

Effects of Diet on the Growth of twospotted Spider Mites

Elena Leonard^{1,2} and Dr. James Nechols¹



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

²Department of Horticulture and Natural Resources, College of Agriculture, Kansas State University

Abstract

Twospotted spider mites—*Tetranychus urticae* Koch—are a major pest, and so knowing as much about the pesky creatures as possible will allow those in horticultural fields to prepare better defenses against infestations, and reduce damage if infestation is unavoidable. A few particular points we could take from this experiment are whether any increase in size that may occur leads to a preference, and whether it leads to an increase in population size due to an increase in fecundity of adult female mites. It is commonly understood that the larger a female insect is, generally the more eggs she will lay in her lifetime. As further explained by Alois Honek (1993), the common slope of the fecundity/size relationship is close to 1 and this indicates that female size is a principal constraint on insect potential fecundity. Therefore, knowing whether or not insects will grow larger when feeding on certain food sources will warn us as to how quickly we should expect insect populations to increase.

There is currently little to no information about the effects of food on body size in spider mites, and so this experiment could assist in this regard. If results are positive, we can use the information to assess differences in pest infestation and population growth. If not, then either we can change the test plants or conclude that there is likely no effect of diet whatsoever. However, in this study, we expected to see some difference in the sizes of either population of spider mites due to the contents of their diets. From a previous study done by Teder et. al. (2014) on the correlation between age and size at maturity and diet of over 200 species of insects, it was found that there was in fact a difference in body size for nearly all insect species based on source of diet. Working off of what is already known about correlations between body size and diet, it can be assumed that even in an arachnid population, there will be some significant variation based on diet.

Our hypothesis was supported as there was a statistically significant difference (t-test: $P=0.02$, $t=2.36$, $df=48$) in average body length of the two populations, with the green bean population being the larger of the two (figure 1). The results of this study show that certain plants are more nutritious for twospotted spider mites, which may lead to a preference on their part, giving agricultural and horticultural workers a heads-up as to what plants they should watch more carefully.

Purpose

The purpose of this research was to determine if the host plant twospotted spider mites feed on affect adult female body size. The overall goal was to improve pest management of this troublesome pest by showing that populations grow at different rates depending on what plant they feed on.

Questions, Hypotheses, and Predictions

Question: Will different food sources affect the size of adult female twospotted spider mites?

Hypothesis: There will be a difference in the body size of spider mites from the two populations.

Prediction: I predict that the spider mites feeding on green beans will on average grow larger than those feeding on cotton.

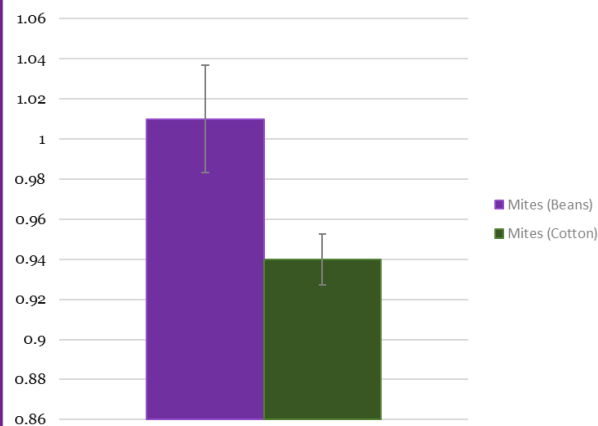
Study System

Twospotted spider mites are biological pests that have been known to feed upon up to 200 plant species, mainly ornamental woody plants, some fruit crops, and various deciduous trees (Johnson, 1991). They belong to the Arachnidae family, and their taxonomic name is *Tetranychus urticae* Koch. Their common name is contrived from their two most noticeable features, being the two dark spots on the backs of nearly all the mites and the fact that these pests spin fine webs wherever they reside. These spider mites are typically found in greenhouses in the US, and on occasion in deciduous fruit trees, according to Fasulo and Denmark (2009) from the University of Florida. Twospotted spider mites feed on plant tissue using piercing-sucking mouthparts, which can eventually lead to obvious plant damage, and economic loss depending on the crop. Some clear signs of the presence of twospotted spider mites are, of course, the thin webbing on the undersides of leaves and in between stems which is littered with mites, and after some time, yellow spotting on the leaves where the most damage has been incurred.

Methods and Experimental Design

In this study, we looked at two populations of twospotted spider mites, one fed on cotton, and the other fed on green beans. In order to test our hypothesis, we measured the body length of adult female spider mites using a stereomicroscope fitted with an ocular grid. Grid units (squares) were calibrated to number of millimeters at different magnifications using a stage micrometer. Data were then recorded over several weeks on 25 spider mites. In order to get specific body measurement of the mites, the number of grid units of body length were multiplied by the known size of one grid unit.

Comparison of Mite Body Size (mm.) Based on Diet of Green Beans or Cotton



Conclusions

The results of this experiment open a new chapter in pest management, in a way. Having the knowledge that pests such as twospotted spider mites do in fact vary body size, depending on their source of nutrition, allows people working in horticultural fields to be more aware of increased pest risks. This may very well lead to further studies on the subject, as there are still many questions left unanswered.

Future Directions

Seeing as the results of this project showed that there is in fact a correlation between food source and body size in twospotted spider mites, the next step would be to further this research to see what other relations there are between food sources and twospotted spider mites. One particular area of study would be that of reproductive rates. Many researchers have verified that larger body size in most insects and arachnids leads to higher reproduction rates (e.g. Honek, 1993). We could perhaps continue this research by studying the effects of food source on population growth, using the same environment in this current experiment, or possibly even expanding by using one or two more crops that are commonly affected by twospotted spider mites.

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