

A journal of world insect systematics

INSECTA MUNDI

0885

Parasitoids (Hymenoptera: Chalcidoidea) of
the white peach scale, *Pseudaulacaspis pentagona*
(Targioni-Tozzetti) (Homoptera: Diaspididae)
on *Prunus salicina* Lindl. (Rosales: Rosaceae) in South Korea

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Date of issue: September 24, 2021

Center for Systematic Entomology, Inc., Gainesville, FL

Suh S-J. 2021. Parasitoids (Hymenoptera: Chalcidoidea) of the white peach scale, *Pseudaulacaspis pentagona* (Targioni-Tozzetti) (Hemiptera: Diaspididae) on *Prunus salicina* Lindl. (Rosales: Rosaceae) in South Korea. *Insecta Mundi* 0885: 1–5.

Published on September 24, 2021 by
Center for Systematic Entomology, Inc.
P.O. Box 141874
Gainesville, FL 32614-1874 USA
<http://centerforsystematicentomology.org/>

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Parasitoids (Hymenoptera: Chalcidoidea) of
the white peach scale, *Pseudaulacaspis pentagona*
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Abstract. Four aphelinid and one encyrtid parasitoid species (Hymenoptera: Chalcidoidea) were collected from *Pseudaulacaspis pentagona* (Targioni-Tozzetti) infesting twigs and stems of Japanese plum tree (*Prunus salicina* Lindl.) in a survey conducted in 2020 in South Korea. These were identified as *Aphytis proclia* (Walker), *Encarsia berlesei* (Howard), *Marietta carnesi* (Howard), *Pteroptrix orientalis* (Silvestri) (Aphelinidae) and *Arrhenophagus chionaspidis* Aurivillius (Encyrtidae). In this paper, the list of parasitoid species of *P. pentagona* that occur on Japanese plum trees in South Korea is updated and a brief diagnosis and photographs of each species are provided.

Key words. Aphelinidae, Encyrtidae, pest scale insects, Japanese plums, biological agents.

ZooBank registration. urn:lsid:zoobank.org:pub:9542D266-DAFC-4D5A-810F-C332C00EC1B2

Introduction

Plum and sloe belong to the family Rosaceae, which is grown in temperate zones and ranks fifth among deciduous fruits produced in the world (FAO 2019). In South Korea, the Japanese plum (*Prunus salicina* Lindl. (Rosales: Rosaceae)) is the sixth largest deciduous fruit in production, following apple, persimmon, peach, pear and grape (KOSIS 2019). In 2019, the total production and cultivated area of Japanese plums in South Korea were 51,087 metric tons and 7,100 hectares, respectively (KOSIS 2019). This type of plum that originated in the Yangtze River basin is consumed as a fresh fruit (Faust and Surányi 1999; Kwon et al. 2018). The principal armored scale insect, occurring on this tree, is the white peach scale, *Pseudaulacaspis pentagona* (Targioni-Tozzetti) (Hemiptera: Diaspididae). This pest has become a concern in many commercial Japanese plum orchards due to its high populations and economic impact.

The white peach scale is the native to Asia, although it was first discovered and described in Italy by Targioni-Tozzetti in 1886. This species is a polyphagous pest that has been reported on 251 genera in 89 plant families (Garcia Morales et al. 2021). In South Korea, *P. pentagona* was first reported by Machida and Aoyama (1928) and has become one of the most common armored scale insects occurring on 31 species in 18 plant families such as peach, Japanese plum trees and woody ornamentals across South Korea (Paik 2000; Suh 2020). This pest primarily feeds on *Prunus* plants and this leads to the loosening of the epidermis of trees, which damages nutrient and water transportation in the branches, leading to branch death (Paik 1978; Paik 2000; Suh 2015; Toorani et al. 2019; Lu et al. 2020).

In 2020, the author conducted a survey of hymenopteran parasitoid species associated with the white peach scale on Japanese plum trees in South Korea. According to the Noyes' Universal Chalcidoidea Database (Noyes 2019), 74 species of chalcidoid wasps are associated with this pest worldwide. The chalcidoid parasitoids are distributed in five families, namely, Aphelinidae (35 spp.), Encyrtidae (15 spp.), Azotidae (11 spp.), Signiphoridae (9 spp.) and Eulophidae (4 spp.). Species of Aphelinidae and Encyrtidae are the most successful groups of Chalcidoidea used in the biological control of pest scale insects (Guerrieri and Noyes 2000). During this survey, four species of aphelinid and one species of encyrtid wasps were collected and identified as follows: *Aphytis proclia* (Walker), *Encarsia berlesei* (Howard), *Marietta carnesi* (Howard), *Pteroptrix orientalis* (Silvestri) (Aphelinidae)

and *Arrhenophagus chionaspidis* Aurivillius (Encyrtidae). In this paper, the list of parasitoid species of *P. pentagona* that occur on Japanese plum trees in South Korea is updated and a brief diagnosis and photographs of each of the five species are provided.

Materials and Methods

The specimens used in this study were reared from the white peach scale, *P. pentagona* infesting twigs and stems of Japanese plum trees from March to September 2020 (Fig. 1). Some 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, Gimcheon, South Korea. The Universal Chalcidoidea Database (Noyes 2019) provides a comprehensive summary of information on the nomenclature, hosts and distribution of each species. Herein the author provides a brief diagnosis and photographs of major characters, based on morphological characters of adult female specimens reared from the white peach scale. Terminology for the morphological structures used in the diagnoses follows that of Noyes (2019). Photographs were taken using an AxioCam MRc5 camera mounted on a ZEISS Axio Imager M2 microscope and a Leica M165C microscope with a Dhyana 400DC-Tucsen camera.

Results

Four aphelinid and one encyrtid species were collected in association with *P. pentagona* on Japanese plum trees in South Korea during the survey of 2020. Of these, only a single species, *Pteroptrix orientalis*, was prevalent, whereas the others were not frequently encountered.

1. *Aphytis proclia* (Walker)

(Fig. 2)

Description. Body about 1 mm long, pale yellowish with fuscous markings; head with a transverse, strongly pigmented black bar on occiput, on each side of foramen; antennal scape pale, with a longitudinal fuscous stripe, pedicel and funicular segments fuscous, basal part of club usually somewhat paler, apex of club blackish; propodeal crenulae fairly numerous, narrow, elongate and nonoverlapping; centre of abdomen immaculate, short fuscous stripes on sides of tergites, tergite VII with a crossband; forewing usually about 2.6× as long as wide, marginal vein considerably longer than submarginal vein, with a delta-shaped area basad of speculum bearing 10–12 rows of 100–116 setae; ovipositor shaft about 1.5 × as long as the middle tibia.

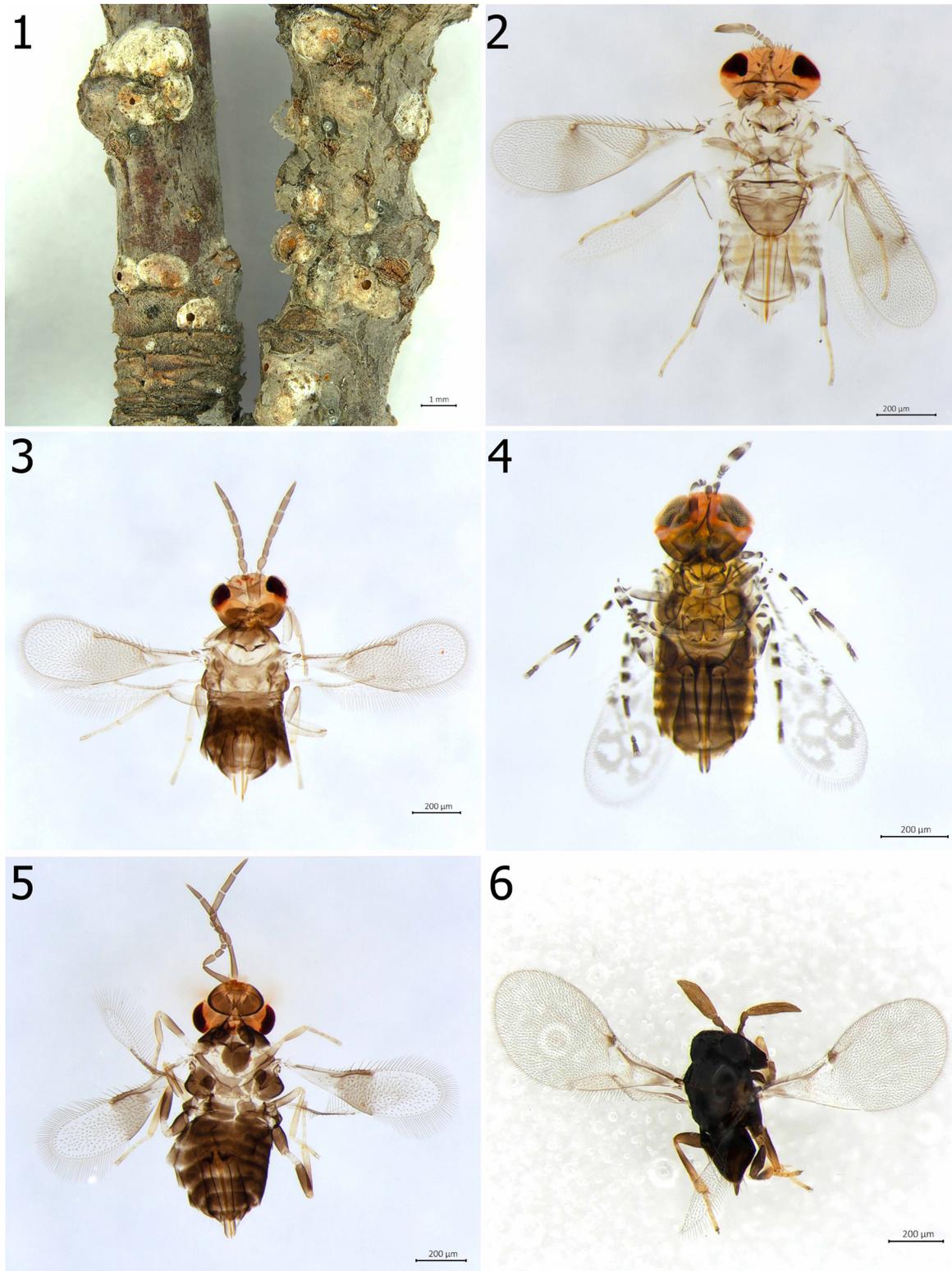
Material examined. Korea. Gyeongsangbukdo (GB) 500 Obong-ri, Nam-myeon, Gimcheon-si, 2 females, ex. *P. pentagona* on *P. salicina*, 24-iii-2020 (S.J. Suh); Bongcheon 2-ri, Nam-myeon, Gimcheon-si, 3 females, ex. *P. pentagona* on *P. salicina*, 12-v-2020 (S.J. Suh).

2. *Encarsia berlesei* (Howard)

(Fig. 3)

Description. Body generally brown to dark brown except posterior mesoscutum and posterior mesosoma yellow; forewing hyaline, slightly infuscated below marginal vein; antenna eight-segmented, F1 (flagellar segment) about twice as long as wide, slightly longer than F2, F3–F6 with longitudinal sensilla; placoid sensilla on scutellum separated by about twice their diameter; mid lobe of mesoscutum with 7–8 setae; ovipositor about as long as middle tibia and basitarsus combined; tarsi five-segmented.

Material examined. Korea. GB: 500 Obong-ri, Nam-myeon, Gimcheon-si, 2 females, ex. *P. pentagona* on *P. salicina*, 24-iii-2020 (S.J. Suh); 119, Hyeoksin 8-ro, Gimcheon-si, 2 females, ex. *P. pentagona* on *P. salicina*, 5-iv-2020 (S.J. Suh); 308 Obong-ri, Nam-myeon, Gimcheon-si, 1 female, ex. *P. pentagona* on *P. salicina*, 1-vii-2020 (S.J. Suh).



Figures 1–6. Five species of parasitoids associated with *Pseudaulacaspis pentagona* (Targioni-Tozzetti) on Japanese plum trees in South Korea. **1)** Parasitoid emergence holes in scale covers of *P. pentagona* (white peach scale). **2)** *Aphytis proclia* (Walker), female. **3)** *Encarsia berlesei* (Howard), female. **4)** *Marietta carnesi* (Howard), female. **5)** *Pteroptrix orientalis* (Silvestri), female. **6)** *Arrhenophagus chionaspidis* Aurivillius, female.

3. *Marietta carnesi* (Howard)

(Fig. 4)

Description. Body yellow to silvery white; forewing with hyaline cells or infuscated patterns, without hyaline cells along margin and apex; antenna six-segmented (1,1,2,2), scape slender, about 6.0× as long as broad; midlobe of mesoscutum with 14 to 16 setae; gastral 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; legs whitish to pale yellow, with dark brown complete or incomplete bands, tarsi five-segmented.

Material examined. Korea. GB: Bongcheon 2-ri, Nam-myeon, Gimcheon-si, 3 females, ex. *P. pentagona* on *P. salicina*, 12-v-2020 (S.J. Suh).

Remarks. This species is a hyperparasitoid.

4. *Pteroptrix orientalis* (Silvestri)

(Fig. 5)

Description. Body about 1 mm long, head generally yellow, thorax yellow to light brownish yellow except pronotum, mid lobe of mesoscutum largely, axillae, metanotum and propodeum brown to blackish brown, abdomen brown to blackish brown; antenna 8-segmented (1,1,3,3), antennal flagellum relatively longer, all the flagellar segments about equal in width, F3 longer than wide; forewing hyaline, about 3.2 × as long as wide, the longest marginal fringe about 0.5 × as long as the greatest width of the wing, wing disc moderately densely setose from the level of the base of the marginal vein to the wing apex; ovipositor protruding a little at the gastral apex, 1.8 × as long as the middle tibia; legs with all tarsi four-segmented.

Material examined. Korea. GB: 119, Hyeoksin 8-ro, Gimcheon-si, 16 females, ex. *P. pentagona* on *P. salicina*, 5-iv-2020 (S.J. Suh); 167-4, Seokjeong-ri, Yecheon-eup, Yecheon-gun, 20 females, ex. *P. pentagona* on *P. salicina*, 22-iv-2020 (S.J. Suh); Bongcheon 2-ri, Nam-myeon, Gimcheon-si, 14 females, ex. *P. pentagona* on *P. salicina*, 12-v-2020 (S.J. Suh); 308 Obong-ri, Nam-myeon, Gimcheon-si, 16 females, ex. *P. pentagona* on *P. salicina*, 1-vii-2020 (S.J. Suh).

5. *Arrhenophagus chionaspidis* Aurivillius

(Fig. 6)

Description. Body dark brown; antennae, ocelli, tegula, and legs yellowish brown; forewing hyaline with marginal fringe short, marginal, postmarginal, and stigma veins absent; clypeal margin of mouth strongly emarginated at base of each mandible; antenna five-segmented, three funicle segments narrow and aneliform, clava large and unsegmented; mesonotum and axillae reticulate, scutellum protruding posteriorly with fine sculpture; gaster slightly shorter than thorax, ovipositor about two-thirds length of middle tibia; tarsi four-segmented.

Material examined. Korea. GB: 167-4, Seokjeong-ri, Yecheon-eup, Yecheon-gun, 3 females, ex. *P. pentagona* on *P. salicina*, 22-iv-2020 (S.J. Suh).

Discussion

The updated list of the parasitoids associated with *P. pentagona* on Japanese plum trees will aid in recognition and identification of the South Korean chalcidoid fauna. The large majority of chalcidoid species are economically and environmentally beneficial although some chalcidoids are hyperparasitoids and others are known to be agricultural pests. They are primary parasitoids of other insects and, as such, they are important participants in nature's own control system for regulating populations of their hosts. Thus, aphelinids such as *Encarsia berlesei* (Howard) and *Pteroptrix orientalis* (Silvestri), discovered through this survey, might be good candidates as biological control agents against the white peach scale in South Korea, and in other countries as well, where this pest causes damage.

Acknowledgments

I am grateful to Drs. Gregory A. Evans (USDA/APHIS/NIS, Washington, DC, USA) and Takumasa Kondo (Corporación Colombiana de Investigación Agropecuaria (Corpoica), Centro de Investigación Palmira, Palmira, Valle, Colombia) for reviewing the manuscript. Funding for this project came from Animal and Plant Quarantine Agency (APQA).

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Received July 29, 2021; accepted September 3, 2021.

Review editor Kevin A. Williams.

