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Life table studies on *Eupeodes corollae* (Fabricius) (Diptera : Syrphidae), a predator of the cabbage aphid, *Brevicoryne brassicae* (Linnaeus) (Homoptera : Aphididae)

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ABSTRACT : Life table studies on *Eupeodes corollae* (Fabricius), an important syrphid predator of the cabbage aphid, *Brevicoryne brassicae* (Linnaeus) in the mid-hill region of Himachal Pradesh revealed that the net reproductive rate (R_0) of the species was 187.52 female eggs/female. The true intrinsic rate of natural increase (r_m) was 0.134. The population multiplied 1.14 times per day during the generation and was able to multiply 2.55 times every week. On reaching a stable age-distribution, the population comprised approximately 97 per cent of immature stages.

KEY WORDS : *Brevicoryne brassicae*, *Eupeodes corollae*, intrinsic rate of increase, life-table, net reproductive rate

Syrphids are important predators of many aphid species. *Eupeodes corollae* (Fabricius) (Diptera : Syrphidae) is an important predator reported to feed upon the cabbage aphid, *Brevicoryne brassicae* (Linnaeus) (Sharma and Bhalla, 1988). Life-tables provide a valuable picture of the fecundity and growth potential of the predator under prevailing environmental conditions. The present studies aim at generating useful information in constructing the population model of *E. corollae*.

MATERIALS AND METHODS

The culture of *E. corollae* was initiated in the laboratory (16-21 °C and 61 % RH) from field collected females. To stimulate egg laying, cauliflower leaves infested with the cabbage aphid were kept inside glass chimneys (20 x 15 cm) covered with muslin cloth. Eggs were picked with the help of a camel hair brush and placed on moistened filter paper in a petri plate (9 cm diameter). On hatching the larvae were transferred individually to glass tubes (10 x 2 cm) and given first and second instar nymphs of *B. brassicae* as food while the second and third instar larvae of *E. corollae* were provided with third and fourth instar nymphs. To facilitate pupation, a few leaves were kept inside the tube. Adults emerging each day were held in pairs in glass chimneys having aphid infested cauliflower plants. A cotton swab with 10 per cent honey solution and a few shoots of mustard inflorescence were kept in the chimney as carbohydrate and protein source required for oogenesis in flies as reported by Barlow (1979). Observations on mortality of eggs, larvae, pupae and adults were recorded daily. Fecundity was recorded till the death of the last female. A life table was constructed according to Birch (1948) and Southwood (1976). Stable age-distribution was calculated with the help of the true intrinsic rate of increase and age-specific mortality.

RESULTS AND DISCUSSION

The maximum life span of *E. corollae* from egg to adult was 55 days. Oviposition began 32 days after egg laying when 78 per cent survival was observed. In ovipositing females, mortality was observed from the 11th day of oviposition but during peak oviposition only 50 per cent of the females survived (Table 1). A female produced 6.45 female progeny on the first day of oviposition which increased till 40th day when 18.66 females were produced. A second peak was observed on 47th day (19.26 female eggs/female) and oviposition ceased on 53rd day. Maximum oviposition period was 21 days and maximum adult longevity 31 days.

The population growth statistics (Table 1) of *E. corollae* revealed that the net reproductive rate was lesser than the gross reproductive rate due to a sharp decline in the survivorship value of the parent females. Mean length of generation (T_c) was 40.85 days which

Table 1. Life table of *E. corollae* on the cabbage aphid, *B. brassicae*

Pivotal age in days x	Survival of females at age x l_x	Number of females/female m_x	$l_x m_x$	$x l_x m_x$
0-31	Immature stage and pre-oviposition period			
32	0.78	6.45	5.031	160.992
33	0.78	6.55	5.109	168.597
34	0.78	9.86	7.691	261.494
35	0.78	15.06	11.747	411.145
36	0.78	16.42	12.808	461.088
37	0.78	14.88	11.606	429.422
38	0.78	17.39	13.564	515.432
39	0.78	17.80	13.884	541.476
40	0.78	18.66	14.554	582.160
41	0.78	11.24	8.767	359.447
42	0.74	14.72	10.893	457.506
43	0.74	15.50	11.470	493.210
44	0.66	16.90	11.154	490.776
45	0.62	15.59	9.666	434.970
46	0.62	18.05	11.191	514.786
47	0.50	19.26	9.630	452.610
48	0.50	9.90	4.950	237.600
49	0.47	14.47	6.801	333.249
50	0.31	11.98	3.714	185.700
51	0.23	10.07	2.316	118.116
52	0.11	8.88	0.977	50.804
53	0.11	0.00	0.000	0.000
54	0.11	0.00	0.000	0.000
55	0.11	0.00	0.000	0.000
56	0.00	0.00	0.000	0.000
Total		289.63	187.523	7660.580

Table 2. Growth rate statistics of *E. corollae*

Gross reproductive rate (GRR)		= 289.63 eggs/female
Net reproductive rate (R_o)		= 187.52 female eggs/female
Mean length of generation (T_c)		= 40.85 days
Innate capacity for increase in number (r_c)		= 0.128 females/day
The intrinsic rate of increase (r_m)		= 0.134 females/day
Corrected generation time (T)		= 39.06 days
Finite rate of increase in number (λ)		= 1.14 females/day
Weekly multiplication of population		= 2.55
Stable age-distribution		
	Eggs	= 45.16 %
	Larvae	= 39.00 %
	Pupae	= 12.78 %
	Adults	= 3.06 %

The population growth statistics (Table 1) of *E. corollae* revealed that the net reproductive rate was lesser than the gross reproductive rate due to a sharp decline in the survivorship value of the parent females. Mean length of generation (T_c) was 40.85 days which approximated the true generation time (T) of 39.06 days, during which the species multiplied 187.52 times. The innate capacity for natural increase (r_c) was 0.128 while the true intrinsic rate of increase (r_m) was 0.134. Makhmoor and Verma (1989) reported lower values of net reproductive rate (R_o) of 173.47 and 56.30 for winter and spring generations of *Eupeodes confrater* (Wiedemann), respectively, while the true intrinsic rate of increase was 0.102 and 0.118 in the two generations. The differences, besides being intrinsic characteristics of the species concerned, might be attributed to higher fecundity and better survival of females observed in this study. With a daily finite rate of increase of 1.14 the population was able to multiply 2.55 times every week on the cabbage aphid. The stable age-distribution revealed that eggs, larvae and pupae contributed 45.16, 39.00 and 12.78 per cent to the population comprising 97 per cent of all the stages. The immature stages and particularly the feeding larval stage comprising a large per cent, is a good index of the predatory potential.

The population growth statistics (Table 2) observed in the present study indicated the capability of rapid increase in population size with a strong possibility of bringing about an effective check of aphid population. Tamaki *et al.* (1967) reported that even a limited number of syrphid flies with their efficient oviposition and voracious feeding were effective in suppressing a potentially explosive population of *Myzus persicae* (Sulzer) on peach tree in Yakima Valley, Washington. In Kullu valley (Himachal Pradesh), *E. confrater* along with *Brinkochrysa scelestes* (Banks) was able to reduce the woolly apple aphid population by 23.81- 34.76% at four sites (Thakur *et al.*, 1992). In Germany, Groeger (1993) reported that when cereal aphids and syrphids were well synchronized, the aphid infestation was reduced substantially.

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