flies in the Malaise collections showed that the traps would have detected the outbreak and shown temporal and population limits of its occurrence. Also, the trap would have adequately measured the distribution of the mosquito fauna (Breeland and Pickard, 1965) even in the absence of other standard mosquito collecting devices.

The operation of traps in routine entomological surveys also makes available valuable specimens for taxonomists. For example, Dr. Townes determined over 400 species of ichneumonids from these collections which were easily removed during the summer and shipped to him.

Workers concerned with the measurement of insect faunas of public health significance should include the use of the Malaise trap in their plans.

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CONTROL OF MOSQUITO LARVAE IN WILLAMETTE VALLEY, OREGON LOG PONDS[1, 2]

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Log ponds are a major source of pest mosquitoes in many communities of the Pacific Northwest (Hoffman and Yates, 1956; Lewis and Eddy, 1959; McHugh *et al.*, 1964). At present some control districts annually treat more than 300 surface acres of these impoundments. Current control methods consist of sprays applied with ground equipment or airplanes.

In spraying log ponds with ground equipment, the prime difficulty is in obtaining good coverage, often difficult because of sawmill structures, cold-decks (stock-piled logs), or the nature of surrounding terrain. Similar difficulties are encountered in using aircraft; users are often confronted with the problem of insecticide drift as well as the general hazard to nearby residents, who often complain of the noise involved.

To obtain additional information about other methods for treating log ponds, we have explored two approaches. We ran a series of tests with granules as insecticide carriers and another series with emulsion concentrates incorporated into a small amount of liquid carrier (the resultant formulation was applied to the surface of ponds with a pump oil can). Results are reported here for the consideration of those who may need alternative methods or materials to control mosquito larvae in log ponds.

MATERIALS AND METHODS. In tests preliminary to those reported here, we found it best to avoid granules with a high specific gravity because they sink rapidly into, and lose much effectiveness in, the oozy bottoms which characterize many log ponds.

In the granular treatments (Table 1), fenthion was formulated on 16-mesh Durham Duratex® H.R. granules manufactured by the Durham Chemical Co. of Los Angeles, Calif. The composition of the granules was not available to us. The Abate® (*o,o*-dimethyl phosphorothioate *o,o*-diester with 4,4′-thiodiphenol) was formulated on 30–60 mesh Pyrax® gran-

[1] Accepted for publication.

[2] Mention of a company or its product does not necessarily imply endorsement of this company or products by the U. S. Department of Agriculture.

ules, by American Cyanamid Company. The surfaces of these particular granules flaked off immediately when wet and the small flakes remained suspended remarkably well at all levels in the water.

In the emulsion treatments (Table 1) until effectiveness had ceased. Protection was judged to have ended when reinfesting larvae had developed to the fourth instar. Initially the treatment we used as a standard was malathion applied at 1 lb./acre with a Bean® power sprayer. This

TABLE 1.—Results of tests with fenthion and Abate® as a mosquito larvicide in log ponds.

Material	Lbs./acre	No. of tests	Control within 24 hours (%)	Average number of days effective[a]
	Emulsion concentrates in oil			
Fenthion (Baytex®)	0.20	3	100	15
	.10	12	100	11
Abate®	.15	2	100	18
	.10	3	100	18
	.075	3	100	13
	1% Granules			
Fenthion (on 15 mesh Duratex H.R.®)	.15	12	100	14
	.10	7	99[b]	14
Abate® (on 30–60 Pyrax®)	.15	4	100	17
	.10	2	95[b]	9

[a] Days to 4th instar of larvae developing after treatment.
[b] Control in all tests reached 100% after 24 hours.

fenthion and Abate® were formulated from concentrates prepared by the company at 4 lb./gal. Appropriate dosages from these concentrates were diluted with enough SAE 30 motor oil or No. 1 fuel oil to make approximately 1 quart/acre of the finished product.

The log ponds treated were in Benton, Linn, and Lane Counties and ranged in surface area from ¾ to 12 acres. The granules were applied by hand and the liquids with a 1-quart pump oil can. We obtained thorough coverage with both methods by walking the logs in the ponds.

Treatments were randomized and run continuously throughout the summers of 1963 and 1964. We considered that this procedure would minimize differences in mosquito control due to species composition in the various ponds. All sampling was with a white painted 1 pint dipper. Initial kill was judged from a minimum of 20 pre- and post-treatment dips, but generally more dips than the minimum were taken. With but few exceptions, ponds were checked within 24 hours after application and every 48 hours thereafter

material was purchased locally as an emulsion concentrate containing 5 lb. of malathion/gal. However, we could not obtain good coverage on all ponds with ground equipment; this difficulty limited the usefulness of the malathion as a standard treatment. For the remainder of the series we used 1 percent fenthion formulated on Duratex® H.R. granules applied at 0.15 lb. of fenthion/acre as the standard of comparison. All materials were applied on the basis of pounds of active ingredient/acre of pond surface.

RESULTS. Both the granules and emulsion concentrates of fenthion and Abate® gave excellent initial and residual control (Table 1). Higher dosages than those given in the table were tested with each compound; but even at higher levels residual effectiveness with fenthion seldom exceeded 16 days, and Abate® at the higher dosages never exceeded a residual effectiveness of 18 days. For both compounds smaller dosages than those reported were also tested; but the smaller concentrations tended to give erratic results, especially toward the latter part of the control season

when the heavily used ponds became highly polluted and the resultant heavy scum seriously retarded surface circulation.

DISCUSSION. During the course of these tests the chief species encountered were *Culex peus* Dyar, *C. pipiens* (L.), *C. tarsalis* Coquillett, and *Culiseta incidens* (Thomson). The relative abundance of each varied from month to month, from pond to pond, and from year to year. In the cities of Eugene and Springfield, for instance, data for the combined months of July and August show that *C. pipiens* accounted for 51 percent of the larvae determined in 1963 and 46 percent in 1964. In several ponds in the more rural areas near Philomath and Sweet Home for the same months, *C. pipiens* averaged 18 percent and 27 percent, respectively, of the total determined. Thus this pest species may thrive better in urban than in rural areas.

The combination of either motor or fuel oil with each of the two emulsion concentrates resulted in a hydrophobic liquid that gave remarkably good coverage with a minimum of effort and time. Also, no material was wasted by driftage or by deposition directly on the logs, either by this method or from the use of granules.

SUMMARY. Tests were conducted in Oregon with emulsions and granules of fenthion and Abate® (*o,o*-dimethyl phosphorothioate *o,o*-diester with 4,4'-thiodiphenyl) against mixed species of log pond mosquito larvae (*Culex pipiens* (L.), *C. peus* Dyar, *C. tarsalis* Coquillett, and *Culiseta incidens* (Thomson)). Emulsions of Abate® gave 13 to 18 days' control at 0.075–0.15 lb./acre and those of fenthion 11 to 15 days' control at 0.1–0.2 lb./acre. One-percent granules of Abate® and fenthion gave 9 to 17 and 14 days' control, respectively, at 0.1–0.15 lb./acre. The materials were formulated on different granulated carriers.

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