Uttar Pradesh Journal of Zoology

Volume 45, Issue 15, Page 188-193, 2024; Article no.UPJOZ.3754
ISSN: 0256-971X (P)

Seasonal Incidence of Onion Thrips, *Thrips tabaci* Lindeman in Gird Region of 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/10.56557/upjoz/2024/v45i154234

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://prh.mbimph.com/review-history/3754

Original Research Article

Received: 04/05/2024
Accepted: 08/07/2024
Published: 09/07/2024

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Cite as: *Seervi, Sitaram, Pradyumn Singh, Rajni Singh Sasode, NS Bhadauria, Shivani Suman, and Naveen. 2024. "Seasonal Incidence of Onion Thrips, Thrips Tabaci Lindeman in Gird Region of Madhya Pradesh, India". UTTAR PRADESH JOURNAL OF ZOOLOGY 45 (15):188-93. https://doi.org/10.56557/upjoz/2024/v45i154234.*

ABSTRACT

An investigation was undertaken to study the seasonal incidence of onion thrips, Thrips tabaci Lindeman, on onion in the Grid region of Madhya Pradesh, India. The experiment revealed that the thrips infestations in plants occurred during 52 Standard Metrological Week (SMW) in 2022–23 and 2023–24, with an average of 6.28 and 5.80 thrips per plant, respectively. The maximum incidence was 41.70 and 41.98 thrips per plant, respectively, during the 9 SMW in both consecutive years. The number of thrips was significantly positively correlated with minimum and maximum temperature during both the consecutive years of study. However, evening relative humidity was negatively correlated with thrips population during 2022–23 and 2023-24, but the morning relative humidity showed negative correlation only during 2022-23.

Keywords: Thrips tabaci Lindeman; abiotic factors; regression; correlation; population; sucking insect pest; onion.

1. INTRODUCTION

One of the most important vegetables among the different bulbous crops is the onion (*Allium cepa* L.) belonging to the Amaryllidaceae family. It is commercially grown in tropical and subtropical countries. Among the vegetable crops grown in the India, onions assume significance in the national economy by occupying the third position, next to potato and tomato crops [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, among others. 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. In India, the area under the crop is reported to about 16.24 mha and production is about 266.41 million tons with a productivity of 16.4 metric tons per ha [2]. In Madhya Pradesh, onion is cultivated on 1.96 mha and with the production 47.40 million tons with a productivity of 24.10 metric tons per ha. Maharashtra is the leading onion-producing state, followed by Karnataka and Madhya Pradesh [3]. Thrips are a regular and potentially devastating insect pest of onions that cause huge significant losses in quality and yield [4]. Although this pest has been discovered in various Indian states, nothing is known about its seasonal prominence or how it interacts with meteorological conditions in India's widely varied environment. This pest has been reported in several Indian states, but information about its seasonal occurrence and relationship to meteorological factors in such a different Indian climate still are unknown [5]. Thus, the purpose of this study was to determine the incidence and severity of *T. tabaci* damage the Gird region of M.P.

2. MATERIALS AND METHODS

The present study was carried out at the Entomological Research Field, College of Agriculture, Gwalior, Madhya Pradesh, India during the *Rabi* season of 2022-23 and 2023-24. All the recommended agronomical practices were adopted for raising the crop. The onion cultivar Nasik red (N-53), was sown in the assigned plot of size 5m x 5m with the row to row spacing of 20 cm and plant to plant 10 cm. The observations on number of thrips were recorded on five randomly selected and tagged plants, respectively at weekly intervals starting from the first appearance of the insect pest till harvesting of the crop. The simple correlation and regression studies were also carried out for the number of thrips and abiotic factors, *viz*., maximum and minimum temperature, morning and evening relative humidity and rain fall.

3. RESULTS

The results presented in Table 1 showed that the number of thrips was ranged from 6.28 (52nd SMW) to 41.70 (9th SMW) thrips/plant during *Rabi* 2022-23. During the first two weeks of observations, the number of thrips was very low, *i.e.,* 6.28 thrips/plant in 52nd SMW and 8.50 thrips/plant in 1st SMW. Further, the population started increasing from 2nd SMW with 14.30 thrips/plant and reached its peak in 9th SMW with 41.70 thrips/plant. Thereafter, the population of thrips was consistent up to 14th SMW with 40.20 thrips/plant.

Table 1. Seasonal incidence of onion thrips, *T. tabaci* in relation to environmental factors during 2022-23

SMW	Number of Thrips/ Plant	Temperature (°C)		Rainfall (mm)	Relative Humidity (%)	
		Maximum	Minimum		Morning	Evening
52	6.28	23.7	6	0	80.1	60.3
1	8.50	17.9	3.5	0	95.7	73.4
2	14.30	24.1	6.7	0	93.7	53.8
3	20.38	20.2	2.8	0	86.2	56.4
4	21.10	20.2	9.8	13	91.5	63.7
5	26.48	21.9	7.8	2	89.8	46.5
6	31.25	28.6	9.6	0	84.5	37.2
7	30.40	27.4	10.3	0	83	52.1
8	35.35	31.7	12.6	0	87	41.8
9	41.70	32.7	13.2	0	85.2	43.1
10	38.60	30.9	13.9	0	84.5	48.1
11	40.30	33.3	15.9	4.4	83.2	47.7
12	36.34	30.6	16.1	0	84.5	55.1
13	39.15	33.6	16.2	5.2	86.5	46.1
14	40.20	34.78	16.8	0	65.2	40.4

Table 2. Correlation between weather parameters and population of onion thrips, *Thrips tabac*i L. incidence during 2022-23

Weather Parameters	Correlation Coefficient	Regression Equation and Coefficient of Determinants
Maximum Temperature (°C)	0.874*	y = 0.4125x + 15.606, R^2 = 0.7631
Minimum Temperature (°C)	0.880*	y = 0.3441x + 0.8742, R^2 = 0.7743
Rainfall (mm)	0.004^{NS}	-
Morning Relative Humidity (%)	-0.454^{NS}	-
Evening Relative Humidity (%)	-0.762*	y = -0.6178x + 68.771, R^2 = 0.5807

**Significant at 5% level of significance, NS: Non-Significant*

Further, the correlation studies presented in Table 2 revealed that the number of thrips was found to be significantly and positively correlated with minimum temperature (r = 0.880), maximum temperature (r = 0.874) and significantly negatively correlated with evening relative humidity (r= -0.762) during the study year. However, morning relative humidity and rainfall were non-significant with thrips population. The regression studies revealed that, the model fit specifics indicate a strong relationship between the weather parameters and thrips incidence (Table 2). The regression models for maximum temperature and minimum temperature have high coefficients of determination (R^2) of 0.7631 and 0.7743, respectively, indicating that with every unit increase in maximum temperature and minimum temperature, the number of thrips increased by 76.31% and 77.43%, respectively. This suggests that temperature significantly influences thrips incidence. These high R^2 values reflect that the models provide a good fit for the data. For evening relative humidity, the model has an R^2 of 0.5807, meaning it accounts for 58.07% of the variability in thrips population, indicating a significant but less strong inverse relationship compared to temperature.

During *Rabi* 2023-24, the results presented in Table 3 showed that the number of thrips was ranged from 5.80 (52nd SMW) to 41.98 (9th SMW) thrips/plant. During the first two weeks of observations, the number of thrips was very low, *i.e.,* 5.80 thrips/plant in 52nd SMW and 7.90 thrips/plant in 1st SMW. Further, the population started increasing from 2nd SMW with 12.40 thrips/plant and reached its peak in 9th SMW with 41.98 thrips/plant. Thereafter, the population of thrips was consistent up to 14th SMW with 40.56 thrips/plant.

Further, the correlation studies presented in Table 4 revealed that the number of thrips was found to be significantly and positively correlated with maximum temperature (r = 0.878), minimum temperature (r = 0.669) and significantly

Table 3. Seasonal incidence of onion thrips, *T. tabaci* L. in relation to environmental factors during 2023-24

SMW	Number of Thrips/Plant	Temperature (^{0}C)		Rainfall (mm)	Relative Humidity (%)	
		Maximum	Minimum		Morning	Evening
52	5.8	22.3	7	0	95.3	75.7
1	7.9	15.6	8.7	0	94.4	67.1
2	12.4	21	5.7	36	93.1	61.6
3	17.8	17.2	5.3	0	94.9	66.6
4	20.6	20.6	5.3	0	87.9	63.1
5	28.1	25.7	9.6	0	89.0	60.0
6	26.35	23	7.2	6.2	88.7	67.6
7	32.7	26.7	7.2	0	91.6	57.1
8	34.3	29.4	10.2	0	83.0	56.3
9	41.98	27.2	10.7	20.6	85.4	63.3
10	38.44	28	8.1	0	79.9	48.6
11	36.64	32.2	11.6	0	75.3	39.7
12	33.22	34.3	13.9	0	70.7	34.7
13	37.22	38.6	17.7	0	70.6	31.3
14	40.56	37.5	23.7	0	70.4	28.4

Table 4. Correlation between weather parameters and population of onion thrips, *Thrips tabac*i L. incidence 2023-24

Weather Parameters	Correlation Coefficient	Regression Equation and Coefficient of Determinants
Maximum Temperature (^{o}C)	0.878*	y = 0.4613x + 13.887, R^2 = 0.6361
Minimum Temperature (^{o}C)	0.669*	y = 0.2503x + 3.2181, R^2 = 0.3519
Rainfall (mm)	- 0.252^{NS}	-
Morning Relative Humidity (%)	- 0.860*	y = - 0.5859x + 100.85, R^2 = 0.5812
Evening Relative Humidity (%)	- 0.823*	y = - 0.8603x + 78.484, R^2 = 0.4905

**Significant at 5% level of significance, NS: Non-significant*

negatively correlated with morning relative humidity (r= -0.860) and evening relative humidity (r= -0.823) during the study year. However, morning relative humidity and rainfall were non-significant with thrips population. The regression studies revealed that, the model fit specifics indicate a strong relationship between the weather parameters and thrips incidence (Table 4). The regression models for maximum temperature and minimum temperature have high coefficients of determination (R^2) of 0.6361 and 0.3519, respectively, indicating that with every unit increase in maximum temperature and minimum temperature, the number of thrips increased by 63.61% and 35.19%, respectively. This suggests that temperature significantly influences thrips incidence. These high R^2 values reflect that the models provide a good fit for the data. For morning and evening relative humidity, the model has an R^2 of 0.5812 and 0.4905, meaning it accounts for 58.12% and 49.05% of the change in thrips population, indicating a significant but inverse relationship as compared to temperature.

4. DISCUSSION

The results of the current study are strongly supported by the findings of Ahemed et al. [6] who reported that the number of thrips was active the whole onion growing season, according to the findings. The highest number of thrips (62.34 thrips/plant) was seen in the eleventh week following transplantation, while the lowest population (2.05 thrips/plant) was observed in the first week following transplantation. Further, the findings of Kadri and Goud [7] reported that the number of thrips per plant varied from 17.29 to 46.88. The transplanted crop in May had the most thrips per plant, with a high of 46.88, followed by the transplanted crops in April (45.00) and March (39.90). The aforementioned findings are partially in agreement with the findings of the current investigation. The current results differ from those published by Meena et al. [8] who examined the population dynamics of the thrips, *Scirtothrips dorsalis* (Hood) and its relationship with environmental factors in the chilli species.

The findings revealed that the number of thrips and maximum temperature were positively correlated. The findings were consistent with those reported Vijaya et al. [9], who revealed a substantial positive association between the percent thrips damage and the relative humidity in the morning (r= 0.34), and in the evening (r= 0.37). The association between meteorological factors and thrips occurrence in chilli was documented by Barot et al. [10] and found that the number of thrips was shown to be significantly negatively correlated with both the relative humidity (-0.708) and lowest temperature (-0.433). Abiotic variables' effects on the number of thrips were investigated by Muhammad et al. [11]. The maximum and lowest temperatures had a considerable and favorable (r= 0.692) impact on the thrips population, according to the results. The number of thrips and relative humidity had a strongly negative connection (r= -0.776). Studies were done to find out how abiotic variables affected number of thrips fluctuations. The findings revealed a strong negative connection for humidity (r= 0.777) and a substantial positive correlation between maximum temperature (r= 0.587) and minimum temperature (r= 0.765). A non-significant negative connection between rainfall (r= -0.321) and the number of thrips was observed [12].

5. CONCLUSION

Thrips initially occurred at 52 SMW in 2022–23 and 2023–24, with 6.28 and 5.8 thrips/ plant, respectively. The population fluctuated, with 9 SMW being the highest. The number of thrips was shown to be positively and significantly correlated with the minimum and maximum temperatures. In comparison, the number of thrips was positively significantly correlated with minimum and maximum temperatures and negatively significant with evening relative humidity during 2022–23. The thrips were negatively correlated with morning and evening humidity during 2023–24.

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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Peer-review history:
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