Reducing food loss with insecticide-treated storage material

Clara Wicoff[1,2], Dr. James Campbell[1,3], and Dr. Deanna Scheff[3]

[1]Department of Entomology, College of Agriculture, Kansas State University
[2]Department of Agricultural Economics, College of Agriculture, Kansas State University
[3]USDA Center for Grain and Animal Health Research, Manhattan, KS

Introduction

At the global level, approximately one-third of food produced for human consumption is lost or wasted each year. According to the Food and Agriculture Organization of the United Nations, more than 40 percent of food losses in developing countries occurs at the post-harvest and processing levels. In developing countries stored product insects can be one of the most important loss factors. Grain commodities in developing countries is typically stored in bags in homes and in warehouses. Even if the grain added to these bags is free of insects the stored bags are vulnerable to insect colonization during storage and transport. This loss to insect damage could potentially be reduced by utilizing insecticide-treated bags to store commodities. However, to be effective a rapid knockdown of the insect is needed so they don't gain access to the grain inside the bag.

Objective

The purpose of this research was to determine how quickly three stored product insect species were affected by exposure to Vestergaard Zerofly storage bag (an insecticide impregnated bag being evaluated for use in developing countries).

Study System

The three stored product insect species studied in this experiment were the larger grain borer, *Prostephanus truncatus*; the cowpea weevil, *Callosobruchus maculatus*; and the lesser grain borer, *Rhyzopertha dominica.* All three species are major pests that attack intact seeds and are internal feeders, meaning that they develop to the adult stage within the kernel. Information on impact of insecticide treated bags was not available for the cow pea weevil, and the impact of short term exposures was not available for any of these species.

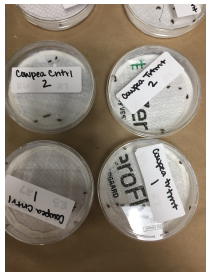
The larger grain borer is a dark brown beetle measuring 3-4 mm in length. The larger grain borer is a primary pest of maize and cassava. The lesser grain borer is a black-brown insect with a slim body, measuring approximately 3 mm in length. The lesser grain borer infests all cereal grains, especially wheat, corn, and rice. The cowpea weevil is a reddish-brown beetle approximately 3 mm in length with two blackish-red spots on its wing covers. The cowpea weevil infests stored legumes, such as cowpeas and chickpeas.

Cowpea weevils may "play dead" if disturbed, remaining still for up to five minutes. For this reason, in the context of this research, it is important to observe the insects for an extended period of time to determine whether the insects truly are affected by the insecticide-treated bags.

Methods and Experimental Design

The insecticide-treated bag material used in this experiment was Vestergaard ZeroFly storage bag material. The active ingredient in this insecticide-treated material is deltamethrin, which is approved by the Food and Agriculture Organization and the World Health Organization.

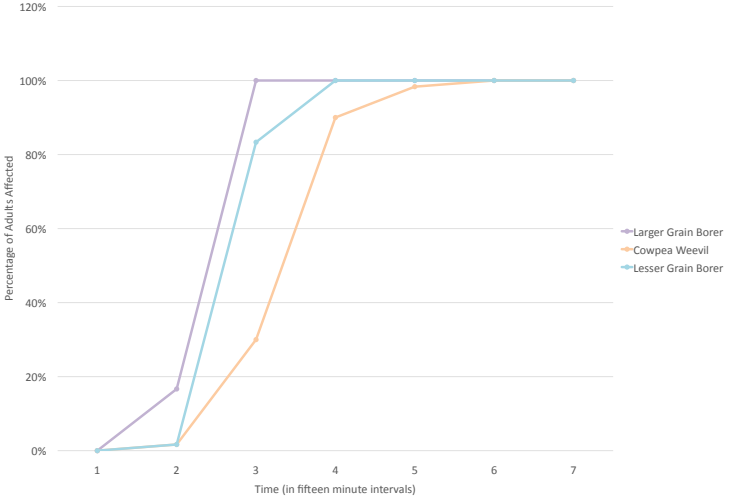
This experiment was run in two blocks, with three sets of dishes with Zerofly bag and three sets of dishes with control material for each species. This resulted in a total of 18 dishes in each block. This experiment was performed in two blocks on different days to include any variation due to the environment that day and variation in the insect colonies. Ten insects were added to each dish at the start of the trial. These insects were observed every 15 minutes for a total of 90 minutes. The number of unaffected insects (walking normally) and affected insects (immobile, legs and antennae may or may not be moving) were recorded.



After this experiment was performed, the data was analyzed to determine the average percentage of adults affected at each time interval for the three species.

Results

After 75 minutes, 100 percent of the adults in all three species were affected. Among all species, the number of affected adults was ≤2% for all time points with the control material (data not shown).



Conclusions

Previous research has shown long term exposure to the ZeroFly package material has negative impacts on stored product insect survival. If insects stay on the insecticide-treated bag, they are unlikely to recover. However, in the real world, insects may move on and off of the package, and would thus have short periods of exposure.

The Vestergaard ZeroFly storage bag material rapidly affected the three stored product insect species studied (the larger grain borer, the cowpea weevil, and the lesser grain borer). These three species are some of the most damaging species in developing countries in Africa, so rapidly immobilizing these species is important for the efficacy of this bag material. There was a lack of research regarding the effect this material has on the cowpea weevil, which is a major pest in Africa and Asia. Protecting stored commodities by reducing insect damage in these areas of the world could potentially reduce post-harvest loss and improve food security.

Future Directions

The next step in this research would be to determine whether short term exposure ultimately leads to reduced survival and prevents insects from entering bags.

References

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