Trichogramma limit pest damage to Ord River Irrigation Area (ORIA) cotton crops by killing the developing embryo of their insect host at the egg stage, effectively reducing the number of emergent pests ingesting transgenic tissue. Their impact on the potentially resistant species, *Helicoverpa armigera* (Hübner), is considered integral to the Insect Resistance Management (IRM) strategy for transgenic cotton production in the ORIA. This thesis examines aspects of *Trichogramma* ecology pertinent to this strategy.

The dominant species of egg parasitoid in ORIA cotton crops is the introduced *Trichogramma pretiosum* Riley. Other species make up less than one percent of collected specimens. Surveys revealed *T. pretiosum* has been introduced or adventitiously dispersed to all developed agricultural regions of northern Australia. Several new species were discovered during surveys in more pristine habitats. Based on field collected eggs, *T. pretiosum* appears to prefer *H. armigera* over *H. punctigera* Wallengren as a host in ORIA cotton.

Measured as percent parasitism, *Trichogramma* activity appears highly variable and does not necessarily coincide with periods of peak insect pest density. Host abundance alone does not define conditions suitable for *Trichogramma* activity. Environmental constraints on wasp survival, such as the impact of temperature, humidity and insecticide applications, limit their effectiveness in biological control. Despite consistently high rates of percentage egg parasitism (60-99%), acceptable pest control is not readily achieved in ORIA cotton without the aid of insecticides as *Helicoverpa* numbers exceed damage thresholds. Insecticides inhibit *Trichogramma* considerably, hence the conundrum regarding initiation of insecticidal control.

Trichogramma activity is relatively high early season (May to July), significantly limiting the buildup of pests. *Trichogramma* effectively stifle *Helicoverpa* population increase following initial pest egg lay at least during high density years. The impact of farming practices, especially insecticide applications, should be avoided early season to ensure pest mortality attributed to *Trichogramma* egg parasitisation is maximised. Pre-season habitat manipulation to establish large populations of *Trichogramma* in alternative hosts is advised. Despite being rare in surrounding habitats and suffering near 50% immature mortality in the field, *Trichogramma* effectively disperse into young crops attractive to ovipositing hosts and display a high intrinsic rate of increase.

Spatial patterns of parasitism tend toward heterogeneity and do not necessarily coincide with host spatio-temporal dynamics. Both host abundance patterns and mean rates of parasitism are not good indicators of parasitoid patchiness. Parasitism rates are highest within the middle strata of the plant canopy prior to complete canopy closure despite a similar number of host eggs being available elsewhere in the plant.

Pest density declines as the season progresses. However, insecticide applications become necessary if *Bt* expression in cotton plants wanes and larval damage increases. Measuring parasitism during periods of declining and low host density is prone to inaccuracy due to small sample size, but can be overcome with the use of egg cards. A better indication of parasitoid activity is achieved using egg cards during periods when insecticide applications are possibly required. As *Trichogramma* are most active in ORIA cotton from morning to early afternoon, insecticide applications if needed should occur outside of these periods.

Trichogramma survival is constrained by environmental influences. Adult female *T. pretiosum* were exposed to ambient conditions in dialysis tubing sleeve cages to test survival and fecundity in cotton fields. Peak survival and fecundity occurs mid season with both life history variants displaying an inverse relationship to temperature. Adult female *T. pretiosum* survive longest in the field when provided with sustenance however mortality attributed to handling was considerable. Sleeve cages are not effective for survival measurement of small parasitoids if the cages are frequently moved.

Trichogramma effectively reduce pest abundance but are clearly hindered by insecticides and hot dry conditions in ORIA cotton crops. The decision to initiate insecticide applications is best delayed unless absolutely necessary to avoid disruption of *Trichogramma* impact on pests. Parasitoid activity must be carefully monitored if chemical control becomes imminent. The impact of *Trichogramma* on pest species can then be optimally exploited.