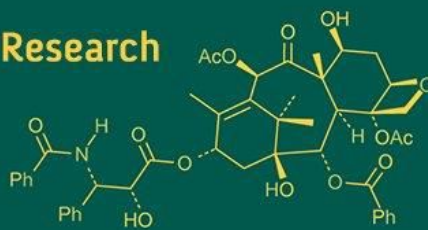


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Surendra Prasad
Department of Entomology
Post Graduate College of
Agriculture, Dr. Rajendra
Prasad Central Agricultural
University, Pusa, Samastipur,
Bihar, India

Swetalin Gouda
Department of Entomology
Post Graduate College of
Agriculture, Dr. Rajendra
Prasad Central Agricultural
University, Pusa, Samastipur,
Bihar, India

Corresponding Author:
Surendra Prasad
Department of Entomology
Post Graduate College of
Agriculture, Dr. Rajendra
Prasad Central Agricultural
University, Pusa, Samastipur,
Bihar, India

Population dynamics of natural enemies *Stethorus punctillum* on okra at Samastipur, Bihar

Surendra Prasad and Swetalin Gouda

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Abstract

Field experiment was conducted to study the population dynamic of natural enemies *Stethorus punctillum* on okra and its relation with different abiotic factors under field conditions during summer 2023 at Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar. The population of *Stethorus punctillum* in okra commenced from the first fortnight of March and reached its peak of 10.67/leaf on the first fortnight of June. There was a positive and significant correlation of the population of *Stethorus punctillum* with maximum temperature ($r = 0.591^*$) and minimum temperature ($r = 0.818^{**}$). Based on the calculation, the coefficient value (R^2) derived as 88.10% which suggests that of the fluctuations in the *Stethorus punctillum* population were attributed to the impact of abiotic factors.

Keywords: Correlation, okra, seasonal incidence, predatory mite

Introduction

Okra, *Abelmoschus esculentus* (L.) Moench (Family: Malvaceae), is one of the world's oldest, traditional cultivated vegetables. its cultivation occurs during both the summer and rainy seasons. It is commonly farmed as a summer crop in Northern India and is also prevalent as a winter crop in states like Gujarat, Andhra Pradesh, Karnataka, and Tamil Nadu. (Lal and Sinha, 2005) [7]. In India okra crop is cultivated in an area of 0.531 million hectares and its production is 6.47 million tons (Anonymous, 2020-21) [2].

The low yield of okra is attributed to the attack of different pests from sowing to harvesting. Recently, there has been a change in agricultural scenario and mites are becoming serious pests in most crops and okra is no exception. The spider mite, *Tetranychus urticae* Koch, poses a serious threat to okra crop particularly

during spring, summer and post rainy seasons. This crop is infested mainly by six different mite pest species, viz., *T. urticae*, *T. macfarlanei*, *T. ludeni*, *Brevipalpus phoenicis* (Gij.), *Polyphagotarsonemus latus* (Bank) and *Aceria lycopersici* (Wolff.), (Prasad and Singh, 2011) [9]. Out of these mite species, *T. urticae* is responsible for causing the loss of foliage of the crop plant resulting in a reduction of the economic yield of fruits ranging from 20-45% depending upon cropping season and agro-climatic conditions. *T. urticae* is well adapted to various environmental conditions, causing loss of quality and yield or death of plants by sucking out the contents of leaf cells (Mondel and Ara, 2006, Kumaran *et al.*, 2007) [8, 6].

Due to high reproductive potential and extremely short life cycle, combined with frequent acaricide applications this mite has developed resistance to almost all conventional pesticides in vogue (Chiasson *et al.*, 2004; Van Leeuwen *et al.*, 2005) [4, 10]. The *Stethorus punctillum* of family coccinellidae have great importance in biological control and have promising effect in regulating the phytophagous mites, if used judiciously as bio-control agents. Bio-agents are generally considered safer to the environment for controlling the pest (Gupta, 1985) [5]. Since the degree of incidence of *Stethorus punctillum* changes with the season, it is desirable to have a thorough understanding of the seasonal incidence of the mite, which will lead to the development of suitable management programs. Hence, an attempt was made to correlate the effect of weather factors on the incidence and population dynamics of the *Stethorus punctillum* in okra.

Materials and Methods

Field trials were conducted from the first fortnight of March 2023 to second fortnight of July during the *summer*, 2023 at the Vegetable Research plot of Dr Rajendra Prasad Central Agricultural University, Pusa, Bihar. Okra cultivar of the variety “Kashi Kranti” was sown on 3rd February 2023. The plot selected had uniform topography with well-drained sandy loam soil. The latitude, longitude and altitude of the place are 85.67° E 25.98° N and 52.92 m respectively. The climate in this region is hot dry summers with mild winters. Other climatic factors such as rainfall, temperature and humidity in this region are highly favourable for the growth of vegetables and other crops in all seasons with the proliferation of mites infesting a variety of crops.

A bulk-plot was raised to conduct research on the population fluctuation of *Stethorus punctillum* associated with okra. The crop was cultivated by following appropriate agricultural practices and managed without the application of any insecticide. The population of *Stethorus punctillum* was recorded at fortnight intervals. Five places were selected for each host and three leaves were plucked randomly from host plants for recording population. All the leaves were mixed, labeled, and brought to the laboratory of the Department of Entomology, Dr. Rajendra Prasad Central Agricultural University, Pusa, Bihar for counting the *Stethorus punctillum*. Care was taken to avoid disturbance to the natural population of mites on the leaf. All the mites were counted under a stereo binocular microscope. The whole population was recorded on per leaf and the mean population was recorded. The meteorological data were taken from the meteorological section, Dr Rajendra Prasad Central Agricultural University, Pusa, Bihar. After that, these abiotic parameters were correlated with the corresponding *Stethorus punctillum* population. For testing the significance of the simple correlation coefficient, the ‘t’ test was applied. The multiple regression coefficients and multiple correlation coefficients (R) of the *Stethorus punctillum* population in relation to abiotic factors were also computed. The significance of all the multiple correlation coefficients (R) was tested for their significance by applying the ‘F’ test. The value of the coefficient of determination (R²) was calculated to highlight the joint contribution of independent variables on *Stethorus punctillum* population.

Results and Discussion

Population fluctuation of *Stethorus punctillum* was recorded on okra at different months during 1st fortnight of March to 2nd fortnight of July in 2023 are presented in table 1 and figs 1. The *Stethorus punctillum* population started increasing from March 2nd fortnight and reached its peak during the summer months. Maximum population of mite was recorded

in the month of June 1st fortnight (10.67) during 2023 where the maximum, minimum temperature (°C), relative humidity (%) Maximum and Minimum, and rainfall (mm) were 40.26 °C, 23.88 °C, 71.66%, 34.20%, 0.00 mm and May 2nd fortnight (8.73) in 2023. The population of *Stethorus punctillum* gradually decreased from June 2nd fortnight in 2023 and July 1st fortnight in 2023 with decrease in temperature. Minimum incidence of *Stethorus punctillum* was recorded in the month of March 1st fortnight (0.73) in years 2023.

This findings are somehow similar with Adly (2023) [1] who noted *Stethorus punctillum* was introduced on two occasions, with a density of 0.5 individuals per square meter. There was a direct correlation between *S. punctillum* abundance and temperature, while relative humidity showed an inverse correlation. Across both seasons, the population of *Tetranychus urticae* dwindled gradually to complete absence on croton leaves within the controlled greenhouse. In contrast the population increased on croton leaf in the control greenhouse.

A simple correlation (r) was established between *Stethorus punctillum* population and weather parameters in okra (Table 2). It was observed that there was a positive and significant correlation with maximum temperature ($r = 0.591^*$) and minimum temperature ($r = 0.818^{**}$) and then it was observed that there is a negative and non-significant relation with maximum relative humidity ($r = -0.137^{NS}$), positive and non significant with minimum relative humidity ($r = 0.315^{NS}$) negative and non-significance with rainfall ($r = 0.315^{NS}$).

The regression equation for the data, with a population(Y) as the dependent variable and weather factors as the independent variables, was as follows a determined coefficient of determination and (R²) and regression model (Table 2):

X_1 = Maximum temperature, X_2 = Minimum temperature, X_3 = Maximum relative humidity, X_4 = Minimum relative humidity, X_5 = Rainfall.

Based on the calculation, the coefficient value (R²) derived as 88.10% which suggests that of the fluctuations in the *Stethorus punctillum* population were attributed to the impact of abiotic factors. In other words, R² value indicates that percent of variation in the *Stethorus punctillum* population were influenced by abiotic factors.

Our present study is supported by Chandrakumar *et al.*, 2008 [3], They observed Coccinellid density was significantly positively correlated with wind speed velocity (0.580), but negatively correlated with maximum temperature and rainfall (-0.641 and 0.776, respectively). Relative humidity was found to be non-significant and unrelated to the coccinellid density.

Table 1: Population dynamic of natural enemies *Stethorus punctillum* on okra during *summer* 2023

Fortnight Interval	*Mean population of <i>Stethorus punctillum</i> /leaf	Temperature (°C)		Relative humidity (%)		Total Rainfall (mm)
		Maximum	Minimum	Maximum	Minimum	
March-1 st	0.73	31.11	14.67	93.33	48.67	0.00
March- 2 nd	1.87	30.18	16.73	89.06	50.56	18.00
April-1 st	1.73	35.67	16.20	76.80	27.46	0.00
April-2 nd	4.33	35.80	20.73	71.06	34.27	0.00
May-1 st	6.00	35.71	19.93	75.07	37.20	1.40
May-2 nd	8.73	35.20	22.52	82.56	52.18	16.80
June-1 st	10.67	40.26	23.88	71.66	34.20	0.00
June-2 nd	8.80	36.27	25.36	86.20	55.20	92.60
July-1 st	7.67	33.22	19.70	89.20	50.40	59.40
July-2 nd	4.73	32.45	20.20	85.30	51.20	24.00

* Mean of 5 plants per plot, 3 leaves of each plant.

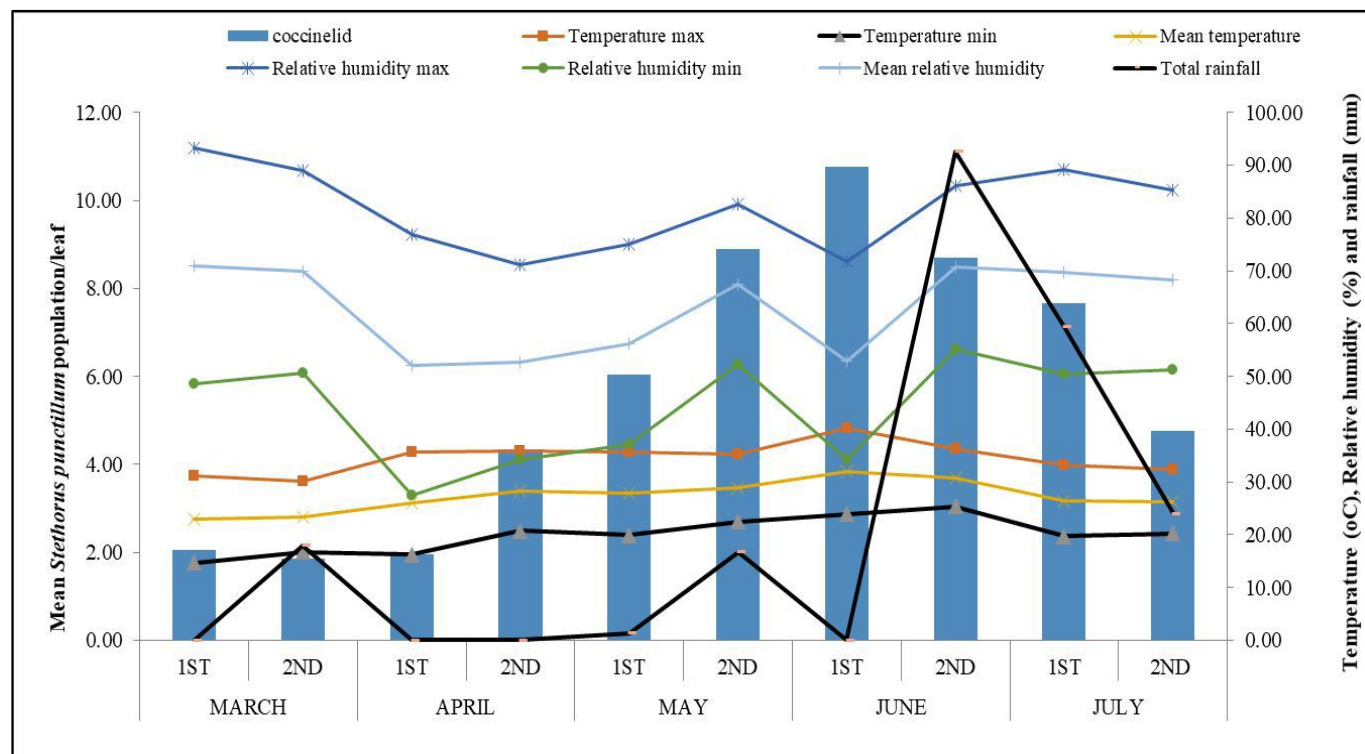


Fig 1: Influence of weather parameters on the population of *Stethorus punctillum* on okra crop during summer 2023

Table 2: Correlation coefficients and regression equation of *Stethorus punctillum* with weather parameters on okra crop during crop period 2023

Correlation Factor	Temperature (°C)		Relative humidity (%)		Rainfall
	Maximum	Minimum	Maximum 700 hr	Minimum 1400 hr	
<i>Stethorus punctillum</i>	0.591*	0.818**	-0.137 ^{NS}	0.315 ^{NS}	0.609 ^{NS}
Regression factor	Regression equation				Multiple R ² Value
<i>Stethorus punctillum</i>	Y = -24.44 + X ₁ (1.194) - X ₂ (0.378) - X ₃ (0.186) + X ₄ (0.226) + X ₅ (0.048)				0.9387
					R ² Value
					0.881

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

X₁ - Maximum temperature, X₂ - Minimum Temperature, X₃ - Relative humidity max., X₄ - Relative humidity min., X₅ - Rainfall, R² - Coefficient of Determination

Conclusion

The population of *Stethorus punctillum* was the highest during the 1st fortnight of June 2023. There was a positive significant correlation of the *Stethorus punctillum* population with maximum temperature and minimum temperature.

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