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EVALUATIONS OF ABATE® FOR MOSQUITO CONTROL IN POLLUTED WATER [1]

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Control of mosquitoes becomes more difficult each year due to continuing development of insect resistance to insecticides. This results in a seemingly never-ending search for new insecticides. Partial control of mosquitoes appears to encourage man's desire for higher levels of control. Pest mosquitoes (those not normally involved in human disease transmission) continue to be a major target in mosquito control work because of their abundance in metropolitan and residential areas. However, since many pest mosquitoes typically breed in man-made mosquito breeding sites such as water in ditches, artificial containers, sewage outflows, etc., their potential for finding a breeding site in close proximity to man is great.

One insecticide that has shown considerable promise for mosquito control in both urban and rural areas is Abate (Bang and Tonn, 1969a; Bang and Tonn, 1969b; Bang and Tonn, 1969c; Barnes, *et al.*, 1967; Barnes and Webb, 1968; Bowman and Orloski, 1966; Brooks, *et al.*, 1966; Brooks, *et al.*, 1967; Brooks and Schoof, 1965; Gahan, *et al.*, 1966; Glancey, *et al.*, 1968; Lofgren, *et al.*, 1967; Mulla, *et al.*, 1969; Parker, 1970; Schober, 1967; Taylor, 1968; and Whitlaw and Evans, 1968). The various physical forms of the insecticide (liquid, dust, granules, and gelatinous capsules, "Tossits") all have advantages and disadvantages. The purpose of this study was to assess the value of two types of Abate, granules and Tossits, for control of mosquito immatures in highly polluted waters.

METHODS AND MATERIALS. Several sites in Yang Ming Shan (a suburb of Taipei) were used for this study. Two types of mosquito breeding sites were utilized, septic tanks and ditches. The septic tanks and ditches were found not only to con-

[1] This study was supported through funds provided by the Bureau of Medicine and Surgery, Navy Department, for Work Unit MRQ 41.09.01–0083B OGI.

The opinions and assertions contained herein are those of the authors and are not to be construed as official or as reflecting the views of the Navy Department or the Naval Service at large.

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tain highly polluted waters but to breed *Culex fatigans* and *Armigeres subalbatus* mosquitoes.

The three ditches used for this study had slightly different water flow rates. The slowest water flow was in the well ditch where the water seeped from a faulty pipe connection at a rate of only 7 gallons per hour. Although the water was fairly clean when it came from the pipe it quickly became polluted with a high degree of organic matter from rotting vegetation and debris in the ditch.

The cement ditch had a slightly higher water flow rate of 15 gallons per hour. This was drainage from sinks and washing machines. The shaded ditch had a water flow rate of 25 gallons per hour and also came from sinks and washing machines.

Two types of 1 percent Abate granules were used. One type of granule, perlite, resembled ground styrofoam. The other, small particles of impregnated ground corn cobs, was Kobrite. The gelatinous capsules, Tossits, (0.26 gram active ingredients each) made up the third Abate formulation under consideration. All three materials could float in water although at least 50 percent of the Kobrite granules sank almost immediately after their application.

PROCEDURES. Figure 1 indicates the treatment and subsequent results realized in the ditches which contained stagnant water. The upper portion of the shaded ditch which formed both a widened pool and a narrow shallow ditch was left untreated and was designated as the control. This was an ordinary ditch dug out of the soil. Both the cement and well ditches had cement bottoms and sides. On the day treatment began the shaded ditch and the cement ditch had great numbers of mosquito larvae and were estimated to be TNTC (too numberous to count). Both ditches were treated with Abate Kobrite granules at a rate of 10 pounds (45.0 grams active ingredient) to the acre as was the well ditch which showed a larval count of 10/dip.

Twenty-four hours posttreatment all three ditch sites were again examined. In both the well ditch and the cement ditch all larvae were dead and lay in the bottom of the water. However, in the shaded ditch the larvae were still TNTC at the water inlet and eight larvae per dip along the ditch edges. Examination 48 hours posttreatment still revealed no larvae in the well ditch or in the cement ditch while in the shaded ditch the larvae were now TNTC at the water inlet and 15/dip along the edges. Seventy-two hours posttreatment there were still no larvae in the well ditch or in the cement ditch while everywhere in the shaded ditch larvae were now TNTC. Since the shaded ditch had the greatest water flow of the three it became apparent that the effect of the Abate was rapidly lost due to the greater water movement.

The well ditch and the cement ditch again showed first instar larvae in numbers TNTC 10 days posttreatment with the Kobrite granules. Both ditches were treated the following day with Abate Tossits at a rate of one Tossit per 500 square feet. Twenty-four hours posttreatment with Tossits the well ditch and the cement ditch showed all larvae dead resting on the bottom of the ditches.

Six days posttreatment of the well ditch with Abate Tossits, first instar mosquito larvae TNTC were again noted. The Tossits had apparently lost their effectiveness because they floated on the surface of the water at the edge and lost contact with the water as the pool water partly dried up. These observations agree completely with those of Parker (1970). The cement ditch showed no larvae at that time. Eight days posttreatment with Abate Tossits the cement ditch showed return of larvae at a rate of two/dip. Three weeks following treatment of the ditches with Abate Tossits both returned to high mosquito larvae counts TNTC/dip. These sites were soon afterward treated with oil by local health officials to help reduce the mosquito population in the area and were then deleted from this study.

FIGURE 1. STAGNANT WATER DITCHES

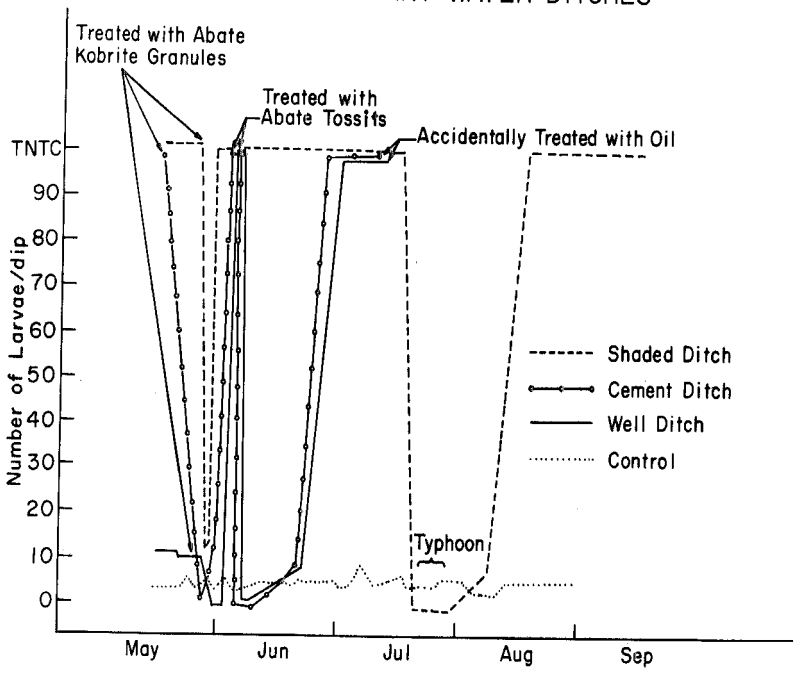


Figure 2 indicates the resultant larval mosquito populations in septic tanks that were treated with the two forms of Abate, Perlite and Tossits. The septic tanks were 2 x 2 x 1.5 meters deep. The following information concerns the occupancy of the houses whose septic tanks were used in this study:

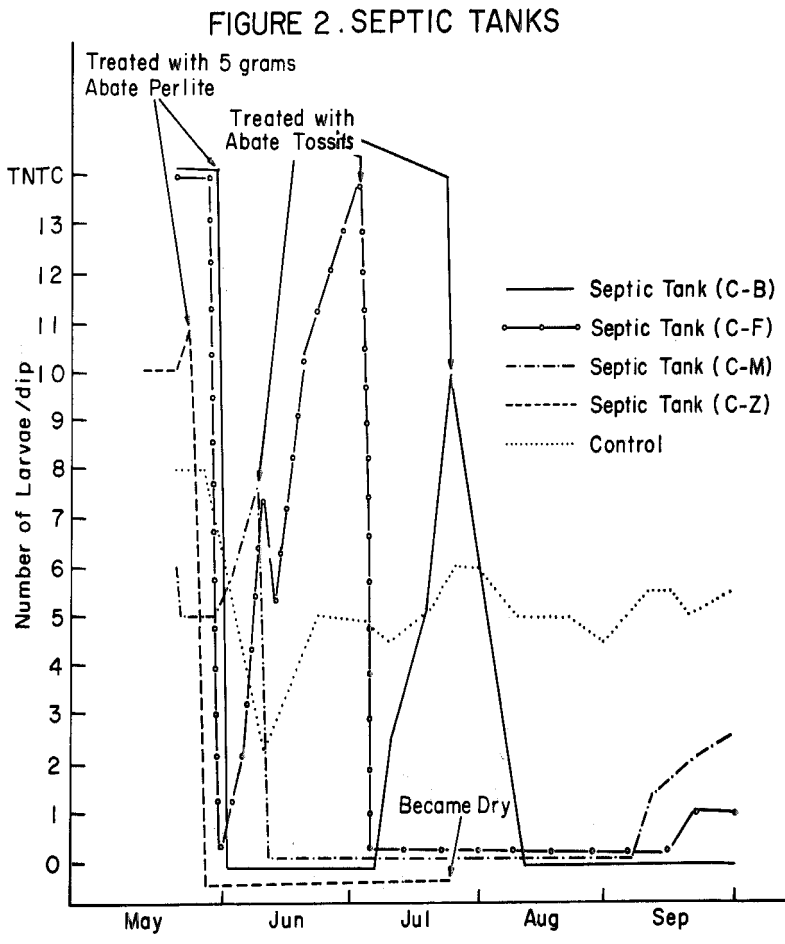
House	Occupants
C–B	House vacant from beginning of study until 24 June when a family of 4 moved in.
C–F	Family of 7
C–H	Control 1 occupant
C–M	Family of 4
C–Z	Family of 2 adults and one baby

On 28 May septic tanks C–B, C–F, and C–Z had mosquito larvae counts per dip of TNTC, TNTC, and 11 respectively. All three tanks were treated at that time with 5 grams of Abate Perlite granules. Twenty-four hours posttreatment all mosquito larvae in the septic tanks were dead.

Six days posttreatment with the perlite granules septic tanks showed first instar mosquito larvae 1/dip in the C–F tank; and no larvae in either the C–B or C–Z septic tank. Eleven days posttreatment septic tank C–F revealed 4th instar mosquito larvae at 8/dip; neither C–B nor C–Z was found to have any mosquito larvae.

C–M septic tank which was averaging approximately 6 mosquito larvae/dip was treated on 9 June with an Abate Tossit. Twenty-four hours posttreatment all mosquito larvae were dead. This continued to be the finding for the next 90 days, up to 7 September, when the mosquito larvae began to reappear.

On 2 July septic tank C–F was treated with 1 Abate Tossit. At the time of this treatment the mosquito larval count was TNTC/dip. Twenty-four hours posttreat-



ment the mosquito larval count was zero. This zero count continued for the next 75 days up to September 15 when first instar larvae began to reappear.

The mosquito larval count in septic tank C–B remained at zero from the time of treatment with Abate perlite in late May until early July. However, it should be noted that the C–E septic tank house was vacant from 1 May until 24 June. On 24 July, the C–B septic tank mosquito larval count reached 10/dip so it was treated with one Abate Tossit. From 10 August until 30 September (when observations were discontinued) no mosquito larvae were noted to return to septic tank C–B.

It is immediately apparent that water flow rates greatly influenced the effectiveness of the Abate regardless of its vehicle. The water flow rate and subsequent dilution of toxified waters in the septic tanks were definitely affected by the number of occupants in a given dwelling. The larger the family, of course, the more often the toilet was flushed and this diluted the water in the septic tanks. Treatment of polluted water with Abate was most effec-

tive when there was no dilution due to flowing water or increased water volume due to flushing of toilets. It is not the purpose of this study to determine whether the increased water flow reduced the effectiveness of the Abate because of dilution of the toxicity of the insecticide or because of dilution of the organic matter in the water. There is, nevertheless, apparently a correlation between water flow and span of the Abate effectiveness. Perhaps the short time of effectiveness of these carriers of Abate can be attributed to floatability and probable loss by simply floating away.

SUMMARY. Three physical forms of Abate (Kobrite and perlite granules and Tossits) were evaluated with respect to their control of *Culex fatigans* and *Armigeres subalbatus* mosquitoes in polluted waters. Three ditches and five septic tanks with polluted waters (mosquito breeding sites) were used for this evaluation. Water flow rates dramatically influenced the length of the active period of the Abate. Where water stands, Abate works best.

ACKNOWLEDGMENT. The author expresses his thanks to the American Cyanamid Company, Princeton, New Jersey, for generous assistance in supplying the insecticides used in this evaluation.

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