Red Imported Fire Ant:[1] Laboratory Tests with Additional Candidate Bait Toxicants[2]

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A screening program was initiated in 1970 to evaluate various candidate chemicals as potential replacements for mirex in baits for control of the red imported fire ant, *Solenopsis invicta* Buren.

The criteria used to assess effectiveness of the compounds was described by Stringer et al. (1964). According to these workers, an effective bait toxicant must (1) possess the quality of a delayed killing action over at least a 10-fold dose range and preferably above a 100-fold dose range; (2) be readily transferred between ants and result in mortality of the recipient; and (3) not be repellent to the ants. Lofgren et al. (1967) described screening techniques for toxicants and reported results of laboratory tests with 334 compounds. Lofgren et al. (1962, 1964) reported the results of field studies with mirex, the most effective toxicant found to date for use in baits for control of imported fire ants.

This paper presents results of laboratory tests with 590 compounds evaluated at the Insects Affecting Man and Animals Research Laboratory at Gainesville, Fla., during 1970–71.

MATERIALS AND METHODS.—The test chamber and procedure employed were the same as those used by Lofgren et al. (1967) except that the ants were not anesthetized with CO_2. All ants used in the screening program were obtained from the area surrounding Baldwin, Fla.

The candidate toxicants, depending on the solubility of the chemical, were dissolved in the food material (once-refined soybean oil or 10% sucrose solution). However, when the compound was not completely soluble in soybean oil, 1% monoglycerides of lards were added to hold the chemical in suspension. In preliminary tests, all chemicals were tested at 1.0, 0.1, and 0.01% concentrations, and those that gave complete kill at the lowest dosage were further tested until the lowest concentration that gave complete kill was determined. Those that did not give complete kill at 0.01% were not tested further. Eight knockdown and mortality counts were made at intervals of 1, 2, 3, 6, 8, 10, 13, and 14 days after exposure.

The following classification system, designed by Lofgren et al. (1967), was used to rate the chemicals: Delayed toxicity was defined as less than 15% mortality after 24 hr and more than 89% mortality at the end of the test period.

Class I.—Compounds that gave insufficient kill at the preliminary test concentrations (less than 90% kill at the end of the test period).

Class
Ia—Maximum kill 0–29%
Ib—Maximum kill 30–59%
Ic—Maximum kill 60–89%

Class II.—Compounds that killed too fast at the higher concentrations but gave insufficient kill at the lower concentrations, that is, 15% or more kill after 24 hr and 90–100% at the end of the test period at the higher concentrations but less than 90% kill with the lower concentrations at the end of the test period.

Class
IIa—Produced fast kill at 1.0%
IIb—Produced fast kill at 0.1 and 1.0%
IIc—Produced fast kill at 0.01, 0.1, and 1.0%

Class III.—Compounds that showed delayed action over a 1-fold to 9-fold dose range.

Class
IIIa—Delayed action occurred between 0.25 and 1%
IIIb—Delayed action occurred between 0.025 and 0.1%
IIIc—Delayed action occurred between 0.0025 and 0.01%

Class IV.—Compounds that showed delayed action over a 10-fold to 99-fold dose range.

Class V.—Compounds that showed delayed action over a 100-fold or greater dose range.

RESULTS.—None of the 590 candidate toxicants was as effective as mirex (Class V, Lofgren et al. 1967). The number in each class was: Ia, 177; Ib, 134; Ic, 96; IIa, 45; IIb, 58; IIc, 4; IIIa, 26; IIIb, 26; IIIc, 22; IV, 2; and V, 0.

The chemical names and classes of toxicants in Classes I–III are recorded in Special Report no. 72-03W, a copy of which may be obtained by request to the authors.

The 2 Class IV chemicals found were ENT-24875 (1,1a,3,3a,4,5,5,5a,5b,6-decachlorooctahydro-1,3,4-metheno-2*H*-cyclobuta[*cd*]pentalen-2-ol) and ENT-27737 (1,1a,3,3a,4,5,5,5a,5b,6-decabromooctahydro-1-3-4-metheno-2*H*-cyclobuta[*cd*]pentalene-2,2-diol (Dowco 245). Both of these chemicals are analogues of mirex.

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[1] Hymenoptera: Formicidae.

[2] This paper reflects the results of research only. Mention of a pesticide, commercial, or proprietary product does not constitute recommendation or endorsement by the USDA. Received for publication Sept. 25, 1972.

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