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Journal of Asia-Pacific Biodiversity

journal homepage: <http://www.elsevier.com/locate/japb>Journal of
Asia-Pacific
Biodiversity

Original article

Two species of *Elasmus japonicus* Ashmead and *Elasmus polistis* Burks (Hymenoptera: Eulophidae) reared from nests of *Polistes* (Hymenoptera: Vespidae) in Korea

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ARTICLE INFO

Article history:

Received 15 March 2016

Received in revised form

1 July 2016

Accepted 15 July 2016

Available online xxx

Keywords:

*Elasmus japonicus**Elasmus polistis*

Eulophidae

Korea

Polistes

ABSTRACT

Two species of *Elasmus* (Hymenoptera: Eulophidae) are newly recognized in South Korea: *Elasmus japonicus* Ashmead and *Elasmus polistis* Burks. They were reared from the nests of *Polistes* (Hymenoptera: Vespidae): *E. japonicus* from *Polistes rothneyi koreanus* and *E. polistis* from *Polistes snelleni* and *P. rothneyi koreanus*. Both species are biparental and usually have more females than males.

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Introduction

The family Eulophidae (Hymenoptera: Chalcidoidea) is one of the largest families with 3,977 species currently identified, 283 genera of which belong to 4 subfamilies across the world (Noyes 1998). Most species of Eulophidae are useful insects, such as parasitoid wasps which provide biological control, but some species are phytophagous and predatory.

Among them, the genus *Elasmus* Westwood is a cosmopolitan genus of Eulophidae and currently contains 258 species worldwide (Noyes 2015). It has long been treated as the only genus of the family Elasmidae (e.g. Ashmead 1904; Graham 1995). Gauthier et al (2000) transferred the genus into Eulophinae of the family Eulophidae based on the result of molecular analyses using 28S sequences with morphological supports. Most species of *Elasmus* are larval or pupal ectoparasitoids of Lepidoptera and some species are ectoparasitoids (or hyperparasitoids) of larvae of hymenoptera families, Braconidae, Ichneumonidae, and Bethyridae (Graham

1995; Herting 1975; Narendran et al 2008; Thompson 1954; Trjapitzin 1978; Verma and Hayat 1986).

In particular, five species of *Elasmus* (*Elasmus schmitti*, *Elasmus biroi*, *Elasmus lamborni*, *Elasmus polistis*, and *Elasmus japonicus*) are known as primary parasitoids of various paper wasps (Hymenoptera, Vespidae, *Polistes*) (Burks 1971; Graham 1995; Gumovsky et al 2007; Makino and Sayama 1994; Trjapitzin 1978). Of them, *E. japonicus* had been recorded only in the East Palearctic region (Ashmead 1904; Iwata and Tachikawa 1966) but *E. schmitti* and *E. polistis* were recently recognized from this region (Yefremova and Strakhova 2010).

In South Korea, an unidentified *Elasmus* sp. was recorded for the first time as a larval parasitoid of *Caloptilia theivora* (Lepidoptera, Gracillariidae) by Lee et al (1995), and Yefremova and Strakhova (2010) recently added *Elasmus nephantidis* Rohwer and *Elasmus viridiceps* Thomson to the Korean insect fauna.

In the present study, we report *E. japonicus* and *E. polistis* from South Korea. We also provide a redescription, and basic biology from the nests of three *Polistes* species (including two new hosts).

Materials and methods

The specimens of *Elasmus* collected in this study were the emerged individuals from nests of *Polistes* in the Busan, Daegu and

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Peer review under responsibility of National Science Museum of Korea (NSMK) and Korea National Arboretum (KNA).

<http://dx.doi.org/10.1016/j.japb.2016.07.005>pISSN2287-884X eISSN2287-9544/Copyright © 2016, National Science Museum of Korea (NSMK) and Korea National Arboretum (KNA). Production and hosting by Elsevier. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).



Figure 1. *Elasmus japonicus* Ashmead, 1904: A, Habitus in lateral view, female; B, Habitus in dorsal view, female (wings removed); C, Head and antenna in lateral view, female; D, Forewing, female; E, Forewing, male; F, habitus lateral view, male.

Gangwon Province in South Korea, from 2010 to 2015. *Polistes* nests were collected from August to December and deposited in plastic bags after removing the adults. The adults of *Elasmus* emerged from the *Polistes* nests from March to May of the following year and they were stored in 70% alcohol. The keys by Yefremova and Strakhova (2010, 2011) were followed to identify the *Elasmus* species. The images were captured with an Axiocam HRC camera through a Discovery V20 stereomicroscopy and were produced with AxioVision40AC software (Carl Zeiss, Oberkochen, Germany). Final plates were prepared in Adobe Photoshop CS6.

The terminology used in this paper is taken from Graham (1995) and Yefremova and Strakhova (2010, 2011).

Taxonomic accounts

Genus *Elasmus* Westwood, 1833
Elasmus Westwood, 1833: 343.

Diagnosis. The genus can be easily recognized by the following characters: antenna of female with two anelli, three-segmented flagellum, and three-segmented clava; and male with trifurcate four-segmented flagellum and two-segmented clava. Mesoscutum densely covered with hairs; scutellum with two pairs of long setae. Forewing with marginal vein elongated, postmarginal vein short, and stigma vein slightly reduced. Hind coxa smooth, subdiscoidal (or plate-like), and strongly enlarged; hind tibia with short setae forming continuous diamond-shape. Colorations are yellow, black, and brown, frequently with spots.

***Elasmus japonicus* Ashmead, 1904** 일본쌍살벌살이좀벌(신칭)

Elasmus japonicus Ashmead, 1904: 160

Redescription

Female. Body length 2.4–2.6 mm, length of forewing 2.8 mm (Figure 1A). Color: head mainly pale yellow, upper part of frons and vertex including ocellar region black with blue-greenish tinge. Antenna brown except scape and pedicel ventral yellow (Figure 1C). Pronotum black. Mesoscutum yellow with median weak longitudinal strip and three spots horizontally on midlobe, two spots each side of basal mesoscutum black, tegula yellow with horizontal strip, axillae black, scutellum yellow with a wide black spot, dorsellum projected V-shape yellow except anterior part black, propodeum black (Figure 1B). Mesosoma in lateral view black dorsal posterior part of mesopleuron. Legs mainly pale yellow except for dorsal part of coxa and dorsal margin of femur of hind leg black. Wings hyaline, veins bright brown (Figure 1D). Metasoma mainly yellow or bright brown laterally, tergum of gaster (T) T1–T5 red-brown dorsally, black spot either side and one large black spot between them on T1, a median large black spot on T2–T3, and faint median black spot on T4, T5–T6 almost black dorsally (Figures 1A, 1B). Head: head in dorsal view almost smooth, vertex and frons setigerous with setigerous punctures, subquadrate, 1.1 times as broad as long. Eyes without setae. Postocellar distance (POL) 1.5–1.6 times ocellar–ocellar distance (OOL); POL 1.5–1.6 times the minimum distance between posterior ocellus and anterior ocellus (AOL); AOL almost equal to OOL; OOL 1.7–1.8 times the longest diameter of the anterior ocellus (OD). Length of forewing (FL) 1.4–1.5 times as long as pedicel; FL almost equal to F2 and F3; club 4.2 times as long as wide and 2.0–2.1 times as long as F3. Mesosoma: pronotum and

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