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# Impact of Egg Parasitoid, *Trichogramma bactrae* for the Management of Pink Bollworm in Cotton

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The pink bollworm (PBW) *Pectinophora gossypiella* is an important pest of cotton, causing significant economic losses across the world wherever cotton is grown. In recent years, outbreak of pink bollworm has been recorded from central and northern regions of India. Cotton researchers are claiming that, it is due to poor adaptation of refuge strategy and development of resistance against both *Cry1Ac* and *Cry2Ab* toxins. Basically, it is a steno-phagous pest (feed on two or more crops within the same group or family), but preferably adopted and feed on cotton bolls. The larva feeds internally on the developing seeds within the bolls, therefore makes it difficult to detect the pest incidence and control in the early stage of infestation. This concealed feeding behaviour has probably favour this pest to thrive well on Bt cotton and escape from the natural enemies especially from larval or pupal parasitoids. Sometimes, application of insecticides also may not provide satisfactory results as it spends most of the time inside the boll.

The female moth lay eggs singly or in small groups on the young shoots/squares/cotton bolls. At least, the egg could take 3-d days to hatch and enters into the bolls within a day or two after hatching to escape from the natural enemies. Apparently, the egg stage is exposed to the outside world for 3-4 days and possible control measure can be adopted at this juncture. Eventually, researchers have exploited this weakness and started working on the area of biocontrol approach specifically to target pink bollworm eggs. Although larval parasitoids such as *Bracon sp* and *Chelonus blackburni* are reported to attacks on pink bollworm larvae but their efficacy was minimum. Of the various biocontrol agents, trichogrammatid egg parasitoids are currently used successfully against several lepidopteran pests in Integrated Pest Management (IPM) programme. Although Trichogramma spp. are well known as parasitoids having wide range of host species, especially those belonging to Lepidoptera, the different species of the parasitoid vary in their potentiality in controlling different pest species; i .e, each species is better to be used for controlling a target pest than the others. However, the selection of the strain showing the higher efficiency against a target pest in a given ecosystem is an important step for achieving an efficient biological control program. The female trichogrammatid parasitize the eggs of the target host and kill them before they emerge into larval stage. Hence, several trichogrammatids are commercially produced for augmentative biological control crop pests.

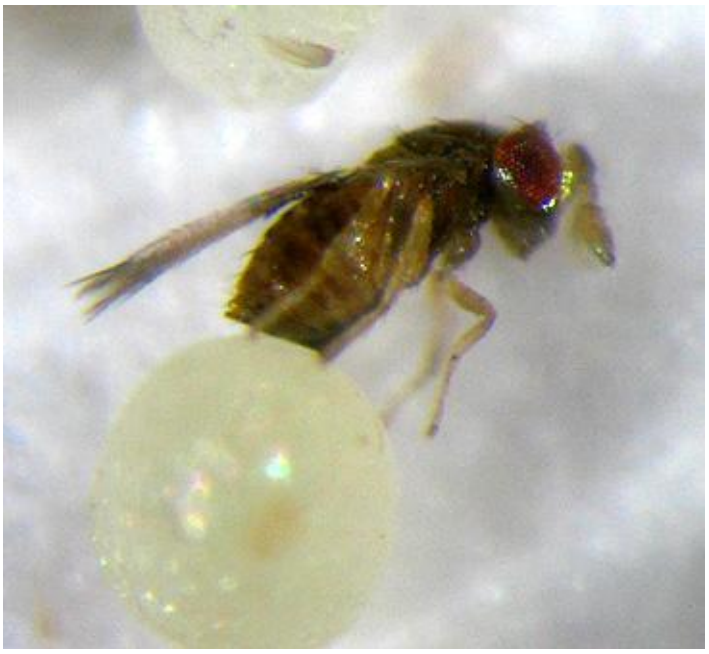

**Fig.1. The adult wasp parasitizing the eggs**

Several researchers have conducted their research to evaluate the efficacy of this tiny parasitoid against pink bollworm across cotton growing regions and observed that the rate of parasitisation was ranges from 35-60%. However, parasitisation may vary from place to place due to multiple factors including availability host at the time of releasing, crop canopy

and other environmental factors. This wasp can complete its life cycle at quick time and produce multiple progenies before it dies. The progenies continue to feed inside the egg, completes ots larval and pupal stage and they emerged as adult from the parasitized egg. Upon emergence, the adult wasp again continues to look for parasitisation and this cycle helps in augmenting their population in the nature. However, the success of biological control program depends on host availability, frequency of release and optimum environmental conditions (temperature).

Field release can be made with Tricho cards and released into the field using a release card that protect them from predators and unfavorable weather. For each parasitoid species, the release card consists of thick paper (6 x 8cm) folded to make a closed container of 4 x 6 cm. Three strips of grain moth eggs that contain parasitoid (about 500 eggs/ each) at three different stages of development (1, 3 & 5 days before emergence) were glued in this container. Thus, the total number of parasitoids/cards was about 1500 parasitoids. Six waves of Trichogramma adults emerge from each card with a rate of two waves per each stage. The emergence of parasitoid's waves begins within 12-24h after release, and continue through six days. On this way, Trichogramma adults cover a control period ranged between 8-10 days according to the longevity of the emerged adults.

Overall, the inundative releases of *T. bactrae* must be coinciding with cotton flowering onwards which reduces the pink bollworm infestation. However, to avoid the late-season explosion of pink bollworm population in *T. bactrae* released fields, safer and selective chemical insecticides may be used. The yield obtained from *T. bactrae* released field was comparably lower than the insecticide sprayed field but inundative release of *T. bactrae* may offer indirect benefits such as increase and conserve the non-target organisms including the natural enemies and pollinators and aids in risk free crop production. Furthermore, it is recommended to integrate biological control with cultural and pheromone-based control measures to combat the menace from pink bollworm in cotton.

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