

Foraging of egg parasitoids after release against heliothis in dryland cotton.

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Introduction

Heliothis (*Helicoverpa armigera* (Hübner) and *H. punctigera* (Wallengren)) are serious pests of field crops in Australia (Zalucki *et al.* 1986). Control is achieved primarily through the use of insecticides. However, the development of resistance, the increasing cost of insecticides, and increasing community opposition to the use of toxic agricultural chemicals require that alternatives to this form of control be found. Biological control using egg parasitoids is one such method.

Egg parasitoids are small wasps (0.3-0.5 mm long) that attack the egg stage of heliothis, killing them before they hatch and cause damage. Egg parasitoids are used to manage insect pests in Europe, China, Russia, Mexico and South America, but are not currently available in Australia.

Recent research has indicated that two species of native egg parasitoids, *Trichogramma (Trichogrammanza) carverae* Oatman and Pinto and *Trichogrammatoidea bactrae* Nagaraja, have potential as biological control agents of heliothis (Scholz, 1990). This paper presents data on the foraging movements of *T. carverae* after release at a single point against heliothis in dryland cotton on the Darling Downs.

Materials and Methods

The study site was 1 ha of unsprayed, single skip row dryland cotton (Siokra 3-24) located on the Darling Downs at St. Ruth (27°24'S 151°18'E). The crop was sown on December 12, 1991 and was adjacent to 15 hectares of commercially managed dryland cotton that was sprayed by ground rig seven times throughout the season.

The egg parasitoid *T. carverae* was reared on the eggs of the Angoumois grain moth (AGM), *Sitotroga cerealella* (Olivier) (Scholz *et al.*, 1992). Approximately 16,000 female parasitoids were released as pupae in AGM host eggs (Bouse and Morrison, 1985) as a point release in the centre of the study site.

White and brown heliothis eggs were randomly collected throughout the study site and adjacent commercially managed site prior to the release of parasitoids on 20 January 1992, and two days after the release. Parasitoid dispersal was assessed by collecting heliothis eggs from ten consecutive plants at intervals of 1, 5, 10 and 25 metres from the release point along the primary compass directions (north, south, east and west). The prevailing winds were from the east during the trial.

Heliothis eggs were collected with a leaf punch (after Hoffman *et al.*, 1970), and individually held in multi-celled plastic microtitre trays at $25\pm 2^\circ\text{C}$ and $70\pm 10\%$ R.H.. After 4 days egg development was recorded as hatched, parasitised or unhatched. Heliothis eggs turn black 4 days after parasitisation at 25°C , and adult parasitoids emerge after a further 6 days. Dispersal data were arcsine transformed and analysed by analysis of variance.

Results

The release of *T. carverae* resulted in a 5-fold increase in levels of heliothis egg parasitism in the release site (Table 1). Levels of egg parasitism after the release were higher in the release site than in an adjacent commercially managed site (Table 1), probably due to the effect of an insecticide application in the commercial site on parasitoid survival. Heliothis egg densities were lower in the commercial site (Table 2).

There were no significant differences in the mean levels of heliothis egg parasitism for the distances and directions from the release point studied (Table 3). It was notable, however, that low levels of parasitism were recorded on the most distant upwind sample locations (0% for 10 m east, and 9.1% for 25 m east).

Site	Before release (20 January)	After release (22 January)
release	7.0	34.4
commercial	9.6	11.3

TABLE 2: Heliothis egg densities before and after parasitoid release (average % infestation per plant). *

Site	Before release (20 January)	After release (22 January)
release	113	210
commercial	53	38

* A synthetic pyrethroid (cyfluthrin) was applied to the commercial block on 19 January.

Discussion

Despite the release being made in the centre of the study site, overall egg parasitism increased from 7.0% to 34.4% in 2 days, indicating that parasitoids had dispersed throughout the site and were actively foraging. These findings suggest that egg parasitoids are content to forage in cotton where they are released if hosts are present.

T. carverae is capable of dispersing over distances greater than 25 m during 48 hours. There was some evidence to suggest that foraging is influenced by wind. The lowest levels of heliothis egg parasitism were recorded at the two most distant eastern sites (Table 3). The prevailing winds were from the east throughout the study.

More research is needed to determine the proportion of released parasitoids that actively forage for hosts in the crop after inundative release. It may then be possible to determine release rates of parasitoids that will be effective in managing heliothis egg lays.

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TABLE 3: Levels of heliothis egg parasitism (%) at different distances and directions from a central release point 48 hours after release of *T. carverae*.

Distance from release point (metres)	DIRECTION FROM RELEASE POINT				Mean \pm S.E. *
	North	South	East	West	
1	50.0	71.4	85.7	81.8	72.2 \pm 8.0
5	55.6	50.0	50.0	15.4	42.8 \pm 9.2
10	50.0	100.0	0.0	40.0	47.5 \pm 20.6
25	45.5	60.0	9.1	54.5	42.3 \pm 11.5
Mean \pm S.E. *	50.3 \pm 2.1	70.3 \pm 10.8	36.3 \pm 19.8	47.9 \pm 13.9	51.2 \pm 6.7

* There were no significant differences between distance or direction means.

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