# EVALUATION OF CYFLUTHRIN AS A ULV COLD AEROSOL AGAINST CAGED MOSQUITOES[1]

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ABSTRACT. Cyfluthrin was evaluated against caged mosquitoes using a truck-mounted Leco HD model ULV cold aerosol generator and the results were compared to the effectiveness of malathion. Calculated effective dosages (ED) for 90% and 95% control with cyfluthrin against *Aedes taeniorhynchus* were 0.2 and 0.3 g AI/ha and against *Anopheles quadrimaculatus* were 0.09 and 0.1 g AI/ha. Cyfluthrin was about 106X more effective against *An. quadrimaculatus* and about 69X more effective against *Ae. taeniorhynchus* at the ED-95 level than malathion.

## INTRODUCTION

The present paper reports on the field evaluation against caged mosquitoes of the sixth pyrethroid identified in our laboratory evaluation program as a potential mosquito adulticide. Results of field studies of the other 5 pyrethroids have been reported previously (Roberts 1981, 1982, 1983).

In the laboratory evaluation, cyfluthrin was about 15X and 8X more effective at the $LC_{50}$ and $LC_{90}$ levels, respectively, than the malathion standard as an aerosol against the test mosquito, *Aedes taeniorhynchus* (Wiedemann). This was sufficiently effective to warrant further evaluation as a ULV cold aerosol against caged mosquitoes under field conditions.

## MATERIALS AND METHODS

The candidate adulticide, cyfluthrin (=Bay FCR 1272; cyano (4-fluoro-3 phenoxyphenyl) methyl 3-(2,2 dichloroethenyl)-2.2 dimethylcyclopropane carboxylate), a synthetic pyrethroid, was supplied as an emulsifiable concentrate formulation containing 0.38 kg AI/liter.

The tests were conducted in an open field near Gainesville, FL, during April and May 1983. Applications were made in the evening between 1800 and 2200 hours. Air temperature at 2 m above ground ranged from 19 to 26°C and averaged 23°C during the period of testing. Wind velocities ranged from 3 to 18 km/hr and averaged 8 km/hr during evaluations.

A Leco Model HD cold aerosol generator with a blower pressure of 27.6 kPa was used to disperse the adulticide, which was delivered to the nozzle by a positive displacement pump at 60 ml/min. The adulticide was diluted in a 50:50 mixture of Klearol and Solv-G to obtain the concentrations necessary for treatment at the desired rate of AI/ha based on a 91 m swath and a truck speed of 16 km/hr.

Laboratory insecticide-susceptible strains of *Ae. taeniorhynchus* and *Anopheles quadrimaculatus* Say were used. Adult female mosquitoes (4-6 days old) were immobilized on a cold table (Barry et al. 1978) for handling and counting. Groups of 25 were placed in 16 × 16-mesh screen wire cages (4.5 cm diam × 15 cm long) for exposure to the aerosol. The screen cage replaced one of the plastic tubes of a World Health Organization test kit assembly. The screen wire cage and companion plastic holding tube lined with paper were mounted on opposite sides of a divider containing a slide unit with a 20 mm diam opening that could be positioned between the cage and tube (Haile et al. 1982). Thus, a rapid transfer of the exposed mosquitoes could be made from the cage into the clean holding tubes without the necessity of additional immobilization stress. This also eliminated the exposure to residues left on the treatment cage wire from the aerosol that would occur if the screen cages had been used to retain the mosquitoes until the time for mortality counts.

Four cages of each species were suspended 1.2 m above ground on stakes, 2 at 46 m and 2 at 91 m downwind in 2 rows 30.5 m apart perpendicular to the line of travel of the truck-mounted ULV aerosol generator. After each aerosol had drifted through the test plot (about 5-10 min), the insects were transferred to the plastic holding tubes lined with clean paper. The cages containing the test insects were held in chilled insulated chests containing moist cotton for transportation between the laboratory and the test site. During the 12 hr holding period prior to mortality counts, the test insects were held at room temperature (24°C) and supplied with 10% sugar water on cotton pads. Cages of test insects not exposed to the insecticide but handled in the same manner were

[1] This paper reports the results of research only. Mention of a pesticide in this paper does not constitute a recommendation for use by the U.S. Department of Agriculture nor does it imply registration under FIFRA as amended. Also, mention of a commercial or proprietary product does not constitute an endorsement of this product by the USDA.

used as controls. Droplet size measurements were made by the handwave method (Mount and Pierce 1972).

Effective dosages (Ed) for 50, 90 and 95% control were calculated from the regression line developed with a probit analysis program written for a Hewlett-Packard Model 9810A Programmable Calculator following procedures given by Finney (1971).

## RESULTS AND DISCUSSION

The results of the aerosol tests with cyfluthrin are presented in Table 1 and the calculated effective dosages for 50, 90 and 95% control as determined from the log dosage probit regression analysis are presented in Table 2. Also included in Table 2 for comparson are the effective dosages for malathion that were previously determined (Roberts 1983).The volume median diameter (VMD) was 14.2 μm at the standard rate of application.

Cyfluthrin was about 230X more effective against *An. quadrimaculatus* and about 227X more effective against *Ae. taeniorhynchus* at the ED-50 level than malathion. However, the effectiveness decreased at the ED-95 level to about 106X and about 69X, respectively, compared to malathion.

Cyfluthrin, as stated earlier, is the sixth pyrethroid that has been evaluated as a mosquito adulticide at this laboratory. In Table 3, these 6 pyrethroids are listed in decreasing order of their effectiveness, based on the ED-95 dosage level. The most effective pyrethroid tested was cyfluthrin, while the least effective was phenothrin. In addition, malathion is included in this table for comparsion purposes.

Two pyrethroids and natural pyrethrins are presently registered as mosquito adulticides. Resmethrin has a label for a treatment rate of 7.8 g/ha while phenothrin has a label for treatment rates ranging from 4.5 to 17.9 g/ha, depending on the mosquito species. Natural pyrethrins has a label for a treatment rate of 2.2-8.9 g/ha. Several of the pyrethroids that have been tested would be more effective, but additional studies are needed against natural populations of a number of important medical and veterinary species to determine actual treatment rates.

Table 1. Efficacy of ULV ground cold aerosols of cyfluthrin discharged at 60 ml/min at a dispersal speed of 16 km/hr against caged adult female mosquitoes[a] (number of replicates in parentheses).

| Treatment rate (mg/ha) | Average 12 hr % mortality: *Aedes taeniorhynchus* | Average 12 hr % mortality: *Anopheles quadrimaculatus* |
|---|---|---|
| | $\bar{x}$ ± S.E. | $\bar{x}$ ± S.E. |
| 6.7 | 16 ± 4.7 (10) | 22 ± 4.8 (8) |
| 14.5 | 29 ± 4.8 (10) | 33 ± 3.4 (8) |
| 28.0 | 50 ± 5.6 (10) | 63 ± 5.4 (8) |
| 56.0 | 69 ± 4.0 (10) | 84 ± 4.5 (8) |
| 112.0 | 81 ± 2.5 (10) | 92 ± 2.2 (8) |
| Control | 4 ± 0.7 (10) | 3 ± 0.7 (8) |

[a] Caged mosquitoes at 1.2 elevation 46 and 91 m downwind from the spray line.

Table 3. Comparison of pyrethroids tested as ULV aerosols against *Aedes taeniorhynchus*.

| Insecticide | ED-50 (g AI/ha) | ED-95 (g AI/ha) |
|---|---|---|
| Cyfluthrin | 0.03 | 0.3 |
| Deltamethrin | 0.08 | 0.7 |
| Flucythrinate | 0.2 | 4.0 |
| Cypermethrin | 0.08 | 4.5 |
| Fenvalerate | 0.6 | 9.3 |
| Phenothrin | 2.8 | 44.0 |
| Malathion | 6.6 | 22.3 |

Table 2. Calculated effective dosage (ED) for 50, 90 and 95% control of caged adult female mosquitoes with ULV ground cold aerosols (fiducial limits at 95% level of probability in parentheses).

| Species | ED-50 (g AI/ha) | ED-90 (g AI/ha) | ED-95 (g AI/ha) |
|---|---|---|---|
| | | Cyfluthrin (Bay FCR 1272) | |
| *Anopheles quadrimaculatus* | 0.020 | 0.091 | 0.140 |
| | (0.018–0.021) | (0.078–0.108) | (0.116–0.173) |
| *Aedes taeniorhynchus* | 0.029 | 0.190 | 0.325 |
| | (0.026–0.032) | (0.157–0.240) | (0.254–0.429) |
| | | Malathion[a] | |
| *Anopheles quadrimaculatus* | 4.6 | 11.4 | 14.8 |
| | (4.0–5.1) | (10.2–13.2) | (12.9–17.9) |
| *Aedes taeniorhynchus* | 6.6 | 17.0 | 22.3 |
| | (5.9–7.2) | (15.1–19.2) | (19.3–27.0) |

[a] Malathion data from Roberts 1983.

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