

Effect of Source and Novel Host Plants on Twospotted Spider Mites

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Abstract

A laboratory experiment was conducted to determine how well spider mite populations would develop on different host plants, and if the source plant the mite was reared on would affect their performance on other plants. This study was important because twospotted spider mite is a notorious pest on many greenhouses and household plants, but different plants may not be equally suitable for mite development and survival. The main question in my study was: Does the host plant have a significant effect on spider mite population growth? My results showed no difference in mite population numbers based on which colony plant mites were reared on. However, they tended to do better on marigold, which was a new host plant, than on their source plants – lima bean and cotton. This experiment is important because it helps us determine the level of damage risk from spider mites on different plants, and also if a new host plant is more or less likely to experience high pest populations. My results differed from a previous study (Gould 1978) which showed that twospotted spider mites had lower survival on new host plants compared to the one on which they had been reared.

Purpose

To determine the suitability of different plant species for spider mite population growth.

Questions and Predictions

Questions: 1) Will spider mite populations from different host plants develop differently when challenged with a rival host plant? 2) Will they do the best on the plant to which they are adapted (colony plant)?

Predictions: I predicted that neither colony of twospotted spider mites would do very well on marigolds (no prior experience) and that mites from each colony would do the best on the host plant from which they were reared.

Study System

The twospotted spider mite is a tiny but very serious pest that is able to feed on hundreds of plants, including ornamental, vegetable, and fruit crops. However, not all plants are equal as food sources. Spider mites feed by sucking leaf tissue cell by cell, which leaves behind tiny scars where the epidermal cells have been injured. When you have hundreds or thousand of mites eating, damage can be seen on the plant surface and plants are not productive because of the loss of chlorophyll.



Methods and Experimental Design

We took mites originating from bean and cotton plants and moved them to different plants (beans, cotton, or marigolds) in the laboratory. We were able to keep the mites separate by keeping the plants apart in plastic trays with a water moat. This prevented the mites from being able to cross over to the neighboring plants. There were four replicates for each plant type. From there, we left the mites for ten days before counting them. In order to obtain an accurate number, we cut off leaves from each plant and froze them. Once the mites were dead, we took careful notes and counted each one including the eggs. The data were analyzed with two- and one-way ANOVA followed by a Tukey mean separation test.



Results

I found that the mite's source plant did not have a general effect on population growth averaged over all plants ($p=0.426$). However, population growth was not equal across all test plants ($p=0.032$). Marigolds were a much better plant for twospotted spider mites as they became very populated. There was a significant difference between the marigold and the cotton plants ($p=0.05$) and there was a trend for more mites on marigolds vs. beans, but the difference was not significant (see Table 1, below; different lowercase letter indicates statistical significance).

Table 1. Number of twospotted spider mites on different plants

Plant		Mean	±	S.E
Marigold	a	865.8	±	24.1
Bean	ab	694.8	±	59.7
Cotton	b	667.3	±	73.3

Conclusions

My conclusions are (1) not all plants are equal for spider mites, which I had predicted, and (2) the plant that mites were reared on was not necessarily the one they did the best on, which was different from my prediction. My results differed from at least one other study (Gould, 1978) which showed that mites did better on their colony plant compared to the new plant. It is possible that marigolds are a higher quality plant for spider mites, which may have allowed their numbers to be higher compared to beans and cotton. This study will help me to better understand greenhouse pests and their management.

Future Directions

Because my test was in an extremely controlled environment, I think it would be beneficial to do this experiment again in an outdoor environment that is more realistic. Would the mites be affected by different kinds of weather? Would field conditions change plant quality? If plants had different nutrients or defenses, would it attract mites differently or change mite populations? An important research question is if mites were allowed to feed on different plants for longer periods, would that affect their survival and population growth as was shown by Gould (1978)?

References

Gould, Fred. 1978. "Rapid host range evolution in a population of the phytophagous mite *Tetranychus urticae* Koch." Evolution. 33: 791-802.

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