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(Hemiptera: Coccoidea)
in Korea

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Notes on oak-infesting species of scale insects (Hemiptera: Coccoidea) in Korea

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Abstract. Scale insects (Hemiptera: Coccoidea) were collected on oak trees (*Quercus* spp.; Fagaceae) in Korea and identified as *Asterodiaspis luteola* (Russell) (Asterolecaniidae) and *Nidularia japonica* (Kuwana) (Kermesidae), which are newly documented in the Korean fauna of scale insects. Characteristics of these species are briefly given and illustrative photographs and information on their distribution and hosts are provided.

Key Words. Pit scale species, kermesid species, identification, biodiversity data

Introduction

Over 600 different species of oaks (*Quercus*; Fagaceae) are known; most of these species are deciduous with only a couple of evergreen forms (Lee et al. 2010). In Korea, oak trees cover about 40% of the forested area (Jeong et al. 2016). On oak trees, scale insects (Hemiptera: Coccoidea) occur on leaves, twigs, branches or tree trunks. Although they are often reported as pests of some oak species, the species that develop on oak trees in Korea are not considered as economic pests (Paik 1978; Paik 2000).

Over the course of surveying the oak forests in Korea, some scale insects were collected, and identified as *Asterodiaspis luteola* (Russell) (Asterolecaniidae) and *Nidularia japonica* (Kuwana) (Kermesidae); these represent the first records of the occurrence of these species in Korea.

The genus *Nidularia* is characterized by having microtubular ducts on the entire dorsum, and ventral submarginal rows of quinquelocular and/or bilocular pores within the submarginal band of tubular ducts (Spodek and Ben-Dov 2014). Species of *Nidularia* are monophagous and mainly develop in bark crevices of oak trees (Bullington and Kosztarab 1985). *Nidularia* contains three species worldwide and among them, *N. japonica* collected on the bark of *Quercus dentata* (Fagaceae) is newly added to the catalogue of Korean scale insects.

The pit scale genus *Asterodiaspis* is comprised of 26 species worldwide (García et al. 2017). Species of *Asterodiaspis* are found only on oaks (Stumpf and Lambdin 2006) and are characterized by having a marginal row of large 8-shaped pores on the dorsum. Nakayama's (1933) report of *Asterodiaspis japonica* (Cockerell) was the first record of a *Asterodiaspis* scale in Korea.

In this paper, the author adds two scale insect species of two families, *Asterodiaspis luteola* (Russell) and *Nidularia japonica* (Kuwana), to the Korean fauna, and provides illustrations and information on their distribution and host plants for each of these species.

Materials and Methods

Stumpf and Lambdin (2006) and Liu et al. (1997) respectively provided descriptions for the pit scale species and the kermesid species that are newly reported herein for the Korean scale insect fauna. García et al. (2017) provide a comprehensive summary of information on the nomenclature, hosts and distribution of scale insects of the world. Herein we provide a brief diagnosis and photographs of the major characters of two species.

All slide-mounted specimens studied for this paper are deposited in the Collection of Plant Quarantine Technology Center (PQTC #2078-2079, #2281-2282, and #2339-2341), South Korea. The characters provided below for diagnoses are based on specimens of adult females collected on the bark of their plant hosts. Terminology for morphological structures follows that of Stumpf and Lambdin (2006) for Asterolecaniidae, and Spodek and Ben-Dov (2014) for Kermesidae. Acronyms of collecting regions are as follows: Gyeonggido (GG), Gyeongsangbukdo (GB), and Jeollanamdo (JN). Photographs were taken using an AxioCam MRc5 camera mounted on a ZEISS Axio Imager M2 Microscope and a Leica M165C microscope with a Delta pix camera. An asterisk (*) is used to indicate new distribution records.

Species Diagnoses

Asterodiaspis luteola (Russell) (Asterolecaniidae)

Asterolecanium luteolum Russell, 1941. Type data: Japan, on *Quercus serrata*.

Field characters. Adult female cover slightly convex subcircular; approximately 0.63 mm long; semi-transparent; green to yellow.

Slide-mounted characters. Adult female round to oval with 8-shaped pores of a single row on dorsal margin, two types of dorsal 8-shaped pores; apical setae on separate lobes, about 42 µm long; with about 10 quinquelocular pores in each spiracular furrow; multilocular pores in transverse abdominal rows on venter.

Material examined. Korea. JN: Jirisan, 3 adult females, on *Quercus* sp. (Fagaceae) bark, vi-3-2011 (S.J. Suh); GB: Apsangongwon, 3 adult females, on *Quercus* sp. (Fagaceae) bark, vi-6-2011 (S.J. Suh).

Distribution. Japan, USA (García et al. 2017), *Korea.

Hosts. Fagaceae: *Quercus serrata*, *Quercus* sp. (García et al. 2017).

Remarks. This species was collected on bark of *Quercus* and no damage to its host plants was observed.

Nidularia japonica Kuwana (Kermesidae)

Nidularia japonica Kuwana, 1918. Type data: Japan, on *Quercus glandulifera*.

Field characters. Adult female oval, moderately convex, dark gray to brown, dorsal surface with distinct ridges; matured adult female sclerotized and turtle-shell shaped, dorsal midline ridge, with white and nest-like ovisac covering the sides of body; 2.8–6.0 mm long. Male covered by a loose cottony white wax.

Slide-mounted characters. Adult female oval with a single row of spinose marginal setae on dorsal margin; one-segmented antennae each with 7 setae; legs absent; anal ring present on venter, with 6 setae and pores; tubular ducts present on dorsal abdomen; multilocular pores in 1–2 rows present on medial and submedial areas of abdominal segments; 4–5 quinquelocular pores lateral to each anterior spiracle, 1–2 pores medial to each posterior spiracle.

Material examined. Korea. GG: 2850 Unseo-dong, Jung-gu, Incheon-si, 17 adult females, on *Quercus dentata* (Fagaceae) bark, v-14-2015 (M.S. Gwak); same data except for iv-5-2016 (S.J. Suh).

Distribution. China, Japan (García et al. 2017), *Korea.

Hosts. Fagaceae: *Quercus acutissima*, *Quercus aliena*, *Quercus dentata*, *Quercus serrata*, *Quercus* sp. (García et al. 2017).

Remarks. This species is considered of no-economic importance in Korea.

Updated list of scale insect species associated with oak trees in Korea

(*) indicates new species record for Korea

Asterolecaniidae

Asterodiaspis japonica (Cockerell)

**Asterodiaspis luteola* (Russell)

Asterodiaspis variolosa (Ratzeburg)

Coccidae

Ceroplastes japonicus Green

Coccus hesperidum Linnaeus

Parthenolecanium corni (Bouché)

Diaspididae

Andaspis kashicola (Takahashi)

Andaspis recurrens Takagi and Kawai

Chionaspis saitamaensis Kuwana

Comstockaspis pernicioso (Comstock)

Diaspidiotus cryptoxanthus (Cockerell)

Dynaspidotus pseudomeyeri (Kuwana)

Hypaspidotus jordani (Kuwana)

Pseudaonidia duplex (Cockerell)

Pseudaulacaspis cockerelli (Cooley)

Pseudaulacaspis kiushiuensis (Kuwana)

Eriococcidae

Acanthococcus lagerstroemiae (Kuwana)

Kermesidae

Kermes miyasakii Kuwana

Kermes nakagawae Kuwana

Kermes vastus Kuwana

**Nidularia japonica* Kuwana

Kuwaniidae

Kuwanina quercus (Kuwana)

Lecanodiaspididae

Psoraleococcus quercus (Cockerell)

Monophlebidae

Drosicha corpulenta (Cockerell)

Pseudococcidae

Crisicoccus coreanus (Kanda)

Discussion

This work provides a checklist of scale insect species associated with the native oak trees of Korea: Asterolecaniidae (3 spp.), Coccidae (3 spp.), Diaspididae (10 spp.), Eriococcidae (1 sp.), Kermesidae (4 spp.), Kuwaniidae (1 sp.), Lecanodiaspididae (1 sp.), Monophlebidae (1 sp.), and Pseudococcidae (1 sp.). Of them, two species are reported herein for the first time from Korea. The genus *Nidularia* has not been previously reported in Korea. In the Palaearctic region, this genus is known from China and Japan. According to the scale insect database ScaleNet (García et al. 2017), 424 species of scale insects have been reported on Fagaceae worldwide; of which 5.9% are known to occur in Korea. This list will contribute to the knowledge of the Korean fauna of scale insects. No economic damage to oak trees was observed during the survey, but some of these species on the list are cosmopolitan and considered as pests of economic importance to agricultural crops. This information is critical to assessing the economic impact that a given species poses. Therefore, surveys such as this study will not only increase the data on biodiversity, but also will promote an awareness of pest issues concerning scale insects.

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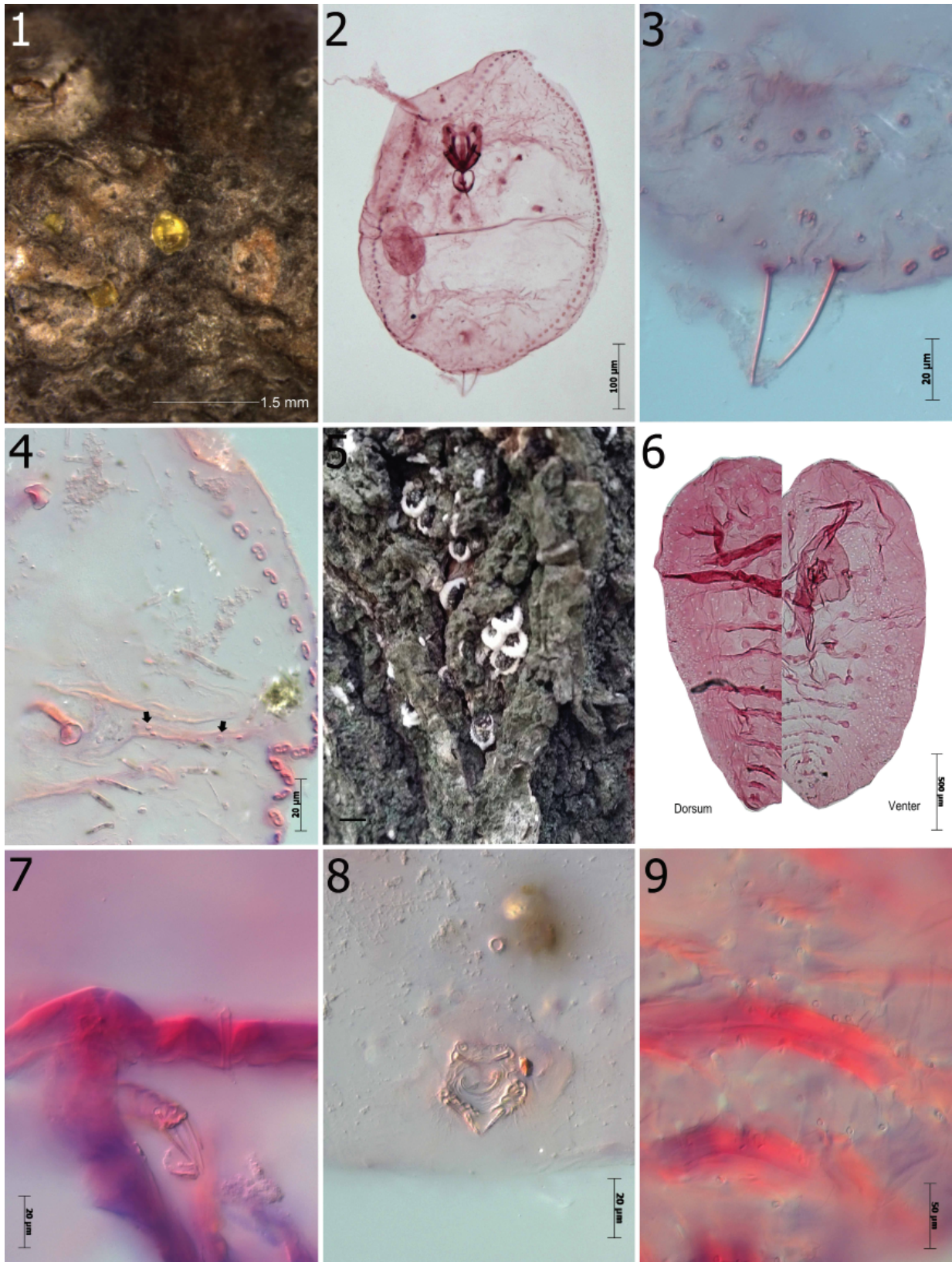
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Figures 1-9. Two species of scale insects on oak trees in Korea. 1-4. *Asterodiaspis luteola* (Russell). 1) Habitus. 2) Female. 3) Apical setae. 4) Anterior and posterior spiracular furrows (arrow: quinquelocular pores). 5-9. *Nidularia japonica* Kuwana. 5) Habitus. 6) Female. 7) Antenna. 8) Anal ring. 9) Tubular ducts on dorsal abdominal segments.

