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# Impact of different weather parameters on thrips population (*Thrips parvispinus* Karny) in chilli

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**Abstract**
This study investigates the relationship between thrips population dynamics and weather parameters in chilli (*Capsicum annuum*) at the HRS Lam experimental location. Over a period from January to April, the thrips population showed a significant negative correlation with morning relative humidity (-0.673**) and evening relative humidity (-0.372**), suggesting that higher humidity levels may suppress thrips proliferation. Conversely, temperature (mean, minimum, and maximum) exhibited a positive but non-significant correlation with thrips abundance, supporting earlier studies that link warmer temperatures to higher pest activity. A negative correlation between wind speed and thrips population was observed, though it was not statistically significant. Additionally, sunshine hours showed a positive correlation with thrips numbers, which is consistent with findings from previous research. Regional variation in peak thrips activity is discussed in relation to ecological conditions, transplantation dates, and differences in chilli variety resistance. The results underscore the potential of developing weather-based pest prediction models, aiding in timely pest control interventions. Understanding the interplay between weather conditions, thrips behaviour, and chilli plants will help optimize pest management strategies, especially in regions with varying environmental factors.

**Keywords:** Thrips population, weather parameters, pest prediction models, chili, *Capsicum annuum*

## 1. Introduction

The chilli plant, *Capsicum annum* L., is an annual shrub with singly borne flowers and typically pendent fruits. It yields huge, inflated fruits and mild varieties of bell peppers, sweet peppers, cayenne, and paprika. It is a member of the Solanaceae family. The chilli chromosome number is 2n = 24. It is indigenous to Mexico in South America. It is cultivated commercially for both its green and dried, mature pods. Because of its striking colour, intense heat, pungency, flavour, and perfume, chillies are employed as spices or culinary additions in many different national cuisines.

It is known that several species of capsicum produce capsaicin. The chemical formula for it is $C_{18}H_{27}NO_3$, and its molecular weight is 305.5 g/mol. Capsaicin is known by its IUPAC designation (E)-N-[(4-hydroxy-3-methoxyphenyl)methyl].-8-methylnon-6-enamide. India's top export destinations for chillies are Saudi Arabia, Malaysia, Singapore, USA, UK, and Germany. Of all the spices that are exported from India, chilli is the most valuable.

*Thrips parvispinus* (Karny) (Thysanoptera: Thripidae) is an invasive species that has caused significant damage and sparked alarm recently. Both nymphs and adults of thrips cause damage by scrapping the epidermis and sucking the cell sap from tender leaves, growing shoots and exhibit characteristic upward curling of leaves and reduction in leaf size [1]. It multiplies noticeably more quickly when the weather is dry. Chilli is more susceptible to insect pests due to their tenderness and softness compared to other crops and absences of resistance make it more susceptible because of exhaustive hybrid cultivation [13].

In addition to causing direct attack, thrips also spread Tospo viruses, which results in indirect damage [2]. Occurrence of this species in India has been first reported by Veeranna *et al.* (2022) [3] on papaya from Bangalore. The most harmful disease to chillies in India is called Murda, or chilli leaf curl. It is well recognized that murda in chilli is a highly complicated illness brought on by thrips, mites, and viruses.

Even with the use of chemical pesticides, farmers are now having trouble controlling thrips. Farmers are generally known to heavily (about 25-40 times) spray chemical pesticides for a single crop harvest. Further it favors unwanted effects such as pesticide resistance, elimination of non-target species, pest resurgence and secondary pest outbreaks (Foster *et al*., 2010) [4]. The recent occurrence of Southeast Asia thrips made this scenario more difficult. Hence, the most effective and sustainable approach is exploring host plant resistance. Identification of resistant sources is key and initial step which will help in breeding thrips-resistant varieties (Pavani *et al*., 2024) [5].

## 2. Materials and Methods

The experiment was conducted in late kharif 2024 at HRS Lam in Guntur on an open field. Seeds of chilli were raised in the nursery bed for 60 days and then transplanted to main field with a plant spacing of 75×30 cm. Before transplanting the seedling were root dipped in the Bavistin 0.1% solution to prevent the initial pathogen attack to the seedling. Every suggested agronomic technique, including fertilizer application, irrigation, weeding, and hoeing, was followed on a regular basis.

### 2.1 Recording the pest count

After observing the occurrence of thrips, observations of the thrips living in the flowers were made during the 50% and peak flowering stages, as well as in the chilli crop. Ten healthy plants were chosen at random from each genotype and tagged to record the pest incidence.

#### 2.1.1 Collection of thrips from each genotype

By carefully tapping ten flowers from each plant in zip-lock polythene bags, the thrips species that feed on the chilli flowers were gathered and labelled for laboratory identification.

#### 2.1.2 Counting of thrips from chilli flowers

After collecting thrips in a zip-lock polythene cover, the thrips were taken to the lab and immobilized for ten minutes at 4°C in a refrigerator before counted by using a paintbrush to remove each thrip individually and then discarding them in water.

### 2.2 Weather parameters used in the study

The Regional Agricultural Research Station (RARS) weather station at Lam, Guntur, is where the meteorological data was collected. Wind speed (W.S) (km/hr), evaporation (E-pan) (mm), rainfall (R.F), mean temperature (T. mean), morning relative humidity (RH I), evening relative humidity (RH II), and maximum temperature (T. max) were among the weather parameters that were collected and utilized in the study.

### 2.3 Statistical analysis

Simple correlation coefficients were calculated between the mean thrips population and observatory weather data to determine the impact of different weather conditions on the population. The resulting correlation coefficients were examined at the 5% levels of significance.

## 3. Results and Discussion

Population dynamics of thrips were recorded from flowers at weekly intervals during the crop growth period to find out the role of weather parameters on thrips population. Correlation coefficients were worked out between these parameters and the results pertaining to the studies are presented in Tables 1 and 2.

### 3.1 Seasonal incidence of chilli thrips

#### 3.1.1 Initial Thrips Population in January

The thrips population was very low at the start of the monitoring period, with an average value of 0.3 observed during the early days of January. This suggests that either the pest population was still in its early stages of infestation or that environmental factors (such as temperature or humidity) were not yet conducive to thrips proliferation at this time.

#### 3.1.2 Gradual Increase in Thrips Population

From the third week of January onward, there was a notable increase in the thrips population, with the mean value rising to 2.31. This gradual increase indicates that favorable conditions (likely temperature, humidity, or the presence of suitable host plants) were beginning to support the development and reproduction of thrips.

The population continued to rise and peaked in the first week of March, reaching a mean value of 31.09. This suggests a period of rapid population growth, possibly due to optimal environmental conditions such as warmer temperatures, increased food availability, or minimal predation that allowed thrips to thrive and reproduce more effectively.

#### 3.1.3 Slow Decrease in Population

After reaching its peak in early March, the thrips population began to slowly decline. By the second week of March, the population decreased to 22.21, and by the second week of April, it had further declined to 10.57. This reduction in population could be attributed to a variety of factors, including:

- **Abiotic factors:** Changes in temperature, humidity, or wind conditions that became less favourable for thrips.
- **Biotic factors:** Natural predators (such as other insects or birds), diseases, or competition for resources could have contributed to the decline in thrips numbers.
- **Plant defenses:** As the host plants matured, they may have developed defence mechanisms (such as increased chemical defenses) that made the environment less hospitable for thrips.These parametric data were presented in Table 1.

### 3.2 Relation of weather parameters with thrips population on flowers

The correlation coefficient studies' findings were presented in Table 2. The study found a significant negative correlation between thrips population and relative humidity. Specifically, there was a stronger negative correlation with morning relative humidity (-0.673) and a weaker correlation with evening relative humidity (-0.372). This means that as the relative humidity increases, the thrips population tends to decrease. This could be due to thrips' preference for dry conditions; higher humidity could either reduce their survival or impact their reproductive cycle. This finding aligns with previous studies, such as those by Pathipati *et al*. (2014) [6] and Borgohain *et al*. (2024) [12], which also reported similar negative correlations with relative humidity.

The study found a positive correlation between thrips population and temperature variables (i.e., mean temperature, maximum temperature, and minimum temperature), though the correlation was not statistically significant. This suggests that while higher temperatures might support the growth and reproduction of thrips to some extent, the effect might not be as strong or direct as initially expected. Previous studies like Samanta *et al.* (2017) [7], Seervi *et al.* (2024) [10] and Archunan *et al.* (2024) [12] also observed a positive correlation between temperature and thrips populations, indicating that thrips might be more abundant in warmer climates, where they can reproduce more quickly.

A negative correlation was observed between wind speed and the thrips population, meaning that stronger winds could potentially reduce thrips numbers. However, this correlation was not statistically significant, suggesting that while wind might affect thrips dispersal or survival, and it may not be a strong enough factor to significantly influence population dynamics. Lakshmi *et al.* (2024) [9] also observed a negative relationship between wind speed and thrips populations, which could be due to winds physically displacing thrips or making it more difficult for them to find suitable plants.

The correlation between sunshine hours and thrips population was found to be positive, meaning that more sunshine hours could potentially lead to higher thrips numbers. This might be because thrips, like many insects, thrive in sunny, warm conditions, which support their activity and reproduction. This observation is consistent with the findings of Patel *et al.* (2009) [8], who reported a positive correlation between sunshine and thrips activity.

The study also examined evaporation content (a proxy for water loss from the environment) but found it to have a positive but non-significant correlation with thrips populations. While evaporation could indirectly affect plant water stress and the conditions for pest development, the relationship may not be strong enough to show a significant statistical effect in this study.

The findings, particularly the negative correlation with relative humidity and the positive correlation with temperature, can help in the development of weather-based pest prediction models. By incorporating weather variables like temperature, humidity, and sunshine hours, these models could predict thrips outbreaks more accurately, enabling timely interventions and pest control efforts. For example, pest management strategies could be adjusted based on expected weather conditions, such as applying pest control treatments before conditions become favorable for thrips proliferation.

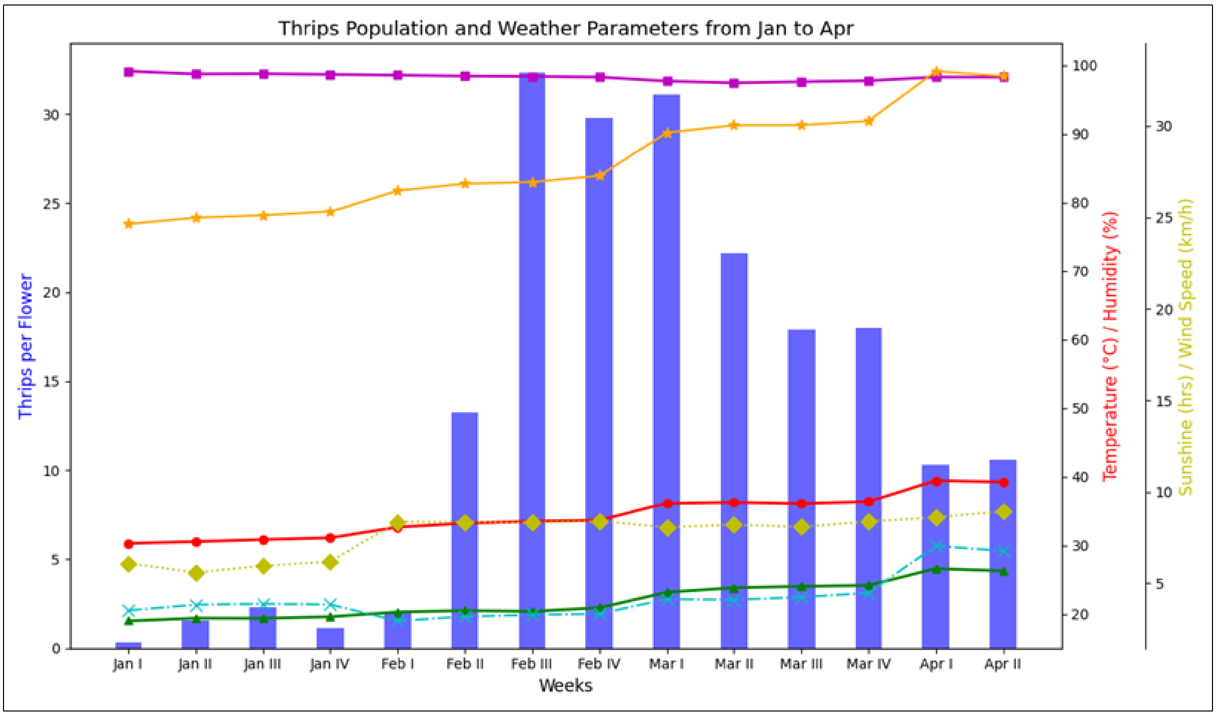


**Fig 1:** Graph depicting weather parameters and thrips population

**Table 1:** Incidence of Thrips parvispinus at different month and weeks

| DAT | Months and weeks | Thrips/flower | Temperature (ºC) | | R.H. (%) | | Sun-Shine | Wind Speed | Evaporation | Mean Temp. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Max. | Min. | I | II | (Hrs.) | (km/hr) | (mm) | (ºC) |
| 50 | Jan I week | 0.3 | 30.29 | 19.00 | 99.14 | 66.86 | 6.09 | 3.53 | 4.14 | 24.64 |
| 57 | Jan II week | 1.56 | 30.55 | 19.40 | 98.74 | 68.99 | 5.58 | 3.84 | 4.21 | 24.98 |
| 64 | Jan III week | 2.31 | 30.84 | 19.37 | 98.78 | 68.69 | 5.95 | 3.89 | 4.49 | 25.11 |
| 71 | Jan IV week | 1.14 | 31.10 | 19.61 | 98.67 | 68.63 | 6.21 | 3.85 | 4.70 | 25.32 |
| 78 | Feb I week | 2.04 | 32.64 | 20.29 | 98.57 | 65.86 | 8.36 | 2.96 | 6.00 | 26.47 |
| 85 | Feb II week | 13.25 | 33.21 | 20.49 | 98.44 | 65.66 | 8.36 | 3.20 | 6.60 | 26.85 |
| 92 | Feb III week | 32.34 | 33.49 | 20.38 | 98.39 | 65.98 | 8.33 | 3.29 | 7.03 | 26.94 |
| 99 | Feb IV week | 29.76 | 33.64 | 20.91 | 98.29 | 63.45 | 8.40 | 3.35 | 7.39 | 27.28 |
| 106 | Mar I week | 31.09 | 36.14 | 23.14 | 97.71 | 55.29 | 8.07 | 4.14 | 6.57 | 29.64 |
| 113 | Mar II week | 22.21 | 36.28 | 23.81 | 97.45 | 53.55 | 8.20 | 4.11 | 6.50 | 30.04 |
| 120 | Mar III week | 17.87 | 36.11 | 24.00 | 97.62 | 57.12 | 8.09 | 4.25 | 6.63 | 30.05 |
| 127 | Mar IV week | 17.99 | 36.39 | 24.15 | 97.77 | 57.66 | 8.38 | 4.48 | 6.85 | 30.27 |
| 134 | Apr I week | 10.31 | 39.43 | 26.57 | 98.29 | 51.14 | 8.61 | 7.06 | 7.71 | 33.00 |
| 140 | Apr II week | 10.57 | 39.23 | 26.24 | 98.29 | 48.28 | 8.93 | 6.78 | 8.11 | 32.73 |

**Table 2:** Correlation coefficient of thrips in flower with weather parameters in chilli

| Weather Parameters | Correlation Coefficients |
|---|---|
| Maximum Temperature | 0.438 |
| Minimum Temp | 0.322 |
| Morning Relative humidity I (RH I%) | -0.673** |
| Evening Relative Humidity II (RH II%) | -0.372** |
| Sunshine (hrs) | 0.617 |
| Wind speed (km/hr) | -0.065 |
| Evaporation E.Pan (mm) | 0.644 |
| Mean Temperature | 0.387 |

## 4. Conclusion
The study provides valuable insights into the environmental factors that influence thrips population dynamics and highlights how weather parameters like relative humidity, temperature, wind speed, and sunshine hours play key roles in regulating pest populations. The findings underscore the potential for weather-based prediction models in pest management, which could lead to more effective and timely control measures. Furthermore, the observed regional variation suggests that local factors such as ecological conditions, transplantation timing, and chilli variety should be considered when studying and managing thrips infestations in different areas.

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