Determining Aerosol Insecticide Efficacy on Eight Species of Stored Product Insects

Deanna Scheff[1], Dan Brabec[1], and Joseph Bindel[2]

USDA Agricultural Research Service U.S. DEPARTMENT OF AGRICULTURE

MRIGlobal

Introduction

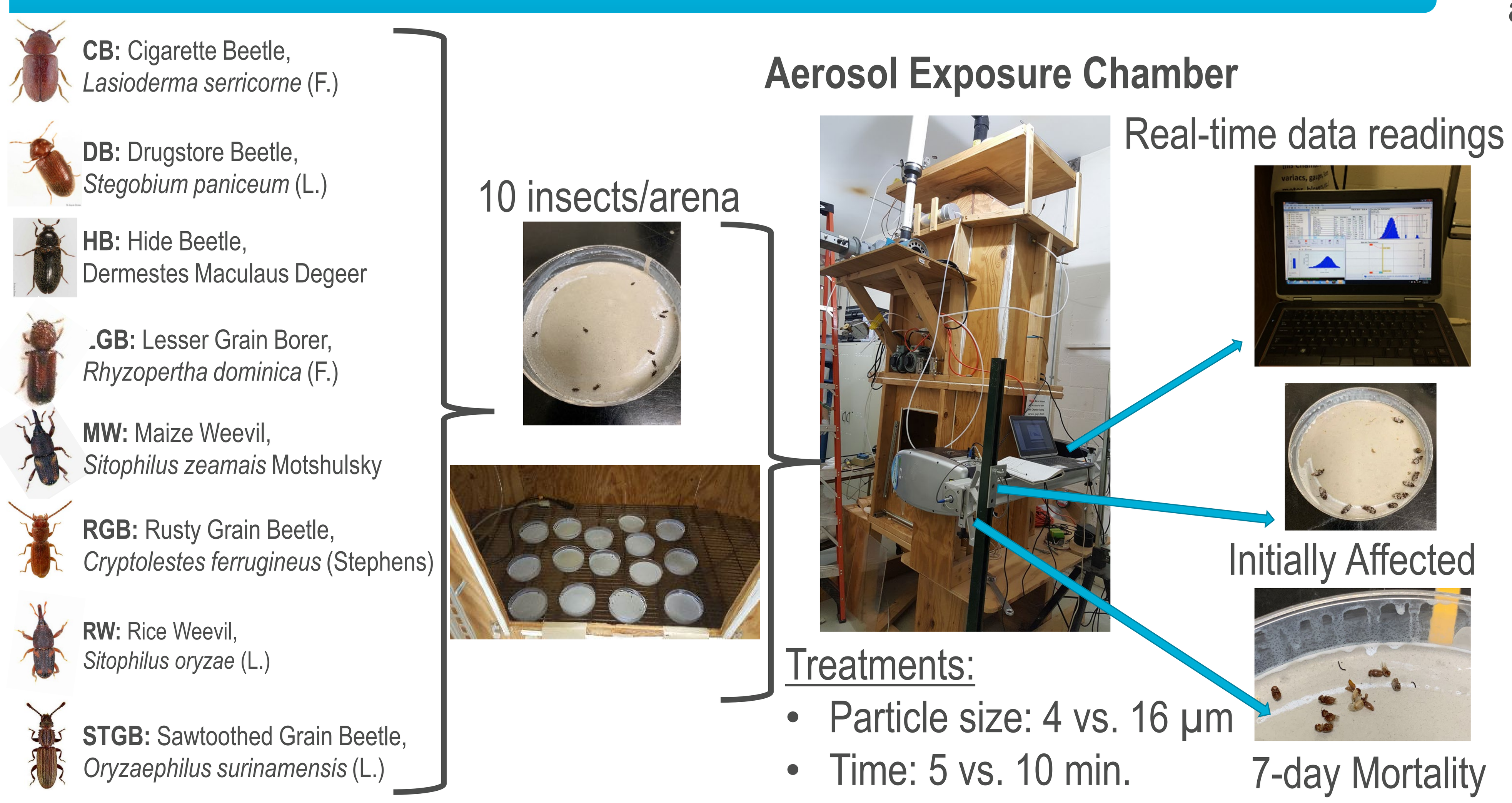



- Aerosols insecticides are liquid insecticide formulations that are atomized through pressure or mechanical means in particles sizes 5 – 50 micron and distribute throughout a given space
- Aerosols are increasingly used as an alternative to fumigants to control insect pests in mills, warehouses, and processing plants
- Aerosol particle size depends on:
  - Chemical properties and formulation, flow rates, nozzle type and size, configuration, means of atomization, etc.
- Insecticidal coverage depends on:
  - Spatial configuration, moving vs. static application, application techniques, ambient conditions, cleanliness
- Entomologists and engineers at the USDA-ARS-Center for Grain and Animal Health Research (CGAHR) in Manhattan, Kansas and Engineers at MRIGlobal have been investigating the effect of aerosol particle size on insecticide efficacy on the model species, *Tribolium confusum* Jaquelin du Val, confused flour beetle
  - Small particles = lower efficacy

Objective

The objective of this study was to investigate the effect of aerosol particle size (4 and 16 µm) and treatment time (5 and 10 min) on insecticidal efficacy on adults of eight different species of stored product insects commonly found in mills, warehouses, and processing plants in the United States

Materials and Methods



Results – Particle Distribution

Table 1. Median particle sizes (Dv50) measured by the Malvern Spraytec during experiments inside the aerosol chamber

Target Size (µm)	5 min Spray	10 min Spray
4	4.00 ± 0.01	4.27 ± 0.01
16	19.33 ± 1.08	19.29 ±1.28

- A larger distribution in particle sizes was observed for the 16 µm targeted size compared to the 4 µm

Results – Effect on Adult Beetles

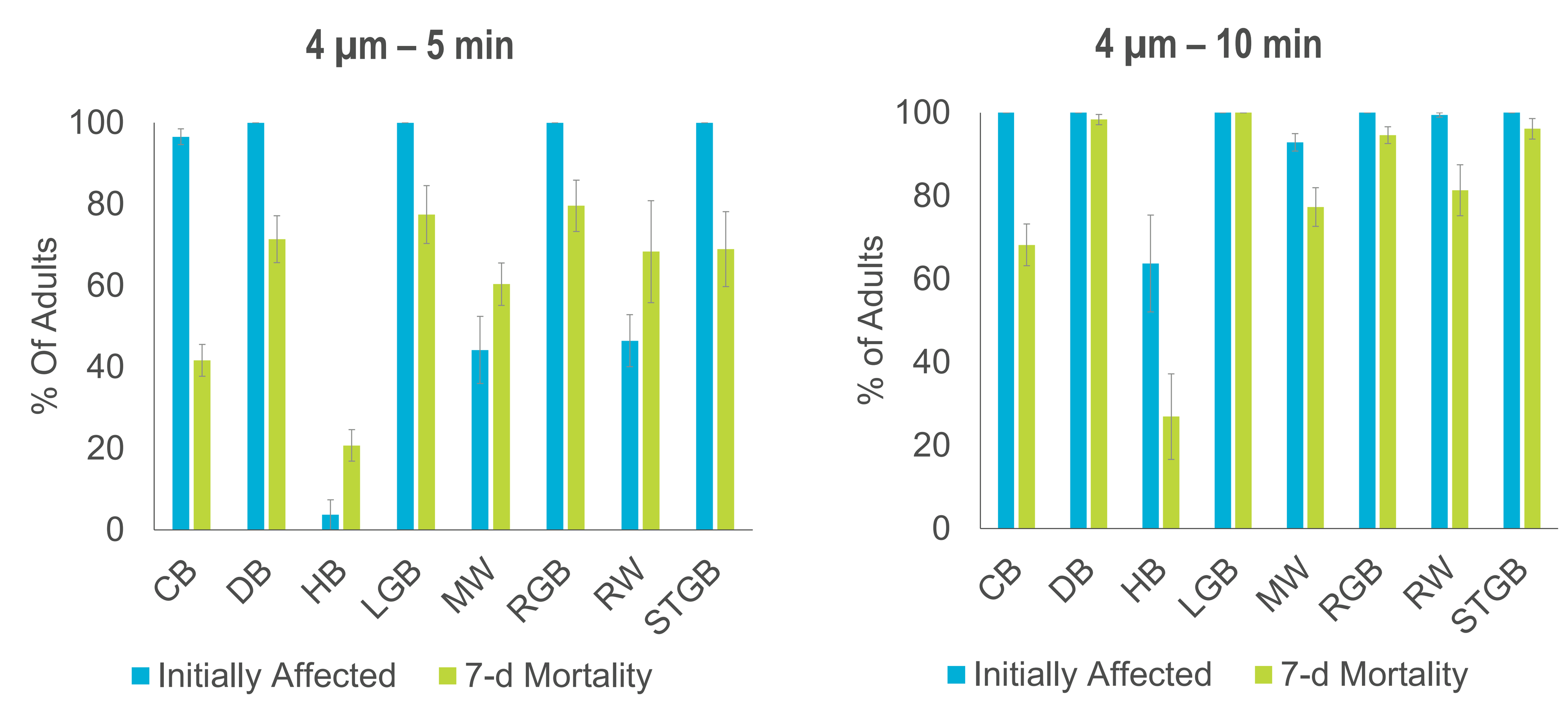


Figure 1. Mean (±SE) initially affected adults (blue) and 7-day mortality (green) among all species after a 4 µm and 5 min (left) and 4 µm and 10 min (right) aerosol treatment

- There was a wide range in the number of initially affected adults (adults on their backs and unable to move) among all species
  - CB, DB, LGB, RGB, and STGB had ≥ 97% affected adults at both treatment times
  - Increase in treatment time = Increase in affected adults
- There was little recovery from the initial aerosol treatment after the 4 µm and 10 min treatment
  - DB, LGB, RW, RGB, STGB mortality was ≥81%
- The HB was the most tolerant among all species

Results – Effect on Adult Beetles

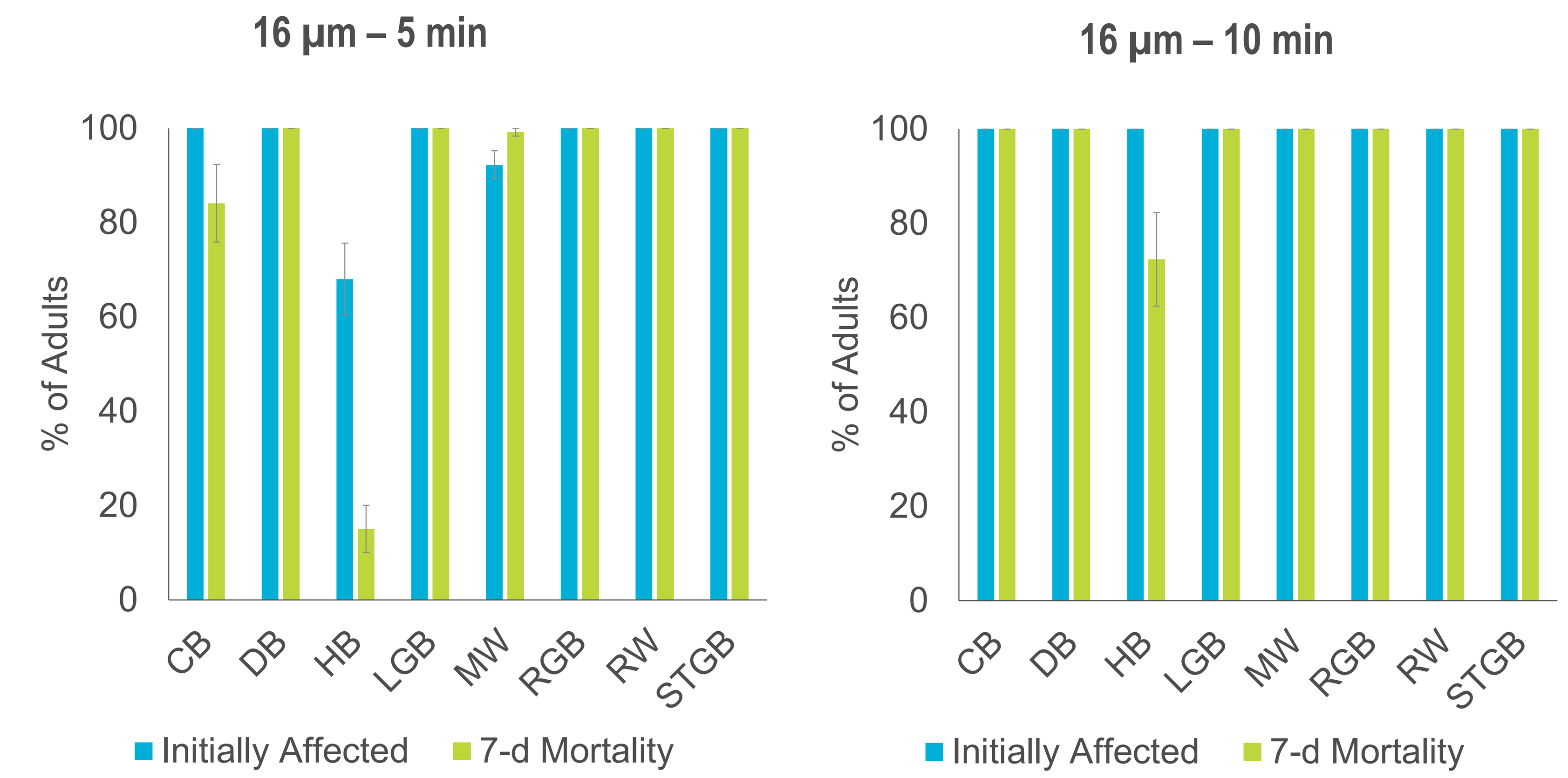


Figure 2. Mean (±SE) initially affected adults (blue) and 7-day mortality (green) among all species after a 16 µm and 5 min (left) and 16 µm and 10 min (right) aerosol treatment

- The larger particle size (16 µm) had a more affected adults compared with the smaller particles size (4 µm)
  - ≥ 68% at 5 min and 100% at 10 min among all species
- Higher mortality among all species was overserved at the 16 µm treatment
  - ≥ 84% at 5 min for CB, DB, LGB, MW, RGB, RW and STGB
  - ≥ 72% at 10 min for all species

Conclusions

- Affected adults ≠ mortality
  - Recovery may occur in some species if treatment is not sufficient
- 16 µm mortality > 4 µm mortality at both treatment times
  - Longer treatments and larger particles sizes are more effective

Contact Information

[1]Deanna Scheff, USDA – ARS, Deanna.Scheff@usda.gov
[1]Daniel Brabec, USDA – ARS, Daniel.Brabec@usda.gov
[2]Joseph Bindel, MRIGlobal, jbindel@mriglobal.prg

Acknowledgement

This research was partially supported by the USDA-NIFA Methyl Bromide Transitions Program (grant no. 2016-51102-25816)