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Life-Fecundity Tables of *Earias vittella* (Fabricius) on Cotton and Okra

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Life-table studies were made on *Earias vittella* (Fabricius) when reared on cotton flowers, bolls, okra fruits, seeds and epicarps under laboratory conditions. The net reproductive rate on cotton flowers, bolls, okra fruits, seeds and epicarps was 93.17, 93.96, 114.50, 140.23 and 112.71 females per female per generation, respectively. On the basis of innate capacity for increase in numbers (r_m), the host plants could be arranged as okra seeds (0.1569), okra epicarps (0.1384), okra fruits (0.1569), cotton bolls (0.1365) and cotton flowers (0.1151). The maximum contribution towards stable age-distribution was made by the immature stages.

Key words : *Earias vittella* **(Fabricius Life fecundity tables Cotton, Okra**

Introduction

The spotted bollworm, *Earias vittella* (Fabricius) is the most important pest of cotton and okra in this region. The life-fecundity table is the most important technique in the study of insect population dynamics. Life tables can be used to make quantitative and qualitative evaluation of different host plants. Though there is considerable information available on the aspect of chemical control, relatively less information is available on the aspects of the reproductive potential of the pest on different hosts. In the present investigation, the projected potential rate of increase of *E. vittella* on different hosts were computed by following the method described by Birch (1948) and elaborated by Howe (1953) and Atwal and Bains (1974).

Materials and Methods

The initial culture of spotted bollworm, *Earias vittella* (Fabricius) was started by collecting a large number of larvae in the month of August 1980, from cotton fields around Parbhani. The larvae were reared individually up to adult emergence. Sexing was done in the pupal stage. The newly emerged male and female (1 : 1) moths were placed in an oviposition cage

(30×30×30 cm) for egg laying. In order to study the life fecundity tables, 100 eggs were placed in ten circular plastic boxes (5×5 cm) in batches of ten for each host. The eggs were glued with the help of wet camel hair brush on the white paper in one row to facilitate observations on hatching. After hatching, all the larvae were reared individually on cotton *(Gossypium hirsutum* L.*)* flowers, bolls, okra *(Abelmoschus esculentus* L.) fruits seeds and epicarps. Observations on hatching, larval and pupal development, successful adult emergence, fecundity and age-specific mortality in eggs, larvae, prepupae, pupae and adults were noted daily. For determining the age specific fecundity, the total number of adults emerged on a particular day were transferred to a separate cage for egg laying. The healthy twigs of respective hosts were kept into the cage as oviposition site. The following column headings proposed by Birch (1948), elaborated by Howe (1953) and Atwal and Bains (1974) were used for the construction of life fecundity tables under laboratory conditions at 26±2°C temperature.

X=Picotal age in days;
l_x=Survival of females at age X;
m_x=age schedule for female births at age X

The values of X, l_x and m_x were calculated from the data in life tables. The life table parameters were calculated by following the method of Birch (1948), Howe (1953) and Atwal and Bains (1974).

Results and Discussion

The results are discussed in the light of available literature on other pests. The results in table 1 indicate that the survival values of immature stages differed greatly on different host plants. On the basis of survival values of immature stages of *E. vittella*, the different food plants could be arranged in descending order as : okra seeds (96), okra epicarps (92), okra fruits (72) cotton flowers (68) and cotton bolis (59). The net reproductive rate (R_o) of *E. vittella* was 93.17 on cotton flowers, 93.96 on cotton bolls, 144.50 on okra fruits, 140.23 on okra seeds and 112.71 on okra epicarps (table 2). In all the host plants tested, *E. vittella* has distinctly similar trend of

Table 1 *The survival of life stages of* E. vittella *on different hosts*

Host	Egg Kept	Number surviving			
		Egg stage (days)	Larval stage (days)	Pre-pupal stage (days)	Pupal stage
Cotton flowers		(0–4)	(5–19)	(20–21)	(22–34)
	100	100	69	69	68
Cotton bolls		(0–4)	(5–16)	(17–18)	(19–27)
	100	100	68	68	59
Okra fruits		(0–4)	(5–15)	(16–17)	(18–29)
	100	100	73	73	72
Okra seeds		(0–3)	(4–14)	(15–16)	(17–16)
	100	100	98	98	96
Okra epicarps		(0–3)	(4–14)	(15–16)	(17–29)
	100	100	97	97	92

Table 2 *Life tables (for females), age specific fecundity for* E. vittella *on different hosts*

Host	Pivotal age in days X	Life table for female births l_x	Age schedule for female births m_x	$l_x m_x$	$l_x m_x X$
1	2	3	4	5	6
Cotton flowers	0–34	0.68	—	Immature stages	
	35–36	0.68	—	Preoviposition period	
	37	0.68	6.40	4.35	160.95
	38	0.68	26.30	17.88	679.44
	39	0.68	33.40	22.71	885.69
	40	0.68	31.40	21.35	854.00
	41	0.68	20.80	14.14	579.74
	42	0.68	12.70	8.70	365.40
	43	0.61	6.62	4.04	173.72
	44	0.34	0.0	0.0	0.0
				= 93.17 $\Sigma l_x m_x$	= 3698.94 $\Sigma l_x m_x X$
Cotton bolls	0–27	0.59	—	Immature stages	
	28–30	0.59	—	Preoviposition period	
	31	0.59	12.90	7.61	235.91
	32	0.59	37.70	22.24	711.68
	33	0.59	37.60	22.18	731.94
	34	0.59	27.00	15.93	514.62
	35	0.59	23.70	13.98	489.40
	36	0.59	13.60	8.02	288.86
	37	0.41	9.75	3.99	147.91
	38	0.0	0.0	0.0	0.0
				=93.96	=3147.32
Okra fruits	0–29	0.72	—	Immature stages	
	30–31	0.72	—	Preoviposition period	
	32	0.72	7.40	5.33	170.56
	33	0.72	23.60	16.99	560.67
	34	0.72	33.70	24.26	824.84
	35	0.72	34.60	24.91	871.85
	36	0.72	29.40	21.17	762.12
	37	0.65	23.12	15.03	556.11
	38	0.56	12.16	6.81	258.78
	39	0.36	0.0	0.0	0.0
				114.50	4004.93

1	2	3	4	5	6
Okra seeds	0–26	0.96	—	Immature stages	
	27–28	0.96	—	Preoviposition period	
	29	0.96	4.70	4.51	130.79
	30	3.96	25.20	24.19	725.70
	31	0.96	38.30	36.77	1139.87
	32	0.96	35.80	34.37	1099.84
	33	0.96	22.40	21.50	709.50
	34	0,86	16.12	13.86	471.24
	35	0.60	7.50	5.03	176.05
	36	0.48	0.0	0.0	0.0
				140.23	4452.99
Okra epicarp	0–29	0.92	—	Immature stages	
	30–31	0.92	—	Preoviposition period	
	32	0.92	11.30	10.39	332.48
	33	0.92	26.60	24.47	807.51
	34	0.92	30.50	28.06	954.04
	35	0.92	29.60	27.23	953.05
	36	0.92	12.10	11.13	400.68
	37	0.92	9.60	8.83	326.71
	38	0.65	4.00	2.60	98.80
				112.71	3873.27

births (m_x) patterns. The values of m_x rises gradually and attains a peak to be followed by gradual decrease. In general, the contribution of female towards the female birth (m_x) was maximum on second or third day of oviposition. Thus, it is seen that okra seeds proved to be nutritionally the most superior host plants from the point of view of pest multiplication under the given set of conditions. The mean length of generation differed considerably on different hosts (table 3). It was maximum (39.39 days) on cotton flowers and minimum (31.51 days) on okra seeds. The innate capacity for increase in numbers (r_m) ranged from 0.1151 to 0.1569 females per female per day. On the basis of r_m values the descending order of food plants for *E. vittella* was: okra seeds (0.1569), okra epicarps (0.1384), okra fruits (0.1366), cotton bolls (0.1365) and cotton flowers (0.1151). The results in table reveal that on reaching a stable age distribution, the population of *E. vittella* at egg, larva, prepupa, pupa and adult stages comprised 49.16, 43.53, 1.60, 4.80, 0.87 on cotton flowers, 47.26, 43.68, 2.54, 5.45 and 1.03 on okra seeds, respectively.

According to Birch (1948), the comparison of two or more populations by means of their net reproductive rates may be quite misleading unless the mean length of generations are the same. Two or more populations may have the same reproductive rate but their intrinsic rate of increase may be quite different because of different length of their generation. Indeed, it is evident that on the basis of net reproductive rates (R_0), okra fruits occupied second position however, it

Table 3 *Mean length of generation (T), intrinsic rate of increase in numbers (r^m) and finite rate of increase in numbers (λ) of* E. vittella *on different hosts*

Name of host	Mean length of generation $Tc = \frac{\Sigma l_x m^x X}{Ro}$ (days)	Innate capacity for increase in numbers $rc = \frac{logo\ Ro}{Tc}$	Corrected rm $\Sigma e^{7-r} m^x l_x m_x =$ 1096.6	Corrected generation time $T = \frac{loge\ Ro}{rm}$ (days)	Finite rate of increase in numbers λ- anti loge rm	Weekly multiplication of population	Doubling time (days)	Hypothetical F_2 females
Cotton flowers	39.70	0.1142	0.1151	39.39	1.12	2.21	6.02	8,680,65
Cotton bolls	33.50	0.1356	0.1365	33.28	1.15	2.66	5.08	8,828.48
Okra fruits	34.98	0.1355	0.1366	34.70	1.15	2.66	5.07	13,110.25
Okra seeds	31.75	0.1557	0.1569	31.51	1.17	3.00	4.42	19,664.45
Okra epicarps	34.36	0.1375	0.1384	34.14	1.15	2.66	5.01	12,703.54

ranked third on the basis of innate capacity for increase in numbers (r_m) though the values of R_o were not appreciably different. The shift in position thus attributable to relatively higher values of generation time which reduced the values for intrinsic rate of increase (r_m). The innate capacity of a species for increase in numbers has a number of components viz. the length of development of immature stages, the adult life table and the age specific fecundity. These components have their own significance and apply their respective weights (Birch 1948). The applications of life table statistics are as diverse on the insect for which the life tables are developed. The differences observed in the r_m values in the present studies can be attributed difference in the food plants tested. However, from the point of view of pest multiplication, okra seeds with high r_m values would be most suitable. *E. vittella* would multiply 140.23 times per generation on okra seeds while the corresponding increase in okra fruits or cotton flowers will be 114.50 and 93.17 times. Several authors stated that there is a range of innate capacity for individuals of a population (Dewitt 1954). Tamaki et al. (1972) developed life-tables for evaluating the rearing of zebra caterpillar, *Ceramica picta*. They observed that the insects reared as larvae on sugar beet leaves in trays had a multiplication rate of 422 females per females per generation and the rate of reproduction was 9 and 16 fold greater than the rates of those from larvae reared on artificial diets in cups or trays, respectively. The life table studies were made for *Dichocrocis punctiferalis* Guen. When reared on castor, maize, brinjal, okra, bottle gourd and pomegranate (Bilapate 1977 and Bilapate 1978). Life table studies were made on *Heliothis armigera* (Hubner) when reared on lucerne, lima bean, pea, sorghum, safflower, sunflower, maize and chickpea (Bilapate et al. 1977, Bilapate et al. 1978, Bilapate & Pawar 1978, Bilapate & Pawar 1980, Bilapate et al. 1980a, Bilapate et al 1980b and Bilapate et al. 1981).

Table 4 *Percentage contribution of various stages to the stable age distribution of* E. vittella *on different hosts*

Name of host	Percent contribution of various stages				
	Egg	Larva	Pre-pupa	Pupa	Adult
Cotton flowers	49.16	43.53	1.60	4.80	0.87
Cotton bolls	55.59	37.15	1.81	3.94	1.06
Okra fruits	55.20	36.03	2.21	5.62	0.94
Okra seeds	47.26	43.68	2.54	5.45	1.03
Okra epicarps	43.23	44.89	3.00	7.81	1.02

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