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Comparative Rates of Population Growth of *Pyrilla perpusilla* (Walker) and its Ectoparasitoid, *Epiricania melanoleuca* (Fletcher) under Laboratory Conditions

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ABSTRACT

Observations on the survival, development and reproduction of *Pyrilla perpusilla* (Walker) and its ectoparasitoid, *Epiricania melanoleuca* (Fletcher) were recorded in the laboratory to determine the comparative rates of population growth in these species. The finite rate of increase (λ) was higher (8.984/♀ /month) in the parasitoid than that of the host (4.711/♀ /month). Host specificity and inadequate availability of the proper host stage for the randomly searching parasitoid larvae were found to be limiting for the rapid multiplication of the latter under field conditions. In view of the above limitations of *E.melanoleuca*, a control strategy against pyrilla has been suggested.

KEY WORDS : *Pyrilla perpusilla, Epiricania melanoleuca,* rate of increase

Sugarcane leafhopper, *Pyrilla perpusilla* (Walker) is a sporadic pest of sugarcane in Punjab. During the period between two consecutive outbreaks, its population is kept under control by the combined action of a variety of parasitoids and predators (Brar, 1978). *Epiricania (=Epipyrops) melanoleuca* (Fletcher), an ectoparasitoid of nymphal and adult stages of pyrilla, plays a key role in affecting the pest population during the monsoon and post-monsoon seasons in the State (Dhaliwal and Bains, 1983a). Its potential as a biocontrol agent of the leafhopper through artificial augmentation has been reported by Misra and Pawar (1981). Though many reports on the extent of parasitism of pyrilla by the parasitoid are available, its capacity to increase in relation to increasing host density still remains to be investigated. Keeping in view the utility of studying the comparative growth rates of the host and *E.melanoleuca* in deciding the need for artificial release(s) of the latter, the present study was undertaken.

MATERIALS AND METHODS

Comparative growth rates of *P.perpusilla* and *E.melanoleuca* were studied under variable laboratory conditions (mean monthly temperatures 24.6-29.6 ^{0}C and R.H. 71.2- 81.7%) during the favourable monsoon and post-monsoon (August- October) seasons in 1986 at the Punjab Agricultural University, Ludhiana. For experimental purpose, freshly laid eggs of pyrilla were kept in glass tubes (10 cm x 2.5 cm) @ one egg mass/tube and subsequent rearing of feeding stages was carried out on sugarcane (cv.Co.J.64) leaves in rearing sets (see Dhaliwal and Bains, 1983b) @ 5 nymphs/set and one pair of adults/set. Fresh eggs of *E.melanoleuca* were confined to glass vials @ one egg mass/vial and their hatchability was determined with the aid of a binocular microscope. The parasitoid larve were reared on pyrilla adults in rearing sets and freshly formed pupae were transferred to Petri dishes (8.5 cm.dia) @ 5 individuals/dish. Newly emerged adults of the epipyropid were shifted to Petri dishes @ one pair/dish for mating and oviposition on the filter paper kept at the bottom of the dish. The number of eggs laid by the parasitoid were counted under a binocular microscope. Observations on the development and survival of the immature stages and on the

Table 1. Comparative survival and development of *P.perpusilla* and *E.melanoleuca* during August-October at Ludhiana

P.perpusilla	Egg	Nymph	Adult	
			Male	Female
Cohort	18 masses	31	18	18
Survival (%)	95.00	70.97	-	-
Duration (days)	10.44 ± 1.46	31.55 ± 1.29	32.11 ± 6.88	34.22 ± 10.14

E. melanoleuca	Egg	Larva	Pupa	Adult	
				Male	Female
Cohort	26 masses	67	35	28	28
Survival (%)	96.15	25.37	60.00	-	-
Duration (Days)	8.96 ± 0.60	19.88 ± 5.36	5.88 ± 0.46	25.61 ± 5.51*	31.63 ± 12.45*

* Duration in hours

longevity and egg laying of the adults of the two species were recorded daily.

The biological data collected on the host and the parasitoid were subjected to mathematical treatment as suggested by Birch (1948) and Atwal and Bains (1974) to determine the rate of increase in each case.

RESULTS AND DISCUSSION

Results of the observations on the survival and development of various stages of *P.perpusilla* and *E.melanoleuca* revealed that the life-cycle of the parasitoid was comparatively shorter than that of the host mainly due to the shorter life span of the adults of the former (Table 1). The survival of the two species in the various stages was comparable except in the larvae of the parasitoid where it was quite low. Though the neonates of the parasitoid were found to survive for a maximum period of 24 hours without food in search of the host, only 25% of these were successful to locate, parasitise and complete the larval development on the host. The fecundity records of the two species indicated that it was higher (345.15 ± 160.43 eggs/ ♀) in the parasitoid than that (157.11 ± 23.70) of the host.

Mathematical computations of the biological data in each species yielded the information which has been tabulated in Tables 2, 3 and 4. Perusal of the results indicated that the multiplication per generation (net reproductive rate) was higher in case of the host (26.42 times) when compared with that of the parasitoid (12.72). However, when the generation period and net reproductive rate were taken into account together, the values of innate capacity for increase (rm) of the two species revealed that the parasitoid would multiply at a faster rate (0.073) than that of the host (0.052). Similarly, the finite rate of increase (λ) was almost double (8.984/♀ /month) in case of the parasitoid as compared to that (4.711) of the host. However, these rates of increase were attainable only under favourable weather conditions when the other natural enemies of pyrilla were excluded from the experiment. Further, the faster growth of the parasitoid numbers under experimental conditions was made possible by ensuring the sufficient supply of the appropriate host stage for parasitism. However, earlier studies by Dhaliwal (1982) indicated low parasitism (27.10%) of feeding stages of pyrilla under field conditions, even at the peak of the host population. Probably the host specificity of *E.melanoleuca* and inadequate availability of the proper stages (third to fifth nymphal instars and adults) of the host for parasitism due to changes in age structure of pyrilla population may act as limiting factors for the rapid multiplication of the parasitoid in sugarcane.

Table 1. Comparative survival and development of *P.perpusilla* and *E.melanoleuca* during August-October at Ludhiana

Pivotal age in days (x)	Age schedule of survival for females (lx)	Age schedule for female births (mx)	lxmx	x. lxmx
0.5-53.5	Immature stages and preoviposition period			
54.5	0.33	1.30	0.43	23.38
55.5	0.33	0.00	0.00	0.00
56.5	0.33	5.85	1.93	107.14
57.5	0.33	2.00	0.66	37.95
58.5	0.33	9.15	3.02	176.64
59.5	0.33	5.60	1.85	109.96
60.5	0.33	1.95	0.64	38.93
61.5	0.33	7.05	2.33	143.08
62.5	0.33	8.45	2.79	174.28
63.5	0.30	2.00	0.60	38.10
64.5	0.30	9.22	2.77	178.41
65.5	0.27	5.44	1.47	96.21
66.5	0.23	4.50	1.04	68.83
67.5	0.23	6.72	1.55	104.33
68.5	0.23	1.50	0.35	23.63
69.5	0.20	4.50	0.90	62.55
70.5	0.17	3.20	0.54	38.35
71.5	0.17	3.60	0.61	43.62
72.5	0.10	2.83	0.28	20.52
73.5	0.10	4.50	0.45	33.07
74.5	0.10	0.00	0.00	0.00
75.5	0.10	6.16	0.62	46.51
76.5	0.07	0.00	0.00	0.00
77.5	0.03	0.00	0.00	0.00
78.5	0.03	0.00	0.00	0.00
79.5	0.03	17.50	0.53	41.74
80.5	0.03	0.00	0.00	0.00
81.5	0.03	14.50	0.44	35.45
82.5	0.03	0.00	0.00	0.00
83.5	0.03	0.00	0.00	0.00
84.5	0.03	0.00	0.00	0.00
85.5	0.03	20.50	0.62	52.58
86.5-110.5	0.03	0.00	0.00	0.00
111.5	0.00	0.00	0.00	0.00
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Net reproductive rate (Ro) = $\sum$ lxmx			= 26.42	1685.26

This contention is further supported by the observations of Gupta *et al.* (1971) that magnitude of the parasitism of the leafhopper by *E.melanoleuca* was higher in heavily infested fields and vice-versa. Again the ratio of initial populations of the two species being generally in favour of the host may allow the pest population to increase with a little restraining

Table 3. Life-table of *E.melanoleuca* based on the biological data recorded during August-October at Ludhiana

Prvotal age (days) (x)	Age schedule of survival for females (lx)	Age schedule for female births (mx)	lx.mx	x.lx.mx
0.5-33.5	Immature stages			
34.5	0.07	134.04	9.38	323.71
35.5	0.02	167.00	3.34	118.57
Net reproductive rate (Ro) = $\sum$ lxmx			= 12.72	442.28

Table 4. Comparative rates of increase of *P.perpusilla* and *E.melanoleuca* derived from their respective life-tables

Subject species	Corrected generation time (days)	Corrected innate capacity for increase (rm)	Finite rate of increase (λ) per female per			Doubling time (days)
			day	week	month	
P.perpusilla	63.37	0.05166	1.053	1.436	4.711	13.42
E.melanoleuca	34.75	0.07318	1.076	1.669	8.984	9.47

effect of the parasitoid. Thus, it may be concluded that *E.melanoleuca* may be considered for the effective control of pyrilla on sugarcane either in combination with another egg parasitoid *(Ooencyrtus papilionis* Ashmead) or by flooding the fields with *E.melanoleuca* eggs through artificial releases.

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