EFFICACY OF THE PLANT PHOTOTOXIN
\(\alpha\)-TERTHIENYL AGAINST \textit{Aedes intrudens}
AND EFFECTS ON NONTARGET ORGANISMS

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(Received May 28, 1985; accepted September 30, 1985)

Abstract—The botanical phototoxin, \(\alpha\)-terthienyl (\(\alpha\)-T) was spray applied to natural or artificial pools containing mosquito (\textit{Aedes intrudens}) larvae and nontarget invertebrates (caddisfly, damselfly, midge, shrimp, \textit{Daphnia}, snail) and one vertebrate (trout) at concentrations varying from 0.01 to 1 kg/hectare, under field and laboratory conditions. All field-treated nontarget invertebrates survived \(\alpha\)-T treatment better than \textit{A. intrudens} which can be controlled at doses as low as 0.01 kg/hectare within one week. Under laboratory conditions, snails and trout survived \(\alpha\)-T and UV treatments up to 10 kg/hectare. These results compare favorably with organophosphates and pyrethroid insecticides currently used for mosquito control. The results confirm that \(\alpha\)-T is a highly effective larvicide with acceptable nontarget effects.

Key Words—\(\alpha\)-Terthienyl, \textit{Aedes intrudens}, Diptera, Culicidae, caddisfly, Trichoptera, Limnephilidae, damselfly, Odonata, Libellulidae, midge, Chaoaridae, shrimp, \textit{Daphnia}, snail, Physa, trout, Salmo, thiophene.

INTRODUCTION

The thiophene \(\alpha\)-terthienyl (\(\alpha\)-T) was recently shown to have exceptional larvicidal activity to mosquitoes and blackflies in laboratory and field trials (Wat et al., 1981, Arnason et al., 1981, Philogène et al., 1985). The value of this naturally occurring compound from the tribe \textit{Tagetae} (Asteraceae) as a commercially acceptable insecticide depends upon its efficacy towards target species and its toxicity level towards nontarget organisms. In the present paper, we
report on further field and laboratory experiments with the mosquito *Aedes intrudens* and some nontarget invertebrates and vertebrates and demonstrate that α-T is an efficient mosquito larvicide that is relatively nontoxic to nontarget species.

**METHODS AND MATERIALS**

*Field Trials.* Spray applications of α-T formulated in ethanol to large (20–40 m²) natural breeding pools (temporary snow-melt ponds) were undertaken in the same way as described earlier (Philogène et al., 1985). Water temperature was in the range 10–14°C during the testing period.

The following organisms were field tested: *Aedes intrudens* (Diptera, Culicidae); caddisfly larvae (Trichoptera, Limnephidae), damselfly larvae (Odonata, Libellulidae), midge larvae (Diptera, Chaoboridae), the freshwater shrimp, *Chirocephalopsis bundyi*, and an unidentified ostracod (Crustacea).

Two tests were undertaken: one in early May with third- and fourth-instar *A. intrudens* larvae present and a second in mid-May with fourth-instar larvae and pupae. In the first test, eight pools were treated in applications of 0, 0.01, 0.1, and 1.0 kg/hectare, in duplicate. Intermediate application rates were used in the second test: 0.05, 0.1, 0.5 kg/hectare. Larval counts were made in 25 dips, and the percent reduction calculated according to the formula of Mulla et al. (1971).

To achieve a more precise evaluation of effective levels of control, applications were also made to 25 fourth-instar larvae (the most resistant instar) of *A. intrudens* in bioassay cages placed in 1-m-diameter wading pools containing pond water. The bioassay cages consisted of a cylindrical cage (12.5 x 15 cm) constructed of diamond-stamped aluminum surrounded by muslin held in place by rubber bands.

The pools were placed in a hardwood forest in partial shade, as in the preceding field trials, with 3 replicates for each application. Nontarget organisms (caddisfly, damselfly, and midge larvae) were also treated in the same way, but the pools were moved out of the canopy into full sunlight, adjacent to a permanent pond from which the nontarget organisms were taken.

EC₅₀ and EC₉₀ values were calculated on the basis of three concentrations giving intermediate survival of larvae.

The numbers of ostracods and freshwater shrimps present in temporary snow-melt pools did not permit observations in contained enclosures. These ecosystems were, however, treated with α-T in the same way as the bioassay cages.

*Laboratory Tests.* The water flea, *Daphnia magna* (Ostracoda), was obtained from Carolina Biological Supply and the snail, *Physa* sp. (Gastropoda), purchased from a local supplier. These organisms were treated at 23°C in Pyrex