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Influence of abiotic factors on relative abundance of fruit flies (Diptera: Tephritidae) infesting cucumber

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Abstract

The present study was carried out on influence of abiotic factors on relative abundance of fruit flies (Diptera: Tephritidae) infesting cucumber during *khariif* season of 2017 at Central Experimental Station, Wakawali, Dist. Ratnagiri. The study on seasonal incidence of fruit flies infesting cucumber revealed that there were marked differences in infestation of fruit flies. The initiation of fruit flies infestation was started after fruit setting in the last week of July (30th SMW). Minimum per cent fruit flies infestation (35.71 ± 36.91) was recorded in 34th SMW (20-26 August), while maximum (100.00 ± 36.91) per cent infestation was recorded during 30th SMW (23-29 July) and 31st SMW (30 July- 05 August). The data on correlation between fruit flies with different meteorological parameters showed that the various meteorological parameters were found to be non-significant.

Keywords: Seasonal incidence, weather parameters, correlation, fruit flies, etc.

Introduction

Cucumber (*Cucumis sativus* L.) belongs to family cucurbitaceae which is used as vegetable crop while its fruits are used for pickle or salad purpose in India. Cucumber provides protein (1%), carbohydrates (1%), potassium (4%), vitamin C (4%) and small amount of iron, calcium, magnesium and vitamin A (Szalay, 2017) [7].

India is the second largest producer of vegetables in the world, next to China, by producing around 171.8 million tonnes of vegetables annually from an area of around 10.1 million hectares. Maharashtra produced vegetables with an annual production of 103.60 lakh tonnes from an area of 6.93 lakh ha (Anon., 2017) [1]. Cucumber has been reported as a commercial cash crop in tropical and sub-tropical parts of India with an annual production of 1.14 million tonnes from an area of 78 thousand hectares and productivity is 15 tonnes per hectare (Anon., 2017) [1].

Cucurbits are attacked by several pests which affect the quality and quantity of produce adversely. Most of the insect-pests cause damage at any stage of plant growth, but some of them are serious at seedling stage *viz.*, red pumpkin beetle, leaf miner, flea beetle, while fruit fly appears at fruiting stage (at crop maturity) (Ram *et al.*, 2009) [6].

Fruit fly belonging to family Tephritidae, order Diptera is the most important pest of cucurbitaceous crops. These are mostly dominant in tropical and sub-tropical areas. Presently, there are 199 species of fruit flies known to occur in India (Chaudhary and Patel, 2012) [2]. The extent of damage due to fruit flies varies between 30 to 100 per cent depending upon the season and susceptibility of the crops species and varieties. It prefers to infest young, soft skinned ovaries even before anthesis. When the humidity is high, intensity of cucurbit fruit fly damage becomes severe. Its abundance increases with increase in daily temperatures, however higher than 31 °C is harmful for fruit fly growth and reproduction (Dhillion *et al.*, 2005) [3]. Damage caused by cucurbit pests depends mostly on the prevailing climatic conditions and the diversity of hosts in a particular agro ecosystem. Therefore, it is necessary to study the seasonal incidence of the pest species which helps in determining appropriate time of action and suitable method of management (Vignesh and Viraktamath, 2015) [8]. Though the crop is economically important, the information on the fruit flies and seasonal incidence and its correlation to weather factors are very much lacking particularly in Konkan region in Maharashtra. Hence, the present investigations were undertaken on influence of abiotic factors on relative abundance of fruit flies (Diptera: Tephritidae) infesting cucumber.

Materials and methods

The field experiment was carried out at Central Experiment Station, Wakawali, from June 2017 to September 2017. The details of experiment are given in below.

Details of the field experiment

1	Size of plot	:	10 m x 10 m (100 m ²)
2	Method of planting	:	On small hills
3	Spacing	:	1.50 m × 0.50 m
4	Cultivar	:	Sheetal
5	Date of sowing	:	12 th June, 2017

Method of recording observations

The experimental plot was kept unsprayed throughout the crop season. The observations were recorded as soon as the incidence is noticed. Twenty vines were selected randomly and marked permanently to record the observations. The observations were recorded at weekly interval throughout the crop season. The damaged and healthy fruits were recorded at each picking for recording fruit infestation by fruit flies by following formula. The mean per cent infestation was taken and standard deviation was worked out.

$$\text{Percent fruit infestation} = \frac{\text{No. of infested fruits}}{\text{Total no. of fruits}} \times 100$$

Table 1: Mean per cent infestation of fruit flies infesting cucumber in relation to weather parameters

SMW No.	Date of week	Temperature (°C)		Relative humidity (%)		BSS*	Rainfall (mm)	Mean percent Infestation
		Tmax	Tmin	RH I	RH II			
26	25/06/17-01/07/17	29.46	24.09	95.86	92.71	0.59	577.6	0
27	02/07/17-08/07/17	29.67	23.87	94.71	80.43	4.09	244.6	0
28	09/07/17- 15/07/17	28.44	23.71	95.14	82.86	2.26	161.3	0
29	16/07/17- 22/07/17	27.51	23.74	94.43	92.86	0.82	516.9	0
30	23/07/17- 29/07/17	28.69	24.31	94.86	86.86	1.06	138.6	100
31	30/07/17- 05/08/17	29.54	23.83	97.00	85.57	4.23	116.8	100
32	06/08/17- 12/08/17	29.54	24.00	96.14	82.14	2.81	113.1	39.68
33	13/08/17- 19/08/17	29.83	23.97	96.43	80.43	2.87	43.2	37.27
34	20/08/17- 26/08/17	29.6	23.51	97.57	85.29	3.01	151.6	35.71
35	27/08/17-02/09/17	29.06	23.54	97.00	94.8	2.70	246.3	56.52
36	03/09/17- 09/09/17	31.31	23.43	98.16	93.82	4.35	71.6	60.00
37	10/09/17- 16/09/17	31.35	24.2	97.14	84.18	3.32	97.3	66.67
SD								± 36.91

*Bright Sun Shine Hours

Correlation between mean per cent fruit infestation of fruit flies infesting cucumber and weather parameters

Data on correlation coefficient of mean infestation of fruit flies in relation to different weather parameters are presented in Table 2.

Table 2: Correlation coefficient of mean per cent fruit infestation of fruit flies infesting cucumber in relation to different weather parameters

Climatic parameters	Correlation coefficient (r)
Maximum temperature (T _{max})	-0.189
Minimum temperature (T _{min})	0.392
Morning relative humidity (RH I)	-0.356
Evening relative humidity (RH II)	0.199
Bright Sun Shine Hours (BSS)	-0.104
Rainfall	0.100
*Significant at 5 per cent level	r= 0.666

The observations of fruit fly infesting cucumber were recorded at weekly interval as per standard meteorological week. Data on incidence of pest infesting cucumber and different weather parameters were correlated.

Results and Discussion

Seasonal incidence of fruit flies infesting cucumber

The data on seasonal incidence of fruit flies infesting cucumber are presented in Table 1.

The initiation of fruit flies infestation was started after fruit setting in the last week of July (30th SMW). During cropping season, the infestation varied from 35.71 to 100.00 per cent on number basis. Minimum per cent fruit flies infestation (35.71 ± 36.91) was recorded in 34th SMW (20-26 August), while maximum (100.00 ± 36.91) per cent infestation was recorded during 30th SMW (23-29 July) and 31st SMW (30 July-05 August). It was evident from the results that fruit flies infestation started with peak (100.00%) during the 30th SMW (23-29 July) and 31st SMW (30 July-05 August) further declined (35.71%) up to the 34th SMW (20-26 August) and again infestation increased till harvest.

The present results are strongly supported by Mwatawala *et al.* (2010) [5]. They reported that the incidence of melon fruit fly during October 2004 to October 2006 and noticed that the population reached a peak between July to September. Highly preferred cucurbit hosts were cucumber, melon and watermelon.

During the cropping season, data on correlation between mean per cent infestation of fruit flies and different meteorological parameters showed that the various meteorological parameters *viz.*, maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, Bright Sunshine Hours (BSS) and rainfall were found to be non-significant. The minimum temperature, evening relative humidity and rainfall had a positive correlation with infestation of fruit flies (r = 0.392, 0.199 and 0.100, respectively). While, maximum temperature, morning relative humidity and Bright Sunshine hours (BSS) had negative correlation with fruit flies infestation (r = -0.189, -0.356 and -0.104, respectively).

The present findings are more or less in conformity with the results of Kate *et al.* (2009) [4]. They revealed that the maximum and minimum temperature had positive correlation with infestation to fruits (r = 0.6667 and 0.3798, respectively). While, morning relative humidity had positive correlation (r= 0.2160) and evening relative humidity had negative correlation (r= -0.1738) with fruit infestation.

Conclusion

From the present investigation, it can be concluded that the initiation of fruit flies infestation was started after fruit setting in the last week of July (30th SMW). Minimum per cent fruit flies infestation (35.71 ± 36.91) was recorded in 34th SMW (20-26 August), while maximum (100.00 ± 36.91) per cent infestation was recorded during 30th SMW (23-29 July) and 31st SMW (30 July-05 August). Fruit flies infestation started with peak (100.00%) during the 30th SMW (23-29 July) and 31st SMW (30 July-05 August) further declined (35.71%) up to the 34th SMW (20-26 August) and again infestation increased till harvest. The minimum temperature, evening relative humidity and rainfall had a positive correlation with infestation of fruit flies ($r = 0.392, 0.199$ and 0.100 , respectively). While, maximum temperature, morning relative humidity and Bright Sunshine hours (BSS) had negative correlation with fruit flies infestation ($r = -0.189, -0.356$ and -0.104 , respectively).

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