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Satish Tirkey
Department of Entomology, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, Uttar Pradesh, India

Vikram Tigga
Department of Entomology, SHUATS Allahabad, Uttar Pradesh, India

Ashwani Kumar
Associate Professor, Department of Entomology, SHUATS Allahabad, Uttar Pradesh, India

Corresponding Author
Satish Tirkey
Department of Entomology, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, Uttar Pradesh, India

Population dynamics of chilli thrips and their natural enemies in relation to weather parameter on chilli

Satish Tirkey, Vikram Tigga and Ashwani Kumar

Abstract
Observation for incidence of thrips and natural enemies of the thysanopteran pest were recorded in each meteorological week until harvesting of crop. Thrips population was analyzed Initial incidence of the chilli thrips was noticed on the 37th standard week (September third week) with an average population of 0.32 insect / plant. The chilli thrips, *Scirtothrips dorsalis* population increased and gradually reached the peak level of 6.75 insect / plant at 45th standard week (November second week). At that time, average maximum temperature was 37.77 ºC and minimum temperature was 21.42 ^{0}C, average morning relative humidity was 86.28% and evening 45.42%. There after declined trend was observed due to fall of maximum and minimum temperatures as optimum weather condition are decreasing. The natural enemies observed were two species of Coccinellid beetle and Spider. Similarly, incidence of the most commonly found natural enemies consisting of coccinellid beetle was recorded low as 0.92/plant 38th standard week (September fourth week) to maximum of 5.87/plant 44th standard week during (first week of November). When the average temperature, relative humidity and weekly total rainfall were average maximum temperature was 36.34 ºC and minimum temperature was 26.71 ^{0}C, average morning relative humidity was 85.14% and evening relative humidity 48.14% and weekly total rainfall 0.0 mm respectively. After which the pest population gradually decreased. Populations of spider were found to be low as 0.42/plant 39th standard week (September five week) to maximum during 46th standard week (November second week) 3.74/plant. When the average temperature, relative humidity and weekly total rainfall were average maximum temperature was 38.71 ºC and minimum temperature was 25.74 ^{0}C, average morning relative humidity was 83.85% and evening relative humidity 50.28% and weekly total rainfall 0.0 mm respectively. Population fluctuation of thrips and spider was found positively correlated with temperature and negatively correlated with total rainfall. Other abiotic factors (relative humidity, rainfall) were found non-significant with the incidence of thrips and spider population.

Keywords: Chilli, correlation, natural enemy, population dynamics, thrips

Introduction
Chilli *Capsicum annuum* L. (2n=24) is one of the important cash crops grown in almost all parts of the country. Chilli is considered as one of the most commercial spice crops and is widely used universal spice, named as wonder spice. Chilli is an indispensable condiment in every household in India which is rich in Vitamin A and C. It is widely used as vegetable, sauce, pickles and curries. Chilli is an important vegetable and condiment crop in India. India is the largest consumer and exporter of chilli in the world. In India, Chilli is grown in an area of 7.67 L ha with a production of 12.34 L tones. Uttar Pradesh occupy about 1.8 thousand ha area with 1.7 thousand tones production. The area occupied in Allahabad region is 2455 ha and the production is 2993 tones (Rai and Pandey 2007).
Chilli thrips, *Scirtothrips dorsalis* (Hood) (Thysanoptera: Thripidae) is a serious pest of chilli (*Capsicum annuum* L.) in India, responsible for leaf curling (Ananthakrishnan, 1971) [2]**.** The major insects that attacked chilli are mites *Polyphagotarsonemus latus* (Banks), thrips *Scirtothrips dorsalis* (Hood), aphids (*Myzus persicae* (Sulzer) and *Aphis gossypii* (Glover) and Fruit borer *Helicoverpa armigera* etc. Among the above insects, due to chilli thrips and mites only the estimated loss tuned up to 50 per cent (Ahmed *et al.*, 1987 and Ananthakrishnan, 1990). Knowing the peak period of pest population could help in taking pest management tactics more effectively with less incorporation of highly toxic chemical insecticides substance in the field. Due to variation in the agro-climatic conditions of different regions, insects show varying trends in their incidence on crop.

The present investigation was aimed to study on the seasonal incidence of thrips and their natural enemies in relation to various weather parameters like rainfall, temperature, relative humidity, sunshine and wind velocity etc.

Materials and Methods

Site of Field experiment

The present investigation was conducted at the Agricultural Research Farm of "Sam Higginbottom University of Agriculture, Technology and Sciences" Allahabad, Uttar Pradesh during *Kharif* season, 2016. The research farm is situated on the right side of Allahabad Rewa road at 20 degree and 150 North, 600 East longitude cities and is about 129.2 cm above sea level. The site selected will uniform, cultivable with typical sandy loam soil having good drainage.

Experimental Layout

In the experiment, the variety under supervision 'Suryamukhi' was grown for this study. Seedlings of Chilli variety-Suryamukhi. Seed rate 1-1.5kg/ha. The seedlings of the 35 days were transplanted. Row to row and plant to plant spacing will 45 X 30 cm. will be maintaine between bedlings. The experiment was laid out in a randomized block design with seven treatments (including control) and three replications. Population dynamics of *S. dorsalis* and their natural enemies were studied in chilli agro-ecosystem.

Observations recorded

Observations on both pest and natural enemies population were started one week after transplanting of the crop and continued at an 7 days interval, from the occurrence or initiation of the pest infestation and was continued up to harvest. The crop was raised / grown as per the recommended package of practices except the plant protection measures. Observations were recorded at three plots from each plot eight plants were selected and tagged further; detailed observations were made at weekly intervals on the incidence of thrips. The population of thrips, were recorded from three leaves one each from the upper, middle and lower position on eight selected plants. The population was recorded under stereo binocular microscope on 2 × 2cm leaf bit area. The incidence and population dynamics of chilli thrips was recorded from the eight randomly selected and tagged plants by correlating with weather parameter. Weather data was recorded simultaneously from the Department of Agriculture Metrology, SHUATS, Allahabad. Among weather parameters, relative humidity, maximum temperature, minimum temperature, sunshine hour and rainfall were considered for correlating with the occurrence and population dynamics of chilli thrips (Roopa and Kumar 2014) [19]. Population of natural enemies coccinellid beetle and spider was recorded from five plants selected randomly and expressed the natural enemies population as number per plant. The data thus obtained were converted into the average number of thrips, coccinellid beetle and spider per plant and represented in Table 1. To determine the effect of various weather parameters on the fluctuation of *S. dorsalis* infesting chilli, weather data were collected from meteorology laboratory on the farm and the relationship between the insect population and weather parameter was worked out.

Population of natural enemies namely-

Statistical Analysis

The role of abiotic factors on population fluctuation of the chilli thrips and naturally occurring predators and correlation between them was analyzed by calculating respective r (correlation coefficient) with the help of SPSS (Statistical Package for Social Sciences).

Results and Discussion

Population dynamics of chilli thrips (*S. dorsalis*)

Data presented in the incidence of chilli thrips, *Scirtothrips dorsalis* population with weather parameters given in Table 1.The occurrence of chilli thrips, *Scirtothrips dorsalis* 2016 *rainy* season pest population of chilli thrips was of regular occurrence and caused considerable damage to the crop. Chilli thrips *Scirtothrips dorsalis* were initiated in peak level of 0.32 insect /3 leaves third week of September (37th Standard week) and continue up to third week of December (50th Standard week) in peak level of 2.64 insect /3 leaves. Chilli thrips population increased and gradually reached peak level of 6.75 insect /3 leaves second week of November (45th Standard week).The observations were almost similar to Patel (1998) [17] who reported that the population of chilli thrips remains low during July-August due to rains and showed a peak in September- October. Similar findings were also made by Krantz *et al.*, (1978) [11] who reported that, the number of thrips on chilli crop increased rapidly during dry weather and decrease rapidly after rain. Thereafter, declined trend was observed due to fall of maximum and minimum temperatures as optimum weather condition are decreasing. The probable reason for such finding may be that the occurrence of chilli thrips, *Scirtothrips dorsalis* might be due to congenial weather factor like temperature, wind velocity, humidity, and sunshine hours prevailed during the investigation. It was observed that the maximum temperature favored the multiplication of chilli thrips, *Scirtothrips dorsalis* whereas, decline of maximum and minimum temperature lead to decline of the chilli thrips, *dorsalis* population

Table 1: Incidence of thrips and natural enemies (coccinellid and spider) on chilli during *kharif* season 2016

Standard Weeks	Thrips (No./leaf)	Coccinellid (No./Plant)	Spider (No./Plant)	Temperature ^{0}C		R. H (%)		Rain fall (mm)	Wind Velocity (k/hr)	Sunshine (hr/days)
				Max.	Min.	Max.	Min.			
33th	0	0	0	37.4	27.8	72.85	36	1	3.02	7.42
34th	0	0	0	35.92	28.65	84.42	54.42	14.45	1.23	4.05
35th	0	0	0	33.5	27.27	83.85	63.85	5.37	1.67	5
36th	0	0	0	35.31	27.65	82.28	57.71	8.17	1.57	5.1
37th	0.32	0	0	33.45	26.82	90.57	62.71	13.8	2.58	1.5
38th	0.62	0.92	0	34.05	28.14	87	59.14	3.51	2.8	3.62
39th	1.24	1.47	0.42	37.22	28.4	82.71	51.42	0.77	3.45	6.91
40th	1.66	1.89	0.87	37.08	29.8	81.28	50.42	0.01	2.12	8.8
41th	2.58	2.93	1.94	36.42	26.51	87.28	54.71	1.98	2.56	6.37
42th	3.65	3.82	1.42	36.25	25.97	86.42	49.28	2.15	1.49	6.31

43th	4.72	4.96	2.25	34.88	26.68	87.42	48.57	1.77	0.19	6.7
44th	5.73	5.87	2.25	36.34	26.71	85.14	48.14	0	1.76	6.87
45th	6.75	5.63	3.36	37.77	21.42	86.28	45.42	0	1.09	7.34
46th	6.53	4.82	3.74	38.71	25.74	83.85	50.28	0	1.03	7.65
47th	5.97	4.35	2.72	32.70	21.12	87	62.28	15.8	1.83	6.17
48th	5.42	3.93	2.36	33.00	20.14	87.14	54.28	0	0.63	8.45
49th	4.86	3.27	1.69	33.80	20.31	85.71	50.57	0	0.58	8.25
50th	2.64	2.51	1.18	33.08	19.11	86.57	46.14	0	0.83	8.15

Table 2: Coefficient between thrips population and weather parameter in *kharif* season 2016

S. No.	Weather parameter	r- value	t- value	F-test
1	Temperature Max. (^{0}C)	0.070	0.279	S
2	Temperature Min. (^{0}C)	-0.626	-3.209	S
3	Humidity morning%	0.347	1.482	NS
4	Humidity Evening%	-0.227	-0.930	NS
5	Rainfall (mm)	-0.332	-1.406	NS
6	Wind velocity	-0.563	-2.727	S
7	Sunshine (hr/day)	0.542	2.581	S

The data presented in Table 2 on pest population of chilli thrips *S. dorsalis* was commenced from 37th standard week (September third week) with an average 0.32 insect /3 leaves. The chilli thrips, *S. dorsalis* population increased and gradually reached peak level of 6.75 insect / 3 leaves at 45th standard week (November second week). The correlation studies revealed that only sunshine (r = 0.542) showed significant positively correlation with minimum temperature (r = -0.626), maximum temperature (r = 0.070) morning relative humidity (r = 0.347) and evening relative humidity (r = 0.227), rainfall (r = 0.332) with per cent incidence of chilli thrips (*Scirtothrips dorsalis*) at 1 and 5 per cent level of significance. At the time, average maximum temperature was 37.77 ^{0}C and minimum temperature was 21.42 ^{0}C, average morning relative humidity was 86.28% and evening relative humidity 45.42%, average wind velocity was 1.09 km/hour and average sun shine hour was 7.34 hours. The population did not show any significant correlation with maximum-minimum temperature, morning -evening relative humidity. Similar observations were also reported by other workers (Lingeri *et al.*, 1998 and Panickar and Patel, 2001) [15]. The present finding get supported with the observation of Bhede *et al.*, (2008) [5] who reported correlation of minimum temperature, morning and evening relative humidity with thrips population was negative and non significant, on the other hand highest incidence of thrips in the 40th meteorological week and the population was positively correlated with bright sunshine. Zainab *et al.*, (2016) [20]. found that population of thrips showed significant positive correlation with maximum temperature and negative correlated with rainfall, relative humidity, which corroborates the present study. Patel *et al.*, (2009) [16]. reported that thrips incidence showed a significant positive correlation with bright sunshine hours and maximum temperature, but exhibited a significant negative correlation with rainfall and evening relative humidity and vapour pressure.

Population dynamics of natural enemies of chilli thrips

Coccinellid beetle

The data presented in Table 1 on pest population of natural enemies of thrips first recorded on 0.92/ plant 38th standard week of (September fourth week) when temperature ranged between maximum temperature 34.05 ^{0}C to minimum temperature 26.14 ^{0}C and relative humidity ranged between morning time 87% to evening time 59.14%, rainfall 3.51mm, wind velocity 2.8 km/hours with an average sunshine 3.62 hours/days. Population build-up of natural enemies coccinellid beetle gradually increased and reached peak level 5.87 /plant at 44th standard week (November first week) when temperature ranged between maximum temperature 36.34 ^{0}C to minimum temperature 26.71 ^{0}C and relative humidity ranged between morning time 85.14% to evening time 48.14%, rainfall 0.0 mm, wind velocity 1.76 km/hours with an average sunshine 6.87 hours/days. After which population gradually decreased and remained at low level 2.51/plant at the end of experiment during the 50th standard week (December third week). Similar observations were also recorded by Chintkuntlawar *et al.*, (2015) [7]. who observed coccinellid beetle population at reproductive stage of the crop and remained active till the end of experiment.

Spider

Observation taken as spider /plant revealed that infestation was started 0.42/plant from 39th standard week (September five week) with the peak population reaching 3.74/plant in 46th standard week (November third week) when the average maximum temperature 38.71 ^{0}C to minimum temperature 25.74 ^{0}C and relative humidity ranged between morning time 83.85% to evening time 50.28%, rainfall 0.0 mm, wind velocity 1.03 km/hours with an average sunshine 7.65 hours/days.

Role of weather parameter on the population fluctuation of chilli thrips and their natural enemies

Correlation studies (Table 2 and 3) between thrips population and their natural enemies coccinellid beetle, spider population and weather parameters were carried out. Result revealed that the weather parameters played important role on population build-up thrips on which all the weather parameters exerted positive impact except maximum temperature (r= 0.070) and minimum temperature (r= -0.626) which had negative role on population build up. However, minimum relative humidity had significant correlation (r= -0.626). Similar results have been reported by Gopal *et al.*, (2018) [8]. significant negative correlation with rainfall, maximum relative humidity and positive correlation with sunshine. Chakraborty (2011) [6]. recorded significant negative correlation of thrips population with maximum temperature and positive significant correlation with minimum relative humidity. Minimum relative humidity established a significant negatively linear relationship with thrips population in the plant samples. The study showed both relative humidity and rainfall were

negatively correlated with thrips population increase. Heavy rain has been reported wash thrips off plants down to the soil surface, causing sharp declines in their population density (Harris *et al.*, 1936, North and Shelton, 1986) [14].

Table 3: Coefficient between natural enemies population and weather parameter in *kharif* season 2016

S. No.	Weather parameter	r- value	t- value	F-test
1	Temperature Max. (^{0}C)	0.082	0.291	S
2	Temperature Min. (^{0}C)	-0.629	-3.212	S
3	Humidity morning%	0.371	1.506	NS
4	Humidity Evening%	-0.126	-0.829	NS
5	Rainfall (mm)	-0.447	-0.521	NS
6	Wind velocity	-0.346	-1.420	S
7	Sunshine (hr/day)	0.438	2.477	NS

Coccinellid beetle is an important biological agent of chilli pest assisting to reduce the damage of insect infestation appeared in the year 2016. The observation was taken as coccinellid beetle per plant and found that coccinellid was its peak during 44th standard week (November first week) 5.87 per plant when temperature ranged between maximum temperature 36.34 ^{0}C to minimum temperature 26.71 ^{0}C and relative humidity ranged between morning time 85.14% to evening time 48.14%, rainfall 0.0 mm, wind velocity 1.76 km/hours with an average sunshine 6.87 hours/days. A significant positive correlation found between coccinellid population and maximum temperature and significant negative correlation of coccinellid population with weekly total rainfall was reported. Similar finding were recorded by Batt *et al.*, (2018) observed non-significant correlation between natural enemies population (both Coccinellid and spider) with majority of weather parameter except sunshine and relative humidity. On the other hand in case of spiders the mean temperature and total rainfall showed significant and positive correlation (r= 0.082) and significant but negative correlation (r= -0.447) the other factors like relative humidity, sunshine and wind velocity has got no influence on the population of spiders. Similar result have been observed by Meena and Kanwat (2010) and Asma and Hanumantharaya (2015) [3].

Conclusion

From the critical analysis of the present finding it can be concluded that chilli thrips population increase with maximum temperature and decrease with decline in maximum and minimum temperature. Incidence of thrips could help in suitable pest control by identifying thrips taking appropriate measures for their control. Biological control measure should be taken with the help natural enemies for management of thrips without polluting the soil and environment by minimizing the frequent application of toxic pesticides to save the environment from being polluted.

References

1. Ahmed K, Mehmood MG, Murthy NSR. Losses due to various pests in pepper. Capsicum Newsletter. 1987; 6:83-84.
2. Ananthakrishnan TN. Thrips (Thysanoptera) in agriculture, horticulture, forestry Diagnosis, bionomics and control. Journal of Scientific and Industrial Research. 1971; 30:113-146.
3. Asma A, Hanumantharaya L. Population dynamics of major insect and mite pests of chilli. Journal of Experimental Zoology. 2015; 18 (1):173-176.
4. Bhatt CV, Vos JGM, Frinking HD. Pest and disease of hot pepper (*Capsicum spp*) in tropical low land of java. Indonesia. Journal of Plant Protection Tropical. 2018; 11:53-71.
5. Bhede BV, Suryawanshi DS, More DG. Population dynamics and bioefficacy of newer insecticide against chilli thrips, *Scirtothrips dorsalis* (Hood). Indian Journal of Entomology. 2008; 70 (3):223-226.
6. Chakraborty S. Sustainable management of apical leaf curling in chilli. Journal of Applied Zoological Researches. 2011; 15(1): 34-36.
7. Chintkuntlawar PS, Pawar UA, Saxena AK. Insect pest complex of chilli, *Capsicum annuum* L. and their natural enemies in Jabalpur. International Journal of Plant Protection. 2015; 8 (2):270-278.
8. Gopal GV, Lakshmi KV, Babu BS, Verma PK. Seasonal incidence of chilli thrips, *Scirtothrips dorsalis* hood in relation to weather parameters. Journal of Entomology and Zoology Studies. 2018; 6 (2):466-471.
9. Harris HM, Drake CJ, Tate HD. Observation on the onion thrips Iowa College. J Sci. 1936; 10:155-172.
10. Kandasamy C, Mohansundaram MP. Evaluation of insecticides for the control of thrips *Scirtothrips dorsalis* (Hood) in chillies (*Capsicum annuum* L.). Madras Agriculture Journal. 1990; 77: 169-172.
11. Krantz GV. A manual of Acarology (2nd Ed.) Origon State University, Corvallis, 1978, 509.
12. Lingeri MS, Awakanavar JS, Lingappa S, Kullarni KA. Seasonal occurrence of chilli mites (*Polyphagotarsonemus latus* Banks) and thrips (*S. dorsalis* Hood). Karnataka Journal of Agricultural Sciences. 1998; 11(2):380-385.
13. Meena NK, Kanwat PM. Studies on seasonal incidence and relative safety of pesticides against Coccinellids in okra ecosystem. Journal of Biological Control. 2010; 24(2):116-122.
14. North RC, Shelton AM. Ecology of thysanoptera within cabbage fields. Environmental Entomology. 1986; 15:520-526.
15. Panickar BK, Patel JR. Population dynamics of different species of thrips on chilli, cotton and pigeon pea. Indian Journal of Entomology. 2001; 63 (2):170-175.
16. Patel BH, Koshiya DJ, Korat DM, Vaishnav PR. Evaluation of some insecticides against chilli thrips *Scirtothrips dorsalis* (Hood). Karnataka Journal Agriculture Science. 2009; 22 (2):327-330.
17. Patel VN, Gupta HCL. Estimation of losses and management of thrips infesting chillies. In National Seminar on Entomology in 21st century. Biodiversity, Sustainability, Environmental Safety and Human Health Held at Udaipur, 1998, 98-99.
18. Rai MAK. Towards a rainbow revolution. The Hindu Survey of Indian Agriculture, 2007, 112-119.

19. Roopa M, Kumar ACT. Seasonal incidence of pest of capsicum Bangalore condition of Karnataka, India. Global Institute for Research and Education. 2014; 3(3):203-207.
20. Zainab K, Singh RN. Study of population dynamics and impact of abiotic factors on thrips, *Scirtothrips dorsalis* of chilli, *Capsicum annuum* and comparative bio-efficacy of few novel pesticides against it. International Journal of Agriculture, Environment and Biotechnology. 2016; 9(3):451-456.