# EFFECTIVENESS OF ULTRALOW VOLUME GROUND AEROSOLS OF PYRETHROID ADULTICIDES AGAINST MOSQUITOES AND HOUSE FLIES [1]

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ABSTRACT. Ground applications of ultralow volume (ULV) aerosols against caged adult females of *Aedes taeniorhynchus* (Wiedemann), *Anopheles quadrimaculatus* Say, and *Musca domestica* L. showed that Roussel-Uclaf RU-12063 ((5-benzyl-3-furyl)methyl *cis*-(+)-2,2-dimethyl-3-(2-methylpropenyl)cyclopropanecarboxylate), Roussel-Uclaf RU-11679 ((5-benzyl-3-furyl-methyl *trans*-(+)-3-(cyclopentylidenemethyl)-2,2-dimethylcyclopropanecarboxylate), Roussel-Uclaf RU-11484 ((5-benzyl-3-furyl)methyl *trans*-(+)-2,2-dimethyl-3-(2-methylpropenyl) cyclopropanecarboxylate), and resmethrin (all synergized with piperonyl butoxide) were more effective than the malathion standard against mosquitoes and than both synergized pyrethrins and the naled standard against house flies. Synergized tetramethrin was less effective than synergized pyrethrins against house flies.

We have continued to evaluate new insecticides as ultralow volume (ULV) ground aerosols for the control of *Aedes taeniorhynchus* (Wiedemann), *Anopheles quadrimaculatus* Say, and house flies, *Musca domestica* L. This method of applying adulticides has gained wide popularity in mosquito control programs in recent years and has shown promise for the control of house flies (Wilson and Mount, 1974). The present paper reports the results obtained with new pyrethroid insecticides tested as ULV ground aerosols against caged adult mosquitoes and house flies.

TECHNIQUES AND MATERIALS. The tests were conducted in an open field near Gainesville, Florida, in April, May, and September 1973. Applications of the aerosols were made between 9 and 10:30 am when climatic conditions were favorable. Air temperatures ranged from 78 to 86° F and were usually ~80° F. Wind velocities ranged from 2 to 5 miles per hour (mph) and were usually ~3 mph.

The pyrethroid adulticides evaluated were Roussel-Uclaf RU-12063 ((5-benzyl-3-furyl)methyl *cis*-(+)-2,2-dimethyl-3-(2-methylpropenyl) cyclopropanecarboxylate), Roussel-Uclaf RU-11679 ((5-benzyl-3-furyl) methyl *trans*-(+)-3-(cyclopentylidene-methyl)-2,2-dimethylcyclopropanecarboxylate), Roussel-Uclaf RU-11484 ((5-benzyl-3-furyl)methyl *trans*-(+)-2-dimethyl-3-(2-methylpropenyl) cyclopropanecarboxylate), resmethrin, pyrethrins, and tetramethrin. All pyrethroids were synergized at a ratio of 1 part adulticide to 5 parts piperonyl butoxide. Malathion and naled were included in the tests as standards for mosquitoes and flies, respectively.

A Leco ULV® (Model HD) cold aerosol generator was used to disperse the aerosols. The instrument panel for this generator was located in the cab of the truck on which it was carried so that insecticide flow rate, air pressure, and insecticide temperature could be monitored during applications. Flow meter calibrations were made for a temperature range of 80 to 82° F. The reservoirs of insecticide (1 gal jugs) were carried in the truck cab which was maintained at ~80° F so the viscosity of the liquid insecticides during testing would be about the same as during calibration.

The dose of each insecticide was varied by changing either flow rate and/or vehicle speed. Flow rates ranged from 2.6 to 13.5 fluid ounces per minute, and vehicle speeds ranged from 2.5 to 20 mph.

Adult female *A. taeniorhynchus* and *A.*

[1] This paper reflects the results of research only. Mention of a pesticide or a commercial or proprietary product in this paper does not constitute a recommendation or an endorsement of this product by the USDA.

*quadrimaculatus* 2 to 5 days old and 4- to 5-day-old adult female *M. domestica* from our Cradson-P strain (multi-resistant) were exposed in 16-mesh screen wire cages (25 mosquitoes or 20 flies per cage) that were suspended on stakes in two rows perpendicular to the line of travel of the generator. The flies were exposed at distances of 25, 50, 100, 200, and 300 feet downwind, and the mosquitoes were exposed at distances of 150 and 300 feet downwind. From one to five tests were conducted with each dose of each adulticide. After the passage of the generator, the insects were transferred to plastic tubes lined with clean paper. Except during exposure to the aerosols, the insects were held in insulated chests containing ice in cans and moist cotton. Absorbent cotton pads moistened with 10% sugar-water solution were placed on the holding tubes when they were returned to the laboratory. Mortality counts were made 24 hours after the insects were exposed to the aerosols.

RESULTS AND DISCUSSION. The $LC_{90}$'s for each adulticide are reported in Table 1. Synergized RU-12063, 11679, 11484, and resmethrin were 6 to 10 times more effective than malathion against *A. taeniorhynchus*. These results agree closely with the results of previous wind-tunnel tests that showed these pyrethroids 8 to 14 times more toxic than malathion to this species of mosquito (Mount and Pierce 1973, 1974). Synergized RU-12063, 11679, 11484, and resmethrin were 3 to 4 times more effective as ULV ground aerosols against *A. quadrimaculatus* than against *A. taeniorhynchus*. Thus these results too agree with those obtained in the previous wind-tunnel tests (*A. quadrimaculatus* was 3.5 to 10 times more susceptible to these adulticides than *A. taeniorhynchus* (Mount and Pierce, 1973, 1974).

Synergized RU-11679 was the most effective pyrethroid against the multiresistant strain of house flies and was 8 times more effective than synergized pyrethrins (Table 1). Synergized RU-12063 and RU-11484 as ULV ground aerosols were about 4.5 times more effective against house flies than synergyzed pyrethrins. Also our wind-tunnel tests (unpublished data) indicated that synergized RU-12063 and RU-11484 were 3 to 7 times more toxic than synergized pyrethrins to the same strain of house flies. The remaining pyrethroid, tetramethrin, and the naled standard were less effective than synergized pyrethrins.

TABLE 1. Effectiveness of ULV ground aerosols of pyrethroid insecticides against caged adult mosquitoes and house flies.

| Adulticide [a] | Al (lb/gal) [b] | $LC_{90}$ (lb/acre) for indicated species [c] | | |
|---|---|---|---|---|
| | | *A. taeniorhynchus* | *A. quadrimaculatus* | *M. domestica* |
| Roussel-Uclaf | | | | |
| RU-12063 | 0.34 | 0.006 | 0.0019 | 0.051 |
| RU-11679 | 0.84 | 0.007 | 0.0019 | 0.031 |
| RU-11484 | 0.84 | 0.01 | 0.0025 | 0.056 |
| Resmethrin | 0.9 | 0.01 | 0.003 | 0.13 |
| Malathion (standard) | 9.7 | 0.06 | .... | .... |
| Pyrethrins | 0.7 | .... | .... | 0.25 |
| Tetramethrin | 0.9 | .... | .... | >.25 |
| Naled (standard) | 1.4 | .... | .... | >.25 |

[a] All except malathion and naled synergized at a ratio of 1 part adulticide to 5 parts piperonyl butoxide.

[b] Undiluted as received from manufacturer except for addition of piperonyl butoxide and for naled (as Dibrom 14®, which was diluted to 10% in heavy aromatic naphtha (HAN).

[c] Based on 300-ft swath for mosquitoes and 100-ft swath for house flies.

*Literature Cited*

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# BIOLOGICAL ACTIVITY OF JUVENILE HORMONE ANALOGUES AGAINST LARVAE OF *CULEX PIPIENS PIPIENS* TESTED IN SMALL-SCALE FIELD TRIALS

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ABSTRACT. Five synthetic materials with juvenile hormone activity has been tested in small-scale field trials under subtropical climatic conditions. Their inhibiting effects on morphogenesis, as well as their persistence, were investigated. Emulsifiable concentrates (50% AI) and granular formulations (5% AI) were used. Ro 8–9801 was the most active compound tested and caused inhibition of adult emergence in both formulations.

INTRODUCTION. Increase of mosquito resistance to conventional insecticides has turned world-wide attention to the use of juvenile hormone mimics in the control of this vector. At present, various juvenile hormone analogues are known. Their effect on mosquitoes under laboratory conditions has been demonstrated by Spielman and Williams (1966), Spielman and Skaff (1967), Nair (1967), Sacher (1971), Jakob and Schoof (1971, 1972), Jakob (1972), Bransby-Williams (1972). The first outdoor experiences with juvenile hormone mimics have been obtained by Wheeler and Thebault (1971) and Schaeffer and Wilder (1972).

Small-scale field trials with juvenile hormone analogues were conducted in middle Italy over a period of 3 months. The primary objectives of these tests were to determine the morphogenetic activity and persistence of the candidate compounds. The results obtained are presented here.

MATERIALS AND METHODS. Test No. 1 (morphogenetic activity). The trials were conducted in the vicinity of Grosseto, Tuscany. The experimental area was established in the neighborhood of a farm and a rice-field. Forty-liter plastic basins were situated in 4 rows and placed under cages (Fig. 1). Each cage consisted of a light metal frame covered with gauze and was fixed with 3 small stakes to the ground. All manipulations inside the cages could be performed through two terminal openings which were fastened by using clothes pegs. To protect the larvae from strong midday sunshine, each cage was partly covered with a piece of jute sacking. Each basin was filled with 30 liters of

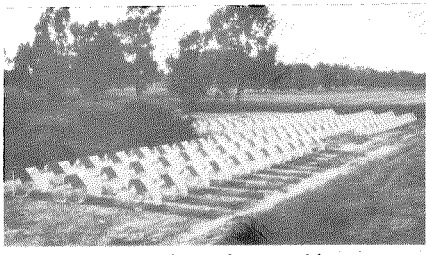

FIG. 1. Experimental area with cages.