International Journal of Fauna and Biological Studies
Available online at www.faunajournal.com

IJFBS
International Journal of Fauna And Biological Studies

ISSN 2347-2677
IJFBS 2016; 3(3): 185-187
Received: 18-03-2016
Accepted: 20-04-2016

TM Chougale
Department of Zoology,
Bhogawati Mahavidyalaya,
Kurukali, Maharashtra, India.

Correspondence
TM Chougale
Department of Zoology,
Bhogawati Mahavidyalaya,
Kurukali, Maharashtra, India.

Life tables and intrinsic rate of increase in *Apanteles baoris* Wilkinson, a larval parasitoid of *Udaspes folus* Cramer from Western Maharashtra

TM Chougale

Abstract
Life tables and intrinsic rate of increase have been studied in *Apanteles baoris* Wilkinson (Hymenoptera: Braconidae), a larval parasitoid of *Udaspes folus* Cramer. The longevity of ovipositing females of *A. baoris*, ranged from 8 to 9 days (mean 8.4 days). The number of progeny produced averaged 53.4 (range 51–57) individuals. The male: female offsprings averaged 1: 1.308 (range 1: 1.111 – 1.600). The first adult mortality was on the fifth day. Average length of immature stages of parasitoid was 17 days. The maximum progeny production per day, (m_x) was 41.7 on second day and reproduction stopped on fifth day. The intrinsic rate of increase (r_m) per female per day was 0.214 and population multiplied 53.4 times in mean generation time 'T' of 18.58 days.

Keywords: Life table, *Apanteles baoris*, larval parasitoid, *Udaspes folus*

Introduction
Udaspes folus Cramer (Lepidoptera) is potential pest of paddy in India. The pest rolls the leaves and feed upon them. Thus, the pest affects quality and quantity of leaves and further the crop yield. Use of pesticides on paddy is not without danger. Therefore, for hoping ecofriendly control (biological control) of *U. folus* 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) [2] 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, Sathe *et al.* 2010, etc) [4, 7-12]. 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 *U. folus.*

Material and Methods
The life tables were constructed according to Birch (1948) [3], Howe (1953) [5] and Watson (1964) [13]. The parasitoids were reared on 4 day old *U. folus* larvae. A constant number of 10 host 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 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, *U. folus* larvae were fed with paddy 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 8.4 days (range 8.0 – 9.0 days). The number of progeny produced averaged 53.4 (range 51–57) individuals. The male: female offsprings averaged 1: 1.308 (range 1: 1.111 - 1: 1.600). Most of the females reached their peak of oviposition on the second day. The first adult mortality was on the fifth day. Oviposition period averaged 5.0 days (ranged 4.5 – 6.0 days). Average length of immature stages of parasitoid was 17 days. The maximum progeny production per day, m_x was 41.7 on second day and reproduction stopped on fifth day. The intrinsic rate of increase per female per day was 0.214 (Fig.1) and population multiplied 53.4 times in mean generation

Time 'T' of 18.58 days.

$$Tc = \frac{l_x m_x x}{l_x m_x} = \frac{1005.4}{53.40} = 18.82$$

Where, Tc is arbitrary 'T'

$$r_c = \frac{\log_e R_0}{Tc} = \frac{\log_e 53.40}{18.82} = 0.2113$$

Where r_c is arbitrary 'r_m'

Tc = 18.82, r_c = 0.2113

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

$\sum = e^{7-r_m} x l_x m_x = 1$

r_m = 0.214 (Fig. 97)

Where λ is the finite rate of natural increase.

$$Tc = \frac{\log_e 53.40}{0.214}$$

Tc = 18.58

T = 18.58 days.

In *Agathis unicolorata* (Shenefelt) (Chundurwar, 1977) [4], *Cotesia flavipes* (Cameron) (Nikam and Sathe, 1983) [7] and in *Cotesia orientalis* C. & N. and *Cotesia diurnii* R. & N., (Sathe and Nikam, 1984; Sathe, 1986) [8, 9] 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. baoris* the period of immature stages was 17 days.

Sathe (1991) [10] 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: 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) [11] 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. baoris* mated female's ovipositional period averaged 5.0 days, the progeny production averaged 53.4 individuals with average sex ratio (m: f) 1: 1.308 and the first adult mortality was on the fifth day. Reproduction stopped on fifth day and the innate capacity of increase was 0.214 per female per day. The present work will be helpful for rating the parasitoid in mass rearing programme.

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

Replicate	Longevity of Female parasitoids	Oviposition Period (days)	No. of Larvae exposed	Parasitoid progeny			Sex ratio
				Male	Female	Total	Male : Female
A	8.5	5.0	50	24	30	54	1: 1.250
B	8.0	4.5	50	23	31	54	1: 1.340
C	8.0	6.0	50	22	29	51	1: 1.318
D	9.0	5.0	50	24	28	52	1: 1.166
E	8.5	5.5	50	22	31	53	1: 1.409
F	9.0	4.5	50	27	30	57	1: 1.111
G	8.0	5.0	50	23	32	55	1: 1.391
H	8.5	5.0	50	25	30	55	1: 1.200
I	8.0	4.5	50	20	32	52	1: 1.600
J	8.5	5.0	50	21	30	51	1: 1.304
Avg.	8.4	5.0	50	23.1	30.3	53.40	1: 1.308

Table 2: Production of progeny by mated females of *A. baoris*.

Female	No. of individuals produced per day									Sex ratio	Total number
	1	2	3	4	5	6	7	8	9	M : F	
A	10	44	-	-	D	-	-	-	-	24: 30	54
B	8	45	1	-	-	D	-	-	-	23: 31	54
C	10	39	2	-	-	-	-	-	D	22: 29	51
D	11	40	1	-	-	-	D	-	-	24: 28	52
E	9	42	2	-	-	-	-	D	-	22: 31	53
F	12	43	1	1	D	-	-	-	-	27: 30	57
G	10	44	1	-	-	-	D	-	-	23: 32	55
H	11	43	1	-	-	-	-	D	-	25: 30	55
I	12	39	1	-	-	D	-	-	-	20: 32	52
J	12	38	1	-	D	-	-	-	-	21: 30	51
Avg.	10.5	41.7	1.1	0.1	0	0	0	0	0	23.1: 30.3	53.4

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

Pivotal age (days)	Proportional live at age	No. of female progeny/ female	$l_x m_x$	$l_x m_x x$
x	l_x	m_x		
Immature stages 17 days				
18	1	10.5	10.5	189
19	1	41.7	41.7	792.3
20	1	1.1	1.1	22
21	1	0.1	0.1	2.1
22	0	0	0	0
23	0	0	0	0
24	0	0	0	0
25	0	0	0	0
			Σ 53.40	Σ 1005.4

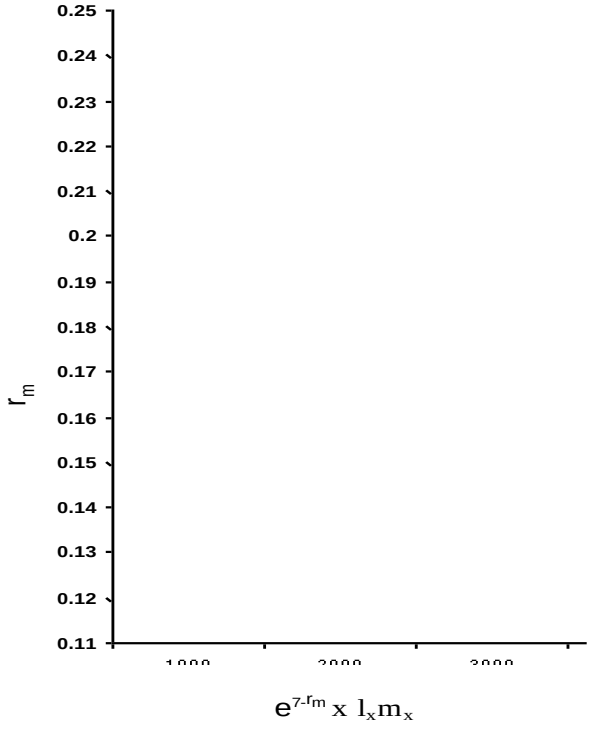

Fig 1: Determination of intrinsic rate increase in *A. baoris*.

Acknowledgement
The author is thankful to Principal, Bhogawati Mahavidyalaya, Kurukali, Kolhapur (MS), India for providing facilities.

References

1. Bhatnagar SP. Studies on *Apanteles* Forester (Vipionidae: Parasitic Hymenoptera) from India. Indian J Ent. 1948; 10:133-203.
2. Bilapate GG, Pawar VM. Life fecundity tables for *Heliothis armigera* Hubner (Lepidoptera, Noctuidae) on sorghum earhead. Porc. Indian Acad. Sci. (Ani. Sci.). 1980; 89:69-73.
3. Birch LC. The intrinsic rate of natural increase in an insect population. J Anim. Ecol. 1948; 17:15-26.
4. Chundurwar RD. Life table studies and intrinsic rate of increase of *Agathis unicolorata* (Shenefelt). Indian Acad. Sci. 1977; 86 (B1):39-43.
5. Howe RW. The rapid determination of intrinsic rate of increase of an insect population. Appl. Biol. 1953; 40:134-155.
6. Ingawale DE. Biosystematic studies on Microgastrinae of some important economic crop pests. Ph. D. thesis, Shivaji University, 1991, 1-200.
7. Nikam PK, Sathe TV. Life tables and intrinsic rates of natural increase of *Cotesia flavipes* (Cameron) (Hymenoptera: Braconidae) population on *Chilo partellus* (Swin.) (Lepidoptera: Pyralidae). Zang. Ent. 1983; 95:171-175.
8. Nikam PK, Sathe TV. Life tables and intrinsic rate of natural increase of *Cotesia orentalis* C. & N. (Hymenoptera: Braconidae), population on Exelastis atomosa Fab. Entamon. 1984; 9:169-171.
9. Sathe TV. Life table and intrinsic rate of increase of *Cotesia diurnii* Rao and Nikam (Hymenoptera: Braconidae), a larval parasitoid of *Exelastis atomosa* Walsingham. Entomon. 1986; 11(4):281-283.
10. Sathe TV Fecundity and life table studies in *Glyptapanteles malshri* S. & I (Braconidae), a larval parasitoid of *Plutella xylostella* (Plutellidae). Riv. di Parassitologia. 1991; 8(LII3):299-306.
11. Sathe TV, Ingawale DM. Fecundity, life tables and intrinsic rate of increase in *Apanteles jayanagarensis* Bhatnagar, a parasitoid of *Spilosoma obliqua* (Wlk.). J Biol Control. 1993; 7:69-71.
12. Sathe TV, Jadhav AD, Chougale TM. Life tables and intrinsic rate of natural increase in *Apanteles agilis* Ashmead, a parasitoid of *Diaphania pulverulentalis* (Hampson).The Scientific Temper. 2010; 1:139-144.
13. Watson TF. Influence of host plant conditions of population of larvae of *Tetranychus telarius* (L.) (Acarina: Tetraychidae). Hilgardia. 1964; 35:273-322.