Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2020; 8(3): 1549-1552

Received: 25-03-2020
Accepted: 27-04-2020

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Screening of different genotypes of tomato against major pests infesting tomato (*Solanum lycopersicum* L.)

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Abstract
The present investigation entitled "Screening of different genotypes of tomato against major pests infesting tomato (*Solanum lycopericum* L.)" was carried during *rabi* season of 2018-2019 at Central Experimental Station, Wakawali. Fifteen genotypes were screened against whiteflies, aphids, leaf miner and fruit borer under field condition. The genotypes showed different responses for different pests. The highest mean population of whiteflies was recorded on the genotype Konkan Vijay (4.74), while lowest was observed on N-2257 (3.34) per three leaves. In aphids, the most promising genotype was N-2257 (2.10) mean population per three leaves, while genotype SUN-7610 was most infested by aphid (3.05) per three leaves. Highest leaf miner infestation was recorded on genotype LE-66 (34.32%) and lowest was noticed on genotype BT-1 (30.24%). The maximum fruit borer infestation recorded in genotype N-2257 which were found 44.71 and 41.28 per cent on number and weight basis, respectively. The lowest 19.78 mean per cent fruit infestation on number basis was recorded in genotype BT-105, whereas 18.74 per cent on weight basis was found in same genotype. N-2257 was the best genotype with least attack of whitefly and aphids while, BT-1 was proved as the best against leaf miner infestation and BT-105 against fruit borer infestation.

Keywords: Screening, tomato, genotypes, *Helicoverpa armigera* (Hub.)

Introduction
Tomato (*Solanum lycopersicum* L.) is one of the most important vegetable crop in the world belonging to family Solanaceae. Temperature below 10°C and above 30°C adversely affects plant tissue. The 21-24°C is the optimum range of temperature for successful cultivation of tomato (Singh, 2017). Tomato fruit contain water 93.1 per cent, protein 1.9 per cent, fat 0.3gm, fibre 0.7 per cent, carbohydrates 3.6 per cent, calorie 23, vitamin 'A' (320 I. U.), vitamin 'B1'(0.07 mg), vitamin 'B2' (0.01 mg), nicotinic acid (0.4 mg), vitamin 'C' (31 mg), calcium (20 mg), phosphorus (36 mg) and iron (0.8 mg) (Mandloi *et al*., 2015) [11]. In India, it is cultivated in 789.15 thousand hectares area with 19759.32 metric tons production and 25.03 tons per hectare productivity. In Maharashtra, tomato is grown over an area of 45,500 hectares with a production of 1086.56 metric tons and productivity is 23.88 tons per hectare during 2017-18 (Anonymous, 2018) [3].The estimated losses to tomato due to attack of different insect pests have been reported in the range of 30-35% (Anonymous, 2007) [2].
The foliage pests such as aphids, thrips and whiteflies suck plant sap and cause leaf distortion and stunting of tomato plants (Waiganjo *et al*., 2006) [18]. Leaf miner (*L. trifolii*) attacks tomato leaves causing various losses (Ahmed, 2000) [1]. Tomato fruit borer (*Helicoverpa armigera*) is the major constraints in the higher production of tomato fruits. Indiscriminate use of pesticides resulted in failure of control of the tomato fruit borer (Lal and Lal, 1996) [9]. Cultivation of *Helicoverpa* resistant tomato cultivars is limited due to a lack of data on potential genetic sources and plant mechanisms (antixenosis) of resistance (Dhillon *et al*., 2005) [4].
Hence, the investigation was undertaken to study the screening of different genotypes against major pests infesting tomato under field condtions.

Materials and methods
The field experiment was conducted at Vegetable Improvement Scheme, Central Experimental Station, Wakawali, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli during the *rabi* season of 2018-19. Seedlings of the tomato genotypes (35 days old) were transplanted in the well prepared field. All the recommended package of practices were followed.

The genotypes were kept unsprayed throughout the crop season. The details of the experiment are given below in table 1 & 2.

Table 1: Details of the field experiment to screen genotypes against pests infesting tomato

1)	Number of genotypes	:	15
2)	Size of the plot	:	3.00m ×1.2m
3)	Spacing	:	60 cm ×60 cm
4)	Method of planting	:	Raised bed

Table 2: List of genotypes used for screening against pests infesting tomato

i	LE-1-2	ix	Sonali Cluster
ii	LE-66	x	Sonali SD-1
iii	LE-474	xi	BMZ-21
iv	BT-1102-22	xii	BL-142
v	BT-105	xiii	SUN-7611
vi	BT-317	xiv	SUN-7610
vii	BT-1	xv	Konkan Vijay
viii	N-2257		

Data were recorded from five randomly selected and tagged plants in each plot at an weekly interval. The population of whiteflies and aphids were counted on three leaves top, middle and bottom and expressed as number on three leaves. The infestation of leaf miner (*Liriomyza trifolii*) were recorded by counting healthy and infested three compound leaves on top, middle and bottom. Percent infestation was calculated by following formula,

$$\text{Per cent leaf miner infestation} = \frac{\text{No. of damaged leaf observed}}{\text{Total no. of leaf observed}} \text{ X100}$$

The per cent fruit infestation of fruit borer were recorded on the basis of number and weight of healthy and infested fruits at each picking using following formula,

$$\text{Per cent fruit infestation} = \frac{\text{No. of infested fruits}}{\text{Total no. of fruits}} \text{ X 100}$$

Results and Discussion

The population of sucking pests including whitefly and aphid and per cent infestation damage by leaf miner and fruit borer were recorded during the investigation and presented below in table 3. The data on overall mean population of whiteflies was in the range of 3.34 to 4.74. The highest mean population was recorded on the genotype Konkan Vijay (4.74 ± 0.42) per three leaves. The mean population recorded in remaining genotypes in descending order was LE-474 (4.60), BL-142 (4.48), LE-1.2 (4.37), Sonali Cluster (4.29), BT-17 (4.25), SUN-7611 (4.23), LE-66 (4.22), SUN-7610 (4.21), Sonali SD-1 (4.06), BMZ-21 (3.90), BT-1 (3.83), BT-105 (3.48) and BT-1102-22 (3.44). The lowest population was recorded on the genotypes N-2257 (3.34 ± 0.42) per three leaves. Same kind of observations was also recorded by different researchers, Jamuna *et al.* (2017) [7] who revealed that Vybhav was most resistant and recorded least number of adult (1.00/three leaves) followed by Arka Samrat whereas PTR 4 was most susceptible and preferred variety with highest (4.50/three leaves) number of adult whitefly population. Harshita *et al.* (2019) [5] found that most susceptible variety with highest mean population of whiteflies was observed on variety LE-415 (4.60/three leaves), followed by LE-474 (4.51/three leaves), BL-142 (4.47/three leaves).

The data on overall mean population of aphid was in the range of 2.10 to 3.05. The highest mean population was recorded on the genotypes SUN-7610 (3.05 ± 0.31) per three leaves. The mean population recorded in remaining genotypes in descending order was LE-1-2 (3.02), LE-66 (3.00), Konkan Vijay (2.97), BL-142 (2.94), LE-474 and BT-317 (2.92), SUN-7611 (2.91), Sonali Cluster (2.75), Sonali SD-1 (2.71), BT-1 (2.53), BMZ-21 (2.45), BT-1102-22 (2.30) and BT-105 (2.26). The lowest population was recorded on the genotypes N-2257 (2.10 ± 0.31) per three leaves. The results are in conformity with Harshita *et al.* (2019) [5] who also found that most susceptible variety with highest mean population of aphids was observed on variety SUN-7610 (3.05/three leaves), followed by LE-1-2 (3.02/three leaves), LE-66 (3.00/three leaves), BL-142 (2.94/three leaves), BT-317 (2.92/three leaves) and so on. Hath and Das (2004) [6] who reported the peak population of aphids, during the first week of March (4.47 and 6.66 aphids/5 leaves) in Pusa Ruby and Abhinash-11 respectively.

The data on overall mean leaf miner per cent infestation was in the range of 30.24 per cent to 34.32 per cent. The highest mean leaf miner per cent infestation was recorded on the genotypes LE-66 (34.32% ± 1.07). The mean leaf miner per cent infestation recorded in remaining genotypes in descending order was BL-142 (34.02%), LE-1-2 (34.00%), LE-474 (33.97%), N-2257 (33.75%), SUN-7610 (33.74%), BT-317 (33.25%), BT-1102-22 (33.14%), Konkan Vijay (33.08%), Sonali Cluster (33.01%), Sonali SD-1 (32.89%), BMZ-21 (32.53%), BT-105 (32.28%) and SUN-7611 (31.64%). The lowest mean leaf miner per cent infestation was recorded on the genotypes BT-1 (30.24% ± 1.07). Similar results were reported by Sarkar *et al.* (2017) [14] who revealed that none of test genotypes were found either as tolerant or resistant against leaf miner. Patherkuchi (18.11%) was found less susceptible and others were moderately susceptible (Ruby, Roja cherry, Romeo and Priya) to highly susceptible NS 501 (43.04%). Rai *et al.* (2013) [12] reported that test varieties *viz.* HS-102, SEL-14, Pant T-4, PS-8, PT-28, NDT-44, BT-117-5-3-1, Pusa Ruby, KS-118, Pant Bahar, CO-3, Pant Hybrid-1, BBs-109, NTH-337, BRH-01, ARTH-04, BS-2530, NDT-9, Meenakshi-H1, Punjab Chhuhara and NDT-96 were found to be resistant/less susceptible. Only nine test cultivars viz. BT-20-1-4, KS-2, PT-3, Sweet-72, Pant Hybid-2, TH-2312, Ratna, Avinash and Sohali were found to be moderately susceptible/moderately resistant. No cultivar was found highly susceptible against leaf miner.

During present study the maximum fruit borer infestation recorded in genotype N-2257 which were found 44.71 and 41.28 per cent on number and weight basis, respectively. The mean per cent infestation recorded in remaining genotypes in descending order on number and weight basis was on cultivars BL-142 (42.87% and 38.51%), LE-66 (40.45% and 35.19%), Sonali Cluster (35.09% and 32.57%), SUN-7610 (33.91% and 30.54%), BMZ-21 (33.63% and 29.91%), LE-1-2 (32.99% and 29.27%), LE-474 (32.66% and 28.35%), Konkan Vijay (27.73% and 27.16%), Sonali SD-1 (27.58% and 25.04%), SUN-7611 (27.39% and 23.93%), BT-1102-22 (24.78% and 21.68%), BT-317 (22.78% and 19.24%), BT-1 (21.35% and 20.41%) respectively. The lowest 19.78 mean per cent fruit infestation on number basis was recorded in genotype BT-105, whereas 18.74 per cent fruit infestation on weight basis was recorded in same genotype. The results

obtained during the investigation showed wide variation among different varieties for their resistance to fruit borer, *H. armigera* infesting tomato. The result revealed that none of the genotype fall under highly resistant and resistant category. The maximum per cent fruit damage by *H. armigera* was recorded in genotypes N-2257, BL-142 and LE-66 on the number and weight basis and therefore categorised under highly susceptible genotypes. The genotypes that were under category susceptible are Sonali Cluster, SUN-7610, BMZ-21, LE-1-2 and LE-474. The genotypes that fall under category moderately susceptible on the number and weight basis are BT-1, BT-317, BT-1102-22, SUN-7611, Konkan Vijay and Sonali SD-1. The minimum per cent fruit damage by fruit borer on the number and weight basis was recorded in genotype BT-105 therefore categorised under moderately resistant genotypes.

The result of the present study is similar to the findings of Safna (2018) [13] who reported that BT-105, BT-1, BT-317 varieties were found to be moderately resistant and BL-142 to be highly susceptible. Singh *et al*. (2013) [16] who reported that none of the varieties were found to be highly resistant. Kashyap and Verma (1986) [8] reported 42 to 55 per cent damage of tomato fruits in susceptible varieties. Lal *et al*. (1999) [10] noticed that all the varieties revealed more than five percent fruit infestation and maximum fruit damage recorded was 40.71 per cent. Usman *et al.* (2013) [17] reported that the genotypes R-165 and GS-5575 had maximum (39.40% and 40.47%) number of infested fruits.

Table 3: Overall mean population/ infestation of major pests infesting on different genotypes of tomato

Sr. No.	Genotypes	Mean population of whitefly per 3 leaves per plant	Mean population of aphid per 3 leaves per plant	Mean leaf miner infestation (%)	Fruit borer infestation (%)	
					Number basis	Weight basis
1	LE-1-2	4.37	3.02	34.00	32.99	29.27
2	LE-66	4.22	3.00	34.32	40.45	35.19
3	LE-474	4.60	2.92	33.97	32.66	28.35
4	BT-1102-22	3.44	2.30	33.14	24.78	21.68
5	BT-105	3.48	2.26	32.28	19.38	18.74
6	BT-317	4.25	2.92	33.25	22.78	19.24
7	BT-1	3.83	2.53	30.24	21.35	20.41
8	N-2257	3.34	2.10	33.75	44.71	41.28
9	Sonali Cluster	4.29	2.75	33.01	35.09	32.57
10	Sonali SD-1	4.06	2.71	32.89	27.58	25.04
11	BMZ-21	3.90	2.45	32.53	33.63	29.91
12	BL-142	4.48	2.94	34.02	42.87	38.51
13	SUN-7611	2.23	2.91	31.64	27.39	23.93
14	SUN-7610	4.21	3.05	33.74	33.91	30.54
15	Konkan Vijay	4.74	2.97	33.08	27.73	27.16
	SD	0.42	0.31	1.07	7.68	6.85

Table 4: Distribution of tomato genotypes based on mean rating system of fruit borer infestation (number basis and weight basis)

Sr. No.	Genotypes	Fruit borer infestation (%)		Remark
		Number basis	Weight basis	
1	LE-1-2	32.99	29.27	Susceptible
2	LE-66	40.45	35.19	Highly susceptible
3	LE-474	32.66	28.35	Susceptible
4	BT-1102-22	24.78	21.68	Moderately susceptible
5	BT-105	19.38	18.74	Moderately resistant
6	BT-317	22.78	19.24	Moderately susceptible
7	BT-1	21.35	20.41	Moderately susceptible
8	N-2257	44.71	41.28	Highly susceptible
9	Sonali Cluster	35.09	32.57	Susceptible
10	Sonali SD-1	27.58	25.04	Moderately susceptible
11	BMZ-21	33.63	29.91	Susceptible
12	BL-142	42.87	38.51	Highly susceptible
13	SUN-7611	27.39	23.93	Moderately susceptible
14	SUN-7610	33.91	30.54	Susceptible
15	Konkan Vijay	27.73	27.16	Moderately susceptible

Conclusion

Among the different genotypes used for screening, the genotypes showed variation in resistance against different pests. For sucking pests like whitefly and aphids genotype N-2257 was best than remaining genotypes. Genotype BT-1 was superior over other genotypes against percent leaf miner infestation. In case of percent fruit borer infestation genotype BT-105 recorded with minimum infestation.

Acknowledgements

The researchers would like to express their gratitude to the Department of Agricultural Entomology, Dr. Balasaheb Sawnat Konkan Krishi Vidyapeeth, Dapoli for the support of labour cost, experimental land and research facility support.

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