Proc. Indian Acad. Sci., Vol. 87 B, (Animal Sciences-3), No. 9, September 1978, pp. 217–220,

Life table for the castor capsule borer, *Dichocrocis punctiferalis* Gn. on different hosts

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MS received 15 October 1977; revised 23 January 1978

Abstract. Castor capsule borer, *Dichocrocis punctiferalis* Gn. is the most destructive pest of castor seed in India. Studies on the rate of multiplication were carried out at a constant temperature of 27±2°C under a limited space and sufficient food supply, the population increased with an infinitesimal rate (*rm*) of 0·0736, 0·0416, 0·0669, 0·0492 and 0·0864 and finite rate (λ) 1·0763, 1·0424, 1·0691, 1·0504 and 1·0902 per female per day on maize, brinjal, bhindi, bottlegourd and pomegranate respectively. The net reproductive rate (R_0) was maximum (20·19) on pomegranate. The population on reaching a stable age distribution, in all the hosts, comprised approximately 97 per cent of the immature stages.

Keywords. Life table; *Dichocrocis punctiferalis* Gn.

1. Introduction

A successful insect colonization is a basic necessity for an efficient and productive research on virtually every aspect of entomology. In the field of entomological research, continuous, and large supply of insects under investigation is a prerequisite and this is not always available from natural sources. These requirements can be met only by means of rearing insects under controlled conditions. The castor capsule borer, *Dichocrocis punctiferalis* Gn. is one of the most destructive pests of castor crop in India. Few researchers have made some efforts to know the habits and other aspects of life cycle of this pest (David *et al* 1964, Mishra and Teotia 1965, Patel and Gangrade 1971 and Bilapate and Talati 1977a). Life table is a concise summary of certain vital statistics of insect population. The intrinsic rate of increase (*rm*), net reproductive rate (R_0) and mean generation time (T) were the basic population parameters used to assess the population growth at a constant temperatures of 27±2°C. In the present studies, life fecundity tables were constructed when the larvae were reared on maize, brinjal, bhindi, bottlegourd and pomegranate.

2. Materials and methods

The moths do not copulate under laboratory conditions; hence some castor heads were selected in the castor field and freshly laid eggs were brought to the laboratory along with capsules for further rearing. One hundred eggs were kept for hatching in a group of 25. Immediately after hatching, the tiny larvae were transferred in the petridishes,

and reared individually on maize(*Zea mays* L.), brinjal (*Solanum melongena* L.), bhindi (*Abelmoschus esculentus* L.), bottlegourd (*Lagneria siceraira* St.), and pomegranate (*Punica granatum* L.). The food was renewed daily in the morning till pupation. The adults emerged on a particular day and host were paired and released in rearing cages for egg laying. In spite of several efforts female moths failed to lay fertile eggs (David *et al* 1964). However, the fecundity of the female moths was worked out on the basis of unfertile eggs. If the eggs were to be fertile this would have contributed for multiplication of population in subsequent generation. The fecundity of the females on subsequent days were noted daily till all the females died. As the sex-ratio was 1 : 1·5 (male to female), the number of eggs laid per female was divided by 2·5 and then multiplied with 1·5 to get the number of female births (*mx*). Observations from hatching of eggs till the emergence of adults were recorded everyday which provided the values for the life tables (*lx*). The life tables were constructed according to the methods of Birch (1948), Howe (1953), Atwal and Bains (1974) and followed by Bilapate *et al* (1977 b, c and d). The stable age-distribution (per cent distribution of various stages) was also worked out by calculating the population schedule of birth-rate and death-rate (*mx* and *lx*) when grown in a limited space.

3. Results and discussion

During this study the highest survival from egg to adult emergence was observed on pomegranate (62 adults) followed by maize (52 adults). Brinjal (16 adults) was found

Table 1. Life table (for females), age specific fecundity for *D. punctiferalis* Gn. on different hosts.

Name of host	Pivotal age in days *x*	Life table for female births *lx*	Age schedule for female births *mx*	*lxmx*	*xlxmx*
1	2	3	4	5	6
Maize	0-31	0·52	—	Immature stages	
	32	0·52	—	0·52	16·64
	33	0·52	—	0·52	17·16
	34	0·52	—	0·52	17·68
	35	0·52	—	0·52	18·20
	36	0·52	4·8	2·49	89·85
	37	0·52	6·36	3·30	122·36
	38	0·52	7·77	4·04	153·53
	39	0·50	3·43	1·71	66·88
	40	0·42	1·57	0·65	26·36
	41	0·30	0·99	0·29	12·17
	42	0·21	0·00	0·00	0·00
			$\Sigma lxmx =$	14·55	$\Sigma xlxmx =$ 540·84
Brinjal	0-30	0·16	—	Immature stages	
	31	0·16	—	0·16	4·96
	32	0·16	—	0·16	5·12
	33	0·16	—	0·16	5·28
	34	0·16	—	0·16	5·44
	35	0·16	3·84	0·61	21·50
	36	0·16	5·88	0·94	33·86
	37	0·16	7·50	1·20	44·40
	38	0·15	3·79	0·56	21·60
	39	0·12	1·99	0·23	9·31
	40	0·06	0·00	0·00	0·00
			$\Sigma lxmx =$	4·18	$\Sigma xlxmx =$ 151·47

(Contd.)

1	2	3	4	5	6
Bhindi	0-30	0·34	—	Immature stages	
	31	0·34	—	0·34	10·54
	32	0·34	—	0·34	10·88
	33	0·34	—	0·34	11·22
	34	0·34	—	0·34	11·56
	35	0·34	4·38	1.49	52·15
	36	0·34	6·54	3·44	80·04
	37	0·34	7·60	2·58	95·70
	38	0·34	3·51	1·19	45·42
	39	0·25	3·52	0·80	31·47
	40	0·13	1·80	0·25	9·36
	41	0·12	0·00	0·00	0·00
			$\Sigma lxmx =$ 9·87		$\Sigma xlxmx =$ 358·34
Bottlegourd	0-31	0·22	—	Immature stages	
	32	0·22	—	0·22	7·04
	33	0·22	—	0·22	7·26
	34	0·22	—	0·22	7·48
	35	0·22	—	0·22	7·70
	36	0·22	3·68	0·81	29.17
	37	0·22	5·36	1·29	47·46
	38	0·22	7·32	1·61	61·24
	39	0·22	3·64	0·80	31·24
	40	0·21	2·44	0·51	20·51
	41	0·14	1·50	0·21	8·61
	42	0·08	0·00	0·00	0·00
			$\Sigma lxmx =$ 6·11		$\Sigma xlxmx =$ 228·01
Pomegranate	0-27	0·62	—	Immature stages	
	28	0·62	—	0·62	17·34
	29	0·62	—	0·62	17·98
	30	0·62	—	0·62	18·50
	31	0·62	—	0·62	19·22
	32	0·62	4·60	2·85	91·30
	33	0·62	6·28	3·89	128·65
	34	0·62	7·96	4·93	167·83
	35	0·62	5·54	3·43	120·30
	36	0·62	3·43	2·12	76·60
	37	0·62	1·98	1·20	44·68
	38	0·45	1·11	0·49	18·98
	39	0·25	0·00	0·00	0·00
			$\Sigma lxmx =$ 20·19		$\Sigma xlxmx =$ 721·49

Table 2. Mean length of generation (T), intrinsic rate of increase in numbers (rm) and finite rate of increase in numbers (λ) of *D. punctiferalis* Gn. on different hosts.

Name of host	Mean length of a generation $Tc = \frac{\Sigma xlxmx}{R_0}$ (days)	Innate capacity for increase in numbers $rc = \frac{\log eR_0}{Tc}$	Corrected rm $\Sigma e^{rt} = rm \times lx \times mx = 1096{\cdot}6$ (per head/day)	Corrected generation time $T = \frac{\log e\ R_0}{rm}$ (days)	Finite rate of increase in numbers = anti-log $e\ rm$/day	Weekly multiplication of population
Maize	37·14	0·0721	0·0736	36·38	1·0763	1·6739
Brinjal	36·23	0·0394	0·0416	34·38	1·0424	1·3380
Bhindi	36·30	0·0630	0·0669	34·44	1·0691	1·5972
Bottlegourd	36·31	0·0485	0·0492	36·78	1·0504	1·4111
Pomegranate	35·73	0·0841	0·0864	34·78	1·0902	1·8308

to be the lowest food plant which did not support the successful development of life stages. The larval development was faster on pomegranate than others. The survival of females (lx) and rate of *multiplication* (R_0) has been calculated (table 1) The first mortality of the females occurred after 37th day of the pivotal age. It was found that the rate of multiplication per generation i.e. the net reproductive rate of the population of *D. punctiferalis* Gn. would multiply 14·56 times on maize, 4.18 times on brinjal, 9·87 times on bhindi, 6.11 times on bottlegourd and 20·19 times on pomegranate, at the end of each generation. The mean duration of a generation (T), the innate capacity for increase in numbers (rm), finite rate of increase in numbers (λ) and weekly multiplication of population on different host are given in table 2. It took 34 days to complete one generation on brinjal, bhindi, pomegranate and 36 days on maize and bottlegourd. Similarly the innate capacity for increase in numbers (rm) was the highest (0·0864 per day) on pomegranate followed by maize (0·0736 days). With a daily finite rate of increase (rm) 1·0763, 1·0424, 1·0902 on maize, brinjal and pomegranate respectively, the population would multiply 1·6739, 1·3380 and 1·8308 times every week on respective food plants.

It is also concluded that the maximum contribution towards the stable age distribution in all the hosts was made by the immature stages. The population on reaching a stable age distribution, in all the hosts, comprised approximately 97% of the immature stages.

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