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Life table of *Bracon hebetor* on rice moth, *Corcyra cephalonica* Stainton (Lepidoptera: Pyralidae)

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Abstract

Existence desk take a look at can be very beneficial for designing mass rearing applications in addition to identifying the timing of creation in inoculative releases. in the gift look at maximum obvious mortality in the course of the egg degree turned into 30 eggs. Highest mortality rate become registered in larval level with fifty two larvae. The quantity that survived from 126 eggs to adult emergence turned into 96 individuals. Women deposited first batch of eggs on thirteenth day and stopped it after twenty first day with lx values being zero.98 and 0.56, respectively. The lx decreased gradually after 14th day of pivotal age because of adult mortality. The women contributed highest wide variety of progeny ($m_x = 10$. zero) inside the life cycle on the thirteenth day of pivotal age. The net reproductive ability (R_o) turned into worked as fifty one.27 women/ woman with the imply technology time (T) of 15. ninety six days. The intrinsic charge of increase (r_m) and finite price of natural increase in numbers (λ) changed into 0.2466 and 1.2796 females/woman/day, respectively. Weekly multiplication of population turned into 9.1974 instances in step with week. The hypothetical female's population in F2 technology became 2628.6129. The suggest era time (T_c) became 15.96 days recorded.

Keywords: *Bracon hebetor*, *Corcyra cephalonica*, life table, rice moth

Introduction

The use of natural control has been a treasured technique in handling pests within the local vicinity for many years. herbal control is a way hired in incorporated pest management (ipm) for numerous agricultural structures and in protected flowers systems. this period is economically possible and has no terrible effects at the surroundings, human fitness, or home animals (orr, 2009) [4]. inside the realm of pest control, the number one adversaries are numerous insects, referred to as entomophagous, or microorganisms, known as entomopathogens. The institution that focuses on studying insects is represented by using the resources of predators and parasitoids. the majority of the herbal enemies fall under the order hymenoptera. Hymenopterans are one of the 4 primary orders of bugs that exhibit the highest level of biodiversity on a worldwide scale. Braconidae is the second largest own family of hymenoptera, inclusive of about 4,000 species, which may be observed in diverse habitats internationally (Sharkey, 1993) [5]. the important thing-species may be taken into account for the safety and stability of insect organizations. Braconids had been considerably used in lots of studies on host-parasitoid interactions due to their high reproductive price, brief development time, and huge range of host species. The lifestyles table is a device used in quantitative evaluation and populace estimation. the continued studies on the lifestyles of bracon hebetor on Corfu Island, Greece, become currently concluded.

Materials and Methods

Host Insect Culture

Grains (Jawar+Maize+Bajra) 2.5 kg were stored in wood cages (45cm× 30cm×15cm). The grains have been sterilized in hot air oven for one hour at 1000C. After cooling the grains had been grinded coarsely. five ml of 10% honey answer along side 5g of yeast and a pinch of Streptomycin had been jumbled together each field. eventually the containers were charged with zero.25cc (approximately 4750) eggs of *C. cephalonica*.

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Experiment

Using natural manipulate has been a precious approach in handling pests within the nearby area for many years. natural manage is a way hired in included pest management (ipm) for numerous agricultural structures and in blanketed plants systems. this era is economically feasible and has no terrible outcomes at the environment, human fitness, or home animals (orr, 2009) [4]. within the realm of pest control, the primary adversaries are numerous insects, known as entomophagous, or microorganisms, referred to as entomopathogens. The group that specializes in reading bugs is represented by means of the resources of predators and parasitoids. the general public of the natural enemies fall beneath the order hymenoptera. Hymenopterans are one of the four fundamental orders of bugs that exhibit the best degree of biodiversity on a worldwide scale. Braconidae is the second largest family of hymenoptera, which includes approximately 4,000 species, which can be observed in various habitats the world over (Sharkey, 1993) [5]. the important thing-species could be taken into account for the protection and stability of insect groups. Braconids were extensively used in lots of studies on host-parasitoid interactions because of their high reproductive price, quick improvement time, and huge variety of host species. The existence table is a tool used in quantitative evaluation and population estimation. the continued research on the existence of bracon hebetor on Corfu Island, Greece, became these days concluded 25 0C, sixty five.5% RH and replicated for 5 times.

Life table construction

The strategies recommended by Sokal and Rohlf (1981) [6] have been used for constructing the life-tables. From 126 eggs the wide variety of alive and lifeless, had been recorded day by day and the following column heads have been used within the documentation of age-precise lifestyles-desk.

mx: As the sex ratio was 1:1, the number of eggs obtained / female were divided by two to get the number of female birth (mx). The column headings for the construction of the life fecundity tables proposed by Howe and Atwal and Bains were used in this study, viz.,

x = Pivotal age in days

lx = Survival of female at age 'X'

mx = Age schedule for female births at age 'X'.

Net reproductive rate (Ro)

The values of 'x', 'lx' and 'mx' were calculated from the data given in life tables. The sum total of the products 'lxmx' is the net reproductive rate (Ro). The 'Ro' is the rate of multiplication of population in generation measured in terms of females produced per generation. The number of times a population would multiply per generation was calculated by the following formula, $Ro = \sum lxmx$.

Mean duration of generation (Tc)

The appropriate value of generation time (Tc) i.e. the mean age of the mothers in a cohort at the birth of female offspring was calculated by using the following formula:

$$Tc = \frac{\sum xlxmx}{Ro}$$

Innate capacity for increase (rm)

Total number of individuals survived and mean number of female offspring births were recorded at each age interval. From these data, the arbitrarily value of 'rm (rc)' was derived by the following formula:

$$rm = \log_e Ro / Tc$$

Tc = Mean generation time

$$T = T = \log_e Ro / rm.$$

The finite rate of natural increase (λ)

The number of females per female per day i.e. finite rate of increase was determined as: $\lambda = \text{antilog } e^{rm}$.

From this data, the weekly multiplication of the population was calculated. The hypothetical F2 females were also be worked out with the formula $(Ro)^2$.

Life table for computing life expectancy of *Bracon hebetor* Say

Life expectancy of the pest was worked out by using columns x, lx,

dx, 100qx, Lx, Tx and ex. Where,

x = Pivotal age (days)

lx = Number of surviving at the beginning of age interval out of 100

dx = Number dying during 'x'

100qx = $\frac{dx}{lx} \times 100$, Mortality rate per hundred alive at the beginning of age interval.

$$Lx = \frac{lx + (lx+1)}{2} \text{ Alive between } x \text{ and } x+1$$

Tx = Number of individual's life days beyond 'x' and

$$ex = \frac{Tx}{lx} \times 2$$

Results and Discussion

Life table study can be very useful for designing mass rearing programs as well as deciding the timing of introduction in inoculative releases. The results on number of individuals those survived during development of *B. hebetor* Say on *C. cephalonica* Stainton revealed that maximum apparent mortality during the egg stage was 30 eggs. Highest mortality rate was registered in larval stage with 52 larvae.

The number that survived from 126 eggs to adult emergence was 96 individuals. Life fecundity tables were constructed to determine the survival of female (lx) and age specific fecundity (mx). The life fecundity data presented in Table 1 indicated that pre-oviposition period was recorded on 11th -12th day of pivotal age. Females deposited first batch of eggs on 13th day and stopped it after 21st day with lx values being 0.98 and 0.56, respectively. The lx decreased gradually after 14th day of pivotal age due to adult mortality. The females contributed highest number of progeny (mx = 10.0) in the life cycle on the 13th day of pivotal age.

Table 1: Life table (for female) and age specific fecundity of *Bracon hebetor* Say on *Corcyra cephalonica* Stainton.

Pivotal age in days (x)	Survival of female at different age interval (lx)	Age schedule for female birth (mx)	(lxmx)	(xlxmx)
0-10	Immature stages			
11-12	Pre-oviposition stage			
13	0.98	10.0	9.78	127.11
14	0.89	9.0	7.98	111.68
15	0.87	8.5	7.41	111.15
16	0.85	7.5	6.40	102.35
17	0.83	6.5	5.38	91.45
18	0.79	6.0	4.75	85.50
19	0.74	6.0	4.42	84.00
20	0.64	5.0	3.21	64.29
21	0.56	3.5	1.94	40.83
			$Ro = \sum lxmx$ =51.27	$\sum xlxmx$ =818.37

Table 2: Mean length of generation, innate capacity for increase in numbers and finite rate of increase in numbers of *Bracon hebetor* Say on *Corcyra cephalonica* Stainton.

Population growth statistics	Formula	Calculated values
Net reproductive rate	$Ro = \sum lxmx$	51.27
Mean length of generation	$Tc = \frac{\sum xlxmx}{Ro}$	15.96
Innate capacity for increase in numbers	$rm = \frac{\log Ro}{Tc}$	0.2466 Females/female/day
Corrected generation time	$T = \frac{\log Ro}{rm}$	15.9655
Finite rate of increase in numbers	$\lambda = \text{antilog } e^{rm}$	1.2796
Weekly multiplication of population	$(\lambda)^9$	9.1974
Hypothetical F2 females	$(Ro)^2$	2628.6129

Table 3: Life table for computing life expectancy of *Bracon hebetor* Say on *Corcyra cephalonica* Stainton.

Life stages	Pivotal age (Days)	Number of surviving to the beginning of age interval	Number of dying during 'x'	Mortality factors	Mortality rate per hundred alive at beginning of age interval $\frac{dx.100}{lx}$	Alive between age 'x' and 'x+1' $\frac{lx + (lx+1)}{2}$	No. of the individuals of further life days beyond 'x'	Expectation of further life $\frac{Tx}{lx} \times 2$
	(x)	(lx)	(dx)		(100qx)	(Lx)	(Tx)	(ex)
Egg	0-2	126	30	Abiotic factor	24	127	313	4.96
Larvae	2-6	96	50	NPV	52	97	186	3.88
Pupa	6-12	46	5	Unknown	11	47	89	3.87
Adult	12-20	41	0	-	0	42	42	2.05

The net reproductive potential (Ro) was worked as 51.27 females/ female with the mean generation time (T) of 15.96 days. The intrinsic rate of increase (rm) and finite rate of natural increase in numbers (λ) was 0.2466 and 1.2796 females/female/day, respectively. Weekly multiplication of population was calculated 9.1974 times per week. The hypothetical female's population in F2 generation was 2628.6129. The mean generation time (Tc) was 15.96 days recorded.

Almost similar results were reported by Nikam and Pawar (1993) [3] who reported the innate capacity of increase (rm) was 0.215/female per day and mean generation time (Tc) of 18.38 days but results of the weekly multiplication of population (λ) was found 52.12 times which differed from present finding with 9.1974 times weekly multiplication of population. Maafi and Hsin (2006) [2] also found more or less similar observations on life fecundity tables when *H. hebetor* (Say) reared on *G. mellonella* (L.). They recorded finite rate of increase (λ) 1.1640 times and mean generation time (T) 16.8 days which were much more similar to the present findings.

The above findings are in line with the findings of Farag *et al.* (2015) [1] who found that the intrinsic rate (rm), the finite rate of

increase (λ), the net reproductive rate (Ro) and the mean generation time (T) of *B. hebetor* reared on *C. cephalonica* with 0.1942 female per day, 1.2133 times, 30.6 and 18.09 days, respectively.

The computation of life expectancy table of *B. hebetor* Say on *C. cephalonica* Stainton clearly showed that the life expectancy of newly deposited eggs was 4.96 days. Further, it has been clearly observed that the mortality rate was comparatively high at the age of 2 to 6 days, when the expectation of further life was reduced to 2.05 days from 4.96 days in the beginning.

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