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## New records of *Chionaspis* armored scales (Hemiptera: Diaspididae) in Korea

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**Abstract.** *Chionaspis acer* (Takagi and Kawai) and *Chionaspis wistariae* Cooley, occurring respectively on *Acer* and *Wisteria* plants, are newly reported in the Korean fauna of armored scales (Hemiptera: Diaspididae). The characters of these species are briefly redescribed with illustrative photographs and information on distribution and hosts. A dichotomous key to species of *Chionaspis* Signoret in Korea is provided for correct species identification.

**Key words.** *Chionaspis acer*, *Chionaspis wistariae*, Coccids

### Introduction

The genus *Chionaspis* was described by Signoret (1869) and is currently comprised of 80 species worldwide (García et al. 2015). Of these, many species are distributed in eastern Asia and North America. According to the concepts presented by Takagi (1985), *Chionaspis* originated from eastern Asia, invaded North America in a comparatively recent time and then extended into certain montane tropical areas of southern Asia. This genus is characterized by the following characters: 1) median lobes larger than the lobules of the second and third lobes; 2) median lobes joined by a basal zygois; 3) dorsal ducts 2-barred, present marginally as far as abdominal segment 1. *Pseudaulacaspis* and *Aulacaspis* share most of these characters, but *Chionaspis* and *Aulacaspis* lack a pair of setae between the median lobes, which are present in *Pseudaulacaspis*, and *Chionaspis* can be distinguished from *Aulacaspis* by possessing dorsal ducts and (except for one species) gland spines anterior to the second abdominal segment (Williams and Watson 1988). Some species of *Chionaspis* occurring on deciduous trees usually have two morphological forms associated with the site of infestation, which differ in the shape of the pygidial lobes; in the bark-infesting form the median lobes normally protrude beyond the second lobes and are robust, whereas in the leaf-infesting form the median lobes are usually as long as or not protruding beyond the second lobes and deeply sunken into the apex of the pygidium. The latter form was usually referred to the genus *Phenacaspis*, a synonym of *Chionaspis* due to the site-caused dimorphism (Takagi 1985; García et al. 2015).

Nakayama's (1933) report of *Chionaspis alnus* Kuwana represents the first record of the genus in Korea. To date, the following three species have been reported in the Korean armored scale fauna: *Chionaspis alnus*, *Chionaspis saitamaensis* Kuwana and *Chionaspis salicis* (L.) (Paik 2000; Lee 2010). During a field survey to update the list of the Korean armored scales, the following two species of the genus of *Chionaspis* were collected and are newly reported from the Republic of Korea: *Chionaspis acer* (Takagi and Kawai) and *Chionaspis wistariae* Cooley. These two species have a restricted host range; *C. acer* was collected on the bark of *Acer negundo* L. and *Acer* sp. (Sapindaceae), and *C. wistariae* on bark and leaves of *Wisteria floribunda* (Willd.) DC. (Fabaceae).

In this paper, a dichotomous key to the species of *Chionaspis* known from the Republic of Korea is presented and diagnoses, photographs, host plants and distributions of *C. acer* and *C. wistariae* are provided for accurate species identification.

### Materials and Methods

All slide-mounted specimens studied for this paper are deposited in the Collection of Plant Quarantine Technology Center, South Korea. The dichotomous key is based on adult females collected on the bark and leaves of their plant hosts. Terminology for morphological structures used in the descriptions and identification key follows that of Miller and Davidson (2005). Abbreviations of collecting regions

are as follows: Gyeonggido (GG), Chungcheongnamdo (CN), Gyeongsangnamdo (GN), Jeollabukdo (JB) 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 a new host and distribution record.

## Results and Discussion

### Descriptions of species

#### *Chionaspis acer* (Takagi and Kawai) (Figures 1–3)

*Phenacaspis acer* Takagi and Kawai, 1966: 112. Type data: Japan, on *Acer palmatum* Thunb.

**Field Characters.** Adult female cover white, flattened, oyster-shell shaped; shed skins marginal, yellow to brown. Male not collected by author.

**Slide-mounted Characters.** Adult female with 3 pairs of lobes, median lobes lacking a pair of setae between them. Median lobes in the bark-infesting form closely appressed medially from base to one-half of length of lobes, with inverse U-shaped yoke, protruding beyond the second lobes, medial margins parallel basally, diverging apically, lateral margins diverging, with 2-3 lateral notches, with 2 medial notches; in the leaf-infesting form (not examined by author) deeply sunken into the apex of the pygidium, usually not protruding beyond the second lobes (Takagi and Kawai 1966); second lobes with paraphysis on mesial margin of medial lobule, usually with small paraphysis on lateral margin of medial lobule. Macroducts on pygidium about same size, with 5-6 macroducts on each side of body on abdominal segment 5; with 7 to 9 macroducts on submedial area of segments 3 to 5 each; with 8 to 10 macroducts on submarginal area of segments 3 to 5 each. Gland spines absent on thorax, with 8 to 24 on abdominal segments 1 to 4 each. Perivulvar pores in 5 groups, about 85 pores. Perispiracular pores with 3 loculi, anterior spiracles each with 12 to 14 pores, posterior spiracles each with 3 to 5 pores. Anal opening located at upper of pygidium. Antennae each with 1 conspicuous seta. Body elongated fusiform with prepygidial segments each slightly convex laterally. Only found on *Acer* L. plants.

**Material Examined.** Korea. GG: 476, Dongtanjiseong-ro, Yeongtong-gu, Suwon-si, 2 adult females, on *Acer negundo* (Sapindaceae) bark, 22-iv-2006 (S.J. Suh). JB: Jeonju Arboretum (30-11, Wonbanworan-gil, Deokjin-gu, Jeonju-si), 7 adult females, on *Acer* sp. (Sapindaceae) bark, 16-iii-2006 (S.J. Suh).

**Distribution.** Japan (García et al. 2015), \*Korea.

**Hosts.** Sapindaceae: \**Acer negundo*, *A. palmatum*, *Acer* sp. (García et al. 2015).

#### *Chionaspis wistariae* Cooley (Figures 4–9)

*Chionaspis wistariae* Cooley, 1897: 280-281. Type data: Japan, on *Wisteria* sp.

**Field Characters.** Adult female cover white, flattened, broadly oyster-shell shaped; shed skins marginal, yellow to brown. Male cover white, elongate oval, with 3 longitudinal ridges weakly indicated, shed skin marginal, yellowish brown.

**Slide-mounted Characters.** Adult female with 3 pairs of lobes, median lobes lacking a pair of setae between them. In the bark-infesting form median lobes closely appressed medially from base to one-half of length of lobes, robust, with strongly protruding yoke, protruding beyond the second lobes, medial margins parallel basally, diverging apically, lateral margins diverging; third lobes represent by low prominences. In the leaf-infesting form median lobes deeply sunken into the apex of the pygidium, usually not protruding beyond the second lobes; second and third lobes well developed. Second lobes with paraphysis on mesial margin of medial lobule. Macroducts on pygidium about same size, with about 12

macroducts on each side of body on abdominal segments 5 to 6; with about 16 macroducts on submedial area of segments 3 to 6 each; with about 20 macroducts on submarginal area of segments 3 to 6 each. Gland spines absent on thorax, with about 21 on abdominal segments 1 to 4 each. Perivulvar pores in 5 groups, about 102 pores. Perispiracular pores with 3 loculi, anterior spiracles each with 14 to 16 pores, posterior spiracles each with 3 to 5 pores. Anal opening located at upper of pygidium. Antennae each with 1 conspicuous seta. Body elongated fusiform with prepygidial segments each slightly convex laterally. Primarily found on *Wisteria* Nuttall. (Fabaceae).

**Material Examined.** Korea. GG: 476, Dongtanjiseong-ro, Yeongtong-gu, Suwon-si, 5 adult females, on *Wisteria floribunda* (Fabaceae) leaf, 23-vii-2007 (S.J. Suh); same data except for 11-ix-2008; same locality, 6 adult females, on *Wisteria floribunda* (Fabaceae) bark, 19-xi-2015 (S.J. Suh). CN: Chollipo Arboretum (187, Cheollipo 1-gil, Sowon-myeon, Taean-gun), 2 adult females, on *Wisteria floribunda* (Fabaceae) bark, 17-iv-2009 (S.J. Suh); Kohwun Garden (398-23, Singmurwon-gil, Cheongyang-eup, Cheongyang-gun), 3 adult females, same host, 20-x-2006 (S.J. Suh). GN: Geumjeongsan, 3 adult females, on *Wisteria floribunda* (Fabaceae) leaf, 28-ix-2006 (S.J. Suh); 386, Sumogwon-ro, Ibanseong-myeon, Jinju-si, same host, 20-v-2008 (S.J. Suh). JN: Gathawi (166-1, Namnong-ro, Mokpo-si), 5 adult females, on *Wisteria floribunda* (Fabaceae) bark, 10-v-2007 (S.J. Suh); 33, Yongbong-ro, Buk-gu, Gwangju, 3 adult females, same host, 26-vii-2007 (S.J. Suh).

**Hosts.** Betulaceae: *Alnus japonica* (Thunb.). Fabaceae: *Wisteria brachybotrys* Sieb. et Zucc, *W. floribunda*, *W. sinensis* Sweet, *Wisteria* sp. Salicaceae: *Salix babylonica* L. (García et al. 2015).

**Distribution.** China, Japan, Taiwan, Romania, USA (García et al. 2015), \*Korea.

#### Key to species of *Chionaspis* in Korea (slide-mounted adult females)

1. With a series of small dorsal macroducts (wider than microducts in gland spines) on the submedial area of the abdomen ..... **2**
- Without a series of small dorsal macroducts on the submedial area of the abdomen ..... **4**
- 2(1). Median lobes strongly divergent, with a straight medial margin; with small dorsal macroducts on the submedial area of abdominal segments 1 to 5 ..... **3**
- Median lobes only slightly divergent, with a rounded medial margin; with small dorsal macroducts on the submedial area of abdominal segments 1 to 4; on many hosts including *Salix* L. and *Populus* L. .... ***Chionaspis salicis* (Linnaeus)**
- 3(2). With small dorsal macroducts on the submedial area of the prothorax and mesothorax; primarily on *Alnus* Mill. .... ***Chionaspis alnus* Kuwana**
- Without small dorsal macroducts on the submedial area of the prothorax and mesothorax; on *Quercus* L. .... ***Chionaspis saitamaensis* Kuwana**
- 4(1). With dorsal macroducts on abdominal segment 6; primarily on *Wisteria* Nutt. ....
- Without dorsal macroducts on abdominal segment 6; on *Acer* L. ....
- ..... ***Chionaspis acer* (Takagi and Kawai)**

#### Discussion

The updated list of the armored scales known to occur in Korea, including *Chionaspis acer* (Takagi and Kawai) and *Chionaspis wistariae* Cooley which are newly recorded in Korea, adds to our knowledge of the Korean fauna of armored scales, and the key provided here aids in the correct identification of



species. In Korea, *C. acer* and *C. wistariae* are found on the bark and leaves of *Acer* and *Wisteria* plants respectively, and no economic damage to these host plants was observed during the survey. While conducting the survey of the *Chionaspis* scale insects of Korea, Borchsenius (1966) recorded *Chionaspis micropori* Marlatt, a junior synonym of *C. salicis*, from the Korean peninsula. The presence of *Chionaspis salicis* could not be confirmed because no specimen has been found during collection efforts made from 2006 to the present time. Therefore, further surveys and studies are needed to confirm the existence of *C. salicis* in Korea.

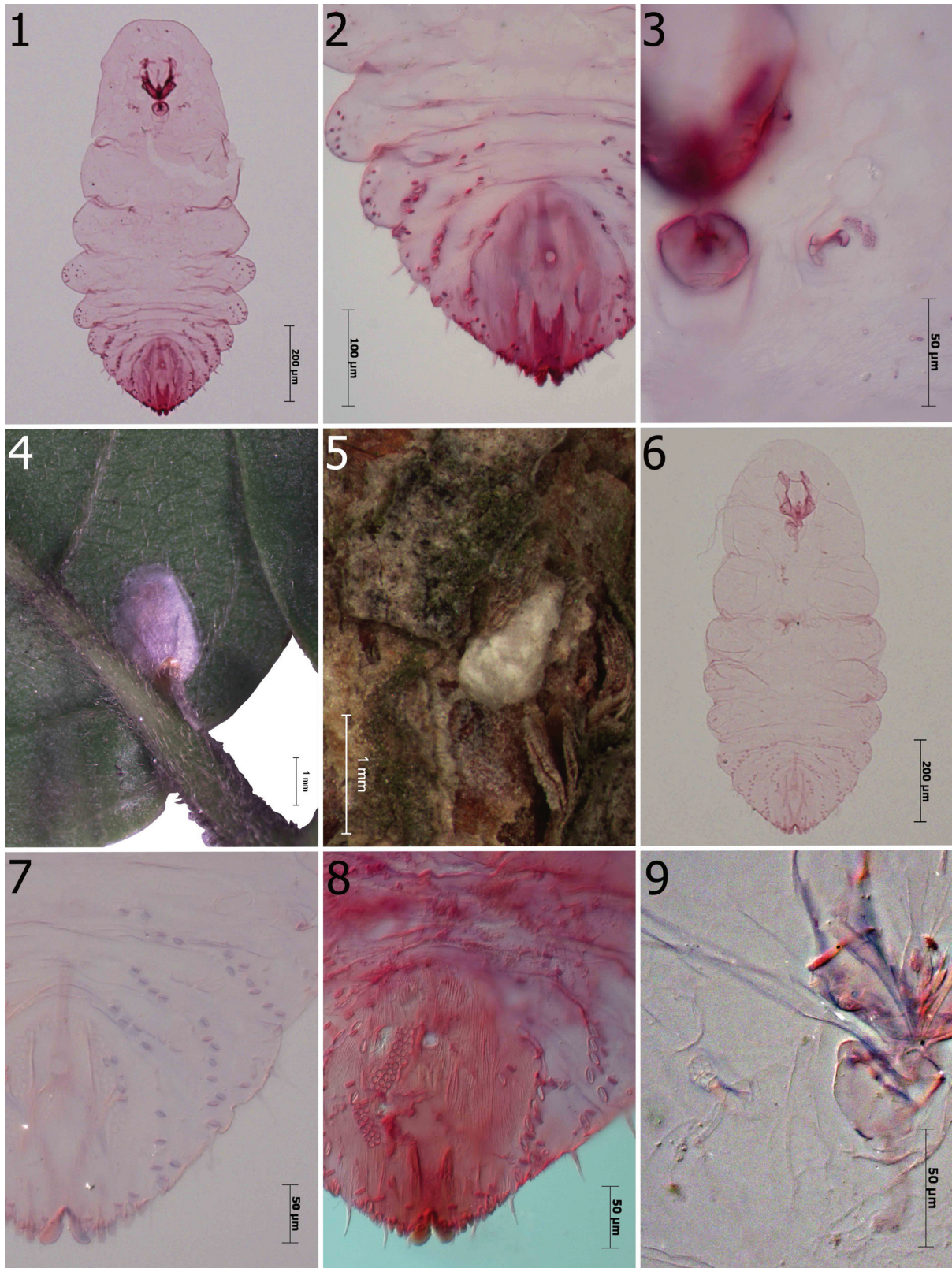
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**Figures 1–9.** Habitus and structures of two species of *Chionaspis*. 1–3: *Chionaspis acer* (Takagi and Kawai), 1) female, 2) pygidium (bark-infesting form), 3) anterior spiracle. 4–9: *Chionaspis wistariae* Cooley, 4–5) habitus, 6) female, 7) pygidium of leaf-infesting form with median lobes sunken into the apex of pygidium, 8) pygidium of bark-infesting form with median lobes appressed medially, 9) anterior spiracle.



