runs made by each machine. When the nozzle/nozzles were turned away from the microphone the graph was basically the same except for the maximum decibel level reached.

As a result of this evaluation our control operators now have the option of wearing protective hearing devices or of wearing a headset that is connected into the truck radio system. Either of these options reduce the in-cab noise level to a point that no operator discomfort is noted.

SUSCEPTIBILITY OF *AEDES AEGYPTI* TO FOUR VARIETIES OF *BACILLUS THURINGIENSIS*[1]

C. M. IGNOFFO[2], C. GARCIA[2], M. J. KROHA[2] AND T. FUKUDA[3]

U. S. Department of Agriculture, Science and Education Administration, Agricultural Research

More than 20 commercial trade-named products formulated from *Bacillus thuringiensis* Berliner are used today throughout the world (Ignoffo and Anderson 1979), yet none is registered for use against mosquitoes. This is rather surprising, since at least a dozen varieties of *B. thuringiensis* are known to be active against several species of *Aedes, Culex,* and *Anopheles* (Lavrentyev et al. 1965, Reeves and Garcia 1971, Hall et al. 1977). The recent isolation of a new variety of *Bacillus thuringiensis* named *israelensis* by de Barjac (1978), which rapidly kills species of *Aedes, Anopheles, Culex,* and *Uranotaenia* (Goldberg and Margalit 1977, de Barjac 1978, Garcia and Desrochers 1979), has rekindled interest in *B. thuringiensis* as a potential mosquito control agent. Thus we designed studies to compare the extent and rate of mortality of larvae of *Aedes aegypti* (L.) exposed to the following 4 varieties of *B. thuringiensis: galleriae* (International Minerals and Chemical Corp.: IMC-10001.3, a calcium precipitate containing 10.8% Thuringiensin); *israelensis* (Abbott Laboratories: ABG-6108, Lot 6406-106, 10000 IU/mg);[4] *kurstaki* (Abbott Laboratories: Lot 6406-106, ca. 35000 IU/mg),[4] and *thuringiensis* (C. Garcia culture of BA-068).

Four-day-old, 3rd instar larvae of *Ae. aegypti*, reared from eggs at room temperature (24 ± 1°C)[5] were used for all bioassays. We obtained eggs from a rearing colony maintained at the Gulf Coast Mosquito Research Laboratory (USDA, SEA, AR) at Lake Charles, Louisiana. Bioassays were conducted at room temperature (24 ± 1°C) in 8-ounce, waxed ice cream cups (8 S-8G, Lily Corp., Toledo, Ohio 43666) containing the test variety at 90 μg/ml in a total volume of 200 ml/cup. This dosage (ca. 200 × the LC-50 dose against larvae of *Ae. aegypti*) translates to a field rate of 2.7 pounds/acre-ft^3 and a cost of about \$25.00/acre-ft^3 (based upon costs of current commercial formulations of *B. thuringiensis*). To each cup we added 50 larvae and recorded mortality at 10-min intervals for 1 hr, 60-min intervals for the next 3 hr, and 24-hr intervals thereafter until all surviving pupae had either died or the adults had emerged. Larvae were fed pulverized Tetramin (TetraWerke, D-452, Melle, West Germany) at 24- to 48-hr intervals. Each varietal treatment, with its untreated control, was replicated 4 times. The data were summarized as percent larval mortality, percent total mortality, and the time required to obtain 50% mortality (LT-50).

Variety *israelensis* was the most active of the 4 tested (Table 1). All larvae were dead after 1 hr of exposure; the LT-50 was 12.2 ± 1.1 min. The next most active variety was *kurstaki*, followed in decreasing order of activity by *galleriae* and *thuringiensis* (Table 1). The LT-50 for the latter 3 varieties was 1.3 ± 0.1, 3.9 ± 0.2, and 3.4 ± 0.2 days, respectively, with initial mortality obtained at 1, 1, and 2 days, respectively. Initial pupation and adult emergence of controls were recorded on day 5 and 7 respectively. In contrast, only 1 of the 200 larvae exposed to var. *galleriae* pupated, and no adult emerged. Initial pupation and adult emergence for var. *thuringiensis* were recorded on day 10 and 12 respectively.

There was an obvious difference in the

[1] This paper reflects the results of research only. Mention of a pesticide or proprietory product in this paper does not constitute a recommendation for use by the USDA nor does it imply registration under FIFRA as amended.

[2] Biological Control of Insects Research Laboratory, Columbia, MO, 65205.

[3] Gulf Coast Mosquito Research Laboratory, Lake Charles, LA, 70601.

[4] IU based on cabbage looper, *Trichoplusia ni* (Hübner) bioassay.

[5] mean ± standard error of the mean.

Table 1. Percentage larval mortality, total mortality, and LT-50 for 4-day-old larvae of *Aedes aegypti* continuously exposed to suspensions of several varieties of *Bacillus thuringiensis*.[a]

Variety of *Bacillus thuringiensis*	Average % Mortality[b]		Larval LT-50 (days)
	Larval	Total	
israelensis	100.0	100.0	0.01 ± 0.001
kurstaki	100.0	100.0	1.3 ± 0.1
galleriae	99.5 ± 0.5	100.0	3.9 ± 0.2
thuringiensis	80.5 ± 2.6	83.0 ± 2.4	3.4 ± 0.2
None	1.1 ± 0.5	5.0 ± 1.9	—

[a] Concentration of 90 μg/ml.
[b] Average of 4 replicates ± S.E. of the mean; 50 larvae/replicate.

rapidity of kill between *israelensis* and *galleriae* and when the larvae died. Larval death due to *israelensis* was immediate and probably due to a quick-acting toxin. In variety *galleriae*, however, few larvae died immediately, most appeared to develop normally and only died at molting or pupation. The mode of action of *thuringiensis* and *kurstaki* was similar to that of *israelensis*, although not as rapid. Differences in the rapidity and type of activity between *israelensis* and *galleriae* may make it desirable to combine the two to obtain more effective field control of mosquitoes.

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MODIFICATIONS TO THE MICRO-GEN ED-2-20A ULV FOGGER

RICHARD D. MORTON
Benton County Mosquito Control District,
6174 Van Giesen, West Richland, Washington
99352

The Benton County Mosquito Control District found that certain modifications to the Micro-Gen Model ED-2-20A Ultra Low Volume Fogger were advantageous to both the control operator and the maintenance personnel. All of these modifications were minimum in nature and required no major design changes. The modifications are listed below with an explanation of each.

1. The small gas tank was removed and a