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MOSQUITO CONTROL AT NASA'S MISSISSIPPI TEST OPERATIONS

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The mosquito control program at NASA's Mississippi Test Operations is unique among organized mosquito control programs in this area for several reasons: First, the area under control has no permanent residents, only transient employees of NASA and its contractors, many of whom have never lived in an area with a serious mosquito problem. Secondly, the program is under the supervision of a non-governmental agency, the General Electric Company, which is NASA's support contractor at M.T.O.

Mississippi Test Operations consists of two areas, the Fee Area and the Buffer Zone.

The Fee Area consists of approximately 13,500 acres of pine forest and hardwood swamps. This is the area where all work activity will be concentrated.

The Buffer Zone is an unpopulated area consisting of approximately 128,500 acres. The north and south-central portion of the Buffer Zone is made up of flat, poorly drained pine forest. Southeast and bordering the Fee Area is a 20-square-mile pine and hardwood swamp referred to as the "Devil's Swamp."

The Pearl River Swamp acts as the western boundary of the Fee Area. Beginning at the northwest corner of the Buffer Zone, it is already some 5 miles wide and extends 20 miles south to the Gulf of Mexico at Lake Borgne, at which point it is approximately 18 miles wide. North of Highway 90 it is primarily a very dense hardwood swamp, criss-crossed by the three branches of the Pearl River and numerous small bayous and streams. At a point just north of Highway 90, the tree swamp begins a transition into a grassy salt marsh. Within 20 miles of the Fee Area there is approximately 50,000 acres of grass salt marsh and some 50,000 acres of river flood plain tree swamps.

During most of 1963, salt-marsh mosquitoes, *Aedes sollicitans* and *Aedes taeniorhynchus,* and the flood-water mosquito, *Aedes vexans,* were present in astronomical numbers. *Aedes sollicitans* were the primary problem, however. Head nets and mosquito repellent had little effect. The Corp of Engineers estimated that work efficiency at M.T.O. due to mosquitoes was 25 percent less than that which could be normally expected, and in addition, some crews left their jobs.

With the mosquito annoyance so severe, it was decided to employ airplane spraying in July of 1963, due to the fact that no organized mosquito control program was in existence on the site. During the period of July 17 through 26, malathion

was applied in oil at the rate of 0.2 lb. per acre, giving control up to several weeks. The cost of this one treatment was $30,000.00. This operation showed local people for the first time that mosquitoes could be controlled.

The organized program had only been under way since March 25, 1964, when a consultant entomologist was retained to evaluate the mosquito problem and make recommendations for its control. Truck adulticiding was begun in April and an entomologist was employed in early May. One field inspector was added in May, a second in August, and a third in January.

In early May, an insecticide mixing plant was set up, utilizing one 14,000-gallon tank for diesel oil storage, one 500-gallon mixing plant with 70 g.p.m. pump and meter.

During April and May, 1964, the program utilized one 4-wheel drive truck, using a Dynafog 1200B fog machine. In June a second truck with a Tifa 100E was brought into service. A third truck with a Leco 120 will be available this spring. All units are self-contained and are designed to be quick-coupled and interchanged in a matter of minutes from one truck to another, so that the fog trucks can be utilized as inspection trucks during the day.

At the present time Dibrom 14 is the insecticide used in the fogging program and is mixed with #2 diesel oil at the rate of 1.5 ounces by weight of Tech. Dibrom per gallon in oil plus 2 quarts Ortho 10–20 per 100 gallons of oil. The fog trucks are operated at night from midnight to 8 a.m. at a speed of 5 m.p.h., with an insecticide output of 60–90 g.p.h. giving an effective swath width of 600–1000 feet. The cholinesterase levels of *all employees* are checked three times during the fogging season.

In the beginning, it became quite evident that there was a shortage of roads for adequate fogging coverage of the Fee Area. Consequently, we have cleared approximately 10 miles of old logging roads, which has greatly increased the efficiency of the fog program. At the present time, approximately 50 miles of road are in use on a regular basis. This summer the total miles of roads should reach approximately 100 miles. From April to November, 1964, the fog truck drove a total of 2200 miles and expended 18,000 gallons of insecticide.

One 4-wheel drive truck with a Potts mist blower is being utilized in applying water emulsion sprays within the Fee Area for the control of adults when normal fogging operations cannot be conducted due to weather conditions. Depending upon wind velocity, all misting is done during the day at a truck speed of 5 to 10 miles per hour. Excellent results have been obtained around buildings by applying a residual in the dense undergrowth. Five percent DDT emulsion or malathion at 0.48 pound per gallon are applied at 25–50 g.p.h. A Buffalo turbine unit was added this month as an interchange unit.

One of the most important aspects of adequate mosquito control depends upon entomological inspection. Information presently being gathered is obtained by such means as: Landing rate counts, light traps, rain gauges, identification of species collected, and the location and mapping of mosquito breeding areas by species.

Landing rate counts have been an invaluable method of determining quickly the mosquito annoyance in any given area at any given time. It also assists in determining the approximate location of breeding areas and enables us to estimate the percent control achieved in our adulticiding program day by day. When taking a landing rate count, the inspector stands in a predetermined place and waits one minute then brushes off the mosquitoes and then counts the number of mosquitoes that land on the front of the trousers in the next minute. Counts of 100+ per minute are not uncommon during outbreaks of *Aedes sollicitans*. The same stations are taken every day at approximately the same time. These counts, in conjunction with light traps, give the entomologist a good indication of the mosquito index on a day-to-day basis. At

the present time we have 35 stations in the Fee Area and 25 in the Buffer Zone, and 25 outside the Buffer Zone for a total of 85 stations.

The highest count so far this year within the Fee Area has been 40/minute, while at the same time counts two miles south in the Buffer Zone were 60+/minute, however, 12/minute would be a more accurate mean high count for the Fee Area. The 12/minute count in the Fee Area is usually reduced to 0 or ½/minute by the night fogging program. The daily counts between the salt marsh to the south and the Fee Area give us a good indication as to whether the mosquitoes in the salt marsh have begun to move north toward the Mississippi Test Operations.

This past summer we operated 6 New Jersey light traps both 110-volt and 12-volt twice/week. In addition, 2 CDC 6-volt light traps were operated to collect live mosquitoes in a virus study at M.T.O. this past fall. This summer this program will be stepped up to 10 CDC traps and the New Jersey traps to 15.

Ten rain gauges have been established in the Fee Area and Buffer Zone to determine the rainfall pattern in the survey area. These gauges are located at established landing rate count stations; this number will be increased to 25 this summer.

Future plans for mosquito control at Mississippi Test Operations will include temporary and permanent control in both the Test and Buffer Areas.

Three fog trucks and two mist machines will be necessary to cope with the immediate problem, within the Fee Area and certain portions of the south Buffer Zone.

With proposed use of three field inspectors, the adult landing rate counts will be expanded to 120 stations.

A program of elimination of breeding areas within the Fee Area is scheduled. In addition, it may become necessary to do some dragline ditching of fresh water and salt-marsh breeding areas within the Buffer Zone to the south, once it can be shown that these areas have a direct effect on the Fee Area mosquito population.

The physical make up of the salt marshes in the Buffer Zone and farther south will make it necessary to use a helicopter to inspect properly the breeding marsh. Through the use of regular helicopter inspection a paris green larviciding program is scheduled for the Buffer Zone and farther south if necessary.

A total of 33 species has been collected either as adults or as larvae during the past 8 months: 10 species of *Aedes,* 6 species of *Anopheles,* 6 species of *Culex,* 1 of *Culiseta,* 1 of *Orthopodomyia,* 6 of *Psorophora,* 1 of *Toxorhynchites,* and 2 of *Uranotaenia.*

In the early spring, March, April and May, *Aedes sollicitans, Culex salinarius* and *Culiseta inornata* were found breeding throughout the salt marsh from Lake Borgne north into the Pearl River marsh a distance 12 miles north to a point 1 mile below the Fee Area. The northern point was a dredge fill area not typical of the surrounding cypress marsh. Following the spring overflows, *Aedes sollicitans* breeding apparently was restricted to the area below Highway 90 with the exception of the dredge fill area on the north Pearl. Counts varied from 5 to 6/minute in the spring to a high of 75/minute in the Rigolets Area. The highest count in the Buffer Zone was 60/minute at Logtown.

During the early and late spring *Aedes canadensis, Aedes taeniorhynchus, Aedes vexans, Aedes atlanticus, Aedes sticticus, Culex salinarius, Psorophora ferox, Psorophora varipes,* and *Aedes triseriatus* were found biting in annoying numbers throughout the Fee Area and Buffer Zone.

During the summer, breeding was restricted to *Aedes mitchellae, Aedes sollicitans, Aedes vexans, Psorophora ferox, Psorophora howardii, Psorophora confinnis,* and various *Culex* species.

This winter, *Aedes canadensis, Aedes vexans, Culex restuans,* and *Culiseta inornata* were the predominant species found throughout the area, with the majority being *Culex restuans* and *Culiseta inornata.*

Compared to 1963, 1964 was apparently a very light mosquito year, especially for *Aedes sollicitans*.

There are several other insects that affect the personnel at Mississippi Test Operations and in some cases are as serious a problem as the mosquitoes. Since 1964 was a relatively light salt-marsh mosquito year, these other insects became more evident.

In the early spring, blackflies, belonging to the family Simuliidae, can be found in tremendous numbers in the Fee Area along the Pearl River; fortunately they disappear in the early summer. As the blackflies disappear, deerflies, belonging to the family Tabanidae, take their place and are found in annoying numbers throughout the summer and fall. Intermingled with the above, but occurring without a definite pattern, are the dog fly, *Stomoxys calcitrans,* the house fly, *Musca domestica,* and sand flies belonging to the family Ceratopogonidae, genus *Culicoides*. In addition to controlling the above insects the mosquito control unit is also responsible for general pest control at the Site, fire ant control and the control of weeds and brush, and rodent control.

At the present time there is only one organized program adjoining Mississippi Test Operations, that being the Gulf Coast Mosquito Control Commission which covers Hancock, Harrison and Jackson Counties, Mississippi of which Chris Elmore is the director. The Parish of St. Tammany, Louisiana, is in the process of attempting to form an organized mosquito control program as is Pearl River County, Mississippi. Both of these proposed programs would interface with the Mississippi Test Operations Program.

At the present time, during the construction phase of the Mississippi Test Operations, there are some 2,500 workers at the Site, the vast majority working in the open. With a work force of this size, any loss of efficiency due to mosquitoes can become extremely costly.

Once the Mississippi Test Operations becomes operational, the problem will become even more acute, since the type of work to be performed at the Site will require a great deal of critical work tasks to be performed out in the open where personnel will be subject to mosquito annoyance.

If we are to attract and hold the qualified personnel necessary to activate and operate Mississippi Test Operations, a continuous program of mosquito control will be an absolute necessity. It will also be desirable to cooperate in the establishment of control programs in communities surrounding the Site so that these areas will be desirable from a housing and recreational standpoint for the families of the personnel at Mississippi Test Operations.