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EFFECT OF THE MEXICAN BLACK SCALE, *SAISSETIA MIRANDA* (HEMIPTERA : COCCOIDEA : COCCIDAE) IN IRAQI AGROECOSYSTEM

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ABSTRACT : The presence and spreading of Mexican black scale, *Saissetia miranda* (Cockerell and Parrott) on fig trees (*Ficus carica*) in the orchards of the middle of Iraq (south of Baghdad) during 2017 and 2018 was detected. The insect was identified in international scientific centers by specialists in scales insects. Also, it has several generations a year, including one generation during the springand then entered aestivation during the summer when the temperature exceeded 45° C and two generations during the autumn and then entered the winter when the temperature ranged between 12 -18 °C and entered the insect hibernation in the stage of eggs under complete insect cover. The population density of the insect in the autumn more than in the spring and the insect was found on the modern branches and leaves and fruits, but the numerical density on the modern branches more than on the rest of the plant parts. Female body shape *S. miranda* was convex with color of the outer shell gradually changes from white to dark brown then black, body width rate was 3.69 mm and length was 2.01 mm, average number of eggs per female 920 eggs under field conditions, pale yellow egg color gradually turns to reddish orange hatching crawling nymphs with the same color of eggs and four pairs of legs and then turn into static nymphs characterized by the shape of her body with the emergence of a plan similar to the letter H on the dorsal side. The appearance of the Mexican black scale with the *Planococcus ficus* was reported in Fig. Parasitic cases of parasites belonging to the families of Encyrtidae and Cecidomyidae were recorded. These results serve to study invasive species of the Iraqi environment and applications of integrated pest management programs.

Key words : *Saissetia miranda*, cortical insects, fig trees, Iraq.

INTRODUCTION

Ficus carica is an important source of fruit and commercial crop when planted widely. Its cultivation was spread widely in the Middle East and West Asia and it was known from the old decades and nowadays its cultivation spreadingin many areas around the world due to the content of carbohydrates, proteins, vitamins and mineral salts (https:en.wikipedi). *Ficus carica* and it is fruits were susceptible to many insect pests, fungal diseases, bacteria, viruses and nematodes resulted in a big losses (UC IPM, 2009). The spread of insect pests has increased significantly in recent years due to the increase in the trade of plant species and their crops, in particular the invasion of scales insects (Hemptera: Coccoidea) (Moghddam *et al*, 2015). These include soft-scale insects, which about 8000 species belong to 49 families (Ben-Dov *et al*, 2013). The type *Saissetia* followed by 47 species were widespread in the world, four of them found in Mexico. These species are Mexican Black Scale and *S. miranda*. This species was common around the Gulf of Mexico and the Caribbean and has entered Washington from Portugal through trade Plants, collect of the fig trees in South Africa (De Lotto, 1976). The insects of this species attack many crops, including citrus, olive and ornamental plants (Myartseva *et al*, 2004). This species was first described by Mexico (Cockerell and Parrot, 1899) and was considered to be one of the most common tropical soft plant species (Williams and Watson, 1990) and is now widely recognized in tropical Africa and Australia (Dov *et al*, 2015). Additionally, this type was recorded in Japan by Tanaka (2012) and in Portugal by De Lotto (1976). Franco *et al* (2011) and Moghaddam (2013) noted the entry of many insects of mealybug and scales insects into Iran on the southern and southeastern borders of the country and spread in large areas of its territory. This insect was first recorded in Iran in 2013 in the southern governorates of Azadakht and found the highest population density on its branches.

De Castro *et al* (2018) demonstrated that the Mexican black scale *S. miranda* was similar to the *S. oleae*. This insect turns gray or black in the full stages of growth and was characterized by the presence of the appearance of the letter H on the dorsal side of the body of the nymphs static, and similar types *S. oleae* and *S. coffeae* with *S. miranda* because their body color was light brown and there was a H-like appearance in the female immature phases (Choi and Lee, 2017). The scales insects have a wide family range and cause direct and indirect damage to the trees. The direct damage was due to the absorption of the vegetative juices, the production of the honeycomb, it is accumulation on the leaves and the external feeding on the plant parts, the staining of the leaves, the yellowing and the abnormal shape of the leaves. The indirect damage was the result of the growth of the sooty mold on the honeycomb on leaves, which causes low photosynthesis by blocking sunlight from leaves (Beardsley and Gonsalves, 1975; Dekle, 1965; Valand *et al*, 1989).

Planococcus ficus (the Vine mealybug or Mediterranean Vine mealybug or the Grape vine mealybug) was widely spread in many countries and the species were spread over 12 plant families but the most common are grapes, figs and pomegranates which have wide family range and entered America in the second half of the 20th century. Until the beginning of 1980, there was an error in diagnosing this species. It was classified as the *Planococcus citri* Citrus mealybug and in the middle of 1980, it was called Vitis (Nidiielski) Planococcus, while the *Planococcus ficus* was called fig. The *P. ficus* was recorded firstly in 1930 (Joubert, 1934) and later became a major species in large vineyards in South Africa. This type was recently categorized by Ben-Dov (1994), De Lotto (1975), Cox (1981, 1989). Kriegler (1954) described the different roles of this type in terms of color, size and other morphological characteristics and has 5-6 generations per year. *Planococcus ficus* was a major pest on grapes in West, Northwest and Southwest Africa, and has recently increased in the United States and caused significant losses to the grape harvest for the wine industry due to its honeycomb seminar. The severe infection leads to the death of a large quantity of the leaves and reduce the amount and content of sugars and increase the acidity and non-resistance of trees to drought, and was a vector of viral diseases (Walton and Pringle, 2004; Cabaleiro *et al*, 1999). *P. ficus* was registered in many countries of the world, including Iraq (Ben-Dov, 1994; Cox, 1989).

MATERIALS AND METHODS

Location of the research

The research was carried out at one of the fruit orchards (south of Baghdad), which including different fruit trees like citrus, grapes, figs, palm trees.

Sampling

The samples were collected from the branches and leaves of fig trees and placed in containers and transported to the laboratory. Some of them were stored in glass vials containing 70% alcohol and the other part was left for inspection and follow-up.

Identification

1. Cortex: collected samples of the insect and kept in alcohol 70% and sent for identification.

Purposes to the external scientific centers concerned with the classification of insects scales:

2. Dr. Mehmet Bora Kaydan, Cukurova University, Biotechnology and Research Center, Adana, Turkey.

3. Mrs Masumeh Moghaddam, Insect Taxonomy Research Department, Iranian Institute Research of Plant Protection, Tehran, Iran.

4. Dr. Christofer Hogdsen, Digital Learning Specialist and Director at Discover eLearning Ltd. The Nottingham University, Newcastle, UK.

5. *Planococcus ficus*: The samples were identified locally according to Ben-Dov (1994).

Spreading and number of generations

The presence of the two insects on fig trees, citrus fruits, grapes and olives was observed during the winter season 2017, winter, spring, summer and autumn 2018, the presence of the two insects was recorded on the families in the orchards and the number of generations for each season.

The two insect‘s life and their evolutionary stages

The development of the two insects was monitored under field conditions and the morphological changes of their different roles were recorded. The number of generations was calculated during the year and the aestivation periods and the presence of the two insects on the plant families. The various developmental stages at field and laboratory were filmed, where a group of leaves, branches and fruits of the infected trees were transferred to the laboratory to measure the dimensions of the body and the number of eggs for the two insects.

Natural enemies

The cases of parasitism were monitored on the two insects and the isolation and character of the natural

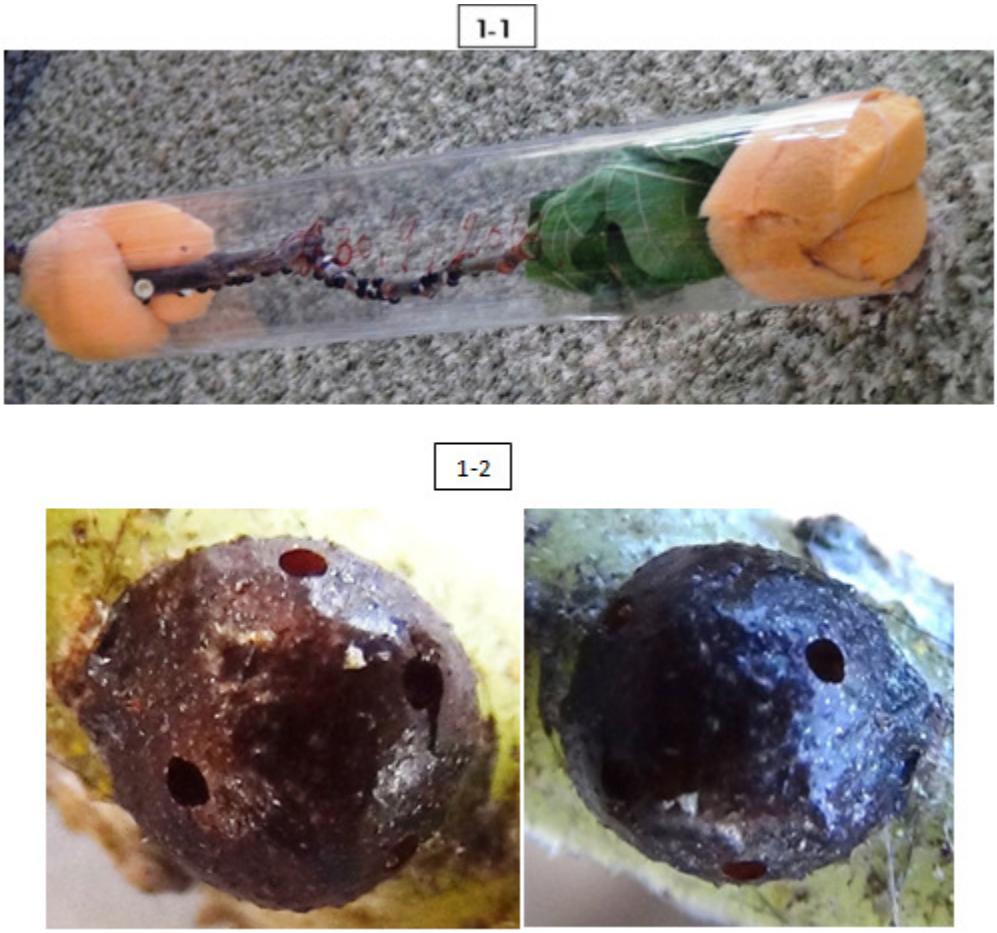

Fig. 1 : Branch isolation to detect the natural enemies (1-1) and the outlets of parasites (1-2).

Fig. 2 : The interstitial presence of the mexican black scale *Saissetia miranda* and the *Planucoccus ficus* tender grapes on Fig trees.

enemies in the workplace environment. For this purpose, use 30 cm diameter transparent nylon drums and 5 cm diameter open from both sides and insert in each cylinder a severely injured branch with two bolts and cylinder openings sealed with sponges. The emergence of natural enemies (Fig. 1), a group of insects were transferred to the laboratory for the purpose of examining parasitism and the possibility of identification the natural enemies active on the two insects. The first identification of some natural enemies was made using some taxonomic keys.

Identification

The identificationindicated that the samples were the Mexican black scale (Cockerell & Parrott) *Saissetia miranda* which belong to Hemiptera: Coccoidea: Coccidae. It was the first record of this insect in the environment of the Iraqi orchards. *Saissetia miranda* insect has a global spread and that the map of its global distribution indicates that Iraq was free of this insect until this registration, and its presence in the neighboring countries of Iraq only in Iran was recorded in 2013 and has a wide family range (personal contacts with researchers who completed the Identification). The results of the identification indicated that the dice of the grape vine mealybug, *Planococcus ficus* (Signoret) was

Fig. 3 : Mexican black insect *Saissetia miranda* on Fig leaves.

found on fig trees (*Ficus carica*), also known as the Vine mealybug, Mediterranean Vine mealybug or Grape vine mealybug (Hemiptera: Pseudococcidae).

Spreading and number of generations

The results in Table 1 indicated the presence of the two insects on Fig trees only, although there were other trees such as citrus, grapes, olives and palms, but no presence of the two insects was noted and there was a significant interaction between the two insects (Fig. 2) and their density on the peripheral branches and the leaves (Figs. 3, 4, 5, 6). The two groups had one generation in the spring and their activity started at the end of February and two generation atautumn and their activity started at

Fig. 4 : The Mexican black scale *Saissetia miranda* on the sheath of fig leaves (modern and adult nymphs).

Fig. 5 : Mexican black scale *Saissetia miranda* on the peripheral branches of fig.

Fig. 6 : The Mexican black scale *Saissetia miranda* on ancient branches and figs.

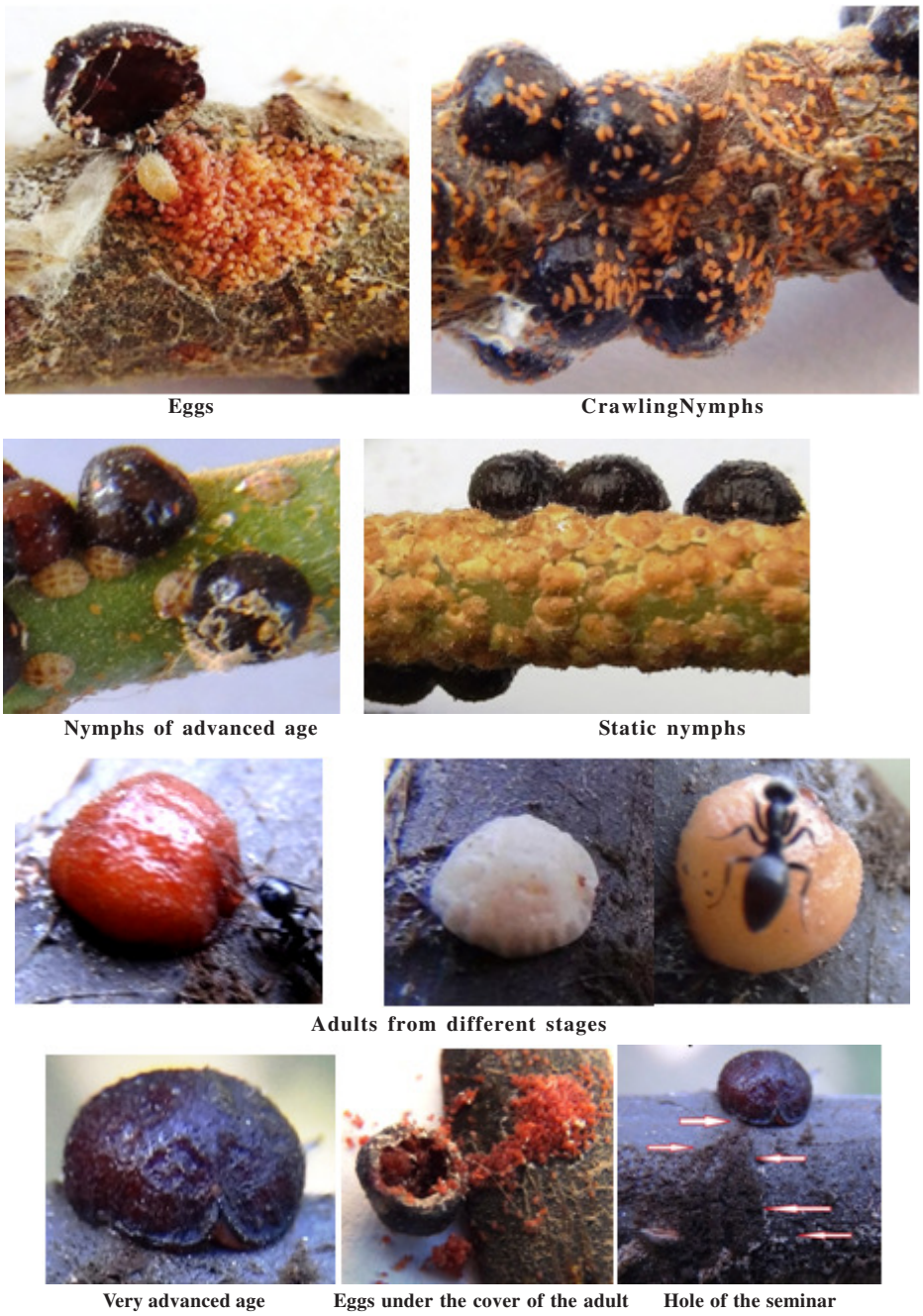

Fig. 7 : Stages of formation and discoloration of Mexican black scale, *Saissetia miranda.*

the end of September. Summer and winter may be due to extreme weather conditions in these two seasons (Table 2), the Mexican black scale entered the aestivation during the month of June when temperatures exceeded 45°C and hibernation when temperatures ranged from 12-18°C at the end of November, when the insect was in the egg stage was fully developed and under the cover of the adult. The population density of the two insects in the spring was very few did not exceed 10 people each on each tree, but in the autumn was very high numbers and difficult to calculate and cover the insect sometimes full sheet or branch.

Morphological and life form

The obtained results indicated that the two insects have a hibernation period on the plant waste on the surface of the earth by noting that the preparation of the two insects in the autumn generation were on the branches and leaves near the surface of the earth did not record any occurrence of the insect on the middle and upper part of the tree at the beginning of autumn, however, after the egg hatching of the first autumn generation, the two insects begin to spread and the branches and leaves of the fig trees become infected.

Fig. 8 : *Planococcus ficus* on Figs.

Fig. 9 : Parasites collected from parasitic cases on the *Saissetia miranda* and *Planococcus ficus*.

Table 1 : Plant populations and the number of generations of Mexican black scale *Saissetia miranda* and *Planococcus ficus* under the conditions of Baghdad orchards during 2017- 2018.

Season and year	Insect name	The host plant			Generation number	Temperature during hibernation
		Grapes	Figs	Citrus		
Winter 2017-2018	*S. miranda*	Non	Hibernation at egg stage	Non	*S. miranda*	18 - 12
	P. ficus	Non	Hibernation at egg stage	Non	*P. ficus*	18 - 12
Spring 2018	*S. miranda*	Non	All stages	Non	*S. miranda*	38 -20
	P. ficus	Non	All stages	Non	*P. ficus*	38 -20
Summer 2018	*S. miranda*	Non	Aestivation at egg stage	Non	*S. miranda*	Above 45
	P. ficus	Non	Aestivation at egg stage	Non	*P. ficus*	Above 45
Autumn 2018	*S. miranda*	Non	All stages	Non	*S. miranda*	35 -25
	P. ficus	Non	All stages	Non	*P. ficus*	35 -25

The female *S. miranda* puts her eggs under the casing, with range of 920 eggs per female. The color of the eggs was yellow, pale yellow, then turns gradually into reddish orange, hatched hummingbirds that look exactly like eggs and have four pairs of legs, moving crawling and spreading on branches and leaves. A period that lives and loses legs and covers itself with a pale yellow cover that gradually turns into a dark red color. The age-old mermaid was 2.85 mm wide and 2.14 mm high, then turns into a white-hemisphere-shaped casing

then it turns brown into reddish brown. The color gradually changes to reddish brown and then to black. 2.01 mm has a side opening similar to the letter V inverted out of which the honeycomb and waste (Fig. 7). The *P. picus* is an interstitial and synchronous black Mexican skin. The female has a body length of 1.75 - 3.7 mm and has legs extended from the sides. Its body was surrounded by 18 pairs of short textile threads. Its body covers a waxy cover that was white and tends to gray (Fig. 8). The average number of eggs per female 375 eggs, male dark brown color body smaller than the female and has one pair of wings.

Natural enemies

The field and laboratory examination revealed that there are cases of parasitism on the two insects, through the existence of 1-3 holes on the cover of the Mexican black scale, indicating that these holes are to exit parasites as shown in (Fig. 1) in addition, parasites werecollected by isolating the branches that contains insects. At the laboratory examination under the microscope, some parasites were isolated from under the wax cover of the *Planococcus ficus*. These parasites were first diagnosed as belonging to the family of *Cecidom ayidae* and *Anagyrus* sp parasite, which belong to the Encyrtidae family (Fig. 9). Some sources pointed out that the presence of ants (Fig. 10) through its feeding on the seminar honey works indirectly to protect the insects from the activity of natural enemies.

The results showed that the Mexican black scale *S. miranda* has entered the Iraqi environment during the past years from one of the neighboring countries of Iraq, although the sources did not indicate its registration previously in Iraq and it was recorded for the first time in Iran in 1913 (Moghaddam *et al*, 2015). Kaydan *et al* (2014) demonstrated that several samples of scales insects were collected from different parts of Turkey, the presence of this insect was not recorded in the environment of Turkey. The results were identical to those

Fig. 10 : Activity of the ants around the Mexican black scale, *Saissetia miranda*.

Table 2 : Temperature and relative humidity at the site of completion of the research.

Date	Temperature Celsius			Relative Humidity%		
	Minimum	Maximum	Average	Minimum	Maximum	Average
November 2017	13.6	26.2	19.9	22.2	61.2	41.7
December 2017	8.5	21.7	15.1	22.2	65.8	44.0
January 2018	9.5	19.1	14.3	26.2	71.3	48.8
February 2018	10.1	21.3	15.7	33.8	77.1	55.4
March 2018	14.3	28.5	21.4	16.6	57.5	37.0
April 2018	16.2	31.3	23.6	15.4	65.0	40.2
May 2018	22.0	36.5	29.3	14.5	50.7	32.6
June 2018	29.0	42.9	35.9	8.1	24.8	16.5
July 2018	30.4	44.9	37.7	8.0	21.9	15.0
August 2018	29.8	44.5	37.2	8.5	21.1	14.8
September 2018	26.4	43.0	34.7	8.1	28.6	18.4
October 2018	20.9	34.8	27.8	15.9	49.4	32.7

found by Dean and Hart (1972), which found figs, guava and daphni when studied in South Texas. The results of the study also coincided with Williams and Moghaddam, (1999) that *P. ficus* was present in Iran and that Fig trees are one of its main families with a population explosion, causing large losses and transmitting plant diseases. As Al-Azzawi pointed out in 1980 that the parasite was one of the pests of figs, which agreed with the results of the present study.

Several studies have pointed to the recording of many natural enemies on the Mexican black scale and the parasites (Myartseva *et al*, 2004). A number of 17 parasites belonging to 5 families including the Encyrtidae family. (Chormanski, 2018) also the parasite *Anagyrus pseudococci* was recorded as one of the parasites on several types of the genus *Planococcus* spp.

CONCLUSION

The Mexican black scale *S. miranda* has entered the Iraqi environment recently and its favorite family was the fig trees so it is necessary to take the necessary measures to reduce its potency. Additionally, the activity of *Planococcus* spp. has increased as well its population density which may have been due to global climate change.

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