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## Screening of onion genotypes against thrips

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**Abstract**

The present study, entitled “Screening of Onion Genotypes against Thrips,” was carried out during the Rabi season of 2025-26 at the research farm of the Department of Vegetable Science, Dr. PDKV, Akola. Fifteen onion genotypes were evaluated for resistance to thrips, and the relationship between thrips population and weather parameters was examined. The experiment was conducted in a randomized block design with 15 treatments and three replications. Thrips incidence was recorded from 15 days after transplanting until crop harvest.

Among the evaluated genotypes, AKO-L-22 recorded the lowest mean thrips population (3.46 thrips/plant) and was classified as highly resistant, performing comparably to the resistant check Light Red (3.12 thrips/plant). In contrast, Nashik Red N-53 recorded the highest thrips population (9.05 thrips/plant). Based on thrips infestation, Light Red and AKO-L-22 were categorized as highly resistant. Eight genotypes—AKP-11, AKO-L-6, AKO-4-1, AKO-L-11, AKO-L-15, AKO-L-9, AKO-L-34 and AKO-L-41—were classified as resistant. Genotypes AKO-L-17, AKO-L-13, AKO-L-2 and AKO-L-18 were found to be susceptible, while Nashik Red N-53 was categorized as highly susceptible. Thrips population exhibited significant positive correlations with maximum temperature ( $r = 0.626$ ) and minimum temperature ( $r = 0.540$ ). Conversely, morning relative humidity ( $r = -0.689$ ) and evening relative humidity ( $r = -0.783$ ) showed significant negative correlations with thrips abundance. Considering its overall performance, AKO-L-22 was identified as a promising genotype for further evaluation and use in onion breeding programmes.

**Keywords:** Onion genotypes, resistance screening, thrips incidence, weather parameters, *Thrips tabaci*

**Introduction**

Onion (*Allium cepa* L.) is an important vegetable crop belonging to the family Alliaceae (Amaryllidaceae), with a chromosome number of  $2n = 16$ . It is locally known as Kanda in Maharashtra and is among the most extensively cultivated and widely consumed vegetable crops in India. Onion has considerable culinary, nutritional, medicinal and commercial importance and also contributes substantially to income and employment generation. The area under onion cultivation is projected to increase by 2.31%, or 0.46 lakh ha, from 19.68 lakh ha in 2024-25 to 20.14 lakh ha in 2025-26. Onion production is estimated at 307.37 lakh tonnes in 2025-26, compared with 307.67 lakh tonnes in 2024-25 (Ministry of Agriculture & Farmers Welfare, 2025-26).

Fresh onion bulbs contain approximately 86.8% moisture, 11.6% carbohydrates, 1.2% protein, 0.2-0.5% calcium and 0.05% phosphorus, along with small quantities of iron, thiamine, riboflavin and ascorbic acid. Although the bulbs are primarily consumed as vegetables, the flowering shoot, commonly known as the scape, is also used for culinary purposes. Onion is a valuable source of phosphorus, calcium, carbohydrates, protein and vitamin C (Yadav *et al.*, 2018) [12].

In India, onion cultivation is constrained by several abiotic and biotic factors. Among the biotic stresses, insect pests represent a major limitation to successful crop production. Onion is reportedly attacked by 149 pest species belonging to 11 arthropod orders and two groups of acarines. Worldwide, these species are distributed across 49 arthropod families and 97 insect genera. The greatest number of species belongs to the family Noctuidae, comprising 16 genera and 27 species, followed by mites and members of the families Aphididae, Agromyzidae, Anthomyiidae, Syrphidae, Muscidae, Thripidae, Elateridae, Acrididae and Scarabaeidae. Among these pests, onion thrips, *Thrips tabaci* Lindeman, and western flower thrips, *Frankliniella occidentalis* (Pergande), are important sucking pests responsible for considerable economic losses worldwide (Karuppaiah *et al.*, 2022) [6].

Screening onion genotypes for resistance to *Thrips tabaci* offers a cost-effective and environmentally sustainable approach to pest management (Engla *et al.*, 2014) [2]. Therefore, the present investigation was undertaken to assess the response of different onion genotypes to thrips infestation under field conditions, determine their relative susceptibility and identify superior resistant genotypes for future breeding programmes.

### Materials and Methodology

The field experiment was conducted during the Rabi season of 2025-26 at the experimental farm of the Department of Vegetable Science, Post Graduate Institute, Dr. PDKV, Akola. The selected experimental site was uniform and cultivable, with well-drained medium black soil suitable for onion production and standard field-screening trials.

The experiment was laid out under field conditions in a randomized block design with 15 treatments and three replications. The onion genotypes evaluated were AKO-4-1, AKO-L-2, AKO-L-6, AKO-L-9, AKO-L-11, AKO-L-13, AKO-L-15, AKO-L-17, AKO-L-18, AKO-L-22, AKO-L-34, AKO-L-41, AKP-11, Light Red and Nashik Red N-53. Light Red was included as the resistant check, while Nashik Red N-53 served as the susceptible check.

### Observation of Thrips Population

Observations on thrips population were recorded at weekly intervals, beginning 15 days after transplanting and continuing until crop harvest. Five plants were randomly selected from each experimental plot, and the absolute thrips population was determined through careful examination of each selected plant.

The mean pest population was calculated from the recorded observations. The resulting data were subjected to square-root transformation before statistical analysis to determine the relative susceptibility of the onion genotypes to *Thrips tabaci*.

### Categorization of Onion Genotypes

The onion genotypes were classified into four resistance categories: highly resistant, resistant, susceptible and highly susceptible. Classification was based on the number of thrips recorded per plant. For this purpose, the mean thrips population of each individual genotype ( $X_i$ ) was compared with the overall mean population of all genotypes ( $X$ ) and

the corresponding standard deviation (SD), following the modified scale proposed by Shaikh *et al.* (2014) [11].

Square-root-transformed data were used to calculate  $X_i$ ,  $X$  and SD for this parameter. The genotypes were subsequently assigned to the appropriate resistance categories according to the prescribed classification scale.

| Category of resistance         | Scale for resistance            |
|--------------------------------|---------------------------------|
| Highly Resistant (HR)          | $X_i < X_{-sd}$                 |
| Resistant (R)                  | $X_i > X_{-sd} < X$             |
| Susceptible (S)                | $X_i > X < (X_{+sd})$           |
| Highly Susceptible (HS)        | $X_i > (X_{+sd}) < (X_{+2sd})$  |
| Highly Highly Susceptible (HS) | $X_i > (X_{+2sd}) < (X_{+3sd})$ |

### Correlation of weather parameters with thrips population

Simple correlation coefficients were calculated to determine the relationships between thrips population and weather parameters, including maximum and minimum temperatures and morning and evening relative humidity.

### Results and Discussion

#### Thrips Population on Different Onion Genotypes

Thrips incidence on 15 onion genotypes was recorded from 15 days after transplanting until crop harvest. The mean thrips population ranged from 3.12 to 9.05 thrips per plant, with the highest infestation observed during the third week of March 2026.

The data presented in Table 1 indicate considerable variation in thrips population among the evaluated onion genotypes. AKO-L-22 recorded the lowest mean thrips population (3.46 thrips/plant), which was statistically comparable to the resistant check Light Red (3.12 thrips/plant).

The genotypes AKP-11, AKO-L-6, AKO-4-1, AKO-L-11, AKO-L-15, AKO-L-9, AKO-L-34 and AKO-L-41 recorded mean populations of 3.76, 3.88, 4.11, 4.24, 4.32, 4.46, 4.52 and 4.71 thrips per plant, respectively. These genotypes exhibited resistance to thrips infestation when compared with the resistant check Light Red.

In contrast, AKO-L-17, AKO-L-13, AKO-L-2 and AKO-L-18 recorded mean thrips populations of 5.23, 5.40, 5.47 and 6.12 thrips per plant, respectively, and were categorized as susceptible. Nashik Red N-53 recorded the highest population of 9.05 thrips per plant and was therefore classified as highly susceptible to thrips infestation.

**Table 1:** Population of thrips on different genotypes of onion

| Sr No.         | Genotypes | Number of thrips / plants at different standard week |                 |                 |                 |                 |                 |                  |                  |                  |                  |                  |                  |                  |                  | Mean           |
|----------------|-----------|------------------------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|----------------|
|                |           | 4 <sup>th</sup>                                      | 5 <sup>th</sup> | 6 <sup>th</sup> | 7 <sup>th</sup> | 8 <sup>th</sup> | 9 <sup>th</sup> | 10 <sup>th</sup> | 11 <sup>th</sup> | 12 <sup>th</sup> | 13 <sup>th</sup> | 14 <sup>th</sup> | 15 <sup>th</sup> | 16 <sup>th</sup> | 17 <sup>th</sup> |                |
| T <sub>1</sub> | AKO-4-1   | 1.33<br>(1.35)                                       | 1.73<br>(1.49)  | 2.27<br>(1.66)  | 2.73<br>(1.80)  | 3.27<br>(1.94)  | 4.33<br>(2.20)  | 5.07<br>(2.36)   | 5.53<br>(2.46)   | 6.27<br>(2.60)   | 5.93<br>(2.54)   | 5.53<br>(2.46)   | 5.07<br>(2.36)   | 4.47<br>(2.23)   | 4.07<br>(2.14)   | 4.11<br>(2.15) |
| T <sub>2</sub> | AKO-L-2   | 1.53<br>(1.43)                                       | 2.47<br>(1.72)  | 3.07<br>(1.89)  | 3.60<br>(2.02)  | 4.13<br>(2.15)  | 5.13<br>(2.37)  | 5.87<br>(2.35)   | 7.27<br>(2.79)   | 8.80<br>(3.05)   | 8.60<br>(3.02)   | 7.80<br>(2.88)   | 7.07<br>(2.75)   | 6.07<br>(2.56)   | 5.20<br>(2.39)   | 5.47<br>(2.44) |
| T <sub>3</sub> | AKO-L-6   | 1.73<br>(1.49)                                       | 2.13<br>(1.62)  | 2.53<br>(1.74)  | 2.73<br>(1.80)  | 3.33<br>(1.96)  | 3.67<br>(2.04)  | 4.40<br>(2.21)   | 4.93<br>(2.33)   | 5.67<br>(2.48)   | 5.27<br>(2.40)   | 5.07<br>(2.36)   | 4.87<br>(2.32)   | 4.07<br>(2.14)   | 3.87<br>(2.09)   | 3.88<br>(2.09) |
| T <sub>4</sub> | AKO-L-9   | 1.80<br>(1.52)                                       | 2.07<br>(1.60)  | 3.33<br>(1.96)  | 3.67<br>(2.04)  | 4.07<br>(2.14)  | 4.73<br>(2.89)  | 5.13<br>(2.37)   | 5.73<br>(2.50)   | 6.33<br>(2.61)   | 6.07<br>(2.56)   | 5.47<br>(2.44)   | 5.07<br>(2.36)   | 4.87<br>(2.32)   | 4.13<br>(2.15)   | 4.46<br>(2.23) |
| T <sub>5</sub> | AKO-L-11  | 1.67<br>(1.47)                                       | 1.87<br>(1.54)  | 2.13<br>(1.62)  | 2.67<br>(1.78)  | 3.07<br>(1.89)  | 4.33<br>(2.20)  | 4.87<br>(2.32)   | 5.67<br>(2.48)   | 6.67<br>(2.68)   | 6.13<br>(2.58)   | 5.53<br>(2.46)   | 5.40<br>(2.43)   | 4.93<br>(2.33)   | 4.47<br>(2.23)   | 4.24<br>(2.18) |
| T <sub>6</sub> | AKO-L-13  | 1.60<br>(1.45)                                       | 3.20<br>(1.92)  | 3.40<br>(1.97)  | 4.80<br>(2.30)  | 5.07<br>(2.36)  | 5.80<br>(2.51)  | 6.67<br>(2.68)   | 7.33<br>(2.80)   | 8.07<br>(2.93)   | 7.87<br>(2.89)   | 7.13<br>(2.76)   | 5.27<br>(2.40)   | 4.87<br>(2.32)   | 4.53<br>(2.24)   | 5.40<br>(2.43) |
| T <sub>7</sub> | AKO-L-15  | 1.60<br>(1.45)                                       | 2.27<br>(1.66)  | 3.07<br>(1.89)  | 3.47<br>(1.99)  | 4.07<br>(2.14)  | 4.33<br>(2.20)  | 5.27<br>(2.40)   | 5.93<br>(2.54)   | 6.20<br>(2.59)   | 5.73<br>(2.50)   | 5.33<br>(2.42)   | 4.87<br>(2.32)   | 4.27<br>(2.18)   | 4.13<br>(2.15)   | 4.32<br>(2.20) |
| T <sub>8</sub> | AKO-L-17  | 2.20<br>(1.64)                                       | 3.0<br>(1.87)   | 3.33<br>(1.96)  | 4.27<br>(2.18)  | 4.80<br>(2.30)  | 5.87<br>(2.52)  | 6.80<br>(2.70)   | 7.27<br>(2.79)   | 8.13<br>(2.94)   | 7.33<br>(2.80)   | 6.07<br>(2.56)   | 5.20<br>(2.39)   | 4.60<br>(2.26)   | 4.33<br>(2.20)   | 5.23<br>(2.39) |
| T <sub>9</sub> | AKO-L-18  | 2.47<br>(1.72)                                       | 3.07<br>(1.89)  | 3.47<br>(1.99)  | 4.47<br>(2.23)  | 5.13<br>(2.37)  | 6.07<br>(2.56)  | 7.20<br>(2.77)   | 8.33<br>(2.97)   | 9.47<br>(3.16)   | 9.00<br>(3.08)   | 8.73<br>(3.04)   | 7.20<br>(2.77)   | 6.07<br>(2.56)   | 5.07<br>(2.36)   | 6.12<br>(2.57) |

|                 |                                        |                |                |                |                |                |                |                |                 |                 |                 |                 |                 |                |                |                |
|-----------------|----------------------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|-----------------|-----------------|-----------------|-----------------|-----------------|----------------|----------------|----------------|
| T <sub>10</sub> | AKO-L-22                               | 1.53<br>(1.43) | 2.07<br>(1.60) | 2.53<br>(1.74) | 2.67<br>(1.78) | 2.93<br>(1.85) | 3.27<br>(1.94) | 3.80<br>(2.07) | 4.53<br>(2.24)  | 5.13<br>(2.37)  | 4.87<br>(2.32)  | 4.20<br>(2.17)  | 4.07<br>(2.14)  | 3.60<br>(2.02) | 3.27<br>(1.94) | 3.46<br>(1.99) |
| T <sub>11</sub> | AKO-L-34                               | 1.47<br>(1.40) | 2.13<br>(1.62) | 3.27<br>(1.94) | 3.73<br>(2.06) | 4.27<br>(2.18) | 4.80<br>(2.30) | 5.20<br>(2.39) | 5.73<br>(2.50)  | 6.87<br>(2.71)  | 6.20<br>(2.59)  | 5.47<br>(2.44)  | 5.27<br>(2.40)  | 4.60<br>(2.26) | 4.27<br>(2.18) | 4.52<br>(2.24) |
| T <sub>12</sub> | AKO-L-41                               | 1.67<br>(1.47) | 2.20<br>(1.64) | 3.20<br>(1.92) | 3.67<br>(2.04) | 4.67<br>(2.27) | 5.20<br>(2.39) | 6.13<br>(2.58) | 6.40<br>(2.63)  | 7.07<br>(2.75)  | 6.53<br>(2.65)  | 5.87<br>(2.52)  | 5.07<br>(2.36)  | 4.40<br>(2.21) | 3.87<br>(2.09) | 4.71<br>(2.28) |
| T <sub>13</sub> | AKP-11                                 | 1.60<br>(1.45) | 2.07<br>(1.60) | 2.53<br>(1.74) | 3.20<br>(1.92) | 3.60<br>(2.02) | 4.07<br>(2.14) | 4.20<br>(2.17) | 4.67<br>(2.27)  | 5.47<br>(2.44)  | 5.13<br>(2.37)  | 4.80<br>(2.30)  | 4.27<br>(2.18)  | 3.67<br>(2.04) | 3.33<br>(1.96) | 3.76<br>(2.06) |
| T <sub>14</sub> | Light Red<br>(Resistant check)         | 1.27<br>(1.33) | 1.87<br>(1.54) | 2.27<br>(1.66) | 2.60<br>(1.76) | 2.87<br>(1.83) | 3.2<br>(1.92)  | 3.53<br>(2.01) | 4.47<br>(2.23)  | 4.93<br>(2.33)  | 3.87<br>(2.09)  | 3.40<br>(1.97)  | 3.20<br>(1.92)  | 3.13<br>(1.91) | 3.07<br>(1.89) | 3.12<br>(1.90) |
| T <sub>15</sub> | Nashik Red N-53<br>(Susceptible Check) | 3.20<br>(1.92) | 6.53<br>(2.65) | 7.07<br>(2.75) | 8.27<br>(2.96) | 8.67<br>(3.03) | 9.27<br>(3.13) | 9.87<br>(3.22) | 10.73<br>(3.35) | 12.07<br>(3.54) | 11.47<br>(3.46) | 10.47<br>(3.31) | 10.13<br>(3.26) | 9.53<br>(3.17) | 9.40<br>(3.15) | 9.05<br>(3.09) |
| S.Em. ±         |                                        | 0.11           | 0.15           | 0.14           | 0.09           | 0.14           | 0.12           | 0.18           | 0.15            | 0.20            | 0.16            | 0.17            | 0.14            | 0.14           | 0.11           |                |
| C.D. at 5%      |                                        | 0.32           | 0.42           | 0.40           | 0.25           | 0.42           | 0.35           | 0.54           | 0.42            | 0.57            | 0.47            | 0.50            | 0.40            | 0.40           | 0.31           |                |
| C.V.%           |                                        | 10.69          | 9.84           | 7.55           | 4.02           | 5.88           | 4.26           | 5.75           | 4.03            | 4.81            | 4.25            | 4.94            | 4.33            | 4.89           | 4.19           |                |

\*Figures in parentheses are square root transformed values

### Categorization of onion genotypes

The onion genotypes were classified into four categories: highly resistant, resistant, susceptible and highly susceptible. The overall mean and standard deviation used for categorization were 2.30 and 0.29, respectively. Table 2 presents the classification of the evaluated genotypes based on their transformed mean thrips populations.

Light Red and AKO-L-22 recorded values below 2.01 and were categorized as highly resistant. The genotypes AKP-

11, AKO-L-6, AKO-4-1, AKO-L-11, AKO-L-15, AKO-L-9, AKO-L-34 and AKO-L-41 recorded values above 2.01 but below 2.30 and were classified as resistant.

In contrast, AKO-L-17, AKO-L-13, AKO-L-2 and AKO-L-18 recorded values above 2.30 but below 2.59 and were therefore categorized as susceptible. Nashik Red N-53 recorded a value above 2.87 and was consequently classified as highly susceptible to thrips infestation.

**Table 2:** Categorization of onion genotypes on the basis of mean thrips population per plant

| Category of resistance                                       | Scale            | Genotypes (Xi)  |        |
|--------------------------------------------------------------|------------------|-----------------|--------|
| Based on population of thrips/plant : X = 2.30 and sd = 0.29 |                  |                 |        |
| Highly Resistant (HR)                                        | Xi < 2.01        | Light Red       | (1.90) |
|                                                              |                  | AKO-L-22        | (1.99) |
| Resistant (R)                                                | Xi > 2.01 < 2.30 | AKP-11          | (2.06) |
|                                                              |                  | AKO-L-6         | (2.09) |
|                                                              |                  | AKO-4-1         | (2.15) |
|                                                              |                  | AKO-L-11        | (2.18) |
|                                                              |                  | AKO-L-15        | (2.20) |
|                                                              |                  | AKO-L-9         | (2.23) |
|                                                              |                  | AKO-L-34        | (2.24) |
|                                                              |                  | AKO-L-41        | (2.28) |
| Susceptible (S)                                              | Xi > 2.30 < 2.59 | AKO-L-17        | (2.39) |
|                                                              |                  | AKO-L-13        | (2.43) |
|                                                              |                  | AKO-L-2         | (2.44) |
|                                                              |                  | AKO-L-18        | (2.57) |
| Highly Susceptible (HS)                                      | Xi > 2.59 < 2.87 | -               | -      |
| Highly Highly Susceptible (HS)                               | Xi > 2.87 < 3.16 | Nashik Red N-53 | (3.09) |

**Table 3:** Seasonal incidence of onion thrips *Thrips tabaci* in relation to weather parameters during rabi season 2025-2026

| Sr. No.                                             | Standard Meteorological Week (SMW) | Date of observations | Mean population of thrips (per plant) | Temperature (°C) |         | Relative humidity (%) |           |
|-----------------------------------------------------|------------------------------------|----------------------|---------------------------------------|------------------|---------|-----------------------|-----------|
|                                                     |                                    |                      |                                       | Maximum          | Minimum | Morning               | Evening   |
| 1                                                   | 3                                  | 19/01/2026           | 1.78                                  | 30.0             | 13.5    | 80                    | 33        |
| 2                                                   | 4                                  | 26/01/2026           | 2.58                                  | 29.8             | 15.7    | 74                    | 32        |
| 3                                                   | 5                                  | 02/02/2026           | 3.16                                  | 30.9             | 15.1    | 76                    | 31        |
| 4                                                   | 6                                  | 09/02/2026           | 3.77                                  | 31.6             | 14.2    | 74                    | 24        |
| 5                                                   | 7                                  | 16/02/2026           | 4.26                                  | 33.4             | 16.9    | 65                    | 23        |
| 6                                                   | 8                                  | 23/02/2026           | 4.94                                  | 34.0             | 18.5    | 68                    | 25        |
| 7                                                   | 9                                  | 02/03/2026           | 5.60                                  | 31.0             | 17.0    | 57                    | 19        |
| 8                                                   | 10                                 | 09/03/2026           | 6.30                                  | 38.4             | 18.4    | 50                    | 11        |
| 9                                                   | 11                                 | 16/03/2026           | 7.14                                  | 39.1             | 21.1    | 45                    | 13        |
| 10                                                  | 12                                 | 23/03/2026           | 6.67                                  | 35.6             | 19.6    | 52                    | 19        |
| 11                                                  | 13                                 | 30/03/2026           | 6.06                                  | 39.3             | 23.6    | 51                    | 20        |
| 12                                                  | 14                                 | 06/04/2026           | 5.47                                  | 36.7             | 23.5    | 64                    | 23        |
| 13                                                  | 15                                 | 13/04/2026           | 4.88                                  | 40.0             | 24.0    | 39                    | 14        |
| 14                                                  | 16                                 | 20/04/2026           | 4.47                                  | 42.9             | 27.3    | 35                    | 12        |
| Correlation coefficient with mean thrips population |                                    |                      |                                       | 0.626 *          | 0.540 * | -0.689 **             | -0.783 ** |

r = 0.532 at 5%, r = 0.661 at 1%, \*\* = level of significance

### Correlation of weather parameters with thrips population

The data presented in Table 3 illustrate the seasonal incidence of onion thrips in relation to weather parameters during the Rabi season of 2025-26. The findings revealed significant associations between thrips population and the evaluated weather variables. Thrips population exhibited significant positive correlations with maximum temperature ( $r = 0.626^*$ ) and minimum temperature ( $r = 0.540^*$ ). Conversely, morning relative humidity ( $r = -0.689^{**}$ ) and evening relative humidity ( $r = -0.783^{**}$ ) showed significant negative correlations with thrips population.

These findings are consistent with those of Salame *et al.* (2022)<sup>[9]</sup>, who reported that Light Red possesses resistance to thrips, whereas Nashik Red N-53 is susceptible to infestation. Similarly, Salunkhe *et al.* (2018)<sup>[10]</sup> observed that thrips population buildup was positively correlated with maximum and minimum temperatures but showed significant negative correlations with morning and evening relative humidity.

### Conclusion

The screening of onion genotypes against thrips demonstrated that AKO-L-22 was highly resistant to infestation and performed comparably to the resistant check Light Red. Thrips incidence was also significantly influenced by prevailing weather conditions. Maximum and minimum temperatures were positively associated with thrips population, whereas morning and evening relative humidity exhibited negative associations. Therefore, AKO-L-22 may be considered a promising source of thrips resistance for further evaluation and use in onion breeding programmes.

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