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# The scale insects (Hemiptera: Coccomorpha) on *Artemisia* spp. (Asteraceae) in Iran

**Masumeh Moghaddam[1] and Abbas Mohammadi-Khoramabadi[2]**

**1** Insect Taxonomy Research Department, Iranian Research Institute of Plant Protection, Tehran, 19395-1454, Iran.

**2** Department of Plant Production, College of Agriculture and Natural Resources of Darab, Shiraz University, Darab, 74711-96711, Iran

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**ABSTRACT.** A total of 12 species of Coccomorpha from five scale insect families have been recorded on *Artemisia* spp. (Asteraceae) in Iran. They were belong to Acanthococcidae (1), Coccidae (3), Diaspididae (4), Ortheziidae (1) and Pseudococcidae (3). In this study *Peliococcus chersonensis* (Kiritshenko), *Pelionella grassiana* (Goux) (Pseudococcidae) are redescribed and illustrated based on adult females to show their morphology in Iran. *Rhizococcus borchsenii* (Danzig) (Acanthococcidae) was also the third newly recorded species for the fauna of Iran. Species that have been previously collected or recorded on *Artemisia* in Iran are listed and information is given about host plants and global distribution for each species.

**Key words:** *Artemisia*, Scale insects, Coccomorpha, *Peliococcus chersonensis*, *Pelionella grassiana*, *Rhizococcus borchsenii*, Iran.

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## Introduction

Large areas of Iran are naturally covered with pasture *Artemisia* spp. (Asteraceae). Thirty-four species belonging to *Artemisia* are thought to occur in Iran, which from the viewpoint of distribution, density and coverage, is one of the most important plant genera in the country (Ahadai-Dolatsara *et al*. 2015). The total number of scale insect species associated with *Artemisia* spp. is 86 species belonging to 10 families worldwide (Garcia *et al*. 2015).

Host specificity of scale insects on Asteraceae and particularly on *Artemisia* spp., is known for species belonging to several scale insect families and genera. The species of the family Acanthococcidae exclusively known to feed on *Artemisia* (Kozár *et al*. 2013), and also the family Pseudococcidae with twenty and one species develop only on *Artemisia* spp. (Garcia *et al*. 2015).

A survey of scale insects on *Artemisia* in Iran was undertaken by Moghaddam (2013), she recorded only five species: *Acanthopulvinaria orientalis* (Nazonov) (Coccidae), *Contigaspis farsetiae* (Hall), *C. sarkissiani* (Kaussari & Balachowsky), *Orthezia urticae* (L.) (Ortheziidae) and *Targionia porifera* (Borchsenius) (Diaspidae). The objectives of this study

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

are to update the list of scale insects known on *Artemisia* spp. in Iran.

## Materials and Methods

The scale insect specimens were collected from different areas in Iran. Collecting data, include locality (name of the province, city, GIS coordinates, etc.), date of collection, collector name are given. Each sample was put into 75% ethanol in the field. The preparation of slide-mounted specimens followed the methods described by Williams & Granara de Willink (1992). The terms used in the descriptions of mealybugs are those used by Williams (2004).

Each illustration shows the dorsum on the left and the venter on the right with enlargements of important characters around the margins. These enlargements are not drawn to scale. The host plant information for each scale insect species is taken from Moghaddam (2013) and the biogeographical data are those of Garcia *et al*. (2015).

All specimens were collected by M. Moghaddam, unless otherwise indicated. Microscope slides of scale insects of *Artemisia* spp. collected by other workers in Iran were examined and their identification confirmed. All slide material used in this study are deposited in the Coccoidea Collection, Hayk Mirzayans Insect Museum (HMIM), Insect Taxonomy Research Department, Iranian Research Institute of Plant Protection, Tehran, Iran (IRIPP).

## Results

### Family Acanthococcidae (felt scales)
### *Rhizococcus borchsenii* (Danzig)

**Material examined:** on *Artemisia* sp. Semnan province, Shahroud, Parvar Area Protected, 9 ♀♀, 06.ix.2014, N:35°58′04.4″ E:53°30′22.7″, 2013 m.

**Remarks:** A Palaeartic species, European parts and Far East. *Rhizococcus borchsenii* known only on the roots or root crown of *Artemisia* sp. This is the first record of this species from Iran.

### Family Coccidae (soft scales)
### *Acanthopulvinaria orientalis* (Nasonov)

**Material examined**: on *Artemisia* sp. in Iran: Khorasan -e Razavi province, Mashhad, Binaloud Mnt., 7 adult ♀♀, 11.v.2012, Coll. Rabiye.

**Remarks.** A Palaeartic species, mainly occurs in Irano-Turanian area. *A. orientalis* is a polyphagous species (Garcia *et al*. 2015) and known from at least 9 host plants in Iran (Moghaddam 2013).

### *Rhizopulvinaria artemisiae* (Signoret)

**Material examined:** on *Artemisia* sp. in Iran. Khorasan -e Jonoubi province, Tabas, Naibandan Protected Area, 4 adult ♀♀, 06.ii.2014, N:32°30′15.6″, E:57°22′03.9″, 1533 m.

**Remarks.** *Rhizopulvinaria artemisia*e is a Palaearctic species, and is already recorded from all the Palaearctic subregions (Garcia *et al*. 2015). In addition of *Artemisia*, it occurs on *Astragalus* spp. (Fabaceae) and *Noaea* spp. (Amaranthaceae) in Iran (Moghaddam 2013).

### *Rhizopulvinaria turkestanica* (Archangelskaya)

**Material examined:** on *Artemisia* sp. in Iran: Semnan province, Shahmirzad, 10 ♀♀, 07.ix.2014, N:35°46′47.0″, E:33°19′36.2″.

**Remarks.** *Rh. turkestanica* is a Palaearctic species, and is recorded from Irano-Turanian subregion (Garcia *et al*. 2015). In addition of *Artemisia*, it occurs on *Carthamus* spp. (Asteraceae), *Astragalus* spp. (Fabaceae) and *Noaea* spp. (Amaranthaceae) in Iran (Moghaddam 2013).

**Family Diaspididae (armored scales)**

***Contigaspis farsetiae* (Hall)**

**Material examined:** on *Artemisia* sp. in Iran: Azarbaijan -e Sharghi province, Jolfa, Asiab Kharabeh, 6 ♀♀, 04.ix.2007, N:38°51′30.5″, E:45°51′24.1″, 980 m.; Kerman province, Kerman, 6 ♀♀, 1.vi.1953, N:30°17′20.7″, E:57°04′11.7″, Coll. Sarkissian.

**Remarks.** *Contigaspis farsetiae* is a Palaearctic species, that is known from Irano-Turanian and Mediterranean subregions (Garcia *et al*. 2015). The other host plants are mentioned in Moghaddam (2013).

***Contigaspis sarkissiani* (Kaussari & Balachowsky)**

**Material examined**: on *Artemisia* sp. in Iran: Esfahan province, Biabanak, 8 ♀♀, 05.v.1952, Coll. Sarkissian; Fars province, Jahrom, 4 ♀♀, 15.v.1956, Coll. M. Kaussari; Khorasan -e Jonoubi province, Ferdos, Tabas, 1 ♀, 25.i.1955, Coll. Sarkissian.

**Remarks.** *Contigaspis sarkissiani* is recorded in Palaearctic and only from Iran. In addition of *Artemisia*, it is recorded on *Astragalus* spp. (Fabaceae) (Moghaddam, 2013).

***Rhizaspidiotus canariensis* (Lindinger)**

**Material examined:** on *Artemisia* sp. in Iran: Semnan province, Shahroud, Parvar Protected Area, 2 ♀♀, 07.ix.2014, N:36°02′30.4″ E:53°36′28.1″, 2512 m.

**Remarks.** *Rhizaspidiotus canariensis* is a Palaearctic species (Garcia *et al*. 2015). In addition to *Artemisia*, it occurs on *Achillea* spp. (Asteraceae) in Iran (Moghaddam 2013).

***Targionia porifera* (Borchsenius)**

**Material examind:** on *Artemisia* sp. in Iran: 5 ♀♀, (No. 173, 239) in collection HMIM without collection data.

**Remarks.** *Targionia porifera* is a Palaearctic species, and it is recorded in Irano-Turanian subregion (Garcia *et al*. 2015). In addition of *Artemisia*, the host plants *Seidlitzia* spp. (Amaranthaceae) and *Zygophyllum* spp. (Polygonaceae) are recorded in Iran (Moghaddam 2013).

**Family Ortheziidae**

***Orthezia urticae* (Linnaeus)**

**Material examined**: on *Artemisia* sp. in Iran: Kerman province, Baft, Khabr National Park, Kaht, 21.v.2011, N:28°45′55.2″, E:56°26′49.3″, 2468 m; Khorasan -e Jonoubi province, Ghaen, Shaskooh, 2 ♀♀, 31.v.2014, N:33°39′41.1″, E:59°56′42.0″, 1270 m; Khorasan -e Shomali province: Ashkhaneh, Ghorkhod National Park, 2 ♀♀, 23.viii.2012, N:38°02′56.6″, E:57°02′36.7″, 1370 m.; Esfarayen, Salook National Park, 5 ♀♀, 17.vi.2012, N:37°10′18.4″, E:57°12′18.7″, 1268 m.; Sistan & Balouchestan, Khash, Koosheh, Sardarya, 1 ♀♀, 22.iv.2012, N:28°37′38.7″ E:61°00′56.3″, 2583 m.

**Remarks.** This species has been mainly found in Palaearctic region and also *O. urticae* is recorded on various plant species in Iran (Moghaddam 2013).

**Family Pseudococcidae (mealybugs)**

***Artemicoccus bispinus* (Borchsenius)**

**Material examined**: on *Artemisia* sp. in Iran: Khorasan -e Jonoubi province, Tabas, Naibandan National Park, Abbaneh, 4 ♀♀, 02.vi.2014, N:32°30′07.4″ E:57°16′50.5″, 1522 m; Khorasan -e Shomali province, Esfarayen, Salook National Park, 3 ♀♀, 21.vi.2012, N:37°09′20.9″ E:57°16′24.5″, 1190 m.

**Distribution:** Palaearctic, Armenia, Tajikistan, Turkey and Turkmenistan (Garcia *et al*. 2015).

**Remarks.** *Artemicoccus bispinus* was recorded first time in Iran by Moghaddam (2015).

### *Pelionella* Kaydan, 2015

*Pelionella* Kaydan, 2015. Type species: *Peliococcus manifectus* Borchsenius, 1949: 242.

Kaydan (2015) introduced the genus *Pelionella* Kaydan based on his molecular data, separating from *Peliococcus* Borchsenius by the following character-states (data for *Peliococcus* in brackets): (i) dorsal enlarged setae without a trilocular pore near basal socket [with a trilocular pore near basal socket] (ii) each marginal cerarius with 2 setae, not on an elevated area and each with 3 or more trilocular pores [marginal cerarius (except anal lobe cerarii) on an elevated area with 2 setae and just 1 trilocular pore]. (iii) Multilocular disc pores each with 2 rings of 11 loculi, restricted to clusters, [all multilocular disc pores on other species have a single ring of 12 loculi]. Here *Pelionella grassiana* Goux is recorded for the first time from Iran.

### *Pelionella grassiana* (Goux) (Fig. 1)

*Peliococcus grassianus* Goux, 1989: 306.

**Material examined**: 1 ♀: Iran, Yazd province, Mehriz, N:31°35′08.5″ E:54°28′12.8″, inside galls apparently made by another insect on the distal end of *Artemisia* sp. (Asteraceae), 9.iv.2013, Coll. A. Mohammadi-Khorramabadi (HMIM: 2464).

Diagnostic characters (Goux (1989) and Kaydan (2015), with additions). Mounted adult female elongate oval. Antennae 9-segmented. Anterior and posterior ostioles present. Circulus absent. Legs well developed; claw with a denticle; translucent pores a few present on distal part of posterior surface of hind tibia. Anal ring with 6 setae. Cerarii numbering 17 marginal pairs; anal lobe cerarii each with 2 conical to lanceolate setae, 5−7 trilocular pores, plus 1 spine-like auxiliary seta; other marginal cerarii widely spaced, each with 2 enlarged setae and 1 pore, C3 with 3 setae, and 2 trilocular pores, and only C8 and C9 with 1 seta and 1 trilocular pore. Dorsal setae conical-lanceolate, mainly of two sizes; long setae similar to cerarian setae; small setae randomly distributed among large setae.

Clusters, each with 3–5 (mainly 4) multilocular disc pores; each cluster with a single small oral collar tubular duct in centre, 2 or 3 large oral collar tubular ducts, plus also 0 or 1 minute discoidal pores, present in each cluster (plus a few scattered elsewhere); clusters present on head and thorax and also on abdominal segments, except segment IX. Trilocular pores scattered throughout. Ventral setae of 2 types: (i) slender hair-like setae, longest setae medially on head; (ii) spine-like setae present on submargin and in marginal rows.

Multilocular disc pores of 2 kinds: (i) those with a single ring of loculi, present in bands on abdominal segments as follows: V 6, VI 20, VII 52, VIII + IX 32; and (ii) cluster of multilocular disc pores with 2 rings of loculi as on dorsum, present submarginally and marginally on abdominal segments I–IV as follows: I 3, II 3, III 1 and IV 1; and also present submarginally and marginally of mesothorax and metathorax. Quinquelocular pores present in middle area of head, thorax and first 6 abdominal segments. Trilocular pores present submarginally and marginally, and also scattered on median and submedian of abdominal segments. Minute discoidal pores few scattered. Oral collar tubular ducts present, of 3 sizes: (i) a small tubular duct, present in centre of each cluster, (ii) 1–3 larger oral collar tubular ducts, situated among multilocular disc pores; and (iii) a

medium-sized duct, present on across abdominal segments as follows: II 1, III 0, IV 1, V 5, VI 7, VII 5, VIII+IX 3.

**Comment.** The Iranian specimen of *P. grassiana* differs in some respects from the description by Kaydan (2015) as follows (character states of specimens described by the latter author in brackets): (i) oral collar tubular ducts sparsely distributed on margins of ventral abdominal segments V–VIII [tending to be concentrated], (ii) most cluster with 4 multilocular pores [1 or 2 multilocular pores].

### *Peliococcus chersonensis* (Kiritshenko) (Fig. 2)

*Phenacoccus chersonensis* Kiritshenko, 1936: 138. *Spinococcus artemisiae* Tereznikova, 1968: 281. *Peliococcus lycicola* Tang, 1992: 598.

**Material examined:** 1 ♀, Iran, Yazd province, Mehriz, N:31°35′08.5″ E:54°28′12.8″, inside galls apparently made by another insect on the distal end of on *Artemisia* sp. (Asteraceae) and associated with the species *P. grassiana*, 09.iv.2013, Coll. A. Mohammadi-Khoramabadi.

**Diagnostic characters.** (Danzig (2001), with additions). Adult female elongate oval. Antennae 9-segmented. Anterior and posterior ostioles present. Circulus present, lying between abdominal segments III and IV. Legs well developed, hind legs without translucent pores, claw with a denticle. Anal ring with 6 setae. Cerarii numbering 17 marginal pairs; each normally on an elevated area, with 2 enlarged setae and 1–3 trilocular pores, except C3 with 3 enlarged setae, plus 3 or 4 trilocular pores, anal lobe cerarii each with 2 enlarged setae, plus 5–7 trilocular pores and 1 spine-like auxiliary seta.

Dorsal setae of 2 sizes: (i) enlarged setae similar to cerarian setae, forming longitudinal rows on body; each with 1 or 2 setae, and also with 1 or 2 trilocular pores near basal socket on elevated areas; and (ii) smaller spine-like setae, randomly distributed among larger setae. Multilocular disc pores present, singly with oral collar tubular ducts of 2 sizes or with only 1 widest tubular duct; each cluster present on posterior abdominal segments. Trilocular pores scattered on dorsum. Most ventral setae slender, variable in size; setae on submargin spine-like. Oral collar tubular ducts of up to 3 sizes, varying in length and width; multilocular disc pores and ducts present in submarginal zone. Multilocular disc pores present on posterior abdominal segments, especially around vulva, but also present on thorax and head, both in clusters and separately. Quinquelocular pores mainly present in median areas of thorax and abdomen. Trilocular pores scattered throughout.

**Comment.** According to Danzig (2001), P. chersonensis is common on a range of herbaceous plants throughout the Palaearctic region and varies morphologically quite significantly throughout its range in the following characters: i) number of oral collar tubular ducts on dorsum, ii) number of clusters on dorsum and venter, iii) size and number of enlarged dorsal setae, and iv) number of dorsal cerarii.

Because of this variation, this species deserves more attention as it may represent a species complex. The Iranian specimen of *P. chersonensis* differs in some respects from the description by Danzig (2001), Ter-Grigorian (1973) as follows (character states of specimens described by them in brackets): cluster of multilocular pores present only on abdominal segments [on all segments], ventral multilocular pores present on midline of abdominal segments numerous on head, thorax and abdominal segments.

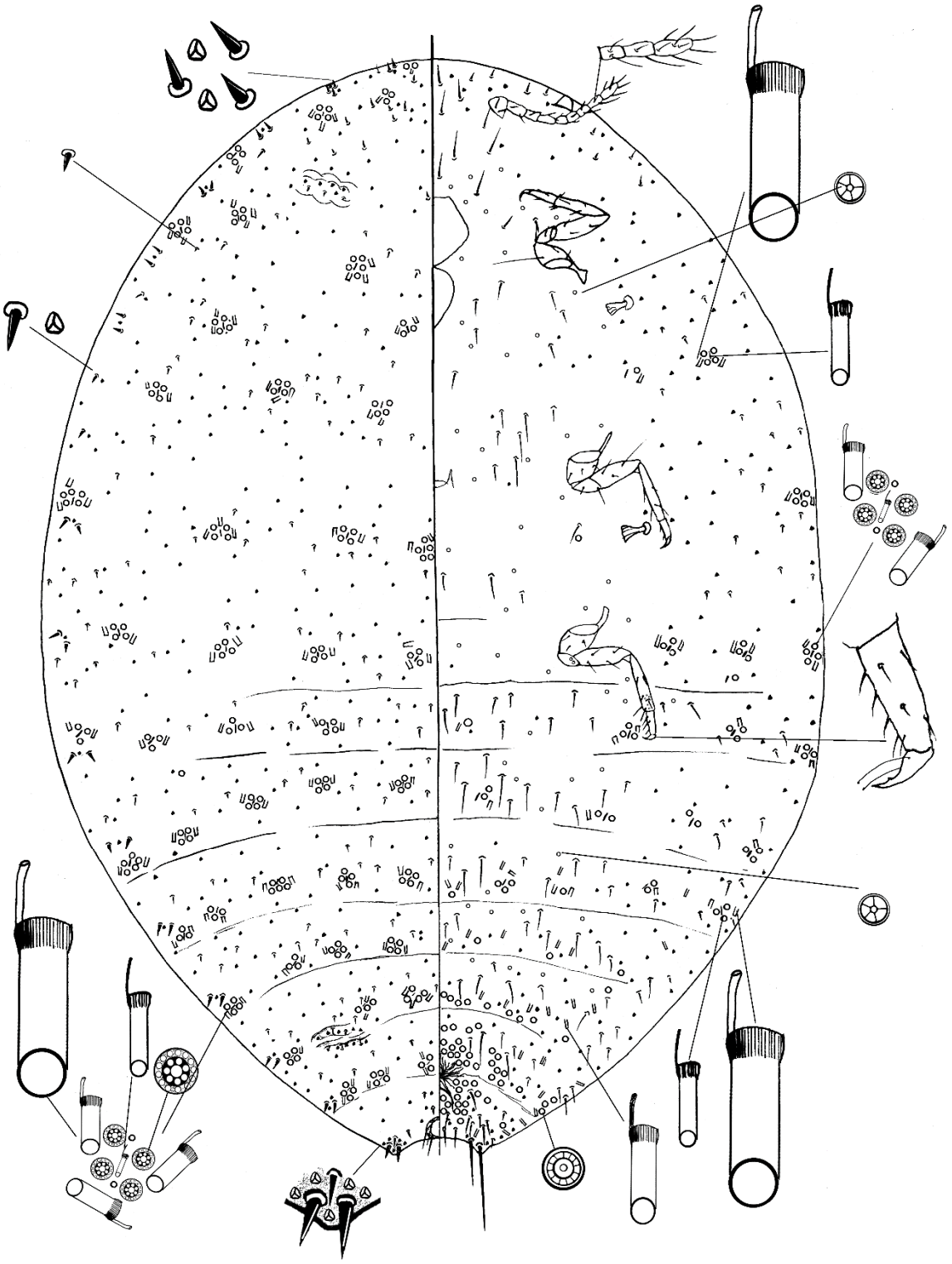

**Figure 1.** Adult female of *Pelionella grassiana* (Goux) (Hemiptera: Pseudococcidae).

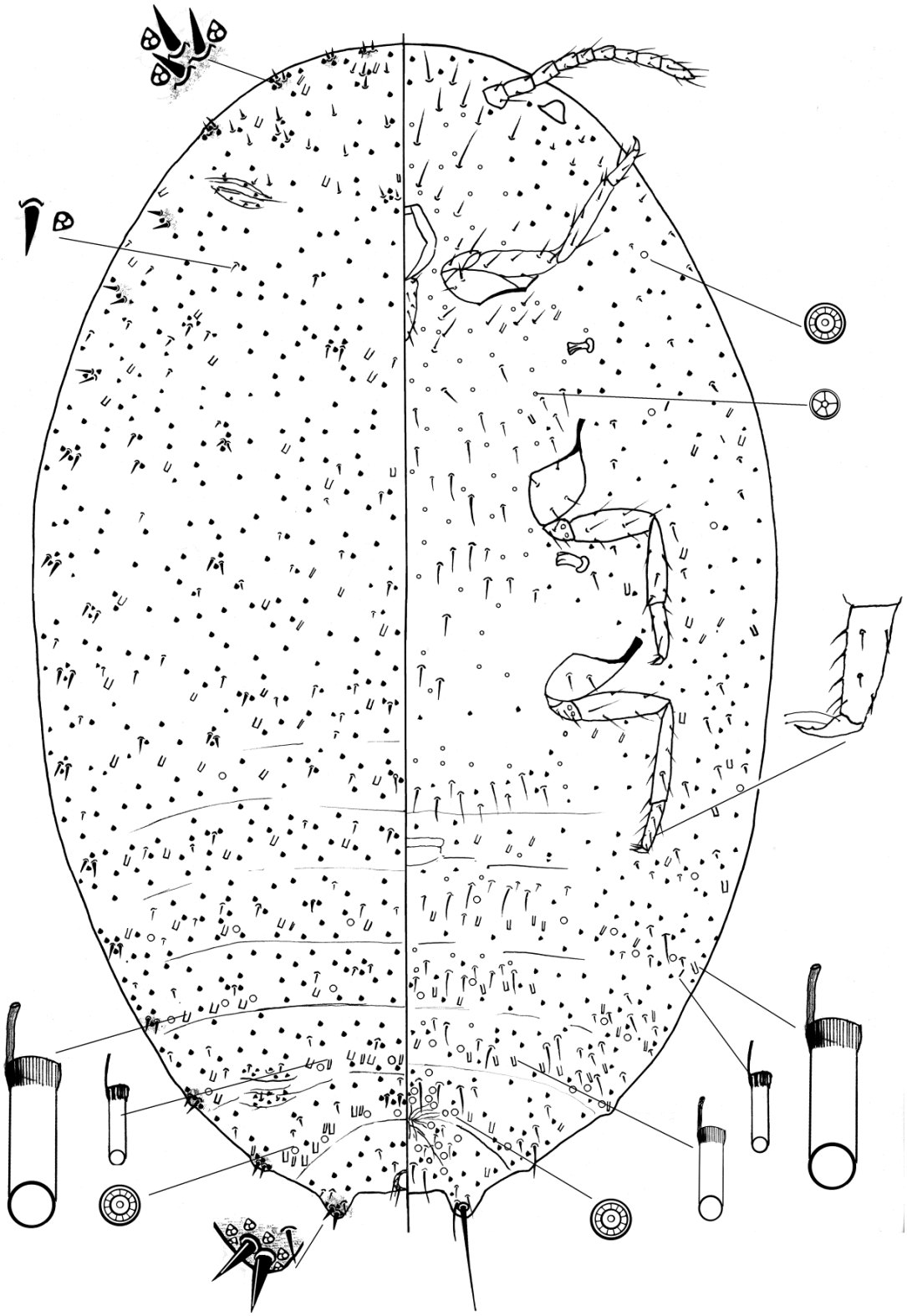

**Figure 2.** Adult female *Peliococcus chersonensis* (Kiritshenko) (Hemiptera: Pseudococcidae).

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# شپشک‌های گیاهی (Hemiptera, Coccomorpha) از روی گیاه میزبان *Artemisia* spp. (Asteraceae) در ایران

**معصومه مقدم[1] و عباس محمدی خرم آبادی[2]**

**۱** بخش رده‌بندی حشرات، مؤسسه تحقیقات گیاهپزشکی، تهران، صندوق پستی ۱۴۵۴-۱۹۳۹۵، ایران
۲ گروه گیاهپزشکی، دانشکده کشاورزی و منابع طبیعی داراب، دانشگاه شیراز، صندوق پستی ۹۶۷۱۱-۷۴۷۱۱، ایران

* پست الکترونیکی نویسنده مسئول مکاتبه: *moghadam@iripp.ir*
تاریخ دریافت: ۵ مهر ۱۳۹۴ تاریخ پذیرش: ۲۱ آبان ۱۳۹۴ تاریخ انتشار: ۴ آذر ۱۳۹۴

**چکیده:** در این مطالعه، ۱۲ گونه شپشک گیاهی (Coccomorpha) متعلق به پنج خانواده شپشک‌های گیاهی روی گیاه میزبان *Artemisia* spp. جمع‌آوری شد. این شپشک‌ها متعلق به خانواده‌های Acanthococcidae (یک گونه)، Coccidae (سه گونه)، Diaspididae (چهار گونه)، Ortheziidae (یک گونه و Pseudococcidae (سه گونه) بودند. در این مطالعه گونه‌های شپشک‌آردآلود *Peliococcus chersonensis* (Kiritshenko) و *Pelionella grassiana* (Goux) (Pseudococcidae)، جهت مشخص شدن شکل‌شناسی آن‌ها بر اساس ماده بالغ در ایران ترسیم و توصیف و هم‌چنین *Rhizococcus borchsenii* (Danzig) (Acanthococcidae) برای اولین بار از ایران گزارش می‌شوند. گونه‌های شپشک گیاهی روی گیاه میزبان *Artemisia* که پیشتر جمع‌آوری و یا از ایران گزارش شده فهرست و اطلاعات لازم در مورد سایر گیاهان میزبان و پراکنش جهانی هر یک از گونه‌ها ارائه شده است.

**واژگان کلیدی:** *Artemisia*، شپشک، Coccomorpha، *Peliococcus chersonensis*، *Pelionella grassiana*، *Rhizococcus borchsenii*، ایران