

CONTROLLED ATMOSPHERE TREATMENTS TO CONTROL ARTHROPOD PESTS OF AMERICAN DRY CURED HAMS

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Chemical pesticides are routinely used to control the activity of insects or microorganisms in food commodities, and have been used for decades. An increased awareness of the environmental and health risks to consumers of the harmful chemical residues in food and the environment has led to the restricted use of chemical preservatives in food. Chemical fumigation, for example with methyl bromide (MB), is the most common method that is used for controlling arthropod pests in food commodities. A wide variety of durable stored products of animal origin, including dried fish, cheese and dried cured hams are subject to insect pest infestation during storage and in certain cases, also at the processing stage. The precise extent of losses of different animal-origin products due to insect pest infestation is unknown. Dry-cured ham products become infested by insect pests such as the ham skipper *Piophilha casei* L., red legged ham beetle *Necrobia rufipes* DeGeer, dermestid beetles in the genus *Dermestes* and the ham mite *Tyrophagus putrescentiae* Schrank during product aging. This aging step is very important for product preservation and flavor development. Currently, there are no known viable alternatives to MB for the eradication of insect pests in dried-cured ham facilities in the Southeastern United States and the current research explores some possibilities.

We evaluated the feasibility of using various controlled atmosphere (CA) treatments to control arthropod pests that infest dried-cured ham facilities in the Southeastern United States using low oxygen (O₂) achieved under low pressure, high carbon dioxide (CO₂) and Ozone (O₃). Results showed that both low oxygen and higher CO₂ levels required longer exposure (144h) to kill 100% of all stages of red legged ham beetle, *Necrobia rufipes* DeGeer (Coleoptera: Cleridae) and ham mite *Tyrophagus putrescentiae* Schrank (Astigmata: Acaridae; Fig. 1 for mite eggs) at 23°C. In addition, both of these treatments had no significant mortality effects against the ham beetle and ham mites at short exposures ranging from 12 to 48 h. Ham beetles showed more tolerance to higher CO₂ (75.08%) and low pressure (25 mmHg) than ham mites. Our CA trials also showed that the egg stages of both species were usually more tolerant to CA than other life stages that were tested (Fig. 2 for ham mite eggs). The ozone trials showed more promise among the three CA treatments in controlling both the beetle and mite pests (Fig. 3 for mites). The results suggest that O₃ has potential for controlling ham beetle and ham mites particularly with higher concentration (≈155 ppm) at 24h exposure. In addition, sensory tests indicated that consumers could not detect differences between dry cured hams that were treated with carbon dioxide or ozone and hams that were not exposed to CA.

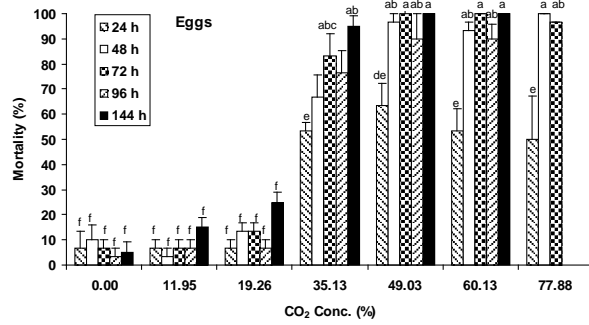


Fig. 1. Percentage mortality of *T. putrescentiae* eggs exposed to different concentrations and exposures of CO₂. Bars followed by the same letters in insect stage and CO₂ exposure are not significantly different at the 5% level by DMRT.

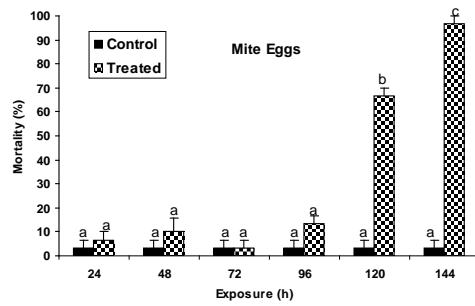


Fig 2. Mortality percent for mite *T. putrescentiae* eggs treated at low oxygen with pressure (25 mmHg; approx. 3.0% O₂) at 23°C. Bars followed by the same letters in exposure are not significantly different at the 5% level by DMRT.

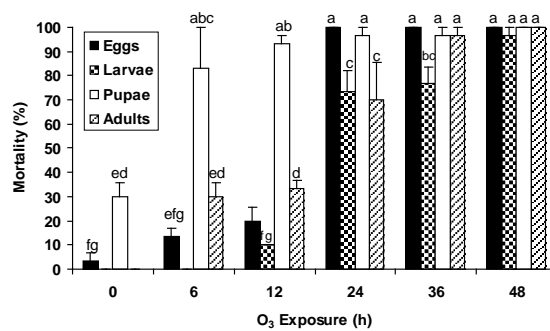


Fig. 3. Percent mortality of ham beetle *N. rufipes* exposed to high doses (155 ppm) of ozone, O₃ at different exposures. Bars followed by the same letters in insect stage and O₃ exposure are not significantly different at the 5% level by DMRT.