PAPERS AND PROCEEDINGS OF THE 12th ANNUAL MEETING

OF THE AMERICAN MOSQUITO CONTROL ASSOCIATION HELD JOINTLY WITH THE JEFFERSON COUNTY MOSQUITO CONTROL ASSOCIATION

BEAUMONT, TEXAS, FEBRUARY 5-7, 1956

PART 2

TEXAS MOSQUITO PROBLEMS FROM A SPECIES STANDPOINT

R. B. EADS AND G. C. MENZIES *
Entomology Section, Bureau of Laboratories, Texas State Dpartment of Health, Austin

Marked diversity in geographical and ecological factors in Texas account for a wide range of generic and specific variation in the mosquitoes present. The rain forest pools, permanent ponds and lakes of East Texas; the salt marshes and rice growing regions of the Gulf Coast; the semi-tropical Lower Rio Grande Valley with its vast acreage of surface water; and the irrigation areas of arid West Texas produce a mosquito fauna characterized by numerous species and large populations. Texas State Department of Health records currently include approximately 75 species, exclusive of subspecies, which have been collected in the state, 8 of which do not appear to be permanently established elsewhere in the United States.

Historically, mosquito control in Texas has been motivated chiefly by efforts to control malaria and dengue; hence, species control has been directed against *Anopheles quadrimaculatus* in East Texas and the Lower Rio Grande Valley and *Aedes aegypti* in the larger cities. The gradual disappearance of malaria as a disease of consequence and the fact that the most recent outbreak of dengue occurred in 1941 have considerably lessened enthusiasm for controlling these species, although both are still quite abundant in certain sections of the state.

Population studies conducted by W. E. Burris, Aquatic Biologist, Corps of Engineers, in the vicinity of nine reservoirs in the Fort Worth district have indicated that the *Anopheles quadrimaculatus* index has not dropped substantially in the past decade. At several of the reservoirs adult counts of 500 to 1,000 per resting station have not been uncommon. With this plethora of vectors, a resurgence of malaria is an ever present possibility. In certain of our cities *Aedes aegypti* is prevalent. We have recently been identifying specimens from Dallas and Laredo. This species was found to be breeding in 12 percent of the premises inspected in San Antonio and 9 percent in Houston during a 1952 urban mosquito survey made by entomologists of the Communicable Disease Center and Texas State Department of Health.

Interest in mosquito control in West Texas has been greatly stimulated in recent years by increased mosquito annoyance and the occurrence of a considerable number of cases of arthropod-borne en-

* Deceased.

cephalitis in both human beings and horses. The population expansion in this area has been tremendous, effected chiefly by the spectacular spread of irrigation agriculture. The increase in encephalitis cases is undoubtedly a real one, although in part a reflection of improved ability on the part of the medical profession to differentiate the neurotropic virus diseases.

In Texas extensive utilization of oxidation ponds for the secondary treatment of sewage is an important factor in the production of encephalitis vectors, *Culex tarsalis* and *C. quinquefasciatus*. In consideration of the limited amount of time available to this discussion of Texas mosquito problems from a species standpoint it is felt that our principal attention should be centered on a survey now being made of the mosquito breeding propensities of these ponds.

Smallhorst, *et al.* (1953) define sewage oxidation ponds as those ponds of regular and controlled shape, depth and marginal area which have been specifically designed and constructed as waste treatment devices. Sewage lagoons are simply natural depressions, dry creeks or dammed ravines in which sewage is allowed to accumulate. Both ponds and lagoons are capable of producing satisfactory results but the present trend is toward the construction of oxidation ponds because they present less difficulty in controlling objectionable odors, weeds, and mosquitoes. Holding ponds are not intended to provide treatment for sewage as are the oxidation ponds or lagoons, but function simply as storage for the effluent during peak flows until it can be utilized in irrigation practices.

The reduction of the organic matter of sewage in these ponds by aerobic bacteria and algae has proven effective, economically feasible, and in accordance with the basic objective of water conservation. Consequently, their utilization by municipalities for treatment of both sewage and industrial wastes has been increasing tremendously, particularly since World War II.

There is as yet no general agreement as to the proper shape and size of these oxidation ponds. It is agreed that to discourage non-aquatic vegetation the depth should be maintained at 2.5 to 3 feet. Since oxygen production by algae is directly dependent upon sunlight penetration there is little to be gained by having the water over 3 or 4 feet deep. The interior dike banks are usually constructed as steeply as possible to minimize marginal shallow water.

The development of oxidation ponds or sewage lagoons in Texas has been primarily concerned with the holding of the water for irrigation. The earliest of these installations appears to have been in San Antonio. This city passed an ordinance in 1901 authorizing the construction of a ditch, dam, and reservoir on Mitchell Lake for the proper disposal of its sewage. About 1925 Abilene, Texas, began using a series of oxidation ponds for the secondary treatment of sewage and to hold the effluent for the irrigation of city farm lands. In 1929–30 an experimental oxidation pond was constructed at College Station by Texas A. & M. College; results were so satisfactory that a 14-acre oxidation lake was built in 1933. There are now well over 200 cities in Texas utilizing these oxidation ponds for secondary treatment of sewage and the number is increasing rapidly.

The sewage oxidation ponds of 37 cities have been surveyed for mosquito breeding since June, 1953. Mosquito larvae were discovered in 23, or 62 percent, of these systems, 9 with only *Culex quinquefasciatus*, 6 with only *C. tarsalis* and 8 with both species. Other *Culex* taken from the ponds included a single collection each of *salinarius* and *thriambus*. Inspections were made during all seasons of the year and breeding was demonstarted during both winter and summer. Particularly in the southern half of the state the cold is seldom severe enough to do other than lengthen larval developmental periods.

The magnitude of the mosqito problem presented by the oxidation ponds surveyed has been directly proportional to the effectiveness of the management of grass and

other plants on the banks and in the ponds. To prevent erosion newly constructed soil banks are usually sodded with Bermuda grass. Unless this grass is mowed short it will hang over into the water and provide a favorable refuge for mosquito larvae. Elimination of the various types of emergent aquatic vegetation from the body of the ponds has not been observed to be much of a problem. Unless good vegetation management practices were in effect at the oxidation ponds which have been inspected, heavy mosquito breeding has almost invariably been found.

Mosquitoes actually breeding in the oxidation ponds constitute but a part of the over-all problem. During our survey extensive larval development has also been noted in close association with the ponds in such areas as ditches or potholes fed with seepage from the ponds. Often depressions have been created by shoveling out the dirt to build the pond dikes. These became hazards when filled with rain or seepage water. In the 37 cities surveyed mosquito breeding adjacent to the oxidation ponds was seen in 12 cases. *Culex tarsalis* and *C. quinquefasciatus* were the common mosquitoes but the collections also included several species of *Aedes* and *Psorophora*. In a single instance *Anopheles punctipennis* was taken.

The oxidation ponds may also be of importance in the production of *Culex* and a variety of other mosquitoes as a result of effluent disposal. At 17 of the 37 cities surveyed, mosquito breeding was resulting from improper handling of effluent irrigation water or in creeks receiving the effluent. *Culex tarsalis* and *C. quinquefasciatus* were the usual mosquitoes taken although *Aedes, Psorophora* and occasionally *Anopheles* were also being produced in quantity.

In summary, well over half of the oxidation ponds being utilized by municipalities for secondary sewage treatment which we have surveyed have been breeding *Culex tarsalis* and/or *quinquefasciatus* either in the ponds, in adjacent seepage water, or in the effluent from the ponds. The production of encephalitis vectors threatens seriously to impair the usefulness of this valuable development in sewage treatment. However, it is felt that this problem can be alleviated by training the sewage plant operators in basic mosquito control techniques. In adequately designed oxidation ponds mosquito control is largely a matter of proper vegetation management and should require minimal use of insecticides.

Reference

SMALLHORST, D. F., WALTON, B. F. and MEYERS, JACK. 1953. The use of oxidation ponds in sewage treatment. Read before Engr. Sect., APHA meeting, No. 10, 1953.