

# Aphelinids (Hymenoptera: Aphelinidae) of *Unaspis euonymi* (Comstock) (Hemiptera: Diaspididae) in Korea

Soo-Jung Suh\* and Gregory A. Evans<sup>1</sup>

QIA/PQTC, 476 Dongtanjiseong-ro, Yeongtong-gu, Suwon 443-400 Korea

<sup>1</sup>USDA/APHIS/NIS, 10300 Baltimore Avenue, Beltsville, MD 20705 USA

## 우리나라 사철각지벌레 (*Unaspis euonymi* (Comstock) (Hemiptera: Diaspididae))에 발생하는 면충좀벌 (Hymenoptera: Aphelinidae)

서수정\* · Gregory A. Evans<sup>1</sup>

농림축산검역본부, <sup>1</sup>미농림부

**ABSTRACT:** Four species of aphelinids from *Unaspis euonymi* (Comstock) infesting Japanese spindle (*Euonymus japonicus* Thunb. (Celastraceae)) leaves and twigs were collected and identified as *Ableris perspicuosus* Girault, *Encarsia citrina* (Craw), *Marietta carnesi* (Howard) and *Pteroptrix machiaveli* (Girault). Of these, *Pteroptrix machiaveli* (Girault) is newly documented in the Korean fauna of Aphelinidae. Brief diagnostic criteria and illustrative photographs of these species are provided and there is information on the distribution and hosts of each species as well.

**Key words:** *Pteroptrix machiaveli*, *Unaspis euonymi*, Aphelinidae

**초 록:** 사철나무 잎과 가지에 발생하는 사철각지벌레로부터 4종의 면충좀벌, 제철각지좀벌, 주걱각지좀벌, 장미각지좀벌 및 *Pteroptrix machiaveli* (Girault)가 채집되었고, 이중 *Pteroptrix machiaveli* (Girault) [사철각지네마디좀벌(신칭)] 1종을 국내분포로 처음 보고한다. 또한 이들 종들의 식별형질, 사진자료, 분포 및 기주 정보도 함께 제공하였다.

**검색어:** 사철각지네마디좀벌, 사철각지벌레, 면충좀벌과

In Korea, the Japanese spindle (*Euonymus japonicus* Thunb. (Celastraceae)) has commonly been planted as landscape and fence trees. The principal armored scale insect, occurring on this tree, is the euonymus scale, *Unaspis euonymi* (Comstock) (Diaspididae). But recently this pest has become a concern in many landscapes due to its high populations. It is generally found on leaves, twigs and branches and its high populations reduce plant vigour, cause leaf drop and eventual plant death

(Paik, 2000). Trees located near buildings are especially more prone to attack by this pest since poor air circulation, higher temperatures and lack of biological agents such as parasitoids in these areas provide a favorable environment for outbreaks of the scale population.

In 2014, we conducted a survey of the species of Aphelinidae associated with the euonymus scale in Korea. According to the Noyes' Universal Chalcidoidea Database (Noyes, 2014), ten species of aphelinids have been reported to parasitize *Unaspis euonymi* (Comstock) worldwide. Of these, *Aphytis proclia* (Walker) and *Encarsia citrina* (Craw) have been previously

\*Corresponding author: suhsj97@korea.kr

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documented in Korea, but from hosts other than *U. euonymi* until now (Paik, 1978; Li and Yang, 2004). During the survey, four species of aphelinids were collected and identified as *Ablerus perspeciosus* Girault, *Encarsia citrina* (Craw), *Marietta carnesi* (Howard) and *Pteroptrix machiaveli* (Girault). Of these, *Pteroptrix machiaveli* (Girault) is recorded newly from Korean parasitoid fauna. *Ablerus perspeciosus* Girault and *Marietta carnesi* (Howard) are newly recorded from *Unaspis euonymi* (Comstock), although species in both of these genera are generally known to be secondary or hyperparasitoids.

In this paper, the list of parasitoid species of *Unaspis euonymi* (Comstock) that occur in Korea is updated and a brief diagnosis and photographs of each of the four species newly documented in Korea from this host are provided.

## Materials and Methods

The specimens used in this study were reared from the euonymus scale, *Unaspis euonymi* (Comstock) infesting Japanese spindle leaves and twigs from May to October 2014 (Fig. 1). Some of specimens of the species reported in this paper were mounted on microscope slides in Hoyer's mounting medium for identification and the others were stored in alcohol. They are deposited in the Collection of Plant Quarantine Technology Center.

Hayat (1998) gave a good description and illustration of *Pteroptrix machiaveli* (Girault) that is newly reported in Korean aphelinid fauna. Also Noyes' Universal Chalcidoidea Database provided a comprehensive summary of information on the nomenclature, hosts and distribution of aphelinids of the world (Noyes, 2014). Herein we provide a brief diagnosis and photographs of major characters, based on morphological characters of the adult female reared from the euonymus scale insects. With respect to hosts of the four species, the primary hosts are only addressed here. Terminology for the morphological structures used in diagnoses follows that of Hayat (1998). Photographs were taken using an AxioCam MRc5 camera through ZEISS Axio Imager M2 Microscope. An asterisk(\*) is used to indicate a new host and distribution record.

## Results and Discussion

### Description

***Ablerus perspeciosus* Girault, 1916** 제졸각지좀벌(Fig. 2)  
*Ablerus perspeciosus* Girault, 1916: 292. Female, Japan.

**Diagnosis.** Female: Body 0.6 mm long, almost black; head generally orange; eyes red; thorax and gaster dark brown except white apical half of gasteral tergite VII and ovipositor sheaths dark brown. Antenna 7-segmented (1,1,4,1); antennal F1 (flagellum) and F3 dark brown; F2 and F4 white. Forewing with three infusate bands. Ovipositor long and the apical part exposed.

**Material examined.** Korea. Gyeongsangnamdo (GN): Yokjido (34°38'31.5"N/128°14'7.5"E), 1 female, ex. *Unaspis euonymi* (Comstock) on *Euonymus japonicus* Thunb., 16-ix-2014 (S.J. Suh).

**Distribution.** Korea (Paek, 2010), China, Japan, India, Thailand, France, Yugoslavia, Turkey, Italy, Israel, Egypt, USA, Argentina (Noyes, 2014).

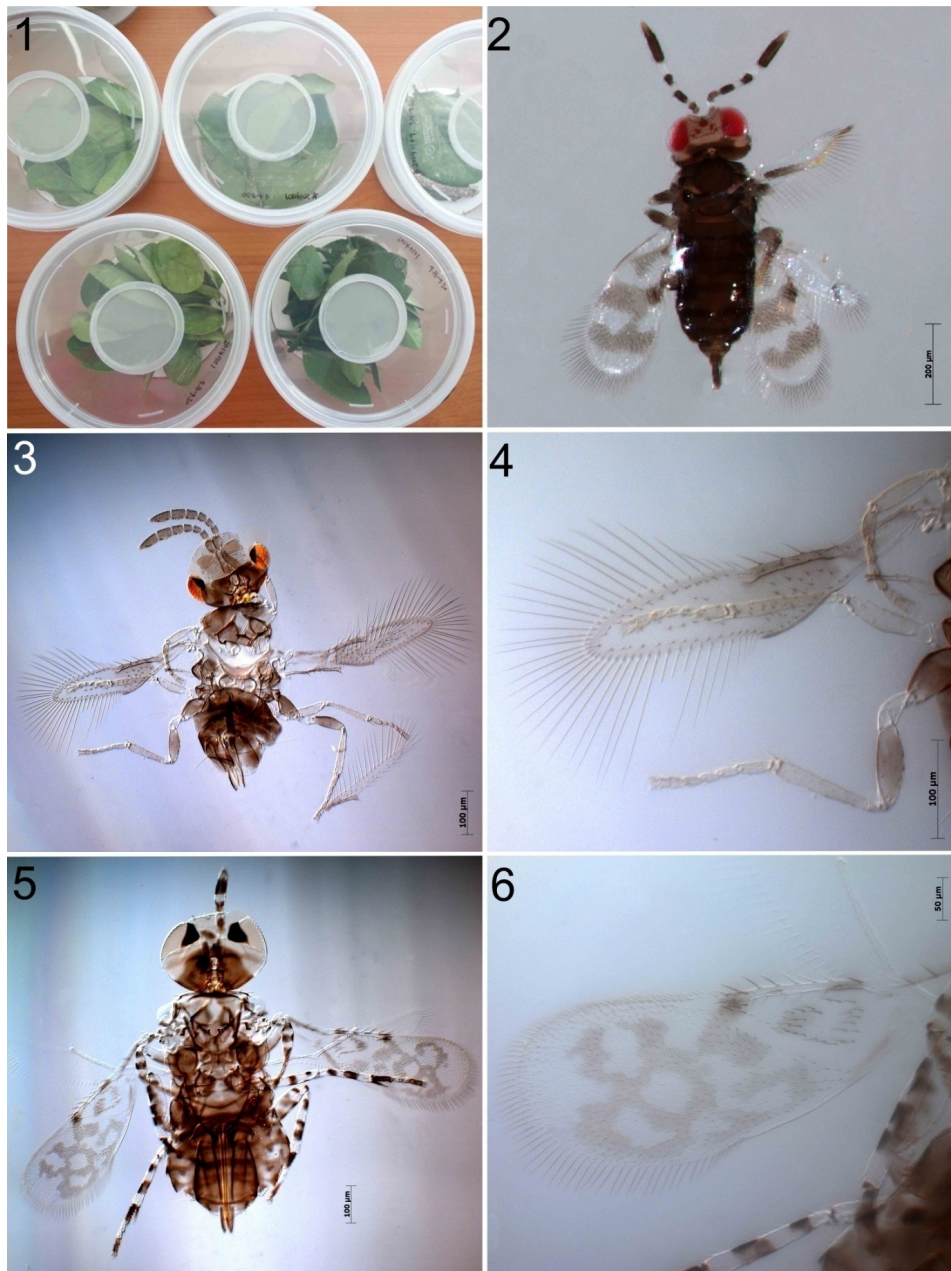
**Hosts.** Aleyrodidae: *Aleurolobus barodensis*. Coccidae: *Saissetia oleae*. Diaspididae: *Aulacaspis difficilis*, *Chrysomphalus aonidum*, *Comstockaspis macroporana*, *Comstockaspis perniciosus*, *Diaspidiotus gigas*, *Lepidosaphes gloverii*, *Lepidosaphes ulmi*, *Melanaspis obscura*, *Pseudaonidia duplex*, *Pseudaulacaspis pentagona* (Noyes, 2014), *Unaspis euonymi*\*.

**Remarks.** This species is probably a hyperparasitoid (Hayat, 1998).

***Encarsia citrina* (Craw, 1891)** 주각각지좀벌(Figs. 3-4)  
*Coccophagus citrinus* Craw, 1891: 5. Female, USA.

**Diagnosis.** Female: Body 0.5 mm long, brown to dark brown; head almost light yellow. Midlobe of mesoscutum with 4 setae. Petiole with distinct sculpture. Tarsi 5-5-5. Forewing with an asetose area around stigmal vein; forewing more or less parallel-sided beyond venation; marginal fringe longer than width of wing; submarginal vein with 2 setae.

**Material examined.** Korea. Gyeonggido: 19, Taejang-ro 71 beon-gil, Yeongtong-gu, Suwon-si (37°14'5.9"N/127°3'15.1"E), 1 female, ex. *Unaspis euonymi* (Comstock) on *Euonymus japonicus* Thunb., 4-vii-2014 (S.J. Suh).



**Figs. 1-6.** Three species of aphelinids. 1) aphelinids rearing in plastic containers. 2) *Ablerus perspicuosus* Girault, habitus. 3-4) *Encarsia citrina* (Craw), female and forewing. 5-6) *Marietta carnesi* (Howard), female and forewing.

**Distribution.** Virtually worldwide (Noyes, 2014).

**Hosts.** Recorded from 157 species belonging to Diaspididae, Coccidae, Asterolecaniidae, Conchaspidae, Eriococcidae and Aleyrodidae (Hemiptera) (Noyes, 2014).

*Marietta carnesi* (Howard, 1910) 장미까치좀벌(Figs. 5-6)  
*Perissopterus carnesi* Howard, 1910: 162-163. Female, China.

**Diagnosis.** Female: Body 0.8 mm long, yellow to silvery white. Gasteral dorsum infuscate brown with sides from base to apex silvery white and a narrow dark brown cross-band on tergum I to V extending to silvery sides; a dark spot on each of silvery sides. Antenna 6-segmented (1,1,2,2); scape slender, about 6.0x as long as broad. Midlobe of mesoscutum with 14 to 16 setae. Legs whitish to pale yellow; with dark brown complete or incomplete bands. Forewing with hyaline cells or infuscated



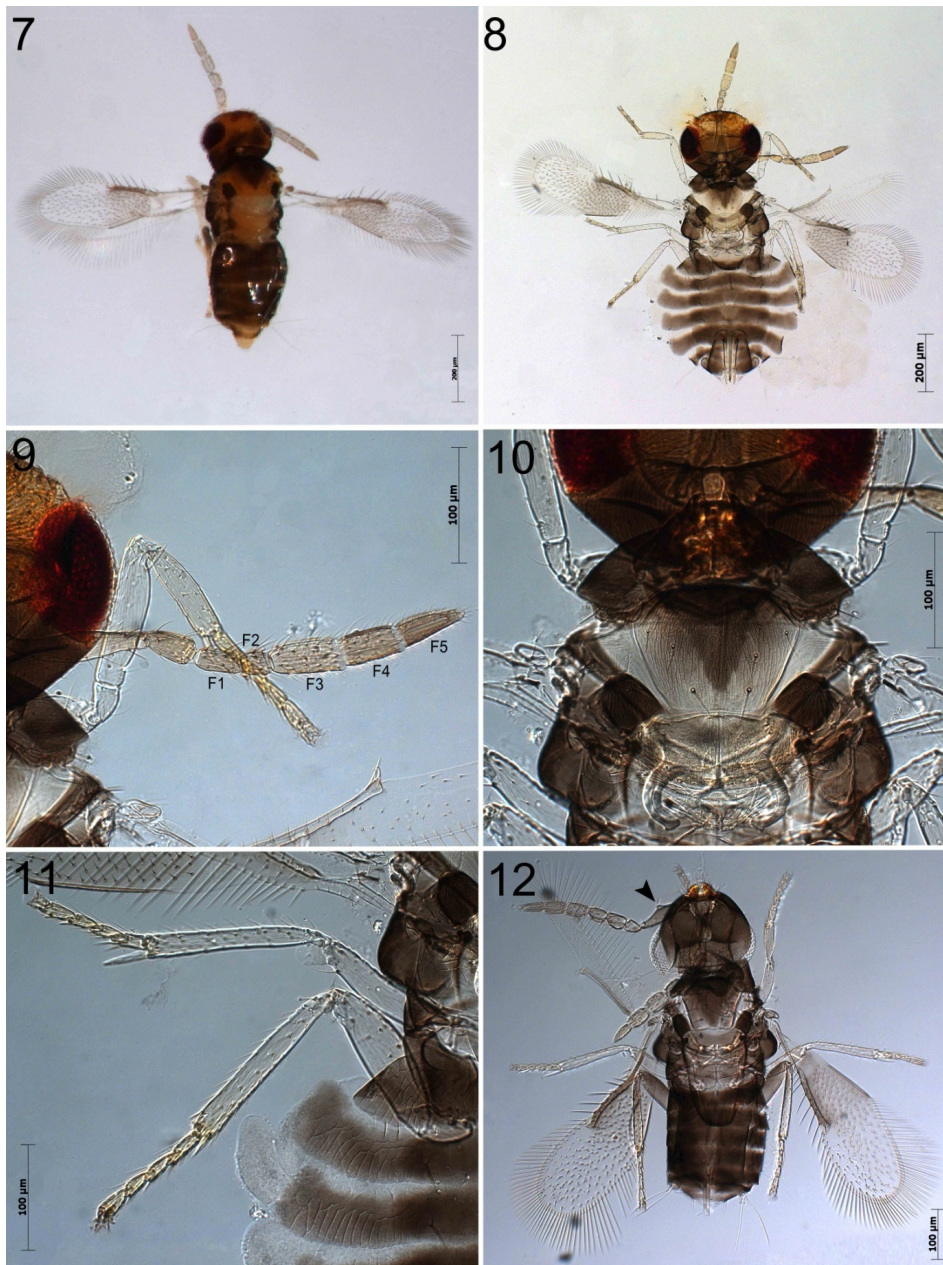
patterns; without hyaline cells along margin and apex.

**Material examined.** Korea. GN: Yokjido (34°38'31.5" N/128°14'7.5" E), 3 females, ex. *Unaspis euonymi* (Comstock) on *Euonymus japonicus* Thunb., 16-ix-2014 (S.J. Suh).

**Distribution.** Korea (Li et al., 2001), China, Japan, India, Russia, Spain, Italy, Egypt, Mauritius, USA, Hawaii, Australia, Micronesia (Noyes, 2014).

**Hosts.** Coccidae: *Ericerus pela*, *Mesolecanium nigrofasciatum*,

*Pulvinaria* sp. Diaspididae: *Aonidiella aurantii*, *Aulacaspis tegalensis*, *Chrysomphalus aonidum*, *Chrysomphalus bifasciculatus*, *Comstockaspis perniciosus*, *Diaspis echinocacti*, *Furcaspis oceanica*, *Hemiberlesia pitysophila*, *Lepidosaphes beckii*, *Lepidosaphes gloverii*, *Parlatoria* sp., *Parlatoria pergandii*, *Parlatoria ziziphi*, *Pseudaonidia duplex*, *Pseudaonidia trilobitiformis*, *Pseudaulacaspis pentagona*, *Unaspis yanonensis*. Pseudococcidae: *Nesticoccus sinensis* (Noyes, 2014). *Unaspis*



**Figs. 7-12.** *Pteroptrix machiaveli* (Girault). 7) habitus. 8) female. 9) antenna. 10) midlobe of mesoscutum. 11) middle and hind legs. 12) male (arrow: scape with a sensory structure).

*euonymi*\*.

**Remarks.** This species is a hyperparasitoid.

***Pteroptrix machiaveli* (Girault, 1922)** 사철꼭지네마디좀벌 (신칭) (Figs. 7-12)

*Casca machiaveli* Girault, 1922: 101. Female. Australia.

**Diagnosis.** Female: Body 0.8 mm long, dark brown; head almost yellow; sides and posterior third of mid lobe, side lobes, scutellum, and propodeum except sides, pale yellow; scutellum nearly white. Antenna 7-segmented (1,1,2,3); F1 shorter than or subequal in length to pedicel; F2 quadrate or slightly longer than broad, F3 to F5 with a few longitudinal sensilla. Midlobe of mesoscutum with 8-10 setae. Tarsi 4-4-4. Forewing with an infuscation behind marginal and stigmal veins. Male: Body 0.5 mm long, similar to female except for the antennal scape with a sensory structure in basal third.

**Material examined.** Korea. GN: Yokjido (34°38'31.5'' N/128°14'7.5'' E), 57 females and 31 males, ex. *Unaspis euonymi* (Comstock) on *Euonymus japonicus* Thunb., 16-ix-2014 (S.J. Suh).

**Distribution.** India, Australia (Hayat, 1998; Noyes, 2014), Korea\*.

**Hosts.** Diaspididae: *Chionaspis ramakrishnai* (Hayat, 1998), *Unaspis euonymi*\*.

**Remarks.** This species can easily be distinguished by numbers of the antennal segments from *Pteroptrix japonica* (Huang) and *Pteroptrix orientalis* (Silverstri) documented in Korea, with antenna 8 segments (Li et al., 2002). It is also similar to *Pteroptrix chinensis* (Howard), which is not known to occur in Korea, but F1 is shorter than or subequal in length to pedicel and the midlobe of the mesoscutum has 8 to 10 setae; male scape has a sensory structure in basal third. Whereas, with respect of *P. chinensis*, F1 is longer than in length to pedicel and the midlobe of the mesoscutum has 4 setae; male scape has a sensory structure in apical third (Hayat, 1998).

## Discussion

The updated list of the aphelinids known to parasitize *Unaspis euonymi* (Comstock), including *Pteroptrix machiaveli*

(Girault) which is newly recorded in Korea, adds to our understanding of the Korean fauna of aphelinids and aids in the correct identification of species. Aphelinids are primarily known as a source of biological control agents for pests belonging to the armored scales (Diaspididae) and whiteflies (Aleyrodidae). Thus, the native *Pteroptrix machiaveli* (Girault) discovered through this survey would be useful as a biological control agent against the euonymus scale and might be a good candidate to introduce into countries causing damages by this pest as well.

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