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Life table and intrinsic rate of increase in *Eutectona machaeralis* Walker (Lepidoptera : *Pyralidae*).

T. V. Sathe[a]* & V. Y. Kadam[a]
[a]*Department of Zoology, Shivaji University, Kolhapur - 416004 India.

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Abstract : *Eutectona machaeralis* Walker (Lepidoptera : Pyralidae) is forest pest which acts as defoliator of *Tectona grandis*. Therefore, life table and intrinsic rate of increase have been studied. The first adult mortality was noted on sixth day. Avarage period of immature stages was 28 days. Maximum mean progeny production per day, mx was 26.8 on the 3rd day. The intrinsic rate of increase was found to be 0.149 per female per day and population multiplied 88.16 times in mean generation time of 30.6 days.

Key words: *Eutectona machaeralis*, Teak defoliator, life table, intrinsic rate of increase.

INTRODUCTION

The estimates of the rate of growth of the pest have tremendous importance in pest management Howe (1953)[1]. According to Thompson (1924)[2] the characteristics of the animal are collectively called the "inate capacity for increase". He visualized the first mathematical method for population dynamics. Later, Lotka (1925)[3] derived the function for the intrinsic rate of natural increase and then Birch (1948)[4] used the same for animal ecology and for the insect populations. In the present study the life tables were constructed as per Birch, (1948)[4] elaborated by Howe (1953)[1] and Watson (1964)[5].

Review of literature indicates that life table studies have been attempted by several workers on lepidopteran pests, Morris and Miller (1954)[6] on *Choristoneura fumiferanea*, Stark (1959)[7] on *Recurvaia starki*, Le Roux *et al*. (1963)[8] on *Spilonota ocellana*. Bains and Shukla (1976)[9] on *Chilo partellus* (Swinh), Bilapate and Pawar (1980)[10] on *Helicoverpa (Heliothis) armigera* (Hubn), etc.

*Correspondent author :
Phone : 09975141654
E-mail : profdrtvsathe@rediffmail.com

MATERIALS AND METHODS:

Birch (1948)[4] visualized the following equation to study intrinsic rate of natural increase.

$$\sum e^{-r} m^x l_x m_x = 1$$

Where

'e' is the base of the natural logarithm,

'x' the age of the individual in days,

1x the number of individuals alive at age 'x' as a portion of one, and m_x the number of female offsprings produced per female in the age interval 'x'

The sum of the products 1_x m_x is the net reproductive rate,

'R_0' which is the rate of multiplication of the population in each generation measured in terms of females produced per generation.

The approximate value of cohort generation time 'Tc' was calculated as follows:

$$T_c = \frac{1_x m_x X}{1_x m_x}$$

The formula: $r_c = \frac{\log_e R_o}{T_c}$

provides the arbitrary value of innate capacity for increase, r_c'

This was an arbitrary value for r_m and value of r_m upto two decimal places was substituted in the formula until the two values of the equation were found which lies immediately above or below 1096.6.

The two values of $\sum e^{7-r} m^x 1_x m_x = 1$ were then plotted on the horizontal axis against their respective arbitrary r_m on the vertical axis. The point of intersection gives the value of r_m accurate to 3 decimal places. The precise generation time 'T' was calculated as

$T = \frac{\log_e R_0}{r_m}$ and

the finite rate of increase (λ) was calculated as-

$\lambda = e^r m.$

Adults of *E. machaeralis* have been reared under laboratory conditions (25 ± 2^0c,.65 ±5 R.H,12 hr photoperiod). The laboratory culture was used for determining intrinsic rate of increase. The life tables were prepared with the help of fecundity data and later, the intrinsic rate of natural increase of population of moths were calculated. All experiments were carried out at laboratory conditions (25±2^0c,.65± 5 R.H, 12hr photoperiod) and replicated for ten times.

RESULTS

Results are recorded in tables 1 and 2 and fig. -1. The first adult mortality was noted on the 6th day. Average period of immature stages was 28 days. Maximum mean progeny production per day, m_x was 26.8 on the 3rd day. The innate capacity for increase was found to be 0.149 (Fig, 1) per female per day and population multiplied 88.16 times in mean generation time 'T' of 30.6 days.

$$T_c = \frac{1_x m_x X}{1_x m_x} = \frac{2743.2}{88.16} = 31.11$$

Where T_c is arbitrary T.

$$= \frac{\log_e \quad R_0}{T_c} \quad = \frac{88.16}{31.11} = 0.143$$

Where r_c is arbitrary r_m

T_c = 31.11

R_c = 0.143

Now arbitrary 'r_m's are 0.12 and 0.16 where λ is the finite rate of natural increase.

r_m = 0.149 (fig.1)

$$T = \frac{\log_e 88.16}{0.149} = 30.06$$

$$T = \quad 30.06 \ days.$$

DISCUSSION:

Bains and Shukla (1976)[9] studied the life tables and intrinsic rate of increase in C. *partellus* (lepidoptera) where in the intrinsic rate of increase (r_m) at different temperatures were in assending order 0.0002 (35^{0}C), 0.165 (32.5 ^{0}C), 0.223 (25^{0}C), 0.383 (27.5^{0}C) and 0.435 (30^{0}C). The rate of increase was maximum at 30^{0}C which should be considered to be the optimum temperature for the multiplication of this lepidopterous pest. Further observations of Bains and Shukla (1976)[9] on the finite rate of increase per week were 4.67, 15.59, 21, 3.177 and 1.002 at 25^{0}C, 27.5^{0}C, 30^{0}C , 32.5^{0}C and 35^{0}C respectively.

In *H. armigera* Bilapate and Pawar (1980)[10] the value of R_0 indicated that 285.06 females were produced per female during one generation. The innate capacity and finite rate for increase in numbers were 0.1210 and 1.1260 respectively. The mean duration of a generation was 46.71 days. Under conditions of abundant space, the daily finite rate of increase of *H. armigera* was 1.1286 which enabled the insect to multiply 2.3322 times every week. (Bilapate and Pawar, 1980)[10].

According to Reddy and Bhattacharya (1988)[11] the life expectancy (e_x) of *H. armigera* declined up to first 6 days due to egg mortality and increased upto 10 days due to larval mortality. Later, with the advancement of development e_x decreased steadily till it reached 46th day. This type of enhancement in e_x due to heavy mortality at any age group was also reported for *Naranga diffua* Walker, *Phyllonistis citrella* Stainton, *Creatonotus gangis* Linneaus, *Spilosoma obliqua* Walker and *Spodoptera litura* (Fabricius). There was indication of the survival fraction

(lx) of each cohort. Females started laying eggs after 31.5th day and stopped it after 39.5th day with lx values being 0.42 and 0.17 respectively. The l_x decreased gradually after 4.5th day due to adult mortality.

Reddy and Bhattacharya (1988)[11] studied various life parameters computed to get an overall picture of different vital statistics of *H. armigera* on maize based diet. Mean length of generation (T) indicated that this insect completed first generation in 35.5 days. Similarly, net reproductive rate (R_0), accurate estimate of intrinsic rate(R), finite rate of increase or the population multiplication in on unit time (λ)', time required for the population become double (DT), potential fecundity (PT) and annual ratio of increase (AR) were 46.98, 0.1090, 1.1152, 3.36, 134.40 and 1.898 × 10^{17} respectively.

In the present study 'r_m' of *E. machaeralis* was 0.149. The first adult mortality was noted on sixth day. Average period of immature stages was 28 days. Maximum mean progeny production per day, m_x was 26.8 on the 3rd day and population multiplied 88.16 times in mean generation time of 30.6 days.

The above studies will be helpful for population dynamics of above forest pest and in deciding its control strategies.

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