J. Biol. Control, 12 (1): 31-35 , 1998

Low temperature storage of the parasitoids of uzi fly, *Exorista bombycis* Louis (Diptera: Tachinidae) a pest of silkworm, *Bombyx mori* Linnaeus(Lepidoptera: Bombycidae)

H. K. JYOTHI, G. VEERANNA and GEETHA BALI*
Karnataka State Sericulture Research and Development Institute
Thalghattapura, Bangalore 560 062, Karnataka, India

ABSTRACT: Possibility of low temperature storage of indigenous hymenopteran parasitoids of uzi fly (*Exorista bombycis* Louis) namely, *Nesolynx thymus* (Girault), *Dirhinus anthracia* Walker and *Pachycrepoideus veerannai* Narendran and Anil at various stages of life cycle, was investigated. Egg, larvae, pupae and adults of all the three parasitoids died when stored at 5 and 10°C. However, *Dirhinus anthracia* and *Pachycrepoideus veerannai* could be stored for 90 and 45 days, respectively at 15°C without hampering their reproductive potential. With increase in the duration of storage, a reduction in the adult parasitoid longevity and fecundity at ambient temperature was noticed.

KEY WORDS: *Dirhinus anthracia*, *Exorista bombycis*, *Nesolynx thymus*, *Pachycrepoideus veerannai*, storage, uzi fly

Uzi fly, *Exorista bombycis* Louis (Diptera: Tachinidae) is a serious pest of mulberry silkworm *Bombyx mori* L. (Lepidoptera: Bombycidae) in India (Kumar and Jolly, 1986). Various control measures aimed at suppressing this pest have met with limited success. In recent years, substantial efforts towards achieving biological control have resulted in recording hymenopteran parasitoids of this pest and their evaluation. Some of the parasitoids thus reported, are also tested in the field as a component of integrated approach for containing the pest (Jyothi, 1994). In biological control, low temperature conditions are used to facilitate storage and transportation of parasitoids (Holloway, 1933; van Lentern, 1986).

Department of Zoology, Bangalore University, Bangalore 560 056, Karnataka

However, review of literature is indicative of dearth of information on storage methods for uzi fly parasitoids. Hence, present investigation is attempted to determine the ideal temperature, stage and duration of storage so as to harness the reproductive potential of the three parasitoids of the pest namely, *Nesolynx thymus* (Girault) (Eulophidae), *Dirhinus anthracia* Walker (Chalcididae) and *Pachycrepoideus veerannai* (Narendran and Anil) (Pteromalidae).

MATERIALS AND METHODS

Storage of eggs, larvae, pupae and adults of the three parasitoids, *N. thymus*, *D. anthracia* and *P. veerannai* at 5, 10 and 15°C, a relative humidity of 70 per cent and a photoperiod of L:D = 12:12 was carried out in a B.O.D incubator in the laboratory. Hundred host pupae each, parasitized by the three parasitoids were kept in temperature chambers and observed for hatching of the eggs, prolongation of the stage, larval development and adult parasitoid eclosion under storage. Similarly, 100 host pupae each, parasitized by the three parasitoids were incubated at 25 ± 2°C for 5 days for the eggs to hatch and subsequently transferred to temperature chambers maintained at 5, 10 and 15°C. These host pupae were observed for development of the parasitoid larvae and enhancement in the larval duration. Fifty host pupae parasitized by the three parasitoids under investigation were maintained in three replications in temperature chambers (5, 10 and 15°C) after the onset of pupation in the developing parasitoids. Host pupae were removed periodically from storage, thawed and kept under observation for a period of 60 days each at room temperature.

To evaluate temperature suitable for adult storage, 15 male and female adults each of *D. anthracia* and *N. thymus* and 20 each of male and female *P. veerannai*, immediately after emergence were maintained at the temperatures mentioned earlier in three replications and provided with honey and sucrose solution. They were observed for survival once in 24 h and compared with those maintained at room temperature.

To study the behaviour of stored adults at ambient temperature, 100 male and female (each of the three parasitoids) were stored at low temperatures separately and were provided with honey and sucrose solution. Ten adults were removed to room temperature at different intervals and were provided with food. Three pairs were allowed to mate and the rest were observed for their survival at ambient temperature. These adults were provided with uzi fly pupae for parasitization. Progeny obtained from these adults were counted and sexed. Batches maintained at room temperature acted as control. Data were subjected to analysis of variance.

RESULTS AND DISCUSSION

Storage at egg, larval and pupal stage

Eggs and larvae of *N. thymus*, *P. veerannai* and *D. anthracia* did not survive at 5 and 10°C. At 15°C development was

observed only in *D. anthracia*. However, percentage of survival was only 2.5. Eclosion of adults did not take place in all the parasitoids when stored as pupae at 5 and 10°C. At 15°C only in *D. anthracia* emerged and developmental duration was 27.3 ± 0.43 days for males and 28.4 ± 0.51 days for females which is comparable with their developmental time at ambient temperature.

Storage of adult parasitoid

Nesolynx thymus and *P. veerannai* adult susceptible to low temperature (Table 1).

Longevity of males and females of *N. thymus*, *P. veerannai* and *D. anthracia* stored for different duration was reduced at room temperature, with increased storage duration. Significant reduction in longevity was observed beyond 15 days of storage in males and 20 days in females of *N. thymus*; 10 days in males and 15 days in females of *P. veerannai* and 20 days in adults of *D. anthracia*. Similarly, reduction in the production of progeny with increased storage duration was observed. *Nesolynx*

Table 1. Longevity of adult parasitoids (in days) at different temperatures

Storage temperature	*N. thymus*		*P. veerannai*		*D. anthracia*	
	Male	Female	Male	Female	Male	Female
5°C	killed	killed	killed	killed	12.05 ± 0.05	11.13 ± 0.33
10°C	16.50 ± 8.33	20.40 ± 2.09	11.85 ± 1.57	12.85± 1.57	31.15 ± 9.76	33.70 ± 3.40
15°C	16.73 ± 2.85	20.86 ± 0.51	36.75 ± 2.57	39.15± 2.18	64.80 ± 25.25	81.80 ± 2.10
Ambient temperature	19.00 ± 2.45	21.00 ± 0.72	19.40 ± 0.72	22.00± 0.20	49.93 ± 0.46	51.26 ± 0.54

did not survive at 5°C. Though *D. anthracia* adults survived at this temperature, survival periods were shorter than their normal longevity. All the three parasitoids survived at 10°C, but their survival duration was significantly shorter compared to control. At 15°C adults of *D. anthracia* and *P. veerannai* lived longer than those kept at room temperature. With increase in the duration of storage, increase in the percentage mortality was observed. However, males were found to be more

thymus produced a progeny of 452, 363 and 190 after storage of 5, 10 and 15 days comparing with 450 in untreated control. Increased duration of storage of *P. veerannai* brought a reduction in fecundity from 42.0 to 5.8 adults, if stored for 40 days. However, fecundity of *D. anthracia* was not affected upon storage up to 50 days as it could produce a progeny of 81.8 comparing with 100.0 in unstored adults. Sex ratio remained female biased in all three parasitoids irrespective of storage period (Table 2).

Table 2. Longevity of stored adult parasitoids at room temperature

Storage period (days)	Longevity (in days)					
	N. thymus		*P. veerannai*		*D. anthracia*	
	Male	Female	Male	Female	Male	Female
5	19.1 ± 0.76	20.4 ± 1.50	20.2 ± 1.41	21.1 ± 0.99	*	*
10	19.0 ± 0.56	20.1 ± 0.53	17.7 ± 0.82	19.8 ± 0.78	46.9 ± 1.52	51.8 ± 1.39
15	17.3 ± 0.94	18.3 ± 0.48	15.7 ± 0.94	16.9 ± 0.73	*	*
20	16.1 ± 0.87	17.5 ± 0.52	13.1 ± 0.73	14.6 ± 0.69	45.5 ± 0.52	47.5 ± 0.70
25	15.5 ± 0.68	15.8 ± 0.72	11.2 ± 1.31	12.2 ± 2.59	*	*
30	*	*	8.6 ± 0.63	9.6 ± 0.69	43.6 ± 1.49	45.0 ± 0.66
35	*	*	7.6 ± 0.96	8.6 ± 0.84	*	*
40	*	*	6.0 ± 0.00	7.0 ± 0.00	41.9 ± 2.13	45.0 ± 2.16
50	*	*	*	*	36.0 ± 1.52	38.9 ± 0.76
60	*	*	*	*	30.3 ± 1.45	32.9 ± 1.59
70	*	*	*	*	26.2 ± 1.22	29.0 ± 1.24
80	*	*	*	*	21.6 ± 1.57	25.4 ± 0.68
90	*	*	*	*	21.7 ± 2.00	23.3 ± 1.11
100	*	*	*	*	-	19.7 ± 0.57
Normal	19.0 ± 2.45	21.0 ± 0.54	19.4 ± 0.72	22.0 ± 0.20	49.9 ± 0.46	51.3 ± 0.46
CD (P=0.05)	2.84	4.25	1.83	2.95	1.83	2.95

Cold storage is a useful technique to ensure availability of large number of parasitoids for timely release and transportation. However, Anderson (1935) indicated a possibility of infertility among parasitoids subjected to low temperatures during development. Recognition of this possibility is of utmost importance in biological control programmes. In the present investigation, *D. anthracia* and *P. veerannai* exhibited enhanced longevity when stored at 15°C without apparent loss in reproductive potential.

De Bach and Rao (1968) have reported mortality of sperms in the testes of males and in the spermathecae of females when *Aphytis liganensis* was stored at low temperatures. In *Bracon brevicornis* an alternation of sex ratio of the progeny in favour of males with increase in the duration of storage is reported (Jayanth and Nagarkatti, 1985), while the adult *Euchalcida caryobori* Hanna produced progeny with normal sex ratio when exposed to low temperatures at larval stage and male population was resultant progeny

when stored as pupae. In the present study, parasitoids failed to survive at 5 and 10°C in any of the developing stages or as adults. At 15°C their longevity could be enhanced without affecting the sex ratio of the progeny. Hence, it may be concluded that the parasitoids of uzi fly may be conveniently stored as adult at 15°C.

ACKNOWLEDGEMENTS

The authors are thankful to the Director and the Division Chief of Karnataka State Sericulture Research and Development Institute for providing the facilities and encouragement.

REFERENCES

Anderson, R. L. 1935. Offspring obtained from the males reared at different temperature in *Habrobracon*. *American Naturalist*, **69**: 183-187.

De Bach, P. and Rao, S. V. 1968. Transformation of inseminated females of *Aphytis lignansis* into factitious virgins by low temperature treatment. *Annals of Entomological Society of America*, **61**: 332-337.

Hanna, A. D. 1935. Fertility and tolerance of low temperature in *Euchalcida caryobori* Hanna (Hymenoptera: Chalcididae). *Bulletin of Entomological research*, **26**: 315-322.

Holloway, J. K. 1933. Shipping adult insect parasites in refrigerated containers. *Journal of Economic Entomology*, **26**: 280-282.

Jayanth, K. P. and Nagarkatti, S. 1985. Low temperature storage of *Bracon brevicornis* Wesmel (Hymenoptera: Braconidae). *Entomon*, **10**: 39-41.

Jyothi, H. K. 1994. Studies on the Biological Control of uzi fly, *Exorista bombycis* (Louis) a serious pest of mulberry silkworm, *Bombyx mori* L. Ph. D. thesis, Bangalore University, pp. 211.

Kumar Pradip and Jolly, M. S. 1986. Studies on the ovipositional preference of uzi fly *Tricholyga bombycis* Beck. (Diptera: Tachinidae). *Indian Journal of Sericulture*, **25**: 64-68.

van Lenteren, J. C. 1986. Parasitoids in Green house, pp. 342-368. In: Jeff Waage and David Greathead (Eds.). *Insect parasitoids*. Academic Press, New York.