PARASITOID RELEASES ON THE DARLING DOWNS

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Various parasitoids of heliothis have been considered in integrated pest management programs throughout the world. Despite the rhetoric that parasitoids have an important role in heliothis management, their niche in Australian cotton fields has yet to be fully evaluated. In this paper we present information from Darling Downs trials where egg and larval parasitoids were released as components of an integrated approach to pest management.

Methods

Data from two trials are presented. The first trial at Warra compared parasitoid activity in an unsprayed block and an adjacent 'biological' block. The biological treatment used *Bacillus thuringiensis* (Bt) only and relied on the conservation of natural enemies, plus the release of egg and larval parasitoids. Siokra L-23 was sown in single skip configuration on 13 October 1993. The second trial was an organic cotton block at Brigalow where treatment paralleled that of the biological at the Warra site. There was no unsprayed area for comparison. Siokra L-23 was sown in double skip configuration on 20 November 1993.

Egg parasitoids used in these trials were reared at QDPI Toowoomba or purchased from one of the commercial insectaries. They were released as pupae in the eggs of their facultative rearing host, *Sitotroga*. Development of pupae was programmed so that adult wasps emerged within hours of field application. In our trials they were applied manually on paper cards stapled to the underside of leaves or as loose pupae sprinkled onto leaves moistened with water from a hand-held atomiser.

Larval parasitoids were reared at QDPI Toowoomba as they are not commercially available. They were released as adult wasps. Parasitoid release rates and timing are presented in the respective figures.

Egg parasitism was determined by regularly sampling brown eggs. Eggs were removed from plants using a leaf disc punch and held in 96-well microtitre trays covered with plastic film. Parasitism was determined after 4 days at 25°C when parasitised eggs were black and healthy eggs had hatched. Eggs that failed to hatch or failed to produce egg parasitoids were not included in the calculation of percentage parasitism. Age specific larval parasitism was determined by collecting small and medium larvae (3 - 20 mm long) which were then reared on artificial diet until pupation or emergence of a parasitoid. Larvae that died from causes other than ascovirus were not included in the calculation of percentage parasitism.

Results and discussion

Warra Trial: Releases used either *Trichogramma* nr. *brassicae* or *T. funiculatum* during and following periods of moderate to high heliothis egg laying activity. *T.* nr. *brassicae* and *T. funiculatum* are both dark-coloured and can be separated only by detailed microscopic examination. For practical purposes it was not possible to separate them in field collections. Sampling immediately after releases on 21 and 24 December indicated poor initial recovery of the released species (Figure 1A). However, on 5 January egg parasitism in the release area was 73% compared to 33% in the non-release area. This increase occurred approximately one generation period (about 12 days) after the first releases. Dark *Trichogramma* were responsible for 68% of total egg parasitism in the release area on 5 January, while none were recorded in the non-release area (Figure 1B). Egg parasitoids from the non-release area were either light-coloured *Trichogramma* (*T. carverae*) or *Trichogrammatoidea bactrae*. Dark *Trichogramma* were recovered from the non-release area subsequently, probably as a result of dispersal from the release area. Despite apparent establishment in early January, the released species did not persist. Egg parasitism later in the season did not show a typical pattern of increase to high levels.

Two releases of the native larval parasitoid, *Microplitis demolitor*, were made. The first release on 27 November resulted in an apparent increase in larval parasitism in the release area compared to the non-release area (Figure 2). Follow-up sampling was disrupted by heavy rainfall. Recovery of parasitised larvae was poor after the second release on 24 December. Parasitism of heliothis larvae by *M. demolitor* increased in both the release and non-release areas during January and February, presumably the result of natural population increase. However, contrary to expectations, parasitism levels declined to insignificant levels late in the season despite an abundance of suitable hosts. Interactions between *M. demolitor* and an ascovirus are possibly implicated in the downturn of the *M. demolitor* population. Ascovirus infected larvae grow and develop much more slowly than healthy larvae. Internal parasites in larvae infected with ascovirus may fail to complete development.

Brigalow Trial: All egg parasitoid releases used *T.* nr. *brassicae*. Egg parasitism levels increased during the trial (Figure 3A), but most of the recorded increases were not the result of repeated inundative releases. As with the Warra trial, post release recoveries of dark *Trichogramma* were poor (Figure 3B). When parasitism levels were high during late February and March, *T. bactrae* was the most common species recovered. Establishment releases of the exotic larval parasitoid, *Hyposoter didymator*, were made on several occasions. At least 50 females were released each time. Suitably sized heliothis larvae were abundant when releases were made, but only one *H. didymator* parasitised larvae was recovered during post release sampling.

Conclusion

In both trials, heliothis numbers were high and crops suffered serious damage. It is apparent that when pest densities are well above threshold, some intervention with selective insecticides will be necessary to reduce infestations below economically damaging levels. Under lower heliothis pressure it is our opinion that egg parasitoids will make a significant contribution to heliothis mortality. These studies also showed that parasitoid populations were conserved by selective Bt sprays. The challenge is to learn how to maximise the benefits which parasitoids can provide.

The naturally high incidence of *T. bactrae* in mid to late season field collections indicates that this species warrants further investigation in manipulation studies. Production of *T. bactrae* will be increased so that we can make inundative releases of *T. bactrae* early in the 1994/95 season.

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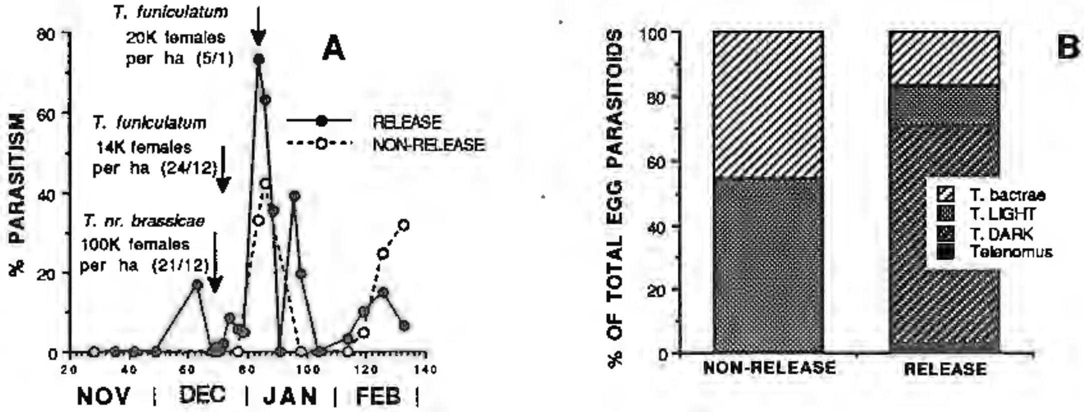

Figure 1A. Percentage egg parasitism in non-release and release areas at Warra, 1993/94 and B. Composition of egg parasitoids emerging in release and non-release areas at Warra on 5 January, 1994.

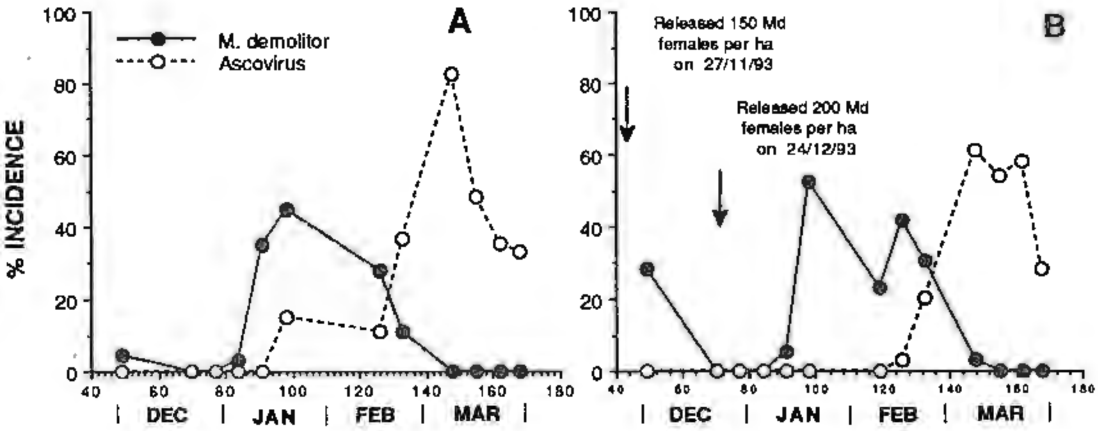

Figure 2. Incidence of *M. demolitor* and ascovirus in A. non-release and B. release areas at Warra, 1993/94.

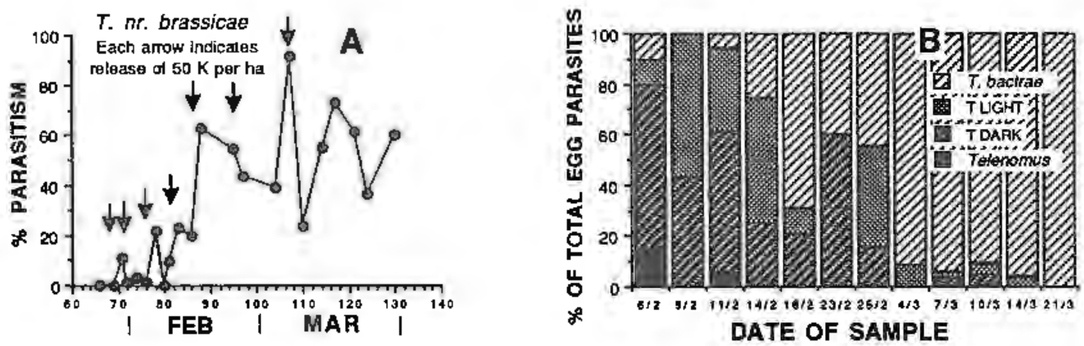

Figure 3. Percentage egg parasitism in release area at Brigalow, 1993/94 and B. Composition of egg parasitoids emerging in release area at Brigalow during February and March, 1994.