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**PROCEEDINGS OF THE
CARIBBEAN FOOD CROPS
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A FIELD STUDY ON SEX ATTRACTION OF THE POD-BORER OF PIGEON PEAS, *CAJANUS CAJAN* (L) MILL sp.

Ronald M. Barrow*

Pulses form the chief source of plant protein in the diet of the average Trinidadian. Among the different crops included in this group, pigeon peas, *Cajanus cajan* (L) Mill sp., is the most important. In a survey conducted from 1952–1955 by Bennett (1960) in Trinidad on the insect pests of green pigeon peas, it was revealed that the pod-borer, *Ancylostomia stercorea* (Zellner) Pyralidae, is one of the most important. In several instances chemical control of *A. stercorea* has proven to be both phytotoxic and uneconomical. Chemical control is uneconomical since most of the 5,800 acres of pigeon peas grown in Trinidad and Tobago are grown on small holdings (i.e. less than one acre) and several insecticide applications are required to control the pod-borer. It was therefore decided to observe the pod-borer in the field and to determine whether there is any attraction between the sexes of this insect and if so, to employ this attraction to control *A. stercorea*. This study herein outlined was undertaken at Central Experiment Station, Centeno, from October, 1965 to May, 1967. The study continues.

MATERIALS AND METHODS

The cages in which the adult moths were confined singly were of the type used by Perez and Long (1964). Each cage consisted of a cylinder of bristol board 1 inch long \times 1.5 inch in diameter, with a disc of fine muslin cloth glued to each end. The cage was suspended by a hook inside a cylindrical trap, which was made by removing the ends of a one-gallon can (5 lb. milk can). The inner surface of each trap was lined with a sticker—Trecband, an adhesive substance based on halogenated carbons, a product of Aseptafabriek N.V.—Delft Holland. The traps were suspended from the topmost branches of the pigeon pea bushes since a survey conducted revealed that these branches are the most infested (unpublished data). The traps were placed at least 20 feet apart to avoid competition between the traps.

Selection of sites: Two sites were chosen:—

- (1) St. Augustine Nurseries
- (2) Toco Road, Valencia

Both sites were not readily accessible to the public and contained more than $\frac{1}{2}$ acre of pure stand untreated with insecticide. These fields also had high infestations of pod-borers.

Variety of pigeon pea grown at St. Augustine:—

Dwarf variety 56-57-2A, developed at U.W.I., St. Augustine, Trinidad

Variety of pigeon pea grown at Valencia:—

Peasant variety (i.e. bush variety).

The test insects were reared in the laboratory from infested pods collected in

*Entomologist, Ministry of Agriculture, Trinidad and Tobago.

the field. All attempts to rear *A. stercorea* on synthetic diets failed, due largely to the inability to secure disease free media.

It is possible to sex the pupae by locating the genital pore. In the female, the genital pore is on the 8th segment. In the male, the genital pore is on the 9th segment. The pupae are placed individually in stoppered test tubes (5/8 inch \times 6 inches). When the adults emerge it is also possible to sex them quite readily. The adult male has a fringe of dark scales on the inner surface of the basal segments of the antennae. These scales are not present in the adult female pod-borer. The adult moths were unfed and their average life was 3 days.

Ability to attract: To determine whether there was any attraction between the sexes, 1-day old unmated specimens of each sex which had been reared from the same batch of infested pods in the laboratory were randomly selected and tested. For this test 12 traps were used—4 with unmated females, 4 with unmated males and 4 control traps, i.e. without test insects. Since *A. stercorea* is a nocturnal insect, the traps were placed in the field at dusk i.e., after 5 p.m. They were collected the following morning when the 'catch' was counted, identified, sexed, and recorded as indicated in Table I. The conditions of the test moths were also noted. This test was replicated at least four times at one site only—St. Augustine Nurseries. In each replication the treatments were rotated to all locations.

Age and attractiveness: Once it was established that there was an attraction between the sexes it was decided to determine how attractiveness varied with age. Virgin females varying in age from one to six days (six days being the average length of life of the adult female tested. The test insects were randomly selected from the adults that emerged from the same batch of infested pods. The insects were only employed once, i.e. they were only left in the field overnight since it was found that they rarely lived beyond two days when set out in the field. At each site four virgin females, one unmated male the same age as the female, and one check were used. This was repeated four times and the catch was recorded as previously stated. This procedure was adopted for each virgin female of different age employed. The weather conditions at the two sites at testing time were also recorded.

The effect of mating on attractiveness: This exercise was designed to determine whether attractiveness in the female pod-borer increased with mating. At St. Augustine Nurseries four traps were baited with mated females, also four traps were baited with 2-day old virgin females for comparison (2-day old virgins were found to be the most attractive of the moths previously tested) and one empty trap as a check. The daily catch was accurately counted and recorded as shown in Table III. This test was repeated four times. To ensure that the test insects used were mated after each count the mated female were dissected and the spermatophores located.

Dissected abdomens of virgin females used as bait: Observations of the mating behaviour of the pod-borer revealed that the female extended her ovipositor and exposed glandular appearing structures and its base prior to mating.

Since it is known that the sex attractants of several other Lepidoptera are produced in the lateral glands situated on the last abdominal segment of the females it was decided to remove the last three abdominal segments from 2-day old virgin females and use these cut sections (1) as bait in traps, (2) pulverized and extracted with

various solvents and used the residue to impregnate 5 cm. discs of filter paper, which can be used as bait. So far only the cut sections have been used as bait and for comparison 2-day old virgin females were also used. The results of this trial are still being collected.

DISCUSSION

The results in Table I indicate that male pod-borers are attracted to virgin female pod-borers. Many of the moths caught on the sticky traps were found with their claspers extended, others had extruded spermatophores hanging from the tips of their abdomens. From the results obtained in Table II it is apparent that there may be a high incidence of pod-borer damage on the bush type pigeon pea as opposed to the dwarf variety, 56-57-2A. This is not to be interpreted as varietal resistance, for the difference is not statistically significant and may be influenced by several other factors. Table II also revealed that at 2-3 days old, virgins reach their peak of sexual attraction. It was found that once mated, females are no longer attractive and on the few occasions on which they were observed only occurred once in the life of the female.

This field study was limited to some extent by the photoperiodism displayed by *Cajanus cajan*. Pigeon pea will only pod during periods of short day length—late October to April, thus limiting the source of the natural diet of *A. stercorea*. Heinrich (1956) lists chick pea, *Cicer arietinum* (L) and black-eyed peas, *Dolichos* sp., as alternate hosts of *A. stercorea*. Surveys made locally do not substantiate Heinrich's claim. Failure to rear the moths on a synthetic diet made this study entirely dependent on green pigeon peas. There were isolated instances where green pigeon peas were available during the 'off' season but the number of male pod-borers baited by virgin females was very reduced, especially during July-September. This reduction could be attributed to several factors—but the least of which is the lack of food for the moths and the possible occurrence of pupal diapause. It is my intention to try and rear *A. stercorea* on synthetic diet so that a more uniform test population may be had and also to determine whether pupal diapause does occur and if so the factor or factors involved.

The abdominal tips of the virgin female moths have demonstrated attractiveness for the male pod-borer. It is possible that this attractiveness may be the result of an extractable excretion or of other factors. For further studies use will be made of solvent extracts of female abdominal tips as baits for luring males to field traps. If this is successful, the isolation, identification and synthesis of the chemical sex attractant could be a useful tool for use in any control programme. It must be remembered, however, that the capture of male pod-borer is of no importance unless female fertility is reduced. In this study so far there is no evidence that this was achieved, i.e. reduction of female fertility. It is intended to determine the level of male trapping necessary to achieve control and possibly to make use of an integrated control programme as outlined by Christenson. Christenson (1963) established that male lures used in combination with an insecticide greatly reduced the Oriental fruit fly, *Dacus dorsalis* Hendel in Hawaii.

Hence, it is likely that greater use of sex attractants will be made in planning effective insect control programmes as Hall (1963) suggested. Since there is an increasing number of problems arising from the presence of undesirable insecticide residues as well as the resistance developed by insects to insecticides.

TABLE I

SITE: ST. AUGUSTINE NURSERIES

DATE: MARCH 1966

Daily average number of male pod-borers caught in traps baited with:

1-day old virgin females	1-day old virgin males	Control	Remarks
16	0	0	
24	0	0	
22	0	0	
18	0	0	
35	0	—	
16	0	—	
5*	0	0	*Rain, moths died
Total 131	0	0	
Average 23.5	0	0	

TABLE II

SITE: ST. AUGUSTINE NURSERIES

DATE: MARCH-JULY 1966

Average number of male pod-borers caught by females of differing ages in four (4) replications.

Age of female in days					
1	2	3	4	5	6
8.0	29.2	16.0	7.5	3.1*	2.5†

No females were caught on traps baited with males or in empty traps.

*Average for 3 replications

†Average for 2 replications

SITE: TOCO ROAD, VALENCIA

DATE: MAY-JULY 1966

Age of female in days					
1	2	3	4	5	6
15.5	33.0	20.1	2.4*	—	—

Heavy rains hampered the collection of reproducible data for virgin females five and six days old.

*Average for 2 replications.

No female moths were caught in traps containing males or in the empty traps. However, one female was caught in one of the traps baited with 3-day old virgin females.

TABLE III

SITE: ST. AUGUSTINE NURSERIES

DATE: APRIL-JULY 1966

Daily average number of male pod-borers caught by traps baited with:

Mated females	2-day old virgin females	Control
0	24	0
0	32	0
0	31	0
0	30	0
Total 0	117	0
Average 0	29.2	0

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