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Seasonal dynamics of thrips, *T. tabaci* and fruit flies, *B. cucurbitae* on cucumber

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Abstract
An experiment entitled "Seasonal dynamics of thrips, *T. tabaci* and fruit flies, *B. cucurbitae* on cucumber" was conducted at PG Research Farm, Department of Agricultural Entomology, Mahatma Phule Krishi Vidyapeeth, Rahuri during *summer* 2022. Studies on seasonal dynamics revealed that, thrips incidence started from 6th meteorological week (0.34 thrips/plant) and lasted upto the harvesting of the crop i.e. 19th standard meteorological week (1.3 thrips/plant). Thrips population ranged from 0.34 thrips/plant to 15.22 thrips/plant during the crop growth period. Highest population of thrips was found in last week of March i.e. 17th standard meteorological week (15.22 thrips/plant). The fruit fly incidence started from 6th standard meteorological week (3 fruit flies/trap) and lasted upto the harvesting of the crop i.e. 19th standard meteorological week (5 fruit flies/trap). Fruit fly population ranged from 3 fruit flies/trap to 24 fruit flies/trap during the crop growth period. The population of fruit flies then gradually increased up to the 14th standard meteorological week i.e. first week of April (24 fruit flies/trap) which was found to be the highest trap catches during whole experimental trail.

Keywords: Cucumber, thrips, fruit fly, seasonal incidence

Introduction
In India, vegetables have occupied the important place in human diet. Among different vegetables Cucumber (*Cucumis sativus*) belonging to Cucurbitaceae family is an important annual vegetable crop widely cultivated round the year in India. The attack of insect pests is one of the significant factors limiting cucumber cultivation, they damage the crop by sucking cell sap and devitalise the plant. Thrips and fruit fly are one of the major and devastating pests of cucumber which causes heavy nuisance to the crop quality as well as yield. Thrips (*Thrips Tabaci* L.) are considered as one of the most devastating pests of cucumber due to its direct feeding habit which leads to damage plant parts such as foliage and flower. (Lall and Singh, 1968) [3]. Another important pest of cucumber is fruit fly, *Bactrocera cucurbitae* belongs to Tephritidae family. It is one of the largest, most diversified and fascinating acalypterate families of order Diptera which includes more than 4200 known species of true flies arranged in 471 genera (Norrbom *et al.*, 1998) [6]. Due to lot of variations in the agro climatic conditions of different regions, the nature and damage caused by these harmful pests varies. Environmental factors play a vital role in determining the seasonal incidence and damage caused by the insects pests. Hence it is important to study the influence of various abiotic factors which affect the population fluctuation of thrips and fruit flies on cucumber crop. These studies would give an idea about the peak period of their activity which in turn may be useful in developing better pest management strategies.

Materials and Methods
In order to study the seasonal dynamics of thrips and fruit flies in cucumber, an experiment was carried out during *summer* 2022 at PG Research Farm, Department of Agril. Entomology, MPKV, Rahuri. The crop was sown in 100 m^2 with the spacing of 1.5 x 0.5 m. Observations on number of thrips were recorded from five randomly selected and tagged plants. Total number of thrips were recorded from three leaves of each selected and tagged plant. The observations were recorded at weekly interval starting from first appearance of pest and continued till harvest of the crop. In case of fruit fly observation was carried out by installing pheromone traps (Cue-lure traps). Number of adult flies trapped were recorded from each trap. The observations were recorded at weekly interval.

Observations on Meteorological Parameters

Different meteorological parameters like maximum and minimum temperature (ºC), relative humidity at morning and evening (%), sunshine period (hr) and rainfall (mm) were taken into account to workout correlation study. Data on meteorological parameters were obtained from the meteorological observatory located at Central Campus, MPKV, Rahuri. Then correlation coefficient between various climatic factors and incidence of thrips and fruit flies was worked out by using standard statistical procedure (Steel and Torrie, 1980) [9]

Results and Discussion

1. Seasonal Incidence of thrips, *T. tabaci* on cucumber

Standard meteorological week wise data on incidence of thrips during *summer* 2022 is presented in Table 1.

From the data, it was observed that, thrips incidence started from 6th meteorological week (0.34 thrips/plant) and lasted upto the harvesting of the crop i.e. 19th standard meteorological week (1.33 thrips/plant). Thrips population ranged from 0.34 thrips/plant to 15.22 thrips/plant during the crop growth period. Minimum population of thrips was noticed in the 6th standard meteorological week i.e. 2nd week of February, which may be due to less influence of abiotic factors. Afterwards, population of thrips gradually increased upto the 13th standard meteorological week i.e. last week of March (8.45 thrips/plant) and reached to its peak (15.22 thrips/plant) during the 17th standard meteorological week i.e. 4th week of April. In these period, maximum and minimum temperature, morning and evening relative humidity, bright sunshine hours and rainfall were 39.4 and 27.5 ºC, 45 and 17%, 8.7 hr./day and 0.0 mm respectively.

Results of the present finding are in close conformity with Kumawat *et al*. (2018) [2] who noticed maximum population of thrips in 13th standard meteorological week. Similarly, the results of present finding on seasonal incidence of thrips are corroborated with the finding of Vinuthan *et al*. (2018) [10] and supported results of the present study.

2. Seasonal incidence of fruit fly, *B. cucurbitae* on cucumber

Standard meteorological week wise data on incidence of fruit fly during *summer* 2022 is presented in Table 1.

From the data, it was observed that, fruit fly incidence started from 6th standard meteorological week (3 fruit flies/trap) and lasted up to the harvesting of the crop i.e. 19th standard meteorological week (5 fruit flies/trap). Fruit fly population ranged from 3 fruit flies/trap to 24 fruit flies/trap during the crop growth period. Minimum population of fruit flies was noticed in the 6th standard meteorological week i.e. 2nd week of February, which may be due to less influence of abiotic factors. Afterwards, population of fruit flies gradually increased up to the 14th standard meteorological week i.e. first week of April (24 fruit flies/trap) which was found to be the highest trap catches during whole experimental trail. In these period, maximum and minimum temperature, morning and evening relative humidity, bright sunshine hours and rainfall were 39.7 and 23.4 ºC, 52 and 12%, 9.4 hr./day and 0.0 mm respectively.

Results of the present finding are in close conformity with Abhilash *et al.* (2017) [1] who noticed maximum population of fruit fly in 9th standard meteorological week. Similarly, the results of present finding on seasonal incidence of fruit fly are corroborated with the finding of Laskar and Chatterjee (2010) [4] and supported results of the present study.

3. Correlation studies of thrips, *T. tabaci* with weather parameters

The data pertaining to correlation between incidence of thrips with weather parameters is presented in Table 2. Significant positive correlation was noticed between incidence of thrips and maximum temperature (r = 0.636*) and minimum temperature (r = 0.649*). However, highly significant negative correlation was noticed between thrips incidence with morning relative humidity (r = -0.665**) as well as evening relative humidity (r = -0.700**). The correlation coefficient showed non-significant positive relation between thrips population and bright sunshine hours (r = 0.070^{NS}) whereas, non-significant negative correlation was noticed between thrips population and rainfall (r = -0.001^{NS}).

According to Vinuthan *et al.* (2018) [10] increased thrips population was associated with periods of low rainfall, low relative humidity and high temperature. Soni and Dhakad (2016) [8] reported that cotton thrips had a significant positive correlation with maximum temperature and significant negative correlation with rainfall, whereas minimum temperature, morning and evening relative humidity exhibited non-significant positive correlation. All of these investigations are consistent with the present findings of these investigations are consistent with the present findings.

4. Correlation studies of fruit flies, *B. cucurbitae* with weather parameters

The data pertaining to correlation between incidence of fruit flies with weather parameters is presented in Table 2. Significant positive correlation was noticed between incidence of fruit flies and maximum temperature (r = 0.618*) and non-significant correlation with minimum temperature (r = 0.504^{NS}). However, significant negative correlation was found between fruit fly incidence and morning relative humidity (r =-0.554*) and highly significant negative correlation was found between fruit fly incidence and evening relative humidity (r = -0.784**). The correlation coefficient showed non-significant positive correlation between fruit fly population and bright sunshine hours (r = 0.111^{NS}) whereas, non-significant negative correlation was found between fruit fly population and rainfall (r = -0.094^{NS}).

According to Nahid *et al*. (2020) [5] increased fruit fly population was associated with periods of daily mean temperature, low rainfall, low relative humidity. Raghuvanshi *et al*. (2012) [7] reported that fruit fly adult abundance had a significant positive correlation with temperature (maximum and minimum) while relative humidity (morning and evening) had non-significant negative correlation with fruit fly population.

Table 1: Seasonal dynamics of thrips, *T. tabaci* and fruit fly, *B. cucurbitae* on cucumber during summer 2022

S. M. W.	Number of thrips/plant	Number of fruit flies/trap/week	Temperature (ºC)		Relative Humidity (%)		Bright Sunshine hour (hr/day)	Rainfall (mm)
			Max.	Min.	Morning	Evening		
6	0.34	3	27.3	13.2	81	33	9.6	0.0
7	2.66	6	29.2	14.4	80	30	9.5	0.0
8	3.65	8	33.0	16.1	73	23	9.7	0.0
9	3.92	9	33.1	18.1	55	21	9.0	0.0
10	5.12	8	32.0	19.7	73	30	7.0	0.0
11	6.71	10	35.7	21.1	59	18	9.0	2.4
12	7.9	12	37.6	22.5	55	16	7.1	0.0
13	8.45	18	38.2	22.3	55	14	9.0	0.0
14	8.12	24	39.7	23.4	52	12	9.4	0.0
15	10.11	22	38.4	24.5	59	17	8.6	0.0
16	12.01	19	38.3	24.4	52	16	9.2	0.0
17	15.22	16	39.4	27.5	45	17	8.7	0.0
18	8.77	10	39.9	26.4	50	17	10.2	0.0
19	1.33	5	40.9	28.1	50	21	7.0	0.0

Table 2: Correlation of weather parameters with number of thrips/plant and fruit flies/trap/week during summer 2022

Weather parameters	Correlation coefficient values	
	Mean no. of thrips	Fruit fly catches
Maximum temperature (°C)	0.636*	0.618*
Minimum temperature (°C)	0.649*	0.504^{NS}
Morning relative humidity (%)	-0.665**	-0.554*
Evening relative humidity (%)	-0.700**	-0.784**
Sunshine hours (hr)	0.070^{NS}	0.111^{NS}
Rainfall (mm)	-0.001^{NS}	-0.094^{NS}
*5% level of significance df = 0.533 (Table value)		
**1% level of significance df = 0.661 (Table value)		

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