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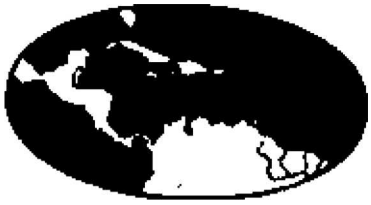

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INTRODUCTION OF EXOTIC PARASITES FOR CONTROL OF *SPODOPTERA* AND *HELIOTHIS* IN TRINIDAD

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INTRODUCTION

In several West Indian territories, corn, *Zea mays*, is cultivated as a subsistence crop. Recently, in order to meet the increasing demands for human consumption as well as for animal feeds, corn production is expanding. Production is adversely affected by the noctuid pests *Spodoptera* spp. and *Heliothis* spp. As control by chemical pesticides is not feasible under local conditions biological control would be desirable. Commencing in 1976 the Commonwealth Institute of Biological Control (CIBC) was commissioned by the Ministry of Agriculture, Republic of Trinidad and Tobago to attempt biocontrol of these pests by the introduction of readily available natural enemies from the CIBC Stations in India, Pakistan and Europe.

Spodoptera spp.

Several species of *Spodoptera (eridania, frugiperda, latifascia* and *sunia)* are known to attack corn in the Caribbean. In Trinidad, *S. frugiperda* is the major pest of young corn. It occurs throughout the West Indies, on the mainland from northeastern Canada to northern Argentina and Chile. This species has a wide host range including tomatoes, pepper, egg plant and grasses.

Attack usually commences while the plants are very young and may continue until the corn is mature. Eggs laid in clusters of up to 200 are covered with hairs or scales shed from the body of the female. Eggs hatch in two days and the larvae feed mainly on the leaves but also attack the developing ears. The larval period lasts for 12 – 16 days. Pupation occurs in soil and adults emerge after 7 – 8 days.

Parasites recorded in Trinidad include:-

Species	Stage attacked
Apanteles sp. (Braconidae)	young larvae
Palinzele sp. (Braconidae)	young larvae
Chelonus insularis (Braconidae)	egg – larval
Euplectrus plathypenae (Eulophidae)	larval
Archytas marmoratus (Tachinidae)	larval – pupal
Winthemia sp. (Tachinidae)	larval

Incidence of parasitism is very low amongst larvae collected on maize.

INTRODUCED PARASITES

Stocks of several parasites of *Spodoptera* spp. were obtained from the Indian and Pakistan Stations of the CIBC. These included *Apanteles ruficrus, Chelonus heliopae, C. formosanus, Macrocentrus collaris* (Braconidae), *Paribaea orbate* (Tachinidae) and *Telenomus remus* (Scelionidae). To initiate laboratory stocks of parasites a colony of the host was set up on a synthetic diet, slightly modified from the formulation given by Yaseen (1975). The formula for the diet is the following:-

Corn meal	40.0 g	Sorbic acid	0.4 g
Wheat germ	20.0 g	Vitamin mixture	20 ml
Ascorbic acid	1.3 g	Agar	5 g
Brewers yeast	12.5 g	Antibiotic (Tetracycline)	250 mg
Methyl paraben	1.0 g	Water	

This amount of diet was sufficient to rear 50 two – three days old larvae.

The numbers of adults of *C. heliopae, M. collaris* and *P. orbata* obtained from the incoming shipments were insufficient to establish laboratory colonies while cultures of the others were set up and releases made.

Telenomus remus occurs naturally in Sarawak (Rothschild, 1970); it is an egg parasite. Stocks were obtained from the Indian Station for Barbados and elsewhere. Egg to adult development at laboratory conditions of 82 – 84°F is completed in ten days. Following its successful establishment in Barbados (Alam 1974), stocks were obtained in 1976.

Apanteles ruficrus is widely distributed in Europe, Asia, Australia, New Zealand and Africa. It is a gregarious larval endoparasite with a wide host range but mainly attacks noctuids. A strain of this parasite introduced from Pakistan into New Zealand against *Mythimna separata* has provided excellent control (Mohyuddin and Shah 1977). In Trinidad it has been bred.

C. formosanus is an egg-larval parasite. Eggs are deposited within the host eggs and hatch in the host larvae. In about 12 days the larva leaves the host, constructs a protective cocoon and pupates. The pupal period lasts for five to six days. Stocks from the Indian Station, CIBC, were obtained in March, 1978, and it is being cultured in the laboratory in Trinidad.

Details of releases are given in table 1.

Table 1. Releases of *Spodoptera* parasites in Trinidad 1976 – 1978

Species	Origin	Numbers released			
		1976	1977	1978	Total
Apanteles ruficrus	Pakistan	2910	2090	–	5000
Chelonus formosanus	India	–	–	1105	1105
Telenomus remus	India	5850	7300	30750	43900

Releases have been mainly in the market garden areas of Macoya and Aranguez. Shortly after the release of *C. formosanus* a few specimens of a *Chelonus,* probably the released species, were reared from host larvae collected at Macoya. *T. remus* has been occasionally reared from eggs of *Spodoptera frugiperda* at Macoya.

In addition, stocks of *T. remus* have been supplied to Antigua, Colombia, Nicaragua and Guatemala. While no recovery surveys have been made in Antigua it is firmly established in the Cauca Valley of Colombia and is considered to have effectively controlled *Spodoptera sunia.* (J. Gaviria, Per. Comm.). It was released in St. Kitts and Montserrat in 1973 and shortly thereafter it was recovered from Montserrat (F.D. Bennett, Per. Comm.). Detailed recovery surveys have not been made since and it is not certain whether it is established permanently.

Corn ear worms Heliothis spp.: Heliothis zea and H. virescens) have a wide host spectrum including maize (corn ear worm), cotton (boll worm), pigeon pea (pod borer) and fruits of tomatoes, etc. An account of the life histories of the pests, their native natural enemies and attempts to establish exotic natural enemies in the Lesser Antilles have been given by Bennett and Yaseen (1972) and Yaseen (1975). Recent investigations in Trinidad and Tobago have shown that with the exception of a complex of native Trichogrammatid egg parasites, *Trichogramma brasiliensis, T. exiguum (=fasciatum)* and *T. semifumatum,* there is a general paucity of natural enemies. The Trichogrammatids seasonally exert some level of control; in September – October 1978, about 5% to 37% eggs in corn silks at Macoya were parasitised. There was some predation by Anthocorids, Chysopids and Hemerobids but these are general predators.

Several parasites of *Heliothis armigera* are known form India and Southern Europe (Achan et al, 1968 Carl 1977). Stocks of several of these as well as parasites of *Heliothis* spp. from Texas have been obtained. (table 2)

Table 2. Exotic parasites of *Heliothis* spp. obtained for trial in Trinidad.

Parasite	Host	Stage Attacked	Origin
Braconidae			
Microplitis croecipes	*H. virescens*	Larvae	Texas, USA
Ichneumonidae			
Camooletis chloridae	*H. armigera*	Larvae	India
Cardiochiles nigriceps	*Heliothis* spp.	Larvae	Texas, USA
Eriborus argentiopilosa	*H. armigera*	Larvae	India
Hyposotor didymator	*H. armigera*	Larvae	Yugoslavia
Tachinidae			
Goniophthalmus halli	*H. armigera*	Larvae	India
Palexorista laxa	*H. armigera*	Larvae	India
Trichogrammatidae			
Trichogramma achaeae	*Achaea janata*	Egg	India
Trichogramma chilotraeae	*Chilo* spp.	Egg	India
Trichogrammatoidea armigera	*H. armigera*	Egg	India

Due to the high rate of mortality as a result of delays, insufficient adults of *M. croecipes*, *C. nigriceps* and *G. halli* were obtained to start laboratory colonies. We have confired our attention to the propagation of parasites attacking eggs and early larval instars as these are the stages of the pest most exposed to parasites. The later larval stages are concealed in the corn ear which bestows some degree of immunity from attack. Cultures of several of the parasites were set up and released are in progress. Details are given in table 3.

Table 3. Releases of *Heliothis* parasites in Trinidad, 1976 – 1978.

Species	Numbers released			Total
	1976	1977	1978	
Bracon hebetor	7,376	20,761	1,150	29,287
Campoletis chloridae	–	185	748	933
Trichogramma achaeae	–	18,100	18,600	36,700
Trichogramma chilotraeae	2,300	1,500	700	4,500
Trichogrammatoidea armigera	1,450	3,400	18,500	23,350

*A tachinid *Eucelatoria* sp. (origin Arizona, USA) was released against *Heliothis* spp. on pigeon peas in several territories in the Caribbean including Grenada, St. Vincent, Antigua, Barbados, St. Kitts, St. Lucia, Dominica and Trinidad in 1972 but recoveries have not been reported.

Releases of these species are being continued and those of other parasites attacking young larvae *E. argentiopilosa* and *H. didymator* are planned next season. When adequate release of *C. chloridae* has been made recovery surveys will be conducted.

Stocks of *T. armigera* have been provided to Colombia and Nicaragua.

DISCUSSION

While both *Telenomus remus* and *Chelonus formosanus* have been recovered from a few samples it is too early to say if establishment is permanent and whether effective biocontrol of *Spodoptera frugiperda* will be achieved. Although the introduced parasites of *Heliothis* spp. have not yet been recovered additional releases are warranted to enhance the possibilities of establishment.

There are several other species of parasites which can be introduced against *Spodoptera* and *Heliothis* spp. Also, trials with pathogens including *B. thuringiensis* and the nuclear polyhedrosis virus *Baculovirus heliothis* should be undertaken against the earworms. Bearing in mind the threat posed by these two pests to any future plans for large-scale maize cultivation in Trinidad and the rest of the Caribbean continued attempts are warranted to obtain biological control.

* Trichogrammatidae

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NAME OF PAPER: Introduction of exotic Parasites for control of *Spodoptera* and *Heliothis* in Trinidad (M. Yaseen)

Question by: Remillet
Country: French Guyana

QUESTION: Have you found any bacterial or fungal disease, virus or – nematode on *Spodoptera* or *Heliothis*. What is the potential of these diseases in *Spodoptera* control.

ANSWER: A virus on *Heliothis* i.e., *Baculovirus heliothis* is known and can be tried against *Heliothis Armigera*.
We have not encountered with any disease on *Spodoptera* in Trinidad.

Question by: Muller
Country: Guyana

QUESTION: What is the potential for commercial application of biological control of maize pests in the Carribean?

ANSWER: Here have been several successful examples of biocontrol of pests in the caribbean like the citrus black fly and cottony cushion scale in several islands. As for biocontrol of pests of maize *Telenomus remus* is already established in Barbados. It is hoped to exert a controlling effect on Spodopters of given trial established in other territories. Similarly there are several parasites to be tried against *Heliothis*. While we still believe in classical biological control attention should be paid to develop a pest management programme where all available methods of control should be used in such a way that natural enemies play the major role and exert an appreciable level of control.

Questions by: P. Segeren
Country: Suriname

QUESTIONS:

1. Why control by chemical insecticides is not feasible under local conditions in Trinidad?
2. What numbers of the different parasites have to be released for any effective control or is this only related to the time after releasing?
3. What is the infestation-level of *Spodoptera* at not-treated plots in Trinidad?
4. Is super-parasitism by local super-parasites noticed with one of the imported and released parasites?

ANSWERS:

1. To small substitute farms where chemical application becomes uneconomic. More *Spodoptera* occurs in wild growth around the small corn plots.
2. It is difficult to determine the exact number of parasites to be released but due consideration should be given to its biotic potential, searching ability and availability of the host in the field at the time of the release. It is advisable to release fairly large numbers over a considerable period to give an adequate chance for establishment.
3. Usually up to 100% in 2-4 weeks old plants.
4. Not yet.