AEDES SOLLICITANS AND *A. TAENIORHYNCHUS* LARVAL EMERGENCE FROM SOD SAMPLES[1]

C. M. ELMORE, JR., AND R. W. FAY

One method for evaluating the mosquito production potential of various salt marsh areas has been based on counts of larvae from flooded sod samples. The present study on the sod sampling technique was made to determine the variation in the numbers of larvae hatching introduced by different temperatures prior to and at the time of flooding, by the original distribution of the mosquito eggs, and by seasonal differences in the time of flooding.

A salt marsh area located about one-half mile north of the Savannah River near Elba Island, Georgia, was selected for study. The area, essentially level and about 8 feet above mean low water, was flooded only by the highest spring tides and by heavy rainfall. Plant growth was a uniform stand of *Distichlis spicata* which had been burned off to about 2 inches above the surface in late December, 1955.

On January 9–10, 1956, 108 sod samples of 0.2 sq. ft. each were cut to a depth of 2 inches from an 11 x 22 ft. area. Each sample was boxed in a 1-gallon cardboard container. On January 11, groups of 36 samples were stored at 60°, 70°, and 80° F., respectively. Initial flooding at each of the three storage conditions was begun on the same day. For flooding, a sample was transferred to a battery jar and sufficient water was used to cover plant material during a 24-hour period. Three sod samples were flooded each day for 12 days so that the last samples were under storage conditions, including the 24-hour flooding period, for 12 days. After a flooding period, the water was poured off carefully and the larvae were designated as hatch 1. Each sample then was held for an additional 10 days at 80° F. and 70 percent relative humidity and then reflooded for 24 hours. Larvae secured were designated as hatch 2. The viable egg population was taken as the sum of the two hatches for any given sod sample.

The effects of air temperature and of flood water temperature at the three storage conditions upon the hatching of salt-marsh mosquito eggs were measured by comparing the numbers of larvae from hatch 1 with the total larvae from hatches 1 and 2, for each three samples at each test interval. These results (table 1) demonstrate that storage of the sod at 60° F. and flooding with water at 60° F. did not produce any increase in the hatch over the 12-day test period. After 7 days at 70° F., there was some increase in hatch. After 3 days at 80° F. there was an essentially continuous increase in the percentage of eggs hatching, passing the 90 percent level on the seventh day. Although there is a progressive increase in the total larvae from hatch 1 and 2 for storage conditions of 60°, 70°, and 80° F., this increase was not statistically significant.

Larvae, recovered from flooding each set of three sod samples under given conditions, were combined and a random sample of 25 first instar larvae was taken for species identification. The remaining larvae were reared using 200 larvae in 1 liter of tap water for each porcelain enamel pan. A second sample of 25 larvae for identification was taken when the larvae reached the fourth instar.

First instar larvae of *Aedes sollicitans* and *A. taeniorhynchus* were readily distinguished under the microscope by the arrangement of the four subapical and terminal antennal hairs. *A. sollicitans* has two long and two short hairs while *A. taeniorhynchus* has one long and three

[1] From the Communicable Disease Center, Bureau of State Services, Public Health Service, U. S. Department of Health, Education, and Welfare, Savannah, Georgia.

TABLE 1.—Salt marsh mosquito eggs hatching from sod samples after storage and flooding under test conditions. Values represent combined results of three sod samples

Days of Conditioning [1]	Store at 60° F.			Stored at 70° F.			Stored at 80° F.		
	Hatch 1	Hatch [2] 1 and 2	Percent (Hatch 1)	Hatch 1	Hatch [2] 1 and 2	Percent (Hatch 1)	Hatch 1	Hatch [2] 1 and 2	Percent (Hatch 1)
1	33	570	6	14	688	2	61	556	11
2	37	1040	4	40	935	4	107	1069	10
3	11	1111	1	124	603	21	182	804	23
4	33	1301	2	32	663	5	614	1081	57
5	14	447	3	16	321	5	407	622	65
6	5	341	2	84	799	11	1153	1386	83
7	13	1358	1	34	180	19	1226	1308	94
8	19	577	3	835	2698	31	425	446	95
9	34	674	5	247	984	25	1587	1718	92
10	38	392	10	106	445	24	871	964	90
11	43	797	5	390	1068	36	568	591	96
12	14	616	2	247	818	30	546	553	99
Total	294	9224		2169	10202		7747	11098	

[1] Days of conditioning include days of storage and a 24-hour flood period at storage conditions.

[2] Hatch 1 & 2 or total hatch includes original storage & flooding and additional 10-day storage at 80° F. and 70 percent relative humidity and a second 24-hour flooding period.

short hairs. Under storage and flooding conditions of 60° F., the larvae produced were *A. sollicitans; A. taeniorhynchus* represented less than 3 percent in the total first instar larvae identified. With conditioning at 70° F., samples for 1 to 3 days produced no *A. taeniorhynchus* larvae, and then the proportion of this species gradually rose so that the 7- to 12-day samples showed the two species in about equal numbers. At 80° F., only a few *A. taeniorhynchus* hatched in 1 or 2 days of conditioning. Thereafter, the numbers of *A. taeniorhynchus* rapidly exceeded those of *A. sollicitans.* Using the proportions represented in the identified first instar samples for hatch 1 and hatch 2, calculations of the number of each species in the total hatch of 30,536 larvae gave three estimates of species distribution from combined 60°, 70°, and 80° tests, namely: *A. sollicitans,* 21.2, 22.4, and 22.3 percent; and *A. taeniorhynchus,* 78.8, 77.6, and 77.7 percent. Based on the combined results for all temperatures, the values were *A. sollicitans,* 22.0 percent and *A. taeniorhynchus,* 78.0 percent.

Although *A. sollicitans* larvae were essentially all that emerged at 60° F., only about 25 percent of the available *A. sollicitans* eggs hatched when results from hatch 2 were considered. Under 70° F. conditioning for 1 to 6 days, about 40 percent of the *A. sollicitans* eggs hatched, with 7 to 12 days conditioning about 70 percent of the eggs hatched. Only 1 percent of the *A. taeniorhynchus* eggs hatched during the first 6 days at 70° F. and about 16 percent with 7 to 12 days of conditioning. At 80° F. about 40 percent of each species hatched with 1 to 6 days of conditioning and about 95 percent with 7 to 12 days conditioning.

The samples of fourth instar larvae taken from the rearing pans also were used to estimate the species proportions. The two species were distinguished primarily by differences in the comb scales on the eighth abdominal segment. Using the proportions in the identified fourth instar samples for hatch 1 and hatch 2, calculations of the number of each species in the total pupal production and the fourth instar samples (11,738 individuals) were made. For purposes of comparison, the estimates again were based on tests from combined 60°, 70°, and 80° F. samples. *A. sollicitans* represented 26.0, 31.6, and 27.1 percent, while *A. taeniorhynchus* represented 73.9, 68.3, and 72.8 percent. Combined results for all temperatures gave *A. sollicitans,* 28.4 percent and *A. taeniorhynchus,* 71.6 percent. Comparison between these values and those obtained from the identified first instar larvae indicate that *A. sollicitans* was favored by the rearing procedure used.

Of the 8475 adults which emerged, 25.9 percent were *A. sollicitans* and 74.1 percent were *A. taeniorhynchus.* Males exceeded the females in both species by less than 1 percent.

Although the field area selected for sampling was uniform in elevation, plant growth and composition, the viable egg populations in the 0.2 sq. ft. sod samples varied from 14 to 1444 eggs per sample, with a mean of 283 eggs per sample, and a standard deviation of 229 eggs per sample. The samples grouped by population sizes were distributed as follows: 0 to 100 eggs—19 samples; 100 to 200 eggs—26 samples; 200 to 300 eggs—25 samples; 300 to 400 eggs—16 samples; 400 to 500 eggs—8 samples; 500 to 600 eggs—5 samples; 600 to 700 eggs—5 samples; 1 sample each in the 800 to 900 and the 900 to 1000 groups; and 2 samples having over 1000 eggs. There was no evidence of any stratification in the areal distribution of the populations listed.

Some study was made to determine progressive changes in the field area with an advancing season. A second series of 40 samples, taken from the area on February 24, 1956, were held for 10 days at 80° F. and 70 percent relative humidity. When flooded for 24 hours in groups of 10 samples each the average hatches were 108, 212, 115, and 164 larvae per sample with a mean of 150 larvae per sample. A third series of 48 samples taken on March 22,

1956, were flooded in three groups of 16 samples each. Total average hatches per group were 152, 97, and 152 per sample, or a mean of 133 larvae per sample. A fourth series of 48 sod samples taken on April 19, 1956, were flooded in groups of 16 samples each. The average hatch per sample in each group was 23, 24, and 27 larvae, or a mean of 25 larvae per sample. A fifth series of 32 samples was taken on May 29, 1956, and yielded a mean of 13 larvae per sample. The last series, 32 samples, was collected from the field area on June 29, 1956, and gave a mean of only 2 larvae per sample. This progressive decrease in the numbers of larvae from the samples as the season advanced was due largely to natural flooding of the area by the spring tides and heavy rains. There was little apparent replacement of the eggs in this particular area by the population produced. In view of the studies with sod samples held over periods of 1 to 4 months (Bidlingmayer and Schoof, 1956), there was a gradual loss in viable eggs during January-May with marked loss during late June. The periodic flooding, as well as a loss in viable eggs, may account for the progressive seasonal decrease in egg hatch shown in the present study.

SUMMARY. Results from flooding sod samples of *Distichlis spicata* taken from an area of salt marsh having uniform elevation and plant growth show that the estimates of the production potential of *Aedes sollicitans* and *A. taeniorhynchus* may be influenced by the following factors: (a) temperature conditions during a preflood period; (b) counts and identification based on 1st instar larvae, 4th instar larvae, or on emerging adults; (c) a wide range in the numbers of eggs per sample from a relatively small area; and (d) the season of the year at which samples are taken from the field.

References

BIDLINGMAYER, W. L., and SCHOOF, H. F., 1956. Studies on the viability of salt-marsh mosquito eggs. Mosquito News 16(4):298–301, Dec. 1956.

CDC COURSES IN INSECT AND MOSQUITO CONTROL IN FY 1959

The Insect and Rodent Control Training Section of the Communicable Disease Center, Public Health Service, Atlanta, Georgia, is holding courses during the fiscal year 1959, which may be of interest to readers of *Mosquito News*.

Insect Control	September 15–26, 1958
Mosquito Control	November 3–7, 1958
Biology and Identification of Arthropods of Public Health Importance	January 12–23, 1959
Epidemiology and Control of Vector-Borne Diseases	February 16–20, 1959
Insect and Rodent Control	June 1–12, 1959

There is no charge for this training in any of the courses, but persons attending should make their own arrangements for travel and living accommodations. Preference will be given to interested personnel from State and local health departments, the Public Health Service, members of the Armed Forces, and mosquito abatement districts. Additional information about these courses will be found in the "CDC Training Program Bulletin" which may be seen in State and local health departments.

Applications should be made through the sponsoring agency to Chief, Training Branch, Communicable Disease Center, Public Health Service, Department of Health, Education, and Welfare, 50 Seventh Street, N. E., Atlanta 23, Georgia.