Efficacy of Different Pet Treat Formulations to Prevent Infestation by the Mite *Tyrophagus putrescentiae*

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Abstract

The pet food industry is a major part of the high-value processed food market in the USA and worldwide. Pest control associated with pet foods is an important activity. The mite *Tyrophagus putrescentiae* is a prolific cosmopolitan species that can infests high-value pet treats undetected until the infestations increase to very large numbers. Propylene glycol is a food-safe additive used to prevent mite infestations (Zhang et al., 2018; Abbar et al. 2015). Unfortunately, propylene glycol in certain foods can harm pets, and many companies are changing formulations. Here we conducted forced infestation of mites on three experimental pet treats and compared these to the current product that contains propylene glycol for susceptibility to mite infestation. We confirmed that the current product with propylene glycol did not support any mite population growth after a forced infestation with 20 mites. Two of the test formulations showed promise in preventing mite infestation, but one formulation was clearly susceptible to mites.

Purpose

Special pet treats are currently protected from mite infestation by the addition of propylene glycol (PG). The purpose of this research was to determine if alternative formulations without PG could also prevent mite infestation.

Questions, Hypotheses, and Predictions

Question: Which pet treat formulation is most effective against mite infestation relative to the standard formulation with PG?

Hypothesis: *T. putrescentiae* population growth will vary based on pet treat formulation.

Prediction: We predict that the standard PG-containing formulation will have the lowest number of mite progeny following a controlled infestation. Non-PG alternative formulations may vary in their abilities to suppress mite infestation, and one or more of these could be as effective as PG in suppressing mite population growth.

Study System

Tyrophagus putrescentiae referred to here as "TP") is a common mite pest of dried meats, cheeses and semi-moist pet foods. TP populations thrive on foods with moisture contents between 15-45% with high protein and fat concentrations, all characteristic of semi-moist pet treats. The lifecycle of the TP includes egg, larva (6 legs), developing nymph stages with 8 legs, then a reproductive adult. It takes 10-14 days for an egg to reach adulthood. TP populations thrive at 27 ° C and 70% R.H.

Figure 1. Left-Mixed life stages of the mite *Tyrophagus putrescentiae* including large adults, smaller nymphs and eggs (eggs are < 1.0 mm long); Middle-an aging country ham infested with mites; Right-a semi-moist pet treat infested with mites.

Study System (continued)

Propylene glycol (PG), 1,2-propan-diol, was routinely used to inhibit mite infestation, but is currently being removed from many pet foods due to its serious health impact on cats. The research described here evaluated three proprietary formulations of a commercial pet treat for risk of infestation by TP.

Methods and Experimental Design

Pet treats were supplied by the manufacturer in four formulations: the current product that contains PG, referred to herein as the negative control as it should prevent mite infestation, and three experimental formulations labeled A, B and C. Single square sections of each treat were placed in a 120-ml glass jar and 20 large mites were added to each jar with a singled-haired paint brush (Fig. 2). Jars were sealed with 60 µm mesh to prevent mite escape but provide adequate ventilation.. Each treatment was replicated four times in a completely randomized design. The standard lab diet (Amoah, 2016) was similarly evaluated to confirm mites would reproduce normally under these conditions. Jars were stored for two weeks at an average 32 ° C and an average relative humidity of 77%, after which all mobile mites were counted (Fig. 2).

Figure 2 (left to right). Lab colony jar of TP to supply mites for infestation of pet treats; a small number of TP from which 20 large mites were transferred to a cube of food in a jar; a cube of standard rearing diet in a jar; a jar of the same size containing an experimental pet treat for inoculation with 20 mites.

Results

Jars with laboratory diet had upwards of 1,800 living mobile mites 14 days after inoculation with just 20 mites (Fig. 3, second from left). The comparison of the four pet treat formulations confirmed that the negative control, which contained propylene glycol, did not support mite infestation (Figs. 3 and 4). The mite numbers counted from treats A and B were not statistically different from those counted from the negative control, but jars with formulation C produced an average of 140 mites, statistically more than the others formulations tested Fig. 4).

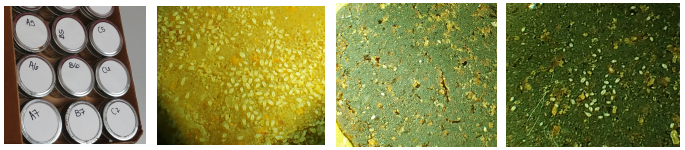

Figure 3. (left to right). Jars prepared with experimental pet treats and each inoculated with 20 large mites; sample of lab-diet for mass-rearing TP showing a large number of mites found 14 days after inoculation wit h 20 mites; surface of a test cube from treat B showing very few mite progeny after 14 days; the surface of a cube form treat formulation C showing several mites indicating a successful infestation 20 days after inoculation .

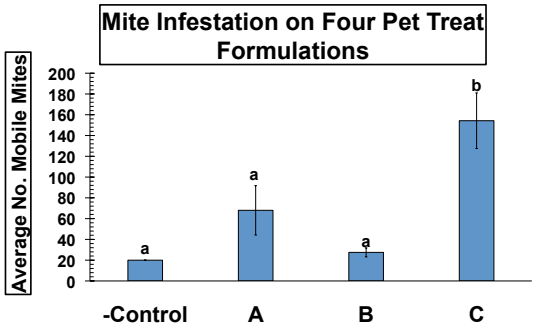

Figure3 . Mean number (+/- standard error) of living mobile mites in jars with a given pet treat 14 days after inoculation with 20 adult mites. The –Control is a standard treat containing propylene glycol; treatments A, B and C are experimental formulations. Mean values with the same lower case letter are not significantly different from each other (P < 0.01 with Tukey's HSD).

Conclusions

Treatments A and B sustained significantly lower populations of mites following mite infestation compared to treatment C, which produced over 100 mites per jar. With this finding, it can be concluded that treatments A and B could be suitable substitutes for treats containing propylene glycol.

Future Directions

Future research could investigate which formulations can retain their ability to prevent mite infestation over several months in storage. Palatability tests with pets would be needed to assure that any change in formulation does not affect feeding preferences by pets.

References

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