EFFECTS OF VARIOUS FOOD-GRADE COATINGS ON MITE MORTALITY AND SENSORY QUALITY OF DRY CURED HAM

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The ham mite, *Tyrophagus putrescentiae*, is the major target pest of dry cured ham. Ham mites infest a wide range of stored food products such as dried meats, dried eggs, nuts, cheese, pet foods and grains (Townsend, 2007). Mites are very small (1/2 mm long), feed on the surface of dry cured meat and follow the seam fat to the interior of the bone and interior of the hams. Mites cannot fly, but they can crawl around extensively and may be carried from one spot to another by humans and other insects. Heavily infested materials may have a sweet or minty odor and infested areas will have a powdery appearance from the buildup of dead mites and their coverings (Townsend, 2007).

Methyl bromide has been used to fumigate dry cured ham plants and is the only known fumigant that is effective at eradiating ham mite infestations at this time (EPA, 2010). However, methyl bromide is classified as a Class 1 ozone depletion substance and will be phased out for all industries by 2015 (EPA, 2006). A survey of 34 dry cured ham plants indicated that 22 of plants surveyed used methyl bromide fumigation one to five times a year based on the severity of the infestation (Rentfrow, *et al*., 2008). This demonstrates that methyl bromide fumigation is important to the economic viability of the dry cured ham industry, which justifies the need for an alternative method to prevent and control mite infestation.

The pressure of losing this versatile pesticide has forced researchers to find alternatives to methyl bromide. These alternatives include techniques that were applied before methyl bromide was extensively used and some innovative methods such as biological control, high pressure fumigation, new chemical pesticides and new trapping methods (MBTOC, 1998; TEAP, 2000). Evaluations of simple, effective and non-chemical coating methods to control ham mite infestations are a possibility if it does not negatively affect flavor and the aging process and is effective at controlling mites. Use of edible coatings and films to preserve meat and poultry product quality is not a novel concept. Coatings based on lipid, polysaccharide and/or proteins have been developed to prevent moisture loss, to reduce dripping loss, to prevent lipid oxidation, to reduce spoilage microorganisms, to restrict volatile flavor loss, and/or to reduce oil uptake during frying (Gennadios, *et al.*, 1997). Different from these traditional applications, the purpose of this trial was to evaluate the effectiveness of food grade ingredients on mite control and sensory quality of dry cured ham.

In this experiment, five food grade ingredients were tested for their efficacy at controlling mite infestations. These treatments included lard, mineral oil, glycerol, propylene glycol, and 10% potassium sorbate. Among these ingredients, applying a paste of lard on the cured meat to prevent flies and bacteria was developed several decades ago (Smith, 1923). Coating hams with vegetable oil or hot lard is a common practice in Spain (Garcia, 2004).

Ham slices/cubes were dipped directly into mineral oil, propylene glycol, 10% potassium sorbate solution and glycerin for 1 minute and dripped on a mesh colander for another minute. Lard was applied directly by rubbing a thin layer to cover the whole piece. Ham cubes (2.5 cm ×2.5 cm × 2.5cm) were used for the mite infestation study. During the study, 20 mites (mostly adult female) were placed on one cube of ham which was placed in a ventilated, mite proof glass container and incubated for 21 days at 27 º C and 70% relative humidity. Mite populations on ham cubes were counted every week. Coatings on ham slices were washed off before cooking. Ham slices were oven baked to internal temperature of 71˚C and served to trained panelists. A randomized complete block design with 3 replications was used to determine if differences ($P<0.05$) existed between treatments with respect to mite number and sensory differences between products in a Difference from Control Test.

Results indicated that both lard and propylene glycol were effective ($P<0.05$) at controlling mite reproduction. No difference was detected in sensory characteristics between control ham slices and samples treated with food grade ingredients. In addition, potassium sorbate and mineral oil did not inhibit mite reproduction but slowed mite population growth ($P<0.05$) when compared to the control, and glycerine was ineffective at lowering mite counts ($P>0.05$) when compared to the control.

The majority of research that has been conducted on use of food grade ingredients with meat products has been to prevent water loss and reduce rancidity in meat products (Baldwin, 2007). However, a finished ham product needs to lose at least 18% of its original weight during aging (USDA, 1999). At the same time, the unique flavors of dry cured ham are caused by proteolysis and lipolysis with the presence of oxygen. In this case, water vapor permeability of the films and coatings needs to be considered when choosing a proper coating. Current and future research is being conducted to develop a cost-effective food grade coating with high oxygen and water vapor permeability.

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