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BIONOMICS OF A LEAF-EATING BEETLE (*DIPHAULACA n.sp.*) ON PIGEON PEA (*CAJANUS CAJAN*) IN TRINIDAD.

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INTRODUCTION

Fleabeetles are not new pests in Trinidad and Tobago. However, the fleabeetle that ravaged acres of seedling pigeon peas, *Cajanus cajan* L., in Marac, Moruga, was until July 1965 unknown. This Halticid belongs to the genus *Diphaulaca* Chevrolat. Earliest records of *Diphaulaca* in Trinidad are of specimens found in the Montserrat Hills by Busck in 1905 and Aripo Savannah by Morrison in 1918. Barber (1941) reported that these specimens found by Busck and Morrison are paratypes of *D. meridae* Barber. *D. meridae* occurs in Venezuela and is probably the abundant species in Surinam.

Systematics

Diphaulaca Chevrolat 1837 was first proposed to include sixteen tropical American Species. *Diphaulaca* (*Altica*) *aulica* Olivier 1808 became the genotype through designation by Chevrolat (1845). Jacoby (1883) found variability in more than one hundred specimens from Mexico to Guiana and claimed that they were varieties of *D. aulica*. Bechyne (1958) and Barber (1941) both agree that *Diphaulaca* is highly unstable in morphological and ecotypical characters. However, Bechyne claims that *D. panamae* Barber and *D. meridae* Barber are ecotypes of *D. aulica*. Bechyne examined the local species, unnamed both in the British Museum of Natural History and the U.S. Natural History Museum and concluded that this species could be a variety of *D. aulica*.

Bechyne also claims that the abundant species found in Surinam, *D. meridae* could be a biotype of *D. aulica*. Examination of the aedeagi of several of the local specimens indicates that they differed slightly from those described both for *D. aulica* and *D. ameride*. The aedeagus of *Diphaulaca* n. sp. is slightly upturned and shows no recognisable armature other than that of the orificial plate. The apex is slightly rounded and bituberculate at the middle of the upper margin (*See* fig. I)

So far cytology has proven no more helpful in solving this matter. The Halticidae are known to have very unusual chromosome relationships and very variable karyotypes. Cytological examination of two Trinidad specimens by Virkki (1966) revealed that they had 14 pairs of autosomes and Xy (14 Xyp). The same karyotype found in the abundant Surinam species. But Virkki points out that the sex chromosomes are very strongly negatively heteropycnotic in the spermatocyte, which together with their tendency to associate with the autosomes renders the species somewhat troublesome cytologically. It is hoped that a survey of the *Diphaulaca* occurring in Trinidad will be made and the cytology of the abundant species determined.

Distribution

Blackwelder (1946) in his coleopteran checklist reveals that the genus Diphaulaca

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is distributed from Mexico down through Central America as far as Argentina, in South America. Long and Mutchler (1914) mention the incidence of *D. advena* F. and *D. sancta-crucis* F. in St. Croix in the West Indies. Barber (1941) believes that *Diphaulaca* spp. listed as occurring in the West Indies by Leng and Mutchler could have possibly been found on the South American mainland, since Pflug who collected these specimens collected throughout the West Indian Islands and the Caribbean mainland and died in St. Croix. Arnett (1960) states that *Diphaulaca* does not occur in North America.

As mentioned in the systematics, *Diphaulaca* n.sp. found in Trinidad closely resembles the South American *D. aulica* Olivier and *D. meridae*. In Trinidad *Diphaulaca* is distributed mainly in the South—from Marac, Moruga in the West to Cascadoux Trace, Ortoire in the East. Mount Harris, Biche is the northermost region where the pest is epidemic. There are no reports of its occurence in the sister isle of Tobago.

Host Plants and Status of Pest

Some fleabeetles are general feeders, others feed on one group of plants, whilst others are host specific, eg., egg plant fleabeetle, spinach fleabeetle. According to Barber (1941) *Diphaulaca* has been known to attack both cultivated and wild leguminous plants. In Surinam, Dinther (1960) reports that *D. meridae* feeds on several types of beans; *phaseolus radeatus* L., *Phaseolus valquris* L., *Glycine max.* L., *Vigna sinensis* (L) Walp. in Trinidad, Diphaulaca has been found to feed sole on *Cajanus cajan*. Local farmers have reported that the adults feed on Bodi (Vigna spp.), Seim (Delichos lablab L.) and Caraqui or "grater wood" (Lantana camara L). This has not been coroborated by the author. Attempts to get adults to feed on leguminous plants other than *Cajanus cajan* under laboratory conditions have proven futile.

The beetle gnaws tiny holes in the leaves of the food plant so that they look as if fine shot has been fired through them. Heavily attacked plants are often killed as the fleabeetle completely destroys the leaf tissue between the main veins. Seedling peas are especially susceptible to these fleabeetles and attack is heaviest when the plants are 1–2 months old. Diphaulaca is a major pest when conditions favour its establishment in epidemic proportions as evidenced by the outbreak in Marac, Moruga, and Cascadoux Trace, Ortiore in 1965. Since this outbreak the pest has been found in isolated areas in North Trinidad where pigeon peas are grown, e.g. Brooklyn and Vega de Oropouche, Sangre Grande.

External Morphology

Adult: Male 4.0–5.0 mm. long; female 4.8–6.0 m.m. long.

Elongate oval in outline with narrowed prothorax and narrower head. Head and prothorax shiny orange brown not punctate, frons twice as wide as diameter of the eye, genae reduced. Ends of the prothorax slightly indented. Thorax 1.5× as wide as long. Elytra metallic blue-green. Punctatestraite with the punctures regular, forming fine striae to the apex. The humeral and discobasal gibhosites distinct. Membranous fore wings are not visible from above.

Body and appendage, yellowish-brown. Antennae and tarsi somewhat infuscate. Antenna $\frac{1}{3}$–$\frac{1}{2}$ as long as body. Hind femora enlarged characteristic of Halticidae. Sexual dimorphism: in male 5th abdominal sternite lobed; in female 5th abdominal sternite regularly rounded. (*See* Figure II.).

Bionomics of Diphaulaca n. sp.

Life cycle studies in the Laboratory: The determination of the life history of this fleabeetle in the laboratory has been a frustrating task. Egg mortality is very high—at least 90 per cent of those obtained never hatched. The adult fleabeetles were caged on seedling pigeon peas. The females begin to lay their eggs 3–4 days after mating. The eggs as already described are laid on the soil around the base of the seedling plants either singly or in clusters. The eggs were removed from the soil with a camel's hair brush and rinsed in very dilute detergent water and placed on dampened filter in a petri dish. The petri dish was kept in a cupboard to simulate the darkened conditions to which the eggs are exposed in the field. The eggs were checked daily. They hateh in 14–15 days.

The larval and pupal stages are passed in the soil and those conditions were simulated with dampened soil in a petri dish. Larval mortality was also high, possibily due to the lack of food. The larval stage averages about one month and the pupal stage one week.

Adults caught in the field lived an average of two weeks in cages in the laboratory. Length of complete life cycle is $2\frac{1}{2}$–3 months and the number of generations per year is 3. This is based on reports by Virkki (1966) who found that the condition of the tests of males collected in January revealed that they were either in a post copulation stage or preparing for a dry period. On this basis there maybe only three generation per year, if during the dry spell there is a diapause. Mortality of the adults in the laboratory is partly attributed to parasitism. Large dipterous larvae were found in the abdomens of some of the adults which were disssected.

Sex ratio: A check of the 'catches' revealed that the sexes are almost equally divided with the females having a slight edge, 48 per cent males: 52 per cent females.

Field Studies: Ecological studies of *Diphaulaca* n.sp. were initiated at the beginning of 1966 and are continuing. The site chosen for this study was Cascadoux Trace, Mayaro. Periodic checks have been made at Marac, Moruga and Mount Harris, Biche. The reasons why Cascadoux Trace was chosen as the main site are as follows:—

(i) Ease of access and proximity to Central Experiment Station as opposed to other areas.
(ii) Relatively large acreage of pure stand of pigeon peas.
(iii) Isolation from other pigeon peas fields.
(iv) Pigeon pea bushes are found in this area throughout the year.
(v) The area is uutreated with pesticide.

At Cascadoux Trace the variety of pigeon peas grown is the bushy variety. The peas are usually planted iu late May and the bushes are cut when the crop is finished the following April. Some farmers let their crop stand, hence, there is always a stand of pigeon peas in the area.

Sampling techniques: These had to be modified as the study progressed. The site was visited at least twice monthly, but when possible once per week. It was not originally intended to centre interest on any particular age interval or any particular factor and process, but on all factors affecting mortality that could be adequately measured. The factors that were measured were as follows: The number of adults collected over a particular interval of time, the weather conditions—rainfall, &c., the

percentage of parasites found when a fixed number of adults were dissected, number of mating pairs noted in a particular period. It was not possible to measure the microclimate, a factor that is now believed to have some effect on the population density.

Results

TABLE I

Population Sampling—*Diphaulaca n. sp.*

Site: Cascadoux Trace, Mayaro. 1967

Month	Average Number of adults caught/hour	Average Number of Mating pairs caught /hour	Average Rainfall per month	Adult parasitised in 20 dissected
January	102.0	5	3.41	4
February	51.5	—	2.24	2
March	—	—	—	3
April	413.0	52	2.40	—
May	385.7	48	3.44	2
June	560.5	72	8.67	4
July	667.6	58	11.85	1
August	—	—	—	3
September... ...	523.0	70	7.50	3
October	476.3	46	4.37	—
November ...	210.0	41	4.20	2
December	360.5	30	3.40	2

Discussions

Results obtained in Table I indicate that the highest incidence of *Diphaulaca* n. sp. in Cascadoux Trace was from June to September. It may be significant that this was the period of highest rainfall. It may well be that 'key factor' studies, i.e. measurement of population at one point in life cycle as outlined by Morris (1963) applies to the adult fleabeetle. Hence, a study of the adult population density could be useful in forecasting population trends. It was noted that the fleabeetles were more plentiful during the cooler periods of the day when more matings were also noticed. No definite pattern could be ascertained *re* the significance of control effected by the dipterous parasites. Natural control may be correlated with high egg mortality. It is obvious that adequate sampling techniques have to be worked out and this will include the significance of stand density, the variations in the microclimate, and an estimation of the amount of damage the fleabeetle does.

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