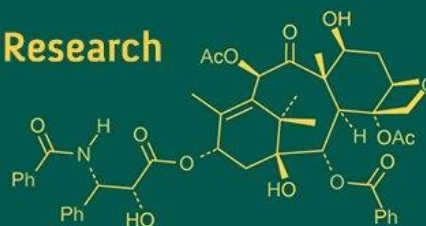


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Genotypic Screening and Seasonal Incidence of Thrips (*Thrips tabaci* Lind.) in Onion (*Allium cepa* L.) under Natural Field Conditions in the Gird Region of Madhya Pradesh

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Abstract

The present investigation was conducted during *Rabi* 2023-24 and 2024-25 at the Research Farm, College of Agriculture, RVSKVV, Gwalior, to study the seasonal incidence of thrips and to evaluate thirty-five onion genotypes for their reaction to infestation. Thrips population ranged from 2.59 thrips per plant (51st SMW) to a peak of 42.91 thrips/plant (8th SMW), with maximum temperature showed a significant positive correlation ($r = 0.547$), while relative humidity exhibited a suppressive effect during *rabi* season of 2023-24. Significant variation among genotypes allowed their categorization into four resistance groups. Out of 35 genotypes, 5 genotypes viz., 1783, Bhima Safed, 1769, Bhima Raj and 1774 were classified as highly resistant (9.61 to 10.19 thrips/plant). fourteen genotypes, GL-3, 1772, GL-1, 1770, Bhima Super, Bhima Kiran, Arka Pragati, Bhima Light Red, Bhima Shakti, GL-2, N-53, Bhima Shweta, Bhima Dark Red and Bhima Red were grouped as resistant (10.30-12.06 thrips/plant). Nine genotypes, such as W-125, Arka Kalyan, W-504, W-361, W-401, 1771, 1768, W-344 and 1773 were susceptible (12.32-13.92 thrips/plant), while Seven genotypes i.e., Bhima Shubhra, W-355, W-507, N-2-4-1, W-500, W-085 and W-043 were rated as highly susceptible (14.20-16.45 thrips/plant). Based on these findings, Genetic resistance reduced thrips infestation; genotypes 1783 and Bhima Safed offer potential for breeding and integrated pest management.

Keywords: Onion, thrips, *Thrips tabaci*, screening, genotypes

Introduction

Onion (*Allium cepa* L.) is one of the most economically significant and nutritionally valuable vegetable crops cultivated worldwide (Havey, 2018) ^[5]. Belonging to the family Alliaceae (Manjunathagowda *et al.*, 2019; Yogita *et al.*, 2023) ^[9, 19], it is popularly known as the “Queen of Kitchen” owing to its wide culinary and dietary applications. India is among the leading onion-producing nations, contributing nearly 28-30% of global production. The crop is cultivated on about 1.74 million hectares with an annual output exceeding 30.21 million metric tonnes with a productivity 1.73 tonnes per hectare (Anonymous, 2023) ^[1]. In Madhya Pradesh, onion are grown on approximately 213.75 thousand hectares, yielding about 5.26 million metric tonnes annually (Anonymous, 2023) ^[1].

The Gird region of Madhya Pradesh has emerged as a prominent onion-producing belt, particularly during the *rabi* season. Districts such as Gwalior, Morena, Bhind, Sheopur and Shivpuri fall within this zone, which is characterized by a semi-arid, sub-tropical climate marked by high summer temperatures, cold winters, irregular rainfall and loamy to alluvial soils of moderate fertility. In addition to abiotic challenges, biotic stresses severely restrict onion productivity. The crop is attacked by several insect pests such as onion fly, cutworms, tobacco caterpillars and particularly thrips. Among these, onion thrips (*Thrips tabaci* Lindeman; Thysanoptera: Thripidae) is the most destructive pest (Kumar *et al.*, 2019) ^[8]. Thrips directly feed on onion foliage, causing silvery blotches, curling and distortion of leaves. Infested plants often develop undersized bulbs, leading to yield reductions that may exceed 50% under severe infestations. More critically, thrips also act as vectors of viral pathogens such as *Iris yellow spot virus* (IYSV), thereby amplifying crop losses. Under warm and dry weather conditions, thrips populations proliferate rapidly, causing widespread infestations that threaten both yield and bulb quality (Karar *et al.*, 2014; Osman *et al.*, 2024) ^[7, 11].

The combined effect of thrips infestation and prevailing climatic stresses in the Gird region poses a major challenge to onion cultivation. Despite the economic importance of this pest, systematic screening of onion genotypes under field conditions in this region has been limited. Therefore, evaluating the performance of diverse onion genotypes against *T. tabaci* is crucial for identifying promising genetic resources that can be utilized in breeding programmes and integrated pest management strategies to ensure sustainable onion production.

Materials and Methods

The field experiment was conducted during the *rabi* seasons of 2023-24 and 2024-25 at the Research Farm, College of Agriculture, RVSKVV, Gwalior (Madhya Pradesh). In this study thirty-five onion genotypes were Bhima Shubhra, Bhima Red, Bhima Raj, Bhima Shweta, Bhima Shakti, Bhima Super, Bhima Kiran, Bhima Safed, Bhima Dark Red, Bhima Light Red, Arka Pragati, Arka Kalyan, N-53, N-2-4-1, 1768, 1769, 1770, 1771, 1772, 1773, 1774, 1783, W-043, W-085, W-125, W-344, W-355, W-361, W-401, W-500, W-504, W-507, GL-1, GL-2 and GL-3 Selected. Forty-five-day-old healthy and uniform onion seedlings, each having three to four true leaves, were selected for transplanting. Crop was transplanted on first week of November in both year 2023-24 and 2024-25 with plot size of 2.0 X 1.5 m and replicated three times with spacing of 15 cm between rows and 10 cm between plants. Five plants were selected randomly in each plot and absolute population of thrips was recorded by examining the plant. The observations were taken at weekly interval during the whole cropping season. The method modified as according to (Ibrahim and Adesiyun, 2010, Ullah *et al.*, 2010) [6, 17].

Incidence of insect-pest

The population of thrips was recorded with the help of 10X magnifying lens on randomly selected 5 plants from each plot during crop growth. The pest population was recorded in selected plants and average number of pests were computed. All genotypes were categorized into 4 groups viz., Highly resistance, resistance, susceptible and highly susceptible (Table 1). For the grouping purpose, mean value of individual genotypes (X_i) was compared with mean value of all genotypes (X) and standard deviation (sd) following the scale adopted by Sheikh *et al.*, (2014) [16].

Table 1: Insect-pest susceptibility scale against onion thrips in onion genotypes

Resistance level	Scale
Highly resistance	$X_i < (X - sd)$
Resistance	$X_i > (X - sd) < X$
susceptible	$X_i > X < (X + sd)$
Highly susceptible	$X_i > (X + sd) < (X + 2sd)$

Results and Discussion

Seasonal incidence of *Thrips tabaci*

The results presented in Table 2 revealed that thrips population ranged from 2.59 (51st SMW) to 42.91 (8th SMW) thrips/plant during *Rabi* 2023-24. In the initial three weeks of observations, the infestation level was very low, with 2.59 thrips/plant in the 51st SMW, 4.19 in the 52nd SMW and 3.47 in the 1st SMW. Thereafter, the thrips population started increasing from the 4th SMW (10.94 thrips/plant) and reached its peak during the 8th SMW (42.91

thrips/plant). A nearly similar level was recorded in the 9th SMW (41.86 thrips/plant), after which the population gradually declined until harvest. Correlation analysis (Table 3) showed a significant positive relationship between thrips population and maximum temperature ($r = 0.547$), while minimum temperature ($r = 0.421$), rainfall ($r = 0.052$) and evaporation ($r = 0.478$) exhibited positive but non-significant associations. Conversely, morning relative humidity ($r = -0.433$) and evening relative humidity ($r = -0.292$) showed negative but non-significant correlations with thrips incidence.

These findings indicated that rising temperatures promote thrips multiplication, whereas higher relative humidity tends to suppress their population. This is consistent with the biology of thrips, which are polyphagous and highly temperature-sensitive pests that thrive under warm and dry conditions. Moderate to high temperatures, coupled with low relative humidity, provide favorable microclimatic conditions for rapid multiplication, whereas excessive moisture or high humidity restricts population build-up. The present findings are in close agreement with those of Seervi *et al.* (2024) [15], who reported that thrips infestation commenced in the 52nd SMW and peaked around the 9th SMW in Madhya Pradesh, with populations showing a positive correlation with maximum and minimum temperatures but a negative association with relative humidity. Similarly, Meena *et al.* (2024) [10] observed that thrips incidence was positively correlated with maximum temperature and evaporation, while rainfall and both morning and evening relative humidity exhibited negative relationships with thrips incidence.

Table 2: Seasonal population dynamics of *Thrips tabaci* on onion in different weathers parameters during the year of 2024-25.

SMW	Thrips/ Plant	Temperature		Relative Humidity (%)		Weekly Rainfall (mm)	Evaporation
		Max. (°C)	Min. (°C)	Morn.	Even.		
51	2.59	24.6	6.2	94.5	63.8	0	1.6
52	4.19	22.3	7	95.3	75.7	0	0.9
1	3.47	15.6	8.7	94.4	67.1	0	0.8
2	7.45	21	5.7	93.1	61.6	36	1.2
3	7.14	17.2	5.3	94.9	66.6	0	0.7
4	10.94	20.6	5.3	87.9	61.7	0	0.9
5	18.32	25.7	9.6	89	60	0	1.2
6	20.59	23	7.2	88.7	67.6	6.2	1.2
7	32.11	26.7	7.2	91.6	57.1	0	1.7
8	42.91	29.4	10.2	83	56.3	0	3.3
9	41.86	27.2	10.7	85.4	63.3	20.6	2.2
10	32.55	28	8.1	79.9	48.6	0	1.8
11	21.69	32.2	11.6	75.3	39.7	0	3.4
12	11.99	34.3	13.3	70.7	34.7	0	3.9

Table 3: Simple correlation between weather parameters on onion during the year of 2024-25.

Weather factor	Thrips/Plant
Maximum Temperature (°C)	0.547
Minimum Temperature (°C)	0.421
Morning RH (%)	-0.433
Evening RH (%)	-0.292
Weekly rainfall (mm)	0.052
Evaporation	0.478

Thrips incidence in onion genotypes

The evaluation of thirty-five onion genotypes for their response to *Thrips tabaci* under natural field infestation during the *rabi* seasons 2023-24 and 2024-25. Five onion genotypes were classified as highly resistant, with mean thrips infestation ranged from 9.61 to 10.19 thrips per plant (Table 4). The genotypes in this group included 1783 (9.61 thrips/plant), Bhima Safed (9.67 thrips/plant), 1769 (10.02 thrips/plant), Bhima Raj (10.12 thrips/plant), and 1774 (10.19 thrips/plant). Year-wise analysis revealed slight variation, with infestation levels ranged from 9.52 thrips/plant in genotype 1783 to 11.37 thrips/plant in Bhima Raj during 2023-24, and from 8.87 thrips/plant in Bhima Raj to 9.70 thrips/plant in 1783 during 2024-25. These findings are in line with Gupta (2015) ^[3], who reported ON14-6, ON14-25 and OSK-1364 as highly resistant. Similarly, Patel *et al.* (2012) ^[13] documented JRO-2000-181 (7.57 thrips/plant) and Gujarat White Onion-1 (9.61 thrips/plant) as resistant.

Fourteen genotypes were classified in the resistant category, with mean thrips infestations ranging from 10.30 to 12.06 thrips per plant (Table 4). The resistant group included genotypes Bhima Red (10.30 thrips/plant), Bhima Dark Red (10.35 thrips/plant), Bhima Shweta (10.37 thrips/plant), N-53 (10.55 thrips/plant), GL-2 (10.83 thrips/plant), Bhima Shakti (10.91 thrips/plant), Bhima Light Red (10.92 thrips/plant), Arka Pragati (10.92 thrips/plant), Bhima Kiran (11.00 thrips/plant), Bhima Super (11.08 thrips/plant), 1770 (11.14 thrips/plant), GL-1 (11.64 thrips/plant), 1772 (11.96 thrips/plant) and GL-3 (12.06 thrips/plant). Year-wise analysis revealed considerable variation, with infestation levels ranged from 10.02 thrips/plant in Bhima Dark Red to 13.14 thrips/plant in Bhima Super during 2023-24, and from 9.01 thrips/plant in Bhima Super to 12.60 thrips/plant in GL-3 during 2024-25. Similar observations were reported by Kumar *et al.* (2019) ^[8], who grouped ten genotypes as resistant, while Shaikh *et al.* (2014) ^[16] identified resistant entries in both red and white onion cultivars. Salame *et al.* (2023) ^[14] reported that the strong influence of genotype $\times$ environment interactions on thrips resistance expression.

Nine genotypes were classified as susceptible, with pooled mean thrips infestations ranging from 12.32 to 13.92 thrips/plant (Table 4). Among these, 1773 (12.32 thrips/plant), W-344 (12.41 thrips/plant), 1768 (12.67 thrips/plant), 1771 (12.71 thrips/plant), W-401 (12.84 thrips/plant), W-361 (13.41 thrips/plant), W-504 (13.41 thrips/plant), Arka Kalyan (13.90 thrips/plant) and W-125 (13.92 thrips/plant). Across years, thrips incidence varied from 11.58 thrips/plant in genotype 1768 to 15.77 thrips/plant in W-125 during 2023-24, and from 9.76 thrips/plant in W-344 to 13.76 thrips/plant in 1768 during 2024-25. Comparable findings were reported by Karar *et al.* (2014) ^[7], who identified VRIO-3 as highly susceptible, and by Palaskar *et al.* (2021) ^[12], who observed in garlic genotype PB-11.

The highly susceptible group comprised seven genotypes, with mean thrips infestations ranged from 14.20 to 16.45 thrips/plant (Table 4). Within this group, genotypes W-043 (14.20 thrips/plant), W-085 (14.26 thrips/plant), W-500 (14.64 thrips/plant), N-2-4-1 (14.76 thrips/plant), W-507 (15.44 thrips/plant), W-355 (16.01 thrips/plant) and Bhima Shubhra (16.45 thrips/plant) exhibited consistently high thrips populations. Across years, infestation levels ranged

from 14.04 thrips/plant in W-085 to 17.18 thrips/plant in Bhima Shubhra during 2023-24, and from 12.33 thrips/plant in W-043 to 16.14 thrips/plant in W-355 during 2024-25. The highly susceptible reactions observed in the present study corroborate the findings of Hamza *et al.* (2024) ^[4], who reported Dark Red (8.63 thrips/plant) and Diana (8.48 thrips/plant) as highly susceptible, as well as Karar *et al.* (2014) ^[7], who also documented susceptible genotypes. The variation in thrips incidence observed across categories can be attributed to both genetic and environmental factors. Environmental conditions also play a critical role: Vinutha *et al.* (2024) ^[18] and Garai *et al.* (2023) ^[2] reported that thrips populations peak under high temperatures and low humidity during the *rabi* season, whereas rainfall and cooler temperatures suppress infestations.

Table 4: Incidence of *Thrips tabaci* Lind. In different onion genotypes

Genotypes		Mean population per plant			Reaction
		2023-24	2024-25	Pooled	
G ₁	Bhima Shubhra	17.18(4.2)	15.72(4.03)	16.45(4.12)	HS
G ₂	Bhima Red	11.06(3.4)	9.54(3.17)	10.30(3.29)	R
G ₃	Bhima Raj	11.37(3.45)	8.87(3.06)	10.12(3.26)	HR
G ₄	Bhima Shweta	11.12(3.41)	9.62(3.18)	10.37(3.3)	R
G ₅	Bhima Shakti	11.23(3.42)	10.59(3.33)	10.91(3.38)	R
G ₆	Bhima Super	13.14(3.69)	9.01(3.08)	11.08(3.4)	R
G ₇	Bhima Kiran	10.26(3.28)	11.74(3.5)	11.00(3.39)	R
G ₈	Bhima Safed	10.40(3.3)	8.95(3.07)	9.67(3.19)	HR
G ₉	Bhima Dark Red	10.02(3.24)	10.69(3.35)	10.35(3.29)	R
G ₁₀	Bhima Light Red	11.72(3.5)	10.11(3.26)	10.92(3.38)	R
G ₁₁	Arka Pragati	10.77(3.36)	11.06(3.4)	10.92(3.38)	R
G ₁₂	Arka Kalyan	14.72(3.9)	13.08(3.69)	13.9(3.79)	S
G ₁₃	N-53	10.55(3.32)	10.56(3.33)	10.55(3.32)	R
G ₁₄	N-2-4-1	15.84(4.04)	13.67(3.77)	14.76(3.91)	HS
G ₁₅	1768	11.58(3.48)	13.76(3.78)	12.67(3.63)	S
G ₁₆	1769	10.98(3.39)	9.06(3.09)	10.02(3.24)	HR
G ₁₇	1770	11.38(3.45)	10.91(3.38)	11.14(3.41)	R
G ₁₈	1771	13.84(3.79)	11.57(3.47)	12.71(3.63)	S
G ₁₉	1772	13.04(3.68)	10.88(3.37)	11.96(3.53)	R
G ₂₀	1773	14.26(3.84)	10.37(3.3)	12.32(3.58)	S
G ₂₁	1774	10.80(3.36)	9.58(3.17)	10.19(3.27)	HR
G ₂₂	1783	9.52(3.17)	9.7(3.19)	9.61(3.18)	HR
G ₂₃	W-043	16.06(4.07)	12.33(3.58)	14.20(3.83)	HS
G ₂₄	W-085	14.48(3.87)	14.04(3.81)	14.26(3.84)	HS
G ₂₅	W-125	15.77(4.03)	12.08(3.55)	13.92(3.8)	S
G ₂₆	W-344	15.05(3.94)	9.76(3.2)	12.41(3.59)	S
G ₂₇	W-355	15.88(4.05)	16.14(4.08)	16.01(4.06)	HS
G ₂₈	W-361	15.40(3.99)	11.41(3.45)	13.41(3.73)	S
G ₂₉	W-401	13.31(3.72)	12.37(3.59)	12.84(3.65)	S
G ₃₀	W-500	14.56(3.88)	14.72(3.9)	14.64(3.89)	HS
G ₃₁	W-504	15.34(3.98)	11.49(3.46)	13.41(3.73)	S
G ₃₂	W-507	15.15(3.96)	15.72(4.03)	15.44(3.99)	HS
G ₃₃	GL-1	11.16(3.41)	12.12(3.55)	11.64(3.48)	R
G ₃₄	GL-2	10.22(3.27)	11.43(3.45)	10.83(3.37)	R
G ₃₅	GL-3	11.52(3.47)	12.60(3.62)	12.06(3.54)	R
S.Em ($\pm$)		0.40	0.40	0.35	
CD (5%)		1.14	0.99	099	

Table 5: Categorization of onion genotypes for their susceptibility to *T. tabaci*

Resistance level	Scale	Genotypes
Highly resistance	$X < 10.28$	1774, Bhima Raj, 1769, Bhima Safed and 1783
Resistance	$X > 10.28 < 12.20$	GL-3, 1772, GL-1, 1770, Bhima Super, Bhima Kira, Arka Pragati, Bhima Light Red, Bhima Shakti, GL-2, N-53, Bhima Shweta, Bhima Dark Red and Bhima Red
susceptible	$X > 12.20 < 14.11$	W-125, Arka Kalyan, W-504, W-361, W-401, 1771, 1768, W-344 and 1773
Highly susceptible	$X > 14.11 < 16.02$	Bhima Shubhra, W-355, W-507, N-2-4-1, W-500, W-085, W-043

Based on population of thrips/plant; $X=12.20$ and $sd=1.91$. Source rating scale as suggested by Sheikh *et al.* (2014).

Conclusion

The findings of the present investigation clearly demonstrated substantial variability among onion genotypes in their response to *Thrips tabaci*. The study revealed that thrips population increased with rising temperatures and declining relative humidity, reached its peak during the 8th standard meteorological week. Among thirty-five genotypes, five genotypes 1783, Bhima Safed, 1769, Bhima Raj and 1774, showed strong resistance, while Bhima Shubhra and W-355 were highly susceptible. Genetic resistance significantly reduced thrips infestation across environments. The identified resistant genotypes, particularly 1783 and Bhima Safed, offer valuable sources for breeding thrips-resistant onion cultivars and integrated pest management strategies suited to *rabi* season conditions in Gird region of Madhya Pradesh.

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