LABORATORY AND FIELD TESTS ON VACUUM OR CO_2 FOR THE CONTROL OF STORAGE INSECTS

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The suggested potential alternatives to MB (methyl bromide) for disinfestation of durable commodities are likely to be costly compared to the use of MB. In addition, very few of the suggested treatments have the effectiveness of short exposure time comparable to MB. The objective of our investigation was to identify the combinations that enhance the effectiveness of the treatments based on vacuum or a combination of heat and CO_2.

The influence of CO_2 at 45°C on reducing the exposure time expressed as LT_{99} values for diapausing larvae of *Trogoderma granarium* showed that by increasing the CO_2 concentration to 90% the exposure time decreased to about 9.5 h. For the same species at 35ºC the LT_{99} value was 29.1 h. To obtain LT_{99} values for diapausing larvae of *Trogoderma granarium* at 25 mm Hg and 35°C, 172-h exposure was necessary.

Tests with *Ephestia cautella* showed that the pupae was the most resistant stage to the treatment of 90% CO_2 at 35ºC for which an LT_{99} value of 17 h was required. For pupae, the most resistant stage of *Tribolium castaneum*, the LT_{99} value was 25 h when exposed to 92% CO_2, and at 100 mm Hg the LT_{99} value was 45 h at 30ºC. *Oryzaephilus surinamensis* exposed to 90% CO_2 required the LT_{99} value of 9 h for the eggs, most resistant stage at 35°C. Laboratory studies with *Lasioderma serricorne* exposed to low pressures at 30ºC, LT_{99} values for adults was 15.3 h when exposed to 25 mm Hg.

These encouraging reports led to the idea of developing a transportable system to render the technology a practical tool for the control of insect pests. Experiments were carried out using a 15-m^3 capacity plastic container termed the "Volcani Cube" or "GrainPro Cocoon". The pressure was maintained between 25 to 29 mm Hg for 17 days. Bioassays in field trials were conducted with 7 tonnes of cocoa beans stored in the "Volcani Cube". These trials demonstrated that complete mortality of test insects composed of mixed ages of *E. cautella*, and *T. castaneum* was observed on the 3-days exposure to low pressures maintained within the range of .22 and 75 mm Hg.