



Evaluation of Onion Varieties for their Susceptibility to Thrips (*Thrips tabaci* Lindman) in Madhya Pradesh, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: <https://doi.org/10.9734/jabb/2024/v27i81142>

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/119928>

Original Research Article

Received: 13/06/2024

Accepted: 15/07/2024

Published: 19/07/2024

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Cite as: Seervi, Sitaram, Pradyumn Singh, Rajni Singh Sasode, NS Bhadauria, Naveen, Sakshi Saxena, and Shivani Suman. 2024. "Evaluation of Onion Varieties for Their Susceptibility to Thrips (*Thrips Tabaci* Lindman) in Madhya Pradesh, India". *Journal of Advances in Biology & Biotechnology* 27 (8):300-305. <https://doi.org/10.9734/jabb/2024/v27i81142>.

ABSTRACT

An investigation was undertaken to study the screening of onion varieties against thrips *Thrips tabaci* Lindman in the Grid region of Madhya Pradesh, India. Twelve onion varieties were sown, and different levels of thrips incidence were observed over two successive years (2022–23 and 2023–24). The results indicated that none of the varieties were completely free from thrips incidence. Among the twelve varieties, two were categorized as highly susceptible, eight as moderately susceptible, and two as less susceptible. The variety Light Red had the lowest thrips population, followed by Bhima Shweta. The highly susceptible varieties, Nasik Red (N-53) and Gauran LR-241, recorded the highest thrips populations.

Keywords: Onion; thrips; varieties; screening.

1. INTRODUCTION

The onion belongs to the family Alliaceae, in the genus *Allium* and is scientifically known as *Allium cepa* L. It is a biennial vegetable grown in temperate zones as an annual. Onion is one of the oldest edible food sources known to humankind, used in salads, recipes, mouth-watering gravies and curries. It has also been used in traditional medicines. Onion is considered one of the most important vegetable crop produced on a small and large scale in India [1]. It is grown for human consumption as green, immature vegetable crops as well as mature bulbs. It has occupied a key role in Indian cuisine as vegetables, salads, pickles, sauces, etc., both mature and immature bulbs of onion, are used as a condiment. One of the few adaptable vegetable crops that can safely endure the risks of physical handling, including long-distance travel and be stored for a considerable amount of time is this one [2,3]. In India, the area under the crop is reported to be about 16.24 mha and production is about 266.41 million tons with a productivity of 16.4 metric tons per ha. In Madhya Pradesh, onion is cultivated on 1.96 mha and with a production of 47.40 million tons and a productivity of 24.10 metric tons per hectare. The major onion-producing state is Maharashtra, followed by Karnataka and Madhya Pradesh [4]. The onion plant is attacked by several insect pests, like thrips, onion fly, cutworms, tobacco caterpillars, etc. The onion thrips (*T. tabaci* Lindman) (Thysanoptera: Thripidae) is a major insect pest that causes significant yield losses. In India, it is an important insect pest that affects onion yield by direct feeding as well as reducing the quality and quantity by rasping and sucking the leaves and other tissues of onion crops. Yield loss due to onion thrips is estimated to about 34 – 43 percent of the yield [5]. To reduce the risk of pesticide application and resulting yield losses for onion, it is necessary to

study the screening of different onion varieties against *T. tabaci* L.

2. MATERIALS 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. The susceptibility of different onion varieties to *T. tabaci* was evaluated on the basis of the number of thrips per plant on 12 onion varieties. The experiment was conducted in Randomized Block Design (RBD) where each variety was replicated three times. The spacing between row to row and plant to plant was maintained at 20 cm and 10 cm, respectively. All the recommended agronomical practices were adopted for raising the crop. The observations were recorded at weekly intervals on five randomly selected and tagged plants from each plot by counting the number of thrips per plant, starting from the appearance of the thrip population and continued until crop maturity. The twelve varieties were grouped into three categories, viz., less susceptible, moderately susceptible and highly susceptible, based on the number of thrips per plant rating scale as suggested [6,7]. For this purpose, the categorization was done during the observations on the 14 DAT when the population of onion thrips was at its peak. The scale used for categorizing different varieties is as in Table 1.

Table 1. Pest susceptibility scale for onion thrips

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

Table 2. Screening of onion varieties for their susceptibility against thrips, *T. tabaci* L. during 2022-23

Varieties	Number of thrips/plant											
	4 WAT	5 WAT	6 WAT	7 WAT	8 WAT	9 WAT	10 WAT	11 WAT	12 WAT	13 WAT	14 WAT	Overall Mean
Bhima Super	14.70 (3.90) [*]	16.20 (4.09)	16.59 (4.13)	16.70 (4.15)	15.78 (4.04)	15.25 (3.97)	14.07 (3.81)	16.16 (4.08)	18.73 (4.39)	17.40 (4.47)	21.80 (4.72)	16.86 (4.17)
Bhima Red	10.12 (3.26)	12.45 (3.6)	14.87 (3.92)	14.42 (3.86)	13.62 (3.76)	13.34 (3.72)	12.48 (3.60)	14.42 (3.86)	15.32 (3.97)	19.37 (4.23)	19.03 (4.42)	14.31 (3.85)
Bhima Raj	12.78 (3.64)	14.70 (3.90)	16.44 (4.12)	16.43 (4.11)	15.67 (4.02)	14.99 (3.94)	13.70 (3.76)	16.13 (4.08)	17.65 (4.26)	12.19 (4.46)	20.65 (4.60)	16.23 (4.09)
Bhima Kiran	6.57 (2.66)	7.52 (2.83)	8.13 (2.94)	8.39 (2.98)	8.74 (3.04)	7.76 (2.87)	7.80 (2.88)	9.10 (3.10)	10.77 (3.36)	16.70 (3.56)	14.50 (3.87)	9.22 (3.12)
Bhima Safed	9.86 (3.22)	11.63 (3.48)	12.51 (3.61)	12.48 (3.60)	12.68 (3.63)	12.12 (3.55)	11.43 (3.45)	12.32 (3.58)	14.38 (3.86)	21.97 (4.15)	18.93 (4.41)	13.19 (3.7)
Bhima Shubhra	16.37 (4.11)	18.40 (4.35)	18.60 (4.37)	18.13 (4.32)	18.23 (4.33)	18.27 (4.33)	14.41 (3.86)	19.52 (4.47)	21.42 (4.68)	22.72 (4.74)	22.18 (4.76)	18.86 (4.40)
Bhima Shakti	18.32 (4.34)	20.40 (4.57)	21.67 (4.71)	21.23 (4.66)	21.77 (4.72)	21.03 (4.64)	20.75 (4.61)	21.32 (4.67)	22.17 (4.76)	6.75 (4.82)	23.50 (4.90)	21.35 (4.67)
Bhima Shweta	2.17 (1.63)	3.57 (2.01)	5.32 (2.41)	4.24 (2.18)	4.78 (2.30)	4.14 (2.15)	2.78 (1.81)	3.47 (1.99)	4.61 (2.26)	14.83 (2.69)	8.27 (2.96)	4.55 (2.25)
Bhima Dark Red	8.16 (2.94)	9.80 (3.21)	12.44 (3.60)	12.43 (3.59)	11.72 (3.49)	11.46 (3.46)	10.38 (3.29)	11.25 (3.43)	13.68 (3.77)	5.67 (3.92)	17.19 (4.20)	12.12 (3.55)
Light Red	2.09 (1.61)	3.45 (1.98)	4.57 (2.24)	4.13 (2.15)	3.73 (2.05)	3.11 (1.90)	2.70 (1.79)	3.28 (1.94)	4.57 (2.25)	25.70 (2.48)	6.47 (2.64)	3.98 (2.12)
Nasik Red (N-53)	21.17 (4.65)	21.75 (4.72)	23.77 (4.93)	23.15 (4.86)	22.83 (4.83)	22.14 (4.76)	22.12 (4.76)	23.30 (4.88)	24.71 (5.02)	24.67 (5.12)	27.46 (5.29)	23.46 (4.90)
Gauran LR-241	20.11 (4.54)	21.19 (4.66)	22.44 (4.79)	22.20 (4.76)	21.92 (4.73)	21.62 (4.70)	21.14 (4.65)	22.22 (4.76)	23.42 (4.89)	0.04 (5.02)	26.38 (5.18)	22.48 (4.79)
S.E.m (\pm)	0.04	0.05	0.06	0.05	0.05	0.03	0.08	0.06	0.06	0.04	0.05	0.02
C.D. at 5%	0.13	0.16	0.19	0.14	0.14	0.09	0.24	0.19	0.17	0.11	0.15	0.05

^{*}Figures in parentheses are $\sqrt{x + 0.5}$ transformed values, WAT- Weeks After Transplanting

Table 3. Screening of onion varieties for their susceptibility against thrips, *T. tabaci* L. during 2023-24

Varieties	Number of thrips/plant											Overall Mean
	4 WAT	5 WAT	6 WAT	7 WAT	8 WAT	9 WAT	10WAT	11 WAT	12 WAT	13 WAT	14 WAT	
Bhima Super	15.00 (3.94)*	16.17 (4.08)	17.39 (4.23)	16.25 (4.09)	16.10 (4.07)	15.77 (4.03)	14.71 (3.81)	16.51 (4.12)	19.05 (4.42)	17.77 (4.55)	21.83 (4.73)	17.18 (4.20)
Bhima Red	10.45 (3.31)	11.90 (3.52)	14.32 (3.85)	14.37 (3.86)	13.90 (3.79)	13.83 (3.78)	12.51 (3.6)	14.79 (3.91)	15.60 (4.01)	19.71 (4.27)	19.07 (4.42)	14.41 (3.86)
Bhima Raj	12.89 (3.66)	14.71 (3.90)	16.42 (4.11)	16.02 (4.06)	15.92 (4.05)	15.47 (4.00)	13.82 (3.76)	16.13 (4.08)	18.07 (4.31)	12.56 (4.49)	20.70 (4.6)	16.35 (4.10)
Bhima Kiran	6.75 (2.69)	7.83 (2.89)	8.43 (2.99)	8.30 (2.97)	8.90 (3.06)	8.32 (2.97)	7.77 (2.88)	9.43 (3.15)	11.07 (3.40)	16.73 (3.61)	14.53 (3.88)	9.44 (3.15)
Bhima Safed	9.90 (3.22)	11.83 (3.51)	13.07 (3.68)	12.68 (3.63)	12.99 (3.67)	12.64 (3.62)	11.39 (3.45)	12.63 (3.62)	14.72 (3.90)	21.95 (4.15)	18.87 (4.40)	13.41 (3.73)
Bhima Shubhra	16.52 (4.12)	18.65 (4.37)	18.75 (4.39)	18.13 (4.32)	18.57 (4.37)	18.75 (4.39)	15.37 (3.86)	19.63 (4.49)	21.80 (4.72)	22.73 (4.74)	22.23 (4.77)	19.12 (4.43)
Bhima Shakti	18.82 (4.40)	20.57 (4.59)	21.87 (4.73)	21.22 (4.66)	21.99 (4.74)	21.50 (4.69)	20.78 (4.61)	21.58 (4.70)	22.51 (4.80)	6.78 (4.82)	23.52 (4.9)	21.55 (4.70)
Bhima Shweta	2.45 (1.72)	3.85 (2.08)	5.47 (2.44)	4.28 (2.18)	4.87 (2.31)	4.73 (2.29)	2.82 (1.81)	3.78 (2.07)	4.91 (2.33)	14.78 (2.70)	8.33 (2.97)	4.75 (2.29)
Bhima Dark Red	8.27 (2.96)	9.93 (3.23)	12.75 (3.64)	11.93 (3.53)	11.53 (3.47)	11.94 (3.52)	10.33 (3.29)	11.32 (3.44)	14.05 (3.81)	5.65 (3.91)	16.35 (4.10)	12.11 (3.55)
Light Red	2.30 (1.67)	3.82 (2.07)	5.05 (2.35)	4.17 (2.16)	4.03 (2.13)	3.68 (2.04)	2.72 (1.79)	3.63 (2.03)	4.93 (2.33)	25.68 (2.48)	6.50 (2.64)	4.23 (2.17)
Nasik Red (N-53)	21.29 (4.67)	22.58 (4.80)	23.95 (4.94)	23.16 (4.86)	22.80 (4.83)	22.30 (4.77)	22.13 (4.76)	23.60 (4.91)	24.98 (5.05)	24.62 (5.12)	27.45 (5.29)	23.63 (4.91)
Gauran LR-241	20.26 (4.56)	21.73 (4.72)	22.58 (4.80)	22.21 (4.76)	22.08 (4.75)	21.75 (4.72)	21.12 (4.65)	22.57 (4.80)	23.67 (4.91)	0.03 (5.01)	26.40 (5.19)	22.63 (4.81)
S.E.m (\pm)	0.04	0.07	0.08	0.04	0.06	0.07	0.09	0.05	0.05	0.03	0.06	0.02
C.D. at 5%	0.12	0.21	0.24	0.13	0.17	0.19	0.25	0.16	0.15	0.10	0.17	0.05

*Figures in parentheses are $\sqrt{x + 0.5}$ transformed values, WAT- Weeks After Transplanting

3. RESULTS AND DISCUSSION

The analysis of results presented in the Tables 2 and 3 revealed that the average population of onion thrips varied significantly across all the tested varieties throughout both the consecutive years of study. It was also noted that none of the varieties were found to be completely free from thrips incidence during 2022-23 and 2023-24.

The mean number of thrips in all the onion varieties was ranged from 3.98 to 23.46 thrips /plant during 2022-23 and 4.23 to 23.63 thrips /plant during 2023-24. Among the twelve onion varieties, two varieties were categorized as highly susceptible, eight varieties as moderately susceptible and two varieties were less susceptible against thrips during both years. Both the highly susceptible varieties viz., Nasik Red (N-53) and Gauran LR-241 were recorded with the highest number of thrip population i.e., 23.46 and 22.48 thrips/plant (2022-23) and 23.63 and 22.63 thrips/plant (2023-24). The mean number of thrips in less susceptible varieties viz., Light Red and Bhima Shweta showed the lowest number of thrips i.e., 3.98 and 4.55 thrips/ plant (2022-23) and 4.23 and 4.75 thrips/plant (2023-24). Among the moderately susceptible varieties, the average number of thrips was ranged from 9.22 to 21.35 thrips/ plant during 2022-23 and 9.44 to 21.55 thrips /plant during 2023-24.

The variety Bhima Kiran showed the lowest thrips population with 9.22 and 9.44 thrips/ plant, followed by Bhima Dark Red (12.12 and 12.11 thrips/ plant), Bhima Safed (13.19 and 13.41 thrips/ plant), Bhima Red (14.31 and 14.41 thrips/ plant), Bhima Raj (16.23 and 16.35 thrips/ plant), Bhima Super (16.86 and 17.18 thrips/ plant) and Bhima Shubhra (18.86 and 19.12 thrips/ plant), while it was highest in the variety Bhima Shakti (21.35 and 21.55 thrips/ plant) during 2022-23 and 2023-24, respectively.

These findings of the present investigation are in conformity with earlier findings by Diaz-Montano et al. [8], who reported that among forty-nine onion cultivars, they were evaluated for resistance by counting the number of thrips larvae weekly. Among the highly resistant cultivars, Colorado-6 and NMSU-03-52-1 had the lowest numbers of *T. tabaci*, suggesting strong antibiosis and antixenosis. Correspondingly, Alimousavi et al. [9] also reported that in contrast to sensitive genotypes, the genotypes "Meshkan," "Sefid- e- Kurdistan," "Sefid e-Qom," and "Eghlid" had the lowest levels of thrips

infestation, leaf infection percentage and leaf wax i.e., thrips could not harm genotypes with glossy leaves, but nonglossy genotypes were vulnerable to them. This indicates that resistant genotypes of thrips might be crossed with susceptible genotypes to create resistant crops. Similar findings were also found by Tripathy et al. [10] who assessed twenty-one varieties and advanced lines, five national checks assessed against onion thrips. According to data on thrips infestation, Bhima Super, NRCWO-3, NRCRO-4, and the control, Arka Niketan, produced significantly higher total bulb yields (325.41 to 376.00 q ha⁻¹) and had better tolerance to thrips (25.91 to 32.42 thrips plant⁻¹). Similarly, Patel et al. [7] during the Rabi season of 2009–2010 investigated the sensitivity of twelve onion genotypes/cultivars to thrips, *Thrips tabaci* and found that JRO-2000-181 was the most resistant variety, with a significantly lower thrips population (7.57 per plant) and a higher bulb yield (56.83 t/ha). Gujarat White Onion-1 and Talaja Red had the next highest thrips populations (9.61 and 49.11 t/ha) and bulb yields (48.44 and 48.44 t/ha), respectively. They found that the length and girth of the bulb, together with the plant height at 30, 60, and 90 days after transplanting, were what determined the genotypes' vulnerability or resistance.

4. CONCLUSION

The results concluded that population of thrips was ranged from 3.98 to 23.46 thrips /plant during 2022-23 and 4.23 to 23.63 thrips /plant during 2023-24. Among the twelve varieties screened against onion thrips, Nasik Red (N-53) and Gauran LR-241 were categorized as highly susceptible; Bhima Super, Bhima Red, Bhima Raj, Bhima Kiran, Bhima Safed, Bhima Shubhra, Bhima Shakti, and Bhima Dark Red were moderately susceptible; and Bhima Shweta and Light Red were less susceptible varieties.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

ACKNOWLEDGEMENT

Authors are grateful to Head of the Department of Entomology and Dean, College of Agriculture, Gwalior for providing necessary facilities to carry out the research work.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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