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Screening of tomato varieties against white fly, *Bemisia tabaci* (Gen.) under field condition at Pantnagar Uttarakhand

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Abstract
Whitefly (*Bemisia tabaci*) feeds on tomato plants and possess great economic threat by transmitting plant viruses, primarily begomoviruses tomato yellow leaf curl virus (TYLCV). Twelve tomato hybrids *viz*; Karan, Shivam, RDS2755, Avirat, Heemsohna, Angad, Arjun, To1458, Sawan, Laxmi, Naveen and Pant T3 were evaluated against whitefly, *Bemisia tabaci* during 2020-21 in a Randomized Complete Block Design (RBD) with three replication at VRC GBPUAT Pantnagar, (U.K, India). Observation on whitefly population on tomato hybrids was recorded at weekly intervals from appearance of whiteflies during morning hours. The results showed that none of the tomato variety was found completely free from the whitefly infestation. The infestation of whitefly started in the third week of November. The infestation increased gradually and attained its peak in the last week of March. Thereafter, the population declined abruptly. The average minimum (1.16 /plant) and maximum (3.99/plant) whitefly population during crop season was observed on Heemsohna and Karan, respectively. According to mean of whitefly population the maximum resistance among tested cultivar was found in Heemsohna followed by Arjun, RDS 2755, Avirat, Laxmi, To1458, Shivam, Pant T3, Sawan, Angad, Naveen and Karan. Among all the varieties, Heemsohna recorded only 11.14% disease incidence and found statistically significant as compared to other varieties while the highest disease incidence was observed in Variety Karan (36.97%).

Keywords: Tomato, screening, variety, whitefly, *Bemisia tabaci*

1. Introduction
Tomato, belonging to Solanaceae family is one of the most popular and widely grown vegetables in the world. This crop has high nutritive value and is grown for fresh marketing and processing (Ravi *et al*., 2008) [9]. In India total cultivated area under tomato was 8.12 lakh ha with the production of 20.57 million tons during 2019-20 and India occupies the second position in the world in tomato production contributing nearly 11% to the world tomato production(FAOSTAT,2020) [3]. The productivity of tomato is affected by various disease, insect pest and other abiotic factors. More than 100 insect pests are reported to attck on the tomato crop (Lange and Bronson, 1981) [6] Many insect pests cause considerable damage to tomato out of which whitefly, *Bemisia tabaci* is one of the most economically important pests in tropical and sub-tropical regions. Whitefly (*Bemisia tabaci*) damage tomato plants by feeding and possess great economic threat by acting as vector for transmission of plant viruses, primarily begomoviruses tomato yellow leaf curl virus (TYLCV) (Lapidot and Polston, 2006) [7]. The farmers mainly depends up on chemical pesticide for the management of whitefly which leads to problems like development of resistance in pest towards pesticides, resurgence and environmental and health hazards (Dhaliwal and koul 2010) [2]. If a variety could be searched out for any region which possess resistance or even tolerance, it can be well utilized in an integrated pest management.
Keeping in view the importantance of whitefly on tomato crop, the present study was undertaken to screen the different commercially available varieties of tomato against whitefly (*Bemisia tabaci*) under open field conditions at Pantnagar, Uttarakhand India.

2. Materials and Methods
The field experiment was conducted at vegetable research centre, GBPUA&T Pantnagar Uttarakhand (India) during two successive seasons of 2020-21 and 2021-22. Twelve tomato hybrids *viz*; Karan, Shivam, RDS2755, Avirat, Heemsohna, Angad, Arjun, To1458, Sawan, Laxmi, Naveen and Pant T3 were selected for the study and evaluated against whitefly, *Bemisia tabaci* in a Randomized Complete Block Design (RBD) with three replications and

each variety was considered as a separate treatment. The plot size was 5 x 5 m and row to row and plant to plant distances were kept 60 and 60 cm, respectively for all the varieties. The experimental field were kept free from weeds by weeding and hoeing. All the agronomic practices were followed from time to time as per package for region. Observation on whitefly population on tomato hybrids was recorded at weekly intervals during morning hours. The observations were taken on five randomly selected and tagged plants per plot. The data obtained on whitefly population from experimental field were transformed in to $\sqrt{x} + 0.5$ and subjected to analysis of variance. The incidence of Tomato leaf curl virus disease was also recorded to know the susceptibility of hybrids/varieties to disease. The mean insect populations of tomato varieties observed during the crop season were categorized on the basis of the following formula (Nagar *et al*., 2017) [4]:

Mean insect population Per plant	Category
Below $\bar{x} - \sigma$	less susceptible
$\bar{x} - \sigma$ to $\bar{x} + \sigma$	moderately susceptible
Above $\bar{x} + \sigma$	highly susceptible

Where, $\bar{x}$ = Mean of peak population and σ = Standard deviation of insect population

3. Result and Discussion:

The data presented in the table 1 revealed that none of the varieties of tomato under study were found completely free from of whitefly infestation. The infestation of whitefly was first observed in the last week of november (2^{nd} week after transplanting). Initially, the mean whitefly population ranged from 0.07 to 0.87/plant. The maximum mean whitefly population was recorded on variety Naveen (0.87/ three leaves) followed by Karan (0.73/plant). Three tomato varieties *viz*., Heemsohna, Arjun and RDS2755 were found have no infestation whitefly at this stage. The infestation of whitefly on each variety increased gradually and attained to its peak in third week of March. The mean whitefly population on different varieties ranged from 3.27 to 9.80 whiteflies/plant. The maximum whitefly population was observed on variety Karan(9.80/plant) followed by Naveen(9.53/plant). These were statistically different from each other and found significantly inferior to rest of the varieties under study. The minimum infestation of whitefly was observed on Heemsohna (3.27 whiteflies per plant) followed by Arjun(3.73whiteflies/plant) and these were found significantly superior over rest of the varieties. The variety Heemsohna was found at par with Arjun. The varieties, Laxmi (4.93 whiteflies per plant), To1458(5.07 whiteflies per plant), RDS2755 (5.20 whiteflies per plant), Avirat (5.27 whiteflies per plant), Shivam, Sawan and Pant T3 (all having 6.73 whiteflies per plant) and Angad (6.87 whiteflies per plant was observed and categorized in middle order of infestation. The average whitefly population at all the intervals during the crop season ranged from 1.16 to 3.99 per plant. The maximum population of whitefly was observed on variety Karan (3.99 per plant) followed by Naveen (3.85 per plant) and minimum population of whitefly was observed on variety Heemsohna (1.16 per plant) followed by Arjun (1.24 per plant). The varieties RDS 2755, Avirat, Laxmi, To1458, Shivam, Pant T3, Sawan and Angad along with mean whitefly population 1.76, 1.83, 1.95, 2.10, 2.35, 2.50, 2.62,2.67and 2.67 per plant, respectively categorized as middle order of infestation.

According to mean whitefly population, the tomato varieties were categorized as least susceptible (Mean whitefly population below 1.49/ three leaves), moderately susceptible (1.49 to 3.19/ three leaves) and highly susceptible (above 11.40/ three leaves) by evaluating the mean whitefly population on the basis of formula $\bar{x} \pm \sigma$. According to these criteria, the varieties Heemsohna and Arjun were rated as least susceptible. The varieties, RDS 2755, Avirat, Laxmi, To1458, Shivam, Pant T3, Sawan and Angad were categorised as moderately susceptible, however the varieties, Karan and Naveen were rated as highly susceptible. The ascending order of tomato varieties against whitefly susceptibility based on the mean whitefly population during crop period was Heemsohna<Arjun< RDS 2755< Avirat< Laxmi< To1458< Shivam< Pant T3< Sawan< Angad< Naveen< Karan. Some other studies have also recorded the variation in response of the varieties for their susceptibility towards the pest infestation (Ashfaq *et al*., 2010) [1]; Kruger (2001) [5] reported that the population of whitefly, *B. tabaci* on resistant plant varieties was relatively lower than that on preferred host plants.

3.1 Disease Incidence

All the varieties significantly different from each other in terms of yellow leaf curl disease incidence percentage. Mean disease incidence percentage value exhibited a range of 11.14 – 36.97 among different varieties (Table-2 and Fig 2). Among all the varieties minimum disease incidence was recorded on Heemsohna variety (11.14%) followed by Arjun (13.25%); while maximum disease incidence was observed in variety Karan (36.97%) followed by Naveen (35.45). Similarly, Mishra *et al* 2019 [8] evaluated the performance of tomato hybrids in relation to disease incidence and reported that the incidence of yellow leaf curl disease ranged from 0.00-83.00%.

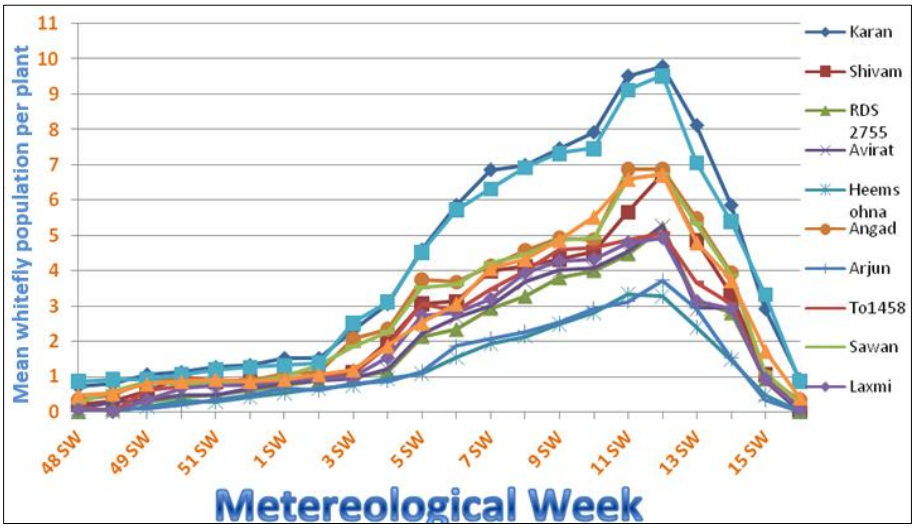

Fig 1: Population build-up of whitefly in different tomato varieties during crop season

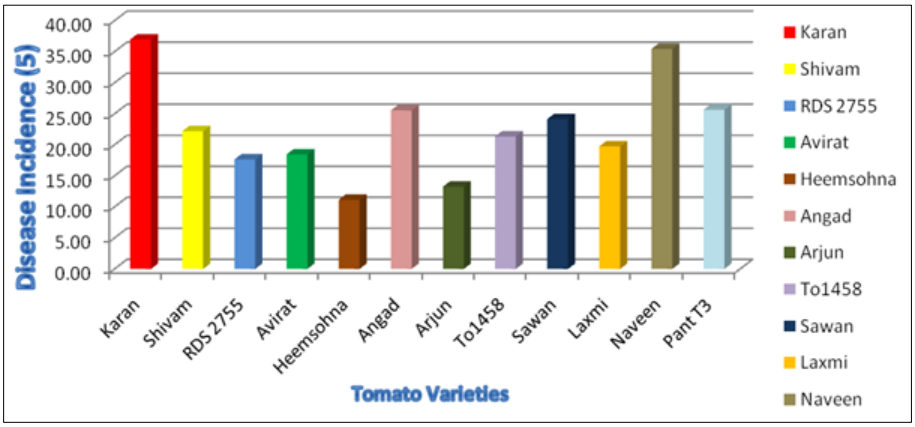

Fig 2: Tomato leaf curl disease incidence in different varieties under field condition

Table 1: Seasonal incidence of white fly on different tomato varieties at Pantnagar, Uttarakhand (India)

Variety	Whitefly (*Bemisia tabaci*) population per Plant* Week after transplanting of seedlings																						
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Overall mean
Karan	0.73 (1.31)	0.80 (1.34)	1.07 (1.43)	1.13 (1.46)	1.27 (1.50)	1.33 (1.52)	1.53 (1.59)	1.53 (1.59)	2.33 (1.82)	3.07 (2.02)	4.60 (2.37)	5.87 (2.81)	6.87 (2.83)	7.00 (2.83)	7.47 (2.91)	7.93 (2.99)	9.53 (3.25)	9.80** (3.29)	8.13 (3.02)	5.87 (2.62)	2.93 (1.98)	0.93 (1.39)	3.99 (2.23)
Shivam	0.20 (1.09)	0.33 (1.15)	0.60 (1.26)	1.00 (1.41)	0.87 (1.36)	0.93 (1.38)	0.93 (1.39)	1.07 (1.43)	1.13 (1.46)	2.00 (1.73)	3.07 (2.02)	3.13 (2.24)	4.00 (2.24)	4.13 (2.27)	4.33 (2.31)	4.53 (2.35)	5.67 (2.58)	6.73 (2.78)	4.87 (2.42)	3.33 (2.08)	1.07 (1.44)	0.07 (1.03)	2.35 (1.83)
RDS 2755	0.00 (1.00)	0.07 (1.03)	0.27 (1.12)	0.40 (1.18)	0.47 (1.21)	0.60 (1.26)	0.73 (1.31)	0.87 (1.36)	1.00 (1.41)	1.13 (1.46)	2.13 (1.76)	2.33 (1.82)	2.93 (1.98)	3.27 (2.07)	3.80 (2.19)	4.00 (2.24)	4.47 (2.35)	5.20 (2.49)	3.13 (2.03)	2.80 (1.95)	0.93 (1.39)	0.00 (1.00)	1.76 (1.66)
Avirat	0.07 (1.03)	0.27 (1.12)	0.33 (1.15)	0.47 (1.21)	0.47 (1.21)	0.67 (1.29)	0.80 (1.34)	0.87 (1.36)	0.93 (1.39)	1.20 (1.48)	2.20 (1.79)	2.66 (1.92)	3.00 (2.00)	3.67 (2.16)	4.00 (2.24)	4.07 (2.25)	4.53 (2.08)	5.27 (2.50)	2.93 (1.98)	2.93 (1.98)	0.87 (1.37)	0.00 (1.00)	1.83 (1.68)
Heemsohna	0.00 (1.00)	0.00 (1.00)	0.13 (1.06)	0.27 (1.09)	0.27 (1.12)	0.40 (1.18)	0.53 (1.23)	0.67 (1.29)	0.73 (1.31)	0.93 (1.39)	1.07 (1.44)	1.53 (1.59)	1.93 (1.71)	2.13 (1.77)	2.47 (1.88)	2.80 (1.95)	3.33 (2.08)	3.27 (2.06)	2.40 (1.84)	1.47 (1.57)	0.47 (1.20)	0.00 (1.00)	1.16 (1.47)
Angad	0.33 (1.15)	0.47 (1.21)	0.87 (1.36)	0.93 (1.39)	0.87 (1.36)	0.87 (1.36)	1.07 (1.43)	1.13 (1.46)	2.07 (1.75)	2.33 (1.83)	3.73 (2.18)	3.67 (2.16)	4.13 (2.27)	4.57 (2.36)	4.93 (2.37)	4.87 (2.42)	6.87 (2.81)	6.87 (2.81)	5.47 (2.54)	3.93 (2.22)	1.00 (1.41)	0.33 (1.15)	2.67 (1.91)
Arjun	0.00 (1.00)	0.07 (1.03)	0.07 (1.03)	0.20 (1.06)	0.33 (1.15)	0.47 (1.21)	0.67 (1.29)	0.60 (1.26)	0.80 (1.34)	0.87 (1.37)	1.13 (1.46)	1.86 (1.69)	2.07 (1.75)	2.27 (1.81)	2.53 (2.42)	2.93 (1.98)	3.13 (2.03)	3.73 (2.18)	2.93 (1.98)	1.53 (1.59)	0.33 (1.15)	0.00 (1.00)	1.24 (1.49)
To1458	0.13 (1.06)	0.00 (1.00)	0.60 (1.26)	0.73 (1.31)	0.87 (1.36)	0.80 (1.34)	0.87 (1.36)	1.00 (1.41)	1.07 (1.43)	1.87 (1.69)	3.07 (2.02)	2.86 (1.97)	3.47 (2.11)	4.00 (2.24)	4.60 (2.29)	4.67 (2.38)	4.87 (2.42)	5.07 (2.46)	3.67 (2.16)	3.07 (2.02)	0.87 (1.36)	0.13 (1.06)	2.10 (1.76)
Sawan	0.27 (1.12)	0.60 (1.39)	0.87 (1.36)	0.80 (1.34)	0.87 (1.36)	0.87 (1.36)	1.00 (1.41)	1.33 (1.52)	1.87 (1.69)	2.27 (1.81)	3.53 (2.13)	3.60 (2.14)	4.20 (2.28)	4.47 (2.34)	4.87 (2.89)	4.93 (2.44)	6.60 (2.76)	6.73 (2.78)	5.33 (2.52)	3.87 (2.21)	1.13 (1.46)	0.27 (1.13)	2.62 (1.90)
Laxmi	0.07 (1.03)	0.00 (1.00)	0.33 (1.15)	0.67 (1.29)	0.73 (1.31)	0.73 (1.31)	0.87 (1.36)	0.93 (1.39)	1.00 (1.41)	1.53 (1.59)	2.73 (1.93)	2.80 (1.95)	3.20 (2.05)	3.93 (2.22)	4.27 (2.29)	4.33 (2.31)	4.80 (2.41)	4.93 (2.44)	3.13 (2.03)	2.93 (1.98)	0.93 (1.39)	0.07 (1.03)	1.95 (1.71)
Naveen	0.87 (1.36)	0.93 (1.39)	0.93 (1.39)	1.07 (1.43)	1.20 (1.48)	1.27 (1.50)	1.33 (1.52)	1.40 (1.54)	2.53 (1.87)	3.13 (2.03)	4.53 (2.35)	5.73 (2.59)	6.33 (2.71)	6.93 (2.82)	7.33 (2.89)	7.47 (2.91)	9.13 (3.18)	9.53 (3.25)	7.07 (2.84)	5.40 (2.53)	3.33 (2.08)	0.87 (1.10)	3.85 (2.20)
Pant T3	0.47 (1.21)	0.53 (1.23)	0.80 (1.34)	0.87 (1.36)	0.93 (1.39)	0.87 (1.36)	0.93 (1.39)	1.07 (1.43)	1.20 (1.49)	1.87 (1.69)	2.53 (1.88)	3.06 (2.01)	4.07 (2.25)	4.33 (2.31)	4.87 (2.42)	5.53 (2.56)	6.60 (2.76)	6.73 (2.78)	4.80 (2.41)	3.73 (2.17)	1.73 (1.64)	0.07 (0.03)	2.50 (1.87)
CD(0.005)	0.07	0.12	0.09	0.09	0.07	0.10	0.07	0.09	0.12	0.10	0.15	0.12	0.09	0.08	0.10	0.10	0.08	0.13	0.13	0.12	0.18	0.10	0.03
S.E(m)±	0.02	0.04	0.03	0.03	0.02	0.34	0.02	0.03	0.04	0.03	0.05	0.04	0.03	0.03	0.04	0.03	0.03	0.04	0.04	0.04	0.06	0.04	0.01
C.V.	3.77	5.73	4.34	3.84	2.99	4.39	3.05	3.541	4.49	3.45	4.56	3.30	2.39	2.05	2.56	2.35	1.73	2.81	3.26	3.25	7.14	2.56	0.88

Figure in parenthesis are √x + 0.5 transformed values *Means of three replication, **Peak populaton

Table 2: Tomato leaf curl disease incidence in different varieties in field condition

S. No.	Tomato hybrids	Disease incidence** (%)
1	Karan	36.97(37.42)
2	Shivam	22.19(28.09)
3	RDS 2755	17.64(24.82)
4	Avirat	18.45(25.42)
5	Heemsohna	11.14(19.49)
6	Angad	25.54(30.34)
7	Arjun	13.25(21.32)
8	To1458	21.34(27.49)
9	Sawan	24.14(29.41)
10	Laxmi	19.74(26.36)
11	Naveen	35.45(36.52)
12	Pant T3	25.65(30.41)
S.Em±		0.34
CD(0.005)		0.99

4. Conclusion

Results of the present findings lead towards a conclusion that, among the twelve tested variety, none of the variety showed complete resistance or immune reaction against whitefly. Among the twelve tomato varieties Heemsohna and Arjun was found least infested by whitefly and disease incidence was also found to be lower than other tested varieties. These two hybrids are more suitable for growing commercially in the tarai region of Uttarakhand (India) as they have resistance to various biotic/abiotic stresses.

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References

1. Ashfaq M, Noor-ul-Ane M, Zia K, Nasreen A, Mansoorul- Hasan. The correlation of abiotic factors and physiomorphic characteristics of (*Bacillus thuringiensis*) BT transgenic cotton with whitefly, *Bemisia tabaci* (Homoptera: Aleyrodidae) and jassid, Amrasca devastans (Homoptera: Jassidae) populations. African Journal of Agriculture Research. 2010;5:3102-3107.
2. Dhaliwal GS, Koul O. Quest for Pest Management: From Green Revolution to Gene Revolution. Kalyani Publishers, New Delhi, 2010.
3. https://www.fao.org/ FAOSTAT, Food and Agriculture Organization of the united Nations, 1/02/22, 2020.
4. Nagar J, Khinchi SK, Kumawat KC, Sharma A. Screening different varieties of okra [*Abelmoschus esculentus* (L.) Moench] against sucking insect pests. Journal of Pharmacognosy and Phytochemistry. 2017;6(3):30-34.
5. Kruger K. Whitefly control: the use of intercropping with different tomato cultivar. Plant Protection. 2001;58:7-8.
6. Lange WH, Bronson L. Insect pests of tomatoes. Annual Review Entomology. 1981;26:345-371.
7. Lapidot M, Polston JE. Resistance to Tomato yellow leaf curl virus in tomato. 'In': Loebenstein, G. and Carr, J.P. (eds.) Natural Resistance Mechanisms of Plants to Viruses, Springer Verlag, New York, 2006, 503-520.
8. Mishra SK, Saraf RK, Gupta V, Tiwari A. Screening of tomato hybrids against white fly, *Bemisia tabaci* (Gen.) under field condition. Journal of Entomology and Zoology Studies 2019;7(4):479-481.
9. Ravi M, Santharam G, Sathiah N Eco-friendly management of tomato fruit borer, Helicoverpa armigera (Hub.). J Biopestic. 2008;1:134-37.