RELATIVE HUMIDITY AND TEMPERATURE EFFECTS ON DRY CURED HAM MITE INFESTATIONS

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Since methyl bromide is an ozone depleting substance, there is a significant need to find safe, economical, and effective alternative compounds and methods to replace the use of methyl bromide (US EPA, 2017). Recent studies have indicated that food grade ingredient infused nets are effective at controlling mite infestations on dry cured ham cubes under laboratory conditions (Campbell et al., 2017; Zhang et al., 2017). Mite infestations and mold growth vary on dry cured ham due to environmental changes in relative humidity (RH) and temperature. Mite proliferation on dry cured ham has been related to the increase in RH from 70 to 90% RH, with a reduction in both mite and mold growth at below 60% RH (Garcia, 2003). Therefore, the objective of this study was to determine the most effective relative humidity and/or temperature to minimize mite reproduction and mold growth on dry cured hams treated with food grade ingredient infused nets.

Food grade coating formulations containing 1) xanthan gum (XG) and propylene glycol (PG) and 2) carrageenan (CG), propylene glycol alginate (PGA), and PG were infused into ham nets. Control nets without infused coatings were also used. Ham cubes (2.5 cm^3) and slices (2.5 cm × 9.0 cm × 15.5 cm) were wrapped in nets and then placed in 216 mL and 3.8 L glass jars, respectively (n=3 per treatment). Each ham cube was inoculated with 20 adult mites, and each ham slice was inoculated with 50 adult mites. Jars were stored in an environmental chamber for 14 days at temperature and relative humidity combinations of 24, 28, and 32°C and 55±2, 65±2, 75±2, and 85±2% RH. Mobile mites on ham cubes, slices, and nets were counted using a microscope to determine mite reproduction. Nine trained panelists scaled the moldiness of ham slice surfaces on a 0 to 100 % scale. A 3 × 4 factorial arrangement within a completely randomized design was used to determine the impact of temperature and RH on mite infestations of ham cubes, ham slices, and mold growth for each of the control, XG+PG, and CG+PGA+PG net treatments. Tukey's HSD test was used to separate treatment means ($P<0.05$).

For untreated nets, ham cubes stored at 75% RH had more mites ($P<0.05$) than those at 55 and 85% RH, but did not differ ($P>0.05$) from the 65% RH treatment. At 85% RH, there were fewer mites ($P<0.05$) on the ham slices than at other RH's. There was also more mold growth ($P<0.05$) at 65% RH than 55 and 75% RH. Ham cubes in untreated nets had fewer ($P<0.05$) mites at 24°C × 55% RH, 28°C × 85% RH, and 32°C × 65% RH than other combinations tested, with the exception of 24°C × 75% RH, 24°C × 85% RH, 28°C × 55% RH, 32°C × 55% RH, and 32°C × 85% RH. More mites ($P<0.05$) were present on ham slices treated at 32°C × 75% RH than any other of the combinations tested. In addition, the 85% RH treatments at 24, 28, and 32°C were the only treatments that had fewer mites than the initial inoculum level of 50.

The XG+PG treatments had more mites ($P<0.05$) on ham cubes at 65% RH than any other RH treatments. No other differences existed ($P>0.05$) among temperature and RH treatments in XG+PG nets. In addition, mold growth was greater ($P>0.05$) at 65% RH than 75% RH. For ham slices, the 24°C × 65% RH treatment had more mites ($P<0.05$) than all other treatments with the exception of the 28°C × 65% RH treatment. The ham slices that were stored in XG+PG coated nets at 75 and 85% RH completely inhibited mite growth, regardless of temperature. Results indicated that hams should be stored at 75% RH or greater to minimize mite reproduction when XG+PG coated nets are used.

For CG+PGA+PG nets, ham cubes had more mites ($P<0.05$), and ham slices had more mold at 28°C than any other temperature tested. Similarly, more mites ($P<0.05$) were on ham cubes at 65% RH than any other RH treatments. Mold growth was greater ($P<0.05$) on ham slices at 85% RH than other RH treatments, with the exception of 65% RH. In addition, all temperature and RH combinations within the CG+PGA+PG net treatments maintained mite counts for both ham cubes and slices below the initial inoculation level. Furthermore, there were no mites on the ham slices at all 85% RH treatments and the 75% RH treatments at 24 and 28°C within CG+PGA+PG net treatments.

Untreated ham nets did not control mite reproduction at any temperature and RH combination other than 32°C × 85% RH. XG+PG net treatments inhibited mite reproduction and mold growth on dry cured hams at all tested conditions with the exception of 24°C × 65% RH and 28°C × 65% RH. The CG+PGA+PG net treatments inhibited mite reproduction and mold growth on dry cured ham cubes and slices at all conditions that were tested, with the 85% RH treatments showing the greatest level of inhibition. Further research will be conducted on whole hams to test the efficacy of treated nets at controlling mite reproduction and mold growth in commercial settings.

References

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