

## Original Research Article

### Seasonal occurrence of melon fruit flies (*Zeugodacus cucurbitae* Coq.) and its natural enemies on Bitter gourd

#### ABSTRACT

**Aim:** To study the seasonal occurrence of cucurbit melon fly and correlation study with weather parameters to know impact of abiotic environmental factors on activity of melon fruit fly with respect to infesting the fruits of bitter gourd in crop ecosystem.

**Place and duration of study:** College of Agriculture, VNMKV Parbhani, Maharashtra. Studies during two seasons *Rainy* and *Summer* 2021 and 2022 respectively.

**Methodology:** The experimental plot was kept unsprayed throughout the crop season. The observation has been recorded as soon as the incidence was noticed from five randomly selected plants at weekly interval. The observations of fruit flies were recorded from day of fruit formation to till last picking of the fruit. The damaged and healthy fruits were recorded at each picking for knowing per cent fruit infestation by fruit fly.

**Results:** Fruit fly was the major pest of bitter gourd in fruit damaging. The fruit damage record range was 15.65 to 59.33 per cent in *Rainy* season whereas, 28.99 to 61.14 per cent in *summer* season. The per cent fruit infestation shows significant and positive correlation with no. of maggots per fruit ( $r = 0.857$  and  $0.905$ ) during both seasons respectively. Weather parameters like morning relative humidity (MRH) and rainfall during rainy season shows significant and positive correlation ( $r = 0.87$  and  $r = 0.71$  respectively) whereas, during summer season significant and positive correlation ( $r = 0.77$ ) with MRH and significant and negatively correlated with ( $r = -0.66$ ) minimum temperature. The record of larval pupal parasitoid *Psytalia fletcheri* (Silvestri) and it was discovered that 16% of the population was parasitized during experimental period.

**Conclusion:** The infestation may vary from season to season, region to region and with respect to variety also. Here the infestation range was more during summer season may be because of coincidence with fruit season of mango in that area.

**Keywords:** Melon fruit fly, Bitter gourd, Weather parameters, Rainy, Summer, correlation

#### 1. Introduction

Melon fly is a serious pest of vegetable crops, especially cucurbits such as melon, pumpkin, squash, zucchini and cucumber. It damages over 81 plant species, but plants belonging to the family Cucurbitaceae are preferred most (Allwood *et al.* 1999). As one of the most serious, even though enough

research has been done so far in India, there is still very little information accessible for melon fly. Moreover, due to regional variations in meteorological circumstances, the seasonal incidence of any pest may vary from place to place.

Fruit flies use a wide spectrum of hosts, from severe monophagy to extreme polyphagy. Some tephritid species, particularly those of the subfamilies Dacinae and Trypetinae, have frugivorous larvae that feed on the fruit pulp of both cultivated and wild plants, giving rise to their common name of "fruit flies." Larvae of remaining species feed on stems, shoots and flowers (Christenson and Foote, 1960). It infests more than 125 species of plants, including cucurbits, tomatoes, and many other vegetables, have been recorded as hosts of the melon fly. Preferred hosts include: cantaloupe, cowpea, cucumber, gourd, pumpkin, squash, string bean, tomato and watermelon. Occasional hosts include: eggplant, fig, mango, orange, papaya and peach. Wild hosts include: balsam apple; Chinese cucumber, *Momordica spp.*; colocynth; two genera of cucurbits-*Sicyos sp.*; *Cucumis trigonus*; *Diplocyclospalmatus*; and passion-flower, *Passiflora spp.* However, White and Elson-Harris (1994) claim that a lot of these reports might have been based on haphazard observations of adults trapped in traps placed on non-host trees or resting on plants.

As this pest is polyphagous in nature it may cause significant economic losses, which can be range from 30% to 100% depending on the crop and season (Dhillon *et al.* 2005). Now a day's *Z. cucurbitae* has become threat to the intensive agriculture. Therefore, the purpose of the current proposal was to consider the seasonal occurrence of *Z. cucurbitae* and to investigate the impact of meteorological parameters on the population dynamics of the bitter gourd crop pests in order to forecast the most effective management strategies with respect to both space and time for this pest.

## 2. Materials and Methods:

The experiment was conducted during *Rainy 2020-21* and *Summer 2021-22* at Experimental Farm of Department of Agricultural Entomology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani Maharashtra. To study the population dynamics of fruit fly the experimental plot was kept unsprayed throughout the crop season. The observation has been recorded as soon as the incidence was noticed from five randomly selected plants at weekly interval.

The observations of fruit flies were recorded from day of fruit formation to till last picking of the fruit. The damaged and healthy fruits were recorded at each picking for recording fruit infestation by fruit flies by following formula. The mean percent fruit infestation was taken and standard deviation has been worked out.

$$\text{Percent Fruit infestation} = \frac{\text{Number of infested fruits}}{\text{Total number of Fruits}} \times 100$$

The fruit infestation subjected to correlation and multiple regression with weather parameters like maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, rainfall, wind velocity, number of rainy days, sunshine hours. The weather data was collected from observatory of Department of Agricultural Meteorology, Vasant Rao Naik Marathwada Krishi Vidyapeeth, Parbhani.

### **3. Results and Discussion:**

#### **3.1 Fruit fly infestation during *Rainy* 2021**

The per cent fruit infestations during *Rainy* shows that (Table.1) the per cent fruit infestation varies from 15.65 to 59.33 per cent with mean 41.23 per cent of fruit infestation on number basis whereas, on weight basis the per cent fruit infestation during this season vary 12.41 to 65.00 per cent with mean 12.41 to 65.00 per cent fruit infestation. The number of maggots count per fruit was varies from 4.49 to 21.00 maggots per fruit with mean 11.96 number of maggots per fruit

##### **3.1.1 The correlation study between fruit infestation and maggots count with weather parameters**

The correlation studies with weather parameters (Table 2) and Fig.1. shows that the significant and positive correlation existed between per cent fruit infestation (on number basis) and morning relative humidity. While, non significant and positive correlation with maximum temperature, minimum temperature, evening relative humidity, rainfall and Rainy days  $r = 0.21$ ,  $r = 0.61$ ,  $r = 0.51$ ,  $r = 0.62$  and  $r = 0.59$  respectively whereas, non significant and negative correlated with evaporation, bright sunshine hours and wind speed  $r = -0.49$ ,  $r = -0.09$  and  $r = -0.59$ , respectively.

The correlation between weather parameters and per cent fruit infestation on weight basis showing (Fig.2) significant and positive correlation with morning relative humidity and rainfall  $r = 0.84$  and  $r = 0.71$  respectively. The non significant and positive correlation was existed with maximum temperature ( $r = 0.21$ ), minimum temperature ( $r = 0.55$ ), evening relative humidity ( $r = 0.46$ ) and Rainy days ( $r = 0.63$ ) whereas, non significant negative correlation with evaporation ( $r = -0.48$ ), bright sunshine hours ( $r = -0.02$ ) and wind speed ( $r = -0.644$ ), respectively.

The correlation with number of maggots per fruit with weather parameter shows (Fig.3) that significant and positive correlation with minimum temperature ( $r = 0.73$ ), morning relative humidity ( $r = 0.92$ ), evening relative humidity ( $r = 0.76$ ), rainfall ( $r = 0.89$ ) and Rainy days ( $r = 0.89$ ) whereas, significant and negative correlation with evaporation ( $r = -0.78$ ). The maggot population was non significant and negatively correlated with maximum temperature ( $r = -0.086$ ) bright sunshine hours ( $r = -0.44$ ) and wind speed ( $r = -0.302$ ).

##### **3.1.2 The association between per cent fruit infestation and maggots count per fruit during season *Rainy* 2021**

The association between number of maggots per fruit and per cent fruit infestation on bitter gourd during *Rainy* season 2021 in (Table 3). It shows that percent fruit infestation both on number basis and weight basis showed significant and positive correlation with number of maggots per fruit  $r = 0.838$  and  $r = 0.857$  respectively.

### **3.2 Fruit fly infestation during *Summer* 2022**

The per cent fruit infestation of bitter gourd during *Summer* season recorded data presented in (Table 4) it shows that the per cent fruit infestation varies from 28.99 to 47.57 per cent with mean per cent fruit infestation 47.57 per cent on number basis and weight basis varied from 61.93 to 25.84 per cent with mean per cent fruit infestation of 48.66 per cent. While, number of maggots per fruits varies from 27.40 to 6.53 maggots per fruits with the mean number of maggots were 18.59 per fruits during *Summer* season.

#### **3.2.1 Correlation study with weather parameters**

The correlation association between fruit infestation and their maggots with weather parameters during *Summer* season represented in Table 3 and Fig.4 it shows that percent fruit infestation on number basis was non significant and positively correlated with morning relative humidity ( $r = 0.52$ ), evening relative humidity ( $r = 0.25$ ), rainfall ( $r = 0.12$ ), *Rainy* days ( $r = 0.13$ ) bright sunshine hours ( $r = 0.17$ ), wind speed ( $r = 0.09$ ) whereas, non significant and negatively correlated with maximum temperature ( $r = -0.44$ ), minimum temperature ( $r = -0.37$ ) and with evaporation ( $r = -0.45$ ).

The per cent fruit infestation recorded on weight basis showed significant and positive correlation with morning relative humidity ( $r = 0.77$ ) whereas, significant and negative correlated with minimum temperature ( $r = -0.66$ ). Non significant and positively correlated with evening relative humidity ( $r = 0.58$ ), rainfall ( $r = 0.34$ ), *Rainy* days ( $r = 0.34$ ) evaporation ( $r = 0.62$ ), wind speed ( $r = 0.11$ ) while, non significant and negatively correlated with maximum temperature ( $r = -0.65$ ) shown in Fig.5

The correlation study (Fig.6) of number of maggots per fruit during *Summer* season with weather parameters shows that significant and positive correlation with the morning relative humidity ( $r = 0.88$ ) and evening relative humidity ( $r = 0.83$ ) whereas, significant but negatively correlated with maximum temperature and minimum temperature  $r = -0.73$  and  $r = -0.77$  respectively. Non significant and positively correlated with rainfall ( $r = 0.34$ ), *Rainy* days ( $r = 0.34$ ), evaporation ( $r = 0.62$ ) and wind velocity ( $r = 0.19$ ) whereas, non significant and negative correlation with bright sunshine hours ( $r = -0.14$ ).

#### **3.2.2 The association between per cent fruit infestation and maggots count per fruit**

The correlation association between number of maggots per fruit and per cent fruit infestation during *Summer* season in (Table 4) shows that the percent fruit infestation both on number basis and weight basis shows significant and positive correlation with number of maggots per fruit  $r = 0.682$  and  $r = 0.905$  respectively.

More or less similar results were recorded by following authors at different topographic region. Laskar *et al.* (2013) noticed during warm *Rainy* months flies were more active as compared to dry and winter months in the foot hills of Himalaya. Similarly, Nair *et al.* (2020) concluded in their work as

maximum temperature and minimum temperature have significant influence of *Z.tau* population on cucurbits at Tripura ecosystem. Beer *et al.* (2021) concluded that the trapped *B.cucurbita* had positive correlation with minimum temperature, maximum temperature and relative humidity during *Kharif* season. Similarly, Bhowmik *et al.* (2014) recorded highest fruit infestation i.e. 51.66 and 58.88 per cent on pointed gourd while on bitter gourd the recorded highest infestation 40.14 and 54.71 per cent during 2012 and 2013 respective years.

### 3.2.3 Record of natural enemies:

A total of 50 pupae were maintained under observation, and their color gradually changed from light cream to dark brownish. Eight of the pupae turned out as being parasitoids. In the last week of October, it was discovered that 16% of the population was parasitized. This process was conducted twice to ensure the associated parasitoid. The emerged parasitoids was confirmed as *Psytaliafletcheri*(Silvestri) Fig.1 b It was a larval pupal parasitoid, it lay egg on the larvae of melon fly and emerged as adult from pupae.



**Fig.1 a) Fruit fly (Male and Female)**



**b) Parasitoid**

**Table 1: Percent fruit infestation of bitter gourd during both season *Rainy 2021* and *Summer 2022***

<i>Rainy Season 2021</i>				<i>Summer Season 2022</i>			
SMW	Per cent fruit infestation		No. of Maggots/fruit	SMW	Per cent fruit infestation		No. of Maggots/Fruit
	Number basis	Weight basis			Number basis	Weight basis	
38	48.61*	46.15	16.67	21	28.99	25.84	6.53
39	54.41	54.66	21.00	22	36.81	26.45	8.33
40	56.12	65.00	21.74	23	61.14	53.68	14.73
41	59.33	52.16	13.04	24	38.66	40.77	17.67
42	42.53	45.99	10.26	25	55.12	55.93	20.47
43	37.67	41.24	8.12	26	49.00	54.68	19.40
44	33.16	34.33	5.30	27	51.04	61.86	25.67
45	23.55	22.34	7.00	28	53.53	56.76	27.40
46	15.65	12.41	4.49	29	53.86	61.93	27.07
Max.	59.33	65.00	21.74	Max.	61.14	61.93	27.40
Min.	15.65	12.41	4.49	Min.	28.99	25.84	6.53
Mean	41.23	41.59	11.96	Mean	47.57	48.66	18.59
STDV	14.24	15.44	6.17	STDV	9.84	13.36	7.23

**Table 2: Correlation between percent fruit infestation by fruit fly and their maggots/fruit with weather parameters during *Rainyseason 2021*.**

Percent fruit infestation	Temperature(*C)		Relative Humidity (%)		R.F (mm)	Rainy days	Evaporation (%)	BSS (Hours)	WS (Km/hr)
	Max.	Min.	MRH	ERH					
Number Basis	0.21	0.61	0.87**	0.51	0.62	0.59	-0.49	-0.09	-0.59
Weight basis	0.21	0.55	0.84**	0.46	0.71*	0.63	-0.48	-0.02	-0.644
No. of maggots/fruit	-0.086	0.73*	0.92**	0.76*	0.89**	0.89**	-0.78*	-0.44	-0.302

\* Significance at 5 %, \*\* Significance at 1 %

**Table 3: Correlation between percent fruit infestation by fruit fly and their maggots/fruit with weather parameters during Summer season 2022.**

Percent fruit infestation	Temperature(*C)		Relative Humidity (%)		Rain fall (mm)	Rainy days	Evaporation (%)	BSS (hrs/day)	Wind Speed (Km/hr)
	Max.	Min.	Morning	Evening					
No. Basis	-0.44	-0.37	0.52	0.25	0.12	0.13	-0.45	0.17	0.09
Weight basis	-0.65	-0.66*	0.77*	0.58	0.34	0.34	0.62	-0.05	0.11
No. of maggots/fruit	-0.73*	-0.77*	0.88**	0.83**	0.34	0.34	0.62	-0.14	0.19

\* Significance at 5 %, \*\* Significance at 1 %

**Table 4: Association between per cent fruit infestation and maggots of melon fruit fly in bitter gourd crop during both *Rainy* 2021 and *Summer* season 2022**

<i>Rainy Season 2021</i>				<i>Summer Season 2022</i>			
SMW	% Fruit Infestation		Maggots/ Fruits	SMW	% Fruit Infestation		Maggots/ Fruits
	No.basis	Wt.basis			No.basis	Wt.basis	
38	48.61	46.15	16.67	21	28.99	25.84	6.53
39	54.41	54.66	21.00	22	36.81	26.45	8.33
40	56.12	65.00	21.74	23	61.14	53.68	14.73
41	59.33	52.16	13.04	24	38.66	40.77	17.67
42	42.53	45.99	10.26	25	55.12	55.93	20.47
43	37.67	41.24	8.12	26	49.00	54.68	19.40
44	33.16	34.33	5.30	27	51.04	61.86	25.67
45	23.55	22.34	7.00	28	53.53	56.76	27.40
46	15.65	12.41	4.49	29	53.86	61.93	27.07
Maggots	0.838*	0.857*		Maggots	0.682*	0.905**	

#### Summary and Conclusion:

Fruit fly was the major pest of bitter gourd in fruit damaging. The fruit damage record range was 15.65 to 59.33 per cent in *rainy* season whereas, 28.99 to 61.14 per cent in *summer* season. Per cent fruit infestation was positively correlated with relative humidity and rainfall of weather factors.

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