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Seasonal incidence of thrips in chilli crop and correlation to abiotic parameters

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Abstract
Chilli is considered as one of the commercial spice crops. Three thrips species *Thrips parvispinus* Karny, *Thrips florum* Schmutz and *Thrips hawaiiensis* Morgan were found and identified from chilli crop from IGKV, Raipur during the study period. Among the most damaging pests and number of thrips infested crops increased gradually up to 12.4 thrips/three leaves/plant during the 3rd SMW (3rd week of January), which was the peak activity period. The average of two years the thrips population density in chilli crop. The maximum temperature minimum temperature bright sunshine hours had significant negative correlation.

Keywords: Thrips, seasonal incidence, weather factors, correlation and simple regressions

Introduction
Chilli is a major commercial spice crop in India, grown for vegetable, spice, and industrial uses. It is cultivated on 775 thousand hectares nationally, with Andhra Pradesh contributing significantly (131.32 thousand ha, 601.99 thousand Mt production).
Over 20 insect species have been reported on chillies in India, with thrips (*Scirtothrips dorsalis*), mites (*Polyphagotarsonemus latus*), and aphids (*Aphis gossypii* and *A. craccivora*) being the most damaging (Butani, 1975) [3]. *Thrips parvispinus*, a notorious pest from Southeast Asia, is a serious threat to various agricultural and horticultural crops. Belonging to the "*Thrips orientalis* group" (Mound, 2005) [15], it is of quarantine importance and has been reported from Thailand to Australia (Mound & Collins, 2000) [10]. It affects a wide range of plant families, including papaya in Hawaii, Gardenia in Greece, and vegetables like chili, green beans, potato, and eggplant in several countries (Murai *et al.,* 2009) [14].
Chilli thrips are among the most serious sucking pests of chilli crops. Both nymphs and adults damage the plant by scraping the leaf surface and sucking sap, leading to upward leaf curling and reduced leaf size. They also indirectly harm crops by transmitting Tospo viruses (Jones, 2005) [6]. Their population increases rapidly during dry weather, causing yield losses of 30–50% in South India (Vasundararajan, 1994) [16], and in severe cases, up to 90% (Kumar, 1995) [8].
Due to varying agro-climatic conditions, the extent of thrips damage in chilli crops differs across regions. Environmental (abiotic) factors significantly influence their population and seasonal abundance. Studying these factors helps identify peak infestation periods, aiding in the development of effective and timely pest management strategies.

Materials and Methods
Observation of thrips on leaves: The population of thrips (nymphs and adults) were recorded from three leaves one each from the upper, middle and lower position on five randomly selected plants at weekly intervals in the chilli crop.

Collection of thrips samples
Thrips were collected from the field by tapping on various plant parts *viz*; leaves, bud and flowers on different crops such as pulses, vegetables and flowering plants. A piece of white paper (A4 size) was placed underneath the canopy to collect the fallen thrips.

Thrips mounting and Identification of thrips

The collected thrips were transferred using a fine brush to a labeled vial containing collection fluid (nine parts 10% alcohol + one part glacial acetic acid + 1 ml Triton X-100 in 1000 ml of the mixture) and were send for identification. The thrips were identified by using the key morphology characteristics listed in Mound and Ng (2009) [13], Mound and Azidah (2009) [12], Sartiami and Mound (2013) [15] and Kirk (1996) [7].

Weather parameters used in the study

The weather data was collected from the weather station located at College of Agricultural Raipur. The various weather parameters collected and utilized in the study were Maximum temperature (T. max), Minimum temperature (T. min), Morning Relative humidity (RH I), Evening Relative humidity (RH II), Rainfall (RF), (mm), and Sun Shine Hours (S.S.H).

Statistical Analysis

To find out the effect of various weather parameters on thrips population simple correlation coefficients were worked out between thrips population and observatory weather data of preceding one week. The correlation coefficients obtained were tested at five percent and one percent level of significance. Correlation analyses were worked out as per method given by Gomez and Gomez, (1994) [4].

$$r = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{\sqrt{[n\Sigma x^2 - (\Sigma x)^2][n\Sigma y^2 - (\Sigma y)^2]}}$$

Where, X = Mean of first factor. Y= Mean of second factor n = Total no. of observations r = Correlation coefficient

Results and Discussion

Population density of two years was observed in the 46th SMW (2nd to 3rd week of November) with a mean population of 1.2 thrips/three leaves/plant. Number of thrips infested crops increased gradually up to 12.4 thrips/three leaves/plant during the 3rd SMW (3rd week of January), which was the peak activity period. When the population of thrips gradually declined up to 6.2 thrips/three leaves/plant in the 6th SMW (2nd week of February) with a seasonal mean of 5.60 thrips/three leaves/plant. Thrips population disappeared from the crop after 14th SMW (1st week of April) of crop maturity (Table 1.1 and Fig 1.1). The maximum temperature, minimum temperature, rainfall, morning relative humidity, evening relative humidity and bright sunshine hours were recorded 38.15 °C, 8.17 °C, 7.51 mm, 90.11 percent, 49.72 percent, 65.65 percent and 8.36 hrs, respectively. Thrips was active from 46th SMW to 14th SMW (third week of November to first week of April).

The present findings conformity with Yadav *et al.* 2018 who reported that the thrips population appeared on the crop in the first week of March and increased in population started from 9th standard week *i. e.* first week of April and build up to the third week of May and declined gradually till the crop was matured in September. The population of thrips ranged from 0.60 to 20.12 per three leaves.

The correlation between thrips and abiotic parameters on chilli crop during 2022-23 and 2023-24

As regard the pooled data, maximum temperature (-0.461*), minimum temperature (-0.471*), bright sunshine hours (-0.685**) had significant negative correlation. The positive correlation were observed with morning relative humidity (r = 0.244) and evening relative humidity (r = 0.337). The rainfall (-0.172) had non- significant negative correlation with the incidence of thrips. But in case of maximum temperature and minimum temperature was observed significant negative correlation with thrips population. The regression line was worked out for number of thrips laid Y= 0.1701x-0.2 and Y= 0.3454x-0.518 and R^2 0.73 and 0.66 (Table 1.2 & Fig. 1.1). Similarly in case of bright sunshine hours was observed negative highly significant trend of correlation with thrips observed. The regression line was worked out for number of thrips laid Y= -0.7329x-1.136 and $R^2 = 0.68$.

The present results close agreed with Bokan *et al.* (2015) [12] who observed that thrips population was negatively correlated with minimum temperature and bright sun shine hours but disagrees with the statement of positive correlation with temperature. The present findings are also in concurrence with Gopal *et al.* 2018 [5], observed that the thrips population had significant negative correlation with temperature. Bhatt and Karnatak (2020) [1] found that thrips population had positive correlations with morning, evening relative humidity and rainfall.

Table 1: Complex seasonal incidence with mean population of chilli thrips (*Thrips parvispinus* Karny, *Thrips florum* Schmutz and *Thrips hawaiiensis* Morgan) during 2022-23 to 2023-24 along with pooled mean.

Thrips recorded in chilli crop (Number/leaves)			
SMW	**Year 2022-23**	**Year 2023-24**	**Pooled mean**
45	0.0	0.0	0.0
46	2.4	0.0	1.2
47	4.8	3.4	4.1
48	4.8	4.2	4.5
49	5.2	2.6	3.9
50	7.2	4.8	6.0
51	7.8	5.4	6.6
52	8.6	7.2	8.2
1	10.4	8.2	9.3
2	12.8	8.6	10.7
3	14.6	10.2	12.4
4	8.2	7.2	7.7
5	11.2	7.4	9.3
6	7.2	5.2	6.2
7	3.8	5.2	4.5
8	6.8	4.4	5.6
9	6.4	4.0	5.2
10	5.0	3.4	4.2
11	3.8	3.8	3.8
12	4.8	2.8	3.8
13	3.0	3.4	3.2
14	3.2	2.6	2.9
Seasonal mean	6.45	4.72	5.60

Table 2: Correlation matrix of incidence of thrips with weather parameters in chilli during 2022-23 and 2023-24.

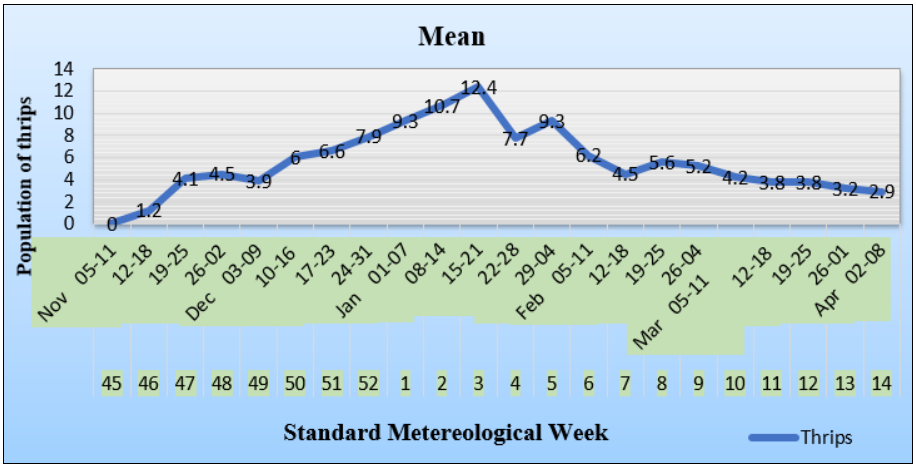
Weather parameters	2022-23	2023-24	Pooled
Maximum temperature (°C)	-0.426*	-0.441*	-0.461*
Minimum temperature (°C)	-0.474*	-0.440*	-0.471*
Rainfall (mm)	-0.170	0.049	-0.172
Relative humidity (percent) I	0.227	0.220	0.244
Relative humidity (percent) II	0.207	0.371	0.337
Bright sunshine hours	-0.678**	-0.628**	-0.685**

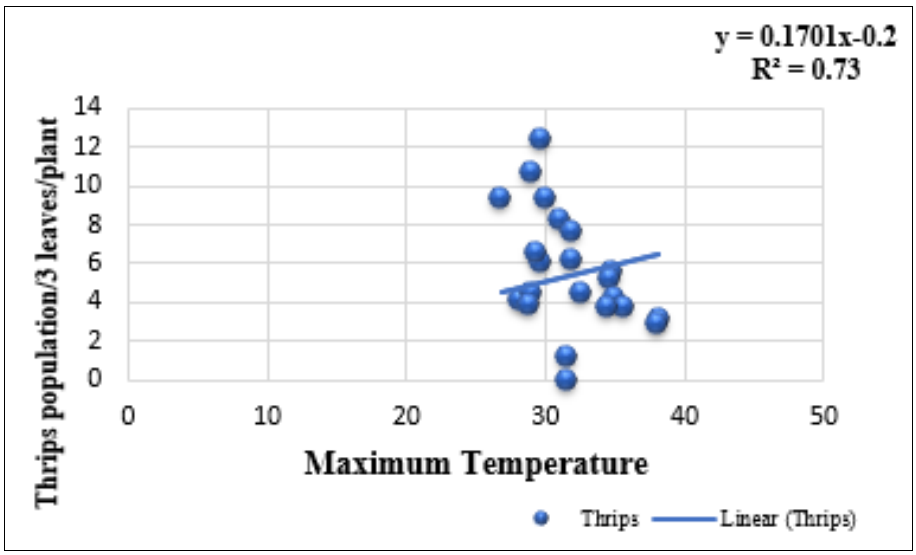
*Correlation significant at the 0.05percent level **Correlation significant at the 0.01percent level.

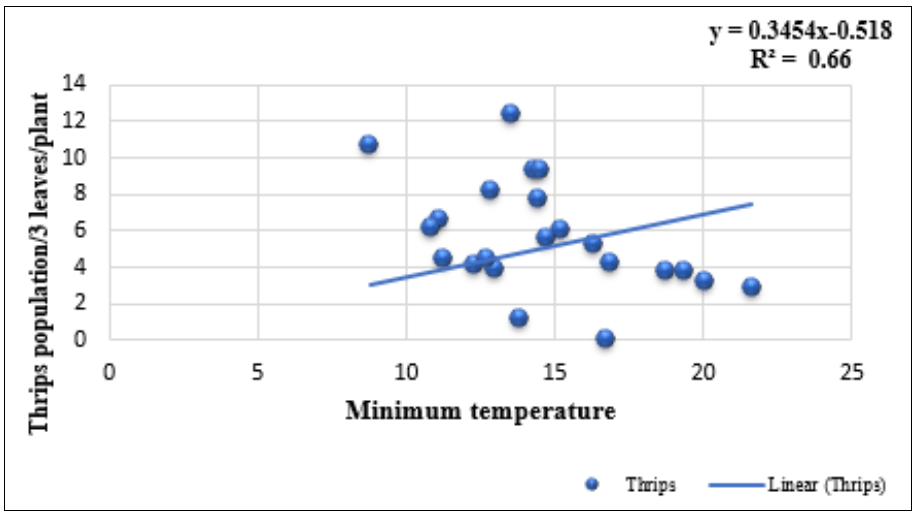
Table 3: Regression line analysis for thrips population on chilli crop in relation to weather parameters during 2022 -23 to 2023-24 (Pooled).

Parameters	Regression equation	R^2
Maximum temperature	Y= 0.1701x-0.2	0.73
Minimum temperature	Y= 0.3454x-0.518	0.66
Bright sunshine hours	Y= -0.7329x-1.136	0.68

Where,
Y= Estimated thrips population, X1=Maximum temperature, X2= Minimum temperature, X3= Bright sunshine hours, R^2= Co-efficient of Determination.







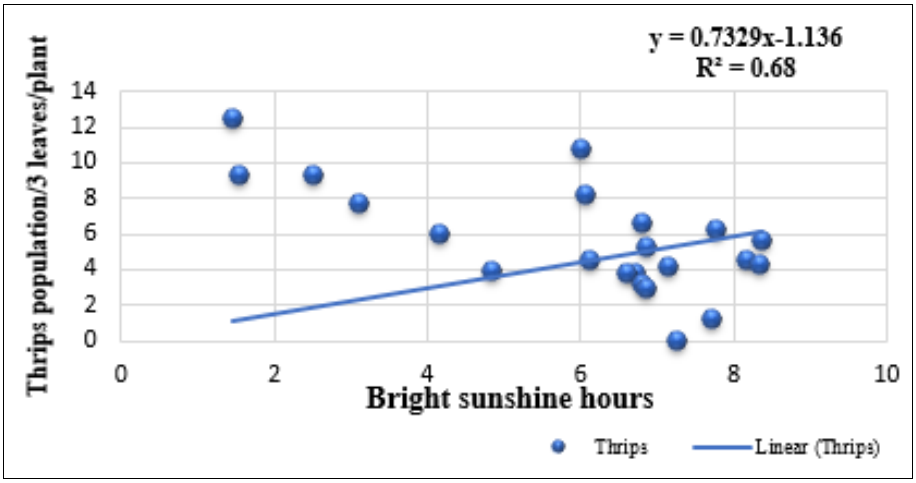


Fig 1: Correlation co-efficient (r) between thrips population and weather parameters during 2022-23

Conclusion

The average of two years the thrips population density was increased gradually up to 12.4 thrips/three leaves/plant during the 3rd SMW (3rd week of January), which was the peak activity period in chilli crop.

The average of two years the thrips population density in chilli crop. The maximum temperature minimum temperature bright sunshine hours had significant negative correlation.

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