EFFECTS OF SALINITY ON SITE SELECTION BY OVIPOSITING TREE HOLE MOSQUITOES IN LOUISIANA

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ABSTRACT. When oviposition of tree-hole mosquitoes in artificial habitats containing various dilutions of saline water was studied, *Orthopodomyia signifera* (Coquillett) oviposited more frequently and *Aedes triseriatus* (Say) less frequently as salinity (measured as electrical conductivity) increased. Also, larval *O. signifera* were collected significantly more often than *A. triseriatus* from traps with higher conductivity. Water in traps containing *O. signifera* had an average electrical conductivity of 4.6 mmho/cm compared with 3.2 mmho/cm for *Aedes triseriatus*.

Four other species of mosquitoes were collected from the traps, but the numbers were insufficient for meaningful comparisons.

INTRODUCTION. Four species of mosquitoes, *Aedes triseriatus* (Say), *Anopheles barberi* Coquillett, *Orthopodomyia signifera* (Coquillett), and *Toxorhynchites rutilus septentrionalis* (Dyar and Knab) are commonly found breeding in cavities of trees in southwestern Louisiana. These four species have been reported to be associated in tree holes and, on occasion, in artificial containers (Jenkins and Carpenter, 1946; King *et al.*, 1960; Horsfall, 1955), but a definite relationship seems to exist between the chemical makeup of the water in the tree holes and the species of mosquitoes occupying them. For example, Petersen and Chapman (1969) reported that *T. r. septentrionalis* and *Anopheles barberi* were generally collected from habitats characterized by high salinity; *O. signifera* was taken over the entire range of salinity; and *Aedes triseriatus* was generally restricted to habitats with low salinity. However, these investigators did not establish whether the chemical differences or the physical factors causing the chemical differences were responsible for the distribution of the species. The present study was conducted from August 1968 to October 1969 at the Gulf Coast Marsh and Rice Field Mosquito Investigations Laboratory, Lake Charles, Louisiana in an attempt to determine the importance of salinity (measured as electrical conductivity) in the selection of suitable breeding sites by tree hole mosquitoes in southwestern Louisiana.

MATERIALS AND METHODS. Four sets of six oviposition traps each were made from bamboo stalks cut to form open-topped containers about 30 centimeters deep by 7 centimeters in diameter. Since the bamboo was green, the containers seasoned in the field for about a month with weekly changes of tree hole water, until they became attractive to mosquitoes. Water for use in the test was obtained from natural tree holes containing high conductivity water, filtered through a 100-mesh screen, held for at least one week, and filtered again to prevent contamination by naturally occurring mosquitoes; distilled water was used to dilute the natural water to obtain the desired conductivity. Then 300 mls of 6 dilutions with measured electrical conductivities ranging from 0.8 to 80 mmhos/cm (EC x 10^3) were added to each of the six containers in each set.

In August, 1968, the four sets of traps were set out in wooded areas southeast of Lake Charles, three in rot cavities in trees and the fourth at ground level in a hollow stump. The traps were collected every 2 weeks during the summer, and once a month during the winter, and were returned to the laboratory where the conductivity of the water was determined and any larvae present were identified.

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Then the containers were filled with tap water and held 24 hours to hatch eggs that might have been laid above the water line. After any additional larvae were removed, the containers were filled with hot water (55° C) for 10 minutes to kill any viable eggs remaining. Then fresh dilutions of tree hole water, obtained as before, were made up, and the containers were refilled and returned to the collection sites. Since the conductivity of the water in the containers varied while the traps were in the field, all values reported were those measured when the containers were returned to the laboratory. Where necessary, larvae were reared to the fourth instar for positive identification.

Measurements of conductivity were made on a conductivity bridge; values are reported in millimhos per cm at 25° C (mmho/cm).

RESULTS AND DISCUSSION. Six species of mosquitoes were recovered from the traps during the study; *O. signifera* 56 times, *Aedes triseriatus* 40 times, *Anopheles barberi* and *Culex pipiens quinquefasciatus* Say 5 times, *T. r. septentrionalis* 3 times, and *Culex restuans* Theobald once. The first three species were collected from all four collecting sites, and *C. p. quinquefasciatus* and *T. r. septentrionalis* were collected from three of the four sites. During the study, no relationship was evident between the frequency of use of the containers for oviposition by these mosquitoes and the amount of precipitation, though we had thought that the traps would become more attractive as the natural habitats were reduced during dry weather. Actually, the greatest activity occurred during May (20 traps contained larvae), though the combined rainfall for April and May was 16.18 inches, far above normal. In contrast, activity in June was somewhat lower (15 traps contained larvae), though only 0.84 inch of rain fell during that month.

Larval *O. signifera* were found in collections from May through November; larval *Aedes triseriatus* were found in traps every month of the year except January. Peak oviposition activity of *Aedes triseriatus*, as indicated by new larvae, occurred during May, June, and July; and from September through March, activity was limited to only one or two traps each month. *Anopheles barberi, C. p. quinquefasciatus,* and *T. r. septentrionalis* were collected infrequently from June through October, and *C. restuans* was collected once during December.

The mean conductivity of all traps containing *O. signifera* was 4.6 (1.1–15.0) mmho/cm compared with 3.2 (0.8–7.0) mmho/cm for *Aedes triseriatus* (Table 1).

TABLE 1.—Mean conductivity of water in artificial tree holes (traps) used by ovipositing females of six species of mosquitoes.

Mosquito species	No. of times collected in traps	Mean electrical conductivity of water (mmhos/cm) (standard deviation)				
		Site 1	Site 2	Site 3	Site 4	Sites 1–4
Orthopodomyia signifera	56	4.7	4.9	3.1	4.7	4.6 (± 2.3)
Aedes triseriatus	40	5.0	3.6	4.0	2.0	3.2 (± 2.0)
Anopheles barberi [1]	5	5.4	2.6	5.1	2.8	3.9 (± 1.4)
Culex p. quinquefasciatus [1]	5	4.1	5.0	...	2.7	3.3 (± 1.9)
Toxorhynchites r. septentrionalis [1]	3	2.9	...	4.8	2.3	3.8 (± 1.3)
Culex restuans [1]	1	1.3	...	...	...	1.3

[1] So few were collected that comparisons are of doubtful validity.

Traps containing *Anopheles barberi* averaged 3.9 (2.2–5.4) mmho/cm, *T. r. septentrionalis* 3.8 (2.9–4.8) mmho/cm and *C. p. quinquefasciatus* 3.3 (0.8–6.0) mmho/cm. With the exception of *O. signifera* and *Aedes triseriatus,* no meaningful comparisons could be made between species and conductivity of the water used for oviposition because so few larvae were obtained. When *O. signifera* and *Aedes triseriatus* were compared, the mean conductivity of the water used by *Aedes triseriatus* at two of the four sites was higher than that used by *O. signifera*, but at both of these sites, the number of collections containing *Aedes triseriatus* was small (3 and 5 for sites 1 and 3, respectively). At sites 2 and 4 where the numbers were larger, the mean conductivities for traps containing *O. signifera* were much higher than for traps containing *Aedes triseriatus.* Also, when the data from the four sites were pooled and analyzed by group comparison, *O. signifera* was found to oviposit in traps characterized by higher conductivity signficantly more often ($P < 0.01$) than did *Aedes triseriatus.* However, when the sites were analyzed separately only site 4 was significantly different ($P < 0.05$) from *Aedes triseriatus.* At site 2 the difference had a probability of $0.10 < P < 0.05$. At sites 1 and 3, no valid statistical determination could be made because of the small numbers collected.

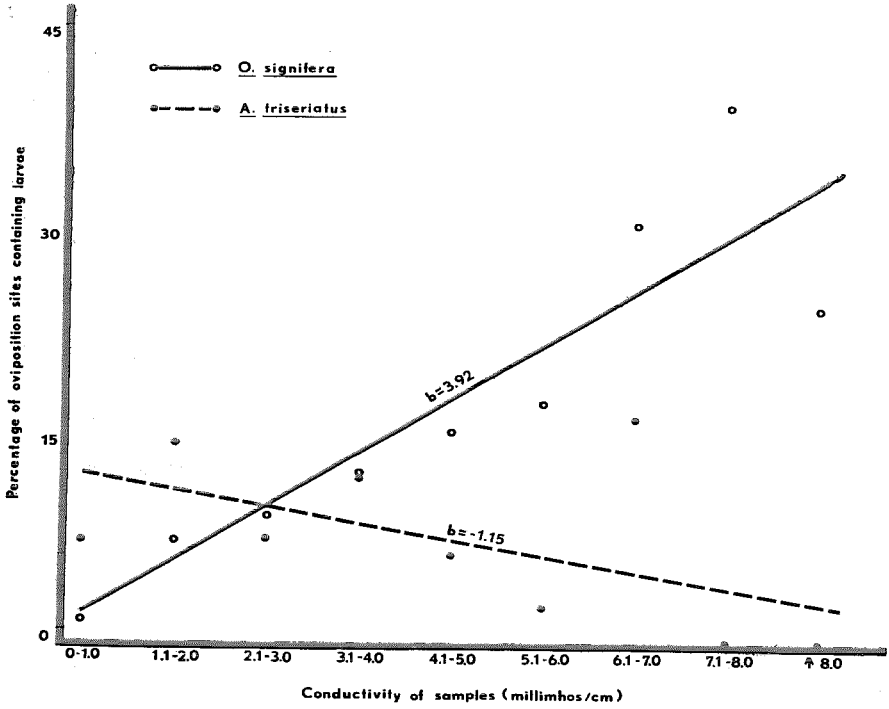

FIG. 1.—Relationship between salinity of the oviposition sites and the frequency of use by ovipositing female *Orthopodomyia signifera* and *Aedes triseriatus.*

Since some concentrations of salts were made available to the mosquitoes more often than others because of dilution by rain, percentages were calculated for the number of times each species chose to oviposit in a given range of concentrations (Fig. 1). As salinity increased, the frequency of use by *O. signifera* increased; the regression was positive (b=3.92) and was significant at the 0.01 level (F=31.8, DF=1, 7) for the concentrations of salinity used in our study. In contrast, *Aedes triseriatus* generally oviposited less frequently in traps as the conductivities of the water increased; the regression was negative (b=1.15), but it was not significant (F=2.45, DF=1, 7). We nevertheless believe that there may be a definite difference in the preference of the two species for concentrations of salts in the water occurring in tree holes.

Our results support previous observations (Petersen and Chapman 1969) that *Aedes triseriatus* is generally restricted to habitats with lower salinity and that *O. signifera* appears to have a broader tolerance to salinity. Throughout their study *O. signifera* was most often recovered from habitats with low salinity; undoubtedly, this discrepancy occurred because of the larger number of natural sites with low salinity. In the present study, *O. signifera* preferred sites with higher salinity when they were given a choice. This difference in the preference of these two species may explain in part the differences in the frequency of their occurrence in various types of habitats such as tin cans, tires, and various types of tree holes.

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Some Program Highlights (abstracted from a preliminary report by the Program Chairman, Kenneth L. Knight): . . . . Keynote address by Dr. E. F. Knipling, followed by an address by K. R. Fitzsimmons, General Manager, Agricultural Chemicals Division, Shell Chemical Company . . . . A report by W. D. Sudia on the recent VEE epidemic in the southwestern states . . . . A session on mosquito colonization and rearing organized by Gene Gerberg . . . . A special program in honor of Carlos Finlay. Details and other information will be available later.

Deadline for submission of titles for paper reading sessions is January 15, 1972.