

Studies of the Biological Control of *Diatraea saccharalis* F. (Lepidoptera: Crambidae) on St. Croix, U. S. Virgin Islands

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INTRODUCTION

The small moth borer of sugarcane (*Diatraea saccharalis*) has been known on St. Croix for many years. Until recently the damage it caused had not been fully appreciated. Since the moth borer is apparently the principal pest of sugarcane on St. Croix, a study of it and its parasites and predators was begun in January 1959. Extensive field examination was made of three cane crops: 1958, 1959, 1960, to determine the severity of *Diatraea* attacks. All life stages of the borer were studied. Cane samples were taken from a wide variety of locations throughout the Island to determine whether there were differences under unlike ecological conditions. Locations, soil data, rainfall, and borer infestation percentages for our most common cane, B.37161, are listed in table 1.

A study of this sort is difficult to make in St. Croix because of extremely variable rainfall from year to year and from place to place on the Island. A composite figure for Island rainfall for the 60 years, 1852-1911 inclusive, arrived at by averaging readings at Christiansted, Kingshill, and Frederiksted, is 46.86 inches. The range during these years was 29.10 to 71.44 inches. The monthly average ranged from a low of 1.70 in March to a high of 6.56 in October (4)². Soil conditions are also quite variable, but most soils in the cane area have a high clay content.

FINDINGS

In certain drier areas borer infestation in some varieties of mature cane was over 50 percent of all joints, although the average on St. Croix was 18 percent, ranging in different years between 10 and 20, depending upon rainfall levels.

EGG PARASITIZATION AND PREDATION

The egg parasite *Trichogramma minutum* Riley (Hymenoptera:Trichogrammatidae) is very efficient on St. Croix. Over a period of 15 months, from January 1959 to March 1960 inclusive, 1,500 egg masses averaging 18 eggs per mass were examined. Parasitization was over 97 percent. There

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² Italic numbers in parentheses refer to Literature Cited, p. 139.

seemed to be little significant seasonal variation in the extent of control. Table 2 illustrates the findings.

Several hundred parasitized eggs were hatched out but no parasites other than *Trichogramma* were found. Little improvement could seemingly

TABLE 1.—Locations, soil types, rainfall, and borer infestation of *B.37161* sugarcane in areas examined in St. Croix, 1958–60

Location and soil type	Rainfall in—			B.37161 infestation		
	1958	1959	1960	1958	1959	1960
	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>
Experiment Station (Fredensborg clay)	41.12	32.97	60.41	8.89	13.76	10.43
Fountain (Descalabrado clay)	49.78	35.83	59.06	14.38	14.27	—
River (Parasol clay)	48.90	35.04	62.58	13.60	20.72	9.48
Fredensborg (Hope clay)	47.26	32.88	65.60	11.40	—	—
Barren Spot (Aguilita clay)	49.30	36.17	61.88	15.03	16.80	—
Diamond (Hope clay)	42.99	32.26	53.03	—	15.59	11.19
Enfield Green (Hope clay)	42.99	32.26	53.03	43.94	28.64	11.21

TABLE 2.—Parasitization levels of *Diatraea saccharalis* eggs by *Trichogramma minutum* on St. Croix between January 1959 and March 1960

Month in 1959	Egg masses examined	Parasitization level	Month and year	Egg masses examined	Parasitization level
	<i>Number</i>	<i>Percent</i>		<i>Number</i>	<i>Percent</i>
January	100	95.26	September, 1959	50	99.83
February	150	97.85	October, 1959	150	100.00
March	150	99.88	November, 1959	150	88.10
April	150	94.83	December, 1959	100	95.56
May	150	96.00	January, 1960	100	99.03
June	50	98.17	February, 1960	50	96.72
July	50	96.88	March, 1960	50	97.05
August	50	99.76			

be made when parasitization was already of this magnitude. In addition, no predators were noted attacking eggs although frequent observations at different times of the day were made.

PUPAL AND LARVAL PARASITIZATION AND PREDATION

Attention then was focused on larval and pupal stages. Three parasites have been used with considerable success in the Caribbean and in South America to combat the moth borer. These are *Lixophaga diatraeae* Townsend and *Metagonistylum minense* Townsend (Diptera:Tachinidae), and *Paratheresia claripalpis* Vander Wulp (Diptera:Dexiidae). In a preliminary survey during 1959 and 1960 large numbers of borer puparia were hatched out but no parasites were found. Then, between April 17 and August 3, 1960, a series of 197 middle- and late-instar larvae were placed within sugarcane joints treated with Copper-A fungicide and sealed at each end with wax. One hundred and twenty-one moths were reared from these larvae. An additional 11 larvae pupated and emerged but were trapped in the emergence tunnel. The remainder of the larvae died, probably from fungus infections or other unfavorable environmental factors. Only two small flies were found in the entire lot of jars. These were a nonpredatory species of Chloropidae, *Hippelates peruanus* Becker. None of the host-specific tachinid or dexiid predators were found.

This series of observations made it reasonably certain that St. Croix had none of the predators which have been such useful control organisms elsewhere. Reports from other locations (1, 2, 3) indicated that *Lixophaga* would probably be best suited to our rather dry conditions. Arrangements were made with the Commonwealth Institute of Biological Control in Trinidad, B.W.I., to purchase puparia of *Lixophaga*, and four shipments were made by airmail on August 17 and 26, September 26, and October 21, 1960. All arrived in good condition and were placed in rearing cages where they were hatched out and kept for one additional week to insure a high mating percentage. Desiccation produced high mortality in our first shipment, after which a new and better type of box was devised by Oliver Skov of our Station. Subsequent shipments sustained almost no mortality. Mated flies were placed in the field at a number of points having variable rainfall, in an effort to assure their survival. A total of 3,050 flies was liberated in the principal cane-producing areas indicated in the following tabulation:

<i>Location</i>	<i>Date and number of flies</i>
River	Sept. 2, 1960 (350)
Bonne Esperance	Sept. 1, 1960 (350), Oct. 6, 1960 (400), Oct. 29, 1960 (300), Oct. 30, 1960 (250), Nov. 4, 1960 (300)
Barren Spot	Aug. 29, 1960 (200)
Lower Love	Sept. 7, 1960 (250), Oct. 6, 1960 (350)
Diamond	Sept. 7, 1960 (300)

Dates of release were from August 29 to November 4, a period during which rainfall varied considerably. Numbers released are shown in parentheses.

The first check on success of the introduction was made between December 20, 1960 and January 5, 1961. Five man-hours of field net-sweeps took a total of seven live flies. So much effort was required to catch these that it was decided to rear from a series of infested joints as had been done in the past. Eighty-nine joints were obtained from Estate Bonne Esperance on May 15, were waxed, and placed in jars covered with a very fine cloth. After 30 days the samples were examined. From 89 joints utilized in this study, 51 moths emerged, 2 viable pupae were found, 28 larvae had died, and 10 *Lixophaga* flies were also found. Most of the larval mortality of the borers again appeared to have been caused by fungus rather than the flies; dead larvae were found in only two out of eight bottles in which flies emerged.

The 10 flies found indicate that, after several generations *Lixophaga* is still present and may be established permanently. This introduction was beset by rather severe weather conditions. During the field release rainfall was abnormally heavy, while from January until 1961 it was exceptionally dry. It would appear that those that have survived have been rigidly selected and may do well in the future on St. Croix.

SUMMARY

A study of *Diatraea saccharalis* F. (Lepidoptera:Crambidae) and its effects upon sugarcane was made from 1958 through 1960 on St. Croix in the U.S. Virgin Islands. *Diatraea* is our principal sugarcane pest, its attacks on B.37161 cane ranging up to 43.94 percent of all joints bored during the study period. Parasitization of *Diatraea* eggs by *Trichogramma minutum* Riley (Hymenoptera:Trichogrammatidae) averaged over 97 percent. Pupae and larvae were not found to be parasitized, so *Lixophaga diatraea* Townsend (Diptera:Tachinidae) was imported and released at five locations on the Island. Nine months after release this tachinid fly was apparently established.

RESUMEN

Durante el 1958 al 1960, en la isla de Santa Cruz, Islas Vírgenes, se llevó a cabo un estudio de la *Diatraea saccharalis* F. (Lepidoptera:Crambidae) y los efectos de sus ataques a la caña de azúcar. La *Diatraea* es la plaga más nociva de nuestros cañaverales; sus ataques a la variedad B.37161 constituyeron hasta un 43.94 por ciento de todos los entrenudos observados durante el periodo del estudio. El parasitismo de los huevos de la *Diatraea* por el *Trichogramma minutum* Riley (Hymenoptera Trichogrammatidae)

llegó a un 97 por ciento en promedio. Las pupas y larvas no se encontraron parasitadas por lo cual se importó el *Lixophaga diatraea* Townsend (Diptera:Tachinidae) y se distribuyó en cinco sitios de la Isla. Al cabo de nueve meses parece que esta mosca taquinida quedó establecida aquí.

LITERATURE CITED

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