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ORIGINAL ARTICLE

TEST OF THE CHEMICAL PESTICIDES EFFECT AND SOME BIOLOGICAL AGENTS IN THE CONTROL OF WHITE FLY NYMPHS, *BEMISIA TABACI* (GENN) ON EGGPLANT

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Abstract: The study aimed to evaluate the effect of the pesticides Avaunt, Biotech ,Actara , Acetampride and Sulfur, and some biological agents as *Bacillus thuringiensis* and *Metarhizum anisopliae* and *Trichoderma harzianum* on the percentage of mortality of nymphs *Bemisia tabaci* (Genn) in the Plant Protection Department and the fields of the Agricultural Research Station of the College of Agriculture, University of Basrah. The laboratory results showed the highest percentage of mortality of 100% in the treatment of all pesticides except sulfur after 72 hours of treatment. The study showed an increase in the percentage of mortality of all the pesticides above when the exposure period increased and the rate of impact of the exposure period in the percentage of depreciation 45.51, 56.61, 88.27% during 24, 48, 72 hours, respectively. Furthermore, the highest pesticide impact of Acetampride, the rate of its impact on the percentage mortality of 82.22%. The best biological agents were the treatment with the fungi exudates of *M. anisopliae*, where the percentage of mortality was 53.71%, followed by the effect of bacteria and its effect was 40.60% at the field trials, the pesticide Acetampride the average efficiency of the pesticide was 75.04%. The use of fungi exudates increased the percentage of mortality to reach 41.19%. The increased concentration has increased the percentage rate 25.51, 32.23, 40.63%, respectively. The use of fungi exudates increased the percentage of mortality to reach 41.19%. The increased concentration has increased the percentage rate 25.51, 32.23, 40.63%, respectively.

***Key words*:** Pesticides, White fly, Nymphs *Bemisia tabaci*, Bioagent.

Cite this article

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1. Introduction

All species of whitefly consider one of the most dangerous economic insects harmful to the crops worldwide, despite its small size. However, it is incredibly harmful and hazardous as it multiplies in huge numbers up to thousands of individuals and absorbs plant sap, leading to the weakening of its plant families in addition to the transmission of many viral diseases [Hilje *et al*. (2001), Mishra *et al*. (2014)].

There are 1156 species of Aleyrodidae family of flies belonging to 126 genres spread in the world. It was observed that the whitefly, *Bemisia tabaci* (Genn) affects cotton, tomato, pepper, cucumber, eggplant, beans. Sesame, grape, yellow watermelon, red melon, beetroot, tobacco, potato, pumpkin, zucchini, and many ornamental plants and have several generations in a year according to temperatures [Evans (2007)]. Nicotine pesticides were used to control four types of insect pests, *Thrips tabaci*, *Aphis gossypii* and *Empoasca* spp. *Bemisia tabaci* reduced its numbers by 100% [Zidan (2012)]. Pesticides of Imidacloprid, Thiomethoxam, and Acetamapride were used to control whitefly on the cotton plant. However, using pesticides, actara and acetambride reduced the population density of the insect [Abbas *et al*. (2012), Aslam *et al*. (2012)]. Avaunt was used against whitefly nymphs, which reduced the insect population density from 7.51 to 1.01 after 14 days of treatment [Patel *et al*. (2014)]. In the

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field of biological control, the fungus *M. anisopliae* was used against the whitefly nymphs and gave a mortality rate of 28.7% and its effect on the adult insects 98.72% during 14 days of treatment [Antonio *et al*. (2012), Borisade (2015)]. Al-Darraji *et al*. (2018) indicated the efficacy of *T. harzianum* against the crawling nymph with 66.62% mortality after nine days of treatment with the commercial preparation of the fungus at a concentration of 14 × 10 spores/g. In order to obtain better control of whitefly on eggplant, this study aimed to characterize the effect of the use of chemical pesticides and some biological agents on the percentage of mortality of nymphs.

Pesticides	Concentration used in experiments	Active material
Avaunt	20mL/100L water	Indoxcarb 150 g/L Avaunt Oxadiazine
Biotech	50 mL/100 L water	Oxymatrine6% + Abamctine5%
Upson247sc	40mL/100L water	Thiamethoxam 141g+ lamba cyhalothrin 106g
Acetampride	75mL/100L water	Acetampride
Sulfur	0.5, 0.25, 0.125 g /plant leaf	Element, it is an inorganic pesticide

1.1 Preparation of pesticides

The following chemical pesticides: Avaunt, Biotech, Actara, Astembrid and sulfur were used in the control of whitefly nymphs, which belong to different chemical groups, as shown in this table below:

1.2 The bioagents

The isolation of the fungus *M. anisopolia* was obtained from the Applied Research Department, Baghdad and the isolation of the fungus *T. harzianum* from the postgraduate laboratories, Department of Plant Protection, University of Basra.

1.3 Preparation of the fungi suspension

The liquid culture medium of PDB was prepared and poured in 500 ml glass flasks. Then the medium was sterilized in the autoclave at a temperature of 121°C and pressed 15 pounds/square for 30 minutes. The medium cooled and then took a bulge from the ends of the fungus culture at the age of 7 days. After that, all the glass flasks were inoculated and incubated for two weeks. After 28 days, the broth was filtered using filter papers 0.45 mM. The supernatant was exposed to further filter using an electric discharge device to obtain the raw fungal filtrate of the fungi at a concentration of 100% separately. Sterile distilled water was added to the raw filtrate to obtain the 50 and 25% concentrations used in subsequent experiments.

1.4 *B. thuringiensis* strain preparation

B. thuringiensis strain was obtained from Prof. Dr. Hossam El-Din Abdullah Muhammad, Department of Plant Protection, The University of Baghdad, which is a ready-made biocide in the form of a powder. The concentrations of 0.5, 1 and 2 g of biocide were prepared in 500 ml sterile distilled water.

1.5 Samples collection

The study was carried out at the Agricultural Research Station, College of Agriculture, Basra University, Karmat Ali in a plastic house planted with *Solanum melongena* L. Eggplant, which belongs to the Solanaceae family. When the population density of the nymphs reached 27 insects/vegetable leaves, the leaves were collected randomly from the greenhouse by cutting the leaves and putting them in polyethylene bags and transporting them to the laboratory. The bags were labelled and examined under a direct dissecting microscope for further experiments.

1.6 Test of the effect of chemical pesticides and some biological agents on the percentage of mortality of whitefly nymphs in laboratory

The leaves of the eggplant plant were taken randomly from the greenhouse and distributed on sterile Petri dishes containing a cotton swab moistened with water covered by filter paper to prevent drying of the leaves. One plant leaf was placed in each container contain ten nymphs as a soft brush removed the other nymphs. The leaves were sprayed by the pesticides using the recommended concentration for each pesticide (Table 1) and at a rate of three replicates for each pesticide separately, using a sterile medical syringe at the rate of 1 ml for each repeater. Experimenting with biological factors: *B. thuringiensis* bacteria were used in concentrations of 0.5, 1 and 2 g per 500 ml distilled water. The fungi suspension was used separately at a concentration of 25, 50 and 100% each. The control treatment, the plant leaves were sprayed with distilled water only, and the number of dead whitefly nymphs were calculated. The mortality of nymphs was calculated after 24, 48 and 72 hours of spraying. The

mortality percentages were corrected according to the Orell and Schneider equation [Shaban and Al-Mallah (1993)] according to the following equation:

$$\text{The corrected mortality percentages} = \frac{A - B}{100 - B} \times 100\%$$

A = The mortality percentage of treatment

B = The mortality percentage of control treatment

1.7 Effect of chemical pesticides and some biological agents on the percentage of mortality of whitefly nymphs in the field

The plants were sprayed with pesticides inside the greenhouse at a rate of three replicates using the recommended concentration and for each pesticide separately using a hand sprayer with a constant pressure of 2.5 litres. The treatment of bacteria, the plants were sprayed by *B. thuringiensis* at a concentration of 0.5, 1, and 2 g per 500 ml distilled water. The fungi suspension was used separately at a concentration of 25, 50 and 100% each. The control treatment, sprayed with distilled water only. The population density of the nymphs was calculated after 1, 2, 3 and 7 days of treatment according to the Henderson and Tilton equation mentioned in Shaaban and Al-Mallah (1993)

$$\text{Relative efficiency} = = \left(1 - \frac{A \times C}{B \times D}\right) \times 100$$

where, A = Number of the individuals of the pest after treatment

B = Number of the individuals of the pest before treatment

C = Number of the individuals of the pest in control before treatment

D = Number of the individuals of the pest in control after treatment

1.8 Statistical analysis

The laboratory experiments were carried out according to the complete random design as two-factor and three-factor experiments. The field experiments were carried out according to the design of random block as factorial experiments and averages were compared according to the method of the least significant difference and under the probability level of 0.01 and 0.05 using the SPSS program.

2. Results and Discussion

2.1 Effect of chemical pesticides and some biological agents on the percentage of mortality of whitefly nymphs in the in laboratory

The results in Table 1 indicated that the type of pesticide and the exposure period had a significant effect on the percentage of the mortality of whitefly nymphs. The lowest mortality of nymphs was 20.68, 28.96 and 41.37% after 24, 48 and 72 hours in treatment with sulfur and with a significant difference from the control treatment. The highest mortality was 100% when treated with Biotech, Avaunt, Actara and Acetampride after 72 hours of the treatment. The Acetampride is the superior insecticide that affects the mortality rate of the whitefly because this pesticide has systemic effects that affect the nervous system by closing the neural network in insects. The lowest effect was 30.33 when used Sulfur as shown in Table 1. The results showed that there was a highly significant difference between all the treatments and control treatment. The reason behind the percentage of the mortality may be due to the effect of the pesticides through body contact

Table 1: The effect of pesticides on the corrected percentage for the mortality of whitefly nymphs in laboratory.

Pesticides	Mortality percentage of nymphs/ hour			Pesticide effect rate
	72	48	24	
Avaunt	58.62	75.85	100	78.15
Biotech	31.03	40.34	100	57.12
Actara	51.72	58.62	100	70.11
Acetampride	65.51	79.31	100	81.60
Sulfur	20.68	28.96	41.37	30.33
Control	3.33	3.33	3.33	3.33
Days effect rate	45.51	56.61	88.27	

RLSD of the influence of pesticides in mortality % = 3.23, the effect of time on % of mortality = 4.55 of the effect of interference in% of mortality = 2.54.

of the insect's then through the hemolymph affect the digestive system and the central nervous system in insects led to the paralysis of the insects and then their death by affecting acetylcholine. Sulfur effect by disturbing the water content of the insect's body as it scratches the cutical and is considered a physical way to kill the insect. The acaricide is a systemic pesticide that is characterized by its ability to transfer and absorb into the plant [Awwad *et al*. (2002)]. The results of Table 2 showed the superiority of the *M. anisopolia* suspension over the rest of the treatments, which give an average 53.71. The percentage of mortality was 100% when using the fungus suspension with a concentration of 100% after 72 hours of treatment. The exposure period and concentration had a significant effect, led to increasing the percentage of mortality. Reyad (2017) indicated that the fungus *M. anisopliae* caused a mortality rate of 70% after a week of laboratory treatment, while the mortality rate was 63.0% after three days of field treatment. The effect of *M. anisopliae* suspension is due to these fungi enter the insect's body by penetrating the epicuticle and this requires appropriate conditions of temperature and humidity. When the fungus enters the physical void, as it begins to attack the tissues and fill the body cavity with growths of mycelium. Then, it sends the conidia that enable the fungus to penetrate the body of the host. When the insect becomes infected with this fungus, it dries, dies, becomes mummy and is often covered with the fungus mycelium [Al-Bashir and Al-Ashkar (2011)]. The *T. harzianum* fungus is one of the essential fungi that is considered as a vital control factor. It rapidly

Table 2: The effect of bio treatments on the corrected mortality percentage of nymphs in laboratory.

Treatments	Concentration	Mortality percentage of nymphs/ hour			Effect of treatment	Effect of conc
		24	48	72		
B. thuringiensis	0.5 glL	3.44	24.13	51.72	40.60	29.22
	1 g	6.89	41.37	72.41		40.68
	2 g	34.47	48.27	82.75		52.48
M. anisopliae	*25%*	10.34	34.47	86.20	53.71	
	50%	27.58	48.27	79.99		
	100%	24.13	72.41	100		
T.harzianum	*25%*	1.03	20.68	31.03	28.07	
	50%	13.78	20.68	55.16		
	100%	17.24	34.47	58.62		
Control		3.33	3.33	3.33		
Effect of time		15.43	38.30	68.65		

RLSD of the influence of pesticides in mortality % = 6.03, the effect of time on% of mortality= 4.34, of the effect of interference in% of mortality= 8.66.
0.01The effect of interaction between treatments, time, and concentrations, in% of mortality = 7.46

Table 3: Effect of the pesticides on the mortality of nymphs in the field.

Pesticides	Mortality percentage of nymphs/ hour				The relative efficiency of pesticides
	1 day	2 day	3 day	7 day	
Avaunt	52.68	69.67	83.17	85.47	72.75
Biotech	32.11	35.76	56.04	61.89	46.45
Actara	47.59	52.56	74.39	80.71	64.06
Acetampride	52.95	72.21	81.72	89.30	75.04
Sulfur	14.30	18.42	25.22	32.61	22.64
Impact rate of the days	39.93	49.92	64.91	70.00	

RLSD of the influence of pesticides in mortality % =2.91 effect of time on% of mortality = 4.34, of the effect of interference in% of mortality = 5.52.

Table 4: Effect of the bio agents on the mortality of nymphs in the field.

Treatments	Concentration	Mortality percentage of nymphs/ hour				Effect of treatment	Effect of conc
		1	2	3	7		
B. thuringiensis	0.5 glL	7.21	20.90	30.25	31.69	31.76	25.51
	1 g	8.07	31.51	41.84	39.00		32.23
	2 g	22.80	35.23	54.24	59.38		40.63
M. anisopliae	*25%*	11.95	22.38	34.63	64.08	41.19	
	50%	14.96	22.79	56.17	72.01		
	100%	16.74	35.75	61.98	80.82		
T. harzianum	*25%*	3.00	14.13	31.78	34.11	25.42	
	50%	6.19	20.08	36.72	37.45		
	100%	8.51	30.37	39.71	42.98		
Effect of time		10.94	25.90	43.04	51.28		

RLSD of the influence of treatments in mortality % = 2.48, the effect of time on % of mortality = 0.05. The effect of interaction between treatments, time and concentrations in % of mortality = 4.97.

grows and has a high potential for secondary metabolism and is associated with producing degradative enzymes, including Chitinase.

2.2 Effect of chemical pesticides and some biological agents on the percentage of mortality of whitefly nymphs in the field

The results in Table 3 showed the effect of pesticides on the percentage of mortality of whitefly nymphs, and that the superior pesticide was Acetampride with mortality percentage reached 75.04%. The lower effective pesticides were the sulfur, with the relative efficiency of 22.64% and the results showed a significant effect and effectiveness of the pesticides compared to the control treatment. The effect of pesticides may be due to killing insects or preventing them from feeding on plants treated with these pesticides. The pesticides affected the digestive system of the insect. Acetampride is a highly permeable systemic pesticide. The pesticides work through contact and intestinal poisoning. The Avaunt is a dangerous and contacting pesticide that affects various insect pests. Actara has the capability to penetrate the plant through the leaves and roots. It has high efficiency and rapid inhibition of intestinal insect feeding, penetrates the plant tissues and remains for a long time leading to the eradication of the pest. Sulfur affects by disturbing the water content of the insect's body. It damages the cuticle, the water quickly evaporates from the insect's body then dies, and it is known that it increases the vegetative system and improves plant growth [Kazem (2016)]. The results in Table 4 showed that the biological treatments, concentrations and exposure period had a different effect on the percentage of nymphs mortality. The suspension of *M. anisopliae* give 41.19% effectiveness rate and the percentage of mortality increased with increasing concentration and the effect of concentrations reached 25.51, 32.23 and 40.63%, respectively. The average duration of exposure was 10.94, 25.90, 43.04 and 51.28% after 1, 2, 3 and 7 days of treatment, respectively. The increase in the percentage of mortality rate could be due to the increased exposure to the active substances contained by the suspension of the bacteria and fungi were used [Al-Madhidi and Al-Rubaie (2000)].

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