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Surveillance of fruit fly, *Bactrocera cucurbitae* (Coquillet) on ridge gourd in relation to abiotic factors

VM Shinde, GB Kabre and SA Pawar

Abstract

The study was conducted with the aim of furthering our understanding influence of abiotic factors on relative abundance and infestation rates of the fruit flies in ridge gourd during *kharif* season of 2018 and *kharif* 2019 at Post Graduate Research Farm, Department of Agricultural Entomology, MPKV, Rahuri, Dist. Ahmednagar. The data on *kharif* season of 2018, the catch number of adults fruit flies ranged between 31.77 to 98.33 per trap per week. The activity of fruit flies reaching the peak of 98.33 fruit flies/trap/week during 1st week of September (36th standard week). During cropping season, the infestation varied from 15.18 to 56.98 per cent on number basis. Minimum per cent fruit damage (15.18) was recorded in 2nd week of October (41st SMW), while maximum (56.98) during 1st week September (36th SMW). In *kharif* 2019 number of fruit fly adults ranged between 18.67 to 83.33 per trap per week. Minimum per cent fruit damage (7.33) was recorded in 1st week of August (31st SMW), while maximum (56.12) during 1st week of September (35th SMW). The data on correlation between fruit flies with different meteorological parameters showed that the various meteorological parameters were found to be non-significant except minimum temperature.

Keywords: Sureveillance, weather parameters, correlation, fruit flies, ridge gourd, trap etc.

Introduction

Ridge gourd (*Luffa acutangula* L.) is considered to be the native of tropical Africa and South East Asian region including India. It is generally widely grown in tropical and sub-tropical parts of the country. It belongs to the family Cucurbitaceae and genus *Luffa*. Ridge gourd is one of the important vegetable crops belonging to cucurbits and locally called as Shiral, Dodka (Marathi), Turai (Gujrat) and Koshataki (Sanskrit). It is rich source of various antioxidants, vitamins, minerals, lipids and other nutrients. Several management practices are being used against this pest as there of its life-stages are hidden and the only adult stage is usual target for its management. The extent of losses caused by *B. cucurbitae* varies from 30 to 100 percent depending on the cucurbit vegetable and season (Dhillon *et al.*, 2005) [3]. The attention has to be given on more species-specific pest management tactics based on seasonal fluctuation of pest, which are better defined and more effective in controlling the pest under field conditions. Some of the approaches include population monitoring (by using lures, food baits or attractant) and use of plant extracts that possesses insecticidal properties. Attractants or lures are commonly used to trap fruit flies as they provide an easy way to collect large numbers of flies in a short period of time. Males of many species respond to chemicals referred to as parapheromones. Pheromone traps provide an easy and efficient method to monitor the activities of fruit fly populations (Alyokhin *et al.*, 2000) [1] and they have been successfully used worldwide. These lures attract flies from large distances. Cue lure (CUE and methyl eugenol (ME) are two male attractants widely used in collecting *Bactrocera* spp. fruit flies. Most species appear to be attracted to one lure or the other, however other species are attracted to a combination of both lures (Dominiak *et al.*, 2011) [4]. Some of the approaches include population monitoring (by using lures, food baits or attractant). Hence, the present investigations were undertaken on surveillance of fruit fly, *Bactrocera cucurbitae* (Coquillet) on ridge gourd in relation to abiotic factors.

Materials and Methods

The present investigation was conducted at Post Graduate Research Farm, Department of Agricultural Entomology, MPKV, Rahuri during *Kharif* season 2018 and *Kharif* 2019. The experimental field was prepared well. Then field lay-out and sowing of ridge gourd seeds was carried out by dibbling method.

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After commencement of monsoon rain the sowing seeds of ridge gourd crop variety Pusa Nasdar was carried out. After sowing, intercultural operations as well as fertilizer applications were done as per university recommendations. Fertilizer dose 150:50:00 kg of N, P₂O₅ and K₂O per hectare, respectively was applied to the experimental plots. Due care was taken to maintained proper growth of the crop and experimental site except any plant protection measure.

Monitoring of fruit fly population

The field experiment was conducted for monitoring the population abundance of melon fruit fly, *Bactrocera cucurbitae* on ridge gourd crop. Ridge gourd crop was raised in 1000 m² by following recommended package of practices during *kharif* 2018 and *kharif* 2019. Traps were baited with Cue-lure deployed at three-meter height in selected sites. Three traps were set up in the field and care was taken to maintain a distance of 300 m² between the traps to avoid the trap interference effect. From the date of installation of traps, fruit flies captured in each trap were collected separately and the mean trap catches were counted for every standard week throughout the cropping season.

Per cent fruit infestation

Ridge gourd crop was raised during *kharif* 2018 and *kharif* 2019 season for monitoring the population abundance of fruit fly, was used for this study. No control measures were taken except monitoring with cue-lure traps. The observations on infested and healthy fruits on number basis recorded during each picking, for working out percentage of infestation of fruit fly. The percent infestation was worked out by using the following formula:

$$\% \text{ Fruit infestation} = \frac{\text{No. of damaged fruits}}{\text{Total no. of fruits}} \times 100$$

Results and Discussion

Fruit fly catches and percent fruit damage during *Kharif*, 2018

The data on average fruit fly catches/trap and percent fruit damage are tabulated in Table 1. The surveillance of *B. cucurbitae* on ridge gourd crop was done by using cue-lure (male attractant). The active population of fruit fly on ridge gourd crop was observed during flowering and fruit development season *i.e.*, from 1st week of August (33.33 fruit flies/trap/week) to 2nd week of October (31.67 fruit flies/trap/week). The data on number of fruit fly caught per trap revealed that, the catch number of adults ranged between 31.77 to 98.33 per trap per week. The activity of melon fruit flies commenced in the 1st week of August (32nd standard week) with trap catches of 33.33 fruit flies/trap/week which continued to increase rapidly reaching the peak of 98.33 fruit flies/trap/week during first week of September (36th standard week). Afterwards, the incidence declined and the lowest catch of 31.67 fruit flies/trap/week was recorded during second week of October (41st standard week).

Fruit damage was noticed throughout the observational period, the initiation of fruit damage was started after fruit setting in the second week of August (32nd SMW). During cropping season, the infestation varied from 15.18 to 56.98 per cent on number basis. Minimum per cent fruit fly damage (15.18) was recorded in 2nd week of October (41st SMW),

while maximum (56.98) per cent infestation was recorded during first week September (36th SMW).

The correlation studies (Table 3) during *Kharif* 2018 revealed that minimum temperature ($r = -0.6068$) and ($r = -0.5426$) and wind velocity ($r = -0.6811$) and ($r = -0.6274$) had significantly negative correlation with mean number of average fruit fly catches/trap and percent fruit damage, respectively. Bright sunshine ($r = 0.5585$) had significantly positive correlation with average fruit fly catches/trap and percent fruit damage had non-significant positive correlation ($r = 0.5197$). There was non-significant negative correlation was observed in mean number of average fruit fly catches/trap and percent fruit damage with, morning RH (%) ($r = -0.1904$) and ($r = -0.1206$), evening relative humidity ($r = -0.2715$) and ($r = -0.2140$) and rainfall ($r = -0.1075$) and ($r = -0.0906$) and number of rainy days ($r = -0.1871$) and ($r = 0.1358$), respectively. Maximum temperature ($r = 0.1693$) and ($r = 0.1074$) and evaporation ($r = 0.2014$) and ($r = 0.1331$) had non-significant positive correlation with mean number average fruit fly catches/trap and percent fruit damage, respectively.

Fruit fly catches and percent fruit damage during *Kharif*, 2019

The active population of fruit fly on ridge gourd crop observed during flowering and fruit development season *i.e.*, from last week of July (18.67 fruit flies/trap/week) to 2nd week of October (19.00 fruit flies/trap/week). The data on number of fruit fly catch of adults ranged between 18.67 to 83.33 per trap per week. The activity of melon fruit flies commenced in the 31st week of July (31st standard week) with trap catches of 18.67 fruit flies/trap/week which continued to increase rapidly reaching the peak of 83.33 fruit flies/trap/week during last week of August (35th standard week), when the crop was at full ripening stage. Afterwards, the incidence declined and the lowest catch of 19.00 fruit flies/trap/week was recorded during second week of October (41st standard week).

Minimum per cent fruit damage (7.33) was recorded in 1st week of August (31st SMW), while maximum (56.12) per cent infestation was recorded during first week of Septem %

The correlation studies between the average fruit fly catches/trap and percent fruit damage with weather parameters (Table 3) during *Kharif* 2019 revealed that minimum temperature ($r = -0.5325$ and ($r = -0.5620$) had significantly negative correlation with mean number of average fruit fly catches/trap and percent fruit damage, respectively. There was non significantly negative correlation observed in mean number of average fruit fly catches/trap and percent fruit damage with abiotic factors like morning RH (%) ($r = -0.1373$) and ($r = -0.0036$), Evening RH (%) ($r = -0.0744$) and ($r = -0.0082$), wind velocity (Km/hr) ($r = -0.2633$) and ($r = -0.4667$) and number of rainy days ($r = -0.1601$) and ($r = -0.0299$), respectively. Max. temperature ($^{\circ}\text{C}$) ($r = 0.0570$) and ($r = 0.0177$), bright sunshine (hrs) ($r = 0.1761$) and ($r = 0.1570$), rainfall ($r = 0.2584$) and ($r = 0.3339$) and evaporation ($r = 0.2188$) and ($r = 0.1158$) had non significantly positive correlation with mean number of average fruit fly catches/trap and percent fruit damage, respectively.

In the present investigations, active population of fruit fly on ridge gourd crop was observed during the month of August and September, when the crop was at full ripening stage. Shivayya and Kumar (2008) ^[9] observed the peak incidence of *B. cucurbitae* on bitter gourd during September. Similarly,

Kakar *et al.* (2014) [7] observed that, the infestations of fruit fly peaks in August and thereafter, started decline. Also, Maharjan *et al.* (2015) [8] observed the highest number of fruit flies was recorded in cue-lure trap during the 1st week of September.

The studies carried out on percent fruit damage during *kharif* 2018 and *kharif* 2019 indicates the similar results obtained increased the population of fruit fly there by; obviously, the increase in percent fruit damage relates with the availability of new fruit. Also, observed that maximum percent fruit damage during the month of August and September when the crop was at full ripening stage. The similar results were obtained by Dubale *et al.* (2018a) [5].

The present findings are also in agreement with Ganie *et al.* (2013) [6] reported that maximum temperature was positively correlated with the population of melon fruit flies Among the weather parameters, minimum temperature was significantly negatively correlated with the population of fruit flies, while maximum temperature, relative humidity, the morning,

relative humidity in the evening, rainfall, and sunshine were not significantly correlated with the population of fruit flies. The negative correlation of the minimum temperature and population is most likely because the population of fruit flies increases with the ripening of fruits and ripen from July until October, a period in which the minimum temperature decreased in the studied area. More or less similar observations have been reported by Dubale *et al.* (2018a) [5] who showed per cent infestation of fruit flies with different meteorological parameters that the significant negative correlation ($r = -0.720$) with morning relative humidity, while, remaining various meteorological parameters were found to be non-significant. Similarly, Devi and Mehta (2015) [2] study temperature was observed to play a significant role in regulating population dynamics indicated by a positive correlation. Relative humidity and rainfall, however, had a negative correlation thereby indicating negative impact on abundance of fruit fly species.

Table 1: Surveillance of *B. cucurbitae* and percent fruit damage on ridge gourd during *Kharif*, 2018

Month	Meteor. Week	Fruit damage (%)	Average fruit fly catches/ trap*	Temperature (°C)		Relative humidity (%)		Wind velocity (Km/hr)	Sunshine (hrs)	Evaporation (mm)	Rain (mm)	No. of rainy days
				Max	Min	I	II					
July 2018	27	0	0	31.71	23.31	76.14	59.43	8.01	3.90	5.29	3.74	1
	28	0	0	28.26	22.83	80.00	69.71	5.00	0.30	3.37	1.97	4
	29	0	0	29.40	22.99	76.71	64.71	8.67	1.84	4.09	0.63	1
	30	0	0	28.66	22.73	75.14	62.29	7.54	1.47	4.14	0.00	0
	31	0	0	31.34	23.27	71.71	53.29	7.93	4.01	5.43	0.00	0
August 2018	32	15.67	33.33	30.00	22.99	75.14	62.57	6.81	1.49	5.10	0.00	0
	33	21.45	39.67	27.86	22.53	80.71	72.86	4.83	0.59	3.63	8.34	3
	34	43.33	68	27.94	21.49	80.00	70.57	5.01	3.40	3.71	3.46	2
	35	54.16	76.67	29.66	21.14	74.71	61.14	3.47	5.88	4.43	0.91	1
September 2018	36	56.98	98.33	30.09	19.64	70.57	53.14	4.16	5.97	5.14	0.00	0
	37	46.19	85.33	32.40	19.50	69.14	48.71	0.83	7.79	5.47	0.00	0
	38	56.84	87.67	31.94	22.11	71.57	45.14	2.71	6.16	5.47	0.54	1
	39	34.43	55.67	33.83	22.29	71.43	44.43	1.31	8.10	6.34	0.00	0
October 2018	40	19.63	43.33	34.03	21.54	67.29	42.86	1.27	7.80	6.33	0.00	0
	41	15.18	31.67	34.03	18.37	54.71	30.14	1.57	8.80	7.06	0.00	0

* Average mean of three replication

Table 2: Surveillance of *B. cucurbitae* and percent fruit damage on ridge gourd during *Kharif*, 2019

Month	Meteor. Week	Fruit damage (%)	Average fruit fly catches/ trap*	Temperature (°C)		Relative humidity (%)		Wind velocity (Km/hr)	Sunshine (hrs)	Evaporation (mm)	Rain (mm)	No. of rainy days
				Max	Min	I	II					
July 2019	27	0	0	30.61	23.54	79.00	63.14	4.93	1.30	4.34	5.29	3
	28	0	0	32.00	23.60	76.00	56.57	7.37	4.70	5.33	0.54	1
	29	0	0	32.83	23.24	74.43	53.29	6.44	7.77	5.87	4.57	2
	30	0	0	30.51	23.59	78.43	68.14	4.11	2.31	3.30	2.63	4
	31	7.33	18.67	27.03	22.86	87.00	77.43	4.79	0.23	1.86	6.80	6
August 2019	32	16.29	25.33	28.03	23.27	80.57	68.14	8.17	1.99	3.60	0.51	3
	33	17.36	66.67	31.00	22.47	75.14	59.57	6.96	4.29	5.43	0.20	1
	34	45.72	76.33	32.49	21.29	72.43	47.57	4.13	7.91	6.19	0.00	0
	35	56.12	83.33	32.55	22.09	75.14	52.71	4.07	5.90	5.74	12.57	4
September 2019	36	49.43	65.00	29.97	23.33	77.57	70.57	3.57	1.86	4.29	0.43	2
	37	44.38	54.00	28.77	22.47	78.57	68.43	4.64	1.36	3.67	3.09	3
	38	51.74	68.67	29.83	21.73	83.57	71.00	1.61	4.23	3.69	12.03	4
	39	39.36	49.33	30.23	21.94	83.43	66.86	0.83	4.96	3.40	5.23	2
October 2019	40	31.89	33.33	31.14	21.11	80.57	55.71	1.10	6.07	5.06	1.11	4
	41	14.56	19.00	31.69	21.13	77.00	52.29	0.76	7.13	4.83	0.40	2

* Average mean of three replication

Table 3: Correlation of weather parameters with adult fruit fly catches and percent fruit damage by fruit fly *B. cucurbitae* on ridge gourd

Weather parameters	Correlation coefficient value			
	Kharif 2018		Kharif 2019	
	Fruit damage (%)	Average fruit fly/trap/week	Fruit damage (%)	Average fruit fly/trap/week
Max. Temperature (°C)	0.1074	0.1693	0.0177	0.0570
Min. Temperature (°C)	-0.5426*	-0.6068*	-0.5620*	-0.5325*
Morning RH (%)	-0.1206	-0.1904	-0.0036	-0.1373
Evening RH (%)	-0.2140	-0.2715	-0.0082	-0.0744
Wind velocity (Km/hr)	-0.6274*	-0.6811**	-0.4667	-0.2633
Bright Sunshine (hrs)	0.5197*	0.5585*	0.1570	0.1761
Evaporation	0.1331	0.2014	0.1158	0.2188
Rainfall (mm)	-0.0906	-0.1075	0.3339	0.2584
No. of rainy days	-0.1358	-0.1871	-0.0299	-0.1601

* 5% level of significance = 0.514

**1% level of significance df 20 = 0.641

Conclusion

The studies carried out on percent fruit damage during *kharif* 2018 and 2019 indicates the similar results obtained increased the population of fruit fly there by; obviously, the increase in percent fruit damage relates with the availability of new fruit. Also, observed that maximum percent fruit damage during the month of August and September when the crop was at full ripening stage. The data on correlation between fruit flies with different meteorological parameters showed that the various meteorological parameters were found to be non-significant except minimum temperature. Number of fruit fly caught per trap and their correlation with weather parameters may assist to develop the suitable forecasting and forewarning model which minimize crop loss and optimize pest control leading to reduction of cost of cultivation.

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