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Incidence study of yellow mite and thrips and their natural enemies in relation to weather parameters on chilli

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Abstract
The present field experiment was conducted to study the incidence of yellow mite and thrips and their natural enemies and their interaction with the abiotic factors during 2012-13 at District Seed Farm (AB Block) of BCKV, West Bengal. The results revealed that the 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 population (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. The mean population of coccinellids maintained throughout the observation dates in variable number ranging from 0.25 to 2.05/plant whereas the mean spider population ranges from 0.58 to 1.40/plant respectively. Population fluctuation of yellow mite, thrips and spiders was found positively correlated with mean temperature and negatively correlated with total rainfall. Other abiotic factors (mean relative humidity, wind speed and bright sunshine) were found non-significant with the incidence of yellow mite, thrips and spider population. In case of coccinellids, none of the abiotic factors exerted influence on the population builds up in chilli ecosystem.

Keywords: Chilli, Yellow mite, Thrips, Abiotic factors, Natural enemy

1. Introduction
Chilli (*Capsicum annuam* L.) is an important spice as well as commercial vegetable crop grown all over India. It is an essential ingredient of Indian curry, which is characterized by tempting colour and titillating pungency [13]. In India, green chilli is cultivated in an area of 292 thousand hectares with annual production of 2955 thousand metric tonnes during 2015-16 [5]. Chilli accounts for 40 percent of the total spices exported from India and 23 percent in terms of value. Although, the crop has got great export potential besides huge domestic requirement, a number of limiting factors have been attributed for low productivity [14]. Chilli is widely grown in states among them occurrence of viral diseases as well as ravages caused by insect pets are significant ones [7]. Chilli is known to be affected by 57 insect and non-insect pests of which the Tarsonemid mite, *Polyphagotarsonemus latus* (Banks) (Acari: Tarsonemidae) and thrips, *Scirtothrips dorsalis* are most destructive sucking pests and are considered as major pests [2, 12]. Chilli thrips and mites affected leaves curl “upward” and “down ward” resulting in a typical damage known as ‘leaf curl syndrome’ [15]. Economic yield loss may be 11-75% quantitatively and 60-80% qualitatively in the event of serious infestation [6]. Since there is great variation in different agro climatic conditions of various regions; the pests show varying trends in their distribution, incidence, nature and extent of damage to the crop. Besides, there may also be some known and unknown factors contributing a key role in determining the incidence and dominance of a particular pest or pest complex [9, 17]. Knowing the peak period of pest infestations could help in taking pest management tactics more effectively with less incorporation of highly toxic chemical substances in the field. Keeping above aspects in mind, the present investigation was aimed to study on the seasonal incidence of yellow mite and thrips and their natural enemies in relation to various weather parameters like rainfall, temperature, relative humidity etc.

2. Materials and Methods
2.1 Site of Field Experiment
The present experiment was conducted at the District Seed Farm (A-B Block) of Bidhan Chandra Krishi Viswavidyalaya located at Kalyani, Nadia, West Bengal in experimental field

during the year 2012-13. The geographical details of the site are 23° N latitude, 89° E longitude and 9.75 meter above mean sea level (MSL).

2.2 Experimental Layout

The present experiment was conducted in a Randomized Block Design (RBD) with three replications. Chilli cultivar "Bullet" (*Capsicum annum* var. *annum* L.) was used for the study which is a very common cultivar used by the farmers of West Bengal. Seedlings were raised in nursery beds and 40 days old seedlings were transplanted in the plot size of 3 m × 3 m at a distance of 50 cm between plant and 50 cm between rows on raised beds in the main field during January 10, 2013. Each plot in each replication in the main filed was represented by 5 rows accommodating 25 plants. A light irrigation was applied immediate after transplanting to prevent "transplanting shock" or wilting of transplanted seedlings. All the recommended agronomic packages of practices free from pesticide application were adopted for raising the crop.

2.3 Observations recorded

Incidence of yellow mite and thrips was recorded at an interval of 3 days during morning hours between 6:00 AM to 8:30 AM. Pest counts were made from three leaves one each from the upper, middle and lower position on five randomly selected plants per plot [16]. The leaves thus collected from the fields were put in a zip lock polypropelene bag and brought to the laboratory for observation under stereo-zoom binocular microscope (Olympus SZ-40). The meteorological data on different abiotic factors viz. temperature (maximum & minimum in °C), relative humidity (maximum & minimum in %), total rainfall (mm), wind speed (Km/hr) and bright sunshine hours (hr) during the period of investigation were collected from the AICRP on Agro meteorology, BCKV, Kalyani. Population of natural enemies namely spider and coccinelid predators (*Coccinella septempunctata*, *Coccinella transversalis*, *Cheilomenes sexmaculata*, *Micraspis discolor*) were also recorded for the study.

2.4 Statistical Analysis

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

3. Results and Discussion

The maximum mean mite population/leaf (7.25) was recorded during 02/05/2013 and the minimum population (3.54 mites/leaf) was registered during 17/04/2013 (Table 1). It is interesting to note that the population of yellow mite increased gradually with gradual increment of ambient temperature. After attaining peak during 02/05/2013 population dwindles during the later parts of observation and again least population during 29/05/2013 after wards plant was unfit for recording of data. In case of thrips, highest mean population (6.15/leaf) was recorded during 11/04/2013 and 02/05/2013 and that was the highest population recorded during the period. Minimum population of thrips (1.85/leaf) was observed on 17/04/2013 which also exhibited a similar trend in population rise pattern like yellow mite and after attaining first peak during 11/04/2013 the population declined and the second peak noticed on 02/05/2013 afterwards the population went down. From Table 2, it was revealed that mean temperature has profound influence on build up of yellow mite and thrips population in chilli (r-value-0.772 in mite and 0.700 in thrips). A significant positive correlation was found between the population of yellow mite and thrips and mean temperature, which indicates that mite and thrips population increases with the increase in temperature. Total rainfall was found to exert negative effect on the population of mite and thrips indicating decrease in population with the increase in rainfall that is their interaction was negatively correlated with rainfall (-0.486 and -0.408 respectively). The other parameters like mean relative humidity (%), wind speed, sunshine has got no influence on the population oscillation on these two sucking pests.

Table 1: Incidence of yellow mite, thrips and natural enemies (Coccinellids, Spiders) on chilli (cv-Bullet) during March'13- May'13 at Kalyani.

Date	Mean mite population/leaf	Mean thrips population/leaf	Mean Coccinellid population/leaf	Mean Spider population/leaf	Mean Temperature (◦C)	Total Rainfall (mm)	Mean RH (%)	Wind speed (km/hr)	Bright sunshine (hrs)
03.03.2013	3.80	2.40	1.65	0.75	21.00	0	63.00	2.00	10.60
06.03.2013	4.20	3.40	1.15	1.00	24.70	0	58.50	0.50	10.20
09.03.2013	4.40	3.20	1.06	0.85	25.45	0	70.00	0.20	9.90
12.03.2013	5.40	4.65	1.05	0.85	28.50	0	76.00	0.80	7.40
15.03.2013	5.64	4.25	0.80	0.60	29.75	0	75.50	0.60	5.80
18.03.2013	4.85	3.68	1.15	0.85	24.70	0	60.50	3.20	10.10
21.03.2013	5.40	4.65	0.95	1.00	29.80	0	66.00	0.70	8.90
24.03.2013	5.25	5.20	1.25	0.58	29.05	0	80.00	0.70	7.90
27.03.2013	4.90	3.75	1.65	1.16	28.55	0	56.00	1.00	9.60
30.03.2013	3.60	2.85	1.00	0.85	27.60	0	65.00	0.50	5.20
02.04.2013	6.20	5.86	0.85	1.00	31.75	0	67.00	0.80	8.90
05.04.2013	5.85	4.35	1.05	0.95	30.00	0	50.00	1.00	10.50
08.04.2013	5.65	4.05	1.15	0.85	30.75	0	61.50	1.20	9.30
11.04.2013	6.60	6.15	1.88	1.16	33.10	0	74.50	2.00	8.20
14.04.2013	5.64	3.85	1.56	1.08	30.75	0	52.50	2.60	6.60
17.04.2013	3.54	1.85	1.88	0.58	29.15	48.20	82.00	2.20	7.00
20.04.2013	4.60	3.65	1.05	0.43	25.80	1.00	78.00	1.70	5.60
23.04.2013	5.50	4.85	1.85	0.96	27.50	0	76.00	0.20	8.50
26.04.2013	6.40	5.68	2.05	1.00	30.70	0	72.50	0.50	10.40
29.04.2013	6.80	5.85	1.60	1.05	31.00	0	81.50	2.30	8.00
02.05.2013	7.25	6.15	1.04	1.40	32.25	0	78.50	2.30	10.90
05.05.2013	6.25	4.26	1.60	1.24	30.50	0	84.50	4.40	7.30
08.05.2013	6.45	5.84	2.05	1.40	32.15	0	79.50	2.00	5.30
11.05.2013	6.05	5.60	1.25	1.28	32.05	0	78.00	4.10	9.30
14.05.2013	4.25	2.85	1.08	0.80	28.30	11.00	83.50	2.50	8.50
17.05.2013	5.65	4.80	0.85	1.05	30.25	0	77.50	0.60	7.60
20.05.2013	4.68	2.85	0.25	0.60	28.25	12.20	82.00	3.20	8.40
23.05.2013	4.80	3.65	0.65	0.85	29.00	0	99.00	0.20	0.40
26.05.2013	4.45	4.35	1.24	1.05	27.60	0	81.00	3.10	5.70
29.05.2013	4.30	2.90	0.84	1.00	27.60	3.00	97.00	6.00	0.00

Table 2: Correlation between key abiotic factors and the population of yellow mite, thrips and natural enemies on chilli.

Insect and Mite Pests & Natural Enemies	Correlation Coefficient (r)				
	Mean Temperature (ºC)	Total Rainfall (mm)	Mean Relative Humidity (%)	Wind Speed (Km/hr)	Bright Sunshine (hrs)
Yellow Mite	0.772*	- 0.448*	0.002	0.003	0.247
Thrips	0.700*	- 0.486*	0.011	- 0.128	0.218
Coccinellids	0.144	0.129	- 0.157	0.230	0.020
Spiders	0.516*	- 0.371*	0.061	0.128	0.241

*Significant at 5% level

The present findings are in conformity of the results obtained by Chatterjee [4] who reported that yellow mite population was significantly correlated with temperature and did not vary significantly with relative humidity. Similar to our findings, Patil and Nandihalli [11] have also reported that yellow mite population showed negative correlation with morning and evening humidity, rainfall and age of crop. Similar results were also obtained by Patel *et al*. [10] who 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 morning, afternoon and mean relative humidity and vapour pressure. Zainab *et al*. [17] found that population of thrips showed significant positive correlation with maximum temperature and negatively correlated with rainfall, relative humidity, which corroborate the present study. The present findings also supported by Bhede *et al*. [3] who reported the correlation of minimum temperature, morning and evening relative humidity with mite population was negative and non significant, on the other hand highest incidence of thrips in the 40th meteorological week and the population was negatively correlated with evening humidity and rainfall and positively correlated with bright sunshine. However Meena *et al*. [9] found that mean temperature, relative humidity and average rainfall had negative correlation with thrips population, while positive with mite population. This might be due to the factors like variation in agro climatic conditions of different geographical regions and the time of cultivation of the particular crop.

From Table 1, it is evident that the mean population of coccinellid predators remain in variable number ranging from 0.25 to 2.05/plant whereas the mean spider population ranges from 0.58 to 1.40/plant respectively throughout the observation dates. They were also homogeneously distributed during different dates of observation. In case of coccinellids none of the abiotic factors exerted influence on the population builds up of coccinellid predators in chilli ecosystem (Table 2). On the other hand in case of spiders the mean temperature and total rainfall showed significant and positive correlation (r=0.516) and significant but negative correlation (r= -0.371), the other factors like relative humidity, sunshine hour and wind speed has got no influence on the population of spiders. Similar results have been observed by Meena and Kanwat [8] and Asma and Hanumantharaya [1].

4. Conclusion

The findings of present investigation on seasonal incidence of yellow mite, thrips and their natural enemies could help in taking suitable pest control measures by identifying the vulnerable stages of these pests and minimizing the frequent application of toxic pesticides providing suitable opportunities to grow natural enemies in less hazardous environment which will be helpful in the conservation process of biological control programme.

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