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Sohrab
Department of Entomology, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, Utter Pradesh, India

CS Prasad
Department of Entomology, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, Utter Pradesh, India

Wajid Hasan
Krishi Vigyan Kendra, Jehanabad, Bihar Agricultural University, Sabour Bhagalpur, Bihar, India

Correspondence
Sohrab
Department of Entomology, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, Utter Pradesh, India

Study on the biology and life cycle of cucurbit fruit fly, *Bactrocera cucurbitae* (Coquillett)

Sohrab, CS Prasad and Wajid Hasan

Abstract
The mean Pre-oviposition period13.5±1.5 and oviposition period 18.0±6 days while, mean mating period (3±1hrs), fecundity 80.0±20 eggs/life cycle and incubation period of eggs varied from 1.25±0.25 days was observed of cucurbit fruit fly. Hatching % eggs of fruit fly 87.5±2.5 was observed in 2015 at average maximum and minimum temperature 34.36 – 25.46° C and average relative humidity 87.5%. There are total maggot periods (three larval instars) was 5.180±1.16 days while, Prepupal period and pupal period was 0.75±0.25 and 9.5±0.5days respectively during experiment in the month of June and July. The average longevity of adult fruit flies were neither food nor water immediately, die after range of 1.5± 0.5 days after emergence from pupa. When was provided with cucurbit vegetables materials to fruit flies then fruit flies were lived 13.5±1.5 days. The duration of total life cycle was 16.81±2.18days during 2015 in June and July under room temperature in meerut condition.

Keywords: Biology, cucurbit and *Bactrocera cucurbitae*

Introduction
Cucurbits are infested by several insect pests which are considered to be the significant obstacles for economic production. Among them, cucurbit fruit fly is the serious pest responsible for considerable damage of cucurbits (Butani and Jotwani 1984). The cucurbit fruit fly, *Bactrocera cucurbitae* can attack about 16 different types of cucurbit crops. Although the rate of attack varies among the crop, infestation reduced both the yield and quality of the cucurbit fruits. Yield losses due to fruit fly infestation vary from 19.19 to 69.96 percent in different fruits and vegetables (Kabir *et al.* 1991). Depending on the environmental conditions and susceptibility of the crop species, the extent of losses varies between 30 to 100% (Gupta and Verma, 1992; Dhillon *et al*., 2005a, b, c; Shooker *et al*., 2006). The major constraint to sustainable increased productivity of cucurbits is the high incidence of insect pests. Cucurbits are infested by a number of pests such as cucurbit fruit fly, red pumpkin beetle, epilachna beetle etc. Among them cucurbit fruit fly, *Bactroceracucurbitae* (Coquillett) is a devastating pest of different cucurbit vegetables in many parts of the world which may cause more than 60% yield loss (Kapoor 1993). The pest has been reported to damage about 81 host plants and as a major pest of cucurbitaceous vegetables, especially the bitter gourd, musk melon, snap melon, snake gourd, ridge gourd etc. Meerut is situated in a semi-arid and sub-tropical climate zone where are found hot climate in summer and sever cold in winter. The maximum temperature 36.94 ^{0}C was noticed in June, which is the hottest month of year. Since under meerut condition, no literature available on the biology and life cycle of this pest, it was thought imperative the study the biology and life cycle of cucurbit fruit fly, *B. cucurbitae*on cucurbit for sustainable IPM module.

Materials and Methods
Thestudies of fruit flies biology and life cycle was repeated for one time in June and July 2015. All studies carried out under laboratory condition at room temperature.The initial culture was started with cucurbit plant parts (flowers, fruits leaves etc) to study the biology and life cycle of cucurbit fruit fly. Infected fruits (egg laying fruits and flowers etc) were kept into laboratory under room temperature condition. After 1-1.5 day eggs are hatch out and maggot (larvae) appear inside the fruits. The insect culture was raised for larvae and reared into glass jar to the adult stage under ambient temperature and humidity conditions. The sex wasseparated and released in pair into glass jar (20 × 15 cm) for mating. A cotton swab soaked in sucrose solution was placed in each jar for feeding by the adults. The observations duration of pre- oviposition, oviposition and fecundity etc were recorded. The eggs from each jar were transferred to the pertridishes for hatching and the incubation period and percentage hatching was recorded. The neonate larvae were placed initially inside cucurbit fruits by making small

incisions. The daily observation will be recorded on different developmental stages of cucurbit fruit fly.

Biological studies of cucurbit fruit fly on cucurbits hosts andsets of experiment *i.e.*

1. Study of mating period and time
2. Study of fecundity, incubation period and hatching period of cucurbit fruit fly.
3. Study of maggot (larval) period (from first instar to third instar).
4. Study of pre pupa to pupal period.
5. Study of emergence period adult from pupa
6. Study of pre-oviposition and oviposition period
7. Study of adult and adult longivity

Results and Discussion

Infected fruits by fruit flies were kept into in separate rearing jar and were given cucurbit fruits, flowers, levies, etc.) as food. Mating of male adult and female fruit fly was occurred late in the afternoon as the light intensity drops and sleep among the leaves in the evening. After mating a single female fruit fly were laid about 225±25 eggs in batches of 1-2 up to several dozen.

Development of cucurbit fruit fly

Cucurbit fruit flies comes under the Diptera-order which complete metamorphosis and are found four different stages *viz*., egg, larvae (maggot), pupa and adult. The life cycle of cucurbit fruit fly was completed 16.81±2.18 days in June and July 2015. The development data of all fruit flies were split under the following heads.

Mating Period and time of cucurbit fruit fly

Present study was carried out in lab condition revealed that the mating adult's cucurbit fruit flies pursued their female counterparts for a long time for sexual copulation, but in majority of the encounters the female was rejected the males and mating did not occur. Mating of adult and female fruit fly was occurred late in the afternoon as the light intensity drops and sleep among the leaves in the evening. Anonymous (1987) also reported mating of adult and female cucurbit fruit fly was occurred at about dusk and lasts for about one hour or more. According to Shivay *et al.* (2007) fruit flies mated during the night between 18:30 PM- 01:30 AM.

Fecundity and viability of cucurbit fruit fly

Cucurbit fruit flies generally eggs were laid into flowers or tender fruits and well rearing cage. The total numbers of eggs of fruit flies were varied in species to species. The egg laying capacity of a sexually mature adult female was 200-250 in entire life span. Fairly closed this result Shivayy *et al*. (2007) and Laskar (2013**)** has been reported fruit fly 188-250 and 138±44.05 eggs laid in entire life span. According to Mir *et al*., (2014) also reported fecundity was 52.75 and 58-98 eggs per female respectively. Lanjar *et al.*, (2013) also reported 50-91 eggs of the melon fly per female during her entire life span under laboratory conditions. Mean hatching percentage was 87.50±2.5. Mir *et al.* (2014) has been reported mean hatching percentage of fruit fly 86.10±0.5.Yang *et al*. (1994) reported the net reproductive rate to be 72.9 births per female.

Description of different stages of cucurbit fruit fly

Eggs- The eggs of *B. cucurbitae*were shiny white, slightly curved, 1.3 mm in length, elongated and tapering at one end while rounded at the other end. In the same way Narayanan and Batra (1960) *B. cucurbitae* eggs laidcreamy white, oblong, bananas shaped and are about 1.3 mm in length. The posterior extremity was broadly rounded while the anterior end was appeared more pointed. The eggs were fixed vertically or slightly at an angle and touching each other. The eggs are laid singly or in clusters of into flowers or tender fruits.

Pre-oviposition and Oviposition Periods of cucurbit fruit fly

Mean of the pre-oviposition period was 13.5±1.5 of days and varied from 12 to 15 days, whereas the mean of oviposition period was 18±6 days and ranged from 12 to 24 days. The durations of pre-oviposition and oviposition Periods of cucurbit fruit flieswere observed on ridge gourd. (Lanjar *et al.* (2013) and Mir *et al.* (2014) were fairly closed this experiment and who reported the respective range of pre-oviposition and oviposition (11±0.62 and 19.29±1.19) and 10-15 and 12-28 days respectively.

Incubation periodof cucurbit fruit fly

The present investigation was shown incubation period of eggs of fruit fly was 24 to 36 hrs (1-1.5 days) with a mean of 1.25±0.25. Manzar andSrivastava (2007) and Lanjar *et al.* (2013) were fairly close this experiment and who reported the respective range of incubation period of eggs of fruit fly were 1.4±0.16 and 2.29±0.18 days respectively.The egg incubation period on pumpkin, bitter gourd, and squash gourd has been reported to be 4.0 to 4.2 days at 27 ± 1° C (Doharey, 1983), 1.1 to 1.8 days on bitter gourd, cucumber and sponge gourd (Gupta and Verma, 1995), and 1.0 to 5.1 days on bitter gourd (Koul and Bhagat, 1994; Hollingsworth *et al*., 1997).

Maggots (larvae) period of cucurbit fruit fly

The eggs were hatch out from eggs in 1-1.5 days feed on the pulp and seeds of fruit, drop to the ground.Fully developed maggot of fruit fly was white in color white grey color patches on body. The apodous maggot was passed through 3 instars. Mean of total maggot period was with a mean 5.18±1.16 days.

The description of different stages of maggots is as follow:

First instar maggot

Freshly emerged first instars maggot was translucent and white in color. First instar maggots were taken the rang of time 15-24 hrs and with a mean (0.81±0.19) days for go to second instar maggot.

Second instar maggot

The second instar maggots were slightly different from the first instar maggots of fruit flies. There were larger sizes from the first instar maggots of fruit flies. The second instar maggots were translucent, elongate and ellipsoidal in shape and creamy white in color. The second instar maggots were taken average time of 1.5±0.5 days to complete this stage and go to next instar maggot of fruit fly.

Third instar maggot

The fully grown thirdinstars were a pointed head with well developed mandibular hooks and anterior and posterior spiracles. The 3rd instar was a conspicuous dark transverse line extending between intermediate areas of the caudal segment and exhibited a peculiar habit of curving itself and springing into the air to a lateral distance of 15-20 cm by the sudden relaxation of certain muscles. In this way, the 3rd instar was displaced itself 6 to 8 inches (15-20 cm) from the fruit to the site of pupation. The second 3rdinstars maggot were taken average time of 3.0±0.5 days to complete this stage.

Total developmental period maggot

The developmental period of the 1st, 2nd and 3rdinstars were 0.625-1.0 (15-24 hrs), 1-2 and 2.5-3.5 days, respectively; and their total developmental periods maggot were 4.125-6.50 and with a mean 5.18±1.16 days, respectively. Total maggot period was 4.125-6.50 days.Manzar and Srivastava (2007),Shivay *et al.* (2007), Ullah *et al.* (2008), Lanjar *et al.* (2013) and Mir *et al.* (2014)were fairly close this experiment and whoreported the respective range ofMaggots (larvae) period of cucurbit fruit fly were 5.9±0.9, 12.25, 4.5-7.5, 7.00, 4-7, 8.94±0.6, 4.5±1.13 days respectively.The larval period lasts for 3 to 21 days (Renjhan, 1949; Hollingsworth *et al*., 1997), depending on temperature and the host. On different cucurbit species, the larval period varies from 3 to 6 days (Koul and Bhagat, 1994; Gupta and Verma, 1995). Egg viability and larval and pupal survival on cucumber have been reported to be 91.7, 86.3, and 81.4%, respectively; while on pumpkin these were 85.4, 80.9, and 73.0%, respectively, at 27 ± 1° C (Samalo *et al*., 1991).

Pre-pupal period

Mean of pre-pupal period of cucurbit fruit fly was reported 0.75±0.25days (table-6). Mir *et al.* (2014) has been reported Pre-pupal period of cucurbit fruit fly 0.8±.25 day who fairly closed this result. The pre-oviposition period of flies fed on cucumbers ranged between 11 to 12 days (Hollingsworth *et al*., 1997). Pre-oviposition and oviposition periods range between 10 to 16.3, and 5 to 15 days, respectively, and the females live longer (21.7 to 32.7 days) than the males (15.0 to 28.5 days) (Koul and Bhagat, 1994).

Pupa

The full grown pupa was pupated in the soil at depth of 1.5 to 15 cm**.** The newly formed pupae were 11 segmented, barrel shaped or cylindrical and yellowish white to deep brownish yellow when freshly formed. Later on, the color of pupa was changed into light brown to brownish grey. The pupa had a single black dot on posterior portion that distinguished it from the pupae of other species**.** The average length and breadth of pupae were observed 5-6 mm and 2.5-2.7 mm, respectively. This experiment results were fairly agree with Dhillon *et al.* (2005), Shivayya *et al*. (2007) and Lanjar *et al.* (2013). The duration of pupal stage varied 9 to 10 days with a mean of 9.5±0.5 days, respectively. Manzar and Srivastava (2007), Shivay *et al.* (2007), Ullah *et al.* (2008), Lanjar *et al.* (2013) and Mir *et al*. (2014) were fairly close and differ this experiment result and whoreported the respective range of pupal period of cucurbit fruit fly were 7.3±0.23, 7.75, 7.00-711.50, 8.33, 9, 9.94±1.03 and 8.4±0.51 days respectively at different hosts, time, weather conditions and etc.

Adult and Adult Longevityof cucurbit fruit fly

The maximum number of adults were emerged from the puparia between 8.00 to 10.00 AM and the freshly emerged adult flies were inactive, pale yellow with wings fixed their bodies and each flies required 25-35 Minute to gain the appearance of a fly. After 2-3 hrs the flies were attained their normal reddish brown with lemon yellow curved vertical markings on the thorax and fuscous shadings on the outer margins of the wings. A few Minute after was seen eclosion, the flies spread their wings and developed color on the wings and thorax. Adult's flies were moderate in size while, female flies were larger than males, and their tapered abdomens that ended in pointed ovipositors easily distinguished the females. The length and breadth of the male with expanded wings was 8.5-9.0 mm and 11-12 mm, respectively, whereas, the female with expanded wings were measured 9.0-10.0 mm in length and 15.75-16.50 mm in breadth. Thus the males were smaller than the females. Similarly findings results of size and shape of fruit fly by Laskar (2013) and Mir *et al.* (2014). The adults survive for 27.5, 30.71 and 30.66 days at 27 ± 1° C on pumpkin, squash gourd and bitter gourd, respectively (Doharey, 1983). Khan *et al*. (1993) reported that the males and females survived for 65 to 249 days and 27.5 to 133.5 days respectively. The pre-mating and oviposition periods lasted for 4 to 7 days and 14 to 17 days, respectively. The females survived for 123 days on papaya in the laboratory (24° C, 50% RH and LD 12: 12) (Vargas *et al*., 1992), while at 29° C they survived for 23.1 to 116.8 days (Vargas *et al*., 1997). Mean single generation time is 71.7 days, net reproductive rate 80.8 births per female, and the intrinsic rate of increase is 0.06 times (Vergas *et al.* 1992). Adults were provided neither food nor water immediately; die after range of 1 to 2 days after emergence from pupa. The longevity of adults was extended up to 2-3 and 3-4 days by access to water only. When was provided with cucurbit vegetables materials then fruit flies were lived 12-15 days. Manzar and Srivastava (2007), Shivay *et al.* (2007), Ullah *et al.* (2008), Lanjar *et al.* (2013) and Mir *et al.* (2014) were fairly closed and differed this experiment and whoreported the respective range of adult longevity of cucurbit fruit fly were 13.09±2.7, 18.4±0.64, 26.00, 37.86±1.40 and 30-52 days respectively at different hosts, time, temperature and weather conditions.

Table 1: Biology and life cycle of cucurbit fruit fly under the lab condition

S.N.	Development stages of fruit fly	Duration (Days)	
		Range	Mean
1.	Pre-oviposition period	12-15	13.5±1.5
2.	Oviposition period	12-24	18.0±6
3.	Mating period	0.083-0.16 (2-4hrs)	0.12 (3±1hrs)
4.	Fecundity	200-250 eggs/life	225±25
5.	Egg incubation period	1-1.5	1.25±0.25
6.	Hatching % of eggs	85-90 %	87.5±2.5
7.	First instar	0.625-1.0 (15-24 hrs)	0.81±0.19
	Second instar	1-2	1.5±0.5
	Third instar	2.5-3.5	3.0±0.5
	Total Maggot Period	4.125-6.5	5.180±1.16
8.	Prepupal period	0.5-1.0	0.75±0.25
	Pupal period	9-10	9.5±0.5
9.	Total period taken from egg laying to adult emergence	14.625-19.0	16.81±2.18
10.	Adult longevity	12-15	13.5±1.5
11	Temperature and Relative humidity min and max.	25- 35 ^{0}C	56-75 %

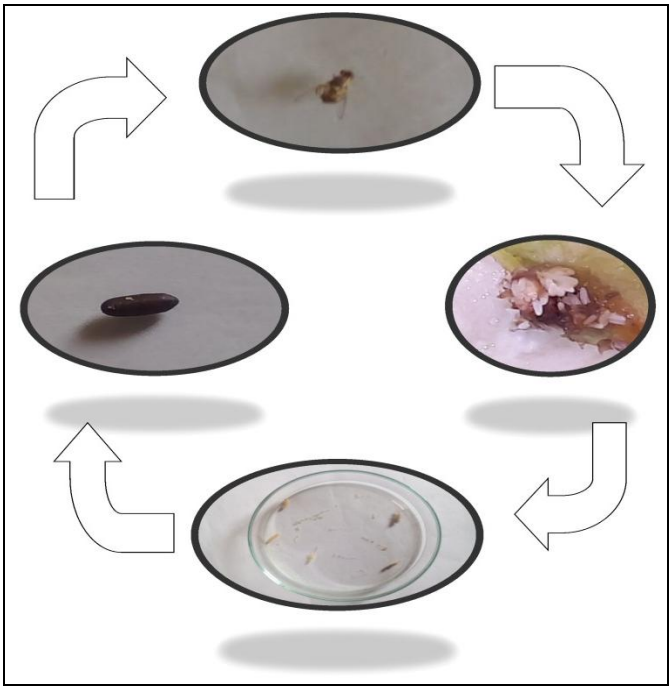

Plate 1: Life cycle of cucurbit fruit fly. A adult of fruit fly. B. eggs of fruit fly. C. Maggot of fruit fly and d. pupae of fruit fly.

References

1. Anonymous. Melon Fly Eradication Project in Okinawa Prefecture. Akatsuki Printing Ltd. Japan, 1987, 28.
2. Butanni DK, Jotwani MG. Insects in vegetables. Periodical Expert Book Agency. Vivek-Vihar, Delhi, India, 1984, 69-79.
3. Dhillon MK, Naresh JS, Ram S, Sharma NK. Influence of physico chemical traits of bitter gourd, *MomordicacharantiaL.* on larval density and resistance to melon fruit fly, *Bactrocera cucurbitae* (Coquillett). J Appl. Entomol. 2005b; 129:393-399.
4. Dhillon MK, Naresh JS, Singh R, Sharma NK. Evaluation of bitter gourd (*Momordicacharantia L.)* genotypes for resistance to melon fruit fly, *Bactrocera cucurbitae*. Indian J Pl. Prot. 2005c; 33(1):55-59.
5. Dhillon MK, Sing R, Naresh JS, Sharma HS. The melon fruit fly, *Bactrocera cucurbitae*: A review of its biology and management. Journal of Insect Science. 2005a; 5:40.
6. Doharey KL. Bionomics of fruit flies (*Dacus* spp.) on some fruits. Indian Journal of Entomology. 1983; 45:406-413.
7. Gupta D, Verma AK. Population fluctuations of the maggots of fruitflies Dacuscucurbitae Coquillett and D. tau (Walker) infesting cucurbitaceous crops. Adv. Pl. Sci. 1992; 5:518-523.
8. Hollingsworth R, Vagalo M, Tsatsia F. Biology of melon fly, with special reference to the Solomon Islands. In: Allwood AJ and Drew RAI editors. Management of fruit flies in the Pacific. Proceedings of Australian Country Industrial Agricultural Research. 1997; 76:140-144.
9. Kabir SMH, Rahman R, Molla MAS. Host plants of Dacinae fruit flies (Diptera: Tephritidae) of Bangladesh. Bangladesh. J Entomol. 1991; 1:60-75.
10. Khan L, Haq MU, Mohsin AU, andInayat-Tullah C. Biology and behavior of melon fruit fly, Dacuscucurbitae Coq. (Diptera: Tephritidae) Pakistan Journal of Zoology. 1993; 25:203-208.
11. Koul VK, Bhagat KC. Biology of melon fruit fly, Bactrocera (Dacus) cucurbitae Coquillett (Diptera: Tephritidae) on bottle gourd. *Pest* Management and Economic Zoology. 1994; 2:123-125.
12. Lanjar AG, Sahito A, Ali TMMSC. Biology and population of melon fruit fly on musk melon and Indian squash. International Journal of Farming and Allied Sciences, 2013; 2(2):42-47.
13. Laskar N. Biology and biometrics of melon fruit fly, *Bactrocera cucurbitae* (Coq.) on bitter gourd, *Momordica charantia* L. and pumpkin, *Cucurbitapepo*L. *Current Biotica.* 2013; 7(1/2):51-59.
14. Manzar A, Srivastava JP. Biology of melon fruit fly, *(Bactrocera cucurbitae*) on bitter gourd (*Momordicacharantia*). Progressive Horticulture. 2007; 39(1):70-73.
15. Mir SH, Dar SA, Mir GM, Ahmad SB. Biology of *Bactrocera Cucurbitae* on cucumber. Florida Entomologist, 2014, 97(2).
16. Narayanan ES, Batra HN. Fruit flies and their control. Indian Council of Agricultural Research, New Delhi, India, 1960, 68.
17. Renjhan PL. On the morphology of the immature stages of Dacus (Strumeta) cucurbitae Coq. (the melon fruit fly) with notes on its biology. Indian Journal of Entomology. 1949; 11:83-100.
18. Samalo AP, Beshra RC, Satpathy CR. Studies on comparative biology of the melon fruit fly, Dacuscucurbitae Coq. Orissa Journal of Agricultural Research. 1991; 4:1-2.
19. Shivay V, Kumar CT, Chakravarthy AK. Biology of melon fly, *Bactrocera cucurbitae* on different food sources. Indian Journal of Plant Protection. 2007; 35(1):25-28.
20. Ullah MS, Das G, Islam KS. Biology and host suitability of cucurbit fruit fly, *Bactrocera cucurbitae* (Coq.): a comparative study on five different cucurbits. J. Agro for. Environ. 2008; 2(1):1-6.
21. Vargas RI, Stark JD, Nishida T. Ecological framework for integrated pest management of fruit flies in papaya orchards. In: Ooi PAC, Lim GS, Teng PS editors. Proceedings of the third International Conference on Plant Protection in the Tropics. Malaysian Plant Protection Society, Genting Highlands, Kuala Lumpur, Malaysia. 1990-1992; 64(69):20-23.
22. Vargas RI, Walsh WA, Kanehira D, Jang EB, Armstrong JW. Demography of four Hawaiian fruit flies (Diptera: Tephritidae) reared at five constant temperatures. Annals of the Entomological Society of America. 1997; 90:162-168.
23. Yang PJ, Carey JR, Dowell RV. Tephritid fruit flies in China: Historical background and current status. Pan-Pacific Entomologist. 1994; 70:159-167.