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Biology of gregarious parasitoids of uzi fly, *Exorista bombycis* Louis (Diptera: Tachinidae)

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ABSTRACT: Biology of indigenous parasitoids namely, *Trichopria* sp., *Exoristobia philippinensis* Ashmead and *Spalangia endius* Walker of the uzi fly *Exorista bombycis* Louis was studied in the laboratory. All the parasitoids lived significantly longer in the presence of host and diet compared to either diet or host. They preferred to parasitize 2-4 days old host pupae and per cent parasitism was highest (4.23, 5.0 and 8.43) on this age group. Adult parasitoids mated soon after emergence. The average fecundity was higher in *E. philippinensis* and *Trichopria* sp. compared to *S. endius*. Arrhenotokous parthenogenesis occurred in all the three species of parasitoids.

KEY WORDS: Biology, *Exorista bombycis*, *Exoristobia philippinensis*, gregarious parasitoid, *Spalangia endius*, *Trichopria* sp.

The uzi fly, *Exorista bombycis* Louis is a serious endoparasitoid and inflicts damage to an extent of 12 to 20 per cent to the sericulture industry. As many as 12 indigenous parasitoids of uzi fly were recorded. Successful multiplication and colonization of *Trichopria* sp. (Hymenoptera: Diapriidae), *Exoristobia philippinensis* (Hymenoptera: Encyrtidae) Ashmead (Veeranna *et al.*, 1987 a,b) and *Spalangia endius* Walker (Veeranna and Nirmala, 1992) on uzi fly pupae indicate that these are potential biocontrol agents. An understanding of the biology of parasitoids is essential to employ them in biological control. The present investigation was undertaken to study the biology of gregarious parasitoids of uzi fly and to utilize the results to formulate IPM of uzi fly.

MATERIALS AND METHODS

The cultures of *Trichopria* sp.,

E. philippinensis and *S. endius* maintained in the laboratory on uzi fly pupae were used in the present study. The methodology adopted was common for all the three species and the experiments were carried out under laboratory conditions with three replications during 1993.

Longevity

To determine the longevity of adult parasitoids in different treatments, soon after emergence, 10 females and males of each were taken in 500 ml glass beaker. The treatments were: parasitoids without host and diet, with only host puparia, with only diet, with water and host puparia, and with diet and host puparia. Two day old host puparia, and sucrose and honey mixture (1:1) were provided daily as per the treatments. Mortality of adults was recorded.

Parthenogenesis

Parthenogenesis was studied by taking freshly emerged ten unmated females individually in 500 ml beaker and providing 2 to 3 days old puparia for parasitization daily till the death of the female parasitoids. Mated female parasitoids were utilized as control. Emergence of adults and sex-ratio was recorded in both the cases.

Effect of host age on parasitization

Hundred healthy uzi fly puparia of 0 to 13 days of age were provided to five pairs of adult parasitoids (one day old) in 500 ml beakers, separately. The exposed puparia were replaced by new ones after every 24 h and were maintained separately for emergence. Observation was made on the effect of host age on parasitization depending upon the number of host pupae parasitized in each age group.

Mating and oviposition behaviour

A pair of female and male adults was confined in a 1000 ml beaker. The behaviour of the parasitoids during pre and post mating periods was observed. Five gravid females taken in a 1000 ml beaker with 25 healthy host puparia to study the process of oviposition.

Data were analyzed statistically using Student 't' test for comparison of treatments (P=0.05).

RESULTS AND DISCUSSION

Longevity

The lifespan of *Trichopria* sp., *E. philippinensis* and *S. endius* increased significantly ($P < 0.05$) in presence of diet and host. Females of all the species lived longer as compared to males in all the treatments (Table 1). Similar observations have been reported in *Spalangia nigra* Latrielle (Hall and Fischer, 1988), *Anthrocephalus hakonensis* (Ashmead) (Mohandas and Abdurahiman, 1992), *Dirhinus anthracia* Walker, *Nesolynx thymus* (Girault) and *Pachycrepoideus veerannai* Narendran and Anil (Jyothi, 1994).

Parthenogenesis

Arrhenotokous parthenogenesis was observed in all the three parasitoids and the progeny production was significantly

Table 1. Adult longevity (in days) of *Trichopria* sp., *E. philippinensis* and *S. endius* in the presence and absence of host and food

Treatment	*Trichopria sp.*		*E. philippinensis*		*S. endius*	
	Female	Male	Female	Male	Female	Male
No diet + No host	3.00 ± 0.1	2.32 ± 0.0	4.0 ± 0.0	4.0 ± 0.9	6.8 ± 0.8	6.2 ± 0.0
No diet + host	3.89 ± 0.5	2.90 ± 0.6	5.9 ± 0.1	5.0 ± 0.3	8.2 ± 0.2	6.4 ± 0.3
Water + host	4.10 ± 0.2	3.08 ± 0.1	6.1 ± 0.5	5.5 ± 0.4	14.2 ± 0.6	13.9 ± 0.6
Diet + No host	6.58 ± 0.3	5.89 ± 0.5	10.7 ± 0.4	7.8 ± 0.8	16.0 ± 0.6	15.9 ± 0.6
Diet + host	*9.79 ± 0.0	*7.35 ± 0.3	*14.1 ± 0.5	*10.3 ± 0.3	*23.8 ± 1.1	*21.8 ± 0.6

*Significant at P<0.05

Table 2. Progeny production per unmated and mated female of *Trichopria* sp., *E. philippinensis* and *S. endius*

Parasitoid	Unmated female			Mated female			
	Adult host emergence (%)	Para-sitism (%)	Male parasitoid emerged	Adult host emergence (%)	Para-sitism (%)	Emerged parasitoids Female	Male
Trichopria sp.	54.68	5.18	*423 ± 9.8	40.28	4.1	180.24 ± 1.3	191.3 ± 2.5
E. philippinensis	62.36	6.29	*250 ± 5.6	50.12	5.2	164.59 ± 1.5	40.4 ± 1.4
S. endius	55.38	8.29	*42.9 ± 4.5	48.65	7.3	18.86 ± 0.5	15.1 ± 0.3
Host puparia without exposure (control)	89.25	-	-	-	-	- -	

*Significant (P<0.05)

Table 3. Effect of host age on parasitization of *Trichopria* sp.

Age of host puparia (in days)	Adult host emergence (%)	Host mortality (%)	Parasitism (%)	Adult parasitoid emergence
0	60.25	39.75	0.00	0.0 ± 0.0
1	63.27	36.32	0.41	75.0 ± 5.7
2	60.16	37.64	2.20	180.6 ± 10.2
3	65.51	30.26	4.23	* 362.8 ± 12.7
4	61.92	35.46	2.62	255.0 ± 3.8
5	66.51	30.68	2.81	232.6 ± 4.6
6	66.45	31.08	2.47	205.3 ± 5.6
7	65.48	32.92	1.60	135.0 ± 7.8
8	63.34	35.06	1.60	102.0 ± 8.3
9	73.48	26.32	0.20	30.6 ± 9.2
10	77.17	22.83	-	-
11	78.39	21.61	-	-
12	79.08	20.92	-	-
13	81.35	18.65	-	-

*Significant (P<0.05)

Table 4. Effect of host age on parasitization of *S. endius*

Age of host puparia (in days)	Adult host emergence (%)	Host mortality (%)	Parasitism (%)	Adult parasitoid emergence
0	61.74	38.26	-	
1	80.73	15.02	4.25	22.26 ± 1.8
2	78.68	12.89	8.43	*29.30 ± 1.5
3	80.26	15.65	4.09	18.00 ± 0.1
4	78.77	21.23	-	-
5	71.64	28.36	-	-
6	77.07	22.93	-	-
7	74.04	25.06	-	-
8	71.79	28.21	-	-
9	78.14	21.86	-	-
10	72.35	27.65	-	-
11	79.08	20.92	-	-
12	77.74	22.26	-	-
13	81.94	18.06	-	-

*Significant (P<0.05)

Table 5. Effect of host age on parasitization of *E. philippinensis*

Age of host puparia (in days)	Adult host emergence (%)	Host mortality (%)	Parasitism (%)	Adult parasitoid emergence
0	54.45	44.45	1.0	48.8 ± 5.28
1	70.72	26.28	3.0	125.9 ± 2.96
2	66.08	28.92	5.0	*218.0 ± 1.28
3	70.95	26.05	3.8	120.6 ± 1.06
4	62.48	34.72	2.8	92.7 ± 0.18
5	61.82	35.13	2.5	83.8 ± 1.28
6	69.19	27.76	2.1	74.3 ± 2.96
7	56.68	40.29	2.0	70.0 ± 1.26
8	68.68	28.34	2.0	65.0 ± 2.80
9	57.57	39.82	1.6	54.0 ± 3.21
10	66.69	32. 89	0.4	32.6 ± 1.62
11	70.79	29.21	-	-
12	68.50	31.50	-	-
13	71.50	28.50	-	-

*Significant (P<0.05)

reduced in mated females (P<0.05) (Table 2) as has been observed in *S. nigra* (Hall and Fischer, 1988) and the uzi fly parasitoids such as *D. anthracia*, *P. veerannai* and *N. thymus* (Jyothi, 1994). The unmated females parasitized more hosts.

Effect of host age on parasitization

The adults of *Trichopria* sp. and *S. endius* emerged from 1-9 days and 1-3 days old puparia, respectively (Table 3 & 4). No emergence of adults was observed on '0' day host pupae in these two species, whereas emergence was observed from '0' to 10 days old host puparia in the case of *E. philippinensis* (Table 5). All the three parasitoids preferred to oviposit on young age pupae, as has been observed in *N. thymus* (Kumar *et al.*, 1990), *Tetrastichus howardi* (Oliff) (Ram Kishore *et al.*, 1993).

Dirhinus himalayanus Westwood (Srinivasan and Panicker, 1998), *S. nigra* (Hall and Fischer, 1988) and in *D. anthracia* (Jyothi and Veeranna, 1993). The adult host emergence indirectly relates to the quality of host provided and the percentage of infestation by the parasitoids.

Mating and oviposition behaviour

The adults of all the three parasitoids were found to mate immediately after emergence. The duration of mating ranged from 45 to 75s in *Trichopria* sp., 5 to 10s in *E. philippinensis* and 35 to 50s in *S. endius*. These observations are in accordance with the reports on other hymenopterans such as *Trichopria popei*

(Muesebeck) and *T. atrichomelinae* Muesebeck (O'Neill, 1973).

Prior to oviposition, repeated probing of the host was observed in all the three parasitoids. The adults of *Trichopria* sp. and *S. endius* drummed the host with their antennae as has been observed in *T. gallerucae* (Fonscolombe) (Michael and Richard, 1989). Among *Trichopria* sp., *E. philippinensis* and *S. endius*, the former two species laid more number of eggs per host (Table 3 to 5). The sex ratio was almost equal in *Trichopria* sp., but female biased sex-ratio was observed in *E. philippinensis* and *S. endius*. The highly female biased sex-ratio is advantageous in maintaining the mass culture of the parasitoids (Mohandas and Abdurahiman, 1992). These parasitoids were found to live longer in the presence of host and diet, prefer to lay eggs on 2-4 days old pupae and the resultant progeny had a female biased sex-ratio. Thus, these parasitoids could be promising candidates as components in Integrated Pest Management (IPM) of uzi fly, *E. bombycis*.

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