

SELECTION OF EGG PARASITES FOR THE BIOCONTROL OF HELIOTHIS

by

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INTRODUCTION

Insecticides are the only commercially accepted method of Heliothis control. Because of increasing concern about the continued use of insecticides, research has been directed at either optimising the use of insecticides or looking for alternatives to insecticides that may be incorporated into integrated pest management strategies.

Biological control represents one alternative to insecticides. The Cotton Research Council (CRC) has funded a project to study native egg parasites of Heliothis. This work is part of a program aimed at using egg parasites to control Heliothis on cotton, by:

1. Selecting a suitable species of egg parasite based on biological/ecological studies.
2. Evaluating the field performance of the parasite as a biocontrol agent.
3. Establishing a mass-rearing facility to produce enough parasites for inundative releases.
4. Developing a pest management strategy that incorporates egg parasites.

The objectives of the CRC funded project were to:

- . Sample the native egg parasite fauna.
- . Establish laboratory colonies of egg parasites from different localities.

- . Investigate the biology of each colony, including: rates of parasitism, fecundity, longevity, rate of development, host preference and host searching ability.
- . Select one (or more) species that have the greatest potential as biocontrol agents.

This paper presents data on some of the biological characteristics of four species of native trichogrammatid egg parasites collected in Queensland (Table 1). The field performance of one (or more) of the ten egg parasite colonies currently being studied at the Toowoomba laboratories will be evaluated in a new project funded by the CRC which commenced in July 1988.

MATERIALS AND METHODS

The egg parasites in this study were reared on Heliothis spp. eggs in the laboratory at approximately 25°C and 70% R.H.. Parasitized eggs turn black after four days and adult egg parasites emerge after a further six days.

Natural Parasitism Levels

Field collections of Heliothis eggs on siokra cotton were undertaken at Norwin and Brookstead (on the Darling Downs) in 1986/87 and 1987/88 respectively. The rate of parasitism was calculated as follows:

$$\% \text{ parasitism} = \frac{\text{number of eggs parasitized}}{\text{number of eggs collected}} \times 100$$

All parasitized eggs were individually placed into clear gelatin capsules and checked daily for emergence. The number and sex of all emerged parasites was recorded, and each parasite was identified to genus.

Laboratory Parasitism Rates

Individual mated female egg parasites were placed into small glass vials (25 x 50 mm) containing approximately 50 Heliothis armigera eggs. A small streak of honey was

provided as food for each parasite. The H. armigera eggs were replaced every 24 hours until the female parasite was dead. The number of parasitized eggs was recorded for each female on each day of her life, and female longevity was determined.

Host Preference

Individual mated female egg parasites were placed into small glass vials (25 x 50 mm) containing either Heliothis armigera or Heliothis punctigera eggs. The parasites were removed after 24 hours, and the number of parasitized eggs was recorded for each female.

The effect of Host Plant on Parasitism

The levels of egg parasitism on eight different field crops was assessed in a glasshouse. The crops were: siokra cotton, DP90 cotton, sorghum, soybeans, lucerne, maize, sunflowers and chickpeas. An 8 x 4 completely randomized block was arranged in the glasshouse. Five Heliothis armigera eggs were placed on the upper leaf surface in each replicate. Twenty-five egg parasites were liberated between the replicates at eight locations in the block.

The host eggs were removed after 24 hours and placed into small clear gelatin capsules. The number of eggs parasitized on each replicate was recorded.

RESULTS AND DISCUSSION

Field Surveys

Natural parasitism levels varied from 0-70% (mean 7.3%) in 1986/87 (Figure 1B) and 0-79% (mean 18.2%) in 1987/88. Three genera of parasitic wasps from two families were collected from Heliothis eggs i.e. Telenomus (SCELIONIDAE), Trichogramma and Trichogrammatoidea (TRICHOGRAMMATIDAE) (Figure 1C). Trichogrammatoidea accounted for 86% of all parasites collected during both seasons, followed by Trichogramma (10%) and Telenomus (4%).

Laboratory and Glasshouse Studies

None of the parasites displayed an obvious preference for either Heliothis armigera or Heliothis punctigera (Table 2), suggesting that all have a potential to control either or both host species.

Figure 2 shows the daily parasitism levels by egg parasites on days 1 to 5 of their lives in the laboratory.

T. carverae parasitized the greatest number of hosts on each day, and there were only small differences between the numbers of eggs parasitized by T. australicum, T. sp. nr. raoi and T. bactrae. Some female parasites lived for over 20 days (maximum of 26 days) in the laboratory, but are not likely to live this long in the field.

The glasshouse trial indicated that egg parasites will not attack Heliothis eggs on chickpea, probably because of the acidic droplets that occur on the leaflet hairs of chickpeas. T. bactrae parasitized the greatest number of eggs on cotton (Table 3).

CONCLUSIONS

Although T. carverae parasitized the greatest number of hosts in the laboratory (Figure 2), the glasshouse trial indicated that T. bactrae (and Trichogramma sp. nr. raoi) are more efficient parasites of Heliothis eggs on cotton (Table 3). T. bactrae was also the most abundant species collected from all crops in the field.

Results to date suggest that T. bactrae may be the best candidate for the biocontrol of Heliothis. Future research will assess the field performance of T. bactrae, and one or two other species of egg parasites. Ultimately, a species of egg parasite will be mass-reared and released in the field to determine the level of Heliothis control that can be achieved. Should such releases prove effective at controlling Heliothis, appropriate pest management guidelines incorporating egg parasites as biocontrol agents will be developed.

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TABLE 1.

The species and collection localities of egg parasites studied.

<u>Trichogramma australicum</u>	Kingaroy
<u>Trichogramma</u> sp. nr. <u>raoi</u>	Kingsthorpe
<u>Trichogramma</u> (<u>Trichogrammanza</u>) <u>carverae</u>	Brookstead
<u>Trichogrammatoidea</u> <u>bactrae</u>	Biloela

TABLE 2.

The mean number of Heliothis spp. eggs parasitized by four species of egg parasites in the laboratory.

SPECIES	MEAN NO. HOSTS PARASITIZED AFTER 24 HOURS:	
	H. ARMIGERA	H. PUNCTIGERA
<u>T. australicum</u>	7.6	7.4
<u>T. sp. nr. raoi</u>	9.8	11.2
<u>T. carverae</u>	11.5	12.2
<u>T. bactrae</u>	6.3	6.1

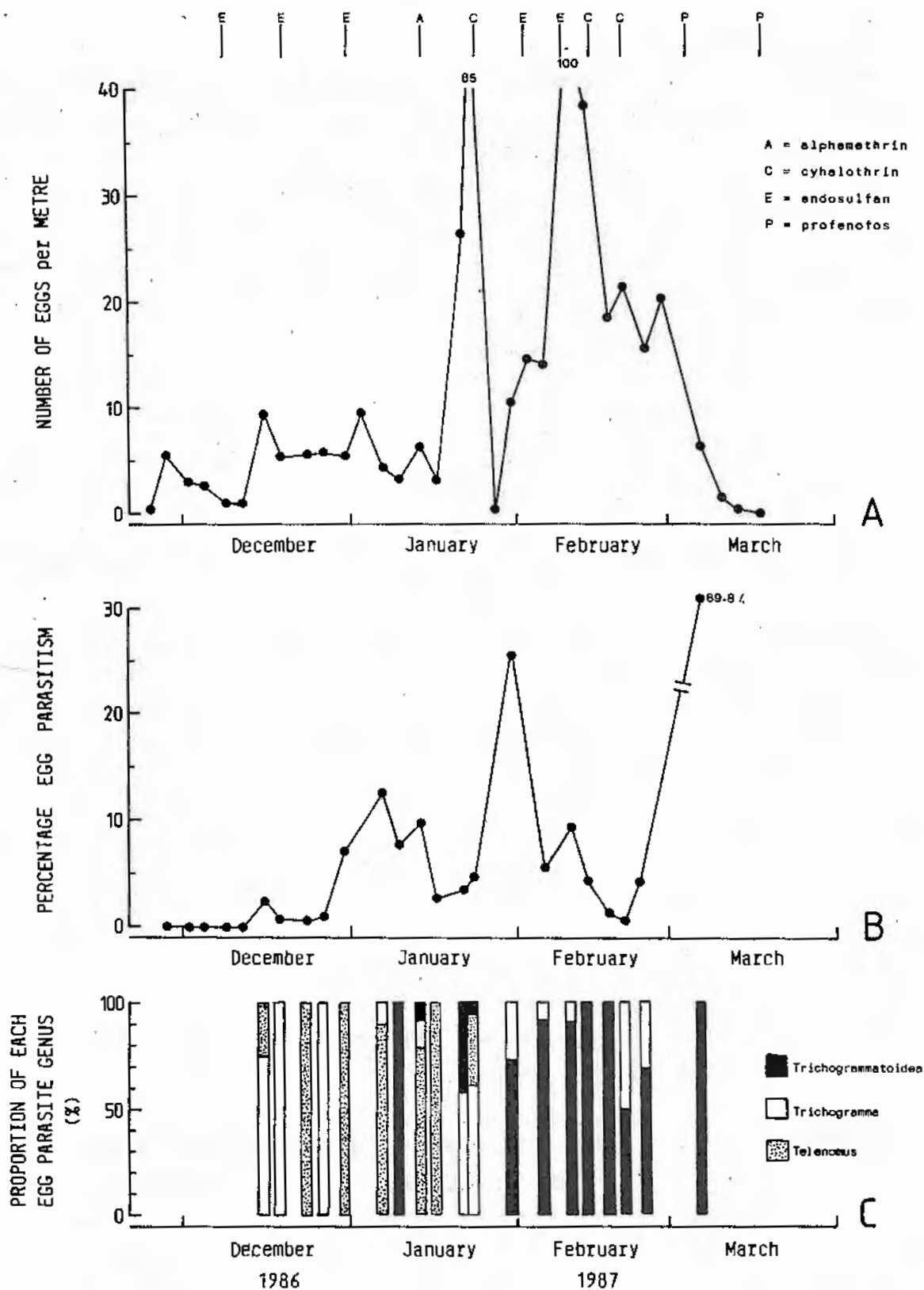


FIGURE 1: The variation in (a) the number of *Heliothis* eggs per metre of crop, (b) the percentage egg parasitism, and (c) the proportion of each egg parasite genus in siokra cotton at Norwin during 1986/87. The spray intervals and insecticides used are shown.

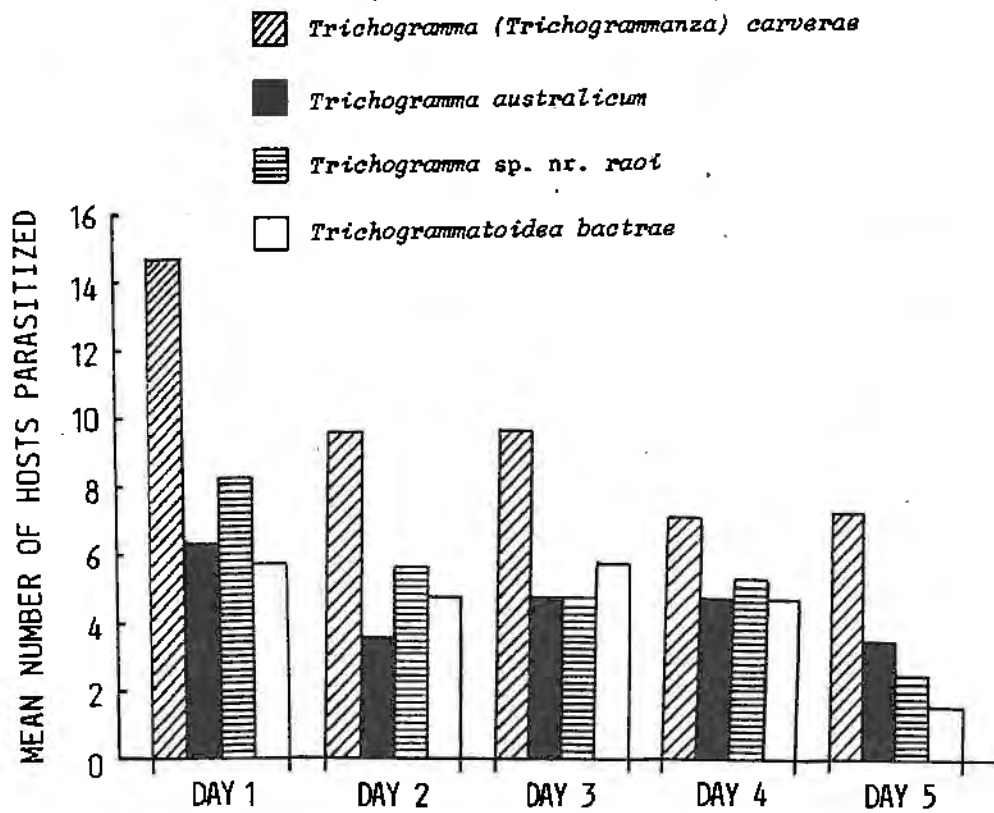


FIGURE 2: The mean number of *Heliothis armigera* eggs parasitized by egg parasites on days 1 to 5 of their lives.

TABLE 3.

The percentage of Heliothis armigera eggs parasitized by egg parasites on different field crops.

	<i>Trichogramma</i> <i>australicum</i>	<i>Trichogramma</i> sp. nr. raol	<i>Trichogramma</i> (<i>Trichogramma</i>) <i>carverae</i>	<i>Trichogrammatoidea</i> <i>bactrae</i>
SIKRA	0	48	21	70
DP90	0	35	23	64
SORGHUM	2	23	20	21
SOYBEAN	2	49	7	33
LUCERNE	2	21	0	23
MAIZE	2	45	8	3
SUNFLOWER	2	38	1	3
CHICKPEA	0	0	0	0