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THE INTRODUCTION OF PARASITES OF THE SUGARCANE BORER INTO PUERTO RICO

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In July 1935, when the Bureau of Entomology and Plant Quarantine began by use of special funds, the study of certain insect pests of Puerto Rico the, writer was assigned to the Division of Foreign Parasite Introduction and delegated to exploratory work in the British West Indies and in South America. His primary objective was to secure the natural enemies of the sugarcane borer (*Diatraea saccharalis* Fab.) for the control of this pest in Puerto Rico. Incidental thereto, shipments of certain species were also made to the United States. The work was begun in Trinidad, B. W. I., on August 12, 1935, and terminated in Peru on May 22, 1936.

INVESTIGATION IN TRINIDAD

In addition to *Diatraea saccharalis,* there are two other species in the same genus that are important pests of sugarcane in Trinidad. As a matter of fact both of them, *D. impersonatella* Walk. and *D. canella* Hamps., have been much more serious there for several years than *saccharalis.* In all the writer's collections of borers for the rearing of parasites the numbers of *impersonatella* and *canella* far exceded those of *saccharalis.*

The actual collecting and rearing of borers was begun on August 26 and continued to the middle of October 1935. The collection of borers was confined to dead hearts of sugarcane. During these 7 weeks 17,630 dead-heart shoots of sugar cane were collected, and they produced, upon dissection, 639 pupae and 4,653 larvae of the three species. No parasites emerged from the pupae, but three species of larval parasites were reared. The commonest of them was the fly *Theresia claripalpis* Van der Wulp, parasitizing 9.2 percent of the borers; the fly *Stomatodexia diadema* Wied. was responsible for killing 1.1 percent, and the braconid *Apanteles diatraeae* Mues., about 0.05 percent. This braconid is said to be more common on *Diatraea* spp. attacking rice in Trinidad, killing 100 times as many as it attacks in cane. *Stomatodexia* is believed to be a

seasonal parasite, being more common in the summer than in the fall. The writer's work was apparently begun just too late to reveal the true effectiveness of this dexiid.

No parasites were forwarded from the rearings in Trinidad. While the work there was in progress three trips were made to other countries to arrange for the conduct of projects, and, what is more important, although nearly 500 puparia and cocoons of the three species of parasites were obtained, at no time was the emergence of adults sufficiently large to justify air-express shipments.

In connection with the rearing of the dipterous parasites it might be mentioned that neither *Theresia* nor *Stomatodexia* adults would mate when placed in cages covered with white, coarse mosquito netting, but when the cages were painted green mating was induced. The cages were cylindrical, 14 inches in diameter and about 22 inches in height. As a precaution against molestation by ants, they were suspended from the ceiling of the laboratory, and were doubly protected from them by the use of sticky tree-banding material.

Investigations in British Guiana

The work in British Guiana had two distinct phases, the breeding of the Amazon fly (*Metagonistylum minense* Towns.) and the rearing of the parasites of the sugarcane borer indigenous to British Guiana.

In 1932, while in search of beneficial insects for the control of the large moth borer *Castnia licoides* Boisd. in the jungles of the Amazon basin in Brazil, J. G. Myers, of the Imperial Bureau of Entomology, discovered a new parasite attacking the larvae of *Diatraea saccharalis* infesting the two grasses *Paspalum repens* and *Echinochloa polystachya* about 500 miles from the Atlantic Ocean. His attempt to bring this unknown parasite with him into British Guiana that year failed on account of transportation difficulties. This obstacle was overcome the following year when the British Guiana Sugar Producers' Association, anxious to cooperate with the British Guiana Department of Agriculture, volunteered to purchase a launch and hire an experienced navigator to operate it. Thus, in the summer of 1933, Dr. Myers succeeded in bringing 200 adults of *Metagonistylum* into the entomological laboratory at Georgetown, Demarara. It cost the combined treasuries of these two organizations approximately $35,000 to get those 200 individuals of the Amazon fly. Yet it was an investment of inestimable value! During the short time since its introduction and colonization in the cane fields

of the country it has saved the sugar growers many times that amount. The justification of their faith in this parasite is amply demonstrated to one who visits the sugarcane fields on the plantations where liberations were made. It may be seen in abundant numbers everywhere. In 1934 it was introduced into the Island of St. Lucia, where its establishment, dispersion, and control of the borer, as observed by the writer, may be said to be phenomenal. As soon as arrangements had been completed for securing material for importation into Puerto Rico and the United States, all efforts were concentrated on breeding and sending as many adults as possible to assure adequate numbers for establishment.

Particular acknowledgment is due to the Hon. J. Sidney Dash, Director of the Department of Agriculture of British Guiana, and to the British Guiana Sugar Producers' Association, for permission to collect material in colonized areas and for aid given during the course of the rearing work.

The breeding of the Amazon fly involved the careful mating of the female, the dissection of her ovaries at the end of the gestation period of 7 days to secure first-stage maggots, the inoculation of the *Diatraea* borers with these maggots, the care of the inoculated borers during the period of development of the fly maggot, and the removal and care of the resulting puparia and of the adults emerging from them.

The airplane schedule in effect during the period of the operations in British Guiana called for only weekly service to Puerto Rico. Beginning October 29, ten shipments were made at weekly intervals, representing a total of 6,575 adults of *Metagonistylum*, of which 88.6 percent reached their destination alive. In some of these consignments two other species of *saccharalis* parasites were included in small numbers. Out of 8 adults of *Stomatodexia diadema* and 62 adults of *Bassus stigmaterus* (Cress.), all except 1 *Bassus* were alive upon reaching Puerto Rico.

Literature records at least 12 species of parasites of *Diatraea saccharalis* larvae and pupae indigenous to British Guiana. Bulk rearings of sugarcane borers were undertaken in the expectation that at least some of these species would be found in sufficiently large numbers to permit an attempt at their establishment in Puerto Rico. Arrangements were made with four sugar plantations, located in different parts of the country, for the collection of *saccharalis* larvae and pupae, which were to be forwarded daily to the laboratory at Georgetown. The entire month of December 1935 was devoted to this work. More than 13,000 borers (of all stages) and pupae of

the sugarcane borer were reared in the laboratory; yet only two species of parasites were recovered. These were *Bassus stigmaterus* and the recently introduced Amazon fly, both parasites of the larvae. It was indeed surprising that not a single individual of the many other species recorded from this country was obtained from such a large and representative mass of material.

Investigations in Peru

In developing the project it was considered wise to introduce parasites from regions of diverse climatic conditions. The Amazon fly obtained in British Guiana has a decided preference for swampy or semiswampy conditions. This may be accounted for by the fact that its original home is along the banks of the Amazon River and it attacks its host inhabiting the grasses in the swamps bordering the river. One reason for the selection of Peru for the conduct of our search for the beneficial insects of the sugarcane borer was its climate, which was in marked contrast to that in British Guiana. Much of the sugarcane in Peru is grown in certain of the numerous valleys along its extensive west coast. Although very near the equator, the climate is subtropical, owing to the cooling effects of the Humboldt current from the Antarctic Ocean. For practically its entire length of 1,300 miles this coastal belt is almost rainless and is virtually destitute of vegetation except where irrigation makes cultivation possible. Most of these valleys are intensely cultivated and rendered fruitful by extensive systems of irrigation.

Three species of *Diatraea* are recorded from Peru, but only *saccharalis* is of economic importance. Two of the four parasites of *saccharalis* indigenous here, the dexiid fly *Theresia claripalpis* and the wasp *Ipobracon rimac* Wolc., were found in extraordinary abundance during the period of operation in Peru, April 7 to May 21, 1936. Both species were found in all the cane and numerous corn fields in the region about Trujillo. More than 12,000 puparia of the dexiid fly were accumulated in 3 weeks, and more than 13,000 adults of the wasp were collected in 29 days.

All the field-collected wasps and the adults emerging from the collection of puparia were cared for in a large storage cage of cheese-cloth, having a wooden frame 6½ by 6½ by 3 feet, until ready to be shipped. The upper frame and the uprights of the cage, towards the course of light, were literally covered with cubes of white sugar as food, and water was furnished by wetting the cheese-cloth on the sides of the cage and every 2 hours throughout the day. The

humid atmosphere produced in the cage by this wetting made the sugar more easily available to the adults.

The adult wasps and flies were shipped to their destinations in distinct types of cages. Metal cylindrical containers were used for *Theresia,* and wooden cages of the type used in the United States for shipping the parasites of the oriental fruit moth were utilized for *Ipobracon.* On the morning of the days of departure of the airplanes the parasites were prepared for shipment. Each insect was examined before being placed in the container, a practice which the writer has strictly followed in all shipments from foreign countries, and is specially necessary in the case of field-collected material. Since Peru had more frequent airplane service than British Guiana, it was possible to forward two consignments each week. A total of 13,533 adults of *Ipobracon rimac* were shipped from Peru, of which 10,705 went to Puerto Rico and the remainder, 2,828 adults, to the United States. The mortality en route to Florida was 21 percent, while to Puerto Rico, a trip requiring 2 days longer, it was 24.1 percent. In each case the mortality among the females was greater than among the males. Eighty-one percent of the adult wasps forwarded from Peru were females and only 19 percent males. Three hundred and fourteen adults of *Theresia claripalpis* were sent to Florida with a loss of 20.4 percent, while the mortality en route for the 1,713 flies shipped to Puerto Rico was 66.5 percent. For the four that reached Puerto Rico according to schedule the mortality was only 32.4 percent, but three of the consignments were misrouted or otherwise delayed, with consequent heavier mortalities.

Summary

Search for the parasites of the sugarcane borer (*Diatraea saccharalis* Fab.) was conducted in five countries in the American Tropics, in three of which actual field and laboratory work was performed. Three dipterous and two hymenopterous parasites were found and shipped to Puerto Rico and Florida, the former receiving 19,063 adults and the latter 3,142. The shipments to Puerto Rico comprised 8,296 flies and 10,767 wasps, while the shipments to Florida totaled 314 flies and 2,828 wasps.