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Effects of Different Abiotic and Biotic factors on Abundance of Sucking Pests of Chilli (*Capsicum annuum* L.)

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ABSTRACT

The present investigation was carried out to study the effects of different weather parameters and natural enemies on abundance of sucking pests of chilli (*Capsicum annuum* L.) during January to May 2022. The outcomes revealed that sucking insect pests viz., thrips, aphids and whiteflies were found to be major infesting chilli. The activity of thrips was initiated during 1st week of February (6th SMW) and attained peak during 4th week of March (13th SMW). The aphids infestation started in the 1st week of January (1st SMW) and peak activity were observed in the 4th week of April (17th SMW). The population of whitefly was started appearing from last week of January (5th SMW) and the highest incidence was recorded during 2nd week of March (11th SMW). Thrips and aphids populations exhibited significant positive correlation with minimum (r = 0.752 and r 0.549) and maximum temperature (r = 0.560 and r = 0.700) and non-significant negative correlation with relative humidity (r = -0.247 and r = -0.166) and rainfall (r = -0.027 and r = -0.022). Whitefly population showed significant positive correlation with maximum temperature (r = 0.757) and negative correlation with relative humidity (r = -0.483) while non-significant positive correlation with minimum temperature (r = 0.381) and negative correlation with rainfall (r = -0.157). All the sucking pests exhibited significant positive correlation with coccinellid beetles and spiders. Regular monitoring and prediction aids in timely forecasting and devising effective spray schedules against insect pests.

Keywords Abiotic factors, Chilli, Correlation, Natural enemies, Sucking pests.

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INTRODUCTION

Chilli (*Capsicum annuum* L.) is a warm season vegetable crop, grown for its spicy fruits. It is originated from Mexico and introduced into India during 16th century by the Portuguese traders (Mehta 2017). Green chilli fruits are mainly used as vegetables and are rich sources of vitamin C and A also contains phosphorus and potassium (Kumar *et al.* 2020). 'Capsaicin' is the spicy ingredient of chilli fruits.

Chilli is threatened by insect pests throughout its growth stage. About 57 species of insect pests were recorded on chilli crop (Reddy and Puttaswamy 1988). Among those, thrips (*Scirtothrips dorsalis* Hood), aphids (*Aphis gossypii* Glover) and whiteflies (*Bemisia tabaci* Genn) are the major sucking insect pests infesting chilli.

The abundance of insect pests varies in time and place. Seasonal abundance and distribution of insect pests are highly influenced by various biotic and abiotic factors as well as their interactions. Monitoring and prediction of pest population assists in timely and efficient management of crop pests. Considering the above mentioned facts, the present experiment was conducted to study the seasonal abundance and impact of different weather parameters and natural enemies on sucking pests of chilli.

MATERIALS AND METHODS

Experimental site: Geographically the experimental area is situated 25˚45’43’’ N lattitude and 93˚33’04’’ E longitude with an elevation of 310 m from the mean sea level (MSL). The soil type of the experimental area is sandy loam in texture, well drained with mean pH range of 4.5-6.5 and acidic in nature.

Climatic condition: The experimental site falls under subtropical climatic condition with a predominantly high humidity (70-85%), medium to high rainfall 2000-2500 mm. Mean summer temperature varies from 28-32 °C and winter temperature varies from 10-15 °C.

Layout: An experiment was carried out in the experimental farm, Department of Entomology, School of Agricultural Sciences and Rural Development, Nagaland, India during November to May 2022. Chilli variety KSP-1347 NIRMITI was grown in an area of 27 m^2 with a spacing of 60 cm × 45 cm. During the study period no insecticidal sprays were given in order to maintain natural condition.

Observation of insects: Observations on abundance of sucking pests and their natural enemies were recorded at an interval of seven days during morning hours on ten randomly selected plants. The population of thrips, aphids and whiteflies was counted on three leaves per plant from the upper, middle and lower

Table 1. Seasonal abundance of sucking pests and their natural enemies in Chilli.

Standard meteorological week	Date of observation	Mean population of pests per three leaves			Mean population of predators per plant	
		Thrips	Aphids	Whiteflies	Coccinellids	Spiders
1	3-Jan-22	0.00	0.90	0.00	0.00	0.00
2	10-Jan-22	0.00	0.30	0.00	0.10	0.20
3	17-Jan-22	0.00	0.70	0.00	0.10	0.30
4	24-Jan-22	0.00	0.20	0.00	0.30	0.50
5	31-Jan-22	0.00	1.20	0.40	0.50	0.20
6	7-Feb-22	0.90	0.60	1.40	0.30	0.10
7	14-Feb-22	1.20	2.30	2.60	0.40	0.30
8	21-Feb-22	2.90	1.10	2.20	0.70	0.60
9	28-Feb-22	4.30	2.70	5.40	1.20	1.20
10	7-Mar-22	7.50	6.60	11.40	0.80	0.90
11	14-Mar-22	9.60	8.30	11.90	2.60	1.50
12	21-Mar-22	12.20	9.80	10.60	1.90	3.30
13	28-Mar-22	14.80	15.10	10.10	1.40	1.90
14	4-Apr-22	13.40	10.80	8.80	2.20	2.80
15	11-Apr-22	8.70	7.60	5.00	1.30	3.10
16	18-Apr-22	10.60	16.90	5.50	1.10	2.90
17	25-Apr-22	11.30	20.70	6.90	2.20	2.60
18	2-May-22	6.70	7.30	6.10	0.90	1.90
19	9-May-22	3.80	4.70	4.20	0.50	1.30
20	16-May-22	2.10	1.30	1.70	0.70	0.70
21	23-May-22	0.40	0.80	0.20	0.30	0.90

positions as per the method suggested by Satpathy (1973) by using 10X magnifying lens. The population of predatory coccinellid beetles and spiders were counted per plant.

Statistical analysis: Weekly average data on different weather parameters and natural enemies were statistically subjected with the mean population of insect pests to find their level of association. For this purpose, the Pearson correlation coefficient was worked out.

RESULTS AND DISCUSSION

Thrips, *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae)

The data presented in the Table 1 revealed that the activity of thrips was initiated during 1st week of February (6th Standard Meteorological Week) i.e. 0.90 thrips/ three leaves. There was no thrips activity found in the month of January when the crop was at vegetative stage. This may be due to low temperature and high relative humidity prevailed in the investigation area. Then thrips population gradually started increasing when the crop was at flowering stage and attained peak (14.80 thrips/ three leaves) during 4th week of March (13th SMW) when the minimum and maximum temperature, relative humidity and rainfall were 19.3 °C, 30.7 °C, 70.5 % and 0.9 mm respectively (Fig.1). Thereafter, drastic decline in thrips population was observed until crop maturity. The present findings are almost in confirmation with the findings of Kumar *et al.* (2020) who reported that maximum population (20.20 thrips/plant) of chilli thrips were recorded during second week of April (15th SMW).

Correlation coefficient was worked out between thrips population and different weather parameters viz., minimum and maximum temperature, relative humidity and rainfall (Table 2). The result indicated that thrips population exhibited significant positive correlation with minimum (r = 0.752) and maximum temperature (r = 0.560) and non- significant negative correlation with relative humidity (r = -0.247) and rainfall (r = -0.027). Study of Havanoor and Rafee (2018) supports the findings about maximum temperature, relative humidity and rainfall but opposes the present findings about minimum temperature who reported that thrips shown significant positive correlation with maximum temperature and non-significant negative correlation with minimum temperature, rainfall and relative humidity.

Table 2. Correlation coefficient (r) between sucking pests and weather parameters and natural enemies.

Abiotic and biotic factors	Thrips	Aphids	Whiteflies
Weather Parameters			
Minimum Temperature	0.560**	0.549**	0.381NS
Maximum Temperature	0.752**	0.700**	0.757**
Relative Humidity	-0.247NS	-0.166NS	-0.483*
Rainfall	-0.027NS	-0.022NS	-0.157NS
Natural enemies			
Coccinellids	0.860**	0.746**	0.829**
Spiders	0.878**	0.813**	0.683**

Note: *= Correlation is significant at 0.05 % level
** = Correlation is significant at 0.01 % level
NS = Correlation is Non Significant.

Aphids, *Aphis gossypii* Glover (Homoptera: Aphididae)

The aphid infestation on chilli started in the 1st week of January (1st SMW) with the mean population of 0.90 aphids/ three leaves. Aphid populations had no significant increase until 9th SMW due to prevailed lowest minimum and maximum temperature. Peak activity (20.70 aphids/ three leaves) of aphids were observed in the 4th week of April (17th SMW) when the corresponding minimum and maximum temperature, relative humidity and rainfall were 20.0 °C, 32.6 °C, 74.0 % and 18.3 mm respectively (Fig. 1). After that, sudden decrease in aphid population was recorded. This may be due to negative effect of rainfall and relative humidity on aphid population. This result is also similar with the findings of Priyadarshini *et al*. (2018).

The results of correlation studies (Table 2) revealed that the aphid population showed significant positive correlation with minimum (r = 0.549) and maximum temperature (r = 0.700). This shows that aphid population increases when temperature

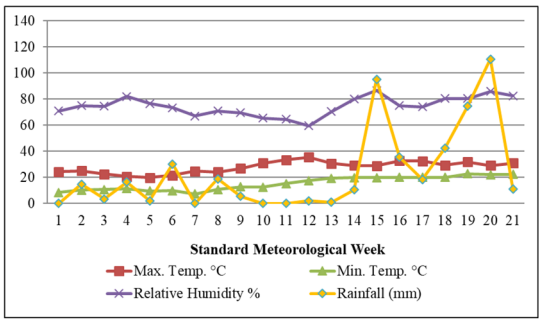

Fig. 1. Meteorological Observations during the study period (January to May 2022).

Source: ICAR- Research Complex For NEH Region, Nagaland Center, Medziphema.

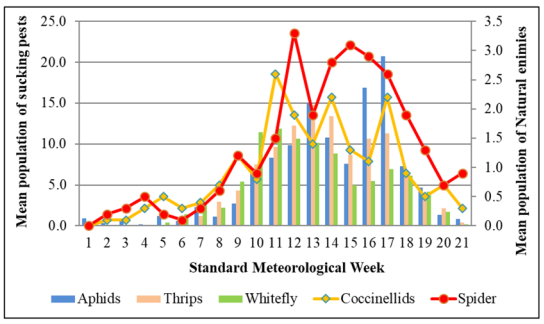

Fig. 2. Correlation coefficient (r) between sucking pests and natural enemies.

increases. On the contrary non-significant negative correlation was observed with relative humidity (r = -0.166) and rainfall (r = -0.022). The obtained results are at par with Prathyusha *et al.* (2021) who reported as maximum temperature exhibited significant positive correlation with aphid population while relative humidity and rainfall showed a negative correlation.

Whitefly, *Bemisia tabaci* Genn. (Hemiptera: Aleyrodidae)

The population of whitefly on chilli was started appearing from last week of January (5th SMW) with the mean population of 0.40/ three leaves and observed till 21st SMW. The highest incidence (11.90 whiteflies/ three leaves) was recorded during 2nd week of March (11th SMW) when the corresponding minimum and maximum temperature, mean relative humidity and rainfall were 15.2 °C, 33.5 °C, 64.5 % and 0.0 mm respectively (Fig. 1). Harshita *et al.* (2019) observed that high infestation levels of whitefly were observed from mid-February to mid- March. This supports the present findings.

Correlation studies (Table 2) revealed that significant positive correlation was found between whitefly population and maximum temperature (r = 0.757) and non-significant positive correlation with minimum temperature (r = 0.381). Relative humidity (r = -0.483) and rainfall (r = -0.157) showed negative correlation. However, the association was significant and non-significant respectively. Harshita *et al.* (2019) found whitefly population exhibited significant positive correlation with maximum temperature and negative correlation with average relative humidity.

Natural enemies

The population of natural enemies viz., coccinellid beetles and spiders were observed and expressed as number per plant. The first incidence of predatory coccinellid beetles and spiders commenced in the second week of January (2nd SMW) with the mean population of 0.10 and 0.20 per plant respectively (Table 1). The highest population of coccinellids (2.60 /plant) and spiders (3.30 /plant) were recorded during 11th and 12th Standard Meteorological Week (SMW) respectively (Fig. 2). Aarwe *et al.* (2020) found that peak activity of coccinellids was recorded in 11th SMW.

Correlation coefficient was worked out between sucking pests and natural enemies and presented in Table 2. The results indicated that sucking pests viz., thrips, aphids and whiteflies populations exhibited significant positive correlation with predatory coccinellid beetles with the r value of 0.860, 0.746 and 0.829 respectively. Similar findings were reported by Jambagi *et al*. (2021). They found that the population of coccinellid beetles was associated significantly positive with aphid population. Spiders also showed significant positive correlation with thrips, aphids and whiteflies with the r value of 0.878, 0.813 and 0.683 respectively.

CONCLUSION

From this study, sucking insect pests viz., thrips (*Scirtothrips dorsalis*), aphids (*Aphis gossypii*) and

whitefly (*Bemisia tabaci*) were found to be major infesting chilli crop during January to May 2022. Sucking insect pests infesting chilli were persistent throughout the growing season. Abundance of insects pests were highly influenced by abiotic factors. Coccinellids and spiders were positively associated with sucking pests. These factors aids in timely forecasting and devising spray schedules against insect pests.

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