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Viability of *Trichogrammatoidea bactrae* Pupae at Different Temperatures

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Abstract: The experiment was performed to determine the viability of the *Trichogrammatoidea bactrae* (Trichogrammatidae: Hymenoptera) pupae, after being held, at three different temperatures (10, 12 & 14 °C) for 80, 100 and 120 days in complete darkness with 45% relative humidity. Temperature 10 °C with 80 days holding time is the best combination for the storage of the pupae of the parasitoid. Under the said environmental conditions >53% adult emergence was obtained when the stored pupae wereexposed to normal physical conditions (28 °C, 55% relative humidity and 11/13 light/dark photoperiod).

Key words: *T. bactrae*, pupae, parasitoid, biological agent, Quetta, Pakistan

Introduction

T. bactrae is founded an effective biological agent against a number of lepidopterous pests in different crops like rice (*Oryza sativa* L.), Cabbage (*Brassica oleracea* Var.) and Corn (*Zea mays* L.) (Hutchison *et al.*, 1990). The origin of this parasitoid is South East Asia, Malaysia, Africa, Australia, Costa Rica, and the West Indies (Nagaraja, 1978). Hosts were generally stem, stalk or pine shoot borers from Pyralidae and Olethreutidae. One specimen was taken from *Trichopluia* sp. (Hubner) (Noctuidae) eggs (Nagaraja, 1978).

T. bactrae is widely distributed in the orient (India, Pakistan, China, Malaysia, Taiwan and Indonesia). It is adapted to terrestrial humid habitat s and is known to attack various pests of cotton, sugarcane, fruits and vegetables (Nagaraja, 1978). Cotton contributes about 60% of the total national export. Pink Bollworm (PBW, *Pecthophora gossypiella*) is a major pest of the crop. The pest causes >30 % damage to the cotton crop in Pakistan (Korejo *et al.*, 2000). Once, after hatching, the PBW larvae have entered into the cotton bolls, the pest could not be controlled through the chemical use (Chamberlain *et al.*, 1994). Thus their is a need to control the pest in egg stage. *T. bactrae* is an effective egg parasitoid of PBW. The life table of the parasitoid suggests that the pupal stage has good tolerance against temperature (Malik, 2000). Keeping in view this study was conducted to determine the viability of *T. bactrae* pupae after being held at different environmental conditions. The data obtained could be used for the mass production of the parasitoid for field releases against PBW in cotton crop during the egg stage of the pest.

Materials and Methods

Post Graduate Laboratory, Department of Entomology, Plan t Pathology & Weeds Science, New Mexico State University, USA was used to determine the viability of *T. bactrae* pupae after being stored under different environmental conditions; three temperatures (10, 12 & 14 °C), three holding times (80, 100 and 120 days) with constant 45% relative humidity (RH) in complete darkness. The experiment was replicated six times in the environmental chambers (Atmar and Ellington, 1972). The emerged adults were counted for each treatment an d analyzed by ANOVA (Analysis of Variance), using split plot design, for the effects of temperature on the pupae for different holding times. A Least Significance Difference (LSD) test was used on significant interactions found by ANOVA. SAS (1990), computer program was used for statistical analysis.

Malik (2000) reported that at 28 °C the egg/larval stage of *T. bactrae* lasts about 05 days and the pupal stage lasted about 4 days after parasitization.

More than 1500 PBW eggs were exposed to the newly emerged *T. bactrae*. Parasitized PBW eggs turn black (Hutchison *et al.*, 1990). After five days, 30 randomly selected black eggs were placed in an air tight (50 x 9 mm) petri dish. 54 petri dishes were prepared in the same way. 18 petri dishes were placed at each temperature 10, 12 and 14 °C. After 80, 100, and 120 days, 18 petri dishes were removed (6 from each temperature) and placed at 28 °C at 55% RH and 11/13 photoperiod for emergence (Malik, 2000).

Results and Discussion

Pupae which were placed at 14 °C emerged during the treatment for any holding time (80, 100 & 120 days). They were not analyzed. Pupal stage lasts about 23 days at 13 °C (Malik, 2000).

Table 1: Mean [*1] Number and percent of adult *T. bactrae* that emerged after being held at 80, 100 and 120 days & 10, 12 °C temperatures at 45% relative humidity in complete darkness.

Temperature °C	Holding Time (days)		
	80	100	120
10	16.2 a[*2] α (53.3%)	13.5 a β (45%)[*4]	10 a γ (33.3%)
12	14 b α[*3] (46.6%)	8.0 b β (26.6%)	6.0 b γ (20%)

[*1] Means are from six replicates (n = 30). [*2] Lower case letters indicate significant difference down the column. [*3] Greek characters represent significance difference across the row using LSD test. [*4] Numbers in brackets are percent emergence. LSD values for same temperature and different holding times was 0.47, and for same holding time and different temperatures was 0.792 at significance level of 0.05.

Among the environmental factors tested (temperature & holding time) temperature was the most important. Marco *et al*. (1997) in *Aubeonymus mariaefranciscae* (Coleoptera Curculionidae) and Shipp & Houten (1997) in *Amblyseius cucumeris* (Acari: Phytoseiidae) found the same. Photoperiod affects the temperature of the environment (Yeargan & Barney, 1996). Humidity also influences on the development of an organism (Sharma & Chaudhary, 1988; Ship & Houten, 1997). Photoperiod and humidity were constant in this study thus their effect had equal influence on all the replications.

Analysis of variance for rest of the treatments showed that temperatures, 10 and 12 °C had significant interactions with holding times, 80, 100 and 120 days in complete darkness with 45% RH. Double significant interaction was found

between temperatures & holding times. The LSD for this double significant interactions showed that a holding time of 80 days at 10 °C was the most suitable. Adult emergence was highest (> 53%) when pupae were stored at 10 °C for 80 days (Table 1). Sharma & Chaudhary (1988) also observed minimum mortality in pupal stage at different temperatures in *Heliothis armigera* (Hubner) while Hutchison *et al.* (1990) found the same in *T. bactrae*.

The results of the experiment suggested that the parasitoid may be stored as pupae for at least 80 days at 10 °C. Thus the mass releases in the field would be possible. As a result *T. bactrae* may turn a good biological agent for different pests of cotton and rice as reported by Nagaraja (1978), Hutchison *et al.* (1990) and Malik (2000).

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