

Evaluation of Hexadecyl Cyclopropanecarboxylate for Preventive Control of the Mold Mite¹ in Stored Grain²

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ABSTRACT

Hexadecyl cyclopropanecarboxylate (ZR-856, Zardex®) applied to high moisture wheat and artificial rearing medium at rates of 10–500 ppm reduced the population of *Tyrophagus putrescentiae* (Schrank) in the laboratory.

Stored grain is a substrate for several species of mites including the mold mite, *Tyrophagus putrescentiae* (Schrank) (Harein and Las Casas 1974). This species is active in grain with high moisture content where it feeds primarily on the germ (Solomen 1946, Griffiths 1964, Boczek 1974). Since compounds derived from cyclopropanecarboxylic acid proved to be effective against the twospotted spider mite, *Tetranychus urticae* Koch (Staal et al. 1975, Nelson and Show 1975), we evaluated a cyclopropane derivative ZR-856 (hexadecyl cyclopropanecarboxylate; Zardex®) as a method of controlling populations of the mold mite in wheat and on agar based culture media.

MATERIALS AND METHODS.—*T. putrescentiae* were obtained from 2 sources, a laboratory strain from ARS, USDA, Madison, Wis., and a strain collected from field-shelled Pioneer 3306 corn (23% moisture) in storage at the U.S. Grain Marketing Research Center. The laboratory strain was tested on the agar-based rearing medium of Bot and Meyer (1967); the collected strain was evaluated on kernels of the Chanute variety of wheat after the kernels were cleaned and tempered to a moisture of 19±1% as determined by a Motomco moisture meter.

ZR-856 was obtained from Zoecon Corp., Palo Alto, Calif. (40% WP) and stored at 4°C until used. Dicofol, a commercial miticide used for comparison, was purchased from Science Products Co., Chicago, Ill., in an 18.5% EC. These materials were mixed with an appropriate volume of water to provide doses of 10 and 100 ppm (wt/wt) AI on grain. Wheat (1 kg) was treated by pipetting 1 ml of solution onto the inside surface of a rotating 3.8 liter glass jar that was placed for 20 min on a mechanical tumbler operating at 40 rpm. After 24 h of equilibration, the treated grain was divided into 250-g lots in 0.96 liter jars that were capped with a 40-mesh screen. Then the jars were placed under the surface of the mite-infested corn. After an exposure of 2

weeks, the jars were sealed and incubated at 25°C for 3 weeks. Then the wheat was examined for the presence of mites with a binocular microscope.

The artificial medium (30 g) was surface-treated (45 cm²) with 1 ml of the appropriate solution to give doses of 1, 10, 50, 100, and 500 ppm (wt/wt) AI. Each culture dish was stocked with 5 mating pairs of mites; populations were estimated after 5 weeks. Data are presented as an approximation (± 10–20%) of the actual populations present.

RESULTS AND DISCUSSION.—The 5 mating pairs of mites in the control culture dish produced ca. 2500 progeny in 5 weeks. Surface treatments of 50, 100, and 500 ppm ZR-856 reduced this level by 6–16%, 24–36%, and 90–95%, respectively. When applied homogeneously to wheat at a dose of 100 ppm, ZR-856 almost suppressed the entire population to less than 100 animals/jar compared with ca. 4400 mites in the control. A dose of 10 ppm reduced the total population by 69–96%. For comparison, dicofol applied at 100 and 10 ppm yielded reductions of 79–99% and 36–79%, respectively. ZR-856 was therefore as effective as dicofol in preventing the population build-up of *T. putrescentiae* in our tests. It may have potential as a mite specific chemical protectant of grain, particularly in those parts of the world where the climate is temperate and it may be too expensive to store grain with low moisture content. In such cases, a chemical means of control such as ZR-856 may be a more practical procedure. Direct application of ZR-856 to stored commodities holds a reasonable expectation of regulatory acceptance based on preliminary toxicology and metabolism studies (Steward 1962). The acute oral LD₅₀ in rats is 12200 mg/kg. The major metabolite had no effect in chronic studies in guinea pigs, rats, and monkeys and has been administered to man as part of a pharmacological study.

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¹ Acarina: Acaridae.

² 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 commercial or proprietary product does not constitute an endorsement by the USDA. Received for publication May 6, 1976.

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