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Role of key mortality factors in overlapping generations of *Earias vittella* (Fabricius) in insecticides treated cotton field

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Abstract. The spotted bollworm, *Earias vittella* (Fabricius) passed through four overlapping generations in insecticides treated cotton field. The parasitisation due to *Microchelonus* sp and *Bracon* sp was 8·43 and 19·26% during first generation. *Rogas aligarhensis* (Quadri) is the important larval parasite of spotted bollworm in Marathwada region.

Keywords. Key mortality factors; *Earias vittella* (Fabricius); insecticides; cotton field.

1. Introduction

The spotted bollworm, *Earias vittella* (Fabricius) is a serious cotton pest causing severe economic losses (Butani 1976). To determine the role of various factors (comprising of environmental parameters) which cause mortality during different developmental stages, it was necessary to have a series of life tables for a number of generations of the same or different population by measuring density, mortality and associated factors in different parts of habitats (Harcourt 1969).

2. Materials and methods

The sampling techniques and the plan described by Harcourt (1969) were followed with certain modifications. The first appearance of spotted bollworm, *E. vittella* in the egg stage was recorded by regular observations in the early morning and late evening hours. An area of 0.5 acre SRT-1 cotton was regularly sprayed with recommended insecticides according to the plant protection schedule (carbaryl 50 WP 0·2%, quinalphos 25 EC 0·05%, carbaryl 0·2%, phosphamidon 85 EC 0·02% and carbaryl 0·2%). The sampling for the egg stage of overlapping generation was made 15 days from the start of regular generation. The eggs from the samples of 2 × 2 m quadrates were collected and reared on cotton squares after hatching under laboratory conditions. Since the generations of *E. vittella* overlapped considerably and all the stages of pest found simultaneously, the sampling for an overlapping generation in the field was based on the developmental stages reared in the laboratory. This generation was assumed to be distinct from the regular generations of the pest in field condition. Sampling of the entire cotton plants from the field (2 × 2 m quadrate) was examined and data on the larval population of the pest recorded. Ten sample quadrates were observed for each larval instar. The parasitisation of larvae and pupae due to different parasites was observed. The mortality due to unknown causes was also studied.

Table 1. Key mortality factors for overlapping generations of *E. vittella* on cotton (population/ha).

Age interval *x*	Number alive at beginning of *x* *lx*	Factors responsible for *dx* *dxF*	Number dying during *x* *dx*	*dx* as a % of *lx* 100 *qx*	Survival rate at age *x* *Sx*	log (*lx*)	*k*
1	2	3	4	5	6	7	8
			I Generation (22 August to 22 September 1982)				
Larval instars							
I–II (N_1)	4925	Unknown	550	11·17	0.89	3·6924	
III–IV	4375	*Rogas* sp	2300	52·57	0·35	3·6410	0·0514
		Microchelonus sp	175	8·43			
		Bracon sp	125	6·58			
		B. greeni	225	12·68			
V–VI	1550	*Microchelonus* sp	250	16·13	0.76	3·1903	0·4507
		B. greeni	100	7·84			$K = 0·5021$
Trend index (N_2/N_1)			1·90				
Generation survival (N_3/N_1)			0·24				
			II Generation (25 September to 25 October 82)				
Larval instars							
I–II (N_1)	9350	Unknown	350	3·74	0·96	3·9708	
III–IV	9000	*Rogas* sp	5050	56·11	0·41	3·9542	0·0166
		Bracon sp	125	3·16			
		Microchelonus sp	125	3·27			
V–VI	3700	*Microchelonus* sp	175	4.73	0·90	3·5682	0·3860
		Bracon sp	125	3·55			$K = 0·4026$
		Unknown	75	2.20			
Trend index (N_2/N_1)			1·15				
Generation survival (N_3/N_1)			0·35				

III Generation (28 October to 28 November 82)							
Larval instars							
I–II (N_1)	10725	Unknown	125	1·16	0·99	4·0304	
III–IV	10600	*Rogas* sp	6850	64·62	0·35	4·0253	0·0051
V–VI	3750	*Microchelonus* sp	50	1·33	0·95	3·5740	0·4513
		Unknown	25	0·67			$K = 0·4564$
Trend index (N_2/N_1)			1·09				
Generation survival (N_3/N_1)			0·17				
IV Generation (1 December 82 to 1 January 83)							
Larval instars							
I–II (N_1)	11675	Unknown	350	3·00	0·97	4·0672	
III–IV	11325	*Rogas* sp	5100	45·03	0·52	4·0540	0·0132
		Unknown	150	2·41			
		Microchelonis sp	75	1·23			
		Bracon sp	150	2·50			
V–VI	5850	*Microchelonus* sp	750	12·82	0·79	3·7671	0·2869
		B. greeni	250	4·90			$K = 0·3001$
		Unknown	25	0·54			
Trend index (N_2/N_1)			Nil				
Generation survival (N_3/N_1)			0·39				

3. Results and discussion

The results on key mortality factors of *E. vittella* for overlapping generations in the insecticides treated cotton field are presented in table 1. The parasitisation due to *Rogas aligarhensis* (Quadri), *Microchelonus* sp and *Bracon* sp was 52·57, 8·43 and 19·26% in III-IV instar group respectively. The mortality due to *Microhelonus* sp and *Bracon* sp was 16·13 and 7·84% in the last instar group. The positive trend index value (1·9) indicated that the mortality parameters operating during this generation were ineffective in checking further multiplication of population in the next generation. The III–IV instar stage was the most vulnerable for the larval mortality to parasites ($K = 0{\cdot}4507$). During second generation, the mortality in III–IV instar group due to *R. aligarhensis*, *Bracon* sp and *Microchelonus* sp was 56·11, 3·16 and 3·27%, respectively. The parasitisation due to *Microchelonus* sp and *Bracon greeni* was 4·73 and 3·55% in V–VI instar group. There was a positive trend index (1·15) in the second generation. Thus, the trend index value indicated that the mortality factors which operated during this generation were ineffective in suppressing the population of spotted bollworm on cotton. The III–IV instar group had the maximum contribution towards generation mortality ($K = 0.3860$). Parasitisation due to *R. aligarhensis* was 64·62% in the third generation. There was a positive trend index (1·09). The III–IV instar group resulted in highest contribution ($K = 0{\cdot}4513$) towards generation mortality. The population of *E. vittella* was not observed after the fourth generation on cotton and resulted in zero trend index value.

The range of parasitisation due to *R. aligarhensis* during different overlapping generations ranged from 45·03 to 64·12%. The population of *E. vittella* was comparatively greater when there was a decrease in the mean temperature, relative humidity and rainfall (table 2). Dhurve *et al* (1980) reported highest parasitisation of 27.09% in untreated control followed by insecticidal treatment of endosulphan which accounted for 25·18% parasitism. Between two schedules (one comprising of only spray *i.e.* carbaryl, endosulphan and endrin and the other predominantly of dusts *i.e.* carbaryl), spray schedule was less harmful to *R. aligarhensis* indicating its suitability for integrated control and the parasite was able to account for around 20% parasitism in insecticides-treated plots (Patel 1980). Maninder and Verma (1981) reported that *R. aligarhensis* was not recorded in cotton fields treated with recommended insecticides. Patange (1981) observed that parasitism by *R. aligarhensis* was highest (33·34%) in plots treated with endosulphan (0·06%) and lowest (20%) in plots treated with cyfloxylate (0·006%) indicating that synthetic pyrethroid is relatively more toxic to natural enemies of bollworms. Patel *et al* (1969) reported *Rogas* near *Rogas pallidater* (Thnd.), *Chelonus heliopae* (Gupta) and *Strebliomyia plebeia* (Mall) parasites for the first time in India. Thontadarya and Jai Rao (1980) mentioned the possibility of utilizing *R. aligarhensis* in the control of *Earias* spp in India. Patel (1983) stated that *R. aligarhensis* was active in all the plots except those treated with methyl parathion 2% dust. Thus, from the present findings it could be concluded that III–IV instar stage was most vulnerable for parasitisation.

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Table 2. Meteorological details for overlapping generations of *E. vittella* on cotton during 1982–83.

Generation	Meteorological week	Mean		
		Temperature (C°)	Relative humidity (%)	Rainfall (mm)
I	34–38	27·00	69·74	25·86
II	39–43	26·77	61·55	14·40
III	43–48	25·05	63·17	4·20
IV	49–1	20·41	45·76	0·0

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