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TOWARDS AN IPM PROGRAM FOR PIGEON PEA POD-BORERS IN THE CARIBBEAN

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ABSTRACT

The pigeon pea **Cajanus cajan** is an important cultivated legume in the Caribbean. It is attacked by several insect pests. The pod borers **Ancylostomia stercorea, Fundella pellucens** and **Heliothis virescens** are major limiting factors. **A. stercorea** has a rich complex of natural enemies in Trinidad and some of these may be given trials in territories where they do not occur. While some natural enemies of **F. pellucens** and **H. virescens** are known, these are inefficient. There is a need to introduce exotic natural enemies of these as well as related pod borers to improve natural control. The parasites usually build after severe initial borer damage has been inflicted. Possibilities of control by use of pheromones as well as by efficient use of chemical pesticides at early stage of damage by the borers need to be investigated. Two hitherto insignificant borers **Pococera atramentalis** and **Sphenarches caffer** have in recent years been seen inflicting severe damage which calls for investigations of susceptibility of new varieties of pigeon peas.

INTRODUCTION

Pigeon pea, **Cajanus cajan**, is cultivated throughout most of the Commonwealth Caribbean and forms an important source of protein. Traditionally, it has been a subsistence crop. Due to the drop in sugar prices on the world market, some sugar-producing countries have embarked on a programme of diversification, placing emphasis on increased pigeon pea production both for domestic consumption and export markets. Other countries are also increasing production in order to conserve foreign exchange. Pigeon pea is attacked by several insects throughout its growth, including several defoliators, stink bugs, leaf hoppers, scale insects and pod borers. The major pests are lepidopterous pod-borers which are considered the limiting factor. Damage inflicted to green peas by these borers is particularly serious, as they attack the edible seeds in the pod which are rendered unfit for consumption.

THE POD BORERS

The major pod borers are the pyralid **Ancylostomia stercorea** and **Fundella pellucens**, and the noctuid **Heliothis virescens**. The pyralid larvae feed primarily as pod borers. **A. sterocrea** is known from most of tropical America, extending up to Florida. It is known to attack **Cicer** and **Dolichos** but pigeon pea is considered the most favoured food. **F. pellucens**, described from St. Thomas in the Virgin Islands and Barbados, is widely distributed in the neotropics. The host spectrum is very wide and includes **Vigna unguiculata, Bauhinia variegata, Canavalia enisformis, C. maritima, C. cajanus** and **Phaseolus** spp. (Heinrich, 1956). **H. virescens**, known as tobacco budworm or tomato budworm, is known from most of the

United States and northern Mexico, parts of Central America and the Caribbean as well as from Argentina, Brazil, Colombia, Paraguay, Peru, Uruguay, and Venezuela. Although the larvae are not primarily pod borers, in the Caribbean they do considerable damage to pigeon pea pods and are seasonally the chief pests in some countries. The occurrence and relative degree of damage caused by these are given in Table 1.

Table 1. Main pod borers of pigeon pea (**Cajanus cajan**) and the damage caused in the Commonwealth Caribbean

Country	**A. stercocera**	**F. pellucens**	**H. virescens**
Antigua	++1/	+	++
Bahamas	++	-	++
Barbados	+	+	++
Dominica	++	+	+
Grenada	++	-	++
Guyana	++	-	+
Jamaica	++	-	+
Montserrat	++	-	+
St. Kitts	++	+	++
St. Lucia	++	+	++
St. Vincent	++	++	++
Trinidad	++	-	++

1/ ++ heavy damage; + considerable damage; - absent.

The pyralids **Maruca testulalis** and **Etiella zinckenella**, which are often serious pests in other parts of the world, are present in the region but are considered insignificant. **M. testulalis**, however, is known to destroy the pods seasonally to a considerable extent in Guyana. Hughes (1979) has reported the pyralid **Pococera atramentalis** and the pterophorid **Sphenarches caffer**, two comparatively less well documented pod borers from the region, inflicting severe damage on two new dwarf varieties of pigeon pea, UW 17 and UW 26.

CONTROL MEASURES

As a subsistence crop, pigeon pea has not received much attention for pest control. The use of traditional tall indeterminate varieties with overlapping flowering over a prolonged period makes the use of chemical pesticides uneconomic. There have been isolated attempts at biological control by the introduction of parasites of **A. stercorea** into the Bahamas and Barbados against the pyralids, but no recoveries have been reported (Bennet et al., 1985). Yaseen (1975) reported the introduction of three exotic parasites against **Heliothis** spp. into several territories in the eastern Caribbean, but recoveries were not reported. Alam and Gibbs (1985) introduced 17 species of parasites against **H. virescens** in Barbados, and two of these, **Bracon hebetor** and **Bracon** sp. probably **hebetor**, were established and reported to attack both **H. virescens** and **Fundella**. However, the level of parasitism was fairly low and they reported 60% yield losses due to pod borers. Hence, there is an urgent need for an integrated pest management programme in the region to reduce yield losses.

IPM OF POD BORERS

For the development of an IPM programme, strategies should recognize the ecological characteristics of the pod borers such as dispersability--including long distance migrations and the ability to find and concentrate on particular crops which are attractive or in an attractive stage of growth--that make them difficult to control by any single method., e.g., chemical or biological.

There are only scattered references to the incidence, host plants, damage caused and control of these pests, especially the pyralid, requiring detailed investigations of biology and behaviour, so that integrated control strategies should be based on adequate knowledge of the economics of the pests concerned. It should be developed for both the small farmer growing pigeon pea in a mixed cropping system as well as for the large-scale production of pigeon pea in monocultures. This calls for coordinated efforts for biological control, chemical control, pheromones and cultural practices.

BIOLOGICAL CONTROL

Six primary parasites--**Goniozus** sp. **punctulaticeps** group (bethylidae), **Apanteles etiellae**, **Bracon cajani**, **B. thurberiphagi**, **Phanerotoma bennetti** (braconidae) and **Eiphosoma dentator** (ichneumonidae)--in association with **A. stercorea**--occur in Trinidad but do not adequately control the pest (Bennett, 1960). There is a dearth of information about natural enemies in the region. During two brief surveys in 1985 and 1986, **Apanteles** and **Bracon** were reared in St. Lucia, Bahamas, Guyana and Jamaica but the specific determinations are under investigation and it is not certain if they occur naturally or were introduced from Trinidad.

Alam and Gibbs (1985) reported four parasites--**Goniozus** sp. nr **nigrifemur** (=**Parasierola** sp. nr **nigrifemur**) (bethylidae), **Bracon** sp. (braconidae), **Stomatomyla ipse** (tachinidae) and **Trichogramma exguum** (=**T. fasciatum**) (trichogrammatidae) - and four predators--**Cycloneda sanguinea** (coccinellidae) and **Chrysopa** spp. (chrysopidae) associated with **F. pellucens** in Barbados. Species of **Bracon** are also known to occur in several eastern Caribbean countries--St. Vincent, St. Lucia and St. Kitts--but these fall to provide adequate control. There is a lack of information about natural enemies of other pyralid pod borers in the Commonwealth Caribbean. In addition to various natural enemies associated with **F. pellucens**, Alam and Gibbs (1985) reported two tachinids (**Archytas marmoratus** and **A. piliventris**, a coccinelid (**Nephus** sp.) and a vespid (**Polistis barbadensis**) attacking **H. virescens** in Barbados. Bennett and Yaseen (1972, Yaseen (1975) have shown that with the exception of a complex of native trichogrammatid egg parasites **T. brasiliensis**, **T. exiguum**, **T. semifumatum**, **Apanteles muesbecki**, **Chelonus insularis**, **Bracon hebetor** and **Polistis** sp., there is a general paucity of natural enemies in Trinidad and the Lesser Antilles, and these do not provide adequate natural control.

The failure of few biocontrol attempts should not rule out further efforts for biological control of pod borers. These were made in the absence of information on ecological prerequisites essential to initiate a biocontrol programme. Parasites of **A. stercorea** from Trinidad were successfully been tried against related pod borers elsewhere, and

Bracon cajani and **Eiphosoma dentator** established against **Haruca testulalis** in Mauritius, and according to Orian and de Charmoy (1959), led to an increase of harvestable crop from 40% of potential to 70%. Parasites from **A. stercorea** from Trinidad should be given trials against the pests in countries where they do not occur. Similarly, parasites of **Fundella** reported from Barbados, St. Vincent and St. Kitts (Alam, pers. comm.), warrant trials against this phycitid elsewhere. In addition, parasites of **Etiella zinckenella** and **Haruca** from other areas should be selected from trials. Herting and Simmonds (1975) have catalogued several natural enemies of **H. testulalis** (Table 2). The same authors have listed 23 ichneumonids, 36 braconids, 1 chalcid, 3 pteromalids, 3 eupelmids, 1 clasmid, 2 trichogrammatids, 1 mymarid, 2 scelionids, 3 bethylids and 2 tachinids as primary parasites of **E. zinckenella** from Europe, Africa and North and South America, and those promising should be given trials.

Table 2. Natural enemies of **Haruca testulalis** Geyer

Species	Distribution
Coleoptera	
Coleoptera inaequalis	Hawaii
Ichneumonidae	
Cremastus flavoorbitalis	Hawaii
Eiphosoma nr **dentator**	Mauritius[1/]
Braconidae	
Apanteles hedyleptae	Puerto Rico
Bracon cajani	Mauritius[1/]
B. hebetor	Mauritius
Cedria paradoxa	India
Phanerotoma handicassiella	India
P. philippinensis	Java
Chalcididae	
Brachymeria obscurata	India
Vespidae	
Pachodynerus nasidens	Hawaii

1/ Introduced.

Heliothis virescens has a fairly wide distribution in the Hemisphere although usually on other crops. Its biology and ecology is well documented and is currently an important subject of investigation by the International **Heliothis** Biological Control Work Group of the International Organization of Biological Control (IOBC). Several parasites, such as

Cardiochiles nigriceps (ichneumonidae), **Microplitis croecepes** and **Apanteles kazak**, are considered promising and are being studied in the United States. In addition, there are other known natural enemies. Herting and Simmonds (1976) have listed seven hemipterons and three coccinelids, one ichneumonid, one braconid, one aphelinid, two vespids, one chrysopid and two tachinids as natural enemies from the USA and Peru, and the most promising should be given trials.

The term biological control in its wider definition includes the use of pheromones, resistant varieties and diseases.

Barrow (1968) investigated the possibilities of sex attractants as a means of controlling **A. stercorea** and showed that female moths demonstrated attractiveness for male pod borers. He considers it possible that this attractiveness may be the result of an extractable excretion or of other factors. Barrow (1975) reported that when the female moths become sexually mature and receptive to the males, they adopt a calling posture and there is a marked periodicity of "calling" subject to photoperiodic rhythm. These require further investigation for the development of sex pheromone and trapping of the male pod borers.

Hughes (1979) reported heavy infestations of the pyralid **Pococera atramentalis** and the pterphorid **Sphenarches caffer** on some of the new determinate varieties. **S. caffer** is a widespread but usually minor pest of many grain legumes and several parasites are known from West Africa (Herting and Simmonds (1975 (Table 3).

Table 3. Parasites of **Sphenarches caffer** Zeller (Family Pterophoridae)

Parasite	Distribution
Braconidae	
Apanteles paludicolae	India
A. parvicornis	Senegal
A. pterophori	Senegal, West Africa
A. ruficrus	West Africa
A. ruidus	India
A. sphenarchi	Senegal, West Africa
Bracon kirkpatricki	West Africa
Chalcididae	
Brachymeria eublemmae	Senegal
Tropimeris excavata	Senegal, West Africa
Euritomidae	
Euritoma cylasaecida	Senegal, West Africa

P. atramentalis is a serious pest of cotton in Peru and a search for natural enemies will be required if it is taken to the new varieties at economic threshold. Development of cultivars resistant to such new pests is warranted.

CHEMICAL CONTROL

While control by natural enemies in small farmers' plots is advocated, there is no doubt that conventional and other kinds of chemicals will be needed in large-scale monocultures involving, particularly, all-season, dwarf, determinate varieties. Key elements will be the development of suitable application technologies, the use of selective chemicals or non-selective chemicals in a selective manner in order to preserve biological control and the possible use of pathogens. A vital aspect of chemical use will be to determine whether a chemical is needed and when it should be applied. This must involve investigation of damage relations of different cultivars of pigeon pea aimed at establishing economic injury threshold, or at least some decision-making rules on the use of chemical pesticides.

CONCLUSIONS

Lepidopterous pod borers are a major limiting factor for production of pigeon pea. Control by chemical pesticides is not feasible. Limited biological control efforts have failed mainly because these were made before accummulation of information on ecological characteristics of the pests and failure to select natural enemies with attributes to succeed. Also, the numbers and size of releases of most of the natural enemies were not sufficient for adequate trials. With the increased importance of the crop in the region, control strategies require integrated pest management, involving biological control by introduction of natural enemies as well as by selective use of chemicals which do not interfere with the natural enemies.

Development of resistant varieties may reduce pest damage. Investigations of sex attractants are warranted and may lead to the commercial development of pheromones for trapping. This may prove helpful to small farmers in combating pod borers.

REFERENCES

Alam, M.M. and Gibbs, I.H. 1985. Pigeon pea pod borers and their natural enemies in Barbados, West Indies. Proc. Caribbean Food Crops Soc. 20: 38-41.

Barrow, R.M. 1968. A field study on sex attraction of the pod borer of pigeon peas, **Cajanus cajan** (L.) Millsp. Proc. Caribbean Food Crops Soc. 6: 57-61.

Barrow, R.M. 1980. Behavioural studies of **Ancylostomia stercorea** (Zeller) (Lepidoptera: Phycitidae): A pod borer on pigeon pea in Trinidad. Proc. Caribbean Food Crops Soc. 13: 11-18.

Bennett, F.D. 1960. Parasites of **Ancylostomia stercorea** (Zell.) (Pyralidae: Lepidoptera), a pod borer attacking pigeon pea in Trinidad. Bull. Ent. Res. 50: 737-757.

Bennett, F.D., Cock, M.J.N., Hughes, I.W., Simmonds, F.D., and Yaseen, M. 1985. A review of biological control of pests in the Commonwealth Caribbean and Bermuda up to 1982. (Ed. M.J.W. Cock). Commonwealth Institute of Biological Control, Tech. Comm. 9: xii+1-218.

Bennett, F.D. and Yaseen, M. 1972. Parasite introductions for biological control of three pests in the Lesser Antilles and British Honduras. PANS 18(4): 468-474.

Heinrich, C. 1956. American moths of the subfamily Phycitinae. Smithsonian Institution. Washington, DC, USNM Bull. 207, 581 pp.

Herting, B. and Simmonds, F.J. 1975. A catalogue of parasites and predators of terrestrial arthropods. Section A. 6: 1-218.

Herting, B. and Simmonds, F.J. 1976. A catalogue of parasites and predators of terrestrial arthropods. Section A. 7: 1-221.

Hughes, G. 1979. Lepidopterous larvae attacking the pods of two new pigeon pea varieties in Trinidad. Univ. West Indies, Trinidad. Unpublished report, 8 pp.

Orian, A.J.E. and de Charmoy, A. d'E. 1959. La lutte biologique contre les insectes s'attaquant a a'ambrevade. Revue Agric. Sucr. Maurice 38: 298-301.

Yaseen, M. 1975. A further note on the introduction of **Heliothis** parasites into the Lesser Antilles. PANS 21: 155-157.

Yaseen, M. 1985. Report on a visit to the Lesser Antilles, Guyana and Jamaica in connection with the project "Evaluation of pigeon pea pod borer in pigeon pea production". TCP/RLA/4404 (T). CIBC Report, 18 pp.