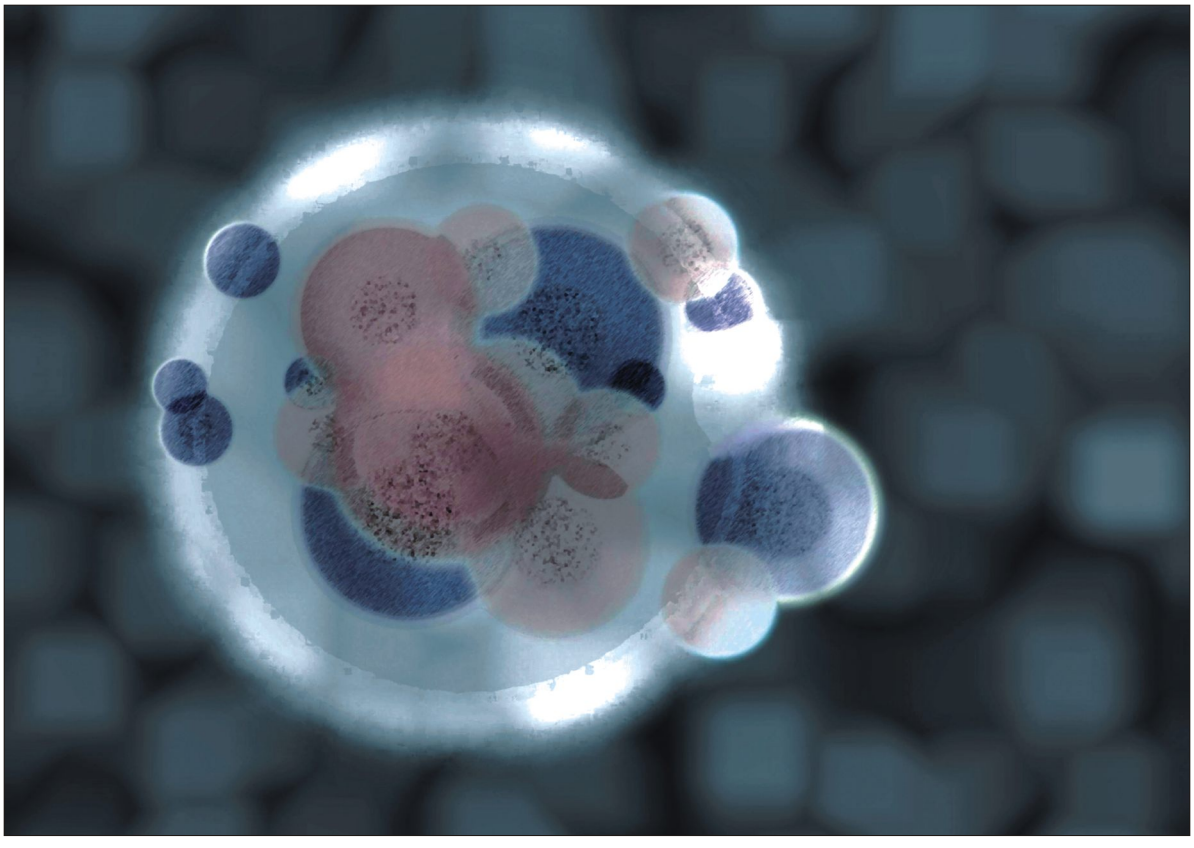

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Field Release of *Trichogrammatoidea bactrae*, Hymenoptera: Trichogrammatidae an Effective Biological Agent of Pink Bollworm (*Pectinophora gossypiella*, Lepidoptera: Gelechiidae) of Cotton (*Gossypium hirsutum* L.)

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Abstract: *Trichogrammatoidea bactrae,* Hymenoptera: Trichogrammatidae (about 72,000 adults) were released in long staple, Upland 1517-88 cotton (*Gossypium hirsutum* L.). Total parasitization in Pink Bollworm (*Pectinophora gossypiella*, Lepidoptera, Gelechiidae, PBW) eggs in two replications was 19.56 and 26.84% respectively.

Key words: *Trichgrammatoidea bactrae*, parasitoid, *Pectinophora gossypiella*, pest, parasitization, IPM, mortality

Introduction

T. bactrae is an egg parasitoid of Pink Bollworm (Nagaraja, 1978). PBW is a key pest of cotton, due to the absence of effective natural enemies in the cotton field the damage by this pest to the crop is getting worse (Anonymous, 1978). Lawson *et al.* (1997), reported >70% PBW infestation even when multiple insecticides were used for the control of the pest. Cotton is the eighth most important cultivated crop in the world (Anonymous, 1986) and the first among the fiber crops (Anonymous, 1992). Without natural enemies, many cotton pests of minor importance would increase to the levels that would make cotton farming economically impossible.

Efforts to permanently establish imported parasitic Hymenoptera on PBW, in the lower Colorado desert of California and Arizona in 1969-78 failed even though field reproduction of some species was recorded. A *Chelonus* sp.nr.*curvimaculatus* (Cameron) obtained from Northwestern Australia was most effective giving an adjusted 69.9% infestation at the equivalent release rate of 2667 female/ha (Legner and Medved, 1979). Several attempts to establish biological control agent of PBW in cotton fields were made none became productive but the population of the pest reduced in the year of release (Hentz *et al*., 1997). *T. bactrae* is not native to Pakistan (Mushtaque *et al.,* 1986). By using an egg parasitoid it may be possible to biologically control PBW before it becomes an economic pest.

The objective of this experiment was to determine if a mass release of laboratory reared *T. bactrae* can be used to control PBW in the cotton field.

Materials and Methods

Trichogrammatoidea bactrae were reared at 28°C, 55% RH and 11/13 photoperiod on PBW eggs. Both PBW eggs and adult *T. bactrae* were obtained from the colonies locally established in the Department of Entomology, Plant Pathology and Weed Science, New Mexico State University, USA. The average field temperature during the PBW season in New Mexico State ranged from 22 to 38°C. Releases were made early in the morning to give the parasitoid an opportunity to adjust to field temperatures.

The Plant Science Farm (PSF), Las Cruces, New Mexico State was selected for the release of *T. bactrae*. No chemical insecticides were applied at this farm. The PSF cotton farm plot was about 0.996 hectares and was rectangular in shape. Upland 1517-88, long staple, cotton (*G. hirsutum* L.) was planted in this field.

Pink Bollworm eggs were collected on blotting paper cards. The eggs cards were cut down into small pieces (500 PBW eggs/card) and were stapled to the lower side of a cotton leaf, in the middle portion of the plant on each of 50 randomly selected plants. PBW eggs on the cards were turned towards the leaf surface to avoid being eaten by predators. After 48 hours each egg card was brought back to the laboratory and placed in an air tight petri dish (50×9 mm) at 28°C, 55% RH and 11/13 photoperiod for emergence. This was the check treatment.

The next morning 50 egg cards (500 PBW eggs/card) were again stapled in the same way on different plants on one side of the field (north west) and newly emerged 72,000 (½ hour old) adults *T. bactrae* (>55% female) were released randomly at other side of field (South west). The distance from point of release of *T. bactrae* to the stapled host eggs was 75 m. Temperature at the time of release was 26.5°C. Wind speed was 10-11 Km/h from east to west. After 48 hours, all samples were brought back to the laboratory in air tight petri dishes counted and allowed to emerge for 20 days at 28°C, 55% RH and 11/13 (light/dark hours) photoperiod. Blackening of the vitelline membrane of the host egg means parasitization by *T. bactrae* (Hutchison *et al*., 1990). Thus black PBW eggs were counted. The experiment was replicated with same procedure after 20 days of the first release. Plots were arranged in a randomized complete block design. The data were analyzed by SAS (SAS., 1990). Analysis of variance (ANOVA) to get the difference between the parasitization rate before and after release of *T. bactrae* in two replications was used.

Results and Discussion

Analysis of variance shows that egg parasitization was not significantly different in the two replications but there was a big difference between pre and post release of *T. bactrae*.

Percent parasitization of stapled PBW eggs on cards before the *T. bactrae* release was the control. Out of 25,000 PBW eggs on cards, 14,563 and 13,027 eggs remained at the Ist and 2nd replications respectively. Others were probably destroyed by predators. Out of the remaining PBW eggs only 12 and 107 were parasitized. These results suggest that natural parasitization rates were very low in both replications and

Table 1: Number of *P. gossypiella* (PBW) Eggs Parasitized by *T. bactrae* Before its Release at the Plant Science Farm (PSF) in Two Replications

Replications	No. of PBW Eggs stapled to leaves	No. of PBW recovered	No. of Black PBW Eggs (Parasitized by T. bactrae)	Percent parasitization
lst	25,000	14,563	12	0.082
2nd	25,000	13,027	107	0.821

Table 2: Number of *P. gossypiella* (PBW) Eggs Parasitized by *T. bactrae* after its Release at the Plant Science Farm (PSF) in Two replications

Replications	No. of T. Bactrae	No. of PBW Eggs stapled to leaves	No. of PBW recovered	No. of Black PBW Eggs (Parasitized by T. bactrae)	Percent parasitization
1st	72,000	25,000	10,883	2,129	19.56
2nd	72,000	25,000	97,040	26,053	26.84

therefore could be ignored in later analysis. Higher rate of parasitization in the 2nd replication shows that some of the *T. bactrae* were still there from the 1st replication even after 20 days (Table 1).

The rate of post-release parasitization was 19.56 and 26.84% in two different replications respectively (Table 2). If we compare pre and post-release parasitization rates, the results are encouraging. Higher parasitization rates would be expected closer to the release points and future studies on release patterns and densities are required (Keller and Lewis 1985; Hope *et al.*, 1990; Smith, 1994; Cerutti and Bigler, 1995).

This is not a high rate of parasitization compared with Glenn and Hoffmann (1997). They found 37 to 87.5% parasitization by *Trichogramma carverae* oatman and pinto, (Hymenoptera: Trichogrammatidae) against leafroller *Epiphyas postvittana* (Walker) in wine grapes. Factors affect the rate of parasitization are often difficult to define (Hassan, 1994).

Wind speed affects adversely the distribution of the tiny parasitoids (Dyer and Landis, 1997). Glenn and Hoffmann (1997) attempted the release in mild wind (0.3 to 6.8 Km/h) while the wind speed was about 11 Km/h at the time of this release. Glenn and Hoffmann (1997) stapled the host eggs cards on the upper surface of the leaves while PBW eggs in this study were stapled on the lower side of the leaves which might cause problems to the parasitoids in host findings (Legner and Medved, 1979). Glenn and Hoffmann (1997) high parasitization rate might also be due to the high population density of the parasitoid over host (3:1) while in this release the ratio was about 2:1. Population density affects directly to the parasitization (Keller and Lewis, 1985). Dyer and Landis (1997) reported that high temperature affects inversely the distribution of the parasitoid. Glenn and Hoffmann (1997) carried out their releases in 23°C while the temperature was 26.5°C when *T. bactrae* were released. Parasitization rate has indirect relations to the distance between the host and parasitoid (Lawson *et al.*, 1997). The distance between *T. bactrae* and the host eggs was 75 m while the distance was <10 m in Glenn and Hoffmann (1997) releases.

This study has shown that *T. bactrae* could be a significant and effective mortality factor in IPM programs for PBW control in cotton, when used in combination with other mortality factors with elimination of the above discussed factors. Since *T. bactrae* is not a native parasitoid in Pakistan, frequent releases may be necessary to get it established in this country.

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