

Seasonal Activity, Weather Relations and Biology of Melon Fly (*Bactrocera cucurbita* Coq.) on Pumpkin

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Abstract *Bactrocera cucurbitae* (Coq.) is considered as a serious pest of pumpkin. Maximum population of melon fruit fly were observed in the months of May 2014 (17th and 24th may) and showed a higher positive correlation with seasonal average maximum temperature (823**) and positive correlation with minimum temperature (0.123) and morning humidity (0.4). Negative correlation with afternoon humidity (-0.726*) and rainfall (-0.54). The biology of *Bactrocera cucurbitae* (Coq.) was studied on pumpkin fruit under laboratory conditions at B.C.K.V. (West Bengal) during April-May (2014). The average length and breadth of egg was 1.30 ± 0.08 and 0.25 ± 0.05 mm, respectively. The incubation period was 1.9 ± 0.65 day. The average length and breadth of first, second, and third instar maggots were 1.57 ± 0.26 and 0.25 ± 0.07 , 4.71 ± 0.34 and 0.93 ± 0.31 , 8.44 ± 0.88 and $1.57 \pm$

0.29 mm respectively. The mean duration of corresponding instar was 1.4 ± 0.55 , 1.4 ± 0.55 and 3.6 ± 0.55 days respectively. The average length and breadth of pupa was 5.65 ± 0.42 and 2.3 ± 0.18 mm respectively, the pupal period was 6.2 ± 0.45 days. The average length and breadth of male and female were 6.79 ± 0.40 and 13.14 ± 1.05 , 8.55 ± 0.71 and 14.95 ± 1.48 mm respectively. The male flies lived shorter (25 ± 8.72) than female (30 ± 10.07) days. Similarly, total life period of male was shorter (39.5 ± 8.82) than female (44.5 ± 10.56) days.

Keywords Biology, Pumpkin, Fruit fly, *Bactrocera cucurbitae*.

Introduction

Cucurbitaceous crop like, gourds, melons, cucumber and pumpkin are attacked by a number of insect pest during different growth stages and seasons. There are about 325 species of fruit flies occurring in the Indian subcontinent, of which 205 are from India alone. The major pest species belong to the genus *Bactrocera*: *B. cucurbitae*, *B. dorsalis* and *B. zonata*, while other species, such as *B. correcta*, *B. diversa* and *B. latifrons*, are still localized in their distribution [1]. Melon fruit fly, *Bactrocera cucurbitae* (Coq.) (Diptera: Tephritidae) is one of the most important pests of the cucurbits. The fruit fly attacks the ultimate economic part, i.e. fruits of the crop that alone can inflict yield loss in different cucurbitaceous vegetables ranging from 30–100% depending upon cucurbit species and the season [2]. The maximum melon

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Table 1. Correlation studies between incidence of melon fruit flies (average 3 trap data) and weather parameters during March to May (2014). **. Correlation is significant at the 0.01 level. *. Correlation is significant at the 0.05 level.

Fruit fly species	Temperature (°C)		Relative humidity (%)		Rainfall
	Maximum	Minimum	Morning	Afternoon	
<i>B. cucurbitae</i>	.823**	0.123	0.4	-.726*	-0.54

fruit fly infestation was 77.03% on bitter gourd, 75.65% on ridge gourd, 73.83% on cucumber and 63.31% on pickling cucumber [3]. *Bactrocera cucurbitae* damage 81 host plants and is a major pest of cucurbitaceous vegetables, particularly the bitter gourd (*Momordica charantia*), muskmelon (*Cucumis melo*), snap melon (*C. melo* var *momordica*) and snake gourd (*Trichosanthes anguina*).

Materials and Methods

Healthy treated dry pumpkin seeds had been sown under normal practices at spacing of 8 m × 4 m in plots with a pit of 15 cm height at the middle of the plot after optimum land preparation. There were 21 plots each with five plants per pit. This study was conducted at Jaguli instructional farm BCKV Dist Nadia, (WB) during last week of March to May in 2014 with cue-lure traps installed at the platforms fixed in pumpkin (var IR 8. pumpkin) fields three trap in three location at the time of 30 days after germination. Cue-lure is the specific para-pheromone for attracting this fruit fly. The traps were made with plastic jars with six holes (0.5 cm in diameter) on each side at middle of the lid and the radius of the jar was 0.3 mm with transparent colored body and yellow colored lid. This para-pheromone lure (cue-lure) attracts male melon fruit flies. The size of the trap was 10 cm in diameter and 12 cm in length. The cue-lure blocks were placed inside a green colored plastic cage (3 cm in diameter and 4 cm in length) with 8 longitudinal holes (for better evaporation and communication with fruit fly) fixed with a screw from the middle of the jar attached with the body. The observations were taken at seven days intervals and adult fruit flies were dried properly to preserve for proper identification. This data was correlated with weather parameters of the correspond-

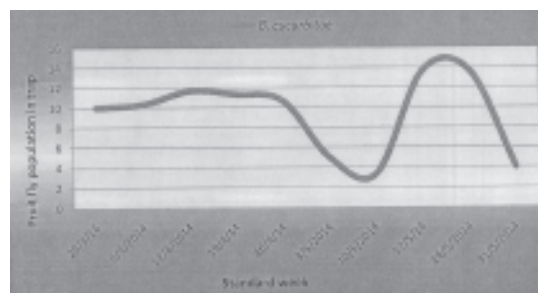


Fig. 1. Incidence pattern of melon fruit flies with the use of cue lure trap

ing orchards, viz., maximum temperature, minimum temperature, relative humidity (I and II, and rainfall.

The life cycle study was carried out in the Department of Agril. Entomology, BCKV located at Mohanpur in the district of Nadia, West Bengal during 2014 (April-May). Infested pumpkin fruits were collected from fields and cut very carefully with sharp knife at the point of injury. Then tiny whitish cluster of eggs were observed within the cut portion with the help of hand lens. The fresh pumpkin fruits then cut into cylindrical shapes and the middle portion of one side was scooped out with the help of sharp knife. The eggs of melon fruit fly were then placed on this small hole and the scooped out portion was placed over it to cover it so that eggs did not lose moisture. After that the cylindrical shaped cucurbit fruit with eggs was kept in a beaker with mixture of 1:1 ratio of soil and sand at the bottom of beaker (3 cm. thick layer) to facilitate the pupation. The upper portion of the beaker was covered with cloth to prevent the egg laying by other insects. The data was recorded every day closely to observe different stages of fruit fly. After hatching of maggots, the food was replaced as and when required until their pupation took place. When all the full grown maggots entered the soil for pupation, the rotten fruits and the cloth from beaker were removed and placed it into a cage (0.5 × 1 m²) for better movement of the adults. After emergence, the adults flies were provided with honey solution diet (water, honey) soaked in cotton and sponge on Petri dish.

Table 2. Morphometrics of different life stage of *B. cucurbitae* reared on pumpkin. Data based on 10 observations.

Life stage	Parameter	Host (pumpkin)	
		Mean±SD	Data range
Egg	Length (mm)	1.30 ± 0.08	1.2–1.4
	Breadth (mm)	0.25 ± 0.05	0.19–0.32
1 st instar	Length (mm)	1.57 ± 0.26	1.1–1.9
	Breadth (mm)	0.25 ± 0.07	0.1–0.3
2 nd instar	Length (mm)	4.71 ± 0.34	4–5.1
	Breadth (mm)	0.93 ± 0.31	0.9–1.3
3 rd instar	Length (mm)	8.44 ± 0.88	7–9.2
	Breadth (mm)	1.57 ± 0.29	1.2–2
Pupa	Length (mm)	5.65 ± 0.42	5–6
	Breadth (mm)	2.3 ± 0.18	2–2.5
Adult (Male)	Length (mm)	6.79 ± 0.40	6–7.1
	Breadth (mm)	13.14 ± 1.05	12.1–15.3
Adult (Female)	Length (mm)	8.55 ± 0.71	7.5–9.3
	Breadth (mm)	14.95 ± 1.48	12–17.5

Results and Discussion

Incidence pattern of melon fruit flies with the use of cue lure trap

Cue lure trap catches of male melon fruit fly ranged between 3.33 to 33.67 fruit fly/trap/week during March to May. During 4th week of April (26th April), the mean population of fruit fly was 10.67/trap/week. After that the population decreased (5 fruit fly/trap/week) at first week of May and lowest no. of population found in second week of May (3.33 fruit fly/trap/week). It was followed by certain increase in population during 3rd week of May. The population then through some fluctuation attained a peak of 13.67/trap/week during 3rd and 4th week of May (17th and 24th May).

Findings of the present study are in corroboration with the earlier works of some workers who noted peak population of the fly during April–May i.e., around 18th–20th standard weeks [4].

Correlation between fruit fly population (*B. cucurbitae*) and different weather parameters

The results indicated that trap catches of *B. cucurbitae* showed a highly significant positive cor-

Table 3. Duration of different life stages of *B. cucurbitae* on pumpkin.

Life stage	Duration (in day)	
	Mean ± SD	Data range
Egg	1.9 ± 0.65	1.5–3
1 st instar	1.4 ± 0.55	1–2
2 nd instar	1.4 ± 0.55	1–2
3 rd instar	3.6 ± 0.55	3–4
Pupa	6.2 ± 0.45	6–7
Adult (Male)	25 ± 8.72	15–32
Adult (Female)	30 ± 10.07	18–38
Total life period of male	39.5 ± 8.82	29.5–48
Total life period of female	44.5 ± 10.56	31.5–53

relation with maximum temperature (.823**) and significant positive correlation with minimum temperature, morning humidity (0.123), (0.4) respectively. Negative correlation with afternoon humidity (-0.726*) and rainfall (-0.54) (Table 1).

Findings of the present study are in corroboration with the earlier works of workers who reported that the per cent fruit infestation was positively correlated with minimum temperature during *rabi* and summer seasons. In *kharif* season, infestation of melon fly showed positive correlation with maximum temperature and maximum relative humidity [5].

Biology of the fruit fly, *B. cucurbitae* (Coq)

Eggs

The eggs were white, cylindrical, elongated and slightly curved and tapering at one end. The posterior end being broadly rounded and the anterior end were found to be pointed. The surface of the eggs was variously sculptured with ridges and grooves. Morphometric observations revealed that the length of egg varied from 1.2–1.4 mm on pumpkin with mean of 1.30±0.08 mm. Breadth of egg varied 0.19–0.32 mm in pumpkin. The average value of breadth was derived as 0.25±0.05 mm in pumpkin (Table 2). Duration of developmental days between laying and hatching i.e. the incubation period was recorded. It varied from 1.5–3 (mean ± SD=1.9 ± 0.65) days (Table 3).

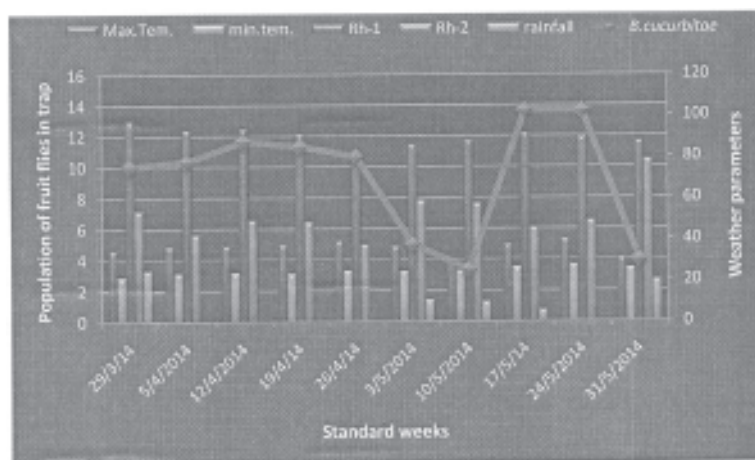


Fig. 2. Correlation between fruit fly population (*B. cucurbitae*) and different weather parameters.

Maggot

They passed through three larval instars to become adult. The 1st instar maggots were apodus, translucent and white in color, a little bit flattened dorso-ventrally and pointed at anterior ends. They had mouth hooks at anterior part of the body. The length of 1st instar larvae varied from 1.1 mm to 1.9 mm with an average of 1.57 ± 0.26 mm and the width ranged between 0.1 to 0.3 mm with an average of 0.25 ± 0.07 mm (Table 2). Duration of 1st instar was varied from 1–2 (mean \pm SD = 1.4 ± 0.55) days (Table 3).

The 2nd instar maggots were also a little bit flattened dorso-ventrally and broad posteriorly but gradually anteriorly and pointed at the head with mouth hooks. The length of the 2nd instar larvae varied from 4 to 5.1 mm with an average of 4.71 ± 0.34 mm and the width ranged between 1.9 to 1.3 mm with an average of 0.93 ± 0.31 mm (Table 2). Duration of 2nd instar varied from 1–2 (mean \pm SD = 1.4 ± 0.55) days (Table 3).

The 3rd instar maggots were yellow in color due to accumulation of reserved food materials and were more opaque than the first and second instar maggots. The last body segment of the maggots was largest. The mature maggots, unlike the first and second instar, had the peculiar capacity of shifting itself from

one place to another by a series of jumps after leaving the host period to pupation. The length and width of 3rd instar maggots varied from 7 mm to 9.2 mm with an average of 8.44 ± 0.88 mm and 1.2 to 2 mm with an average of 1.57 ± 0.29 mm respectively (Table 2). Duration of 3rd instar varied from 3–4 (mean \pm SD = 3.6 ± 0.55) days (Table 3).

Pupa

The pupae were segmented, barrel shaped or cylindrical and yellowish white to deep brownish yellow when freshly formed. Later on, the color changed into light brown to brownish grey. The length and breadth of pupa varied from 5 to 6 (mean \pm SD = 5.65 ± 0.42) mm and breadth from 2.00 to 2.5 (mean \pm SD = 2.3 ± 0.18) mm (Table 2). The duration of pupal stage varied from 6 to 7 days. The mean \pm SD. value of pupal duration was derived as 6.2 ± 0.45 days (Table 3).

Adult

The adults were moderate in size, yellowish grey to reddish brown with curved lemon yellow colored (vittae) vertical markings on the thorax. The wings contain fuscous shading (wing band) on the outer margin. On the apical margin of wing grayish brown patches were noted and black bands on the radio-medial veins were observed.

Male

In adult male the abdomen was blunt, ovipositor became absent. They were also smaller in size than that of the females length was recorded to vary from 6 to 7.1 (mean \pm SD=6.79 \pm 0.40) mm. Breadth of the fly, i.e. the wing expanse varied from 12.1 to 15.3 (mean \pm SD=13.14 \pm 1.05) mm (Table 2). Logevity of male adult was observed (mean \pm SD = 25 \pm 8.72 days) that ranged from 15 to 32 days (Table 3).

Findings of the present study was more or less similar with the earlier works of Laskar [6], who observed that 16.00–34.00 days on pumpkin and 18.00–41.00 days on bitter gourd with (mean 27.20 \pm 7.40 and 31.00 \pm 9.14) respectively.

Female

Adult females were easily distinguishable by the presence of tapering abdomen extending into an ovipositor. They are also comparatively larger than the males. Length and breadth (wing expanse) of the female adult were found varied from 7.5 to 9.3 (mean \pm SD=8.55 \pm 0.71) mm and 12 to 17.5 (mean \pm SD=14.95 \pm 1.48) mm (Table 2).

The female adult lived longer than that of the male. Duration of female adult was ranged from 18 to 38 days, the average being 30 \pm 10.07 days (mean \pm SD)(Table 3).

Total life period

Total life period, right from egg to death of the adult of melon fly varied from male to female and also on the host on which the insect was reared. In case of

male it varied from 29.5–48 day with mean of 39.5 \pm 8.82 days. In female fly, it was slightly longer where it varied from 31.5–53 days. The average duration was derived as days 44.5 \pm 10.56 (Table 3).

Conclusion

The peak incidence of *B. cucurbitae* was noticed during May (2014) and found that correlation coefficient between populations of melon fly with weather parameters exhibited a significant positive correlation with maximum temperature, minimum temperature, RH-I and negative correlation with RH-II and rainfall. Female flies survived more days than male flies throughout the year.

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