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Studies on Population Dynamics of Major Insect Pests Infesting Chilli (*Capsicum annum* L.)

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ABSTRACT

A Field experiment was conducted to study the population dynamics of major insect pests infesting chilli (Capsicum annum L.). Results revealed that whitefly (Bemisia tabaci Genn.), leafhopper (Amrasca biguttula biguttula Ishida), and aphid (Aphis gossypii Glover) commenced the activity during the last week of July. The aphid reached its peak during the first week of September (8.36 aphid/ 3 leaves,) while the peak activity of whitefly and leafhopper was recorded during the second week of September (7.12 whitefly/ 3 leaves and 6.44 leafhopper/ 3 leaves), respectively. The incidence of thrips (Scirtothrips dorsali Hood) was commenced during the second week of August and reached the peak during the third week of September (9.50 thrips/ 3 leaves). Yellow mite (Polyphagotarsonemus latus Banks) appeared on the crop during the third week of August and reached its peak level during the third week of September (6.54 mite/ 3 leaves). Further, the incidence of fruit borer, Halicoverpa armigera Hubner was commenced during the third week of September and recorded at peak in the third week of October (2.88 larvae/ plant).The correlation study showed that thrips exhibited highly significant negative correlation with evening relative humidity and significant positive correlation with maximum temperature. The leafhopper population showed positive and significant correlation with minimum temperature. None of weather parameters showed significant impact on whitefly and aphid population. The correlation between yellow mite and maximum temperature was significant and positive, while, evening relative humidity had significant negative correlation. The fruit borer showed highly significant and negative correlation with morning and evening relative humidity while, maximum temperature and sunshine hours were significant with positive correlation.

Key words: *Chilli, Incidence, Population, Peak, Seasonal, Correlation, Significant*

INTRODUCTION

Chilli is an important vegetable and condiment crop in India. The two cultivated species (*Capsicum annum* L. and *Capsicum frutescens* L.; family Solanaceae) are raised in the tropics and sub-tropics with a temperature range of 20-25 °C considered as ideal. The medicinal value of chilli is much realized because of its vitamin 'C' and capsaicin (C_{18} H_{27} O_3 N). It is widely used throughout the tropics as major ingredient of curry powder in the culinary production.

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Besides essential alkaloid, red colouring matter, which is non-pungent. India is the largest consumer and exporter of chilli in the world with a production of 3292 MT from an area of 238 thousand ha and productivity 10 MT per ha during 2015[1]. The major chilli growing states are Andhra Pradesh, Maharashtra, Karnataka, Tamil Nadu and Rajasthan. In Gujarat, it is cultivated in an area of 6500 ha with the production of 6600 MT[2]. The major chilli growing districts of Gujarat include Anand, Banaskantha, Kheda, Vadodara, Navsari, Patan, Mehsana and Surat.A number of factors responsible for low yield include adverse climate, poor quality seeds, diseases, insect and mites which significantly affect both the quality as well as production of chilli. The yield losses range between 50 to 90 per cent due to insect pests of chilli[9,15]. Thrips (*Scirthothrips dorsalis* Hood), whiteflies (*Bemisia tabaci* Genn), aphids (*Aphis gossypii* Glover) and yellow mites (*Polyphagotarsonemus latus* Banks) are the important sucking pests which contributed to reduction in the crop yield[7]. The damage due to mites and thrips together had been estimated to the tune of 50 per cent [8].

MATERIALS AND METHODS

Field experiment was conducted with GCh 1, a local cultivar of chilli during *kharif* 2016-17 at Horticulture Instructional Farm of Chamanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University Sardarkrushinagar,. The plot gross plot size was 20 m x 20 m while, net plot size was 18 m x 18 m with 60 cm x 60 cm row to row and plant to plant spacing.

(i) Sucking pests

The incidence of insect pests was recorded from randomly selected and tagged fifty plants of chilli. Observations were recorded on these tagged plants after 15 days of transplanting at weekly interval during morning between 7.00 AM to 8.00 AM. The chilli crop was kept insecticide free throughout the crop season. Number of sucking pests *viz.*, leafhopper, thrips, whitefly and aphid were counted separately from three leaves one each from top, middle and bottom region per plant with the help of magnifying lens.

(ii) Yellow mite

Weekly observations on the population of *P. latus* **were** recorded starting one month after transplanting. Three leaves representing top, middle and bottom canopy were plucked randomly from each of the fifty plants and one cm^2 area of each selected leaf from each plant were observed with the help of 10x eye glass.

(iii) Fruit borer

The observations of number of fruit borer larvae per plant were recorded from these fifty randomly selected plants. Observations were recorded during early morning hrs at weekly interval.

Weather parameters

Weekly meteorological data on temperature, relative humidity, sunshine hours, wind velocity and rainfall were obtained from the Agro-meteorological observatory, S. D. Agricultural University, Sardarkrushinagar. The data was utilized to work out simple correlation co-efficient between pest population and various abiotic factors.

Statistical analysis

Data of different insect pests thus, obtained were subjected to statistical analysis.

RESULTS AND DISCUSSION

Thrips (*Scirtothrips dorsalis* Hood)

The incidence of thrips was first noticed during the second week of August (34th SMW) with a mean population of 2.12 thrips per 3 leaves (Table 1). Then, its population gradually increased and reached its peak level (9.5 thrips /3 leaves) in the third week of September (39th SMW). The second peak was noticed during the third week of October (43rd SMW) with a mean population of 6.50 thrips per 3 leaves. The thrips population started declining and reached low level (2.20 thrips /3 leaves at the end of crop period during *kharif*, 2016-17. The results obtained in the present investigation are in close agreement with the earlier reported by Bhade *et al.*[4] and Panicker[16].

Whitefly (*Bemisia tabcai* Genn.)

Whitefly first appeared in the last week of July (32rd SMW) with 1.38 numbers per 3 leaves. Its population increased gradually and reached the peak (7.12 whiteflies/ 3 leaves) in the second week of September (38th SMW). Later

the population decreased gradually and reached at low level (1.94 whitefly/ 3 leaves) during the fourth week of November (Table 1). The similar results obtained by Meena *et al.*[14], Bharadia and Patel[3].

Leafhopper (*Amrasca biguttula biguttula* Ishida)

The incidence of leafhopper was first recorded during 4th week after transplanting. The population reached its peak (6.44 leafhoppers /3 leaves) during the second week of September (38th SMW). Thereafter, the population decreased gradually and lower number of leafhoppers (1.12 leafhopper / 3 leaves) were observed during fourth week of November (48th SMW) (Table 1). The results obtained in the present investigations are in close agreement with the earlier reports of Gambhiri and Kumar[6] who observed higher incidence of leafhopper during the month of August and September.

Aphid (*Aphis gossypii* Glover)

The infestation of aphids appeared three weeks after transplanting and reached at its maximum level (8.36 aphids/ 3 leaves) during the first week of September (37th SMW). Thereafter, population was steadily declined and finally disappeared during the third week of November (47th SMW) (Table 1). Earlier to this, Meena *et al.*[14] (reported that the aphid population peaked in the first week of September (9.0 aphid/ 3 leaves) and second week of September (9.3 aphid/ 3 leaves).

Yellow mite (*Polyphagotarsonemus latus* Banks)

The yellow mite population commenced the activity third weeks after transplanting i.*e.* third week of August. The peak population (6.54 yellow mites /3 leaves) was observed during the third week of September (39th SMW). The population was recorded minimum (1.42 yellow mite / 3 leaves) at harvest of the crop *i.e.*, the fourth week of November (48 SMW) (Table 1). Similar results were obtained by Meena *et al.*[14] who reported that the population density of mite was observed to its peak in the second week of September (9.2 and 9.0 mite/ 3 leaves).

Fruit borer (*Helicoverpa armigera* Hubner)

The fruit borer, *H. armigera* appeared in the crop during the third week of September (39th SMW) with the larval population recorded to be 0.76 larva per plant (Table 1). The population increased gradually and reached its peak of 2.88 larvae per plant during 43th SMW and thereafter, started declining. In early reports Roopa and Kumar[17] Nadaf and Kulkarni[13] reported the peak incidence of fruit borer during the first fortnight of November.

Correlation between population of major insect pests and weather parameters

Thrips (*Scirtothrips dorsalis* Hood)

Among the different weather parameters studied (Table 2), evening relative humidity (r= - 0.61**) exhibited highly significant negative correlation with thrips population, while maximum temperature (r= 0.56*) had significant positive correlation with thrips. Minimum temperature, wind velocity and sunshine hours showed non- significant positive correlation with its population, whereas, morning relative humidity and rainfall exhibited negative but non-significant association with the thrips. The similar results obtained Meena *et al.*[14] and Bhede *et al.*[4] reported that the negative correlation with evening relative humidity while positive correlation with bright sunshine of thrips population.

Whitefly (*Bemisia tabcai* Genn.)

The results presented in table 2 revealed that none of weather parameter had significant impact on whitefly population. Minimum temperature, maximum temperature, morning relative humidity, wind velocity and sunshine hours had non-significant positive association, whereas, evening relative humidity and rainfall showed non- significant negative association with the incidence of whitefly. Earlier, Bharadia and Patel[3], Yadav *et al.*[19] reported high temperature with significant positive correlation while relative humidity and rainfall were negatively correlated with whitefly population.

Leafhopper (*Amrasca biguttula biguttula* Ishida)

The leafhopper population had positive and significant correlation with minimum temperature (r=0.48*). Though, maximum temperature, morning relative humidity, wind velocity and sunshine hours had positive correlation but was non- significant. The

leafhopper population had negative and non-significant correlation with evening relative humidity, and rainfall (Table 4). The present findings are confirmed with workers of Gambhiri and Kumar[6], Mahmood *et al.*[11] who observed the maximum and minimum temperature with positive and significant correlation. While,relative humidity and rainfall were found negative and non-signifacant with leafhopper population.

Aphid (*Aphis gossypii* Glover)

The results revealed (Table 2) that none of the weather parameter showed significant effect on aphid population. However, maximum temperature, minimum temperature, wind velocity, sunshine hours displayed non-significant positive correlation, whereas, morning relative humidity, evening relative humidity, and rainfall showed non- significant negative correlation with aphid population. In early reports, Debaraj and Singh[5], Roopa and Kumar[17] revealed that the aphid population exhibited a negative correlation with maximum temperature, minimum temperature and sunshine hours.

Yellow mite (*Polyphagotarsonemus latus* Banks)

The results presented in table 2 revealed that maximum temperature (r=0.48*) had significant positive correlation, while evening relative humidity (r= -0.54*) had significant negative correlation with yellow mite population. The correlation of minimum temperature, morning relative humidity, wind velocity and sunshine was positive and non-significant. Hoever, rainfall showed non-significant and negative correlation with the population of yellow mite. Similar observation was also recorded by Lingeri *et al.*[10] and Montasser *et al.*[12].

Fruit borer (*Helicoverpa armigera* Hubner)

The results presented in table 2 indicated that morning relative humidity (r=-0.68**) and evening relative humidity (r= -0.66**) had highly significant and negative correlation with fruit borer population, while maximum temperature (r=0.55*), sunshine hours (r=0.48*) showed significant positive correlation with fruit borer population. Further, minimum temperature, wind velocity and rainfall showed non-significant negative correlation with fruit borer population. In early reports, Nadaf and Kulkarni[13], Singh *et al.*[18] observed rainfall and relative humidity with negative correlation while, temperature with positive correlation with pest activity.

Table 1: Mean population of insect pests infesting chilli during *kharif* 2016-17

Month and Week	SMW	No. of sucking pests/ 3 leaves					Fruit borer larvae/plant
		Thrips	Whitefly	Leafhopper	Aphid	Yellow mite	
July							
IV	32	0.00	1.38	1.28	0.40	0.00	0.0
August							
I	33	0.00	1.50	1.68	1.22	0.00	0.0
II	34	2.12	2.74	2.06	2.66	0.00	0.0
III	35	3.22	3.00	2.38	2.54	1.72	0.0
IV	36	3.54	3.60	2.66	2.54	3.24	0.0
September							
I	37	4.78	4.00	3.82	8.36	4.30	0.0
II	38	6.32	7.12	6.44	8.18	5.20	0.0
III	39	9.50	7.0	6.22	7.20	6.54	0.76
IV	40	8.16	6.40	5.62	6.90	5.90	1.08
October							
I	41	5.22	6.12	5.44	6.36	4.30	1.88
II	42	6.32	5.78	4.72	5.84	4.12	2.34
III	43	6.50	3.50	2.68	5.30	3.82	2.88
IV	44	5.86	2.88	2.50	4.20	3.52	2.46
November							
I	45	4.70	2.18	2.40	2.94	2.64	2.32
II	46	3.24	2.28	1.96	2.86	2.30	1.18
III	47	2.50	2.14	1.56	0.00	1.98	1.04
IV	48	2.20	1.94	1.12	0.00	1.42	0.00

SMW- Standard Meteorological Week

Table 2: Correlation between population of major insect pests and weather parameters during *kharif* 2016-17

Insect pests	Weather parameters						
	Temperature (°C)		Relative Humidity (%)		Wind velocity (km/hr)	Rainfall (mm)	Bright Sunshine (Hrs/day)
	Max.	Min.	Morning	Evening			
Thrips	0.56*	0.13	-0.20	-0.61**	0.02	-0.31	0.46
Whitefly	0.34	0.46	0.19	-0.26	0.21	-0.08	0.14
Leafhopper	0.32	0.48*	0.18	-0.23	0.27	-0.10	0.13
Aphid	0.39	0.43	-0.06	-0.30	0.37	-0.21	0.24
Yellow mite	0.48*	0.18	0.06	-0.54*	0.01	-0.22	0.40
Fruitborer	0.55*	-0.27	-0.68**	-0.66**	-0.30	-0.34	0.48*

* Significant at 5 per cent level (r=0.48)

**Significant at 1 per cent level (r=0.60)

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