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associated with *Acanthococcus lagerstroemiae* (Kuwana)
(Hemiptera: Eriococcidae) in the Republic of Korea

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Notes on some parasitoids (Hymenoptera: Chalcidoidea) associated with *Acanthococcus lagerstroemiae* (Kuwana) (Hemiptera: Eriococcidae) in the Republic of Korea

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Abstract. A survey of the parasitoids associated with *Acanthococcus lagerstroemiae* (Kuwana) (Hemiptera: Eriococcidae) in the Republic of Korea in 2014 resulted in the documentation of one species of Aphelinidae, *Marietta picta* (Andre), and two species of Encyrtidae, *Metaphycus eriococci* (Timberlake) and *Zaomma eriococci* (Ferrière). Of these, *M. eriococci* and *Z. eriococci* are newly recorded from Korea. In addition, one species of encyrtid is newly recognized as a parasitoid associated with *A. lagerstroemiae* from Korea. In this paper, the list of parasitoid species of *A. lagerstroemiae* that occur in Korea is updated and a brief diagnosis and photographs of these species are provided.

Key words. Aphelinidae, crapemyrtle scale, biological agent, Encyrtidae, parasitic wasps.

Introduction

The crapemyrtle scale, *Acanthococcus lagerstroemiae* (Kuwana) (Hemiptera: Eriococcidae), was first reported in 1930 by Machida and Aoyama in the Republic of Korea. Kanda (1941) documented this species as a pest of crapemyrtles (*Lagerstroemia indica* (L.) Pers.; Lythraceae) and Japanese cherries (*Prunus serrulata* Lindl.; Rosaceae) in Korea, and it has become a common pest of crapemyrtles grown as shrub trees in urban landscapes in Korea (Paik 1978; Paik 2000; Kwon and Han 2003; Kwon et al. 2005). Recently, however, this pest has become a concern for crapemyrtles due to blackened trunks and limbs of the trees. The blackened symptoms are caused by sooty mold that grow on the sugary exudate that is excreted from the crapemyrtle scales. So far, it does not seem that the crapemyrtle scale is causing a great deal of harm to the trees, but due to the copious amounts of sooty mold that grows on the sweet substrate, the trees can look unsightly. Crapemyrtle trees planted in urban landscapes are especially more prone to attack by this pest due to higher temperature and relative humidity conditions, and the lack of biological agents such as parasitoids in these places; these factors provide a favorable environment for outbreaks of the scale population.

In 2014, the author conducted a survey of the species of parasitoids (Hymenoptera: Chalcidoidea) associated with the crapemyrtle scale in Korea. According to Noyes' Universal Chalcidoidea Database (Noyes 2018), ten species of parasitoids, including one aphelinid species and nine encyrtid species, have been reported to parasitize or be associated with *A. lagerstroemiae* worldwide. Two species of these parasitoids, *Metaphycus* sp. and *Trichomasthus cyanifrons* (Dalman) (Encyrtidae), have been previously recorded in Korea based on surveys conducted in the 1970s (Paik 1978); the parasitoid assemblage across the entire country of Korea, however, is poorly understood. During the survey, three parasitoid species were identified as *Marietta picta* (Andre) (Aphelinidae), *Metaphycus eriococci* (Timberlake), and *Zaomma eriococci* (Ferrière) (Encyrtidae). Of these, *Metaphycus eriococci* (Timberlake) and *Zaomma eriococci* (Ferrière) are newly recorded from Korea. In addition, one species of encyrtid is newly added as a parasitic wasp associated with *A. lagerstroemiae* in Korea. Of these, *Metaphycus eriococci* (Timberlake) is a primary parasitoid of eriococcids and may play an important role in biological control of this species and other eriococcid pest species (Ghahari et al. 2010; Wang et al. 2013).

In this paper, the list of parasitoid species of *A. lagerstroemiae* that occur in Korea is updated and a brief diagnosis and photographs are provided for each of the three species newly documented in Korea from this eriococcid host.

Materials and Methods

The specimens used in this study were reared from the crapemyrtle scale, *Acanthococcus lagerstroemiae* (Kuwana) that were infesting crapemyrtle twigs from May to October, 2014 (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, Korea. Wang et al. (2014) and Ferrière (1955) provided good descriptions and illustrations of *Metaphycus eriococci* (Timberlake) and *Zaomma eriococci* (Ferrière), both of which are newly reported in Korea. The Universal Chalcidoidea Database (Noyes 2018) provides a comprehensive summary of information on the nomenclature, hosts and distribution of the species. Herein the author provides a brief diagnosis and photographs of major characters, based on morphological characters of adult female specimens reared from the crapemyrtle scale insects. Only the primary hosts of the three parasitoid species are addressed here. Terminology for the morphological structures used in the diagnoses follows that of Noyes (2018). Photographs were taken using an AxioCam MRc5 camera through ZEISS Axio Imager M2 Microscope. An asterisk (*) is used to indicate a new host or distribution record. Abbreviations of collection regions in Korea are as follows: GG, Gyeonggido; CN, Chungcheongnamdo; GB, Gyeongsangbukdo; GN, Gyeongsangnamdo; JN, Jeollanamdo; JJ, Jeju.

Results and Discussion

Marietta picta (Andre, 1878) [Aphelinidae] (Fig. 2)

Agonioneurus pictus Andre, 1878: 85. Female, France.

Diagnosis. *Female.* Body about 0.5 mm long, brownish yellow. Head and thorax with black spots. Antenna light yellow; scape with two black oblique bands; base of pedicel and antennal funicle III (F3) black; F1–F2 and clava black. Legs light yellow, femora and tibia with black transverse bands. Dorsum and venter of abdomen in central portion brown; both sides of abdomen with segmentally arranged dark reticulate strips. Fore wing relatively short, its length less than $2.5 \times$ its width; wing disc with contrasting areas of dark and hyaline setae with fuscated patterns.

Male. Similar to the female except for the antenna and genitalia: tip of antennal clava and F3 pale; dorsum of gaster reticulate; genitalia $4 \times$ as long as wide (Li et al. 2001).

Material examined. Korea. CN: Techno 4-ro, Ryuseong-gu, Daejeon-si, 1 female, *ex. A. lagerstroemiae* on *L. indica*, 31-V-2014 (S.J. Suh).

Distribution. Canada, China, Europe, Korea, Mexico, Peru (Noyes 2018).

Hosts. Recorded from 50 species of scale insects (Coccoidea), aphids (Aphididae), and psyllids (Psyllidae, Triozidae) (Noyes 2018).

Remarks. This species is a hyperparasitoid (Li et al. 2001).

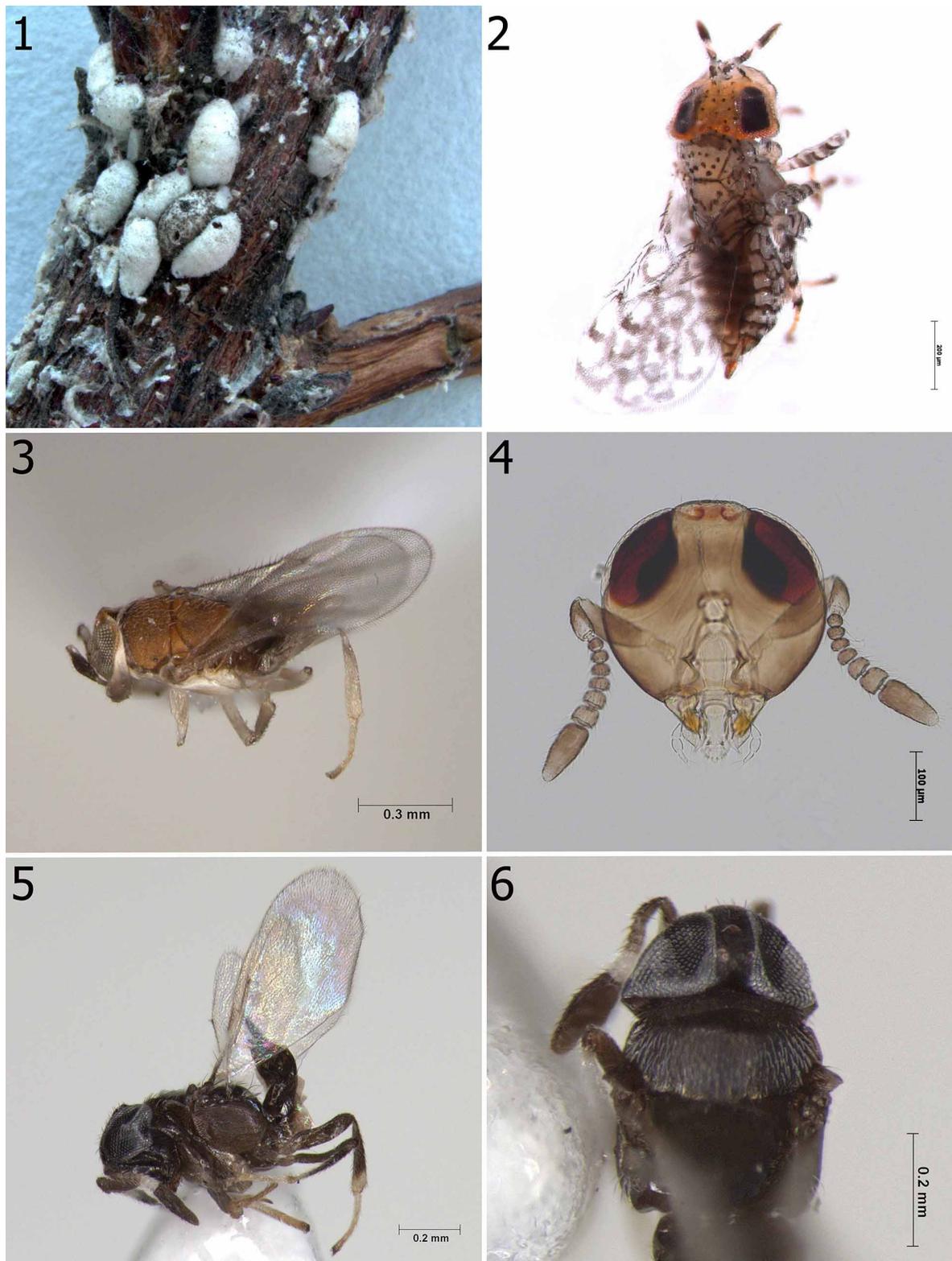
**Metaphycus eriococci* (Timberlake, 1916) [Encyrtidae] (Fig. 3–4)

Aphycus eriococci Timberlake, 1916: 631. Female, USA.

Diagnosis. *Female.* Body 0.7–0.9 mm long, orange to brown. F1–F4 dark brown, F5–F6 brownish yellow, clava dark brown; F1–F4 subequal in length, each segment about $0.7 \times$ as long as wide; scape slightly expanded, $3\text{--}4 \times$ as long as broad. Maxillary and labial palpi three-segmented. Legs usually pale yellow; mid tibia and hind tibia with faintly brown mark. Fore wing hyaline, linea calva interrupted; venation yellow-brown; hind wing hyaline. Ovipositor slightly projecting, $4\text{--}5 \times$ as long as gonostylus.

Male. Body 0.7–0.8 mm long, dark brown; very similar to the female except for antenna and genitalia.

Material examined. Korea. GG: 476 Dongtanjiseong-ro, Yeongtong-gu, Suwon-si ($37^{\circ}14'5.8''\text{N}/127^{\circ}2'53.5''\text{E}$), 3 females and 5 males, *ex. A. lagerstroemiae* on *L. indica*, 6-VI-2014 (S.J. Suh); same



Figures 1–6. Three species of parasitoids associated with *Acanthococcus lagerstroemiae* (Kuwana) in Korea. **1)** Parasitoid emergence holes in scale covers of *A. lagerstroemiae* (crapemyrtle scale). **2)** *Marietta picta* (Andre), female. **3–4)** *Metaphycus eriococci* (Timberlake), female and head. **5–6)** *Zaomma eriococci* (Ferrière), female and mesoscutum.

locality, 1 female and 6 males, *ex. A. lagerstroemiae* on *L. indica*, 26-VI-2014 (S.J. Suh); 126 Suin-ro, Gwonseon-gu, Suwon-si, 1 female, *ex. A. lagerstroemiae* on *L. indica*, 18-VI-2014 (S.J. Suh); 10 Taejang-ro 54beon-gil, Yeongtong-gu, Suwon-si, 1 female, *ex. A. lagerstroemiae* on *L. indica*, 9-X-2014 (S.J. Suh). CN: Techno 4-ro, Ryuseong-gu, Daejeon-si, 11 females and 9 males, *ex. A. lagerstroemiae* on *L. indica*, 31-V-2014 (B.J. Lee). GB: 80 Daehak-ro, Buk-gu, Daegu-si (35°53'26.5"N/ 128°37'12.3"E), 26 females and 6 males, *ex. A. lagerstroemiae* on *L. indica*, 31-V-2014 (S.J. Suh); same locality, 65 females and 15 males, *ex. A. lagerstroemiae* on *L. indica*, 6-VII-2014 (S.J. Suh); same locality, 42 females and 9 males, *ex. A. lagerstroemiae* on *L. indica*, 27-VII-2014 (S.J. Suh). GN: 592-15 Hadan-dong, Saha-gu, Busan-si, 2 females and 5 males, *ex. A. lagerstroemiae* on *L. indica*, 13-VI-2014 (S.J. Suh); Yongdusan park (35°06'03.28"N/ 129°01'59.88"E), 1 male, *ex. A. lagerstroemiae* on *L. indica*, 14-VI-2014 (S.J. Suh); Yokjido (34°38'17.8"N/ 128°16'31.1"E), 1 female and 3 males, *ex. A. lagerstroemiae* on *L. indica*, 16-IX-2014 (S.J. Suh); 1074-2 Mulgeon-ri, Samdong-myeon, Naehae-gun (34°47'53.7"N/ 128°2'33.2"E), 2 males, *ex. A. lagerstroemiae* on *L. indica*, 16-IX-2014 (S.J. Suh); Minam-ri, Sanyang-eup, Tongyeong-si (34°46'7.7"N/ 128°24'0.7"E), 6 females and 8 males, *ex. A. lagerstroemiae* on *L. indica*, 17-IX-2014 (S.J. Suh). JN: 60 Geurin-ro, Geumcheon-myeon, Naju-si, 4 females and 5 males, *ex. A. lagerstroemiae* on *L. indica*, 26-V-2014 (S.J. Suh); Baeksa-ri, Gongsan-myeon, Naju-si, 16 females and 1 male, *ex. A. lagerstroemiae* on *L. indica*, 27-V-2014 (S.J. Suh). JJ: Susan-ri, Awol-eup, Jeju-si, 6 females and 5 males, *ex. A. lagerstroemiae* on *L. indica*, 20-V-2014 (S.J. Suh); Topyeong-dong, Seogwipo-si, 1 male, *ex. A. lagerstroemiae* on *L. indica*, 20-V-2014 (S.J. Suh); 293-28 Ieodo-ro, Seogwipo-si, 1 male, *ex. A. lagerstroemiae* on *L. indica*, 20-V-2014 (S.J. Suh).

Distribution. China, USA (Wang et al. 2014; Noyes 2018); Korea*.

Hosts. Coccidae: *Coccus hesperidum*. Eriococcidae: *Acanthococcus lagerstroemiae*, *A. quercus* (Noyes 2018).

Remarks. This species is recorded for the first time in Korea.

**Zaomma eriococci* (Ferrière, 1955) [Encyrtidae] (Fig. 5-6)

Apterencyrtus eriococci Ferrière, 1955: 117–118. Female, Germany.

Diagnosis. *Female.* Body about 1.3 mm long, black with frons and mesoscutum having metallic reflections. Antenna black except for F5–F6 white; clava three-segmented, apically obliquely truncated, larger, wider than last funicle segment; six-segmented funicle cylindrical. Mesoscutum with white setae; black tuft of bristles located about on middle of scutellum. Middle tibiae white; tarsus five-segmented. Fore wing hyaline; venation yellow-brown. Ovipositor slightly projecting.

Male. Body 1 mm long, generally similar to the female except for antenna and genitalia; antennae brownish, funicle cylindrical, with long hairs; mesoscutum with blackish setae (Tachikawa 1979).

Material examined. Korea. GG: 126 Suin-ro, Gwonseon-gu, Suwon-si, 1 female and 1 male, *ex. A. lagerstroemiae* on *L. indica*, 18-VI-2014 (S.J. Suh).

Distribution. China, Europe, Japan, Kazakhstan (Noyes 2018); Korea*.

Hosts. Recorded from eight species belonging to Eriococcidae (7 species) and Pseudococcidae (1 species) (Noyes 2018); Eriococcidae: *Acanthococcus lagerstroemiae**.

Remarks. This species is recorded for the first time in Korea.

Discussion

This work provides an updated list of the parasitoids associated with *A. lagerstroemiae*, including two species (*Metaphycus eriococci* (Timberlake) and *Zaomma eriococci* (Ferrière)) which are newly recorded in Korea, adds to our understanding of the Korean fauna of the chalcidoid insects, and aids in the correct identification of species. Many chalcid species are economically and environmentally beneficial, although some chalcids 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 the population of their hosts. Thus, at least two of the parasitoid species recorded in this survey, *Metaphycus eriococci* (Timberlake) and *Zaomma eriococci* (Ferrière), may be good candidates as biological control agents against the crapemyrtle scale in Korea and in other countries where this pest causes economic damage to crapemyrtle trees.

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