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Seasonal incidence of thrips (*Thrips tabaci*) infesting *kharif* onion and its correlation with abiotic factors

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Abstract
The investigation on "Seasonal Incidence of Thrips (*Thrips tabaci* Lindeman) Infesing Onion" was conducted at Instructional Farm and Department of Entomology, Rajasthan College of Agriculture, Udaipur during *kharif*, 2024. The study on the seasonal incidence of thrips reveal that the infestation of thrips commenced in the first week of August (32nd standard meteorological week), with its peak of 16.07 thrips per plant in the second week of September (38th SMW) and declined during the last week of October (41th SMW). The maximum temperature (32.6 °C) and sunshine (6.3 hr) during the peak period showed a significant positive correlation with thrips population (r = 0.644* and r = 0.745*, respectively) whereas morning and evening relative humidity, minimum temperature, wind velocity and rainfall exhibited non-significant negative correlation (r = -0.475, -0.582, -0.287, -0.483, -0.136, respectively). The maximum percent damaged leaf number of 21.33 percent per five plants was recorded during 38th standard meteorological week (SMW). While the minimum percent damaged leaf number of 3.33 percent per five plants, during 32nd SMW.

Keywords: Seasonal incidence, thrips, onion, significant, leaf damage

Introduction
Onion (*Allium cepa* L.), member of Alliaceae family is one of the most important crop among the vegetables grown in our nation. It is popularly known as the "Queen of the Kitchen," utilized in a variety of meals and soups in both its mature and green forms, making it a vital component of cooking (Amit *et al*., 2023) [2]. Onion cultivation is widely practised across the globe with an estimated area of 5.4 million hectares and 104.5 million tons of production. India, China, USA, Egypt, Turkey, Pakistan and Bangladesh are the onion producing countries in the world. India ranks first in area (1.4 million hectares) followed by China (1.08 million hectares) (Anonymous, 2020) [3, 4]. India leads the world in production with 242.12 Lakh Metric Tons (Anonymous, 2024) [5]. Major onion growing states of India include Maharashtra, Karnataka, Madhya Pradesh, Gujarat, Bihar, Andhra Pradesh, Rajasthan, Haryana and Telangana (Nivetha and Uma, 2020) [17]. Rajasthan contribute the production of onion 16.31 Lakh Metric Tons growing on 76.93 thousand hectares area (Anonymous, 2024) [5]. Insect pests are the important factors causing significant losses in onion production. Onion flies, cut worms, Armyworms, Thrips and Leaf miners are the major insect pests that attack onion crop (Dhaker *et al*., 2024) [12]. Among these insect pests, thrips (*Thrips tabaci* Lindeman) (Thysanoptera: Thripidae) is an important insect pest having potential of causing direct losses upto the extent of >50 percent. Onion thrips cause stunting of plant length, blotches, decreased bulb weight, undersized & deformed bulbs (Montano *et al*., 2011) [11]. The newly developed leaves in the middle of onion necks are the preferred food source for thrips. Thrips, both adults and nymphs, use a punch-and-suck technique to feed inside the mesophyll layer. The feeding area turns white to silvery as the chlorophyll is removed. Leaf damage might show up as patches or streaks. Leaves may wither and take on a silvery cast when there is significant feeding damage (Altson and Drost, 2008) [1]. Understanding the seasonal incidence of pests has a significant impact on pest infestations in crops (Anonymous, 2001; Reddy and Gowdar, 2005 and Kadri and Goud, 2006) [6, 21, 14]. The dry weather (30.3 mm of rainfall) along with the high temperatures (15.6-28.20 °C) favours the increase in thrips populations (Waiganjo *et al*., 2008) [25].

It is therefore, necessary to know the seasonal incidence of thrips so as to adopt the control measure strategy at an appropriate time.

Materials and Methods

In order to study the seasonal incidence of thrips infesting onion, var. N-53 was undertaken for experimental study during *kharif*, 2024.

1. **Nymph and Adult population (Thrips):** The incidence of thrips was recorded from five randomly tagged plants from the three unsprayed plots. Starting from a week after transplantation, the data on the number of thrips (nymphs and adults) was recorded at 7-days intervals on five randomly selected plants in each 2 × 3 sq. mtr plot at the Horticulture farm, RCA Udaipur and continued until physiological maturity. To record the population of thrips (nymphs and adults), the entire plant was examined using a 10x magnifying hand lens. The thrips counting was done during wind free time of the day *i.e*. during early morning and late afternoon (Birhanu *et al*., 2024) [9]. Throughout experimental period, weekly meteorological data on temperature, relative humidity and precipitation were recorded. A simple correlation between the population of insect pests, biotic and abiotic parameters was determined, by using the Pearson (1900) [20] equation as under:

$$r_{xy} = \frac{\sum XY - \frac{(\sum X)(\sum Y)}{n}}{\sqrt{\left[\sum X^2 - \frac{(\sum X)^2}{n}\right]\left[\sum Y^2 - \frac{(\sum Y)^2}{n}\right]}}$$

Where,
r_{xy} = Simple correlation coefficient
X = Variable, i.e., abiotic component (average temperature, relative humidity, and total rainfall)
Y = Variable, i.e., mean number of insect pests per plant
n = Number of observations

Number of damaged leaves: The observations on the number of leaves damaged due to the infestation of thrips were recorded by counting the number of damaged leaves of five randomly selected plants at weekly interval and percent damaged leaf number was calculated.

$$\text{Percent damaged leaf number} = \frac{\text{Number of infested leaves}}{\text{Total number of leaves observed}} \text{X100}$$

Results

Seasonal incidence of thrips (*T. tabaci* Lindeman) infesting onion

Seasonal incidence of thrips, *T. tabaci* was studied on the onion crop variety N-53 during *kharif*, 2024 under unsprayed conditions. The thrips population was recorded on five randomly selected tagged plants from each plot at weekly intervals, during *kharif*, 2024.The observations to study the seasonal incidence of thrips infesting onion during *kharif*, 2024 were recorded on the mean population of thrips per plant and the percent damaged leaf number caused by the population of thrips per five plants have been tabulated in Table 1 and depicted in Fig. 1. The data on the mean number of thrips per plant reveal that the appearance of thrips started during the first week of August, 32nd standard meteorological week (SMW) with the initial mean population of 2.33 thrips per plant, then the population gradually increased and reached to its peak during the second week of September (38th SMW) with mean population of 16.07 thrips per plant. Similarly the observations on percent damaged leaf number caused by thrips infestation per five plants reveal that the percent damaged leaf number was minimum of 3.33 percent during the initial appearance of thrips in the month of august which increased and reached to its maximum damage of 21.33 percent during the month of September and the damage continued to persist till the harvest in the onion crop during *kharif*, 2024. The meteorological parameters *viz*., maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, rainfall, sunshine and wind velocity recorded during the peak population were 32.6 °C, 22.4 °C, 80 percent, 54 percent, 23.5 mm, 6.3 hr and 3.6 km per hr, respectively. The population of thrips, then gradually declined to the mean population of 9.73 thrips per plant and afterwards it completely disappeared in the last week of October (41th SMW).

Correlation between population of thrips (*T. tabaci*) with weather parameters, during *kharif*, 2024

The results of the present investigation on the correlation coefficient between population of insect pests of onion with weather parameters during *kharif*, 2024 tabulated in Table 4.2 show that the population of thrips and the morning relative humidity, evening relative humidity, minimum temperature, wind velocity and rainfall showed a non-significant negative correlation (r = -0.475,-0.582,-0.287,-0.483,-0.136, respectively) whereas, maximum temperature (0.644*) and sunshine (0.745*) had significant positive correlation with thrips population.

Table 1: Seasonal incidence and effect of abiotic factors on onion thrips (*T. tabaci*) during *kharif*, 2024

SMW	Temperature (°C)		Relative humidity (%)		Rainfall (mm)	Sunshine hours	Wind velocity (km/hr)	Mean thrips/plant	Percent damaged leaf number/five plants
	Maximum	Minimum	Morning	Evening					
32	29.2	23.4	90.1	78.1	2.3	1.2	5.7	2.33	3.33
33	31.3	23.9	85.7	64.1	0	3.7	5.3	5.33	5.11
34	31.5	23.6	87.1	77.9	84.3	2.5	3.5	7.47	7.78
35	28.1	22.4	92.4	81.6	79.6	2.2	6.3	9	10
36	30.4	23.2	94.7	76.3	147.3	3.6	3.1	7.93	8.67
37	30.4	22.9	85	65.1	23.7	3.4	5.1	12.07	14.67
38	32.6	22.4	80	54	23.5	6.3	3.6	16.07	21.33
39	33.9	24.1	89.9	66.3	14.5	4.2	2.2	14.6	17.78
40	33.2	21.3	84.3	47.4	0	7.1	3.3	12.67	15.56
41	31.3	20.8	85.7	51.9	60	3.3	1.8	9.73	13.33

Table 2: Correlation between population of thrips and abiotic factors

S. No.	Weather parameters	Incidence of thrips on onion
1	Maximum temperature (°C)	0.644*
2	Minimum temperature (°C)	-0.287
3	Morning relative humidity (%)	-0.475
4	Evening relative humidity (%)	-0.582
5	Rainfall (mm)	-0.136
6	Sunshine hours (hr)	0.745*
7	Wind velocity (km/hr)	-0.483

SMW-Standard meteorological week; *Values significant at 5% level

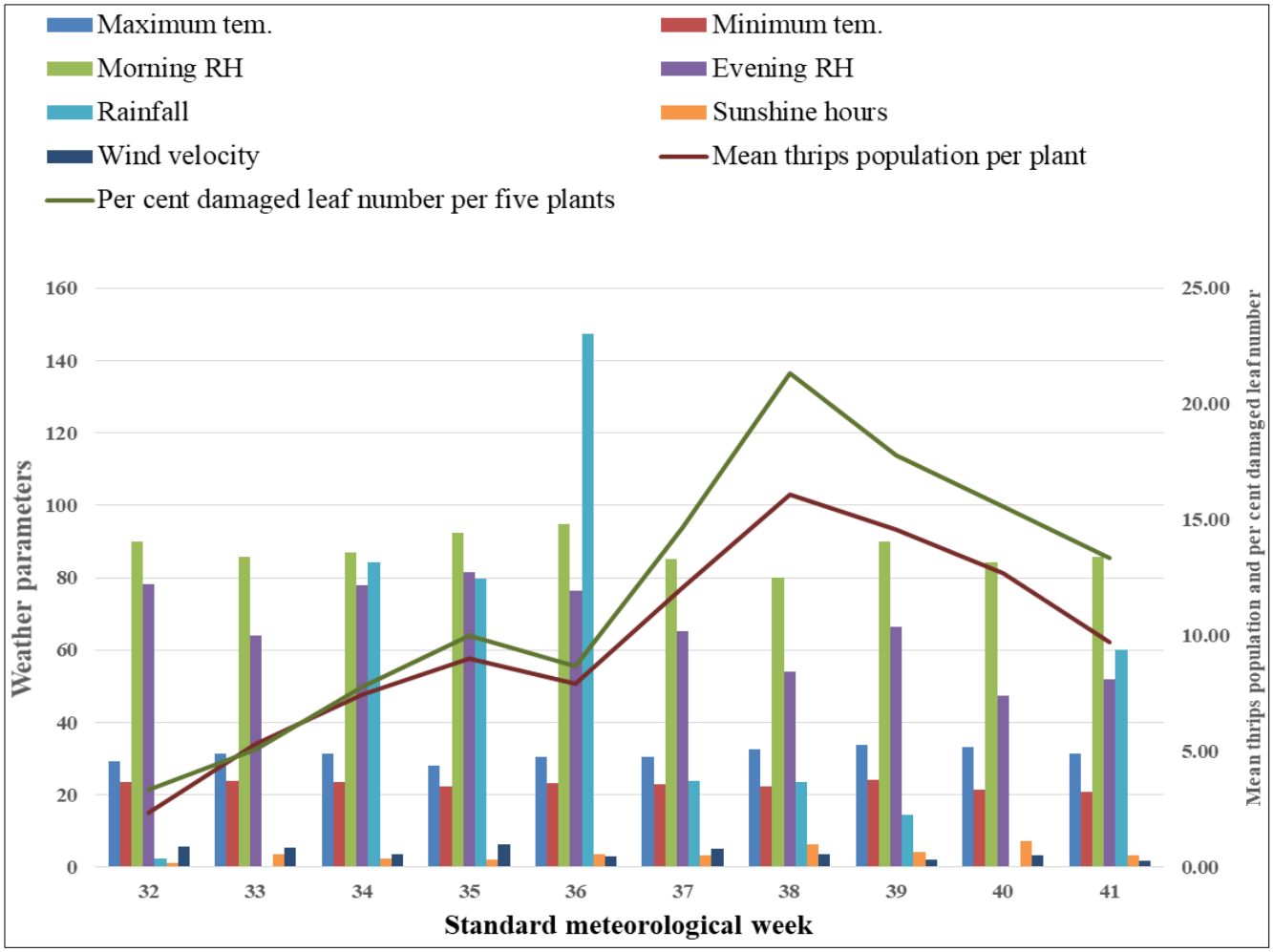

Fig 1: Seasonal incidence and effect of abiotic factors on onion thrips (*T. tabaci*) during *kharif*, 2024

Discussion

The results of the present investigation on the seasonal incidence of onion thrips are in line with the findings of the earlier workers Neergude *et al*. (2014) [15], Birhade *et al*. (2017) [8], Bhonde *et al*. (2019) [7], Yadav *et al*. (2019) [26], Pandi *et al*. (2024) [18] and Pathak and Singh (2024) [19] who have also recorded the incidence of thrips population during August to October, 2nd week of September, 34th SMW, 2nd week of August, throughout the vegetative and flowering periods and at 75 DAT (days after transplanting),

respectively. However the population of thrips infestation in onion reported to be the maximum in second week of September during *kharif*, 2024 by Birhade *et al*. (2017) [8] and Yadav *et al*. (2019) [26]. These findings confer the finding of present investigation and are in full support to the results of present investigation. Yadav *et al*. (2019) [26] and Singh *et al*. (2022) [22] have also recorded the peak population of *Thrips tabaci* in onion crop during the middle week of October to the first week of the November and 40th SMW, respectively which also support the findings of present investigation.

The findings of the present studies on correlation between population of thrips with weather parameters are in accordance to the earlier work of Vinuthan *et al*. (2018) [23] who have recorded thrips population had substantial negative correlation with maximum and minimum relative humidity and positive correlation with maximum temperature. Similarly Singh *et al*. (2022) [22] who recorded that the wind speed showed negative correlation with thrips population while, significant positive correlation with sunshine hours and Negash *et al*. (2024) [16] have recorded the population of thrips had negative correlation with rainfall which are line with the results of present investigation. A very scanty literature is available regarding the correlation of abiotic factors with the leaf damage caused by thrips in onion. However, the results of present investigation get full support from the research of Vinutha *et al*. (2024) [24] who reported that leaf damage caused by thrips appears as silvery patches or streaks on the leaves and the incidence of thrips started from the 31th SMW *i.e*. August 1st week and reached a peak at the 38th SMW *i.e*. 3rd week of September in *kharif*, 2022. Similarly, Boateng *et al*. (2014) [10] also observed that feeding by thrips results in destruction of epidermal and parenchyma tissues which leads to chlorophyll loss causing reduction in photosynthesis. Gadad *et al*. (2014) [13] reported that foliage damage by thrips in the groundnut to increase with the increase in the population of thrips which is in the accordance of the results of present investigation.

Conflict of Interest
Authors have no conflict of interest.

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Conclusion
During the experimental study it was observed that the maximum population of thrips was recorded in 2nd week of September (38th SMW) and it showed significant positive correlation with maximum temperature and sunshine hours while minimum temperature, wind velocity, relative humidity and rainfall showed negative correlation. The maximum percent damaged leaf number was recorded 21.33 percent per five plants during 38th standard meteorological week (SMW). These findings highlight the need for weather-based pest management strategies. By incorporating weather parameters into decision-making, farmers can optimize the timing of control measures, such as pesticide applications, and enhance the effectiveness of integrated pest management (IPM) practices.

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