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Host plant, distribution and natural enemies of the red date scale insect, *Phoenicococcus marlatti* (Hemiptera: Phoenicococcidae) and its infestation status in Egypt

Mona Moustafa

Plant Protection Research Institute, Agricultural Research Center, Dokki, Giza, Egypt

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Abstract Recently, the red date scale insect, *Phoenicococcus marlatti* Cockerell (Hemiptera: Phoenicococcidae) was recorded as an economic pest of date palm in Egypt. The present work dealt with a survey of host plants, distribution, natural enemies and its infestation status with *P. marlatti*. The results of the present work indicated that *P. marlatti* infested *Phoenix dactylifera* and *Washingtonia filifera* were found only in 5 governorates in Egypt; Alexandria, Daqahilyia, North Sinai (El-Arish), Giza and Ismailyia. Also, the results indicated that two species of predators were recorded that attacked *P. marlatti*. These species belong to the Order: Coleoptera, Family Coccinellidae, *Pharoscymnus varius* (Kirsch) and *Scymnus punetillum* Weise. The results of *P. marlatti* population dynamics on date palm trees in the first year 2009–2010, indicated that egg density reached its maximum on May 1st, 2010, and its minimum on February 15th, 2010. Preadult density reached its maximum and minimum on May 15th, 2010, and January 15th, respectively, while the highest and lowest adult density were recorded on May 15th, 2010 and January 15th, 2010, respectively. In the second year (2010–2011) egg density reached its maximum and minimum levels on May 1st, 2011 and September 1st, 2010, respectively. Preadult density reached its maximum and minimum on May 15th, 2011 and October 15th, 2010, respectively. Adult density was highest and lowest on May 1st and January 1st, 2011, respectively. The predator recorded in this work in El-Arish region was *P. varius*. During the first year (2009–2010) no occurrence of predators was noticed from October 15th, 2009 to February 15th, 2010 and the individual population reached its maximum number of 62 individuals per sample. During the second year (2010–2011) no predators were noticed from November 1st, 2010 to February 15th, 2011 and the population reached its maximum number of 58 individuals per sample.

Introduction

The red date scale insect, *Phoenicococcus marlatti* Cockerell (Hemiptera: Phoenicococcidae) infests Arecaceae (Palmae), *Phoenix* spp. and *Eucalyptus* (Myrtaceae) and is distributed in North Africa, Middle East, Europe, Asia, the Caribbean

E-mail address: mona_attya@yahoo.com
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Region, North America, Central America, and South America (Lepeseme, 1947; Avidov and Harpaz, 1969; Carpenter and Elmer, 1978; Ben-Dov et al., 2000; Howard et al., 2001; Blumberg, 2008). It is found massed on the white tissue at the bases of leaves and fruit stalks, leaf bases and roots of the palm (Stickney et al., 1950). Heavy scale populations may weaken the survival prospects of newly planted young shoots of date palm and cause dryness and mortality of the infested palms. In cases of very heavy infestation the underlying tissues can be damaged to a depth of a few millimeters (Avidov and Harpaz, 1969; Carpenter and Elmer, 1978; Blumberg, 2008).

Predators reported from North Africa and Spain are *Pharoscymnus anchorago* F., and *Rhyzobius lophanthae* (Blaisdell) (Coleoptera:Coccinellidae) (Stickney et al., 1950; Gomez, 2002). Red date scale insect has recorded four generations per year that occur in the U.S., and overlapping of generations with all instars present concurrently is possible (Avidov and Harpaz, 1969). Development time ranges from 60 to 158 days, depending upon temperature (Zaid et al., 2002). Munoz et al. (2008) demonstrated low levels of population of red date scale insect during the whole period of the study, with very few fluctuations. A generation of *P. marlatti* was observed in the month of May and the presence of the predator, *R. lophanthae* was registered during the whole year with a considerable increase in summer (Munoz et al., 2008).

Mousa et al. (1999) and Abd-Rabou (2000) recorded the red date palm scale insect, *P. marlatti* as an economic pest on date palm in Egypt. Abou-Elkhair (2001) recorded that *P. marlatti* attacks *Phoenix dactylifera* and *Washingtonia fili*. Abd El-Razzik (2000) recorded that *P. marlatti* infested the date palm in North Sinai (El-Arish).

The present work dealt with a survey of host plants, distribution, natural enemies and the infestation status of *P. marlatti*, as well as constructing a key to the economic scale insect species infesting date palm in Egypt.

Materials and methods

Key to the economic scale insect species infesting date palm in Egypt

The literature data, description of the species infesting date palm and keys of species by Ben-Dov et al. (2000) was adopted and modified to construct the key of the species.

Host plants and distribution of P. marlatti

Infested shoots and leaves were examined in the field using a pocket magnification lens. Infested shoots and leaflets were collected from different host plants and different locations in Egypt during 2009–2011. Identification of *P. marlatti* insect was done by examining adults in Canada Balsam.

Natural enemies of P. marlatti

Infested date palm shoots and leaflets were examined in the field, using a pocket lens. The leaflets and shoots were collected and placed separately in paper bags for further examination in the laboratory. Materials were kept in a well-ventilated container until the emergence of any natural enemies. Identification of natural enemies was done by examining mounted adults in Hoyers medium.

Abundance of P. marlatti and its predators

Dynamics of *P. marlatti* on date palm trees was carried out in Alexandria governorate, during 2009–2010 and 2010–2011. The selected orchard did not receive any chemical control for two years before starting these studies and during the study period.

Ten trees were selected at each grove infested with these scale insects. Selected trees were similar in size, shape, height and vegetation. Samples were picked up at two-week intervals throughout the study. Samples' random size was 30 shoots and 30 leaflets representing all directions. The samples were packed in polyethylene bags with minute holes and transferred to the laboratory for examination, using stereoscopic microscope binoculars. All alive insects found on each leaf surface were assorted and recorded as: eggs, preadults or adults. Obtained data were pooled for each inspection, direction and leaf surface.

The abundance of the predators of *P. marlatti* was carried out from 2009 to 2010 and 2010 to 2011 on date palm trees in El-Arish. The location heavily infested by the *P. marlatti* was selected to achieve investigations and was sampled on a monthly basis. During the study, no chemical control for the pest was performed on these trees. In the locations, 10 trees were selected randomly for sampling. Units of sampling consisted of 30 shoots and 30 leaflets. These were detached off and brought to the laboratory for inspection.

Simple correlation and regression values were calculated to obtain information about the relationships between the three tested weather factors and the population of *P. marlatti* and its predator.

Results and discussion

Key to the economic scale insect species infested date palm in Egypt

1. Tubular ducts 8-shaped.
2. Tubular ducts different, body of slide-mounted adult female pyriform to elongated pyriform, membranous, with two-bar ducts; fringed plates extending as far forward as the abdominal segment 2; and submarginal duct tubercles absent from prosoma. Pygidium with three pairs of unilibulate lobes; 3 plates present between the third and fourth lobes on each side; and without any submedian macroducts within the frame formed by the preivulvar pores *Parlatoria blanchardi* (Targioni–Tozetti).
3. Tubular ducts divided longitudinally, adult female is completely enclosed in a reddish brown hard rigid puparium. The sac is broadly oval, strongly convex above and flattened below (Hall, 1923). Female body semi-circular or slightly ovate, about 0.8 mm long and 0.7 mm wide. Body segmentation quite obscure and the outer margin smooth. Dermis membranous, so thin and delicate that it is extremely difficult to extract without rupturing *Halimococcus thebaicae* Hall.
4. Tubular ducts divided differently.
5. Anal ring with pores, 2 anal-ring setae; marginal 8-shaped pores forming a continuous single band on the head, thorax, and anterior abdomen; quinquelocular pores present

near spiracles and in submarginal areas near spiracles, absent from the posterior end of body; multilocular pores absent from the vulvar area; discoidal pores scattered over the dorsum but not forming a submarginal row. Other characters: Legs absent; antennae 1-segmented; without a pygidium; 8-shaped pores prevalent *Palmaspis phoenicis* (Ramachandra Rao).

6. Anal ring without pores, Body margin with a series of dermal papillae; 8-shaped tubular ducts present; with setae; legs absent; spiracles with bar and no associated sclerotized area; antennae with 1 segment *P. marlatti* (Cockerell).

Host plants of P. marlatti

The results of the present work indicated that *P. marlatti* infested *Phoenix dactylifera* and *Washingtonia filifera* in Egypt. These results agree with the findings of Abou-Elkhair (2001).The host plants *Calamus* spp., *Daemonorops* spp., *Pandanus* sp., *Phoenix canariensis*, *Phoenix reclinata*, *Phoenix roebelenii*, *W. filifera* and *Eucalyptus* sp. were recorded by Stickney et al. (1950), Sinacori (1995) and Miller and Gimpel (2009).

Geographical distribution of P. marlatti

The results of the present work indicated that *P. marlatti* was distributed in 5 governorates. These were Alexandria, Daqahilyia, North Sinai (El-Arish), Giza and Ismailyia. Red date scale insect is native to North Africa and the Middle East, but it has been found almost everywhere, including Europe, Asia, the Caribbean Region, North America, Central America, and South America (Miller and Gimpel, 2009). Within the United States, it is found in limited distribution in Florida. Populations of date palm scales were intercepted and eradicated in Arizona, California, and Texas (Ferris, 1942; Stickney et al., 1950; Miller and Gimpel, 2009).

Natural enemies of P. marlatti

Parasitoids

The results indicated that there were no parasitoids collected during the present work.

Predators

The results indicated that two species of predators were recorded that attack *P. marlatti*. These species belong to Coleoptera, *P. varius* (Kirsch) and *Scymnus punetillum* Weise. No countryside work was conducted on the predators of *P. marlatti*. The Acari family Eupodidae; *Laemonphloeus* sp. (family Laemophloeidae, superfamily Cucujoidea); *Cybocephalus californicus* (family Nitidulidae), and the Coccinellids *Chilocorus* sp. and *Pharoscymnus anchorago* (Fairmaire), are reported as predators of the red date scale insect (Stickney et al., 1950; Zaid et.al., 2002; Miller and Gimpel, 2009).

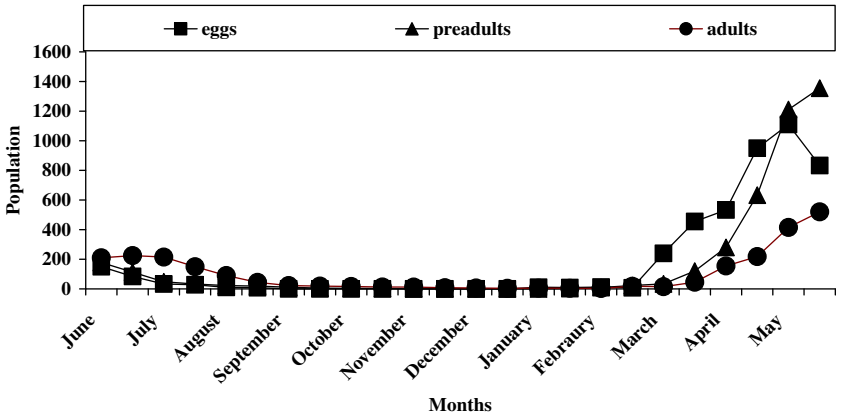

Figure 1 Population dynamics of *Phoenicococcus marlatti* stages in Al-Arish region during 2009–2010.

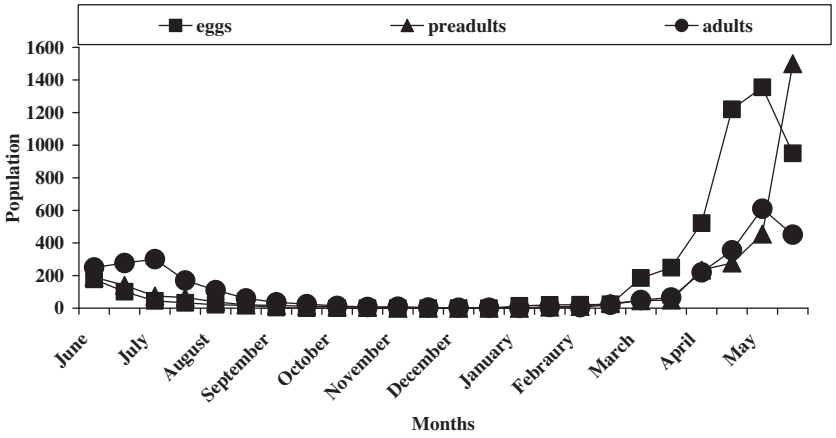

Figure 2 Population dynamics of *Phoenicococcus marlatti* stages in Al-Arish region during 2010–2011.

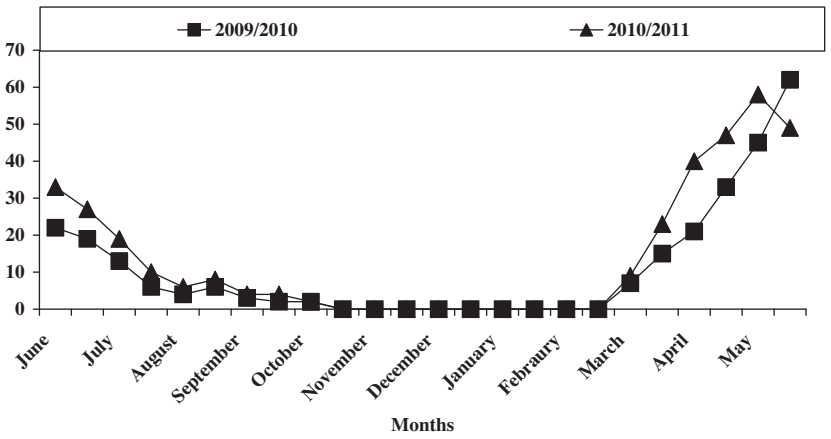

Figure 3 Population dynamics of *Pharoscymnus varius* as predator stages in Al-Arish region during 2009–2010 and 2010–2011.

Abudance of P. marlatti and its predator

The results of *P. marlatt* population dynamics on date palm trees over 2009–2010 and 2010–2011 years are presented in Figs. 1 and 2. The mean numbers of individuals were 186.4, 171 and 101.3 for eggs, preadults and adults of *P. marlatti*, respectively. Eggs' density reached its maximum on May 1st, 2010, showing 1110 eggs/sample. Lowest egg density occurred during the period of February 15th showing 7 eggs/sample. Preadult density reached its maximum on May 15th, 2010, showing 1355 preadults/sample. Lowest preadult density occurred during the period of January 15th showing 2 preadults/sample. Adults' density was highest on May 15th, 2010 as 520 adults/sample. Lowest population of adults was observed during January 15th 2010 with 3 adults/sample (Fig. 1).

The mean numbers of individuals were 167, 132.7 and 127.4 for eggs, preadults and adults of *P. marlatt*, respectively. Egg density reached its maximum on May 1st, 2011, showing 1430 eggs/sample. Lowest egg density occurred during the period of September 1st showing 4 eggs/sample. Preadult density reached its maximum on May 15th, 2011, showing 1500 preadults/sample. Lowest preadult density occurred during the period of October 15th showing 6 preadults/sample. Adult density was highest on May 1st, 610 adults/sample. Lowest population was observed during January 1st, 2011 with 2 adults/sample (Fig. 2).

The predator recorded in this work in the El-Arish region was *P. varius*. During the first year (2009–2010) no occurrence of predators was noticed from October 15th, 2009 to February 15th, 2010. Low numbers of predators continued until late fall and increased gradually till early spring reaching a maximum number of 62 individuals/sample. During the second year (2010–2011) no occurrence of predators was noticed from November 1st to February 15th, 2011. Low numbers of predators continued until early spring and increased gradually till end of spring reaching a maximum number of individuals, 58 individuals/sample (Fig. 3).

Data in Table 1, showed that the simple correlation between the population of predator, maximum temperature, minimum temperature, relative humidity % and the mean number of insects is significant ($r = 0.71$, 0.82, 0.70 and 0.69), respectively during the first year 2009–2010. Also, results in Table 1, showed that the simple regression for changing the population of predator, maximum temperature, minimum temperature, relative humidity % and the mean number of insects is significant ($b = 0.72$, 0.80, 0.73 and 0.74), respectively during the year 2009–2010.

Table 1 Simple correlation and regression values of the population dynamics of Al-Arish region during 2009–2010.

Variable	Simple correlation "*r*"	Probability "*P*"	Regression	Probability "*P*"
Pharoscymnus varius	0.71	*	0.72	*
Maximum	0.82	**	0.80	**
Minimum	0.70	*	0.73	*
RH%	0.69	*	0.74	*

Table 2 Simple correlation and regression values of the population dynamics of Al-Arish during 2010–2011.

Variable	Simple correlation "*r*"	Probability "*P*"	Regression	Probability "*P*"
Pharoscymnus varius	0.75	*	0.74	*
Maximum	0.85	**	0.84	**
Minimum	0.82	**	0.80	**
RH%	0.62	*	0.61	*

Data in Table 2, showed that the simple correlation between the population of predator, maximum temperature, minimum temperature, relative humidity % and the mean number of insects is significant ($r = 0.75$, 0.85, 0.82 and 0.62), respectively during the year 2010–2011. Also, results in Table 2, show that the simple regression for changing the population of predator, maximum temperature, minimum temperature, % relative humidity and the mean number of insects is significant ($b = 0.74$, 0.84, 0.80 and 0.61), respectively during the year 2010–2011.

During the present work, the results indicated that the populations of red date scale insects have three peaks in January, May and July. These results contradict the findings of Avidov and Harpaz (1969). They stated that red date scale insects have four generations per year in the U.S. and overlapping of generations with all instars present concurrently is possible. The results here also recorded one predator, *P. variusm*, associated with *P. marlatti* and its abundance was observed to occur all year through except the period from October to January. This role in controlling the pest is obvious by Munoz et al. (2008). They demonstrated that the population of the red date scale stayed at low levels during the whole period of the study, with very few fluctuations. A generation of *P. marlatti* was observed in the month of May and the presence of the predator, *R. lophanthae* was registered during the whole year with a considerable increase in summer.

References

Abd-Rabou, S., 2000. A local outlook to available species of the superfamily Coccoidae (Hemiptera) in Egypt. Ann. Agric. Sci. Moshtohor 38 (1), 919–930.

Abou-Elkhair, S., 2001. Scale insects (Hemiptera: Coccoidea) and their parasitoids on ornamental plants in Alexandria, Egypt. Entomologica, Bari 33, 185–189.

Abd el-razzik, M.E., 2000. Survey of date palm in North Sinai with special reference to the ecology and biology of the species, *Parlatoria blanchardii* (Targ.-Tozz) superfamily Coccidea. M.Sc. Thesis. Fac. Agric. Cairo University, p. 97.

Avidov, Z., Harpaz, I., 1969. Plant Pests of Israel. Israel Universities Press, Jerusalem, Israel.

Ben-Dov, Y., Miller, D.R., Gibson, G.A.P., 2000. ScaleNet, A Systematic Database of the Scale Insects of the World. http://www.sel.barc.usda.gov/scalenet/scalenet.htm.

Blumberg, D., 2008. REVIEW: date palm arthropod pests and their management in Israel. Phytoparasitica 36 (5), 411–448.

Carpenter, J.B., Elmer, H.S., 1978. Pests and diseases of the date palm. U.S. Dept. Agric. Agric. Handbook 527, 1–42.

FERRIS, G.F., 1942. Atlas of the Scale Insects of North America. Series 4. Stanford University Press, Palo Alto, California, pp. 253.

Gomez, S.V., 2002. Cría masiva de *Rhyzobius lophanthae* Blaisdell (Coleoptera: Coccinellidae) depredador de la cochinilla roja de las palmeras (*Phoenicococcus marlatti* Cockerell). Bol. San. Veg. Plagas 28, 167–176.

Howard, F.W., Moore, D., Giplin-Davis, R.M., Abad, R.G., 2001. Insects on Palms. CAB International, Wallingford, UK.

Lepeseme, P., 1947. Les Insectes des Palmiers. P. Lechevalier, Paris, France.

Miller, D.R., Gimpel, M.E., 2009. Phoenicococcidae: *Phoenicoccus marlatti*. ScaleNet. http://www.sel.barc.usda.gov/scalenet/scalenet.htm (20 May 2009).

Mousa, S.F., Helal, H.A., EL Awady, S., Eraki, M.M., 1999. Population dynamics of the red wax scale insect, *Phoenicococcus marlati* Cockerell (Homoptera: Cococidea: Phoenicococcidae) at Qalyubia governorate, Egypt. Fayoum J. Agric. Res. Dev. 13 (20), 234–241.

Munoz, I.C., Gomez, V.S., Ferry, M., 2008. Fiel study of the effectiveness of Rhyzobius lophanthae Blaisdell in the biological control of the red date scale, *Phoenicoccocus marlatti* by means of inoculative releases. Boletin de Sanidad Vegetal, Plagas 34 (1), 117–127.

Sinacori, A., 1995. *Phoenicoccus marlatti* (Cockerell) (Homoptera: Phoenicoccidae) in Sicilia. Phytophaga (Palermo) 6, 55–61.

Stickney, F.A., Barnes, D.F., Simmons, P., 1950. Date Palm Insects in the United States. U.S. Dept. Agric. Circ., 846.

Zaid, A., De Wet, P.F., Djerbi, M., Oihabi, A., 2002. Diseases and pests of date palms. In: Zaid, A. (Ed.), Date Palm Cultivation. FAO, Rome-Italy.