INSECTICIDES TO CONTROL INSECTS IN MILLS, PROCESSING PLANTS, FOOD WAREHOUSES, AND URBAN STORAGES

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Introduction

In the early 1990s the Methyl Bromide Technical Options Committee (MBTOC) established a broad interpretation of alternatives to Methyl Bromide, especially in the post-harvest arena. Options were not limited to new fumigants, and a variety of chemical and non-chemical control strategies were identified as alternatives. One of these alternatives was contact and residual insecticides applied to specific target areas instead of broad-scale application. It is important to identify physical, biological, and environmental factors that can affect efficacy and performance of conventional insecticides and natural products that can be used to replace methyl bromide. Also, new chemical compounds should be evaluated for potential use in post-harvest markets.

Selective summaries are presented here to illustrate concepts and ideas. More detailed information can be obtained from research reprints listed at bru.usgmrl.ksu.edu/arthur, which is part of the web page maintained by our Biological Research Unit. This research unit is part of the Grain Marketing and Production Research Center, USDA-ARS, Manhattan, KS (www.gmprc.ksu.edu). Most of the studies summarized below have been conducted with the red flour beetle, *Tribolium castaneum*, and the confused flour beetle, *Tribolium confusum*, two major insect pests in mills, processing plants, food warehouses, and other areas where food is stored.

Research Summaries

Formulation Effects: Contact insecticides labeled as residual treatments to flooring surfaces may be available in both wettable powder (WP) or emulsifiable concentrate (EC) formulations. One of these insecticides is the pyrethroid cyfluthrin (Tempo), which is heavily used as a surface treatment. The WP formulation of this insecticide is much more effective than the EC formulation and gives greater residual persistence when applied to concrete. A waterproofing sealing applied to concrete may be necessary to achieve the same level of control with the EC as compared to the WP formulation (Arthur 1994).

Environmental Effects: Diatomaceous earth (DE) is a natural product composed of the cell walls of fossilized diatoms, and can be either of freshwater or marine origin. There are various commercial products on the market today, and they kill insects generally by interfering with absorption of lipids through the epicuticle, and insects become vulnerable to desiccation. Survival of adult red flour beetle and confused flour beetle increases when these species are exposed to diatomaceous earth at increasing levels of relative humidity (Arthur 2000a).

Physical Effects: Survival increases when red flour beetles and confused flour beetles are given food either during or after they are exposed to insecticides. In one test concrete was treated with the label rate of cyfluthrin WP, and residual bioassays were conducted every 2 weeks. For up to 12 weeks, exposure intervals of 60 minutes or less killed adult red flour beetles starved after exposure, in contrast, by week 4 survival of beetles given food after exposure was 80 to 100% at all exposure intervals (Arthur 1998). Similar results have been obtained in studies with diatomaceous earth (Arthur 2000b).

New Research with Insect Growth Regulators, Hydroprene EC: Little published research with insect growth regulators (IGRs) has involved studies with treated surfaces. Tests were conducted by exposing 4-week-old last instar red flour beetles and confused flour beetles on concrete treated with the label rate of hydroprene (Gentrol) EC. In general, effects were more pronounced in the red flour beetle compared to the confused flour beetle. Temperature effects were variable and inconclusive, but more deleterious effects (arrested larvae, adults that were either unable to eclose or died shortly after emergence, or adults with morphological defects) were produced in both species with increasing levels of relative humidity (Arthur 2001).

New Research with Insect Growth Regulators, Pointsource: Three and 4-week old red flour beetle and confused flour beetle larvae were exposed to a volatile formulation of the insect growth regulator (IGR) hydroprene (Pointsource™). Both species were susceptible, although the confused flour beetle was the more tolerant species. Most of red flour beetle larvae either did not develop to the pupal or adult stages or died after emergence. More of the confused flour beetles were able to reach the adult stage, some had twisted or incomplete wings but remained alive, but most were affected by exposure to the IGR (Arthur 2002).

References

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