Population dyanamics of new insecticides against major insect pests of chilli and their correlation with weather parameters

P. R. Zanwar[1], Matre Y. B.[2*] and Baral S. B.[3]

[1] Associate Professor, Department of Agricultural Entomology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

[2] Ph.D, Research Scholar, Department of Agricultural Entomology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

[3] Msc Student, Department of Agricultural Entomology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Correspondence Author: Matre Y. B.

Received 3 May 2022; Accepted 29 Jun 2022; Published 26 Jul 2022

Abstract

The experiment was conducted at Experimental Research Farm, Department of Agricultural Entomology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, during the *Kharif* season of the year 2016-17 to study population dynamics of new insecticides against insect pests of chilli. The experiment was laid out in a randomized block design with 9 treatments replicated three times. The treatments comprised of fipronil 5 SC @ 1000 ml/ha, hexythiaziox 5.45EC @ 500 ml/ha, spinosad 45 SC @ 187.5 ml/ha, acetamiprid 20 SP @ 250 g/ha, fenpyroximate 5 EC @ 600 ml/ha, emamectin benzoate 5 SG @ 250 g/ha, spiromesifen 22.9 SC @ 250 ml/ha, diafenthiuron 50 WP @ 625 g/ha and untreated control. The observations on the effect of these insecticidal treatments on thrips, mites, white fly and fruit borer were recorded. The observations on population dynamics of thrips, mites, white fly and fruit borer also recorded. The infestation of thrips, *Scirtothrips dorsalis* Hood was initiated in the third week of August (33rd meteorological week) and remained continue up to fourth week of December (51st meteorological week) during 2016-17. The data on correlation between meteorological factors and thrips population revealed that the population exhibited a significant positive correlation with maximum temperature while the correlation was negatively non-significant with evening relative RH and average rainfall. The whitefly, *Bemisia tabaci* Genn. appeared in the third week of August (33rd meteorological week) and continue up to fourth week of December (51st meteorological week). The population increased gradually and touched its peak in third week of October (42nd meteorological week). The population exhibited significant positive correlation with maximum temperature and evaporation whereas negative and non-significant correlation with rainfall, morning and evening RH and minimum temperature. The mite population persist throughout the crop season from fourth week of August (34th meteorological week) and was continue up to fourth week of December (51st meteorological week). The population increased gradually and touched its peak in the third week of October (42nd meteorological week). The fruit borer population touched its peak in the fourth week of November and showed the negatively non-significant correlation with rainfall, morning RH, evening RH and minimum temperature.

Keywords: population dynamics, chilli pests, weather parameters

Introduction

Chilli, *Capsicum annum* L. is one of the important Solanaceous crops. *Capsicum annum* is widely cultivated throughout the world, specially in tropical and subtropical regions. It is one of the important spice as well as vegetable crop grown all over the India. Chilli fruits are used for culinary purposes as fresh green or dried. It is eaten raw in salad, cooked as a vegetable, pickled or used for flavorings different dishes. India is the largest producer of chillies in the world accounting for 13.76 million tonnes of production annually. In India, chilli was grown in an area 774.9 thousand hectare and production 1492.10 thousand tonnes and the productivity was 1.93 tonnes per hectare in 2014-15. (Geetha and Selvarani, 2017) [20]. Among many other reasons responsible for the lower yield, damage done by insect pests holds a major share. A survey conducted in Benin for finding production constraints in chilli, ranked the attack of insect pests on leaves, flowers and fruits as first among all other constraints (Orobiyi *et al.*, 2013) [23]. Another survey conducted by Asian Vegetable Research and Development Committee in Asia indicated that the key insect pests of chilli are aphids (*Myzus persicae* Sulzer, *Aphis gossypii*, Glover), thrips (*Scirtothrips dorsalis* Hood) and yellow mite (*Polyphagotarsonemus latus* Banks) which act as limiting factors in chilli production. Fifty-one species of insects and two species of mites belonging to 27 families under 9 orders were recorded on chilli transplanted crop. Further, *Gonocephalum dorsogranosum* Frm. (vegetable beetle), *Melanotus sp.* (wire worms), *Odontotermes obesus* (termite), *Holotrichia serrata* (white grub), *Helicoverpa armigera* (fruit borer), thrips (*S. dorsalis* and *Thrips flavus* Schrank) and mites (*P. latus* and *Tetranychus neocaledonicus* Andre) were considered as important pests (Reddy and Puttaswamy, 1984) [19]. Various environmental factors like temperature, humidity, rainfall etc. have been observed to influence the population dynamics of insect pests. Varadharajan and Veeravel (1995) [22] reported lowest population of *S. dorsalis* during last week of July when maximum temperature was 35°C with 44 mm rainfall and peak occurrence was recorded during 1st week of September when maximum temperature was 35˚C and there was no rainfall. The pest population was positively correlated with maximum temperature but negatively correlated with rainfall. It seems important to verify such environmental influences on dynamics of *Bemisia tabaci* and *S. dorsalis* chilli on crop in Kymore plateau and Satpura hills zone also. Determining correlation of pest population with various abiotic factors of the environment prove helpful in the formulation of an appropriate pest management strategy. Suitable pest control schedules can only be derived when enough information is available about the seasonal activity of the pest under consideration. *Scirtothrips dorsalis* is considered as one of the most destructive pest and under severe infestation 30 to 50 % crop may be lost (Bhede *et al*., 2008) [23].

Materials and Methods

A field experiment was conducted during *Kharif* 20016-2017 to study the population dynamics major insect pests of chilli at the farm of Department of Agricultural Entomology, VNMKV, Parbhani. The geographical location of the experimental fields The climate of the region is typically sub-tropical which is characterized by slightly extremes of the temperature in summer. During summer temperature may rise as high as 40-42^{0}C and in winter it may fall as low as 15-30^{0}C. The total rainfall is 800-1000 mm which is mostly received from July-September. Parbhani is situated 408.50 m above the mean sea level. It lies between 19^{0}16´ North Latitude and 76^{0}47´ East Longitude. The mean relative humidity ranges from 30 to 90 per cent. The seeds of chilli variety 'Parbhani chilli' were obtained from Department of Horticulture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. In order to raise the seedlings for transplanting, chilli (var. Parbhani chilli) were sown in nursery before one and half month of transplanting chilli in main field. The seedlings of chilli were transplanted in 100 m^2 area by adopting 60 cm x 45 cm spacing. This area was divided into four quadrates (5 m x 5 m). The experiment was conducted in 2016-17. No insecticidal treatment was applied at any stage of the crop growth. The crop was grown following recommended package of practices. Plot size : 10 m x 10 m, Date of transplanting : 14/8/2017, Variety : Parbhani chilli, Spacing: 60 cm x 45 cm, Season : *Kharif* 2016-17. For recording the observation of seasonal incidence of sucking pests and Fruit borer of chilli was done by methodology suggested by (Meena *et al.* 2013) [10] counting the population of insect pests on five randomly selected plants in three plots of 4.5 m x 3.0 m were maintained without employing any plant protection measures. The observations of sucking pests and fruit borer were recorded at weekly intervals during morning hours between 6:30 AM to 8:30 AM. The population of mites and whiteflies were recorded from five leaves, two from the middle, two from the lower and one from the upper position on five randomly selected plants and population of thrips was recorded from terminal five leaves and for fruit borer the number of larvae per plant on 5 randomly selected plants per plot.

Results and Discussion

The present investigation was carried out on population dynamics of major pests in chilli. The results obtained are presented under following heading.

Population dynamics of different pests in chilli

Population dynamics of thrips (*Scirtothrips dorsalis* Hood)

The data on population fluctuation of thrips *S. dorsalis* on chilli during *kharif* 2016-17 is represented in Table 3 and Fig. 3. The thrips population ranged between (2.08 to 10.2 thrips/ leaf). The incidence of thrips started from 33rd MW (5.4 thrips/ leaf) and peak incidence observed from 34th MW up to 43th MW. Maximum population of thrips observed in 42ndMW (10.2 thrips/ leaf). After that population of thrips decreased and reached up to (2.08 thrips/ leaf) in 51th MW.

These trends of thrips infestation in present studies were more or less similar to those of earlier workers like, Sanap *et al.* (1985) [24] reported thrips occurrence during the 1st week of August on chilli. The buildup of population of thrips started from the 2nd week of August reaching its peak (109 thrips/15 shoots) in the 1st week of September. Thereafter the incidence declined towards the harvest of crop. Meena *et al.* (2013) [10] studied population dynamics of sucking pests and their correlation with weather parameters in chilli, *capsicum annum* and reported that infestation of thrips, *Scirtothrips dorsalis* Hood was initiated in the 4th week of July (30th meteorological week) and remained continue up to 4th week of November (48th meteorological week) during both the years 2007-2008. The peak population of thrips (14.5 and 14.7/3leaves/plant) was recorded in the 1st week of October.

Population dynamics of whitefly (*Bemisia tabaci* Genn)

The data on population dynamics of whitefly *B. tabaci* during *kharif* 2016-17 (Table 3 and Fig. 3) denoted that whitefly population ranged from (1.2 to 4.32 whiteflies/leaf). The incidence of whiteflies started from 33rd MW (1.68 whiteflies/leaf). The peak activity of whitefly was observed from 34th MW (22-28 Aug.) to 43th MW (24-30 Oct.), while highest incidence (4.32 whiteflies/leaf) of whiteflies population observed in 42th MW. Thereafter the population decreased up to 1.52 whiteflies/leaf in 51th MW (19-25th December).

The present findings are similar with the findings of earlier research worker like Arif *et al*. (2006) [2] studied the effect of abiotic factors on population dynamics of sucking insect pests of cotton at post graduate Agricultural Research Station, Univercity of Agriculture, Faisalabad during 2003-2004 and reported that incidence of whiteflies appeared from 4th week of jully and peak population of whiteflies was observed during 4th week of August and 1st week of September. Meena *et al.* (2013) [10] studied the seasonal incidence of whiteflies on chilli var. Pusa jwala at Rajasthan College of Agriculture Farm, Maharana Pratap University of Agriculture and Technology, Udaipur during *kharif* season of 2006-07 and reported that incidence of whitefly was appeared in the 3rd week of July (29th meteorological week) and continue up to fourth week of November (48th meteorological week). The population increased gradually and touched its peak with mean population of 6.9 whiteflies /3leaves /plant in 1st week of September (36th meteorological week) during 2006-07 while, the population of whitefly touched its peak with 6.7 whiteflies/3leaves/plant in the 2nd week of September (41st meteorological week) during 2007-08.

Population dynamics of mites *(Polyphagotarsonemus latus* Banks)

The data on population fluctuation of mites *P. latus* during *kharif* 2016-2017 is presented in Table 3 and Fig. 3.

The data from Table 3 and Fig. 3 revealed that the mites population ranges between (0.8 to 3.24 mites/leaf). The incidence of mites started from 34th MW. The peak incidence of mites was recorded in 36th MW to 43th MW. Maximum population of mites recorded (3.24 mites/leaf) during 42nd MW (17-23th Oct.). After 45th MW the population of mites fluctuated throught the season and reached up to (1.72 mites/leaf) in 51st MW (19-25th December).

The present finding agreements are more or less similar with those of earlier researchers like, Sanap *et al.* (1985) [24] reported that mites occurrence during the 1st week of August on chilli. The buildup of population of mites started from the 3rd week of August reaching its peak (22.9 mites/3leaves) in the 2nd week of November. Thereafter the incidence declined towards the harvest of crop. Lingeri *et al.* (1998) [25] studied seasonal incidence of mites and thrips in chilli var. Byadagi at the main Research Station, Dharwad and revealed that mite (*P. latus)* appered throughout the cropping period and peak population 18.20, 19.40, 18.30 mites per leaf recorded during 1st week of November, 3rd week of November, and 1st week of February.

Population dynamics of fruit borer (*Helicoverpa armigera* Hubner)

The data on population of fruit borer *H. armigera* during *kharif* 2016-17 (Table 3 and Fig. 3) revealed that on chilli fruit borer population ranged between 0.8 to 2.32 larvae per plant. The peak incidence of fruit borer was recorded during 41st MW to 47th MW. Maximum population of fruit borer recorded (2.32 larvae/plant) during 47th MW (21-27th Nov.). After 47th MW the population decreased and reached up to (1.2 larvae/plant) in 51st MW (19-25th December).

These trends of fruit borer infestation were more or less similar with those reported by earlier research workers like, Yadava and Lal (1988) [26] found that larval population of the *H. armigera* showed 2 peaks during the 47th to 50th and 11th to 15th weeks in chickpea. Nadaf and Kulkarni (2006) [27] conducted a field experiment during *kharif* 2001, in Dharwad, Karnataka, India, to study the seasonal incidence of *Helicoverpa armigera* Hood. and *Spodoptera litura* F. on chilli (*Capsicum annum*). The peak incidence of *H. armigera* eggs was recorded during the second fortnight of September, while the peak incidence of larvae occurred during the second fortnight of November. Dajya *et al.* (2010) [4] studied population dynamics of *Helicoverpa armigera on* chickpea, pigeonpea and cotton in Correlation with weather parameters and reported that pest incidence initiated in last week of July and incresed from 5.0 to 6.3 larvae/10 plants during 1st week of August peak incidence was observed during 3rd week of November.

Table 1: Population dynamics of different pests on chilli in relation to climatic condition in *Kharif* 2016-2017

Duration	SMW	Thrips/leaf	Whitefly /leaf	Mites/leaf	Fruit borer/plant
08-14 Aug	32	0	0	0	0
15-21 Aug	33	5.4	1.68	0	0
22-28 Aug	34	9.6	2.72	1.12	0
29-04 Sep	35	3.04	2.04	0.8	0
05-11 Sept	36	5.12	2.48	1.16	0
12-18 Sep	37	4.08	1.52	1	0
19-25 Sep	38	3.52	1.2	0.84	0
26-02 Oct	39	4.56	3.00	1.28	0.8
03-09 Oct	40	6.48	2.04	1.96	1.28
10-16 Oct	41	9.36	3.12	2.52	1.72
17-23 Oct	42	10.2	4.32	3.24	2
24-30 Oct	43	7.36	3.6	2.68	1.84
31-06 Nov	44	5.32	2.12	1.8	1.48
07-13 Nov	45	4.28	2	1.52	1.2
14-20 Nov	46	3.44	1.92	1.28	1.04
21-27 Nov	47	4.16	2.36	1.84	2.32
28-04 Dec	48	5	2.84	2.52	1.48
05-11 Dec	49	2.4	1.68	1.88	1.72
12-18 Dec	50	3.32	1.8	2.2	1.6
19-25 Dec	51	2.08	1.52	1.72	1.2

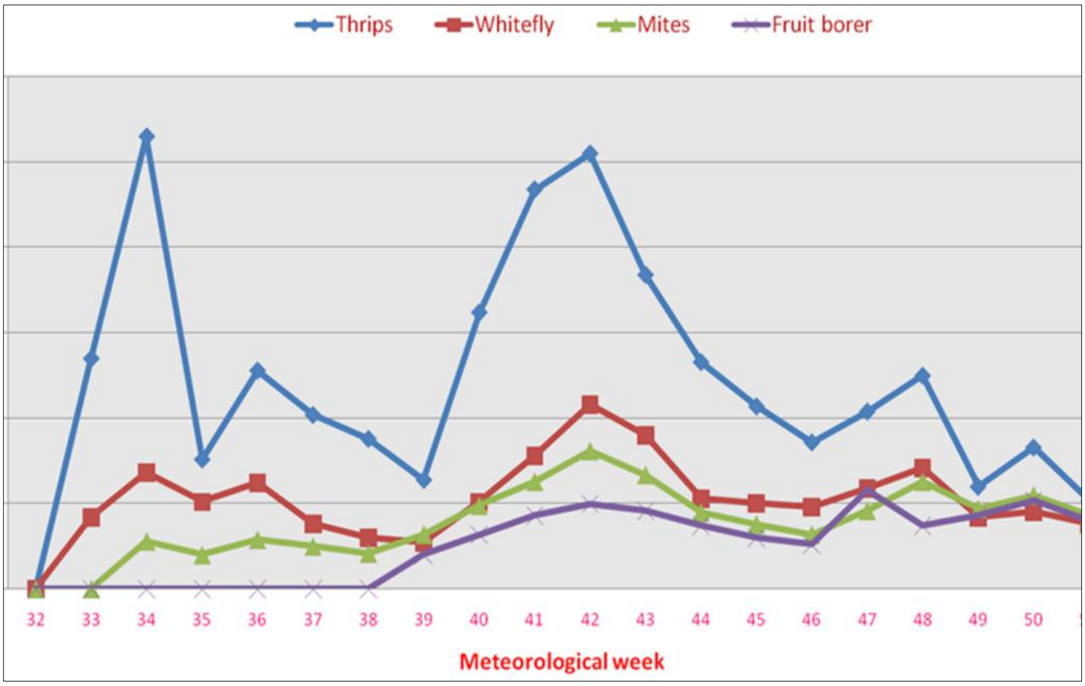

Fig 1: Population dynamics of different insect pests on chilli during *Kharif* 2016-2017

Simple correlation and regression between weather parameters and different pests of chilli

Simple correlation studies

Thrips (*S. dorsalis*)

The data on correlation and regression between weather parameters and thrips population presented in Table 4 indicated that the thrips population was positively significant with maximum temperature (r = 0.623**). The non significant and negative correlation was observed between thrips population and rainfall (r= -0.108) and evening RH (r= -0.090). Possitive and non significant correlation was observed between minimum temperatre (0.179), morning RH (0.023), evaporation (r= 0.377) and thrips population during 2016-17.

Whitefly (*Bemisia tabaci*)

The data on correlation and regression between co-efficient of weather parameters and whiteflies population presented in Table 4. Showed that the result of correlation between whitefly population and maximum temperature (r= 0.482*), evaporation (r= 0.481*) were positively significant. The non significant and negative correlation was observed between rainfall, morning relative humidity and evening relative humidity, minimum temperature.

Mites (*Polyphagotarsonemus latus*)

The data presented (Table 4) showed that the correlation between minimum temperature (r = -0.462*), morning RH (r = -0.517*), evening RH (r = -0.568**) and mite population was negative and significant whereas positively non significant correlation was observed between mite population on chilli and maximum temperature (r = 0.173) and evaporation (r = 0.296). Negatively non significant correlation was observed between rainfall (r = -0.308) and mite population.

Fruit borer (*Helicoverpa armigera*)

The data presented in Table 4 showed that rainfall (r = -0.499*), morning RH (r = -0.700**), evening RH (r = -0.787**) and minimum temperature (r = -0.730**) and fruit borer population was negative and significant whereas maximum temperature (r = 0.062) and evaporation (r = 0.267) was possitive and non significant during 2016-2017.

Simple regression studies

Thrips (*Scirtothrips dorsalis*)

The regression on chilli during 2016-2017 was Y= 5.060-0.043x, Y= 5.439-0.012x indicating that every one unit increase in rainfall and evening RH decreases thrips population by 0.043, 0.012. Y= -43.03+1.556x, Y= 3.324+0.093x, Y= 4.201+0.008, Y= -2.578+0.093 indicates that every unit increase in maximum temperature, minimum temperature, morning RH, evaporation increased thrips population by 1.556, 0.093, 0.008, 0.093.

The above findings are parallel with those of earlier research workers Pathipati *et al.* (2014) [15] reported thrips population had positive correlation with maximum temperature and negative correlation with minimum temperature, morning and evening relative humidity and rain fall in both the years. Singh *et al*. (2015) [17] studied the impact of Weather Parameters and Plant Spacing on Population Dynamics of Sucking Pests of Cotton in South Western Punjab and revealed that thrips population showed a positive correlation with the maximum temperature and morning relative humidity but a negative correlation with minimum temperature, evening relative humidity and rainfall. Misal *et al.* (*2016*) [11] conducted an experiment at Organic Farm, Agronomy Division, College of Agriculture, Pune and reported that thrips on organic green chilli were positively correlated with Tmax (0.782*), Tmin (0.453), BSS (0.494) and canopy temperature (oC) (0.921**) and negatively correlated with RH I (- 0.240), RH II (-0.741*).

Whitefly (*Bemisia tabaci*)

The regression on chilli during 2016-17 was Y=2.292-0.046x, Y=2.625-0.031x and -5.521-0.042, Y= 2.935- 0.018. This indicating that every unit of increase in rain fall, minimum temperature, morning RH and evening RH decreased whitefly population 0.046, 0.031, 0.042 and 0.018 respectively. While Y = -10.52+0.410x and Y=-1.137+0.696x indicated that every unit increase in maximum temperature and evaporation increased whitefly population by 0.410, 0.696 respectively.

The above findings are in confirmation with those of earlier research workers Shivanna *et al*. (2011) [16] studied population dynamics and the impact of abiotic factors on population dynamics of sucking insect pests of transgenic cotton *viz.* leafhopper (*Amrasca biguttula biguttula* Ishida), aphid (*Aphis gossypii* Glover), whitefly (*Bemisia tabaci* Gennadius) and revealed that revealed that maximum temperature showed significant positive effect on all the sucking pests. The minimum temperature showed negative and non significant effect on whitefly and thrips population. Misal *et al.* (*2016*) [11] conducted an experiment at Organic Farm, Agronomy Division, College of Agriculture, Pune and reported that whitefly pest on organic green chilli were positively correlated with Tmax (0.778), Tmin (0.952*) and canopy temperature (^oC) (0.965**) and negatively correlated with RH I (- 0.662), RH II (-0.281) and BSS (-0.408).

Mites (*Polyphagotarsonemus latus* Banks)

The regression on chilli during 2016-2017 was Y= -2.499+ 0.132x and Y= -0.225+0.175x indicated that every unit increase in maximum temperature and evaporation increased mites population by 0.132, and 0.175 respectively. Whereas, Y= 1.720-0.037x, Y= 2.801-0.073x, Y= 6.227-0.057x, Y= 2.641-0.023x indicated that every unit increase in rainfall, minimum temperature, morning RH and evening RH decreased mites population by 0.037, 0.073, 0.057, 0.023.

The above findings are in confirmation with the earlier research workers like, Monica *et al*. (2014) [12] revealed that relationship between the population of mites and the weather parameters showed significant positive correlation with maximum temperature and significant negative correlation with the relative humidity at 700 hrs, when the temperature increased the mite population also increased and with increasing relative humidity at 700 hrs, the mite population decreased. Bathari *et al.* (2016) [3] reported that correlation between *P. latus* and weather parameters revealed that population build up of *P. latus* found to be significant negative correlation with morning relative humidity (r= -0.787 and r= -721) and rainfall (r= -0.526) in both the years, respectively. Maximum temperature, minimum temperature and evening relative humidity showed a negative and non- significant correlation with mite population. Misal *et al.* (*2016*) [11] conducted an experiment at Organic Farm, Agronomy Division, College of Agriculture, Pune and reported that mites on organic green chilli were positively correlated with Tmax (0.898*), Tmin (0.276), BSS (0.539) and canopy temperature (oC) (0.266) and negatively correlated with RH I (- 0.863), RH II (-0.591).

Fruit borer (*Helicoverpa armigera*)

The regression equation on chilli during 2016-17 was Y = -0.442+0.048x, Y = -0.592+0.348x, this indicates that on every unit increase in maximum temperature and evaporation increases the *H. armigera* population by 0.048 and 0.348 respectively. Whereas, Y = 1.276- 0.061x, Y = 2.978 – 0.116x, Y = 7.350 – 0.077x and Y= 2.520 – 0.032x indicates that every unit increase in rainfall, minimum temperature, morning and evening RH decreases the *H. armigera* population by 0.181, 0.370, 0.212, 0.094 respectively.

The above finding is in consonance with those of earlier research workers like, Balasubramanian *et al*. (1981) studied the effect of different weather parameters on the incidence of *H. armigera* on cotton and chickpea in Tamilnadu and New Delhi, respectively. They found negative significant correlations between the incidence of the pest and morning relative humidity, evening relative humidity, intensity of rainfall and number of rainy days. Yadava and Lal, (1988) [26] found that larval population of the *H. armigera* was positively correlated with maximum and minimum temperatures and negatively correlated with relative humidity. Patel, (1991) [28] reported that maximum temperature has positive correlation with incidence of *H. armigera* in pigeonpea. The maximum pod damage of 13.03 per cent was recorded in 2nd week of December. Kanhere *et al.* (2013) [6] studied correlation between larval population of *H. armigera* on cowpea and weather parameters *viz*., the possitive correlation was found between the pest population and sunshine hours and temperature (maximum).

Table 2: Simple correlation and regression between weather parameters and insect pests of chilli

Sr. no.	Weather parameters	Intercept(a)	Slope(b)	R value
Thrips				
1	Rainfall	5.060	-0.043	-0.108
2	T max	-43.03	1.556	0.623**
3	T min	3.324	0.093	0.179
4	R.H (%) Am	4.201	0.008	0.023
5	R.H (%) Pm	5.439	-0.012	-0.090
6	Evp	-2.578	0.093	0.377
Whiteflies				
1	Rainfall	2.292	-0.046	-0.344
2	T max	-10.52	0.410	0.482*
3	T min	2.625	-0.031	-0.176
4	R.H (%) Am	5.521	-0.042	-0.341
5	R.H (%) Pm	2.935	-0.018	-0.396
6	Evp	-1.137	0.696	0.481*
Mites				
1	Rainfall	1.720	-0.037	-0.308
2	T max	-2.499	0.132	0.173
3	T min	2.801	-0.073	-0.462*
4	R.H (%) Am	6.227	-0.057	-0.517*
5	R.H (%) Pm	2.641	-0.023	-0.568**
6	Evp	-0.225	0.175	0.296
Fruit borer				
1	Rainfall	1.276	-0.061	-0.499*
2	T max	-0.442	0.048	0.062
3	T min	2.978	-0.116	-0.730**
4	R.H (%) Am	7.350	-0.077	-0.700**
5	R.H (%) Pm	2.520	-0.032	-0.787**
6	Evp	-0.592	0.348	0.267

** - Significant at 1%, r = Correlation coefficient, * - Significant at 5%, b = regression coefficient (slope), RH – Relative humidity, a = constan (intercept)

Table 3: Correlation coefficient of different pests of chilli with weather parameters during 2016-17

Weather parameters	Correlation coefficient ('r' value)			
	Pests in chilli			
	Thrips	Whiteflies	Mites	Fruit borer
Rainfall	-0.108	-0.344	-0.308	-0.499*
temp(max)	0.623**	0.482*	0.173	0.062
temp(min)	0.179	-0.176	-0.462*	-0.730**
RH(morning)	0.023	-0.341	-0.517*	-0.700**
RH(evening)	-0.090	-0.396	-0.568**	-0.787**
EVP	0.377	0.481*	0.296	0.267

* - Significant at 5%, r = Correlation coefficient, ** - Significant at 1%

Conclusions

The seasonal incidence of thrips, *Scirtothrips dorsalis* Hood on chilli revealed that population of thrips was initiated in the third week of August (33rd meteorological week) and remained continue up to fourth week of December (51st meteorological week) during 2016-17. The population increased gradually and touched its peak in third week of October (42nd meteorological week). The data on correlation between meteorological factors and thrips population revealed that the population exhibited a significant positive correlation with maximum temperature while the correlation was negatively non significant with evening relative RH and average rainfall. The whitefly, *Bemisia tabaci* Genn. appeared in the third week of August (33rd meteorological week) and continue up to fourth week of December (51st meteorological week). The population increased gradually and touched its peak in third week of october (42nd meteorological week). The population exhibited significant positive correlation with maximum temperature and evaporation whereas negative and non significant correlation with rainfall, morning and evening RH and minimum tempearature. The mite population persist throughout the crop season from fourth week of August (34th meteorological week) and was continue up to fourth week of December (51st meteorological week). The population increased gradually and touched its peak in the third week of October (42th meteorological week). The population exhibited significantly negative correlation with morning RH, evening RH and minimum temperature whereas maximum temperature and evaporation was positive and non significant. The fruit borer population touched its peak in the fourth week of November (47th meteorological week). The population exhibited significantly negative correlation with rainfall, morning RH, evening RH and minimum temperature whereas maximum temperature and evaporation was positive and non significant during 2016-2017.

References

1. Akram M, Hafeez F, Farooq M, Arshad M, Hussain M, Ahmed S, *et al*. A Case to Study Population Dynamics of *Bemisia tabaci* and *Thrips tabaci* on Bt and Non-Bt Cotton Genotypes. Pak. J. Agri. Sci., 2013; 50(4):617-623.
2. Arif MJ, Gogi MD, Mirza M, Zia K, Hafeez F. Impact of

Plant Spacing and Abiotic Factors on Population Dynamics of Sucking Pests of Cotton. Pakistan Journal Biological Science, 2006; 9(7):1364-1369.

3. Bathari M, Rahman S, Sharmah D. Incidence and Population Builds up of *P. latus* Infesting Capsicum chinense Jacq. in Relation to Weather Factors. International Journal of Plant Protection, 2016; 9(2):578-582.
4. Dajya DR, Monga D, Yagi MP, Meena DL. Population Dynamics of *Helicoverpa armigera* on Chickpea, Pigeonpea and Cotton in Correlation with Weather Parameters. Ann. Pl. Protec. Sci., 2010; 18(1):223-282.
5. Johari A. Population Dynamics and Thrips (Thysanoptera) Attack on Chili Plant (*Capsicum annuum L.*) in Jambi Province, Indonesia. IOSR Journal of Agriculture and Veterinary Science., 2016; 9(2):68-71.
6. Kanhere RD, Patel VN, Umbarkar PS, Kakde AM. Impact of Weather Parameters on Population of Pod Borer, *Helicoverpa armigera* (Hubner) Infesting Cowpea. Insect Environment., 2013; 19(2):96-97.
7. Khan MA, Khaliq A, Subhani MN, Saleem MW. Incidence and Development of *Thrips tabaci* and *Tetranychus urticae* on Field Grown Cotton. Int. J. Agri. Biol., 2008; 10(1):232–236.
8. Kumar D, Raghuraman M, Singh J. Population Dynamics of Spider Mite, *Tetranychus urticae* Koch on Okra in Relation to Abiotic Factors of Varanasi Region. Journal of Agrometeorology., 2015; 17(1):102-106.
9. Kumawat RL, Pareek BL, Meena BL. Seasonal Incidence of Jassid and Whitefly on Okra and their Correlation with Abiotic factors. Annals. Biol., 2000; 16(20):167-169.
10. Meena RS, Ameta OP, Meena B. Population Dynamics of Sucking Pests and Their Correlation with Weather Parameters in Chilli, *Capsicum annuum* L. Crop. The Bioscan., 2013; 8(1):177-180.
11. Misal SS, Shaikh AA, Kharbade SB. Correlations Between Weather Parameters and Pests in Organic Green Chilli (*Capsicum annum* L.). Advances in Life Science, 2016; 5(1):164-166.
12. Monica VL, Kumar A, Chand H, Paswan S, Sanjeev K. Population Dynamics Of *Tetranychus urticae* Koch on Brinjal Crop Under North Bihar Conditions. Pest Management in Horticultural Ecosystems., 2014; 20(1):47-49.
13. Naik V, Chinna Babu P, Arjuna Rao PV, Krishnayya and Srinivasa Rao V. Seasonal Incidence and Management of *Leucinodes orbonalis* Guence on Brinjal. Ann. Pl. Protec. Sci., 2008; 16(2):329-332.
14. Patel BH, Koshiya DJ, Korat DM. Population Dynamics of Chilli Thrips, *Scirtothrips dorsalis* Hood in Relation to Weather Parameters of Karnataka. Journal of Agriculture Science., 2008; 5(1):140-141.
15. Pathipati VL, Vijayalakshmi T, Naidu LN. Seasonal Incidence of Major Insect Pests of Chilli in Relation to Weather Parameters in Andhra Pradesh. Pest Management in Horticultural Ecosystems., 2014; 20(1):36-40.
16. Shivanna BK, Gangadhara Naik B, Basavaraja MK, Nagaraja R, Kalleswara Swamy CM, Karegowda C. Impact of Abiotic Factors on Population Dynamics of Sucking Pests in Transgenic Cotton Ecosystem. I.J.S.N., 2011; 2(1):72-74.
17. Singh H, Kaur P, Mukherje J. Impact of Weather Parameters and Plant Spacing on Population Dynamics of Sucking Pests of Cotton in South Western Punjab. Journal of Agricultural Physics., 2015; 15(2):167-174.
18. Virani VR. Population Dynamics, Varietal Screening and Chemical Control of Insect Pests of Blackgram, *Vigna mungo* (L.) Hepper. Ph. D. (Agri.) Thesis submitted to Gujarat Agricultural University, Sardar Krushinagar, 2000, p78.
19. Reddy D, Puttaswamy NR. Pests Infesting Chilli (*Capsicum annuum* L.) in the Nursery. Mysore J. Agric Sci, 1984; 18(3):122-127.
20. Geetha R, Selvarani K. A Study of Chilli Production and Export from India. IJARIIE-ISSN(O)., 2017; 3(2):2395-4396.
21. Orobiyi A, Dansi A, Assogba P, Loko LY, Dansi M, Vodouhè R. Chilli (*Capsicum annuum* L.) in Southern Benin: Production Constraints, Varietal Diversity, Preference Criteria and Participatory Evaluation. International Research Journal of Agricultural Science and Soil Science, 2013; 3(1):107-20.
22. Varadhrajan S, Veeravel R. Population Dynamics of Chilli Thrips, *Scirtothrips dorsalis* (Hood) in Annamalainagar. Indian Journal Ecology, 1995; 22(1):27-30.
23. Bhede BV, Suryawanshi DS, More DG. Population Dynamics and Bioefficacy of Newer Insecticides against Chilli Thrips, *Scirtothrips dorsalis* (Hood*).* Indian Journal of Entomology, 2008; 70(3):223-226.
24. Sanap MM, Nawale RN, Ajri DS. Seasonal Incidence of Chilli Thrips and Mites. Journal of Maharashtra Agriculture Universities, 1985; 10(3):345-346.
25. Lingeri MS, Awaknavar JS, Lingappa S, Kulkarni KA. Seasonal Incidence of Chilli Mites (*P.latus)* and Thrips (*S. dorsalis).* Karnataka J. Agric. Sci, 1998; 11(2):380-385.
26. Yadava CP, Lal SS. Relationship between Certain Abiotic and Biotic Factors and the Occurrence of Gram Pod Borer, *Heliothis armigera* (Hbn.) on Chickpea. Entomon, 1988; 13(3-4):269-273.
27. Nadaf AM, Kulkarni KA. Seasonal Incidence of Fruit Borers, *Helicoverpa armigera* (Hubner) and *Spodoptera litura* (Fabricius) on Chilli in Dharwad, Karnataka. Journal of Agriculture Science, 2006; 19(3):549-552.
28. Patel BH, Koshiya DJ, Korat DM. Population Dynamics of Chilli Thrips, *Scirtothrips dorsalis* Hood in Relation to Weather Parameters of Karnataka. Journal of Agriculture Science, 1991; 5(1):140-141.