THE TOBACCO BUDWORM[1] ON ST. CROIX, U. S. VIRGIN ISLANDS: HOST PLANTS, POPULATION SURVEY AND ESTIMATES[2,3]

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ABSTRACT

The maximum tobacco budworm, *Heliothis virescens* (F.), population on St. Croix occurs during October and November, while the low is during June, July and August. Pigeon pea and *Bastardia* serve as the principle host plants throughout the year. Population estimates show the species at a sufficiently low level to make St. Croix an excellent location for suppression or eradication studies.

St. Croix, a member of the U. S. Virgin Islands, is situated in the Caribbean Sea 60 miles southeast of Puerto Rico. It has an area of 84 miles[2] and offers diverse ecological situations seldom found on a small land mass. Stanley et al. (1971) gave detailed information concerning the physical features and environment. Since St. Croix is so isolated and thus potentially suitable for evaluation of suppression and eradication techniques against the tobacco budworm, *Heliothis virescens* (F.), a population survey was conducted there from October 1970 to September 1971. In addition, considerable host plant data have been collected, as well as a population estimate.

METHODS AND MATERIALS

The survey system involved the periodic operation of sticky traps baited with virgin female *H. virescens* as described by Snow and Copeland (1969). These traps were constructed of quart plastic containers that had openings in each end and were coated inside with a thin layer of Stickem[R]. From 4 to 5 virgin females were held within the trap in smaller plastic cages and provided with a small piece of sponge soaked in sugar water. A total of 28 sites was selected for traps and all types of terrain were represented. The traps were placed at 4-ft elevations on fences or stakes and were serviced twice weekly by replacing the entire trap unit; thus, the bait females were usually in the field for 3 or 4 nights only.

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In the release and recapture experiment, we used males reared on meridic diet at Brownsville, Tex. and shipped as pupae to St. Croix. Calco oil red N-1700^R dye had been incorporated into the larval diet so the moths were marked internally (Hendricks and Graham 1970). The newly emerged adults were collected daily, cooled at 50°F for 30 min, and placed in pre-chilled insulated jars for irradiation (32 krad). After irradiation, the moths were placed in 1-gal cages (50 males per cage) and held outdoors until late evening at which time 50 males were released at each of 10 locations. All points on the island were within a 2-mile radius of a release site. The release of 500 males per night was made for 7 consecutive nights during which no traps were operated (to allow the number of marked insects to become stabilized). At the end of the week, 100 sticky traps, 15 grid traps, and 50 light traps were placed in operation. Daily releases of 500 males per day were then continued for 4 more days until all 3 trap systems were operated and the capture recorded. Thereafter, no releases were made, and the grid traps were operated daily to determine how long the marked insects remained in the environment.

The sticky traps were of the type and operated in the same manner as in the survey; the light traps were of the type described by Stanley et al. (1964); and the grid traps were of the type described by Kishaba et al. (1970) with slight modifications. The charged rods were spaced ½ in. apart in a cylindrical pattern with 4,000 v AC applied across the elements. Ten virgin females were used as bait. All 3 types of traps were placed randomly over the island, with independent randomization of each type.

Suspect host plant species have been examined for tobacco budworm eggs and larvae since 1967. After finding larvae on a plant periodic samples were made to determine the infestation level and relative importance of the plant species in the population dynamics of the insect.

Results

Population Survey

The data for the survey have been combined into 2-week averages which are reported in Table 1 as the average capture/trap-night. A shortage of virgin females often prevented continuous operation so the actual number of nights trapped within each 2-week period are given. The population appeared to be at a maximum at the initiation of the trapping in October 1970. The lowest population occurred during June and July 1971, probably because of an extreme drought. All 28 traps caught males at some time, but more were captured in the arid eastern areas.

Host Plants

The host plant situation on St. Croix is complex, and includes several species of plants and ovipositional patterns by the insects.

Pigeon pea, *Cajan cajan* (L.), appears to be the most important budworm host. The plant is a bushy branched perennial growing up to 2 m high and is a favored food by Virgin Islanders. Pods and blossoms can be found at all times of the year and oviposition is usually on the pod. After eclosion from the eggs, there is some feeding on the outside of the pod by small larvae but they soon eat into the pod and consume the beans. Thirteen eggs and 1 larva/pod have been the maximum infestation. The normal level has been about 0.05 larvae and 0.20 eggs/pod. Tobacco grown for experimental reasons near pigeon pea has shown lower egg and larval population levels than the adjacent peas.

TABLE 1. CAPTURE OF TOBACCO BUDWORMS IN 28 STICKY TRAPS DURING 2-WEEK PERIODS (AVERAGE NIGHTLY CAPTURE/TRAP).

Time period	Total days trapped	Average capture/ Trap/Day
Oct. 12-25, 1970	11	1.86
Oct. 27-Nov. 8	8	0.71
Nov. 9-22	0	
Nov. 23-Dec. 6	3	1.02
Dec. 7-20	3	0.21
Dec. 21-Jan. 3, 1971	14	0.22
Jan. 4-17	7	0.58
Jan. 18-31	11	0.11
Feb. 1-14	13	0.24
Feb. 15-28	14	0.63
Mar. 1-14	14	0.16
Mar. 15-28	14	0.11
Mar. 29-Apr. 11	0	
Apr. 12-25	14	0.39
Apr. 26-May 9	14	0.07
May 10-23	10	0.27
May 24-June 6	14	0.28
June 7-20	8	0.09
June 21-July 4	12	0.01
July 5-18	0	
July 19-Aug. 1	7	0.11
Aug. 2-15	4	0.12
Aug. 16-29	4	0.43
Aug. 30-Sept. 12*	4	0.51

*Based on captures in 100 sticky traps.

The malvaceous plant, *Bastardia viscosa* (Kth.), appears to be the second most important budworm host on St. Croix and infestations often exceed those found on pigeon pea. This plant is fairly pubescent and very sticky to the touch. The plant occurs throughout St. Croix but mostly in the flat areas receiving 25-40 in. of rain. The plant is regularly attacked, with most oviposition and feeding on the upper leaves and fruit.

Turkey berry, *Solanum torrum* Sw. Prodr., a rather high and stout branched plant with fruit about 10 to 14 cm diam, is fairly abundant in the northwestern hills. The maximum attack level has been 8 eggs and 0.5 larvae/flower head. However, population levels are usually below this level and based on abundance and the sporadic nature of infestations, the plant probably is of importance only at certain times of the year.

Beggar's lice, *Desmodium spp.*, is a perennial herb sparsely found in low to high elevations throughout the 30-60 in. rainfall area of St. Croix. Occasionally the plant has been found heavily infested with eggs and larvae. However, in terms of budworm survival on St. Croix the plant is probably of little importance.

Other wild plants that are occasionally attacked on St. Croix are Pop Bush, *Passiflora foetida* L., and Spider-Flower, *Cleome spinosa* Jacq. Enum. Other wild host species probably exist that have not been found. Populations of the tobacco budworm have been found on the pods of okra when it is available. Generally pods are harvested while larvae are small and the acreage is extremely limited. Therefore, the plant probably contributes little to the island budworm population.

Population Estimate

The results of the release and recapture experiment are shown in Tables 2 and 3. Table 2 reports the capture in the 3 trap systems from 3 to 7 Sept., a period during which daily releases were being made. During the 4 nights the 15 grid traps caught over twice as many native and released males as the sticky traps. Only 1 native male was positively identified from a light trap. The large number of other species caught in light traps made identification difficult, though the inefficiency of these traps compared with grid and sticky traps was apparent.

TABLE 2. CAPTURE OF MARKED AND NATIVE TOBACCO BUDWORM MALES IN 3 TYPES OF TRAPS FROM 3 SEPT. TO 7 SEPT. (4 DAYS CAPTURE).

Type trap*	Capture		Ratio
	Marked	Native	Marked:Native
50 light traps	0	1	—
15 grid traps	91	473	1:5.20
100 sticky traps	27	202	1:7.48
Totals	118	676	1:5.73

*Sticky traps baited with 5 virgin females and grid traps with 10 virgin females.

As shown in Table 2, a total of 118 released and 676 native males were captured, a 1:5.73 ratio. Thus it would have required the release of 2865 males/day (instead of 500) to achieve a 1:1 ratio of natural to marked males. To achieve ratios necessary to attempt suppression or eradication at this population level (by the sterile male technique) 28,650 males per day would have been required to achieve a 10:1 ratio and 57,300 males per day to achieve a 20:1 ratio. However, if the releases had begun in June or July when sticky traps were catching only 0.10 males per night (they were catching 0.51/night at the time of the population estimates), presumably only 1/5 as many released males would be needed. These estimates are valid for Brownsville-reared insects treated and handled in the procedures used in our experimentation. In this type of estimate, mortality factors, vigor of the released insects, etc., are automatically incorporated into the population estimate.

The 676 native insects caught from 3 to 7 Sept. were taken from all areas of St. Croix ranging from the drier eastern tip (less than 25 in. rainfall/year) to

the rain forests in the northwestern hills (average 60 in. rainfall/year). Apparently, the species is able to infest the entire island.

The captures in the 15 grid traps are reported by dates in Table 3. The last release of marked males was made 7 Sept., but marked males were recovered for the next 8 days. This daily operation of the grid traps was intended to demonstrate the daily loss of released insects in the environment. Virgin females are not equally attractive each night so this evaluation can not be considered valid. Nevertheless, the fact that these released males survived for 8 nights is important. All indications show St. Croix as an excellent location for suppression or eradication studies for the tobacco budworm.

TABLE 3. CAPTURE OF NATIVE AND MARKED TOBACCO BUDWORMS IN 15 GRID TRAPS BAITED WITH VIRGIN FEMALES AFTER TERMINATION OF RELEASES ON 7 SEPT.

Date operated	Age of bait (days)	Capture	
		Native	Marked
Sept. 3-7	1-4	473	91
Sept. 8	1	103	29
Sept. 9	2	230	40
Sept. 10	3	139	14
Sept. 11	1	168	14
Sept. 12	2	180	8
Sept. 13	3	122	9
Sept. 14	1	158	6
Sept. 15	2	202	2
Sept. 16	3	178	0

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