



Preferences of Indian Meal Moth Larvae for Different Dog Foods

Tanner Schmidt^{1,2}, M. Jamie Aikins¹ and Thomas W. Phillips¹

¹Department of Entomology, College of Agriculture, Kansas State University

²Department of Animal Science and Industry, College of Agriculture, Kansas State University



Abstract

Indian meal moths (IMM) constantly find ways to be a pest to our foods (Fasulo et al. 1998). When they find a good source of food to colonize, not only is their destruction the fact they get into all the products, value-loss from IMM is the result of contamination by larvae that leave droppings and silken webs in grain and grain products (Jacob and Calvin 2001). An important concern is if there is more to the IMM attention to dog food than just the grain components of the product. Experiments were conducted with eggs of the IMM to determine if moths would choose and infest the grain-based dog food in comparison to dog foods with a higher meat content. All experiments included the laboratory rearing diet for comparison. No-choice and choice tests confirmed the IMM diet to be the most preferred and best for larval development forced infestation of 50 IMM eggs on the four test diets found no significant different among the four dog foods. In two-choice test that require newly hatched larvae to walk to and infest either lab diet or a dog food, the highest proportion of larvae selecting any of the dog foods was on product C, which was a medium quality, grain-free food. These results suggest that IMM infestations in warehouses or consumer's homes could be prevalent on some dog foods more than others.

Purpose

The purpose of this research is to determine if the newly hatched larvae of the Indian Meal Moth differs in its ability to select and infest a variety of commercial pet foods.

Questions, Hypotheses, and Predictions

Question: How will the small variation between the dog foods affect the feeding preference of Indian Meal Moths for them?

Hypothesis: The Indian Meal Moth will find will develop better on grain-based dog food, as represented by product A.

Prediction: With Indian Meal larvae eating grain, I think they will favor the higher quality grain dog food.

Study System

Indian Meal Moth (IMM), *Plodia interpunctella*, is a pest of stored grains, value-added grain products like pet foods and also in consumer households. It is commonly found in stored products due to that being its main source of food. IMM's can get into spices, animal foods, grains, dried fruit and seeds. A female can lay up to 400 eggs in her short lifetime. Eggs are laid near a good food source presumably so larvae do not have to go far (Sambaraju et al. 2016). The most harmful things about the IMM is their ability to get into stored products and damage them by not only eating them, but also spinning their web as larvae (Figs. 1 and 2).



Fig. 1, left, Adult IMM's in copula; Fig. 2, IMM eggs

Methods and Experimental Design

Two sets of experiments were conducted, one as a forced infestation to determine relative quality of the foods for IMM development, the second being a behavioral two-choice experiment to see if newly hatched IMM larvae had a preference for one food more than others. I began by grinding the dog food in a blender to a particle size ranging from 2mm to 4mm so the IMM larvae could easily infest the food (Figs. 3, 4, 5 and 6). The ground pet foods had similar particle sizes to that of the IMM lab diet (Fig. 7) in particle size and the grinding helped to remove the kibble shape as a variable among the foods. The four dog foods consisted of product A which is a high quality that has grain, product B will be a lower quality grain-based, dog food. Product C will be a medium quality food that is grain free. Then lastly, Product D will be a high end, grain, medicinal dog food.

We placed 25 g of each of the four dog foods and of the IMM diet separately into 3 glass 120 ml Mason jars (Figs. 3-7-), thus having three complete replicates of the 5-foods, for forced infestation studies to evaluate the suitability of each dog food for larval development of IMM. Each jar was inoculated with 50 IMM eggs and larvae in each jar were counted after 28 days. Two-choice bioassays used rectangular plastic tubs (Fig. 8, 30 cm long X 10 cm wide X 15 cm tall) where 50 eggs were put in the middle of the tub and with a dog food on one side and the IMM lab diet on the other side. Newly hatched larvae needed to traverse at least 12 cm to a cup of food. The larvae would then make the decision of which food they choose to feed and develop on. Jars for the forced infestation and plastic boxes for the two-choice studies were placed in a growth chamber kept at 25° C and 50% RH with a L:D photoperiod of 16:8.

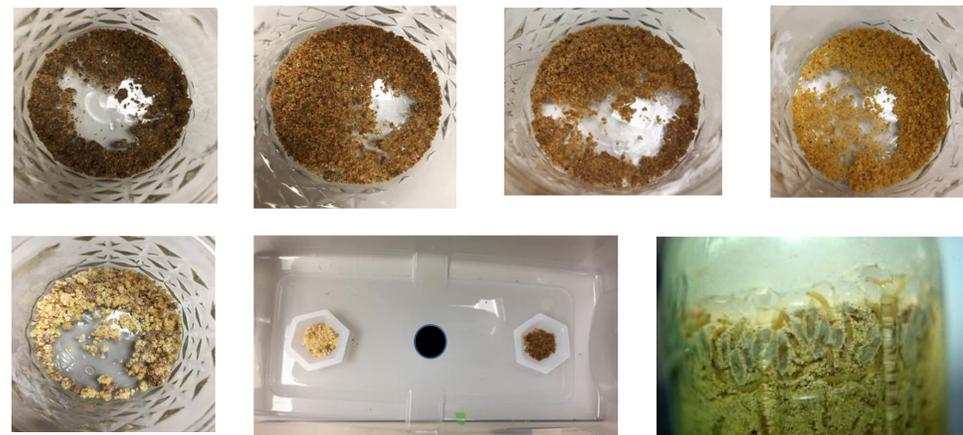


Fig. 3-6, top, left to right, ground experimental dog foods A, B, C and D. Fig. 7, bottom, left, IMM lab diet. Fig. 8, bottom middle, plastic box, from top, for two-choice bioassay with lab diet on left and dog food on right; black circle is where eggs were deposited. Fig. 9, bottom right, a laboratory colony of IMM showing mature larvae like those counted in our no-choice and two-choice studies.

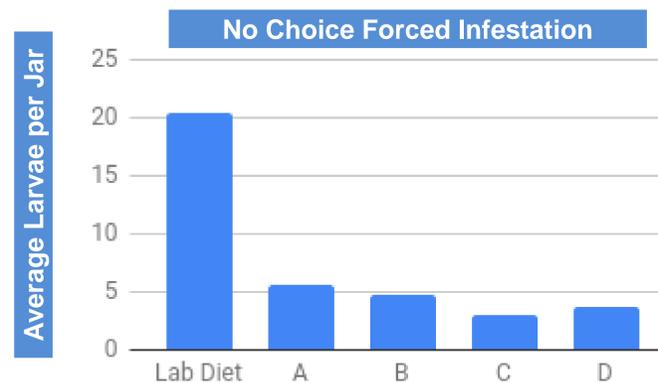


Fig. 10. Average number of larvae produced per jar 28 days after addition of 50 IMM eggs.

Results

No-choice forced infestation trials clearly showed that the IMM lab diet was the most suitable for growth and development of IMM compared to dog foods, as expected, with an average of 20.5 larvae per jar (Fig. 10). Larvae produced in the four dog foods had similar numbers with food A having an average of 5 larvae per jar. The two-choice experiment had most larvae produced in the IMM diet, but the proportion of all larvae that were in dog food was highest for dog food C, which was twice the proportion of larvae in the other three dog foods (Fig 11).



Conclusions

Even though Indian Meal Moths are drawn specifically to grain products, dried fruits, dog food, seeds, as well as spices, they will still get into any stored item. They are still a pest and will still pose issues especially if food is not stored properly.

Future Directions

The nutritional quality of a pet food can play an important role in its risk of infestation, so future research could have experiments in which the concentration of particular nutrients are varied in a standard diet, to determine which nutrients influence risk of infestation.

References

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