J.Biol.Control, **9** (1), 5-8, 1995

Life - Table Studies of the egg parasitoid, *Psix striaticeps* (Hymenoptera : Scelionidae) on the silkworm predator *Canthecona furcellata* (Pentatomidae, Heteroptera)

RAVINDRA NATH SINGH, SHASHI SHEKHAR SINHA AND K. THANGAVELU

Central Tasar Research and Training Institute
Ranchi - 835 303

ABSTRACT

A life-table was constructed under laboratory conditions for a little known Scelionid egg parasitoid *Psix striaticeps* Dodd on *Canthecona furcellata* Wolff. The female parasitoid survived for 12 days and oviposited intensively for 3.5 days. The net reproductive rate (Ro) representing the total births was 38.30. The population increased with an infinitesimal rate [r_m] of 0.275 and finite rate of 1.32 per female per day. A generation was completed in 13.25 days. Life-table analysis indicated the preponderance of females due to solitary parasitism and a balanced sex ratio due to superparasitism.

KEY WORDS : Life-table, *Psix striaticeps, Canthecona furcellata,* Hymenoptera, Scelionidae

Psix striaticeps Dodd (Hymenoptera : Scelionidae) is a poorly known (Safavi, 1968; Okuda and Yeargan, 1988; Orr and Boethel, 1990; Singh *et al.*, 1992; Thangavelu and Singh, 1992) egg parasitoid of the tasar silkworm predator *Canthecona furcellata* Wolff (Heteroptera: Pentatomidae) (Singh and Thangavelu, 1991). Life-table studies under laboratory conditions were therefore constructed for *P.striaticeps* on *C.furcellatta.*

MATERIALS AND METHODS

The parasitoid *P. striaticeps was reared on the eggs of C.furcellata* at 25 ± 2°C and 70-75% RH in plastic Petri dishes, and fed with 30% honey streaked on the lid. Fecundity and longevity of (0-12 h old) 10 mated females were observed by exposing ten freshly laid egg clusters (7-50) of *C.furcellata* along with 30% honey. The exposed host eggs were replaced by fresh ones every 25h throughout the life of the parasitoids and held singly in glass tubes (1x5 cm) each having a piece of moist filter paper. The specimens emerged were sexed and counted. The net reproductive rate [Ro] (Total female offspring/female) and intrinsic rate of natural increase [r_m] were derived according to Birch (1948). A close approximation of r_m was made using the trial and error substitute of r_m in Lotka-Euler equation:

$$\Sigma_x\, l_x m_x e^{-r_m x} = 1.$$

Where, x = age interval, l_x = proportion of females surviving out of the cohort on d_x and m_x = the number of offspring produced or emerged/female on dx (Table 1). A finite rate of increase was computed as [λ] = antilog r_m. R_0 and R_t were calculated as $R_0 = \Sigma x^1 x\ m_x$ and R_t = x l_c m_x divided by R_o. Mean generation time was calculated as log = R_0/r_m. Other life table parameters calculated as follows : (i) mean generation time in d= R_0/r_m ; Weekly multiplication of the population, $r_w = (e^{rm})^7$.

RESULTS AND DISCUSSION

Age-specific survival and fecundity of *p.striaticeps* on *C.furcellata* are presented in Table 1. At 25 ± 2°C, the development of *P.striaticeps* from egg to adult took 12 days. The total duration of immature stages was 10.75 days. The first mortality within the cohort occurred on the fourth day and increased

Present address : National Silkworm Seed Project Bangalore - 560 068

Table 1. Life table and age-specific fecundity of *psix striaticeps* at 25 ± 20C and 70-75% RH.

Age interval	Life table for female adult l_x	Age schedule for female births m_x	$l_x m_x$	$X l_x m_x$
12.00	1.00	1.00	1.00	12.00
13.00	1.00	5.80	5.80	75.40
14.00	1.00	15.60	15.60	218.40
15.00	0.90	7.80	7.02	105.30
16.00	0.70	5.80	4.06	64.96
17.00	0.50	4.40	2.20	37.40
18.00	0.40	3.20	1.28	23.04
19.00	0.30	2.60	0.78	14.82
20.00	0.20	2.00	0.40	8.00
21.00	0.10	1.60	0.16	3.36
			R_o = 38.30	561.68

thereafter. The number of female progeny produced by *P.striaticeps* ranged from 35 to 52 per female. The maximum mean female progeny per day was attained on the 3rd day and the production ceased by 10th day after the first oviposition [fig 1]. The population increased with an infinitesimal rate [r_m] of 0.275 and finite rate[λ] of 1.32 per female per day. A generation was completed in 13.25 days [T]. The weekly multiplication of the population was 6.85 times (Table 2). The mean sex ratio was 1:4.5. The intrinsic rate of increase [r_m] and the other life-table statistics of the female *P.striaticeps* are given in Table 2. *P. striaticeps* is a solitary parasitoid but high incidence of superparasitism was observed under laboratory condition. Two to three individuals emerged from the superparasitized eggs of *C.furcellata* but had reduced body size. The fecundity of scelionid parasitoids in general has been variously estimated as between 30-85 eggs. However, the actual number of eggs laid depends upon several, factors *viz.*, temperature (yeargan, 1983), stages of host (Gerling, 1972; Muthukrishnan and Senthamizhselvan, 1988), functional and numerical responses of the parasitoid (Waage Godfray, 1985; Waage, 1986) and nutrition of the parasitoid during its larval development (Ruberson, 1989; Yeargan, 1982). The estimates of the R_0 and R_t for the female *P. striaticeps* are lower compared to commonly known scelionids (Velayudhan, 1987). The innate capacity for increase of species (r_m) was found to be 0.275. As an index of parasitoid fitness, r_m was found to vary somewhat among scelionids studied. It is lower in less fecund species. However, such a comparison is difficult as the experiments have seldom been performed in similar conditions. A number of factors and measurement methods influence R_0 and r_m values to a great extent (Pickford, 1964; Viktorov, 1968; Safavi, 1968). The mean length of the generation time of *P.striaticeps* is 14.67 which is higher than in *Trissolcus* sp. Values of r_m indicated that *P.striaticeps* was able to multiply 6.8 x / week. The Mx curve of *P.striaticeps* was skewed

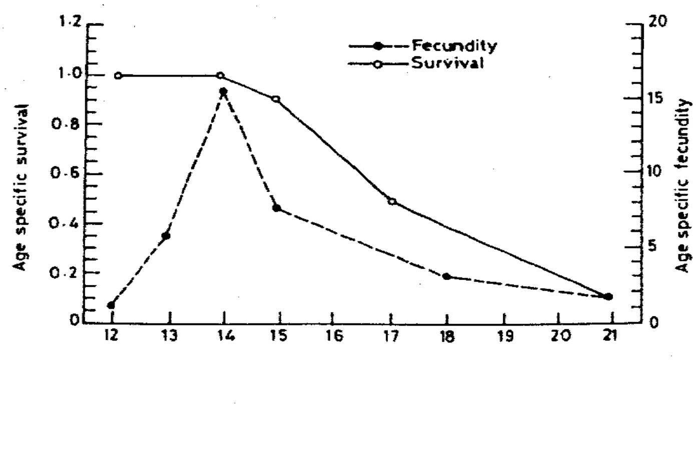

Fig. 1 **Age - specific survival and fecundity of *Psix striaticeps* on *C.furcellata***

Table 2. Life-table statistics of *Psix striaticeps* on the eggs of *Canthecona furcellata*

Particulars	Mean
Survival (in days)	12.00
Age at first reproduction	12.00
Duration of immature stages	10.75 ± 0.35*
Length of period of intensive egg laying (PIEL)	3.5 ± 0.15*
Mean number of eggs/female (m_x)	49.80 ± 0.27*
Total female offspring/female (R_0)	38.30
Mean length of the generation (T_c)	14.67
Innate capacity for increase in numbers (rc)	0.248
Now arbitary r_m (rc) are 0.24 and 0.26 e^{7} $-r_m \times l_x m_x = 1096.6$ .... rm 0.275 Finite rate of increase in numbers/ anti log e rm	1.32
Cohort generation Time (T)	13.25
Weekly generation time r_w $(e^{rm})^7$	6.85

* ± SD

highly to the right [Fig 1] indicating that females in older age classes (6 days after eclosion) contributed very little female progenies to the cohort. The mean sex ratio was higher than the predicted sex ratio of 0.5. The mean sex ratio was above 0.5 throughout the life of *P.striaticeps* indicating higher proportion of females leading to the accelerated growth rate of the population (Hamilton 1967; Hartl and Brown, 1970; Werrern, 1980). The results of the life-tables clearly indicated the fact that a higher number of females were produced from the eggs of *C.furcellata* when parasitized solitarily while superparasitism of eggs resulted in a more balanced sex ratio. The superparasitism and higher female progeny appears to be a reproductive adaptation of this parasitoid to utilize less suitable hosts for the production of females.

ACKNOWLEDGEMENTS

We thank Dr. William C. Nettles, Jr. Research Entomologist, Agricultural Research Services, Biological Pest Control Research, Weslaco, U.S.A. for going through the earlier draft of the manuscript and critical comments and suggestion; Dr.K.M. Harris, Director, British Museum, London for identification of the parasitoid.

REFERENCES

BIRCH, L.C. 1948. The intrinsic rate of natural increase of an insect population. *J.Anim. Ecol.*, **17**, 15-26.

GERLING, D. 1972. The developmental biology of *Telenomus remus* Nixon (Hymenoptera ; Scelionidae). Bull. *Entomol Res.*, **61**, 385- 388.

HAMILTON, W.D. 1967. Extraordinary sex ratio. *Science*, **156**, 477-488.

HARTL, D.L., and BROWN, S.W. 1970. The origin of male haploid genetic systems and their expected sex ratio. *Theory popul. Biol.*,**1**, 165-190.

MUTHUKRISHNAN, J. and SENTHAMIZHSELVAN, M. 1988. On certain correlation between host parameters and parasitoid production. *Ann. Entomol.*, **5**, 7-10.

OKUDA, M.S. and YEARGAN, K.V. 1988. Intra and interspecific host discrimination of *Telenomus podisi* and *Trissolcus eushchisti* (Hymenoptera : Scelionidae). *Ann. Ent. Soc. Amer.*, **81**, 1017-1020.

ORR, D.B. and BOETHEL, D.J. 1990. Reproductive potential of *Telenomus cristatus and T.podisi* (Hymenoptera : Scelionidae). *Ann. Ent.Soc. Amer.*, **83**, 902- 905.

PICKFORD, R. 1964. Life history and behaviour of *Scelio calopteni* Riley (Hymenoptera : Scelionidae), a parasite of grass hopper eggs. *Can. Ent.*, **96**, 1167-1172.

RUBBERSION, J.R. 1989. Development and survival of *Telenomus lobatus* a parasitoid of chrysopid eggs : Effect of host species. *Entomol. Exp. App.*, **51**, 101-106.

SAFAVI, M. 1968. Etude biologique et. ecologique des Hymenopteres parasites des oeufs des punaises des careales. *Entomophaga*, **13**, 381-495.

SINGH, R.N. and THANGAVELU, K. 1991. Parasites and predators of tasar silkworm *Antheraea mulitta* and their control.. *Indian silk*, **29**, 33-36.

SINGH, R.N., THANGAVELU, K., MISHRA, P.K. and JAYASWAL, J. 1992. Reproductive strategy and sex ratio of stinkbug parasitoid *Psix striaticeps* Dodd. in tasar Eco-system. G. *it Ent.*,*6* 151-155.

THANGAVELU, K. and SINGH, R.N. 1992. Record of new egg parasites of *Canthecona furcellata* (Pentatomidae: Hemiptera). *Entomon*, **17**, 137-138.

VELAYUDHAN, R. 1987. Host preference in some pentatomids and related impact on the fecundity of their parasitoids. *Proc. Indian Acad. Sci. (Anim, Sci.)*, **96**, 281-291.

VIKTOROV, G.A. 1968. The influence of density on the sex ratio in *Trissolcus grandis*. (Hymenoptera: Scelionidae). *Zhurnal Obschchei Biology*, **34**, 554-562.

WAAGE, J.K. and GODFRAY, H.C.J. 1985. Reproductive strategies and population ecology of insect parasitoids. In, "Behavioural Ecology, Ecological consequences of Adaptive behaviour "(R.M.Sibly and R.H. Smith eds.) pp. 449-470. Black Well Scientific publications. Oxford.

WAAGE, J.K. 1986. Family planning in parasitoids: Adaptive pattern of progeny and sex allocation. In "Insect Parasitoids" (J.K.Waage, and D. Greathead, eds.) pp. 63-95, XIII Symp. Royal Ent. Soc. London, Academic Press, London.

WERRENRN, J.H. 1980. Sex ratio adaptations to local mate competition in a parasitic wasp. *Science*, **208**, 1157 - 1159.

YEARGAN, K.V. 1982. Reproductive capability and longevity of the parasitic wasps, *Telenomus podisi* and *Trissolcus eushisti*. *Ann. Ent. soc. Amer.*, **75**, 181-183

YEARGAN, K.V. 1983. Effects of temperature on developmental rate of *Trissolcus euschisti* (Hymenoptera:Scelionidae) parasite of stink bug eggs, *Ann. Entomol. Soc. Amer.*, **76**, 757-760.