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Seasonal Incidence of Major Insect Pests of Chilli and Their Correlation with Weather Parameters

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Study Design: Randomised Block Design (RBD) with three (3) replications.
Place and Duration of Study: Biswanath College of Agriculture, Assam Agricultural University, Assam,India. The experiment was conducted during *Rabi 2022-23*.
Methodology: Suryamukhi variety of chilli from packages of practices for Organic crops of Assam was used for this investigation. Three sucking pests *viz*, *Aphis gossypii, Scirtothrips dorsalis, Amrasca biguttula biguttula* and one fruit borer *Helicoverpa armigera* was found infesting the chilli plants. Weather parameters such as maximum temperature, minimum temperature, average relative humidity, rainfall and bright sunshine hours were correlated with the insect populations.

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Results: Aphids were positively correlated with sunshine hours (r=0.503*), thrips showed negative correlation with average relative humidity (r= -0.620*), jassids had a negative correlation with minimum temperature (r=-0.701*) and fruit borer showed negative correlation with sunshine hours (r= -0625**). Rainfall had no significant effect on incidence of pest population in chilli.

Conclusion: Insect pest populations are highly influenced by weather parameters. Through this research we can develop new pest management strategies according to their appearance and peak activity period.

Keywords: Chilli; Suryamukhi; thrips; aphids; jassid; population dynamics; correlation.

1. INTRODUCTION

Chilli, scientifically known as *Capsicum annum* L., belonging to the family Solanaceae is a widely cultivated crop in many parts of the world. It is an economically important vegetable and spice crop with culinary and therapeutic uses. It is packed with vitamin A and C, as well as minerals such as potassium, magnesium and manganese. [1] The vibrant color of chillies comes from the pigment “capsanthin”, while their pungency or spiciness is due to the presence of an alkaloid “capsaicin”. India is the leading producer of chilli followed by China and Pakistan [2]. India accounts for about one-fourth of the world's chilli exports [3].

Chilli plants are susceptible to a variety of pests, which can cause significant damage to the crop. The crop is affected by various insect pests, mainly sucking pests such as whiteflies *(Bemisia tabaci),* thrips *(Scirtothrips dorsalis),* and mites *(Polyphagotarsonemus latus)*, as well as fruit borers like *Helicoverpa armigera* and *Spodoptera litura* [4,5]. These insects feed on the sap of the plants. Chilli thrips and mites cause leaves to curl upward and downward, leading to a characteristic damage referred to as 'leaf curl syndrome' [6,7]. Fruit borer infestations also result in significant yield losses by making bore holes into the fruit making it unmarketable.

Weather conditions have a significant impact on pests that attack chilli plants. Changes in temperature, humidity, rainfall and other meteorological parameters can directly and indirectly affect the population dynamics, distribution and behavior of insect pests attacking chilli plants [8-10]. Due to different agro-climatic conditions between regions, insects show different trend in the incidence and extent of crop damage. For effective pest control, studying the impact of various factors responsible for population fluctuations can help predict their occurrence in a particular area [11,12,13]. The study on seasonal incidence of major insect pests of chilli were lacking under Assam condition of India and was undertaken to give an insight on the peak activities of the insect pests.

2. METHODOLOGY

The experiment was conducted at PG experimental farm in Biswanath College of Agriculture, Assam Agricultural University, Assam during Rabi 2022-23. For this experiment Suryamukhi variety of chilli was used. The seedlings of Suryamukhi were raised in open nursery beds and 25-30 days olds seedlings were transplanted to a field of 342 sq. m. with each plot size of 3 x 3 sq. m. and plant to plant distance of 60cm x 60 cm. The experiment was carried out in Randomized Block Design with three replications. Pest population was recorded in morning hours starting from first appearance to harvest of Final fruits. Observation of nymphs and adults of sucking pests were taken from 3 leaves per plant from top, middle and bottom in 5 randomly selected plants in each plot. Observation of fruit borer was also recorded from 5 randomly selected plant in each plot. The observation of pest population was taken regularly at weekly intervals. To determine the effect of various weather parameters on incidence of insect pests of chilli, the weekly meteorological data was collected from Department of Meteorology, Biswanath College of Agriculture, Assam Agricultural University. The data collected during seasonal incidence studies of insect pests affecting chilli crops were subjected to correlation and multiple regression with various weather parameters viz., maximum temperature, minimum temperature, average relative humidity, rainfall and bright sunshine hours. The correlation analysis was done to find out the relationship between incidence of sucking pests and fruit borer with weather parameters.

3. RESULTS AND DISCUSSION

During the course of the investigation aphids, thrips, jassids and fruit borer were recorded as the major insect pests of chilli. The results pertaining to the seasonal incidence of these insect pests and their respective peaks are presented and discussed in Tables 1 and 2.

Table 1. Seasonal incidence of major insect pests in chilli crop

SMW No.	*A. gossypii* No./leaf	*S. dorsalis* No./leaf	*A. biguttula biguttula* No./leaf	*H. armigera* No./plant	Temperature		BSSH (hrs)	Average RH (%)	Rainfall (mm)
					Maximum (°C)	Minimum (°C)			
45	5.82	0.00	0.20	0.00	29.60	14.31	9.27	72.21	0.00
46	6.07	0.00	0.00	0.00	29.57	13.88	8.83	72.42	0.00
47	7.23	0.60	2.93	0.00	27.65	11.32	8.45	73.42	0.00
48	6.07	2.98	2.00	0.00	27.71	11.38	9.11	71.50	0.00
49	12.54	5.75	1.13	0.00	27.88	11.87	8.96	68.14	0.00
50	7.86	4.32	4.60	0.26	27.31	11.42	8.38	70.00	0.00
51	10.20	5.86	4.20	0.31	26.62	12.21	7.69	72.35	0.00
52	4.40	1.03	2.60	1.60	26.31	13.25	7.44	73.92	0.42
1	4.82	1.12	1.00	1.02	21.87	11.20	2.6	77.21	0.51
2	8.06	3.13	3.97	0.82	24.57	8.01	7.91	68.35	0.00
3	6.07	4.63	3.46	1.18	25.82	9.34	5.73	68.00	0.00
4	5.93	4.12	4.26	2.36	23.65	8.44	2.84	68.57	0.00
5	5.24	3.60	3.07	1.32	25.67	9.77	7.13	69.50	0.00
6	5.80	2.94	2.48	2.32	27.21	13.24	4.04	71.88	0.00
7	3.73	3.00	0.80	0.40	23.08	13.58	1.92	73.81	2.33

Table 2. Correlation coefficient of various pests population with weather parameters

Insect pests	Maximum temperature (°C)	Minimum temperature (°C)	Average Relative humidity (%)	Bright sunshine hours(hr)	Rainfall(mm)
A. gossypii	0.227^{NS}	-0.145^{NS}	-0.479^{NS}	**0.503***	-0.449^{NS}
S. dorsalis	-0.204^{NS}	-0.441^{NS}	**-0.620***	-0.137^{NS}	-0.083^{NS}
H. armigera	-0.4670^{NS}	-0.186^{NS}	-0.128^{NS}	**-0.625****	0.0556^{NS}
A. biguttula biguttula	-0.399^{NS}	**-0.701***	-0.432^{NS}	-0.204^{NS}	-0.557^{NS}

*`*Significant at 0.05 level; **Significant at 0.01 level*

3.1 APHID (*Aphis gossypii* Glover)

The first occurrence of aphid was observed during the first week of November 2022 (45 SMW) with a mean population of 5.82/leaf. Peak population was observed during 49 Standard Meteorological Week with a population of 12.54/leaf. The population of aphids varied from 3.73/leaf to 12.54/leaf during different weeks of observation. The mean aphid population showed a non-significant positive correlation with maximum temperature (r=0.227). Minimum temperature (r= -0.145), average relative humidity (r= -0.479) and rainfall (r= -0.449) resulted in a non-significant negative correlation. The average aphid population recorded a significant positive correlation with bright sunshine hours (r=0.503). These results are in conformity with the findings of Kachave [14] in which they have found that aphid had a positive correlation with bright sunshine hours in tomatoes. Prashanth [15] also found the relation of bright sunshine hours with aphid population to be positive and significant in brinjal ecosystem. Mondal [2] found positive non-significant correlation of aphids with sunshine hours in chilli.

3.2 THRIPS (*Scirtothrips dorsalis* Hood)

The appearance of thrips was observed in third week of observation (47 SMW). Peak population was found during 51st SMW with a population of 5.86/leaf. In thrips, both maximum temperature (r = -0.204) and minimum temperature (r = -0.441) displayed non-significant negative correlations. Similarly, bright sunshine hours (r = -0.137) and rainfall (r = -0.083) also exhibited non-significant negative correlations with thrips population levels. Average relative humidity (r = -0.620) demonstrated a significant negative correlation with thrips population. Similar results were documented by Begam [11] who found thrips to have a significant negative correlation with average relative humidity. The differences in the peak activity of thrips observed during different weeks of observation may be attributed to the climatic conditions, date of transplantation, and the specific chilli variety employed in the experiment. Kumar [16] also reported to have found significant negative correlation of thrips with morning and evening relative humidity. The findings are also supported by Mondal [2] who found significant negative correlation of thrips population with relative humidity in chilli. Yadav [17] found significant negative correlation of thrips with morning relative humidity but non-significant negative correlation with evening relative humidity.

3.3 JASSID (*Amrasca biguttula biguttula* Ishida)

Jassid or leafhopper population was first observed during 45 SMW. The population fluctuated during different weeks of observation. The average population of leafhoppers displayed a prominent and statistically significant negative correlation (r = -0.701) with minimum temperature. Maximum temperature (r = -0.399) and rainfall (r = -0.557) were also observed to exhibit non-significant negative correlations with average leafhopper population, while bright sunshine hours showed a similarly non-significant negative correlation (r = -0.204). The present findings are supported by the work of Kumar, Shivam [18] who reported that minimum temperature had significant negative correlation with mean population of leafhopper in tomato. Waman [19] also found highly significant negative correlation of leafhopper population with minimum temperature in Okra.

3.4 FRUIT BORER (*Helicoverpa armigera* Hubner)

First appearance of fruit borer population was observed during 50th Standard Meteorological Week (SMW). Highest population was found during 4th SMW with a mean population of 2.36/plant. The population of fruit borer displayed a negative and non-significant correlation (r = -0.407) with maximum temperature. Similarly, it exhibited negative and non-significant correlations with minimum temperature (r = -0.701) and average relative humidity (r = -0.128). Rainfall demonstrated a positive but non-significant correlation (r = 0.056). Bright sunshine hours, revealed a negative and highly significant correlation (r = -0.625) with mean fruit borer population. The present findings corroborate the findings of Bhatt, Karnatak [1] who found significant negative correlation of fruit borer population with bright sunshine hours in chilli. Harshita [20] found negative non-significant correlation of fruit borer population with bright sunshine hours in tomato.

4. CONCLUSION

The findings from the present study suggested that the seasonal abundance and activity of insect pests of chilli crop are impacted significantly by a variety of abiotic factors. Weather parameters such as maximum temperature, minimum temperature, average relative humidity and bright sunshine hours played a significant role in regulating and appearance of the pest population density. These findings can help in implementing effective pest control measures by identifying the susceptible stages of these pests and when to take mitigation strategies. This knowledge enables the optimization of control measures such as implementation of cultural practices, release of biological control agents and precise timing of pesticide applications to mitigate pest impact. These studies can help predict shifts in pest populations and the emergence of new pests in different regions, which leads in the development of adaptive management strategies to protect crops and ecosystems. Accurate predictions of pest outbreaks and the best times to intervene can also reduce crop losses and lower pest management costs leading to improved crop yields and quality.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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