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EGG PARASITES OF HELIOTHIS PUNCTIGERA AND H. ARMIGERA IN SOUTH-EASTERN QUEENSLAND

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SUMMARY

A study of egg parasitism of *Heliothis punctigera* Wall. and *H. armigera* (Hubn.), species attacking a variety of agricultural crops, ornamental plants and weeds in south-eastern Queensland, showed that a mean of 8.0% of all eggs collected was parasitized. *Telenomus* sp. nr *triptus* Nixon (Scelionidae) was bred from 92.7% of parasitized eggs. *Trichogramma australicum* Girault, *Trichogrammatoidea flava* Girault and a Gen. et sp. indet. nr. *Trichogramma* together represented the remaining 7.3% of parasitism.

I. INTRODUCTION

The native budworm (*Heliothis punctigera* Wall.) and the corn ear worm (*H. armigera* (Hubn.)) are important economic pests of a wide variety of field crops in south-eastern Queensland. Farmers may often use regular applications of insecticides throughout the growing season on some of these, particularly in high-value crops such as cotton, tomatoes and tobacco. Control investigations on these pests in Queensland in the past have centred largely on insecticides, but resistance to the commonly used pesticides has been recorded in areas outside the State during recent years and some attention to alternative control methods therefore is required.

A prerequisite to the formulation of any type of pest management against *Heliothis* species is a study of the natural biological and ecological factors which operate against the pest in the field. A technique which has received attention in overseas areas is the use of egg parasitism (Oatman 1966; Fye and Larsen 1969). Sloan (1940) reported *Trichogrammatoidea rara* Gir. (identification not definite) as the most common species of Heliothis egg parasites bred during 1938-39 at Biloela, in Central Queensland, and together with *Trichogramma australicum* Gir. it was responsible for 93% of the parasitized eggs collected.

The present study, therefore, was designed to establish the nature and degree of egg parasitism in the Lockyer Valley and Darling Downs of south-eastern Queensland.

II. MATERIALS AND METHODS

A leaf punch and an egg-holding card similar to those outlined by Hoffman *et al.* (1970) were constructed to facilitate collection and holding of large numbers of egg of the *Heliothis* species. The punch cut and held the individual leaf discs without injury to the egg and allowed the leaf disc with attached egg to be released into a hole of the egg card. The cards were covered with the transparent plastic to totally enclose each egg.

Random samples of eggs were taken on various *Heliothis* host plants at irregular times during the season. They were incubated at 24°C in the laboratory under total darkness and examined daily. Hatched larvae were transferred to an

TABLE 1

OCCURRENCES AND PERCENTAGES OF HELIOTHIS EGG PARASITISM*

Month	Toowoomba	Gatton	Brookstead	Kingsthorpe	Esk	Kingaroy	Nambour	Mount Tyson	St. George	Wyreema	Emerald	Totals
1971	81–6	557–70 (1)	85–3 (3)	120–0	..	..	..	20–0	241–4	..	..	1,104–83 (4)
September ..	7·41%	12·5%	3·53%	..	..	..	..	..	1·65%	..	..	7·5%
October ..	..	139–4	..	100–3	..	242–32 (1)	194–8 (7)	..	..	..	..	675–47 (8)
		2·88%		3·00%		13·22%	4·12%					6·9%
November ..	..	186–20 (2)	20–0	239–28	77–15 (5)	..	..	..	210–11 (2)	..	..	732–74 (9)
		7·53%	..	11·72%	19·48%				5·24%			10·1%
December ..	..	80–9	206–5	..	200–53	13–3	..	..	..	..	..	499–70 (0)
		11·25%	2·43%		26·50%	23·08%						13·75%
1972	..	61–7	88–3	..	..	..	..	..	..	..	..	149–10 (0)
January ..	..	11·48%	3·41%	..	..	..	..	..	..	..	..	7·5%
February ..	..	..	133–3	..	..	..	..	..	..	192–0	..	325–3 (0)
			2·26%									0·9%
March ..	..	..	8–0	..	..	..	..	..	39–0	71–0	20–0	138–0
												Overall Total 3,622–287 (21) 7·92%

* Top row of figures for each month show the number of eggs collected, the number of parasitized eggs, and (in brackets) the number of *Trichogramma* parasitized eggs.

TABLE 2

LOCALITIES, HOSTS AND PARASITES OF *Heliothis punctigera*

Parasite and Locality	Host	Date Collected	No. of Eggs Collected	Percentage of Parasitism
Telenomus sp.				
Gatton	Lucerne	24.viii.1971	15	40·0
		25.viii.1971	55	16·4
		31.viii.1971	59	3·4
		9.ix.1971	101	5·9
		29.ix.1971	40	5·0
		12.x.1971	99	2·0
		26.x.1971	36	8·3
		11.xi.1971	19	10·5
		19.xi.1971	120	5·8
		24.xi.1971	20	15·0
		30.xi.1971	60	10·0
		4.i.1972	61	11·5
Gatton	Cotton	7.i.1972	50	6·0
St. George	Lucerne	22.ix.1971	201	2·0
		2.xi.1971	103	9·7
Kingsthorpe	Lucerne	8.ix.1971	102	0·0
		23.ix.1971	20	0·0
		22.x.1971	100	3·0
		27.x.1971	20	5·0
		4.xi.1971	101	10·9
		10.xi.1971	98	16·3
Kingaroy	Lucerne	5.x.1971	242	13·2
Kingaroy	Peanuts	29.xi.1971	10	30·0
Esk	Lucerne	5.xi.1971	18	11·1
		30.xi.1971	158	33·5
Brookstead	Cotton	15.xi.1971	20	0·0
		1.xii.1971	23	4·3
		9.xii.1971	95	0·0
		21.xii.1971	20	20·0
Toowoomba	Lupins	1.ix.1971	25	16·0
Trichogramma australicum				
Brookstead	Linseed	10.ix.1971	80	1·3
Kingaroy	Lucerne	5.x.1971	242	0·4
Trichogramma flava				
Brookstead	Linseed	10.ix.1971	80	1·3
St. George	Lucerne	3.xi.1971	103	1·0
Gen. et sp. indet. nr. *Trichogramma*				
Gatton	Lucerne	26.x.1971	36	11·1
Unparasitized				
Gatton	Peas	25.viii.1971	20	..
		31.viii.1971	20	..
		9.ix.1971	82	..
		16.ix.1971	11	..
Mount Tyson	Rape	10.ix.1971	40	..
St. George	Cotton	29.ii.1972	39	..
Brookstead	Sunflower	6.i.1972	38	..

artificial diet for rearing to the adult for specific identification. The parasitized eggs remained white for about 3 days, in which time the unattacked ones hatched. Later the parasitized eggs became dark.

III. RESULTS

The numbers of eggs collected and the incidence of parasitized eggs in several districts (see Figure 1) are recorded in Table 1 on a monthly basis and the detailed host records are presented in Tables 2 and 3, which show also the host plants of the *Heliothis* species.

IV. DISCUSSION

The overall parasitism of eggs of both species of *Heliothis* on different plants in various districts in the months September to March was 7·92%. In this period the peak of 13·75% occurred in December, although in one collection in September it was as high as 65·0% for eggs of *H. armigera.* From the few eggs collected in March no parasites were bred.

Sloan (1940) recorded the percentages of 58, 18, 53, 38 and 53 respectively for random collections in the months of November, December (1938), January, February and March (1939) in the Callide Valley. The totals of eggs collected were not stated.

Identification of the parasites bred during the present study showed that four were operating. The more important of these was *Telenomus* sp. nr. *triptus* Nixon (Scelionidae), which accounted for 92·7% of the parasitized eggs. The other

TABLE 3

LOCALITIES, HOSTS AND PARASITES OF *Heliothis armigera*

Parasite and Locality	Host	Date Collected	No. of Eggs Collected	Percentage Parasitism
Telenomus sp.				
Gatton	Potatoes ..	25.viii.1971	13	15·4
		9.ix.1971	60	45·0
		16.ix.1971	20	65·0
		20.x.1971	11	27·3
Beerwah	Tobacco ..	29.ix.1971	20	5·0
Moore	Maize ..	5.xi.1971	59	16·9
Brookstead	Cotton ..	24.i.1972	133	2·3
Trichogramma australicum				
Nambour	Tomatoes ..	28.ix.1971	60	5·0
Esk	Maize ..	5.xi.1971	59	8·5
Unparasitized				
Wyreema	Maize ..	4.ii.1972	20	..
		7.ii.1972	20	..
		9.iv.1972	18	..
		11.ii.1972	10	..
		16.ii.1972	62	..
		18.ii.1972	47	..
		21.ii.1972	13	..
		6.iii.1972	46	..
		10.iii.1972	25	..
		13.iii.1972	28	..

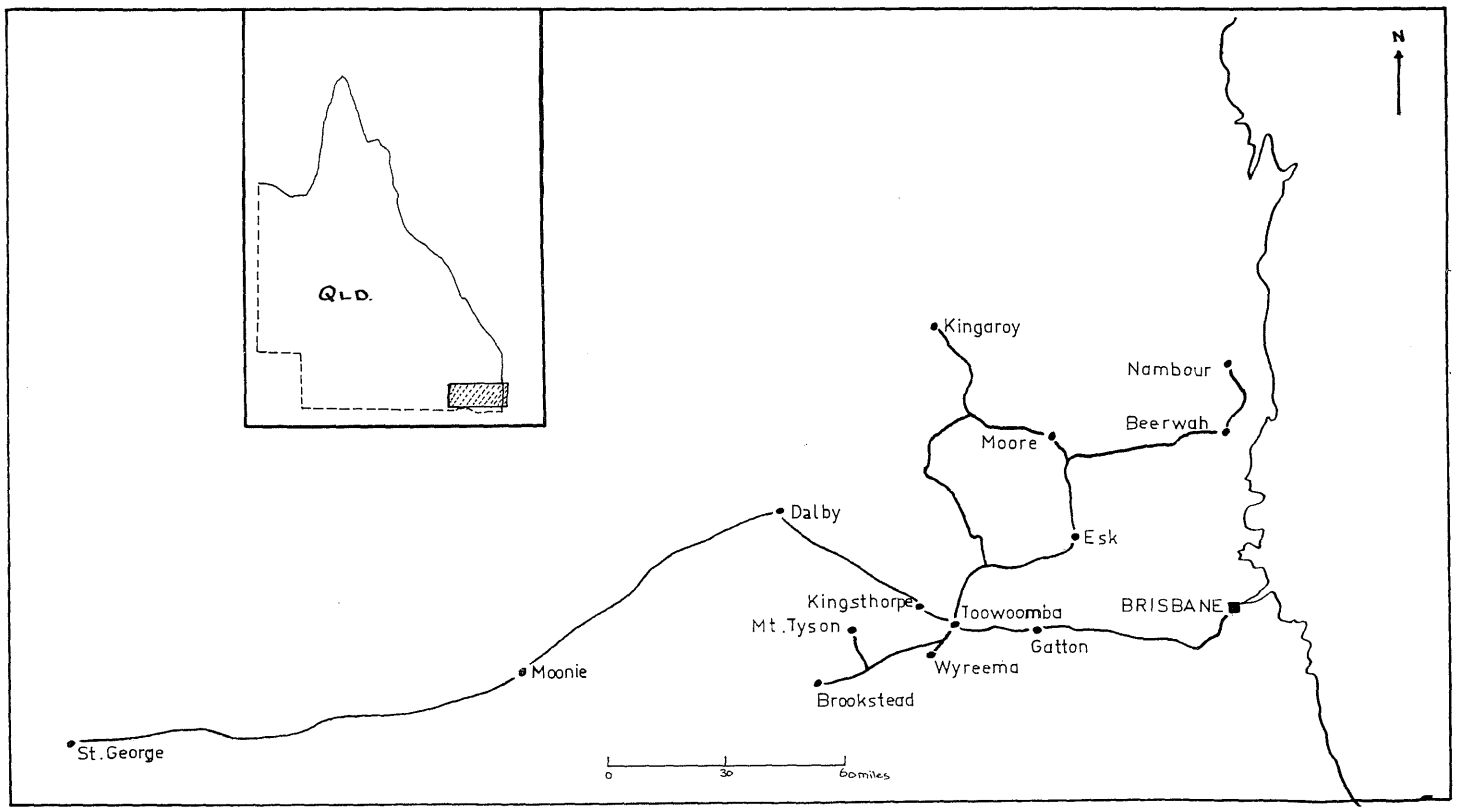

Fig. 1.—Sketch map showing collection localities.

species bred were *Trichogramma australicum, Trichogrammatoidea flava* Gir. and Gen. et sp. indet. nr. *Trichogramma.* These results are in reverse to the trend from data collected by Sloan (1940), which showed that less than 7·0% of the parasitism was due to *Telenomus.* Oatman (1966) also reported an average of 38% parasitism by *T. praetiosum* Riley for eggs of *H. zea* (Boddie) collected over a 3-year period from sweet corn in southern California. The examples of Sloan and Oatman indicate that egg parasitism by the *Trichogramma* group of species might be a major mortality factor affecting corn ear worm populations. The present results, however, showed that only 0·6% of total eggs collected were parasitized by the *Trichogramma* group.

The average number of the *Trichogramma* group which emerged from individual host eggs, 2·32, compared favourably with results obtained by Winburn and Painter (1932) and Oatman (1966), who reported 2·5 per egg. Sloan (1940) reported an average of 2·86 for eggs parasitized presumably by the *Trichogramma* group, because he stated, and the present study confirmed, that only one *Telenomus* emerged from any eggs.

Random sampling as used in this study must be continued over an extended period, preferably of several years, to take into account a number of factors which could influence the percentage of parasitism. Such factors include the variation in the number of available *Heliothis* eggs at different times of the year which is related to the population dynamics, and host supply of *Heliothis.*

As well as this time of sampling bias, Sloan (1940) regarded the personal element as important because white, newly oviposited eggs are more conspicuous than dark, parasitized eggs. The eggs collected in the present study varied in stages of development from the pearly white newly laid to the dark parasitized eggs and for those experienced in egg collecting this bias would not exist.

Tables 2 and 3 indicate a *Heliothis* host preference factor for oviposition by the two insect species except cotton, where eggs of both species were found.

As egg parasitism by *Telenomus* sp. must represent a substantial mortality factor for populations of *H. punctigera* and *H. armigera* an extended study of its biology and ecology is warranted with the view to investigating its more intensive use as a biological controlling agent against *Heliothis* species.

V. ACKNOWLEDGEMENT

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