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Two New Records of Braconid Wasps, Genus *Phaedrotoma* (Hymenoptera: Braconidae: Opiinae), from South Korea

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한국산 미기록 고치벌 *Phaedrotoma* (벌목: 고치벌과: 꽃파리고치벌아과)속 2종에 대한 보고

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ABSTRACT: The genus *Phaedrotoma* Foerster, 1862 (Hymenoptera: Braconidae: Opiinae) parasitize in larvae of flies, Tephritidae, Agromyzidae, Ephydridae, Anthomyiidae, Scathophagidae, and Drosophilidae, of which 12 species are recorded in South Korea. As results of our survey, *Phaedrotoma rugulifera* Li et al. (2013) and *Phaedrotoma vermiculifera* Li et al. (2013) are reported for the first time in South Korea. Those specimens were collected by sweeping. Descriptions, and diagnostic illustrations of *P. rugulifera* and *P. vermiculifera* are provided.

Key words: Ichneumonoidea, Koinobiont, Morphological identification, Natural enemy, Parasitoid

초 록: *Phaedrotoma*속은 주로 과실파리과, 혹파리과, 물가파리과, 꽃파리과, 똥파리과, 초파리과의 유충에 기생을 하는 고치벌로 한국에는 12종이 기록되어 있다. 본 조사연구 결과로 *Phaedrotoma rugulifera*와 *Phaedrotoma vermiculifera* 2종을 국내 최초로 보고한다. 이들의 표본은 쓸어잡기로 채집되었다. 두 종의 기술과 진단형질도판을 수록한다.

검색어: 맵시벌상과, 활물기생, 형태동정, 천적, 기생벌

The subfamily Opiinae, having mostly koinobiont endoparasitoid wasps (Whitfield et al., 1997), is one of the biggest groups in the family Braconidae (Hymenoptera: Ichneumonoidea), containing approximately 2,000 species in 39 genera worldwide (Yu et al., 2016). In the genus *Phaedrotoma* 12 species in South Korea have been reported: *Phaedrotoma postremus, Phaedrotoma benignus, Phaedrotoma alconana, Phaedrotoma dudichi, Phaedrotoma turneri, Phaedrotoma zomborii, Phaedrotoma nitidulator, Phaedrotoma pulchriceps, Phaedrotoma diversiformis, Phaedrotoma exigua, Phaedrotoma staryi,* and *Phaedrotoma rudis* Papp, 1981, 1982, 1985, 1989. Because most species of *Phaedrotoma* attack the agricultural dipteran pests such as Tephritidae, Agromyzidae, Ephydridae, Anthomyiidae, Scathophagidae and Drosophilidae, they can be commercially used for biological control using nature enemy characters (Ovruski et al., 2000; Whitfield et al., 1997).

Phaedrotoma is often called to "taxonomic dustbin genus of Opiinae" because of no obvious synapomorphies in this genus except for the lack of a dorsope (Li et al., 2013). For the above reason, it is most likely that this is not a monophyletic assemblage but not yet proven, thus this work will be based for

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further phylogenetic study. Diagnosis, descriptions, biology and illustrations are provided in this study.

Materials and Methods

The specimens examined were collected by sweeping which were preserved in 80% ethyl alcohol for dried. These specimens are deposited in Kunsan National University (KSNU).

For identification of the subfamily Opiinae, we referred van Achterberg (1990), for identification of the genus, Li et al. (2013) and, for references to the Opiinae, Yu et al. (2016). We used LEICA DMC2900 digital camera and LEICA M205 C microscope (Leica Geosystems AG) for observation and photography in this study. Illustrations were stacked using LAS V4.11 (Leica Geosystems AG, Wetzlar, Germany) and HeliconFocus 7 (Helicon Soft, Kharkiv, Ukraine). Illustrations were edited using Adobe Photoshop CS6. Terminology used for morphological characters followed van Achterberg (1993).

Systematic Accounts

Family Braconidae Nees, 1811

Subfamily Opiinae Blanchard, 1845

Genus *Phaedrotoma* Foerster, 1862

Hexaulax Cameron, 1910

Coeloreuteus Roman, 1910

Neodiospilus Szepligeti, 1911

Mimirus Fischer, 1972

***Phaedrotoma rugulifera* 가슴배주름어리고치벌(신칭) Li et al., 2013 (Figs 1A-1G)**

Phaedrotoma rugulifera Li et al., 2013: 134-137.

Diagnosis

Total length of body 2.26 mm (Fig. 1A), of fore wing 2.36 mm. Malar suture largely absent, clypeus medium, propodeum usually largely rugose.

Description. Head (Figs 1B, 1C): Length of antenna 1.4 times as long as fore wing with 29 segments covered with white setae; depression between antennal sockets; length of first segment 1.17 times second segment. Occipital carina present laterally, absent dorsally. Frons glabrous and smooth. Face covered with yellowish setae overall and largely smooth. Length of clypeus 3.04 times its width; clypeus protrude and smooth except for some punctures, concave ventrally. Hypoclypeal depression comparatively large. Malar suture absent. Mandible normal and with ventral carina and widened basally. **Mesosoma** (Fig. 1D): Length of mesosoma 4.20 times as long as length of propodeum. Pronope round and large. Mesoscutum smooth and glabrous with few setae; lateral margin of mesoscutum narrowly crenulate. Notauli absent completely, only present anteriorly by smooth depressions. Medio-posterior depression of mesoscutum absent. Scutellar sulcus crenulate and curved. Postpectal carina absent. Length of propodeum 0.63 times as wide as its width, propodeum rugose. **Wings** (Fig. 1E): Covered with yellowish brown setae overall. Fore wing pterostigma triangular-shape; length of pterostigma 7.49 times as long as its width. r short and medium-size. 1-M and SR1 slightly curved. cu-a widened and postfurcal. First subdiscal cell closed. CU1b short. Hind wing m-cu absent. **Legs** (Fig. 1F): Length of hind femur and hind tibia respectively 2.10 and 3.30 times as long as length of propodeum, with setae. **Metasoma** (Fig. 1G): Length of metasoma 4.30 times as long as length of first tergite and 1.33 times as long as length of mesosoma. First tergite rugose posteriorly. Second and third tergites superficially granulate generally, rarely smooth and glabrous with setae partially.

Colour (Fig. 1A)**.** Generally black with brown excepting wing and leg. Leg, metasoma ventrally and second and third tergites yellowish-brown.

Distribution. South Korea (new, Gyeongnam, Busan Prov.), China (Hunan).

Biology. Unknown.

Specimens examined. South Korea, 1♀ (KSNU): Sancheong-gun, Gyeongnam, 35°21'44.1"N, 127°47'48.9"E, 14. VII. 2019, 1♂ (KSNU): Seo-gu, Busan, 35°04'48.6"N, 129°00'59.2"E, 14. V. 2020, Hyojoong Kim leg.

Remark. *Phaedrotoma rugulifera* does not run well by Chen and Weng (2005). Length of mesosoma 1.3-1.6 times as long as its high. *P. rugulifera* differs by having the malar suture largely absent.

***Phaedrotoma vermiculifera* 가슴배설주름어리고치벌(신칭)**

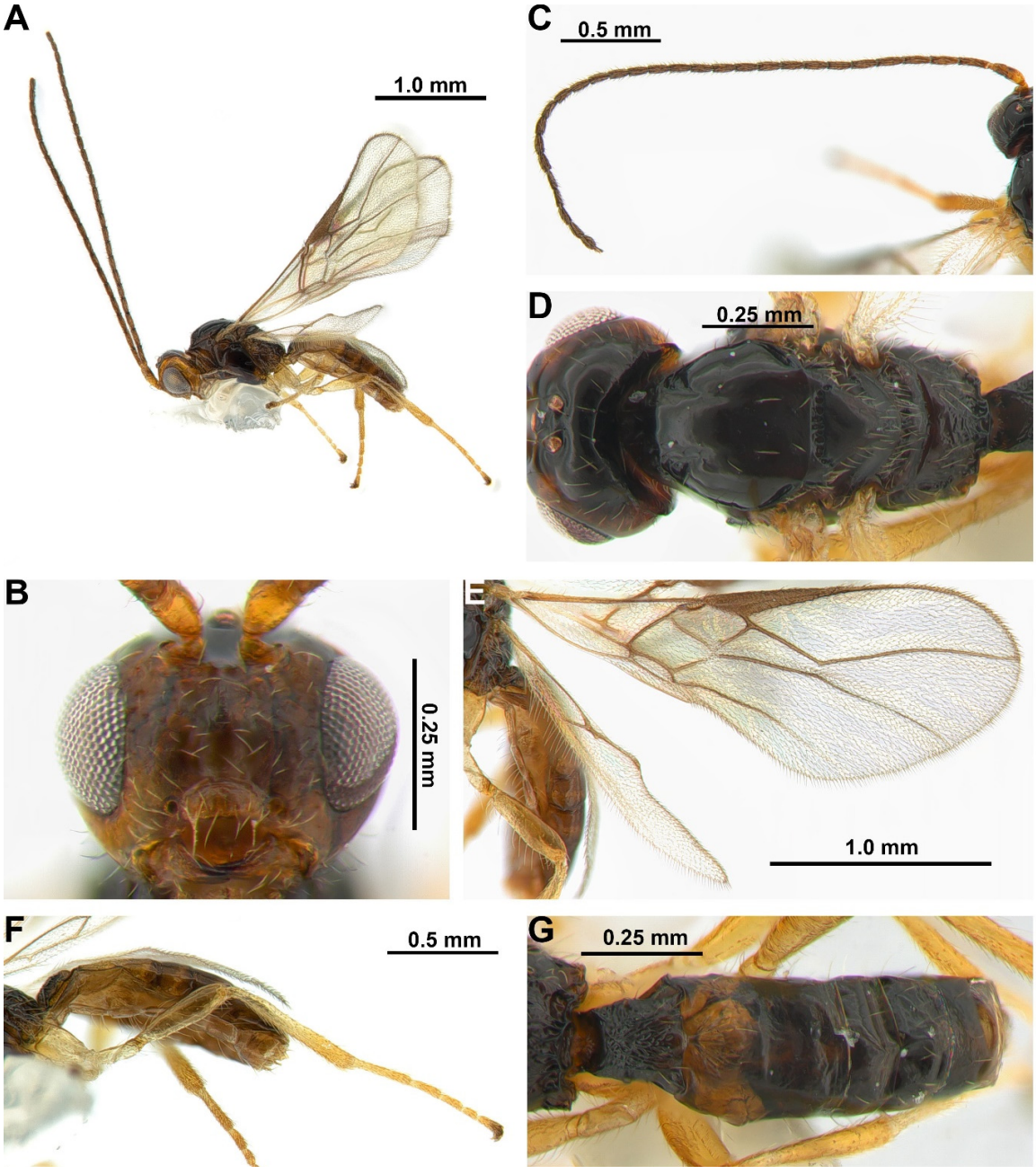

Fig. 1. Habitus of *Phaedrotoma rugulifera* Li et al. (2013): A, whole body in lateral view; B, head in frontal view; C, antenna; D, mesosoma in dorsal view; E, wings; F, hind leg in lateral view; G, metasoma in dorsal view.

Li et al., 2013 (Figs 2A-2E)

Phaedrotoma vermiculifera Li et al., 2013: 144-147.

Diagnosis

Total length of body 1.51 mm (Fig. 2A), of fore wing 1.95 mm. Malar suture absent and malar space short, clypeus medium, pronope small and round shape, propodeum largely vermiculate rugose.

Description. Head (Fig. 2B): Length of antennal first segment 1.01 times second segment, covered with setae. Occipital carina present laterally. Face smooth and covered with yellowish setae overall. Length of clypeus 3.61 times its width; clypeus smooth, concave ventrally and narrow. Hypoclypeal

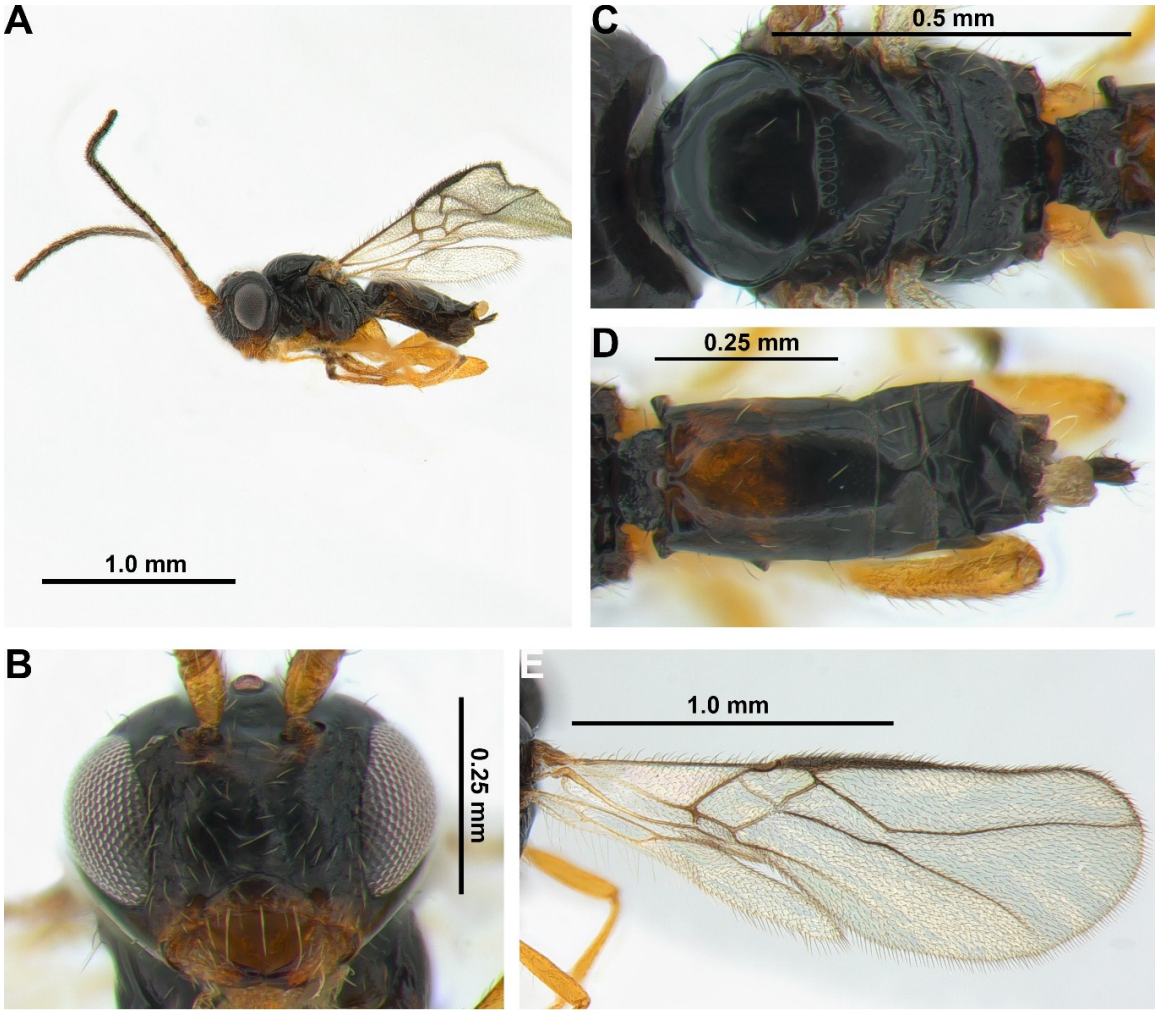

Fig. 2. Habitus of *Phaedrotoma vermiculifera* Li et al. (2013): A, whole body in lateral view; B, head in frontal view; C, mesosoma in dorsal view; D, metasoma in dorsal view; E, wings.

depression large. Malar suture absent; malar space comparatively short. Mandible normal and widened basally with ventral carina. **Mesosoma** (Fig. 2C): Length of mesosoma 1.28 times as long as its height. Pronope small and round-shape. Mesoscutum smooth and glabrous with few setae; lateral margin carina of mesoscutum smooth. Pronotum largely smooth, except for distinctly crenulate groove anteriorly. Epicnemial carina absent. Precoxal sulcus present and crenulate medially. Notauli absent completely, only present anteriorly by smooth depressions. Medio-posterior depression of mesoscutum absent. Scutellar sulcus medium-size and crenulate. Propodeum finely rugose except for deeply crenulate posteriorly without distinctly median carina. **Wings** (Fig. 2E): Covered with brown setae overall. Fore wing pterostigma elongate triangular. 1-R1 and SR1 reaching wing apex. Length of 1-R1 1.41 times length of pterostigma. r short and narrow. 1-M straight. SR1 slightly curved. 2-SR:3-SR:SR1 = 15:26:76. First subdiscal cell closed and transverse. CU1b short. Hind wing m-cu absent. **Legs**: Length of hind femur and hind tibia respectively 3.10 and 4.18 times as long as length of propodeum, with setae. **Metasoma** (Fig. 2D): Length of metasoma 4.17 times as long as length of first tergite and 1.33 times as long as length of mesosoma. First tergite rugose entirely. Second and third tergites superficially smooth and glabrous with setae partially.

Colour (Fig. 2A)**.** Generally Black excepting antenna, clypeus, mandible, vein of wing and leg. Antenna, pterostigma and veins dark brown. Clypeus ventrally and mandible yellowish-dark-brown. Leg yellowish-light-brown.

Distribution. South Korea (new, Jeonbuk Prov.), China (Hunan).

Biology. Unknown.

Specimens examined. South Korea, 1♀ (KSNU): Mt Gongchi, Eochungdo, Gunsan, Jeonbuk, 36°07'28.0"N, 125°58'24.4"E, 24. Ⅵ. 2021, Hyojoong Kim leg.

Remark. *Phaedrotoma vermiculifera* runs in the key by Chen and Weng (2005) to *P. osculas*. *P. vermiculifera* differs by having the malar space short and the surface of the propodeum largely vermiculate-rugulose.

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Statements for Authorship Position & Contribution

Han, Y.: Kunsan National University, Student in Ph.D; Designed the research, wrote the manuscript and conducted the experiments

Kim, H.: Kunsan National University, Professor, Ph.D; Examined specimens and designed the research

All authors read and approved the manuscript.

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