Population assessment of whitefly (*Bemisia tabaci* (Genn.)) for ten tomato genotypes

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Abstract: The field tests were conducted during the The field tests were carried out during the 2021-2022 growing season. The experiment was designed in a randomized complete block design (RCBD). Ten tomato genotypes were tested to determine their tolerance or sensitivity to whitefly insect infection and the extent of the insect's nutritional preference for any cultivated genetic structure, as the whitefly insect destroys tomato production in Iraq by absorbing plant juices and transmitting viruses, including the Tomato yellow leaf curl virus (TYLCV), which is a major problem for tomato production in Iraq. In terms of plant height, the Camry F1 genotype had the lowest decrease in chlorophyll percentage, the Faten F1 genotype had the highest, while the Romeo F1 genotype had the lowest productivity among the tested genotypes. The genotype for the number of adult whiteflies was Star F1. The least preferred and most appealing to the insects' adults**.**

Keywords: *Bemisia tabaci***;** Genotypes; Tomato; Tolerance; % Decrease.

Introduction

Tomato (*Solanum lycopersicum* L.) is one of the most widely consumed vegetables, Value of Gross Production 102,622,543 US$ and yield 369798 hg/ha (United Nations Food and Agriculture Organization (FAO 2020) statistics; http://faostat.fao.org). The tomato goes back to its wild origins found in the Andes, Peru, and Ecuador in western South America, and from there it moved to Mexico in 1529, spread to European countries, and from there to Germany, Holland, and Italy (Gerszberg *et al.*, 2015). are quite nutritious. They include minerals such as calcium, iron, and phosphorus, as well as vitamins A and C, as well as dietary fiber, protein, carotenoids, lycopene, polyphenols, citric acid, and sugars (Ssekyewa, 2006). In Iraq, the area planted with tomato crops in 2018 was around 17,421 hectares, with a productivity rate of 133,430 tons (Central Statistical Organization, 2022). Whiteflies *Bemisia tabaci* (Genn.) (Hemiptera: Aleyrodidae) have long been understood as an economically valuable insect problem globally (Binkmoenen and Mound, 1990). This insect has a high rate of fecundity and fertility, is polyphagous, and lives in temperate, subtropical, and tropical regions(Carrière *et al.*, 2017). So the whitefly has a broad host range, Crops such as cotton, beans, squash, melon, and tomato may act as alternate hosts for B. tabaci infesting soybean crops (Li *et al.*, 2011). The whitefly causes several problems in Iraqi crops, and the insect may cause direct damage by sucking phloem sap. Indirect damage is linked to the excretion of honeydew and transmits a lot of viruses (Karem *et al.*, 2016). One of the methods used to control the whitefly is the use of genotypes from plants that are susceptible to whitefly infestation (Mansour *et al.*, 2012). This study aimed to find out the susceptibility of the genotypes available in the market and their ability to withstand whitefly infestation and to recommend their cultivation.

Materials and methods

2.1 Experimental design

The field tests were conducted during the growing season of 2021–2022. The experiment was designed in randomized complete block design (RCBD). The ten genotypes under study were planted in Table (1), in plastic pots of 20 * 24 cm. With 10 plants of each genotype, the plants were divided into two groups, the first group (A) and the second group (B), each group containing five plants of each genotype.

Group (A) was placed in a greenhouse with the doors closed and an anti-insect screen to prevent insects from entering, while the other plant group (B) was placed in another greenhouse under the same conditions as the first greenhouse.

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When the tomato plants reached the age of six true leaves, the whitefly was released on the plants (Group A) at a rate of 10 insects per plant, and the insects were left with the plants until the end of the experiment, while the group B was left without insects.

Table 1: Experimental genotypes information.

Seq.	genotypes	Producing Company	Country
1	Faten F1	Huizer	Netherland
2	Rahaf F1	Jarmo Seeds	USA
3	Camry F1	Jarmo Seeds	USA
4	Tala F1	Fito	Spain
5	Star F1	Horton Seed	USA
6	Dragon F1	Shine Brand Seeds	India
7	Heemsohna F1	Syngenta Seeds	Switzerland
8	Sahara F1	Ashoka Seeds	India
9	Romeo F1	Siam Best Seeds	India
10	Suraj F1	Chia Tai Seeds	India

2.2 Rearing Insect Whitefly

The insects employed in the experiments were reared on eggplant plants for one month prior to the starting of the research in cages measuring 50×100 cm at the bottom and 100 cm in height and covered by an anti-insect screen.

2.3 Whitefly population trend estimated using different tomato genotypes

2.3.1 Mean number of eggs and adults:

The number of eggs and adults was estimated by collecting three leaves from different heights of the plant and dividing the total by the number of plants in each duplicate.

2.3.2 Adjectives were studied in the tomato plant.

Height (cm): The plant's height was measured in cm from the ground to the tip of the longest stem of five plants, and a mean value was derived. measured at 120 days after planting..

Indirect chlorophyll content (SPAD): Each plant's chlorophyll content was measured using a SPAD meter, and each plant was tested 70 days following sowing.

Yield per plant (gm.): From the beginning through the conclusion of the season, yields were estimated in grams.

% decrease: (Farina *et al.*, 2022).

$$\% \text{ decrease} = \frac{\text{Value of uninfested plants - Value of infested plants}}{\text{Value of uninfested plants}}$$

2.4 Statistical analysis

The experiment followed a randomized complete block design (RCBD). GenStat Version 18 was used to do a statistical analysis of the data (LSD, 0.05)**.**

Results and discussion

The results shown in Table (2) show that the number of adults of whitefly insects was the highest during the 60 days, then the genotype Suraj F1 gave an average of 11 insects per leaf, which did not differ significantly from the Sahra F1 genotype, which gave an average of 10.33 insects per leaf, and the Star F1 genotype gave the lowest rate of 5.67 insects per leaf. while the genotypes vary in terms of the number of whitefly insects and the time of year Anu *et al.*, 2020

Table 2: Number of adult whiteflies according to periods, per tomato genotype

genotypes	Number of adult whiteflies (insects/ leaf)			average
	30 day	60 day	90 day	
Faten F1	3.00	7.00	3.67	4.56
Rahaf F1	5.00	8.67	4.00	5.89
Camry F1	4.00	8.00	5.33	5.78
Tala F1	4.33	10.00	3.67	6.00
Star F1	3.33	5.67	2.33	3.78
Dragon F1	2.67	8.00	3.33	4.67
Heemsohna F1	2.00	8.33	4.00	4.78
SAHARA F1	1.67	10.33	4.00	5.33
Romeo F1	3.00	6.00	2.00	3.67
Suraj F1	4.00	11.00	3.00	6.00
average	3.30	8.30	3.53	
LSD $_{(0.05)}$	**genotypes**	**time**	**intersection**	
	0.8893	**0.4871**	**1.5403**	

It is evident from the results of the number of whitefly eggs that it increased for a period of 30 days, reached its highest rate after 60 days, and then gradually decreased (Table 3). We also find that the number of eggs reached the highest rate for the Sahara F1 genotype at a rate of 33 eggs per leaf, followed by the composition Heemsohna F1 genotype at 28.67 eggs per leaf. while the Romeo F1 genotype gave the lowest average of 11.33 eggs per leaf in the 60-day period. These findings are consistent with the findings Neiva *et al.*, 2019.

Table 3: Number of egg whiteflies according to periods, per tomato genotype

genotypes	Number of egg whiteflies (egg/ leaf)			average
	30 day	60 day	90 day	
Faten F1	12.00	16.33	10.33	12.89
Rahaf F1	9.00	14.33	11.33	11.56
Camry F1	11.67	15.33	13.00	13.33
Tala F1	16.00	20.00	15.33	17.11
Star F1	20.67	22.67	17.00	20.11
Dragon F1	9.00	13.67	8.33	10.33
Heemsohna F1	23.67	28.67	19.67	24.00
SAHARA F1	25.33	33.00	21.67	26.67
Romeo F1	10.67	11.33	9.33	10.44
Suraj F1	9.67	16.67	12.67	13.00
average	14.77	19.20	13.87	
LSD $_{(0.05)}$	**genotypes**	**time**	**intersection**	
	1.538	**0.843**	**2.665**	

The length of tomato plants indicated that the Romeo F1 genotype had the longest length (145.17 cm), which differed significantly from the other genotypes tested. It was followed by the Camry F1 genotype, which assessed 123.17 cm, and the faten F1 genotype, which evaluated 88.75 cm. (Fig. 1).

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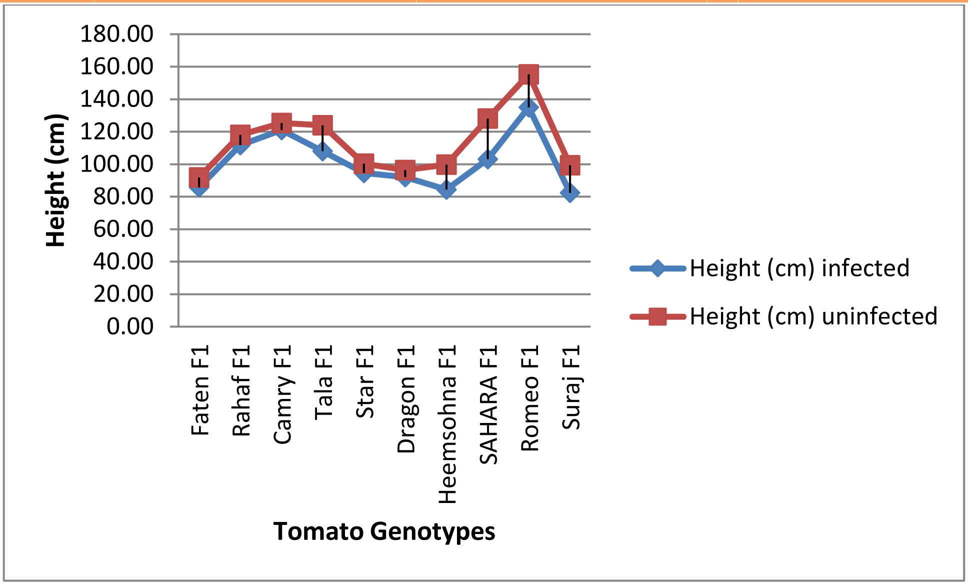

Figure 1: Whitefly insect impact on tomato plant height

The Rahaf F1 genotype had the highest chlorophyll concentration of 49.92 SPAD, followed by the Star F1 and Suraj F1 genotypes, each of which had 48.83 SPAD, and the Tala F1 genotype had the lowest concentration of 39.92 SPAD. (Fig. 2).

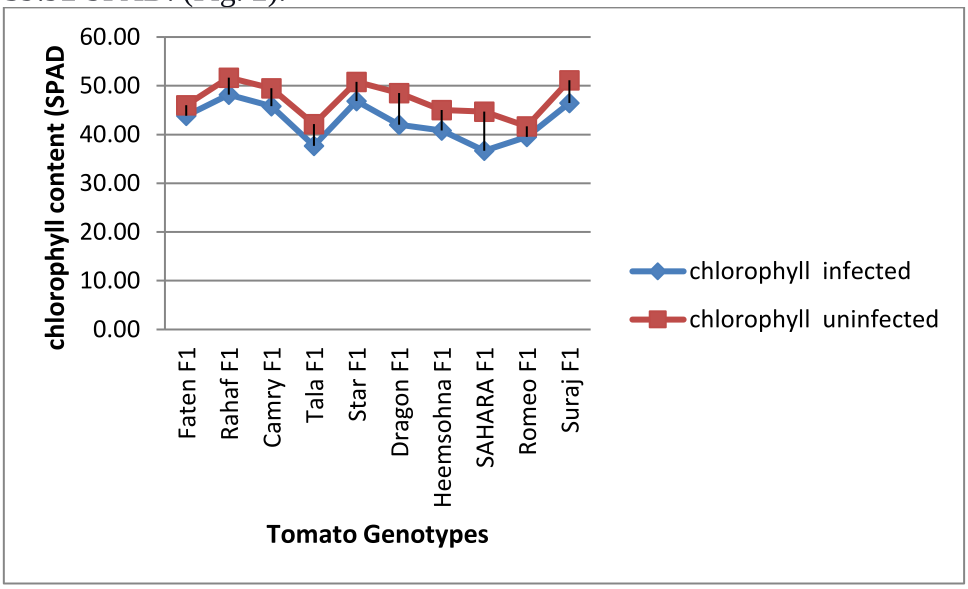

Figure 2: Whitefly insect impact on chlorophyll content (SPAD)

Figure (3) shows that the genotype Star F1 seemed to have the highest yield of 1310.5 g/plant, followed by the genotype Suraj F1 with an average of 1231.83 g/plant, and the Heemsohna F1 genotype with the lowest yield of 803.83 g/plant.

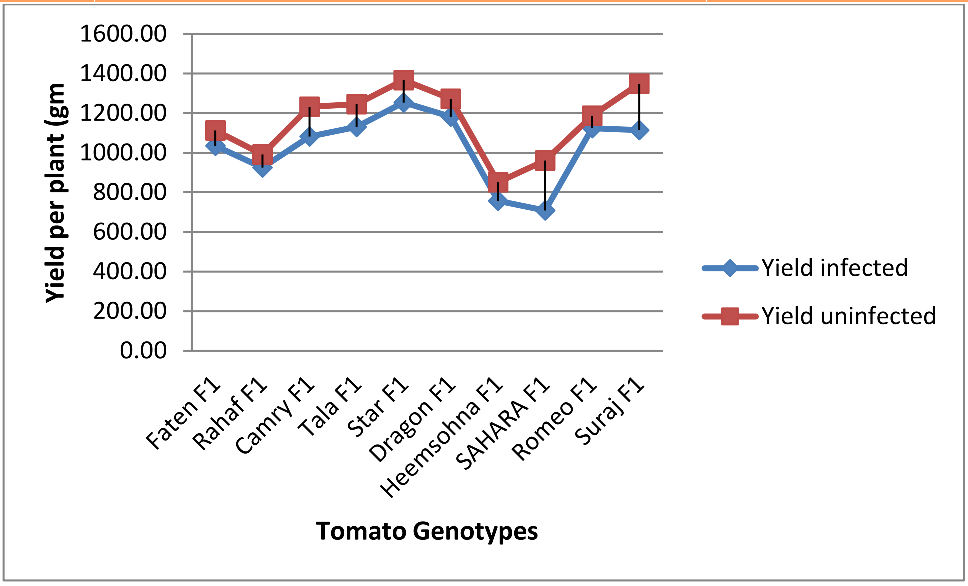

Figure 3: Whitefly insect impact on yield per plant (gm.)

The results of the % decrease (Fig. 4) showed that the highest decrease was for the Sahara F1 genotype, which gave a decrease of 19.53% in relation to the height of the tomato plant, followed by the Heemsohna F1 genotype that gave a decrease of 15.38%, while we find that the lowest percentage of decrease in the genotype Camry F1 is 3.46%. As for the concentration of chlorophyll, genotype Faten F1 had the lowest percent decrease, amounting to 4.71%, while genotype Sahara F1 had the highest percentage decrease, amounting to 17.91%. Finally, we find that the Sahara F1 genotype had the highest decrease in the yield per plant, amounting to 26.27%, followed by the genotype Suraj F1 with a rate of 17.42%, while the Romeo F1 genotype gave the lowest decrease, amounting to 5.36%, The decrease in productivity is thought to be caused by the insect's absorption of plant juices, which affected metabolism and thus decreased production (Rodríguez-López *et al.*, 2020).

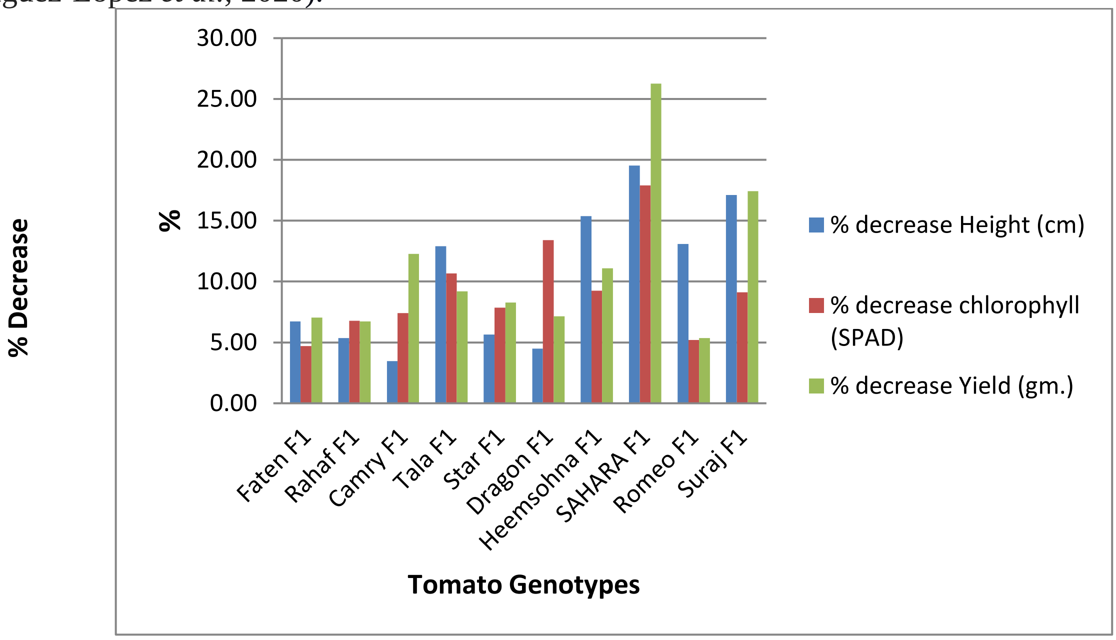

Figure 4: % decrease in height, chlorophyll, and yield of ten tomato genotypes

Conclusion

The current study shows that the whitefly caused a decrease in plant physiological processes, which was reflected in productivity across all genotypes tested. However, some genotypes showed a small decrease when compared to those that showed a large decrease. The Faten F1 and Star F1 genotypes had the least decrease when compared to the other structures, but the issue is their low productivity when compared to the genotypes that provided productivity.

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