

Title Laboratory selection for resistance to diatomaceous earth.
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Abstract

Three selection methods were used to evaluate the development of resistance to diatomaceous earth (DE) in 3 stored products pests. In the first method, the insects were constantly cultured on wheat with a low rate of DE. In the second method, the insects were constantly exposed to DE at a rate two-fold higher than the previous rate applied only to the top half of wheat. In the third method, the adults were exposed to a high DE rate for 10-14 days. DE resulted in 50-80% insect mortality at approximately every 2-3 months. Three insect species were tested: *Tribolium castaneum* (red flour beetle), *Cryptolestes ferrugineus* (rusty grain beetle) and *Sitophilus oryzae* (rice weevil). In the first method, DE was applied at 200, 30 and 100 ppm for *T. castaneum*, *C. ferrugineus* and *S. oryzae*, respectively. The initial DE rates using the third method were 500 ppm for *T. castaneum*, 100 ppm for *C. ferrugineus* and 300 ppm for *S. oryzae*. Constant exposures to sublethal concentrations of DE, either mixed wheat sample or in only the top half, did not increase tolerance to DE over a three-year period. Occasional high rates of DE that killed 50-80% of the population increased the tolerance of all three insect species. At the end of the three years of selection, the LD50 value was 1004 (831-1143) ppm (two-fold higher than that of the control) for *T. castaneum*, 379 (321-501) ppm (three-fold higher than that of the control) for *C. ferrugineus*, and 1286 (1198-1375) (four-fold higher than that of the control) for *S. oryzae*. The results suggest that the method of using DE will affect the rate at which DE-resistant populations develop.