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Population dynamics of new invasive black thrips (*Thrips parvispinus* KARNZ) infesting chilli under open field conditions

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Abstract
The present experiment was conducted during the summer season of 2024, in open field of farmer in the Kolhapur District (Maharashtra) with the objective to study the population dynamics of new invasive black thrips infesting chilli under open field conditions. The study revealed that population increased from 11 M.W. (2nd week of March). It was observed that peak population of thrips was recorded in the 19th M.W. (2st week of May), reaching 13.85 thrips/leaves at a temperature of 41.60°C and 76.4% relative humidity. Correlation analysis revealed a positive correlation of 0.478 with maximum temperature, 0.199 with bright sunshine hours, and negative correlations of -0.238 with minimum temperature, -0.497 with morning relative humidity, and -0.135 with evening relative humidity.

Keywords: *Thrips parvispinus,* chilli black thrips, population dynamics, invasive pest, weather correlation

1. Introduction

India is a significant producer of chilli (*Capsicum annuum* L.), a solanaceae family member, which was first grown in Central America, possibly in Mexico [1]. Chilli is a versatile crop, grown as both a spice and vegetable, and is cultivated in various agroclimatic conditions across India, including tropical, subtropical, and temperate regions [2]. The major chilli-producing states in India are Andhra Pradesh, Karnataka, Tamil Nadu, and Maharashtra, which together account for more than 75% of the country's total chilli-growing area [3]. Chillies are a fundamental component of Indian cuisine, serving as a versatile ingredient in various forms.

Insect pest infestations cause significant harm to crops and are a major contributor to the reduced quality and productivity of chilli. The crop is vulnerable to attacks from 55 insect pest species. Among them, *Thrips parvispinus* Karny, which belongs to the *Thrips orientalis* group [4], is a prevalent pest of quarantine concern, especially in Southeast Asia. This pest has been reported from Thailand to [5], and has been observed on papaya in Hawaii, *Gardenia* species in Greece, and various vegetable crops such as capsicum, green beans, potatoes, and brinjal in other regions [6]. In India, *T. parvispinus* was first recorded by [7] on papaya in Bangalore, and later found on several host plants, including *Brugmansia*, *Tagetes*, *Citrullus lanatus*, *Momordica charantia*, *Chrysanthemum*, *Gossypium*, *Mangifera indica*, *Tamarindus indica*, *Dahlia rosea*, and *Capsicum annuum* [8, 9].

The morphology of female and male *T. parvispinus* thrips exhibits distinct differences in size and coloration. Females measure approximately 1 mm in length, characterized by a brown head and prothorax, yellowish-brown meso- and metathorax, and a black abdomen, with dark forewings featuring light-colored bases. Notably, the third antennal segment and bases of the fourth and fifth segments display light-colored markings (yellow or white). In contrast, males are smaller, measuring 0.6 mm in length, with a uniform yellow coloration. The life cycle of *T. parvispinus* commences with egg insertion into leaves, followed by a 4-5 days incubation period. Nymph feed on leaves and flowers, undergoing two molts within 4-5 days, before maturing and pupating. The pupal stages span 2-3 days, culminating in a complete life cycle of 13-14 days. Reproduction is sexual, with females laying an average of 15 eggs, mated females survive for 9 days, while adult males have a lifespan of 6 days on chilli plants [10]. The present experiment was conducted during the summer season of 2024, in open field of farmer in the Kolhapur District (Maharashtra) with the objective to study the population dynamics of new invasive black thrips infesting chilli under open field conditions to add to the knowledge about the seasonal incidence of chilli black thrips under the sub-montane zone of Kolhapur.

2. Material and Methods

2.1 Experimental Site

The experiment was carried during summer season of 2024 on the farmer's field in Hatkanangale in Kolhapur district (Maharashtra) in the NARP sub-montane zone.

2.2 Soil Type

The selected field for the experiment was uniform, with sandy loam soil having medium fertility and fairly good drainage.

2.3 Climate and Location

Hatkanangale has subtropical climate and average rainfall 721 mm. It is situated on 616.27 meter (2021.89 ft.) above mean sea level. It lies between 16°46' N to 74°23' E latitude with the average annual temperature of 25 °C

2.4 Population dynamics of (*Thrips parvispinus* Karnz)

Observations were recorded from three leaves (top, middle, bottom), of five randomly selected plants from plot. Observations were recorded at weekly interval during 3 months period on selected chilli plants and the count was taken with the help of 10x magnifying lens. (Meena *et al.* 2017) from the first appearance of the pest.

2.5 Meteorological parameters

In order to study the effect of climatic condition on the incidence of pest, meteorological parameters *viz*., maximum (T max °C) and minimum temperature (T min °C), relative humidity 14 (RH_1 & RH_2) and bright sunshine hours BSH (hrs) in different meteorological weeks during the crop season were taken into account. The meteorological data were obtained from Skymet Weather Services Pvt. Ltd.

2.6 Analysis

In order to find out the specific impact of different weather parameters on black thrips (*Thrips parvispinus* Karnz) observations on thrips were correlated with the meteorological data like maximum (T max °C) and minimum temperature (T min °C), relative humidity (%), bright sunshine hours in different standard meteorological weeks during the crop season using OPSTAT.

3. Results and Discussion

Using thrips counts on five randomly chosen and tagged plants, the study examined the population dynamics of (*Thrips parvispinus* Karnz). Weekly observations were made from March 5, 2024, to August 3, 2024. Table 1 shows the number of thrips per leaf in an open chilli field together with the highest and minimum temperature, the relative humidity (RH^1 & RH_2) in the morning and afternoon, and the number of hours of bright sunshine. Furthermore, Table 2 presents connections between the incidence of *Thrips parvispinus* Karnz with meteorological parameters

Based on the observations, the infection started on March 12th with a density of 0.6 thrips per leaf at a temperature of 37.80°C and 84.26% relative humidity. The incidence of chilli thrips increased gradually between the 13th and the 19th meteorological week, or the 4th week of March to the 2nd week of May. At 41.60°C and 76.40% relative humidity, the highest infection level was recorded in the 19th week, with 13.85 thrips per leaf. Furthermore, the incidence was noteworthy in the 11th week, with 12.57 thrips per leaf at 39.29°C and 78.20% relative humidity. It was noted that high temperatures and more hours of sunshine were favourable for the growth of black thrips on chilli.

A positive correlation of 0.478 with maximum temperature, 0.199 with bright sunshine hours, and negative correlations of -0.238 for minimum temperature, -0.497 for morning relative humidity (RH_1), and -0.135 for evening relative humidity (RH_2) was calculated.

These results are consistent with the study conducted by Barot *et al.* [11], who also found a strong positive association between chilli thrips and the highest temperature. The finding that the thrips population favourably correlates with maximum temperature and negatively correlates with minimum temperature, morning, and evening relative humidity is also supported by research by Havanoor and Rafee [12] and Patel *et al.* [13].

The thrips population exhibited a substantial and negative association with rainfall, morning relative humidity, and evening relative humidity, according to studies by Jayewar, *et al.*, [14] The maximum temperature and the number of hours of bright sunshine showed a substantial and positive association. Lowest temperature and wind speed have a negative, non-significant relationship.

The prior research by Pathipati *et al.* [15], also found that the population of thrips exhibited positive correlations with maximum temperature and negative correlations with minimum temperature, relative humidity in the morning and evening, and rainfall, is consistent with the above findings.

Table 1: Population dynamics of black thrips (*Thrips parvispinus* Karnz) in relation to weather parameters recorded in open chilli field.

Week after transplanting (WAT)	Standard Meteorological Week (SMW)	No. of thrips /leaf	Temperature (°C)		Relative Humidity (%)		Bright Sunshine Hours (BSH)(Hrs)
			Maximum	Minimum	RH_1	RH_2	
1	10	0	35.60	24.91	88.76	36.00	3.14
2	11	0.2	37.80	27.12	84.26	34.24	5.70
3	12	0.96	40.20	26.14	80.59	38.60	5.90
4	13	1.32	36.12	24.25	84.89	38.40	8.40
5	14	2.35	39.60	21.69	71.83	38.73	9.70
6	15	4.07	37.46	25.28	70.07	37.80	8.30
7	16	5.95	40.44	24.46	76.54	38.60	6.00
8	17	7.88	38.14	23.70	51.19	37.20	7.20
9	18	9.68	40.12	26.18	58.00	36.80	6.00
10	19	13.85	41.60	24.12	76.40	35.40	8.40
11	20	12.57	39.29	23.74	78.20	36.42	6.00
12	21	9.04	37.41	24.59	52.39	38.13	7.60
13	22	5.91	35.43	23.77	64.00	40.20	9.30

(Weather Data Source-Skymet Weather Services Pvt. Ltd.)

Table 2: Relationship between black thrips (*Thrips parvispinus* Karnz) and weather parameters.

Sr. No.	Chilli pest	Temperature (°C)		Relative Humidity (%)		Bright Sunshine Hours (Hrs.)
		Maximum	Minimum	Morning	Evening	
1.	Black thrips	0.478 NS	-0.238 NS	-0.497 NS	-0.135 NS	0.199 NS

4. Conclusion
It was concluded that the black thrips population density increased with an increase in the maximum temperature and bright sunshine hours in the summer season in open field conditions in chilli. The correlation however was non-significant in the study period.

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