

## First record of two invasive scale insects (Hemiptera: Coccoomorpha: Diaspididae & Pseudococcidae) attacking ornamental plants in Iran

Masumeh Moghaddam\* & Mohammad Reza Nematian

Department Insect Taxonomy Research Department, Iranian Research Institute of Plant Protection (IRIPP), Agricultural Research, Education and Extension Organization (AREEO), Tehran, Iran

\*Corresponding author, E-mail: moghadam@iripp.ir

### Abstract

Two invasive scale insects: *Aspidiotus hedericola* Leonardi (Hemiptera: Coccoomorpha: Diaspididae) and *Planococcus kraunhiae* (Kuwana) (Hemiptera: Coccoomorpha: Pseudococcidae) have been recorded for the first time in Iran. Both probably arrived by the ornamental plants without quarantine inspections. The diagnostic characters, the illustrations based on slide-mounted characters and field characters of the adult females are presented. In addition, the dichotomous keys to species of *Aspidiotus* Bouché and *Planococcus* Ferris in Iran are provided.

**Key words:** *Aspidiotus hedericola*, *Planococcus kraunhiae*, Aceraceae, *Acer negundo*, Moraceae, *Ficus retusa*, Iran

### گزارش دو گونه شپشک گیاهی & (Hemiptera: Coccoomorpha: Diaspididae & Pseudococcidae) مهاجم روی گیاهان زیتنی از ایران

معصومه مقدم\* و محمدرضا نعمتیان

بخش تحقیقات رده‌بندی حشرات، مؤسسه تحقیقات گیاه‌پزشکی کشور، سازمان تحقیقات، آموزش و ترویج کشاورزی،

تهران، ایران

\*مسئول مکاتبات، پست الکترونیکی: moghadam@iripp.ir

### چکیده

دو گونه شپشک گیاهی مهاجم (*Aspidiotus hedericola* Leonardi (Hemiptera: Coccoomorpha: Diaspididae) و *Planococcus kraunhiae* (Kuwana) (Hemiptera: Coccoomorpha: Pseudococcidae) برای اولین بار از ایران گزارش می‌شود. احتمال داده می‌شود، هر دو گونه، توسط گیاهان زیتنی بدون اعمال مقررات قرنطینه‌ای وارد شده‌اند. صفات تشخیصی، ترسیم‌ها بر اساس حشرات ماده بالغ ارائه شده است. علاوه بر آن، کلید تشخیص گونه‌های هر دو جنس *Aspidiotus* Bouché و *Planococcus* Ferris در ایران تهیه شده است.

واژه‌های کلیدی: *Aspidiotus hedericola*، *Planococcus kraunhiae*، Aceraceae، *Acer negundo*، Moraceae، *Ficus retusa*، ایران

دریافت: ۱۳۹۸/۱۰/۲۸، پذیرش: ۱۳۹۸/۱۱/۲۷

### Introduction

Scale insects (Hemiptera: Coccoomorpha) are often cryptic in habit and can escape detection during quarantine inspection of plants species. When scale insects are introduced without their natural enemies, they can establish and become economically important pests. In recent years, several species of economically important scale insects have been introduced

into Iran. For example, *Maconellicoccus hirsutus* (Green) (Fallahzadeh *et al.*, 2002), *Phenacoccus solani* (Moghaddam *et al.*, 2004), *Phenacoccus solenopsis* (Moghaddam & Bagheri, 2011), *Icerya aegyptiaca* (Moghaddam *et al.*, 2015a), *Saissetia miranda* (Moghaddam *et al.*, 2015b) and *Vryburgia succulentarum* (Moghaddam, 2015).

This paper reports on the presence in Iran of two newly recorded scale insect species, belonging to the genera *Aspidiotus* and *Planococcus*, namely *Aspidiotus hedericola* Leonardi and *Planococcus kraunhiae* (Kuwana).

The genus *Aspidiotus* Bouché (Hemiptera: Coccoomorpha: Diaspididae) is one of the largest armoured scale insect genera, including 104 species worldwide (García Morales *et al.*, 2016). Of these, three species were recorded in Iran: *Aspidiotus destructor* Signoret (Moghaddam, 2013), *A. mousavii* Moghaddam (Moghaddam, 2018) and *A. nerii* Bouché (Moghaddam, 2013). In this paper, *Aspidiotus hedericola* Leonardi is recorded for the first time in Iran; this species has been recorded mainly from Mediterranean subregion of Palearctic region; it is found on three plant families: Araliaceae, Fabaceae and Lauraceae (García Morales *et al.* 2016). The species occurs on ornamental plants. This paper reports the presence of *A. hedericola* in Iran and a new record of host plant is mentioned.

The genus *Planococcus* Ferris (Hemiptera: Coccoomorpha: Pseudococcidae) includes 48 described species worldwide (García Morales *et al.*, 2016). Three species are known in Iran: *P. citri* (Risso), *P. ficus* (Signoret) and *P. vovae* (Nasonov) (Williams & Moghaddam, 2000). These species are important pests of agricultural and ornamental plants in worldwide. *Planococcus kraunhiae* (Kuwana) is an important pest of fruit trees including pear, citrus and grape in Japan (Teshiba, 2013); this species has been recorded from China, Japan, Philippines, South Korea, Taiwan and United States (García Morales *et al.*, 2016).

The new recorded species *A. hedericola* and *P. kraunhiae* are described and illustrated based on the morphology of the adult females. Moreover identification keys to Iranian species of *Aspidiotus* and *Planococcus* are provided.

## Materials and methods

The descriptions below are based on specimens slide-mounted using the method described by Williams & Granara de Willink (1992). The terminology follow Williams (2004) for Pseudococcidae and Williams & Watson (1988) for Diaspididae. Each illustration shows the dorsum on the left and the venter on the right, with enlargements of important characters around the edges, not drawn to scale. In the Material examined section, data written on the type slide labels are given, using / to indicate the line breaks, as required by International Code of Zoological Nomenclature.

All material is deposited at the Hayk Mirzayans Insects Museum (HMIM), Tehran, Iran.

## Results

### Genus *Aspidiotus* Bouché

**Main characters:** Body broadly pyriform, membranous except for parts of pygidium. Pygidium with 3 pairs of well-developed lobes; median lobes ( $L_1$ ) sometimes with a basal sclerosis. Plates well-developed, present laterally as far forward as segment V, fringed, becoming simpler lateral to third lobe ( $L_3$ ). Perivulvar pores present in 2–4 groups (usually 4). Anterior spiracles often with an associated area of dermal granulation, a smooth tubercle and 1–3 microducts. Antennae often with sclerotized spurs, each antenna bearing 1 robust seta.

### Key to species of *Aspidiotus* Bouché recorded in Iran

- I (0) Median lobes with basal scleroses; dorsal ducts quite short; prepygidial macroducts present ..... *nerii* (Bouché)  
 - Median lobes without basal scleroses; dorsal ducts of moderate length or long ..... 2  
 2 (1) Perivulvar pores present. Dorsal prepygidial macroducts absent ..... 3  
 - Perivulvar pores absent. Dorsal prepygidial macroducts present .....  
*mousavii* Moghaddam  
 3 (2) Median and lateral plates slightly exceeding of  $L_1$ ,  $L_2$  and  $L_3$  length; external plates same size and structure as lateral plates, slightly spiniform. Upper perivulvar pores group framed at their base by a strong forked paragenital crest ... *hedericola* Leonardi  
 - Median and lateral plates much exceeding of  $L_1$ ,  $L_2$  and  $L_3$  length; external plates, spiniform, with finely denticulate external side. Upper perivulvar pores group not framed by a strong forked paragenital crest ..... *destructor* Signoret

### *Aspidiotus hedericola* Leonardi (Figs. 1 and 2)

*Aspidiotus hedericola* Leonardi, 1918: 188.

**Material examined. 5 adult females:** IRAN, left label: 2965 / Tehran province: / Tehran, Evin (a garden center) / 23.07.2018 / N35°47'59.3" / E51°23'59.7"; right label: *Aspidiotus hedericola* / Leonardi / on *Acer negundo* / (Aceraceae) / coll. M.R. Nematian. (5 slides HMIM).

**Field characters** (Fig. 1), Scale of the female flat, white, circular, exuviae central, and yellowish. Scale of the male slightly elongate, exuviae toward one end (Ferris, 1946).

**Diagnosis** (Fig. 2), Slide-mounted adult female broadly pyriform, membranous except for parts of pygidium. Pygidium with 3 pairs of well-developed lobes; median lobes ( $L_1$ ) notched subapically on either side; second lobes ( $L_2$ ) slightly smaller than median lobes; third lobes ( $L_3$ ) similar size to, or slightly smaller than  $L_2$ ;  $L_2$  and  $L_3$  each strongly notched on outer margin. Median plates (between  $L_1$ ) as long as lobes, each spiniform at apex; 2 plates between

L<sub>1</sub> and L<sub>2</sub>, and 3 plates present between L<sub>2</sub> and L<sub>3</sub>; 6 plates present lateral to third lobes, all longer than lobes and finely fringed. Anus oval, almost as wide as a median lobe; situated near posterior third of pygidium. Dorsal macroducts long, forming longitudinal rows on each side between segment VII & VIII, VI & VII and on abdominal segment V; pygidial macroducts not opening anterior to anus, and 1 macroduct present between median lobes; macroducts absent from prepygidial segments. Venter of pygidium with 4 groups of perivulvar pores; upper perivulvar pores group framed at their base by a strong forked paragenital crest. Ventral marginal and submarginal microducts few, more numerous on pygidium and abdominal segments. Antennae quite small, each with 2 short spurs and 1 fairly large seta.

**Host plants:** *Aspidiotus hedericola* has been recorded so far on three genera host plants: *Hedera* (Araliaceae), *Acacia* (Fabaceae) and *Laurus* (Lauraceae) (Garcia Morales *et al.*, 2016). In Iran it has been recorded of leaves of *Acer negundo* (Aceraceae). This host plant and host family is for *A. hedericola*.

**Distribution:** This species is distributed mostly European countries in Palaearctic region (Garcia Morales *et al.*, 2016). It was probably introduced to Iran with ornamental plants.



**Fig. 1.** Immature and mature female covers of *Aspidiotus hedericola* Leonardi (Photograph: M.R. Nematian)

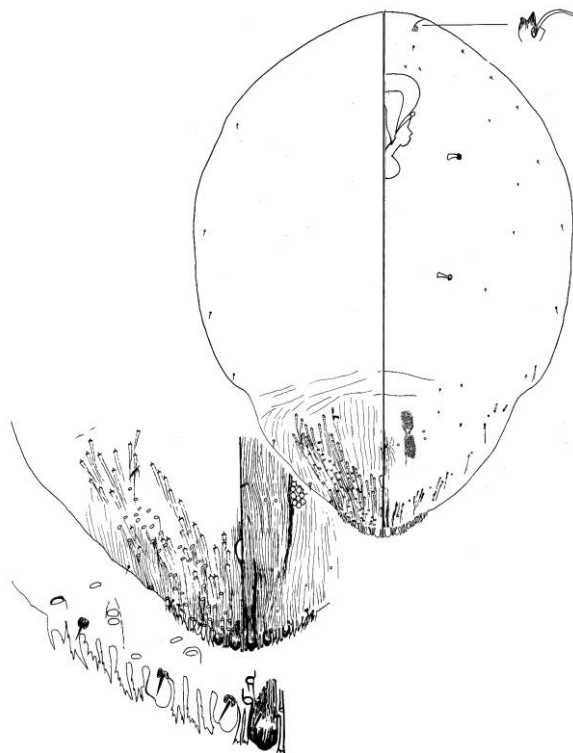


Fig. 2. Adult female of *Aspidiotus hedericola* Leonardi.

**Genus *Planococcus* Ferris**

**Main characters:** Adult female body oval. Cerarii numbering 18 pairs, all cerarii with two conical setae (sometimes cerarii on head with 3 conical setae) and without auxiliary setae. Anal lobes with anal lobe bars. Antennae 8-segmented. Legs well developed; hind coxa, tibia and sometimes femur with translucent pores. Ventral circulus usually present. Multilocular disc pores numerous on ventral parts of abdominal segments. Tubular ducts present on both body sides; usually dorsal ducts larger and sometimes with collars.

**Key to species of *Planococcus* Ferris recorded in Iran**

- 1(0) Dorsal setae with distinctly swollen bases. Dorsal oral collar tubular ducts if present (not seen in Iranian specimens), in groups of 2-5 ducts adjacent to abdominal cerarii ..... *kraunhiae* (Kuwana)
- Dorsal setae without swollen bases. Dorsal oral collar tubular ducts usually present singly adjacent to cerarii ..... 2
- 2 (1) Modified dorsal oral collar ducts numerous and conspicuous, numbering 13–110, occurring in marginal and medial areas, at least on abdomen. All cerarii anterior to anal lobe pair or penultimate pair with thin flagellate setae resembling dorsal setae but usually slightly wider ..... *vovae* (Nasonov)

- Modified dorsal oral collar ducts, if present, occurring singly adjacent to cerarii except for 1 or 2 in medial areas of abdomen. Either all cerarii with distinct conical setae or some, long and slender, often flagellate at tips, on anterior end of body ..... 3
- 3 (2) Venter of head and thorax with 0–4 oral collar ducts. Translucent pores present on hind coxa and tibia, sometimes present on hind femur. Cerarian setae on head and thorax often long and slender. Some dorsal setae on medial area of abdominal segments VI and VII 40–50  $\mu\text{m}$  long ..... *ficus* (Signoret)
- Venter of head and thorax with 0–35 oral collar ducts. Translucent pores present on hind coxa and tibia, never present on hind femur. Cerarian setae on head and thorax always conical. Longest dorsal setae on medial area of abdominal segments VI and VII 25–33  $\mu\text{m}$  long ..... *citri* (Risso)

***Planococcus kraunhiae* (Kuwana)** (Figs. 3 and 4)

*Dactylopius kraunhiae* Kuwana 1902: 55. *Planococcus siakwanensis* Borchsenius 1962: 586, junior synonym.

**Material examined.** 2 adult females: IRAN, left label: 2990 / Tehran province: / Tehran, Evin (a garden center) / 23.vii.2018 / N35°47'59.3" / E51°23'59.7"; right label: *Planococcus kraunhiae* / (Kuwana) / on *Ficus retusa* / (Moraceae) / coll. M.R. Nematian. (2 slides HMIM).

**Field characters** (Fig. 3 A, B): Adult female with body long oval; white mealy wax covering body; dorsomedial area bare; marginal wax filaments, most relatively short, straight (Figs. 3, A, B). Male not observed.



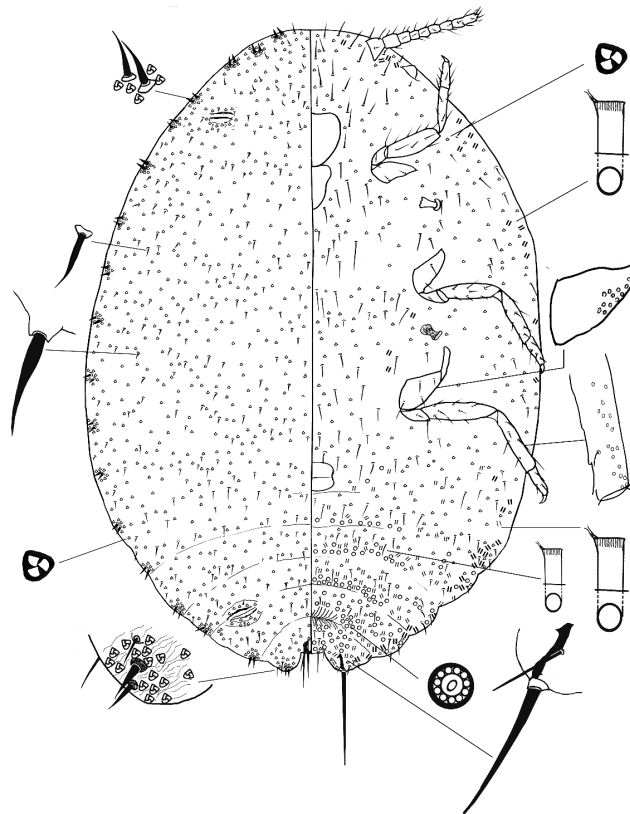
**Fig. 3.** A & B, *Planococcus kraunhiae* adult female; C, *Ficus retusa* (Moraceae) (Photograph: M.R. Nematian)

**Diagnosis:** (Fig. 4), Slide-mounted adult female broadly oval. Anal lobes well developed. Antennae each with 8 segments. Legs well developed, translucent pores present on hind coxa and tibia. Cerarii numbering 18 pairs; anal lobe cerarii each with 2 large conical setae, 1 auxiliary seta and numerous trilocular pores, all situated on lightly sclerotized area. Anterior cerarii with 2 large setae and 5–7 trilocular pores. Circulus normally quadrate, divided by

intersegmental line. Ostioles well developed. Anal ring with 3 rows of pores and 6 long setae. Cisanal setae shorter than anal ring setae.

*Dorsum* with long lanceolate to conical setae, same as cerarii setae, but smaller, each with swollen base and prominent collar. Multilocular disc pores absent. Trilocular pores and minute discoidal pores scattered throughout. Dorsal oral collar tubular ducts absent in Iranian specimens.

*Venter* with normal flagellate setae. Multilocular disc pores present around vulva, in single to double rows across posterior edges of median areas of abdominal segments III–VII, in single rows across anterior edges of segment VII; 2 or 3 located on each margin of segments V–VII, and absent from thorax and head. Oral collar tubular ducts of 2 sizes; smaller size occurring mainly across middle of abdominal segments. Larger type sparsely scattered over median areas of thorax and in small groups on margin of head and thorax. Trilocular pores moderately numerous and evenly distributed.



**Fig. 4.** Adult female of *Planococcus kraunhiae* (Kuwana)

**Host plants:** *Planococcus kraunhiae* is a polyphagous species recorded on 24 plant families (Garcia Morales *et al.*, 2016). In Iran, it was collected on *Ficus retusa* (Moraceae) (bonsai trees). Its host plant is recorded for the first time.

**Distribution:** *Planococcus kraunhiae* is recorded from China, Korea, Japan and Madeira Islands in Palaearctic region, Taiwan in Oriental region, and also USA on fruit imported from Japan (Garcia Morales *et al.*, 2016). This species probably is imported with the ornamental plants.

**Comments:** There is an important difference between the specimens described by Cox (1989) with the Iranian specimens as following: the groups of tubular ducts not seen on the dorsum adjacent to the posterior abdominal segments.

## References

- Borchsenius, N. S.** (1962) Notes on coccid fauna of China. 10. Descriptions of some new species of Pseudococcidae (Homoptera, Coccoidea). *Entomologicheskoe Obozrenye* 41, 583–595.
- Cox, J. M.** (1989) The mealybug genus *Planococcus* (Homoptera: Pseudococcidae). Bulletin British Museum (Natural History). *Entomology* 58 (1), 1–78.
- Fallahzadeh, M., Hesami, Sh., Moghaddam, M.** (2002) New Record of *Coccophagus pseudococci* (Hym.:Aphelinidae) Parasitoid of Mealybugs (Hom.:Pseudococcidae) in Iran. *Journal of Entomological Society of Iran* 22 (1), 81–82.
- Ferris, G. F.** (1946) Information concerning the genera *Chortinaspis* and *Aspidiotus* (Homoptera: Coccoidea: Diaspididae). (Contribution no. 51). *Microentomology* 11, 37–49.
- García Morales, M., Denno, B. D., Miller, D. R., Miller, G. L., Ben-Dov, Y. & Hardy, N.B.** (2016) *ScaleNet: A literature-based model of scale insect biology and systematics*. Database. doi: 10.1093/database/bav118. <http://scalenet.info> (accessed January 2020).
- Kuwana, S. I.** (1902) Coccidae (scale insects) of Japan. *Proceedings of the California Academy of Sciences* 3, 43–98.
- Leonardi, G.** (1918) Terza contribuzione alla conoscenza delle cocciniglie Italiane. *Bollettino del R. Laboratorio di Entomologia Agraria di Portici* 12, 188–216.
- Moghaddam, M.** (2013) An annotated checklist of the scale insects of Iran (Hemiptera, Sternorrhyncha, Coccoidea) with new records and distribution data. *Zookeys* 334, 1–92.
- Moghaddam, M.** (2015) New records of mealybug species in Iran with discussions on morphological variations (Hemiptera, Coccoidea: Pseudococcidae). *Entomologica Fennica* 26, 122–131.
- Moghaddam, M.** (2018) A new armored scale species from Iran (Hemiptera: Coccomorpha: Diaspididae). *Journal of Entomological Society of Iran* 37 (4), 411–415.
- Moghaddam, M. & Bagheri, A. N.** (2011) A new record of mealybug pest in the south of Iran, *Phenacoccus solenopsis* (Hemiptera: Coccoidea: Pseudococcidae). *Journal of Entomological Society of Iran* 30 (1), 67–69.
- Moghaddam, M., Esfandiari, M. & Khosravi, M.** (2015a) First record of *Icerya aegyptiaca* (Hemiptera: Coccoidea: Monophlebidae) from Iran. 1<sup>st</sup> Iranian International Congress of Entomology 42.



- Moghaddam, M., Hatami, B., Zibaii, K. & Sabzalian, M. R.** (2004) Report of *Phenacoccus solani* (Hom.: Coccoidea: Pseudococcidae) from Iran. *Journal of Entomological Society of Iran* 24 (1), 135–136.
- Moghaddam, M., Sahraian, H. & Abbasi, J.** (2015b) The first record of invasive soft scale of *Saissetia miranda* (Hemiptera: Coccoidea: Coccidae) and with an identification key to species of genus *Saissetia* in Iran. 1<sup>st</sup> Iranian International Congress of Entomology 228–231.
- Teshiba, M.** (2013) Integrated management of *Planococcus kraunhiae* (Kuwana) (Homoptera: Pseudococcidae) injuring Japanese persimmons. *Japanese Journal of Applied Entomology and Zoology* 57 (3), 129–135.
- Williams, D. J.** (2004) *Mealybugs of Southern Asia*. 896 pp. The Natural History Museum Kuala Lumpur: Southdene SDN. BHD.
- Williams, D. J. & Granara de Willink, M. C.** (1992) *Mealybugs of Central and South America*. 635 pp. CAB International London, U.K..
- Williams, D. J. & Moghaddam, M.** (2000) Mealybug species of the genus *Planococcus* Ferris in Iran (Homoptera: Coccoidea: Pseudococcidae) with a discussion of *Planococcus vovae* (Nasonov). *Journal of Entomological Society of Iran* 18 (1999-1/2), 32–43.
- Williams, D. J. & Watson, G. W.** (1988) *The Scale Insects of the Tropical South Pacific Region. Pt. 1. The Armoured Scales (Diaspididae)*. 290 pp. CAB International Wallingford, U.K..