Susceptibility of different life stages of *Tribolium* spp. to pyrethhrin aerosol

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When adult red flour beetle, *Tribolium castaneum*, and confused flour beetle, *Tribolium confusum* are exposed to aerosol insecticides, dispersion of the formulation within the target area, recovery after knockdown, and the presence of food material can all affect final mortality. However, differences between aerosol formulations and or application systems can also contribute to recovery from knockdown following aerosol application. In this trial, a study was conducted in a commercial food warehouse with an installed aerosol system. The specific formulation contained a mixture of 1% pyrethrin, 2% piperonyl butoxide synergist, 3.33% N-octyl biclopheptene dicarboximide, and 93.67% other ingredients. Particle size delivered by the system was in the range of 15-20 microns.

Six separate field trials at a commercial site in Kansas City, Missouri. Two sets of standard plastic 100 by 15 mm Petri dishes containing either 10 late-stage larvae, 10 pupae, or 10 adults of the red flour beetle or confused flour beetle were placed at 15 locations within the test room. One set of dishes for the adult exposures contained about 250 mg of flour in each Petri dish, the other set did not contain food materials. All larvae and pupae were exposed with food material.

Separate sets of dishes were placed in the warehouse office as untreated controls. Dishes were exposed to the aerosol for normal operation, left in the room overnight, and picked up the next morning. At 7 and 14 days post-treatment, dishes were examined, and

adults classified as running (survival), knocked down (on their backs and moving) or dead (failure to move when touched with a probe). Immature life stages were examined for the presence of live adults only. There was little mortality or knockdown in untreated controls, and survival was virtually 100%.

Survival of adult confused flour beetles was significantly greater at both 7 and 14 days post-treatment in dishes containing the flour food source, while a significant difference for red flour beetles occurred only at the 7-day post-exposure period. The red flour beetle was the more susceptible species; final mortality was > 98%, compared to 85 to 90% mortality of adult confused flour beetles. More adult confused flour beetles were in the knockdown stage at both assessment intervals compared to the red flour beetle. At 14 days, some confused flour beetles that were knocked down at 7 days had recovered, but the majority of the red flour beetles had died by the 7-day assessment period.

No immature red flour beetles emerged as live healthy adults in any of the treatments. Larvae were usually discolored and failed to reach the pupal stage, and exposed pupae could not emerge as adults. Emergence of confused flour beetle exposed as pupae was low and sporadic, and occurred primarily in the first replicate. No exposed confused flour beetle larvae emerged as adults.