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Seasonal incidence of mites and thrips in chilli

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Abstract
Chilli (*Capsicum annuum* L.) is native to Mexican region which is an unavoidable part of Indian culinary world as well as it's known for its medicinal uses, and India is chief grower and exporter of chilli in world. The present investigation was conducted at vegetable research farm, Institute of agricultural sciences, Banaras Hindu University, Varanasi to study "Infestation of Aphids and Thrips chilli (*Capsicum annuum L.*) with through seasonal incidence ". Mite infestation started from first week of December and the peak was observed during the last week of December, mites showed a negative but significant correlation with maximum and minimum temperature and there was a positive non-significant correlation between mite population and relative humidity (morning and evening) and wind, there was negative non-significant correlation between rainfall and the population of mite. Thrips infestation was observed from 46th SMW and the peak reached during the 48th SWM, thrips showed positive significant correlation along with morning relative humidity and positive but non-significant relation with evening relative humidity, there was a negative but significant correlation between thrips and sunshine hours and evaporation, there was a negative non-significant correlation between thrips with rainfall and maximum temperature.

Keywords: Chilli, mite, thrips, seasonal incidence

Introduction
Seasonal incidence of *P. latus* throughout the cropping season during 2004-05 around Dharwad, the peaks in population was observed during 17th standard week and 20th standard week during summer, 42nd standard week during *Kharif*, in *Rabi* it was observed during 2nd week of November, there was a positive significance change in the natural enemies as well. The correlation studies indicate that, predators (0.663) established highly significant positive correlation with *P. latus*. Significant negative correlation with morning and evening relative humidity. Rainfall (-0.405) was highly detrimental and showed highly significant negative correlation with mite population [1]. Seasonal incidence of *P. latus* on potato crop, field observations on potato mite in transitional southern zone of Karnataka during 2004-06 revealed that mite population exceeded economic injury level from 2nd week of July to 1st week of August. This is the critical period to protect cultivated potato from mite infestation [2].
Experiment on brinjal mite *Tetranychus neocaledonicus*, the vegetable mite feeds on the under surface of leaves of plant has the extra ordinary ability to cover the plant with the web and cause serious injuries. Fortnightly population count of *Tetranychus neocaledonicus* showed positive correlation with maximum temperature (r = +0.161), negative correlation with minimum temperature (r = -0.247), significant negative correlation was found with morning Relative humidity (r=-.581) and evening Relative humidity (r = -0.717). Mite population was significantly negatively correlated with rainfall (r= -0.576) [3].
Study done during kharif 2014 that seasonal incidence of sucking pest of chilli like thrips, whitefly and jassid, the population of these pest were shown in peak time during 2nd week and 3rd week of September, for whitefly jassid and thrips respectively and these are correlated along with the weather parameters at 5% significance whereas thrips showed negative correlation with mean temperature and rainfall and positively correlated with the mean RH, whereas jassid shown the positive correlation with mean temperature, and negative in case of RH and rain fall, and the all three weather parameters were positively correlated to that of whitefly. These studies help in designing the management strategies for crops which will help in avoiding unnecessary losses [4].
Maximum mean mite population/leaf (7.25) was recorded on 02/05/2013 and the minimum population (3.54 mites/leaf) was registered on 17/04/2013. Highest mean thrips inhabitants (6.15/leaf) was recorded during 11/04/13 and 02/05/13 whereas the minimum population of

thrips (1.85/leaf) was recorded on 17/04/13. It was also noticed that there was a positive correlation between the thrips and mite population to that of mean temperature and negative correlation with the rainfall, where as other abiotic factors were found to be non-significant [5].

Materials and methods

Experiment site

The trial was conducted on the field, at the vegetable research farm, institute of agricultural sciences, Banaras Hindu University, Varanasi during 2018-19 which is located beside the central office of BHU at south-eastern end of the area.

Soil and its preparation

Chilli can be grown in all type of soil, but the sandy - loam, clay loam and loam soils are best suited for it, the soil must be well drained, sandy loamy soils rich in organic matter with pH range 6-7 and well aerated. The field was prepared thoroughly with the addition of FYM @ 150-200 quintals, spread and mixed well in the soil 15-20 days before sowing and ridges and furrows were formed at a spacing of 56 cm. Applied 20 kg of FYM. Irrigated the furrows and transplanted 40-45 days old seedlings, with the ball of earth on the ridges.

Transplanting

Seeds of chilli (*Capsicum annum* L.) verity Kashi Anmol were raised in the nursery of the vegetable research farm, BHU, Varanasi with proper care and procedure. Forty two day old seedling were transplanted in well prepared main field on 17th October 2018 with a plant spacing of 56X56 cm. before transplanting the seedling were root dipped in the Bavistin (Carbendazim) 0.1% solution to prevent the initial fungal damage to the seedling. Transplanting requires fine tilth and transplanting was done in evening. After transplanting, irrigation was undertaken immediately for better establishment of plants.

Fertilizer Application

The plot was treated with the well rotten Farm Yard Manure at the rate of (40 tonnes/ha) during the field preparation after deep ploughing of the soil. Chilli has a long growing season therefore fertile soil with humus is most desirable for growing chilli. The fertilizer Urea, Single Super Phosphate (SSP) and Muriate of Potash (MOP) were applied to provide a recommended dose of 60 kg N, 75 Kg P_2O_5 and 60 Kg K_2O/ha respectively. The total amount of the nitrogenous fertilizer applied in three split doses. One-third amount of the urea, total amount of SSP and total amount of MOP were applied in all the plots as basal application at the time of transplantation. The remaining dose of nitrogen was applied in two splits in form of foliar application, one after first intercultural operation and second at 60 days after transplanting.

Irrigation

Irrigation depends upon soil type and season; frequent irrigation was given to the field. First irrigation was given immediately after transplanting and later at an interval of 10 days. Chilli plants cannot withstand stagnation and excess moisture, hence light irrigation and proper drainage is recommended. Water stress usually restricts fruit set and fruit development, hence optimum moisture level was maintained at the time of flowering, fruit set and fruit development.

Inter-cultural operation

Many plants were dead or wilted so gap filling was done to maintain the plant population. Two to three hand weeding at 20 and 40 days after transplanting was done. The most abundant weed species occurred in the field during the experiment were *Cyperus rotundus*, *cynodon dactylon*, and *Chenopodium album*. Hoeing was done twice on 20 and 45 days after transplanting. The earthing-up operation was made to cover the crop root carefully and weeding was done whenever necessary during the crop season.

Results and discussion

The abundance study on mite and thrips was taken at vegetable research farm, Institute of Agricultural Science, BHU, Varanasi the mite infestation were started from first week of December and the peak was observed during last week of December, mite showed a negative but significant correlation with maximum and minimum temperature and there was positive non-significant correlation between mite population and relative humidity (morning and evening) and wind there was negative non-significant correlation between rainfall and the population of mite [2-5].

Thrips infestations were observed from 46th SMW and the peak was reached during the 48th SWM, thrips showed positive significant correlation along with morning relative humidity positive but non-significant relation with evening relative humidity, there was a negative but significant correlation between thrips and sunshine hours and evaporation, there was a negative non-significant correlation between thrips with rainfall and maximum temperature [6-10].

Table 1: Seasonal incidence of major sucking pests of chilli during Rabi 2018-19

Standard week	Year	month	Date	Rainfall mm	Temperature ^{0}C		R.H. %		Wind	Sunshine hours	Evaporation mm	Mite	Thrips
					MAX	MIN	Morn.	Even	Speed km/hr				
46	2018	Nov	12 to18	0	29	11.7	89	45	0.9	7.6	1.8	0	1.46
47	2018	Nov	19 to 25	0	27.9	10.1	88	44	0.6	7.2	2	0	3.98
48	2018	Nov/Dec	26 to 2	0	26.4	10.1	93	48	1.1	4.3	1.5	0	4.63
49	2018	Dec	3 to 9	0	20.3	16.3	94	78	1	0.2	0.8	0.76	3.87
50	2018	Dec	10 to 16	0	20.2	10	94	73	0.8	1.2	0.7	1.34	3.08
51	2018	Dec	17 to 23	0	23.3	9.8	89	50	2.4	3.2	1.8	3.79	3.89
52	2019	Dec	24 to 30	0	20.5	10.9	94	69	1.4	0.2	0.9	5.23	3.25
1	2019	Dec/Jan	31 to 6	4.8	22.7	6.1	92	46	1.9	6.5	1.6	2.23	1.8
2	2019	Jan	7 to 13	0	21.5	6.8	90	50	2.4	6.7	1.4	3.67	1.71
3	2019	Jan	14 to 20	0	22.1	4.7	90	45	1.2	8.5	1.7	4.32	0.5
4	2019	Jan	21 to 27	13	19.8	10.5	85	69	3.1	4.1	4.2	0.798	0.12
5	2019	Jan/Feb	28 to 3	0	21.7	6.3	91	57	2.3	7.1	2.2	1.23	0

Table 2: Correlation co-efficient values of major sucking pest of chilli during Rabi 2018-19

	Rainfall mm	Temperature ^{0}C		R.H. %		Wind Speed km/hr	Sunshine hours	Evaporation mm
		MAX	MIN	Morn.	Even			
Mite	-0.074^{NS}	-0.608**	-0.538*	0.259^{NS}	0.178^{NS}	0.311^{NS}	-0.277^{NS}	-0.350^{NS}
Thrips	-0.274^{NS}	-0.255^{NS}	0.027^{NS}	0.502*	0.286^{NS}	-0.254^{NS}	-0.626**	-0.601*

NS: Non-significant,
* Significant at 5% level
** Significant at 1% level

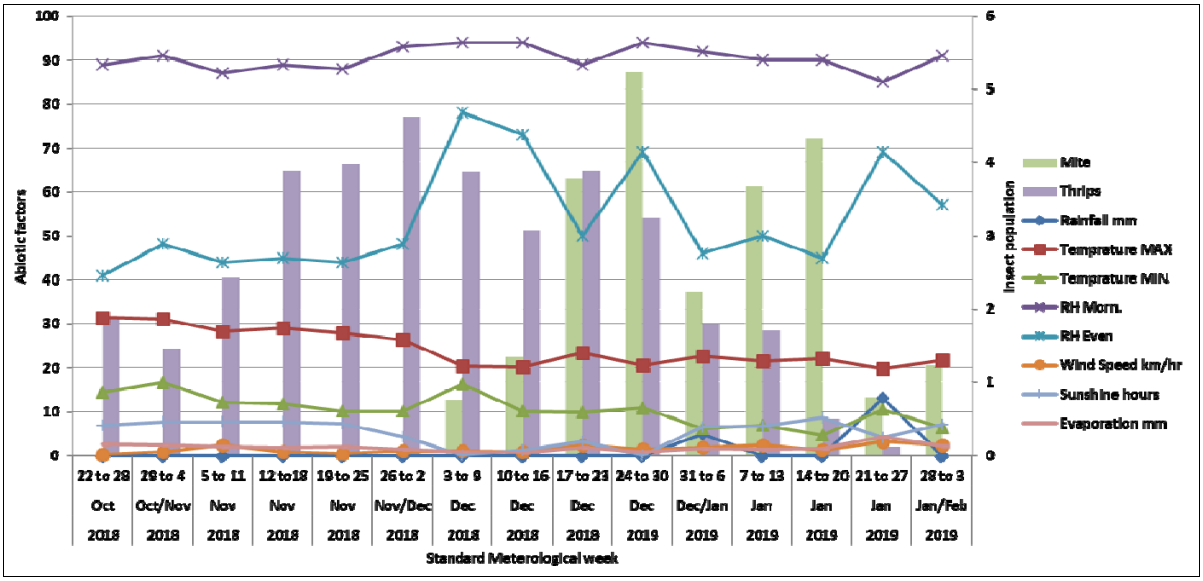

Fig 1: Standard metrological week

Seasonal incidence and population dynamics of sucking pests of chilli

For better collective information on seasonal incidence and population dynamics of sucking pests of chilli we conducted a field study at Vegetable Research Farm at Institute of Agricultural Science, BHU, Varanasi in *rabi* 2018-19. The relationship between chilli pests and the abiotic factors (*viz.* temperature, RH, rainfall, wind etc.) was worked out with the help of Microsoft Excel spreadsheet.

Seasonal incidence of yellow mite *Polyphagotarsonemus latus* Banks on chilli during *Rabi* 2018-19.

The population of broad mite, *Polyphagotarsonemus latus*, eggs, nymphs and adults was recorded weekly intervals (table-1) (figure-1) from transplanting to maturity of the crop and then the data was correlated with the data of weather parameters taken from the meteorological values from Agricultural farm, I. Ag. Sc. BHU, to portray the relationship of population abundance of mite with that of different meteorological parameters (maximum temperature, minimum temperature, rainfall, relative humidity (morning and evening), sunshine hours, wind speed, and evaporation. Mite grow with maximum biotic potential when there is a favored or optimum abiotic factors wind speed at optimum help in spread of mite from one region to another the same wind may kill the mite if its speed is above optimum level.

From survey conducted weekly by collecting samples leaves from chilli plant and observing them, the data of population fluctuation of mite per treatment before and after application of insecticide were noted. On 49th SMW ie one and half month after transplantation with a mean population of 0.76 mites per leaf, the maximum and minimum temperature observed was 20.3 ^{0}C and 16.3 ^{0}C respectively and the relative humidity of morning and evening hours were 94% and 78% respectively where wind speed was 1 km/hr. A peak population of mites was observed during 52nd SWM corresponding 20.5 ^{0}C and 10.9 ^{0}C maximum and minimum temperature respectively, and the relative humidity during morning and evening hours were 94% and 69% respectively with wind speed of about 1.4 km/hr., thereafter it showed gradual decrease in the mite population to 1.23 on the first week of February.

To know the relationship between the weather parameters and the population of mites, correlation was worked out (table-2). The result indicated that mite population showed negative and significant (r=-0.608**) correlation with maximum temperature and negative and significant (r=-0.538*) correlation with minimum temperature. The relationship between the relative humidity in morning (r=0.259) and evening (r=0.178) was positive and non-significant the correlation with relative humidity was positive but non-significant. The rainfall showed negative and non-significant (r=-0.074) correlation. Wind speed in relation to mite population showed positive but non-significant (r=0.311) correlation whereas sunshine hours showed negative but non-significant (r=-0.277) correlation with that of mite population.

Seasonal incidence of chilli thrips *Scirtothrips dorsalis* Hood on chilli during *Rabi* 2018-19.

The population of broad mite, *Scirtothrips dorsalis* nymphs and adults was recorded weekly intervals (table-1) (figure-1) from transplanting to maturity of the crop and then the data was correlated with the data of weather parameters taken from the meteorological values from Agricultural farm, I. Ag. Sc., BHU to portray the relationship of population abundance of thrips with that of different meteorological parameters

(maximum temperature, minimum temperature, rainfall, relative humidity (morning and evening), sunshine hours, wind speed, and evaporation. Thrips grow with maximum biotic potential when there is a favored or optimum abiotic factors wind speed at optimum help in spread of mite from one region to another the same wind may kill the mite if its speed is above optimum level.

From survey conducted weekly by collecting samples leaves from chilli plant and observing them, the data of population fluctuation of thrips per treatment before and after application of insecticide were noted. On 46th SMW i.e. twenty one days after transplantation with a mean population of 1.46 thrips per leaf, the maximum and minimum temperature observed was 29 ^{0}C and 11.7 ^{0}C respectively and the relative humidity of morning and evening hours were 89% and 45% respectively where wind speed was 0.9 km/hr. A peak population of thrips were observed during 48th SWM corresponding 26.4^0 C and 10.1^0 C maximum and minimum temperature respectively and the relative humidity during morning and evening hours were 93% and 48% respectively with wind speed of about 1.1 km/hr., thereafter it showed gradual decrease in the thrips population to 0.12 on the first last week of January.

To know the relationship between the weather parameters and the population of thrips, correlation was worked out (table-3). The result indicated that thrips population showed positive and significant (r=-0.502*) correlation with morning relative humidity and negative and significant (r=-0.626**) correlation with sunshine hours. The relationship between the relative maximum temperature (r=-0.255) was negative and non-significant and minimum temperature (r=0.027) was positive and non-significant. The evening relative humidity (r=0.286) was positive and non-significant. The rainfall showed negative and non-significant (r=-0.274) correlation. Wind speed in relation to thrips population showed negative and non-significant (r=-0.254) correlation.

Conclusion

Weekly observations were taken from transplant till maturity to monitor the fluctuations in population of pest *viz.* mites and thrips, populations were correlated along with that of weather parameters and noticed that there was a negative correlation with that of rainfall for both pests as rain washes off the population, mite had a positive correlation with that of wind as it is the chief component in transporting mite from one plant to another as they don't posses wings so they largely depend on the aerial mode of distribution. Temperature usually favors the growth of these pests but in our case we found out that it was negatively correlated with that of mite as the temperature fluctuations and the time of rainfall are on par to each other as rain leads to population decrease even though the temperature was favorable the population showed negative correlation. From this we can conclude that abiotic factors do have a major role to play in maintaining the pest population and these studies help us to design the better treatment plan.

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