known from the Canal Zone and Panama.

The foregoing account differs somewhat from that given by Bates (1949) of the experimental oviposition behavior of *Haemagogus spegazzinii falco* Kumm *et al.,* which he called *H. spegazzinii.* Bates states that the female was placed in a glass vial, with "a filter-paper disc in the bottom, moistened with distilled water. The mosquito was observed making exploratory movements over the disc with the tip of the abdomen, but no eggs were deposited. A slip of filter-paper was inserted into the vial until it touched the wet disc in the bottom, and then appressed to the side of the vial, making a moisture gradient. The mosquito crawled onto this, continuing the exploratory movements of the abdomen. Finally one egg was laid, at about the point on the filter paper where the moisture ceased to be visible. Then seven more eggs were laid in about five minutes. Between each egg the female explored the paper carefully with the tip of the abdomen, and usually laid another egg when she chanced to touch a previous egg—in other words, responding to irregularities in the surface . . . the tip of the abdomen was placed in close contact with the surface of the paper and drawn steadily forward (the mosquito remaining motionless except for the abdominal movement), leaving the egg adhering to the paper."

The female *H. equinus* seen ovipositing by the writer could not be observed as closely as Bates watched his *H. spegazzinii falco* female, for fear of distracting it and causing it to fly away. But apparently it made no preliminary probing movements with the tip of the abdomen, but placed its eggs at random on the moss surrounding the tree hole, at some distance from the water-line below.

Bates also quotes Wesenberg-Lund (1921, p. 75) as describing the oviposition of *Aedes communis* (de Geer), but from his account it is evident that Wesenberg-Lund did not actually observe the process, as did Bates and the writer, but only found the eggs where they had been deposited by the females.

References

BATES, M. 1949. The Natural History of Mosquitoes. The Macmillan Co., New York. (p. 93).

WESENBERG-LUND, C. 1921. Contribution to the Biology of the Danish Culicidae. Mem. Acad. Roy. Sci. et Lettres, Copenhagen, Sec. Sci., 8th Ser., 7, No. 1, 210 pp.

AN INVASION OF THE GULF COAST BY SALT-MARSH MOSQUITOES

GEORGE A. THOMPSON

Director, Jefferson County Mosquito Control District, Texas

During September, 1954 the Gulf Coast area of Texas and Louisiana was subjected to a severe invasion of the salt-marsh mosquitoes, *Aedes sollicitans* and *Aedes taeniorhynchus.* The factors that contributed to the enormous swarms that invaded the Gulf Coast communities are of interest.

During the months of June, July and August, 1954, the rainfall in Jefferson County, Texas, totaled 8.41 inches, about three inches of which fell during the last four days of August. The average rainfall of the area for this period is 16.71 inches. As a result of the reduced precipitation the coastal marshes became completely dry. The brackish marshes that extend inland as much as 30 to 40 miles also became dry. Drought conditions also prevailed in the watersheds of the Sabine and Neches rivers, further contributing to the drying of the inland marshes.

During the summer there were no high tides that reached a point that would flood the marshes. By the end of August, even

the ditches in the marshes were dry. Minnows and other natural predators of mosquito larvae were completely absent.

It had been necessary, early in the summer, to construct a temporary dam across the Neches River north of Beaumont to prevent salt water from entering the fresh water supply for the county. The dam was located about 47 miles, via the river, from the Gulf of Mexico.

In late August and early September there were rains which provided some water. High tides and high water also occurred, the tides reaching a mark of 4.1 feet above mean level. At about this time a tropical disturbance moved inshore around Brownsville. It is possible some of the tides were influenced by that storm especially since the off-shore areas of the Gulf of Mexico are very shallow and tides are considerably affected by wind velocity and direction. (As an example of the topography of this area, the Mosquito Control office is 19 miles from the nearest point on the Gulf. The elevation here is 15 feet above mean sea level. The river marshes around Beaumont are below the five foot contour.)

The water remained high for several days, allowing time for it to back up into all the low-lying areas. Observations made from the District's airplane showed vast reaches of flooded marshlands.

On the evening of September 9 swarms of mosquitoes moved into Port Arthur. On September 11 and 12 they rolled across the mid-county area and on September 13 Beaumont was invaded. The entire city of Beaumont was not covered completely until the 14th or 15th of September.

The slow flooding of the marsh areas provided for what might be termed a continuous production of salt-marsh mosquitoes. Emergence of adults occurred for at least a week, and possibly for ten days. During the prolonged emergence period, the winds in the area averaged 10 to 15 miles per hour greater than normal. There was, also, a constant changing of wind direction. Communities that were surrounded by breeding areas were invaded from the north, south, east and west on successive days. Each invasion added to the numbers already established in the community.

The combination of factors created conditions that made control measures in Jefferson County ineffective as far as the general public was concerned. As the following figures show, our operations were inadequate to provide relief, regardless of how efficient they may have been.

Surrounding our cities are at least 450,000 acres or 19,602,000,000 square feet of marshes capable of producing *Aedes sollicitans* and *A. taeniorhynchus*. Assuming an average of 10 adults emerging from each square foot, there would be 196,020,000,000 mosquitoes surrounding our populated areas. Field observations indicated that our spraying by airplane resulted in at least 99 percent kill. However, a 99 percent kill would still leave 1,960,200,000 mosquitoes to annoy a population of 250,000. Or, 7,840 mosquitoes per person!

There seems to be no one factor that caused such a massive flight. Every indication points to general conditions that were most unfavorable to the natural enemies of the mosquitoes, and favorable for the mosquitoes themselves.

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