Infestation by the Mite, *Tyrophagus putrescentiae* (Schrank) (Acaridae: Sarcoptiformes), on Dog Treat and Processed Meats: Relative Susceptibility and Protection with Propylene Glycol

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Undergraduate Research Experience in Entomology

K-State 2025 — K·STATE Research and Extension

Abstract

T. putrescentiae is a common pest in dried meats and pet food products where they can reproduce. Propylene glycol (PG) is a food-safe additive known to inhibit mite infestation, but some consumers have considered it as a controversial additive to use in products mainly due to its similarity to the toxic ethylene glycol, which is a key component in anti-freeze (DogFoodAdvisor, 2009). The purpose of experiments here were to evaluate the susceptibility of high-valued dog treats and different aged meats to *T. putrescentiae*, and then to determine if application of PG reduces infestation to the susceptible foods. Of five different dog treats tested, only one was susceptible to mite infestation and this product had the highest moisture content (28%) of those tested. For dried meats, the Prosciutto and Salami were mildly susceptible compared to the others with no infestation. Dipping the susceptible dog treat in 50% PG prevented mite infestation compared to being dipped just in water. Prosciutto dipped in 50% PG was fully protected from mite infestation. This work confirms that PG can protect foods from mites and its use as a coating, rather than as a complete additive, points to new applications to protect dried meats and pet treats.

Purpose

The purpose of this study was to test the relative susceptibility of high-valued processed dog treats and aged-dried processed meats to *T. putrescentiae,* and then determine if dipping the product in propylene glycol (PG) gives protection.

Study System

Tyrophagus putrescentiae (Schrank) (Acaridae: Sarcoptiformes) is known as the mold, ham, or cheese mite. These mites are common infestation pests on stored food products with relatively high protein, fat, and moisture (between 15-40%) contents. These mites are about the size of a pinhead; just barely visible to the naked eye. Their bodies are soft with a clear-to-white color. Females are larger than males, especially when ready for oviposition (Fig. 1). They can lay up to 500 eggs total, typically 5 eggs a day, and will develop into adults between 9-12 days (Abbar et al., 2016). Mite populations can increase exponentially until resources are exhausted.

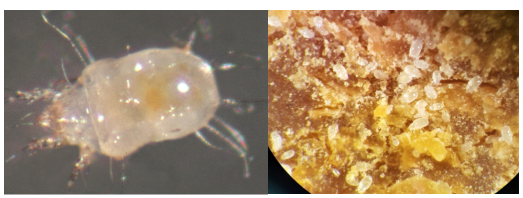

Figure 1. *Tyrophagus putrescentiae* (Schrank) (Acaridae: Sarcoptiformes) on left from Gaines (2012). Population on laboratory diet on right.

Methods and Experimental Design

Five semi-moist dog treats and four processed meats (Fig. 2) were chosen for the experiments along with a laboratory diet used as our control. Small jelly jars were prepared as infestation containers with dark colored construction paper at the bottom for accurate counting of mites. Filter paper was used in the lid ring to prevent mite escape while allowing air and humidity exchange from outside the jar. Each product of 7-7.5 grams was individually placed into a jelly jar. To help maintain moisture, a damp paper towel or cotton ball was added in the control jars. Twenty large female mites were selected and placed on food inside each jars. All jars were placed in a high humidity environment (>60% RH) at 25 °C and in total darkness for 14 days. After incubation was complete, the numbers of mites were determined by counting on all sides of the food and inside the jar for all mobile mite stages, excluding eggs. Once the most susceptible foods were found, another experiment was conducted in to determine susceptibility of products dipped in either 50% propylene glycol in water for one minute and compared to the same food dipped just in water. Dipped products were dried for 1-2 hours then placed in jelly jars and twenty large female mites were added. Mite progeny were counted as the before. Raw data was subjected to Analysis of Variance. Comparison of two or more treatments was conducted and mean values followed by the same letter are not different.

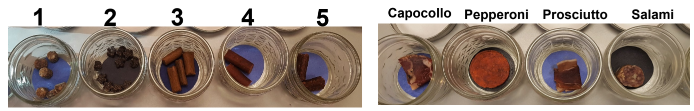

Figure 2. Dog treats (left) and aged meats (right) in jelly jars before inoculation with 20 adult mites.

Results. Dog treat 2 supported an infestation of mites that averaged about 104 mites per jar, while the other foods produced very low numbers of mites (Fig.3)

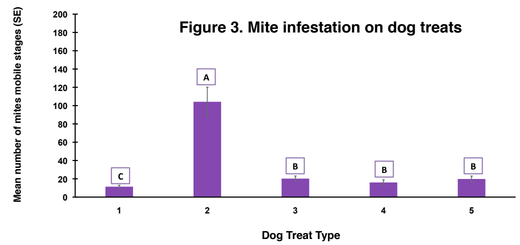

Figure 3. Mite infestation on dog treats

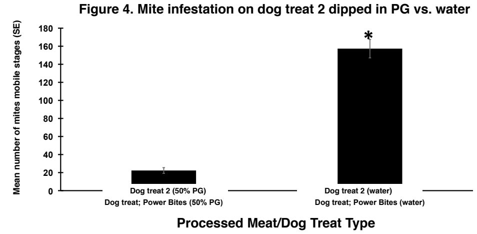

Figure 4. Mite infestation on dog treat 2 dipped in PG vs. water

Dog treat 2 dipped in 50% PG produced very low numbers of mites in 14 days, while treats dipped in water only, produced nearly 160 mites per jar in 14 days Fig. 4).

Of the four aged meats tested there were no more than about the 20 original mites on Capocollo and Pepperoni, but Prosciutto and Salami supported small infestations of mites resulting in slightly increased populations (Fig 5).

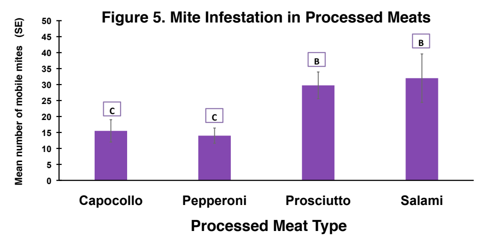

Figure 5. Mite Infestation in Processed Meats

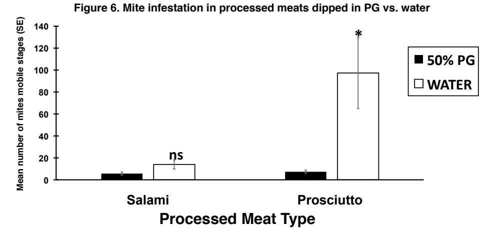

Figure 6. Mite infestation in processed meats dipped in PG vs. water

Prosciutto dipped in 50% PG was protected from mite infestation while the same meat dipped in water only, produced infestations averaging about 100 mites. Salami, though susceptible in the initial trial, had very low numbers of mites whether dipped in PG or water only.

Infestations on the control diet were quite large, ranging between 695-816 mites, and confirmed we used healthy mites from our culture. All diet control were significantly greater than other treatments, but are not shown in the graph.

Conclusions

We found significant variation of infestation among the different dog treats and the different processed meats. The most susceptible products produced significantly fewer mites when dipped in a PG solution compared to those dipped in water only. Our results support the hypothesis that PG inhibits mite population growth and could be considered a food-safe compound to maintain quality in stored food products.

Future Directions

We began this work with a curiosity of how mite infestation would vary among different meat or dog food treatments. If we were to redo the experiments, we would take a step back and design experiments with variable under greater control so that reasons for certain outcomes might be more easily explained. Lack of experience in handling and counting mites presented difficulties, so more experience in future work should improve efficiency. Humidity during incubation was a struggle to maintain at optimal levels. However, our control diet showed that our experimental conditions were ideal for mite reproduction. In future experiments we will ensure that the incubation period is maintained with an ideal environment. Moving forward with this project, we would work more with improving the process of applying a PG protective coating for dried-aged meats and evaluate the efficiency of a PG protective coating vs. PG that mixed within the product. Our overall goal is to find a solution to preserve our stored food products longer without debilitating mite infestations and ultimately reduce losses of mite-susceptible foods worldwide.

References

Abbar, S., Amoah, B., Schilling, M. W., & Phillips, T. W. (2016). Efficacy of selected food-safe compounds to prevent infestation of the ham mite, Tyrophagus putrescentiae (Schrank) (Acarina: Acaridae), on southern dry-cured hams. *Pest Management Science, Volume 72* (Issue 8), pp. 1604-1612. doi: 10.1002/ps.4196

DogFoodAdvisor. (2009). *Propylene Glycol — Dog Food Aid or Automotive Antifreeze?* Retrieved on Nov. 2017 from https://www.dogfoodadvisor.com/red-flag-ingredients/propylene-glycol-dog-food-aid-or-automotive-anti-freeze/

Gaines, P. (2012). *Tyrophagus putrescentiae*. Flickr. Retrieved Nov. 2017 from https://www.flickr.com/photos/patgaines/6928491846

Acknowledgements

I would like to thank Dr. Thomas Phillips for accepting to be my mentor, helping me crack open my critical thinking, and balancing entomology with my interest in companion animal nutrition to make a great first experience of undergrad research. I would also like to thank Dr. Salehe Abbar for prepping experiments, helping me with the results, and giving her advice and encouragement. I appreciate having the opportunity to finally try out what I have been interested in and to try new things outside of my comfort zone.