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Biology and control of fig leaf worm *Ocnerogyia amanda* Stgr. (Lymantridae: Lepidoptera)

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Abstract

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The fig leaf worm *Ocnerogyia amanda* Stgr. from the order Lepidoptera, it began to appear at the beginning of the third week of March, laying 94–140 eggs at night. The eggs hatch from larvae with thick white hairs that cover the entire body of the larva. The larva passes through five larval ages during (18–26) days to turn into a Obtect pupae for a period of (10–15) days for the complete insect to come out and repeat the life cycle, and the length of the female's lifespan is (5–10) days and the male's (2-6) days. The study showed that Malathion had the best effect on the third instar larvae, followed by Davey Coz, then Vinam, and the least effect was abamectin. When sesame oil was mixed with pesticides , the toxicity of the three pesticides (Malathion, Devi Coz and Vinam) was synergism . The synergistic ratio was (1.57, 1.35 and 1.32), respectively, and no effect on abamectin.

Keywords: Ocnerogyia amanda Stgr.; pesticides; biology

Introduction

The West Asia region is the original home of the fig tree, then it moved widely from Asian Turkey to northern India, then the cultivation of figs spread throughout the Mediterranean and the Middle East since ancient times, where it was a staple food for thousands of years, due to its easy drying and storage along with grains and raisins, as well because it is a rich source of nutrients. The fig tree is a perennial, deciduous, its fruits are multi-colored and shapes and enjoys a high nutritional, economic and medicinal value. The fig tree is a blessed tree because it was mentioned in the Holy Qur'an. The Lord of the world's swore by it in Surat Al-Tin (and figs, olives, and Tur Sennin) and *Ficus carica* L. 1753 is one of the most rich fruits In its calcium and fiber content, it has been cultivated since about the ninth century BC. It has delicious fruits that are distinguished by its treatment for many diseases. Its cultivation is spread in all countries of the world, such as Britain, Australia and South Africa. The production of fig trees in the world is 1.051.000 million tons, a report (FAO) for the year 2012, and Turkey is considered the product the first in the world is 380 000 tons, while Iraq's production is 3.271 tons.

Fig trees are affected by many insect pests, including the fig leaf moth, *Ocnerogyia amanda* Stgr. (Al-Azzawi et al., 1990) is one of the most important, especially in our country, where great losses occur in fig productivity (Stary & Ibrahim, 1970) as fig leaf moth larvae feed on the leaves of the tree at the beginning of infection on one of the leaf surfaces in the first and second ages and when the larvae reach the third age begin by feeding and devouring the entire leaf, leaving only the veins, especially the large ones, and that this pest is considered a dangerous pest in rainforests (Novotany et al., 2005), whereas Harrison et al. (2008) that fig trees have an obligatory mutual beneficial relationship and various interactions with a group of organisms, including the fig leaf worm, which can be considered beneficial to some extent. Al-Malallah & Ghani (2013) reported that feeding fig moth larvae on plant leaves leads to the damage of the entire leaf and does not remain of it except for the veins of the leaf, which leads to the fruits withering and falling before they ripen. Ismael & Banan (2010 a) mentioned that the fig leaf moth begins to appear at the beginning of April, when the female lays (100-145) eggs. The eggs hatch, the larvae pass five larval ages, after which they start weaving a cocoon around themselves in the soil or under fallen leaves or on tree stems and turn into a pupae after which they turn into an adult insect and then repeat their life cycle, the insect have five generations/year and overwintering is in the form of a fully-grown larva between fallen leaves on the surface of the soil that turn into a pupae at the beginning of spring.

Materials and Methods

Insect Biology

From the beginning of the third month, visits were made weekly and sometimes every three days to the fig trees scattered in the homes to see the appearance of the insect for the first time. When we noticed the first group of eggs on the fresh leaves, we began to collect egg masses, where the paper was cut and placed in a glass bottle covered with a boring cloth and fixed with a rubber band after placing a piece of cotton moistened with water at the neck of the plant leaf to ensure that it does not dry out quickly, after that, the larval stages, pupal stage and the exit of the adult insects are followed and to ensure that the larvae do not die, new leaves are added daily whenever the leaves dry inside the bottle to ensure feeding of the larvae. These bottles were repeated five replications. Daily examinations of the plant leaves were carried out to observe the shapes of the eggs, the incubation period of the eggs, the shape of the larvae, the number of larval ages, the method of feeding the larvae, the shape of the pupa, the length of the period of the pupa stage, and the exit of adult insects from the pupal stage. The pupa were collected and placed in a cage, and when the adult insects came out, the females were transferred after each female mate in a cage of boredom containing a seedlings of figs that had been planted from the previous season to know the number of eggs laid by one female and the length of the female's life, a glass bottle was added with it 10% sugar solution, blocking the opening of the glass bottle with a piece of cotton to feed the adult insects, These bottles were repeated five replications to observe the longevity of the female, the number of eggs for each female.

Chemical Control

For the purpose of conducting chemical control, eggs laid on the fig leaf were collected in glass bottles in the same way above, taking into account the exchange of leaves with new fresh leaves to ensure the feeding of the larvae, when the larvae reached the third age, the larvae were collected to conduct chemical control in the laboratory to extract the value of the deadly concentration of 50% of individuals LC50. The pesticides below were used, Purchased from the local market.

- Malathion pesticide 50% is a concentrated emulsifier from the group of organ phosphorous pesticides;
- Davy-Coz pesticide is a group of synthetic pyrethroids;
- The carbamate group of phenam is a pesticide;
- Abamectin is a group of biocides.

The pesticides were diluted with water by five dilutions for each pesticide. Each concentration of the pesticide was placed in bottles for the purpose of conducting a dipping treatment of the larvae by 10 larvae for each concentration and repeated three times where the larvae are placed in a cloth of boredom in the form of a net and immersed in the required concentration for a period of 10 s and then transferred to dishes containing filter paper, leave the larvae to get rid of the excess pesticide and dry, then transfer the larvae to a fresh fig leaf inside a glass bottle covered with a cloth of boredom fixed with a rubber band and leave at room temperature to take the reading after 24 h of treatment. As for the control, the larvae are immersed in water only and left to dry, they are transferred to a glass bottle containing a fig leaf for feeding the larvae.

Oil treatment

Sesame oil was purchased from the local market, the production of Al-Emad plant for the production of vegetable oils, the previous experiment was repeated using sesame oil with chemical pesticides by mixing 1:1 sesame oil with each pesticide, and then diluting the pesticides with the same dilution ratios mentioned above by five dilutions of each pesticide with oil, the sesame was placed in glass bottles to treat the larvae in the same way of the treatment.

The readings were taken 24 h after the treatment, the results were recorded, and in the case of a control, the percentage of mortality is corrected according to the Abbott equation mentioned in Al-Mallah & Al-Joburi (2012). The results were statistically analyzed using the randomized complete block design, and the difference between the means was tested using Duncan's test at a probability level of 5% on the SAS ready statistical program according to Antar (2010).

Results and Discussion

Description of the insect

Fig Leaf Worm *Ocnerogyia amanda* Stgr. Family Lymantridae Insect is full of scale-wing order, brown in color tending to gray color. Wings are scaly, there is a mass of brown hair on both sides of the thorax, the female and the male are similar in shape, but the female can be distinguished from the male by the size of the male is smaller than the female and the end of the abdomen of the male is conical in shape. The end of the female abdomen is round, it is a type of nocturnal moth, which lays eggs at night in groups of 10–12, with an average of 10.75 eggs, a total of 30–95 eggs laid by the female, with an average of 56.37 eggs, throughout her lifespan, which ranges from 7–10 with an average of 7 days, and this is in contrast to what was mentioned by Ismail & Banan (2010 b) that one female lays 100–145 eggs throughout the female's life.

Eggs

The eggs are circular in shape, stick tightly to the fig leaf, with a low top compressed from the top and bottom. The incubation period for eggs lasts 7-10 days, with an average of 7.8 days. The eggs hatch into larvae (Figures 1 and 2, Table 1).

Fig. 1. Male and female

Fig. 2. Eggs deposid on a fig leaf

Larvae

A larvae with three pairs of thoracic legs, yellowish-brown color with thick and long hair that surrounds the entire body of the larva. It is noted on the dorsal edges brown spots on both sides of the ring, its mouth parts are of the chewing type of brown color. The larvae begin after they emerge from the egg shell by feeding on the skin of the plant leaf. On one side, especially the lower side of the leaf, leaving the skin on the upper side, where the feeding places appear silver because the larva cannot feed on both skins, especially in the first age, which took 2–3 days with an average of 2.37 days (Figure 3). The larvae molt to the second instar, which took 2–4 days with an average of 3.2 days (Figure 4), the injury or chewing part is limited in shape on the plant

Fig. 3. First age

Fig. 4. Second age

Fig. 5. Third age

Table 1. The periods of the different stages of the *Ocnerogyia amanda* Stgr.

Year	Incubation period/day	Larval stages/day					Pupa/day	Longevity/day	
		1st	2nd	3rd	4th	5th		Male	Female
2018–2019	5–10 (7.50)	2–3 (2.75)	3–4 (3.25)	4–6 (4.50)	5–7 (5.75)	5–7 (6.50)	12–16 (13.50)	3–7 (5.25)	5–10 (6.50)
2019–2020	7–10 (7.80)	2–3 (2.75)	2–4 (3.20)	4–6 (4.40)	5–6 (5.37)	5–7 (6.00)	10–15 (11.85)	2–6 (3.5)	5–10 (7.00)
Mean	7.65	2.75	3.23	4.45	5.56	6.25	12.68	4.38	6.75

leaves, and when the larva molts to the third instar, which took 4-6 days with an average of 4.4 days (Figure 5), the infection begins to intensify as it changes The color of the larvae is due to the density of the hair around the body, and the color of the larva becomes waxy due to the density of the hair strands (Ali et al., 2012).

The presence of larvae of this age can be inferred from the presence of skeletons skins and by the level of the chewing, which includes the two surfaces of the plant leaf, and from the abundance of excrement on the lower leaves, which is in the form of black-colored masses resembling crushed peppercorns, after which the larva molts to the fourth age, which takes 5–6 days with an average of 5.37 days (Figure 6), and then moult to the fifth instar, which takes 5–7 days with an average of 6 days (Figure 7), at this stage, the level of chewing in leaves increases to include all the plant leaf, leaving the veins only, The larvae move from leaf to leaf by walking, and sometimes they can go down, When the growth of the larvae of the fifth age (which takes 18–26 days) is completed, the larvae leave the leaves and fall to the soil looking for a place to be pupate, or it may be among the fallen and wrapped fig leaves or in the plant residues in the soil. It may climb the nearby walls and enter inside the house, due to the lack of air current and the warmth of the area, the larva pupate in the skin of the last molt, transforming into a obtect pupa inside a simple silky cocoon, where the pupa lasts 10-15 days with an average of 6 days (Figure 8), after which the adult insects emerge to repeat the life cycle (Table 1).

Fig. 6. Fourth age

Fig. 7. Fifth age larva

Fig. 8. Obtect pupa

Chemical Control

Through preliminary experiments conducted on larvae, it was found that the larvae of the third instar were more sensitive than the larvae of the fourth and fifth in stars. The reason may be due to the density of hair on the larvae of the fourth and fifth in stars, which leads to a reduction in the effect of the pesticide due to preventing it from reaching the body of the larva, which requires a longer period to immersion the larvae, the primary toxicity experiment showed that Malathion was the best effective pesticide with a value of LC50 0.0011 (Table 2), followed by davy coz and vinam with a

Table 2. Value of LC50 and the slop for the four pesticides alone and after mixing them with sesame oil on the third instar larvae of *O. amanda* Stgr.

Pesticides	Pesticides effect			Pesticides effect + Sesame oil			
	LC50	Toxicity Index	Slop	LC50	Toxicity Index	Slop	synergistic rate
Abamactin	0.0095 d	11.5	4.95	0.009 d	7.77	2.72	1.05
Malathion	0.0011 a	100	2.84	0.0007 a	100	2.88	1.57
Davy Koz	0.0038 b	28.9	3.94	0.0028 b	25	4.96	1.35
Vinam	0.0045 a b	24.4	2.2	0.0034 ab	20.5	1.77	1.32

value of LC50 0.0038 and 0.004, respectively, the same was true for the values of the slope of the toxicity line, which was 4.94 for abamectin, due to the low sensitivity of the larvae to the pesticide, and it was 2.84 to 2.2 for each of the pesticides Malathion and davy coz respectively, which indicates the sensitivity of the larvae to the above two pesticides. When adding oil, the LC50 values decreased significantly, especially for Malathion from 0.001 to 0.0007 because sesame oil led to activation of the pesticide with an activation rate of 1.57, as well as for davy koz and vinam with an activation rate of 1.35 and 1.32, respectively.

While it had no effect on the pesticide abamectin, and this result is in agreement with what Muhammed (2008) stated that sesame oil was the best activating oil in the pesticides used to control the southern cowpea beetle.

Conclusion

Similar letters in the same column have no significant differences between them according to Duncan's multiple test at 5% probability level.

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