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Biology of Fruit Fly, *Dacus ciliatus* Loew (Tephritidae : Diptera) Infesting Little Gourd, *Coccinia indica* W. & A*

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ABSTRACT

Studies were conducted on the bionomics of *Dacus ciliatus* Loew using little gourd as host in the laboratory of Department of Entomology, N. M. College of Agriculture, GAU, Navsari during Aug., '92 to May '93 (Aug.-Sept., Dec-Jan., April- May). The life history, brief description of various stages, sex difference and sex ratio are given. There are three larval instars. The larval period was 4.40 ± 0.55, 6.80 ± 0.89 and 3.75 ± 0.95 days while, pupal period was 9.03 ± 0.82, 13.50 ± 1.13 and 7.05 ± 0.78 days during August-September, December-January and April-May, respectively. The average longevity of male was 13.41 ± 5.03, 24.80 ± 8.67 and 12.15 ± 3.84 days whereas that of female was 15.12 ± 6.27, 26.76 ± 10.05 and 14.35 ± 4.35 days. The duration of total life span (egg to death of adult) for male was 19.05 ± 1.43, 31.58 ± 4.07 and 16.50 ± 1.13 days while, for female was 19.98 ± 2.00, 33.84 ± 4.82 and 18.48 ± 1.79 days during August-September, December-January and April-May, respectively. The average number of eggs laid by female was 25.79 ± 13.30, 19.33 ± 12.28 and 35.32 ± 16.94. The hatching percentage of eggs was 85.50 ± 4.60, 83.02 ± 3.46 and 88.20 ± 6.19. The preoviposition, oviposition and post-oviposition periods were 6.96 ± 1.74, 4.87 ± 2.28 and 4.52 ± 1.68 days, 8.00 ± 2.05, 5.29 ± 2.28 and 4.38 ± 2.44 days and 4.53 ± 1.17, 3.89 ± 1.41 and 3.58 ± 1.74 days, respectively. The sex ratio of male : female was 1 : 0.98.

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INTRODUCTION

Among the different gourds, little gourd, *C. indica* is widely cultivated in central America, China, Ceylon, India, Malaya & Tropical Africa as a vegetable. Little gourd has its own importance as a human food because of good source of nutritional components. The roots, stems and leaves are also used to cure skin diseases, bronchitis and diabetes.

Little gourd is attacked by a number of insect pests during different growth stage of crop. Out of which, fruit fly, *D. ciliatus* has been observed to cause serious damage to little gourd fruits. The female fruit flies puncture the soft and tender fruits of *C. indica* with their stout and hard ovipositor and lay eggs below the epidermis of fruits. The maggots feed inside on the pulp of fruits. The punctures may also serve as a site of secondary infection by pathogens causing rotting and premature falling. The damage was estimated to the tune of 3 to 100 per cent on *C. Indica* in Gujarat (Patel, 1976). Keeping this in view, the

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bionomics of *D. ciliatus* was carried out at Department of Entomology, N. M. College of Agriculture, Navsari during Aug. '92 to May '93.

MATERIALS AND METHODS

Initial culture of fruit fly, *D. ciliatus* was raised by collecting infested fruits of *C. indica*. The infested fruits were kept vertically in the rearing jars (11 x 15 cm) on a 5 cm, thick layer of Sieved moist soil, at bottom to facilitate pupation. Top of the jar was covered with clean white muslin cloth to prevent the escape of maggots. When, all the full grown maggots entered the soil for pupation, the rotten fruits were removed from the jar. After 4 to 5 days, the soil in the jar was sieved to collect pupae. The pupae were then transferred in clean glass tubes (1.5 x 7.5 cm), individually. The tubes were plugged with cotton lint to prevent the escaping of adult flies when emerged. To raise the laboratory culture, freshly emerged adults (males and females) were confined in round iron bar cage (30 x 45 cm) lined with white muslin bag. Top of the cloth bag was kept open which was tightened with rubber band after releasing adults in the cage.

Enzymatic yeast hydrolysate was provided as a food to the adults by smearing 1 gram of it on the lid (4 x 1 cm) of plastic bottle and placing the lid at the bottom of the iron cage. The tender unifested fruits of little gourd were hung inside the iron cage with thread for oviposition. Fresh fruits were replaced daily for oviposition and food was also given every day in the morning till the adults died. The fruit with eggs, laid on it, was kept in glass jar with the layer of soil for further studies.

The studies on the colour, shape, size and periods of eggs, Maggots, pupa and adults were studied. The preoviposition, oviposition and post-oviposition periods, sex ratio and longevity of adults were also studied.

RESULTS AND DISCUSSION

Egg

Freshly laid eggs were shiny, translucent and whitish in colour. They were cylindrical in shape, slightly curved and narrow at one end. The average length and breadth of eggs was 0.98 ± 0.03 and 0.20 ± 0.02 mm, respectively (Table 1).

Maggot

The maggot passed through three instars. Freshly emerged first instar maggots were translucent and white in colour while second instar maggots were translucent, elongate, ellipsoidal in shape and creamy white or pale white in colour with pointed cephalic end and blunt at posterior end and had peculiar habit of jumping. The first, second and third instar maggots were measured on an average 1.31 ± 0.22, 4.51 ± 0.28 and 8.27 ± 0 .49 mm in length and 0.31 ± 0.05, 1.26 ± 0.12 and 2.03 ± 0.13 mm in breadth, respectively, (Table 1). The average duration of first, second and third instar maggots was 1.75 ± 0.50, 1.33 ± 0.56 and 2.33 ± 0.58 days, 2.16 ± 0.41, 2.33 ± 0.52 and 3.25 ± 0.50 days and 1.25 ± 0.50, 1.33 ± 0.58 and 1.50 ± 0.58 days at the temperatures of 29.78 ± 1.94°C, 26.60 ± 145°C and 32.34 ± 1.24 °C and relative humidity of 83.35 ± 3.27, 65.86 ± 6.84 and 77.43 ± 2.69 per cent respectively (Table 2).

TABLE 1

Measurement of different stages of *D. ciliatus*.

Stage	*Number observed*	*Length (mm)*			*Breadth (mm)*		
		Min.	*Max.*	*Av. ± S.D.*	*Min.*	*Max.*	*Av. ± S.D.*
Egg	50	0.94	1.03	0.98 ± 0.03	0.17	0.23	0.20 ± 0.02
Maggot							
I instar	50	1.00	1.72	1.31 ± 0.22	0.22	0.39	0.31 ± 0.05
II instar	50	4.06	4.94	4.51 ± 0.28	1.06	1.44	1.26 ± 0.12
III instar	50	7.50	9.25	8.27 ± 0.49	1.81	2.19	2.03 ± 0.13
Prepupa	50	6.50	7.31	6.97 ± 0.28	2.06	2.44	2.25 ± 0.13
Pupa	50	3.75	5.44	4.68 ± 0.44	1.50	2.38	1.95 ± 0.27
Adult							
Male	25	6.75	7.81	7.32 ± 0.35	9.25	10.31	9.82 ± 0.35
Female	25	7.81	8.93	8.40 ± 0.35	9.56	10.68	10.35 ± 0.35

TABLE 2

Life cycle of *D. ciliatus* on little gourd.

Sr. No.	*Particulars*	*Aug.-Sept., '02 Range*	*Dec.-Jan. '92-93 Range*	*Apri. May '93 Range*
1.	Egg period (days)	2-3 (2.50 ± 0.55)	2-5 (3.30 ± 0.95)	1-2 (1.50 ± 0.55)
2.	Maggot period (days)			
	I instar	1-2 (1.75 ± 0.50)	2–3 (2.16 ± 0.41)	1-2 (1.25 ± 0.50)
	II instar	1-2 (2.33 ± 0.58)	2-3 (2.33 ± 0.52)	1-2 (1.33 ± 0.58)
	III instar	2-3 (2.33 ± 0.58)	3-4 (3.25 ± 0.50)	1-2 (1.50 ± 0.58)
	Total maggot period	4-5 (4.40 ± 0.55)	6-8 (6.80 ± 0.89)	3-5 (3.75 ± 0.95)
3.	Prepupal period (days)	0.5-1 (0.75 ± 0.27)	1-2 (1.50 ± 0.55)	0.5-1 (0.63 ± 0.25)
4.	Pupal period (days)	8-10 (9.03 ± 0.82)	12-15 (13.50 ± 1.13)	6-8 (7.05 ± 0.78)
5.	Adult period (days)			
	Male	6-24 (13.41 ± 5.03)	7-38 (24.80 ± 8.67)	5-18 (12.15 ± 3.84)
	Female	6-25 (15.12 ± 6.27)	6-42 (26.76 ± 10.05)	6-21 (14.35 ± 4.35)
6.	Total life period (days)			
	Male	17-21 (19.05 ± 1.43)	25-38 (31.58 ± 4.07)	15-18 (16.50 ± 1.13)
	Female	17-23 (19.98 ± 2.00)	26-42 (33.84 ± 4.82)	16-21 (18.48 ± 1.79)
7.	Temperature (°C)	27.00 – 32.00 (29.78 ± 1.94)	22.50 – 29.00 (26.60 ± 1.45)	30.00 – 34.00 (32.34 ± 1.24)
8.	Relative humidity (%)	78 – 86 (83.35 ± 3.27)	55–83 (65.86 ± 6.84)	73 -79 (77.43 ± 2.69)

Figures in parenthses are average values ± S.D.

Prepupa

In this stage, the full grown maggot was slightly bent in position, became sluggish and stopped feeding. The size of prepupa was measured on an average 6.97 ± 0.28 mm in length and 2.25 ± 0.13 mm in breadth (Table 1). The average duration of prepupal stage was 0.75 ± 0.27, 1.50 ± 0.55 and 0.63 ± 0.25 days during August-September, December-January and April-May, respectively (Table 2).

Pupa

The freshly formed pupa was of cream coloured which turned to dark yellow within 4-5 hours. Lateron, the colour changed to brownish to ochraceous. The pupae were barrel shaped with single black dot on posterior portion. The average length and breadth of pupae were 4.68 ± 0.44 and 1.95 ± 0.27 mm, respectively (Table 1). The average duration of pupal stage was 9.03 ± 0.82, 13.50 ± 1.13 and 7.05 ± 0.78 days at an average temperatures of 29.78 ± 1.94, 26.60 ± 1.45 and 32.34 ± 1.24°C and relative humidity of 83.35 ± 3.27, 65.86 ± 6.84 and 77.43 ± 2.69 per cent respectively (Table 2).

Adult

The maximum number of adults were found to be emerged from the pupae between 8.00 to 10.00 a.m. The eclosion time varied from 3 to 40 (Av. 16.52 ± 7.75) minutes. The freshly emerged adult flies were less active, pale yellow with wings attached to body. The files attained its normal bright brown or ferrugineous brown colour after 2-3 hours. Two lemon yellow coloured markings were observed either side on dorsum of prothorax, one at the anterior side and other at posterior side. Another large sized marking of same colour was observed at mid dorsum of metathorax. Two round dark brown spots were present on dorsal side of fourth abdominal segment. The average length and breadth (with expanded wings) of male was 7.32 ± 0.35 and 9.82 ± 0.35 mm, respectively. Whereas, the female measured on an average 8.40 ± 0.35 mm in length and 10.35 ± 0.35 mm breadth (with expanded wings) indicating the males being smaller in size than females (Table 1).

The average number of eggs laid by a female was 25.79 ± 13.30, 19.33 ± 12.28 and 35.32 ± 16.94 at an average temperatures of 28.75 ± 1.83, 26.61 ± 1.42 and 32.63 ± 1.30°C and relative humidity of 83.90 ± 2.13, 67.78 ± 5.50 and 76.13 ± 6.62 per cent, respectively (Table 3). The fecundity was lower with lower temperature and vice versa.

The hatching percentage of eggs was 85.50 ± 4.60, 83.02 ± 3.46 and 88.20 ± 6.19 at an average fluctuating temperatures of 28.56 ± 1.86, 26.31 ± 1.66 and 32.54 ± 1.22°C and relative humidity of 83.75 ± 2.38, 70.50 ± 7.46 and 77.43 ± 5.93 per cent, respectively (Table 3).

The average longevity of male was 13.41 ± 5.03, 24.80 ± 8.67 and 12.15 ± 3.84 days whereas, that of female was 15.12 ± 6.27, 26.76 ± 10.05 and 14.35 ± 4.15 days at an average temperatures of 29.78 ± 1.94, 26.60 ± 1.45 and 32.34 ± 1.24°C and relative humidity of 83.35 ± 3.27, 65.86 ± 6.84 and 77.43 ± 2.69 per cent respectively (Table 2).

The female fruit fly preferred to lay eggs in proximal half part of the fruit at an average depth of 1.98 ± 0.45 mm.

TABLE 3

Pre oviposition, oviposition, post-oviposition periods, fecundity and hatching percentage of fruit fly, *D. ciliatus*.

Sr. No.	*Particulars*	*Temperature (°C)*	*Relative humidity (%)*
1.	Preoviposition period (days)	29.29 ± 1.92	83.47 ± 2.84
	6.96 ± 1.74	26.02 ± 1.79	64.78 ± 6.82
	8.00 ± 2.05	32.88 ± 1.82	73.92 ± 5.80
	4.53 ± 1.17		
2.	Oviposition period (days)	29.29 ± 1.92	83.47 ± 2.84
	4.87 ± 2.28	26.02 ± 1.79	64.78 ± 6.82
	5.29 ± 2.28	32.88 ± 1.82	73.92 ± 5.80
	3.89 ± 1.41		
3.	Postoviposition period (days)		
	4.52 ± 1.68	29.29 ± 1.92	83.47 ± 2.84
	4.38 ± 2.44	26.02 ± 1.79	64.78 ± 6.82
	3.58 ± 1.74	32.88 ± 1.82	73.92 ± 5.80
4.	Fecundity		
	25.79 ± 13.30	28.75 ± 1.83	83.90 ± 2.13
	19.33 ± 12.28	26.61 ± 1.42	67.78 ± 5.50
	35.32 ± 16.94	32.63 ± 1.30	76.13 ± 6.62
5.	Hatching percentage		
	85.50 ± 4.60	28.56 ± 1.86	83.75 ± 2.38
	83.02 ± 3.46	26.31 ± 1.66	70.50 ± 7.46
	88.20 ± 6.19	32.54 ± 1.22	77.43 ± 5.93

Duration of entire life span

The entire life span of *D. cillatus* from egg to the death of adult male was completed within on an average of 19.05 ± 1.43, 31.58 ± 4.07 and 16.50 ± 1.13 days whereas, that of female completed within on an average of 19.98 ± 2.00, 33.84 ± 4.82 and 18.48 ± 1.79 days at an average temperatures of 29.78 ± 1.94, 26.60 ± 1.45 and 32.34 ± 1.24°C and relative humidity of 83.35 ± 3.27, 65.86 ± 6.84 and 77.43 ± 2.69 per cent, respectively (Table 2).

Pre oviposition, oviposition and post-oviposition period

The average pre oviposition, oviposition and post oviposition periods were 6.96 ± 1.74, 4.87 ± 2.28 and 4.52 ± 1.68 days, 8.00 ± 2.05, 5.29 ± 2.28 and 4.38 ± 2.44 days and 4.53 ± 1.17, 3.89 ± 1.41 and 3.58 ± 1.74 days at temperatures of 29.29 ± 1.92, 26.02 ± 1.79 and 32.88 ± 1.82°C and relative humidity of 83.47 ± 2.84, 64.78 ± 6.82 and 73.92 ± 5.80 per cent, respectively (Table 3).

Sex ratio

The adults emerged from pupae were critically examined and sexed by observed presence or obsence of pointed ovipositor. Out of 399 adults observed, 202 were males and 197 were females indicating preponderance of male population over female. Thus, the sex ratio of male : female was found to be 1:0.98.

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