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# Seasonal incidence of major sucking pests complex of Capsicum in relation to weather parameters in Eastern Plateau and Hill region of India

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**Abstract**
Seasonal incidence of sucking pest complex were studied on capsicum during 2014-2015 in Eastern Plateau and Hill region of India. The three major sucking pests viz., thrips, *Scirtothrips dorsalis*; mites, *Polyphagotarsonemus latus* and whitefly, *Bemisia tabaci* population along with weather parameters were recorded. Incidence of pests started from second to third week of September and reach its peak in month of Octber. The correlation analysis between thrips population and weather parameters indicated negative correlation between the number of thrips and rainfall. Mites showed significant positive correlation with temperature and realtive humidity ($p<0.01$), but found a non significant negative correlation with rainfall. Similarly, whiteflies also showed positive with temerature and relative humidity and a negative correlation with rainfall. The linear regression analysis based on weather parameters as independent variable and thrips, mites and whiteflies population fluctuation as dependent variable, explained to 42, 65 and 47 percent population variability, respectively. So, environmental varables played significant role in distribution and abundance of mites population on capsicum.

**Keywords:** Correlation, sucking pest complex, seasonal incidence, capsicum

## 1. Introduction

Capsicum (*Capsicum annuum*) which is also known as sweet pepper, bell pepper or green pepper cultivated in temperate regions of Central and South America and European countries, tropical and subtropical regions of Asian continent [1]. The sweet pepper cultivation in India is mostly under non-traditional category of vegetables [2]. Insect and mite pests are the major biotic factor responsible for low yield and inferior quality of capsicum. The reported yield losses in *Capsicum* spp. range from 50-90 per cent due to infestation of insect pests [3, 4]. Among reported species of insect and mite pests, thrips (*Scirtothrips dorsalis* Hood, *Thrips palmi* Karny), whitefly (*Bemisia tabaci* Gennadius) and mites (*Polyphagotarsonemus latus* Banks, *Tetranychus cinnabarinus* Boisd.) are the major sucking pest complex in *Capsicum* spp. causes approximately 50 per cent loss crop yield [4, 5, 6, 7, 8, 9, 10, 11, 12]. Similarly Eswara Reddy [13] reported that chilli mite, *P. latus* and thrips, *S. dorsalis* as the major pests infesting sweet pepper both under protected and open field conditions. Variation in prevailing environmental conditions such as temperature, relative humidity and precipitation different regions leads to varying trends of insect pests incidence, population build up and extent of damage to the crop [14, 15]. Besides these there are other known and unknown factors also play a key role in determining the population dynamics and dominance of a particular pest or pest complex [14]. Published literature confirms that not so much information is available especially on population dynamics and influence of various environmental factors on the fluctuation of sucking pests on capsicum crop in Eastern plateau and Hill (EPH) Region of India. Therefore, the region oriented present study was carried out to analyze the population dynamics of sucking pest complex on capsicum in EPH region conditions and also to analyze factors that affect the population dynamics.

## 2. Materials and Methods

The present study was conducted at the research farm of ICAR Research complex for Eastern Region, Research Centre, Ranchi (23° 45' N, 85° 30' E, Altitude 620 m above msl) Jharkhand, during the two successive years (2014 and 2015). Capsicum Variety *Swarna Atulya*, seedlings of 35 days old raised in pro trays were transplanted to the plastic mulched raised beds with a spacing of 40 cm, during the second week of July under drip irrigation.

The distance between two laterals and drippers were maintained at 1m and 40cm. The experiment was laid down in Randomized Block Design in three replicates with a plot size of $6m^{2.}$ All agronomical practices except plant protection were followed as per recommended package and practices of the crop.

The major species of thrips was determined as *Scirtothrips dorsalis* Hood, mites as *Polyphagotarsonemus latus* Banks and that of whitefly as *Bemisia tabaci* Gennadius) based on the morphological descriptions given by Aliakbarpour et al. [16], Casuso and Smith [17] and identified specimens of thrips were sent to Zoological Survey of India, Kolkata for further confirmation. The population of sucking pests viz., thrips (*S. dorsalis*), whitefly (*B. tabaci*) and mites (*P. latus*) were recorded at weekly intervals during morning hours on five randomly selected plants in each plot. Population were recorded from three leaves one each from the upper, middle and lower position and expressed as number per three leaves. Data on population of the sucking pests were recorded from the first appearance to till maturity of the crop. The data on weather parameters viz., minimum and maximum temperature ($^0$C), relative humidity (RH) (%) and rainfall (mm) were collected from the agro-meteorological observatory of the Centre.

### 2.1 Statistical analysis

All the data were subjected to statistical analysis and correlation coefficient and regression was worked out using PAST: Paleontological Statistics Software Package. The figures in the article were drawn using Microsoft office excel 2007.

## 3. Results and Discussion

### 3.1 Population dynamics

Mean pooled population of thrips, *S. dorsalis*, whitefly, *B. tabaci* and mites, *P. latus* at different stages of the crop, from the first incidence to till end of the crop harvesting stage are depicted in Fig. 1. All the observed sucking pests *viz.*, thrips, whiteflies and mites population were observed from low to high during the entire cropping season and the incidences of all the sucking pests were also more or less in the same pattern of population fluctuation in both the years.

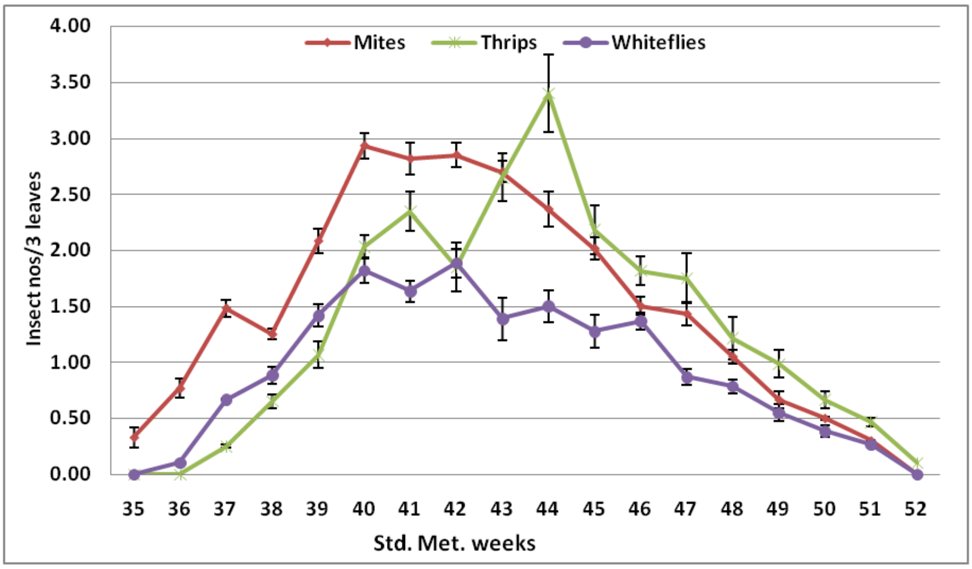


**Fig 1:** Population dynamics (pooled) of major sucking pests complex infesting capsicum (*C. annum*).

The infestation of pooled population of thrips commenced in the second week of September (37th standard meteorological week) and remain continued upto the last week of December (52nd SMW). The population gradually increased and reach its peak with 3.40 thrips per three leaves in the last week of October (44 SMW) and gradually declined and reach 0.10 thrips per three leaves in the last week of December. Results were in line with reporting by Rai *et al.* [18] who observed that the incidence of thrips commenced from second week of September and continued up to the first week of November, reaching its maximum population in the first week of October. Panicker [19] also observed the activity of thrips from first week of September, and continued up to second week of January on chilli. The present finding is also supported by Bhede *et al.* [20] who reported the highest incidence of thrips in the 40th meteorological week of year.

Similialry, the population of whitefly appeared in the first week of September (36 SMW) and continue upto the third week of December (51 SMW). The population gradually increased and reached its maximum with 1.88 whiteflies per three leaves in the third week of October (42 SMW) and thereafter, it gradually decline and reach upto 0.26 whiteflies per three leaves. Saini *et al.* [21] also observed the appearance of whiteflies in the last week of July which reached its peak population in the second week of September. The findings confirmed with the results obtained by Bharadia and Patel [22] who reported that the maximum population of whitefly in the fourth week of October.

The infestation of mite commenced in the last week of August (35 SMW) and was in the crop till third week of December (51 SMW). The highest mite population 2.93 per three leaves was recorded in the first week of October (40 SMW) and thereafter it gradually declined and reached 0.30 mite per three leaves. Mote [23] reported the peak incidence of *P. latus* on chilli during Feb-May and Oct- Nov period from adjoining state of Maharashtra. Similarly Roopa and Nandihalli [24] revealed the peak activity of broad mite *P. latus* on 42nd SMW during kharif season which is in lined with the present study.

### 3.2 Relationship between population and weather factors

Weather factors plays an important role in influencing the flactuation of population of sucking pests. The data on correlation between the incidence of sucking pests population with weather parameters showed a significant relationship as presented in Table 1.

**Table 1:** Correlation Co-efficient values (r) between key abiotic factors and major sucking pests' population on capsicum

| Sucking pests species | Year | Temperature (° C) | | | Relative humidity (%) | Rainfall (mm) |
|---|---|---|---|---|---|---|
| | | Minimum | Maximum | Mean | | |
| Thrips | 2014 | -0.07 | 0.06 | -0.04 | -0.23 | -0.49 |
| | 2015 | 0.05 | 0.21 | 0.12 | 0.43 | -0.02 |
| Mites | 2014 | 0.33 | 0.40 | 0.37 | 0.12 | -0.38 |
| | 2015 | 0.62** | 0.67** | 0.66** | 0.50* | -0.20 |
| Whiteflies | 2014 | 0.24 | 0.43 | 0.30 | 0.06 | -0.45 |
| | 2015 | 0.33 | 0.50* | 0.41 | 0.50* | -0.10 |

* Significant at $P \leq 0.05$; ** Significant at $P \leq 0.01$; n=18

The data on correlation between weather and thrips population exhibited a positive correlation with temperature, however a negative correlation was revealed with minimum and mean temperature in 2014 but not significant at all. Earlier studies also explained that thrips population on different crops are positively influenced by temperature and population density increased with increasing temperature [15, 25], but Meena *et al.* [26] reported a negative correlation of thrips population with minimum and mean temperature. A non-significant negative relationship was observed with rainfall in both the years and relative humitidy in 2015 where as a non-significant postive correlation with humitidy was recorded in 2014. The present observations are in close agreement with the results obtained by Patel [27] and Saini *et al.* [21] who reported negative correlation between thrips population and rainfall. Considering multiple factors influencing population of thrips as dependent variable and weather conditions as independent variable, linear regression analysis was carried out and presented in Table 2. The linear regression model based on weather variables could explain 42% variability on thrips population fluctuation and variability.

**Table 2:** Multiple regression ($R^2$) analysis using major sucking pests' populations with key abiotic factors (Pooled).

| Sucking pests species | Regression equations | $R^2$ |
|---|---|---|
| Thrips | $Y= -16.7-(0.14T_{min})+(0.17T_{max})+(0.18RH)-(7.98RF)$ | 0.42 |
| Mites | $Y= -12.9-(2.85T_{min})+(0.14T_{max})+(0.12RH)-(2.77RF)$ | 0.65* |
| Whiteflies | Y= -8.7-(1.77Tmin)+(8.85Tmax)+(8.70RH)-(1.50RF) | 0.47 |

*Significant $P \leq 0.05$

The correlation analysis between mite population and weather factors showed a positive correlation with temperature and rainfall. In 2015, it indicated a strong significant positive correlation between the number of mite and with maximum, minimum and mean temperature (p<0.01). Similarly rainfall exhibited a negative correlation on mite population fluctuation. The present findings concord with the findings of Chavan *et al.* [28] and Chinniah *et al.* [29] who reported a significant and positive correlation of mite population with temperature and a negative correlation with rainfall. Most of the studies showed that temperature has positive and rainfall a negative relation with mite population [26, 30]. The present study are also in line with the findings of earlier workers. Roopa and Nandihalli [24] and Meena *et al.* [26] who reported a positive correlation of mite population with relative humidity. Considering multiple factors influencing population of mite as dependent variable and weather conditions as independent variable, linear regression analysis was carried out and presented in Table 2. The linear regression model based on weather conditions as independent variable and mite population fluctuation as dependent variable, revealed 65% variability in the mites population fluctuation which shows that weather parameters significantly influence the population density of mite and temperature plays a regulatory factor in population build up of mite pests.

Similarly, temperature and relative humitidy showed a positive and a negative correlation with rainfall on whitefly population flacutation in both the years. The findings confirmed with the results obtained by Meena *et al.* (2013) [26] who reported a positive correlation of whitefly population with temperature and relative humidity. Selvaraj and Ramesh [31] and Shivanna *et al.* [32] also revealed a positive correlation with minimum and maximum temperature which is in line with the present study. The present findings concord with the findings of Soni and Dhakad [33] who revealed a negative relationship with rainfall and whitefly populations. Considering multiple factors influencing population of whitefly as dependent variable and weather conditions as independent variable, linear regression analysis was carried out and presented in Table 2. The linear regression model based on weather parameters as independent variable and whitefly population fluctuation as dependent variable, could explain 47% variability on population flactuation of whiteflies. It's also showed that weather conditions alone does not significantly influence the increase of population density of whiteflies.

## 4. Conclusion
From the study, It can be concluded that weather factors have regulatory roles for sucking pests complex population build up in capsicum crop in EPH region of India. These data suggest that sowing dates can be adjusted in order to protect capsicum crop from severe insect pests attack and data can also be used for developing weather based forecasting models for successful development and implementation of the pest management strategies against insect pest of capsicum.


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