

Scale insect species (Hemiptera, Coccoomorpha) on the date palms (*Phoenix dactylifera*) in Iran with description of a new species

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ABSTRACT. Surveys of scale insects (Hemiptera, Coccoomorpha) infesting date palms (*Phoenix dactylifera* L., Areaceae) in Iran represented the occurrence of 10 species belonging to five families. The recorded species were: Asterolecaniidae - *Palmaspis phoenicis* (Ramachandra Rao); Diaspididae - *Aonidiella orientalis* (Newstead), *Fiorinia phoenicis* Balachowsky, *Parlatoria blanchardi* (Targioni Tozzetti) and *Parlatoria crypta* McKenzie; Monophlebidae - *Pseudaspidopectus hyphaeniacus* (Hall); Phoenicococcidae - *Phoenicococcus marlatti* Cockerell; and Pseudococcidae - *Dysmicoccus brevipes* (Cockerell), *Maconellicoccus hirsutus* (Green), and *Formicococcus phoenicis* Moghaddam & Zarghami **sp. nov.**, a new species of mealybug feeding on the roots of the date palm, is described and illustrated based on the adult female. An annotated list of these species is presented.

Keywords: *Formicococcus*, Pseudococcidae, root mealybug, Sternorrhyncha

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INTRODUCTION

Date palm (*Phoenix dactylifera* L., Areaceae), which includes more than 400 cultivars, is an economically important crop and very well adapted to the arid environments in Middle Eastern countries, particularly in Iran (Botes & Zaid, 2002). Date palm is the second most important horticultural crop in Iran after pistachio (*Pistacia vera*, Anacardiaceae), and it is mostly grown in the southern belt of the country (Hajian & Hamidi Esfahani, 2015). Worldwide, the total number of scale insect species currently associated with date palms is 49, belonging to six families: Asterolecaniidae (1 species); Coccidae (6), Diaspididae (27), Monophlebidae (2), Phoenicococcidae (1), and Pseudococcidae (12 species) (García Morales et al., 2016). There are several scattered reports about the scale insects associated with date palms in Iran. A review of the most recent of these studies indicated that nine species of scale insects belonging to five families had been recorded previously (Moghaddam, 2013; Zarghami & Moghaddam, 2023). Worldwide, the mealybug genus of *Formicococcus* Takahashi (Pseudococcidae) currently contains 47 species (García Morales et al., 2016), of which only *F. robustus* (Ezzat & McConnell) has been recorded from Iran (Moghaddam, 2004). The genus can be recognized by having the following morphological characters: anal lobes each with an anal lobe bar; cerarii numbering 11–18 pairs; cerarii on anal lobes and posterior abdominal segments usually each containing multiple conical setae, sometimes accompanied by few normal setae and a concentration of trilocular pores; circulus present or absent; ostioles prominent; multilocular disc-pores and oral collar tubular ducts absent from dorsum but present on

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venter; ventral oral collar ducts present, usually of 1 size only but sometimes of 2 or 3 sizes present (Williams, 2004).

The objectives of this study are (i) to update the list of scale insects known on date palms in Iran; (ii) to summarize information on the geographic distribution of scale insects recorded on palm date worldwide and in Iran; and (iii) to describe and illustrate a new species of *Formicococcus* found on the roots of date palms in Iran.

MATERIAL AND METHODS

Scale insects species were collected from date palms mostly in the south of Iran. Collection data, including locality (province, city), longitude, latitude, altitude (if available) and date of collection are presented. All the specimens were collected by M. Moghaddam unless otherwise indicated. Each sample was preserved in 75% ethyl alcohol in the field. The preparation of slide-mounted adult female specimens for microscopic study followed the methods described by Williams & Granara de Willink (1992). The terms used in the descriptions of the new mealybug species are those used by Williams (2004); measurements and counts given in the description provide a value for the holotype, followed by the range for all the specimens examined, given in parenthesis. The taxonomic illustration shows features of the dorsum on the left and the venter on the right, with enlargements of important characters (not drawn to scale) around the margins. The host-plant information for each species in Iran is taken from Moghaddam (2013), and the world biogeographical data are from García Morales et al. (2016). All slide materials studied in this work are deposited in the scale insect collection, Hayk Mirzayans Insect Museum (HMIM), Insect Taxonomy Research Department, Iranian Research Institute of Plant Protection, Tehran, Iran (IRIPP).

RESULTS

Taxonomic hierarchy

Class Insecta Linnaeus, 1758

Order Hemiptera Linnaeus, 1758

Family Asterolecaniidae Cockerell, 1896

***Palmaspis phoenicis* (Ramachandra Rao, 1922) (Fig. 1A)**

Material examined. on *Ph. dactylifera* (Arecaceae). BUSHEHR: 1♀, Riz (28°04'52.2"N, 52°05'41.0"E, 505 m a.s.l.), 28.x.2002; ESFAHAN: 2♀♀, Khur & Biabanak (33°56'23"N, 54°21'29"E), 10.viii.2006; FARS: 1♀, Darab (28°45'32.3"N, 53°59'43.0"E), 10.viii.2006; SOUTH KHORASAN: 4♀♀, Nehbandan (31°32'38.9"N, 60°03'04.6"E), 15.ii.2007; SISTAN-o BALOUCHESTAN: 3♀♀, Iranshahr, Damen (25°09'53.5"N, 61°30'07.6"E), 27.iv.1995; YAZD: 4♀♀, Bafgh (31°35'46.7"N, 55°04'43.0"E), 26.x.1998.

Remarks. This species has been recorded on hosts belonging to three plant families Arecaceae, Myrtaceae and Pandanaceae, but it is found only on *Ph. dactylifera* in Iran. *P. phoenicis* is distributed in the Palaearctic Region (Egypt, Iraq, Israel and Libya) and the Afrotropical Region (Qatar, Saudi Arabia and Sudan) (García Morales et al., 2016).

Family Diaspididae Maskell, 1878

***Aonidiella orientalis* (Newstead, 1894) (Fig. 1B)**

Material examined. on *Ph. dactylifera* (Arecaceae). SISTAN-o BALOUCHESTAN: 2♀♀, Chabahar, Pishin (26°01'29.0"N, 61°45'11.7"E, 540 m a.s.l.), 10.ii.1996; 3♀♀, Saravan, Nahook (27°22'31.7"N, 62°19'32.0"E, 1157 m a.s.l.), 25.xi.2011.

Remarks. *Aonidiella orientalis* is a tropical and subtropical species with a cosmopolitan distribution. The species is highly polyphagous and it can attack almost any host except conifers, according to Williams & Watson (1988). In Iran, the species has been recorded on 26 host plant species belonging to 13 plant families (Moghaddam & Watson, 2021).

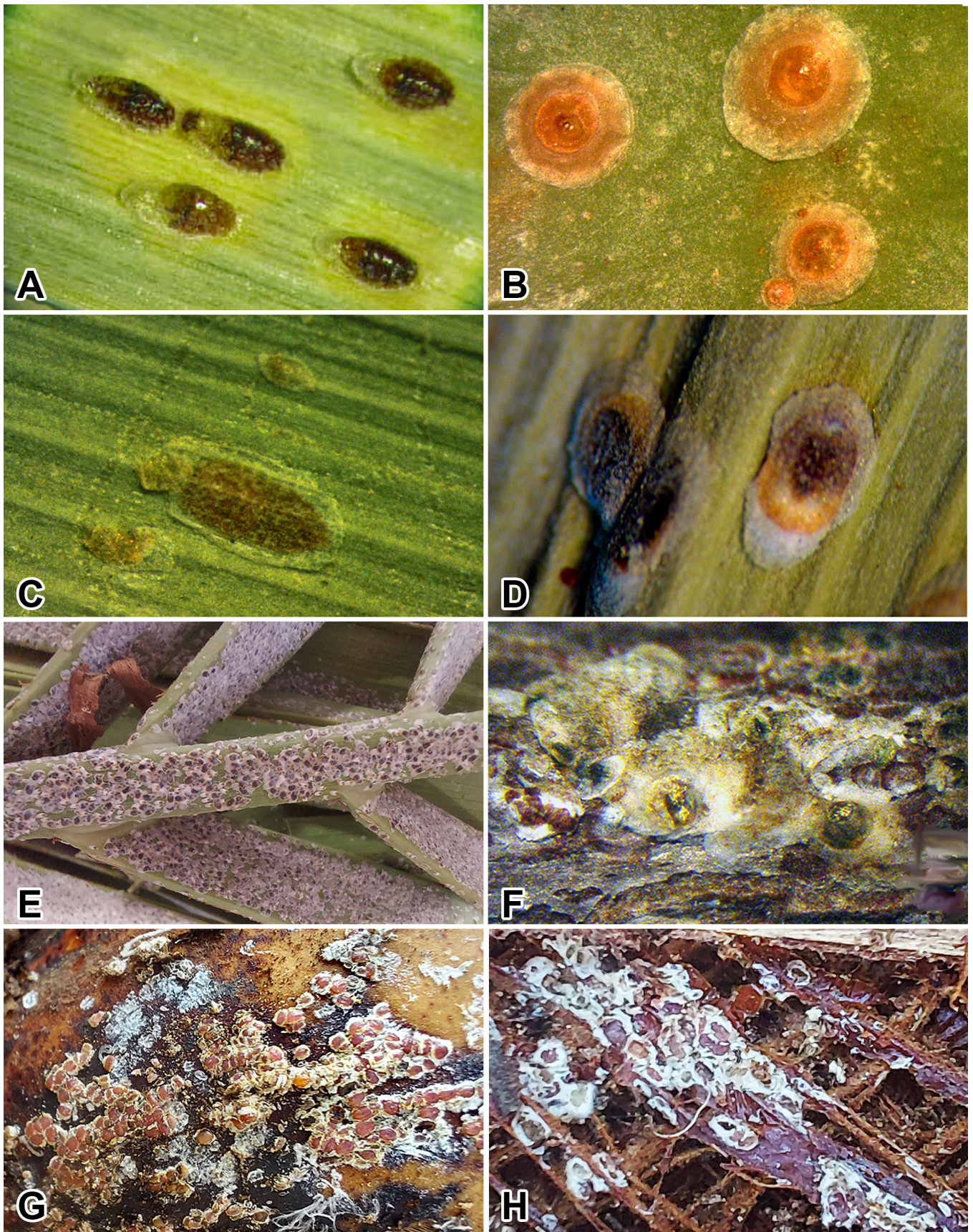


Figure 1. Scale insects associated with date palms in Iran. **A.** *Palmaspis phoenicis* (Ramachandra Rao); **B.** *Aonidiella orientalis* (Newstead); **C.** *Fiorinia phoenicis* Balachowsky; **D-E.** *Parlatoria blanchardi* Targioni Tozzetti; **F.** *Parlatoria crypta* McKenzie; **G-H.** *Phoenicococcus marlatti* Cockerell.

***Fiorinia phoenicis* Balachowsky, 1967 (Fig. 1C)**

Material examined. on *Ph. dactylifera* (Arecaceae). FARS: 9♀♀, Jahrom (28°29'42.5"N, 53°33'28.7"E, 950 m a.s.l.), 8.xi.1993; 11♀♀, Shiraz (29°37'53"N, 52°32'07"E), 1.xii.1997; HORMOZGAN: 5♀♀, Khark (29°15'43"N, 50°19'26"E), 15.iv.1999; SISTAN-o BALOUCHESTAN: 2♀♀, Iranshahr, Damen (27°22'50"N, 60°46'20"E), 17.iv.2005; 3♀♀, Nikshahr, Hichan (26°50'15.7"N, 61°10'03.6"E), 1.x.2009; 8♀♀, Rask, Jahli-Tandar (27°36'01"N, 62°34'26"E), 1.v.2003; 5♀♀, Saravan (27°38'41"N, 62°31'14"E), 29.iv.1995.

Remarks. *Fiorinia phoenicis* was described from Iran and this is monophagous on date palm (Balachowsky, 1967); in addition, it has been recorded in Egypt, Saudi Arabia and Spain (García Morales et al., 2016, Elwan et al., 2011; Radwan, 2012). There are no records of the damage of this species in Iran.

***Parlatoria blanchardi* (Targioni Tozzetti, 1892) (Figs 1D-E)**

Material examined. on *Ph. dactylifera* (Arecaceae) unless otherwise specified. BUSHEHR: 3♀♀, Borazjan, Abpakhsh (29°11'20"N, 50°56'12"E), 20.x.2001; 3♀♀, Borazjan, Rood-e Helleh, Haft Joosh (29°26'03"N, 50°58'39"E), 24.x.2001; 2♀♀, Bushehr (28°57'39"N, 50°51'01"E), 20.x.2001; 8♀♀, Bushehr, Ahram (28°55'43"N, 50°59'28"E), 30.x.2003; 4♀♀, Jam (27°57'36"N, 52°01'51"E, 645 m a.s.l.), 28.x.2003; 5♀♀, Kangan, Naiband (27°25'05"N, 52°33'41"E), 18.x.2001. FARS: 3♀♀, Jahrom (28°29'42.5"N, 53°33'28.0"E), 8.xi.1993; 3♀♀, Kazeroun, Parishan Lake (29°31'17.7"N, 51°48'22.0"E), 2.xi.1996. HORMOZGAN: 8♀♀, Bandarabbas (27°24'09"N, 56°36'38"E), 4.iii.1974; 2♀♀, Lavan (26°48'43"N, 53°21'10"E), 20.ii.1999; 3♀♀, Bandarabbas, Sarkhoon (27°38'18"N, 56°39'02"E), 3.iv.2001; 3♀♀, Gheshm, Band-e Hajali (26°45'44"N, 56°02'07"E), 7.iii.2001; 7♀♀, Hajiabad, Sarchahan (28°18'26"N, 56°04'01"E), 13.iii.2001; 2♀♀, Minab (27°08'06"N, 57°08'02"E), 12.iii.2001. ILAM: 2♀♀, Mehran (33°09'20"N, 46°11'45"E, 181 m a.s.l.), 1.x.2005. KERMAN: 1♀♀, Jiroft, Faryab (28°12'40"N, 57°29'25"E, 652 m a.s.l.), 12.iv.2011; KHOUZESTAN: 9♀♀, Abadan, Haeer (30°12'51.4"N, 48°24'27.5"E), 07.viii.2021; 7♀♀, Abadan, Tange Doo (30°11'39.7"N, 48°28'16.4"E), 03.v.2023; 4♀♀, Ahvaz, Omol-Tamir (31°15'17.3"N, 48°32'41.7"E), 10.xii.2021; SISTAN-o BALOUCHESTAN: 3♀♀, Bampur (27°20'01"N, 60°46'58"E), 1.i.2001; 3♀♀, Bent, Dahan (26°55'02"N, 59°02'28"E), 26.iv.2001; 2♀♀, Chabahar (25°17'37"N, 60°38'39"E), 10.xi.2000, on *Chamaerops humilis* (Arecaceae); 3♀♀, Chabahar, Kahir (25°35'12"N, 60°07'49"E), 23.iv.2001; 3♀♀, Chabahar, Ouraki (25°41'44"N, 60°53'28"E), 25.iv.2001; 6♀♀, Chabahar, Pir Sohrab (25°39'53"N, 60°59'03"E, 50 m a.s.l.), 25.iv.2003; 1♀, Chabahar, Ramin (25°14'58"N, 60°56'14"E), 5.xi.2000; 5♀♀, Ghasr-e Ghand, Jakigur (26°25'06"N, 61°17'30"E), 27.v.2001; 3♀♀, Ghasr-e Ghand, Shadgoor (26°21'06"N, 60°38'29"E), 27.iv.2001; 4♀♀, Iranshahr, Damen (27°26'34"N, 60°53'23"E, 864 m a.s.l.), 24.xi.2011; 1♀, Khash, Sabzgas (28°21'09"N, 61°28'35"E, 1321 m a.s.l.), 1.xi.2004; 13♀♀, Mir Javeh, Behesht-e Kavir (29°13'57"N, 61°18'41"E, 922 m a.s.l.), 1.xi.2004; 3♀♀, Nikshahr-Chabahar Road (25°43'19"N, 60°23'47"E), 1.ix.2009; 2♀♀, Rask, Firouzabad (26°29'28"N, 61°42'50"E), 28.iv.2001; 4♀♀, Sarbaz, Zaboli Road (26°47'57"N, 60°47'57"E, 1122 m a.s.l.), 26.xi.2011; 3♀♀, Zabol, Zahak (30°54'04"N, 61°40'09"E, 557 m a.s.l.), 28.x.2004; 4♀♀, Zaboli (27°55'41"N, 62°53'30"E), 11.xi.2000, on *Nannorrhops ritchiana* (Arecaceae); YAZD: 2♀♀, Tabas (33°35'53"N, 56°55'07"E), 18.iv.2010.

Remarks. *Parlatoria blanchardi* is considered a serious pest in several countries. It is mostly common on date and other ornamental palms (Borchsenius, 1966); it has been found on *Chamaerops humilis*, *Nannorrhops ritchiana* and *P. dactylifera* palms (Moghaddam, 2013). This species is distributed mostly in tropical and subtropical regions and is a well-known pest of date palms.

***Parlatoria crypta* McKenzie, 1943 (Fig. 1E)**

Material examined. on *Ph. dactylifera* (Arecaceae). BUSHEHR: 1♀, Genaveh (29°57'47"N, 50°55'47"E), 21.x.2001. SISTAN-o BALOUCHESTAN: 6♀♀, Saravan, Gosht (27°46'59"N, 61°56'47"E), 5.ii.2003.

Remarks. *Parlatoria crypta* is currently distributed in tropical and subtropical regions of the world (García Morales et al., 2016). The species is one of the important pests of productive and non-productive trees in the southern provinces of Iran. It is a highly polyphagous species; in Iran, it occurs on host plants in 23 species including *P. dactylifera*, belonging to 16 families (Moghaddam & Watson, 2021).

Family Monophlebidae Signoret, 1875

Pseudaspidoproctus hyphaeniacus (Hall, 1925)

Material examined. on *Ph. dactylifera* (Arecaceae). SISTAN-o BALOUCHESTAN: 3♀♀, Iranshahr (27°15'17"N, 60°36'25"E), 28.ii.1995; 5♀♀, Sarbaz, Jalilabad (26°28'12"N, 61°15'26"E), 9.xi.2000; 8♀♀, Chabahar (25°17'37"N, 60°38'39"E), 23.iv.2001.

Remarks. *Pseudaspidoproctus hyphaeniacus* has been recorded on host plants in six genera belonging to four families: Arecaceae, Poaceae, Rosaceae and Scrophulariaceae, its distribution covers 10 countries, mostly from the Middle East and North Africa (García Morales et al., 2016). Infestations were found especially on young palms in Iran and it is limited to the southeast of Sistan-o Balouchestan province (Moghaddam, 2013).

Family Phoenicococcidae Stickney, 1934

Phoenicococcus marlatti Cockerell, 1899 (Figs 1G–H)

Material examined. on *Ph. dactylifera* (Arecaceae). HORMOZGAN: 2♀♀, Hajiabad (28°18'01"N, 55°56'02"E), 13.iii.2001. KERMANSHAH: 4♀♀, Ghasr-e Shirin (34°16'09"N, 45°48'18"E), 4.ix.1950; KHOUZESTAN: 3♀♀, Ahvaz, Omol-Tamir (31°15'17.3"N, 48°32'41.7"E), 02.iv.2022; 4♀♀, Abadan, Shalheh Soamr (30°14'51.0"N, 48°22'22.7"E), 14.i.2021; 2♀♀, Khorramshahr, Minoo (30°21'14.3"N, 48°12'12.1"E), 19.iv.2021; 6♀♀, Shadegan, Darkhovin (30°45'39.6"N, 48°25'49.7"E), 03.viii.2023; SISTAN-o BALOUCHESTAN: 3♀♀, Chabahar, Shamesar (25°33'28"N, 60°29'12"E), 1.vii.2009; 9♀♀, Iranshahr, Bazman (27°49'04"N, 60°09'07"E 11.xi.2000; 6♀♀, Saravan (27°38'41"N, 62°31'14"E), 27.iv.1995. YAZD: 2♀♀, Tabas (33°35'53"N, 56°55'07"E), 18.iv.2010.

Remarks. *Phoenicococcus marlatti* is native to North Africa and the Middle East, but it is presently distributed everywhere ornamental or date palms are grown (Stickney et al., 1950). It has been recorded on host plants in six genera belonging to four families: Arecaceae, Poaceae, Myrtaceae and Pandanaceae. In Iran, it has been found only on *P. dactylifera*, and it is not considered to be a serious pest.

Family Pseudococcidae Heymons, 1915

Dysmicoccus brevipes (Cockerell, 1893) (Figs 2A–B)

Material examined. on the root of *Ph. dactylifera* (Arecaceae). KHOUZESTAN: 16♀♀, Ahvaz (31°17'18"N, 48°37'35"E), 17.vii.2022, leg. S. Zarghami.

Remarks. *Dysmicoccus brevipes* is distributed in all zoogeographical regions, mainly in the tropical and subtropics (Ben-Dov, 1994). This is one of the most economically important mealybug pests and highly polyphagous, attacking plant species belonging to more than 161 genera placed in 68 families (García Morales et al., 2016). This species was recorded for the first time on the root of *Medicago sativa* (Fabaceae) in Sistan-o Balouchestan province (Moghaddam, 2004). *Dysmicoccus brevipes* was first recorded from Iran on imported pineapples from Uganda or Kenya (Moghaddam, 1999). Recently, it has been seen on the roots of *P. dactylifera*, but there is no record of its damage on the palm (Zarghami & Moghaddam, 2023).

Formicococcus phoenicis Moghaddam & Zarghami sp. nov. (Figs 2C, 2D, 3)

<https://zoobank.org/urn:lsid:zoobank.org:act:E8883D5C-D757-4F9F-B7FB-60D5447385CC>

Material examined. Holotype. adult female: IRAN, left label: No. 3044 / IRAN / KHOUZESTAN, Ahvaz / Date. 21.viii.2023 / Alt. 200 m / 31°19'07"N, 48°45'24"E; right label: Holotype / *Formicococcus phoenicis* sp. nov. / Pl. root of *Phoenix dactylifera* / (Arecaceae) / Col. S. Zarghami / (HMIM); holotype mounted on a slide together with 1 paratype adult female. **Paratypes.** same data as for holotype: 1 adult female on holotype slide; 4 adult females mounted singly on slides; and 2 adult females mounted together on one slide (HMIM).

Etymology. The species epithet is based on the Latin genitive of the host-plant genus name, *Phoenix*.]

Appearance (Figs 2C–D). Live specimens were found on the roots of date palms. Unmounted live specimens - adult female broadly oval, grey to red, dorsum of body lightly dusted with white mealy wax secretion; posterior end with marginal white wax filaments very slightly developed.

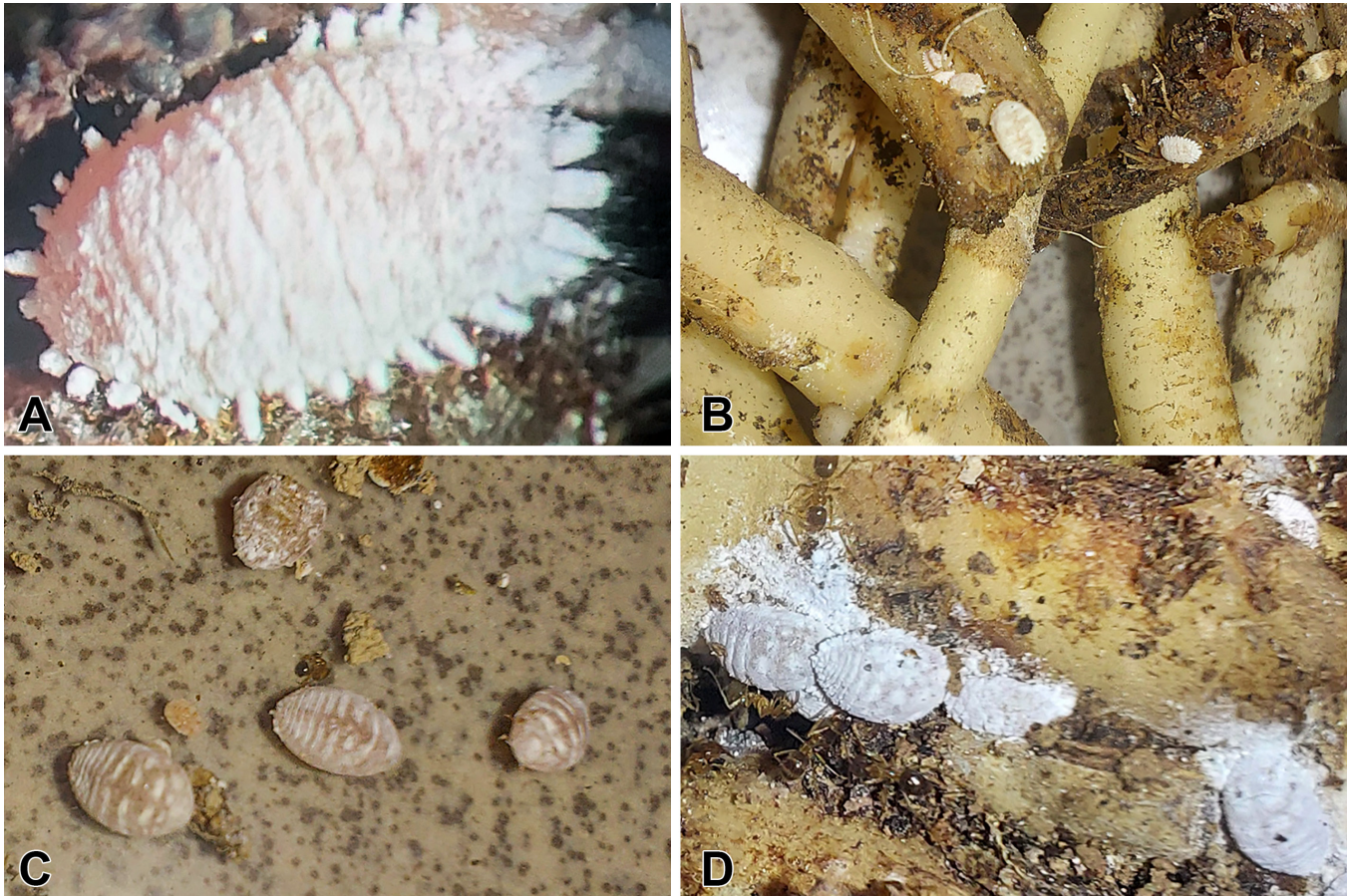


Figure 2. Scale insects associated with date palms in Iran. **A–B.** Adult female of *Dysmicoccus brevipes* (Cockerell); **C–D.** *Formicococcus phoenicis* Moghaddam & Zarghami **sp. nov.**

Diagnosis. *Formicococcus phoenicis* **sp. nov.** is most similar to *F. tripurensis* Williams, 2004, in sharing the following characteristics: (i) circulus present; (ii) lacking oral collar tubular ducts on head and thorax; (iii) posterior abdominal segments VI and VII with marginal groups of oral collar tubular ducts; and (iv) stiff dorsal setae. However, *F. phoenicis* differs from the latter by the following features (character states of *F. tripurensis* given in parentheses): (i) cerarii numbering 9 or 10 pairs (15 or 16 pairs); (ii) anal lobe cerarii each containing 7–9 conical setae and 4 or 5 auxiliary setae (3 conical setae and 0 auxiliary setae); (iii) apical, cisanal and obanal setae flagellate, long (all thick and relatively short); (iv) posterior abdominal segments with some medial ventral setae apparently wide, and blunt or pointed at the apex (medial setae on posterior abdominal segments usually thicker at bases than at apices). *Formicococcus phoenicis* is also similar to *F. robustus* (Ezzat & McConnel) in having: (i) circulus present; (ii) anal lobe cerarii each with more than 2 cerarian setae and auxiliary setae; and (iii) ventral oral collar tubular ducts absent from head and thorax. However, *F. phoenicis* differs from the latter by having (character states of *F. robustus* given in parentheses): (i) cerarii numbering 7 pairs on abdomen and only 2 on head (normally 18 pairs); (ii) ventral multilocular disc-pores present on abdominal segments IV–IX (V–IX); and (iii) posterior abdominal segments with some ventral setae thicker, and a few medial setae distorted and widening at apex (all setae flagellate).

Description. — **Holotype** ♀ (Fig. 3) and 7 **paratypes** ♀♀ (Slide-mounted). Body broadly oval, 2.81 (1.95–3.07) mm long, 2.27 (1.31–2.52) mm wide. Eyes situated on margin, each 38 (32–40) µm wide. Anal lobes well developed, each with ventral surface bearing stout apical seta, 236 (196–240) µm long and about 8 µm wide at base; and anal lobe bar, 40 (30–60) µm long, extending forwards mainly from bar seta. Antennae each 316 (308–360) µm long, with 8 segments, apical segment longest, with 3 fleshy setae;

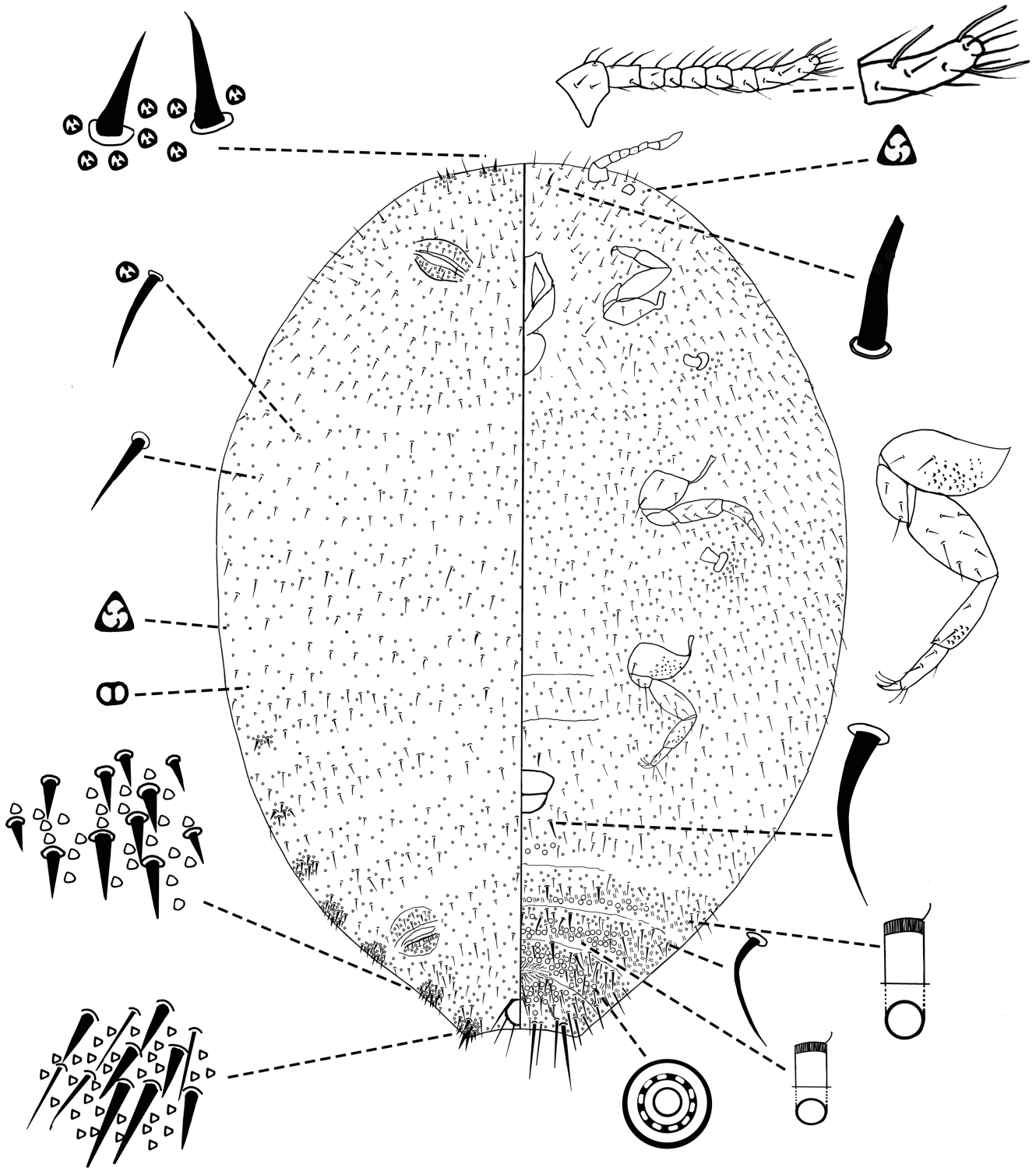


Figure 3. Adult female of *Formicococcus phoenicis* Moghaddam & Zarghami **sp. nov.**

the ratio of length for each segment: I-60; II-48; III-32; IV-24; V-24; VI-28, VII-32 and VIII-72 μm long. Legs well developed; hind leg segment lengths (in μm): trochanter+femur 270 (240–280), tibia+tarsus 220 (204–220); claw 41 (36–41), without denticle. Tarsal digitules slightly knobbed at apex, each 43(38–43) μm long and smaller than claw; claw digitules apically knobbed, each 27(20–28) μm long, slightly longer than claw. Ratio of lengths of hind tibia+tarsus to trochanter+femur 1: 0.81 (0.22–0.81), and ratio of lengths of hind tibia to tarsus 1: 1.03 (1.16–1.03). Translucent pores present on anterior and posterior

surfaces of hind coxa, and on posterior surface of hind tibia. Cerarii numbering 7 or 8 pairs on abdomen and 2 pairs on head; anal lobe cerarii (C_{18}) each containing 7–9 conical setae of different sizes, with 2 setae larger than others, 15–22 (20–26) μm long, and 4–6 (3–6) μm wide at base; 4–6 long auxiliary setae, each 25–33 (32–40) μm long; and about 35 (30–40) trilocular pores, all in a compact group; penultimate cerarii (C_{17}) each about 11 (10–19) conical setae, 0 auxiliary setae, and a compact group of trilocular pores. Cerarii on abdominal segment VI (C_{16}) each bearing 18 (16–18) conical setae; cerarii on abdominal segment V (C_{15}) each with 15 (13–16) conical setae; C_{14} with 8 (7–9) conical setae; C_{13} with 5 (4–5); and C_{12} with 2 conical setae. Frontal and preocular cerarii each containing 2 (2 or 3) conical cerarii with flagellate tips. Circulus present, slightly sclerotised, 244 (192–244) μm wide, divided by intersegmental line. Both pairs of ostioles prominent, with inner edges of lips thick and heavily sclerotised, each lip bearing fairly crowded short setae and trilocular pores. Anal ring 88 (80–92) μm long and 76 (64–76) μm wide, with 1 row of pores on anterior half and 2 rows of pores on posterior half; bearing 6 setae, each about 88 (78–90) μm long.

Dorsum. with slender, stiff setae in various sizes present, each 6–24 μm long, almost all curved. Some setae with base associated with 1 trilocular pore. Trilocular pores numerous, each about 3 μm in diameter, present throughout. Bilocular pores, smaller than trilocular pores, scattered.

Venter. with some setae stiff, long, pointed, each 22–50 μm long; setae toward posterior end of abdomen usually thicker at base; distorted setae, each widening at apex or with pointed apex, usually numbering 1 pair on each of abdominal segments III–VII; also with 1 pair thick setae on head. Cisanal setae thick, each about 176 (110–176) μm long; obanal setae similar in shape to cisanal setae but slightly shorter, each about 120 (110–120) μm long. Multilocular disc-pores each about 5 μm in diameter, present posterior to vulva, and in medial and submedial to submarginal areas of abdominal segments IV–VII in double to triple rows at posterior edges of segments. Trilocular pores numerous and discoidal pores scattered throughout. Oral collar tubular ducts of 2 sizes: larger ducts, each about 7 μm long and 3 μm wide, present in groups near posterior margins of abdominal segments V and VI; and smaller ducts, each about 5 μm long, present in groups on marginal areas of segments V–VII.

Host plants. *Phoenix dactylifera* L. (Arecaceae).

Distribution. Iran (Khouzestan province).

Maconellicoccus hirsutus (Green, 1908)

Material examined. on *Ph. dactylifera* (Arecaceae). SISTAN-o BALOUCHESTAN: 1♀♀, Chabahar, Bahookalat [25°42'26"N, 61°25'34"E], 1.v.2001.

Remarks. *Maconellicoccus hirsutus* was first recorded in Iran (Moghaddam, 2006), this species is native to southern Asia (Williams, 1996). *M. hirsutus* is highly polyphagous and it shows some preference for hosts in the Malvaceae, Fabaceae and Moraceae (García Morales et al., 2016). In Iran, it has been found on 25 host-plant species belonging to 18 families, including *P. dactylifera* (Moghaddam & Watson, 2022). There is not any report of damage on *Ph. dactylifera*.

DISCUSSION

Ten scale insect species have been recorded on date palms in Iran. According to the zoogeographical distribution, these species are widespread in the tropical and subtropical regions (García Morales et al., 2016). Two species *Palmaspis phoenicis* and *Fiorinia phoenicis* exclusively active on palms, in Iran and the world. *Parlatoria blanchardi*, *Phoenicococcus marlatti* and *Pseudaspidopectus hyphaeniacus* have been found on palms in Iran, although there are some records of its activity on other host plants in other countries (García Morales et al., 2016). *Parlatoria blanchardi* and *Ph. marlatti* are common in Iran and other neighbouring countries, and they are found in all areas where dates are grown. *Aonidiella orientalis*, *Parlatoria cypta* and *Maconellicoccus hirsutus*, are the most widespread and the highly polyphagous in Iran and the world; but there is only one record of each species on palms in Iran (Moghaddam, 2013). *Dysmicoccus brevipes* was a quarantine pest for Iran, which was recently recorded on the roots of the

palms in Khuzestan province (Zarghami & Moghaddam, 2023), so far, there is no report on the damage, and more investigations are needed.

The genus *Formicococcus* comprises a total of 76 species, the only recorded species of this genus in Iran is *F. robustus* which has been recorded on *Mangifera indica* (Anacardiaceae) in Hormozgan province (Moghaddam, 2013). This species with 16 host plant families has been found mainly in the Oriental region (García Morales et al., 2016), also it is found on palms in India (Avasthi & Shafee, 1986). At present, there is no report on the possible damage of *F. phoenicis* on palm, especially since this is active on the roots of dates, and more studies should be done.

AUTHOR'S CONTRIBUTION

The authors confirm their contribution to the paper as follows: M. Moghaddam: slide preparations, scientific drawing, morphological identification. S. Zarghami: Sample collection. The authors read and approved the final version of the manuscript.

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AVAILABILITY OF DATA AND MATERIAL

The specimens listed in this study are deposited in the scale insect collection, Hayk Mirzayans Insect Museum (HMIM), Insect Taxonomy Research Department, Iranian Research Institute of Plant Protection, Tehran, Iran (IRIPP) and are available from the curator, upon request.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study only included plants and arthropod material, and all required ethical guidelines for the treatment and use of animals were strictly adhered to in accordance with international, national, and institutional regulations. No human participants were involved in any studies conducted by the authors for this article.

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this paper.

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شپشک‌های گیاهی (Hemiptera, Coccoomorpha) درختان خرما (*Phoenix dactylifera*) در ایران، همراه با توصیف یک گونه جدید

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چکیده: شپشک‌های گیاهی (Hemiptera, Coccoomorpha) درختان خرما (*Phoenix dactylifera* L.) در ایران، ۱۰ گونه متعلق به پنج خانواده شپشک‌های گیاهی در ایران برآورد شده است که عبارتند از: *Diaspididae - Aonidiella orientalis*؛ *Asterolecaniidae - Palmaspis phoenicis* (Ramachandra Rao)؛ *Parlatoria* و *Parlatoria blanchardi* (Targioni Tozzetti)؛ *Fiorinia phoenicis* Balachowsky (Newstead)؛ *Phoenicococcidae - Monophlebidae - Pseudaspidopectus hyphaeniacus* (Hall)؛ *crypta* McKenzie و *Pseudococcidae - Dysmicoccus brevipes* (Cockerell) و *Phoenicococcus marlatti* Cockerell و *Formicococcus phoenicis* Moghaddam & Zarghami **sp. nov.** و معرفی *Maconellicoccus hirsutus* (Green) گونه جدید از شپشک‌های آردآلود که از ریشه‌های خرما تغذیه می‌کند، که بر اساس حشره ماده بالغ توصیف و ترسیم شد. چک لیستی از گونه‌های موجود روی درختان خرما در ایران ارائه شد.

واژگان کلیدی: *Pseudococcidae*؛ *Formicococcus*؛ شپشک آردآلود ریشه، Sternorrhyncha