

Studies on the natural enemies of *Heliothis armigera* (Hubner) and its biological control using an egg-Parasite, *Trichogramma australicum* Girault. (Hymenoptera : Trichogrammatidae)"

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A year programme was undertaken to develop biological control of *Heliothis armigera* from 1972 through 1975 at Anand campus of Gujarat Agricultural University. Seasonal abundance of *H. armigera* on potato, tomato, gram and lucerne was studied. A complete parasite and predatory fauna attacking *Heliothis* on above host plants was also studied. Apart from this effectiveness of inundative releases of an egg parasite, *Trichogramma australicum* Gir on different plants was tested.

The result revealed that *Heliothis armigera* was most important pest attacking tomato, gram, potato and lucerne in this area. Its activity commences with the onset of the monsoon on lucerne and then moves over to tomato, gram, potato and then back on lucerne by April. The peak period of infestation was observed from December to February. The activity declines as the summer advances and the pest becomes almost inactive during May when high temperature prevails.

Potato was observed to be most preferred host of *Heliothis* in this area. The preference was in the order of potato, gram, tomato and lucerne.

Trichogramma australicum Gir. was the only parasite reared from *Heliothis* eggs. It was found to be quite important parasite and

actively associated with *Heliothis* eggs from October to April. The highest activity was recorded during February when 98.2% parasitism in 1973-74 and 84.2% in 1974-75 was recorded. The early season parasitism of *Trichogramma* appeared to have been affected by adverse weather conditions such as heavy rains in the early part of the season during 1973-74 and drought conditions during 1974-75. The high parasitism by the egg parasite, *T. australicum* and the larval parasite, *Campoletis chloridae* has resulted in effective regulation of *Heliothis* infestation in potato during 1973-1974 and 1974-75 seasons.

Luxuriant growth of the food plants of *Heliothis* was found to be an important factor in attracting *Trichogramma*. *Heliothis* eggs collected from gram fields did not yield any parasites, indicating that small egg parasitoids do not survive in gram fields.

Three Ichneumonids, *Campoletis chloridae* Uchida, *Brioborus* sp. 7 Braconids, *Chelonus heliopa* Gupta, *C. Formosanus* Sonan, *Bracon gelechia* Ashm. *Microplitis flaviventris* Kok. *Apanteles* sp. nr. *phytometae* w. *Apanteles* sp. nr. *taprebaniae* and *Rogas* sp., one Eulophid, *Stenomiesius impressus* (Masi), six Tachinids, *Eucarcelia illeta* Curr. *Drine imberbis* Wied. *exorista xanthaspis* Wied. *Paloxorista laxa* Curr. *Ganio-phththalmus halli* Mesnil and an unidentified species were also reared from *H. armigera*.

Campoletis chloridae was the most important species and was found active throughout the period of activity of *Heliothis*. The parasite was more abundant during January and February. It was able to exert appreciable check on *Heliothis* in potato. However, it failed to give desirable control in tomato.

Parasites other than *C. Chloridae* do not seem to have any appreciable effect on *Heliothis* population in this area.

Six species of hyperparasites viz. *Habrocytus* sp. *Tetrastichus* sp. *Brachymeria* sp. and *Eurytoma* sp. were reared from the cocoons of *C. chlorideae*. The remaining two are unidentified.

Of the larval parasites reared from *H. armigera*, Braconids, *Apanteles* sp. nr. *phytometae* Wilk, *Apanteles* sp. nr. *taprobanae* Cam. *Microplitis flaviventris* Kok, Eulophid, *Stenomacrus impressus* (Masi) and two Tachinids, *Palexorista laxa* Curr. and *Exorista xanthaspis* wied. were reared for the first time. Thus they constitute new parasite record for *Heliothis*. Tachinids, *G. halli* and *D. imberbis* exhibited some host plant specificity, as they were invariably reared from *Heliothis* larvae infesting lucerne.

A Reduviid predator, *Coranus* was found preying on *Heliothis* larvae of all the stages and was found to be active from July to March.

Majority of the parasites were reared from *Heliothis* infesting potato and lucerne fields. In gram fields, no parasite except *Campoplexis* was found to be active.

Field releases of *T. australicum* were effective in checking *Heliothis* infestations in tomato and potato fields when released at the rate 2,50,000/ha/week.

T. australicum releases proved to be ineffective against *Heliothis* in gram.

T. australicum could not survive as the temperature began to increase (above 38° C), hence the parasite would have to be seeded in the environment after the establishment of monsoon when the temperature drops below 35° C.

The culture of *Corcyra cephalonica* was successfully maintained in the laboratory to meet the daily requirements of the *Corcyra* eggs for the breeding of *Trichogramma*.

Laboratory studies on the competitive parasitism have revealed that *T. australicum* was a superior parasite than *C. heliopa*, when both occurred simultaneously in the *Heliothis* eggs. *Campoplexis* was found suppressing *Eriborus* when both occurred simultaneously.

In view of the serious damage caused by *Heliothis armigera* and no effective check exerted by its natural enemies in this area, especially in tomato where use of insecticides is highly objectionable it is recommended to introduce 2 or 3 more parasites of *H. armigera* in order to manage the *Heliothis* infestation by biological agents.

Similarly, the parasite species, recorded in the present study, particularly *T. australicum*, *C. chlorideae*, *Apanteles* sp. nr. *phytometae* and *Coranus* sp. should be considered for introduction in other areas, where they do not occur and *Heliothis* is doing serious damage.