Summary

Helicoverpa (=Heliothis) punctigera (Wallengren) and *H. armigera* (Hübner) are two of the most destructive insect pests of field and horticultural crops in Australia. *Helicoverpa* management relies almost entirely on insecticides and other problems associated with this dependence include secondary pest outbreaks, environmental contamination, human health hazards and insecticide resistance. Investigations into the use of larval parasitoids for inoculative, augmentative and/or inundative releases were warranted. Central to this issue was the need to have parasitoid production systems. Development of satisfactory culturing techniques would allow experimentation with native larval parasitoids, as well as allow researchers to consider a classical biocontrol approach, where exotic agents could be cultured and released.

The objectives of this project were to evaluate the potential of larval parasitoids, principally *Microplitis*, for use in biological control programs against *Helicoverpa* spp. and to introduce and monitor the establishment of exotic larval parasitoids of *Helicoverpa* spp.

Significant improvements were achieved in the culture and production of host insects, particularly *H. armigera*. Four other noctuid species - *H. punctigera, Neocleptria punctifera* (Walker), *Chrysodeixis argentifera* Guenee and *Spodoptera litura* (F.) - were also maintained using improved procedures developed for *H. armigera* and modified where necessary for each species. Recovery of *H. armigera* exceeded the target of 80% and production costs were significantly reduced over previous culture methods.

Several strains of *M. demolitor* Wilkinson were maintained in culture to allow taxonomic studies to be carried out. Although *M. demolitor* shows substantial morphological variability, the genetic data support the notion that all populations sampled were representatives of a single biological species. *M. demolitor* was included in a complete revision of Australian and New Guinean Microgastrine Braconids (Austin and Dangerfield in press).

Rearing methods were developed for *M. demolitor* which showed great promise for producing large numbers of parasitoids for use in field release experiments. However infection by *Streptococcus faecium* Orla-Jensen caused major parasitoid production problems during the period November 1991 to March 1993. As a consequence of the *S. faecium* contamination, some of the proposed experimental activities were curtailed.

Two exotic larval parasitoids were introduced and inoculative releases commenced in Queensland during November 1991. *Cotesia kazak* (Telenga) and *Hyposoter didymator* Thunberg adapted readily to the rearing methods developed for *M. demolitor*. A total of 33 releases were made throughout Queensland during the 1991/92 and 1992/93 summer cropping seasons. As at 30 June 1993 neither exotic species had confirmed establishment (overwinter), although post-release surveys recorded successful recoveries of parasitised larvae 1-2 weeks after release at a number of sites.

All three parasitoids were reared successfully in *H. punctigera, H. armigera, N. punctifera* and *C. argentifera*. *H. didymator* was the only parasitoid that developed in *S. litura*. The value of having evaluated these alternative hosts was realised when *S. faecium* severely limited production of *H. punctigera, H. armigera* and *N. punctifera*. Production was ultimately resumed using *C. argentifera* to rear *M. demolitor* and *C.*

kazak and *S. litura* to rear *H. didymator*. *C. argentifera* and *S. litura* were unaffected by *S. faecium*.

The performance of *M. demolitor*, *C. kazak* and *H. didymator* against *H. armigera* was evaluated on several crop hosts. Parasitism was low (0-11.8%) for all parasitoid species on chickpea. Moderate to high levels of parasitism (25.7-85.0%) were recorded on sorghum, sunflower, cotton, soybean and pigeonpea. Establishment releases should be directed against *Helicoverpa* spp. infestations on the major summer crops - sorghum, sunflower, cotton and soybean - rather than against the first spring generation infesting chickpea. Releases of larval parasitoids into chickpea are unlikely to enhance parasitism levels during the first spring generation of *Helicoverpa* spp.