RESIDUAL TOXICITY OF FOUR INSECTICIDES TO *AEDES TRISERIATUS* IN SCRAP TIRES

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ABSTRACT. Four insecticides were tested for residual activity to *Aedes triseriatus* in scrap tires. Abate (temephos) granules applied at 10 ppm (AI) resulted in 100% mortality of 4th instar larvae for more than one year. The other insecticides caused no mortality within 4 wk after application.

In the United States, several mosquito species of public health importance are container breeders that may complete larval development in scrap tires containing water. *Aedes triseriatus* (Say), the primary vector of La Crosse (LAC) encephalitis virus in the upper midwestern states (DeFoliart et al. 1986), is one of these. Haramis (1984) suggests that due to faster development times, transovarially infected *Ae. triseriatus* females bred in tires may initiate LAC virus amplification a month earlier than females bred in tree holes. Other important tire-breeding *Aedes* of vector importance include *Ae. aegypti* (Linn.) (Focks et al. 1981) and *Ae. albopictus* (Skuse) (Reiter and Darsie 1984).

Scrap tires present a risk to public health as they place breeding populations of vector species in close proximity to human habitation. The Department of Natural Resources in Wisconsin estimates that approximately 60,000 tons of tires were discarded in 1983 (Anonymous 1986). Many tires are taken to landfills, but they are often stored above ground as landfill operators report that they may "float" to the surface as other waste decomposes and settles. This problem often results in either a higher tipping fee or refusals of landfills to accept scrap tires. Tires are often disposed of improperly, as a result. Wisconsin recently has enacted a law requiring clean-up of scrap tires and mandatory tire recycling, but old tire dumps and tires discarded near roads remain a problem.

Our study was to determine the residual toxicity of 4 commonly used mosquito larvicides against *Ae. triseriatus* larvae in tires. Fifteen tires were taken from the Dane County Landfill in Verona, WI, to the University of Wisconsin experimental farm in Arlington, WI. A drain hole was opened in each tire by removing a triangular piece of rubber from the sidewall. The tires then were scrubbed with water and a wire brush and thoroughly rinsed with water. The tires were placed in an American Elm (*Ulmus americana* Linn.) grove and arranged in groups of 3 with the drain holes at the top.

On July 21, 1986, the 4 treatments, each replicated 3 times, were randomly assigned to the tires. Three tires were not treated and served as controls. Tap water (3.8 liters) was placed in each tire and the insecticides were applied. Tires were checked in 1986 (July 28, August 5 (all tires were dry on both dates), August 19, September 21), in 1987 (June 19, July 17, August 14, September 10) and in 1988 (April 4). On each sample date, with the exception of the first 2 dates, when the tires were dry, water (250 ml) was removed from each tire and returned to the laboratory for bioassay. This experimental design allowed similar comparison of residual toxicities under field conditions through laboratory bioassay of tire contents.

Two organophosphate insecticides were tested, Dursban® 1G (chlorpyrifos) applied at 1 ppm AI and Abate® 5G (temephos) granules applied at 10 ppm AI. A nonneurotoxic, carbamate, insect growth regulator (fenoxycarb 1E) was tested at 10 ppm AI. Vectobac® (*Bacillus thuringiensis* var. *israelensis* de Barjac) (*B.t.i.*), a bacterial product, was applied in liquid formulation at 100 ppm AI.

Bioassays using 4th instar *Ae. triseriatus* larvae held at 22 ± 2°C were conducted in 9-cm diam dental cups using 150 ml of water from each treatment. Ten larvae were placed in each cup with 0.5 g of ground tropical fish food (Tetramin®). A laboratory control using distilled water also was used in each trial. The treatments containing organophosphate insecticides were held for 24 h and mortality data were collected. The other treatments were held until pupation before mortality data were collected.

Of the 2 organophosphates, only Abate provided long residual activity. Mortality (100%) in bioassayed *Ae. triseriatus* persisted for 14 months, through September 10, 1987. Mortality dropped to a mean of 40% at 21 months (April 4, 1988, the last date sampled). By contrast, chlorpyrifos, fenoxycarb and *B.t.i.* showed less than 4 wk residual activity in the tires. All tires became dry for approximately 2 wk shortly after

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application of insecticides, and mortality of bioassay larvae was 0 for each of the 3 insecticides at 4 weeks, 1 year and 21 months after treatment. This result with chlorpyrifos contrasts with those of Mather and DeFoliart (1983) who observed residual activity for at least 11 months in tree holes after applications of temephos and 2 formulations of chlorpyrifos. There was no significant mortality in any of the controls.

In situations where long term control is required, Abate offers good control in scrap tires. Novak et al. (1990) showed that granules could be effectively applied in large tire yards. The granules remained 100% effective for more than one year despite repeated drying and refilling of the tires.

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