Journal of Agrometeorology

ISSN : 0972-1665
Vol. No. 24 (1) : 86-89 (March 2022)
https://journal.agrimetassociation.org/index.php/jam

Short Communication

Influence of prevailing weather conditions on incidence of thrips on different *solanaceous* vegetables cultivation

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The solanaceous family of vegetables including tomatoes (*Solanum lycopersicum*), brinjal (eggplant) (*Solanum melongena*), potatoes (*Solanum tuberosum*), capsicum and chilli (*Capsicum spp*) species holds much economic importance. These crops are grown throughout the year in most parts of the India. The key pests of *solanaceous* vegetables are mainly biting type or sucking types *viz*., fruit borer, beetles, leafhopper, aphids, bugs, thrips, whitefly, mites, and leaf miner (Ahmad *et al*., 2019). Among the insect pests, *thrips* (Thysanoptera: Thripidae) is an important insect pest with a worldwide distribution. Infestation caused by thrips is easily perplexed with feeding damage from broad mites. In severe infestation, the tender leaves and buds become brittle, followed by necrosis of plant tissue and complete defoliation (Kumar *et al*., 2013). The estimated yield losses in chilli due to thrips ranged from 50 to 90 per cent. The direct injury and the virus disease transmitted by *thrips* result in discoloration of tomato fruits and thus lower the quality of the fruits with yield losses up to 23.7 per cent (Kagezi *et al*., 2001). Therefore, population dynamics is an important tool for the developing pest management strategies against this pest. Periods of no incidence, initiation of incidence, low incidence, peak incidence etc. carry important information to decide the time for adoption of management tactics. Therefore, correlations between *thrips* incidence and the weather parameters i.e. temperature, humidity, rainfall and rainy days have been worked out by using SPSS 16 statistical software for management strategies.

The experiment was conducted during *Kharif* and *Rabi* seasons of 2018-19 and 2019-20 at the Vegetable Research Farm, Bihar Agricultural University, Sabour, Bhagalpur. Weather data were obtained from automatic weather station installed approx. 150 meters away from the experimental site. Nursery of the test variety of Chilli (Arka Lohit) and brinjal (muktakeshi) were raised at the experimental site in first week of July 2018 and 2019, while the nursery of tomato (Kashi Vishesh) in the first week of October, 2018 and 2019. Twenty-five days old seedlings of brinjal and chilli crops were transplanted in the last week of July, 2018 and 2019 and tomato in the third week of November, 2018 and 2019 following spacing pattern of 60×45 cm. The experimental area used standard agronomic practices for cultivation excluding pesticide application. The observations of *thrips* were done at 7 days interval (Standard meteorological weeks) from 15 days after transplanting (DAT) up to harvesting of the crop. The population of thrips on fully opened leaves was recorded from thirty (30) randomly selected plants of brinjal and tomato and three leaves (One from the top, middle and lower canopy) from each plant were taken for recording the thrips population. As far as chili plant is concerned, thrips were collected from terminal leaves. Both nymphs and adults population was counted early in the morning before 8.00 am when the pests were not much active. *Thrips* were collected by Beat Method selected leaves tapped on a white paper board (30×30cm) and gathered with a fine hair brush. Gathered *thrips* were transferred to a vial containing 70 per cent ethanol marked with the date, plot and crops to count the population.

A simple correlation coefficient was calculated between meteorological parameters such as atmospheric temperature (maximum and minimum), relative humidity (morning and evening), rainfall and sunshine hours and thrips population. Multiple regressions analysis was also worked out taking meteorological parameters as an independent variable to know the combined effects

***Article info - DOI:** https://doi.org/10.54386/jam.v24i1.784*
Received: 10 February 2021; Accepted: 29 December 2021; Published online: 11 February 2022

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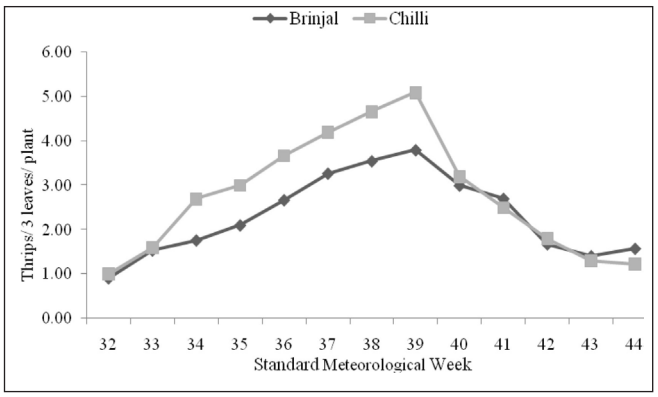

Fig 1: Mean incidence of thrips on brinjal and chilli during *kharif,* 2018-19 and 2019-20

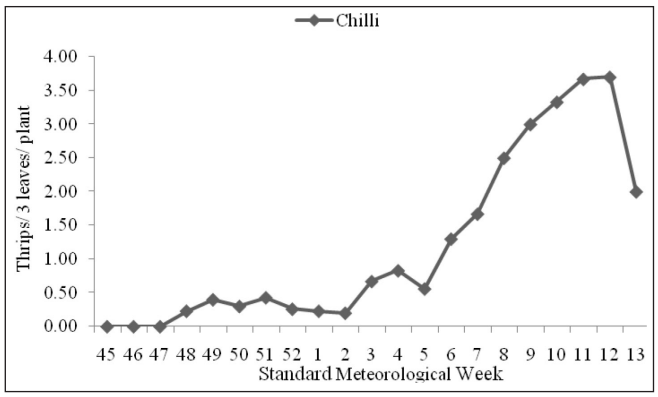

Fig 2: Mean incidence of thrips on tomato during *rabi* season of 2018-19 and 2019-20

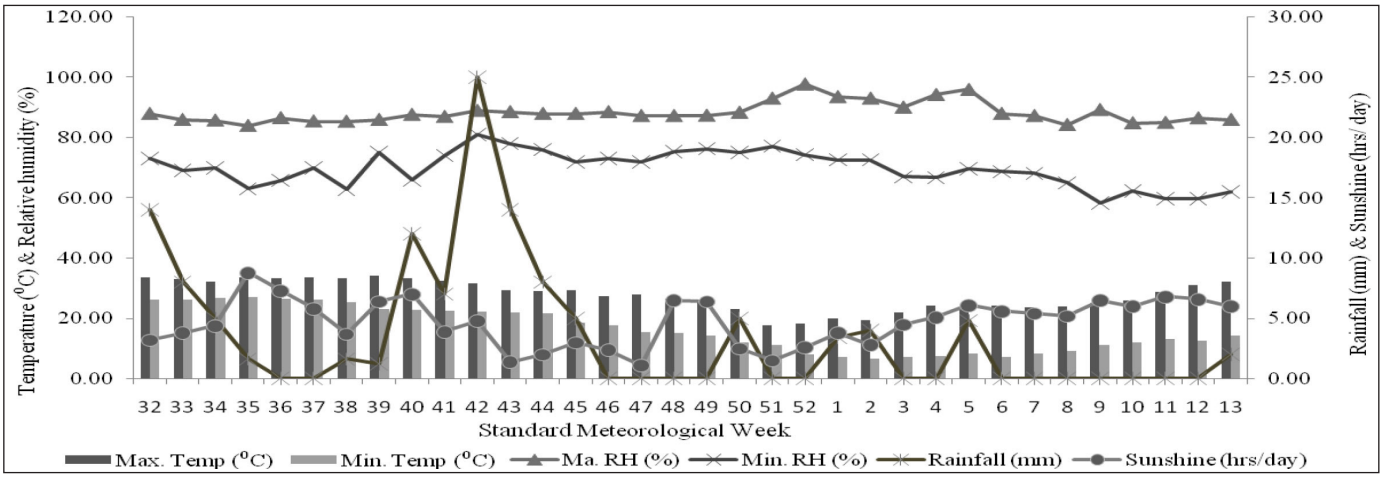

Fig 3: Prevailing weather conditions during crop growing period of *kharif* and *rabi* 2018-19 and 2019-20

of all these factors leading to upsurge in *thrips* population.

Incidence of brinjal thrips during kharif season

Three thrips species; *Thrips palmi, Frankliniella schultzei* and *Scirtothrips dorsalis* were identified from brinjal crop. It is revealed from the figure (Fig. 1) that the incidence of thrips was first appeared (0.90 *thrips*/3 leaves) in 32nd standard meteorological week (SMW) and and it reached at peak (3.80 *thrips*/3 leaves) during 39th SMW in both the years (Fig. 1), when mean maximum and minimum temperature, mean relative humidity (morning and evening), rainfall and sunshine hrs were 34.2 and 23.0 ºC, 86 and 75 per cent, 1.2 mm and 6.40 hrs/day, respectively. The *thrips* population ranged from 0.90 to 3.80 *thrips*/3 leaves in Brinjal crop during kharif season, 2018-19 and 2019-20. The correlation study showed that the population of *thrips* exhibited significant positive association with maximum temperature (r = 0.54*), which indicates *thrips* population increases with the increase in temperature (Table 1). On the other hand, most of the weather parameters like minimum temperature (r=-0.02), maximum and minimum relative humidity (r=-0.46; -0.39) had no significant effect on the population of thrips. Rainfall showed significant negative correlation (r=-0.60*) on the population of *thrips* at 5 % level of significance. However, sunshine hours showed only positive impact (r=0.49) on *thrips* population. The present study revealed that, the population of *thrips* had considerable positive effect with maximum temperature, whereas, significant negative impact with rainfall. The multiple regression equation indicated that the weather parameters were found to contribute around 83 per cent (Table 2) impact on population of thrips in brinjal crop when acted together (R^2 =0.83). The present findings are in accordance with the reports of Rashid *et al*. (2013) who found that the average temperature recorded had a significant positive effect on population of thrips. Moanaro and Jaipal (2016) also reported that a strong significant positive correlation existed between the number of *thrips* and maximum temperature, whereas, significant negative correlation between thrips population and rainfall.

Incidence of chilli thrips during Kharif season

Two *thrips* species; *Scirtothrips dorsalis* and *Thrips palmi* were identified from chilli crop. The *thrips* infestation commenced in the 32nd standard meteorological week with an average population of 1.00/ 3 leaves (Fig. 1) where maximum and minimum temperatures, maximum and minimum relative humidity and rainfall were 33.6ºC, 26.3ºC, 88 and 73 per cent and rainfall 14 mm, respectively (2018-19 and 2019-20) (Fig. 3) and the *thrips* population ranged from 1.00 to 5.10 *thrips*/3 leaves in chilli crop during kharif season. The correlation study revealed that the population of *thrips* had significant positive correlation (significant at p=0.05) with maximum temperature (r=0.64*) and sunshine hrs (r = 0.59*), while minimum temperature showed non-

Table 1: Correlation between the thrips population (Number of thrips/ 3 leaves/ plant) and weather parameters

Weather parameters	Brinjal	Chilli	Tomato
Maximum temperature	0.54*	0.64*	0.43*
Minimum temperature	-0.02	0.23	-0.04
Maximum relative humidity	-0.46	-0.61*	-0.54**
Minimum relative humidity	-0.39	-0.49	-0.90**
Rainfall	-0.60*	-0.69**	-0.38
Sunshine	0.49	0.59*	0.67**

*Significant at 5% level, **Significant at 1% level

Table 2: Regression analysis between the thrips population and weather parameters

Crop	Regression equation	R^2
Brinjal	$Y= 4.944+0.358X_1-0.380\ X_2-0.033\ X_3-0.023\ X_4-0.077\ X_5+0.023\ X_6$	0.83
Chilli	$Y= 5.186+0.440X_1-0.335\ X_2-0.096\ X_3-0.003X_4-0.109\ X_5+0.096\ X_6$	0.77
Tomato	$Y= 25.797-0.169X_1+0.092\ X_2-0.096\ X_3-0.198X_4-0.027\ X_5+0.166\ X_6$	0.90

Where, Y = Number of thrips, X_1 = Maximum temperature (ºC), X_2 = Minimum temperature (ºC), X_3 = Morning relative humidity (%), X_4 = Evening relative humidity (%), X_5 = Rainfall (mm), X_6 = Sunshine (hrs/day)

significant positive correlation (r = 0.23) with the population of *thrips* (Table: 1). However, maximum relative humidity (r = -0.61*) and rainfall (r= -0.69**) had strong negative correlation with thrips population. Minimum relative humidity exhibited non significant negative correlation (r = -0.49) with the population of thrips. The multiple regression analysis revealed that weather factors was found to be most influencing factor, which contributed (R^2= 0.77) 77 per cent influence on population of *thrips* in chilli crop when acted together (Table 2). The present finding are in collaboration with the earlier results of Kumar *et al*. (2019), who reported that the thrips population in chilli was first noticed during September and attained its peak during the 3rd week of October. The correlation study showed that the thrips population had significant positive association with maximum temperature. The present findings are also in line with the earlier findings of Pathipati *et al*. (2014), who also observed that thrips population had a positive correlation with maximum temperature.

Incidence of tomato thrips during rabi season

Two *thrips* species were identified namely *T. palmi* and *T. tabaci* from tomato. The data on seasonal incidence of *thrips* presented in fig. 2 revealed that the incidence of *thrips* was observed throughout the last week of November (48th standard week) with a mean population of 0.23 *thrips*/3 leaves where maximum and minimum temperature was 26.5 ºC and 15.0 ºC, respectively, with mean relative humidity (morning and evening) and sunshine hours was 87, 75 per cent and 6.50 hrs/day, respectively (Fig. 3). The population of thrips reached at peak in 11th and 12th standard meteorological week with 3.67 and 3.70 *thrips*/leaves (Fig. 2) and there after the population was declined. The experimental results revealed that maximum temperature (r= 0.43*) and sunshine hrs (r = 0.67**) showed considerable positive impact on the population of thrips infesting tomato leaves, whereas, maximum and minimum relative humidity (r=-0.54**, -0.90**) had direct negative effect on the population of *thrips* (Table. 1). The other parameters like minimum temperature (r = -0.04) and rainfall (r = -0.38) has no impact on the population oscillation on thrips population. The regression equation indicated that all the weather factors like maximum and minimum temperature, maximum and minimum relative humidity, rainfall and sunshine hrs showed 90 per cent effect (R^2 = 0.90) on the population of *thrips* (Table: 2). The present findings are supported with earlier findings of Naresh *et al*. (2017) who reported that maximum and minimum temperature had positive impact on the incidence of thrips. Akashe *et al*. (2016) also reported that thrips population was positively correlated with maximum temperature while it was negatively correlated with morning and evening relative humidity and rainfall.

It is concluded that the population of *thrips* had significant positive correlation with maximum temperature in both the seasons and it indicates that thrips population increases with the increase in temperature, whereas, the maximum and minimum relative humidity was negatively associated (no significant effect on the population of *thrips*) with all the three vegetable crops but highly significant during *Rabi* season. Sunshine hours had a significant positive impact on the population of *thrips*.

Conflict of Interest Statement: The author(s) declare(s) that there is no conflict of interest.

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