Introduction to the Family Coniopterygidae (Neuroptera) with Semidalis aleyrodiformis (Stephens) from the Korean Peninsula

Seonglyun Lee¹, Seulk Kim¹, Jaecheon Sohn² and Soowon Cho¹*  
¹Dept. of Plant Medicine, Chungbuk National University, Cheongju, CB 361-763 Korea  
²Dept. of Entomology, University of Maryland, College Park, MD 20742 U.S.A.

한반도에서 Semidalis aleyrodiformis (Stephens)가 속한 가루풀잠자리과(Coniopterygidae: Neuroptera)의 소개

ABSTRACT: The family Coniopterygidae belonging to Neuroptera with Semidalis aleyrodiformis (Stephens) is introduced from the Korean Peninsula in the present study. Taxonomic descriptions of the family and the species and illustrations of its wing and male genitalia are presented.

Key words: Coniopterygidae, dusty wings, Semidalis aleyrodiformis

내용: 한반도에서 Semidalis aleyrodiformis (Stephens)가 속한 가루풀잠자리과(Coniopterygidae)에 대해 소개하고, 과(family)와 종(species)의 형태적 특징, 낱개 및 수컷공식기의 도해를 제공하였다.

감사의: 가루풀잠자리과, Semidalis aleyrodiformis, 흰눈사과가루풀잠자리

The dusty wings, Coniopterygidae of the order Neuroptera are minute predators, often less than 3 mm long, of small arthropods such as mites, aphids, scale insects and whiteflies. They are known to have a strong predator/prey associations with scale insects, about 17% (14 species) of the known species in America feed on coccoid insects (Miller et al., 2004). They typically reside in trees and shrubs where their prey are found. The eggs are laid on bark or leaves, often singly and at the edges of the leaves (Withycombe, 2008). The common name was derived from their covering of a whitish powdery exudation, and it caused they are often mistaken for whiteflies (Arnett, 1993). The white wax is known to be produced mainly from the abdomen as tiny circled ribbon-like particles and the adults use the particles to cover all parts of their body except their eyes (Nelson et al., 2003).

Their wing venation is quite simple, being greatly reduced as compared with other species of Planipennia. However, the structural characters of the larvae strongly claims that these have to be neuropterous insects (Townsend, 1939). There are nearly 500 species in Coniopterygidae and many species have been also found as fossils around the world, dating back close to mid-Jurassic (Jepson and Penney, 2007). Cladistic analyses of Neuroptera (Aspöck et al., 2001; Aspöck, 2002) suggested that this family is a sister group of another unusual family, Sisyridae, not known to exist in Korea, of which their larvae are aquatic, feeding on fresh-water sponge, and the two are within the group Hemerobiiformia, suggesting they are closely allied to Hemerobiidae and Mantispidae. However, a recent molecular evidence supported a Permian (299-251 million years ago)
origin of the order with Coniopterygidae as the closest relative of all other neuropterans (Winterton and Wiegemann, 2009).

Meinander first revised Coniopterygidae of the world in 1972 and later produced a checklist of the species of the world, listing 483 recent and 11 fossil named species (Meinander, 1990). Since then, about 60 species have been added, including recent additions of four Heterocoris spp. from China (Liu et al., 2004).

In Asia, both China and Japan have several or more species of Coniopterygidae described (Enderlein, 1907; Kuwayama, 1962; Liu and Yang, 2002) but it has never been taxonomically treated in Korea. In North Korea, the family was introduced as ga-ru-jam-ja-ri-gwa including Coniopteryx pulverulenta Enderlein (www.nktech.net), a synonym of C. abdominis ("Coniopterygidae" 2005). On the other hand, the only record on coniopterygid species in South Korea was on a book titled as ‘Natural Enemy Understanding & Utilizing’ where only a species name Semidalis albata, a synonym of S. aleurodiformis, was listed in a table as one of many natural enemies to the pest of mandarin oranges in Jeju-do [Is.] (Kim, 1998). No systematic or biological description was provided, and no further study has been done. Recently we found this species from Chungcheongbuk-do [province], and introduced this species with a brief taxonomic description of the family.

MATERIALS AND METHODS

We used light trap and sweeping net for collecting. For the study of genitalia, we first soaked the sample in 10% KOH for a few hours to a day, and saved it in 95% alcohol. For actual examination, the sample was soaked in glycerol and examined through a stereo light microscope, often with a 3D imaging computer system. The specimens examined were deposited in the Insect Collection of the Department of Plant Medicine, Chungbuk National University in Cheongju, Korea.

TAXONOMY

Coniopterygidae Burmeister, 1839

가루꼴잠자리과(신청)

Coniopterygidae Burmeister, 1839. Handbuch der Ento-
band while glands on sternites a rather broad area laterally.

Genital structures very polymorphic, often difficult to identify homologous structures in different genera. The ninth tergite and sternite generally fused into a synscleritious well-sclerotized ring, often anteriorly strengthened by an apodeme; the tergite much reduced or incorporated into tenth tergite. The ninth coxopodites almost always fused into a structure called hypandrium. In most genera, the hypandrium incorporated into the ring of the ninth segment forming the ventral caudal part of the ring. The styli of the ninth coxopodites present in almost every genus; styli not articulating with hypandrium, rather articulating with an arcuate sclerite called gonarcus, a part of the ninth coxopodites, sometimes a separate structure or sometimes obliterate (Farris, 1940). Tenth tergite, usually incorporated into the ring of the ninth segment; ectoproct possibly formed not only with the tenth tergite but also with the ninth. The tenth sternite represented by a small plate between the anus and the parameres. Parameres present, usually elongated as a pair of long slender rods laterally of the aedeagus. The eleventh segment obliterate.

Eggs. The eggs laid on bark or leaves, usually singly but sometimes in twos or threes; oval and dorso-ventrally somewhat depressed. A small conical micropylar projection present at the anterior end. The chorion with polygonal depressions caused by the secretion of follicle cells.

Larvae. Almost all with three larval instars. The third-instar larva shortly fusiform, anteriorly swollen, being widest at thorax. Thorax and abdomen of about equal length. Head prognathous, small, often partly concealed within prothorax. Eyes just behind bases of antennae, composed of four or five ommatidia. Labrum projecting beyond head and covering the jaws, completely in Coniopteryginae, and partly in Aleuropteryginae. Antennae two-segmented. Two tarsal claws, between them a pad-like empodium. Malpighian tubules numbering six, although eight in all other Planipennia larvae.

Pupae. For pupation, a flat circular cocoon of white silk spun, consisting of two envelopes, more or less separated from each other. Pupa short and in profile somewhat square, with head bent over at an angle to thorax.

Biology. Many species are associated with certain types of vegetation or a single species of bushes or trees. Both adults and larva feed on small inactive arthropods, such as aphids and coccids. The adults fly at sunset and both sexes are attracted to light.

*Semidalis* Enderlein, 1905

*Semidalis* Enderlein, 1905. Wiener Entomol. Zeitung 24: 197. (Type species: *Coniopteryx aleurodiformis* Stephens, 1836 by original designation and monotypy.)

There are 60+ species worldwide except for the Australian region. At least five different species groups (S. decipiens group, S. meridionalis group, S. vicina group, S. inconspicua group, and S. tenerifiae group) were recognized (Meinander, 1972, 1990).

*Semidalis aleurodiformis* (Stephens, 1836)

(시달리 또는 흉용약가루풀잠자리)

(Fig. 1)

Aleyrodes gigantea Stephens, 1829:367 (listed); Hagen, 1866: 379 (listed). [nomen nudum]

Coniopteryx tineiformis Curtis. Curtis, 1834, pl. 528 nec text to pl. (wings)


Semidalis albata Enderlein, 1907: 5 (description).

Semidalis alpina Worthycombe, 1925: 17, f. 15, 27 (description).

Semidalis poinciana Worthycombe, 1925: 18, f. 16, 28 (description).

Head brown. Antennae rather dark brown, 18-21 segmented. Flagellar segments of male except basal ones slightly longer than broad.

Thorax brown with large blackish brown shoulder spots. Membrane of wings almost hyaline.

Length of forewing 2.1-2.7 mm, of hind wing 1.8-2.4 mm.
Male genitalia. Outer process of ectoprocts long and slender. Process of inner angle of ectoprocts triangular in dorsal view, dentiform in lateral view. Hypandrium small and truncate. Parameres with two dorsal membranous acute teeth, one at apex of parameres and the other near middle, slightly apicad; variable in shape among different specimens. Uncinus small and unguiform or almost absent; dorsum of parameres, withdrawn into abdomen, forming a transverse plate.

Specimen examined,


Biology,

*Semidalis aleyrodiformis* is mostly found on deciduous trees and bushes and the specimens found in Cheongju were from a persimmon tree and around.

Distribution,

India, Thailand, Palaearctic region (except North Africa) including Korea, Japan and China (Withycombe, 1925).

Remarks,

Due to morphological variations within a species, we compared the DNA barcodes of the three specimens. Maximum 0.2% dissimilarity among the sequences confirmed they belong to one species. Kim et al. (1978) referred the name in the abstract of their paper as "Semidalis albate E." which is a misspelled synonym, and we do not count it valid as the name of the species or the family was not mentioned at all in the text.

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Literature Cited


