RADIO COMMUNICATIONS IN MOSQUITO CONTROL

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Box Elder County covers an area of 5,594 miles. We don't attempt to control mosquitoes in all of this vast area, but we do have approximately 3,000 square miles in our present control area of which over one-half million acres are active, semi-active, and potential mosquito breeding sources. The budget of the district is approximately $150,000. Within the county there are 18 incorporated cities. Brigham City is the largest with a population of approximately 16,000, almost half the entire county population. There are numerous unincorporated towns scattered throughout the county. All cities and most towns are located within our control area. The district also has 81 private duck clubs and 6 public waterfowl management areas.

We have radio-equipped units operating weekly in all of these areas with good success. In June 1973, the district started operating Station KVD-732 using solid-state Motorola® FM radio equipment. This system has proven to be one of the finest, most helpful tools in our program. We have saved many hours in the field through constant communication with our field units. Keeping track of our units, their location, and any problems that occur, has saved us a great deal of time and money. We have no one else on our frequency, which is an advantage, and we keep a daily log of all outgoing and incoming calls to the base radio.

During the month of July 1976, 332 calls were made in to and out of the base station. This averages about 13½ calls per 8-hr workday. This does not include the mobile-to-mobile calls which are made daily and are not recorded. In past years when a vehicle was disabled in the field, the average response time was 2 hr and 51 min. Sometimes nearly an entire day was lost getting the disabled vehicle back into service. This past season with our radio-equipped units, the average time was 42 min. That's a big saving in field time, manpower, and money. If a battery happens to fail, then the radio is out but this is a rare occurrence when proper maintenance is carried out and proper equipment is used. We have, at the present time, 10 mobile 110-watt FM radios with 3-ft. Hi-Gain roof-mounted antennae, one aircraft FM radio which can be transferred from one aircraft to another in less than 15 min, and a 110-watt base station radio with two consoles, one in the office and one in the shop, including a 100-ft. tower. We have approximately $10,000.00 invested in this equipment and as far as I'm concerned it's one of the best investments the district has ever made. We are licensed by the FCC and have certain regulations to follow. We use the standard 10 signal codes as much as possible to cut down on air time.

We are planning to purchase 2 hand-talkie radios next year to supplement our mobile units. Those of you in mosquito control know of the many problems that can come up during the day, and these radios have helped us to solve many of these problems at the time they occur. In the field the mosquito control operator can report "hot" areas in need of immediate attention. He can report high adult mosquito populations and request special equipment to be sent in to take care of the problem. When the district receives a complaint from an upset citizen, we can generally call the operator who is working in that vicinity to make a personal contact with the complaining party. This practice has greatly improved our public relations. Operators have called requesting names of property owners, locations, and other information. With the aircraft radio we have constant ground-to-air communications. We know where the aircraft is at all times and the pilot can communicate with base or the operator in the field if he has any questions.

The radios have been used to report traffic accidents, to assist stranded motorists, to report fires, and to inform farmers of stray animals out of fenced areas. We could go on and on about the many uses of 2-way radio communication.

It is my personal opinion that a good radio system can greatly benefit any sized mosquito abatement district by improving the tie between the field operator and the office from which he works, making the control program more economical and efficient by saving many hours of delay when a problem or question occurs. The money saved will pay for the equipment many times over, considering the long life of these radios which is 15–20 years.

INSECTICIDE AVOIDANCE BY OVIPOSITING *AEDES AEGYPTI*

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Mosquito studies performed during a dengue outbreak in southwestern Puerto Rico (Lee and Moore 1973) provided an opportunity for evaluating the effectiveness of larviciding operations against *Aedes aegypti* in specific types of containers. Although there was an overall reduction in the total number of containers with larvae (positive containers) between pretreatment and posttreatment surveys, effectiveness varied between container types. In one category, 50-gallon water storage drums, no positives were found after treatment. For 2 categories, animal watering pans and miscellaneous containers (car bodies, tin cans, etc.), the percentage of positivity increased after the control operations (from 3% to 22% of all positive containers in both categories). Since watering pans are probably rinsed frequently, and miscellaneous containers are most likely to be missed by the spray operator, it is not surprising that control was least effective in these groups. The increase in positivity in watering pans and miscellaneous containers is probably explainable simply as the result of an overall popula-

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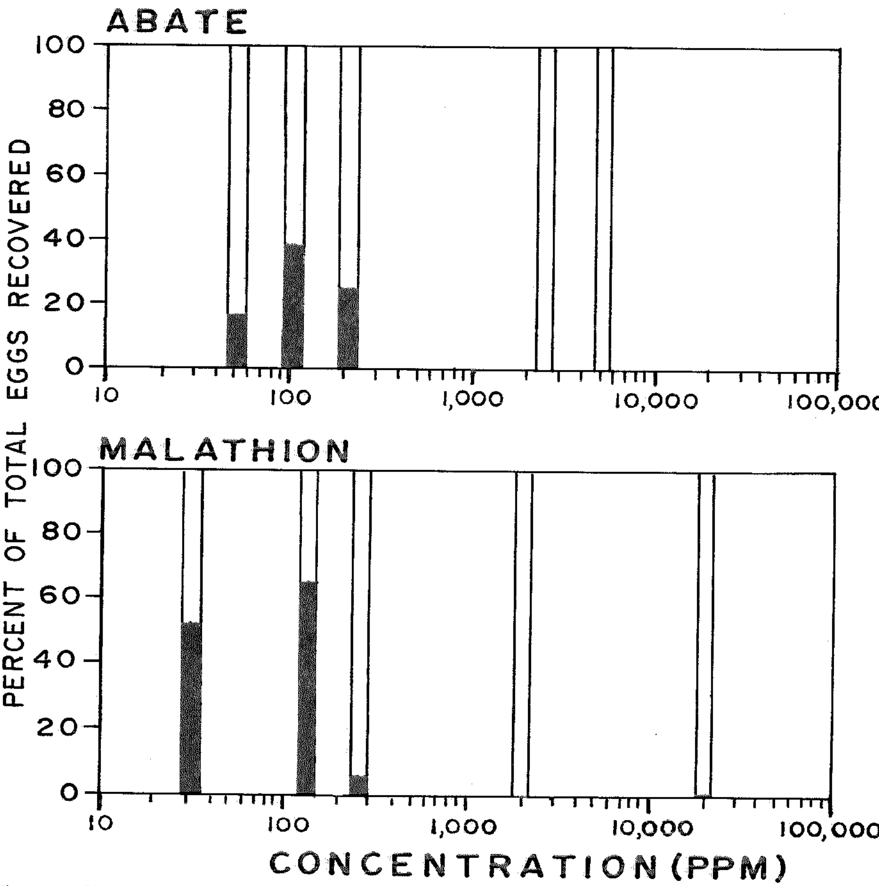

Fig. 1. Effect of malathion and Abate on oviposition by *Aedes aegypti* in nature, shown as percent of total eggs recovered from treated ovitraps (solid bars) and control ovitraps (open bars).

tion increase (observed in an unsprayed control area) resulting from heavy rainfall. An alternative or additional explanation might be that gravid females are irritated by insecticide in a container and therefore are more likely to oviposit in unsprayed containers, as was shown in large-cage tests of amine ovicides for *Ae. aegypti* (Jakob 1969).

A small field test was conducted to test this hypothesis. The results, although very preliminary in nature, confirm a previously suspected aspect of *Ae. aegypti* oviposition behavior and a potentially important problem in control operations.

Four ovitraps (Fay and Eliason 1966), two containing water only (control) and one each containing malathion or Abate®[2] at various dilutions, were placed in suitable locations around 2 houses in a residential area near the University campus in Mayaguez. Twice each week, ovitraps and hardboard paddles were collected and returned to the laboratory for examination. Fresh ovitraps and paddles were placed

[2] Use of a trade name is for identification purposes only and does not constitute endorsement by the Public Health Service, the U.S. Department of Health, Education, and Welfare, or the University of Puerto Rico.

in the same locations, with treatments and controls rotated among the four locations at each house to reduce bias.

Data were collected from a total of 46 observations for each insecticide and control over a 4-month period from August to December 1973. Oviposition was fairly low during these observations, the total for the study being 2,053 eggs (5.6 eggs/trap per observation period).

In determining starting concentrations, we recognized that excessive quantities of insecticide are frequently applied, especially to small or nearly dry containers. The starting concentrations of 2% malathion and 0.5% for Abate were reduced in successive tests until no effect could be observed.

Results are shown in Figure 1. Malathion was repellent at concentrations above 125 ppm, but at 20 and 125 ppm it had no apparent effect. Abate was repellent at all levels tested, down to and including 50 ppm. The study was discontinued before a nonrepellent concentration of Abate could be found.

As far as I am aware, this is the first demonstration of insecticide avoidance by ovipositing mosquitoes under field conditions. The problem was suggested as a potential factor in *aegypti* eradication (McClelland 1967); and Jakob (1969) found that 2 amine ovicides repelled ovipositing females when treated tires were placed in a large cage containing *Ae. aegypti*. Von Windeguth et al. (1971) also suggested that avoidance might have occurred during their studies of several larvicides in Florida.

In order to determine the extent to which avoidance represents a practical problem, more detailed studies are needed to accurately determine the limits of repellency by these and other larvicides. It also remains to be determined whether this type of avoidance is a widespread phenomenon, and whether other species or populations vary in ability to detect the presence of insecticides in potential oviposition sites.

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DIROFILARIA IMMITIS ENCAPSULATION IN *AEDES AEGYPTI*

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Encapsulation of filarial nematodes by mosquito intermediate hosts is a commonly observed phenomenon. However, few studies correlate extent of filarial encapsulation with type of larva and with site of encapsulation within the mosquito. Although Kartman (1956) presented quantitative data on *Dirofilaria immitis* microfilarial encapsulation in *Aedes aegypti*, the present study quantitates *D. immitis* encapsulation in *Ae. aegypti* and relates it to larval type and location within the mosquito.

The colony of *Ae. aegypti* at Southern Illinois University had been maintained for 3 years prior to the onset of this investigation. Mosquitoes were housed at 24°C to 26°C, 60% to 80% relative humidity and sustained on sugar solution. Blood meals were provided twice a week using anesthetized New Zealand White rabbits. A beagle possessing a microfilaremia of approximately 34,000 microfilariae per milliliter of blood served as a source of *D. immitis* infection. Mosquitoes were killed using carbon dioxide, necropsied in insect saline (Taylor 1960) and examined for *D. immitis* larvae. Results for three infections are summarized in Table I.

Viable microfilariae (mf) were observed 48 and 72 hr postinfection in Malpighian tubule (mt) lumina. Sausage stage (ss) larvae first appeared 72 hr postinfection in Malpighian tubule cells. This development was expected and corresponded to studies by Taylor (1960). Second stage larvae (L^2) were recovered on days 14 through 16, and 3rd stage larvae (L_3) were recovered on days 17 through 18 postinfection. Encapsulated microfilariae and sausage stage larvae were first observed 4 days postinfection. Encapsulated larvae were associated only with Malpighian tubules exhibiting cellular damage. Larvae were completely encapsulated and non-motile. As seen in Fig. 1, microfilariae were most susceptible to encapsulation on days 7 and 9 through 13 with 100% encapsulation. Sausage stage larvae were encapsulated to a lesser extent, and 2nd and 3rd stage larvae were not encapsulated.

Although Brug (1932) did not consider mosquito encapsulation of filarial nematodes a successful means