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LIFE TABLE AND INTRINSIC RATE OF INCREASE IN *APANTELES AGILIS* ASHMEAD, A LARVAL PARASITOID OF *DIAPHANIA PULVERULENTALIS* (HAMPSON).

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ABSTRACT

Life table and intrinsic rate of increase have been studied in Apanteles agilis Ashmead (Hymenoptera: Braconidae), a larval parasitoid of Diaphania pulverulentalis (Hampson). The longevity of ovipositing females of A. agilis, ranged from 6 to 8 days (mean 7.4 days). The number of progeny produced averaged 47.3 (range 40 – 53) individuals. The male : female offsprings averaged 1 : 1.529 (range 1 : 1.208 – 2.00). The first adult mortality was on the fifth day. Average length of immature stages of parasitoid was 16 days. The maximum progeny production per day, (m_x) was 12.7 on third day and reproduction stopped on seventh day. The intrinsic rate of increase (r_m) per female per day was 0.180 and population multiplied 27.94 times in mean generation time 'T' of 18.50 days.

Key words : Life table, *Apanteles agilis,* larval parasitoid, *Diaphania pulverulentalis*

INTRODUCTION

Diaphania pulverulentalis (Hampson) (Lepidoptera) is potential pest of mulberry in India. The pest rolls the leaves and feed upon them and contaminate by webbing, sheltering and by producing excrement. Thus, the pest affect quality and quantity of leaves and further rearing of mulberry silkworms *Bombyx mori* L. as mulberry leaves is food for *B. mori*. Use of pesticides on mulberry ecosystem is not without danger. Therefore, for hoping ecofriendly control (biological control) of *D. pulverulentalis* the present work will add great relevance. Review of literature indicates that life tables and intrinsic rate of increase have been studied in different insects by several workers to understand the population ecology (Bilapate and Pawar, 1980) but, very little attention has been paid on Hymenopterous parasitoids (Chundurwar, 1977; Nikam and Sathe, 1983; Sathe and Nikam, 1984; Sathe, 1986, 1991, Sathe and Ingawale, 1993, etc). Keeping in view all above facts, the present work was carried out. The data will be helpful for raring the parasitoid in biocontrol programme of *D. pulverulentalis.*

MATERIALS AND METHODS

The life tables were constructed according to Birch (1948), Howe (1953) and Watson (1964). The parasitoids were reared on 4 day old *D. pulverulentalis* larvae. A constant number of 30 hosts larvae were exposed to the parasitoids daily for 24 hr. The parasitized host larvae were transferred to separate containers for parasitoid / moth emergence. The observations were made on immature forms, longevity of adult parasitoids and daily emergence of parasitoids from each lot of hosts to determine the fecundity. The life tables were constructed with the help of fecundity data

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and later, the intrinsic rate of natural increase of population (r_m) of parasitoid was calculated. All experiments were conducted under laboratory conditions (25 $\pm$ 1 ^{0}C, 60 - 65 % R.H., 12 hr photoperiod). During the experiments, *D. pulverulentalis* larvae were fed with Mulberry (*Morus alba* L.) leaves and parasitoids with 50 per cent honey.

RESULTS AND DISCUSSION

Results are tabulated in tables 1 to 3 and Fig. 1. Longevity of ovipositing females averaged 7.4 days (range 6.0 – 8.0 days). The number of progeny produced averaged 47.3 (range 40 – 53) individuals. The male : female offsprings averaged 1 : 1.529 (range 1 : 1.208 - 1 : 2.00). Most of the females reached their peak of oviposition on the first day. The first adult mortality was on the fifth day. Oviposition period averaged 5.3 days (ranged 4.0 – 6.0 days). Average length of immature stages of parasitoid was 16 days. The maximum progeny production per day, m_x was 12.7 on third day and reproduction stopped on seventh day. The intrinsic rate of increase per female per day was 0.180 (Fig.1) and population multiplied 47.3 times in mean generation time 'T' of 18.50 days.

$$Tc = \frac{l_x m_x x}{l_x m_x} = \frac{525.68}{27.94} = 18.81$$

Where, Tc is arbitrary 'T'

$$r_c = \frac{\log_e R_0}{Tc} = \frac{\log_e 27.94}{18.81} = 0.177$$

Where r_c is arbitrary 'r_m'

Tc = 18.30, r_c = 0.177

Now arbitrary 'r_m's (r_c) are 0.19 and 0.23

? = $e^{7-r_m} \times l_x m_x = 1$

r_m = 0.180 (Fig. 1)

Where ë is the finite rate of natural increase.

$$Tc = \frac{\log_e 27.94}{0.180} \quad Tc = 18.50 \quad \mathbf{T = 18.50 days.}$$

In *Agathis unicolorata* (Shenefelt) (Chundurwar, 1977), *Cotesia flavipes* (Cameron) (Nikam and Sathe, 1983) and in *Cotesia orientalis* C. & N. and *Cotesia diurnii* R. & N., (Sathe and Nikam, 1984; Sathe, 1986) the intrinsic rates of increase were 0.144, 0.176, 0.188 and 0.158 respectively. The populations multiplied by 34.56, 30.72, 41.93 and 25.99 times in mean generation time of 24.60, 19.45, 19.87 and 20.61 days respectively. In *C. orientalis* and *C. diurnii* the average periods of immature stages were 17 and 18 days respectively while, in *A. agilis* the period of immature stages was 16 days.

Sathe (1991) studied the fecundity, life tables and intrinsic rate of natural increase in *Glyptapanteles malshri* Sathe and Inamdar, a parasitoid of *Plutella xylostella* (Linn.). He reported that mated female had an average of 10.4 days ovipositional period and found producing on an average 96.3 adult progeny with a sex ratio (m

Table 1 : Longevity, oviposition period, fecundity and sex ratio of mated females of *A. agilis*

Replicate	Longevity (days)	Oviposition Period	No. of larvae exposed (days)	Parasitoid progeny			Sex ratio
				Male	Female	Total	Male : Female
A	8.0	6.0	150	21	29	50	1 : 1.380
B	7.5	6.0	150	23	28	51	1 : 1.217
C	7.5	5.0	150	15	30	45	1 : 2.000
D	8.0	6.0	150	24	29	53	1 : 1.208
E	6.0	4.0	150	14	20	34	1 : 1.428
F	8.0	5.0	150	18	28	46	1 : 1.555
G	7.0	5.0	150	17	32	49	1 : 1.882
H	6.0	4.0	150	16	24	40	1 : 1.500
I	8.0	6.0	150	21	31	52	1 : 1.476
J	8.0	6.0	150	20	33	53	1 : 1.650
Avg.	**7.4**	**5.3**	**150**	**18.9**	**28.4**	**47.3**	**1 : 1.529**

Table 2 : Daily production of progeny by mated females of *A. agilis*

Replicate / Female number	No. of females produced per day								Total
	1	2	3	4	5	6	7	8	
A	2	7	13	4	2	1	D	-	29
B	2	6	12	5	2	1	-	D	28
C	4	8	14	3	1	D	-	-	30
D	3	7	14	4	1	-	D	-	29
E	2	7	9	2	D	-	-	-	20
F	3	6	12	5	2	D	-	-	28
G	2	9	15	4	2	-	D	-	32
H	3	7	11	3	D	-	-	-	24
I	2	9	13	4	2	1	D	-	31
J	2	7	14	6	3	1	-	D	33
Total number of Females produced	**25**	**73**	**127**	**40**	**15**	**04**	**0**	**0**	**284**

Table 3 : Life table statistics of *A. agilis*

Pivotal age (days) x	Proportional live at age l_x	No. of female progeny/ female m_x	$l_x m_x$	$l_x m_x x$
Immature stages 16 days				
17	1	2.5	2.5	42.50
18	1	7.3	7.3	131.40
19	1	12.7	12.7	241.30
20	1	4.0	4.0	80.00
21	0.8	1.5	1.2	25.20
22	0.6	0.4	0.24	5.28
23	0.2	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0
			Σ 27.94	**Σ 525.68**

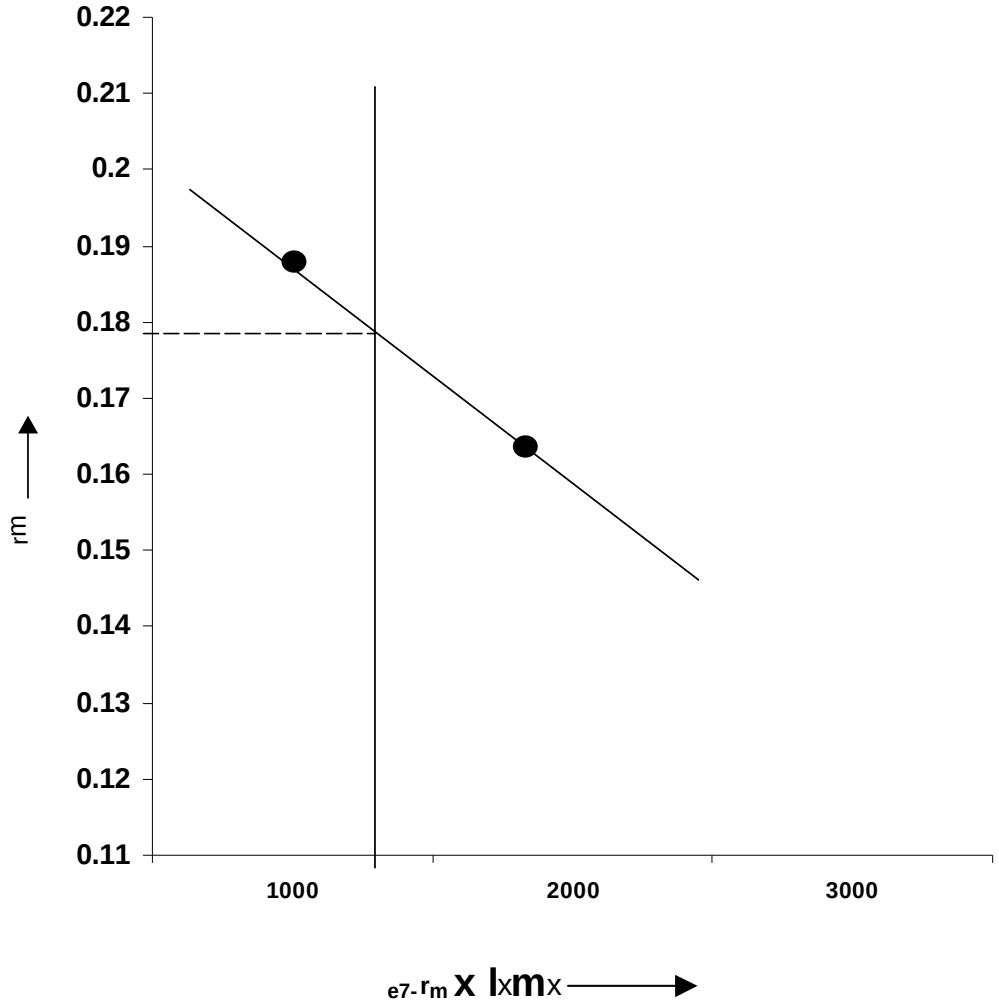

Fig. 1 : Determination of intrinsic rate of increase in *A. agilis*.

: f) 1 : 1.365. The mean progeny production per day (m_x) was 9.00 on the fifth day. The innate capacity of increase was 0.179 per female per day and population multiplied 39.54 times in mean generation time of 20.54 days.

Sathe and Ingawale (1993) studied fecundity, life tables and intrinsic rate of increase in *Apanteles jayanagarensis* Bhatnagar, a larval parasitoid of *Spilosoma obliqua* (Wlk.) in which average adult longevity was 6.8 days, average progeny production was 119.6 individuals and male : female offsprings averaged 1 : 1.349. They also reported first adult mortality on 5th day and average length of immature stages 16 days. The maximum mean progeny production per day (m_x) was 18.8 on the 2nd day in the parasitoid. The intrinsic rate of increase per female per day was 0.225 and population multiplied 66.71 times in mean generation time of 18.66 days while, in *A. agilis* mated female's ovipositional period averaged 5.3 days, the progeny production averaged 47.3 individuals with average sex ratio (m : f) 1 : 1.529 and the first adult mortality was on the fifth day. Reproduction stopped on seventh day and the innate capacity of increase was 0.180 per female per day. The present work will be helpful for rating the parasitoid in mass rearing programme.

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