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Reproductive Inhibition of Stored Product Insects by Mobil 9087¹

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ABSTRACT: Mobil 9087 (1-(1,1-dimethylethyl)-4-[1-(4-ethoxyphenyl)-2-nitrobutyl] benzene) was tested for activity against eight species of stored product insects. The compound was relatively ineffective in wheat toward adult stages of all species. It was effective in suppressing progeny of *Rhyzopertha dominica* (F.) (ID₉₅ = 10.7 ppm), *Oryzaephilus surinamensis* (L.) (ID₉₅ = 17.3 ppm), *Tribolium confusum* Jacquelin du Val (ID₉₅ = 70 ppm), *Sitotroga cerealella* (Oliver) (ID₉₅ = 89.6 ppm), *Ephestia cautella* (Walker) (ID₉₅ = 85.3 ppm), and *Plodia interpunctella* (Hübner) (ID₉₅ = 92.2 ppm). No significant antipopulation activity was observed against *Sitophilus oryzae* (L.) or *Paramyelois transitella* (Walker).

Mobil 9087 (1-(1,1-dimethylethyl)-4-[1-(4-ethoxyphenyl)-2-nitrobutyl] benzene) is an experimental insecticide that is a stomach poison and also has some contact activity (Kruger 1976). Because this substituted diphenyl nitroalkane derivative is a broad spectrum pesticide (Kruger 1976), it might be useful as a protectant of stored products. We therefore applied the chemical to wheat and evaluated the activity against 4 species each of Coleoptera and Lepidoptera.

Materials and Methods

The rice weevil, *Sitophilus oryzae* (L.), confused flour beetle, *Tribolium confusum* Jacquelin du Val, lesser grain borer, *Rhyzopertha dominica* (F.), sawtoothed grain beetle, *Oryzaephilus surinamensis* (L.), Indian meal moth, *Plodia interpunctella* (Hübner), Angoumois grain moth, *Sitotroga cerealella* (Olivier), almond moth, *Ephestia cautella* (Walker), and navel orangeworm, *Paramyelois transitella* (Walker) were obtained from cultures maintained at the U.S. Grain Marketing Research Laboratory. 'Chanute' wheat, obtained from a commercial source, was used in all tests. Kernels were cleaned and tempered to a moisture of 12.5 ± 0.5% as determined by a Motomco[®] moisture meter.

Mobil 9087 (AI3-29328) was obtained from Mobil Chemical Co. as 24% EC (0.23 kg/liter) and stored at -10°C until used. The insects were exposed

¹ This paper reports the results of research only. Mention of a pesticide does not constitute a recommendation for use by the USDA nor does it imply registration under FIFRA as amended. Also, mention of a proprietary product does not constitute endorsement by the USDA.

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Table 1. Reproductive inhibition of stored product beetles by Mobil 9087.

| Species | No F ₁ insects in untreated sample | ID ₉₅ (95% confidence limits) |
|-------------------------|---|---|
| Lesser grain borer | 627 | 10.7 (7.5-17.3) |
| Sawtoothed grain beetle | 414 | 17.3 (14.6-21.9) |
| Confused flour beetle | 510 | ~70 |
| Rice weevil | 890 | ≥100 |

Table 2. Activity of Mobil 9087 against lepidopteran eggs in wheat or wheat based medium.

| Species | No. moths found in untreated sample ^a | ID ₉₅ (95% confidence limits) |
|----------------------|--|---|
| Almond moth | 35 | 85.3 (50.1-148.3) |
| Angoumois grain moth | 35 | 89.6 (76.2-113.1) |
| Indian meal moth | 43 | 92.2 (71.8-128.3) |
| Navel orange worm | 33 | ≥100 |

^a Fifty eggs added to 100 g of diet.

to this insecticide admixed with diet in ventilated pint jars. Appropriate stock solutions were prepared in water to provide 1-100 ppm dosages of insecticides (wt/wt). The dilutions were applied to whole wheat or to ground wheat moth medium (Kinsinger 1975)³ as described by McGregor and Kramer (1975, 1976). Then the diet was infested with 50 lepidopteran eggs or adult Coleoptera of mixed ages and held at 27 ± 2°C and 60 ± 5% RH (4 replicates of each species). Toxicity was determined after 21 days of exposure. Inhibition of progeny was determined after 9 weeks by subtracting the number of parent insects from the average total dead and live insects found and using the values when statistically possible to establish the ID₉₅ (ppm per weight of grain required to suppress 95% of progeny). When the numbers of progeny were reduced significantly (>10-20%), the samples were also reexamined after 6 months. Probit analyses of the data were conducted according to Finney (1952).

Results and Discussion

Mobil 9087 was not highly toxic to the adult stages of any of the eight species of stored product insects. The most susceptible species were the

³ Kinsinger, R. A. 1975. Stability of *Bacillus thuringiensis* and a granulosis virus of *Plodia interpunctella* (Hübner) in stored wheat. Master's Thesis, Kansas State University. 75 p.

lesser grain borer and sawtoothed grain beetle which displayed 80% and 30% mortalities respectively at the highest dose tested, 100 ppm. No difference from control mortalities (0-10%) was observed with any other species. The progeny from six species was significantly suppressed when exposed to Mobil 9087 (Tables 1 and 2). Coleoptera except for the rice weevil were more susceptible ($ID_{95} = 10-70$ ppm) than Lepidoptera ($ID_{95} = 85-92$ ppm) except for the navel orangeworm. As was the case with adult toxicity, the lesser grain borer and sawtoothed grain beetle produced the most susceptible progeny ($ID_{95} = 10-17$ ppm, respectively). Progeny of the rice weevil and navel orangeworm were hardly affected by the compounds (16% and 11% progeny reduction at 100 ppm, respectively).

The progeny inhibition activity of Mobil 9087 toward the lesser grain borer and sawtoothed grain beetle indicates that this compound would be a useful protectant if these insects were the only species present in the commodity. For use against other species, more active formulations or derivatives need to be developed.

Acknowledgment

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