

# Laboratory Selection for Resistance to Diatomaceous Earth

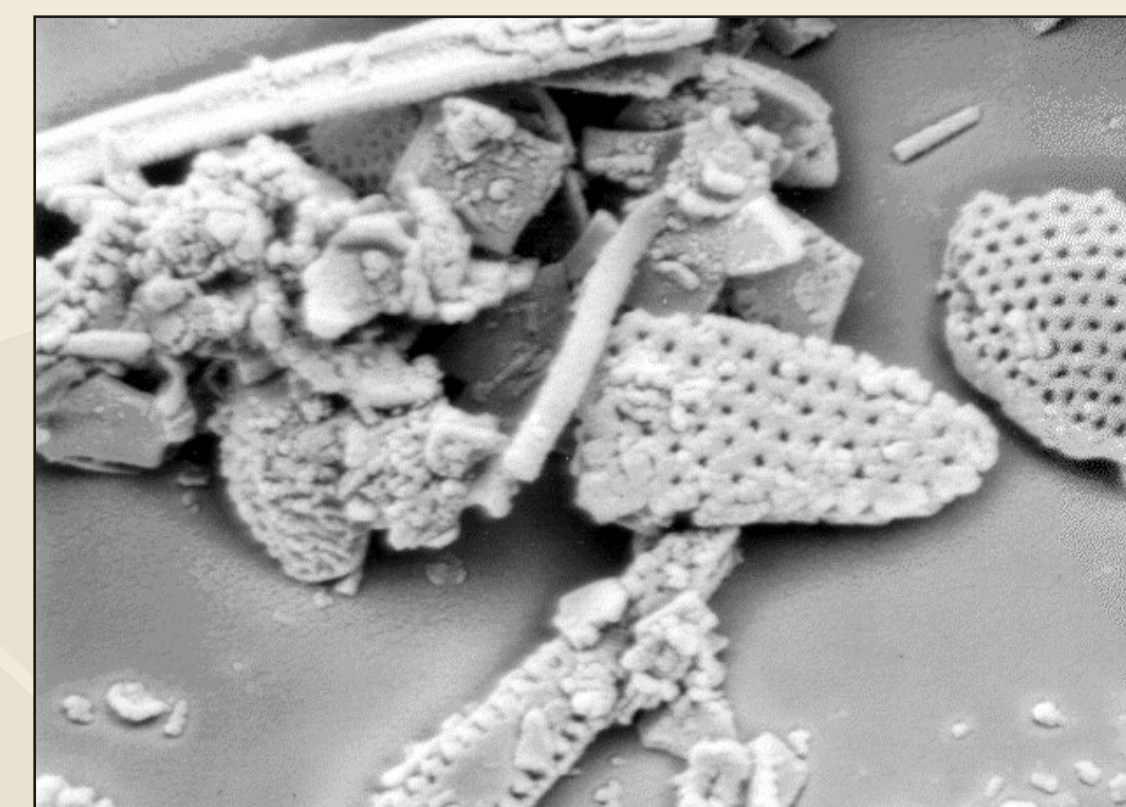
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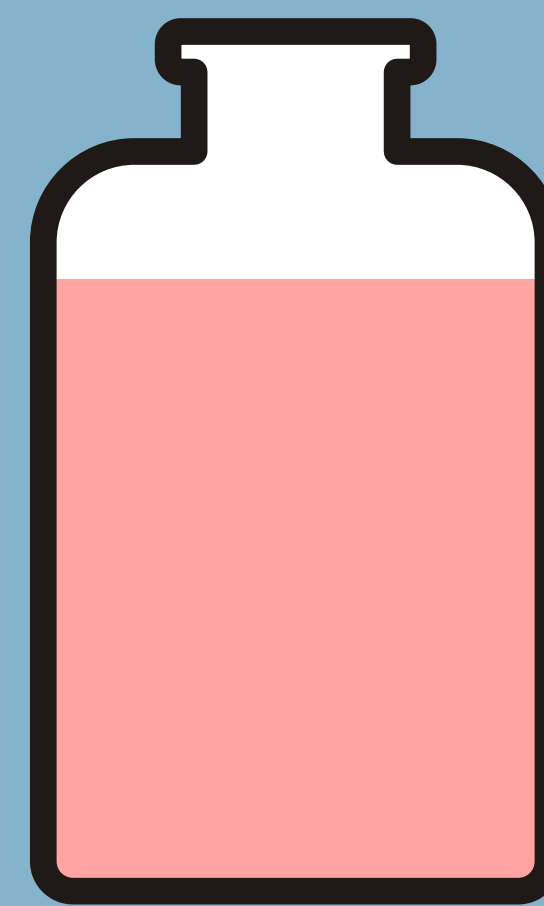
*This work suggests that methods of using diatomaceous earth will affect the rate at which the DE-resistant populations develop.*

## INTRODUCTION

Resistance to synthetic contact insecticides by stored-product insects is a common problem throughout the world. There is increased interest in diatomaceous earth (DE) because of insect populations resistant to synthetic insecticides, worker safety and concerned consumers. DE is obtained from geological deposits of diatomite, which are fossilized sedimentary layers of microscopic algae called diatoms. The fine DE dust, made up mainly of SiO<sub>2</sub>, absorbs wax from the insect cuticle, causing death due to desiccation.

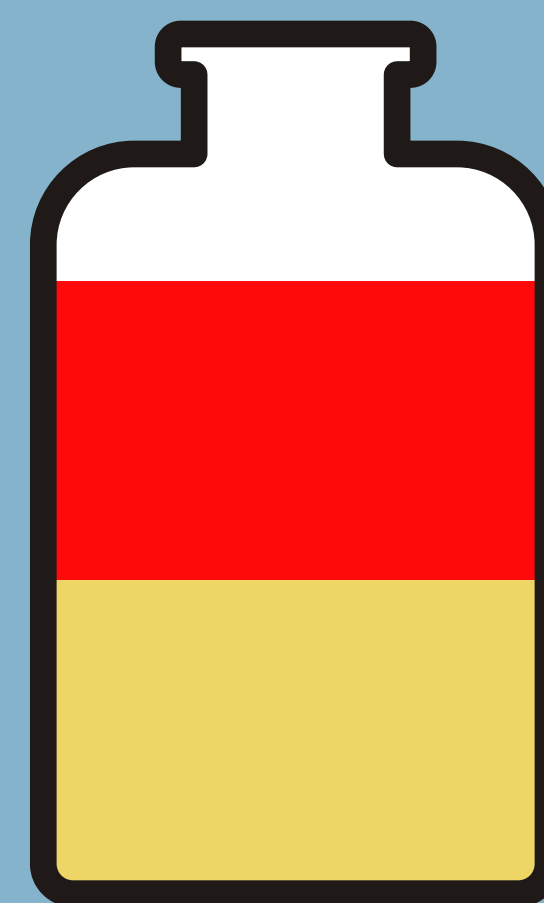


Protect-It® diatomaceous earth (DE) was used in all tests.



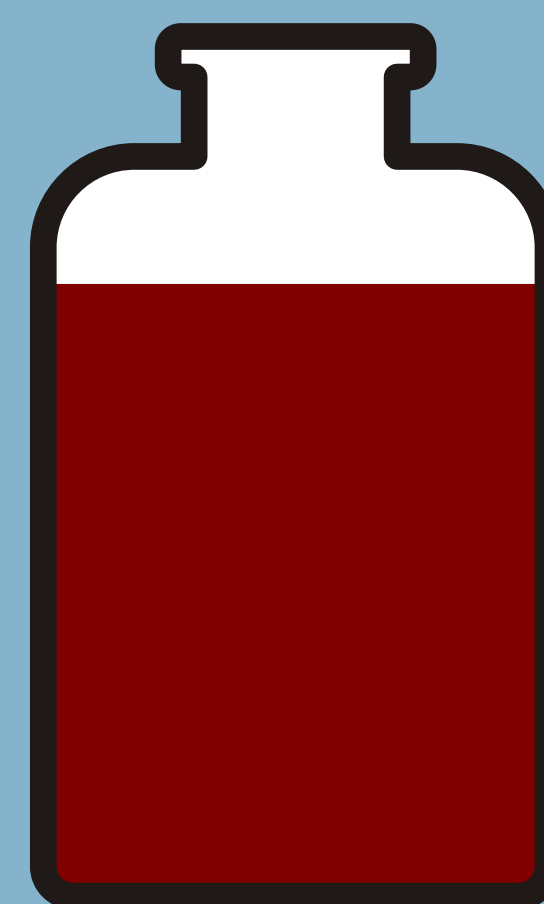
### Constant Low Doses

Insects were always held on DE-treated wheat.



### Top-Half Treated

Insects were always held in a jar that had the top half of the wheat treated with DE at twice the dose of the Constant Low Dose.



### Occasional High Doses

Every 2-3 months, insects were placed on DE-treated wheat for 10-16 days, to obtain 50 to 80% mortality. Survivors were reared on untreated wheat.

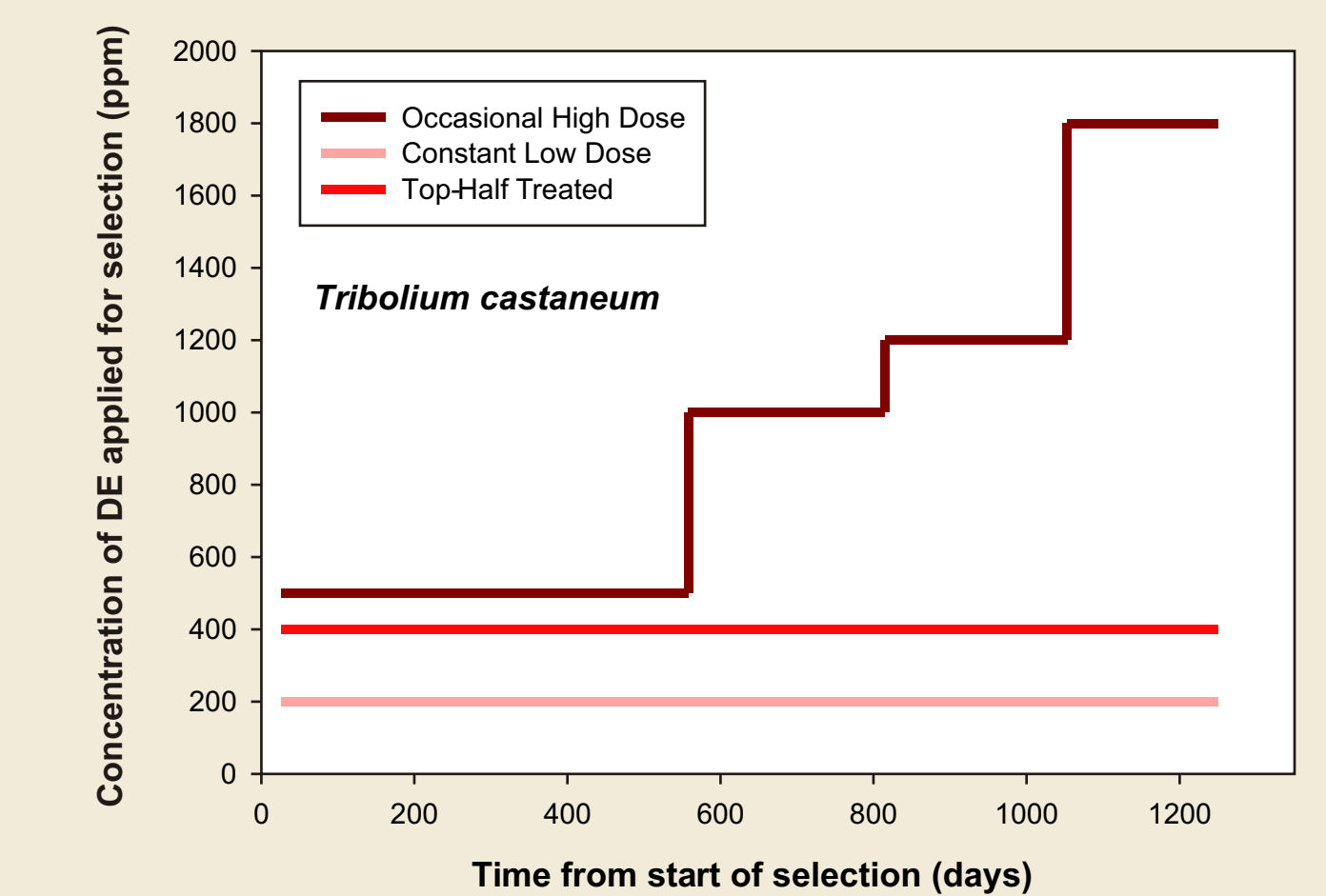
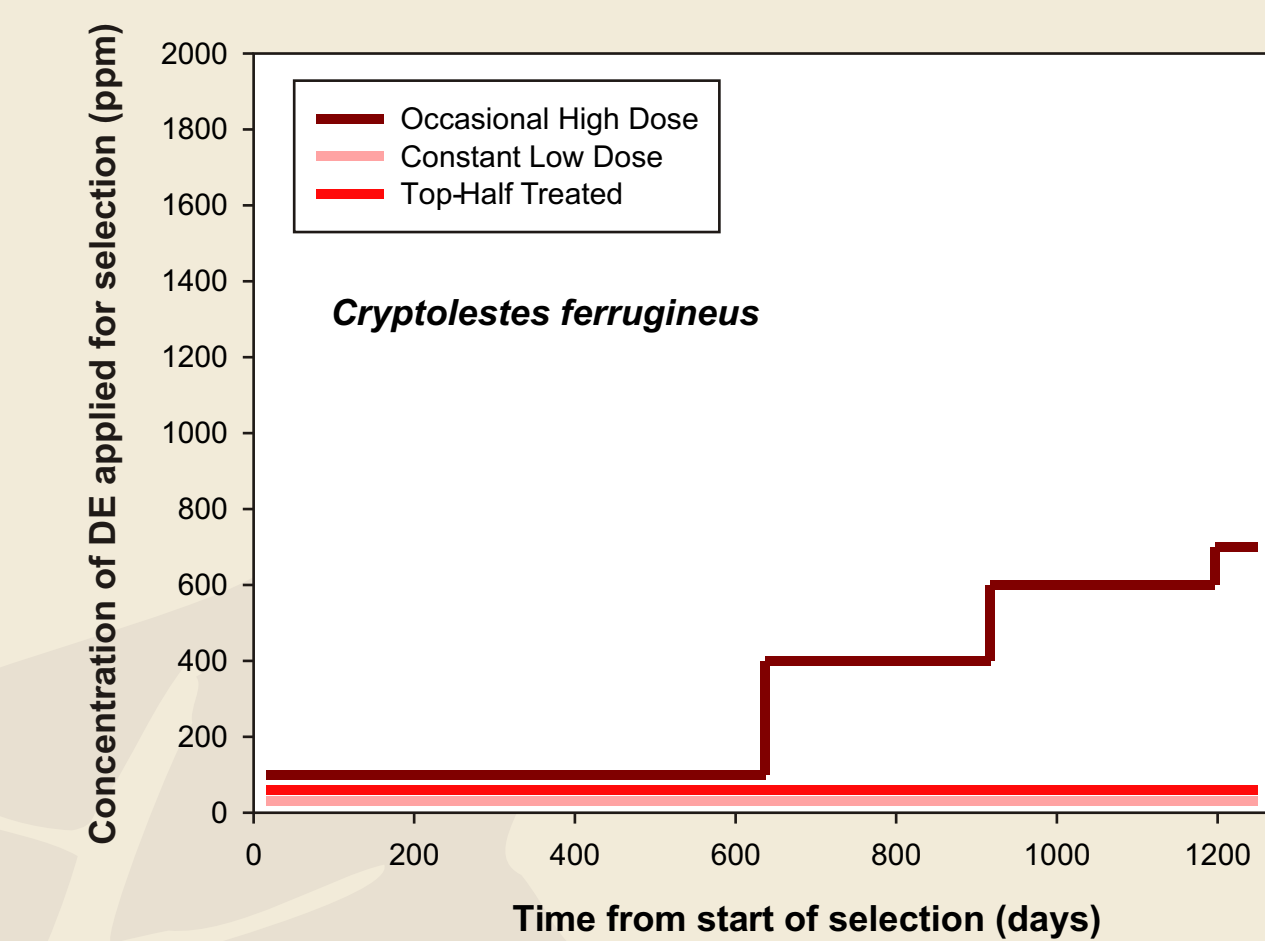
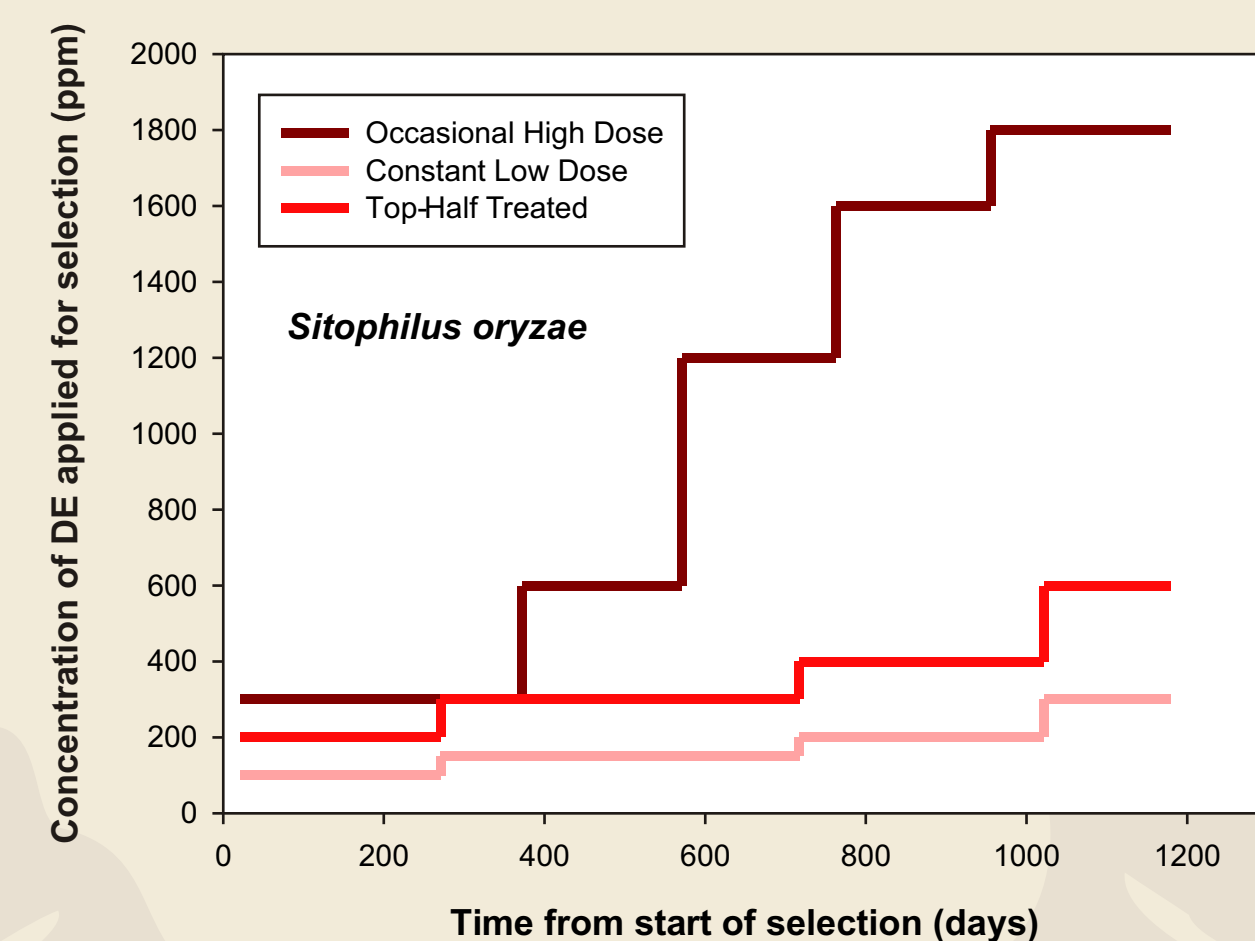
## OBJECTIVE

To determine if tolerance of stored-product insects to DE increases depending upon the method of exposure to DE.

## METHODS

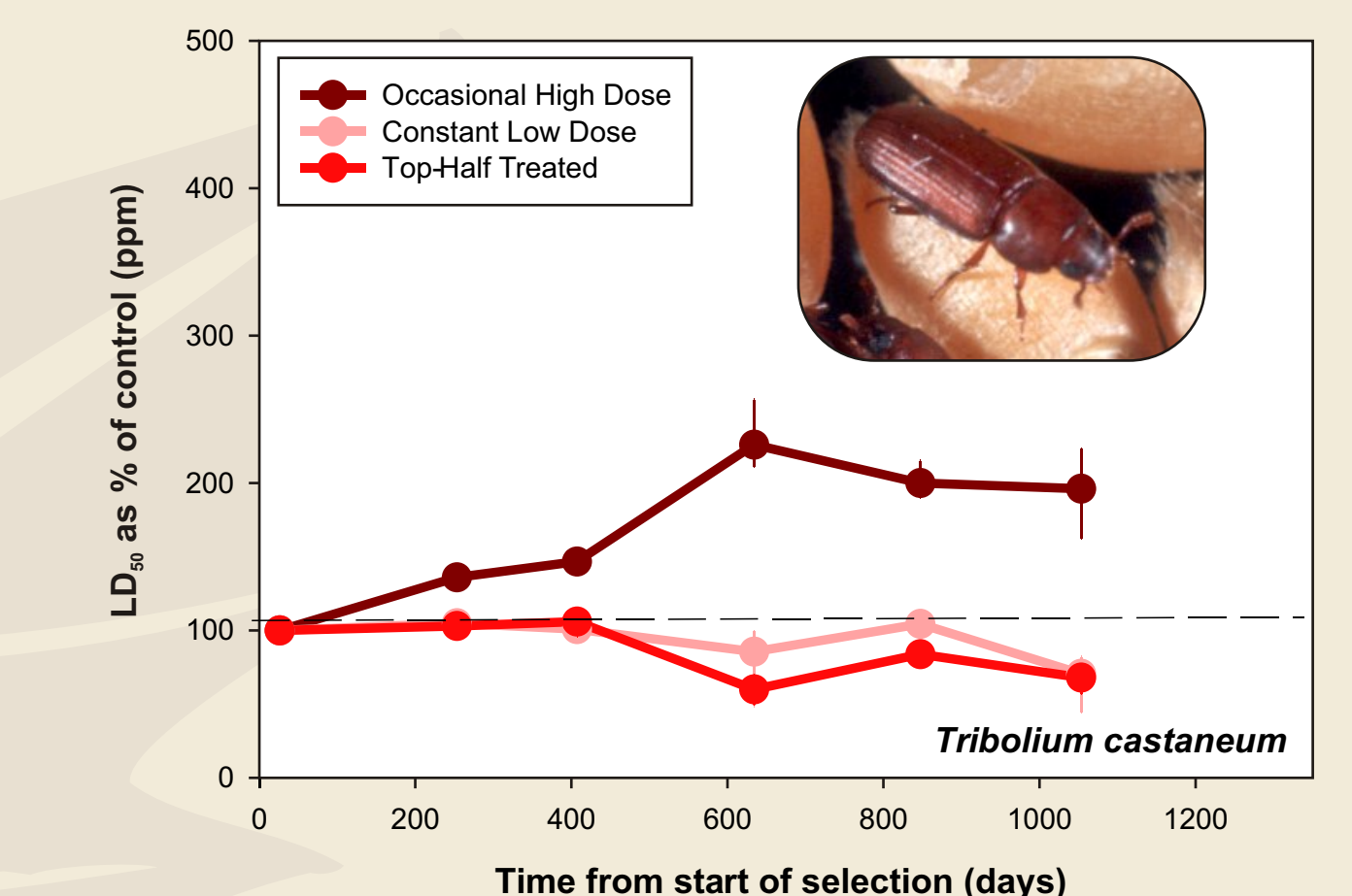
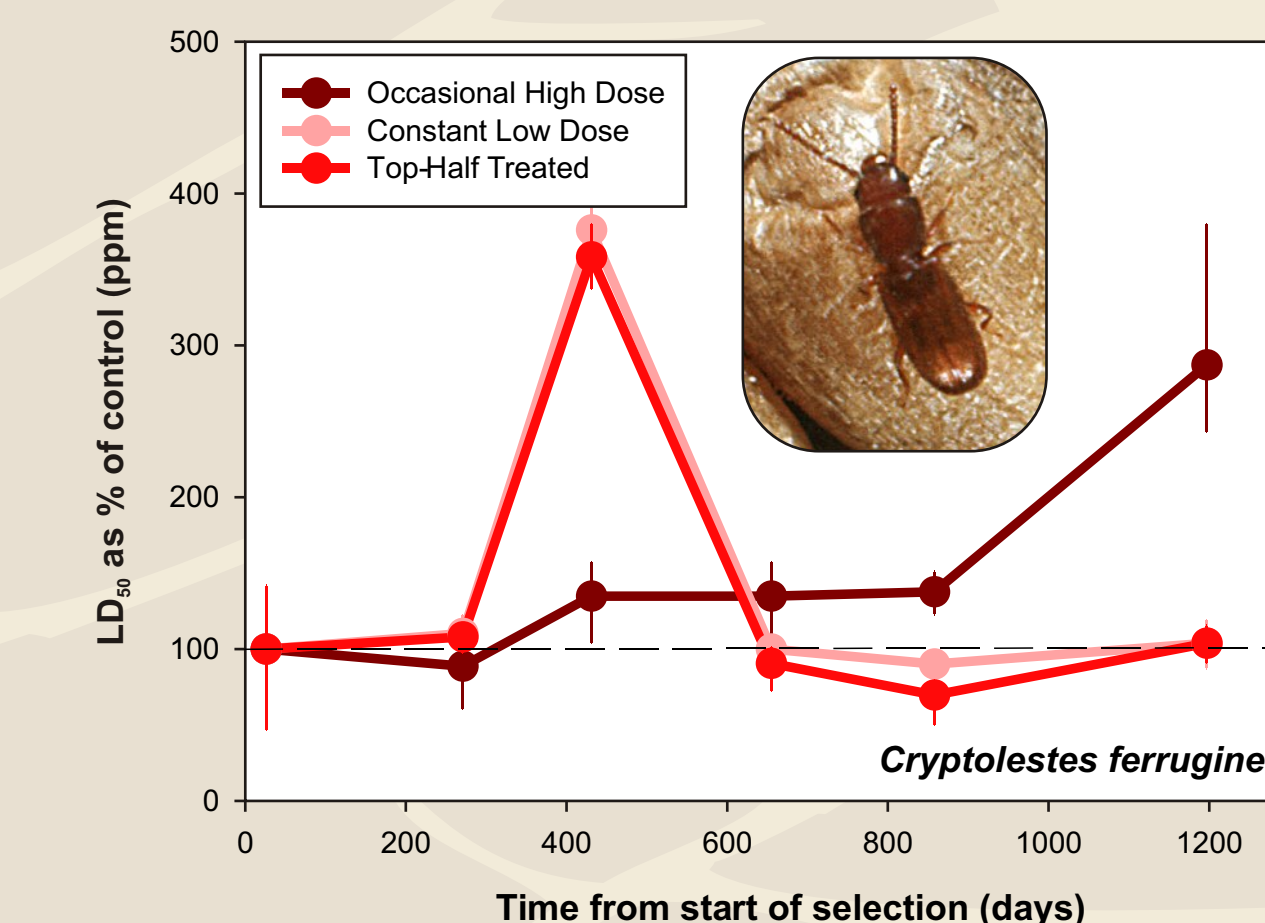
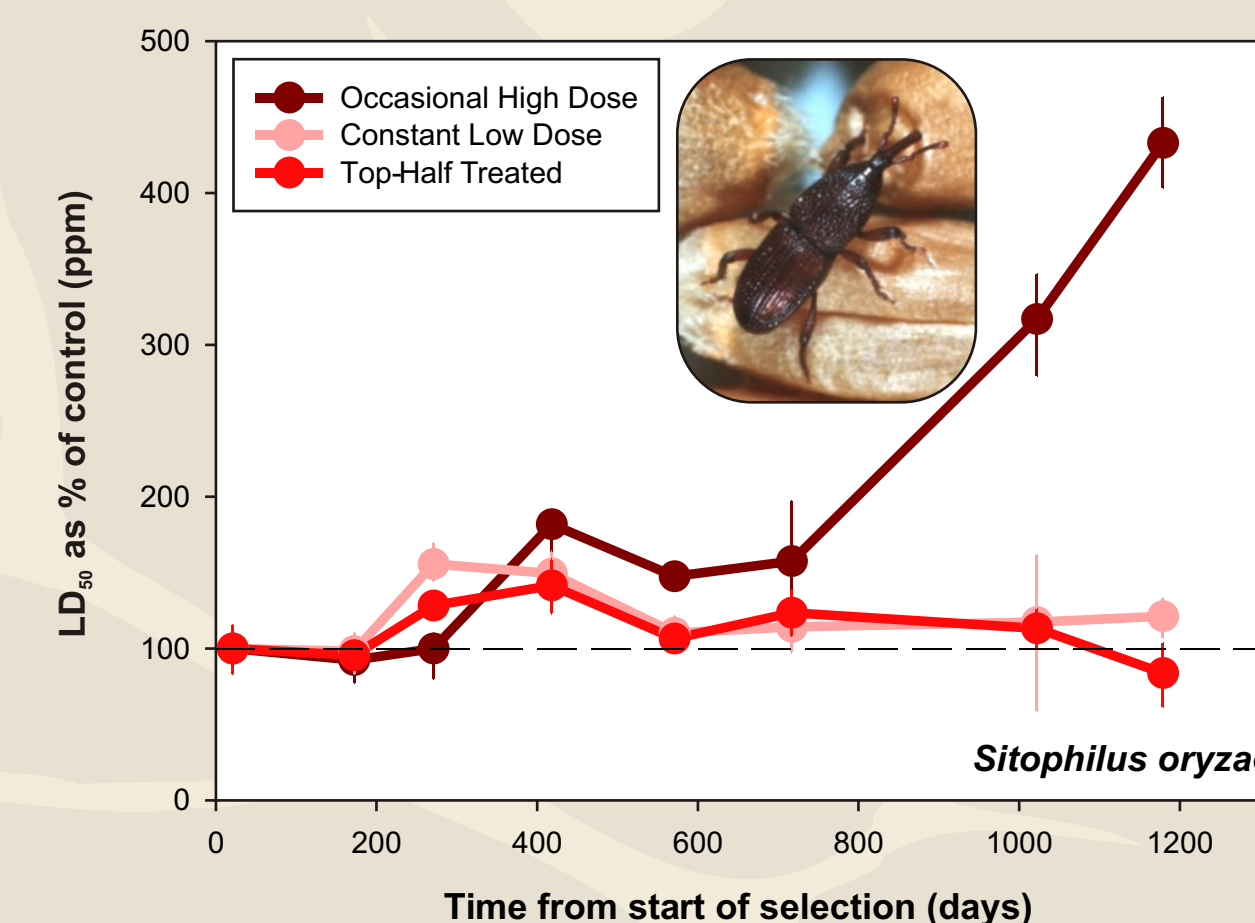
A dose response test with 6 to 9 concentrations of DE, 50 adults/replicate, 3 replicates per concentration, in 100 g of wheat at 14% m.c. was run approximately every 6 months. All tests and rearing were conducted at 30°C, 60% r.h.

## The concentrations of DE were increased in some cases to increase the selection pressure



## RESULTS

## The changes in the Lethal Dose of 50% of the population (LD<sub>50</sub>) during selection for over 3 years



## CONCLUSIONS

Constant exposures to sublethal concentrations of DE, either mixed throughout the wheat or just the top half of the wheat, did not increase tolerance to DE over a 3 year period. Occasional high doses of DE that killed 50 to 80% of the population increased the tolerance of all 3 insects tested. At the end of the 3 years of selection:

- *S. oryzae* had a LD<sub>50</sub> of 1286 (1198, 1375), (4 times the control)
- *C. ferrugineus* had a LD<sub>50</sub> of 379 (321 - 501), ppm (3 times the control)
- *T. castaneum* had a LD<sub>50</sub> of 1004 (831, 1143), ppm (2 times the control)

Future work will examine the mechanisms of tolerance to DE.