Screening of tomato varieties/hybrids against aphid (*Aphis gossypii* Glover) under field condition

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ABSTARCT

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An investigation was undertaken to study **screening of tomato varieties/hybrids against aphid (*Aphis gossypii* Glover) under field condition**. Eighteen varieties/hybrids were sown, and different levels of aphid incidence were observed over two successive years (2022–23 and 2023–24). The results indicated that none of the varieties/hybrids were completely free from aphid incidence. Among the eighteen varieties/hybrids, two were categorized as less susceptible, twelve as moderately susceptible and four as highly susceptible against aphid. The variety/hybrid Arka Vishal had the lowest aphid population followed by Kashi Adarsh. The highest aphid population found in variety/hybrid Vaishali which was statically at par with Swati 444.

KEYWORDS: aphid; *Aphis gossypii* Glover; varieties; hybrids; susceptible; tomato.

INTRODUCTION

The most significant vegetable farmed extensively for both the fresh market and processing is the tomato (*Solanum lycopersicum* L.) a member of the Solanaceae family (Snehal *et al.,* 2019). According to Mushtaq and Pathania (2020), it is believed to have originated in western South America and was brought to India by the Portuguese. It is also referred to as Vilaayati baingan, Love of Apple and Wolf Apple (Patil *et al.,* 2018). Tomato is the most commonly and extensively grown vegetable all over the country occupying an important place in the food basket of Indian consumers (Snehal *et al.,* 2019). The main tomato-producing nations are China, The United States, Italy, Turkey, India and Egypt. In India, the area and production of tomato is of 841 thousand ha. and 21.18 million tonnes (Anonymous, 2021). The major tomato producing states are Andhra Pradesh, Karnataka, Madhya Pradesh, Telangana, Odisha, Gujarat, Maharashtra, West Bengal, Bihar, Chhattisgarh and Himachal Pradesh. Madhya Pradesh is endowed with favourable climatic and soil conditions for cultivation of tomato, with an area and production of tomato is of 96.45 thousand ha. and production of 2825.07 thousand metric tonnes (DA and FW, 2021). The production quality of tomato fruits are considerably affected by array of insect pests infesting

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at different stages of crop growth (Sreedhar *et al*. 2019). One of the major insect pests of tomato is aphid (*Aphis gossypii* Glover). Crop plants attacked by this pest include cotton, citrus, coffee, eggplant, pepper and tomato (Bugti *et al*. 2016). The aphid suck sap from plants, deposit honeydew on the leaves of the plant causing sooty mould, and transmit viral diseases (Shahrin *et al.,* 2022). The aphid transmits yellowing virus reduces yield and quality of tomato. Early infection (2-3 week after transplanting) causes the greater plant stunting 8-15 per cent and reduction in yields 60-83 per cent (Thakoor *et al.* 2019). To overcome this constraint host plant resistance is one of the important and eco-friendly approaches of keeping the pest populations below the (EIL) economic injury levels. Improving host plant protection against insects and reduced losses due to herbivores, reduced use of insecticides, increased crop production and safer (Kumar *et al.,* 2020). Identification and cultivation of cultivars that are less preferred by insect pests have many advantages, particularly for the eco-friendly management of this insect pest on tomato crop. Hence, the present research was, aimed to **screening of tomato varieties/hybrids against aphid (*Aphis gossypii* Glover) under field condition**

MATERIAL AND METHODS

The present experiment was conducted at the Entomological Research Field, College of Agriculture, Gwalior, Madhya Pradesh, India during *Rabi* seasons 2022-23 and 2023-24. Eighteen tomato varieties/hybrids *i.e.* Pusa Rohini, Pusa Ruby, Pusa Uphar, Arka Abhijit, Arka Vikas, Arka Abhed, Arka Samrat, Arka Rakshak, Arka Vishal, Kashi Adarsh, Kashi Aman, Kashi Vishesh, Kashi Sharad, THS – 333 Shivam, Roma, Swati 444, Vaishali and Heemsohna were selected for the study and all varieties/hybrids were grown in plot size of 4.0 m x 2.0 m.

The experiment was conducted in Randomized Block Design (RBD) where each varieties/hybrids was replicated three times. The spacing between row to row and plant to plant was maintained at 50 cm and 50 cm, respectively. All the recommended agronomical practices were adopted for raising the crop. The observations were recorded at weekly intervals on five randomly selected plants from each plot by counting the number of aphid/three leaves (Upper, middle and lower leaves). The eighteen varieties/hybrids were grouped into three categories, *viz.,* less susceptible, moderately susceptible and highly susceptible based on the number of aphids/three leaves. For this purpose, the categorization was done during the observations on the 78 DAT when the population of aphid was at its peak. The scale used for categorizing different varieties/hybrids is as in Table 1.

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Table 1: Pest susceptibility scale for tomato aphid.

Category of resistance	Scale for resistance
Less susceptible	$< \bar{x} - \sigma$
Moderately susceptible	$> \bar{x} - \sigma < \bar{x} + \sigma$
Highly susceptible	$> \bar{x} + \sigma$

Results

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The analysis of data presented in the Tables 3 revealed that the average population of aphid varied significantly across all the tested varieties/hybrids throughout both the consecutive years of study. It was also noted that none of the varieties/hybrids were found to be completely free from aphid (*Aphis gossypii* Glover) incidence during 2022-23 and 2023-24. During the year 2022-23, the mean number of aphid in all the tomato varieties/hybrids was ranged from 4.22 to 13.87 aphids/three leaves. Among the varieties/hybrids minimum lenumber of aphid population was recorded on variety/hybrid Arka Vishal (4.22 aphids/three leaves), which found significantly less than rest of the varieties/hybrids except Kashi Adarsh (4.43 aphids/three leaves). While maximum aphid population was recorded on variety/hybrid Vaishali (13.87 aphids/three leaves), which was found significantly higher than rest of the varieties/hybrids except Swati 444 (13.18 aphids/three leaves). During the year 2023-24, the mean number of aphid in all the tomato varieties/hybrids was ranged from 3.90 to 13.02 aphids/three leaves. Among the varieties/hybrids minimum number of aphid population was recorded on variety/hybrid Arka Vishal (3.90 aphids/three leaves), which found significantly less than rest of the varieties/hybrids except Kashi Adarsh (4.16 aphids/three leaves). While maximum aphid population was recorded on variety/hybrid Vaishali (13.02 aphids/three leaves), which was found significantly higher than rest of the varieties/hybrids except Swati 444 (12.49 aphids/three leaves). Overall mean of both the years showed significant difference among different varieties/hybrids with regards to aphid population. Minimum aphid incidence was recorded on variety/hybrid Arka Vishal (4.06 aphids/three leaves), which found significantly less than rest of the varieties/hybrids except Kashi Adarsh (4.30 aphids/three leaves). While maximum aphid incidence was recorded on variety Vaishali (13.44 aphids/three leaves), which was found significantly higher than rest of the varieties except Swati 444 (12.84 aphids/three leaves). Categorization of varieties/hybrids during this investigation, eighteen varieties/hybrids of tomato were screened against aphid population. The result of both the year indicated that not all varieties/hybrids were found to be completely resistant to aphid. For the purpose of interpreting the results, all the

varieties/hybrids were categorized for their reaction based on average data of peak in both the years (*Rabi* 2022-23 and 2023-24) of mean aphid population. The statistical formula $\bar{X} \pm \sigma$ was used to categorized the varieties/hybrids, with the average value being ($\bar{X}$ =15.74) and the standard deviation being (σ = 5.83). As a result, three separate groupings of aphid population - below 9.91, between 9.91 and 21.57 and above 21.57 were identified. Based on this statistical categorization method, it was determined that the varieties/hybrids Arka Vishal and Kashi Adarsh exhibited lower susceptibility. On the other hand, the varieties/hybrids Arka Abhijit, Kashi Sharad, Pusa Uphar, Kashi Vishesh, Pusa Rohini, Kashi Aman, THS-333 Shivam, Arka Abhed, Arka Vikas, Roma, Arka Samrat and Arka Rakshak were classified as moderately susceptible. Lastly, Vaishali, Swati 444, Heemsohna and Pusa Ruby were identified as highly susceptible varieties/hybrids.

Table 2. Categorization of varieties/hybrids

Category	Varieties/hybrids
Less susceptibility	Arka Vishal, Kashi Adarsh
Moderately susceptible	Arka Abhijit, Kashi Sharad, Pusa Uphar, Kashi Vishesh, Pusa Rohini, Kashi Aman, THS-333 Shivam, Arka Abhed, Arka Vikas, Roma, Arka Samrat, Arka Rakshak
Highly susceptible	Pusa Ruby, Heemsohna, Swati 444, Vaishali

Discussion

These findings of the present investigation are in conformity with earlier findings by Bugti (2016) who reported that the variety Zatooni was found highly susceptible to the aphid. The variety Hybrid 1000 found more resistant among the varieties was studied. On the basis of finding the variety Hybrid-1000 is suggested grown at field condition to avoid the insect pest burden and achieved the maximum growth and yield of tomato crops. The current findings are also consistent with Solangi *et al.* (2017) observed that the Nagina genotype was more susceptible to attack of aphid, whereas Rutgar and Eden Oblong genotypes were the least susceptible against aphid. Similarly, Sarkar *et al.* (2018) results showed that none of tested tomato genotypes were found either as tolerant or resistant against aphid. In terms of relative susceptibility against aphid, the tomato genotypes could be arranged in the following sequence (higher to lower): NS 501, Priya, Roja, Romeo, Rubi, Patherkuchi and NS501,

Romeo, Rubi, Priya, Roja, Patherkuchi respectively. Here Patherkuchi was found less susceptible for aphid as well as found to be immune against ToLCV (Tomato leaf curl virus) disease incidence. Remaining other genotypes were moderately susceptible (Ruby, Roja cherry, Romeo and Priya) to highly susceptible NS501. Correspondingly, Anu *et al.* (2020) also reported that among all the tomato genotypes showed varying degree of responses. Out of the twenty genotypes, five genotypes namely *Solanum peruvianum*, EC 620421, BRDT-1, EC 538455 and *Solanum cheesmaniae* were considered tolerance/less susceptible to aphid population in all the three seasons. Remaining other genotypes were considered susceptible. According to Mahmoud *et al.* (2020) observed that the Casterlok variety had the lowest mean number of *Aphis gossypii*, while, Super strain B and Strain B recorded the highest values. The same findings were made by Wade *et al*. (2020) who screened fifteen genotypes of tomato against aphids under field condition. The genotypes showed different responses for different pests. The most promising genotype was N-2257, while genotype SUN-7610 was most infested by aphid. Present finding also supported by Shahrin *et al.* (2022) who screened five tomato varieties *viz.,* BARI Tomato 2, BARI Tomato 14, BARI Tomato 15, BARI Tomato 16, and BARI Tomato 17 were for their reaction against aphid *Aphis gossypi*, the major sucking pests of tomato plants in Bangladesh. Infestation levels of aphid found less on BARI Tomato 15 followed by BARI Tomato 16.

CONCLUSION

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The result concluded that population of during the year 2022-23, the mean number of aphid in all the tomato varieties/hybrids was ranged from 4.22 to 13.87 aphids/three leaves. During the year 2023-24, the mean number of aphid in all the tomato varieties/hybrids was ranged from 3.90 to 13.02 aphids/three leaves. Overall mean of both years were ranged from 4.06 - 13.44 aphid/three leaves). Among the eighteen varieties/hybrids it was determined that the Arka Vishal and Kashi Adarsh exhibited lower susceptibility. On the other hand, the varieties/hybrids Arka Abhijit, Kashi Sharad, Pusa Uphar, Kashi Vishesh, Pusa Rohini, Kashi Aman, THS-333 Shivam, Arka Abhed, Arka Vikas, Roma, Arka Samrat and Arka Rakshak were classified as moderately susceptible. Lastly, Vaishali, Swati 444, Heemsohna and Pusa Ruby were identified as highly susceptible varieties/hybrids.

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Table 3: Screening of tomato varieties/hybrids against aphid (*Aphis gossypii* Glover) under field condition during *Rabi* 2022-23 and *Rabi* 2023-24

Varieties/hybrids	2022-23	2023-24	Overall mean
Pusa Rohini	6.95 (2.66)*	6.64 (2.59)	6.79 (2.62)
Pusa Ruby	11.94 (3.40)	11.31 (3.29)	11.62 (3.34)
Pusa Uphar	6.09 (2.50)	5.58 (2.38)	5.83 (2.44)
Arka Abhijit	5.35 (2.35)	4.91 (2.25)	5.13 (2.30)
Arka Vikas	8.49 (2.92)	7.79 (2.80)	8.14 (2.86)
Arka Abhed	8.03 (2.84)	7.58 (2.76)	7.81 (2.80)
Arka Samrat	9.25 (3.03)	8.67 (2.93)	8.96 (2.98)
Arka Rakshak	9.88 (3.12)	9.36 (3.03)	9.62 (3.08)
Arka Vishal	4.22 (2.10)	3.90 (2.02)	4.06 (2.06)
Kashi Adarsh	4.43 (2.16)	4.16 (2.08)	4.30 (2.12)

Kashi Aman	7.42 (2.74)	6.84 (2.63)	7.13 (2.68)
Kashi Vishesh	6.39 (2.56)	6.03 (2.47)	6.21 (2.52)
Kashi Sharad	5.70 (2.42)	5.26 (2.32)	5.48 (2.37)
THS - 333 Shivam	7.70 (2.79)	7.14 (2.68)	7.42 (2.74)
Roma	8.88 (2.97)	8.45 (2.90)	8.67 (2.94)
Swati 444	13.18 (3.58)	12.49 (3.47)	12.84 (3.53)
Vaishali	13.87 (3.67)	13.02 (3.54)	13.44 (3.61)
Heemsohna	12.55 (3.48)	12.01 (3.40)	12.28 (3.44)
SEm±	0.04	0.04	0.04
CD at 5%	0.11	0.11	0.11

*Figures in parentheses are $\sqrt{x+0.5}$ transformed values,

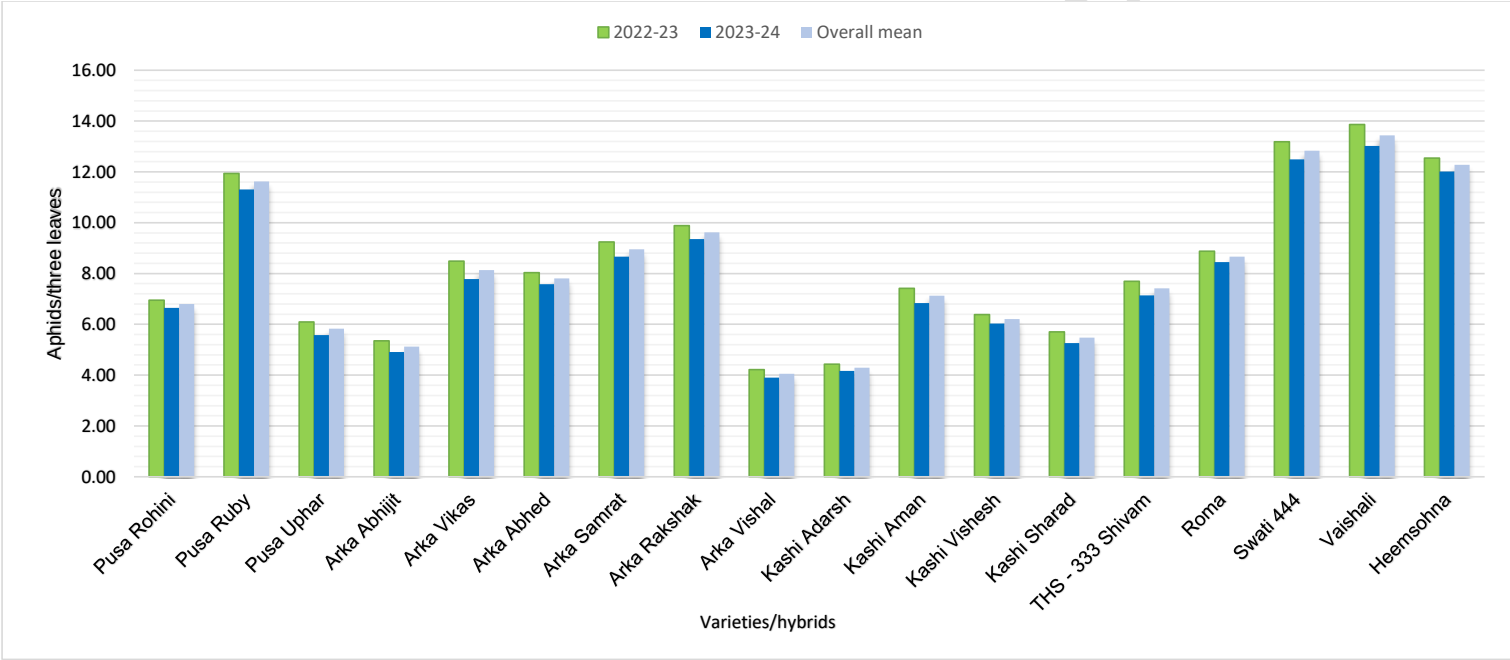

Fig. 1: Screening of tomato varieties/hybrids against aphid (*Aphis gossypii* Glover) under field condition during *Rabi* 2022-23 and 2023-24