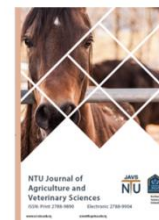




P-ISSN: 2788-9890 E-ISSN: 2788-9904

NTU Journal of Agricultural and Veterinary Sciences

Available online at: <https://journals.ntu.edu.iq/index.php/NTU-JAVS/index>



The Effect of Host Plant and Treatment with Growth Regulators Salicylic Acid and Paclobetrazole on the Adults Density of Tobacco Whitefly *Bemisia Tabac*

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Article Informations

Received: 12-07- 2023,
Accepted: 06-08-2023,
Published online: 18-10-2023

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Key Words:

PGR, Tobacco whitefly ,
reduction rates ,
paclobetrazole , salicylic acid

ABSTRACT

The results of using yellow traps in catching the adults of tobacco whitefly showed a difference in the numbers caught because of the different crops in which they are found. Where the traps between eggplant plants were better in catching larger numbers of Adults than those placed between the tomato and pepper plants, and the traps placed between the lines of the tomato plant were better than their counterparts between the pepper plants. The averages were 4.17, 5.28 and 2.54 Adult /cm² respectively . Adults numbers of tobacco whitefly also decreased with the use of paclobetrazole and salicylic acid to reach reduction rates of 26.30 and 23.59%, respectively.



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Introduction

In recent years, many studies and scientific research have appeared on the induction of resistance in plants against pathogens through the use of plant growth regulators, but the studies related to the induction of systemic resistance in plants against insects are still few in this aspect. Plant growth regulators are organic substances that are naturally produced in plants, control growth or other physiological functions at a location far from where they are produced and are activated in small amounts [1]. Some scientific research literature indicated the important role played by salicylic acid in enhancing the acquired systemic resistance (ASR) within plants against insects, and in increasing the effectiveness of insecticides, through the production of secondary metabolic compounds such as phenols, alkaloids and other compounds that are toxic to insects inside the plant [2]. Salicylic acid is involved in many physiological processes such as growth, photosynthesis, cellular metabolism, protein synthesis, as well as the closure of stomata and gas exchange, in addition to its role in strengthening the plant defense system against various diseases and insects and increasing the effectiveness of antioxidants, oxidation and enzymes, and is also important in the absorption and transport of nutrients within the plant [3]. Paclobutrazol belongs to the group of triazoles and is one of the effective growth retardants at low concentrations. It is a polycyclic nitrogen-containing chemical. Its chemical formula is $(C_{15}H_{20}N_3O)$ [4]. Some studies have indicated that paclobutrazole can enhance plant resistance to insect pests [5], [6], pathogens [7], [8], [9], [10], and water stress [11]. Approximately 1560 species of white flies have been described in the world, but the numbers recorded in the Arab world are modest numbers that do not exceed 27 species [12]. *Bemisia tabaci* is the most important of these species that invade many plants of the Solanaceae family. The current study aimed at knowing the nutritional preference of tobacco white fly on tomato, eggplant and pepper plants, and proving the role of some plant growth regulators in enhancing plant resistance against insects by reducing the population density of the white-fly which is detected by yellow sticky traps.

Materials & Methods :

The field experiment was carried out in one of the greenhouses of the Plant Protection Department / College of Agriculture and Forestry/ University of Mosul for the fall agricultural season 2021-2022 to study the food preference of the tobacco white fly, *Bemisia tabaci*, on some Solanaceae Plants (viz. tomatoes, eggplants, peppers) and the effect of treatment with plant growth regulators (Salicylic acid and Paclobutrazol) at a concentration of 200

ppm in the rates of infection of the three hosts with adults of the tobacco whitefly. Small seedlings (seedlings with three leaves) of tomato, eggplant and pepper plants were grown in 5 kg anvils, at the rate of 60 anvils for each of the three families, after sterilizing the soil with oxy (Active oxygen, Ethane peroxy Acid) . By inserting cucumber seedlings infected with the insect inside the plastic house and placing them at an equal distance from the three families, leaving the freedom for the adults to spread over the planted seedlings in a random, unbiased manner.

The factorial experiment was applied with two variable factors: i.e. the first being the types of plant hosts (tomatoes, eggplants and peppers) and the second factor being two types of plant growth regulators (Salicylic acid and Paclobutrazol) in addition to the comparison treatment. A plant host, and the number of experimental units for the experiment was 180. The plants were sprayed each according to its treatment with growth regulators at a rate of two sprays. The first was on 29/6/2022 and the second was on 1/8/2022, while the comparison treatments were sprayed with distilled water only.

To estimate the number of adults, yellow adhesive traps measuring were installed with three traps for each transaction, making the number of traps 27 for the experiment, and the reading was taken twenty days after the date of spraying. The numbers of insect adults for each trap were calculated using a manual magnifying glass and the numbers of adult / cm^2 were calculated using the following equation:

$$\text{Number of adults per } cm^2 = \frac{\text{number of adults in the trap}}{\text{area of the trap}}$$

The correlation among the numbers of adults with some phenotypic and chemical traits (viz. the proportion of carotene, chlorophyll, phenols, thickness and number of hairs in the leaves) of plants was also studied in all experimental parameters after they were measured and analyzed in the central laboratory in the case of significant differences based on ANOVA and F-values for treatment effects LSD ($p < 0.05$) test to identify significant means. Correlation analysis was conducted to investigate the relationship among the study trait using Genstat.

Results & Discussion :

Effect of Host Plant on the Number of Adults Caught by Yellow Traps:

The results of using yellow traps to catch Adult of tobacco whitefly showed a variation in the numbers caught due to the different crops in which they were present. Where the traps located among eggplant plants were superior in catching larger numbers of adults than those placed among tomato and pepper plants. The traps placed among tomato plants were

superior to those placed among pepper plants. The averages were 5.28, 4.17 and 2.54 Adult / cm² respectively as shown in Table (1).

The dark green color of pepper plants resulting from the high content of carotene and chlorophyll of both types may be a reason for not favoring pepper plants. [11] showed that adults of white flies, in general, were attracted to long-wavelength colors, while short-wave, near-ultraviolet radiation was an insect repellent. The results showed a highly significant correlation between carotene and chlorophyll A and B with the numbers of adults, as the values were -0.77**, -0.92***, 0.93***- respectively. There was also a significant positive correlation with the number of hairs on the leaves, with a value of 0.72**, and a highly significant negative correlation with the pH, with a value of -0.91*** (see Table No. 2)

[13] reported on their study of the whitefly's selection of the plant host and its impact on some vital parameters such as nutrition, development, growth and survival on plants (i.e. eggplant, tomato, cucumber, pepper), where the highest percentage of survival from eggs to adults for the entire population was on eggplant (80-98%), and the lowest was on pepper (0-20%).

The Influence of Plant Growth Regulators in the Entire Population of the Tobacco Whitefly *Bemisia Tabaci* :

The results of the experiment showed the difference in the effect of plant growth regulator paclopetrazole and salicylic acid in the numerical density of the whitefly attracted to yellow traps , where the use of the growth regulator paclopetrazol reduced the numerical density of the whitefly insect to the lowest level, followed by the growth regulator salicylic acid and then the control . The rates were 3.53, 3.66 and 4.79 adult/ cm² respectively. There were no significant differences between paclopetrazol and salicylic acid at the probability level of 0.05, while both exceeded the control treatment with obvious significant differences, as shown in Table No. (3), and the numerical density reduction ratios reached 26.30% when treating paclopetrazol and 23.59% when treating salicylic acid, (seeTable No. (3)).

mentioned by [14] where they pointed to the high efficiency of salicylic acid in reducing the numerical density of the whitefly using concentrations of 0.5, 0.75 and 1 mmol L⁻¹ the ratios of reducing the numerical density .The results also agreed with [15] , that the effect of salicylic (SA) spraying at concentrations of 0,50, 100,200 mg L⁻¹ led to a decrease in aphid communities and their colonies on flowers , and the concentration of 50 mg L⁻¹ exceeded the other concentrations in reducing aphid numbers .

As for the growth regulator paclopetrazol, the results agreed with [5] , where spraying pear trees

with paclopetrazol and chlormiquat chloride reduced the numerical density of pear rust mites (*Epirimerus piri*) by 60% compared with non-sprayed trees, and the numerical density of pear pycella (*Cacopsylla pyricola*) on the treated trees was with paclopetrazol about half of those found in untreated trees. The results also agreed with[6] .The use of the highest rate of growth regulator paclopetrazol led to slower growth and a lower survival rate for the early ages of the insect compared with the comparison coefficients .

The Effect of the Date of Spraying Plant Growth Regulators in the Entire Population of Tobacco Whitefly *Bemisia Tabaci* :

The effects of plant growth regulators vary depending on the timing of spraying during the different age stages of the plant . The study showed that spraying plants with growth regulators, when the third, fourth and fifth real leaves appeared, led to a reduction in the numerical density of the adults by 20.80 % . On the contrary, when the plants were sprayed with the second spray on the period just before flowering, it led to a reduction in the numerical density by 29.54 % . The average number of completions after the first spray was 3.96 adult / cm², while the average number of completions after the second spray was 3.22 adult / cm² . The effects of plant growth regulators vary depending on the timing of spraying during the different age stages of the plant . The study showed that the date of the first spraying led to a reduction in the numerical density of adult 20.80 % ; while the second spraying date led to a reduction in the numerical density of 29.54% .

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Table 1. effect of host plant and plant growth regulator on the numbers of adults of tobacco white fly *Bemisia tabaci*.

Host plant	Spray date	PGR	Adults numbers adult/cm ²	average plant(cv)	average PGR	average spraying time
Tomato	First	Paclopetrazol	4.98	4.17	Paclopetrazol	First
		Salisylic acid	4.63			
		Control.	5.52			
	Second	Paclopetrazol	2.96			
		Salisylic acid	3.14			
		Control.	3.76			
Eggplant	First	Paclopetrazol	4.99	5.28	Salisylic acid	Second
		Salisylic acid	5.94			
		Control.	6.71			
	Second	Paclopetrazol	4.18			
		Salisylic acid	4.19			
		Control.	5.66			
Pepper	First	Paclopetrazol	1.51	2.54	Control.	
		Salisylic acid	1.74			
		Control.	2.77			
	Second	Paclopetrazol	2.57			
		Salisylic acid	2.31			
		Control.	4.30			

Table 2. correlation relationship between the preparation of adults and some phenotypic and chemical characteristics of plants

	Carotene	Chlorophyll A	Chlorophyll B	The number of hairs on the leaves	PH	Phenol	Plant leaf thickness
Adults	-0.77 **	-0.92***	-0.93***	0.72**	-0.91***	-0.56	-0.24

Table 3. Reduction rates in the preparation of adults as a result of treatment with plant growth regulators

PGR	Preparation of adults whitefly / cm ²		Reduction ratio
	Range	Average	
Paclopetrazol	1.51-4.99	3.53	26.30
Salisylic acid	1.74 -5.94	3.66	23.59
Control.	2.77-6.71	4.79	

Table 4. Reduction rates in the preparation of adults due to the effect of the timing of treatment with plant growth regulators.

Spray date	Preparation of adults whitefly / cm ²		Reduction ratio
	Range	Average	
First spraying	5.94 1.51-	3.96	20.80
Control.1	6.71 - 2.77	5	
Second spraying	4.19 - 2.31	3.22	29.54
Control.2	- 5.66 3.76	4.57	