in that there may be an intermediate host (Triplehorn, 2005). The biology of *Taeniogonalos* is almost unknown, but it has been identified as a hyperparasitoid of *Phanerotoma flava* (Braconidae) and *Vibrissina turrita* (Tachinidae) (He and Chen, 1986; Chen et al., 2014).

To date, only four species of *Taeniogonalos* have been known from Korea: *T. fasciata*, *T. mongolica*, *T. subtruncata*, and *T. tricolor* (Carmean and Kimsey, 1998; Lelej, 2003). In the present study, we report *T. flavoscutellata* (Chen, 1949) for the first time in Korea. Its diagnosis and photographs are provided, and a key to the Korean species of the genus *Taeniogonalos* is given.

MATERIALS AND METHODS

The examined materials were deposited at the Science Museum of Natural Enemies (SMNE), Geochang, Korea, and National Institute of Biological Resources (NIBR), Incheon, Korea. The specimen was photographed with the Leica M205C

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using the Leica Application Suite [Leica Camera; Aktiengesellschaft (AG), Wetzlar, Germany]. The terminology used in this paper was the same as that used by van Achterberg (1988, 1993), Chen et al. (2014) and Tan et al. (2017). The abbreviations used in the present study are as follows: GN-Prov, Gyeongsangnam-do; MT, Malaise trap.

SYSTEMATIC ACCOUNTS

Order Hymenoptera Linnaeus, 1758
 Family Trigonalidae Cresson, 1887
 Subfamily Trigonalinae Cresson, 1887

Genus *Taeniogonalos* Schulz, 1906

Taeniogonalos Schulz, 1906: 212; Weinstein and Austin, 1991: 416; Tsuneki, 1991: 59; Carmean and Kimsey, 1998: 65; Lelej, 2003: 5; Chen et al., 2014: 95; Tan et al., 2017: 47. Type species (by monotypy): *Trigonalys maculata* Smith, 1851.

Nanogonalos Schulz, 1906: 211; Teranishi, 1929: 150; Marshakov, 1981: 107; Tsuneki, 1991: 56; Weinstein and Austin, 1991: 421. Type species (by monotypy): *Nanogonalos enderleini* De Santis, 1980 (Syn. by Carmean and Kimsey, 1998).

Poecilogonalos Schulz, 1906: 212; Marshakov, 1981: 105; Tsuneki, 1991: 46; Weinstein and Austin, 1991: 422; Lelej, 1995: 14. Type species (by monotypy): *Trigonalys thwaitesii* Westwood, 1874 (Syn. by Carmean and Kimsey, 1998).

Ichnogonalos Schulz, 1907: 11; 1908: 33; Bischoff, 1933: 482; 1938: 11; Weinstein and Austin, 1991: 413; Carmean and Kimsey, 1998: 65. Type species (by monotypy): *Trigonalys dubia* Magretti, 1897 (Syn. by Chen et al., 2014).

Lycogastroides Strand, 1912: 129; Weinstein and Austin, 1991: 413. Type species (by original designation): *Lycogastroides gracilicornis* Strand, 1912 (Syn. by Carmean and Kimsey, 1998).

Lycogonalos Bischoff, 1913: 155; Weinstein and Austin, 1991: 415. Type species (by original designation): *Lycogonalos flavicincta* Bischoff, 1913 (Syn. by Carmean and Kimsey, 1998).

Taiwanogonalos Tsuneki, 1991: 35. Type species (by original designation): *Taiwanogonalos alishana* Tsuneki, 1991 (Syn. by Carmean and Kimsey, 1998).

Diagnosis. Body length 4.3–13.0 mm. Antenna with 21–26 segments. Anterior propodeal carina smooth laterally and medially narrow. Vein 1-SR of fore wing medium-sized to long; fore wing often with subapical dark or dark brown

patch. 2nd metasomal sternite sometimes with a medial elevation posteriorly; 3rd metasomal sternite at most 0.7 times as long as 2nd metasomal sternite.

Distribution. Cosmopolitan, most species are from Eastern Asia and South America.

¹*Taeniogonalos flavoscutellata* (Chen, 1949) (Fig. 1A–J)

Poecilogonalos flavoscutellata Chen, 1949: 14; He and Chen, 1986: 231; Weinstein and Austin, 1991: 423; He and Chen, 1992: 1291 (Syn. by Tsuneki, 1991).

Taeniogonalos flavoscutellata: Chen et al., 2014: 126.

Material examined. Korea: GN: 24♀♀, Jinju-si, Ibanseong-myeon, Changchon-ri, 25 Jun–16 Jul 2022 (Malaise trap) (An TH), deposited-coll. SMNE; 1♀, ditto, deposited-coll. NIBR.

Diagnosis. Body 7.3–8.6 mm long. Antenna with 24 segments. Head with wide lozenge-shaped brown to black pattern forward stemmaticum; clypeus concave; malar space narrow; mandible with three teeth (Fig. 1A). Mesoscutum reticulate-wrinkled; scutellar sulcus narrow; metanotum slightly convex medially (Fig. 1D); mesopleuron with big irregular yellow or yellowish-brown pattern (Fig. 1E). Vein 1-M of fore wing 1.4–1.5 times as long as vein 1-SR; fore wing with dark brown patch subapical (Fig. 1F). 1st metasomal sternite 0.7 times as long as wide (Fig. 1H); 2nd sternite with distinct medio-apical protuberance. Hypopygium triangular (Fig. 1I). Body yellow with brown to black pattern; antenna dark brown; trochanters and trochantelli yellow; hind leg with apex of tibia and tarsus dark brown.

Distribution. Korea (new record), China (Beijing, Fujian, Hunan, Shandong, and Zhejiang).

Host. *Phanerotoma flava* (Hymenoptera: Braconidae) in *Locastra muscosalis* (Lepidoptera: Pyralidae) (He and Chen, 1986).

Key to Korean species of the genus *Taeniogonalos* Schulz, 1906

1. 2nd metasomal sternite with slightly convex *T. mongolica* (Popov, 1945)
- 2nd metasomal sternite distinctly convex 2
2. Head with extensive brown to black pattern. Mesopleuron with big irregular yellow or yellowish-brown pattern. Fore wing with dark brown patch subapical *T. flavoscutellata* (Chen, 1949)
- Head almost dark brown to black. Mesopleuron brown or black, sometimes with tiny yellow or orange-brown pattern. Fore wing with cover a wide range a dark brown patch 3

Korean name: ¹*황고치벌살이갈고리벌 (신칭)

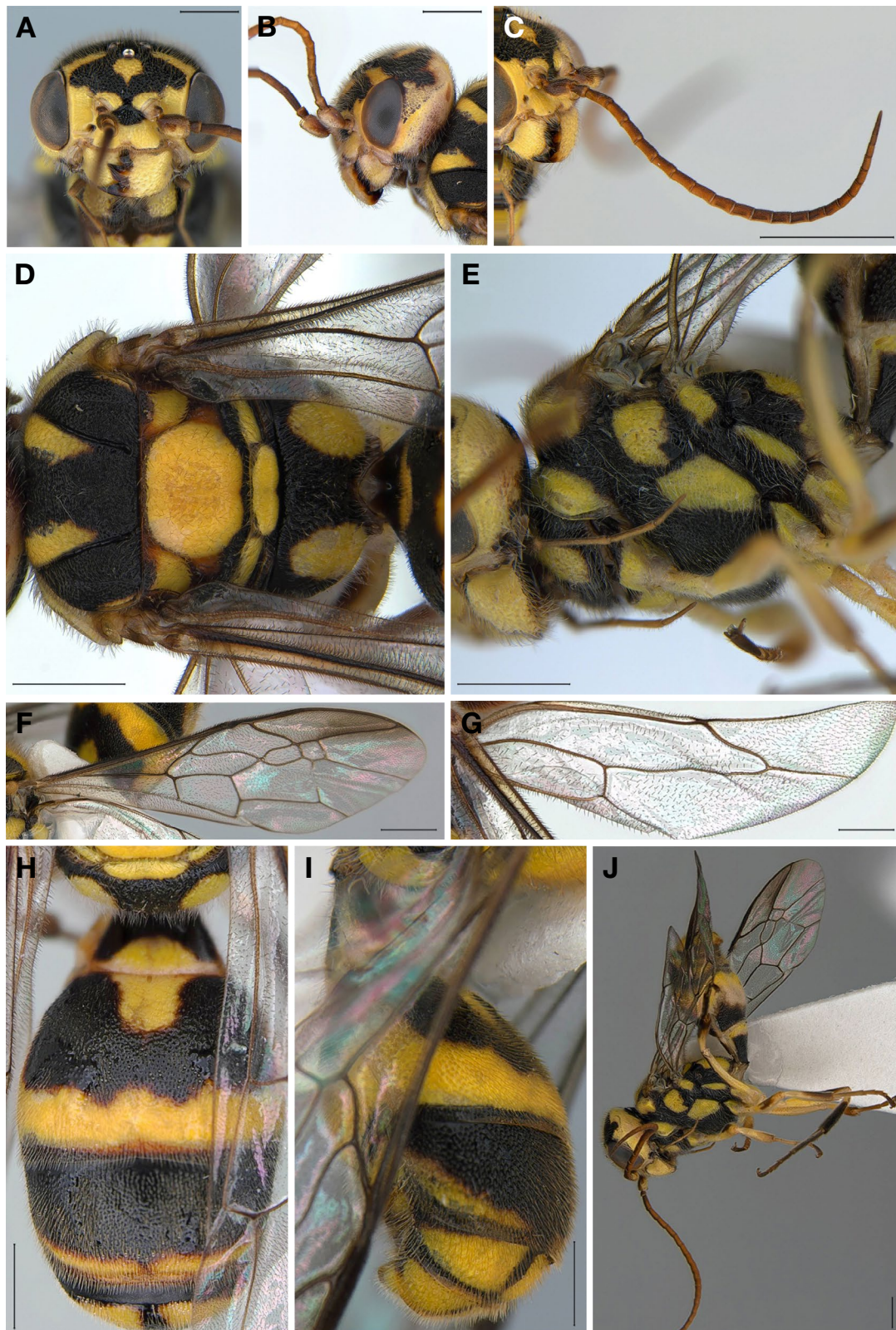


Fig. 1. *Taeniogonalos flavoscutellata* (Chen, 1949) (female). A, Head, frontal view; B, Head, lateral view; C, Antenna; D, Mesosoma, dorsal view; E, Mesosoma, lateral view; F, Fore wing; G, Hind wing; H, Metasoma, dorsal view; I, Metasoma, lateral view; J, Habitus, lateral view. Scale bars: A-J=1 mm.

3. Antenna more than 25 segments. Eye in dorsal view shorter than temple. Legs without white part, mostly dark brown to black, sometimes yellowish-brown 4
 – Antenna with 22 segments. Eye in dorsal view longer than temple. Legs with white part: trochanters, fore tibia and tarsus and bases of mid and hind tibiae white
 *T. fasciata* (Strand, 1913)
4. Antenna with 26 segments. 2nd metasomal sternite without medio-apical protuberance; 2nd sternite tricoloured: anterior dark brown, medial chestnut brown and posterior yellow
 *T. tricolor* (Chen, 1949)
- Antenna with 25 segments. 2nd metasomal sternite with distinct medio-apical protuberance, curved and rounded in lateral view (female); medio-posterior shallow depression (male); 2nd sternite bicoloured: black and wide yellow or orange-brown band
 *T. subtruncata* Chen, Achterberg, He and Xu, 2014

Checklist of *Taeniogonalos* Schultz in Korea

1. *Taeniogonalos fasciata* (Strand, 1913)

Poecilogonalos fasciata Strand, 1913: 97; Weinstein and Austin, 1991: 422; Lelej, 1995: 14; He and Lou, 2001: 686.
Poecilogonalos magnifica Teranishi, 1929: 144; Marshakov, 1981: 105; Tsuneki, 1991: 50; Lelej, 1995: 14 (Syn. by Carmean and Kimsey, 1998).
Taeniogonalos fasciata: Carmean and Kimsey, 1998: 67; Lelej, 2003: 5; Chen et al., 2014: 117.

Distribution. Korea, China (Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Henan, Hunan, Jilin, Liaoning, Shaanxi, Zhejiang), Indonesia, Japan (Honshu, Kyushu), Malaysia, Russia (Primorski Krai).

Host. Unknown.

Remarks. This species was first recorded in Korea by Carmean and Kimsey (1998), examined materials were deposited at the Hungarian National Museum of History (HNHM).

2. *Taeniogonalos mongolica* (Popov, 1945)

Nanogonalos mongolicus Popov, 1945: 76; Marshakov, 1981: 107; Weinstein and Austin, 1991: 421.
Taeniogonalos flavocincta: Lelej, 1995: 14; Carmean and Kimsey, 1998: 67 (Syn. By Lelej, 2003).
Taeniogonalos mongolica: Lelej, 2003: 6; Chen et al., 2014: 150.

Distribution. Korea, China, Mongolia, Russia (Amurskaya oblast, Primorski Krai).

Host. Unknown.

Remarks. This species was first recorded in Korea by Carmean and Kimsey (1998), examined materials were deposited

at the Hungarian National Museum of History (HNHM) and United States National Museum (USNM).

3. *Taeniogonalos subtruncata*

Chen, Achterberg, He and Xu, 2014

Nanogonalos flavocincta Teranishi, 1929: 150; Weinstein and Austin, 1991: 421.

Poecilogonalos flavocincta: Marshakov, 1981: 107; Lelej, 1995: 14 (Syn. by Marshakov, 1981).

Taeniogonalos flavocincta: Carmean and Kimsey, 1998: 67.

Distribution. Korea, China (Shaanxi).

Host. Unknown.

Remarks. This species was first recorded in Korea by Teranishi (1929), examined materials were deposited at the Osaka Museum of Natural History (OMNH).

4. *Taeniogonalos tricolor* (Chen, 1949)

Poecilogonalos tricolor Chen, 1949: 16; Weinstein and Austin, 1991: 424; Lelej, 2003: 6.

Taeniogonalos tricolor: Carmean and Kimsey, 1998: 68.

Distribution. Korea, China (Fujian, Guangxi, Guizhou, Hainan, Henan, Hubei, Jianxi, Shaanxi, Sichuan, Yunnan, Zhejiang), Thailand.

Host. Unknown.

Remarks. This species was first recorded in Korea by Carmean and Kimsey (1998), examined materials were deposited at the Hungarian National Museum of History (HNHM).

DISCUSSION

Taeniogonalos is a natural enemy of sawflies and is an important biological resource that maintains an appropriate density in the ecosystem of the natural enemy, Ichneumonidae. However, this genus is a hyperparasitoid that spends most of its life cycle inside the body of other insects, which makes it difficult to collect and study. Therefore, the host records of the four Korean recorded species are unknown.

In the future, if biological research is conducted by rearing Tenthredinidae larvae or primary parasitoids (Pylalidae larvae), it will be possible to establish basic data that can be used as a useful resource.

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CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

ACKNOWLEDGMENTS

This work was supported by a grant from the National Institute of Biological Resources (NIBR), funded by the Ministry of Environment (MOE) of the Republic of Korea (NIBR2023 04203).

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Received November 20, 2023
 Revised December 25, 2023
 Accepted December 29, 2023